Summary of Revised and Supplemental Materials

Brickhaven No. 2 Mine Tract A

HDR Response to Comments, December 31, 2014

Section / Item	Action Needed	Comments
Binder		
Cover	replace	added revision date
Spine	replace	added revision date
Mining Permit Application		
Application for Mining Permit	replace pg nos. 7-10	Revised to correct basin and cell references in Item C.1 and drawing reference in Item C.6b
Correspondence		
Coversheet	replace	Updated for current content
HDR Response letter 12/31/14	add	
Permit Transfer Acceptance, 12/22/14	add	As requested by DEMLR Review Comment 1
NCDENR comment letter, 12/19/14	add	
Permit Modification Request Transmittal Letter, 11/14/14	relocate	provided with original submittal; move from front of binder to Correspondence section
Permit Transfer Request Transmittal Letter, 11/14/14	relocate	provided with original submittal; move from front of binder to Correspondence section
Calculations		
Coversheet	replace entire section	added revision date
Table of Contents		updated for current content
A - Stability		updated header, no change to calculation data
B - Stormwater		updated headers throughout Subcell Divider Berms revised due to supplemental hydrogeological data Sediment Basins revised per Erosion & Sediment Control Review Comment 1
C - Reclamation Timeline		new as requested by DEMLR Review Comment 2
Related Documents		
Coversheet	replace	Updated for current content
NDPES Certificate of Coverage	add	As requested by DWR Review Comment 4
Reclamation Bond	add	As requested by DEMLR Review Comment 6
Drawings		
Complete set, half and full size	replace entire section	Revised per Erosion and Sediment Control Review Comment
CD		
PDF files of the materials listed above		

Mine Permit Transfer/Modification

Brickhaven No.2 Mine Tract “A”

Charah, Inc.

Moncure, North Carolina

November 2014
Revised December 2014

APPLICATION FOR A MINING PERMIT

C. PROTECTION OF NATURAL RESOURCES

1. Describe in detail the sequence of events for the development and operation of the mine and *reference the sequence to the mine map(s).* Attach additional sheets as needed.

Mining operations will continue in the area designated as Phase 1 (Cells 1 and 2). Drainage will be directed to Basin #7. Continued mine development will progress into the Phase 2 (Cells 3-4) area and Phase 3 (Cell 5) area. Basins 1-7 will be constructed as the mine operations expand. Interim stockpiling may occur in the mine footprint or one of two designated stockpile areas. Erosion and sediment control will be designed and permitted for the stockpile areas prior to use. Stormwater benches, slope drains and diversion berms will direct stormwater from the closed structural fill to an existing sediment basin.

2. Describe specific erosion control measures to be installed prior to land disturbing activities and during mining to prevent offsite sedimentation *(include specific plans for sediment and erosion control for mine excavation(s), waste piles, access/mine roads and process areas)*, and give a detailed sequence of installation and schedule for maintenance of the measures. *Locate and label all sediment and erosion control measures on the mine map(s) and provide typical cross-sections/construction details of each measure.* Engineering designs and calculations are required to justify the adequacy of any proposed measures.

Mine operations will continue in the Phase 1 area and expand to the Phase 2 area. Basins will be constructed as needed to collect stormwater and prevent offsite sedimentation. The base of the excavation will be lined and contain a leachate collection system for the reclamation structural fill. The structural fill will be capped.

3. a. Will the operation involve washing the material mined, recycling process water, or other waste water handling? Yes ☒ No ☐. If yes, briefly describe all such processes including any chemicals to be used.

Contact water from the coal combustion product structural fill will be collected and discharged to the local wastewater treatment plant. No chemicals will be used. Flocculants may be used to control TSS in stormwater prior to discharge as allowed in the existing permit.

b. Will the operation involve discharging fresh or waste water from the mine or plant as a point discharge to the waters of the State? Yes ☐ No ☒. *If yes, briefly describe the nature of the discharge and locate all proposed discharge points (along with their method of stabilization) on your mine map(s).*

c. Will any part of the proposed mine excavation(s) extend below the water table? Yes ☐ No ☒.
If yes, do you intend to dewater the excavation(s)? Yes ☐ No ☐.
If yes, what impact, if any, will mine dewatering have on neighboring wells? Estimated withdrawal rate in gallons per day:___________________. *Locate all existing wells on the mine map(s) that lie within 500 feet of the proposed excavation area*. Provide data to support any conclusions or statements made, including any monitoring well data, well construction data and current water withdrawal rates. Indicate whether the proposed mine locale is served by a public water system or private wells.

d. If you answered yes to any of the above questions, provide evidence that you have applied for or obtained the appropriate water quality permit(s) (i.e., non-discharge, NPDES, Stormwater, etc.) from the Division of Water Quality, Water Quality Section. In addition, the applicant is required to register water use with the Division of Water Resources if the operation withdraws more than 10,000 gallons per day and needs a capacity use permit from the Division of Water Resources if the operation lies in a capacity use area and withdraws more than 100,000 gallons per day.

The current mine NPDES permit is included under related documents.

4. a. Will the operation involve crushing or any other air contaminant emissions? Yes ☐ No ☒.
If yes, indicate evidence that you have applied for or obtained an air quality permit issued by the Division of Air Quality or local governing body.

b. How will dust from stockpiles, haul roads, etc., be controlled?

Haul roads, stockpiles and structural fills will be wetted as necessary to control dust. Chemical dust suppressants may be utilized as needed to control dust from areas where construction activity may be extended for periods greater than 30 days.

5. a. A buffer will be required between any mining activity and any mining permit boundary or right-of-way. It may be an unexcavated buffer (no excavation, but roadways, berms and erosion & sedimentation control measures may be installed within it), an undisturbed buffer (no disturbance within the buffer whatsoever), or a combination of the two, depending upon the site conditions. Note that all buffers must be located within the mining permit boundaries.

   How wide a buffer will be maintained between any mining activity and any mining permit boundary or right-of-way at this site? A minimum buffer of 25 feet is recommended, although a wider buffer may be needed depending on site conditions. *Show all buffer locations and widths on the mine map(s).*

A 50-foot undisturbed property line buffer is maintained. A 50-foot buffer to wetlands and stream is also maintained except where impacts are permitted through the USACE and NCDWQ. A 300-foot buffer is maintained to residences and private groundwater wells.

   b. A minimum 50 foot wide undisturbed buffer will be required between any land disturbing activities within the mining permit boundaries and any natural watercourses and wetlands unless smaller undisturbed buffers can be justified. Depending on site conditions, a buffer wider than 50 feet may be needed.

   How wide an undisturbed buffer will be maintained between any land disturbing activities within the mining permit boundaries and any natural watercourses and wetlands at this site? *Show all buffer locations and widths on the mine map(s).*

50 feet

6. a. Describe methods to prevent landslide or slope instability adjacent to adjoining permit boundaries during mining. Minimum 2 horizontal to 1 vertical slopes or flatter for clayey material and minimum 3 horizontal to 1 vertical slopes or flatter for sandy material are generally required, unless technical justification can be provided to allow steeper slopes.

2H:1V slopes will be maintained in the excavation area. Final cut slopes are designed at 3H:1V. The structural fill is designed to have a 4H:1V side slope.

b. *Provide a cross-section on the mine map(s) for all fill slopes (berms, wastepiles, overburden disposal areas, etc.), clearly indicating the intended side slope gradient, installation of any benches and/or slope drains (with supporting design information) if needed, and the method of final stabilization.*

See Drawing 03C-03

c. In excavation(s) of unconsolidated (non-rock) materials, specify the angle of all cut slopes including specifications for benching and sloping. *Cross-sections for all cut slopes must be provided on the mine map(s).*

No benching will be conducted in the excavation area. Cut slopes will maintain a 3H:1V slope.

d. In hardrock excavations, specify proposed bench widths and heights in feet. *Provide cross-sections of the mine excavation clearly noting the angles of the cut slopes, widths of all safety benches and mine benches, and the expected maximum depth of the excavation.*

N/A

7. Describe other methods to be taken during mining to prevent physical hazard to any neighboring dwelling house, public road, public, commercial or industrial building from any mine excavation. *Locate all such structures on the mine map if they are within 300 feet of any proposed excavation.*

N/A

8. Describe what kind of barricade will be used to prevent inadvertent public access along any high wall area and when it will be implemented. Vegetated earthen berms, appropriate fencing and adequate boulder barriers may be acceptable high wall barricades. *A construction detail/cross-section and location of each type of barricade to be used must be indicated on the mine map(s).*

Gates will be installed at the mine entrances to prevent unwanted access. Fencing may also be constructed as needed.

Correspondence

Brickhaven No.2 Mine Tract "A"

Charah, Inc.

Moncure, NC

November 2014
Revised December 2014

HDR Response to Comments, Dec 31, 2014
Permit Transfer Acceptance, Dec 22, 2014
NCDENR Comment Letter, Dec 19, 2014
Permit Renewal Fee, Dec 10, 2014
Permit Modification Request Transmittal Letter, Nov 14, 2014
Permit Transfer Request Transmittal Letter, Nov 14, 2014

HDR

December 31, 2014

Ms. Judith A Wehner
Land Quality Section
Division of Energy, Mineral, and Land Resources
Department of Environment and Natural Resources
1612 Mail Service Center
Raleigh NC 27699-1612

Re: Brickhaven No. 2 Mine Tract A
Mining Permit No. 19-25

Dear Ms. Wehner,

On behalf of Green Meadow, LLC and Charah, Inc., HDR provides the following response to NCDENR's comments regarding the Mine Permit Transfer/Modification request for Brickhaven No.2 Mine Tract A, Mining Permit No. 19-25.

Six complete sets of revised or supplemental material for the permit application have been provided with this response to comments. Please insert the revised or supplemental material into the applicable sections of the permit application binder previously provided to you. Please discard any pages that are being replaced. A detailed summary of the specific revised and supplemental materials is included for your reference. In addition, one CD with pdf files of the revised and supplemental material is provided for your use.

As a reminder, the application includes a Correspondence section which is intended to be used to track communication received from DENR or provided to DENR on behalf of the applicant while the application is under review. To that end, HDR had included copies of the Division of Energy, Mineral, and Land Resources (DEMLR) December 19, 2014 review letter as well as this response letter in that section of the application. Future correspondence will be handled similarly.

Comments from DEMLR are listed below as provided in your letter of December 19, 2014. HDR's responses follow in *italics*.

DEMLR Review Comments

1. Please request in writing that the existing permit be transferred and clearly state the new operator's name (Green Meadows LLC). In the letter please also indicate that you will accept any and all responsibilities and liabilities with respect to the Mining Act of 1971.

   The requested letter from Green Meadow LLC is included with this response.

2. Please provide time frames for the final reclamation of the structural fill areas.

A table indicating anticipated timeframes for reclamation has been added to the Calculations section of the application submittal. A copy is provided with this response.

3. Please find enclosed the Division of Water Resources' Water Quality Operations comments regarding this site. Please contact Danny Smith at (919) 781-4200 to address these concerns and advise this office of any changes to your modification proposal.

   HDR's itemized response is provided below in the section entitled "Division of Water Resources Review Comments".

4. Please find enclosed comments from the NC Wildlife Resources Commission regarding this site. Please address the concerns outlined in the memorandum.

   HDR's itemized response is provided below in the section entitled "North Carolina Wildlife Resources Commission Review Comments".

5. Please find enclosed comments from our Raleigh Regional Office regarding the erosion and sediment control measures/plans. Please revise the erosion and sediment control plan to include these changes. Please note that the western access road noted in #4 must include access to the state maintained road. The entire roadway to its intersection of the publically maintained road must be included within the permit boundary.

   HDR's itemized response is provided below in the section entitled "Erosion and Sediment Control Review Comments". Regarding the western access, Drawings 03G-02, 02C-02, and 02C-08 have been revised to remove any reference to access from the west side of the property. Drawings 02C-01 and 02C-07 indicate that site access will continue to be from Moncure Flatwood Road. The revised drawings are included with this response.

6. The reclamation bond calculation exceeds the reclamation bond cap of $500,000.00. Therefore, the reclamation bond for this site and the Colon mine would be $500,000.00 and will be required prior to approval of this request.

   The reclamation bond in the amount of $500,000 is included with this response.

Division of Water Resources Review Comments

Comments provided by Danny Smith dated December 11, 2014

1. A review of an aerial, USGS map and a review of the site map that was included in the application packet depicted blue lines and crenulations that indicate stream(s) are present within and adjacent to the subject project.

   Comment noted.

2. 404/401. It is recommended that the owner contact both the USACE and DWRs for a joint wetland and stream determination and to discuss permitting. Impacts indicated in the

application include the following: 2,662 linear feet of stream, 0.45 ac of wetlands. This will trigger an Individual permit from USACE and individual 401 Water Quality Certification.

Comment noted. The owner's representative, ClearWater Environmental Consultants, is in the process of permitting for mitigation of the impacted wetlands and streams that have been identified on the subject plans. No disturbance of these areas will occur without the issuance of the necessary permit(s).

3. Water Supply Watershed. The project is in the Cape Fear River Basin (UT to Gulf Creek Water Supply IV waters). If "new development" occurs on this tract and a sediment and erosion control plan is required per the Sediment Act, the project may trigger local government approval per WS IV Supply Watershed Rules. [If this occurs, I recommend that you contact see Julie Ventaloro (water supply watershed coordinator – DEMLR), review §130A-309.205 and 15A NCAC 02B .0216.] Also, Chatham County is delegated to implement the Erosion and Sedimentation Control Act for DEMLR.

   Comment noted. At this time no specific "new development" is proposed. The project represents a modification to the proposed reclamation plan for the existing mine and the sediment and erosion control plan for the proposed mine modification remains part of the overall mine permit.

4. The proposed land use/activity will need to comply with the appropriate stormwater permit (NCG010000, NCG020000m, or NCG120000.)

   NCG020000 (Certificate of Coverage NCG020354) has been transferred to Green Meadow, LLC and is in place and in effect based upon the mining operations. A copy of Certificate of Coverage NCG020354 is provided for your records.

5. Wetland and stream monitoring plan: It is recommends that mine site (owner) develop a wetland and stream monitoring plan such that they can demonstrate that the change of hydraulic gradient that results from the mining activity does not remove the hydrology from adjacent wetlands and streams. [This is to ensure: 1) the streams and wetlands do not get disturbed prior to permitting and 2) it is to ensure that adjacent mining, reclamation efforts, beneficial use preparation, or landfill efforts do not remove the hydrology prior to permitting.]

   Comment noted. The mining operations and subsequent reclamation plans have been phased in a manner to mitigate any impacts to the existing streams and wetlands noted in the subject plans for impact. The Individual 401/404 Permits are in process and are anticipated to be in place by late August 2015 at which time the identified stream and wetland impacts could occur. An operational requirement is being placed on the mining plan (structural fill plan) that requires these permits be issued and in effect prior to any disturbance to the wetlands and streams, or the areas that contribute runoff that support the streams and wetlands, and therefore, is planned in the overall mine operation.

6. Any ash/mine pit discharges to surface waters (beneficial fill or not) will need to be covered by an appropriate NDPES wastewater discharge permit if it discharges ash/comingled ash and stormwater. (The site is not permitted to discharge coal combustion products – coal ash and/or leachate collection system is not authorized to discharge to water or violate 2L groundwater standards.)

   Comment noted. Neither ash nor leachate discharge is planned for this project. As indicated in Section C.3. of the Mining Permit Application, contact water from the coal combustion product structural fill will be collected and conveyed to a local wastewater treatment facility. See also, response to Item 7 below.

7. Wastewater Pump and Haul System – Leachate will need to be addressed through 15A NCAC 02T .0203 (2). Please see attached industrial pump and haul application.

   At this time the applicant, Green Meadow, LLC, is working to secure necessary permit(s) for conveyance of contact water (i.e., leachate) to a local wastewater treatment facility via gravity or force main sewer system. Alternatively, a pump and haul permit may be utilized in the event the direct connection to a sewer system is not feasible or is not timely. In either event, a proper leachate discharge permit will be obtained prior to placement of ash.

North Carolina Wildlife Resources Commission Review Comments
Comments provided by David R. Cox, dated December 16, 2014

1. Generally, where federally listed species are found, we recommend maintaining a minimum 200-foot undisturbed native, forested buffer along perennial streams, and a minimum 100-foot buffer along intermittent streams and wetlands (NCWRC 2002).

   Comment noted. The habitat assessment performed by ClearWater Environmental Consultants only identified potential habitat for the northern long-eared bat which currently has no development constraints. The report concludes "...development of the Brickhaven Mine is not likely to adversely affect federally threatened or endangered species." Buffers required by GS 130-309.216 have been met with the proposed facility design.

2. Calgon Cat-Floc DL has been used previously. Cationic polyelectrolytes are toxic to fish; therefore, measures should be used to prevent spills or direct discharge of Calgon Cat-Floc DL into any natural watercourses.

   Comment noted. The flocculent noted is part of the approved permitted operation of the existing mine. Green Meadow, LLC will strive to implement measures to prevent spills or direct discharge of the material and will seek to minimize its use or identify alternative flocculants if feasible.

3. Water quality monitoring should be performed in Shaddox Creek and Gulf Creek downstream of the site. In addition to monitoring for the constituents in Appendix I (i.e., Appendix I to 40 C.P.R. Part 258), aluminum, boron and mercury should be added since these are not included in

Appendix I and have the potential to adversely impact aquatic and terrestrial wildlife resources (RTI 2000). If constituents are found in downstream surface waters, then the applicant should notify NCDENR and measures to identify the source and contain the constituents should be implemented immediately.

Comment noted. A water quality monitoring plan is included in the Hydrogeologic Report section of the Structural Fill Permit Application submitted to the Division of Waste Management for review. The plan currently includes proposed surface water monitoring locations at a tributary to Gulf Creek and in Shaddox Creek. Green Meadow, LLC will monitor onsite water quality as required by current regulations governing the operation of the mine and modified mine reclamation method and as required under the Coal Ash Management Act of 2014.

4. We support post-closure care for at least 30 years. Downstream water quality monitoring for constituents (i.e., Appendix I and aluminum, boron, and mercury) should continue during post-closure; however, at a minimum, monitoring of downstream water quality should be performed if constituents (i.e., Appendix I and aluminum, boron and mercury) are found during groundwater monitoring.

   Comment noted, refer also to the response above. The post-closure care plan included in the Structural Fill Permit Application includes water quality monitoring.

5. Use dust control measures to minimize aerial deposition of coal combustion products into surface waters and terrestrial landscapes. If chemical dust suppressants are used, the product should be non-toxic to plants and animals, and should be applied to minimize environmental impact.

   Comment noted. Dust control measures are discussed in the Operations Plan included in the Structural Fill Permit Application submitted to the Division of Waste Management and will be provided throughout the project duration as required by the Coal Ash Management Act of 2014.

6. Consider using seed mixtures that are beneficial to wildlife (e.g., native warm season grasses) in the final reclamation plan. Additionally, for relatively shallow sediment basin reclamation, we recommend these areas be reclaimed as wetlands where practicable. We refer the applicant to Jason Allen, District Wildlife Biologist at (336) 524-9801 for additional information and ideas on reclamation for wildlife.

   Comment noted. Mr. Allen will be consulted at the appropriate time.

Erosion and Sediment Control Review Comments
Comments provided by Raleigh Regional Office.

1. While the conceptual sediment basin designs appear acceptable, the numbers used to support the sediment storage and settling efficiency provided by the basins appear problematic. The stage-area data used does not appear to reflect the actual basin layouts. The design data should be checked and adjusted to ensure that surface areas and storage volumes more accurately support the adequacy (and efficiency) of the proposed structures. Also, the

construction details for the basins need updating. The reference to perforations in the riser structure must be removed, and ballast stone shown around the riser should be eliminated in that it will prevent proper operation of the flexible riser connection associated with the proposed skimmer. The detail dimensional table should include the anticipated dewatering time for the proposed basins, and in light of the fine-grained soils being dealt with during this project, it is recommended that you consider increasing the time closer to 5 days. In addition, the skimmer arm guides proposed should be eliminated and replaced with an access rope for retrieval and maintenance of the device. Finally, the baffle details should eliminate the spillway throats and should specify appropriate coir materials for effective operation.

The sediment basin calculations have been revised and accurately support the adequacy (and efficiency) of the proposed structures. The sediment basin details on Drawing 02C-14 have been updated to removed the reference to perforation and ballast stone.

The skimmer calculation has been revised to allow a dewatering time closer to five days. Table 1 on Drawing 02C-14 has been modified to indicate the skimmer dewatering time. In addition, the skimmer detail on Drawing 02C-14 has been modified to remove the guide posts and include a retrieval rope.

The sediment baffle detail on Drawing 02C-15 has been edited to eliminate the spillway throats and specify appropriate coir materials.

Revised drawings and calculations are included with this response.

2. A specific construction sequence and more detailed sediment control measures are required for construction of basin #7 in the footprint of the existing settling ponds. Dewatering into silt bags or other appropriate measures must be addressed as well construction of the multiple riser/barrel structures.

   A construction sequence for SB #7 has been added to Drawing 02C-06. The construction sequence addresses installation of the riser/barrel structure and dewatering. Revised Drawing 02C-06 is included with this response.

3. Silt fences should not be used on downhill grades where they will tend to divert and/or concentrate runoff. In addition, where one row of silt fence will not be appropriate, neither will two rows of silt fence. Please substitute appropriately designed diversion swales/berms directing runoff to basins or traps, as appropriate, and use silt fence below basin construction areas and along roadway construction where the runoff will be relatively sheet flow. The reinforced silt fence outlets should be specified wherever minor concentration of runoff will occur along the silt fence alignment.

   The use of silt fence is in part to provide a visual delineation of the limits of work. Diversion swales/berms are indicated in a number of locations adjacent to silt fenced to direct runoff. To further emphasize this, notes have been added to Drawing 02C-01 instructing the contractor to *install diversion swales/berms in areas where silt fence may divert and/or concentrate runoff, and instructing the contractor to install rock outlets within silt fence wherever minor concentration of runoff will occur along the silt fence alignment. Silt fence is generally indicated below basin construction areas. Revised Drawing 02C-01 is provided with this response.*

4. A more specific construction sequence and additional measures will be needed where the western access road is to be built per sheet 02C-02. The proposed culvert inlet protection is not appropriate for such a double culvert installation. Further, a cofferdam/pump-around arrangement appears necessary to accommodate the proposed culvert installation. Appropriate diversion swales and traps appear necessary west of the crossing.

   The western access is no longer proposed in this application. Drawings 02C-01, 02C-02, 02C-07 and 02C-08 have been revised to indicate that the primary access will remain from Moncure Flatwood Road. The revised drawings are provided with this response.

5. The protective linings for perimeter stormwater channels should be more specifically identified on the drawings. Where riprap slope drain outlet protection is proposed into grassed channel sections, the riprap should be extended to armor the entire transition cross section. Construction details should be provided for proposed concrete sections.

   A note has been added to Drawing 02C-09 indicating the channel linings. The note indicates to refer to Drawing 03C-04 for the construction details for slope drain outlets. A construction detail for the concrete section has been added to Drawing 03C-04. The revised drawings are provided with this response.

6. The proposed covering for construction entrances should be extended to at least 100 feet in length.

   The construction entrance detail on Drawing 02C-13 has been revised to indicate 100-ft in length. Drawings 02C-01 and 02C-07 indicate the location of the construction entrance. The revised drawings are provided with this response.

7. All NCDOT class 1or B riprap linings or aprons must be placed at least 18" thick over a suitable geotextile fabric.

   All references to NCDOT Class1 and Class B rip rap linings and aprons have been revised to indicate 18” thickness.

Please refer to the enclosed Summary of Revised and Supplemental Materials for a complete list of documents provided with this response.

If you have any questions, comments, or require additional information, please contact me at 704.338.6843.

Sincerely,
HDR Engineering, Inc. of the Carolinas

Michael D. Plummer, PE
Project Manager

Enclosures

Summary of Revised and Supplemental Materials

Brickhaven No. 2 Mine Tract A

HDR Response to Comments, December 31, 2014

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Complete set, half and full size	replace entire section	Revised per Erosion and Sediment Control Review Comment
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PDF files of the materials listed above		

December 22, 2014

North Carolina Department of Environment
And Natural Resources
Division of Energy, Mineral, and Land Resources
Land Quality Section
512 North Salisbury Street
Raleigh, NC 27604

Attention: Judy Wehner, Asst. State Mining Specialist

RE: Brickhaven No. 2 Mine, Tract A
Mining Permit No. 19-25
Chatham County
Cape Fear River Basin

Dear Ms. Wehner:

In response to comments received concerning our application requesting the transfer and modification of the aforementioned mining permit, we are clearly stating that Green Meadow, LLC is accepting the transference of the facility mining permit and do hereby accept all the responsibilities associated with the permit and the requirements of the Mining Act of 1971.

We are expecting to renew mining activities onsite in February 2015, with your approval and issuance of the mining permit. We anticipate the mine to remain active for the next seven years with the completion of reclamation activities associated with the development of the structural fill to be completed in 2022.

Attached please find enclosed the reclamation bond in the amount of $500,000. The surety has been issued to Green Meadow, LLC as directed and required per the mining permit application.

We appreciate your continued support of the mining project and should you have any questions, please do not hesitate to contact us.

Sincerest regards,
Green Meadow, LLC

Charles E. Price
Managing Partner

Pat McCrory
Governor

John E. Skvarla, III
Secretary

December 19, 2013

Certified Mail
Return Receipt Requested
7013 2630 0001 8990 0803

Mr. Charles Price
Green Meadow, LLC
12601 Plantside Drive
Louisville, Kentucky 40299

RE: Brickhaven No. 2 Mine Tract A
Mining Permit No. 19-25
Chatham County
Cape Fear River Basin

Dear Mr. Price:

We have reviewed the transfer, modification and renewal application your company submitted for the referenced mine site. In order for this office to complete its review of the referenced project in accordance with GS 74-50, 51 and 52 of the Mining Act of 1971, please provide the additional or revised information in accordance with the following comments:

1. Please request in writing that the existing permit be transferred and clearly state the new operator's name (Green Meadows LLC). In the letter please also indicate that you will accept any and all responsibilities and liabilities with respect to the Mining Act of 1971.

2. Please provide time frames for the final reclamation of the Structural fill areas.

3. Please find enclosed Division of Water Resources' Water Quality Operations comments regarding this site. Please contact Danny Smith at (919) 781-4200 to address these concerns and advise this office of any changes to your modification proposal.

4. Please find enclosed comments from the NC Wildlife Resources Commission regarding this site. Please address the concerns outlined in the memorandum.

5. Please find enclosed comments from our Raleigh Regional Office regarding the erosion and sediment control measures/plans. Please revise the erosion and sediment control plan to include these changes. Please note that the western access road noted in #4 must include access to the state maintained road. The entire roadway to its intersection of the publically maintained road must be included within the permit boundary.

Please note, the Land Quality Section may request additional information, not included in this letter, as the mining application review progresses.

The reclamation bond calculation exceeds the reclamation bond cap of $500,000.00. Therefore, the reclamation bond for this site and the Colon Mine would be $500,000.00 and will be required prior to approval of this request.

For your convenience, I have enclosed a bond form, an assignment of a savings account form and irrevocable standby letter of credit form for your use in securing the required bond. The name on the security must be the same as the name appearing on the application for a mining permit, i.e., **Green Meadow, LLC**. In addition to one of these alternatives, you may, upon request, substitute a cash deposit.

Please be advised that our review cannot be completed until all of the items listed above have been fully addressed.

In order to complete the processing of your application, please forward two (2) copies of the requested information and the bond to my attention at the following address:

Land Quality Section
Division of Land Resources
Department of Environment and Natural Resources
1612 Mail Service Center
Raleigh, NC 27699-1612

As required by 15A NCAC 5B.0013, you are hereby advised that you have 180 days from the date of your receipt of this letter to submit all of the requested information. If you are unable to meet this deadline and wish to request additional time, you must submit information, in writing, to the Director clearly indicating why the deadline cannot be met and request that an extension of time be granted. If an extension of time is not granted, a decision will be made to grant or deny the mining permit based upon the information currently in the Department's files at the end of the 180-day period.

Though the preceding statement cites the maximum time limit for your response, we encourage you to provide the additional information requested by this letter as soon as possible. Your prompt response will help us to expedite the processing your application.

Please contact me at (919) 733-4574 if you have any questions.

Sincerely,

Judith A. Wehner
Assistant State Mining Specialist
Land Quality Section

Enclosures: DWR Comments
NCWRC Comments
Bond Forms

cc: Mr. John Holley, PE
Mr. Michael Plummer, PE – HDR, via email
Ms. Elizabeth Werner – DWM, via email
Mr. Norman Divers, via email

MINING PERMIT APPLICATION REVIEW FORM

for the

DIVISION OF WATER RESOURCES

THIS SECTION TO BE FILLED OUT BY DEMLR:

Project Name: Brockhaven #2 Tract "A"Mine **DEMLR Permit #** 19-25 **County:** Chatham
Applicant's Email: joe.readling@hdrinc.com

PERMIT ACTION TYPE: **Modification**

	YES	NO	Date Commencing
Have land disturbing activities started? Date?	☑	☐	1985

Latitude: 35.6028 **Longitude: -79.0172**

Please return comments to (at DEMLR CO): Judy Wehner

Comments due by: December 16, 2014

SECTION BELOW TO BE FILLED OUT BY DWR:

Is the RO concerned that the operation, as proposed, would violate standards of water quality? Please see comments below
Comments: **please see comments below**

Watershed/Stream Name & Classification: UT Gulf Creek, Water Supply IV, Cape Fear River Basin

DWR Compliance Status of Mine: did not find permit for Brickhaven in BIMS database
Does this mine (or previous owner) have DWR back fees to pay? ____ If yes, amount: ____
Is this mine an active permit in BIMS? did not find a NCG020000 permit in BIMS

	YES	NO
401 Wetland Cert. required?	☐ ____	☐ ____
401 Wetland Cert. existing?	☐ Permit #____	☐ ____
Does DWR RO have enough information to determine if a 401 certification is required?	☐ ____	☐ ____

Is an O & M Plan needed?	YES	NO
Are wetlands disturbed at this site?	☐ ____	☐ ____
Does DWR RO suspect or know of nearby wetlands to the site?	☐ ____	☐ ____
Is a wetland delineation required prior to DWR issuing the permit?	☐ JD ____ ☐ Consultant ____	☐ ____

	(Onsite? _____ (Offsite? _____		
Stream Determination Needed?	(_____	(_____	
Stream Determination Completed?	(_____	(_____	
Does DWR RO need a statement that no wetlands/streams are disturbed for this project from applicant?	(_____	(_____	
Buffer Determination Needed?	(_____	(_____	
Buffer Determination Completed?	(_____	(_____	
Recycle system permit existing?*	(Permit # _____	(_____	
New Recycle System permit required? Enough information to determine?	(_____	(_____	
Non-discharge permit existing?	(Permit # _____	(_____	
Will wastewaters discharge to HQW waters with a 7Q10=0?	(_____	(7Q10 Flow: _____	(Unknown. Permittee must determine. _____
Does DWR require DEMLR to hold the permit (e.g. so DWR can review it further or because DWR requires more information)?	(Has Violation (O&M Requirements (HQW/7Q10 Concerns (Pay back fees or renew DWR permit (Other. Please describe the reason to hold the permit: _____ RO contact: _____ (Hold Until: _____	(_____	
Mine must wait to dewater until an O&M plan is approved?	(_____	(_____	

Reviewed by:

DWR RO Surface Water: Danny Smith Regional Office: RRO Date: December 11, 2014

RO Aquifer Protection Section: _____ Regional Office: _____ Date: _____

Brickhaven No. 2 Mine Tract A: Permit 19-25:

- A review of an aerial, USGS map and a review of the site map that was included in in the application packet depicted blue lines and crenulations that indicate stream(s) are present within and adjacent to the subject project.

- 404/401. It is recommended that the owner contact both the USACE and DWRs for a joint wetland and stream determination and to discuss permitting.

- Impacts indicated in application include the following:
  2,662 linear feet of steam
  0.45 ac of wetlands

  This will trigger an Individual permit from USACE and individual 401 Water Quality Certification

- Water supply Watershed. The project is in the Cape Fear River Basin (UT to Gulf Creek Water Supply IV waters). If "new development" occurs on this tract and a sediment and erosion control plan is required per the Sediment Act, the project may trigger local government approval per WS IV Supply Watershed Rules. [If this occurs I recommend that you contact see Julie Ventaloro (water supply watershed coordinator -DEMLR), review §130A-309.205 and 15A NCAC 02B .0216.] Also, Chatham County is delegated to implement the Erosion and Sedimentation Control Act for DEMLR.

- The proposed land use/activity will need to comply with the appropriate stormwater permit (NCG010000, NCG020000, or NCG120000.)

- Wetland and stream monitoring plan: It recommended that mine site (owner) develop a wetland and stream monitoring plan such that they can demonstrate that the change of hydraulic gradient that results from the mining activity does not remove the hydrology from adjacent wetlands and streams. [This is to ensure: 1) the streams and wetlands do not get disturbed prior to permitting and 2) it is to ensure that adjacent mining, reclamation efforts, beneficial use preparation, or landfill efforts does not remove the hydrology prior to permitting.]

- Any ash/mine pit discharges to surface waters (beneficial fill or not) will need to be covered by an appropriate NPDES wastewater discharge permit if it discharges ash/comingled ash and stormwater. (The site is not permitted to discharge coal combustion products. - coal ash and/or leachate collection system is not authorized to discharge to waters or violate 2L groundwater standards.)

- Wastewater Pump and Haul system - Leachate will need to be addressed through 15A NCAC 02T .0203 (2) Please see attached industrial pump and haul application.

North Carolina Department of Environment and Natural Resources
Division of Water Quality
Raleigh Regional Office

(THIS FORM MAY BE PHOTOCOPIED FOR USE AS AN ORIGINAL)

PUMP AND HAUL OF INDUSTRIAL WASTEWATER

I. GENERAL INFORMATION:

1. Applicant (corporation, individual, other): ______________________________

2. Print owner or signing official name and title (the person who is legally responsible for the facility and its compliance): ______________________________

   ____

3. Mailing address: ____

   ____

   Telephone no.: ____

4. Project name (facility or establishment name): ____________________________

   ____

5. Application date: ____

6. County where facility being pumped is located: ___________________________

7. Specify whether the applicant is: _____ public or _____ private.

II. INFORMATION ON WASTEWATER:

1. Please provide a short description specifying the origin of the wastewater, such as school, hospital, commercial, etc.: ___________________________________

2. Volume of wastewater to be pumped and hauled: ______________ gallons per day

3. Explanation of how wastewater volume was determined: ____________________

   ____

   ____

III. TREATMENT FACILITY INFORMATION:

1. Name of treatment facility receiving wastewater: ____________________________

   ____

2. Treatment facility NPDES permit no.: ____________________________________

3. Treatment facility contact person and telephone no.: _______________________

   ____

4. County where treatment facility is located: ________________________________

IV. OTHER INFORMATION:

1. Brief project description: ____

   ____

   ____

2. Explanation of why pump and haul is being requested: _______________________

   ____

   ____

3. Specify how long pump and haul will be needed: ____________________________

4. Describe how the wastewater will be transported (truck, rail car, etc.) and provide the typical hauling volume of the vehicle providing the hauling: ______________

   ____

5. Name of owner/company of transporting (hauler) vehicle: ____________________

   ____

6. Mailing address of hauler: ____

   ____

   Telephone no. of hauler: ____

7. What type of tank or container will the wastewater be pumped from and what is the volume of this container: ______________________________

8. Is the tank or container already in place or will it be installed for these activities?

____

9. What type of high water alarm(s) does the container have?

_____ audible and visual _____ auto dialer

PLEASE ENSURE THAT THE FOLLOWING INFORMATION IS PROVIDED AND THAT THE FOLLOWING ISSUES ARE ADDRESSED

a. Provide this completed and signed form.

b. It is the current policy of the Division of Water Quality that a permit is not required for pump and haul of industrial wastewater; **however, the regional office must approve such pumping and hauling. The owner and engineer, by signing this application, affirm that the conditions under which this pump and haul activity are to be conducted are in full compliance with North Carolina Administrative Code (NCAC), Title 15A NCAC .02T .0200.**

c. A fee is not currently required for approval to pump and haul industrial wastewater.

d. Two sets of detailed plans/specifications signed and sealed by a North Carolina Professional Engineer must be provided, showing the components associated with the pump and haul activity (drains, piping, tanks, etc.), a general location map, a plan view of the storage facility and its relationship to property lines, structures, etc. The tank detail should indicate the high water alarm (either audible and visual or an auto dialer). Each sheet of the plans and the first page of the specifications must be signed/sealed by the Professional Engineer.

e. A letter must be provided from the owner/authority of the receiving wastewater treatment facility stating that the pumped and hauled wastewater will be accepted and specifying the volume of wastewater that will be accepted.

f. A letter or contract from the hauler stating his capability and willingness to perform the pumping and hauling.

g. Please provide a cover letter explaining the circumstances associated with this pump and haul request.

Name and address of engineering firm: ______________________________

____

____

Telephone no.: ______________________ Fax No. ______________________

North Carolina Professional Engineer Seal, Signature and Date:

Applicant's Certification:

I, ______________________________, attest that this request for ______________________
(print owner name)

____
(print name of facility)

has been reviewed by me and is complete to the best of my knowledge. I understand that if all required parts of this document are not completed and that if all required supporting information and attachments are not included, this package will be returned as incomplete.

Signature: ______________________________ Date: ______________________

SEND THE COMPLETED PUMP AND HAUL APPLICATION WITH ATTACHMENTS TO THE FOLLOWING MAIL ADDRESS

DWQ Surface Water Protection Supervisor
Department of Environment and Natural Resources
1628 Mail Service Center
Raleigh, N. C. 27699-1628
Telephone No.: 919-791-4200

North Carolina Wildlife Resources Commission
Gordon Myers, Executive Director

MEMORANDUM

TO: Brenda M. Harris, Mining Program Secretary, Land Quality Section

FROM: David R. Cox, Supervisor
Habitat Conservation
David R. Cox

DATE: December 16, 2014

SUBJECT: Mining Permit Modification and Transfer for General Shale Brick, Inc. & Green Meadow LLC, Brickhaven #2 Mine Tract "A"– Permit No. 19-25, Chatham County, North Carolina

Biologists with the North Carolina Wildlife Resources Commission have reviewed the subject permit application. Our comments are provided in accordance with provisions of the Mining Act of 1971 (as amended, 1982)(G.S. 74-46 through 74-68 15 NCAC 5).

General Shale Brick, Inc. is requesting a transfer of their permit to Green Meadow, LLC. Green Meadow, LLC is requesting a modification of the permit to mine clay. The total permitted area is 301 acres, and the modification involves acreage within and outside the approved permitted boundary. The operation will not discharge fresh or waste water, but will discharge stormwater. Flocculants and chemical dust suppressants may be used. According to the existing permit, a 50-foot buffer will be maintained along streams and wetlands except where impacts have been permitted. The site will be reclaimed as an encapsulated beneficial coal combustion product structural fill designed in accordance with General Statute §130A-309.216 in the Coal Ash Management Act of 2014.

An unnamed tributary to Gulf Creek in the Cape Fear River basin flows through the site and a portion of the site drains to an unnamed tributary to Shaddox Creek. There are records for the federal and state endangered Cape Fear shiner (*Notropis mekistocholas*); the federal species of concern and state endangered yellow lampmussel (*Lampsilis cariosa*); the federal species of concern and state threatened Carolina redhorse (*Moxostoma* sp.); and the state threatened Roanoke slabshell (*Elliptio roanokensis*) and Eastern lampmussel (*Lampsilis radiata*) in the Cape Fear River. In addition, there are records for the federal species of concern and state special concern Bachman's sparrow (*Peucaea aestivalis*), the state threatened bald eagle (*Haliaeetus leucocephalus*), and the state special concern four-toed salamander (*Hemidactylium scutatum*) near the site. The Natural Heritage Program Natural Area – Cape Fear River/McKay Island Floodplain – is located downstream of the site. NCWRC Game Lands are located near the site.

EPA (2010) found landfills that used composite liners effectively reduced the risk of coal combustion products constituents being found in the environment. While disposing of coal combustion product as structural fill is preferred to storing it in surface impoundments, there is the potential for coal combustion product or its constituents to enter streams through aerial deposition, stormwater/erosion runoff, or leaching/infiltration. Additionally, the liners have an estimated safe life of 80 to 100 years if no mechanical stress is induced (Reddy

1999). If either of these occurs, aquatic and terrestrial wildlife resources can be exposed to coal combustion product or its constituents through direct contact with contaminated soil or surface water, or through ingestion of contaminated plants, soil, or aquatic and terrestrial invertebrates. Should the permit be transferred and modified, we offer the following recommendations to minimize the potential for these impacts to aquatic and terrestrial wildlife resources.

1. Generally, where federally listed species are found, we recommend maintaining a minimum 200-foot undisturbed native, forested buffer along perennial streams, and a minimum 100-foot buffer along intermittent streams and wetlands (NCWRC 2002).

2. Calgon Cat-Floc DL has been used previously. Cationic polyelectrolytes are toxic to fish; therefore, measures should be used to prevent spills or direct discharge of Calgon Cat-Floc DL into any natural watercourses.

3. Water quality monitoring should be performed in Shaddox Creek and Gulf Creek downstream of the site. In addition to monitoring for the constituents in Appendix I (i.e., Appendix I to 40 C.F.R. Part 258), aluminum, boron and mercury should be added since these are not included in Appendix I and have the potential to adversely impact aquatic and terrestrial wildlife resources (RTI 2000). If constituents are found in downstream surface waters, then the applicant should notify NCDENR and measures to identify the source and contain the constituents should be implemented immediately.

4. We support post-closure care for at least 30 years. Downstream water quality monitoring for constituents (i.e., Appendix I and aluminum, boron, and mercury) should continue during post-closure; however, at a minimum, monitoring of downstream water quality should be performed if constituents (i.e., Appendix I and aluminum, boron and mercury) are found during groundwater monitoring.

5. Use dust control measures to minimize aerial deposition of coal combustion products into surface waters and terrestrial landscapes. If chemical dust suppressants are used, the product should be non-toxic to plants and animals, and should be applied to minimize environmental impact.

6. Consider using seed mixtures that are beneficial to wildlife (e.g., native warm season grasses) in the final reclamation plan. Additionally, for relatively shallow sediment basin reclamation, we recommend these areas be reclaimed as wetlands where practicable. We refer the applicant to Jason Allen, District Wildlife Biologist at (336) 524-9801 for additional information and ideas on reclamation for wildlife.

Thank you for the opportunity to comment on this permit application. If we can provide further assistance, please contact Gabriela Garrison at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Literature cited

N.C. Wildlife Resource Commission (NCWRC). 2002. *Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality* (August 2002; http://www.ncwildlife.org/Portals/0/Conserving/documents/2002_GuidanceMemorandumforSecondaryandCumulativeImpacts.pdf).

RTI. 2002. Constituent screening for coal combustion wastes. October 2002. (https://www.rti.org/pubs/epa-hq-rcra-2006-0796-04701.pdf)

Reddy, D.V. and B. Butul. 1999. A comprehensive literature review of liner failures and longevity. July 1999 (http://www.epa.gov/region5/waste/clintonlandfill/PDFClintonLFChemicalWaste_USEPAApplication/cl_044.pdf)

U.S. Environmental Protection Agency. 2010. Human and Ecological Risk Assessment of Coal Combustion Wastes. April 2010 (http://earthjustice.org/sites/default/files/library/reports/epa-coal-combustion-waste-risk-assessment.pdf)

cc: Gregory A. Bowles, General Shale Brick, Inc.
Charles Price, Green Meadow, LLC

RRO Comments – Transfer/Modification Application

Brickhaven #2, Tract A (19-25)

(1) While the conceptual sediment basin designs appear acceptable, the numbers used to support the sediment storage and settling efficiency provided by the basins appear problematic. The stage-area data used does not appear to reflect the actual basin layouts. The design data should be checked and adjusted to ensure that surface areas and storage volumes more accurately support the adequacy (and efficiency) of the proposed structures. Also, the construction details for the basins need updating. The reference to perforations in the riser structure must be removed, and ballast stone shown around the riser should be eliminated in that it will prevent proper operation of the flexible riser connection associated with the proposed skimmer. The detail dimensional table should include the anticipated dewatering time for the proposed basins, and in light of the fine-grained soils being dealt with during this project, it is recommended that you consider increasing the time closer to 5 days. In addition, the skimmer arm guides proposed should be eliminated and replaced with an access rope for retrieval and maintenance of the device. Finally, the baffle details should eliminate the spillway throats and should specify appropriate coir materials for effective operation.

(2) A specific construction sequence and more detailed sediment control measures are required for construction of basin #7 in the footprint of the existing settling ponds. Dewatering into silt bags or other appropriate measures must be addressed as well construction of the multiple riser/barrel structures.

(3) Silt fences should not be used on downhill grades where they will tend to divert and/or concentrate runoff. In addition, where one row of silt fence will not be appropriate, neither will two rows of silt fence. Please substitute appropriately designed diversion swales/berms directing runoff to basins or traps, as appropriate, and use silt fence below basin construction areas and along roadway construction where the runoff will be relatively sheet flow. The reinforced silt fence outlets should be specified wherever minor concentration of runoff will occur along the silt fence alignment.

(4) A more specific construction sequence and additional measures will be needed where the western access road is to be built per sheet 02C-02. The proposed culvert inlet protection is not appropriate for such a double culvert installation. Further, a cofferdam/pump-around arrangement appears necessary to accommodate the proposed culvert installation. Appropriate diversion swales and traps appear necessary west of the crossing.

(5) The protective linings for perimeter stormwater channels should be more specifically identified on the drawings. Where riprap slope drain outlet protection is proposed into grassed channel sections, the riprap should be extended to armor the entire transition crossection. Construction details should be provided for proposed concrete sections.

(6) The proposed covering for construction entrances should be extended to at least 100 feet in length.

(7) All NCDOT class 1 or B riprap linings or aprons must be placed at least 18" thick over a suitable geotextile fabric.

December 10, 2014

Ms. Judith A. Wehner
Assistant State Mining Specialist
Division of Energy Mineral and Land Resources
Land Quality Section
N.C. Dept. of Environment and Natural Resources
512 N. Salisbury Street
Raleigh, NC 27699

Re: Brickhaven Mine No. 2, Tract A, Permit No. 19-25

Dear Ms. Wehner,

On behalf of Green Meadow, LLC, we are requesting a 10 year renewal for the above referenced mine permit. Attached is a check for $1,000.00 as required.

Please contact me should you have any questions

Sincerely,
HDR Engineering, Inc. of the Carolinas

Joe Readling, PE
Vice President

cc: Norman Divers, Charah

HDR ENGINEERING, INC

8404 Indian Hills Drive
Omaha, Nebraska
68114-4049

usbank.

93-455/929

Havre, MT 59604-8002

1338845

Date 12/09/2014 **Pay Amount** **$1,000.00****

ONE THOUSAND AND XX / 100 DOLLAR

Pay To The Order

NC DENR
LAND QUALITY SECTION
1612 MAIL SERVICE CTR
RALEIGH, NC 27699-1612

Alan J Olson

⑈1338845⑈ ⑆092904554⑆ 15008064668 3⑈

Check Date: 12/09/2014 **Check No.** 1338845

Invoice Number	Invoice Date	Voucher ID	Comment	Paid Amount
BRICKHAVEN NO2-10YR	12/09/2014	01904814		1,000.00

Vendor Number	Name			
0000110878	NC DENR			

Check Number	Date		Total Amount	Discounts Taken	Total Paid Amount
1338845	12/09/2014		$1,000.00	$0.00	$1,000.00

AP01

Calculations

Brickhaven No.2 Mine Tract "A"

Charah, Inc.

Moncure, NC

November 2014
Revised December 2014

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Table of Contents

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A

Stability

Slope Stability Analysis

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HDR Computation

Project:	Charah Brickhaven No.2 Mine	Computed By:	TMY	Date:	11/6/2014
Subject:	Permit Application	Checked By:	K. Perera	Date:	11/7/2014
Task:	Slope Stability Analyses	Sheet:	1	Of:	3

Objective:

Evaluate the slope stability of the proposed coal ash structural fill. Evaluate both global stability of the foundation soils, the stability of the structural fill ash slope, and the sliding block stability of the ash along the bottom liner system using PCSTABL 5M and the STEDwin editor (Ref. 3).

References:

1. Naval Facilities Engineering Command (1986). Design Manual 7.01 - Soil Mechanics.
2. Bowles, J.E. (1984). Physical and Geotechnical Properties of Soils. McGraw-Hill.
3. Van Aller, H.W. (1999 - 2013). STEDwin 2.88 (32 bit), The Smart Editor for PCSTABL 5M. Annapolis Engineering Software.
4. Naval Facitities Engineering Command (1982). Design Manual 7.02 - Foundations and Earth Structures.

5. Koerner, G.R. and D. Narejo (2005). Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces. GRI Report #30.

Steps:

1. Estimate subsurface conditions beneath the structural fill using soil boring logs provided by Buxton Environmental, Inc. (see Attachment A). Based on the boring logs, the typical soil profile for the in unmined areas of the site consists of approximately 5' soil horizon consisting of medium to very stiff silty and sandy clay soils underlain by approximately 10' to 20' of stiff to very stiff residuum. Very hard partially weathered rock (PWR) underlies the residuum. In areas that have been mined, the soil horizon has typically been removed leaving residuum at the surface. The estimated intervals of the soil horizon, residuum, and PWR are shown in Attachment A.

2. Estimate the coal ash parameters for input into PCSTABL 5M using physical characterization testing information provided by Charah for samples obtained at the Riverbend Steam Station. This testing information, performed by Geotrack Technologies, Inc., is provided in Attachment B. An estimate of the compacted unit weight (γ) of the ash was obtained based on the results of a standard Proctor test assuming the material would be placed at maximum dry density and optimum moisture content. Total and effective stress strength properties of the coal ash were obtained from the Triaxial Shear Test reports provided in Attachment B. The total stress parameters are applicable for undrained conditions when loading occurs over a relatively short time which leads to the development of excess pore water pressures within the ash. The effective stress parameters are applicable for drained conditions when loading occurs over a sufficient amount of time to allow excess pore water pressures to dissipate. Since typical hydraulic conductivity values for fly ash generally range between 1x10-4 to 1x10-5 cm/sec, it is not clear whether undrained or drained conditions will develop within the ash therefore both sets of parameters were analyzed. The assumed values for unit weight (γ), friction angle (φ), and cohesion (c) for the ash are provided below:

Compacted Ash (Total Stress): γ = 83.8 pcf, φ = 8˚ , c = 4,300 psf
Compacted Ash (Effective Stress): γ = 83.8 pcf, φ = 22˚ , c = 2,600 psf

3. Estimate foundation soil parameters for input into PCSTABL 5M. Use Ref. 1 to correlate γ based with soil type (see Attachment C). From information provided in soil borings (Attachment A), which includes geotechnical laboratory classification data, use Attachments D and E to correlate total and effective stress parameters for the soil horizon and residuum, respectively (see Ref. 2). Note that in Attachment D, c = 1/2 q_u where q_u is the unconfined compressive strength of the soil. Since the PWR at the site is typically classified as "very hard" with blowcounts generally in excess of 50/6in and often contains rock fragments, it is assumed the material behaves as a very dense sand (see Attachment D). Since the soil horizon and residuum soils are generally fine grained at the site, it is not clear whether undrained or drained conditions will develop within the soils, therefore both sets of parameters were analyzed. The assumed values for unit weight (γ), friction angle (φ), and cohesion (c) for the foundation soils are provided below:

Soil Horizon (Total Stress): γ = 120 pcf, φ =0˚ , c = 470 psf
Soil Horizon (Effective Stress): γ = 120 pcf, φ = 31˚ , c = 0
Residuum (Total Stress): γ = 130 pcf, φ =0˚ , c = 1,045 psf
Residuum (Effective Stress): γ = 130 pcf, φ = 32˚ , c = 0 psf
Partially Weathered Rock (PWR): γ = 135 pcf, φ = 35

4. Estimate soil parameters for the compacted soil berm that will be constructed along the perimeter of the structural fill and to fill low areas to achieve basegrades. Assume on site soils consisting of predominantly clayey and silt soils will be used. Use Attachment F (Ref. 1) to obtain obtain estimated strength parameters and Attachment C to estimate γ as shown below:

Compacted Clayey Fill: γ = 125 pcf, φ = 28˚ , c = 1,800 psf

5. Estimate soil parameters for the final cover soils. Since a variety of soils may be used for final cover and considering that a high degree of

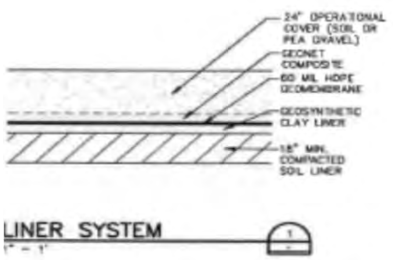
HDR Computation

Project:	Charah Brickhaven No.2 Mine	Computed By:	TMY	Date:	11/6/2014
Subject:	Permit Application	Checked By:	K. Perera	Date:	11/7/2014
Task:	Slope Stability Analyses	Sheet:	2	Of:	3

compaction of the final cover probably can not be achieved without the risk of damaging the underlying geomembrane, conservatively assume the following parameters:

Final Cover soils: γ = 120 pcf, φ = 30˚ , c = 0 psf

6. Determine critical liner interface for sliding block analyses. A detail of the proposed liner system is provided below. Determine typical interface strength parameters for each interface based on Attachment G (Ref. 5) for each interface as shown below. Use peak parameters which are appropriate to use before failure initiates. Based on this information, the critical (i.e. lowest strength) interface is between the textured 60 mil HDPE geomembrane and the saturated cohesive soil. Therefore, use these parameters for the critical interface.



Geocomposite/Granular Soil Interface: φ = 33˚ , c = 0
Critical → Geocomposite/Textured HDPE Interface: φ = 26˚ , c = 0
Textured HDPE/Saturated Reinforced GCL: φ = 23˚ , c = 167 psf
Saturated Reinforced GCL/Saturated Cohesive Soil: φ = 29˚ , c = 0

7. Determine most critical cross-section for stability analysis. Factors to consider include proposed ash height, liner slope, foundation conditions, perimeter berm height, and water table location. Using this criteria, two potential critical stability sections were selected for analysis. Section A is located on the west perimeter berm at a topographic low. Section B is located on the east perimeter berm and extends through the currently flooded pit at a location where the perimeter berm will be constructed across the pit. The locations of these sections are shown superimposed on the Basegrade Plan (Attachment H), the Proposed Final Closure Plan (Attachment I), and a groundwater contour map (Attachment J). These sections represent areas with the greatest depth of waste that will be placed resulting in the greatest amount of driving forces leading to potential failure, areas where the perimeter berm will be constructed above existing grade resulting in less buttressing effect at the toe of the slope, and areas with the greatest liner slopes resulting in greater potential for liner interface instability.

8. Determine the peak ground accelleration for the site for use in the seismic stability analyses. From Attachment K (Ref. 6), the estimated peak ground acceleration for the site with a 2% probability of exceedance in 50 years (equivalent to 10% probability of exceedance in 250 years) is 0.09g. This values was entered as a horizontal pseudo-static coefficient in the PCSTABL 5M seismic analyses.

9. Using the information developed in Steps 1 through 7, input the data into PCSTABL 5M using the STEDwin editor (Ref. 3). Evaluate the the global stability of the foundation soils beneath the structural fill as well as the stability of the ash slope and sliding block failure along the bottom liner system.

Results/Conclusions

Plots showing the output results from the PCSTABL 5M analyses for the global, ash slope, and sliding block stability under both static and seismic conditions are attached to this calculation for Section A and Section B. The minimum factors of safety are summarized in the table below. The most critical analysis was for the Section A global failure under total stress conditions with factors of safety of 4.13 and 2.63 for static and seismic conditions, respectively. The generally accepted minimum static and seismic factors of safety for landfill stability are 1.5 and 1.0, respectively. Since the calculated factors of safety exceed the minimum acceptable, the proposed structural fill is adequately stable.

HDR Computation

Project:	Charah Brickhaven No.2 Mine	Computed By:	TMY	Date:	11/6/2014
Subject:	Permit Application	Checked By:	K. Perera	Date:	11/7/2014
Task:	Slope Stability Analyses	Sheet:	3	Of:	3

Since the interface shear strength parameters for the liner system components can vary significantly based on soil and product properties, it is helpful to determine the minimum φ value required for the interfaces to achieve an adequate factor of safety. The last two plots show the minimum φ required to achieve factors of safety of 1.5 and 1.0 for static and seismic analyses, respectively. The plots show that along the critical cross section, very little friction is required along the bottom liner interfaces due to the buttressing effect of the perimeter berm. Due to variations of slope along the structural fill liner system and temporary loading conditions during filling, however, it is recommended that a minimum bottom liner interface φ of 26 be required. This requirement should be confirmed by project specific interface shear strength testing.

Analysis	**Static FS**	**Seismic FS**	
SECTION A			
Global/Static/Total Stress	4.13	2.63	←Critical Analysis
Global/Static/Effective Stress	4.56	2.87	
Ash Slope/Static/Total Stress	6.47	4.52	
Ash Slope/Static/Effective Stress	6.84	4.72	
Sliding Block/Static/Total Stress	6.96	4.68	
Sliding Block/Static/Effective Stress	5.75	3.98	
SECTION B			
Global/Static/Total Stress	5.71	3.54	
Global/Static/Effective Stress	5.39	3.37	
Ash Slope/Static/Total Stress	8.06	5.26	
Ash Slope/Static/Effective Stress	7.13	4.94	
Sliding Block/Static/Total Stress	5.71	4.00	
Sliding Block/Static/Effective Stress	4.93	3.43	

Minimum φ Required for Static FS = 1.5	0˚
Minimum φ Required for Seismic FS = 1.0	0˚

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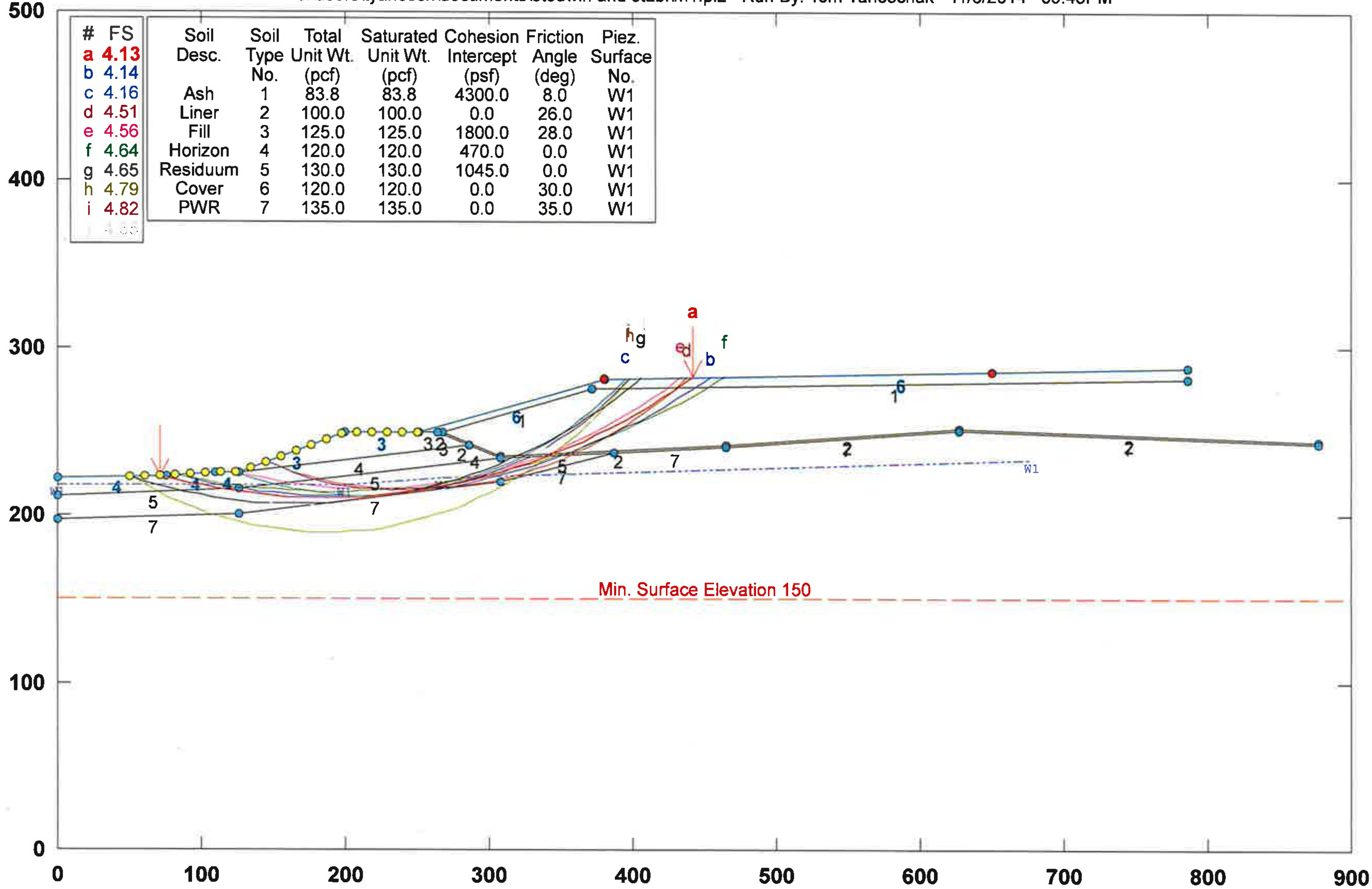
SECTION A

Moncure Mine Structural Fill - Section AGlobal - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m1.pl2 Run By: Tom Yanoschak 11/5/2014 09:43PM

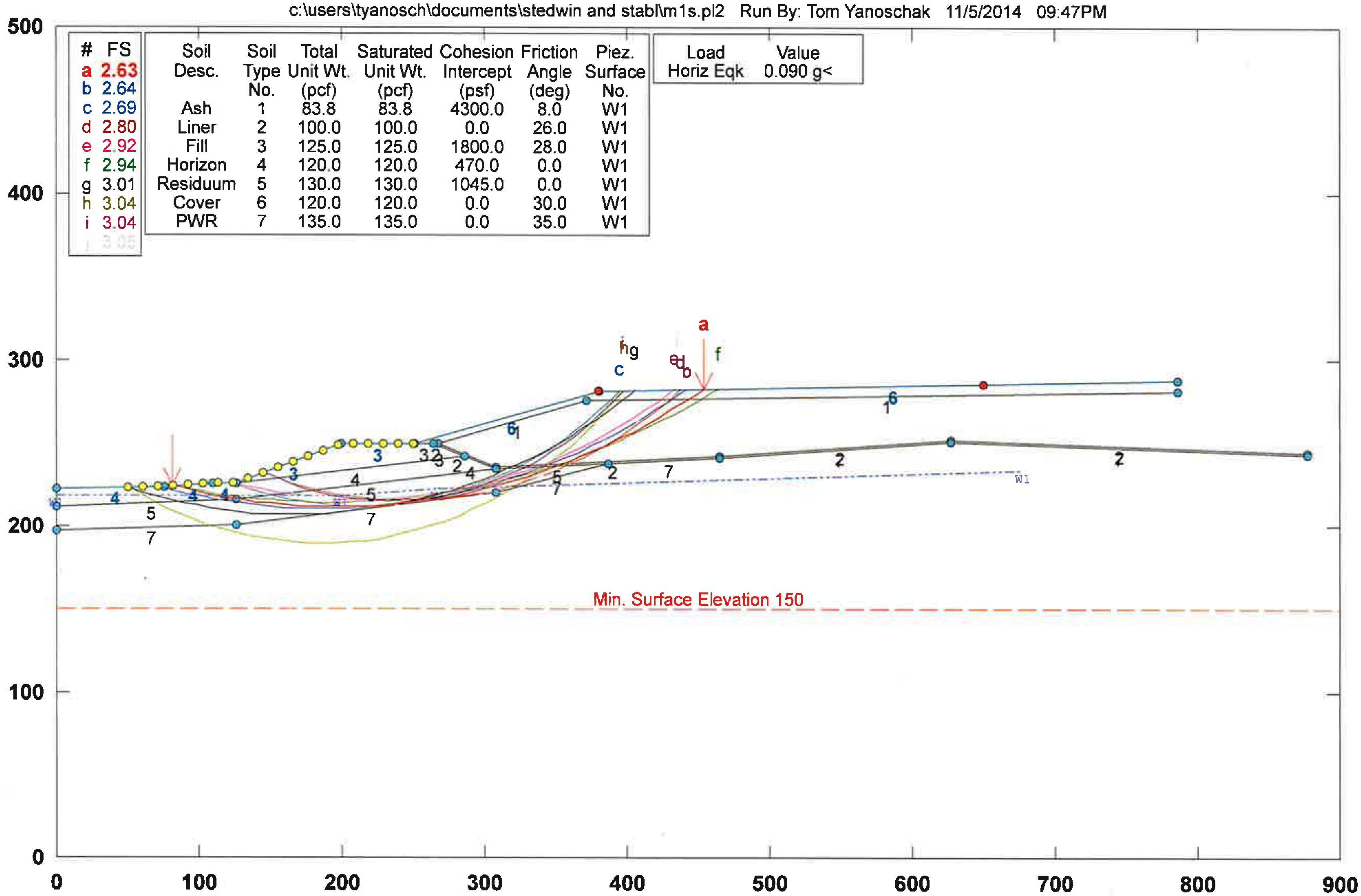


PCSTABL5M/si FSmin=4.13

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AGlobal - Seismic (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m1s.pl2 Run By: Tom Yanoschak 11/5/2014 09:47PM

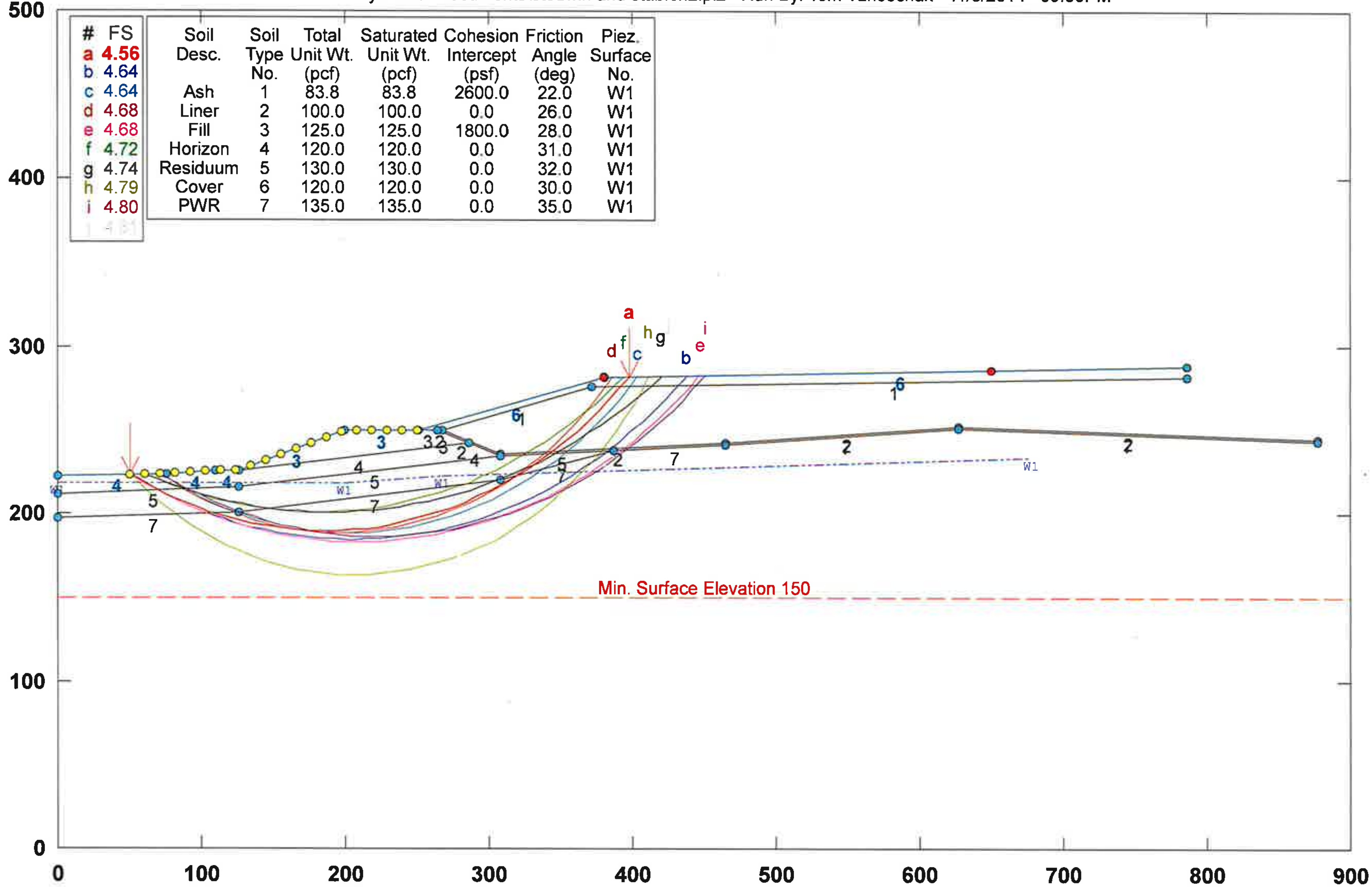


PCSTABL5M/si FSmin=2.63

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AGlobal - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m2.pl2 Run By: Tom Yanoschak 11/5/2014 09:50PM

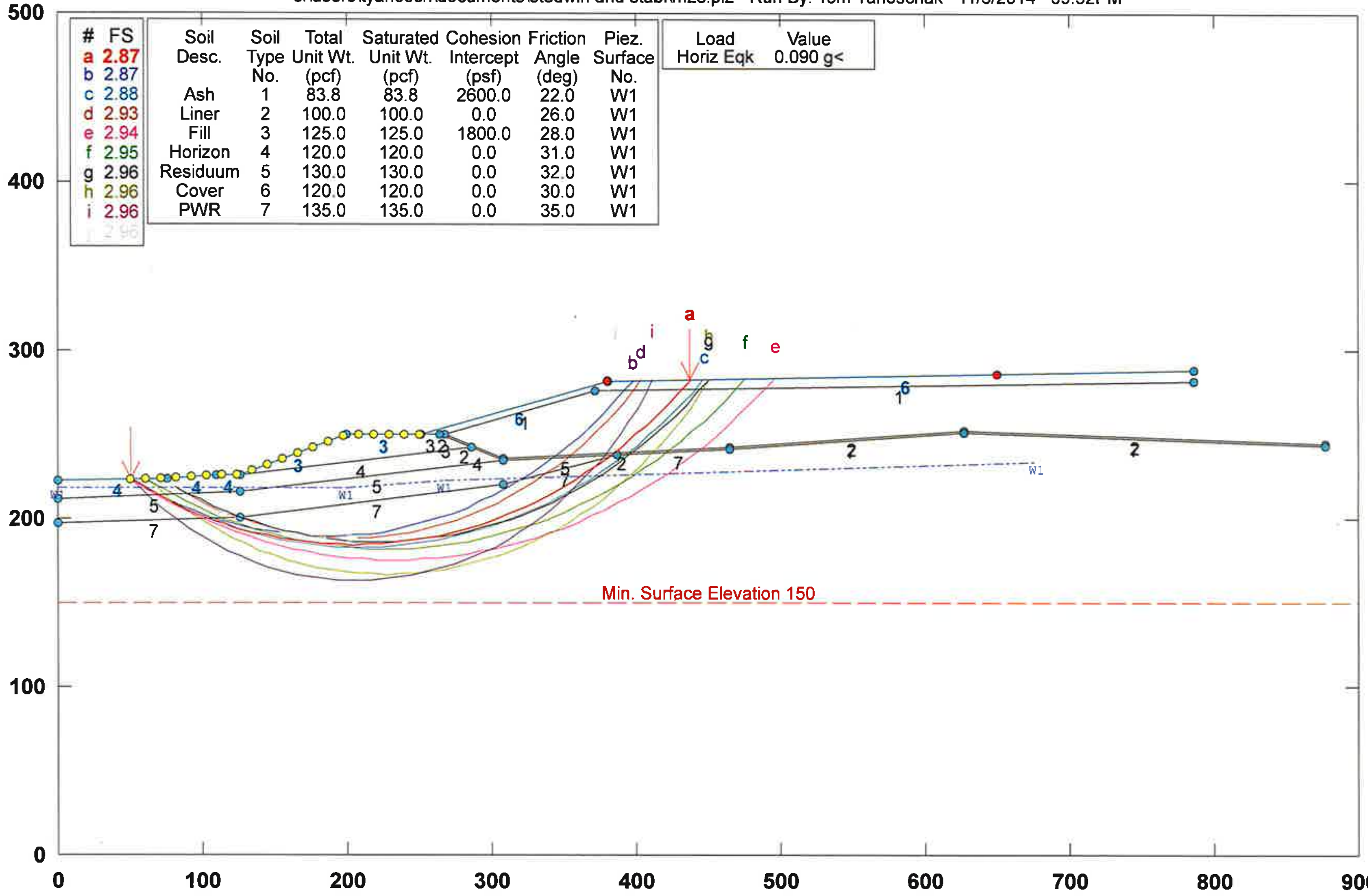


PCSTABL5M/si FSmin=4.56

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AGlobal - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m2s.pl2 Run By: Tom Yanoschak 11/5/2014 09:52PM

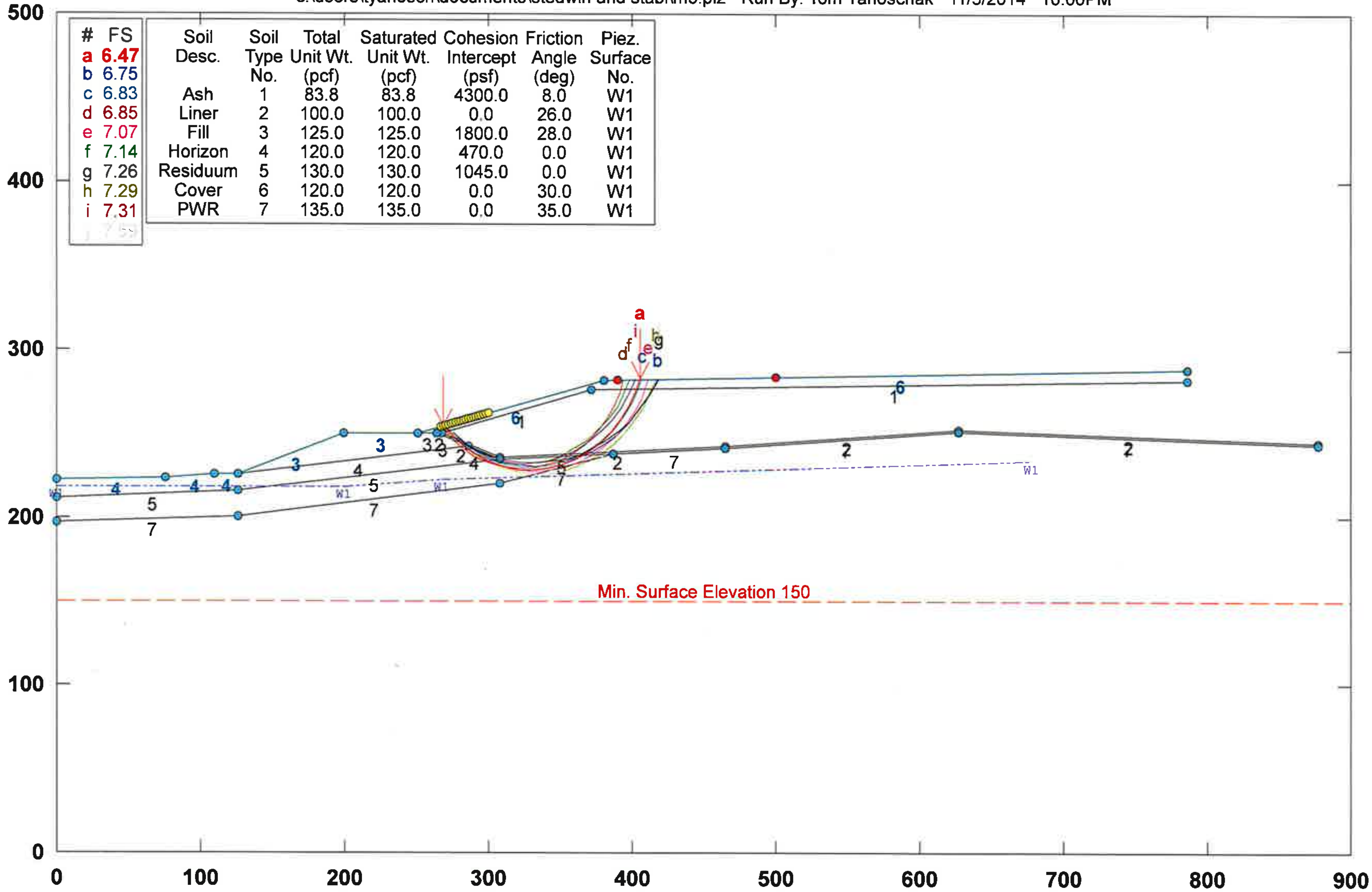


PCSTABL5M/si FSmin=2.87

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AAsh Slope - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m3.pl2 Run By: Tom Yanoschak 11/5/2014 10:00PM

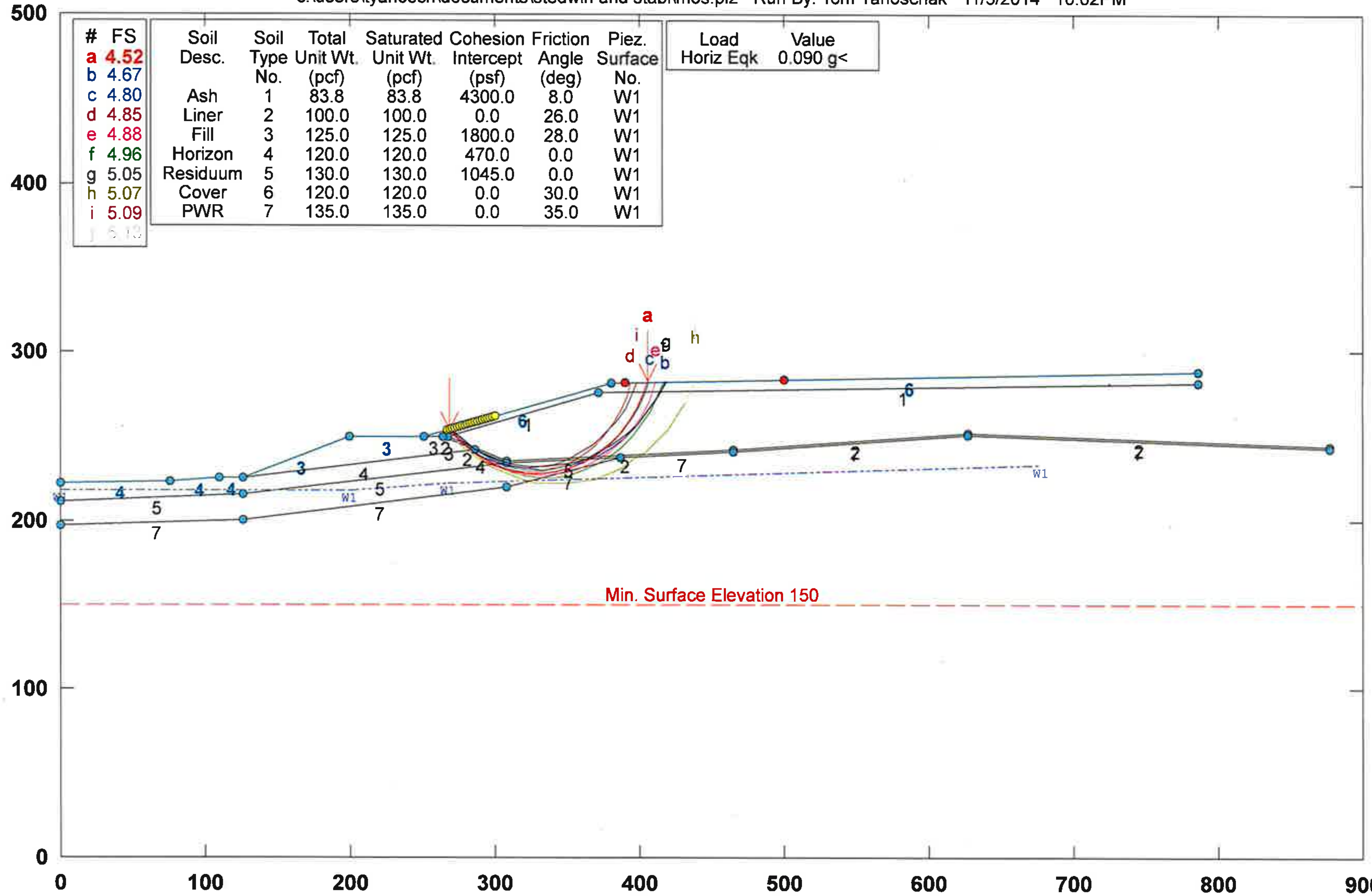


PCSTABL5M/si FSmin=6.47

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AAsh Slope - Seismic (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m3s.pl2 Run By: Tom Yanoschak 11/5/2014 10:02PM

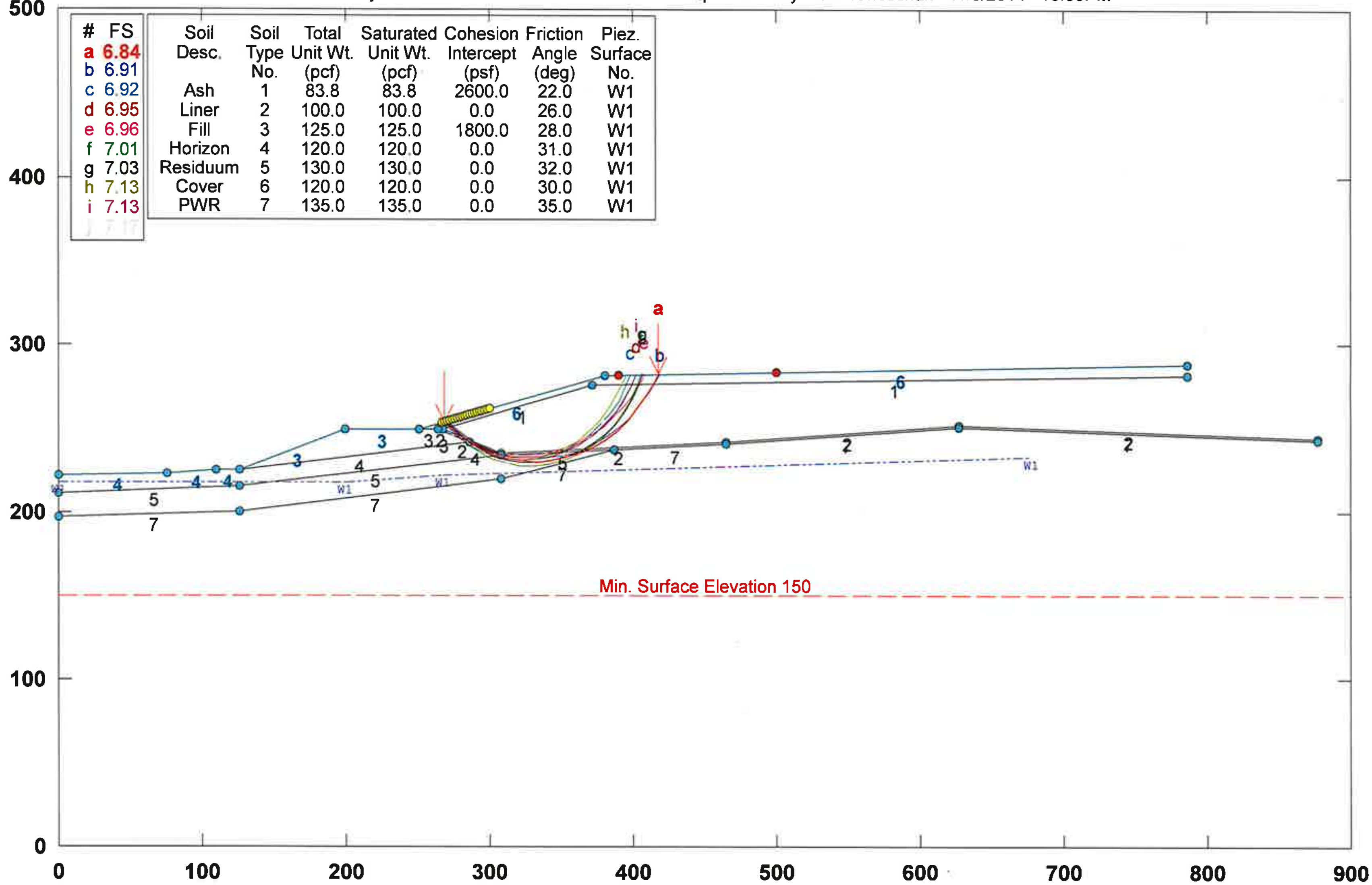


PCSTABL5M/si FSmin=4.52

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AAsh Slope - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m4.pl2   Run By: Tom Yanoschak   11/5/2014   10:05PM



#	FS
a	6.84
b	6.91
c	6.92
d	6.95
e	6.96
f	7.01
g	7.03
h	7.13
i	7.13

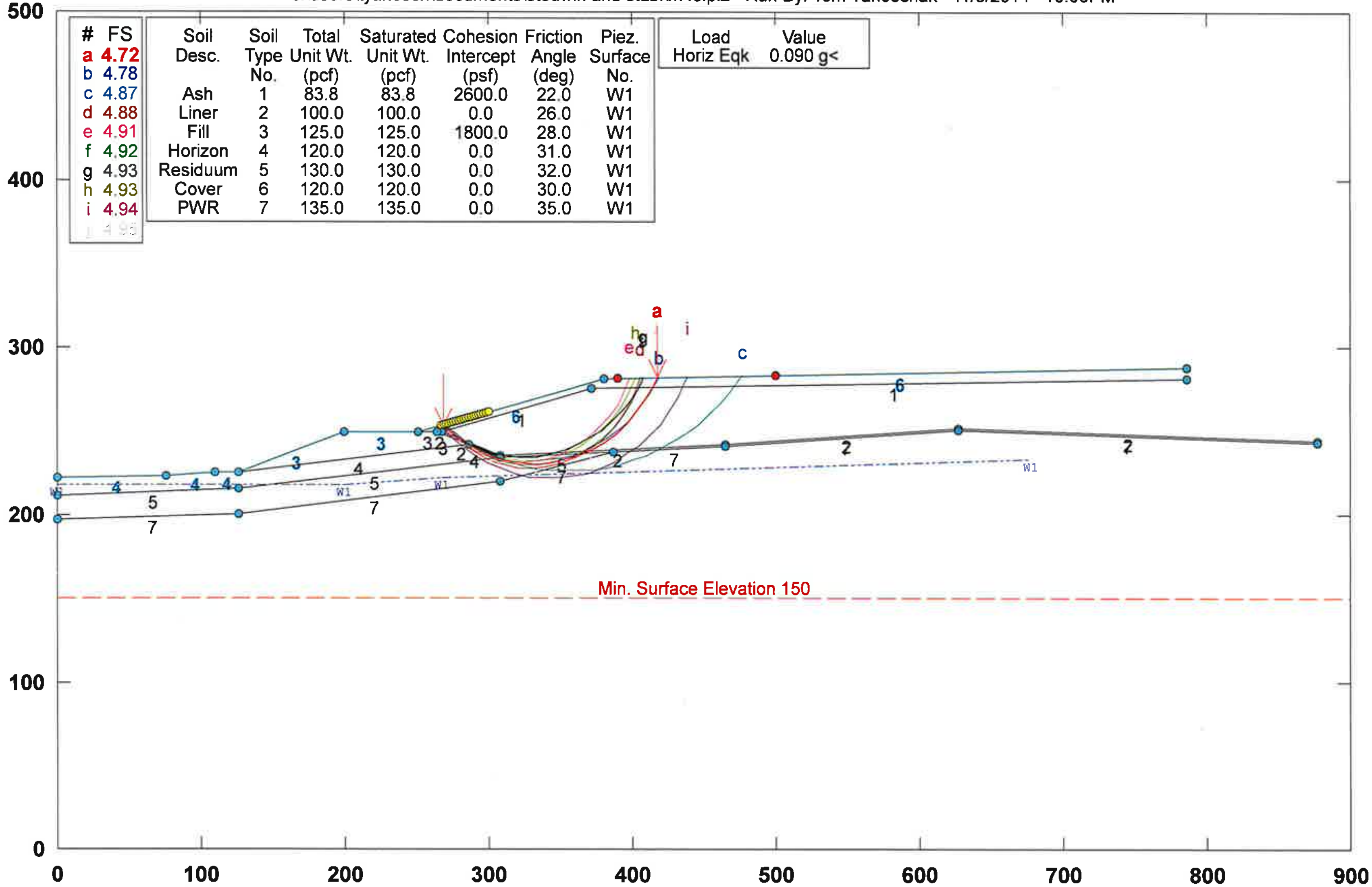
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	2600.0	22.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	0.0	31.0	W1
Residuum	5	130.0	130.0	0.0	32.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

PCSTABL5M/si FSmin=6.84

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section AAsh Slope - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m4s.pl2 Run By: Tom Yanoschak 11/5/2014 10:06PM

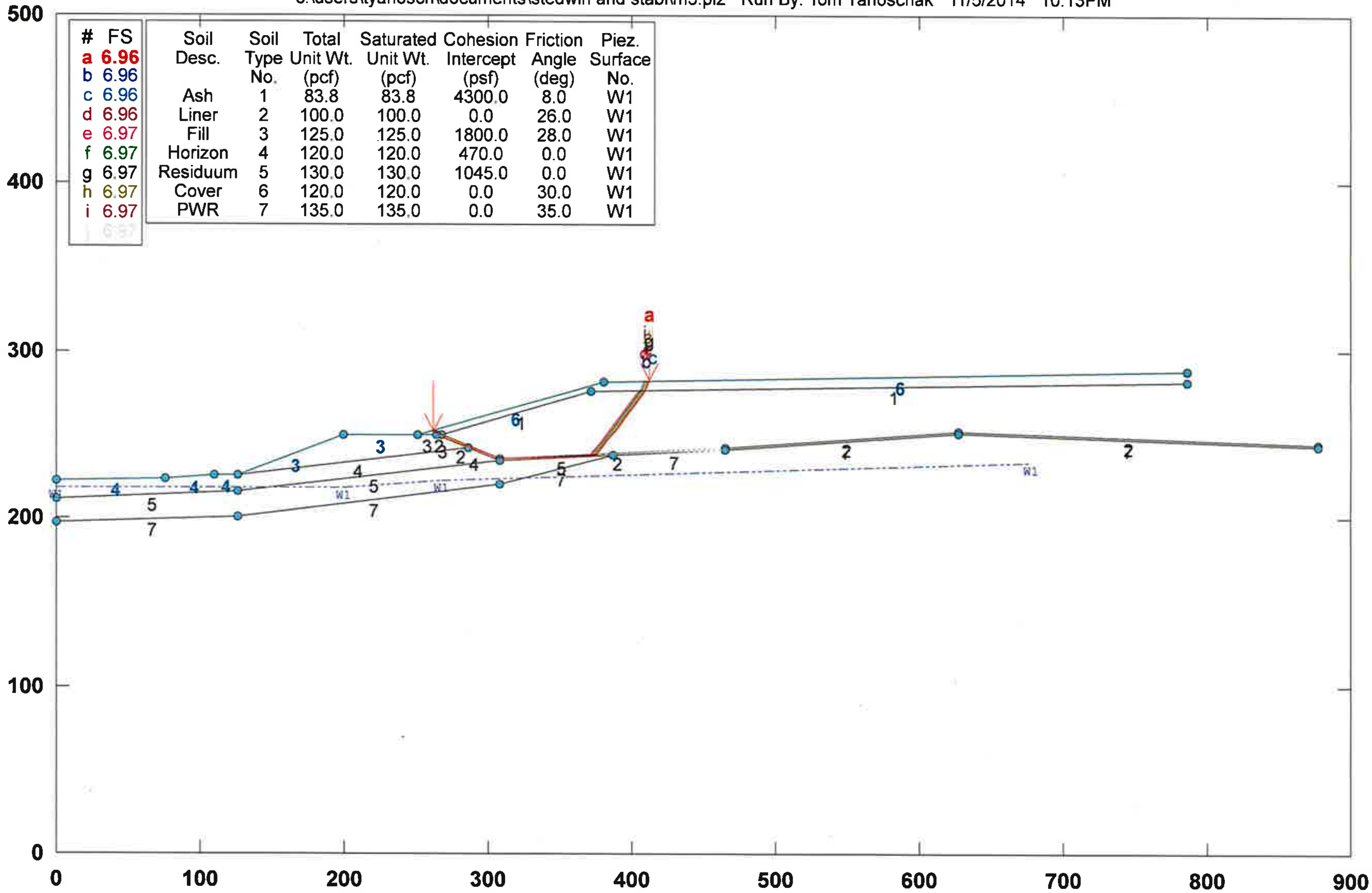


PCSTABL5M/si FSmin=4.72

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section ABlock - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m5.pl2 Run By: Tom Yanoschak 11/5/2014 10:13PM



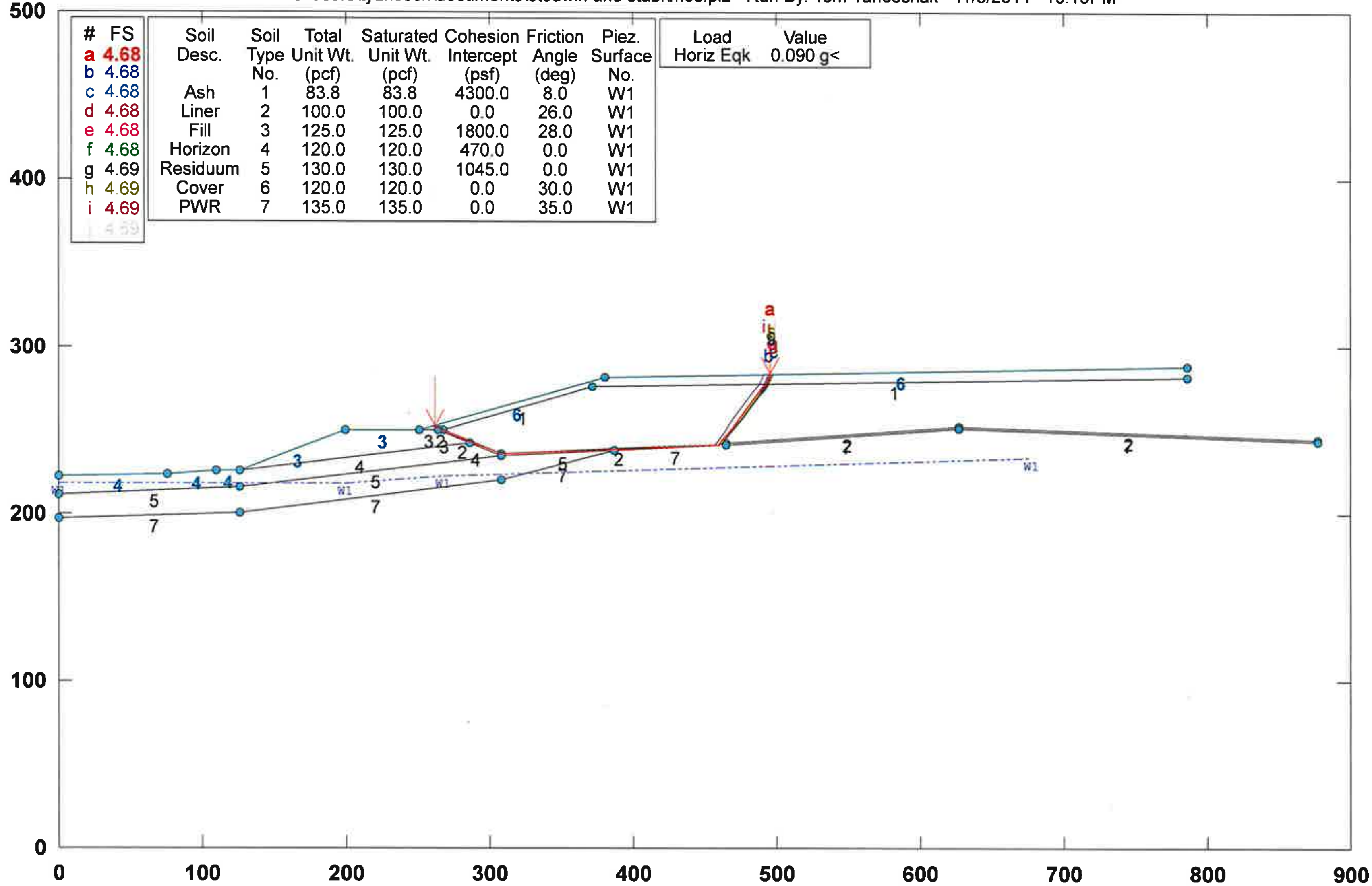
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	4300.0	8.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	470.0	0.0	W1
Residuum	5	130.0	130.0	1045.0	0.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

PCSTABL5M/si FSmin=6.96

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section ABlock - Seismic (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m5s.pl2 Run By: Tom Yanoschak 11/5/2014 10:15PM

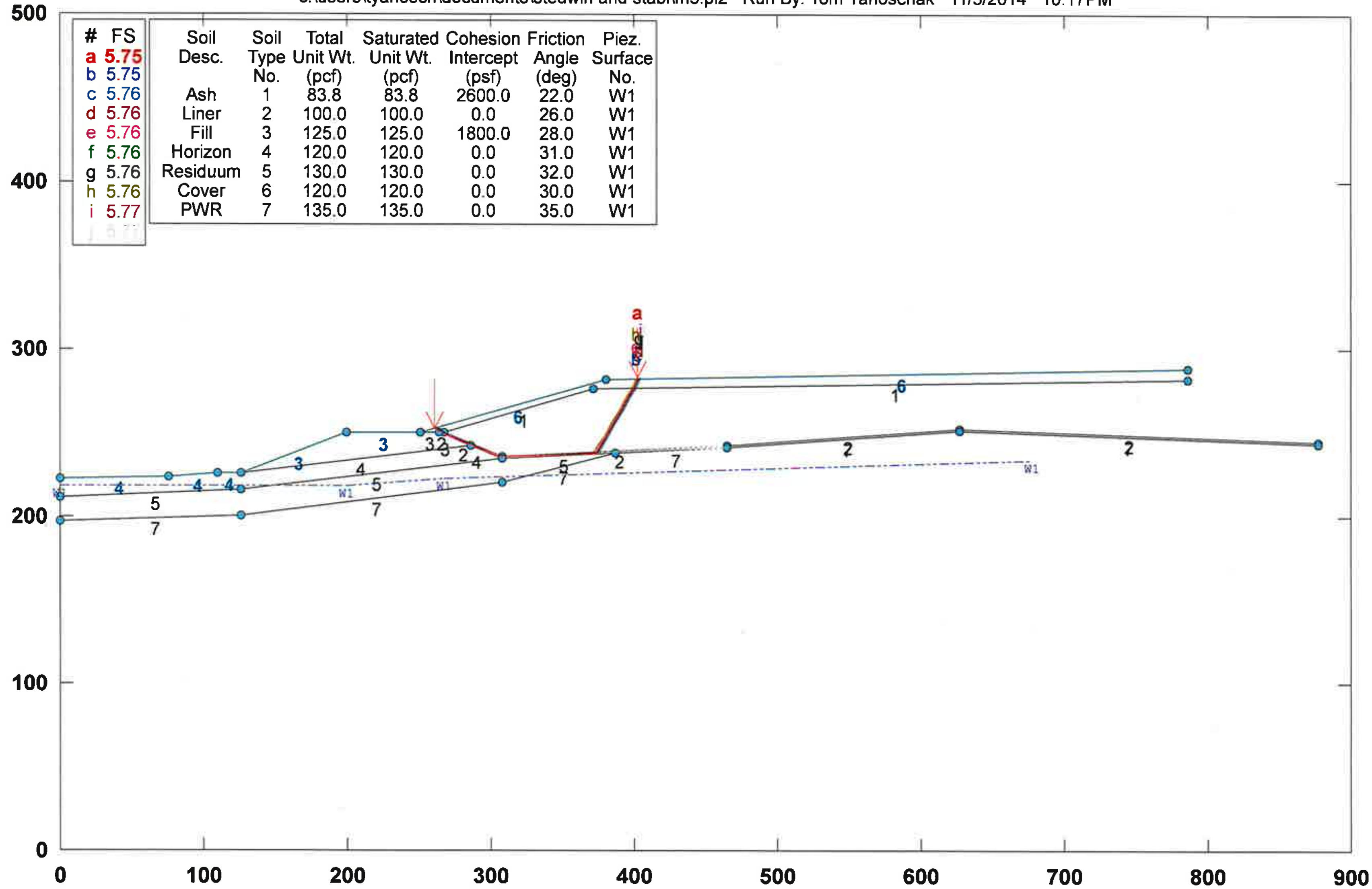


PCSTABL5M/si FSmin=4.68

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section ABlock - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m5.pl2 Run By: Tom Yanoschak 11/5/2014 10:17PM

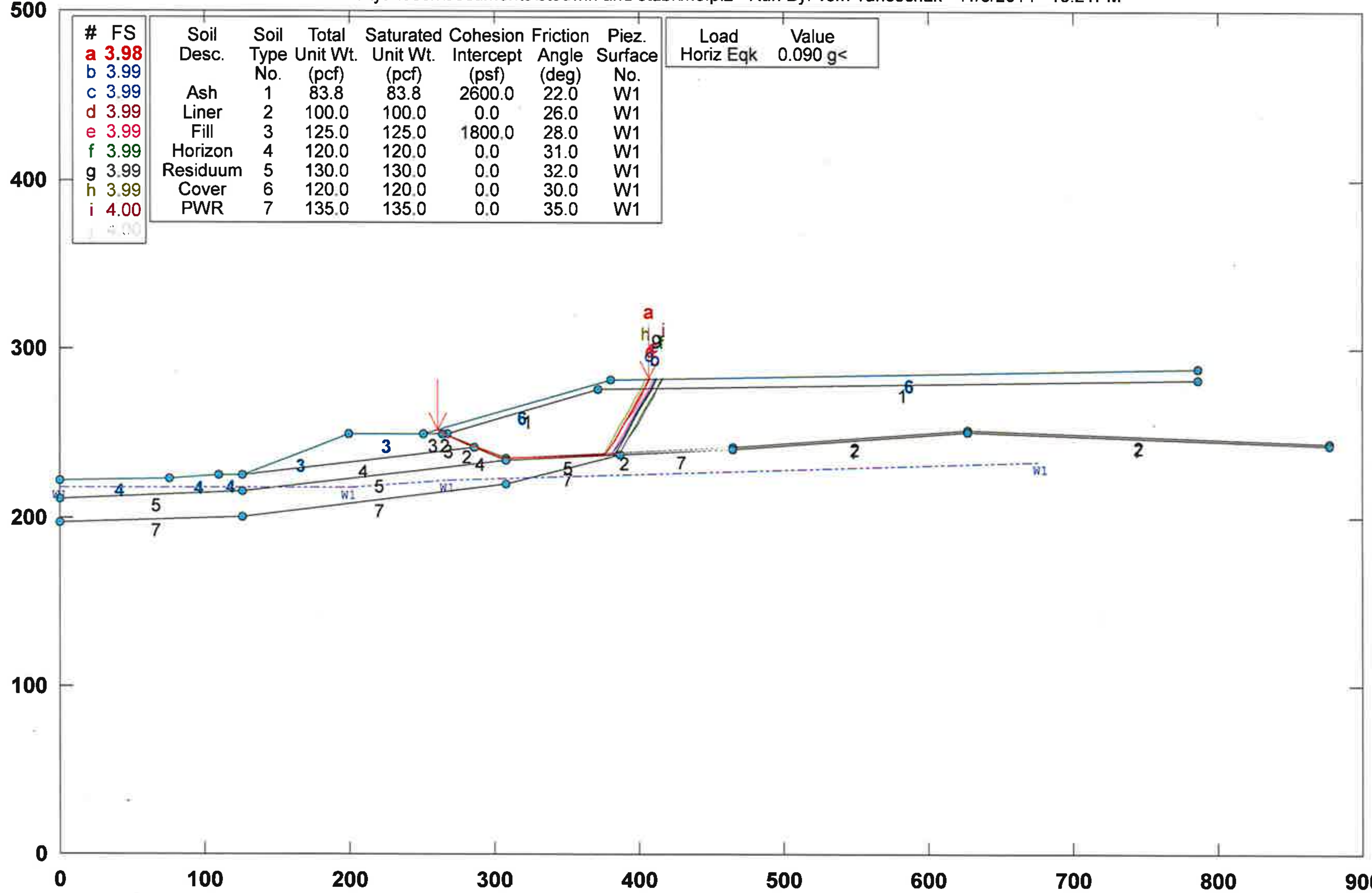


PCSTABL5M/si FSmin=5.75

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section ABlock - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m6.pl2 Run By: Tom Yanoschak 11/5/2014 10:21PM



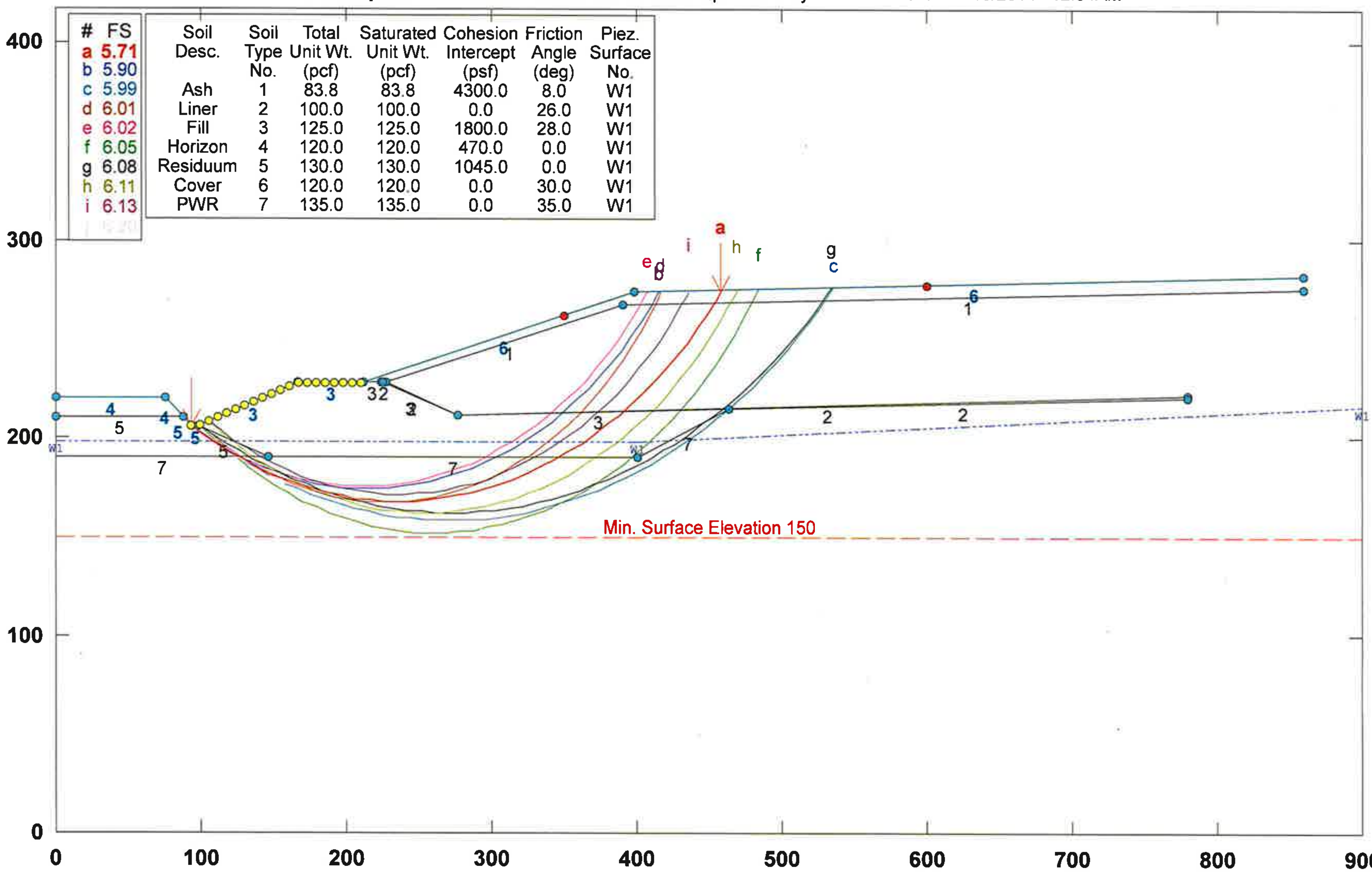
PCSTABL5M/si FSmin=3.98

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

SECTION B

Moncure Mine Structural Fill - Section BGlobal - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m1a.pl2 Run By: Tom Yanoschak 11/6/2014 12:04AM

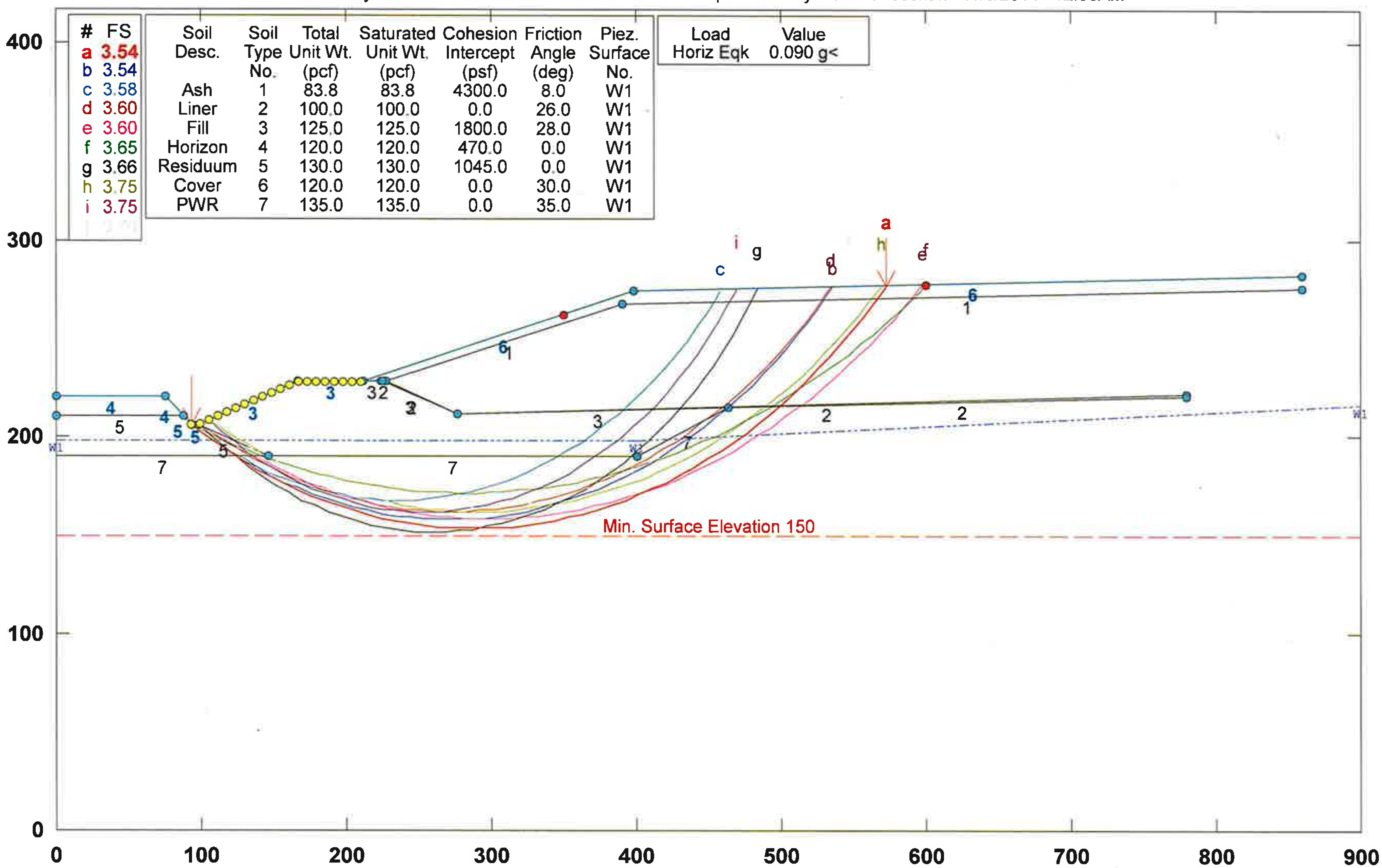


PCSTABL5M/si FSmin=5.71

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BGlobal - Seismic (Total Stress)

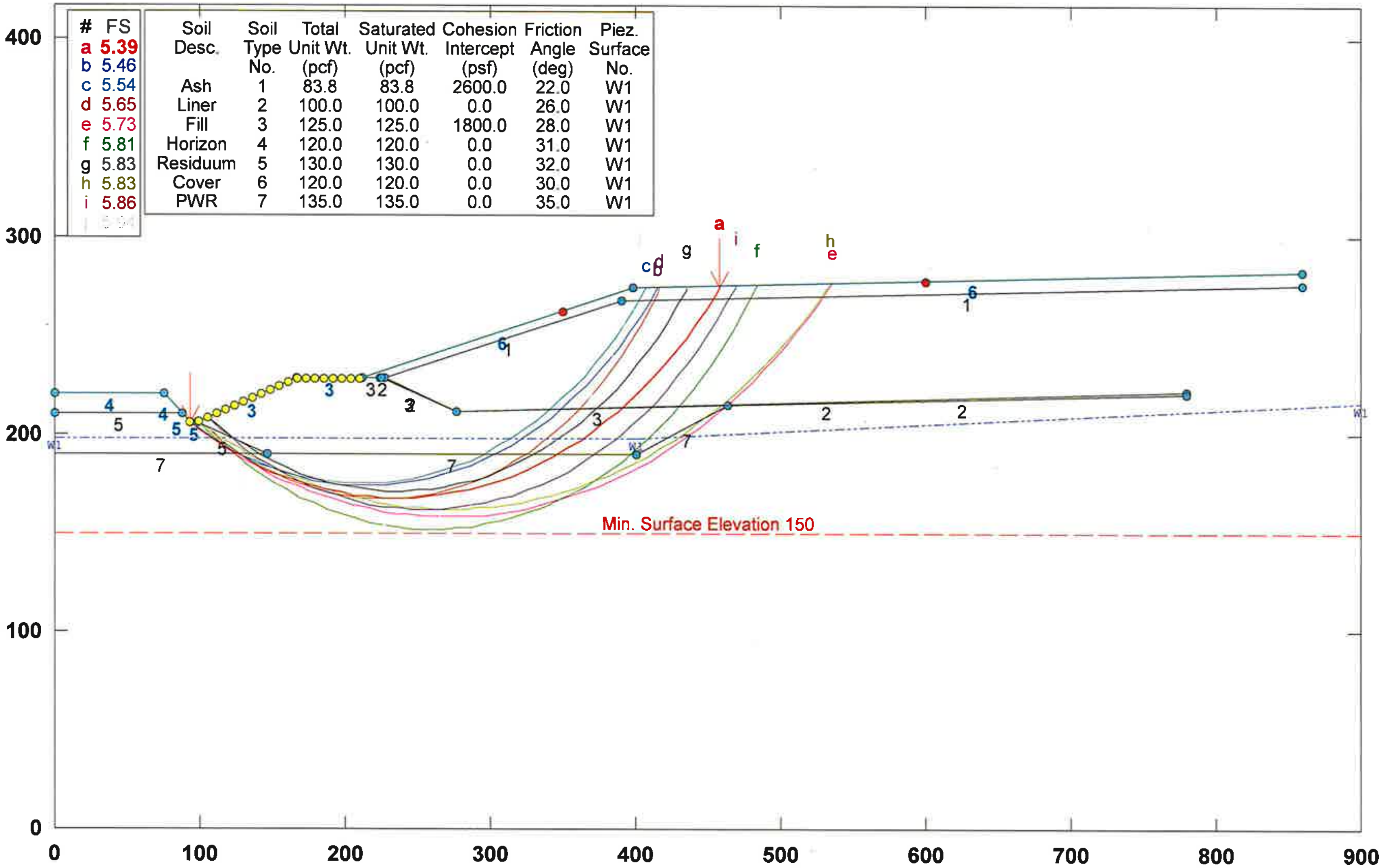
c:\users\tyanosch\documents\stedwin and stabl\m1as.pl2 Run By: Tom Yanoschak 11/6/2014 12:06AM



PCSTABL5M/si FSmin=3.54
Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BGlobal - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m2a.pl2   Run By: Tom Yanoschak   11/6/2014   12:09AM

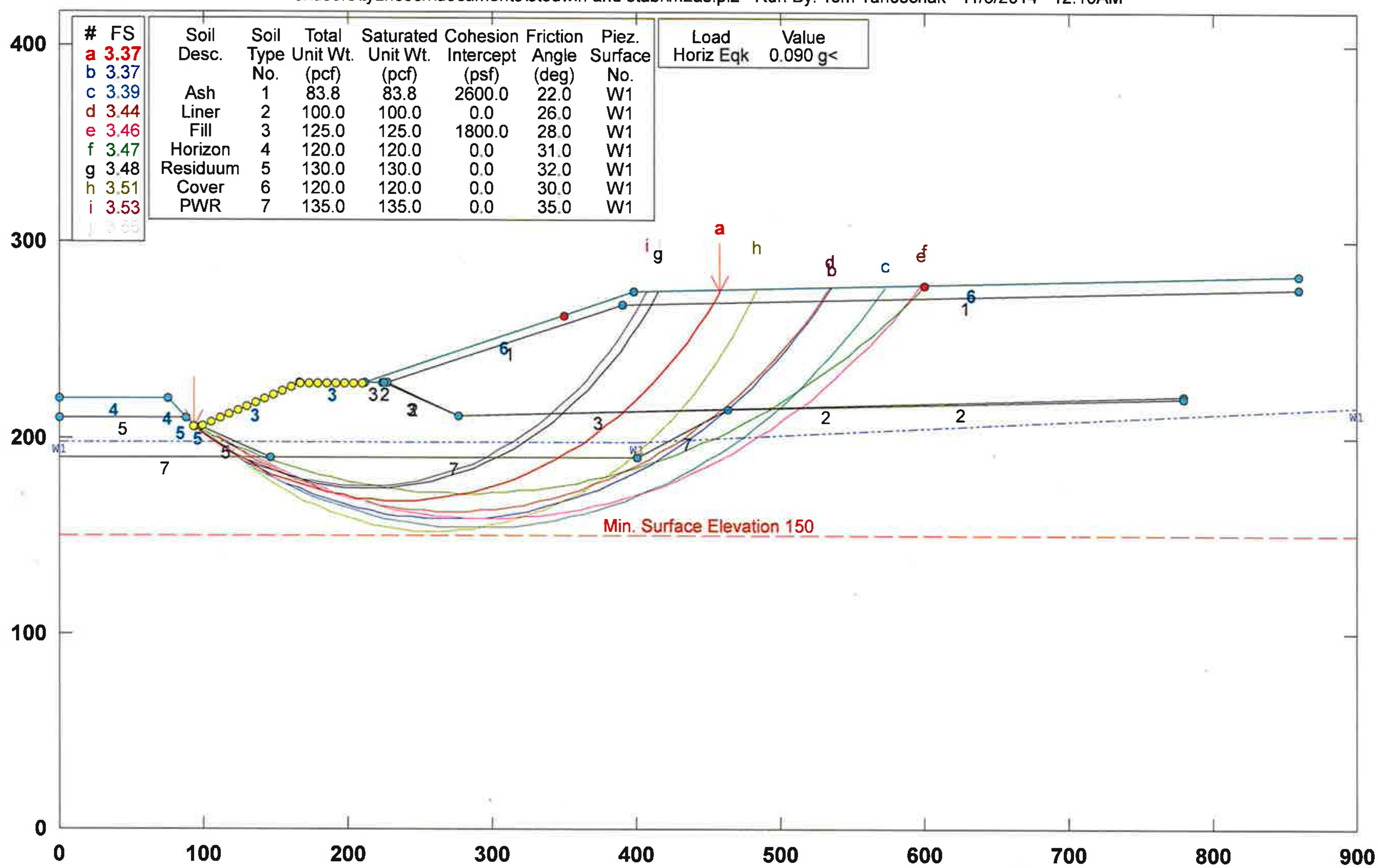


PCSTABL5M/si FSmin=5.39

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BGlobal - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m2as.pl2 Run By: Tom Yanoschak 11/6/2014 12:10AM

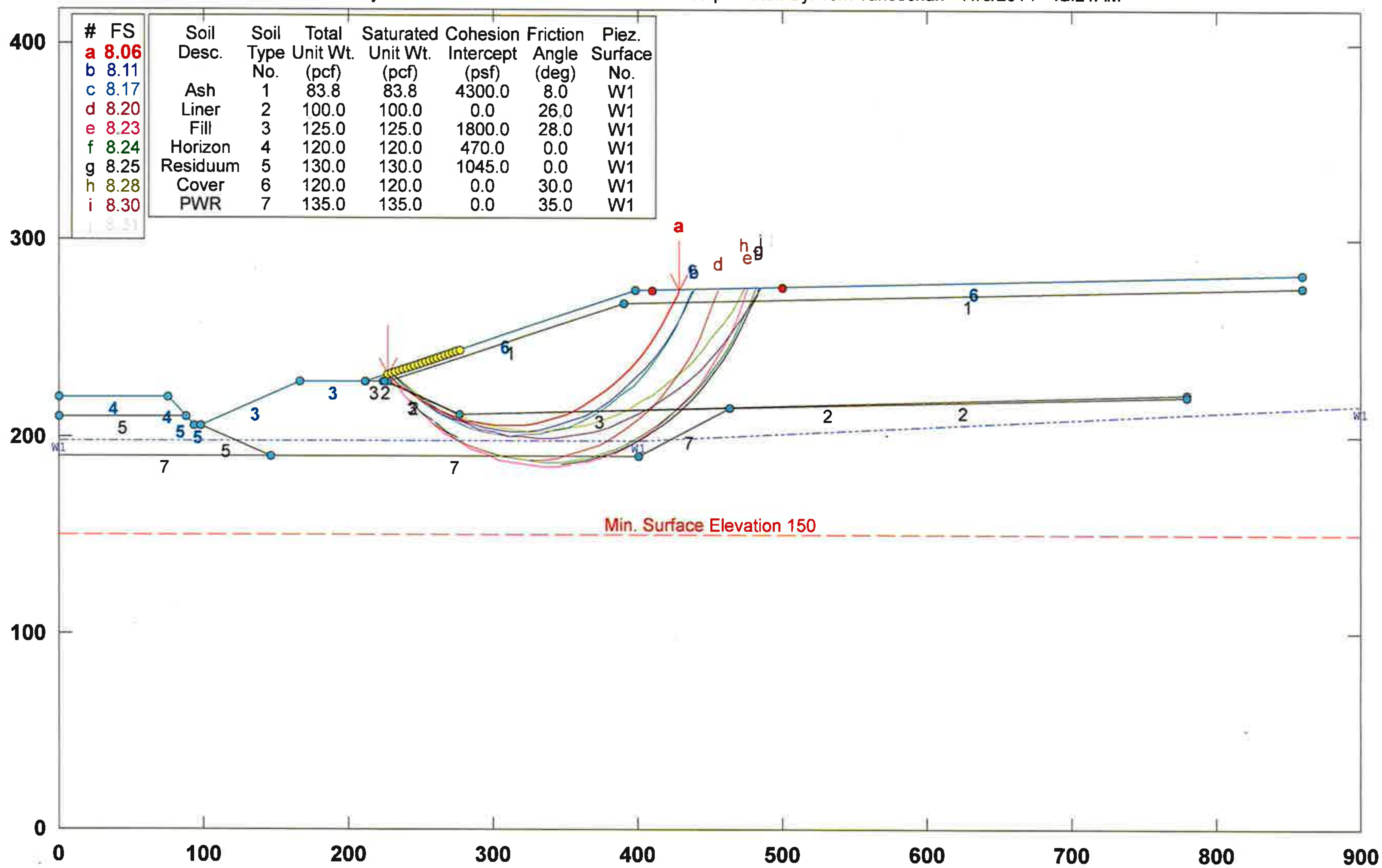


PCSTABL5M/si FSmin=3.37

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BAsh Slope - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m3a.pl2 Run By: Tom Yanoschak 11/6/2014 12:21AM



PCSTABL5M/si FSmin=8.06

Safety Factors Are Calculated By The Modified Bishop Method

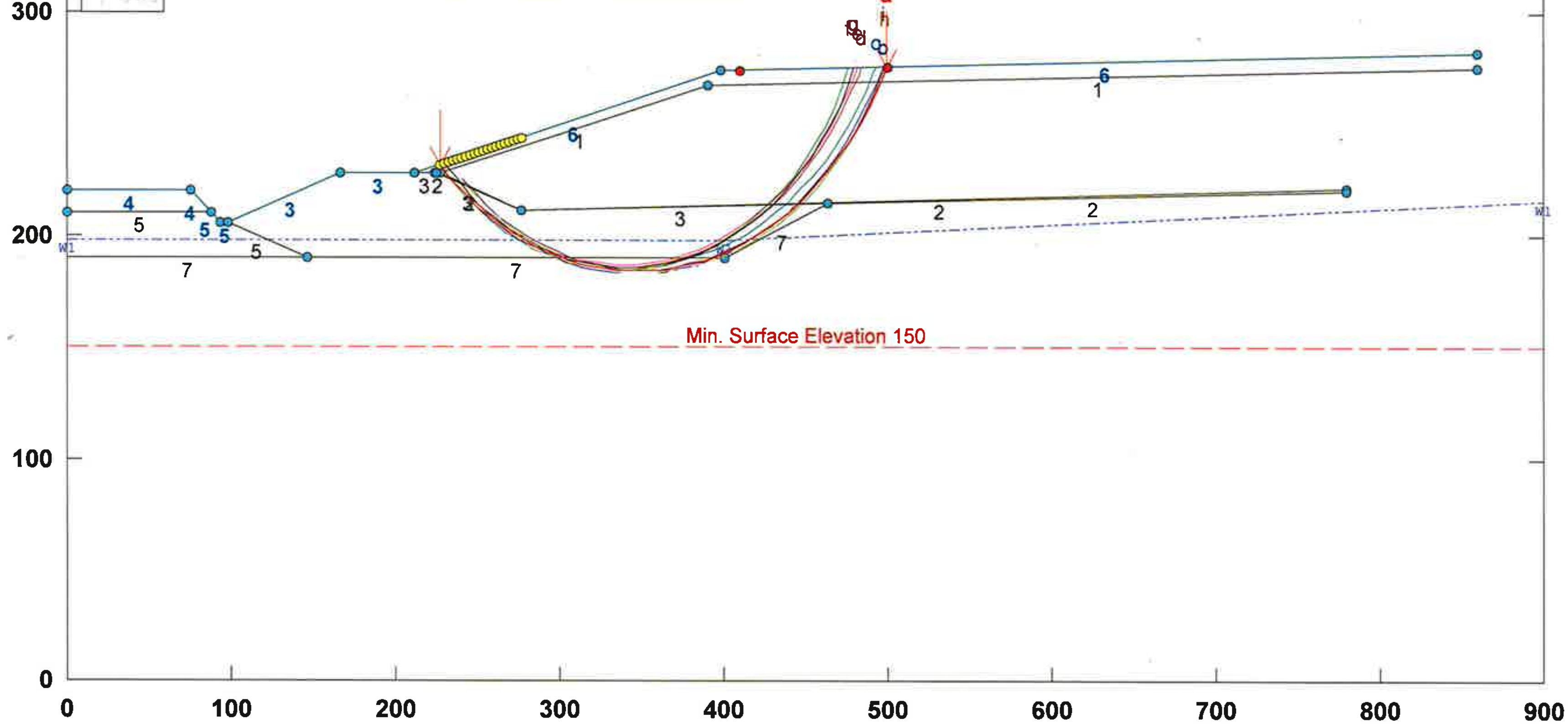
Moncure Mine Structural Fill - Section BAsh Slope - Seismic (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m3as.pl2 Run By: Tom Yanoschak 11/6/2014 12:22AM

#	FS
a	5.26
b	5.26
c	5.28
d	5.31
e	5.33
f	5.33
g	5.40
h	5.42
i	5.42

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	4300.0	8.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	470.0	0.0	W1
Residuum	5	130.0	130.0	1045.0	0.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

Load	Value
Horiz Eqk	0.090 g<

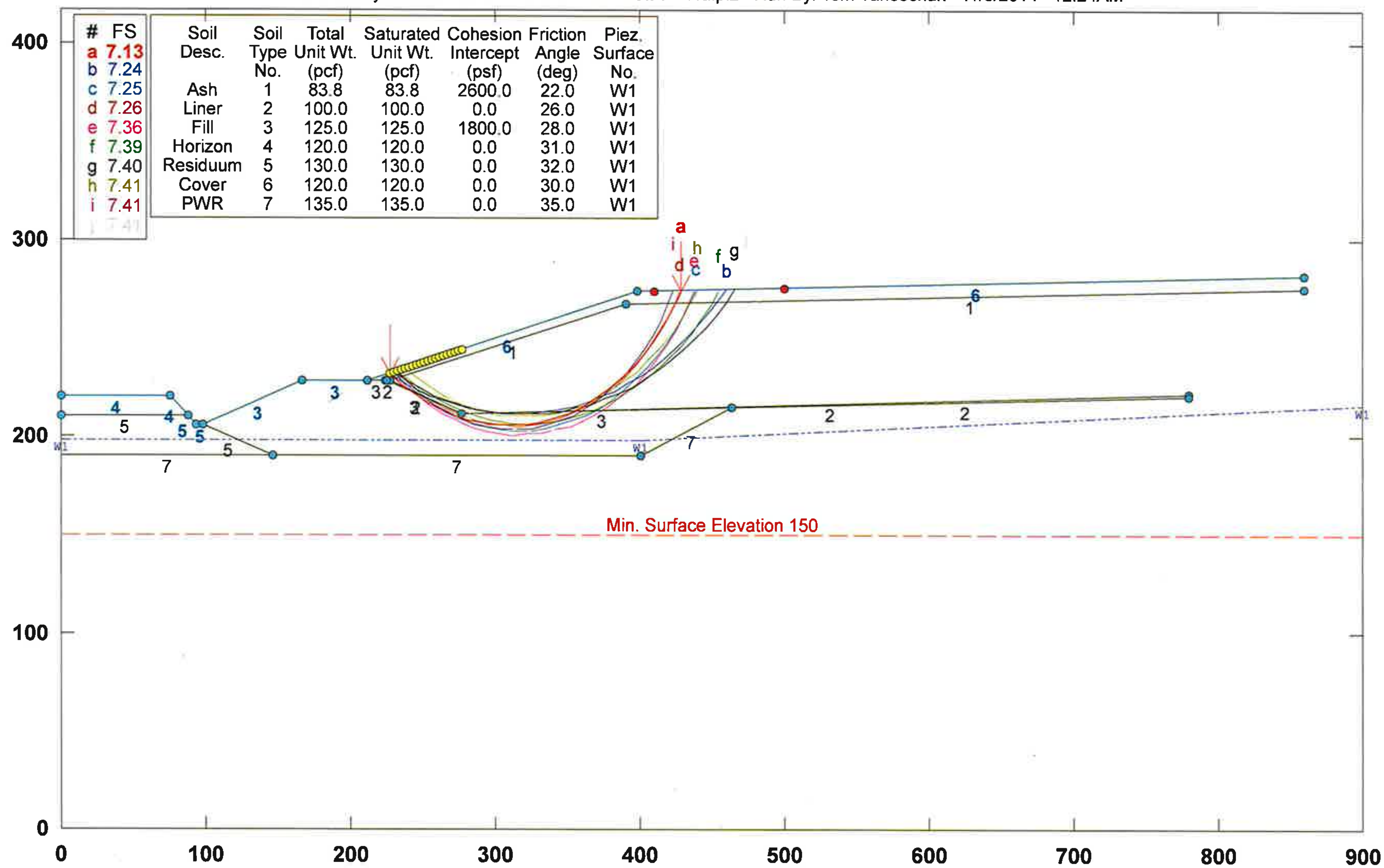


PCSTABL5M/si FSmin=5.26

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BAsh Slope - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m4a.pl2 Run By: Tom Yanoschak 11/6/2014 12:24AM

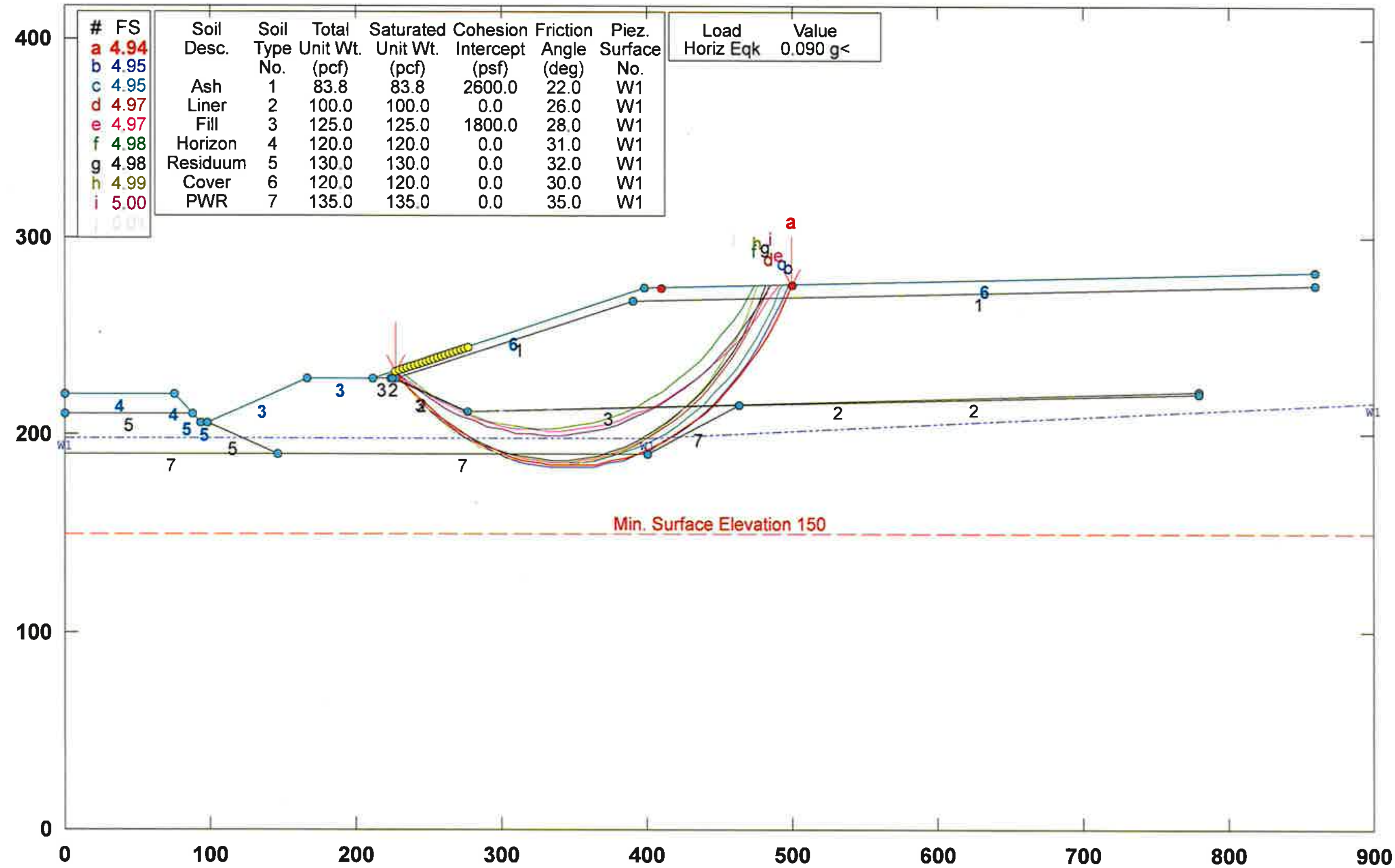


PCSTABL5M/si FSmin=7.13

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BAsh Slope - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m4as.pl2   Run By: Tom Yanoschak   11/6/2014   12:26AM



#	FS
a	4.94
b	4.95
c	4.95
d	4.97
e	4.97
f	4.98
g	4.98
h	4.99
i	5.00

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	2600.0	22.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	0.0	31.0	W1
Residuum	5	130.0	130.0	0.0	32.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

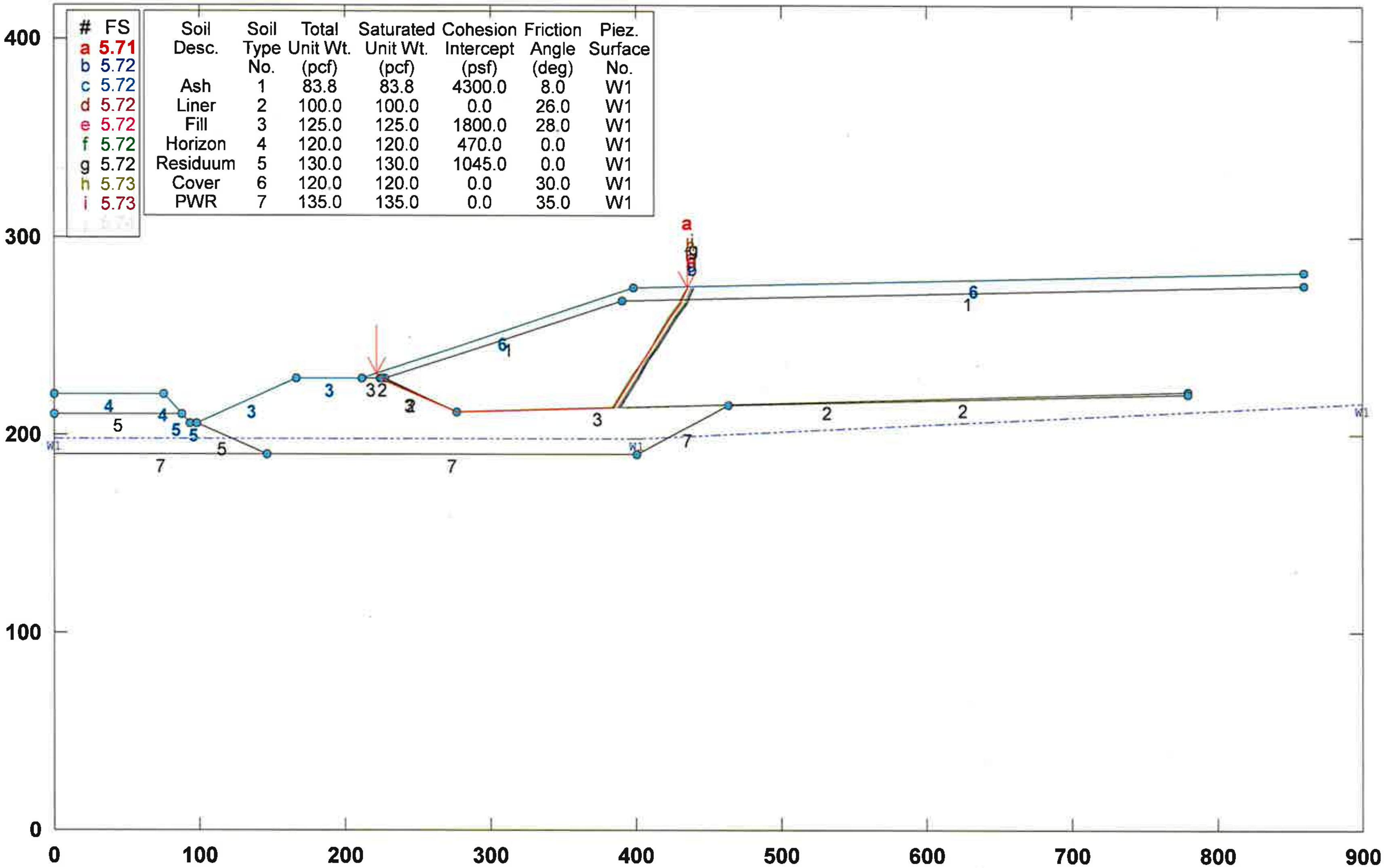
Load	Value
Horiz Eqk	0.090 g<

PCSTABL5M/si FSmin=4.94

Safety Factors Are Calculated By The Modified Bishop Method

Moncure Mine Structural Fill - Section BBlock - Static (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m5a.pl2 Run By: Tom Yanoschak 11/6/2014 12:32AM



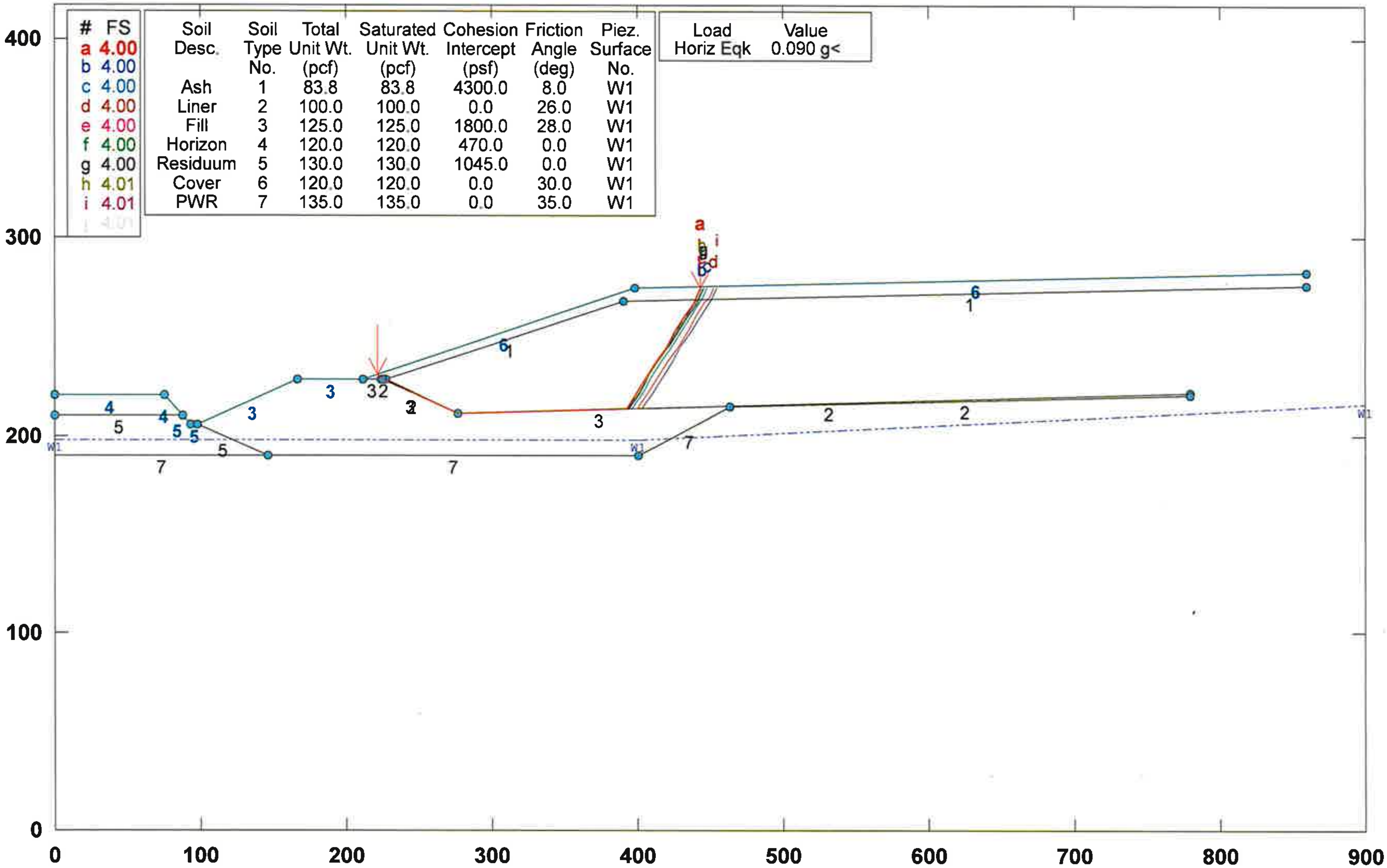
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	4300.0	8.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	470.0	0.0	W1
Residuum	5	130.0	130.0	1045.0	0.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

PCSTABL5M/si FSmin=5.71

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section BBlock - Seismic (Total Stress)

c:\users\tyanosch\documents\stedwin and stabl\m5as.pl2   Run By: Tom Yanoschak   11/6/2014   12:35AM

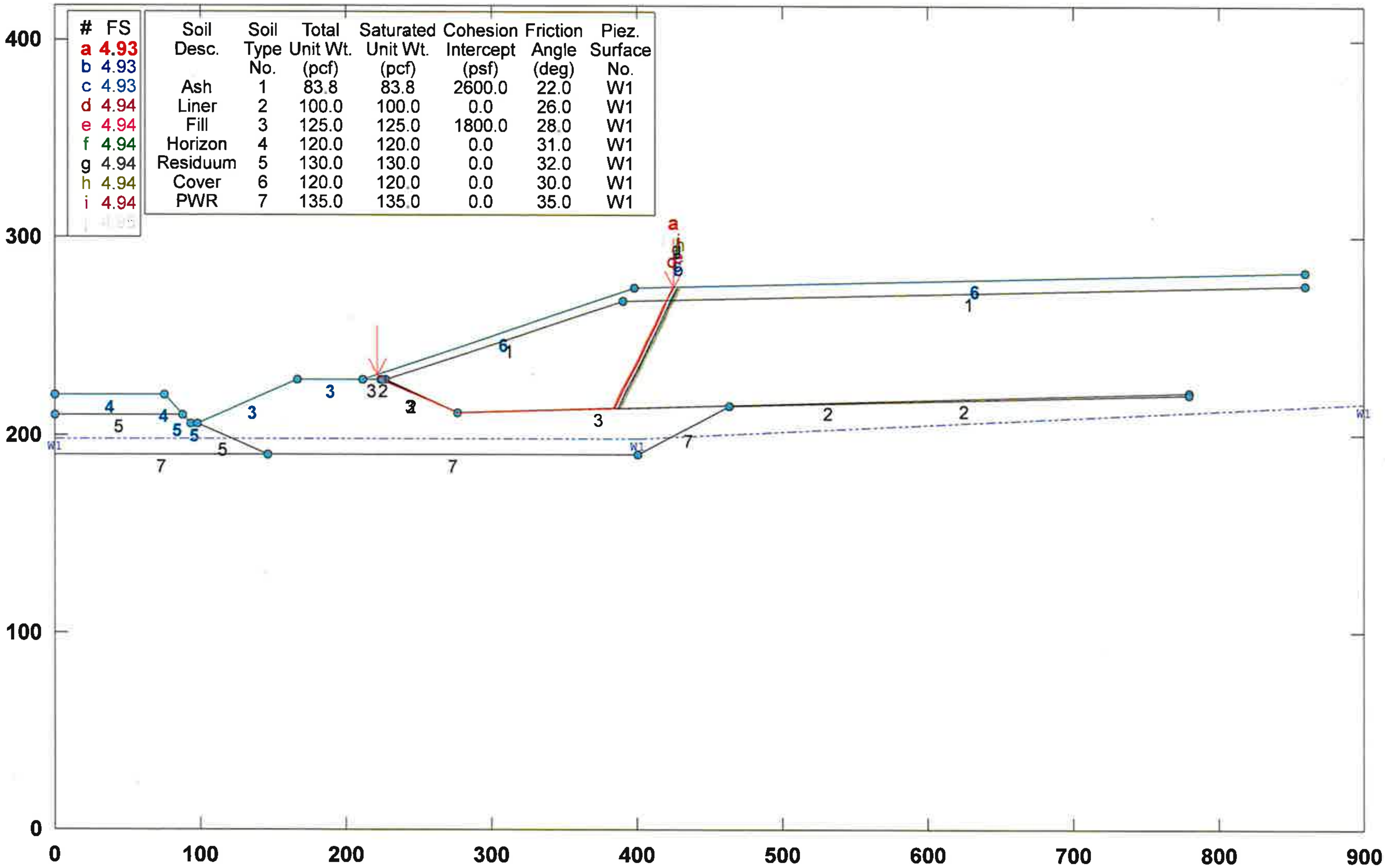


PCSTABL5M/si FSmin=4.00

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section BBlock - Static (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m6a.pl2 Run By: Tom Yanoschak 11/6/2014 12:38AM



#	FS
a	4.93
b	4.93
c	4.93
d	4.94
e	4.94
f	4.94
g	4.94
h	4.94
i	4.94

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	2600.0	22.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	0.0	31.0	W1
Residuum	5	130.0	130.0	0.0	32.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

PCSTABL5M/si FSmin=4.93

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

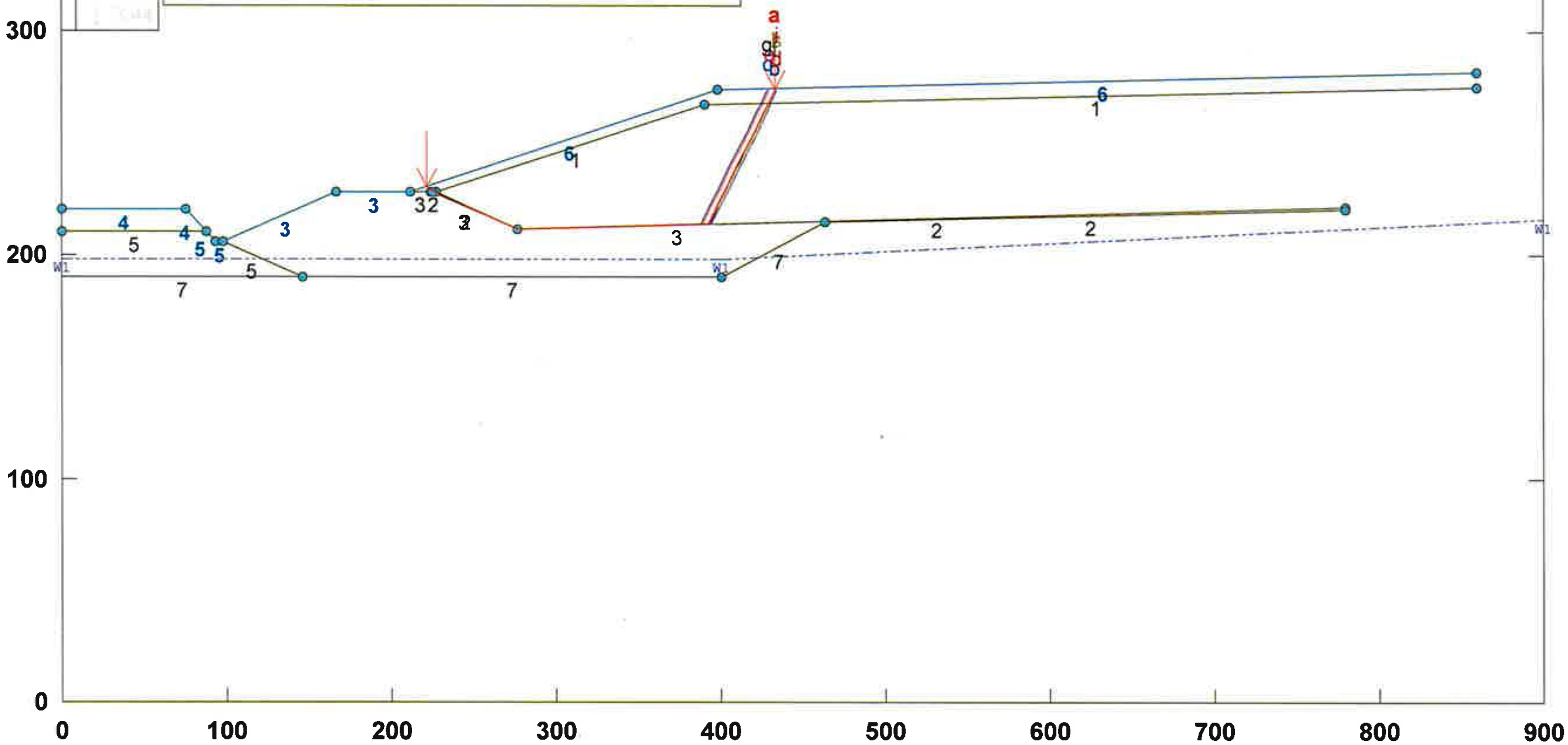
Moncure Mine Structural Fill - Section BBlock - Seismic (Effective Stress)

c:\users\tyanosch\documents\stedwin and stabl\m6as.pl2 Run By: Tom Yanoschak 11/6/2014 12:40AM

#	FS
a	3.43
b	3.43
c	3.43
d	3.43
e	3.44
f	3.44
g	3.44
h	3.44
i	3.44

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	83.8	83.8	2600.0	22.0	W1
Liner	2	100.0	100.0	0.0	26.0	W1
Fill	3	125.0	125.0	1800.0	28.0	W1
Horizon	4	120.0	120.0	0.0	31.0	W1
Residuum	5	130.0	130.0	0.0	32.0	W1
Cover	6	120.0	120.0	0.0	30.0	W1
PWR	7	135.0	135.0	0.0	35.0	W1

Load	Value
Horiz Eqk	0.090 g<

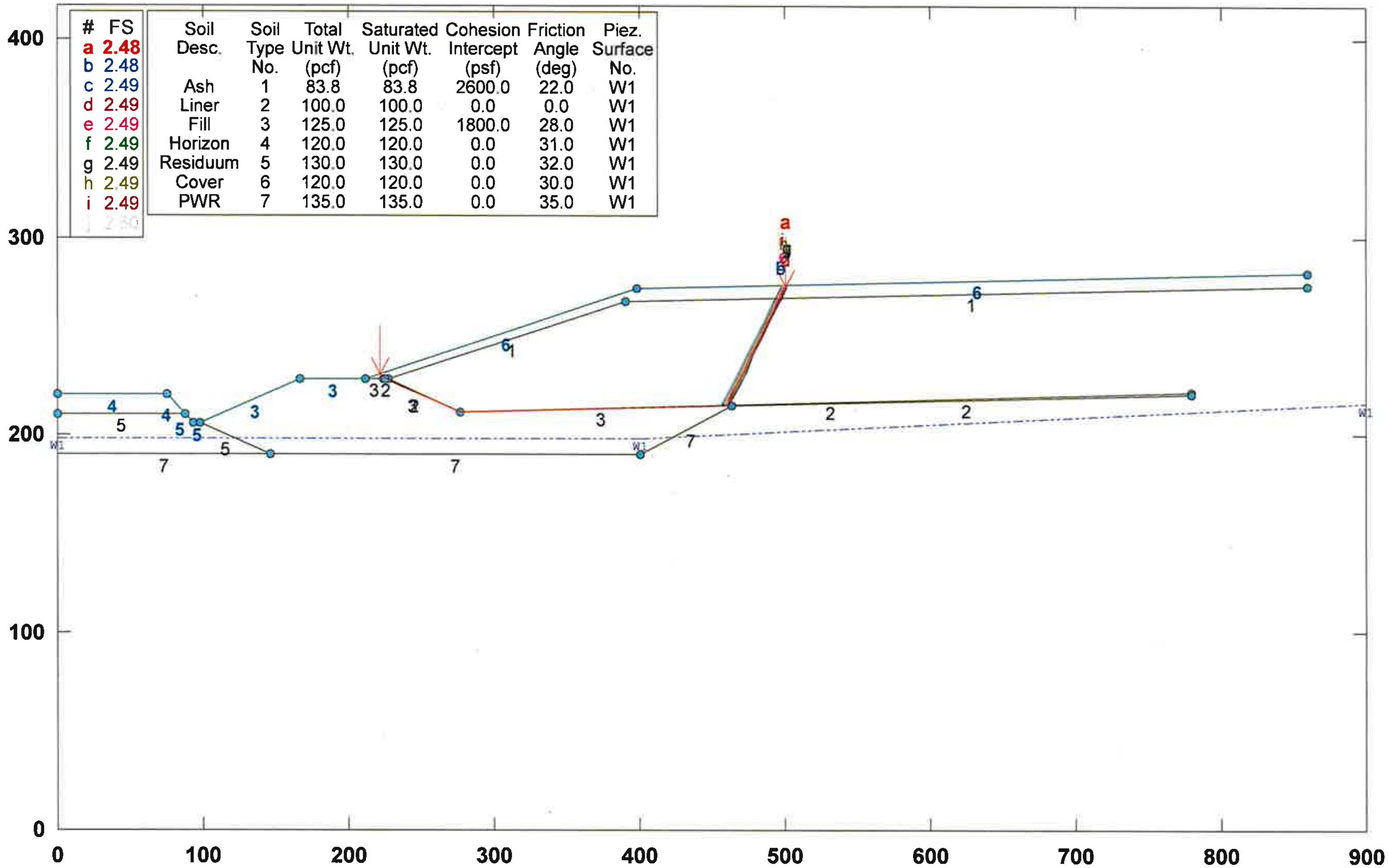


PCSTABL5M/si FSmin=3.43

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section BBlock - Static (Min Liner Interface Phi)

c:\users\tyanosch\documents\stedwin and stabl\m6a1.pl2   Run By: Tom Yanoschak   11/6/2014   12:45AM

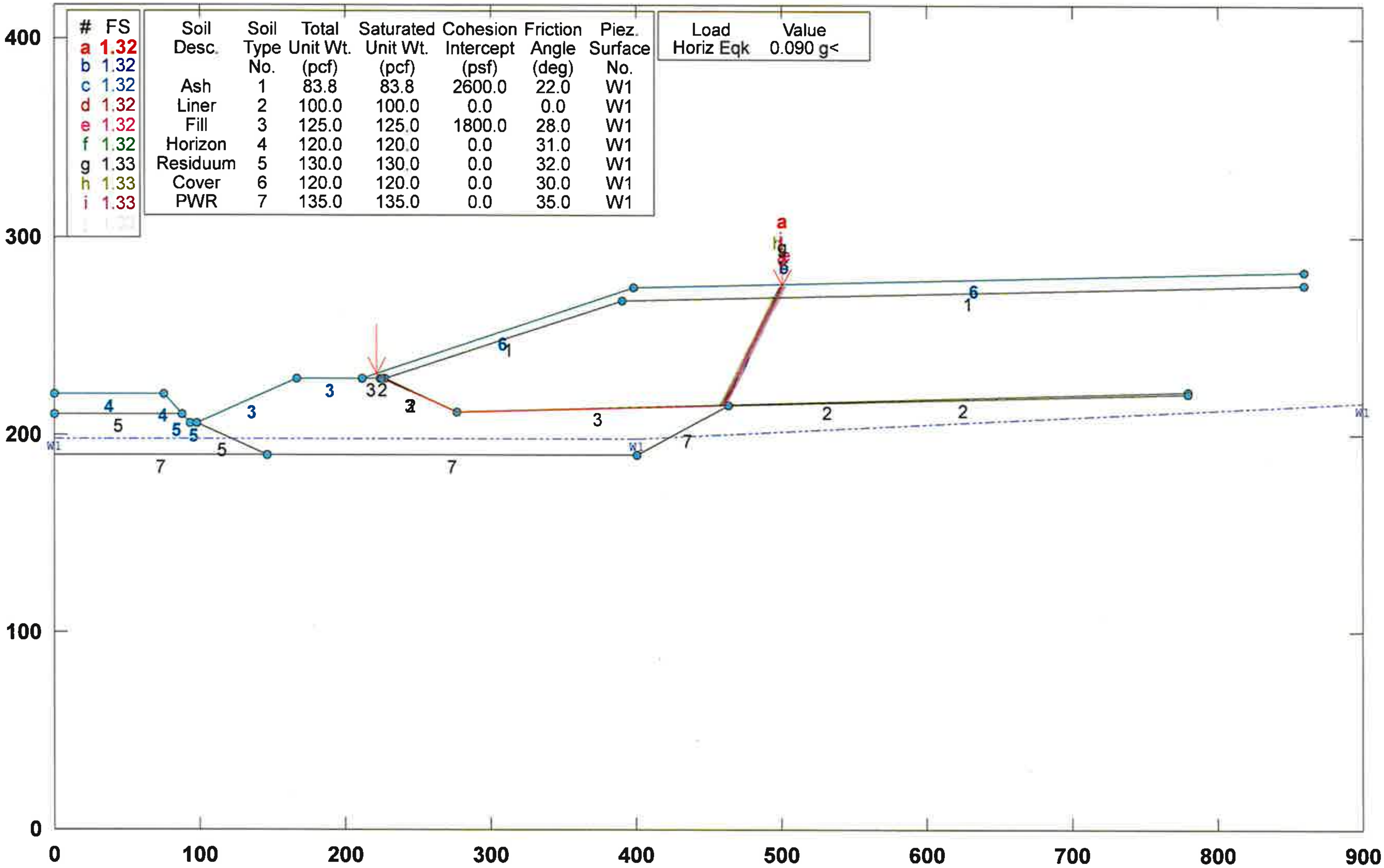


PCSTABL5M/si FSmin=2.48

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Moncure Mine Structural Fill - Section BBlock - Seismi (Min Liner Interface Phi)

c:\users\tyanosch\documents\stedwin and stabl\m6a2.pl2 Run By: Tom Yanoschak 11/6/2014 12:47AM



PCSTABL5M/si FSmin=1.32

Safety Factors Are Calculated By The Modified Janbu Method for the case of c & phi both > 0

Outside of Ash Limits
ATTACHMENT A

Buxton Environmental, Inc.
Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-1

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/13/14	Logged By:	Ross Klingman, P.G.
Date Completed:	8/13/14	Drilling Method:	Geoprobe 8049DT
Drilling Company:	Geologic Exploration	Top-of-Casing Elev.:	217.13'(Lawrence Survey)
Drillers Name:	Johnny Burr	Ground Surface Elev.:	214.49'(Lawrence Survey)
NC Driller Certification:	3098A	Natural, Cut, Fill Grade:	Fill (road bed)

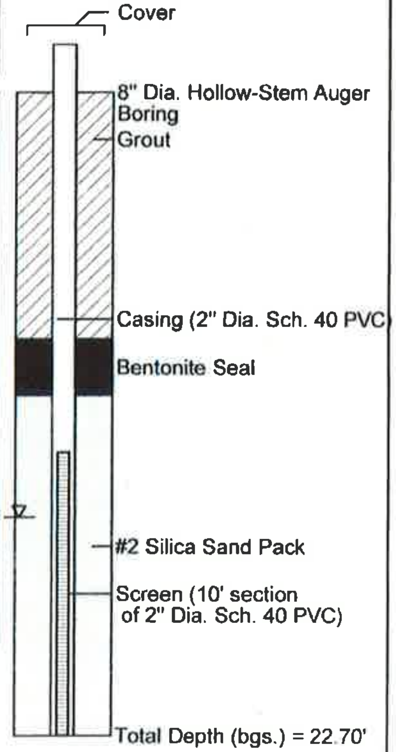
Water Levels
▼ 1 Hour = dry
▽ 24 Hours = 15.00' bgs

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	214.49	4 14 12 (26)	SS	14	moist; very stiff; reddish yellow (7.5YR 6/6) with orange, yellow and light gray mottled; fine sandy silty clay with quartz gravel; low plasticity; cohesive; Fill CL
5	209.49	4 5 6 (11)	SS	9	moist; stiff; strong brown (7.5YR 5/6) with light gray and brown mottled; medium sandy silty clay with brick and quartz gravel; medium plasticity; cohesive; Fill CL
10	204.49	7 5 4 (9)	SS,BAG	12	moist; stiff; gray (5YR 6/1) with light orange mottles; very fine sandy coarse silty clay; low plasticity; cohesive; Flood Plain; (Lab Results: PZ-1 Bag (9-10.5'); USCS=CL; Gravel=0.3%; Sand=33.4%; Silt=38.7%; Clay=27.6%; Effective Porosity=5%; Atterberg Limits: PL=18; LL=34, PI=16) CL
▽	202.90				
15	199.49	7 10 50/5" (>50)	SS,BAG	13	moist/wet; reddish brown (5YR 4/3) with gray mottles; fine sandy silty clay; medium plasticity; cohesive; Residuum; (Lab Results: PZM-1 Bag (14.5-16'); USCS=CL; Gravel=0.1%; Sand=49.6%; Silt=33.1; Clay=17.2%; Effective Porosity=14%; Atterberg Limits: PL=16; LL=24; PI=8) CL
		16 50/2" (>50)	SS	6	dry; light gray (5YR 7/1); horizontal fissle weathered mudstone; Partially Weathered Rock
20	194.49				Auger Refusal @ 22.7'
25	189.49				
30	184.49				
35	179.49				
40	174.49				
45					

Fill
Flood Plain
RESID.
PWR

Well: PZM-1
TOC Elev.: 217.43



Outside of Ash Limits

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-2s and 2

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	: 8/6/14	Logged By:	: Ross Klingman, P.G.
Date Completed:	: 8/6/14	Drilling Method:	: HSA; CME-550
Drilling Company:	: HPC Land Services	Top-of-Casing Elev.:	: 222.37'/222.40'
Drillers Name:	: Jason Cain	Ground Surface Elev.:	: 219.73
NC Driller Certification:	: 3112A	Natural, Cut, Fill Grade::	fill, road bed

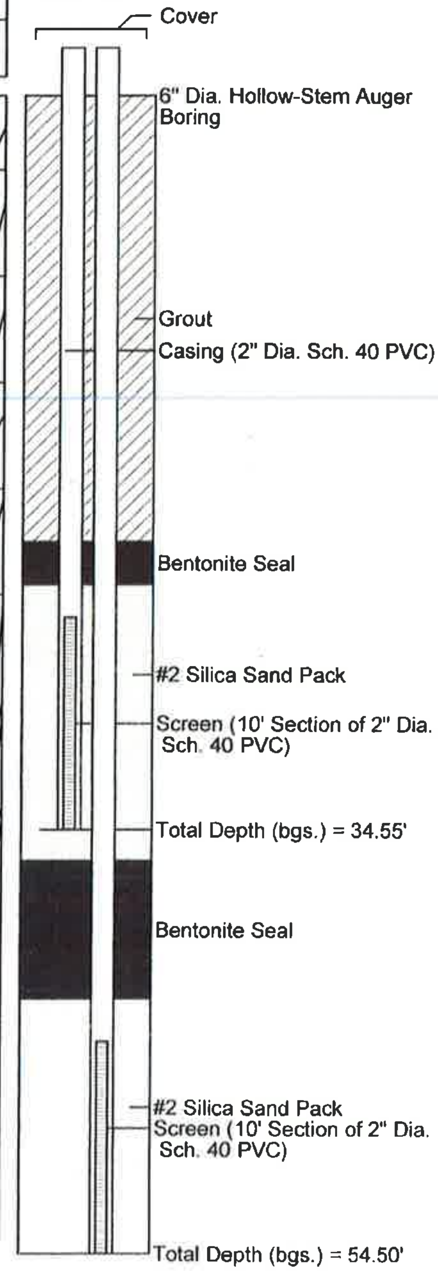
Water Levels
- 1 Hour = 32.00' bgs/dry
- 24 Hours = 16.76'/29.49' bgs

Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

Well1: PZM-2s
Well2: PZM-2
TOC Elev.:

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	219.73	9 7 13 (20)	SS	10	moist/dry; very stiff; strong brown (7.5YR 5/6) with orange mottles; quartz gravelly clayey silt; no plasticity; cohesive; Fill MH
5	214.73	4 3 5 (8)	SS	8	wet; stiff; strong brown (7.5YR 5/6) with orange mottles; quartz gravelly silty clay with brick fragments; no plasticity; cohesive; Fill CL
10	209.73	3 5 8 (13)	SS	16	moist; stiff; light brownish gray (10YR 6/2) with orange mottles; silty fat clay with roots; high plastcity; cohesive; Soil Horizon CH
	208.22				
15	204.73	4 11 12 (23)	SS	24	moist; very stiff; reddish brown (5YR 4/4) with black mottles; medium horizontal fissile; silty clay; low plasticity; Residuum CL
20	199.73	50/4"	SS	8	moist; reddish gray (5YR 5/2); highly horizontal fissile; clayey silt; no plasticity; cohesive; Partially Weathered Rock
25	194.73	50/6"	SS,BAG	10	moist; very hard; reddish gray (5YR 5/2) with green flecks; medium horizontal fissile; silty clay; no plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-2 Bag (23.5-24); USCS=CL; Gravel=4.7%; Sand=19.9%; Silt=50.3%; Clay=25.1%; Effective Porosity=5%; Atterberg Limits: PL=20, LL=38, PI=18)
30	189.73	50/4"	SS	8	moist; very hard; reddish gray (5YR 5/2) with green flecks; highly horizontal fissile; weathered mudstone; Partially Weathered Rock
35	184.73	50/2"	SS	6	dry; very hard; dark reddish gray (5YR 4/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
40	179.73	50/1"	SS	6	dry; very hard; dark reddish gray (5YR 4/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
45	174.73	50/2"	SS	6	dry; very hard; dark reddish gray (5YR 4/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
50	169.73	50/3"	SS	8	dry; very hard; dark reddish gray (5/YR 4/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
55	164.73	50/3"	SS	4	dry; vary hard; dark reddish gray (5YR 4/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
60					

Fill
Soil Horizon
Residuum
PWR



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Charlotte, North Carolina 28203
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Boring Log, PZM-3

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started: : 8/5/14
Date Completed: : 8/6/14
Drilling Company: : Environmental Drilling & Probing
Drillers Name: : David Brown
NC Driller Certification: : 4155

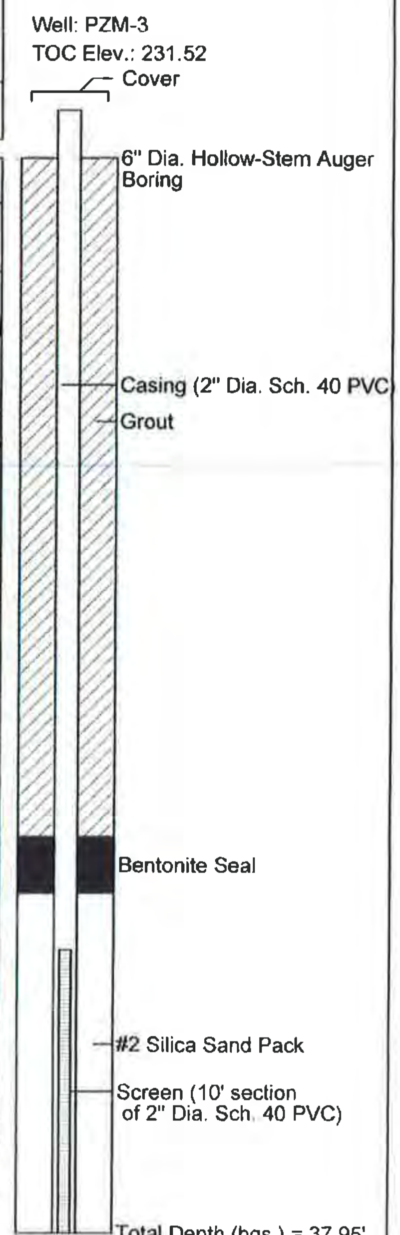
Logged By: : Sean Quarry (HDR)
Drilling Method: : HSA; CME-55
Top-of-Casing Elev.: : 231.52'(Lawrence Survey)
Ground Surface Elev.: : 229.29'(Lawrence Survey)
Natural, Cut, Fill Grade:: Fill (road bed)

Water Levels
1 Hour = dry
24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	214.49	4 6 12 (19)	SS	5	dry; very stiff; red brown (7.5YR 5/3) with yellow mottles; fine sandy silty clay with minor gravel; low plasticity; cohesive; Fill CL
5	209.49	24 11 16 (27)	SS,BAG	14	moist; very stiff; strong brown (7.5YR 4/4) with gray; fine to medium sandy silty clay; low plasticity; cohesive; Residuum; (Lab Results: PZM-3 Bag (4-5.5'); USCS=CL; Sand=5.4%; Silt=46.3%; Clay=48.3%; Effective Porosity=1%; Atterberg Limits: PL=23, LL=42, PI=19) CL
10	204.49	20 50/6"	SS	17	moist; very hard; dark reddish gray (5YR 4/2); silty clay; medium plasticity; cohesive; Partially Weathered Rock
	201.37				
15	199.49	16 50/2"	SS	8	moist; very hard; reddish brown (5YR 4/4); fine sandy silty clay; medium plasticity; cohesive; Partially Weathered Rock
20	194.49	20 35 50/3"	SS	12	moist; very hard; brown (7.5YR 5/4) with gray; silty clay; low plasticity; cohesive; Partially Weathered Rock
25	189.49	21 18 50/2"	SS,BAG	13	moist; very hard; brown (7.5YR 5/4) with gray; fine sandy silty clay; low plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-3 Bag (24-24.5'); USCS=CL; Gravel=0.8%; Sand=26.3%; Silt=50.2%; Clay=22.7%; Effective Porosity=6%; Atterberg Limits: PL=18, LL=31, PI=13)
30	184.49	50/2"	SS	7	moist; very hard; brown (7.5YR 5/3) with gray; silty clay; low plasticity; cohesive; Partially Weathered Rock
35	179.49	50/3"	SS	9	moist; browm (7.5YR 5/3) with gray; horizontal fissile; fine to medium sandy silty clay; medium plasticity; cohesive; Partially Weathered Rock
40	174.49				
45					

Fill
Residuum
PWR



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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
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Boring Log, PZM-4

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/6/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/6/14	Drilling Method:	HSA; CME-550
Drilling Company:	HPC Land Services	Top-of-Casing Elev.	232.72'(Lawrence Survey)
Drillers Name:	Jason Cain	Ground Surface Elev.:	229.85'(Lawrence Survey)
NC Driller Certification:	3112A	Natural, Cut, Fill Grade:	natural

Water Levels
- ▼ 1 Hour = dry
- ▽ 24 Hours = dry

Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

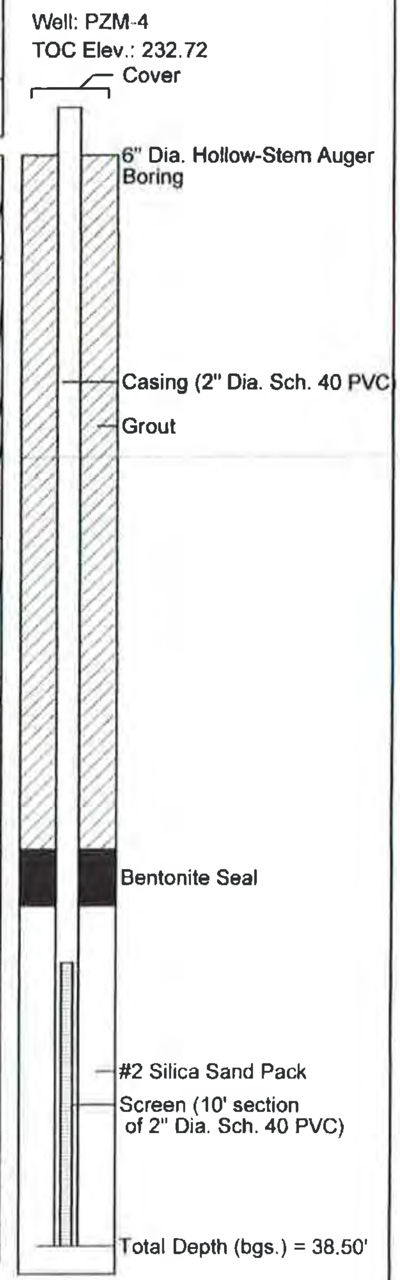
Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	229.85	3 3 4 (7)	SS,BAG	20	moist; yellowish brown (10YR 5/6) with yellow mottles; silty clay; medium plasticity; cohesive; Soil Horizon; (Lab Results: PZM-4 Bag (0-1.5'); USCS=CL; Sand=15.6%; Silt=54.7%; Clay=29.7%; Effective Porosity=4%; Atterberg Limits: PL=17; LL=29, PI=12) CL
5	224.85	4 5 5 (10)	SS,ST	21	moist; stiff; light brownish gray (10YR 4/6) with dark yellowish brown mottles; silty sandy clay; medium plasticity; cohesive; Residuum; (Lab Results: PZM-4 UD (3.5-4.5'); USCS=CL; Gravel=0.9%; Sand=23.4%; Silt=41.2%; Clay=34.5%; Specific Gravity=2.56; Hydraulic Conductivity=7.69 x 10-8 cm/sec; Total Porosity=41%; Effective Porosity=3%; Atterberg Limits: PL=18, LL=38, PI=20) CL
10	219.85	6 9 12 (21)	SS	16	moist; very stiff; brown (7.5YR 4/4) with light green/gray; horizontal fissle; silty clay; medium plastic; cohesive; Residuum CL
15	214.85	42 50/3"	SS,BAG	16	moist; brown (7.5YR 4/3) with light green; fine sandy silty clay; low plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-4 Bag (13.5-15'); USCS=CL; Sand=42.6%; Silt=44.9%; Clay=12.5%; Effective Porosity=15%; Atterberg Limits: PL=18, LL=29, PI=11) CL
	▽ 213.00				
20	209.85	50/6"	SS	7	moist; very hard; brown (7.5YR 4/3) with light green; fine dsany silty clay; medium plasticity; cohesive; Partially Weathered Rock
25	204.85	50/2"	SS	2	moist; very hard; reddish brown (7.5YR 4/4); clayey silt; low plasticity; cohesive; Partially Weathered Rock
30	199.85	50/5"	SS	3	moist; very hard; reddish brown (7.5YR 4/4); clayey silt; low plasticity; cohesive; Partially Weathered Rock
35	194.85	50/1"	SS	0.5	moist; grayish brown (5YR 5/2); horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
40	189.85	50/1"	SS	1	dry; gray and dark gray; weathered mudstone; Partially Weathered Rock
45					

Auger Refusal @ 39.5'

Soil Horizon

Resid

PWR



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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
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Boring Log, PZM-5

TOA 269.0

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/6/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/6/14	Drilling Method:	HSA; CME-550
Drilling Company:	HPC Land Services	Top-of-Casing Elev.:	232.34'(Lawrence Survey)
Drillers Name:	Jason Cain	Ground Surface Elev.:	229.26'(Lawrence Survey)
NC Driller Certification:	3112A	Natural, Cut, Fill Grade:	natural

Water Levels
▼ 1 Hour = 15.95'
▽ 24 Hours = 12.49'

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

41.74'

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	229.26	13	SS,BAG	18	moist; stiff; reddish brown (5 YR 4/4) with gray; fine sandy silty clay; medium plasticity; cohesive; Residuum; (Lab Results: PZM-5 Bag (0-1.5'); USCS=CL; Gravel=15.7; Sand=21.4%; Silt=48.3%; Clay=14.6%; Effective Porosity=15%; Atterberg Limits: PL=22, LL=35, PI=13) CL
5	224.26				
10	219.26	50/1"	SS	4	moist; very hard; reddish brown (5YR 4/4) with gray; fine sandy silty clay; medium plasticity; cohesive; Partially Weathered Rock
15	214.26				
20	209.26	50/0.5"	SS	0	soil cuttings; moist; very hard; reddish brown (5YR 4/4); fine sandy silty clay; medium plasticity; cohesive; Partially Weathered Rock
25	204.26	50/0.5"	SS	0	soil cuttings; wet; very hard; dark reddish brown (5YR 3/3); fine sandy silty clay' medium plastic; cohesive; Partially Weathered Rock
30	199.26				
35	194.26				
40	189.26				
45					

Auger Refusal @ 27'

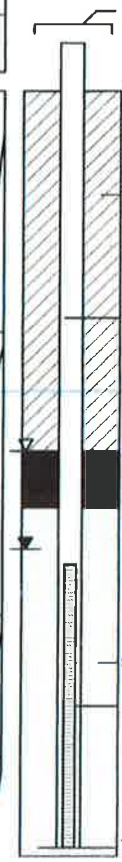
BG 227.26

Resid.

219.72

PWR

Well: PZM-5
TOC Elev.: 232.34



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Consulting Services
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Boring Log, PZM-6

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/11/14
Date Completed:	8/11/14
Drilling Company:	Summit Engineering
Drillers Name:	Robert Cassell
NC Driller Certification:	4143A
Logged By:	Ross Klingman, P.G.
Drilling Method:	HSA; CME-550
Top-of-Casing Elev.:	243.13'(Lawrence Survey)
Ground Surface Elev.:	239.92'(Lawrence Survey)
Natural, Cut, Fill Grade:	natural

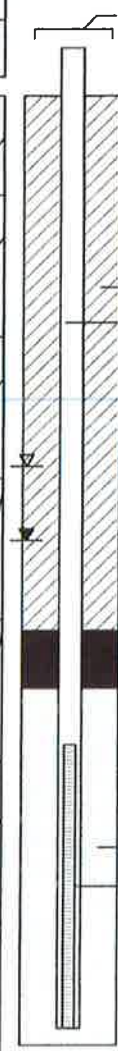
Water Levels
1 Hour = dry
24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	239.92	3 5 5 5 (10)	SS	16	moist; stiff; strong brown (7.5YR 5/8) with light gray mottles; silty clay; high plasticity; cohesive; Soil Horizon CL
5	234.92	4 6 4 4 (10)	SS	18	moist; stiff; yellowish red (5YR 4/6) with ligh gray specks; silty clay; medium plasticity; cohesive; Soil Horizon CL
10	229.92	15 21 33 (54)	SS	12	moist; very hard; reddish brown (2.5YR 5/4); silty clay with quartz cobbles; low plasticity; cohesive; Residuum CL
	227.15				
15	224.92	50/2"	SS	6	moist; very hard; dark reddish brown (2.5YR 3/4); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
20	219.92	50/1"	SS	6	moist; very hard; dark reddish brown (2.5YR 3/4); blocky; weathered mudstone; Partially Weathered Rock
25	214.92	34 32 50/6"	SS,BAG	20	moist/wet; very hard; weak red (10R 5/2) with light gray stringers; silty clay with quartz cobbles; medium plasticity; cohesive; Residuum
30	209.92	50/2"	SS	10	moist; very hard; reddish brown (2.5YR 5/3); clayey silt; low plasticity; cohesive; Partially Weathered Rock
35	204.92	50/1"	SS	8	wet; very hard; reddish brown (2.5YR 5/3); blosky; weathered mudstone; Partially Weathered Rock
40	199.92				
45					

Auger Refusal @ 34'

Soil Hor.
Resid.
PWR



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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
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Boring Log, PZM-7s and 7

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	: 8/11/14	Logged By:	: Ross Klingman, P.G.
Date Completed:	: 8/11/14	Drilling Method:	: HSA; CME-550
Drilling Company:	: Summit Engineering	Top-of-Casing Elev.:	: 266.04'/265.79'
Drillers Name:	: Robert Cassell	Ground Surface Elev.:	: 263.59'
NC Driller Certification:	: 4143A	Natural, Cut, Fill Grade:	: slight cut

Water Levels
1 Hour = dry/dry
24 Hours = dry/dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	263.59	3 3 7	SS	18	moist; stiff; yellowish red (5YR 4/6) with yellow and orange mottles; silty clay; medium plasticity; cohesive; Soil Horizon CL
5	258.59	5 7 15	SS,ST	24/4	moist; very stiff; weak red (2.5YR 5/2) with light green mottles; silty clay; no plasticity; cohesive; Residuum; (Lab Results: PZM-7 UD (5-5.5'); USCS=CL; Sand=2.2%; Silt=59.5%; Clay=38.3%; Specific Gravity=2.66; Hydraulic Conductivity=4.94 x 10-8 cm/sec; Total Porosity=22.7%; Effective Porosity=2%; Atterberg Limits: PL=22, LL=38; PI=16) CL
10	253.59	22 50/5"	SS	18	moist; very hard; weak red (10R 5/2) with orange yellow mottles; wavey horizontal fissile; silty clay; no plasticity; cohesive; Partially Weathered Rock
15	248.59	50/4"	SS	10	moist; very hard; weak red (10R 5/2) with orange yellow mottles; wavey horizontal fissile; weathered mudstone; Partially Weathered Rock
20	243.59	50/4"	SS	10	moist; very hard; weak red (10R 5/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
25	238.59	50/3"	SS	14	moist; very hard; red (2.5YR 4/6) with light green specks; highly horizontal fissile; weathered mudstone and sandstone layers; Partially Weathered Rock
30	233.59	50/3"	SS	6	moist; very hard; dark blueish gray (Glay 2 4/1); horizontal blocky; weathered mudstone; Partially Weathered Rock
35	228.59	50/0"	SS	3	dry; very hard; reddish brown (2.5YR 4/3) with light green specks; blocky; weathered mudstone; Partially Weathered Rock
40	223.59	50/0"	SS	1	wet; very hard; reddish brown (2.5YR 4/3) with light green specks; blocky; weathered mudstone; Partially Weathered Rock
45					

Auger Refusal @ 40'

Soil Horizon
Resid
PWR
239.36

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Boring Log, PZM-8

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/11/14	Logged By:	Ross Klingman, P.G.
Date Completed:	8/11/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev	246.23'(Lawrence Survey)
Drillers Name:	Robert Cassell	Ground Surface Elev.:	243.98'(Lawrence Survey)
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	natural

Water Levels
▼ 1 Hour = dry
▽ 24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

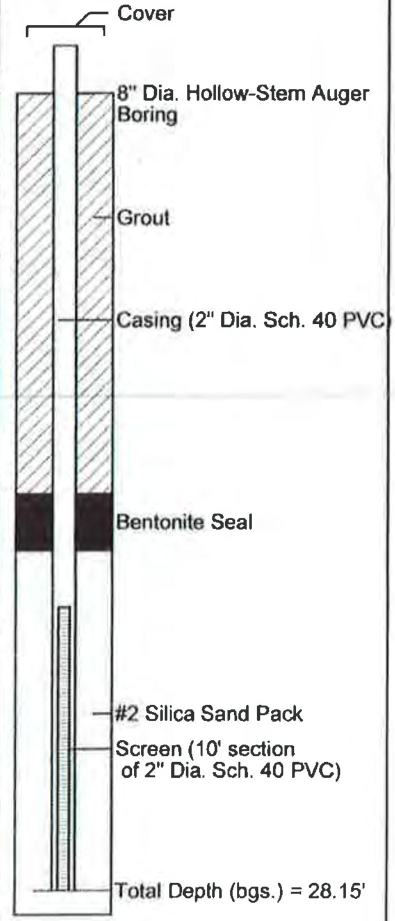
Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	243.98	8-8-8-8	SS,BAG	24	moist; stiff; light yellowish brown (10YR 6/4) with black and light gray specks; clayey silty fine to coarse sand; no plasticity; cohesive; Soil Horizon; (Lab Results: PZM-8 Bag (0-1.5'); USCS=SC; Sand=68%; Silt=19.3%; Clay=12.7%; Effective Porosity=20%; Atterberg Limits: PL=20, LL=37; PI=13) SC
5	238.98	5-8-8-8	SS	20	moist; stiff; weak red (2.5YR 4/2) with orange and gray mottles; silty clay; low plasticity; cohesive; Soil Horizon CL
		50/1"	SS	3	moist/dry; very hard; weak red (10R 4/2); horizontal fissile; weathered sandy mudstone; Partially Weathered Rock
10	233.98				
		50/5"	SS	6	dry; very hard; red (2.5YR 4/6); highly horizontal fissle; weathered sandy mudstone; Partially Weathered Rock
15	228.98				
		50/5"	SS	6	dry; very hard; red (2.5YR 4/6); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
20	223.98				
		50/3"	SS	7	dry; very hard; red (2.5YR 4/6); highly horizontal fissle; weathered mudstone; Partially Weathered Rock
25	218.98				
		50/1"	SS	3	dry; very hard; red (2.5YR); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
30	213.98				Auger Refusal @ 29'
35	208.98				
40	203.98				
45					

Soil Horizon (0–8.5')

PWR

▽ 225.10

Well: PZM-8
TOC Elev.: 246.23'



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Charlotte, North Carolina 28203
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Boring Log, PZM-9s and 9

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/12/14	Logged By:	Ross Klingman, P.G.
Date Completed:	8/12/14	Drilling Method:	Geoprobe 8040DT
Drilling Company:	Geologic Exploration	Top-of-Casing Elev.:	227.03'/227.20'
Drillers Name:	Johnny Burr	Ground Surface Elev.:	224.24'
NC Driller Certification:	3098A	Natural, Cut, Fill Grade:	slight cut

Water Levels
1 Hour = dry/dry
24 Hours = dry/dry

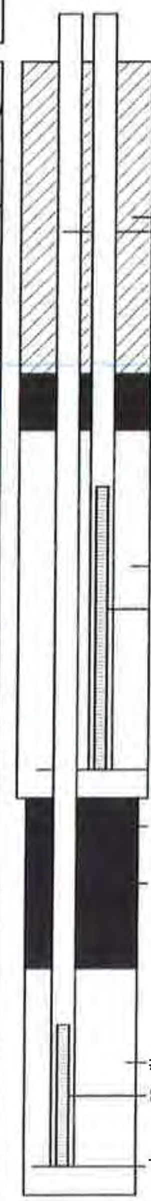
Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Well1: PZM-9s
Well2: PZM-9
TOC Elev. Cover

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	224.24	5 19 15 15 (34)	SS	24	moist; hard; brownish yellow (10YR 6/6) with brown gray mottles; highly horizontal fissle; clayey silt; no plasticity; cohesive; Residuum MH
5	219.24	1 39 43 (82)	SS	24	very moist; very hard; yellowish brown (10YR 5/6) with gray and rust mottles; cleyey silt; no plasticity; cohesive; Residuum MH
10	214.24	6 8 39 (47)	SS	8	moist; hard; yellowish brown (10YR 5/6) with gray and rust mottles; silty clay; no plasticity; cohesive; Residuum CL
15	209.24	15 28 50/5" (>50)	SS	9	moist; very hard; dusky red (10R 3/2); silty clay; no plasticity; cohesive; Residuum CL
20	204.24	28 34 50/3" (>84)	SS,BAG	17	moist; very hard; dusky red (10R 3/2) with gray and yellow mottles; silty clay; no plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-9 Bag (18.5-20'); USCS=CL; Sand=2%; Silt=54.5%; Clay=43.5%; Effective Porosity=1%; Atterberg Limits: PL=22; LL=41; PI=19)
25	199.24	17 50/2"	SS	17	moist; very hard; dark greenish gray (Gley 2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
					Auger Refusal @ 26'
					Advance 5 5/8" Diameter Mud-Rotay Bit from 26-29' (solid rock)
30	194.24				Advance HQ rock core (3 5/8" outer diameter) from 29-31.5' (muddy sandstone rock), then break-through rock into muddy material clogging rock core barrel; remove rock core drilling equipment.
35	189.24				Advance bore with 5 5/8" diameter mud-rotary drilling from 31.5-40'; in and out of rock layers to terminus of the boring.
40	184.24				
45					

Resid.

PWR



Outside of Ash Limits

Buxton Environmental, Inc.
Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-10

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/12/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/12/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	265.06'(Lawrence Survey)
Drillers Name:	Robert Cassell	Ground Surface Elev.:	262.23'(Lawrence Survey)
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	cut

Water Levels
- 1 Hour = dry
- 24 Hours = dry

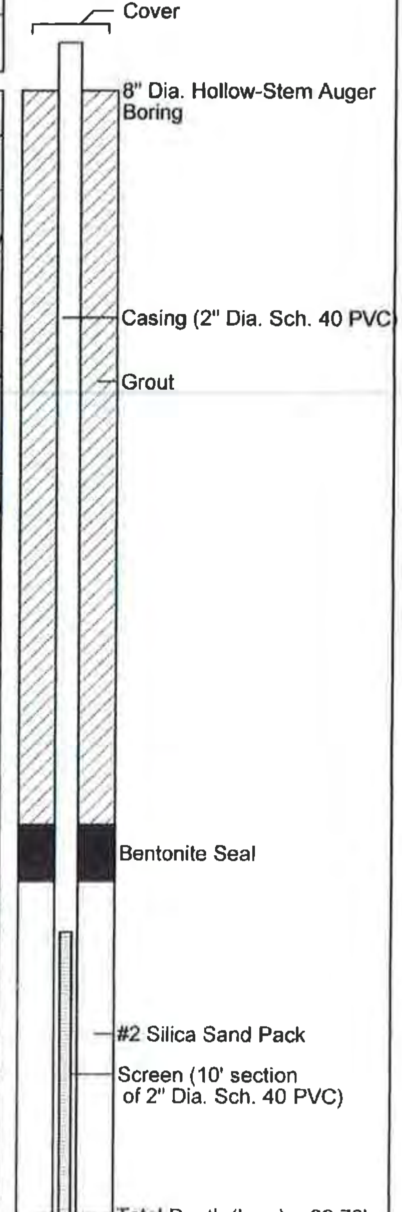
Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	262.23	4 4 6 (10)	SS	20	moist; stiff; dark reddish brown (5YR 3/4) with gray; silty clay; medium plasticity; cohesive; Residuum CL
5	257.23	7 11 14 (25)	SS	17	moist; very stiff; dark reddish brown (5YR 3/4) with gray; horizontal fissile; sandy silty clay; medium plasticity; cohesive; Residuum CL
10	252.23	7 9 22 (31)	SS	16	moist; very stiff; dark reddish brown (5YR 3/3) with gray, yellow and black; silty sandy clay; medium plasticity; cohesive; Residuum CL
15	247.23	24 50/5" (74)	SS	13	moist; very hard; reddish brown (5YR 4/3) with gray; horizontal fissle; sandy silty clay; low plasticity; cohesive; Partially Weathered Rock CL
20	242.23	25 50/5"	SS,BAG	11	moist; very hard; reddish brown (5YR 6/3) with gray; sandy silty clay; low plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-10 Bag (18.5-20'); USCS=CL; Sand=11.9%; Silt=59.1%; Clay=29%; Effective Porosity=4%; Atterberg Limits: PL=19, LL=30, PI=11)
25	237.23	50/5"	SS	5	moist; very hard; dark reddish gray (5YR 4/2); horizontal fissle; silty sandy clay; low plasticity; cohesive; Partially Weathered Rock
30	232.23	50/2"	SS	2	moist; very hard; dark reddish gray (5YR 4/2); silty clay; low plasticity; cohesive; Partially Weathered Rock
35	227.23	43 50/2"	SS	10	moist/wet; very hard; yellowish red (5YR 4/6); silty clay; low plasticity; cohesive; Partially Weathered Rock
40	222.23	50/0.5"	SS	1	wet; very hard; yellowish red (5YR 4/6); silty clay; low plasticity; cohesive; Partially Weathered Rock
45					

Resd

PWP

238.05



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290.87

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-11

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/12/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/12/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	248.71'(Lawrence Survey)
Drillers Name:	Robert Cassell	Ground Surface Elev.:	246.27'(Lawrence Survey)
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	cut

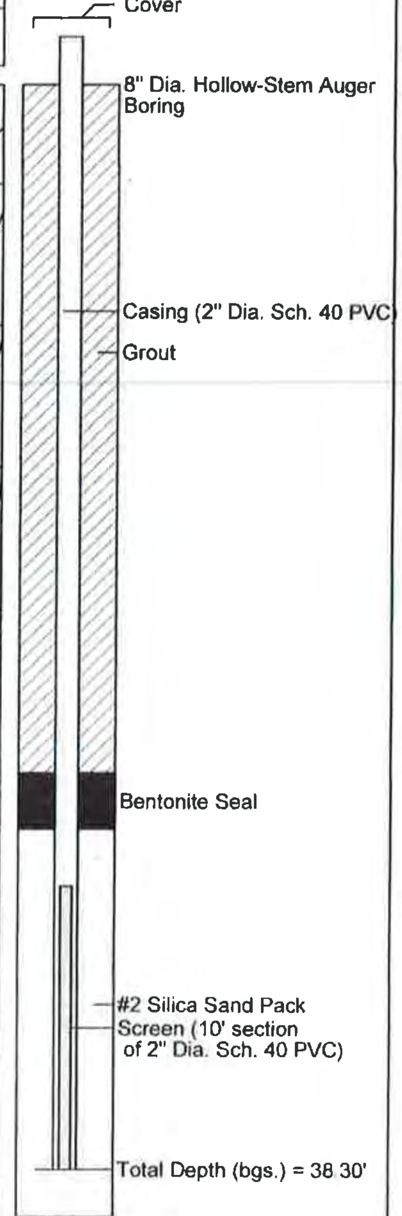
Water Levels
▼ 1 Hour = dry
▽ 24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	246.27	8 9 17 (26)	SS	17	moist; very stiff; gray (5YR 6/1) with yellow mottles; silty clay; low plasticity; cohesive; Residuum CL
5	241.27	14 50/3" (>50)	SS	10	moist; very hard; gray (5YR 6/2); fine sandy silty clay; low plasticity; cohesive; Partially Weathered Rock
10	236.27	50/3"	SS	3	moist; very hard; grayish green (Gley 1 4/2); weathered sandstone; Partially Weathered Rock
15	231.27	50/6"	SS	6	dry; very hard; grayish green (Gley 1 4/1) with gray; fine sandy silty clay and weathered mudstone; low plasticity; cohesive; Partially Weathered Rock
20	226.27	50/4"	SS	4	dry; redish brown (5YR 4/4); horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
25	221.27	24 50/4"	SS	8	moist; very hard; dark gray (5YR 4/1) with gray and yellow mottles; silty clay with thin weathered mudstone; medium plasticity; cohesive; Partially Weathered Rock
30	216.27	50/3"	SS	4	moist; very hard; reddish brown (5YR 4/3); silty clay with mudstone; low plasticity; cohesive; Partially Weathered Rock
35	211.27	50/1"	SS	1	moist; very hard; reddish brown (5YR 4/3); silty clay with mudstone; low plasticity; cohesive; Partially Weathered Rock
40	206.27	50/3"	SS,BAG	2	moist; very hard; reddish brown (5YR 4/3); silty clay with mudstone; low plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-11 Bag (38.5-40'); USCS=CL; Gravel=4.6%; Sand=12.6%; Silt=62.4%; Clay=20.4%; Effective Porosity=7%; Atterberg Limits: PL=21, LL=37, PI=16)
45					

Resid.
PWR
BC 236.38
228.0

Well: PZM-11
TOC Elev.: 248.71'



TOA 290.94

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-12

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/14/14
Date Completed:	8/14/14
Drilling Company:	Summit Engineering
Drillers Name:	Robert Cassell
NC Driller Certification:	4143A
Logged By:	Ross Klingman, P.G.
Drilling Method:	HSA; CME-550
Top-of-Casing Elev.:	236.07'(Lawrence Survey)
Ground Surface Elev.:	233.21'(Lawrence Survey)
Natural, Cut, Fill Grade:	cut

Water Levels
▼ 1 Hour = 10.50' bgs
▽ 24 Hours = 11.20' bgs

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	233.21	11 12 18 (40)	SS,ST	18	dry; very stiff; red (2.5YR 4/6) with black hroizontal planes; silty clay and weathered mudstone; no plasticity; cohesive; Residuum; (Lab Results: PZM-12 UD (0.5-1.5'); USCS=CL; Sand=16.3%; Silt=71.3%; Clay=12.4%; Specific Gravity=2.68; Hydraulic Conductivity=2.36 x 10-6 cm/sec; Total Porosity=19.2%; Effective Porosity=9%; Atterberg Limits: PL=20, LL=31, PI=11) CL
		22 50/5" (>50)	SS	16	
5	228.21				dry; very hard; red (2.5YR 4/6); horizontal to 5 degree fissile; silty clay and weathered mudstone; no plasticity; cohesive; Partially Weathered Rock
		21 50/6"	SS	13	dry; very hard; red (2.5YR 4/6) with light pink horizontal layers; highly horizontal fissile; silty clay and weathered mudstone; ; no plasticity; cohesive; Partially Weathered Rock
10	223.21				
	▽ 221.49				
		50/4"	SS	6	dry; very hard; reddish brown (2.5YR 4/4); highly horizontal fissile; weathered mudstone; Partially Weathered Rock hard rock layer 16-18.5'
15	218.21				
		32 50/3"	SS	20	wet; hard; reddish brown (2.5YR 4/4); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
20	213.21				Auger Refusal @ 21'
25	208.21				
30	203.21				
35	198.21				
40	193.21				
45					

Resid

BG 228.28

PWR

Well: PZM-12
TOC Elev.: 236.07'

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-13

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/12/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/12/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	251.23'(Lawrence Survey)
Drillers Name:	Robert Cassell	Ground Surface Elev.:	249.19'(Lawrence Survey)
NC Driller Certification:	4143A	Natural, Cut, Fill Grade::	natural

TOA 280.15

Water Levels
1 Hour = 33.00' bgs
24 Hours =22.96' bgs

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	249.19	3 3 2 6 (8)	SS	19	moist; medium; reddish brown (5YR 5); silty clay; medium plasticity; cohesive; Soil Horizon CL
5	244.19	22 50/3" (>50)	SS	8	moist; very hard; reddish brown (5YR 4/3) with gray and yellow; sandy silty clay; low plasticity; cohesive; Partially Weathered Rock CL
10	239.19	5 7 14 (21)	SS,BAG	16	moist; very stiff; light gray (10YR 7/2) with red brown bands; silty sandy clay; low plasticity; cohesive; Residuum; (Lab Results: PZM-13 Bag (8.5-10'); USCS=CL; Sand=16.4%; Silt=59.8%; Clay=23.8%; Effective Porosity=4%; Atterberg Limits: PL=16, LL=31, PI=15) CL
15	234.19	50/1" (>50)	SS	1	moist; very hard; light gray (10YR 7/2) with red brown; silty sandy clay; low plasticity; cohesive; Partially Weathered Rock
20	229.19	50/6"	SS	5	moist; very harr; dark reddish brown (5YR 4/3) with gray; horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
25	224.19	50/4"	SS	3	dry; very hard; reddish brown (5YR 4/3); silty clay with weathered muddy sandstone; low plasticity; cohesive; Partially Weathered Rock
30	219.19	50/4"	SS	3	dry; very hard; gray; horizontal fissile; silty clay with weathered mudstone; low plasticity; cohesive; Partially Weathered Rock
35	214.19	50/3"	SS	2	dry; very hard; gray; weathered mudstone; Partially Weathered Rock
40	209.19				
45					

Auger Refusal @ 36.5'

Soil Horizon
Resid
BG 235.87
PWR
226.35

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-14s and 14

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/13/14	Logged By:	Sean Quarry (HDR)
Date Completed:	8/13/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	277.90'/277.75'
Drillers Name:	Robert Cassell	Ground Surface Elev.:	274.79'
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	natural

TOA 277.76

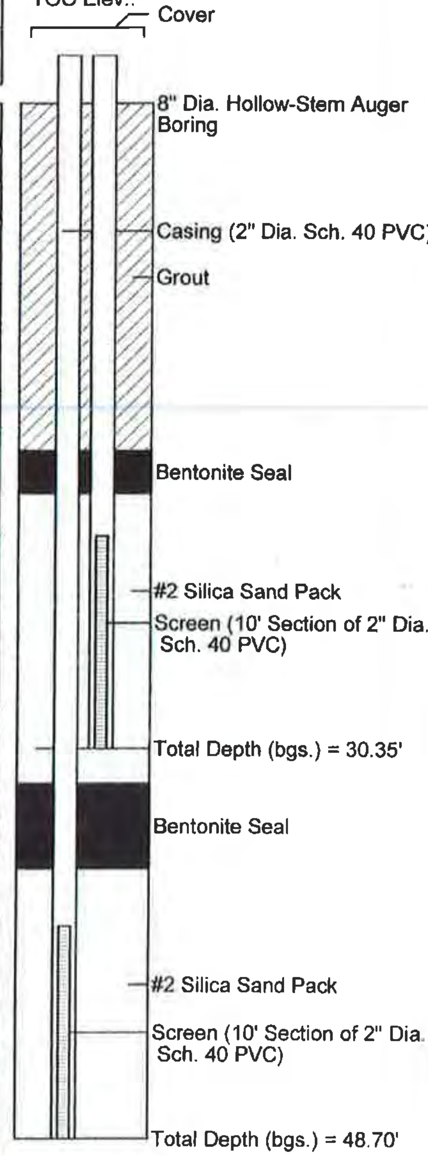
Water Levels
- 1 Hour = dry/dry
- 24 Hours = dry/dry

Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

Well1: PZM-14s
Well2: PZM-14
TOC Elev.:

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	274.79	5 3 3 (6)	SS	6	moist; medium; light reddish brown (5YR 6/4); sandy silty clay with rocks, gravel and roots; low plasticity, cohesive; Soil Horizon CL
5	269.79	5 6 10 (16)	SS	18	moist; very stiff; yellowish red (5YR 4/6) with yellow and gray mottles; silty sandy clay; low plasticity; cohesive; Soil Horizon CL
10	264.79	10 18 19 (37)	SS	17	moist; hard; dark gray with red brown; silty clay; medium plasticity; cohesive; Residuum CL
15	259.79	13 25 50/6" (>50)	SS	17	moist; very hard; dark reddish brown (5YR 3/4) with gray; sandy silty clay; medium plasticity; cohesive; Residuum CL
20	254.79	8 20 50/6"	SS	15	moist; very hard; dark reddish brown (5YR 3/4) with gray; silty clay; medium plasticity; cohesive; Residuum CL
25	249.79	39 50/2"	SS	10	moist; very hard; reddish brown (5YR 4/3); horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
30	244.79	50/2"	SS	6	moist; very hard; reddish brown (5YR 4/3) with yellow mottles; horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
35	239.79	50/3"	SS	3	moist; very hard; reddish brown (5YR 4/3) with yellow mottles; horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
40	234.79	35 50/2"	SS	7	moist; very hard; reddish brown (5YR 4/4) with gray; horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
45	229.79	50/4"	SS	3	wet; very hard; reddish brown (5YR 4/4) with gray; horizontal fissile; low plasticity; cohesive; Partially Weathered Rock
50	224.79	50/6"	SS,BAG	5	wet; very hard, reddish brown (5YR 4/4) with gray and olive; horizontal fissile; silty clay; low plastcity; cohesive; Partially Weathered Rock; (Lab Results: PZM-14 Bag (48-50'): USCS=CL; Sand=1.3%; Silt=66%; Clay=32.7%; Effective Porosity=3%; Atterberg Limits: PL=19, LL=35, PI=16)
55	219.79				
60					

Soil Horizon
PWR
BG.72 3.06
245.22



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TOA

ON PERIMETER BERM

Buxton Environmental, Inc.
Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-15

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	: 8/13/14	Logged By:	: Sean Quarry (HDR)
Date Completed:	: 8/13/14	Drilling Method:	: HSA; CME-550
Drilling Company:	: Summit Engineering	Top-of-Casing Elev.:	: 234.69'(Lawrence Survey)
Drillers Name:	: Robert Cassell	Ground Surface Elev.:	: 231.82'(Lawrence Survey)
NC Driller Certification:	: 4143A	Natural, Cut, Fill Grade:	: natural

Water Levels
▼ 1 Hour = 22.00' bgs
▽ 24 Hours = 18.00' bgs

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Well: PZM-15
TOC Elev.: 234.69'

BG|234

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	231.82	2 2 5 (7)	SS	13	moist; medium; strong brown (7YR 5/6) with mottles; sandy silty clay with roots; low plasticity; cohesive; Soil Horizon CL
			ST	10	moist; reddish gray (5YR 5/2); silty clay; low plasticity; cohesive; Residuum; (Lab Results: PZM-15 UD (3.5-4.5'); USCS=CL; Sand=12.1%; Silt=39.6%; Clay=48.3%; Specific Gravity=2.72; Hydraulic Conductivity=3.69 x 10-9 cm/sec; Total Porosity=39.2%; Effective Porosity=1%; Atterberg Limits: PL=19, LL=39, PI=20) CL
5	226.82	8 11 36 (47)	SS	18	
		22 50/3" (>50)	SS	11	moist; very hard; reddish gray (5YR 5/2); horizontal fissile; silty clay; low plasticity; cohesive; Residuum CL
10	221.82				moist; very hard; reddish gray (5YR 5/2); horizontal fissile; silty clay; low plasticity; cohesive; Partially Weathered Rock
		50/2"	SS	1	moist; very hard; reddish brown (5YR 4/4); fine sandy clayey silt; low plasticity; cohesive; Partially Weathered Rock
15	~~216.82~~ 216.85				
		50/2"	SS	2	moist; very hard; light reddish brown (5YR 6/3); horizontal fissile; fine sandy silt with weathered; low plasticity; cohesive; Partially Weathered Rock
20	211.82				
		50/3"	SS,BAG	3	wet; very hard; very dark gray; silty clay; medium plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-15 Bag (23.5-25'): USCS=CL; Sand=6.3%; Silt=60.7%; Clay=33%; Effective Porosity=3%; Atterberg Limits: PL=17, LL=36, PI=33)
25	206.82				Auger Refusal @ 23.5'
30	201.82				
35	196.82				
40	191.82				
45					

Soil Horizon
Residual
PWR

Cover
8" Dia. Hollow-Stem Auger Boring
Grout
Casing (2" Dia. Sch. 40 PVC)
Bentonite Seal
#2 Silica Sand Pack
Screen (10' section of 2" Dia. Sch. 40 PVC)
Total Depth (bgs.) = 23.50'

ON TOP OF POWER LINE ISLAND

Buxton Environmental, Inc.
Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-16

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/14/14	Logged By:	Ross Klingman, P.G.
Date Completed:	8/14/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	269.68'(Lawrence Survey)
Drillers Name:	Robert Cassell	Ground Surface Elev.:	267.41'(Lawrence Survey)
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	natural

Water Levels
▼ 1 Hour = dry
▽ 24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

TOA AND BG 268

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	267.41	3 5 6 (11)	SS	1	very moist; stiff; yellowish brown (10YR 6/6); fine to coarse sandy silty clay with quartz cobbles; medium plasticity; cohesive; Soil Horizon CL
5	262.41	4 5 8 (13)	SS	16	moist; stiff; light yellowish brown (2.5YR 6/4) with red orange mottles; clay; high plasticity; cohesive; Soil Horizon CH
10	257.41	2 3 4 (7)	SS	17	moist; medium; light yellowish brown (2.5YR 6/4) with red orange mottles; silty clay; medium plasticity; cohesive; Soil Horizon CL
			ST	10	moist; light yellowish brown (2.5YR 6/4) with red orange mottles; silty clay; medium plasticity; cohesive; Soil Horizon; (Lab Results; PZM-16 UD (10-11'); USCS=MH; Gravel=0.1%; Sand=7.2%; Silt=51.1%; Clay=47.9%; Specific Gravity=2.70; Hydraulic Conductivity=2.86 x 10-7 cm/sec; Total Porosity=48%; Effective Porosity=1%; Atterberg Limits: PL=32, LL=56, PI=24) CL
15	252.41	8 10 16 (26)	SS	18	moist; very stiff; weak red (10YR 4/3) with ligh gray and yellow stringers; silty clay; medium plasticity; cohesive; Residuum CL
20	247.41	8 16 27 (43)	SS	20	moist; hard; gray (10YR 6/1) with light orange and light maroon mottles and stringers; silty clay; no plasticity; cohesive; Residuum CL
25	242.41	21 50/6" (>50)	SS	14	moist; very hard; gray (10YR 6/1) with light orange and light maroon mottles and stringers; silty clay; no plasticity; cohesive; Partially Weathered Rock
30	237.41	22 50/2"	SS	14	moist; very hard; reddish brown (2.5YR 4/4); wavey horizontal fissile; silty clay; no plasticity; cohesive; Partially Weathered Rock; (Lab Results: PZM-16 Bag (28.5-30'): USCS=CL; Sand=21.3%; Silt=61.8%; Clay=16.9%; Effective Porosity=10; Atterberg Limits: PL=17, LL=32, PI=15)
35	232.41 (232.84)	50/6"	SS	10	dry; very hard; pinkish gray (7.5YR 6/2); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
40	227.41	50/1"	SS	3	dry; very hard; pinkish gray (7.5YR 6/2); highly horizontal fissile; weathered sandy mudstone; Partially Weathered Rock
45					

Soil Horizon
Resid.
PWR

Auger Refusal @ 41'

Well: PZM-16
TOC Elev.: 269.68'
Cover
8" Dia. Hollow-Stem Auger Boring
Casing (2" Dia. Sch. 40 PVC)
Grout
Bentonite Seal
#2 Silica Sand Pack
Screen (10' section of 2" Dia. Sch. 40 PVC)
Total Depth (bgs.) = 40.80'

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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-17s and 17

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/14/14	Logged By:	Ross Klingman, P.G
Date Completed:	8/14/14	Drilling Method:	HSA; CME-550
Drilling Company:	Summit Engineering	Top-of-Casing Elev.:	266.74'/266.85'
Drillers Name:	Robert Cassell	Ground Surface Elev :	263.78'
NC Driller Certification:	4143A	Natural, Cut, Fill Grade:	cut

Water Levels
1 Hour = dry/dry
24 Hours = dry/dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

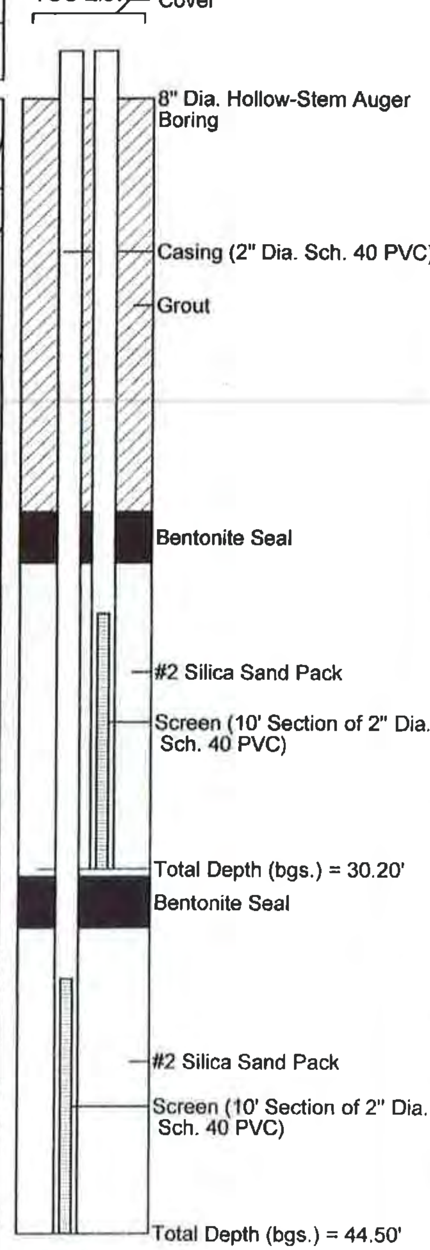
Well1: PZM-17s
Well2: PZM-17

TOA 283.93

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	263.78	4 10 (17)	SS	24	moist; very stiff; dark reddish brown (2.5YR 3/4) with tan and light gray mottles; sandy clay, clayey silt and clayey sand; no plasticity; cohesive; Soil Horizon CL
5	258.78	8 17 24 (41)	SS	18	moist; hard; dark red (2.5YR 3/6) with light green gray mottles; silty clay; no plasticity; cohesive; Residuum CL
10	253.78	8 11 29 (40)	SS	19	moist; hard; dark red (2.5YR 3/6) with light green gray mottles; silty clay; no plasticity; cohesive; Residuum CL
15	248.78	23 15 17 (32)	SS,BAG	14	moist; hard; dark red (2.5YR 3/6) with light green gray mottles; blocky horizontal fissile; silty clay; no plasticity; cohesive; Residuum; (Lab Results PZM-17 Bag (13.5-15'); USCS=CL; Sand 1.5%; Silt=75%; Clay 23.5%; Effective Porosity=4%; Atterberg Limits: PL=19, LL=35, PI=16) CL
20	243.78	50/3" (>50)	SS	10	moist; very hard; dark red (2.5YR 3/6); blocky horizontal fissile; silty clay; no plasticity, cohesive; Partially Weathered Rock
25	238.78	50/4"	SS	6	moist; very hard; dark red (2.5YR 3/6); blocky horizontal fissile; silty clay; no plasticity; cohesive; Partially Weathered Rock
30	233.78	50/4"	SS	6	moist; very hard; reddish brown (2.5YR 4/4); highly horizontal fissile; weathered sandy mudstone; Partially Weathered Rock
35	228.78	50/1" (229.64)	SS	3	moist; very hard; dark red (2.5YR 3/6); silty clay with rock fragments; no plasticity; cohesive; Partially Weathered Rock
40	223.78	50/2"	SS	8	dry; very hard; weak red (10R 4/4); highly horizontal fissile; weathered mudstone; Partially Weathered Rock
45	218.78	50/1"	SS	6	wet; very hard; dark red (2.5YR 3/6); silty clay; no plasticity; cohesive; Partially Weathered Rock
50					

Auger Refusal @ 44.5'

Soil Horizon
Resid
PWR
WG 241.86
20



Buxton Environmental, Inc.
Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-18

TOA 270.00

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

Date Started:	8/13/14	Logged By:	Ross Klingman, P.G.
Date Completed:	8/13/14	Drilling Method:	HSA; Geoprobe 8040DT
Drilling Company:	Geologic Exploration	Top-of-Casing Elev.:	236.64'(Lawrence Survey)
Drillers Name:	Johnny Burr	Ground Surface Elev.:	233.78'(Lawrence Survey)
NC Driller Certification:	3098A	Natural, Cut, Fill Grade:	cut

Water Levels
- 1 Hour = dry
- 24 Hours = dry

Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	233.78	12 12 14 (26)	SS	24	dry; very stiff; yellowish red (5YR 4/6) with light gray specks; silty clay with mudstone fragments; no plasticity; cohesive; Residuum CL
5	228.78	2 8 12 (20)	SS	18	dry; very stiff; gray (7.5YR 6/1) with brown and light gray mottles; horizontal fissile; silty clay; no plasticity; cohesive; Residuum CL
10	223.78	2 4 14 (18)	SS,BAG	24	moist; very stiff; grayish brown (10YR 5/2); silty clay with weathered mudstone fragments; no plasticity; cohesive; Residuum; (Lab Results: PZM-18 Bag (8.5-10'); USCS=CL; Sand=7.2%; Silt=56.3%; Clay=36.5%; Effective Porosity=3; PL=20, LL=39; PI=19) CL
15	218.78	50/2" (>50)	SS	8	moist; very hard; dark greenish gray (Gley 2 3/1); weathered sandy mudstone; Partially Weathered Rock
20	213.78	23 50/1"	SS	14	dry; very hard; gray (7.5YR 6/1) with maroon mottles; clayey silt with mudstone fragments; no plasticity; cohesive; Partially Weathered Rock
25	208.78				
30	203.78				
35	198.78				
40	193.78				
45					

Resid.

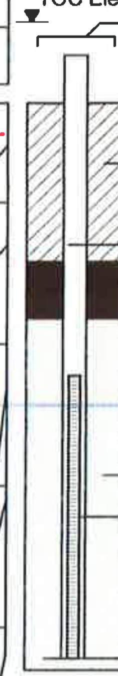
BG. 224

PWR

214.43

Auger Refusal @ 20'

Well: PZM-18
TOC Elev.: 236.64'



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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-19

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

TOR 269.96

Date Started:	: 8/13/14	Logged By:	: Ross Klingman, P.G.
Date Completed:	: 8/13/14	Drilling Method:	: HSA; Geoprobe 8040DT
Drilling Company:	: Geologic Exploration	Top-of-Casing Elev.:	: 243.23'(Lawrence Survey)
Drillers Name:	: Johnny Burr	Ground Surface Elev.:	: 240.56'(Lawrence Survey)
NC Driller Certification:	: 3098A	Natural, Cut, Fill Grade:	: road bed, cut

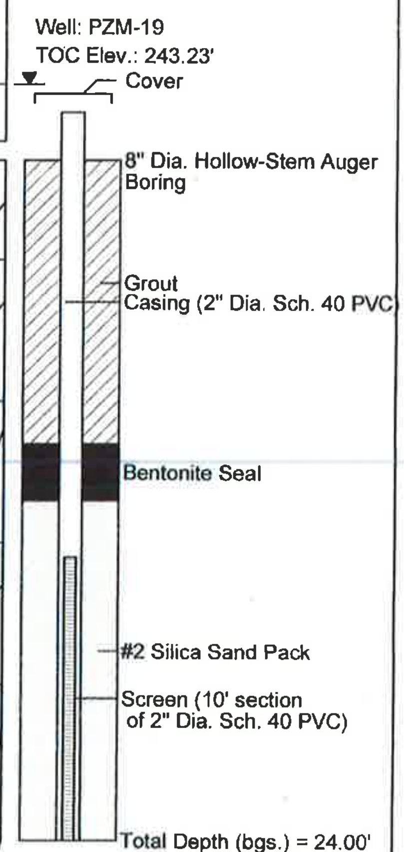
Water Levels
1 Hour = dry
24 Hours = dry

Sample Type
SS = Split Spoon
ST = Shelby Tube
RC = Rock Core
BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	240.56	3 3 3 (6)	SS	19	wet; medium; reddish brown (5YR 4/4); sandy silty clay with roots; low plasticity; cohesive; Soil Horizon CL
5	235.56	3 3 5 (8)	SS	14	wet; medium; reddish brown (5YR 4/4); sandy silty clay; medium plasticity; cohesive; Soil Horizon CL
10	230.56	14 50/5" (75)	SS	12	moist; very hard; reddish brown (5YR 4/4); sandy silty clay; medium plasticity; cohesive; Soil Horizon CL
15	225.56	6 18 15 (33)	SS	18	moist; hard; light rust and light yellow green mottled; wavey horizontal fissile; silty clay; low plasticity; cohesive; Residuum CL
20	220.56	7 14 50/1" (75)	SS,BAG	16	moist; very hard; dark reddish brown (5YR 3/4); highly horizontal fissile; weathered mudstone; Partially Weathered Rock; (Lab Results: PZM-19 Bag (18.5-20'); USCS=CL; Sand=5.8%; Silt=69.5%; Clay=24.7%; Effective Porosity=3%; Atterberg Limits: PL=22, LL=42, PI=20)
25	215.56	50/3"	SS	10	moist; very hard; dark reddish brown (5YR 3/4); blocky horizontal fissle; weathered mudstone; Partially Weathered Rock
30	210.56				
35	205.56				
40	200.56				
45					

Auger Refusal @ 24'

Soil Horizon
Resid
PWR
BG 211.56
201



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Consulting Services
1101 South Blvd., Suite 101
Charlotte, North Carolina 28203
Ph (704) 344-1450 Fax (704) 344-1451
buxtonenv@bellsouth.net

Boring Log, PZM-20

Moncure Mine Reclamation Site
1315 Moncure-Flatwood Road
Moncure, North Carolina

TOR 265.58

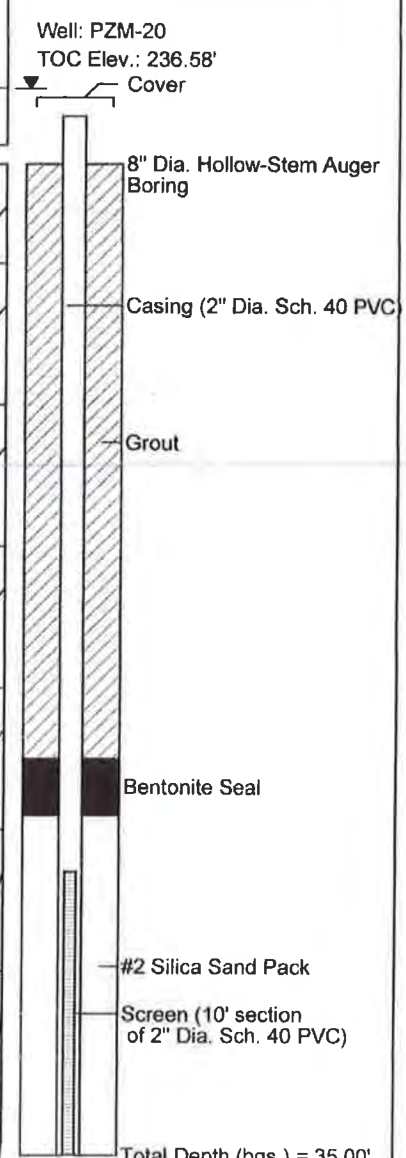
Date Started:	: 8/13/14	Logged By:	: Ross Klingman, P.G
Date Completed:	: 8/13/14	Drilling Method:	: HSA; Geoprobe 8040DT
Drilling Company:	: Geologic Exploration	Top-of-Casing Elev.:	: 236.58'(Lawrence Survey)
Drillers Name:	: Johnny Burr	Ground Surface Elev.:	: 233.93'(Lawrence Survey)
NC Driller Certification:	: 3098A	Natural, Cut, Fill Grade:	: road bed, fill

Water Levels
- 1 Hour = dry
- 24 Hours = dry

Sample Type
- SS = Split Spoon
- ST = Shelby Tube
- RC = Rock Core
- BAG = Bag Sample

Depth (feet bgs.)	Elevation (feet asl.)	Blow Count/6-inches	Sampler Type	Recovery (in.)	Lithologic Description
0	233.93	2 3 6 (9)	SS	24	moist; stiff; reddish brown (5YR 5/4) with yellow and gray mottles; silty clay; medium plastic; cohesive; Fill
5	228.93	1 2 2 (4)	SS	20	moist; soft; reddish brown (2.5YR 4/4) with light gray mottles; silty clay; low plasticity; cohesive; Fill
10	223.93	2 2 4 (6)	SS	14	moist; medium; pinkish gray (7.5YR 7/2) with red orange mottles; silty clay; medium plasticity; cohesive; Soil Horizon
15	218.93	14 13 21 (34)	SS	13	moist; hard; pale red (2.5YR 6/2) with light rust mottles; silty clay with quartz gravel; no plasticity; cohesive; Residuum
20	213.93	5 8 10 (18)	SS	16	moist; very stiff; dark gray, yellow and light rust mottled; wavey horizontal fissile; silty clay; no plasticity; cohesive; Residuum
25	208.93	6 48 50/1" (>50)	SS	17	moist; very hard; weak red (10R 4/2) with light gray mottles; wavey highly horizontal fissile; silty clay; no plasticity; cohesive; Partially Weathered Rock
30	203.93	12 28 36	SS,BAG	24	moist; very hard; weak red (10R 4/2) with light gray mottles; wavey highly horizontal fissile; silty clay; no plasticity; cohesive; Residuum;)Lab Results: PZM-20 Bag (28-30'); USCS=CL; Gravel=0.3%; Sand=3.7%; Silt=54.8%; Clay=41.2%; Effective Porosity=2%; Atterberg Limits: PL=22, LL=39; PI=17)
35	198.93	19 50/4" (200)	SS,BAG	15	moist; very hard; weak red (10R 4/2) with light gray mottles; wavey highly horizontal fissile; silty clay; no plasticity; Partially Weathered Rock; (Lab Results: PZM-20 Bag (33.5-34.5'); USCS=CL; Sand=9%; Silt=61.5%; Clay=29.5%; Effective Porosity=4%; Atterberg Limits: PL=20, LL=38, PI=18)
40	193.93				
45					

Fill
Soil Horizon
Resid.
210.78 BG
PWR



ATTACHMENT B

GEOTRACK Technologies, Inc.

3620 Pelham Road, PMB #292 Phone: 864-329-0013
Greenville, SC 29615-5044 FAX: 864-329-0014

June 30, 2014

Charah, Inc
12601 Plantside Drive
Louisville, KY 40299

Attention: Mr. Norman E. Divers, III

Re; Physical Characterization Testing of Coal Combustion By-products
Riverbend Steam Station
Mount Holly, NC
GeoTrack Project No. 14-3425-N

Ladies and Gentlemen:

GeoTrack Technologies, Inc. has completed characterization testing of a sample from the referenced plant, and we present the results herein. The work was performed as a preliminary evaluation of whether the material is satisfactory for use as structural fill at the Charlotte-Douglas Airport, Area C. This letter presents a brief summary of the procedures and presents the testing results.

Project Description: The material in question includes coal combustion by-products that might include a mixture of fly ash and bottom ash that are collected and discharged to holding ponds on the power plant property. The combined combustion by-products (hereinafter referred to as CCB's) are proposed for use in an engineered fill. The engineered fill will be constructed by excavating native soils, constructing a composite (membrane) liner, placing the CCB as compacted fill, and covering the fill with a combination of a membrane cap and compacted soil. Subsequent uses of the completed fill have not been finalized; we anticipate that the property could be developed as part of nearby airport expansion, for commercial purposes (retail development, light industrial, etc), or to reclaim land that was previously excavated for other purposes.

Sampling Procedures: GeoTrack visited the power plant on May 15, 2014 and collected CCB samples. Grab samples were collected from the pond nearest the plant site (a wet pond). The sample locations included the northern corner, at the primary effluent structure, and the diagonally opposite corner, near the primary influent. Those locations were selected because they provided access to the CCB. Most areas of the exposed CCB were saturated and soft to both vehicular and pedestrian traffic.

Sampling was performed using procedures in general conformance with ASTM C 311 (ASTM D 75) for physical testing. The physical test sample was split in accordance with ASTM procedures and subjected to various laboratory tests. The physical (engineering) tests included classification tests, strength tests, and consolidation tests.

Portions of the samples were also placed in laboratory-prepared containers in accordance with applicable EPA SW846 procedures for the chemical analyses. The chemical analyses are reported separately.

Physical (Engineering) Testing: Table 1 presents the physical (engineering) tests performed, the applicable test methods, and the results. Where applicable, individual test reports are attached. Detailed evaluation of the engineering characteristics is beyond the scope of this report, and the suitability of the various properties is dependent upon final site geometry and fill usage; however, a few comments are offered based upon our preliminary review of the test results.

The grain size characteristics and specific gravity are within expected ranges based on general experience with similar CCB's. The material consists predominantly of silt-sized particles that are essentially cohesionless in nature. Atterberg limits tests indicate the material to be non-plastic despite the fine grained size characteristics. The sand content of the sample might be influenced by the bottom ash content of this CCB.

The Standard Proctor Maximum Dry Density achieved for this sample (56.6 pounds per cubic foot (pcf) at an optimum moisture content of 48 percent) was low relative to the range typically achieved for similar products. The Proctor curve is relatively flat, indicating the material is not sensitive to moisture content. The compaction curve indicates that 95 percent compaction can be theoretically achieved with the standard Proctor compactive effort over a range of moisture contents spanning greater than 10 percent. Our experience indicates considerable variability in densities, moisture contents, etc. might be expected, and these properties are most likely influenced by long-term variations in plant procedures and the flow/sedimentation processes within the pond.

Three separate specimens were collected from the bulk sample and tested for field moisture content. They were selected based on their proximity to the prevailing water level within the pond at the time of sampling (collected from above and below the water surface). They ranged from 50.0 to 92.2 percent by dry weight. The average of the three moisture contents was 73.3 percent. While this average moisture content is well above the optimum moisture content, the wide variation in collected samples indicates that significant reductions in moisture content can occur simply by passively draining the materials. Also, more active moisture adjustment should require minor effort within temporary stockpiles and in the fill lifts.

Despite the low compacted dry density, the strength properties of this sample are favorable for most routine engineering applications. Three sets of strength properties were derived from two separate strength tests. The tests simulate both drained (effective or long-term) and undrained (total or short-term loading) conditions that might be experienced in service. The undrained strength test results indicate short-term strengths that varied, but are characteristic of fine grained materials. The undrained strength tests exhibited strength envelops that are combinations of cohesion and internal friction. They exhibited undrained cohesion ranging from moderate to high (C = 1,900 to 4,300 pounds per square foot; psf), with corresponding angles of internal friction ranging from low to moderate (Ø = 8 to 27°). In combination, the two sets of computed undrained strength parameters represent moderately high overall strength characteristics.

The effective (drained) strength properties reported by the laboratory (C = 2,600 psf and Ø = 22°) based on a "best-fit" strength envelope were uncharacteristic of cohesionless materials. That result is assessed to be the result of scatter in the laboratory results, which is common with earthen materials. Often CCB materials and similar fine-grained, non-plastic materials exhibit low to non-existent cohesion, and the strength is derived almost entirely from internal friction. The reported drained parameters are more characteristic of undrained behavior; however, review of the graphical results indicates the drained test is subject to interpretation. A strength envelope drawn through the graphical origin (C = 0) and tangent to the lowest failure circle indicates a relatively high angle of internal friction (Ø = 39°), with little deviation from the other failure circles. That adjusted strength envelop is both characteristic of non-plastic, cohesionless materials, and relatively high internal strength. The adjusted test results are similar to drained strengths of CCB materials sampled from other plants. The laboratory interpretation and adjusted strength parameters are shown in attachments.

Similarly, the consolidation test results indicate settlement characteristics of the CCB's will be favorable. With total strain of less than 3 percent and 4 percent at applied pressures of 8 and 16 kips per square foot (psf), respectively, the material has characteristics of low compressibility. Our experience indicates that the settlement characteristics will be comparable, or more favorable (less compressible) than, typical area soils.

<u>Closing</u>: GeoTrack is pleased to be of service to you on this project. Please call if you have any questions concerning this letter or if we may provide additional assistance.

Respectfully submitted,
GeoTrack Technologies, Inc.

David D. Wilson, P.E.
Senior Engineer
NC Registration No. 17088

NORTH CAROLINA PROFESSIONAL
PE
17088
6/30/14
ENGINEER
DAVID D. WILSON

TABLE 1 – PHYSICAL/ENGINEERING CHARACTERISTICS
RIVERBEND STEAM STATION
GEOTRACK PROJECT NO. 14-3425-N

Physical/Engineering Characteristic	Test Method	Test Result/ Applicable Parameters	Remarks
Grain Size Distribution	ASTM 422	22 Percent Sand 72 Percent Silt 6 Percent Clay *Grain Size Distribution Attached*	Sieve and Hydrometer
Specific Gravity	ASTM 854	Specific Gravity: $G_s = 2.13$	
Water Content	ASTM D 2216	Field Moisture Content: $w = 73.3$ %	Moisture Content at Time of Sampling – Note 5
Compaction	ASTM D 698	Maximum Dry Density: $\gamma_{d\,max} = 56.6$ pcf Optimum Moisture Cont.: $w_{opt} = 48.0$ % *Moisture Density Relationship Attached*	Standard Proctor Compaction Test
Strength:			
Shear Strength	ASTM 4767	Total Cohesion: C = 4.3 ksf Total Angle of Int. Friction: = 8° Eff. Cohesion: C'= 2.6 ksf Eff. Angle of Int. Friction: Ø' = 22° *Triaxial Shear Test Report Attached*	Consolidated Undrained Triaxial Shear Test with Pore Pressure Measurements Note 3 Note 4
Compressive Strength	ASTM 2850	Total Cohesion: C = 1.9 ksf Total Angle of Int. Friction: Ø = 27° *Triaxial Shear Test Report Attached*	Unconsolidated Undrained Triaxial Shear Test. Unconfined Compressive Strength not Meaningful for Ash Samples Note 3
Compressibility	ASTM D 2435	*Consolidation Test Report Attached*	Note 3

See notes on next page

Notes:
1. Sample collected May 15, 2014
2. The referenced ASTM procedures are as suggested in ASTM E 2277, and common geotechnical practice.
3. Tests performed on specimens remolded in the laboratory to approx. 95% of the Standard Proctor Maximum Dry Density at approximately the Optimum Moisture Content.
4. An alternative strength envelope derived from the test data is shown graphically in the attachments.
5. The reported field moisture content is the average of three separate specimens with moisture contents ranging from 50.0 to 92.2 %.

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

S&ME
Quality Assurance

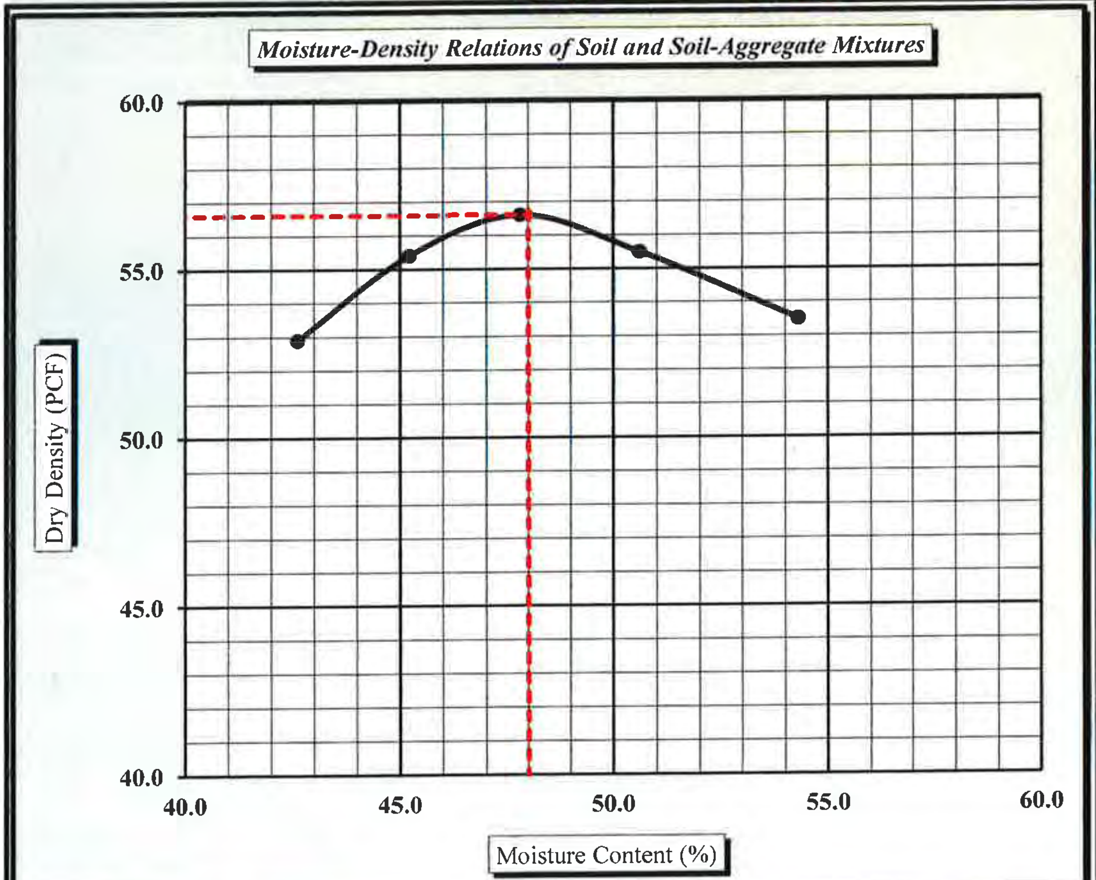
S&ME, Inc. - Greenville 281 Fairforest Way Greenville, SC 29607

S&ME Project #:	1263-10-195	Report Date:	6/02/14
Project Name:	Geotrack Technologies, Inc. - 14-3425-N	Test Date:	5/30/14
Client Name:	3620 Pelham Road, PMB #292 Greenville, SC 29615		
Client Address:	336 Longview Drive Piedmont, South Carolina 29673		

Boring #:	N/A	Log #:	44g	Sample Date:	5/15/14
Location:	Riverbend Pond	Type:	Bulk	Depth:	N/A
Sample Description:	Coal Ash				

Maximum Dry Density 56.6 PCF. **Optimum Moisture Content 48.0%**

ASTM D 698 -- Method A



Soil Properties

Natural Moisture Content	N/A
Specific Gravity of Soil (D 854)	N/A
Liquid Limit	-
Plastic Limit	NP
Plastic Index	NP

% Passing

3/4"	-
3/8"	-
#4	99.9%
#10	
#40	
#60	
#100	
#200	

Oversize Fraction

Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Rammer ☐ Manual Rammer ☒ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations:

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Brian Vaughan, P.E.	*Brian Vaughan*	Location Coordinator	6/02/14
Technical Responsibility	*Signature*	*Position*	*Date*

Particle Size Analysis of Soils

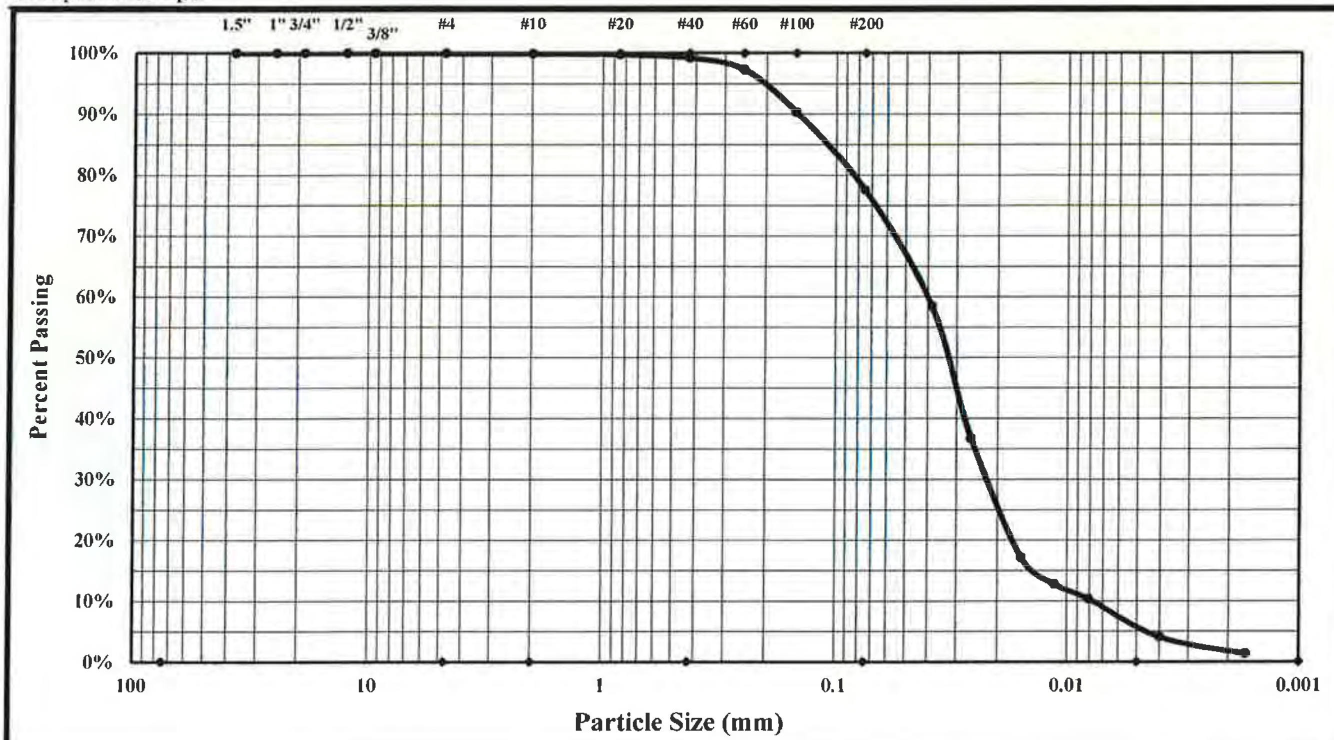
ASTM D 422

S&ME
Quality Assurance

S&ME, Inc. - Greenville 281 Fairforest Way Greenville, SC 29607

S&ME Project #:	1263-10-195			Report Date:	6/05/14
Project Name:	Geotrack Technologies, Inc. - 14-3425-N			Test Date(s):	6/02 - 6/05/14
Client Name:	Geotrack Technologies, Inc.				
Address:	3620 Pelham Road, PMB #292 Greenville, SC 29615				
Boring #:	N/A	Log #:	44g	Sample Date:	5/15/14
Location:	Riverbend Pond	Type:	Bulk	Sample Depth:	N/A

Sample Description: Coal Ash



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size:	.425 mm	Gravel:	0.1%	Silt	71.9%
Silt & Clay (% Passing #200):	77.5%	Total Sand:	22.4%	Clay	5.7%
Specific Gravity	2.130	Moisture Content		Colloids	1.0%
Liquid Limit	-	Plastic Limit	NP	Plastic Index	NP
Coarse Sand:	0.0%	Medium Sand:	0.7%	Fine Sand:	21.7%

Description of Sand and Gravel: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☒ Weathered & Friable ☐

Mechanical Stirring Apparatus A Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: ASTM D 4318, D 854, D 2487

Brian Vaughan, P.E.	Brian Vaughan	Location Coordinator	6/05/14
Technical Responsibility	*Signature*	*Position*	*Date*

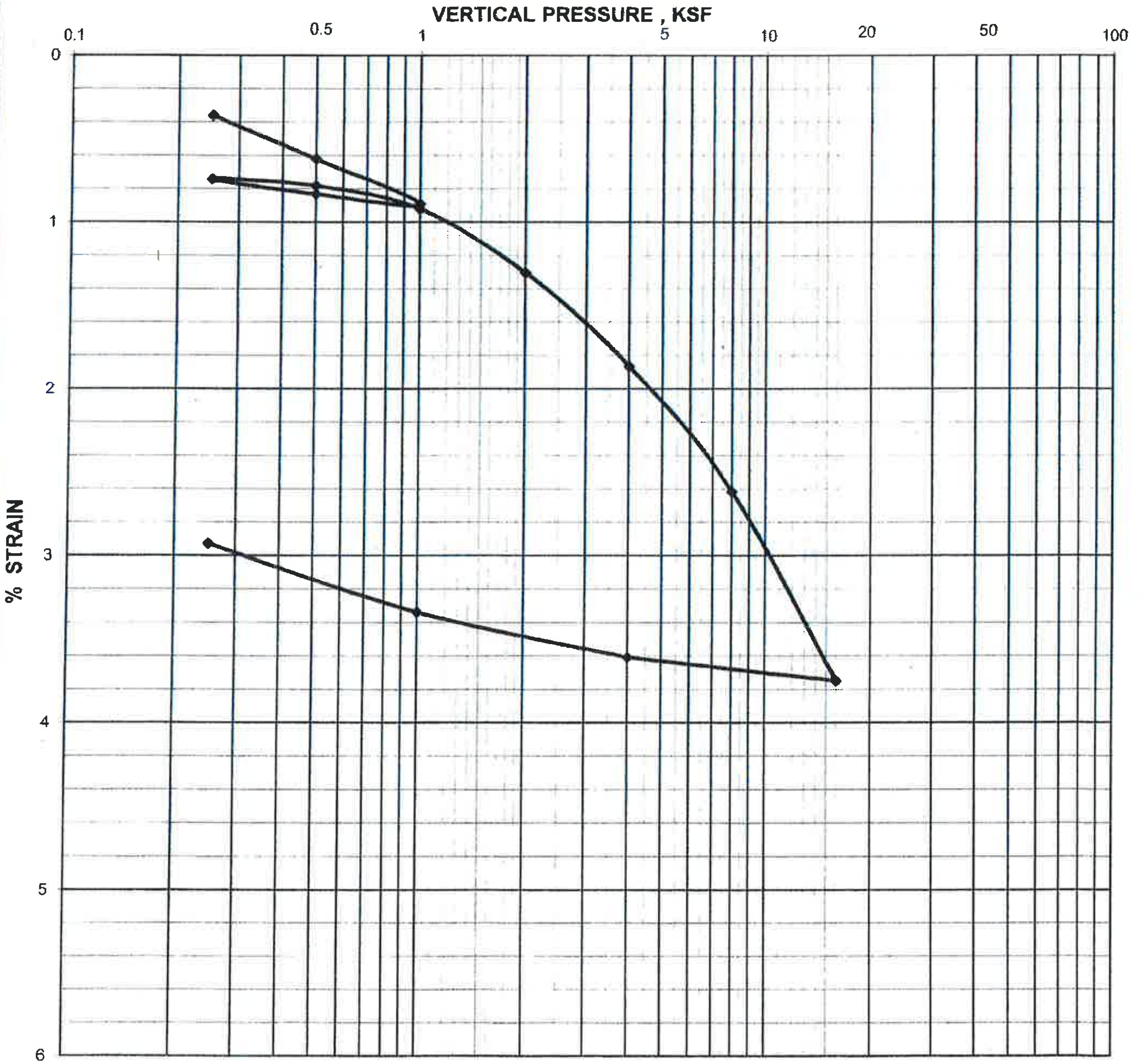
CONSOLIDATION TEST REPORT

(ASTM D 2435)

Page 1

Project Name :	Geotrack Technologies, Inc. - 14-3425-N				
Project No. :	1263-10-195			Report Date:	6/13/2014
Client Name :	Geotrack Technologies, Inc.			Boring No.:	N/A
Client Address :	3620 Pelham Road, PMB #292 Greenville, SC 29615			Depth/Elev.:	N/A
Initial Wet Density, γ_{wet}, pcf :	79.6	Load vs. Time Plot :	Log of time	Sample Type:	Bulk
Initial Void Ratio, e_o :	1.472	Final Void Ratio, e_f :	1.400	Log No.:	44g
Initial Saturation, S_O , % :	69.4	Final Saturation, S_f , % :	100.0	Sp. Gravity , G_S :	2.13
Initial Dry Density, γ_{DRY}, pcf :	53.8	Final Dry Density, γ_{DRY}, pcf :	54.7	Estimated Preconsolidation	
Initial Moisture Content, %.:	48.0	Final Moisture Content, %.:	67.1	Stress, P_e, ksf :	1.0
Liquid Limit, % :	-	Plasticity Index, % :	NP	Fines, % :	77.5
Sample Description :	Coal Ash				
Remolded Properties :	Specimen was remolded to 95% of maximum dry density at about 0% wet of optimum				

Notes: Loading Schedule - as requested by client (ksf)- 0.25, 0.5, 1.0, 0.5, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, 4.0, 1.0, 0.25



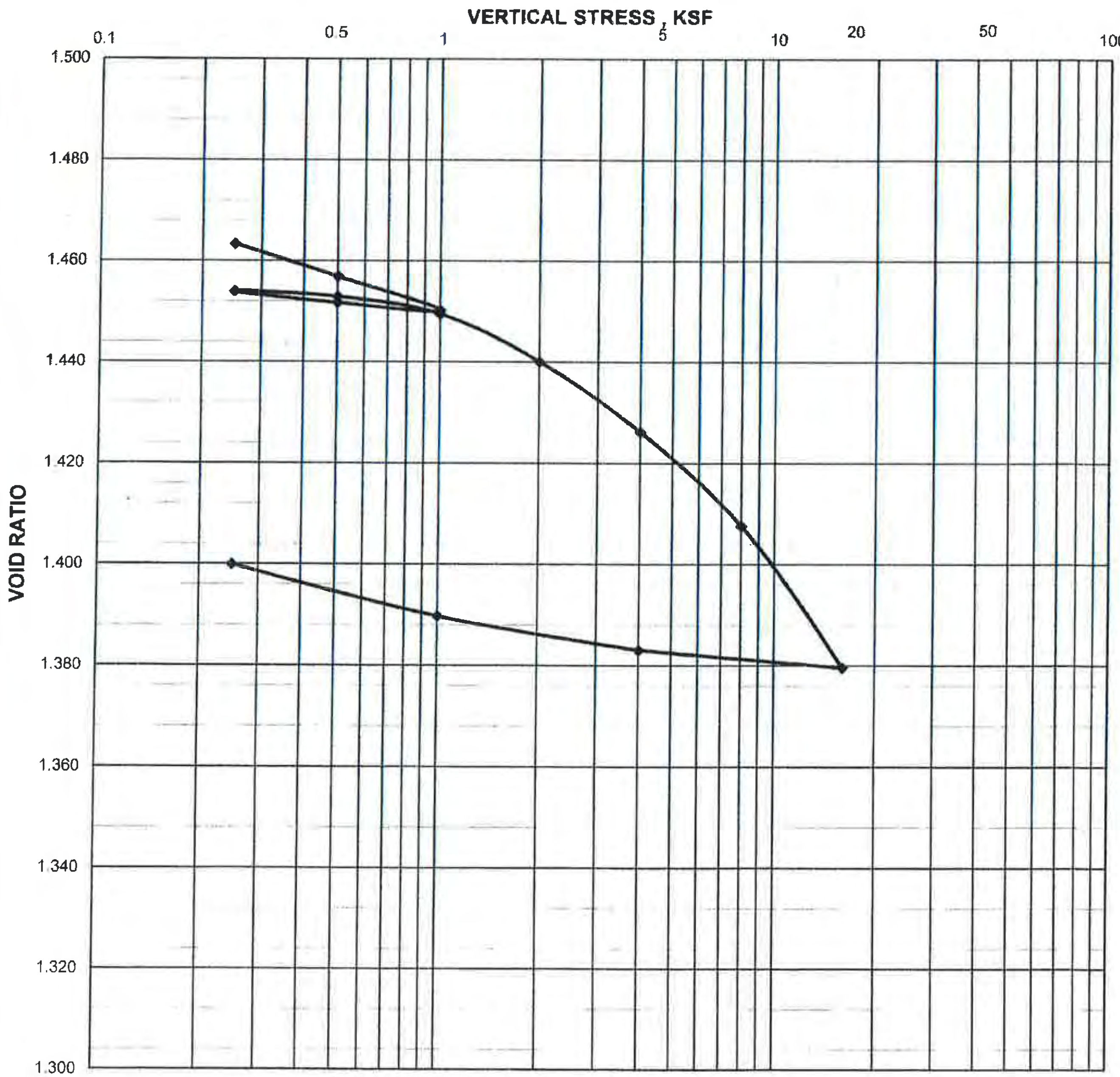
S&ME

CONSOLIDATION TEST REPORT

(ASTM D 2435)

Project Name :	Geotrack Technologies, Inc. - 14-3425-N				
Project No. :	1263-10-195			Report Date:	6/13/2014
Client Name :	Geotrack Technologies, Inc.			Boring No.:	N/A
Client Address :	3620 Pelham Road, PMB #292 Greenville, SC 29615			Depth/Elev.:	N/A
Initial Wet Density, γ_{wet}, pcf :	79.6	Load vs. Time Plot :	Log of time	Sample Type:	Bulk
Initial Void Ratio, e_o :	1.472	Final Void Ratio, e_f :	1.400	Log No.:	44g
Initial Saturation, S_O, % :	69.4	Final Saturation, S_f, % :	100.0	Sp. Gravity, G_S :	2.13
Initial Dry Density, γ_{DRY}, pcf :	53.8	Final Dry Density, γ_{DRY}, pcf :	54.7	Estimated Preconsolidation	
Initial Moisture Content, %.:	48.0	Final Moisture Content, %.:	67.1	Stress, P_c, ksf :	1
Liquid Limit, % :	-	Plasticity Index, % :	NP	Fines, % :	77.5
Sample Description :	Coal Ash				
Remolded Properties :	Specimen was remolded to 95% of maximum dry density at about 0% wet of optimum				

Notes: Loading Schedule - as requested by client (ksf)- 0.25, 0.5, 1.0, 0.5, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, 4.0, 1.0, 0.25



S&ME

TRIAXIAL SHEAR TEST REPORT

(ASTM D 2850)

Unconsolidated Undrained

AASHTO R18

REV4,1/13/04

Project Name:	Geotrack Technologies, Inc. - 14-3425-N		
Project No.:	1263-10-195	**Report Date:**	06/10/14
Client Name:	Geotrack Technologies, Inc.	**Test Date:**	6/9/14
Client Address:	3620 Pelham Road, PMB #292 Greenville, SC 29615		
Boring #: N/A	**Depth / Elev. :** N/A	**Log #:** 44g	**Type:** Bulk
Sample Location :	Riverbend Pond		
Sample Description :	Coal Ash		
LL, % : -	**PI , % :** NP	**Percent Passing #200 :** 77.5	**G_s :** 2.130

SPECIMEN PROPERTIES

SPECIMEN NO.		INITIAL 1	INITIAL 2	INITIAL 3		FINAL 1	FINAL 2	FINAL 3
DIAMETER , INCHES	D_o	2.82	2.81	2.82	D_c	N/A	N/A	N/A
HEIGHT , INCHES	H_o	6.04	6.02	6.03	H_c	N/A	N/A	N/A
WATER CONTENT, %	W_o	48.0	48.0	48.0	W_c	N/A	N/A	N/A
DRY DENSITY, PCF	γ_{dryo}	53.7	53.9	53.7	γ_{dryc}	N/A	N/A	N/A
SATURATION ,%	S_o	69.2	69.8	69.3	S_c	N/A	N/A	N/A
VOID RATIO	e_o	1.477	1.464	1.476	e_c	N/A	N/A	N/A

TEST PARAMETERS , TEST TYPE : UU

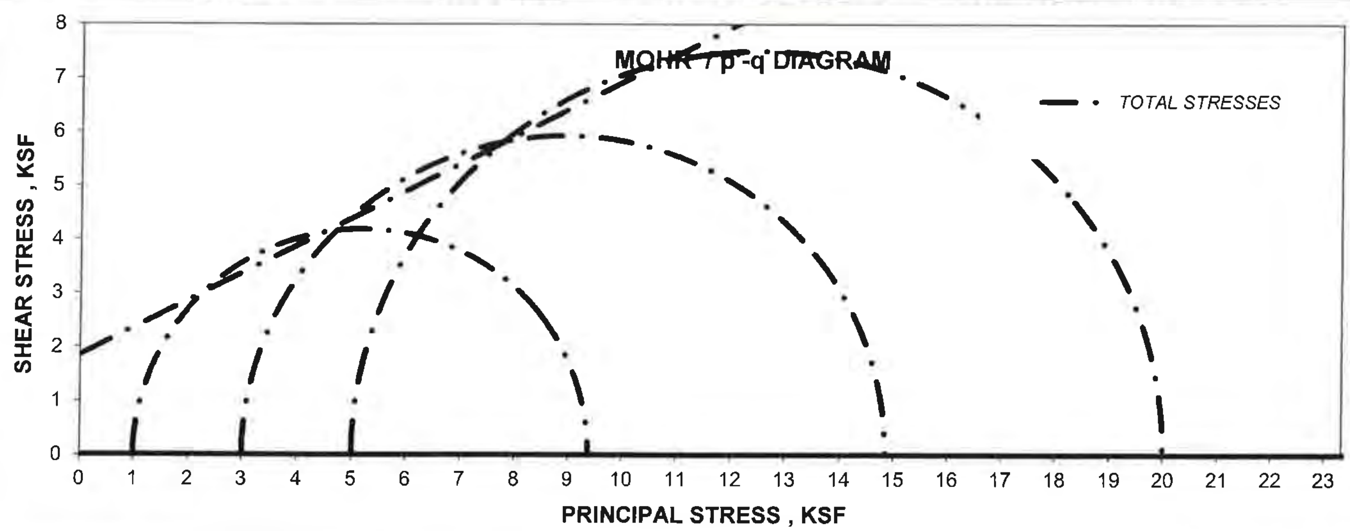
SPECIMEN NO.		1	2	3
B Value		N/A	N/A	N/A
BACK PRESSURE, ksf	U_o	7.2	7.2	7.2
CONFINING PRESSURE , ksf	σ_3	1.0	3.0	5.0
MAX. DEVIATOR STRESS ,ksf	$\sigma_1-\sigma_3$	8.4	11.9	15.0
ULT. DEVIATOR STRESS , ksf	$\sigma_1-\sigma_3$	8.4	10.7	14.8
Specimen Shape @ Failure	Sheared			

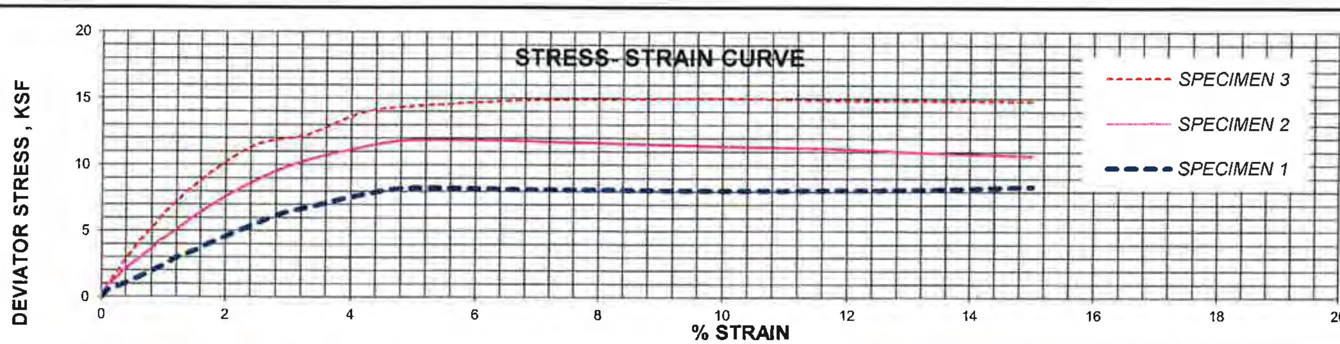
CONTROLLED : Strain @ 1.0 % per minute

PROCTOR TYPE : *Standard* , **MAXIMUM DRY DENSITY , PCF :** *56.6* **,OPTIMUM MOISTURE CONTENT , % :** *48.0*

REMOLDED : *Specimens were remolded to* **95** *% of maximum dry density at about* **0.0** *% wet of o.m.c.*

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION , C (ksf) :	1.9	APPARENT COHESION , (ksf) :	N/A
	ANGLE OF INTER. FRICTION, Φ(DEGREES)	27	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	N/A





Brian Vaughan, P.E.	Brian Vaughan	Location Coordinator	06/10/14
Technical Responsibility	*Signature*	*Position*	*Date*

S&ME

TRIAXIAL SHEAR TEST REPORT
(ASTM D 4767)

REV4,1/13/04

Project Name:	Geotrack Technologies, Inc. - 14-3425-N				
Project No.:	1263-10-195		**Report Date:**	06/10/14	
Client Name:	Geotrack Technologies, Inc.		**Test Date:**	6/02 - 6/10/14	
Client Address:	3620 Pelham Road, PMB #292 Greenville, SC 29615				
Boring No. :	N/A	**Depth / Elev. :** N/A	**Sample No . :**	44g	**Type:** Bulk
Sample Location :	Riverbend Pond				
Sample Description :	Coal Ash				
LL, % :	-	**PI , % :** NP	**Percent Passing #200 :**	77.5	**G_s :** 2.130

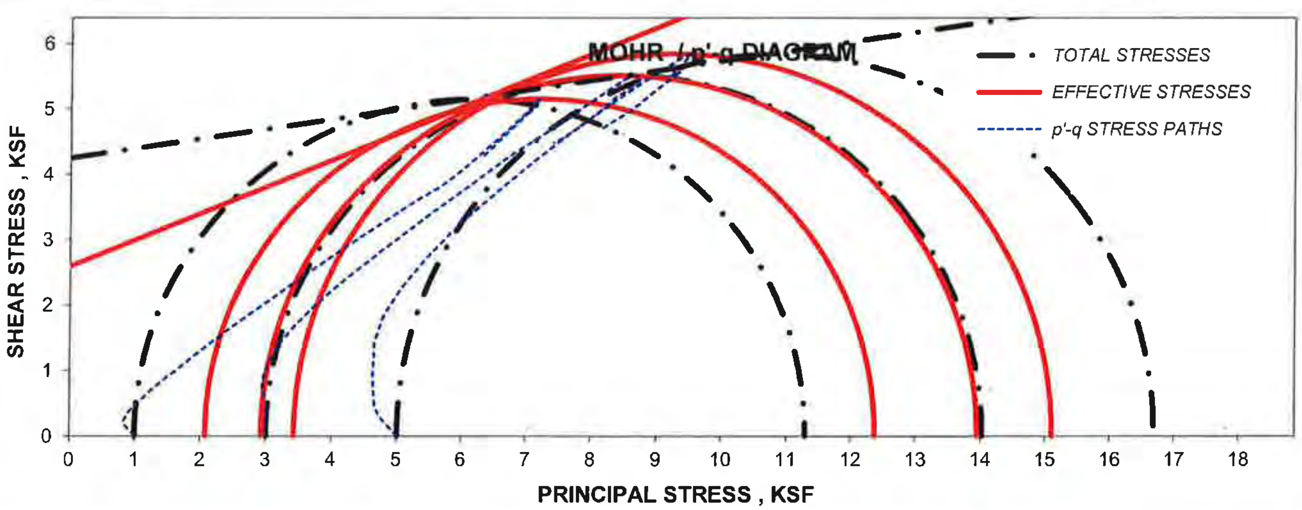
SPECIMEN PROPERTIES		INITIAL				AFTER CONSOLIDATION			TEST PARAMETERS , TEST TYPE : CU/PP				
SPECIMEN NO.		1	2	3		1	2	3	**SPECIMEN NO.**		1	2	3
									B Value		0.95	0.95	0.95
DIAMETER , INCHES	D_o	2.82	2.82	2.82	D_c	2.81	2.79	2.79	BACK PRESSURE, ksf	U_o	7.2	7.2	7.2
HEIGHT , INCHES	H_o	6.03	6.01	6.01	H_c	6.00	5.96	5.95	CONFINING PRESSURE , ksf	σ_3	1.0	3.0	5.0
WATER CONTENT, %	W_o	48.0	48.0	48.0	W_c	67.6	65.8	65.0	MAX. DEVIATOR STRESS ,ksf	σ_1-σ_3	10.3	11.0	11.7
DRY DENSITY, PCF	γ_{dryo}	53.8	53.9	54.0	γ_{dryc}	54.5	55.4	55.8	ULT. DEVIATOR STRESS , ksf	σ_1-σ_3	8.5	9.0	9.4
SATURATION ,%	S_o	69.4	69.7	70.0	S_c	100.0	100.0	100.0	Specimen Shape @	Sheared			
VOID RATIO	e_o	1.472	1.468	1.461	e_c	1.439	1.401	1.384	Failure				

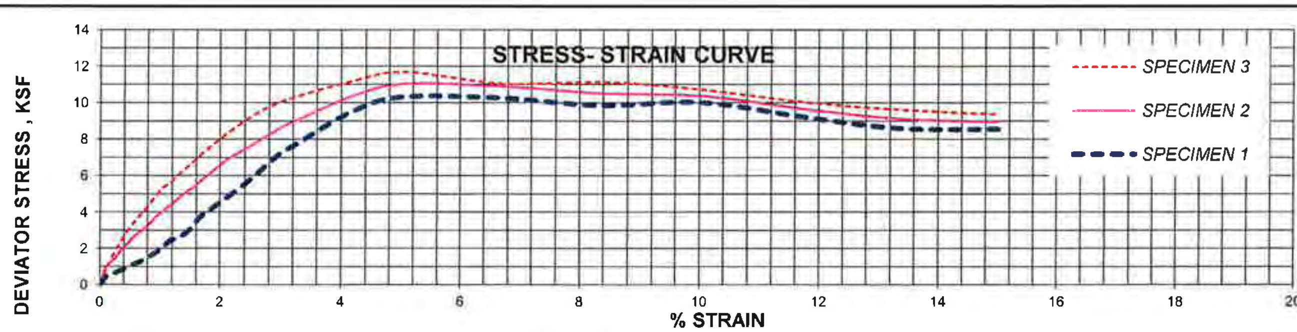
CONTROLLED : Strain @ 0.02 % per minute T50, Minutes = 18.0

PROCTOR TYPE : *Standard* , **MAXIMUM DRY DENSITY , PCF :** *56.6* **,OPTIMUM MOISTURE CONTENT , % :** *48.0*

REMOLDED : ***Specimens were remolded to 95 % of maximum dry density at about 0.0 % wet of o.m.c.***

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION , C (ksf) :	4.3	APPARENT COHESION , (ksf) :	2.6
	ANGLE OF INTER. FRICTION, Φ(DEGREES)	8	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	22





Brian Vaughan, P.E. — *Technical Responsibility*

Signature

Location Coordinator — *Position*

06/10/14 — *Date*

S&ME

TRIAXIAL SHEAR TEST REPORT

(ASTM D 4767)

AASHTO R18

REV4,1/13/04

Project Name:	Geotrack Technologies, Inc. - 14-3425-N				
Project No.:	1263-10-195		**Report Date:**	06/10/14	
Client Name:	Geotrack Technologies, Inc.		**Test Date:**	6/02 - 6/10/14	
Client Address:	3620 Pelham Road, PMB #292 Greenville, SC 29615				
Boring No. :	N/A	**Depth / Elev. :** N/A	**Sample No . :**	44g	**Type:** Bulk
Sample Location :	Riverbend Pond				
Sample Description :	Coal Ash				
LL, % :	-	**PI , % :** NP	**Percent Passing #200 :**	77.5	**G_s :** 2.130

SPECIMEN PROPERTIES		INITIAL			AFTER CONSOLIDATION			
SPECIMEN NO.		1	2	3		1	2	3
DIAMETER , INCHES	D_o	2.82	2.82	2.82	D_c	2.81	2.79	2.79
HEIGHT , INCHES	H_o	6.03	6.01	6.01	H_c	6.00	5.96	5.95
WATER CONTENT, %	W_o	48.0	48.0	48.0	W_c	67.6	65.8	65.0
DRY DENSITY, PCF	γ_{dryo}	53.8	53.9	54.0	γ_{dryc}	54.5	55.4	55.8
SATURATION ,%	S_o	69.4	69.7	70.0	S_c	100.0	100.0	100.0
VOID RATIO	e_o	1.472	1.468	1.461	e_c	1.439	1.401	1.384

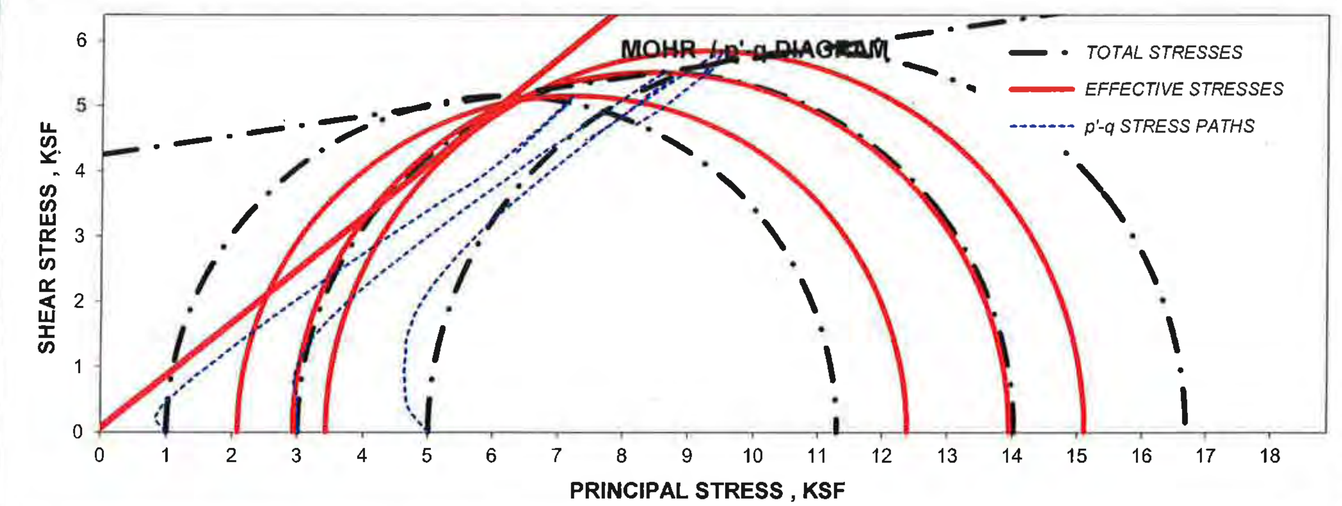
TEST PARAMETERS , TEST TYPE : CU/PP				
SPECIMEN NO.		1	2	3
B Value		0.95	0.95	0.95
BACK PRESSURE, ksf	U_o	7.2	7.2	7.2
CONFINING PRESSURE , ksf	σ_3	1.0	3.0	5.0
MAX. DEVIATOR STRESS ,ksf	$\sigma_1-\sigma_3$	10.3	11.0	11.7
ULT. DEVIATOR STRESS , ksf	$\sigma_1-\sigma_3$	8.5	9.0	9.4
Specimen Shape @ Failure	Sheared			

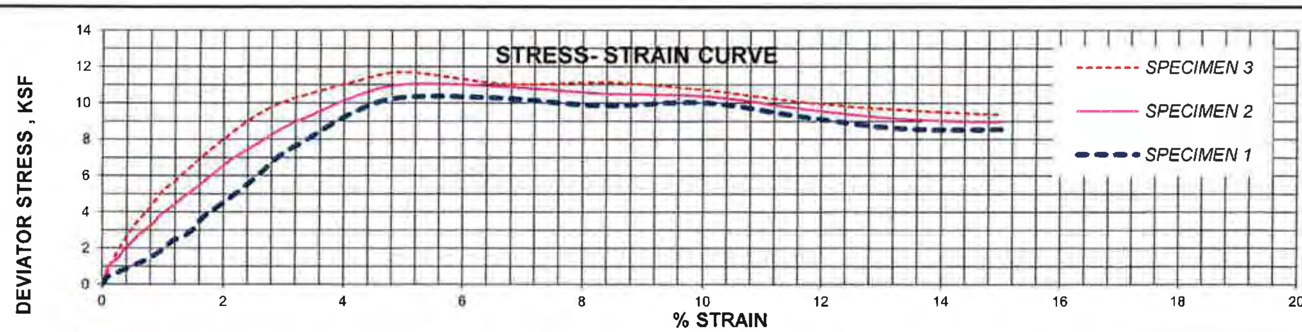
CONTROLLED : Strain @ 0.02 % per minute T50, Minutes = 18.0

PROCTOR TYPE : *Standard* , MAXIMUM DRY DENSITY , PCF : 56.6 ,OPTIMUM MOISTURE CONTENT , % : 48.0

REMOLDED : *Specimens were remolded to 95 % of maximum dry density at about 0.0 % wet of o.m.c.*

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE (ALT. FAILURE INTERPRETATION)	
	COHESION , C (ksf) :	4.3	APPARENT COHESION , (ksf) :	0
	ANGLE OF INTER. FRICTION, Φ(DEGREES)	8	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	39





Brian Vaughan, P.E.	Brian Vaughan	Location Coordinator	06/10/14
Technical Responsibility	*Signature*	*Position*	*Date*

ATTACHMENT C

TABLE 6
Typical Values of Soil Index Properties

	Particle Size and Gradation				Voids[1]					Unit Weight[2] (lb./cu.ft.)						
	Approximate Size Range (mm)		Approx. D_{10} (mm)	Approx. Range Uniform Coefficient C_u	Void Ratio			Porosity (%)		Dry Weight			Wet Weight		Submerged Weight	
	D_{max}	D_{min}			e_{max} loose	e_{cr}	e_{min} dense	n_{max} loose	n_{min} dense	Min loose	100% Mod. AASHO	Max dense	Min loose	Max dense	Min loose	Max dense
GRANULAR MATERIALS																
Uniform Materials																
a. Equal spheres (theoretical values)	-	-	-	1.0	0.92	-	0.35	47.6	26	-	-	-	-	-	-	-
b. Standard Ottawa SAND	0.84	0.59	0.67	1.1	0.80	0.75	0.50	44	33	92	-	110	93	131	57	69
c. Clean, uniform SAND (fine or medium)	-	-	-	1.2 to 2.0	1.0	0.80	0.40	50	29	83	115	118	84	136	52	73
d. Uniform, inorganic SILT	0.05	0.005	0.012	1.2 to 2.0	1.1	-	0.40	52	29	80	-	118	81	136	51	73
Well-graded Materials																
a. Silty SAND	2.0	0.005	0.02	5 to 10	0.90	-	0.30	47	23	87	122	127	88	142	54	79
b. Clean, fine to coarse SAND	2.0	0.05	0.09	4 to 6	0.95	0.70	0.20	49	17	85	132	138	86	148	53	86
c. Micaceous SAND	-	-	-	-	1.2	-	0.40	55	29	76	-	120	77	138	48	76
d. Silty SAND & GRAVEL	100	0.005	0.02	15 to 300	0.85	-	0.14	46	12	89	-	146[3]	90	155[3]	56	92
MIXED SOILS																
Sandy or Silty CLAY	2.0	0.001	0.003	10 to 30	1.8	-	0.25	64	20	60	130	135	$\boxed{100}$	$\boxed{147}$	38	85
Skip-graded Silty CLAY with stones or rk fgmts	250	0.001	-	-	1.0	-	0.20	50	17	84	-	140	115	151	53	89
Well-graded GRAVEL, SAND, SILT & CLAY mixture	250	0.001	0.002	25 to 1000	0.70	-	0.13	41	11	100	140	148[4]	125	156[4]	62	94
CLAY SOILS																
CLAY (30%-50% clay sizes)	0.05	0.5μ	0.001	-	2.4	-	0.50	71	33	50	105	112	94	133	31	71
Colloidal CLAY (-0.002 mm: 50%)	0.01	10Å	-	-	12	-	0.60	92	37	13	90	106	71	128	8	66
ORGANIC SOILS																
Organic SILT	-	-	-	-	3.0	-	0.55	75	35	40	-	110	87	131	25	69
Organic CLAY (30% - 50% clay sizes)	-	-	-	-	4.4	-	0.70	81	41	30		100	81	125	18	62

See Ref. 1

a height of 760 mm (30 in).

g of the falling weight onto the
ding to the ground surface, the
test. The free fall and height of
· of drill rigs use a rope wrapped
the rope which then tightens on
rope until the weight is visually
ıe the rope is released with the
;estion around the power pulley
count will be obtained. Several
ıechanical hoist-trip device. This
factors such as pushing a rock,
: pressures also contribute error
ducible in situ).
ɔw count $N \geq 100$. The log may
indicating 70 blows for 150 mm
ration. Large blow counts both
:ause rapid equipment wear and
:efusal" by ASTM at 100 assists
; firm to better identify drilling

igate the status of cohesionless
y used in both cohesionless and
types of foundations. In loose
available to aid in retaining the
ithout falling out of the sampler

the string of rods, the sampler
ay (see Fig. 6-3*a*) the recovered
ısually immediately tested for
(Fig. 6-3*a*) or a portable field
ıally stored in small glass jars
mple depth, and blow count *N*.
ıs necessary for sieve analyses,
rg limits. The boxes of samples
boratory for a stated period of

ɪroperties have been proposed.
than guesses. For example, in
ıost meaningless. The estimate

ATTACHMENT D

Table 6-1 Standard penetration test (SPT) correlations

Strength correlations will be given in later chapters as needed. Values shown are primarily for "order of magnitude."

	Cohesionless Soil			Pwr?
N	0–10	11–30	31–50	>50
Unit weight γ, kN/m^3	12–16	14–18	16–20	18–23
Angle of friction ϕ	25–32	28–36	30–40	>35
State	Loose	Medium	Dense	Very dense
Relative density D_r	see Eq. (6-3) and Eq. (6-4) since depends on $p_0 = \gamma y$			

1 kN/m^3 = 6.36 pcf

	Cohesive Soil				
N	<4	4–6	6–15	16–25	>25
Unit weight† γ, kN/m^3	14–18	16–18	16–18	16–20	>20
q_u, kPa†	<25	20–50	30–60	40–200	>100
Consistency	Very soft	Soft	Medium	Stiff	Hard
			SOIL HORIZON	RESIDUUM	

† Values heavily dependent on water content.

for angle of internal friction ϕ is generally conservative, and (as noted in Chap. 13) it is common to estimate ϕ as 30 to 32° for many projects.

The relative density D_r is often related to N but is often a very poor correlation. This results from N being somewhat project- and site-dependent and from D_r being rather tenuous to define (or reliably compute). As a consequence of this and some recent work which seems promising, it was decided not to include D_r in Table 6-1, but rather provide the current "best estimate" equations.

According to Marcusson and Bieganousky (1977)

$$D_r = 0.086 + 0.0083(2311 + 222N - 711(OCR) - C_1\sigma'_v)^{1/2} \tag{6-3}$$

and according to Fardis and Veneziano (1981), who applied much of the data used to develop Eq. (6-3), the relationship is

$$\ln N = C_2 + 2.06 \ln D_r + C_3 \ln \sigma'_v \tag{6-4}$$

where $C_1 = 7.7$ for σ'_v in kPa; 53 for psi units
C_2 = depth function which should be determined at a site by measuring N and D_r†
$C_3 = 0.222$ for σ'_v in kPa; 0.442 for psi units
OCR = overconsolidation ratio defined by Eq. (11-2)

Both of these equations are based on regression analyses. Equation (6-3) is based on four dissimilar soils and a large number of tests and claims a 78 percent reliability with a ± 0.075 standard deviation.

Example 6-2 Given: the SPT blow count at a depth of 4 m is 12. The soil is very sandy with traces of gravel and has an estimated unit weight $\gamma = 17.9$ kN/m^3. The soil is damp but above the water table.

† If no correlation is made for C_2, use the value of $C_2 = 2.67$ obtained from the data base used for the equation.

See Ref. 2

ATTACHMENT E

as glacial till clays and those found in the *B* horizon of residual deposits, are of medium sensitivity. A few glacial clays and most fresh-water deposits are very sensitive. A few of the fresh-water and marine deposits are quick. The sensitivity of the large majority of cohesive deposits will range from 2 to 8. Sensitivities greater or less than this are much less commonly encountered. Most quick clays seem to be found (or at least reported) in Canada and Scandinavia.

13-10 EMPIRICAL METHODS FOR SHEAR STRENGTH

Numerous correlations for shear strength or shear strength parameters have been proposed in the literature. Several will be presented here to illustrate some of those available.

One of the earliest correlations is that between the SPT (Sec. 6-9) and the unconfined compression strength, as was illustrated in Table 6-1.

Correlations between ϕ and plasticity index I_P are shown in Fig. 13-20. A relationship between ϕ and percent clay fraction (Skempton, 1964) is shown in Fig. 13-21. Both of these curves should be used cautiously, as there are several major exceptions which can be found in the literature as well as substantial scatter in the data points used to establish the curves. For routine soil work, however, particularly in regions where w_L is on the order of 20 to 45 and I_P on the order of 15 to 30, these curves will be reasonably reliable.

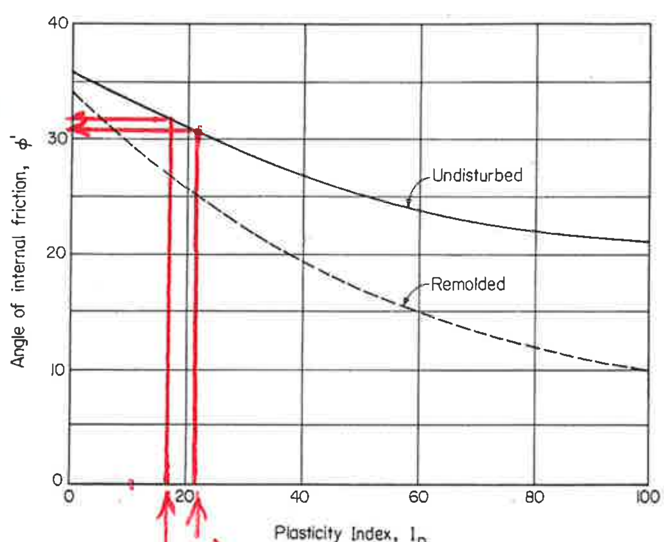


Figure 13-20 Correlation between angle of internal friction ϕ' (true) and plasticity index for both undisturbed and remolded soil. *(After Bjerrum and Simons, 1960.)*

16 Avg. Residuum

See Ref. 2

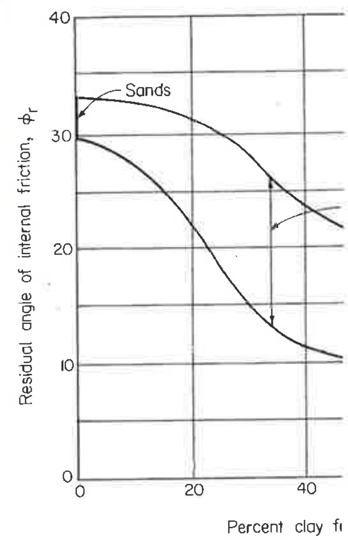


Figure 13-21 Correlation between ton, 1964.)*

Figure 13-22 illustrates shear strength of soft to ver be made for statistical dete test pits.

Figure 13-23 (also Fig. can be used in test pits or where a person can be low works well in any fine-grain free location, pushes the pi

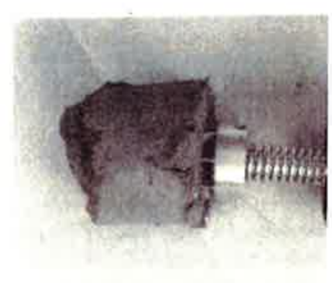


Figure 13-22 The torvane.

ATTACHMENT F

TABLE 1
Typical Properties of Compacted Soils

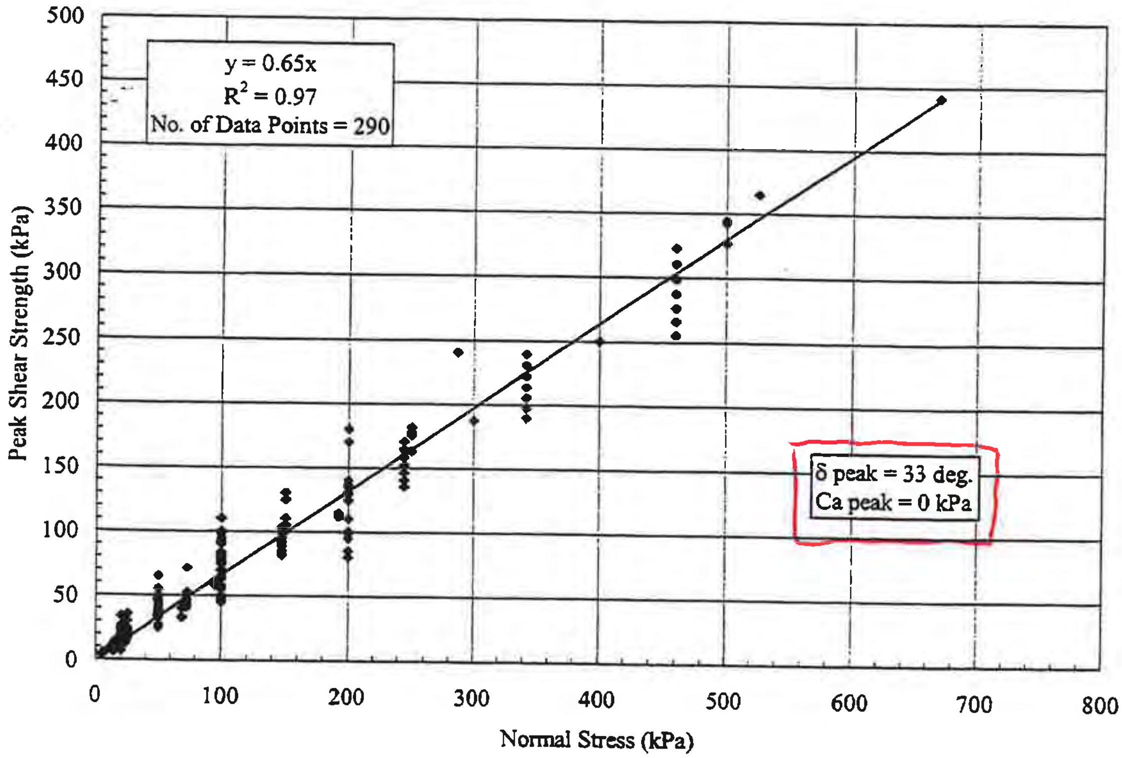
Group Symbol	Soil Type	Range of Maximum Dry Unit Weight, pcf	Range of Optimum Moisture, Percent	Typical Value of Compression (Percent of Original Height) At 1.4 tsf (20 psi)	Typical Value of Compression (Percent of Original Height) At 3.6 tsf (50 psi)	Typical Strength Characteristics: Cohesion (as compacted) psf	Typical Strength Characteristics: Cohesion (saturated) psf	Typical Strength Characteristics: Ø (Effective Stress Envelope Degrees)	Typical Strength Characteristics: Tan Ø	Typical Coefficient of Permeability ft./min.	Range of CBR Values	Range of Subgrade Modulus k ~~lbs/cu in.~~ psi/in
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	.....	.....	>34	>0.67	$>10^{-6}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	.....	.....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	$5 \times >10^{-5}$	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	$2 \times >10^{-6}$	5 - 30	100 - 300
SC	Clayey sands, poorly graded sand-clay-mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	$5 \times >10^{-7}$	5 - 20	100 - 300
ML	Inorganic silts and clayey silts.	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	$>10^{-5}$	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay.	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	$5 \times >10^{-7}$	.....	
CL	Inorganic clays of low to medium plasticity.	95 - 120	24 - 12	1.3	2.5	1800	270	28	0.54	$>10^{-7}$	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	$5 \times >10^{-7}$	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	$>10^{-7}$	15 or less	50 - 150
OH	Organic clays and silty clays	65 - 100	45 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	25 - 100

Notes:

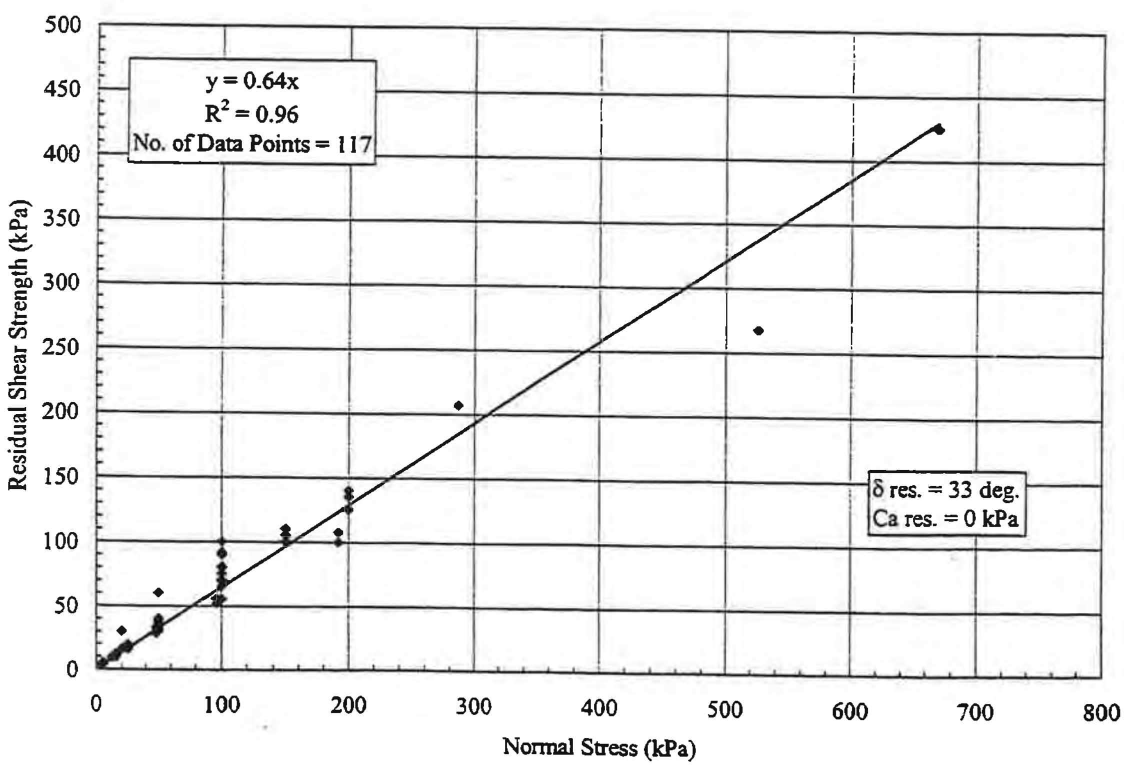
1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical strength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
(..) indicates insufficient data available for an estimate.

See Ref. 4

ATTACHMENT G

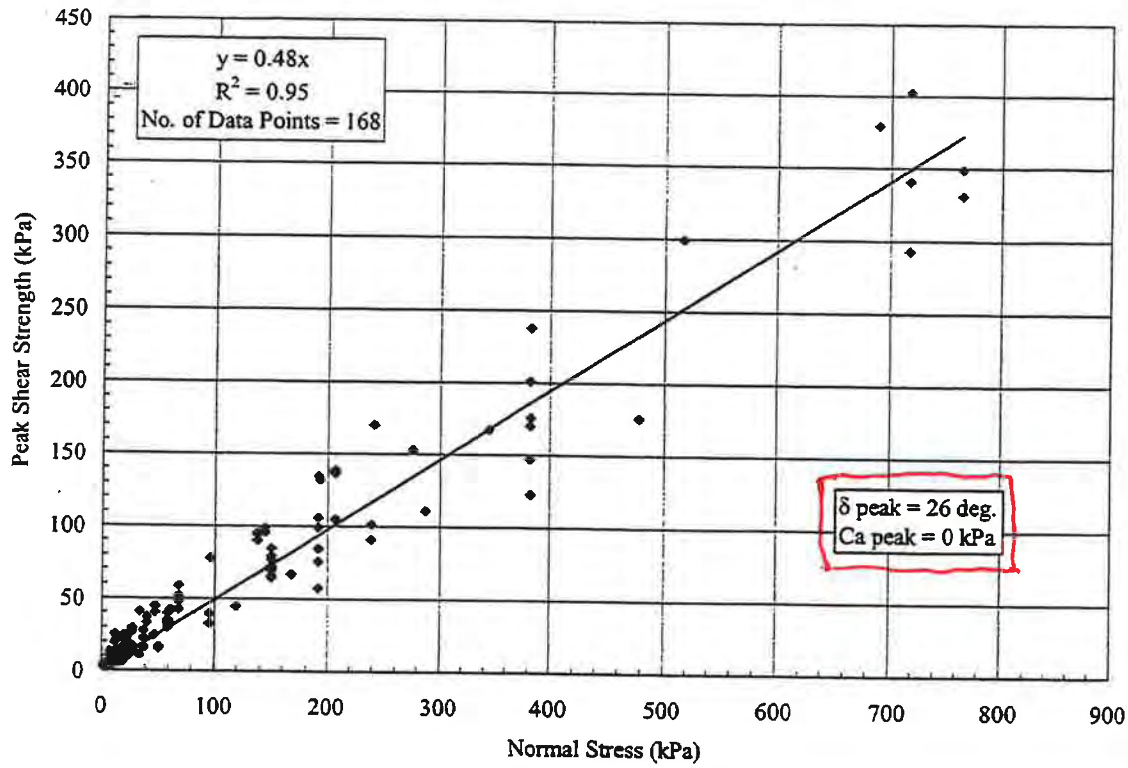


Appendix Figure 8a – Peak Shear Strength; NW-NP Geotextile against Granular Soil.

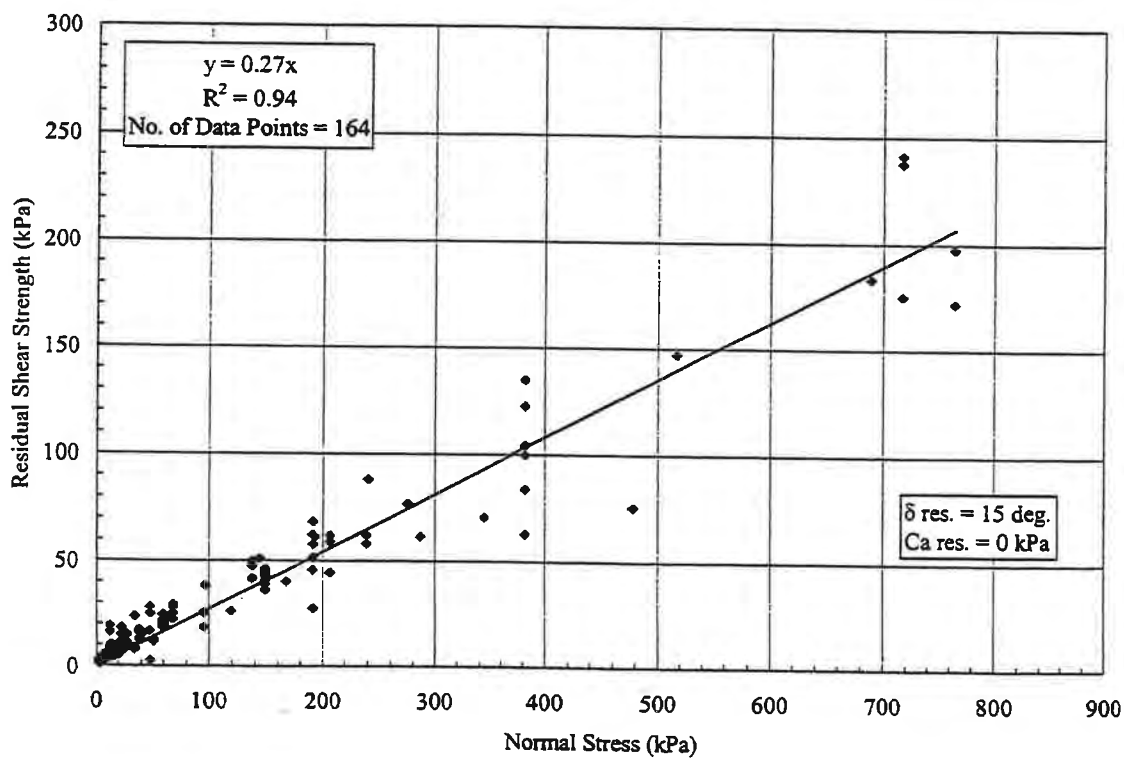


Appendix Figure 8b – Residual Shear Strength; NW-NP Geotextile against Granular Soil.

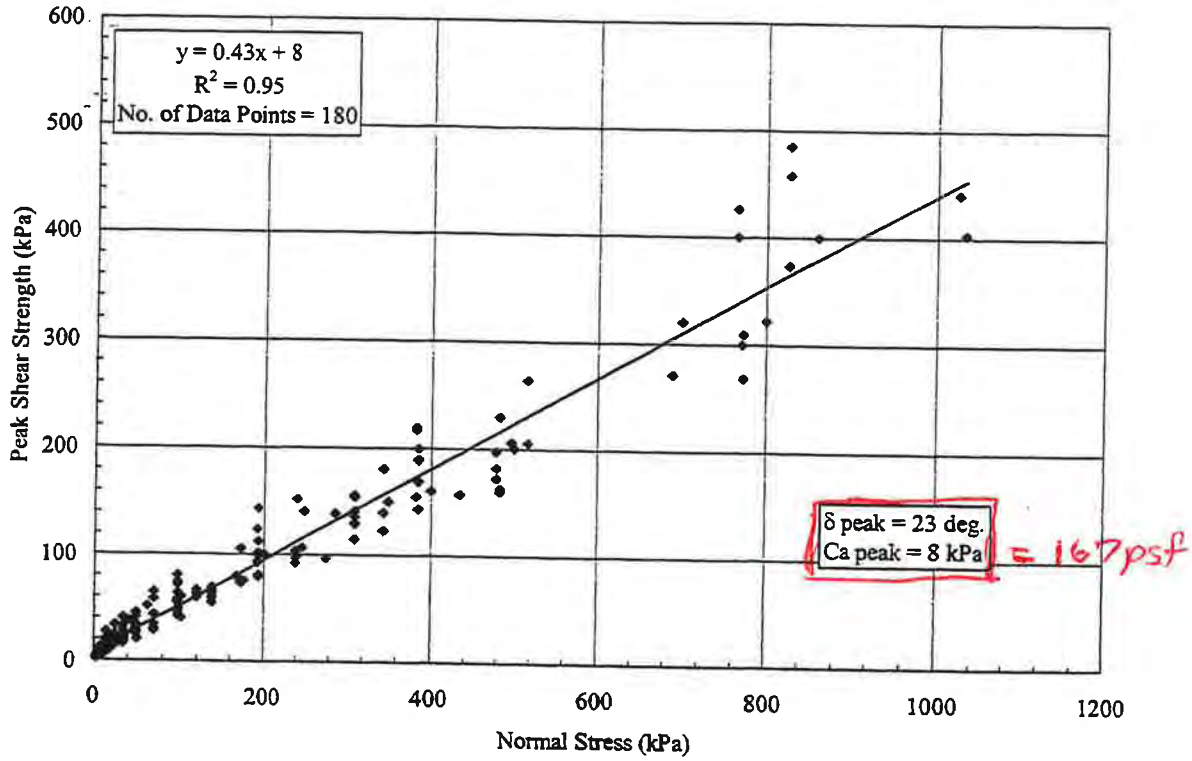
See Ref. 5



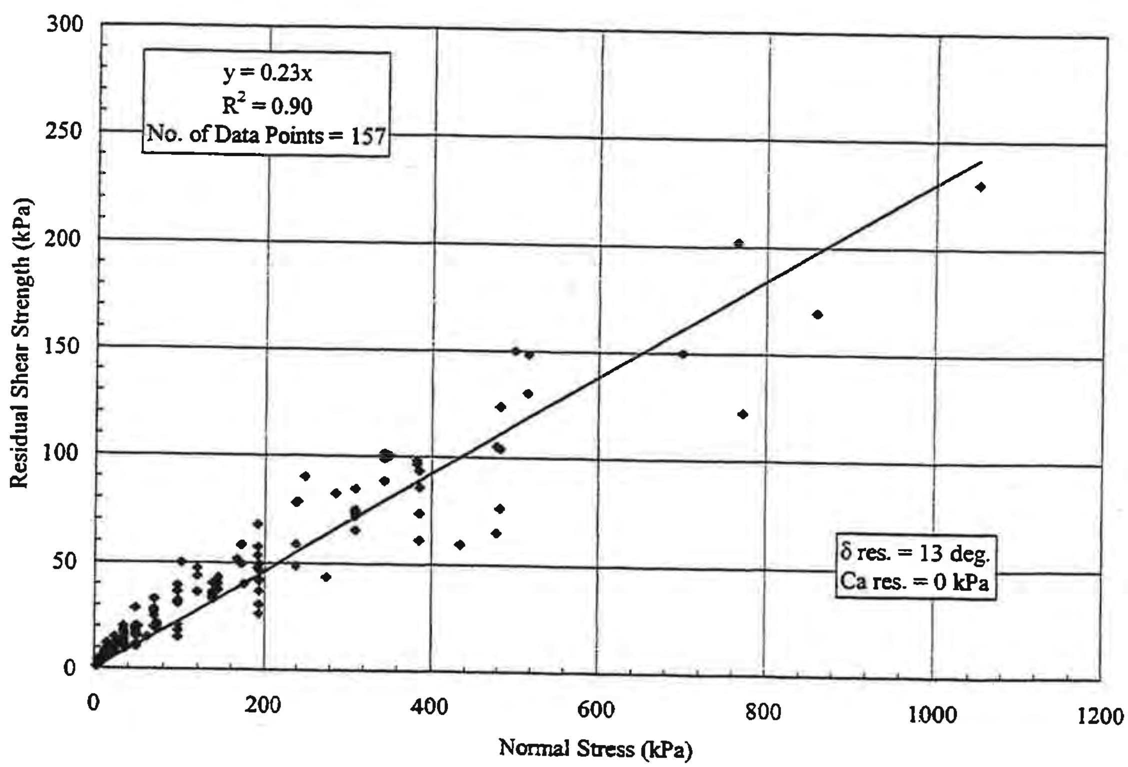
Appendix Figure 2i – Peak Shear Strength; Textured HDPE against NW-NP Geotextile on a Drainage Geocomposite.



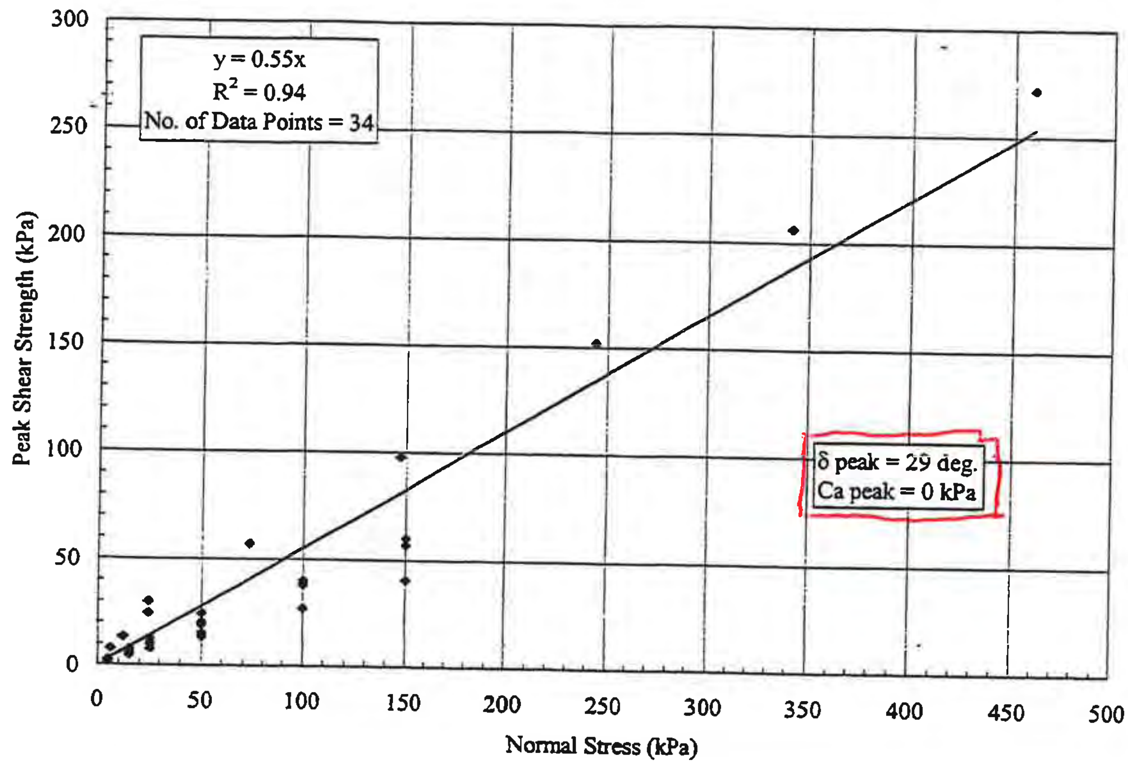
Appendix Figure 2j – Residual Shear Strength; Textured HDPE against NW-NP Geotextile on a Drainage Geocomposite.



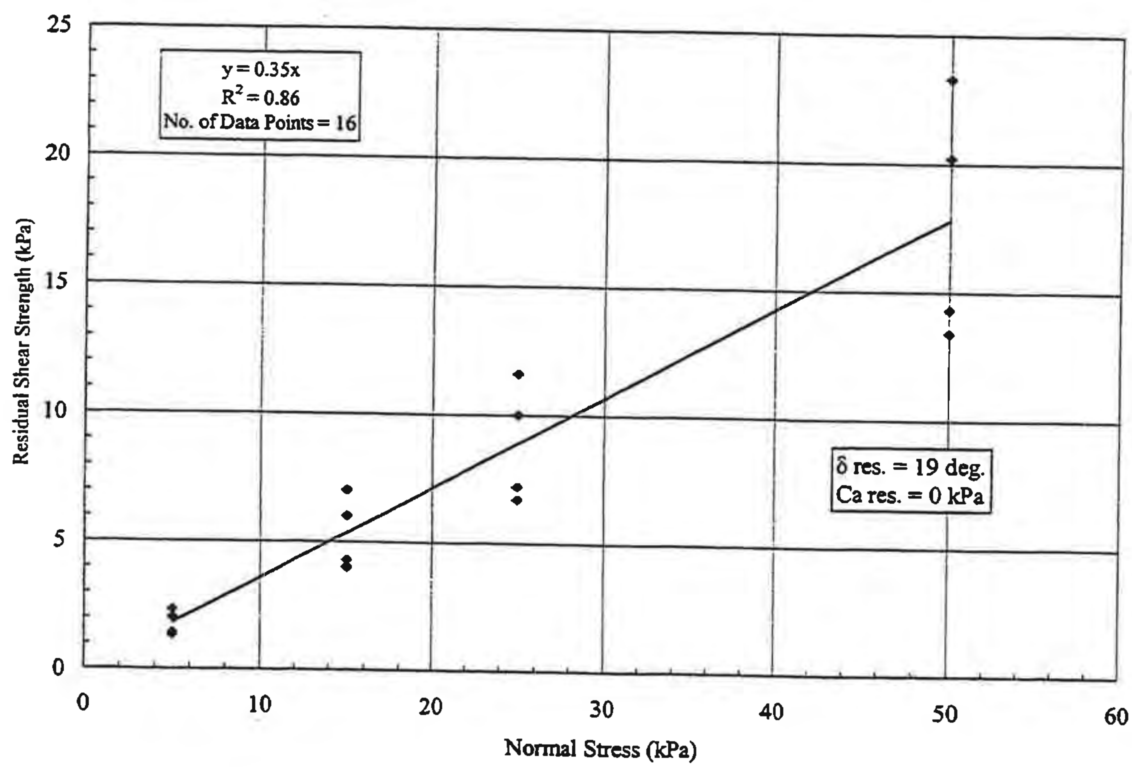
Appendix Figure 11a - Peak Shear Strength; Textured HDPE against NW-NP Side of Fabric-Reinforced GCL.



Appendix Figure 11b - Residual Shear Strength; Textured HDPE against NW-NP Side of Fabric-Reinforced GCL.

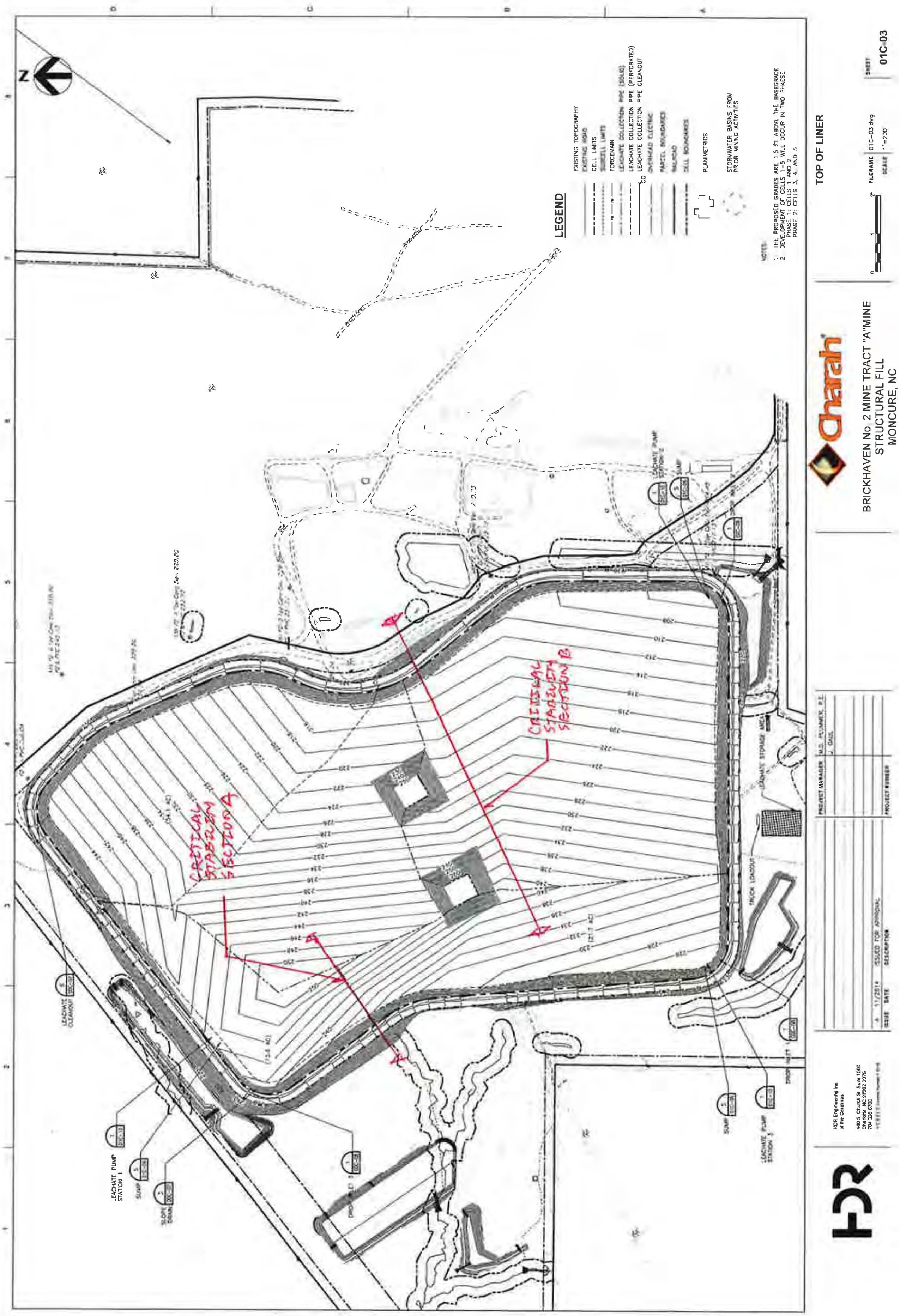


Appendix Figure 9e - Peak Shear Strength; Woven Geotextile against Cohesive Soil.

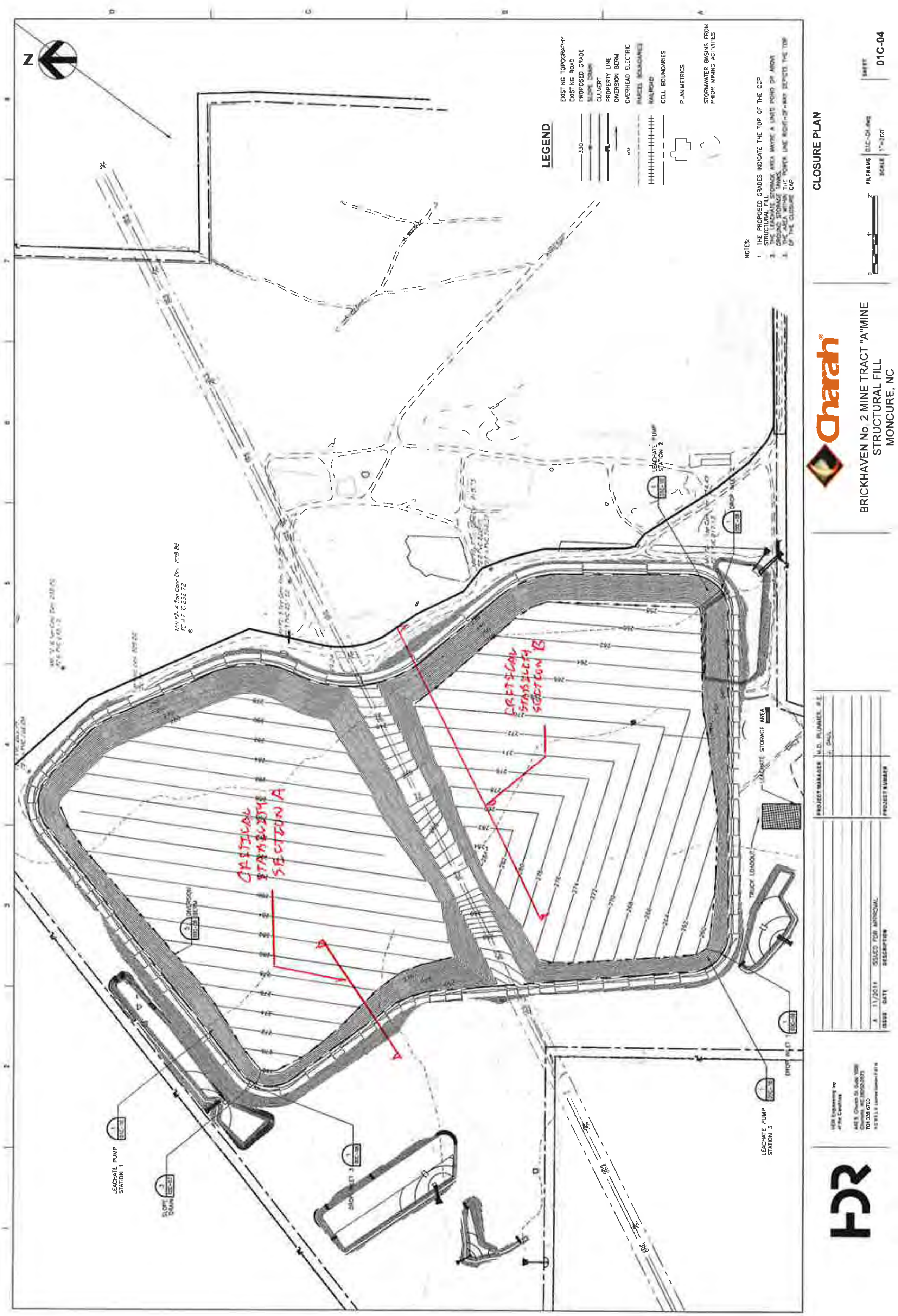


Appendix Figure 9f - Residual Shear Strength; Woven Geotextile against Cohesive Soil.

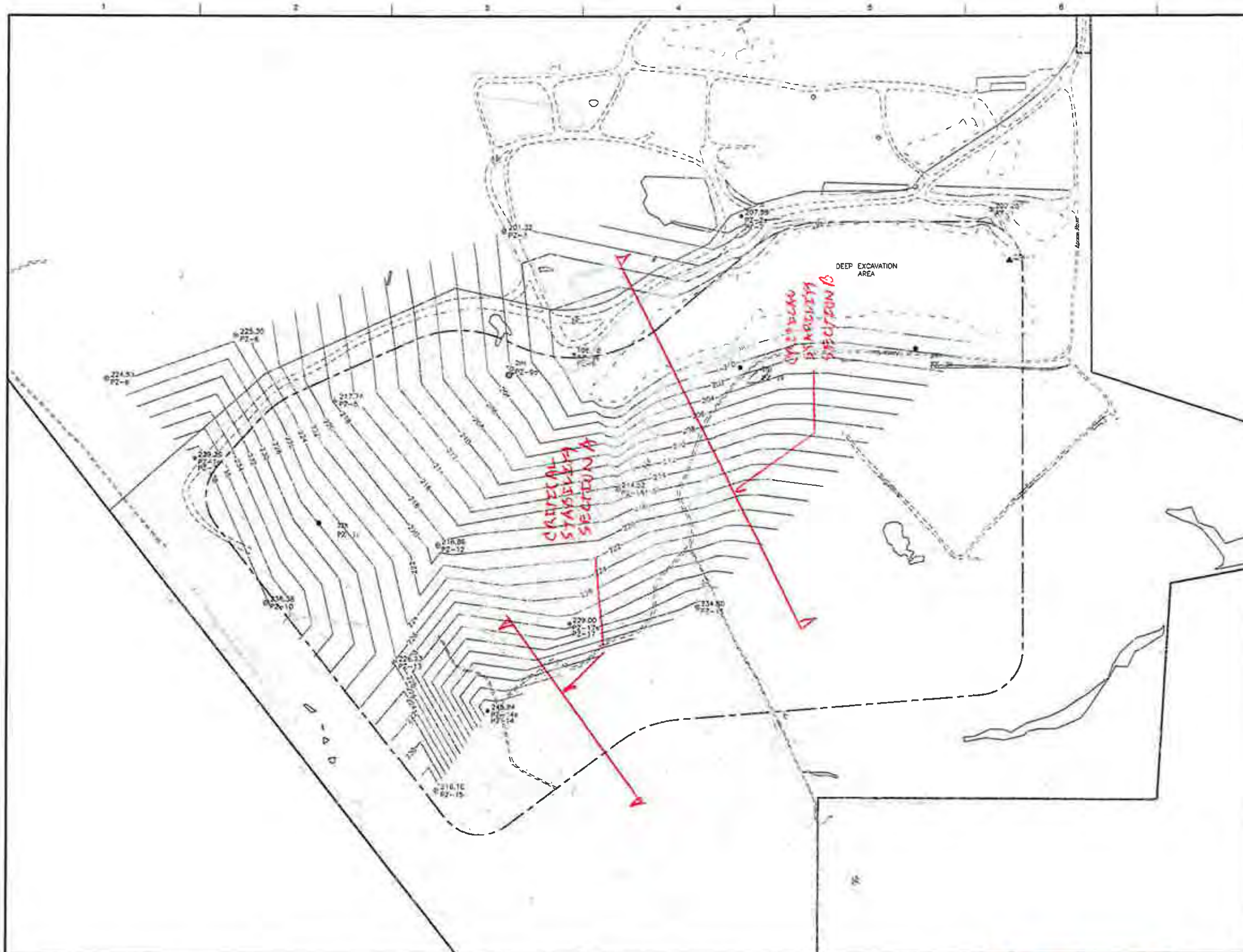
ATTACHMENT H



ATTACHMENT I



ATTACHMENT J



NOTES:

1. SURVEY BASE MAP PREPARED BY LAWRENCE SURVEYING OF MONROE DATED AUGUST 21, 2014
2. GROUNDWATER POTENTIOMETRIC CONTOURS GENERATED UTILIZING AUTOCAD DRAFTING AND INTERPOLATION SOFTWARE BY HDR ENGINEERING INC. WITH OVERSIGHT BY ROSS KLINGMAN, P.G. WITH BUXTON ENVIRONMENTAL, INC. GROUNDWATER CONTOURS WERE GENERATED WITH STABILIZED WATER LEVELS AT INTERMEDIATE AND DEEP PIEZOMETERS AND LARGE POND SURFACE WATER ELEVATION

LEGEND

- SINGLE SHALLOW OR INTERMEDIATE PIEZOMETER
- NESTED SHALLOW AND INTERMEDIATE PIEZOMETER PAIR
- NESTED SHALLOW AND INTERMEDIATE PIEZOMETER PAIR (WITH ROCK CORE)
- ATTEMPTED PIEZOMETER AND ROCK CORE
- GEOTECHNICAL SOIL BORING (GEOTRACK) (APPROX. LOCATIONS FOR B-2, B-4 & B-5)
- EXCAVATION WATER STAKE

HDR Engineering Inc. of the Carolinas
440 S. Church St. Suite 1000
Charlotte, NC 28202-2075
704 338 6700

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER	M.D. PLUMMER, P.E.
				R. PENNINGTON, P.G.
				J. GAUL
A	11/20/14	ISSUED FOR APPROVAL	PROJECT NUMBER	

Charah®

BRICKHAVEN MINE SITE STRUCTURAL FILL
MONCURE, NC

MONCURE MINE RECLAMATION STRUCTURAL FILL SITE PLAN WITH PIEZOMETER LOCATIONS

FILENAME: 01G-11.dwg
SCALE: 1"=200'

SHEET
FIGURE 3

ATTACHMENT K

Earthquake Hazards Program

US Seismic Hazard 2008

Layers | Tools

Hazard maps

Transparency

Peak ground acceleration (%g) with 10% probability of exceedance in 50 years

Peak ground acceleration (%g) with 2% probability of exceedance in 50 years

0.2-second acceleration with 10% probability of exceedance in 50 years

0.2-second acceleration with 2% probability of exceedance in 50 years

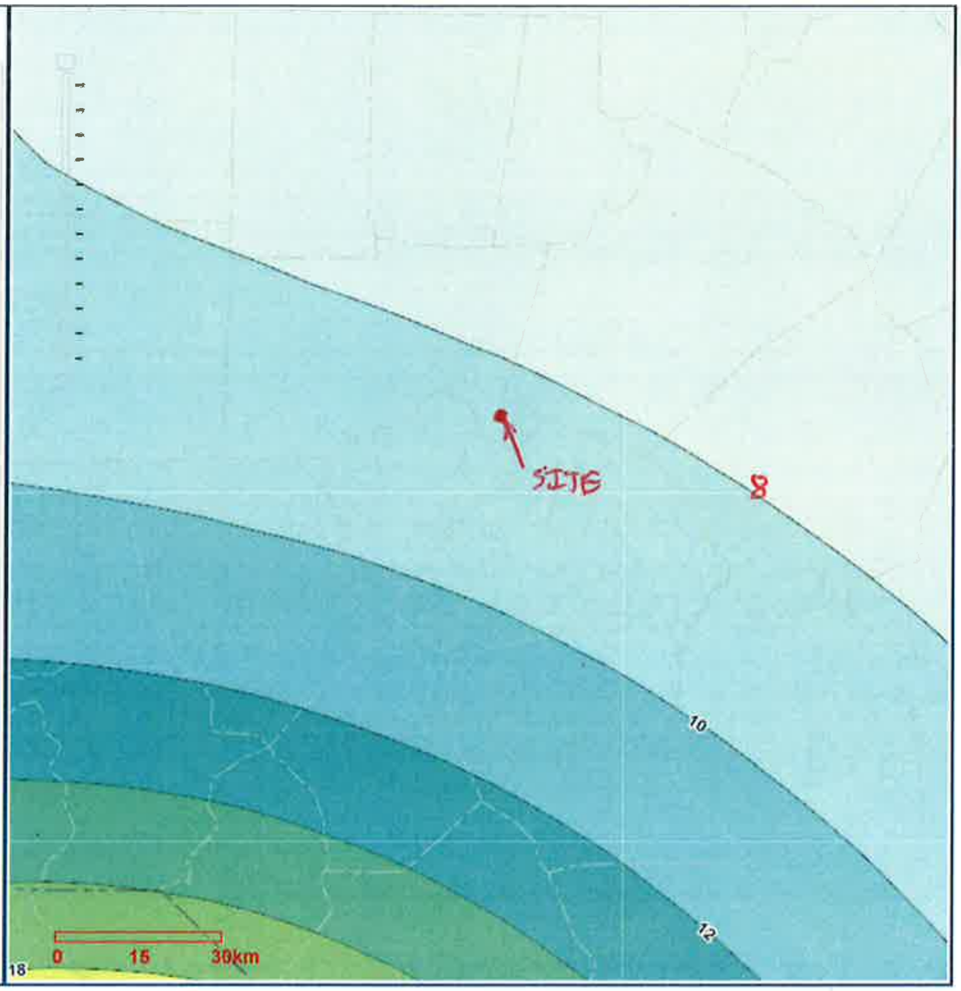
1.0-second acceleration with 10% probability of exceedance in 50 years

1.0-second acceleration with 2% probability of exceedance in 50 years

Hazard map faults

Basemap

Transparency



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B

Stormwater

Subcell Divider Berms
Stormwater Pipe Perforations and Sizing
Stormwater Management System
Sediment Basins

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HDR Computation

Job Number	453925-235673-018	No.	

Project	Charah Brickhaven No 2 Mine	**Computed**	EAW	**Date**	12/31/2014
Subject	Permit Application	**Checked**	PAW	**Date**	1/2/2015
Task	Subcell Divider Berms	**Sheet**	1	**Of**	1

Objective: Determine if the subcell berms are large enough to handle a 2-year, 24-hour storm event.

References:

1. NC Erosion and Sediment Control Planning and Design Manual.

Given:

3.6 in, 2-year, 24-hour precipitation event (Raleigh, NC) Ref 1

$$V_R = A \times \frac{43{,}560\, ft^2}{acre} \times p \times \frac{12 in}{ft}$$

$$V = \frac{1}{3} hA$$

Where:

V_R = Precipitation event volume (ft^3)
A = Area (acres)
p = precipitation event (in)

V = Volume of Pond (pyramid) (ft^3)
h = Height of the berm (pyramid) (ft)
A= Area of ponding (pyramid base) (ft^2)

Case 1: Will Subcell Divider Berm handle precipitation into one subcell?

Subcell	Subcell Area (acres)	Required Volume (ft^3)	Berm Height (ft)	Area of ponding behind berm (sf)	Area of Ponding (acres)	Available Volume (ft^3)	Factor of Safety	Check
1A	15.5	202,554	7	214,728	4.93	501,032	2.5	OK
1B	18.4	240,451	10	118,554	2.72	395,180	1.6	OK
2A	19.3	252,212	8	159,909	3.67	426,424	1.7	OK
2B	9	117,612	9	53,477	1.23	160,431	1.4	OK
3A	18.8	245,678	10	219,430	5.04	731,433	3.0	OK
3B	11.4	148,975	8	63,780	1.46	170,080	1.1	OK
4A	9.9	129,373	10	111,033	2.55	370,110	2.9	OK
4B	7.4	96,703	9	38,724	0.89	116,172	1.2	OK
5A	17.8	232,610	8	207,625	4.77	553,667	2.4	OK
5B	17	222,156	7	117,906	2.71	275,114	1.2	OK

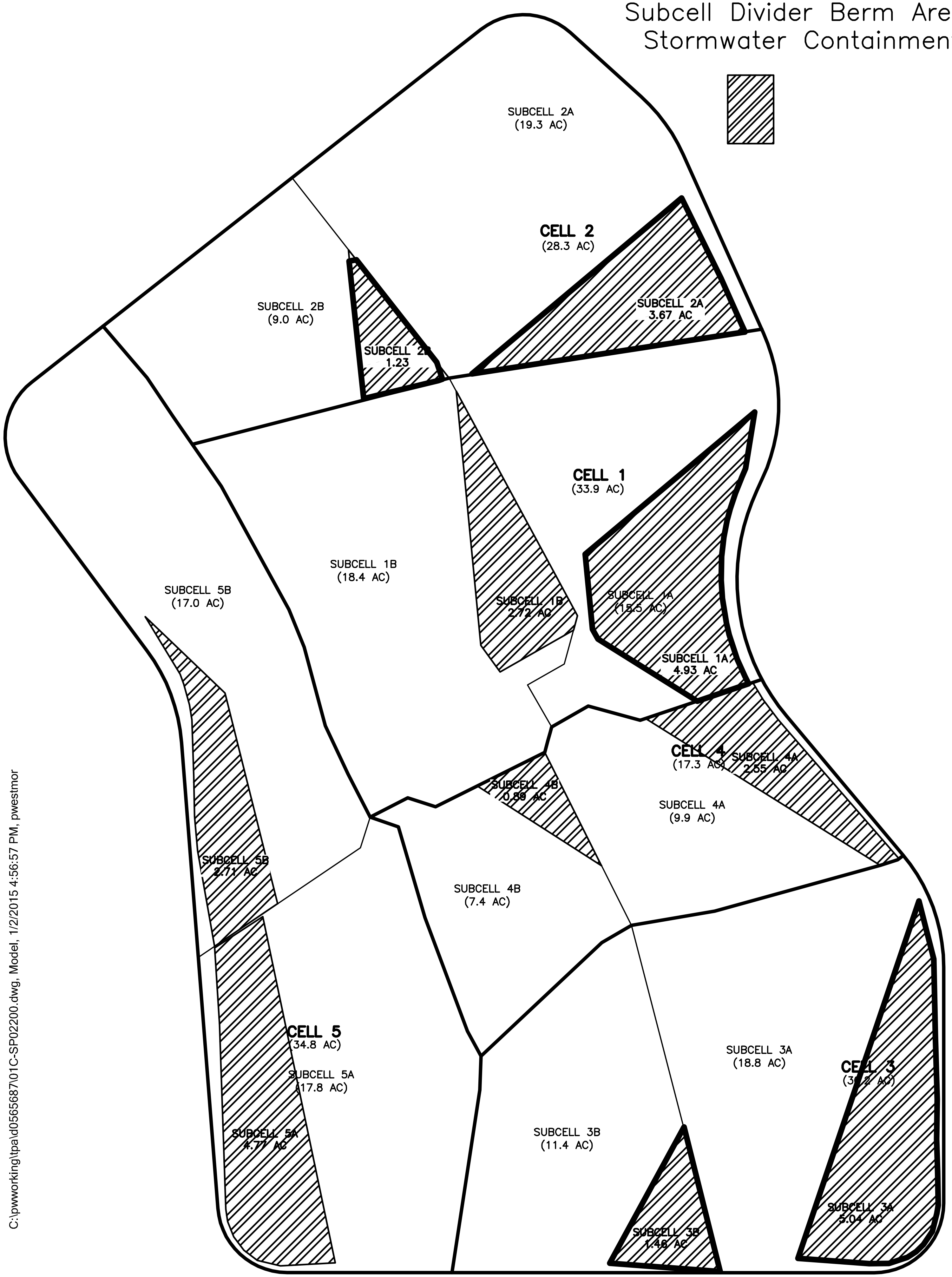
Case 2: Will downstream Subcell Divider Berm handle precipitation from upstream subcells?

Lower Subcell	Downstream Subcell Available Volume (ft^3)	Downstream Subcell Required Volume (ft^3)	Contributing Subcells	Contributing Subcells Required Volume (ft^3)	Total Required Volume (ft^3)	Factor of Safety	Check
1A	501,032	202,554	1B	240,451	443,005	1.1	OK
2A	426,424	252,212	2B	117,612	369,824	1.2	OK
3A	731,433	245,678	3B	148,975	394,654	1.9	OK
4A	370,110	129,373	4B	96,703	226,076	1.6	OK
5A	553,667	232,610	5B	222,156	454,766	1.2	OK

Conclusion:

Individual subcells can contain the design storm event.
All Subcells can contain the flow from the upstream subcells.

Subcell Divider Berm Areas
Stormwater Containment



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HDR Computation

		Job Number	453925-237673-018	**No.**	
Project	Charah Brickhaven No.2 Mine	**Computed**	MDP	**Date**	11/5/2014
Subject	Permit Application	**Checked**	**EAW**	**Date**	11/6/2014
Task	Stormwater Pipe Perforations and Sizing	**Sheet**	1	**Of**	3

Objective: Determine if the leachate pipes and perforations are large enough to handle the 10 year 24 hour storm event.

References:

1. Malcom, H. Rooney (1989). *Elements of Urban Stormwater Design* . Raleigh: NC State Univ.
2. Sharma, H. D., & Lewis, S. P. (1994). *Waste Containment Systems, Waste Stabilization, and Landfills: Design and Evaluation* . New York: John Wiley & Sons, Inc.

Calculations:

Eq. 1 $$\boxed{Q = C_d A\sqrt{2gh}}$$ Reference 1

Where:

Q = Flow Rate (cfs)
C_d = Coefficient of Discharge (dimensionless)
A = Cross-sectional Area of Orifice
g = gravity (ft/s^2)
h = head (ft)

7.48	gal/cf	12	in/ft
60	s/min	43,560	sf/acre
60	min/hr		
24	hr/day		

Determine the actual Flow Rate per Acre based on HELP model runs

Intensity $_{10yr,24hr}$ =	5.62	inches
Maximum Subcell Size =	17.5	acres
Storm Event Q_{cfs} =	357,011	cf/acre/day
Q_{gpm} =	1854.60	gal/acre/min
Maximum Drainage distance =	950	feet
Area of Drainage per foot of pipe =	950	sf
Area of Drainage per foot of pipe =	0.022	ac
Required Drainage per foot of pipe =	**40.447**	**gpm (actual flow rate per acre for the drainage area of the pipe)**

Determine the maximum allowable flow in the pipe based on the perforations into the pipe and a maximum head

Diameter of perforation, $d_{perforation}$ = 0.375 in

$d_{perforation}$ = 0.03125 ft

Eq. 2

$$A = \pi \left(\frac{d}{2} \right)^2$$

$A_{perforation}$ = 0.00077 ft^2

Using Equation 1, determine the flow in the pipe

C_d = 0.6 typical default value (Ref. 1)

$A_{perforation}$ = 0.00077 ft^2

g = 32.2 ft/s^2

h = 8 in

h = 0.67 ft

The pipe is 8 inches in diameter. The head was assumed to be from the center of the pipe to 12 inches above the liner.

$Q_{perforation}$ = 0.003 cfs

$Q_{perforation}$ = 1.35 gpm per perforation

Number of Perforations per foot of pipe = 30 perforations per foot of pipe

$Q_{per\ foot\ of\ pipe}$ = 40.60 gpm

Required Flow Rate		**Allowable Flow Rate**
gpm	**<**	**gpm**
40.447		**40.60**

Conclusion:
The allowable flow rate is greater than the required flow rate. Therefore the allowable flow rate based on pipe perforations will be sufficient to meet the actual expected flow rate. Sufficient volume can get into the pipe through the orifices.

HDR Computation

Job Number	453925-237673-018	**No.**	
Project Charah Brickhaven No.2 Mine		**Computed** MDP	**Date** 11/5/2014
Subject Permit Application		**Checked** EAW	**Date** 11/6/2014
Task Stormwater Pipe Perforations and Sizing		**Sheet** 3	**Of** 3

Determine the maximum allowable flow in the pipe based on the pipe size and flowing full

Eq. 3 $$Q = \left(\frac{D}{16}\right)^{\frac{8}{3}} \frac{\sqrt{s}}{n}$$ Reference 1

Where:

Q = Flow Rate (cfs)
D = Theoretical Pipe Diameter (in) for just-full flow
n = Manning roughness coefficient (dimensionless)
s = Longitudinal slope (ft/ft)

D = 8 in
n = 0.009 Reference 2, page 472

Slope	Allowable Q (cfs)	Allowable Q (gpm)	Check
0.10%	0.55	248	Allowable Q is greater than Required Q
0.25%	0.87	393	Allowable Q is greater than Required Q
0.50%	1.24	555	Allowable Q is greater than Required Q
0.75%	1.52	680	Allowable Q is greater than Required Q
1.00%	1.75	785	Allowable Q is greater than Required Q
1.25%	1.96	878	Allowable Q is greater than Required Q
1.50%	2.14	962	Allowable Q is greater than Required Q
1.75%	2.31	1,039	Allowable Q is greater than Required Q
2.00%	2.47	1,111	Allowable Q is greater than Required Q
2.25%	2.62	1,178	Allowable Q is greater than Required Q
2.50%	2.77	1,242	Allowable Q is greater than Required Q
2.75%	2.90	1,302	Allowable Q is greater than Required Q
3.00%	3.03	1,360	Allowable Q is greater than Required Q
3.25%	3.15	1,416	Allowable Q is greater than Required Q
3.50%	3.27	1,469	Allowable Q is greater than Required Q
3.75%	3.39	1,521	Allowable Q is greater than Required Q

Conclusion:
The allowable flow rate is greater than the required flow rate for slopes 0.1% and above. Smaller pipe slopes were not run, but it is assumed that the bottom slope will not be smaller than 2% accounting for settlement. Therefore the allowable flow based on pipe size will be sufficient to meet the actual expected flow rate.

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Project:	Charah Brickhaven No.2 Mine	Computed	EAW	Date	11/6/14
Subject:	Permit Application	Checked	PAW	Date	11/6/2014
Task:	Drainage - Time of Concentration	Sheet	1	Of	1

Objective Determine the Time of Concentration based on the proposed top of fill grades.

References

1. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.

Equations

Time of Concentration, (t_c) is the longest time of flow from points on the watershed ridge to the outlet of the watershed.

$$t_c = \frac{[L^3 / H]^{0.385}}{128}$$

Time of Concentration,(min) = t_c
Hydraulic length of watershed, (ft) = L
Elevation change along length, (ft) = H

Drop Inlet #2

Hydraulic length of watershed L (ft) =	2,420
Peak Elevation of watershed (ft) =	287
Low Elevation of watershed (ft) =	218
Elevation change along length H (ft) =	69
t_c (min) =	**12.4**

Drop Inlet #1

Hydraulic length of watershed L (ft) =	1,498
Peak Elevation of watershed (ft) =	287
Low Elevation of watershed (ft) =	235
Elevation change along length H (ft) =	52
t_c (min) =	**8.0**

Drop Inlet #3

Hydraulic length of watershed L (ft) =	1,810
Peak Elevation of watershed (ft) =	294
Low Elevation of watershed (ft) =	249
Elevation change along length H (ft) =	45
t_c (min) =	**10.4**

North Cell to DI #2

Hydraulic length of watershed L (ft) =	3,889
Peak Elevation of watershed (ft) =	294
Low Elevation of watershed (ft) =	218
Elevation change along length H (ft) =	76
t_c (min) =	**20.7**

CONCLUSION

Use a Time of Concentration of 15-Minutes=> 5.71 25-yr, 15-min Design Storm

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HDR Computation

Project:	Charah Brickhaven No.2 Mine	Computed	EAW		11/6/2014
Subject:	Permit Application	Checked	PAW	Date	11/6/14
Task:	Drainage - Perimeter Channels	Sheet	1	Of	3

Objective Design the stormwater channels around the perimeter of the structural fill for the 25-yr storm.
Assume sideslope swales and/or sloe drains are installed as fill progresses. This will minimize the drainage area.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. NCDOT Standard Specifications for Roads and Structures
4. North American Green Product Brochure version 4.11
5. East Coast Erosion Blankets (ECS-1)
6. Maccaferri
7. Green Armor Systems
8. NOAA Atlas 14, Volume 2, Version 3 (Sanford, NC)

Equations

Normal Depth Procedure (Manning's Eqn) Ref 2

$Z_{av} = AR^{2/3}$ Area (A) = $bd + z\,d^2$

$Z_{req} = Q\,n / 1.49s^{0.5}$ $R = \text{Area} / (b+2d(z^2+1)^{0.5})$

$AR^{2/3} = Q\,n / 1.49s^{0.5}$ Avg Shear Stress (T) = d*s*unit weight of water

Q (cfs) = CIA $Z_{av} = Z_{req}$

Channel Design

Min Channel Freeboard =	0.2	ft	
Inside Channel Side Slope =	2	(enter X for X:1)	
Outside Channel Side Slope =	2	(enter X for X:1)	
Bottom Width, b =	4	ft	
Runoff Coeff (initial)=	0.60	Ag land, smooth	Ref 1
Runoff Coeff (permanent)=	0.25	Pasture, Sandy	Ref 1
I (in/hr) =	5.71	25-yr, 15-min Design Storm	Ref 8

Various Lining Types *Depth of Flow is not specified for Manning's' n

Lining Type	Lining Description	Manning's n depths of 0-0.5 ft	Manning's n depths of 0.5-2.0 ft	Vp (ft/sec)	Allowable Shear Stress (psf)
A	Jute Net (HEC-15)		0.015	2.0	0.45
B	Erosion Control Blanket Single Net (Curlex 1)		0.034	5.0	1.55
C	Erosion Control Blanket, Straw w/ Single Net (Ref 4)*		0.025	6.7	1.50
D	Erosion Control Blanket Double Net (Curlex HV)		0.026	10.0	1.65
E	Ordinary Firm Loam (Ref 2)	0.023	0.020	3.5	2.0
F	Grass Lined (Ref 1)*		0.030	5.0	2.0
G	6" Rip Rap (Ref 2, Ref 1)		0.069	9.0	2.0
H	GreenArmor 7010 (vegetated)		0.034	16.0	8.0
I	Unvegetated Turf Reinforcement Mat (TRM) (NAG C350)		0.025	9.5	2.25
J	Class D Phase 2 (Partially vegetated) TRM (NAG C350)		0.048	14.0	3.34
K	12" Rip Rap (Ref 2, Ref 1)		0.078	12.5	4.0
L	Class B Phase 3 (Fully vegetated) TRM (NAG C350)		0.048	18.0	5.7
M	Reno Mattress (6-inch, unvegetated) Ref 6		0.0277	13.8	4.3
N	Reno Mattress (6-inch, vegetated) Ref 6		0.050	13.8	8.35
O	Smart Ditch (Pre-formed HDPE channel)		0.022	-	-
P	Concrete (HEC-15, EPA 832-F-99-002)		0.013	25.0	10.0

Project: Charah Brickhaven No.2 Mine	Computed EAW		11/6/2014
Subject: Permit Application	Checked PAW	Date	11/6/14
Task: Drainage - Perimeter Channels	Sheet 2	Of	3

Drainage Area is measured in plan view and does not account slope. Refer to sheet "Channels" for drainage areas.
Select Lining System for each channel slope that will handle the design flow when vegetated and when initially placed

Node	Drainage Area (sf)	Drainage Area (acres)	Channel Slope	Channel Side Slope Inside (X:1)	Channel Side Slope Outside (X:1)	Bottom Width, b (ft)
DI #1	151,343	3.47	2.5%	2	2	4
DI #2	126,288	2.90	1.2%	2	2	4
DI #3	207,620	4.77	2.5%	2	2	4
DI #4	494,592	11.35	2.5%	2	2	4
DI #5	193,321	4.44	0.7%	2	2	4
DI #6	244,717	5.62	2.0%	2	2	4
A	302,929	6.95	2.5%	2	2	4
AB	1,153,885	26.49	1.1%	2	2	4
ABC	1,677,879	38.52	0.9%	2	2	4
ABCD	2,030,610	46.62	0.6%	2	2	4
E	1,177,817	27.04	0.5%	2	2	4
F	180,590	4.15	2.5%	2	2	4

	Channel Location	Flow Q (cfs)	Lining Type	Z_{req}	Flow Depth d (ft)	Cross Sectional Area (sf)	R	Z_{av}	Velocity (ft/sec)	Avg Shear Stress (lb/sf)	Comment
Initial Lining											
	DI #1	11.9	E	1.01	0.42	2.04	0.35	1.01	5.8	0.7	Need Liner
	DI #2	9.9	E	1.21	0.47	2.31	0.38	1.21	4.3	0.4	Need Liner
	DI #3	16.3	E	1.39	0.51	2.54	0.41	1.39	6.4	0.8	Need Liner
	DI #4	38.9	E	3.30	0.82	4.62	0.60	3.30	8.4	1.3	Need Liner
	DI #5	15.2	E	2.36	0.68	3.66	0.52	2.36	4.2	0.3	Need Liner
	DI #6	19.2	E	1.83	0.59	3.07	0.46	1.83	6.3	0.7	Need Liner
	A	23.8	E	2.02	0.63	3.28	0.48	2.02	7.3	1.0	Need Liner
	AB	90.8	E	11.39	1.57	11.25	1.02	11.39	8.1	1.1	Need Liner
	ABC	132.0	E	18.67	2.01	16.15	1.24	18.67	8.2	1.1	Need Liner
	ABCD	159.7	E	27.70	2.44	21.61	1.45	27.70	7.4	0.9	Need Liner
	E	92.6	E	17.58	1.95	15.46	1.21	17.58	6.0	0.6	Need Liner
	F	14.2	E	1.21	0.47	2.31	0.38	1.21	6.1	0.7	Need Liner
Temp Lining											
	DI #1	11.9	D	1.31	0.49	2.44	0.39	1.31	4.9	0.8	OK
	DI #2	9.9	D	1.57	0.54	2.76	0.43	1.57	3.6	0.4	OK
	DI #3	16.3	D	1.80	0.59	3.03	0.46	1.80	5.4	0.9	OK
	DI #4	38.9	D	4.29	0.95	5.57	0.68	4.29	7.0	1.5	OK
	DI #5	15.2	D	3.07	0.79	4.39	0.58	3.07	3.5	0.4	OK
	DI #6	19.2	D	2.37	0.68	3.67	0.52	2.37	5.2	0.9	OK
	A	23.8	D	2.63	0.72	3.94	0.54	2.63	6.0	1.1	OK
	AB	90.8	D	14.81	1.80	13.63	1.13	14.81	6.7	1.3	OK
	ABC	132.0	D	24.27	2.29	19.60	1.38	24.27	6.7	1.3	OK
	ABCD	159.7	D	36.01	2.76	26.25	1.61	36.01	6.1	1.0	OK
	E	92.6	D	22.86	2.22	18.75	1.35	22.86	4.9	0.7	OK
	F	14.2	D	1.57	0.54	2.76	0.43	1.57	5.1	0.8	OK

Project:	Charah Brickhaven No.2 Mine	Computed	EAW		11/6/2014
Subject:	Permit Application	Checked	PAW	Date	11/6/14
Task:	Drainage - Perimeter Channels	Sheet	3	Of	3

	Channel Location	Flow Q (cfs)	Lining Type	Z_{req}	Flow Depth d (ft)	Cross Sectional Area (sf)	R	Z_{av}	Velocity (ft/sec)	Avg Shear Stress (lb/sf)	Comment
Permanent Lining											
	DI #1	5.0	F	0.63	0.32	1.49	0.27	0.63	3.3	0.5	OK
	DI #2	4.1	F	0.76	0.36	1.69	0.30	0.76	2.4	0.3	OK
	DI #3	6.8	F	0.87	0.39	1.85	0.32	0.87	3.7	0.6	OK
	DI #4	16.2	F	2.06	0.63	3.33	0.49	2.06	4.9	1.0	OK
	DI #5	6.3	F	1.47	0.52	2.64	0.42	1.47	2.4	0.2	OK
	DI #6	8.0	F	1.14	0.45	2.22	0.37	1.14	3.6	0.6	OK
	A	9.9	F	1.26	0.48	2.37	0.39	1.26	4.2	0.7	OK
	AB	37.8	F	7.12	1.24	8.00	0.84	7.12	4.7	0.9	OK
	ABC	55.0	P	5.06	1.03	6.26	0.73	5.06	8.8	0.6	OK
	ABCD	66.5	P	7.50	1.27	8.31	0.86	7.50	8.0	0.5	OK
	E	38.6	P	4.76	1.00	5.99	0.71	4.76	6.4	0.3	OK
	F	5.9	F	0.75	0.36	1.68	0.30	0.75	3.5	0.6	OK

CONCLUSION

Channel	Inside Channel (X:1)	Outside Channel (X:1)	Bottom Width, b (ft)	Slope (%)	Min Depth (ft)	Build Depth (ft)	Top Width (ft)	Temporary Lining	Permanent Lining
DI #1	2	2	4	2.5%	0.7	2	12	Curlex HV (or equiv)	Grass Lined
DI #2	2	2	4	1.2%	0.7	2	12	Curlex HV (or equiv)	Grass Lined
DI #3	2	2	4	2.5%	0.8	2	12	Curlex HV (or equiv)	Grass Lined
DI #4	2	2	4	2.5%	1.1	2	12	Curlex HV (or equiv)	Grass Lined
DI #5	2	2	4	0.7%	1.0	2	12	Curlex HV (or equiv)	Grass Lined
DI #6	2	2	4	2.0%	0.9	2	12	Curlex HV (or equiv)	Grass Lined
A	2	2	4	2.5%	0.9	2	12	Curlex HV (or equiv)	Grass Lined
AB	2	2	4	1.1%	2.0	2	12	Curlex HV (or equiv)	Grass Lined
ABC	2	2	4	0.9%	1.2	2	12		Concrete
ABCD	2	2	4	0.6%	1.5	2	12		Concrete
E	2	2	4	0.5%	1.2	2	12		Concrete
F	2	2	4	2.5%	0.7	2	12	Curlex HV (or equiv)	Grass Lined

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Objective Design the sideslope channels on the structural fill for the 25-yr storm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. NCDOT Standard Specifications for Roads and Structures
4. North American Green Product Brochure version 4.11
5. East Coast Erosion Blankets (ECS-1)
6. Maccaferri
7. Green Armor Systems
8. NOAA Atlas 14, Volume 2, Version 3 (Sanford, NC)

Equations

Normal Depth Procedure (Manning's Eqn) Ref 2

$Z_{av} = AR^{2/3}$ Area (A) = $bd + z\,d^2$

$Z_{req} = Q\,n / 1.49s^{0.5}$ $R = \text{Area} / (b+2d(z^2+1)^{0.5})$

$AR^{2/3} = Q\,n / 1.49s^{0.5}$ Avg Shear Stress (T) = d*s*unit weight of water

$Q\,(\text{cfs}) = CIA$

$Z_{av} = Z_{req}$

Channel Design

Min Channel Freeboard =	0.2	ft	
Inside Channel Side Slope =	Varies	(enter X for X:1)	
Outside Channel Side Slope =	Varies	(enter X for X:1)	
Bottom Width, b =	Varies	ft	
Runoff Coeff (initial)=	0.60	Ag land, smooth	Ref 1
Runoff Coeff (permanent)=	0.25	Pasture, Sandy	Ref 1
I (in/hr) =	5.71	25-yr, 15-min Design Storm	Ref 8

Various Lining Types

Lining Type	Lining Description	Manning's n depths of 0-0.5 ft	Manning's n depths of 0.5-2.0 ft	Vp (ft/sec)	Allowable Shear Stress (psf)
A	Jute Net (HEC-15)		0.015	2.0	0.45
B	Erosion Control Blanket Single Net (Curlex 1)		0.034	5.0	1.55
C	Erosion Control Blanket, Straw w/ Single Net (Ref 4)*		0.025	6.7	1.50
D	Erosion Control Blanket Double Net (Curlex HV)		0.026	10.0	1.65
E	Ordinary Firm Loam (Ref 2)	0.023	0.020	3.5	2.0
F	Grass Lined (Ref 1)*		0.030	5.0	2.0
G	6" Rip Rap (Ref 2, Ref 1)		0.069	9.0	2.0
H	GreenArmor 7010 (unvegetated)		0.034	12.0	3.3
I	Unvegetated Turf Reinforcement Mat (TRM) (NAG C350)		0.025	9.5	2.25
J	Class D Phase 2 (Partially vegetated) TRM (NAG C350)		0.048	14.0	3.34
K	12" Rip Rap (Ref 2, Ref 1)		0.078	12.5	4.0
L	Class B Phase 3 (Fully vegetated) TRM (NAG C350)		0.048	18.0	5.7
M	Reno Mattress (6-inch, unvegetated) Ref 6		0.0277	13.8	4.3
N	Reno Mattress (6-inch, vegetated) Ref 6		0.050	13.8	8.35
O	Smart Ditch (Pre-formed HDPE channel)		0.022	-	-
P	Concrete (HEC-15, EPA 832-F-99-002)		0.013	25.0	10.0

*Depth of Flow is not specified for Manning's' n

HDR Computation

Project:	Charah Brickhaven No.2 Mine	Computed	EAW	Date	11/6/2014
Subject:	Permit Application	Checked	PAW	Date	11/6/2014
Task:	Drainage - Top Slope Swales	Sheet	2	Of	2

Drainage Area is measured in plan view and does not account slope.
Select Lining System for each channel slope that will handle the design flow when vegetated and when initially placed

Berm Location	Drainage Area (sf)	Drainage Area (acres)	Channel Slope	Channel Side Slope Inside (X:1)	Channel Side Slope Outside (X:1)	Bottom Width, b (ft)	
Area E	1,177,817	27	0.17%	50	2	0	Largest Drainage Area
1/2 Area B	425478	12.1	0.63%	50	2	0	Largest Drainage Area

Berm Location	Flow Q (cfs)	Lining Type	Z_{req}	Flow Depth d (ft)	Cross Sectional Area (sf)	R	Z_{av}	Velocity (ft/sec)	Avg Shear Stress (lb/sf)	Comment
Initial Lining										
Area E	92.6	E	30.46	1.26	41.50	0.63	30.46	2.2	0.1	OK
1/2 Area B	41.5	E	6.98	0.73	13.75	0.36	6.98	3.0	0.3	OK
Temp Lining										
Area E	92.6	C	38.07	1.37	49.06	0.68	38.07	1.9	0.1	OK
1/2 Area B	41.5	C	8.73	0.79	16.26	0.39	8.73	2.5	0.3	OK
Permanent Lining										
Area E	38.6	F	19.04	1.06	29.18	0.53	19.04	1.3	0.1	OK
1/2 Area B	17.3	F	4.36	0.61	9.66	0.30	4.36	1.8	0.2	OK

CONCLUSION

	Side Slope Inside Channel (X:1)	Side Slope Outside Channel (X:1)	Bottom Width, b (ft)	Min to Construct Slope (%)	Min to Construct Depth (ft)	Min to Construct Top Width (ft)
Area E	50	2	0	0.17%	1.1	55.1
1/2 Area B	50	2	0	0.63%	0.6	31.7

Channels to have a temporary liner (Straw w/ Single Net)
Permanent liner is grass.

HDR Computation

Job No. 453925-237673-018

Project:	Charah Brickhaven No.2 Mine	Computed	EAW	Date	11/06/14
Subject:	Permit Application	Checked:	PAW	Date: 11/6/14	
Task:	Drainage - Slope Drains	Sheet:	1	Of:	1

Objective: Size the slope drains for the 25-year storm.

Equations:

Q (cfs) = CIA

Runoff Coeff (permanent)= 0.25 Pasture, Sandy

.71 25-yr, 15-min Design Storm

Drai $D_{REQD} = 16\left[\frac{Qn}{\sqrt{s}}\right]^{\frac{3}{8}}$ e largest drainage area

Drainage area to pipe is in "post" condition

Manning's

Theoretical Size for pipe flowing full

D = Pipe diameter (inches)

Q = Peak Flow (cfs)

0.012 = n, Manning's Roughness Coefficient for ADS CPP

s = Pipe Slope (ft fall / ft run)

Orifice $Q = C_d * A * (2gh)^{0.5}$

Q (cfs) = Discharge

0.60 = C_d Coefficient of Discharge (dimensionless)

A (sf) = Cross Sectional Area of Flow at the orifice entrance

32.2 = Acceleration of Gravity g (ft/sec^2)

h (ft) = driving head measured from centroid of the orifice (pipe) to the water surface

"Driving Headwater Rqd for Total Flow" is the depth of water above the centerline of the pipe required to achieve the flow.
"Driving Head Available" is the depth of the channel from the center of the pipe to the top of the channel.

Allowable head 2.0 feet (depth of channel)

Location	Pipe Slope (ft fall / ft run)	Drainage Area (acres)	Flow Q (cfs)	Theoretical Size for pipe (in)	Pipe Dia Selected (in)	Cross Sectional Area of orifice (sf)	Driving Headwater Rqd for Total Flow (ft)	Driving Head Available (ft)	Manning's Possible Discharge Q (cfs)	Comments
B	25%	19.5	27.9	13.8	18	1.8	10.7	1.3	57.0	
E	25%	27.0	38.6	15.5	18	1.8	20.6	1.3	57.0	
H	25%	19.5	27.8	13.8	18	1.8	10.7	1.3	57.0	
L	25%	15.6	22.2	12.6	18	1.8	6.8	1.3	57.0	

Conclusion:

Use 18" corrugated plastic pipe (smooth wall)

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HDR Computation

Job No. 453925-237673-018

Project:	Charah Brickhaven No.2 Mine	Computed:	EAW	Date	11/06/14
Subject:	Permit Application	Checked	PAW	Date	11/6/14
Task:	Drainage - Drop Inlets	Sheet	1	Of	1

Objective: Size the drop inlet outlet pipe and grates for the 25-year storm.

References: 1. Elements of Urban Stormwater Design, H. Rooney Malcom, P.E.

Equations:

$Q = C_d * A (2 * g * h)^{0.5}$ Orifice Equation

Q = cfs, discharge (based on permanent condition)

C_d = coefficient of discharge = 0.59 Ref 1, p III-11

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

A = sf, cross sectional open area

	Open area (A)	Grate	Manufacturer
A	3.6	V-3610-7	East Jordan Iron Works
B	4.8	R-1792-KG	Neenah
C	6.0	R-3531-A	Neenah

Allowable head 2.0 feet (depth of channel)

Flow from Slope Drains 27.9

Check for inlet control

Channel Location	Contributing Area (sf)	Q (cfs)	C_d	# of Grates		Grate	Open Area (sf)	Required head(ft)	
DI #1	151,343	11.9	0.59	1	C	R-3531-A	6.0	0.2	Ok
DI #2	126,288	9.9	0.59	1	C	R-3531-A	6.0	0.1	Ok
DI #3	207,620	16.3	0.59	1	C	R-3531-A	6.0	0.3	Ok
DI #4	494,592	38.9	0.59	1	C	R-3531-A	6.0	1.9	Ok
DI #5	193,321	15.2	0.59	1	C	R-3531-A	6.0	0.3	Ok
DI #6	244,717	19.2	0.59	1	C	R-3531-A	6.0	0.5	Ok
DI #7	2,211,200	173.9	0.59	5	C	R-3531-A	30.0	1.5	Ok

Size the Outlet culvert

$D=16*(Qn/s^{0.5})^{3/8}$ Theoretical Pipe Size (in) for pipe flowing full

D = Pipe diameter (inches)

Q = Peak Flow (cfs)

n = 0.013 Manning's Roughness Coefficient for RCP

s = Pipe Slope (ft fall / ft run)

Check pipe size based on Gravity Flow

Pipe	Q (cfs)	Slope (%)	# of pipes	Theoretical Diameter (in)	Culvert Diameter (in)
DI #1	11.9	0.5%	1	21.5	24
DI #2	9.9	0.5%	1	20.1	24
DI #3	16.3	0.5%	1	24.2	30
DI #4	38.9	0.5%	1	33.5	36
DI #5	15.2	0.5%	1	23.5	30
DI #6	19.2	0.5%	1	25.7	30
DI #7	173.9	0.5%	5	32.1	36

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HDR Computation

Job No. 453925-237673-018

Project:	Charah Brickhaven No.2 Mine	Computed	EAW	Date	11/06/14
Subject:	Permit Application	Checked:	PAW	Date:	11/6/14
Task:	Drainage - Apron Outlets	Sheet	1	Of	1

Objective: Design the apron outlets for the drop inlets for the 25-year storm.

References:
1. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
2. North Carolina Erosion and Sediment Control Planning and Design Manual

Equations: Determine Tailwater conditions to size apron
Use Normal Depth Procedure (Manning's Eqn.) — Ref 1, II-7

$Z_{av} = AR^{2/3}$ — Area (A) = $bd + z\,d^2$

$Z_{req} = Q\,n / 1.49s^{0.5}$ — $R = \text{Area} / (b+2d(z^2+1)^{0.5})$

$AR^{2/3} = Q\,n / 1.49s^{0.5}$ — Avg Shear Stress (T) = d*s*unit weight of water

Set $Z_{av} = Z_{req}$ by adjust flow depth

n =	0.104	6-Inch Rip Rap Lined Channel (for depths of 0 to 0.5 ft)	Ref 2
n =	0.069	6-Inch Rip Rap Lined Channel (for depths of 0.5 to 2 ft)	Ref 2
Vp (ft/sec) =	9	Permissible Velocity for lining	Ref 2
Side Slope (z) =	6	enter X for X:1 (assumed)	
s (ft/ft) =	0.5%	Outlet Slope (assumed)	
Diameter (in) =	varies	Drop Inlet Culvert	
Bottom Width (ft) =	10	Assumed	

Flows (Q) based on the "Manning's Possible Discharge Q (cfs)" from the pipe calcualation.

Minimum Tailwater Conditions: Flow Depth (d) < 0.5*Diameter of Culvert — Ref 2 8.06a
Maximum Tailwater Conditions: Flow Depth (d) > 0.5*Diameter of Culvert — Ref 2 8.06b

Diameter (in)	Q (cfs)	Z_{req}	Flow Depth, d (ft)	Cross Sectional Area (sf)	R (ft)	Z_{av}	Velocity (ft/sec)	Tailwater
24	11.9	7.80	0.77	11.2	0.58	7.80	1.1	Min
30	19.2	12.60	0.99	15.8	0.72	12.60	1.2	Min
36	34.8	22.78	1.34	24.1	0.92	22.78	1.4	Min

Size the aprons for each pipe using Ref 2:
The discharge on Figure 8.06a do not intersect the pipe size. Use the minimum length.

Conclusion:

Culvert Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
2	6	14	16	0.5	Class B
2.5	7.5	16	19	0.5	Class B
3	9	20	23	0.5	Class B

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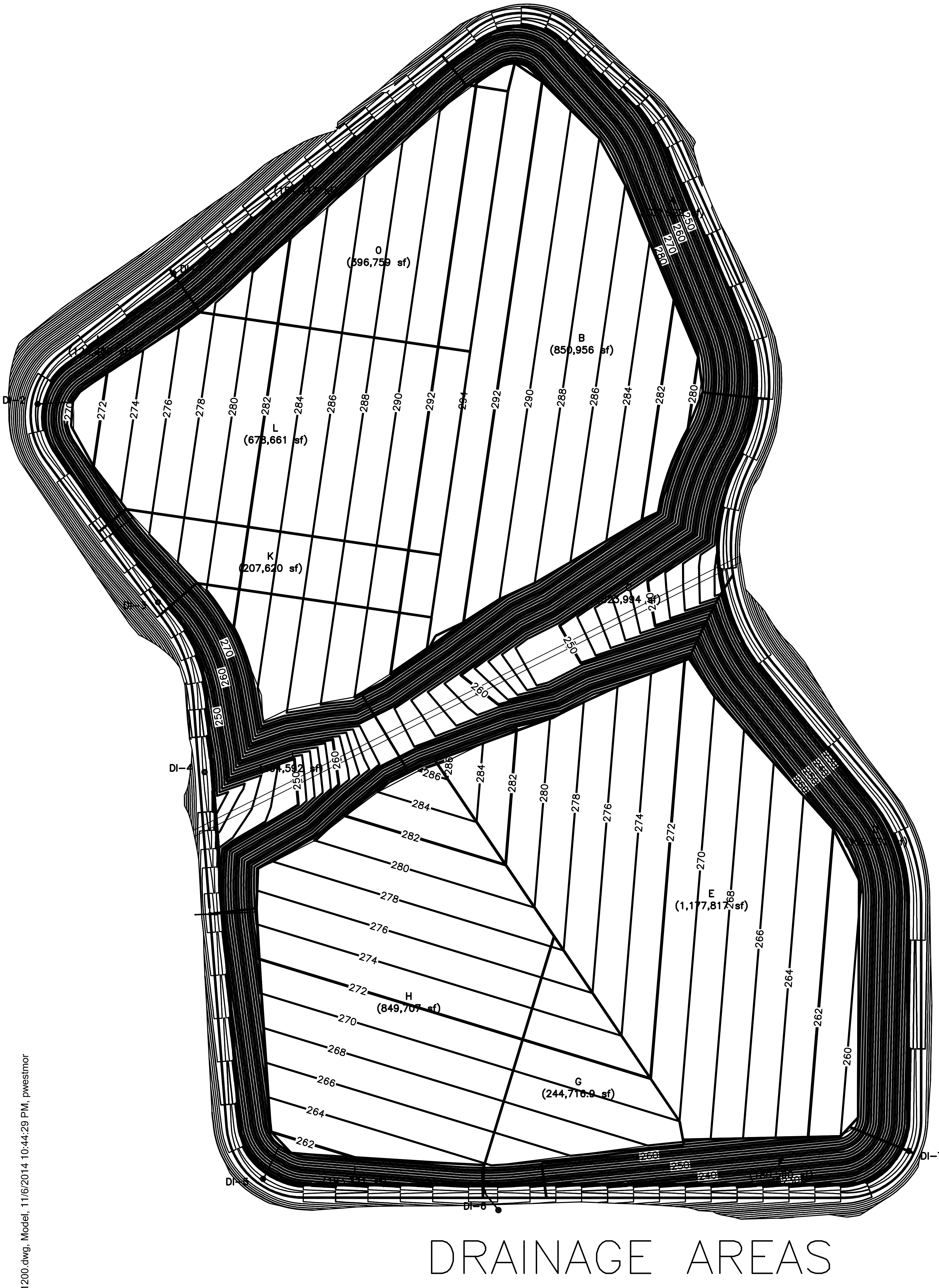

DRAINAGE AREAS

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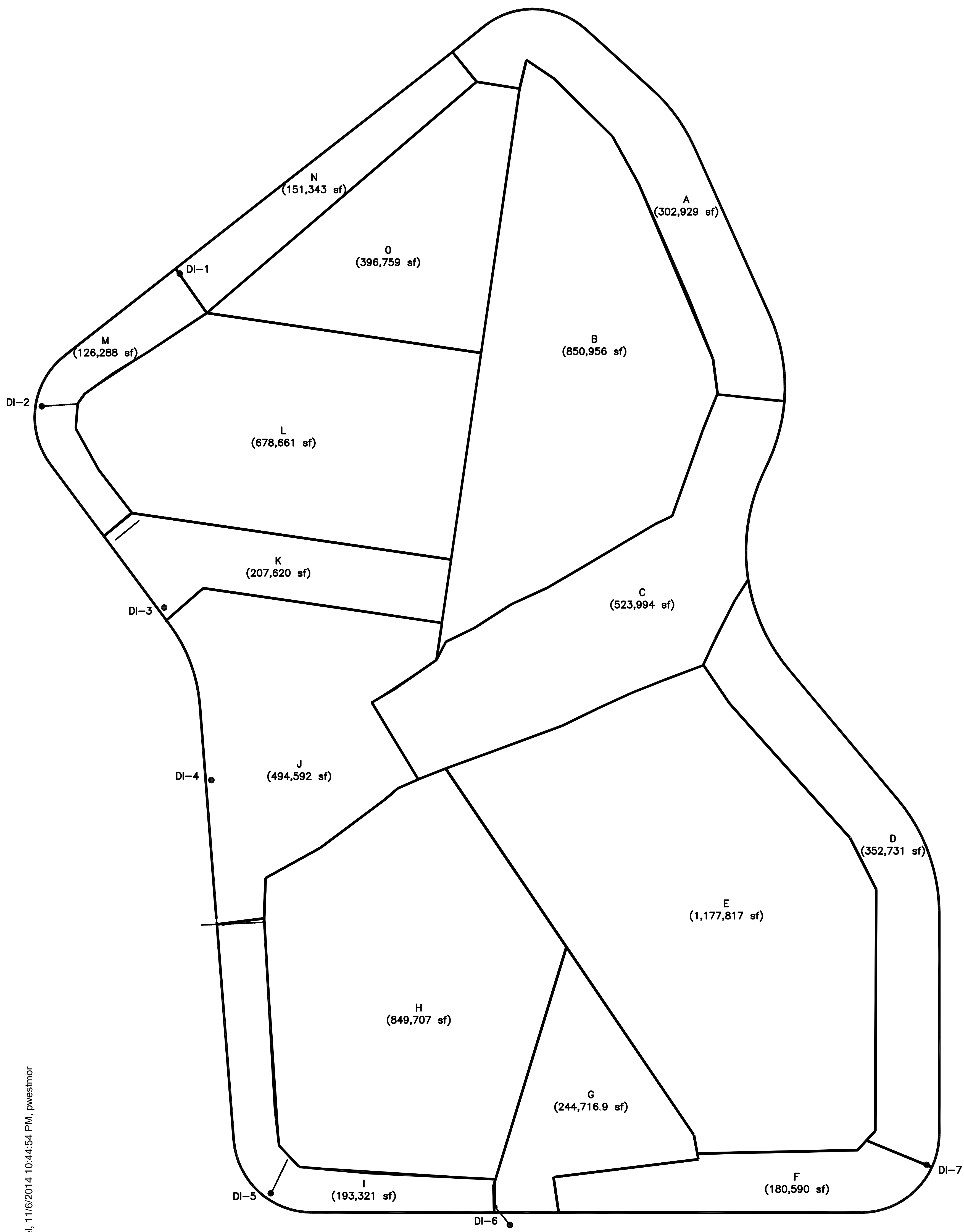

DRAINAGE AREAS

NOAA Atlas 14, Volume 2, Version 3
Location name: Sanford, North Carolina, US*
Latitude: 35.5361°, Longitude: -79.1459°
Elevation: 297ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.10** (4.66–5.62)	**6.04** (5.51–6.64)	**7.00** (6.38–7.70)	**7.69** (7.00–8.45)	**8.48** (7.68–9.31)	**9.01** (8.14–9.89)	**9.52** (8.53–10.4)	**9.95** (8.88–10.9)	**10.4** (9.23–11.4)	**10.8** (9.48–11.8)
10-min	**4.08** (3.72–4.48)	**4.82** (4.40–5.31)	**5.60** (5.11–6.17)	**6.15** (5.60–6.76)	**6.76** (6.12–7.42)	**7.18** (6.48–7.87)	**7.56** (6.78–8.28)	**7.88** (7.03–8.64)	**8.26** (7.30–9.05)	**8.50** (7.46–9.33)
15-min	**3.40** (3.10–3.74)	**4.04** (3.69–4.45)	**4.72** (4.31–5.20)	**5.19** (4.72–5.70)	**5.71** (5.17–6.27)	**6.06** (5.47–6.64)	**6.37** (5.72–6.98)	**6.63** (5.92–7.27)	**6.92** (6.13–7.59)	**7.11** (6.24–7.81)
30-min	**2.33** (2.13–2.56)	**2.79** (2.55–3.07)	**3.36** (3.06–3.69)	**3.76** (3.42–4.13)	**4.23** (3.83–4.64)	**4.56** (4.12–5.00)	**4.88** (4.38–5.34)	**5.16** (4.61–5.66)	**5.51** (4.87–6.04)	**5.76** (5.06–6.32)
60-min	**1.45** (1.33–1.60)	**1.75** (1.60–1.93)	**2.15** (1.96–2.37)	**2.45** (2.23–2.69)	**2.82** (2.55–3.09)	**3.09** (2.79–3.39)	**3.36** (3.01–3.68)	**3.62** (3.23–3.97)	**3.95** (3.50–4.33)	**4.20** (3.69–4.61)
2-hr	**0.856** (0.776–0.951)	**1.04** (0.940–1.15)	**1.29** (1.17–1.43)	**1.48** (1.34–1.64)	**1.73** (1.55–1.91)	**1.92** (1.71–2.12)	**2.10** (1.87–2.33)	**2.29** (2.02–2.53)	**2.53** (2.21–2.80)	**2.72** (2.35–3.01)
3-hr	**0.605** (0.550–0.672)	**0.733** (0.666–0.814)	**0.915** (0.831–1.02)	**1.06** (0.957–1.17)	**1.25** (1.12–1.38)	**1.40** (1.25–1.54)	**1.55** (1.37–1.71)	**1.70** (1.50–1.88)	**1.91** (1.66–2.11)	**2.08** (1.79–2.30)
6-hr	**0.363** (0.331–0.401)	**0.439** (0.401–0.484)	**0.549** (0.500–0.606)	**0.636** (0.577–0.700)	**0.753** (0.679–0.827)	**0.846** (0.758–0.928)	**0.942** (0.837–1.03)	**1.04** (0.915–1.14)	**1.18** (1.02–1.29)	**1.29** (1.10–1.41)
12-hr	**0.214** (0.195–0.236)	**0.258** (0.236–0.286)	**0.325** (0.296–0.359)	**0.378** (0.342–0.417)	**0.452** (0.406–0.496)	**0.511** (0.456–0.560)	**0.573** (0.506–0.627)	**0.638** (0.558–0.698)	**0.730** (0.627–0.799)	**0.804** (0.681–0.880)
24-hr	**0.125** (0.116–0.134)	**0.151** (0.141–0.162)	**0.190** (0.177–0.204)	**0.220** (0.205–0.236)	**0.262** (0.242–0.281)	**0.295** (0.273–0.316)	**0.328** (0.303–0.353)	**0.364** (0.334–0.390)	**0.412** (0.377–0.442)	**0.449** (0.410–0.483)
2-day	**0.073** (0.068–0.078)	**0.088** (0.082–0.094)	**0.109** (0.102–0.117)	**0.126** (0.117–0.136)	**0.150** (0.138–0.161)	**0.168** (0.155–0.180)	**0.187** (0.172–0.201)	**0.206** (0.189–0.222)	**0.233** (0.213–0.251)	**0.254** (0.231–0.274)
3-day	**0.051** (0.048–0.055)	**0.062** (0.058–0.066)	**0.077** (0.071–0.082)	**0.088** (0.082–0.095)	**0.104** (0.097–0.112)	**0.117** (0.108–0.126)	**0.130** (0.120–0.140)	**0.144** (0.132–0.154)	**0.162** (0.148–0.174)	**0.177** (0.161–0.190)
4-day	**0.041** (0.038–0.044)	**0.049** (0.046–0.052)	**0.060** (0.056–0.065)	**0.069** (0.065–0.074)	**0.082** (0.076–0.088)	**0.092** (0.085–0.098)	**0.102** (0.094–0.109)	**0.112** (0.103–0.120)	**0.127** (0.116–0.136)	**0.138** (0.125–0.148)
7-day	**0.027** (0.025–0.029)	**0.032** (0.030–0.034)	**0.039** (0.036–0.042)	**0.044** (0.041–0.048)	**0.052** (0.048–0.056)	**0.058** (0.054–0.062)	**0.064** (0.060–0.069)	**0.071** (0.065–0.076)	**0.080** (0.073–0.085)	**0.087** (0.079–0.093)
10-day	**0.021** (0.020–0.023)	**0.025** (0.024–0.027)	**0.031** (0.029–0.033)	**0.035** (0.032–0.037)	**0.040** (0.037–0.043)	**0.044** (0.041–0.047)	**0.049** (0.045–0.052)	**0.053** (0.049–0.057)	**0.059** (0.055–0.063)	**0.064** (0.059–0.068)
20-day	**0.014** (0.014–0.015)	**0.017** (0.016–0.018)	**0.020** (0.019–0.021)	**0.022** (0.021–0.024)	**0.026** (0.024–0.027)	**0.028** (0.026–0.030)	**0.031** (0.029–0.033)	**0.034** (0.031–0.036)	**0.037** (0.034–0.039)	**0.040** (0.037–0.042)
30-day	**0.012** (0.011–0.013)	**0.014** (0.013–0.015)	**0.016** (0.015–0.017)	**0.018** (0.017–0.019)	**0.020** (0.019–0.022)	**0.022** (0.021–0.024)	**0.024** (0.022–0.025)	**0.026** (0.024–0.027)	**0.028** (0.026–0.030)	**0.030** (0.028–0.032)
45-day	**0.010** (0.010–0.011)	**0.012** (0.011–0.013)	**0.014** (0.013–0.014)	**0.015** (0.014–0.016)	**0.017** (0.016–0.017)	**0.018** (0.017–0.019)	**0.019** (0.018–0.020)	**0.020** (0.019–0.022)	**0.022** (0.021–0.023)	**0.023** (0.022–0.025)
60-day	**0.009** (0.009–0.010)	**0.011** (0.010–0.011)	**0.012** (0.011–0.013)	**0.013** (0.012–0.014)	**0.014** (0.014–0.015)	**0.015** (0.015–0.016)	**0.016** (0.016–0.017)	**0.017** (0.016–0.018)	**0.019** (0.018–0.020)	**0.020** (0.018–0.021)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

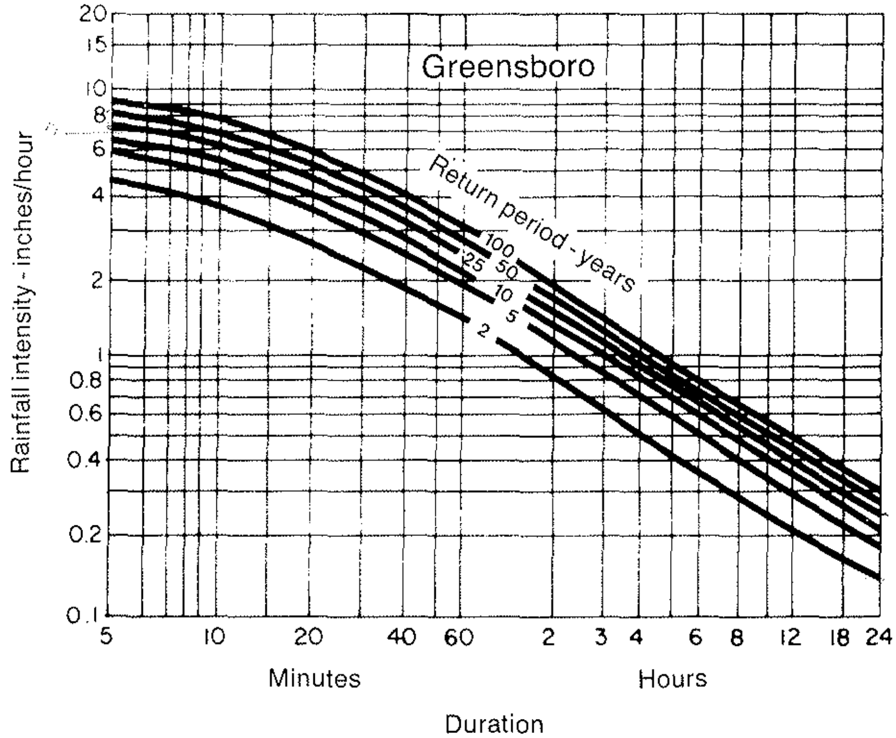


Figure 8.03d Rainfall intensity duration curves—Greensboro.

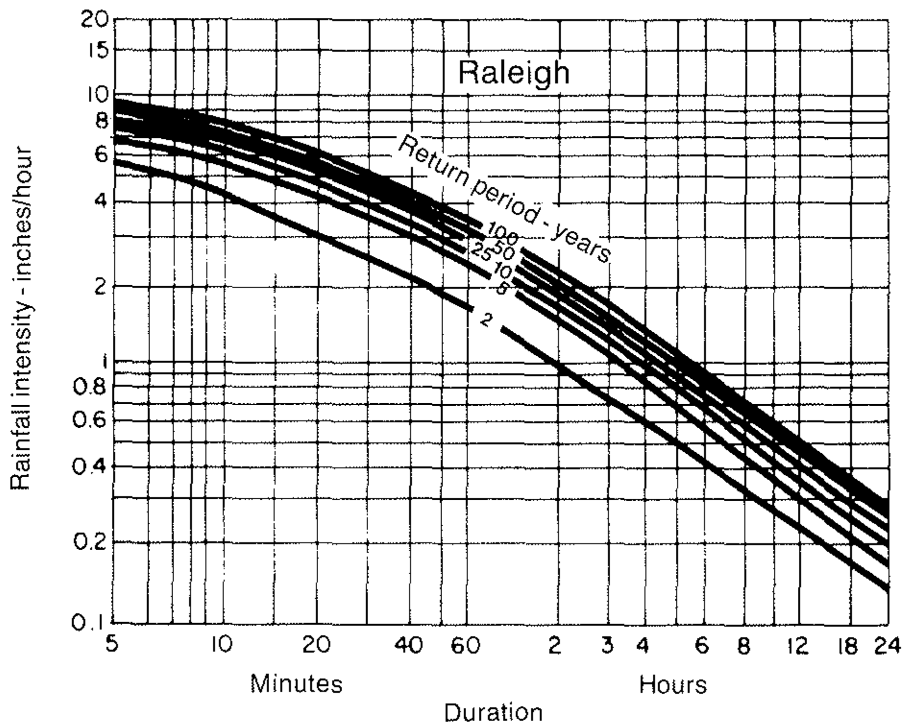


Figure 8.03e Rainfall intensity duration curves—Raleigh.

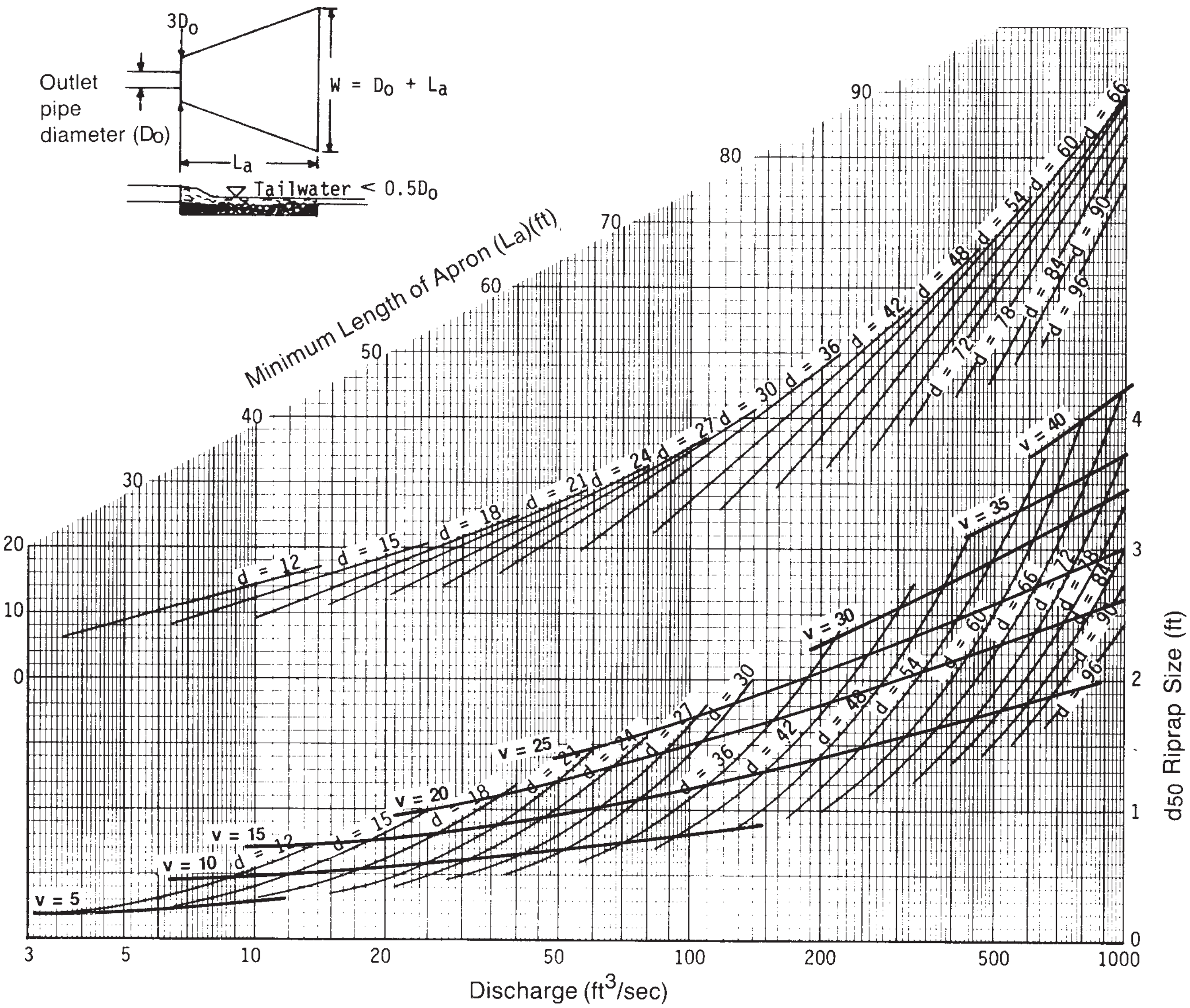
Table 8.03b
Value of Runoff Coefficient (C) for Rational Formula

Land Use	C
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.50-0.70
Residential:	
Single-family areas	0.30-0.50
Multi units, detached	0.40-0.60
Multi units, Attached	0.60-0.75
Suburban	0.25-0.40
Industrial:	
Light areas	0.50-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad yard areas	0.20-0.40
Unimproved areas	0.10-0.30
Streets:	
Asphalt	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Drives and walks	0.75-0.85
Roofs	0.75-0.85

Land Use	C
Lawns:	
Sandy soil, flat, 2	0.05-0.10
Sandy soil, ave.,	0.10-0.15
2-7%	0.15-0.20
Sandy soil, steep,	0.13-0.17
7%	0.18-0.22
Heavy soil, flat, 2	0.25-0.35
Heavy soil, ave.,	
2-7%	
Heavy soil, steep,	
7%	0.30-0.60
	0.20-0.50
Agricultural land:	
Bare packed soil	0.30-0.60
Smooth	0.20-0.50
Rough	0.20-0.40
Cultivated rows	0.10-0.25
Heavy soil no crop	
Heavy soil with	0.15-0.45
crop	0.05-0.25
Sandy soil no crop	0.05-0.25
Sandy soil with	
crop	0.10-0.25
Pasture	
Heavy soil	0.15-0.45
Sandy soil	0.05-0.25
Woodlands	0.05-0.25

NOTE: The designer must use judgement to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C values.

Source: American Society of Civil Engineers



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #1	Sheet: 1	Of: 4

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	19.8	40.4	40.4	40.4		
Disturbed Area (ac) =	18.1	38.7	38.7	38.7		
Curve Number CN =	93	93	93	93	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	132.65	208.12	250.82	319.48	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	72,720	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	90,532	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:

Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
213	0	1,339	-	-	-
214	1	78,402	29,996	29,996	1,111
215	2	85,484	81,917	111,913	4,145
216	3	92,621	89,029	200,942	7,442
217	4	99,815	96,196	297,137	11,005
218	5	107,065	103,419	400,556	14,835

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 200,942 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 92,621 *Required Surface Area Achieved*

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #1	Sheet: 2	Of: 4

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	200,942		
Number of skimmers	2		
Days to Drain =	5	*assumed*	
Q (cf/day) =	20,094		0.23 cfs

Selected Skimmer Size (inches) =	8
Head on Skimmer (feet) =	0.5
Diameter of Orifice (inches) =	3.5

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

S = (1000/CN) - 10

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	0.75	0.75	0.75	0.75
Runoff Depth Q* (inches) =	4.36	4.36	5.32	6.87
Time to Peak T_p (min) =	28.36	36.88	37.30	37.84

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 200,942

Z_2 (ft) = 5 S_2 (cf) = 400,556

$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$ 1.4 Ref 2, III-8

$K_S = S_2/Z_2^{\,b} =$ 45,577

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #1		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 n^2 / sec @ 20^o C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2$ = 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 7.50

Set Top of Dam at (ft) = 8.00

See Hydrograph

Emergency Spillway

Q_E (cfs) = 100-Yr Storm

Q_E (cfs) = 16.5

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 20

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.34	7.27	3.33	0.31	3.33	2.3	0.2
0.02	0.27	5.83	2.35	0.26	2.35	2.8	0.3

Construct the channel to be : 20 ft, Bottom Width (measured at top of lining)

0.5 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 6

Use Anti-Seep Collar Size (ft) = 6 x 6

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #1	Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) =	72	From Hydrograph
Avg Density of Concrete (lbs/cf) =	87.6	
Density of Water (lbs/cf) =	62.4	
Riser Displacement (cf) =	200.75	Pi * $(D_R/24)^2$ * Total Ht of Riser
Convert cf to cy =	27^{-1}	
Min Concrete Needed (cy) =	5.30	
Width & Length (ft) =	7	
Thickness (ft) =	2.9	

Anti-Vortex Device:

Diameter of Riser (in) =	72	From Hydrograph
Cylinder Diameter (in) =	102	Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) =	14	
Cylinder Height (in) =	36	

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	18	6 * Barrel Diameter
Q_B (cfs) =	32.6	Peak Flow from barrel(s) of 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
32.6	10.68	0.70	15.0	0.60	10.68	2.2

Flow Depth = Tailwater, d (ft) = 0.70 0.5* Barrel Diameter (ft) = 1.50 Ref 1, 8.06.3

Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe

Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe

Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
3	9	16	19	0.5	Class B

Conclusion

The basin can contain the 10-yr storm and pass the 100-yr storm without overtopping the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow SB #A	Sheet 1	Of 2

Diameter of Riser (in) =	72	
Circumference of Riser (in) =	226.2	
eight of Riser from bottom of barrel (in) =	85	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	2	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.00	0.00
0.39	0.00	0.00	0.00			0.00	0.00
0.44	0.00	0.00	0.00			0.00	0.00
0.49	0.00	0.00	0.00			0.00	0.00
0.54	0.00	0.00	0.00			0.47	0.47
0.59	0.00	0.00	0.00			0.47	0.47
0.64	0.00	0.00	0.00			0.47	0.47
0.69	0.00	0.00	0.00			0.47	0.47
0.74	0.00	0.00	0.00			0.47	0.47
0.79	0.00	0.00	0.00			0.47	0.47
0.84	0.00	0.00	0.00			0.47	0.47
0.89	0.00	0.00	0.00			0.47	0.47
0.94	0.00	0.00	0.00			0.47	0.47
0.99	0.00	0.00	0.00			0.47	0.47
1.04	0.00	0.00	0.00			0.47	0.47
1.09	0.00	0.00	0.00			0.47	0.47
1.14	0.00	0.00	0.00			0.47	0.47
1.19	0.00	0.00	0.00			0.47	0.47
1.24	0.00	0.00	0.00			0.47	0.47
1.29	0.00	0.00	0.00			0.47	0.47
1.34	0.00	0.00	0.00			0.47	0.47
1.39	0.00	0.00	0.00			0.47	0.47
1.44	0.00	0.00	0.00			0.47	0.47
1.49	0.00	0.00	0.00			0.47	0.47
1.54	0.00	0.00	0.00			0.47	0.47
1.59	0.00	0.00	0.00			0.47	0.47

HDR Computation

| Job No. 06985-10570-018 |

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow SB #A	Sheet 2	Of 2

1.64	0.00	0.00	0.00	0.47	0.47
1.69	0.00	0.00	0.00	0.47	0.47
1.74	0.00	0.00	0.00	0.47	0.47
1.79	0.00	0.00	0.00	0.47	0.47
1.84	0.00	0.00	0.00	0.47	0.47
1.89	0.00	0.00	0.00	0.47	0.47
1.94	0.00	0.00	0.00	0.47	0.47
1.99	0.00	0.00	0.00	0.47	0.47
2.04	0.00	0.00	0.00	0.47	0.47
2.09	0.00	0.00	0.00	0.47	0.47
2.14	0.00	0.00	0.00	0.47	0.47
2.19	0.00	0.00	0.00	0.47	0.47
2.24	0.00	0.00	0.00	0.47	0.47
2.29	0.00	0.00	0.00	0.47	0.47
2.34	0.00	0.00	0.00	0.47	0.47
2.39	0.00	0.00	0.00	0.47	0.47
2.44	0.00	0.00	0.00	0.47	0.47
2.49	0.00	0.00	0.00	0.47	0.47
2.54	0.00	0.00	0.00	0.47	0.47
2.59	0.00	0.00	0.00	0.47	0.47
2.64	0.00	0.00	0.00	0.47	0.47
2.69	0.00	0.00	0.00	0.47	0.47
2.74	0.00	0.00	0.00	0.47	0.47
2.79	0.00	0.00	0.00	0.47	0.47
2.84	0.00	0.00	0.00	0.47	0.47
2.89	0.00	0.00	0.00	0.47	0.47
2.94	0.00	0.00	0.00	0.47	0.47
2.99	0.00	0.00	0.00	0.47	0.47
3.04	0.00	0.00	0.00	0.47	0.47
3.09	0.00	0.00	0.00	0.47	0.47
3.14	0.00	0.00	0.00	0.47	0.47
3.19	0.00	0.00	0.00	0.47	0.47
3.24	0.00	0.00	0.00	0.47	0.47
3.29	0.00	0.00	0.00	0.47	0.47
3.34	0.00	0.00	0.00	0.47	0.47
3.39	0.00	0.00	0.00	0.47	0.47
3.44	0.00	0.00	0.00	0.47	0.47
3.49	0.00	0.00	0.00	0.47	0.47
3.54	0.00	0.00	0.00	0.47	0.47
3.59	0.00	0.00	0.00	0.47	0.47
3.64	0.00	0.00	0.00	0.47	0.47
3.69	0.00	0.00	0.00	0.47	0.47
3.74	0.00	0.00	0.00	0.47	0.47
3.79	0.00	0.00	0.00	0.47	0.47
3.84	0.00	0.00	0.00	0.47	0.47
3.89	0.00	0.00	0.00	0.47	0.47
3.94	0.00	0.00	0.00	0.47	0.47
3.99	0.00	0.00	0.00	0.47	0.47

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1__of _2_

Sediment Basin # 1 Brickhaven

Phase 1

10 - year Storm Event

Qp = 132.65 cfs
Tp = 28.36 minutes
dT = Max of 2 minutes
or 1.0% of increment to peak

b = 1.4
Ks = 45,577

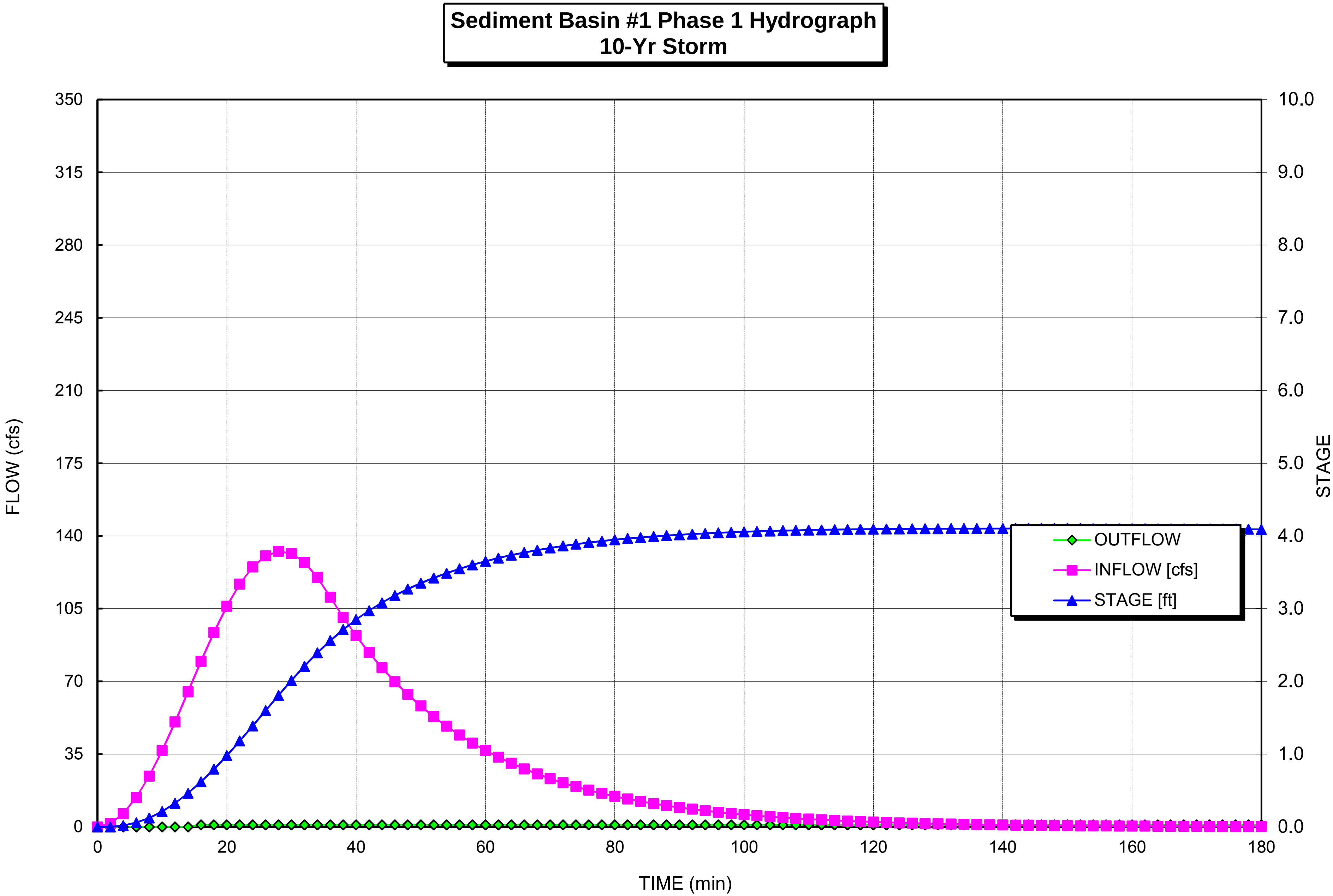
Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	4.1	(ft)	
Height of Riser from bottom of barrel=	7.1	(ft) elevation	220.10
Emergency Spillway =	7.5	(ft) elevation	220.50
Total Height of Dam =	8.0	(ft) elevation	221.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	213.0

4.0E-03	Settling Velocity of design particle (fps)		
2	Effective number of cells (2 is construction site #)		
100%	Minimum Settling Efficiency		
4.1	ft Maximum Stage	217.10	msl elevation
0.9	cfs Peak outflow		
0.9	cfs Peak Riser/Barrel outflow		
0.0	cfs Peak Weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.6	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	6.4	195	0.0	0.00	0.00	0.00	0.00	0.00	32.86	14,938	N/A
6	14.1	963	0.1	0.00	0.00	0.00	0.00	0.00	49.77	22,624	N/A
8	24.4	2,658	0.1	0.00	0.00	0.00	0.00	0.00	64.77	29,440	N/A
10	36.7	5,584	0.2	0.00	0.00	0.00	0.00	0.00	78.53	35,696	N/A
12	50.5	9,989	0.3	0.00	0.00	0.00	0.00	0.00	91.32	41,510	N/A
14	65.0	16,045	0.5	0.00	0.00	0.00	0.00	0.00	103.27	46,942	N/A
16	79.6	23,846	0.6	0.47	0.47	0.00	0.47	0.93	114.46	52,026	100%
18	93.6	33,288	0.8	0.47	0.47	0.00	0.47	0.93	124.81	56,730	100%
20	106.2	44,405	1.0	0.47	0.47	0.00	0.47	0.93	134.50	61,134	100%
22	116.9	57,037	1.2	0.47	0.47	0.00	0.47	0.93	143.52	65,238	100%
24	125.1	70,949	1.4	0.47	0.47	0.00	0.47	0.93	151.89	69,040	100%
26	130.4	85,846	1.6	0.47	0.47	0.00	0.47	0.93	159.59	72,540	100%
28	132.6	101,382	1.8	0.47	0.47	0.00	0.47	0.93	166.63	75,740	100%
30	131.6	117,182	2.0	0.47	0.47	0.00	0.47	0.93	173.01	78,641	100%
32	127.3	132,857	2.2	0.47	0.47	0.00	0.47	0.93	178.74	81,245	100%
34	120.1	148,024	2.4	0.47	0.47	0.00	0.47	0.93	183.82	83,556	100%
36	110.5	162,326	2.6	0.47	0.47	0.00	0.47	0.93	188.28	85,580	100%
38	100.8	175,478	2.7	0.47	0.47	0.00	0.47	0.93	192.12	87,328	100%
40	92.0	187,467	2.8	0.47	0.47	0.00	0.47	0.93	195.44	88,839	100%
42	83.9	198,397	3.0	0.47	0.47	0.00	0.47	0.93	198.34	90,155	100%
44	76.6	208,359	3.1	0.47	0.47	0.00	0.47	0.93	200.88	91,308	100%
46	69.9	217,439	3.2	0.47	0.47	0.00	0.47	0.93	203.11	92,324	100%
48	63.8	225,713	3.3	0.47	0.47	0.00	0.47	0.93	205.09	93,223	100%
50	58.2	233,253	3.4	0.47	0.47	0.00	0.47	0.93	206.85	94,022	100%
52	53.1	240,122	3.4	0.47	0.47	0.00	0.47	0.93	208.41	94,733	100%
54	48.4	246,380	3.5	0.47	0.47	0.00	0.47	0.93	209.81	95,367	100%
56	44.2	252,080	3.5	0.47	0.47	0.00	0.47	0.93	211.06	95,935	100%
58	40.3	257,271	3.6	0.47	0.47	0.00	0.47	0.93	212.18	96,444	100%
60	36.8	261,997	3.7	0.47	0.47	0.00	0.47	0.93	213.18	96,900	100%
62	33.6	266,299	3.7	0.47	0.47	0.00	0.47	0.93	214.08	97,311	100%
64	30.6	270,215	3.7	0.47	0.47	0.00	0.47	0.93	214.90	97,680	100%
66	27.9	273,777	3.8	0.47	0.47	0.00	0.47	0.93	215.63	98,013	100%
68	25.5	277,018	3.8	0.47	0.47	0.00	0.47	0.93	216.29	98,312	100%
70	23.3	279,966	3.8	0.47	0.47	0.00	0.47	0.93	216.88	98,583	100%
72	21.2	282,645	3.9	0.47	0.47	0.00	0.47	0.93	217.42	98,827	100%
74	19.4	285,080	3.9	0.47	0.47	0.00	0.47	0.93	217.90	99,047	100%
76	17.7	287,291	3.9	0.47	0.47	0.00	0.47	0.93	218.34	99,246	100%
78	16.1	289,299	3.9	0.47	0.47	0.00	0.47	0.93	218.74	99,425	100%
80	14.7	291,122	3.9	0.47	0.47	0.00	0.47	0.93	219.09	99,587	100%
82	13.4	292,775	4.0	0.47	0.47	0.00	0.47	0.93	219.41	99,734	100%
84	12.2	294,273	4.0	0.47	0.47	0.00	0.47	0.93	219.71	99,866	100%

86	11.2	295,630	4.0	0.47	0.47	0.00	0.47	0.93	219.97	99,985	100%
88	10.2	296,859	4.0	0.47	0.47	0.00	0.47	0.93	220.20	100,093	100%
90	9.3	297,970	4.0	0.47	0.47	0.00	0.47	0.93	220.42	100,190	100%
92	8.5	298,974	4.0	0.47	0.47	0.00	0.47	0.93	220.61	100,278	100%
94	7.7	299,881	4.0	0.47	0.47	0.00	0.47	0.93	220.78	100,356	100%
96	7.1	300,698	4.0	0.47	0.47	0.00	0.47	0.93	220.94	100,427	100%
98	6.4	301,434	4.1	0.47	0.47	0.00	0.47	0.93	221.08	100,491	100%
100	5.9	302,095	4.1	0.47	0.47	0.00	0.47	0.93	221.21	100,548	100%
102	5.4	302,689	4.1	0.47	0.47	0.00	0.47	0.93	221.32	100,600	100%
104	4.9	303,221	4.1	0.47	0.47	0.00	0.47	0.93	221.42	100,645	100%
106	4.5	303,697	4.1	0.47	0.47	0.00	0.47	0.93	221.51	100,686	100%
108	4.1	304,121	4.1	0.47	0.47	0.00	0.47	0.93	221.59	100,723	100%
110	3.7	304,498	4.1	0.47	0.47	0.00	0.47	0.93	221.66	100,755	100%
112	3.4	304,832	4.1	0.47	0.47	0.00	0.47	0.93	221.72	100,784	100%
114	3.1	305,128	4.1	0.47	0.47	0.00	0.47	0.93	221.78	100,809	100%
116	2.8	305,387	4.1	0.47	0.47	0.00	0.47	0.93	221.83	100,831	100%
118	2.6	305,615	4.1	0.47	0.47	0.00	0.47	0.93	221.87	100,851	100%
120	2.4	305,812	4.1	0.47	0.47	0.00	0.47	0.93	221.91	100,868	100%
122	2.1	305,982	4.1	0.47	0.47	0.00	0.47	0.93	221.94	100,882	100%
124	2.0	306,128	4.1	0.47	0.47	0.00	0.47	0.93	221.97	100,895	100%
126	1.8	306,251	4.1	0.47	0.47	0.00	0.47	0.93	221.99	100,905	100%
128	1.6	306,354	4.1	0.47	0.47	0.00	0.47	0.93	222.01	100,914	100%
130	1.5	306,438	4.1	0.47	0.47	0.00	0.47	0.93	222.03	100,921	100%
132	1.4	306,504	4.1	0.47	0.47	0.00	0.47	0.93	222.04	100,927	100%
134	1.2	306,555	4.1	0.47	0.47	0.00	0.47	0.93	222.05	100,931	100%
136	1.1	306,592	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,935	100%
138	1.0	306,616	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,937	100%
140	0.9	306,628	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,938	100%
142	0.9	306,629	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,938	100%
144	0.8	306,620	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,937	100%
146	0.7	306,603	4.1	0.47	0.47	0.00	0.47	0.93	222.06	100,935	100%
148	0.7	306,577	4.1	0.47	0.47	0.00	0.47	0.93	222.05	100,933	100%
150	0.6	306,543	4.1	0.47	0.47	0.00	0.47	0.93	222.05	100,930	100%
152	0.5	306,503	4.1	0.47	0.47	0.00	0.47	0.93	222.04	100,927	100%
154	0.5	306,456	4.1	0.47	0.47	0.00	0.47	0.93	222.03	100,923	100%
156	0.5	306,404	4.1	0.47	0.47	0.00	0.47	0.93	222.02	100,918	100%
158	0.4	306,346	4.1	0.47	0.47	0.00	0.47	0.93	222.01	100,914	100%
160	0.4	306,284	4.1	0.47	0.47	0.00	0.47	0.93	222.00	100,908	100%
162	0.3	306,218	4.1	0.47	0.47	0.00	0.47	0.93	221.99	100,903	100%
164	0.3	306,147	4.1	0.47	0.47	0.00	0.47	0.93	221.97	100,896	100%
166	0.3	306,073	4.1	0.47	0.47	0.00	0.47	0.93	221.96	100,890	100%
168	0.3	305,995	4.1	0.47	0.47	0.00	0.47	0.93	221.94	100,884	100%
170	0.2	305,915	4.1	0.47	0.47	0.00	0.47	0.93	221.93	100,877	100%
172	0.2	305,832	4.1	0.47	0.47	0.00	0.47	0.93	221.91	100,870	100%
174	0.2	305,746	4.1	0.47	0.47	0.00	0.47	0.93	221.90	100,862	100%
176	0.2	305,658	4.1	0.47	0.47	0.00	0.47	0.93	221.88	100,855	100%
178	0.2	305,568	4.1	0.47	0.47	0.00	0.47	0.93	221.86	100,847	100%
180	0.2	305,477	4.1	0.47	0.47	0.00	0.47	0.93	221.85	100,839	100%
182	0.1	305,383	4.1	0.47	0.47	0.00	0.47	0.93	221.83	100,831	100%
184	0.1	305,288	4.1	0.47	0.47	0.00	0.47	0.93	221.81	100,823	100%
186	0.1	305,191	4.1	0.47	0.47	0.00	0.47	0.93	221.79	100,815	100%
188	0.1	305,093	4.1	0.47	0.47	0.00	0.47	0.93	221.77	100,806	100%
190	0.1	304,994	4.1	0.47	0.47	0.00	0.47	0.93	221.76	100,798	100%
192	0.1	304,894	4.1	0.47	0.47	0.00	0.47	0.93	221.74	100,789	100%
194	0.1	304,793	4.1	0.47	0.47	0.00	0.47	0.93	221.72	100,780	100%
196	0.1	304,690	4.1	0.47	0.47	0.00	0.47	0.93	221.70	100,772	100%
198	0.1	304,587	4.1	0.47	0.47	0.00	0.47	0.93	221.68	100,763	100%
200	0.1	304,484	4.1	0.47	0.47	0.00	0.47	0.93	221.66	100,754	100%
202	0.1	304,379	4.1	0.47	0.47	0.00	0.47	0.93	221.64	100,745	100%
204	0.0	304,274	4.1	0.47	0.47	0.00	0.47	0.93	221.62	100,736	100%
206	0.0	304,169	4.1	0.47	0.47	0.00	0.47	0.93	221.60	100,727	100%


Sediment Basin #1 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
0
35
70
105
140
175
210
245
280
315
350
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Sediment Basin # 1 Brickhaven

Phase 2

10 - year Storm Event

Qp =	208.12	cfs
Tp =	36.88	minutes
dT = Max of	2	minutes
or	1.0%	of increment to peak

b = 1.4
Ks = 45,577

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	4.1	(ft)	
Height of Riser from bottom of barrel=	7.1	(ft) elevation	220.10
Emergency Spillway =	7.5	(ft) elevation	220.50
Total Height of Dam =	8	(ft) elevation	221.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	213.0

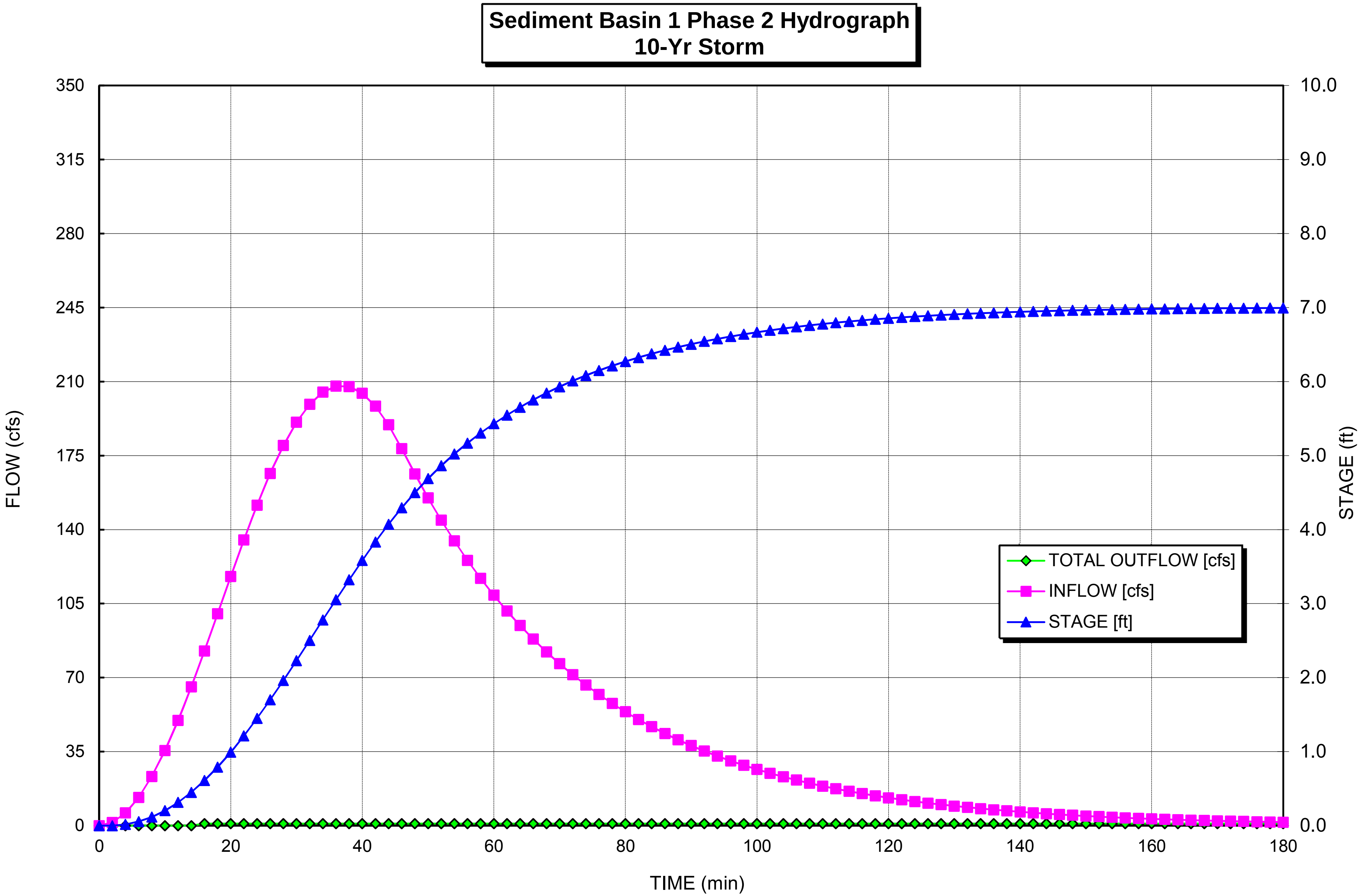
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency	
7.0	ft Maximum Stage	220.00 msl elevation
0.9	cfs Peak outflow	
0.9	cfs Peak Riser/Barrel outflow	
0.0	cfs peak weir flow	

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.5	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	6.0	181	0.0	0.00	0.00	0.00	0.00	0.00	32.24	14,656	N/A
6	13.3	899	0.1	0.00	0.00	0.00	0.00	0.00	48.88	22,220	N/A
8	23.2	2,495	0.1	0.00	0.00	0.00	0.00	0.00	63.71	28,960	N/A
10	35.5	5,284	0.2	0.00	0.00	0.00	0.00	0.00	77.41	35,187	N/A
12	49.8	9,547	0.3	0.00	0.00	0.00	0.00	0.00	90.26	41,025	N/A
14	65.6	15,522	0.5	0.00	0.00	0.00	0.00	0.00	102.39	46,541	N/A
16	82.6	23,399	0.6	0.47	0.47	0.00	0.47	0.93	113.90	51,771	100%
18	100.2	33,198	0.8	0.47	0.47	0.00	0.47	0.93	124.72	56,690	100%
20	117.9	45,106	1.0	0.47	0.47	0.00	0.47	0.93	135.04	61,383	100%
22	135.1	59,136	1.2	0.47	0.47	0.00	0.47	0.93	144.88	65,853	100%
24	151.5	75,241	1.4	0.47	0.47	0.00	0.47	0.93	154.22	70,100	100%
26	166.5	93,312	1.7	0.47	0.47	0.00	0.47	0.93	163.08	74,127	100%
28	179.7	113,186	2.0	0.47	0.47	0.00	0.47	0.93	171.46	77,936	100%
30	190.8	134,643	2.2	0.47	0.47	0.00	0.47	0.93	179.36	81,527	100%
32	199.3	157,422	2.5	0.47	0.47	0.00	0.47	0.93	186.78	84,902	100%
34	205.0	181,222	2.8	0.47	0.47	0.00	0.47	0.93	193.73	88,061	100%
36	207.8	205,711	3.1	0.47	0.47	0.00	0.47	0.93	200.21	91,005	100%
38	207.6	230,539	3.3	0.47	0.47	0.00	0.47	0.93	206.22	93,737	100%
40	204.5	255,344	3.6	0.47	0.47	0.00	0.47	0.93	211.76	96,256	100%
42	198.4	279,769	3.8	0.47	0.47	0.00	0.47	0.93	216.84	98,565	100%
44	189.6	303,462	4.1	0.47	0.47	0.00	0.47	0.93	221.47	100,666	100%
46	178.3	326,097	4.3	0.47	0.47	0.00	0.47	0.93	225.64	102,563	100%
48	166.3	347,377	4.5	0.47	0.47	0.00	0.47	0.93	229.37	104,259	100%
50	155.0	367,225	4.7	0.47	0.47	0.00	0.47	0.93	232.70	105,774	100%
52	144.5	385,715	4.9	0.47	0.47	0.00	0.47	0.93	235.69	107,131	100%
54	134.6	402,938	5.0	0.47	0.47	0.00	0.47	0.93	238.37	108,352	100%
56	125.5	418,982	5.2	0.47	0.47	0.00	0.47	0.93	240.80	109,455	100%
58	116.9	433,925	5.3	0.47	0.47	0.00	0.47	0.93	243.00	110,455	100%
60	109.0	447,844	5.4	0.47	0.47	0.00	0.47	0.93	245.00	111,364	100%
62	101.5	460,808	5.5	0.47	0.47	0.00	0.47	0.93	246.82	112,192	100%
64	94.6	472,882	5.7	0.47	0.47	0.00	0.47	0.93	248.48	112,947	100%
66	88.2	484,126	5.8	0.47	0.47	0.00	0.47	0.93	250.00	113,638	100%
68	82.2	494,597	5.8	0.47	0.47	0.00	0.47	0.93	251.40	114,271	100%
70	76.6	504,348	5.9	0.47	0.47	0.00	0.47	0.93	252.67	114,851	100%
72	71.4	513,427	6.0	0.47	0.47	0.00	0.47	0.93	253.85	115,384	100%
74	66.5	521,881	6.1	0.47	0.47	0.00	0.47	0.93	254.92	115,874	100%
76	62.0	529,752	6.1	0.47	0.47	0.00	0.47	0.93	255.92	116,325	100%
78	57.8	537,079	6.2	0.47	0.47	0.00	0.47	0.93	256.83	116,741	100%
80	53.8	543,900	6.3	0.47	0.47	0.00	0.47	0.93	257.67	117,124	100%
82	50.2	550,249	6.3	0.47	0.47	0.00	0.47	0.93	258.45	117,477	100%
84	46.8	556,158	6.4	0.47	0.47	0.00	0.47	0.93	259.17	117,803	100%

86	43.6	561,657	6.4	0.47	0.47	0.00	0.47	0.93	259.83	118,104	100%
88	40.6	566,775	6.5	0.47	0.47	0.00	0.47	0.93	260.44	118,382	100%
90	37.8	571,536	6.5	0.47	0.47	0.00	0.47	0.93	261.01	118,640	100%
92	35.3	575,966	6.5	0.47	0.47	0.00	0.47	0.93	261.53	118,878	100%
94	32.9	580,087	6.6	0.47	0.47	0.00	0.47	0.93	262.02	119,098	100%
96	30.6	583,919	6.6	0.47	0.47	0.00	0.47	0.93	262.46	119,301	100%
98	28.5	587,483	6.6	0.47	0.47	0.00	0.47	0.93	262.88	119,490	100%
100	26.6	590,797	6.7	0.47	0.47	0.00	0.47	0.93	263.26	119,665	100%
102	24.8	593,878	6.7	0.47	0.47	0.00	0.47	0.93	263.62	119,826	100%
104	23.1	596,741	6.7	0.47	0.47	0.00	0.47	0.93	263.95	119,976	100%
106	21.5	599,402	6.7	0.47	0.47	0.00	0.47	0.93	264.25	120,114	100%
108	20.1	601,874	6.8	0.47	0.47	0.00	0.47	0.93	264.53	120,243	100%
110	18.7	604,170	6.8	0.47	0.47	0.00	0.47	0.93	264.80	120,362	100%
112	17.4	606,302	6.8	0.47	0.47	0.00	0.47	0.93	265.04	120,472	100%
114	16.2	608,282	6.8	0.47	0.47	0.00	0.47	0.93	265.26	120,574	100%
116	15.1	610,119	6.8	0.47	0.47	0.00	0.47	0.93	265.47	120,668	100%
118	14.1	611,824	6.8	0.47	0.47	0.00	0.47	0.93	265.66	120,755	100%
120	13.1	613,405	6.9	0.47	0.47	0.00	0.47	0.93	265.84	120,836	100%
122	12.2	614,870	6.9	0.47	0.47	0.00	0.47	0.93	266.00	120,911	100%
124	11.4	616,229	6.9	0.47	0.47	0.00	0.47	0.93	266.16	120,980	100%
126	10.6	617,487	6.9	0.47	0.47	0.00	0.47	0.93	266.30	121,045	100%
128	9.9	618,652	6.9	0.47	0.47	0.00	0.47	0.93	266.43	121,104	100%
130	9.2	619,730	6.9	0.47	0.47	0.00	0.47	0.93	266.55	121,158	100%
132	8.6	620,727	6.9	0.47	0.47	0.00	0.47	0.93	266.66	121,209	100%
134	8.0	621,649	6.9	0.47	0.47	0.00	0.47	0.93	266.76	121,256	100%
136	7.5	622,500	6.9	0.47	0.47	0.00	0.47	0.93	266.86	121,299	100%
138	7.0	623,286	6.9	0.47	0.47	0.00	0.47	0.93	266.94	121,338	100%
140	6.5	624,010	6.9	0.47	0.47	0.00	0.47	0.93	267.03	121,375	100%
142	6.1	624,678	6.9	0.47	0.47	0.00	0.47	0.93	267.10	121,409	100%
144	5.6	625,293	7.0	0.47	0.47	0.00	0.47	0.93	267.17	121,440	100%
146	5.3	625,858	7.0	0.47	0.47	0.00	0.47	0.93	267.23	121,468	100%
148	4.9	626,377	7.0	0.47	0.47	0.00	0.47	0.93	267.29	121,494	100%
150	4.6	626,853	7.0	0.47	0.47	0.00	0.47	0.93	267.34	121,518	100%
152	4.3	627,290	7.0	0.47	0.47	0.00	0.47	0.93	267.39	121,540	100%
154	4.0	627,689	7.0	0.47	0.47	0.00	0.47	0.93	267.43	121,560	100%
156	3.7	628,053	7.0	0.47	0.47	0.00	0.47	0.93	267.47	121,579	100%
158	3.4	628,385	7.0	0.47	0.47	0.00	0.47	0.93	267.51	121,595	100%
160	3.2	628,686	7.0	0.47	0.47	0.00	0.47	0.93	267.54	121,610	100%
162	3.0	628,960	7.0	0.47	0.47	0.00	0.47	0.93	267.57	121,624	100%
164	2.8	629,207	7.0	0.47	0.47	0.00	0.47	0.93	267.60	121,637	100%
166	2.6	629,430	7.0	0.47	0.47	0.00	0.47	0.93	267.62	121,648	100%
168	2.4	629,630	7.0	0.47	0.47	0.00	0.47	0.93	267.65	121,658	100%
170	2.3	629,809	7.0	0.47	0.47	0.00	0.47	0.93	267.67	121,667	100%
172	2.1	629,968	7.0	0.47	0.47	0.00	0.47	0.93	267.68	121,675	100%
174	2.0	630,108	7.0	0.47	0.47	0.00	0.47	0.93	267.70	121,682	100%
176	1.8	630,232	7.0	0.47	0.47	0.00	0.47	0.93	267.71	121,688	100%
178	1.7	630,339	7.0	0.47	0.47	0.00	0.47	0.93	267.73	121,693	100%
180	1.6	630,432	7.0	0.47	0.47	0.00	0.47	0.93	267.74	121,698	100%
182	1.5	630,510	7.0	0.47	0.47	0.00	0.47	0.93	267.74	121,702	100%
184	1.4	630,576	7.0	0.47	0.47	0.00	0.47	0.93	267.75	121,705	100%
186	1.3	630,630	7.0	0.47	0.47	0.00	0.47	0.93	267.76	121,708	100%
188	1.2	630,672	7.0	0.47	0.47	0.00	0.47	0.93	267.76	121,710	100%
190	1.1	630,704	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,712	100%
192	1.0	630,726	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,713	100%
194	1.0	630,739	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,713	100%
196	0.9	630,744	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,714	100%
198	0.8	630,740	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,713	100%
200	0.8	630,729	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,713	100%
202	0.7	630,712	7.0	0.47	0.47	0.00	0.47	0.93	267.77	121,712	100%
204	0.7	630,688	7.0	0.47	0.47	0.00	0.47	0.93	267.76	121,711	100%


Sediment Basin 1 Phase 2 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE (ft)
TIME (min)
350
315
280
245
210
175
140
105
70
35
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]

Sediment Basin # 1 Brickhaven

Phase 2

25 - year Storm Event

Qp = 250.82 cfs
Tp = 37.30 minutes
dT = Max of 2 minutes
or 1.0% of increment to peak

b = 1.4
Ks = 45,577

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	4.1	(ft)	
Height of Riser from bottom of barrel=	7.1	(ft) elevation	220.10
Emergency Spillway =	7.5	(ft) elevation	220.50
Total Height of Dam =	8.0	(ft) elevation	221.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	213.0

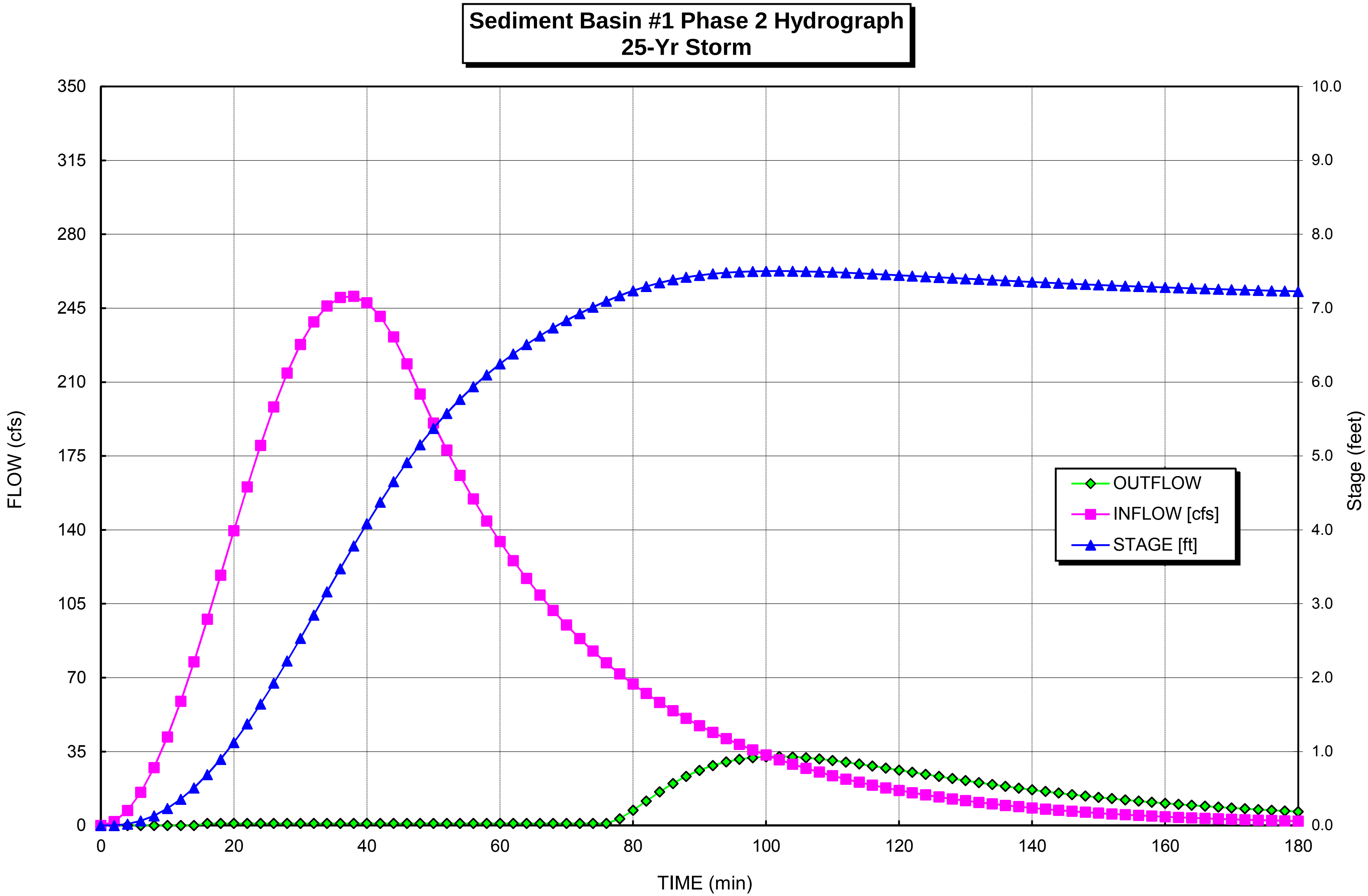
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

99%	Minimum Settling Efficiency		
7.5	ft Maximum Stage	220.5	msl elevation
32.6	cfs Peak outflow		
32.6	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.8	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	7.0	213	0.0	0.00	0.00	0.00	0.00	0.00	33.64	15,293	N/A
6	15.7	1,059	0.1	0.00	0.00	0.00	0.00	0.00	51.01	23,186	N/A
8	27.4	2,940	0.1	0.00	0.00	0.00	0.00	0.00	66.49	30,221	N/A
10	41.9	6,228	0.2	0.00	0.00	0.00	0.00	0.00	80.79	36,721	N/A
12	58.8	11,257	0.4	0.00	0.00	0.00	0.00	0.00	94.20	42,818	N/A
14	77.5	18,310	0.5	0.00	0.00	0.00	0.00	0.00	106.87	48,579	N/A
16	97.6	27,614	0.7	0.47	0.47	0.00	0.47	0.93	118.90	54,044	100%
18	118.5	39,219	0.9	0.47	0.47	0.00	0.47	0.93	130.23	59,196	100%
20	139.6	53,332	1.1	0.47	0.47	0.00	0.47	0.93	141.04	64,111	100%
22	160.3	69,975	1.4	0.47	0.47	0.00	0.47	0.93	151.34	68,792	100%
24	180.0	89,101	1.6	0.47	0.47	0.00	0.47	0.93	161.14	73,244	100%
26	198.2	110,591	1.9	0.47	0.47	0.00	0.47	0.93	170.43	77,468	100%
28	214.3	134,259	2.2	0.47	0.47	0.00	0.47	0.93	179.23	81,466	100%
30	227.8	159,859	2.5	0.47	0.47	0.00	0.47	0.93	187.53	85,241	100%
32	238.5	187,088	2.8	0.47	0.47	0.00	0.47	0.93	195.34	88,792	100%
34	246.0	215,599	3.2	0.47	0.47	0.00	0.47	0.93	202.67	92,121	100%
36	250.1	245,008	3.5	0.47	0.47	0.00	0.47	0.93	209.50	95,229	100%
38	250.6	274,904	3.8	0.47	0.47	0.00	0.47	0.93	215.86	98,117	100%
40	247.6	304,865	4.1	0.47	0.47	0.00	0.47	0.93	221.73	100,787	100%
42	241.1	334,465	4.4	0.47	0.47	0.00	0.47	0.93	227.13	103,240	100%
44	231.4	363,289	4.7	0.47	0.47	0.00	0.47	0.93	232.05	105,478	100%
46	218.7	390,945	4.9	0.47	0.47	0.00	0.47	0.93	236.51	107,506	100%
48	204.3	417,071	5.2	0.47	0.47	0.00	0.47	0.93	240.52	109,326	100%
50	190.6	441,481	5.4	0.47	0.47	0.00	0.47	0.93	244.09	110,951	100%
52	177.8	464,239	5.6	0.47	0.47	0.00	0.47	0.93	247.30	112,408	100%
54	165.8	485,458	5.8	0.47	0.47	0.00	0.47	0.93	250.18	113,719	100%
56	154.6	505,241	5.9	0.47	0.47	0.00	0.47	0.93	252.79	114,904	100%
58	144.2	523,684	6.1	0.47	0.47	0.00	0.47	0.93	255.15	115,978	100%
60	134.5	540,878	6.2	0.47	0.47	0.00	0.47	0.93	257.30	116,954	100%
62	125.4	556,907	6.4	0.47	0.47	0.00	0.47	0.93	259.26	117,844	100%
64	117.0	571,849	6.5	0.47	0.47	0.00	0.47	0.93	261.04	118,657	100%
66	109.1	585,777	6.6	0.47	0.47	0.00	0.47	0.93	262.68	119,400	100%
68	101.8	598,761	6.7	0.47	0.47	0.00	0.47	0.93	264.18	120,081	100%
70	94.9	610,862	6.8	0.47	0.47	0.00	0.47	0.93	265.55	120,706	100%
72	88.5	622,142	6.9	0.47	0.47	0.00	0.47	0.93	266.82	121,281	100%
74	82.6	632,654	7.0	0.47	0.47	0.00	0.47	0.93	267.98	121,809	100%
76	77.0	642,452	7.1	0.47	0.47	0.00	0.47	0.93	269.05	122,296	100%
78	71.8	651,582	7.2	0.47	1.59	0.00	80.91	3.17	270.04	122,745	100%
80	67.0	659,820	7.2	0.47	3.58	0.00	81.38	7.15	270.92	123,145	100%
82	62.5	667,001	7.3	0.47	5.78	0.00	81.79	11.56	271.68	123,492	100%
84	58.3	673,112	7.3	0.47	7.93	0.00	82.14	15.87	272.33	123,784	100%

86	54.4	678,201	7.4	0.47	9.90	0.00	82.43	19.80	272.86	124,027	99%
88	50.7	682,347	7.4	0.47	11.61	0.00	82.66	23.22	273.29	124,223	99%
90	47.3	685,643	7.4	0.47	13.04	0.00	82.85	26.07	273.63	124,378	99%
92	44.1	688,188	7.5	0.47	14.17	0.00	82.99	28.34	273.90	124,498	99%
94	41.1	690,078	7.5	0.47	15.04	0.00	83.10	30.07	274.09	124,587	99%
96	38.4	691,405	7.5	0.47	15.65	0.00	83.17	31.31	274.23	124,649	99%
98	35.8	692,251	7.5	0.47	16.05	0.00	83.22	32.10	274.31	124,688	99%
100	33.4	692,692	7.5	0.47	16.26	0.00	83.24	32.52	274.36	124,709	99%
102	31.1	692,794	7.5	0.47	16.31	0.00	83.25	32.62	274.37	124,714	99%
104	29.0	692,614	7.5	0.47	16.22	0.00	83.24	32.44	274.35	124,705	99%
106	27.1	692,204	7.5	0.47	16.03	0.00	83.22	32.06	274.31	124,686	99%
108	25.2	691,606	7.5	0.47	15.75	0.00	83.18	31.49	274.25	124,658	99%
110	23.5	690,856	7.5	0.47	15.40	0.00	83.14	30.79	274.17	124,623	99%
112	22.0	689,987	7.5	0.47	14.99	0.00	83.09	29.99	274.08	124,582	99%
114	20.5	689,024	7.5	0.47	14.55	0.00	83.04	29.10	273.98	124,537	99%
116	19.1	687,989	7.5	0.47	14.08	0.00	82.98	28.16	273.87	124,489	99%
118	17.8	686,902	7.5	0.47	13.59	0.00	82.92	27.19	273.76	124,438	99%
120	16.6	685,778	7.4	0.47	13.10	0.00	82.86	26.19	273.65	124,385	99%
122	15.5	684,629	7.4	0.47	12.59	0.00	82.79	25.18	273.53	124,331	99%
124	14.5	683,467	7.4	0.47	12.09	0.00	82.73	24.18	273.41	124,276	99%
126	13.5	682,300	7.4	0.47	11.59	0.00	82.66	23.19	273.29	124,221	99%
128	12.6	681,136	7.4	0.47	11.10	0.00	82.60	22.21	273.16	124,166	99%
130	11.7	679,980	7.4	0.47	10.62	0.00	82.53	21.25	273.04	124,111	99%
132	10.9	678,838	7.4	0.47	10.16	0.00	82.47	20.32	272.92	124,057	99%
134	10.2	677,713	7.4	0.47	9.71	0.00	82.40	19.41	272.81	124,003	99%
136	9.5	676,607	7.4	0.47	9.27	0.00	82.34	18.54	272.69	123,951	100%
138	8.9	675,524	7.4	0.47	8.85	0.00	82.28	17.70	272.58	123,899	100%
140	8.3	674,466	7.4	0.47	8.44	0.00	82.22	16.89	272.47	123,849	100%
142	7.7	673,433	7.3	0.47	8.05	0.00	82.16	16.11	272.36	123,800	100%
144	7.2	672,426	7.3	0.47	7.68	0.00	82.10	15.36	272.25	123,752	100%
146	6.7	671,447	7.3	0.47	7.32	0.00	82.05	14.65	272.15	123,705	100%
148	6.3	670,495	7.3	0.47	6.98	0.00	81.99	13.96	272.05	123,659	100%
150	5.8	669,571	7.3	0.47	6.66	0.00	81.94	13.31	271.95	123,615	100%
152	5.4	668,675	7.3	0.47	6.35	0.00	81.89	12.69	271.86	123,572	100%
154	5.1	667,806	7.3	0.47	6.05	0.00	81.84	12.10	271.77	123,530	100%
156	4.7	666,964	7.3	0.47	5.77	0.00	81.79	11.53	271.68	123,490	100%
158	4.4	666,149	7.3	0.47	5.50	0.00	81.75	11.00	271.59	123,451	100%
160	4.1	665,360	7.3	0.47	5.24	0.00	81.70	10.48	271.51	123,413	100%
162	3.8	664,597	7.3	0.47	5.00	0.00	81.66	10.00	271.43	123,376	100%
164	3.6	663,858	7.3	0.47	4.77	0.00	81.61	9.53	271.35	123,341	100%
166	3.3	663,145	7.3	0.47	4.55	0.00	81.57	9.10	271.27	123,306	100%
168	3.1	662,454	7.3	0.47	4.34	0.00	81.53	8.68	271.20	123,273	100%
170	2.9	661,788	7.3	0.47	4.14	0.00	81.50	8.28	271.13	123,241	100%
172	2.7	661,143	7.2	0.47	3.95	0.00	81.46	7.90	271.06	123,209	100%
174	2.5	660,520	7.2	0.47	3.77	0.00	81.42	7.55	270.99	123,179	100%
176	2.4	659,918	7.2	0.47	3.60	0.00	81.39	7.21	270.93	123,150	100%
178	2.2	659,337	7.2	0.47	3.44	0.00	81.35	6.88	270.87	123,122	100%
180	2.1	658,775	7.2	0.47	3.29	0.00	81.32	6.58	270.81	123,095	100%
182	1.9	658,232	7.2	0.47	3.14	0.00	81.29	6.29	270.75	123,068	100%
184	1.8	657,708	7.2	0.47	3.00	0.00	81.26	6.01	270.69	123,043	100%
186	1.7	657,201	7.2	0.47	2.87	0.00	81.23	5.75	270.64	123,018	100%
188	1.6	656,711	7.2	0.47	2.75	0.00	81.20	5.50	270.59	122,995	100%
190	1.4	656,238	7.2	0.47	2.63	0.00	81.18	5.26	270.54	122,972	100%
192	1.4	655,781	7.2	0.47	2.52	0.00	81.15	5.04	270.49	122,949	100%
194	1.3	655,338	7.2	0.47	2.41	0.00	81.12	4.82	270.44	122,928	100%
196	1.2	654,911	7.2	0.47	2.31	0.00	81.10	4.62	270.40	122,907	100%
198	1.1	654,497	7.2	0.47	2.21	0.00	81.08	4.43	270.35	122,887	100%
200	1.0	654,098	7.2	0.47	2.12	0.00	81.05	4.25	270.31	122,867	100%
202	1.0	653,711	7.2	0.47	2.04	0.00	81.03	4.07	270.27	122,848	100%
204	0.9	653,337	7.2	0.47	1.95	0.00	81.01	3.91	270.23	122,830	100%
206	0.8	652,975	7.2	0.47	1.87	0.00	80.99	3.75	270.19	122,813	100%



Sediment Basin #1 Phase 2 Hydrograph
25-Yr Storm
350
315
280
245
210
175
140
105
70
35
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1___of ___2___

Sediment Basin # 1 Brickhaven

Phase 2

100 - year Storm Event

Qp =	319.5	cfs
Tp =	37.8	minutes
dT = Max of	**2**	minutes
or	**1.0%**	of increment to peak

b = 1.4
Ks = 45,577

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	4.1	(ft)	
Height of Riser from bottom of barrel=	7.1	(ft) elevation	220.10
Emergency Spillway =	7.5	(ft) elevation	220.50
Total Height of Dam =	8.0	(ft) elevation	221.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	213.0

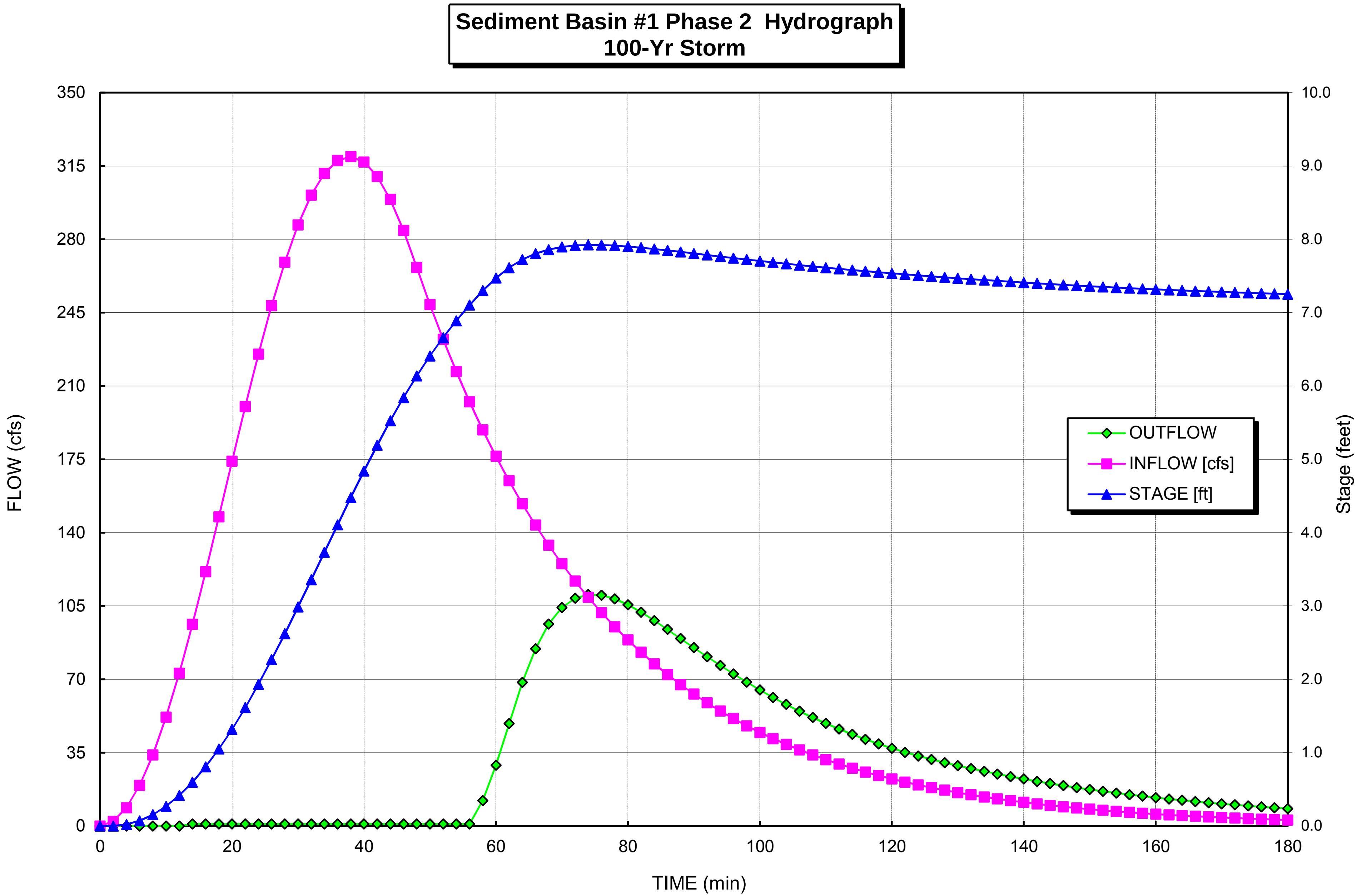
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

91%	Minimum Settling Efficiency		
7.9	ft Maximum Stage	220.9	msl elevation
110.4	cfs Peak outflow		
93.9	cfs Peak Riser/Barrel outflow		
16.5	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	2.2	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	8.7	264	0.0	0.00	0.00	0.00	0.00	0.00	35.56	16,164	N/A
6	19.4	1,311	0.1	0.00	0.00	0.00	0.00	0.00	53.92	24,507	N/A
8	34.0	3,641	0.2	0.00	0.00	0.00	0.00	0.00	70.28	31,945	N/A
10	52.0	7,716	0.3	0.00	0.00	0.00	0.00	0.00	85.40	38,819	N/A
12	72.9	13,951	0.4	0.00	0.00	0.00	0.00	0.00	99.59	45,269	N/A
14	96.3	22,703	0.6	0.47	0.47	0.00	0.47	0.93	113.01	51,367	100%
16	121.4	34,147	0.8	0.47	0.47	0.00	0.47	0.93	125.63	57,106	100%
18	147.6	48,602	1.0	0.47	0.47	0.00	0.47	0.93	137.69	62,584	100%
20	174.0	66,197	1.3	0.47	0.47	0.00	0.47	0.93	149.18	67,809	100%
22	200.1	86,971	1.6	0.47	0.47	0.00	0.47	0.93	160.13	72,786	100%
24	225.1	110,877	1.9	0.47	0.47	0.00	0.47	0.93	170.54	77,520	100%
26	248.3	137,782	2.3	0.47	0.47	0.00	0.47	0.93	180.43	82,016	100%
28	269.1	167,469	2.6	0.47	0.47	0.00	0.47	0.93	189.81	86,276	100%
30	286.8	199,646	3.0	0.47	0.47	0.00	0.47	0.93	198.66	90,302	100%
32	301.1	233,953	3.4	0.47	0.47	0.00	0.47	0.93	207.01	94,095	100%
34	311.4	269,970	3.7	0.47	0.47	0.00	0.47	0.93	214.85	97,657	100%
36	317.6	307,230	4.1	0.47	0.47	0.00	0.47	0.93	222.18	100,989	100%
38	319.5	345,233	4.5	0.47	0.47	0.00	0.47	0.93	229.00	104,092	100%
40	316.9	383,458	4.8	0.47	0.47	0.00	0.47	0.93	235.33	106,967	100%
42	310.0	421,376	5.2	0.47	0.47	0.00	0.47	0.93	241.16	109,617	100%
44	299.0	458,470	5.5	0.47	0.47	0.00	0.47	0.93	246.50	112,044	100%
46	284.2	494,243	5.8	0.47	0.47	0.00	0.47	0.93	251.35	114,250	100%
48	266.5	528,235	6.1	0.47	0.47	0.00	0.47	0.93	255.73	116,239	100%
50	248.8	560,108	6.4	0.47	0.47	0.00	0.47	0.93	259.64	118,019	100%
52	232.3	589,856	6.7	0.47	0.47	0.00	0.47	0.93	263.15	119,615	100%
54	216.9	617,622	6.9	0.47	0.47	0.00	0.47	0.93	266.31	121,051	100%
56	202.5	643,537	7.1	0.47	0.48	0.00	80.44	0.95	269.17	122,349	100%
58	189.0	667,720	7.3	0.47	6.02	0.00	81.84	12.04	271.76	123,526	100%
60	176.5	688,960	7.5	0.47	14.52	0.00	83.04	29.05	273.98	124,534	99%
62	164.8	706,653	7.6	0.47	23.30	2.27	84.01	48.86	275.78	125,356	97%
64	153.8	720,562	7.7	0.47	31.08	6.33	84.77	68.48	277.18	125,992	95%
66	143.6	730,803	7.8	0.47	37.24	10.08	85.32	84.56	278.20	126,454	94%
68	134.1	737,888	7.9	0.47	41.71	12.98	85.70	96.40	278.90	126,771	92%
70	125.2	742,409	7.9	0.47	44.64	14.95	85.94	104.24	279.34	126,972	92%
72	116.9	744,920	7.9	0.47	46.30	16.09	86.07	108.69	279.58	127,084	91%
74	109.1	745,901	7.9	0.47	46.95	16.54	86.12	110.44	279.68	127,127	91%
76	101.9	745,740	7.9	0.47	46.84	16.46	86.12	110.15	279.66	127,120	91%
78	95.1	744,744	7.9	0.47	46.18	16.01	86.06	108.37	279.57	127,076	91%
80	88.8	743,151	7.9	0.47	45.13	15.29	85.98	105.55	279.41	127,005	91%
82	82.9	741,138	7.9	0.47	43.81	14.39	85.87	102.02	279.21	126,916	92%
84	77.4	738,842	7.9	0.47	42.32	13.39	85.75	98.04	278.99	126,814	92%

86	72.2	736,363	7.8	0.47	40.74	12.34	85.62	93.81	278.75	126,703	93%
88	67.4	733,775	7.8	0.47	39.10	11.27	85.48	89.46	278.49	126,587	93%
90	63.0	731,132	7.8	0.47	37.45	10.21	85.34	85.10	278.23	126,469	94%
92	58.8	728,476	7.8	0.47	35.81	9.18	85.20	80.80	277.97	126,350	94%
94	54.9	725,834	7.8	0.47	34.21	8.19	85.06	76.60	277.71	126,231	95%
96	51.2	723,227	7.7	0.47	32.65	7.25	84.92	72.54	277.45	126,113	95%
98	47.8	720,670	7.7	0.47	31.14	6.37	84.78	68.65	277.19	125,997	95%
100	44.7	718,173	7.7	0.47	29.69	5.54	84.64	64.92	276.94	125,883	96%
102	41.7	715,741	7.7	0.47	28.30	4.77	84.51	61.37	276.70	125,773	96%
104	38.9	713,380	7.7	0.47	26.97	4.07	84.38	58.00	276.46	125,665	97%
106	36.3	711,090	7.6	0.47	25.70	3.42	84.26	54.81	276.23	125,560	97%
108	33.9	708,873	7.6	0.47	24.49	2.82	84.14	51.80	276.01	125,458	97%
110	31.7	706,728	7.6	0.47	23.34	2.29	84.02	48.96	275.79	125,360	97%
112	29.6	704,654	7.6	0.47	22.24	1.80	83.90	46.28	275.58	125,264	98%
114	27.6	702,648	7.6	0.47	21.19	1.37	83.79	43.76	275.38	125,172	98%
116	25.8	700,710	7.6	0.47	20.20	1.00	83.69	41.40	275.18	125,082	98%
118	24.1	698,835	7.6	0.47	19.25	0.67	83.58	39.18	274.99	124,995	98%
120	22.5	697,020	7.5	0.47	18.35	0.40	83.48	37.11	274.80	124,911	98%
122	21.0	695,263	7.5	0.47	17.49	0.19	83.39	35.17	274.62	124,829	98%
124	19.6	693,559	7.5	0.47	16.67	0.04	83.29	33.39	274.45	124,749	99%
126	18.3	691,902	7.5	0.47	15.89	0.00	83.20	31.77	274.28	124,672	99%
128	17.1	690,283	7.5	0.47	15.13	0.00	83.11	30.26	274.11	124,596	99%
130	15.9	688,699	7.5	0.47	14.40	0.00	83.02	28.81	273.95	124,522	99%
132	14.9	687,154	7.5	0.47	13.71	0.00	82.93	27.41	273.79	124,449	99%
134	13.9	685,649	7.4	0.47	13.04	0.00	82.85	26.08	273.63	124,379	99%
136	13.0	684,186	7.4	0.47	12.40	0.00	82.77	24.80	273.48	124,310	99%
138	12.1	682,766	7.4	0.47	11.79	0.00	82.69	23.58	273.33	124,243	99%
140	11.3	681,389	7.4	0.47	11.21	0.00	82.61	22.42	273.19	124,178	99%
142	10.5	680,055	7.4	0.47	10.66	0.00	82.54	21.31	273.05	124,114	99%
144	9.8	678,763	7.4	0.47	10.13	0.00	82.46	20.26	272.92	124,053	99%
146	9.2	677,514	7.4	0.47	9.63	0.00	82.39	19.26	272.79	123,994	99%
148	8.6	676,307	7.4	0.47	9.15	0.00	82.32	18.30	272.66	123,937	100%
150	8.0	675,141	7.4	0.47	8.70	0.00	82.26	17.40	272.54	123,881	100%
152	7.5	674,014	7.4	0.47	8.27	0.00	82.19	16.54	272.42	123,827	100%
154	7.0	672,927	7.3	0.47	7.87	0.00	82.13	15.73	272.31	123,776	100%
156	6.5	671,877	7.3	0.47	7.48	0.00	82.07	14.96	272.20	123,725	100%
158	6.1	670,865	7.3	0.47	7.11	0.00	82.02	14.23	272.09	123,677	100%
160	5.7	669,888	7.3	0.47	6.77	0.00	81.96	13.53	271.99	123,630	100%
162	5.3	668,946	7.3	0.47	6.44	0.00	81.91	12.88	271.89	123,585	100%
164	5.0	668,038	7.3	0.47	6.13	0.00	81.85	12.25	271.79	123,542	100%
166	4.6	667,162	7.3	0.47	5.83	0.00	81.80	11.66	271.70	123,499	100%
168	4.3	666,317	7.3	0.47	5.55	0.00	81.76	11.11	271.61	123,459	100%
170	4.0	665,502	7.3	0.47	5.29	0.00	81.71	10.58	271.52	123,420	100%
172	3.8	664,717	7.3	0.47	5.04	0.00	81.66	10.07	271.44	123,382	100%
174	3.5	663,960	7.3	0.47	4.80	0.00	81.62	9.60	271.36	123,345	100%
176	3.3	663,230	7.3	0.47	4.57	0.00	81.58	9.15	271.28	123,310	100%
178	3.1	662,526	7.3	0.47	4.36	0.00	81.54	8.72	271.21	123,276	100%
180	2.9	661,847	7.3	0.47	4.16	0.00	81.50	8.32	271.14	123,243	100%
182	2.7	661,192	7.2	0.47	3.97	0.00	81.46	7.93	271.07	123,212	100%
184	2.5	660,560	7.2	0.47	3.78	0.00	81.43	7.57	271.00	123,181	100%
186	2.3	659,951	7.2	0.47	3.61	0.00	81.39	7.22	270.93	123,152	100%
188	2.2	659,364	7.2	0.47	3.45	0.00	81.36	6.90	270.87	123,123	100%
190	2.0	658,796	7.2	0.47	3.29	0.00	81.32	6.59	270.81	123,096	100%
192	1.9	658,249	7.2	0.47	3.15	0.00	81.29	6.29	270.75	123,069	100%
194	1.8	657,721	7.2	0.47	3.01	0.00	81.26	6.02	270.70	123,044	100%
196	1.7	657,211	7.2	0.47	2.88	0.00	81.23	5.75	270.64	123,019	100%
198	1.5	656,719	7.2	0.47	2.75	0.00	81.20	5.50	270.59	122,995	100%
200	1.4	656,243	7.2	0.47	2.63	0.00	81.18	5.26	270.54	122,972	100%
202	1.3	655,784	7.2	0.47	2.52	0.00	81.15	5.04	270.49	122,949	100%
204	1.3	655,341	7.2	0.47	2.41	0.00	81.12	4.82	270.44	122,928	100%


Sediment Basin #1 Phase 2 Hydrograph
100-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
0
35
70
105
140
175
210
245
280
315
350
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #2		Sheet: 1	Of: 4

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	54.6	53.8	53.8	53.8		
Disturbed Area (ac) =	54.6	53.8	53.8	53.8		
Curve Number CN =	93	94	94	94	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	353.56	281.10	337.65	428.64	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	98,298	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	153,799	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:

Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
193	0	400	-	-	-
194	1	65,070	23,524	23,524	871
195	2	69,950	67,495	91,019	3,371
196	3	166,212	114,663	205,682	7,618
197	4	172,002	169,099	374,781	13,881
198	5	177,848	174,917	549,698	20,359

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 205,682 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 166,212 *Required Surface Area Achieved*

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
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Task:	Sediment Basin #2	Sheet: 2	Of: 4

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	205,682		
Number of Skimmers	2		
Days to Drain =	5	*assumed*	
Q (cf/day) =	20,568		0.24 cfs

Selected Skimmer Size (inches) =	4
Head on Skimmer (feet) =	0.333
Diameter of Orifice (inches) =	3.9

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

$S = (1000/CN) - 10$

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	0.75	0.64	0.64	0.64
Runoff Depth Q* (inches) =	4.36	4.48	5.44	6.99
Time to Peak T_p (min) =	29.34	37.28	37.69	38.21

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 205,682

Z_2 (ft) = 5 S_2 (cf) = 549,698

$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$ 1.9 Ref 2, III-8

$K_S = S_2/Z_2^{\,b} =$ 24,832

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #2		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 m^2 / sec @ 20° C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2$ = 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 7.00

Set Top of Dam at (ft) = 8.00

See Hydrograph

Emergency Spillway

Q_E (cfs) = 100-Yr Storm

Q_E (cfs) = 4.4

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 20

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.15	3.16	0.88	0.15	0.88	1.4	0.1
0.02	0.12	2.55	0.62	0.12	0.62	1.7	0.2

Construct the channel to be : 20 ft, Bottom Width (measured at top of lining)

1.0 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 5

Use Anti-Seep Collar Size (ft) = 5 x 5

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #2	Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 72 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 180.96 $Pi * (D_R/24)^2$ * Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 4.77
Width & Length (ft) = 7
Thickness (ft) = 2.6

Anti-Vortex Device:

Diameter of Riser (in) = 72 From Hydrograph
Cylinder Diameter (in) = 102 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 14
Cylinder Height (in) = 36

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	15	6 * Barrel Diameter
Q_B (cfs) =	25.8	Peak Flow out of the barrel 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
25.8	8.43	0.67	12.3	0.56	8.43	2.1

Flow Depth = Tailwater, d (ft) = 0.67 0.5* Barrel Diameter (ft) = 1.25 Ref 1, 8.06.3
Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe
Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe
Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
2.5	7.5	14	17	0.5	Class B

Conclusion

The basin can contain the 10-yr storm and pass the 100-yr storm without overtopping the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) =	72	
Circumference of Riser (in) =	226.2	
eight of Riser from bottom of barrel (in) =	77	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	2	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.48	0.48
0.39	0.00	0.00	0.00			0.48	0.48
0.44	0.00	0.00	0.00			0.48	0.48
0.49	0.00	0.00	0.00			0.48	0.48
0.54	0.00	0.00	0.00			0.48	0.48
0.59	0.00	0.00	0.00			0.48	0.48
0.64	0.00	0.00	0.00			0.48	0.48
0.69	0.00	0.00	0.00			0.48	0.48
0.74	0.00	0.00	0.00			0.48	0.48
0.79	0.00	0.00	0.00			0.48	0.48
0.84	0.00	0.00	0.00			0.48	0.48
0.89	0.00	0.00	0.00			0.48	0.48
0.94	0.00	0.00	0.00			0.48	0.48
0.99	0.00	0.00	0.00			0.48	0.48
1.04	0.00	0.00	0.00			0.48	0.48
1.09	0.00	0.00	0.00			0.48	0.48
1.14	0.00	0.00	0.00			0.48	0.48
1.19	0.00	0.00	0.00			0.48	0.48
1.24	0.00	0.00	0.00			0.48	0.48
1.29	0.00	0.00	0.00			0.48	0.48
1.34	0.00	0.00	0.00			0.48	0.48
1.39	0.00	0.00	0.00			0.48	0.48
1.44	0.00	0.00	0.00			0.48	0.48
1.49	0.00	0.00	0.00			0.48	0.48
1.54	0.00	0.00	0.00			0.48	0.48
1.59	0.00	0.00	0.00			0.48	0.48

1.64	0.00	0.00	0.00	0.48	0.48
1.69	0.00	0.00	0.00	0.48	0.48
1.74	0.00	0.00	0.00	0.48	0.48
1.79	0.00	0.00	0.00	0.48	0.48
1.84	0.00	0.00	0.00	0.48	0.48
1.89	0.00	0.00	0.00	0.48	0.48
1.94	0.00	0.00	0.00	0.48	0.48
1.99	0.00	0.00	0.00	0.48	0.48
2.04	0.00	0.00	0.00	0.48	0.48
2.09	0.00	0.00	0.00	0.48	0.48
2.14	0.00	0.00	0.00	0.48	0.48
2.19	0.00	0.00	0.00	0.48	0.48
2.24	0.00	0.00	0.00	0.48	0.48
2.29	0.00	0.00	0.00	0.48	0.48
2.34	0.00	0.00	0.00	0.48	0.48
2.39	0.00	0.00	0.00	0.48	0.48
2.44	0.00	0.00	0.00	0.48	0.48
2.49	0.00	0.00	0.00	0.48	0.48
2.54	0.00	0.00	0.00	0.48	0.48
2.59	0.00	0.00	0.00	0.48	0.48
2.64	0.00	0.00	0.00	0.48	0.48
2.69	0.00	0.00	0.00	0.48	0.48
2.74	0.00	0.00	0.00	0.48	0.48
2.79	0.00	0.00	0.00	0.48	0.48
2.84	0.00	0.00	0.00	0.48	0.48
2.89	0.00	0.00	0.00	0.48	0.48
2.94	0.00	0.00	0.00	0.48	0.48
2.99	0.00	0.00	0.00	0.48	0.48
3.04	0.00	0.00	0.00	0.48	0.48
3.09	0.00	0.00	0.00	0.48	0.48
3.14	0.00	0.00	0.00	0.48	0.48
3.19	0.00	0.00	0.00	0.48	0.48
3.24	0.00	0.00	0.00	0.48	0.48
3.29	0.00	0.00	0.00	0.48	0.48
3.34	0.00	0.00	0.00	0.48	0.48
3.39	0.00	0.00	0.00	0.48	0.48
3.44	0.00	0.00	0.00	0.48	0.48
3.49	0.00	0.00	0.00	0.48	0.48
3.54	0.00	0.00	0.00	0.48	0.48
3.59	0.00	0.00	0.00	0.48	0.48
3.64	0.00	0.00	0.00	0.48	0.48
3.69	0.00	0.00	0.00	0.48	0.48
3.74	0.00	0.00	0.00	0.48	0.48
3.79	0.00	0.00	0.00	0.48	0.48
3.84	0.00	0.00	0.00	0.48	0.48
3.89	0.00	0.00	0.00	0.48	0.48
3.94	0.00	0.00	0.00	0.48	0.48
3.99	0.00	0.00	0.00	0.48	0.48

Sediment Basin # 2 Brickhaven

Phase 1

10 - year Storm Event

Qp = 353.56 cfs

Tp = 29.34 minutes

dT = Max of 2 minutes

or 1.0% of increment to peak

b = 1.9

Ks = 24,832

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	30	(in)	
Height of Riser above barrel =	3.9	(ft)	
Height of Riser from bottom of barrel=	6.4	(ft) elevation	199.40
Emergency Spillway =	7.0	(ft) elevation	200.00
Total Height of Dam =	8.0	(ft) elevation	201.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	193.0

4.0E-03 Settling Velocity of design particle (fps)

2 Effective number of cells (2 is construction site #)

100% Minimum Settling Efficiency

6.3 ft Maximum Stage 199.30 msl elevation

1.0 cfs Peak outflow

1.0 cfs Peak Riser/Barrel outflow

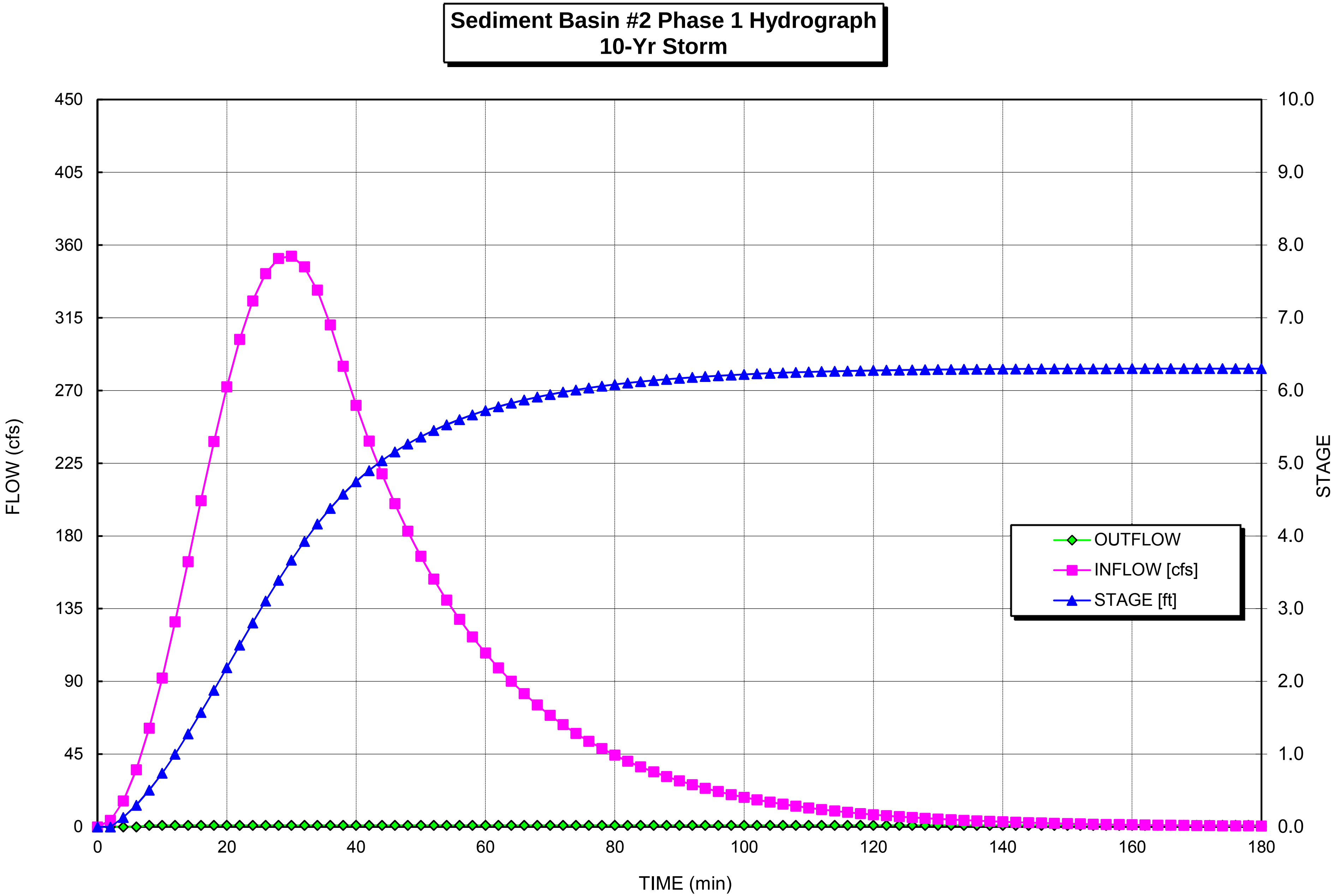
0.0 cfs Peak Weir flow

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	4.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	16.0	484	0.1	0.00	0.00	0.00	0.00	0.00	15.86	7,211	N/A
6	35.2	2,400	0.3	0.00	0.00	0.00	0.00	0.00	34.22	15,554	N/A
8	61.0	6,628	0.5	0.48	0.48	0.00	0.48	0.95	55.74	25,338	100%
10	92.0	13,830	0.7	0.48	0.48	0.00	0.48	0.95	79.37	36,076	100%
12	126.9	24,755	1.0	0.48	0.48	0.00	0.48	0.95	104.98	47,717	100%
14	164.1	39,868	1.3	0.48	0.48	0.00	0.48	0.95	131.98	59,991	100%
16	201.8	59,442	1.6	0.48	0.48	0.00	0.48	0.95	159.89	72,679	100%
18	238.4	83,547	1.9	0.48	0.48	0.00	0.48	0.95	188.30	85,590	100%
20	272.2	112,045	2.2	0.48	0.48	0.00	0.48	0.95	216.81	98,549	100%
22	301.7	144,599	2.5	0.48	0.48	0.00	0.48	0.95	245.07	111,394	100%
24	325.4	180,685	2.8	0.48	0.48	0.00	0.48	0.95	272.75	123,977	100%
26	342.3	219,619	3.1	0.48	0.48	0.00	0.48	0.95	299.55	136,160	100%
28	351.7	260,587	3.4	0.48	0.48	0.00	0.48	0.95	325.20	147,820	100%
30	353.1	302,680	3.7	0.48	0.48	0.00	0.48	0.95	349.46	158,844	100%
32	346.5	344,941	3.9	0.48	0.48	0.00	0.48	0.95	372.10	169,136	100%
34	332.1	386,402	4.2	0.48	0.48	0.00	0.48	0.95	392.95	178,614	100%
36	310.6	426,135	4.4	0.48	0.48	0.00	0.48	0.95	411.87	187,212	100%
38	285.0	463,286	4.6	0.48	0.48	0.00	0.48	0.95	428.74	194,882	100%
40	260.8	497,372	4.7	0.48	0.48	0.00	0.48	0.95	443.61	201,643	100%
42	238.7	528,557	4.9	0.48	0.48	0.00	0.48	0.95	456.76	207,620	100%
44	218.5	557,089	5.0	0.48	0.48	0.00	0.48	0.95	468.45	212,930	100%
46	199.9	583,191	5.2	0.48	0.48	0.00	0.48	0.95	478.86	217,666	100%
48	183.0	607,071	5.3	0.48	0.48	0.00	0.48	0.95	488.19	221,902	100%
50	167.5	628,916	5.4	0.48	0.48	0.00	0.48	0.95	496.55	225,703	100%
52	153.3	648,899	5.5	0.48	0.48	0.00	0.48	0.95	504.06	229,120	100%
54	140.3	667,179	5.5	0.48	0.48	0.00	0.48	0.95	510.84	232,198	100%
56	128.4	683,898	5.6	0.48	0.48	0.00	0.48	0.95	516.94	234,975	100%
58	117.5	699,190	5.7	0.48	0.48	0.00	0.48	0.95	522.47	237,484	100%
60	107.5	713,176	5.7	0.48	0.48	0.00	0.48	0.95	527.46	239,754	100%
62	98.4	725,967	5.8	0.48	0.48	0.00	0.48	0.95	531.98	241,810	100%
64	90.1	737,663	5.8	0.48	0.48	0.00	0.48	0.95	536.08	243,674	100%
66	82.4	748,357	5.9	0.48	0.48	0.00	0.48	0.95	539.80	245,365	100%
68	75.4	758,136	5.9	0.48	0.48	0.00	0.48	0.95	543.18	246,900	100%
70	69.1	767,075	5.9	0.48	0.48	0.00	0.48	0.95	546.25	248,294	100%
72	63.2	775,247	6.0	0.48	0.48	0.00	0.48	0.95	549.03	249,561	100%
74	57.8	782,716	6.0	0.48	0.48	0.00	0.48	0.95	551.57	250,713	100%
76	52.9	789,542	6.0	0.48	0.48	0.00	0.48	0.95	553.87	251,761	100%
78	48.4	795,780	6.1	0.48	0.48	0.00	0.48	0.95	555.97	252,714	100%
80	44.3	801,479	6.1	0.48	0.48	0.00	0.48	0.95	557.88	253,582	100%
82	40.6	806,685	6.1	0.48	0.48	0.00	0.48	0.95	559.62	254,372	100%
84	37.1	811,440	6.1	0.48	0.48	0.00	0.48	0.95	561.20	255,091	100%

86	34.0	815,782	6.1	0.48	0.48	0.00	0.48	0.95	562.64	255,746	100%
88	31.1	819,747	6.2	0.48	0.48	0.00	0.48	0.95	563.95	256,342	100%
90	28.5	823,365	6.2	0.48	0.48	0.00	0.48	0.95	565.15	256,885	100%
92	26.1	826,667	6.2	0.48	0.48	0.00	0.48	0.95	566.24	257,380	100%
94	23.8	829,679	6.2	0.48	0.48	0.00	0.48	0.95	567.23	257,830	100%
96	21.8	832,427	6.2	0.48	0.48	0.00	0.48	0.95	568.13	258,239	100%
98	20.0	834,931	6.2	0.48	0.48	0.00	0.48	0.95	568.95	258,612	100%
100	18.3	837,214	6.2	0.48	0.48	0.00	0.48	0.95	569.69	258,952	100%
102	16.7	839,293	6.2	0.48	0.48	0.00	0.48	0.95	570.37	259,260	100%
104	15.3	841,186	6.2	0.48	0.48	0.00	0.48	0.95	570.99	259,541	100%
106	14.0	842,909	6.2	0.48	0.48	0.00	0.48	0.95	571.55	259,796	100%
108	12.8	844,477	6.2	0.48	0.48	0.00	0.48	0.95	572.06	260,028	100%
110	11.7	845,901	6.3	0.48	0.48	0.00	0.48	0.95	572.53	260,239	100%
112	10.7	847,196	6.3	0.48	0.48	0.00	0.48	0.95	572.95	260,430	100%
114	9.8	848,370	6.3	0.48	0.48	0.00	0.48	0.95	573.33	260,604	100%
116	9.0	849,436	6.3	0.48	0.48	0.00	0.48	0.95	573.67	260,761	100%
118	8.2	850,401	6.3	0.48	0.48	0.00	0.48	0.95	573.99	260,903	100%
120	7.5	851,275	6.3	0.48	0.48	0.00	0.48	0.95	574.27	261,032	100%
122	6.9	852,065	6.3	0.48	0.48	0.00	0.48	0.95	574.53	261,148	100%
124	6.3	852,779	6.3	0.48	0.48	0.00	0.48	0.95	574.76	261,253	100%
126	5.8	853,422	6.3	0.48	0.48	0.00	0.48	0.95	574.97	261,348	100%
128	5.3	854,001	6.3	0.48	0.48	0.00	0.48	0.95	575.15	261,433	100%
130	4.8	854,521	6.3	0.48	0.48	0.00	0.48	0.95	575.32	261,510	100%
132	4.4	854,988	6.3	0.48	0.48	0.00	0.48	0.95	575.47	261,578	100%
134	4.1	855,405	6.3	0.48	0.48	0.00	0.48	0.95	575.61	261,639	100%
136	3.7	855,777	6.3	0.48	0.48	0.00	0.48	0.95	575.73	261,694	100%
138	3.4	856,108	6.3	0.48	0.48	0.00	0.48	0.95	575.83	261,743	100%
140	3.1	856,401	6.3	0.48	0.48	0.00	0.48	0.95	575.93	261,786	100%
142	2.8	856,660	6.3	0.48	0.48	0.00	0.48	0.95	576.01	261,824	100%
144	2.6	856,887	6.3	0.48	0.48	0.00	0.48	0.95	576.09	261,857	100%
146	2.4	857,085	6.3	0.48	0.48	0.00	0.48	0.95	576.15	261,886	100%
148	2.2	857,256	6.3	0.48	0.48	0.00	0.48	0.95	576.20	261,911	100%
150	2.0	857,404	6.3	0.48	0.48	0.00	0.48	0.95	576.25	261,933	100%
152	1.8	857,529	6.3	0.48	0.48	0.00	0.48	0.95	576.29	261,951	100%
154	1.7	857,634	6.3	0.48	0.48	0.00	0.48	0.95	576.33	261,967	100%
156	1.5	857,720	6.3	0.48	0.48	0.00	0.48	0.95	576.35	261,979	100%
158	1.4	857,789	6.3	0.48	0.48	0.00	0.48	0.95	576.38	261,989	100%
160	1.3	857,843	6.3	0.48	0.48	0.00	0.48	0.95	576.39	261,997	100%
162	1.2	857,882	6.3	0.48	0.48	0.00	0.48	0.95	576.41	262,003	100%
164	1.1	857,909	6.3	0.48	0.48	0.00	0.48	0.95	576.42	262,007	100%
166	1.0	857,923	6.3	0.48	0.48	0.00	0.48	0.95	576.42	262,009	100%
168	0.9	857,927	6.3	0.48	0.48	0.00	0.48	0.95	576.42	262,010	100%
170	0.8	857,920	6.3	0.48	0.48	0.00	0.48	0.95	576.42	262,009	100%
172	0.8	857,905	6.3	0.48	0.48	0.00	0.48	0.95	576.41	262,006	100%
174	0.7	857,881	6.3	0.48	0.48	0.00	0.48	0.95	576.41	262,003	100%
176	0.6	857,849	6.3	0.48	0.48	0.00	0.48	0.95	576.40	261,998	100%
178	0.6	857,811	6.3	0.48	0.48	0.00	0.48	0.95	576.38	261,993	100%
180	0.5	857,766	6.3	0.48	0.48	0.00	0.48	0.95	576.37	261,986	100%
182	0.5	857,715	6.3	0.48	0.48	0.00	0.48	0.95	576.35	261,979	100%
184	0.4	857,659	6.3	0.48	0.48	0.00	0.48	0.95	576.33	261,970	100%
186	0.4	857,597	6.3	0.48	0.48	0.00	0.48	0.95	576.31	261,961	100%
188	0.4	857,532	6.3	0.48	0.48	0.00	0.48	0.95	576.29	261,952	100%
190	0.3	857,462	6.3	0.48	0.48	0.00	0.48	0.95	576.27	261,941	100%
192	0.3	857,388	6.3	0.48	0.48	0.00	0.48	0.95	576.25	261,931	100%
194	0.3	857,311	6.3	0.48	0.48	0.00	0.48	0.95	576.22	261,919	100%
196	0.3	857,231	6.3	0.48	0.48	0.00	0.48	0.95	576.20	261,908	100%
198	0.2	857,148	6.3	0.48	0.48	0.00	0.48	0.95	576.17	261,895	100%
200	0.2	857,062	6.3	0.48	0.48	0.00	0.48	0.95	576.14	261,883	100%
202	0.2	856,974	6.3	0.48	0.48	0.00	0.48	0.95	576.11	261,870	100%
204	0.2	856,884	6.3	0.48	0.48	0.00	0.48	0.95	576.08	261,857	100%
206	0.2	856,792	6.3	0.48	0.48	0.00	0.48	0.95	576.05	261,843	100%


Sediment Basin #2 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE
TIME (min)
0
45
90
135
180
225
270
315
360
405
450
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1__of _2___

Sediment Basin # 2 Brickhaven

Phase 2

10 - year Storm Event

Qp = 281.10 cfs
Tp = 37.28 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.9
Ks = 24,832

Number of Riser/Barrel Assemblies	2			
Diameter of Barrel =	30	(in)		
Height of Riser above barrel =	3.9	(ft)		
Height of Riser from bottom of barrel=	6.4	(ft) elevation	199.40	
Emergency Spillway =	7	(ft) elevation	200.00	
Total Height of Dam =	8	(ft) elevation	201.00	
Length of Emergency Spillway =	20	(ft)		
Diameter of Riser =	72	(in)		
Permanent Pond Stage =	0	(ft) elevation	193.0	

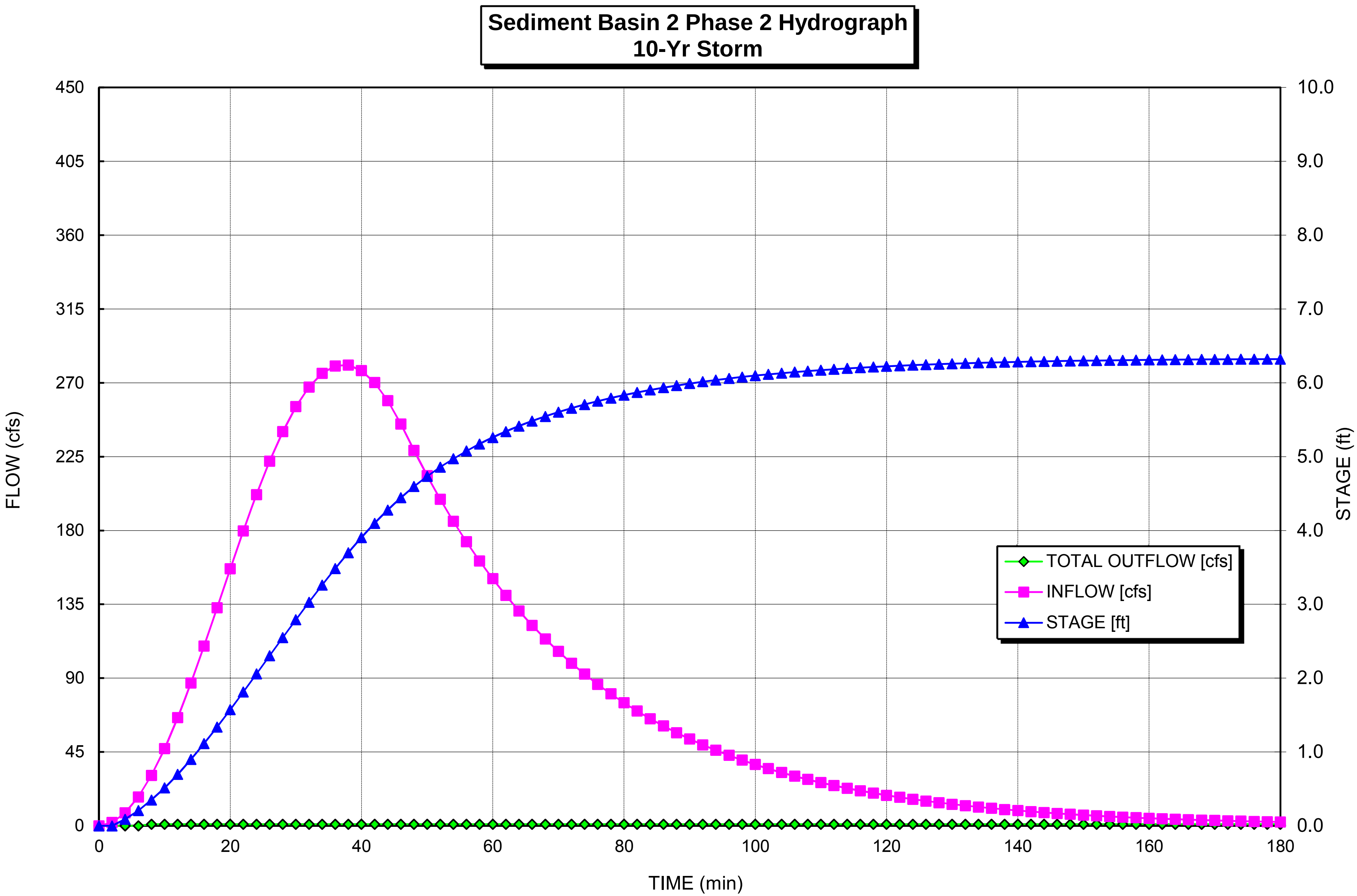
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency		
6.3	ft Maximum Stage	199.33	msl elevation
1.0	cfs Peak outflow		
1.0	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	2.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	7.9	239	0.1	0.00	0.00	0.00	0.00	0.00	11.30	5,135	N/A
6	17.6	1,188	0.2	0.00	0.00	0.00	0.00	0.00	24.41	11,095	N/A
8	30.7	3,298	0.4	0.48	0.48	0.00	0.48	0.95	39.86	18,119	100%
10	47.0	6,872	0.5	0.48	0.48	0.00	0.48	0.95	56.72	25,782	100%
12	65.9	12,399	0.7	0.48	0.48	0.00	0.48	0.95	75.31	34,232	100%
14	87.0	20,197	0.9	0.48	0.48	0.00	0.48	0.95	95.20	43,272	100%
16	109.5	30,518	1.1	0.48	0.48	0.00	0.48	0.95	116.08	52,763	100%
18	132.9	43,546	1.3	0.48	0.48	0.00	0.48	0.95	137.69	62,588	100%
20	156.6	59,385	1.6	0.48	0.48	0.00	0.48	0.95	159.82	72,646	100%
22	179.8	78,062	1.8	0.48	0.48	0.00	0.48	0.95	182.26	82,843	100%
24	201.9	99,522	2.1	0.48	0.48	0.00	0.48	0.95	204.81	93,095	100%
26	222.2	123,632	2.3	0.48	0.48	0.00	0.48	0.95	227.30	103,319	100%
28	240.2	150,183	2.5	0.48	0.48	0.00	0.48	0.95	249.57	113,440	100%
30	255.4	178,897	2.8	0.48	0.48	0.00	0.48	0.95	271.45	123,386	100%
32	267.4	209,436	3.0	0.48	0.48	0.00	0.48	0.95	292.80	133,090	100%
34	275.8	241,410	3.3	0.48	0.48	0.00	0.48	0.95	313.48	142,490	100%
36	280.3	274,386	3.5	0.48	0.48	0.00	0.48	0.95	333.36	151,529	100%
38	280.8	307,905	3.7	0.48	0.48	0.00	0.48	0.95	352.34	160,155	100%
40	277.4	341,492	3.9	0.48	0.48	0.00	0.48	0.95	370.31	168,322	100%
42	270.2	374,670	4.1	0.48	0.48	0.00	0.48	0.95	387.17	175,988	100%
44	259.2	406,974	4.3	0.48	0.48	0.00	0.48	0.95	402.86	183,120	100%
46	244.9	437,963	4.4	0.48	0.48	0.00	0.48	0.95	417.32	189,691	100%
48	228.8	467,233	4.6	0.48	0.48	0.00	0.48	0.95	430.49	195,678	100%
50	213.4	494,578	4.7	0.48	0.48	0.00	0.48	0.95	442.42	201,098	100%
52	199.0	520,074	4.9	0.48	0.48	0.00	0.48	0.95	453.23	206,013	100%
54	185.6	543,844	5.0	0.48	0.48	0.00	0.48	0.95	463.06	210,483	100%
56	173.1	566,006	5.1	0.48	0.48	0.00	0.48	0.95	472.03	214,561	100%
58	161.5	586,667	5.2	0.48	0.48	0.00	0.48	0.95	480.23	218,288	100%
60	150.6	605,929	5.3	0.48	0.48	0.00	0.48	0.95	487.74	221,702	100%
62	140.4	623,886	5.3	0.48	0.48	0.00	0.48	0.95	494.63	224,834	100%
64	131.0	640,625	5.4	0.48	0.48	0.00	0.48	0.95	500.97	227,712	100%
66	122.2	656,229	5.5	0.48	0.48	0.00	0.48	0.95	506.79	230,359	100%
68	113.9	670,775	5.5	0.48	0.48	0.00	0.48	0.95	512.16	232,798	100%
70	106.3	684,333	5.6	0.48	0.48	0.00	0.48	0.95	517.10	235,047	100%
72	99.1	696,970	5.7	0.48	0.48	0.00	0.48	0.95	521.67	237,122	100%
74	92.4	708,748	5.7	0.48	0.48	0.00	0.48	0.95	525.88	239,038	100%
76	86.2	719,725	5.8	0.48	0.48	0.00	0.48	0.95	529.78	240,809	100%
78	80.4	729,955	5.8	0.48	0.48	0.00	0.48	0.95	533.38	242,448	100%
80	75.0	739,488	5.8	0.48	0.48	0.00	0.48	0.95	536.72	243,964	100%
82	69.9	748,371	5.9	0.48	0.48	0.00	0.48	0.95	539.81	245,367	100%
84	65.2	756,649	5.9	0.48	0.48	0.00	0.48	0.95	542.67	246,667	100%

86	60.8	764,361	5.9	0.48	0.48	0.00	0.48	0.95	545.32	247,871	100%
88	56.7	771,546	6.0	0.48	0.48	0.00	0.48	0.95	547.77	248,988	100%
90	52.9	778,239	6.0	0.48	0.48	0.00	0.48	0.95	550.05	250,023	100%
92	49.3	784,474	6.0	0.48	0.48	0.00	0.48	0.95	552.16	250,983	100%
94	46.0	790,281	6.0	0.48	0.48	0.00	0.48	0.95	554.12	251,874	100%
96	42.9	795,689	6.1	0.48	0.48	0.00	0.48	0.95	555.94	252,701	100%
98	40.0	800,725	6.1	0.48	0.48	0.00	0.48	0.95	557.63	253,468	100%
100	37.3	805,415	6.1	0.48	0.48	0.00	0.48	0.95	559.19	254,180	100%
102	34.8	809,780	6.1	0.48	0.48	0.00	0.48	0.95	560.65	254,840	100%
104	32.5	813,844	6.1	0.48	0.48	0.00	0.48	0.95	562.00	255,454	100%
106	30.3	817,627	6.1	0.48	0.48	0.00	0.48	0.95	563.25	256,024	100%
108	28.2	821,147	6.2	0.48	0.48	0.00	0.48	0.95	564.42	256,553	100%
110	26.3	824,422	6.2	0.48	0.48	0.00	0.48	0.95	565.50	257,044	100%
112	24.6	827,469	6.2	0.48	0.48	0.00	0.48	0.95	566.50	257,499	100%
114	22.9	830,303	6.2	0.48	0.48	0.00	0.48	0.95	567.43	257,923	100%
116	21.4	832,938	6.2	0.48	0.48	0.00	0.48	0.95	568.29	258,316	100%
118	19.9	835,389	6.2	0.48	0.48	0.00	0.48	0.95	569.10	258,680	100%
120	18.6	837,666	6.2	0.48	0.48	0.00	0.48	0.95	569.84	259,019	100%
122	17.3	839,783	6.2	0.48	0.48	0.00	0.48	0.95	570.53	259,333	100%
124	16.2	841,749	6.2	0.48	0.48	0.00	0.48	0.95	571.17	259,625	100%
126	15.1	843,575	6.2	0.48	0.48	0.00	0.48	0.95	571.77	259,895	100%
128	14.1	845,270	6.3	0.48	0.48	0.00	0.48	0.95	572.32	260,146	100%
130	13.1	846,843	6.3	0.48	0.48	0.00	0.48	0.95	572.83	260,378	100%
132	12.2	848,303	6.3	0.48	0.48	0.00	0.48	0.95	573.31	260,594	100%
134	11.4	849,657	6.3	0.48	0.48	0.00	0.48	0.95	573.75	260,793	100%
136	10.6	850,912	6.3	0.48	0.48	0.00	0.48	0.95	574.15	260,978	100%
138	9.9	852,074	6.3	0.48	0.48	0.00	0.48	0.95	574.53	261,149	100%
140	9.3	853,151	6.3	0.48	0.48	0.00	0.48	0.95	574.88	261,308	100%
142	8.6	854,147	6.3	0.48	0.48	0.00	0.48	0.95	575.20	261,454	100%
144	8.1	855,069	6.3	0.48	0.48	0.00	0.48	0.95	575.50	261,590	100%
146	7.5	855,921	6.3	0.48	0.48	0.00	0.48	0.95	575.77	261,715	100%
148	7.0	856,707	6.3	0.48	0.48	0.00	0.48	0.95	576.03	261,831	100%
150	6.5	857,433	6.3	0.48	0.48	0.00	0.48	0.95	576.26	261,937	100%
152	6.1	858,103	6.3	0.48	0.48	0.00	0.48	0.95	576.48	262,035	100%
154	5.7	858,719	6.3	0.48	0.48	0.00	0.48	0.95	576.68	262,126	100%
156	5.3	859,287	6.3	0.48	0.48	0.00	0.48	0.95	576.86	262,209	100%
158	4.9	859,808	6.3	0.48	0.48	0.00	0.48	0.95	577.03	262,285	100%
160	4.6	860,287	6.3	0.48	0.48	0.00	0.48	0.95	577.18	262,356	100%
162	4.3	860,726	6.3	0.48	0.48	0.00	0.48	0.95	577.32	262,420	100%
164	4.0	861,127	6.3	0.48	0.48	0.00	0.48	0.95	577.45	262,479	100%
166	3.7	861,494	6.3	0.48	0.48	0.00	0.48	0.95	577.57	262,532	100%
168	3.5	861,828	6.3	0.48	0.48	0.00	0.48	0.95	577.68	262,581	100%
170	3.3	862,132	6.3	0.48	0.48	0.00	0.48	0.95	577.78	262,626	100%
172	3.0	862,408	6.3	0.48	0.48	0.00	0.48	0.95	577.87	262,666	100%
174	2.8	862,658	6.3	0.48	0.48	0.00	0.48	0.95	577.95	262,703	100%
176	2.6	862,883	6.3	0.48	0.48	0.00	0.48	0.95	578.02	262,736	100%
178	2.5	863,085	6.3	0.48	0.48	0.00	0.48	0.95	578.08	262,765	100%
180	2.3	863,266	6.3	0.48	0.48	0.00	0.48	0.95	578.14	262,792	100%
182	2.1	863,427	6.3	0.48	0.48	0.00	0.48	0.95	578.19	262,815	100%
184	2.0	863,570	6.3	0.48	0.48	0.00	0.48	0.95	578.24	262,836	100%
186	1.9	863,695	6.3	0.48	0.48	0.00	0.48	0.95	578.28	262,854	100%
188	1.7	863,804	6.3	0.48	0.48	0.00	0.48	0.95	578.31	262,870	100%
190	1.6	863,898	6.3	0.48	0.48	0.00	0.48	0.95	578.34	262,884	100%
192	1.5	863,978	6.3	0.48	0.48	0.00	0.48	0.95	578.37	262,896	100%
194	1.4	864,045	6.3	0.48	0.48	0.00	0.48	0.95	578.39	262,906	100%
196	1.3	864,100	6.3	0.48	0.48	0.00	0.48	0.95	578.41	262,914	100%
198	1.2	864,143	6.3	0.48	0.48	0.00	0.48	0.95	578.42	262,920	100%
200	1.1	864,176	6.3	0.48	0.48	0.00	0.48	0.95	578.43	262,925	100%
202	1.1	864,199	6.3	0.48	0.48	0.00	0.48	0.95	578.44	262,928	100%
204	1.0	864,213	6.3	0.48	0.48	0.00	0.48	0.95	578.45	262,930	100%



Sediment Basin 2 Phase 2 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE (ft)
TIME (min)
450
405
360
315
270
225
180
135
90
45
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1__of _2__

Sediment Basin # 2 Brickhaven

Phase 2

25 - year Storm Event

Qp =	337.65	cfs
Tp =	37.69	minutes
dT = Max of	2	minutes
or	1.0%	of increment to peak

b = 1.9
Ks = 24,832

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	30	(in)	
Height of Riser above barrel =	3.9	(ft)	
Height of Riser from bottom of barrel=	6.4	(ft) elevation	199.40
Emergency Spillway =	7.0	(ft) elevation	200.00
Total Height of Dam =	8.0	(ft) elevation	201.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	193.0

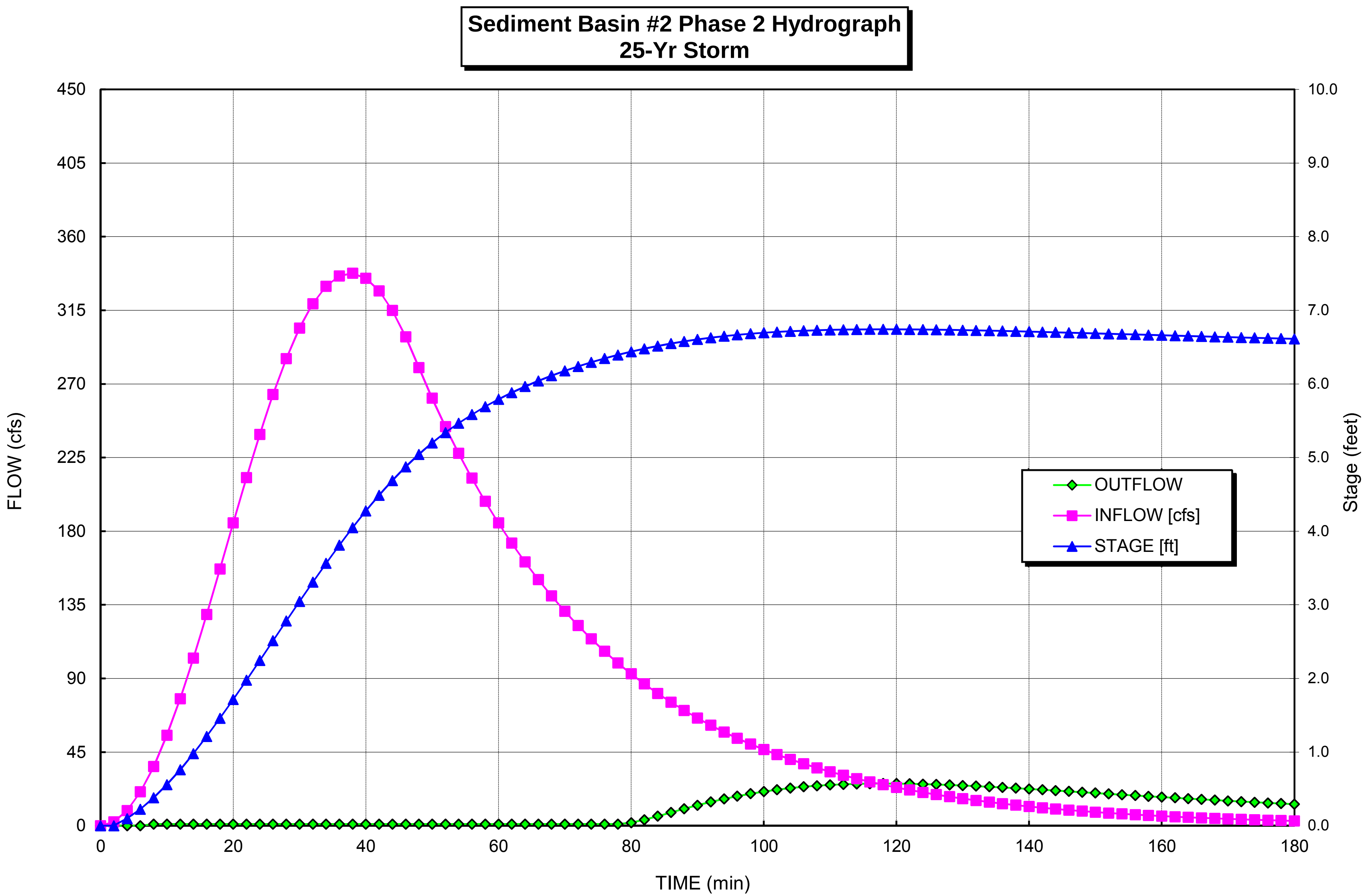
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency		
6.7	ft Maximum Stage	199.7	msl elevation
25.8	cfs Peak outflow		
25.8	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	2.3	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	9.3	281	0.1	0.00	0.00	0.00	0.00	0.00	12.21	5,549	N/A
6	20.7	1,396	0.2	0.00	0.00	0.00	0.00	0.00	26.38	11,990	N/A
8	36.2	3,877	0.4	0.48	0.48	0.00	0.48	0.95	43.08	19,583	100%
10	55.3	8,101	0.6	0.48	0.48	0.00	0.48	0.95	61.38	27,902	100%
12	77.6	14,625	0.8	0.48	0.48	0.00	0.48	0.95	81.53	37,057	100%
14	102.5	23,826	1.0	0.48	0.48	0.00	0.48	0.95	103.06	46,847	100%
16	129.1	36,007	1.2	0.48	0.48	0.00	0.48	0.95	125.68	57,126	100%
18	156.9	51,389	1.5	0.48	0.48	0.00	0.48	0.95	149.09	67,770	100%
20	185.0	70,104	1.7	0.48	0.48	0.00	0.48	0.95	173.08	78,673	100%
22	212.7	92,192	2.0	0.48	0.48	0.00	0.48	0.95	197.42	89,736	100%
24	239.1	117,599	2.2	0.48	0.48	0.00	0.48	0.95	221.91	100,866	100%
26	263.6	146,179	2.5	0.48	0.48	0.00	0.48	0.95	246.35	111,977	100%
28	285.5	177,698	2.8	0.48	0.48	0.00	0.48	0.95	270.57	122,988	100%
30	304.1	211,841	3.0	0.48	0.48	0.00	0.48	0.95	294.41	133,822	100%
32	319.0	248,219	3.3	0.48	0.48	0.00	0.48	0.95	317.70	144,407	100%
34	329.7	286,384	3.6	0.48	0.48	0.00	0.48	0.95	340.29	154,677	100%
36	336.0	325,835	3.8	0.48	0.48	0.00	0.48	0.95	362.05	164,569	100%
38	337.6	366,037	4.0	0.48	0.48	0.00	0.48	0.95	382.86	174,028	100%
40	334.5	406,434	4.3	0.48	0.48	0.00	0.48	0.95	402.61	183,004	100%
42	326.9	446,465	4.5	0.48	0.48	0.00	0.48	0.95	421.19	191,451	100%
44	314.9	485,578	4.7	0.48	0.48	0.00	0.48	0.95	438.53	199,332	100%
46	298.8	523,248	4.9	0.48	0.48	0.00	0.48	0.95	454.55	206,616	100%
48	279.9	558,990	5.0	0.48	0.48	0.00	0.48	0.95	469.21	213,279	100%
50	261.3	592,465	5.2	0.48	0.48	0.00	0.48	0.95	482.51	219,322	100%
52	243.8	623,701	5.3	0.48	0.48	0.00	0.48	0.95	494.56	224,802	100%
54	227.6	652,848	5.5	0.48	0.48	0.00	0.48	0.95	505.53	229,789	100%
56	212.4	680,045	5.6	0.48	0.48	0.00	0.48	0.95	515.54	234,338	100%
58	198.3	705,421	5.7	0.48	0.48	0.00	0.48	0.95	524.70	238,499	100%
60	185.0	729,099	5.8	0.48	0.48	0.00	0.48	0.95	533.08	242,311	100%
62	172.7	751,191	5.9	0.48	0.48	0.00	0.48	0.95	540.78	245,810	100%
64	161.2	771,802	6.0	0.48	0.48	0.00	0.48	0.95	547.86	249,028	100%
66	150.5	791,033	6.0	0.48	0.48	0.00	0.48	0.95	554.38	251,989	100%
68	140.4	808,973	6.1	0.48	0.48	0.00	0.48	0.95	560.38	254,718	100%
70	131.1	825,711	6.2	0.48	0.48	0.00	0.48	0.95	565.92	257,237	100%
72	122.3	841,326	6.2	0.48	0.48	0.00	0.48	0.95	571.04	259,562	100%
74	114.2	855,892	6.3	0.48	0.48	0.00	0.48	0.95	575.76	261,711	100%
76	106.6	869,479	6.3	0.48	0.48	0.00	0.48	0.95	580.14	263,698	100%
78	99.5	882,154	6.4	0.48	0.48	0.00	0.48	0.95	584.18	265,538	100%
80	92.8	893,976	6.4	0.48	0.93	0.00	53.75	1.86	587.93	267,241	100%
82	86.7	904,894	6.5	0.48	1.84	0.00	53.96	3.68	591.37	268,804	100%
84	80.9	914,851	6.5	0.48	2.91	0.00	54.15	5.82	594.49	270,221	100%

86	75.5	923,858	6.5	0.48	4.03	0.00	54.32	8.07	597.29	271,496	100%
88	70.5	931,948	6.6	0.48	5.16	0.00	54.47	10.31	599.80	272,635	100%
90	65.8	939,165	6.6	0.48	6.23	0.00	54.61	12.47	602.02	273,647	100%
92	61.4	945,560	6.6	0.48	7.25	0.00	54.72	14.49	603.99	274,541	100%
94	57.3	951,186	6.6	0.48	8.18	0.00	54.83	16.36	605.71	275,324	100%
96	53.5	956,098	6.7	0.48	9.02	0.00	54.92	18.04	607.21	276,006	100%
98	49.9	960,349	6.7	0.48	9.77	0.00	55.00	19.54	608.51	276,595	100%
100	46.6	963,992	6.7	0.48	10.43	0.00	55.06	20.86	609.62	277,099	100%
102	43.5	967,078	6.7	0.48	11.00	0.00	55.12	22.00	610.55	277,525	100%
104	40.6	969,655	6.7	0.48	11.48	0.00	55.17	22.97	611.33	277,879	100%
106	37.9	971,768	6.7	0.48	11.88	0.00	55.21	23.77	611.97	278,170	100%
108	35.3	973,460	6.7	0.48	12.21	0.00	55.24	24.41	612.49	278,403	100%
110	33.0	974,772	6.7	0.48	12.46	0.00	55.26	24.92	612.88	278,583	100%
112	30.8	975,741	6.7	0.48	12.65	0.00	55.28	25.30	613.18	278,716	100%
114	28.7	976,400	6.7	0.48	12.78	0.00	55.29	25.55	613.37	278,806	100%
116	26.8	976,783	6.7	0.48	12.85	0.00	55.30	25.70	613.49	278,859	100%
118	25.0	976,918	6.7	0.48	12.88	0.00	55.30	25.75	613.53	278,877	100%
120	23.4	976,831	6.7	0.48	12.86	0.00	55.30	25.72	613.50	278,866	100%
122	21.8	976,549	6.7	0.48	12.81	0.00	55.29	25.61	613.42	278,827	100%
124	20.4	976,093	6.7	0.48	12.72	0.00	55.28	25.43	613.28	278,764	100%
126	19.0	975,484	6.7	0.48	12.60	0.00	55.27	25.20	613.10	278,681	100%
128	17.7	974,740	6.7	0.48	12.45	0.00	55.26	24.91	612.87	278,579	100%
130	16.6	973,879	6.7	0.48	12.29	0.00	55.24	24.58	612.61	278,460	100%
132	15.4	972,916	6.7	0.48	12.10	0.00	55.23	24.21	612.32	278,328	100%
134	14.4	971,866	6.7	0.48	11.90	0.00	55.21	23.80	612.00	278,184	100%
136	13.5	970,739	6.7	0.48	11.69	0.00	55.19	23.38	611.66	278,029	100%
138	12.6	969,549	6.7	0.48	11.46	0.00	55.16	22.93	611.30	277,865	100%
140	11.7	968,305	6.7	0.48	11.23	0.00	55.14	22.46	610.93	277,694	100%
142	10.9	967,017	6.7	0.48	10.99	0.00	55.12	21.98	610.54	277,516	100%
144	10.2	965,693	6.7	0.48	10.74	0.00	55.09	21.49	610.13	277,334	100%
146	9.5	964,340	6.7	0.48	10.50	0.00	55.07	20.99	609.72	277,147	100%
148	8.9	962,965	6.7	0.48	10.24	0.00	55.04	20.49	609.31	276,957	100%
150	8.3	961,574	6.7	0.48	9.99	0.00	55.02	19.98	608.88	276,765	100%
152	7.8	960,172	6.7	0.48	9.74	0.00	54.99	19.48	608.46	276,571	100%
154	7.2	958,765	6.7	0.48	9.49	0.00	54.97	18.98	608.03	276,376	100%
156	6.8	957,355	6.7	0.48	9.24	0.00	54.94	18.48	607.60	276,181	100%
158	6.3	955,947	6.7	0.48	8.99	0.00	54.92	17.99	607.17	275,986	100%
160	5.9	954,545	6.7	0.48	8.75	0.00	54.89	17.50	606.74	275,791	100%
162	5.5	953,150	6.7	0.48	8.51	0.00	54.86	17.02	606.31	275,597	100%
164	5.1	951,766	6.7	0.48	8.28	0.00	54.84	16.55	605.89	275,405	100%
166	4.8	950,395	6.6	0.48	8.04	0.00	54.81	16.09	605.47	275,214	100%
168	4.5	949,038	6.6	0.48	7.82	0.00	54.79	15.64	605.06	275,026	100%
170	4.2	947,698	6.6	0.48	7.60	0.00	54.76	15.19	604.65	274,839	100%
172	3.9	946,375	6.6	0.48	7.38	0.00	54.74	14.76	604.24	274,655	100%
174	3.6	945,071	6.6	0.48	7.17	0.00	54.72	14.33	603.84	274,473	100%
176	3.4	943,786	6.6	0.48	6.96	0.00	54.69	13.92	603.45	274,293	100%
178	3.2	942,522	6.6	0.48	6.76	0.00	54.67	13.52	603.06	274,117	100%
180	3.0	941,279	6.6	0.48	6.56	0.00	54.65	13.13	602.68	273,943	100%
182	2.8	940,059	6.6	0.48	6.37	0.00	54.62	12.74	602.30	273,772	100%
184	2.6	938,860	6.6	0.48	6.19	0.00	54.60	12.37	601.93	273,605	100%
186	2.4	937,684	6.6	0.48	6.01	0.00	54.58	12.01	601.57	273,440	100%
188	2.2	936,530	6.6	0.48	5.83	0.00	54.56	11.66	601.21	273,278	100%
190	2.1	935,399	6.6	0.48	5.66	0.00	54.54	11.32	600.86	273,120	100%
192	2.0	934,291	6.6	0.48	5.50	0.00	54.51	11.00	600.52	272,964	100%
194	1.8	933,206	6.6	0.48	5.34	0.00	54.49	10.68	600.19	272,812	100%
196	1.7	932,143	6.6	0.48	5.18	0.00	54.47	10.37	599.86	272,663	100%
198	1.6	931,103	6.6	0.48	5.03	0.00	54.46	10.07	599.54	272,516	100%
200	1.5	930,085	6.6	0.48	4.89	0.00	54.44	9.78	599.22	272,373	100%
202	1.4	929,090	6.6	0.48	4.75	0.00	54.42	9.50	598.91	272,233	100%
204	1.3	928,116	6.6	0.48	4.61	0.00	54.40	9.22	598.61	272,096	100%
206	1.2	927,164	6.6	0.48	4.48	0.00	54.38	8.96	598.32	271,962	100%


Sediment Basin #2 Phase 2 Hydrograph
25-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
0
45
90
135
180
225
270
315
360
405
450
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1___of _2___

Sediment Basin # 2 Brickhaven

Phase 2

100 - year Storm Event

Qp =	428.6	cfs
Tp =	38.2	minutes
dT = Max of	**2**	minutes
or	**1.0%**	of increment to peak

b = 1.9

Ks = 24,832

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	30	(in)	
Height of Riser above barrel =	3.9	(ft)	
Height of Riser from bottom of barrel=	6.4	(ft) elevation	199.40
Emergency Spillway =	7.0	(ft) elevation	200.00
Total Height of Dam =	8.0	(ft) elevation	201.00
Length of Emergency Spillway =	20	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	193.0

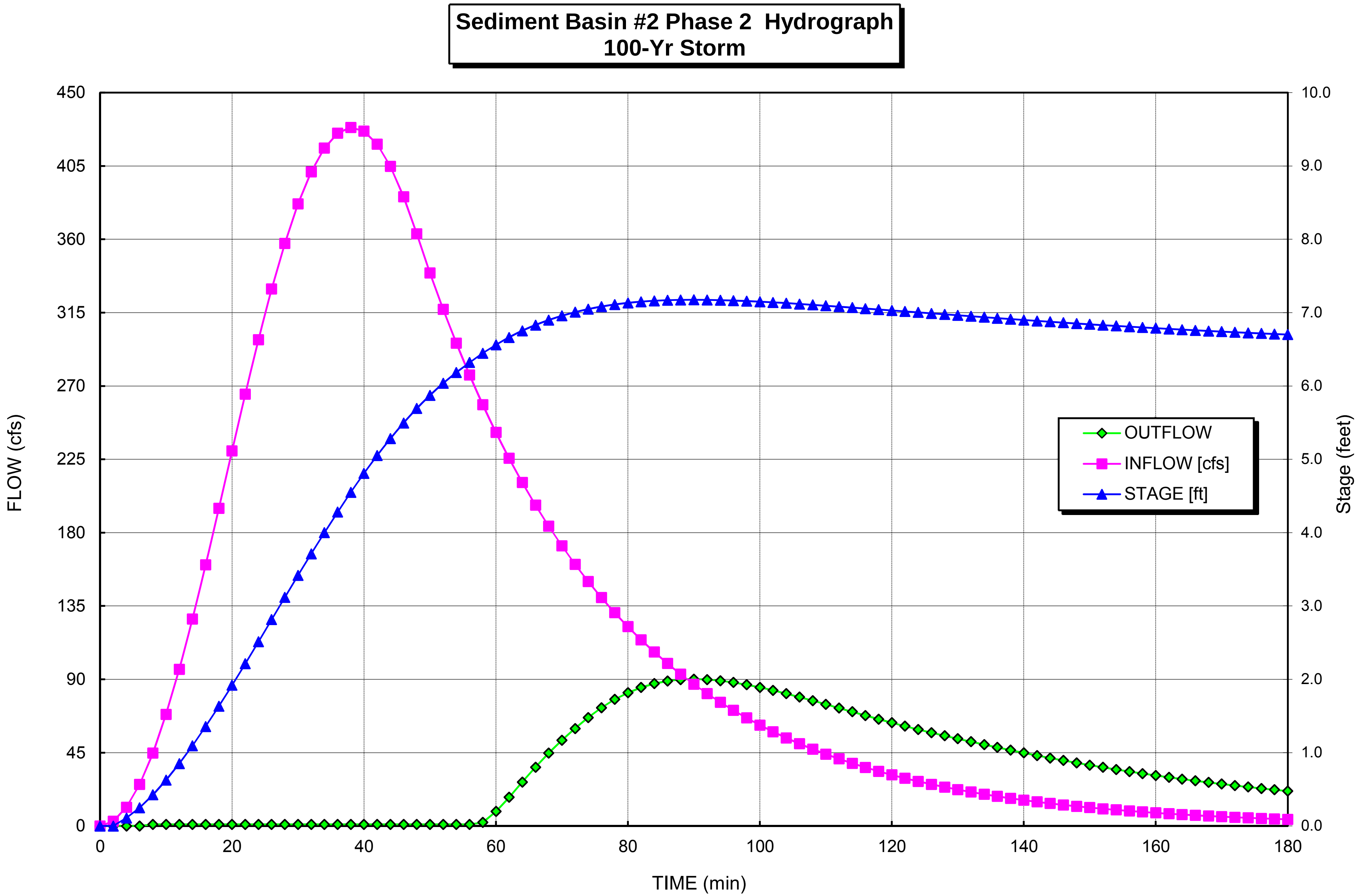
4.0E-03	Settling Velocity of design particle (fps)		
2	Effective number of cells (2 is construction site #)		
98%	Minimum Settling Efficiency		
7.2	ft Maximum Stage	200.2	msl elevation
90.1	cfs Peak outflow		
85.7	cfs Peak Riser/Barrel outflow		
4.4	cfs peak weir flow		

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	2.9	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	11.5	347	0.1	0.00	0.00	0.00	0.00	0.00	13.52	6,143	N/A
6	25.6	1,726	0.3	0.00	0.00	0.00	0.00	0.00	29.20	13,275	N/A
8	44.7	4,793	0.4	0.48	0.48	0.00	0.48	0.95	47.70	21,684	100%
10	68.5	10,045	0.6	0.48	0.48	0.00	0.48	0.95	68.07	30,939	100%
12	96.1	18,147	0.8	0.48	0.48	0.00	0.48	0.95	90.43	41,104	100%
14	127.0	29,569	1.1	0.48	0.48	0.00	0.48	0.95	114.33	51,968	100%
16	160.2	44,696	1.4	0.48	0.48	0.00	0.48	0.95	139.43	63,376	100%
18	194.9	63,809	1.6	0.48	0.48	0.00	0.48	0.95	165.43	75,196	100%
20	230.1	87,083	1.9	0.48	0.48	0.00	0.48	0.95	192.09	87,312	100%
22	264.9	114,583	2.2	0.48	0.48	0.00	0.48	0.95	219.15	99,615	100%
24	298.3	146,256	2.5	0.48	0.48	0.00	0.48	0.95	246.41	112,005	100%
26	329.5	181,938	2.8	0.48	0.48	0.00	0.48	0.95	273.66	124,389	100%
28	357.5	221,359	3.1	0.48	0.48	0.00	0.48	0.95	300.69	136,677	100%
30	381.7	264,144	3.4	0.48	0.48	0.00	0.48	0.95	327.33	148,785	100%
32	401.3	309,830	3.7	0.48	0.48	0.00	0.48	0.95	353.40	160,635	100%
34	415.9	357,876	4.0	0.48	0.48	0.00	0.48	0.95	378.74	172,154	100%
36	425.1	407,676	4.3	0.48	0.48	0.00	0.48	0.95	403.20	183,272	100%
38	428.6	458,577	4.6	0.48	0.48	0.00	0.48	0.95	426.64	193,928	100%
40	426.3	509,895	4.8	0.48	0.48	0.00	0.48	0.95	448.95	204,066	100%
42	418.3	560,939	5.1	0.48	0.48	0.00	0.48	0.95	470.00	213,636	100%
44	404.8	611,020	5.3	0.48	0.48	0.00	0.48	0.95	489.71	222,595	100%
46	386.1	659,478	5.5	0.48	0.48	0.00	0.48	0.95	507.99	230,907	100%
48	363.3	705,697	5.7	0.48	0.48	0.00	0.48	0.95	524.80	238,543	100%
50	339.4	749,179	5.9	0.48	0.48	0.00	0.48	0.95	540.09	245,494	100%
52	317.1	789,794	6.0	0.48	0.48	0.00	0.48	0.95	553.96	251,799	100%
54	296.2	827,728	6.2	0.48	0.48	0.00	0.48	0.95	566.58	257,538	100%
56	276.7	863,160	6.3	0.48	0.48	0.00	0.48	0.95	578.11	262,776	100%
58	258.5	896,252	6.4	0.48	1.09	0.00	53.79	2.18	588.65	267,568	100%
60	241.5	927,013	6.6	0.48	4.46	0.00	54.38	8.92	598.27	271,941	100%
62	225.6	954,925	6.7	0.48	8.82	0.00	54.90	17.63	606.86	275,844	100%
64	210.8	979,883	6.8	0.48	13.46	0.00	55.35	26.92	614.42	279,284	100%
66	196.9	1,001,946	6.8	0.48	18.04	0.00	55.75	36.09	621.03	282,287	100%
68	184.0	1,021,245	6.9	0.48	22.37	0.00	56.08	44.74	626.75	284,886	99%
70	171.9	1,037,951	7.0	0.48	26.33	0.00	56.37	52.66	631.65	287,115	99%
72	160.6	1,052,255	7.0	0.48	29.86	0.03	56.62	59.76	635.82	289,009	99%
74	150.0	1,064,350	7.0	0.48	32.95	0.64	56.82	66.53	639.32	290,600	99%
76	140.1	1,074,365	7.1	0.48	35.57	1.43	56.99	72.56	642.20	291,910	99%
78	130.9	1,082,472	7.1	0.48	37.72	2.20	57.13	77.65	644.53	292,966	99%
80	122.3	1,088,862	7.1	0.48	39.45	2.88	57.23	81.79	646.35	293,796	99%
82	114.2	1,093,723	7.1	0.48	40.78	3.44	57.31	85.00	647.73	294,425	98%
84	106.7	1,097,233	7.2	0.48	41.74	3.86	57.37	87.35	648.73	294,878	98%

86	99.7	1,099,559	7.2	0.48	42.39	4.15	57.41	88.92	649.39	295,178	98%
88	93.1	1,100,853	7.2	0.48	42.75	4.31	57.43	89.80	649.76	295,345	98%
90	87.0	1,101,254	7.2	0.48	42.86	4.37	57.44	90.08	649.87	295,397	98%
92	81.3	1,100,887	7.2	0.48	42.75	4.32	57.43	89.83	649.77	295,350	98%
94	75.9	1,099,863	7.2	0.48	42.47	4.19	57.41	89.13	649.48	295,218	98%
96	71.0	1,098,281	7.2	0.48	42.03	3.99	57.39	88.06	649.03	295,014	98%
98	66.3	1,096,228	7.2	0.48	41.47	3.74	57.35	86.67	648.45	294,749	98%
100	61.9	1,093,781	7.1	0.48	40.79	3.45	57.31	85.04	647.75	294,432	98%
102	57.8	1,091,008	7.1	0.48	40.03	3.13	57.27	83.20	646.96	294,074	98%
104	54.0	1,087,966	7.1	0.48	39.21	2.79	57.22	81.20	646.09	293,679	99%
106	50.5	1,084,707	7.1	0.48	38.33	2.43	57.16	79.09	645.16	293,257	99%
108	47.2	1,081,276	7.1	0.48	37.40	2.08	57.11	76.89	644.18	292,811	99%
110	44.1	1,077,709	7.1	0.48	36.45	1.73	57.05	74.64	643.16	292,346	99%
112	41.2	1,074,040	7.1	0.48	35.48	1.40	56.99	72.36	642.11	291,868	99%
114	38.5	1,070,297	7.1	0.48	34.50	1.08	56.92	70.07	641.03	291,379	99%
116	35.9	1,066,503	7.1	0.48	33.51	0.79	56.86	67.80	639.94	290,882	99%
118	33.6	1,062,678	7.0	0.48	32.52	0.53	56.80	65.56	638.84	290,380	99%
120	31.4	1,058,838	7.0	0.48	31.53	0.30	56.73	63.37	637.73	289,876	99%
122	29.3	1,054,997	7.0	0.48	30.56	0.12	56.67	61.23	636.61	289,370	99%
124	27.4	1,051,164	7.0	0.48	29.59	0.01	56.60	59.19	635.50	288,865	99%
126	25.6	1,047,345	7.0	0.48	28.64	0.00	56.53	57.27	634.39	288,360	99%
128	23.9	1,043,540	7.0	0.48	27.70	0.00	56.47	55.39	633.28	287,857	99%
130	22.3	1,039,759	7.0	0.48	26.77	0.00	56.40	53.54	632.18	287,355	99%
132	20.8	1,036,011	7.0	0.48	25.86	0.00	56.34	51.72	631.09	286,857	99%
134	19.5	1,032,306	6.9	0.48	24.97	0.00	56.28	49.94	630.00	286,364	99%
136	18.2	1,028,650	6.9	0.48	24.10	0.00	56.21	48.21	628.93	285,876	99%
138	17.0	1,025,048	6.9	0.48	23.26	0.00	56.15	46.51	627.87	285,395	99%
140	15.9	1,021,506	6.9	0.48	22.43	0.00	56.09	44.86	626.83	284,921	99%
142	14.8	1,018,027	6.9	0.48	21.63	0.00	56.03	43.26	625.80	284,454	100%
144	13.9	1,014,616	6.9	0.48	20.85	0.00	55.97	41.71	624.79	283,996	100%
146	12.9	1,011,274	6.9	0.48	20.10	0.00	55.91	40.20	623.80	283,546	100%
148	12.1	1,008,003	6.9	0.48	19.37	0.00	55.85	38.74	622.83	283,105	100%
150	11.3	1,004,804	6.8	0.48	18.67	0.00	55.80	37.34	621.88	282,673	100%
152	10.6	1,001,680	6.8	0.48	17.99	0.00	55.74	35.97	620.95	282,251	100%
154	9.9	998,630	6.8	0.48	17.33	0.00	55.69	34.66	620.04	281,838	100%
156	9.2	995,654	6.8	0.48	16.70	0.00	55.63	33.39	619.15	281,434	100%
158	8.6	992,752	6.8	0.48	16.08	0.00	55.58	32.17	618.29	281,040	100%
160	8.0	989,924	6.8	0.48	15.50	0.00	55.53	30.99	617.44	280,655	100%
162	7.5	987,170	6.8	0.48	14.93	0.00	55.48	29.86	616.61	280,279	100%
164	7.0	984,488	6.8	0.48	14.38	0.00	55.43	28.77	615.81	279,913	100%
166	6.6	981,878	6.8	0.48	13.86	0.00	55.39	27.72	615.02	279,557	100%
168	6.1	979,339	6.7	0.48	13.35	0.00	55.34	26.71	614.26	279,209	100%
170	5.7	976,869	6.7	0.48	12.87	0.00	55.30	25.74	613.52	278,871	100%
172	5.3	974,467	6.7	0.48	12.40	0.00	55.25	24.80	612.79	278,541	100%
174	5.0	972,132	6.7	0.48	11.95	0.00	55.21	23.91	612.08	278,220	100%
176	4.7	969,862	6.7	0.48	11.52	0.00	55.17	23.04	611.40	277,908	100%
178	4.4	967,657	6.7	0.48	11.11	0.00	55.13	22.22	610.73	277,604	100%
180	4.1	965,514	6.7	0.48	10.71	0.00	55.09	21.42	610.08	277,309	100%
182	3.8	963,431	6.7	0.48	10.33	0.00	55.05	20.66	609.45	277,021	100%
184	3.6	961,409	6.7	0.48	9.96	0.00	55.02	19.93	608.83	276,742	100%
186	3.3	959,444	6.7	0.48	9.61	0.00	54.98	19.22	608.23	276,470	100%
188	3.1	957,536	6.7	0.48	9.27	0.00	54.95	18.55	607.65	276,206	100%
190	2.9	955,682	6.7	0.48	8.95	0.00	54.91	17.90	607.09	275,949	100%
192	2.7	953,882	6.7	0.48	8.64	0.00	54.88	17.27	606.54	275,699	100%
194	2.5	952,134	6.7	0.48	8.34	0.00	54.85	16.68	606.00	275,456	100%
196	2.4	950,436	6.6	0.48	8.05	0.00	54.81	16.10	605.48	275,220	100%
198	2.2	948,787	6.6	0.48	7.78	0.00	54.78	15.55	604.98	274,991	100%
200	2.1	947,186	6.6	0.48	7.51	0.00	54.75	15.02	604.49	274,768	100%
202	1.9	945,631	6.6	0.48	7.26	0.00	54.73	14.51	604.01	274,551	100%
204	1.8	944,120	6.6	0.48	7.01	0.00	54.70	14.03	603.55	274,340	100%



Sediment Basin #2 Phase 2 Hydrograph
100-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
450
405
360
315
270
225
180
135
90
45
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #3		Sheet: 1	Of: 4

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	7.8	7.8	7.8	7.8		
Disturbed Area (ac) =	5.0	5.0	5.0	5.0		
Curve Number CN =	89	89	89	89	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	42.46	42.46	51.95	67.22	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	13,950	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	18,470	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:

Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
190	0	11,418	-	-	-
191	1	13,556	12,472	12,472	462
192	2	15,800	14,664	27,135	1,005
193	3	19,042	17,396	44,531	1,649
194	4	22,364	20,681	65,212	2,415
195	5	25,753	24,039	89,251	3,306
196	6	29,226	27,471	116,722	4,323

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 44,531 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 19,042 *Required Surface Area Achieved*

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #3		Sheet: 2	Of: 4

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	44,531		
Number of skimmers	1		
Days to Drain =	5	*assumed*	
Q (cf/day) =	8,906		0.10 cfs

Selected Skimmer Size (inches) =	3
Head on Skimmer (feet) =	0.25
Diameter of Orifice (inches) =	2.8

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

$S = (1000/CN) - 10$

Runoff Depth Q^* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	1.24	1.24	1.24	1.24
Runoff Depth Q* (inches) =	3.93	3.93	4.87	6.40
Time to Peak T_p (min) =	31.26	31.26	31.63	32.13

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 44,531

Z_2 (ft) = 5 S_2 (cf) = 89,251

$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$ 1.4 Ref 2, III-8

$K_S = S_2/Z_2^{\,b} =$ 9,983

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
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Task: Sediment Basin #3		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 n^2 / sec @ 20^o C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2 =$ 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 6.20

Set Top of Dam at (ft) = 7.00

See Hydrograph

Emergency Spillway

Q_E (cfs) = 100-Yr Storm

Q_E (cfs) = 5.3

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 10

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.25	2.85	1.06	0.23	1.06	1.8	0.2
0.02	0.21	2.28	0.75	0.19	0.75	2.3	0.3

Construct the channel to be : 10 ft, Bottom Width (measured at top of lining)

0.8 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 6

Use Anti-Seep Collar Size (ft) = 6 x 6

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #3	Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 54 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 93.84 $Pi * (D_R/24)^2 *$ Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 2.48
Width & Length (ft) = 5.5
Thickness (ft) = 2.2

Anti-Vortex Device:

Diameter of Riser (in) = 54 From Hydrograph
Cylinder Diameter (in) = 78 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 16
Cylinder Height (in) = 25

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$
$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	18	6 * Barrel Diameter
Q_B (cfs) =	8.2	Peak Flow out of the barrel 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
8.2	2.68	0.70	15.0	0.60	10.68	0.5

Flow Depth = Tailwater, d (ft) = 0.70 0.5* Barrel Diameter (ft) = 1.50 Ref 1, 8.06.3
Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe
Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe
Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
3	9	16	19	0.5	Class B

Conclusion

The basin can contain the 10-yr storm and pass the 100-yr storm without overtopping the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) =	54	
Circumference of Riser (in) =	169.6	
eight of Riser from bottom of barrel (in) =	71	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	1	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.10	0.10
0.34	0.00	0.00	0.00			0.10	0.10
0.39	0.00	0.00	0.00			0.10	0.10
0.44	0.00	0.00	0.00			0.10	0.10
0.49	0.00	0.00	0.00			0.10	0.10
0.54	0.00	0.00	0.00			0.10	0.10
0.59	0.00	0.00	0.00			0.10	0.10
0.64	0.00	0.00	0.00			0.10	0.10
0.69	0.00	0.00	0.00			0.10	0.10
0.74	0.00	0.00	0.00			0.10	0.10
0.79	0.00	0.00	0.00			0.10	0.10
0.84	0.00	0.00	0.00			0.10	0.10
0.89	0.00	0.00	0.00			0.10	0.10
0.94	0.00	0.00	0.00			0.10	0.10
0.99	0.00	0.00	0.00			0.10	0.10
1.04	0.00	0.00	0.00			0.10	0.10
1.09	0.00	0.00	0.00			0.10	0.10
1.14	0.00	0.00	0.00			0.10	0.10
1.19	0.00	0.00	0.00			0.10	0.10
1.24	0.00	0.00	0.00			0.10	0.10
1.29	0.00	0.00	0.00			0.10	0.10
1.34	0.00	0.00	0.00			0.10	0.10
1.39	0.00	0.00	0.00			0.10	0.10
1.44	0.00	0.00	0.00			0.10	0.10
1.49	0.00	0.00	0.00			0.10	0.10
1.54	0.00	0.00	0.00			0.10	0.10
1.59	0.00	0.00	0.00			0.10	0.10

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 2	Of 2

1.64	0.00	0.00	0.00	0.10	0.10
1.69	0.00	0.00	0.00	0.10	0.10
1.74	0.00	0.00	0.00	0.10	0.10
1.79	0.00	0.00	0.00	0.10	0.10
1.84	0.00	0.00	0.00	0.10	0.10
1.89	0.00	0.00	0.00	0.10	0.10
1.94	0.00	0.00	0.00	0.10	0.10
1.99	0.00	0.00	0.00	0.10	0.10
2.04	0.00	0.00	0.00	0.10	0.10
2.09	0.00	0.00	0.00	0.10	0.10
2.14	0.00	0.00	0.00	0.10	0.10
2.19	0.00	0.00	0.00	0.10	0.10
2.24	0.00	0.00	0.00	0.10	0.10
2.29	0.00	0.00	0.00	0.10	0.10
2.34	0.00	0.00	0.00	0.10	0.10
2.39	0.00	0.00	0.00	0.10	0.10
2.44	0.00	0.00	0.00	0.10	0.10
2.49	0.00	0.00	0.00	0.10	0.10
2.54	0.00	0.00	0.00	0.10	0.10
2.59	0.00	0.00	0.00	0.10	0.10
2.64	0.00	0.00	0.00	0.10	0.10
2.69	0.00	0.00	0.00	0.10	0.10
2.74	0.00	0.00	0.00	0.10	0.10
2.79	0.00	0.00	0.00	0.10	0.10
2.84	0.00	0.00	0.00	0.10	0.10
2.89	0.00	0.00	0.00	0.10	0.10
2.94	0.00	0.00	0.00	0.10	0.10
2.99	0.00	0.00	0.00	0.10	0.10
3.04	0.00	0.00	0.00	0.10	0.10
3.09	0.00	0.00	0.00	0.10	0.10
3.14	0.00	0.00	0.00	0.10	0.10
3.19	0.00	0.00	0.00	0.10	0.10
3.24	0.00	0.00	0.00	0.10	0.10
3.29	0.00	0.00	0.00	0.10	0.10
3.34	0.00	0.00	0.00	0.10	0.10
3.39	0.00	0.00	0.00	0.10	0.10
3.44	0.00	0.00	0.00	0.10	0.10
3.49	0.00	0.00	0.00	0.10	0.10
3.54	0.00	0.00	0.00	0.10	0.10
3.59	0.00	0.00	0.00	0.10	0.10
3.64	0.00	0.00	0.00	0.10	0.10
3.69	0.00	0.00	0.00	0.10	0.10
3.74	0.00	0.00	0.00	0.10	0.10
3.79	0.00	0.00	0.00	0.10	0.10
3.84	0.00	0.00	0.00	0.10	0.10
3.89	0.00	0.00	0.00	0.10	0.10
3.94	0.00	0.00	0.00	0.10	0.10
3.99	0.00	0.00	0.00	0.10	0.10

Sediment Basin # 3 Brickhaven

Phase 1

10 - year Storm Event

Qp = 42.46 cfs

Tp = 31.26 minutes

dT = Max of **2** minutes

or **1.0%** of increment to peak

b = 1.4

Ks = 9,983

Number of Riser/Barrel Assemblies	**1**		
Diameter of Barrel =	**36**	(in)	
Height of Riser above barrel =	**2.9**	(ft)	
Height of Riser from bottom of barrel=	**5.9**	(ft) elevation	195.90
Emergency Spillway =	**6.2**	(ft) elevation	196.20
Total Height of Dam =	**7.0**	(ft) elevation	197.00
Length of Emergency Spillway =	**10**	(ft)	
Diameter of Riser =	**54**	(in)	
Permanent Pond Stage =	**0**	(ft) elevation	190.0

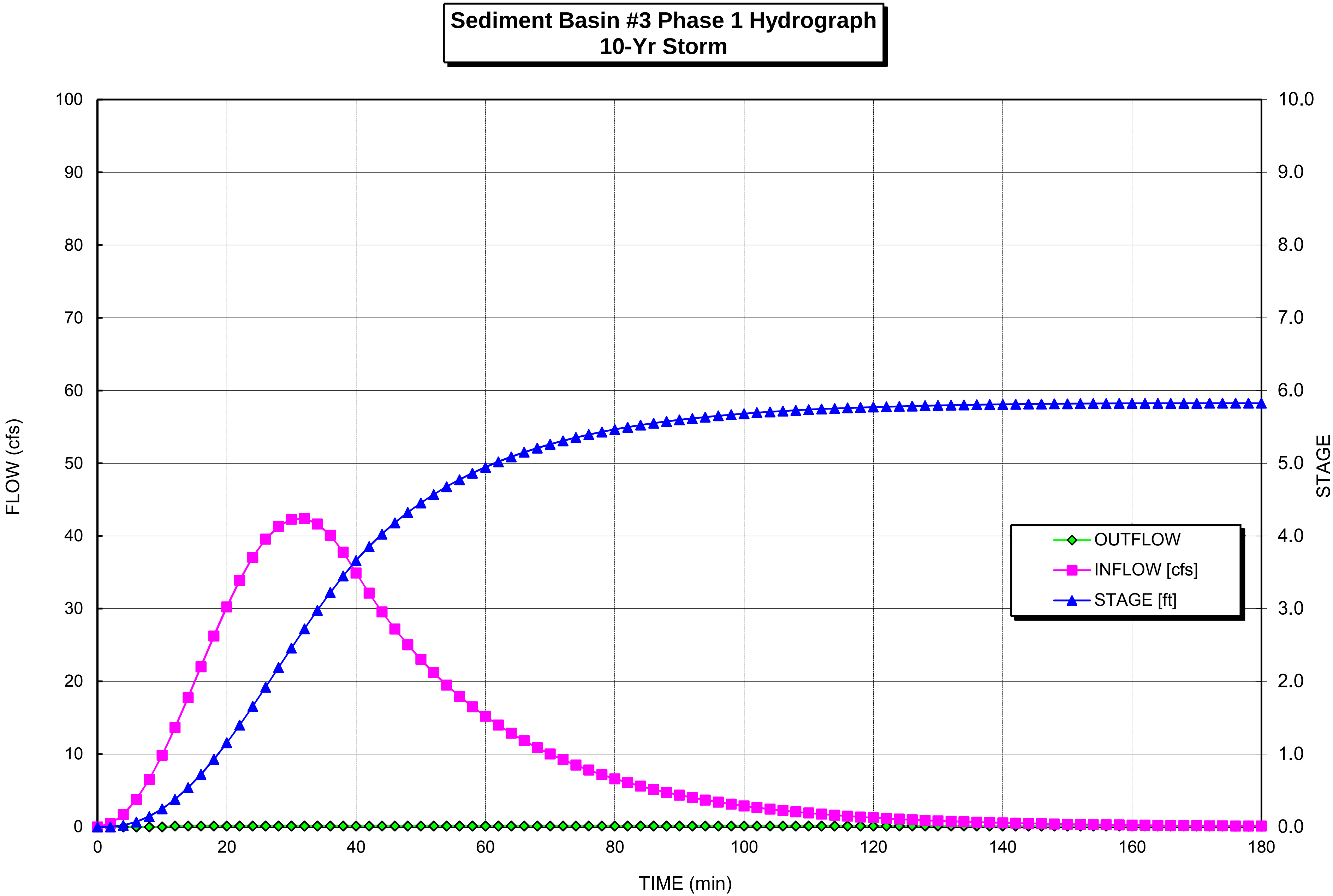
4.0E-03	Settling Velocity of design particle (fps)		
2	Effective number of cells (2 is construction site #)		
100%	Minimum Settling Efficiency		
5.8	ft Maximum Stage	195.83	msl elevation
0.1	cfs Peak outflow		
0.1	cfs Peak Riser/Barrel outflow		
0.0	cfs Peak Weir flow		

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.4	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	1.7	51	0.0	0.00	0.00	0.00	0.00	0.00	7.38	3,356	N/A
6	3.7	254	0.1	0.00	0.00	0.00	0.00	0.00	11.29	5,133	N/A
8	6.5	704	0.1	0.00	0.00	0.00	0.00	0.00	14.79	6,723	N/A
10	9.8	1,484	0.2	0.00	0.00	0.00	0.00	0.00	18.03	8,194	N/A
12	13.7	2,665	0.4	0.10	0.10	0.00	0.10	0.10	21.06	9,572	100%
14	17.8	4,292	0.5	0.10	0.10	0.00	0.10	0.10	23.90	10,862	100%
16	22.0	6,411	0.7	0.10	0.10	0.00	0.10	0.10	26.58	12,082	100%
18	26.2	9,041	0.9	0.10	0.10	0.00	0.10	0.10	29.12	13,235	100%
20	30.3	12,178	1.2	0.10	0.10	0.00	0.10	0.10	31.51	14,323	100%
22	33.9	15,796	1.4	0.10	0.10	0.00	0.10	0.10	33.76	15,347	100%
24	37.1	19,853	1.7	0.10	0.10	0.00	0.10	0.10	35.87	16,306	100%
26	39.6	24,287	1.9	0.10	0.10	0.00	0.10	0.10	37.84	17,202	100%
28	41.3	29,022	2.2	0.10	0.10	0.00	0.10	0.10	39.67	18,034	100%
30	42.3	33,969	2.5	0.10	0.10	0.00	0.10	0.10	41.37	18,803	100%
32	42.4	39,032	2.7	0.10	0.10	0.00	0.10	0.10	42.92	19,509	100%
34	41.7	44,108	3.0	0.10	0.10	0.00	0.10	0.10	44.33	20,152	100%
36	40.1	49,095	3.2	0.10	0.10	0.00	0.10	0.10	45.61	20,733	100%
38	37.8	53,894	3.5	0.10	0.10	0.00	0.10	0.10	46.75	21,252	100%
40	34.9	58,414	3.7	0.10	0.10	0.00	0.10	0.10	47.76	21,711	100%
42	32.1	62,592	3.9	0.10	0.10	0.00	0.10	0.10	48.65	22,112	100%
44	29.6	66,435	4.0	0.10	0.10	0.00	0.10	0.10	49.42	22,465	100%
46	27.2	69,971	4.2	0.10	0.10	0.00	0.10	0.10	50.11	22,776	100%
48	25.0	73,223	4.3	0.10	0.10	0.00	0.10	0.10	50.71	23,052	100%
50	23.0	76,215	4.5	0.10	0.10	0.00	0.10	0.10	51.26	23,298	100%
52	21.2	78,968	4.6	0.10	0.10	0.00	0.10	0.10	51.74	23,519	100%
54	19.5	81,499	4.7	0.10	0.10	0.00	0.10	0.10	52.18	23,716	100%
56	18.0	83,828	4.8	0.10	0.10	0.00	0.10	0.10	52.57	23,894	100%
58	16.5	85,969	4.9	0.10	0.10	0.00	0.10	0.10	52.92	24,055	100%
60	15.2	87,939	4.9	0.10	0.10	0.00	0.10	0.10	53.24	24,200	100%
62	14.0	89,751	5.0	0.10	0.10	0.00	0.10	0.10	53.53	24,331	100%
64	12.9	91,417	5.1	0.10	0.10	0.00	0.10	0.10	53.79	24,450	100%
66	11.8	92,949	5.2	0.10	0.10	0.00	0.10	0.10	54.03	24,558	100%
68	10.9	94,357	5.2	0.10	0.10	0.00	0.10	0.10	54.24	24,656	100%
70	10.0	95,653	5.3	0.10	0.10	0.00	0.10	0.10	54.44	24,745	100%
72	9.2	96,844	5.3	0.10	0.10	0.00	0.10	0.10	54.62	24,827	100%
74	8.5	97,939	5.4	0.10	0.10	0.00	0.10	0.10	54.78	24,901	100%
76	7.8	98,945	5.4	0.10	0.10	0.00	0.10	0.10	54.93	24,969	100%
78	7.2	99,871	5.4	0.10	0.10	0.00	0.10	0.10	55.07	25,030	100%
80	6.6	100,721	5.5	0.10	0.10	0.00	0.10	0.10	55.19	25,087	100%
82	6.1	101,503	5.5	0.10	0.10	0.00	0.10	0.10	55.30	25,138	100%
84	5.6	102,221	5.5	0.10	0.10	0.00	0.10	0.10	55.41	25,185	100%

86	5.2	102,881	5.6	0.10	0.10	0.00	0.10	0.10	55.50	25,228	100%
88	4.7	103,487	5.6	0.10	0.10	0.00	0.10	0.10	55.59	25,268	100%
90	4.4	104,044	5.6	0.10	0.10	0.00	0.10	0.10	55.67	25,304	100%
92	4.0	104,556	5.6	0.10	0.10	0.00	0.10	0.10	55.74	25,337	100%
94	3.7	105,025	5.6	0.10	0.10	0.00	0.10	0.10	55.81	25,367	100%
96	3.4	105,456	5.7	0.10	0.10	0.00	0.10	0.10	55.87	25,394	100%
98	3.1	105,852	5.7	0.10	0.10	0.00	0.10	0.10	55.92	25,420	100%
100	2.9	106,215	5.7	0.10	0.10	0.00	0.10	0.10	55.97	25,443	100%
102	2.7	106,549	5.7	0.10	0.10	0.00	0.10	0.10	56.02	25,464	100%
104	2.4	106,854	5.7	0.10	0.10	0.00	0.10	0.10	56.06	25,483	100%
106	2.2	107,135	5.7	0.10	0.10	0.00	0.10	0.10	56.10	25,501	100%
108	2.1	107,392	5.7	0.10	0.10	0.00	0.10	0.10	56.14	25,517	100%
110	1.9	107,627	5.7	0.10	0.10	0.00	0.10	0.10	56.17	25,532	100%
112	1.7	107,843	5.7	0.10	0.10	0.00	0.10	0.10	56.20	25,545	100%
114	1.6	108,040	5.8	0.10	0.10	0.00	0.10	0.10	56.23	25,558	100%
116	1.5	108,221	5.8	0.10	0.10	0.00	0.10	0.10	56.25	25,569	100%
118	1.4	108,386	5.8	0.10	0.10	0.00	0.10	0.10	56.27	25,580	100%
120	1.3	108,537	5.8	0.10	0.10	0.00	0.10	0.10	56.30	25,589	100%
122	1.2	108,675	5.8	0.10	0.10	0.00	0.10	0.10	56.31	25,598	100%
124	1.1	108,801	5.8	0.10	0.10	0.00	0.10	0.10	56.33	25,605	100%
126	1.0	108,916	5.8	0.10	0.10	0.00	0.10	0.10	56.35	25,613	100%
128	0.9	109,021	5.8	0.10	0.10	0.00	0.10	0.10	56.36	25,619	100%
130	0.8	109,117	5.8	0.10	0.10	0.00	0.10	0.10	56.38	25,625	100%
132	0.8	109,204	5.8	0.10	0.10	0.00	0.10	0.10	56.39	25,631	100%
134	0.7	109,283	5.8	0.10	0.10	0.00	0.10	0.10	56.40	25,635	100%
136	0.6	109,354	5.8	0.10	0.10	0.00	0.10	0.10	56.41	25,640	100%
138	0.6	109,419	5.8	0.10	0.10	0.00	0.10	0.10	56.42	25,644	100%
140	0.5	109,478	5.8	0.10	0.10	0.00	0.10	0.10	56.42	25,648	100%
142	0.5	109,531	5.8	0.10	0.10	0.00	0.10	0.10	56.43	25,651	100%
144	0.5	109,579	5.8	0.10	0.10	0.00	0.10	0.10	56.44	25,654	100%
146	0.4	109,622	5.8	0.10	0.10	0.00	0.10	0.10	56.44	25,657	100%
148	0.4	109,661	5.8	0.10	0.10	0.00	0.10	0.10	56.45	25,659	100%
150	0.4	109,695	5.8	0.10	0.10	0.00	0.10	0.10	56.45	25,661	100%
152	0.3	109,726	5.8	0.10	0.10	0.00	0.10	0.10	56.46	25,663	100%
154	0.3	109,754	5.8	0.10	0.10	0.00	0.10	0.10	56.46	25,665	100%
156	0.3	109,778	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,666	100%
158	0.3	109,799	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,668	100%
160	0.2	109,818	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,669	100%
162	0.2	109,834	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,670	100%
164	0.2	109,848	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
166	0.2	109,859	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
168	0.2	109,869	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
170	0.2	109,877	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
172	0.1	109,884	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
174	0.1	109,889	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
176	0.1	109,892	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
178	0.1	109,895	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
180	0.1	109,896	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
182	0.1	109,896	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
184	0.1	109,895	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
186	0.1	109,893	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
188	0.1	109,890	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
190	0.1	109,887	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
192	0.1	109,883	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
194	0.1	109,878	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
196	0.1	109,872	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
198	0.0	109,866	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
200	0.0	109,860	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
202	0.0	109,853	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
204	0.0	109,845	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,670	100%
206	0.0	109,838	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,670	100%


Sediment Basin #3 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE
TIME (min)
0
10
20
30
40
50
60
70
80
90
100
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1___of __2___

Sediment Basin # 3 Brickhaven

Phase 2

10 - year Storm Event

Qp = 42.46 cfs
Tp = 31.26 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.4
Ks = 9,983

Number of Riser/Barrel Assemblies	1			
Diameter of Barrel =	36	(in)		
Height of Riser above barrel =	2.9	(ft)		
Height of Riser from bottom of barrel=	5.9	(ft)	elevation	195.90
Emergency Spillway =	6.2	(ft)	elevation	196.20
Total Height of Dam =	7	(ft)	elevation	197.00
Length of Emergency Spillway =	10	(ft)		
Diameter of Riser =	54	(in)		
Permanent Pond Stage =	0	(ft)	elevation	190.0

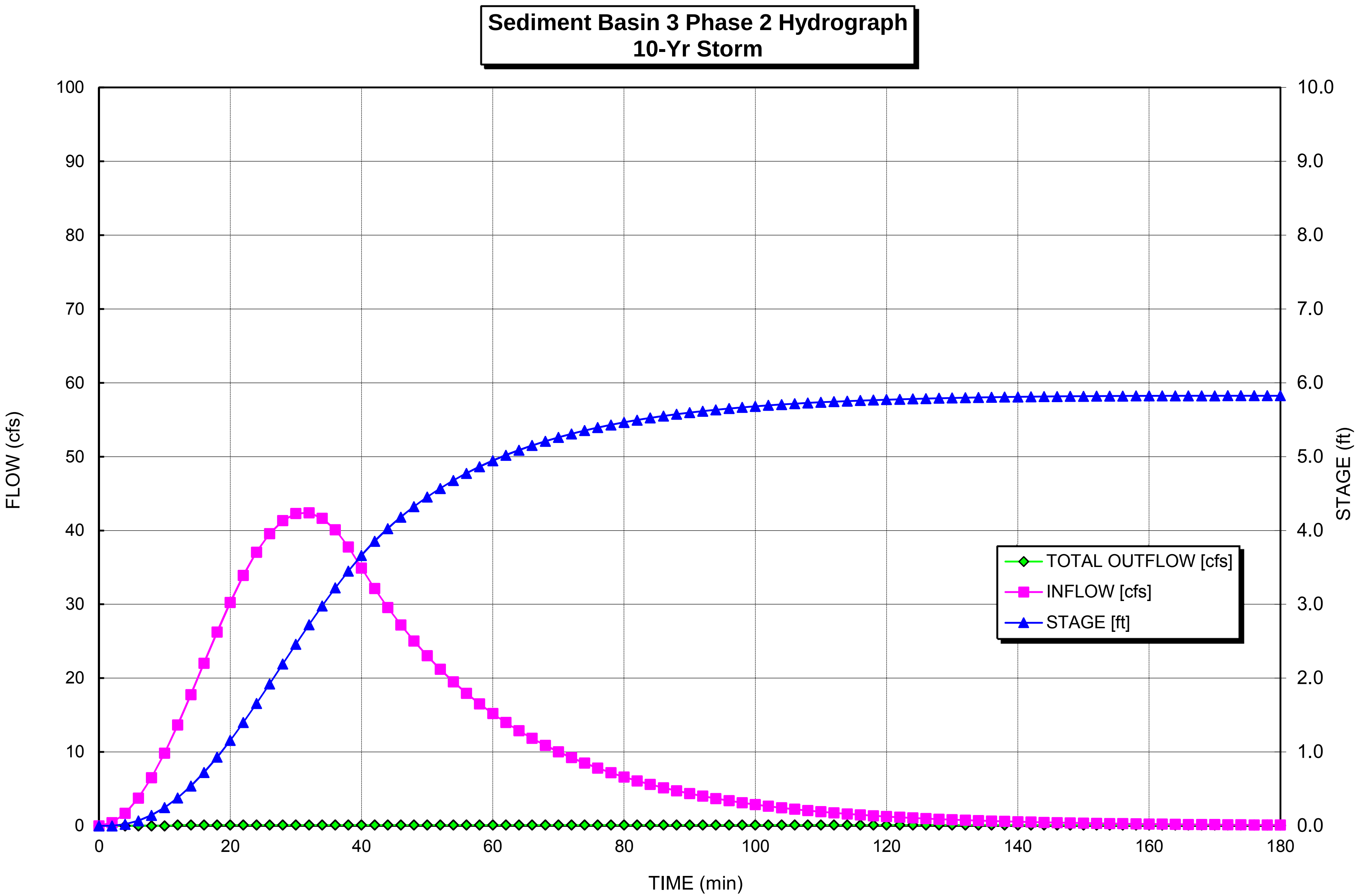
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency		
5.8	ft Maximum Stage	195.83	msl elevation
0.1	cfs Peak outflow		
0.1	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.4	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	1.7	51	0.0	0.00	0.00	0.00	0.00	0.00	7.38	3,356	N/A
6	3.7	254	0.1	0.00	0.00	0.00	0.00	0.00	11.29	5,133	N/A
8	6.5	704	0.1	0.00	0.00	0.00	0.00	0.00	14.79	6,723	N/A
10	9.8	1,484	0.2	0.00	0.00	0.00	0.00	0.00	18.03	8,194	N/A
12	13.7	2,665	0.4	0.10	0.10	0.00	0.10	0.10	21.06	9,572	100%
14	17.8	4,292	0.5	0.10	0.10	0.00	0.10	0.10	23.90	10,862	100%
16	22.0	6,411	0.7	0.10	0.10	0.00	0.10	0.10	26.58	12,082	100%
18	26.2	9,041	0.9	0.10	0.10	0.00	0.10	0.10	29.12	13,235	100%
20	30.3	12,178	1.2	0.10	0.10	0.00	0.10	0.10	31.51	14,323	100%
22	33.9	15,796	1.4	0.10	0.10	0.00	0.10	0.10	33.76	15,347	100%
24	37.1	19,853	1.7	0.10	0.10	0.00	0.10	0.10	35.87	16,306	100%
26	39.6	24,287	1.9	0.10	0.10	0.00	0.10	0.10	37.84	17,202	100%
28	41.3	29,022	2.2	0.10	0.10	0.00	0.10	0.10	39.67	18,034	100%
30	42.3	33,969	2.5	0.10	0.10	0.00	0.10	0.10	41.37	18,803	100%
32	42.4	39,032	2.7	0.10	0.10	0.00	0.10	0.10	42.92	19,509	100%
34	41.7	44,108	3.0	0.10	0.10	0.00	0.10	0.10	44.33	20,152	100%
36	40.1	49,095	3.2	0.10	0.10	0.00	0.10	0.10	45.61	20,733	100%
38	37.8	53,894	3.5	0.10	0.10	0.00	0.10	0.10	46.75	21,252	100%
40	34.9	58,414	3.7	0.10	0.10	0.00	0.10	0.10	47.76	21,711	100%
42	32.1	62,592	3.9	0.10	0.10	0.00	0.10	0.10	48.65	22,112	100%
44	29.6	66,435	4.0	0.10	0.10	0.00	0.10	0.10	49.42	22,465	100%
46	27.2	69,971	4.2	0.10	0.10	0.00	0.10	0.10	50.11	22,776	100%
48	25.0	73,223	4.3	0.10	0.10	0.00	0.10	0.10	50.71	23,052	100%
50	23.0	76,215	4.5	0.10	0.10	0.00	0.10	0.10	51.26	23,298	100%
52	21.2	78,968	4.6	0.10	0.10	0.00	0.10	0.10	51.74	23,519	100%
54	19.5	81,499	4.7	0.10	0.10	0.00	0.10	0.10	52.18	23,716	100%
56	18.0	83,828	4.8	0.10	0.10	0.00	0.10	0.10	52.57	23,894	100%
58	16.5	85,969	4.9	0.10	0.10	0.00	0.10	0.10	52.92	24,055	100%
60	15.2	87,939	4.9	0.10	0.10	0.00	0.10	0.10	53.24	24,200	100%
62	14.0	89,751	5.0	0.10	0.10	0.00	0.10	0.10	53.53	24,331	100%
64	12.9	91,417	5.1	0.10	0.10	0.00	0.10	0.10	53.79	24,450	100%
66	11.8	92,949	5.2	0.10	0.10	0.00	0.10	0.10	54.03	24,558	100%
68	10.9	94,357	5.2	0.10	0.10	0.00	0.10	0.10	54.24	24,656	100%
70	10.0	95,653	5.3	0.10	0.10	0.00	0.10	0.10	54.44	24,745	100%
72	9.2	96,844	5.3	0.10	0.10	0.00	0.10	0.10	54.62	24,827	100%
74	8.5	97,939	5.4	0.10	0.10	0.00	0.10	0.10	54.78	24,901	100%
76	7.8	98,945	5.4	0.10	0.10	0.00	0.10	0.10	54.93	24,969	100%
78	7.2	99,871	5.4	0.10	0.10	0.00	0.10	0.10	55.07	25,030	100%
80	6.6	100,721	5.5	0.10	0.10	0.00	0.10	0.10	55.19	25,087	100%
82	6.1	101,503	5.5	0.10	0.10	0.00	0.10	0.10	55.30	25,138	100%
84	5.6	102,221	5.5	0.10	0.10	0.00	0.10	0.10	55.41	25,185	100%

86	5.2	102,881	5.6	0.10	0.10	0.00	0.10	0.10	55.50	25,228	100%
88	4.7	103,487	5.6	0.10	0.10	0.00	0.10	0.10	55.59	25,268	100%
90	4.4	104,044	5.6	0.10	0.10	0.00	0.10	0.10	55.67	25,304	100%
92	4.0	104,556	5.6	0.10	0.10	0.00	0.10	0.10	55.74	25,337	100%
94	3.7	105,025	5.6	0.10	0.10	0.00	0.10	0.10	55.81	25,367	100%
96	3.4	105,456	5.7	0.10	0.10	0.00	0.10	0.10	55.87	25,394	100%
98	3.1	105,852	5.7	0.10	0.10	0.00	0.10	0.10	55.92	25,420	100%
100	2.9	106,215	5.7	0.10	0.10	0.00	0.10	0.10	55.97	25,443	100%
102	2.7	106,549	5.7	0.10	0.10	0.00	0.10	0.10	56.02	25,464	100%
104	2.4	106,854	5.7	0.10	0.10	0.00	0.10	0.10	56.06	25,483	100%
106	2.2	107,135	5.7	0.10	0.10	0.00	0.10	0.10	56.10	25,501	100%
108	2.1	107,392	5.7	0.10	0.10	0.00	0.10	0.10	56.14	25,517	100%
110	1.9	107,627	5.7	0.10	0.10	0.00	0.10	0.10	56.17	25,532	100%
112	1.7	107,843	5.7	0.10	0.10	0.00	0.10	0.10	56.20	25,545	100%
114	1.6	108,040	5.8	0.10	0.10	0.00	0.10	0.10	56.23	25,558	100%
116	1.5	108,221	5.8	0.10	0.10	0.00	0.10	0.10	56.25	25,569	100%
118	1.4	108,386	5.8	0.10	0.10	0.00	0.10	0.10	56.27	25,580	100%
120	1.3	108,537	5.8	0.10	0.10	0.00	0.10	0.10	56.30	25,589	100%
122	1.2	108,675	5.8	0.10	0.10	0.00	0.10	0.10	56.31	25,598	100%
124	1.1	108,801	5.8	0.10	0.10	0.00	0.10	0.10	56.33	25,605	100%
126	1.0	108,916	5.8	0.10	0.10	0.00	0.10	0.10	56.35	25,613	100%
128	0.9	109,021	5.8	0.10	0.10	0.00	0.10	0.10	56.36	25,619	100%
130	0.8	109,117	5.8	0.10	0.10	0.00	0.10	0.10	56.38	25,625	100%
132	0.8	109,204	5.8	0.10	0.10	0.00	0.10	0.10	56.39	25,631	100%
134	0.7	109,283	5.8	0.10	0.10	0.00	0.10	0.10	56.40	25,635	100%
136	0.6	109,354	5.8	0.10	0.10	0.00	0.10	0.10	56.41	25,640	100%
138	0.6	109,419	5.8	0.10	0.10	0.00	0.10	0.10	56.42	25,644	100%
140	0.5	109,478	5.8	0.10	0.10	0.00	0.10	0.10	56.42	25,648	100%
142	0.5	109,531	5.8	0.10	0.10	0.00	0.10	0.10	56.43	25,651	100%
144	0.5	109,579	5.8	0.10	0.10	0.00	0.10	0.10	56.44	25,654	100%
146	0.4	109,622	5.8	0.10	0.10	0.00	0.10	0.10	56.44	25,657	100%
148	0.4	109,661	5.8	0.10	0.10	0.00	0.10	0.10	56.45	25,659	100%
150	0.4	109,695	5.8	0.10	0.10	0.00	0.10	0.10	56.45	25,661	100%
152	0.3	109,726	5.8	0.10	0.10	0.00	0.10	0.10	56.46	25,663	100%
154	0.3	109,754	5.8	0.10	0.10	0.00	0.10	0.10	56.46	25,665	100%
156	0.3	109,778	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,666	100%
158	0.3	109,799	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,668	100%
160	0.2	109,818	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,669	100%
162	0.2	109,834	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,670	100%
164	0.2	109,848	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
166	0.2	109,859	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
168	0.2	109,869	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
170	0.2	109,877	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
172	0.1	109,884	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
174	0.1	109,889	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
176	0.1	109,892	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
178	0.1	109,895	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
180	0.1	109,896	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
182	0.1	109,896	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
184	0.1	109,895	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,674	100%
186	0.1	109,893	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
188	0.1	109,890	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
190	0.1	109,887	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
192	0.1	109,883	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,673	100%
194	0.1	109,878	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
196	0.1	109,872	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
198	0.0	109,866	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,672	100%
200	0.0	109,860	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
202	0.0	109,853	5.8	0.10	0.10	0.00	0.10	0.10	56.48	25,671	100%
204	0.0	109,845	5.8	0.10	0.10	0.00	0.10	0.10	56.47	25,670	100%


Sediment Basin 3 Phase 2 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE (ft)
TIME (min)
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]
0
10
20
30
40
50
60
70
80
90
100
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1___of _2__

Sediment Basin # 3 Brickhaven

Phase 2

25 - year Storm Event

Qp = 51.95 cfs
Tp = 31.63 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.4
Ks = 9,983

Number of Riser/Barrel Assemblies	1		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	2.9	(ft)	
Height of Riser from bottom of barrel=	5.9	(ft) elevation	195.90
Emergency Spillway =	6.2	(ft) elevation	196.20
Total Height of Dam =	7.0	(ft) elevation	197.00
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	190.0

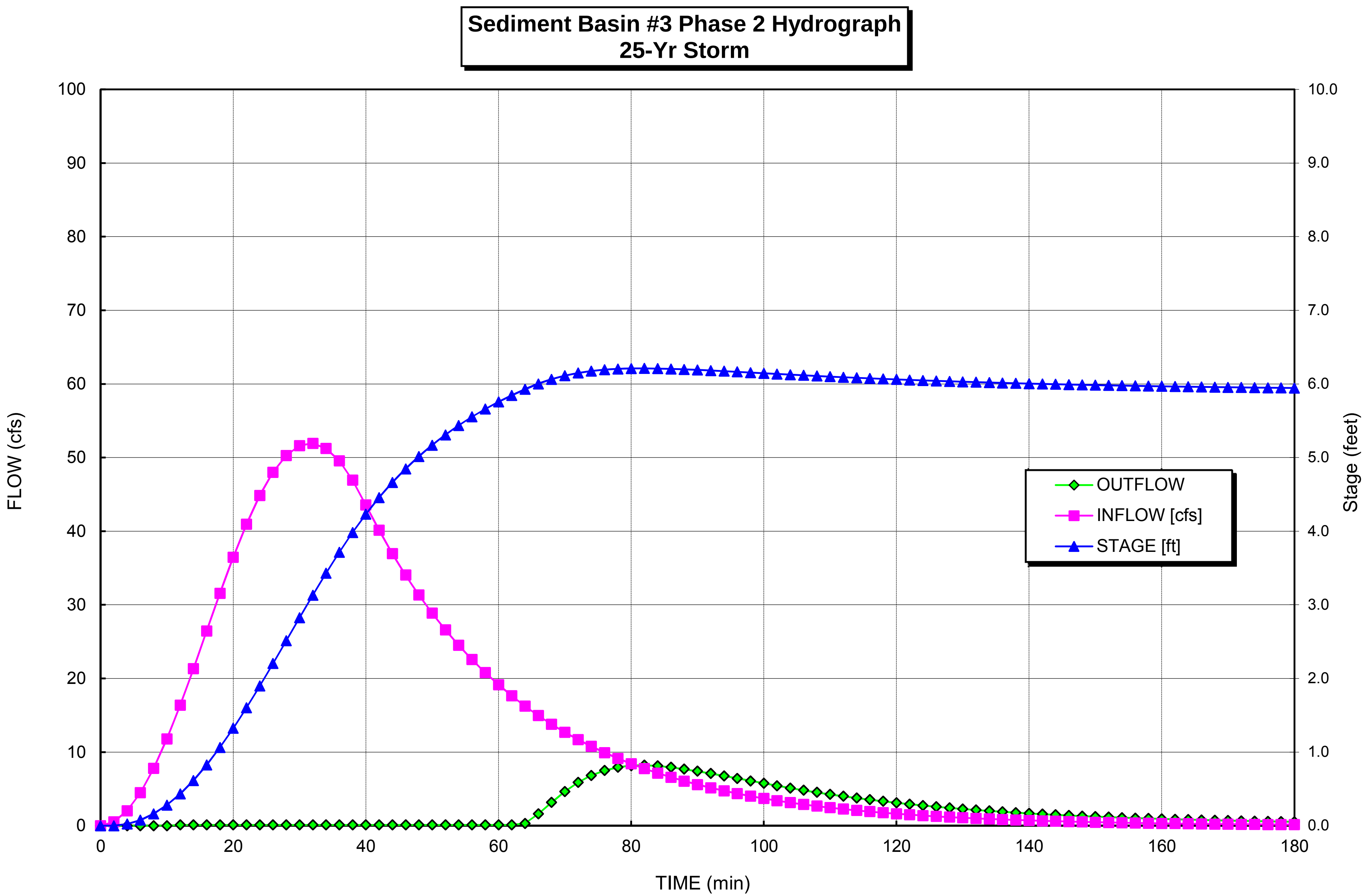
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

98% Minimum Settling Efficiency
6.2 ft Maximum Stage 196.2 msl elevation
8.2 cfs Peak outflow
8.2 cfs Peak Riser/Barrel outflow
0.0 cfs peak weir flow

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.5	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	2.0	61	0.0	0.00	0.00	0.00	0.00	0.00	7.74	3,519	N/A
6	4.5	304	0.1	0.00	0.00	0.00	0.00	0.00	11.84	5,382	N/A
8	7.8	841	0.2	0.00	0.00	0.00	0.00	0.00	15.51	7,050	N/A
10	11.8	1,775	0.3	0.00	0.00	0.00	0.00	0.00	18.91	8,593	N/A
12	16.4	3,190	0.4	0.10	0.10	0.00	0.10	0.10	22.09	10,040	100%
14	21.3	5,142	0.6	0.10	0.10	0.00	0.10	0.10	25.07	11,395	100%
16	26.5	7,688	0.8	0.10	0.10	0.00	0.10	0.10	27.89	12,678	100%
18	31.6	10,850	1.1	0.10	0.10	0.00	0.10	0.10	30.56	13,891	100%
20	36.5	14,626	1.3	0.10	0.10	0.00	0.10	0.10	33.08	15,036	100%
22	40.9	18,989	1.6	0.10	0.10	0.00	0.10	0.10	35.45	16,115	100%
24	44.8	23,890	1.9	0.10	0.10	0.00	0.10	0.10	37.68	17,127	100%
26	48.0	29,259	2.2	0.10	0.10	0.00	0.10	0.10	39.76	18,073	100%
28	50.3	35,006	2.5	0.10	0.10	0.00	0.10	0.10	41.70	18,954	100%
30	51.6	41,027	2.8	0.10	0.10	0.00	0.10	0.10	43.49	19,769	100%
32	51.9	47,208	3.1	0.10	0.10	0.00	0.10	0.10	45.14	20,518	100%
34	51.2	53,428	3.4	0.10	0.10	0.00	0.10	0.10	46.65	21,203	100%
36	49.5	59,563	3.7	0.10	0.10	0.00	0.10	0.10	48.01	21,823	100%
38	46.9	65,496	4.0	0.10	0.10	0.00	0.10	0.10	49.24	22,380	100%
40	43.6	71,114	4.2	0.10	0.10	0.00	0.10	0.10	50.32	22,874	100%
42	40.1	76,329	4.5	0.10	0.10	0.00	0.10	0.10	51.28	23,307	100%
44	37.0	81,131	4.7	0.10	0.10	0.00	0.10	0.10	52.11	23,688	100%
46	34.0	85,553	4.8	0.10	0.10	0.00	0.10	0.10	52.85	24,024	100%
48	31.4	89,625	5.0	0.10	0.10	0.00	0.10	0.10	53.51	24,322	100%
50	28.9	93,375	5.2	0.10	0.10	0.00	0.10	0.10	54.09	24,588	100%
52	26.6	96,828	5.3	0.10	0.10	0.00	0.10	0.10	54.62	24,826	100%
54	24.5	100,008	5.4	0.10	0.10	0.00	0.10	0.10	55.09	25,039	100%
56	22.6	102,935	5.6	0.10	0.10	0.00	0.10	0.10	55.51	25,232	100%
58	20.8	105,631	5.7	0.10	0.10	0.00	0.10	0.10	55.89	25,405	100%
60	19.1	108,113	5.8	0.10	0.10	0.00	0.10	0.10	56.24	25,562	100%
62	17.6	110,398	5.8	0.10	0.10	0.00	0.10	0.10	56.55	25,705	100%
64	16.2	112,502	5.9	0.10	0.31	0.00	71.50	0.31	56.83	25,834	100%
66	15.0	114,414	6.0	0.10	1.60	0.00	72.09	1.60	57.09	25,949	100%
68	13.8	116,017	6.1	0.10	3.16	0.00	72.59	3.16	57.30	26,045	100%
70	12.7	117,291	6.1	0.10	4.64	0.00	72.97	4.64	57.47	26,121	99%
72	11.7	118,257	6.1	0.10	5.88	0.00	73.26	5.88	57.59	26,178	99%
74	10.8	118,955	6.2	0.10	6.83	0.00	73.47	6.83	57.68	26,219	99%
76	9.9	119,427	6.2	0.10	7.51	0.00	73.62	7.51	57.74	26,246	98%
78	9.1	119,716	6.2	0.10	7.93	0.01	73.70	7.93	57.78	26,263	98%
80	8.4	119,861	6.2	0.10	8.14	0.03	73.74	8.17	57.80	26,272	98%
82	7.8	119,890	6.2	0.10	8.18	0.03	73.75	8.22	57.80	26,273	98%
84	7.1	119,834	6.2	0.10	8.10	0.02	73.74	8.12	57.79	26,270	98%

86	6.6	119,716	6.2	0.10	7.93	0.01	73.70	7.93	57.78	26,263	98%
88	6.1	119,553	6.2	0.10	7.69	0.00	73.65	7.69	57.76	26,254	98%
90	5.6	119,357	6.2	0.10	7.41	0.00	73.59	7.41	57.73	26,242	98%
92	5.1	119,138	6.2	0.10	7.09	0.00	73.53	7.09	57.70	26,229	99%
94	4.7	118,904	6.2	0.10	6.76	0.00	73.46	6.76	57.67	26,216	99%
96	4.4	118,660	6.2	0.10	6.43	0.00	73.39	6.43	57.64	26,202	99%
98	4.0	118,412	6.2	0.10	6.09	0.00	73.31	6.09	57.61	26,187	99%
100	3.7	118,164	6.1	0.10	5.76	0.00	73.24	5.76	57.58	26,172	99%
102	3.4	117,917	6.1	0.10	5.43	0.00	73.16	5.43	57.55	26,158	99%
104	3.1	117,674	6.1	0.10	5.12	0.00	73.09	5.12	57.52	26,144	99%
106	2.9	117,436	6.1	0.10	4.82	0.00	73.02	4.82	57.48	26,130	99%
108	2.7	117,204	6.1	0.10	4.53	0.00	72.95	4.53	57.45	26,116	99%
110	2.5	116,979	6.1	0.10	4.26	0.00	72.88	4.26	57.43	26,103	99%
112	2.3	116,762	6.1	0.10	4.01	0.00	72.81	4.01	57.40	26,090	99%
114	2.1	116,553	6.1	0.10	3.76	0.00	72.75	3.76	57.37	26,077	100%
116	1.9	116,351	6.1	0.10	3.53	0.00	72.69	3.53	57.34	26,065	100%
118	1.8	116,157	6.1	0.10	3.32	0.00	72.63	3.32	57.32	26,054	100%
120	1.6	115,971	6.1	0.10	3.11	0.00	72.57	3.11	57.29	26,043	100%
122	1.5	115,792	6.1	0.10	2.92	0.00	72.52	2.92	57.27	26,032	100%
124	1.4	115,621	6.0	0.10	2.74	0.00	72.46	2.74	57.25	26,022	100%
126	1.3	115,457	6.0	0.10	2.58	0.00	72.41	2.58	57.23	26,012	100%
128	1.2	115,300	6.0	0.10	2.42	0.00	72.37	2.42	57.21	26,003	100%
130	1.1	115,150	6.0	0.10	2.27	0.00	72.32	2.27	57.19	25,994	100%
132	1.0	115,007	6.0	0.10	2.14	0.00	72.28	2.14	57.17	25,985	100%
134	0.9	114,870	6.0	0.10	2.01	0.00	72.23	2.01	57.15	25,977	100%
136	0.8	114,739	6.0	0.10	1.89	0.00	72.19	1.89	57.13	25,969	100%
138	0.8	114,613	6.0	0.10	1.77	0.00	72.15	1.77	57.12	25,961	100%
140	0.7	114,493	6.0	0.10	1.67	0.00	72.12	1.67	57.10	25,954	100%
142	0.7	114,379	6.0	0.10	1.57	0.00	72.08	1.57	57.08	25,947	100%
144	0.6	114,269	6.0	0.10	1.48	0.00	72.05	1.48	57.07	25,941	100%
146	0.6	114,165	6.0	0.10	1.39	0.00	72.02	1.39	57.06	25,934	100%
148	0.5	114,065	6.0	0.10	1.31	0.00	71.98	1.31	57.04	25,928	100%
150	0.5	113,969	6.0	0.10	1.24	0.00	71.96	1.24	57.03	25,923	100%
152	0.4	113,878	6.0	0.10	1.17	0.00	71.93	1.17	57.02	25,917	100%
154	0.4	113,790	6.0	0.10	1.10	0.00	71.90	1.10	57.01	25,912	100%
156	0.4	113,706	6.0	0.10	1.04	0.00	71.87	1.04	56.99	25,907	100%
158	0.3	113,626	6.0	0.10	0.98	0.00	71.85	0.98	56.98	25,902	100%
160	0.3	113,550	6.0	0.10	0.92	0.00	71.83	0.92	56.97	25,897	100%
162	0.3	113,477	6.0	0.10	0.87	0.00	71.80	0.87	56.96	25,893	100%
164	0.3	113,407	6.0	0.10	0.83	0.00	71.78	0.83	56.96	25,889	100%
166	0.2	113,340	6.0	0.10	0.78	0.00	71.76	0.78	56.95	25,885	100%
168	0.2	113,275	6.0	0.10	0.74	0.00	71.74	0.74	56.94	25,881	100%
170	0.2	113,214	6.0	0.10	0.70	0.00	71.72	0.70	56.93	25,877	100%
172	0.2	113,155	6.0	0.10	0.66	0.00	71.70	0.66	56.92	25,873	100%
174	0.2	113,098	6.0	0.10	0.63	0.00	71.69	0.63	56.91	25,870	100%
176	0.2	113,044	5.9	0.10	0.60	0.00	71.67	0.60	56.91	25,867	100%
178	0.1	112,992	5.9	0.10	0.57	0.00	71.65	0.57	56.90	25,864	100%
180	0.1	112,942	5.9	0.10	0.54	0.00	71.64	0.54	56.89	25,860	100%
182	0.1	112,894	5.9	0.10	0.51	0.00	71.62	0.51	56.89	25,858	100%
184	0.1	112,849	5.9	0.10	0.48	0.00	71.61	0.48	56.88	25,855	100%
186	0.1	112,805	5.9	0.10	0.46	0.00	71.59	0.46	56.87	25,852	100%
188	0.1	112,762	5.9	0.10	0.44	0.00	71.58	0.44	56.87	25,850	100%
190	0.1	112,722	5.9	0.10	0.42	0.00	71.57	0.42	56.86	25,847	100%
192	0.1	112,682	5.9	0.10	0.40	0.00	71.56	0.40	56.86	25,845	100%
194	0.1	112,645	5.9	0.10	0.38	0.00	71.54	0.38	56.85	25,842	100%
196	0.1	112,609	5.9	0.10	0.36	0.00	71.53	0.36	56.85	25,840	100%
198	0.1	112,574	5.9	0.10	0.34	0.00	71.52	0.34	56.84	25,838	100%
200	0.1	112,541	5.9	0.10	0.33	0.00	71.51	0.33	56.84	25,836	100%
202	0.1	112,508	5.9	0.10	0.31	0.00	71.50	0.31	56.83	25,834	100%
204	0.1	112,477	5.9	0.10	0.30	0.00	71.49	0.30	56.83	25,832	100%
206	0.0	112,447	5.9	0.10	0.29	0.00	71.48	0.29	56.83	25,830	100%



Sediment Basin #3 Phase 2 Hydrograph
25-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
100
90
80
70
60
50
40
30
20
10
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1___of _2___

Sediment Basin # 3 Brickhaven

Phase 2

100 - year Storm Event

Qp =	67.2	cfs
Tp =	32.1	minutes
dT = Max of	**2**	minutes
or	**1.0%**	of increment to peak

b = 1.4
Ks = 9,983

Number of Riser/Barrel Assemblies	1		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	2.9	(ft)	
Height of Riser from bottom of barrel=	5.9	(ft) elevation	195.90
Emergency Spillway =	6.2	(ft) elevation	196.20
Total Height of Dam =	7.0	(ft) elevation	197.00
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	190.0

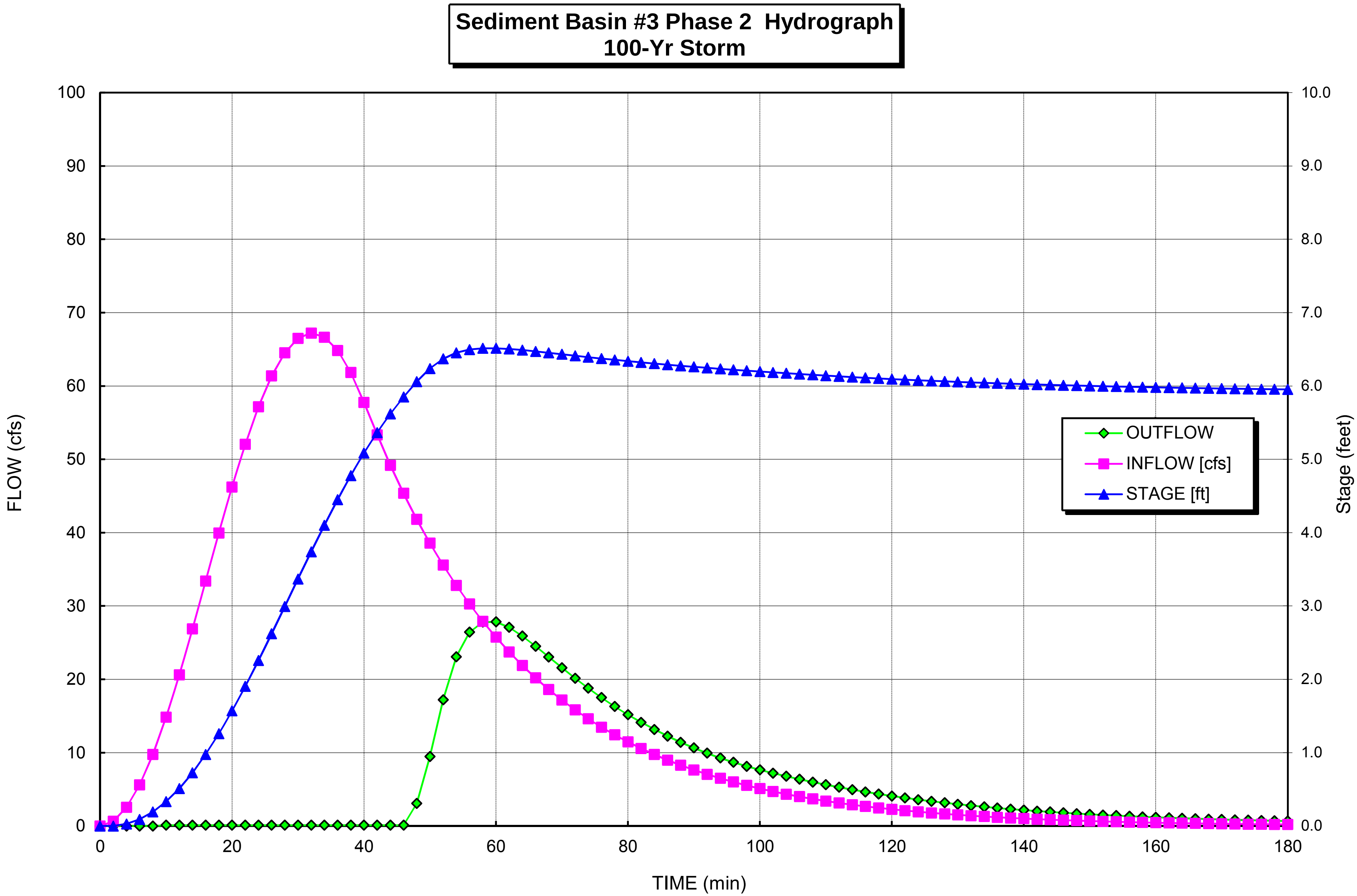
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

88%	Minimum Settling Efficiency		
6.5	ft Maximum Stage	196.5	msl elevation
27.8	cfs Peak outflow		
22.6	cfs Peak Riser/Barrel outflow		
5.3	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.6	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	2.5	77	0.0	0.00	0.00	0.00	0.00	0.00	8.22	3,737	N/A
6	5.6	381	0.1	0.00	0.00	0.00	0.00	0.00	12.57	5,715	N/A
8	9.8	1,056	0.2	0.00	0.00	0.00	0.00	0.00	16.47	7,488	N/A
10	14.8	2,228	0.3	0.10	0.10	0.00	0.10	0.10	20.08	9,128	100%
12	20.6	3,995	0.5	0.10	0.10	0.00	0.10	0.10	23.45	10,657	100%
14	26.9	6,455	0.7	0.10	0.10	0.00	0.10	0.10	26.63	12,104	100%
16	33.4	9,667	1.0	0.10	0.10	0.00	0.10	0.10	29.64	13,472	100%
18	39.9	13,663	1.3	0.10	0.10	0.00	0.10	0.10	32.49	14,767	100%
20	46.2	18,442	1.6	0.10	0.10	0.00	0.10	0.10	35.18	15,990	100%
22	52.0	23,977	1.9	0.10	0.10	0.00	0.10	0.10	37.72	17,143	100%
24	57.2	30,210	2.3	0.10	0.10	0.00	0.10	0.10	40.10	18,227	100%
26	61.4	37,056	2.6	0.10	0.10	0.00	0.10	0.10	42.33	19,242	100%
28	64.5	44,407	3.0	0.10	0.10	0.00	0.10	0.10	44.41	20,188	100%
30	66.5	52,137	3.4	0.10	0.10	0.00	0.10	0.10	46.35	21,066	100%
32	67.2	60,104	3.7	0.10	0.10	0.00	0.10	0.10	48.13	21,876	100%
34	66.7	68,157	4.1	0.10	0.10	0.00	0.10	0.10	49.76	22,618	100%
36	64.8	76,144	4.4	0.10	0.10	0.00	0.10	0.10	51.24	23,293	100%
38	61.8	83,913	4.8	0.10	0.10	0.00	0.10	0.10	52.58	23,901	100%
40	57.7	91,320	5.1	0.10	0.10	0.00	0.10	0.10	53.77	24,443	100%
42	53.3	98,237	5.4	0.10	0.10	0.00	0.10	0.10	54.83	24,921	100%
44	49.2	104,624	5.6	0.10	0.10	0.00	0.10	0.10	55.75	25,341	100%
46	45.4	110,513	5.8	0.10	0.10	0.00	0.10	0.10	56.57	25,712	100%
48	41.8	115,944	6.1	0.10	3.08	0.00	72.56	3.08	57.29	26,041	100%
50	38.6	120,593	6.2	0.10	9.25	0.22	73.96	9.47	57.89	26,314	98%
52	35.6	124,087	6.4	0.10	15.12	2.10	74.99	17.22	58.33	26,514	94%
54	32.8	126,290	6.5	0.10	19.27	3.81	75.62	23.08	58.60	26,638	91%
56	30.3	127,459	6.5	0.10	21.59	4.84	75.96	26.43	58.75	26,703	89%
58	27.9	127,918	6.5	0.10	22.53	5.27	76.09	27.80	58.80	26,729	88%
60	25.7	127,932	6.5	0.10	22.56	5.28	76.09	27.84	58.81	26,730	88%
62	23.7	127,680	6.5	0.10	22.04	5.05	76.02	27.09	58.77	26,716	89%
64	21.9	127,278	6.5	0.10	21.23	4.68	75.91	25.91	58.73	26,693	89%
66	20.2	126,797	6.5	0.10	20.27	4.25	75.77	24.51	58.67	26,667	90%
68	18.6	126,278	6.5	0.10	19.25	3.80	75.62	23.05	58.60	26,638	91%
70	17.2	125,748	6.4	0.10	18.22	3.36	75.47	21.58	58.54	26,608	92%
72	15.8	125,220	6.4	0.10	17.21	2.94	75.32	20.15	58.47	26,578	92%
74	14.6	124,702	6.4	0.10	16.25	2.54	75.17	18.79	58.41	26,549	93%
76	13.5	124,200	6.4	0.10	15.33	2.18	75.02	17.51	58.35	26,521	94%
78	12.4	123,717	6.4	0.10	14.46	1.84	74.88	16.30	58.28	26,493	94%
80	11.5	123,252	6.3	0.10	13.64	1.54	74.74	15.18	58.23	26,467	95%
82	10.6	122,806	6.3	0.10	12.86	1.27	74.61	14.13	58.17	26,441	96%
84	9.7	122,378	6.3	0.10	12.13	1.02	74.49	13.16	58.12	26,417	96%

86	9.0	121,969	6.3	0.10	11.45	0.81	74.37	12.26	58.07	26,393	96%
88	8.3	121,577	6.3	0.10	10.81	0.61	74.25	11.42	58.02	26,371	97%
90	7.6	121,201	6.3	0.10	10.20	0.45	74.14	10.65	57.97	26,349	97%
92	7.1	120,841	6.2	0.10	9.63	0.30	74.04	9.94	57.92	26,328	97%
94	6.5	120,494	6.2	0.10	9.10	0.19	73.93	9.28	57.88	26,308	98%
96	6.0	120,161	6.2	0.10	8.59	0.09	73.83	8.68	57.84	26,289	98%
98	5.5	119,839	6.2	0.10	8.11	0.02	73.74	8.13	57.79	26,270	98%
100	5.1	119,527	6.2	0.10	7.65	0.00	73.64	7.65	57.75	26,252	98%
102	4.7	119,221	6.2	0.10	7.21	0.00	73.55	7.21	57.72	26,234	99%
104	4.3	118,921	6.2	0.10	6.79	0.00	73.46	6.79	57.68	26,217	99%
106	4.0	118,627	6.2	0.10	6.38	0.00	73.38	6.38	57.64	26,200	99%
108	3.7	118,342	6.2	0.10	5.99	0.00	73.29	5.99	57.60	26,183	99%
110	3.4	118,065	6.1	0.10	5.63	0.00	73.21	5.63	57.57	26,167	99%
112	3.1	117,799	6.1	0.10	5.28	0.00	73.13	5.28	57.53	26,151	99%
114	2.9	117,542	6.1	0.10	4.95	0.00	73.05	4.95	57.50	26,136	99%
116	2.7	117,295	6.1	0.10	4.65	0.00	72.97	4.65	57.47	26,121	99%
118	2.5	117,058	6.1	0.10	4.36	0.00	72.90	4.36	57.44	26,107	99%
120	2.3	116,830	6.1	0.10	4.09	0.00	72.83	4.09	57.41	26,094	99%
122	2.1	116,613	6.1	0.10	3.83	0.00	72.77	3.83	57.38	26,081	100%
124	1.9	116,404	6.1	0.10	3.59	0.00	72.70	3.59	57.35	26,068	100%
126	1.8	116,205	6.1	0.10	3.37	0.00	72.64	3.37	57.32	26,057	100%
128	1.6	116,015	6.1	0.10	3.16	0.00	72.58	3.16	57.30	26,045	100%
130	1.5	115,832	6.1	0.10	2.97	0.00	72.53	2.97	57.28	26,034	100%
132	1.4	115,658	6.0	0.10	2.78	0.00	72.48	2.78	57.25	26,024	100%
134	1.3	115,492	6.0	0.10	2.61	0.00	72.42	2.61	57.23	26,014	100%
136	1.2	115,333	6.0	0.10	2.45	0.00	72.38	2.45	57.21	26,005	100%
138	1.1	115,182	6.0	0.10	2.30	0.00	72.33	2.30	57.19	25,996	100%
140	1.0	115,037	6.0	0.10	2.16	0.00	72.28	2.16	57.17	25,987	100%
142	0.9	114,898	6.0	0.10	2.03	0.00	72.24	2.03	57.15	25,979	100%
144	0.9	114,766	6.0	0.10	1.91	0.00	72.20	1.91	57.14	25,971	100%
146	0.8	114,640	6.0	0.10	1.80	0.00	72.16	1.80	57.12	25,963	100%
148	0.7	114,519	6.0	0.10	1.69	0.00	72.13	1.69	57.10	25,956	100%
150	0.7	114,404	6.0	0.10	1.59	0.00	72.09	1.59	57.09	25,949	100%
152	0.6	114,294	6.0	0.10	1.50	0.00	72.06	1.50	57.07	25,942	100%
154	0.6	114,189	6.0	0.10	1.41	0.00	72.02	1.41	57.06	25,936	100%
156	0.5	114,088	6.0	0.10	1.33	0.00	71.99	1.33	57.05	25,930	100%
158	0.5	113,992	6.0	0.10	1.25	0.00	71.96	1.25	57.03	25,924	100%
160	0.5	113,900	6.0	0.10	1.18	0.00	71.93	1.18	57.02	25,918	100%
162	0.4	113,812	6.0	0.10	1.12	0.00	71.91	1.12	57.01	25,913	100%
164	0.4	113,728	6.0	0.10	1.05	0.00	71.88	1.05	57.00	25,908	100%
166	0.4	113,648	6.0	0.10	0.99	0.00	71.86	0.99	56.99	25,903	100%
168	0.3	113,571	6.0	0.10	0.94	0.00	71.83	0.94	56.98	25,899	100%
170	0.3	113,497	6.0	0.10	0.89	0.00	71.81	0.89	56.97	25,894	100%
172	0.3	113,427	6.0	0.10	0.84	0.00	71.79	0.84	56.96	25,890	100%
174	0.3	113,359	6.0	0.10	0.79	0.00	71.77	0.79	56.95	25,886	100%
176	0.2	113,295	6.0	0.10	0.75	0.00	71.75	0.75	56.94	25,882	100%
178	0.2	113,233	6.0	0.10	0.71	0.00	71.73	0.71	56.93	25,878	100%
180	0.2	113,173	6.0	0.10	0.67	0.00	71.71	0.67	56.92	25,875	100%
182	0.2	113,117	6.0	0.10	0.64	0.00	71.69	0.64	56.92	25,871	100%
184	0.2	113,062	5.9	0.10	0.61	0.00	71.67	0.61	56.91	25,868	100%
186	0.2	113,010	5.9	0.10	0.58	0.00	71.66	0.58	56.90	25,865	100%
188	0.1	112,960	5.9	0.10	0.55	0.00	71.64	0.55	56.90	25,862	100%
190	0.1	112,911	5.9	0.10	0.52	0.00	71.63	0.52	56.89	25,859	100%
192	0.1	112,865	5.9	0.10	0.49	0.00	71.61	0.49	56.88	25,856	100%
194	0.1	112,821	5.9	0.10	0.47	0.00	71.60	0.47	56.88	25,853	100%
196	0.1	112,778	5.9	0.10	0.45	0.00	71.59	0.45	56.87	25,851	100%
198	0.1	112,737	5.9	0.10	0.43	0.00	71.57	0.43	56.87	25,848	100%
200	0.1	112,698	5.9	0.10	0.41	0.00	71.56	0.41	56.86	25,846	100%
202	0.1	112,660	5.9	0.10	0.39	0.00	71.55	0.39	56.86	25,843	100%
204	0.1	112,623	5.9	0.10	0.37	0.00	71.54	0.37	56.85	25,841	100%



Sediment Basin #3 Phase 2 Hydrograph
100-Yr Storm
100
90
80
70
60
50
40
30
20
10
0
FLOW (cfs)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Stage (feet)
0
20
40
60
80
100
120
140
160
180
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #4		Sheet: 1	Of: 4

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	22.6	29.7	29.7	29.7		
Disturbed Area (ac) =	22.6	29.7	29.7	29.7		
Curve Number CN =	94	94	94	94	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	134.64	143.97	173.01	219.72	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	53,460	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	62,627	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:
Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
219	0	400	-	-	-
220	1	56,268	20,471	20,471	758
221	2	59,975	58,112	78,582	2,910
222	3	63,739	61,847	140,430	5,201
223	4	67,559	65,640	206,070	7,632
224	5	71,435	69,488	275,558	10,206
225	6	75,368	73,393	348,950	12,924
226	7	79,357	77,354	426,304	15,789

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 140,430 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 63,739 *Required Surface Area Achieved*

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #4	Sheet: 2	Of: 4

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	140,430		
Number of Skimmers	2		
Days to Drain =	5	*assumed*	
Q (cf/day) =	14,043		0.16 cfs
Selected Skimmer Size (inches) =	4		
Head on Skimmer (feet) =	0.333		
Diameter of Orifice (inches) =	3.2		

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

$S = (1000/CN) - 10$

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	0.64	0.64	0.64	0.64
Runoff Depth Q* (inches) =	4.48	4.48	5.44	6.99
Time to Peak T_p (min) =	32.70	40.19	40.61	41.15

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 140,430

Z_2 (ft) = 5 S_2 (cf) = 275,558

b = $\ln(S_2/S_1)/\ln(Z_2/Z_1)$ = 1.3 Ref 2, III-8

$K_S = S_2/Z_2^{\,b}$ = 32,949

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
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Task: Sediment Basin #4		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (v) = 1.14E-06 n^2 / sec @ 20^o C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / v] d^2$ = 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 5.50

Set Top of Dam at (ft) = 7.00

See Hydrograph

Emergency Spillway

Q_E (cfs) = 100-Yr Storm

Q_E (cfs) = 1.1

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 10

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.10	1.08	0.23	0.10	0.23	1.1	0.1
0.02	0.08	0.86	0.16	0.08	0.16	1.3	0.1

Construct the channel to be : 10 ft, Bottom Width (measured at top of lining)

1.5 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 6

Use Anti-Seep Collar Size (ft) = 6 x 6

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #4		Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 54 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 57.26 $Pi * (D_R/24)^2$ * Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 1.51
Width & Length (ft) = 5.5
Thickness (ft) = 1.3

Anti-Vortex Device:

Diameter of Riser (in) = 54 From Hydrograph
Cylinder Diameter (in) = 78 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 16
Cylinder Height (in) = 25

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	18	6 * Barrel Diameter
Q_B (cfs) =	124.7	Peak Flow out of the barrel 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
124.7	40.83	1.48	37.5	1.13	40.83	3.3

Flow Depth = Tailwater, d (ft) = 1.48 0.5* Barrel Diameter (ft) = 1.50 Ref 1, 8.06.3
Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe
Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe
Since the Tailwater is <u>less</u> than half of the diameter of the outlet, use <u>Minimum</u> Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
3	9	40	43	1.4	Class 2

Conclusion

The basin can contain the 10-yr storm and pass the 100-yr storm without overtopping the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) =	54	
Circumference of Riser (in) =	169.6	
eight of Riser from bottom of barrel (in) =	43	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	2	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.33	0.33
0.39	0.00	0.00	0.00			0.33	0.33
0.44	0.00	0.00	0.00			0.33	0.33
0.49	0.00	0.00	0.00			0.33	0.33
0.54	0.00	0.00	0.00			0.33	0.33
0.59	0.00	0.00	0.00			0.33	0.33
0.64	0.00	0.00	0.00			0.33	0.33
0.69	0.00	0.00	0.00			0.33	0.33
0.74	0.00	0.00	0.00			0.33	0.33
0.79	0.00	0.00	0.00			0.33	0.33
0.84	0.00	0.00	0.00			0.33	0.33
0.89	0.00	0.00	0.00			0.33	0.33
0.94	0.00	0.00	0.00			0.33	0.33
0.99	0.00	0.00	0.00			0.33	0.33
1.04	0.00	0.00	0.00			0.33	0.33
1.09	0.00	0.00	0.00			0.33	0.33
1.14	0.00	0.00	0.00			0.33	0.33
1.19	0.00	0.00	0.00			0.33	0.33
1.24	0.00	0.00	0.00			0.33	0.33
1.29	0.00	0.00	0.00			0.33	0.33
1.34	0.00	0.00	0.00			0.33	0.33
1.39	0.00	0.00	0.00			0.33	0.33
1.44	0.00	0.00	0.00			0.33	0.33
1.49	0.00	0.00	0.00			0.33	0.33
1.54	0.00	0.00	0.00			0.33	0.33
1.59	0.00	0.00	0.00			0.33	0.33

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 2	Of 2

1.64	0.00	0.00	0.00	0.33	0.33
1.69	0.00	0.00	0.00	0.33	0.33
1.74	0.00	0.00	0.00	0.33	0.33
1.79	0.00	0.00	0.00	0.33	0.33
1.84	0.00	0.00	0.00	0.33	0.33
1.89	0.00	0.00	0.00	0.33	0.33
1.94	0.00	0.00	0.00	0.33	0.33
1.99	0.00	0.00	0.00	0.33	0.33
2.04	0.00	0.00	0.00	0.33	0.33
2.09	0.00	0.00	0.00	0.33	0.33
2.14	0.00	0.00	0.00	0.33	0.33
2.19	0.00	0.00	0.00	0.33	0.33
2.24	0.00	0.00	0.00	0.33	0.33
2.29	0.00	0.00	0.00	0.33	0.33
2.34	0.00	0.00	0.00	0.33	0.33
2.39	0.00	0.00	0.00	0.33	0.33
2.44	0.00	0.00	0.00	0.33	0.33
2.49	0.00	0.00	0.00	0.33	0.33
2.54	0.00	0.00	0.00	0.33	0.33
2.59	0.00	0.00	0.00	0.33	0.33
2.64	0.00	0.00	0.00	0.33	0.33
2.69	0.00	0.00	0.00	0.33	0.33
2.74	0.00	0.00	0.00	0.33	0.33
2.79	0.00	0.00	0.00	0.33	0.33
2.84	0.00	0.00	0.00	0.33	0.33
2.89	0.00	0.00	0.00	0.33	0.33
2.94	0.00	0.00	0.00	0.33	0.33
2.99	0.00	0.00	0.00	0.33	0.33
3.04	0.00	0.00	0.00	0.33	0.33
3.09	0.00	0.00	0.00	0.33	0.33
3.14	0.00	0.00	0.00	0.33	0.33
3.19	0.00	0.00	0.00	0.33	0.33
3.24	0.00	0.00	0.00	0.33	0.33
3.29	0.00	0.00	0.00	0.33	0.33
3.34	0.00	0.00	0.00	0.33	0.33
3.39	0.00	0.00	0.00	0.33	0.33
3.44	0.00	0.00	0.00	0.33	0.33
3.49	0.00	0.00	0.00	0.33	0.33
3.54	0.00	0.00	0.00	0.33	0.33
3.59	0.00	0.00	0.00	0.33	0.33
3.64	0.00	0.00	0.00	0.33	0.33
3.69	0.00	0.00	0.00	0.33	0.33
3.74	0.00	0.00	0.00	0.33	0.33
3.79	0.00	0.00	0.00	0.33	0.33
3.84	0.00	0.00	0.00	0.33	0.33
3.89	0.00	0.00	0.00	0.33	0.33
3.94	0.00	0.00	0.00	0.33	0.33
3.99	0.00	0.00	0.00	0.33	0.33

Qp = 134.64 cfs

Tp = 32.70 minutes

dT = Max of 2 minutes

or 1.0% of increment to peak

Sediment Basin # 4 Brickhaven

Phase 1

10 - year Storm Event

b = 1.3

K_s = 32,949

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	0.6	(ft)	
Height of Riser from bottom of barrel=	3.6	(ft) elevation	222.60
Emergency Spillway =	5.5	(ft) elevation	224.50
Total Height of Dam =	7.0	(ft) elevation	226.00
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	219.0

4.0E-03 Settling Velocity of design particle (fps)

2 Effective number of cells (2 is construction site #)

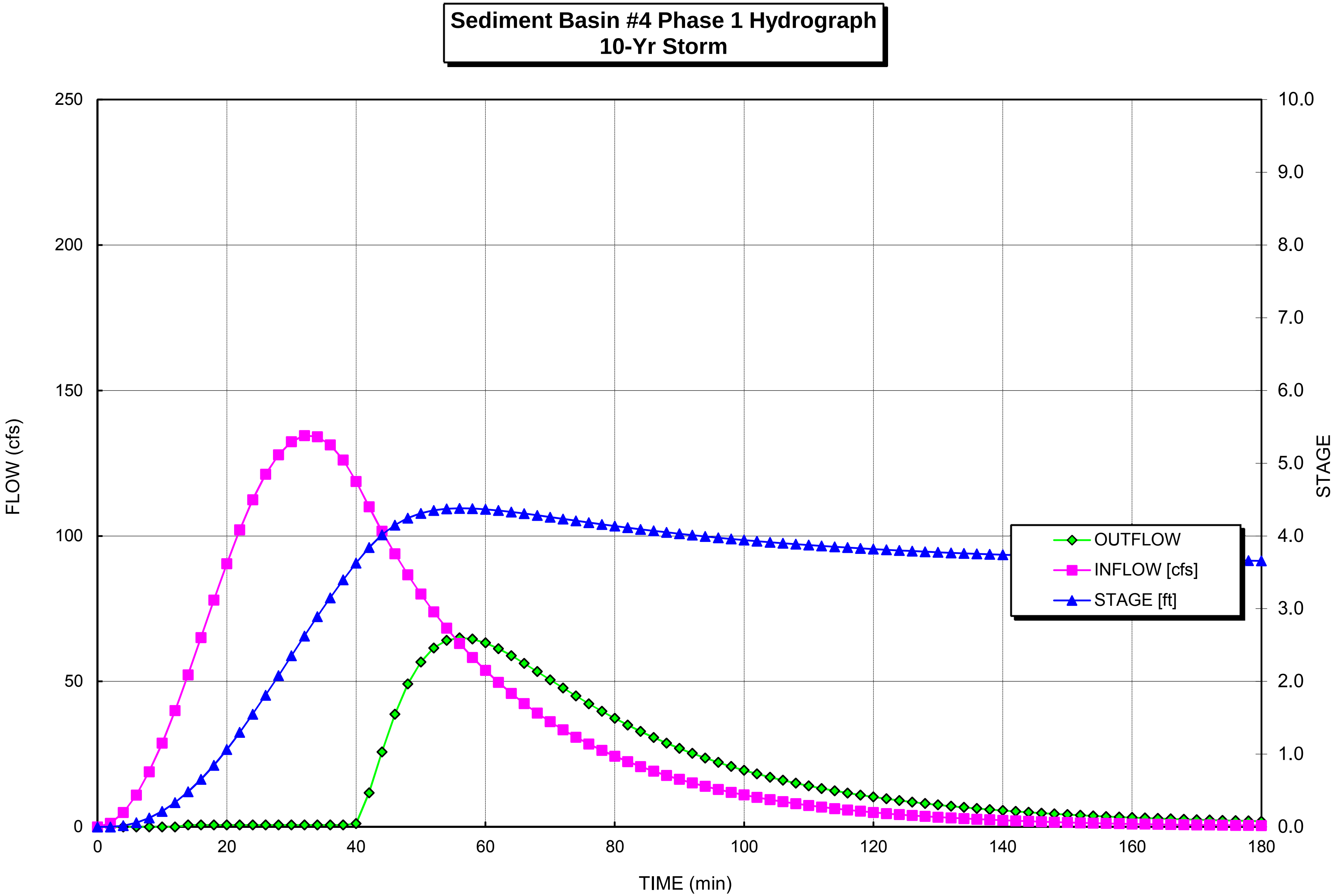
90%	Minimum Settling Efficiency		
4.4	ft Maximum Stage	223.38	msl elevation
65.0	cfs Peak outflow		
65.0	cfs Peak Riser/Barrel outflow		
0.0	cfs Peak Weir flow		

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.2	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	4.9	149	0.0	0.00	0.00	0.00	0.00	0.00	25.86	11,754	N/A
6	10.9	738	0.1	0.00	0.00	0.00	0.00	0.00	38.12	17,326	N/A
8	18.9	2,043	0.1	0.00	0.00	0.00	0.00	0.00	48.78	22,174	N/A
10	28.8	4,314	0.2	0.00	0.00	0.00	0.00	0.00	58.46	26,573	N/A
12	40.0	7,764	0.3	0.00	0.00	0.00	0.00	0.00	67.40	30,638	N/A
14	52.3	12,564	0.5	0.33	0.33	0.00	0.33	0.65	75.74	34,426	100%
16	65.1	18,756	0.7	0.33	0.33	0.00	0.33	0.65	83.45	37,934	100%
18	77.9	26,485	0.8	0.33	0.33	0.00	0.33	0.65	90.73	41,240	100%
20	90.4	35,761	1.1	0.33	0.33	0.00	0.33	0.65	97.57	44,351	100%
22	102.1	46,537	1.3	0.33	0.33	0.00	0.33	0.65	104.00	47,273	100%
24	112.5	58,710	1.5	0.33	0.33	0.00	0.33	0.65	110.02	50,009	100%
26	121.2	72,128	1.8	0.33	0.33	0.00	0.33	0.65	115.64	52,566	100%
28	127.9	86,590	2.1	0.33	0.33	0.00	0.33	0.65	120.88	54,944	100%
30	132.4	101,859	2.4	0.33	0.33	0.00	0.33	0.65	125.73	57,149	100%
32	134.5	117,668	2.6	0.33	0.33	0.00	0.33	0.65	130.20	59,181	100%
34	134.1	133,729	2.9	0.33	0.33	0.00	0.33	0.65	134.30	61,043	100%
36	131.3	149,744	3.1	0.33	0.33	0.00	0.33	0.65	138.03	62,739	100%
38	126.1	165,420	3.4	0.33	0.33	0.00	0.33	0.65	141.39	64,270	100%
40	118.7	180,474	3.6	0.33	0.55	0.00	49.57	1.09	144.41	65,640	100%
42	110.0	194,593	3.8	0.33	5.85	0.00	52.00	11.71	147.07	66,849	99%
44	101.6	206,391	4.0	0.33	12.87	0.00	53.91	25.73	149.18	67,809	97%
46	93.9	215,498	4.2	0.33	19.36	0.00	55.32	38.72	150.75	68,522	95%
48	86.7	222,113	4.2	0.33	24.57	0.00	56.31	49.13	151.86	69,025	93%
50	80.1	226,619	4.3	0.33	28.32	0.00	56.98	56.64	152.60	69,362	92%
52	73.9	229,429	4.4	0.33	30.74	0.00	57.39	61.48	153.05	69,569	91%
54	68.3	230,923	4.4	0.33	32.05	0.00	57.60	64.10	153.29	69,679	90%
56	63.1	231,425	4.4	0.33	32.50	0.00	57.67	64.99	153.37	69,715	90%
58	58.2	231,193	4.4	0.33	32.29	0.00	57.64	64.58	153.34	69,698	90%
60	53.8	230,433	4.4	0.33	31.62	0.00	57.53	63.24	153.21	69,643	90%
62	49.7	229,299	4.4	0.33	30.63	0.00	57.37	61.25	153.03	69,560	91%
64	45.9	227,910	4.3	0.33	29.42	0.00	57.17	58.85	152.81	69,457	91%
66	42.4	226,354	4.3	0.33	28.09	0.00	56.94	56.19	152.55	69,342	92%
68	39.1	224,697	4.3	0.33	26.70	0.00	56.70	53.40	152.28	69,219	92%
70	36.1	222,986	4.3	0.33	25.28	0.00	56.44	50.56	152.00	69,091	93%
72	33.4	221,256	4.2	0.33	23.87	0.00	56.19	47.74	151.71	68,961	93%
74	30.8	219,534	4.2	0.33	22.49	0.00	55.93	44.98	151.43	68,830	94%
76	28.5	217,836	4.2	0.33	21.16	0.00	55.67	42.31	151.14	68,701	94%
78	26.3	216,175	4.2	0.33	19.88	0.00	55.42	39.75	150.86	68,574	95%
80	24.3	214,561	4.1	0.33	18.65	0.00	55.18	37.31	150.59	68,449	95%
82	22.4	212,999	4.1	0.33	17.50	0.00	54.94	34.99	150.32	68,328	96%

84	20.7	211,491	4.1	0.33	16.40	0.00	54.70	32.80	150.06	68,211	96%
86	19.1	210,041	4.1	0.33	15.37	0.00	54.48	30.74	149.81	68,097	97%
88	17.7	208,649	4.0	0.33	14.40	0.00	54.26	28.79	149.57	67,988	97%
90	16.3	207,314	4.0	0.33	13.49	0.00	54.05	26.97	149.34	67,882	97%
92	15.1	206,036	4.0	0.33	12.63	0.00	53.85	25.26	149.12	67,780	98%
94	13.9	204,814	4.0	0.33	11.83	0.00	53.66	23.66	148.90	67,683	98%
96	12.9	203,645	4.0	0.33	11.08	0.00	53.47	22.16	148.70	67,589	98%
98	11.9	202,529	4.0	0.33	10.38	0.00	53.29	20.76	148.50	67,499	98%
100	11.0	201,463	3.9	0.33	9.72	0.00	53.12	19.45	148.31	67,413	98%
102	10.1	200,446	3.9	0.33	9.11	0.00	52.96	18.22	148.13	67,330	99%
104	9.4	199,475	3.9	0.33	8.54	0.00	52.80	17.08	147.95	67,251	99%
106	8.6	198,548	3.9	0.33	8.00	0.00	52.65	16.01	147.79	67,175	99%
108	8.0	197,664	3.9	0.33	7.50	0.00	52.50	15.01	147.63	67,103	99%
110	7.4	196,821	3.9	0.33	7.04	0.00	52.36	14.07	147.47	67,033	99%
112	6.8	196,016	3.9	0.33	6.60	0.00	52.23	13.20	147.33	66,967	99%
114	6.3	195,249	3.9	0.33	6.20	0.00	52.10	12.39	147.19	66,903	99%
116	5.8	194,516	3.8	0.33	5.82	0.00	51.98	11.63	147.05	66,842	99%
118	5.4	193,817	3.8	0.33	5.46	0.00	51.87	10.92	146.93	66,784	99%
120	5.0	193,150	3.8	0.33	5.13	0.00	51.76	10.26	146.80	66,728	99%
122	4.6	192,513	3.8	0.33	4.82	0.00	51.65	9.64	146.69	66,675	100%
124	4.2	191,906	3.8	0.33	4.53	0.00	51.55	9.06	146.57	66,624	100%
126	3.9	191,325	3.8	0.33	4.26	0.00	51.45	8.52	146.47	66,575	100%
128	3.6	190,771	3.8	0.33	4.01	0.00	51.36	8.01	146.36	66,528	100%
130	3.3	190,242	3.8	0.33	3.77	0.00	51.27	7.54	146.26	66,484	100%
132	3.1	189,736	3.8	0.33	3.55	0.00	51.18	7.10	146.17	66,441	100%
134	2.8	189,253	3.8	0.33	3.34	0.00	51.10	6.69	146.08	66,400	100%
136	2.6	188,791	3.8	0.33	3.15	0.00	51.02	6.30	145.99	66,361	100%
138	2.4	188,350	3.7	0.33	2.97	0.00	50.94	5.94	145.91	66,323	100%
140	2.2	187,928	3.7	0.33	2.80	0.00	50.87	5.60	145.83	66,287	100%
142	2.1	187,524	3.7	0.33	2.64	0.00	50.80	5.28	145.76	66,252	100%
144	1.9	187,138	3.7	0.33	2.49	0.00	50.74	4.99	145.68	66,219	100%
146	1.8	186,769	3.7	0.33	2.35	0.00	50.67	4.71	145.61	66,188	100%
148	1.6	186,415	3.7	0.33	2.22	0.00	50.61	4.45	145.55	66,157	100%
150	1.5	186,077	3.7	0.33	2.10	0.00	50.55	4.20	145.48	66,128	100%
152	1.4	185,753	3.7	0.33	1.99	0.00	50.50	3.98	145.42	66,100	100%
154	1.3	185,442	3.7	0.33	1.88	0.00	50.44	3.76	145.36	66,074	100%
156	1.2	185,144	3.7	0.33	1.78	0.00	50.39	3.56	145.31	66,048	100%
158	1.1	184,859	3.7	0.33	1.69	0.00	50.34	3.37	145.25	66,023	100%
160	1.0	184,585	3.7	0.33	1.60	0.00	50.29	3.20	145.20	65,999	100%
162	0.9	184,323	3.7	0.33	1.52	0.00	50.25	3.03	145.15	65,977	100%
164	0.9	184,071	3.7	0.33	1.44	0.00	50.21	2.87	145.10	65,955	100%
166	0.8	183,830	3.7	0.33	1.36	0.00	50.16	2.73	145.05	65,934	100%
168	0.7	183,598	3.7	0.33	1.30	0.00	50.12	2.59	145.01	65,914	100%
170	0.7	183,375	3.7	0.33	1.23	0.00	50.08	2.46	144.97	65,894	100%
172	0.6	183,161	3.7	0.33	1.17	0.00	50.05	2.34	144.93	65,876	100%
174	0.6	182,955	3.7	0.33	1.11	0.00	50.01	2.23	144.89	65,858	100%
176	0.5	182,757	3.7	0.33	1.06	0.00	49.98	2.12	144.85	65,841	100%
178	0.5	182,566	3.7	0.33	1.01	0.00	49.94	2.02	144.81	65,824	100%
180	0.5	182,383	3.7	0.33	0.96	0.00	49.91	1.93	144.78	65,808	100%
182	0.4	182,206	3.7	0.33	0.92	0.00	49.88	1.84	144.74	65,792	100%
184	0.4	182,036	3.7	0.33	0.88	0.00	49.85	1.75	144.71	65,778	100%
186	0.4	181,872	3.6	0.33	0.84	0.00	49.82	1.68	144.68	65,763	100%
188	0.3	181,714	3.6	0.33	0.80	0.00	49.79	1.60	144.65	65,749	100%
190	0.3	181,562	3.6	0.33	0.77	0.00	49.77	1.53	144.62	65,736	100%
192	0.3	181,415	3.6	0.33	0.73	0.00	49.74	1.47	144.59	65,723	100%
194	0.3	181,272	3.6	0.33	0.70	0.00	49.71	1.41	144.56	65,711	100%
196	0.2	181,135	3.6	0.33	0.67	0.00	49.69	1.35	144.54	65,699	100%
198	0.2	181,002	3.6	0.33	0.65	0.00	49.67	1.29	144.51	65,687	100%
200	0.2	180,874	3.6	0.33	0.62	0.00	49.64	1.24	144.49	65,676	100%
202	0.2	180,750	3.6	0.33	0.60	0.00	49.62	1.19	144.46	65,665	100%
204	0.2	180,629	3.6	0.33	0.57	0.00	49.60	1.15	144.44	65,654	100%
206	0.2	180,512	3.6	0.33	0.55	0.00	49.58	1.11	144.42	65,644	100%



Sediment Basin #4 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
0
50
100
150
200
250
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Qp =	143.97	cfs
Tp =	40.19	minutes
dT = Max of	2	minutes
or	1.0%	of increment to peak

Sediment Basin # 4 Brickhaven

Phase 2

10 - year Storm Event

b = 1.3
Ks = 32,949

Number of Riser/Barrel Assemblies	2			
Diameter of Barrel =	36	(in)		
Height of Riser above barrel =	0.6	(ft)		
Height of Riser from bottom of barrel=	3.6	(ft) elevation	222.60	
Emergency Spillway =	5.5	(ft) elevation	224.50	
Total Height of Dam =	7	(ft) elevation	226.00	
Length of Emergency Spillway =	10	(ft)		
Diameter of Riser =	54	(in)		
Permanent Pond Stage =	0	(ft) elevation	219.0	

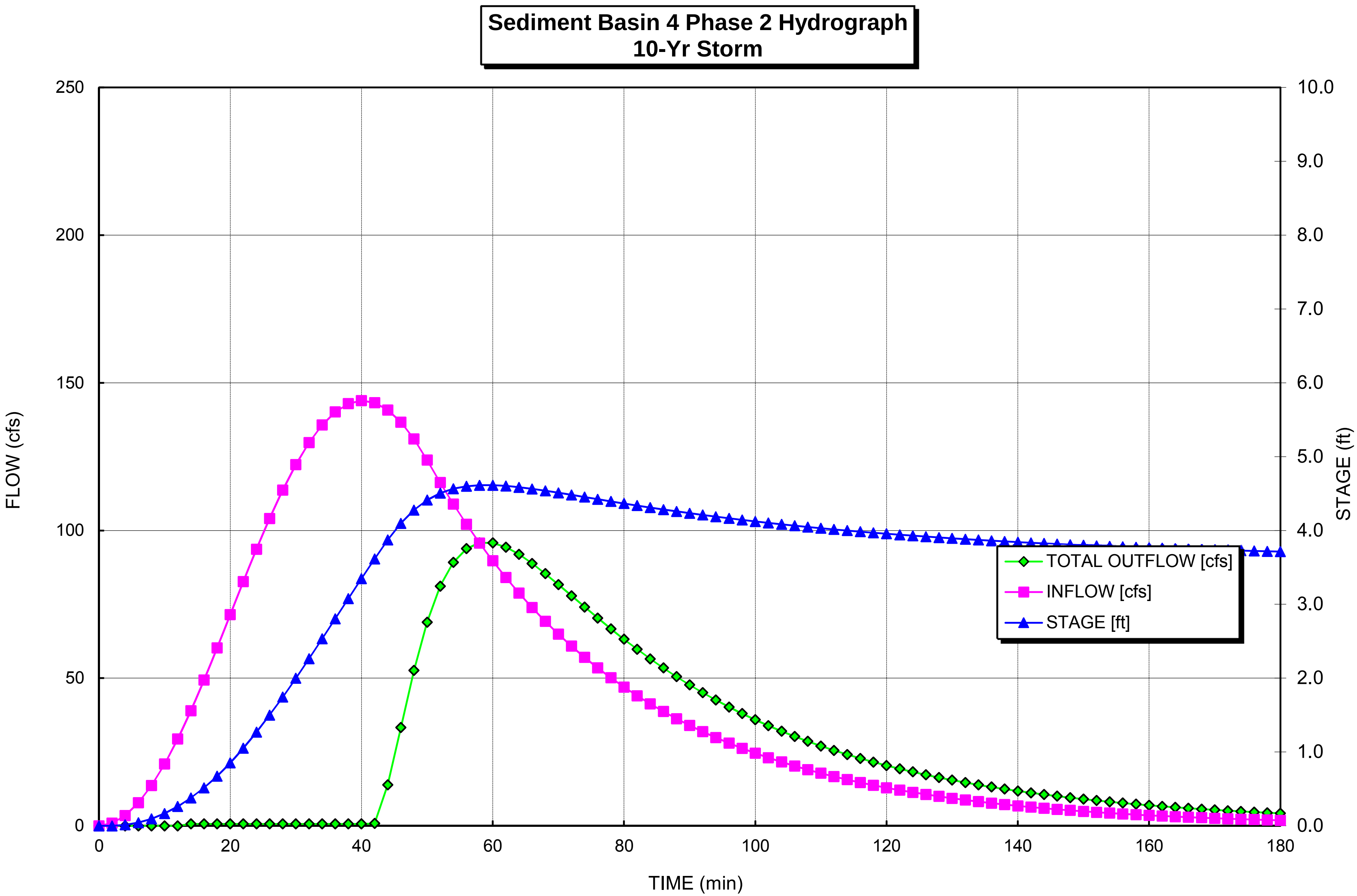
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

84%	Minimum Settling Efficiency		
4.6	ft Maximum Stage	223.61	msl elevation
95.8	cfs Peak outflow		
95.8	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.9	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	3.5	105	0.0	0.00	0.00	0.00	0.00	0.00	23.79	10,814	N/A
6	7.8	524	0.0	0.00	0.00	0.00	0.00	0.00	35.09	15,949	N/A
8	13.6	1,457	0.1	0.00	0.00	0.00	0.00	0.00	44.95	20,430	N/A
10	20.9	3,092	0.2	0.00	0.00	0.00	0.00	0.00	53.93	24,514	N/A
12	29.4	5,600	0.3	0.00	0.00	0.00	0.00	0.00	62.27	28,306	N/A
14	39.0	9,130	0.4	0.33	0.33	0.00	0.33	0.65	70.10	31,864	100%
16	49.3	13,729	0.5	0.33	0.33	0.00	0.33	0.65	77.38	35,173	100%
18	60.3	19,572	0.7	0.33	0.33	0.00	0.33	0.65	84.32	38,327	100%
20	71.5	26,724	0.9	0.33	0.33	0.00	0.33	0.65	90.93	41,330	100%
22	82.7	35,221	1.1	0.33	0.33	0.00	0.33	0.65	97.21	44,188	100%
24	93.6	45,064	1.3	0.33	0.33	0.00	0.33	0.65	103.19	46,906	100%
26	104.1	56,221	1.5	0.33	0.33	0.00	0.33	0.65	108.87	49,487	100%
28	113.7	68,629	1.7	0.33	0.33	0.00	0.33	0.65	114.26	51,936	100%
30	122.3	82,195	2.0	0.33	0.33	0.00	0.33	0.65	119.36	54,255	100%
32	129.7	96,795	2.3	0.33	0.33	0.00	0.33	0.65	124.18	56,447	100%
34	135.7	112,284	2.5	0.33	0.33	0.00	0.33	0.65	128.73	58,513	100%
36	140.1	128,491	2.8	0.33	0.33	0.00	0.33	0.65	133.00	60,456	100%
38	142.9	145,231	3.1	0.33	0.33	0.00	0.33	0.65	137.01	62,276	100%
40	144.0	162,303	3.3	0.33	0.33	0.00	0.33	0.65	140.74	63,975	100%
42	143.2	179,501	3.6	0.33	0.40	0.00	49.40	0.79	144.22	65,554	100%
44	140.8	196,595	3.9	0.33	6.91	0.00	52.33	13.83	147.43	67,015	99%
46	136.7	211,832	4.1	0.33	16.65	0.00	54.76	33.29	150.12	68,237	96%
48	131.0	224,236	4.3	0.33	26.31	0.00	56.63	52.63	152.21	69,184	92%
50	123.8	233,636	4.4	0.33	34.47	0.00	57.99	68.95	153.73	69,876	89%
52	116.2	240,219	4.5	0.33	40.56	0.00	58.92	81.13	154.77	70,348	87%
54	108.9	244,429	4.6	0.33	44.61	0.00	59.50	89.21	155.42	70,644	85%
56	102.1	246,794	4.6	0.33	46.93	0.00	59.82	93.85	155.78	70,809	84%
58	95.7	247,784	4.6	0.33	47.91	0.00	59.96	95.81	155.93	70,878	84%
60	89.7	247,771	4.6	0.33	47.89	0.00	59.96	95.79	155.93	70,877	84%
62	84.1	247,042	4.6	0.33	47.17	0.00	59.86	94.34	155.82	70,827	84%
64	78.8	245,812	4.6	0.33	45.96	0.00	59.69	91.92	155.63	70,741	85%
66	73.9	244,240	4.6	0.33	44.42	0.00	59.47	88.85	155.39	70,631	85%
68	69.3	242,445	4.5	0.33	42.69	0.00	59.23	85.37	155.11	70,505	86%
70	64.9	240,510	4.5	0.33	40.84	0.00	58.96	81.68	154.81	70,368	87%
72	60.8	238,499	4.5	0.33	38.94	0.00	58.68	77.89	154.50	70,225	87%
74	57.0	236,454	4.5	0.33	37.05	0.00	58.39	74.09	154.17	70,079	88%
76	53.5	234,408	4.4	0.33	35.17	0.00	58.10	70.35	153.85	69,932	89%
78	50.1	232,382	4.4	0.33	33.35	0.00	57.81	66.70	153.53	69,785	90%
80	47.0	230,392	4.4	0.33	31.58	0.00	57.52	63.17	153.21	69,640	90%
82	44.0	228,449	4.3	0.33	29.89	0.00	57.24	59.78	152.89	69,497	91%
84	41.3	226,559	4.3	0.33	28.27	0.00	56.97	56.54	152.59	69,357	92%

86	38.7	224,728	4.3	0.33	26.72	0.00	56.70	53.45	152.29	69,221	92%
88	36.3	222,957	4.3	0.33	25.26	0.00	56.44	50.51	151.99	69,089	93%
90	34.0	221,247	4.2	0.33	23.86	0.00	56.18	47.72	151.71	68,960	93%
92	31.9	219,599	4.2	0.33	22.54	0.00	55.94	45.08	151.44	68,835	94%
94	29.9	218,013	4.2	0.33	21.29	0.00	55.70	42.59	151.17	68,714	94%
96	28.0	216,486	4.2	0.33	20.11	0.00	55.47	40.23	150.91	68,598	95%
98	26.2	215,018	4.1	0.33	19.00	0.00	55.25	38.00	150.67	68,485	95%
100	24.6	213,608	4.1	0.33	17.95	0.00	55.03	35.89	150.43	68,376	96%
102	23.1	212,253	4.1	0.33	16.95	0.00	54.82	33.90	150.19	68,270	96%
104	21.6	210,951	4.1	0.33	16.01	0.00	54.62	32.03	149.97	68,169	96%
106	20.3	209,701	4.1	0.33	15.13	0.00	54.43	30.26	149.76	68,071	97%
108	19.0	208,501	4.0	0.33	14.30	0.00	54.24	28.59	149.55	67,976	97%
110	17.8	207,349	4.0	0.33	13.51	0.00	54.06	27.02	149.35	67,885	97%
112	16.7	206,243	4.0	0.33	12.77	0.00	53.88	25.53	149.15	67,797	98%
114	15.6	205,181	4.0	0.33	12.07	0.00	53.71	24.14	148.97	67,712	98%
116	14.7	204,161	4.0	0.33	11.41	0.00	53.55	22.82	148.79	67,631	98%
118	13.7	203,182	4.0	0.33	10.79	0.00	53.40	21.57	148.61	67,552	98%
120	12.9	202,242	4.0	0.33	10.20	0.00	53.25	20.40	148.45	67,476	98%
122	12.1	201,340	3.9	0.33	9.65	0.00	53.10	19.30	148.29	67,403	98%
124	11.3	200,473	3.9	0.33	9.13	0.00	52.96	18.25	148.13	67,333	99%
126	10.6	199,641	3.9	0.33	8.63	0.00	52.82	17.27	147.98	67,265	99%
128	9.9	198,841	3.9	0.33	8.17	0.00	52.69	16.34	147.84	67,199	99%
130	9.3	198,074	3.9	0.33	7.73	0.00	52.57	15.47	147.70	67,137	99%
132	8.7	197,336	3.9	0.33	7.32	0.00	52.45	14.64	147.57	67,076	99%
134	8.2	196,627	3.9	0.33	6.93	0.00	52.33	13.86	147.44	67,017	99%
136	7.7	195,946	3.9	0.33	6.56	0.00	52.22	13.13	147.31	66,961	99%
138	7.2	195,292	3.9	0.33	6.22	0.00	52.11	12.44	147.20	66,907	99%
140	6.7	194,663	3.8	0.33	5.89	0.00	52.01	11.78	147.08	66,855	99%
142	6.3	194,059	3.8	0.33	5.58	0.00	51.91	11.16	146.97	66,804	99%
144	5.9	193,478	3.8	0.33	5.29	0.00	51.81	10.58	146.86	66,756	99%
146	5.6	192,919	3.8	0.33	5.02	0.00	51.72	10.03	146.76	66,709	100%
148	5.2	192,382	3.8	0.33	4.76	0.00	51.63	9.51	146.66	66,664	100%
150	4.9	191,865	3.8	0.33	4.51	0.00	51.54	9.02	146.57	66,621	100%
152	4.6	191,368	3.8	0.33	4.28	0.00	51.46	8.56	146.47	66,579	100%
154	4.3	190,890	3.8	0.33	4.06	0.00	51.38	8.12	146.38	66,539	100%
156	4.0	190,430	3.8	0.33	3.85	0.00	51.30	7.71	146.30	66,500	100%
158	3.8	189,988	3.8	0.33	3.66	0.00	51.22	7.32	146.22	66,462	100%
160	3.5	189,562	3.8	0.33	3.47	0.00	51.15	6.95	146.14	66,426	100%
162	3.3	189,152	3.8	0.33	3.30	0.00	51.08	6.60	146.06	66,391	100%
164	3.1	188,757	3.8	0.33	3.14	0.00	51.01	6.27	145.99	66,358	100%
166	2.9	188,377	3.7	0.33	2.98	0.00	50.95	5.96	145.92	66,325	100%
168	2.7	188,011	3.7	0.33	2.83	0.00	50.89	5.66	145.85	66,294	100%
170	2.6	187,658	3.7	0.33	2.69	0.00	50.83	5.39	145.78	66,264	100%
172	2.4	187,318	3.7	0.33	2.56	0.00	50.77	5.12	145.72	66,235	100%
174	2.2	186,991	3.7	0.33	2.44	0.00	50.71	4.87	145.65	66,207	100%
176	2.1	186,675	3.7	0.33	2.32	0.00	50.66	4.64	145.60	66,180	100%
178	2.0	186,371	3.7	0.33	2.21	0.00	50.60	4.42	145.54	66,154	100%
180	1.8	186,078	3.7	0.33	2.10	0.00	50.55	4.21	145.48	66,128	100%
182	1.7	185,795	3.7	0.33	2.00	0.00	50.50	4.01	145.43	66,104	100%
184	1.6	185,523	3.7	0.33	1.91	0.00	50.46	3.82	145.38	66,081	100%
186	1.5	185,260	3.7	0.33	1.82	0.00	50.41	3.64	145.33	66,058	100%
188	1.4	185,006	3.7	0.33	1.73	0.00	50.37	3.47	145.28	66,036	100%
190	1.3	184,761	3.7	0.33	1.65	0.00	50.33	3.31	145.23	66,015	100%
192	1.3	184,524	3.7	0.33	1.58	0.00	50.28	3.16	145.19	65,994	100%
194	1.2	184,296	3.7	0.33	1.51	0.00	50.24	3.01	145.14	65,974	100%
196	1.1	184,075	3.7	0.33	1.44	0.00	50.21	2.88	145.10	65,955	100%
198	1.0	183,862	3.7	0.33	1.37	0.00	50.17	2.75	145.06	65,937	100%
200	1.0	183,657	3.7	0.33	1.31	0.00	50.13	2.63	145.02	65,919	100%
202	0.9	183,458	3.7	0.33	1.26	0.00	50.10	2.51	144.98	65,902	100%
204	0.9	183,265	3.7	0.33	1.20	0.00	50.06	2.40	144.95	65,885	100%



Sediment Basin 4 Phase 2 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE (ft)
TIME (min)
250
200
150
100
50
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]

Sediment Basin # 4 Brickhaven

Phase 2

25 - year Storm Event

Qp = 173.01 cfs
Tp = 40.61 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.3
Ks = 32,949

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	0.6	(ft)	
Height of Riser from bottom of barrel=	3.6	(ft) elevation	222.60
Emergency Spillway =	5.5	(ft) elevation	224.50
Total Height of Dam =	7.0	(ft) elevation	226.00
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	219.0

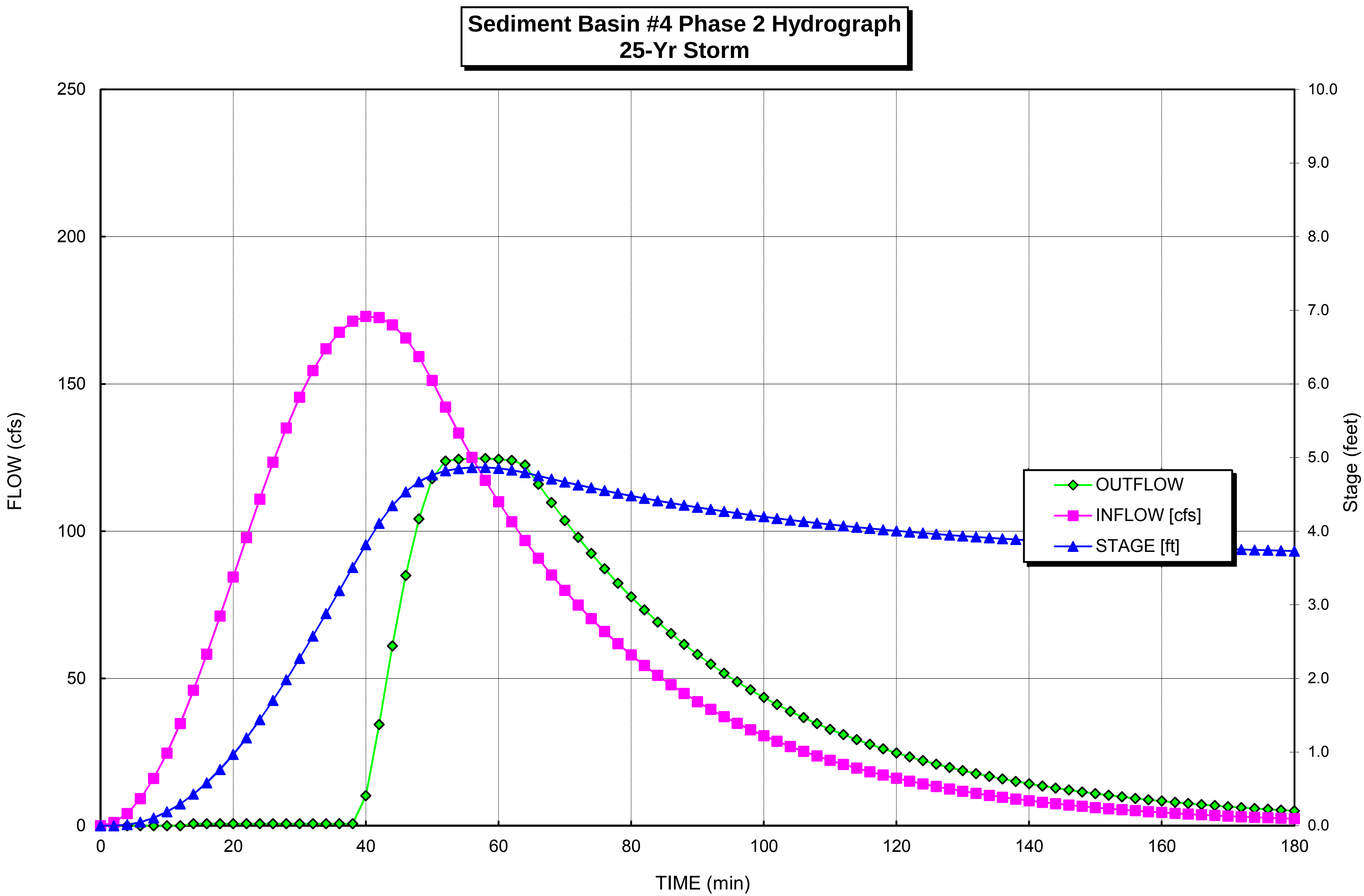
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

79%	Minimum Settling Efficiency		
4.9	ft Maximum Stage	223.9	msl elevation
124.7	cfs Peak outflow		
124.7	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	4.1	124	0.0	0.00	0.00	0.00	0.00	0.00	24.75	11,248	N/A
6	9.2	617	0.0	0.00	0.00	0.00	0.00	0.00	36.50	16,591	N/A
8	16.0	1,715	0.1	0.00	0.00	0.00	0.00	0.00	46.76	21,253	N/A
10	24.6	3,640	0.2	0.00	0.00	0.00	0.00	0.00	56.11	25,502	N/A
12	34.7	6,594	0.3	0.00	0.00	0.00	0.00	0.00	64.79	29,449	N/A
14	46.0	10,755	0.4	0.33	0.33	0.00	0.33	0.65	72.94	33,153	100%
16	58.2	16,192	0.6	0.33	0.33	0.00	0.33	0.65	80.54	36,607	100%
18	71.2	23,101	0.8	0.33	0.33	0.00	0.33	0.65	87.77	39,897	100%
20	84.5	31,562	1.0	0.33	0.33	0.00	0.33	0.65	94.66	43,029	100%
22	97.8	41,619	1.2	0.33	0.33	0.00	0.33	0.65	101.22	46,011	100%
24	110.9	53,278	1.4	0.33	0.33	0.00	0.33	0.65	107.46	48,847	100%
26	123.4	66,507	1.7	0.33	0.33	0.00	0.33	0.65	113.39	51,543	100%
28	135.0	81,236	2.0	0.33	0.33	0.00	0.33	0.65	119.02	54,101	100%
30	145.5	97,358	2.3	0.33	0.33	0.00	0.33	0.65	124.36	56,526	100%
32	154.5	114,736	2.6	0.33	0.33	0.00	0.33	0.65	129.40	58,820	100%
34	161.9	133,200	2.9	0.33	0.33	0.00	0.33	0.65	134.17	60,985	100%
36	167.6	152,555	3.2	0.33	0.33	0.00	0.33	0.65	138.65	63,022	100%
38	171.3	172,584	3.5	0.33	0.33	0.00	0.33	0.65	142.85	64,934	100%
40	172.9	193,056	3.8	0.33	5.08	0.00	51.74	10.17	146.79	66,721	100%
42	172.5	212,586	4.1	0.33	17.19	0.00	54.87	34.39	150.25	68,296	96%
44	170.1	229,161	4.3	0.33	30.51	0.00	57.35	61.01	153.01	69,549	91%
46	165.6	242,246	4.5	0.33	42.50	0.00	59.20	84.99	155.08	70,491	86%
48	159.3	251,919	4.7	0.33	52.07	0.00	60.52	104.13	156.56	71,163	82%
50	151.2	258,534	4.8	0.33	58.92	0.00	61.39	117.84	157.54	71,611	80%
52	142.1	262,535	4.8	0.33	63.18	0.00	61.92	123.83	158.13	71,878	79%
54	133.3	264,730	4.9	0.33	65.55	0.00	62.20	124.40	158.45	72,023	79%
56	125.0	265,798	4.9	0.33	66.72	0.00	62.34	124.67	158.60	72,093	79%
58	117.3	265,842	4.9	0.33	66.77	0.00	62.34	124.68	158.61	72,096	79%
60	110.0	264,954	4.9	0.33	65.80	0.00	62.23	124.46	158.48	72,038	79%
62	103.2	263,221	4.8	0.33	63.92	0.00	62.00	124.01	158.23	71,923	79%
64	96.8	260,723	4.8	0.33	61.24	0.00	61.68	122.48	157.87	71,757	79%
66	90.8	257,639	4.8	0.33	57.98	0.00	61.28	115.96	157.41	71,551	80%
68	85.2	254,619	4.7	0.33	54.84	0.00	60.88	109.67	156.96	71,347	81%
70	79.9	251,677	4.7	0.33	51.82	0.00	60.48	103.64	156.52	71,146	82%
72	74.9	248,825	4.6	0.33	48.95	0.00	60.10	97.89	156.09	70,950	83%
74	70.3	246,069	4.6	0.33	46.21	0.00	59.72	92.42	155.67	70,759	84%
76	65.9	243,412	4.6	0.33	43.62	0.00	59.36	87.24	155.26	70,573	85%
78	61.8	240,853	4.5	0.33	41.17	0.00	59.01	82.33	154.86	70,393	86%
80	58.0	238,393	4.5	0.33	38.85	0.00	58.66	77.69	154.48	70,218	87%
82	54.4	236,030	4.4	0.33	36.65	0.00	58.33	73.31	154.11	70,049	88%
84	51.0	233,761	4.4	0.33	34.59	0.00	58.01	69.17	153.75	69,885	89%

86	47.9	231,583	4.4	0.33	32.64	0.00	57.70	65.27	153.40	69,727	90%
88	44.9	229,494	4.4	0.33	30.80	0.00	57.39	61.59	153.06	69,574	91%
90	42.1	227,490	4.3	0.33	29.06	0.00	57.10	58.13	152.74	69,426	91%
92	39.5	225,568	4.3	0.33	27.43	0.00	56.82	54.86	152.42	69,284	92%
94	37.0	223,724	4.3	0.33	25.89	0.00	56.55	51.78	152.12	69,146	93%
96	34.8	221,957	4.2	0.33	24.44	0.00	56.29	48.88	151.83	69,013	93%
98	32.6	220,262	4.2	0.33	23.07	0.00	56.04	46.14	151.55	68,885	94%
100	30.6	218,637	4.2	0.33	21.78	0.00	55.79	43.56	151.28	68,762	94%
102	28.7	217,078	4.2	0.33	20.57	0.00	55.56	41.14	151.01	68,643	95%
104	26.9	215,583	4.2	0.33	19.42	0.00	55.33	38.85	150.76	68,528	95%
106	25.2	214,149	4.1	0.33	18.35	0.00	55.11	36.69	150.52	68,417	96%
108	23.7	212,773	4.1	0.33	17.33	0.00	54.90	34.66	150.28	68,311	96%
110	22.2	211,454	4.1	0.33	16.37	0.00	54.70	32.75	150.06	68,208	96%
112	20.8	210,188	4.1	0.33	15.47	0.00	54.50	30.94	149.84	68,109	97%
114	19.5	208,974	4.1	0.33	14.62	0.00	54.31	29.24	149.63	68,013	97%
116	18.3	207,808	4.0	0.33	13.82	0.00	54.13	27.64	149.43	67,921	97%
118	17.2	206,690	4.0	0.33	13.07	0.00	53.95	26.13	149.23	67,832	97%
120	16.1	205,616	4.0	0.33	12.35	0.00	53.78	24.71	149.04	67,747	98%
122	15.1	204,585	4.0	0.33	11.68	0.00	53.62	23.36	148.86	67,665	98%
124	14.2	203,596	4.0	0.33	11.05	0.00	53.46	22.10	148.69	67,585	98%
126	13.3	202,646	4.0	0.33	10.45	0.00	53.31	20.90	148.52	67,509	98%
128	12.5	201,734	3.9	0.33	9.89	0.00	53.16	19.78	148.36	67,435	98%
130	11.7	200,858	3.9	0.33	9.36	0.00	53.02	18.71	148.20	67,364	99%
132	11.0	200,017	3.9	0.33	8.86	0.00	52.89	17.71	148.05	67,295	99%
134	10.3	199,209	3.9	0.33	8.38	0.00	52.75	16.77	147.90	67,230	99%
136	9.7	198,433	3.9	0.33	7.94	0.00	52.63	15.87	147.77	67,166	99%
138	9.1	197,687	3.9	0.33	7.52	0.00	52.51	15.03	147.63	67,105	99%
140	8.5	196,970	3.9	0.33	7.12	0.00	52.39	14.24	147.50	67,046	99%
142	8.0	196,281	3.9	0.33	6.74	0.00	52.27	13.49	147.38	66,989	99%
144	7.5	195,619	3.9	0.33	6.39	0.00	52.17	12.78	147.25	66,934	99%
146	7.0	194,982	3.8	0.33	6.06	0.00	52.06	12.11	147.14	66,881	99%
148	6.6	194,370	3.8	0.33	5.74	0.00	51.96	11.48	147.03	66,830	99%
150	6.2	193,782	3.8	0.33	5.44	0.00	51.86	10.89	146.92	66,781	99%
152	5.8	193,216	3.8	0.33	5.16	0.00	51.77	10.32	146.81	66,734	99%
154	5.4	192,672	3.8	0.33	4.90	0.00	51.67	9.79	146.71	66,688	100%
156	5.1	192,148	3.8	0.33	4.64	0.00	51.59	9.29	146.62	66,644	100%
158	4.8	191,644	3.8	0.33	4.41	0.00	51.50	8.81	146.52	66,602	100%
160	4.5	191,160	3.8	0.33	4.18	0.00	51.42	8.37	146.43	66,561	100%
162	4.2	190,693	3.8	0.33	3.97	0.00	51.34	7.94	146.35	66,522	100%
164	3.9	190,244	3.8	0.33	3.77	0.00	51.27	7.54	146.26	66,484	100%
166	3.7	189,812	3.8	0.33	3.58	0.00	51.19	7.16	146.18	66,447	100%
168	3.5	189,396	3.8	0.33	3.40	0.00	51.12	6.81	146.11	66,412	100%
170	3.3	188,995	3.8	0.33	3.23	0.00	51.05	6.47	146.03	66,378	100%
172	3.1	188,609	3.8	0.33	3.07	0.00	50.99	6.15	145.96	66,345	100%
174	2.9	188,237	3.7	0.33	2.92	0.00	50.92	5.85	145.89	66,313	100%
176	2.7	187,879	3.7	0.33	2.78	0.00	50.86	5.56	145.82	66,283	100%
178	2.5	187,534	3.7	0.33	2.64	0.00	50.80	5.29	145.76	66,253	100%
180	2.4	187,201	3.7	0.33	2.52	0.00	50.75	5.03	145.69	66,225	100%
182	2.2	186,881	3.7	0.33	2.40	0.00	50.69	4.79	145.63	66,197	100%
184	2.1	186,572	3.7	0.33	2.28	0.00	50.64	4.56	145.58	66,171	100%
186	1.9	186,273	3.7	0.33	2.17	0.00	50.59	4.35	145.52	66,145	100%
188	1.8	185,986	3.7	0.33	2.07	0.00	50.54	4.14	145.46	66,120	100%
190	1.7	185,708	3.7	0.33	1.97	0.00	50.49	3.95	145.41	66,097	100%
192	1.6	185,441	3.7	0.33	1.88	0.00	50.44	3.76	145.36	66,073	100%
194	1.5	185,182	3.7	0.33	1.79	0.00	50.40	3.59	145.31	66,051	100%
196	1.4	184,933	3.7	0.33	1.71	0.00	50.36	3.42	145.27	66,030	100%
198	1.3	184,692	3.7	0.33	1.63	0.00	50.31	3.26	145.22	66,009	100%
200	1.2	184,460	3.7	0.33	1.56	0.00	50.27	3.12	145.17	65,989	100%
202	1.2	184,235	3.7	0.33	1.49	0.00	50.23	2.98	145.13	65,969	100%
204	1.1	184,018	3.7	0.33	1.42	0.00	50.20	2.84	145.09	65,950	100%
206	1.0	183,809	3.7	0.33	1.36	0.00	50.16	2.72	145.05	65,932	100%



Sediment Basin #4 Phase 2 Hydrograph
25-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
250
200
150
100
50
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1___of _2_____

Sediment Basin # 4 Brickhaven

Phase 2

100 - year Storm Event

Qp =	219.7	cfs
Tp =	41.1	minutes
dT = Max of	2	minutes
or	1.0%	of increment to peak

b = 1.3
Ks = 32,949

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	0.6	(ft)	
Height of Riser from bottom of barrel=	3.6	(ft) elevation	222.60
Emergency Spillway =	5.5	(ft) elevation	224.50
Total Height of Dam =	7.0	(ft) elevation	226.00
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	219.0

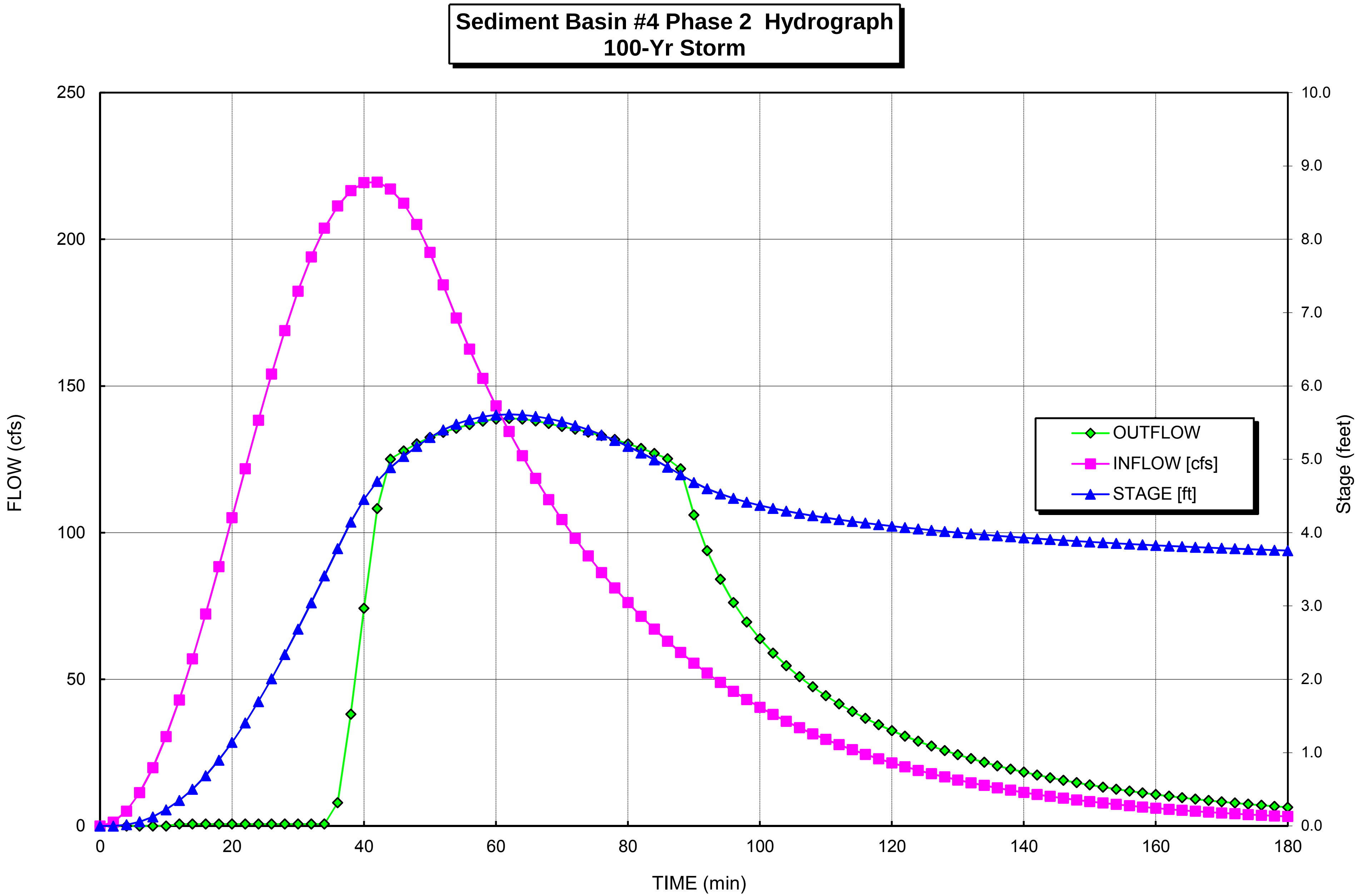
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

77%	Minimum Settling Efficiency		
5.6	ft Maximum Stage	224.6	msl elevation
138.9	cfs Peak outflow		
137.8	cfs Peak Riser/Barrel outflow		
1.1	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.3	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	5.1	153	0.0	0.00	0.00	0.00	0.00	0.00	26.06	11,844	N/A
6	11.3	763	0.1	0.00	0.00	0.00	0.00	0.00	38.43	17,470	N/A
8	19.9	2,123	0.1	0.00	0.00	0.00	0.00	0.00	49.23	22,379	N/A
10	30.5	4,507	0.2	0.00	0.00	0.00	0.00	0.00	59.08	26,855	N/A
12	43.0	8,166	0.3	0.33	0.33	0.00	0.33	0.65	68.23	31,014	100%
14	57.0	13,245	0.5	0.33	0.33	0.00	0.33	0.65	76.71	34,868	100%
16	72.3	20,008	0.7	0.33	0.33	0.00	0.33	0.65	84.77	38,532	100%
18	88.4	28,604	0.9	0.33	0.33	0.00	0.33	0.65	92.44	42,016	100%
20	105.1	39,135	1.1	0.33	0.33	0.00	0.33	0.65	99.73	45,330	100%
22	121.8	51,664	1.4	0.33	0.33	0.00	0.33	0.65	106.67	48,484	100%
24	138.3	66,203	1.7	0.33	0.33	0.00	0.33	0.65	113.27	51,485	100%
26	154.1	82,718	2.0	0.33	0.33	0.00	0.33	0.65	119.55	54,339	100%
28	168.9	101,131	2.3	0.33	0.33	0.00	0.33	0.65	125.51	57,049	100%
30	182.3	121,318	2.7	0.33	0.33	0.00	0.33	0.65	131.16	59,620	100%
32	194.0	143,113	3.0	0.33	0.33	0.00	0.33	0.65	136.52	62,055	100%
34	203.8	166,316	3.4	0.33	0.33	0.00	0.33	0.65	141.58	64,354	100%
36	211.3	190,690	3.8	0.33	3.97	0.00	51.34	7.94	146.35	66,522	100%
38	216.6	215,099	4.1	0.33	19.06	0.00	55.26	38.12	150.68	68,491	95%
40	219.3	236,513	4.5	0.33	37.10	0.00	58.40	74.20	154.18	70,083	88%
42	219.5	253,925	4.7	0.33	54.12	0.00	60.78	108.24	156.86	71,300	81%
44	217.1	267,274	4.9	0.33	68.34	0.00	62.53	125.05	158.82	72,190	79%
46	212.3	278,323	5.0	0.33	80.77	0.00	63.92	127.83	160.38	72,902	78%
48	205.0	288,454	5.2	0.33	92.66	0.00	65.15	130.31	161.78	73,536	78%
50	195.6	297,419	5.3	0.33	103.53	0.00	66.22	132.44	162.98	74,083	78%
52	184.4	304,993	5.4	0.33	112.96	0.00	67.10	134.21	163.98	74,535	78%
54	173.1	311,020	5.5	0.33	120.62	0.00	67.80	135.59	164.76	74,889	78%
56	162.5	315,526	5.5	0.33	126.43	0.24	68.31	136.85	165.33	75,151	77%
58	152.6	318,608	5.6	0.33	130.45	0.70	68.65	138.00	165.72	75,328	77%
60	143.2	320,359	5.6	0.33	132.74	1.02	68.85	138.71	165.94	75,428	77%
62	134.5	320,903	5.6	0.33	133.46	1.12	68.91	138.93	166.01	75,459	77%
64	126.2	320,368	5.6	0.33	132.75	1.02	68.85	138.71	165.94	75,428	77%
66	118.5	318,871	5.6	0.33	130.79	0.74	68.68	138.10	165.75	75,343	77%
68	111.3	316,520	5.6	0.33	127.72	0.37	68.42	137.21	165.46	75,208	77%
70	104.4	313,405	5.5	0.33	123.69	0.04	68.07	136.17	165.06	75,028	77%
72	98.0	309,597	5.5	0.33	118.80	0.00	67.63	135.27	164.57	74,806	78%
74	92.0	305,130	5.4	0.33	113.14	0.00	67.12	134.24	164.00	74,543	78%
76	86.4	300,066	5.3	0.33	106.80	0.00	66.53	133.07	163.33	74,242	78%
78	81.1	294,466	5.3	0.33	99.91	0.00	65.87	131.75	162.59	73,904	78%
80	76.1	288,390	5.2	0.33	92.58	0.00	65.15	130.29	161.77	73,532	78%
82	71.5	281,892	5.1	0.33	84.91	0.00	64.36	128.71	160.88	73,127	78%
84	67.1	275,025	5.0	0.33	77.00	0.00	63.51	127.01	159.92	72,691	78%

86	63.0	267,836	4.9	0.33	68.95	0.00	62.60	125.20	158.90	72,227	79%
88	59.1	260,372	4.8	0.33	60.87	0.00	61.63	121.74	157.81	71,734	79%
90	55.5	252,860	4.7	0.33	53.03	0.00	60.64	106.05	156.70	71,227	82%
92	52.1	246,796	4.6	0.33	46.93	0.00	59.82	93.86	155.78	70,809	84%
94	48.9	241,787	4.5	0.33	42.06	0.00	59.13	84.11	155.01	70,459	86%
96	45.9	237,565	4.5	0.33	38.07	0.00	58.55	76.15	154.35	70,159	88%
98	43.1	233,939	4.4	0.33	34.75	0.00	58.03	69.50	153.78	69,898	89%
100	40.5	230,774	4.4	0.33	31.92	0.00	57.58	63.84	153.27	69,668	90%
102	38.0	227,970	4.3	0.33	29.48	0.00	57.17	58.95	152.82	69,462	91%
104	35.7	225,456	4.3	0.33	27.33	0.00	56.81	54.67	152.41	69,275	92%
106	33.5	223,176	4.3	0.33	25.44	0.00	56.47	50.87	152.03	69,105	93%
108	31.4	221,090	4.2	0.33	23.74	0.00	56.16	47.47	151.69	68,948	93%
110	29.5	219,166	4.2	0.33	22.20	0.00	55.87	44.40	151.36	68,802	94%
112	27.7	217,380	4.2	0.33	20.80	0.00	55.60	41.60	151.07	68,666	95%
114	26.0	215,712	4.2	0.33	19.52	0.00	55.35	39.04	150.78	68,538	95%
116	24.4	214,148	4.1	0.33	18.35	0.00	55.11	36.69	150.52	68,417	96%
118	22.9	212,674	4.1	0.33	17.26	0.00	54.89	34.52	150.27	68,303	96%
120	21.5	211,283	4.1	0.33	16.25	0.00	54.67	32.50	150.03	68,195	96%
122	20.2	209,965	4.1	0.33	15.31	0.00	54.47	30.63	149.80	68,091	97%
124	19.0	208,713	4.1	0.33	14.44	0.00	54.27	28.88	149.58	67,993	97%
126	17.8	207,523	4.0	0.33	13.63	0.00	54.08	27.25	149.38	67,899	97%
128	16.7	206,388	4.0	0.33	12.86	0.00	53.91	25.73	149.18	67,809	97%
130	15.7	205,306	4.0	0.33	12.15	0.00	53.73	24.30	148.99	67,722	98%
132	14.7	204,273	4.0	0.33	11.48	0.00	53.57	22.96	148.81	67,640	98%
134	13.8	203,285	4.0	0.33	10.85	0.00	53.41	21.70	148.63	67,560	98%
136	13.0	202,340	4.0	0.33	10.26	0.00	53.26	20.52	148.46	67,484	98%
138	12.2	201,435	3.9	0.33	9.71	0.00	53.12	19.41	148.30	67,411	98%
140	11.4	200,568	3.9	0.33	9.18	0.00	52.98	18.37	148.15	67,340	99%
142	10.7	199,736	3.9	0.33	8.69	0.00	52.84	17.38	148.00	67,273	99%
144	10.1	198,939	3.9	0.33	8.23	0.00	52.71	16.45	147.86	67,207	99%
146	9.5	198,174	3.9	0.33	7.79	0.00	52.59	15.58	147.72	67,145	99%
148	8.9	197,440	3.9	0.33	7.38	0.00	52.47	14.76	147.59	67,084	99%
150	8.3	196,735	3.9	0.33	6.99	0.00	52.35	13.98	147.46	67,026	99%
152	7.8	196,058	3.9	0.33	6.62	0.00	52.24	13.25	147.33	66,970	99%
154	7.3	195,408	3.9	0.33	6.28	0.00	52.13	12.56	147.22	66,917	99%
156	6.9	194,783	3.8	0.33	5.95	0.00	52.03	11.91	147.10	66,865	99%
158	6.5	194,182	3.8	0.33	5.64	0.00	51.93	11.29	146.99	66,815	99%
160	6.1	193,605	3.8	0.33	5.35	0.00	51.83	10.71	146.89	66,766	99%
162	5.7	193,049	3.8	0.33	5.08	0.00	51.74	10.16	146.78	66,720	100%
164	5.4	192,515	3.8	0.33	4.82	0.00	51.65	9.64	146.69	66,675	100%
166	5.0	192,002	3.8	0.33	4.58	0.00	51.56	9.15	146.59	66,632	100%
168	4.7	191,507	3.8	0.33	4.34	0.00	51.48	8.69	146.50	66,591	100%
170	4.4	191,031	3.8	0.33	4.12	0.00	51.40	8.25	146.41	66,550	100%
172	4.2	190,573	3.8	0.33	3.92	0.00	51.32	7.84	146.33	66,512	100%
174	3.9	190,133	3.8	0.33	3.72	0.00	51.25	7.44	146.24	66,474	100%
176	3.7	189,708	3.8	0.33	3.54	0.00	51.18	7.07	146.16	66,439	100%
178	3.4	189,299	3.8	0.33	3.36	0.00	51.11	6.72	146.09	66,404	100%
180	3.2	188,905	3.8	0.33	3.20	0.00	51.04	6.39	146.01	66,370	100%
182	3.0	188,526	3.8	0.33	3.04	0.00	50.97	6.08	145.94	66,338	100%
184	2.8	188,160	3.7	0.33	2.89	0.00	50.91	5.78	145.88	66,307	100%
186	2.7	187,808	3.7	0.33	2.75	0.00	50.85	5.50	145.81	66,277	100%
188	2.5	187,468	3.7	0.33	2.62	0.00	50.79	5.24	145.74	66,248	100%
190	2.4	187,141	3.7	0.33	2.49	0.00	50.74	4.99	145.68	66,220	100%
192	2.2	186,825	3.7	0.33	2.38	0.00	50.68	4.75	145.62	66,193	100%
194	2.1	186,521	3.7	0.33	2.26	0.00	50.63	4.52	145.57	66,166	100%
196	1.9	186,227	3.7	0.33	2.16	0.00	50.58	4.31	145.51	66,141	100%
198	1.8	185,943	3.7	0.33	2.05	0.00	50.53	4.11	145.46	66,117	100%
200	1.7	185,670	3.7	0.33	1.96	0.00	50.48	3.92	145.41	66,093	100%
202	1.6	185,406	3.7	0.33	1.87	0.00	50.44	3.74	145.35	66,070	100%
204	1.5	185,151	3.7	0.33	1.78	0.00	50.39	3.57	145.31	66,048	100%



Sediment Basin #4 Phase 2 Hydrograph
100-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
0
50
100
150
200
250
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #5		Sheet: 1	Of: 4

Objective This basin is only active during Phase 1. Will only have skimmer.
Design the sediment basin to contain the 10-year storm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1		
Storm Event (yrs) =	10		
Total Drainage Area A (ac) =	24.3		
Disturbed Area (ac) =	24.3		
Curve Number CN =	94	Hydrographs	
Rainfall Depth P (in) =	5.17	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	144.76	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	43,740	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	62,971	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:
Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
229	0	400	-	-	-
230	1	56,327	20,491	20,491	759
231	2	61,173	58,733	79,225	2,934
232	3	66,075	63,608	142,833	5,290
233	4	71,034	68,540	211,372	7,829
234	5	79,286	75,122	286,495	10,611
235	6	88,989	84,091	370,585	13,725
236	7	104,062	96,427	467,013	17,297

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 142,833 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 66,075 *Required Surface Area Achieved*

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	142,833		
Number of Skimmers	2		
Days to Drain =	5	*assumed*	
Q (cf/day) =	14,283		0.17 cfs

Selected Skimmer Size (inches) =	4
Head on Skimmer (feet) =	0.333
Diameter of Orifice (inches) =	3.3

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

$S = (1000/CN) - 10$

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1
Storm Event (yrs) =	10
S =	0.64
Runoff Depth Q* (inches) =	4.48
Time to Peak T_p (min) =	32.70

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 142,833

Z_2 (ft) = 6 S_2 (cf) = 370,585

$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$ 1.4 Ref 2, III-8

$K_S = S_2/Z_2^{\,b} =$ 31,518

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #5		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 n^2 / sec @ 20° C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2$ = 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 7.00

Set Top of Dam at (ft) = 7.50

See Hydrograph

Emergency Spillway

Q_E (cfs) = 10-Yr Storm

Q_E (cfs) = 0.0

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 10

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.00	0.00	0.00	0.00	0.00	0.0	0.0
0.02	0.00	0.00	0.00	0.00	0.00	0.0	0.0

Construct the channel to be : 10 ft, Bottom Width (measured at top of lining)

0.5 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 2

Use Anti-Seep Collar Size (ft) = 2 x 2

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #5		Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 12 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 5.11 $\text{Pi} * (D_R/24)^2 *$ Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 0.13
Width & Length (ft) = 2
Thickness (ft) = 0.9

Anti-Vortex Device:

Diameter of Riser (in) = 12 From Hydrograph
Cylinder Diameter (in) = 18 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 16
Cylinder Height (in) = 6

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	6	6 * Barrel Diameter
Q_B (cfs) =	0.7	Peak Flow out of the barrel 10-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
0.7	0.22	0.13	0.9	0.12	0.22	0.7

Flow Depth = Tailwater, d (ft) = 0.13 0.5* Barrel Diameter (ft) = 0.50 Ref 1, 8.06.3
Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe
Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe
Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
1	3	8	9	0.5	Class B

Conclusion

This is a short term basin that can contain the 10-yr storm. It has no riser only skimmers.

HDR Computation

| Job No. 06985-10570-018 |

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) =	12	
Circumference of Riser (in) =	37.7	
eight of Riser from bottom of barrel (in) =	78	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	2	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.33	0.33
0.39	0.00	0.00	0.00			0.33	0.33
0.44	0.00	0.00	0.00			0.33	0.33
0.49	0.00	0.00	0.00			0.33	0.33
0.54	0.00	0.00	0.00			0.33	0.33
0.59	0.00	0.00	0.00			0.33	0.33
0.64	0.00	0.00	0.00			0.33	0.33
0.69	0.00	0.00	0.00			0.33	0.33
0.74	0.00	0.00	0.00			0.33	0.33
0.79	0.00	0.00	0.00			0.33	0.33
0.84	0.00	0.00	0.00			0.33	0.33
0.89	0.00	0.00	0.00			0.33	0.33
0.94	0.00	0.00	0.00			0.33	0.33
0.99	0.00	0.00	0.00			0.33	0.33
1.04	0.00	0.00	0.00			0.33	0.33
1.09	0.00	0.00	0.00			0.33	0.33
1.14	0.00	0.00	0.00			0.33	0.33
1.19	0.00	0.00	0.00			0.33	0.33
1.24	0.00	0.00	0.00			0.33	0.33
1.29	0.00	0.00	0.00			0.33	0.33
1.34	0.00	0.00	0.00			0.33	0.33
1.39	0.00	0.00	0.00			0.33	0.33
1.44	0.00	0.00	0.00			0.33	0.33
1.49	0.00	0.00	0.00			0.33	0.33
1.54	0.00	0.00	0.00			0.33	0.33
1.59	0.00	0.00	0.00			0.33	0.33

1.64	0.00	0.00	0.00	0.33	0.33
1.69	0.00	0.00	0.00	0.33	0.33
1.74	0.00	0.00	0.00	0.33	0.33
1.79	0.00	0.00	0.00	0.33	0.33
1.84	0.00	0.00	0.00	0.33	0.33
1.89	0.00	0.00	0.00	0.33	0.33
1.94	0.00	0.00	0.00	0.33	0.33
1.99	0.00	0.00	0.00	0.33	0.33
2.04	0.00	0.00	0.00	0.33	0.33
2.09	0.00	0.00	0.00	0.33	0.33
2.14	0.00	0.00	0.00	0.33	0.33
2.19	0.00	0.00	0.00	0.33	0.33
2.24	0.00	0.00	0.00	0.33	0.33
2.29	0.00	0.00	0.00	0.33	0.33
2.34	0.00	0.00	0.00	0.33	0.33
2.39	0.00	0.00	0.00	0.33	0.33
2.44	0.00	0.00	0.00	0.33	0.33
2.49	0.00	0.00	0.00	0.33	0.33
2.54	0.00	0.00	0.00	0.33	0.33
2.59	0.00	0.00	0.00	0.33	0.33
2.64	0.00	0.00	0.00	0.33	0.33
2.69	0.00	0.00	0.00	0.33	0.33
2.74	0.00	0.00	0.00	0.33	0.33
2.79	0.00	0.00	0.00	0.33	0.33
2.84	0.00	0.00	0.00	0.33	0.33
2.89	0.00	0.00	0.00	0.33	0.33
2.94	0.00	0.00	0.00	0.33	0.33
2.99	0.00	0.00	0.00	0.33	0.33
3.04	0.00	0.00	0.00	0.33	0.33
3.09	0.00	0.00	0.00	0.33	0.33
3.14	0.00	0.00	0.00	0.33	0.33
3.19	0.00	0.00	0.00	0.33	0.33
3.24	0.00	0.00	0.00	0.33	0.33
3.29	0.00	0.00	0.00	0.33	0.33
3.34	0.00	0.00	0.00	0.33	0.33
3.39	0.00	0.00	0.00	0.33	0.33
3.44	0.00	0.00	0.00	0.33	0.33
3.49	0.00	0.00	0.00	0.33	0.33
3.54	0.00	0.00	0.00	0.33	0.33
3.59	0.00	0.00	0.00	0.33	0.33
3.64	0.00	0.00	0.00	0.33	0.33
3.69	0.00	0.00	0.00	0.33	0.33
3.74	0.00	0.00	0.00	0.33	0.33
3.79	0.00	0.00	0.00	0.33	0.33
3.84	0.00	0.00	0.00	0.33	0.33
3.89	0.00	0.00	0.00	0.33	0.33
3.94	0.00	0.00	0.00	0.33	0.33
3.99	0.00	0.00	0.00	0.33	0.33

Sediment Basin # 5 Brickhaven

Phase 1

10 - year Storm Event

Qp = 144.76 cfs
Tp = 32.70 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.4
K_s = 31,518

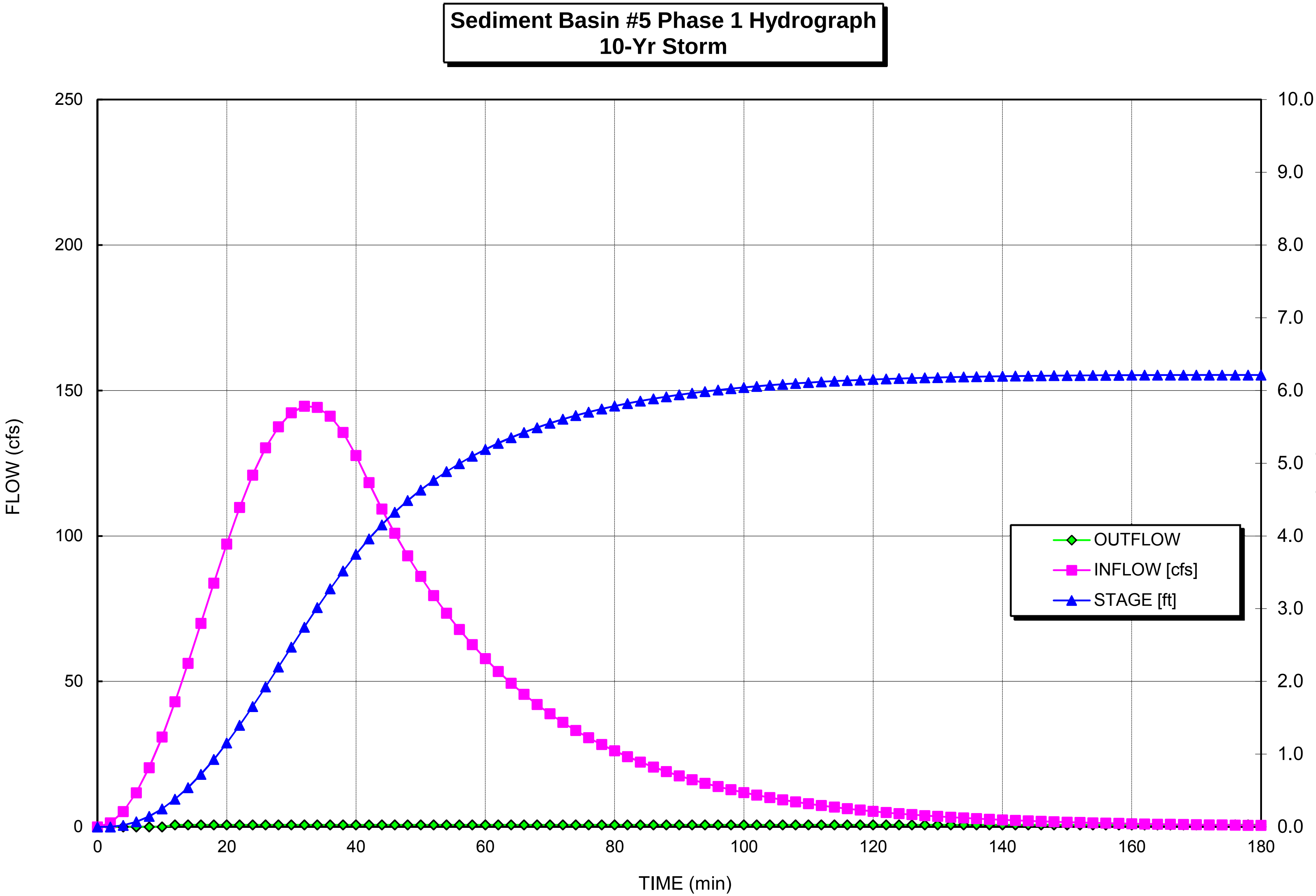
Number of Riser/Barrel Assemblies	**2**		
Diameter of Barrel =	**12**	(in)	
Height of Riser above barrel =	**5.5**	(ft)	
Height of Riser from bottom of barrel=	**6.5**	(ft) elevation	235.50
Emergency Spillway =	**7.0**	(ft) elevation	236.00
Total Height of Dam =	**7.5**	(ft) elevation	236.50
Length of Emergency Spillway =	**10**	(ft)	
Diameter of Riser =	**12**	(in)	
Permanent Pond Stage =	**0**	(ft) elevation	229.0

4.0E-03	Settling Velocity of design particle (fps)	
2	Effective number of cells (2 is construction site #)	
100%	Minimum Settling Efficiency	
6.2	ft Maximum Stage	235.21 msl elevation
0.7	cfs Peak outflow	
0.7	cfs Peak Riser/Barrel outflow	
0.0	cfs Peak Weir flow	

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.3	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	5.3	160	0.0	0.00	0.00	0.00	0.00	0.00	22.54	10,246	N/A
6	11.7	793	0.1	0.00	0.00	0.00	0.00	0.00	34.91	15,866	N/A
8	20.3	2,197	0.1	0.00	0.00	0.00	0.00	0.00	46.09	20,952	N/A
10	30.9	4,638	0.2	0.00	0.00	0.00	0.00	0.00	56.53	25,694	N/A
12	43.0	8,347	0.4	0.33	0.33	0.00	0.33	0.66	66.36	30,165	100%
14	56.2	13,428	0.5	0.33	0.33	0.00	0.33	0.66	75.56	34,345	100%
16	69.9	20,089	0.7	0.33	0.33	0.00	0.33	0.66	84.34	38,337	100%
18	83.8	28,403	0.9	0.33	0.33	0.00	0.33	0.66	92.70	42,138	100%
20	97.2	38,380	1.2	0.33	0.33	0.00	0.33	0.66	100.64	45,747	100%
22	109.8	49,969	1.4	0.33	0.33	0.00	0.33	0.66	108.16	49,164	100%
24	120.9	63,061	1.7	0.33	0.33	0.00	0.33	0.66	115.25	52,388	100%
26	130.3	77,491	1.9	0.33	0.33	0.00	0.33	0.66	121.92	55,420	100%
28	137.5	93,044	2.2	0.33	0.33	0.00	0.33	0.66	128.17	58,257	100%
30	142.3	109,465	2.5	0.33	0.33	0.00	0.33	0.66	133.98	60,900	100%
32	144.6	126,466	2.7	0.33	0.33	0.00	0.33	0.66	139.37	63,348	100%
34	144.2	143,738	3.0	0.33	0.33	0.00	0.33	0.66	144.32	65,601	100%
36	141.2	160,963	3.3	0.33	0.33	0.00	0.33	0.66	148.85	67,659	100%
38	135.6	177,822	3.5	0.33	0.33	0.00	0.33	0.66	152.95	69,524	100%
40	127.7	194,013	3.7	0.33	0.33	0.00	0.33	0.66	156.64	71,198	100%
42	118.3	209,255	4.0	0.33	0.33	0.00	0.33	0.66	159.90	72,683	100%
44	109.3	223,373	4.2	0.33	0.33	0.00	0.33	0.66	162.78	73,990	100%
46	100.9	236,406	4.3	0.33	0.33	0.00	0.33	0.66	165.32	75,144	100%
48	93.2	248,436	4.5	0.33	0.33	0.00	0.33	0.66	167.57	76,170	100%
50	86.1	259,541	4.6	0.33	0.33	0.00	0.33	0.66	169.59	77,084	100%
52	79.5	269,791	4.8	0.33	0.33	0.00	0.33	0.66	171.39	77,904	100%
54	73.4	279,252	4.9	0.33	0.33	0.00	0.33	0.66	173.01	78,640	100%
56	67.8	287,983	5.0	0.33	0.33	0.00	0.33	0.66	174.47	79,304	100%
58	62.6	296,042	5.1	0.33	0.33	0.00	0.33	0.66	175.79	79,903	100%
60	57.8	303,478	5.2	0.33	0.33	0.00	0.33	0.66	176.98	80,446	100%
62	53.4	310,340	5.3	0.33	0.33	0.00	0.33	0.66	178.07	80,939	100%
64	49.3	316,671	5.4	0.33	0.33	0.00	0.33	0.66	179.05	81,386	100%
66	45.6	322,512	5.4	0.33	0.33	0.00	0.33	0.66	179.95	81,793	100%
68	42.1	327,901	5.5	0.33	0.33	0.00	0.33	0.66	180.76	82,164	100%
70	38.9	332,872	5.5	0.33	0.33	0.00	0.33	0.66	181.51	82,502	100%
72	35.9	337,457	5.6	0.33	0.33	0.00	0.33	0.66	182.18	82,811	100%
74	33.2	341,685	5.7	0.33	0.33	0.00	0.33	0.66	182.80	83,093	100%
76	30.6	345,584	5.7	0.33	0.33	0.00	0.33	0.66	183.37	83,351	100%
78	28.3	349,179	5.7	0.33	0.33	0.00	0.33	0.66	183.89	83,587	100%
80	26.1	352,494	5.8	0.33	0.33	0.00	0.33	0.66	184.37	83,803	100%
82	24.1	355,549	5.8	0.33	0.33	0.00	0.33	0.66	184.80	84,000	100%

84	22.3	358,364	5.9	0.33	0.33	0.00	0.33	0.66	185.20	84,181	100%
86	20.6	360,958	5.9	0.33	0.33	0.00	0.33	0.66	185.56	84,347	100%
88	19.0	363,348	5.9	0.33	0.33	0.00	0.33	0.66	185.90	84,499	100%
90	17.6	365,549	5.9	0.33	0.33	0.00	0.33	0.66	186.20	84,639	100%
92	16.2	367,576	6.0	0.33	0.33	0.00	0.33	0.66	186.49	84,766	100%
94	15.0	369,441	6.0	0.33	0.33	0.00	0.33	0.66	186.74	84,884	100%
96	13.8	371,159	6.0	0.33	0.33	0.00	0.33	0.66	186.98	84,991	100%
98	12.8	372,738	6.0	0.33	0.33	0.00	0.33	0.66	187.20	85,090	100%
100	11.8	374,191	6.0	0.33	0.33	0.00	0.33	0.66	187.40	85,180	100%
102	10.9	375,527	6.1	0.33	0.33	0.00	0.33	0.66	187.58	85,263	100%
104	10.1	376,755	6.1	0.33	0.33	0.00	0.33	0.66	187.75	85,339	100%
106	9.3	377,883	6.1	0.33	0.33	0.00	0.33	0.66	187.90	85,409	100%
108	8.6	378,919	6.1	0.33	0.33	0.00	0.33	0.66	188.04	85,473	100%
110	7.9	379,869	6.1	0.33	0.33	0.00	0.33	0.66	188.17	85,531	100%
112	7.3	380,741	6.1	0.33	0.33	0.00	0.33	0.66	188.29	85,585	100%
114	6.8	381,540	6.1	0.33	0.33	0.00	0.33	0.66	188.39	85,634	100%
116	6.2	382,271	6.1	0.33	0.33	0.00	0.33	0.66	188.49	85,678	100%
118	5.8	382,941	6.1	0.33	0.33	0.00	0.33	0.66	188.58	85,719	100%
120	5.3	383,554	6.2	0.33	0.33	0.00	0.33	0.66	188.67	85,757	100%
122	4.9	384,114	6.2	0.33	0.33	0.00	0.33	0.66	188.74	85,791	100%
124	4.5	384,624	6.2	0.33	0.33	0.00	0.33	0.66	188.81	85,822	100%
126	4.2	385,090	6.2	0.33	0.33	0.00	0.33	0.66	188.87	85,850	100%
128	3.9	385,514	6.2	0.33	0.33	0.00	0.33	0.66	188.93	85,876	100%
130	3.6	385,900	6.2	0.33	0.33	0.00	0.33	0.66	188.98	85,900	100%
132	3.3	386,250	6.2	0.33	0.33	0.00	0.33	0.66	189.03	85,921	100%
134	3.1	386,567	6.2	0.33	0.33	0.00	0.33	0.66	189.07	85,940	100%
136	2.8	386,854	6.2	0.33	0.33	0.00	0.33	0.66	189.11	85,958	100%
138	2.6	387,113	6.2	0.33	0.33	0.00	0.33	0.66	189.14	85,973	100%
140	2.4	387,346	6.2	0.33	0.33	0.00	0.33	0.66	189.17	85,987	100%
142	2.2	387,555	6.2	0.33	0.33	0.00	0.33	0.66	189.20	86,000	100%
144	2.1	387,743	6.2	0.33	0.33	0.00	0.33	0.66	189.23	86,011	100%
146	1.9	387,909	6.2	0.33	0.33	0.00	0.33	0.66	189.25	86,022	100%
148	1.7	388,057	6.2	0.33	0.33	0.00	0.33	0.66	189.27	86,031	100%
150	1.6	388,188	6.2	0.33	0.33	0.00	0.33	0.66	189.28	86,038	100%
152	1.5	388,302	6.2	0.33	0.33	0.00	0.33	0.66	189.30	86,045	100%
154	1.4	388,402	6.2	0.33	0.33	0.00	0.33	0.66	189.31	86,051	100%
156	1.3	388,488	6.2	0.33	0.33	0.00	0.33	0.66	189.32	86,057	100%
158	1.2	388,562	6.2	0.33	0.33	0.00	0.33	0.66	189.33	86,061	100%
160	1.1	388,623	6.2	0.33	0.33	0.00	0.33	0.66	189.34	86,065	100%
162	1.0	388,674	6.2	0.33	0.33	0.00	0.33	0.66	189.35	86,068	100%
164	0.9	388,715	6.2	0.33	0.33	0.00	0.33	0.66	189.35	86,070	100%
166	0.9	388,747	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,072	100%
168	0.8	388,770	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,074	100%
170	0.7	388,786	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,075	100%
172	0.7	388,794	6.2	0.33	0.33	0.00	0.33	0.66	189.37	86,075	100%
174	0.6	388,796	6.2	0.33	0.33	0.00	0.33	0.66	189.37	86,075	100%
176	0.6	388,791	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,075	100%
178	0.5	388,781	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,074	100%
180	0.5	388,765	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,073	100%
182	0.5	388,744	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,072	100%
184	0.4	388,719	6.2	0.33	0.33	0.00	0.33	0.66	189.36	86,071	100%
186	0.4	388,690	6.2	0.33	0.33	0.00	0.33	0.66	189.35	86,069	100%
188	0.4	388,657	6.2	0.33	0.33	0.00	0.33	0.66	189.35	86,067	100%
190	0.3	388,621	6.2	0.33	0.33	0.00	0.33	0.66	189.34	86,065	100%
192	0.3	388,581	6.2	0.33	0.33	0.00	0.33	0.66	189.34	86,062	100%
194	0.3	388,538	6.2	0.33	0.33	0.00	0.33	0.66	189.33	86,060	100%
196	0.3	388,492	6.2	0.33	0.33	0.00	0.33	0.66	189.33	86,057	100%
198	0.2	388,444	6.2	0.33	0.33	0.00	0.33	0.66	189.32	86,054	100%
200	0.2	388,394	6.2	0.33	0.33	0.00	0.33	0.66	189.31	86,051	100%
202	0.2	388,341	6.2	0.33	0.33	0.00	0.33	0.66	189.30	86,048	100%
204	0.2	388,286	6.2	0.33	0.33	0.00	0.33	0.66	189.30	86,044	100%
206	0.2	388,229	6.2	0.33	0.33	0.00	0.33	0.66	189.29	86,041	100%


Sediment Basin #5 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE
TIME (min)
0
50
100
150
200
250
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180
OUTFLOW
INFLOW [cfs]
STAGE [ft]

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Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #6		Sheet: 1	Of: 4

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	13.6	16.8	16.8	16.8		
Disturbed Area (ac) =	13.6	16.8	16.8	16.8		
Curve Number CN =	94	94	94	94	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	87.89	100.08	120.20	152.57	Hydrographs	

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required sediment storage	30,240	cf (based on largest Phase)
Required Surface Area	435	sf/cfs of the 10-yr storm peak flow (based on the largest Phase in cfs)
Required Surface Area (SF)	43,535	of the 10-yr storm peak flow (based on the largest Phase)

Determine Shape of Basin:

Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be gretaer than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
211	0	400	-	-	-
212	1	39,836	14,743	14,743	546
213	2	42,297	41,060	55,803	2,067
214	3	44,814	43,549	99,352	3,680
215	4	47,388	46,095	145,447	5,387
216	5	50,019	48,698	194,145	7,191
217	6	52,706	51,357	245,502	9,093
218	7	55,450	54,072	299,574	11,095

Design Sediment Depth (ft) = 3
Sediment Storage (cf) = 99,352 *Required Sediment Storage Achieved*

Design Surface Area Depth (ft) = 3
Surface Area (sf) = 44,814 *Required Surface Area Achieved*

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #6		Sheet: 2	Of: 4

Select Skimmer

A. R. Jarrett Method

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Sizes (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	99,352		
Number of Skimmers	1		
Days to Drain =	5	*assumed*	
Q (cf/day) =	19,870		0.23 cfs

Selected Skimmer Size (inches) =	5
Head on Skimmer (feet) =	0.333
Diameter of Orifice (inches) =	3.9

Route the flow through the Basin

Riser is not perforated, but skimmer is attached.

$S = (1000/CN) - 10$

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	0.64	0.64	0.64	0.64
Runoff Depth Q* (inches) =	4.48	4.48	5.44	6.99
Time to Peak T_p (min) =	30.14	32.70	33.07	33.52

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 3 S_1 (cf)= 99,352

Z_2 (ft) = 6 S_2 (cf) = 245,502

$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$ 1.3 Ref 2, III-8

$K_S = S_2/Z_2^{\,b} =$ 23,686

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
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Task: Sediment Basin #6		Sheet: 3	Of: 4

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 m^2 / sec @ 20° C — Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2$ = 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 7.00

Set Top of Dam at (ft) = 7.50

See Hydrograph

Emergency Spillway

Q_E (cfs) = 100-Yr Storm

Q_E (cfs) = 7.6

Cross Section = Trapezoid

Channel Side Slope (z) = 5 (enter X for X:1)

n = 0.03 Grass Lined

Vp (ft/sec) = 5.0 Permissible Velocity for lining — Ref 2, II-7

Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining

Bottom Width, b (ft) = 10

Calculate Required Depth of Spillway:

Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ — Q=VA

$Z_{req}=Qn/1.49s^{0.5}$ — Area (A)= bd+z(d^2)

$Z_{av}=AR^{2/3}$ — R=Area/(b+2d((z^2)+1)^.5)

Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.31	3.62	1.53	0.27	1.53	2.1	0.2
0.02	0.26	2.89	1.08	0.23	1.08	2.6	0.3

Construct the channel to be : 10 ft, Bottom Width (measured at top of lining)

0.5 ft, depth (measured at top of lining)

1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia

Anti-Seep Collar Size (ft) = 6

Use Anti-Seep Collar Size (ft) = 6 x 6

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #6	Sheet: 4	Of: 4

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 54 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 103.38 $Pi * (D_R/24)^2$ * Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 2.73
Width & Length (ft) = 5.5
Thickness (ft) = 2.4

Anti-Vortex Device:

Diameter of Riser (in) = 54 From Hydrograph
Cylinder Diameter (in) = 78 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 16
Cylinder Height (in) = 25

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	18	6 * Barrel Diameter
Q_B (cfs) =	14.0	Peak Flow out of the barrel 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
14.0	4.59	0.43	8.7	0.39	4.59	1.6

Flow Depth = Tailwater, d (ft) = 0.43 0.5* Barrel Diameter (ft) = 1.50 Ref 1, 8.06.3
Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe
Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe
Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
3	9	12	15	0.5	Class B

Conclusion

The basin can contain the 10-yr storm and pass the 100-yr storm without overtopping the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) = 54
Circumference of Riser (in) = 169.6
eight of Riser from bottom of barrel (in) = 78 From Hydrograph
Vertical spacing between holes (in) = 0 center to center
Water Stage increment (ft) 0.05

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge
C_d = 0.6 coefficient of discharge
A = sf, cross sectional area
g = 32.2 ft/sec^2, gravity
h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	1	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.23	0.23
0.39	0.00	0.00	0.00			0.23	0.23
0.44	0.00	0.00	0.00			0.23	0.23
0.49	0.00	0.00	0.00			0.23	0.23
0.54	0.00	0.00	0.00			0.23	0.23
0.59	0.00	0.00	0.00			0.23	0.23
0.64	0.00	0.00	0.00			0.23	0.23
0.69	0.00	0.00	0.00			0.23	0.23
0.74	0.00	0.00	0.00			0.23	0.23
0.79	0.00	0.00	0.00			0.23	0.23
0.84	0.00	0.00	0.00			0.23	0.23
0.89	0.00	0.00	0.00			0.23	0.23
0.94	0.00	0.00	0.00			0.23	0.23
0.99	0.00	0.00	0.00			0.23	0.23
1.04	0.00	0.00	0.00			0.23	0.23
1.09	0.00	0.00	0.00			0.23	0.23
1.14	0.00	0.00	0.00			0.23	0.23
1.19	0.00	0.00	0.00			0.23	0.23
1.24	0.00	0.00	0.00			0.23	0.23
1.29	0.00	0.00	0.00			0.23	0.23
1.34	0.00	0.00	0.00			0.23	0.23
1.39	0.00	0.00	0.00			0.23	0.23
1.44	0.00	0.00	0.00			0.23	0.23
1.49	0.00	0.00	0.00			0.23	0.23
1.54	0.00	0.00	0.00			0.23	0.23
1.59	0.00	0.00	0.00			0.23	0.23

HDR Computation

Job No. 06985-10570-018

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 2	Of 2

1.64	0.00	0.00	0.00	0.23	0.23
1.69	0.00	0.00	0.00	0.23	0.23
1.74	0.00	0.00	0.00	0.23	0.23
1.79	0.00	0.00	0.00	0.23	0.23
1.84	0.00	0.00	0.00	0.23	0.23
1.89	0.00	0.00	0.00	0.23	0.23
1.94	0.00	0.00	0.00	0.23	0.23
1.99	0.00	0.00	0.00	0.23	0.23
2.04	0.00	0.00	0.00	0.23	0.23
2.09	0.00	0.00	0.00	0.23	0.23
2.14	0.00	0.00	0.00	0.23	0.23
2.19	0.00	0.00	0.00	0.23	0.23
2.24	0.00	0.00	0.00	0.23	0.23
2.29	0.00	0.00	0.00	0.23	0.23
2.34	0.00	0.00	0.00	0.23	0.23
2.39	0.00	0.00	0.00	0.23	0.23
2.44	0.00	0.00	0.00	0.23	0.23
2.49	0.00	0.00	0.00	0.23	0.23
2.54	0.00	0.00	0.00	0.23	0.23
2.59	0.00	0.00	0.00	0.23	0.23
2.64	0.00	0.00	0.00	0.23	0.23
2.69	0.00	0.00	0.00	0.23	0.23
2.74	0.00	0.00	0.00	0.23	0.23
2.79	0.00	0.00	0.00	0.23	0.23
2.84	0.00	0.00	0.00	0.23	0.23
2.89	0.00	0.00	0.00	0.23	0.23
2.94	0.00	0.00	0.00	0.23	0.23
2.99	0.00	0.00	0.00	0.23	0.23
3.04	0.00	0.00	0.00	0.23	0.23
3.09	0.00	0.00	0.00	0.23	0.23
3.14	0.00	0.00	0.00	0.23	0.23
3.19	0.00	0.00	0.00	0.23	0.23
3.24	0.00	0.00	0.00	0.23	0.23
3.29	0.00	0.00	0.00	0.23	0.23
3.34	0.00	0.00	0.00	0.23	0.23
3.39	0.00	0.00	0.00	0.23	0.23
3.44	0.00	0.00	0.00	0.23	0.23
3.49	0.00	0.00	0.00	0.23	0.23
3.54	0.00	0.00	0.00	0.23	0.23
3.59	0.00	0.00	0.00	0.23	0.23
3.64	0.00	0.00	0.00	0.23	0.23
3.69	0.00	0.00	0.00	0.23	0.23
3.74	0.00	0.00	0.00	0.23	0.23
3.79	0.00	0.00	0.00	0.23	0.23
3.84	0.00	0.00	0.00	0.23	0.23
3.89	0.00	0.00	0.00	0.23	0.23
3.94	0.00	0.00	0.00	0.23	0.23
3.99	0.00	0.00	0.00	0.23	0.23

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: _1___of __2__

Sediment Basin # 6 Brickhaven

Phase 1

10 - year Storm Event

Qp = 87.89 cfs

Tp = 30.14 minutes

dT = Max of **2** minutes

or **1.0%** of increment to peak

b = 1.3

K_s = 23,686

Number of Riser/Barrel Assemblies	**1**		
Diameter of Barrel =	**36**	(in)	
Height of Riser above barrel =	**3.5**	(ft)	
Height of Riser from bottom of barrel=	**6.5**	(ft) elevation	217.50
Emergency Spillway =	**7.0**	(ft) elevation	218.00
Total Height of Dam =	**7.5**	(ft) elevation	218.50
Length of Emergency Spillway =	**10**	(ft)	
Diameter of Riser =	**54**	(in)	
Permanent Pond Stage =	**0**	(ft) elevation	211.0

4.0E-03 Settling Velocity of design particle (fps)

2 Effective number of cells (2 is construction site #)

100% Minimum Settling Efficiency

5.5 ft Maximum Stage 216.50 msl elevation

0.2 cfs Peak outflow

0.2 cfs Peak Riser/Barrel outflow

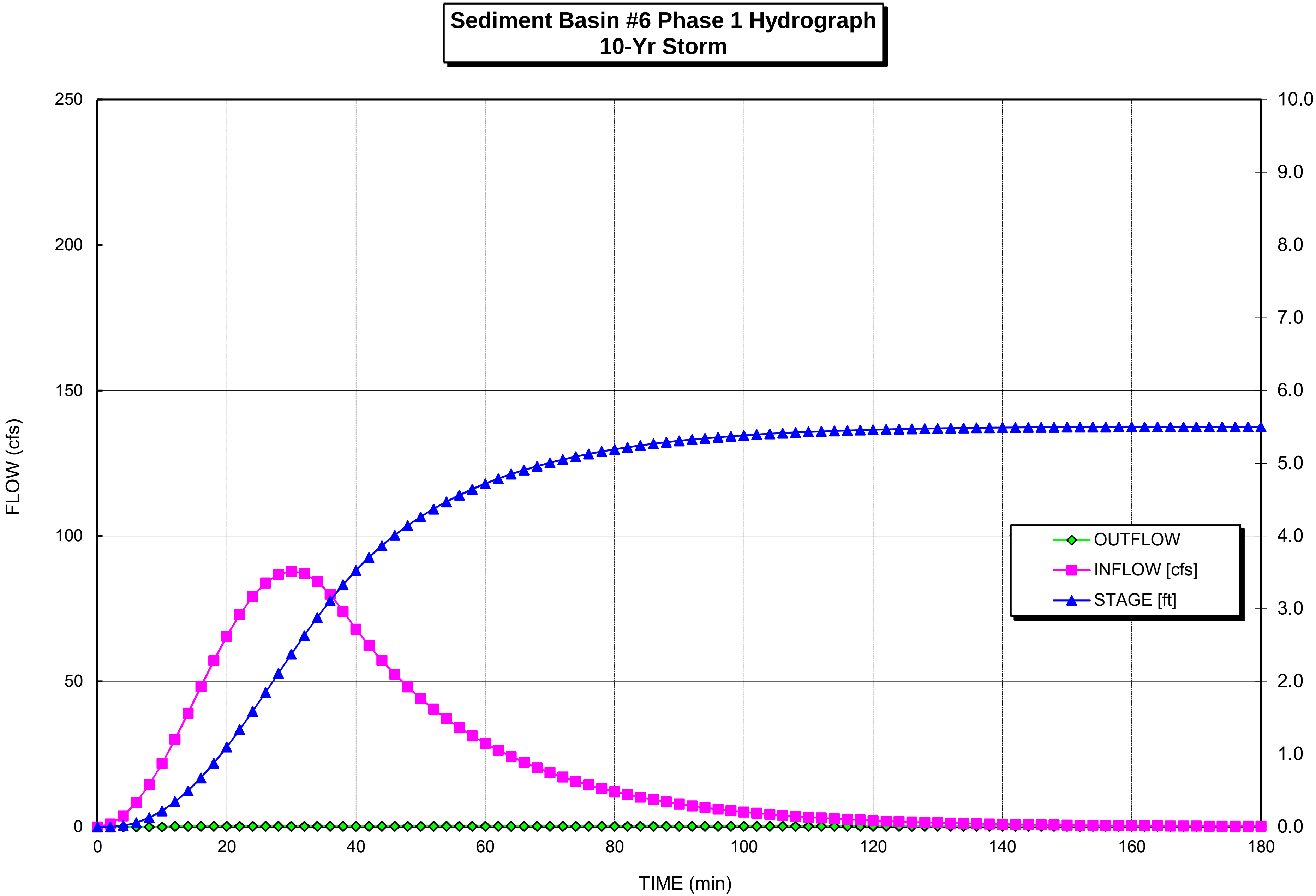
0.0 cfs Peak Weir flow

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACIT Y [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimate d Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	3.8	114	0.0	0.00	0.00	0.00	0.00	0.00	19.54	8,881	N/A
6	8.3	566	0.1	0.00	0.00	0.00	0.00	0.00	28.41	12,911	N/A
8	14.4	1,564	0.1	0.00	0.00	0.00	0.00	0.00	36.03	16,375	N/A
10	21.8	3,293	0.2	0.00	0.00	0.00	0.00	0.00	42.88	19,489	N/A
12	30.1	5,906	0.3	0.23	0.23	0.00	0.23	0.23	49.15	22,342	100%
14	39.0	9,493	0.5	0.23	0.23	0.00	0.23	0.23	54.92	24,963	100%
16	48.2	14,150	0.7	0.23	0.23	0.00	0.23	0.23	60.29	27,405	100%
18	57.1	19,905	0.9	0.23	0.23	0.00	0.23	0.23	65.30	29,681	100%
20	65.5	26,735	1.1	0.23	0.23	0.00	0.23	0.23	69.96	31,800	100%
22	73.0	34,572	1.3	0.23	0.23	0.00	0.23	0.23	74.29	33,770	100%
24	79.2	43,303	1.6	0.23	0.23	0.00	0.23	0.23	78.31	35,595	100%
26	83.9	52,777	1.8	0.23	0.23	0.00	0.23	0.23	82.02	37,280	100%
28	86.8	62,812	2.1	0.23	0.23	0.00	0.23	0.23	85.42	38,828	100%
30	87.9	73,200	2.4	0.23	0.23	0.00	0.23	0.23	88.53	40,243	100%
32	87.1	83,719	2.6	0.23	0.23	0.00	0.23	0.23	91.36	41,526	100%
34	84.4	94,140	2.9	0.23	0.23	0.00	0.23	0.23	93.90	42,681	100%
36	80.0	104,239	3.1	0.23	0.23	0.00	0.23	0.23	96.16	43,710	100%
38	74.1	113,806	3.3	0.23	0.23	0.00	0.23	0.23	98.16	44,616	100%
40	68.0	122,668	3.5	0.23	0.23	0.00	0.23	0.23	99.89	45,405	100%
42	62.3	130,796	3.7	0.23	0.23	0.00	0.23	0.23	101.40	46,091	100%
44	57.2	138,250	3.9	0.23	0.23	0.00	0.23	0.23	102.72	46,692	100%
46	52.5	145,086	4.0	0.23	0.23	0.00	0.23	0.23	103.89	47,222	100%
48	48.1	151,354	4.1	0.23	0.23	0.00	0.23	0.23	104.92	47,692	100%
50	44.2	157,102	4.3	0.23	0.23	0.00	0.23	0.23	105.84	48,109	100%
52	40.5	162,373	4.4	0.23	0.23	0.00	0.23	0.23	106.66	48,482	100%
54	37.2	167,206	4.5	0.23	0.23	0.00	0.23	0.23	107.39	48,815	100%
56	34.1	171,637	4.6	0.23	0.23	0.00	0.23	0.23	108.05	49,114	100%
58	31.3	175,700	4.6	0.23	0.23	0.00	0.23	0.23	108.64	49,384	100%
60	28.7	179,425	4.7	0.23	0.23	0.00	0.23	0.23	109.18	49,627	100%
62	26.3	182,840	4.8	0.23	0.23	0.00	0.23	0.23	109.66	49,846	100%
64	24.1	185,970	4.8	0.23	0.23	0.00	0.23	0.23	110.10	50,044	100%
66	22.1	188,839	4.9	0.23	0.23	0.00	0.23	0.23	110.49	50,224	100%
68	20.3	191,469	5.0	0.23	0.23	0.00	0.23	0.23	110.85	50,386	100%
70	18.6	193,880	5.0	0.23	0.23	0.00	0.23	0.23	111.17	50,534	100%
72	17.1	196,088	5.1	0.23	0.23	0.00	0.23	0.23	111.47	50,668	100%
74	15.7	198,112	5.1	0.23	0.23	0.00	0.23	0.23	111.74	50,790	100%
76	14.4	199,967	5.1	0.23	0.23	0.00	0.23	0.23	111.98	50,900	100%
78	13.2	201,666	5.2	0.23	0.23	0.00	0.23	0.23	112.20	51,001	100%
80	12.1	203,222	5.2	0.23	0.23	0.00	0.23	0.23	112.40	51,093	100%
82	11.1	204,648	5.2	0.23	0.23	0.00	0.23	0.23	112.59	51,176	100%

84	10.2	205,953	5.2	0.23	0.23	0.00	0.23	0.23	112.76	51,252	100%
86	9.3	207,148	5.3	0.23	0.23	0.00	0.23	0.23	112.91	51,322	100%
88	8.6	208,242	5.3	0.23	0.23	0.00	0.23	0.23	113.05	51,385	100%
90	7.9	209,244	5.3	0.23	0.23	0.00	0.23	0.23	113.17	51,443	100%
92	7.2	210,160	5.3	0.23	0.23	0.00	0.23	0.23	113.29	51,495	100%
94	6.6	210,999	5.3	0.23	0.23	0.00	0.23	0.23	113.40	51,543	100%
96	6.1	211,766	5.4	0.23	0.23	0.00	0.23	0.23	113.49	51,587	100%
98	5.6	212,467	5.4	0.23	0.23	0.00	0.23	0.23	113.58	51,627	100%
100	5.1	213,108	5.4	0.23	0.23	0.00	0.23	0.23	113.66	51,663	100%
102	4.7	213,693	5.4	0.23	0.23	0.00	0.23	0.23	113.73	51,696	100%
104	4.3	214,228	5.4	0.23	0.23	0.00	0.23	0.23	113.80	51,727	100%
106	3.9	214,717	5.4	0.23	0.23	0.00	0.23	0.23	113.86	51,754	100%
108	3.6	215,163	5.4	0.23	0.23	0.00	0.23	0.23	113.91	51,779	100%
110	3.3	215,570	5.4	0.23	0.23	0.00	0.23	0.23	113.96	51,802	100%
112	3.0	215,940	5.4	0.23	0.23	0.00	0.23	0.23	114.01	51,823	100%
114	2.8	216,278	5.4	0.23	0.23	0.00	0.23	0.23	114.05	51,842	100%
116	2.6	216,586	5.5	0.23	0.23	0.00	0.23	0.23	114.09	51,859	100%
118	2.4	216,866	5.5	0.23	0.23	0.00	0.23	0.23	114.12	51,875	100%
120	2.2	217,121	5.5	0.23	0.23	0.00	0.23	0.23	114.16	51,889	100%
122	2.0	217,352	5.5	0.23	0.23	0.00	0.23	0.23	114.18	51,902	100%
124	1.8	217,562	5.5	0.23	0.23	0.00	0.23	0.23	114.21	51,914	100%
126	1.7	217,752	5.5	0.23	0.23	0.00	0.23	0.23	114.23	51,924	100%
128	1.5	217,924	5.5	0.23	0.23	0.00	0.23	0.23	114.25	51,934	100%
130	1.4	218,080	5.5	0.23	0.23	0.00	0.23	0.23	114.27	51,943	100%
132	1.3	218,221	5.5	0.23	0.23	0.00	0.23	0.23	114.29	51,950	100%
134	1.2	218,348	5.5	0.23	0.23	0.00	0.23	0.23	114.31	51,957	100%
136	1.1	218,461	5.5	0.23	0.23	0.00	0.23	0.23	114.32	51,964	100%
138	1.0	218,564	5.5	0.23	0.23	0.00	0.23	0.23	114.33	51,970	100%
140	0.9	218,655	5.5	0.23	0.23	0.00	0.23	0.23	114.34	51,975	100%
142	0.8	218,737	5.5	0.23	0.23	0.00	0.23	0.23	114.35	51,979	100%
144	0.8	218,810	5.5	0.23	0.23	0.00	0.23	0.23	114.36	51,983	100%
146	0.7	218,874	5.5	0.23	0.23	0.00	0.23	0.23	114.37	51,987	100%
148	0.6	218,931	5.5	0.23	0.23	0.00	0.23	0.23	114.38	51,990	100%
150	0.6	218,980	5.5	0.23	0.23	0.00	0.23	0.23	114.38	51,993	100%
152	0.5	219,024	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,995	100%
154	0.5	219,061	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,997	100%
156	0.5	219,094	5.5	0.23	0.23	0.00	0.23	0.23	114.40	51,999	100%
158	0.4	219,121	5.5	0.23	0.23	0.00	0.23	0.23	114.40	52,000	100%
160	0.4	219,143	5.5	0.23	0.23	0.00	0.23	0.23	114.40	52,002	100%
162	0.4	219,162	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,003	100%
164	0.3	219,177	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,004	100%
166	0.3	219,188	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,004	100%
168	0.3	219,196	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
170	0.2	219,201	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
172	0.2	219,203	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
174	0.2	219,203	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
176	0.2	219,201	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
178	0.2	219,196	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,005	100%
180	0.2	219,190	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,004	100%
182	0.1	219,182	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,004	100%
184	0.1	219,172	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,003	100%
186	0.1	219,161	5.5	0.23	0.23	0.00	0.23	0.23	114.41	52,003	100%
188	0.1	219,148	5.5	0.23	0.23	0.00	0.23	0.23	114.40	52,002	100%
190	0.1	219,135	5.5	0.23	0.23	0.00	0.23	0.23	114.40	52,001	100%
192	0.1	219,120	5.5	0.23	0.23	0.00	0.23	0.23	114.40	52,000	100%
194	0.1	219,104	5.5	0.23	0.23	0.00	0.23	0.23	114.40	51,999	100%
196	0.1	219,087	5.5	0.23	0.23	0.00	0.23	0.23	114.40	51,999	100%
198	0.1	219,069	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,998	100%
200	0.1	219,050	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,997	100%
202	0.1	219,031	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,995	100%
204	0.1	219,011	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,994	100%
206	0.1	218,990	5.5	0.23	0.23	0.00	0.23	0.23	114.39	51,993	100%



Sediment Basin #6 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
250
200
150
100
50
0
STAGE
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Sediment Basin # 6 Brickhaven

Phase 2

10 - year Storm Event

Qp = 100.08 cfs
Tp = 32.70 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

b = 1.3
Ks = 23,686

Number of Riser/Barrel Assemblies	1			
Diameter of Barrel =	36	(in)		
Height of Riser above barrel =	3.5	(ft)		
Height of Riser from bottom of barrel=	6.5	(ft) elevation	217.50	
Emergency Spillway =	7	(ft) elevation	218.00	
Total Height of Dam =	7.5	(ft) elevation	218.50	
Length of Emergency Spillway =	10	(ft)		
Diameter of Riser =	54	(in)		
Permanent Pond Stage =	0	(ft) elevation	211.0	

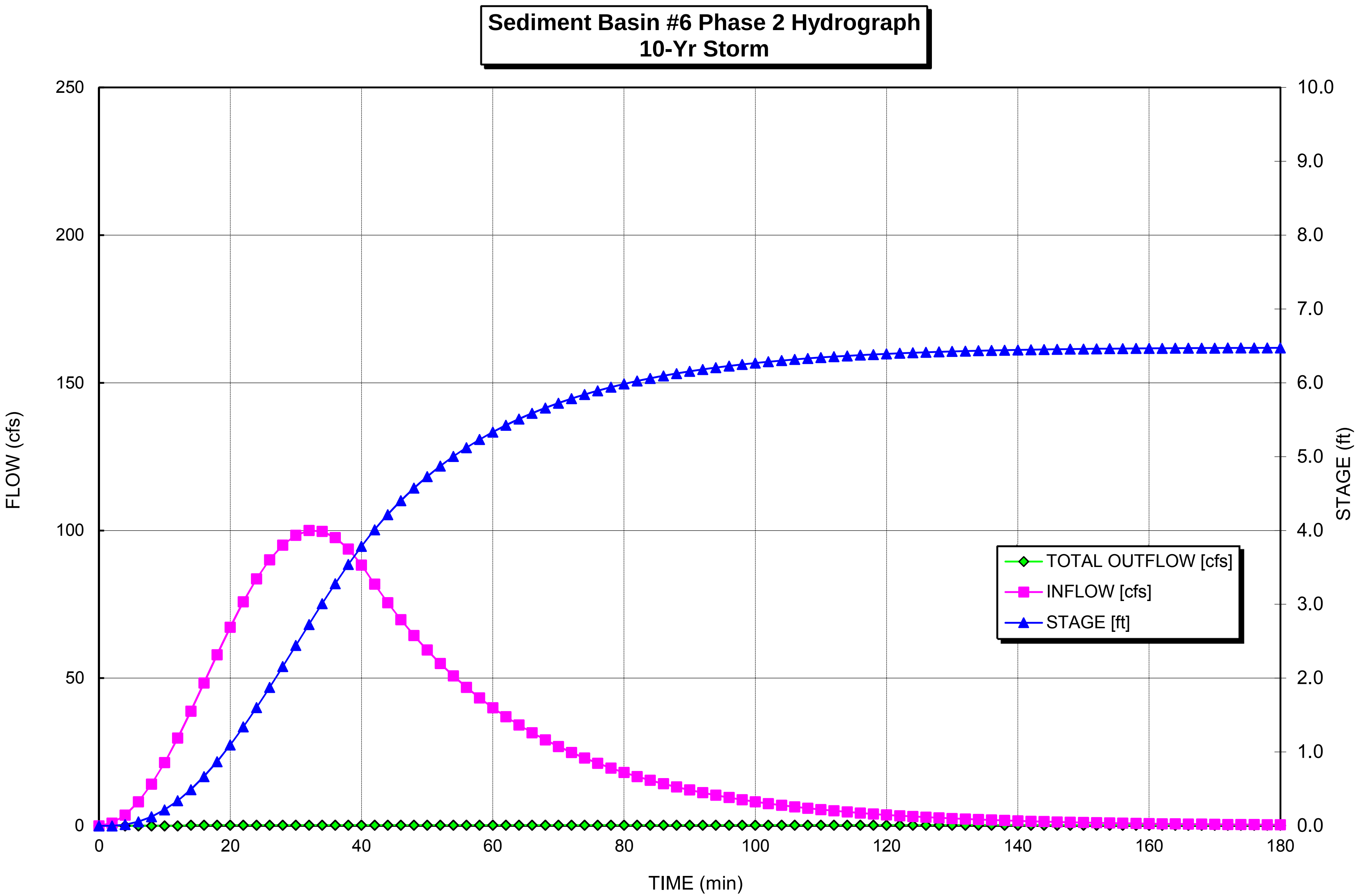
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency		
6.5	ft Maximum Stage	217.47	msl elevation
0.2	cfs Peak outflow		
0.2	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	0.9	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	3.6	110	0.0	0.00	0.00	0.00	0.00	0.00	19.39	8,814	N/A
6	8.1	548	0.1	0.00	0.00	0.00	0.00	0.00	28.20	12,818	N/A
8	14.1	1,519	0.1	0.00	0.00	0.00	0.00	0.00	35.78	16,264	N/A
10	21.4	3,206	0.2	0.00	0.00	0.00	0.00	0.00	42.61	19,369	N/A
12	29.7	5,771	0.3	0.00	0.00	0.00	0.00	0.00	48.89	22,221	N/A
14	38.8	9,338	0.5	0.23	0.23	0.00	0.23	0.23	54.71	24,867	100%
16	48.4	13,971	0.7	0.23	0.23	0.00	0.23	0.23	60.11	27,323	100%
18	57.9	19,746	0.9	0.23	0.23	0.00	0.23	0.23	65.17	29,625	100%
20	67.2	26,670	1.1	0.23	0.23	0.00	0.23	0.23	69.92	31,782	100%
22	75.9	34,710	1.3	0.23	0.23	0.00	0.23	0.23	74.36	33,801	100%
24	83.6	43,788	1.6	0.23	0.23	0.00	0.23	0.23	78.51	35,688	100%
26	90.1	53,791	1.9	0.23	0.23	0.00	0.23	0.23	82.38	37,446	100%
28	95.1	64,571	2.2	0.23	0.23	0.00	0.23	0.23	85.98	39,080	100%
30	98.4	75,951	2.4	0.23	0.23	0.00	0.23	0.23	89.30	40,591	100%
32	100.0	87,732	2.7	0.23	0.23	0.00	0.23	0.23	92.36	41,983	100%
34	99.7	99,700	3.0	0.23	0.23	0.00	0.23	0.23	95.17	43,257	100%
36	97.6	111,636	3.3	0.23	0.23	0.00	0.23	0.23	97.71	44,416	100%
38	93.7	123,319	3.5	0.23	0.23	0.00	0.23	0.23	100.02	45,461	100%
40	88.3	134,539	3.8	0.23	0.23	0.00	0.23	0.23	102.07	46,396	100%
42	81.8	145,105	4.0	0.23	0.23	0.00	0.23	0.23	103.89	47,224	100%
44	75.5	154,893	4.2	0.23	0.23	0.00	0.23	0.23	105.49	47,950	100%
46	69.8	163,930	4.4	0.23	0.23	0.00	0.23	0.23	106.90	48,590	100%
48	64.4	172,275	4.6	0.23	0.23	0.00	0.23	0.23	108.15	49,157	100%
50	59.5	179,980	4.7	0.23	0.23	0.00	0.23	0.23	109.26	49,662	100%
52	55.0	187,093	4.9	0.23	0.23	0.00	0.23	0.23	110.25	50,115	100%
54	50.8	193,662	5.0	0.23	0.23	0.00	0.23	0.23	111.14	50,520	100%
56	46.9	199,725	5.1	0.23	0.23	0.00	0.23	0.23	111.95	50,886	100%
58	43.3	205,324	5.2	0.23	0.23	0.00	0.23	0.23	112.67	51,216	100%
60	40.0	210,492	5.3	0.23	0.23	0.00	0.23	0.23	113.33	51,514	100%
62	36.9	215,263	5.4	0.23	0.23	0.00	0.23	0.23	113.93	51,785	100%
64	34.1	219,668	5.5	0.23	0.23	0.00	0.23	0.23	114.47	52,031	100%
66	31.5	223,734	5.6	0.23	0.23	0.00	0.23	0.23	114.96	52,254	100%
68	29.1	227,487	5.7	0.23	0.23	0.00	0.23	0.23	115.41	52,458	100%
70	26.9	230,951	5.7	0.23	0.23	0.00	0.23	0.23	115.82	52,644	100%
72	24.8	234,148	5.8	0.23	0.23	0.00	0.23	0.23	116.19	52,813	100%
74	22.9	237,098	5.8	0.23	0.23	0.00	0.23	0.23	116.53	52,968	100%
76	21.2	239,821	5.9	0.23	0.23	0.00	0.23	0.23	116.84	53,110	100%
78	19.6	242,334	5.9	0.23	0.23	0.00	0.23	0.23	117.13	53,239	100%
80	18.1	244,653	6.0	0.23	0.23	0.00	0.23	0.23	117.39	53,358	100%
82	16.7	246,792	6.0	0.23	0.23	0.00	0.23	0.23	117.63	53,466	100%
84	15.4	248,766	6.1	0.23	0.23	0.00	0.23	0.23	117.85	53,566	100%

86	14.2	250,587	6.1	0.23	0.23	0.00	0.23	0.23	118.05	53,657	100%
88	13.1	252,266	6.1	0.23	0.23	0.00	0.23	0.23	118.23	53,741	100%
90	12.1	253,815	6.2	0.23	0.23	0.00	0.23	0.23	118.40	53,818	100%
92	11.2	255,244	6.2	0.23	0.23	0.00	0.23	0.23	118.56	53,889	100%
94	10.4	256,561	6.2	0.23	0.23	0.00	0.23	0.23	118.70	53,954	100%
96	9.6	257,776	6.2	0.23	0.23	0.00	0.23	0.23	118.83	54,013	100%
98	8.8	258,895	6.2	0.23	0.23	0.00	0.23	0.23	118.95	54,068	100%
100	8.2	259,927	6.3	0.23	0.23	0.00	0.23	0.23	119.06	54,119	100%
102	7.5	260,878	6.3	0.23	0.23	0.00	0.23	0.23	119.16	54,165	100%
104	7.0	261,754	6.3	0.23	0.23	0.00	0.23	0.23	119.26	54,207	100%
106	6.4	262,561	6.3	0.23	0.23	0.00	0.23	0.23	119.34	54,246	100%
108	5.9	263,304	6.3	0.23	0.23	0.00	0.23	0.23	119.42	54,282	100%
110	5.5	263,989	6.3	0.23	0.23	0.00	0.23	0.23	119.49	54,315	100%
112	5.1	264,618	6.4	0.23	0.23	0.00	0.23	0.23	119.56	54,345	100%
114	4.7	265,198	6.4	0.23	0.23	0.00	0.23	0.23	119.62	54,373	100%
116	4.3	265,731	6.4	0.23	0.23	0.00	0.23	0.23	119.68	54,399	100%
118	4.0	266,222	6.4	0.23	0.23	0.00	0.23	0.23	119.73	54,422	100%
120	3.7	266,673	6.4	0.23	0.23	0.00	0.23	0.23	119.78	54,444	100%
122	3.4	267,087	6.4	0.23	0.23	0.00	0.23	0.23	119.82	54,463	100%
124	3.1	267,467	6.4	0.23	0.23	0.00	0.23	0.23	119.86	54,482	100%
126	2.9	267,817	6.4	0.23	0.23	0.00	0.23	0.23	119.90	54,498	100%
128	2.7	268,137	6.4	0.23	0.23	0.00	0.23	0.23	119.93	54,513	100%
130	2.5	268,431	6.4	0.23	0.23	0.00	0.23	0.23	119.96	54,527	100%
132	2.3	268,700	6.4	0.23	0.23	0.00	0.23	0.23	119.99	54,540	100%
134	2.1	268,947	6.4	0.23	0.23	0.00	0.23	0.23	120.01	54,552	100%
136	1.9	269,172	6.4	0.23	0.23	0.00	0.23	0.23	120.04	54,563	100%
138	1.8	269,379	6.4	0.23	0.23	0.00	0.23	0.23	120.06	54,572	100%
140	1.7	269,567	6.4	0.23	0.23	0.00	0.23	0.23	120.08	54,581	100%
142	1.5	269,739	6.4	0.23	0.23	0.00	0.23	0.23	120.10	54,589	100%
144	1.4	269,896	6.5	0.23	0.23	0.00	0.23	0.23	120.11	54,597	100%
146	1.3	270,038	6.5	0.23	0.23	0.00	0.23	0.23	120.13	54,604	100%
148	1.2	270,168	6.5	0.23	0.23	0.00	0.23	0.23	120.14	54,610	100%
150	1.1	270,285	6.5	0.23	0.23	0.00	0.23	0.23	120.15	54,615	100%
152	1.0	270,392	6.5	0.23	0.23	0.00	0.23	0.23	120.16	54,620	100%
154	1.0	270,488	6.5	0.23	0.23	0.00	0.23	0.23	120.17	54,625	100%
156	0.9	270,575	6.5	0.23	0.23	0.00	0.23	0.23	120.18	54,629	100%
158	0.8	270,653	6.5	0.23	0.23	0.00	0.23	0.23	120.19	54,633	100%
160	0.8	270,723	6.5	0.23	0.23	0.00	0.23	0.23	120.20	54,636	100%
162	0.7	270,785	6.5	0.23	0.23	0.00	0.23	0.23	120.21	54,639	100%
164	0.6	270,841	6.5	0.23	0.23	0.00	0.23	0.23	120.21	54,641	100%
166	0.6	270,890	6.5	0.23	0.23	0.00	0.23	0.23	120.22	54,644	100%
168	0.5	270,934	6.5	0.23	0.23	0.00	0.23	0.23	120.22	54,646	100%
170	0.5	270,972	6.5	0.23	0.23	0.00	0.23	0.23	120.22	54,648	100%
172	0.5	271,004	6.5	0.23	0.23	0.00	0.23	0.23	120.23	54,649	100%
174	0.4	271,033	6.5	0.23	0.23	0.00	0.23	0.23	120.23	54,650	100%
176	0.4	271,057	6.5	0.23	0.23	0.00	0.23	0.23	120.23	54,652	100%
178	0.4	271,077	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,653	100%
180	0.3	271,093	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,653	100%
182	0.3	271,106	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,654	100%
184	0.3	271,116	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,654	100%
186	0.3	271,124	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
188	0.2	271,128	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
190	0.2	271,130	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
192	0.2	271,130	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
194	0.2	271,127	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
196	0.2	271,123	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,655	100%
198	0.2	271,117	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,654	100%
200	0.2	271,109	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,654	100%
202	0.1	271,100	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,654	100%
204	0.1	271,089	6.5	0.23	0.23	0.00	0.23	0.23	120.24	54,653	100%



Sediment Basin #6 Phase 2 Hydrograph
10-Yr Storm
250
200
150
100
50
0
FLOW (cfs)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
STAGE (ft)
0
20
40
60
80
100
120
140
160
180
TIME (min)
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1__of __2__

Qp =	120.20	cfs	
Tp =	33.07	minutes	
dT = Max of	2	minutes	
or	1.0%	of increment to peak	

Sediment Basin # 6 Brickhaven

Phase 2

25 - year Storm Event

b = 1.3
Ks = 23,686

Number of Riser/Barrel Assemblies	1		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	3.5	(ft)	
Height of Riser from bottom of barrel=	6.5	(ft) elevation	217.50
Emergency Spillway =	7.0	(ft) elevation	218.00
Total Height of Dam =	7.5	(ft) elevation	218.50
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	211.0

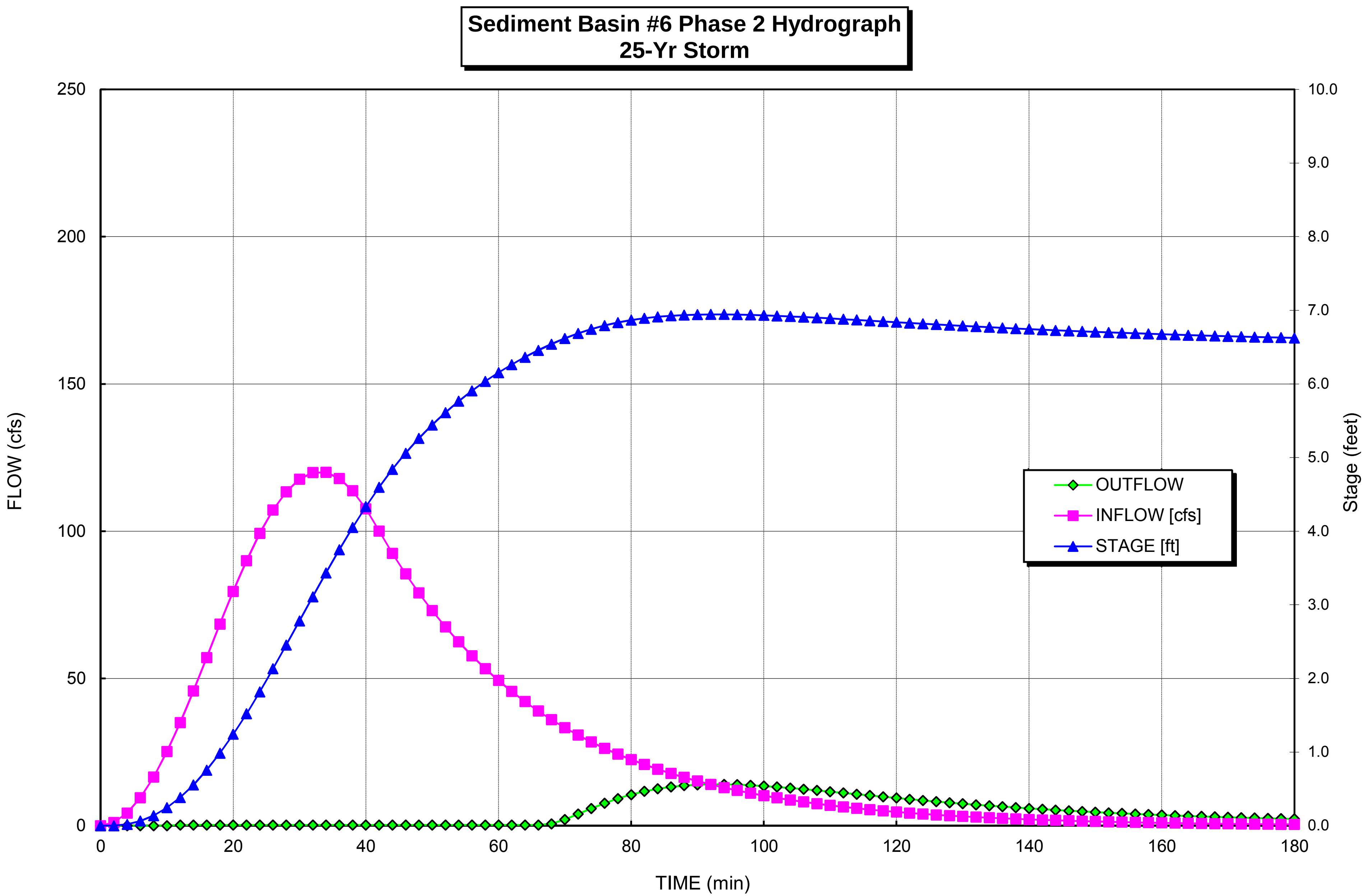
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

99%	Minimum Settling Efficiency		
6.9	ft Maximum Stage	217.9	msl elevation
14.0	cfs Peak outflow		
14.0	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.1	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	4.3	130	0.0	0.00	0.00	0.00	0.00	0.00	20.13	9,152	N/A
6	9.5	644	0.1	0.00	0.00	0.00	0.00	0.00	29.28	13,310	N/A
8	16.5	1,785	0.1	0.00	0.00	0.00	0.00	0.00	37.16	16,890	N/A
10	25.1	3,770	0.2	0.00	0.00	0.00	0.00	0.00	44.25	20,116	N/A
12	35.0	6,788	0.4	0.23	0.23	0.00	0.23	0.23	50.78	23,080	100%
14	45.8	10,961	0.6	0.23	0.23	0.00	0.23	0.23	56.80	25,817	100%
16	57.1	16,427	0.8	0.23	0.23	0.00	0.23	0.23	62.43	28,378	100%
18	68.5	23,247	1.0	0.23	0.23	0.00	0.23	0.23	67.71	30,777	100%
20	79.5	31,433	1.2	0.23	0.23	0.00	0.23	0.23	72.66	33,027	100%
22	89.9	40,951	1.5	0.23	0.23	0.00	0.23	0.23	77.29	35,133	100%
24	99.3	51,716	1.8	0.23	0.23	0.00	0.23	0.23	81.63	37,103	100%
26	107.2	63,598	2.1	0.23	0.23	0.00	0.23	0.23	85.67	38,941	100%
28	113.4	76,430	2.5	0.23	0.23	0.00	0.23	0.23	89.43	40,651	100%
30	117.7	90,007	2.8	0.23	0.23	0.00	0.23	0.23	92.92	42,235	100%
32	119.9	104,100	3.1	0.23	0.23	0.00	0.23	0.23	96.13	43,696	100%
34	120.0	118,460	3.4	0.23	0.23	0.00	0.23	0.23	99.08	45,036	100%
36	117.9	132,827	3.7	0.23	0.23	0.00	0.23	0.23	101.77	46,258	100%
38	113.7	146,945	4.0	0.23	0.23	0.00	0.23	0.23	104.20	47,363	100%
40	107.6	160,563	4.3	0.23	0.23	0.00	0.23	0.23	106.38	48,355	100%
42	100.1	173,450	4.6	0.23	0.23	0.00	0.23	0.23	108.32	49,235	100%
44	92.5	185,429	4.8	0.23	0.23	0.00	0.23	0.23	110.02	50,010	100%
46	85.5	196,501	5.1	0.23	0.23	0.00	0.23	0.23	111.52	50,693	100%
48	79.0	206,732	5.3	0.23	0.23	0.00	0.23	0.23	112.86	51,298	100%
50	73.1	216,189	5.4	0.23	0.23	0.00	0.23	0.23	114.04	51,837	100%
52	67.5	224,928	5.6	0.23	0.23	0.00	0.23	0.23	115.10	52,319	100%
54	62.4	233,004	5.8	0.23	0.23	0.00	0.23	0.23	116.06	52,753	100%
56	57.7	240,467	5.9	0.23	0.23	0.00	0.23	0.23	116.91	53,143	100%
58	53.3	247,364	6.0	0.23	0.23	0.00	0.23	0.23	117.69	53,495	100%
60	49.3	253,737	6.2	0.23	0.23	0.00	0.23	0.23	118.39	53,814	100%
62	45.6	259,626	6.3	0.23	0.23	0.00	0.23	0.23	119.03	54,104	100%
64	42.1	265,068	6.4	0.23	0.23	0.00	0.23	0.23	119.61	54,367	100%
66	38.9	270,096	6.5	0.23	0.23	0.00	0.23	0.23	120.13	54,606	100%
68	36.0	274,741	6.5	0.23	0.61	0.00	76.29	0.61	120.61	54,824	100%
70	33.3	278,989	6.6	0.23	2.11	0.00	76.87	2.11	121.05	55,021	100%
72	30.8	282,729	6.7	0.23	3.96	0.00	77.38	3.96	121.42	55,193	100%
74	28.4	285,945	6.7	0.23	5.84	0.00	77.81	5.84	121.75	55,339	100%
76	26.3	288,656	6.8	0.23	7.61	0.00	78.18	7.61	122.01	55,461	100%
78	24.3	290,897	6.8	0.23	9.19	0.00	78.47	9.19	122.24	55,562	99%
80	22.5	292,709	6.9	0.23	10.54	0.00	78.71	10.54	122.41	55,642	99%
82	20.8	294,139	6.9	0.23	11.65	0.00	78.90	11.65	122.55	55,706	99%
84	19.2	295,233	6.9	0.23	12.52	0.00	79.04	12.52	122.66	55,754	99%

86	17.7	296,034	6.9	0.23	13.17	0.00	79.15	13.17	122.74	55,789	99%
88	16.4	296,582	6.9	0.23	13.62	0.00	79.22	13.62	122.79	55,814	99%
90	15.2	296,916	6.9	0.23	13.90	0.00	79.26	13.90	122.82	55,828	99%
92	14.0	297,068	6.9	0.23	14.02	0.00	79.28	14.02	122.84	55,835	99%
94	13.0	297,067	6.9	0.23	14.02	0.00	79.28	14.02	122.84	55,835	99%
96	12.0	296,938	6.9	0.23	13.91	0.00	79.27	13.91	122.82	55,829	99%
98	11.1	296,706	6.9	0.23	13.72	0.00	79.24	13.72	122.80	55,819	99%
100	10.2	296,387	6.9	0.23	13.46	0.00	79.20	13.46	122.77	55,805	99%
102	9.5	296,000	6.9	0.23	13.14	0.00	79.14	13.14	122.73	55,788	99%
104	8.7	295,558	6.9	0.23	12.78	0.00	79.09	12.78	122.69	55,768	99%
106	8.1	295,074	6.9	0.23	12.39	0.00	79.02	12.39	122.64	55,747	99%
108	7.5	294,557	6.9	0.23	11.98	0.00	78.96	11.98	122.59	55,724	99%
110	6.9	294,016	6.9	0.23	11.55	0.00	78.88	11.55	122.54	55,700	99%
112	6.4	293,458	6.9	0.23	11.12	0.00	78.81	11.12	122.49	55,676	99%
114	5.9	292,890	6.9	0.23	10.68	0.00	78.74	10.68	122.43	55,650	99%
116	5.5	292,317	6.9	0.23	10.24	0.00	78.66	10.24	122.37	55,625	99%
118	5.0	291,742	6.8	0.23	9.81	0.00	78.59	9.81	122.32	55,599	99%
120	4.7	291,169	6.8	0.23	9.39	0.00	78.51	9.39	122.26	55,574	99%
122	4.3	290,601	6.8	0.23	8.98	0.00	78.43	8.98	122.21	55,548	99%
124	4.0	290,040	6.8	0.23	8.58	0.00	78.36	8.58	122.15	55,523	99%
126	3.7	289,489	6.8	0.23	8.19	0.00	78.29	8.19	122.10	55,499	100%
128	3.4	288,948	6.8	0.23	7.81	0.00	78.21	7.81	122.04	55,474	100%
130	3.1	288,418	6.8	0.23	7.45	0.00	78.14	7.45	121.99	55,451	100%
132	2.9	287,901	6.8	0.23	7.11	0.00	78.08	7.11	121.94	55,427	100%
134	2.7	287,398	6.8	0.23	6.77	0.00	78.01	6.77	121.89	55,405	100%
136	2.5	286,908	6.8	0.23	6.45	0.00	77.94	6.45	121.84	55,383	100%
138	2.3	286,431	6.8	0.23	6.15	0.00	77.88	6.15	121.79	55,361	100%
140	2.1	285,969	6.7	0.23	5.86	0.00	77.82	5.86	121.75	55,340	100%
142	2.0	285,521	6.7	0.23	5.58	0.00	77.76	5.58	121.70	55,320	100%
144	1.8	285,087	6.7	0.23	5.31	0.00	77.70	5.31	121.66	55,300	100%
146	1.7	284,667	6.7	0.23	5.06	0.00	77.64	5.06	121.62	55,281	100%
148	1.5	284,261	6.7	0.23	4.82	0.00	77.59	4.82	121.58	55,263	100%
150	1.4	283,868	6.7	0.23	4.60	0.00	77.53	4.60	121.54	55,245	100%
152	1.3	283,488	6.7	0.23	4.38	0.00	77.48	4.38	121.50	55,228	100%
154	1.2	283,122	6.7	0.23	4.17	0.00	77.43	4.17	121.46	55,211	100%
156	1.1	282,768	6.7	0.23	3.98	0.00	77.39	3.98	121.43	55,195	100%
158	1.0	282,426	6.7	0.23	3.79	0.00	77.34	3.79	121.39	55,179	100%
160	1.0	282,097	6.7	0.23	3.62	0.00	77.30	3.62	121.36	55,164	100%
162	0.9	281,779	6.7	0.23	3.45	0.00	77.25	3.45	121.33	55,149	100%
164	0.8	281,472	6.7	0.23	3.29	0.00	77.21	3.29	121.30	55,135	100%
166	0.8	281,176	6.7	0.23	3.14	0.00	77.17	3.14	121.27	55,122	100%
168	0.7	280,891	6.7	0.23	3.00	0.00	77.13	3.00	121.24	55,109	100%
170	0.7	280,616	6.6	0.23	2.86	0.00	77.09	2.86	121.21	55,096	100%
172	0.6	280,350	6.6	0.23	2.74	0.00	77.06	2.74	121.18	55,084	100%
174	0.6	280,095	6.6	0.23	2.61	0.00	77.02	2.61	121.16	55,072	100%
176	0.5	279,848	6.6	0.23	2.50	0.00	76.99	2.50	121.13	55,061	100%
178	0.5	279,610	6.6	0.23	2.39	0.00	76.96	2.39	121.11	55,050	100%
180	0.4	279,380	6.6	0.23	2.29	0.00	76.93	2.29	121.09	55,039	100%
182	0.4	279,159	6.6	0.23	2.19	0.00	76.90	2.19	121.06	55,029	100%
184	0.4	278,945	6.6	0.23	2.09	0.00	76.87	2.09	121.04	55,019	100%
186	0.3	278,740	6.6	0.23	2.00	0.00	76.84	2.00	121.02	55,010	100%
188	0.3	278,541	6.6	0.23	1.92	0.00	76.81	1.92	121.00	55,001	100%
190	0.3	278,349	6.6	0.23	1.84	0.00	76.79	1.84	120.98	54,992	100%
192	0.3	278,164	6.6	0.23	1.76	0.00	76.76	1.76	120.96	54,983	100%
194	0.3	277,985	6.6	0.23	1.69	0.00	76.74	1.69	120.95	54,975	100%
196	0.2	277,813	6.6	0.23	1.62	0.00	76.71	1.62	120.93	54,967	100%
198	0.2	277,646	6.6	0.23	1.56	0.00	76.69	1.56	120.91	54,959	100%
200	0.2	277,485	6.6	0.23	1.50	0.00	76.67	1.50	120.89	54,952	100%
202	0.2	277,330	6.6	0.23	1.44	0.00	76.65	1.44	120.88	54,945	100%
204	0.2	277,180	6.6	0.23	1.38	0.00	76.63	1.38	120.86	54,938	100%
206	0.2	277,035	6.6	0.23	1.33	0.00	76.61	1.33	120.85	54,931	100%



Sediment Basin #6 Phase 2 Hydrograph
25-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
0
50
100
150
200
250
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1__of __2__

Qp = 152.6 cfs
Tp = 33.5 minutes
dT = Max of 2 minutes
or 1.0% of increment to peak

Sediment Basin # 6 Brickhaven

Phase 2

100 - year Storm Event

b = 1.3
Ks = 23,686

Number of Riser/Barrel Assemblies	1		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	3.5	(ft)	
Height of Riser from bottom of barrel=	6.5	(ft) elevation	217.50
Emergency Spillway =	7.0	(ft) elevation	218.00
Total Height of Dam =	7.5	(ft) elevation	218.50
Length of Emergency Spillway =	10	(ft)	
Diameter of Riser =	54	(in)	
Permanent Pond Stage =	0	(ft) elevation	211.0

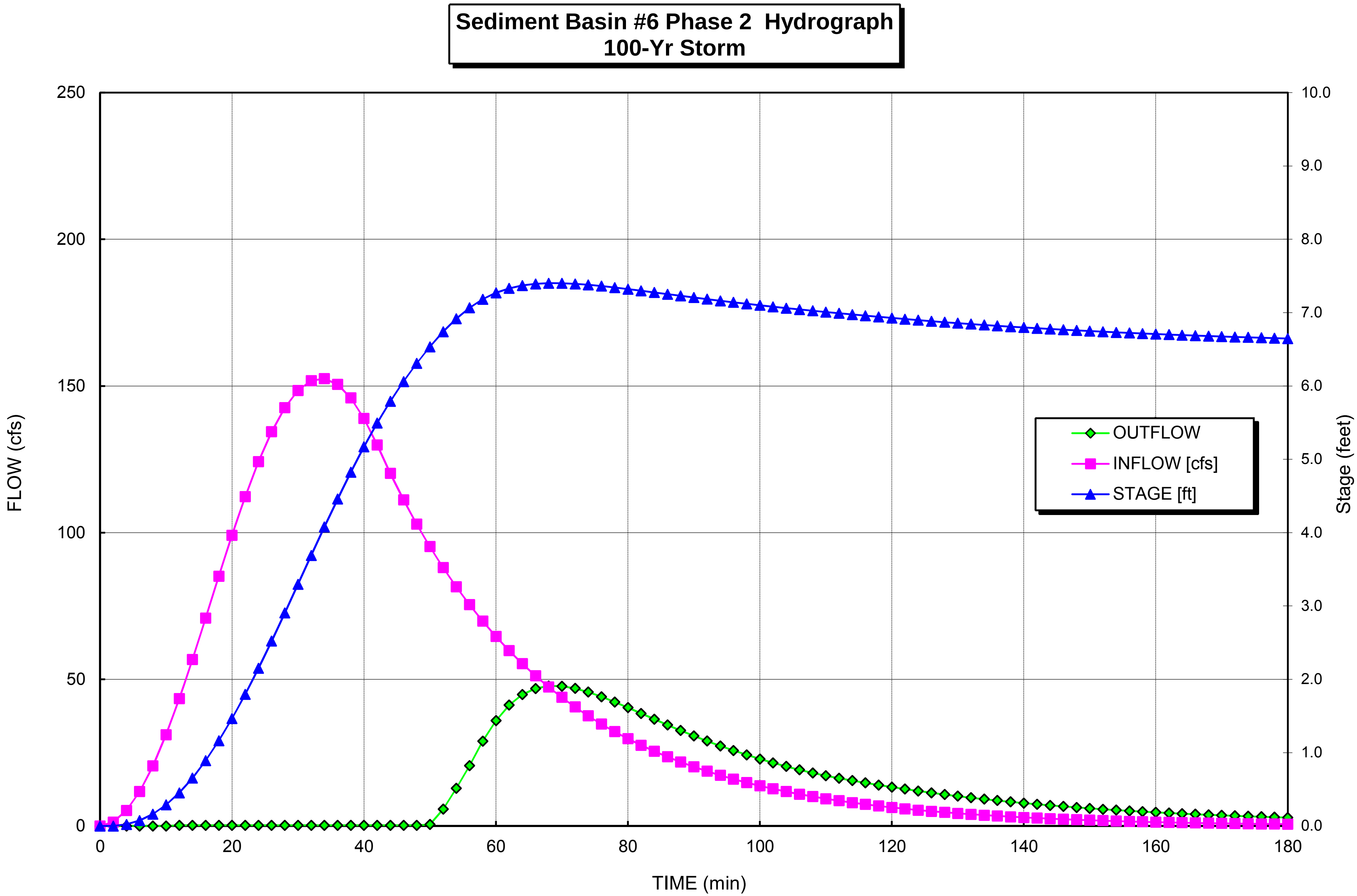
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

91%	Minimum Settling Efficiency		
7.4	ft Maximum Stage	218.4	msl elevation
47.7	cfs Peak outflow		
40.1	cfs Peak Riser/Barrel outflow		
7.6	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.3	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	5.3	160	0.0	0.00	0.00	0.00	0.00	0.00	21.15	9,616	N/A
6	11.7	796	0.1	0.00	0.00	0.00	0.00	0.00	30.77	13,985	N/A
8	20.5	2,206	0.2	0.00	0.00	0.00	0.00	0.00	39.04	17,747	N/A
10	31.1	4,661	0.3	0.00	0.00	0.00	0.00	0.00	46.51	21,139	N/A
12	43.4	8,396	0.5	0.23	0.23	0.00	0.23	0.23	53.37	24,257	100%
14	56.8	13,573	0.7	0.23	0.23	0.00	0.23	0.23	59.71	27,140	100%
16	70.9	20,359	0.9	0.23	0.23	0.00	0.23	0.23	65.64	29,838	100%
18	85.1	28,835	1.2	0.23	0.23	0.00	0.23	0.23	71.21	32,367	100%
20	99.1	39,024	1.5	0.23	0.23	0.00	0.23	0.23	76.43	34,740	100%
22	112.3	50,888	1.8	0.23	0.23	0.00	0.23	0.23	81.32	36,964	100%
24	124.2	64,333	2.2	0.23	0.23	0.00	0.23	0.23	85.90	39,046	100%
26	134.4	79,206	2.5	0.23	0.23	0.00	0.23	0.23	90.18	40,992	100%
28	142.6	95,307	2.9	0.23	0.23	0.00	0.23	0.23	94.17	42,804	100%
30	148.5	112,390	3.3	0.23	0.23	0.00	0.23	0.23	97.87	44,486	100%
32	151.8	130,178	3.7	0.23	0.23	0.00	0.23	0.23	101.29	46,040	100%
34	152.5	148,366	4.1	0.23	0.23	0.00	0.23	0.23	104.43	47,470	100%
36	150.5	166,637	4.5	0.23	0.23	0.00	0.23	0.23	107.31	48,776	100%
38	145.9	184,672	4.8	0.23	0.23	0.00	0.23	0.23	109.92	49,962	100%
40	138.9	202,157	5.2	0.23	0.23	0.00	0.23	0.23	112.27	51,030	100%
42	129.9	218,799	5.5	0.23	0.23	0.00	0.23	0.23	114.36	51,983	100%
44	120.2	234,356	5.8	0.23	0.23	0.00	0.23	0.23	116.21	52,824	100%
46	111.2	248,750	6.1	0.23	0.23	0.00	0.23	0.23	117.84	53,565	100%
48	102.9	262,067	6.3	0.23	0.23	0.00	0.23	0.23	119.29	54,222	100%
50	95.2	274,389	6.5	0.23	0.52	0.00	76.24	0.52	120.58	54,808	100%
52	88.1	285,753	6.7	0.23	5.72	0.00	77.79	5.72	121.73	55,330	100%
54	81.5	295,641	6.9	0.23	12.85	0.00	79.10	12.85	122.70	55,772	99%
56	75.5	303,884	7.1	0.23	20.07	0.50	80.17	20.57	123.49	56,132	98%
58	69.8	310,470	7.2	0.23	26.54	2.34	81.00	28.88	124.11	56,414	96%
60	64.6	315,384	7.3	0.23	31.72	4.20	81.62	35.92	124.57	56,621	94%
62	59.8	318,827	7.3	0.23	35.52	5.69	82.05	41.22	124.88	56,765	93%
64	55.3	321,056	7.4	0.23	38.05	6.74	82.33	44.79	125.09	56,858	92%
66	51.2	322,320	7.4	0.23	39.51	7.35	82.48	46.87	125.20	56,910	92%
68	47.4	322,840	7.4	0.23	40.12	7.61	82.55	47.73	125.25	56,932	91%
70	43.8	322,798	7.4	0.23	40.07	7.59	82.54	47.66	125.25	56,930	91%
72	40.6	322,339	7.4	0.23	39.53	7.36	82.48	46.90	125.20	56,911	92%
74	37.5	321,580	7.4	0.23	38.66	6.99	82.39	45.65	125.13	56,879	92%
76	34.7	320,607	7.4	0.23	37.54	6.52	82.27	44.06	125.05	56,839	92%
78	32.1	319,488	7.3	0.23	36.27	6.00	82.13	42.26	124.94	56,793	93%
80	29.7	318,274	7.3	0.23	34.90	5.44	81.98	40.35	124.83	56,742	93%
82	27.5	317,002	7.3	0.23	33.49	4.88	81.82	38.37	124.72	56,689	94%
84	25.5	315,701	7.3	0.23	32.07	4.33	81.66	36.39	124.60	56,635	94%

86	23.6	314,390	7.3	0.23	30.65	3.79	81.50	34.44	124.48	56,580	95%
88	21.8	313,085	7.2	0.23	29.26	3.28	81.33	32.55	124.35	56,525	95%
90	20.2	311,797	7.2	0.23	27.91	2.81	81.17	30.72	124.23	56,470	95%
92	18.7	310,533	7.2	0.23	26.60	2.36	81.01	28.96	124.12	56,417	96%
94	17.3	309,299	7.2	0.23	25.35	1.95	80.86	27.30	124.00	56,364	96%
96	16.0	308,097	7.1	0.23	24.14	1.58	80.70	25.72	123.89	56,313	97%
98	14.8	306,930	7.1	0.23	22.99	1.24	80.56	24.23	123.78	56,263	97%
100	13.7	305,798	7.1	0.23	21.89	0.94	80.41	22.83	123.67	56,214	97%
102	12.7	304,701	7.1	0.23	20.84	0.68	80.27	21.52	123.57	56,167	97%
104	11.7	303,639	7.1	0.23	19.84	0.45	80.13	20.30	123.47	56,121	98%
106	10.9	302,611	7.0	0.23	18.89	0.27	80.00	19.15	123.37	56,077	98%
108	10.0	301,615	7.0	0.23	17.98	0.12	79.87	18.10	123.27	56,034	98%
110	9.3	300,648	7.0	0.23	17.11	0.02	79.75	17.13	123.18	55,992	98%
112	8.6	299,707	7.0	0.23	16.28	0.00	79.63	16.28	123.09	55,951	98%
114	8.0	298,785	7.0	0.23	15.48	0.00	79.51	15.48	123.00	55,910	99%
116	7.4	297,883	7.0	0.23	14.71	0.00	79.39	14.71	122.92	55,871	99%
118	6.8	297,001	6.9	0.23	13.97	0.00	79.28	13.97	122.83	55,832	99%
120	6.3	296,143	6.9	0.23	13.26	0.00	79.16	13.26	122.75	55,794	99%
122	5.8	295,309	6.9	0.23	12.58	0.00	79.05	12.58	122.67	55,757	99%
124	5.4	294,500	6.9	0.23	11.93	0.00	78.95	11.93	122.59	55,722	99%
126	5.0	293,716	6.9	0.23	11.32	0.00	78.85	11.32	122.51	55,687	99%
128	4.6	292,957	6.9	0.23	10.73	0.00	78.75	10.73	122.44	55,653	99%
130	4.3	292,224	6.9	0.23	10.18	0.00	78.65	10.18	122.37	55,621	99%
132	4.0	291,517	6.8	0.23	9.65	0.00	78.56	9.65	122.30	55,589	99%
134	3.7	290,834	6.8	0.23	9.15	0.00	78.47	9.15	122.23	55,559	99%
136	3.4	290,176	6.8	0.23	8.67	0.00	78.38	8.67	122.16	55,529	99%
138	3.1	289,541	6.8	0.23	8.23	0.00	78.29	8.23	122.10	55,501	100%
140	2.9	288,931	6.8	0.23	7.80	0.00	78.21	7.80	122.04	55,474	100%
142	2.7	288,343	6.8	0.23	7.40	0.00	78.13	7.40	121.98	55,447	100%
144	2.5	287,777	6.8	0.23	7.02	0.00	78.06	7.02	121.93	55,422	100%
146	2.3	287,232	6.8	0.23	6.66	0.00	77.99	6.66	121.87	55,397	100%
148	2.1	286,709	6.8	0.23	6.32	0.00	77.92	6.32	121.82	55,374	100%
150	2.0	286,205	6.7	0.23	6.00	0.00	77.85	6.00	121.77	55,351	100%
152	1.8	285,721	6.7	0.23	5.70	0.00	77.78	5.70	121.72	55,329	100%
154	1.7	285,255	6.7	0.23	5.42	0.00	77.72	5.42	121.68	55,308	100%
156	1.6	284,808	6.7	0.23	5.15	0.00	77.66	5.15	121.63	55,288	100%
158	1.4	284,377	6.7	0.23	4.89	0.00	77.60	4.89	121.59	55,268	100%
160	1.3	283,964	6.7	0.23	4.65	0.00	77.55	4.65	121.55	55,249	100%
162	1.2	283,566	6.7	0.23	4.42	0.00	77.49	4.42	121.51	55,231	100%
164	1.1	283,184	6.7	0.23	4.21	0.00	77.44	4.21	121.47	55,214	100%
166	1.1	282,816	6.7	0.23	4.00	0.00	77.39	4.00	121.43	55,197	100%
168	1.0	282,463	6.7	0.23	3.81	0.00	77.34	3.81	121.40	55,181	100%
170	0.9	282,123	6.7	0.23	3.63	0.00	77.30	3.63	121.36	55,165	100%
172	0.8	281,796	6.7	0.23	3.46	0.00	77.25	3.46	121.33	55,150	100%
174	0.8	281,481	6.7	0.23	3.30	0.00	77.21	3.30	121.30	55,136	100%
176	0.7	281,179	6.7	0.23	3.14	0.00	77.17	3.14	121.27	55,122	100%
178	0.7	280,888	6.7	0.23	3.00	0.00	77.13	3.00	121.24	55,109	100%
180	0.6	280,608	6.6	0.23	2.86	0.00	77.09	2.86	121.21	55,096	100%
182	0.6	280,339	6.6	0.23	2.73	0.00	77.06	2.73	121.18	55,083	100%
184	0.5	280,080	6.6	0.23	2.61	0.00	77.02	2.61	121.16	55,072	100%
186	0.5	279,830	6.6	0.23	2.49	0.00	76.99	2.49	121.13	55,060	100%
188	0.5	279,590	6.6	0.23	2.38	0.00	76.95	2.38	121.11	55,049	100%
190	0.4	279,358	6.6	0.23	2.28	0.00	76.92	2.28	121.08	55,038	100%
192	0.4	279,135	6.6	0.23	2.18	0.00	76.89	2.18	121.06	55,028	100%
194	0.4	278,921	6.6	0.23	2.08	0.00	76.86	2.08	121.04	55,018	100%
196	0.3	278,714	6.6	0.23	1.99	0.00	76.83	1.99	121.02	55,009	100%
198	0.3	278,514	6.6	0.23	1.91	0.00	76.81	1.91	121.00	54,999	100%
200	0.3	278,322	6.6	0.23	1.83	0.00	76.78	1.83	120.98	54,991	100%
202	0.3	278,136	6.6	0.23	1.75	0.00	76.76	1.75	120.96	54,982	100%
204	0.2	277,958	6.6	0.23	1.68	0.00	76.73	1.68	120.94	54,974	100%


Sediment Basin #6 Phase 2 Hydrograph
100-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
250
200
150
100
50
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #7		Sheet: 1	Of: 5

Objective Design the sediment basin to contain the 10-year storm and pass the 100-year storm without over topping the berm.

References

1. NC Erosion and Sediment Control Planning and Design Manual.
2. "Elements of Urban Stormwater Design" by H. Rooney Malcom, P.E.
3. VA Erosion and Sediment Control Handbook
3. NOAA Atlas 14, Volume 2, Version 3

Given

Phase	1	2	2	2		
Storm Event (yrs) =	10	10	25	100		
Total Drainage Area A (ac) =	93.1	91.8	91.8	91.8		
Disturbed Area (ac) =	93.1	44.9	44.9	44.9		
Curve Number CN =	94	89	89	89	Hydrographs	
Rainfall Depth P (in) =	5.17	5.17	6.14	7.71	(24-hr rainfall)	Ref 3
Peak Flow Q_p (cfs) =	554.63	321.57	394.45	511.71	Hydrographs	

Route the flow through the Basin

S = (1000/CN) - 10

Runoff Depth Q* (inches) = $(P-0.2S)^2/(P+0.8S)$ Ref 2, III-4

T_P (min) = $60.5(Q^*)A/Q_P/1.39$

Phase	1	2	2	2
Storm Event (yrs) =	10	10	25	100
S =	0.64	1.24	1.24	1.24
Runoff Depth Q* (inches) =	4.48	3.93	4.87	6.40
Time to Peak T_p (min) =	32.70	48.89	49.34	49.99

Determine Shape of Basin: Phase 1

Measure the area of the Basin using AutoCADD.
Calculate Volume of the Basin using Truncated Pyramid Method.
Shape factor used in hydrographs basin depth may be greater than indicated below

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
209	0	2,961	-	-	-
210	1	229,994	86,350	86,350	3,198
211	2	236,344	233,162	319,512	11,834
212	3	242,747	239,538	559,051	20,706
213	4	249,202	245,967	805,018	29,815
214	5	255,711	252,450	1,057,468	39,165
215	6	262,272	258,985	1,316,452	48,757
216	7	268,886	265,572	1,582,024	58,593

HDR Computation

Job No. 0453925-237673-018

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #7	Sheet: 2	Of: 5

Determine Shape of Basin: Phase 2

Elevation (ft)	Depth (ft)	Area (sf)	Volume (cf)	Cumulative Vol (cf)	Cumulative Vol (cy)
208	0	0	-	-	-
209	1	122,008	40,669	40,669	1,506
210	2	128,730	125,354	166,023	6,149
211	3	135,491	132,096	298,119	11,041
212	4	142,292	138,878	436,997	16,185
213	5	149,133	145,699	582,696	21,581
214	6	156,012	152,560	735,256	27,232
215	7	162,931	159,459	894,715	33,138
216	8	169,889	166,398	1,061,113	39,300

Design Criteria

Required sediment storage	1,800	cf / acre of drainage
Required Surface Area	435	sf/cfs (10-yr storm peak)

	Phase 1	Phase 2	
Required sediment storage (cf)	167,580	165,240	
Required Surface Area (SF)	241,264	139,883	
Design Sediment Depth (ft) =	3	3	
Design Surface Area Depth (ft) =	3	3	
Sediment Storage (cf) =	559,051	298,119	*Required Sediment Storage Achieved*
Surface Area (sf) =	242,747	135,491	*Increase Surface Area*

Determine Pond Storage Elevation (Z_{Water}):

Pick one point near max expected water surface and the other at the mid depth.

Z_1 (ft) = 5	S_1 (cf)=	1,057,468	582,696
Z_2 (ft) = 7	S_2 (cf) =	1,582,024	894,715
$b = \ln(S_2/S_1)/\ln(Z_2/Z_1) =$		1.2	1.3
$K_S = S_2/Z_2^b =$		153,976	74,919

Ref 2, III-8

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #7	Sheet: 3	Of: 5

Select Skimmer

$D = [Q / (2{,}310 * (H^{0.5})]^{0.5}$ A. R. Jarrett Method

D =Diameter of Orifice (inches)

Q = Dewater Rate (cf/day)

H = Head on orifice, varies based on skimmer size (ft)

Skimmer Size (Inches)	Head (ft)
1.5	0.125
2	0.167
2.5	0.167
3	0.250
4	0.333
5	0.333
6	0.417
8	0.500

Volume to Dewater (cf) =	559,051	298,119	
Number of Skimmers	2	2	
Days to Drain =	3	3	*assumed*
Q each (cf/day) =	93,175	49,687	
cfs	1.08	0.58	

Selected Skimmer Size (inches) =	8	8
Head on Skimmer (feet) =	0.5	0.5
Diameter of Orifice (inches) =	7.6	5.5

Riser is not perforated, but skimmer is attached.

use larger orifice for all phases

Determine Settling Velocity

Conversion Factor = 3.281 ft/sec per m/sec

Gravitational Acceleration, g (m/s^2) = 9.81

Specific Gravity of soil (s_s)= 2.6

Kinematic Viscosity of water (ν) = 1.14E-06 n^2 / sec @ 20^o C   Ref 2, IV-11

Diameter of the Design Particle d_{15} = 40.00E-06 m

Design Particle Settling Velocity = $(g / 18) * [(s_s - 1) / \nu] d^2 =$ 4.02E-03 ft/sec

Route the Storm through the Basin using the Hydrograph Model

Set Height of Emergency Spillway at (ft) = 8.50

Set Top of Dam at (ft) = 9.00

See Hydrograph

Project: Charah Brickhaven No 2. Mine		Computed: PAW	Date: 12/31/14
Subject: Permit Application		Checked: EAW	Date: 1/2/15
Task: Sediment Basin #7		Sheet: 4	Of: 5

Emergency Spillway

Q_E (cfs) = 25-Yr Storm
Q_E (cfs) = 20.1
Cross Section = Trapezoid
Channel Side Slope (z) = 5 (enter X for X:1)
n = 0.03 Grass Lined
Vp (ft/sec) = 5.0 Permissible Velocity for lining Ref 2, II-7
Allowable Shear Stress (psf) = 2.0 Allowable Shear Stress for lining
Bottom Width, b (ft) = 50

Calculate Required Depth of Spillway:
Normal-Depth Procedure

$AR^{2/3}=Qn/1.49s^{0.5}$ Q=VA
$Z_{req}=Qn/1.49s^{0.5}$ Area (A)= bd+z(d^2)
$Z_{av}=AR^{2/3}$ R=Area/(b+2d((z^2)+1)^.5)
Avg Shear Stress(T) = K_b*d*s*unit weight of water

Channel Slope ft/ft	Depth, d (ft)	A (sf)	Z_{req}	R	Z_{avail}	V (ft/sec)	T (psf)
0.01	0.22	11.25	4.04	0.22	4.04	1.8	0.1
0.02	0.18	9.11	2.86	0.18	2.86	2.2	0.2

Construct the channel to be : 50 ft, Bottom Width (measured at top of lining)
0.5 ft, depth (measured at top of lining)
1% slope

Anti-Seep Collar:

Anti-Seep Collar Size = 2 * Barrel Dia
Anti-Seep Collar Size (ft) = 6
Use Anti-Seep Collar Size (ft) = 6 x 6

Minimum Concrete Base for Riser:

Diameter of Riser (in) = 72 From Hydrograph
Avg Density of Concrete (lbs/cf) = 87.6
Density of Water (lbs/cf) = 62.4
Riser Displacement (cf) = 231.85 Pi * $(D_R/24)^2$ * Total Ht of Riser
Convert cf to cy = 27^{-1}
Min Concrete Needed (cy) = 6.12
Width & Length (ft) = 7
Thickness (ft) = 3.4

Anti-Vortex Device:

Diameter of Riser (in) = 72 From Hydrograph
Cylinder Diameter (in) = 84 Ref 3, III-104, Table 3.14-D
Cylinder Thickness (gage) = 16
Cylinder Height (in) = 13

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Sediment Basin #7	Sheet: 5	Of: 5

Determine Tailwater conditions to size outlet apron

Use Normal Depth Procedure (Manning's Eqn.) Ref 2, II-7

$A*R^{2/3} = Q*n/1.49\ s^{0.5}$ Area (A)= bd+z(d^2) $Z_{av} = A*R^{2/3}$

$Z_{req} = Q*n/1.49s^{0.5}$ R=Area/(b+2d((z^2)+1)^.5)

n =	0.069	6-inch diameter Rip Rap, Lined Channel
Vp (ft/sec) =	9	Permissible Velocity for lining
Side Slope (z) =	5	enter X for X:1
s (ft/ft) =	0.02	Outlet Slope (estimated)
Bottom Width (ft) =	18	6 * Barrel Diameter
Q_B (cfs) =	56.7	Peak Flow out of the barrel 25-yr Hydrograph

Q (cfs)	Z_{req}	Flow Depth d (ft)	A (sf)	R (ft)	Z_{av}	V (ft/sec)
56.7	18.56	0.96	21.8	0.79	18.56	2.6

Flow Depth = Tailwater, d (ft) = 0.96 0.5* Barrel Diameter (ft) = 1.50 Ref 1, 8.06.3

Minimum Tailwater Conditions: d<0.5*Diameter of Outlet Pipe

Maximum Tailwater Conditions: d>0.5*Diameter of Outlet Pipe

Since the Tailwater is less than half of the diameter of the outlet, use Minimum Tailwater conditions.

Barrel Diameter (ft)	Entrance (ft)	Length (ft)	Outlet Width (ft)	Median Rip Rap Size d_{50}	Selected Rip Rap Size (in)
3	9	16	19	0.5	Class B

Conclusion

The basin can contain the 10-yr storm and pass the 25-yr storm without overtopping the berm.
The 100 year storm over tops the berm.

Project:	Charah Brickhaven No 2. Mine	Computed: PAW	Date: 12/31/14
Subject:	Permit Application	Checked: EAW	Date: 1/2/15
Task:	Riser Pipe Perforations/Skimmer Flow	Sheet 1	Of 2

Diameter of Riser (in) =	72	
Circumference of Riser (in) =	226.2	
eight of Riser from bottom of barrel (in) =	98	From Hydrograph
Vertical spacing between holes (in) =	0	center to center
Water Stage increment (ft)	0.05	

Orifice Equation

$Q = C_d * A * (2 * g * h)^{0.5}$ Ref 1, p III-11

Q = cfs, discharge

C_d = 0.6 coefficient of discharge

A = sf, cross sectional area

g = 32.2 ft/sec^2, gravity

h = ft, driving head measured from the center of the pipe

	Perforations					Skimmer	
Row	1	2	3	4	5	2	# of skimmers
Holes per row	0	0	0	0	0		
Hole Diameter (in)	0.75	0.75	0.75	0.75	0.75		
Spacing edge to edge (in)							
Inlet Area (sf)	0.000	0.000	0.000	0.000	0.000		
Hole Stage (in)	0.50	0.50	0.50	0.50	0.50		
Hole Stage (ft)	0.04	0.04	0.04	0.04	0.04		

Water Stage (ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Total Flow (cfs)
0.00	0.00	0.00	0.00			0.00	0.00
0.04	0.00	0.00	0.00			0.00	0.00
0.09	0.00	0.00	0.00			0.00	0.00
0.14	0.00	0.00	0.00			0.00	0.00
0.19	0.00	0.00	0.00			0.00	0.00
0.24	0.00	0.00	0.00			0.00	0.00
0.29	0.00	0.00	0.00			0.00	0.00
0.34	0.00	0.00	0.00			0.00	0.00
0.39	0.00	0.00	0.00			0.00	0.00
0.44	0.00	0.00	0.00			0.00	0.00
0.49	0.00	0.00	0.00			0.00	0.00
0.54	0.00	0.00	0.00			2.16	2.16
0.59	0.00	0.00	0.00			2.16	2.16
0.64	0.00	0.00	0.00			2.16	2.16
0.69	0.00	0.00	0.00			2.16	2.16
0.74	0.00	0.00	0.00			2.16	2.16
0.79	0.00	0.00	0.00			2.16	2.16
0.84	0.00	0.00	0.00			2.16	2.16
0.89	0.00	0.00	0.00			2.16	2.16
0.94	0.00	0.00	0.00			2.16	2.16
0.99	0.00	0.00	0.00			2.16	2.16
1.04	0.00	0.00	0.00			2.16	2.16
1.09	0.00	0.00	0.00			2.16	2.16
1.14	0.00	0.00	0.00			2.16	2.16
1.19	0.00	0.00	0.00			2.16	2.16
1.24	0.00	0.00	0.00			2.16	2.16
1.29	0.00	0.00	0.00			2.16	2.16
1.34	0.00	0.00	0.00			2.16	2.16
1.39	0.00	0.00	0.00			2.16	2.16
1.44	0.00	0.00	0.00			2.16	2.16
1.49	0.00	0.00	0.00			2.16	2.16
1.54	0.00	0.00	0.00			2.16	2.16
1.59	0.00	0.00	0.00			2.16	2.16

1.64	0.00	0.00	0.00	2.16	2.16
1.69	0.00	0.00	0.00	2.16	2.16
1.74	0.00	0.00	0.00	2.16	2.16
1.79	0.00	0.00	0.00	2.16	2.16
1.84	0.00	0.00	0.00	2.16	2.16
1.89	0.00	0.00	0.00	2.16	2.16
1.94	0.00	0.00	0.00	2.16	2.16
1.99	0.00	0.00	0.00	2.16	2.16
2.04	0.00	0.00	0.00	2.16	2.16
2.09	0.00	0.00	0.00	2.16	2.16
2.14	0.00	0.00	0.00	2.16	2.16
2.19	0.00	0.00	0.00	2.16	2.16
2.24	0.00	0.00	0.00	2.16	2.16
2.29	0.00	0.00	0.00	2.16	2.16
2.34	0.00	0.00	0.00	2.16	2.16
2.39	0.00	0.00	0.00	2.16	2.16
2.44	0.00	0.00	0.00	2.16	2.16
2.49	0.00	0.00	0.00	2.16	2.16
2.54	0.00	0.00	0.00	2.16	2.16
2.59	0.00	0.00	0.00	2.16	2.16
2.64	0.00	0.00	0.00	2.16	2.16
2.69	0.00	0.00	0.00	2.16	2.16
2.74	0.00	0.00	0.00	2.16	2.16
2.79	0.00	0.00	0.00	2.16	2.16
2.84	0.00	0.00	0.00	2.16	2.16
2.89	0.00	0.00	0.00	2.16	2.16
2.94	0.00	0.00	0.00	2.16	2.16
2.99	0.00	0.00	0.00	2.16	2.16
3.04	0.00	0.00	0.00	2.16	2.16
3.09	0.00	0.00	0.00	2.16	2.16
3.14	0.00	0.00	0.00	2.16	2.16
3.19	0.00	0.00	0.00	2.16	2.16
3.24	0.00	0.00	0.00	2.16	2.16
3.29	0.00	0.00	0.00	2.16	2.16
3.34	0.00	0.00	0.00	2.16	2.16
3.39	0.00	0.00	0.00	2.16	2.16
3.44	0.00	0.00	0.00	2.16	2.16
3.49	0.00	0.00	0.00	2.16	2.16
3.54	0.00	0.00	0.00	2.16	2.16
3.59	0.00	0.00	0.00	2.16	2.16
3.64	0.00	0.00	0.00	2.16	2.16
3.69	0.00	0.00	0.00	2.16	2.16
3.74	0.00	0.00	0.00	2.16	2.16
3.79	0.00	0.00	0.00	2.16	2.16
3.84	0.00	0.00	0.00	2.16	2.16
3.89	0.00	0.00	0.00	2.16	2.16
3.94	0.00	0.00	0.00	2.16	2.16
3.99	0.00	0.00	0.00	2.16	2.16

Computed By: PAW Date: 12/31/14

Checked By: EAW Date: 1/2/15

Sheet: __1__of _2_

Sediment Basin # 7 Brickhaven

Phase 1

10 - year Storm Event

Qp =	554.63	cfs
Tp =	32.70	minutes
dT = Max of	**2**	minutes
or	**1.0%**	of increment to peak

b = 1.2

K_s = 153,976

Number of Riser/Barrel Assemblies	**2**		
Diameter of Barrel =	**36**	(in)	
Height of Riser above barrel =	**5.2**	(ft)	
Height of Riser from bottom of barrel=	**8.2**	(ft) elevation	217.20
Emergency Spillway =	**8.5**	(ft) elevation	217.50
Total Height of Dam =	**9.0**	(ft) elevation	218.00
Length of Emergency Spillway =	**50**	(ft)	
Diameter of Riser =	**72**	(in)	
Permanent Pond Stage =	**0**	(ft) elevation	209.0

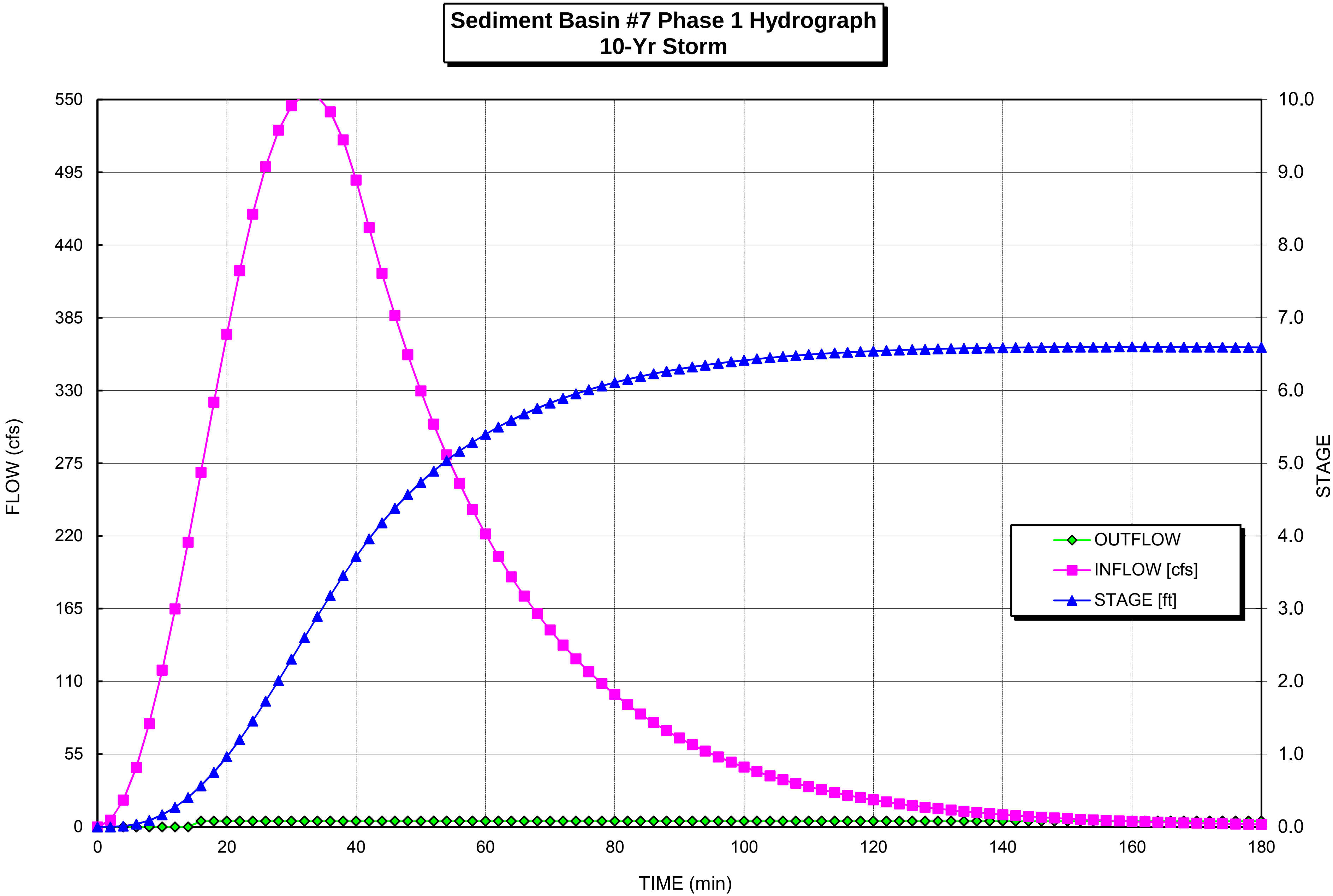
4.0E-03	Settling Velocity of design particle (fps)		
2	Effective number of cells (2 is construction site #)		
100%	Minimum Settling Efficiency		
6.6	ft Maximum Stage	215.60	msl elevation
4.3	cfs Peak outflow		
4.3	cfs Peak Riser/Barrel outflow		
0.0	cfs Peak Weir flow		

Notes:

1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACIT Y [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimate d Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	5.1	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	20.2	612	0.0	0.00	0.00	0.00	0.00	0.00	163.17	74,168	N/A
6	44.8	3,039	0.0	0.00	0.00	0.00	0.00	0.00	212.44	96,566	N/A
8	78.0	8,417	0.1	0.00	0.00	0.00	0.00	0.00	251.25	114,206	N/A
10	118.4	17,771	0.2	0.00	0.00	0.00	0.00	0.00	284.17	129,168	N/A
12	164.8	31,983	0.3	0.00	0.00	0.00	0.00	0.00	313.05	142,296	N/A
14	215.2	51,754	0.4	0.00	0.00	0.00	0.00	0.00	338.88	154,037	N/A
16	268.0	77,582	0.6	2.16	2.16	0.00	2.16	4.31	362.25	164,659	100%
18	321.1	109,222	0.8	2.16	2.16	0.00	2.16	4.31	383.25	174,203	100%
20	372.6	147,235	1.0	2.16	2.16	0.00	2.16	4.31	402.57	182,987	100%
22	420.6	191,426	1.2	2.16	2.16	0.00	2.16	4.31	420.36	191,072	100%
24	463.3	241,375	1.5	2.16	2.16	0.00	2.16	4.31	436.72	198,511	100%
26	499.1	296,449	1.7	2.16	2.16	0.00	2.16	4.31	451.76	205,346	100%
28	526.8	355,827	2.0	2.16	2.16	0.00	2.16	4.31	465.55	211,616	100%
30	545.3	418,529	2.3	2.16	2.16	0.00	2.16	4.31	478.17	217,350	100%
32	554.0	483,453	2.6	2.16	2.16	0.00	2.16	4.31	489.66	222,575	100%
34	552.5	549,416	2.9	2.16	2.16	0.00	2.16	4.31	500.09	227,314	100%
36	540.8	615,195	3.2	2.16	2.16	0.00	2.16	4.31	509.49	231,588	100%
38	519.5	679,575	3.5	2.16	2.16	0.00	2.16	4.31	517.91	235,416	100%
40	489.2	741,392	3.7	2.16	2.16	0.00	2.16	4.31	525.40	238,816	100%
42	453.3	799,577	4.0	2.16	2.16	0.00	2.16	4.31	531.98	241,807	100%
44	418.6	853,451	4.2	2.16	2.16	0.00	2.16	4.31	537.72	244,418	100%
46	386.6	903,168	4.4	2.16	2.16	0.00	2.16	4.31	542.76	246,709	100%
48	357.1	949,045	4.6	2.16	2.16	0.00	2.16	4.31	547.21	248,730	100%
50	329.8	991,377	4.7	2.16	2.16	0.00	2.16	4.31	551.15	250,525	100%
52	304.6	1,030,433	4.9	2.16	2.16	0.00	2.16	4.31	554.67	252,124	100%
54	281.3	1,066,465	5.0	2.16	2.16	0.00	2.16	4.31	557.82	253,556	100%
56	259.8	1,099,703	5.2	2.16	2.16	0.00	2.16	4.31	560.65	254,841	100%
58	239.9	1,130,361	5.3	2.16	2.16	0.00	2.16	4.31	563.20	255,998	100%
60	221.6	1,158,637	5.4	2.16	2.16	0.00	2.16	4.31	565.49	257,042	100%
62	204.7	1,184,711	5.5	2.16	2.16	0.00	2.16	4.31	567.57	257,986	100%
64	189.0	1,208,754	5.6	2.16	2.16	0.00	2.16	4.31	569.45	258,841	100%
66	174.6	1,230,919	5.7	2.16	2.16	0.00	2.16	4.31	571.16	259,617	100%
68	161.2	1,251,350	5.8	2.16	2.16	0.00	2.16	4.31	572.71	260,322	100%
70	148.9	1,270,181	5.8	2.16	2.16	0.00	2.16	4.31	574.12	260,963	100%
72	137.5	1,287,532	5.9	2.16	2.16	0.00	2.16	4.31	575.40	261,547	100%
74	127.0	1,303,518	6.0	2.16	2.16	0.00	2.16	4.31	576.57	262,079	100%
76	117.3	1,318,242	6.0	2.16	2.16	0.00	2.16	4.31	577.64	262,565	100%
78	108.3	1,331,802	6.1	2.16	2.16	0.00	2.16	4.31	578.62	263,008	100%
80	100.1	1,344,285	6.1	2.16	2.16	0.00	2.16	4.31	579.51	263,412	100%
82	92.4	1,355,775	6.2	2.16	2.16	0.00	2.16	4.31	580.32	263,782	100%

84	85.4	1,366,347	6.2	2.16	2.16	0.00	2.16	4.31	581.06	264,120	100%
86	78.8	1,376,072	6.2	2.16	2.16	0.00	2.16	4.31	581.74	264,428	100%
88	72.8	1,385,014	6.3	2.16	2.16	0.00	2.16	4.31	582.36	264,711	100%
90	67.2	1,393,232	6.3	2.16	2.16	0.00	2.16	4.31	582.93	264,969	100%
92	62.1	1,400,783	6.3	2.16	2.16	0.00	2.16	4.31	583.45	265,205	100%
94	57.4	1,407,718	6.3	2.16	2.16	0.00	2.16	4.31	583.93	265,421	100%
96	53.0	1,414,082	6.4	2.16	2.16	0.00	2.16	4.31	584.36	265,618	100%
98	48.9	1,419,921	6.4	2.16	2.16	0.00	2.16	4.31	584.76	265,798	100%
100	45.2	1,425,274	6.4	2.16	2.16	0.00	2.16	4.31	585.12	265,963	100%
102	41.7	1,430,178	6.4	2.16	2.16	0.00	2.16	4.31	585.45	266,114	100%
104	38.5	1,434,668	6.5	2.16	2.16	0.00	2.16	4.31	585.75	266,251	100%
106	35.6	1,438,775	6.5	2.16	2.16	0.00	2.16	4.31	586.03	266,376	100%
108	32.9	1,442,529	6.5	2.16	2.16	0.00	2.16	4.31	586.28	266,491	100%
110	30.4	1,445,956	6.5	2.16	2.16	0.00	2.16	4.31	586.51	266,595	100%
112	28.0	1,449,081	6.5	2.16	2.16	0.00	2.16	4.31	586.72	266,690	100%
114	25.9	1,451,929	6.5	2.16	2.16	0.00	2.16	4.31	586.91	266,776	100%
116	23.9	1,454,519	6.5	2.16	2.16	0.00	2.16	4.31	587.08	266,854	100%
118	22.1	1,456,871	6.5	2.16	2.16	0.00	2.16	4.31	587.24	266,925	100%
120	20.4	1,459,004	6.5	2.16	2.16	0.00	2.16	4.31	587.38	266,990	100%
122	18.8	1,460,935	6.5	2.16	2.16	0.00	2.16	4.31	587.51	267,048	100%
124	17.4	1,462,678	6.6	2.16	2.16	0.00	2.16	4.31	587.62	267,100	100%
126	16.1	1,464,249	6.6	2.16	2.16	0.00	2.16	4.31	587.72	267,148	100%
128	14.8	1,465,660	6.6	2.16	2.16	0.00	2.16	4.31	587.82	267,190	100%
130	13.7	1,466,923	6.6	2.16	2.16	0.00	2.16	4.31	587.90	267,228	100%
132	12.7	1,468,051	6.6	2.16	2.16	0.00	2.16	4.31	587.98	267,262	100%
134	11.7	1,469,052	6.6	2.16	2.16	0.00	2.16	4.31	588.04	267,292	100%
136	10.8	1,469,938	6.6	2.16	2.16	0.00	2.16	4.31	588.10	267,318	100%
138	10.0	1,470,716	6.6	2.16	2.16	0.00	2.16	4.31	588.15	267,342	100%
140	9.2	1,471,396	6.6	2.16	2.16	0.00	2.16	4.31	588.20	267,362	100%
142	8.5	1,471,983	6.6	2.16	2.16	0.00	2.16	4.31	588.24	267,380	100%
144	7.9	1,472,487	6.6	2.16	2.16	0.00	2.16	4.31	588.27	267,395	100%
146	7.3	1,472,912	6.6	2.16	2.16	0.00	2.16	4.31	588.30	267,407	100%
148	6.7	1,473,265	6.6	2.16	2.16	0.00	2.16	4.31	588.32	267,418	100%
150	6.2	1,473,552	6.6	2.16	2.16	0.00	2.16	4.31	588.34	267,426	100%
152	5.7	1,473,777	6.6	2.16	2.16	0.00	2.16	4.31	588.35	267,433	100%
154	5.3	1,473,945	6.6	2.16	2.16	0.00	2.16	4.31	588.36	267,438	100%
156	4.9	1,474,061	6.6	2.16	2.16	0.00	2.16	4.31	588.37	267,442	100%
158	4.5	1,474,129	6.6	2.16	2.16	0.00	2.16	4.31	588.38	267,444	100%
160	4.2	1,474,152	6.6	2.16	2.16	0.00	2.16	4.31	588.38	267,444	100%
162	3.8	1,474,133	6.6	2.16	2.16	0.00	2.16	4.31	588.38	267,444	100%
164	3.5	1,474,077	6.6	2.16	2.16	0.00	2.16	4.31	588.37	267,442	100%
166	3.3	1,473,985	6.6	2.16	2.16	0.00	2.16	4.31	588.37	267,439	100%
168	3.0	1,473,860	6.6	2.16	2.16	0.00	2.16	4.31	588.36	267,436	100%
170	2.8	1,473,706	6.6	2.16	2.16	0.00	2.16	4.31	588.35	267,431	100%
172	2.6	1,473,524	6.6	2.16	2.16	0.00	2.16	4.31	588.34	267,426	100%
174	2.4	1,473,316	6.6	2.16	2.16	0.00	2.16	4.31	588.32	267,419	100%
176	2.2	1,473,084	6.6	2.16	2.16	0.00	2.16	4.31	588.31	267,412	100%
178	2.0	1,472,831	6.6	2.16	2.16	0.00	2.16	4.31	588.29	267,405	100%
180	1.9	1,472,557	6.6	2.16	2.16	0.00	2.16	4.31	588.27	267,397	100%
182	1.7	1,472,265	6.6	2.16	2.16	0.00	2.16	4.31	588.25	267,388	100%
184	1.6	1,471,956	6.6	2.16	2.16	0.00	2.16	4.31	588.23	267,379	100%
186	1.5	1,471,630	6.6	2.16	2.16	0.00	2.16	4.31	588.21	267,369	100%
188	1.4	1,471,290	6.6	2.16	2.16	0.00	2.16	4.31	588.19	267,359	100%
190	1.3	1,470,936	6.6	2.16	2.16	0.00	2.16	4.31	588.17	267,348	100%
192	1.2	1,470,570	6.6	2.16	2.16	0.00	2.16	4.31	588.14	267,337	100%
194	1.1	1,470,192	6.6	2.16	2.16	0.00	2.16	4.31	588.12	267,326	100%
196	1.0	1,469,804	6.6	2.16	2.16	0.00	2.16	4.31	588.09	267,314	100%
198	0.9	1,469,406	6.6	2.16	2.16	0.00	2.16	4.31	588.07	267,302	100%
200	0.8	1,468,998	6.6	2.16	2.16	0.00	2.16	4.31	588.04	267,290	100%
202	0.8	1,468,582	6.6	2.16	2.16	0.00	2.16	4.31	588.01	267,278	100%
204	0.7	1,468,159	6.6	2.16	2.16	0.00	2.16	4.31	587.98	267,265	100%
206	0.7	1,467,728	6.6	2.16	2.16	0.00	2.16	4.31	587.95	267,252	100%



Sediment Basin #7 Phase 1 Hydrograph
10-Yr Storm
FLOW (cfs)
550
495
440
385
330
275
220
165
110
55
0
STAGE
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]

Qp = 321.57 cfs
Tp = 48.89 minutes
dT = Max of 2 minutes
or 1.0% of increment to peak

Sediment Basin # 7 Brickhaven

Phase 2

10 - year Storm Event

b = 1.3
Ks = 74,919

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	5.2	(ft)	
Height of Riser from bottom of barrel=	9.2	(ft) elevation	217.20
Emergency Spillway =	9.5	(ft) elevation	217.50
Total Height of Dam =	10	(ft) elevation	218.00
Length of Emergency Spillway =	50	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	208.0

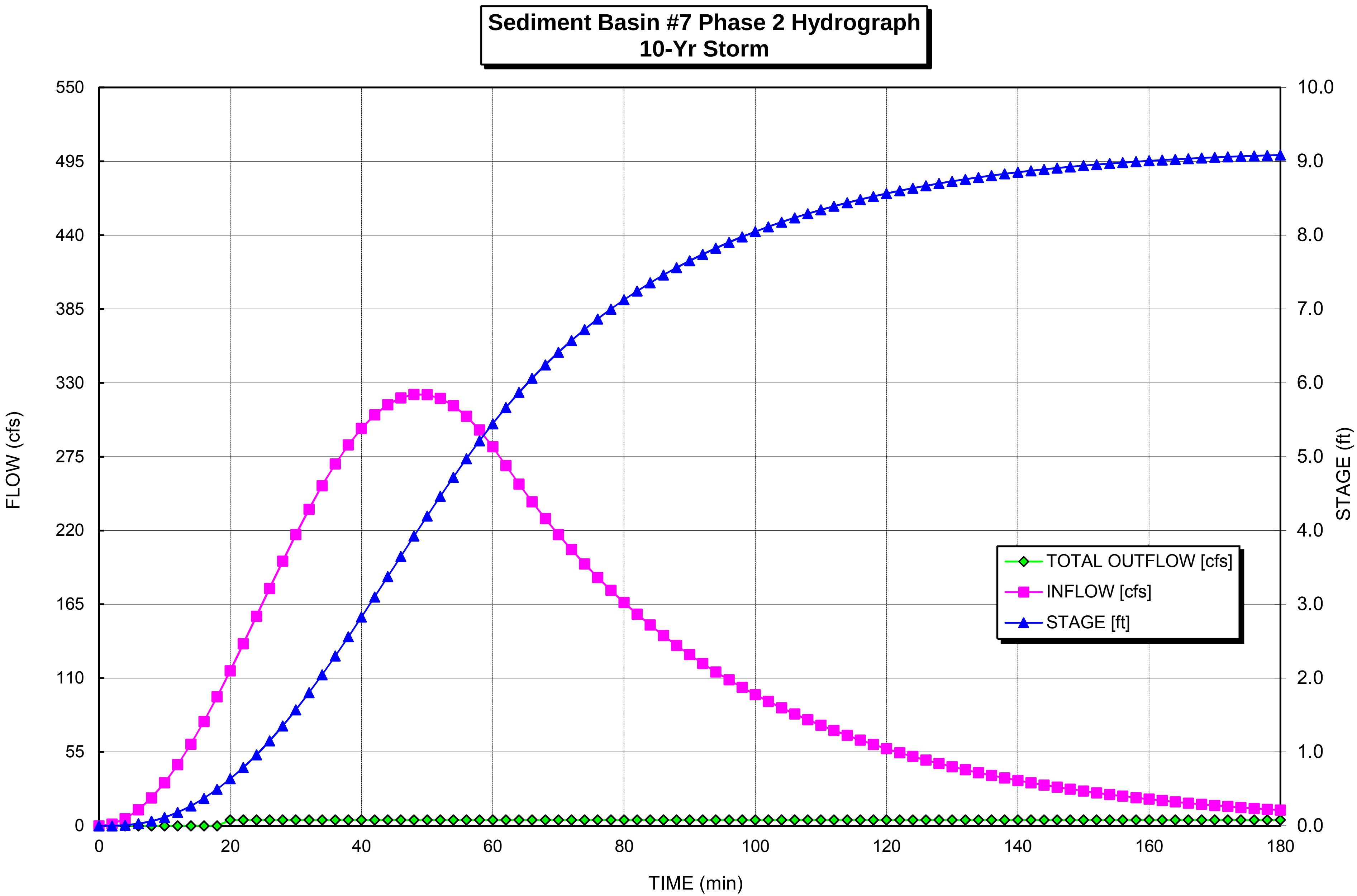
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

100%	Minimum Settling Efficiency		
9.1	ft Maximum Stage	217.12	msl elevation
4.3	cfs Peak outflow		
4.3	cfs Peak Riser/Barrel outflow		
0.0	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACIT Y [cfs]	WEIR FLOW [cfs]	BARREL CAPACIT Y [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.3	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	5.3	159	0.0	0.00	0.00	0.00	0.00	0.00	55.80	25,364	N/A
6	11.8	793	0.0	0.00	0.00	0.00	0.00	0.00	78.87	35,848	N/A
8	20.8	2,209	0.1	0.00	0.00	0.00	0.00	0.00	98.34	44,701	N/A
10	32.1	4,703	0.1	0.00	0.00	0.00	0.00	0.00	115.72	52,600	N/A
12	45.5	8,551	0.2	0.00	0.00	0.00	0.00	0.00	131.62	59,829	N/A
14	60.8	14,008	0.3	0.00	0.00	0.00	0.00	0.00	146.39	66,541	N/A
16	77.7	21,302	0.4	0.00	0.00	0.00	0.00	0.00	160.22	72,828	N/A
18	96.1	30,631	0.5	0.00	0.00	0.00	0.00	0.00	173.26	78,755	N/A
20	115.5	42,161	0.6	2.16	2.16	0.00	2.16	4.31	185.60	84,364	100%
22	135.6	55,500	0.8	2.16	2.16	0.00	2.16	4.31	196.92	89,510	100%
24	156.2	71,256	1.0	2.16	2.16	0.00	2.16	4.31	207.81	94,460	100%
26	176.8	89,480	1.1	2.16	2.16	0.00	2.16	4.31	218.26	99,209	100%
28	197.2	110,179	1.4	2.16	2.16	0.00	2.16	4.31	228.27	103,757	100%
30	217.0	133,324	1.6	2.16	2.16	0.00	2.16	4.31	237.84	108,107	100%
32	235.8	158,840	1.8	2.16	2.16	0.00	2.16	4.31	246.98	112,263	100%
34	253.4	186,619	2.0	2.16	2.16	0.00	2.16	4.31	255.70	116,228	100%
36	269.5	216,510	2.3	2.16	2.16	0.00	2.16	4.31	264.02	120,007	100%
38	283.8	248,330	2.6	2.16	2.16	0.00	2.16	4.31	271.93	123,605	100%
40	296.0	281,865	2.8	2.16	2.16	0.00	2.16	4.31	279.45	127,023	100%
42	306.1	316,871	3.1	2.16	2.16	0.00	2.16	4.31	286.59	130,267	100%
44	313.7	353,081	3.4	2.16	2.16	0.00	2.16	4.31	293.34	133,339	100%
46	318.8	390,206	3.7	2.16	2.16	0.00	2.16	4.31	299.73	136,241	100%
48	321.3	427,944	3.9	2.16	2.16	0.00	2.16	4.31	305.75	138,977	100%
50	321.2	465,983	4.2	2.16	2.16	0.00	2.16	4.31	311.41	141,550	100%
52	318.4	504,005	4.5	2.16	2.16	0.00	2.16	4.31	316.72	143,961	100%
54	313.0	541,693	4.7	2.16	2.16	0.00	2.16	4.31	321.67	146,215	100%
56	305.1	578,734	5.0	2.16	2.16	0.00	2.16	4.31	326.29	148,313	100%
58	294.8	614,827	5.2	2.16	2.16	0.00	2.16	4.31	330.57	150,258	100%
60	282.3	649,687	5.4	2.16	2.16	0.00	2.16	4.31	334.52	152,054	100%
62	268.4	683,048	5.7	2.16	2.16	0.00	2.16	4.31	338.15	153,703	100%
64	254.5	714,742	5.9	2.16	2.16	0.00	2.16	4.31	341.47	155,211	100%
66	241.3	744,767	6.1	2.16	2.16	0.00	2.16	4.31	344.51	156,593	100%
68	228.8	773,210	6.2	2.16	2.16	0.00	2.16	4.31	347.30	157,862	100%
70	217.0	800,153	6.4	2.16	2.16	0.00	2.16	4.31	349.87	159,031	100%
72	205.8	825,675	6.6	2.16	2.16	0.00	2.16	4.31	352.24	160,111	100%
74	195.1	849,847	6.7	2.16	2.16	0.00	2.16	4.31	354.44	161,109	100%
76	185.0	872,741	6.9	2.16	2.16	0.00	2.16	4.31	356.47	162,034	100%
78	175.4	894,423	7.0	2.16	2.16	0.00	2.16	4.31	358.36	162,893	100%
80	166.3	914,955	7.1	2.16	2.16	0.00	2.16	4.31	360.12	163,691	100%
82	157.7	934,396	7.2	2.16	2.16	0.00	2.16	4.31	361.75	164,434	100%
84	149.5	952,805	7.4	2.16	2.16	0.00	2.16	4.31	363.28	165,126	100%

86	141.8	970,233	7.5	2.16	2.16	0.00	2.16	4.31	364.70	165,772	100%
88	134.5	986,731	7.6	2.16	2.16	0.00	2.16	4.31	366.03	166,375	100%
90	127.5	1,002,348	7.7	2.16	2.16	0.00	2.16	4.31	367.27	166,939	100%
92	120.9	1,017,130	7.7	2.16	2.16	0.00	2.16	4.31	368.43	167,466	100%
94	114.6	1,031,119	7.8	2.16	2.16	0.00	2.16	4.31	369.51	167,960	100%
96	108.7	1,044,357	7.9	2.16	2.16	0.00	2.16	4.31	370.53	168,422	100%
98	103.1	1,056,883	8.0	2.16	2.16	0.00	2.16	4.31	371.48	168,855	100%
100	97.7	1,068,733	8.0	2.16	2.16	0.00	2.16	4.31	372.37	169,261	100%
102	92.7	1,079,943	8.1	2.16	2.16	0.00	2.16	4.31	373.21	169,642	100%
104	87.9	1,090,545	8.2	2.16	2.16	0.00	2.16	4.31	374.00	169,999	100%
106	83.3	1,100,572	8.2	2.16	2.16	0.00	2.16	4.31	374.74	170,334	100%
108	79.0	1,110,052	8.3	2.16	2.16	0.00	2.16	4.31	375.43	170,649	100%
110	74.9	1,119,015	8.3	2.16	2.16	0.00	2.16	4.31	376.08	170,945	100%
112	71.0	1,127,486	8.4	2.16	2.16	0.00	2.16	4.31	376.69	171,223	100%
114	67.4	1,135,492	8.4	2.16	2.16	0.00	2.16	4.31	377.27	171,484	100%
116	63.9	1,143,057	8.5	2.16	2.16	0.00	2.16	4.31	377.81	171,730	100%
118	60.6	1,150,203	8.5	2.16	2.16	0.00	2.16	4.31	378.31	171,960	100%
120	57.4	1,156,952	8.6	2.16	2.16	0.00	2.16	4.31	378.79	172,177	100%
122	54.4	1,163,325	8.6	2.16	2.16	0.00	2.16	4.31	379.24	172,381	100%
124	51.6	1,169,341	8.6	2.16	2.16	0.00	2.16	4.31	379.66	172,573	100%
126	49.0	1,175,018	8.7	2.16	2.16	0.00	2.16	4.31	380.06	172,753	100%
128	46.4	1,180,375	8.7	2.16	2.16	0.00	2.16	4.31	380.43	172,922	100%
130	44.0	1,185,428	8.7	2.16	2.16	0.00	2.16	4.31	380.78	173,081	100%
132	41.7	1,190,192	8.8	2.16	2.16	0.00	2.16	4.31	381.11	173,231	100%
134	39.6	1,194,682	8.8	2.16	2.16	0.00	2.16	4.31	381.42	173,371	100%
136	37.5	1,198,913	8.8	2.16	2.16	0.00	2.16	4.31	381.71	173,504	100%
138	35.6	1,202,899	8.8	2.16	2.16	0.00	2.16	4.31	381.98	173,628	100%
140	33.7	1,206,651	8.9	2.16	2.16	0.00	2.16	4.31	382.24	173,744	100%
142	32.0	1,210,182	8.9	2.16	2.16	0.00	2.16	4.31	382.48	173,853	100%
144	30.3	1,213,503	8.9	2.16	2.16	0.00	2.16	4.31	382.70	173,956	100%
146	28.8	1,216,625	8.9	2.16	2.16	0.00	2.16	4.31	382.92	174,052	100%
148	27.3	1,219,559	8.9	2.16	2.16	0.00	2.16	4.31	383.11	174,143	100%
150	25.9	1,222,314	8.9	2.16	2.16	0.00	2.16	4.31	383.30	174,227	100%
152	24.5	1,224,900	9.0	2.16	2.16	0.00	2.16	4.31	383.47	174,307	100%
154	23.3	1,227,325	9.0	2.16	2.16	0.00	2.16	4.31	383.64	174,381	100%
156	22.0	1,229,597	9.0	2.16	2.16	0.00	2.16	4.31	383.79	174,450	100%
158	20.9	1,231,725	9.0	2.16	2.16	0.00	2.16	4.31	383.93	174,515	100%
160	19.8	1,233,717	9.0	2.16	2.16	0.00	2.16	4.31	384.07	174,576	100%
162	18.8	1,235,578	9.0	2.16	2.16	0.00	2.16	4.31	384.19	174,633	100%
164	17.8	1,237,316	9.0	2.16	2.16	0.00	2.16	4.31	384.31	174,686	100%
166	16.9	1,238,937	9.0	2.16	2.16	0.00	2.16	4.31	384.42	174,735	100%
168	16.0	1,240,447	9.0	2.16	2.16	0.00	2.16	4.31	384.52	174,781	100%
170	15.2	1,241,852	9.1	2.16	2.16	0.00	2.16	4.31	384.61	174,824	100%
172	14.4	1,243,158	9.1	2.16	2.16	0.00	2.16	4.31	384.70	174,863	100%
174	13.7	1,244,369	9.1	2.16	2.16	0.00	2.16	4.31	384.78	174,900	100%
176	13.0	1,245,491	9.1	2.16	2.16	0.00	2.16	4.31	384.85	174,934	100%
178	12.3	1,246,528	9.1	2.16	2.16	0.00	2.16	4.31	384.92	174,965	100%
180	11.6	1,247,484	9.1	2.16	2.16	0.00	2.16	4.31	384.99	174,994	100%
182	11.0	1,248,364	9.1	2.16	2.16	0.00	2.16	4.31	385.05	175,021	100%
184	10.5	1,249,172	9.1	2.16	2.16	0.00	2.16	4.31	385.10	175,045	100%
186	9.9	1,249,911	9.1	2.16	2.16	0.00	2.16	4.31	385.15	175,067	100%
188	9.4	1,250,585	9.1	2.16	2.16	0.00	2.16	4.31	385.19	175,088	100%
190	8.9	1,251,197	9.1	2.16	2.16	0.00	2.16	4.31	385.23	175,106	100%
192	8.5	1,251,751	9.1	2.16	2.16	0.00	2.16	4.31	385.27	175,123	100%
194	8.0	1,252,249	9.1	2.16	2.16	0.00	2.16	4.31	385.30	175,138	100%
196	7.6	1,252,695	9.1	2.16	2.16	0.00	2.16	4.31	385.33	175,151	100%
198	7.2	1,253,090	9.1	2.16	2.16	0.00	2.16	4.31	385.36	175,163	100%
200	6.8	1,253,439	9.1	2.16	2.16	0.00	2.16	4.31	385.38	175,174	100%
202	6.5	1,253,742	9.1	2.16	2.16	0.00	2.16	4.31	385.40	175,183	100%
204	6.2	1,254,003	9.1	2.16	2.16	0.00	2.16	4.31	385.42	175,191	100%



Sediment Basin #7 Phase 2 Hydrograph
10-Yr Storm
FLOW (cfs)
STAGE (ft)
TIME (min)
TOTAL OUTFLOW [cfs]
INFLOW [cfs]
STAGE [ft]
0
55
110
165
220
275
330
385
440
495
550
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0
20
40
60
80
100
120
140
160
180

Qp = 394.45 cfs
Tp = 49.34 minutes
dT = Max of **2** minutes
or **1.0%** of increment to peak

Sediment Basin # 7 Brickhaven

Phase 2

25 - year Storm Event

b = 1.3
Ks = 74,919

Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	5.2	(ft)	
Height of Riser from bottom of barrel=	9.2	(ft) elevation	217.20
Emergency Spillway =	9.5	(ft) elevation	217.50
Total Height of Dam =	10.0	(ft) elevation	218.00
Length of Emergency Spillway =	50	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	208.0

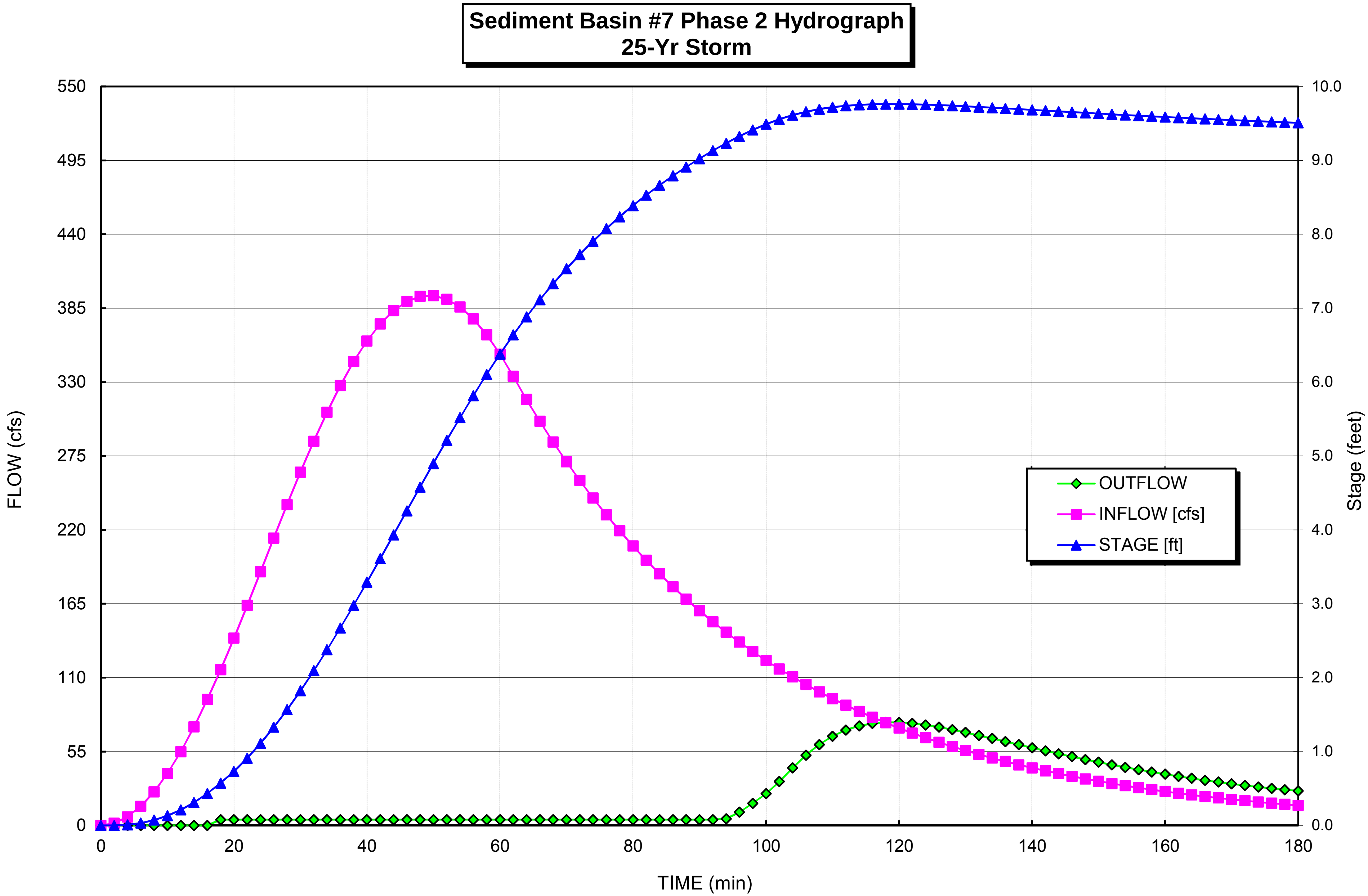
4.0E-03 Settling Velocity of design particle (fps)
2 Effective number of cells (2 is construction site #)

97%	Minimum Settling Efficiency		
9.8	ft Maximum Stage	217.8	msl elevation
76.7	cfs Peak outflow		
56.7	cfs Peak Riser/Barrel outflow		
20.1	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	1.6	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	6.4	192	0.0	0.00	0.00	0.00	0.00	0.00	58.08	26,401	N/A
6	14.2	955	0.0	0.00	0.00	0.00	0.00	0.00	82.09	37,314	N/A
8	25.0	2,661	0.1	0.00	0.00	0.00	0.00	0.00	102.36	46,529	N/A
10	38.6	5,665	0.1	0.00	0.00	0.00	0.00	0.00	120.46	54,753	N/A
12	54.8	10,302	0.2	0.00	0.00	0.00	0.00	0.00	137.02	62,280	N/A
14	73.3	16,881	0.3	0.00	0.00	0.00	0.00	0.00	152.39	69,269	N/A
16	93.8	25,676	0.4	0.00	0.00	0.00	0.00	0.00	166.80	75,818	N/A
18	115.9	36,931	0.6	2.16	2.16	0.00	2.16	4.31	180.38	81,992	100%
20	139.4	50,327	0.7	2.16	2.16	0.00	2.16	4.31	192.82	87,644	100%
22	163.8	66,541	0.9	2.16	2.16	0.00	2.16	4.31	204.77	93,078	100%
24	188.8	85,684	1.1	2.16	2.16	0.00	2.16	4.31	216.23	98,287	100%
26	213.9	107,822	1.3	2.16	2.16	0.00	2.16	4.31	227.21	103,275	100%
28	238.7	132,972	1.6	2.16	2.16	0.00	2.16	4.31	237.70	108,045	100%
30	262.9	161,099	1.8	2.16	2.16	0.00	2.16	4.31	247.73	112,604	100%
32	285.9	192,125	2.1	2.16	2.16	0.00	2.16	4.31	257.31	116,958	100%
34	307.6	225,921	2.4	2.16	2.16	0.00	2.16	4.31	266.45	121,112	100%
36	327.5	262,316	2.7	2.16	2.16	0.00	2.16	4.31	275.16	125,072	100%
38	345.2	301,094	3.0	2.16	2.16	0.00	2.16	4.31	283.45	128,842	100%
40	360.6	342,002	3.3	2.16	2.16	0.00	2.16	4.31	291.34	132,426	100%
42	373.3	384,753	3.6	2.16	2.16	0.00	2.16	4.31	298.82	135,829	100%
44	383.1	429,030	3.9	2.16	2.16	0.00	2.16	4.31	305.92	139,053	100%
46	390.0	474,491	4.3	2.16	2.16	0.00	2.16	4.31	312.63	142,102	100%
48	393.7	520,773	4.6	2.16	2.16	0.00	2.16	4.31	318.96	144,980	100%
50	394.3	567,503	4.9	2.16	2.16	0.00	2.16	4.31	324.91	147,688	100%
52	391.6	614,299	5.2	2.16	2.16	0.00	2.16	4.31	330.51	150,230	100%
54	385.8	660,777	5.5	2.16	2.16	0.00	2.16	4.31	335.74	152,609	100%
56	377.0	706,560	5.8	2.16	2.16	0.00	2.16	4.31	340.62	154,827	100%
58	365.2	751,282	6.1	2.16	2.16	0.00	2.16	4.31	345.15	156,887	100%
60	350.8	794,593	6.4	2.16	2.16	0.00	2.16	4.31	349.34	158,793	100%
62	334.2	836,167	6.6	2.16	2.16	0.00	2.16	4.31	353.20	160,547	100%
64	317.1	875,760	6.9	2.16	2.16	0.00	2.16	4.31	356.74	162,154	100%
66	300.8	913,293	7.1	2.16	2.16	0.00	2.16	4.31	359.98	163,627	100%
68	285.4	948,874	7.3	2.16	2.16	0.00	2.16	4.31	362.95	164,979	100%
70	270.7	982,601	7.5	2.16	2.16	0.00	2.16	4.31	365.70	166,225	100%
72	256.8	1,014,571	7.7	2.16	2.16	0.00	2.16	4.31	368.23	167,375	100%
74	243.6	1,044,873	7.9	2.16	2.16	0.00	2.16	4.31	370.57	168,440	100%
76	231.1	1,073,594	8.1	2.16	2.16	0.00	2.16	4.31	372.74	169,426	100%
78	219.3	1,100,813	8.2	2.16	2.16	0.00	2.16	4.31	374.75	170,342	100%
80	208.0	1,126,609	8.4	2.16	2.16	0.00	2.16	4.31	376.63	171,194	100%
82	197.3	1,151,054	8.5	2.16	2.16	0.00	2.16	4.31	378.37	171,988	100%
84	187.2	1,174,218	8.7	2.16	2.16	0.00	2.16	4.31	380.00	172,727	100%

86	177.6	1,196,167	8.8	2.16	2.16	0.00	2.16	4.31	381.52	173,418	100%
88	168.5	1,216,962	8.9	2.16	2.16	0.00	2.16	4.31	382.94	174,063	100%
90	159.8	1,236,663	9.0	2.16	2.16	0.00	2.16	4.31	384.27	174,666	100%
92	151.6	1,255,327	9.1	2.16	2.16	0.00	2.16	4.31	385.51	175,230	100%
94	143.9	1,273,005	9.2	2.16	2.50	0.00	94.48	5.00	386.67	175,759	100%
96	136.5	1,289,668	9.3	2.16	4.93	0.00	95.06	9.87	387.75	176,252	100%
98	129.5	1,304,860	9.4	2.16	8.23	0.00	95.58	16.45	388.73	176,697	100%
100	122.8	1,318,422	9.5	2.16	11.80	0.00	96.04	23.60	389.60	177,091	100%
102	116.5	1,330,328	9.6	2.16	15.36	1.98	96.45	32.69	390.36	177,434	99%
104	110.5	1,340,387	9.6	2.16	18.63	5.65	96.79	42.92	390.99	177,722	99%
106	104.9	1,348,501	9.7	2.16	21.44	9.43	97.06	52.31	391.50	177,954	98%
108	99.5	1,354,808	9.7	2.16	23.72	12.77	97.27	60.21	391.89	178,133	98%
110	94.4	1,359,520	9.7	2.16	25.48	15.47	97.43	66.42	392.18	178,266	98%
112	89.5	1,362,874	9.7	2.16	26.75	17.50	97.54	71.00	392.39	178,360	97%
114	84.9	1,365,097	9.8	2.16	27.61	18.88	97.61	74.11	392.53	178,423	97%
116	80.6	1,366,397	9.8	2.16	28.12	19.71	97.65	75.95	392.61	178,460	97%
118	76.4	1,366,952	9.8	2.16	28.34	20.07	97.67	76.74	392.65	178,475	97%
120	72.5	1,366,916	9.8	2.16	28.32	20.05	97.67	76.69	392.64	178,474	97%
122	68.8	1,366,415	9.8	2.16	28.13	19.72	97.65	75.97	392.61	178,460	97%
124	65.3	1,365,554	9.8	2.16	27.79	19.17	97.63	74.75	392.56	178,436	97%
126	61.9	1,364,415	9.7	2.16	27.35	18.45	97.59	73.15	392.49	178,404	97%
128	58.7	1,363,066	9.7	2.16	26.83	17.62	97.54	71.27	392.40	178,366	97%
130	55.7	1,361,562	9.7	2.16	26.25	16.69	97.49	69.20	392.31	178,323	97%
132	52.9	1,359,945	9.7	2.16	25.64	15.72	97.44	67.00	392.21	178,278	98%
134	50.1	1,358,248	9.7	2.16	25.00	14.72	97.38	64.72	392.11	178,230	98%
136	47.6	1,356,500	9.7	2.16	24.35	13.72	97.32	62.41	392.00	178,180	98%
138	45.1	1,354,719	9.7	2.16	23.69	12.72	97.27	60.09	391.89	178,130	98%
140	42.8	1,352,924	9.7	2.16	23.03	11.73	97.21	57.79	391.77	178,079	98%
142	40.6	1,351,126	9.7	2.16	22.38	10.78	97.15	55.53	391.66	178,028	98%
144	38.5	1,349,336	9.7	2.16	21.74	9.85	97.09	53.32	391.55	177,977	98%
146	36.6	1,347,561	9.7	2.16	21.11	8.96	97.03	51.17	391.44	177,927	98%
148	34.7	1,345,807	9.6	2.16	20.49	8.10	96.97	49.09	391.33	177,877	99%
150	32.9	1,344,078	9.6	2.16	19.89	7.29	96.91	47.07	391.22	177,828	99%
152	31.2	1,342,376	9.6	2.16	19.31	6.52	96.85	45.13	391.11	177,779	99%
154	29.6	1,340,705	9.6	2.16	18.74	5.79	96.80	43.27	391.01	177,732	99%
156	28.1	1,339,066	9.6	2.16	18.19	5.10	96.74	41.48	390.91	177,685	99%
158	26.6	1,337,458	9.6	2.16	17.65	4.46	96.69	39.77	390.81	177,639	99%
160	25.3	1,335,884	9.6	2.16	17.14	3.85	96.63	38.13	390.71	177,594	99%
162	24.0	1,334,342	9.6	2.16	16.64	3.29	96.58	36.56	390.61	177,549	99%
164	22.7	1,332,832	9.6	2.16	16.15	2.77	96.53	35.07	390.51	177,506	99%
166	21.6	1,331,353	9.6	2.16	15.68	2.29	96.48	33.65	390.42	177,464	99%
168	20.5	1,329,905	9.6	2.16	15.22	1.85	96.43	32.30	390.33	177,422	99%
170	19.4	1,328,485	9.5	2.16	14.78	1.45	96.39	31.02	390.24	177,381	99%
172	18.4	1,327,094	9.5	2.16	14.36	1.09	96.34	29.80	390.15	177,341	99%
174	17.5	1,325,729	9.5	2.16	13.94	0.77	96.29	28.66	390.06	177,302	99%
176	16.6	1,324,388	9.5	2.16	13.54	0.50	96.25	27.58	389.98	177,263	99%
178	15.7	1,323,069	9.5	2.16	13.15	0.27	96.20	26.56	389.90	177,225	100%
180	14.9	1,321,769	9.5	2.16	12.76	0.10	96.16	25.63	389.81	177,188	100%
182	14.2	1,320,485	9.5	2.16	12.39	0.00	96.11	24.78	389.73	177,151	100%
184	13.4	1,319,210	9.5	2.16	12.03	0.00	96.07	24.05	389.65	177,114	100%
186	12.7	1,317,935	9.5	2.16	11.66	0.00	96.03	23.33	389.57	177,077	100%
188	12.1	1,316,665	9.5	2.16	11.31	0.00	95.99	22.62	389.49	177,040	100%
190	11.5	1,315,402	9.5	2.16	10.96	0.00	95.94	21.92	389.41	177,004	100%
192	10.9	1,314,147	9.5	2.16	10.62	0.00	95.90	21.23	389.33	176,967	100%
194	10.3	1,312,905	9.5	2.16	10.28	0.00	95.86	20.56	389.25	176,931	100%
196	9.8	1,311,676	9.5	2.16	9.96	0.00	95.82	19.91	389.17	176,895	100%
198	9.3	1,310,461	9.4	2.16	9.64	0.00	95.77	19.27	389.09	176,860	100%
200	8.8	1,309,263	9.4	2.16	9.33	0.00	95.73	18.65	389.02	176,825	100%
202	8.4	1,308,082	9.4	2.16	9.03	0.00	95.69	18.05	388.94	176,791	100%
204	7.9	1,306,919	9.4	2.16	8.73	0.00	95.65	17.47	388.87	176,757	100%
206	7.5	1,305,774	9.4	2.16	8.45	0.00	95.61	16.90	388.79	176,724	100%



Sediment Basin #7 Phase 2 Hydrograph
25-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
550
495
440
385
330
275
220
165
110
55
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180

Sediment Basin # 7 Brickhaven

Phase 2

100 - year Storm Event

Qp = 511.7 cfs
Tp = 50.0 minutes
dT = Max of 2 minutes
or 1.0% of increment to peak

b = 1.3
Ks = 74,919

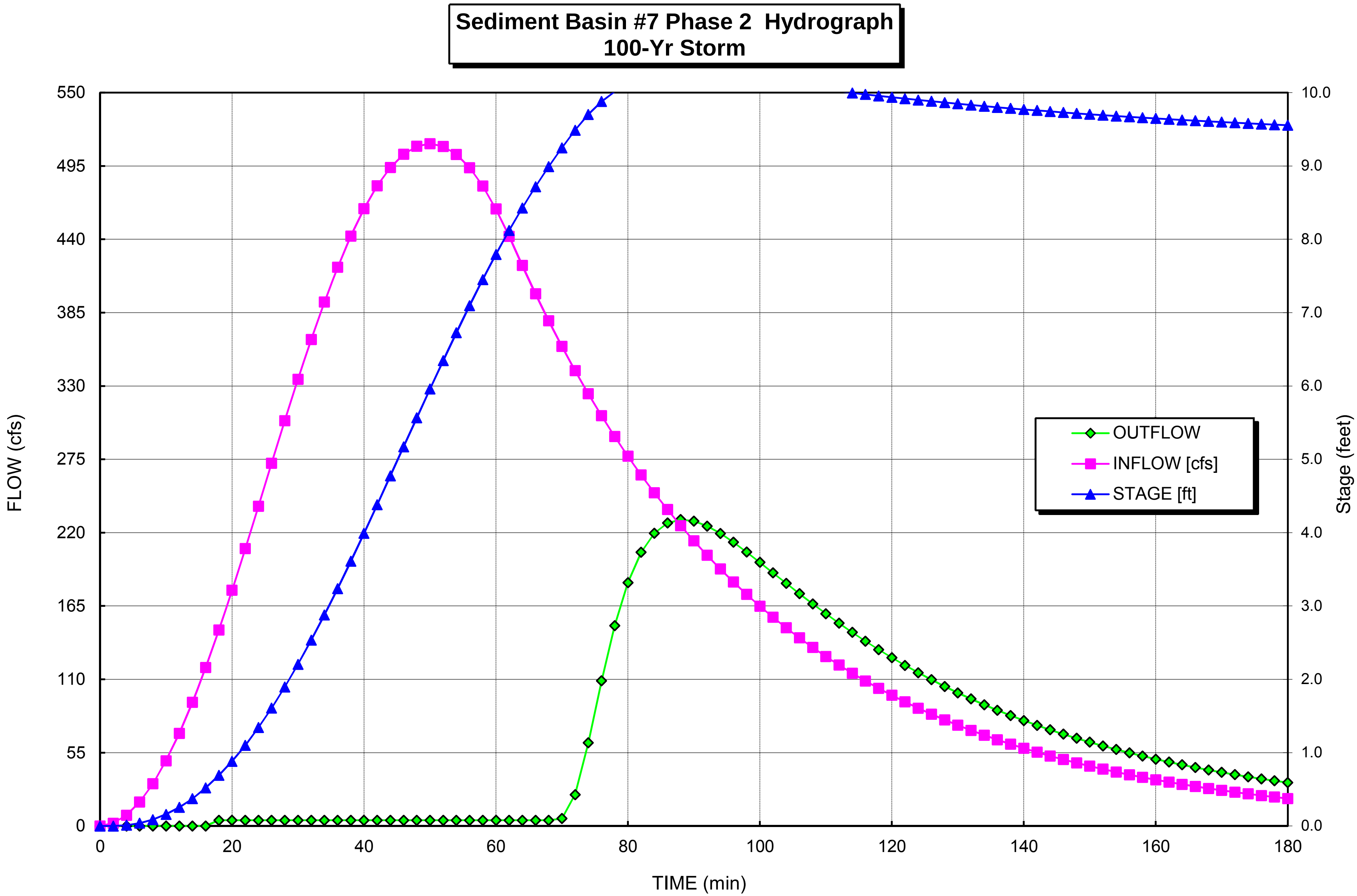
Number of Riser/Barrel Assemblies	2		
Diameter of Barrel =	36	(in)	
Height of Riser above barrel =	5.2	(ft)	
Height of Riser from bottom of barrel=	9.2	(ft) elevation	217.20
Emergency Spillway =	9.5	(ft) elevation	217.50
Total Height of Dam =	10.0	(ft) elevation	218.00
Length of Emergency Spillway =	50	(ft)	
Diameter of Riser =	72	(in)	
Permanent Pond Stage =	0	(ft) elevation	208.0

4.0E-03	Settling Velocity of design particle (fps)		
2	Effective number of cells (2 is construction site #)		
85%	Minimum Settling Efficiency		
10.2	ft Maximum Stage	218.2	msl elevation
229.8	cfs Peak outflow		
135.3	cfs Peak Riser/Barrel outflow		
94.5	cfs peak weir flow		

Notes:
1. Length of emergency spillway is the bottom width of the emergency spillway.
2. Settling efficiency neglects permanent pond volume

TIME (min)	INFLOW [cfs]	STORAGE [cu ft]	STAGE [ft]	Skimmer/ Perf Flow [cfs]	RISER CAPACITY [cfs]	WEIR FLOW [cfs]	BARREL CAPACITY [cfs]	TOTAL OUTFLOW [cfs]	Bound Discharge [cfs]	Estimated Surface Area (sf)	Settling Efficiency [%]
0	0.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
2	2.0	0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	-	N/A
4	8.0	242	0.0	0.00	0.00	0.00	0.00	0.00	61.09	27,766	N/A
6	18.0	1,207	0.0	0.00	0.00	0.00	0.00	0.00	86.34	39,244	N/A
8	31.7	3,364	0.1	0.00	0.00	0.00	0.00	0.00	107.66	48,938	N/A
10	48.9	7,162	0.2	0.00	0.00	0.00	0.00	0.00	126.70	57,590	N/A
12	69.4	13,028	0.3	0.00	0.00	0.00	0.00	0.00	144.12	65,509	N/A
14	92.8	21,352	0.4	0.00	0.00	0.00	0.00	0.00	160.30	72,865	N/A
16	118.8	32,487	0.5	0.00	0.00	0.00	0.00	0.00	175.47	79,758	N/A
18	147.0	46,742	0.7	2.16	2.16	0.00	2.16	4.31	189.77	86,260	100%
20	176.8	63,859	0.9	2.16	2.16	0.00	2.16	4.31	202.96	92,256	100%
22	208.0	84,561	1.1	2.16	2.16	0.00	2.16	4.31	215.62	98,009	100%
24	239.8	108,999	1.3	2.16	2.16	0.00	2.16	4.31	227.74	103,517	100%
26	272.0	137,263	1.6	2.16	2.16	0.00	2.16	4.31	239.33	108,787	100%
28	303.9	169,383	1.9	2.16	2.16	0.00	2.16	4.31	250.42	113,827	100%
30	335.0	205,329	2.2	2.16	2.16	0.00	2.16	4.31	261.02	118,645	100%
32	364.9	245,010	2.5	2.16	2.16	0.00	2.16	4.31	271.14	123,247	100%
34	393.0	288,276	2.9	2.16	2.16	0.00	2.16	4.31	280.81	127,640	100%
36	419.0	334,920	3.2	2.16	2.16	0.00	2.16	4.31	290.03	131,831	100%
38	442.4	384,683	3.6	2.16	2.16	0.00	2.16	4.31	298.81	135,823	100%
40	462.9	437,257	4.0	2.16	2.16	0.00	2.16	4.31	307.17	139,623	100%
42	480.1	492,287	4.4	2.16	2.16	0.00	2.16	4.31	315.11	143,234	100%
44	493.8	549,383	4.8	2.16	2.16	0.00	2.16	4.31	322.65	146,660	100%
46	503.7	608,119	5.2	2.16	2.16	0.00	2.16	4.31	329.79	149,904	100%
48	509.7	668,045	5.6	2.16	2.16	0.00	2.16	4.31	336.53	152,969	100%
50	511.7	728,692	6.0	2.16	2.16	0.00	2.16	4.31	342.89	155,859	100%
52	509.7	789,580	6.3	2.16	2.16	0.00	2.16	4.31	348.87	158,576	100%
54	503.6	850,224	6.7	2.16	2.16	0.00	2.16	4.31	354.47	161,124	100%
56	493.7	910,143	7.1	2.16	2.16	0.00	2.16	4.31	359.71	163,505	100%
58	480.0	968,868	7.5	2.16	2.16	0.00	2.16	4.31	364.59	165,722	100%
60	462.8	1,025,950	7.8	2.16	2.16	0.00	2.16	4.31	369.11	167,778	100%
62	442.3	1,080,964	8.1	2.16	2.16	0.00	2.16	4.31	373.29	169,676	100%
64	420.5	1,133,518	8.4	2.16	2.16	0.00	2.16	4.31	377.12	171,420	100%
66	399.2	1,183,458	8.7	2.16	2.16	0.00	2.16	4.31	380.64	173,019	100%
68	378.9	1,230,841	9.0	2.16	2.16	0.00	2.16	4.31	383.87	174,488	100%
70	359.7	1,275,795	9.2	2.16	2.79	0.00	94.58	5.58	386.85	175,842	100%
72	341.5	1,318,294	9.5	2.16	11.77	0.00	96.04	23.53	389.59	177,087	100%
74	324.2	1,356,450	9.7	2.16	24.33	13.69	97.32	62.34	391.99	178,179	98%
76	307.8	1,387,873	9.9	2.16	36.93	34.95	98.36	108.81	393.93	179,060	95%
78	292.2	1,411,748	10.0	2.16	47.65	54.91	99.14	150.20	395.38	179,719	91%
80	277.4	1,428,784	10.1	2.16	55.83	70.83	99.69	182.49	396.40	180,184	89%
82	263.3	1,440,169	10.2	2.16	61.54	82.17	100.05	205.25	397.08	180,492	87%
84	250.0	1,447,136	10.2	2.16	65.12	89.38	100.28	219.61	397.50	180,680	86%

86	237.3	1,450,779	10.2	2.16	67.01	93.22	100.39	227.25	397.71	180,778	85%
88	225.3	1,451,984	10.2	2.16	67.65	94.50	100.43	229.79	397.78	180,810	85%
90	213.9	1,451,441	10.2	2.16	67.36	93.92	100.41	228.65	397.75	180,796	85%
92	203.0	1,449,666	10.2	2.16	66.43	92.04	100.36	224.91	397.65	180,748	85%
94	192.7	1,447,039	10.2	2.16	65.07	89.27	100.27	219.41	397.49	180,677	86%
96	183.0	1,443,838	10.2	2.16	63.41	85.94	100.17	212.77	397.30	180,591	86%
98	173.7	1,440,261	10.2	2.16	61.58	82.27	100.06	205.43	397.09	180,495	87%
100	164.9	1,436,451	10.1	2.16	59.65	78.41	99.94	197.72	396.86	180,392	88%
102	156.5	1,432,511	10.1	2.16	57.68	74.48	99.81	189.84	396.63	180,285	88%
104	148.6	1,428,514	10.1	2.16	55.70	70.57	99.68	181.96	396.39	180,177	89%
106	141.1	1,424,510	10.1	2.16	53.74	66.71	99.55	174.19	396.15	180,068	89%
108	133.9	1,420,535	10.1	2.16	51.82	62.96	99.42	166.59	395.91	179,959	90%
110	127.1	1,416,615	10.0	2.16	49.94	59.32	99.30	159.20	395.68	179,852	91%
112	120.7	1,412,766	10.0	2.16	48.12	55.82	99.17	152.07	395.44	179,747	91%
114	114.6	1,409,001	10.0	2.16	46.37	52.46	99.05	145.20	395.22	179,644	92%
116	108.8	1,405,325	10.0	2.16	44.67	49.25	98.93	138.60	394.99	179,543	92%
118	103.3	1,401,745	10.0	2.16	43.05	46.19	98.81	132.28	394.78	179,444	93%
120	98.0	1,398,262	9.9	2.16	41.48	43.27	98.70	126.23	394.57	179,348	93%
122	93.1	1,394,876	9.9	2.16	39.98	40.49	98.59	120.45	394.36	179,254	94%
124	88.3	1,391,589	9.9	2.16	38.54	37.86	98.48	114.93	394.16	179,163	94%
126	83.9	1,388,397	9.9	2.16	37.16	35.35	98.38	109.66	393.96	179,075	95%
128	79.6	1,385,301	9.9	2.16	35.83	32.98	98.28	104.64	393.77	178,989	95%
130	75.6	1,382,297	9.8	2.16	34.56	30.72	98.18	99.85	393.59	178,905	95%
132	71.7	1,379,384	9.8	2.16	33.35	28.59	98.08	95.29	393.41	178,824	96%
134	68.1	1,376,560	9.8	2.16	32.19	26.57	97.99	90.94	393.24	178,745	96%
136	64.7	1,373,820	9.8	2.16	31.07	24.65	97.90	86.79	393.07	178,668	96%
138	61.4	1,371,164	9.8	2.16	30.00	22.84	97.81	82.85	392.91	178,594	96%
140	58.3	1,368,588	9.8	2.16	28.98	21.13	97.73	79.09	392.75	178,521	97%
142	55.3	1,366,090	9.8	2.16	28.00	19.52	97.64	75.51	392.59	178,451	97%
144	52.5	1,363,667	9.7	2.16	27.06	17.99	97.56	72.10	392.44	178,383	97%
146	49.9	1,361,316	9.7	2.16	26.16	16.54	97.48	68.86	392.30	178,316	97%
148	47.3	1,359,035	9.7	2.16	25.29	15.18	97.41	65.77	392.15	178,252	98%
150	44.9	1,356,822	9.7	2.16	24.47	13.90	97.34	62.83	392.02	178,190	98%
152	42.7	1,354,673	9.7	2.16	23.67	12.69	97.26	60.03	391.88	178,129	98%
154	40.5	1,352,587	9.7	2.16	22.91	11.55	97.19	57.37	391.75	178,070	98%
156	38.4	1,350,562	9.7	2.16	22.18	10.48	97.13	54.83	391.63	178,012	98%
158	36.5	1,348,595	9.7	2.16	21.47	9.47	97.06	52.42	391.50	177,956	98%
160	34.6	1,346,683	9.6	2.16	20.80	8.53	97.00	50.12	391.38	177,902	98%
162	32.9	1,344,825	9.6	2.16	20.15	7.64	96.93	47.94	391.27	177,849	99%
164	31.2	1,343,018	9.6	2.16	19.53	6.81	96.87	45.86	391.15	177,798	99%
166	29.6	1,341,261	9.6	2.16	18.93	6.03	96.82	43.89	391.04	177,747	99%
168	28.1	1,339,551	9.6	2.16	18.35	5.30	96.76	42.01	390.94	177,699	99%
170	26.7	1,337,886	9.6	2.16	17.80	4.63	96.70	40.22	390.83	177,651	99%
172	25.4	1,336,265	9.6	2.16	17.26	4.00	96.65	38.52	390.73	177,605	99%
174	24.1	1,334,685	9.6	2.16	16.75	3.42	96.59	36.91	390.63	177,559	99%
176	22.9	1,333,144	9.6	2.16	16.25	2.88	96.54	35.38	390.53	177,515	99%
178	21.7	1,331,641	9.6	2.16	15.77	2.38	96.49	33.93	390.44	177,472	99%
180	20.6	1,330,173	9.6	2.16	15.31	1.93	96.44	32.55	390.35	177,430	99%
182	19.5	1,328,739	9.5	2.16	14.86	1.52	96.39	31.24	390.25	177,389	99%
184	18.6	1,327,335	9.5	2.16	14.43	1.15	96.35	30.01	390.17	177,348	99%
186	17.6	1,325,961	9.5	2.16	14.01	0.83	96.30	28.85	390.08	177,309	99%
188	16.7	1,324,613	9.5	2.16	13.61	0.54	96.25	27.75	389.99	177,270	99%
190	15.9	1,323,290	9.5	2.16	13.21	0.31	96.21	26.73	389.91	177,232	100%
192	15.1	1,321,988	9.5	2.16	12.83	0.12	96.17	25.78	389.83	177,194	100%
194	14.3	1,320,703	9.5	2.16	12.45	0.01	96.12	24.92	389.75	177,157	100%
196	13.6	1,319,430	9.5	2.16	12.09	0.00	96.08	24.18	389.66	177,120	100%
198	12.9	1,318,159	9.5	2.16	11.73	0.00	96.04	23.45	389.58	177,083	100%
200	12.2	1,316,892	9.5	2.16	11.37	0.00	95.99	22.74	389.50	177,047	100%
202	11.6	1,315,632	9.5	2.16	11.02	0.00	95.95	22.05	389.42	177,010	100%
204	11.0	1,314,381	9.5	2.16	10.68	0.00	95.91	21.36	389.34	176,974	100%



Sediment Basin #7 Phase 2 Hydrograph
100-Yr Storm
FLOW (cfs)
Stage (feet)
TIME (min)
OUTFLOW
INFLOW [cfs]
STAGE [ft]
550
495
440
385
330
275
220
165
110
55
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
20
40
60
80
100
120
140
160
180

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Watershed Model Schematic

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Project: Hydrographs - Phase 1 EC.gpw	Tuesday, 11 / 4 / 2014

Brickhaven Mine Phase 1

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	86.81	-------	-------	132.65	159.67	-------	203.11	Basin #1 - Ph. 1
2	SCS Runoff	------	-------	233.34	-------	-------	353.56	424.45	-------	538.51	Basin #2 - Ph.1
3	SCS Runoff	------	-------	26.41	-------	-------	42.46	51.95	-------	67.22	Basin #3 - Ph.1
4	SCS Runoff	------	-------	88.73	-------	-------	134.64	161.70	-------	205.24	Basin #4 - Ph.1
5	SCS Runoff	------	-------	95.41	-------	-------	144.76	173.86	-------	220.68	Basin #5 - Ph.1
6	SCS Runoff	------	-------	57.94	-------	-------	87.79	105.39	-------	133.72	Basin #6 - Ph.1
7	SCS Runoff	------	-------	365.54	-------	-------	554.63	666.11	-------	845.50	Basin #7 - Ph.1

Hydrograph Summary Report

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	132.65	2	716	294,117	------	------	------	Basin #1 - Ph. 1
2	SCS Runoff	353.56	2	718	887,249	------	------	------	Basin #2 - Ph.1
3	SCS Runoff	42.46	2	720	114,158	------	------	------	Basin #3 - Ph.1
4	SCS Runoff	134.64	2	720	378,657	------	------	------	Basin #4 - Ph.1
5	SCS Runoff	144.76	2	720	407,140	------	------	------	Basin #5 - Ph.1
6	SCS Runoff	87.79	2	718	220,310	------	------	------	Basin #6 - Ph.1
7	SCS Runoff	554.63	2	720	1,559,866	------	------	------	Basin #7 - Ph.1

Hydrograph Report

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

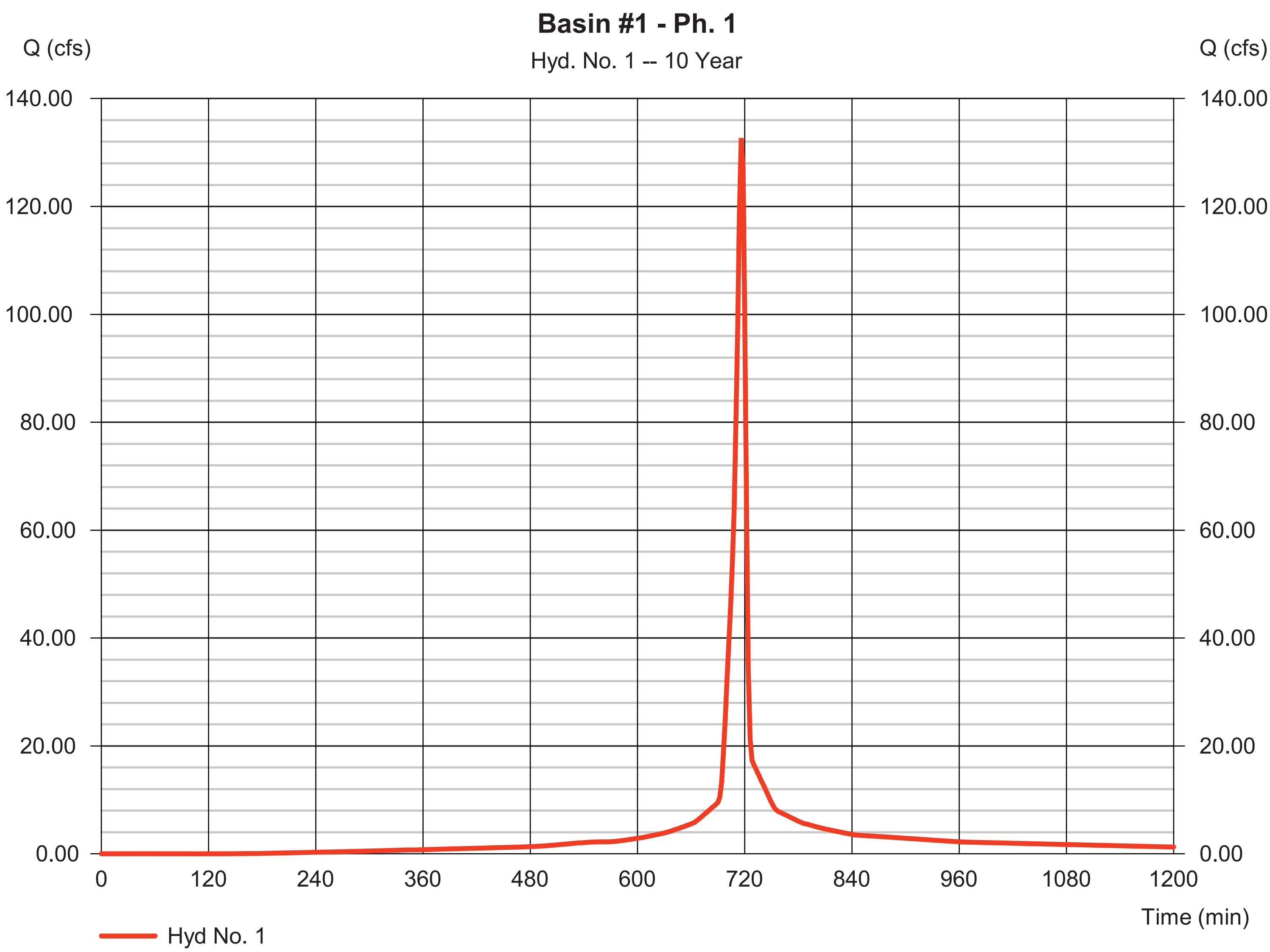
Tuesday, 11 / 4 / 2014

Hyd. No. 1

Basin #1 - Ph. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 132.65 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 294,117 cuft
Drainage area	= 19.800 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.700 x 80) + (18.100 x 94)] / 19.800



Hydrograph Report

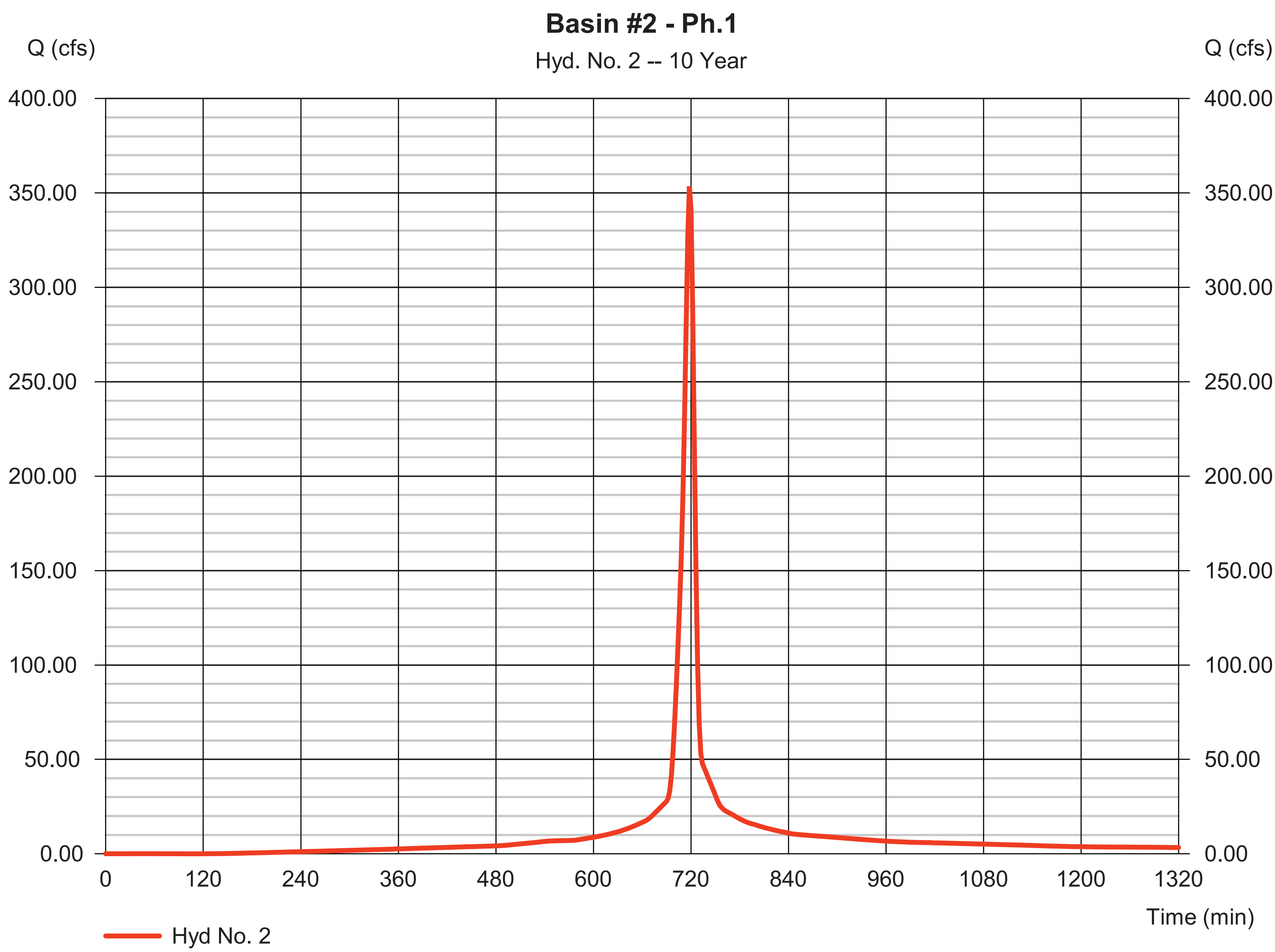
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 2

Basin #2 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 353.56 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 887,249 cuft
Drainage area	= 54.610 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.70 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 2

Basin #2 - Ph.1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.050		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.54		0.00		0.00		
Land slope (%)	=	1.00		0.00		0.00		
Travel Time (min)	**=**	**5.10**	**+**	**0.00**	**+**	**0.00**	**=**	**5.10**
Shallow Concentrated Flow								
Flow length (ft)	=	305.00		0.00		0.00		
Watercourse slope (%)	=	12.10		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	5.61		0.00		0.00		
Travel Time (min)	**=**	**0.91**	**+**	**0.00**	**+**	**0.00**	**=**	**0.91**
Channel Flow								
X sectional flow area (sqft)	=	19.00		0.00		0.00		
Wetted perimeter (ft)	=	12.00		0.00		0.00		
Channel slope (%)	=	3.80		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	26.35		0.00		0.00		
Flow length (ft)		({0})1024.0		0.0		0.0		
Travel Time (min)	**=**	**0.65**	**+**	**0.00**	**+**	**0.00**	**=**	**0.65**

Total Travel Time, Tc .... 6.70 min

Hydrograph Report

Brickhaven Mine Phase 1

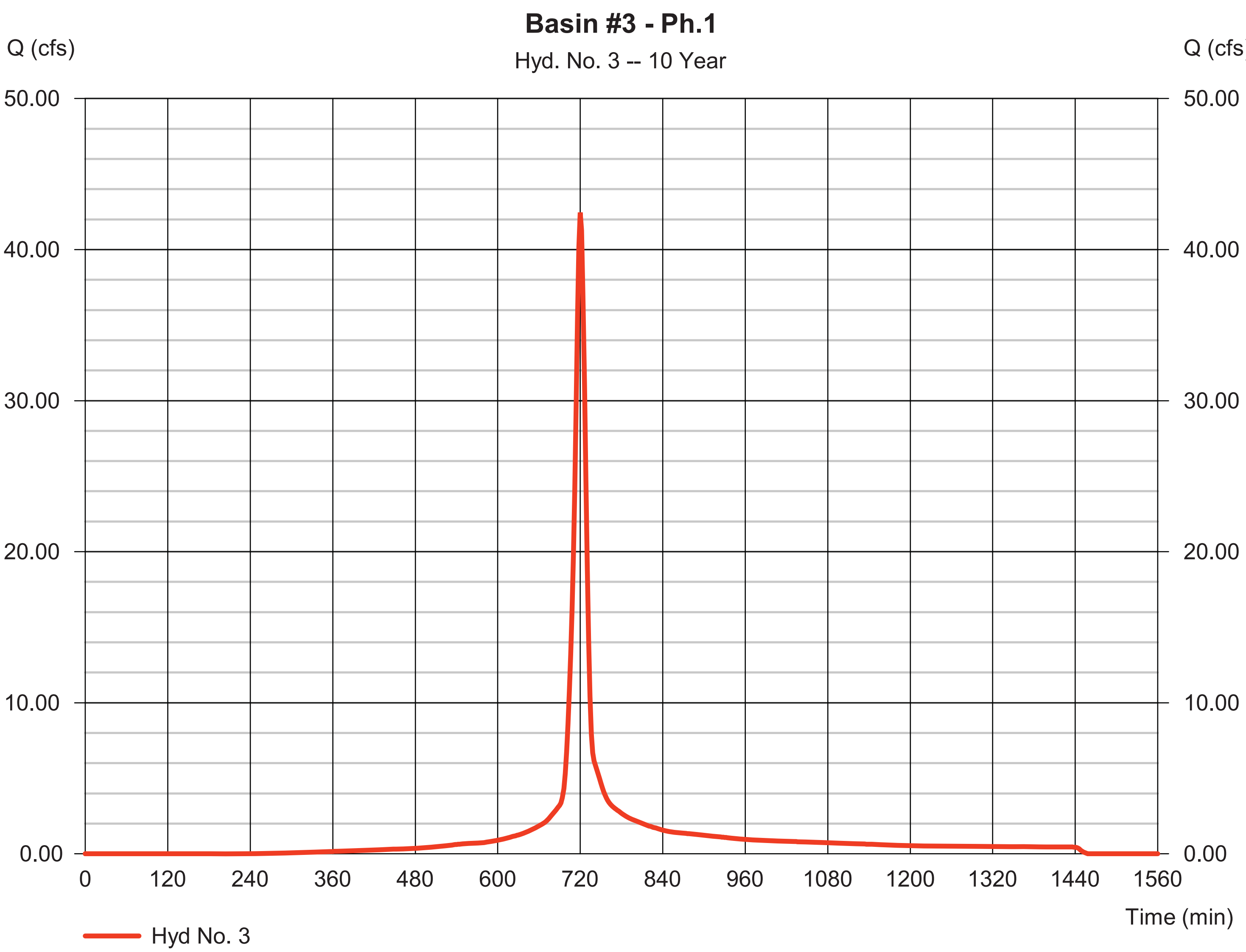
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 | Tuesday, 11 / 4 / 2014

Hyd. No. 3

Basin #3 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 42.46 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 114,158 cuft
Drainage area	= 7.750 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.80 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.000 x 94) + (2.750 x 80)] / 7.750



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 3

Basin #3 - Ph.1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.400		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.54		0.00		0.00		
Land slope (%)	=	9.00		0.00		0.00		
Travel Time (min)	**=**	**11.19**	**+**	**0.00**	**+**	**0.00**	**=**	**11.19**
Shallow Concentrated Flow								
Flow length (ft)	=	392.29		0.00		0.00		
Watercourse slope (%)	=	7.60		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.45			0.00		0.00		
Travel Time (min)	**=**	**1.47**	**+**	**0.00**	**+**	**0.00**	**=**	**1.47**
Channel Flow								
X sectional flow area (sqft)	=	31.00		0.00		0.00		
Wetted perimeter (ft)	=	13.00		0.00		0.00		
Channel slope (%)	=	4.13		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=36.14							
				0.00				
						0.00		
Flow length (ft)	({0})266.6			0.0		0.0		
Travel Time (min)	**=**	**0.12**	**+**	**0.00**	**+**	**0.00**	**=**	**0.12**

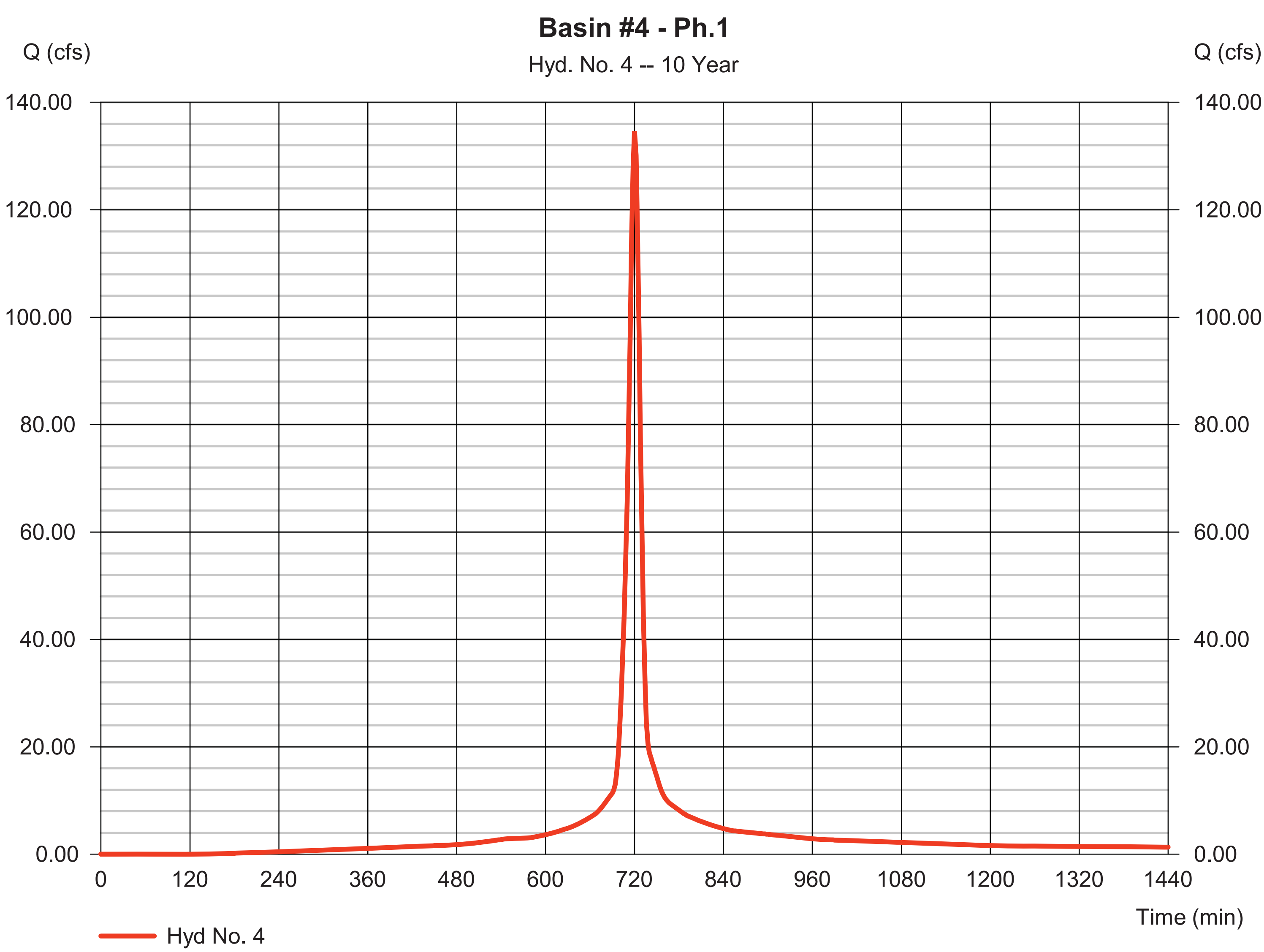
Total Travel Time, Tc .... 12.80 min

Hydrograph Report

Hyd. No. 4

Basin #4 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 134.64 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 378,657 cuft
Drainage area	= 22.600 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.70 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hyd. No. 4

Basin #4 - Ph.1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.050		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.54		0.00		0.00		
Land slope (%)	=	2.00		0.00		0.00		
Travel Time (min)	**=**	**3.87**	**+**	**0.00**	**+**	**0.00**	**=**	**3.87**
Shallow Concentrated Flow								
Flow length (ft)	=	1085.00		0.00		0.00		
Watercourse slope (%)	=	3.00		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)		=2.79		0.00		0.00		
Travel Time (min)	**=**	**6.47**	**+**	**0.00**	**+**	**0.00**	**=**	**6.47**
Channel Flow								
X sectional flow area (sqft)	=	130.00		0.00		0.00		
Wetted perimeter (ft)	=	21.00		0.00		0.00		
Channel slope (%)	=	1.80		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)		=45.20						
				0.00				
						0.00		
Flow length (ft)		({0})1094.0		0.0		0.0		
Travel Time (min)	**=**	**0.40**	**+**	**0.00**	**+**	**0.00**	**=**	**0.40**

Total Travel Time, Tc .... **10.70 min**

Hydrograph Report

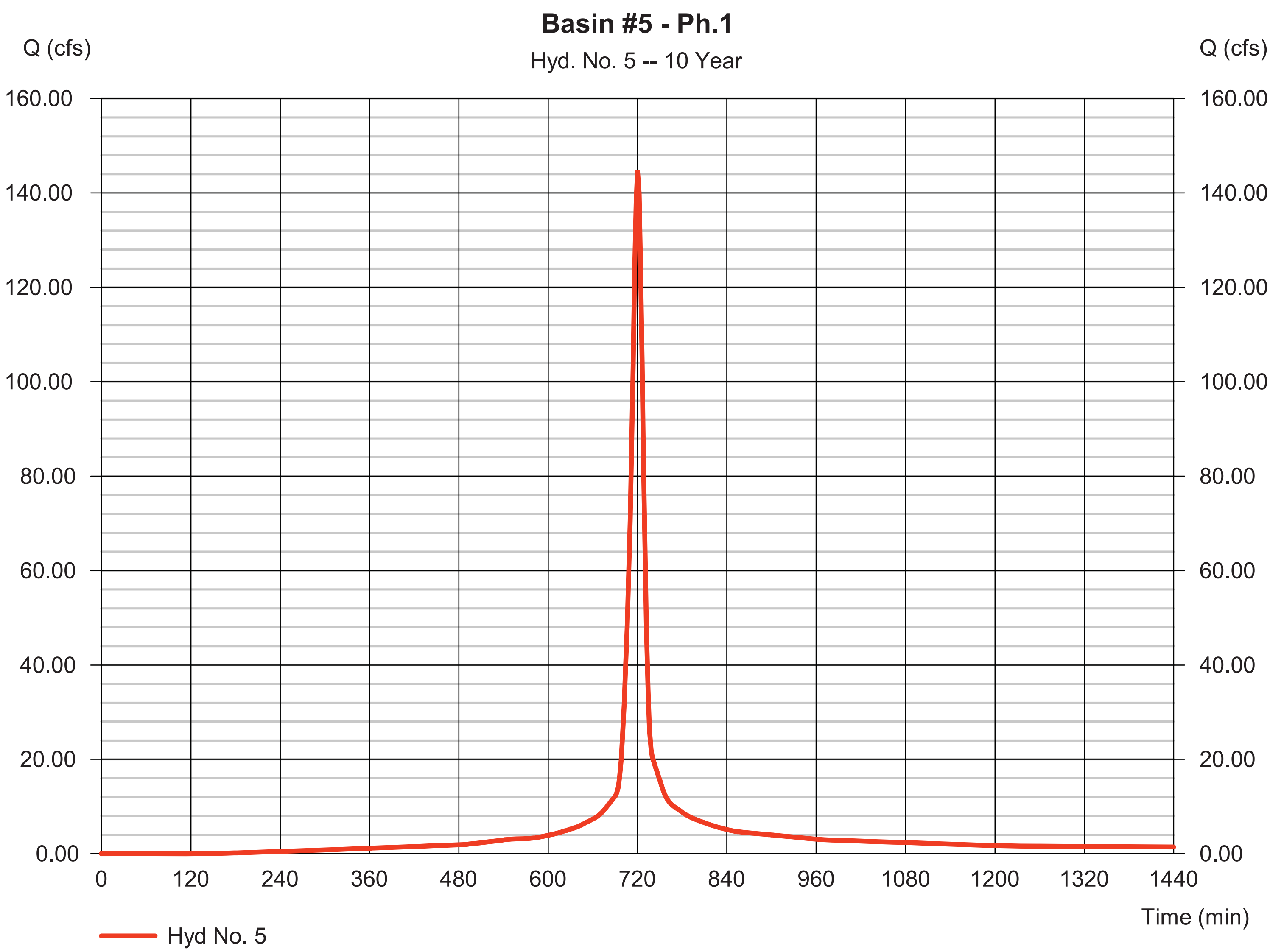
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 5

Basin #5 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 144.76 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 407,140 cuft
Drainage area	= 24.300 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.20 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 5

Basin #5 - Ph.1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 3.87**	**+**	**0.00**	**+**	**0.00**	**=**	**3.87**
Shallow Concentrated Flow							
Flow length (ft)	= 991.00		0.00		0.00		
Watercourse slope (%)	= 2.85		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.72		0.00		0.00		
Travel Time (min)	**= 6.06**	**+**	**0.00**	**+**	**0.00**	**=**	**6.06**
Channel Flow							
X sectional flow area (sqft)	= 24.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 2.40		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=22.08						
			0.00				
					0.00		
Flow length (ft)	({0})290.0		0.0		0.0		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**

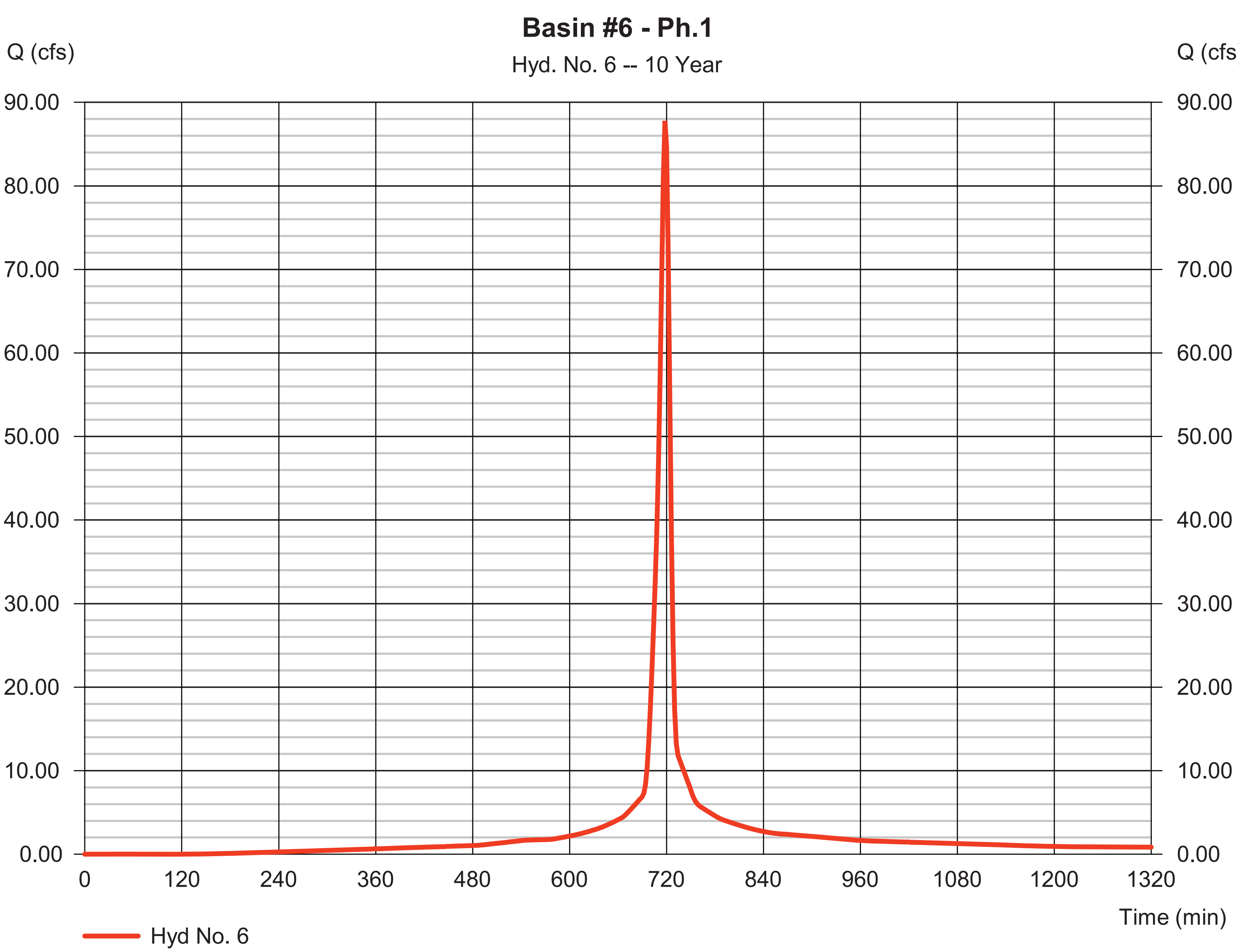
Total Travel Time, Tc .... 10.20 min

Hydrograph Report

Hyd. No. 6

Basin #6 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 87.79 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 220,310 cuft
Drainage area	= 13.560 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.30 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hyd. No. 6

Basin #6 - Ph.1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.050		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.54		0.00		0.00		
Land slope (%)	=	1.00		0.00		0.00		
Travel Time (min)	**=**	**5.10**	**+**	**0.00**	**+**	**0.00**	**=**	**5.10**
Shallow Concentrated Flow								
Flow length (ft)	=	612.00		0.00		0.00		
Watercourse slope (%)	=	3.30		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	2.93		0.00		0.00		
Travel Time (min)	**=**	**3.48**	**+**	**0.00**	**+**	**0.00**	**=**	**3.48**
Channel Flow								
X sectional flow area (sqft)	=	20.00		0.00		0.00		
Wetted perimeter (ft)	=	14.00		0.00		0.00		
Channel slope (%)	=	1.40		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	14.93		0.00		0.00		
Flow length (ft)		({0})661.0		0.0		0.0		
Travel Time (min)	**=**	**0.74**	**+**	**0.00**	**+**	**0.00**	**=**	**0.74**

Total Travel Time, Tc .... 9.30 min

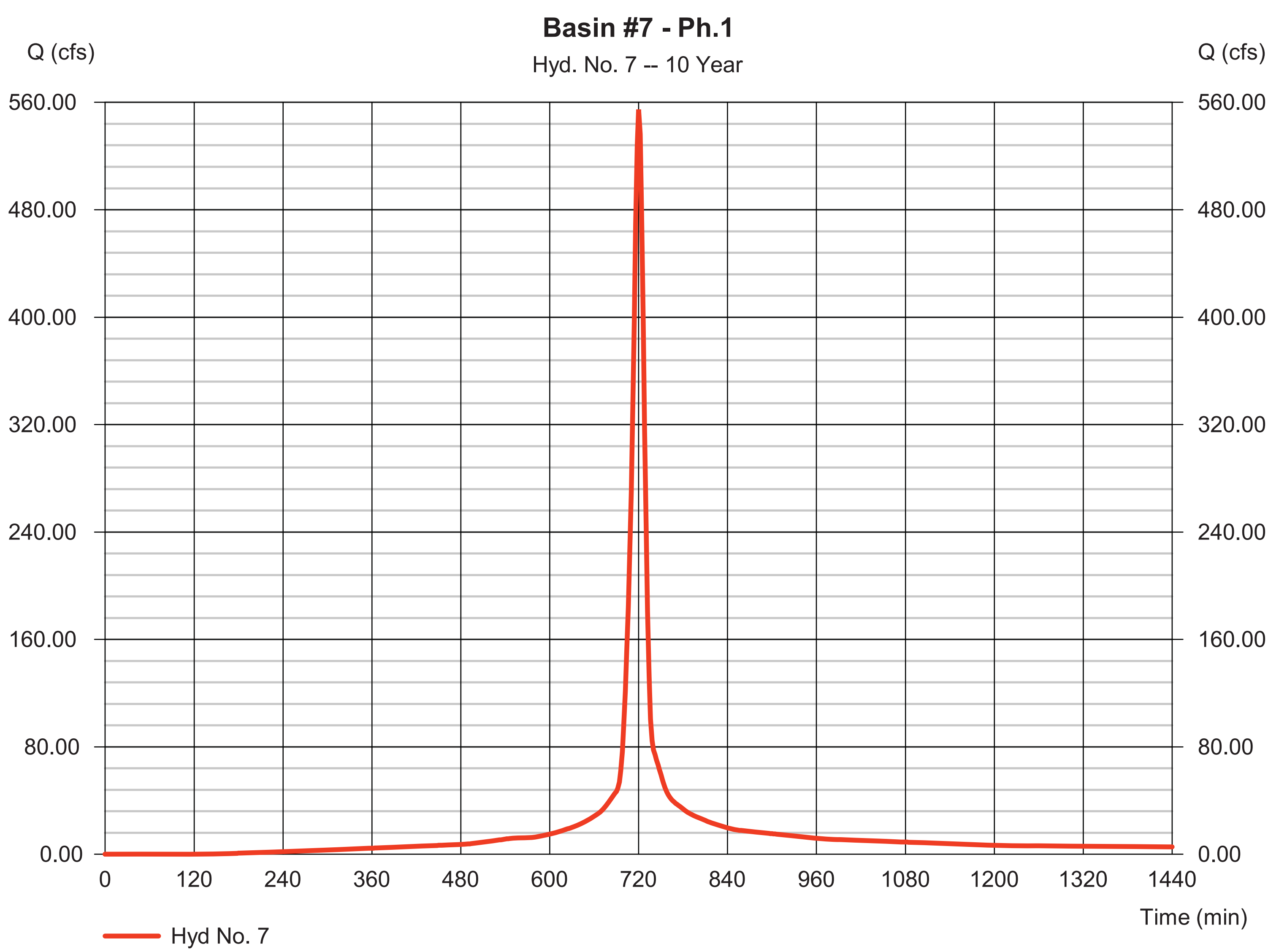
Hydrograph Report

Hyd. No. 7

Basin #7 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 554.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,559,866 cuft
Drainage area	= 93.100 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.50 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(92.100 x 94) + (1.000 x 80)] / 93.100



TR55 Tc Worksheet

Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 7

Basin #7 - Ph.1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 3.87**	**+**	**0.00**	**+**	**0.00**	**=**	**3.87**
Shallow Concentrated Flow							
Flow length (ft)	= 1095.00		0.00		0.00		
Watercourse slope (%)	= 5.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.82		0.00		0.00		
Travel Time (min)	**= 4.78**	**+**	**0.00**	**+**	**0.00**	**=**	**4.78**
Channel Flow							
X sectional flow area (sqft)	= 20.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=12.61		0.00		0.00		
Flow length (ft)	({0})2886.0		0.0		0.0		
Travel Time (min)	**= 3.81**	**+**	**0.00**	**+**	**0.00**	**=**	**3.81**

Total Travel Time, Tc .... 12.50 min

Brickhaven Mine Phase 1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	203.11	2	716	463,246	------	------	------	Basin #1 - Ph. 1
2	SCS Runoff	538.51	2	718	1,386,372	------	------	------	Basin #2 - Ph.1
3	SCS Runoff	67.22	2	720	185,746	------	------	------	Basin #3 - Ph.1
4	SCS Runoff	205.24	2	720	591,671	------	------	------	Basin #4 - Ph.1
5	SCS Runoff	220.68	2	720	636,177	------	------	------	Basin #5 - Ph.1
6	SCS Runoff	133.72	2	718	344,245	------	------	------	Basin #6 - Ph.1
7	SCS Runoff	845.50	2	720	2,437,370	------	------	------	Basin #7 - Ph.1

Hydrograph Report

Brickhaven Mine Phase 1

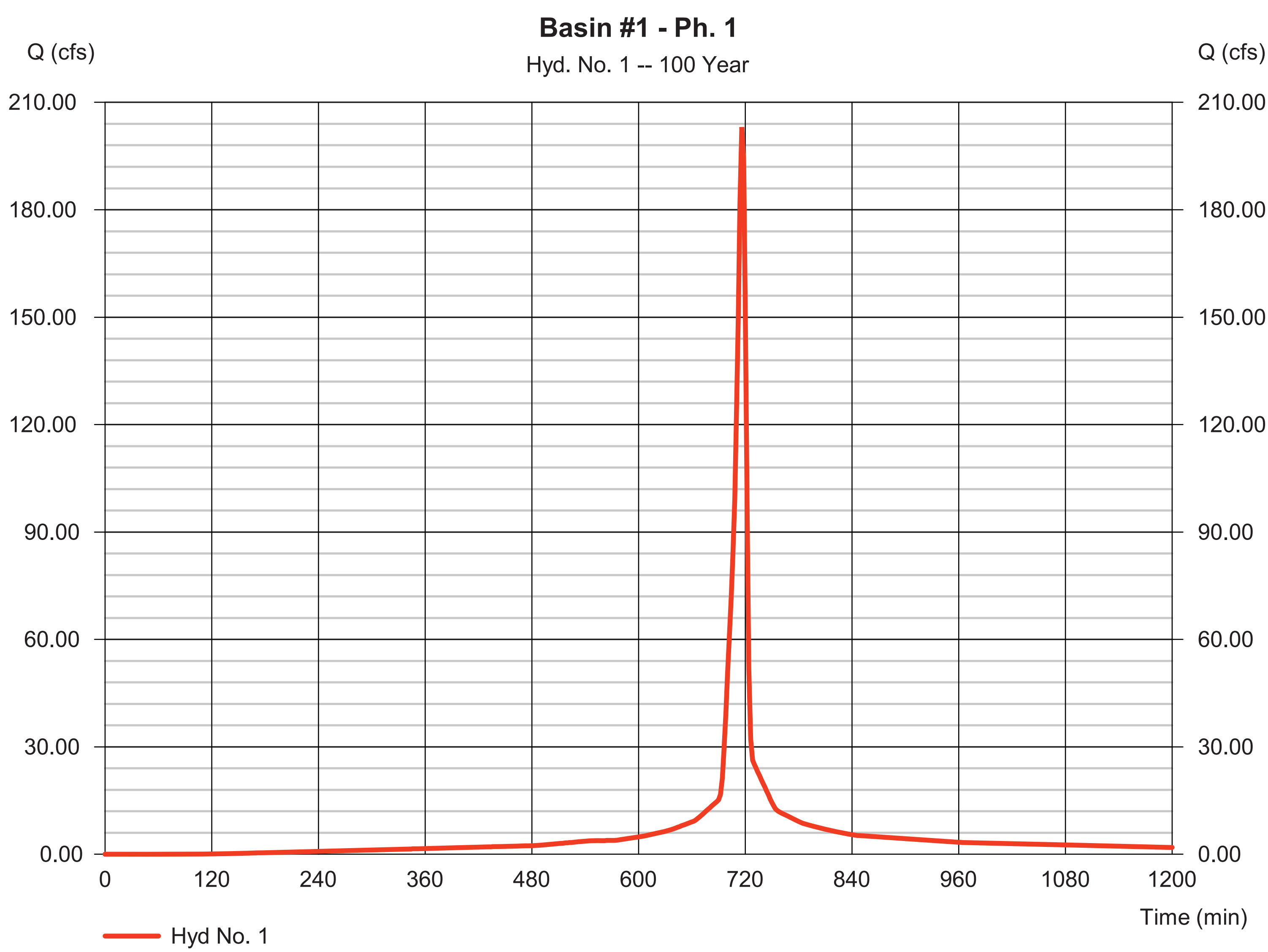
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 1

Basin #1 - Ph. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 203.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 463,246 cuft
Drainage area	= 19.800 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.700 x 80) + (18.100 x 94)] / 19.800



Hydrograph Report

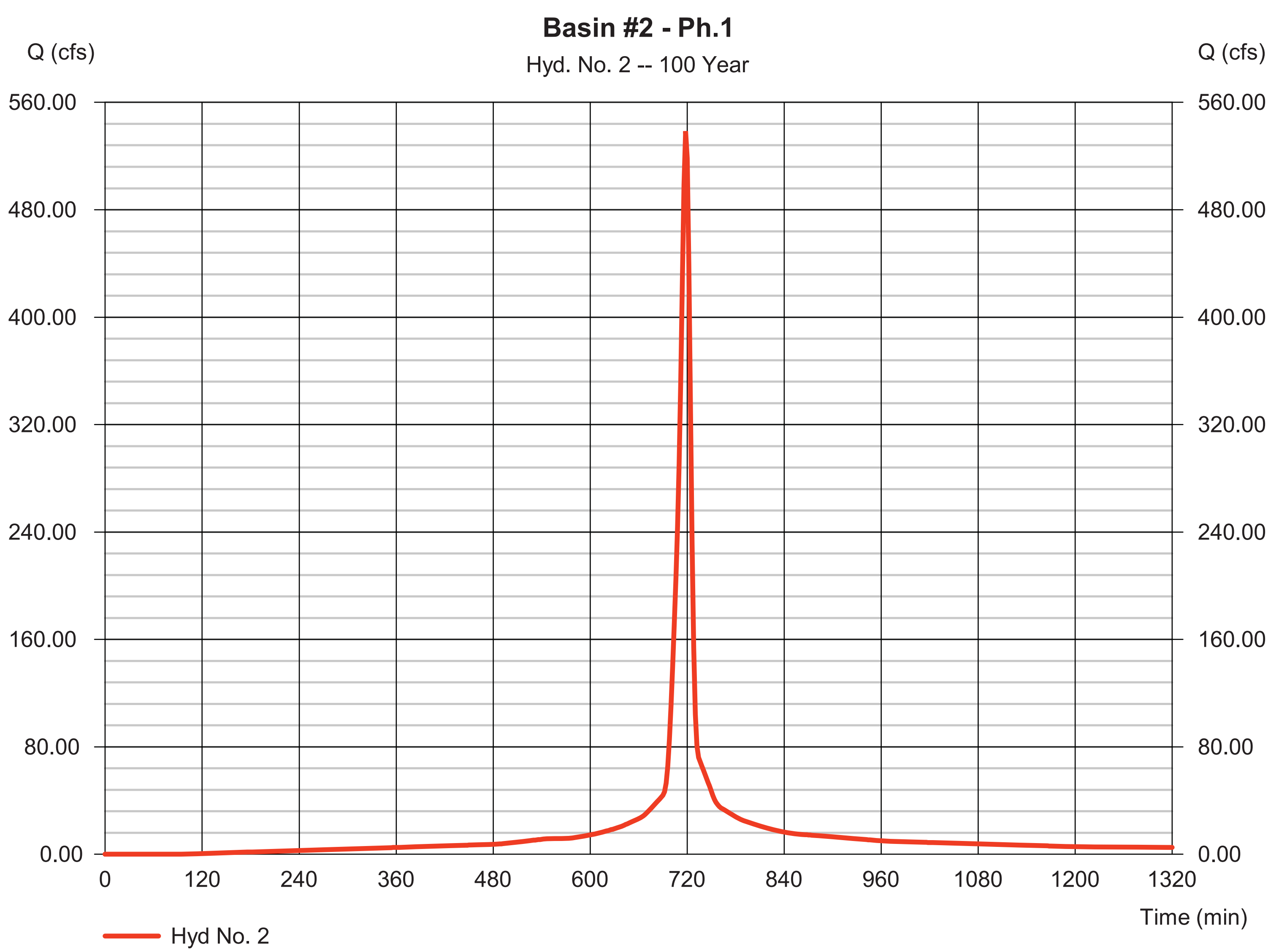
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 2

Basin #2 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 538.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,386,372 cuft
Drainage area	= 54.610 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.70 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Brickhaven Mine Phase 1

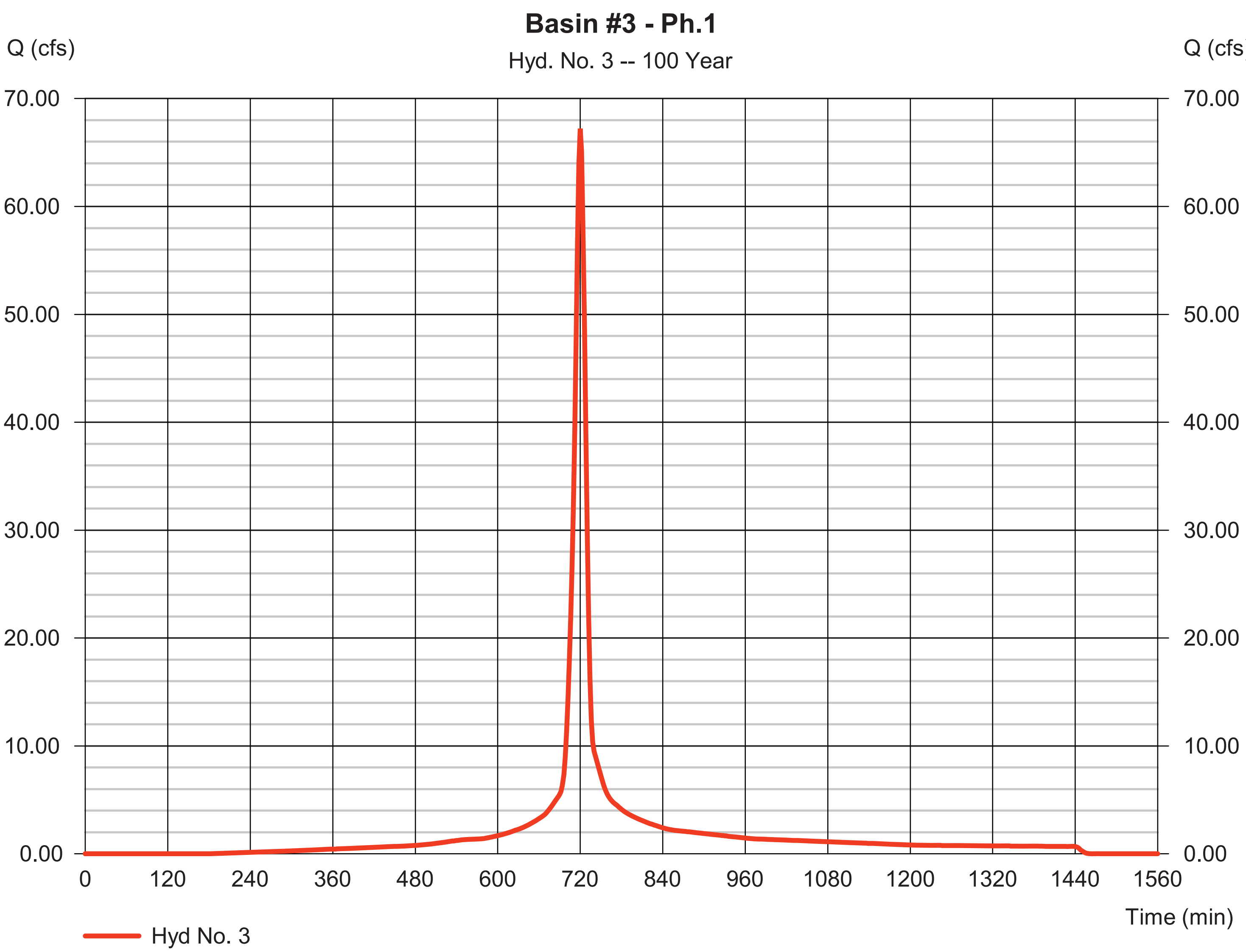
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 | Tuesday, 11 / 4 / 2014

Hyd. No. 3

Basin #3 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 67.22 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 185,746 cuft
Drainage area	= 7.750 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.80 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.000 x 94) + (2.750 x 80)] / 7.750



Hydrograph Report

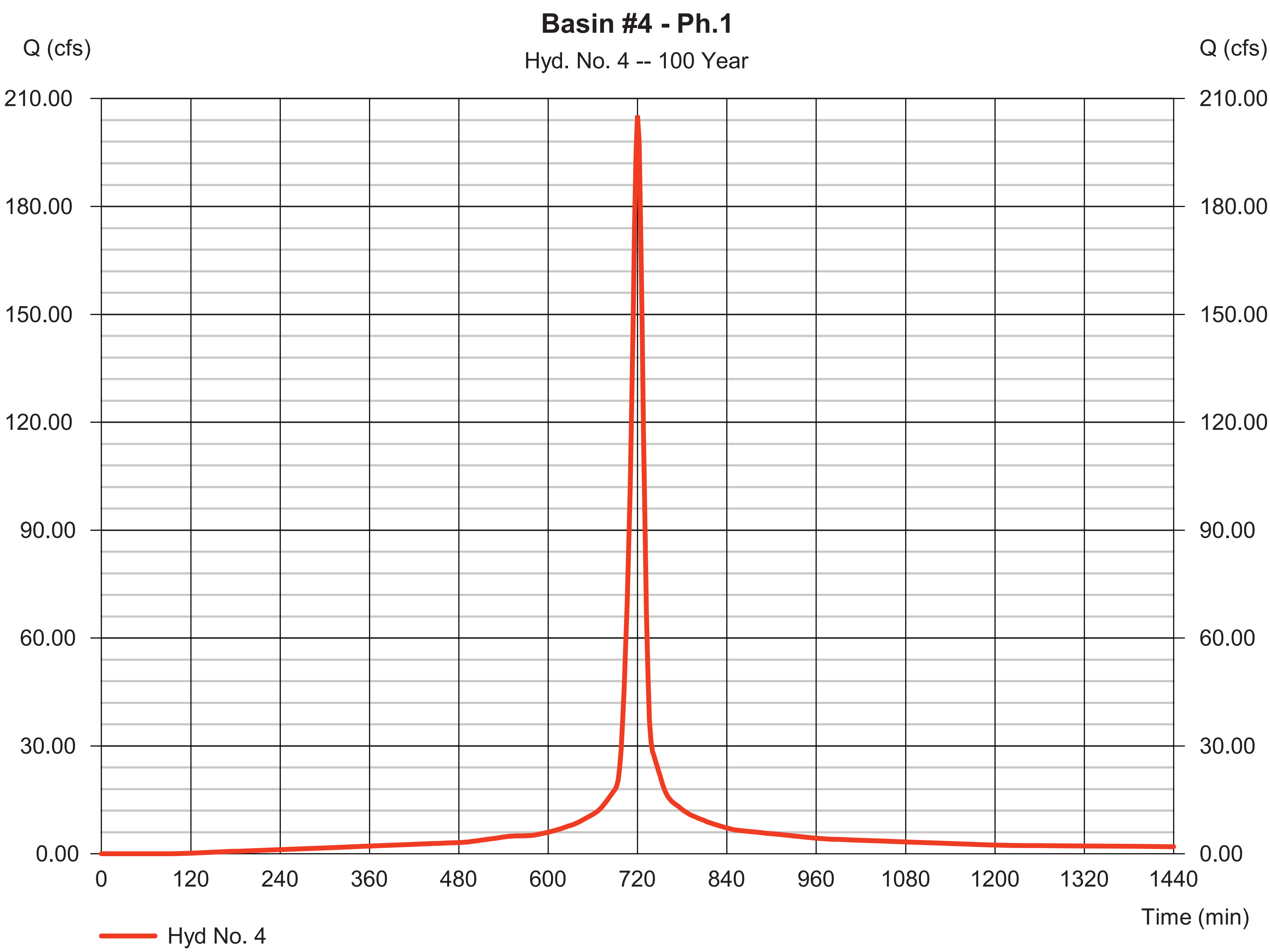
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 4

Basin #4 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 205.24 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 591,671 cuft
Drainage area	= 22.600 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.70 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

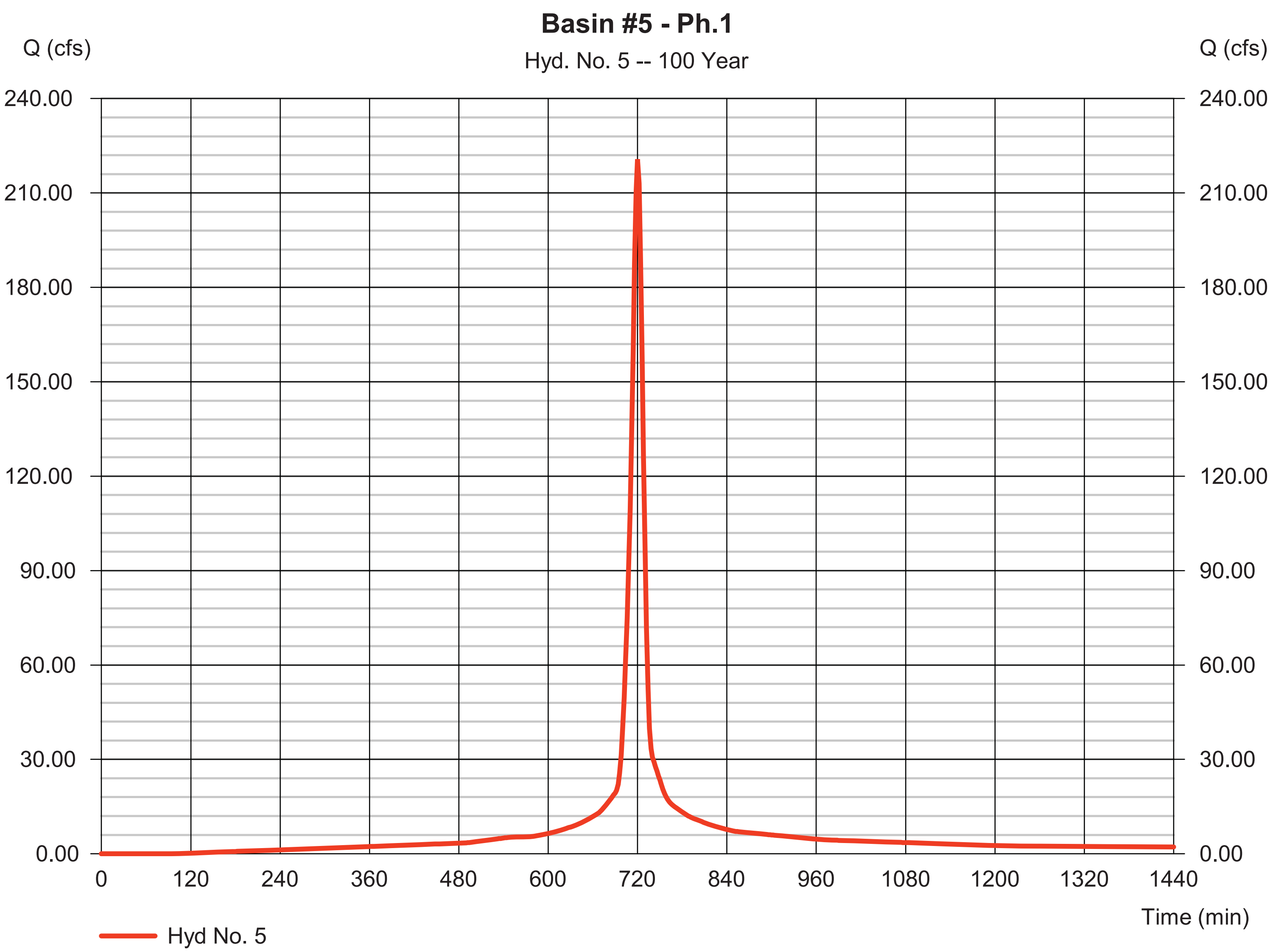
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 5

Basin #5 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 220.68 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 636,177 cuft
Drainage area	= 24.300 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.20 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

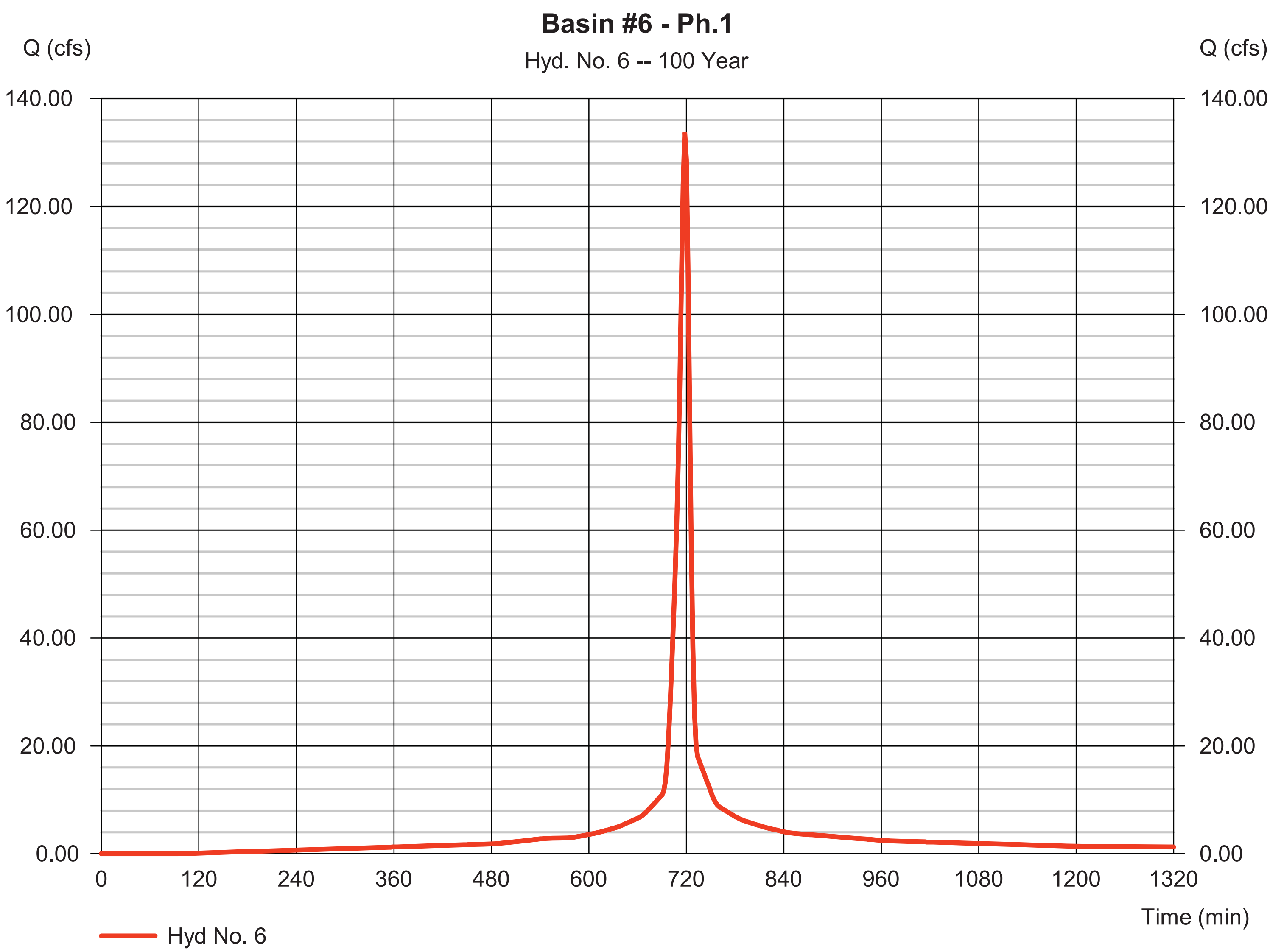
Brickhaven Mine Phase 1

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 | Tuesday, 11 / 4 / 2014

Hyd. No. 6

Basin #6 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 133.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 344,245 cuft
Drainage area	= 13.560 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.30 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Brickhaven Mine Phase 1

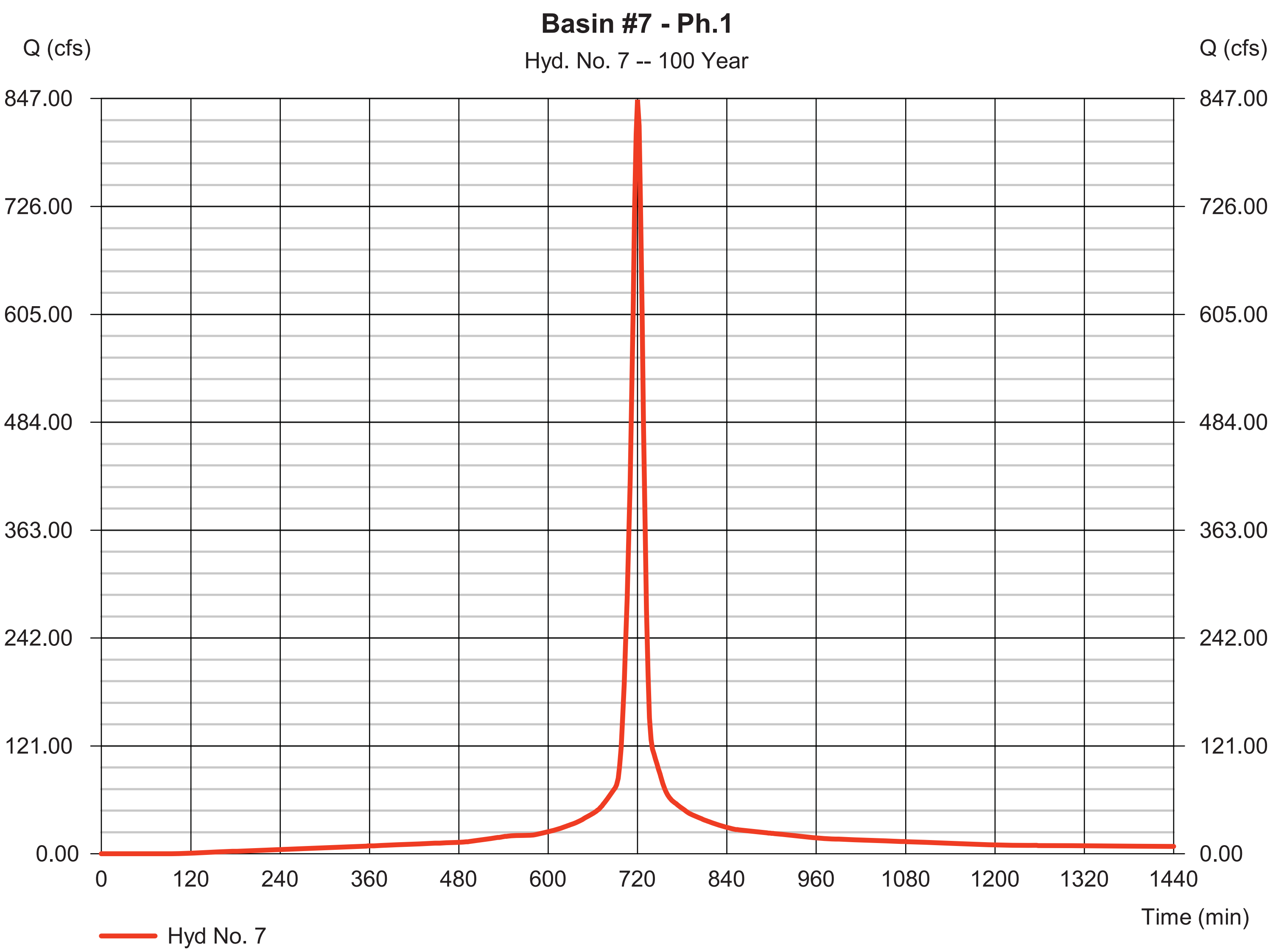
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 7

Basin #7 - Ph.1

Hydrograph type	= SCS Runoff	Peak discharge	= 845.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 2,437,370 cuft
Drainage area	= 93.100 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.50 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(92.100 x 94) + (1.000 x 80)] / 93.100



Watershed Model Schematic

Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Project: Hydrographs - Phase2 EC.gpw	Tuesday, 11 / 4 / 2014

Brickhaven Mine Phase 2

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	135.66	-------	-------	208.12	250.82	-------	319.48	Basin #1 - Ph. 2
2	SCS Runoff	------	-------	185.18	-------	-------	281.10	337.65	-------	428.64	Basin #2 - Ph.2
3	SCS Runoff	------	-------	26.41	-------	-------	42.46	51.95	-------	67.22	Basin #3 - Ph.2
4	SCS Runoff	------	-------	94.73	-------	-------	143.97	173.01	-------	219.72	Basin #4 - Ph.2
5	SCS Runoff	------	-------	34.90	-------	-------	52.96	63.61	-------	80.74	Basin #5 - Ph.2
6	SCS Runoff	------	-------	65.96	-------	-------	100.08	120.20	-------	152.57	Basin #6 - Ph.2
7	SCS Runoff	------	-------	198.73	-------	-------	321.57	394.45	-------	511.71	Basin #7 - Ph.2

Proj. file: Hydrographs - Phase2 EC.gpw | Tuesday, 11 / 4 / 2014

Brickhaven Mine Phase 2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	208.12	2	722	624,121	------	------	------	Basin #1 - Ph. 2
2	SCS Runoff	281.10	2	722	852,238	------	------	------	Basin #2 - Ph.2
3	SCS Runoff	42.46	2	720	114,158	------	------	------	Basin #3 - Ph.2
4	SCS Runoff	143.97	2	724	482,537	------	------	------	Basin #4 - Ph.2
5	SCS Runoff	52.96	2	720	148,950	------	------	------	Basin #5 - Ph.2
6	SCS Runoff	100.08	2	720	281,480	------	------	------	Basin #6 - Ph.2
7	SCS Runoff	321.57	2	730	1,311,237	------	------	------	Basin #7 - Ph.2

Hydrographs - Phase2 EC.gpw	Return Period: 10 Year	Tuesday, 11 / 4 / 2014

Hydrograph Report

Brickhaven Mine Phase 2

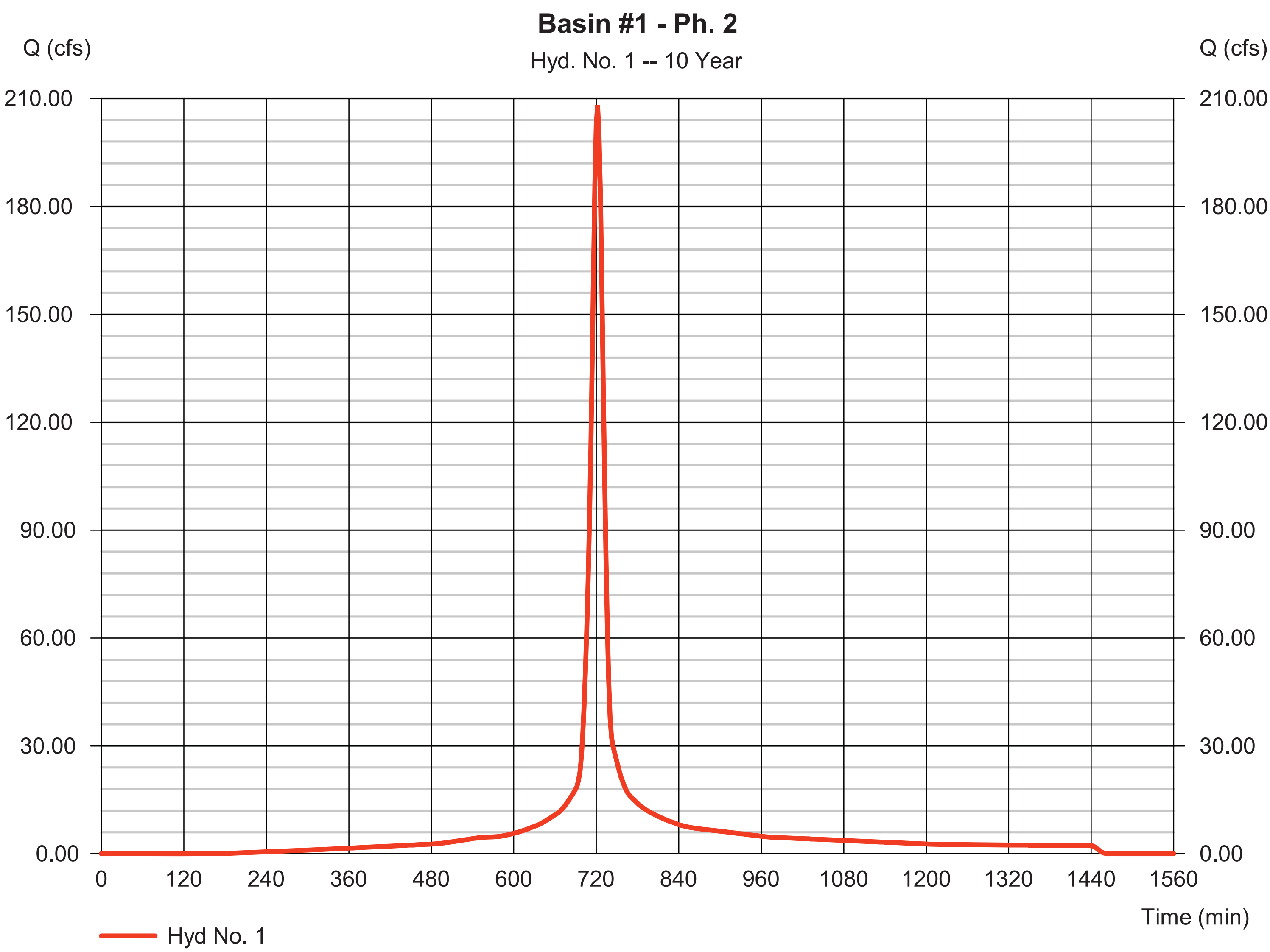
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 1

Basin #1 - Ph. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 208.12 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 624,121 cuft
Drainage area	= 40.400 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.50 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.700 x 80) + (38.700 x 94)] / 40.400



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hyd. No. 1

Basin #1 - Ph. 2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.050		0.011		0.011		
Flow length (ft)	=	300.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.54		0.00		0.00		
Land slope (%)	=	2.00		0.00		0.00		
Travel Time (min)	**=**	**9.32**	**+**	**0.00**	**+**	**0.00**	**=**	**9.32**
Shallow Concentrated Flow								
Flow length (ft)	=	917.00		0.00		0.00		
Watercourse slope (%)	=	2.00		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	2.28		0.00		0.00		
Travel Time (min)	**=**	**6.70**	**+**	**0.00**	**+**	**0.00**	**=**	**6.70**
Channel Flow								
X sectional flow area (sqft)	=	24.00		0.00		0.00		
Wetted perimeter (ft)	=	16.00		0.00		0.00		
Channel slope (%)	=	6.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	31.93		0.00		0.00		
Flow length (ft)	({0})	899.0		0.0		0.0		
Travel Time (min)	**=**	**0.47**	**+**	**0.00**	**+**	**0.00**	**=**	**0.47**

Total Travel Time, Tc .... **16.50 min**

Hydrograph Report

Brickhaven Mine Phase 2

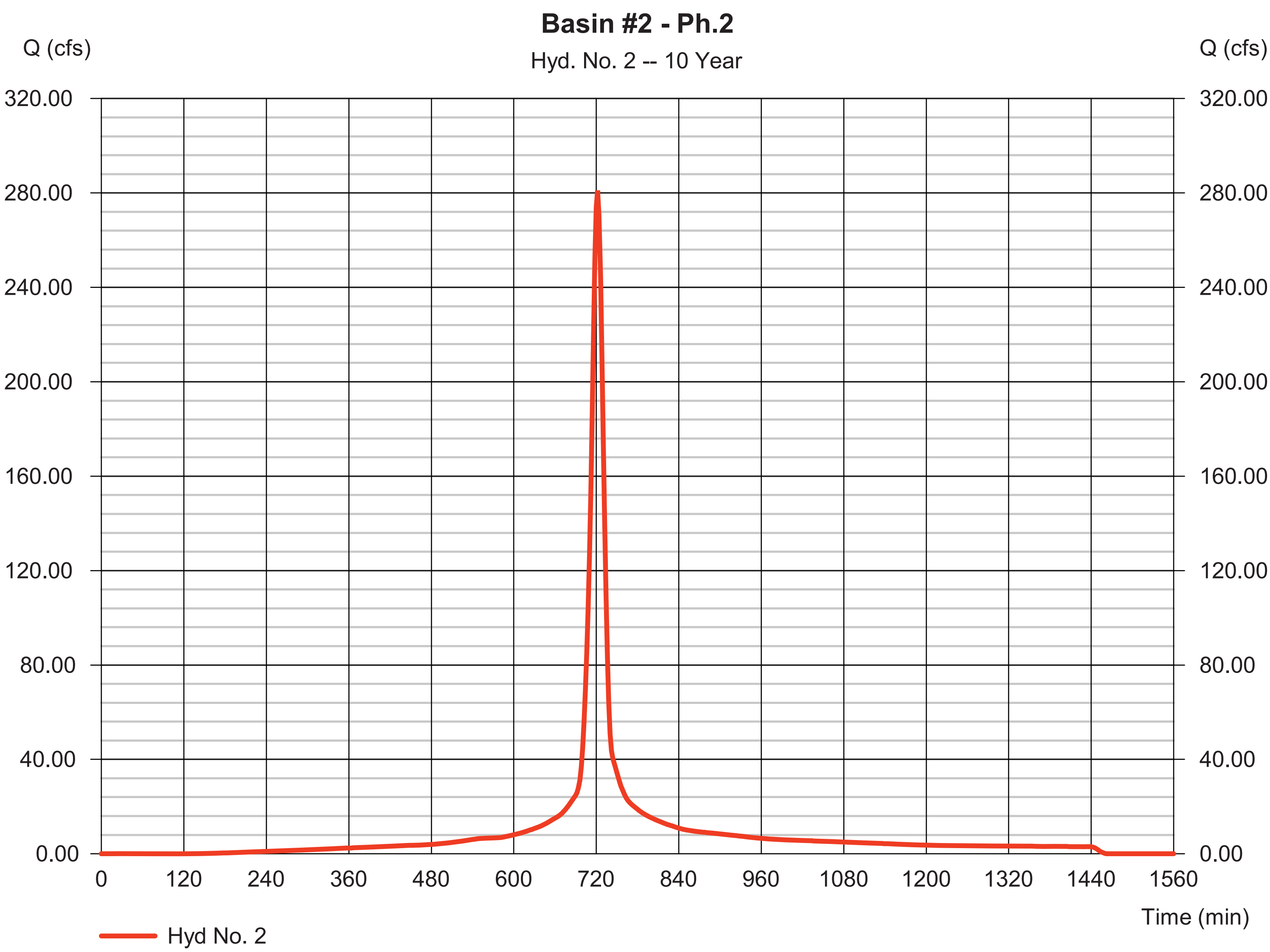
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Tuesday, 11 / 4 / 2014

Hyd. No. 2

Basin #2 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 281.10 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 852,238 cuft
Drainage area	= 53.800 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.00 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 2

Basin #2 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		3.54		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 9.32**	**+**	**0.00**	**+**	**0.00**	**=**	**9.32**
Shallow Concentrated Flow							
Flow length (ft)	= 466.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.40**	**+**	**0.00**	**+**	**0.00**	**=**	**3.40**
Channel Flow							
X sectional flow area (sqft)	= 19.00		0.00		0.00		
Wetted perimeter (ft)	= 12.00		0.00		0.00		
Channel slope (%)	= 3.90		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=26.69						
			0.00				
					0.00		
Flow length (ft)	({0})2029.0		0.0		0.0		
Travel Time (min)	**= 1.27**	**+**	**0.00**	**+**	**0.00**	**=**	**1.27**

Total Travel Time, Tc .... 14.00 min

Hydrograph Report

Brickhaven Mine Phase 2

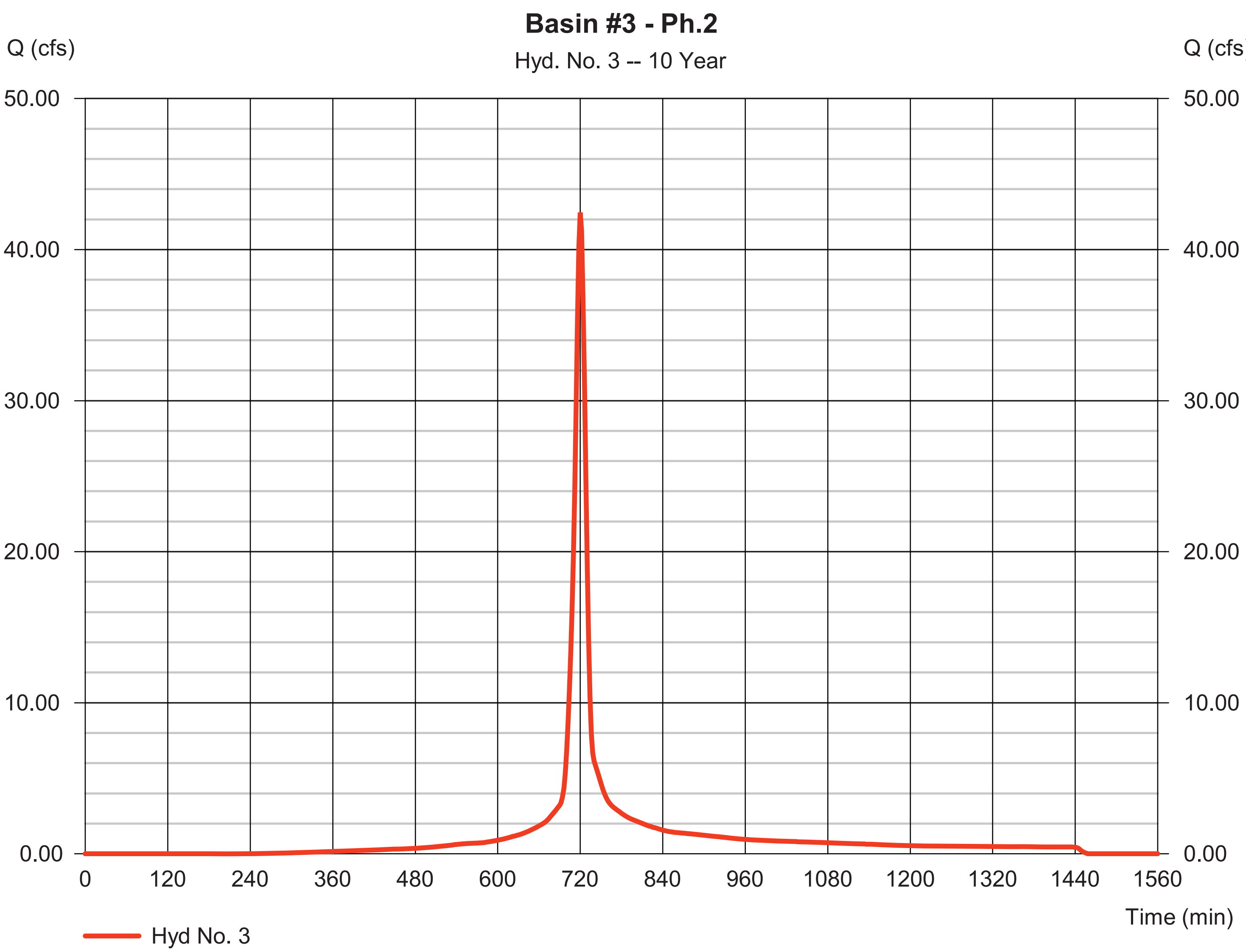
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 3

Basin #3 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 42.46 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 114,158 cuft
Drainage area	= 7.750 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.80 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.000 x 94) + (2.750 x 80)] / 7.750



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hyd. No. 3

Basin #3 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 9.00		0.00		0.00		
Travel Time (min)	**= 11.19**	**+**	**0.00**	**+**	**0.00**	**=**	**11.19**
Shallow Concentrated Flow							
Flow length (ft)	= 392.29		0.00		0.00		
Watercourse slope (%)	= 7.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.45		0.00		0.00		
Travel Time (min)	**= 1.47**	**+**	**0.00**	**+**	**0.00**	**=**	**1.47**
Channel Flow							
X sectional flow area (sqft)	= 31.00		0.00		0.00		
Wetted perimeter (ft)	= 13.00		0.00		0.00		
Channel slope (%)	= 4.13		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=36.14		0.00		0.00		
Flow length (ft)	({0})266.6		0.0		0.0		
Travel Time (min)	**= 0.12**	**+**	**0.00**	**+**	**0.00**	**=**	**0.12**

Total Travel Time, Tc .... 12.80 min

Hydrograph Report

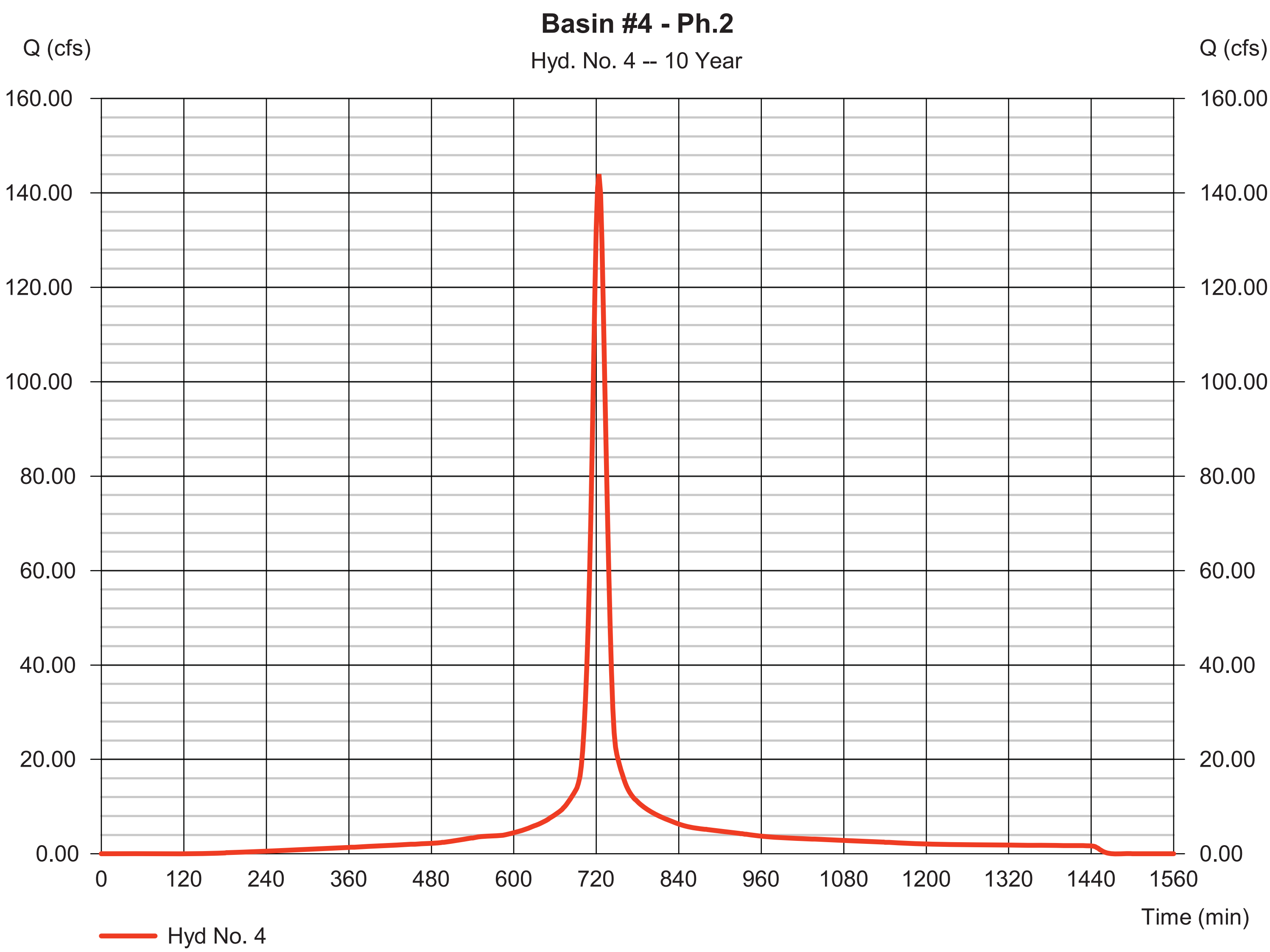
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 4

Basin #4 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 143.97 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 482,537 cuft
Drainage area	= 29.700 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.50 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hyd. No. 4

Basin #4 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 9.32**	**+**	**0.00**	**+**	**0.00**	**=**	**9.32**
Shallow Concentrated Flow							
Flow length (ft)	= 1079.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 7.88**	**+**	**0.00**	**+**	**0.00**	**=**	**7.88**
Channel Flow							
X sectional flow area (sqft)	= 20.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 18.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=54.26		0.00		0.00		
Flow length (ft)	({0})1094.0		0.0		0.0		
Travel Time (min)	**= 0.34**	**+**	**0.00**	**+**	**0.00**	**=**	**0.34**
Total Travel Time, Tc							**17.50 min**

Hydrograph Report

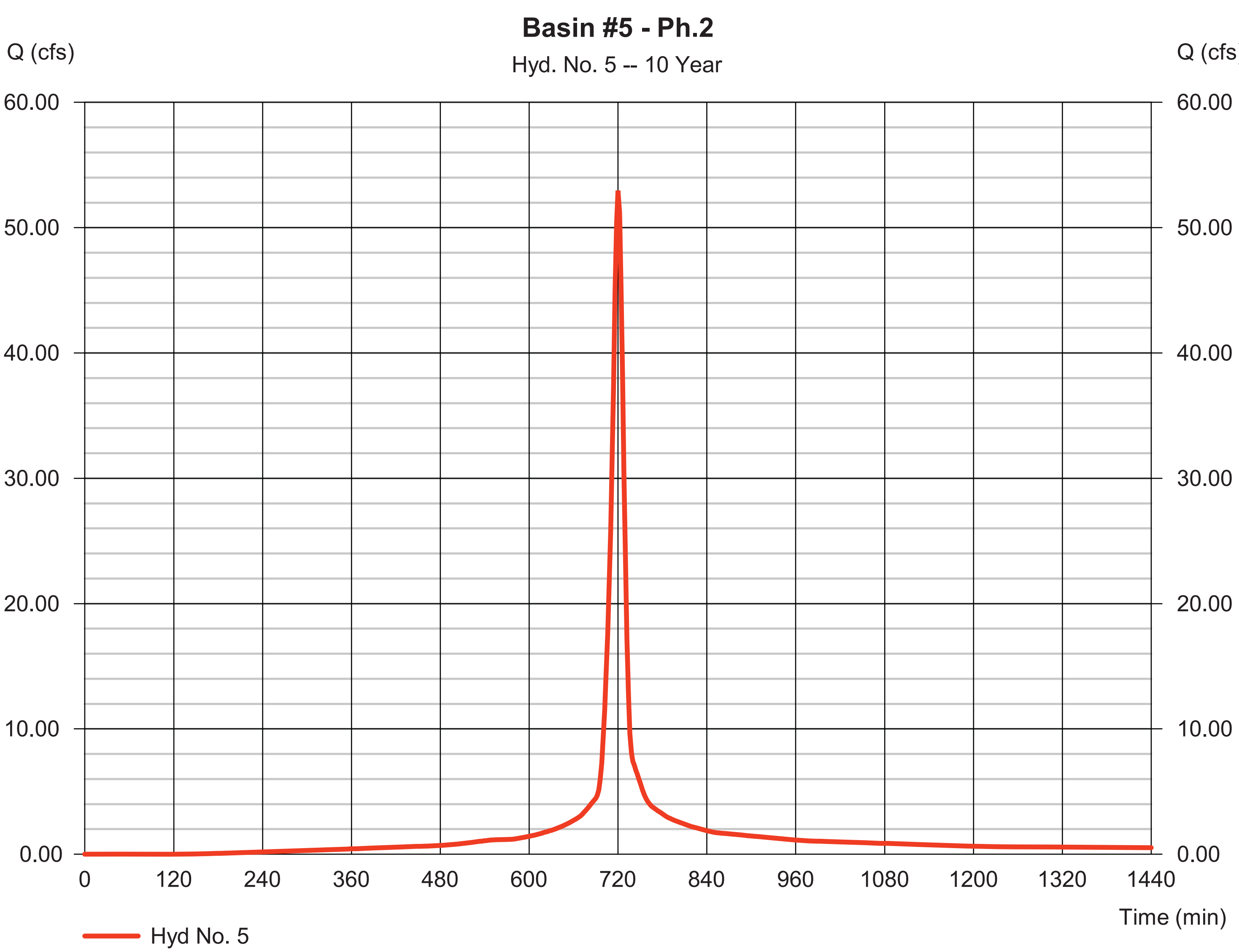
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 5

Basin #5 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 52.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 148,950 cuft
Drainage area	= 8.890 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 5

Basin #5 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 9.32**	**+**	**0.00**	**+**	**0.00**	**=**	**9.32**
Shallow Concentrated Flow							
Flow length (ft)	= 437.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.19**	**+**	**0.00**	**+**	**0.00**	**=**	**3.19**
Channel Flow							
X sectional flow area (sqft)	= 20.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 4.70		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=27.35		0.00		0.00		
Flow length (ft)	({0})290.0		0.0		0.0		
Travel Time (min)	**= 0.18**	**+**	**0.00**	**+**	**0.00**	**=**	**0.18**

Total Travel Time, Tc .... 12.70 min

Hydrograph Report

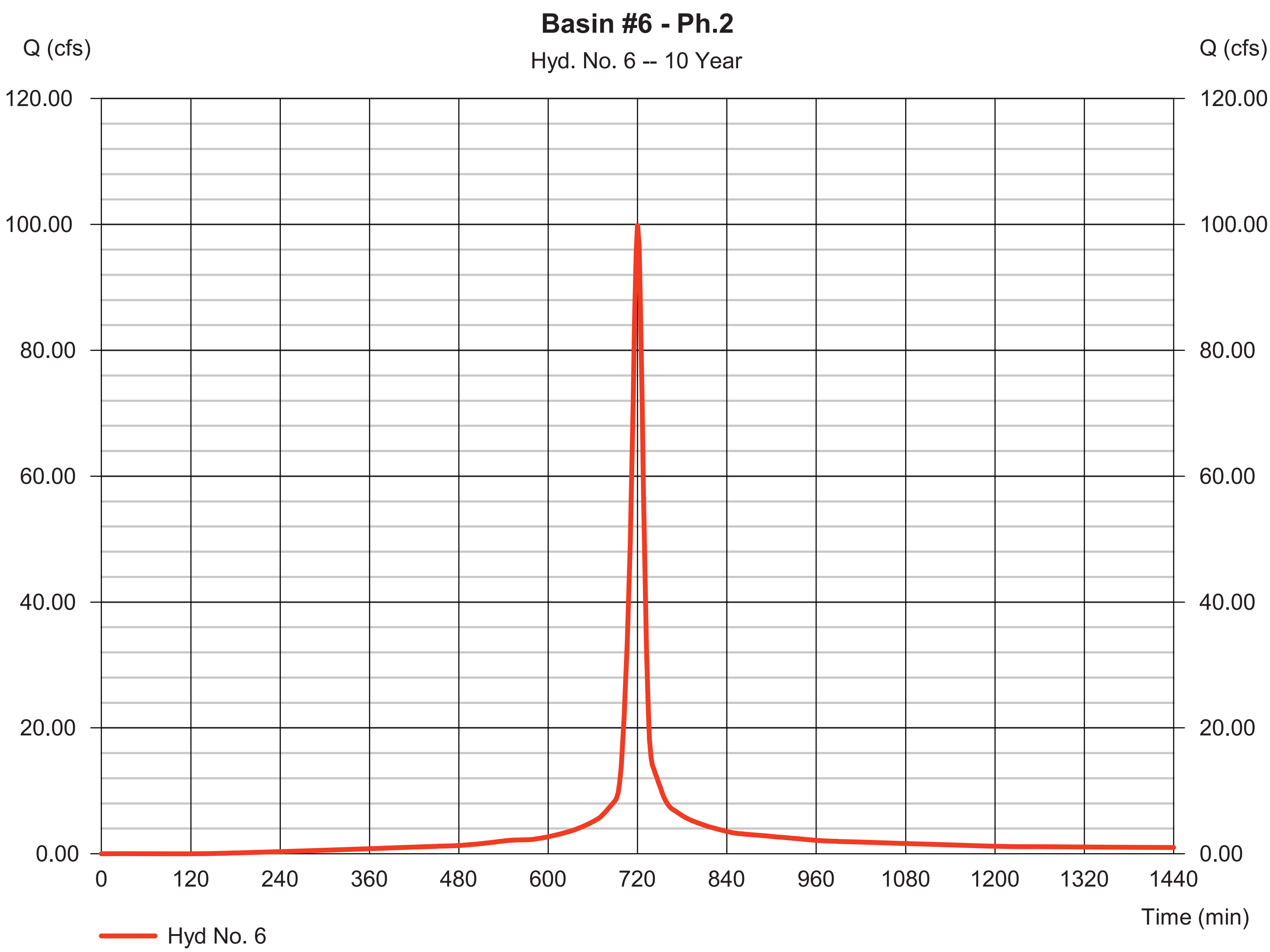
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 6

Basin #6 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 100.08 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 281,480 cuft
Drainage area	= 16.800 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.90 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 6

Basin #6 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.050		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 9.32**	**+**	**0.00**	**+**	**0.00**	**=**	**9.32**
Shallow Concentrated Flow							
Flow length (ft)	= 437.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.19**	**+**	**0.00**	**+**	**0.00**	**=**	**3.19**
Channel Flow							
X sectional flow area (sqft)	= 20.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 5.30		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=29.04						
			0.00				
					0.00		
Flow length (ft)	({0})757.0		0.0		0.0		
Travel Time (min)	**= 0.43**	**+**	**0.00**	**+**	**0.00**	**=**	**0.43**

Total Travel Time, Tc .... **12.90 min**

Hydrograph Report

Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

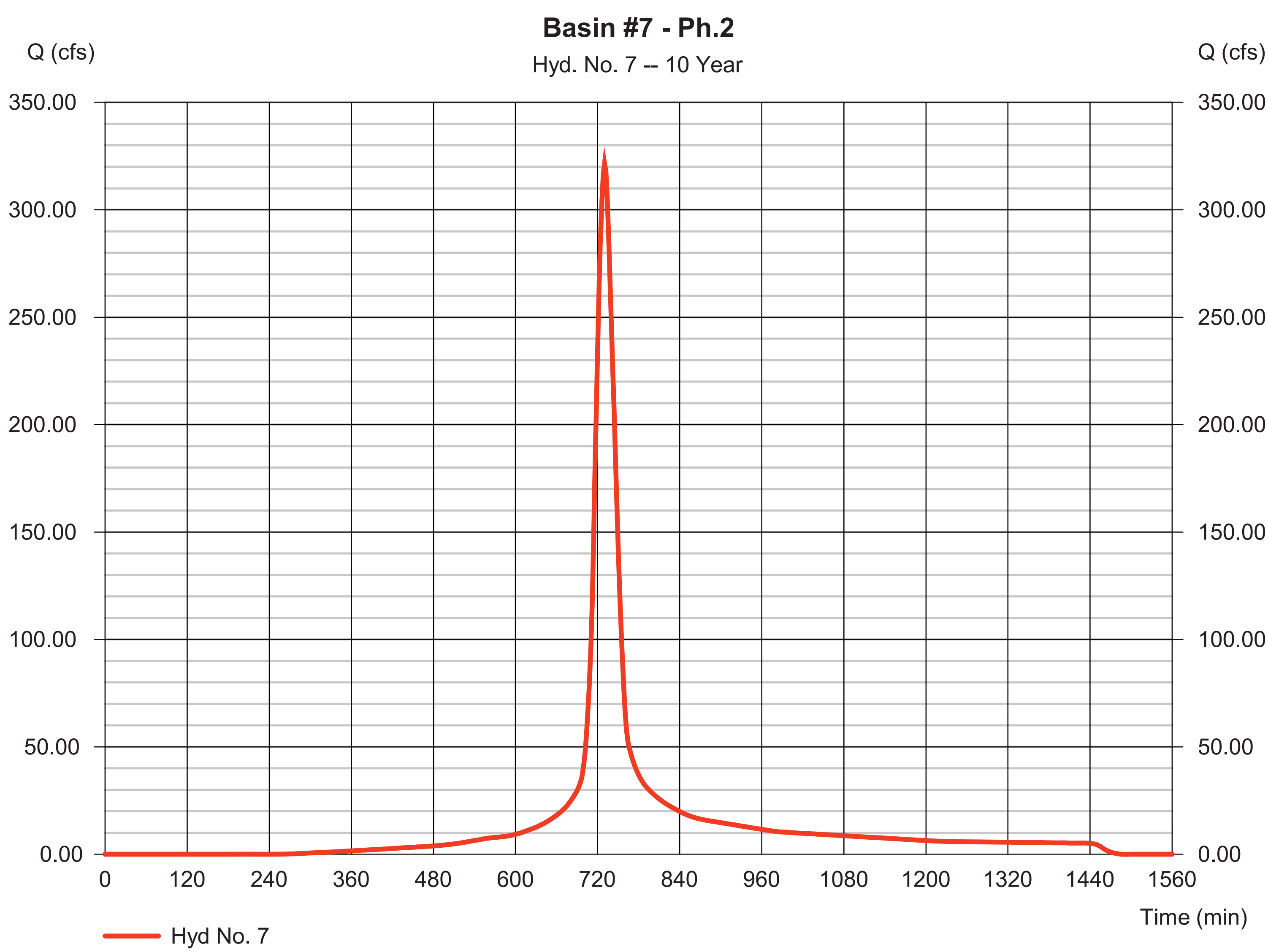
Tuesday, 11 / 4 / 2014

Hyd. No. 7

Basin #7 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 321.57 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 1,311,237 cuft
Drainage area	= 91.800 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.80 min
Total precip.	= 5.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(46.900 x 84) + (44.900 x 94)] / 91.800



TR55 Tc Worksheet

Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No. 7

Basin #7 - Ph.2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.54		3.54		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 22.43**	**+**	**0.00**	**+**	**0.00**	**=**	**22.43**
Shallow Concentrated Flow							
Flow length (ft)	= 862.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 6.30**	**+**	**0.00**	**+**	**0.00**	**=**	**6.30**
Channel Flow							
X sectional flow area (sqft)	= 20.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 3.30		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=22.92						
			0.00				
					0.00		
Flow length (ft)	({0})1449.0		0.0		0.0		
Travel Time (min)	**= 1.05**	**+**	**0.00**	**+**	**0.00**	**=**	**1.05**

Total Travel Time, Tc .... **29.80 min**

Brickhaven Mine Phase 2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	319.48	2	722	983,017	------	------	------	Basin #1 - Ph. 2
2	SCS Runoff	428.64	2	722	1,331,664	------	------	------	Basin #2 - Ph.2
3	SCS Runoff	67.22	2	720	185,746	------	------	------	Basin #3 - Ph.2
4	SCS Runoff	219.72	2	724	753,987	------	------	------	Basin #4 - Ph.2
5	SCS Runoff	80.74	2	720	232,741	------	------	------	Basin #5 - Ph.2
6	SCS Runoff	152.57	2	720	439,826	------	------	------	Basin #6 - Ph.2
7	SCS Runoff	511.71	2	730	2,133,519	------	------	------	Basin #7 - Ph.2

Hydrographs - Phase2 EC.gpw	Return Period: 100 Year	Tuesday, 11 / 4 / 2014

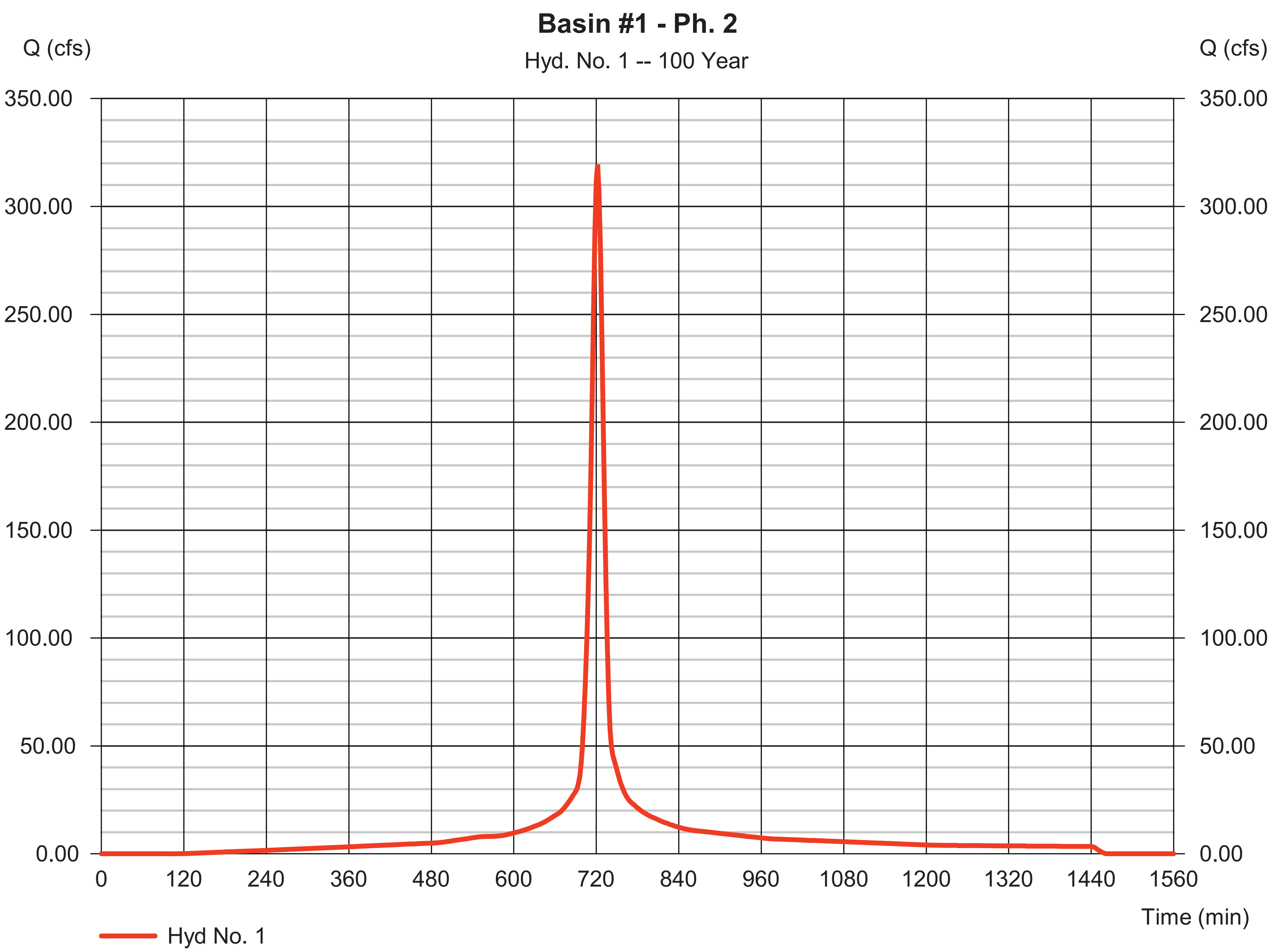
Hydrograph Report

Hyd. No. 1

Basin #1 - Ph. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 319.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 983,017 cuft
Drainage area	= 40.400 ac	Curve number	= 93*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.50 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.700 x 80) + (38.700 x 94)] / 40.400

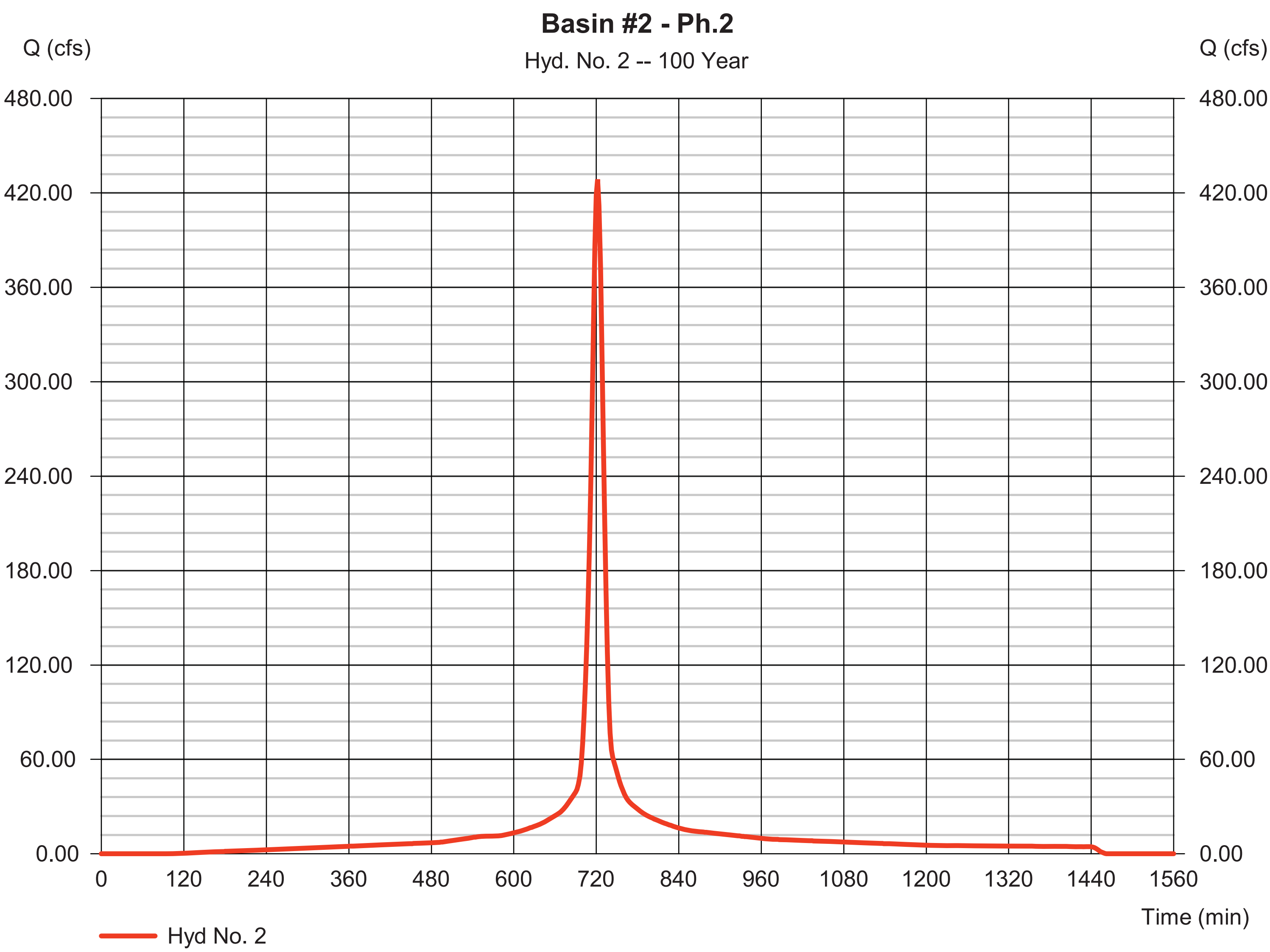


Hydrograph Report

Hyd. No. 2

Basin #2 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 428.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,331,664 cuft
Drainage area	= 53.800 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.00 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Brickhaven Mine Phase 2

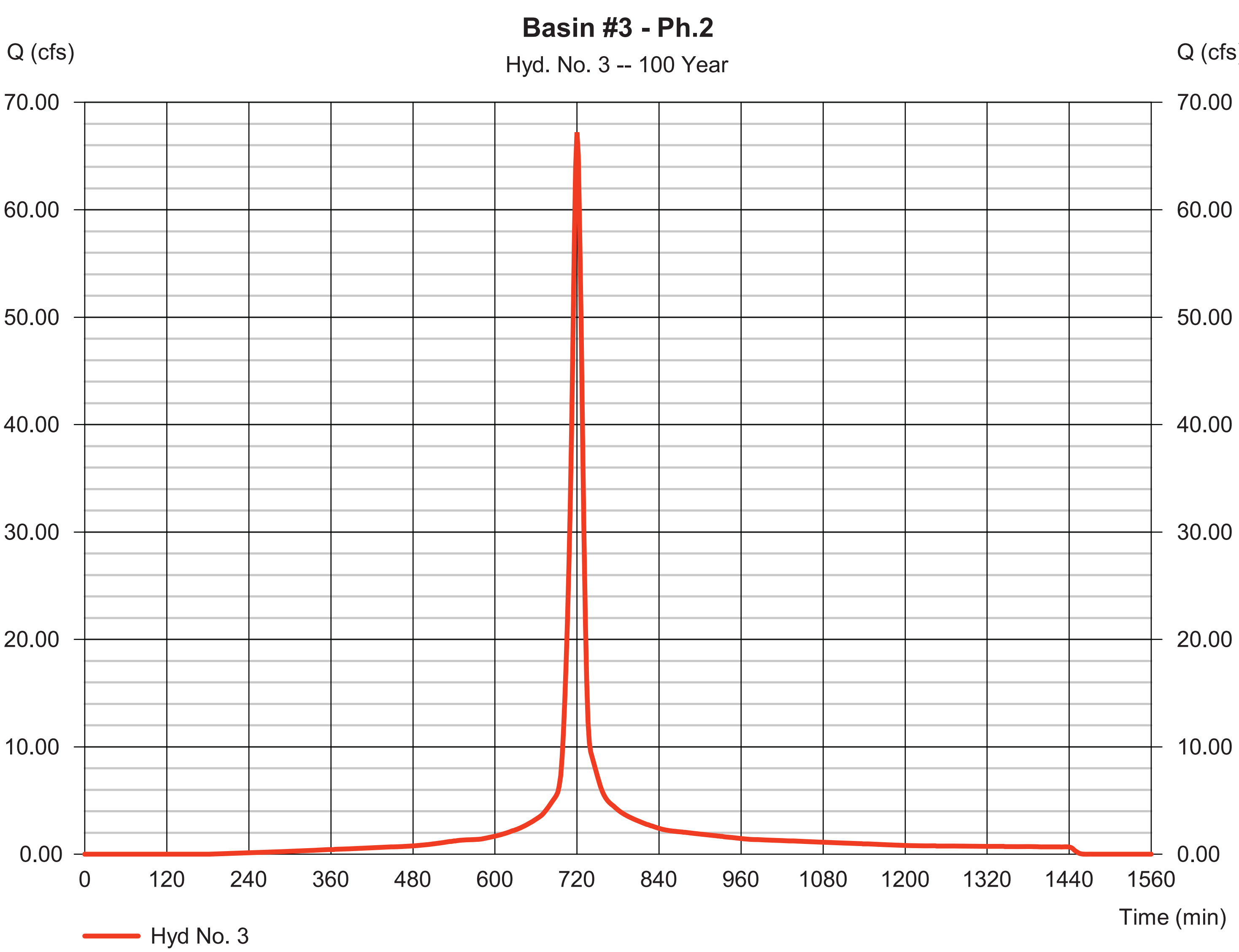
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 3

Basin #3 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 67.22 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 185,746 cuft
Drainage area	= 7.750 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.80 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.000 x 94) + (2.750 x 80)] / 7.750



Hydrograph Report

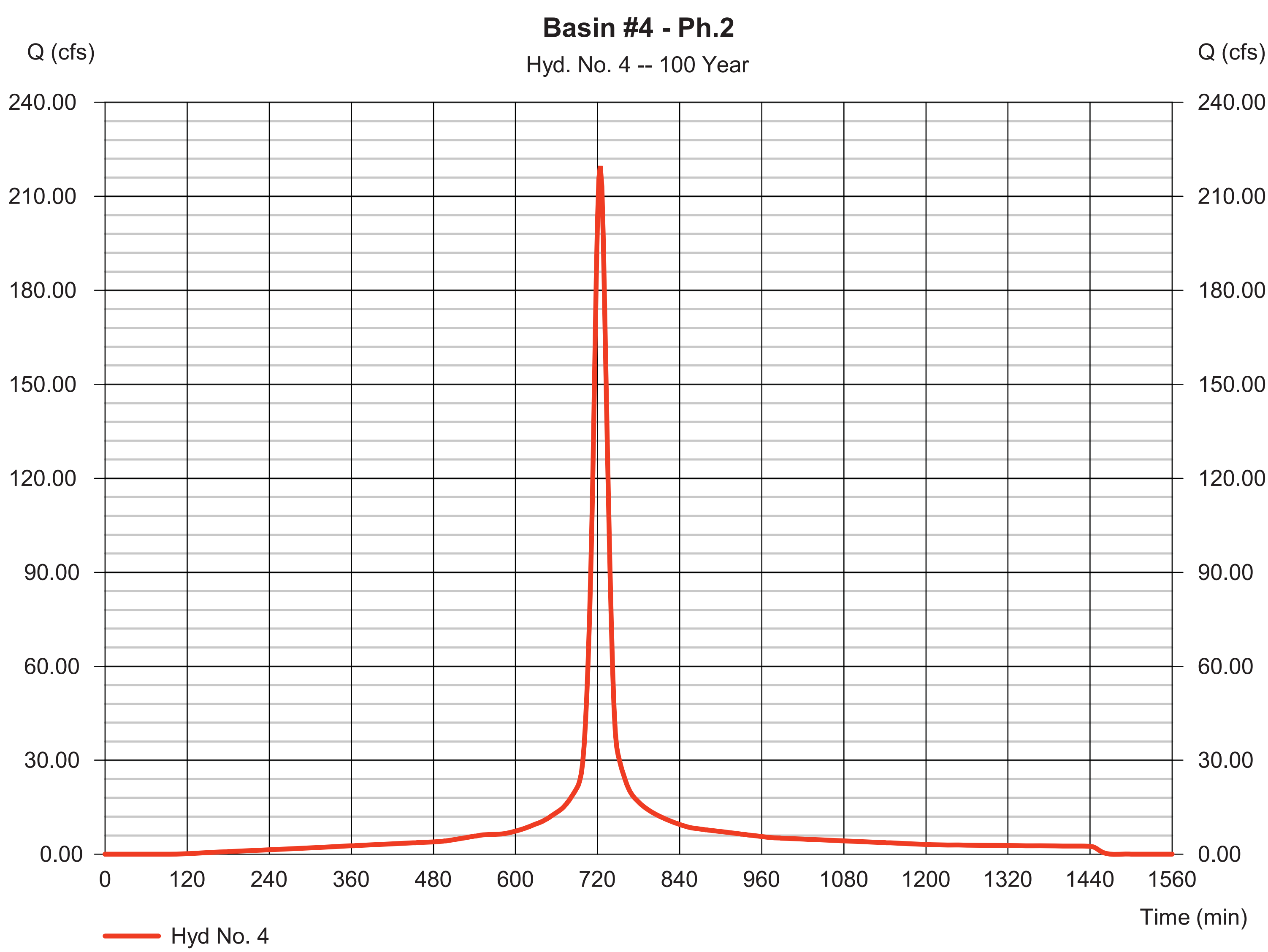
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Tuesday, 11 / 4 / 2014

Hyd. No. 4

Basin #4 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 219.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 753,987 cuft
Drainage area	= 29.700 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.50 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

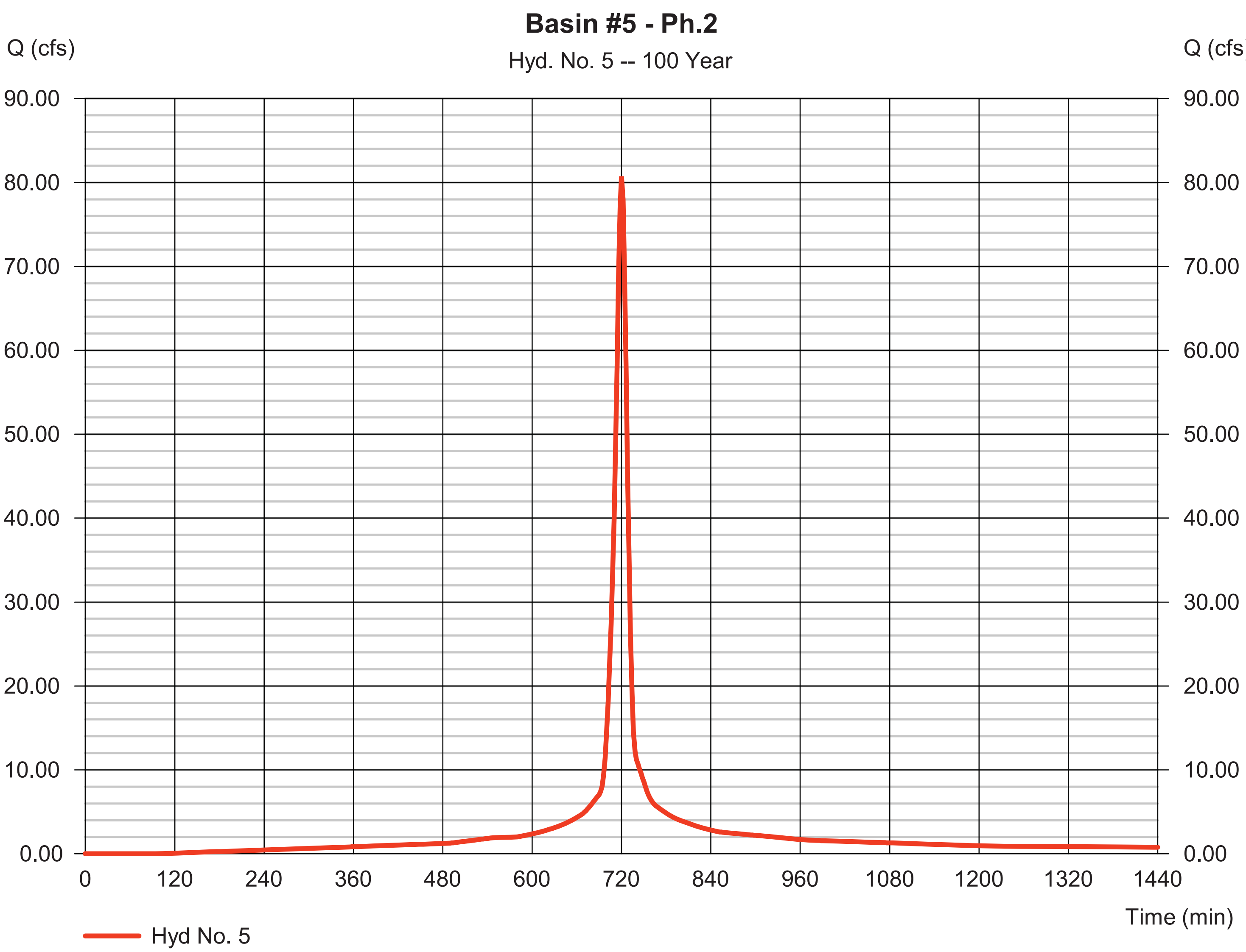
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 5

Basin #5 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 80.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 232,741 cuft
Drainage area	= 8.890 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.70 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

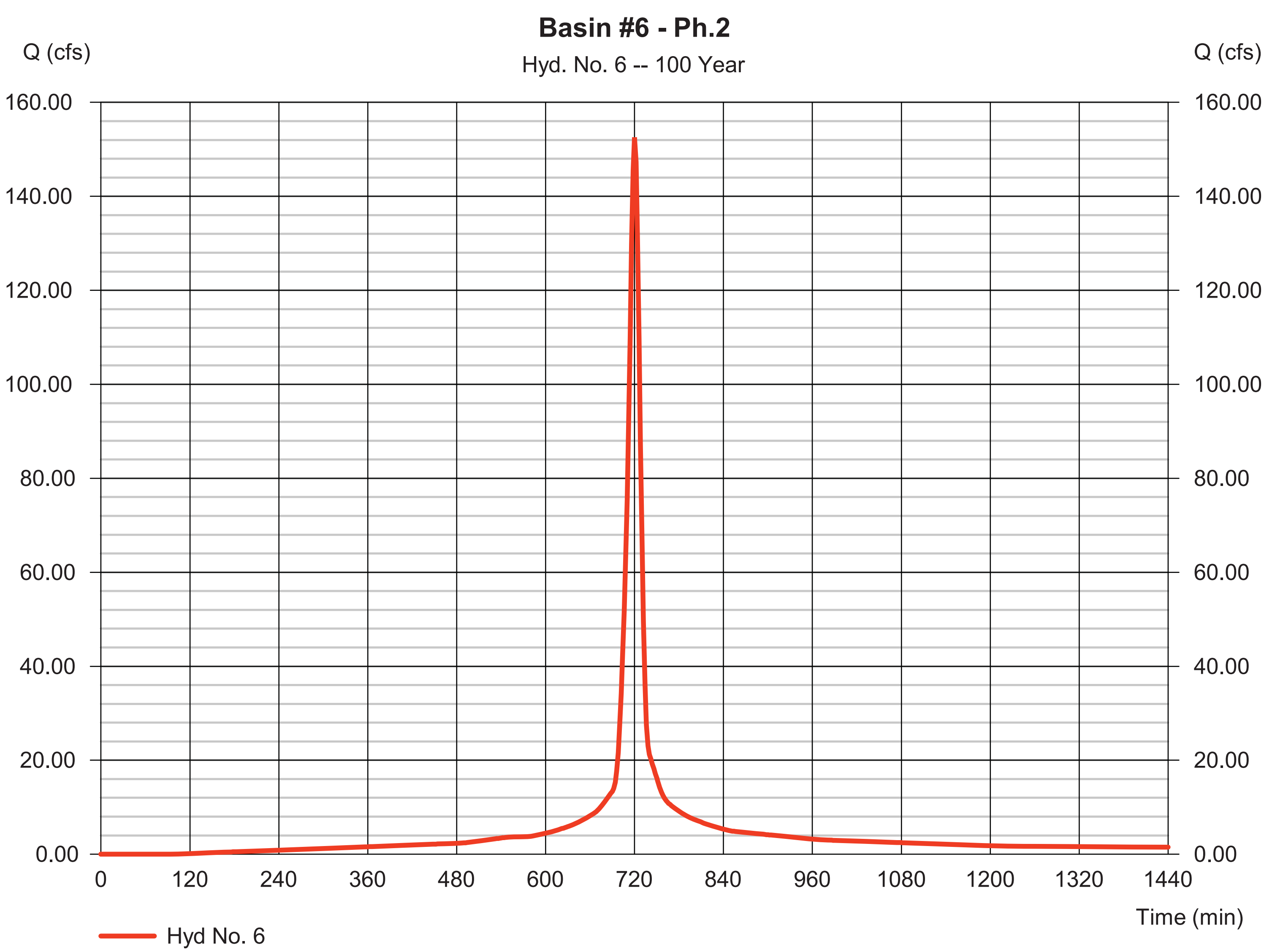
Brickhaven Mine Phase 2

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 11 / 4 / 2014

Hyd. No. 6

Basin #6 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 152.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 439,826 cuft
Drainage area	= 16.800 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.90 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Brickhaven Mine Phase 2

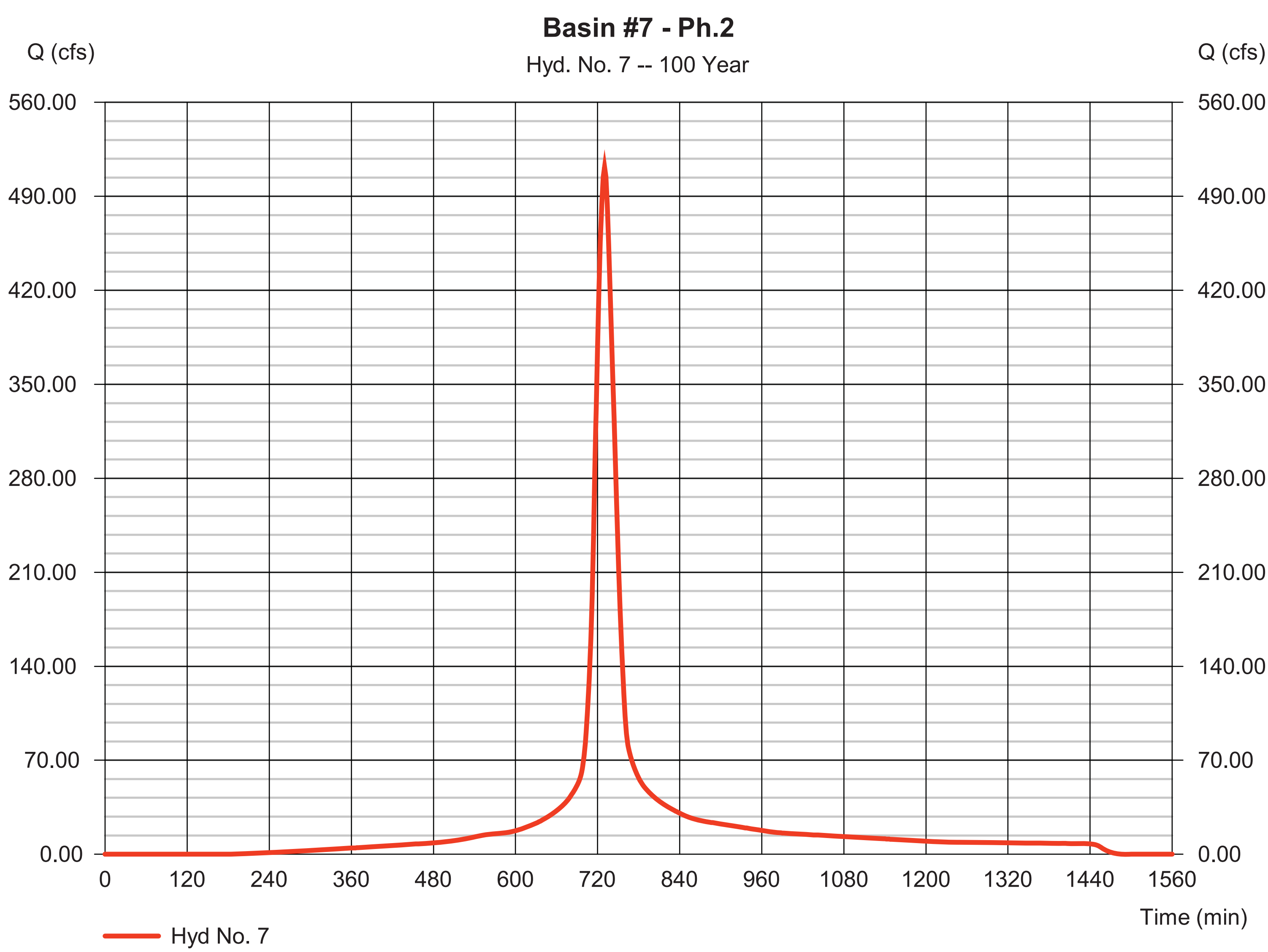
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 | Tuesday, 11 / 4 / 2014

Hyd. No. 7

Basin #7 - Ph.2

Hydrograph type	= SCS Runoff	Peak discharge	= 511.71 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 2,133,519 cuft
Drainage area	= 91.800 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.80 min
Total precip.	= 7.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(46.900 x 84) + (44.900 x 94)] / 91.800



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NOAA Atlas 14, Volume 2, Version 3
Location name: Moncure, North Carolina, US*
Latitude: 35.6094°, Longitude: -79.0156°
Elevation: 209 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.418** (0.382–0.459)	**0.492** (0.450–0.541)	**0.569** (0.520–0.624)	**0.628** (0.573–0.689)	**0.694** (0.629–0.759)	**0.740** (0.669–0.809)	**0.782** (0.703–0.855)	**0.819** (0.733–0.897)	**0.862** (0.764–0.943)	**0.895** (0.787–0.980)
10-min	**0.668** (0.611–0.733)	**0.787** (0.720–0.865)	**0.911** (0.833–1.00)	**1.01** (0.916–1.10)	**1.11** (1.00–1.21)	**1.18** (1.07–1.29)	**1.24** (1.12–1.36)	**1.30** (1.16–1.42)	**1.36** (1.21–1.49)	**1.41** (1.24–1.54)
15-min	**0.835** (0.763–0.916)	**0.990** (0.905–1.09)	**1.15** (1.05–1.27)	**1.27** (1.16–1.39)	**1.40** (1.27–1.53)	**1.49** (1.35–1.63)	**1.57** (1.41–1.72)	**1.64** (1.47–1.79)	**1.72** (1.52–1.88)	**1.77** (1.56–1.94)
30-min	**1.15** (1.05–1.26)	**1.37** (1.25–1.50)	**1.64** (1.50–1.80)	**1.84** (1.68–2.02)	**2.08** (1.88–2.27)	**2.25** (2.03–2.46)	**2.41** (2.16–2.63)	**2.55** (2.28–2.79)	**2.73** (2.42–2.99)	**2.86** (2.52–3.14)
60-min	**1.43** (1.31–1.57)	**1.72** (1.57–1.88)	**2.10** (1.92–2.30)	**2.40** (2.19–2.63)	**2.76** (2.51–3.03)	**3.05** (2.75–3.33)	**3.32** (2.98–3.62)	**3.58** (3.20–3.92)	**3.92** (3.47–4.29)	**4.18** (3.68–4.58)
2-hr	**1.67** (1.52–1.85)	**2.02** (1.83–2.23)	**2.50** (2.27–2.77)	**2.89** (2.61–3.19)	**3.37** (3.03–3.73)	**3.76** (3.37–4.16)	**4.14** (3.68–4.58)	**4.53** (4.00–5.00)	**5.03** (4.40–5.55)	**5.44** (4.71–6.01)
3-hr	**1.78** (1.62–1.97)	**2.14** (1.95–2.37)	**2.67** (2.42–2.95)	**3.09** (2.80–3.42)	**3.66** (3.29–4.04)	**4.12** (3.68–4.54)	**4.58** (4.06–5.05)	**5.06** (4.45–5.57)	**5.71** (4.97–6.29)	**6.24** (5.38–6.89)
6-hr	**2.13** (1.95–2.34)	**2.56** (2.35–2.83)	**3.19** (2.91–3.52)	**3.71** (3.38–4.08)	**4.41** (3.98–4.83)	**4.98** (4.47–5.46)	**5.56** (4.95–6.09)	**6.17** (5.44–6.75)	**7.01** (6.09–7.66)	**7.70** (6.61–8.44)
12-hr	**2.52** (2.30–2.77)	**3.04** (2.78–3.35)	**3.80** (3.46–4.19)	**4.45** (4.03–4.89)	**5.32** (4.79–5.83)	**6.05** (5.41–6.61)	**6.81** (6.02–7.43)	**7.61** (6.66–8.30)	**8.74** (7.52–9.53)	**9.68** (8.21–10.6)
24-hr	**2.94** (2.74–3.15)	**3.54** (3.31–3.80)	**4.45** (4.16–4.77)	**5.17** (4.82–5.54)	**6.14** (5.71–6.58)	**6.92** (6.41–7.40)	**7.71** (7.13–8.25)	**8.53** (7.86–9.14)	**9.65** (8.86–10.4)	**10.5** (9.64–11.3)
2-day	**3.41** (3.18–3.66)	**4.11** (3.83–4.42)	**5.13** (4.77–5.51)	**5.93** (5.51–6.36)	**7.01** (6.49–7.52)	**7.86** (7.26–8.44)	**8.74** (8.05–9.39)	**9.65** (8.86–10.4)	**10.9** (9.95–11.7)	**11.9** (10.8–12.8)
3-day	**3.61** (3.36–3.87)	**4.34** (4.04–4.65)	**5.38** (5.01–5.78)	**6.21** (5.77–6.65)	**7.33** (6.78–7.86)	**8.22** (7.58–8.81)	**9.13** (8.40–9.79)	**10.1** (9.23–10.8)	**11.3** (10.4–12.2)	**12.4** (11.2–13.3)
4-day	**3.80** (3.55–4.08)	**4.57** (4.26–4.89)	**5.64** (5.25–6.04)	**6.49** (6.03–6.94)	**7.65** (7.07–8.20)	**8.57** (7.90–9.18)	**9.51** (8.74–10.2)	**10.5** (9.61–11.2)	**11.8** (10.8–12.7)	**12.9** (11.7–13.8)
7-day	**4.38** (4.09–4.68)	**5.23** (4.89–5.59)	**6.37** (5.95–6.80)	**7.28** (6.79–7.77)	**8.52** (7.93–9.10)	**9.52** (8.83–10.2)	**10.5** (9.75–11.2)	**11.6** (10.7–12.4)	**13.0** (11.9–13.9)	**14.1** (12.9–15.1)
10-day	**5.00** (4.70–5.33)	**5.95** (5.59–6.34)	**7.16** (6.71–7.63)	**8.11** (7.59–8.64)	**9.39** (8.76–10.0)	**10.4** (9.67–11.1)	**11.4** (10.6–12.2)	**12.4** (11.5–13.3)	**13.8** (12.7–14.8)	**14.9** (13.7–15.9)
20-day	**6.71** (6.31–7.13)	**7.92** (7.45–8.41)	**9.36** (8.80–9.95)	**10.5** (9.86–11.2)	**12.0** (11.3–12.8)	**13.2** (12.4–14.1)	**14.5** (13.5–15.4)	**15.7** (14.6–16.7)	**17.3** (16.0–18.5)	**18.6** (17.2–19.9)
30-day	**8.34** (7.86–8.85)	**9.81** (9.24–10.4)	**11.4** (10.7–12.1)	**12.7** (11.9–13.4)	**14.3** (13.4–15.2)	**15.5** (14.6–16.5)	**16.8** (15.7–17.9)	**18.0** (16.8–19.2)	**19.7** (18.3–21.0)	**21.0** (19.4–22.4)
45-day	**10.6** (10.1–11.2)	**12.5** (11.8–13.2)	**14.3** (13.5–15.1)	**15.7** (14.8–16.5)	**17.5** (16.5–18.4)	**18.8** (17.8–19.9)	**20.2** (19.0–21.3)	**21.5** (20.2–22.7)	**23.2** (21.7–24.6)	**24.5** (22.8–26.0)
60-day	**12.7** (12.1–13.4)	**14.9** (14.1–15.6)	**16.8** (16.0–17.7)	**18.3** (17.4–19.3)	**20.3** (19.2–21.3)	**21.7** (20.5–22.9)	**23.1** (21.8–24.4)	**24.5** (23.1–25.8)	**26.3** (24.7–27.7)	**27.6** (25.9–29.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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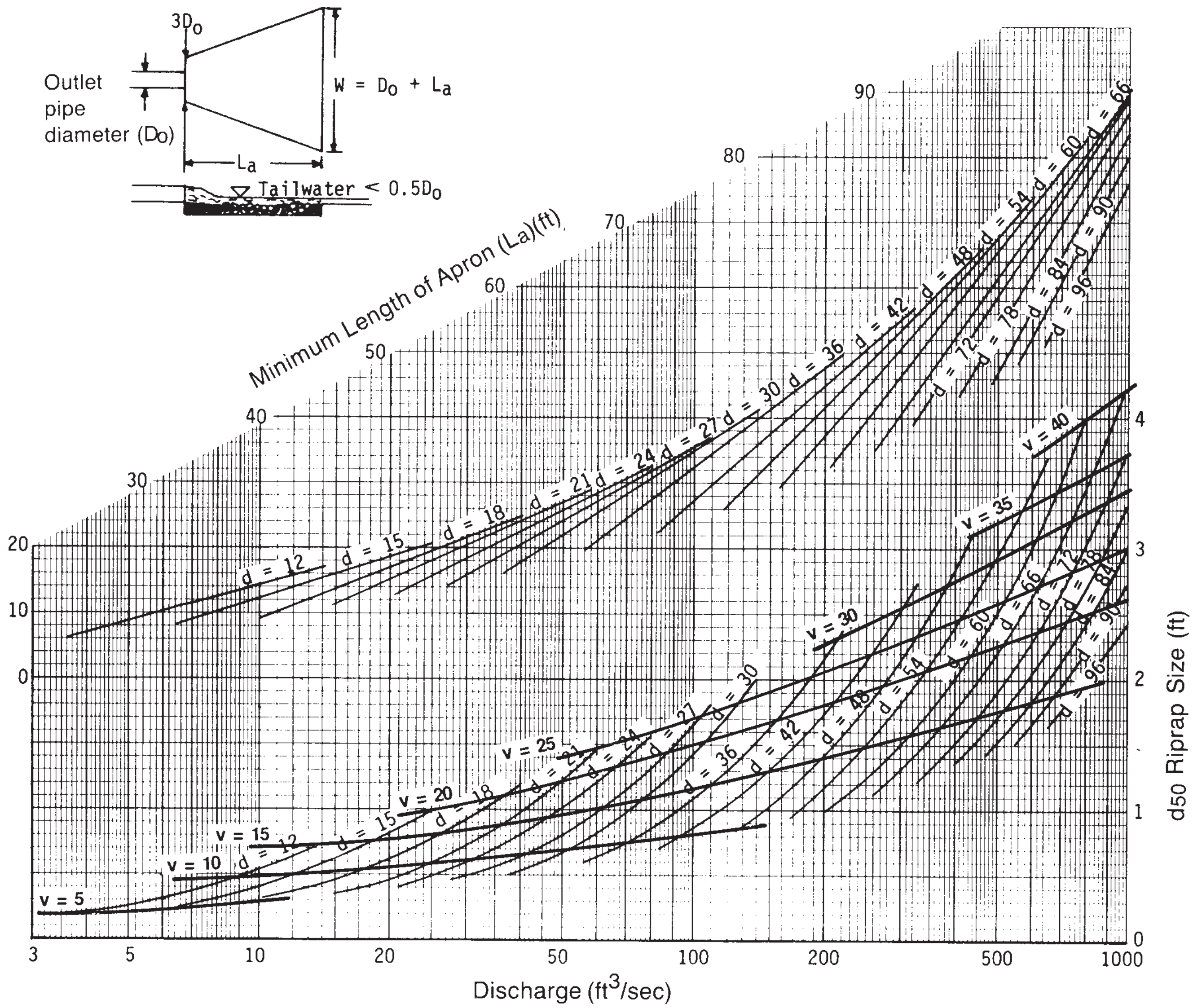
PF graphical



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

TABLE 3.14-D

CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE DESIGN TABLE

Riser Diam., in.	Cylinder		Height, inches	Minimum Size Support Bar	Minimum Top	
	Diameter, inches	Thickness, gage			Thickness	Stiffener
12	18	16	6	#6 Rebar or 1½ x 1½ x 3/16 angle	16 ga. (F&C)	-
15	21	16	7	" "	" "	-
18	27	16	8	" "	" "	-
21	30	16	11	" "	16 ga.(C), 14 ga.(F)	-
24	36	16	13	" "	" "	-
27	42	16	15	" "	" "	-
36	54	14	17	#8 Rebar	14 ga.(C), 12 ga.(F)	-
42	60	16	19	" "	" "	-
48	72	16	21	1¼" pipe or 1¼ x 1¼ x ¼ angle	14 ga.(C), 10 ga.(F)	-
54	78	16	25	" "	" "	-
60	90	14	29	1½" pipe or 1½ x 1½ x ¼ angle	12 ga.(C), 8 ga.(F)	-
66	96	14	33	2" pipe or 2 x 2 x 3/16 angle	12 ga.(C), 8 ga.(F) w/stiffener	2 x 2 x ¼ angle
72	102	14	36	" "	" "	2½ x 2½ x ¼ angle
78	114	14	39	2½" pipe or 2 x 2 x ¼ angle	" "	" "
84	120	12	42	2½" pipe or 2½ x 2½ x ¼ angle	" "	2½ x 2½ x 5/16 angle

Note$_1$: The criterion for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.
Note$_2$: Corrugation for 12"-36" pipe measures 2⅔" x ½"; for 42" -84" the corrugation measures 5" x 1" or 8" x 1".
Note$_3$: C = corrugated; F = flat.

Source: Adapted from USDA-SCS and Carl M. Henshaw Drainage Products Information.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Chatham County, North Carolina

Moncure

November 1, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:11,700 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

N

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Chatham County, North Carolina
Survey Area Data: Version 17, Sep 9, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 20, 2010—Apr 2, 2011

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

Map Unit Legend

Chatham County, North Carolina (NC037)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CcB	Carbonton-Brickhaven complex, 2 to 6 percent slopes	4.0	0.6%
CcD	Carbonton-Brickhaven complex, 10 to 15 percent slopes	0.2	0.0%
CrC	Creedmoor-Green Level complex, 6 to 10 percent slopes	11.5	1.7%
PeA	Peawick fine sandy loam, 0 to 2 percent slopes	6.6	0.9%
PeB	Peawick fine sandy loam, 2 to 8 percent slopes	408.8	58.7%
UdC	Udorthents, loamy, 2 to 10 percent slopes	64.0	9.2%
W	Water	2.0	0.3%
WhB	White Store-Polkton complex, 2 to 6 percent slopes	1.7	0.2%
WhC	White Store-Polkton complex, 6 to 10 percent slopes	107.1	15.4%
WhD	White Store-Polkton complex, 10 to 15 percent slopes	90.4	13.0%
Totals for Area of Interest		**696.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Chatham County, North Carolina

CcB—Carbonton-Brickhaven complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1lvsh
Elevation: 200 to 300 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Carbonton and similar soils: 50 percent
Brickhaven and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carbonton

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

A - 0 to 8 inches: silt loam
BE - 8 to 12 inches: silty clay loam
Bt - 12 to 28 inches: silty clay
BCt - 28 to 34 inches: silty clay loam
Cr - 34 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

Description of Brickhaven

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

A - 0 to 4 inches: silt loam
E - 4 to 7 inches: silt loam
Bt1 - 7 to 12 inches: silty clay loam
Bt2 - 12 to 37 inches: silty clay
BCt - 37 to 51 inches: silty clay loam
Cr - 51 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

CcD—Carbonton-Brickhaven complex, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1lvsf
Elevation: 200 to 300 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Carbonton and similar soils: 45 percent
Brickhaven and similar soils: 40 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carbonton

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

A - 0 to 8 inches: silt loam
BE - 8 to 12 inches: silty clay loam
Bt - 12 to 28 inches: silty clay
BCt - 28 to 34 inches: silty clay loam
Cr - 34 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

Description of Brickhaven

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

A - 0 to 4 inches: silt loam
E - 4 to 7 inches: silt loam
Bt1 - 7 to 12 inches: silty clay loam
Bt2 - 12 to 37 inches: silty clay
BCt - 37 to 51 inches: silty clay loam
Cr - 51 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

CrC—Creedmoor-Green Level complex, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 1lvtj
Elevation: 150 to 550 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Creedmoor and similar soils: 65 percent
Green level and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Creedmoor

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 5 inches: sandy loam
E - 5 to 10 inches: sandy loam
Bt1 - 10 to 15 inches: sandy clay loam
Bt2 - 15 to 45 inches: clay
C - 45 to 80 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 13.0
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Description of Green Level

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 7 inches: sandy loam
E - 7 to 10 inches: sandy loam
BE - 10 to 13 inches: sandy loam
Btss - 13 to 51 inches: clay
BCg - 51 to 65 inches: clay loam
CB - 65 to 80 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 20.0
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

PeA—Peawick fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1lvyg
Elevation: 150 to 440 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Peawick and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old clayey alluvium

Typical profile

Ap - 0 to 6 inches: fine sandy loam
BE - 6 to 10 inches: loam
Bt1 - 10 to 64 inches: clay
Bt2 - 64 to 80 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D

PeB—Peawick fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1lvyl
Elevation: 150 to 440 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Peawick and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peawick

Setting

Landform: Stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Old clayey alluvium

Typical profile

Ap - 0 to 6 inches: fine sandy loam
BE - 6 to 10 inches: loam
Bt1 - 10 to 64 inches: clay
Bt2 - 64 to 80 inches: clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

UdC—Udorthents, loamy, 2 to 10 percent slopes

Map Unit Setting

National map unit symbol: 1lvzw
Elevation: 200 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 50 to 66 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 85 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy and clayey human transported material derived from igneous, metamorphic and sedimentary rock

Typical profile

C - 0 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C

Minor Components

Urban land

Percent of map unit: 8 percent
Landform: Hillslopes on ridges
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w

WhB—White Store-Polkton complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1lw1d
Elevation: 190 to 370 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

White store and similar soils: 55 percent
Polkton and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of White Store

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 8 inches: loam
Btss - 8 to 33 inches: clay
BC - 33 to 37 inches: clay loam
C - 37 to 42 inches: sandy loam
Cr - 42 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

Description of Polkton

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 4 inches: silt loam
E - 4 to 8 inches: silt loam
BE - 8 to 15 inches: sandy clay loam
Btss - 15 to 27 inches: clay
BC - 27 to 30 inches: silty clay loam
C - 30 to 33 inches: silt loam
Cr - 33 to 80 inches: weathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

WhC—White Store-Polkton complex, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 1lw1g
Elevation: 190 to 1,400 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

White store and similar soils: 50 percent
Polkton and similar soils: 35 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of White Store

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 8 inches: loam
Btss - 8 to 33 inches: clay
BC - 33 to 37 inches: clay loam
C - 37 to 42 inches: sandy loam
Cr - 42 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: D

Description of Polkton

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 4 inches: silt loam
E - 4 to 8 inches: silt loam
BE - 8 to 15 inches: sandy clay loam
Btss - 15 to 27 inches: clay
BC - 27 to 30 inches: silty clay loam
C - 30 to 33 inches: silt loam
Cr - 33 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Minor Components

Wehadkee, undrained

Percent of map unit: 1 percent
Landform: Depressions on flood plains
Down-slope shape: Concave
Across-slope shape: Linear

WhD—White Store-Polkton complex, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1lw1b
Elevation: 190 to 370 feet
Mean annual precipitation: 37 to 60 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 200 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

White store and similar soils: 60 percent
Polkton and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of White Store

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 8 inches: loam
Btss - 8 to 33 inches: clay
BC - 33 to 37 inches: clay loam
C - 37 to 42 inches: sandy loam
Cr - 42 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: D

Description of Polkton

Setting

Landform: Hillslopes on ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone and/or shale and siltstone and/or sandstone

Typical profile

Ap - 0 to 4 inches: silt loam
E - 4 to 8 inches: silt loam
BE - 8 to 15 inches: sandy clay loam
Btss - 15 to 27 inches: clay
BC - 27 to 30 inches: silty clay loam
C - 30 to 33 inches: silt loam
Cr - 33 to 80 inches: weathered bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

References

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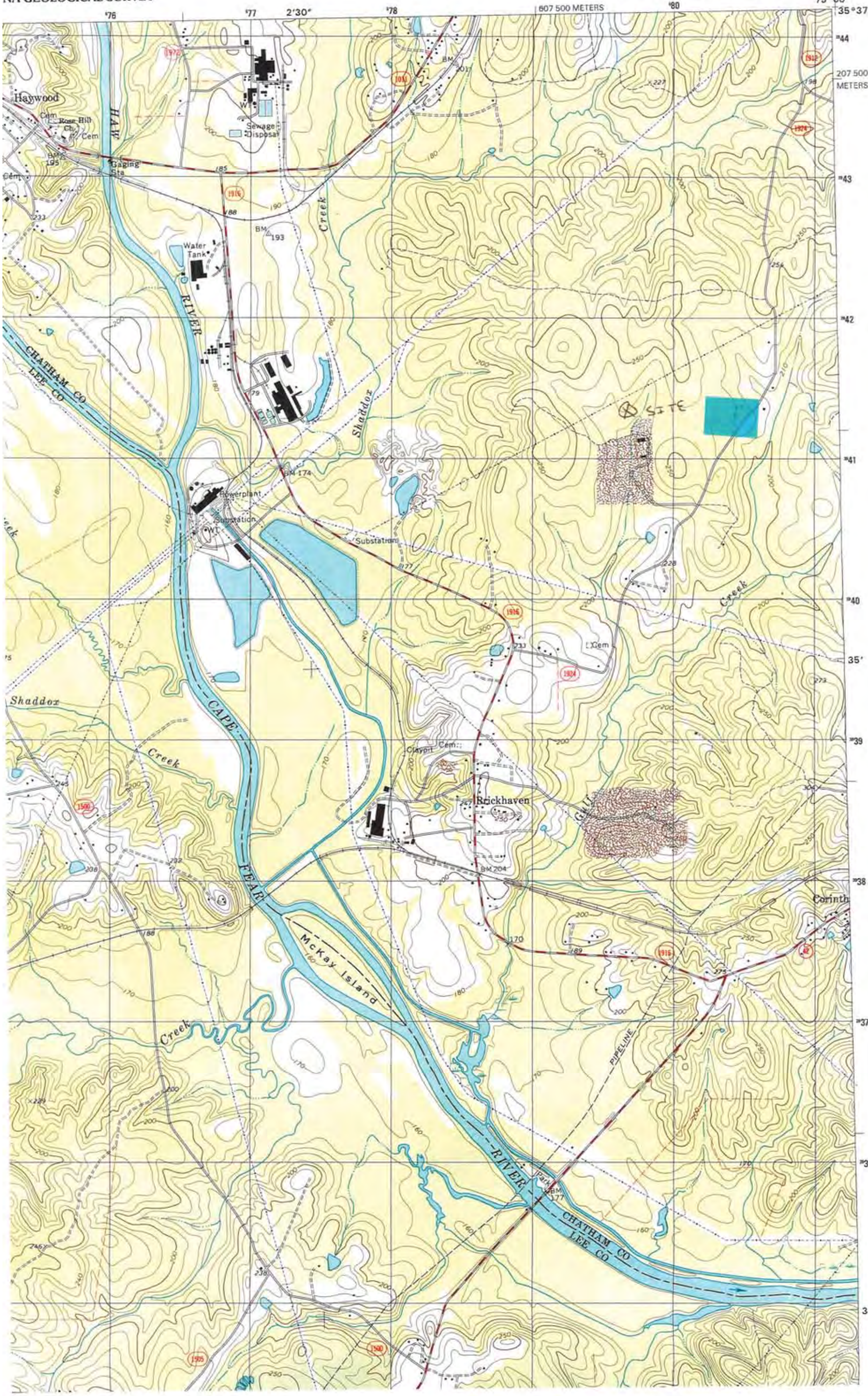
NMENT AND NATURAL RESOURCES
)F LAND RESOURCES
NA GEOLOGICAL SURVEY

MONCURE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES (TOPOGRAPHIC)



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C

Reclamation Timeline

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Charah Brickhaven No. 2 Mine
Reclamation Timeline

Estimated Daily Ash Placement =	8,000	tons per day		
Operational days =	260	days per year		
Estimated Annual Ash Placement =	2,080,000	tons per year or	1,664,000	cys per year
Estimated Ash Density =	1.25	tons per cy		
Estimated Start of Filling =	Aug-15			

	Footprint (Ac)	Ash Volume (cy)*	Estimated Time fro Ash Placement (yr)	Estimated Start of Closure Date	Estimated Closure Completion Date**
Phase 1	62.6	4,846,000	2.91	Jun-18	Dec-19
Phase 2	47.5	2,673,100	1.61	Feb-20	Jul-21
Phase 3	34.8	1,708,800	1.03	Feb-21	Aug-22

*Ash volume assumes vertical boundaries between phases

**Assumes 18 months to close from date of last ash placement

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Related Documents

Brickhaven No.2 Mine Tract "A"

Charah, Inc.

Moncure, NC

November 2014
Revised December 2014

NPDES Permit NCG020354, December 2014
Reclamation Bond, November 2014
NCDENR Permit Mod, October 2014
Wetlands Determination, August 2014
Threatened/Endangered Study, August 2014
Archeological Study, August 2014
Brickhaven Mine Drawings, January 2008
NCDENR Permit Mod, October 2007
NCDENR Permit Mod Review, July 2007

December 16, 2014

Mr. Charles E. Price
Green Meadow, LLC
12601 Plantside Drive
Louisville, KY 40299

Subject: NPDES General Permit NCG020354
Green Meadow, LLC
Formerly General Shale Brick, Inc.
Certificate of Coverage NCG020354
Chatham County

Dear Mr. Price:

Division personnel received your request to revise your stormwater permit Certificate of Coverage to accurately reflect your new company and/or facility name.

Please find enclosed the revised Certificate of Coverage. The terms and conditions contained in the General Permit remain unchanged and in full effect. This revised Certificate of Coverage is issued under the requirements of North Carolina General Statutes 143-215.1 and the Memorandum of Agreement between North Carolina and the U.S. Environmental Protection Agency.

If you have any questions or need further information, please contact the Stormwater Permitting Program at (919) 707-9220.

Sincerely,

for Tracy E. Davis, P.E., CPM, Director
Division of Energy, Mineral and Land Resources

cc: Raleigh Regional Office
Stormwater Permitting Program Files
Central Files

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES

GENERAL PERMIT NO. NCG020000
CERTIFICATE OF COVERAGE No. NCG020354

STORMWATER DISCHARGES

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provision of North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and the Federal Water Pollution Control Act, as amended,

Green Meadow, LLC

is hereby authorized to operate treatment systems and to discharge stormwater and mine dewatering wastewater and process wastewater, from a facility located at:

Brickhaven No.2 Mine Tract "A"
1149 Moncure Flatwood Road
Moncure
Chatham County

to receiving waters designated as unnamed tributary to Gulf Creek, a class WS-IV stream, in the Cape Fear River Basin, in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III, and IV of General Permit No. NCG020354 as attached.

This certificate of coverage shall become effective December 16, 2014.

This Certificate of Coverage shall remain in effect for the duration of the General Permit.

Signed this day December 16, 2014.

for Tracy E. Davis, P.E., Director
Division of Energy, Mineral, and Land Resources
By the Authority of the Environmental Management Commission

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Land Quality Section

Bond Pursuant to "The Mining Act of 1971"
(G.S. 74-46 through G.S. 74-68)

KNOW ALL MEN BY THESE PRESENTS, That Green Meadow, LLC
a Limited Liability Company and having its principal office at 100 N. Tryon St, Ste 4700, Charlotte
in the State of NC, as principal, and U.S. Specialty Insurance Company
a corporation organized under the laws of the State of Texas and duly authorized by the Insurance Commissioner of North Carolina to do business in North Carolina, with an office located at 4700 Homewood Court, in the City of Raleigh, North Carolina, as surety, are held and firmly bound unto the State of North Carolina in the sum Five Hundred Thousand and 00/100 ($500,000.00) of Bond No. 1001032762 lawful money of the United States of America, to the payment of which will and truly be made, we bind ourselves, our heirs, administrators and successors jointly and severally, firmly by these presents.

Signed, sealed and delivered this 5th day of November, 2014.

THE CONDITIONS OF THIS BOND ARE SUCH, That Whereas, the said Green Meadow, LLC conducts or will conduct mining operations in North Carolina as described in the application for an operating permit which includes a Reclamation Plan as provided in G.S. 74-53 and has obtained approval of this application on the 19th day of December, 2014, from the Department of Environment and Natural Resources.

NOW THEREFORE, if the said Green Meadow, LLC

shall comply with the requirements set forth in "The Mining Act of 1971" (G.S. 74-46 through 74-68) and with the rules and regulations adopted pursuant thereto and faithfully perform all obligations under his approved Reclamation Plan then this obligation shall be null and void; otherwise to be and remain in full force and effect until released by the Department of Environment and Natural Resources in accordance with G.S. 74-56 or canceled by the surety. Cancellation by the surety shall be effectuated only upon 60 days written notice thereof to the Department of Environment and Natural Resources and the operator as provided in G.S. 74-54.

ATTEST:

Janet Price

Secretary or
Assistant Secretary

Green Meadow, LLC

Principal

(Attach)
(Corporate Seal)
(here of Corporation)

By Charles Price

President, Vice President,
Partners, or Owner

U.S. Specialty Insurance Company

Surety

Countersigned at Raleigh, North Carolina

By: Robert W. Moore

Resident Agent of NC Robert W. Moore

Agent and Attorney in Fact Todd P. Loehnert

***PLEASE MAIL THIS FORM AND THE ATTACHED INSTRUMENT**
TO THE FOLLOWING ADDRESS:

LAND QUALITY SECTION
1612 MAIL SERVICE CENTER
RALEIGH, NC 27699

POWER OF ATTORNEY

AMERICAN CONTRACTORS INDEMNITY COMPANY **U.S. SPECIALTY INSURANCE COMPANY**

KNOW ALL MEN BY THESE PRESENTS: That American Contractors Indemnity Company, a California corporation, and U.S. Specialty Insurance Company, a Texas corporation (collectively, the "Companies"), do by these presents make, constitute and appoint:

Monica A. Kaiser, John B. Ayres, Todd P. Loehnert or Paula J. Teague of Louisville, Kentucky

its true and lawful Attorney(s)-in-fact, each in their separate capacity if more than one is named above, with full power and authority hereby conferred in its name, place and stead, to execute, acknowledge and deliver **any and all bonds, recognizances, undertakings or other instruments or contracts of suretyship to include riders, amendments, and consents of surety, providing the bond penalty does not exceed** ******Twenty Five Million****** **Dollars ($** **25,000,000.00** **).** This Power of Attorney shall expire without further action on March 18, 2015. This Power of Attorney is granted under and by authority of the following resolutions adopted by the Boards of Directors of the Companies:

Be it Resolved, that the President, any Vice-President, any Assistant Vice-President, any Secretary or any Assistant Secretary shall be and is hereby vested with full power and authority to appoint any one or more suitable persons as Attorney(s)-in-Fact to represent and act for and on behalf of the Company subject to the following provisions:

Attorney-in-Fact may be given full power and authority for and in the name of and on behalf of the Company, to execute, acknowledge and deliver, any and all bonds, recognizances, contracts, agreements or indemnity and other conditional or obligatory undertakings, including any and all consents for the release of retained percentages and/or final estimates on engineering and construction contracts, and any and all notices and documents canceling or terminating the Company's liability thereunder, and any such instruments so executed by any such Attorney-in-Fact shall be binding upon the Company as if signed by the President and sealed end effected by the Corporate Secretary.

Be it Resolved, that the signature of any authorized officer and seal of the Company heretofore or hereafter affixed to any power of attorney or any certificate relating thereto by facsimile, and any power of attorney or certificate bearing facsimile signature or facsimile seal shall be valid and binding upon the Company with respect to any bond or undertaking to which it is attached.

IN WITNESS WHEREOF, The Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 3rd day of October, 2011.

AMERICAN CONTRACTORS INDEMNITY COMPANY **U.S. SPECIALTY INSURANCE COMPANY**

Corporate Seals

AMERICAN CONTRACTORS INDEMNITY CO. INCORPORATED SEPT. 25, 1990 CALIFORNIA

U.S. Specialty Insurance Company T E X A S

By:

Daniel P. Aguilar, Vice President

State of California

County of Los Angeles SS:

On this 3rd day of October, 2011, before me, Deborah Reese, a notary public, personally appeared Daniel P. Aguilar, Vice President of American Contractors Indemnity Company and U.S. Specialty Insurance Company who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct. WITNESS my hand and official seal.

Signature deborah reese (Seal)

DEBORAH REESE
Commission # 1926048
Notary Public - California
Los Angeles County
My Comm. Expires Mar 18, 2015

I, Jeannie Lee, Assistant Secretary of American Contractors Indemnity Company and U.S. Specialty Insurance Company, do hereby certify that the above and foregoing is a true and correct copy of a Power of Attorney, executed by said Companies, which is still in full force and effect; furthermore, the resolutions of the Boards of Directors, set out in the Power of Attorney are in full force and effect.

In Witness Whereof, I have hereunto set my hand and affixed the seals of said Companies at Los Angeles, California this 5th day of November, 2014

Corporate Seals

AMERICAN CONTRACTORS INDEMNITY CO. INCORPORATED SEPT. 25, 1990 CALIFORNIA

U.S. Specialty Insurance Company T E X A S

Jeannie Lee, Assistant Secretary

Bond No. ________

Agency No. 16578

To inquire about this bond, please write to us at surety-bond-inquiry@hcc.com

Drawings

Brickhaven No.2 Mine Tract “A”

Charah, Inc.

Moncure, NC

November 2014
Revised December 2014

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