Stormwater Pollution Prevention Plan

for:

Coal Storage Area Stabilization Project (CSAS)
Y-12 National Security Complex
Anderson County
Oak Ridge, TN 37831

Prepared for:

National Nuclear Security Administration (NNSA)
P.O. Box 2009
Oak Ridge, TN 37831

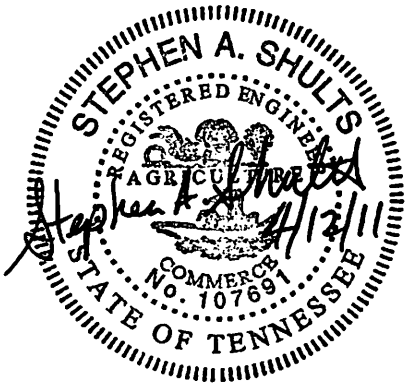
Prepared by:

Y-12 National Security Complex
Project and Design Engineering
P.O. Box 2009
Oak Ridge, TN 37831

Managed by:
B&W Y-12, L.L.C.
For the
U.S. Department of Energy
Under contract number
DE-AC05-00OR22800

March 2011

Estimated Project Dates:
Project Start Date: June 2011
Project Completion Date: August 2012



This document has been reviewed by a Y-12 DC/UCNI RO and has been determined to be UNCLASSIFIED and contains no UCNI. This review does not constitute clearance for Public Release.
Name: [illegible] / **Date:** 4/12/11
ENGINEERING

Contents

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Project/Site Name: Coal Storage Area Stabilization (CSAS)
Project Street/Location: Y-12 National Security Complex; Second Street
City: Oak Ridge State: TN ZIP Code: 37830
County or Similar Subdivision: Anderson County

Latitude:
35° 58.926' N

Longitude:
84 ° 15.720' W

Method for determining latitude/longitude:
☒ USGS topographic map (specify scale: 1:24000) ☐ EPA Web site ☐ GPS
☒ Other (please specify): USGS Map Store, 7.5' Quadrangle, Bethel Valley, TN 2010

Is the project located in Indian country? ☐ Yes ☒ No
If yes, name of Reservation, or if not part of a Reservation, indicate "not applicable." N/A_____

Is this project considered a federal facility? ☒ Yes ☐ No

NPDES project or permit tracking number*:_____

**(This is the unique identifying number assigned to your project by your permitting authority after you have applied for coverage under the appropriate National Pollutant Discharge Elimination System (NPDES) construction general permit.)*

1.2 Contact Information/Responsible Parties

Emergency 24-Hour Contact:
B&W Y-12, LLC
Plant Shift Superintendent (PSS)
(865) 574-7172

Contact Information
This Storm Water Pollution Prevention Plan (SWPPP) is developed in accordance with the Tennessee General NPDES Permit (TNR 100000) for Storm Water Discharges Associated with Construction Activity (TNCGP) and is prepared using sound engineering practices.
As instructed by Part III.F of the TNCGP, this plan and all attachments are hereby submitted to the local Environmental Assistance Center (EAC), along with the complete, correctly signed Notice of Intent (NOI). Construction will not be initiated prior to 30 days from the date of submittal of this document, or prior to receipt of the Notice of Coverage (NOC) from the Tennessee Department of Environment and Conservation (TDEC).

Owner: National Nuclear Security Administration (NNSA)
P.O. Box 2009
Bear Creek Road
Oak Ridge, TN 37831
Contact person: Paul Wasilko – Acting Division Manager, ES&H
Phone: (865) 241-5104
E-mail: wasilkopr@y12.doe.gov

I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Paul Wasilko – Acting Division Manager

Representative of Owner and Title	Signature	Date

Contractor: B&W Y-12, LLC
P.O. Box 2009
Bear Creek Road
Oak Ridge, TN 37831
Contact Person: J. T. Kato
Phone: (865) 574-3804

E-mail: katojt@y12.doe.gov

I certify under penalty of law that I have reviewed this document and any attachments. Based on my inquiry of the construction owner identified above, and/or my inquiry of the person directly responsible for assembling this Storm Water Pollution Prevention Plan, I believe the information is accurate. I am aware that this plan, if approved, makes the above-described construction activity subject to NPDES permit number TNR 100000, and that certain of my activities on-site are hereby regulated. I am aware that there are significant penalties, including the possibility of fine or imprisonment for knowing violations, and for failure to comply with these permit requirements.

J. T. Kato – Manager, Construction

Representative of Owner and Title	Signature	Date

The individual responsible for the installation, maintenance, and inspection of erosion and sediment control measures will be Joe Kato of B&W Y-12 Construction.
Current versions of this SWPPP, the NOI, and the NOC will be kept on site for the duration of the project. These items will be available for the use of all operators and site personnel involved in erosion and sediment controls, and be available to TDEC personnel visiting the site. A notice will be posted near the construction entrance containing a copy of the NOC with the tracking number assigned by the EAC, the name and 24 hour telephone number of a contact person for the development, and a brief description of the project. The contact person shall be responsible for the implementation of BMPs and shall be determined by the contractor prior to commencement of work. The site inspector must have completed the TDEC course for stormwater.
The contractor shall install erosion control measures as soon as possible prior to the beginning of grading activities.

1.3 Site Description and Project Scope

The scope of this project is to stabilize the abandoned coal storage area and redirect the storm water runoff from sanitary sewer system to the storm drain system. Currently, The existing storm water runoff is directed to a perimeter concrete drainage swale and collected in a containment basin. The collected water is then pumped to a treatment facility and after treatment, is discharged to the Y-12 sanitary sewer system. The existing drainage swale and collection basin along with silt fencing will be used during aggregate placement and grading to provide erosion and sediment control. Inlet protection will also be installed around existing structures during the storm water diversion construction.
This project scope will include the installation of a non-woven geotextile fabric and compacted mineral aggregate base (paving optional) to stabilize the site. The geotextile specifications are provided on the vendor cut sheets in Appendix B.
The installation of a stormwater collection/retention area will also be installed on the southern side of the site in accordance with EPA Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act. The total area to be disturbed is approximately 2.5 acres.

The order of activities for this SWPPP will be:

1. Post Notice of Coverage (NOC) in a prominent display near entrance of the site.
2. Install rain gauge on site or contact Y-12 Plant Shift Superintendent daily for Met tower rain gauge readings.
3. Install stabilized construction exit on site.
4. Install silt fencing along perimeter as indicated on the attached site plan.
5. Regrade site.
6. Install geotextile fabric and compacted mineral aggregate base.
7. Install catch basin inlet protection where required.
8. Excavate and lower existing catch basin tops, re-grade and asphalt to drain.
9. When all disturbed areas are re-stabilized, remove silt fencing and any other temporary erosion controls.

What is the function of the construction activity?

☐ Residential ☐ Commercial ☒ Industrial ☐ Road Construction ☐ Linear Utility
☐ Other (please specify):

Estimated Project Start Date: June 2011
Estimated Project Completion Date: August 2012

1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns

Soil type(s):

Ur – Urban land. Site was previously a coal storage yard. There is currently some remnant coal and clay material remaining on site.

Slopes:

The existing site is relatively flat with a general slope of 3% from northwest to southeast. According to the topographic survey the high elevation for the disturbed area is 975' and the low elevation is 965'.

Drainage Patterns:

The existing drainage is collected in a perimeter concrete drainage swale and collected in a basin on the west side of the site. Project will re-direct the runoff toward existing catch basins located on the southeast and southwest corner of the site. The existing storm drain pipe routes east toward Y-12 outfall #200 which day lights into East Fork Poplar Creek (EFPC). Y-12's industrial/non-construction discharges are located at EFPC under NPDES permit# TN0002968.

Vegetation:

There is no vegetation on site.

Other:
There is an existing burial trench located on the northwest corner of the site that will not be disturbed. No excavation is allowed in this area. The design drawings direct the contractor to only fill with aggregate base stone over this area.

1.5 Construction Site Estimates

The following are estimates of the construction site.

Total project area:	3.3 acres
Construction site area to be disturbed:	2.5 acres
Percentage impervious area before construction:	25%
Runoff curve number (CN) before construction:	91
Percentage impervious area after construction:	90%
Runoff curve number (CN) after construction	98

1.6 Receiving Waters

Description of receiving waters:
East Fork Poplar Creek

Description of storm sewer systems:
Currently the runoff from the site is collected, stored, treated and released to the Y-12 sanitary sewer system. This collection/treatment system will be kept operational during construction of the Coal Storage Area Stabilization. The storm drain system located due south of the coal storage area is reinforced concrete pipe but does not currently collect runoff from this site.

Description of impaired waters or waters subject to TMDLs:
The portion of East Fork Poplar Creek in Anderson County is listed on the 303d List for PCBs, Mercury, Escherichia coli, nutrients, siltation, and other Anthropogenic Habitat Alterations.

1.7 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

The primary potential source of storm water pollution from this project site will be erosion from exposed soils during stone base placement, re-grading of the site and the excavation to lower two existing catch basin grates. Best management practices (BMP) have been designed to manage and filter runoff while utilizing the existing collection and treatment system. Also, BMPs will prevent erosion from occurring as well as remove sediment from storm water in the event that erosion occurs.

Potential pollutants and sources, other than sediment, to stormwater runoff:

During the anticipated course of construction events, coal fines are the other potential pollutants identified. In the event pollutants are released during construction activities, they will be addressed by the Y-12 Spill Response team and in accordance with section 3.2 of this SWPPP.

1.8 Maps and Figures

See Appendix A for General Location Map using the USGS Bethel Valley Quadrangle.

See Appendix B for Site Design Figures and Details

Figure 1: Site Location

Figure 2: Existing Site Plan

Figure 3: Grading and Drainage Site Plan

Figure 4: Details

Figure 5: Geotextile Specifications

1.9 Calculations

Runoff Calculations

The stormwater objective of the CSAS project was to provide a design that minimizes the impact to the peak discharge of the existing watershed. The calculations were used to determine the pre-developed flow rates within the existing storm drain system at the points where post-developed flows from the CSAS project will be introduced. Soil Conservation Service (SCS) Technical Release No. 55 (TR-55) method was used to estimate pre and post-development runoff.

The calculations determine the additional flow rate from the CSAS site runoff that will impact the existing watershed. The increase will have minimal impact on the watershed due to CSAS site's close proximity to the receiving catch basin. The CSAS site will discharge its peak flow rate prior to the existing watershed's peak flow. Calculation number CCOALYD-F-001 is found in Appendix C.

Collection/Retention Area

Based on guidance found in "Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security

Act" (EISA 438 Guidance), this project is considered a 'redevelopment' and as such, must comply with EISA 438. EISA 438 states that "The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow".
In order to comply with EISA 438, the project team has chosen to construct a stormwater collection/retention area on the downstream side of the project. Calculations to support the stormwater collection/retention area size proposed for this project are found in Appendix C, CCOALYD-F-002.
Based on EISA 438 guidance, the stormwater collection/retention area will be sized to prevent the offsite discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event to the maximum extent technically feasible.

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

General Erosion and Sediment Controls:

1. Construction on the site will start with installation of perimeter erosion control measures. These include silt fence and inlet protection. All sediment control measures will be maintained until all upstream disturbed ground within the site has been completely stabilized with fabric and permanent compacted aggregate base stone.
2. All control measures must be installed and maintained in accordance with the manufacturer's specifications, project plans and details, and using good engineering practices.
3. Every effort will be made to control sediment, if sediment does leave the construction site, the contractor shall remove the accumulated sediment and restore the off-site affected area to a clean, sediment free condition.
4. Sediment and erosion control measures shall be inspected before anticipated storms, within 24 hours after a 0.5" rain event and twice every 7 days.
5. Any construction debris shall be picked up on a regular basis and the site shall be kept in a clean orderly manner especially prior to any anticipated storm events.
6. Construction activities shall be sequenced to minimize the exposed time of disturbed areas.
7. If sediment escapes the construction site, off-site accumulations of sediment that have not reached a stream must be removed at a frequency sufficient to minimize

offsite impacts (e.g., fugitive sediment that has escaped the construction site and has collected in street must be removed so that it is not subsequently washed into the storm sewers and streams by the next rain and/or so that it does not pose a safety hazard to users of public or private streets). Permittees shall not initiate remediation/restoration of a stream without consulting the Division first.

2.2 Phase Construction Activity

- Phase I
  - Grade site, installation of geotextile fabric and aggregate base stone over existing coal storage area.
  - Start date: June 2011
  - BMPs include existing collection and treatment system. Perimeter silt fence or engineering approved equal controls.
  - Final CSAS will include a proof rolled subgrade, installation of getextile fabric, compacted aggregate base stone.

- Phase II
  - Excavation and lowering of two existing catch basin inlet grates.
  - Install pavement to re-direct storm water runoff away from containment basin and ensure positive flow toward storm drain catch basins.
  - End date: August 2012
  - BMPs include a typical inlet protection installed around catch basin. Inlet protection detail includes a 2"x4" wood frame and posts with geotextile filter fabric attached or engineering approved equal.
  - Inlet protection is required until catch basin modification and paving around structures is complete.

2.3 Control Stormwater Flowing onto and through the Project

BMP Description: Utilize the existing concrete drainage swale, collection system, containment basin and treatment facility located around the perimeter of the site. This system is currently operational and will remain in service during the construction of the CSAS project.

Installation Schedule:	Existing collection and treatment system.
Maintenance and Inspection:	B&W Y-12 Construction
Responsible Staff:	B&W Y-12 Construction

2.4 Protect Storm Drain Inlets

BMP Description: Typical storm drain inlet protection will be installed around two existing catch basins. Inlet protection detail includes a 2"x4" wood frame and posts with geotextile filter fabric attached (or engineering approved equal). Filer fabric shall be installed into a 6" deep x 6"wide trench. Sand bags and/or gravel shall be installed on fabric as an alternate method from staking around the perimeter if area is paved. Straw (hay) bales shall also be used around the perimeter of the inlet protection to help filter any sediment, but hay bales shall not be used as a stand alone BMP.

Installation Schedule:	Inlet protection to be installed prior to construction activities.
Maintenance and Inspection:	Sediment and erosion control measures shall be inspected before anticipated storms, within 24 hours after a 0.5" rain event and twice every 7 days. Maintenance needs identified in inspections or by other means should be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified. Sediment should not be allowed to wash into the storm drain inlet. Inlet protection structures shall be cleaned of sediment when sediment accumulates deeper than 3 inches in any area of the structure.
Responsible Staff:	B&W Y-12 Construction

2.5 Establish Perimeter Controls and Sediment Barriers

BMP Description: Type "A" silt fence will be installed around the coal storage area (just inside of the existing concrete drainage swale) that is located around the perimeter of the site. Silt fence is filter fabric placed in a fence like manner at approximately 90 degree angles to the land slope to prevent further movement of eroded soils. Silt fence is buried in existing ground and supported with wooded posts.

Installation Schedule:	The silt fence is considered to be the initial erosion and sediment control measure and shall be installed prior to any other construction activities.
Maintenance and Inspection:	Sediment and erosion control measures shall be inspected before anticipated storms, within 24 hours after a 0.5" rain event and twice every 7 days. Maintenance needs identified in inspections or by other means should be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified. Sediment shall be removed from silt fences, and other sediment controls as necessary, and must be removed when design capacity has been reduced by 50%.
Responsible Staff:	B&W Y-12 Construction

2.6 Establish Stabilized Construction Exits

Construction Exit:
The construction entrance/exit shall consist of a minimum pad size of 20 ft x 50 ft with 6" thick stone pad installed on the southwest corner of the site at the existing concrete driveway. The stone pad shall be installed over a geotextile under-liner and consist of washed, well graded stones between 1-1/2" and 3-1/2" in diameter. The geotextile liner shall meet the requirements of AASHTO M288-96, section 7.3 separation requirements. Equivalent materials for exits shall be submitted for engineering approval.

Installation Schedule:
Construction entrance/exit shall be installed prior to any construction activity.

Maintenance and Inspection:
The construction exit shall be maintained to prevent tracking of mud onto the Y-12 streets and public right-of-way. This may require routine maintenance by top dressing the top 1" to 3" of stone. All tracked, spilled or washed materials onto the roadways shall be cleaned up and removed immediately.

Responsible Staff: B&W Y-12 Construction.

SECTION 3: GOOD HOUSEKEEPING BMPS

3.1 Material Handling and Waste Management

The contractor is responsible for providing control of his construction site and any materials or debris generated by his employees. A garbage dumpster shall be located on site to collect the everyday paper trash and garbage. Paint cans, oil cans, used oil, etc... shall be collected and disposed of in accordance with the project Waste Management Plan, WMP-FY11-0015, Rev. 0, dated February 2011. The Contractor will coordinate this disposal through the B&W Y-12 Construction Subcontract Technical Representative (STR).

3.2 Spill Prevention and Control Plan

All spills will be immediately reported to the Y-12 PSS Office at (865)574-7172 and the Construction STR. Spill reporting will be completed at the direction of the Y-12 PSS Office. A waterproof container marked "Spill Kit" will be maintained on the project site with appropriate absorbent material to manage spills. Contaminated soils shall be placed on heavy plastic and covered or placed into approved containers to prevent contact with storm water. Coordinate the disposal of any contaminated soils with B&W Y-12 Construction STR.

SECTION 4: MAINTENANCE

The Contractor shall maintain the site to ensure that erosion control measures are kept in good and effective operating condition. Maintenance needs identified during inspections or by other means shall be accomplished before the next storm if possible, but in no case more than seven days after the need is identified. Specific maintenance activities are as follows:

Silt Fence - Sediment shall be removed from silt fences, and other sediment controls as necessary, and must be removed when design capacity has been reduced by 50%. Sediment shall be removed by manual means or with equipment and spread in a stable area. Stakes shall be replaced or secured if damaged or displaced. Areas of silt fence breach shall be repaired or reinforced as necessary. Silt fence should remain in place until disturbed areas have been permanently stabilized.

Inlet Protection – Inlet protection structures shall be cleaned of sediment when sediment accumulates deeper than 3 inches in any area of the structure. Sediment shall be removed by manual means or with equipment and disposed of and the area stabilized so that it will not enter the inlet again. Stakes shall be replaced or secured if damaged or displaced. Inlet protection is required until the construction around the inlets is complete and stabilized with compacted stone and pavement.

If any revisions are required to this plan they shall be coordinated with the B&W Y-12 Construction STR. Any revisions deemed necessary will be implemented by the Contractor.

SECTION 5: INSPECTIONS and RECORDS

5.1 Inspector Training and Certification

Inspectors must have successfully completed the Tennessee "Level I- Fundamentals of Erosion Prevention and Sediment Control for Construction Sites" course, for individuals involved in land-disturbing activities which provides a working knowledge of erosion prevention and sediment controls. An engineer or landscape architect that prepared the drainage and structure design portion of the SWPPP may also conduct the required inspections. A copy of the certification or training record for inspector qualifications should be kept onsite.

5.2 Inspection Responsibilities

1. A blank stormwater inspection form is located in Appendix E of this plan.
2. Copy of the NOI and SWPPP will be maintained on site and readily available to TDEC personnel upon request.

3. Daily log of rain gauge readings will be kept on site and available to TDEC personnel upon request. Rain gauge readings can be obtained through the Y-12 PSS office.
4. Inspection and maintenance reports will be kept on site and available to TDEC personnel upon request.
5. Inspections shall be performed at least twice every 7 days. Inspections shall be performed before anticipated storms and within 24 hours after a 0.5" rain event.
6. Outfall points (where discharges leave the site or enter East Fork Poplar Creek) shall be inspected to determine whether erosion prevention and sediment control measures are effective in preventing significant impacts to receiving waters. Where discharge locations are inaccessible, nearby downstream locations shall be inspected. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.
7. Silt fence and inlet controls shall be inspected for excess sediment accumulation, damage and to ensure that the filter fabric is properly installed in trench.
8. There are no non-stormwater discharges anticipated.

9. The following records shall be maintained on the site:
    a. Dates when disturbance (i.e. grading) occurs,
    b. Dates when construction activities are completed for different portions of the site work,
    c. Dates when final stabilization measures are initiated.
    d. Inspection of erosion and sediment controls,
    e. Rainfall records and dates.

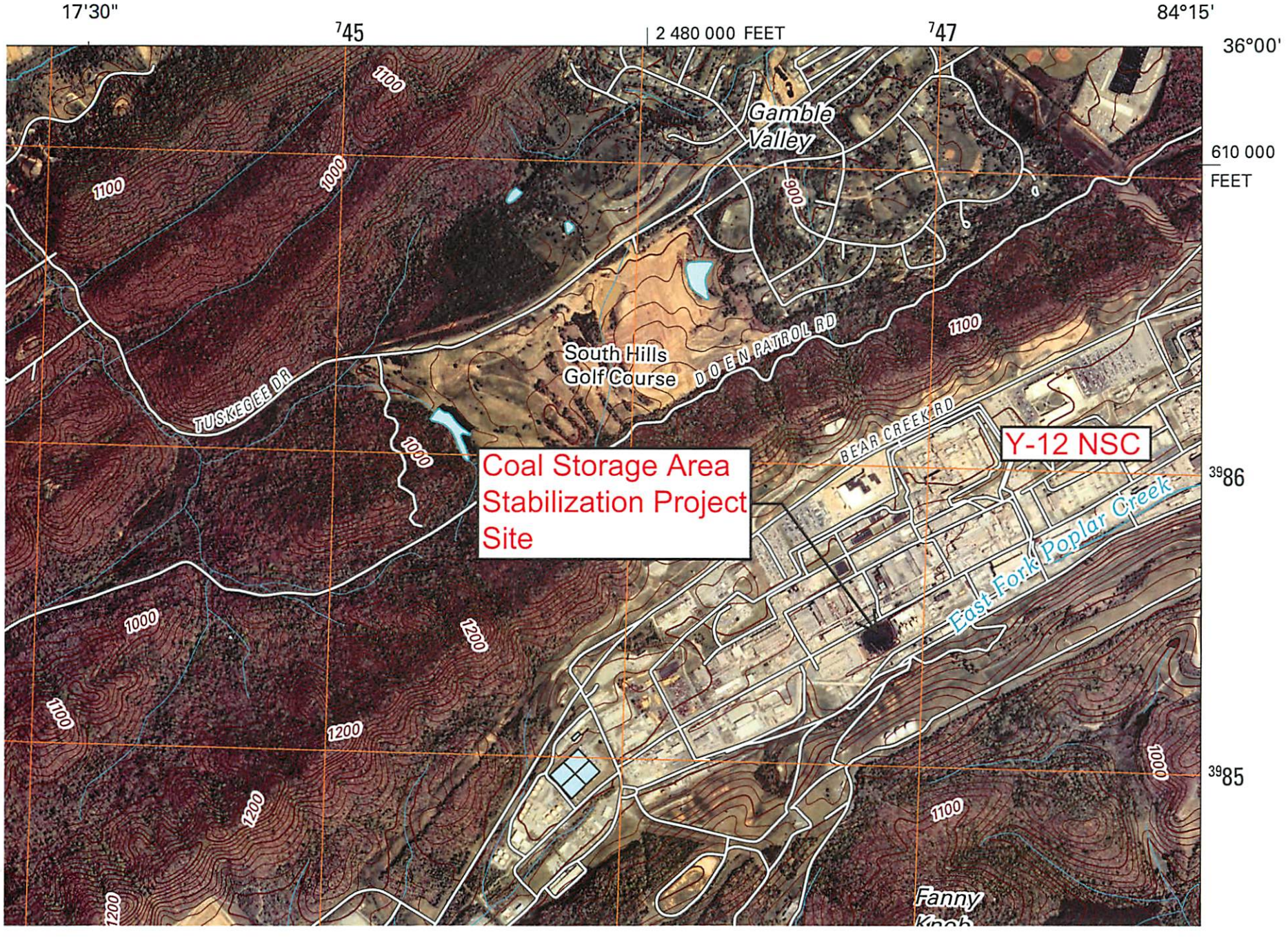
SWPPP APPENDICES:

Appendix A – General Location Map
Appendix B – Site Design Figures and Details
Appendix C – Calculations
Appendix D – NOI and NOT
Appendix E – Stormwater Inspection Reports and Rainfall Record Sheets

Appendix A

General Location Map

Appendix A


BETHEL VALLEY QUADRANGLE
TENNESSEE
7.5-MINUTE SERIES
17'30"
745
2 480 000 FEET
747
84°15'
36°00'
610 000 FEET
3986
3985
Gamble Valley
South Hills Golf Course
DOE N PATROL RD
BEAR CREEK RD
TUSKEGEE DR
Y-12 NSC
Coal Storage Area Stabilization Project Site
East Fork Poplar Creek
Fanny
1100
1000
900
1200

Appendix B

Site Design Figures and Details

Figures:

1. Site Location
2. Existing Site Plan
3. Grading and Drainage Plan
4. Details
5. Geotextile Specifications

Appendix B

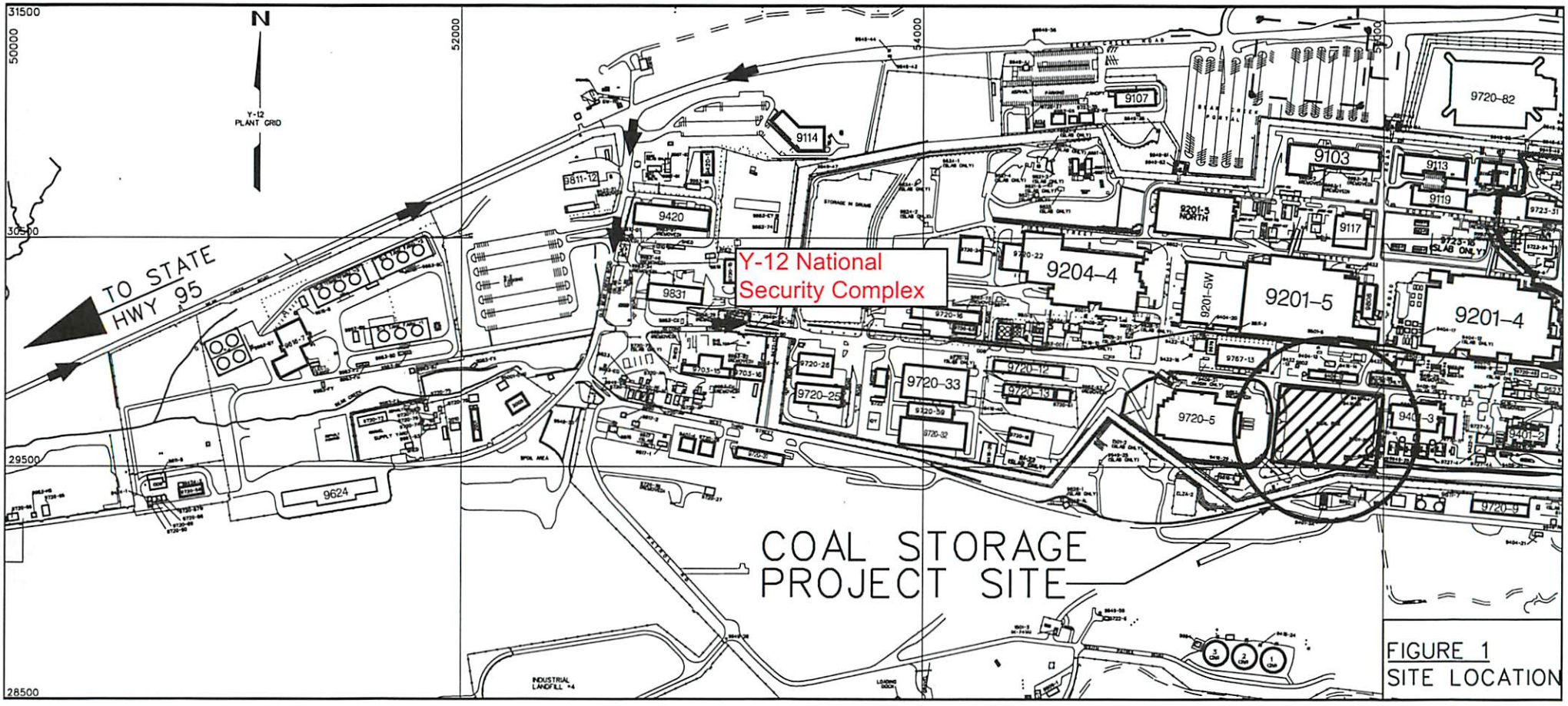
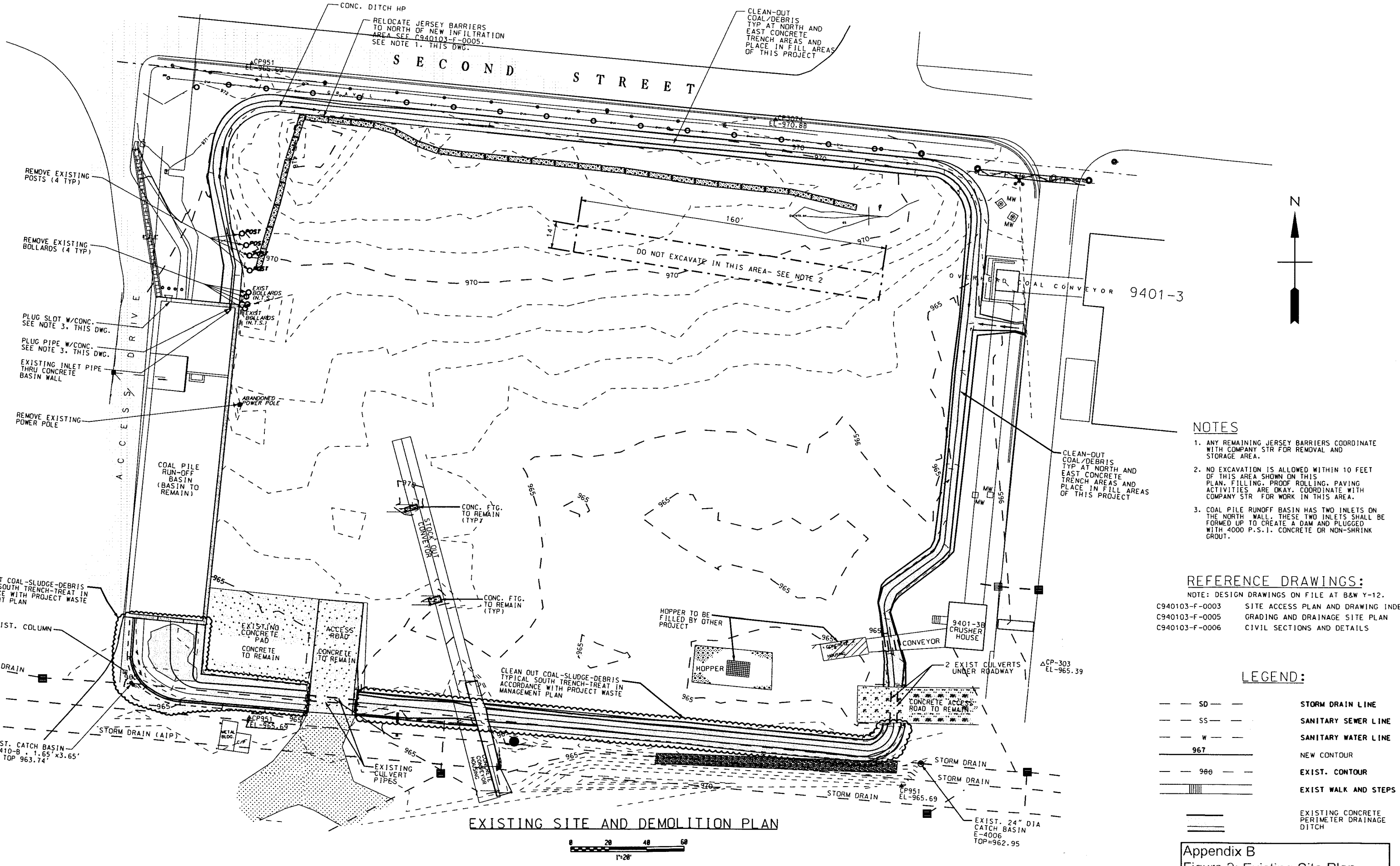


Figure 1: Site Location



EXISTING SITE AND DEMOLITION PLAN

NOTES

1. ANY REMAINING JERSEY BARRIERS COORDINATE WITH COMPANY STR FOR REMOVAL AND STORAGE AREA.
2. NO EXCAVATION IS ALLOWED WITHIN 10 FEET OF THIS AREA SHOWN ON THIS PLAN. FILLING, PROOF ROLLING, PAVING ACTIVITIES ARE OKAY. COORDINATE WITH COMPANY STR FOR WORK IN THIS AREA.
3. COAL PILE RUNOFF BASIN HAS TWO INLETS ON THE NORTH WALL. THESE TWO INLETS SHALL BE FORMED UP TO CREATE A DAM AND PLUGGED WITH 4000 P.S.I. CONCRETE OR NON-SHRINK GROUT.

REFERENCE DRAWINGS:

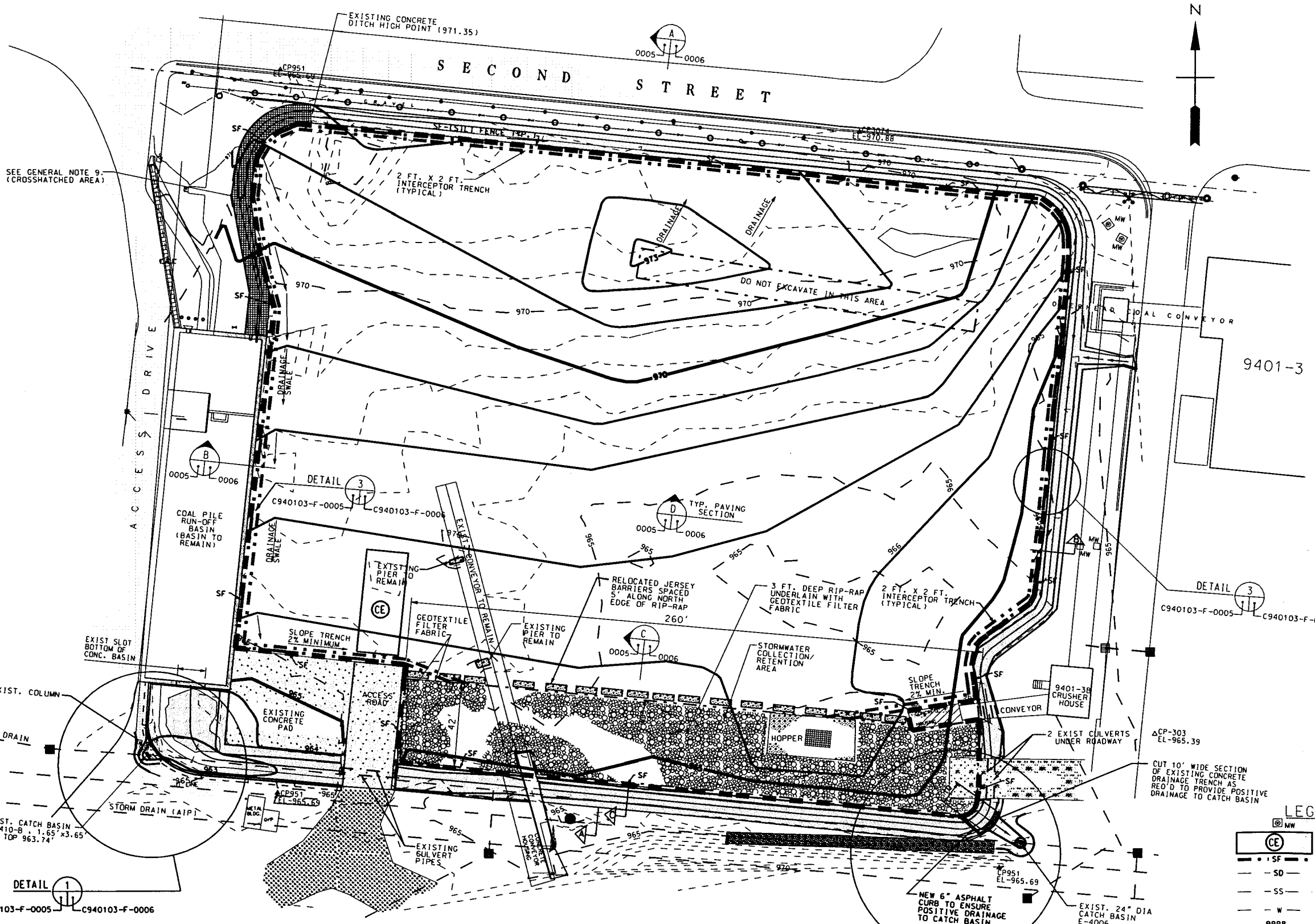
NOTE: DESIGN DRAWINGS ON FILE AT B&W Y-12.

C940103-F-0003	SITE ACCESS PLAN AND DRAWING INDEX
C940103-F-0005	GRADING AND DRAINAGE SITE PLAN
C940103-F-0006	CIVIL SECTIONS AND DETAILS

LEGEND:

— — SD — —	STORM DRAIN LINE
— — SS — —	SANITARY SEWER LINE
— — W — —	SANITARY WATER LINE
967	NEW CONTOUR
— — 980 — —	EXIST. CONTOUR
	EXIST WALK AND STEPS
	EXISTING CONCRETE PERIMETER DRAINAGE DITCH

Appendix B
Figure 2: Existing Site Plan



NOTE: CONSTRUCTION ACTIVITY ON EITHER CATCH BASIN SHALL NOT START UNTIL COAL STORAGE AREA STABILIZATION IS COMPLETE.

GRADING AND DRAINAGE PLAN

0 20 40 60
1"=20'

GENERAL NOTES:

1. SEE SECTION "D" ON DRAWING C940103-F-0006 FOR OPTIONAL PAVEMENT CROSS-SECTIONS.
2. EXISTING CURBS, CONCRETE WALL, AND OTHER MISCELLANEOUS EXTRUSIONS FROM GRADE ARE TO BE CUT FLUSH WITH EXISTING GRADE AS NEEDED.
3. DO NOT PAVE OVER CATCH BASINS, MANHOLES, VALVES, MONITORING WELLS OR SURVEY CONTROL POINTS.
4. NEW GRADING AND PAVEMENT SHALL MAINTAIN POSITIVE DRAINAGE TOWARDS NEW INTERCEPTOR DRAINAGE DITCH AROUND THE PERIMETER OF THE COAL PILE. STORMWATER SHALL ENTER INFILTRATION AREA PRIOR TO ANY RUNOFF GOING TO CONCRETE DRAINAGE DITCH.
5. LOWER EXISTING CATCH BASINS TO NEW GRADE ELEVATION SHOWN IN PLANS AND DETAILS.
6. CLEAN OUT AND REMOVE SHRUBS, WEEDS, GRASS AND COAL SLUDGE OUT OF EXISTING CONCRETE DRAINAGE DITCH. COAL DEBRIS IN NORTH AND EAST TRENCH SHALL BE PLACED ON THE COAL PILE SITE AND GRADED IN SMOOTH WITH EXISTING SURFACE PRIOR TO INSTALLING GEOTEXTILE FABRIC. COAL DEBRIS IN SOUTH TRENCH SHALL BE TREATED IN ACCORDANCE WITH PROJECT WASTE MANAGEMENT PLAN.
7. ALL EXCAVATED MATERIAL IS TO REMAIN ON SITE AND BE USED AS BACKFILL PRIOR TO INSTALLING GEOTEXTILE FABRIC.
8. STORMWATER COLLECTION/RETENTION TO BE FILLED TO GRADE WITH TDOT CLASS A-1 RIP-RAP. SEE TDOT SECTION 709.03.
9. BACKFILL EXISTING CONCRETE DRAINAGE DITCH FROM HIGH POINT (HP) TO THE NORTH TO THE COAL PILE RUNOFF BASIN ON THE SOUTH. DEMOLISH THE EXISTING CURBS/WALL AS NEEDED AND BACKFILL WITH COMPACTED AGGREGATE BASE. RE-GRADE AND SLOPE TO DRAIN AS SHOWN BY FINAL CONTOURS.

EROSION AND SEDIMENT CONTROL

1. MONITOR WELLS ARE NOT TO BE DISTURBED DURING CONSTRUCTION.
2. PROVISIONS TO PREVENT EROSION OF SOIL FROM SITE SHALL BE, AS A MINIMUM, IN CONFORMANCE WITH THE LATEST REVISION TO THE "TENNESSEE EROSION AND SEDIMENT CONTROL HANDBOOK."
3. FAILURE TO INSTALL, OPERATE OR MAINTAIN ALL EROSION CONTROL MEASURES WILL RESULT IN ALL CONSTRUCTION BEING STOPPED ON THE JOB SITE UNTIL SUCH MEASURES ARE CORRECTED.
4. PRIOR TO COMMENCING LAND DISTURBANCE ACTIVITY, THE LIMITS OF LAND DISTURBANCE SHALL BE CLEARLY AND ACCURATELY DEMARCATED WITH STAKES, RIBBONS, OR OTHER APPROPRIATE MEANS. THE LOCATION AND EXTENT OF ALL AUTHORIZED LAND DISTURBANCE ACTIVITY SHALL BE DEMARCATED FOR THE DURATION OF THE CONSTRUCTION ACTIVITY. NO DISTURBANCE ACTIVITY SHALL OCCUR OUTSIDE THE LIMITS INDICATED ON THE DRAWINGS.
5. CONSTRUCTION ON THE SITE WILL BEGIN WITH INSTALLATION OF EROSION. ALL SEDIMENT CONTROL MEASURES WILL BE MAINTAINED UNTIL ALL UPSTREAM DISTURBED GROUND WITHIN THE CONSTRUCTION AREA HAS BEEN COMPLETELY STABILIZED WITH PERMANENT AGGREGATE BASE AND ROADS/PARKING HAVE BEEN PAVED.
6. CONTRACTOR SHALL INSPECT AND REPAIR EROSION CONTROL MEASURES AT LEAST 2 TIMES A WEEK AND AFTER EACH RAINFALL.
7. THE CONTRACTOR SHALL REMOVE ACCUMULATED SILT FROM SEDIMENT BARRIERS WHICH BECOME SILTED ABOVE ONE-HALF OF THEIR ORIGINAL HEIGHT.
8. ALL AREAS TO BE PAVED SHALL BE STABILIZED WITH MINERAL AGGREGATE BASE MATERIAL AS SOON AS PRACTICAL.
9. ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE CORRECTED BY THE END OF EACH DAY. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSTALLED IF DEEMED NECESSARY BY STR.
10. THE LIMITS OF DISTURBANCE SHOWN ON THIS DRAWING SHALL BE STRICTLY ADHERED TO. UNDER NO CIRCUMSTANCES SHALL ANY CLEARING, GRADING, OR OTHER LAND DISTURBANCES OCCUR OUTSIDE THESE LIMITS WITHOUT APPROVAL FROM B&W Y-12 STR.
11. SEE TYPICAL SILT FENCE AND INLET PROTECTION DETAILS ON C940103-F-0006.

SITE WORK NOTES

1. THE RUTS AND ERODED AREAS OBSERVED AT THE COAL PILE SURFACE SHALL BE BACKFILLED WITH MINERAL AGGREGATE BASE MATERIAL TO THE REQUIREMENTS OF TDOT 903.05 TYPE A GRADING D.
2. THE COAL PILE SURFACE SHALL BE PROOF ROLLED AFTER A SUITABLE PERIOD OF DRY WEATHER TO AVOID DEGRADING AN OTHERWISE ACCEPTABLE SUBGRADE. PROOF ROLLING SHALL BE PERFORMED WITH A HEAVILY LOADED DUMP TRUCK OR SMOOTH DRUM ROLLER. SOFT AND EXCESSIVE WET MATERIAL THAT PUMP, RUT OR WAVE DURING THE PROOF ROLLING OPERATION SHALL BE REMOVED OR STABILIZED.
3. INSTALL THE GSE NON-WOVEN NEEDLE PUNCHED GEOTEXTILE NW12 OR EQUIVALENT OVER THE PROOF ROLLED SUBGRADE.
4. THE GEOTEXTILE SHALL BE INSTALLED TO THE LINES AND GRADES AS SHOWN ON THE DRAWING.
5. THE GEOTEXTILE SHALL BE HANDLED IN SUCH A MANNER THAT IT IS NOT DAMAGED IN ANY WAY.
6. THE GEOTEXTILE SHALL BE SECURELY ANCHORED IN AN ANCHOR TRENCH AS SHOWN ON THE DETAIL. NO. 57 STONE SHALL BE IN ACCORDANCE WITH TDOT SECTION 903.22.
7. THE GEOTEXTILE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION.
8. THE GEOTEXTILE SHALL BE COVERED AS SOON AS POSSIBLE AFTER INSTALLATION. INSTALLED GEOTEXTILE SHALL NOT BE LEFT EXPOSED FOR MORE THAN 15 DAYS.
9. PLACE MINERAL AGGREGATE BASE TDOT 903.05 TYPE A GRADING D MATERIAL IN AT LEAST TWO HORIZONTAL LAYERS EACH WITH COMPACTED LIFT THICKNESS OF 6 INCHES. EACH LIFT SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF THE MODIFIED PROCTOR MAXIMUM DRY DENSITY (ASTM D1557) AT MOISTURE CONTENT WITHIN 3 PERCENT OF THE OPTIMUM MOISTURE CONTENT. THE MINERAL AGGREGATE SHALL BE COMPACTED USING STEEL DRUM VIBRATORY ROLLER.
10. COMPACTION OF THE MINERAL AGGREGATE SHALL BE VERIFIED BY IN-PLACE DENSITY AND MOISTURE CONTENT TESTS USING ASTM D6938. TESTING SHALL BE PERFORMED AT A RATE OF ONE TEST FOR EVERY 10,000 SFT PER LIFT OF THE MATERIAL PLACED.

LEGEND:

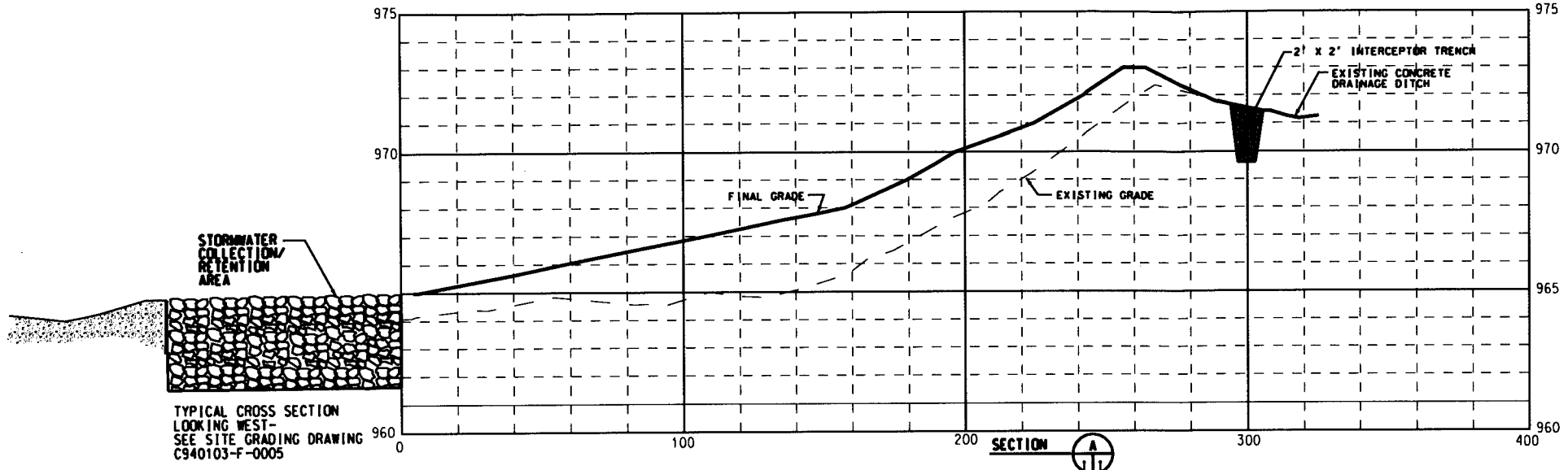
- MW — MONITORING WELL
- CE — CONSTRUCTION EXIT 20'X50'
- SF — SILT FENCE
- SD — STORM DRAIN LINE
- SS — SANITARY SEWER LINE
- W — SANITARY WATER LINE
- 9998 — BLDG LINE AND NUMBER
- 980 — EXIST. CONTOUR
- EXISTING CONCRETE PERIMETER DRAINAGE DITCH
- 980 — NEW MAJOR CONTOUR
- NEW MINOR CONTOUR
- NEW-STORMWATER COLLECTION/ RETENTION
- NEW TRENCH- (2' X 2' X 2')
- JERSEY BOUNCE

REFERENCE DRAWINGS:

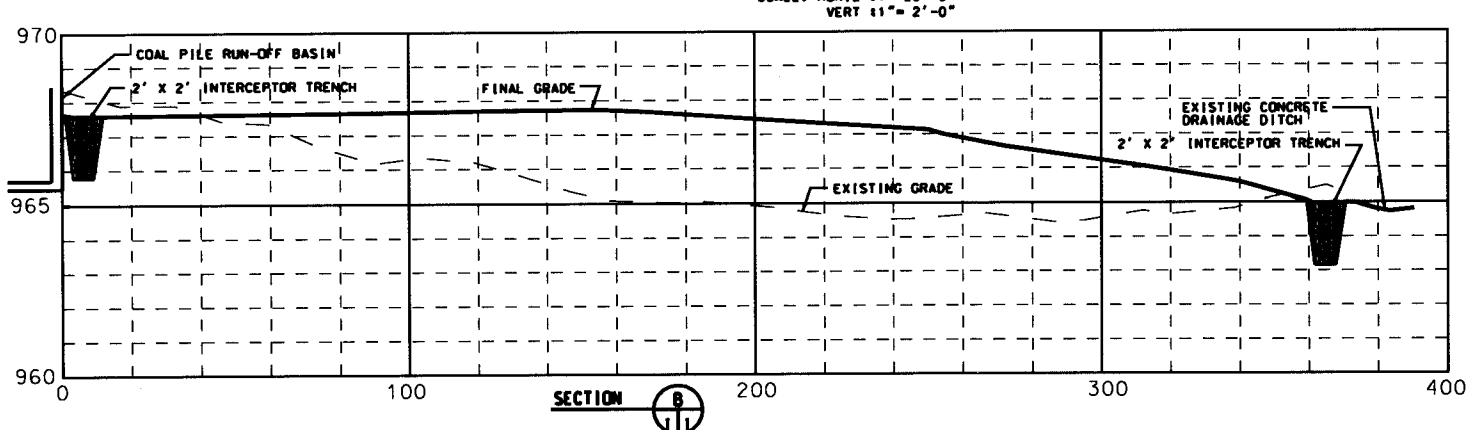
NOTE: DESIGN DRAWINGS ON FILE AT B&W Y-12.

C940103-F-0003	ACCESS PLAN AND DRAWING INDEX
C940103-F-0004	EXISTING SURVEY AND DEMO SITE PLAN
C940103-F-0006	CIVIL SECTIONS AND DETAILS

Appendix B
Figure 3: Grading and Drainage Plan



SECTION A
C940103-F-0005 C940103-F-0006
SCALE: HORIZ :1"=20'-0"
VERT :1"= 2'-0"



SECTION B
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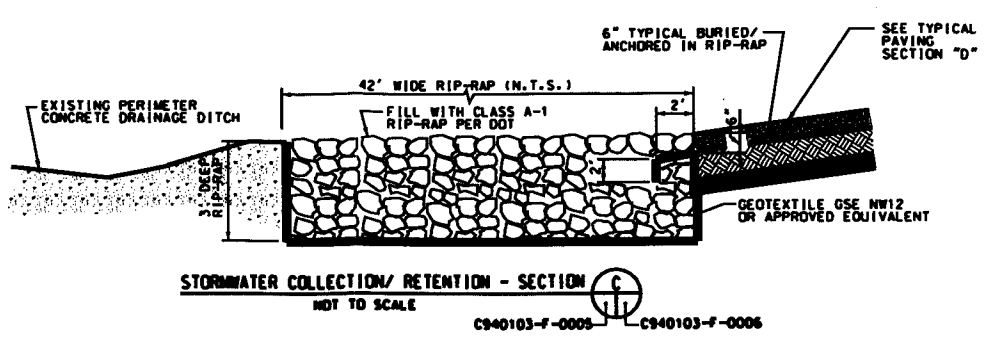
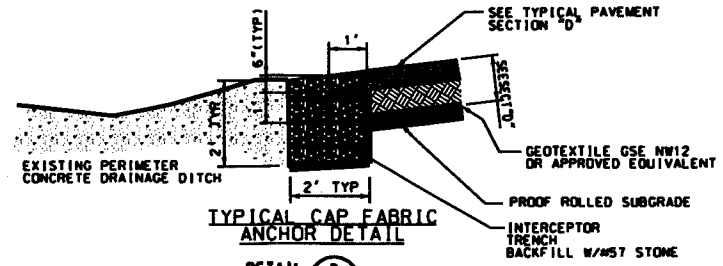
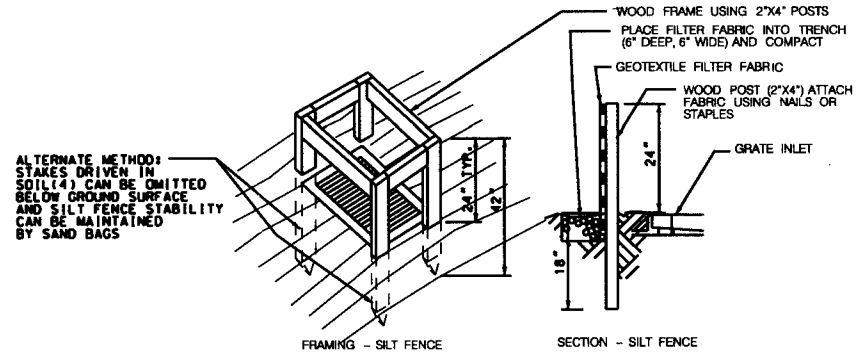


STORMWATER COLLECTION/ RETENTION - SECTION C
NOT TO SCALE
C940103-F-0005 C940103-F-0006

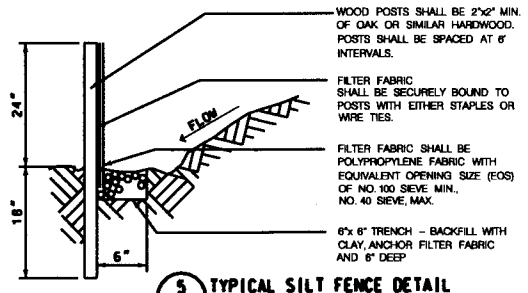


TYPICAL CAP FABRIC ANCHOR DETAIL
DETAIL 3
NOT TO SCALE
C940103-F-0005 C940103-F-0006



TYPICAL INLET PROTECTION DETAIL 4
NOT TO SCALE
C940103-F-0005 C940103-F-0006

NOTES:
1. INSTALL INLET PROTECTION AROUND EACH OF THE CATCH BASINS DURING EXCAVATION AND CONSTRUCTION ACTIVITES.
2. INLET PROTECTION SHALL BE INSTALLED ANYTIME WORK ON THE CATCH BASINS IS NOT BEING PERFORMED (I.E FINISHED FOR THE DAY).
3. INLET PROTECTION IS REQUIRED UNTIL CATCH BASIN MODIFICATIONS AND PAVING AROUND STRUCTURE IS COMPLETE.



TYPICAL SILT FENCE DETAIL 5
NOT TO SCALE
C940103-F-0005 C940103-F-0006

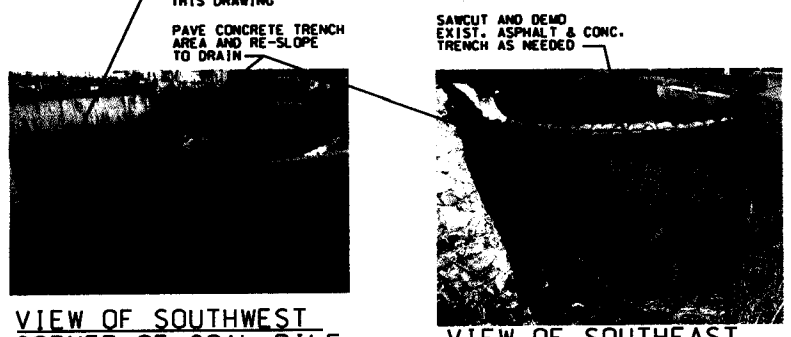
NOTE:
TYPICAL AROUND PERIMETER:
SEE DRAWING C94013-F-0005

GENERAL NOTES:

1. SEE DRAWING C94013-F-0005 FOR PROJECT NOTES.

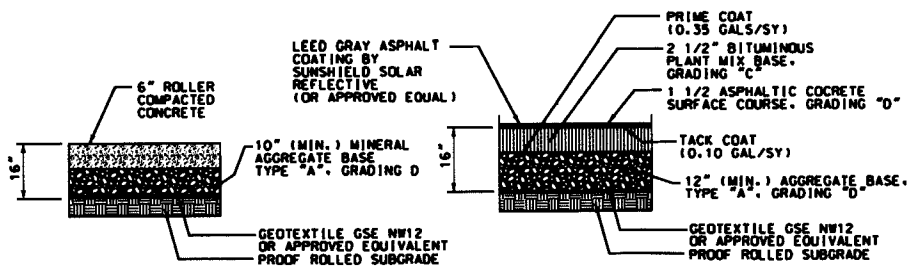
REFERENCE DRAWINGS:

C940103-F-0003	ACCESS PLAN AND DRAWING INDEX
C940103-F-0004	EXISTING SURVEY AND DEMO SITE PLAN
C940103-F-0005	GRADING AND DRAINAGE SITE PLAN



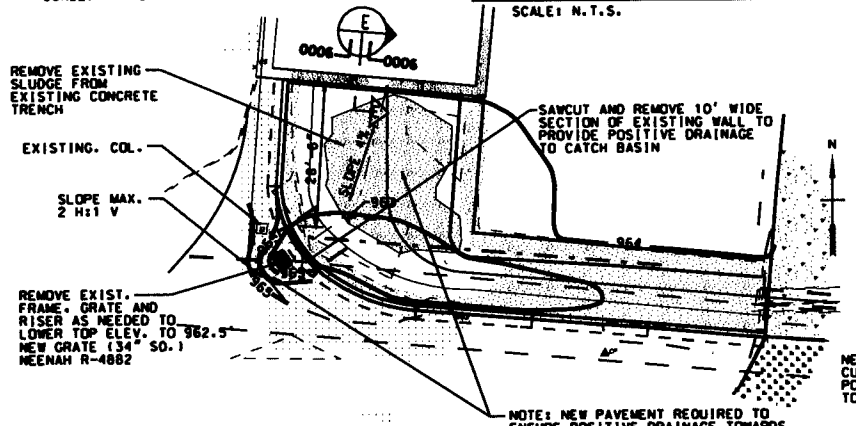
VIEW OF SOUTHWEST CORNER OF COAL PILE LOOKING NORTHEAST
SCALE: N.T.S.

VIEW OF SOUTHEAST CORNER OF COAL PILE LOOKING NORTHWEST
SCALE: N.T.S.

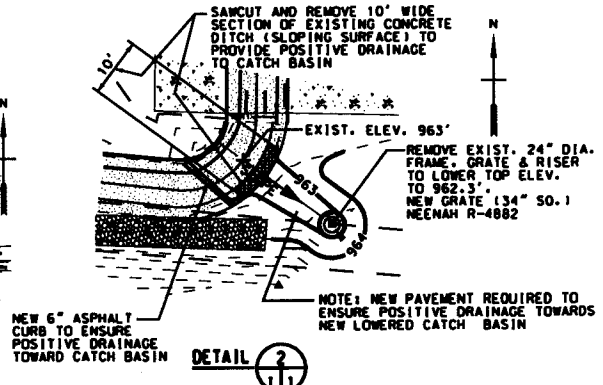


OPTIONAL ROLLER COMPACTED CONCRETE
SCALE: NONE

TYPICAL PAVEMENT CROSS SECTION
SCALE: NONE
C940103-F-0005 C940103-F-0006



DETAIL 1
C940103-F-0005 C940103-F-0006
ENLARGERD PLAN AT SOUTHEAST CORNER OF COAL PILE SEE GRADING DRAWING C940103-F-0005
SCALE: N.T.S.



DETAIL 2
C940103-F-0005 C940103-F-0006
DETAIL 2 - ENLARGERD PLAN AT SOUTHEAST CORNER OF COAL PILE SEE GRADING DRAWING C940103-F-0005
SCALE: N.T.S.

Appendix B
Figure 4: Details

GSE

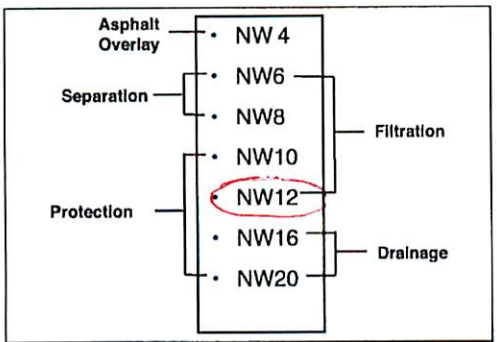
The Pioneer Of Geosynthetics

SINCE 1972

Geotextiles

GSE NONWOVEN NEEDLEPUNCHED GEOTEXTILES

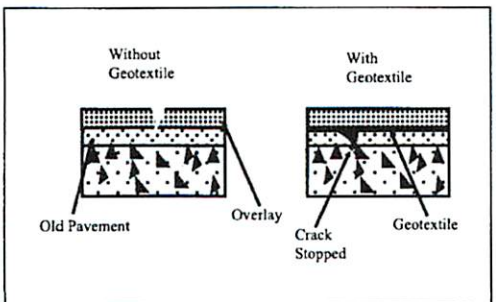
GSE nonwoven needlepunched geotextiles are manufactured at our state-of-the-art needlepunching plant in Kingstree, South Carolina. GSE manufactures 4 to 32 oz/yd^2 geotextiles designated as NW4, NW6, NW8, NW10, NW12, NW16, NW20, NW24, NW28, and NW32. The most common function and usage of these products is shown below. However, the actual selection of the product depends on the specific needs of a project. For example, while NW16 is commonly used for geomembrane protection, it can also be used in filtration and separation because of specific design needs.



Most common usage of GSE nonwoven needlepunched geotextiles

ASPHALT OVERLAY

It is common for asphalt pavements to crack prematurely because of design flaws, material limitations or environmental reasons. A fresh layer of asphalt is the most common remedy for this problem. However, reflective cracking – the propagation of cracks from old cracked surface into the new surface – limits the performance of the fresh asphalt overlay. To prevent reflective cracking, a nonwoven needlepunched geotextile must be placed above the cracked surface before placing the new layer.



Use of GSE nonwoven geotextiles to prevent reflective cracking

The geotextile works as a sealant and stress absorbing layer. There are comprehensive design and construction methods available for this purpose. GSE NW4 is ideal for preventing reflective cracking. The drawing above shows the use of geotextiles to prevent reflective cracking.

SEPARATION

Intermixing of two dissimilar materials always leads to the deterioration of their engineering performance. For example, contamination of aggregate by fine particles always leads to a decrease in the permeability of the aggregate. The separation function refers to the use of geotextiles to maintain physical separation between two adjacent materials.

GSE geotextiles are ideal for this purpose because of their strength, durability, flexibility and a highly porous structure.

FILTRATION

When used as filters, GSE nonwoven needlepunched geotextiles allow the passage of liquid while preventing the loss of soil particles. GSE offers a range of products with opening size to meet filtration needs for different types of soils. For relatively coarse soils, lower mass products – NW4, NW6 and NW8 are recommended. For fine soil particles, it is better to use heavier mass geotextiles such as NW10, NW12 or NW16. Depending on the needs of a specific project, GSE has a geotextile available which will perform the intended design function.

GSE nonwoven geotextile

PROTECTION

Geomembrane liners are very sensitive to damage and puncture during construction as well as over the life of a project. Therefore, geomembranes must be protected both from top and bottom. GSE nonwoven needlepunched geotextiles are ideal for this purpose because of their cushioning ability.

Depending on soil size and overburden loads, one

-Continued-

Application Sheet

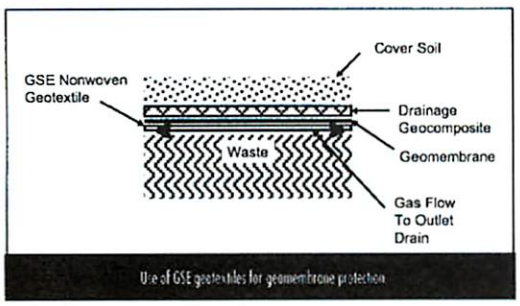
of the many geotextiles offered by GSE can be selected to ensure that geomembrane performance is not compromised.

Use of GSE geotextiles for geomembrane protection

DRAINAGE

Liners are used typically to prevent infiltration of liquids into environmentally sensitive areas. In certain cases, trapped gases and vapors must be vented to prevent uplifting of the liner. GSE nonwoven needlepunched geotextiles are ideal for gas and vapor drainage from under the liners.

The high porosity of GSE geotextiles facilitates drainage while providing added benefit of cushion for the liners. A general configuration of this application is shown in the photo below.



Use of GSE geotextiles for geomembrane protection

COMPLETE INSTALLATION SERVICES

No other company offers more experience installing geosynthetic products than GSE. GSE Installation Services is your one-stop source that offers the experience, training, expertise and complete range of geosynthetic products, fabrication and technical support on any project.

GSE installation crew

THE GEOMEMBRANE PROTECTION DESIGN MANUAL

GSE offers a comprehensive design manual that provides a simple step by step design method to protecting geomembranes from punctures during construction and over the design life of a project. For a free copy, please contact GSE.

ADDITIONAL INFORMATION

If you have an upcoming project please give us a call. We will provide you with recommendations for material and installation.

GSE

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GSE Nonwoven Geotextile

GSE Nonwoven Geotextile is a family of staple fiber needlepunched geotextiles. The geotextile is manufactured using an advanced manufacturing and quality system, to produce the most uniform and consistent nonwoven needlepunched geotextile currently available in the industry. GSE combines a fiber selection and approval system with in-line quality control and a state-of-the-art laboratory to ensure that every roll shipped meets customer specifications and for various applications.

Product Specifications *These product specifications meet or exceed GRI GT12, GRI GT13 and AASHTO M288.*

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE VALUE					
			NW4	NW6	NW8	NW10	NW12	NW16
AASHTO M288 Class			3	2	1	>1	>>1	>>>1
Mass per Unit Area, oz/yd² (g/m²)	ASTM D 5261	90,000 ft²	4 (135)	6 (200)	8 (270)	10 (335)	12 (405)	16 (540)
Grab Tensile Strength, lb (N)	ASTM D 4632	90,000 ft²	120 (530)	160 (710)	220 (975)	260 (1,155)	320 (1,420)	390 (1,735)
Grab Elongation, %	ASTM D 4632	90,000 ft²	50	50	50	50	50	50
Puncture Strength, lb (N)	ASTM D 4833	90,000 ft²	60 (265)	90 (395)	120 (525)	165 (725)	190 (835)	240 (1,055)
Trapezoidal Tear Strength, lb (N)	ASTM D 4533	90,000 ft²	50 (220)	65 (290)	90 (395)	100 (445)	125 (555)	150 (665)
Apparent Opening Size, Sieve No. (mm)	ASTM D 4751	540,000 ft²	70 (0.212)	70 (0.212)	80 (0.180)	100 (0.150)	100 (0.150)	100 (0.150)
Permittivity, sec⁻¹	ASTM D 4491	540,000 ft²	1.80	1.50	1.30	1.00	0.80	0.60
Water Flow Rate, gpm/ft² (l/min/m²)	ASTM D 4491	540,000 ft²	135 (5,495)	110 (4,480)	95 (3,865)	75 (3,050)	60 (2,440)	45 (1,830)
UV Resistance (% retained after 500 hours)	ASTM D 4355	per formulation	70	70	70	70	70	70
NOMINAL ROLL DIMENSIONS								
Roll Length[1], ft (m)			850 (259)	850 (259)	600 (182)	500 (152)	400 (122)	300 (91)
Roll Width[1], ft (m)			15 (4.5)	15 (4.5)	15 (4.5)	15 (4.5)	15 (4.5)	15 (4.5)
Roll Area, ft² (m²)			12,750 (1,185)	12,750 (1,185)	9,000 (836)	7,500 (698)	6,000 (557)	4,500 (418)

NOTES:

- The property values listed are in weaker principal direction. All values listed are Minimum Average Values except apparent opening size in mm and UV resistance. Apparent opening size (mm) is a Maximum Value. UV is a typical value.
- [1]Roll lengths and widths have a tolerance of ±1%.

GSE NW10/1/10

Appendix C

Calculations:

1. CCOALYD-F-001, CSAS Project Stormwater Calculations

2. CCOALYD-F-002, CSAS Project Stormwater Collection/Retention Area Calculations

Design Analysis and Calculation
Title Page

Calculation No:	CCOALYD-F-001				
Calculation Title:	Coal Storage Area Stabilization Project Stormwater Calculations				
Calculation Status:	**Preliminary** ☐	**Contains Unverified Assumptions and/or Partial Verifications** ☐	**Verified** ☒	**Superseded** ☐	**Voided/Cancelled** ☐
Preparer's Org:	Engineering		**SSC Grade:**	CMX	
Project/Task Name:	Coal Storage Area Stabilization Project				

Abstract (e.g., What, Why, How, Results):

Determine the peak flow impact for a 25 year storm event of paving over the existing coal pile on the existing storm flow at the headwaters of East Fork Poplar Creek. The calculations indicate that the peak flow impact from capping the coal yard is minimal to the watershed and no further peak flow controls are appropriate for this project.

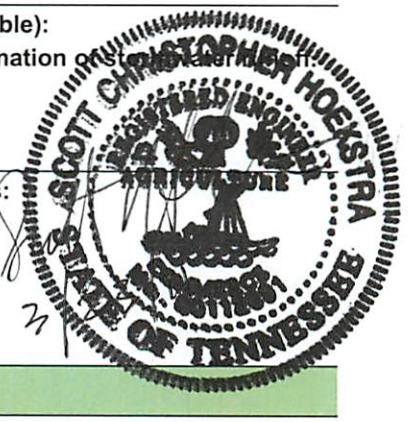
List assumptions requiring subsequent verification or scope of partial verification (as applicable):

Land cover type and hydrologolic conditions based on field observation and used in the estimation of [illegible].

Mannings N for surface condition based on field observation and used in computation of Tc.

Computer Processor Type, Operating System Version, and Software packages used/versions:

Intel Processor, Windows XP, Bentley PondPack 10.0, FlowMaster 8.11, MicroStation V8 XM



Verification Method (See Y17-69-325)

- ☒ Design Technical Review
- ☐ Comparison with Similar Design
- ☐ Alternative Calculation (Doc. No.)_____
- ☐ Qualification Testing (Doc. No.) _____
- ☐ Other (Specify) _____

Approvals

Rev. No.	Preparer (Print/Sign)	Date	Verifier/Checker (Print/Sign)	Date	Approver (Print/Sign)	Date
0	S.C. Hoekstra	12/12/10	W.N. Robinson	12/14/10	M.D. Ritter	12/14/10

Revisions

Rev. No.	Revision Description
0	Initial

This document has been reviewed by a Y-12 ADC/ UCNI RO and has been determined to be UNCLASSIFIED and contains no UCNI. This review does not constitute clearance for Public Release.

Name: [illegible] Date: 3/21/11

TABLE OF CONTENTS

Section 1: Objective/Purpose Statement

Construction of the Coal Storage Area Stabilization (CSAS) Project will utilize an asphalt surface cover over the location of the former coal pile to divert the storm water flow from flowing into the sanitary sewer. The flow will be diverted to the Y-12 Storm Drainage System using the proposed asphalt cap and existing concrete swales (with some modifications). In order to adequately design the CSAS storm water drainage system, existing drainage patterns and flow rates need to be known.

In accordance with the Y-12 Design Criteria, the peak flow rate of storm water runoff from the project site after development cannot exceed the peak flow rate of storm water runoff from the project site prior to development. However since the coal pile's existing peak flow is zero due to the fact that runoff from the coal pile is currently collected, stored, treated, and released to the sanitary sewer system and the close proximity to the watershed discharge point, the calculation will determine that the 25-year, 24-hour storm event's peak flow of the coal pile will have minimal impact on the peak flow at the watershed discharge point.

Section 2: References

1. "Urban Hydrology for Small Watersheds", Technical Release No. 55, U.S. Department of Agriculture, Soil Conservation Service, June 1986.
2. Open Channel Hydraulics, V.T. Chow, McGraw-Hill Book Company, 1959.
3. "Web Soil Surveys for Anderson County", Natural Resource Conservation Service.
4. "Fluid Mechanics with Engineering Applications", E.J. Finnemore & J.B. Franzini, The McGraw-Hill Companies, 2002.

The criteria used for the CSAS project is found in the following documents:

1. Y/EF - 538, "Master Design", DIVISION 5 - CIVIL/SITE DESIGN, Section 5.20.2, December 2007.
2. Functional & Operating Requirements for the Coal Pile Stabilization Project & the Coal Pile Parking Project, Document#: FR 940103-F-0001 000 00

Section 3: Design Input/Assumptions

Design Input

1. Existing

   Storm water runoff from the CSAS site includes all drainage to catch basin E4006 both surface flows and pipe flow. The Coal Pile does not currently drain into the storm drain. The runoff is collected, stored, and processed as sanitary sewerage. The soil types and curve numbers are shown on watershed map. See Attachments A and C.

2. Proposed

   The coal pile will be capped with a nearly impervious surface and storm water will be redirected to the storm drain system at catch basin E4006. Since the predevoloped flow of the coal pile is zero, the hydrograph from the coal pile cap will be added to the existing watershed hydrograph to determine the change in peak runoff. See Attachment C.

Assumptions typical to hydrologic calculations are identified in the body of the calculations.

Section 4: Analytical Methods and Computations

The storm water objective of the CSAS project is to provide a design that minimizes the impact to the peak discharge of the existing watershed. The analysis will be used to determine the pre-development flow rates within the existing storm drain system at the points where post-developed flows from the CSAS project will be introduced.

Peak flow rates are determined from runoff hydrographs that are generated using methodologies outlined in the Soil Conservation Service (SCS) Technical Release No. 55 (TR-55), and the computer program PondPack. TR-55 provides procedures to calculate storm water runoff volume, peak flow rates, and storage volumes required for detention basins. These procedures are applicable for small urban watersheds (up to 2000 acres), and provide analysis for combinations of land uses, using single-event rainfall data. Variables used in development of the inflow hydrographs are taken from TR-55. Variable definitions and reference location within TR-55 are defined below.

1) Runoff Curve Number

A weighted curve number is derived for watershed areas based on the hydrologic soil group, cover type, treatment, hydrologic condition, and antecedent runoff condition. The hydrologic soil groups are based on soil surveys of the area (Attachment A, Reference 3). The cover types and treatment (i.e. existing-wooded, grass cover, or paved) are based on the existing conditions within each watershed. Curve numbers are assigned based on the Curve Number Tables 2-2a, 2-2b, and 2-2c (Reference 1). The weighted curve number is derived as follows.

$$CN = \frac{\sum (CN_i \times Area_i)}{TotalArea}$$

Where:

CN = Weighted curve number for drainage area,
CN_i = Weighted curve number for drainage subarea (i),
$Area_i$ = Area of subarea (i),
Total Area = Total Drainage Area

2) Time of Concentration

Time of concentration is comprised of travel times from sheet flow, shallow concentrated flow, and channel flow components. Each component is described as follows:

Sheet Flow (Equation 3-3, Reference 1)

$$T_t = \frac{0.007(n \times L)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

Where:

T_t = Travel time (hr)
n = Manning's roughness coefficient, use following values for n:
n = 0.011 for smooth surfaces
n = 0.80 for woods with dense underbrush
P_2 = 2-year, 24-hour rainfall (3.3 inches for the Oak Ridge area, in accordance with design criteria)
L = Flow length (ft)
s = Land slope (ft/ft)

Shallow Concentrated Flow (Equation 3-1, Reference 1)

$$T_t = \frac{L}{3600V}$$

Where:

T_t = Travel time (hr)
L = Flow length (ft)
V = Average velocity (ft/s)
3600 = Conversion factor from seconds to hours

Channel Flow (Equation 3-1, Reference 1)

$$T_t = \frac{L}{3600V}$$

Where:

T_t = Travel time (hr)
L = Flow length (ft)
3600 = Conversion factor from seconds to hours
V = Average channel velocity (ft/s), taken from the Manning equation (Equation 3-4, Reference 1):

$$V = \frac{1.49 r^{2/3} s^{1/2}}{n}$$

1.49 = Conversion factor for English units
r = Hydraulic radius (ft), equivalent to a/p
a = Cross sectional area of flow (ft^2)
p = Wetted perimeter of channel (ft)
s = Land slope (ft/ft)
n = Manning's roughness coefficient, values determined from Table 5-6, Reference 2

Pipe flow was calculated using maximum velocity. Each pipe was evaluated at a flow depth of 81.3% of the Diameter (Page 427 Reference 4). The velocity and length are used in the channel flow equation to determine the time of concentration. The channel flow velocities and pipe flow velocities were both determined using Manning's Equation in the computer program FlowMaster. See Attachment B.

Section 5: Results

The peak runoff rates are listed in Table 1 below (See Attachment D for PondPack Report):

TABLE 1

LOCATION	25-Yr, 24-hr Q_p (cfs)	Q_p (hours)
Coal Pile	23.55	11.92
Catch Basin E4006 (Existing)	582.10	12.31
Catch Basin E4006 (Proposed)	584.77	12.31

Section 6: Conclusion

The impact to the existing watershed from the coal pile is an additional 2.67 cfs or a 0.46% flow increase. The 0.46% percent increase will have minimal impact on the watershed and no storm water detention is required. The coal pile cap is located in close proximity to catch basin E4006. The time of concentration for the existing watershed is 36.6 minutes longer than the coal pile cap. That allows the storm water from the coal pile cap to discharge its peak flow prior to the existing watershed's peak flow.

Attachment A: Soil Report

United States Department of Agriculture

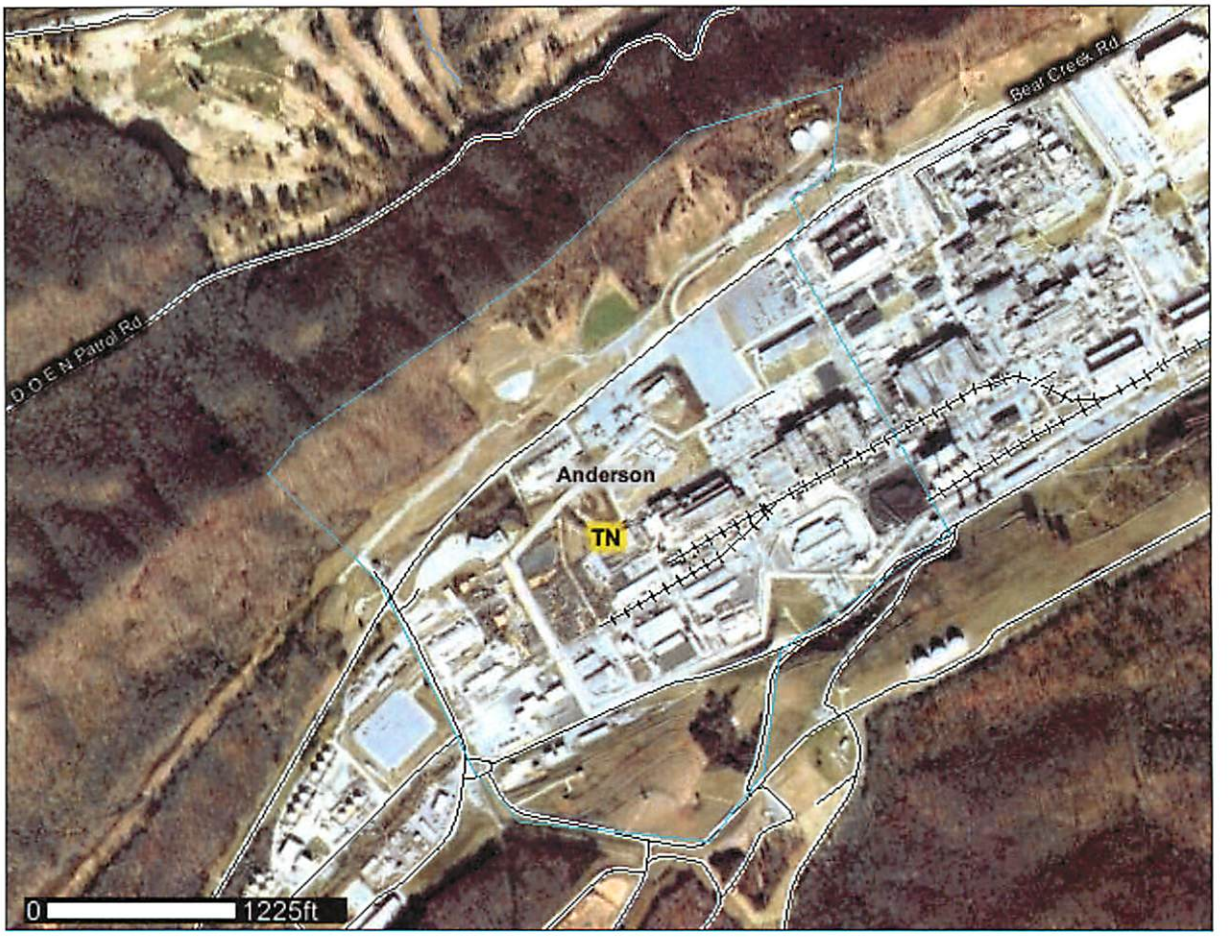
NRCS

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 Anderson County, Tennessee

Coal Pile Cap Project



November 2, 2010

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://soils.usda.gov/sqi/) 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://soils.usda.gov/contact/state_offices/).

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 Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the 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.

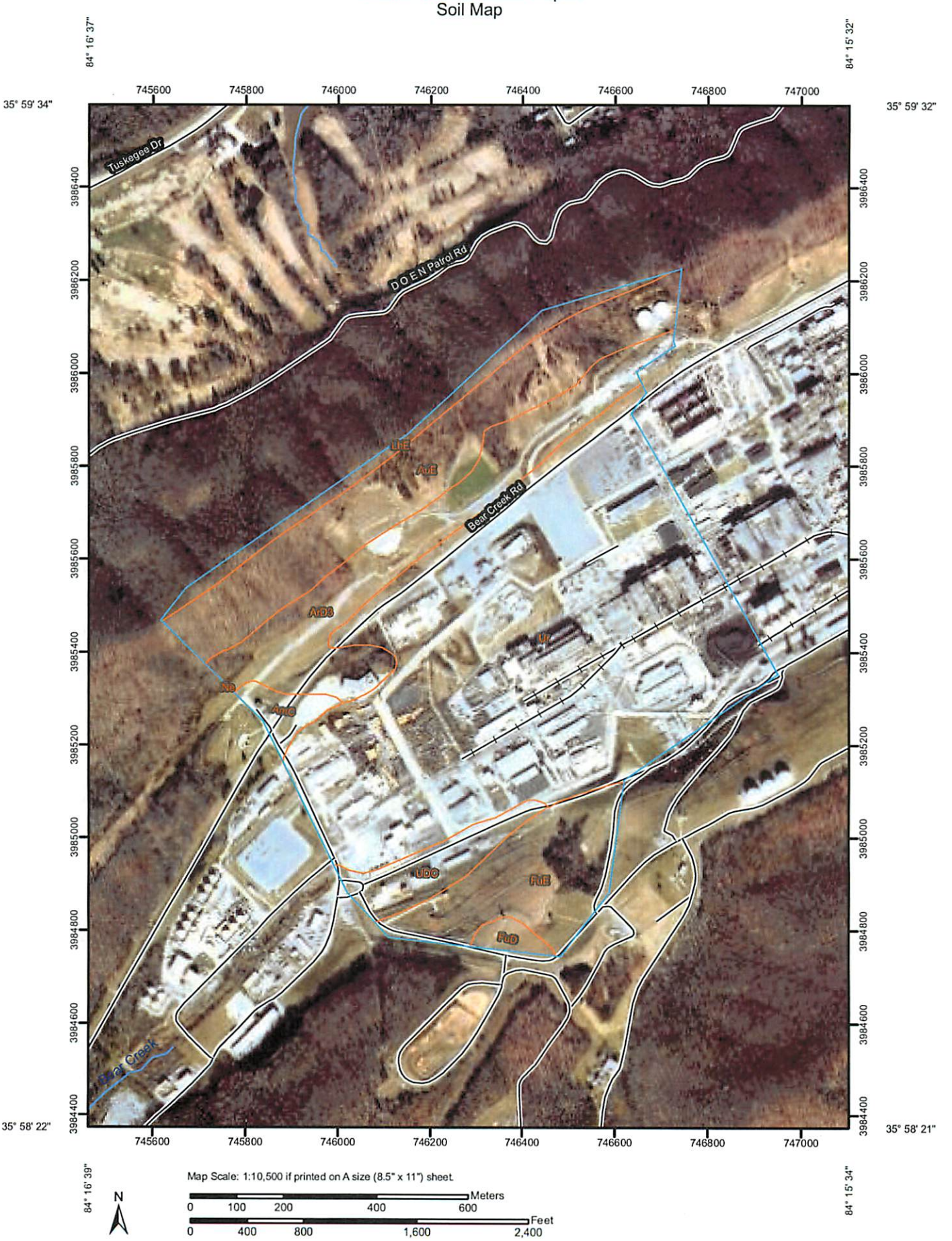
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.

Custom Soil Resource Report
Soil Map



MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:10,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

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

Soil Survey Area: Anderson County, Tennessee
Survey Area Data: Version 6, Oct 29, 2008

Date(s) aerial images were photographed: 12/8/2006

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

Anderson County, Tennessee (TN001)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AmC	Armuchee silt loam, 5 to 12 percent slopes	3.9	1.5%
ArD3	Armuchee shaly silty clay loam, 12 to 20 percent slopes, severely eroded	33.5	12.9%
AuE	Armuchee-Muskingum complex, 25 to 60 percent slopes	39.3	15.1%
FuD	Fullerton cherty silt loam, 12 to 25 percent slopes	2.2	0.9%
FuE	Fullerton cherty silt loam, 25 to 45 percent slopes	22.9	8.8%
LhE	Lehew loam, 25 to 60 percent slopes	7.7	3.0%
Ne	Newark silt loam	0.0	0.0%
UDC	Udorthents, rolling	9.3	3.6%
Ur	Urban land	141.2	54.3%
Totals for Area of Interest		**259.9**	**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.

Anderson County, Tennessee

AmC—Armuchee silt loam, 5 to 12 percent slopes

Map Unit Setting

Elevation: 710 to 1,400 feet
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition

Armuchee and similar soils: 100 percent

Description of Armuchee

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Parent material: Clayey residuum weathered from acid shale

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: 20 to 36 inches to bedrock (paralithic)
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 3.0 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 6 inches: Silt loam
6 to 18 inches: Channery silty clay
18 to 24 inches: Very channery silty clay
24 to 40 inches: Weathered bedrock

ArD3—Armuchee shaly silty clay loam, 12 to 20 percent slopes, severely eroded

Map Unit Setting

Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition

Armuchee and similar soils: 100 percent

Description of Armuchee

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Parent material: Clayey residuum weathered from acid shale

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 20 to 36 inches to bedrock (paralithic)
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 6 inches: Channery silty clay loam
6 to 14 inches: Channery silty clay
14 to 20 inches: Very channery silty clay
20 to 35 inches: Weathered bedrock

AuE—Armuchee-Muskingum complex, 25 to 60 percent slopes

Map Unit Setting

Elevation: 1,200 to 2,500 feet
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition

Armuchee and similar soils: 50 percent
Muskingum and similar soils: 45 percent
Minor components: 5 percent

Description of Armuchee

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Parent material: Clayey residuum weathered from acid shale

Properties and qualities

Slope: 25 to 60 percent
Depth to restrictive feature: 20 to 36 inches to bedrock (paralithic)

Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 3.0 inches)

Interpretive groups
Land capability (nonirrigated): 7e

Typical profile
0 to 6 inches: Silt loam
6 to 18 inches: Channery silty clay
18 to 24 inches: Very channery silty clay
24 to 40 inches: Weathered bedrock

Description of Muskingum

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Parent material: Loamy residuum weathered from sandstone and shale

Properties and qualities
Slope: 25 to 60 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.1 inches)

Interpretive groups
Land capability (nonirrigated): 7e

Typical profile
0 to 5 inches: Silt loam
5 to 26 inches: Channery silt loam
26 to 36 inches: Weathered bedrock

Minor Components

Minor components
Percent of map unit: 5 percent

FuD—Fullerton cherty silt loam, 12 to 25 percent slopes

Map Unit Setting

Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition

Fullerton and similar soils: 100 percent

Description of Fullerton

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Parent material: Clayey residuum or creep deposits over clayey residuum weathered from cherty limestone

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 12 inches: Gravelly silt loam
12 to 27 inches: Gravelly silty clay loam
27 to 64 inches: Gravelly clay

FuE—Fullerton cherty silt loam, 25 to 45 percent slopes

Map Unit Setting

Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition
Fullerton and similar soils: 100 percent

Description of Fullerton

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Parent material: Clayey residuum or creep deposits over clayey residuum weathered from cherty limestone

Properties and qualities
Slope: 25 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups
Land capability (nonirrigated): 7e

Typical profile
0 to 12 inches: Gravelly silt loam
12 to 27 inches: Gravelly silty clay loam
27 to 64 inches: Gravelly clay

LhE—Lehew loam, 25 to 60 percent slopes

Map Unit Setting
Elevation: 800 to 3,000 feet
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition
Lehew and similar soils: 100 percent

Description of Lehew

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountainflank
Parent material: Channery residuum weathered from sandstone and shale

Properties and qualities
Slope: 25 to 60 percent

Depth to restrictive feature: 20 to 40 inches to bedrock (lithic)
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups
Land capability (nonirrigated): 7e

Typical profile
0 to 7 inches: Loam
7 to 36 inches: Channery fine sandy loam
36 to 40 inches: Weathered bedrock

Ne—Newark silt loam

Map Unit Setting
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition
Newark and similar soils: 100 percent

Description of Newark

Setting
Landform: Flood plains
Landform position (three-dimensional): Talf
Parent material: Loamy alluvium derived from interbedded sedimentary rock

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: High (about 11.8 inches)

Interpretive groups
Land capability (nonirrigated): 2w

Typical profile
0 to 8 inches: Silt loam
8 to 30 inches: Silt loam
30 to 61 inches: Silt loam

UDC—Udorthents, rolling

Map Unit Setting
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition
Udorthents and similar soils: 100 percent

Description of Udorthents

Properties and qualities
Slope: 2 to 12 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Ur—Urban land

Map Unit Setting
Mean annual precipitation: 46 to 63 inches
Mean annual air temperature: 47 to 69 degrees F
Frost-free period: 195 to 209 days

Map Unit Composition
Urban land: 100 percent

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Attachment B: FlowMaster Calculations

Circular Pipe (Pipe flow.fm8) Report

Label	Solve For	Friction Method	Roughness Coefficient
Pipe A1	Discharge	Manning Formula	0.013
Pipe A2	Discharge	Manning Formula	0.013
Pipe B	Discharge	Manning Formula	0.013
Pipe C	Discharge	Manning Formula	0.013
Pipe D	Discharge	Manning Formula	0.013
Pipe E	Discharge	Manning Formula	0.013
Pipe F	Discharge	Manning Formula	0.013
Pipe G	Discharge	Manning Formula	0.013
Pipe H	Discharge	Manning Formula	0.013
Pipe I	Discharge	Manning Formula	0.013
Pipe J	Discharge	Manning Formula	0.013
Pipe K	Discharge	Manning Formula	0.013
Pipe L	Discharge	Manning Formula	0.013

Channel Slope (ft/ft)	Normal Depth (in)	Diameter (in)	Discharge (ft^3/s)
0.11310	12.20	15.00	21.56
0.03840	29.27	36.00	129.73
0.05420	48.78	60.00	601.83
0.00051	39.02	48.00	32.10
0.01130	48.78	60.00	274.80
0.01020	58.54	72.00	424.54
0.03350	58.54	72.00	769.39
0.02312	58.54	72.00	639.17
0.00920	58.54	72.00	403.24
0.01188	73.17	90.00	830.72
0.00773	73.17	90.00	670.10
0.02670	73.17	90.00	1245.39
0.00867	73.17	90.00	709.67

Circular Pipe (Pipe flow.fm8) Report

Channel Slope (ft/ft)	Normal Depth (in)	Diameter (in)	Discharge (ft^3/s)

Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (in)	Top Width (ft)
1.07	2.81	4.56	0.97
6.15	6.74	10.96	2.34
17.10	11.24	18.26	3.90
10.94	8.99	14.61	3.12
17.10	11.24	18.26	3.90
24.62	13.48	21.91	4.68
24.62	13.48	21.91	4.68
24.62	13.48	21.91	4.68
24.62	13.48	21.91	4.68
38.47	16.85	27.39	5.85
38.47	16.85	27.39	5.85
38.47	16.85	27.39	5.85
38.47	16.85	27.39	5.85

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
1.25	81.3	0.10673	20.18
2.96	81.3	0.03454	21.08
4.98	81.3	0.05045	35.20
1.68	81.3	0.00366	2.93
4.56	81.3	0.00971	16.07
5.44	81.3	0.00880	17.24
5.94	81.3	0.03035	31.25
5.87	81.3	0.02033	25.96
5.35	81.3	0.00805	16.38

Circular Pipe (Pipe flow.fm8) Report

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
7.01	81.3	0.01012	21.60
6.57	81.3	0.00689	17.42
7.39	81.3	0.02390	32.38
6.70	81.3	0.00757	18.45

Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (ft^3/s)
6.33	7.35	3.40	23.37
6.90	9.34	2.29	140.59
19.26	23.32	2.96	652.20
0.13	3.39	0.28	34.79
4.02	8.08	1.35	297.80
4.62	9.50	1.33	460.08
15.18	20.06	2.40	833.79
10.48	15.35	2.00	692.67
4.17	9.05	1.26	436.99
7.25	13.35	1.48	900.26
4.72	10.81	1.20	726.19
16.29	22.39	2.23	1349.63
5.29	11.39	1.27	769.07

Discharge Full (ft^3/s)	Slope Full (ft/ft)	Flow Type	Notes
21.72	0.11144	SuperCritical	
130.69	0.03784	SuperCritical	
606.30	0.05340	SuperCritical	
32.34	0.00050	SubCritical	
276.84	0.01113	SuperCritical	
427.70	0.01005	SuperCritical	

Circular Pipe (Pipe flow.fm8) Report

Discharge Full (ft^3/s)	Slope Full (ft/ft)	Flow Type	Notes
775.11	0.03301	SuperCritical	
643.92	0.02278	SuperCritical	
406.24	0.00907	SuperCritical	
836.90	0.01171	SuperCritical	
675.08	0.00762	SuperCritical	
1254.64	0.02631	SuperCritical	
714.95	0.00854	SuperCritical	

Messages

Trapezoidal Channel (Pipe flow.fm8) Report

Label	Solve For	Friction Method	Roughness Coefficient
Channel - 1	Discharge	Manning Formula	0.069
Channel - 2	Discharge	Manning Formula	0.069

Channel Slope (ft/ft)	Normal Depth (in)	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))
0.01320	12.00	0.33	0.33
0.05375	12.00	0.33	0.33

Bottom Width (ft)	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)
2.00	3.95	2.33	4.11
2.00	7.97	2.33	4.11

Hydraulic Radius (in)	Top Width (ft)	Critical Depth (ft)	Critical Slope (ft/ft)
6.81	2.66	0.48	0.12864
6.81	2.66	0.76	0.12796

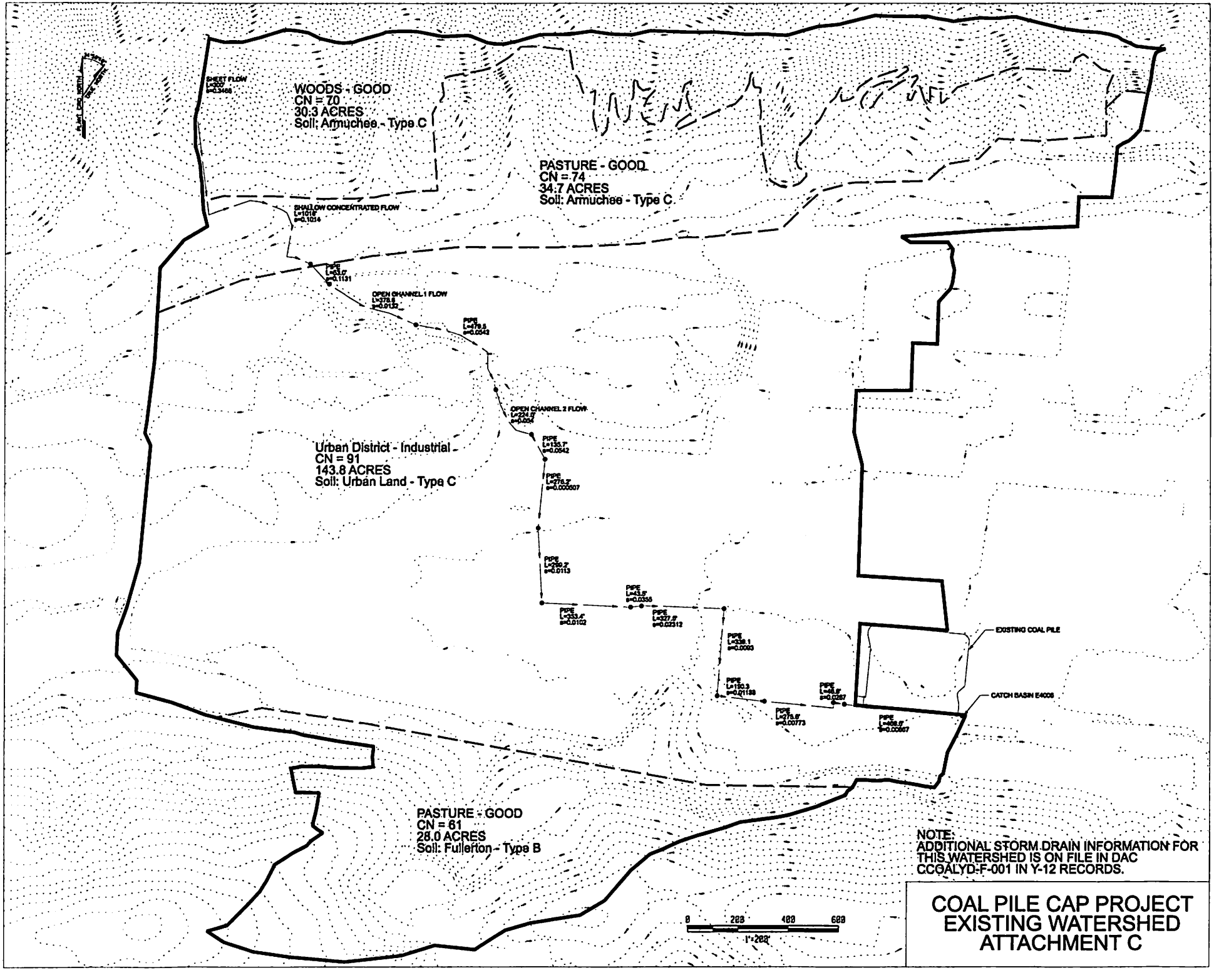
Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number
1.70	0.04	1.04	0.32
3.42	0.18	1.18	0.64

Flow Type	Notes	Messages

Trapezoidal Channel (Pipe flow.fm8) Report

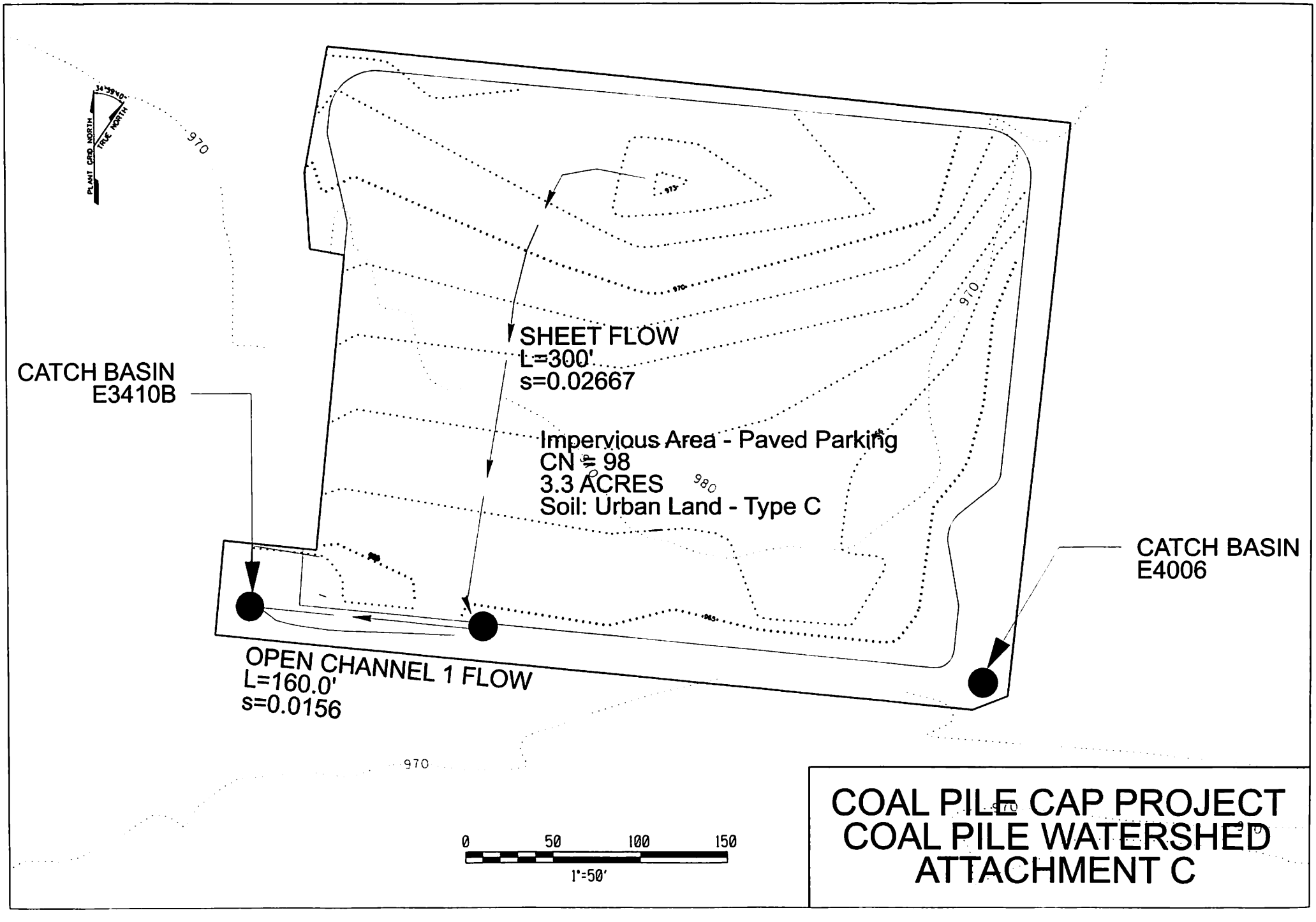
Flow Type	Notes	Messages
Subcritical		
Subcritical		

Attachment C: Watershed Maps



NOTE:
ADDITIONAL STORM DRAIN INFORMATION FOR THIS WATERSHED IS ON FILE IN DAC CCOALYD-F-001 IN Y-12 RECORDS.

COAL PILE CAP PROJECT
EXISTING WATERSHED
ATTACHMENT C



COAL PILE CAP PROJECT
COAL PILE WATERSHED
ATTACHMENT C

Attachment D: PondPack Report

JOB TITLE

Project Date: 11/4/2010
Project Engineer: Scott Hoekstra
Project Title: Coal Pile Cap
Project Comments:

Table of Contents

Table of Contents (continued)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 25 yr

Return Event	Total Depth in	Rainfall Type	RNF ID
25 yr	5.5000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*CB E4006	JCT	25	71.103		12.3100	584.77		
COAL PILE	AREA	25	1.447		11.9200	23.55		
EAST FORK POPLAR	AREA	25	69.656		12.3100	582.10		

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = 25 yr

Storm Tag Name = 25 yr

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	CB E4006	JCT	71.103		12.3100	584.77	
	COAL PILE	AREA	1.447		11.9200	23.55	
	EAST FORK POPLAR	AREA	69.656		12.3100	582.10	

NETWORK SUMMARY -- LINKS
(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = 25 yr

Storm Tag Name = 25 yr

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points
ADDLINK 10	ADD	UN	69.656		12.3100	582.10	EAST FORK POPLAR
		DL	69.656		12.3100	582.10	
		DN	71.103		12.3100	584.77	CB E4006
ADDLINK 20	ADD	UN	1.447		11.9200	23.55	COAL PILE
		DL	1.447		11.9200	23.55	
		DN	71.103		12.3100	584.77	CB E4006

NETWORK RUNOFF NODE SEQUENCE

Runoff Data		Apply to Node		Receiving Link	
SCS UH	COAL PILE	Subarea	COAL PILE	Add Hyd	COAL PILE
SCS UH	EAST FORK POPLAR	Subarea	EAST FORK POPLAR	Add Hyd	EAST FORK POPLAR

NETWORK ROUTING SEQUENCE

Link Operation	UPstream Node	DNstream Node	
Add Hyd ADDLINK 20	Subarea COAL PILE	Jct	CB E4006
Add Hyd ADDLINK 10	Subarea EAST FORK POPLAR	Jct	CB E4006

Title... Project Date: 11/4/2010
Project Engineer: Scott Hoekstra
Project Title: Coal Pile Cap
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = 25 yr

Storm Tag Name = 25 yr

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = 25 yr

Storm Tag Name = 25 yr

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

CUMULATIVE RAINFALL DEPTHS (in)
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.0000	.0056	.0111	.0168	.0224
.5000	.0282	.0340	.0399	.0458	.0518
1.0000	.0578	.0639	.0700	.0762	.0824
1.5000	.0887	.0950	.1015	.1079	.1145
2.0000	.1210	.1277	.1343	.1411	.1478
2.5000	.1547	.1616	.1686	.1756	.1827
3.0000	.1898	.1970	.2042	.2115	.2188
3.5000	.2262	.2336	.2412	.2487	.2564
4.0000	.2640	.2718	.2796	.2876	.2957
4.5000	.3039	.3122	.3206	.3291	.3378
5.0000	.3465	.3554	.3643	.3734	.3826
5.5000	.3919	.4013	.4108	.4204	.4302
6.0000	.4400	.4500	.4600	.4702	.4805
6.5000	.4909	.5014	.5120	.5227	.5336
7.0000	.5445	.5556	.5667	.5780	.5894
7.5000	.6009	.6125	.6242	.6360	.6480
8.0000	.6600	.6724	.6853	.6988	.7128
8.5000	.7274	.7425	.7582	.7744	.7912
9.0000	.8085	.8261	.8437	.8613	.8789
9.5000	.8965	.9145	.9335	.9533	.9739
10.0000	.9955	1.0182	1.0421	1.0674	1.0941
10.5000	1.1220	1.1517	1.1836	1.2177	1.2540
11.0000	1.2925	1.3347	1.3823	1.4351	1.4931
11.5000	1.5565	1.6876	1.9490	2.3693	3.1232
12.0000	3.6465	3.7508	3.8425	3.9217	3.9884
12.5000	4.0425	4.0889	4.1325	4.1732	4.2110
13.0000	4.2460	4.2788	4.3100	4.3397	4.3679
13.5000	4.3945	4.4198	4.4440	4.4671	4.4891
14.0000	4.5100	4.5302	4.5499	4.5693	4.5883
14.5000	4.6070	4.6252	4.6430	4.6605	4.6776
15.0000	4.6943	4.7106	4.7265	4.7420	4.7572
15.5000	4.7720	4.7863	4.8003	4.8139	4.8272
16.0000	4.8400	4.8526	4.8650	4.8773	4.8895
16.5000	4.9015	4.9134	4.9252	4.9368	4.9483
17.0000	4.9596	4.9708	4.9819	4.9928	5.0036
17.5000	5.0143	5.0248	5.0352	5.0454	5.0555
18.0000	5.0655	5.0753	5.0850	5.0946	5.1040
18.5000	5.1133	5.1224	5.1314	5.1403	5.1490
19.0000	5.1576	5.1661	5.1744	5.1826	5.1906
19.5000	5.1985	5.2063	5.2139	5.2214	5.2288
20.0000	5.2360	5.2432	5.2502	5.2573	5.2644
20.5000	5.2714	5.2784	5.2854	5.2923	5.2993
21.0000	5.3061	5.3130	5.3198	5.3266	5.3334
21.5000	5.3402	5.3469	5.3536	5.3602	5.3669

CUMULATIVE RAINFALL DEPTHS (in)
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	5.3735	5.3801	5.3866	5.3932	5.3997
22.5000	5.4062	5.4126	5.4190	5.4254	5.4318
23.0000	5.4381	5.4445	5.4507	5.4570	5.4632
23.5000	5.4694	5.4756	5.4817	5.4878	5.4940
24.0000	5.5000				

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110	
Hydraulic Length	300.00	ft
2yr, 24hr P	3.3000	in
Slope	.026670	ft/ft
Avg.Velocity	1.95	ft/sec

Segment #1 Time: .0427 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	4.3100	sq.ft
Wetted Perimeter	7.12	ft
Hydraulic Radius	.61	ft
Slope	.015600	ft/ft
Mannings n	.0110	
Hydraulic Length	160.00	ft
Avg.Velocity	12.11	ft/sec

Segment #2 Time: .0037 hrs

==========
Total Tc: .0464 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS Channel Flow ==========

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.8000	
Hydraulic Length	300.00	ft
2yr, 24hr P	3.3300	in
Slope	.346670	ft/ft
Avg.Velocity	.18	ft/sec

Segment #1 Time: .4700 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	1016.00	ft
Slope	.101400	ft/ft
Unpaved		
Avg.Velocity	5.14	ft/sec

Segment #2 Time: .0549 hrs

Segment #3: Tc: Length & Vel.

Hydraulic Length	53.00	ft
Avg.Velocity	20.18	ft/sec

Segment #3 Time: .0007 hrs

Segment #4: Tc: TR-55 Channel

Flow Area	2.3300	sq.ft
Wetted Perimeter	4.11	ft
Hydraulic Radius	.57	ft
Slope	.013200	ft/ft
Mannings n	.0690	
Hydraulic Length	378.64	ft
Avg.Velocity	1.70	ft/sec

Segment #4 Time: .0619 hrs

Segment #5: Tc: Length & Vel.

Hydraulic Length	479.48	ft
Avg.Velocity	21.08	ft/sec

Segment #5 Time: .0063 hrs

Segment #6: Tc: TR-55 Channel

Flow Area	2.3300	sq.ft
Wetted Perimeter	4.11	ft
Hydraulic Radius	.57	ft
Slope	.053750	ft/ft
Mannings n	.0690	
Hydraulic Length	224.00	ft
Avg.Velocity	3.43	ft/sec

Segment #6 Time: .0181 hrs

Segment #7: Tc: Length & Vel.

Hydraulic Length	135.68	ft
Avg.Velocity	35.20	ft/sec

Segment #7 Time: .0011 hrs

Segment #8: Tc: Length & Vel.

Hydraulic Length 276.20 ft
Avg.Velocity 2.93 ft/sec

Segment #8 Time: .0262 hrs

Segment #9: Tc: Length & Vel.

Hydraulic Length 299.22 ft
Avg.Velocity 16.07 ft/sec

Segment #9 Time: .0052 hrs

Segment #10: Tc: Length & Vel.

Hydraulic Length 353.36 ft
Avg.Velocity 17.24 ft/sec

Segment #10 Time: .0057 hrs

Segment #11: Tc: Length & Vel.

Hydraulic Length 43.50 ft
Avg.Velocity 31.25 ft/sec

Segment #11 Time: .0004 hrs

Segment #12: Tc: Length & Vel.

Hydraulic Length 327.47 ft
Avg.Velocity 25.96 ft/sec

Segment #12 Time: .0035 hrs

Segment #13: Tc: Length & Vel.

Hydraulic Length 339.06 ft
Avg.Velocity 16.38 ft/sec

Segment #13 Time: .0057 hrs

Segment #14: Tc: Length & Vel.

Hydraulic Length 190.28 ft
Avg.Velocity 21.60 ft/sec

Segment #14 Time: .0024 hrs

Segment #15: Tc: Length & Vel.

Hydraulic Length 275.63 ft
Avg.Velocity 17.42 ft/sec

Segment #15 Time: .0044 hrs

Segment #16: Tc: Length & Vel.

Hydraulic Length 46.79 ft
Avg.Velocity 32.38 ft/sec

Segment #16 Time: .0004 hrs

Segment #17: Tc: Length & Vel.

Hydraulic Length 468.45 ft
Avg.Velocity 18.45 ft/sec

Segment #17 Time: .0071 hrs

==========
Total Tc: .6741 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== User Defined Length & Velocity ==================================

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Impervious Areas - Paved parking lo	98	3.300		3.10	98.00
COMPOSITE AREA & WEIGHTED CN --->		3.300			98.00 (98)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Woods - good	70	30.300			70.00
Pasture, grassland, or range - good	74	34.700			74.00
Pasture, grassland, or range - good	61	28.000			61.00
Urban Districts - Industrial	91	143.800			91.00
COMPOSITE AREA & WEIGHTED CN --->		236.800			82.27 (82)

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

DEFINITION OF TERMS: ----------

At = Total area (acres): At = Ai+Ap
Ai = Impervious area (acres)
Ap = Pervious area (acres)
CNi = Runoff curve number for impervious area
CNp = Runoff curve number for pervious area
fLoss = f loss constant infiltration (depth/time)
gKs = Saturated Hydraulic Conductivity (depth/time)
Md = Volumetric Moisture Deficit
Psi = Capillary Suction (length)
hK = Horton Infiltration Decay Rate (time^-1)
fo = Initial Infiltration Rate (depth/time)
fc = Ultimate(capacity)Infiltration Rate (depth/time)
Ia = Initial Abstraction (length)
dt = Computational increment (duration of unit excess rainfall)
Default dt is smallest value of 0.1333Tc, rtm, and th
(Smallest dt is then adjusted to match up with Tp)
UDdt = User specified override computational main time increment
(only used if UDdt is => .1333Tc)
D(t) = Point on distribution curve (fraction of P) for time step t

K = 2 / (1 + (Tr/Tp)): default K = 0.75: (for Tr/Tp = 1.67)
Ks = Hydrograph shape factor
= Unit Conversions * K:
= ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K
Default Ks = 645.333 * 0.75 = 484

Lag = Lag time from center of excess runoff (dt) to Tp: Lag = 0.6Tc
P = Total precipitation depth, inches
Pa(t) = Accumulated rainfall at time step t
Pi(t) = Incremental rainfall at time step t
qp = Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi.
= (Ks * A * Q) / Tp (where Q = 1in. runoff, A=sq.mi.)
Qu(t) = Unit hydrograph ordinate (cfs) at time step t
Q(t) = Final hydrograph ordinate (cfs) at time step t
Rai(t)= Accumulated runoff (inches) at time step t for impervious area
Rap(t)= Accumulated runoff (inches) at time step t for pervious area
Rii(t)= Incremental runoff (inches) at time step t for impervious area
Rip(t)= Incremental runoff (inches) at time step t for pervious area
R(t) = Incremental weighted total runoff (inches)
Rtm = Time increment for rainfall table
Si = S for impervious area: Si = (1000/CNi) - 10
Sp = S for pervious area: Sp = (1000/CNp) - 10
t = Time step (row) number
Tc = Time of concentration
Tb = Time (hrs) of entire unit hydrograph: Tb = Tp + Tr
Tp = Time (hrs) to peak of a unit hydrograph: Tp = (dt/2) + Lag
Tr = Time (hrs) of receding limb of unit hydrograph: Tr = ratio of Tp

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

PRECIPITATION: ----------
Column (1): Time for time step t
Column (2): D(t) = Point on distribution curve for time step t
Column (3): Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4): Pa(t) = D(t) x P: Col.(2) x P

PERVIOUS AREA RUNOFF (using SCS Runoff CN Method) ----------
Column (5): Rap(t) = Accumulated pervious runoff for time step t
If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
If (Pa(t) is > 0.2Sp) then use:

Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6): Rip(t) = Incremental pervious runoff for time step t
Rip(t) = Rap(t) - Rap(t-1)
Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

IMPERVIOUS AREA RUNOFF ----------
Column (7 & 8)... Did not specify to use impervious areas.

INCREMENTAL WEIGHTED RUNOFF: ----------
Column (9): R(t) = (Ap/At) x Rip(t) + (Ai/At) x Rii(t)
R(t) = (Ap/At) x Col.(6) + (Ai/At) x Col.(8)

SCS UNIT HYDROGRAPH METHOD: ----------
Column (10): Q(t) is computed with the SCS unit hydrograph method
using R() and Qu().

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.5000 in
Rain Dir = U:\soh\Engineering\Coal Pile\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = U:\soh\Engineering\Coal Pile\
HYG File - ID = work_pad.hyg - COAL PILE 25 yr
Tc (Min. Tc) = .0833 hrs
Drainage Area = 3.300 acres Runoff CN= 98

==========
Computational Time Increment = .01111 hrs
Computed Peak Time = 11.9175 hrs
Computed Peak Flow = 23.62 cfs

Time Increment for HYG File = .0100 hrs
Peak Time, Interpolated Output = 11.9202 hrs
Peak Flow, Interpolated Output = 23.55 cfs
==========

DRAINAGE AREA

ID:COAL PILE
CN = 98
Area = 3.300 acres
S = .2041 in
0.2S = .0408 in

Cumulative Runoff

5.2625 in
1.447 ac-ft

HYG Volume... 1.447 ac-ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .08330 hrs (ID: COAL PILE)
Computational Incr, Tm = .01111 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 44.89 cfs
Unit peak time Tp = .05553 hrs
Unit receding limb, Tr = .22213 hrs
Total unit time, Tb = .27767 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.5000 in
Rain Dir = U:\soh\Engineering\Coal Pile\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = U:\soh\Engineering\Coal Pile\
HYG File - ID = work_pad.hyg - COAL PILE 25 yr
Tc (Min. Tc) = .0833 hrs
Drainage Area = 3.300 acres Runoff CN= 98
Calc.Increment= .01111 hrs Out.Incr.= .0100 hrs
HYG Volume = 1.447 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
.7700	.00	.00	.00	.00	.00
.8200	.00	.01	.01	.01	.01
.8700	.01	.01	.01	.01	.01
.9200	.02	.02	.02	.02	.02
.9700	.02	.02	.02	.02	.02
1.0200	.03	.03	.03	.03	.03
1.0700	.03	.03	.03	.03	.03
1.1200	.03	.04	.04	.04	.04
1.1700	.04	.04	.04	.04	.04
1.2200	.04	.04	.05	.05	.05
1.2700	.05	.05	.05	.05	.05
1.3200	.05	.05	.05	.06	.06
1.3700	.06	.06	.06	.06	.06
1.4200	.06	.06	.06	.06	.06
1.4700	.07	.07	.07	.07	.07
1.5200	.07	.07	.07	.07	.07
1.5700	.07	.07	.07	.07	.08
1.6200	.08	.08	.08	.08	.08
1.6700	.08	.08	.08	.08	.08
1.7200	.08	.08	.09	.09	.09
1.7700	.09	.09	.09	.09	.09
1.8200	.09	.09	.09	.09	.09
1.8700	.09	.09	.10	.10	.10
1.9200	.10	.10	.10	.10	.10
1.9700	.10	.10	.10	.10	.10
2.0200	.10	.10	.10	.11	.11
2.0700	.11	.11	.11	.11	.11
2.1200	.11	.11	.11	.11	.11
2.1700	.11	.11	.11	.11	.11
2.2200	.12	.12	.12	.12	.12

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
2.2700	.12	.12	.12	.12	.12
2.3200	.12	.12	.12	.12	.12
2.3700	.12	.12	.12	.13	.13
2.4200	.13	.13	.13	.13	.13
2.4700	.13	.13	.13	.13	.13
2.5200	.13	.13	.13	.13	.13
2.5700	.13	.14	.14	.14	.14
2.6200	.14	.14	.14	.14	.14
2.6700	.14	.14	.14	.14	.14
2.7200	.14	.14	.14	.14	.14
2.7700	.14	.14	.15	.15	.15
2.8200	.15	.15	.15	.15	.15
2.8700	.15	.15	.15	.15	.15
2.9200	.15	.15	.15	.15	.15
2.9700	.15	.15	.15	.16	.16
3.0200	.16	.16	.16	.16	.16
3.0700	.16	.16	.16	.16	.16
3.1200	.16	.16	.16	.16	.16
3.1700	.16	.16	.16	.16	.16
3.2200	.16	.17	.17	.17	.17
3.2700	.17	.17	.17	.17	.17
3.3200	.17	.17	.17	.17	.17
3.3700	.17	.17	.17	.17	.17
3.4200	.17	.17	.17	.17	.18
3.4700	.18	.18	.18	.18	.18
3.5200	.18	.18	.18	.18	.18
3.5700	.18	.18	.18	.18	.18
3.6200	.18	.18	.18	.18	.18
3.6700	.18	.18	.18	.18	.19
3.7200	.19	.19	.19	.19	.19
3.7700	.19	.19	.19	.19	.19
3.8200	.19	.19	.19	.19	.19
3.8700	.19	.19	.19	.19	.19
3.9200	.19	.19	.19	.19	.19
3.9700	.19	.19	.19	.19	.20
4.0200	.20	.20	.20	.20	.20
4.0700	.20	.20	.20	.20	.20
4.1200	.20	.20	.20	.20	.20
4.1700	.20	.20	.20	.20	.20
4.2200	.21	.21	.21	.21	.21
4.2700	.21	.21	.21	.21	.21
4.3200	.21	.21	.21	.21	.21
4.3700	.21	.21	.21	.21	.21
4.4200	.21	.22	.22	.22	.22
4.4700	.22	.22	.22	.22	.22

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
4.5200	.22	.22	.22	.22	.22
4.5700	.22	.22	.22	.22	.22
4.6200	.22	.22	.23	.23	.23
4.6700	.23	.23	.23	.23	.23
4.7200	.23	.23	.23	.23	.23
4.7700	.23	.23	.23	.23	.23
4.8200	.23	.23	.24	.24	.24
4.8700	.24	.24	.24	.24	.24
4.9200	.24	.24	.24	.24	.24
4.9700	.24	.24	.24	.24	.24
5.0200	.24	.24	.24	.25	.25
5.0700	.25	.25	.25	.25	.25
5.1200	.25	.25	.25	.25	.25
5.1700	.25	.25	.25	.25	.25
5.2200	.25	.25	.25	.25	.26
5.2700	.26	.26	.26	.26	.26
5.3200	.26	.26	.26	.26	.26
5.3700	.26	.26	.26	.26	.26
5.4200	.26	.26	.26	.26	.26
5.4700	.26	.27	.27	.27	.27
5.5200	.27	.27	.27	.27	.27
5.5700	.27	.27	.27	.27	.27
5.6200	.27	.27	.27	.27	.27
5.6700	.27	.27	.27	.28	.28
5.7200	.28	.28	.28	.28	.28
5.7700	.28	.28	.28	.28	.28
5.8200	.28	.28	.28	.28	.28
5.8700	.28	.28	.28	.28	.28
5.9200	.28	.29	.29	.29	.29
5.9700	.29	.29	.29	.29	.29
6.0200	.29	.29	.29	.29	.29
6.0700	.29	.29	.29	.29	.29
6.1200	.29	.29	.29	.30	.30
6.1700	.30	.30	.30	.30	.30
6.2200	.30	.30	.30	.30	.30
6.2700	.30	.30	.30	.30	.30
6.3200	.30	.30	.30	.30	.30
6.3700	.31	.31	.31	.31	.31
6.4200	.31	.31	.31	.31	.31
6.4700	.31	.31	.31	.31	.31
6.5200	.31	.31	.31	.31	.31
6.5700	.31	.31	.32	.32	.32
6.6200	.32	.32	.32	.32	.32
6.6700	.32	.32	.32	.32	.32
6.7200	.32	.32	.32	.32	.32

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
6.7700	.32	.32	.32	.32	.32
6.8200	.32	.33	.33	.33	.33
6.8700	.33	.33	.33	.33	.33
6.9200	.33	.33	.33	.33	.33
6.9700	.33	.33	.33	.33	.33
7.0200	.33	.33	.33	.33	.34
7.0700	.34	.34	.34	.34	.34
7.1200	.34	.34	.34	.34	.34
7.1700	.34	.34	.34	.34	.34
7.2200	.34	.34	.34	.34	.34
7.2700	.34	.34	.35	.35	.35
7.3200	.35	.35	.35	.35	.35
7.3700	.35	.35	.35	.35	.35
7.4200	.35	.35	.35	.35	.35
7.4700	.35	.35	.35	.35	.35
7.5200	.35	.36	.36	.36	.36
7.5700	.36	.36	.36	.36	.36
7.6200	.36	.36	.36	.36	.36
7.6700	.36	.36	.36	.36	.36
7.7200	.36	.36	.36	.36	.37
7.7700	.37	.37	.37	.37	.37
7.8200	.37	.37	.37	.37	.37
7.8700	.37	.37	.37	.37	.37
7.9200	.37	.37	.37	.37	.37
7.9700	.37	.37	.37	.38	.38
8.0200	.38	.38	.38	.38	.38
8.0700	.38	.38	.38	.39	.39
8.1200	.39	.39	.39	.39	.40
8.1700	.40	.40	.40	.40	.40
8.2200	.40	.41	.41	.41	.41
8.2700	.42	.42	.42	.42	.42
8.3200	.42	.42	.43	.43	.43
8.3700	.43	.44	.44	.44	.44
8.4200	.44	.44	.44	.45	.45
8.4700	.45	.45	.46	.46	.46
8.5200	.46	.46	.46	.47	.47
8.5700	.47	.47	.47	.47	.48
8.6200	.48	.48	.48	.48	.49
8.6700	.49	.49	.49	.49	.49
8.7200	.50	.50	.50	.50	.50
8.7700	.51	.51	.51	.51	.51
8.8200	.51	.52	.52	.52	.52
8.8700	.52	.53	.53	.53	.53
8.9200	.53	.53	.54	.54	.54
8.9700	.54	.55	.55	.55	.55

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time hrs | Time on left represents time for first value in each row.

Time hrs					
9.0200	.55	.55	.55	.55	.55
9.0700	.56	.56	.56	.56	.56
9.1200	.56	.56	.56	.56	.56
9.1700	.56	.56	.56	.56	.56
9.2200	.56	.56	.56	.56	.56
9.2700	.56	.56	.56	.56	.56
9.3200	.56	.56	.56	.56	.56
9.3700	.56	.56	.56	.56	.56
9.4200	.56	.56	.56	.56	.56
9.4700	.56	.56	.56	.56	.56
9.5200	.56	.57	.57	.57	.57
9.5700	.57	.57	.58	.58	.58
9.6200	.58	.58	.58	.59	.59
9.6700	.60	.60	.60	.60	.60
9.7200	.61	.61	.61	.62	.62
9.7700	.62	.63	.63	.63	.63
9.8200	.64	.64	.64	.65	.65
9.8700	.65	.66	.66	.66	.66
9.9200	.66	.67	.67	.68	.68
9.9700	.68	.69	.69	.69	.69
10.0200	.69	.70	.70	.71	.71
10.0700	.72	.72	.72	.73	.73
10.1200	.73	.73	.74	.75	.75
10.1700	.76	.76	.77	.77	.77
10.2200	.77	.78	.78	.79	.80
10.2700	.80	.81	.81	.81	.81
10.3200	.82	.82	.83	.83	.84
10.3700	.84	.85	.85	.86	.86
10.4200	.86	.87	.87	.88	.88
10.4700	.89	.89	.90	.90	.90
10.5200	.91	.91	.92	.93	.93
10.5700	.94	.95	.95	.95	.96
10.6200	.96	.97	.98	.99	1.00
10.6700	1.01	1.02	1.02	1.03	1.03
10.7200	1.03	1.04	1.05	1.06	1.07
10.7700	1.08	1.09	1.09	1.10	1.10
10.8200	1.11	1.11	1.12	1.13	1.14
10.8700	1.15	1.16	1.17	1.17	1.17
10.9200	1.18	1.19	1.20	1.21	1.22
10.9700	1.23	1.23	1.24	1.24	1.25
11.0200	1.26	1.27	1.28	1.30	1.32
11.0700	1.33	1.34	1.35	1.36	1.37
11.1200	1.38	1.39	1.42	1.44	1.46
11.1700	1.48	1.50	1.52	1.53	1.54
11.2200	1.55	1.57	1.59	1.61	1.64

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
11.2700	1.66	1.68	1.69	1.70	1.71
11.3200	1.72	1.74	1.76	1.79	1.81
11.3700	1.83	1.85	1.86	1.87	1.88
11.4200	1.90	1.91	1.94	1.96	1.99
11.4700	2.01	2.03	2.04	2.06	2.10
11.5200	2.20	2.37	2.62	2.91	3.20
11.5700	3.46	3.68	3.84	3.98	4.13
11.6200	4.37	4.75	5.26	5.85	6.43
11.6700	6.94	7.37	7.69	7.94	8.20
11.7200	8.55	9.05	9.70	10.45	11.17
11.7700	11.81	12.34	12.74	13.08	13.47
11.8200	14.08	15.04	16.36	17.88	19.36
11.8700	20.69	21.78	22.60	23.18	23.51
11.9200	23.55	23.23	22.57	21.71	20.82
11.9700	20.01	19.34	18.83	18.40	17.90
12.0200	17.13	15.92	14.27	12.36	10.50
12.0700	8.83	7.46	6.42	5.66	5.09
12.1200	4.64	4.29	4.01	3.78	3.60
12.1700	3.46	3.35	3.27	3.21	3.15
12.2200	3.10	3.04	2.98	2.91	2.85
12.2700	2.79	2.75	2.72	2.69	2.67
12.3200	2.64	2.60	2.55	2.49	2.43
12.3700	2.38	2.33	2.30	2.28	2.25
12.4200	2.22	2.18	2.13	2.07	2.01
12.4700	1.96	1.92	1.89	1.86	1.84
12.5200	1.82	1.79	1.75	1.71	1.68
12.5700	1.64	1.62	1.60	1.58	1.57
12.6200	1.56	1.55	1.53	1.51	1.50
12.6700	1.49	1.48	1.47	1.46	1.46
12.7200	1.45	1.44	1.43	1.41	1.40
12.7700	1.39	1.38	1.37	1.37	1.36
12.8200	1.35	1.34	1.33	1.32	1.31
12.8700	1.29	1.28	1.28	1.27	1.27
12.9200	1.26	1.25	1.24	1.22	1.21
12.9700	1.20	1.19	1.18	1.18	1.17
13.0200	1.17	1.16	1.15	1.14	1.13
13.0700	1.12	1.11	1.10	1.10	1.10
13.1200	1.09	1.09	1.08	1.07	1.06
13.1700	1.06	1.05	1.05	1.05	1.04
13.2200	1.04	1.03	1.03	1.02	1.01
13.2700	1.01	1.00	1.00	.99	.99
13.3200	.99	.98	.98	.97	.96
13.3700	.96	.95	.95	.94	.94
13.4200	.94	.93	.92	.92	.91
13.4700	.90	.90	.90	.89	.89

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
13.5200	.89	.88	.88	.87	.86
13.5700	.86	.85	.85	.85	.84
13.6200	.84	.84	.83	.83	.82
13.6700	.82	.81	.81	.81	.81
13.7200	.80	.80	.80	.79	.79
13.7700	.78	.78	.78	.77	.77
13.8200	.77	.76	.76	.75	.75
13.8700	.75	.74	.74	.74	.73
13.9200	.73	.73	.72	.72	.71
13.9700	.71	.70	.70	.70	.70
14.0200	.70	.69	.69	.69	.68
14.0700	.68	.68	.68	.67	.67
14.1200	.67	.67	.67	.67	.66
14.1700	.66	.66	.66	.66	.66
14.2200	.66	.66	.65	.65	.65
14.2700	.65	.65	.65	.65	.65
14.3200	.64	.64	.64	.64	.64
14.3700	.64	.63	.63	.63	.63
14.4200	.63	.63	.63	.63	.63
14.4700	.62	.62	.62	.62	.62
14.5200	.62	.62	.62	.61	.61
14.5700	.61	.61	.61	.61	.61
14.6200	.61	.60	.60	.60	.60
14.6700	.60	.60	.60	.60	.59
14.7200	.59	.59	.59	.59	.59
14.7700	.58	.58	.58	.58	.58
14.8200	.58	.58	.58	.58	.57
14.8700	.57	.57	.57	.57	.57
14.9200	.57	.57	.57	.56	.56
14.9700	.56	.56	.56	.56	.56
15.0200	.55	.55	.55	.55	.55
15.0700	.55	.55	.55	.54	.54
15.1200	.54	.54	.54	.54	.54
15.1700	.53	.53	.53	.53	.53
15.2200	.53	.53	.53	.52	.52
15.2700	.52	.52	.52	.52	.52
15.3200	.52	.52	.51	.51	.51
15.3700	.51	.51	.51	.50	.50
15.4200	.50	.50	.50	.50	.50
15.4700	.50	.49	.49	.49	.49
15.5200	.49	.49	.49	.49	.48
15.5700	.48	.48	.48	.48	.48
15.6200	.48	.48	.47	.47	.47
15.6700	.47	.47	.47	.47	.47
15.7200	.47	.46	.46	.46	.46

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
15.7700	.46	.46	.45	.45	.45
15.8200	.45	.45	.45	.45	.45
15.8700	.44	.44	.44	.44	.44
15.9200	.44	.44	.44	.44	.43
15.9700	.43	.43	.43	.43	.43
16.0200	.43	.43	.42	.42	.42
16.0700	.42	.42	.42	.42	.42
16.1200	.42	.42	.42	.42	.42
16.1700	.42	.41	.41	.41	.41
16.2200	.41	.41	.41	.41	.41
16.2700	.41	.41	.41	.41	.41
16.3200	.41	.41	.41	.41	.41
16.3700	.41	.41	.40	.40	.40
16.4200	.40	.40	.40	.40	.40
16.4700	.40	.40	.40	.40	.40
16.5200	.40	.40	.40	.40	.40
16.5700	.40	.40	.40	.40	.40
16.6200	.39	.39	.39	.39	.39
16.6700	.39	.39	.39	.39	.39
16.7200	.39	.39	.39	.39	.39
16.7700	.39	.39	.39	.39	.39
16.8200	.39	.39	.38	.38	.38
16.8700	.38	.38	.38	.38	.38
16.9200	.38	.38	.38	.38	.38
16.9700	.38	.38	.38	.38	.38
17.0200	.38	.38	.38	.38	.37
17.0700	.37	.37	.37	.37	.37
17.1200	.37	.37	.37	.37	.37
17.1700	.37	.37	.37	.37	.37
17.2200	.37	.37	.37	.37	.37
17.2700	.37	.36	.36	.36	.36
17.3200	.36	.36	.36	.36	.36
17.3700	.36	.36	.36	.36	.36
17.4200	.36	.36	.36	.36	.36
17.4700	.36	.36	.36	.36	.35
17.5200	.35	.35	.35	.35	.35
17.5700	.35	.35	.35	.35	.35
17.6200	.35	.35	.35	.35	.35
17.6700	.35	.35	.35	.35	.35
17.7200	.35	.34	.34	.34	.34
17.7700	.34	.34	.34	.34	.34
17.8200	.34	.34	.34	.34	.34
17.8700	.34	.34	.34	.34	.34
17.9200	.34	.34	.34	.33	.33
17.9700	.33	.33	.33	.33	.33

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
18.0200	.33	.33	.33	.33	.33
18.0700	.33	.33	.33	.33	.33
18.1200	.33	.33	.33	.33	.32
18.1700	.32	.32	.32	.32	.32
18.2200	.32	.32	.32	.32	.32
18.2700	.32	.32	.32	.32	.32
18.3200	.32	.32	.32	.32	.32
18.3700	.31	.31	.31	.31	.31
18.4200	.31	.31	.31	.31	.31
18.4700	.31	.31	.31	.31	.31
18.5200	.31	.31	.31	.31	.31
18.5700	.31	.30	.30	.30	.30
18.6200	.30	.30	.30	.30	.30
18.6700	.30	.30	.30	.30	.30
18.7200	.30	.30	.30	.30	.30
18.7700	.30	.30	.30	.30	.29
18.8200	.29	.29	.29	.29	.29
18.8700	.29	.29	.29	.29	.29
18.9200	.29	.29	.29	.29	.29
18.9700	.29	.29	.29	.29	.29
19.0200	.29	.28	.28	.28	.28
19.0700	.28	.28	.28	.28	.28
19.1200	.28	.28	.28	.28	.28
19.1700	.28	.28	.28	.28	.28
19.2200	.28	.28	.28	.27	.27
19.2700	.27	.27	.27	.27	.27
19.3200	.27	.27	.27	.27	.27
19.3700	.27	.27	.27	.27	.27
19.4200	.27	.27	.27	.27	.27
19.4700	.26	.26	.26	.26	.26
19.5200	.26	.26	.26	.26	.26
19.5700	.26	.26	.26	.26	.26
19.6200	.26	.26	.26	.26	.26
19.6700	.26	.26	.25	.25	.25
19.7200	.25	.25	.25	.25	.25
19.7700	.25	.25	.25	.25	.25
19.8200	.25	.25	.25	.25	.25
19.8700	.25	.25	.25	.25	.25
19.9200	.24	.24	.24	.24	.24
19.9700	.24	.24	.24	.24	.24
20.0200	.24	.24	.24	.24	.24
20.0700	.24	.24	.24	.24	.24
20.1200	.24	.24	.24	.24	.24
20.1700	.24	.24	.24	.24	.24
20.2200	.24	.24	.24	.24	.24

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
20.2700	.24	.24	.24	.24	.24
20.3200	.24	.24	.24	.24	.23
20.3700	.23	.23	.23	.23	.23
20.4200	.23	.23	.23	.23	.23
20.4700	.23	.23	.23	.23	.23
20.5200	.23	.23	.23	.23	.23
20.5700	.23	.23	.23	.23	.23
20.6200	.23	.23	.23	.23	.23
20.6700	.23	.23	.23	.23	.23
20.7200	.23	.23	.23	.23	.23
20.7700	.23	.23	.23	.23	.23
20.8200	.23	.23	.23	.23	.23
20.8700	.23	.23	.23	.23	.23
20.9200	.23	.23	.23	.23	.23
20.9700	.23	.23	.23	.23	.23
21.0200	.23	.23	.23	.23	.23
21.0700	.23	.23	.23	.23	.23
21.1200	.23	.23	.23	.23	.23
21.1700	.23	.23	.23	.23	.23
21.2200	.23	.23	.23	.23	.23
21.2700	.23	.23	.23	.23	.23
21.3200	.23	.23	.23	.23	.23
21.3700	.23	.23	.23	.23	.23
21.4200	.22	.22	.22	.22	.22
21.4700	.22	.22	.22	.22	.22
21.5200	.22	.22	.22	.22	.22
21.5700	.22	.22	.22	.22	.22
21.6200	.22	.22	.22	.22	.22
21.6700	.22	.22	.22	.22	.22
21.7200	.22	.22	.22	.22	.22
21.7700	.22	.22	.22	.22	.22
21.8200	.22	.22	.22	.22	.22
21.8700	.22	.22	.22	.22	.22
21.9200	.22	.22	.22	.22	.22
21.9700	.22	.22	.22	.22	.22
22.0200	.22	.22	.22	.22	.22
22.0700	.22	.22	.22	.22	.22
22.1200	.22	.22	.22	.22	.22
22.1700	.22	.22	.22	.22	.22
22.2200	.22	.22	.22	.22	.22
22.2700	.22	.22	.22	.22	.22
22.3200	.22	.22	.22	.22	.22
22.3700	.22	.22	.22	.22	.22
22.4200	.22	.22	.22	.22	.22
22.4700	.22	.22	.22	.22	.22

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
22.5200	.22	.22	.22	.21	.21
22.5700	.21	.21	.21	.21	.21
22.6200	.21	.21	.21	.21	.21
22.6700	.21	.21	.21	.21	.21
22.7200	.21	.21	.21	.21	.21
22.7700	.21	.21	.21	.21	.21
22.8200	.21	.21	.21	.21	.21
22.8700	.21	.21	.21	.21	.21
22.9200	.21	.21	.21	.21	.21
22.9700	.21	.21	.21	.21	.21
23.0200	.21	.21	.21	.21	.21
23.0700	.21	.21	.21	.21	.21
23.1200	.21	.21	.21	.21	.21
23.1700	.21	.21	.21	.21	.21
23.2200	.21	.21	.21	.21	.21
23.2700	.21	.21	.21	.21	.21
23.3200	.21	.21	.21	.21	.21
23.3700	.21	.21	.21	.21	.21
23.4200	.21	.21	.21	.21	.21
23.4700	.21	.21	.21	.21	.21
23.5200	.21	.21	.21	.21	.21
23.5700	.21	.21	.21	.20	.20
23.6200	.20	.20	.20	.20	.20
23.6700	.20	.20	.20	.20	.20
23.7200	.20	.20	.20	.20	.20
23.7700	.20	.20	.20	.20	.20
23.8200	.20	.20	.20	.20	.20
23.8700	.20	.20	.20	.20	.20
23.9200	.20	.20	.20	.20	.20
23.9700	.20	.20	.20	.20	.20
24.0200	.19	.17	.15	.12	.10
24.0700	.07	.06	.04	.03	.02
24.1200	.02	.01	.01	.01	.01
24.1700	.00	.00	.00	.00	.00

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.5000 in
Rain Dir = U:\soh\Engineering\Coal Pile\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = U:\soh\Engineering\Coal Pile\
HYG File - ID = work_pad.hyg - EAST FORK POPLAR 25 yr
Tc = .6741 hrs
Drainage Area = 236.800 acres Runoff CN= 82

==========
Computational Time Increment = .08987 hrs
Computed Peak Time = 12.3127 hrs
Computed Peak Flow = 582.36 cfs

Time Increment for HYG File = .0100 hrs
Peak Time, Interpolated Output = 12.3102 hrs
Peak Flow, Interpolated Output = 582.10 cfs
==========

DRAINAGE AREA

ID:EAST FORK POPLAR
CN = 82
Area = 236.800 acres
S = 2.1951 in
0.2S = .4390 in

Cumulative Runoff

3.5299 in
69.657 ac-ft

HYG Volume... 69.656 ac-ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .67405 hrs (ID: EAST FORK POPLAR)
Computational Incr, Tm = .08987 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 398.05 cfs
Unit peak time Tp = .44937 hrs
Unit receding limb, Tr = 1.79747 hrs
Total unit time, Tb = 2.24684 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.5000 in
Rain Dir = U:\soh\Engineering\Coal Pile\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = U:\soh\Engineering\Coal Pile\
HYG File - ID = work_pad.hyg - EAST FORK POPLAR 25 yr
Tc = .6741 hrs
Drainage Area = 236.800 acres Runoff CN= 82
Calc.Increment= .08987 hrs Out.Incr.= .0100 hrs
HYG Volume = 69.656 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
6.0400	.00	.00	.00	.00	.00
6.0900	.00	.00	.00	.00	.01
6.1400	.01	.01	.01	.01	.01
6.1900	.01	.01	.02	.02	.02
6.2400	.03	.03	.03	.04	.04
6.2900	.04	.05	.05	.06	.07
6.3400	.07	.08	.08	.09	.10
6.3900	.11	.12	.12	.13	.14
6.4400	.15	.16	.17	.18	.19
6.4900	.21	.22	.23	.24	.26
6.5400	.27	.28	.29	.31	.32
6.5900	.34	.35	.37	.38	.40
6.6400	.42	.43	.45	.47	.48
6.6900	.50	.52	.54	.55	.57
6.7400	.59	.61	.63	.64	.66
6.7900	.68	.70	.72	.74	.76
6.8400	.78	.80	.82	.84	.86
6.8900	.88	.90	.92	.94	.96
6.9400	.99	1.01	1.03	1.05	1.07
6.9900	1.09	1.11	1.13	1.16	1.18
7.0400	1.20	1.22	1.25	1.27	1.29
7.0900	1.31	1.33	1.36	1.38	1.40
7.1400	1.43	1.45	1.47	1.49	1.52
7.1900	1.54	1.56	1.59	1.61	1.63
7.2400	1.66	1.68	1.70	1.73	1.75
7.2900	1.78	1.80	1.82	1.85	1.87
7.3400	1.90	1.92	1.94	1.97	1.99
7.3900	2.02	2.04	2.06	2.09	2.11
7.4400	2.14	2.16	2.19	2.21	2.24
7.4900	2.26	2.29	2.31	2.34	2.36

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
7.5400	2.39	2.41	2.44	2.46	2.49
7.5900	2.51	2.54	2.56	2.59	2.61
7.6400	2.64	2.66	2.69	2.72	2.74
7.6900	2.77	2.79	2.82	2.84	2.87
7.7400	2.90	2.92	2.95	2.97	3.00
7.7900	3.02	3.05	3.08	3.10	3.13
7.8400	3.16	3.18	3.21	3.23	3.26
7.8900	3.29	3.31	3.34	3.37	3.39
7.9400	3.42	3.45	3.47	3.50	3.53
7.9900	3.55	3.58	3.61	3.63	3.66
8.0400	3.69	3.71	3.74	3.77	3.80
8.0900	3.82	3.85	3.88	3.91	3.93
8.1400	3.96	3.99	4.02	4.05	4.07
8.1900	4.10	4.13	4.16	4.19	4.22
8.2400	4.25	4.28	4.31	4.34	4.38
8.2900	4.41	4.44	4.47	4.51	4.54
8.3400	4.57	4.61	4.64	4.68	4.71
8.3900	4.75	4.78	4.82	4.86	4.89
8.4400	4.93	4.97	5.01	5.05	5.09
8.4900	5.13	5.17	5.21	5.25	5.29
8.5400	5.33	5.37	5.42	5.46	5.51
8.5900	5.55	5.60	5.64	5.68	5.73
8.6400	5.78	5.83	5.87	5.92	5.97
8.6900	6.02	6.07	6.11	6.16	6.21
8.7400	6.27	6.32	6.37	6.42	6.47
8.7900	6.52	6.57	6.63	6.68	6.74
8.8400	6.79	6.84	6.90	6.95	7.01
8.8900	7.06	7.12	7.18	7.23	7.29
8.9400	7.35	7.41	7.47	7.52	7.58
8.9900	7.64	7.70	7.76	7.82	7.88
9.0400	7.94	8.00	8.07	8.13	8.19
9.0900	8.25	8.31	8.38	8.44	8.50
9.1400	8.56	8.63	8.69	8.75	8.82
9.1900	8.88	8.94	9.01	9.07	9.13
9.2400	9.20	9.26	9.32	9.38	9.44
9.2900	9.51	9.57	9.63	9.69	9.75
9.3400	9.81	9.88	9.93	9.99	10.05
9.3900	10.11	10.17	10.23	10.28	10.34
9.4400	10.40	10.46	10.51	10.57	10.62
9.4900	10.68	10.73	10.79	10.84	10.89
9.5400	10.95	11.00	11.05	11.10	11.15
9.5900	11.21	11.26	11.31	11.36	11.41
9.6400	11.47	11.52	11.57	11.62	11.67
9.6900	11.72	11.78	11.83	11.89	11.94
9.7400	12.00	12.05	12.11	12.16	12.22

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
9.7900	12.27	12.33	12.39	12.46	12.52
9.8400	12.58	12.64	12.71	12.77	12.83
9.8900	12.90	12.97	13.04	13.12	13.19
9.9400	13.26	13.34	13.41	13.48	13.56
9.9900	13.64	13.72	13.81	13.89	13.98
10.0400	14.06	14.14	14.23	14.32	14.41
10.0900	14.51	14.60	14.69	14.79	14.88
10.1400	14.98	15.07	15.17	15.28	15.39
10.1900	15.49	15.60	15.71	15.81	15.92
10.2400	16.02	16.14	16.25	16.37	16.49
10.2900	16.61	16.73	16.85	16.96	17.08
10.3400	17.21	17.34	17.47	17.60	17.73
10.3900	17.86	17.99	18.12	18.25	18.39
10.4400	18.53	18.68	18.82	18.96	19.11
10.4900	19.25	19.39	19.54	19.69	19.84
10.5400	20.00	20.15	20.31	20.47	20.62
10.5900	20.78	20.94	21.10	21.27	21.44
10.6400	21.61	21.79	21.96	22.13	22.30
10.6900	22.47	22.65	22.84	23.03	23.22
10.7400	23.41	23.60	23.79	23.98	24.17
10.7900	24.37	24.58	24.80	25.01	25.22
10.8400	25.43	25.64	25.86	26.07	26.29
10.8900	26.53	26.77	27.01	27.24	27.48
10.9400	27.72	27.96	28.19	28.45	28.71
10.9900	28.97	29.24	29.50	29.77	30.03
11.0400	30.30	30.56	30.84	31.14	31.43
11.0900	31.73	32.03	32.32	32.62	32.91
11.1400	33.21	33.53	33.87	34.21	34.55
11.1900	34.88	35.22	35.56	35.90	36.24
11.2400	36.61	37.01	37.40	37.80	38.20
11.2900	38.59	38.99	39.38	39.78	40.22
11.3400	40.69	41.16	41.62	42.09	42.56
11.3900	43.02	43.49	43.96	44.48	45.03
11.4400	45.58	46.13	46.68	47.24	47.79
11.4900	48.34	48.89	49.59	50.37	51.16
11.5400	51.94	52.72	53.50	54.29	55.07
11.5900	55.85	57.09	58.56	60.04	61.51
11.6400	62.99	64.47	65.94	67.42	68.89
11.6900	71.45	74.54	77.64	80.74	83.84
11.7400	86.94	90.04	93.14	96.24	101.52
11.7900	107.86	114.19	120.53	126.86	133.20
11.8400	139.53	145.86	152.20	161.45	172.03
11.8900	182.60	193.18	203.75	214.33	224.90
11.9400	235.48	246.05	259.02	273.01	287.00
11.9900	300.98	314.97	328.96	342.95	356.94

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
12.0400	370.93	384.64	398.25	411.85	425.46
12.0900	439.07	452.67	466.28	479.89	493.49
12.1400	503.32	511.73	520.14	528.55	536.95
12.1900	545.36	553.77	562.18	570.59	573.57
12.2400	574.63	575.70	576.77	577.83	578.90
12.2900	579.97	581.03	582.10	578.75	573.95
12.3400	569.14	564.34	559.53	554.72	549.92
12.3900	545.11	540.31	532.88	524.64	516.41
12.4400	508.17	499.94	491.70	483.47	475.23
12.4900	467.00	458.07	448.95	439.83	430.70
12.5400	421.58	412.46	403.33	394.21	385.09
12.5900	376.89	368.93	360.97	353.01	345.05
12.6400	337.09	329.13	321.17	313.21	306.73
12.6900	300.62	294.50	288.39	282.27	276.15
12.7400	270.04	263.92	257.81	252.81	248.07
12.7900	243.33	238.59	233.85	229.11	224.37
12.8400	219.63	214.88	210.96	207.20	203.45
12.8900	199.69	195.94	192.18	188.42	184.67
12.9400	180.91	177.84	174.89	171.94	168.99
12.9900	166.04	163.09	160.14	157.19	154.24
13.0400	151.85	149.56	147.27	144.98	142.69
13.0900	140.39	138.10	135.81	133.52	131.66
13.1400	129.86	128.07	126.27	124.47	122.68
13.1900	120.88	119.09	117.29	115.83	114.41
13.2400	112.99	111.58	110.16	108.74	107.32
13.2900	105.91	104.49	103.32	102.19	101.05
13.3400	99.92	98.78	97.64	96.51	95.37
13.3900	94.24	93.29	92.37	91.44	90.52
13.4400	89.59	88.67	87.74	86.82	85.89
13.4900	85.12	84.36	83.59	82.83	82.07
13.5400	81.31	80.55	79.79	79.03	78.39
13.5900	77.75	77.11	76.48	75.84	75.21
13.6400	74.57	73.93	73.30	72.75	72.20
13.6900	71.66	71.11	70.57	70.02	69.48
13.7400	68.93	68.39	67.91	67.43	66.94
13.7900	66.46	65.98	65.50	65.02	64.54
13.8400	64.06	63.62	63.19	62.76	62.32
13.8900	61.89	61.45	61.02	60.59	60.15
13.9400	59.76	59.38	58.99	58.60	58.21
13.9900	57.82	57.43	57.04	56.65	56.32
14.0400	55.99	55.65	55.32	54.99	54.66
14.0900	54.33	53.99	53.66	53.39	53.11
14.1400	52.84	52.56	52.29	52.01	51.73
14.1900	51.46	51.18	50.95	50.71	50.48
14.2400	50.24	50.00	49.77	49.53	49.30

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
14.2900	49.06	48.85	48.64	48.44	48.23
14.3400	48.02	47.81	47.60	47.39	47.19
14.3900	47.01	46.82	46.64	46.46	46.28
14.4400	46.10	45.92	45.74	45.56	45.41
14.4900	45.25	45.10	44.94	44.79	44.63
14.5400	44.47	44.32	44.17	44.03	43.90
14.5900	43.76	43.63	43.50	43.36	43.23
14.6400	43.10	42.96	42.85	42.73	42.61
14.6900	42.49	42.37	42.26	42.14	42.02
14.7400	41.91	41.80	41.69	41.59	41.48
14.7900	41.37	41.27	41.16	41.06	40.95
14.8400	40.85	40.76	40.66	40.56	40.46
14.8900	40.36	40.27	40.17	40.07	39.98
14.9400	39.89	39.79	39.70	39.61	39.52
14.9900	39.43	39.33	39.24	39.16	39.07
15.0400	38.98	38.89	38.80	38.72	38.63
15.0900	38.54	38.45	38.37	38.28	38.20
15.1400	38.11	38.03	37.94	37.86	37.77
15.1900	37.69	37.61	37.52	37.44	37.36
15.2400	37.27	37.19	37.11	37.02	36.94
15.2900	36.86	36.78	36.69	36.61	36.53
15.3400	36.45	36.36	36.28	36.20	36.12
15.3900	36.03	35.95	35.87	35.79	35.71
15.4400	35.63	35.54	35.46	35.38	35.30
15.4900	35.22	35.14	35.06	34.98	34.89
15.5400	34.81	34.73	34.65	34.57	34.49
15.5900	34.41	34.33	34.25	34.17	34.09
15.6400	34.01	33.93	33.85	33.77	33.69
15.6900	33.61	33.52	33.44	33.36	33.28
15.7400	33.20	33.13	33.05	32.97	32.89
15.7900	32.81	32.73	32.65	32.57	32.49
15.8400	32.41	32.33	32.25	32.17	32.09
15.8900	32.01	31.93	31.85	31.77	31.69
15.9400	31.62	31.54	31.46	31.38	31.30
15.9900	31.22	31.14	31.06	30.98	30.90
16.0400	30.82	30.75	30.67	30.59	30.51
16.0900	30.43	30.35	30.27	30.20	30.12
16.1400	30.04	29.96	29.89	29.81	29.73
16.1900	29.66	29.58	29.51	29.43	29.36
16.2400	29.29	29.21	29.14	29.06	29.00
16.2900	28.93	28.86	28.79	28.72	28.65
16.3400	28.58	28.52	28.45	28.39	28.33
16.3900	28.27	28.21	28.14	28.08	28.02
16.4400	27.96	27.90	27.85	27.80	27.74
16.4900	27.69	27.63	27.58	27.53	27.47

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
16.5400	27.42	27.38	27.33	27.28	27.24
16.5900	27.19	27.14	27.10	27.05	27.01
16.6400	26.96	26.92	26.88	26.84	26.80
16.6900	26.76	26.72	26.68	26.64	26.60
16.7400	26.56	26.52	26.49	26.45	26.41
16.7900	26.37	26.34	26.30	26.26	26.23
16.8400	26.20	26.16	26.13	26.09	26.06
16.8900	26.02	25.99	25.95	25.92	25.89
16.9400	25.86	25.82	25.79	25.76	25.72
16.9900	25.69	25.66	25.63	25.60	25.56
17.0400	25.53	25.50	25.47	25.44	25.41
17.0900	25.38	25.35	25.31	25.28	25.25
17.1400	25.22	25.19	25.16	25.13	25.10
17.1900	25.07	25.04	25.01	24.98	24.95
17.2400	24.92	24.89	24.86	24.83	24.80
17.2900	24.77	24.74	24.71	24.68	24.65
17.3400	24.62	24.59	24.56	24.53	24.50
17.3900	24.47	24.44	24.41	24.38	24.36
17.4400	24.33	24.30	24.27	24.24	24.21
17.4900	24.18	24.15	24.12	24.09	24.06
17.5400	24.04	24.01	23.98	23.95	23.92
17.5900	23.89	23.86	23.84	23.81	23.78
17.6400	23.75	23.72	23.69	23.66	23.64
17.6900	23.61	23.58	23.55	23.52	23.49
17.7400	23.46	23.44	23.41	23.38	23.35
17.7900	23.32	23.29	23.27	23.24	23.21
17.8400	23.18	23.15	23.12	23.09	23.07
17.8900	23.04	23.01	22.98	22.95	22.92
17.9400	22.89	22.87	22.84	22.81	22.78
17.9900	22.75	22.72	22.69	22.67	22.64
18.0400	22.61	22.58	22.55	22.52	22.49
18.0900	22.46	22.44	22.41	22.38	22.35
18.1400	22.32	22.29	22.26	22.23	22.21
18.1900	22.18	22.15	22.12	22.09	22.06
18.2400	22.03	22.00	21.98	21.95	21.92
18.2900	21.89	21.86	21.83	21.80	21.77
18.3400	21.75	21.72	21.69	21.66	21.63
18.3900	21.60	21.57	21.54	21.52	21.49
18.4400	21.46	21.43	21.40	21.37	21.34
18.4900	21.32	21.29	21.26	21.23	21.20
18.5400	21.17	21.14	21.12	21.09	21.06
18.5900	21.03	21.00	20.97	20.94	20.92
18.6400	20.89	20.86	20.83	20.80	20.77
18.6900	20.74	20.72	20.69	20.66	20.63
18.7400	20.60	20.57	20.54	20.52	20.49

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
18.7900	20.46	20.43	20.40	20.37	20.34
18.8400	20.31	20.29	20.26	20.23	20.20
18.8900	20.17	20.14	20.11	20.08	20.05
18.9400	20.02	20.00	19.97	19.94	19.91
18.9900	19.88	19.85	19.82	19.79	19.76
19.0400	19.73	19.71	19.68	19.65	19.62
19.0900	19.59	19.56	19.53	19.50	19.47
19.1400	19.44	19.41	19.39	19.36	19.33
19.1900	19.30	19.27	19.24	19.21	19.18
19.2400	19.15	19.12	19.10	19.07	19.04
19.2900	19.01	18.98	18.95	18.92	18.89
19.3400	18.86	18.84	18.81	18.78	18.75
19.3900	18.72	18.69	18.66	18.63	18.60
19.4400	18.58	18.55	18.52	18.49	18.46
19.4900	18.43	18.40	18.37	18.35	18.32
19.5400	18.29	18.26	18.23	18.20	18.17
19.5900	18.14	18.11	18.09	18.06	18.03
19.6400	18.00	17.97	17.94	17.91	17.88
19.6900	17.85	17.83	17.80	17.77	17.74
19.7400	17.71	17.68	17.65	17.62	17.59
19.7900	17.56	17.53	17.50	17.48	17.45
19.8400	17.42	17.39	17.36	17.33	17.30
19.8900	17.27	17.24	17.21	17.18	17.15
19.9400	17.12	17.09	17.07	17.04	17.01
19.9900	16.98	16.95	16.92	16.89	16.86
20.0400	16.83	16.80	16.77	16.75	16.72
20.0900	16.69	16.66	16.63	16.60	16.57
20.1400	16.55	16.52	16.49	16.46	16.44
20.1900	16.41	16.38	16.35	16.33	16.30
20.2400	16.28	16.25	16.23	16.20	16.18
20.2900	16.15	16.12	16.10	16.08	16.06
20.3400	16.03	16.01	15.99	15.97	15.94
20.3900	15.92	15.90	15.88	15.86	15.84
20.4400	15.83	15.81	15.79	15.77	15.75
20.4900	15.73	15.72	15.70	15.69	15.67
20.5400	15.65	15.64	15.62	15.61	15.59
20.5900	15.58	15.57	15.55	15.54	15.53
20.6400	15.52	15.50	15.49	15.48	15.47
20.6900	15.46	15.44	15.43	15.42	15.41
20.7400	15.40	15.39	15.38	15.37	15.36
20.7900	15.35	15.34	15.33	15.32	15.31
20.8400	15.31	15.30	15.29	15.28	15.27
20.8900	15.26	15.25	15.25	15.24	15.23
20.9400	15.22	15.21	15.21	15.20	15.19
20.9900	15.18	15.18	15.17	15.16	15.15

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
21.0400	15.15	15.14	15.13	15.13	15.12
21.0900	15.11	15.10	15.10	15.09	15.08
21.1400	15.08	15.07	15.06	15.06	15.05
21.1900	15.04	15.04	15.03	15.03	15.02
21.2400	15.01	15.01	15.00	14.99	14.99
21.2900	14.98	14.98	14.97	14.96	14.96
21.3400	14.95	14.94	14.94	14.93	14.93
21.3900	14.92	14.91	14.91	14.90	14.90
21.4400	14.89	14.89	14.88	14.87	14.87
21.4900	14.86	14.86	14.85	14.84	14.84
21.5400	14.83	14.83	14.82	14.81	14.81
21.5900	14.80	14.80	14.79	14.79	14.78
21.6400	14.77	14.77	14.76	14.76	14.75
21.6900	14.74	14.74	14.73	14.73	14.72
21.7400	14.72	14.71	14.70	14.70	14.69
21.7900	14.69	14.68	14.68	14.67	14.66
21.8400	14.66	14.65	14.65	14.64	14.64
21.8900	14.63	14.62	14.62	14.61	14.61
21.9400	14.60	14.60	14.59	14.58	14.58
21.9900	14.57	14.57	14.56	14.56	14.55
22.0400	14.54	14.54	14.53	14.53	14.52
22.0900	14.52	14.51	14.51	14.50	14.49
22.1400	14.49	14.48	14.48	14.47	14.47
22.1900	14.46	14.45	14.45	14.44	14.44
22.2400	14.43	14.43	14.42	14.42	14.41
22.2900	14.40	14.40	14.39	14.39	14.38
22.3400	14.38	14.37	14.36	14.36	14.35
22.3900	14.35	14.34	14.34	14.33	14.32
22.4400	14.32	14.31	14.31	14.30	14.30
22.4900	14.29	14.28	14.28	14.27	14.27
22.5400	14.26	14.26	14.25	14.24	14.24
22.5900	14.23	14.23	14.22	14.22	14.21
22.6400	14.21	14.20	14.19	14.19	14.18
22.6900	14.18	14.17	14.17	14.16	14.15
22.7400	14.15	14.14	14.14	14.13	14.13
22.7900	14.12	14.11	14.11	14.10	14.10
22.8400	14.09	14.09	14.08	14.07	14.07
22.8900	14.06	14.06	14.05	14.05	14.04
22.9400	14.03	14.03	14.02	14.02	14.01
22.9900	14.01	14.00	13.99	13.99	13.98
23.0400	13.98	13.97	13.97	13.96	13.96
23.0900	13.95	13.94	13.94	13.93	13.93
23.1400	13.92	13.92	13.91	13.90	13.90
23.1900	13.89	13.89	13.88	13.88	13.87
23.2400	13.86	13.86	13.85	13.85	13.84

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
23.2900	13.84	13.83	13.82	13.82	13.81
23.3400	13.81	13.80	13.80	13.79	13.78
23.3900	13.78	13.77	13.77	13.76	13.76
23.4400	13.75	13.74	13.74	13.73	13.73
23.4900	13.72	13.72	13.71	13.70	13.70
23.5400	13.69	13.69	13.68	13.68	13.67
23.5900	13.66	13.66	13.65	13.65	13.64
23.6400	13.64	13.63	13.62	13.62	13.61
23.6900	13.61	13.60	13.60	13.59	13.58
23.7400	13.58	13.57	13.57	13.56	13.56
23.7900	13.55	13.54	13.54	13.53	13.53
23.8400	13.52	13.52	13.51	13.50	13.50
23.8900	13.49	13.49	13.48	13.48	13.47
23.9400	13.46	13.46	13.45	13.45	13.44
23.9900	13.44	13.42	13.39	13.37	13.34
24.0400	13.31	13.29	13.26	13.23	13.21
24.0900	13.16	13.09	13.02	12.95	12.88
24.1400	12.80	12.73	12.66	12.59	12.48
24.1900	12.34	12.19	12.05	11.90	11.75
24.2400	11.61	11.46	11.31	11.14	10.93
24.2900	10.73	10.52	10.32	10.11	9.90
24.3400	9.70	9.49	9.28	9.06	8.84
24.3900	8.61	8.39	8.17	7.95	7.73
24.4400	7.50	7.29	7.08	6.88	6.67
24.4900	6.46	6.25	6.05	5.84	5.63
24.5400	5.44	5.27	5.09	4.92	4.75
24.5900	4.57	4.40	4.22	4.05	3.90
24.6400	3.77	3.65	3.52	3.40	3.27
24.6900	3.14	3.02	2.89	2.79	2.70
24.7400	2.61	2.52	2.43	2.35	2.26
24.7900	2.17	2.08	2.01	1.94	1.88
24.8400	1.82	1.75	1.69	1.63	1.57
24.8900	1.50	1.45	1.40	1.36	1.31
24.9400	1.26	1.22	1.17	1.12	1.08
24.9900	1.04	1.00	.97	.94	.90
25.0400	.87	.84	.81	.77	.74
25.0900	.72	.70	.67	.65	.62
25.1400	.60	.58	.55	.53	.51
25.1900	.50	.48	.46	.45	.43
25.2400	.41	.39	.38	.37	.35
25.2900	.34	.33	.32	.30	.29
25.3400	.28	.27	.26	.25	.24
25.3900	.23	.22	.22	.21	.20
25.4400	.19	.18	.18	.17	.16
25.4900	.16	.15	.14	.14	.13

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
25.5400	.13	.12	.12	.11	.11
25.5900	.10	.10	.09	.09	.09
25.6400	.08	.08	.08	.07	.07
25.6900	.07	.06	.06	.06	.06
25.7400	.05	.05	.05	.05	.04
25.7900	.04	.04	.04	.04	.03
25.8400	.03	.03	.03	.03	.02
25.8900	.02	.02	.02	.02	.02
25.9400	.02	.02	.01	.01	.01
25.9900	.01	.01	.01	.01	.01
26.0400	.01	.01	.00	.00	.00
26.0900	.00	.00	.00	.00	.00
26.1400	.00				

SUMMARY FOR HYDROGRAPH ADDITION
at Node: CB E4006

HYG Directory: U:\soh\Engineering\Coal Pile\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 20	COAL PILE	work_pad.hyg	COAL PILE	25 yr
ADDLINK 10	EAST FORK POPLAR	work_pad.hyg	EAST FORK POPLAR	25 yr

INFLOWS TO: CB E4006

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	COAL PILE	25 yr	1.447	11.9200	23.55
work_pad.hyg	EAST FORK POPLAR	25 yr	69.656	12.3100	582.10

TOTAL FLOW INTO: CB E4006

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	CB E4006	25 yr	71.103	12.3100	584.77

TOTAL NODE INFLOW...
HYG file = U:\soh\Engineering\Coal Pile\work_pad.hyg
HYG ID = CB E4006
HYG Tag = 25 yr

Peak Discharge =	584.77 cfs
Time to Peak =	12.3100 hrs
HYG Volume =	71.103 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
.7700	.00	.00	.00	.00	.00
.8200	.00	.01	.01	.01	.01
.8700	.01	.01	.01	.01	.01
.9200	.02	.02	.02	.02	.02
.9700	.02	.02	.02	.02	.02
1.0200	.03	.03	.03	.03	.03
1.0700	.03	.03	.03	.03	.03
1.1200	.03	.04	.04	.04	.04
1.1700	.04	.04	.04	.04	.04
1.2200	.04	.04	.05	.05	.05
1.2700	.05	.05	.05	.05	.05
1.3200	.05	.05	.05	.06	.06
1.3700	.06	.06	.06	.06	.06
1.4200	.06	.06	.06	.06	.06
1.4700	.07	.07	.07	.07	.07
1.5200	.07	.07	.07	.07	.07
1.5700	.07	.07	.07	.07	.08
1.6200	.08	.08	.08	.08	.08
1.6700	.08	.08	.08	.08	.08
1.7200	.08	.08	.09	.09	.09
1.7700	.09	.09	.09	.09	.09
1.8200	.09	.09	.09	.09	.09
1.8700	.09	.09	.10	.10	.10
1.9200	.10	.10	.10	.10	.10
1.9700	.10	.10	.10	.10	.10
2.0200	.10	.10	.10	.11	.11
2.0700	.11	.11	.11	.11	.11
2.1200	.11	.11	.11	.11	.11
2.1700	.11	.11	.11	.11	.11
2.2200	.12	.12	.12	.12	.12
2.2700	.12	.12	.12	.12	.12

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
2.3200	.12	.12	.12	.12	.12
2.3700	.12	.12	.12	.13	.13
2.4200	.13	.13	.13	.13	.13
2.4700	.13	.13	.13	.13	.13
2.5200	.13	.13	.13	.13	.13
2.5700	.13	.14	.14	.14	.14
2.6200	.14	.14	.14	.14	.14
2.6700	.14	.14	.14	.14	.14
2.7200	.14	.14	.14	.14	.14
2.7700	.14	.14	.15	.15	.15
2.8200	.15	.15	.15	.15	.15
2.8700	.15	.15	.15	.15	.15
2.9200	.15	.15	.15	.15	.15
2.9700	.15	.15	.15	.16	.16
3.0200	.16	.16	.16	.16	.16
3.0700	.16	.16	.16	.16	.16
3.1200	.16	.16	.16	.16	.16
3.1700	.16	.16	.16	.16	.16
3.2200	.16	.17	.17	.17	.17
3.2700	.17	.17	.17	.17	.17
3.3200	.17	.17	.17	.17	.17
3.3700	.17	.17	.17	.17	.17
3.4200	.17	.17	.17	.17	.18
3.4700	.18	.18	.18	.18	.18
3.5200	.18	.18	.18	.18	.18
3.5700	.18	.18	.18	.18	.18
3.6200	.18	.18	.18	.18	.18
3.6700	.18	.18	.18	.18	.19
3.7200	.19	.19	.19	.19	.19
3.7700	.19	.19	.19	.19	.19
3.8200	.19	.19	.19	.19	.19
3.8700	.19	.19	.19	.19	.19
3.9200	.19	.19	.19	.19	.19
3.9700	.19	.19	.19	.19	.20
4.0200	.20	.20	.20	.20	.20
4.0700	.20	.20	.20	.20	.20
4.1200	.20	.20	.20	.20	.20
4.1700	.20	.20	.20	.20	.20
4.2200	.21	.21	.21	.21	.21
4.2700	.21	.21	.21	.21	.21
4.3200	.21	.21	.21	.21	.21
4.3700	.21	.21	.21	.21	.21
4.4200	.21	.22	.22	.22	.22
4.4700	.22	.22	.22	.22	.22
4.5200	.22	.22	.22	.22	.22

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
4.5700	.22	.22	.22	.22	.22
4.6200	.22	.22	.23	.23	.23
4.6700	.23	.23	.23	.23	.23
4.7200	.23	.23	.23	.23	.23
4.7700	.23	.23	.23	.23	.23
4.8200	.23	.23	.24	.24	.24
4.8700	.24	.24	.24	.24	.24
4.9200	.24	.24	.24	.24	.24
4.9700	.24	.24	.24	.24	.24
5.0200	.24	.24	.24	.25	.25
5.0700	.25	.25	.25	.25	.25
5.1200	.25	.25	.25	.25	.25
5.1700	.25	.25	.25	.25	.25
5.2200	.25	.25	.25	.25	.26
5.2700	.26	.26	.26	.26	.26
5.3200	.26	.26	.26	.26	.26
5.3700	.26	.26	.26	.26	.26
5.4200	.26	.26	.26	.26	.26
5.4700	.26	.27	.27	.27	.27
5.5200	.27	.27	.27	.27	.27
5.5700	.27	.27	.27	.27	.27
5.6200	.27	.27	.27	.27	.27
5.6700	.27	.27	.27	.28	.28
5.7200	.28	.28	.28	.28	.28
5.7700	.28	.28	.28	.28	.28
5.8200	.28	.28	.28	.28	.28
5.8700	.28	.28	.28	.28	.28
5.9200	.28	.29	.29	.29	.29
5.9700	.29	.29	.29	.29	.29
6.0200	.29	.29	.29	.29	.29
6.0700	.29	.29	.30	.30	.30
6.1200	.30	.30	.30	.30	.31
6.1700	.31	.31	.31	.31	.31
6.2200	.32	.32	.33	.33	.33
6.2700	.34	.34	.34	.35	.36
6.3200	.36	.37	.38	.38	.39
6.3700	.40	.40	.41	.42	.43
6.4200	.44	.45	.46	.47	.48
6.4700	.49	.50	.52	.53	.54
6.5200	.55	.57	.58	.59	.61
6.5700	.62	.64	.65	.67	.69
6.6200	.70	.72	.73	.75	.77
6.6700	.78	.80	.82	.84	.86
6.7200	.87	.89	.91	.93	.95
6.7700	.97	.99	1.01	1.03	1.05

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
6.8200	1.06	1.08	1.11	1.13	1.15
6.8700	1.17	1.19	1.21	1.23	1.25
6.9200	1.27	1.29	1.32	1.34	1.36
6.9700	1.38	1.40	1.42	1.45	1.47
7.0200	1.49	1.51	1.54	1.56	1.58
7.0700	1.60	1.63	1.65	1.67	1.69
7.1200	1.72	1.74	1.76	1.79	1.81
7.1700	1.83	1.86	1.88	1.90	1.93
7.2200	1.95	1.98	2.00	2.02	2.05
7.2700	2.07	2.10	2.12	2.14	2.17
7.3200	2.19	2.22	2.24	2.27	2.29
7.3700	2.32	2.34	2.37	2.39	2.42
7.4200	2.44	2.46	2.49	2.51	2.54
7.4700	2.57	2.59	2.62	2.64	2.67
7.5200	2.69	2.72	2.74	2.77	2.79
7.5700	2.82	2.84	2.87	2.90	2.92
7.6200	2.95	2.97	3.00	3.02	3.05
7.6700	3.08	3.10	3.13	3.15	3.18
7.7200	3.21	3.23	3.26	3.29	3.31
7.7700	3.34	3.37	3.39	3.42	3.44
7.8200	3.47	3.50	3.52	3.55	3.58
7.8700	3.60	3.63	3.66	3.68	3.71
7.9200	3.74	3.76	3.79	3.82	3.85
7.9700	3.87	3.90	3.93	3.95	3.98
8.0200	4.01	4.04	4.07	4.09	4.12
8.0700	4.15	4.18	4.21	4.24	4.26
8.1200	4.29	4.32	4.35	4.38	4.41
8.1700	4.44	4.47	4.51	4.54	4.57
8.2200	4.60	4.63	4.66	4.69	4.73
8.2700	4.76	4.79	4.83	4.86	4.90
8.3200	4.93	4.96	5.00	5.03	5.07
8.3700	5.11	5.15	5.18	5.22	5.26
8.4200	5.30	5.34	5.37	5.41	5.46
8.4700	5.50	5.54	5.58	5.62	5.67
8.5200	5.71	5.75	5.79	5.84	5.89
8.5700	5.93	5.98	6.02	6.07	6.12
8.6200	6.16	6.21	6.26	6.31	6.36
8.6700	6.41	6.46	6.51	6.56	6.61
8.7200	6.66	6.71	6.76	6.82	6.87
8.7700	6.93	6.98	7.03	7.08	7.14
8.8200	7.19	7.25	7.31	7.36	7.42
8.8700	7.48	7.54	7.59	7.65	7.71
8.9200	7.77	7.83	7.89	7.95	8.01
8.9700	8.07	8.13	8.19	8.25	8.31
9.0200	8.37	8.43	8.50	8.56	8.62

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
9.0700	8.68	8.74	8.81	8.87	8.93
9.1200	9.00	9.06	9.12	9.19	9.25
9.1700	9.31	9.38	9.44	9.50	9.57
9.2200	9.63	9.69	9.76	9.82	9.88
9.2700	9.94	10.01	10.07	10.13	10.19
9.3200	10.25	10.31	10.38	10.44	10.50
9.3700	10.55	10.61	10.67	10.73	10.79
9.4200	10.85	10.91	10.96	11.02	11.07
9.4700	11.13	11.18	11.24	11.29	11.35
9.5200	11.40	11.46	11.51	11.57	11.62
9.5700	11.67	11.73	11.78	11.83	11.89
9.6200	11.94	12.00	12.05	12.11	12.16
9.6700	12.22	12.27	12.33	12.38	12.43
9.7200	12.49	12.55	12.61	12.67	12.73
9.7700	12.79	12.84	12.90	12.96	13.03
9.8200	13.09	13.16	13.22	13.29	13.36
9.8700	13.42	13.49	13.56	13.63	13.71
9.9200	13.78	13.86	13.93	14.01	14.09
9.9700	14.16	14.24	14.33	14.42	14.50
10.0200	14.59	14.67	14.76	14.85	14.94
10.0700	15.03	15.13	15.23	15.33	15.42
10.1200	15.52	15.62	15.72	15.82	15.93
10.1700	16.04	16.15	16.26	16.37	16.48
10.2200	16.59	16.70	16.81	16.93	17.05
10.2700	17.17	17.30	17.42	17.54	17.66
10.3200	17.78	17.90	18.03	18.17	18.31
10.3700	18.44	18.58	18.71	18.85	18.98
10.4200	19.11	19.25	19.40	19.55	19.70
10.4700	19.85	20.00	20.15	20.29	20.44
10.5200	20.59	20.75	20.92	21.08	21.25
10.5700	21.41	21.57	21.73	21.89	22.06
10.6200	22.24	22.41	22.59	22.78	22.96
10.6700	23.14	23.32	23.49	23.68	23.87
10.7200	24.07	24.26	24.46	24.66	24.86
10.7700	25.06	25.26	25.46	25.68	25.90
10.8200	26.12	26.33	26.56	26.78	27.00
10.8700	27.22	27.46	27.70	27.94	28.18
10.9200	28.42	28.67	28.92	29.16	29.41
10.9700	29.67	29.94	30.21	30.48	30.75
11.0200	31.02	31.30	31.58	31.86	32.16
11.0700	32.47	32.78	33.08	33.39	33.69
11.1200	34.00	34.31	34.63	34.97	35.33
11.1700	35.69	36.05	36.40	36.75	37.10
11.2200	37.45	37.80	38.20	38.62	39.04
11.2700	39.46	39.87	40.28	40.69	41.09

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
11.3200	41.50	41.96	42.45	42.94	43.43
11.3700	43.92	44.41	44.89	45.37	45.84
11.4200	46.38	46.95	47.52	48.10	48.67
11.4700	49.24	49.81	50.38	50.95	51.69
11.5200	52.57	53.52	54.56	55.63	56.71
11.5700	57.75	58.75	59.69	61.06	62.70
11.6200	64.41	66.26	68.25	70.32	72.37
11.6700	74.36	76.26	79.13	82.49	85.85
11.7200	89.29	92.89	96.64	100.49	104.31
11.7700	108.05	113.86	120.60	127.27	134.00
11.8200	140.95	148.24	155.89	163.74	171.56
11.8700	182.14	193.80	205.20	216.36	227.26
11.9200	237.87	248.13	258.05	267.76	279.84
11.9700	293.02	306.33	319.81	333.37	346.86
12.0200	360.08	372.86	385.19	397.00	408.74
12.0700	420.68	432.92	445.49	458.33	471.36
12.1200	484.53	497.79	507.33	515.51	523.74
12.1700	532.01	540.30	548.63	556.97	565.33
12.2200	573.69	576.61	577.61	578.61	579.61
12.2700	580.63	581.65	582.69	583.73	584.77
12.3200	581.39	576.54	571.69	566.82	561.96
12.3700	557.10	552.25	547.42	542.59	535.13
12.4200	526.87	518.59	510.30	502.01	493.72
12.4700	485.43	477.15	468.89	459.94	450.79
12.5200	441.64	432.49	423.33	414.17	405.01
12.5700	395.86	386.71	378.48	370.51	362.54
12.6200	354.57	346.59	338.62	330.64	322.67
12.6700	314.70	308.21	302.08	295.96	289.84
12.7200	283.72	277.59	271.47	265.34	259.21
12.7700	254.20	249.45	244.70	239.96	235.21
12.8200	230.46	225.71	220.96	216.20	212.27
12.8700	208.50	204.73	200.97	197.21	193.45
12.9200	189.68	185.92	182.15	179.06	176.10
12.9700	173.14	170.18	167.22	164.26	161.31
13.0200	158.35	155.39	153.00	150.70	148.39
13.0700	146.09	143.80	141.50	139.20	136.91
13.1200	134.61	132.75	130.94	129.14	127.33
13.1700	125.53	123.73	121.93	120.13	118.33
13.2200	116.87	115.44	114.02	112.60	111.17
13.2700	109.75	108.33	106.90	105.48	104.32
13.3200	103.18	102.03	100.89	99.75	98.61
13.3700	97.46	96.32	95.18	94.23	93.31
13.4200	92.38	91.45	90.52	89.58	88.65
13.4700	87.72	86.79	86.01	85.25	84.48
13.5200	83.72	82.95	82.19	81.42	80.65

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
13.5700	79.89	79.24	78.60	77.96	77.32
13.6200	76.68	76.04	75.40	74.76	74.12
13.6700	73.57	73.02	72.47	71.92	71.38
13.7200	70.83	70.28	69.73	69.18	68.69
13.7700	68.21	67.72	67.24	66.75	66.27
13.8200	65.79	65.30	64.82	64.38	63.94
13.8700	63.50	63.06	62.63	62.19	61.76
13.9200	61.32	60.88	60.49	60.09	59.70
13.9700	59.30	58.91	58.52	58.13	57.74
14.0200	57.35	57.01	56.68	56.34	56.00
14.0700	55.67	55.34	55.00	54.67	54.34
14.1200	54.06	53.78	53.50	53.23	52.95
14.1700	52.67	52.39	52.12	51.84	51.61
14.2200	51.37	51.13	50.89	50.66	50.42
14.2700	50.18	49.94	49.71	49.50	49.29
14.3200	49.08	48.87	48.66	48.45	48.24
14.3700	48.03	47.82	47.64	47.46	47.28
14.4200	47.09	46.91	46.73	46.55	46.37
14.4700	46.19	46.03	45.87	45.72	45.56
14.5200	45.40	45.25	45.09	44.93	44.78
14.5700	44.64	44.51	44.37	44.24	44.10
14.6200	43.97	43.83	43.70	43.56	43.44
14.6700	43.33	43.21	43.09	42.97	42.85
14.7200	42.73	42.61	42.50	42.39	42.28
14.7700	42.17	42.06	41.96	41.85	41.74
14.8200	41.64	41.53	41.43	41.33	41.23
14.8700	41.13	41.03	40.93	40.84	40.74
14.9200	40.64	40.55	40.45	40.36	40.26
14.9700	40.17	40.08	39.98	39.89	39.80
15.0200	39.71	39.62	39.53	39.44	39.35
15.0700	39.26	39.17	39.09	39.00	38.91
15.1200	38.83	38.74	38.65	38.57	38.48
15.1700	38.39	38.31	38.22	38.14	38.05
15.2200	37.97	37.88	37.80	37.71	37.63
15.2700	37.54	37.46	37.38	37.29	37.21
15.3200	37.13	37.04	36.96	36.87	36.79
15.3700	36.71	36.62	36.54	36.46	36.38
15.4200	36.29	36.21	36.13	36.04	35.96
15.4700	35.88	35.79	35.71	35.63	35.55
15.5200	35.47	35.38	35.30	35.22	35.14
15.5700	35.05	34.97	34.89	34.81	34.73
15.6200	34.64	34.56	34.48	34.40	34.32
15.6700	34.24	34.15	34.07	33.99	33.91
15.7200	33.83	33.75	33.67	33.59	33.50
15.7700	33.42	33.34	33.26	33.18	33.10

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0100 hrs
Time on left represents time for first value in each row.

Time hrs					
15.8200	33.02	32.94	32.86	32.78	32.70
15.8700	32.62	32.54	32.45	32.37	32.29
15.9200	32.21	32.13	32.05	31.97	31.89
15.9700	31.81	31.73	31.65	31.57	31.49
16.0200	31.41	31.33	31.25	31.17	31.09
16.0700	31.01	30.93	30.85	30.77	30.69
16.1200	30.62	30.54	30.46	30.38	30.30
16.1700	30.22	30.15	30.07	30.00	29.92
16.2200	29.85	29.77	29.70	29.62	29.55
16.2700	29.47	29.41	29.34	29.27	29.20
16.3200	29.13	29.06	28.99	28.92	28.86
16.3700	28.79	28.73	28.67	28.61	28.55
16.4200	28.49	28.43	28.36	28.31	28.25
16.4700	28.20	28.14	28.09	28.04	27.98
16.5200	27.93	27.87	27.82	27.77	27.73
16.5700	27.68	27.63	27.59	27.54	27.49
16.6200	27.44	27.40	27.36	27.32	27.27
16.6700	27.23	27.19	27.15	27.11	27.07
16.7200	27.03	26.99	26.95	26.91	26.87
16.7700	26.84	26.80	26.76	26.72	26.69
16.8200	26.65	26.62	26.58	26.54	26.51
16.8700	26.47	26.44	26.40	26.37	26.34
16.9200	26.30	26.27	26.24	26.20	26.17
16.9700	26.14	26.10	26.07	26.04	26.01
17.0200	25.97	25.94	25.91	25.88	25.84
17.0700	25.81	25.78	25.75	25.72	25.69
17.1200	25.66	25.62	25.59	25.56	25.53
17.1700	25.50	25.47	25.44	25.41	25.38
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17.2700	25.19	25.16	25.13	25.10	25.07
17.3200	25.04	25.01	24.98	24.95	24.92
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17.4700	24.59	24.57	24.54	24.51	24.48
17.5200	24.45	24.42	24.39	24.36	24.33
17.5700	24.30	24.27	24.24	24.21	24.18
17.6200	24.16	24.13	24.10	24.07	24.04
17.6700	24.01	23.98	23.95	23.92	23.90
17.7200	23.87	23.84	23.81	23.78	23.75
17.7700	23.72	23.69	23.66	23.63	23.61
17.8200	23.58	23.55	23.52	23.49	23.46
17.8700	23.43	23.40	23.37	23.35	23.32
17.9200	23.29	23.26	23.23	23.20	23.17
17.9700	23.14	23.11	23.08	23.05	23.03
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Time on left represents time for first value in each row.

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18.2200	22.41	22.38	22.35	22.32	22.30
18.2700	22.27	22.24	22.21	22.18	22.15
18.3200	22.12	22.09	22.06	22.03	22.00
18.3700	21.97	21.94	21.92	21.89	21.86
18.4200	21.83	21.80	21.77	21.74	21.71
18.4700	21.68	21.65	21.63	21.60	21.57
18.5200	21.54	21.51	21.48	21.45	21.42
18.5700	21.39	21.36	21.33	21.31	21.28
18.6200	21.25	21.22	21.19	21.16	21.13
18.6700	21.10	21.07	21.05	21.02	20.99
18.7200	20.96	20.93	20.90	20.87	20.84
18.7700	20.81	20.78	20.75	20.72	20.70
18.8200	20.67	20.64	20.61	20.58	20.55
18.8700	20.52	20.49	20.46	20.43	20.40
18.9200	20.37	20.34	20.31	20.28	20.25
18.9700	20.23	20.20	20.17	20.14	20.11
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19.0700	19.93	19.90	19.87	19.84	19.81
19.1200	19.78	19.75	19.72	19.69	19.66
19.1700	19.63	19.61	19.58	19.55	19.52
19.2200	19.49	19.46	19.43	19.40	19.37
19.2700	19.34	19.31	19.28	19.25	19.22
19.3200	19.19	19.16	19.14	19.11	19.08
19.3700	19.05	19.02	18.99	18.96	18.93
19.4200	18.90	18.87	18.84	18.81	18.78
19.4700	18.75	18.73	18.70	18.67	18.64
19.5200	18.61	18.58	18.55	18.52	18.49
19.5700	18.46	18.43	18.40	18.37	18.34
19.6200	18.31	18.29	18.26	18.23	18.20
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19.7200	18.02	17.99	17.96	17.93	17.90
19.7700	17.87	17.84	17.81	17.78	17.75
19.8200	17.72	17.69	17.67	17.64	17.61
19.8700	17.58	17.55	17.52	17.49	17.46
19.9200	17.43	17.40	17.37	17.34	17.31
19.9700	17.28	17.25	17.22	17.19	17.16
20.0200	17.13	17.10	17.07	17.04	17.01
20.0700	16.98	16.96	16.93	16.90	16.87
20.1200	16.84	16.81	16.78	16.76	16.73
20.1700	16.70	16.67	16.64	16.62	16.59
20.2200	16.56	16.54	16.51	16.49	16.46
20.2700	16.44	16.41	16.39	16.36	16.34

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20.4200	16.10	16.08	16.06	16.04	16.02
20.4700	16.00	15.99	15.97	15.95	15.94
20.5200	15.92	15.90	15.89	15.87	15.86
20.5700	15.84	15.83	15.81	15.80	15.79
20.6200	15.77	15.76	15.75	15.74	15.72
20.6700	15.71	15.70	15.69	15.68	15.67
20.7200	15.66	15.64	15.63	15.62	15.61
20.7700	15.60	15.59	15.58	15.57	15.56
20.8200	15.55	15.55	15.54	15.53	15.52
20.8700	15.51	15.50	15.49	15.48	15.48
20.9200	15.47	15.46	15.45	15.44	15.44
20.9700	15.43	15.42	15.41	15.40	15.40
21.0200	15.39	15.38	15.38	15.37	15.36
21.0700	15.35	15.35	15.34	15.33	15.33
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21.2200	15.25	15.25	15.24	15.23	15.23
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21.3200	15.19	15.18	15.18	15.17	15.16
21.3700	15.16	15.15	15.15	15.14	15.13
21.4200	15.13	15.12	15.12	15.11	15.10
21.4700	15.10	15.09	15.09	15.08	15.07
21.5200	15.07	15.06	15.06	15.05	15.04
21.5700	15.04	15.03	15.03	15.02	15.01
21.6200	15.01	15.00	15.00	14.99	14.98
21.6700	14.98	14.97	14.97	14.96	14.96
21.7200	14.95	14.94	14.94	14.93	14.93
21.7700	14.92	14.91	14.91	14.90	14.90
21.8200	14.89	14.88	14.88	14.87	14.87
21.8700	14.86	14.86	14.85	14.84	14.84
21.9200	14.83	14.83	14.82	14.82	14.81
21.9700	14.80	14.80	14.79	14.79	14.78
22.0200	14.78	14.77	14.76	14.76	14.75
22.0700	14.75	14.74	14.74	14.73	14.72
22.1200	14.72	14.71	14.71	14.70	14.70
22.1700	14.69	14.68	14.68	14.67	14.67
22.2200	14.66	14.66	14.65	14.64	14.64
22.2700	14.63	14.63	14.62	14.62	14.61
22.3200	14.60	14.60	14.59	14.59	14.58
22.3700	14.57	14.57	14.56	14.56	14.55
22.4200	14.55	14.54	14.53	14.53	14.52
22.4700	14.52	14.51	14.51	14.50	14.49
22.5200	14.49	14.48	14.48	14.47	14.47

HYDROGRAPH ORDINATES (cfs)
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Time on left represents time for first value in each row.

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22.7200	14.37	14.37	14.36	14.36	14.35
22.7700	14.34	14.34	14.33	14.33	14.32
22.8200	14.31	14.31	14.30	14.30	14.29
22.8700	14.29	14.28	14.27	14.27	14.26
22.9200	14.26	14.25	14.25	14.24	14.23
22.9700	14.23	14.22	14.22	14.21	14.21
23.0200	14.20	14.19	14.19	14.18	14.18
23.0700	14.17	14.17	14.16	14.15	14.15
23.1200	14.14	14.14	14.13	14.13	14.12
23.1700	14.11	14.11	14.10	14.10	14.09
23.2200	14.08	14.08	14.07	14.07	14.06
23.2700	14.06	14.05	14.04	14.04	14.03
23.3200	14.03	14.02	14.02	14.01	14.00
23.3700	14.00	13.99	13.99	13.98	13.97
23.4200	13.97	13.96	13.96	13.95	13.95
23.4700	13.94	13.93	13.93	13.92	13.92
23.5200	13.91	13.90	13.90	13.89	13.89
23.5700	13.88	13.88	13.87	13.86	13.86
23.6200	13.85	13.85	13.84	13.83	13.83
23.6700	13.82	13.82	13.81	13.81	13.80
23.7200	13.79	13.79	13.78	13.78	13.77
23.7700	13.76	13.76	13.75	13.75	13.74
23.8200	13.74	13.73	13.72	13.72	13.71
23.8700	13.71	13.70	13.70	13.69	13.68
23.9200	13.68	13.67	13.67	13.66	13.66
23.9700	13.65	13.64	13.64	13.62	13.59
24.0200	13.56	13.51	13.47	13.41	13.36
24.0700	13.31	13.26	13.20	13.12	13.04
24.1200	12.96	12.89	12.81	12.74	12.67
24.1700	12.59	12.49	12.34	12.19	12.05
24.2200	11.90	11.75	11.61	11.46	11.31
24.2700	11.14	10.93	10.73	10.52	10.32
24.3200	10.11	9.90	9.70	9.49	9.28
24.3700	9.06	8.84	8.61	8.39	8.17
24.4200	7.95	7.73	7.50	7.29	7.08
24.4700	6.88	6.67	6.46	6.25	6.05
24.5200	5.84	5.63	5.44	5.27	5.09
24.5700	4.92	4.75	4.57	4.40	4.22
24.6200	4.05	3.90	3.77	3.65	3.52
24.6700	3.40	3.27	3.14	3.02	2.89
24.7200	2.79	2.70	2.61	2.52	2.43
24.7700	2.35	2.26	2.17	2.08	2.01

HYDROGRAPH ORDINATES (cfs)
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Time on left represents time for first value in each row.

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24.8700	1.63	1.57	1.50	1.45	1.40
24.9200	1.36	1.31	1.26	1.22	1.17
24.9700	1.12	1.08	1.04	1.00	.97
25.0200	.94	.90	.87	.84	.81
25.0700	.77	.74	.72	.70	.67
25.1200	.65	.62	.60	.58	.55
25.1700	.53	.51	.50	.48	.46
25.2200	.45	.43	.41	.39	.38
25.2700	.37	.35	.34	.33	.32
25.3200	.30	.29	.28	.27	.26
25.3700	.25	.24	.23	.22	.22
25.4200	.21	.20	.19	.18	.18
25.4700	.17	.16	.16	.15	.14
25.5200	.14	.13	.13	.12	.12
25.5700	.11	.11	.10	.10	.09
25.6200	.09	.09	.08	.08	.08
25.6700	.07	.07	.07	.06	.06
25.7200	.06	.06	.05	.05	.05
25.7700	.05	.04	.04	.04	.04
25.8200	.04	.03	.03	.03	.03
25.8700	.03	.02	.02	.02	.02
25.9200	.02	.02	.02	.02	.01
25.9700	.01	.01	.01	.01	.01
26.0200	.01	.01	.01	.01	.00
26.0700	.00	.00	.00	.00	.00
26.1200	.00	.00	.00		

Index of Starting Page Numbers for ID Names

Design Analysis and Calculation
Title Page

Calculation No:	CCOALYD-F-002				
Calculation Title:	Coal Storage Area Stabilization Project Stormwater Collection/Retention Area Calculations				
Calculation Status:	**Preliminary** ☐	**Contains Unverified Assumptions and/or Partial Verifications** ☐	**Verified** ☒	**Superseded** ☐	**Voided/Cancelled** ☐
Preparer's Org:	Engineering		**SSC Grade:**	CMX	
Project/Task Name:	Coal Storage Area Stabilization Project Stormwater Collection/Retention Area Calculations				

Abstract (e.g., What, Why, How, Results):

Determine the required stormwater collection/retention area dimensions required to retain the 95th percentile storm event from a paved cover over the former coal storage area in accordance with the EPA technical guidance for Section 438 of the Energy Independence and Security Act. Microsoft excel was used for the mathematical calculations. A stormwater collection/retention area of 260 ft(L) X 42 ft (W) X 3'(D) is required.

List assumptions requiring subsequent verification or scope of partial verification (as applicable):

95th percentile storm event rainfall total and crushed stone porosity were used in calculating the required stormwater collection/retention area dimensions.

Computer Processor Type, Operating System Version, and Software packages used/versions:

Intel processor, Windows XP, Microsoft Excel.

Verification Method (See Y17-69-325)

- ☒ Design Technical Review
- ☐ Comparison with Similar Design
- ☐ Alternative Calculation (Doc. No.)_____
- ☐ Qualification Testing (Doc. No.) _____
- ☐ Other (Specify) _____

Approvals

Rev. No.	Preparer (Print/Sign)	Date	Verifier/Checker (Print/Sign)	Date	Approver (Print/Sign)	Date
0	WILLIAM H. ROBINSON WHR	12.8.2010	STEVE SHULTS SAShults	12/9/10 12/14/10	MICHAEL D. RITTER MDRitter	12/14/10

STEPHEN A. SHULTS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 107691 STATE OF TENNESSEE 3/23/11

Revisions

Rev. No.	Revision Description

~~This document has been reviewed by a Y-12 ADC/~~ UCNI RO and has been determined to be UNCLASSIFIED and contains no UCNI. This review does not constitute clearance for Public Release.

Name: SA Shults Date: ~~12/14/10~~ 3/23/11

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DVR/CHK ~~[illegible]~~ 12/9/10

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Section 1: Objective/Purpose Statement

Construction of the Coal Storage Area Stabilization Project will utilize a coated asphalt surface cover over the location of the former coal storage area to divert the storm water flow from flowing into the sanitary sewer. The flow will be diverted to the Y-12 Storm Drainage System using the proposed asphalt cover and existing concrete swales (with some modifications).

Based on guidance found in "Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act" (EISA 438 Guidance) (reference 1), this project is considered a 'redevelopment' and as such, must comply with EISA 438. EISA 438 states that "The sponsor of an development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow".

The original project goal for the Coal Storage Area Stabilization Project was to contain remaining coal fines remaining from the historical use of the site, divert storm water that currently flows to the sanitary sewer system, and provide a hard surface area to use as a laydown or potentially a future automobile parking area. In order to achieve these stated goals and comply with EISA 438, the project team has chosen to construct a coated asphalt cover over the majority of the former coal storage area, with a stormwater collection/retention area on the downstream side of the project.

This Design Analysis and Calculation (DAC) will provide calculations to support the stormwater collection/retention area size proposed for this project. Based on EISA 438 guidance, the stormwater collection/retention area will be sized to prevent the offsite discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event to the maximum extent technically feasible.

Section 2: References

1. "Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act", EPA, December 2009.
2. "Porosity of Structural Backfill", Stormtech, October 2006.

The criteria used for the Coal Storage Area Stabilization Project is found in the following document:

> Y/EF - 538, "Master Design", DIVISION 5 - CIVIL/SITE DESIGN, Section 5.20.2, December 2007.

The Functional and Operating Requirements for the Coal Storage Area Stabilization Project is:

> FR 940103-F-0001 000 00 – Functional & Operating Requirements for the Coal Storage Area Stabilization Project & the Coal Storage Area Parking Project

Section 3: Design Input/Assumptions

Design Input

1. Asphalt cover area is 2.27 acre
2. 95th percentile storm event for Knoxville Tennessee is 1.5 inches (see Attachment A)
3. void percentage for crushed stone is 40% (see Attachment C),(reference 2)

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Assumptions

- no additional storage is provided for rainwater falling on the stormwater collection/retention area (there is no reason to believe that this storm water would be adversely affected with regard to the temperature, rate, volume, and duration of flow)
- based on site soil conditions, storm water infiltration will be limited
- no provision is made for consecutive storm events (if a second rainfall event occurs before the first event has infiltrated or evaporated, it will result in runoff.)

Section 4: Analytical Methods and Computations

Calculation of collection/retention volume required comply with EISA 438 is a simple area (design input 1) x depth (design input 2) computation once the factors are converted to a common unit (in this case english feet). No time of concentration or routing is applied to the volume estimation. EISA does make provision for a limited amount of 'initial abstraction' or water storage in the ground surface. Because the asphalt will be coated to meet the requirements for reduced heat island affect and in the interest of conservatism, this provision was not utilized.

Storage Volume required (Q) = contributing area (A) X depth of rainfall (i)

The calculation of stormwater collection/retention area storage capacity is also a simple calculation using length x width x depth x void percent (design input 3) to determine the amount of storm water that can be contained in the stormwater collection/retention area. Based on the soil types/conditions at Y-12, no infiltration is accounted for in the storage capacity calculation.

Collection/retention storage volume (V_{it}) = Length (L_{it}) X Width (W_{it}) X Depth (D_{it}) X Voids ($Perc_V$)

In the interest of simplicity and repeatability, a Microsoft Excel spreadsheet was created to perform these straightforward calculations as well as some preliminary calculations required to convert acres to feet and inches to feet.

Microsoft Excel formula proof:

Convert inches to feet
inches/12 = feet
1.5/12 = .125 feet

Convert acres to feet
Acre X (43,560 sf / Acre) =square feet
2.27 X 43,560 = 98,881 sf

Total Runoff Calculation (Step 1)
Q = A X i
Q = 98,881 sf X .125 feet
Q = 12,360 ft^3

Stormwater Storage Calculation (Step 2)
$V_{it} = W_{it} X D_{it} X L_{it} X Perc_V$
V_{it} = 42 ft X 3 ft X 260 ft X .4
V_{it} = 13,104 ft^3

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Section 5: Results

The result of the calculations is that an stormwater collection/retention area 42 **feet wide X 3 feet deep X 260 feet long** will be required to contain the storm water runoff for a 95th percentile storm from the coated asphalt paved portion of the Coal Storage Area Stabilization Project. This stormwater collection/retention area was designed using guidance from EPA in for implementing EISA 438.

The required stormwater collection/retention area dimension can be achieved along the downgradient side (south side) of the existing coal storage area. The stormwater collection/retention area will be excavated adjacent to the existing concrete coal storage area perimeter swale. In the event of a storm event greater than the 95th percentile storm or a storm event occurring when the stormwater collection/retention area contains stormwater, excess flow will overflow into the concrete coal storage area perimeter swale and then into the Y-12 stormwater management system. This overflow will be spread over a wide area and into a concrete lined swale and therefore no erosion or flow related issues are expected.

Section 6: Conclusion

It is understood that soils within the Y-12 complex are not conducive to a great deal of storm water infiltration. This however is the natural hydrogeology of the area. The ultimate stated goal of EISA 438 is to maintain or restore the pre-development site hydrology during the development or redevelopment process. The proposed stormwater collection/retention area will achieve this stated goal and mitigate the environmental impact of the proposed coated asphalt cover.

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Attachment A: 95th Percentile Storm Events for Select US Cities

Option 1 was identified because it is a simplified approach to meet the intent of Section 438 in contrast to Option 2 which requires the designer to conduct a hydrologic analysis of the site based on site-specific conditions.

Table 1. Example 95th Percentile Storm Events for Select U.S. Cities (adapted from Hirschman and Kosco, 2008).

City	95th Percentile Event Rainfall Total (in)	City	95th Percentile Event Rainfall Total (in)
Atlanta, GA	1.8	Kansas City, MO	1.7
Baltimore, MD	1.6	Knoxville, TN	1.5
Boston, MA	1.5	Louisville, KY	1.5
Buffalo, NY	1.1	Minneapolis, MN	1.4
Burlington, VT	1.1	New York, NY	1.7
Charleston, WV	1.2	Salt Lake City, UT	0.8
Coeur D'Alene, ID	0.7	Phoenix, AZ	1.0
Cincinnati, OH	1.5	Portland, OR	1.0
Columbus, OH	1.3	Seattle, WA	1.6
Concord, NH	1.3	Washington, DC	1.7
Denver, CO	1.1		

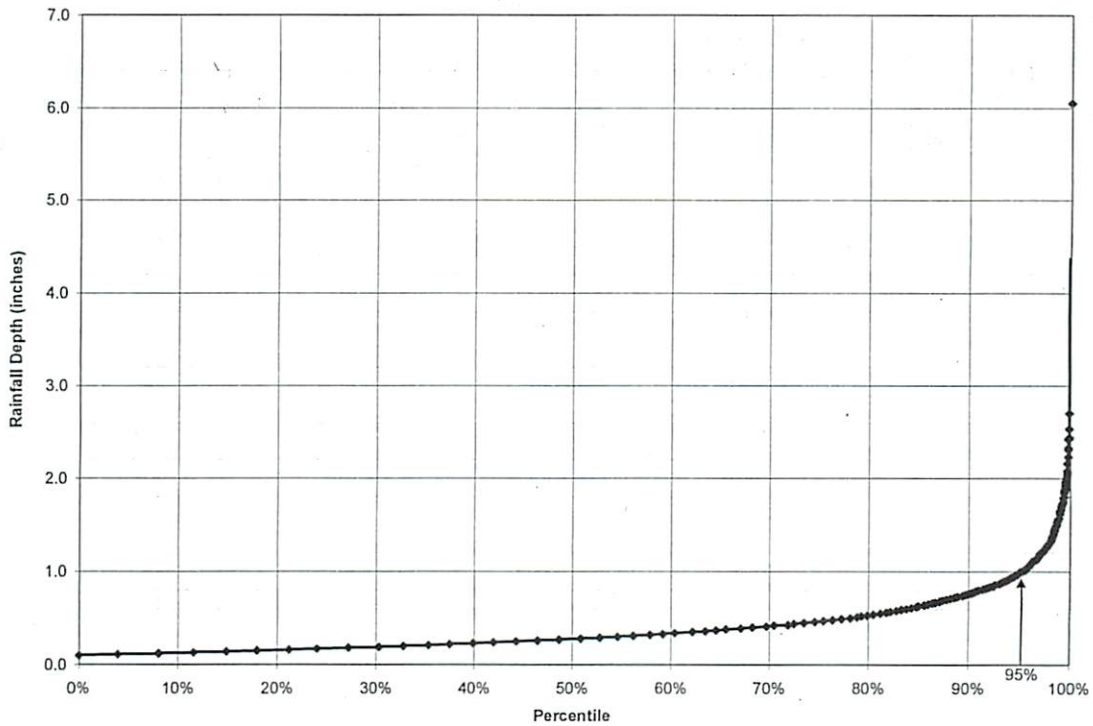

Figure 7. Rainfall Frequency Spectrum showing the 95th percentile rainfall event for Portland, OR (~1.0 inches)

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Attachment B: Typical Stormwater Collection/Retention Area Section

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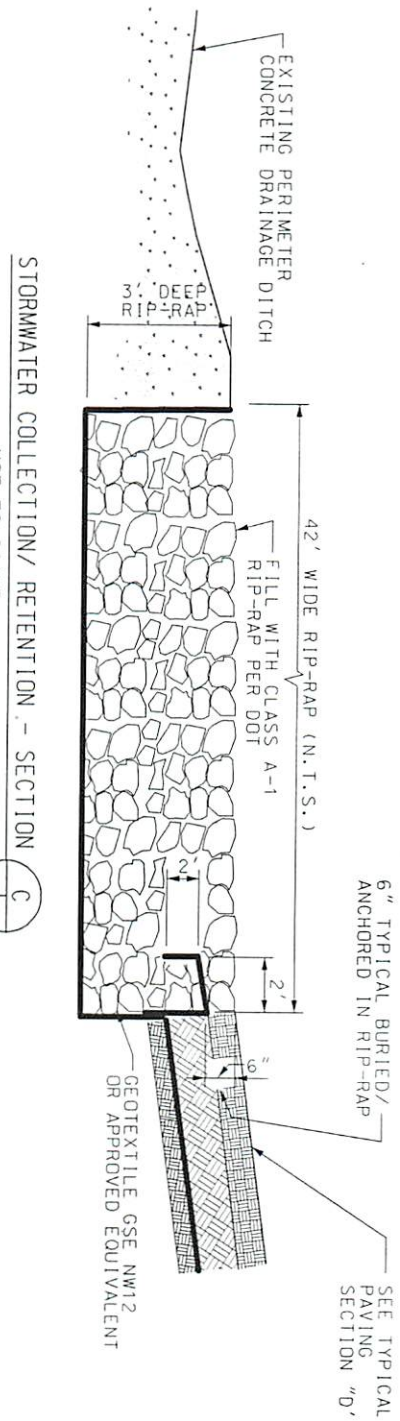

STORMWATER COLLECTION/ RETENTION - SECTION C

NOT TO SCALE

C940103-F-0005

C940103-F-0006

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Attachment C: Porosity of Structural Backfill

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Tech Sheet

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management™

Porosity of Structural Backfill

Tech Sheet # 1
Rev.10/4/06*

General:

StormTech advises that a porosity of 40% is appropriate to use for the storage capacity of structural aggregate used in the bedding and embedment zones around StormTech chambers. This memo provides technical support for the use of a porosity of 40%. The major points of the memo are:

- 40% porosity is appropriate for the clean, open graded, angular aggregate material StormTech recommends for foundation and embedment.
- Most of the porosity data available is based on a compacted condition. StormTech requires compaction of the foundation (bedding) and allows dumped aggregate embedment around the chambers.
- Test data indicates that the average porosity of all gradations of the *compacted* foundation is approximately 40%. The porosity of the *dumped* backfill in the embedment zone is typically greater than 40% and the calculated weighted average porosity therefore exceeds 40% for typical StormTech systems.
- Porosity is protected from soils migration by a non-woven geotextile that surrounds the entire system. For some exfiltration systems, a drainage net is substituted for the geotextile on the bottom of the bed.

Terms:

Porosity (n) is defined as the volume voids over the total volume expressed as a percent: $n = (V_v / V_t) \times 100\%$. Other terms commonly used to describe porosity include; "voids" and "void space". A related term that should not be confused with porosity is *void ratio* (e) which is the volume of voids over the volume of solids expressed as a decimal: $e = V_v / V_s$.

Compilation of Known Test Data:

Sample	Data Source	Porosity	Bulk Density	Test / Description
AASHTO # 4	StormTech lab	39.9%	94.3 lbs/ft^3	dumped, corrected[1]
AASHTO # 57	StormTech lab	45.4%	87.2 lbs/ft^3	dumped, corrected[1]
AASHTO # 4	StormTech lab	37.4%	103.0 lbs/ft^3	jigged & tamped, corrected[1]
AASHTO # 57	StormTech lab	38.7%	97.7 lbs/ft^3	jigged & tamped, corrected[1]
AASHTO # 57	NTH lab	50 - 51%		tapped & agitated, dried[2]
AASHTO # 57	NTH lab	50 - 52 %		tapped & agitated, dried[2]
AASHTO # 3	NTH lab	53 - 54%		tapped & agitated, dried[2]
-1 ½"	Anderson Eng. Cons.	41.9%	96.8 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	35.3%	101.7 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	37.8%	98.6 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	41.3%	93.6 lbs/ft^3	dry rodded, C29[3]
-1 ½"	Anderson Eng. Cons.	38.2%	98.7 lbs/ft^3	dry rodded, C29[3]
-3/4"	Anderson Eng. Cons.	38.5%	100.3 lbs/ft^3	dry rodded, C29[3]
-3/4"	Anderson Eng. Cons.	38.9%	97.9 bs/ft^3	dry rodded, C29[3]

* revisions include corrections to Test / Description terminology and addition of CTL Thompson data

Compilation of Known Test Data:

Sample	Data Source	Porosity	Bulk Density	Test / Description
AASHTO # 4	Universal Eng. Serv.	44.3%	78.6 lbs/ft³	rodded C29[4]
AASHTO # 57	Universal Eng. Serv.	43.2%	79.8 lbs/ft³	rodded C29[4]
AASHTO # 4	Universal Eng. Serv.	46.1%	70.8 lbs/ft³	rodded C29[5]
AASHTO # 57	Universal Eng. Serv.	42.8%	74.8 lbs/ft³	rodded C29[5]
-1 ½" Crushed Rock	CTL Thompson TX	46%	90.5 lbs/ft³	rodded C29[6]
-1" Crushed Rock	CTL Thompson TX	45%	91.6 lbs/ft³	rodded C29[6]
-1 ½" Crushed Conc	CTL Thompson TX	48%	77.1 lbs/ft³	rodded C29[6]

1 Testing was conducted by StormTech in October, 2003 using aggregate from Connecticut. Water was used to fill voids and a correction factor that reduced porosities by 3 to 16% was calculated and applied to correct for wall effects of the test container.

2 Testing was conducted by NTH Consultants, Exton, PA in December, 2002 for ADS. This was dry testing in accordance with the "Civil Engineering Reference Manual, Sixth Edition" by Michael R. Lindburg, PE.

3 Testing was conducted by Anderson Engineering Consultants, Inc., Little Rock, AR in February, 2000 for 7 different aggregate samples from four suppliers in Arkansas.

4 The material tested was lime rock from central Florida. Testing was conducted by University Engineering Sciences in Orlando, FL in November, 2005.

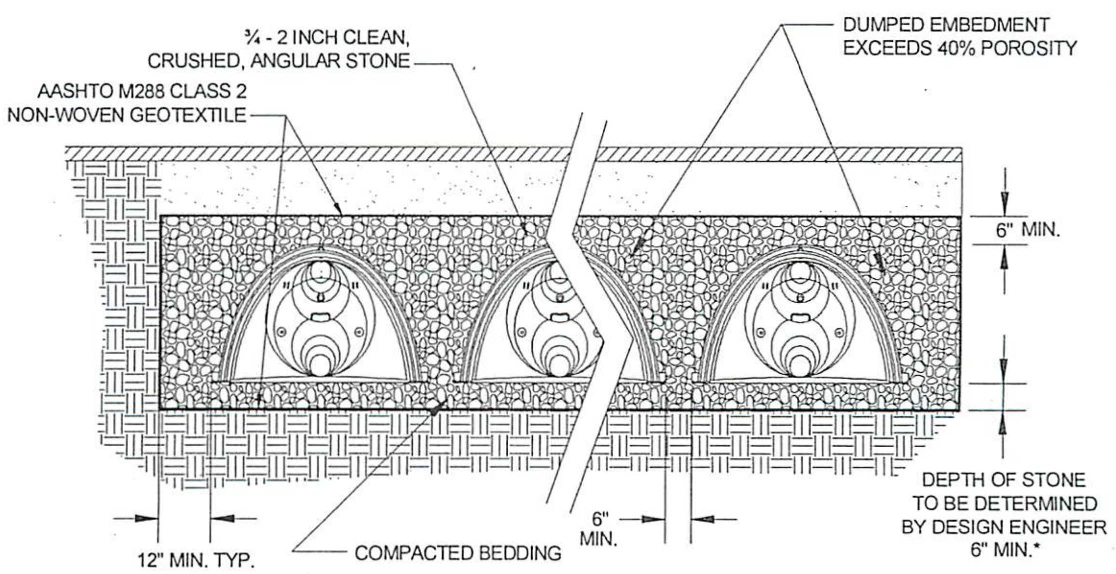
5 The material tested was recycled, crushed concrete from central Florida. Testing was conducted by Universal Engineering Sciences in Orlando, FL in November, 2005.

6 Testing was conducted by CTL | Thompson Texas, LLC in August, 2006.

ASTM C29 is the "Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate".

Porosity References:

- "Urban Runoff Quality Management" WEF MOP 23 / ASCE MOP 87. Table 5.12 lists uniform sized gravel at 40%.
- "Controlling Urban Runoff:" by Thomas R. Schueler, July 1987 describes storage volume of the void space in the trench at 40% of the excavated trench volume.
- "On-site Stormwater Management: Applications for Landscape and Engineering" Second Edition by Bruce Ferguson and Thomas Debo states that open graded crushed stone has 40% void space.



DE WR 12.8.2010
DVR/CHK [illegible] / [illegible]
12/9/10

Attachment D: Computation of Stormwater Storage in Stormwater Collection/Retention Area

DE WR 12-8-2010
DVR/CHK [illegible] 12/9/10

Computation of stormwater storage in stormwater collection/retention area

Inputs

95% runoff	i	1.5	in
Area draining to collection	A	2.27	acre
square feet per acre		43,560	sf
Voids percentage	$Perc_v$	40%	
collection/retention area width	W_{it}	42	ft
collection/retention area depth	D_{it}	3.0	ft
linear ft of trench	L_{it}	260.0	ft

Calculated factors/conversions

95% runoff in feet	i	0.125	ft
Area draining to collection in feet	A	98,881	ft

Calculations

Step 1 - Calculate total runoff for 95th percentile storm

$Q = A \times i$

$= \mathbf{12,360}\ ft^3$

Step 2 - Calculate total stormwater storage for system

$V_{it} = W_{it} \times D_{it} \times L_{it} \times Perc_v$

$= \mathbf{13,104}\ ft^3$

Appendix D

Notice of Intent (NOI)
Notice of Termination (NOT)

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
1-888-891-8332 (TDEC)

Notice of Intent for General NPDES Permit for Storm Water Discharges from Construction Activities (TNR10-0000)

Site or Project Name:	**Coal Storage Area Stabilization (CSAS)**	**Existing Tracking No.**	
Street Address or Location:	P.O. Box 2009 Bear Creek Road, Oak Ridge, TN	Start date:	June 2011
		Estimated end date:	August 2012
Site Description:	Compacted stone backfill and storm water diversion to stabilize the coal storage area.	Latitude:	35 D 58.926' N
		Longitude:	84 D 15.720' W
County(ies): Anderson County	MS4 Jurisdiction:	Acres Disturbed:	2.5
		Total Acres:	3.3

Does a topographic map show dotted or solid blue lines ☒ and/or wetlands ☐ on or adjacent to the construction site?
If wetlands are located on-site and may be impacted, attach wetlands delineation report.
If an Aquatic Resource Alteration Permit has been obtained for this site, what is the permit number? ARAP permit No.: N/A

Receiving waters: East Fork Poplar Creek

Attach the SWPPP with the NOI ☒ SWPPP Attached | Attach a site location map ☒ Map Attached

Name of Site Owner or Developer (Initial Primary Permittee): (person, company, or legal entity that has operational or design control over construction plans and specifications):
Site Owner: NNSA/ DOE
Developer: B&W Y-12

Site Owner or Developer Contact Name: (individual responsible for site): Paul Wasilko		Title or Position: (president, vice-president or equivalent - the party who signs the certification below): Acting Division Manager - E,S&H	
Mailing Address: P.O. Box 2009 / MS-8111		City: Oak Ridge	State: TN / Zip: 37831
Phone: (865) 241-5104	Fax: (865) 241-4533	E-mail: wasilkopr@y12.doe.gov	

Optional Contact: **Mick Wiest**		Title or Position: Surface Water Engineer	
Address: P.O. Box 2009 / MS-8239		City: **Oak Ridge**	State: TN / Zip: **37831**
Phone: (865) 574-3390	Fax: (865) 574-9041	E-mail: wiestmcjr@y12.doe.gov	

Owner or Developer Certification (must be signed by president, vice-president or equivalent, or ranking elected official) (Primary Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner or Developer name (president, vice-president or equivalent); print or type: Paul Wasilko	Signature:	Date:

Contractor(s) Certification (must be signed by president, vice-president or equivalent, or ranking elected official) (Secondary Permittee)

I certify under penalty of law that I have reviewed this document, any attachments, and the SWPPP referenced above. Based on my inquiry of the construction site owner/developer identified above and/or my inquiry of the person directly responsible for assembling this NOI and SWPPP, I believe the information submitted is accurate. I am aware that this NOI, if approved, makes the above-described construction activity subject to NPDES permit number TNR100000, and that certain of my activities on-site are thereby regulated. I am aware that there are significant penalties, including the possibility of fine and imprisonment for knowing violations, and for failure to comply with these permit requirements.

Primary contractor name and address; print or type J. T. Kato, B&W Y-12, P.O.Box 2009 Oak Ridge, TN 37831	Signature:	Date:
Other contractor name and address; print or type	Signature:	Date:
Other contractor name and address; print or type	Signature:	Date:

OFFICIAL STATE USE ONLY

Received Date:	Reviewer:	Field Office:	Permit Number **TNR**	Exceptional TN Water:
Fee(s):	T & E Aquatic Flora and Fauna:		Impaired Receiving Stream:	Notice of Coverage Date:

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
1-888-891-8332 (TDEC)

Notice of Intent for General NPDES Permit for Storm Water Discharges from Construction Activities (TNR10-0000)

Purpose of this form A completed notice of intent (NOI) must be submitted to obtain coverage under the Tennessee General NPDES Permit for Discharges of Stormwater Associated with Construction Activity. **Requesting coverage under this permit means that an applicant has obtained and examined a copy of this permit, and thereby acknowledges applicant's claim of ability to be in compliance with permit terms and conditions.** This permit is required for stormwater discharge(s) from construction activities including clearing, grading, filling and excavating (including borrow pits) of one or more acres of land. This form should be submitted at least 30 days prior to the commencement of land disturbing activities, or no later than 48 hours prior to when a new operator assumes operational control over site specifications or commences work at the site.

Permit fee (see table below) must accompany the NOI and is based on total acreage to be disturbed by an entire project, including any associated construction support activities (e.g. equipment staging yards, material storage areas, excavated material disposal areas, borrow or waste sites). There is no fee for sites less than 1 acre. **If a fee is required, but not submitted at the time the NOI is submitted, the application will be considered incomplete until the fee is received.**

Acres Disturbed	Fee
= or > 150 acres	$7,500
= or > 50 < 150 acres	$4,000
= or > 5 < 50 acres	$1,000
= or > 1 < 5 acres	$250

Who must submit the NOI form? The NOI form must be signed by the "operator(s)" of the construction site. Operators will most likely include the developer of the site, and the primary contractor(s). "Operator" means any party associated with the construction project that meets either of the following two criteria: (1) the party has design or operational control over project specifications (including the ability to make modifications in specifications); or (2) the party has day-to-day operational control of those activities at a project site which are necessary to ensure compliance with the stormwater pollution prevention plan (SWPPP) or other permit conditions (e.g., they are authorized to direct workers at the site to carry out activities identified in the stormwater pollution prevention plan or comply with other permit conditions). If a contractor has not been identified at the time the NOI is submitted by the developer, the contractor(s) must sign an NOI for the project in order to obtain authorization under this permit. The contractor must include the NPDES permit number that is already assigned to the site, along with the name of the construction project and its location.

Notice of Coverage The division will review the NOI for completeness and accuracy and prepare a notice of coverage (NOC). Stormwater discharge from the construction site is authorized as of the effective date of the NOC.

Complete the form Type or print clearly, using ink and not markers or pencil. Answer each item or enter "NA," for not applicable, if a particular item does not fit the circumstances or characteristics of your construction site or activity. If you need additional space, attach a separate piece of paper to the NOI form. **The NOI will be considered incomplete without a map and the SWPPP.**

Describe and locate the project Use the legal or official name of the construction site. If a construction site lacks street name or route number, give the most accurate geographic information available to describe the location (reference to adjacent highways, roads and structures; e.g. intersection of state highways 70 and 100). Latitude and longitude (expressed in decimal degrees) of the center of the site can be located on USGS quadrangle maps. The quadrangle maps can be obtained at the USGS World Wide Web site: http://www.usgs.gov/; latitude and longitude information can be found at numerous other web sites. Attach a copy of a portion of a 7.5 minute quad map, showing location of site, with boundaries at least one mile outside the site boundaries. Provide estimated starting date of clearing activities and completion date of the project, and an estimate of the number of acres of the site on which soil will be disturbed, including borrow areas, fill areas, stockpiles and the total acres. For linear projects, give location at each end of the construction area.

Give name of the receiving waters Trace the route of stormwater runoff from the construction site and determine the name of the river(s), stream(s), creek(s), wetland(s), lake(s) or any other water course(s) into which the stormwater runoff drains. Note that the receiving water course may or may not be located on the construction site. If the first water body receiving construction site runoff is unnamed ("unnamed tributary"), determine the name of the water body that the unnamed tributary enters.

ARAP permit may be required **If your work will disturb or cause alterations of a stream or wetland, you must obtain an appropriate Aquatic Resource Alteration Permit (ARAP).** If you have a question about the ARAP program or permits, contact your local Environmental Field Office (EFO).

Submitting the form and obtaining more information Note that this form must be signed by the company President, Vice-President, or a ranking elected official in the case of a municipality, for details see subpart 2.5. For more information, contact your local EFO at the toll-free number 1-888-891-8332 (TDEC). Submit the completed NOI form (keep a copy for your records) to the appropriate EFO for the county(ies) where the construction activity is located, addressed to **Attention: Stormwater NOI Processing.**

EFO	Street Address	Zip Code	EFO	Street Address	Zip Code
Memphis	8383 Wolf Lake Drive, Bartlett	38133-4119	Cookeville	1221 South Willow Ave.	38506
Jackson	1625 Hollywood Drive	38305-4316	Chattanooga	540 McCallie Avenue STE 550	37402-2013
Nashville	711 R S Gass Boulevard	37243	Knoxville	3711 Middlebrook Pike	37921
Columbia	1421 Hampshire Pike	38401	Johnson City	2305 Silverdale Road	37601

Department of Environment and Conservation
Division of Water Pollution Control

NOTICE OF TERMINATION (NOT) – STORM WATER DISCHARGES CONSTRUCTION ACTIVITY

This form is required to be submitted when requesting termination of coverage from the General NPDES Permit for Discharges of Storm Water Associated with Construction Activities. The purpose of this form is to notify the Tennessee Department of Environment and Conservation that you, as a permitted operator of storm water discharges from a construction activity, no longer have responsibilities related to erosion and sediment controls at the construction site. Submission of this form shall in no way relieve the permittee of permit obligations required prior to submission of this form. Please submit this form to the local Division of Water Pollution Control, Environmental Field Office (EFO) address (see table below), and marked **"Storm Water Notice of Termination"**. For more information, contact your local EFO at the toll-free number 1-888-891-8332 (TDEC). **Type or print clearly, using ink and not markers or pencil.**

Site Name:	**Tracking No.**
Street Address or Location:	
Site Description:	

Site Owner/Developer: (person, company, or legal entity that has operational or design control over construction plans and specifications)			
Site Owner/Developer Contact: (individual responsible for site)	Title or Position:		
Mailing Address:	City:	State:	Zip:
Phone: ( )	E-mail:		

Check the reason for termination of permit coverage:

	Storm water discharge associated with construction activity is no longer occurring and the area previously under construction has been restabilized (i.e., termination of initial permittee coverage). Explain:
	You are no longer the operator of the facility/site (i.e., termination of primary or secondary permittee coverage). Name of Permittee requesting termination of coverage: Explain:

Certification and Signature (must be signed by president, vice-president or equivalent, or ranking elected official)

I certify under penalty of law that either: (a) all storm water discharges associated with construction activity from the portion of the identified facility where I was an operator have ceased or have been eliminated or (b) I am no longer an operator at the construction site. I understand that by submitting this notice of termination, I am no longer authorized to discharge storm water associated with construction activity under this general permit, and that discharging pollutants in storm water associated with construction activity to waters of the United States is unlawful under the Clean Water Act where the discharge is not authorized by a NPDES permit. I also understand that the submittal of this notice of termination does not release an operator from liability for any violations of this permit or the Clean Water Act.

For the purposes of this certification, elimination of storm water discharges associated with construction activity means that all disturbed soils at the portion of the construction site where the operator had control have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time to insure final stabilization is maintained, or that all storm water discharges associated with construction activities from the identified site that are authorized by a NPDES general permit have otherwise been eliminated from the portion of the construction site where the operator had control.

Operator name: print or type	Signature	Date

EFO	Street Address	Zip Code	EFO	Street Address	Zip Code
Memphis	8383 Wolf Lake Drive Bartlett, TN	38133-4119	Cookeville	1221 South Willow Ave.	38506
Jackson	1625 Hollywood Drive	38305	Chattanooga	540 McCallie Avenue STE 550	37402-2013
Nashville	711 R S Gass Boulevard	37243	Knoxville	3711 Middlebrook Pike	37921
Columbia	1421 Hampshire Pike	38401	Johnson City	2305 Silverdale Road	37601

Appendix E

Storm Water Inspection Reports
Rainfall Record Sheets

Department of Environment and Conservation
Division of Water Pollution Control

Construction Storm Water Inspection Certification

(Twice weekly inspections are required for all sites.)

Construction Site Information **Outfall No.___ (or station no. or other identifier of drainage area represented)**

NPDES Permit No. TNR ____________ Notice of Coverage (NOC) Date: ______________ County: __________________

Name of Project: ____

Developer and/or Contractor Name: ______________________________________

Month/Year	Week 1	Week 2	Week 3	Week 4	Week 5
	Yes or *No* / Initials	*Yes* or *No* / Initials	*Yes* or *No* / Initials	*Yes* or *No* / Initials	*Yes* or *No* / Initials
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/
________, ______	Date:	Date:	Date:	Date:	Date:
Inspections Performed	/	/	/	/	/
E&S Controls in Order	/	/	/	/	/

Provide the following information for the person(s) who have performed and initialed the above inspections. If more than two persons have performed these inspections, give information for the two persons who performed the most numbers of inspections.

Initials: ________	Name: ______________________	Phone No. ________________________
Initials: ________	Name: ______________________	Phone No. ________________________

Quarterly Inspection Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated information presented. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that inspections of storm water discharge points (outfalls) and of erosion and sediment controls have been performed as recorded in the table above. I certify that erosion prevention and sediment controls in the drainage area of the identified outfall were installed as planned and designed and in working order as recorded in the table above. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name ____________________ Title ____________________ Signature ____________________________

Company ____ Date ________________________________

CN-1173 (Rev. 03-10) RDAs 2399 and 2400

(continued on reverse)

Environmental Field Offices - Division of Water Pollution Control - Addresses

EFO	Street Address	Zip Code	EFO	Street Address	Zip Code
Memphis	8383 Wolf Lake Drive Bartlett, TN	38133-4119	Cookeville	1221 South Willow Ave.	38506
Jackson	1625 Hollywood Drive	38305	Chattanooga	540 McCallie Avenue, Suite 550	37402-2013
Nashville	711 R.S. Gass Blvd	37243	Knoxville	3711 Middlebrook Pike	37921
Columbia	2484 Park Plus Drive	38401	Johnson City	2305 Silverdale Road	37601

Information and Instructions

The purpose of this form is to certify that inspections of storm water discharge points and erosion prevention and sediment controls (E&S Controls) at the construction site have been performed. You are required to record your twice-weekly inspections for all sites, but you are only required to record your twice-weekly inspections on this form if discharges from the construction site enter waters that have been identified as being impaired by siltation, or if they enter high quality waters. You can determine whether you are discharging to an impaired or high quality stream by looking at the Notice of Coverage (NOC) returned to you after you applied for coverage under the TNCGP. You may also call your local Environmental Field Office (EFO) at the toll-free number of 1-888-891-TDEC.

You are required to inspect outfall points (where discharges leave the site or enter waters of the state) to ascertain whether your erosion prevention and sediment control measures are effective in preventing soil from leaving the construction site and entering nearby streams. You are also required to inspect the erosion prevention and sediment control measures being used at the site, whether these controls have been installed according to the storm water pollution prevention plan (SWPPP), and whether these controls are in working order. These inspections must be performed at the frequency indicated in the appropriate section of the permit.

To record the inspections and observations, write the date that inspections were performed, in the appropriate week's column; write ***Yes*** or ***No*** to indicate if the inspections, both of the outfall points and of the erosion prevention and sediment control measures, were performed; and write ***Yes*** or ***No*** to indicate whether or not erosion prevention and sediment controls are installed and in working order. Sign your initials under the date for that week and to the right of the Yes or No. Certification of inspections is required at the end of each quarter and covers all inspections performed during the quarter.

The inspection results shall be kept at the construction site with a copy of the SWPPP. Use a new form for each quarter until the Notice of Termination is filed.

RAINFALL RECORD SHEET

Month/Year:__________________

Day	Rainfall (Inches)	Start Time	End Time	Misc./Outside Temp.	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					