JOYCE ENGINEERING

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Permit No. 3420-INDUS-2005,
DIN 21157

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May 27, 2014

Mr. John Murray
NCDENR, Solid Waste Section
610 E. Center Ave., Ste. 301
Mooresville, NC 28115

Re: Permit-to-Operate Renewal Application
OmniSource Southeast, LLC
Kernersville, North Carolina
JEI Project No. 799.1403.11

Dear John:

Joyce Engineering, Inc. (JOYCE) is pleased to submit this application for continued operation of the OmniSource Kernersville automobile shredder residue landfill mining and metals recovery operation (Permit No. 34-20) on behalf of OmniSource Southeast, LLC. Please find enclosed an updated Operations Plan, Closure and Post-Closure Plan, Financial Assurance, and Construction Quality Assurance Plan. Also included are the stormwater and slope stability calculations, process flow diagram, and mining sequencing plan.

Please do not hesitate to contact us during the review process with any questions or comments you may have. We look forward to working with you to get OmniSource's permit renewed for continued landfill mining operations.

NORTH CAROLINA PROFESSIONAL SEAL 031203 ENGINEER MARTIN A. SHUMPERT
5/27/14

Sincerely,
JOYCE ENGINEERING, INC.

M.A. "Mark" Shumpert, P.E.
Technical Consultant

C: James Winegar, OmniSource Southeast, LLC

PREPARED FOR:

OMNISOURCE SOUTHEAST, LLC
2233 WAL-PAT ROAD
SMITHFIELD, NORTH CAROLINA 27577

OMNISOURCE – KERNERSVILLE LANDFILL RECLAMATION PROJECT PERMIT NUMBER 34-20

2014 OPERATIONS PLAN

MAY 2014

PREPARED BY:

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JOYCE PROJECT NO. 799.1403.11.01

2014 OPERATIONS PLAN
OmniSource Southeast, LLC
Permit # 34-20

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OmniSource Southeast, LLC
Permit # 34-20

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1.0 GENERAL FACILITY OPERATIONS

1.1 Overview

The purpose of this Operations Plan is to provide a plan for the safe and efficient operations of the OmniSource Landfill Reclamation Project. This Operations Plan presents the operational requirements for: 1) General Facility Operations, 2) Operations Management, 3) Erosion and Sedimentation Control, and 4) Vegetation Management, along with guidance for Landfill Closure and Required Regulatory Submittals.

The OmniSource Landfill is owned and operated by OmniSource Southeast, LLC and is located in Forsyth County, North Carolina. The existing landfill was initially permitted in the early 1970's by the state of North Carolina as a private industrial landfill used to dispose of residue from the automobile shredder. This shredder was one of the first such machines installed in the south and the primary focus was the recovery of ferrous metals. Little effort was made to recover nonferrous metals as the technology for efficient recovery did not exist at that time. As the market for metals evolved and as recovery technology improved, the site began recovering some nonferrous metals from the downstream system on the shredder. Currently, the site has a relatively sophisticated nonferrous recovery system utilizing eddy-currents and other separation technologies. However, up until the time shredder residue was being shipped to an off-site landfill, a fraction of nonferrous and some ferrous metals were buried in the landfill.

Based on all preliminary studies, it is feasible to install recovery equipment and process the waste presently buried in the landfill to recover both ferrous and nonferrous materials.

1.2 Contact Information

Correspondence and questions concerning the operation of the OmniSource Landfill should be directed to the appropriate entity as follows:

<u>Owner</u>

OmniSource Southeast, LLC
2233 Wal-Pat Road
Smithfield, NC 27577
(919) 989-3102
Technical Contact: James Winegar

<u>State Regulatory Agency</u>

North Carolina Department of Environment and Natural Resources
Division of Waste Management, Solid Waste Section
Mooresville Regional Office
610 East Center Avenue
Mooresville, NC 28115
(704) 663-1699
Environmental Engineer: John Murray

1.3 Safety

Operations at the OmniSource Landfill were developed considering the health and safety of the facility's operating staff. The operating staff is provided with site-specific safety training prior to landfill operations, and on-site activities are to be conducted according to this training.

1.4 Access and Security Requirements

The OmniSource Landfill is located entirely within OmniSource property. Access to the project area is limited from the southern end by means of the fenced scrap processing area and from other directions by berms, topography, and the side-slopes of the landfill.

The access road to the site is of all-weather construction and will be maintained in good condition. Potholes, ruts, and debris on the road(s) will receive timely attention in order to avoid damage to vehicles.

1.5 Operating Hours

The OmniSource Landfill is closed to acceptance of new waste. Mining operations may be conducted seven days a week.

1.6 Signs

A sign providing the landfill permit number is posted adjacent to the landfill and shall be maintained in good condition.

1.7 Training

The Landfill Operations Manager shall have a general understanding of all the tasks required for site operations. Individuals performing the various tasks shall have adequate training for the site-specific tasks they are assigned. OmniSource shall provide annual training for facility personnel.

Noteworthy operations and maintenance tasks to be addressed in training include:

- Maintaining accurate records of mining operations
- Operating requirements for stormwater segregation from exposed waste areas
- Emergency response procedures and accident reporting.
- Personnel protective equipment (PPE) and cleanup procedures.
- Safety practices

All training will be documented and training records will be kept on-site. The Landfill Operations Manager will complete operator training courses in accordance with the permit requirements.

1.8 Record Keeping

An operating record is to be maintained on-site and include the following records:

- Groundwater Monitoring (and Sampling) Documentation
- Operations Plan
- Closure Plan
- Employee training records

The above records are to be kept in the operating record for the active mining operation and the post-closure care period. Information contained in the operating record must be furnished upon request to the North Carolina Department of Environment and Natural Resources Division of Waste Management, Solid Waste Section (Division) or be made available for inspection by the Division.

1.9 Drawings

A mining sequencing plan is provided in Appendix I of this Operations Plan. This drawing provides the general location and order of the mining operations. Final grading plans are provided with the Closure Plan.

2.0 OPERATIONS MANAGEMENT

The primary objective of operations management at the OmniSource Landfill is to mine and dispose of waste material in compliance with permit conditions while operating in a safe manner.

2.1 Landfill Capacity

It is estimated that 75 to 100 tons of shredder residue were generated by the shredder during a full production day. Using this generation rate and assuming 230 days per year for 25 years, it is estimated that the potential shredder residue in the landfill is approximately 500,000 tons. As the waste was placed in the landfill, it was covered periodically with native clay soil excavated from a borrow pit located on site. Exact records are not available but it is estimated that the landfill contains between 600,000 and 700,000 cubic yards, including shredder residue and the soil used for intermediate cover.

2.2 Mining

A process flow diagram is shown in Figure 1.

2.2.1 Excavation

- Excavation of the waste will proceed in sequence across the width of the landfill starting on the west side and moving east.
- It is anticipated that some pockets of perched water will be encountered at various places in the landfill. These should be isolated and are not true groundwater. If groundwater is encountered, excavation in that area will cease.

- It is anticipated that sections of the landfill will contain excessive moisture, which makes it difficult to efficiently recover metals. In this situation, material will be spread in wind-rows or stockpiled for drying in a natural gas rotary dryer.
- During dry weather, water will be available to control fugitive dust from the excavation zone to the processing equipment area.
- Excavation will be suspended during periods of extreme wet or extreme cold weather.

2.2.2 Infeed Stockpile

- An in-feed storage area is provided adjacent to the processing equipment area. The volume of the storage area will be equal to approximately two months of production to allow the processing equipment to function during periods when extreme weather suspends excavation.
- The stockpile will be inspected daily for erosion and sedimentation, and erosion control measures implemented as needed.
- Care will be exercised to ensure that material is not washed/blown into nearby storm water conveyance system.

2.2.3 Material Screening

- Screens will process the residue prior to separation.
- Oversize material will be placed on the residue stockpile (except large pieces of ferrous metal) for return to the landfill.

2.2.4 Process Plant

- Processing equipment is installed on a concrete pad to facilitate easy maintenance and materials management.
- There are two identical processing lines, one for landfill material and one for processing newly generated residue.
- The processing equipment for this operation was designed and selected to provide sufficient flexibility to accommodate variations in the infeed composition. It is assumed that the infeed material excavated from the landfill will not be uniform due to differences in shredder operation over the years. It is also likely that some areas will be drier or wetter and will contain varying amounts of dirt mixed with the residue. All of these factors have been included in the design and construction of the equipment.
- Following the screening operations, residue will be passed through a series of magnets, eddy-currents, sensor sorters, and concentrators.
- Recovered metals are either stockpiled on a concrete pad or collected in a container.
- Conveyors carry processed residue to a storage pile located adjacent to the plant and is placed back into the existing landfill via haul trucks.
- The processing equipment is designed with some redundancy so that when minor equipment malfunctions occur, a particular unit can be bypassed and the overall operation will continue.

2.2.5 Fines Processing

- Fines (≤ 19 mm) from the processing plant will be stockpiled just southwest of the landfill until they are dried. Once dried in a natural gas fired rotary dryer, the fines are temporarily stockpiled under cover. The fines are then separated into their nonmetallic and metallic fractions by a patented vacuum process.
- The output from this process includes both an intermediate product and a waste product.
- The waste product will be placed back in the landfill for use in the cap as a leveling course before soil placement.
- The intermediate product will be transferred to the fines polishing plant, where the material is further separated by another vacuum process, resulting in a saleable product and a waste product (it should be noted that if this separation step is not as efficient as anticipated, the fines may be require further processing in a ring mill).

2.2.6 Recovered Metals Stockpile

- Recovered metals will be deposited in stockpiles or containers.
- Except under unusual conditions, recovered metals will be shipped within 30 days of recovery.

2.2.7 Residue Stockpile

- Processed residue will be stockpiled prior to being placed back in the landfill.
- The entire stockpile area is located within the footprint of the existing landfill.
- The stockpile will be inspected daily for erosion and sedimentation, and erosion control measures implemented as needed.

2.2.8 Landfill

- As soon as an excavated area has reached its maximum depth and a sufficient gap exists to allow landfilling and excavation to take place simultaneously, processed residue will be returned to the landfill.
- Waste will be compacted using a suitable track dozer or a landfill compactor.
- As the level of waste approaches the surface of the landfill, processed fines residue will be placed on the landfill as a leveling and consolidation layer.
- Areas which will not have additional wastes placed on them for 12 months or more, but where final termination of disposal operations has not occurred, shall be covered with a minimum of one foot of intermediate cover.
- If an area of the landfill will be left undisturbed for a period exceeding 15 months, the area will be seeded to establish a vegetative cover.
- Filling activities will be conducted in a manner so as to minimize any potential for impoundment of surface water.

2.2.9 Erosion Control Measures

- The existing erosion control measures will be maintained in accordance with appropriate North Carolina Department of Environment and Natural Resources (NCDENR) rules and regulations.
- Areas of the landfill which will be left undisturbed for a period exceeding 15 months will be seeded as soon as weather conditions permit.
- If any areas which include the landfill outside slopes are mined, additional erosion control measures will be installed along the toe of each slope.

2.2.10 Access and Security Measures

- The access and security measures currently in place will be maintained.
- Operating personnel will be present whenever activity associated with the reclamation project is underway.
- Access to the project area is limited from the southern end by means of the fenced scrap processing area and from the other directions by berms, topography, and side-slopes of the landfill.

2.2.11 Safety Requirements

- Equipment and fill dirt for suppression is provided for use to control any accidental fires which may occur in the reclamation area.
- The Town of Kernersville Fire Department is familiar with the best techniques of fire suppression at the site. OmniSource officials have met with officials from the fire department. The Town of Kernersville's Fire Department is the first responder to any incident pertaining to a fire at OmniSource's facility.
- All OSHA reporting and training requirements will be handled by OmniSource's Environmental, Health, and Safety Department.

2.3 Dust, Odor, and Vector Control

Because of the nature of the materials being handled, problems are not anticipated with odors and vectors. Fugitive dust emissions from the access road and the disposal area will be controlled by the application of water or other suitable dust suppressant.

2.4 Fire Control Plan

When an employee encounters a fire that is out of control, he/she shall inform the Landfill Operations Manager. If the Landfill Operations Manager is not available, some personal judgment by the most senior person available shall be required to determine whether to fight the fire with the available personnel and equipment. The possibility of toxic emissions should be considered. The Fire Department shall be contacted if there is any doubt that a fire has been extinguished.

Although open burning is not permitted on the landfill, fires can occasionally start in the disposal area. In preparation for the possible occurrence of small fires within the landfill disposal area, each piece of equipment should be fitted with at least two multi-purpose dry chemical 10 lb. fire extinguishers.

Whenever smoke is noticed by landfill personnel or customers, the source should very carefully be investigated. If detected early, the hand held fire extinguishers should stop most small fires. Equipment should be parked away from the fire and landfill activities should be halted while the fire is extinguished. The Fire Department can provide training in proper use of fire extinguishers. This training is highly recommended since proper fire extinguisher technique is not obvious and must be learned.

2.5 Litter Control

Because of the nature of the materials being landfilled, blowing litter is not expected to be a problem.

2.6 Cover Requirements

2.6.1 Intermediate Cover

A 12-inch thick intermediate cover layer will be placed on areas where final waste grades have been reached or where placement will be inactive for 12 months or more.

2.6.2 Final Cover

Final closure activities shall be initiated no later than 180 days following the beginning of closure activities unless otherwise approved by the division.

The final cover will also be applied to areas of the landfill if the following conditions apply:

- Final elevation has been attained; or
- The permit has been terminated for any reason

Final cover will be placed in accordance with the facility's closure plan. Generally this includes grading for appropriate drainage, placing the appropriate cover material, and placing an appropriate vegetative layer.

2.7 Surface Water

Stormwater run-on onto the landfill is prevented by grading around the landfill. To improve operations, surface water should be diverted from the operational area. Excessive surface water at the working face creates difficulties for maneuvering equipment and prevents the operator from achieving maximum compaction of waste. To divert surface water runoff away from the working face, temporary diversion berms may be installed on the current lift, upslope of the working face and in other locations as dictated by the direction of grade. The soil cover will be graded to prevent the formation of erosion channels. In the event that channels do form, the cover should be promptly repaired.

Stormwater collection and conveyance measures will be checked regularly and maintained such that necessary repairs can be made as early as practical.

Stormwater runon onto the landfill is prevented by diversion ditches around the landfill.

To improve operations, surface water should be diverted from the operational area. Excessive surface water at the working face creates difficulties for maneuvering equipment and prevents the operator from achieving maximum compaction of waste. To divert surface water away from the working face, temporary diversion berms will be installed, upslope of the working face and in other locations as dictated by the direction of grade. The area between the temporary berm and the working face should be graded to prevent any accumulation of water. The soil cover in the areas beyond the diversion berms will be uniformly graded and compacted to prevent the formation of erosion channels. In the event that channels do form, the cover should be promptly repaired.

Stormwater collection and conveyance measures will be checked regularly and maintained such that necessary repairs can be made as early as practical.

3.0 ENVIRONMENTAL REQUIREMENTS

Stormwater runoff and landfill operations are under the jurisdiction of the state of North Carolina, while air quality issues are under the jurisdiction of Forsyth County. The reclamation project is covered by the landfill permit, stormwater runoff from the reclamation area is covered under the facility's general stormwater permit, and currently the air emissions are deemed to be below de minimis levels for permitting. All environmental permitting and reporting requirements will be handled by OmniSource's Environmental, Health, and Safety Department.

4.0 VEGETATION MANAGEMENT

Within six months after final termination of operations at the site, the area shall be stabilized with vegetation as required by design drawings and Closure/Post-Closure Plan (Appendix II). Temporary seeding will be applied as required.

Temporary erosion control measures may be required until permanent cover is established. Mulching, until a vegetative cover is established, can stabilize areas where final grades have been reached. Soil mulching can be achieved using materials such as: wood chips, straw, hay, asphalt emulsion, jute matting, and synthetic fibers. Mulches allow for greater water retention; reduce the amount of runoff; retain seeds, fertilizer, and lime in place; and improve soil moisture and temperature conditions.

4.1 Temporary Seeding

Temporary seeding will be applied as follows (source: *NC Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009]):

LATE WINTER TO EARLY SPRING

Seeds	Pounds Per Acre	Dates of Planting
Rye (grain)	120	January 1 to May 1
Annual lespedeza (kobe)	50	January 1 to May 1

Note: Omit lespedeza when duration of temporary cover is not to extend beyond June.

SUMMER

Seeds	Pounds Per Acre	Dates of Planting
German millet	40	May 1 to August 15

FALL

Seeds	Pounds Per Acre	Dates of Planting
Rye (grain)	50	August 15 to December 31

Soil Amendments	Pounds Per Acre
Agricultural limestone	2,000
Fertilizer (10-10-10)	1,000
Mulch	4,000

Note: Soil amendments are for all-season temporary seeding applications.

4.2 Permanent Seeding

Permanent seeding will be applied as follows (source: NC *Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009]):

Seeds	Pounds Per Acre	Dates of Planting
Tall fescue	100	September 1 to April 15
Sericea lespedeza	15	September 1 to May 1
Kobe lespedeza	10	May 1 to September 1
Rye	40	August 15 to April 15

Soil Amendments	Pounds Per Acre
Agricultural limestone	4,000
Fertilizer (10-10-10)	1,000
Mulch	4,000

Note: Perform soil test to determine proper soil amendments; if not available, use the quantities above.

FIGURES

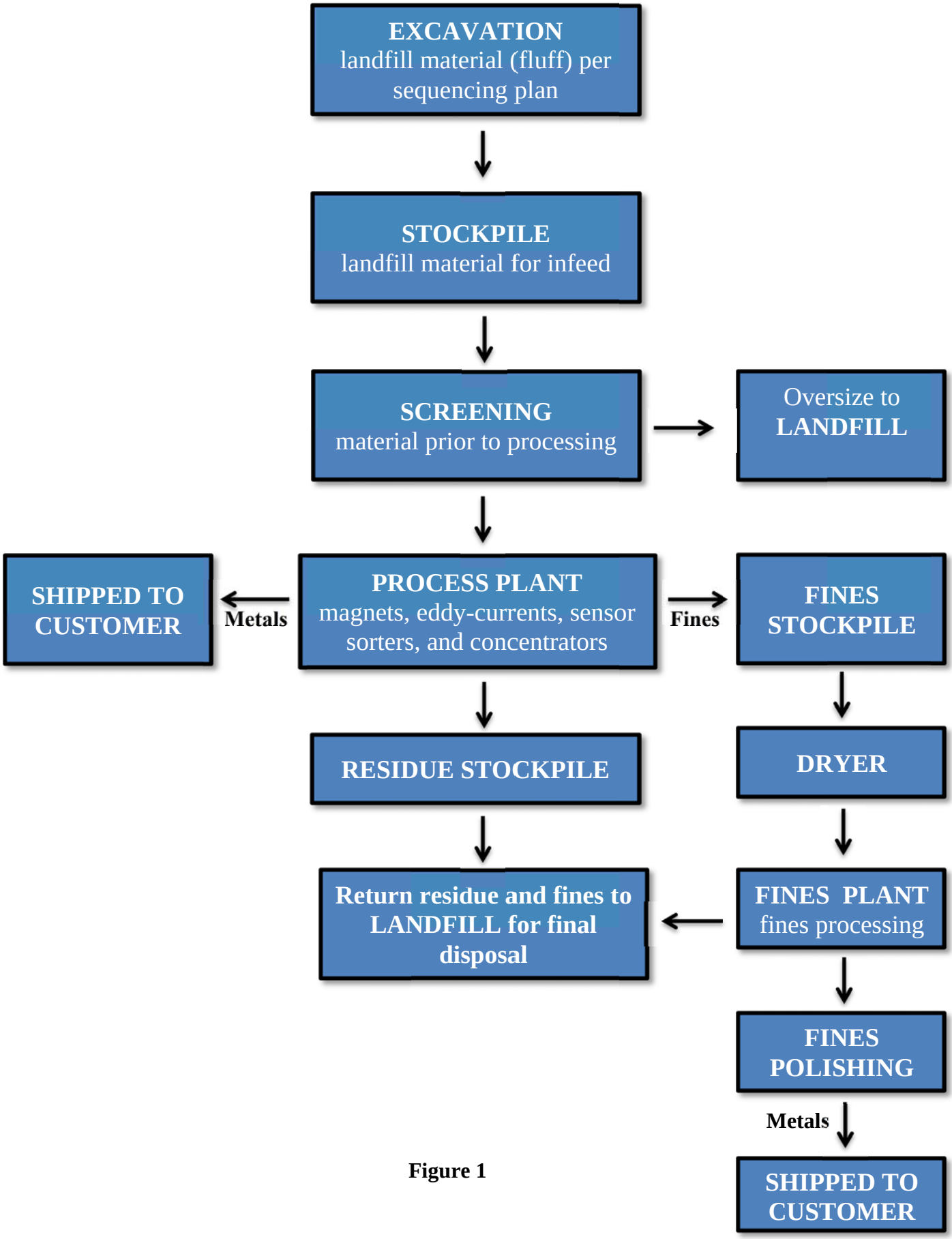
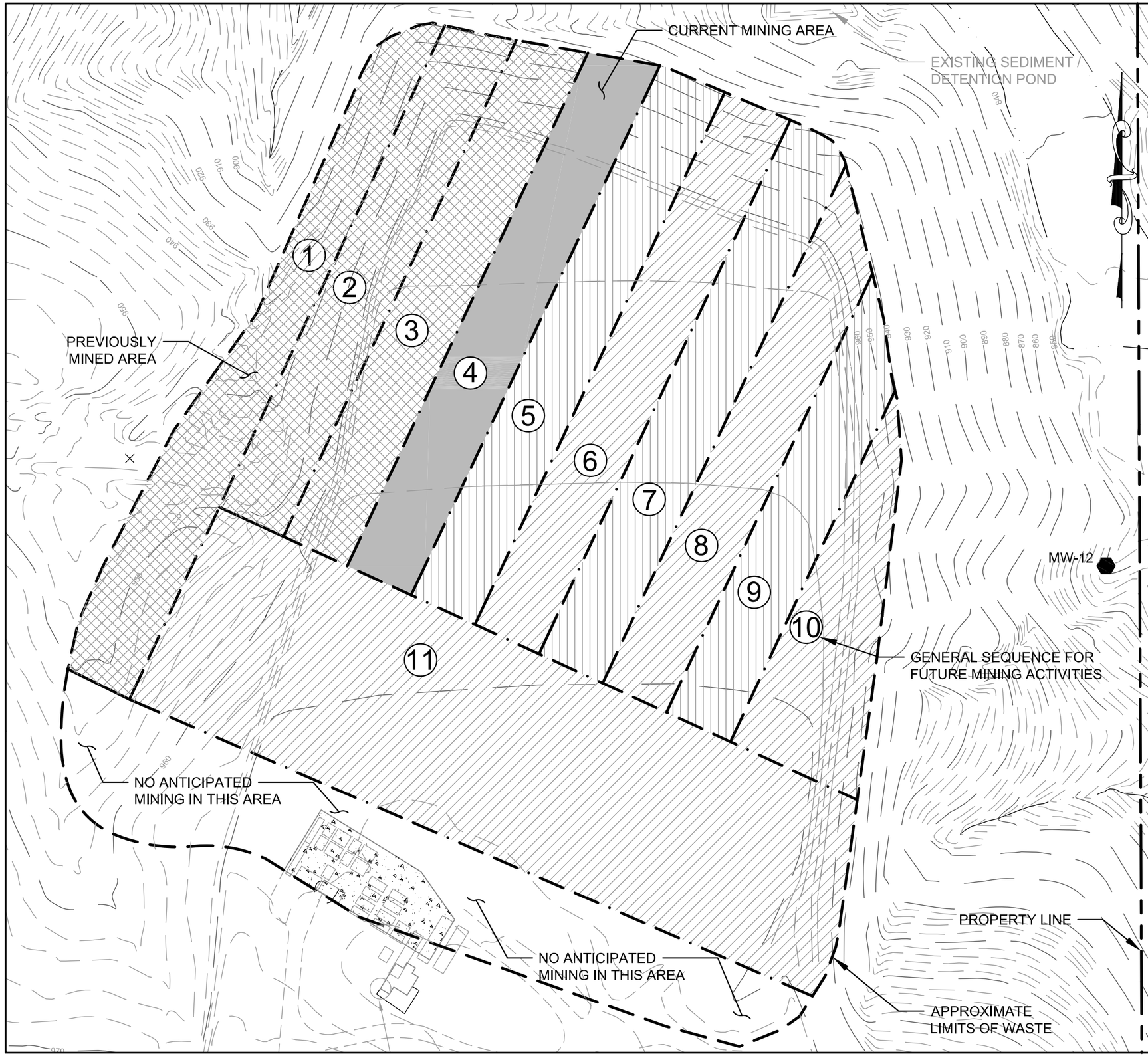

EXCAVATION
landfill material (fluff) per sequencing plan
STOCKPILE
landfill material for infeed
SCREENING
material prior to processing
Oversize to LANDFILL
SHIPPED TO CUSTOMER
Metals
PROCESS PLANT
magnets, eddy-currents, sensor sorters, and concentrators
Fines
FINES STOCKPILE
RESIDUE STOCKPILE
DRYER
Return residue and fines to LANDFILL for final disposal
FINES PLANT
fines processing
FINES POLISHING
Metals
SHIPPED TO CUSTOMER

Figure 1

APPENDIX I

MINING SEQUENCING PLAN



MINING SEQUENCE NOTES:

1. MINING OF THE EXISTING WASTE WILL TAKE PLACE IN THE GENERAL ORDER SHOWN ON THIS PLAN. AS MATERIAL IS MINED, IT WILL BE STOCKPILED WITHIN THE WASTE FOOTPRINT OR PLACED ON PREVIOUSLY MINED AREAS AND GRADED IN ACCORDANCE WITH THE FINAL GRADING PLAN, ALLOWING FOR PLACEMENT OF THE FINAL COVER.
2. AT THE TIME THIS PLAN WAS PREPARED, AREAS 1, 2 AND 3 HAVE BEEN MINED, WITH CURRENT MINING ACTIVITIES ONGOING IN AREA 4.
3. SEQUENCING ORDER FOR FUTURE MINING ACTIVITIES MAY VARY DEPENDING ON SITE CONDITIONS AND OPERATIONAL NEEDS.

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

DESIGNED AD
DRAWN RH
CHECKED LB
APPROVED MS
DATE 04/04/14

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JOYCE ENGINEERING
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NO CORP LIC: C-0782

OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

MINING SEQUENCE MAP

PROJECT NO.
799.1403.11

SCALE
AS SHOWN

DRAWING NO.
OP-1

L:\OMNI SOURCE\KERNERSVILLE\SHEET SET\OP-01 MINE SEQUENCE PLAN.dwg-Layout1

APPENDIX II

CLOSURE/POST-CLOSURE PLAN

PREPARED FOR:

OMNISOURCE SOUTHEAST, LLC
2233 WAL-PAT ROAD
SMITHFIELD, NORTH CAROLINA 27577

OMNISOURCE – KERNERSVILLE LANDFILL RECLAMATION PROJECT PERMIT NUMBER 34-20

2014 CLOSURE PLAN

MAY 2014

PREPARED BY:

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PHONE: 336-323-0092
FAX: 336-323-0093

JOYCE PROJECT NO. 799.1403.11.01

1.0 INTRODUCTION

1.1 Introduction

The following Closure and Post-Closure Plan was prepared for the OmniSource Landfill located in Forsyth County, North Carolina. The purpose of the Closure/Post-Closure Plan is to outline the requirements for closing of the landfill and the post-closure maintenance activities. Closure is designed to minimize the need for long term maintenance and to control the post-closure release of contaminants. Closure activities may be revised as appropriate for materials, specifications, technology advances or changes in regulations at that time.

1.2 Project Information

The OmniSource Landfill is owned and operated by OmniSource Southeast, LLC (OmniSource). The landfill is located in Forsyth County, North Carolina. The existing landfill was initially permitted in the early 1970's by the state of North Carolina as a private industrial landfill used to dispose of residue from the automobile shredder. This shredder was one of the first such machines installed in the south and the primary focus was the recovery of ferrous metals. Little effort was made to recover nonferrous metals as the technology for efficient recovery did not exist at that time. As the market for metals evolved and as recovery technology improved, the site began recovering some nonferrous metals from the downstream system on the shredder. Currently, the site has a relatively sophisticated nonferrous recovery system utilizing eddy-currents and other separation technologies. However, up until the time shredder residue was being shipped to an off-site landfill, a fraction of nonferrous and some ferrous metals were buried in the landfill.

Based on all preliminary studies, it is feasible to install recovery equipment and process the waste presently buried in the landfill to recover both ferrous and nonferrous materials.

2.0 CLOSURE PLAN

Closure of the facility will be conducted in a manner that minimizes the need for further maintenance and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, the post-closure escape of uncontrolled leachate, surface runoff, or waste decomposition products to the groundwater, surface water, or the atmosphere. The proposed cover system will incorporate a number of components which are described in the following sections.

2.1 Cover System

Two final cover designs are proposed. The choice of the final cover system will be made prior to the time of closure construction.

Soil Final Cover (from top to bottom)

- 24-inch soil cover/vegetative support layer (unspecified permeability);

Alternate Final Cover (from top to bottom)

- 24-inch soil cover/vegetative support layer (unspecified permeability);
- a geocomposite drainage layer;
- a 40-mil thick double-sided textured linear low density polyethylene (LLDPE) geomembrane;

2.1.1 Soil Cover/Vegetation Support

The soil cover/vegetative support layer comprised of local soil of unspecified permeability with the top six inches consisting of seeded top soil, native soil, or soil suitably amended to support native vegetation.

2.1.2 Geocomposite Drainage Layer

The geocomposite drainage layer will promote cover system stability by collecting and routing water that infiltrates the soil barrier to the perimeter surface water conveyance measures.

2.1.3 Geomembrane

As an additional measure to prevent infiltration through the cover system and into the waste, a geomembrane will be placed directly over the existing intermediate cover layer.

2.2 Stormwater Management System

The final slopes of the landfill will promote runoff. Upon landfill closure, stormwater will be collected and conveyed, through berms and downslope pipes, off of the landfill. Plans and details illustrating the stormwater management system are provided in the Closure Plan Drawings.

2.3 Largest Area Requiring Cover System

The maximum area that would require closure at any one time is approximately 14 acres.

2.4 Estimated Maximum Waste Inventory

It is estimated that 75 to 100 tons of shredder residue were generated by the shredder during a full production day, using this generation rate and assuming 230 days per year for 25 years, it is estimated that the potential shredder residue in the landfill is 500,000 tons. As the waste was placed in the landfill, it was covered periodically with native clay soil excavated from a borrow pit located on site. Exact records are not available but it is estimated that the landfill contains between 600,000 and 700,000 cubic yards, including shredder residue and the soil used for intermediate cover.

2.5 Closure Schedule

Following the completion of waste mining activities, a final cover system will be constructed. The primary purpose of a final cover system is to minimize infiltration of stormwater into the waste, thus limiting generation of leachate. The proposed final cover system cross sections are discussed above and presented in the Closure Plan Drawings.

Final closure of the landfill will commence when waste mining activities and final grades are achieved, or as directed by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management – Solid Waste Section (the Division). OmniSource may elect to close the landfill incrementally during landfill operations once an area large enough to warrant cover system construction has reached final grades. Prior to beginning closure of the proposed landfill, the Owner or Operator shall notify the Division that a notice of intent to close the landfill has been placed in the operating record. Closure activities for the landfill shall begin no later than 30 days after completion of waste mining activities and unless otherwise approved by the Division

The final cover system will be finished within 180 days following the beginning of closure activities unless otherwise approved by the Division. Extensions of the closure period may be granted by the Division if the Owner or Operator demonstrates that closure will, of necessity, take longer than 180 days and they have taken and will continue to take the necessary steps to prevent threats to human health and the environment from the unclosed landfill unit. The final cover system for the closed phase will be certified by a professional engineer as being completed. OmniSource shall record a notation on the deed to the landfill property stating that the property has been used as a landfill and its use is restricted under the Closure/Post-Closure Plan approved by the Division. The Division will be notified by OmniSource of the closure completion, certification, deed notation, and placement of these records into the landfill's operating record.

3.0 POST-CLOSURE PLAN

The Post-Closure Plan outlines the monitoring and maintenance activities intended to maintain cover system integrity during the post-closure period, which is proposed to be 30 years. During the post-closure period the landfill cover system and related facilities must be monitored and maintained.

3.1 Maintenance Activities

Maintenance activities will be required for the final cover system to remain functional. The vegetative cover shall be mowed a minimum of once a year. The vegetative cover shall be amended and fertilized as needed to maintain healthy vegetation. Depressions in the cover that pond water or otherwise impair the function of the final cover will be filled and/or regraded. Areas subject to regrading will be revegetated. Animal burrows and eroded areas should be filled in with compacted soil and reseeded. If vegetative cover is not adequate in a particular area, fertilizer should be applied and the area reseeded in order to re-establish vegetation. Insecticides may be used to eliminate insect populations that are detrimental to the vegetation. Any deep-rooted or woody vegetation that may have established itself on

the cover soil will be removed. In addition to maintenance of the vegetative cover, any items noted as requiring maintenance in Section 3.2 Monitoring Activities would also require maintenance.

3.2 Monitoring Activities

Post-closure monitoring will be conducted quarterly for the first two years and semi-annually thereafter for the remainder of the post-closure period. The following cover system and landfill components will be monitored:

- security measures such as fences, gates, locks, and other measures that control site and facility access;
- surface water management systems for signs of erosion, sedimentation, and condition;
- cover system for signs of erosion;
- cover system for evidence of settlement or subsidence;
- condition and/or presence of vegetation (for distressed or dying vegetation or woody vegetation with potential to penetrate the low permeability barrier of the alternate cover);
- condition of the groundwater monitoring wells

Post-closure monitoring will be documented on post-closure monitoring forms. Post-Closure Monitoring Form sheets are provided following this Closure Plan. Completed post-closure monitoring forms will be maintained in the facility operating record.

3.2.1 Groundwater Monitoring

The Groundwater Monitoring Plan will be continued semi-annually (or as required) after final closure. The results of the analytical testing will be submitted to NCDENR as directed in the Groundwater Monitoring Plan.

3.2.2 Surface Water Monitoring

Surface water monitoring of the downgradient tributaries will be continued semi-annually (or as required) after final closure. The results of the analytical testing will be submitted to NCDENR as directed in the Groundwater Monitoring Plan.

3.3 Facility Contact

The post-closure maintenance of the landfill will be the responsibility of OmniSource Southeast, LLC. Correspondence should be directed to:

OmniSource Southeast, LLC
2233 Wal-Pat Road
Smithfield, NC 27577
(919) 989-3102

Facility Contact: James Winegar, Environmental Manager

3.4 Post Post-Closure Planned Use

Following closure operations, the landfill will be closed and vegetation will be planted and maintained. OmniSource will maintain control of, and limit access to the facility. No post-closure use is proposed at this time. In the event the post-closure planned use is changed, OmniSource shall obtain prior approval from NCDENR.

3.5 Certification

Consistent with regulations, the end of the closure-post closure period must be certified by a registered professional engineer. To accomplish certification over the required 30-year duration, a registered professional engineer will prepare annual certifications. The annual certifications will document that the cover system has been monitored and maintained in accordance with the Post-Closure Plan. The annual certifications shall be based on observations and results documented on regular post-closure monitoring reports, maintenance records, and compliance monitoring reports maintained in the Operating Record.

POST-CLOSURE INSPECTION CHECKLIST

SYSTEM	COMPONENTS	FREQUENCY	TYPE OF INSPECTION
Final Cover System	Seeding and Vegetative Growth	Quarterly	Visual
	Integrity of Cover	Quarterly	Visual
Security Control System	Fencing and Access Gates	Monthly	Visual
	Posted Signs	Monthly	Visual
Drainage and Erosion Control Systems	Basin	Quarterly	Visual
	Ditches, Channels, and Piping	Quarterly	Visual
	Discharge Outlets and Spillways	Quarterly	Visual
	Slopes and Terraces	Quarterly	Visual
Groundwater Monitoring System	Monitoring Wells	Quarterly	Visual / Mechanical
	Benchmarks	Quarterly / Annually	Visual / Instrument

MAINTENANCE INSPECTION FORM

Inspector:_____ Date of Inspection:_____

SYSTEM	COMPONENTS	ACTION REQUIRED? (Y / N)	COMMENTS
Final Cover	Seeding and Vegetative Growth		
	Integrity of Cover		
Security Control System	Fencing and Access Gates		
	Posted Signs		
Drainage and Erosion Control Systems	Basin		
	Ditches, Channels, Piping		
	Discharge Outlets and Spillways		
	Slopes and Terraces		
Groundwater Monitoring System	Monitoring Wells		
	Benchmarks		
	Cleanouts and Piping		

OPINION OF PROBABLE CLOSURE COSTS - APRIL 2014
SOIL CAP OPTION
OMNISOURCE KERNERSVILLE FACILITY
PERMIT #34-20

ITEM	UNIT	QUANTITY	UNIT COST	COST $
FINAL CAP SYSTEM- 14 ACRES (609,840 sf)				
2 ft Soil Cap (non-specified on-site soil)	cy	45,173	$6.00	**$271,038**
SEDIMENTATION AND EROSION CONTROLS				
Diversion Berms				
Construction	lf	3,240	$6.00	$19,440
E&S Matting	lf	3,240	$0.22	$713
Slope Drains				
Pipe and Installation	lf	670	$30.00	$20,100
Miscellaneous				
Outlet Protection (RipRap)	each	3	$430.00	$1,290
Silt Fence	lf	3,000	$3.58	$10,740
			Subtotal	**$52,283**
VEGETATIVE COVER	acre	14	$1,200	**$16,800**
TOTAL OF ABOVE ITEMS				**$340,121**
MOBILIZATION / DEMOBILIZATION	(construction only)		5%	$17,006
ENGINEERING FEE	-	-		$15,000
CQA	(cap only)	-		$20,000
CONTINGENCY	-	-	5%	$17,006
CLOSURE CERTIFICATION	lump sum	-	-	$3,000
SURVEY AND DEED	lump sum	-	-	$8,500
TOTAL CLOSURE COST (IN 2014 DOLLARS)				**$420,633**

Notes:
1. All costs include labor by a third party.
2. All estimates are valid for the 2014 - 2015 fiscal year.

OPINION OF PROBABLE CLOSURE COSTS - APRIL 2014
ALTERNATE CAP SYSTEM OPTION
OMNISOURCE KERNERSVILLE FACILITY
Permit # 34-20

ITEM	UNIT	QUANTITY	UNIT COST	COST $
ALTERNATE CAP SYSTEM - 14 ACRES (609,840 sf)				
40 mil LLDPE	sf	609,840	$0.44	$268,330
Geocomposite Drainage Layer	sf	609,840	$0.49	$298,822
Protective Cover (18" non-specified on-site soil)	cy	33,880	$6.00	$203,280
Vegetative SupportLayer (6" local on-site soil)	cy	11,293	$6.00	$67,758
			Subtotal	**$838,190**
SEDIMENTATION AND EROSION CONTROLS				
Diversion Berms				
Construction	lf	3,240	$6.00	$19,440
E&S Matting	lf	3,240	$0.22	$713
Slope Drains				
Pipe and Installation	lf	670	$30.00	$20,100
Miscellaneous				
Outlet Protection (RipRap)	each	3	$430.00	$1,290
Silt Fence	lf	3,000	$3.58	$10,740
			Subtotal	**$52,283**
VEGETATIVE COVER	acre	14	$1,200	**$16,800**
TOTAL OF ABOVE ITEMS				**$907,273**
MOBILIZATION / DEMOBILIZATION	(construction only)		5%	$45,364
ENGINEERING FEE	-	-		$25,000
CQA	(cap only)	-		$50,000
CONTINGENCY	-	-	5%	$45,364
CLOSURE CERTIFICATION	lump sum	-	-	$3,000
SURVEY AND DEED	lump sum	-	-	$8,500
TOTAL CLOSURE COST (IN 2014 DOLLARS)				**$1,084,501**

Notes:
1. All costs include labor by a third party.
2. All estimates are valid for the 2014 - 2015 fiscal year.

OPINION OF PROBABLE POST-CLOSURE COSTS - APRIL 2014
OMNISOURCE KERNERSVILLE FACILITY
Permit # 34-20

ITEM	UNIT	QUANTITY	UNIT COST	ANNUAL COST
MONITORING				
Groundwater (semi-annually)	per trip	2	$2,600	$5,200
Surface Water (semi-annually)	per trip	2	$1,000	$2,000
Subtotal				**$7,200**
ROUTINE MAINTENANCE				
Mowing	acre	14	$120	$1,680
Reseed and fertilize (once every 3 years)	acre	5	$1,200	$6,000
Vector and Rodent Control	acre	14	$100	$1,400
Subtotal				**$9,080**
WELL MAINTENANCE				
Groundwater Wells	each	4	$50	**$200**
CAP REPAIR	acre	0.25	$10,880	**$2,720**
TOTAL OF ABOVE ITEMS				**$19,200**
ENGINEERING	-	-	5%	$960
CONTINGENCY	-	-	5%	$960
TOTAL ANNUAL POST-CLOSURE COST (IN 2014 DOLLARS)				**$21,120**
TOTAL 30-YR POST-CLOSURE COST (IN 2014 DOLLARS)				**$633,600**
Potential Assessment & Corrective Action (PACA)				**$2,000,000**

Notes:
1. All costs include labor by a third party.
2. Groundwater monitoring costs include field sampling, Appendix I and II analysis costs for 4 wells and trip and equipment blanks, and reporting for semiannual sampling.
3. Surface water monitoring costs include field sampling, Appendix I analysis and detected Appendix II costs for 2 surface points, and reporting for semiannual sampling.
4. The landfill is not designed with a base liner system or a leachate collection and recovery system; thus, no leachate monitoring or collection and treatment costs are included.

APPENDIX III

CQA PLAN

PREPARED FOR:

OMNISOURCE SOUTHEAST, LLC
2233 WAL-PAT ROAD
SMITHFIELD, NORTH CAROLINA 27577

OMNISOURCE – KERNERSVILLE LANDFILL RECLAMATION PROJECT PERMIT NUMBER 34-20

CQA PLAN

MAY 2014

PREPARED BY:

2211 W. MEADOWVIEW ROAD
GREENSBORO, NC 27407
PHONE: 336-323-0092
FAX: 336-323-0093
JOYCE PROJECT NO. 799.1403.11.01

CONSTRUCTION QUALITY ASSURANCE PLAN (CQA)

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1.0 INTRODUCTION

1.1 PURPOSE

This plan addresses the construction quality assurance (CQA) procedures and requirements to be employed during construction of the project. The plan is intended to supplement, but not supersede, the Contract Drawings and Specifications; where a conflict arises, the Contract Documents or approved Contract Drawings and Specifications shall govern.

All parties involved in the project should obtain a copy of this plan from the OWNER or ENGINEER. They should also obtain copies of any supplemental CQA documents prepared specifically for the project.

The overall goals of the CQA program are to ensure that proper construction techniques and procedures are employed, and to verify that the materials used meet the approved Contract Specifications. Additionally, the program shall identify and define problems that may occur during construction, allowing corrective activities to be implemented in a timely manner. At the completion of the work, the program requires the certifying CQA Consultant(s) to prepare certification reports indicating that the facility has been constructed in accordance with the approved design standards and Contract Specifications.

1.2 DEFINITIONS

The following definitions are applicable to this plan:

1.2.1 Quality Control

Definition (ASTM D3740): - a planned system of activities, or the use of such a system, whose purpose is to provide a level of quality that meets the needs of users. The objective of quality control is to provide quality that is safe, adequate, dependable, and economical. The overall system involves integrating the quality factors of several related steps including: the proper specification of what is wanted, production to meet the full intent of the specification, inspection to determine whether the resulting material, product, service, etc… is in accordance with the Specifications, and review of usage to determine necessary revisions of Specifications.

In practice, Quality Control refers to those procedures, criteria, and tests employed and paid for by the CONTRACTOR(s) to confirm that the work satisfies the CONTRACTOR's standards, and is in compliance with the Contract Drawings and Specifications. This plan does not address Quality Control procedures, criteria, and/or tests employed by the CONTRACTOR.

1.2.2 Quality Assurance

Definition (ASTM D3740): - a planned system of activities whose purpose is to provide assurance that the overall quality control program is in fact being effectively implemented. The system involves a continuing evaluation of the adequacy and effectiveness of the overall quality control program with the ability to have corrective measures initiated where necessary. For a specific material, product, service, etc…, this involves verifications, audits, and the evaluation of the quality factors that affect the specification, production, inspection, and use of the product, service, system, or environment.

In practice, Quality Assurance refers to those procedures, criteria, and tests required and paid for by the OWNER to confirm that the work performed by the CONTRACTOR(s) is in compliance with the approved Contract Drawings and Specifications and any additional requirements of this plan.

1.2.3 Layer

A layer is defined as a compacted stratum composed of several lifts constructed without joints.

1.2.4 Lift

A lift is defined as a segment of a layer composed of the maximum thickness of soil permitted to be placed / compacted at one time.

1.3 PARTIES

1.3.1 OWNER

The OWNER is the owner of the solid waste permit, and bears the ultimate responsibility for the facility; the OWNER may or may not also be the Operator of the facility. The OWNER shall contract and manage the CONTRACTOR(s), and the CQA consultant(s) and laboratories. For this project, the Coastal Regional Solid Waste Management Authority is the OWNER.

1.3.2 ENGINEER

The ENGINEER is the official representative of the OWNER, and is responsible for the preparation of the Contract Drawings, Technical Specifications, and CQA Plan. The ENGINEER is also responsible for the interpretation of those documents and for the resolution of technical matters that may arise during construction. For this project, the ENGINEER is Joyce Engineering, Inc.

1.3.3 CQA Consultant

The CQA Consultant is independent from the CONTRACTOR(s), Manufacturer, and Installer, that is responsible for observing, testing, and documenting activities related to the Quality Assurance of the earthwork and geosynthetic components at the site. The CQA Consultant corresponds with the ENGINEER throughout the project and shall report deviations from the Work and items of non-compliance. The CQA Consultant is also responsible for issuing a certification report, sealed by a registered Professional Engineer, licensed in the State in which the project work is conducted.

1.3.4 Soils CQA Laboratory

The Soils CQA Laboratory is independent from the CONTRACTOR(s), and Supplier, responsible for performing the required laboratory testing of the project earthwork components.

1.3.5 Geosynthetic CQA Laboratory

The Geosynthetic CQA Laboratory is independent from the CONTRACTOR(s), Manufacturer, and Installer, responsible for performing the required laboratory testing of the project geosynthetic materials.

1.3.6 CONTRACTOR

The CONTRACTOR has the primary responsibility for ensuring that the work is performed in accordance with the Contract Drawings and Specifications developed by the ENGINEER and approved by the permitting agency. Other responsibilities include the performance of all construction activities at the site

including site facilities, administration, material purchasing, procurement, supervision, Construction Quality Control, installation, and subcontracting. The CONTRACTOR is responsible for the protection of completed work until it is accepted by the OWNER. The CONTRACTOR is also responsible for informing the OWNER and CQA Consultants of the scheduling and occurrence of all construction activities.

1.3.7 Geomembrane Manufacturer(s)

The geomembrane manufacturer is responsible for the production of geomembrane rolls from resin.

1.3.8 Geomembrane Installer(s)

The Geomembrane Installer is responsible for the handling, sorting, placing, seaming, loading and other construction-related aspects of the project geosynthetics. The Installer is also responsible for transportation of the materials to the site, and the protection of the materials once they arrive on site, until the work is accepted by the CONTRACTOR.

1.3.9 Surveyor

The Surveyor is responsible for establishing and maintaining lines and grades and temporary benchmarks throughout all relevant areas of the construction site. The Surveyor shall issue a complete set of Record Drawings certified by a Professional Land Surveyor, licensed in the State in which the project work is conducted.

1.4 COMMUNICATIONS AND MEETINGS

Frequent and open communications are a necessary and essential component of this plan in order to achieve a high degree of coordination, cooperation, and quality in the finished product, and to minimize or avoid delays. It is one goal of this plan to resolve problems at the lowest possible level of authority while maintaining thorough documentation, informing all responsible parties, and obtaining approvals as necessary or appropriate. The documentation requirements of CQA activities are addressed in various sections of this plan. A series of meetings shall be held before, during, and after construction to facilitate planning, progress reports and problem resolution. Minutes are to be kept of all meetings as directed by the ENGINEER. The meetings shall be as follows unless otherwise directed by the OWNER:

- Preconstruction Meeting to be held as directed by the ENGINEER and to be attended by the OWNER or Owner's Representative, CQA Consultant, CONTRACTOR, significant subcontractors and suppliers as designated by the ENGINEER.
- Progress Meetings to be held as directed by the ENGINEER and to be attended by the OWNER or Owner's Representative, CQA Consultant, CONTRACTOR, and representatives of parties actively involved in the construction as designated by the ENGINEER.

- Post-Construction Resolution Meeting to be attended by the OWNER or Owner's Representative, CQA Consultant, CONTRACTOR, significant subcontractors and suppliers as directed by the ENGINEER.

2.0 EARTH MATERIALS

2.1 INTRODUCTION

This section of the plan describes Construction Quality Assurance (CQA) procedures for the installation of the earth material components of the project.

2.2 SCOPE

2.2.1 General

The work addressed under this section shall facilitate proper construction of all earth material components of the project. All work shall be constructed to the lines, grades, and dimensions indicated on the approved Contract Drawings, in accordance with the Contract Specifications, or as required by the OWNER or OWNER's Representative.

2.3 EARTH MATERIALS CQA TESTING

2.3.1 General

Assurance that construction of the earth material components of the project has been performed in accordance with the approved Contract Drawings and Specifications shall be accomplished by use of CQA testing and visual observations.

CQA testing shall consist of the following:

- Construction Quality Evaluation; and
- Special Testing.

2.3.2 Construction Quality Evaluation Testing

Construction quality evaluation shall be performed on all components of earthwork construction at the frequencies shown in Table 1. Criteria to be used for determination of acceptability of the work shall be as identified in the Contract Specifications and as detailed in this plan. Construction evaluation testing shall consist of visual observations of the work, in-place density/moisture content verification, investigations into the adequacy of layer bonding and clod destruction, elevation and thickness monitoring, and special testing. Evaluation of the construction work shall include the following:

- Observations and documentation of the water content, clod size and other physical properties of the soil during processing, placement and compaction;
- Observation and documentation of each compacted lift's ability to accept and bond to subsequent lifts;
- Observation and documentation of the thickness of compacted and loosely placed lifts;
- Observation and documentation of the performance of the compaction and heavy equipment on the construction surface (sheep's-foot penetration, pumping, cracking, etc…); and
- Observation and documentation of the effectiveness of the procedures used to prevent desiccation and/or freezing of completed lifts and layers.

The in-place density test methods shall cause minimal delay to the placement of subsequent lifts; therefore, the nuclear method is preferred unless construction sequencing is such that fill placement is not interrupted by sand cone or drive cylinder testing. An acceptable test for soils used in structural or

"controlled fill" applications (i.e. embankments, berms, backfill, soil liner, subgrade, etc.) shall be defined as one, which meets or exceeds the specified minimum density within the specified moisture range.

If there is any question as to the classification of the tested soil, and hence the appropriateness of a given moisture-density plot, a "one-point" Standard Proctor compaction test shall be performed for comparison with the available plots. The optimum moisture content and maximum dry density extrapolated from the one-point test result must fall on or near the plotted line of optimums for the classification of a soil to be confirmed. For controlled fill, the reference maximum dry density can be adjusted to accommodate the one-point data.

Questions concerning the accuracy of any single test shall be addressed by retesting in that or another representative location. Periodic sand cone or drive cylinder testing shall be performed to verify the adequacy of the nuclear gauge testing at the frequencies designated in Table 1. If a conflict exists between the sand cone or drive cylinder testing and the corresponding nuclear density test results, then the sand cone and/or drive cylinder results shall control.

It is important to bond lifts together to the greatest extent possible. Bonding of lifts is enhanced by:

- Ensuring that the surface of the previously compacted lift (or subgrade) is rough before placing the new lift of soil;
- Adding moisture to the previously compacted lift (or subgrade); and
- Using a fully penetrating footed roller.

Evaluation of lift bonding in soil liner and similar applications shall be done by using test pits or auger holes to visually observe the lift interfaces. Alternatively, Shelby tubes pushed through the lift interfaces can be visually inspected for proper lift bonding.

2.3.3 Test Pad

A test pad shall be constructed as outlined in the project specifications to develop and demonstrate construction methods that shall be used to produce a compacted soil liner/cap satisfying the requirements of the specifications.

2.4 DOCUMENTATION/CERTIFICATION

2.4.1 General

The CQA Consultant shall document the activities associated with the construction of the earth material components of the project. Such documentation shall include, as a minimum, daily reports of construction activities and a summary technical report on the construction project. Documentation and reporting shall meet all requirements of the Contract Specifications and this CQA Plan.

2.4.2 Construction Monitoring

Construction of earth material components of the project shall be monitored and documented by a CQA Consultant. Soils laboratory testing shall be performed and documented by an independent testing laboratory working under the direction of the CQA Consultant.

Written daily documents shall include a record of observations, test data sheets, identification of problems encountered during construction, corrective measures taken, weather conditions, and personnel and equipment on site.

2.4.3 Certification

The CQA Consultant(s) shall prepare a certification report addressing each major item identified above for each phase of construction under their areas of responsibility. Certification reports required by regulatory agencies shall also be prepared and submitted as required.

Certification shall include assessments of compliance with the Contract Drawings and Specifications and the results of the physical sampling and testing. At a minimum, the certification report shall include:

- Copies of all daily CQA field reports;
- Results of all field testing including drawings depicting the locations of construction testing when appropriate;
- Results of all laboratory testing;
- Photographic record of the project including representative photographs of each major construction activity; and
- Certification statement assessing compliance with the Contract Drawings and Specifications, sealed by a professional engineer, licensed in the State in which the project work is conducted.

3.0 GEOSYNTHETICS

3.1 INTRODUCTION

This section of the plan describes Construction Quality Assurance (CQA) procedures for the installation of all geosynthetic components of the project. This section is devoted to Quality Assurance, not to Quality Control. A separate geosynthetic Quality Control manual shall be submitted by the CONTRACTOR in accordance with the Shop Drawings Submittals of the project.

3.2 SCOPE

3.2.1 General

The work addressed under this section shall facilitate proper construction of all geosynthetic components for the project. All work shall be constructed to the lines, grades, and dimensions indicated on the Contract Drawings, in accordance with the Contract Specifications, and as required by the ENGINEER, OWNER, or the CQA Consultant.

The CQA Consultant shall issue a written daily report of activities. These reports shall include observations and test results as well as problems encountered and solutions achieved. Construction reports summarizing significant events, as well as addressing problems and their solutions, shall be submitted to the CQA Consultant.

3.2.2 Installation

The CQA Consultant shall verify that the geosynthetics are installed in accordance with the Contract Drawings and Specifications.

3.3 GEOMEMBRANE MANUFACTURE, FABRICATION, AND DELIVERY

3.3.1 Geomembrane Manufacturing

The geomembrane shall be manufactured from a first quality resin. Only one type of resin (one manufacturer, one resin classification) shall be used to manufacture the geomembrane for this project. In addition, all geomembrane used for this project shall be from the same batch unless otherwise approved in writing by the CQA Consultant and the installer or manufacturer agree to pay for any additional conformance testing required.

3.3.2 Manufacturing

3.3.2.1 Submittals

The CQA Consultant shall verify that:

- The property values certified by the Manufacturer meet all of the Specifications; and
- The measurements of properties by the Manufacturer are properly documented, the test methods used are acceptable, and the geomembrane meets the Manufacturer's and project specifications

3.3.2.2 Rolls

The CQA Consultant shall verify that the manufacturer's quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it, and review the manufacturer's quality control certificates and verify that the certified roll properties meet the Specifications.

3.3.2.3 Conformance Testing

3.3.2.3.1 In-Plant Material Conformance Test Sampling

The CQA Consultant shall arrange for the CQA Laboratory to sample the geomembrane material in-plant and ship these samples to their laboratory for conformance testing as outlined in the project specifications.

The CQA Consultant shall report any nonconformance of sampling procedures as outlined in the project specifications to the ENGINEER.

The expressed purpose of in-plant Material Conformance Test Sampling is to verify that geomembrane material designated for the OWNER'S project is confirmed as meeting the project Specifications prior to shipment to the site. The Manufacturer shall make available all necessary personnel and equipment to assist the CQA Consultant in retrieving conformance samples of the geomembrane material.

Sampling Procedures

The samples will be taken from selected rolls and cutting full-width, 3 feet long, samples from the outer wrap of the selected roll(s). The outer revolution of geomembrane shall be discarded before the test sample is taken. The sample rolls must be relabeled for future

identification. The CQA Consultant shall mark the roll direction on the samples with an arrow.

Unless otherwise specified, samples shall be taken at a rate of one per batch or one per 100,000 ft^2, whichever is the most frequent.

Test Procedures

Conformance testing shall be conducted in accordance with the test methods stated in Tables 1 and 2 of GRI Test Method GM13 (latest version) for HDPE geomembrane and Tables 1 and 2 of GRI Test Method GM17 (latest version) for LLDPE geomembrane and include the following properties:

- Density;
- Carbon black content;
- Carbon black dispersion;
- Melt index;
- Thickness;
- Tensile strength;
- Tear resistance; and
- Asperity height.

3.3.2.4 Test Results

The CQA Consultant shall examine all results from laboratory conformance testing and shall report any nonconformance to the ENGINEER.

3.3.2.4.1 Procedures in Event of a Conformance Test Failure

The procedures described in the project specifications shall be followed. The CQA Consultant shall document actions taken in conjunction with conformance test failures.

3.3.3 Delivery

3.3.3.1 Transportation and Handling

The CQA Consultant shall verify that:

- Handling equipment used on the site does not damage the geomembrane; and
- The Installer's personnel handle the geomembrane with care.

Upon delivery at the site, the Installer and the CQA Consultant shall conduct a surface observation of all rolls for defects and for damage. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected.

- Rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and
- Rolls which include minor repairable flaws.

3.3.3.2 Storage

The CQA Consultant shall verify that the geosynthetic materials staging area is well draining, that the materials are covered, protected and stay dry during storage.

3.4 GEOMEMBRANE INSTALLATION

3.4.1 Earthwork

3.4.1.1 Surface Preparation

The CONTRACTOR shall be responsible for preparing the supporting soil according to the Specifications.

The CQA Consultant shall verify that:

- A qualified land surveyor, licensed in the State in which the project work is conducted, has verified all lines and grades;
- That the supporting soils meet the density specification and provide a firm foundation;
- Surface of the subgrade has been prepared and has been certified as acceptable to the Installer; and
- The surface is generally free of irregularities, rocks, sticks, roots, loose soil, and abrupt changes in grade which may cause damage to the geomembrane and require its repair after deployment;

In general, at any time before and during the geomembrane installation, the CQA Consultant shall indicate to the CONTRACTOR locations, which may not provide adequate support to the geomembrane.

3.4.2 Geomembrane Placement

3.4.2.1 Field Panel Identification

It shall be the responsibility of the CQA Consultant to ensure that each field panel shall be given an "identification code" (number or letter-number) consistent with the layout plan. This field panel identification code should be as simple and logical (manufacturing roll numbers are usually cumbersome and are not related to location in the field).

3.4.2.2 Field Panel Placement

3.4.2.2.1 Location

The CQA Consultant shall verify that field panel installation follows the Installer's layout plan, as approved or modified.

3.4.2.2.2 Installation Schedule

The CQA Consultant shall:

- Evaluate every change in the schedule proposed by the Installer.
- Verify that the condition of the supporting soil has not changed detrimentally during installation.
- Record the identification code, location, and date of installation of each field panel.

3.4.2.2.3 Weather Conditions

Geomembrane placement shall not proceed:

- At ambient temperatures below 40°F or above 104 °F unless authorized by the CQA Consultant.
- During any precipitation, in an area of ponding water, or during excessive winds.

The CQA Consultant shall verify that the above conditions are fulfilled. Additionally, the CQA Consultant shall verify that the supporting soil has not been damaged by weather conditions.

3.4.2.2.4 Method of Placement

The CQA Consultant shall verify that:

- Any equipment used does not damage the geomembrane by handling, trafficking, heat, leakage of hydrocarbons or other means;
- The prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement; any geosynthetic elements immediately underlying the geomembrane are of acceptable cleanliness and are free of debris;
- All personnel working on the geomembrane do not smoke, wear shoes which may damage the geomembrane, or engage in other activities which could damage the geomembrane;
- The method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring using sand bags has been placed to prevent uplift by wind. The loading should be continuous along the edges of panels to minimize the risk of wind flow under the panels;
- All field seaming and installation of appurtenances (sumps, etc.) are done in accordance with the plans and Specifications; and
- Direct contact of equipment with the geomembrane is minimized; i.e., the geomembrane is protected by geotextile, extra geomembrane, or other suitable material in areas where heavy traffic may be expected.

3.4.2.2.5 Damage

The CQA Consultant shall visually examine each panel, after placement and prior to seaming, for damage. Damaged panels or portions of damaged panels, which have been rejected, shall be

marked, and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in the project specifications.

As a minimum, The CQA Consultant shall ensure that each panel is placed in such a manner that it is unlikely to be damaged, and any tears, punctures, holes, thin spots, etc., are marked for repair or the panel is rejected.

3.4.3 Field Seaming

3.4.3.1 General Seaming Procedure

The CQA Consultant shall verify that the seaming procedures listed in the project specifications are followed.

- The CQA Consultant shall log all appropriate temperatures and conditions, and shall log and report any non-compliance.
- The CQA Consultant shall observe all trial seam procedures and log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. Additional samples may be cut from the remainder of the trial seam to be archived by the OWNER, and/or tested by the CQA Laboratory or CQA Consultant.

3.4.3.2 Seam Preparation

The CQA Consultant shall verify that:

- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;
- If seam overlap grinding is required, the process is completed according to the Manufacturer's Specification, and in a way that does not damage the geomembrane; the depth of the abrasion must not exceed 10 percent of the nominal material thickness;
- Seams are aligned without wrinkles and "fishmouths".

3.4.3.3 Weather Conditions for Seaming

The CQA Consultant shall verify that the weather conditions are suitable for seaming or determine if the installation should be stopped or postponed.

3.4.3.4 Overlapping and Temporary Bonding

The CQA Consultant shall verify that:

- The panels of geomembrane have a finished overlap, sufficient to allow peel tests to be performed on the seam;
- No solvent or adhesive is used unless the product is approved in writing by the ENGINEER (samples shall be submitted to the ENGINEER for testing and evaluation); and
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of any spot seaming apparatus is controlled such that the geomembrane is not damaged. "Damage" includes a loss in durability).

3.4.4 Nondestructive Seam Continuity Testing

The CQA Consultant shall:

- Observe continuity testing;
- Record location, date, time, name of tester, and outcome of all testing; and
- Inform the Installer of any required repairs.

The Installer shall complete any required repairs in accordance with the project specifications.

The CQA Consultant shall:

- Observe the repair and re-testing of the repair;
- Mark on the geomembrane that the repair has been made; and
- Record location, date, time, name of tester, and outcome of all testing.

3.4.5 Destructive Testing

3.4.5.1 Sampling Procedure

The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample, and mark it accordingly; record the reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

3.4.5.2 Field Testing

The CQA Consultant shall witness field tests and mark samples and portions with their number. The CQA Consultant shall also log the date and time, number of seaming unit, name of technician, seaming apparatus temperatures and speeds, pass or fail description.

3.4.5.3 Construction Quality Assurance Laboratory Testing

Destructive test samples shall be packaged and shipped by the CQA Consultant to the CQA Laboratory. The CQA Consultant shall be responsible for storing the archive samples. Test samples shall be tested by CQA Laboratory.

Testing shall follow GRI Test Method GM19. The minimum acceptable values to be obtained in these tests are those indicated in GRI Test Method GM19.

The CQA Laboratory shall provide test results within 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as they become available.

3.4.5.4 Destructive Sample Pass/Fail Criteria

The CQA Consultant shall document all laboratory results for destructive samples to assure that they meet the requirements set forth in the project specifications and GRI Test Method GM19.

3.4.5.5 Procedures for Destructive Test Failure

The CQA Consultant shall document all actions taken in conjunction with destructive test failures to verify that they meet the requirements set forth in the project specifications.

3.4.6 Defects and Repairs

3.4.6.1 Verification of Repairs

The CQA Consultant should observe nondestructive testing of repairs and record the date of the repair and test outcome.

3.4.6.2 Large Wrinkles

The CQA Consultant shall indicate which wrinkles should be cut and repaired by the Installer. The repair thus produced shall be tested like any other repair.

3.4.7 Backfilling of Anchor Trench

The CQA Consultant shall observe the backfilling operation.

3.4.8 Lining System Acceptance

The CQA Consultant shall verify that installation has proceeded in accordance with the CQA Plan for the project.

3.4.9 Materials in Contact with the HDPE Geomembrane

3.4.9.1 Soil

The CQA Consultant shall verify that the Specifications are consistent with the state of practice such as:

- Placement of soils on the geomembrane shall not proceed at an ambient temperature below 40°F nor above 104°F unless otherwise specified;
- A geotextile or other cushion approved by the ENGINEER may be installed between a drainage layer and the geomembrane;
- Equipment used for placing soil shall not be driven directly on the geomembrane;
- A minimum thickness of 1 foot of drainage material is specified between a light dozer (such as a wide pad Caterpillar D-5 or lighter) and the geomembrane;
- A minimum thickness of 4 feet of soil/stone is specified between rubber-tired vehicles and the geomembrane; and
- In heavily trafficked areas such as access ramps, soil/stone thickness should be at least 4 feet.
- Verify the required soil thickness; and that placement of soil is done in such a manner that geomembrane damage is unlikely.

3.4.10 Sumps and Appurtenances

The CQA Consultant shall review the Specifications and verify the use of geosynthetic layers between structures and geomembrane.

The CQA Consultant shall verify that:

- Installation of the geomembrane in sump and appurtenance areas, and connection of geomembrane to sumps and appurtenances have been made according to Drawings and Specifications;
- Welding around appurtenances is complete since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to sumps and appurtenances.

3.5 GEOTEXTILE

3.5.1 Manufacturing

The CQA Consultant shall examine all manufacturer certifications to ensure that the property values listed on the certifications meet or exceed those specified for the particular type of geotextile.

3.5.2 Labeling

The CQA Consultant shall examine rolls upon delivery and note any deviation from the requirements listed in the project specifications.

3.5.3 Shipment and Storage

The CQA Consultant shall observe rolls upon delivery at the site and note any deviation from the requirements listed in the project specifications. Any damaged rolls shall be rejected and replaced at no additional cost to the OWNER.

3.5.4 Conformance Testing

3.5.4.1 Tests

In-Plant Material Conformance Test Sampling

The CQA Consultant shall arrange for the CQA Laboratory to sample the geotextile material in-plant and ship these samples to their laboratory for conformance testing as outlined in the project specifications.

The CQA Consultant shall report any nonconformance of sampling procedures as outlined in the project specifications.

NOTE: All geotextile used for this project shall be from the same lot unless otherwise approved by the CQA Consultant. The manufacturer or supplier shall perform additional conformance testing, at no additional cost to the OWNER.

3.5.4.2 Sampling Procedures

The samples will be taken from selected rolls by removing the protective wrapping and cutting full-width, 1-m-long (3-ft-long) samples from the outer wrap of the selected roll(s). The outer revolution of geotextile is to be discarded before the test sample is taken. The sample rolls must be relabeled for future identification. Items to be considered are the following:

- The conformance test samples shall be identified by type, style, or lot and roll numbers. The machine direction should be noted on the sample(s) with a waterproof marker.
- A lot is defined as a unit of production, a group of other units, rolls having one or more common properties, and being readily separable from other similar units.
- Unless otherwise stated, sampling should be based on one per lot or one per 100,000 sq ft, whichever is greater.

3.5.4.3 Test Procedures

Conformance testing shall be shall be conducted in accordance with the most recent versions of GRI Test Method GT12(a) for geotextile cushions and GRI Test Method GT13(a) (moderate survivability) for geotextile separators, and include the following properties:

Mass per unit area
Grab tensile strength
Trapezoidal tear strength
Puncture strength
Permittivity*
Apparent opening size*

*Only if geotextile is to be used as a filter/separator

3.5.4.4 Test Results

The CQA Consultant shall examine all results from laboratory conformance testing.

3.5.4.5 Conformance Test Failure

The CQA Consultant shall document actions taken in conjunction with conformance test failures as outlined in the project specifications.

3.5.5 Handling and Placement

The CQA Consultant shall note any noncompliance to the project specifications.

3.5.6 Seams and Overlaps

The CQA Consultant shall note any noncompliance to the project specifications.

3.5.7 Repair

The CQA Consultant shall observe any repair, note any noncompliance with the requirements listed in the project specifications.

3.5.8 Placement of Soil Materials

The Installer shall place cover soil materials on top of a geotextile in such a manner as to ensure no damage to the geotextile such as slippage on underlying layers, and tensile stresses in the geotextile.

3.6 GEOCOMPOSITE

3.6.1 Manufacturing

The CQA Consultant shall examine all manufacturer's certifications to ensure that the property values listed on the certifications meet or exceed those specified.

3.6.2 Labeling

The CQA Consultant shall examine rolls upon delivery and note any deviation from the requirements listed in the project specifications.

3.6.3 Shipment and Storage

The CQA Consultant shall verify that geocomposite materials are free of soil and dust before installation and shall record the observation of this verification. Washing operations shall be observed by the CQA Consultant.

3.6.4 Conformance Testing

3.6.4.1 Tests

In-Plant Material Conformance Test Sampling

The CQA Consultant shall arrange for the CQA Laboratory to sample the geocomposite material in-plant and ship these samples to their laboratory for conformance testing as outlined in the project specifications.

The CQA Consultant shall report any nonconformance of sampling procedures as outlined in the project specifications.

NOTE: All geocomposite used for this project shall be from the same lot unless otherwise approved by the ENGINEER. The manufacturer or supplier shall perform additional conformance testing, at no additional cost to the OWNER.

As a minimum, the following tests shall be performed on geocomposite:

Geotextile apparent opening size
Geotextile puncture strength
Geocomposite transmissivity

3.6.4.2 Sampling Procedures

The samples will be taken from selected rolls by removing the protective wrapping and cutting full-width, 1-m-long (3-ft-long) samples from the outer wrap of the selected roll(s). The outer revolution

of geocomposite is to be discarded before the test sample is taken. The sample rolls must be relabeled for future identification. Items to be considered are the following:

- The conformance test samples shall be identified by type, style, or lot and roll numbers. The machine direction should be noted on the sample(s) with a waterproof marker.
- A lot is defined as a unit of production, a group of other units, rolls having one or more common properties, and being readily separable from other similar units.
- Unless otherwise stated, sampling should be based on one per lot or one per 100,000 sq ft, whichever is greater.

3.6.4.3 Test Results

The CQA Consultant shall examine all results from laboratory conformance testing.

3.6.4.4 Conformance Test Failure

The CQA Consultant shall document actions taken in conjunction with conformance test failures as outlined in the project specifications.

3.6.5 Handling and Placement

The CQA Consultant shall note any noncompliance to the project specifications.

3.6.6 Repair

The CQA Consultant shall observe repairs, note any noncompliance to the project specifications.

3.6.7 Placement of Soil Materials

Any noncompliance to the project specifications shall be noted by the CQA Consultant.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the placement of soil.

3.7 GEOSYNTHETIC CLAY LINER (GCL)

3.7.1 Storage

Geosynthetic clay liner rolls must always be stored in a location where they shall not be exposed to moisture.

3.7.2 Handling & Placement

On slopes, geosynthetic clay liners should be placed with overlap oriented parallel to the maximum slope (i.e. down the slope).

Adjoining panels of geosynthetic clay liners should be overlapped a minimum of six inches (6”).

Geosynthetic clay liners should never be installed in standing water or during rain.

Geosynthetic clay liners should always be installed with appropriate side up.

Rolls should be pulled tight to smooth out any creases or folding.

Precautions should be taken to avoid damage to any underlying geosynthetic materials while placing the geosynthetic clay liners.

Cover geosynthetic clay liners with geomembrane or other cover materials after placement to avoid damage from precipitation.

3.7.3 Repairs

Repairs to cuts or tears in installed material should extend a minimum of six inches (6”) beyond the area in need of repair. Repair pieces should be held in place until cover material has been placed.

4.0 LEACHATE COLLECTION PIPING

4.1 INTRODUCTION

This section of the plan addresses the quality assurance of the installation of all pipes and manholes used on the project in the leachate collection and removal system (LCRS) including, leachate collection pipes and leachate transmission pipes.

4.2 SCOPE

4.2.1 General

The work addressed under this section shall facilitate proper construction of all LCRS piping installed in or outside the disposal cells on the project. All work shall be constructed to the lines, grades, and dimensions indicated on the project plans, in accordance with the project specifications, or as required by the OWNER and ENGINEER. The CQA Consultant shall issue a written daily report of activities. These reports shall include, as a minimum, observations and test results as well as problems encountered and solutions achieved. Construction reports summarizing significant events, as well as addressing all problems encountered and their solutions, shall be issued weekly to the OWNER and ENGINEER. The format of these reports shall be established at the pre-construction meeting.

4.3 MANUFACTURING AND DELIVERY OF MATERIALS

4.3.1 Pipe, Fittings, and Manholes

It is a requirement of the contract that prior to delivery of materials, the CONTRACTOR shall submit detailed or shop drawings and manufacturer’s specifications of all materials to be furnished for the project. These drawings and specifications shall be reviewed by the ENGINEER to determine if the materials meet the requirements of the contract specifications. The submittals shall be either approved or rejected. Rejection shall require a resubmission of the information.

4.3.2 Delivery

Upon delivery, the CQA Consultant shall inspect all pipes, fittings, and other appurtenances for conformity with the specifications and proper storage. The CQA Consultant may prescribe corrective repairs or may reject the material as deemed necessary.

4.4 INSTALLATION OF PIPES AND MANHOLES

4.4.1 Testing

Testing shall be done on sections of pipeline as determined ready for testing by the CQA Consultant.

4.4.1.1 Examination of Materials

All pipes, fittings, manholes, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and the deficiency shall be corrected or the material shall be rejected and replaced as deemed necessary by the CQA Consultant.

4.4.1.2 Alignment and Gradient

The alignment of the pipe shall be surveyed by a surveyor licensed in the State in which the project work is conducted.

Alignment and gradient of gravity leachate pipes between manholes shall also be checked by the CQA Consultant by sighting from one manhole to a bright light held at the next manhole. Should alignment vary horizontally more than 1/4 the diameter of the pipe, that is, sags and rises be found in the grade, the CONTRACTOR shall locate and correct the defective joints to the satisfaction of the CQA Consultant.

4.4.1.3 Leak Testing of Leachate Transmission Lines

4.4.1.3.1 Infiltration Test

Infiltration test shall be performed only when the line is below the water table to provide a minimum of four feet of head above the top of the pipe at the highest elevation being tested. A weir shall be installed in the lower end of the section being tested and measurement of the depth of flow over the weir recorded at 15-minute intervals for one hour.

4.4.1.3.2 Exfiltration Test

Exfiltration test shall be performed after replacement of broken or cracked pipe, repair of defective joints, and verification of the pipe installation for line and grade, and after cleaning and conditioning the pipe free from deposits, joint drippings, extrusions, or from foreign matter of any kind. Each section of line between manholes, or for longer distances if allowed before backfilling, shall be maintained completely full of water for a period of not less than 30 minutes to allow for absorption of water by the sewer. By use of pre-installed riser sections of pipes at manholes if necessary, or by plumbers plugs and riser, a column of water shall then be maintained at least four feet above the uppermost top section of pipe under test for lines with grades of one percent or less, and to one inch above the crown of the upper end of the pipe, for grade between one to five percent, and as the CQA

Consultant directs, for greater grades. In case the water table in the trench at the time of the test is above the highest invert of the sewer section under test, the column of water above specified shall be accordingly increased.

4.4.1.3.3 Air Test

Air test shall be performed on all leachate transmission lines with grade greater than five percent as outlined below.

Conduct air test when pipe is clean. Plug line at each manhole with pneumatic balls. Introduce low pressure air into plugged line until internal air pressure reaches 4.0 psig greater than average back pressure of any groundwater pressure that may submerge the pipe. Allow at least two minutes for air temperature to stabilize before readings are taken and timing started.

Portion being tested shall pass if it does not lose air at a rate to cause pressure to drop from 3.6 to 3.0 psig (greater than average back pressure of any groundwater that may submerge the pipe) in less time than listed below:

Pipe Diameter in Inches	Minimum Allowable Minutes 3.6 - 3.0 psig Pressure
8 or less	4.0

In lieu of standard exfiltration test, CONTRACTOR may make air tests on lines.

4.4.1.3.4 Infiltration - Exfiltration Test

Infiltration - exfiltration test shall be made by the CONTRACTOR immediately upon completion of the first run of pipe between two manholes, under the direction of the CQA Representative. The remainder of the sewer installation may be tested as the work progresses or upon completion of the project at the option of the CONTRACTOR.

4.4.1.3.5 Leakage

Acceptance of line shall not be made until test requirements have been met. If leakage is detected, CONTRACTOR shall locate and repair defects until leakage is eliminated.

4.4.1.4 Pipe Bedding and Backfill

The gradation and compaction of pipe bedding shall be tested by the contractor to verify compliance with contract specifications.

4.5 INSTALLATION OF DRAINAGE LAYER

4.5.1 Testing

Hydraulic conductivity and grain size will be tested according to Table 1. Additionally the Contractor shall provide test results, as indicated in the Specifications to ensure density, particle size, hydraulic

conductivity and shear strength meat the required parameters. The CQA consultant will review test result and approve of material prior to placement.

4.5.2 Placement

The Contractor is required to provide surveys in accordance with Specification 01720 to demonstrate that the drainage stone was installed to the specified thickness.

5.0 DOCUMENTATION

5.1 Daily Reports

The CQA Consultant shall complete a daily report and logs on prescribed forms, outlining all of the monitoring activities for that day. The area, panel numbers, and seams completed, and measures taken to protect unfinished areas overnight should be identified. Failed seams or other panel areas requiring remedial action must be identified with regard to nature of action, required repair, and location. Repairs completed must also be identified. Any problems or concerns with regard to operations on site should also be noted.

5.2 Record Drawings

Contractor(s) shall provide Record Drawings of installed components including, as applicable:

- Scaled drawing of the completed installation of geomembrane;
- Panels shown and labeled in their relative locations;
- Location of all destructive test samples;
- Location of all geomembrane repairs;

The Project Record Drawings shall address each layer of soil liner, geomembrane and drainage layer for landfill liner expansion, or intermediate cover, geomembrane, and final cover soil for landfill closure; and if necessary, another drawing that identifies problems or unusual conditions of the geotextile or geocomposite layers. In addition, applicable cross-sections shall show layouts of geocomposite and geotextile that are unusual or different from the design drawings.

5.3 Final Certification Report

A Final Certification Report shall be prepared by the CQA Consultant and submitted upon completion of the work. This report shall include all reports prepared by the CQA Consultant personnel, summarize the activities of the project, and document all aspects of the quality assurance program performed. The Final Certification Report shall include as a minimum the following information:

- Personnel involved with the project;
- Scope of work and outline of project;
- Quality assurance methods;
- All test results, including failed ones (destructive and non-destructive, including laboratory tests);
- Descriptions of deviations from the approved plans and of corrections to remediate the deviation;
- Series of color photographs of major project features;
- Certification sealed and signed by a registered Professional Engineer licensed in the State in which the project work is conducted.

- Record Drawings, sealed and signed by a registered Surveyor or Professional Engineer, licensed in the State in which the project work is conducted.

END OF CONSTRUCTION QUALITY ASSURANCE PLAN

TABLE 1 – SOIL TESTING FREQUENCIES

Test Method	Fill		Soil Cap
	Pre- Construction	Construction	Construction
Particle Size Analysis of Soils ASTM D422	One/Material	One/Material(1)	One/Material(1)
Unified Soil Classification System ASTM D2487	One/Material	One/Material(1)	One/Material(1)
Moisture Content of Soil Lab Method ASTM D2216	One/Material	One/Material(1)	One/Material(1)
Atterberg Limits ASTM D4318	One/Material	One/Material(1)	One/Material(1)
Specific Gravity ASTM D854	One/Material	One/Material(1)	One/Material(1)
Standard Proctor ASTM D698	One/Material	One/Material(1)	One/Material(1)
In-place Density by Sand Cone ASTM D1556 or Drive Cylinder ASTM D2937	NA	1/Acre	1/Acre
In-place Density and Water Content by Nuclear Method ASTM D6938	NA	5/Acre	5/Acre
Undisturbed Hydraulic Conductivity ASTM D5084	NA	NA	NA
Laboratory Compacted Hydraulic Conductivity ASTM D5084	NA	NA	NA
Laboratory Compacted Hydraulic Conductivity ASTM D2434	NA	NA	NA

NA – Not Applicable; (1) Required only if material changes;

APPENDIX IV

STORMWATER CALCULATIONS

Soil Map—Forsyth County, North Carolina
(OmniSource Kernersville Soils Map)

Map Scale: 1:1,930 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Forsyth County, North Carolina
Survey Area Data: Version 13, Dec 16, 2013

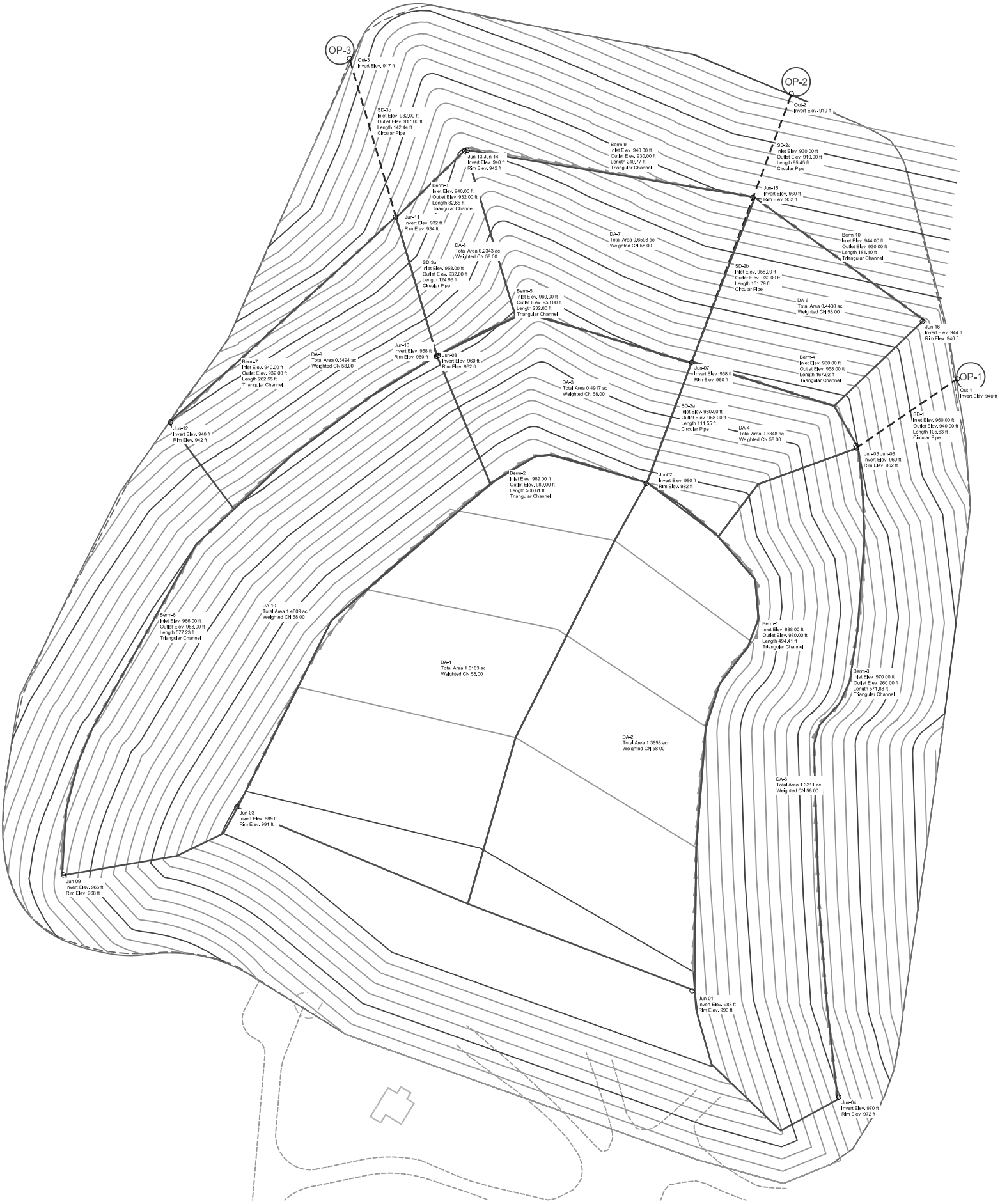
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 10, 2010—Apr 30, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Forsyth County, North Carolina (NC067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BtE	Bannertown-Toast complex, 15 to 25 percent slopes	B	3.8	29.3%
PoF	Poplar Forest fine sandy loam, 15 to 45 percent slopes	B	0.0	0.0%
RoF	Rhodhiss-Bannertown complex, 15 to 45 percent slopes	B	1.0	7.6%
TdB	Toast-Devotion complex, 2 to 6 percent slopes	B	3.6	27.6%
TdC	Toast-Devotion complex, 6 to 10 percent slopes	B	1.4	10.8%
TdD	Toast-Devotion complex, 10 to 15 percent slopes	B	3.3	24.8%
Totals for Area of Interest			**13.1**	**100.0%**


OP-3
Out-3
Invert Elev. 917 ft
SD-3b
Inlet Elev. 932.00 ft
Outlet Elev. 917.00 ft
Length 142.44 ft
Circular Pipe
OP-2
Out-2
Invert Elev. 910 ft
SD-2c
Inlet Elev. 930.00 ft
Outlet Elev. 910.00 ft
Length 95.45 ft
Circular Pipe
Berm-9
Inlet Elev. 940.00 ft
Outlet Elev. 930.00 ft
Length 249.77 ft
Triangular Channel
Jun-13 Jun-14
Invert Elev. 940 ft
Rim Elev. 942 ft
Berm-8
Inlet Elev. 940.00 ft
Outlet Elev. 932.00 ft
Length 82.65 ft
Triangular Channel
Jun-15
Invert Elev. 930 ft
Rim Elev. 932 ft
Jun-11
Invert Elev. 932 ft
Rim Elev. 934 ft
DA-7
Total Area 0.6598 ac
Weighted CN 58.00
Berm-10
Inlet Elev. 944.00 ft
Outlet Elev. 930.00 ft
Length 181.10 ft
Triangular Channel
DA-8
Total Area 0.2343 ac
Weighted CN 58.00
SD-3a
Inlet Elev. 958.00 ft
Outlet Elev. 932.00 ft
Length 124.96 ft
Circular Pipe
SD-2b
Inlet Elev. 958.00 ft
Outlet Elev. 930.00 ft
Length 151.79 ft
Circular Pipe
Berm-5
Inlet Elev. 960.00 ft
Outlet Elev. 958.00 ft
Length 232.60 ft
Triangular Channel
DA-6
Total Area 0.4430 ac
Weighted CN 58.00
Jun-16
Invert Elev. 944 ft
Rim Elev. 946 ft
Berm-7
Inlet Elev. 940.00 ft
Outlet Elev. 932.00 ft
Length 262.55 ft
Triangular Channel
DA-9
Total Area 0.5494 ac
Weighted CN 58.00
Jun-10
Invert Elev. 958 ft
Rim Elev. 960 ft
Jun-08
Invert Elev. 960 ft
Rim Elev. 962 ft
Jun-07
Invert Elev. 958 ft
Rim Elev. 960 ft
Berm-4
Inlet Elev. 960.00 ft
Outlet Elev. 958.00 ft
Length 167.92 ft
Triangular Channel
OP-1
Out-1
Invert Elev. 940 ft
DA-3
Total Area 0.4917 ac
Weighted CN 58.00
SD-3e
Inlet Elev. 980.00 ft
Outlet Elev. 958.00 ft
Length 111.35 ft
Circular Pipe
SD-1
Inlet Elev. 960.00 ft
Outlet Elev. 940.00 ft
Length 105.83 ft
Circular Pipe
Jun-12
Invert Elev. 940 ft
Rim Elev. 942 ft
DA-4
Total Area 0.3348 ac
Weighted CN 58.00
Jun-05 Jun-06
Invert Elev. 960 ft
Rim Elev. 962 ft
Berm-2
Inlet Elev. 989.00 ft
Outlet Elev. 980.00 ft
Length 506.61 ft
Triangular Channel
Jun02
Invert Elev. 980 ft
Rim Elev. 982 ft
Berm-6
Inlet Elev. 966.00 ft
Outlet Elev. 958.00 ft
Length 577.23 ft
Triangular Channel
DA-10
Total Area 1.4809 ac
Weighted CN 58.00
Berm-1
Inlet Elev. 988.00 ft
Outlet Elev. 980.00 ft
Length 494.41 ft
Triangular Channel
DA-1
Total Area 1.5183 ac
Weighted CN 58.00
Berm-3
Inlet Elev. 970.00 ft
Outlet Elev. 960.00 ft
Length 571.88 ft
Triangular Channel
DA-2
Total Area 1.3858 ac
Weighted CN 58.00
DA-5
Total Area 1.3211 ac
Weighted CN 58.00
Jun-03
Invert Elev. 989 ft
Rim Elev. 991 ft
Jun-09
Invert Elev. 966 ft
Rim Elev. 968 ft
Jun-01
Invert Elev. 988 ft
Rim Elev. 990 ft
Jun-04
Invert Elev. 970 ft
Rim Elev. 972 ft

Job:	OmniSource KernersvilleLandfill Reclamation Project
Job Number:	00799.1403.11
Calculated By:	ARD Date: 3/28/2014
Checked By:	LB Date:
Subject:	Berm Summary Sheet
Sheet:	1

Purpose: Summary of the depth and velocity during peak flow for the stormwater conveyance channel sections post closure conditions

Berm ID	Flow Source	Peak 10 yr Flow [cfs]	Slope	Total Flow Depth (10 yr storm) [ft]	Velocity (10 yr storm) [ft/s]	Shear (lbs/ft2)	Temporary Erosion Control	Permanent Erosion Control
1	DA-2	1.1	1.6%	0.5	1.6	0.5	ECB	Vegetation
2	DA-1	1.2	1.8%	0.5	1.7	0.5	ECB	Vegetation
3	DA-5	1.2	1.8%	0.5	1.9	0.5	ECB	Vegetation
4	DA-4	0.3	1.2%	0.3	1.3	0.2	ECB	Vegetation
5	DA-3	0.5	0.9%	0.4	1.3	0.2	ECB	Vegetation
6	DA-10	1.3	1.4%	0.5	1.9	0.5	ECB	Vegetation
7	DA-9	0.6	3.1%	0.3	1.8	0.6	ECB	Vegetation
8	DA-8	0.2	9.7%	0.2	1.9	1.1	ECB	Vegetation
9	DA-7	0.6	4.0%	0.3	1.9	0.8	ECB	Vegetation
10	DA-6	0.5	7.7%	0.3	2.1	1.3	ECB	Vegetation

Job:	OmniSource KernersvilleLandfill Reclamation Project		
Job Number:	00799.1403		
Calculated By:	ARD	Date:	3/28/2014
Checked By:	LB	Date:	
Subject:	Outlet Protection		
Sheet:	2		

Outlet Protection Design

OP-1

The 18" pipe discharges at 1.21 cfs

1. Tailwater

Depth (Tw) = 0.18 ft

Minimum Tailwater Conditions

2. Apron Requirements

From Figure RR-6

La	=	Length of apron	[ft]
	=	**8**	**[ft]**
d50 riprap	=	**6**	**[in]**
apron width at outlet	=	3*Pipe Diameter	
	=	3*1.5 ft	
	=	**4.5**	**[ft]**
apron width at end	=	Pipe Diameter + La	
	=	1.5 ft + 8 ft	
	=	**9.5**	**[ft]**
Thickness (T)	=	**1.25**	**[ft]**

Job:	OmniSource KernersvilleLandfill Reclamation Project		
Job Number:	00799.1403		
Calculated By:	ARD	Date:	3/28/2014
Checked By:	LB	Date:	
Subject:	Outlet Protection		
Sheet:	3		

Outlet Protection Design

OP-2

The 18" pipe discharges at 3.87 cfs

1. Tailwater

Depth (Tw) = 0.31 ft

Minimum Tailwater Conditions

2. Apron Requirements

From Figure RR-6

La	=	Length of apron	[ft]
	=	**8**	**[ft]**
d50 riprap	=	**6**	**[in]**
apron width at outlet	=	3*Pipe Diameter	
	=	3*1.5 ft	
	=	**4.5**	**[ft]**
apron width at end	=	Pipe Diameter + La	
	=	1.5 ft + 8 ft	
	=	**9.5**	**[ft]**
Thickness (T)	=	**1.25**	**[ft]**

Job:	OmniSource KernersvilleLandfill Reclamation Project		
Job Number:	00799.1403		
Calculated By:	ARD	Date:	3/28/2014
Checked By:	LB	Date:	
Subject:	Outlet Protection		
Sheet:	4		

Outlet Protection Design

OP-3

The 18" pipe discharges at 2.01 cfs

1. Tailwater

Depth (Tw) = 0.27 ft

Minimum Tailwater Conditions

2. Apron Requirements

La	=	Length of apron	[ft]
	=	**8**	**[ft]**
d50 riprap	=	**6**	**[in]**
apron width at outlet	=	3*Pipe Diameter	
	=	3*1.5 ft	
	=	**4.5**	**[ft]**
apron width at end	=	Pipe Diameter + La	
	=	1.5 ft + 8 ft	
	=	**9.5**	**[ft]**
Thickness (T)	=	**1.25**	**[ft]**

Project Description

File Name ..... 2014.03.27 OmniSource StormCalcs.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... YES

Analysis Options

Start Analysis On ..... Mar 26, 2013 00:00:00
End Analysis On ..... Mar 28, 2013 00:00:00
Start Reporting On ..... Mar 26, 2013 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	10
Nodes	19
Junctions	16
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	16
Channels	10
Pipes	6
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	10yr	Cumulative	inches	North Carolina	Forsyth	10	5.10	SCS Type III 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DA-1	1.52	58.00	5.10	1.22	1.86	1.27	0 00:20:40
2	DA-10	1.48	58.00	5.10	1.22	1.81	1.43	0 00:13:27
3	DA-2	1.39	58.00	5.10	1.22	1.70	1.16	0 00:20:40
4	DA-3	0.49	58.00	5.10	1.22	0.60	0.51	0 00:10:27
5	DA-4	0.33	58.00	5.10	1.22	0.41	0.33	0 00:12:04
6	DA-5	1.32	58.00	5.10	1.22	1.62	1.30	0 00:12:48
7	DA-6	0.44	58.00	5.10	1.22	0.54	0.48	0 00:09:12
8	DA-7	0.66	58.00	5.10	1.22	0.81	0.65	0 00:12:24
9	DA-8	0.23	58.00	5.10	1.22	0.29	0.24	0 00:11:38
10	DA-9	0.55	58.00	5.10	1.22	0.67	0.60	0 00:08:51

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	988.00	990.00	988.00	0.00	0.00	1.14	988.48	0.00	1.52	0 00:00	0.00	0.00
2	Jun02	Junction	980.00	982.00	980.00	0.00	0.00	2.36	980.48	0.00	1.52	0 00:00	0.00	0.00
3	Jun-03	Junction	989.00	991.00	989.00	0.00	0.00	1.24	989.49	0.00	1.51	0 00:00	0.00	0.00
4	Jun-04	Junction	970.00	972.00	970.00	0.00	0.00	1.28	970.49	0.00	1.51	0 00:00	0.00	0.00
5	Jun-05	Junction	960.00	962.00	960.00	0.00	0.00	1.21	960.48	0.00	1.52	0 00:00	0.00	0.00
6	Jun-06	Junction	960.00	962.00	960.00	0.00	0.00	0.33	960.32	0.00	1.68	0 00:00	0.00	0.00
7	Jun-07	Junction	958.00	960.00	958.00	0.00	0.00	3.00	958.39	0.00	1.61	0 00:00	0.00	0.00
8	Jun-08	Junction	960.00	962.00	960.00	0.00	0.00	0.51	960.40	0.00	1.60	0 00:00	0.00	0.00
9	Jun-09	Junction	966.00	968.00	966.00	0.00	0.00	1.40	966.53	0.00	1.47	0 00:00	0.00	0.00
10	Jun-10	Junction	958.00	960.00	958.00	0.00	0.00	1.34	958.52	0.00	1.48	0 00:00	0.00	0.00
11	Jun-11	Junction	932.00	934.00	932.00	0.00	0.00	2.01	932.33	0.00	1.67	0 00:00	0.00	0.00
12	Jun-12	Junction	940.00	942.00	940.00	0.00	0.00	0.59	940.33	0.00	1.67	0 00:00	0.00	0.00
13	Jun-13	Junction	940.00	942.00	940.00	0.00	0.00	0.24	940.19	0.00	1.81	0 00:00	0.00	0.00
14	Jun-14	Junction	940.00	942.00	940.00	0.00	0.00	0.65	940.33	0.00	1.67	0 00:00	0.00	0.00
15	Jun-15	Junction	930.00	932.00	930.00	0.00	0.00	3.87	930.32	0.00	1.68	0 00:00	0.00	0.00
16	Jun-16	Junction	944.00	946.00	944.00	0.00	0.00	0.47	944.26	0.00	1.74	0 00:00	0.00	0.00
17	Out-1	Outfall	940.00					1.21	940.18					
18	Out-2	Outfall	910.00					3.87	910.31					
19	Out-3	Outfall	917.00					2.01	917.27					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	SD-1	Pipe	Jun-05	Out-1	105.63	960.00	940.00	18.9300	18.000	0.0150	1.21	39.61	0.03	10.15	0.18	0.12	0.00	Calculated
2	SD-2a	Pipe	Jun02	Jun-07	111.55	980.00	958.00	19.7200	18.000	0.0150	2.36	40.43	0.06	12.48	0.24	0.16	0.00	Calculated
3	SD-2b	Pipe	Jun-07	Jun-15	151.79	958.00	930.00	18.4500	18.000	0.0150	3.00	39.10	0.08	13.11	0.28	0.19	0.00	Calculated
4	SD-2c	Pipe	Jun-15	Out-2	95.45	930.00	910.00	20.9500	18.000	0.0150	3.87	41.67	0.09	14.77	0.31	0.21	0.00	Calculated
5	SD-3a	Pipe	Jun-10	Jun-11	124.96	958.00	932.00	20.8100	18.000	0.0150	1.34	41.53	0.03	10.80	0.18	0.12	0.00	Calculated
6	SD-3b	Pipe	Jun-11	Out-3	142.44	932.00	917.00	10.5300	18.000	0.0150	2.01	29.54	0.07	9.49	0.27	0.18	0.00	Calculated
7	Berm-1	Channel	Jun-01	Jun02	494.41	988.00	980.00	1.6200	24.000	0.0500	1.13	51.56	0.02	1.58	0.48	0.24	0.00	
8	Berm-10	Channel	Jun-16	Jun-15	181.10	944.00	930.00	7.7300	24.000	0.0500	0.46	112.70	0.00	2.14	0.25	0.13	0.00	
9	Berm-2	Channel	Jun-03	Jun02	506.61	989.00	980.00	1.7800	24.000	0.0500	1.23	54.03	0.02	1.65	0.48	0.24	0.00	
10	Berm-3	Channel	Jun-04	Jun-05	571.88	970.00	960.00	1.7500	24.000	0.0500	1.21	53.60	0.02	1.92	0.48	0.24	0.00	
11	Berm-4	Channel	Jun-06	Jun-07	167.92	960.00	958.00	1.1900	24.000	0.0500	0.32	44.24	0.01	1.28	0.31	0.16	0.00	
12	Berm-5	Channel	Jun-08	Jun-07	232.80	960.00	958.00	0.8600	24.000	0.0500	0.49	37.57	0.01	1.28	0.39	0.20	0.00	
13	Berm-6	Channel	Jun-09	Jun-10	577.23	966.00	958.00	1.3900	24.000	0.0500	1.34	47.72	0.03	1.86	0.52	0.26	0.00	
14	Berm-7	Channel	Jun-12	Jun-11	262.55	940.00	932.00	3.0500	24.000	0.0500	0.57	70.75	0.01	1.84	0.33	0.16	0.00	
15	Berm-8	Channel	Jun-13	Jun-11	82.65	940.00	932.00	9.6800	24.000	0.0500	0.24	126.11	0.00	1.92	0.19	0.09	0.00	
16	Berm-9	Channel	Jun-14	Jun-15	249.77	940.00	930.00	4.0000	24.000	0.0500	0.63	81.10	0.01	1.94	0.32	0.16	0.00	

Subbasin Hydrology

Subbasin : DA-1

Input Data

Area (ac) 1.52
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.52	B	58.00
Composite Area & Weighted CN	1.52		58.00

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	19.69	0.00	0.00

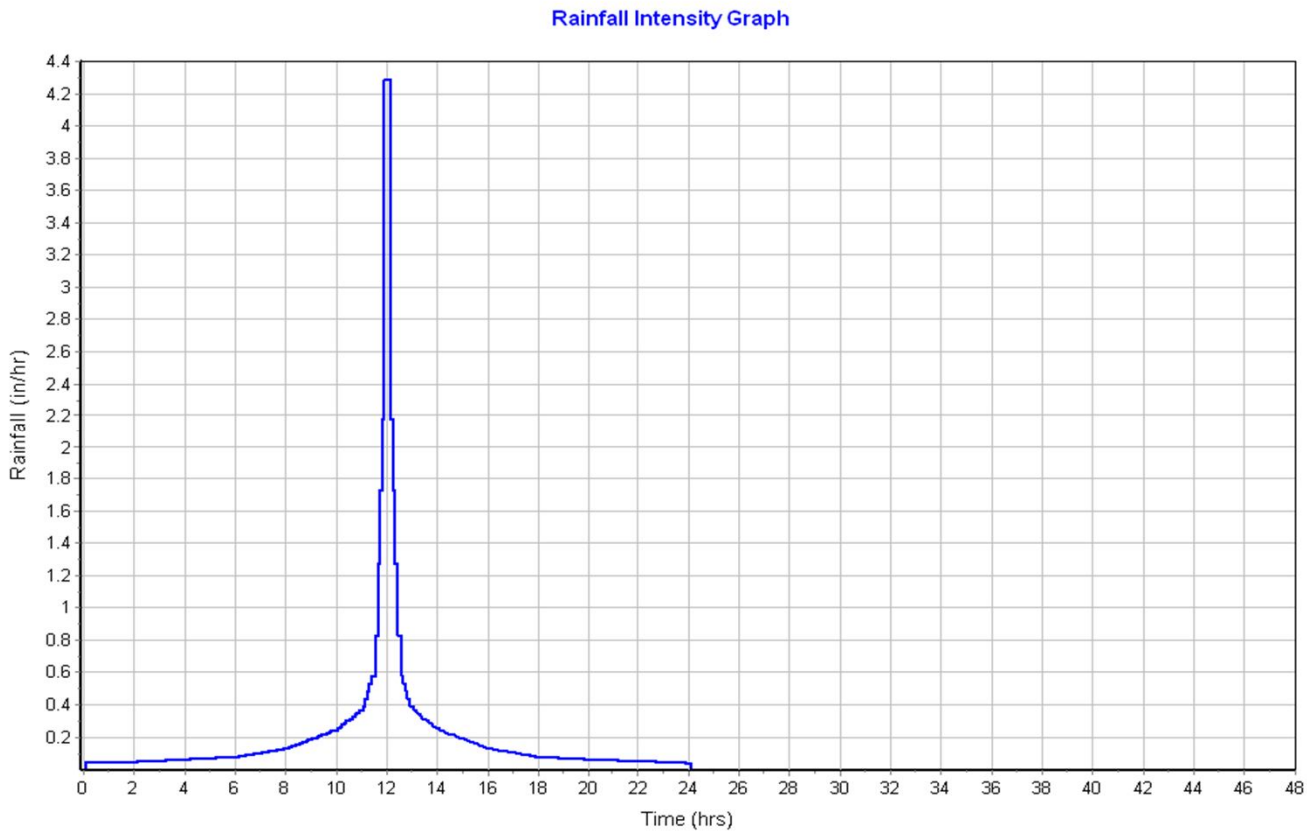
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	240	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.98	0.00	0.00

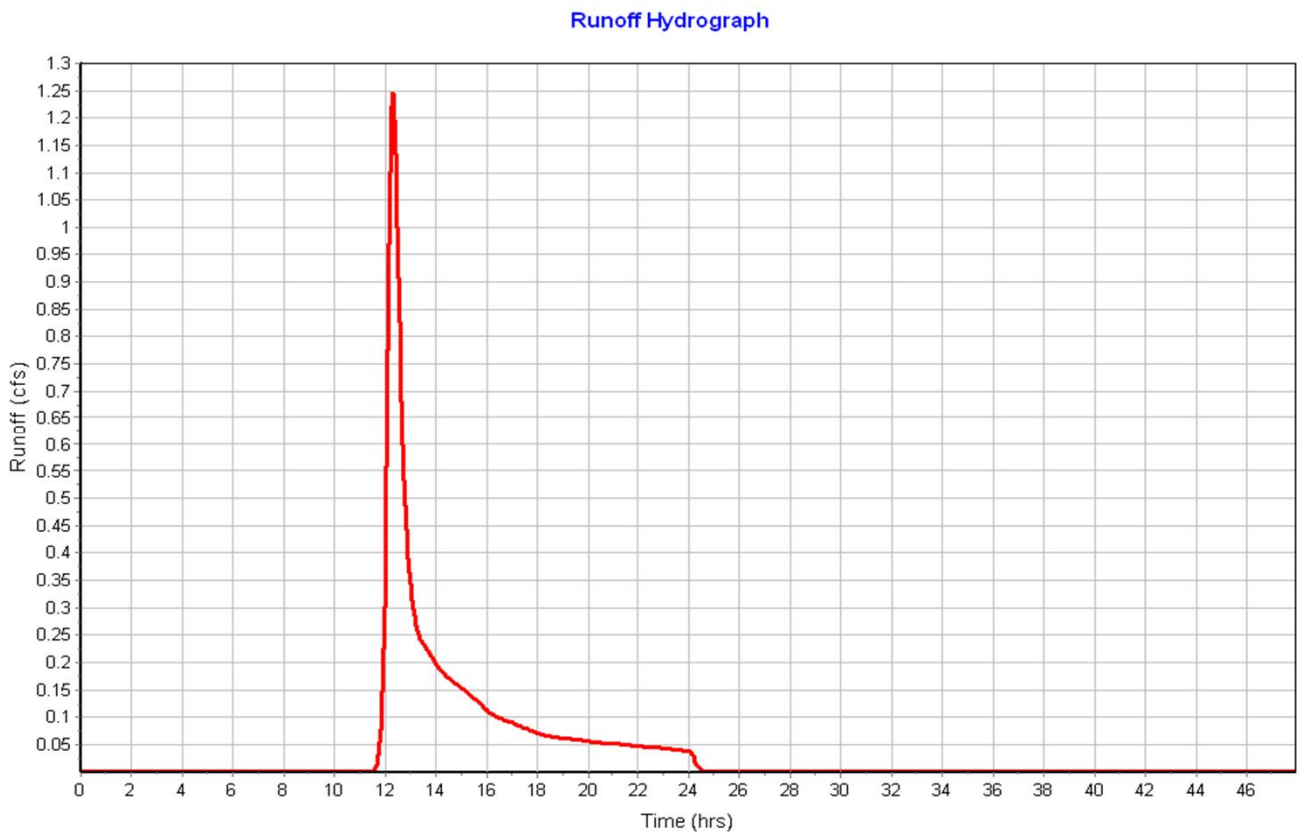
Total TOC (min) 20.67

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 1.27
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:20:40

Subbasin : DA-1





Subbasin : DA-10

Input Data

Area (ac) 1.48
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.48	B	58.00
Composite Area & Weighted CN	1.48		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	146.61	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	11.10	0.00	0.00

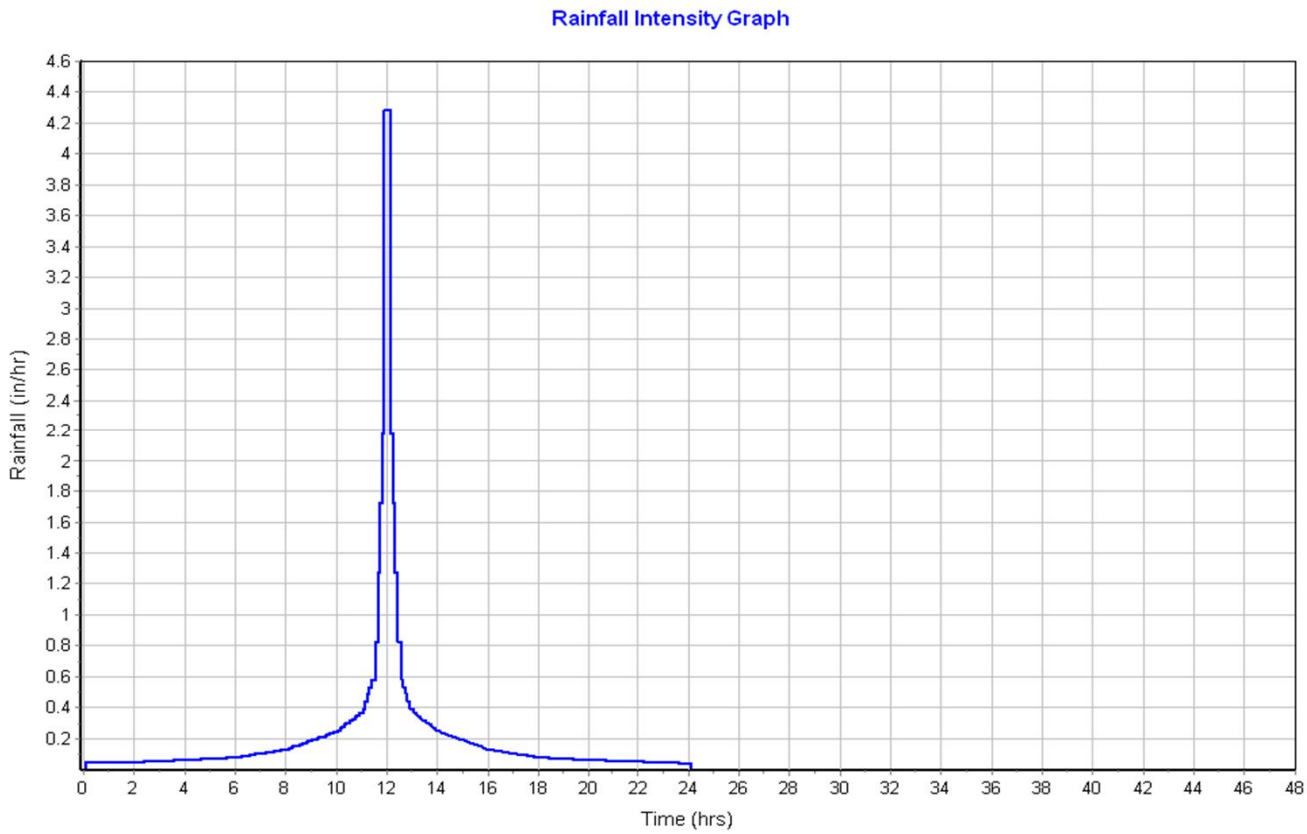
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	577.74	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	2.36	0.00	0.00

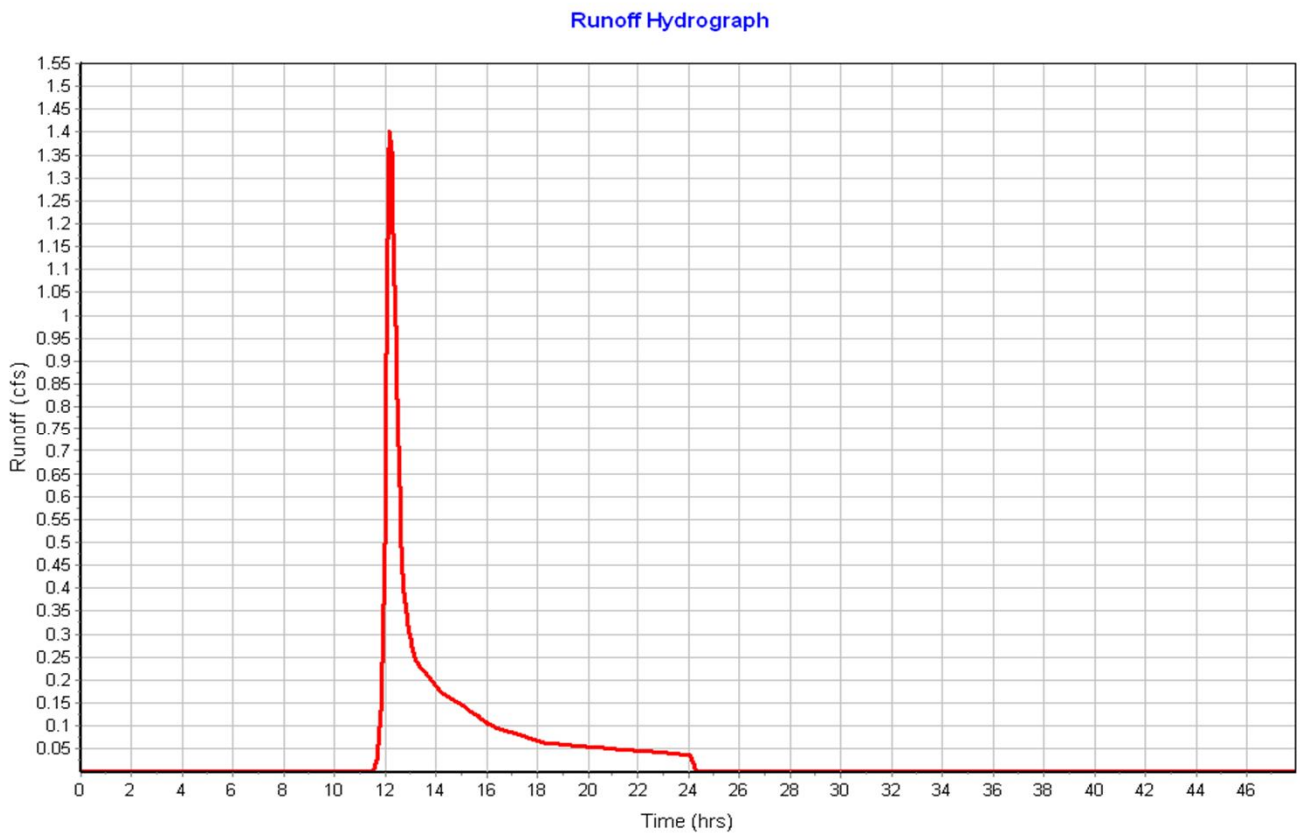
Total TOC (min) 13.46

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 1.43
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:13:28

Subbasin : DA-10





Subbasin : DA-2

Input Data

Area (ac) 1.39
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.39	B	58.00
Composite Area & Weighted CN	1.39		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	19.69	0.00	0.00

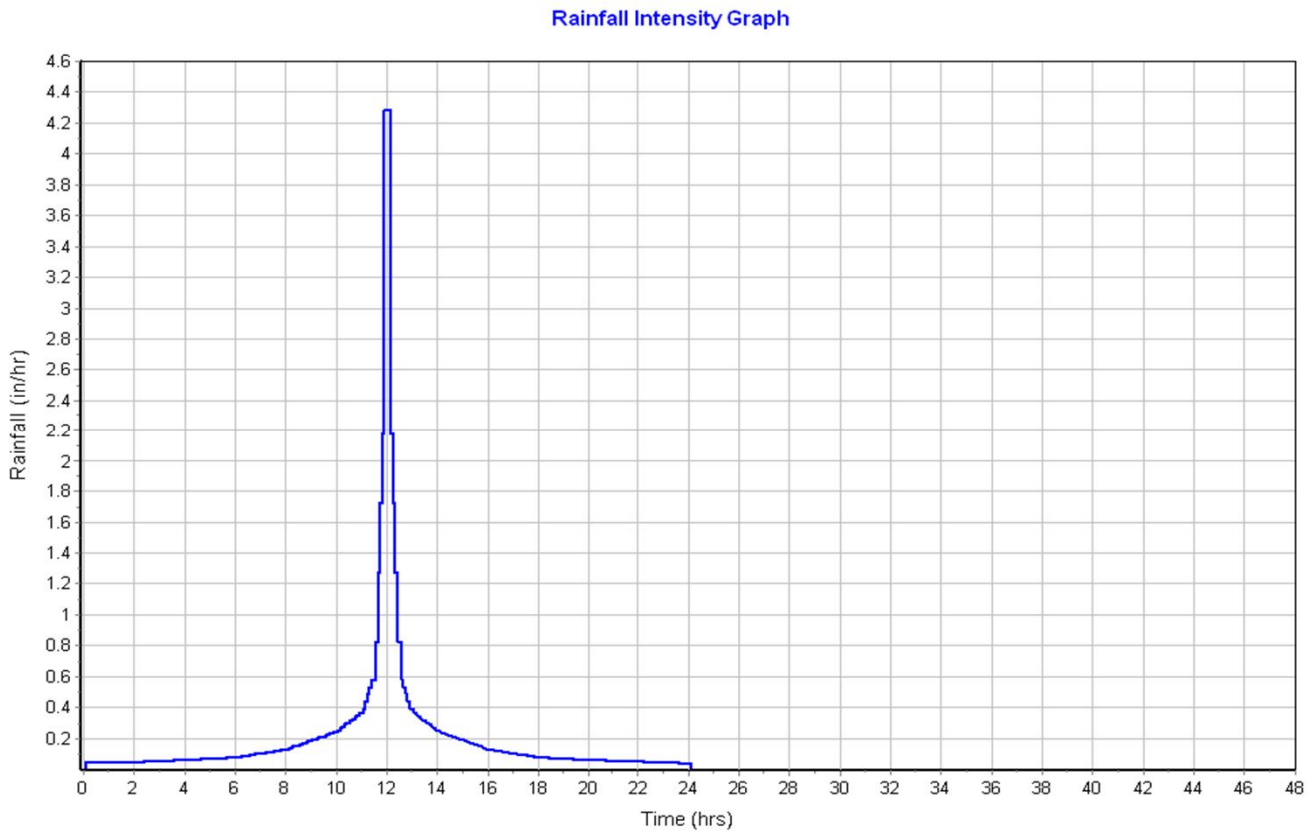
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	240	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.98	0.00	0.00

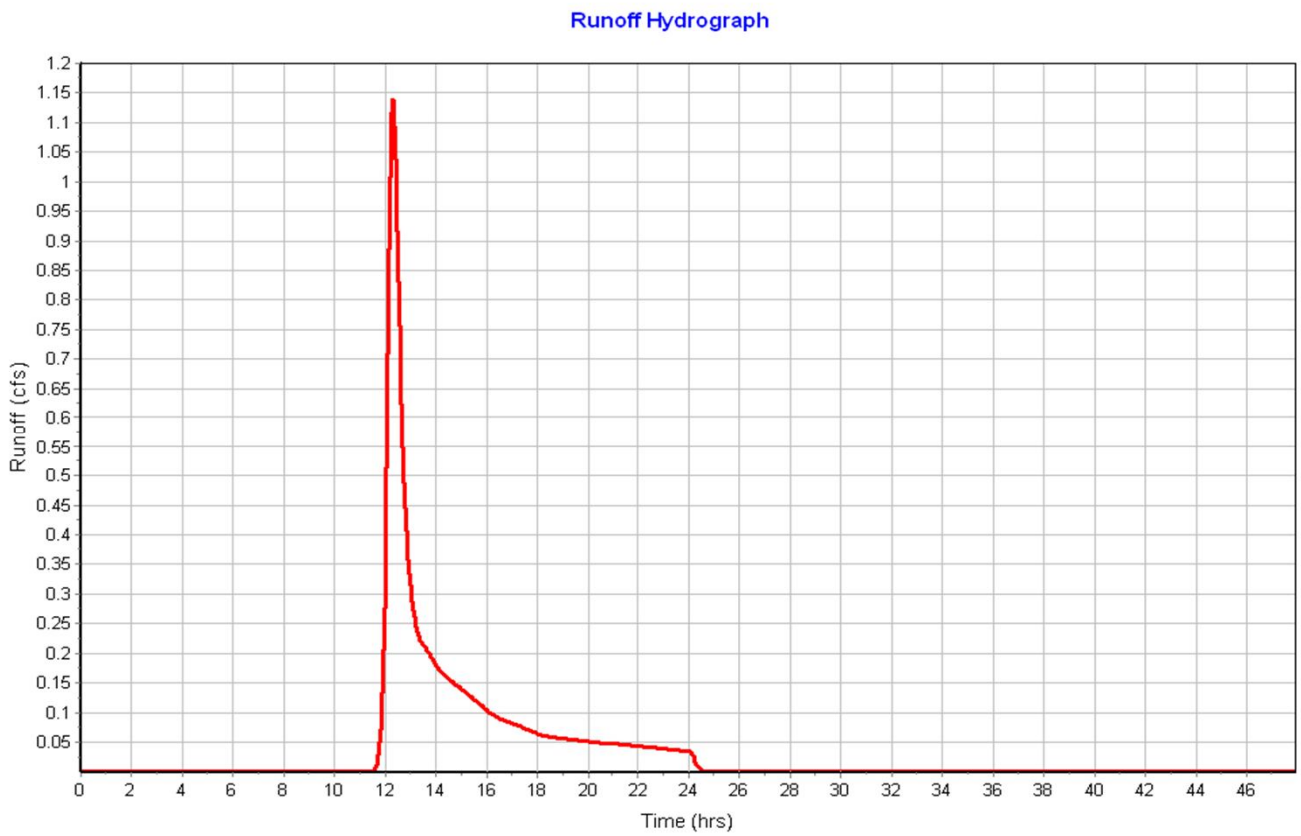
Total TOC (min) 20.67

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 1.16
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:20:40

Subbasin : DA-2





Subbasin : DA-3

Input Data

Area (ac) 0.49
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.49	B	58.00
Composite Area & Weighted CN	0.49		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	120.63	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	9.50	0.00	0.00

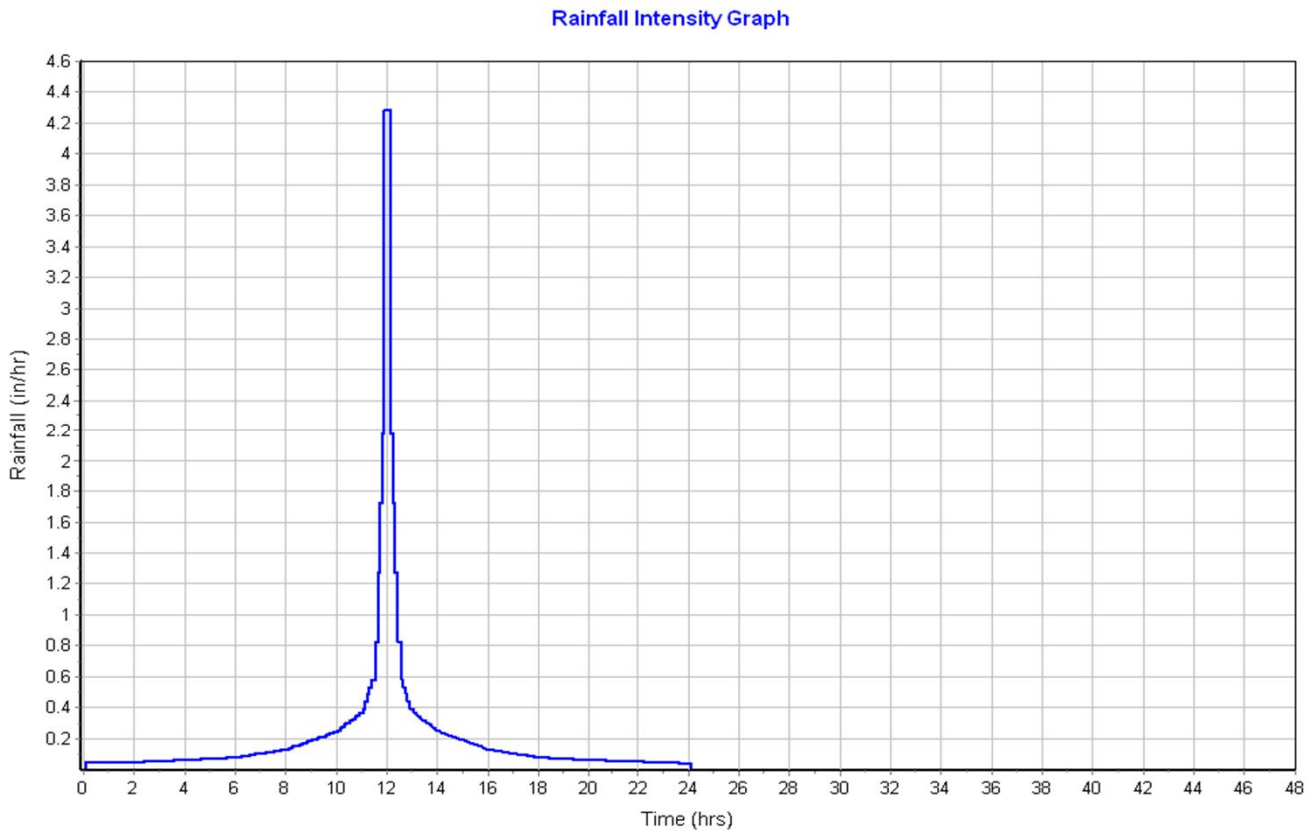
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	233.25	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

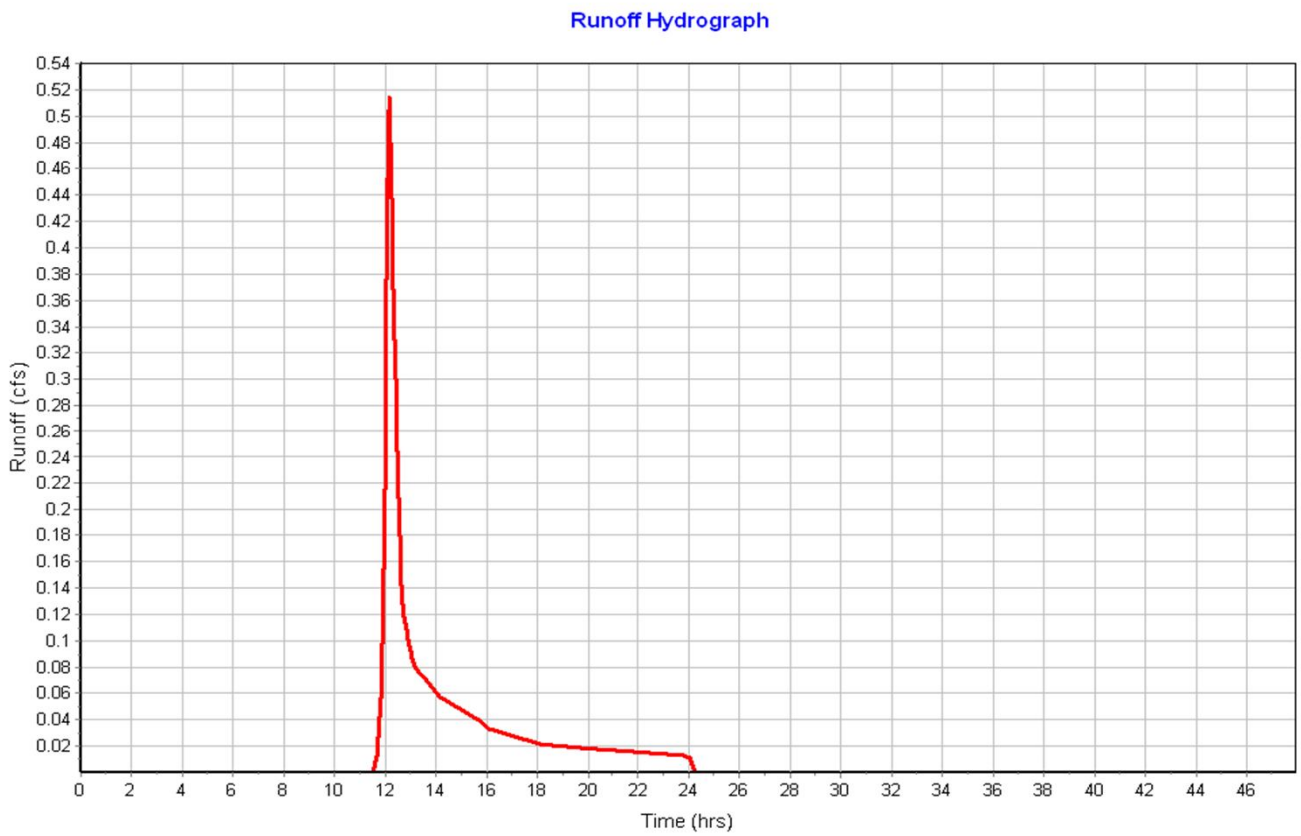
Total TOC (min) 10.45

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.51
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:10:27

Subbasin : DA-3





Subbasin : DA-4

Input Data

Area (ac) 0.33
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.33	B	58.00
Composite Area & Weighted CN	0.33		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	151.49	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	11.40	0.00	0.00

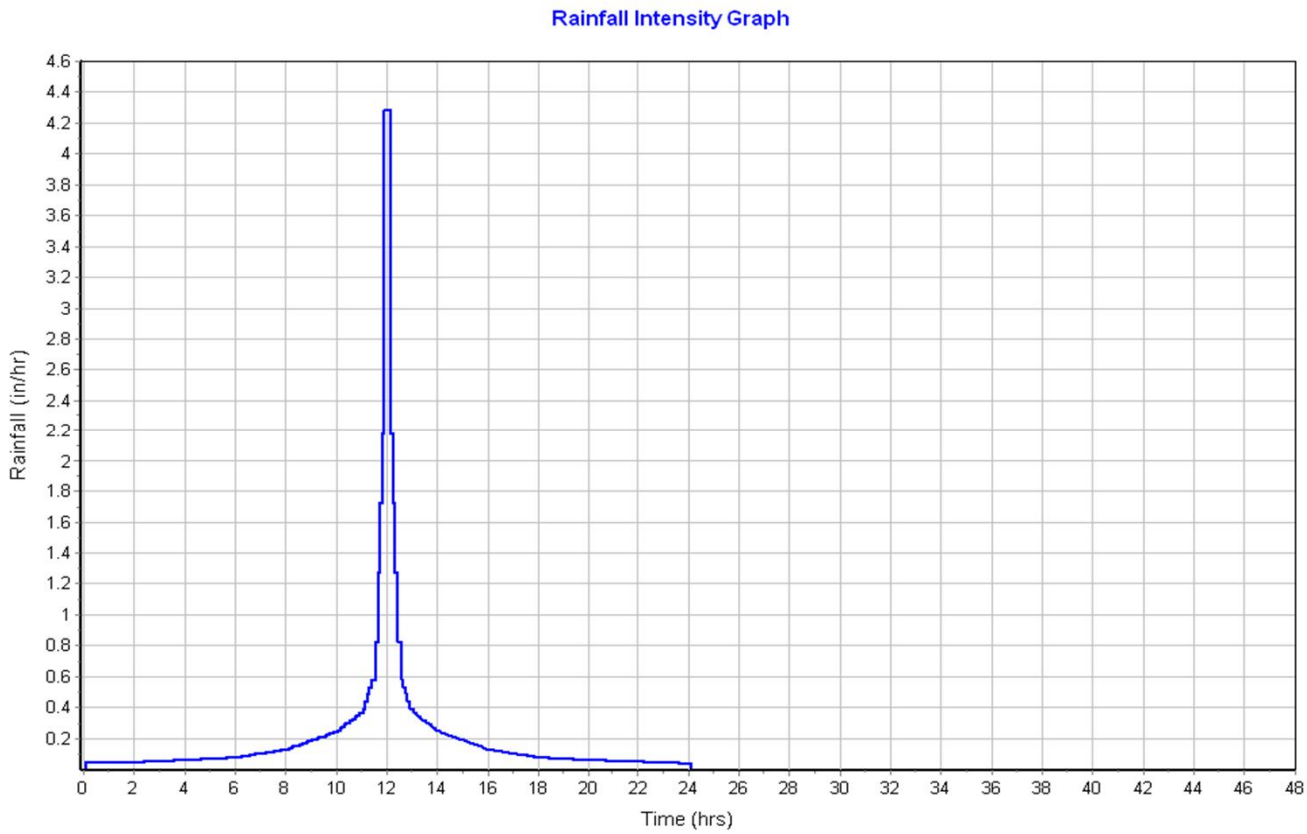
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	166.60	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.68	0.00	0.00

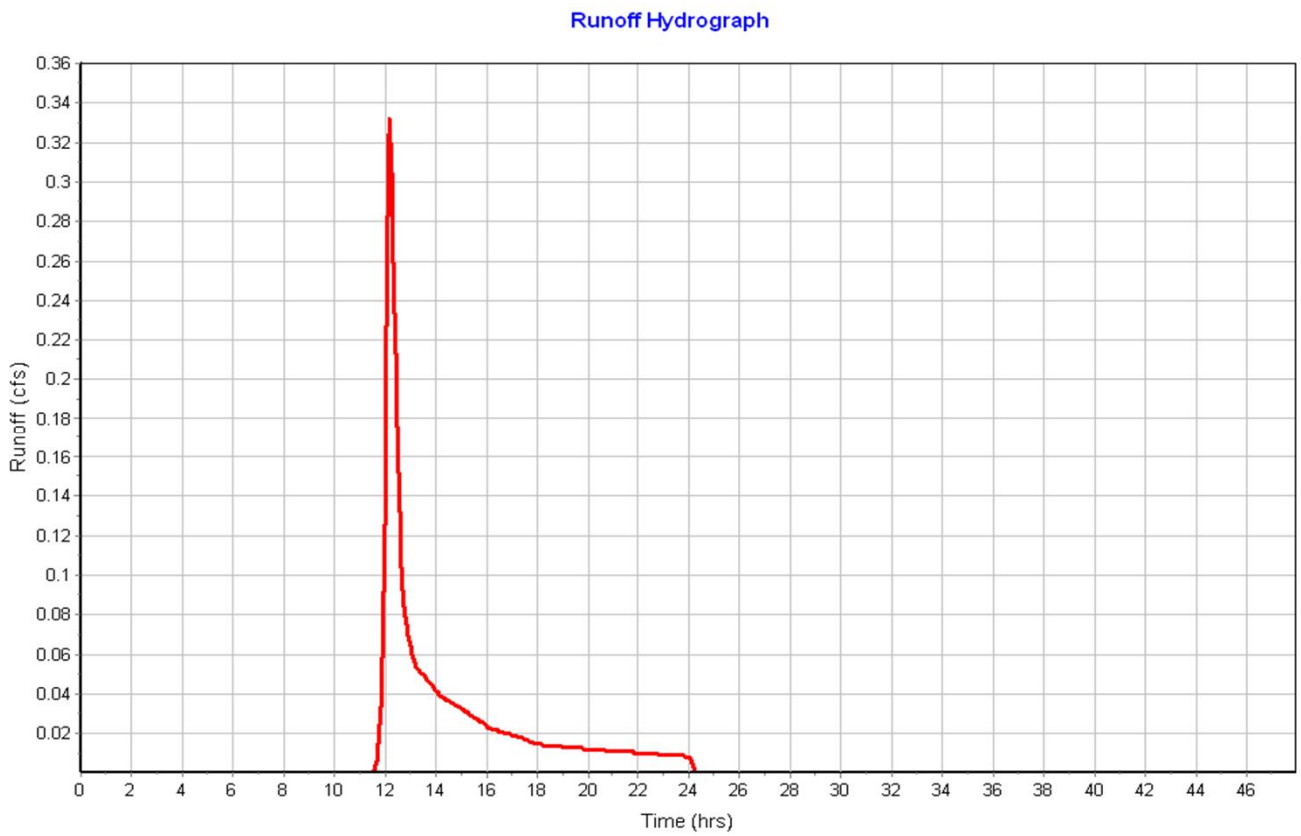
Total TOC (min) 12.08

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.33
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:12:05

Subbasin : DA-4





Subbasin : DA-5

Input Data

Area (ac) 1.32
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	1.32	B	58.00
Composite Area & Weighted CN	1.32		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	135.92	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	10.45	0.00	0.00

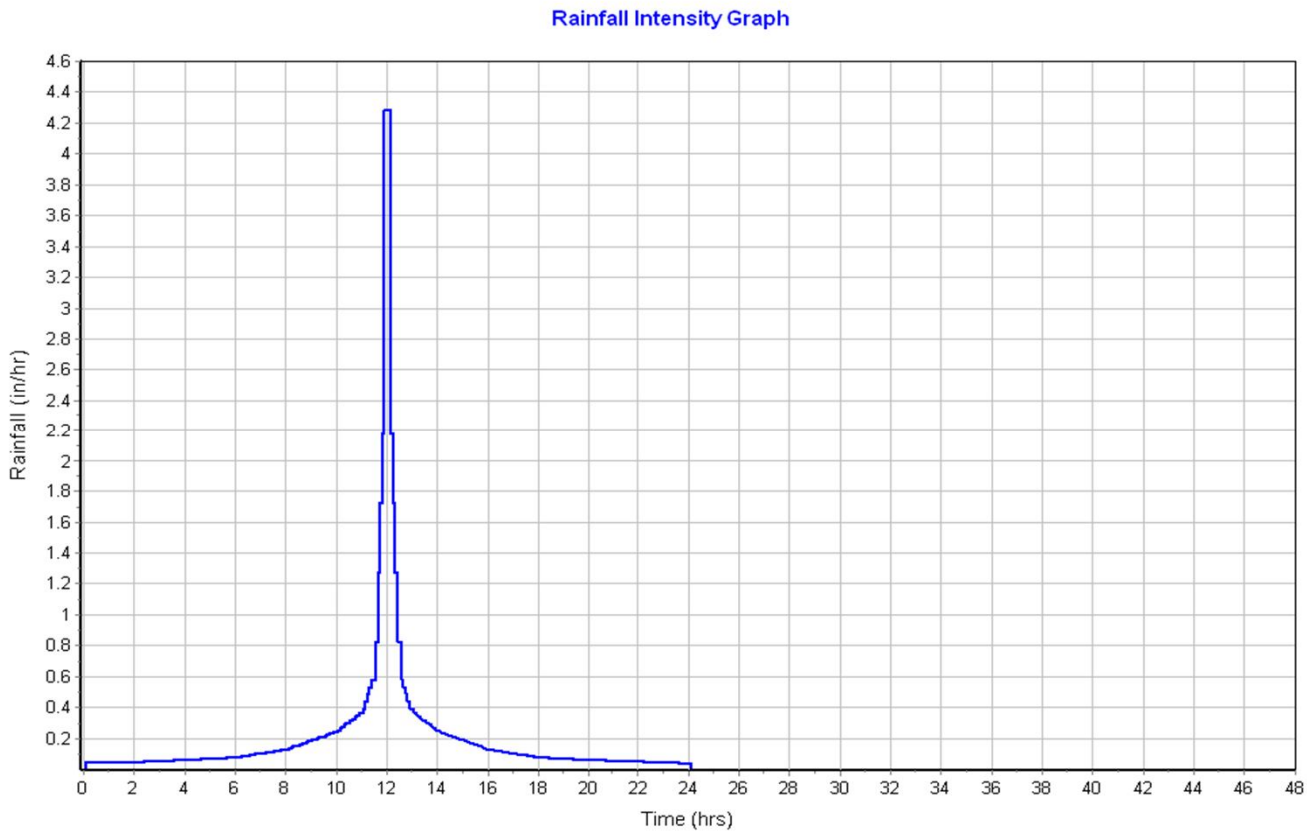
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	576.30	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	2.35	0.00	0.00

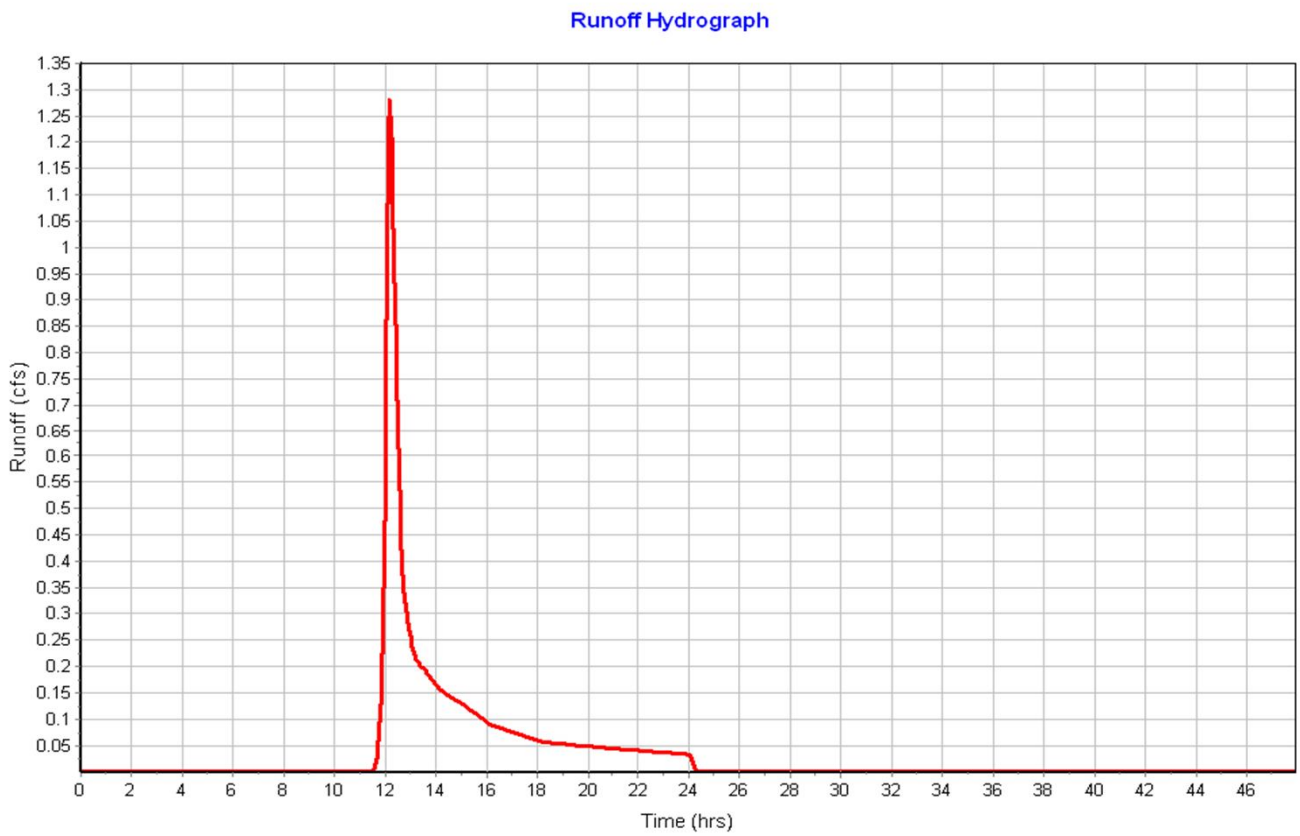
Total TOC (min) 12.80

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 1.30
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:12:48

Subbasin : DA-5





Subbasin : DA-6

Input Data

Area (ac) 0.44
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.44	B	58.00
Composite Area & Weighted CN	0.44		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	104.41	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	8.46	0.00	0.00

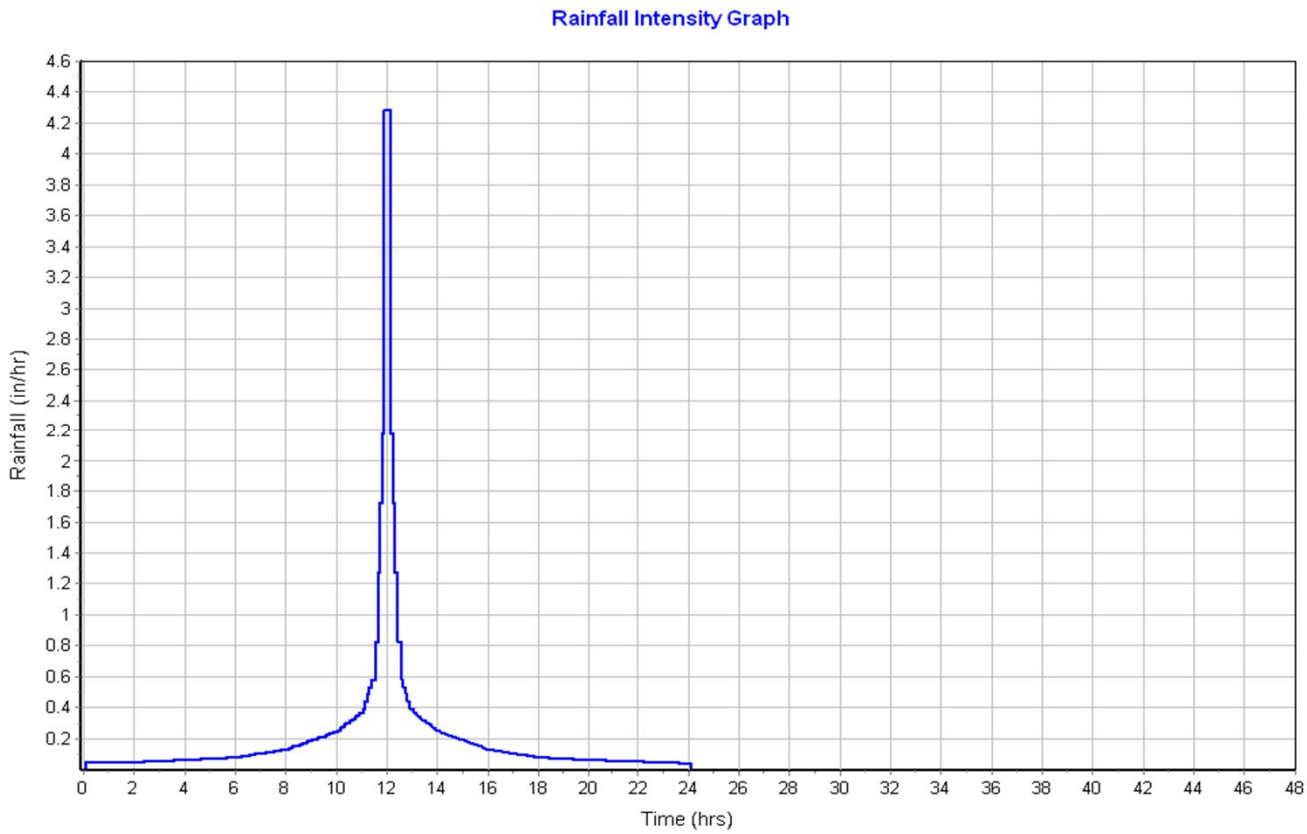
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	183.10	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.75	0.00	0.00

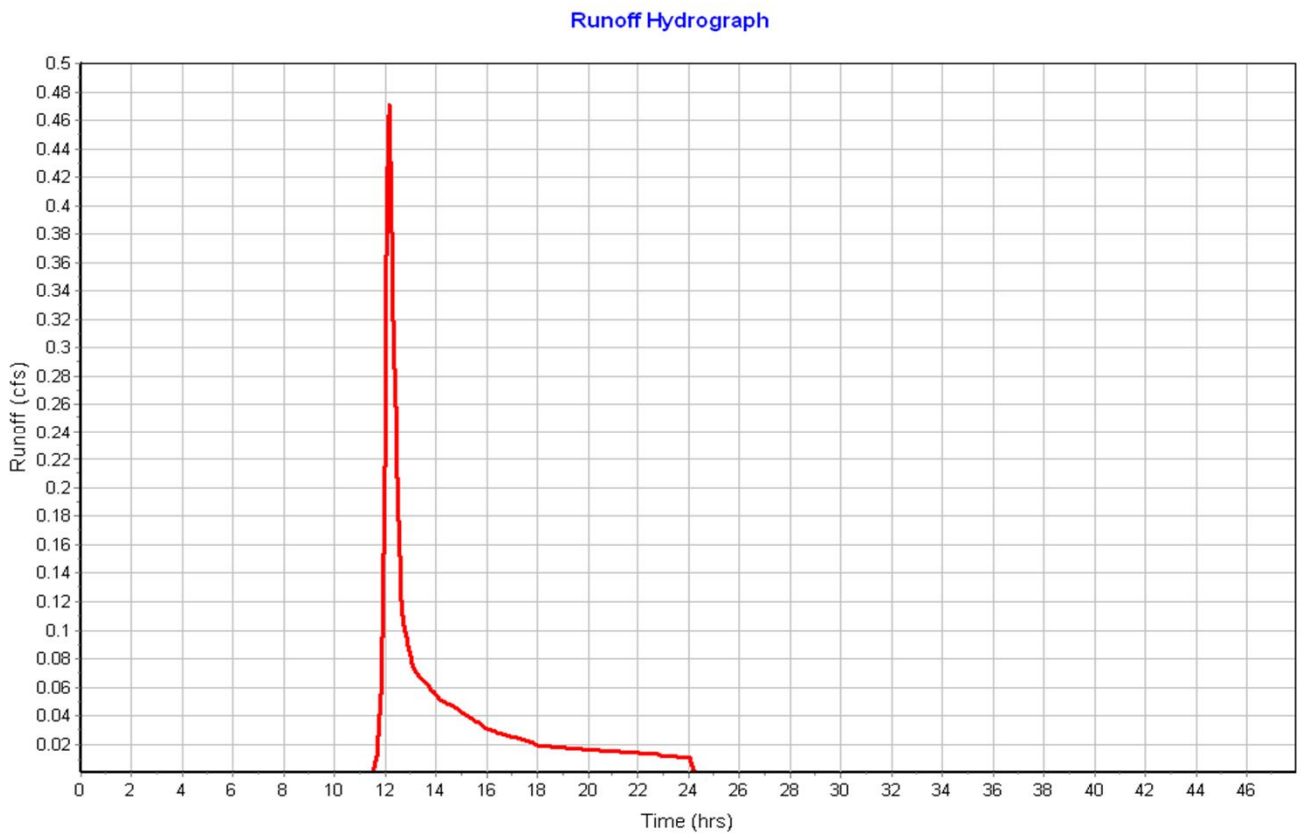
Total TOC (min) 9.21

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.48
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:09:13

Subbasin : DA-6





Subbasin : DA-7

Input Data

Area (ac) 0.66
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.66	B	58.00
Composite Area & Weighted CN	0.66		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	151.29	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	11.38	0.00	0.00

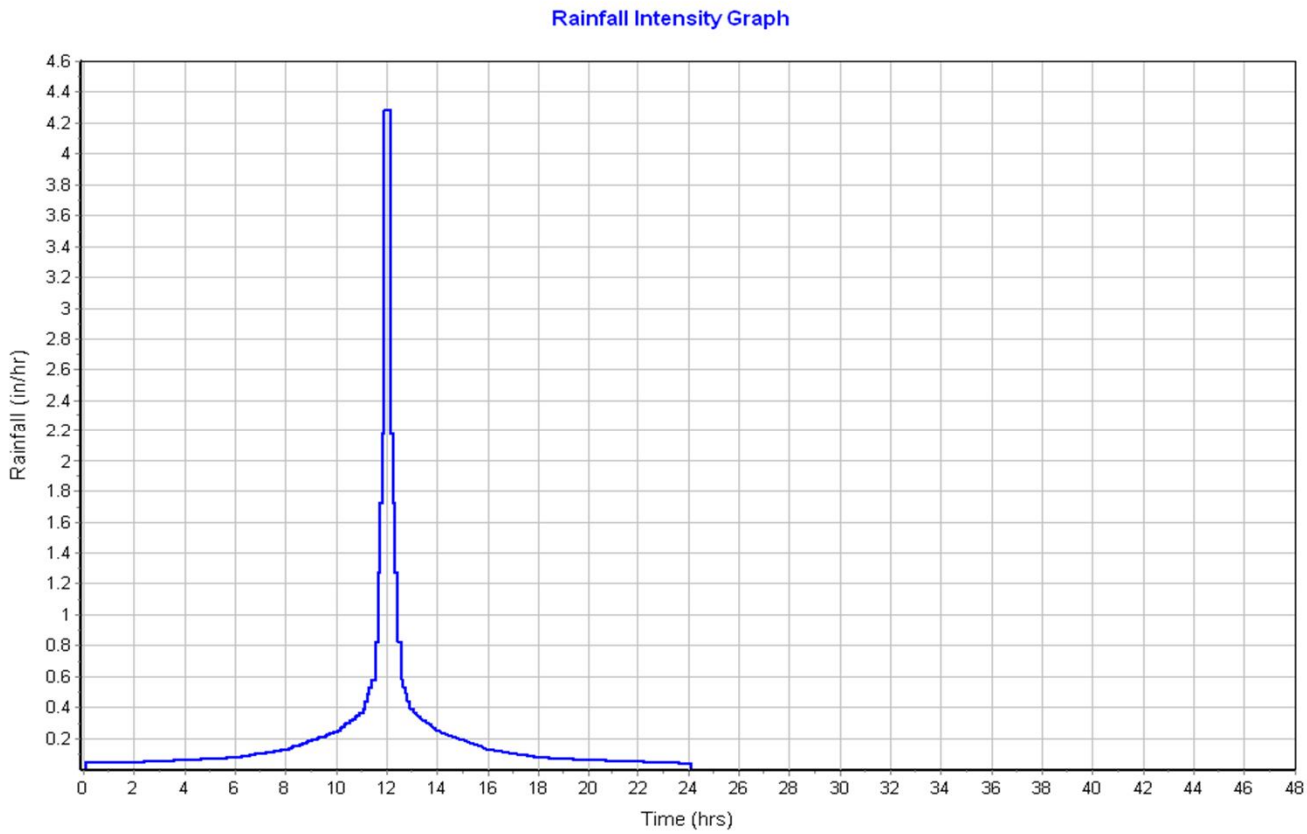
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	250.95	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	1.03	0.00	0.00

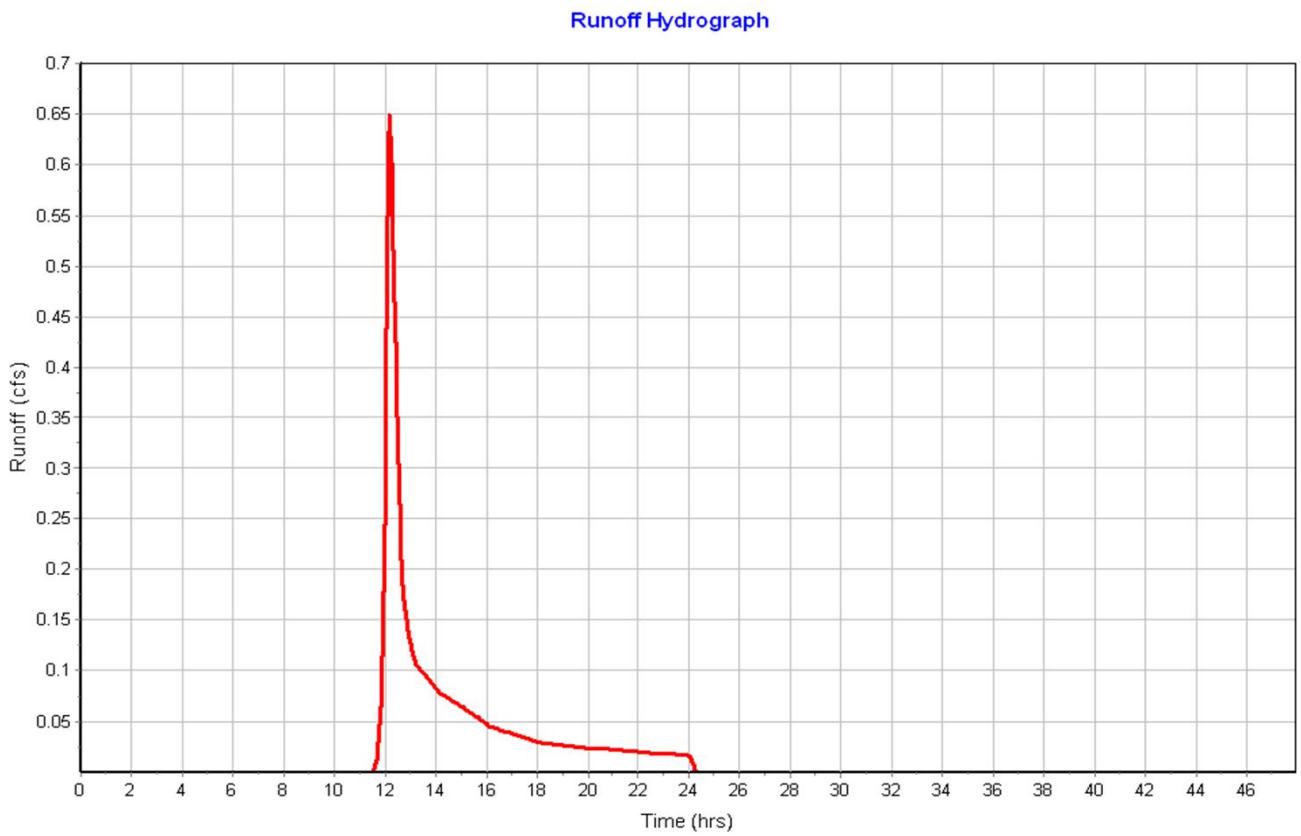
Total TOC (min) 12.41

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.65
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:12:25

Subbasin : DA-7





Subbasin : DA-8

Input Data

Area (ac) 0.23
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.23	B	58.00
Composite Area & Weighted CN	0.23		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	150.34	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	11.33	0.00	0.00

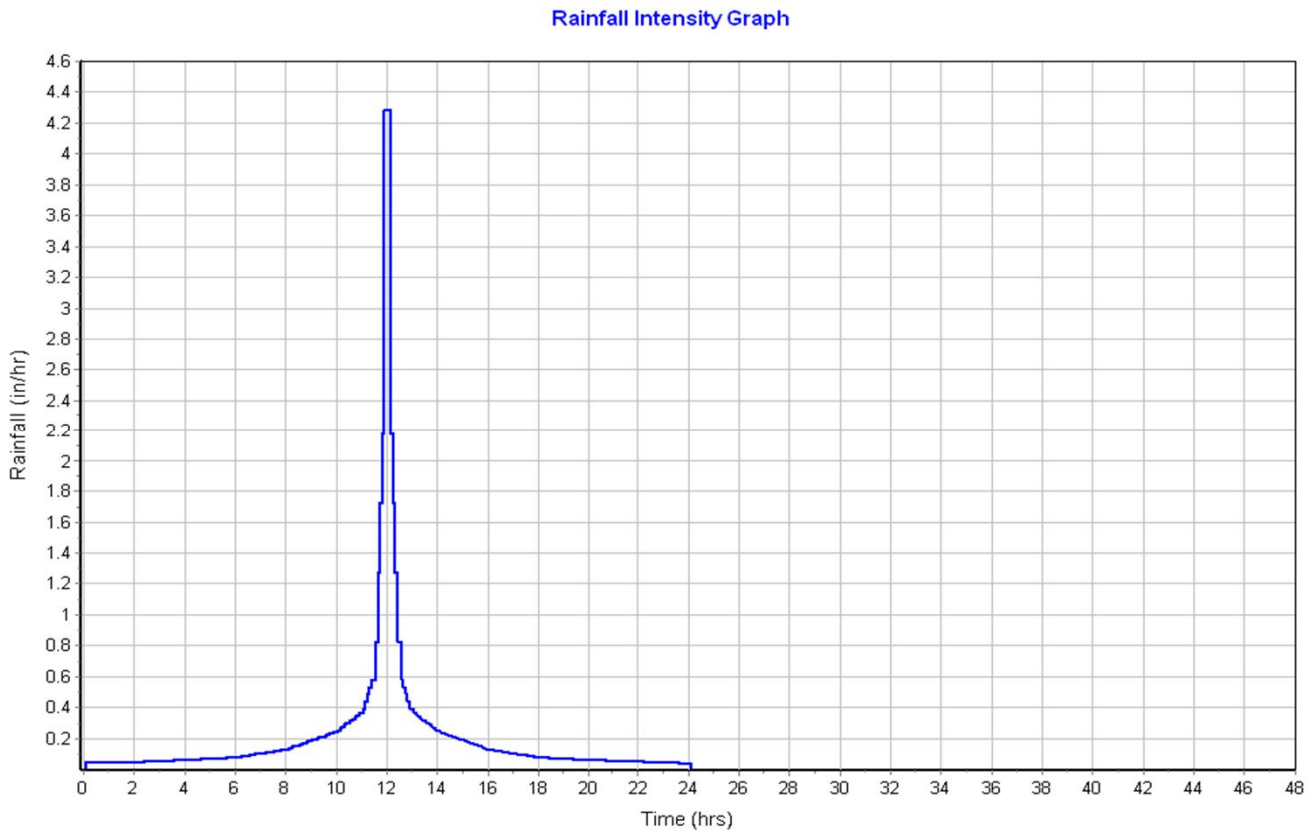
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	77.55	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	0.32	0.00	0.00

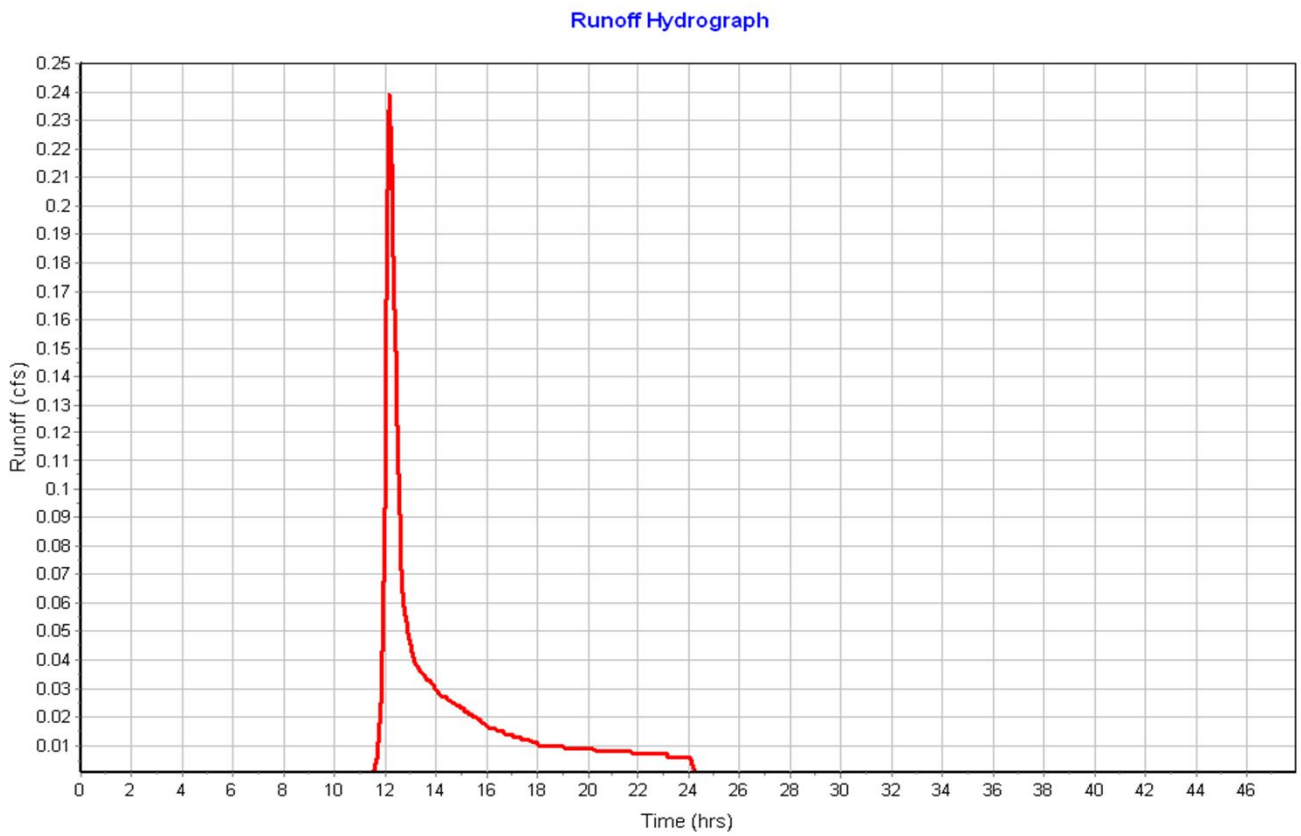
Total TOC (min) 11.64

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.24
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:11:38

Subbasin : DA-8





Subbasin : DA-9

Input Data

Area (ac) 0.55
Weighted Curve Number 58.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Meadow, non-grazed	0.55	B	58.00
Composite Area & Weighted CN	0.55		58.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.4	0.00	0.00
Flow Length (ft) :	93.88	0.00	0.00
Slope (%) :	20	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.20	0.00	0.00
Computed Flow Time (min) :	7.77	0.00	0.00

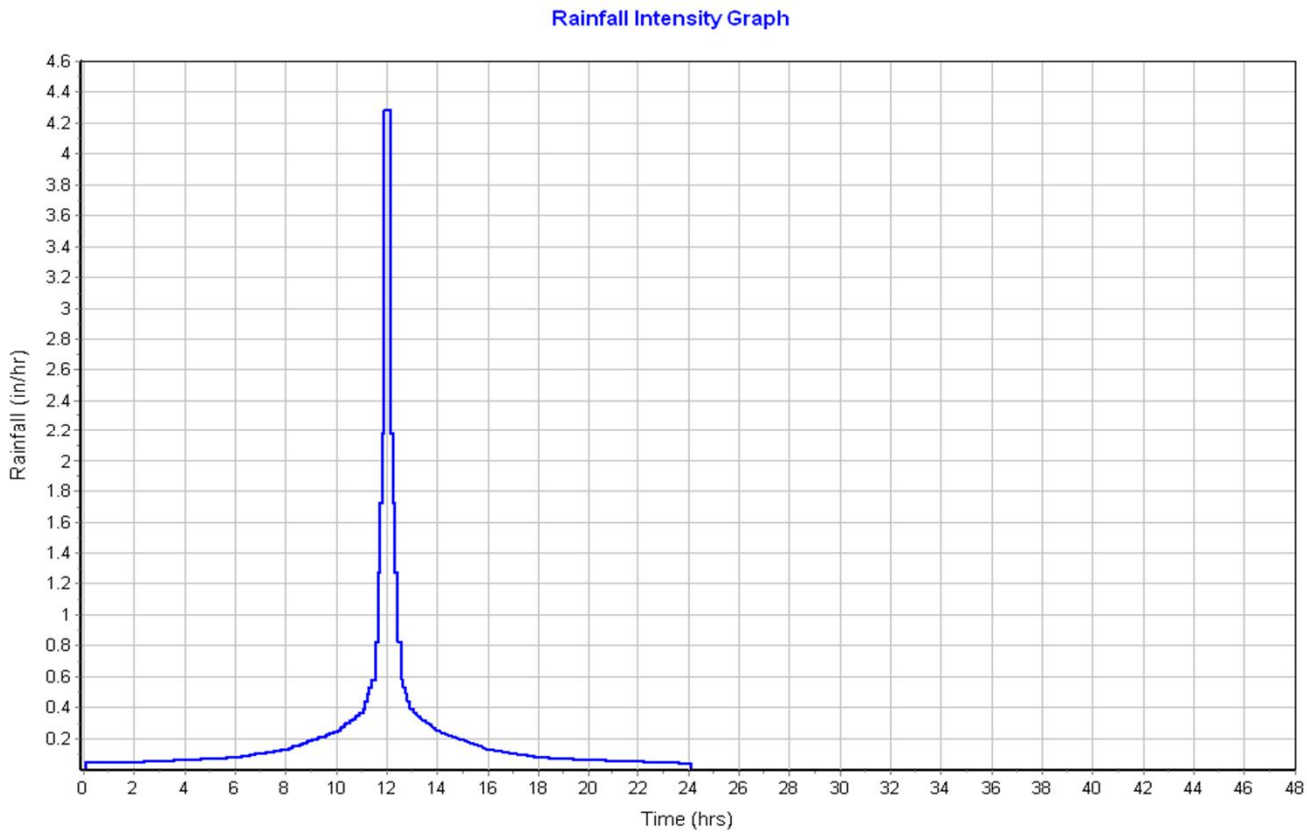
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.05	0.00	0.00
Flow Length (ft) :	263.21	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	14	0.00	0.00
Wetted Perimeter (ft) :	14.7	0.00	0.00
Velocity (ft/sec) :	4.08	0.00	0.00
Computed Flow Time (min) :	1.08	0.00	0.00

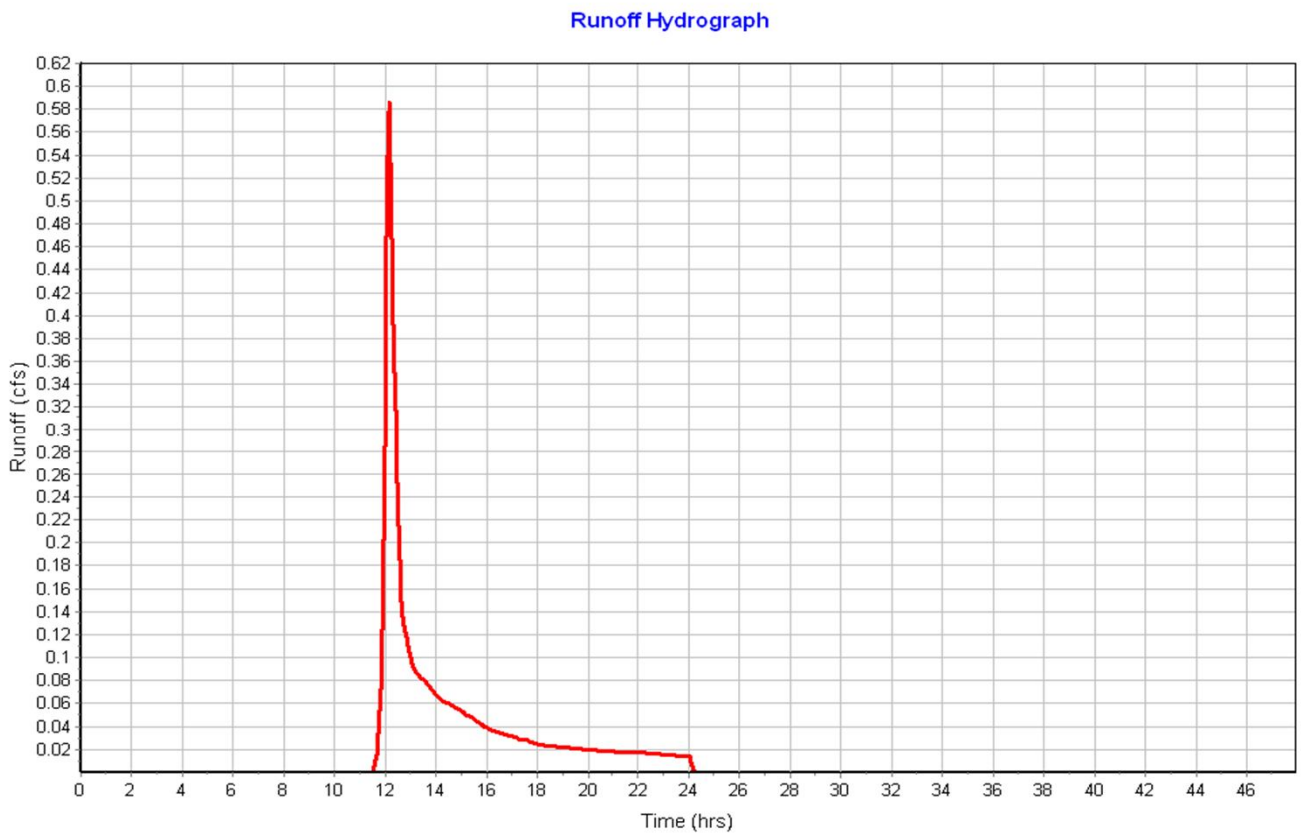
Total TOC (min) 8.85

Subbasin Runoff Results

Total Rainfall (in) 5.10
Total Runoff (in) 1.22
Peak Runoff (cfs) 0.60
Weighted Curve Number 58.00
Time of Concentration (days hh:mm:ss) 0 00:08:51

Subbasin : DA-9





Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Jun-01	988.00	990.00	2.00	988.00	0.00	0.00	-990.00	0.00	0.00
2	Jun02	980.00	982.00	2.00	980.00	0.00	0.00	-982.00	0.00	0.00
3	Jun-03	989.00	991.00	2.00	989.00	0.00	0.00	-991.00	0.00	0.00
4	Jun-04	970.00	972.00	2.00	970.00	0.00	0.00	-972.00	0.00	0.00
5	Jun-05	960.00	962.00	2.00	960.00	0.00	0.00	-962.00	0.00	0.00
6	Jun-06	960.00	962.00	2.00	960.00	0.00	0.00	-962.00	0.00	0.00
7	Jun-07	958.00	960.00	2.00	958.00	0.00	0.00	-960.00	0.00	0.00
8	Jun-08	960.00	962.00	2.00	960.00	0.00	0.00	-962.00	0.00	0.00
9	Jun-09	966.00	968.00	2.00	966.00	0.00	0.00	-968.00	0.00	0.00
10	Jun-10	958.00	960.00	2.00	958.00	0.00	0.00	-960.00	0.00	0.00
11	Jun-11	932.00	934.00	2.00	932.00	0.00	0.00	-934.00	0.00	0.00
12	Jun-12	940.00	942.00	2.00	940.00	0.00	0.00	-942.00	0.00	0.00
13	Jun-13	940.00	942.00	2.00	940.00	0.00	0.00	-942.00	0.00	0.00
14	Jun-14	940.00	942.00	2.00	940.00	0.00	0.00	-942.00	0.00	0.00
15	Jun-15	930.00	932.00	2.00	930.00	0.00	0.00	-932.00	0.00	0.00
16	Jun-16	944.00	946.00	2.00	944.00	0.00	0.00	-946.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	1.14	1.14	988.48	0.48	0.00	1.52	988.05	0.05	0 12:20	0 00:00	0.00	0.00
2	Jun02	2.36	0.00	980.48	0.48	0.00	1.52	980.05	0.05	0 12:27	0 00:00	0.00	0.00
3	Jun-03	1.24	1.24	989.49	0.49	0.00	1.51	989.05	0.05	0 12:20	0 00:00	0.00	0.00
4	Jun-04	1.28	1.28	970.49	0.49	0.00	1.51	970.05	0.05	0 12:15	0 00:00	0.00	0.00
5	Jun-05	1.21	0.00	960.48	0.48	0.00	1.52	960.05	0.05	0 12:21	0 00:00	0.00	0.00
6	Jun-06	0.33	0.33	960.32	0.32	0.00	1.68	960.03	0.03	0 12:15	0 00:00	0.00	0.00
7	Jun-07	3.00	0.00	958.39	0.39	0.00	1.61	958.04	0.04	0 12:17	0 00:00	0.00	0.00
8	Jun-08	0.51	0.51	960.40	0.40	0.00	1.60	960.04	0.04	0 12:15	0 00:00	0.00	0.00
9	Jun-09	1.40	1.40	966.53	0.53	0.00	1.47	966.05	0.05	0 12:15	0 00:00	0.00	0.00
10	Jun-10	1.34	0.00	958.52	0.52	0.00	1.48	958.05	0.05	0 12:22	0 00:00	0.00	0.00
11	Jun-11	2.01	0.00	932.33	0.33	0.00	1.67	932.03	0.03	0 12:16	0 00:00	0.00	0.00
12	Jun-12	0.59	0.59	940.33	0.33	0.00	1.67	940.03	0.03	0 12:15	0 00:00	0.00	0.00
13	Jun-13	0.24	0.24	940.19	0.19	0.00	1.81	940.02	0.02	0 12:15	0 00:00	0.00	0.00
14	Jun-14	0.65	0.65	940.33	0.33	0.00	1.67	940.03	0.03	0 12:15	0 00:00	0.00	0.00
15	Jun-15	3.87	0.00	930.32	0.32	0.00	1.68	930.03	0.03	0 12:17	0 00:00	0.00	0.00
16	Jun-16	0.47	0.47	944.26	0.26	0.00	1.74	944.02	0.02	0 12:15	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Berm-1	494.41	988.00	0.00	980.00	0.00	8.00	1.6200	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
2	Berm-10	181.10	944.00	0.00	930.00	0.00	14.00	7.7300	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
3	Berm-2	506.61	989.00	0.00	980.00	0.00	9.00	1.7800	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
4	Berm-3	571.88	970.00	0.00	960.00	0.00	10.00	1.7500	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
5	Berm-4	167.92	960.00	0.00	958.00	0.00	2.00	1.1900	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
6	Berm-5	232.80	960.00	0.00	958.00	0.00	2.00	0.8600	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
7	Berm-6	577.23	966.00	0.00	958.00	0.00	8.00	1.3900	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
8	Berm-7	262.55	940.00	0.00	932.00	0.00	8.00	3.0500	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
9	Berm-8	82.65	940.00	0.00	932.00	0.00	8.00	9.6800	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No
10	Berm-9	249.77	940.00	0.00	930.00	0.00	10.00	4.0000	Triangular	2.000	14.000	0.0500	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Berm-1	1.13	0 12:27	51.56	0.02	1.58	5.22	0.48	0.24	0.00		
2	Berm-10	0.46	0 12:15	112.70	0.00	2.14	1.41	0.25	0.13	0.00		
3	Berm-2	1.23	0 12:27	54.03	0.02	1.65	5.12	0.48	0.24	0.00		
4	Berm-3	1.21	0 12:21	53.60	0.02	1.92	4.96	0.48	0.24	0.00		
5	Berm-4	0.32	0 12:17	44.24	0.01	1.28	2.19	0.31	0.16	0.00		
6	Berm-5	0.49	0 12:17	37.57	0.01	1.28	3.03	0.39	0.20	0.00		
7	Berm-6	1.34	0 12:22	47.72	0.03	1.86	5.17	0.52	0.26	0.00		
8	Berm-7	0.57	0 12:16	70.75	0.01	1.84	2.38	0.33	0.16	0.00		
9	Berm-8	0.24	0 12:15	126.11	0.00	1.92	0.72	0.19	0.09	0.00		
10	Berm-9	0.63	0 12:17	81.10	0.01	1.94	2.15	0.32	0.16	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	SD-1	105.63	960.00	0.00	940.00	0.00	20.00	18.9300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
2	SD-2a	111.55	980.00	0.00	958.00	0.00	22.00	19.7200	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
3	SD-2b	151.79	958.00	0.00	930.00	0.00	28.00	18.4500	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
4	SD-2c	95.45	930.00	0.00	910.00	0.00	20.00	20.9500	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
5	SD-3a	124.96	958.00	0.00	932.00	0.00	26.00	20.8100	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
6	SD-3b	142.44	932.00	0.00	917.00	0.00	15.00	10.5300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	SD-1	1.21	0 12:22	39.61	0.03	10.15	0.17	0.18	0.12	0.00		Calculated
2	SD-2a	2.36	0 12:27	40.43	0.06	12.48	0.15	0.24	0.16	0.00		Calculated
3	SD-2b	3.00	0 12:26	39.10	0.08	13.11	0.19	0.28	0.19	0.00		Calculated
4	SD-2c	3.87	0 12:23	41.67	0.09	14.77	0.11	0.31	0.21	0.00		Calculated
5	SD-3a	1.34	0 12:22	41.53	0.03	10.80	0.19	0.18	0.12	0.00		Calculated
6	SD-3b	2.01	0 12:21	29.54	0.07	9.49	0.25	0.27	0.18	0.00		Calculated

APPENDIX V

SLOPE STABILITY CALCULATIONS

GLOBAL STATIC AND SEISMIC SLOPE STABILITY

OBJECTIVE

The objective of this calculation is to analyze the stability of the OmniSource Kernersville Landfill (Landfill) at post-closure when the waste has reached final grade. This analysis will determine the landfill stability with the vertical expansion through deep-seated translational and rotational failures in static conditions. To determine the acceptable waste height and bench configuration a worst case cross section of the Landfill was analyzed.

This analysis includes:

- Attachment A – XSTABL Slope Stability Software Static Analysis Output Data for Transitional Failure
- Attachment B – XSTABL Slope Stability Software Static Analysis Output Data for Rotational Failure

METHODOLOGY

This final grade scenario was considered by preparing a cross-section through the proposed landfill final condition configuration that included the maximum crest height in the new landfill phase, and a sloping landfill basegrade.

LANDFILL DESIGN

There are currently two options that may be used for the final cover, a soil final cover, and an alternate final cover. The soil final cover consists of 6-inches of vegetative support layer on top of 18-inches of soil cover. The alternate final cover system design consists of the following (from top to bottom):

- 6-inch vegetative support layer;
- 18-inch soil cover;
- Geocomposite drainage layer;
- 40-mil LLDPE Flexible Membrane Liner; and
- 12-inch soil intermediate cover

STATIC STABILITY ANALYSIS

The software program used to calculate slope stability Factor of Safety (FS) within this analysis is entitled, "XSTABL" version 5.206, compiled by Interactive Software Designs, Inc. of Moscow, Idaho. It is a version of "PC STABL 5M" written by Purdue University for the Indiana Department of Highways.

The program uses limit equilibrium techniques to determine a FS for each given input cross-section and corresponding data file. XSTABL will calculate FS for both rotational and translational failure surfaces within the cross-section in terms of both static and seismic conditions based upon slope geometry, a phreatic surface and the shear strength parameters of soils and the most critical contact interface within the proposed baseliner system.

Bishop's Simplified Method

Bishop's simplified method is a limit equilibrium technique initially used within this analysis by XSTABL to locate the most critical rotational failure surface within the cross-section.

Characteristics of Bishop's Method include:

- Dividing failure mass into a number of slices;
- Satisfies vertical force equilibrium for each slice and overall moment equilibrium about the center of the rotational failure surface;
- Specifically applicable to rotational failure surfaces;
- Considers all interslice shear forces to be horizontal (no interslice shear forces); and
- Produces a conservative FS.

Rankine Method

The Rankine method is a technique used within XSTABL to locate the most critical translational failure surface within the cross-section.

Characteristics of the Rankine Method include:

- The ability to single out a confined zone that may represent a potentially weak layer.
- Generating passive and active portions of the failure surface at angles dependent on the shear strength of the surrounding soil unit;
- Satisfies both vertical force and moment equilibrium for each slice and overall horizontal force equilibrium for the entire wedge;
- Applicable to any shape of failure surface;
- Considers all interslice shear forces to be horizontal (no interslice shear force); and
- Produces a FS that is considerably lower than methods that satisfies all conditions of equilibrium for each slice.

Spencer's Method

The Spencer's Method was utilized for analyzing the single most critical static failure surface for each of the cross sections considering seismic conditions. This method is typically more conservative than Bishop's method when evaluating single surfaces under seismic conditions.

Half-Sine General Limit Equilibrium Method

The Half-Sine General Limit Equilibrium (GLE) Method is an extension of Spencer's procedure and was utilized to minimize negative and unreasonable forces. GLE method satisfies complete force and moment equilibrium using an assumed interslice force angle distribution. These distributions are specified as a function of the normalized x-coordinate along the failure surface. These normalized coordinates range between 0.0 at the toe and 1.0 at the crest of the failure surface. The half sine method chosen is a smooth function that increases from 0.0 at the toe to 1.0 at the mid point, before decreasing to 0.0 at the crest of the failure surface.

Geosynthetic Shear Strength Parameters

The shear strength of the baseliner within this stability analysis is represented by the most critical contact interface along the landfill floor and sideslopes defining the weakest material and plane within the landfill baseliner. The most critical peak strength interface contact of the proposed baseliner was represented in the analysis as a layer with a thickness of 0.5 feet and represents the baseliner floor geosynthetics and interfaces. The cohesion was conservatively set to 0 and the friction angle value was used as a typical textured liner.

c': Cohesion = 0 psf
Φ': Friction angle = 25 degrees

Waste Shear Strength Parameters

The shear strength values for the waste were taken from the Ohio State EPA publication Geotechnical and Stability Analyses for Ohio Waste Containment Facilities, 2004.

γ□: Moist Unit weight of waste = 75 pcf
γ_S□: Saturated Unit weight waste = 100 pcf
c': Cohesion = 500 psf
Φ': Friction angle = 35 degrees

Final Cover System Parameters

The Final Cover System parameters were calculated in the Final Cover Veneer Slope Stability analysis provided in the submittal.

Final Cover System Shear Strength Parameters

γ□: Moist Unit weight of drainage layer = 115 pcf
γ_S□: Saturated Unit weight of drainage layer = 130 pcf
c': Cohesion = 0 psf
Φ': Friction angle = 25 degrees

SLOPE STABILITY RESULTS

Factors of safety (FS) were calculated for the final slope condition for the new landfill phase. The XSTABL software package calculated FS, expressing the ratio of resisting to driving forces, for each failure surface considering static conditions. Attachment A contains the XSTABL slope stability software output data for translational failure under static conditions.

Attachment B contains the XSTABL slope stability software output data for rotational failure under static conditions.

Post-Closure Slopes

The cross-section was used for a global stability analysis to demonstrate the stability of the landfill in the final condition. Rotational analysis also resulted in acceptable factors of safety.

CONCLUSIONS

Considering failure surfaces, it was the rotational surface that produced the lowest FS. Both types of failures have a relatively high factor of safety due to the composition of waste, no base liner, and the 5:1 side slopes. The results show that it was difficult to make the Landfill show a failure surface.

Calculated Factors of Safety

The Factors of Safety calculated within this stability analysis comply with industry excepted standards. All deep-seated translational and rotational analysis provided a static and seismic factor of safety greater than 1.5 and 1.0, respectfully. The results of the analyses are shown in the table below.

Slope Stability Factor of Safety Summary
SECTION A-A' FINAL CONDITION SCENARIO

File	Failure Type	Static/Seismic	FS
ROCK1B	Translational	Static	5.35
SXNA-R	Rotational	Static	2.37

ATTACHMENT A
XSTABL SLOPE STABILITY SOFTWARE
STATIC ANALYSIS, TRANSITIONAL FAILURE
OUTPUT DATA

XSTABL File: SXNA_B 3-12-14 15:13

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : osource

SEGMENT BOUNDARY COORDINATES
---

8 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	870.0	58.7	873.4	1
2	58.7	873.4	83.9	879.1	1
3	83.9	879.1	107.2	890.0	1
4	107.2	890.0	136.0	910.1	1
5	136.0	910.1	417.5	966.6	2
6	417.5	966.6	454.4	974.0	2
7	454.4	974.0	1009.3	978.0	2
8	1009.3	978.0	1029.6	974.0	2

2 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	136.0	910.1	594.5	914.8	1
2	594.5	914.8	1068.4	919.7	1

```
---------------------------
ISOTROPIC Soil Parameters
---------------------------

 2 Soil unit(s) specified

Soil   Unit Weight   Cohesion  Friction    Pore Pressure
Water
Unit  Moist    Sat.  Intercept   Angle  Parameter  Constant
Surface
 No.  (pcf)   (pcf)    (psf)     (deg)      Ru      (psf)
No.

  1   115.0   130.0        .0    25.00      .000         .0
1
  2    75.0   100.0     500.0    35.00      .000         .0
0


 1 Water surface(s) have been specified

Unit weight of water =    62.40  (pcf)


Water Surface No.  1 specified by  2 coordinate points

**********************************
         PHREATIC SURFACE,
**********************************

  Point      x-water     y-water
   No.         (ft)        (ft)

    1          58.70      870.00
    2        1068.00      870.00


A critical failure surface searching method, using a random
technique for generating sliding BLOCK surfaces, has been
specified.


The active and passive portions of the sliding surfaces
are generated according to the Rankine theory.


 1600 trial surfaces will be generated and analyzed.


  2 boxes specified for generation of central block base
```

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

Length of line segments for active and passive portions of sliding block is 21.0 ft

Box no.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Width (ft)
1	140.0	909.5	145.0	909.5	.5
2	440.0	914.0	475.0	914.8	.5

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED JANBU METHOD * * * * *

The 10 most critical of all the failure surfaces examined are displayed below - the most critical first

Failure surface No. 1 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	140.75	911.05
2	142.46	910.17
3	143.89	909.26
4	441.81	913.86
5	451.50	932.49
6	461.20	951.11
7	470.90	969.74
8	473.19	974.14

** Corrected JANBU FOS = 5.243 ** (Fo factor = 1.061)

Failure surface No. 2 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	139.14	910.73
2	140.26	910.14
3	141.53	909.34
4	440.27	913.78
5	449.97	932.41
6	459.67	951.04
7	469.36	969.67
8	471.69	974.12

** Corrected JANBU FOS = 5.247 ** (Fo factor = 1.061)

Failure surface No. 3 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	141.13	911.13
2	142.97	910.17
3	144.29	909.33
4	441.38	913.82
5	451.08	932.45
6	460.77	951.07
7	470.47	969.70
8	472.78	974.13

** Corrected JANBU FOS = 5.254 ** (Fo factor = 1.062)

Failure surface No. 4 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	141.51	911.21
2	143.49	910.18
3	144.93	909.26
4	440.76	913.89
5	450.46	932.51
6	460.15	951.14
7	469.85	969.77
8	472.12	974.13

** Corrected JANBU FOS = 5.261 ** (Fo factor = 1.062)

Failure surface No. 5 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	140.69	911.04
2	142.38	910.17
3	143.58	909.40
4	440.44	913.81
5	450.14	932.44
6	459.83	951.07
7	469.53	969.70
8	471.84	974.13

** Corrected JANBU FOS = 5.310 ** (Fo factor = 1.062)

Failure surface No. 6 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	139.40	910.78
2	140.62	910.15
3	142.00	909.27
4	440.80	913.91
5	450.50	932.54
6	460.19	951.16
7	469.89	969.79
8	472.15	974.13

** Corrected JANBU FOS = 5.313 ** (Fo factor = 1.061)

Failure surface No. 7 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	140.49	911.00
2	142.10	910.16
3	143.31	909.39
4	443.14	913.82
5	452.84	932.45
6	462.53	951.08
7	472.23	969.70
8	474.54	974.15

** Corrected JANBU FOS = 5.314 ** (Fo factor = 1.061)

Failure surface No. 8 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	138.68	910.64
2	139.64	910.14
3	140.92	909.32
4	444.11	913.86
5	453.81	932.49
6	463.50	951.11
7	473.20	969.74
8	475.50	974.15

** Corrected JANBU FOS = 5.321 ** (Fo factor = 1.061)

Failure surface No. 9 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	138.14	910.53
2	138.90	910.13
3	140.17	909.32
4	440.32	913.85
5	450.02	932.48
6	459.72	951.11
7	469.41	969.74
8	471.70	974.12

** Corrected JANBU FOS = 5.324 ** (Fo factor = 1.061)

Failure surface No.10 specified by 8 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	138.47	910.60
2	139.35	910.13
3	140.59	909.35
4	440.93	913.86
5	450.62	932.49
6	460.32	951.11
7	470.02	969.74
8	472.30	974.13

** Corrected JANBU FOS = 5.346 ** (Fo factor = 1.061)

The following is a summary of the TEN most critical surfaces

Problem Description : osource

	Modified JANBU FOS	Correction Factor	Initial x-coord (ft)	Terminal x-coord (ft)	Available Strength (lb)
1.	5.243	1.061	140.75	473.19	5.822E+05
2.	5.247	1.061	139.14	471.69	5.796E+05
3.	5.254	1.062	141.13	472.78	5.822E+05
4.	5.261	1.062	141.51	472.12	5.822E+05

5.	5.310	1.062	140.69	471.84	5.870E+05
6.	5.313	1.061	139.40	472.15	5.889E+05
7.	5.314	1.061	140.49	474.54	5.926E+05
8.	5.321	1.061	138.68	475.50	5.957E+05
9.	5.324	1.061	138.14	471.70	5.892E+05
10.	5.346	1.061	138.47	472.30	5.929E+05

* * * END OF FILE * * *

ATTACHMENT B
XSTABL SLOPE STABILITY SOFTWARE
STATIC ANALYSIS, ROTATIONAL FAILURE
OUTPUT DATA

XSTABL File: SXNA_R 3-12-14 14:56

```
*****************************************
*              X S T A B L              *
*                                       *
*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*        Copyright (C) 1992 - 2002      *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
*  Ver. 5.206                 96 - 1932 *
*****************************************
```

Problem Description : osource

SEGMENT BOUNDARY COORDINATES
---

8 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	.0	870.0	58.7	873.4	1
2	58.7	873.4	83.9	879.1	1
3	83.9	879.1	107.2	890.0	1
4	107.2	890.0	136.0	910.1	1
5	136.0	910.1	417.5	966.6	2
6	417.5	966.6	454.4	974.0	2
7	454.4	974.0	1009.3	978.0	2
8	1009.3	978.0	1029.6	974.0	2

2 SUBSURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	136.0	910.1	594.5	914.8	1
2	594.5	914.8	1068.4	919.7	1

```
---------------------------
ISOTROPIC Soil Parameters
---------------------------

 2 Soil unit(s) specified

Soil   Unit Weight   Cohesion  Friction    Pore Pressure
Water
Unit  Moist    Sat.  Intercept   Angle  Parameter  Constant
Surface
 No.  (pcf)   (pcf)    (psf)     (deg)      Ru      (psf)
No.

  1   115.0   130.0        .0    25.00      .000         .0
1
  2    75.0   100.0     500.0    35.00      .000         .0
0


 1 Water surface(s) have been specified

Unit weight of water =    62.40  (pcf)


Water Surface No.  1 specified by  2 coordinate points

**********************************
         PHREATIC SURFACE,
**********************************

  Point      x-water     y-water
   No.         (ft)        (ft)

    1          58.70      870.00
    2        1068.00      870.00


A critical failure surface searching method, using a random
technique for generating CIRCULAR surfaces has been specified.


 2500 trial surfaces will be generated and analyzed.


  50 Surfaces initiate from each of  50 points equally spaced
along the ground surface between  x =     25.0 ft
                              and  x =     90.0 ft


Each surface terminates between   x =    400.0 ft
                             and   x =    430.0 ft
```

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 ft

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * * *

10.0 ft line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 42 coordinate points

Point No.	x-surf (ft)	y-surf (ft)
1	25.00	871.45
2	34.55	868.50
3	44.18	865.80
4	53.88	863.37
5	63.65	861.20
6	73.46	859.29
7	83.33	857.65
8	93.23	856.28
9	103.17	855.18
10	113.14	854.34
11	123.12	853.77
12	133.12	853.47
13	143.12	853.45
14	153.11	853.69
15	163.10	854.20
16	173.07	854.98

17	183.01	856.03
18	192.93	857.35
19	202.80	858.93
20	212.63	860.79
21	222.40	862.90
22	232.11	865.28
23	241.76	867.92
24	251.33	870.82
25	260.82	873.98
26	270.22	877.39
27	279.52	881.05
28	288.73	884.96
29	297.82	889.13
30	306.80	893.53
31	315.65	898.18
32	324.38	903.06
33	332.97	908.17
34	341.42	913.52
35	349.73	919.09
36	357.87	924.89
37	365.87	930.90
38	373.69	937.13
39	381.35	943.56
40	388.82	950.20
41	396.12	957.04
42	402.80	963.65

**** Simplified BISHOP FOS = 2.366 ****

The following is a summary of the TEN most critical surfaces

Problem Description : osource

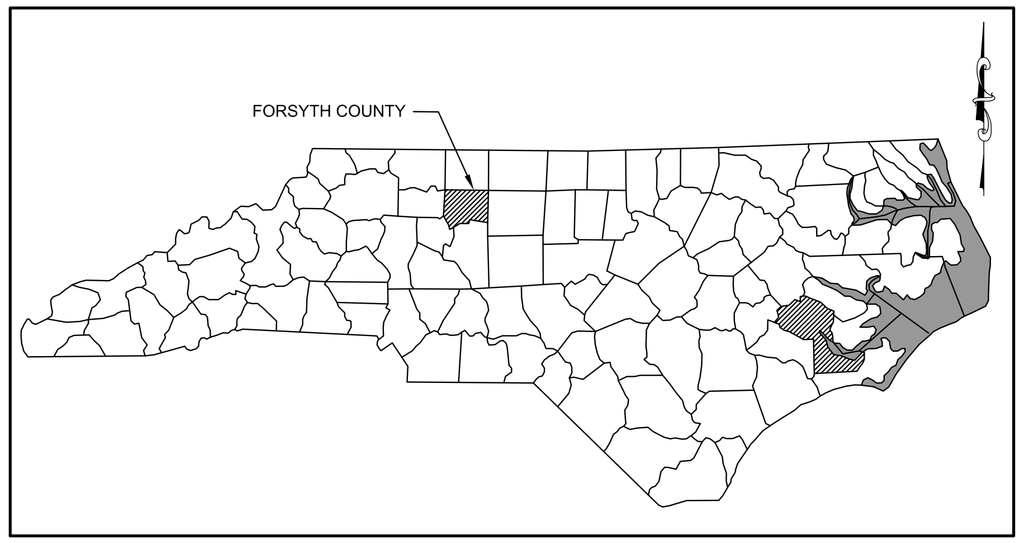
	FOS (BISHOP)	Circle Center x-coord (ft)	Circle Center y-coord (ft)	Radius (ft)	Initial x-coord (ft)	Terminal x-coord (ft)	Resisting Moment (ft-lb)
1.	2.366	139.14	1223.86	370.44	25.00	402.80	2.810E+08
2.	2.381	145.17	1211.66	360.81	25.00	408.25	2.920E+08
3.	2.383	154.65	1157.48	313.43	26.33	400.53	2.734E+08
4.	2.385	146.03	1204.49	352.79	28.98	404.06	2.778E+08

5.	2.387	148.80	1200.18	351.27	25.00	409.77	2.949E+08
6.	2.391	132.05	1268.13	410.87	25.00	409.29	2.984E+08
7.	2.392	142.52	1228.08	374.53	27.65	408.88	2.911E+08
8.	2.394	127.74	1281.01	421.85	26.33	406.46	2.922E+08
9.	2.400	154.59	1182.47	336.94	25.00	412.33	3.005E+08
10.	2.405	130.50	1278.56	419.75	27.65	409.54	2.969E+08

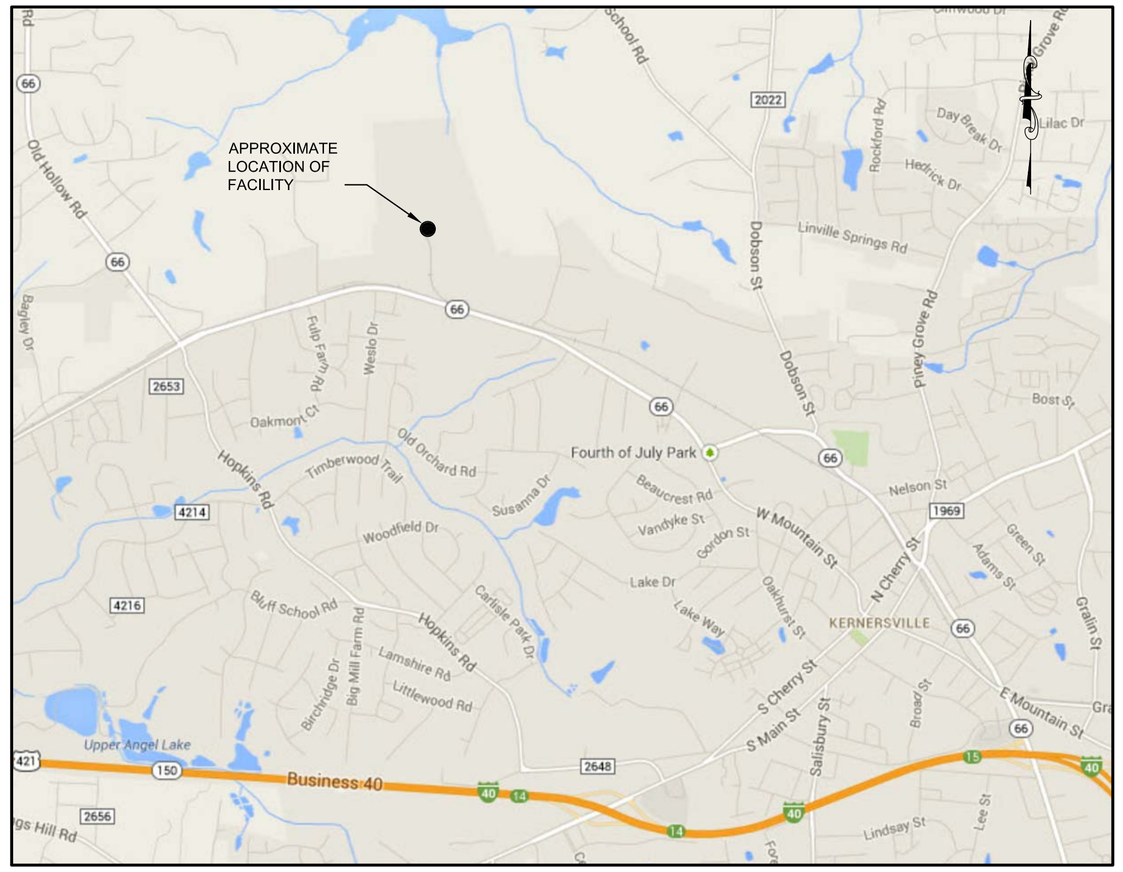
* * * END OF FILE * * *

OMNISOURCE SOUTHEAST
PERMIT 34-20
PERMIT RENEWAL

KERNERSVILLE, NORTH CAROLINA



NORTH CAROLINA
COUNTY LOCATION MAP



VICINITY MAP
SCALE: 1"=2,000 '

DRAWING INDEX

SHEET	SITE PLAN
CP-T	TITLE SHEET
CP-L	LEGEND AND GENERAL NOTES
CP-01	EXISTING CONDITIONS
CP-02	FINAL GRADING AND EROSION CONTROL PLAN
CP-03	PROJECT DETAILS

OWNER INFORMATION

PREPARED FOR: OMNISOURCE SOUTHEAST

ADDRESS: 2233 WAL-PAT ROAD
SMITHFIELD, NC 27577

CONTACT: JAMES WINEGAR

PHONE: (919)-989-3102

PROPERTY INFORMATION

LOCATION: KERNERSVILLE, NORTH CAROLINA

PERMIT ID: 34-20

MAY 2014

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 031203 ENGINEER MARTIN N. SHUMPERT 5/27/14

DESIGNED AD
DRAWN RWH
CHECKED LB
APPROVED MS
DATE 05/27/14

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PHONE: (336) 323-0092

OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

TITLE SHEET

PROJECT NO.
799.1403.11

SCALE
N.T.S.

DRAWING NO.
CP-T

L:\OMNI SOURCE\KERNERSVILLE\SHEET SET\C-T TITLE SHEET.dwg Layout=Layout1

CONVENTIONAL SYMBOLS AND GENERAL NOTES

LINES

	EXISTING	PROPOSED
PROPERTY LINE / FACILITY BOUNDARY		
EASEMENT		
RIGHT OF WAY	R/W	R/W
FENCE LINE	X X	X X
RAILROAD		
GUARDRAIL		
RESOURCE PROTECTION AREA		
SURVEY TIE LINE		
SURFACE WATER		
APPROXIMATE 100 YEAR FLOODPLAIN		
OVERHEAD ELECTRIC		
UNDERGROUND ELECTRIC	UGE UGE	UGE UGE
OVERHEAD TELEPHONE		
UNDERGROUND TELEPHONE	UGT UGT	UGT UGT
FORCEMAIN	FM	
SANITARY SEWER	SS	SS
PROCESS SEWER		
NATURAL GAS		
POTABLE WATER		
SOLID PIPE (TYPE NOTED)		
PERFORATED PIPE (TYPE NOTED)		
CULVERT (SIZE NOTED)		
PAVED ROAD		
GRAVEL/DIRT ROAD		
TREE LINE		
MAJOR TOPOGRAPHIC CONTOUR	100	100
MINOR TOPOGRAPHIC CONTOUR		
GROUNDWATER SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)	80 GW	
BEDROCK SURFACE CONTOUR (FT ABOVE MEAN SEA LEVEL)	70 BR	
APPROXIMATE GROUNDWATER FLOW PATHWAY USED TO CALCULATE HYDRAULIC GRADIENT		
LANDFILL GAS		
LANDFILL GAS CONDENSATE		
LEACHATE COLLECTION TRENCH	LCT LCT	LCT LCT
DUAL CONTAINED LEACHATE FORCEMAIN	DCFM DCFM	DCFM DCFM
LIMITS OF WASTE		
CELL LIMITS		
WASTE MANAGEMENT BOUNDARY		
SECTION CALL-OUT	B ?	

SYMBOLS

	EXISTING	PROPOSED
GROUNDWATER MONITORING WELL	MW-X	MW-X
OBSERVATION WELL	MW-OW-X	MW-OW-X
NES WELL	NES-OW-X	NES-OW-X
PERFORMANCE WELL	MW-PW-X	MW-PW-X
SENTINEL WELL	MW-X	MW-X
EXTRACTION WELL	EW-X	EW-X
WETLANDS PIEZOMETER	PZ-X	PZ-X
PIEZOMETER	PZ-X	PZ-X
LANDFILL GAS PROBE	GP-X	GP-X
PASSIVE LFG VENT	GV-X	GV-X
LFG EXTRACTION WELL WITH PUMP	GWP-X	GWP-X
LFG EXTRACTION WELL	GW-X	GW-X
CONDENSATE TRAP WITH PUMP	CT/P-1	CT/P-1
CONDENSATE TRAP WITHOUT PUMP	CT-1	CT-1
SURFACE WATER MONITORING POINT	SMP-X	SMP-X
LEACHATE MONITORING POINT	LMP-X	LMP-X
BORE HOLE LOCATION	B-X	BH-X
CORING LOCATION	C-X	C-X
SOIL SAMPLING LOCATION	SS-X	SS-X
TEST PIT LOCATION	TP-X	
WELL LOCATION	W	
SPRINGHEAD LOCATION	S-X	
BENCHMARK	BM	
CONTROL POINT	CP	
UTILITY POLE		
SIGN		
HYDRANT		
WATER METER	WM	WM
VALVE		
PIPE FITTINGS		
LIGHT POLE		
TANK (SIZE VARIES)		
TRANSFORMER		
MANHOLE	M	M
CLEANOUT	CO	CO
VALVE LOCATION & IDENTIFICATION	V-3	V-3
STORMWATER PIPE OUTLET PROTECTION		
SPOT ELEVATION	14.70	14.70

PLAN-VIEW HATCHING

	EXISTING	PROPOSED
DEMOLITION		
ASPHALT PAVEMENT		
GRAVEL		
CONCRETE		
WETLANDS		

EROSION AND SEDIMENT CONTROL FEATURES

SYMBOL	NAME
CE	CONSTRUCTION ENTRANCE
SF	SILT FENCE
PS	PERMANENT SEEDING
	DIVERSION BERM
TSD-1	TEMPORARY SLOPE DRAIN
IP	INLET PROTECTION
CIP	CULVERT INLET PROTECTION
OP	OUTLET PROTECTION
CD	ROCK CHECK DAM
SCC-1	STORM WATER CONVEYANCE CHANNEL
ST-1	SEDIMENT TRAP
SB-1	SEDIMENT BASIN

GENERAL NOTES:

1. EXISTING TOPOGRAPHIC DATA SHOWN WITHIN THE MAPPING LIMITS, ARE FROM A TOPOGRAPHIC SURVEY MAP PREPARED BY BAUMGARTNER AND ASSOCIATES, INC, DATED 2001
2. TOPOGRAPHIC CONTOUR INTERVAL = 2 FOOT, UNLESS INDICATED OTHERWISE.
3. THE CONTRACTOR IS REQUIRED TO PROTECT STRUCTURES AND APPURTENANCES INCLUDING BUT NOT NECESSARILY LIMITED TO WELLS, DRAINAGE STRUCTURES, PROPERTY CORNERS, ETC. THE CONTRACTOR WILL BE REQUIRED TO REPAIR ANY DAMAGES AT NO EXPENSE TO THE OWNER.
4. APPROXIMATE LIMITS OF WASTE ASSUMED BY UTILIZING AERIAL PHOTOGRAPH AND DRAWINGS AND COMPARING WITH KNOWN SITE CONDITIONS , AND DISCUSSIONS WITH FACILITY PERSONNEL.

GENERAL EROSION AND SEDIMENT CONTROL NOTES:

1. UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE NORTH CAROLINA EROSION AND SEDIMENT CONTROL HANDBOOK..
2. A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.
3. ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.
4. THE OWNER SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.

NO.	BY	CK.	APP

DATE	REVISIONS AND RECORD OF ISSUE

NORTH CAROLINA PROFESSIONAL SEAL 031203 ENGINEER MARTIN A. SHUMPERT 5/27/14

DESIGNED	AD
DRAWN	RWH
CHECKED	LB
APPROVED	MS
DATE	05/27/14

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OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

LEGEND AND GENERAL NOTES

PROJECT NO. 799.1403.11

SCALE N.T.S.

DRAWING NO. CP-L

L:\OMNI SOURCE\KERNERSVILLE\SHEET SET\CP-L LEGEND AND NOTES.dwg Layout=Layout1

OVERALL PROPERTY MAP

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 031203 ENGINEER MARTIN A. SHUMPERT
5/27/14

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NC CORP LIC: C-0782

OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

EXISTING CONDITIONS

PROJECT NO.
799.1403.11

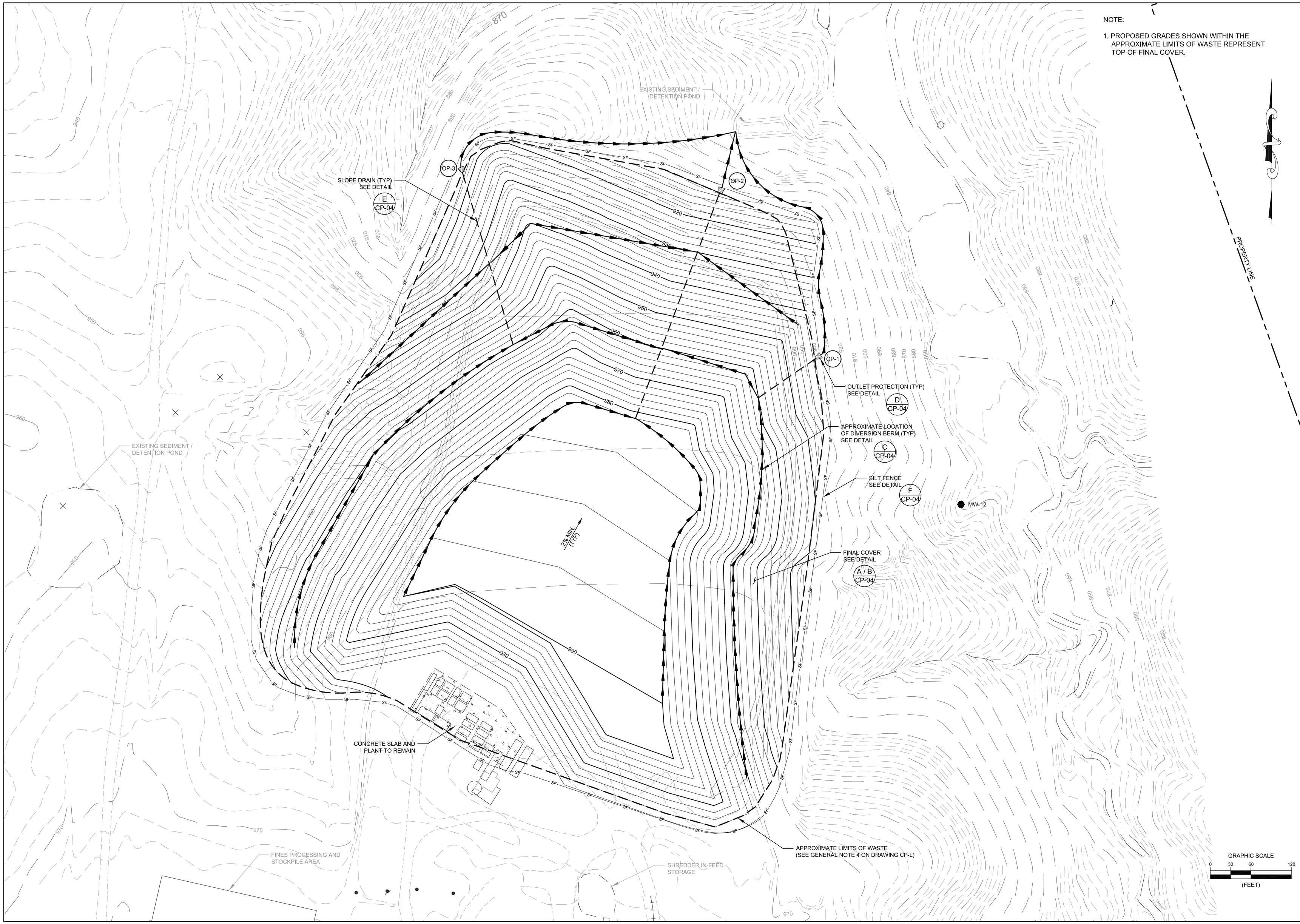
SCALE
AS SHOWN

DRAWING NO.
CP-01

L:\OMNI SOURCE\KERNERSVILLE\SHEET SET\CP-01 EXISTING CONDITIONS.dwg Layout=Layout1

NOTE:

1. PROPOSED GRADES SHOWN WITHIN THE APPROXIMATE LIMITS OF WASTE REPRESENT TOP OF FINAL COVER.



NO	BY	CK	APP	REVISIONS AND RECORD OF ISSUE	DATE

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OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

FINAL GRADING PLAN

PROJECT NO.
799.1403.11

SCALE
AS SHOWN

DRAWING NO.
CP-02

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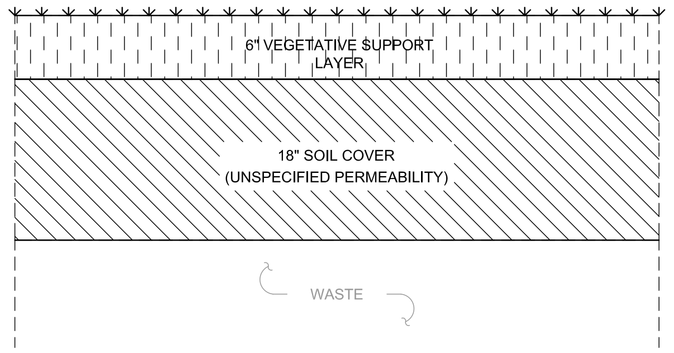
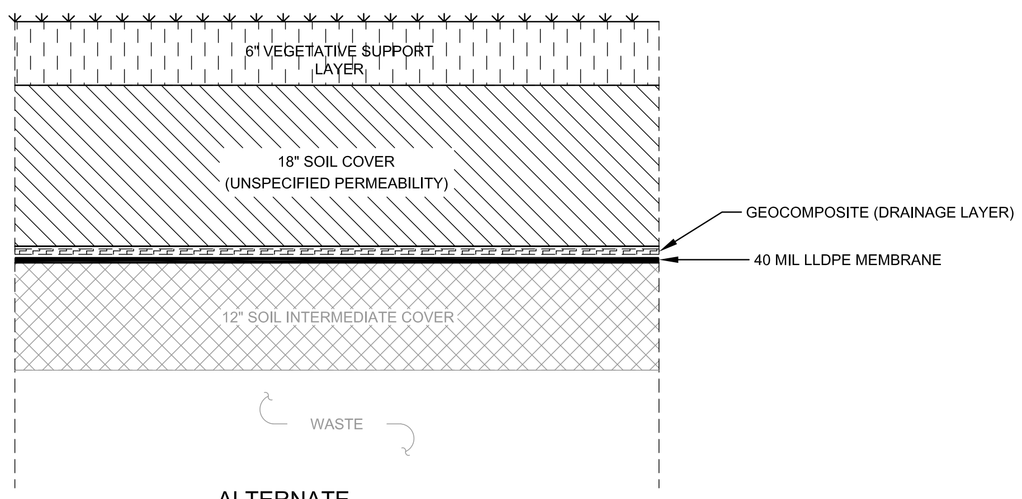
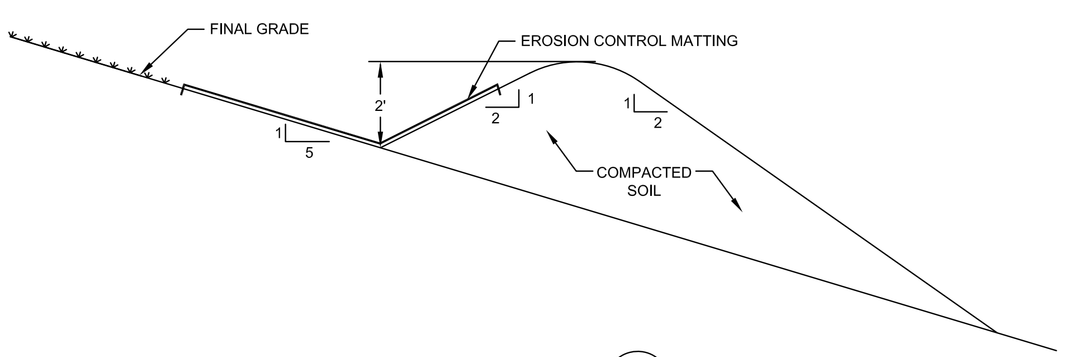


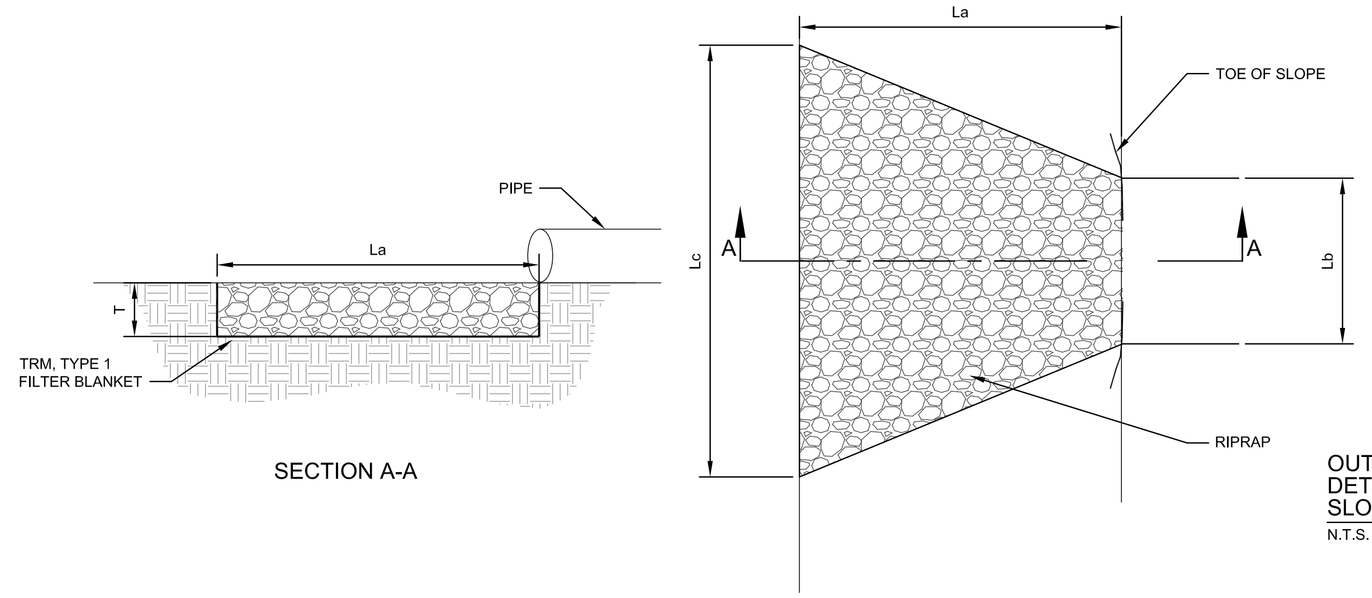
SOIL FINAL COVER
N.T.S.
A



ALTERNATE
FINAL COVER
N.T.S.
B



DIVERSION BERM
N.T.S.
C



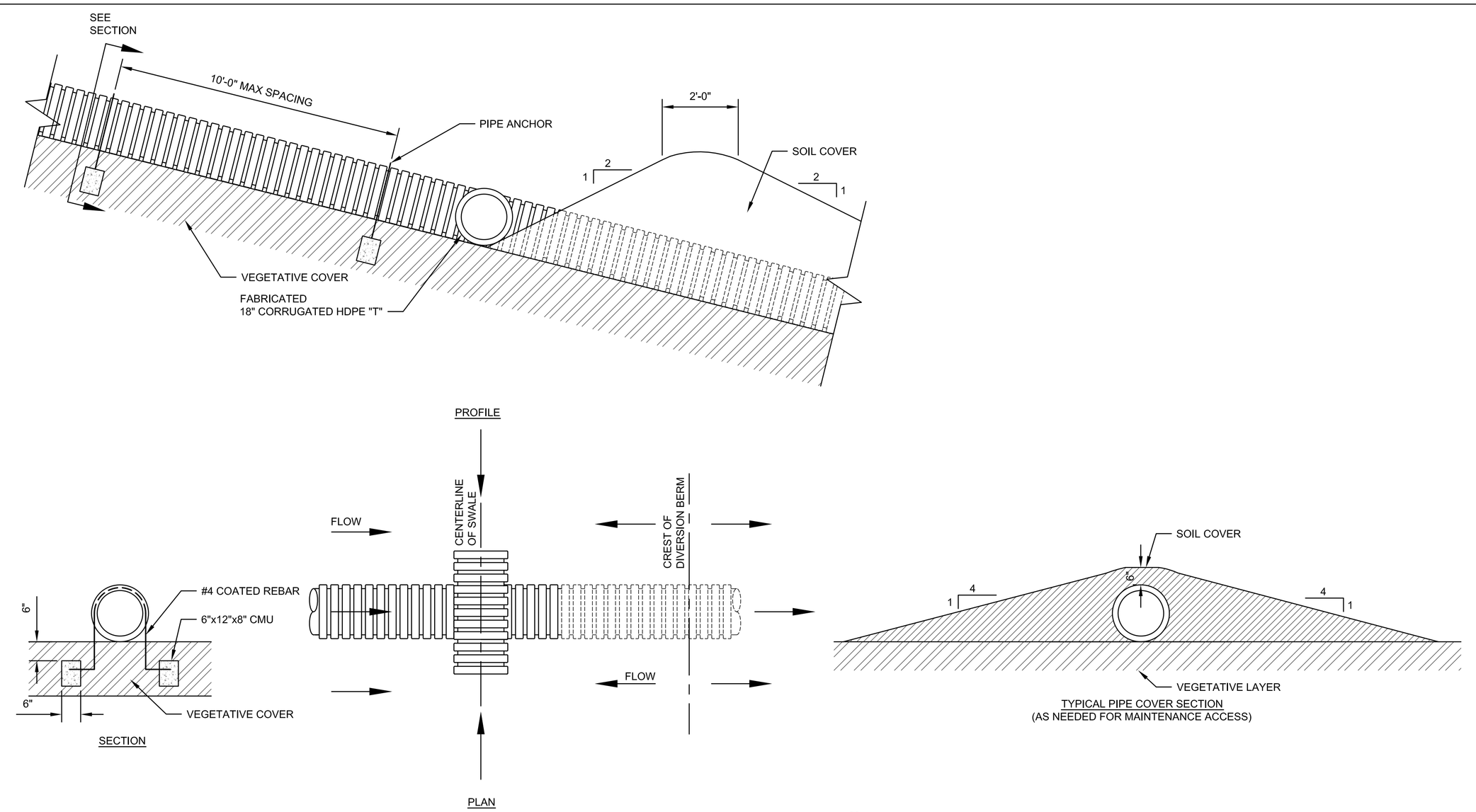
NOTES:

1. INSTALL FILTER FABRIC BETWEEN RIPRAP AND SOIL FOUNDATION.
2. Lb = 2x DIAMETER OF PIPE OR FULL WIDTH OF RECEIVING CHANNEL (WHICHEVER IS LARGER).

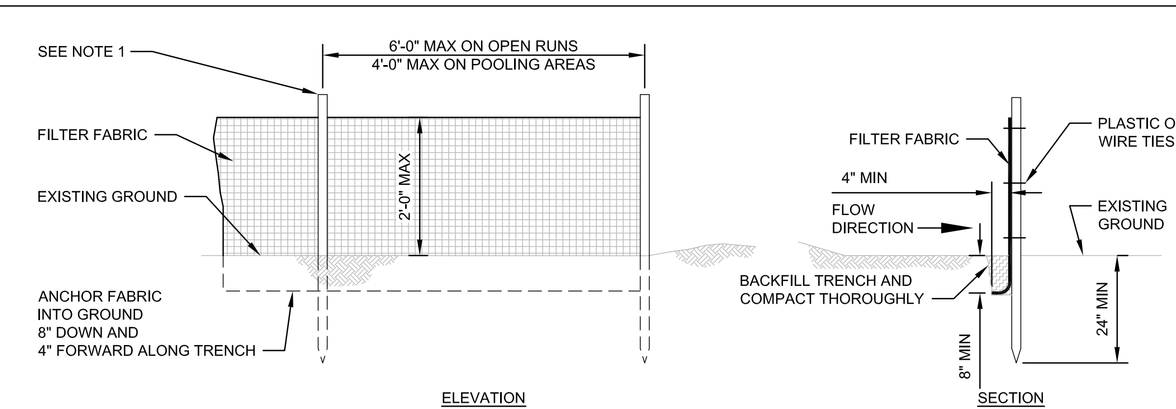
OUTLET PROTECTION SCHEDULE

OUTLET ID	La	Lb	Lc	D_{50} RIPRAP	APRON THICKNESS (T)
OP-1	8.0'	4.5'	9.5'	6"	1.25'
OP-2	8.0'	4.5'	9.5'	6"	1.25'
OP-3	8.0'	4.5'	9.5'	6"	1.25'

OUTLET PROTECTION
DETAIL - TYPE II
SLOPE DRAIN OUTFALLS
N.T.S.
D



SLOPE DRAIN DETAIL
N.T.S.
E



NOTES:

1. POSTS SHALL BE 1.33 LB/L.F. STEEL WITH MIN LENGTH OF 5 FT.
2. LOCATE SILT FENCE AS NEEDED AND AT A SUFFICIENT DISTANCE FROM PROPOSED WORK ACTIVITIES SO THAT IT WILL NOT INTERFERE WITH THE WORK.

SILT
FENCE DETAIL
N.T.S.
F

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CK	APP

NORTH CAROLINA PROFESSIONAL SEAL 031203 ENGINEER MARTIN A. SHUMPERT
5/27/14

DESIGNED AD
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DATE 05/27/14

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OMNISOURCE SOUTHEAST - KERNERSVILLE SITE
KERNERSVILLE, NORTH CAROLINA

PROJECT DETAILS

PROJECT NO.
799.1403.11

SCALE
AS SHOWN

DRAWING NO.
CP-03

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