Coal Combustion Residuals (CCR) Landfill

RUN-ON AND RUN-OFF CONTROL PLAN

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
R.D. Morrow, Sr. Generating Station
Purvis, Lamar County, Mississippi
(601) 235-2700

Prepared by:

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

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Brandon, MS 39047
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Hattiesburg, Mississippi
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Revision Record
Original Plan: October 12, 2016

Certification

This Run-on and Run-off Control Plan for the CCR Landfill at the South Mississippi Electric Power Association, R.D. Morrow, Sr. Generating Station located in Purvis, Mississippi, was prepared by Environmental Management Services, Inc. (EMS) pursuant to the Scope of Services dated March 17, 2016, agreed to and authorized by SMEPA. This Statement of Professional Opinion is based on information available to EMS at the time the Run-on and Run-off Control Plan was prepared and EMS's technical understanding of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (CCR Rule) and associated public guidance and/or interpretation provided by the U.S. EPA and obtained by EMS as of the date of the Run-on and Run-off Control Plan.

On the basis of and subject to the foregoing it is my professional opinion as a Professional Engineer licensed in the State of Mississippi that the Run-on and Run-off Control Plan has been prepared in accordance with good and accepted engineering practices exercised by other engineers practicing in the same discipline(s) under similar circumstances and at the time and place the Run-on and Run-off Control Plan was prepared, and with the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments", published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015. It is my professional opinion based on my understanding of the technical requirements of the CCR Rule and good and accepted engineering practices that the storm water controls as set forth in the Run-on and Run-off Control Plan meets the technical requirements and/or intent of the CCR Rule (40 CFR 257, Section 257.81. This Statement of Professional Opinion is not and shall not be interpreted or construed as a guarantee, warranty or legal opinion.

Environmental Management Services, Inc.

Christopher T. Johnson, P.E., P.S.
Engineering Manager/Vice President

Date: 10/12/2016

Seal

TABLE OF CONTENTS

1. INTRODUCTION 4

1.1 REGULATORY OVERVIEW 4
1.2 PROJECT DESCRIPTION 5
1.3 CCR REGULATORY CHECKLIST 5

2. DESIGN PLAN 9

2.1 DESIGN CRITERIA 9
2.2 RUN-OFF COMPLIANCE WITH §257.3-3 SURFACE WATER 9

3. RUN-ON & RUN-OFF CONTROL SYSTEM PLAN 10

3.1 LANDFILL STORM WATER DIVERSION (RUN-ON PREVENTION) 10
3.2 LANDFILL RUN-OFF COLLECTION 10
3.2.1 Collection Channels 10
3.2.2 Storage Ponds 10
3.3 RECORD OF CONSTRUCTION 11

4. INSPECTION PLAN 12

5. TIMEFRAMES AND REVISIONS 14

5.1 AMENDMENT OF THE PLAN 14
5.2 COMPLIANCE WITH TIMEFRAMES 14
5.3 PRESCRIBED FREQUENCY OF REVISIONS 14

6. RECORDKEEPING PLAN 15

6.1 RECORDKEEPING 15
6.2 NOTIFICATION 15
6.3 SMEPA CCR WEBSITE 16

LIST OF TABLES

1 Run-on/Run-off Control Checklist…….Page 6-8

APPENDIX A - LIST OF FIGURES

1 Site Location Map
2 Final Cover Design Plan
3 Storm water Drainage Plan
4 Final Cover Detail Sheet
5 Final Cover, Leachate Collection Detail Sheet
6 Storm Water Filtration/Detention Area

APPENDIX B – STORM WATER DESIGN CALCULATIONS

1. INTRODUCTION

This Run-on and Run-off Control Plan (Plan) has been developed for the South Mississippi Electric Power Association (SMEPA) R.D. Morrow, Sr. Generating Station located near Purvis, Lamar County, Mississippi. The landfill site is located in the N1/2of the NE1/4 of Sec.21, T3N, R14W, in Lamar County, Mississippi, as shown on the Site Location Map presented as Figure 1. The site is located at latitude 31˚ 12' 40" and longitude -89˚ 23' 53". The approximately 72 acre permitted landfill site is located within the 1,200 acre R.D. Morrow, Sr. property. The permitted landfill area is shown on the Existing Site Plan presented as Figure 2. The 72 acre permitted landfill area includes approximately 46 acres of existing permitted landfill and a proposed 26 acre expansion area located to the west of the existing landfill.

Under the federal CCR regulations the existing footprint is classified as an existing CCR landfill, and the proposed expansion would be classified as a new or lateral expansion of the CCR landfill, if the expansion were built.

During the Mississippi Department of Environmental Quality (MDEQ) permitting process for expansion of the landfill in 2003, various studies and investigations were conducted. This Plan contains excerpts from the original permit document. The permit application included the following that pertain to the Plan requirements of the 2015 CCR Rule (40 CFR Part 257.81).

- Subsurface investigation
- Laboratory testing of site soils
- Site characterization
- Climate analyses
- Surface water hydrologic and hydraulic analyses
- Slope Stability analyses
- Settlement analyses
- Earthwork and construction recommendations
- Quality assurance requirements for construction

1.1 Regulatory Overview

In 1977, South Mississippi Electric Power Association (SMEPA) received Permit No. SW0370020308 from the State of Mississippi, Department of Environmental Quality (MDEQ) to operate its onsite industrial waste landfill. The onsite facility is currently owned and operated by SMEPA. The landfill receives only non-hazardous industrial solid waste from the on-site generating plant as specified in the facility MDEQ nonhazardous solid waste landfill permit. The landfill is also an "existing unit" subject to federal CCR regulations as of the effective date of October 19, 2015. However, the federal regulations have no permitting requirements or EPA oversight. This CCR Run-on and Run-off Control Plan conforms to the requirements of Section 257.81 of the CCR Rule [run-

Management Regulations (NSWMR). This plan addresses the requirements of federal Coal Combustion Residuals (CCR) regulations (40 CFR 257) for storm water run-on and run-off control for an industrial waste landfill containing CCR which requires owners or operator of CCR landfills and all lateral expansions to design, construct and maintain a run-on control system to prevent flow onto the active portion of these units during the peak discharge from a 24-hour, 25 year storm. These run-on controls are designed to prevent erosion, which may damage the physical structure of the landfill, prevent the surface discharge of CCR in solution or suspension; and to minimize the downward percolation of run-on through wastes, creating leachate. The EPA also requires run-off controls in order to collect and control, at a minimum, the water volume resulting from a 24-hour, 25-year storm. These standards have been proposed in order to protect surface waters from contamination. The facility is regulated under the NSWMR 11 Miss. Admin. Code Pt. 4, Rule. 1.4. E and the referenced federal regulations.

1.2 Project Description

This Plan includes run-on and run-off controls applicable to the entire CCR landfill facility. Existing cells that are active and receiving waste include Cells 1, 2, 3, and 4. The landfill is designed to route run-off from the design storm to ditches that surround the perimeter of the present footprint and discharge to a constructed storm water filtration system. Run-off that has contacted the landfill is shed to the filtration system and is treated by a combination of retention time, infiltration, bio-filtering, and passive filtration prior to exiting the system via NPDES monitored discharge.

1.3 CCR Regulatory Checklist

Table 1-1 provides the breakdown of §257.81 and associated sections and lists the applicable Plan section(s) for reference.

Table 1-1: Run-On & Run-Off Control Checklist

***§257.81* Section**	***§257.81* Subsection**	**Requirements**	**Applicable Plan Section**
(a)	*The owner or operator of an existing or new CCR Landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:*		Section 2 – Design Plan
	(1)	*A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge for a 24-hour, 25-year storm; and*	Section 2.1 – Design Criteria
	(2)	*A run-off control system form the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.*	
(b)	*Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.*		Section 2.2-Run-off Compliance with *§257.3-3 Surface Water*
(c)	*Run-on and run-off control system plan-*		Section 3 – Run-on & Run-off Control System Plan
	(1)	*Content of the plan. The owner or operator must prepare initial and periodic run-on and run-off control system plans for the CCR unit according to the timeframes specified in paragraphs(c)(3) and (4) of this section. These plans must document how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator has completed the initial run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(3).*	Section 3.1 – Design Section 3.2 – Record of Construction
	(2)	*Amendment of the plan. The owner or operator may amend the written run-on and runoff control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(3). The owner or operator must amend the written run-on an run-off control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.*	Section 4 – Amendment of the Plan
		Timeframes for preparing the initial plan-	Section 5.2 – Compliance with Timeframes
	(3)	*(i) Existing CCR landfills. The owner or operation of the CCR unit must prepare the initial run-on and run-off control system plan no later than October 17, 2016.*	Section 5.2 – Compliance with Timeframes
		(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must prepare the initial run-on and run-off control system plan no later than the date of initial receipt of CCR in the CCR unit.	Not Applicable at the time

§257.81 Section	*§257.81* Subsection	Requirements	Applicable Plan Section
(c)	(4)	*Frequency of revising the plan. The owner or operator of the CCR unit must prepare periodic run-on and run-off control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic run-on and run-off control system plan when the plan has been placed in the facility's operating records as required by §257.105(g)(3).*	Section 5.3 – Prescribed Frequency of Revisions
	(5)	*The owner or operator must obtain a certification form a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of this section.*	Certification Section
(d)	*The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(g), the notification requirements specified in §257.106(g), and the internet requirements specified in §257.107(g).*		Section 6 – Recordkeeping Plan

§257.84 Section	*§257.84* Subsection	Requirements	Applicable Plan Section
(a)	(1)	*Weekly inspections by a qualified person*	Section 4 – Inspection Plan
	(2)	*Timeframes-* *(i) Existing CCR landfills. The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section no later than October 19, 2015.* *(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must initiate the inspections required under paragraph (a) of this section upon initial receipt of CCR by the CCR unit.*	
(b)	(1), (2)	*Annual inspections and an inspection report by a qualified professional engineer*	
		Timeframes-	
		(i) Existing CCR landfills. The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.	
	(3)	*(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must complete the initial annual inspection required by paragraphs (b) (1) and (2) of this section no later than 14 months following the date of initial receipt of CCR in the CCR unit.*	
	(4)	*Frequency of Inspections. The owner or operator of the CCR unit must conduct the inspection required by paragraph (b) (1) and (2) of this section on an annual basis*	
(c)	*The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(g), the notification requirements specified in §257.106(g), and the internet requirements specified in §257.107(g).*		Section 6 – Recordkeeping Plan

2. DESIGN PLAN

The CCR landfill consists of perimeter and internal berms and storm water collection systems as shown on the design drawings presented in Appendix A. The CCR landfill has an overall permitted area of approximately 72 acres, which is made up of approximately 46 acres of existing landfill and a proposed 26 acre expansion area located to the west of the existing landfill. This landfill is made up of a of a combination of original inactive cells built on existing ground with no improved liner, and 6 newer cells that were constructed with leachate collection and compacted clay liners per approved permit from MDEQ.

As specified in the 2003 MDEQ permit application, final cover surface water diversion berms were designed to minimize erosion. As shown on Figure 2 in Appendix A, the surface diversion berms will be placed approximately every 30 feet in elevation change. These diversion berms will drain at four percent to letdown chutes located around the landfill. Details of the diversion berms and letdown chutes are presented on Figure 4 in Appendix A.

The landfill is designed to route run-off from the design storm to ditches that surround the perimeter of the present landfill footprint and discharge to a designed detention area and storm water filtration system. Run-off that has contacted the active portions of the landfill is shed to the filtration system and is treated by a combination of retention time, infiltration, bio-filtering, and passive filtration prior to exiting the system via NPDES monitored discharge. The north-western portion of the landfill sheds water to the west and around the western edge of the existing landfill. The storm water that contacts the closed slope-face in this area is currently routed to a non-contact storm water ditch which discharges just west of the landfill through an unmonitored outfall.

2.1 Design Criteria

Surface water hydrologic and hydraulic calculations have been performed to establish design peak flows, run-off volumes, channel capacities, minimum channel dimensions, and slopes required to pass the design peak flows from the off-site (non-contact or outside of lined containments) and on-site (inside lined containment) storm events. The facility layout and storm water diversion systems ensure that no up gradient run-off will enter the landfill fancily as run-on. Therefore, storm water considerations are dictated by direct precipitation falling on the facility. On and off-site drainage was evaluated for the 25 year-24 hour storm event.

For containment of precipitation falling on the facility, the Storm Water Filtration Area was conservatively designed to contain 100 percent of the run-off from the eastern (currently developed) portion of the landfill.

2.2 Run-Off Compliance with §257.3-3 Surface Water

The CCR landfill is designed to route any contact storm water through a storm water filtration/detention area then discharge via NPDES monitored outfall.

3. RUN-ON & RUN-OFF CONTROL SYSTEM PLAN

The following sections present a summary of the run-on and run-off control system design for the CCR landfill facility and constitute the Run-on and Run-off Control System Plan (Plan). Referenced design drawings are presented in Appendix A and the hydrologic and hydraulic calculations are presented in Appendix B.

3.1 Landfill Storm Water Diversion (Run-on Prevention)

The landfill area is relatively flat and dissected by small ephemeral drainages that flow generally southward. All up-gradient storm water is directed under Okahola Road via culverts to drainage ditches that convey storm flows to the east and west of the landfill. Perimeter berms/road embankments surround the landfill facility and storm water diversion channels have been established immediately up gradient of the north side of the landfill facility to prevent run-on and divert run-off around the facility.

Storm water diversion channels for the landfill consist of v-shaped or trapezoidal channels, a minimum depth of 2-feet, design gradient of 0.5 percent and 4:1 side slopes. Various depths and bottom widths are used around the perimeter of the landfill to allow for adequate handling of storm flows. Details of each ditch segment are illustrated in the calculations found in Appendix B.

3.2 Landfill Run-off Collection

3.2.1 Collection Channels

The landfill drainage has been designed to collect all storm water in perimeter collection channels to prevent run-on and to convey run-off to storm water filtration/detention areas. The discharge from these areas is monitored under the monitoring requirements of a permitted NPDES discharge.

3.2.2 Storage Ponds

On-site storm water run-off collected in channels is routed to the storm water filtration/detention area for passive treatment and peak flow reduction prior to exiting the facility via NPDES discharge. The storm water filtration/detention area has been designed to accommodate all storm water run-off from the currently developed portion of the landfill. A similar system will be developed should the additional permitted, but as of yet undeveloped portion of the landfill (western expansion area), become necessary.

The required detention area was designed for containment of the run-off-/infiltration created by the 25 year, 24-hour design storm event assuming 100 percent run-off from the entire developed landfill area.

3.3 Record of Construction

The existing CCR landfill facility includes Cells 1 through Cell 6 and were constructed in general accordance with the approved plans and specifications presented to MDEQ in 2003. Landfill cells 4, 5, and 6 were constructed in 2004, while landfill cells 1, 2, and 3 were constructed in 2008. As-built construction plan sets and QA/QC reports were developed for both of these construction efforts. Previous portions of the landfill were constructed prior to MDEQ regulatory oversight and have no construction documents of record.

4. INSPECTION PLAN

Inspections of the CCR landfill are required by the federal CCR regulations under §257.84. These inspections include the run-on and run-off control features of the facility. A summary of the prescribed inspections include:

- **Weekly Inspection Reports**: A qualified person will inspect for any appearance of actual or potential structural weaknesses and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR landfill. The following features will be included in the inspections:
    - Storm water diversion channels for erosion and accumulation of sediments/debris
    - Perimeter berms for damage
    - Exposed liner systems for damage
    - Storm water filtration area water level and apparent damage
    - Evidence of erosion that may affect run-on and run-off control features
- **Annual Inspections**: A qualified professional engineer will make an annual inspection of the CCR landfill to ensure that the design, construction, operation and maintenance of the CCR landfill is consistent with recognized and generally accepted good engineering standards. The inspection will at a minimum include:
    - Review of the existing operating record including weekly and previous annual inspections.
    - Perimeter berms for damage
    - Exposed liner systems for damage
    - Storm water filtration area water level and apparent damage
    - Evidence of erosion that may affect run-on and run-off control features
    - Preparation of an inspection report that addresses the following:
        - Any changes in the geometry of the structure since the previous annual inspection;
        - The approximate volume of the CCR contained in the landfill at the time of the inspection;

- Any appearances of an actual or potential structural weakness of the CCR landfill, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and

- Any other changes which may have affected the stability or operation of the CCR unit since the previous inspection.

5. TIMEFRAMES AND REVISIONS

5.1 Amendment of the Plan

It is understood that the Run-on and Run-off Control System Plan may be amended at any time provided that the revised plan is placed in the facility's operating record as required by §257.105(g)(3) and that an amendment must be made whenever there is a change in conditions that would substantially affect the written plan in effect. Amendments to the Plan are anticipated should construction of the western expansion area and associated detention area be needed.

5.2 Compliance with Timeframes

As an existing facility, the SMEPA R.D. Morrow, Sr. Generating Station is required to prepare an initial Run-on and Run-off Control System Plan for the CCR Landfill by October 17, 2016 per §257.81 (c)(3)(i).

5.3 Prescribed Frequency of Revisions

At a minimum, a periodic Run-on and Run-off Control System Plan must be prepared every five (5) years. The deadline for completion is five (5) years from the date when the initial plan was placed in the facility's operating record.

6. RECORDKEEPING PLAN

This Run-on and Run-off Control Plan must comply with the recordkeeping, notification, and website requirements described in the following sections. Copies of records in electronic and paper (written) formats are kept on site. Unless specified otherwise, records must be retained for at least five (5) years for the date of occurrence, measurement, maintenance, corrective action, report, record or study (§257.105(b)).

6.1 Recordkeeping

In accordance with the requirements of §257.105(g), the following records must be kept as they become available:

- **The initial and periodic Run-on and Run-off Control System Plans as required by §257.81(c).** The plan is submitted herein and shall be amended or revised no later than five years from the date of the last posted plan, amendment, or revision.

- **Documentation detailing the corrective measures taken to remedy a deficiency or release as required by §257.84(b)(5).** Documentation detailing corrective measures must be kept in the operating record regarding any deficiency or release identified during an inspection.

- **Documentation recording the results of the weekly inspection by a qualified person as required by §257.84(a).** Weekly inspection requirements concerning the CCR landfill are presented in Section 4.

- **The periodic inspection report as required by §257.84(b)(2).** Annual inspection requirements concerning the CCR landfill are presented in Section 4.

6.2 Notification

In accordance with §257.106(g)(3), the following entities must be notified when information has been placed in the operating record and on the owner's or operator's publicly accessible internet site:

Branch Chief
Solid Waste and Mining Branch
Environmental Compliance & Enforcement Division
Mississippi Department of Environmental Quality

Street Address:	Mailing Address:
515 E. Amite Street	P.O. Box 2261
Jackson, MS 39201	Jackson, MS 39225

6.3 SMEPA CCR Website

In accordance with 257.106(g), the records described in Section 6.1 must be made available on a publicly accessible internet website.

The publicly accessible internet website is:

http://smepa.coop/portfolio/energy-resources

APPENDIX A

FIGURES

REVISIONS		
REV	DATE	REMARKS

N

SCALE 1 INCH = 1500 FEET

375 750 1500

0 375 750 1500 3000

GRAPHIC SCALE

LEGEND

SMEPA PROPERTY BOUNDARY

CAP BOUNDARY

REFERENCE: 7.5 MIN. SERIES TOPOGRAPHIC MAP
PURVIS, MISSISSIPPI

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PREPARED FOR

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

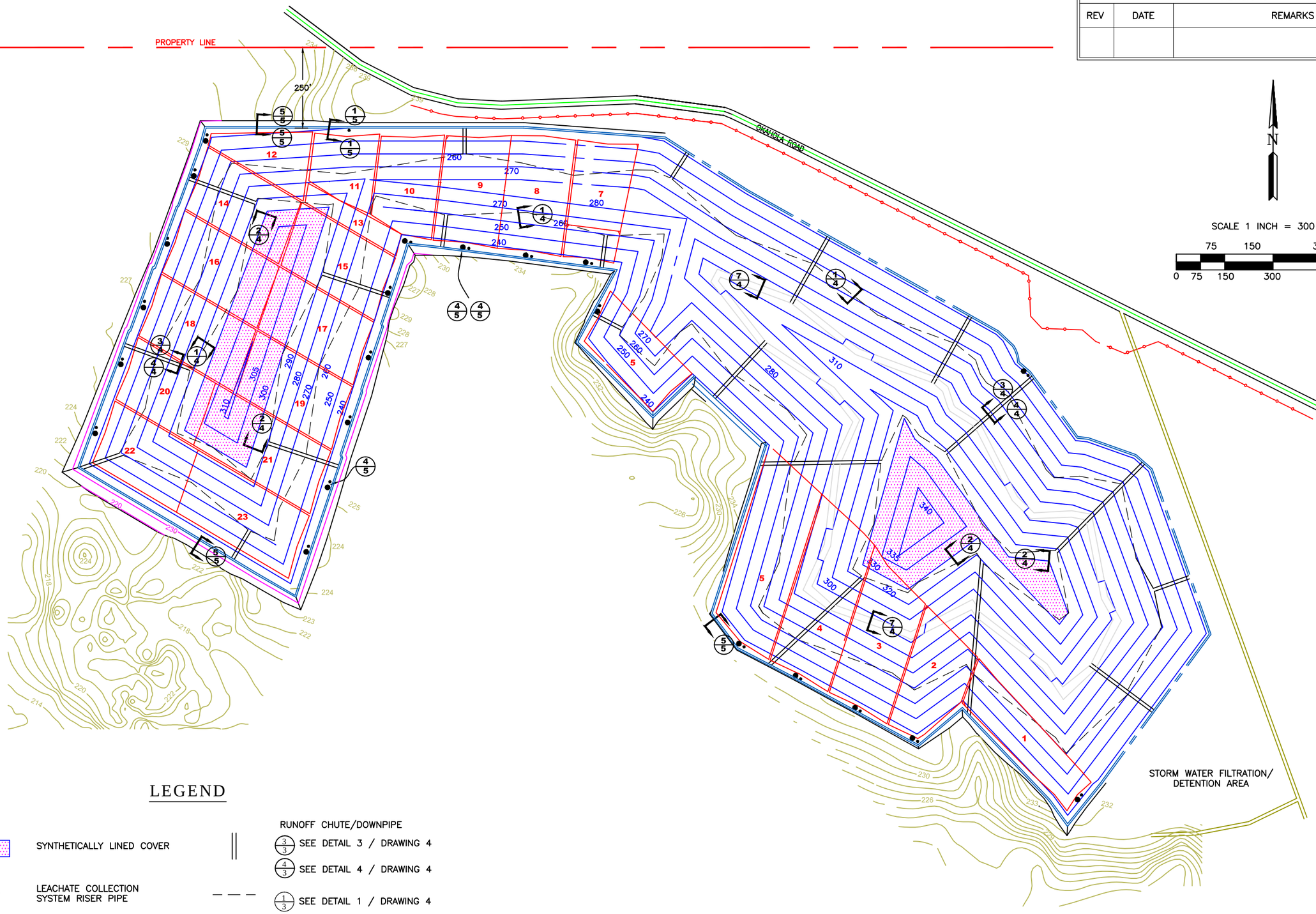
SHEET TITLE

SITE LOCATION

R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	1" = 1500'
DRAWN BY	PDM
PROJECT NO.	SOU2-16-002
SHEET NO.	1

REVISIONS		
REV	DATE	REMARKS



LEGEND

- SYNTHETICALLY LINED COVER
- LEACHATE COLLECTION SYSTEM RISER PIPE
- LEACHATE COLLECTION SYSTEM CLEAN–OUT PIPE
- 23 CELL NUMBER
- RUNOFF CHUTE/DOWNPIPE
- (3/3) SEE DETAIL 3 / DRAWING 4
- (4/3) SEE DETAIL 4 / DRAWING 4
- (1/3) SEE DETAIL 1 / DRAWING 4
- 20' WIDE BENCH
- (7/3) SEE DETAIL 7 / DRAWING 4

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PREPARED FOR

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

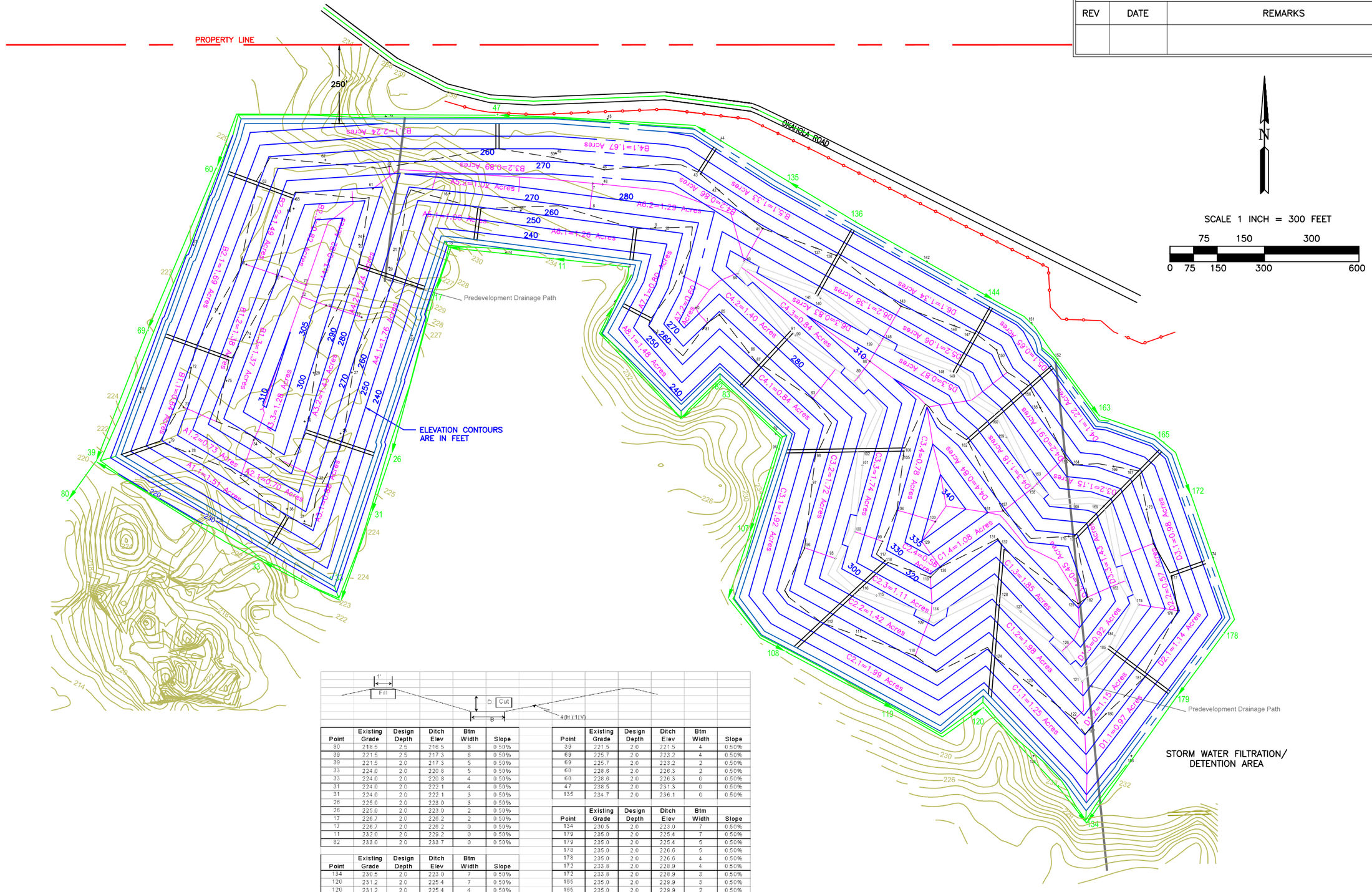
SHEET TITLE

FINAL COVER

R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	1" = 300'
DRAWN BY	KRK
PROJECT NO.	SOU2-16-002
SHEET NO.	2

REVISIONS		
REV	DATE	REMARKS



Fill | Cut | 4(H):1(V)

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
80	218.5	2.5	216.5	8	0.50%
39	221.5	2.5	217.3	8	0.50%
39	221.5	2.0	217.3	5	0.50%
33	224.6	2.0	220.8	5	0.50%
33	224.6	2.0	220.8	4	0.50%
31	224.6	2.0	222.1	4	0.50%
31	224.6	2.0	222.1	3	0.50%
26	225.0	2.0	223.0	3	0.50%
26	225.0	2.0	223.0	2	0.50%
17	226.7	2.0	226.2	2	0.50%
17	226.7	2.0	226.2	0	0.50%
11	232.0	2.0	229.2	0	0.50%
82	233.0	2.0	233.7	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
134	230.5	2.0	223.0	7	0.50%
120	231.2	2.0	225.4	7	0.50%
120	231.2	2.0	225.4	4	0.50%
119	232.6	2.0	227.2	4	0.50%
119	232.6	2.0	227.2	3	0.50%
108	232.5	2.0	229.1	3	0.50%
108	232.5	2.0	229.1	2	0.50%
107	232.5	2.0	231.5	2	0.50%
107	232.5	2.0	231.5	0	0.50%
83	233.0	2.0	233.8	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
39	221.5	2.0	221.5	4	0.50%
69	225.7	2.0	223.2	4	0.50%
69	225.7	2.0	223.2	2	0.50%
60	228.6	2.0	226.3	2	0.50%
60	228.6	2.0	226.3	0	0.50%
47	238.5	2.0	231.3	0	0.50%
135	234.7	2.0	236.1	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
134	230.5	2.0	223.0	7	0.50%
179	235.0	2.0	225.4	7	0.50%
179	235.0	2.0	225.4	5	0.50%
178	235.0	2.0	226.6	5	0.50%
178	235.0	2.0	226.6	4	0.50%
172	233.8	2.0	228.9	4	0.50%
172	233.8	2.0	228.9	3	0.50%
185	235.0	2.0	229.9	3	0.50%
185	235.0	2.0	229.9	2	0.50%
183	235.1	2.0	231.0	2	0.50%
183	235.1	2.0	231.0	0	0.50%
144	235.7	2.0	233.6	0	0.50%
136	234.6	2.0	236.1	0	0.50%

UNITS ARE FEET

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PREPARED FOR
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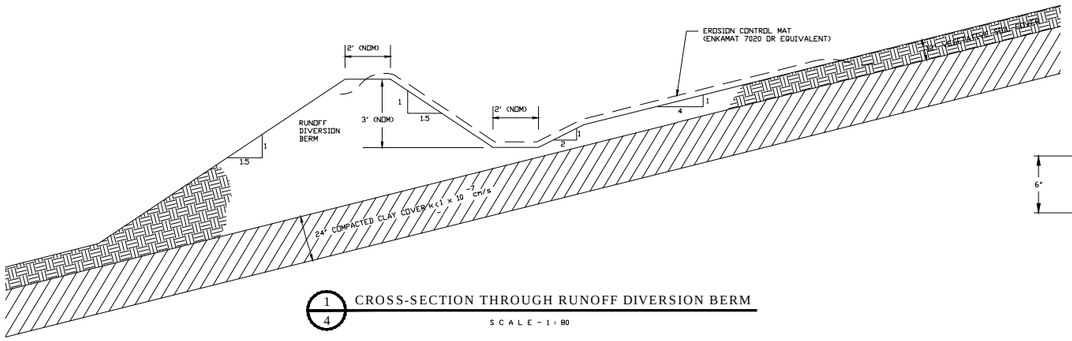
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

SHEET TITLE
STORMWATER DRAINAGE
R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	1" = 300'
DRAWN BY	CTJ
PROJECT NO.	SOU2-16-002
SHEET NO.	3

REVISIONS		
REV	DATE	REMARKS

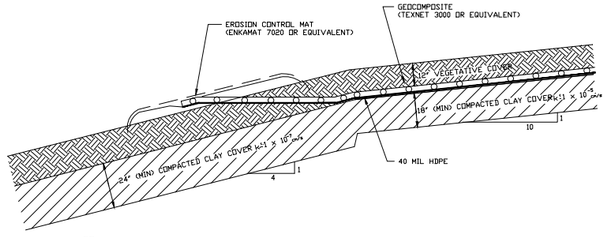


1/4 CROSS-SECTION THROUGH RUNOFF DIVERSION BERM

SCALE - 1 : 80

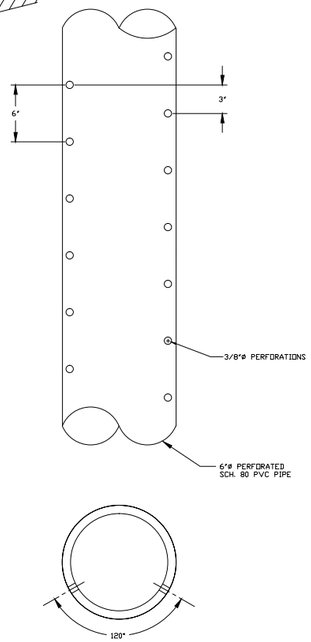
NOTES:

1. DIVERSION BERMS WILL BE LINED WITH EROSION CONTROL MATS (ENKAMAT 7020 OR EQUIVALENT)
2. THIS SECTION WILL SLOPE AT A MINIMUM OF 4% TOWARD THE DRAIN PIPES



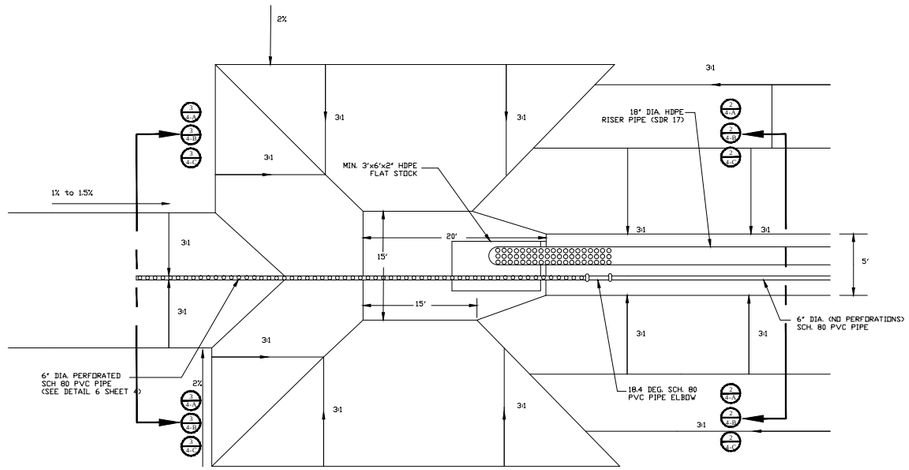
2/4 TRANSITION FROM SYNTHETICALLY LINED TO NON-SYNTHETIC CAP

SCALE - 1 : 80



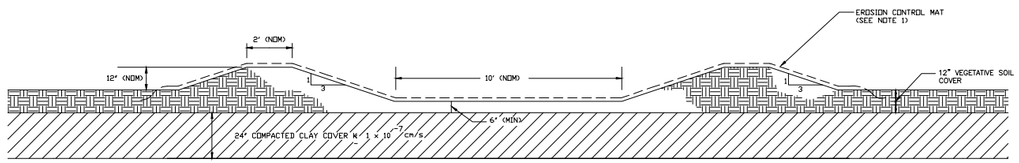
5/4 LEACHATE COLLECTION PIPE (NEW CELLS)

SCALE - 1 : 8



6/4 LEACHATE COLLECTION SUMP PLAN (TOP OF LINER BASE GRADE)

SCALE - 1 : 20

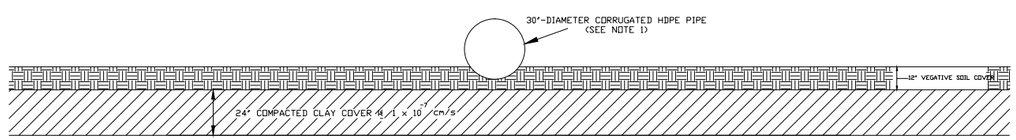


NOTE:

1. RUNOFF CHUTES WILL BE LINED WITH EROSION CONTROL MATS (ENKAMAT 7020 OR EQUIVALENT)

3/4 CROSS SECTION THROUGH RUNOFF CHUTE

SCALE - 1 : 80

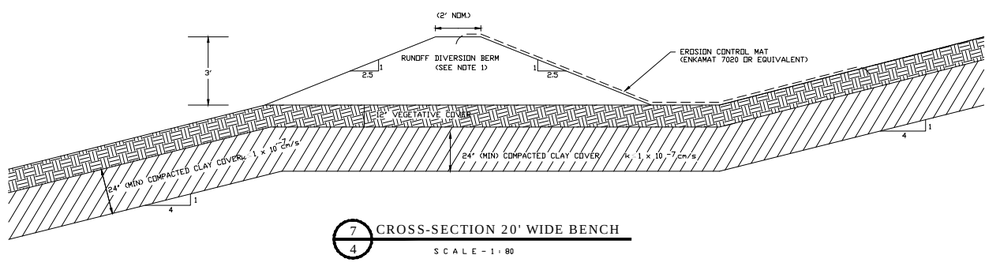


NOTE:

1. DOWNPIPE WILL HAVE TIE-IN PIPES AT ALL EROSION CONTROL BERMS

4/4 CROSS-SECTION THROUGH DOWNPIPE

SCALE - 1 : 80



7/4 CROSS-SECTION 20' WIDE BENCH

SCALE - 1 : 80

NOTES:

1. NO DIVERSION BERM WILL BE PRESENT AT THE ENTRANCE OF THE DOWN PIPES
2. THIS SECTION WILL SLOPE A MINIMUM OF 4% TOWARD THE DOWN PIPES.

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PREPARED FOR

SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

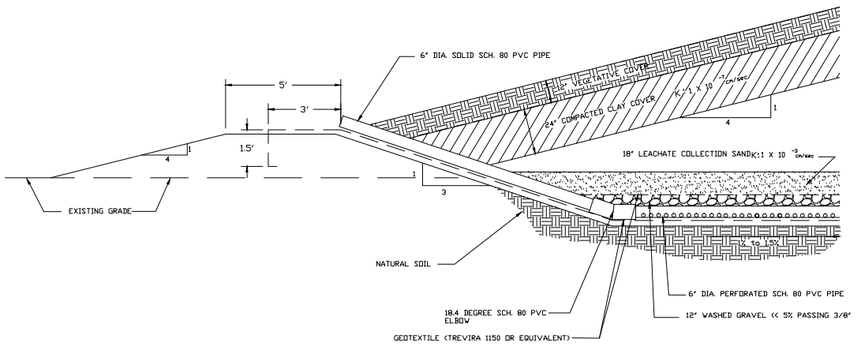
SHEET TITLE

DETAIL SHEET

R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

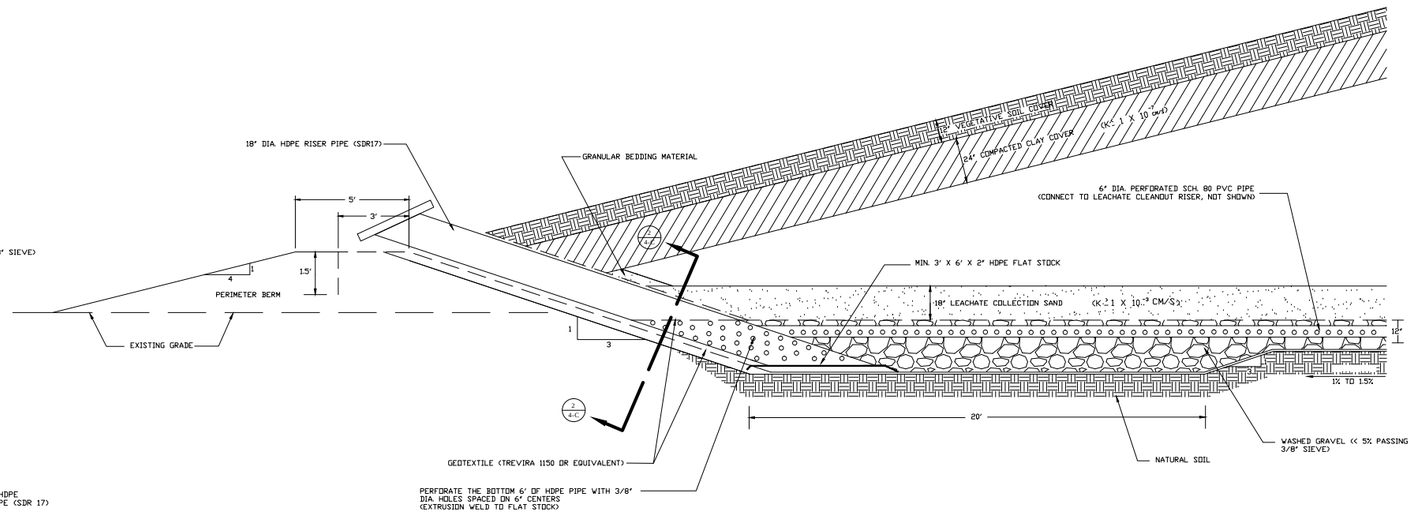
DATE	10/11/2016
SCALE	AS SHOWN
DRAWN BY	PDM, KRK, CTJ
PROJECT NO.	SOU2-16-002
SHEET NO.	4

REVISIONS		
REV	DATE	REMARKS



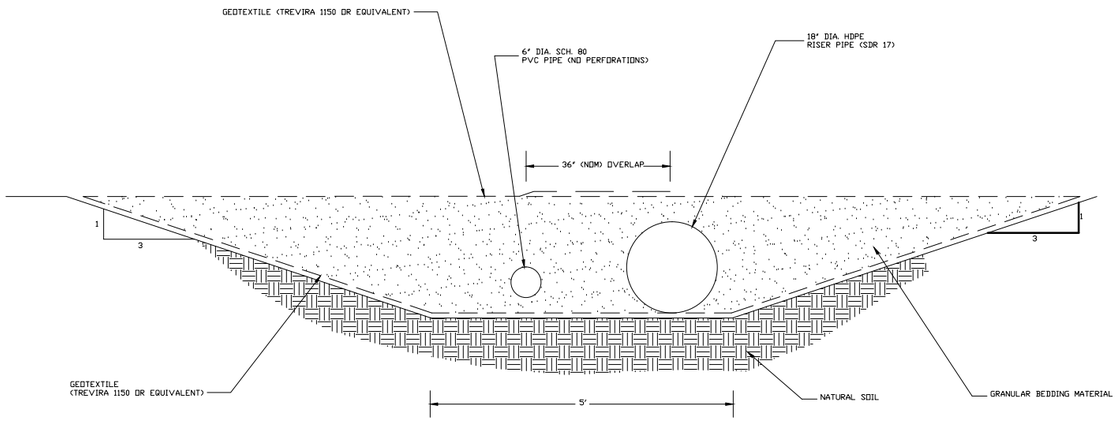
1/5 LEACHATE COLLECTION SYSTEM CLEAN-OUT (NATURAL SOIL)

SCALE - 1 : 80



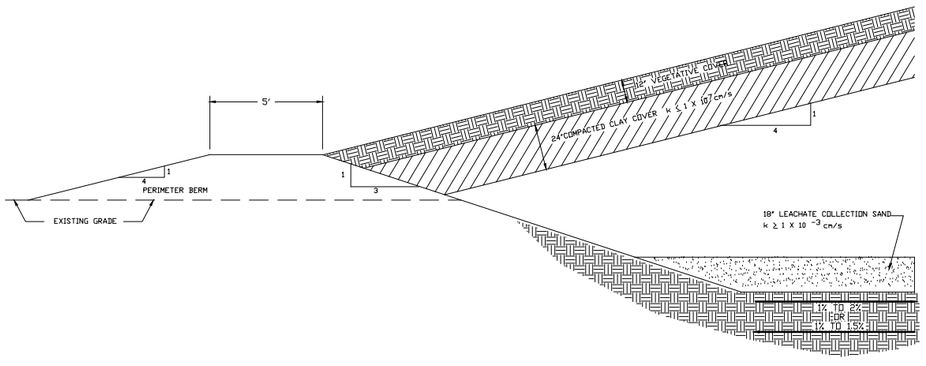
4/5 LEACHATE COLLECTION SUMP RISER (NEW CELLS) NATURAL SOIL

SCALE - 1 : 80



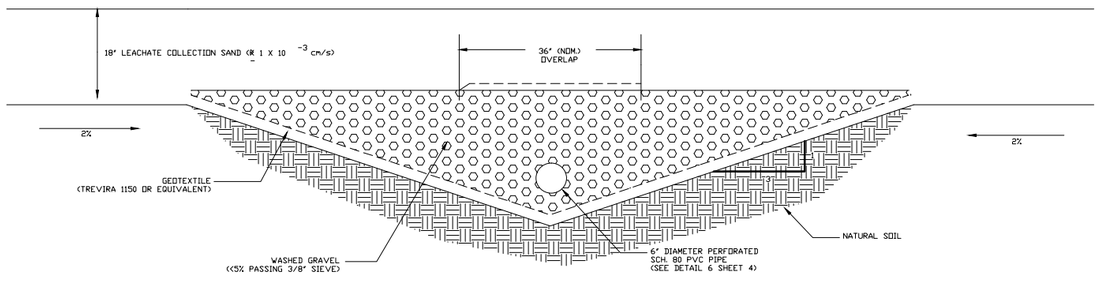
2/5 SUMP RISER TRENCH (NATURAL SOIL)

SCALE - 1 : 30



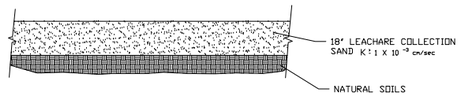
5/5 PERIMETER BERM DETAIL FOR FINAL COVER (NATURAL SOIL)

SCALE - 1 : 80



3/5 LEACHATE COLLECTION TRENCH (NEW CELLS) NATURAL SOIL

SCALE - 1 : 30



6/5 BOTTOM LINER SYTEM

SCALE - 1 : 80

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SHEET TITLE

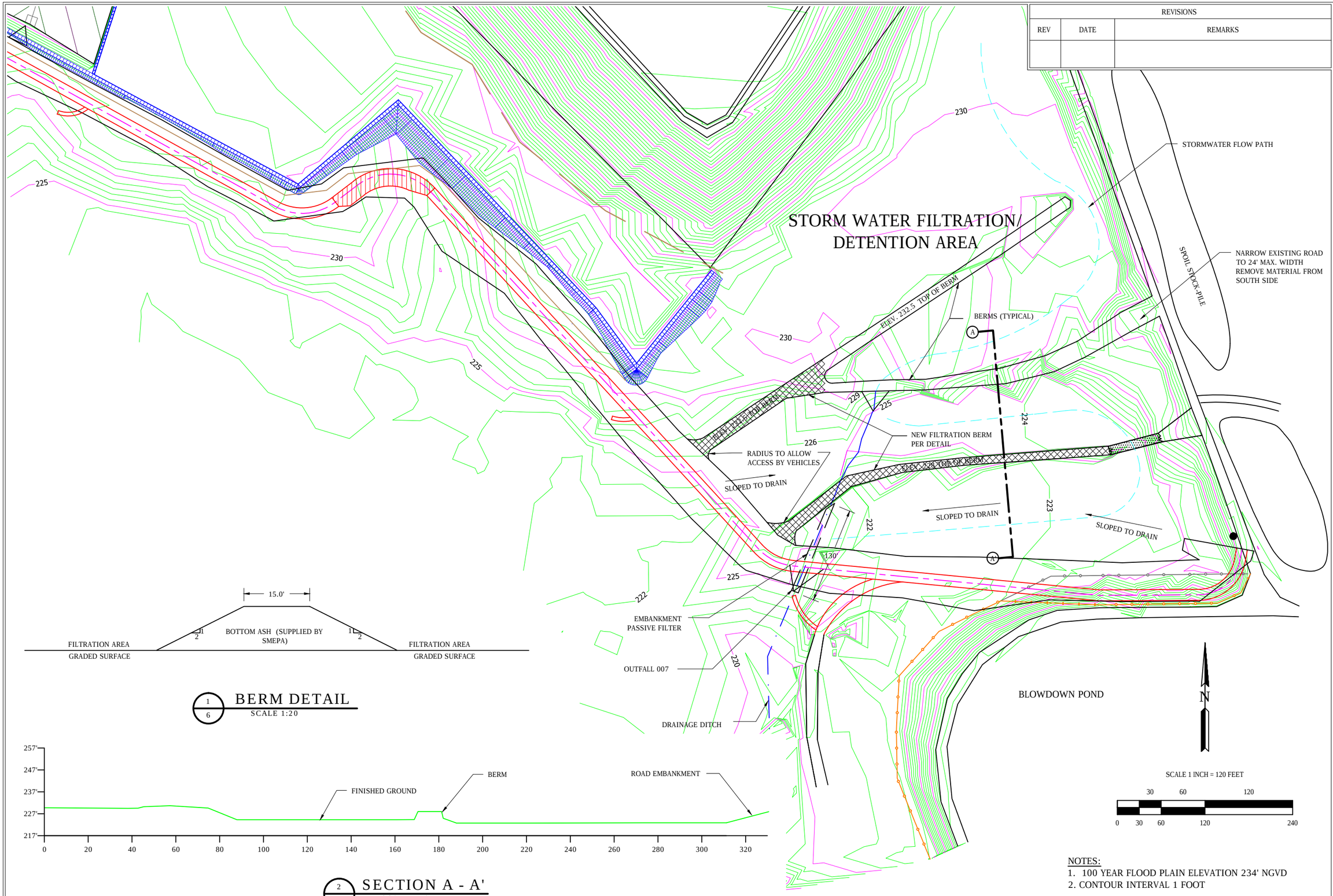
DETAIL SHEET

R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	AS SHOWN
DRAWN BY	PDM, KRK, CTJ
PROJECT NO.	SOU2-16-002
SHEET NO.	5

REVISIONS		
REV	DATE	REMARKS

STORM WATER FILTRATION/ DETENTION AREA



1/6 BERM DETAIL
SCALE 1:20

2/6 SECTION A - A'
SCALE 1:40

NOTES:
1. 100 YEAR FLOOD PLAIN ELEVATION 234' NGVD
2. CONTOUR INTERVAL 1 FOOT

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SHEET TITLE
STORM WATER FILTRATION/DETENTION AREA
R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	AS SHOWN
DRAWN BY	KRK
PROJECT NO.	SOU2-16-002
SHEET NO.	6

APPENDIX B

STORM WATER DESIGN CALCULATIONS

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	1 of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Objective: Determine the size of the ditches for the runoff from the landfill.

Method: Design the ditches and outfall in accordance with *Planning and Design Manual for the Control of Erosion, Sediment & Stormwate*r. Calculate Runoff by SCS Peak Runoff using EFM2 Computer Program.

Predevelopment Flow Rate - Q

The site is basically broken in half. The western side of the site drains by the existing landfill from ~ Elev. 240' to ~Elev. 220' over ~2400 ft. The eastern side also drains from the same elevations over ~2200 ft.

Area (west) = 32 acres
Soil Type - Group D (Trebloc Soils Ref. Table 6-5)
Open space (poor condition); therefore from Table 6-6C in Ref., CN = 89
Longest runoff length is approximately 1560' from the northcentral to the southwest outfall (see pg 110)
Site elevation changes from ~239' to ~222' over 1560' - slope, S of 1.09%
From EFM2, Tc = 0.529 hrs. (see pg. 2)
Lamar County is considered a Type III area from Ref. Figure 6-4
From EFM2, for 25-yr, 24 hr storm, Q = 113 cfs Runoff = 5.61 in (See printout on page 2)

Area (east) = 38 acres
Soil Type - Group D (Trebloc Soils Ref. Table 6-5)
Open space (poor condition); therefore from Table 6-6C in Ref., CN = 89
Longest runoff length is approximately 1620' from the northcentral to the southeast outfall (see pg 110)
Site elevation changes from ~236' to ~220' over 1620' - slope, S of 0.99%
From EFM2, Tc = 0.572 (see pg. 2)
From EFM2, for 25-yr, 24 hr storm, Q = 122 cfs Runoff = 5.61 in (See printout on page 2)

Postdevelopment Flow Rate - Q

24 hr storm event
Lamar County
25 yr 8.6 inches Ref. Table 6-3 "Rainfall Frequency Values"
2 yr 4.9 inches Ref. Table 6-3 "Rainfall Frequency Values"

Runoff Curve Number
Meadow, Soil Type C 71 Ref. Table 6-6B "Runoff Curve Numbers for other agricultural lands"

Rainfall Distribution Type
Type III Ref. Fig. 6-4 "Boundaries for Rainfall Distribution Types"

Direct Runoff (Q)
$Q_{(25\ yr)}$ = 5.1 inches Ref. Fig. 6-5 "Solutions for runoff equation"

Manning's Coefficient
Sheet Flow 0.41 Ref. Table 6-1 "Roughness coefficeints for sheet flow" - use Bermuda grass
Channel Flow 0.05 Ref. App. A Open Channel Flow , Civil Engineering Ref. Manual - use natural channels

Intitial Abstraction
I_a 0.817 Ref. Table 6-7 "I_a values for runoff curve numbers"

Subareas for calculating discharge are shown on the attached final cover drawing on page 110.

Neglect the time of concentration in the runoff chutes.

EFM2 Predevelopment Printout for Western Side

EFM-2 ESTIMATING RUNOFF AND PEAK DISCHARGE VERSION 1.10

Client : SMEPA
County : Lamar State: MS
Practice: Predevelopment Flow Rate (Western Side)

By: KL Date: 02-06-~~03~~
Checked: ____ Date: _____

Drainage Area	: 32.1	Acres
Curve Number	: 89	
Watershed Length	: 1560	Feet
Watershed Slope	: 1.09	Percent
Time of Concentration	: .529	Hours
Rainfall Type	: III	

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr Rainfall (in)	3.5	4.1	5.2	6	6.9	7.6	8.3
Ia/P Ratio	0.07	0.06	0.05	0.04	0.04	0.03	0.03
Used	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Runoff (in)	2.36	2.92	3.96	4.74	5.61	6.29	6.98
Unit Peak Discharge (cfs/acre/in)	0.627	0.627	0.627	0.627	0.627	0.627	0.627
Peak Discharge (cfs)	47	59	80	95	113	127	140

EFM2 Predevelopment Printout for Eastern Side

EFM-2 ESTIMATING RUNOFF AND PEAK DISCHARGE VERSION 1.10

Client : SMEPA
County : Lamar State: MS
Practice: Predevelopment Flow Rate (Eastern Side)

By: KL Date: 02-06-~~03~~
Checked: ____ Date: _____

Drainage Area	: 36.0	Acres
Curve Number	: 89	
Watershed Length	: 1620	Feet
Watershed Slope	: .99	Percent
Time of Concentration	: .572	Hours
Rainfall Type	: III	

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr Rainfall (in)	3.5	4.1	5.2	6	6.9	7.6	8.3
Ia/P Ratio	0.07	0.06	0.05	0.04	0.04	0.03	0.03
Used	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Runoff (in)	2.36	2.92	3.96	4.74	5.61	6.29	6.98
Unit Peak Discharge (cfs/acre/in)	0.606	0.606	0.606	0.606	0.606	0.606	0.606
Peak Discharge (cfs)	51	64	86	103	122	137	152

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date	10/11/16	Sheet No.: 3	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

WESTERN SIDE

Calculate Peak Discharge from Area A8.1

Area 1.48 acres 0.00 sq. miles

Calculate Travel Time, Tt

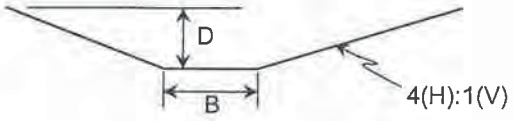
Sheet Flow

Pt. 81 to Pt. 82	Flow Length, L	160	feet		Flow Length, L	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	4.9
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.156	hrs	Ref Eq. 8	Travel Time, Tt	0.000

Shallow, Concentrated Flow

Flow Length, L	52.43	feet	
Watercourse slope, s	0.04	ft/ft	
Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
Travel Time, Tt	0.005	hrs	Ref Eq. 6

Open Channel Flow



Channel Depth, D	2	feet	
Channel Width, B	0	feet	
X-Section Area, a	16	sq ft	
Pt. 82 to Pt. 4 Wetted Perimeter, p_w	16.5	feet	
Hydraulic Radus, r	0.970	ft	
Channel Slope	0.005	ft/ft	
Velocity, V	2.065	ft/sec	Ref Eq. 9
Flow Length, L	630		
Travel Time, Tt	0.085	hrs	Ref Eq. 6

Total Travel Time 0.246 hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

I_a/P_{25}	0.095	in.	
Time of Conc. Tc	0.246	hrs	From calculations above
Unit Peak Disch. q_u	535	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
Runoff, Q	5.1	inches	From pg. 1
Peak Discharge, q_p	6.3097	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	6.3097	cu ft/sec
Peak Velocity	0.3944	ft/sec
	19%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	4	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area A7.2

Area 0.94 acres 0.00 sq. miles

Calculate Travel Time, Tt

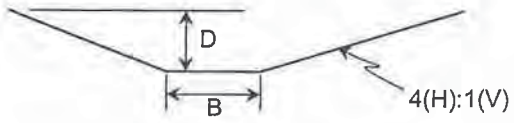
Sheet Flow

	Flow Length, L	173.6	feet		Flow Length, L	126.4	feet
Pt. 0 to	Two-yr 24 hr rainfall, P_2	4.9	inches	Pt. 1 to	Two-yr 24 hr rainfal	4.9	
Pt. 1	Land Slope, s	0.25	ft/ft	Pt. 2	Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.167	hrs	Ref Eq. 8	Travel Time, Tt	0.270	

Shallow,Concentrated Flow

	Flow Length, L	116	feet	
Pt. 2 to	Watercourse slope, s	0.04	ft/ft	
Pt. 3	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.010	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 4 to Pt. 5	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	125		
	Travel Time, Tt	0.017	hrs	Ref Eq. 6

Total Travel Time 0.464 hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

	I_a/P_{25}	0.095	in.	
Area A7.2	Time of Conc. Tc	0.464	hrs	From calculations above
	Unit Peak Disch. q_u	425	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.1835	cu ft/sec	Eq. 10
	Flow Length, L	125		
Area A8.1 (from pt. 4 to Pt. 5)	Travel Time, Tt	0.017	hrs	Ref Eq. 6
	Time of Conc. Tc	0.263	hrs	Tt + Tc for Area A8.1 (pg. 3)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.07	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft	
Peak Discharge, qp	9.26	cu ft/sec	
Peak Velocity	0.5786	ft/sec	
	28%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 5 of 110
Subject: Stormwater Design	Checked By:	Date:	Job No.: SMEPA

Calculate Peak Discharge from Area A7.1

Area 0.89 acres 0.00 sq. miles

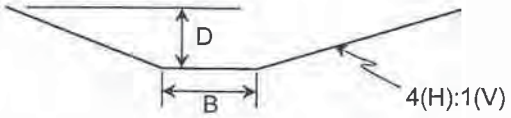
Calculate Travel Time, Tt

Sheet Flow

		Flow Length, L	75.6 feet			Flow Length, L	100 feet
A7.1	Pt. 1 to Pt. 6	Two-yr 24 hr rainfall, P_2	4.9 inches		Pt. 6 to Pt. 5	Two-yr 24 hr rainfal	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.25 ft/ft
		Travel Time, Tt	0.086 hrs	Ref Eq. 8		Travel Time, Tt	0.098

Open Channel Flow

	Channel Depth, D	2 feet	
	Channel Width, B	0 feet	
	X-Section Area, a	16 sq ft	
Pt. 5 to Pt. 11	Wetted Perimeter, p_w	16.5 feet	
	Hydraulic Radus, r	0.970 ft	
	Channel Slope	0.005 ft/ft	
	Velocity, V	2.065 ft/sec	Ref Eq. 9
	Flow Length, L	250	
	Travel Time, Tt	0.034 hrs	Ref Eq. 6
Total Travel Time		0.217 hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge from Area A6.2

Area 1.32 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

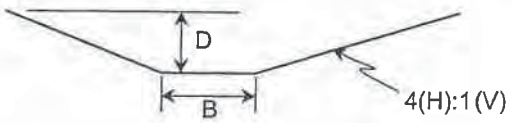
		Flow Length, L	71.7 feet			Flow Length, L	228.3 feet
	Pt. 7 to Pt. 8	Two-yr 24 hr rainfall, P_2	4.9 inches		Pt. 8 to Pt. 9	Two-yr 24 hr rainfal	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.082 hrs	Ref Eq. 8		Travel Time, Tt	0.394

Shallow, Concentrated Flow

A6.2	Pt. 9 to Pt. 10	Flow Length, L	16.3 feet	
		Watercourse slope, s	0.04 ft/ft	
		Avg. Velocity, V.	3.2 ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
		Travel Time, Tt	0.001 hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2 feet	
	Channel Width, B	0 feet	
	X-Section Area, a	16 sq ft	
Pt. 5 to Pt. 11	Wetted Perimeter, p_w	16.5 feet	
	Hydraulic Radus, r	0.970 ft	
	Channel Slope	0.005 ft/ft	
	Velocity, V	2.065 ft/sec	Ref Eq. 9
	Flow Length, L	250	
	Travel Time, Tt	0.034 hrs	Ref Eq. 6
Total Travel Time		0.512 hrs	Sum of Sheet, Shallow Concentrated and Open Channel



ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	6	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area A7.1	I_a/P	0.095	in.	
	Time of Conc. Tc	0.217	hrs	From calculations above
	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.9007	cu ft/sec	Eq. 10
Area A6.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.512	hrs	From calculations above
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.21	cu ft/sec	Eq. 10
Area A8.1 (from pt. 5 to Pt. 11)	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.296	hrs	Tt + Tc for Area A8.1 (pg. 4)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.90	cu ft/sec	Eq. 10
Area A7.2 (from pt. 5 to Pt. 11)	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.497	hrs	Tt + Tc for Area A7.2 (pg. 4)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.03	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	17.04	cu ft/sec
Peak Velocity	1.0649	ft/sec
	52%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 7 of 110
Subject: Stormwater Design	Checked By:	Date:	Job No.: SMEPA

Calculate Peak Discharge from Area A6.1

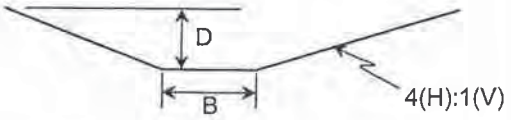
Area 1.35 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

		Flow Length, L	170 feet		Flow Length, L	0 feet
A6.1	Pt. 8 to	Two-yr 24 hr rainfall, P_2	4.9 inches		Two-yr 24 hr rainfal	5.9
	Pt. 11	Land Slope, s	0.25 ft/ft		Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.164 hrs	Ref Eq. 8	Travel Time, Tt	0.000

Open Channel Flow



		Channel Depth, D	2 feet	
		Channel Width, B	0 feet	
		X-Section Area, a	16 sq ft	
	Pt. 11	Wetted Perimeter, p_w	16.5 feet	
	to Pt.	Hydraulic Radus, r	0.970 ft	
	14	Channel Slope	0.005 ft/ft	
		Velocity, V	2.065 ft/sec	Ref Eq. 9
		Flow Length, L	250	
		Travel Time, Tt	0.034 hrs	Ref Eq. 6
	Total Travel Time		0.198 hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

	I_a/P	0.095 in.	
Area	Time of Conc. Tc	0.198 hrs	From calculations above
A6.1	Unit Peak Disch. q_u	560 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q_p	6.02 cu ft/sec	Eq. 10

Area	Flow Length, L	250		
A8.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. Tc	0.330 hrs	Tt + Tc for Area A8.1 (pg. 4)	
pt. 11	Unit Peak Disch. q_u	485 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III	
to Pt.	Runoff, Q	5.1 inches	From pg. 1	
14)	Peak Discharge, q_p	5.72 cu ft/sec	Eq. 10	

Area	Flow Length, L	250		
A7.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. Tc	0.531 hrs	Tt + Tc for Area A7.2 (pg. 6)	
pt. 11	Unit Peak Disch. q_u	395 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III	
to Pt.	Runoff, Q	5.1 inches	From pg. 1	
14)	Peak Discharge, q_p	2.96 cu ft/sec	Eq. 10	

Area	Flow Length, L	250		
A7.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. Tc	0.251 hrs	Tt + Tc for Area A7.1 (pg. 6)	
pt. 11	Unit Peak Disch. q_u	540 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III	
to Pt.	Runoff, Q	5.1 inches	From pg. 1	
14)	Peak Discharge, q_p	3.83 cu ft/sec	Eq. 10	

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	8	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A6.2 (from pt. 11 to Pt. 14)	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.545	hrs	Tt + Tc for Area A6.2 (pg. 6)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.10	cu ft/sec	Eq. 10
Calculate Channel Flow Velocity				
	X-Section Area, a	16	sq ft	
	Peak Discharge, qp	22.64	cu ft/sec	
	Peak Velocity	1.4147	ft/sec	
		69%	of Calculated Channel Flow Velocity	

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	9	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area A5.2

Area 0.97 acres 0.00 sq. miles

Calculate Travel Time, Tt

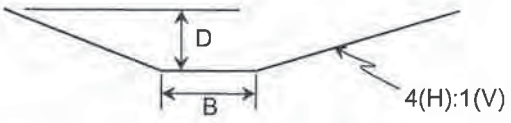
Sheet Flow

	Flow Length, L	71.7	feet		Flow Length, L	228.3	feet
Pt. 7 to	Two-yr 24 hr rainfall, P_2	4.9	inches	Pt. 8 to	Two-yr 24 hr rainfal	5.9	
Pt. 8	Land Slope, s	0.25	ft/ft	Pt. 12	Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.082	hrs Ref Eq. 8		Travel Time, Tt	0.394	

A5.2 Shallow,Concentrated Flow

Pt. 12	Flow Length, L	16.3	feet
to Pt.	Watercourse slope, s	0.04	ft/ft
13	Avg. Velocity, V.	3.2	ft/sec Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet
	Channel Width, B	0	feet
	X-Section Area, a	16	sq ft
Pt. 14	Wetted Perimeter, p_w	16.5	feet
to Pt.	Hydraulic Radus, r	0.970	ft
15	Channel Slope	0.005	ft/ft
	Velocity, V	2.065	ft/sec Ref Eq. 9
	Flow Length, L	80	
	Travel Time, Tt	0.011	hrs Ref Eq. 6
Total Travel Time		0.489	hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

	I_a/P	0.095	in.
Area	Time of Conc. Tc	0.489	hrs From calculations above
A5.2	Unit Peak Disch. q_u	410	csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches From pg. 1
	Peak Discharge, q_p	3.17	cu ft/sec Eq. 10

Area	Flow Length, L	80	
A8.1	Travel Time, Tt	0.011	hrs Ref Eq. 6
(from	Time of Conc. Tc	0.341	hrs Tt + Tc for Area A8.1 (pg. 7)
pt. 14	Unit Peak Disch. q_u	465	csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches From pg. 1
15)	Peak Discharge, q_p	5.48	cu ft/sec Eq. 10

Area	Flow Length, L	80	
A7.2	Travel Time, Tt	0.011	hrs Ref Eq. 6
(from	Time of Conc. Tc	0.542	hrs Tt + Tc for Area A7.2 (pg. 7)
pt. 14	Unit Peak Disch. q_u	395	csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches From pg. 1
15)	Peak Discharge, q_p	2.96	cu ft/sec Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 10 of 110
Subject: Stormwater Design	Checked By:	Date:	Job No.: SMEPA

Area A7.1 (from pt. 14 to Pt. 15)	Flow Length, L	80		
	Travel Time, Tt	0.011	hrs	Ref Eq. 6
	Time of Conc. Tc	0.262	hrs	Tt + Tc for Area A7.1 (pg. 7)
	Unit Peak Disch. q_u	520	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.69	cu ft/sec	Eq. 10
Area A6.2 (from pt. 14 to Pt. 15)	Flow Length, L	80		
	Travel Time, Tt	0.011	hrs	Ref Eq. 6
	Time of Conc. Tc	0.556	hrs	Tt + Tc for Area A6.2 (pg. 8)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.10	cu ft/sec	Eq. 10
Area A6.1 (from pt. 14 to Pt. 15)	Flow Length, L	80		
	Travel Time, Tt	0.011	hrs	Ref Eq. 6
	Time of Conc. Tc	0.209	hrs	Tt + Tc for Area A6.1 (pg. 7)
	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.92	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	25.32	cu ft/sec
Peak Velocity	1.5824	ft/sec
	77%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	11	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas A5.1

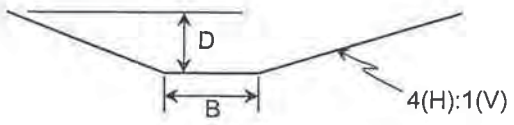
Area 1.02 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

A5.1	Pt. 16 to Pt. 15	Flow Length, L	210	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.194	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow



Pt. 15 to Pt. 17	Channel Depth, D	2	feet		
	Channel Width, B	0	feet		
	X-Section Area, a	16	sq ft		
	Wetted Perimeter, p_w	16.5	feet		
	Hydraulic Radus, r	0.970	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.065	ft/sec	Ref Eq. 9	
	Flow Length, L	140			
	Travel Time, Tt	0.019	hrs	Ref Eq. 6	
Total Travel Time		0.213	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area A5.1	Time of Conc. Tc	0.213	hrs	From calculations above
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.51	cu ft/sec	Eq. 10
Area A8.1 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.359	hrs	Tt + Tc for Area A8.1 (pg. 9)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.07	cu ft/sec	Eq. 10
Area A7.2 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.560	hrs	Tt + Tc for Area A7.2 (pg. 9)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.92	cu ft/sec	Eq. 10
Area A7.1 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.281	hrs	Tt + Tc for Area A7.1 (pg. 10)
	Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.58	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	12	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A6.2 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.575	hrs	Tt + Tc for Area A6.2 (pg. 10)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.05	cu ft/sec	Eq. 10
Area A6.1 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.227	hrs	Tt + Tc for Area A6.1 (pg. 10)
	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.92	cu ft/sec	Eq. 10
Area A5.2 (from pt. 15 to Pt. 17)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.508	hrs	Tt + Tc for Area A5.2 (pg. 9)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.09	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	30.15	cu ft/sec
Peak Velocity	1.8841	ft/sec
	91%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	13	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area A4.2

Area 1.44 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 18 to Pt. 19	Flow Length, L	120	feet	**Pt. 19 to Pt. 20**	Flow Length, L	180	feet	
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9		
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft	
	Travel Time, Tt	0.124	hrs	Ref Eq. 8	Travel Time, Tt	0.326		

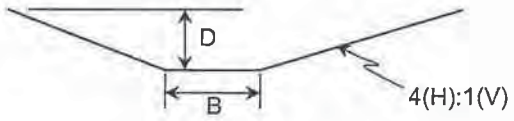
A4.2

Shallow,Concentrated Flow

Pt. 20 to Pt. 21	Flow Length, L	95	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.008	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	2	feet	
	X-Section Area, a	20	sq ft	
Pt. 17 to Pt. 25	Wetted Perimeter, p_w	18.5	feet	
	Hydraulic Radus, r	1.082	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.220	ft/sec	Ref Eq. 9
	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
Total Travel Time		0.494	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge from Area A4.3

Area 1.17 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 22 to Pt.18	Flow Length, L	100.2	feet	**Pt. 22 to Pt. 23**	Flow Length, L	199.8	feet	
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9		
	Land Slope, s	0.1	ft/ft		Land Slope, s	0.04	ft/ft	
	Travel Time, Tt	0.155	hrs	Ref Eq. 8	Travel Time, Tt	0.354		

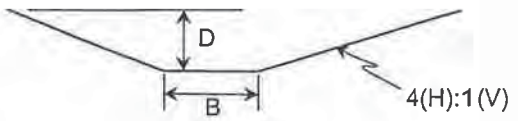
A4.3

Shallow,Concentrated Flow

Pt. 23 to Pt. 24	Flow Length, L	75.2	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.007	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	2	feet	
	X-Section Area, a	20	sq ft	
Pt. 17 to Pt. 25	Wetted Perimeter, p_w	18.5	feet	
	Hydraulic Radus, r	1.082	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.220	ft/sec	Ref Eq. 9
	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
Total Travel Time		0.551	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	14	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area A4.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.494	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.7048	cu ft/sec	Eq. 10
Area A4.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.551	hrs	From calculations above
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.45	cu ft/sec	Eq. 10
Area A8.1 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.394	hrs	Tt + Tc for Area A8.1 (pg. 11)
	Unit Peak Disch. q_u	450	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.31	cu ft/sec	Eq. 10
Area A7.2 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.595	hrs	Tt + Tc for Area A7.2 (pg. 11)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.85	cu ft/sec	Eq. 10
Area A7.1 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.316	hrs	Tt + Tc for Area A7.1 (pg. 11)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.51	cu ft/sec	Eq. 10
Area A6.2 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.610	hrs	Tt + Tc for Area A6.2 (pg. 12)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.94	cu ft/sec	Eq. 10
Area A6.1 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.262	hrs	Tt + Tc for Area A6.1 (pg. 12)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.54	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	15	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A5.2 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.543	hrs	Tt + Tc for Area A5.2 (pg. 12)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.05	cu ft/sec	Eq. 10
Area A5.1 (from pt. 17 to Pt. 25)	Flow Length, L	280		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
	Time of Conc. Tc	0.248	hrs	Tt + Tc for Area A5.1 (pg. 11)
	Unit Peak Disch. q_u	530	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.31	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft
Peak Discharge, qp	36.66	cu ft/sec
Peak Velocity	1.8332	ft/sec
	83%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	16	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas A4.1

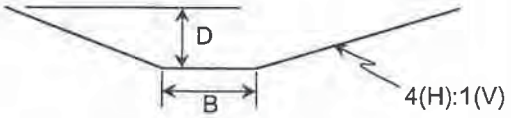
Area 1.54 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

A4.1	Pt. 19 to Pt. 25	Flow Length, L	190	feet		Flow Length, L	0	feet	
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9		
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft	
		Travel Time, Tt	0.179	hrs	Ref Eq. 8	Travel Time, Tt	0.000		

Open Channel Flow



Pt. 25 to Pt. 26	Channel Depth, D	2	feet		
	Channel Width, B	2	feet		
	X-Section Area, a	20	sq ft		
	Wetted Perimeter, p_w	18.5	feet		
	Hydraulic Radus, r	1.082	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.220	ft/sec	Ref Eq. 9	
	Flow Length, L	260			
	Travel Time, Tt	0.033	hrs	Ref Eq. 6	
Total Travel Time		0.212	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area A4.1	Time of Conc. Tc	0.212	hrs	From calculations above
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.81	cu ft/sec	Eq. 10
Area A8.1 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.427	hrs	Tt + Tc for Area A8.1 (pg. 14)
	Unit Peak Disch. q_u	440	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.19	cu ft/sec	Eq. 10
Area A7.2 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.628	hrs	Tt + Tc for Area A7.2 (pg. 14)
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.77	cu ft/sec	Eq. 10
Area A7.1 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.348	hrs	Tt + Tc for Area A7.1 (pg. 14)
	Unit Peak Disch. q_u	475	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.37	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	17	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A6.2 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.642	hrs	Tt + Tc for Area A6.2 (pg. 14)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.84	cu ft/sec	Eq. 10
Area A6.1 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.295	hrs	Tt + Tc for Area A6.1 (pg. 14)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.38	cu ft/sec	Eq. 10
Area A5.2 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.575	hrs	Tt + Tc for Area A5.2 (pg. 15)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.98	cu ft/sec	Eq. 10
Area A5.1 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.281	hrs	Tt + Tc for Area A5.1 (pg. 15)
	Unit Peak Disch. q_u	510	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.15	cu ft/sec	Eq. 10
Area A4.2 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.526	hrs	Tt + Tc for Area A4.2 (pg. 14)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.59	cu ft/sec	Eq. 10
Area A4.3 (from pt. 25 to Pt. 26)	Flow Length, L	260		
	Travel Time, Tt	0.033	hrs	Ref Eq. 6
	Time of Conc. Tc	0.584	hrs	Tt + Tc for Area A4.3 (pg. 14)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.64	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft
Peak Discharge, qp	42.71	cu ft/sec
Peak Velocity	2.1353	ft/sec
	96%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	18	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area A3.2

Area 1.22 acres 0.00 sq. miles

Calculate Travel Time, Tt

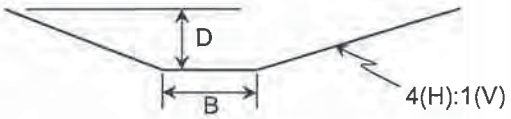
Sheet Flow

Pt. 18 to Pt. 19	Flow Length, L	120	feet		Pt. 19 to Pt. 27	Flow Length, L	180	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.326	

A3.2 Shallow,Concentrated Flow

Pt. 27 to Pt. 28	Flow Length, L	95	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.008	hrs	Ref Eq. 6

Open Channel Flow



Pt. 26 to Pt. 31	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time		0.483	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area A.3.3

Area 1.13 acres 0.00 sq. miles

Calculate Travel Time, Tt

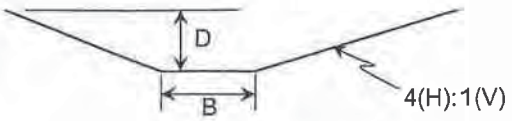
Sheet Flow

Pt. 22 to Pt.18	Flow Length, L	100.2	feet		Pt. 22 to Pt. 29	Flow Length, L	199.8	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.1	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.155	hrs	Ref Eq. 8		Travel Time, Tt	0.354	

A3.3 Shallow,Concentrated Flow

Pt. 29 to Pt. 30	Flow Length, L	75.2	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.007	hrs	Ref Eq. 6

Open Channel Flow



Pt. 26 to Pt. 31	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time		0.541	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	19	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area A3.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.483	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.986	cu ft/sec	Eq. 10
Area A3.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.541	hrs	From calculations above
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.56	cu ft/sec	Eq. 10
Area A8.1 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.451	hrs	Tt + Tc for Area A8.1 (pg. 16)
	Unit Peak Disch. q_u	430	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.07	cu ft/sec	Eq. 10
Area A7.2 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.652	hrs	Tt + Tc for Area A7.2 (pg. 16)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.70	cu ft/sec	Eq. 10
Area A7.1 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.372	hrs	Tt + Tc for Area A7.1 (pg. 16)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.23	cu ft/sec	Eq. 10
Area A6.2 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.667	hrs	Tt + Tc for Area A6.2 (pg. 17)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.58	cu ft/sec	Eq. 10
Area A6.1 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.319	hrs	Tt + Tc for Area A6.1 (pg. 17)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.20	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	20	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A5.2 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.600	hrs	Tt + Tc for Area A5.2 (pg. 17)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.94	cu ft/sec	Eq. 10
Area A5.1 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.305	hrs	Tt + Tc for Area A5.1 (pg. 17)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10
Area A4.2 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.550	hrs	Tt + Tc for Area A4.2 (pg. 17)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.53	cu ft/sec	Eq. 10
Area A4.3 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.608	hrs	Tt + Tc for Area A4.3 (pg. 17)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.54	cu ft/sec	Eq. 10
Area A4.1 (from pt. 26 to Pt. 31)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.236	hrs	Tt + Tc for Area A4.1 (pg. 16)
	Unit Peak Disch. q_u	540	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.63	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	22	sq ft
Peak Discharge, qp	47.97	cu ft/sec
Peak Velocity	2.1806	ft/sec
	95%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	21	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas A3.1

Area 1.32 acres 0.00 sq. miles

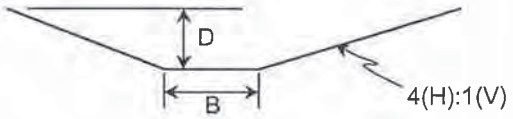
Calculate Travel Time, Tt

Sheet Flow

A3.1	Pt. 32 to Pt. 31	Flow Length, L	185	feet		Flow Length, L	0	feet	
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9		
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft	
		Travel Time, Tt	0.176	hrs	Ref Eq. 8	Travel Time, Tt	0.000		

Open Channel Flow

Pt. 31 to Pt. 33	Channel Depth, D	2	feet		
	Channel Width, B	4	feet		
	X-Section Area, a	24	sq ft		
	Wetted Perimeter, p_w	20.5	feet		
	Hydraulic Radus, r	1.171	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.341	ft/sec	Ref Eq. 9	
	Flow Length, L	560			
	Travel Time, Tt	0.066	hrs	Ref Eq. 6	
Total Travel Time		0.242	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	



Calculate Peak Discharge

	I_a/P	0.095	in.	
Area A3.1	Time of Conc. Tc	0.242	hrs	From calculations above
	Unit Peak Disch. q_u	540	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.68	cu ft/sec	Eq. 10
Area A8.1 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.518	hrs	Tt + Tc for Area A8.1 (pg. 19)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.72	cu ft/sec	Eq. 10
Area A7.2 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.719	hrs	Tt + Tc for Area A7.2 (pg. 19)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.62	cu ft/sec	Eq. 10
Area A7.1 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.439	hrs	Tt + Tc for Area A7.1 (pg. 19)
	Unit Peak Disch. q_u	445	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.16	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	22	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A6.2 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.733	hrs	Tt + Tc for Area A6.2 (pg. 19)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.63	cu ft/sec	Eq. 10
Area A6.1 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.386	hrs	Tt + Tc for Area A6.1 (pg. 19)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.89	cu ft/sec	Eq. 10
Area A5.2 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.666	hrs	Tt + Tc for Area A5.2 (pg. 20)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.78	cu ft/sec	Eq. 10
Area A5.1 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.372	hrs	Tt + Tc for Area A5.1 (pg. 20)
	Unit Peak Disch. q_u	460	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.74	cu ft/sec	Eq. 10
Area A4.2 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.617	hrs	Tt + Tc for Area A4.2 (pg. 20)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.42	cu ft/sec	Eq. 10
Area A4.3 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.675	hrs	Tt + Tc for Area A4.3 (pg. 20)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.36	cu ft/sec	Eq. 10
Area A4.1 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.303	hrs	Tt + Tc for Area A4.1 (pg. 20)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.14	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	23	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A3.2 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.549	hrs	Tt + Tc for Area A3.2 (pg. 19)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.84	cu ft/sec	Eq. 10
Area A3.3 (from pt. 31 to Pt. 33)	Flow Length, L	560		
	Travel Time, Tt	0.066	hrs	Ref Eq. 6
	Time of Conc. Tc	0.607	hrs	Tt + Tc for Area A3.3 (pg. 19)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.42	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	52.39	cu ft/sec
Peak Velocity	2.183	ft/sec
	93%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	24	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas A2.1

Area 0.78 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

A2.1

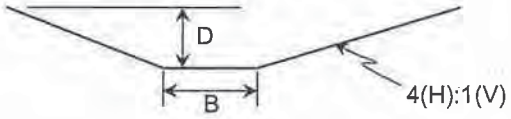
Pt. 34 to Pt. 35	Flow Length, L	127.4	feet		Pt. 35 to Pt. 36	Flow Length, L	172.6	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.130	hrs	Ref Eq. 8		Travel Time, Tt	0.315	

Shallow,Concentrated Flow

Pt. 36 to Pt. 37	Flow Length, L	55.9	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	
	Travel Time, Tt	0.005	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	5	feet	
	X-Section Area, a	26	sq ft	
Pt. 33 to Pt. 38	Wetted Perimeter, p_w	21.5	feet	
	Hydraulic Radus, r	1.210	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.392	ft/sec	Ref Eq. 9
	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6



Total Travel Time		0.478	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area A2.1	Time of Conc. Tc	0.478	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.55	cu ft/sec	Eq. 10

Area A8.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.545	hrs	Tt + Tc for Area A8.1 (pg. 21)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.66	cu ft/sec	Eq. 10

Area A7.2 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.746	hrs	Tt + Tc for Area A7.2 (pg. 21)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.58	cu ft/sec	Eq. 10

Area A7.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.466	hrs	Tt + Tc for Area A7.1 (pg. 21)
	Unit Peak Disch. q_u	425	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.01	cu ft/sec	Eq. 10

Area A6.2 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.761	hrs	Tt + Tc for Area A6.2 (pg. 22)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.58	cu ft/sec	Eq. 10
Area A6.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.413	hrs	Tt + Tc for Area A6.1 (pg. 22)
	Unit Peak Disch. q_u	445	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.79	cu ft/sec	Eq. 10
Area A5.2 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.693	hrs	Tt + Tc for Area A5.2 (pg. 22)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.74	cu ft/sec	Eq. 10
Area A5.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.399	hrs	Tt + Tc for Area A5.1 (pg. 22)
	Unit Peak Disch. q_u	450	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.66	cu ft/sec	Eq. 10
Area A4.2 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.644	hrs	Tt + Tc for Area A4.2 (pg. 22)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.19	cu ft/sec	Eq. 10
Area A4.3 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.702	hrs	Tt + Tc for Area A4.3 (pg. 22)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.31	cu ft/sec	Eq. 10
Area A4.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.330	hrs	Tt + Tc for Area A4.1 (pg. 22)
	Unit Peak Disch. q_u	490	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.01	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	26	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A3.2 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.577	hrs	Tt + Tc for Area A3.2 (pg. 23)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.79	cu ft/sec	Eq. 10
Area A3.3 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.634	hrs	Tt + Tc for Area A3.3 (pg. 23)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.38	cu ft/sec	Eq. 10
Area A3.1 (from pt. 33 to Pt. 38)	Flow Length, L	235		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.269	hrs	Tt + Tc for Area A3.1 (pg. 21)
	Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.31	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	26	sq ft
Peak Discharge, qp	53.56	cu ft/sec
Peak Velocity	2.0601	ft/sec
	86%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	27	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas A1.1

Area 1.33 acres 0.00 sq. miles

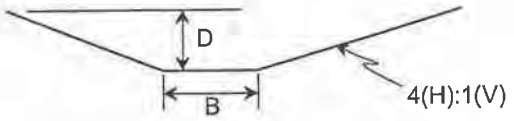
Calculate Travel Time, Tt

Sheet Flow

A1.1	Pt. 35 to Pt. 38	Flow Length, L	200 feet		Flow Length, L	0
		Two-yr 24 hr rainfall, P_2	4.9 inches		Two-yr 24 hr rainfal	5.9
		Land Slope, s	0.25 ft/ft		Land Slope, s	0.04
		Travel Time, Tt	0.187 hrs	Ref Eq. 8	Travel Time, Tt	0.000

Open Channel Flow

	Channel Depth, D	2 feet	
	Channel Width, B	5 feet	
	X-Section Area, a	26 sq ft	
Pt. 38 to Pt. 39	Wetted Perimeter, p_w	21.5 feet	
	Hydraulic Radus, r	1.210 ft	
	Channel Slope	0.005 ft/ft	
	Velocity, V	2.392 ft/sec	Ref Eq. 9
	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
Total Travel Time		0.238 hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I_a/P	0.095 in.	
Area A1.1	Time of Conc. Tc	0.238 hrs	From calculations above
	Unit Peak Disch. q_u	545 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q_p	5.78 cu ft/sec	Eq. 10
Area A8.1 (from pt. 38 to Pt. 39)	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
	Time of Conc. Tc	0.596 hrs	Tt + Tc for Area A8.1 (pg. 24)
	Unit Peak Disch. q_u	380 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q_p	4.48 cu ft/sec	Eq. 10
Area A7.2 (from pt. 38 to Pt. 39)	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
	Time of Conc. Tc	0.797 hrs	Tt + Tc for Area A7.2 (pg. 24)
	Unit Peak Disch. q_u	340 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q_p	2.55 cu ft/sec	Eq. 10
Area A7.1 (from pt. 38 to Pt. 39)	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
	Time of Conc. Tc	0.517 hrs	Tt + Tc for Area A7.1 (pg. 24)
	Unit Peak Disch. q_u	400 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q_p	2.84 cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	28	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A6.2 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.812	hrs	Tt + Tc for Area A6.2 (pg. 25)
	Unit Peak Disch. q_u	335	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.52	cu ft/sec	Eq. 10
Area A6.1 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.464	hrs	Tt + Tc for Area A6.1 (pg. 25)
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.46	cu ft/sec	Eq. 10
Area A5.2 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.744	hrs	Tt + Tc for Area A5.2 (pg. 25)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.67	cu ft/sec	Eq. 10
Area A5.1 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.450	hrs	Tt + Tc for Area A5.1 (pg. 25)
	Unit Peak Disch. q_u	430	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.50	cu ft/sec	Eq. 10
Area A4.2 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.695	hrs	Tt + Tc for Area A4.2 (pg. 25)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.07	cu ft/sec	Eq. 10
Area A4.3 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.753	hrs	Tt + Tc for Area A4.3 (pg. 25)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.22	cu ft/sec	Eq. 10
Area A4.1 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.381	hrs	Tt + Tc for Area A4.1 (pg. 25)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.58	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	29	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A3.2 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.628	hrs	Tt + Tc for Area A3.2 (pg. 26)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.69	cu ft/sec	Eq. 10
Area A3.3 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.685	hrs	Tt + Tc for Area A3.3 (pg. 26)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.20	cu ft/sec	Eq. 10
Area A3.1 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.321	hrs	Tt + Tc for Area A3.1 (pg. 26)
	Unit Peak Disch. q_u	490	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.15	cu ft/sec	Eq. 10
Area A2.1 (from pt. 38 to Pt. 39)	Flow Length, L	380		
	Travel Time, Tt	0.051	hrs	Ref Eq. 6
	Time of Conc. Tc	0.529	hrs	Tt + Tc for Area A2.1 (pg. 24)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.49	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	26	sq ft
Peak Discharge, qp	57.20	cu ft/sec
Peak Velocity	2.1999	ft/sec
	92%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	30	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

WESTERN SIDE

Calculate Peak Discharge from Area B5.1

Area 1.33 acres 0.00 sq. miles

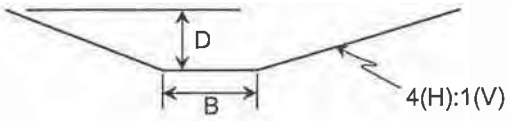
Calculate Travel Time, Tt

Sheet Flow

B.5.1	Pt. 41 to Pt. 135	Flow Length, L	280	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.245	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

Pt. 135 to Pt. 44	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
Total Travel Time		0.278	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I_a/P	0.095	in.	
Area B5.1	Time of Conc. Tc	0.278	hrs	From calculations above
	Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.3522	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	5.35	cu ft/sec
Peak Velocity	0.3345	ft/sec
	16%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	31	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area B4.2

Area 1.1 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

B.4.2 — Pt. 40 to Pt. 41

Flow Length, L	120	feet
Two-yr 24 hr rainfall, P_2	4.9	inches
Land Slope, s	0.25	ft/ft
Travel Time, Tt	0.124	hrs

Ref Eq. 8

Pt. 41 to Pt. 42

Flow Length, L	180	feet
Two-yr 24 hr rainfal	5.9	
Land Slope, s	0.04	ft/ft
Travel Time, Tt	0.326	

Shallow,Concentrated Flow

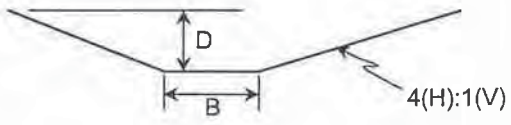
Pt. 42 to Pt. 43

Flow Length, L	83.4	feet	
Watercourse slope, s	0.04	ft/ft	
Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
Travel Time, Tt	0.007	hrs	Ref Eq. 6

Open Channel Flow

Pt. 44 to Pt. 45

Channel Depth, D	2	feet
Channel Width, B	0	feet
X-Section Area, a	16	sq ft
Wetted Perimeter, p_w	16.5	feet
Hydraulic Radus, r	0.970	ft
Channel Slope	0.005	ft/ft
Velocity, V	2.065	ft/sec
Flow Length, L	370	
Travel Time, Tt	0.050	hrs



Ref Eq. 9

Ref Eq. 6

Total Travel Time: 0.507 hrs — Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area B4.2

I_a/P	0.095	in.	
Time of Conc. Tc	0.507	hrs	From calculations above
Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
Runoff, Q	5.1	inches	From pg. 1
Peak Discharge, q_p	4.43	cu ft/sec	Eq. 10

Area B5.1 (from pt. 44 to Pt. 45)

Flow Length, L	370		
Travel Time, Tt	0.050	hrs	Ref Eq. 6
Time of Conc. Tc	0.328	hrs	Tt + Tc for Area B5.1 (pg. 30)
Unit Peak Disch. q_u	490	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
Runoff, Q	5.1	inches	From pg. 1
Peak Discharge, q_p	5.19	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	9.62	cu ft/sec
Peak Velocity	0.6012	ft/sec
	29%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	32	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area B4.1

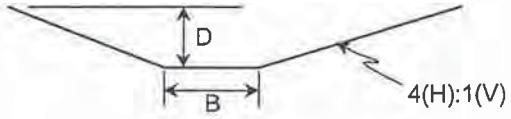
Area 1.67 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

B4.1	Pt. 46 to Pt. 45	Flow Length, L	160	feet		Flow Length, L		feet	
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9		
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft	
		Travel Time, Tt	0.156	hrs	Ref Eq. 8	Travel Time, Tt	0.000		

Open Channel Flow



Pt. 45 to Pt. 47	Channel Depth, D	2	feet		
	Channel Width, B	0	feet		
	X-Section Area, a	16	sq ft		
	Wetted Perimeter, p_w	16.5	feet		
	Hydraulic Radus, r	0.970	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.065	ft/sec	Ref Eq. 9	
	Flow Length, L	345			
	Travel Time, Tt	0.046	hrs	Ref Eq. 6	
Total Travel Time		0.203	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

Area B4.1	I_a/P	0.095	in.	
	Time of Conc. Tc	0.203	hrs	From calculations above
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	7.39	cu ft/sec	Eq. 10
Area B5.1 (from pt. 45 to Pt. 47)	Flow Length, L	345		
	Travel Time, Tt	0.046	hrs	Ref Eq. 6
	Time of Conc. Tc	0.375	hrs	Tt + Tc for Area B5.1 (pg. 31)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.82	cu ft/sec	Eq. 10
Area B4.2 (from pt. 45 to Pt. 47)	Flow Length, L	345		
	Travel Time, Tt	0.046	hrs	Ref Eq. 6
	Time of Conc. Tc	0.554	hrs	Tt + Tc for Area B4.2 (pg. 31)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.42	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft	
Peak Discharge, qp	15.63	cu ft/sec	
Peak Velocity	0.9767	ft/sec	
	47%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	33	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA	

Calculate Peak Discharge from Areas B3.2

Area 1.1 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

B3.2 — Pt. 48 to Pt. 46

Flow Length, L	56.8	feet
Two-yr 24 hr rainfall, P_2	4.9	inches
Land Slope, s	0.25	ft/ft
Travel Time, Tt	0.068	hrs

Ref Eq. 8

Pt. 46 to Pt. 49

Flow Length, L	243.2	feet
Two-yr 24 hr rainfal	5.9	
Land Slope, s	0.04	ft/ft
Travel Time, Tt	0.415	

Shallow,Concentrated Flow

Pt. 49 to Pt. 50

Flow Length, L	97.8	feet
Watercourse slope, s	0.04	ft/ft
Avg. Velocity, V.	3.2	ft/sec
Travel Time, Tt	0.008	hrs

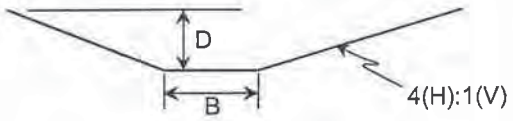
Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved

Ref Eq. 6

Open Channel Flow

Pt. 47 to Pt. 51

Channel Depth, D	2	feet
Channel Width, B	0	feet
X-Section Area, a	16	sq ft
Wetted Perimeter, p_w	16.5	feet
Hydraulic Radus, r	0.970	ft
Channel Slope	0.005	ft/ft
Velocity, V	2.065	ft/sec
Flow Length, L	375	
Travel Time, Tt	0.050	hrs



Ref Eq. 9

Ref Eq. 6

Total Travel Time 0.542 hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area B3.2

I_a/P	0.095	in.
Time of Conc. Tc	0.542	hrs
Unit Peak Disch. q_u	395	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	3.46	cu ft/sec

From calculations above

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

Area B5.1 (from pt. 47 to Pt. 51)

Flow Length, L	375	
Travel Time, Tt	0.050	hrs
Time of Conc. Tc	0.425	hrs
Unit Peak Disch. q_u	440	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	4.66	cu ft/sec

Ref Eq. 6

Tt + Tc for Area B5.1 (pg. 32)

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

Area B4.2 (from pt. 47 to Pt. 51)

Flow Length, L	375	
Travel Time, Tt	0.050	hrs
Time of Conc. Tc	0.604	hrs
Unit Peak Disch. q_u	380	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	3.33	cu ft/sec

Ref Eq. 6

Tt + Tc for Area B4.2 (pg. 32)

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 34	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Area B4.1 (from pt. 47 to Pt. 51)	Flow Length, L	375		
	Travel Time, Tt	0.050	hrs	Ref Eq. 6
	Time of Conc. Tc	0.253	hrs	Tt + Tc for Area B4.1 (pg. 32)
	Unit Peak Disch. q_u	530	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	7.05	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	18.51	cu ft/sec
Peak Velocity	1.1569	ft/sec
	56%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	35	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area B3.1

Area 2.34 acres 0.00 sq. miles

Calculate Travel Time, Tt

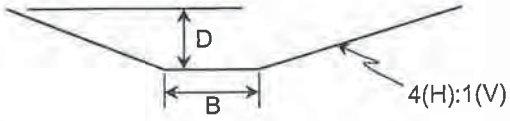
Sheet Flow

B3.1	Pt. 52 to Pt. 51	Flow Length, L	170	feet		
		Two-yr 24 hr rainfall, P_2	4.9	inches		
		Land Slope, s	0.25	ft/ft		
		Travel Time, Tt	0.164	hrs	Ref Eq. 8	

Flow Length, L		feet
Two-yr 24 hr rainfal	5.9	
Land Slope, s	0.04	ft/ft
Travel Time, Tt	0.000	

Open Channel Flow

Pt. 51 to Pt. 60	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	615		
	Travel Time, Tt	0.083	hrs	Ref Eq. 6
Total Travel Time		0.247	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I_a/P	0.095	in.	
Area B3.1	Time of Conc. Tc	0.247	hrs	From calculations above
	Unit Peak Disch. q_u	535	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	9.9761	cu ft/sec	Eq. 10

Area B5.1 (from pt. 51 to Pt. 60)	Flow Length, L	615		
	Travel Time, Tt	0.083	hrs	Ref Eq. 6
	Time of Conc. Tc	0.508	hrs	Tt + Tc for Area B5.1 (pg. 33)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.24	cu ft/sec	Eq. 10

Area B4.2 (from pt. 51 to Pt. 60)	Flow Length, L	615		
	Travel Time, Tt	0.083	hrs	Ref Eq. 6
	Time of Conc. Tc	0.687	hrs	Tt + Tc for Area B4.2 (pg. 33)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.02	cu ft/sec	Eq. 10

Area B4.1 (from pt. 51 to Pt. 60)	Flow Length, L	615		
	Travel Time, Tt	0.083	hrs	Ref Eq. 6
	Time of Conc. Tc	0.336	hrs	Tt + Tc for Area B4.1 (pg. 34)
	Unit Peak Disch. q_u	485	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.45	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	36	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area B3.2 (from pt. 51 to Pt. 60)	Flow Length, L	615		
	Travel Time, Tt	0.083	hrs	Ref Eq. 6
	Time of Conc. Tc	0.625	hrs	Tt + Tc for Area B3.2 (pg. 33)
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.24	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	26.94	cu ft/sec
Peak Velocity	1.6836	ft/sec
	82%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	37	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area B2.2

Area 1.62 acres 0.00 sq. miles

Calculate Travel Time, Tt

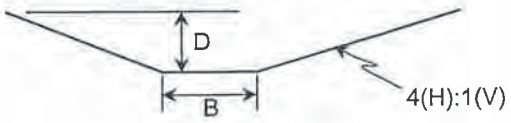
Sheet Flow

Pt. 61 to Pt. 52	Flow Length, L	64.5	feet	Pt. 52 to Pt. 62	Flow Length, L	235.5	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.076	hrs Ref Eq. 8		Travel Time, Tt	0.404	

B2.2 Shallow,Concentrated Flow

Pt. 62 to Pt. 63	Flow Length, L	200	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.017	hrs Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet
	Channel Width, B	2	feet
	X-Section Area, a	20	sq ft
Pt. 60 to Pt. 67	Wetted Perimeter, p_w	18.5	feet
	Hydraulic Radus, r	1.082	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.220	ft/sec Ref Eq. 9
	Flow Length, L	275	
	Travel Time, Tt	0.034	hrs Ref Eq. 6
Total Travel Time		0.532	hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area B2.3

Area 0.96 acres 0.00 sq. miles

Calculate Travel Time, Tt

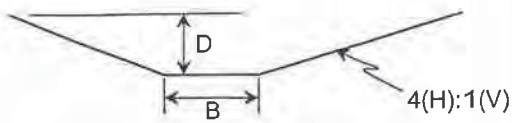
Sheet Flow

Pt. 73 to Pt. 70	Flow Length, L	96.6	feet	Pt. 70 to Pt. 64	Flow Length, L	203.4	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.1	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.151	hrs Ref Eq. 8		Travel Time, Tt	0.360	

B2.3 Shallow,Concentrated Flow

Pt. 64 to Pt. 65	Flow Length, L	71.6	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet
	Channel Width, B	2	feet
	X-Section Area, a	20	sq ft
Pt. 60 to Pt. 67	Wetted Perimeter, p_w	18.5	feet
	Hydraulic Radus, r	1.082	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.220	ft/sec Ref Eq. 9
	Flow Length, L	275	
	Travel Time, Tt	0.034	hrs Ref Eq. 6
Total Travel Time		0.551	hrs Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	38	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area B2.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.532	hrs	From calculations above
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.1638	cu ft/sec	Eq. 10
Area B2.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.551	hrs	From calculations above
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.02	cu ft/sec	Eq. 10
Area B5.1 (from pt. 60 to Pt. 67)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.542	hrs	Tt + Tc for Area B5.1 (pg. 35)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.24	cu ft/sec	Eq. 10
Area B4.2 (from pt. 60 to Pt. 67)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.721	hrs	Tt + Tc for Area B4.2 (pg. 35)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.07	cu ft/sec	Eq. 10
Area B4.1 (from pt. 60 to Pt. 67)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.370	hrs	Tt + Tc for Area B4.1 (pg. 35)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.06	cu ft/sec	Eq. 10
Area B3.2 (from pt. 60 to Pt. 67)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.659	hrs	Tt + Tc for Area B3.2 (pg. 36)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.16	cu ft/sec	Eq. 10
Area B3.1 (from pt. 60 to Pt. 67)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.281	hrs	Tt + Tc for Area B3.1 (pg. 35)
	Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	9.42	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 39	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft
Peak Discharge, qp	34.12	cu ft/sec
Peak Velocity	1.706	ft/sec
	77%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	40	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Areas B2.1

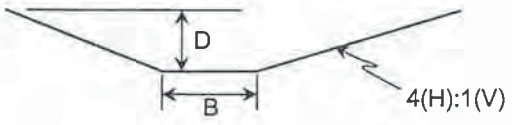
Area 1.53 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

B2.1	Pt. 68 to Pt. 67	Flow Length, L	195	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.183	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow



Pt. 67 to Pt. 69	Channel Depth, D	2	feet		
	Channel Width, B	2	feet		
	X-Section Area, a	20	sq ft		
	Wetted Perimeter, p_w	18.5	feet		
	Hydraulic Radus, r	1.082	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.220	ft/sec	Ref Eq. 9	
	Flow Length, L	275			
	Travel Time, Tt	0.034	hrs	Ref Eq. 6	
Total Travel Time		0.218	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area B2.1	Time of Conc. Tc	0.218	hrs	From calculations above
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.77	cu ft/sec	Eq. 10
Area B5.1 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.577	hrs	Tt + Tc for Area B5.1 (pg. 38)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.08	cu ft/sec	Eq. 10
Area B4.2 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.756	hrs	Tt + Tc for Area B4.2 (pg. 38)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.02	cu ft/sec	Eq. 10
Area B4.1 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.405	hrs	Tt + Tc for Area B4.1 (pg. 38)
	Unit Peak Disch. q_u	445	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.92	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	41	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area B3.2 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.694	hrs	Tt + Tc for Area B3.2 (pg. 38)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.07	cu ft/sec	Eq. 10
Area B3.1 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.316	hrs	Tt + Tc for Area A.4.2 (pg. 38)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	9.23	cu ft/sec	Eq. 10
Area B2.2 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.566	hrs	Tt + Tc for Area B2.2 (pg. 38)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.03	cu ft/sec	Eq. 10
Area B2.3 (from pt. 67 to Pt. 69)	Flow Length, L	275		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.585	hrs	Tt + Tc for Area B2.3 (pg. 38)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.95	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft
Peak Discharge, qp	40.07	cu ft/sec
Peak Velocity	2.0036	ft/sec
	90%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	42	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas B1.2

Area 1.19 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

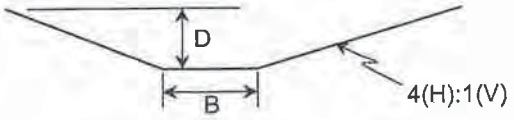
B1.2

Pt. 70 to Pt. 68	Flow Length, L	120	feet	Pt. 68 to Pt. 71	Flow Length, L	180	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs Ref Eq. 8		Travel Time, Tt	0.326	

Shallow,Concentrated Flow

Pt. 71 to Pt. 72	Flow Length, L	95	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec
	Travel Time, Tt	0.008	hrs Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet
	Channel Width, B	4	feet
	X-Section Area, a	24	sq ft
Pt. 69 to Pt. 76	Wetted Perimeter, p_w	20.5	feet
	Hydraulic Radus, r	1.171	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.341	ft/sec Ref Eq. 9
	Flow Length, L	155	
	Travel Time, Tt	0.018	hrs Ref Eq. 6
Total Travel Time		0.477	hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Areas B1.3

Area 1.37 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

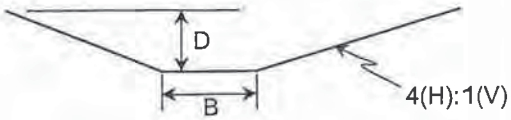
B1.3

Pt. 73 to Pt. 70	Flow Length, L	96.6	feet	Pt. 70 to Pt. 74	Flow Length, L	203.4	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.1	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.151	hrs Ref Eq. 8		Travel Time, Tt	0.360	

Shallow,Concentrated Flow

Pt. 74 to Pt. 75	Flow Length, L	71.6	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec
	Travel Time, Tt	0.006	hrs Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet
	Channel Width, B	4	feet
	X-Section Area, a	24	sq ft
Pt. 69 to Pt. 76	Wetted Perimeter, p_w	20.5	feet
	Hydraulic Radus, r	1.171	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.341	ft/sec Ref Eq. 9
	Flow Length, L	155	
	Travel Time, Tt	0.018	hrs Ref Eq. 6
Total Travel Time		0.535	hrs Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 43 of 110
Subject: Stormwater Design	Checked By:	Date:	Job No.: SMEPA

Calculate Peak Discharge

Area B1.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.477	hrs	From calculations above
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.94	cu ft/sec	Eq. 10
Area B1.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.535	hrs	From calculations above
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.37	cu ft/sec	Eq. 10
Area B5.1 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.595	hrs	Tt + Tc for Area B5.1 (pg. 40)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.08	cu ft/sec	Eq. 10
Area B4.2 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.774	hrs	Tt + Tc for Area B4.2 (pg. 40)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.98	cu ft/sec	Eq. 10
Area B4.1 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.423	hrs	Tt + Tc for Area B4.1 (pg. 40)
	Unit Peak Disch. q_u	440	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.86	cu ft/sec	Eq. 10
Area B3.2 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.712	hrs	Tt + Tc for Area B3.2 (pg. 41)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.07	cu ft/sec	Eq. 10
Area B3.1 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.334	hrs	Tt + Tc for Area A.4.2 (pg. 41)
	Unit Peak Disch. q_u	485	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	9.04	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	44	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area B2.2 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.584	hrs	Tt + Tc for Area B2.2 (pg. 41)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.03	cu ft/sec	Eq. 10
Area B2.3 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.604	hrs	Tt + Tc for Area B2.3 (pg. 41)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.95	cu ft/sec	Eq. 10
Area B2.1 (from pt. 69 to Pt. 76)	Flow Length, L	155		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
	Time of Conc. Tc	0.236	hrs	Tt + Tc for Area B2.1 (pg. 40)
	Unit Peak Disch. q_u	545	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.64	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	47.95	cu ft/sec
Peak Velocity	1.9981	ft/sec
	85%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	45	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas B1.1

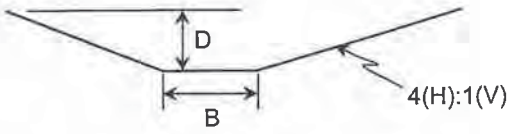
Area 0.93 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

B1.1	Pt. 77 to Pt. 76	Flow Length, L	190	feet		Flow Length, L	0
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04
		Travel Time, Tt	0.179	hrs	Ref Eq. 8	Travel Time, Tt	0.000

Open Channel Flow



Pt. 76 to Pt. 39	Channel Depth, D	2	feet	
	Channel Width, B	4	feet	
	X-Section Area, a	24	sq ft	
	Wetted Perimeter, p_w	20.5	feet	
	Hydraulic Radus, r	1.171	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.341	ft/sec	Ref Eq. 9
	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
Total Travel Time		0.213	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area B1.1	Time of Conc. Tc	0.213	hrs	From calculations above
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.11	cu ft/sec	Eq. 10
Area B5.1 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.629	hrs	Tt + Tc for Area B5.1 (pg. 43)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.97	cu ft/sec	Eq. 10
Area B4.2 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.808	hrs	Tt + Tc for Area B4.2 (pg. 43)
	Unit Peak Disch. q_u	335	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.94	cu ft/sec	Eq. 10
Area B4.1 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.457	hrs	Tt + Tc for Area B4.1 (pg. 43)
	Unit Peak Disch. q_u	425	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.66	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	46	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Area B3.2 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.746	hrs	Tt + Tc for Area B3.2 (pg. 43)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.02	cu ft/sec	Eq. 10
Area B3.1 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.368	hrs	Tt + Tc for Area A.4.2 (pg. 43)
	Unit Peak Disch. q_u	460	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	8.58	cu ft/sec	Eq. 10
Area B2.2 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.618	hrs	Tt + Tc for Area B2.2 (pg. 44)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.91	cu ft/sec	Eq. 10
Area B2.3 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.638	hrs	Tt + Tc for Area B2.3 (pg. 44)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.87	cu ft/sec	Eq. 10
Area B2.1 (from pt. 76 to Pt. 39)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.270	hrs	Tt + Tc for Area B2.1 (pg. 44)
	Unit Peak Disch. q_u	510	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.22	cu ft/sec	Eq. 10
Area B1.2 (from pt. 76 to Pt. 79)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.511	hrs	Tt + Tc for Area B2.2 (pg. 43)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.79	cu ft/sec	Eq. 10
Area B1.3 (from pt. 76 to Pt. 79)	Flow Length, L	285		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.569	hrs	Tt + Tc for Area B2.3 (pg. 43)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.26	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 47	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	50.32	cu ft/sec
Peak Velocity	2.0969	ft/sec
	90%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	48	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Areas A1.2

Area		0.8	acres	0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

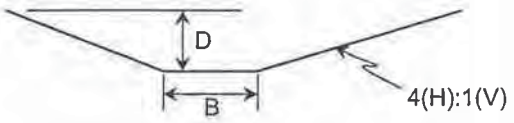
A1.2	Pt. 34 to Pt. 35	Flow Length, L	127.4	feet		Pt. 35 to Pt. 78	Flow Length, L	172.6	
		Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	
		Travel Time, Tt	0.130	hrs	Ref Eq. 8		Travel Time, Tt	0.315	

Shallow,Concentrated Flow

Pt. 78 to Pt. 79	Flow Length, L	55.9	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	
	Travel Time, Tt	0.005	hrs	Ref Eq. 6

Open Channel Flow

Pt. 39 to Pt. 80	Channel Depth, D	2.5	feet	
	Channel Width, B	8	feet	
	X-Section Area, a	45	sq ft	
	Wetted Perimeter, p_w	28.6	feet	
	Hydraulic Radus, r	1.573	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.850	ft/sec	Ref Eq. 9
	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6



Total Travel Time	0.465	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area A1.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.465	hrs	From calculations above
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.65	cu ft/sec	Eq. 10
Area B5.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.643	hrs	Tt + Tc for Area B5.1 (pg. 45)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.82	cu ft/sec	Eq. 10
Area B4.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.823	hrs	Tt + Tc for Area B4.2 (pg. 45)
	Unit Peak Disch. q_u	330	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.89	cu ft/sec	Eq. 10
Area B4.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.472	hrs	Tt + Tc for Area B4.1 (pg. 45)
	Unit Peak Disch. q_u	420	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.59	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	49	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area B3.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.760	hrs	Tt + Tc for Area B3.2 (pg. 46)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.98	cu ft/sec	Eq. 10
Area B3.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.383	hrs	Tt + Tc for Area A.4.2 (pg. 46)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	8.48	cu ft/sec	Eq. 10
Area B2.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.633	hrs	Tt + Tc for Area B2.2 (pg. 46)
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.78	cu ft/sec	Eq. 10
Area B2.3 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.652	hrs	Tt + Tc for Area B2.3 (pg. 46)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.79	cu ft/sec	Eq. 10
Area B2.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.284	hrs	Tt + Tc for Area B2.1 (pg. 46)
	Unit Peak Disch. q_u	505	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.16	cu ft/sec	Eq. 10
Area B1.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.525	hrs	Tt + Tc for Area B2.2 (pg. 46)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.79	cu ft/sec	Eq. 10
Area B1.3 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.583	hrs	Tt + Tc for Area B2.3 (pg. 46)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.26	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	50	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area	Flow Length, L	150		
B1.1	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.228	hrs	Tt + Tc for Area B2.3 (pg. 45)
pt. 39	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	6.00	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A8.1	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.611	hrs	Tt + Tc for Area A8.1 (pg. 27)
pt. 39	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	4.48	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A7.2	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.812	hrs	Tt + Tc for Area A7.2 (pg. 27)
pt. 39	Unit Peak Disch. q_u	335	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	2.51	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A7.1	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.532	hrs	Tt + Tc for Area A7.1 (pg. 27)
pt. 39	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	2.84	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A6.2	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.826	hrs	Tt + Tc for Area A6.2 (pg. 28)
pt. 39	Unit Peak Disch. q_u	330	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	3.47	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A6.1	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.479	hrs	Tt + Tc for Area A6.1 (pg. 28)
pt. 39	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	4.41	cu ft/sec	Eq. 10

Area	Flow Length, L	150		
A5.2	Travel Time, Tt	0.015	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.759	hrs	Tt + Tc for Area A5.2 (pg. 28)
pt. 39	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
80)	Peak Discharge, q_p	2.67	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	51	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A5.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.465	hrs	Tt + Tc for Area A5.1 (pg. 28)
	Unit Peak Disch. q_u	425	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.45	cu ft/sec	Eq. 10
Area A4.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.710	hrs	Tt + Tc for Area A4.2 (pg. 28)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10
Area A4.3 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.768	hrs	Tt + Tc for Area A4.3 (pg. 28)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.22	cu ft/sec	Eq. 10
Area A4.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.396	hrs	Tt + Tc for Area A4.1 (pg. 28)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.58	cu ft/sec	Eq. 10
Area A3.2 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.642	hrs	Tt + Tc for Area A3.2 (pg. 29)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.50	cu ft/sec	Eq. 10
Area A3.3 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.700	hrs	Tt + Tc for Area A3.3 (pg. 29)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.15	cu ft/sec	Eq. 10
Area A3.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.335	hrs	Tt + Tc for Area A3.1 (pg. 29)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.21	cu ft/sec	Eq. 10

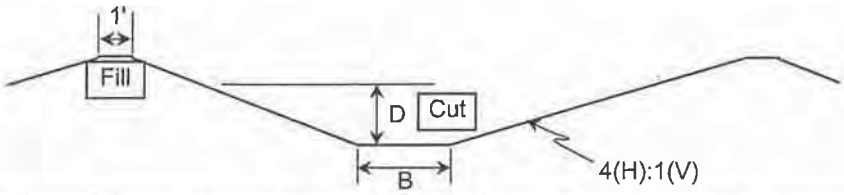
ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	52	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area A2.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.544	hrs	Tt + Tc for Area A2.1 (pg. 29)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.46	cu ft/sec	Eq. 10
Area A1.1 (from pt. 39 to Pt. 80)	Flow Length, L	150		
	Travel Time, Tt	0.015	hrs	Ref Eq. 6
	Time of Conc. Tc	0.253	hrs	Tt + Tc for Area A2.1 (pg. 27)
	Unit Peak Disch. q_u	530	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.62	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	45	sq ft
Peak Discharge, qp	110.77	cu ft/sec
Peak Velocity	2.4615	ft/sec
	86%	of Calculated Channel Flow Velocity

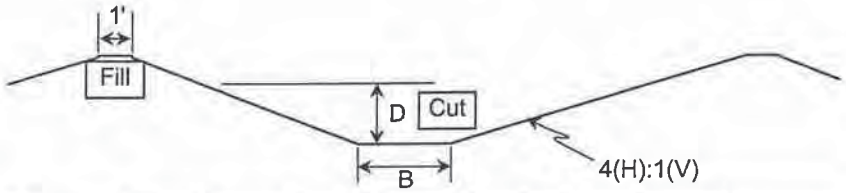


	Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope	Length (ft)	Cut (ft)	Fill (ft)	Area of Cut/Fill (ft^2)	Volume Cut/Fill (yd^3)
	80	218.5	2.5	216.5	8	0.50%	150	2.00	0.50	27.0	
	39	221.5	2.5	217.3	8	0.50%	0	4.25	0.00	106.3	370.1
Drainage Area A	39	221.5	2.0	217.3	5	0.50%	380	4.25	0.00	93.5	0.0
	38	223.0	2.0	219.2	5	0.50%	235	3.85	0.00	78.5	1210.7
	33	224.0	2.0	220.3	5	0.50%	0	3.67	0.00	72.4	656.9
	33	224.0	2.0	220.3	4	0.50%	560	3.67	0.00	68.7	0.0
	31	224.0	2.0	223.1	4	0.50%	0	0.87	1.13	-15.9	547.4
	31	224.0	2.0	223.1	3	0.50%	200	0.87	1.13	-16.8	0.0
	26	225.0	2.0	224.1	3	0.50%	0	0.87	1.13	-16.8	-124.5
	26	225.0	2.0	224.1	2	0.50%	260	0.87	1.13	-17.7	0.0
	25	225.5	2.0	225.4	2	0.50%	280	0.07	1.93	-63.0	-388.3
	17	226.7	2.0	226.8	2	0.50%	0	-0.13	2.13	-76.7	-724.1
	17	226.7	2.0	226.8	0	0.50%	140	-0.13	2.13	-76.4	0.0
	15	228.5	2.0	227.5	0	0.50%	80	0.97	1.03	-15.1	-237.2
	14	233.0	2.0	227.9	0	0.50%	250	5.07	0.00	103.0	130.3
	11	232.0	2.0	229.2	0	0.50%	250	2.82	0.00	31.9	624.7
	5	231.0	2.0	230.4	0	0.50%	125	0.57	1.43	-34.0	-9.7
	4	230.0	2.0	231.1	0	0.50%	630	-1.05	3.05	-150.5	-427.2
	82	233.0	2.0	234.2	0	0.50%		-1.20	3.20	-164.5	-3675.1
						Total					***-2,046.1***

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 53	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA



	Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope	Length (ft)	Cut (ft)	Fill (ft)	Area of Cut/Fill (ft^2)	Volume Cut/Fill (yd^3)
Drainage Area B	39	221.5	2.0	221.5	4	0.50%	285	0.00	2.00	-68.0	
	76	225.2	2.0	222.9	4	0.50%	155	2.27	0.00	29.8	-201.6
	69	225.7	2.0	223.7	4	0.50%	0	2.00	0.00	24.0	154.4
	69	225.7	2.0	223.7	2	0.50%	275	2.00	0.00	20.0	0.0
	67	228.1	2.0	225.1	2	0.50%	275	3.02	0.00	42.7	319.1
	60	228.6	2.0	226.5	2	0.50%	0	2.15	0.00	22.8	333.3
	60	228.6	2.0	226.5	0	0.50%	615	2.15	0.00	18.5	0.0
	51	238.5	2.0	229.5	0	0.50%	375	8.97	0.00	322.2	3880.1
	47	238.5	2.0	231.4	0	0.50%	345	7.10	0.00	201.6	3637.8
	45	237.8	2.0	233.1	0	0.50%	370	4.68	0.00	87.4	1846.8
	44	233.3	2.0	235.0	0	0.50%	250	-1.67	3.67	-212.2	-855.1
	135	234.7	2.0	236.2	0	0.50%		-1.53	3.53	-196.6	-1892.5
	Total										***9,114.8***

Recommendations: (1) At Point 39 from the Area B side put a spillway in to allow the water to drop from Elev. 221.5' to Elev. 217.3' when it meets up with the drainage ditch from Area A. Either rip-rap or concrete should be placed.

(2) The post development rate is calculated as 111 cfs and the predevelopment rate was calculated as 113 cfs; therefore, no storage is required.

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	54	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

EASTERN SIDE

Calculate Peak Discharge from Area C4.2

Area 1.4 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

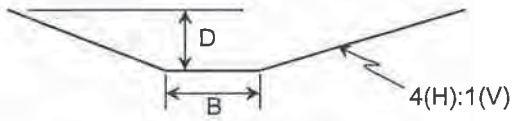
C4.2

Pt. 84 to Pt. 85	Flow Length, L	153	feet		Pt. 85 to Pt. 86	Flow Length, L	147	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.151	hrs	Ref Eq. 8		Travel Time, Tt	0.277	

Shallow,Concentrated Flow

Pt. 86 to Pt. 87	Flow Length, L	56.5	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.005	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 83 to Pt. 92	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	135		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
Total Travel Time		0.451	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area C4.3

Area 0.84 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

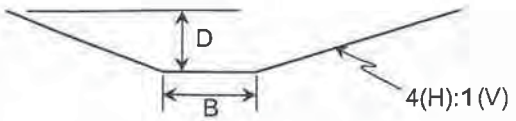
C4.3

Pt. 88 to Pt. 89	Flow Length, L	61.1	feet		Pt. 89 to Pt. 90	Flow Length, L	238.9	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.072	hrs	Ref Eq. 8		Travel Time, Tt	0.409	

Shallow,Concentrated Flow

Pt. 90 to Pt. 91	Flow Length, L	11.1	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 83 to Pt. 92	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	135		
	Travel Time, Tt	0.018	hrs	Ref Eq. 6
Total Travel Time		0.500	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	55	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area C4.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.451	hrs	From calculations above
	Unit Peak Disch. q_u	440	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.9088	cu ft/sec	Eq. 10
Area C4.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.500	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.74	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	7.65	cu ft/sec
Peak Velocity	0.4783	ft/sec
	23%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	56	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C4.1

Area 0.84 acres 0.00 sq. miles

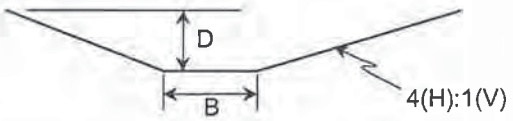
Calculate Travel Time, Tt

Sheet Flow

C4.1	Pt. 93 to Pt. 92	Flow Length, L	160	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.156	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

	Pt. 92 to Pt. 94	Channel Depth, D	2	feet	
		Channel Width, B	0	feet	
		X-Section Area, a	16	sq ft	
		Wetted Perimeter, p_w	16.5	feet	
		Hydraulic Radus, r	0.970	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.065	ft/sec	Ref Eq. 9
		Flow Length, L	60		
		Travel Time, Tt	0.008	hrs	Ref Eq. 6
Total Travel Time			0.165	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area C4.1		Time of Conc. Tc	0.165	hrs	From calculations above
		Unit Peak Disch. q_u	600	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10
Area C4.2 (from pt. 92 to Pt. 94)		Flow Length, L	60		
		Travel Time, Tt	0.008	hrs	Ref Eq. 6
		Time of Conc. Tc	0.459	hrs	Tt + Tc for Area C4.2 (pg. 55)
		Unit Peak Disch. q_u	435	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.85	cu ft/sec	Eq. 10
Area C4.3 (from pt. 92 to Pt. 94)		Flow Length, L	60		
		Travel Time, Tt	0.008	hrs	Ref Eq. 6
		Time of Conc. Tc	0.509	hrs	Tt + Tc for Area C4.3 (pg. 55)
		Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.74	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft	
Peak Discharge, qp	11.61	cu ft/sec	
Peak Velocity	0.7259	ft/sec	
	35%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	57	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C3.2

Area 1.72 acres 0.00 sq. miles

Calculate Travel Time, Tt

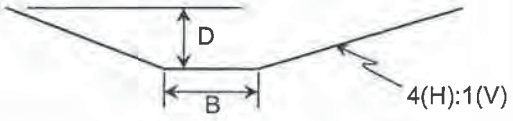
Sheet Flow

Pt. 95 to Pt. 96	Flow Length, L	103.4	feet	Pt. 96 to Pt. 97	Flow Length, L	196.6	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.110	hrs	Ref Eq. 8	Travel Time, Tt	0.350	

C3.2 Shallow,Concentrated Flow

Pt. 97 to Pt. 98	Flow Length, L	108.2	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.009	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 94 to Pt. 107	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	265		
	Travel Time, Tt	0.036	hrs	Ref Eq. 6
Total Travel Time		0.505	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area C3.3

Area 1.74 acres 0.00 sq. miles

Calculate Travel Time, Tt

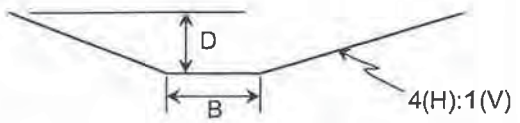
Sheet Flow

Pt. 99 to Pt. 100	Flow Length, L	92.6	feet	Pt. 100 to Pt. 101	Flow Length, L	207.4	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.101	hrs	Ref Eq. 8	Travel Time, Tt	0.365	

C3.3 Shallow,Concentrated Flow

Pt. 101 to Pt. 102	Flow Length, L	42.6	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.004	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 94 to Pt. 107	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	300		
	Travel Time, Tt	0.040	hrs	Ref Eq. 6
Total Travel Time		0.510	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	58	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C3.4

Area 0.78 acres 0.00 sq. miles

Calculate Travel Time, Tt

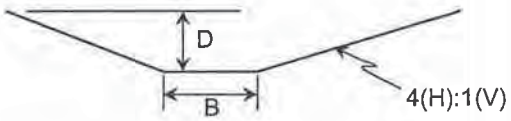
Sheet Flow

Pt. 103 to Pt. 104	Flow Length, L	126.6	feet		Pt. 104 to Pt. 105	Flow Length, L	173.4	feet	
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9		
	Land Slope, s	0.1	ft/ft			Land Slope, s	0.04	ft/ft	
	Travel Time, Tt	0.187	hrs	Ref Eq. 8		Travel Time, Tt	0.316		

C3.4 Shallow, Concentrated Flow

Pt. 105 to Pt. 106	Flow Length, L	15.5	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow



Pt. 94 to Pt. 107	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	265		
	Travel Time, Tt	0.036	hrs	Ref Eq. 6
Total Travel Time		0.541	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area C3.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.505	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.62	cu ft/sec	Eq. 10
Area C3.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.510	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.68	cu ft/sec	Eq. 10
Area C3.4	I_a/P	0.095	in.	
	Time of Conc. Tc	0.541	hrs	From calculations above
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.46	cu ft/sec	Eq. 10
Area C4.2 (from pt. 94 to Pt. 107)	Flow Length, L	265		
	Travel Time, Tt	0.036	hrs	Ref Eq. 6
	Time of Conc. Tc	0.495	hrs	Tt + Tc for Area C4.2 (pg. 56)
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.63	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	59	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C4.3 (from pt. 94 to Pt. 107)	Flow Length, L	265		
	Travel Time, Tt	0.036	hrs	Ref Eq. 6
	Time of Conc. Tc	0.544	hrs	Tt + Tc for Area C4.3 (pg. 56)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.68	cu ft/sec	Eq. 10
Area C4.1 (from pt. 94 to Pt. 107)	Flow Length, L	265		
	Travel Time, Tt	0.036	hrs	Ref Eq. 6
	Time of Conc. Tc	0.200	hrs	Tt + Tc for Area C4.1 (pg. 56)
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.72	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	24.78	cu ft/sec
Peak Velocity	1.5489	ft/sec
	75%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	60	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas C3.1

Area 1.92 acres 0.00 sq. miles

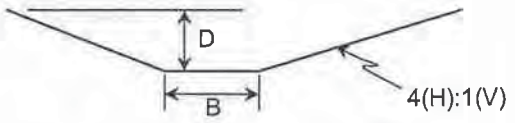
Calculate Travel Time, Tt

Sheet Flow

C3.1	**Pt. 96 to Pt. 94**	Flow Length, L	275	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.241	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

Pt. 107 to Pt. 108	Channel Depth, D	2	feet	
	Channel Width, B	2	feet	
	X-Section Area, a	20	sq ft	
	Wetted Perimeter, p_w	18.5	feet	
	Hydraulic Radus, r	1.082	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.220	ft/sec	Ref Eq. 9
	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
Total Travel Time		0.301	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I_a/P	0.095	in.	
Area C3.1	Time of Conc. Tc	0.301	hrs	From calculations above
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	7.65	cu ft/sec	Eq. 10
Area C4.2 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.554	hrs	Tt + Tc for Area C4.2 (pg. 58)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.41	cu ft/sec	Eq. 10
Area C4.3 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.604	hrs	Tt + Tc for Area C4.3 (pg. 59)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.54	cu ft/sec	Eq. 10
Area C4.1 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.260	hrs	Tt + Tc for Area C4.1 (pg. 59)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.45	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	61	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C3.2 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.565	hrs	Tt + Tc for Area C3.2 (pg. 58)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.41	cu ft/sec	Eq. 10
Area C3.3 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.570	hrs	Tt + Tc for Area C3.3 (pg. 58)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.48	cu ft/sec	Eq. 10
Area C3.4 (from pt. 107 to Pt. 108)	Flow Length, L	475		
	Travel Time, Tt	0.059	hrs	Ref Eq. 6
	Time of Conc. Tc	0.600	hrs	Tt + Tc for Area C3.4 (pg. 58)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.36	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft	
Peak Discharge, qp	31.30	cu ft/sec	
Peak Velocity	1.565	ft/sec	
	70%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	62	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C2.2

Area 1.42 acres 0.00 sq. miles

Calculate Travel Time, Tt

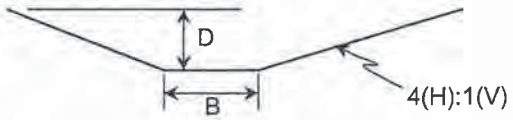
Sheet Flow

Pt. 109 to Pt. 110	Flow Length, L	119.7	feet		**Pt. 110 to Pt. 111**	Flow Length, L	180.3	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.326	

C2.2 Shallow,Concentrated Flow

Pt. 111 to Pt. 112	Flow Length, L	128.7	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.011	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
Pt. 108 to Pt. 119	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
Total Travel Time		0.509	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area C2.3

Area 1.11 acres 0.00 sq. miles

Calculate Travel Time, Tt

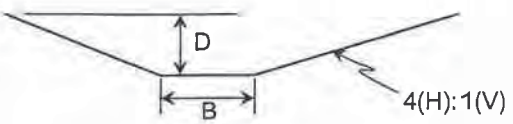
Sheet Flow

Pt. 113 to Pt.114	Flow Length, L	118.5	feet		**Pt. 114 to Pt. 115**	Flow Length, L	181.5	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.123	hrs	Ref Eq. 8		Travel Time, Tt	0.328	

C2.3 Shallow,Concentrated Flow

Pt. 115 to Pt. 116	Flow Length, L	52.4	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.005	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
Pt. 108 to Pt. 119	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
Total Travel Time		0.503	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	63	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C2.4

Area: 0.58 acres (0.00 sq. miles)

Calculate Travel Time, Tt

Sheet Flow

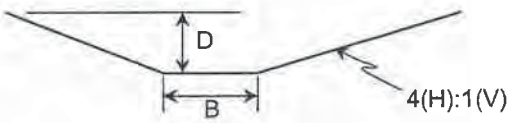
Pt. 103 to Pt. 104	Flow Length, L	126.6	feet		Pt. 104 to Pt. 117	Flow Length, L	173.4	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.1	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.187	hrs	Ref Eq. 8		Travel Time, Tt	0.316	

C2.4 Shallow, Concentrated Flow

Pt. 117 to Pt. 118	Flow Length, L	15.5	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
Pt. 108 to Pt. 119	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6



Total Travel Time: 0.552 hrs — Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area C2.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.509	hrs	From calculations above
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.5828	cu ft/sec	Eq. 10
Area C2.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.503	hrs	From calculations above
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.58	cu ft/sec	Eq. 10
Area C2.4	I_a/P	0.095	in.	
	Time of Conc. Tc	0.552	hrs	From calculations above
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.83	cu ft/sec	Eq. 10
Area C4.2 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.601	hrs	Tt + Tc for Area C4.2 (pg. 60)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.30	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	64	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C4.3 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.650	hrs	Tt + Tc for Area C4.3 (pg. 60)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.44	cu ft/sec	Eq. 10
Area C4.1 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.306	hrs	Tt + Tc for Area C4.1 (pg. 60)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.35	cu ft/sec	Eq. 10
Area C3.2 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.612	hrs	Tt + Tc for Area A3.2 (pg. 61)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.14	cu ft/sec	Eq. 10
Area C3.3 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.616	hrs	Tt + Tc for Area C3.3 (pg. 61)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.20	cu ft/sec	Eq. 10
Area C3.4 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.647	hrs	Tt + Tc for Area C3.4 (pg. 61)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.24	cu ft/sec	Eq. 10
Area C3.1 (from pt. 108 to Pt. 119)	Flow Length, L	385		
	Travel Time, Tt	0.047	hrs	Ref Eq. 6
	Time of Conc. Tc	0.348	hrs	Tt + Tc for Area C3.1 (pg. 60)
	Unit Peak Disch. q_u	565	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	8.64	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	22	sq ft	
Peak Discharge, qp	41.30	cu ft/sec	
Peak Velocity	1.8772	ft/sec	
	82%	of Calculated Channel Flow Velocity	

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	65	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas C2.1

Area 1.99 acres 0.00 sq. miles

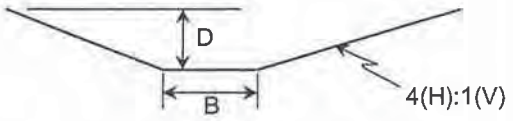
Calculate Travel Time, Tt

Sheet Flow

C2.1	**Pt. 110 to Pt. 119**	Flow Length, L	300	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.259	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

		Channel Depth, D	2	feet	
		Channel Width, B	4	feet	
		X-Section Area, a	24	sq ft	
	Pt. 119 to Pt. 120	Wetted Perimeter, p_w	20.5	feet	
		Hydraulic Radus, r	1.171	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.341	ft/sec	Ref Eq. 9
		Flow Length, L	360		
		Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Total Travel Time		0.301	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area C2.1		Time of Conc. Tc	0.301	hrs	From calculations above
		Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	7.93	cu ft/sec	Eq. 10
Area C4.2 (from pt. 119 to Pt. 120)		Flow Length, L	360		
		Travel Time, Tt	0.043	hrs	Ref Eq. 6
		Time of Conc. Tc	0.644	hrs	Tt + Tc for Area C4.2 (pg. 63)
		Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10
Area C4.3 (from pt. 119 to Pt. 120)		Flow Length, L	360		
		Travel Time, Tt	0.043	hrs	Ref Eq. 6
		Time of Conc. Tc	0.693	hrs	Tt + Tc for Area C4.3 (pg. 64)
		Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.38	cu ft/sec	Eq. 10
Area C4.1 (from pt. 119 to Pt. 120)		Flow Length, L	360		
		Travel Time, Tt	0.043	hrs	Ref Eq. 6
		Time of Conc. Tc	0.349	hrs	Tt + Tc for Area C4.1 (pg. 64)
		Unit Peak Disch. q_u	475	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.18	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	66	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C3.2 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.654	hrs	Tt + Tc for Area C3.2 (pg. 64)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.93	cu ft/sec	Eq. 10
Area C3.3 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.659	hrs	Tt + Tc for Area C3.3 (pg. 64)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.99	cu ft/sec	Eq. 10
Area C3.4 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.690	hrs	Tt + Tc for Area C3.4 (pg. 64)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.21	cu ft/sec	Eq. 10
Area C3.1 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.390	hrs	Tt + Tc for Area C3.1 (pg. 64)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.96	cu ft/sec	Eq. 10
Area C2.2 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.551	hrs	Tt + Tc for Area C2.2 (pg. 63)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.47	cu ft/sec	Eq. 10
Area C2.3 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.545	hrs	Tt + Tc for Area C2.3 (pg. 63)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.54	cu ft/sec	Eq. 10
Area C2.4 (from pt. 119 to Pt. 120)	Flow Length, L	360		
	Travel Time, Tt	0.043	hrs	Ref Eq. 6
	Time of Conc. Tc	0.594	hrs	Tt + Tc for Area C2.3 (pg. 63)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.36	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 67	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	47.96	cu ft/sec
Peak Velocity	1.9985	ft/sec
	85%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	68	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C1.2

Area 1.98 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

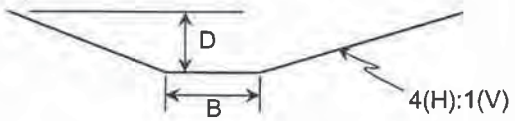
Pt. 121 to Pt. 122	Flow Length, L	130.8	feet		**Pt. 122 to Pt. 123**	Flow Length, L	169.2	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.133	hrs	Ref Eq. 8		Travel Time, Tt	0.310	

C1.2

Shallow,Concentrated Flow

Pt. 123 to Pt. 124	Flow Length, L	151.3	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.013	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	7	feet	
	X-Section Area, a	30	sq ft	
Pt. 120 to Pt. 133	Wetted Perimeter, p_w	23.5	feet	
	Hydraulic Radus, r	1.277	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.480	ft/sec	Ref Eq. 9
	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
Total Travel Time		0.483	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area C1.3

Area 1.85 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

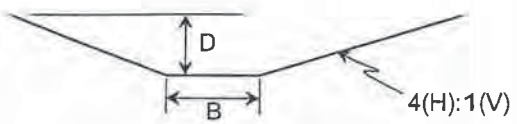
Pt. 125 to Pt.126	Flow Length, L	119.3	feet		**Pt. 126 to Pt. 127**	Flow Length, L	180.7	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.327	

C1.3

Shallow,Concentrated Flow

Pt. 127 to Pt. 128	Flow Length, L	85.4	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.007	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	7	feet	
	X-Section Area, a	30	sq ft	
Pt. 120 to Pt. 133	Wetted Perimeter, p_w	23.5	feet	
	Hydraulic Radus, r	1.277	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.480	ft/sec	Ref Eq. 9
	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
Total Travel Time		0.485	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	69	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area C1.4

Area 1.08 acres 0.00 sq. miles

Calculate Travel Time, Tt

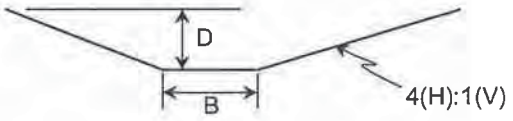
Sheet Flow

Pt. 129 to Pt. 130	Flow Length, L	101.8	feet		Pt. 130 to Pt. 131	Flow Length, L	198.2	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.1	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.157	hrs	Ref Eq. 8		Travel Time, Tt	0.352	

C1.4 Shallow,Concentrated Flow

Pt. 131 to Pt. 132	Flow Length, L	25.1	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.002	hrs	Ref Eq. 6

Open Channel Flow



Pt. 120 to Pt. 133	Channel Depth, D	2	feet	
	Channel Width, B	7	feet	
	X-Section Area, a	30	sq ft	
	Wetted Perimeter, p_w	23.5	feet	
	Hydraulic Radus, r	1.277	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.480	ft/sec	Ref Eq. 9
	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
Total Travel Time		0.538	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area C1.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.483	hrs	From calculations above
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.5479	cu ft/sec	Eq. 10
Area C1.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.485	hrs	From calculations above
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.12	cu ft/sec	Eq. 10
Area C1.4	I_a/P	0.095	in.	
	Time of Conc. Tc	0.538	hrs	From calculations above
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.40	cu ft/sec	Eq. 10
Area C4.2 (from pt. 120 to Pt. 133)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.671	hrs	Tt + Tc for Area C4.2 (pg. 65)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	70	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area	Flow Length, L	240		
C4.3	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.720	hrs	Tt + Tc for Area C4.3 (pg. 65)
pt. 120	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	2.34	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C4.1	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.376	hrs	Tt + Tc for Area C4.1 (pg. 65)
pt. 120	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	3.05	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C3.2	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.681	hrs	Tt + Tc for Area C3.2 (pg. 66)
pt. 120	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	4.87	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C3.3	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.686	hrs	Tt + Tc for Area C3.3 (pg. 66)
pt. 120	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	4.92	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C3.4	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.716	hrs	Tt + Tc for Area C3.4 (pg. 66)
pt. 120	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	2.14	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C3.1	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.417	hrs	Tt + Tc for Area C3.1 (pg. 66)
pt. 120	Unit Peak Disch. q_u	445	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	6.81	cu ft/sec	Eq. 10

Area	Flow Length, L	240		
C2.2	Travel Time, Tt	0.027	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.578	hrs	Tt + Tc for Area C2.2 (pg. 66)
pt. 120	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
133)	Peak Discharge, q_p	4.41	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	71	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C2.3 (from pt. 120 to Pt. 133)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.572	hrs	Tt + Tc for Area C2.3 (pg. 66)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.45	cu ft/sec	Eq. 10
Area C2.4 (from pt. 120 to Pt. 133)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.621	hrs	Tt + Tc for Area C2.3 (pg. 66)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.32	cu ft/sec	Eq. 10
Area C2.1 (from pt. 120 to Pt. 133)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.328	hrs	Tt + Tc for Area C2.1 (pg. 65)
	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	8.72	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	30	sq ft
Peak Discharge, qp	64.11	cu ft/sec
Peak Velocity	2.1371	ft/sec
	86%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	72	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Areas C1.1

Area 1.25 acres 0.00 sq. miles

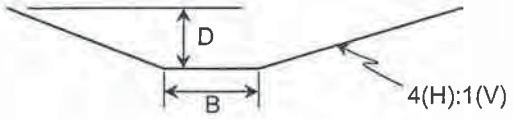
Calculate Travel Time, Tt

Sheet Flow

C1.1	Pt. 122 to Pt. 133	Flow Length, L	175	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.168	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

	Pt. 133 to Pt. 134	Channel Depth, D	2	feet	
		Channel Width, B	7	feet	
		X-Section Area, a	30	sq ft	
		Wetted Perimeter, p_w	23.5	feet	
		Hydraulic Radus, r	1.277	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.480	ft/sec	Ref Eq. 9
		Flow Length, L	240		
		Travel Time, Tt	0.027	hrs	Ref Eq. 6
Total Travel Time			0.195	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area C1.1		Time of Conc. Tc	0.195	hrs	From calculations above
		Unit Peak Disch. q_u	560	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	5.58	cu ft/sec	Eq. 10
Area C4.2 (from pt. 133 to Pt. 134)		Flow Length, L	240		
		Travel Time, Tt	0.027	hrs	Ref Eq. 6
		Time of Conc. Tc	0.698	hrs	Tt + Tc for Area C4.2 (pg. 69)
		Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.96	cu ft/sec	Eq. 10
Area C4.3 (from pt. 133 to Pt. 134)		Flow Length, L	240		
		Travel Time, Tt	0.027	hrs	Ref Eq. 6
		Time of Conc. Tc	0.747	hrs	Tt + Tc for Area C4.3 (pg. 70)
		Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.31	cu ft/sec	Eq. 10
Area C4.1 (from pt. 133 to Pt. 134)		Flow Length, L	240		
		Travel Time, Tt	0.027	hrs	Ref Eq. 6
		Time of Conc. Tc	0.403	hrs	Tt + Tc for Area C4.1 (pg. 70)
		Unit Peak Disch. q_u	450	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.01	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	73	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Area C3.2 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.708	hrs	Tt + Tc for Area C3.2 (pg. 70)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.87	cu ft/sec	Eq. 10
Area C3.3 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.713	hrs	Tt + Tc for Area C3.3 (pg. 70)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.92	cu ft/sec	Eq. 10
Area C3.4 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.743	hrs	Tt + Tc for Area C3.4 (pg. 70)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.11	cu ft/sec	Eq. 10
Area C3.1 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.444	hrs	Tt + Tc for Area C3.1 (pg. 70)
	Unit Peak Disch. q_u	435	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.66	cu ft/sec	Eq. 10
Area C2.2 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.605	hrs	Tt + Tc for Area C2.2 (pg. 70)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.30	cu ft/sec	Eq. 10
Area C2.3 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.599	hrs	Tt + Tc for Area C2.3 (pg. 71)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.36	cu ft/sec	Eq. 10
Area C2.4 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.648	hrs	Tt + Tc for Area C2.4 (pg. 71)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.18	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	74	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area C2.1 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.355	hrs	Tt + Tc for Area C2.1 (pg. 71)
	Unit Peak Disch. q_u	475	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	7.53	cu ft/sec	Eq. 10
Area C1.2 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.510	hrs	Tt + Tc for Area C1.2 (pg. 69)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.39	cu ft/sec	Eq. 10
Area C1.3 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.512	hrs	Tt + Tc for Area C1.3 (pg. 69)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.97	cu ft/sec	Eq. 10
Area C1.4 (from pt. 133 to Pt. 134)	Flow Length, L	240		
	Travel Time, Tt	0.027	hrs	Ref Eq. 6
	Time of Conc. Tc	0.565	hrs	Tt + Tc for Area C1.4 (pg. 69)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.31	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	30	sq ft	
Peak Discharge, qp	67.47	cu ft/sec	
Peak Velocity	2.249	ft/sec	
	91%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	75	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

EASTERN SIDE

Calculate Peak Discharge from Area D6.2

Area 1.38 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

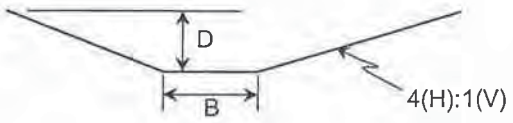
D6.2

Pt. 40 to Pt. 41	Flow Length, L	119.8	feet		**Pt. 41 to Pt. 137**	Flow Length, L	180.2	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.326	

Shallow,Concentrated Flow

Pt. 137 to Pt. 138	Flow Length, L	69.8	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 136 to Pt. 142	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	260		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
Total Travel Time		0.491	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area D6.3

Area 0.83 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

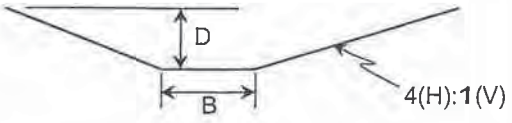
D6.3

Pt. 88 to Pt. 139	Flow Length, L	60.7	feet		**Pt. 139 to Pt. 140**	Flow Length, L	239.3	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.072	hrs	Ref Eq. 8		Travel Time, Tt	0.409	

Shallow,Concentrated Flow

Pt. 140 to Pt. 141	Flow Length, L	10.7	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 136 to Pt. 142	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	260		
	Travel Time, Tt	0.035	hrs	Ref Eq. 6
Total Travel Time		0.517	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 76	of 110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Calculate Peak Discharge

Area D6.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.491	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.5087	cu ft/sec	Eq. 10
Area D6.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.517	hrs	From calculations above
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.68	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	7.19	cu ft/sec
Peak Velocity	0.4492	ft/sec
	22%	of Calculated Channel Flow Velocity

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	77	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area D6.1

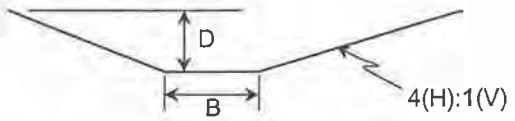
Area 1.34 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D6.1	Pt. 143 to Pt. 142	Flow Length, L	165	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.160	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow



Pt. 142 to Pt. 144	Channel Depth, D	2	feet		
	Channel Width, B	0	feet		
	X-Section Area, a	16	sq ft		
	Wetted Perimeter, p_w	16.5	feet		
	Hydraulic Radus, r	0.970	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.065	ft/sec	Ref Eq. 9	
	Flow Length, L	250			
	Travel Time, Tt	0.034	hrs	Ref Eq. 6	
Total Travel Time		0.194	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area D6.1	Time of Conc. Tc	0.194	hrs	From calculations above
	Unit Peak Disch. q_u	600	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	6.41	cu ft/sec	Eq. 10

Area D6.2 (from pt. 142 to Pt. 144)	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.525	hrs	Tt + Tc for Area D6.2 (pg. 76)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.40	cu ft/sec	Eq. 10

Area D6.3 (from pt. 142 to Pt. 144)	Flow Length, L	250		
	Travel Time, Tt	0.034	hrs	Ref Eq. 6
	Time of Conc. Tc	0.551	hrs	Tt + Tc for Area D6.3 (pg. 76)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.61	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	13.42	cu ft/sec
Peak Velocity	0.8386	ft/sec
	41%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	78	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Area D5.2

Area 1.06 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 145 to Pt. 143	Flow Length, L	119.9	feet		**Pt. 143 to Pt. 146**	Flow Length, L	180.1	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.326	

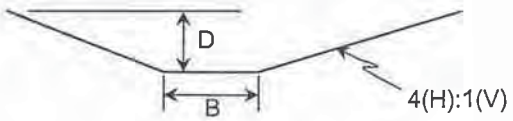
D5.2

Shallow,Concentrated Flow

Pt. 146 to Pt. 147	Flow Length, L	69.9	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 142 to Pt. 151	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
Total Travel Time		0.475	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge from Area D5.3

Area 0.87 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 88 to Pt. 139	Flow Length, L	60.7	feet		**Pt. 139 to Pt. 148**	Flow Length, L	239.3	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.072	hrs	Ref Eq. 8		Travel Time, Tt	0.409	

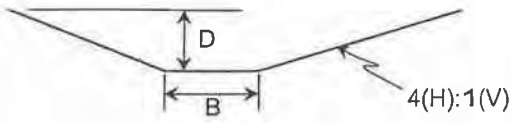
D5.3

Shallow,Concentrated Flow

Pt. 148 to Pt. 149	Flow Length, L	10.7	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 142 to Pt. 151	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
Total Travel Time		0.501	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	79	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge

Area D5.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.475	hrs	From calculations above
	Unit Peak Disch. q_u	415	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.51	cu ft/sec	Eq. 10
Area D5.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.501	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.84	cu ft/sec	Eq. 10
Area D6.2 (from pt. 142 to Pt. 151)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.544	hrs	Tt + Tc for Area D6.2 (pg. 77)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.40	cu ft/sec	Eq. 10
Area D6.3 (from pt. 142 to Pt. 151)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.570	hrs	Tt + Tc for Area D6.3 (pg. 77)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.61	cu ft/sec	Eq. 10
Area D6.1 (from pt. 142 to Pt. 151)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.213	hrs	Tt + Tc for Area D6.1 (pg. 77)
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.93	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	19.29	cu ft/sec
Peak Velocity	1.2053	ft/sec
	58%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	80	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D5.1

Area 0.65 acres 0.00 sq. miles

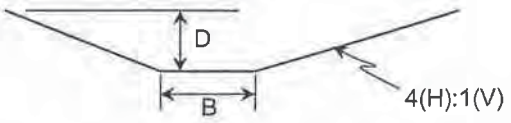
Calculate Travel Time, Tt

Sheet Flow

D5.1	Pt. 150 to Pt. 151	Flow Length, L	140	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.141	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

		Channel Depth, D	2	feet	
		Channel Width, B	0	feet	
		X-Section Area, a	16	sq ft	
	Pt. 151 to Pt. 152	Wetted Perimeter, p_w	16.5	feet	
		Hydraulic Radus, r	0.970	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.065	ft/sec	Ref Eq. 9
		Flow Length, L	140		
		Travel Time, Tt	0.019	hrs	Ref Eq. 6
Total Travel Time			0.159	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area D5.1		Time of Conc. Tc	0.159	hrs	From calculations above
		Unit Peak Disch. q_u	600	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.11	cu ft/sec	Eq. 10
Area D6.2 (from pt. 151 to Pt. 152)		Flow Length, L	140		
		Travel Time, Tt	0.019	hrs	Ref Eq. 6
		Time of Conc. Tc	0.563	hrs	Tt + Tc for Area D6.2 (pg. 79)
		Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.29	cu ft/sec	Eq. 10
Area D6.3 (from pt. 151 to Pt. 152)		Flow Length, L	140		
		Travel Time, Tt	0.019	hrs	Ref Eq. 6
		Time of Conc. Tc	0.589	hrs	Tt + Tc for Area D6.3 (pg. 79)
		Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.55	cu ft/sec	Eq. 10
Area C6.1 (from pt. 151 to Pt. 152)		Flow Length, L	140		
		Travel Time, Tt	0.019	hrs	Ref Eq. 6
		Time of Conc. Tc	0.232	hrs	Tt + Tc for Area D6.1 (pg. 79)
		Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	5.87	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	81	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.2 (from pt. 151 to Pt. 152)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.494	hrs	Tt + Tc for Area D5.2 (pg. 79)
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.46	cu ft/sec	Eq. 10
Area D5.3 (from pt. 151 to Pt. 152)	Flow Length, L	140		
	Travel Time, Tt	0.019	hrs	Ref Eq. 6
	Time of Conc. Tc	0.520	hrs	Tt + Tc for Area D5.3 (pg. 79)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.74	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	22.02	cu ft/sec
Peak Velocity	1.3761	ft/sec
	67%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	82	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Area D4.2

Area 0.91 acres 0.00 sq. miles

Calculate Travel Time, Tt

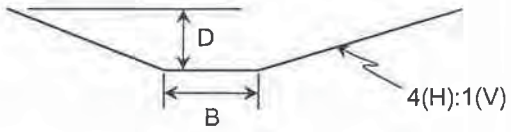
Sheet Flow

Pt. 153 to Pt. 154	Flow Length, L	121.75	feet		**Pt. 154 to Pt. 155**	Flow Length, L	178.25	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.126	hrs	Ref Eq. 8		Travel Time, Tt	0.324	

D4.2 Shallow, Concentrated Flow

Pt. 155 to Pt. 156	Flow Length, L	66.75	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 152 to Pt. 163	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
Total Travel Time		0.485	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Area D4.3

Area 1.18 acres 0.00 sq. miles

Calculate Travel Time, Tt

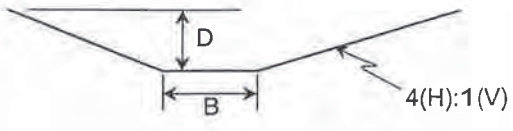
Sheet Flow

Pt. 157 to Pt.158	Flow Length, L	119.5	feet		**Pt. 158 to Pt. 159**	Flow Length, L	180.5	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.327	

D4.3 Shallow, Concentrated Flow

Pt. 159 to Pt. 160	Flow Length, L	67.8	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	0	feet	
	X-Section Area, a	16	sq ft	
Pt. 152 to Pt. 163	Wetted Perimeter, p_w	16.5	feet	
	Hydraulic Radus, r	0.970	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.065	ft/sec	Ref Eq. 9
	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
Total Travel Time		0.487	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	83	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area D4.4

Area 0.84 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D4.4 — Pt. 161 to Pt. 157

Flow Length, L	49.6	feet
Two-yr 24 hr rainfall, P_2	4.9	inches
Land Slope, s	0.1	ft/ft
Travel Time, Tt	0.088	hrs

Ref Eq. 8

Pt. 157 to Pt. 162

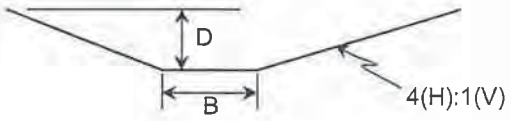
Flow Length, L	245	feet
Two-yr 24 hr rainfal	5.9	
Land Slope, s	0.04	ft/ft
Travel Time, Tt	0.417	

Open Channel Flow — Pt. 152 to Pt. 163

Channel Depth, D	2	feet
Channel Width, B	0	feet
X-Section Area, a	16	sq ft
Wetted Perimeter, p_w	16.5	feet
Hydraulic Radus, r	0.970	ft
Channel Slope	0.005	ft/ft
Velocity, V	2.065	ft/sec
Flow Length, L	225	
Travel Time, Tt	0.030	hrs

Ref Eq. 9

Ref Eq. 6



Total Travel Time 0.536 hrs — Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area D4.2

I_a/P	0.095	in.
Time of Conc. Tc	0.485	hrs
Unit Peak Disch. q_u	40	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	0.2901	cu ft/sec

From calculations above; Ref. Figure 6-3 "Unit peak discharge" Use Type III; From pg. 1; Eq. 10

Area D4.3

I_a/P	0.095	in.
Time of Conc. Tc	0.487	hrs
Unit Peak Disch. q_u	410	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	3.86	cu ft/sec

From calculations above; Ref. Figure 6-3 "Unit peak discharge" Use Type III; From pg. 1; Eq. 10

Area D4.4

I_a/P	0.095	in.
Time of Conc. Tc	0.536	hrs
Unit Peak Disch. q_u	400	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	2.68	cu ft/sec

From calculations above; Ref. Figure 6-3 "Unit peak discharge" Use Type III; From pg. 1; Eq. 10

Area D6.2 (from pt. 152 to Pt. 163)

Flow Length, L	225	
Travel Time, Tt	0.030	hrs
Time of Conc. Tc	0.593	hrs
Unit Peak Disch. q_u	390	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	4.29	cu ft/sec

Ref Eq. 6; Tt + Tc for Area D6.2 (pg. 80); Ref. Figure 6-3 "Unit peak discharge" Use Type III; From pg. 1; Eq. 10

Area D6.3 (from pt. 152 to Pt. 163)

Flow Length, L	225	
Travel Time, Tt	0.030	hrs
Time of Conc. Tc	0.619	hrs
Unit Peak Disch. q_u	380	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	2.51	cu ft/sec

Ref Eq. 6; Tt + Tc for Area D6.3 (pg. 80); Ref. Figure 6-3 "Unit peak discharge" Use Type III; From pg. 1; Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	84	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D6.1 (from pt. 152 to Pt. 163)	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.262	hrs	Tt + Tc for Area D6.1 (pg. 80)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.50	cu ft/sec	Eq. 10
Area D5.2 (from pt. 152 to Pt. 163)	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.524	hrs	Tt + Tc for Area D5.2 (pg. 81)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.38	cu ft/sec	Eq. 10
Area D5.3 (from pt. 152 to Pt. 163)	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.550	hrs	Tt + Tc for Area D5.3 (pg. 81)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.74	cu ft/sec	Eq. 10
Area D5.1 (from pt. 152 to Pt. 163)	Flow Length, L	225		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.190	hrs	Tt + Tc for Area D5.1 (pg. 80)
	Unit Peak Disch. q_u	575	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.98	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	16	sq ft
Peak Discharge, qp	28.22	cu ft/sec
Peak Velocity	1.7637	ft/sec
	85%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	85	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D4.1

Area 1.22 acres 0.00 sq. miles

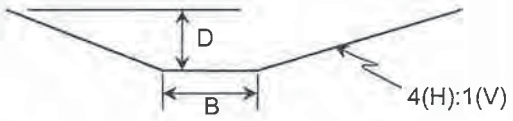
Calculate Travel Time, Tt

Sheet Flow

D4.1	Pt. 164 to Pt. 163	Flow Length, L	175	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.168	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

		Channel Depth, D	2	feet	
		Channel Width, B	2	feet	
		X-Section Area, a	20	sq ft	
	Pt. 163 to Pt. 165	Wetted Perimeter, p_w	18.5	feet	
		Hydraulic Radus, r	1.082	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.220	ft/sec	Ref Eq. 9
		Flow Length, L	225		
		Travel Time, Tt	0.028	hrs	Ref Eq. 6
Total Travel Time			0.196	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area D4.1		Time of Conc. Tc	0.196	hrs	From calculations above
		Unit Peak Disch. q_u	560	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	5.44	cu ft/sec	Eq. 10
Area D6.2 (from pt. 163 to Pt. 165)		Flow Length, L	225		
		Travel Time, Tt	0.028	hrs	Ref Eq. 6
		Time of Conc. Tc	0.621	hrs	Tt + Tc for Area D6.2 (pg. 83)
		Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.07	cu ft/sec	Eq. 10
Area D6.3 (from pt. 163 to Pt. 165)		Flow Length, L	225		
		Travel Time, Tt	0.028	hrs	Ref Eq. 6
		Time of Conc. Tc	0.647	hrs	Tt + Tc for Area D6.3 (pg. 83)
		Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.41	cu ft/sec	Eq. 10
Area D6.1 (from pt. 163 to Pt. 165)		Flow Length, L	225		
		Travel Time, Tt	0.028	hrs	Ref Eq. 6
		Time of Conc. Tc	0.290	hrs	Tt + Tc for Area D6.1 (pg. 84)
		Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	5.34	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	86	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.2 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.553	hrs	Tt + Tc for Area D5.2 (pg. 84)
	Unit Peak Disch. q_u	395	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.34	cu ft/sec	Eq. 10
Area D5.3 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.579	hrs	Tt + Tc for Area D5.3 (pg. 84)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.70	cu ft/sec	Eq. 10
Area D5.1 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.218	hrs	Tt + Tc for Area D5.1 (pg. 84)
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.87	cu ft/sec	Eq. 10
Area D4.2 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.513	hrs	Tt + Tc for Area D4.2 (pg. 83)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.94	cu ft/sec	Eq. 10
Area D4.3 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.515	hrs	Tt + Tc for Area D4.3 (pg. 83)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.81	cu ft/sec	Eq. 10
Area D4.4 (from pt. 163 to Pt. 165)	Flow Length, L	225		
	Travel Time, Tt	0.028	hrs	Ref Eq. 6
	Time of Conc. Tc	0.564	hrs	Tt + Tc for Area D4.3 (pg. 83)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.67	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	20	sq ft
Peak Discharge, qp	36.59	cu ft/sec
Peak Velocity	1.8297	ft/sec
	82%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	87	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area D3.2

Area	1.15	acres	0.00	sq. miles

Calculate Travel Time, Tt

Sheet Flow

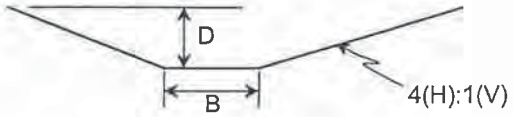
Pt. 153 to Pt. 154	Flow Length, L	121.75	feet		**Pt. 154 to Pt. 166**	Flow Length, L	178.25	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.126	hrs	Ref Eq. 8		Travel Time, Tt	0.324	

D3.2 Shallow,Concentrated Flow

Pt. 166 to Pt. 167	Flow Length, L	66.75	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow

Pt. 165 to Pt. 172	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time		0.479	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge from Area D3.3

Area	1.43	acres	0.00	sq. miles

Calculate Travel Time, Tt

Sheet Flow

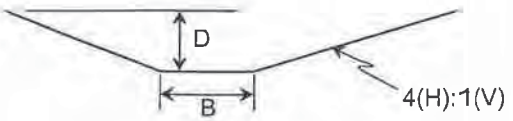
Pt. 157 to Pt.158	Flow Length, L	119.5	feet		**Pt. 158 to Pt. 168**	Flow Length, L	180.5	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft			Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.124	hrs	Ref Eq. 8		Travel Time, Tt	0.327	

D3.3 Shallow,Concentrated Flow

Pt. 168 to Pt. 169	Flow Length, L	70.9	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.006	hrs	Ref Eq. 6

Open Channel Flow

Pt. 165 to Pt. 172	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time		0.481	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	88	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Area D3.4

Area 0.45 acres 0.00 sq. miles

Calculate Travel Time, Tt

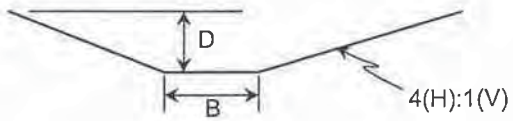
Sheet Flow

Pt. 161 to Pt. 157	Flow Length, L	49.6	feet		**Pt. 157 to Pt. 170**	Flow Length, L	250.4	feet	
	Two-yr 24 hr rainfall, P_2	4.9	inches			Two-yr 24 hr rainfal	5.9		
	Land Slope, s	0.1	ft/ft			Land Slope, s	0.04	ft/ft	
	Travel Time, Tt	0.088	hrs	Ref Eq. 8		Travel Time, Tt	0.425		

Shallow,Concentrated Flow

D3.4 **Pt. 170 to Pt. 171**	Flow Length, L	11.3	feet	
	Watercourse slope, s	0.04	ft/ft	
	Avg. Velocity, V.	3.2	ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.001	hrs	Ref Eq. 6

Open Channel Flow



	Channel Depth, D	2	feet	
	Channel Width, B	3	feet	
	X-Section Area, a	22	sq ft	
Pt. 165 to Pt. 172	Wetted Perimeter, p_w	19.5	feet	
	Hydraulic Radus, r	1.129	ft	
	Channel Slope	0.005	ft/ft	
	Velocity, V	2.284	ft/sec	Ref Eq. 9
	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time		0.538	hrs	Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area D3.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.479	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.7573	cu ft/sec	Eq. 10
Area D3.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.481	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.67	cu ft/sec	Eq. 10
Area D3.4	I_a/P	0.095	in.	
	Time of Conc. Tc	0.538	hrs	From calculations above
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.43	cu ft/sec	Eq. 10
Area D6.2 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.646	hrs	Tt + Tc for Area D6.2 (pg. 85)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.01	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	89	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D6.3 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.671	hrs	Tt + Tc for Area D6.3 (pg. 85)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.38	cu ft/sec	Eq. 10
Area D6.1 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.314	hrs	Tt + Tc for Area D6.1 (pg. 86)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.29	cu ft/sec	Eq. 10
Area D5.2 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.577	hrs	Tt + Tc for Area D5.2 (pg. 86)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.29	cu ft/sec	Eq. 10
Area D5.3 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.603	hrs	Tt + Tc for Area D5.3 (pg. 86)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.67	cu ft/sec	Eq. 10
Area D5.1 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.242	hrs	Tt + Tc for Area D5.1 (pg. 86)
	Unit Peak Disch. q_u	540	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.80	cu ft/sec	Eq. 10
Area D4.2 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.538	hrs	Tt + Tc for Area D4.2 (pg. 86)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.90	cu ft/sec	Eq. 10
Area D4.3 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.539	hrs	Tt + Tc for Area D4.3 (pg. 86)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.76	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	90	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Area D4.4 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.588	hrs	Tt + Tc for Area D4.4 (pg. 86)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.62	cu ft/sec	Eq. 10
Area D4.1 (from pt. 165 to Pt. 172)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.221	hrs	Tt + Tc for Area D4.1 (pg. 85)
	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.35	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	22	sq ft	
Peak Discharge, qp	45.93	cu ft/sec	
Peak Velocity	2.0879	ft/sec	
	91%	of Calculated Channel Flow Velocity	

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	91	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D3.1

Area 0.98 acres 0.00 sq. miles

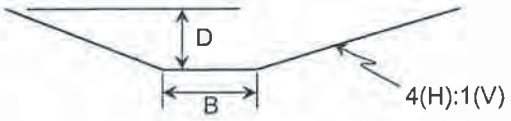
Calculate Travel Time, Tt

Sheet Flow

D3.1	Pt. 173 to Pt. 172	Flow Length, L	150	feet		Flow Length, L	0	feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.149	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

		Channel Depth, D	2	feet	
		Channel Width, B	4	feet	
		X-Section Area, a	24	sq ft	
	Pt. 172 to Pt. 174	Wetted Perimeter, p_w	20.5	feet	
		Hydraulic Radus, r	1.171	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.341	ft/sec	Ref Eq. 9
		Flow Length, L	200		
		Travel Time, Tt	0.024	hrs	Ref Eq. 6
Total Travel Time			0.172	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
Area D3.1		Time of Conc. Tc	0.172	hrs	From calculations above
		Unit Peak Disch. q_u	590	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.61	cu ft/sec	Eq. 10
Area D6.2 (from pt. 172 to Pt. 174)		Flow Length, L	200		
		Travel Time, Tt	0.024	hrs	Ref Eq. 6
		Time of Conc. Tc	0.669	hrs	Tt + Tc for Area D6.2 (pg. 88)
		Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.96	cu ft/sec	Eq. 10
Area D6.3 (from pt. 172 to Pt. 174)		Flow Length, L	200		
		Travel Time, Tt	0.024	hrs	Ref Eq. 6
		Time of Conc. Tc	0.695	hrs	Tt + Tc for Area D6.3 (pg. 89)
		Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.35	cu ft/sec	Eq. 10
Area D6.1 (from pt. 172 to Pt. 174)		Flow Length, L	200		
		Travel Time, Tt	0.024	hrs	Ref Eq. 6
		Time of Conc. Tc	0.338	hrs	Tt + Tc for Area D6.1 (pg. 89)
		Unit Peak Disch. q_u	475	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	5.07	cu ft/sec	Eq. 10

Area D5.2 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.601	hrs	Tt + Tc for Area D5.2 (pg. 89)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.21	cu ft/sec	Eq. 10
Area D5.3 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.627	hrs	Tt + Tc for Area D5.3 (pg. 89)
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.57	cu ft/sec	Eq. 10
Area D5.1 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.266	hrs	Tt + Tc for Area D5.1 (pg. 89)
	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.67	cu ft/sec	Eq. 10
Area D4.2 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.562	hrs	Tt + Tc for Area D4.2 (pg. 89)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.83	cu ft/sec	Eq. 10
Area D4.3 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.563	hrs	Tt + Tc for Area D4.3 (pg. 89)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.67	cu ft/sec	Eq. 10
Area D4.4 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.612	hrs	Tt + Tc for Area D4.3 (pg. 90)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.53	cu ft/sec	Eq. 10
Area D4.1 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.244	hrs	Tt + Tc for Area D4.1 (pg. 90)
	Unit Peak Disch. q_u	540	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	5.25	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	93	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D3.2 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.503	hrs	Tt + Tc for Area D3.2 (pg. 89)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.71	cu ft/sec	Eq. 10
Area D3.3 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.505	hrs	Tt + Tc for Area D3.3 (pg. 89)
	Unit Peak Disch. q_u	405	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.62	cu ft/sec	Eq. 10
Area D3.4 (from pt. 172 to Pt. 174)	Flow Length, L	200		
	Travel Time, Tt	0.024	hrs	Ref Eq. 6
	Time of Conc. Tc	0.562	hrs	Tt + Tc for Area D3.4 (pg. 89)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.40	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	49.43	cu ft/sec
Peak Velocity	2.0594	ft/sec
	88%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	94	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D2.2

Area 0.57 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D2.2 — Pt. 175 to Pt. 176

Flow Length, L	125.8	feet
Two-yr 24 hr rainfall, P_2	4.9	inches
Land Slope, s	0.25	ft/ft
Travel Time, Tt	0.129	hrs

Ref Eq. 8

Pt. 176 to Pt. 177

Flow Length, L	112.1	feet
Two-yr 24 hr rainfal	5.9	
Land Slope, s	0.04	ft/ft
Travel Time, Tt	0.223	

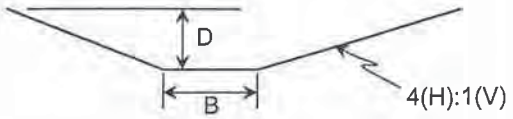
Open Channel Flow

Pt. 174 to Pt. 178

Channel Depth, D	2	feet
Channel Width, B	4	feet
X-Section Area, a	24	sq ft
Wetted Perimeter, p_w	20.5	feet
Hydraulic Radus, r	1.171	ft
Channel Slope	0.005	ft/ft
Velocity, V	2.341	ft/sec
Flow Length, L	255	
Travel Time, Tt	0.030	hrs

Ref Eq. 9

Ref Eq. 6



Total Travel Time	0.383	hrs

Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area D2.2

I_a/P	0.095	in.
Time of Conc. Tc	0.383	hrs
Unit Peak Disch. q_u	455	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	2.07	cu ft/sec

From calculations above

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

Area D6.2 (from pt. 174 to Pt. 178)

Flow Length, L	255	
Travel Time, Tt	0.030	hrs
Time of Conc. Tc	0.700	hrs
Unit Peak Disch. q_u	355	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	3.90	cu ft/sec

Ref Eq. 6

Tt + Tc for Area D6.2 (pg. 91)

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

Area D6.3 (from pt. 174 to Pt. 178)

Flow Length, L	255	
Travel Time, Tt	0.030	hrs
Time of Conc. Tc	0.725	hrs
Unit Peak Disch. q_u	350	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	2.31	cu ft/sec

Ref Eq. 6

Tt + Tc for Area D6.3 (pg. 91)

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

Area D6.1 (from pt. 174 to Pt. 178)

Flow Length, L	255	
Travel Time, Tt	0.030	hrs
Time of Conc. Tc	0.368	hrs
Unit Peak Disch. q_u	455	csm/in
Runoff, Q	5.1	inches
Peak Discharge, q_p	4.86	cu ft/sec

Ref Eq. 6

Tt + Tc for Area D6.1 (pg. 91)

Ref. Figure 6-3 "Unit peak discharge" Use Type III

From pg. 1

Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	95	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.2 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.631	hrs	Tt + Tc for Area D5.2 (pg. 92)
	Unit Peak Disch. q_u	370	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.13	cu ft/sec	Eq. 10
Area D5.3 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.657	hrs	Tt + Tc for Area D5.3 (pg. 92)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.46	cu ft/sec	Eq. 10
Area D5.1 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.296	hrs	Tt + Tc for Area D5.1 (pg. 92)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.59	cu ft/sec	Eq. 10
Area D4.2 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.592	hrs	Tt + Tc for Area D4.2 (pg. 92)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.79	cu ft/sec	Eq. 10
Area D4.3 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.593	hrs	Tt + Tc for Area D4.3 (pg. 92)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.62	cu ft/sec	Eq. 10
Area D4.4 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.642	hrs	Tt + Tc for Area D4.3 (pg. 92)
	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.39	cu ft/sec	Eq. 10
Area D4.1 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.275	hrs	Tt + Tc for Area D4.1 (pg. 92)
	Unit Peak Disch. q_u	510	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.96	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	96	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D3.2 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.533	hrs	Tt + Tc for Area D3.2 (pg. 93)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.67	cu ft/sec	Eq. 10
Area D3.3 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.535	hrs	Tt + Tc for Area D3.3 (pg. 93)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.56	cu ft/sec	Eq. 10
Area D3.4 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.592	hrs	Tt + Tc for Area D3.4 (pg. 93)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.36	cu ft/sec	Eq. 10
Area D3.1 (from pt. 174 to Pt. 178)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.203	hrs	Tt + Tc for Area D3.1 (pg. 91)
	Unit Peak Disch. q_u	555	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.33	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	24	sq ft
Peak Discharge, qp	50.00	cu ft/sec
Peak Velocity	2.0832	ft/sec
	89%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	97	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D2.1

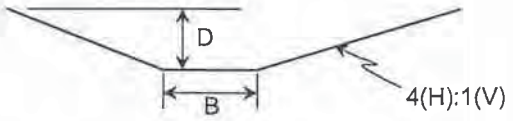
Area 1.14 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D2.1	Pt. 176 to Pt. 178	Flow Length, L	165	feet		Flow Length, L		feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.160	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow



	Channel Depth, D	2	feet		
	Channel Width, B	5	feet		
	X-Section Area, a	26	sq ft		
Pt. 178 to Pt. 179	Wetted Perimeter, p_w	21.5	feet		
	Hydraulic Radus, r	1.210	ft		
	Channel Slope	0.005	ft/ft		
	Velocity, V	2.392	ft/sec	Ref Eq. 9	
	Flow Length, L	255			
	Travel Time, Tt	0.030	hrs	Ref Eq. 6	
Total Travel Time		0.190	hrs	Sum of Sheet, Shallow Concentrated and Open Channel	

Calculate Peak Discharge

	I_a/P	0.095	in.	
Area D2.1	Time of Conc. Tc	0.190	hrs	From calculations above
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.13	cu ft/sec	Eq. 10
Area D6.2 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.729	hrs	Tt + Tc for Area D6.2 (pg. 94)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.85	cu ft/sec	Eq. 10
Area D6.3 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.755	hrs	Tt + Tc for Area D6.3 (pg. 94)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.28	cu ft/sec	Eq. 10
Area D6.1 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.398	hrs	Tt + Tc for Area D6.1 (pg. 94)
	Unit Peak Disch. q_u	450	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.81	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	98	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.2 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.660	hrs	Tt + Tc for Area D5.2 (pg. 95)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.08	cu ft/sec	Eq. 10
Area D5.3 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.686	hrs	Tt + Tc for Area D5.3 (pg. 95)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.43	cu ft/sec	Eq. 10
Area D5.1 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.326	hrs	Tt + Tc for Area D5.1 (pg. 95)
	Unit Peak Disch. q_u	490	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.54	cu ft/sec	Eq. 10
Area D4.2 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.621	hrs	Tt + Tc for Area D4.2 (pg. 95)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.72	cu ft/sec	Eq. 10
Area D4.3 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.623	hrs	Tt + Tc for Area D4.3 (pg. 95)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.53	cu ft/sec	Eq. 10
Area D4.4 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.672	hrs	Tt + Tc for Area D4.3 (pg. 95)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.34	cu ft/sec	Eq. 10
Area D4.1 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.304	hrs	Tt + Tc for Area D4.1 (pg. 95)
	Unit Peak Disch. q_u	495	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.81	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	99	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D3.2 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.563	hrs	Tt + Tc for Area D3.2 (pg. 96)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.57	cu ft/sec	Eq. 10
Area D3.3 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.565	hrs	Tt + Tc for Area D3.3 (pg. 96)
	Unit Peak Disch. q_u	390	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.44	cu ft/sec	Eq. 10
Area D3.4 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.622	hrs	Tt + Tc for Area D3.4 (pg. 96)
	Unit Peak Disch. q_u	375	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.34	cu ft/sec	Eq. 10
Area D3.1 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.232	hrs	Tt + Tc for Area D3.1 (pg. 96)
	Unit Peak Disch. q_u	545	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.26	cu ft/sec	Eq. 10
Area D2.2 (from pt. 178 to Pt. 179)	Flow Length, L	255		
	Travel Time, Tt	0.030	hrs	Ref Eq. 6
	Time of Conc. Tc	0.412	hrs	Tt + Tc for Area D2.2 (pg. 94)
	Unit Peak Disch. q_u	450	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.04	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	26	sq ft
Peak Discharge, qp	53.18	cu ft/sec
Peak Velocity	2.0452	ft/sec
	85%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	100	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge from Areas D1.2

Area 1.15 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D1.2

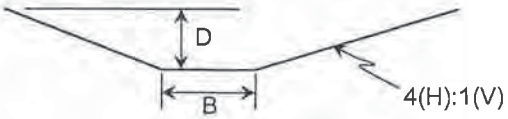
Pt. 121 to Pt. 122				Pt. 122 to Pt. 180			
	Flow Length, L	130.8	feet		Flow Length, L	169.2	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.133	hrs Ref Eq. 8		Travel Time, Tt	0.310	

Shallow,Concentrated Flow

Pt. 180 to Pt. 181	Flow Length, L	152.9	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.013	hrs Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet
	Channel Width, B	7	feet
	X-Section Area, a	30	sq ft
Pt. 179 to Pt. 186	Wetted Perimeter, p_w	23.5	feet
	Hydraulic Radus, r	1.277	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.480	ft/sec Ref Eq. 9
	Flow Length, L	235	
	Travel Time, Tt	0.026	hrs Ref Eq. 6



Total Travel Time 0.483 hrs Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge from Areas D1.3

Area 0.92 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

D1.3

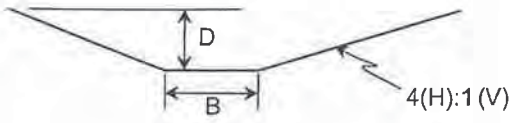
Pt. 182 to Pt. 183				Pt. 183 to Pt. 184			
	Flow Length, L	110.3	feet		Flow Length, L	189.7	feet
	Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
	Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
	Travel Time, Tt	0.116	hrs Ref Eq. 8		Travel Time, Tt	0.340	

Shallow,Concentrated Flow

Pt. 184 to Pt. 185	Flow Length, L	36.3	feet
	Watercourse slope, s	0.04	ft/ft
	Avg. Velocity, V.	3.2	ft/sec Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved
	Travel Time, Tt	0.003	hrs Ref Eq. 6

Open Channel Flow

	Channel Depth, D	2	feet
	Channel Width, B	7	feet
	X-Section Area, a	30	sq ft
Pt. 179 to Pt. 186	Wetted Perimeter, p_w	23.5	feet
	Hydraulic Radus, r	1.277	ft
	Channel Slope	0.005	ft/ft
	Velocity, V	2.480	ft/sec Ref Eq. 9
	Flow Length, L	235	
	Travel Time, Tt	0.026	hrs Ref Eq. 6



Total Travel Time 0.486 hrs Sum of Sheet, Shallow Concentrated and Open Channel

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	101	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Calculate Peak Discharge

Area D1.2	I_a/P	0.095	in.	
	Time of Conc. Tc	0.483	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.76	cu ft/sec	Eq. 10
Area D1.3	I_a/P	0.095	in.	
	Time of Conc. Tc	0.486	hrs	From calculations above
	Unit Peak Disch. q_u	410	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.01	cu ft/sec	Eq. 10
Area D6.2 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.755	hrs	Tt + Tc for Area D6.2 (pg. 97)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.79	cu ft/sec	Eq. 10
Area D6.3 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.781	hrs	Tt + Tc for Area D6.3 (pg. 97)
	Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.25	cu ft/sec	Eq. 10
Area D6.1 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.424	hrs	Tt + Tc for Area D6.1 (pg. 97)
	Unit Peak Disch. q_u	440	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.70	cu ft/sec	Eq. 10
Area D5.2 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.687	hrs	Tt + Tc for Area D5.2 (pg. 98)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.00	cu ft/sec	Eq. 10
Area D5.3 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.713	hrs	Tt + Tc for Area D5.3 (pg. 98)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.43	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	102	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.1 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.352	hrs	Tt + Tc for Area D5.1 (pg. 98)
	Unit Peak Disch. q_u	465	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.41	cu ft/sec	Eq. 10
Area D4.2 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.648	hrs	Tt + Tc for Area D4.2 (pg. 98)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.65	cu ft/sec	Eq. 10
Area D4.3 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.649	hrs	Tt + Tc for Area D4.3 (pg. 98)
	Unit Peak Disch. q_u	365	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.43	cu ft/sec	Eq. 10
Area D4.4 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.698	hrs	Tt + Tc for Area D4.3 (pg. 98)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.29	cu ft/sec	Eq. 10
Area D4.1 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.330	hrs	Tt + Tc for Area D4.1 (pg. 98)
	Unit Peak Disch. q_u	480	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.67	cu ft/sec	Eq. 10
Area D3.2 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.589	hrs	Tt + Tc for Area D3.2 (pg. 99)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.53	cu ft/sec	Eq. 10
Area D3.3 (from pt. 179 to Pt. 186)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.591	hrs	Tt + Tc for Area D3.3 (pg. 99)
	Unit Peak Disch. q_u	385	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.39	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	103	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Area	Flow Length, L	235		
D3.4	Travel Time, Tt	0.026	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.648	hrs	Tt + Tc for Area D3.4 (pg. 99)
pt. 179	Unit Peak Disch. q_u	360	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
186)	Peak Discharge, q_p	1.29	cu ft/sec	Eq. 10

Area	Flow Length, L	235		
D3.1	Travel Time, Tt	0.026	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.258	hrs	Tt + Tc for Area D3.1 (pg. 99)
pt. 179	Unit Peak Disch. q_u	515	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
186)	Peak Discharge, q_p	4.02	cu ft/sec	Eq. 10

Area	Flow Length, L	235		
D2.2	Travel Time, Tt	0.026	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.438	hrs	Tt + Tc for Area D2.2 (pg. 99)
pt. 179	Unit Peak Disch. q_u	435	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
186)	Peak Discharge, q_p	1.98	cu ft/sec	Eq. 10

Area	Flow Length, L	235		
D2.1	Travel Time, Tt	0.026	hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.216	hrs	Tt + Tc for Area D2.1 (pg. 97)
pt. 179	Unit Peak Disch. q_u	550	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1	inches	From pg. 1
186)	Peak Discharge, q_p	5.00	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	30	sq ft
Peak Discharge, qp	59.57	cu ft/sec
Peak Velocity	1.9858	ft/sec
	80%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	104	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

Calculate Peak Discharge from Areas D1.1

Area 0.97 acres 0.00 sq. miles

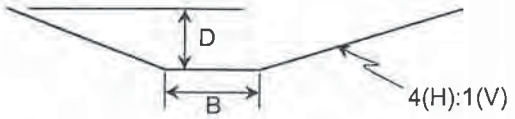
Calculate Travel Time, Tt

Sheet Flow

D1.1	Pt. 187 to Pt. 186	Flow Length, L	150	feet		Flow Length, L		feet
		Two-yr 24 hr rainfall, P_2	4.9	inches		Two-yr 24 hr rainfal	5.9	
		Land Slope, s	0.25	ft/ft		Land Slope, s	0.04	ft/ft
		Travel Time, Tt	0.149	hrs	Ref Eq. 8	Travel Time, Tt	0.000	

Open Channel Flow

		Channel Depth, D	2	feet	
		Channel Width, B	7	feet	
		X-Section Area, a	30	sq ft	
	Pt. 186 to Pt. 134	Wetted Perimeter, p_w	23.5	feet	
		Hydraulic Radus, r	1.277	ft	
		Channel Slope	0.005	ft/ft	
		Velocity, V	2.480	ft/sec	Ref Eq. 9
		Flow Length, L	235		
		Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Total Travel Time		0.175	hrs	Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

		I_a/P	0.095	in.	
	Area D1.1	Time of Conc. Tc	0.175	hrs	From calculations above
		Unit Peak Disch. q_u	585	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.52	cu ft/sec	Eq. 10
	Area D6.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
		Travel Time, Tt	0.026	hrs	Ref Eq. 6
		Time of Conc. Tc	0.782	hrs	Tt + Tc for Area D6.2 (pg. 101)
		Unit Peak Disch. q_u	340	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	3.74	cu ft/sec	Eq. 10
	Area D6.3 (from pt. 186 to Pt. 134)	Flow Length, L	235		
		Travel Time, Tt	0.026	hrs	Ref Eq. 6
		Time of Conc. Tc	0.808	hrs	Tt + Tc for Area D6.3 (pg. 101)
		Unit Peak Disch. q_u	335	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	2.22	cu ft/sec	Eq. 10
	Area D6.1 (from pt. 186 to Pt. 134)	Flow Length, L	235		
		Travel Time, Tt	0.026	hrs	Ref Eq. 6
		Time of Conc. Tc	0.451	hrs	Tt + Tc for Area D6.1 (pg. 101)
		Unit Peak Disch. q_u	430	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
		Runoff, Q	5.1	inches	From pg. 1
		Peak Discharge, q_p	4.59	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	105	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D5.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.713	hrs	Tt + Tc for Area D5.2 (pg. 101)
	Unit Peak Disch. q_u	350	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.96	cu ft/sec	Eq. 10
Area D5.3 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.739	hrs	Tt + Tc for Area D5.3 (pg. 101)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.39	cu ft/sec	Eq. 10
Area D5.1 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.378	hrs	Tt + Tc for Area D5.1 (pg. 102)
	Unit Peak Disch. q_u	455	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.36	cu ft/sec	Eq. 10
Area D4.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.674	hrs	Tt + Tc for Area D4.2 (pg. 102)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.57	cu ft/sec	Eq. 10
Area D4.3 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.675	hrs	Tt + Tc for Area D4.3 (pg. 102)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.34	cu ft/sec	Eq. 10
Area D4.4 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.725	hrs	Tt + Tc for Area D4.3 (pg. 102)
	Unit Peak Disch. q_u	345	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.24	cu ft/sec	Eq. 10
Area D4.1 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.357	hrs	Tt + Tc for Area D4.1 (pg. 102)
	Unit Peak Disch. q_u	465	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.52	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	106	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		

Area D3.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.616	hrs	Tt + Tc for Area D3.2 (pg. 102)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.48	cu ft/sec	Eq. 10
Area D3.3 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.617	hrs	Tt + Tc for Area D3.3 (pg. 102)
	Unit Peak Disch. q_u	380	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.33	cu ft/sec	Eq. 10
Area D3.4 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.675	hrs	Tt + Tc for Area D3.4 (pg. 103)
	Unit Peak Disch. q_u	355	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.27	cu ft/sec	Eq. 10
Area D3.1 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.285	hrs	Tt + Tc for Area D3.1 (pg. 103)
	Unit Peak Disch. q_u	500	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.90	cu ft/sec	Eq. 10
Area D2.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.465	hrs	Tt + Tc for Area D2.2 (pg. 103)
	Unit Peak Disch. q_u	420	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	1.91	cu ft/sec	Eq. 10
Area D2.1 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.243	hrs	Tt + Tc for Area D2.1 (pg. 103)
	Unit Peak Disch. q_u	535	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	4.86	cu ft/sec	Eq. 10
Area D1.2 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.509	hrs	Tt + Tc for Area D1.2 (pg. 101)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	3.67	cu ft/sec	Eq. 10

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	107	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:		SMEPA	

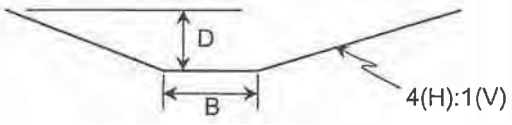
Area D1.3 (from pt. 186 to Pt. 134)	Flow Length, L	235		
	Travel Time, Tt	0.026	hrs	Ref Eq. 6
	Time of Conc. Tc	0.512	hrs	Tt + Tc for Area D1.3 (pg. 101)
	Unit Peak Disch. q_u	400	csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
	Runoff, Q	5.1	inches	From pg. 1
	Peak Discharge, q_p	2.93	cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	30	sq ft	
Peak Discharge, qp	62.81	cu ft/sec	
Peak Velocity	2.0936	ft/sec	
	84%		of Calculated Channel Flow Velocity

Combine the flow from C & D at point 134 and assume the slope is between 0.5 and 2 percent to the outfall

Open Channel Flow



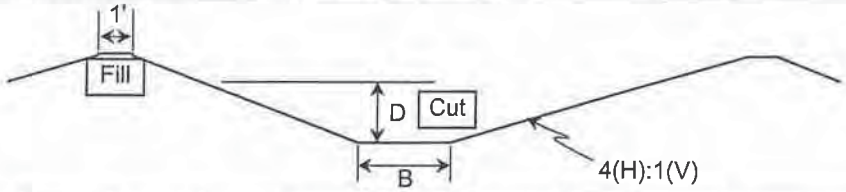
	Channel Depth, D	3	feet		
	Channel Width, B	5	feet		
	X-Section Area, a	51	sq ft		
Pt. 124	Wetted Perimeter, p_w	29.7	feet		
to	Hydraulic Radus, r	1.715	ft		
Outfall	Channel Slope	0.005	to	0.02	ft/ft
	Velocity, V	3.019	to	6.038	ft/sec Ref Eq. 9
	Flow Length, L	0			
	Travel Time, Tt	0.000	hrs		Ref Eq. 6
Total Travel Time		0.000	hrs		Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Channel Flow Velocity

X-Section Area, a	51	sq ft		
Peak Discharge, qp	130.28	cu ft/sec		
Peak Velocity	2.5544	ft/sec		
	85%	to	42%	of Calculated Channel Flow Velocity

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.:	108	of	110
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA		



	Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope	Length (ft)	Cut (ft)	Fill (ft)	Area of Cut/Fill (ft^2)	Volume Cut/Fill (yd^3)
Drainage Area C	134	230.5	2.0	223.0	7	0.50%	240	7.50	0.00	277.5	
	133	232.5	2.0	224.2	7	0.50%	240	8.30	0.00	333.7	2716.3
	120	231.2	2.0	225.4	7	0.50%	0	5.80	0.00	175.2	2261.4
	120	231.2	2.0	225.4	4	0.50%	360	5.80	0.00	157.8	0.0
	119	232.6	2.0	227.2	4	0.50%	0	5.40	0.00	138.2	1973.3
	119	232.6	2.0	227.2	3	0.50%	385	5.40	0.00	132.8	0.0
	108	232.5	2.0	229.1	3	0.50%	0	3.38	0.00	55.7	1344.1
	108	232.5	2.0	229.1	2	0.50%	475	3.38	0.00	52.3	0.0
	107	232.5	2.0	231.5	2	0.50%	0	1.00	1.00	-12.0	354.6
	107	232.5	2.0	231.5	0	0.50%	265	1.00	1.00	-14.0	0.0
	94	232.8	2.0	232.8	0	0.50%	60	-0.02	2.02	-69.7	-410.5
	92	233.0	2.0	233.1	0	0.50%	135	-0.13	2.13	-76.4	-162.3
	83	233.0	2.0	233.8	0	0.50%		-0.80	2.80	-128.5	-512.3
						Total					***7,564.6***

	Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope	Length (ft)	Cut (ft)	Fill (ft)	Area of Cut/Fill (ft^2)	Volume Cut/Fill (yd^3)
Drainage Area D	134	230.5	2.0	223.0	7	0.50%	235	7.50	0.00	277.5	
	186	233.0	2.0	224.2	7	0.50%	235	8.82	0.00	373.3	2832.2
	179	235.0	2.0	225.4	7	0.50%	0	9.65	0.00	440.0	3539.5
	179	235.0	2.0	225.4	5	0.50%	255	9.65	0.00	420.7	0.0
	178	235.0	2.0	226.6	5	0.50%	0	8.37	0.00	322.4	3509.4
	178	235.0	2.0	226.6	4	0.50%	255	8.37	0.00	314.1	0.0
	174	232.1	2.0	227.9	4	0.50%	200	4.20	0.00	87.4	1895.6
	172	233.8	2.0	228.9	4	0.50%	0	4.90	0.00	115.6	751.9
	172	233.8	2.0	228.9	3	0.50%	200	4.90	0.00	110.7	0.0
	165	235.0	2.0	229.9	3	0.50%	0	5.10	0.00	119.3	852.1
	165	235.0	2.0	229.9	2	0.50%	225	5.10	0.00	114.2	0.0
	163	235.1	2.0	231.0	2	0.50%	0	4.07	0.00	74.6	786.7
	163	235.1	2.0	231.0	0	0.50%	225	4.07	0.00	66.4	0.0
	152	236.0	2.0	232.2	0	0.50%	140	3.85	0.00	59.3	523.8
	151	236.0	2.0	232.9	0	0.50%	140	3.15	0.00	39.7	256.6
	144	235.7	2.0	233.6	0	0.50%	250	2.15	0.00	18.5	150.8
	142	235.5	2.0	234.8	0	0.50%	260	0.70	1.30	-27.7	-42.5
	136	234.6	2.0	236.1	0	0.50%		-1.50	3.50	-194.0	-1067.3
						Total					***13,988.8***

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

ENVIRONMENTAL MANAGEMENT SERVICES, INC.

Calculations For:	SMEPA Landfill	Made By:	CJ	Date:	10/11/16	Sheet No.: 109 of 110	
Subject:	Stormwater Design	Checked By:		Date:		Job No.:	SMEPA

Recommendations: (1) Between points 4 and 82, and points 44 and 135 slope toward the west, 2' deep and 0' wide.

(2) The post development rate is calculated as 130.3 cfs and the predevelopment rate was calculated as 122 cfs; therefore, the flow needs to be restricted and some storage is necessary. Currently SMEPA has substantial storage at their outfall due to the culverts and filtration system that has been installed. This system appears to have storage over 120,000 cubic feet. The following design shows that the amount of storage necessary is 110,000 cubic feet.

Design: Required storage using the reference shown at the bottom of the page.

q_o/q_i = (122/130.3) = 0.94

Vs/Vr = 0.15 Ref. Figure 6-2 "Approximate detention basin routing" Use Type III

Q' = 5.61" See page 2 from the output of EFM2

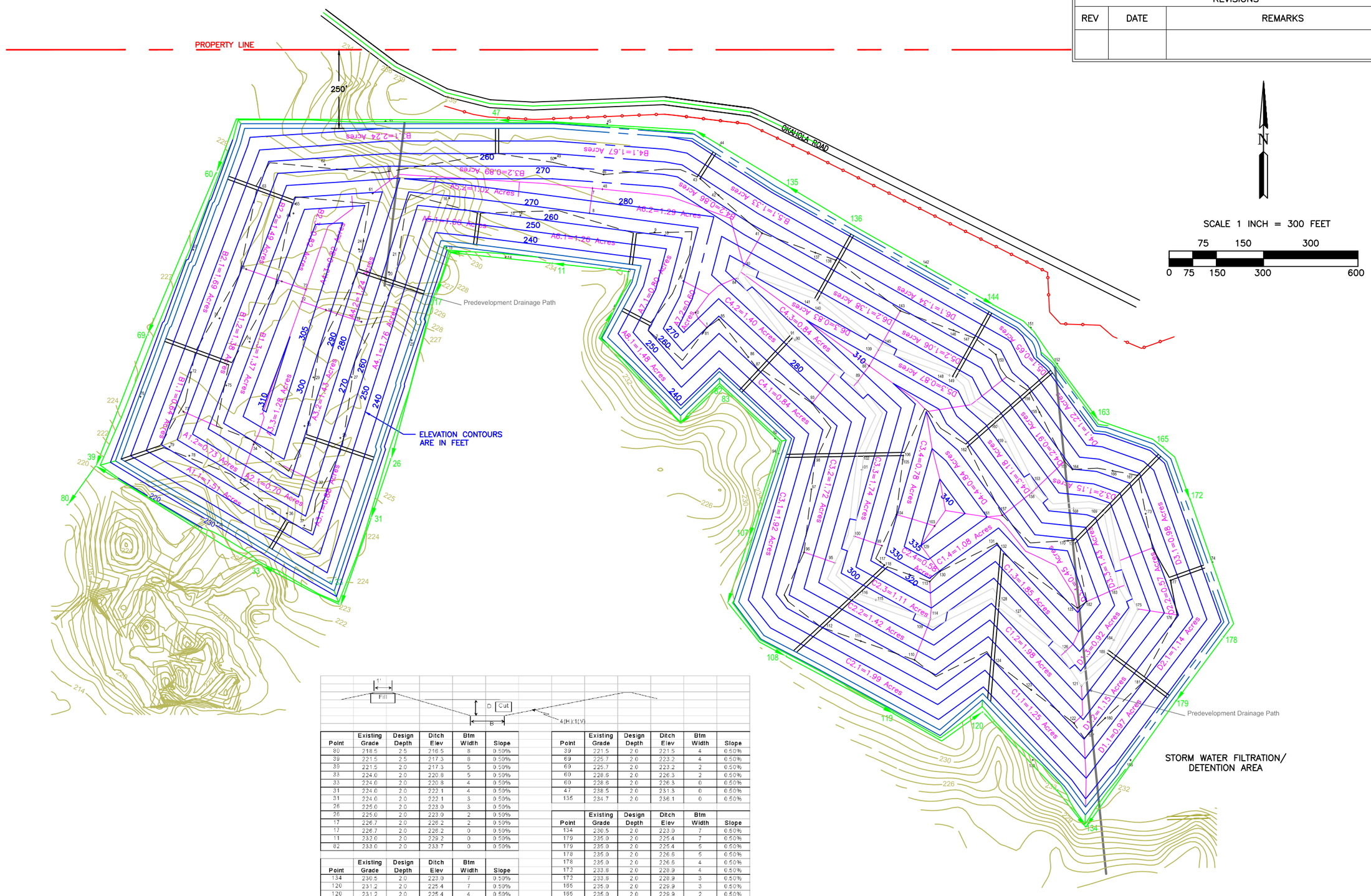
Vs = (Vs/Vr) * Q' * Acreage

Acreage ~ 36 acres

Vs = 0.15 * 5.61"/12 (in/ft) * 3(= 2.5245 acre-ft = 109,967 ft^3

Reference "*Planning and Design Manual for the Control of Erosion, Sediment and Stormwater*", NRCS, April 1994

REVISIONS		
REV	DATE	REMARKS



Fill | Cut | 4:(H):1(V)

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
80	218.5	2.5	216.5	8	0.50%
39	221.5	2.5	217.3	8	0.50%
39	221.5	2.0	217.3	5	0.50%
33	224.6	2.0	220.8	5	0.50%
33	224.6	2.0	220.8	4	0.50%
31	224.6	2.0	222.1	4	0.50%
31	224.6	2.0	222.1	3	0.50%
26	225.0	2.0	223.0	3	0.50%
26	225.0	2.0	223.0	2	0.50%
17	226.7	2.0	226.2	2	0.50%
17	226.7	2.0	226.2	0	0.50%
11	232.0	2.0	229.2	0	0.50%
82	233.0	2.0	233.7	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
134	230.5	2.0	223.0	7	0.50%
120	231.2	2.0	225.4	7	0.50%
120	231.2	2.0	225.4	4	0.50%
119	232.6	2.0	227.2	4	0.50%
119	232.6	2.0	227.2	3	0.50%
108	232.5	2.0	229.1	3	0.50%
108	232.5	2.0	229.1	2	0.50%
107	232.5	2.0	231.5	2	0.50%
107	232.5	2.0	231.5	0	0.50%
83	233.0	2.0	233.8	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
39	221.5	2.0	221.5	4	0.50%
69	225.7	2.0	223.2	4	0.50%
69	225.7	2.0	223.2	2	0.50%
60	228.6	2.0	226.3	2	0.50%
60	228.6	2.0	226.3	0	0.50%
47	238.5	2.0	231.3	0	0.50%
135	234.7	2.0	236.1	0	0.50%

Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope
134	230.5	2.0	223.0	7	0.50%
179	235.0	2.0	225.4	7	0.50%
179	235.0	2.0	225.4	5	0.50%
178	235.0	2.0	226.6	5	0.50%
178	235.0	2.0	226.6	4	0.50%
172	233.8	2.0	228.9	4	0.50%
172	233.8	2.0	228.9	3	0.50%
185	235.0	2.0	229.9	3	0.50%
185	235.0	2.0	229.9	2	0.50%
183	235.1	2.0	231.0	2	0.50%
183	235.1	2.0	231.0	0	0.50%
144	235.7	2.0	233.6	0	0.50%
136	234.6	2.0	236.1	0	0.50%

UNITS ARE FEET

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PREPARED FOR
SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION
P.O. BOX 15849
HATTIESBURG, MS 39404-5849

SHEET TITLE
STORMWATER DRAINAGE
R.D. MORROW SR. GENERATING STATION
PURVIS, MISSISSIPPI

DATE	10/11/2016
SCALE	1" = 300'
DRAWN BY	CTJ
PROJECT NO.	SOU2-16-002
SHEET NO.	Sheet 110 of 110