

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:



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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



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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 N1/2 of 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)		<i>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:</i>	Section 2 – Design Plan
	(1)	<i>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</i>	Section 2.1 – Design Criteria
	(2)	<i>A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.</i>	
(b)		<i>Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.</i>	Section 2.2-Run-off Compliance with §257.3-3 <i>Surface Water</i>
(c)		<i>Run-on and run-off control system plan-</i>	Section 3 – Run-on & Run-off Control System Plan
	(1)	<i>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).</i>	Section 3.1 – Design Section 3.2 – Record of Construction
	(2)	<i>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.</i>	Section 4 – Amendment of the Plan
		<i>Timeframes for preparing the initial plan-</i>	Section 5.2 – Compliance with Timeframes
	(3)	<i>(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.</i>	Section 5.2 – Compliance with Timeframes
		<i>(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.</i>	Not Applicable at the time

§257.81 Section	§257.81 Subsection	Requirements	Applicable Plan Section
(c)	(4)	<i>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).</i>	Section 5.3 – Prescribed Frequency of Revisions
	(5)	<i>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.</i>	Certification Section
(d)		<i>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).</i>	Section 6 – Recordkeeping Plan

§257.84 Section	§257.84 Subsection	Requirements	Applicable Plan Section
	(1)	<i>Weekly inspections by a qualified person</i>	Section 4 – Inspection Plan
(a)	(2)	<i>Timeframes-</i> <i>(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.</i> <i>(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.</i>	
(b)	(1), (2)	<i>Annual inspections and an inspection report by a qualified professional engineer</i>	
		<i>Timeframes-</i> <i>(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.</i>	
	(3)	<i>(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.</i>	
	(4)	<i>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</i>	
(c)		<i>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).</i>	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 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 facility 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:
1515 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:

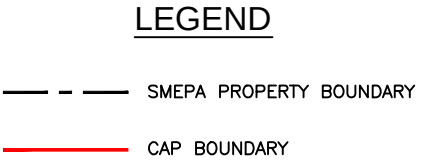
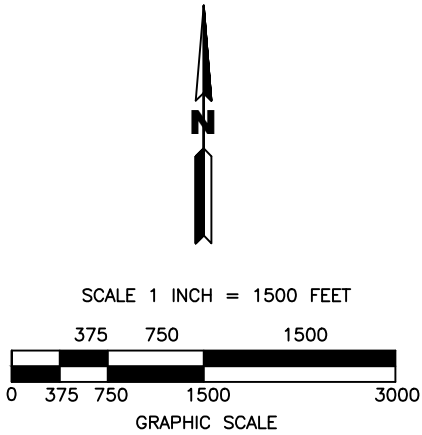
<http://smepa.coop/portfolio/energy-resources>

APPENDIX A

FIGURES

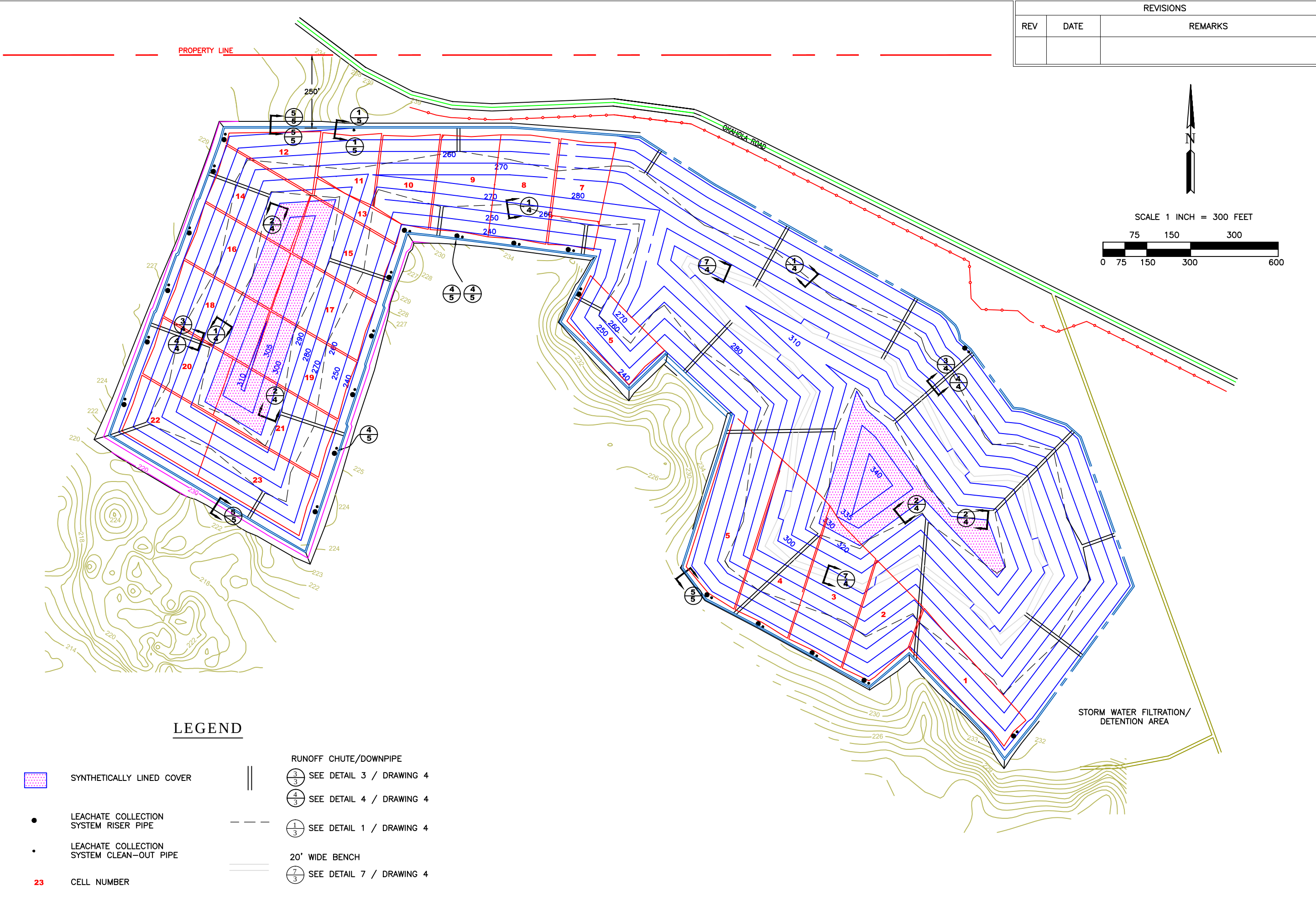


REVISIONS		
REV	DATE	REMARKS



REFERENCE: 7.5 MIN. SERIES TOPOGRAPHIC MAP
PURVIS, MISSISSIPPI

REVISIONS		
REV	DATE	REMARKS



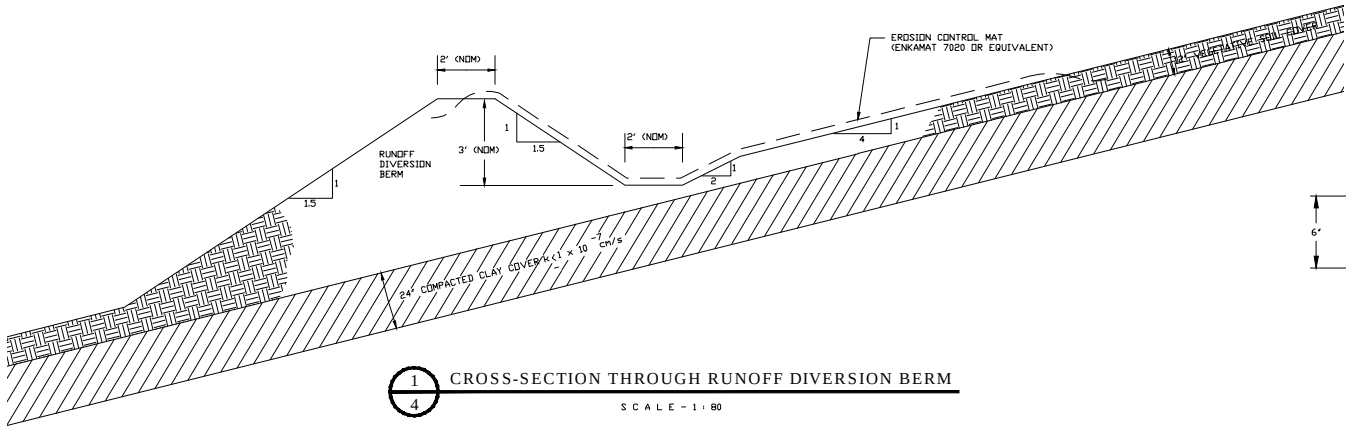
REVISIONS		
REV	DATE	REMARKS

PREPARED FOR

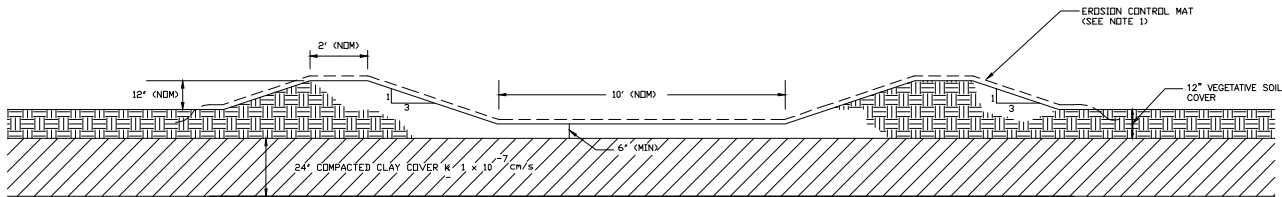
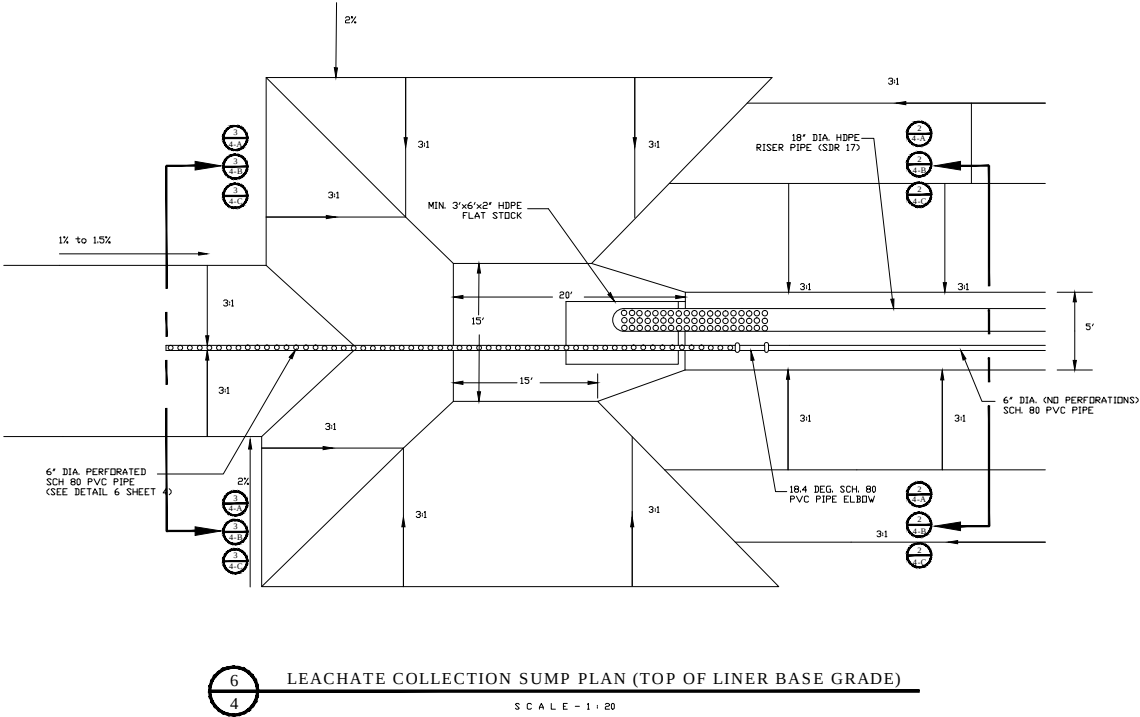
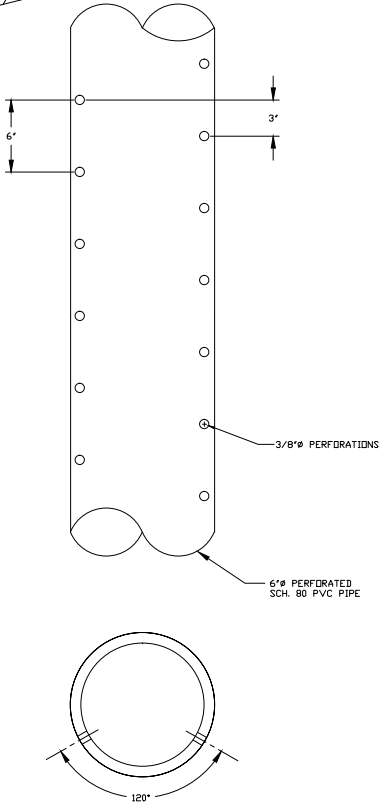
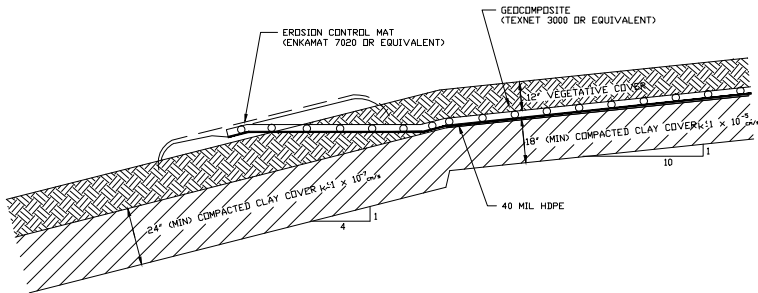
DETAIL SHEET
 R.D. MORROW SR. GENERATING STATION
 PURVIS, MISSISSIPPI

SHEET TITLE

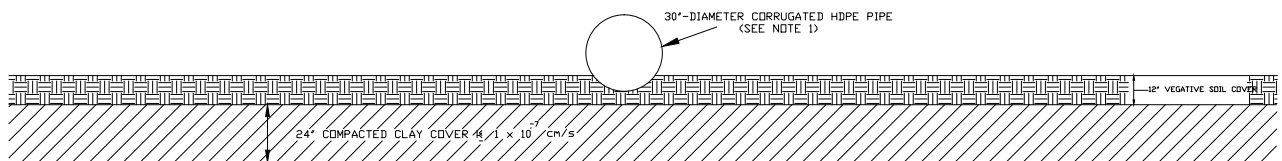
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SCALE	AS SHOWN
DRAWN BY	PDM, KRK, CTJ
PROJECT NO.	SOU2-16-002
SHEET NO.	4



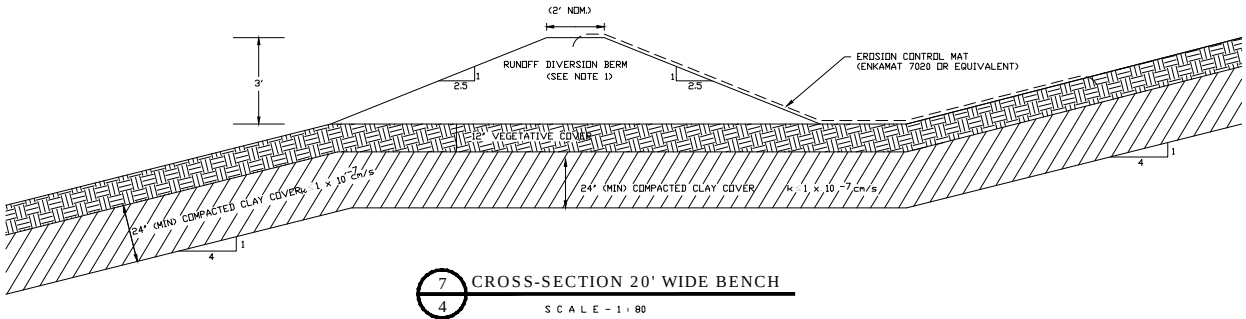
- NOTES:
- DIVERSION BERMS WILL BE LINED WITH EROSION CONTROL MATS (ENKAMAT 7020 OR EQUIVALENT)
 - THIS SECTION WILL SLOPE AT A MINIMUM OF 4% TOWARD THE DRAIN PIPES



- NOTE:
- RUNOFF CHUTES WILL BE LINED WITH EROSION CONTROL MATS (ENKAMAT 7020 OR EQUIVALENT)

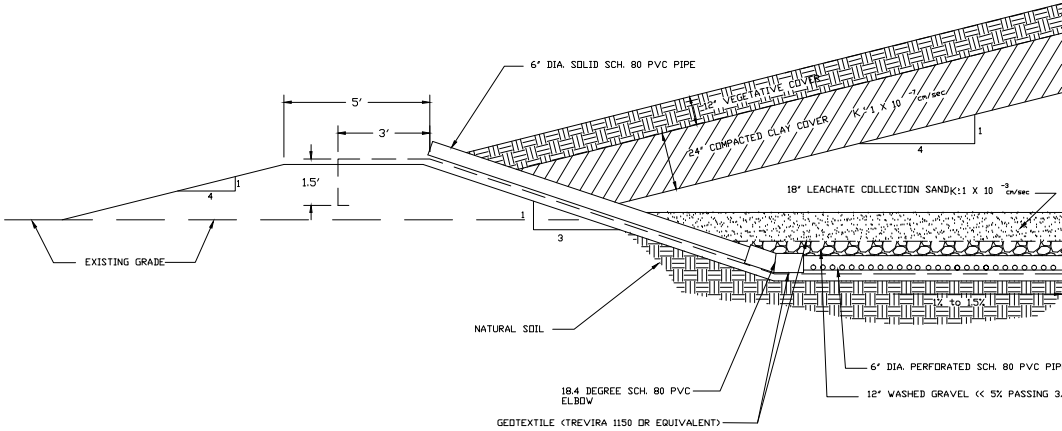


- NOTE:
- DOWNPIPE WILL HAVE TIE-IN PIPES AT ALL EROSION CONTROL BERMS

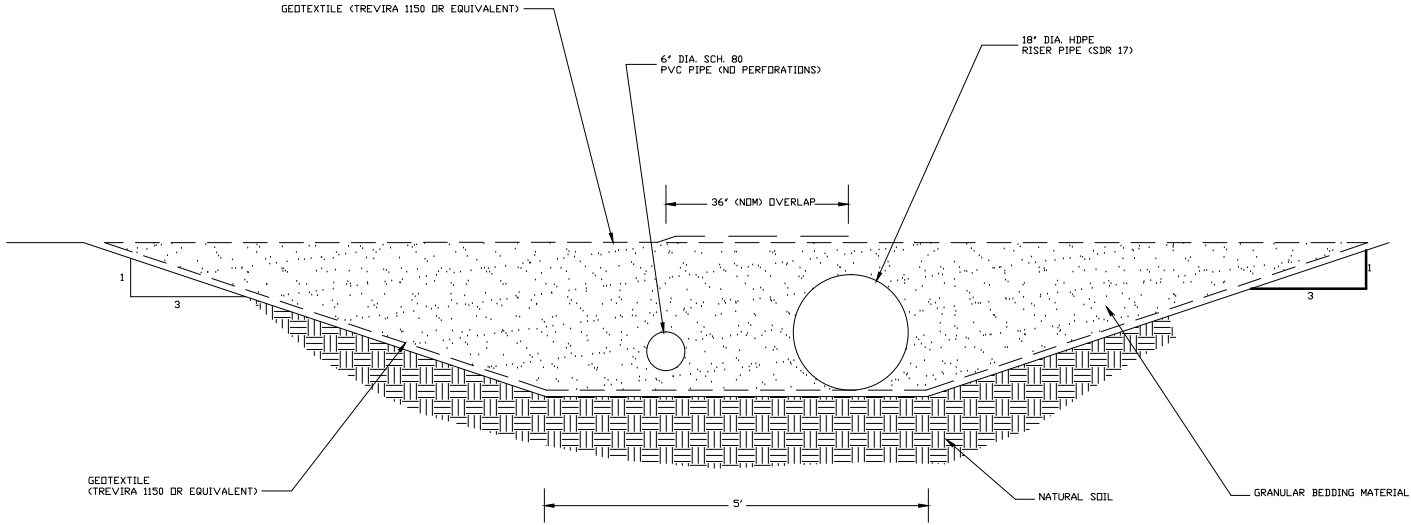


- NOTES:
- NO DIVERSION BERM WILL BE PRESENT AT THE ENTRANCE OF THE DOWN PIPES
 - THIS SECTION WILL SLOPE A MINIMUM OF 4% TOWARD THE DOWN PIPES.

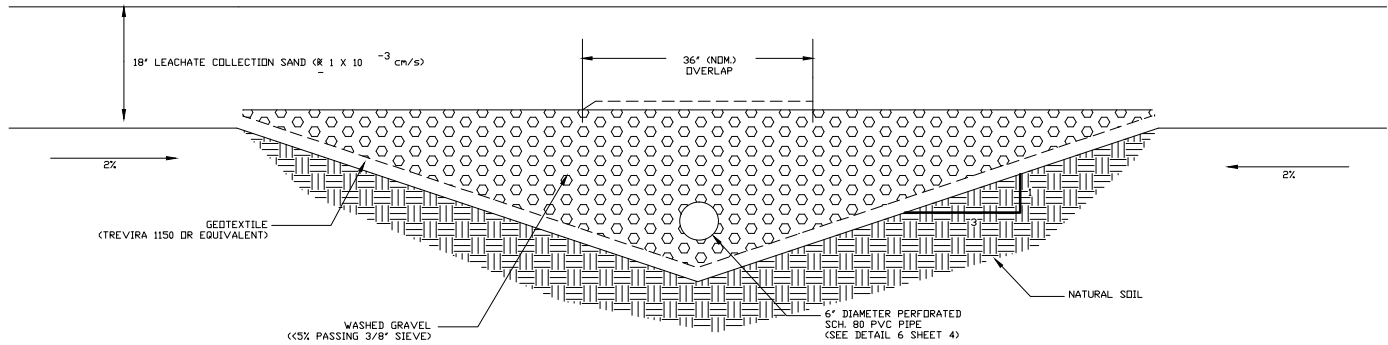
REVISIONS		
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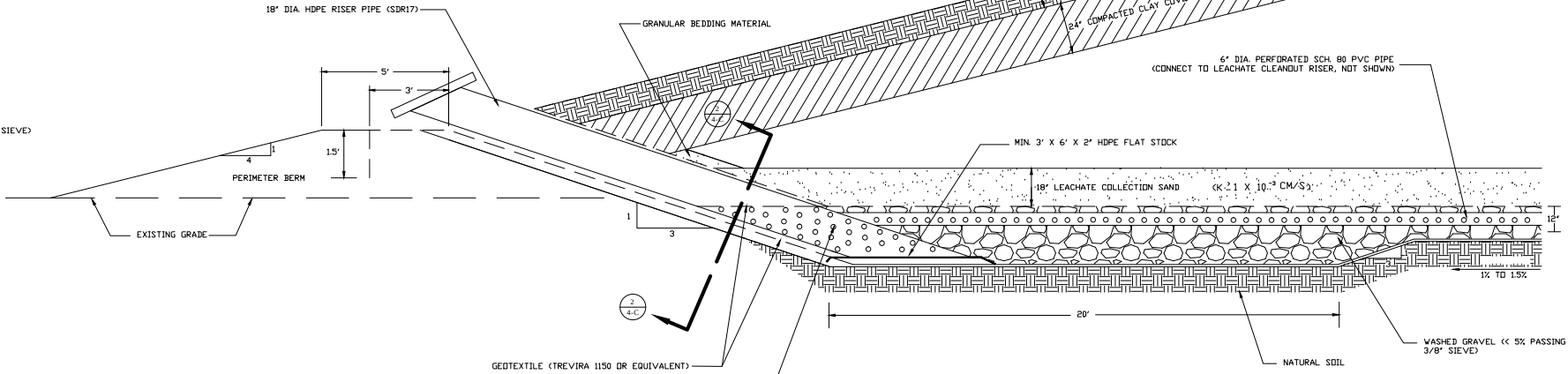
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5 LEACHATE COLLECTION SYSTEM CLEAN-OUT (NATURAL SOIL)
SCALE - 1 : 80



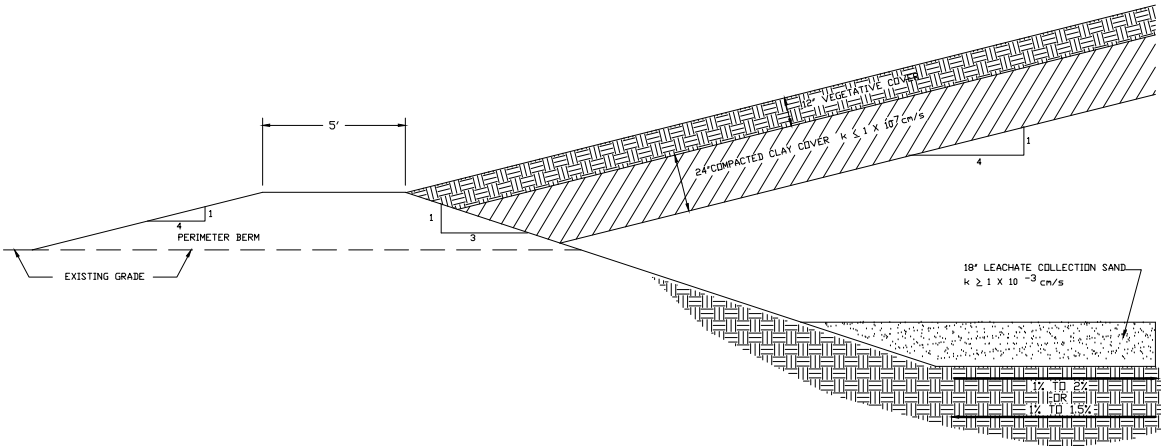
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5 SUMP RISER TRENCH (NATURAL SOIL)
SCALE - 1 : 30



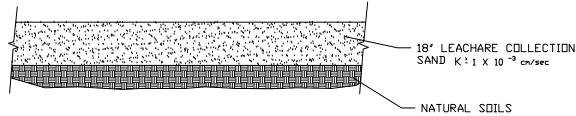
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5 LEACHATE COLLECTION TRENCH (NEW CELLS) NATURAL SOIL
SCALE - 1 : 30



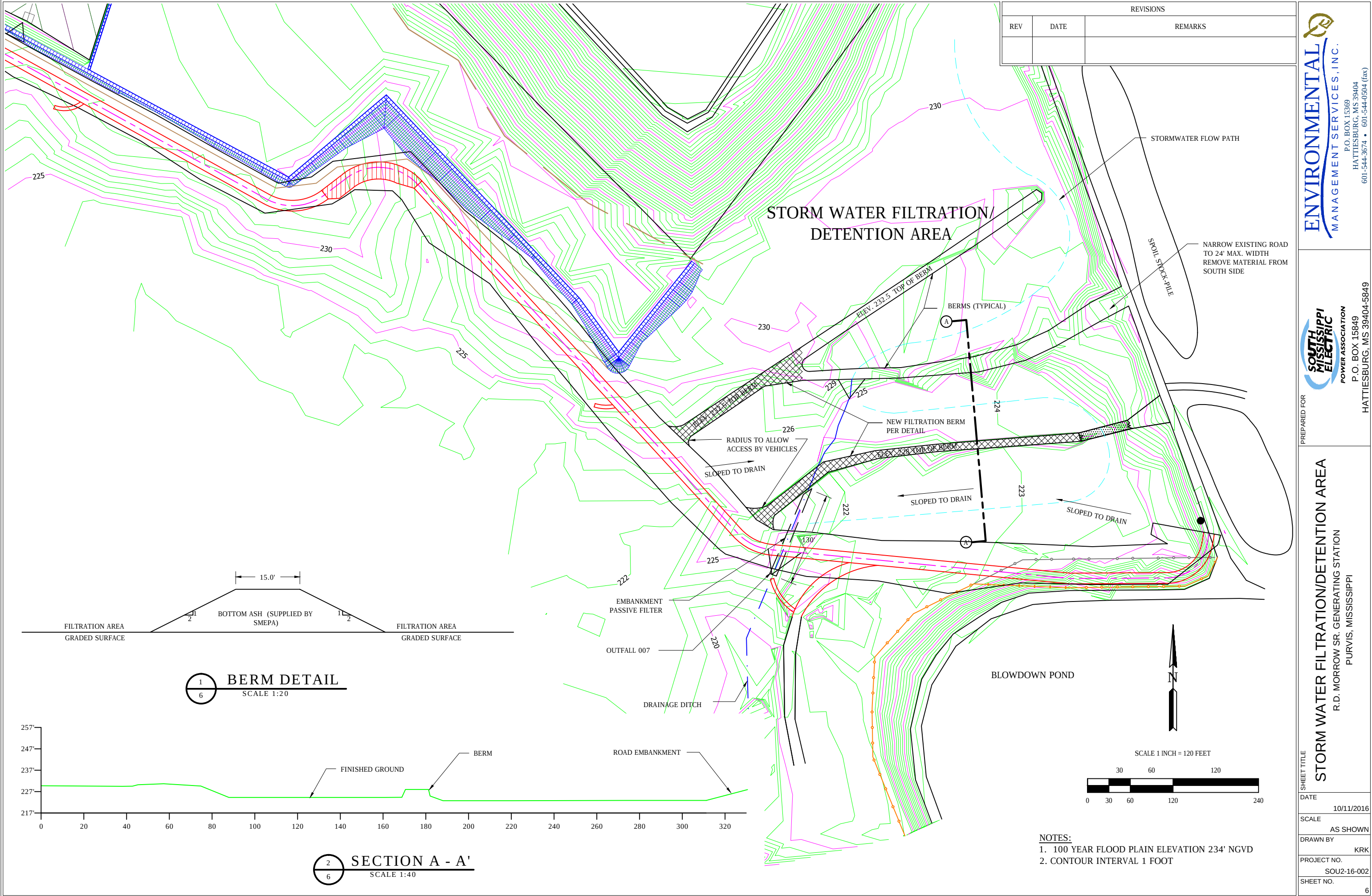
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5 LEACHATE COLLECTION SUMP RISER (NEW CELLS) NATURAL SOIL
SCALE - 1 : 80



5
5 PERIMETER BERM DETAIL FOR FINAL COVER (NATURAL SOIL)
SCALE - 1 : 80



6
5 BOTTOM LINER SYTEM
SCALE - 1 : 80



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 & Stormwater*. 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)

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

Manning's Coefficient

Sheet Flow 0.41 Ref. Table 6-1 "Roughness coefficients for sheet flow" - use Bermuda grass

Channel Flow 0.05 Ref. App. A Open Channel Flow, Civil Engineering Ref. Manual - use natural channels

Initial 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.

ENVIRONMENTAL

MANAGEMENT SERVICES, INC.



Calculations For: SMEPA Landfill Made By: CJ Date: 10/11/16 Sheet No.: 2 of 110
 Subject: Stormwater Design Checked By: Date: Job No.: SMEPA

EFM2 Predevelopment Printout for Western Side

EFM-2 ESTIMATING RUNOFF AND PEAK DISCHARGE VERSION 1.10

Client : SMEPA By: KL Date: 02-06-03
 County : Lamar State: MS Checked: Date:
 Practice: Predevelopment Flow Rate (Western Side)

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 By: KL Date: 02-06-03
 County : Lamar State: MS Checked: Date:
 Practice: Predevelopment Flow Rate (Eastern Side)

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

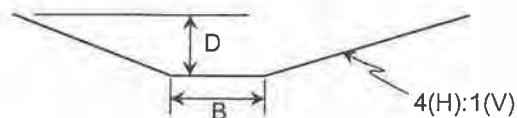
Pt. 81	Flow Length, L	160 feet		Flow Length, L	feet
to Pt. 82	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	4.9
	Land Slope, s	0.25 ft/ft		Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.156 hrs	Ref Eq. 8	Travel Time, Tt	0.000

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	Wetted Perimeter, p _w	16.5 feet	
to Pt. 4	Hydraulic Radius, 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		

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 rainfall 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	Travel Time, Tt 0.270

Ref Eq. 8

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

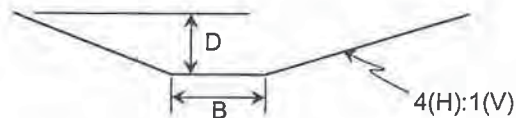
Ref Eq. 6

Open Channel Flow

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

Ref Eq. 9

Ref Eq. 6



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

Calculate Peak Discharge

Area	I _a /P ₂₅ 0.095 in.	
	Time of Conc. Tc 0.464 hrs	From calculations above
A7.2	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

Area	Flow Length, L 125	
A8.1	Travel Time, Tt 0.017 hrs	Ref Eq. 6
(from	Time of Conc. Tc 0.263 hrs	Tt + Tc for Area A8.1 (pg. 3)
pt. 4 to	Unit Peak Disch. q _u 515 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
Pt. 5)	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, q_p 9.26 cu ft/sec
 Peak Velocity 0.5786 ft/sec
 28% of Calculated Channel Flow Velocity

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

Channel Depth, D 2 feet

Channel Width, B 0 feet

X-Section Area, a 16 sq ft

Pt. 5 to Wetted Perimeter, p_w 16.5 feet

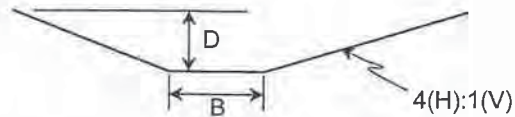
Pt. 11 Hydraulic Radius, r 0.970 ft

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 Pt. 7 to Two-yr 24 hr rainfall, P_2 4.9 inches Pt. 8 Land Slope, s 0.25 ft/ft Travel Time, Tt 0.082 hrs Ref Eq. 8	Flow Length, L 228.3 feet Pt. 8 to Two-yr 24 hr rainfall 5.9 Pt. 9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.394
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A6.2 Shallow, Concentrated Flow

Pt. 9 to Flow Length, L 16.3 feet

Pt. 10 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 Wetted Perimeter, p_w 16.5 feet

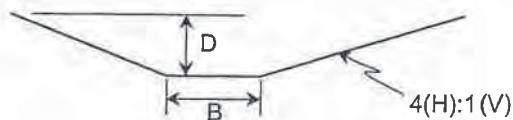
Pt. 11 Hydraulic Radius, r 0.970 ft

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

	I_a/P	0.095 in.	
Area A7.1	Time of Conc. T_c	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

	I_a/P	0.095 in.	
Area A6.2	Time of Conc. T_c	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

	Flow Length, L	250	
Area A8.1 (from pt. 5 to Pt. 11)	Travel Time, T_t	0.034 hrs	Ref Eq. 6
	Time of Conc. T_c	0.296 hrs	$T_t + T_c$ 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

	Flow Length, L	250	
Area A7.2 (from pt. 5 to Pt. 11)	Travel Time, T_t	0.034 hrs	Ref Eq. 6
	Time of Conc. T_c	0.497 hrs	$T_t + T_c$ 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, q_p	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

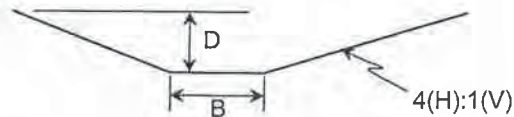
Calculate Travel Time, Tt

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 rainfall	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. 14	Hydraulic Radius, 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

0.198 hrs

 Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

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

	Flow Length, L	250		
A8.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. T _c	0.330 hrs	Tt + T _c 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. 14)	Runoff, Q	5.1 inches	From pg. 1	
	Peak Discharge, q _p	5.72 cu ft/sec	Eq. 10	

	Flow Length, L	250		
A7.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. T _c	0.531 hrs	Tt + T _c 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. 14)	Runoff, Q	5.1 inches	From pg. 1	
	Peak Discharge, q _p	2.96 cu ft/sec	Eq. 10	

	Flow Length, L	250		
A7.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6	
(from	Time of Conc. T _c	0.251 hrs	Tt + T _c 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. 14)	Runoff, Q	5.1 inches	From pg. 1	
	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
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Area	Flow Length, L	250	
A6.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.545 hrs	Tt + Tc for Area A6.2 (pg. 6)
pt. 11	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
14)	Peak Discharge, q_p	4.10 cu ft/sec	Eq. 10
Calculate Channel Flow Velocity			
	X-Section Area, a	16 sq ft	
	Peak Discharge, q_p	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 Pt. 7 to Two-yr 24 hr rainfall, P_2 4.9 inches Pt. 8 Land Slope, s 0.25 ft/ft Travel Time, Tt 0.082 hrs Ref Eq. 8	Flow Length, L 228.3 feet Pt. 8 to Two-yr 24 hr rainfall 5.9 Pt. 12 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.394
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A5.2 Shallow, Concentrated Flow

Pt. 12 Flow Length, L 16.3 feet to Pt. 13 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 Ref Eq. 6
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Travel Time, Tt 0.001 hrs

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. 15 Hydraulic Radius, r 0.970 ft 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	
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Total Travel Time **0.489 hrs** Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

Area	Flow Length, L	0.095 in.	
	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 Flow Length, L 80
 A7.1 Travel Time, Tt 0.011 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.262 hrs Tt + Tc for Area A7.1 (pg. 7)
 pt. 14 Unit Peak Disch. q_u 520 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 3.69 cu ft/sec Eq. 10

Area Flow Length, L 80
 A6.2 Travel Time, Tt 0.011 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.556 hrs Tt + Tc for Area A6.2 (pg. 8)
 pt. 14 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
 15) Peak Discharge, q_p 4.10 cu ft/sec Eq. 10

Area Flow Length, L 80
 A6.1 Travel Time, Tt 0.011 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.209 hrs Tt + Tc for Area A6.1 (pg. 7)
 pt. 14 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
 15) Peak Discharge, q_p 5.92 cu ft/sec Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a 16 sq ft
 Peak Discharge, q_p 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

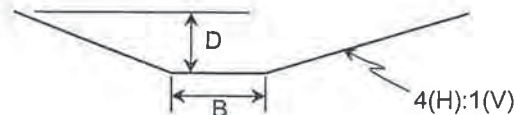
Calculate Travel Time, T_t

Sheet Flow

A5.1	Pt. 16	Flow Length, L	210 feet		Flow Length, L	0 feet
	to Pt. 15	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft		Land Slope, s	0.04 ft/ft
		Travel Time, T _t	0.194 hrs	Ref Eq. 8	Travel Time, T _t	0.000

Open Channel Flow

		Channel Depth, D	2 feet	
		Channel Width, B	0 feet	
		X-Section Area, a	16 sq ft	
Pt. 15		Wetted Perimeter, p _w	16.5 feet	
to Pt. 17		Hydraulic Radius, 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, T _t	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	Time of Conc. T _c	0.213 hrs	From calculations above
A5.1	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	Flow Length, L	140	
A8.1	Travel Time, T _t	0.019 hrs	Ref Eq. 6
(from	Time of Conc. T _c	0.359 hrs	T _t + T _c for Area A8.1 (pg. 9)
pt. 15	Unit Peak Disch. q _u	515 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 17)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	6.07 cu ft/sec	Eq. 10

Area	Flow Length, L	140	
A7.2	Travel Time, T _t	0.019 hrs	Ref Eq. 6
(from	Time of Conc. T _c	0.560 hrs	T _t + T _c for Area A7.2 (pg. 9)
pt. 15	Unit Peak Disch. q _u	390 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 17)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	2.92 cu ft/sec	Eq. 10

Area	Flow Length, L	140	
A7.1	Travel Time, T _t	0.019 hrs	Ref Eq. 6
(from	Time of Conc. T _c	0.281 hrs	T _t + T _c for Area A7.1 (pg. 10)
pt. 15	Unit Peak Disch. q _u	505 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 17)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	3.58 cu ft/sec	Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 12 of 110
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Area	Flow Length, L	140	
A6.2	Travel Time, Tt	0.019 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.575 hrs	Tt + Tc for Area A6.2 (pg. 10)
pt. 15	Unit Peak Disch. q_u	385 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
17)	Peak Discharge, q_p	4.05 cu ft/sec	Eq. 10

Area	Flow Length, L	140	
A6.1	Travel Time, Tt	0.019 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.227 hrs	Tt + Tc for Area A6.1 (pg. 10)
pt. 15	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
17)	Peak Discharge, q_p	5.92 cu ft/sec	Eq. 10

Area	Flow Length, L	140	
A5.2	Travel Time, Tt	0.019 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.508 hrs	Tt + Tc for Area A5.2 (pg. 9)
pt. 15	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
17)	Peak Discharge, q_p	3.09 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 13 of 110
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Calculate Peak Discharge from Area A4.2

Area 1.44 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

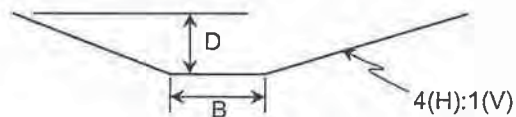
Pt. 18	Flow Length, L	120 feet		Pt. 19	Flow Length, L	180 feet
to Pt. 19	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 20	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.124 hrs	Ref Eq. 8		Travel Time, Tt	0.326

A4.2 Shallow, Concentrated Flow

Pt. 20	Flow Length, L	95 feet	
to Pt. 21	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	Wetted Perimeter, p _w	18.5 feet	
to Pt. 25	Hydraulic Radius, 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

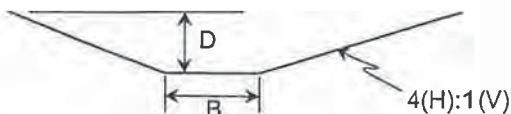
Pt. 22	Flow Length, L	100.2 feet		Pt. 22	Flow Length, L	199.8 feet
to Pt. 18	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 23	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.1 ft/ft			Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.155 hrs	Ref Eq. 8		Travel Time, Tt	0.354

A4.3 Shallow, Concentrated Flow

Pt. 23	Flow Length, L	75.2 feet	
to Pt. 24	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	Wetted Perimeter, p _w	18.5 feet	
to Pt. 25	Hydraulic Radius, 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

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Calculate Peak Discharge

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 15 of 110
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Area	Flow Length, L	280	
A5.2	Travel Time, Tt	0.035 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.543 hrs	Tt + Tc for Area A5.2 (pg. 12)
pt. 17	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
25)	Peak Discharge, q_p	3.05 cu ft/sec	Eq. 10

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 16 of 110
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Calculate Peak Discharge from Areas A4.1

Area 1.54 acres 0.00 sq. miles

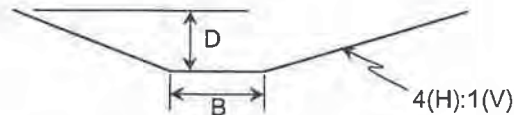
Calculate Travel Time, Tt

Sheet Flow

	Pt. 19	Flow Length, L	190 feet				Flow Length, L	0 feet
A4.1	to Pt. 25	Two-yr 24 hr rainfall, P ₂	4.9 inches				Two-yr 24 hr rainfall	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

		Channel Depth, D	2 feet				
		Channel Width, B	2 feet				
		X-Section Area, a	20 sq ft				
Pt. 25		Wetted Perimeter, p _w	18.5 feet				
to Pt. 26		Hydraulic Radius, 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.				
		Time of Conc. Tc	0.212 hrs	From calculations above			
Area		Unit Peak Disch. q _u	555 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
A4.1		Runoff, Q	5.1 inches	From pg. 1			
		Peak Discharge, q _p	6.81 cu ft/sec	Eq. 10			

		Flow Length, L	260				
A8.1		Travel Time, Tt	0.033 hrs	Ref Eq. 6			
(from		Time of Conc. Tc	0.427 hrs	Tt + Tc for Area A8.1 (pg. 14)			
pt. 25		Unit Peak Disch. q _u	440 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
to Pt.		Runoff, Q	5.1 inches	From pg. 1			
26)		Peak Discharge, q _p	5.19 cu ft/sec	Eq. 10			

		Flow Length, L	260				
A7.2		Travel Time, Tt	0.033 hrs	Ref Eq. 6			
(from		Time of Conc. Tc	0.628 hrs	Tt + Tc for Area A7.2 (pg. 14)			
pt. 25		Unit Peak Disch. q _u	370 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
to Pt.		Runoff, Q	5.1 inches	From pg. 1			
26)		Peak Discharge, q _p	2.77 cu ft/sec	Eq. 10			

		Flow Length, L	260				
A7.1		Travel Time, Tt	0.033 hrs	Ref Eq. 6			
(from		Time of Conc. Tc	0.348 hrs	Tt + Tc for Area A7.1 (pg. 14)			
pt. 25		Unit Peak Disch. q _u	475 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
to Pt.		Runoff, Q	5.1 inches	From pg. 1			
26)		Peak Discharge, q _p	3.37 cu ft/sec	Eq. 10			

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Area Flow Length, L 260
 A6.2 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.642 hrs Tt + Tc for Area A6.2 (pg. 14)
 pt. 25 Unit Peak Disch. q_u 365 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 26) Peak Discharge, q_p 3.84 cu ft/sec Eq. 10

Area Flow Length, L 260
 A6.1 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.295 hrs Tt + Tc for Area A6.1 (pg. 14)
 pt. 25 Unit Peak Disch. q_u 500 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 26) Peak Discharge, q_p 5.38 cu ft/sec Eq. 10

Area Flow Length, L 260
 A5.2 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.575 hrs Tt + Tc for Area A5.2 (pg. 15)
 pt. 25 Unit Peak Disch. q_u 385 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 26) Peak Discharge, q_p 2.98 cu ft/sec Eq. 10

Area Flow Length, L 260
 A5.1 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.281 hrs Tt + Tc for Area A5.1 (pg. 15)
 pt. 25 Unit Peak Disch. q_u 510 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 26) Peak Discharge, q_p 4.15 cu ft/sec Eq. 10

Area Flow Length, L 260
 A4.2 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.526 hrs Tt + Tc for Area A4.2 (pg. 14)
 pt. 25 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
 26) Peak Discharge, q_p 4.59 cu ft/sec Eq. 10

Area Flow Length, L 260
 A4.3 Travel Time, Tt 0.033 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.584 hrs Tt + Tc for Area A4.3 (pg. 14)
 pt. 25 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
 26) Peak Discharge, q_p 3.64 cu ft/sec Eq. 10

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

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Calculate Peak Discharge from Area A3.2

Area 1.22 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

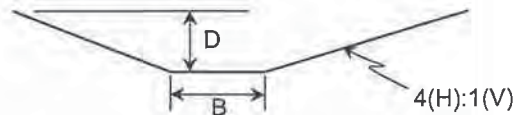
Pt. 18 Flow Length, L 120 feet to Pt. 19 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.25 ft/ft Travel Time, Tt 0.124 hrs Ref Eq. 8	Pt. 19 Flow Length, L 180 feet to Pt. 27 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.326
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A3.2 Shallow, Concentrated Flow

Pt. 27 Flow Length, L 95 feet
to Pt. 28 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 3 feet
 X-Section Area, a 22 sq ft
Pt. 26 Wetted Perimeter, p_w 19.5 feet
to Pt. 31 Hydraulic Radius, 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 A3.3

Area 1.13 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

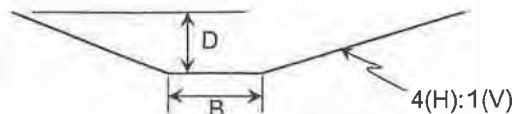
Pt. 22 Flow Length, L 100.2 feet to Pt. 18 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.1 ft/ft Travel Time, Tt 0.155 hrs Ref Eq. 8	Pt. 22 Flow Length, L 199.8 feet to Pt. 29 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.354
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A3.3 Shallow, Concentrated Flow

Pt. 29 Flow Length, L 75.2 feet
to Pt. 30 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 3 feet
 X-Section Area, a 22 sq ft
Pt. 26 Wetted Perimeter, p_w 19.5 feet
to Pt. 31 Hydraulic Radius, 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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 19 of 110
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Calculate Peak Discharge

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

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Area Flow Length, L 200
A5.2 Travel Time, Tt 0.024 hrs Ref Eq. 6
(from Time of Conc. Tc 0.600 hrs Tt + Tc for Area A5.2 (pg. 17)
pt. 26 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
31) Peak Discharge, q_p 2.94 cu ft/sec Eq. 10

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

Area Flow Length, L 200
A4.2 Travel Time, Tt 0.024 hrs Ref Eq. 6
(from Time of Conc. Tc 0.550 hrs Tt + Tc for Area A4.2 (pg. 17)
pt. 26 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
31) Peak Discharge, q_p 4.53 cu ft/sec Eq. 10

Area Flow Length, L 200
A4.3 Travel Time, Tt 0.024 hrs Ref Eq. 6
(from Time of Conc. Tc 0.608 hrs Tt + Tc for Area A4.3 (pg. 17)
pt. 26 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
31) Peak Discharge, q_p 3.54 cu ft/sec Eq. 10

Area Flow Length, L 200
A4.1 Travel Time, Tt 0.024 hrs Ref Eq. 6
(from Time of Conc. Tc 0.236 hrs Tt + Tc for Area A4.1 (pg. 16)
pt. 26 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
31) Peak Discharge, q_p 6.63 cu ft/sec Eq. 10

Calculate Channel Flow Velocity

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

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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

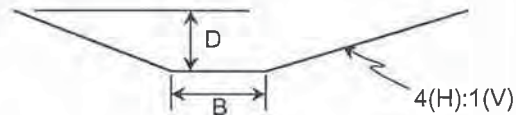
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	185 feet		Flow Length, L	0 feet	
A3.1	Pt. 32 to Pt. 31	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	
		Land Slope, s	0.25 ft/ft		5.9	
		Travel Time, Tt	0.176 hrs	Ref Eq. 8	Land Slope, s	0.04 ft/ft
					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. 31 to Pt. 33	Wetted Perimeter, p _w	20.5 feet			
	Hydraulic Radius, 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	Flow Length, L	560			
	Travel Time, Tt	0.066 hrs	Ref Eq. 6		
(from pt. 31 to Pt. 33)	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	Flow Length, L	560			
	Travel Time, Tt	0.066 hrs	Ref Eq. 6		
(from pt. 31 to Pt. 33)	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	Flow Length, L	560			
	Travel Time, Tt	0.066 hrs	Ref Eq. 6		
(from pt. 31 to Pt. 33)	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		

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 22 of 110
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Area Flow Length, L 560
 A6.2 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.733 hrs Tt + Tc for Area A6.2 (pg. 19)
 pt. 31 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
 33) Peak Discharge, q_p 3.63 cu ft/sec Eq. 10

Area Flow Length, L 560
 A6.1 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.386 hrs Tt + Tc for Area A6.1 (pg. 19)
 pt. 31 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
 33) Peak Discharge, q_p 4.89 cu ft/sec Eq. 10

Area Flow Length, L 560
 A5.2 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.666 hrs Tt + Tc for Area A5.2 (pg. 20)
 pt. 31 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
 33) Peak Discharge, q_p 2.78 cu ft/sec Eq. 10

Area Flow Length, L 560
 A5.1 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.372 hrs Tt + Tc for Area A5.1 (pg. 20)
 pt. 31 Unit Peak Disch. q_u 460 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 33) Peak Discharge, q_p 3.74 cu ft/sec Eq. 10

Area Flow Length, L 560
 A4.2 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.617 hrs Tt + Tc for Area A4.2 (pg. 20)
 pt. 31 Unit Peak Disch. q_u 385 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 33) Peak Discharge, q_p 4.42 cu ft/sec Eq. 10

Area Flow Length, L 560
 A4.3 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.675 hrs Tt + Tc for Area A4.3 (pg. 20)
 pt. 31 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
 33) Peak Discharge, q_p 3.36 cu ft/sec Eq. 10

Area Flow Length, L 560
 A4.1 Travel Time, Tt 0.066 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.303 hrs Tt + Tc for Area A4.1 (pg. 20)
 pt. 31 Unit Peak Disch. q_u 500 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 33) Peak Discharge, q_p 6.14 cu ft/sec Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 23 of 110
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Area	Flow Length, L	560	
A3.2	Travel Time, Tt	0.066 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.549 hrs	Tt + Tc for Area A3.2 (pg. 19)
pt. 31	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
33)	Peak Discharge, q_p	3.84 cu ft/sec	Eq. 10

Area	Flow Length, L	560	
A3.3	Travel Time, Tt	0.066 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.607 hrs	Tt + Tc for Area A3.3 (pg. 19)
pt. 31	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
33)	Peak Discharge, q_p	3.42 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 24 of 110
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Calculate Peak Discharge from Areas A2.1

Area 0.78 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	127.4 feet		Pt. 35	Flow Length, L	172.6 feet
	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt.	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.25 ft/ft		36	Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.130 hrs	Ref Eq. 8		Travel Time, Tt	0.315

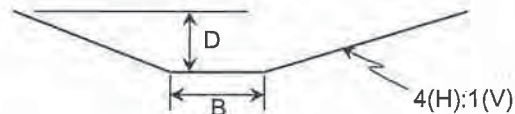
A2.1

Shallow, Concentrated Flow

Pt. 36	Flow Length, L	55.9 feet	
to Pt.	Watercourse slope, s	0.04 ft/ft	
37	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	Wetted Perimeter, p _w	21.5 feet	
to Pt.	Hydraulic Radius, r	1.210 ft	
38	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.	
	Time of Conc. Tc	0.478 hrs	From calculations above
Area	Unit Peak Disch. q _u	410 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
A2.1	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	2.55 cu ft/sec	Eq. 10

Area	Flow Length, L	235	
A8.1	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.545 hrs	Tt + Tc for Area A8.1 (pg. 21)
pt. 33	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
38)	Peak Discharge, q _p	4.66 cu ft/sec	Eq. 10

Area	Flow Length, L	235	
A7.2	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.746 hrs	Tt + Tc for Area A7.2 (pg. 21)
pt. 33	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
38)	Peak Discharge, q _p	2.58 cu ft/sec	Eq. 10

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

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Area Flow Length, L 235
 A6.2 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.761 hrs Tt + Tc for Area A6.2 (pg. 22)
 pt. 33 Unit Peak Disch. q_u 340 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 38) Peak Discharge, q_p 3.58 cu ft/sec Eq. 10

Area Flow Length, L 235
 A6.1 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.413 hrs Tt + Tc for Area A6.1 (pg. 22)
 pt. 33 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
 38) Peak Discharge, q_p 4.79 cu ft/sec Eq. 10

Area Flow Length, L 235
 A5.2 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.693 hrs Tt + Tc for Area A5.2 (pg. 22)
 pt. 33 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
 38) Peak Discharge, q_p 2.74 cu ft/sec Eq. 10

Area Flow Length, L 235
 A5.1 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.399 hrs Tt + Tc for Area A5.1 (pg. 22)
 pt. 33 Unit Peak Disch. q_u 450 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 38) Peak Discharge, q_p 3.66 cu ft/sec Eq. 10

Area Flow Length, L 235
 A4.2 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.644 hrs Tt + Tc for Area A4.2 (pg. 22)
 pt. 33 Unit Peak Disch. q_u 365 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 38) Peak Discharge, q_p 4.19 cu ft/sec Eq. 10

Area Flow Length, L 235
 A4.3 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.702 hrs Tt + Tc for Area A4.3 (pg. 22)
 pt. 33 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
 38) Peak Discharge, q_p 3.31 cu ft/sec Eq. 10

Area Flow Length, L 235
 A4.1 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.330 hrs Tt + Tc for Area A4.1 (pg. 22)
 pt. 33 Unit Peak Disch. q_u 490 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 38) Peak Discharge, q_p 6.01 cu ft/sec Eq. 10

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Area	Flow Length, L	235	
A3.2	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.577 hrs	Tt + Tc for Area A3.2 (pg. 23)
pt. 33	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
38)	Peak Discharge, q_p	3.79 cu ft/sec	Eq. 10

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

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 27 of 110
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Calculate Peak Discharge from Areas A1.1

Area 1.33 acres 0.00 sq. miles

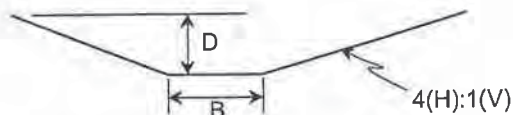
Calculate Travel Time, Tt

Sheet Flow

A1.1	Pt. 35	Flow Length, L	200 feet		Flow Length, L	0
	to Pt. 38	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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	Wetted Perimeter, p _w	21.5 feet	
to Pt. 39	Hydraulic Radius, 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.	
	Time of Conc. Tc	0.238 hrs	From calculations above
Area A1.1	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	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from pt. 38 to Pt. 39)	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	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from pt. 38 to Pt. 39)	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	Flow Length, L	380	
	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from pt. 38 to Pt. 39)	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

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Area Flow Length, L 380
A6.2 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.812 hrs Tt + Tc for Area A6.2 (pg. 25)
pt. 38 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
39) Peak Discharge, q_p 3.52 cu ft/sec Eq. 10

Area Flow Length, L 380
A6.1 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.464 hrs Tt + Tc for Area A6.1 (pg. 25)
pt. 38 Unit Peak Disch. q_u 415 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
39) Peak Discharge, q_p 4.46 cu ft/sec Eq. 10

Area Flow Length, L 380
A5.2 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.744 hrs Tt + Tc for Area A5.2 (pg. 25)
pt. 38 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
39) Peak Discharge, q_p 2.67 cu ft/sec Eq. 10

Area Flow Length, L 380
A5.1 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.450 hrs Tt + Tc for Area A5.1 (pg. 25)
pt. 38 Unit Peak Disch. q_u 430 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
39) Peak Discharge, q_p 3.50 cu ft/sec Eq. 10

Area Flow Length, L 380
A4.2 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.695 hrs Tt + Tc for Area A4.2 (pg. 25)
pt. 38 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
39) Peak Discharge, q_p 4.07 cu ft/sec Eq. 10

Area Flow Length, L 380
A4.3 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.753 hrs Tt + Tc for Area A4.3 (pg. 25)
pt. 38 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
39) Peak Discharge, q_p 3.22 cu ft/sec Eq. 10

Area Flow Length, L 380
A4.1 Travel Time, Tt 0.051 hrs Ref Eq. 6
(from Time of Conc. Tc 0.381 hrs Tt + Tc for Area A4.1 (pg. 25)
pt. 38 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
39) Peak Discharge, q_p 5.58 cu ft/sec Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 29 of 110
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Area	Flow Length, L	380	
A3.2	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.628 hrs	Tt + Tc for Area A3.2 (pg. 26)
pt. 38	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
39)	Peak Discharge, q_p	3.69 cu ft/sec	Eq. 10

Area	Flow Length, L	380	
A3.3	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.685 hrs	Tt + Tc for Area A3.3 (pg. 26)
pt. 38	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
39)	Peak Discharge, q_p	3.20 cu ft/sec	Eq. 10

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

Area	Flow Length, L	380	
A2.1	Travel Time, Tt	0.051 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.529 hrs	Tt + Tc for Area A2.1 (pg. 24)
pt. 38	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
39)	Peak Discharge, q_p	2.49 cu ft/sec	Eq. 10

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

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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

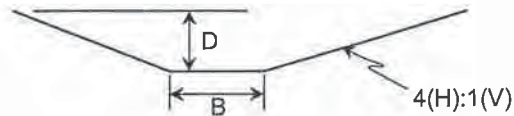
Calculate Travel Time, Tt

Sheet Flow

	Pt. 41	Flow Length, L	280 feet	Flow Length, L	0 feet
B.5.1	to Pt.	Two-yr 24 hr rainfall, P ₂	4.9 inches	Two-yr 24 hr rainfall	5.9
	135	Land Slope, s	0.25 ft/ft	Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.245 hrs	Travel Time, Tt	0.000
			Ref Eq. 8		

Open Channel Flow

	Channel Depth, D	2 feet			
	Channel Width, B	0 feet			
	X-Section Area, a	16 sq ft			
Pt. 135	Wetted Perimeter, p _w	16.5 feet			
to Pt.	Hydraulic Radius, r	0.970 ft			
44	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.			
	Time of Conc. T _c	0.278 hrs	From calculations above		
Area	Unit Peak Disch. q _u	505 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III		
B.5.1	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, q _p	5.35 cu ft/sec			
	Peak Velocity	0.3345 ft/sec			
		16% of Calculated Channel Flow Velocity			

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 31 of 110
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Calculate Peak Discharge from Area B4.2

Area 1.1 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

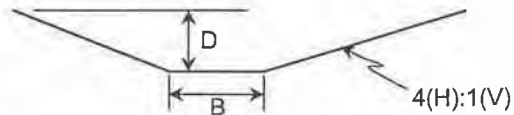
	Pt. 40	Flow Length, L	120 feet		Pt. 41	Flow Length, L	180 feet
B.4.2	to Pt. 41	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 42	Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.124 hrs	Ref Eq. 8		Travel Time, Tt	0.326

Shallow, Concentrated Flow

	Pt. 42	Flow Length, L	83.4 feet			
to Pt. 43		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	0 feet			
		X-Section Area, a	16 sq ft			
Pt. 44		Wetted Perimeter, p _w	16.5 feet			
to Pt. 45		Hydraulic Radius, r	0.970 ft			
		Channel Slope	0.005 ft/ft			
		Velocity, V	2.065 ft/sec	Ref Eq. 9		
		Flow Length, L	370			
		Travel Time, Tt	0.050 hrs	Ref Eq. 6		



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

Calculate Peak Discharge

		I _a /P	0.095 in.			
Area B.4.2		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

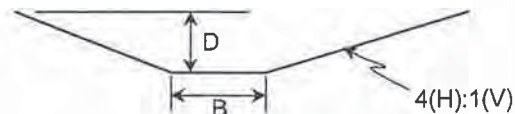
Area 1.67 acres 0.00 sq. miles

Calculate Travel Time, Tt Sheet Flow

B4.1	Pt. 46	Flow Length, L	160 feet		Flow Length, L	feet
	to Pt. 45	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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

	Channel Depth, D	2 feet	
	Channel Width, B	0 feet	
	X-Section Area, a	16 sq ft	
Pt. 45	Wetted Perimeter, p _w	16.5 feet	
to Pt. 47	Hydraulic Radius, 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

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

Area	Flow Length, L	345	
B4.2	Travel Time, Tt	0.046 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.554 hrs	Tt + Tc for Area B4.2 (pg. 31)
pt. 45	Unit Peak Disch. q _u	390 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 47)	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

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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

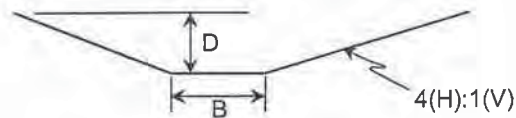
	Pt. 48	Flow Length, L	56.8 feet		Pt. 46	Flow Length, L	243.2 feet
B3.2	to Pt. 46	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 49	Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.068 hrs	Ref Eq. 8		Travel Time, Tt	0.415

Shallow, Concentrated Flow

	Pt. 49	Flow Length, L	97.8 feet			
	to Pt. 50	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	0 feet		
		X-Section Area, a	16 sq ft		
	Pt. 47	Wetted Perimeter, p _w	16.5 feet		
	to Pt. 51	Hydraulic Radius, r	0.970 ft		
		Channel Slope	0.005 ft/ft		
		Velocity, V	2.065 ft/sec	Ref Eq. 9	
		Flow Length, L	375		
		Travel Time, Tt	0.050 hrs	Ref Eq. 6	



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

Calculate Peak Discharge

	I _a /P	0.095 in.			
Area B3.2	Time of Conc. Tc	0.542 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	3.46 cu ft/sec	Eq. 10		

	Area	Flow Length, L	375		
B5.1	Travel Time, Tt	0.050 hrs	Ref Eq. 6		
	(from Time of Conc. Tc	0.425 hrs	Tt + Tc for Area B5.1 (pg. 32)		
pt. 47	Unit Peak Disch. q _u	440 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III		
to Pt. 51)	Runoff, Q	5.1 inches	From pg. 1		
	Peak Discharge, q _p	4.66 cu ft/sec	Eq. 10		

	Area	Flow Length, L	375		
B4.2	Travel Time, Tt	0.050 hrs	Ref Eq. 6		
	(from Time of Conc. Tc	0.604 hrs	Tt + Tc for Area B4.2 (pg. 32)		
pt. 47	Unit Peak Disch. q _u	380 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III		
to Pt. 51)	Runoff, Q	5.1 inches	From pg. 1		
	Peak Discharge, q _p	3.33 cu ft/sec	Eq. 10		

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 34 of 110
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Area	Flow Length, L	375	
B4.1	Travel Time, Tt	0.050 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.253 hrs	Tt + Tc for Area B4.1 (pg. 32)
pt. 47	Unit Peak Disch. q_u	530 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
51)	Peak Discharge, q_p	7.05 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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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	Flow Length, L	feet
		Two-yr 24 hr rainfall, P ₂	4.9 inches	Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft	Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.164 hrs	Travel Time, Tt	0.000

Ref Eq. 8

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 Radius, r	0.970 ft
	Channel Slope	0.005 ft/ft
	Velocity, V	2.065 ft/sec
	Flow Length, L	615
	Travel Time, Tt	0.083 hrs

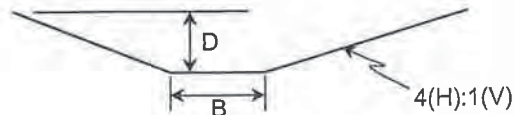
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.247 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

Area B3.1	I _a /P	0.095 in.	
	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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 36 of 110
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Area	Flow Length, L	615	
B3.2	Travel Time, Tt	0.083 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.625 hrs	Tt + Tc for Area B3.2 (pg. 33)
pt. 51	Unit Peak Disch. q_u	370 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
60)	Peak Discharge, q_p	3.24 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 37 of 110
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Calculate Peak Discharge from Area B2.2

Area 1.62 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 61	Flow Length, L	64.5 feet	Pt. 52	Flow Length, L	235.5 feet
to Pt. 52	Two-yr 24 hr rainfall, P ₂	4.9 inches	to Pt. 62	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.25 ft/ft		Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.076 hrs		Travel Time, Tt	0.404

Ref Eq. 8

B2.2 Shallow, Concentrated Flow

Pt. 62	Flow Length, L	200 feet
to Pt. 63	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 Wetted Perimeter, p_w 18.5 feet

to Pt. 67 Hydraulic Radius, r 1.082 ft

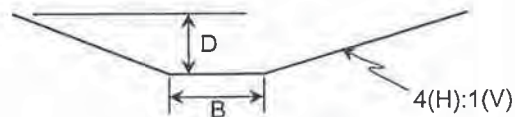
Channel Slope 0.005 ft/ft

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	Flow Length, L	96.6 feet	Pt. 70	Flow Length, L	203.4 feet
to Pt. 70	Two-yr 24 hr rainfall, P ₂	4.9 inches	to Pt. 64	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.1 ft/ft		Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.151 hrs		Travel Time, Tt	0.360

Ref Eq. 8

B2.3 Shallow, Concentrated Flow

Pt. 64	Flow Length, L	71.6 feet
to Pt. 65	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 Wetted Perimeter, p_w 18.5 feet

to Pt. 67 Hydraulic Radius, r 1.082 ft

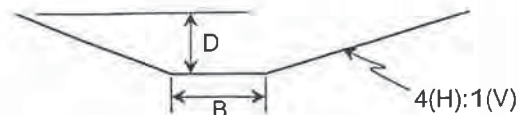
Channel Slope 0.005 ft/ft

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



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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 38 of 110
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Calculate Peak Discharge

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

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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

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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

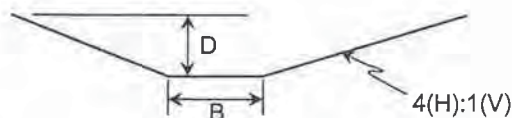
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	195 feet		Flow Length, L	0 feet	
B2.1	Pt. 68 to Pt. 67	Two-yr 24 hr rainfall, P_2	4.9 inches		Two-yr 24 hr rainfall	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

Open Channel Flow

	Channel Depth, D	2 feet	
	Channel Width, B	2 feet	
	X-Section Area, a	20 sq ft	
Pt. 67 to Pt. 69	Wetted Perimeter, p_w	18.5 feet	
	Hydraulic Radius, 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

	Area B2.1	Flow Length, L	0.095 in.	
		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	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	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	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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 41 of 110
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Area	Flow Length, L	275	
B3.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.694 hrs	Tt + Tc for Area B3.2 (pg. 38)
pt. 67	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
69)	Peak Discharge, q_p	3.07 cu ft/sec	Eq. 10

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

Area	Flow Length, L	275	
B2.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.566 hrs	Tt + Tc for Area B2.2 (pg. 38)
pt. 67	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
69)	Peak Discharge, q_p	5.03 cu ft/sec	Eq. 10

Area	Flow Length, L	275	
B2.3	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.585 hrs	Tt + Tc for Area B2.3 (pg. 38)
pt. 67	Unit Peak Disch. q_u	385 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
69)	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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 42 of 110
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Calculate Peak Discharge from Areas B1.2

Area 1.19 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 70 Flow Length, L 120 feet
to Pt. 68 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.25 ft/ft
 Travel Time, Tt 0.124 hrs

Ref Eq. 8

Pt. 68 Flow Length, L 180 feet
to Pt. 71 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.326

B1.2 Shallow, Concentrated Flow

Pt. 71 Flow Length, L 95 feet
to Pt. 72 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 Wetted Perimeter, p_w 20.5 feet
to Pt. 76 Hydraulic Radius, r 1.171 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.341 ft/sec
 Flow Length, L 155
 Travel Time, Tt 0.018 hrs

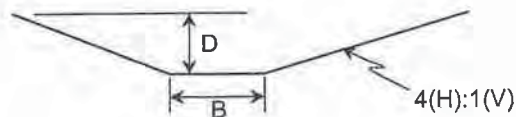
Ref Eq. 9

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

Pt. 73 Flow Length, L 96.6 feet
to Pt. 70 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.1 ft/ft
 Travel Time, Tt 0.151 hrs

Ref Eq. 8

Pt. 70 Flow Length, L 203.4 feet
to Pt. 74 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.360

B1.3 Shallow, Concentrated Flow

Pt. 74 Flow Length, L 71.6 feet
to Pt. 75 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 Wetted Perimeter, p_w 20.5 feet
to Pt. 76 Hydraulic Radius, r 1.171 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.341 ft/sec
 Flow Length, L 155
 Travel Time, Tt 0.018 hrs

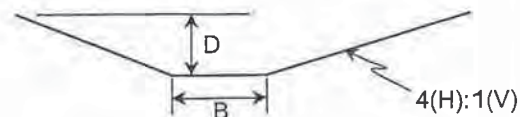
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.535 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 43 of 110
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Calculate Peak Discharge

	I_a/P	0.095 in.	
	Time of Conc. T_c	0.477 hrs	From calculations above
Area B1.2	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

	I_a/P	0.095 in.	
	Time of Conc. T_c	0.535 hrs	From calculations above
Area B1.3	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	Flow Length, L	155	
	Travel Time, T_t	0.018 hrs	Ref Eq. 6
(from pt. 69 to Pt. 76)	Time of Conc. T_c	0.595 hrs	$T_t + T_c$ 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	Flow Length, L	155	
	Travel Time, T_t	0.018 hrs	Ref Eq. 6
(from pt. 69 to Pt. 76)	Time of Conc. T_c	0.774 hrs	$T_t + T_c$ 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	Flow Length, L	155	
	Travel Time, T_t	0.018 hrs	Ref Eq. 6
(from pt. 69 to Pt. 76)	Time of Conc. T_c	0.423 hrs	$T_t + T_c$ 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	Flow Length, L	155	
	Travel Time, T_t	0.018 hrs	Ref Eq. 6
(from pt. 69 to Pt. 76)	Time of Conc. T_c	0.712 hrs	$T_t + T_c$ 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	Flow Length, L	155	
	Travel Time, T_t	0.018 hrs	Ref Eq. 6
(from pt. 69 to Pt. 76)	Time of Conc. T_c	0.334 hrs	$T_t + T_c$ 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

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Area	Flow Length, L	155	
B2.2	Travel Time, Tt	0.018 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.584 hrs	Tt + Tc for Area B2.2 (pg. 41)
pt. 69	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
76)	Peak Discharge, q_p	5.03 cu ft/sec	Eq. 10

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

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 45 of 110
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Calculate Peak Discharge from Areas B1.1

Area 0.93 acres 0.00 sq. miles

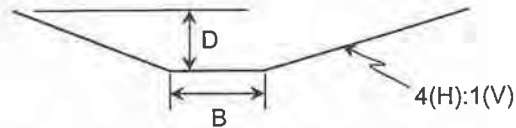
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	190 feet		Flow Length, L	0	
B1.1	Pt. 77 to Pt. 76	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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

	Channel Depth, D	2 feet	
	Channel Width, B	4 feet	
	X-Section Area, a	24 sq ft	
Pt. 76 to Pt. 39	Wetted Perimeter, p _w	20.5 feet	
	Hydraulic Radius, 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.	
	Time of Conc. Tc	0.213 hrs	From calculations above
Area B1.1	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

	Flow Length, L	285	
B5.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from pt. 76 to Pt. 39)	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

	Flow Length, L	285	
B4.2	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from pt. 76 to Pt. 39)	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

	Flow Length, L	285	
B4.1	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from pt. 76 to Pt. 39)	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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 46 of 110
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Area Flow Length, L 285
 B3.2 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.746 hrs Tt + Tc for Area B3.2 (pg. 43)
 pt. 76 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
 39) Peak Discharge, q_p 3.02 cu ft/sec Eq. 10

Area Flow Length, L 285
 B3.1 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.368 hrs Tt + Tc for Area A.4.2 (pg. 43)
 pt. 76 Unit Peak Disch. q_u 460 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 39) Peak Discharge, q_p 8.58 cu ft/sec Eq. 10

Area Flow Length, L 285
 B2.2 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.618 hrs Tt + Tc for Area B2.2 (pg. 44)
 pt. 76 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
 39) Peak Discharge, q_p 4.91 cu ft/sec Eq. 10

Area Flow Length, L 285
 B2.3 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.638 hrs Tt + Tc for Area B2.3 (pg. 44)
 pt. 76 Unit Peak Disch. q_u 375 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 39) Peak Discharge, q_p 2.87 cu ft/sec Eq. 10

Area Flow Length, L 285
 B2.1 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.270 hrs Tt + Tc for Area B2.1 (pg. 44)
 pt. 76 Unit Peak Disch. q_u 510 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 39) Peak Discharge, q_p 6.22 cu ft/sec Eq. 10

Area Flow Length, L 285
 B1.2 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.511 hrs Tt + Tc for Area B2.2 (pg. 43)
 pt. 76 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
 79) Peak Discharge, q_p 3.79 cu ft/sec Eq. 10

Area Flow Length, L 285
 B1.3 Travel Time, Tt 0.034 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.569 hrs Tt + Tc for Area B2.3 (pg. 43)
 pt. 76 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
 79) Peak Discharge, q_p 4.26 cu ft/sec Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 47 of 110
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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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 48 of 110
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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** Flow Length, L 127.4 feet
to Pt. 35 Two-yr 24 hr rainfall, P₂ 4.9 inches
Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.130 hrs Ref Eq. 8

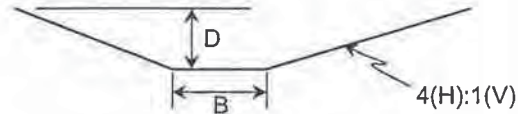
Pt. 35 Flow Length, L 172.6
to Pt. 78 Two-yr 24 hr rainfall 5.9
Land Slope, s 0.04
Travel Time, Tt 0.315

Shallow, Concentrated Flow

Pt. 78 Flow Length, L 55.9 feet
to Pt. 79 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 2.5 feet
Channel Width, B 8 feet
X-Section Area, a 45 sq ft
Pt. 39 Wetted Perimeter, p_w 28.6 feet
to Pt. 80 Hydraulic Radius, 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

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

B5.1 Flow Length, L 150
Travel Time, Tt 0.015 hrs Ref Eq. 6
(from 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

B4.2 Flow Length, L 150
Travel Time, Tt 0.015 hrs Ref Eq. 6
(from 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

B4.1 Flow Length, L 150
Travel Time, Tt 0.015 hrs Ref Eq. 6
(from 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

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Area Flow Length, L 150
 B3.2 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.760 hrs Tt + Tc for Area B3.2 (pg. 46)
 pt. 39 Unit Peak Disch. q_u 340 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 2.98 cu ft/sec Eq. 10

Area Flow Length, L 150
 B3.1 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.383 hrs Tt + Tc for Area A.4.2 (pg. 46)
 pt. 39 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
 80) Peak Discharge, q_p 8.48 cu ft/sec Eq. 10

Area Flow Length, L 150
 B2.2 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.633 hrs Tt + Tc for Area B2.2 (pg. 46)
 pt. 39 Unit Peak Disch. q_u 370 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 4.78 cu ft/sec Eq. 10

Area Flow Length, L 150
 B2.3 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.652 hrs Tt + Tc for Area B2.3 (pg. 46)
 pt. 39 Unit Peak Disch. q_u 365 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 2.79 cu ft/sec Eq. 10

Area Flow Length, L 150
 B2.1 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.284 hrs Tt + Tc for Area B2.1 (pg. 46)
 pt. 39 Unit Peak Disch. q_u 505 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 6.16 cu ft/sec Eq. 10

Area Flow Length, L 150
 B1.2 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.525 hrs Tt + Tc for Area B2.2 (pg. 46)
 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 3.79 cu ft/sec Eq. 10

Area Flow Length, L 150
 B1.3 Travel Time, Tt 0.015 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.583 hrs Tt + Tc for Area B2.3 (pg. 46)
 pt. 39 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
 80) Peak Discharge, q_p 4.26 cu ft/sec Eq. 10

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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

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Area	Flow Length, L	150	
A5.1	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.465 hrs	Tt + Tc for Area A5.1 (pg. 28)
pt. 39	Unit Peak Disch. q_u	425 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	3.45 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A4.2	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.710 hrs	Tt + Tc for Area A4.2 (pg. 28)
pt. 39	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
80)	Peak Discharge, q_p	4.02 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A4.3	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.768 hrs	Tt + Tc for Area A4.3 (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	3.22 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A4.1	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.396 hrs	Tt + Tc for Area A4.1 (pg. 28)
pt. 39	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
80)	Peak Discharge, q_p	5.58 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A3.2	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.642 hrs	Tt + Tc for Area A3.2 (pg. 29)
pt. 39	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
80)	Peak Discharge, q_p	3.50 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A3.3	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.700 hrs	Tt + Tc for Area A3.3 (pg. 29)
pt. 39	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
80)	Peak Discharge, q_p	3.15 cu ft/sec	Eq. 10
Area	Flow Length, L	150	
A3.1	Travel Time, Tt	0.015 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.335 hrs	Tt + Tc for Area A3.1 (pg. 29)
pt. 39	Unit Peak Disch. q_u	495 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	5.21 cu ft/sec	Eq. 10

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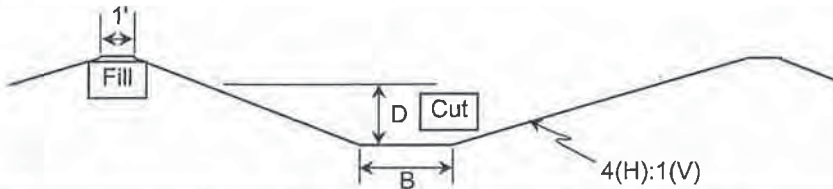
Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 52 of 110
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Area	Flow Length, L	150	
A2.1	Travel Time, T _t	0.015 hrs	Ref Eq. 6
(from	Time of Conc. T _c	0.544 hrs	T _t + T _c for Area A2.1 (pg. 29)
pt. 39	Unit Peak Disch. q _u	395 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
80)	Peak Discharge, q _p	2.46' cu ft/sec	Eq. 10

Area	Flow Length, L	150	
A1.1	Travel Time, T _t	0.015 hrs	Ref Eq. 6
(from	Time of Conc. T _c	0.253 hrs	T _t + T _c for Area A2.1 (pg. 27)
pt. 39	Unit Peak Disch. q _u	530 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	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

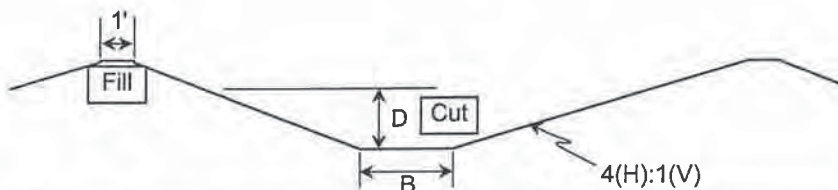


	Point	Existing Grade	Design Depth	Ditch Elev	Btm Width	Slope	Length (ft)	Cut (ft)	Fill (ft)	Area of Cut/Fill (ft ²)	Volume Cut/Fill (yd ³)
	80	218.5	2.5	216.5	8	0.50%	150	2.00	0.50	27.0	
	39	221.5	2.5	217.3	8	0.50%	0	4.25	0.00	106.3	370.1
Drainage Area A	39	221.5	2.0	217.3	5	0.50%	380	4.25	0.00	93.5	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

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	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.

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EASTERN SIDE

Calculate Peak Discharge from Area C4.2

Area 1.4 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 84 Flow Length, L 153 feet
to Pt. 85 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.25 ft/ft
 Travel Time, Tt 0.151 hrs

Pt. 85 Flow Length, L 147 feet
to Pt. 86 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.277

C4.2

Shallow, Concentrated Flow

Pt. 86 Flow Length, L 56.5 feet
to Pt. 87 Watercourse slope, s 0.04 ft/ft
 Avg. Velocity, V. 3.2 ft/sec

Ref Eq. 8

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 Wetted Perimeter, p_w 16.5 feet
to Pt. 92 Hydraulic Radius, r 0.970 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.065 ft/sec
 Flow Length, L 135
 Travel Time, Tt 0.018 hrs

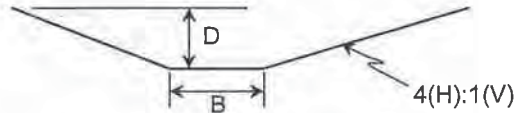
Ref Eq. 9

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

Pt. 88 Flow Length, L 61.1 feet
to Pt. 89 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.25 ft/ft
 Travel Time, Tt 0.072 hrs

Pt. 89 Flow Length, L 238.9 feet
to Pt. 90 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.409

C4.3

Shallow, Concentrated Flow

Pt. 90 Flow Length, L 11.1 feet
to Pt. 91 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 Wetted Perimeter, p_w 16.5 feet
to Pt. 92 Hydraulic Radius, r 0.970 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.065 ft/sec
 Flow Length, L 135
 Travel Time, Tt 0.018 hrs

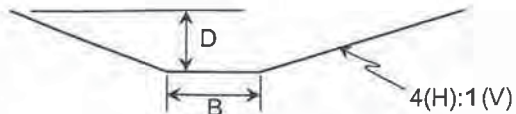
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.500 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



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Calculate Peak Discharge

	I _a /P	0.095 in.	
	Time of Conc. T _c	0.451 hrs	From calculations above
Area	Unit Peak Disch. q _u	440 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
C4.2	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	4.9088 cu ft/sec	Eq. 10

	I _a /P	0.095 in.	
	Time of Conc. T _c	0.500 hrs	From calculations above
Area	Unit Peak Disch. q _u	410 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
C4.3	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, q _p	7.65 cu ft/sec	
Peak Velocity	0.4783 ft/sec	
	23% of Calculated Channel Flow Velocity	

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 56	of 110
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Calculate Peak Discharge from Area C4.1

Area 0.84 acres 0.00 sq. miles

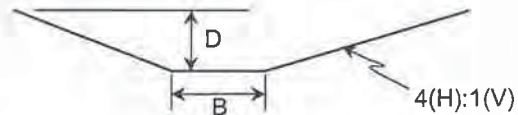
Calculate Travel Time, Tt

Sheet Flow

	Pt. 93	Flow Length, L	160 feet				Flow Length, L	0 feet
C4.1	to Pt. 92	Two-yr 24 hr rainfall, P ₂	4.9 inches				Two-yr 24 hr rainfall	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	Channel Depth, D	2 feet				
C4.1	to Pt. 94	Channel Width, B	0 feet				
		X-Section Area, a	16 sq ft				
		Wetted Perimeter, p _w	16.5 feet				
		Hydraulic Radius, 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.				
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			

		Flow Length, L	60				
C4.2		Travel Time, Tt	0.008 hrs	Ref Eq. 6			
	(from	Time of Conc. Tc	0.459 hrs	Tt + Tc for Area C4.2 (pg. 55)			
	pt. 92	Unit Peak Disch. q _u	435 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
	to Pt. 94)	Runoff, Q	5.1 inches	From pg. 1			
		Peak Discharge, q _p	4.85 cu ft/sec	Eq. 10			

		Flow Length, L	60				
C4.3		Travel Time, Tt	0.008 hrs	Ref Eq. 6			
	(from	Time of Conc. Tc	0.509 hrs	Tt + Tc for Area C4.3 (pg. 55)			
	pt. 92	Unit Peak Disch. q _u	410 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III			
	to Pt. 94)	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				
C4.3		Peak Discharge, q _p	11.61 cu ft/sec				
		Peak Velocity	0.7259 ft/sec				
			35% of Calculated Channel Flow Velocity				

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Calculate Peak Discharge from Area C3.2

Area 1.72 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 95 Flow Length, L 103.4 feet
to Pt. 96 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.25 ft/ft
 Travel Time, Tt 0.110 hrs Ref Eq. 8

Pt. 96 Flow Length, L 196.6 feet
to Pt. 97 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.350

C3.2 Shallow, Concentrated Flow

Pt. 97 Flow Length, L 108.2 feet
to Pt. 98 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
 Ref Eq. 6

Travel Time, Tt 0.009 hrs

Open Channel Flow

Channel Depth, D 2 feet
 Channel Width, B 0 feet
 X-Section Area, a 16 sq ft

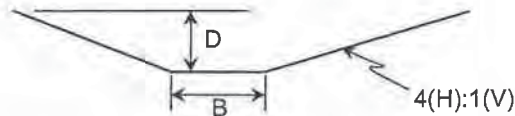
Pt. 94 Wetted Perimeter, p_w 16.5 feet
to Pt. 107 Hydraulic Radius, r 0.970 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.065 ft/sec Ref Eq. 9

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 Flow Length, L 92.6 feet
to Pt. 100 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.25 ft/ft
 Travel Time, Tt 0.101 hrs Ref Eq. 8

Pt. 100 Flow Length, L 207.4 feet
to Pt. 101 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.365

C3.3 Shallow, Concentrated Flow

Pt. 101 Flow Length, L 42.6 feet
to Pt. 102 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
 Ref Eq. 6

Travel Time, Tt 0.004 hrs

Open Channel Flow

Channel Depth, D 2 feet
 Channel Width, B 0 feet
 X-Section Area, a 16 sq ft

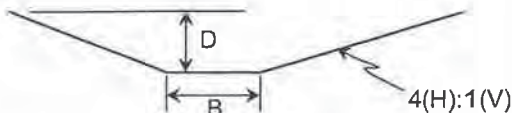
Pt. 94 Wetted Perimeter, p_w 16.5 feet
to Pt. 107 Hydraulic Radius, r 0.970 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.065 ft/sec Ref Eq. 9

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



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Calculate Peak Discharge from Area C3.4

Area 0.78 acres 0.00 sq. miles

Calculate Travel Time, Tt Sheet Flow

Pt. 103	Flow Length, L	126.6 feet		Pt. 104	Flow Length, L	173.4 feet
to Pt. 104	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 105	Two-yr 24 hr rainfall	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 Flow Length, L 15.5 feet
to Pt. 106 Watercourse slope, s 0.04 ft/ft
106 Avg. Velocity, V. 3.2 ft/sec

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

Travel Time, Tt 0.001 hrs

Open Channel Flow

Channel Depth, D 2 feet
 Channel Width, B 0 feet
 X-Section Area, a 16 sq ft
Pt. 94 Wetted Perimeter, p_w 16.5 feet
to Pt. 107 Hydraulic Radius, r 0.970 ft
107 Channel Slope 0.005 ft/ft
 Velocity, V 2.065 ft/sec
 Flow Length, L 265
 Travel Time, Tt 0.036 hrs

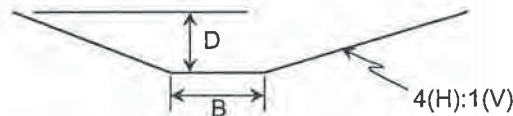
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.541 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.505 hrs	From calculations above
Area C3.2	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	5.62 cu ft/sec	Eq. 10

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.510 hrs	From calculations above
Area C3.3	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

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.541 hrs	From calculations above
Area C3.4	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	Flow Length, L	265	
	Travel Time, Tt	0.036 hrs	Ref Eq. 6
(from pt. 94 to Pt. 107)	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	Flow Length, L	265	
C4.3	Travel Time, Tt	0.036 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.544 hrs	Tt + Tc for Area C4.3 (pg. 56)
pt. 94	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
107)	Peak Discharge, q_p	2.68 cu ft/sec	Eq. 10

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

Calculate Channel Flow Velocity

X-Section Area, a	16 sq ft
Peak Discharge, q_p	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

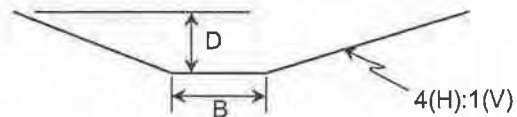
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	275 feet		Flow Length, L	0 feet		
C3.1	Pt. 96 to Pt. 94	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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

	Channel Depth, D	2 feet	
	Channel Width, B	2 feet	
	X-Section Area, a	20 sq ft	
Pt. 107 to Pt. 108	Wetted Perimeter, p _w	18.5 feet	
	Hydraulic Radius, 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

	Flow Length, L	475	
Area C4.2	Travel Time, Tt	0.059 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.554 hrs	Tt + Tc for Area C4.2 (pg. 58)
pt. 107 to Pt. 108)	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

	Flow Length, L	475	
Area C4.3	Travel Time, Tt	0.059 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.604 hrs	Tt + Tc for Area C4.3 (pg. 59)
pt. 107 to Pt. 108)	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

	Flow Length, L	475	
Area C4.1	Travel Time, Tt	0.059 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.260 hrs	Tt + Tc for Area C4.1 (pg. 59)
pt. 107 to Pt. 108)	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	Flow Length, L	475	
C3.2	Travel Time, Tt	0.059 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.565 hrs	Tt + Tc for Area C3.2 (pg. 58)
pt. 107	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
108)	Peak Discharge, q_p	5.41 cu ft/sec	Eq. 10

Area	Flow Length, L	475	
C3.3	Travel Time, Tt	0.059 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.570 hrs	Tt + Tc for Area C3.3 (pg. 58)
pt. 107	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
108)	Peak Discharge, q_p	5.48 cu ft/sec	Eq. 10

Area	Flow Length, L	475	
C3.4	Travel Time, Tt	0.059 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.600 hrs	Tt + Tc for Area C3.4 (pg. 58)
pt. 107	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
108)	Peak Discharge, q_p	2.36 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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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

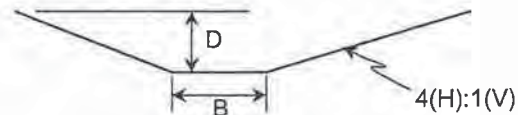
Pt. 109 Flow Length, L 119.7 feet to Pt. 110 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.25 ft/ft Travel Time, Tt 0.124 hrs Ref Eq. 8	Pt. 110 Flow Length, L 180.3 feet to Pt. 111 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.326
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C2.2 Shallow, Concentrated Flow

Pt. 111 Flow Length, L 128.7 feet
to Pt. 112 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 Wetted Perimeter, p_w 19.5 feet
to Pt. 119 Hydraulic Radius, 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

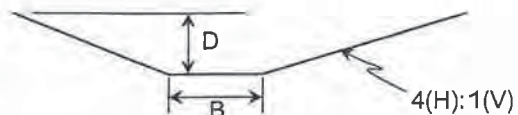
Pt. 113 Flow Length, L 118.5 feet to Pt. 114 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.25 ft/ft Travel Time, Tt 0.123 hrs Ref Eq. 8	Pt. 114 Flow Length, L 181.5 feet to Pt. 115 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.328
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C2.3 Shallow, Concentrated Flow

Pt. 115 Flow Length, L 52.4 feet
to Pt. 116 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 Wetted Perimeter, p_w 19.5 feet
to Pt. 119 Hydraulic Radius, 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

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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 Flow Length, L 126.6 feet to Pt. 104 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.1 ft/ft Travel Time, Tt 0.187 hrs Ref Eq. 8	Pt. 104 Flow Length, L 173.4 feet to Pt. 117 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.316
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C2.4

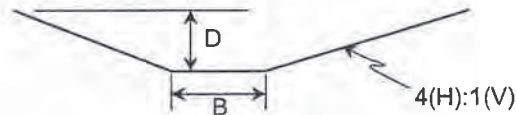
Shallow, Concentrated Flow

Pt. 117 Flow Length, L 15.5 feet
to Pt. 118 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 Wetted Perimeter, p_w 19.5 feet
to Pt. 119 Hydraulic Radius, 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
 Flow Length, L 385
 Travel Time, Tt 0.047 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.601 hrs Tt + Tc for Area C4.2 (pg. 60)
pt. 108 Unit Peak Disch. q_u 385 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 119 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 4.30 cu ft/sec Eq. 10

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MANAGEMENT SERVICES, INC.

Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 64 of 110
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Area	Flow Length, L	385	
C4.3	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.650 hrs	Tt + Tc for Area C4.3 (pg. 60)
pt. 108	Unit Peak Disch. q_u	365 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
119)	Peak Discharge, q_p	2.44 cu ft/sec	Eq. 10

Area	Flow Length, L	385	
C4.1	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.306 hrs	Tt + Tc for Area C4.1 (pg. 60)
pt. 108	Unit Peak Disch. q_u	500 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
119)	Peak Discharge, q_p	3.35 cu ft/sec	Eq. 10

Area	Flow Length, L	385	
C3.2	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.612 hrs	Tt + Tc for Area A3.2 (pg. 61)
pt. 108	Unit Peak Disch. q_u	375 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
119)	Peak Discharge, q_p	5.14 cu ft/sec	Eq. 10

Area	Flow Length, L	385	
C3.3	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.616 hrs	Tt + Tc for Area C3.3 (pg. 61)
pt. 108	Unit Peak Disch. q_u	375 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
119)	Peak Discharge, q_p	5.20 cu ft/sec	Eq. 10

Area	Flow Length, L	385	
C3.4	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.647 hrs	Tt + Tc for Area C3.4 (pg. 61)
pt. 108	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
119)	Peak Discharge, q_p	2.24 cu ft/sec	Eq. 10

Area	Flow Length, L	385	
C3.1	Travel Time, Tt	0.047 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.348 hrs	Tt + Tc for Area C3.1 (pg. 60)
pt. 108	Unit Peak Disch. q_u	565 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
119)	Peak Discharge, q_p	8.64 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

X-Section Area, a	22 sq ft
Peak Discharge, q_p	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

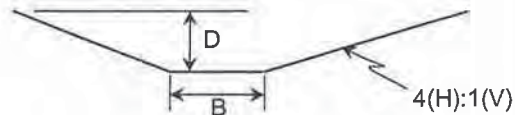
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	300 feet		Flow Length, L	0 feet		
C2.1	Pt. 110 to Pt. 119	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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 Radius, 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

	Flow Length, L	360	
Area C4.2	Travel Time, Tt	0.043 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.644 hrs	Tt + Tc for Area C4.2 (pg. 63)
pt. 119 to Pt. 120	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

	Flow Length, L	360	
Area C4.3	Travel Time, Tt	0.043 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.693 hrs	Tt + Tc for Area C4.3 (pg. 64)
pt. 119 to Pt. 120	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

	Flow Length, L	360	
Area C4.1	Travel Time, Tt	0.043 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.349 hrs	Tt + Tc for Area C4.1 (pg. 64)
pt. 119 to Pt. 120	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

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Area	Flow Length, L	360	
C3.2	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.654 hrs	Tt + Tc for Area C3.2 (pg. 64)
pt. 119	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
120)	Peak Discharge, q_p	4.93 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C3.3	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.659 hrs	Tt + Tc for Area C3.3 (pg. 64)
pt. 119	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
120)	Peak Discharge, q_p	4.99 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C3.4	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.690 hrs	Tt + Tc for Area C3.4 (pg. 64)
pt. 119	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
120)	Peak Discharge, q_p	2.21 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C3.1	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.390 hrs	Tt + Tc for Area C3.1 (pg. 64)
pt. 119	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
120)	Peak Discharge, q_p	6.96 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C2.2	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.551 hrs	Tt + Tc for Area C2.2 (pg. 63)
pt. 119	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
120)	Peak Discharge, q_p	4.47 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C2.3	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.545 hrs	Tt + Tc for Area C2.3 (pg. 63)
pt. 119	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
120)	Peak Discharge, q_p	3.54 cu ft/sec	Eq. 10
Area	Flow Length, L	360	
C2.4	Travel Time, Tt	0.043 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.594 hrs	Tt + Tc for Area C2.3 (pg. 63)
pt. 119	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
120)	Peak Discharge, q_p	3.36 cu ft/sec	Eq. 10

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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

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 Flow Length, L 130.8 feet to Pt. Two-yr 24 hr rainfall, P ₂ 4.9 inches 122 Land Slope, s 0.25 ft/ft Travel Time, Tt 0.133 hrs	Ref Eq. 8	Pt. 122 Flow Length, L 169.2 feet to Pt. Two-yr 24 hr rainfall 5.9 123 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.310
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C1.2 Shallow, Concentrated Flow

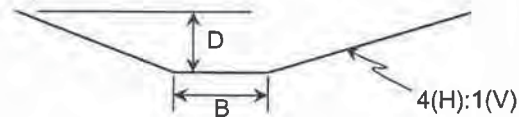
Pt. 123 Flow Length, L 151.3 feet to Pt. Watercourse slope, s 0.04 ft/ft 124 Avg. Velocity, V. 3.2 ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved Ref Eq. 6
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Travel Time, Tt 0.013 hrs

Open Channel Flow

Channel Depth, D 2 feet	
Channel Width, B 7 feet	
X-Section Area, a 30 sq ft	
Pt. 120 Wetted Perimeter, p _w 23.5 feet	
to Pt. Hydraulic Radius, r 1.277 ft	
133 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 Flow Length, L 119.3 feet to Two-yr 24 hr rainfall, P ₂ 4.9 inches Pt. 126 Land Slope, s 0.25 ft/ft Travel Time, Tt 0.124 hrs	Ref Eq. 8	Pt. 126 Flow Length, L 180.7 feet to Pt. Two-yr 24 hr rainfall 5.9 127 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.327
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C1.3 Shallow, Concentrated Flow

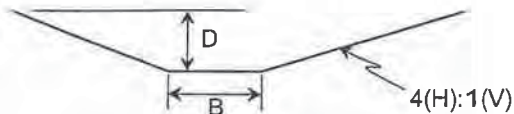
Pt. 127 Flow Length, L 85.4 feet to Pt. Watercourse slope, s 0.04 ft/ft 128 Avg. Velocity, V. 3.2 ft/sec	Ref. Fig. 6-9 "Avg. vel. for est. travel time for shallow concentrated flow" - use Unpaved Ref Eq. 6
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Travel Time, Tt 0.007 hrs

Open Channel Flow

Channel Depth, D 2 feet	
Channel Width, B 7 feet	
X-Section Area, a 30 sq ft	
Pt. 120 Wetted Perimeter, p _w 23.5 feet	
to Pt. Hydraulic Radius, r 1.277 ft	
133 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



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Calculate Peak Discharge from Area C1.4

Area 1.08 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 129 Flow Length, L 101.8 feet to Pt. 130 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.1 ft/ft Travel Time, Tt 0.157 hrs Ref Eq. 8	Pt. 130 Flow Length, L 198.2 feet to Pt. 131 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.352
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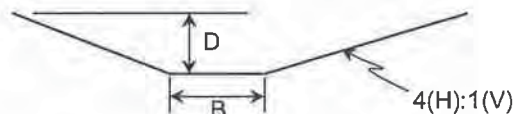
C1.4

Shallow, Concentrated Flow

Pt. 131 Flow Length, L 25.1 feet
to Pt. 132 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

Channel Depth, D 2 feet
 Channel Width, B 7 feet
 X-Section Area, a 30 sq ft
Pt. 120 Wetted Perimeter, p_w 23.5 feet
to Pt. 133 Hydraulic Radius, 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
 Flow Length, L 240
 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.671 hrs Tt + Tc for Area C4.2 (pg. 65)
pt. 120 Unit Peak Disch. q_u 360 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 133 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 4.02 cu ft/sec Eq. 10

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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

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Area	Flow Length, L	240	
C2.3	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.572 hrs	Tt + Tc for Area C2.3 (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	3.45 cu ft/sec	Eq. 10

Area	Flow Length, L	240	
C2.4	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.621 hrs	Tt + Tc for Area C2.3 (pg. 66)
pt. 120	Unit Peak Disch. q_u	375 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	3.32 cu ft/sec	Eq. 10

Area	Flow Length, L	240	
C2.1	Travel Time, Tt	0.027 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.328 hrs	Tt + Tc for Area C2.1 (pg. 65)
pt. 120	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
133)	Peak Discharge, q_p	8.72 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculate Peak Discharge from Areas C1.1

Area 1.25 acres 0.00 sq. miles

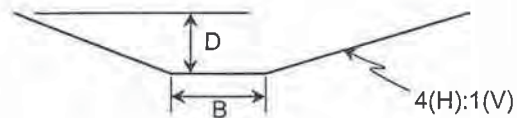
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	175 feet		Flow Length, L	0 feet	
C1.1	Pt. 122 to Pt. 133	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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

Open Channel Flow

	Channel Depth, D	2 feet	
	Channel Width, B	7 feet	
	X-Section Area, a	30 sq ft	
Pt. 133 to Pt. 134	Wetted Perimeter, p _w	23.5 feet	
	Hydraulic Radius, 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 Flow Length, L	240	
C4.2	Travel Time, Tt	0.027 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.698 hrs	Tt + Tc for Area C4.2 (pg. 69)
pt. 133 to Pt. 134)	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 Flow Length, L	240	
C4.3	Travel Time, Tt	0.027 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.747 hrs	Tt + Tc for Area C4.3 (pg. 70)
pt. 133 to Pt. 134)	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 Flow Length, L	240	
C4.1	Travel Time, Tt	0.027 hrs	Ref Eq. 6
	(from Time of Conc. Tc	0.403 hrs	Tt + Tc for Area C4.1 (pg. 70)
pt. 133 to Pt. 134)	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

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

Area Flow Length, L 240
 C2.3 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.599 hrs Tt + Tc for Area C2.3 (pg. 71)
 pt. 133 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
 134) Peak Discharge, q_p 3.36 cu ft/sec Eq. 10

Area Flow Length, L 240
 C2.4 Travel Time, Tt 0.027 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.648 hrs Tt + Tc for Area C2.4 (pg. 71)
 pt. 133 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
 134) Peak Discharge, q_p 3.18 cu ft/sec Eq. 10

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

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

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

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

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

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EASTERN SIDE

Calculate Peak Discharge from Area D6.2

Area 1.38 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 40 Flow Length, L 119.8 feet
to Pt. Two-yr 24 hr rainfall, P₂ 4.9 inches
41 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.124 hrs

Ref Eq. 8

Pt. 41 Flow Length, L 180.2 feet
to Pt. Two-yr 24 hr rainfall 5.9
137 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.326

D6.2

Shallow, Concentrated Flow

Pt. 137 Flow Length, L 69.8 feet
to Pt. Watercourse slope, s 0.04 ft/ft
138 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 Wetted Perimeter, p_w 16.5 feet

to Pt. Hydraulic Radius, r 0.970 ft

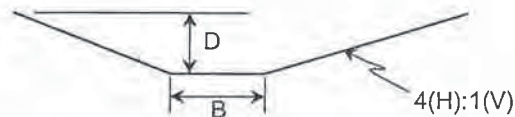
142 Channel Slope 0.005 ft/ft

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

Pt. 88 Flow Length, L 60.7 feet
to Pt. Two-yr 24 hr rainfall, P₂ 4.9 inches
139 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.072 hrs

Ref Eq. 8

Pt. 139 Flow Length, L 239.3 feet
to Pt. Two-yr 24 hr rainfall 5.9
140 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.409

D6.3

Shallow, Concentrated Flow

Pt. 140 Flow Length, L 10.7 feet
to Pt. Watercourse slope, s 0.04 ft/ft
141 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 Wetted Perimeter, p_w 16.5 feet

to Pt. Hydraulic Radius, r 0.970 ft

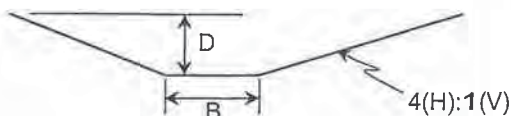
142 Channel Slope 0.005 ft/ft

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



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Calculate Peak Discharge

	I _a /P	0.095 in.	
Area D6.2	Time of Conc. T _c	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

	I _a /P	0.095 in.	
Area D6.3	Time of Conc. T _c	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, q _p	7.19 cu ft/sec
Peak Velocity	0.4492 ft/sec
	22% of Calculated Channel Flow Velocity

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Calculate Peak Discharge from Area D6.1

Area 1.34 acres 0.00 sq. miles

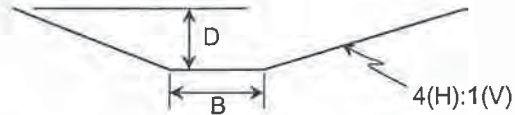
Calculate Travel Time, Tt

Sheet Flow

D6.1	Pt. 143	Flow Length, L	165 feet		Flow Length, L	0 feet
	to Pt. 142	Two-yr 24 hr rainfall, P_2	4.9 inches		Two-yr 24 hr rainfall	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	0 feet	
	X-Section Area, a	16 sq ft	
Pt. 142	Wetted Perimeter, p_w	16.5 feet	
to Pt. 144	Hydraulic Radius, 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.	
	Time of Conc. Tc	0.194 hrs	From calculations above
Area D6.1	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	Flow Length, L	250	
	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from pt. 142 to Pt. 144)	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	Flow Length, L	250	
	Travel Time, Tt	0.034 hrs	Ref Eq. 6
(from pt. 142 to Pt. 144)	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, q_p	13.42 cu ft/sec	
	Peak Velocity	0.8386 ft/sec	
		41% of Calculated Channel Flow Velocity	

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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

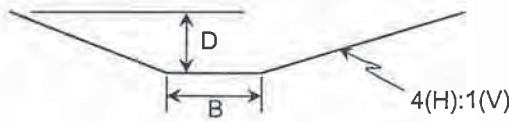
Calculate Travel Time, Tt Sheet Flow

Pt. 145 Flow Length, L 119.9 feet to Pt. 143 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. 143 Flow Length, L 180.1 feet to Pt. 146 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.326
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D5.2 Shallow, Concentrated Flow

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

Channel Depth, D 2 feet Channel Width, B 0 feet X-Section Area, a 16 sq ft Pt. 142 Wetted Perimeter, p _w 16.5 feet to Pt. 151 Hydraulic Radius, 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	
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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

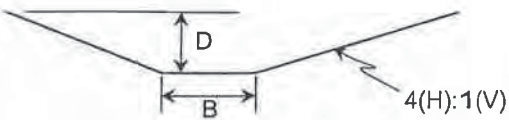
Calculate Travel Time, Tt Sheet Flow

Pt. 88 Flow Length, L 60.7 feet to Pt. 139 Two-yr 24 hr rainfall, P ₂ 4.9 inches Land Slope, s 0.25 ft/ft Travel Time, Tt 0.072 hrs Ref Eq. 8	Pt. 139 Flow Length, L 239.3 feet to Pt. 148 Two-yr 24 hr rainfall 5.9 Land Slope, s 0.04 ft/ft Travel Time, Tt 0.409
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D5.3 Shallow, Concentrated Flow

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

Channel Depth, D 2 feet Channel Width, B 0 feet X-Section Area, a 16 sq ft Pt. 142 Wetted Perimeter, p _w 16.5 feet to Pt. 151 Hydraulic Radius, 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	
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Total Travel Time 0.501 hrs Sum of Sheet, Shallow Concentrated and Open Channel

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 79 of 110
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Calculate Peak Discharge

	I _a /P	0.095 in.	
Area D5.2	Time of Conc. T _c	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

	I _a /P	0.095 in.	
Area D5.3	Time of Conc. T _c	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	Flow Length, L	140	
D6.2 (from pt. 142 to Pt. 151)	Travel Time, T _t	0.019 hrs	Ref Eq. 6
	Time of Conc. T _c	0.544 hrs	T _t + T _c 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	Flow Length, L	140	
D6.3 (from pt. 142 to Pt. 151)	Travel Time, T _t	0.019 hrs	Ref Eq. 6
	Time of Conc. T _c	0.570 hrs	T _t + T _c 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	Flow Length, L	140	
D6.1 (from pt. 142 to Pt. 151)	Travel Time, T _t	0.019 hrs	Ref Eq. 6
	Time of Conc. T _c	0.213 hrs	T _t + T _c 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, q _p	19.29 cu ft/sec
Peak Velocity	1.2053 ft/sec
	58% of Calculated Channel Flow Velocity

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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

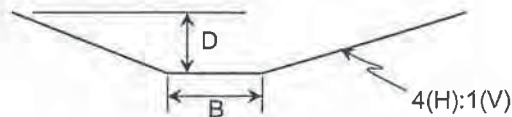
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	140 feet		Flow Length, L	0 feet		
D5.1	Pt. 150 to Pt. 151	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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 Radius, 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	Flow Length, L	140	
(from pt. 151 to Pt. 152)	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	Flow Length, L	140	
(from pt. 151 to Pt. 152)	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	Flow Length, L	140	
(from pt. 151 to Pt. 152)	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

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Area	Flow Length, L	140	
D5.2	Travel Time, Tt	0.019 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.494 hrs	Tt + Tc for Area D5.2 (pg. 79)
pt. 151	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
152)	Peak Discharge, q_p	3.46 cu ft/sec	Eq. 10

Area	Flow Length, L	140	
D5.3	Travel Time, Tt	0.019 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.520 hrs	Tt + Tc for Area D5.3 (pg. 79)
pt. 151	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
152)	Peak Discharge, q_p	2.74 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 82	of 110
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Calculate Peak Discharge from Area D4.2

Area 0.91 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 153 Flow Length, L 121.75 feet
to Pt. Two-yr 24 hr rainfall, P₂ 4.9 inches
154 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.126 hrs

Ref Eq. 8

Pt. 154 Flow Length, L 178.25 feet
to Pt. Two-yr 24 hr rainfall 5.9
155 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.324

D4.2 Shallow, Concentrated Flow

Pt. 155 Flow Length, L 66.75 feet
to Pt. Watercourse slope, s 0.04 ft/ft
156 Avg. Velocity, V. 3.2 ft/sec

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

Travel Time, Tt 0.006 hrs

Open Channel Flow

Channel Depth, D 2 feet
Channel Width, B 0 feet
X-Section Area, a 16 sq ft
Pt. 152 Wetted Perimeter, p_w 16.5 feet
to Pt. Hydraulic Radius, r 0.970 ft
163 Channel Slope 0.005 ft/ft
Velocity, V 2.065 ft/sec
Flow Length, L 225
Travel Time, Tt 0.030 hrs

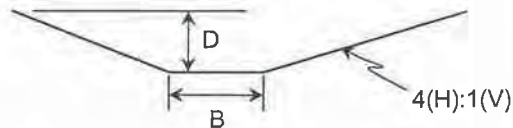
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.485 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 Flow Length, L 119.5 feet
to Two-yr 24 hr rainfall, P₂ 4.9 inches
Pt. 158 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.124 hrs

Ref Eq. 8

Pt. 158 Flow Length, L 180.5 feet
to Pt. Two-yr 24 hr rainfall 5.9
159 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.327

D4.3 Shallow, Concentrated Flow

Pt. 159 Flow Length, L 67.8 feet
to Pt. Watercourse slope, s 0.04 ft/ft
160 Avg. Velocity, V. 3.2 ft/sec

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

Travel Time, Tt 0.006 hrs

Open Channel Flow

Channel Depth, D 2 feet
Channel Width, B 0 feet
X-Section Area, a 16 sq ft
Pt. 152 Wetted Perimeter, p_w 16.5 feet
to Pt. Hydraulic Radius, r 0.970 ft
163 Channel Slope 0.005 ft/ft
Velocity, V 2.065 ft/sec
Flow Length, L 225
Travel Time, Tt 0.030 hrs

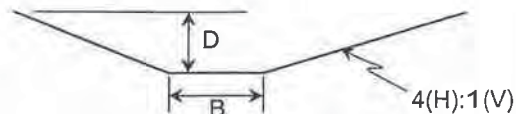
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.487 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 83 of 110
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Calculate Peak Discharge from Area D4.4

Area 0.84 acres 0.00 sq. miles

Calculate Travel Time, Tt

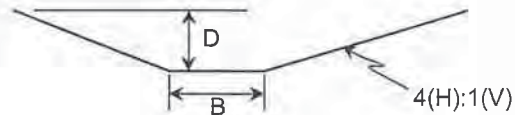
Sheet Flow

Pt. 161 Flow Length, L 49.6 feet
to Pt. 157 Two-yr 24 hr rainfall, P₂ 4.9 inches
 Land Slope, s 0.1 ft/ft
 Travel Time, Tt 0.088 hrs Ref Eq. 8

Pt. 157 Flow Length, L 245 feet
to Pt. 162 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.417

Open Channel Flow

Channel Depth, D 2 feet
 Channel Width, B 0 feet
 X-Section Area, a 16 sq ft
Pt. 152 Wetted Perimeter, p_w 16.5 feet
to Pt. 163 Hydraulic Radius, 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

0.536 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 From calculations above
 Unit Peak Disch. q_u 40 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 0.2901 cu ft/sec Eq. 10

Area D4.3
 I_a/P 0.095 in.
 Time of Conc. Tc 0.487 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 3.86 cu ft/sec Eq. 10

Area D4.4
 I_a/P 0.095 in.
 Time of Conc. Tc 0.536 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 2.68 cu ft/sec Eq. 10

Area D6.2 Flow Length, L 225
 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.593 hrs Tt + Tc for Area D6.2 (pg. 80)
pt. 152 Unit Peak Disch. q_u 390 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 163 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 4.29 cu ft/sec Eq. 10

Area D6.3 Flow Length, L 225
 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.619 hrs Tt + Tc for Area D6.3 (pg. 80)
pt. 152 Unit Peak Disch. q_u 380 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 163 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 2.51 cu ft/sec Eq. 10

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Area	Flow Length, L	225	
D6.1	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.262 hrs	Tt + Tc for Area D6.1 (pg. 80)
pt. 152	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
163)	Peak Discharge, q_p	5.50 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D5.2	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.524 hrs	Tt + Tc for Area D5.2 (pg. 81)
pt. 152	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
163)	Peak Discharge, q_p	3.38 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D5.3	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.550 hrs	Tt + Tc for Area D5.3 (pg. 81)
pt. 152	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
163)	Peak Discharge, q_p	2.74 cu ft/sec	Eq. 10

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 85 of 110
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Calculate Peak Discharge from Areas D4.1

Area 1.22 acres 0.00 sq. miles

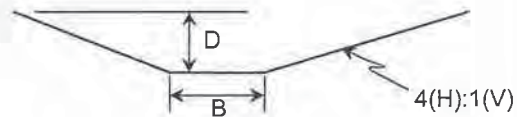
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	175 feet		Flow Length, L	0 feet		
D4.1	Pt. 164 to Pt. 163	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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 Radius, 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	Flow Length, L	225	
(from pt. 163 to Pt. 165)	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	Flow Length, L	225	
(from pt. 163 to Pt. 165)	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	Flow Length, L	225	
(from pt. 163 to Pt. 165)	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

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Area	Flow Length, L	225	
D5.2	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.553 hrs	Tt + Tc for Area D5.2 (pg. 84)
pt. 163	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
165)	Peak Discharge, q_p	3.34 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D5.3	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.579 hrs	Tt + Tc for Area D5.3 (pg. 84)
pt. 163	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
165)	Peak Discharge, q_p	2.70 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D5.1	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.218 hrs	Tt + Tc for Area D5.1 (pg. 84)
pt. 163	Unit Peak Disch. q_u	555 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
165)	Peak Discharge, q_p	2.87 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D4.2	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.513 hrs	Tt + Tc for Area D4.2 (pg. 83)
pt. 163	Unit Peak Disch. q_u	405 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
165)	Peak Discharge, q_p	2.94 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D4.3	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.515 hrs	Tt + Tc for Area D4.3 (pg. 83)
pt. 163	Unit Peak Disch. q_u	405 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
165)	Peak Discharge, q_p	3.81 cu ft/sec	Eq. 10

Area	Flow Length, L	225	
D4.4	Travel Time, Tt	0.028 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.564 hrs	Tt + Tc for Area D4.3 (pg. 83)
pt. 163	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
165)	Peak Discharge, q_p	3.67 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 87 of 110
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Calculate Peak Discharge from Area D3.2

Area 1.15 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 153 Flow Length, L 121.75 feet
to Pt. Two-yr 24 hr rainfall, P_2 4.9 inches
154 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.126 hrs

Ref Eq. 8

Pt. 154 Flow Length, L 178.25 feet
to Pt. Two-yr 24 hr rainfall 5.9
166 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.324

D3.2 Shallow, Concentrated Flow

Pt. 166 Flow Length, L 66.75 feet
to Pt. Watercourse slope, s 0.04 ft/ft
167 Avg. Velocity, V. 3.2 ft/sec

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

Travel Time, Tt 0.006 hrs

Open Channel Flow

Channel Depth, D 2 feet
Channel Width, B 3 feet
X-Section Area, a 22 sq ft
Pt. 165 Wetted Perimeter, p_w 19.5 feet
to Pt. Hydraulic Radius, r 1.129 ft
172 Channel Slope 0.005 ft/ft
Velocity, V 2.284 ft/sec
Flow Length, L 200
Travel Time, Tt 0.024 hrs

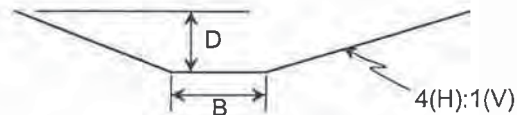
Ref Eq. 9

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 Flow Length, L 119.5 feet
to Two-yr 24 hr rainfall, P_2 4.9 inches
Pt. 158 Land Slope, s 0.25 ft/ft
Travel Time, Tt 0.124 hrs

Ref Eq. 8

Pt. 158 Flow Length, L 180.5 feet
to Pt. Two-yr 24 hr rainfall 5.9
168 Land Slope, s 0.04 ft/ft
Travel Time, Tt 0.327

D3.3 Shallow, Concentrated Flow

Pt. 168 Flow Length, L 70.9 feet
to Pt. Watercourse slope, s 0.04 ft/ft
169 Avg. Velocity, V. 3.2 ft/sec

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

Travel Time, Tt 0.006 hrs

Open Channel Flow

Channel Depth, D 2 feet
Channel Width, B 3 feet
X-Section Area, a 22 sq ft
Pt. 165 Wetted Perimeter, p_w 19.5 feet
to Pt. Hydraulic Radius, r 1.129 ft
172 Channel Slope 0.005 ft/ft
Velocity, V 2.284 ft/sec
Flow Length, L 200
Travel Time, Tt 0.024 hrs

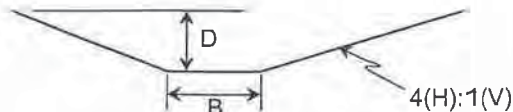
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.481 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



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Calculate Peak Discharge from Area D3.4

Area 0.45 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

Pt. 161	Flow Length, L	49.6 feet	Pt. 157	Flow Length, L	250.4 feet
to Pt. 157	Two-yr 24 hr rainfall, P ₂	4.9 inches	to Pt. 170	Two-yr 24 hr rainfall	5.9
	Land Slope, s	0.1 ft/ft		Land Slope, s	0.04 ft/ft
	Travel Time, Tt	0.088 hrs		Travel Time, Tt	0.425

Ref Eq. 8

D3.4 Shallow, Concentrated Flow

Pt. 170	Flow Length, L	11.3 feet
to Pt. 171	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	Wetted Perimeter, p _w	19.5 feet
to Pt. 172	Hydraulic Radius, r	1.129 ft
	Channel Slope	0.005 ft/ft
	Velocity, V	2.284 ft/sec
	Flow Length, L	200
	Travel Time, Tt	0.024 hrs

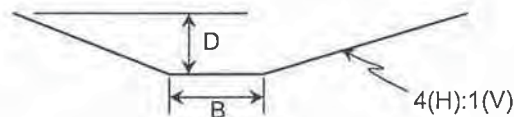
Ref Eq. 9

Ref Eq. 6

Total Travel Time

0.538 hrs

Sum of Sheet, Shallow Concentrated and Open Channel



Calculate Peak Discharge

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.479 hrs	From calculations above
Area D3.2	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	3.7573 cu ft/sec	Eq. 10

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.481 hrs	From calculations above
Area D3.3	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

	I _a /P	0.095 in.	
	Time of Conc. Tc	0.538 hrs	From calculations above
Area D3.4	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	Flow Length, L	200
	Travel Time, Tt	0.024 hrs
(from pt. 165 to Pt. 172)	Time of Conc. Tc	0.646 hrs
	Unit Peak Disch. q _u	365 csm/in
	Runoff, Q	5.1 inches
	Peak Discharge, q _p	4.01 cu ft/sec

Ref Eq. 6

Tt + Tc for Area D6.2 (pg. 85)

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

From pg. 1

Eq. 10

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

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

Area	Flow Length, L	200	
D4.1	Travel Time, Tt	0.024 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.221 hrs	Tt + Tc for Area D4.1 (pg. 85)
pt. 165	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
172)	Peak Discharge, q_p	5.35 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculate Peak Discharge from Areas D3.1

Area 0.98 acres 0.00 sq. miles

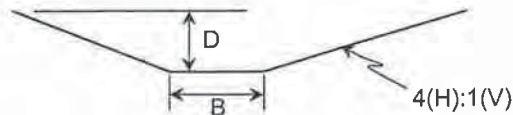
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	150 feet		Flow Length, L	0 feet
D3.1	Pt. 173 to Pt. 172 Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	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 Wetted Perimeter, p_w 20.5 feet
 to Pt. 174 Hydraulic Radius, 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.
 Time of Conc. Tc 0.172 hrs From calculations above
 Area Unit Peak Disch. q_u 590 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 D3.1 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 4.61 cu ft/sec Eq. 10

Area Flow Length, L 200
 D6.2 Travel Time, Tt 0.024 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.669 hrs Tt + Tc for Area D6.2 (pg. 88)
 pt. 172 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
 174) Peak Discharge, q_p 3.96 cu ft/sec Eq. 10

Area Flow Length, L 200
 D6.3 Travel Time, Tt 0.024 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.695 hrs Tt + Tc for Area D6.3 (pg. 89)
 pt. 172 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
 174) Peak Discharge, q_p 2.35 cu ft/sec Eq. 10

Area Flow Length, L 200
 D6.1 Travel Time, Tt 0.024 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.338 hrs Tt + Tc for Area D6.1 (pg. 89)
 pt. 172 Unit Peak Disch. q_u 475 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
 to Pt. Runoff, Q 5.1 inches From pg. 1
 174) Peak Discharge, q_p 5.07 cu ft/sec Eq. 10

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

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

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

Area	Flow Length, L	200	
D3.4	Travel Time, Tt	0.024 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.562 hrs	Tt + Tc for Area D3.4 (pg. 89)
pt. 172	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
174)	Peak Discharge, q_p	1.40 cu ft/sec	Eq. 10

Calculate Channel Flow Velocity

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

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Calculate Peak Discharge from Areas D2.2

Area 0.57 acres 0.00 sq. miles

Calculate Travel Time, Tt

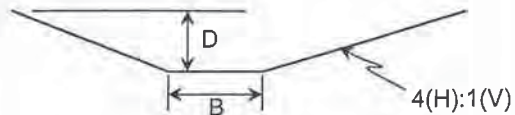
Sheet Flow

Pt. 175 Flow Length, L 125.8 feet
D2.2 to Pt. 176 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 Flow Length, L 112.1 feet
to Pt. 177 Two-yr 24 hr rainfall 5.9
 Land Slope, s 0.04 ft/ft
 Travel Time, Tt 0.223

Open Channel Flow

Channel Depth, D 2 feet
 Channel Width, B 4 feet
 X-Section Area, a 24 sq ft
Pt. 174 Wetted Perimeter, p_w 20.5 feet
to Pt. 178 Hydraulic Radius, r 1.171 ft
 Channel Slope 0.005 ft/ft
 Velocity, V 2.341 ft/sec Ref Eq. 9
 Flow Length, L 255
 Travel Time, Tt 0.030 hrs Ref Eq. 6



Total Travel Time **0.383 hrs** Sum of Sheet, Shallow Concentrated and Open Channel

Calculate Peak Discharge

I_a/P 0.095 in.
 Time of Conc. Tc 0.383 hrs From calculations above
Area D2.2 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 2.07 cu ft/sec Eq. 10

Area D6.2 Flow Length, L 255
 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.700 hrs Tt + Tc for Area D6.2 (pg. 91)
pt. 174 Unit Peak Disch. q_u 355 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 178 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 3.90 cu ft/sec Eq. 10

Area D6.3 Flow Length, L 255
 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.725 hrs Tt + Tc for Area D6.3 (pg. 91)
pt. 174 Unit Peak Disch. q_u 350 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 178 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 2.31 cu ft/sec Eq. 10

Area D6.1 Flow Length, L 255
 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.368 hrs Tt + Tc for Area D6.1 (pg. 91)
pt. 174 Unit Peak Disch. q_u 455 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 178 Runoff, Q 5.1 inches From pg. 1
 Peak Discharge, q_p 4.86 cu ft/sec Eq. 10

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Area Flow Length, L 255
D5.2 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.631 hrs Tt + Tc for Area D5.2 (pg. 92)
pt. 174 Unit Peak Disch. q_u 370 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
178) Peak Discharge, q_p 3.13 cu ft/sec Eq. 10

Area Flow Length, L 255
D5.3 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.657 hrs Tt + Tc for Area D5.3 (pg. 92)
pt. 174 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
178) Peak Discharge, q_p 2.46 cu ft/sec Eq. 10

Area Flow Length, L 255
D5.1 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.296 hrs Tt + Tc for Area D5.1 (pg. 92)
pt. 174 Unit Peak Disch. q_u 500 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
178) Peak Discharge, q_p 2.59 cu ft/sec Eq. 10

Area Flow Length, L 255
D4.2 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.592 hrs Tt + Tc for Area D4.2 (pg. 92)
pt. 174 Unit Peak Disch. q_u 385 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
178) Peak Discharge, q_p 2.79 cu ft/sec Eq. 10

Area Flow Length, L 255
D4.3 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.593 hrs Tt + Tc for Area D4.3 (pg. 92)
pt. 174 Unit Peak Disch. q_u 385 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
178) Peak Discharge, q_p 3.62 cu ft/sec Eq. 10

Area Flow Length, L 255
D4.4 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.642 hrs Tt + Tc for Area D4.3 (pg. 92)
pt. 174 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
178) Peak Discharge, q_p 3.39 cu ft/sec Eq. 10

Area Flow Length, L 255
D4.1 Travel Time, Tt 0.030 hrs Ref Eq. 6
(from Time of Conc. Tc 0.275 hrs Tt + Tc for Area D4.1 (pg. 92)
pt. 174 Unit Peak Disch. q_u 510 csm/in Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. Runoff, Q 5.1 inches From pg. 1
178) Peak Discharge, q_p 4.96 cu ft/sec Eq. 10

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Area Flow Length, L 255
 D3.2 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.533 hrs Tt + Tc for Area D3.2 (pg. 93)
 pt. 174 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
 178) Peak Discharge, q_p 3.67 cu ft/sec Eq. 10

Area Flow Length, L 255
 D3.3 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.535 hrs Tt + Tc for Area D3.3 (pg. 93)
 pt. 174 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
 178) Peak Discharge, q_p 4.56 cu ft/sec Eq. 10

Area Flow Length, L 255
 D3.4 Travel Time, Tt 0.030 hrs Ref Eq. 6
 (from Time of Conc. Tc 0.592 hrs Tt + Tc for Area D3.4 (pg. 93)
 pt. 174 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
 178) Peak Discharge, q_p 1.36 cu ft/sec Eq. 10

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 97 of 110
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Calculate Peak Discharge from Areas D2.1

Area 1.14 acres 0.00 sq. miles

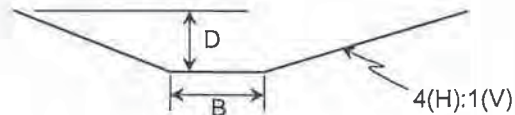
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	165 feet		Flow Length, L	feet
D2.1	Pt. 176 Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	5.9
	to Pt. 178 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	Wetted Perimeter, p _w	21.5 feet	
to Pt. 179	Hydraulic Radius, 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.	
	Time of Conc. Tc	0.190 hrs	From calculations above
Area	Unit Peak Disch. q _u	455 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
D2.1	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	4.13 cu ft/sec	Eq. 10

	Flow Length, L	255	
D6.2	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.729 hrs	Tt + Tc for Area D6.2 (pg. 94)
pt. 178	Unit Peak Disch. q _u	350 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 179)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	3.85 cu ft/sec	Eq. 10

	Flow Length, L	255	
D6.3	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.755 hrs	Tt + Tc for Area D6.3 (pg. 94)
pt. 178	Unit Peak Disch. q _u	345 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 179)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	2.28 cu ft/sec	Eq. 10

	Flow Length, L	255	
D6.1	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.398 hrs	Tt + Tc for Area D6.1 (pg. 94)
pt. 178	Unit Peak Disch. q _u	450 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt. 179)	Runoff, Q	5.1 inches	From pg. 1
	Peak Discharge, q _p	4.81 cu ft/sec	Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 98 of 110
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Area	Flow Length, L	255	
D5.2	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.660 hrs	Tt + Tc for Area D5.2 (pg. 95)
pt. 178	Unit Peak Disch. q_u	365 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
179)	Peak Discharge, q_p	3.08 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D5.3	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.686 hrs	Tt + Tc for Area D5.3 (pg. 95)
pt. 178	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
179)	Peak Discharge, q_p	2.43 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D5.1	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.326 hrs	Tt + Tc for Area D5.1 (pg. 95)
pt. 178	Unit Peak Disch. q_u	490 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
179)	Peak Discharge, q_p	2.54 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D4.2	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.621 hrs	Tt + Tc for Area D4.2 (pg. 95)
pt. 178	Unit Peak Disch. q_u	375 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
179)	Peak Discharge, q_p	2.72 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D4.3	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.623 hrs	Tt + Tc for Area D4.3 (pg. 95)
pt. 178	Unit Peak Disch. q_u	375 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
179)	Peak Discharge, q_p	3.53 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D4.4	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.672 hrs	Tt + Tc for Area D4.3 (pg. 95)
pt. 178	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
179)	Peak Discharge, q_p	3.34 cu ft/sec	Eq. 10
Area	Flow Length, L	255	
D4.1	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.304 hrs	Tt + Tc for Area D4.1 (pg. 95)
pt. 178	Unit Peak Disch. q_u	495 csm/in	Ref. Figure 6-3 "Unit peak discharge" Use Type III
to Pt.	Runoff, Q	5.1 inches	From pg. 1
179)	Peak Discharge, q_p	4.81 cu ft/sec	Eq. 10

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 99 of 110
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Area	Flow Length, L	255	
D3.2	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.563 hrs	Tt + Tc for Area D3.2 (pg. 96)
pt. 178	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
179)	Peak Discharge, q_p	3.57 cu ft/sec	Eq. 10

Area	Flow Length, L	255	
D3.3	Travel Time, Tt	0.030 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.565 hrs	Tt + Tc for Area D3.3 (pg. 96)
pt. 178	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
179)	Peak Discharge, q_p	4.44 cu ft/sec	Eq. 10

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

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

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

Calculate Channel Flow Velocity

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

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 100 of 110
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Calculate Peak Discharge from Areas D1.2

Area 1.15 acres 0.00 sq. miles

Calculate Travel Time, Tt

Sheet Flow

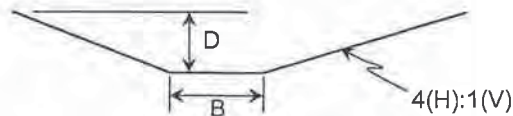
	Pt. 121	Flow Length, L	130.8 feet		Pt. 122	Flow Length, L	169.2 feet
D1.2	to Pt. 122	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 180	Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.133 hrs	Ref Eq. 8		Travel Time, Tt	0.310

Shallow, Concentrated Flow

	Pt. 180	Flow Length, L	152.9 feet	
	to Pt. 181	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	Wetted Perimeter, p _w	23.5 feet	
	to Pt. 186	Hydraulic Radius, 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

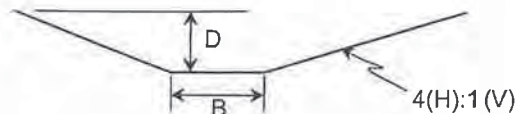
	Pt. 182	Flow Length, L	110.3 feet		Pt. 183	Flow Length, L	189.7 feet
D1.3	to Pt. 183	Two-yr 24 hr rainfall, P ₂	4.9 inches		to Pt. 184	Two-yr 24 hr rainfall	5.9
		Land Slope, s	0.25 ft/ft			Land Slope, s	0.04 ft/ft
		Travel Time, Tt	0.116 hrs	Ref Eq. 8		Travel Time, Tt	0.340

Shallow, Concentrated Flow

	Pt. 184	Flow Length, L	36.3 feet	
	to Pt. 185	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	Wetted Perimeter, p _w	23.5 feet	
	to Pt. 186	Hydraulic Radius, 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

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Calculate Peak Discharge

	I_a/P	0.095 in.	
Area D1.2	Time of Conc. T_c	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

	I_a/P	0.095 in.	
Area D1.3	Time of Conc. T_c	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	Flow Length, L	235	
D6.2 (from pt. 179 to Pt. 186)	Travel Time, T_t	0.026 hrs	Ref Eq. 6
	Time of Conc. T_c	0.755 hrs	$T_t + T_c$ 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	Flow Length, L	235	
D6.3 (from pt. 179 to Pt. 186)	Travel Time, T_t	0.026 hrs	Ref Eq. 6
	Time of Conc. T_c	0.781 hrs	$T_t + T_c$ 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	Flow Length, L	235	
D6.1 (from pt. 179 to Pt. 186)	Travel Time, T_t	0.026 hrs	Ref Eq. 6
	Time of Conc. T_c	0.424 hrs	$T_t + T_c$ 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	Flow Length, L	235	
D5.2 (from pt. 179 to Pt. 186)	Travel Time, T_t	0.026 hrs	Ref Eq. 6
	Time of Conc. T_c	0.687 hrs	$T_t + T_c$ 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	Flow Length, L	235	
D5.3 (from pt. 179 to Pt. 186)	Travel Time, T_t	0.026 hrs	Ref Eq. 6
	Time of Conc. T_c	0.713 hrs	$T_t + T_c$ 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

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Area	Flow Length, L	235	
D5.1	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.352 hrs	Tt + Tc for Area D5.1 (pg. 98)
pt. 179	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
186)	Peak Discharge, q_p	2.41 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D4.2	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.648 hrs	Tt + Tc for Area D4.2 (pg. 98)
pt. 179	Unit Peak Disch. q_u	365 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	2.65 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D4.3	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.649 hrs	Tt + Tc for Area D4.3 (pg. 98)
pt. 179	Unit Peak Disch. q_u	365 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	3.43 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D4.4	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.698 hrs	Tt + Tc for Area D4.3 (pg. 98)
pt. 179	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
186)	Peak Discharge, q_p	3.29 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D4.1	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.330 hrs	Tt + Tc for Area D4.1 (pg. 98)
pt. 179	Unit Peak Disch. q_u	480 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	4.67 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D3.2	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.589 hrs	Tt + Tc for Area D3.2 (pg. 99)
pt. 179	Unit Peak Disch. q_u	385 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	3.53 cu ft/sec	Eq. 10
Area	Flow Length, L	235	
D3.3	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.591 hrs	Tt + Tc for Area D3.3 (pg. 99)
pt. 179	Unit Peak Disch. q_u	385 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	4.39 cu ft/sec	Eq. 10

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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, q_p	59.57 cu ft/sec
Peak Velocity	1.9858 ft/sec
	80% of Calculated Channel Flow Velocity

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Calculations For: SMEPA Landfill	Made By: CJ	Date: 10/11/16	Sheet No.: 104 of 110
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Calculate Peak Discharge from Areas D1.1

Area 0.97 acres 0.00 sq. miles

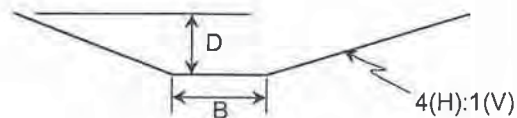
Calculate Travel Time, Tt

Sheet Flow

	Flow Length, L	150 feet		Flow Length, L	feet	
D1.1	Pt. 187 to Pt. 186	Two-yr 24 hr rainfall, P ₂	4.9 inches		Two-yr 24 hr rainfall	
		Land Slope, s	0.25 ft/ft		5.9	
		Travel Time, Tt	0.149 hrs	Ref Eq. 8	Land Slope, s	0.04 ft/ft
					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 Radius, 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

	Flow Length, L	235	
D6.2	Travel Time, Tt	0.026 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.782 hrs	Tt + Tc for Area D6.2 (pg. 101)
pt. 186 to Pt. 134	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

	Flow Length, L	235	
D6.3	Travel Time, Tt	0.026 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.808 hrs	Tt + Tc for Area D6.3 (pg. 101)
pt. 186 to Pt. 134	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

	Flow Length, L	235	
D6.1	Travel Time, Tt	0.026 hrs	Ref Eq. 6
	(from Time of Conc. Tc)	0.451 hrs	Tt + Tc for Area D6.1 (pg. 101)
pt. 186 to Pt. 134	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

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Area Flow Length, L 235
D5.2 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.713 hrs Tt + Tc for Area D5.2 (pg. 101)
pt. 186 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
134) Peak Discharge, q_p 2.96 cu ft/sec Eq. 10

Area Flow Length, L 235
D5.3 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.739 hrs Tt + Tc for Area D5.3 (pg. 101)
pt. 186 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
134) Peak Discharge, q_p 2.39 cu ft/sec Eq. 10

Area Flow Length, L 235
D5.1 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.378 hrs Tt + Tc for Area D5.1 (pg. 102)
pt. 186 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
134) Peak Discharge, q_p 2.36 cu ft/sec Eq. 10

Area Flow Length, L 235
D4.2 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.674 hrs Tt + Tc for Area D4.2 (pg. 102)
pt. 186 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
134) Peak Discharge, q_p 2.57 cu ft/sec Eq. 10

Area Flow Length, L 235
D4.3 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.675 hrs Tt + Tc for Area D4.3 (pg. 102)
pt. 186 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
134) Peak Discharge, q_p 3.34 cu ft/sec Eq. 10

Area Flow Length, L 235
D4.4 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.725 hrs Tt + Tc for Area D4.3 (pg. 102)
pt. 186 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
134) Peak Discharge, q_p 3.24 cu ft/sec Eq. 10

Area Flow Length, L 235
D4.1 Travel Time, Tt 0.026 hrs Ref Eq. 6
(from Time of Conc. Tc 0.357 hrs Tt + Tc for Area D4.1 (pg. 102)
pt. 186 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
134) Peak Discharge, q_p 4.52 cu ft/sec Eq. 10

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

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Area	Flow Length, L	235	
D1.3	Travel Time, Tt	0.026 hrs	Ref Eq. 6
(from	Time of Conc. Tc	0.512 hrs	Tt + Tc for Area D1.3 (pg. 101)
pt. 186	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
134)	Peak Discharge, q_p	2.93 cu ft/sec	Eq. 10

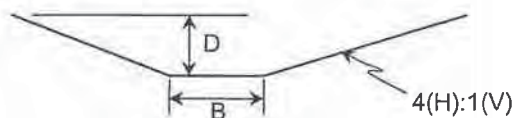
Calculate Channel Flow Velocity

X-Section Area, a	30 sq ft	
Peak Discharge, q_p	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 Radius, 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



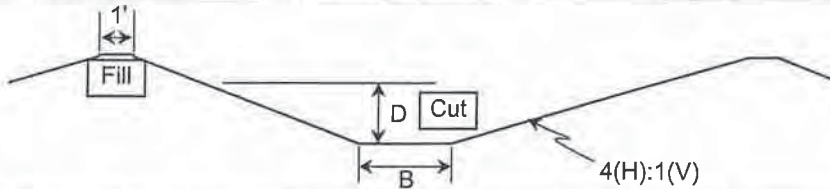
Calculate Channel Flow Velocity

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

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	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

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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.

$$q_o/q_i = (122/130.3) = 0.94$$

$V_s/V_r = 0.15$ Ref. Figure 6-2 "Approximate detention basin routing" Use Type III

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

$V_s = (V_s/V_r) * Q' * \text{Acreage}$
Acreage ~ 36 acres

$$V_s = 0.15 * 5.61"/12 \text{ (in/ft)} * 36 = 2.5245 \text{ acre-ft} = 109,967 \text{ ft}^3$$

