

DEQ Certification Class Presentations

Class presentations are provided for study/review purposes only. Printouts of these PowerPoint slides will not be allowed into the exam testing centers.

August 2024



Exercise 2A

Post-Development Curve Number

Exercise 2A Materials

In your participant guide:

- Exercise 2A Instructions
 - Use this sheet to jot down your results and notes

Exercise 2A: Instructions

SIMPLE SITE DESIGN (EXERCISE 1A SPREADSHEET)

Using the saved spreadsheet from Exercise 1A, follow the instructions below to determine the post-development runoff volume and curve number (CN). Use the site drainage area information given below.

Site Drainage Area Information (Given)

- Drainage area = 6.7 acres
- Post-development land cover (from Exercise 1A):
 - Managed turf = 4.75 acres
 - Impervious cover = 1.95 acres
 - Assume "C" soils throughout
- One-year rainfall = 2.6 inches

DETERMINE POST-DEVELOPMENT RUNOFF VOLUME AND CN

- Determine the post-development curve number for the one-year 24-hour storm computed from the spreadsheet.
- Determine the post-development one-year **runoff depth** (in inches) computed from the spreadsheet.

Instructions

1. Start with the same Site tab information as in Exercise 1A.
2. Copy the land cover summary on the Site tab to the Drainage Area A tab.
3. Go to the Runoff Volume and Curve Number tab.
4. Enter the rainfall amount.
5. Review the Drainage Area A summary information.
6. Save the spreadsheet for further use as "EX2A.xls" or similar.

Helpful Hints: Make sure to copy the site data to the Drainage Area tab.

Exercise 2A Materials

VRRM 4.1

New Development Spreadsheet

- Open Exercise 1A spreadsheet

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - Version 4.1

Project Name:

Date:

BMP Design Specifications List: 2024 Stds & Specs

CLEAR ALL
(Ctrl+Shift+R)

data input cells
constant values
calculation cells
final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/inrequently maintained grass or					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			4.75		4.75
Impervious Cover (acres)			1.95		1.95
					6.70

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)

LAND COVER SUMMARY -- POST DEVELOPMENT

Forest Cover (acres)	0.00
Weighted Rv (forest)	0.00
% Forest	0%
Mixed Open (acres)	0.00
Weighted Rv (mixed open)	0.00
% Mixed Open	0%
Managed Turf Cover (acres)	4.75
Weighted Rv (turf)	0.22
% Managed Turf	71%
Impervious Cover (acres)	1.95
Rv (impervious)	0.95
% Impervious	29%
Site Area (acres)	6.70
Site Rv	0.43

Treatment Volume (acre-ft)	0.2415
Treatment Volume (cubic feet)	10,518
TP Load (lb/yr)	5.21
TN Load (lb/yr)	61.71

Exercise 2A

Post-Development Curve Number

Site Information:

- Drainage area = 6.7 acres
- Post-development land cover
 - Managed turf = **4.75 acres**
 - Impervious cover = **1.95 acres**
 - Assume “C” soils
- One-year rainfall = 2.6 inches

Determine:

- ☐ Approximate curve number for one-year storm
- ☐ Post-development one-year runoff volume (watershed inches)

Solution

Exercise 2A (Post-Development Curve Number)

Site Information

1 From Exercise 1A

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			4.75		4.75
Impervious Cover (acres)			1.95		1.95

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

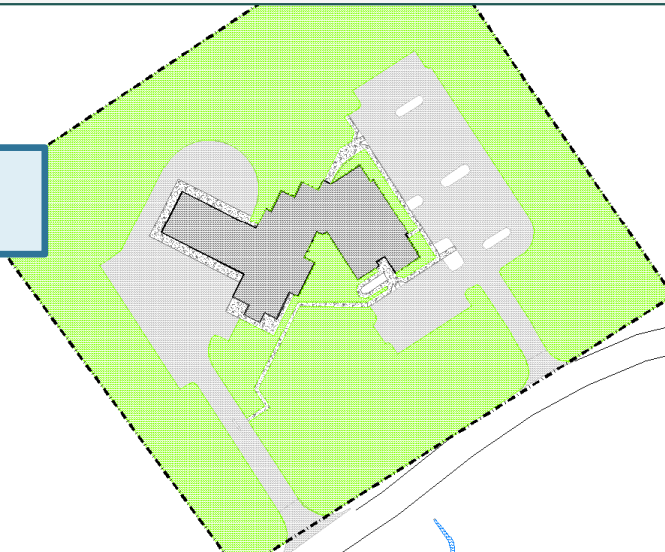
Runoff Volume and CN

Summary

Constants

Notes

Site tab



Light green = Managed turf
Dark gray = Building
Light gray = Parking and sidewalks

Exercise 2A (Post-Development Curve Number)

2 Enter areas on Drainage Area A tab

Drainage Area A

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv	Composite Loading P
Forest (acres)					0.00	0.00	0.00
Mixed Open (acres)					0.00	0.00	0.00
Managed Turf (acres)			4.75		4.75	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

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Notes

Drainage Area tab

Exercise 2A (Post-Development Curve Number)

Runoff Volume and Curve Number Calculations, VRRM 4.1, 2024

Enter design storm rainfall depths (in):

1-year storm

2.60

2-year storm

10-year storm

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

Constants

Notes

Runoff Volume and CN

3

Enter 2.60 inches for one-year storm on Runoff Volume and Curve Number tab

Exercise 2A (Post-Development Curve Number)

4

Review Drainage Area A summary information

Drainage Area A		A Soils	B Soils	C Soils	D Soils	<div>Total Area (acres): 6.70</div> <div>Runoff Reduction Volume (ft³): 0</div>
Forest -- undisturbed, protected forest or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Mixed Open -- undisturbed/infrequently maintained grass or shrub land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	34	59	72	79	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	4.75	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	1.95	0.00	
	CN	98	98	98	98	
		<div>CN_(D.A. A)</div> <div>81</div>				
RV _{Developed} (watershed-inch) with no Runoff Reduction*	1-year storm	2-year storm	10-year storm			
RV _{Developed} (watershed-inch) with Runoff Reduction*	1.01	0.00	0.00			
Adjusted CN*	81	100	100			

*See Notes above

Weighted or composite curve number (CN) = 81

- No CN adjustment
- P-BMPs not yet added—no runoff reduction

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

Constants

Notes

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

$RV_{\text{Developed}}$ (watershed-inch) with no Runoff Reduction*

$RV_{\text{Developed}}$ (watershed-inch) with Runoff Reduction*

Adjusted CN*

*See Notes above

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

Adjusted CN of 81 is unchanged

TR-55 Runoff
Equations 2-3 and 2-4
Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

S = potential maximum retention after runoff begins, inches

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

Constants

Notes

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

$RV_{\text{Developed}}$ (watershed-inch) with no Runoff Reduction*

$RV_{\text{Developed}}$ (watershed-inch) with Runoff Reduction*

Adjusted CN*

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

*See Notes above

Adjusted CN of 81 is unchanged

Q calculated using P and S

TR-55 Runoff
Equations 2-3 and 2-4
Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[2.6 - (0.2 \times 2.35)]^2}{2.6 + (0.8 \times 2.35)} = 1.01 \text{ in}$$

Q = runoff depth, inches

(Runoff volume also expressed as runoff depth)

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

$RV_{\text{Developed}}$ (watershed-inch) with no Runoff Reduction*

$RV_{\text{Developed}}$ (watershed-inch) with Runoff Reduction*

Adjusted CN*

*See Notes above

*RV in VRRM CN adjustment is the same as Q in TR-55 Runoff Equation

TR-55 Runoff Equations 2-3 and 2-4 Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[2.6 - (0.2 \times 2.35)]^2}{2.6 + (0.8 \times 2.35)} = 1.01 \text{ in}$$

Q = runoff depth, inches

(Runoff volume also expressed as runoff depth)

Questions?

