Exercise 1: Simple Bioretention—New Project on Site without Restrictions

Assignment:

- Does the site conform to the performance goal?
- What percentage of TP is removed from WEST, EAST, and Total?
- If the site doesn't conform to the performance goal, make some design changes and use the calculator until your design conforms to the performance goal. What did you do?



	Land Cover (acres) - assume all 'B' Soils						
Drainage Area	Turf	Forest/Open Space	Impervious	Total			
WEST	5.95	0.00	2.53	8.48			
EAST	5.35	0.00	2.60	7.95			
Total:	11.3	0.00	5.13	16.43			

		B	MP Information			
Drainage Area	BMP Description	Overflow Surface area (ft ²)	Bottom Surface Area (ft ²)	Overflow Depth (ft)		
WEST	Bioretention basin	14,000	11,000	1.2		
EAST	Bioretention basin	7,500	5,000	1.2		





MP Properties	u/a unalan	due in)				٦	
Watershed BMP Parameters BMP Summary	v/o under	arain)					
BMP Name West Bioretention basin (w/o underdrain)							
Routing/downstream BMP		•					
BMP Watershed Area	A Soils	B Soils	C Soils	D Soils	Total		
Land Cover Forest/Open Space - Undisturbed, protected	(acres)	(acres)	(acres)	(acres)	(acres)		
forest/open space or reforested land Managed Turf - disturbed, graded for yards		5 95			5.95		
or other turt to be mowed/managed		Impervious Co	over (acres)		2.53	_	
		Total Area (ac	res)		8.48		
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AP Properties				1.0.0	201		
MP Properties: East Bioretention basin (w	ı/o underd	rain)				[
atershed BMP Parameters BMP Summary							
BMP Name East Bioretention basin (w/o underdrain)							
Routing/downstream BMP		•					
Minnesota Stormwater Manual Wiki							
BMP Watershed Area				1			
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		5.35			5.35		
		Impervious C	over (acres)		2.6		
		Total Area (ad	res)		7.95		
		U					
						ОК	HELP



Exercise 1: Answers

Does the site conform to the performance goal?

Answer: No the site does not conform to the performance goal. The site reduced 86% of the performance goal requirement volume. It needed to reduce 100% to meet the performance goal.



What percentage of TP is removed from WEST, EAST and Total?

Answer: West = 92%, East = 82% and Total = 87%.

ē .	BMP Properties			The Manager	Literate Manda				
I	3MP Prop	erties: West E	Bioretention bas	sin (w/o underdrai	n)			[
	Watershed	BMP Parameters	s BMP Summary					L	
		Performance	e Goal Summary						<u>^</u>
		V	Vater volume from dire	ect watershed:	10	102	ft ³		
		V	Vater volume from upst	tream BMPs:			ft ³		
		т	otal water volume rout	ted to BMP:	10	102	ft ³		
		F	Retention volume provid	ided by BMP:	10	102	ft ³		
		C	Outflow volume:			0	ft ³		
		Annual Pollu	itant Loads Summary	,					
		F	Percent Annual runoff v	volume retained:		92	%		
		F	Particulate P load from	direct watershed:		3.85	lbs		
		F	Particulate P load from	upstream BMPs:			lbs		=
		F	Particulate P load reduc	ction:		3.53	lbs		
		F	Particulate P load outflo	OW:		0.32	lbs		
		C	Dissolved P load from w	watershed:		3.15	lbs		
		[Dissolved P load from u	upstream BMPs:			lbs		
		C	Dissolved P load reduct	tion:		2.89	lbs		
		C	Dissolved P load outflow	W:		D.26	lbs		
		F	Percent annual TP redu	uction:		92	%		
		Т	SS load from watershe	ed:	-	272	lbs		
		т	SS load from upstream	m BMPs:			lbs		
		т	SS load reduction:			167	lbs		
		Т	SS load outflow:			105	lbs		-
								014	
								ОК	HELP

BMP Properties					
BMP Properties: East Bioretention ba	sin (w/o underdrain)			7	
Watershed BMP Parameters BMP Summary	1			L	
Performance Goal Summary					<u>^</u>
Water volume from d	rect watershed:	10382	ft ³		
Water volume from u	ostream BMPs:		ft ³		
Total water volume re	outed to BMP:	10382	ft ³		
Retention volume pro	vided by BMP:	7500	ft ³		
Outflow volume:		2882	ft ³		
Annual Pollutant Loads Summa	ry				
Percent Annual runo	f volume retained:	82	%		
Particulate P load fro	m direct watershed:	3.79	lbs		
Particulate P load fro	m upstream BMPs:		lbs		=
Particulate P load red	luction:	3.12	lbs		
Particulate P load ou	flow:	0.67	lbs		
Dissolved P load from	n watershed:	3.1	lbs		
Dissolved P load from	n upstream BMPs:		lbs		
Dissolved P load red	uction:	2.55	lbs		
Dissolved P load out	low:	0.55	lbs		
Percent annual TP re	duction:	82	%		
TSS load from waters	shed:	1253	lbs	-	
TSS load from upstre	am BMPs:		lbs		
TSS load reduction:		1031	lbs		
TSS load outflow:		222	lbs		T
				ок	HELP

IDS Calculator (Version 1: Februa	ry 2014)							_ 0
C1	t c v: C L v: Posulte							
Summary Information:	Information Schematic Results						- 1	
mpenvious area not				Impe	ervious Area (acres) 5.3	13	
routed to a BMP					Total Area (acres) 16.	43	
0 acres								
anious area not								
outed to a BMP	Common Information							
0 acres	Summary Information							
	Performance Goal Requirement							
erformance goal	-							
equirement	Performance goal volume retention r	equirement:	20	484 ft3				
20484 ft ³	Volume removed by BMPs:		1/	602 ft3				
Verformance goal	reicent volume removed		c	50 70				
eduction achieved	Annual Pollutant Load Reduction							
17602 ft ³			-					
ercent TD reduction	Appual particulate P removed by BMI	Piload:	7.	65 lbs				
chieved	Post development annual dissolved P	load:	6.	25 lbs				
87 %	Annual dissolved D removed by BMD		5	44 - 165	_			
ercent TSS reduction	Percent annual total phosphorus re	moved:	8	37 %				
chieved	Post development annual TSS load:		25	i24 lbs				
87 %	Annual TSS removed by BMPs:		21	.98 Ibs				
	Percent annual TSS removed:		8	37 %				
	BMD Summany							
	Sin Sumary				Annual	Annual		1
		Performance	BMP	Performance	Particulate	Dissolved	Annual	
	BMP Name	Goal Volume Recieved	Volume	Goal Volume Reduction	Р	Р	TSS	
		(ft3)	(ft3)	(ft3)	Reduction	Reduction	(lbs)	
					(IDS)	(IDS)		-
	West Bioretention basin (w/o underdi	10102	15000	10102	3.53	2.89	1167	-
	cast bioretention basin (w/o underdra	10382	/500	/500	5.12	2.00	1031	4

If the site doesn't conform to the performance goal, make some design in the calculator to bring it into conformance. What did you do?

Need to increase the size of the East Bioretention Basin to meet performance goal.

Exercise 2: Bioretention Basins with Underdrains

Assignment:

What is the annual TP reduction at WEST and EAST?



	Land	d Cover (acres) - assume a	ll 'D' Soils	
Drainage Area	Turf	Forest/Open Space	Impervious	Total
WEST	5.95	0.00	2.53	8.48
EAST	5.35	0.00	2.60	7.95
Total:	11.3	0.00	5.13	16.43

				BMP Infor	mation		
Drainage Area	BMP Description	Surface Area at Overflow (ft ²)	Surface Area at Media Surface (ft ²)	Surface Area at Underdrain (ft ²)	Bottom Surface Area (ft ²)	Total Media Depth (ft)	Depth below Underdrain (ft)
WEST	Bioretention basin with elevated underdrain	14,000	11,000	8,500	7,875	1.24	0.24
EAST	Bioretention basin with underdrain at bottom	7,500	5,000	2,400	2,400	1	NA

	BMP Information										
Drainage Area	Media field capacity – wilting point (ft ³ /ft ³)	Media porosity (ft ³ /ft ³)	Planting media mix	P content less than 30 mg/kg?	Soil amendments used?	Underlying Soil	Required drawdown time (hours)				
WEST	0.11	0.3	С	Yes	No	CL	48				
EAST	0.11	0.3	С	Yes	No	CL	48				



Exercise 2: Step-by-Step Calculator Inputs

BMP Properties							
BMP Properties: West Bioretention basin (w	vith under	drain)					
Watershed BMP Parameters BMP Summary						L	
BMP Name West Bioretention basin (with underdrain)							
Routing/downstream BMP		•					
Minnesota Stormwater Manual Wiki							
BMP Watershed Area		1					
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				5.95	5.95		
		Impervious Co	over (acres)		2.53		
		Total Area (ac	res)		8.48		
<u> </u>							1
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MP Properties: West B	ioretention basin	n (with underdrain)		
Watershed BMP Parameters	BMP Summary			C
Surface area at media surface (A _M)	/	Total media depth [D]	1 24	μ 4
A TANK PANA	Total media	Depth below underdrain [Do]	0.24	fit
Surface area at underdrain (A _n)	depth (D)	Media field capacity - wilting point (typical values 0.06 - 0.17)	0 11	f13/f13
		Media porosity [n](typical values 0.35-0.50)	03	ft ³ /ft ³
1 2 2 3 2 2	Depth below underdrain (D ₀)	Bioretention planting media mix	Media Mix C 🔹	
Bottom surface area (A ₈)	<u> </u>	Is the P content of the media less than 30 mg/kg?	Yes •	
		Is a soil amendment used to attenuate phosphorus?	No.	
		Underlying soil - Hydrologic Soil Group	11 CL (HSG D. 0.06 in/ -	
		Infiltration rate of underlying soils	0.06	in/hr
		User defined infiltration rate		in/hr
		Required drawdown time	48 🔻	hrs
		Volume reduction from basin bottom infiltration [Vinf_b]	0	ft ³
		Volume reduction from basin sides infiltration [Vinf_s]	660	ft ³
		ET volume reduction of BMP [Vet]	275	ft ³
		Volume reduction stored below underdrain	590	ft ³
		Volume reduction capacity of BMP [V]	1525	ft ³
				1
		Volume of retention provided by BMP	1525	ft ³
				'
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🖳 BMP Properties	the last				
BMP Properties: Wes	t Bioretention basin (with underdrain)			7	
watersned BMP Parame	ters Dwir Summary			_	
Performa	nce Goal Summary				
	Water volume from direct watershed:	10102	ft ³		
	Water volume from upstream BMPs:		ft ³		
	Total water volume routed to BMP:	10102	ft ³		
	Retention volume provided by BMP:	1525	ft ³		
	Outflow volume:	8577	ft ³		
Annual Po	ollutant Loads Summarv				
	Percent Annual runoff volume retained:	8	%		
	Particulate P load from direct watershed:	4.17	lbs		
	Particulate P load from upstream BMPs:		lbs		=
	Particulate P load reduction:	2.06	lbs		
	Particulate P load outflow:	2.11	lbs		
	Dissolved P load from watershed:	3.41	lbs		
	Dissolved P load from upstream BMPs:		lbs		
	Dissolved P load reduction:	0.9	lbs		
	Dissolved P load outflow:	2.51	lbs		
	Percent annual TP reduction:	39	%		
	TSS load from watershed:	1377	lbs		
	TSS load from upstream BMPs:		lbs		
	TSS load reduction:	871	lbs		
	TSS load outflow:	506	lbs		•
				ок	HELP
					· //

MP Properties							
MP Properties: East Bioretention basin (w	vith undero	drain)					
BMP Name East Bioretention basin (with underdrain)							
Routing/downstream BMP		•					
BMP Watershed Area	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				5.35	5.35		
		Impervious Co	over (acres)		2.6		
		Total Area (ac	cres)		7.95		
						ОК	HELP



BMP Properties	1	-	-			- 0	x
BMP Prop	erties: East Bio	pretent	ion basin	(with underdrain)			2
Watershed	Surface area at	BMP S	ummary	bottom sandee area [hoj	2400	ι π .	
	media surface (A _M)			Total media depth [D]	1	∣ี ft	
	14 10 1 14 10 1 1 1	7	fotal media	Depth below underdrain [Do]	0	ft	
	Surface area at underdrain (A ₀)	6	depth (D)	Media field capacity - wilting point (typical values 0.06 - 0.17)	0.11		
			Depth below	Media porosity [n](typical values 0.35-0.50)	0.3	ft ³ /ft ³	
	States States		underdrain (D ₀)	Bioretention planting media mix	Media Mix C 🔹	Ī	
	Bottom surface area (A_{θ})			Is the P content of the media less than 30 mg/kg?	Yes	Ī	
				Is a soil amendment used to attenuate phosphorus?	No	-	
				Underlying soil - Hydrologic Soil Group	11 CL (HSG D, 0.06 in/	-	
				Infiltration rate of underlying soils	0.06	in/hr	
				User defined infiltration rate		in/hr	
				Required drawdown time	48 💌	hrs	
				Volume reduction from basin bottom infiltration [Vinf_b]	576	ft ³	=
				Volume reduction from basin sides infiltration [Vinf_s]	612	ft ³	
				ET volume reduction of BMP [Vet]	125	ft ³	
				Volume reduction stored below underdrain	0	ft ³	
				Volume reduction capacity of BMP [V]	1313	ft ³	
				Volume of retention provided by BMP	1313	ft ³	
							-
					ОК	HELP	

MP Properties				
MP Properties: East Bioretention basin (with underdrain)				
Performance Goal Summary				
Water volume from direct watershed:	10382	ft ³		
Water volume from upstream BMPs:		ft ³		
Total water volume routed to BMP:	10382	ft ³		
Retention volume provided by BMP:	1313	ft ³		
Outflow volume:	9069	ft ³		
Annual Pollutant Loads Summary				
Percent Annual runoff volume retained:	7	%		
Particulate P load from direct watershed:	4.08	lbs		
Particulate P load from upstream BMPs:		lbs		:
Particulate P load reduction:	2	lbs		
Particulate P load outflow:	2.08	lbs		
Dissolved P load from watershed:	3.34	lbs		
Dissolved P load from upstream BMPs:		lbs		
Dissolved P load reduction:	0.86	lbs		
Dissolved P load outflow:	2.48	lbs		
Percent annual TP reduction:	39	%		
TSS load from watershed:	1347	lbs		
TSS load from upstream BMPs:		lbs		
TSS load reduction:	847	lbs		
TSS load outflow:	500	lbs		
			ОК	HELP

Exercise 2 Answer: What is the annual TP reduction at WEST and EAST? 39% and 39%

Exercise 3: Swale

Assignment: Use given swale, cross-section, and no check dam or bioretention base Determine: The volume of runoff lost through the entire swale with

- mowed turf
- with native (tall) grass



Rural Section of Highway 5 in Lake Elmo, MN (55042)

- Drainage Area A5:
- B soils
- Rectangular drainage area: 450' by 100'
- Road/shoulder: 27' wide
- Longitudinal slope is 2%
- Side slope 4:1



Calculate watershed areas

Swale Side slope watershed

- Impervious Area = 27' * 450' * 1 acre/ 43560' = 0.279 acres
- Pervious Area = 20' * 450' * 1 acre/ 43560' = 0.207 acres

Swale main channel watershed

 Pervious area = 53' * 450' * 1 acre/43560' = 0.548 acres

Total Site Watershed

- Pervious area = 0.548 + 0.207 = 0.755 acres
- Impervious area = 0.279 acres





BMP Properties	Past	and the set	Constant,	_		-	_ D X
BMP Properties: 1 - Swale Side Slope							
Watershed BMP Parameters BMP Summary							
BMP Name 1 - Swale Side Slope							
Routing/downstream BMP 1 - Swale main channel		•					
Minnesota Stormwater Manual Wiki							
BMP Watershed Area				-		_	
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.207			0.207		
		Impervious Co	over (acres)		0.279		
		Total Area (ac	res)		0.486		
<u> </u>							
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							//



BMP Name 1 - Swale main channel						
Routing/downstream BMP		•				
Minnesota Stormwater Manual Wiki						
BMP Watershed Area						1
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)	
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0	
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.548			0.548	
		Impervious C	over (acres)			
		Total Area (ad	cres)		0.548	



Exercise 3A: Answer

What is the volume of runoff lost through the swale with mowed turf?

Answer: 346 ft³



What is the volume of runoff lost through the swale with native grass?

Answer: 374 ft³





IDS Calculator (Version 1: Februa	ary 2014)							- 0
Sit	e Information Schematic Results							
Summary Information:							Т	
Impervious area not				Imp	ervious Area (acres) 0.2	79	
routed to a BMP					Total Area (acres) 1.0	34	
0 acres								
Pervious area not								
routed to a BMP	Commence Information							
0 acres	Summary Information							
Derfermente	Performance Goal Requirement							
requirement	Performance goal volume retention r	equirement:	11	.14 ft3	1			
1114 ft 3	Volume removed by BMPs:		37	74 ft3				
Performance goal	Percent volume removed		3	4 %				
reduction achieved	Annual Pollutant Load Reduction							
5/4 ft	Post development annual particulate	P load:	0.	45 lbs				
Percent IP reduction achieved	Annual particulate P removed by BMI	Ps:	0.	39 Ibs				
72 0/	Post development annual dissolved P	load:	0.	37 Ibs				
12 %	Annual dissolved P removed by BMP	5:	0	.2 Ibs				
Percent TSS reduction	Percent annual total phosphorus re	emoved:	7	2 %				
	Post development annual TSS load:		14	49 lbs				
00 %	Annual TSS removed by BMPs:		12	27 Ibs				
	Percent annual TSS removed:		8	85 %				
	BMP Summary							_
		Performance	BMD	Performance	Annual	Annual	Appual	1
	PMD Marrie	Goal Volume	Volume	Goal Volume	Particulate	Dissolved	TSS	
	BMP Name	Recieved	Capacity	Reduction	Reduction	Reduction	Reduction	
		(ft3)	(ft3)	(ft3)	(lbs)	(lbs)	(lbs)	
	1 - Swale Side Slope	1114	26	26	0.02	0.02	8	1
	1 - Swale main channel	1088	348	348	0.37	0.18	119	1

Assignment 3B: Add Stormwater Pond

Givens: Assume an adjacent stormwater pond discharges into the bottom of the swale (with native grasses)

Stormwater Pond drainage area:

- 0.45 acres of B soils in turf
- 0.25 acres of impervious surface

Assignment: Determine if the example conforms to the performance goal? What percent annual TSS is removed?



Exercise 3B: Step-by-Step Calculator Inputs

Make sure to go into the site information tab and add the new watershed areas to the already existing watershed areas.

Total Site Watershed

- Pervious area = 0.755+ 0.45 = 1.205 acres
- Impervious area = 0.279 + 0.25 = 0.529 acres

MIDS Calculator (Version 1: F	February 2014)	
<u>F</u> ile		
Summary Information:	Site Information Schematic Results	
Impervious area not routed to a BMP 0 acres Pervious area not routed to a BMP 0 acres Performance goal requirement 1114 ft ³ Performance goal reduction achieved 374 ft ³ Percent TP reduction achieved	Project Name: Exercise 3 User Name/Company Name: John Hanson, Barr Date: 11/2/2013 Project Description: Image: Company Name: Compan	
72 % Percent TSS reduction achieved 85 %	Land Cover A soils B soils C soils D soils Total (acres) Forest/Open Space - Undisturbed, protected forest/ open space or reforested land Image: Construct of the source	

	Site Information	Schematic R	esults				
Summary Information:							
Impervious area not routed to a BMP	BMPs				Schemati	c	
0.25 acres Pervious area not routed to a BMP 0.45 acres Performance goal requirement 2112 ft ³ Performance goal reduction achieved 374 ft ³ Percent TP reduction achieved % Percent TSS reduction achieved % 48 %			1 - Stormwat	er pond	1 - Swale Side	Slope	
				-			

3MP Name 1 - Stormwater pond						
Routing/downstream BMP 1 - Swale main channel		•				
<u>Minnesota Stormwater Manual Wiki</u>						
BMP Watershed Area						1
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)	
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0	
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.45			0.45	
		Impervious C	over (acres)		0.25	
The calculator does not require sizing inputs for non-volume reducing BMPs.		Total Area (ac	cres)		0.7	-
This BMP should be sized according to the guidelines in the MN stormwater manual.						-

Elle Summary Information: Impervious area not routed to a BMP 0 acres Performance goal requirement 2112 ft ³ Performance goal reduction achieved 496 ft ³ Performance goal reduction achieved 1 - Stormwater pond 1 - Storale main channel
Summary Information: Impervious area not routed to a BMP 0 acres Pervious area not routed to a BMP Impervious area not routed to a BMP 0 acres Performance goal requirement Impervious area not routed to achieved 496 ft ³ Performance goal reduction achieved Impervious area not routed to achieved 1 Summary Information: 1
Image: Contract of the second seco

Exercise 3B: Answer

Does the example conform to the performance goal?

Answer: No

What percent annual TSS is removed?

Answer: 89%

IDS Calculator (Version 1: Februa	ry 2014)							
Site	Information Schematic Results							
Summary Information:							Т	
mpervious area not				Impe	ervious Area (acres) 0.5	29	
routed to a BMP					Total Area (acres) 17	34	
0 acres					Total Area (ucres/ 1./.		
Pervious area not								
outed to a BMP								
0 acres	Summary Information							
	Performance Goal Requirement							
equirement	Performance goal volume retentio	n requirement:	21	12 ft3				
2112 ft ³	Volume removed by BMPs:		4	96 ft3				
Performance goal	Percent volume removed		2	23 %				
eduction achieved	Annual Pollutant Load Reduction	1						
496 ft ³								
Percent TP reduction	Post development annual particula	te P load:	0	.8 lbs				
chieved	Annual particulate P removed by B	MPs:	0.	73 lbs				
70 %	Appual dissolved P removed by RN	d Piload: /Pe-	0.	00 IDS 29 Ibs				
Percent TSS reduction	Percent annual total phosphorus	removed:	7	70 %				
chieved								
89 %	Post development annual TSS load	:	2	66 lbs				
	Annual ISS removed by BMPs: Percent appual TSS removed		2	36 Ibs				
	Percent annual 155 removed:			9 70				
	BMP Summary			-				
		Performance	BMP	Performance	Annual	Annual	Annual	
	BMP Name	Goal Volume	Volume	Goal Volume	Particulate	Dissolved	TSS	
	SATE HUTTE	Recieved	Capacity	Reduction	Reduction	Reduction	Reduction	
		(#3)	(ft3)	(ft3)	(lbs)	(lbs)	(Ibs)	
	1 - Swale Side Slope	1114	26	26	0.02	0.02	8	
	1 - Swale main channel	2086	470	470	0.39	0.27	130	

Exercise 3C: Assignment/Question

Add check dams and a bioretention base until the example conforms to the performance goal. What did you do?





Exercise 4: Individual vs. Clumping of BMPs

Assignment: Use the givens and determine the volume retention results by calculating bioretention basins with individual drainage areas and as one clumped basin.

Are the results different? Why/why not?



Zip code: 55042

Individual BMPs

						Lan	d Cover (acr	es)			Ι
5	BMP										
		Drainage A	rea*	Tu	rf	Fores	t/Open Spac	e	Impervious	Total	
- (` \	🚺 🔪 Drainage area			1.0	8		0.00		0.22	1.30	
- 0		В		0.7	/2		0.00		0.18	0.90	
		С		0.2	2		0.00		0.08	0.30	
*Note	*Note soil types for each			0.3	9		0.00		0.16	0.55	
drainag	ge area designated	E		0.7	76	0.80			0.04	1.60	
by the	bold red line	Total:		3.1	.7	0.80			0.68	4.65	
					_		BMP Infor	mat	ion		
Drainage			Тор	Area	Bo	ttom		Ur	nderlying Soil	Drawdow	/n
Area	BMP Descriptio	n	(f	t²)	Are	a (ft²)	Depth (ft)		Туре	Time (hrs	5)
Α	Bioretention basin (w/o di	rain tile)	6	50	(600	1.4		SP (HSG A)	48	
B	Bioretention basin (w/o di	rain tile)	5	00	4	450	1.4		SP (HSG A)	48	
C	Bioretention basin (w/o di	rain tile)	7	50		500	1.4		SP (HSG A)	48	
D	Bioretention basin (w/o di	rain tile)	5	00		300	1.4		SP (HSG A)	48	
E	Stormwater pond (no volu	ime credit)									



Clumping BMPs

					Lar	d Cover (acr	es)				
5	BMP										
		Drainage A	rea* 1	urf	Fores	t/Open Spac	e Impervious	Total			
- (` \	Drainage area	A + B + C ·	+D 2	.41		0.00	0.64	3.05			
		E	(.76		0.80	0.04	1.60			
		Т	otal: 3	.17		0.80	0.68	4.65			
drainag by the	*Note soil types for each drainage area designated by the bold red line										
Drainago			Top Are			Underlying Soil	Drawdown				
Area	BMP Descriptio	n	(ft ²)	Are	ea (ft²)	Depth (ft)	Type	Time (hrs)			
A+B+C+D	Bioretention basin (w/o d	rain tile)	2400	:	1850	1.4	SP (HSG A)	48			
E	Stormwater pond (no volu	ıme credit)									
	Route BMP A +B +C+D BMP E										

Exercise 4: Step-by-Step Calculator Inputs

Individual Drainage Areas

MIDS Calculator (Version 1: February 2014)	
Ele	
Site Information Schematic Results	
Summary Information: Impervious area not routed to a BMP 0 acres Pervious area not routed to a BMP John Hanson, Barr 0 acres Pervious area not routed to a BMP Date: 0 acres Pervious area not routed to a BMP Project Description: 0 acres Performance goal requirement Introduction achieved ft ⁻¹ Volume Retention Requirement (inches) Interview Introduction achieved ft ⁻¹ Phosphorus EMC (mg/l) 0.3	
Percent Tr Bedduloin TSS EMC (mg/l) 54.5 Machieved % Land Cover A soils B soils C soils % Forest/Open Space - Undisturbed, protected forest/ open space or reforested land	oils D soils Total res) (acres) 0.8 0.8 0.76 3.17 pervious Area 0.68 Total Area 4.65

MIDS Calculator (Version 1: February 2014)	and the second state								
Summany Information: Site Information Scheme	atic Results								
Impervious area not			Schematic						
0.68 acres				-					
Pervious area not routed to a BMP 3.97 acres Performance goal requirement	1 - Bioretent unde	ion basin (w/o rrdrain)	3 - Bioref u	tention basin (w/o nderdrain)	, 				
2715 ft ³ Performance goal reduction achieved ft ³ Percent TP reduction achieved % Percent TSS reduction achieved % M M M M M M M M M M M M M	2 - Bioretent unde	ion basin (w/o rdrain)	4 - Biore	etention basin (w/ underdrain)	1 - Storr	nwater pond			
BMP Properties BMP Properties: A - Bioretention basin	n (w/o underc	drain)	-						
Watershed BMP Parameters BMP Summary]								
BMP Name A - Bioretention basin (w/o underdrain))								
Routing/downstream BMP B - Bioretention basin	(w/o underdrain)	•							
Minnesota Stormwater Manual Wiki									
BMP Watershed Area									
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)				
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0				
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	1.08				1.08				
		Impervious C	over (acres)		0.22				
		Total Area (ad	cres)		1.3				
1						ОК	HELP		

	o underdr	ain)				Vin Marine
Watershed BMP Parameters BMP Summary						
Bioretention basin (w/o underdrain)						
$V = \left[\frac{A_{o} + A_{B}}{2} * (D_{o})\right]$ Overflow surface area (A _o) Overflow Bottom surface area (A _B)	depth (D _o)	Required treatment volume Overflow surface area [Ao] Bottom surface area [Ab] Overflow depth [Do] Underlying soil - Hydrologic Soil Group Infiltration rate of underlying soils User defined infiltration rate Required drawdown time (hrs) Volume reduction capacity of BMP [V]				878 ft³ 650 ft² 600 ft² 1.4 ft 3A, 0.8 in/hr) • 0.8 in/hr in/hr • 1.4 ft 875 ft³
						OK HELP
MP Properties	· Jack					
^{MP Properties} BMP Properties: B - Bioretention basin (w.	/o underdra	ain)				
^{IMP Properties} BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary	/o underdra	ain)				
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain)	′o underdra	ain)				
MP Properties BMP Properties: B - Bioretention basin (W/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u	/o underdr a	ain)				
MP Properties BMP Properties: B - Bioretention basin (w. Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki	/o underdra	ain)				
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area	/o underdra	ain)				
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover	/o underdra nderdrain) A Soils (acres)	ain) B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)	
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land	/o underdra nderdrain) A Soils (acres)	ain)	C Soils (acres)	D Soils (acres)	Total (acres)	
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	/o underdra nderdrain) A Soils (acres) 0.72	ain)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.72	
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	/o underdra nderdrain) A Soils (acres) 0.72	ain) B Soils (acres) Impervious C	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.72 0.18	
MP Properties MP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	/o underdra nderdrain) A Soils (acres) 0.72	ain) B Soils (acres) Impervious C Total Area (ac	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.72 0.18 0.9	
MP Properties BMP Properties: B - Bioretention basin (w/ Watershed BMP Parameters BMP Summary BMP Name B - Bioretention basin (w/o underdrain) Routing/downstream BMP D - Bioretention basin (w/o u Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/open space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	/o underdra	ain) B Soils (acres) Impervious C Total Area (ac	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.72 0.18 0.9	

						V	
Watershed BMP Parameters BMP Summa	ary						
Bioretention basin (w/o underdr	ain)						
$V = \left[\frac{A_{o} + A_{B}}{2} * (D_{o})\right]$ Overflow surface area (A _o) Bottom surface area (A _b)	• Overflow depth (D _o)	Required treatr Overflow surface Bottom surface Overflow depth Underlying soil Infiltration rate User defined in Required drawc Volume reduct	ment volume ce area [Ao] e area [Ab] n [Do] I - Hydrologic S of underlying s o	ioil Group soils) BMP [V] by BMP	5 SP (HSG	722 500 450 1.4 3 A, 0.8 in/hr) 0.8 665 665	ft³ ft² ft v in/hr in/hrs ft³
						ок	HELP
MP Properties	1.000		-				- 0
^{MP Properties} BMP Properties: C - Bioretention ba	asin (w/o underdr	ain)	-				
MP Properties BMP Properties: C - Bioretention ba Natershed BMP Parameters BMP Summa	asin (w/o underdr	ain)					
MP Properties BMP Properties: C - Bioretention ba Natershed BMP Parameters BMP Summa	asin (w/o underdr ary	ain)					
MP Properties BMP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Bouting/downstream BMP D - Bioretention ba	asin (w/o underdr ary ain)	ain)					
MP Properties SMP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention ba Minnesote Stormwater Manual Wiki	asin (w/o underdr ary ain) sin (w/o underdrain)	ain)					
MP Properties MP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summ: BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention ba Minnesota Stormwater Manual Wiki BMP Watershed Area	asin (w/o underdr ary ain) sin (w/o underdrain)	ain)					
MP Properties BMP Properties: C - Bioretention basis Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention basis Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres)	ain)	C Soils (acres)	D Soils (acres)	Total (acres)		
MP Properties BMP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention ba Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres)	ain)	C Soils (acres)	D Soils (acres)	Total (acres) 0		
MP Properties MP Properties: C - Bioretention bas Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention bas Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space - Undisturbed, protected forest/open space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres) 0.22	ain)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.22		
MP Properties MP Properties: C - Bioretention bas Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention bas Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space - Undisturbed, protected forest/Open Space - Indisturbed, graded for yards or other turf to be mowed/managed	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres) 0.22	ain)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.22 0.08		
MP Properties BMP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention ba Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/open space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres) 0.22	ain) B Soils (acres) Impervious C Total Area (ac	C Soils (acres) over (acres)	D Soils (acres)	Total (acres) 0 0.22 0.08 0.3		
MP Properties BMP Properties: C - Bioretention ba Watershed BMP Parameters BMP Summa BMP Name C - Bioretention basin (w/o underdr Routing/downstream BMP D - Bioretention ba Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	asin (w/o underdr ary ain) sin (w/o underdrain) A Soils (acres) 0.22	ain) B Soils (acres) Impervious C Total Area (ac	C Soils (acres) over (acres)	D Soils (acres)	Total (acres) 0 0.22 0.08 0.3		

Watershed BMP Parameters BMP Summary													
Bioretention basin (w/o underdra	in)												
$W = \left[\frac{A_{0} + A_{B}}{2} * (D_{0})\right]$ Required treatment volume $319 ft^{3}$ $V = \left[\frac{A_{0} + A_{B}}{2} * (D_{0})\right]$ Bottom surface area (Ab) $Overflow surface area (Ab)$ $Overflow surface area (Ab)$ $Overflow surface area (Ab)$ $Overflow depth (Do)$ Infiltration rate of underlying soils $0.8 in/hr$ $48 hrs$ $Volume reduction capacity of BMP [V]$ Bottom surface area (Ab) $Volume of retention provided by BMP$ $319 ft^{3}$													
^{MP Properties} 3MP Properties: D - Bioretention ba	sin (w/o underdr	ain)				OK HELP							
Natershed BMP Parameters BMP Summa	ny												
Watershed BMP Parameters BMP Summary													
BMP Name D - Bioretention basin (w/o underdra				BMP Name D - Bioretention basin (w/o underdrain)									
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond	ain)	•											
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki	ain)	•											
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area	ain)	•				_							
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)								
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land	ain) I A Soils (acres)	▼ B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)	_							
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	ain) A Soils (acres) 0.39	▼ B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.39								
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/Open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	ain) A Soils (acres) 0.39	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.39 0.16								
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/open space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.39 0.16 0.55								
BMP Name D - Bioretention basin (w/o underdra Routing/downstream BMP 1 - Stormwater pond Minnesota Stormwater Manual Wiki BMP Watershed Area Land Cover Forest/Open Space - Undisturbed, protected forest/open Space or reforested land Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	ain) I A Soils (acres) 0.39	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres) 0 0.39 0.16 0.55								

3MP Properties							
BMP Properties: D - Bioretention basin (w/o	underdra	ain)				V	Na Na Na
Vatershed BMP Parameters BMP Summary							
Bioretention basin (w/o underdrain)							
$V = \left[\frac{A_{o} + A_{B}}{2} * (D_{o})\right]$ Overflow surface area (A ₀) Overflow of Bottom surface area (A _B)	Jepth (D _o)	Required treatr Overflow surface Bottom surface Overflow depth Underlying soil Infiltration rate User defined in Required drawn Volume reduct	ment volume ce area [Ao] e area [Ab] n [Do] - Hydrologic Sc of underlying su filitration rate down time (hrs) ion capacity of ntion provided b	oil Group oils BMP [V] oy BMP	5 SP (HSG	696 500 300 1.4 3.4, 0.8 in/hr) 0.8 560 560	ft ³ ft ² ft in/hr in/hr hrs ft ³ ft ³
						ОК	HELP
MP Properties							
BMP Properties: 1 - Stormwater pond							
Natershed BMP Summary							
BMP Name 1 - Stormwater pond							
Routing/downstream BMP		·					
Minnesota Stormwater Manual Wiki							
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				0.8	0.8		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				0.76	0.76		
		Impervious C	over (acres)		0.04		
					-	-	
The calculator does not require sizing inputs for non-volume reducing BMPs. This BMP should be sized according to the guidelines in the MN stormwater manual.		Total Area (ad	cres)		1.6		



Clumped BMPs

MIDS Calculator (Version	on 1: February 2014)	- 0 X
<u>F</u> ile		
	Site Information Schematic Results	
Summary Information:	n:	
Impervious area not routed to a BMP	BMPs Schematic	
0.68		
Pervious area not		
routed to a BMP		
3.97 acres		
Performance goal		
requirement		
2715 ft 3		
Performance goal reduction achieved		
ft ³	1 - Rieretartian basin /w/a 1 - Stormwater nond	
Percent TP reduction	underdrain)	
achieved		
%		
achieved		
%		
	Other	

MP Properties	· Jack									
3MP Properties: Clumped - Bioretention ba	asin (w/o u	ınderdrain)				1				
Watershed BMP Parameters BMP Summary										
BMP Name Clumped - Bioretention basin (w/o underdrain))									
Routing/downstream BMP 1 - Stormwater pond										
Minnesota Stormwater Manual Wiki										
BMP Watershed Area										
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)					
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0					
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed	2.41				2.41					
		Impervious C	over (acres)		0.64					
		Total Area (ac	res)		3.05					
						ок	HELP			



IP Properties									
MP Properties: 1 - Stormwater pond									
atershed BMP Summary									
BMP Name 1 - Stormwater pond									
Routing/downstream BMP									
Minnesota Stormwater Manual Wiki									
BMP Watershed Area						-			
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)				
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				0.8	0.8	_			
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				0.76	0.76				
		Impervious Co	over (acres)		0.04				
The calculator does not require sizing inputs for non-volume reducing BMPs.		Total Area (acres)			1.6	-			
This BMP should be sized according to the guidelines in the MN stormwater manual.									
						ок	HELP		



Exercise 4: Answer

Determine the results by calculating bioretention basins with individual drainage areas and as one clumped basin.

Are the results different? Why/why not?

The results are different. Both scenarios require the same volume control treatment—2,715 cubic feet. The "individual" method provides 2,419 cubic feet of retention. The "clumped" method provides 2,556 cubic feet. The results from the two methods differ because in the "individual" method, Basin C is oversized for the Performance Goal, but Basins A, B, and D are undersized. Because Basin C is upstream of the other basins, the excess volume in it cannot be used to treat the excess runoff from the other basins. The "clumped" method is faster for the user to input into the calculator, but it doesn't account for basins that might not receive runoff, such as Basin C (or basins at the top of hills).

Exercise 5: Several BMPs in Series (green roof, permeable pavers, bioretention basins and "other") all in a series

Assignment:

Determine if the site meets the performance goal for new sites without restrictions? Are any BMPs oversized or undersized?



		La	s)		
	Soil type	Turf-	Forest-		Total
Watershed	(HSG)	disturbed	undisturbed	Impervious	(acres)
Cistern	В	0	0	0.080	0.080
Infiltration Tree Box	В	0.11	0	0.070	0.180
Basin 1	В	0.17	0	0.030	0.200
Green Roof (1)	В	0	0	0.020	0.020
Permeable Pavers (2)	В	0	0	0.080	0.080
Basin 2	В	0.09	0	0.150	0.240
Total		0.37	0	0.430	0.800

Notes:

(1) For "Site Information", Green roof area is considered impervious area. 4" media depth. Entire watershed is a green roof (871 sf)

(2) For "site Information", Permeable pavers are considered impervious area. 2,614 sf of pavers with 870 sf of roof draining onto the pavers

Watershed	BMP Description	Surface Area at Overflow (ft ²)	Surface Area at Media Surface (ft ²)	Surface Area at Underdrain (ft ²)	Bottom surface Area (ft ²)	Overflow Depth (ft)	Total Media Depth (ft)	Depth Below Underdrain (ft)
	"Other"							
Cistern (1)	10 ft. high, 500 ft ³	50	NA	NA	50	10	NA	NA
	Infiltration							
Infiltration Tree Box (2)	Trench/Tree Box	562	562	NA	562	0.2	1.0	NA
	Bioretention basin							
Basin 1	(w/o underdrain)	2200	NA	NA	1282	1	NA	NA
	Green Roof - 4 inch							
Green Roof (3)	media depth	NA	NA	NA	NA	NA	NA	NA
Permeable Pavers (4)	Permeable Pavement	2614	NA	NA	2614	NA	NA	1.0
	Bioretention basin							
	(with elevated							
Basin 2 (5)	underdrain)	1546	1150	1100	1000	1	3.0	1.3

Notes:

(1) Assume 80% of annual runoff retained and used between storm events

(2) Media porosity = 0.30. 5'x5' concrete walls connected by 7 ft x 1.5ft rills. Compacted A soil below walls acts like B soil

(3) For "Site Information", Green roof area is considered impervious area. 4" media depth. Entire watershed is a green roof

(4) For "Site Information", Permeable pavers are considered impervious area. 2,614 sf of pavers with 871 sf of roof draining onto the pavers. Media Porosity=0.40

(5) Media field capacity = 0.15. Media porosity = 0.40. Planting media mix = C, P content of media is less than 30 kg/mg, and no soil amendments have been added

MIDS Calculator (Version 1: Fe	bruary 2014)	
Summary Information:	Site Information Schematic Results	
Impervious area not routed to a BMP 0 acres Pervious area not routed to a BMP 0 acres	Project Name: Excercise 5 User Name/Company Name: Date: Project Description:	
requirement ft ³ Performance goal reduction achieved ft ³ Percent TP reduction achieved %	Volume Retention Requirement (inches) 1.1 Site's Zip Code 55418 Annual Rainfall (inches) 31.4 Phosphorus EMC (mg/l) 0.3 TSS EMC (mg/l) 54.5	
Percent TSS reduction achieved %	Land Cover A soils B soils C soils D soils Total (acres) Forest/Open Space - Undisturbed, protected forest/ open space or reforested land Image I and Image I a	
	Impervious Area Total Area 0.43 Total Area	

Exercise 5: Step-by-Step Calculator Inputs





MP Properties: Cistern							Other
Routing/downstream BMP Infiltration Tree Box Minnesota Stormwater Manual Wiki		•					
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0		
		Impervious C	over (acres)		0.08		
		Total Area (ac	cres)		0.08		
						ОК	HELP

BMP Properties	No.t.	
BMP Properties: Cistern		Other
Watershed BMP Parameters BMP Summary		
Other (User Defined Reductions)		
	Required treatment volume	319 ft ³
	BMP volume capacity [V]	500 ft ³
	Volume of retention provided by BMP	319 ft ³
	Annual runnoff volume retained	80 %
	Particulate P removal rate via non volume reduction treatment	0 %
	Dissolved P removal rate via non volume reduction treatment	0 %
	TSS removal rate via non volume reduction treatment	0 %
		OK HELP

BMP Properties	- inter						
BMP Properties: Infiltration Tree Box Watershed BMP Parameters BMP Summary						[*
BMP Name Infiltration Tree Box Routing/downstream BMP Basin 1 Minnesota Stormwater Manual Wiki							
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.11			0.11		
		Impervious Co	over (acres)		0.07		
		Total Area (ac	res)		0.18		
					_	ОК	HELP



BMP Properties							
BMP Properties: Permeable pavement						[<u></u>
Watershed BMP Parameters BMP Summary							数学定型
BMP Name Permeable pavement							
Routing/downstream BMP Basin 1		•					
Minnesota Stormwater Manual Wiki							
BMP Watershed Area							
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0		
		Impervious Co	over (acres)		0.08		
		Total Area (ac	res)		0.08		
					_	ОК	HELP



BMP Properties		_	_	_		_				
BMP Properties: Basin 1						[
Watershed BMP Parameters BMP Summary						L				
BMP Name Basin 1										
Routing/downstream BMP Basin 2										
Minnesota Stormwater Manual Wiki										
BMP Watershed Area										
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)					
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0					
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.17			0.17					
		Impervious Co	over (acres)		0.03					
		Total Area (ac	res)		0.2					
					_	ок	HELP			



BMP Properties							
BMP Properties: Basin 2						Γ	
Watershed BMP Parameters BMP Summary							
BMP Name Basin 2							
Routing/downstream BMP		•					
Minnesota Stormwater Manual Wiki							
BMP Watershed Area							
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)		
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0		
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.09			0.09		
		Impervious Co	over (acres)		0.15		
		Total Area (ac	res)		0.24		
7							
					_	ОК	HELP



BMP Properties	Darberger, 14	and heads	E	
BMP Properties: Basin 2	MD Summani		V	
Surface area at	/ Summary	Dottom Surdee drea [76]	1000	π-
media surface (A _M)		Total media depth [D]	3	ft
	Total media	Depth below underdrain [Do]	1.3	ft
Surface area at underdrain (A ₀)	depth (D)	Media field capacity - wilting point (typical values 0.06 - 0.17)	0.15	ft ³ /ft ³
	Depth below	Media porosity [n](typical values 0.35-0.50)	0.4	ft ³ /ft ³
	underdrain (D ₀)	Bioretention planting media mix	Media Mix C 🔹	
Bottom surface area (A _B)		Is the P content of the media less than 30 mg/kg?	Yes 🔹	
		Is a soil amendment used to attenuate phosphorus?	No 💌	
		Underlying soil - Hydrologic Soil Group	6 SM (HSG B, 0.45 in/ł 💌	
		Infiltration rate of underlying soils	0.45	in/hr
		User defined infiltration rate		in/hr
		Required drawdown time	48 💌	hrs
		Volume reduction from basin bottom infiltration [Vinf_b]	0	ft ³ ≡
		Volume reduction from basin sides infiltration [Vinf_s]	54	ft ³
		ET volume reduction of BMP [Vet]	29	ft ³
		Volume reduction stored below underdrain	546	ft ³
		Volume reduction capacity of BMP [V]	629	ft ³
		Volume of retention provided by BMP	599	ft ³
				*
			ОК	HELP

3MP Name 1 - Green roof						
Routing/downstream BMP Basin 1		•				
<u>Minnesota Stormwater Manual Wiki</u> BMP Watershed Area						
Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)	
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0	
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0	
		Impervious C	over (acres)		0.02	
		Total Area (ad	cres)		0.02	



Exercise 5: Answer

Determine if the site meets the performance goal for new sites without restrictions?

Answer: Yes



Are any BMPs oversized or undersized?

Answer: Yes.

🙀 MIDS Calculator (Version 1: February 2	014)									Į	- D X
<u>F</u> ile											
Cite Ind		Calculation	Results								
Summary Information:	formation	Schematic	Results								
Impervious area not	Perfor	mance Goa	Requiremen	t							
routed to a BMP	Perform	mance goals	volume retent	ion re	quirement:	17	717 #3				
0 acres	Volum	e removed b	ov BMPs:	01110	quirement	17	717 ft3				
Penvious area not	Percer	nt volume r	emoved			1	00 %				
routed to a BMP											
	Annua	l Pollutant	Load Reducti	on							
acres	Post de	evelopment	annual particu	ilate P	load:	0.	51 lbs				
Performance goal	Annua	l particulate	P removed by	BMP	5:	C).5 Ibs				
requirement	Post de	evelopment	annual dissolv	ed P I	oad:	0.	42 Ibs				
1717 43	Annua	I dissolved P	removed by I	3MPs:		0.	42 Ibs				
	Percer	nt annual to	tal phosphor	us rer	noved:	9	99 %				
Performance goal											
	Post de	evelopment	annual TSS loi ad by PMDa	ad:		1	68 lbs				
ft	Percer	nt annual TS	S removed:			1	00 %				
Percent TP reduction	i cicci	it unnour re	is removed.			-					
achieved											
99 %	BMP S	ummary									
Percent TSS reduction				F				Annual	Annual		1
achieved					Performance	BMP	Performance	articulate	Dissolved	Annual	
100 %	BMP N	lame			Recieved	Capacity	Reduction	Р	P	Reduction	
					(ft3)	(ft3)	(ft3)	Reduction	Reduction	(lbs)	
	1 6			┢	80	06	80	(105)	(105)	7	-
	I - Gre Basin 1	en root		┢	120	90	120	01	0.08	26	-
	Basin 2)		╉	599	629	599	0.16	0.00	54	-
	Perme	able paveme	nt		319	1046	319	0.08	0.07	27	-
	Infiltrat	tion Tree Bo	х	t	280	281	280	0.1	0.08	32	1
	Cistern	1		1	319	500	319	0.06	0.06	22	
	Total			Г		4293	1717	0.5	0.42	168	1
	·										3
	BMP S	chematic						-			
	1										1