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Memorandum

300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901
Michael DeCarlo, Township of Verona Engineering Manager Glenn Beckmeyer, Planning Board Engineer
Timothy Derrick, P.E. Michael Fowler, P.E.
Vernon Endo, President – Montclair Golf Club Roger Bacon, General Manager – Montclair Golf Club Michael Campbell, Director of Golf Course Operations – Montclair Golf Club Alan Trembulak
11 December 2019 Revised 10 June 2020 Revised 15 July 2020
Stormwater Calculations Summary Tennis Courts Renovation Montclair Golf Club Verona, New Jersey Langan Project No.: 001039209

This technical memorandum was prepared to demonstrate that the requirements of the Stormwater Management Rule (NJAC 7:8) and Chapter 123 (Stormwater Management) of the Township of Verona Code for the renovation of the tennis courts at Montclair Golf Club (the Club) have been met. The memorandum, calculations, plans, and figures demonstrate that flows from the project area decrease due to a decrease of impervious coverage (0.23 acres) by eliminating a tennis court and tennis court practice area and therefore meet the requirements of the regulations listed above.

The proposed work includes:

- Removal of the 7 existing tennis courts and tennis practice area;
- Construction of 6 new tennis courts;
- Re-grading of the upper portion of the existing golf practice range;
- Re-sodding and installing underdrains in the lower portion of the golf practice range; and
- The reconstruction of areas affected by the improvements listed above.

The Club previously obtained a permit from the Hudson Essex Passaic Soil Conservation District for this work. The project is considered a "major development" because the work will disturb greater than 1 acre of land. Major developments are required to meet the requirements for stormwater quality, stormwater quantity, and groundwater recharge as described in the Stormwater Management Rule. How the project meets the stormwater quality, groundwater recharge, and stormwater quantity is described below and demonstrated in the attached calculations.

Technical Memorandum

Stormwater Quality

Per 7:8-5.5 (a) of the Stormwater Management Rule and Section 123-9.G.(1) of the Township of Verona Code, "Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site." Stormwater quality measures are not required for this project because the impervious surface will decrease by 0.23 acres within the project area as shown in the attached calculations and plans.

Groundwater Recharge

In order to meet groundwater recharge requirements per 7:8-5.4(a)2.i. of the Stormwater Management Rule and Section 123-9.F.(1)(b)[1] of the Township of Verona Code, the design engineer must either demonstrate that either:

- The site maintains 100% of the average annual preconstruction groundwater recharge volume for the site; or
- Demonstrate that the increase or stormwater runoff volume for the two-year storm is infiltrated.

The enclosed completed New Jersey Groundwater Recharge Spreadsheet demonstrates that the proposed project will meet the requirements by infiltrating a greater amount in proposed conditions.

As described in the "Calculation Assumptions" later in this memorandum, the existing soil survey does not provide clear direction for the hydraulic soil groups present within the project limits. Per direction from the National Resources Conservation Service (NRCS) and discussions with you, we assumed a HSG A for confirming groundwater recharge requirements for the project. Per Table 2 of Appendix E of the NJ Stormwater BMP Manual, the "Fort Mott" soil series was chosen in the spreadsheet as the default HSG A series.

Stormwater Quantity

7:8-5.4(a)3 of the Stormwater Management Rule and Section 123-9.F.(1)(c) of the Township of Verona Code allows a project to meet the requirement of the rule/code in one of 3 ways. The project meets the requirements through method 1:

1. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2-, 10-, and 100-year storm events do not exceed, at any point in time, the preconstruction runoff hydrographs for the same storm events;



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The project does not increase the amount of stormwater leaving the site for the 2-, 10-, and 100year storm events as described in item 1 above. A summary of our hydraulic analysis for the project is attached as Table 1.

The project has two drainage areas: one area (Watershed A) that drains to a catch basin located in Prospect Avenue that flows south along Prospect Avenue and discharges into Eagle Rock Reservation and the remaining area (Watershed B) that drains to the golf course. Table 1 demonstrates that the flow from Watershed A decreases for the 2-, 10-, and 100-year storm events. The flow from the project area (Watershed B) will also decrease because the area decreases and the CN value decreases as shown on the enclosed CN calculation sheet and on the watershed area plans.

Calculation Assumptions

The assumptions hydraulic soil groups and land cover used to perform the enclosed calculations are described below.

<u>Watershed A</u> – The reported soil type the National Resources Conservation Service (NRCS) Web Soil Survey is URBONB (Urban Land, Boonton Substratum), which does not have an associated Hydraulic Soil Group (HSG). Due to the unknown HSG associated with the existing soils and in lieu of soil testing, we have prepared hydraulic calculations for each HSG (A, B, C, and D) to demonstrate the flow from the project site will decrease in proposed conditions regardless of the HSG..

<u>Watershed B</u> - As discussed with you, there is a discrepancy in the reported HSG on the National NRCS Web Soil Survey. The online web soil survey maps the majority of the golf course and the area of Watershed be as UdbonB (Udorthents, Boonton Substratum) with a D Type Hydraulic Soil Group (HSG). As confirmed with the NRCS via email on 2/4/2020, the correct HSG to use Type A. The attached calculations for Watershed B have been performed using HSG Type A.

<u>Tennis Courts</u> – The proposed and existing tennis courts will be constructed with the same material and will be maintained the same throughout the year in existing and proposed conditions, which will create identical drainage conditions. The only difference in in the tennis courts is related to the irrigation method used to maintain the playing surface's moisture content. The existing tennis courts use sprinklers and the proposed tennis courts will use a subsurface drip system.

<u>Woods</u> – All "Woods" were assigned to be in "poor condition" in existing and proposed conditions. Per TR-55:

"Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning"

At the golf club forest litter, small trees, and brush are removed by continuous maintenance. As shown below in Photograph 1.



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Stormwater Calculations Summary Tennis Courts Renovation Montclair Golf Club Verona, New Jersey Langan Project No.: 001039209 11 December 2019 Revised 15 July 2020 Page 4 of 4



Photograph 1 – Woods adjacent to site in "poor" condition. Forest litter, small trees, and brush removed by continual maintenance.

Timothy B. Derric , P.E. N.J. Professional Engineer License No. 4678200

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Michael J. Fowler, P.E. N.J. Professional Engineer License No. 3239800

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NJ Certificate of Authorization No. 24GA27996400 \\angan.com\data\PAR\data2\001039209\Project Data_Discipline\Site Civil\Stormwater\Report Text\Tennis Courts\2019.12.10 - MGC Tennis Court Renovation Stormwater Memo.docx

7/15/2020 Montclair Golf Club - Tennis Court Renovation Table 1 - Stormwater Flow Summary

Comparis	Comparison of Existing and Proposed Peak Discharges - HSG A Type Soils								
	Watershed A								
	CN 2-year Flow (cfs)		10-year Flow (cfs)	100-year Flow (cfs)					
Existing	76	3.06	.06 6.49 13.41						
Proposed	71	2.29	5.37	12.18					
Difference	-5	-0.77	-1.12 -1.23						
	Watershed B								
	CN	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)					
Existing	45	0.005	0.137	1.127					
Proposed	41	0.002	0.049	0.813					
Difference	-4	-0.003	-0.088	-0.314					

Note: Per direction received from Edwin Muniz from the NRCS via email on 2/4/2020, the soil type in Waterhsed B should be mapped as a HSG A Type soil.

Comparison of Existing and Proposed Peak Discharges - HSG B Type Soils							
	CN	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)			
Existing	84	4.40	8.00	15.10			
Proposed	81	3.89	7.41	14.51			
Difference	-3	-0.52	-0.59	-0.59			

Comparison of Existing and Proposed Peak Discharges - HSG C Type Soils								
	CN	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)				
Existing	89	5.27	8.90	15.91				
Proposed	87	4.93	8.56	15.61				
Difference	-2	-0.35	-0.35	-0.30				

Comparison of Existing and Proposed Peak Discharges - HSG D Type Soils								
	CN	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)				
Existing	91	5.61	9.22	16.17				
Proposed	90	5.44	9.07	16.04				
Difference	-1	-0.17	-0.15	-0.13				

WATERSHED AREA PLANS

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Filename: C:\Users\Tderrick\Desktop\Temp Work From Home\MGC Tennis Court\CAD\09\SheetFiles\Tennis Courts\Drainage Area Plans\001039209-CG101-0101.dwg Date: 7/15/2020 Time: 14:07 User: tderrick Style Table: Langan.stb Layout: ANSIB-BL



CN CALCULATIONS

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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essay County, NJ		Data	

Present Developed

Existing WS A (Tennis Courts) A-Type Soils

1. Runoff Curve Number (CN)

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and	CN ¹			of	
hydrologic	hydrologic condition;	~	ņ	4	V acres	CN x area
group	percent impervious;	le 2.	Table 2 Fig. 2-	g. 2-	mi ²	
	unconnected/connected impervious	Tab	Tab] Fig			
(Appendix A)	area ratio)					
A	IMPERVIOUS	98			1.21	118.58
А	Grass (Good)	39			0.59	23.01
А	Woods (Poor)	45			0.15	6.75
1 Use only one CN s	source per line	Т	otals	=	1.95	148.34

$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{148.34}{} = 76.07 \text{ Use } CN = 76$	- = <u>148.34</u> = 76.07 Use CN = 76
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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	

Present Developed

Existing WS A (Tennis Courts) B-Type Soils

1. Runoff Curve Number (CN)

Soil Name	Cover description						Area	Product
and	(cover type, treatment, and	CN ¹			of			
hydrologic	hydrologic condition;	5	'n	-4	xacres	CN x area		
group	percent impervious;	le 2	ble 2- ig. 2-		mi ²			
	unconnected/connected impervious	Tab	ъ́	.ਜ ਯ				
(Appendix A)	area ratio)							
В	IMPERVIOUS	98			1.21	118.58		
В	Grass (Good)	61			0.59	35.99		
В	Woods (Poor)	66			0.15	9.90		
1 Use only one CN :	source per line	Т	otals	=	1.95	164.47		

CN	(weighted) = -	total product	_ = _	164.47	=	84.34	Use CN =	84
		total area						

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	

Present Developed

Existing WS A (Tennis Courts) C-Type Soils

1. Runoff Curve Number (CN)

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	2	e	4		CN x area
group	percent impervious;	e 2-	. 2		x acres mi ²	
	unconnected/connected impervious	Tabl	Fig	Fig	JS JS	
(Appendix A)	area ratio)					
С	IMPERVIOUS	98			1.21	118.58
С	Grass (Good)	74			0.59	43.66
С	Woods (Poor)	77			0.15	11.55
1 Use only one CN s	source per line	Т	otals	=	1.95	173.79

CN	(weighted)	=	total product total area	- =	173.79	=	89.12	Use CN =	89
CN	(weighted)	=	total product total area	- =	173.79	=	89.12	Use CN =	89

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	

Present Developed

Existing WS A (Tennis Courts) D-Type Soils

1. Runoff Curve Number (CN)

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN 1	-		of
hydrologic	hydrologic condition;	N 1	e.	-4	Xacres	CN x area
group	percent impervious;	e 5	. 2		mi ²	
	unconnected/connected impervious	Tabl	Fig	ъiд	00	
(Appendix A)	area ratio)					
D	IMPERVIOUS	98			1.21	118.58
D	Grass (Good)	80			0.59	47.20
D	Woods (Poor)	83			0.15	12.45
1 Use only one CN :	source per line	Т	otals	=	1.95	178.23

CN	(woighted) -	total product	_	178.23	_	91 40	Uso CN -	01
CIV	(wergineed) -	total area	_		_	91.40	USE CN -	31

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	
Circle on	Present Developed	Existing WS B (Pract	ice Range) A-	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹	-		of
hydrologic	hydrologic condition;	~	e.	-4	Xacres	CN x area
group	percent impervious;	e 9	. 2		mi ²	
	unconnected/connected impervious	Tabl	Fig	Fіg	00 01	
(Appendix A)	area ratio)					
Α	IMPERVIOUS	98			0.07	6.86
Α	Grass (Good)	39			0.59	23.01
1 Use only one CN :	source per line	Т	otals	=	0.66	29.87

CN (weighted) =	total product	 29.87	 45 26	Use CN =	45
(wergineed) -	total area	 0 66	 43.20	03e CN -	70

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	
Circle on	e: Present Developed	Existing WS B (Pract	ice Range) B-1	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	8	'n	-4	xacres	CN x area
group	percent impervious;	1e 2	g. 2-	g. 2-	mi ²	
	unconnected/connected impervious	Tab	н. 10-	- т н		
(Appendix A)	area ratio)					
В	IMPERVIOUS	98			0.07	6.86
В	Grass (Good)	61			0.59	35.99
1 Use only one CN :	source per line	Т	otals	=	0.66	42.85

$CN (weighted) = \frac{total product}{total area} = \frac{42.85}{total area} = \frac{1}{2}$	= 64.92	Use CN =	65
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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ	<u> </u>	Date	
Circle on	e: Present Developed	Existing WS B (Pract	ice Range) C-1	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹	•		of
hydrologic	hydrologic condition;	5	'n	-4	x acres	CN x area
group	percent impervious;	le 2	ط. 2-	д. 2-	mi ²	
	unconnected/connected impervious	Tab	н. Н	н. Н		
(Appendix A)	area ratio)					
С	IMPERVIOUS	98			0.07	6.86
С	Grass (Good)	74			0.59	43.66
1 Use only one CN :	source per line	Т	otals	=	0.66	50.52

$CN (weighted) = \frac{total product}{total area} = \frac{50.52}{total area}$	=	76.55	Use CN =	77
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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2019
Location	Township of West Orange, Essex County, NJ		Date	
Circle on	e: Present Developed	Existing WS B (Pract	ice Range) D-1	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹	-		of
hydrologic	hydrologic condition;	8	'n	-4	xacres	CN x area
group	percent impervious;	le 2	д. -	g. 2-	mi ²	
	unconnected/connected impervious	Tab	от Ц	л Ц		
(Appendix A)	area ratio)					
D	IMPERVIOUS	98			0.07	6.86
D	Grass (Good)	80			0.59	47.20
1 Use only one CN :	source per line	Т	otals	=	0.66	54.06

CN (weighted) =	total product	 54.06	 Q1 Q1	Uso CN -	82
CN (Weighted)	total area	 0.66	 01.91	USE CN -	02

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2020
Location	Township of West Orange, Essex County, NJ	<u> </u>	Date	
Circle on	e: Present Developed	Proposed WS A (Ten	nis Courts) A-	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	~	ņ	4	V acres	CN x area
group	percent impervious;	le 2		. 2-	mi ²	
	unconnected/connected impervious	Tab	Біg	ъig	ō	
(Appendix A)	area ratio)					
A	IMPERVIOUS	98			1.03	100.94
А	Grass (Good)	39			0.77	30.03
Α	Woods (Poor)	45			0.15	6.75
1 Use only one CN :	source per line	Т	otals	=	1.95	137.72

CN	(weighted) = $-$	total product total area	- = -	137.72	_ =	70.63	Use CN =	71
		total area						1

Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2020
Location	Township of West Orange, Essex County, NJ		Date	
Circle or	e: Present Developed	Proposed WS A (Ten	nis Courts) B-	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and	CN ¹			of	
hydrologic	hydrologic condition;	~	'n	-4	X acres	CN x area
group	percent impervious;	le 2	. 2	. 2-	mi ²	
	unconnected/connected impervious	Tab]	Fig	Fig	×	
(Appendix A)	area ratio)					
В	IMPERVIOUS	98			1.03	100.94
В	Grass (Good)	61			0.77	46.97
В	Woods (Poor)	66			0.15	9.90
1 Use only one CN :	source per line	Т	otals	=	1.95	157.81

CN	(weighted) = $-$	total product total area	- = -	157.81	=	80.93	Use CN =	81
								1

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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2020
Location	Township of West Orange, Essex County, NJ		Date	
Circle or	e: Present Developed	Proposed WS A (Ten	nis Courts) C-	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	~	'n	-4	X acres	CN x area
group	percent impervious;	e 2		. 2	mi ²	
	unconnected/connected impervious	Tab]	Fig	Fig	×	
(Appendix A)	area ratio)					
С	IMPERVIOUS	98			1.03	100.94
С	Grass (Good)	74			0.77	56.98
С	Woods (Poor)	77			0.15	11.55
1 Use only one CN :	source per line	Т	otals	=	1.95	169.47

$CN (weighted) = \frac{total product}{total area} = \frac{169.47}{86.91} = 86.91 Use CN = $	CN (weighted) =	total product total area	- =	169.47	=	86.91	Use CN =	87
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Project	Montclair Golf Club - Tennis Court Reconstruction	TD	Date	6/10/2020
Location	Township of West Orange, Essex County, NJ		Date	
Circle on	e: Present Developed	Proposed WS A (Ter	nis Courts) D-	Type Soils

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	- 2	m	4	v laaraa	CN x area
group	percent impervious;	le 2.	. 2	. 2-	mi ²	
	unconnected/connected impervious	Tab	Бig	Бig	ہ م	
(Appendix A)	area ratio)					
D	IMPERVIOUS	98			1.03	100.94
D	Grass (Good)	80			0.77	61.60
D	Woods (Poor)	83			0.15	12.45
1 Use only one CN :	source per line	Т	otals	=	1.95	174.99

CN	(weighted) = -	total product total area	- =	174.99	=	89.74	Use CN =	90
		cotar area						

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Project	Montclair Golf Club	- Tennis Court Reconstruction	EAJ	Date
Location	Township of West	Orange, Essex County, NJ	LM	Date
Circle on	e: Present	Developed	Proposed WS B (Prac	ctice Range) A-Type Soils

CN (weighted) = <u>total product</u> total area

Soil Name	Cover description				Area	Product					
and	(cover type, treatment, and		CN ¹	r		of					
hydrologic	hydrologic condition;	2	m	51'		CN x area					
group	percent impervious;	1	le 2	N N N	. 2	le 2-1	Je 2- J. 2-:	· 2-)	. 2-,	mi ²	
	unconnected/connected impervious	Tab	ъто н	Fig							
(Appendix A)	area ratio)										
A	IMPERVIOUS	98			0.02	1.96					
Α	Grass (Good)	39			0.64	24.96					
1 Use only one CN :	source per line	T	otals	=	0.66	26.92					

Use CN =	41
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0.66

_ = _

26.92 = 40.79

Project	Montclair Golf Club - Tennis Court Reconstruction	EAJ	Date
Location	Township of West Orange, Essex County, NJ	LM	Date
Circle on	e: Present Developed	Proposed WS B (Practi	ce Range) B-Type Soils

CN (weighted) = <u>total product</u> total area

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹			of
hydrologic	hydrologic condition;	2	m	ST	Б	CN x area
group (Appendix A)	percent impervious; unconnected/connected impervious area ratio)	Table 2-	Fig. 2-3	Fig. 2-4	x acres mi ² %	
В	IMPERVIOUS	98			0.02	1.96
В	Grass (Good)	61			0.64	39.04
1 Use only one CN :	source per line	Т	otals	=	0.66	41.00

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0.66

_ = _

41.00 = 62.12 Use CN =

Project	Montclair Golf Club - Tennis Court Reconstruction	EAJ	Date
Location	Township of West Orange, Essex County, NJ	LM	Date
Circle on	e: Present Developed	Proposed WS B (Pract	ice Range) C-Type Soils

CN (weighted) = total product total area

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹	r		of
hydrologic	hydrologic condition;	2	m	51'	-	CN x area
group	percent impervious;	le 2-	۲. 2	۲. 2	x acres mi ²	
	unconnected/connected impervious	Tab	н. Ч	Fi		
(Appendix A)	area ratio)					
С	IMPERVIOUS	98			0.02	1.96
С	Grass (Good)	74			0.64	47.36
1 Use only one CN :	Т	otals	=	0.66	49.32	

=	75
=	75

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0.66

_ = _

49.32 = 74.73 Use CN

Project	Montclair Golf Club - Tennis Court Reconstruction	EAJ	Date
Location	Township of West Orange, Essex County, NJ	LM	Date
Circle on	e: Present Developed	Proposed WS B (Praction	ce Range) D-Type Soils

 $CN (weighted) = \frac{total product}{total area} = -$

Soil Name	Cover description				Area	Product
and	(cover type, treatment, and		CN ¹	r		of
hydrologic	hydrologic condition;	2	m	51'	Б	CN x area
group	percent impervious;	able 2-	ig. 2-	ig. 2-,	x acres mi ² %	
(Appendix A)	area ratio)	Ĕ	ц	ц		
D	IMPERVIOUS	98			0.02	1.96
D	Grass (Good)	80			0.64	51.20
1 Use only one CN :	T	otals	=	0.66	53.16	

Use CN = 81

0.66

53.16 = 80.55

TIME OF CONCENTRATION CALCULATIONS

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Project	Montclair Golf Club - Tennis Court Re	construction	Ву	TD	_	Date		7/10/2020	_
Location	Township of West Orange,Essex Cou	nty NJ	Checked	-	_	Date		-	_
Circle One:	Present Developed								
Circle One:(T_c T_t through su	lbarea		Ex	cistir	ng Watershe	d A		
<u>Sheet flow</u> (Applicable to T_c Only)	;	Segment ID	A-B					
1. Surface	description (table 3-1)		-	Grass					
2. Manning'	s roughness coeff., n (table 3-	1)	-	0.150					
3. Flow Len	gth, L (total L \leq 150 ft)		ft	39					
4. Two-yr 2	4-hr rainfall, P ₂		in	3.42					
5. Land slo	pe, s		ft/ft	0.050					
6. $T_t = 0$.	$\frac{1007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$	Compute ${\rm T}_{\rm t}$	hr	0.052	+			=	0.052
Shallow conc	entrated flow		Segment ID	В-С					
/. Surface	description (paved or unpaved)		-	unpaved					
8. Flow len	gth, L		It C. (C.	80					
9. Watercou	rse slope, s		It/It	0.0175					
10. Average	velocity, V (figure 3-1)	Compute T	it/s	3.0	ן ר			_	0.007
11. T _t =	3600 V	compute it	11± L	0.007	1-1			-	0.007
			ſ						
Channel flow		:	Segment ID	C-D (6" PIPE)		D-E (8" PIPE)	E-F (8" PIPE)		
12. Cross se	ctional flow area, a		ft ²	0.20		0.35	0.35		
13. Wetted p	erimeter, p _w		ft	1.57		2.09	2.09		
14. Hydrauli	c radius, r $r = \frac{a}{p_w}$	Compute r	ft	0.13		0.17	0.17		
15. Channel	slope, s		ft/ft	0.005		0.009	0.047		
16. Manning'	s roughness coeff., n		F	0.013		0.013	0.013		
17. V =	$\frac{1.49 r^{2/3} s^{1/2}}{n}$	Compute V	ft/s	2.03		3.29	7.53		
18. Flow len	gth, L		ft	38		270	29		
19. ^{Tt} =	L 3600 V	Compute T_t	hr	0.005	+	0.023	0.001	=	0.028
20. Watershe	d or subarea T_c or T_t (add T_t in	steps 6, 11	1, 19)						0.087



C:\Users\Tderrick\Desktop\Temp Work From Home\MGC Tennis Court\Tennis Courts\Tennis Courts Tc\TC Calculations

Project	Montclair Golf Club - Tennis Court Rec	onstruction	Ву	TD	Date		7/10/2020	_
Location	Township of West Orange, Essex Coun	ty NJ	Checked	-	Date		-	_
Circle One: (Present Developed							
Circle One: (T_c T_t through sub	oarea		E	cisting Watershe	ed B		
	_					-		
Sheet flow ()	Applicable to T_c Only)	-	Segment ID	A-B		_		
1. Surface o	description (table 3-1)			Grass		_		
2. Manning's	s roughness coeff., n (table 3-1	.)		0.150		_		
3. Flow Leng	gth, L (total L \leq 150 ft)		ft	86		_		
4. Two-yr 24	4-hr rainfall, P ₂		in	3.42				
5. Land slop	be, s		ft/ft	0.010				
6. $T_t = 0.0$	007 (nL) ^{0.8}	Compute ${\rm T}_{\rm t}$	hr	0.185	+		=	0.185
I	22 ⁰⁰ 5 ⁰¹							
Shallow conce	entrated flow		Segment ID					
7. Surface o	description (paved or unpaved)							
8. Flow leng	gth, L		ft					
9. Watercour	rse slope, s		ft/ft					
10. Average v	velocity, V (figure 3-1)		ft/s		_			
11. T _t =	L 3600 V	Compute ${\rm T}_{\rm t}$	hr		+		=	0.000
			—					
				R.C.			1	
Channel flow			Segment ID	(4" PIPE)				
12. Cross sec	ctional flow area, a		ft ²	0.09				
13. Wetted pe	erimeter, p _w		ft	1.05				
14. Hydraulic	$r = \frac{a}{p_w}$	Compute r	ft	0.08				
15. Channel s	slope, s		ft/ft	0.006				
16. Manning's	s roughness coeff., n			0.013				
17. V =	1.49 $r^{2/3} s^{1/2}$ n	Compute V	ft/s	1.69				
18. Flow leng	gth, L		ft	255				
19. T _t =	L 3600 V	Compute T _t	hr	0.042	+		=	0.042
20. Watershed	d or subarea T_c or T_t (add T_t in	steps 6, 11	L, 19)				ı	0.227 HR
								14 MIN

Project	Montclair Golf Club - Te	ennis Court Reconstruction	Ву	TD	Date		7/10/2020	_
Location	Township of West Oran	ge,Essex County NJ	Checked	-	Date			_
Circle One:	Present Developed							
Circle One: (T _c T _t	through subarea		Prop	osed Watersho	ed A		
			Г			1		
<u>Sheet flow</u> ()	Applicable to T_c Onl	y) S	Segment ID	A-B				
1. Surface o	description (table 3	-1)	_	Grass				
2. Manning's	s roughness coeff.,	n (table 3-1)	-	0.150				
3. Flow Leng	gth, L (total L \leq 15	0 ft)	ft	55				
4. Two-yr 24	4-hr rainfall, P ₂		in	3.42				
5. Land slop	pe, s		ft/ft	0.053				
6. $T_t = 0.0$	007(nL) ^{0.8}	Compute T_t	hr	0.066	+		=	0.066
1	r ₂ 5							
Shallow conce	entrated flow	S	Segment ID					
7. Surface o	description (paved o	r unpaved)						
8. Flow leng	gth, L		ft					
9. Watercour	rse slope, s		ft/ft					
10. Average v	velocity, V (figure	3-1)	ft/s					
11. T _t =	L 3600 V	Compute ${\rm T}_{\rm t}$	hr		+		=	0.000
			Г		7			
				B-C	C-D	D-E	1	
<u>Channel flow</u>		S	Segment ID	(6" PIPE)	(8" PIPE)	(8" PIPE)		
12. Cross sec	ctional flow area, a		ft ²	0.20	0.35	0.35		
13. Wetted pe	erimeter, p _w		ft	1.57	2.09	2.09		
14. Hydraulio	c radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.13	0.17	0.17		
15. Channel s	slope, s		ft/ft	0.005	0.005	0.047		
16. Manning's	s roughness coeff.,	n		0.013	0.013	0.013		
17. V =	1.49 r ^{2/3} s ^{1/2} n	Compute V	ft/s	2.03	2.45	7.53		
18. Flow lend	gth, L		ft	47	290	29		
19. T _t =	L 3600 V	Compute T_t	hr	0.006	+ 0.033	0.001	=	0.039
20. Watershed	d or subarea T _c or T	(add T, in steps 6, 11	, 19)					0.106



Project	Montclair Golf Club	- Tennis Court Reconstruction	Ву	TD	Dat	.e	7/10/2020	_
Location	Township of West	Drange,Essex County NJ	Checked	-	Dat	e	_	_
Circle One:	Present vevelop	ped						
Circle One:	T _c T _t	through subarea		Pro	oposed Wat	tershed B		
			_					
Sheet flow ()	Applicable to T_c	Only)	Segment ID	A-B				
1. Surface o	description (tabl	.e 3-1)		Grass				
2. Manning's	s roughness coeff	., n (table 3-1)		0.150				
3. Flow Leng	gth, L (total L <u><</u>	<u>(</u> 150 ft)	ft	86				
4. Two-yr 24	4-hr rainfall, P_2		in	3.42				
5. Land slop	pe, s		ft/ft	0.010				
6. $T_t = 0.0$	0.5 0.4	Compute T_t	hr	0.185	+		=	0.185
I	P ₂ s							
Shallow conce	entrated flow		Segment ID					
7. Surface o	description (pave	ed or unpaved)						
8. Flow leng	gth, L		ft					
9. Watercour	rse slope, s		ft/ft					
10. Average v	velocity, V (figu	ire 3-1)	ft/s					
11. T _t =	L 3600 V	Compute T_t	hr		+		=	0.000
			F					
			_	D.O.				
<u>Channel flow</u>			Segment ID	(4" PIPE)				
12. Cross sec	ctional flow area	1, a	ft ²	0.09				
13. Wetted pe	erimeter, p _w		ft	1.05				
14. Hydraulic	c radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.08				
15. Channel s	slope, s		ft/ft	0.006				
16. Manning's	s roughness coeff	., n	_	0.013				
17. V =	$\frac{1.49 \text{ r}^{2/3} \text{ s}^{1/2}}{\text{n}}$	Compute V	ft/s	1.69				
18. Flow leng	gth, L		ft	255				
19. T _t =	L 3600 V	Compute T _t	hr	0.042	+		=	0.042
20. Watershed	d or subarea T _c o	r T _t (add T _t in steps 6, 11	L, 19)		_			0.227 HR
								14 MIN

HYDROLOGIC ANALYSIS HSG A Watershed A Watershed B

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Hydrograph Summary Report Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.058	1	727	9,545				EX WSHD A
2	SCS Runoff	2.291	1	727	7,396				PR WSHD A
4	SCS Runoff	0.005	1	871	173				EX WSHD B
5	SCS Runoff	0.002	1	1386	47				PR WSHD B
Terr				<u> </u>					
I ennis Court Hydrologic Calculations Type A Soils.gpw			Return Period: 2 year		Wednesday, 07 / 15 / 2020				

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 1

EX WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.058 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 9,545 cuft
Drainage area	= 1.950 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 330140039120090P roject D	0at a∖_48st cipline\Site Civil\Storr



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 2

PR WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.291 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 7,396 cuft
Drainage area	= 1.950 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912003%P roject D	0at a∖_428s cipline∖Site Civil∖Stor



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 4

EX WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 2 yrs	Time to peak	= 871 min
Time interval	= 1 min	Hyd. volume	= 173 cuft
Drainage area	= 0.660 ac	Curve number	= 45
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 3301aqa92a096P roject D	0at a∖_428s cipline∖Site Civil∖Storn


Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 5

PR WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.002 cfs
Storm frequency	= 2 yrs	Time to peak	= 1386 min
Time interval	= 1 min	Hyd. volume	= 47 cuft
Drainage area	= 0.660 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912009&P roject D	0at a∖_428s cipline∖Site Civil∖Storn



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	6.397	1	727	19,779				EX WSHD A
2	SCS Runoff	5.369	1	727	16,618				PR WSHD A
4	SCS Runoff	0.137	1	739	1,223				EX WSHD B
5	SCS Runoff	0.049	1	752	779				PR WSHD B
Ten Type	nis Court Hydr e A Soils.gpw	ologic Cal	lculations	3	Return Pe	eriod: 10 yea	ar	Wednesday	v, 07 / 15 / 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.397 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 19,779 cuft
Drainage area	= 1.950 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data	2\330ntape912003%Project Da	ata_ 48e cipline\Site Civil\Storr



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.369 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 16,618 cuft
Drainage area	= 1.950 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\F	AR\data2\@0140391203%Project D	0at a∖_48is cipline∖Site Civil∖Storr



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 4

EX WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.137 cfs
Storm frequency	= 10 yrs	Time to peak	= 739 min
Time interval	= 1 min	Hyd. volume	= 1,223 cuft
Drainage area	= 0.660 ac	Curve number	= 45
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\301402912030Project	0at a∖_428s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 5

PR WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.049 cfs
Storm frequency	= 10 yrs	Time to peak	= 752 min
Time interval	= 1 min	Hyd. volume	= 779 cuft
Drainage area	= 0.660 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\330140029120330Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	13.41	1	727	42,397				EX WSHD A
2	SCS Runoff	12.18	1	727	37,969				PR WSHD A
4	SCS Runoff	1.127	1	733	5,087				EX WSHD B
5	SCS Runoff	0.813	1	733	4,029				PR WSHD B
Ten	nis Court Hydro A Soils.gpw	ologic Ca	lculations	5	Return Pe	eriod: 100 y	ear	Wednesday	ı, 07 / 15 / 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 13.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 42,397 cuft
Drainage area	= 1.950 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912009&P roject D	0at a∖_428s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 12.18 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 37,969 cuft
Drainage area	= 1.950 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PA	AR\data2\ 330naqaa9faa3a dProject D	Dat a∖_403s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 4

EX WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.127 cfs
Storm frequency	= 100 yrs	Time to peak	= 733 min
Time interval	= 1 min	Hyd. volume	= 5,087 cuft
Drainage area	= 0.660 ac	Curve number	= 45
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 331140391203%P roject D	0ata 48ie cipline∖Site Civil∖Storr



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 07 / 15 / 2020

Hyd. No. 5

PR WSHD B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.813 cfs
Storm frequency	= 100 yrs	Time to peak	= 733 min
Time interval	= 1 min	Hyd. volume	= 4,029 cuft
Drainage area	= 0.660 ac	Curve number	= 41
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\301402912030Project D	0at a∖_428s cipline∖Site Civil∖Storn



HYDROLOGIC ANALYSIS HSG B Watershed A

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Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

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100 - Year

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Hydrograph No. 1, SCS Runoff, EX WSHD A	8
Hydrograph No. 2, SCS Runoff, PR WSHD A	9

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.402	1	727	13,637				EX WSHD A
2	SCS Runoff	3.885	1	727	12,001				PR WSHD A
Ten Typ	∣ nis Court Hyd e Soils.gpw	rologic C	alculatio	ns - B	Retu	rn Period:	2 years	Wednesday	, 6 / 10 / 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.402 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 13,637 cuft
Drainage area	= 1.950 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912009&P roject D	ata <mark>∖_48se</mark> cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.885 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 12,001 cuft
Drainage area	= 1.950 ac	Curve number	= 81
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 3301aq3a92a036P roject D	ata <mark>∖_48st</mark> cipline\Site Civil\Storn



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.002	1	727	25,279				EX WSHD A
2	SCS Runoff	7.414	1	727	23,152				PR WSHD A
Ten Typ	nis Court Hyc e Soils.gpw	Irologic C	alculatio	ns - B	Retu	Return Period: 10 years		Wednesday, 6 / 10 / 2020	

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 8.002 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 25,279 cuft
Drainage area	= 1.950 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 330140}391203%P roject D	0at a∖_403s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.414 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 23,152 cuft
Drainage area	= 1.950 ac	Curve number	= 81
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &0140029120090P roject D	0at a∖_428s cipline∖Site Civil∖Storn



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	15.10	1	727	49,483				EX WSHD A
2	SCS Runoff	14.51	1	727	46,827				PR WSHD A
Ten Typ	nis Court Hyd e Soils.gpw	rologic C	alculatio	ns - B	Return Period: 100 years		00 years	Wednesday	, 6 / 10 / 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 15.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 49,483 cuft
Drainage area	= 1.950 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912009&P roject D	0at a∖_428s cipline∖Site Civil∖Stor



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 14.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 46,827 cuft
Drainage area	= 1.950 ac	Curve number	= 81
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\301402912030Project D	0at a∖_428s cipline∖Site Civil∖Storn



HYDROLOGIC ANALYSIS HSG C Watershed A

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Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

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Symmary Report	1
Hvdrograph Reports	2
Hvdrograph No. 1. SCS Runoff. EX WSHD A	2
Hvdrograph No. 2. SCS Runoff, PR WSHD A	3
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10 - Year

Summary Report	4
Hvdrograph Reports	5
Hydrograph No. 1, SCS Runoff, EX WSHD A	5
Hydrograph No. 2, SCS Runoff, PR WSHD A	6

100 - Year

Summary Report	7
Hydrograph Reports	8
Hydrograph No. 1, SCS Runoff, EX WSHD A	8
Hydrograph No. 2, SCS Runoff, PR WSHD A	9

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.272	1	727	16,668				EX WSHD A
2	SCS Runoff	4.926	1	727	15,407				PR WSHD A
Ten	l nis Court Hyd	rologic C	alculatio	ns - C	Date	rn Dariad	2 1/0010	Wednesday	6 / 10 / 2020
Type Soils.gpw			Return Period: 2 years		weunesuay, 07 107 2020				

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 5.272 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 16,668 cuft
Drainage area	= 1.950 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 330140939120396P roject D	0at a∖_403s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 4.926 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 15,407 cuft
Drainage area	= 1.950 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\F	AR\data2\@0140291209%Project D	0at a∖_48e cipline∖Site Civil∖Storr



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.904	1	727	29,004				EX WSHD A
2	SCS Runoff	8.559	1	727	27,487				PR WSHD A
Ten	l nis Court Hvd	rologic C	alculatio	ns - C	Dot	n Doriod: 4		Wednesday	6 / 10 / 2020
Type Soils.gpw			Retui		o years	weunesuay, 07 107 2020			

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 8.904 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 29,004 cuft
Drainage area	= 1.950 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\F	AR\data2\@00400291200904Project D	ata <mark>∖_48st</mark> cipline\Site Civil\Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 8.559 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 27,487 cuft
Drainage area	= 1.950 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\301402912030Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	15.91	1	727	53,904				EX WSHD A
2	SCS Runoff	15.61	1	727	52,137				PR WSHD A
Ten Type	e Soils.gpw	rologic C	aiculatio	ns - C	Retur	n Period: 1	00 years	Wednesday	, 6 / 10 / 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

Hydrograph type	= SCS Runoff	Peak discharge	= 15.91 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 53,904 cuft
Drainage area	= 1.950 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ 3301a0a9f203%P roject D	0at a∖_428s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

Hydrograph type	= SCS Runoff	Peak discharge	= 15.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 52,137 cuft
Drainage area	= 1.950 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\0301400291200301Project D	0at a∖_428s cipline∖Site Civil∖Storn



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Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

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Hydrograph Reports	2
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Hydrograph No. 2, SCS Runoff, PR WSHD A	3

10 - Year

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Hvdrograph Reports	5
Hydrograph No. 1, SCS Runoff, EX WSHD A	5
Hydrograph No. 2, SCS Runoff, PR WSHD A	6

100 - Year

Summary Report	7
Hydrograph Reports	8
Hydrograph No. 1, SCS Runoff, EX WSHD A	8
Hydrograph No. 2, SCS Runoff, PR WSHD A	9

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.607	1	727	17,997				EX WSHD A
2	SCS Runoff	5.442	1	727	17,324				PR WSHD A
Tennis Court Hydrologic Calculations - D			Pot	rn Doriod:	2 voore	Wednesday	6 / 10 / 2020		
Type Soils.gpw				Relu	m renou.	2 years	- recuricoudy	, 0, 10, 2020	
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

EX WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.607 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 17,997 cuft
Drainage area	= 1.950 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\ &014003912009&P roject D	0at a∖_428s cipline∖Site Civil∖Stor



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

PR WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.442 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 17,324 cuft
Drainage area	= 1.950 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.42 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\0301400291200301Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hydrograph Summary Report Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	9.220	1	727	30,558				EX WSHD A	
2	SCS Runoff	9.066	1	727	29,776				PR WSHD A	
—										
Ten Typ	nis Court Hyd e Soils.gpw	irologic C	aiculatio	ns - D	Retu	rn Period:	10 years	Wednesday, 6 / 10 / 2020		

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

EX WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 9.220 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 30,558 cuft
Drainage area	= 1.950 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\F	AR\data2\0301400291200310Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

PR WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 9.066 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 29,776 cuft
Drainage area	= 1.950 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.21 in	Distribution	= Custom
Storm duration	= \\langan.com\data\F	AR\data2\0301400291200310Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hydrograph Summary Report Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	16.17	1	727	55,669				EX WSHD A	
2	SCS Runoff	16.04	1	727	54,786				PR WSHD A	
Ten Typ	⊢ nis Court Hyd e Soils.gpw	rologic C	alculatio	ns - D	Return Period: 10 years			Wednesday, 6 / 10 / 2020		

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 1

EX WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 16.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 55,669 cuft
Drainage area	= 1.950 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\0301400291200300Project D	0at a∖_428s cipline∖Site Civil∖Storn



Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 06 / 10 / 2020

Hyd. No. 2

PR WSHD A

Hydrograph type	= SCS Runoff	Peak discharge	= 16.04 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 54,786 cuft
Drainage area	= 1.950 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.71 in	Distribution	= Custom
Storm duration	= \\langan.com\data\P	AR\data2\@0140391203%Project D	0at a∖_428s cipline∖Site Civil∖Storn



NRCS SOILS MAP

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NEW JERSEY GROUNDWATER RECHARGE SPREADSHEET

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New Jers	ey ater	Annual Groundwater Rec	charge Ar	nalysis (based on GS	SR-32) Project Name: Montclair Golf Clu			olf Club			
Recharge Spreadsh Version 2.0	eet	Select Township \downarrow	Average Annual P (in)	Climatic Factor					Description:	Tennis Courts Reconstruction		struction
November 2	003	ESSEX CO., VERONA BORO	48.9	1.67		_	-		Analysis Date:	06/10/20		
		Pre-Developed Cond	litions						Post-Develope	d Conditions		
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)		Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	1.28	Impervious areas	Fort Mott	0.0	-		1	1.05	Impervious areas	Fort Mott	0.0	-
2	0.15	Woods	Fort Mott	19.9	10,829		2	0.15	Woods	Fort Mott	19.9	10,829
3	1.18	Open space	Fort Mott	19.7	84,581		3	1.41	Open space	Fort Mott	19.7	101,067
4	0						4	0				
5	0						5	0				
6	0						6	0				
7	0						7	0				
8	0						8	0				
9	0						9	0				
10	0						10	0				
11	0						11	0				
12	0						12	0				
13	0						13	0				
14	0						14	0				
15	0						15	0				
Total =	2.6			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)		Total =	2.6			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				10.1	95,410		Annual	Recharg	ge Requirements Calculati	on ↓	11.8	111,896
Procedure	to fill the	Pre-Development and Post-Development Conc	ditions Tables			% of Pre-Developed Annual Recharge to Preserve = 100%			100%	Impervious Area (sq.ft)	45,738	
For each land	segment, firs	st enter the area, then select TR-55 Land Cover, then select	Soil. Start from the to	p of the table		Post-D	evelopm	ent Ann	ual Recharge Deficit=	-16,486	(cubic feet)	
and proceed d	ownward. Do	on't leave blank rows (with A=0) in between your segment ent	tries. Rows with A=0 w	ill not be		Recha	arge Effici	iency Pa	rameters Calculations (are	ea averages)		
displayed or us	sed in calcul	ations. For impervious areas outside of standard lots select "	"Impervious Areas" as	the Land Cover.		RWC=	2.47	(in)	DRWC=	2.47	(in)	
Soil type for in	pervious are	eas are only required if an infiltration facility will be built within	n these areas.			ERWC =	0.41	(in)	EDRWC=	0.41	(in)	