DRAINAGE REPORT

PROPOSED 7 TOWNHOUSES
LOTS 6.01, 6.02, 6.03, BLOCK 43
BOROUGH OF ALPINE
BERGEN COUNTY, NEW JERSEY
(FILE # 495.1)

PREPARED ON:

Rev.3: March 31, 2020

PREPARED FOR:

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SUMMARY AND CONCLUSIONS

The existing site in question consists of a 1.09 acre lot, located on Closter Dock Road in the Borough of Alpine and is known as Lots 6.01, 6.02, and 6.03 in Block 43. The existing site contains a single-family dwelling. An accessory building onsite has been removed.

The proposal consists of the construction of 7 townhouse units, and an access road in the center of the project. The site generally slopes in a north east to a south west direction, and the runoff from the site, both existing and proposed, is directed to an existing drainage ditch south west of the site. The existing impervious area on site is 1,588 square feet. The proposed impervious area to be constructed is 22,383 sf which is in greater of one quarter acre. The project is therefore classified as a Major Project by the NJDEP Stormwater Management Regulations.

Because the drainage area is approximately 1 acre, the rational method was utilized in calculating the existing, proposed, and allowable flows from the site. The modified rational method was utilized to calculate the hydrographs and routing thru the retention system. The rainfall intensity utilized in the calculations was taken from the NOAA Atlas 14 Precipitation Frequency Data Server website. The IDF curves generated by the NOAA data server and utilized in this report are provided in Appendix 2.

STORMWATER QUANTITY

The peak stormwater runoff rate was determined for the 2, 10, 25, and 100 year storm in the present and developed condition. The drainage system was designed in accordance with the New Jersey Residential Site Improvement Standards (RSIS) Stormwater Regulations at N.J.A.C. 5:21-7. The standards require that the peak runoff rate be reduced to 50%, 75%, and 80% of the present peak rate in the 2 year, 10 year, and 100 year storm respectively. In order to achieve the required reduction in peak runoff rate, an underground detention system consisting of five- 42" diameter pipes and two drainage structures are proposed. The detention system outflow controls consist of a 4" diameter orifice at elevation 420.00, a 6" diameter at elevation 421.75 and a weir at elevations 423.50. These controls on the structure restrict flow into the downstream drainage system which can be seen in further detail in Sections 5 & 6. To determine the present and developed flows the site was divided into a series of drainage areas, A1 to A27 which flow to the detention system, and B1 which does not flow to the detention system.

Runoff from Area B1 (determined in Section 10) is combined with the detention basin discharge for each storm event which results in the total developed runoff from the project site.

Conclusions:

STORMWATER QUALITY

The required water quality criteria will be addressed utilizing "StormFilter" structures which are certified by the New Jersey Department of Environmental Protection to provide 80% Total Suspended Solids (TSS) Removal as standalone devices for runoff collected over the proposed paved parking and driveway areas which are exposed to runoff. Runoff collected over the roof surface is considered clean and need not be treated to meet this criteria.

An 8' x 11' precast "Peak Diversion StormFilter" is proposed for site to bypass the flow and to house 15 cartridges which are needed to achieve the established design criteria of the State and Borough's reduction in TSS requirements for site runoff exposed to nonpoint pollution source materials. The system has been designed so that the paved areas of the site flow overland to the southwest corner of the site and into the StormFilters before entering the detention system. The StormFilter design calculations are given in Section 7 of the report. The details of the system are given on sheet 495-21 of the design plans prepared by Hubschman Engineering.

GROUNDWATER RECHARGE:

Groundwater recharge calculations are given in Section 8 of this drainage report. Eleven (11) Cultec Recharger 330XLHD chambers with gravel are proposed at two (2) locations for the groundwater recharge. The combined groundwater recharge target area is 9,853 square feet comprised of rooftops. Runoff from these areas will be directed to the storage chambers for groundwater recharge.

STORMWATER MANAGEMENT SUMMARY

Design Storm Year	Present Runoff from Study Area (CFS)	Allowable Runoff from Study Area (CFS)	Developed Detention Basin Discharge (Section 6) (CFS)	Developed Uncaptured Runoff Remaining B1 Area (Section 10) (CFS)	Total Developed Runoff (CFS)	Maximum Runoff Storage (Section 6) (CF)	Maximum Detention Basin Elevation (Section 6) (ft)
2	1.550	0.780	0.500	0.148	0.648	1,974	421.74
10	2.360	1.770	1.190	0.241	1.431	2,532	422.36
25	2.820	2.820	1.180	0.384	1.564	2,510	422.35
100	3.530	2.820	1.860	0.328	2.188	3,643	423.40

SECTION 1

EXISTING CONDITIONS

EXISTING CONDITIONS

Job # 495.1

Description	Area (sf)	Area (acres)
Site	47,540	1.09
Area to Detention System	42,668	0.98
Remaining Area	4,872	0.11
Soil Group	WuB	
Hydrologic Soil Group	"C"	

RUNOFF COEFFICIENTS

Description	C
Impervious	0.99
Pervious	0.45

AREAS - ENTIRE SITE

Description	Area (sf.)	Area (acres)
Impervious	1,588	0.04
Pervious	45,952	1.05
Total	47,540	1.09

AREAS - DETENTION SYSTEM

Description	Area (sf.)	Area (acres)
Impervious	1,588	0.04
Pervious	41,080	0.94
Total	42,668	0.98

WEIGHTED RUNOFF COEFFICIENT

Description	$\bar{C}$
Site	0.468
Detention System	0.470
Remaining Area	0.450

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
ALPINE III LLC	MH	7-12-12
Location	**Checked**	**Date**
CLOSTER DOCK ROAD, ALPINE		

Check one: [X] Present [ ] Developed

Check one: [X] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	AB		
1.	Surface description (table 3-1)	WOODS- C.U.		
2.	Manning's roughness coefficient, n (table 3-1)	0.40		
3.	Flow length, L (total L † 300 ft) ft	100 FT		
4.	Two-year 24-hour rainfall, P_2 in	3.30		
5.	Land slope, s ft/ft	0.09		
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.19	+	= 0.19

Shallow concentrated flow

	Segment ID	BC		
7.	Surface description (paved or unpaved)	UNPAVED		
8.	Flow length, L ft	150 FT		
9.	Watercourse slope, s ft/ft	0.09		
10.	Average velocity, V (figure 3-1) ft/s	4.8		
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.008	+	= 0.008

Channel flow N/A

	Segment ID			
12.	Cross sectional flow area, a ft^2			
13.	Wetted perimeter, p_w ft			
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft			
15	Channel slope, s ft/ft			
16.	Manning's roughness coefficient, n			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s			
18.	Flow length, L ft			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr	0.20		
		12 MIN		

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
ALPINE III LLC	MH	7-12-12
Location CLOSTER DOCK ROAD, ALPINE	**Checked**	**Date**

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	AB	
1.	Surface description (table 3-1)	GRASS	
2.	Manning's roughness coefficient, n (table 3-1)	0.15	
3.	Flow length, L (total L † 300 ft) ft	50 FT	
4.	Two-year 24-hour rainfall, P_2 in	3.3	
5.	Land slope, s ft/ft	0.0352	
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.074	+ =

0.476

Shallow concentrated flow

	Segment ID	BC	
7.	Surface description (paved or unpaved)	PAVED	
8.	Flow length, L ft	193 FT	
9.	Watercourse slope, s ft/ft	0.066	
10.	Average velocity, V (figure 3-1) ft/s	5.2	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.010	+ =

Channel flow

	Segment ID		
12.	Cross sectional flow area, a ft^2		
13.	Wetted perimeter, p_w ft		
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		
15	Channel slope, s ft/ft		
16.	Manning's roughness coefficient, n		
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s		
18.	Flow length, L ft		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	+	=
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr	0.08	

5 min

SECTION 2

EXISTING FLOW AND ALLOWABLE FLOW 2, 10, 25, 100 YEAR STORM

EXISTING FLOW

RATIONAL METHOD
$Q=CiA$

ENTIRE SITE

(tc= 12 min)

Q2	=	0.468	(	3.37	in/hr)	(	1.090	Ac)	=	1.72 cfs
Q10	=	0.468	(	5.13	in/hr)	(	1.090	Ac)	=	2.62 cfs
Q25	=	0.468	(	6.13	in/hr)	(	1.090	Ac)	=	3.13 cfs
Q100	=	0.468	(	7.67	in/hr)	(	1.090	Ac)	=	3.91 cfs

ALLOWABLE FLOW

ENTIRE SITE

Q2	=	1.72	(	0.50	)	=	0.86 cfs
Q10	=	2.62	(	0.75	)	=	1.97 cfs
Q25	=	3.13	(	1.00	)	=	3.13 cfs
Q100	=	3.92	(	0.80	)	=	3.14 cfs

EXISTING FLOW

RATIONAL METHOD
$Q = CiA$

FLOW TO DETENTION BASIN

(tc= 12 min)

Q2	=	0.470	(	3.37	in/hr)	(	0.980	Ac)	=	1.55 cfs
Q10	=	0.470	(	5.13	in/hr)	(	0.980	Ac)	=	2.36 cfs
Q25	=	0.470	(	6.13	in/hr)	(	0.980	Ac)	=	2.82 cfs
Q100	=	0.470	(	7.67	in/hr)	(	0.980	Ac)	=	3.53 cfs

ALLOWABLE FLOW

FLOW TO DETENTION BASIN

(USED TO GENERATE HYDROGRAPHS)

Impervious Area	=	21,926	SF
	=	0.503	AC
Pervious Paving	=	3268	SF
	=	0.075	AC
Pervious Area	=	17,474	SF
	=	0.401	AC

Q2	=	1.55	(	0.50	)	=	0.78 cfs
Q10	=	2.36	(	0.75	)	=	1.77 cfs
Q25	=	2.82	(	1.00	)	=	2.82 cfs
Q100	=	3.53	(	0.80	)	=	2.82 cfs

SECTION 3

PROPOSED AREAS AND RUNOFF COEFFICIENT

	AREA	PERVIOUS SF	IMPERVIOUS SF	PERVIOUS PAVING SF	TOTAL SF
TO DETENTION SYSTEM	A1a	611	2,232	1,184	4,027
	A1b	402	1,326	645	2,373
	A2	-	488	-	488
	A3a	1,913	2,127	743	4,783
	A3b	1,319	1,986	696	4,001
	A4	-	1,044	-	1,044
	A5	-	1,042	-	1,042
	A6	1,681	-	-	1,681
	A7	-	954	-	954
	A8	-	955	-	955
	A9	1,631	-	-	1,631
	A10	-	1,044	-	1,044
	A11	-	1,042	-	1,042
	A12	-	954	-	954
	A13	-	955	-	955
	A14	2,912	-	-	2,912
	A15	1,551	129	-	1,680
	A16	5,454	-	-	5,454
	A17	-	483	-	483
	A18	-	471	-	471
	A19	-	541	-	541
	A20	-	546	-	546
	A21	-	466	-	466
	A22	-	566	-	566
	A23	-	572	-	572
	A24	-	422	-	422
	A25	-	443	-	443
	A26	-	568	-	568
	A27	-	570	-	570
	TO DETENTION	17,474	21,926	3,268	42,668
	B1	4,415	457	-	4,872
	GRAND TOTAL	21,889	22,383	3,268	47,540

RUNOFF COEFFICIENT
PROPOSED CONDITIONS

IMPERVIOUS

C= 0.99

PERVIOUS PAVING

C= 0.99

LAWN

C= 0.51

ENTIRE SITE

$$C = \frac{22{,}383\ (0.99) + 21{,}889\ (0.51) + 3268\ (0.99)}{47{,}540}$$

$\overline{C}$ = 0.76 For 2,10,25,100-year storm

AREA TO DETENTION SYSTEM

$$C = \frac{21{,}926\ (0.99) + 17{,}474\ (0.51) + 3268\ (0.99)}{42{,}668}$$

$\overline{C}$ = 0.79 For 2,10,25,100-year storm

REMAINING AREA (B-1)

$$\overline{C} = \frac{457\ (0.99) + 4{,}415\ (0.51)}{4{,}872}$$

$\overline{C}$ = 0.56 For 2,10,25,100-year storm

PROPOSED FLOWS

C PERVIOUS = 0.51
C IMPERVIOUS = 0.99
C PERVIOUS PARKING= 0.99
Tc = 10 MIN.

	2 year (in/hr)	10 year (in/hr)	25 year (in/hr)	100 year (in/hr)
Intensity =	3.69	5.36	6.41	8.02

			Q			
	AREA	TOTAL ACRES	2 YEAR	10 YEAR	25 YEAR	100 YEAR
TO DETENTION SYSTEM	A1a	0.092	0.312	0.454	0.543	0.679
	A1b	0.054	0.181	0.263	0.315	0.394
	A2	0.011	0.040	0.058	0.070	0.087
	A3a	0.110	0.325	0.472	0.564	0.706
	A3b	0.092	0.282	0.409	0.489	0.612
	A4	0.024	0.088	0.127	0.152	0.191
	A5	0.024	0.088	0.127	0.152	0.191
	A6	0.039	0.073	0.107	0.127	0.160
	A7	0.022	0.080	0.117	0.140	0.175
	A8	0.022	0.080	0.117	0.140	0.175
	A9	0.037	0.070	0.101	0.121	0.151
	A10	0.024	0.088	0.127	0.152	0.191
	A11	0.024	0.088	0.127	0.152	0.191
	A12	0.022	0.080	0.117	0.140	0.175
	A13	0.022	0.080	0.117	0.140	0.175
	A14	0.067	0.126	0.183	0.219	0.274
	A15	0.039	0.079	0.115	0.137	0.172
	A16	0.125	0.235	0.342	0.409	0.511
	A17	0.011	0.040	0.058	0.070	0.087
	A18	0.011	0.040	0.058	0.070	0.087
	A19	0.012	0.044	0.064	0.076	0.095
	A20	0.013	0.047	0.069	0.082	0.103
	A21	0.011	0.040	0.058	0.070	0.087
	A22	0.013	0.047	0.069	0.082	0.103
	A23	0.013	0.047	0.069	0.082	0.103
	A24	0.010	0.037	0.053	0.063	0.079
	A25	0.010	0.037	0.053	0.063	0.079
	A26	0.013	0.047	0.069	0.082	0.103
	A27	0.013	0.047	0.069	0.082	0.103
	TO DETENTION	0.980	2.868	4.169	4.984	6.239
	B1	0.112	0.231	0.336	0.402	0.503
	TOTAL FLOW	1.092	3.099	4.505	5.390	6.744

SECTION 4

MODIFIED RATIONAL METHOD
PROPOSED FLOWS
FOR 2, 10, 25, 100 YEAR STORM

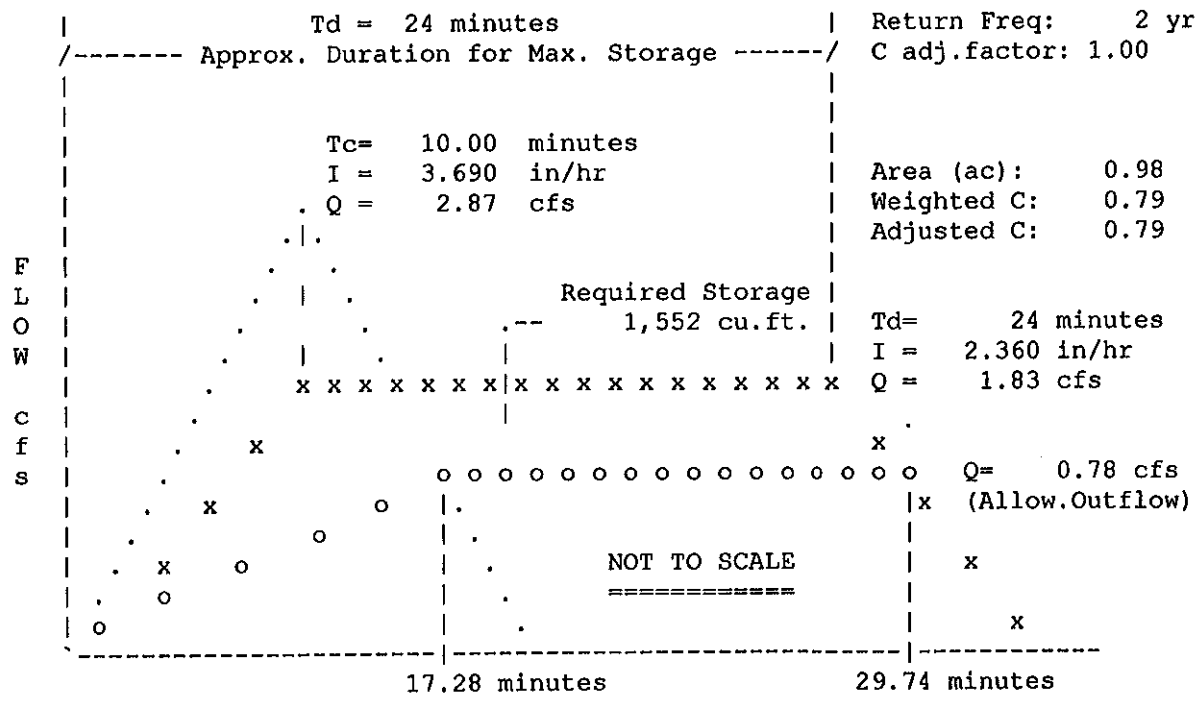
Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 2 yr	Allowable Outflow: 0.78 cfs
'C' Adjustment: 1.000	Required Storage: 1,552 cu.ft.
Peak Inflow: 1.83 cfs	Inflow .HYD stored: 495E2 .HYD



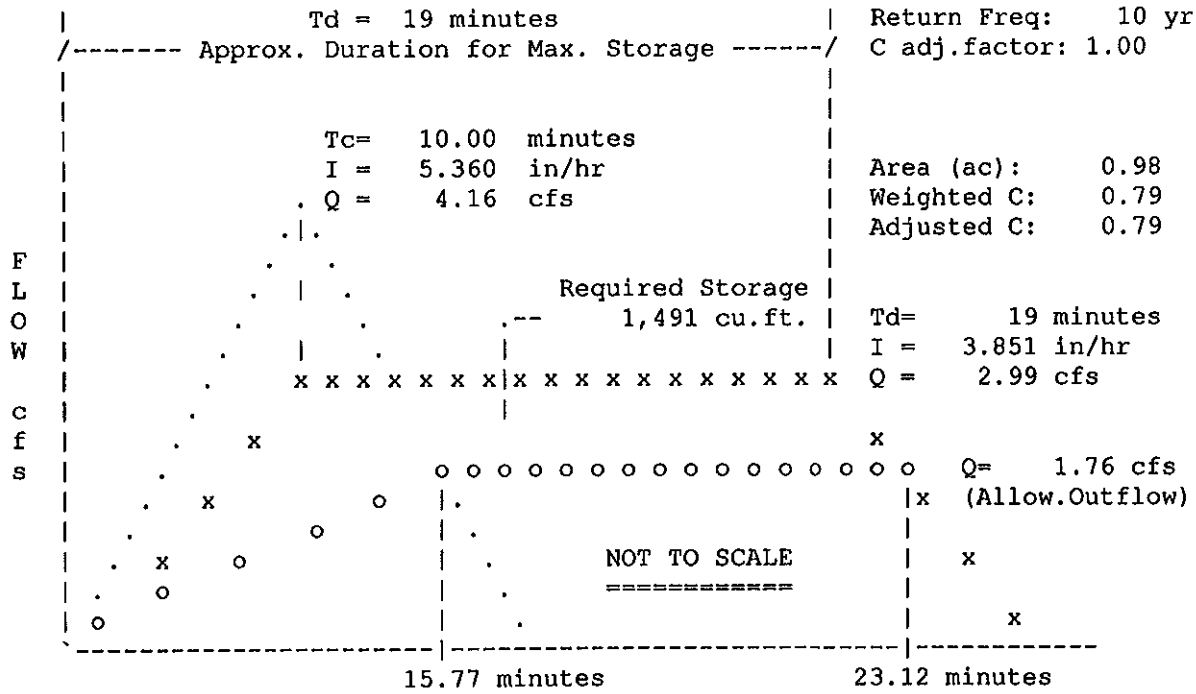
Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 10 yr	Allowable Outflow: 1.76 cfs
'C' Adjustment: 1.000	Required Storage: 1,491 cu.ft.
Peak Inflow: 2.99 cfs	Inflow .HYD stored: 495E10 .HYD



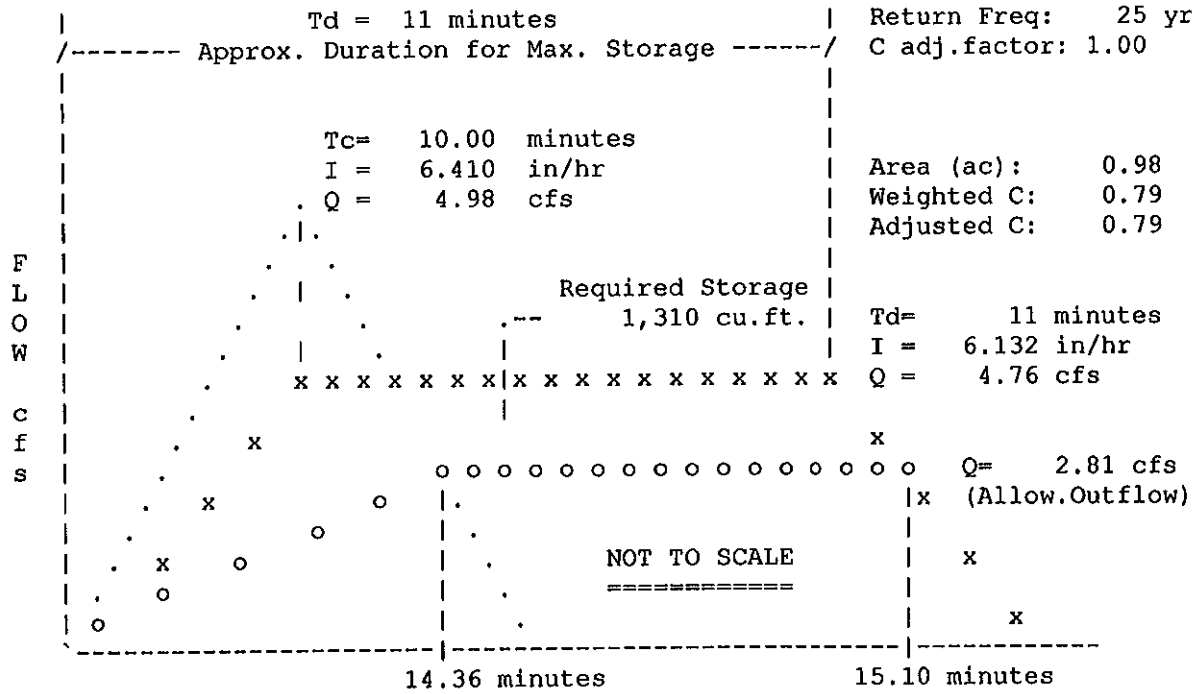
Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

```
**********************************************************************
*  RETURN FREQUENCY:  25 yr     |  Allowable Outflow:     2.81 cfs    *
*  'C' Adjustment: 1.000        |  Required Storage:     1,310 cu.ft. *
*---------------------------------------------------------------------*
*  Peak Inflow:    4.76 cfs        Inflow .HYD stored: 495E25  .HYD    *
**********************************************************************
```



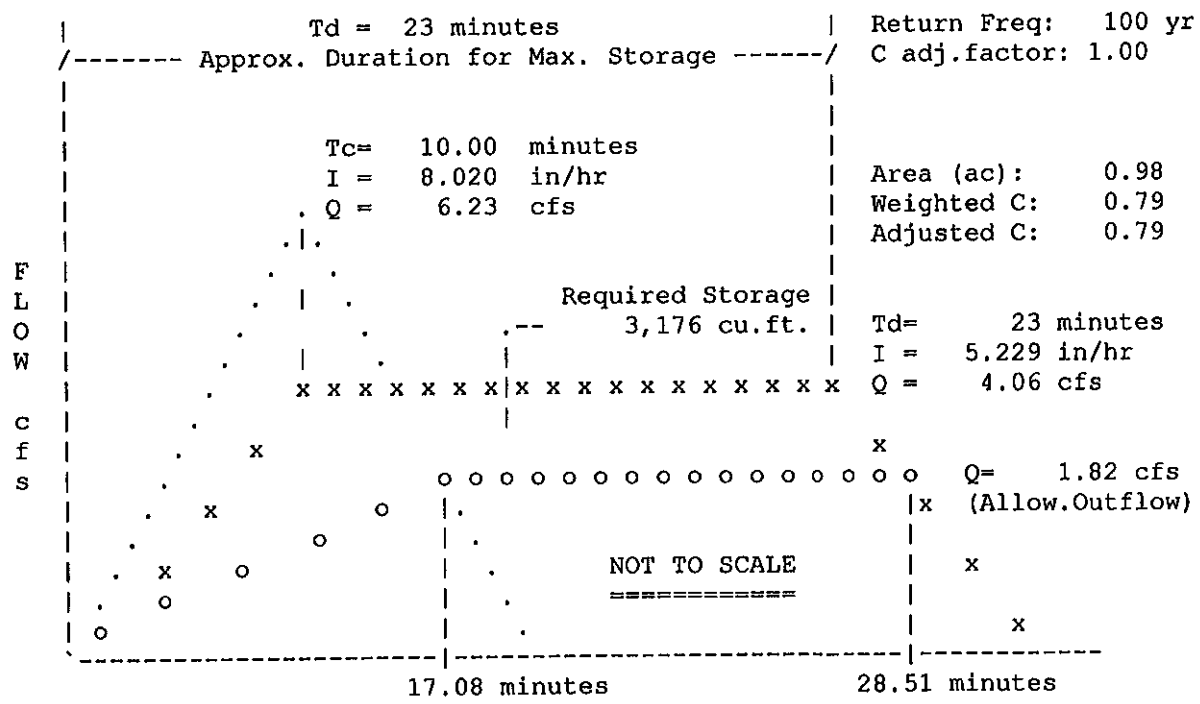
Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 100 yr	Allowable Outflow: 1.82 cfs
'C' Adjustment: 1.000	Required Storage: 3,176 cu.ft.
Peak Inflow: 4.06 cfs	Inflow .HYD stored: 495E100 .HYD



Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

**** Modified Rational Hydrograph *****

Weighted C = 0.793 Area= 0.979 acres Tc = 10.00 minutes

Adjusted C = 0.793 Td= 24.00 min. I= 2.36 in/hr Qp= 1.83 cfs

RETURN FREQUENCY: 2 year storm Adj.factor = 1.00
Output file: 495E2 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 2 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	0.18	0.37	0.55	0.73	0.92	1.10
7.00	1.28	1.47	1.65	1.83	1.83	1.83	1.83
14.00	1.83	1.83	1.83	1.83	1.83	1.83	1.83
21.00	1.83	1.83	1.83	1.83	1.65	1.47	1.28
28.00	1.10	0.92	0.73	0.55	0.37	0.18	0.00

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

**** Modified Rational Hydrograph *****
Weighted C = 0.793 Area= 0.979 acres Tc = 10.00 minutes

Adjusted C = 0.793 Td= 19.00 min. I= 3.85 in/hr Qp= 2.99 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: 495E10 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	0.30	0.60	0.90	1.20	1.50	1.79
7.00	2.09	2.39	2.69	2.99	2.99	2.99	2.99
14.00	2.99	2.99	2.99	2.99	2.99	2.99	2.69
21.00	2.39	2.09	1.79	1.50	1.20	0.90	0.60
28.00	0.30	0.00					

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

**** Modified Rational Hydrograph *****

Weighted C = 0.793 Area= 0.979 acres Tc = 10.00 minutes

Adjusted C = 0.793 Td= 11.00 min. I= 6.13 in/hr Qp= 4.76 cfs

RETURN FREQUENCY: 25 year storm Adj.factor = 1.00
Output file: 495E25 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 25 Year Storm

Time Minutes	Time increment = 1.00 Minutes Time on left represents time for first Q in each row.						
0.00	0.00	0.48	0.95	1.43	1.91	2.38	2.86
7.00	3.33	3.81	4.29	4.76	4.76	4.29	3.81
14.00	3.33	2.86	2.38	1.91	1.43	0.95	0.48
21.00	0.00						

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

**** Modified Rational Hydrograph *****

Weighted C = 0.793 Area= 0.979 acres Tc = 10.00 minutes

Adjusted C = 0.793 Td= 23.00 min. I= 5.23 in/hr Qp= 4.06 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: 495E100 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	0.41	0.81	1.22	1.62	2.03	2.44
7.00	2.84	3.25	3.66	4.06	4.06	4.06	4.06
14.00	4.06	4.06	4.06	4.06	4.06	4.06	4.06
21.00	4.06	4.06	4.06	3.66	3.25	2.84	2.44
28.00	2.03	1.62	1.22	0.81	0.41	0.00	

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 2 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
IMPERVIOUS	0.990	0.58						
PERVIOUS	0.510	0.40						
			10.00	0.793	0.793	3.690	0.98	2.87

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 10 years
`C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
IMPERVIOUS	0.990	0.58						
PERVIOUS	0.510	0.40						
			10.00	0.793	0.793	5.360	0.98	4.16

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 25 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
IMPERVIOUS	0.990	0.58						
PERVIOUS	0.510	0.40						
			10.00	0.793	0.793	6.410	0.98	4.98

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
IMPERVIOUS	0.990	0.58						
PERVIOUS	0.510	0.40						
			10.00	0.793	0.793	8.020	0.98	6.23

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Grand Summary For All Storm Frequencies ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

Area = 0.98 acres Tc = 10.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.793	24	2.360	1.83	0.78	2,640	1,552
10	0.793	19	3.851	2.99	1.76	3,410	1,491
25	0.793	11	6.132	4.76	2.81	3,144	1,310
100	0.793	23	5.229	4.06	1.82	5,605	3,176

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 2 yr `C' Adjustment = 1.000 Allowable Q = 0.78 cfs

Hydrograph file duration= 24.00 minutes
Hydrograph file: 495E2 .HYD Tc = 10.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.793	0.793	10	3.690	0.98	2.87	1,720	1,252
0.793	0.793	15	2.900	0.98	2.25	2,027	1,343
0.793	0.793	20	2.600	0.98	2.02	2,423	1,514
0.793	0.793	24	2.360	0.98	1.83	2,640	1,552
0.793	0.793	30	2.000	0.98	1.55	2,796	1,446
0.793	0.793	40	1.757	0.98	1.36	3,275	1,473
0.793	0.793	50	1.513	0.98	1.18	3,526	1,278
0.793	0.793	60	1.270	0.98	0.99	3,551	865
0.793	0.793	120	0.840	0.98	0.65	Qpeak < Qallow	

********** Storage Maximum **********

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 10 yr `C' Adjustment = 1.000 Allowable Q = 1.76 cfs

Hydrograph file duration= 19.00 minutes
Hydrograph file: 495E10 .HYD Tc = 10.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.793	0.793	10	5.360	0.98	4.16	2,498	1,442
0.793	0.793	15	4.200	0.98	3.26	2,936	1,414
0.793	0.793	19	3.851	0.98	2.99	3,410	1,491
0.793	0.793	20	3.763	0.98	2.92	3,508	1,490
0.793	0.793	30	2.890	0.98	2.24	4,041	1,063
0.793	0.793	40	2.540	0.98	1.97	4,735	759
0.793	0.793	50	2.190	0.98	1.70	Qpeak < Qallow	

Storage Maximum

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 25 yr `C' Adjustment = 1.000 Allowable Q = 2.81 cfs

Hydrograph file duration= 11.00 minutes
Hydrograph file: 495E25 .HYD Tc = 10.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
0.793	0.793	10	6.410	0.98	4.98	2,987	1,301
**********	**********	**********	**********	**********	**********	**********	Storage Maximum
0.793	0.793	11	6.132	0.98	4.76	3,144	1,310
**********	**********	**********	**********	**********	**********	**********	**********
0.793	0.793	15	5.020	0.98	3.90	3,509	1,112
0.793	0.793	20	4.497	0.98	3.49	4,191	1,022
0.793	0.793	30	3.450	0.98	2.68	Qpeak < Qallow	

Quick TR-55 Ver.5.47 S/N:
Executed: 14:25:00 04-29-2019

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

PROPOSED TOWNHOMES
ALPINE, NEW JERSEY

RETURN FREQUENCY: 100 yr `C' Adjustment = 1.000 Allowable Q = 1.82 cfs

Hydrograph file duration= 23.00 minutes
Hydrograph file: 495E100 .HYD Tc = 10.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
0.793	0.793	10	8.020	0.98	6.23	3,738	2,644
0.793	0.793	15	6.280	0.98	4.88	4,390	2,795
0.793	0.793	20	5.623	0.98	4.37	5,241	3,123
0.793	0.793	23	5.229	0.98	4.06	5,605	3,176
0.793	0.793	30	4.310	0.98	3.35	6,026	2,884
0.793	0.793	40	3.787	0.98	2.94	7,059	2,865
0.793	0.793	50	3.263	0.98	2.53	7,604	2,371
0.793	0.793	60	2.740	0.98	2.13	7,662	1,411
0.793	0.793	120	1.730	0.98	1.34	Qpeak < Qallow	

********** Storage Maximum **********

SECTION 5

RETENTION SYSTEM VOLUME CALCULATIONS

PROPOSED VOLUME CALCULATIONS

PIPE: 5 - 42" Pipe - 58 ft LENGTHS

HEIGHT (ft)	ELEV.	ALPHA (Radians)	AREA (sf)	LENGTH (ft)	VOLUME (cu ft)	PERCENT FULL
0.00	420.00	0.0000	0.00	290	0.00	0%
0.25	420.25	0.5411	0.31	290	89.90	3%
0.50	420.50	0.7752	0.84	290	243.60	9%
0.75	420.75	0.9626	1.51	290	437.90	16%
1.00	421.00	1.1279	2.27	290	658.30	24%
1.25	421.25	1.2810	3.08	290	893.20	32%
1.50	421.50	1.4274	3.94	290	1,142.60	41%
1.75	421.75	1.5708	4.81	290	1,394.90	50%
2.00	422.00	1.7141	5.68	290	1,647.20	59%
2.25	422.25	1.8605	6.54	290	1,896.60	68%
2.50	422.50	2.0137	7.35	290	2,131.50	76%
2.75	422.75	2.1790	8.11	290	2,351.90	84%
3.00	423.00	2.3664	8.78	290	2,546.20	91%
3.25	423.25	2.6005	9.32	290	2,702.80	97%
3.50	423.50	3.1416	9.62	290	2,789.80	100%
3.75	423.75	3.1416	9.62	290	2,789.80	100%
4.00	424.00	3.1416	9.62	290	2,789.80	100%
4.25	424.25	3.1416	9.62	290	2,789.80	100%
4.50	424.50	3.1416	9.62	290	2,789.80	100%

CONCRETE BOXES: 2 - 26 x 5' wide Reinforced Concrete

HEIGHT (ft)	ELEV.	AREA (sf)	VOLUME (Cu. ft)	PERCENT FULL
0.00	420.00	260	0.0	0%
0.25	420.25	260	65.0	6%
0.50	420.50	260	130.0	11%
0.75	420.75	260	195.0	17%
1.00	421.00	260	260.0	22%
1.25	421.25	260	325.0	28%
1.50	421.50	260	390.0	33%
1.75	421.75	260	455.0	39%
2.00	422.00	260	520.0	44%
2.25	422.25	260	585.0	50%
2.50	422.50	260	650.0	56%
2.75	422.75	260	715.0	61%
3.00	423.00	260	780.0	67%
3.25	423.25	260	845.0	72%
3.50	423.50	260	910.0	78%
3.75	423.75	260	975.0	83%
4.00	424.00	260	1,040.0	89%
4.25	424.25	260	1,105.0	94%
4.50	424.50	260	1,170.0	100%

TOTAL VOLUME

[illegible] (ft)	ELEV	[illegible] (cu ft)	[illegible] (cu ft)	[illegible] (cu ft)	[illegible]
0.00	420.00	0.00	0	0	0%
0.25	420.25	89.90	65	155	4%
0.50	420.50	243.60	130	374	9%
0.75	420.75	437.90	195	633	16%
1.00	421.00	658.30	260	918	23%
1.25	421.25	893.20	325	1,218	31%
1.50	421.50	1,142.60	390	1,533	39%
1.75	421.75	1,394.90	455	1,850	47%
2.00	422.00	1,647.20	520	2,167	55%
2.25	422.25	1,896.60	585	2,482	63%
2.50	422.50	2,131.50	650	2,782	70%
2.75	422.75	2,351.90	715	3,067	77%
3.00	423.00	2,546.20	780	3,326	84%
3.25	423.25	2,702.80	845	3,548	90%
3.50	423.50	2,789.80	910	3,700	93%
3.75	423.75	2,789.80	975	3,765	95%
4.00	424.00	2,789.80	1040	3,830	97%
4.25	424.25	2,789.80	1,105	3,895	98%
4.50	424.50	2,789.80	1,170	3,960	100%

PROPOSED 7 TOWNHOUSES
ALPINE, NEW JERSEY
BERGEN COUNTY

CALCULATED 01-10-2013 12:12:15
DISK FILE: T:\PP092310\495 .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume * (cubic-ft)	Volume Sum (cubic-ft)
420.00	0.00	0	0	0	0
420.50	2,241.00	2,241	2,241	374	374
421.00	260.00	260	3,264	544	918
421.50	2,607.00	2,607	3,690	615	1,533
422.00	305.00	305	3,804	634	2,167
422.50	2,510.00	2,510	3,690	615	2,782
423.00	147.00	147	3,264	544	3,326
423.25	1,977.00	1,977	2,663	222	3,548
424.00	705.00	705	705	118	3,830
424.50	7.00	7	782	130	3,960

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: 495 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
PROPOSED TOWNHOUSES
BOROUGH OF ALPINE
BERGEN COUNTY, NEW JERSEY
****

***** COMPOSITE OUTFLOW SUMMARY ****

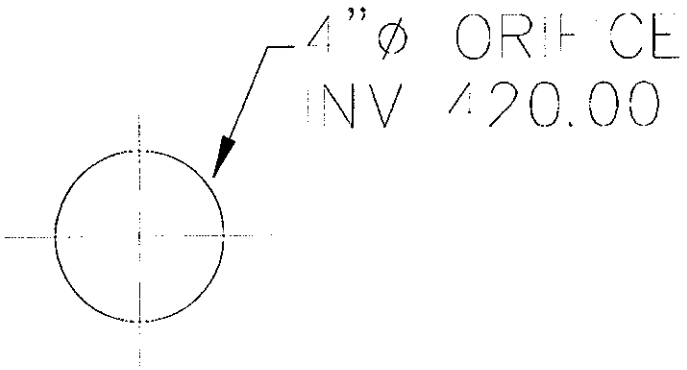
Elevation (ft)	Q (cfs)	Contributing Structures
420.00	0.0	
420.25	0.1	1
420.50	0.2	1
420.75	0.3	1
421.00	0.4	1
421.25	0.4	1
421.50	0.5	1
421.75	0.5	1
422.00	0.6	1 +3
422.25	1.1	1 +3
422.50	1.3	1 +3
422.75	1.5	1 +3
423.00	1.7	1 +3
423.25	1.8	1 +3
423.50	1.9	2 +1 +3
423.75	2.9	2 +1 +3
424.00	4.5	2 +1 +3
424.25	6.5	2 +1 +3
424.50	0.0	

```
Outlet Structure File: 495      .STR

POND-2 Version: 5.20             S/N:
Date Executed:                   Time Executed:


                ************************
                  PROPOSED TOWNHOUSES
                    BOROUGH OF ALPINE
                BERGEN COUNTY, NEW JERSEY

                ************************


 Outlet Structure File:     T:\PP092310\495      .STR
 Planimeter Input File:     T:\PP092310\495      .VOL
 Rating Table Output File:  T:\PP092310\495      .PND


Min. Elev.(ft) = 420   Max. Elev.(ft) = 424.5   Incr.(ft) = .25

   Additional elevations (ft) to be included in table:
   * * * * * * * * * * * * * * * * * * * * * * * * * * * *


     ********************************************
                    SYSTEM CONNECTIVITY
     ********************************************

          Structure      No.    Q Table    Q Table
          ----------     ---     ------    -------
          WEIR-VR         2              ->   2
          ORIFICE         1              ->   1
          ORIFICE         3              ->   3


Outflow rating table summary was stored in file:
T:\PP092310\495      .PND
```

```
Outlet Structure File: 495      .STR

POND-2 Version: 5.20             S/N:
Date Executed:                   Time Executed:


          ************************
            PROPOSED TOWNHOUSES
              BOROUGH OF ALPINE
          BERGEN COUNTY, NEW JERSEY

          ************************


      >>>>>> Structure No. 2 <<<<<<
                (Input Data)

       WEIR-VR
       Weir - Vertical Rectangular


       E1 elev.(ft)?              423.5
       E2 elev.(ft)?              424.5
       Weir coefficient?          2.6
       Weir elev.(ft)?            423.5
       Length (ft)?               2.2
       Contracted/Suppressed (C/S)?  C
```

2.2' Wier @ elevation 423.5

```
Outlet Structure File: 495      .STR

POND-2 Version: 5.20            S/N:
Date Executed:                  Time Executed:

          ************************
            PROPOSED TOWNHOUSES
              BOROUGH OF ALPINE
          BERGEN COUNTY, NEW JERSEY

          ************************


      >>>>>> Structure No. 1 <<<<<<
                (Input Data)

       ORIFICE
       Orifice - Based on Area and Datum Elevation


       E1 elev.(ft)?           420.167
       E2 elev.(ft)?           424.500
       Orifice coeff.?         .6
       Invert elev.(ft)?       420.00
       Datum elev.(ft) ?       420.167
       Orifice area (sq ft)?   .08727
```



Outlet Structure File: 495 .STR

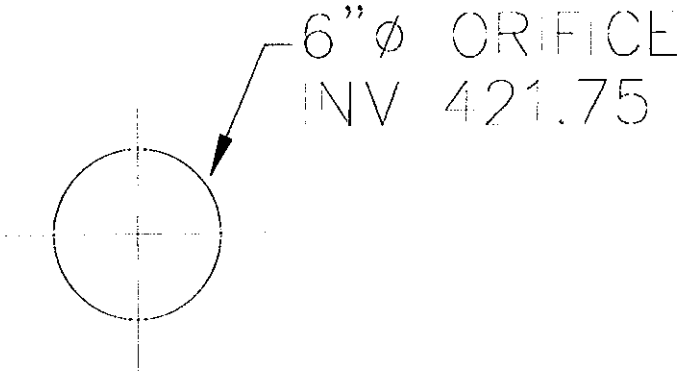
POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
PROPOSED TOWNHOUSES
BOROUGH OF ALPINE
BERGEN COUNTY, NEW JERSEY
****

>>>>>> Structure No. 3 <<<<<<
(Input Data)

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)?	422.000
E2 elev.(ft)?	424.5
Orifice coeff.?	.6
Invert elev.(ft)?	421.75
Datum elev.(ft) ?	422.000
Orifice area (sq ft)?	.1963



SECTION 6

ROUTING CALCULATIONS

POND-2 Version: 5.20 S/N: Page 1
EXECUTED: 04-30-2019 10:56:37 2 YEAR Return Freq: 2 years

```
*************************
*                       *
* PROPOSED TOWNHOUSES   *
* Alpine,  New Jersey   *
*                       *
*                       *
*                       *
*************************
```

Inflow Hydrograph: T:\PP092310\495E2 .HYD
Rating Table file: T:\PP092310\495 .PND

----INITIAL CONDITIONS----
Elevation = 420.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
420.00	0.0	0	0.0	0.0
420.25	0.1	47	1.6	1.7
420.50	0.2	373	12.4	12.6
420.75	0.3	769	25.6	25.9
421.00	0.4	917	30.6	31.0
421.25	0.4	1,079	35.9	36.3
421.50	0.5	1,532	51.1	51.6
421.75	0.5	1,993	66.4	66.9
422.00	0.6	2,167	72.2	72.8
422.25	1.1	2,336	77.9	79.0
422.50	1.3	2,782	92.7	94.0
422.75	1.5	3,201	106.7	108.2
423.00	1.7	3,326	110.8	112.5
423.25	1.8	3,548	118.2	120.0
423.50	1.9	3,712	123.7	125.6
423.75	2.9	3,727	124.2	127.1
424.00	4.5	3,830	127.6	132.1
424.25	6.5	3,939	131.3	137.8

Time increment (t) = 0.017 hrs.

POND-2 Version: 5.20 S/N: Page 2
EXECUTED: 04-30-2019 10:56:37 2 YEAR Return Freq: 2 years

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E2 .HYD
Outflow Hydrograph: T:\PP092310\495PO2 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	420.00
0.017	0.18	0.2	0.2	0.2	0.01	420.03
0.033	0.37	0.6	0.6	0.7	0.04	420.11
0.050	0.55	0.9	1.4	1.5	0.09	420.23
0.067	0.73	1.3	2.4	2.6	0.11	420.27
0.083	0.92	1.7	3.8	4.1	0.12	420.30
0.100	1.10	2.0	5.6	5.8	0.14	420.35
0.117	1.28	2.4	7.6	7.9	0.16	420.39
0.133	1.47	2.8	10.0	10.4	0.18	420.45
0.150	1.65	3.1	12.7	13.1	0.20	420.51
0.167	1.83	3.5	15.8	16.2	0.23	420.57
0.183	1.83	3.7	18.9	19.4	0.25	420.63
0.200	1.83	3.7	22.0	22.6	0.27	420.69
0.217	1.83	3.7	25.1	25.7	0.30	420.75
0.233	1.83	3.7	28.0	28.8	0.36	420.89
0.250	1.83	3.7	30.9	31.7	0.40	421.03
0.267	1.83	3.7	33.8	34.6	0.40	421.17
0.283	1.83	3.7	36.6	37.4	0.41	421.27
0.300	1.83	3.7	39.4	40.3	0.43	421.31
0.317	1.83	3.7	42.2	43.1	0.44	421.36
0.333	1.83	3.7	44.9	45.8	0.46	421.41
0.350	1.83	3.7	47.6	48.6	0.48	421.45
0.367	1.83	3.7	50.3	51.3	0.50	421.50
0.383	1.83	3.7	52.9	53.9	0.50	421.54
0.400	1.83	3.7	55.6	56.6	0.50	421.58
0.417	1.65	3.5	58.1	59.1	0.50	421.62
0.433	1.47	3.1	60.2	61.2	0.50	421.66
0.450	1.28	2.8	62.0	63.0	0.50	421.69
0.467	1.10	2.4	63.3	64.3	0.50	421.71
0.483	0.92	2.0	64.4	65.4	0.50	421.72
0.500	0.73	1.7	65.0	66.0	0.50	421.73
0.517	0.55	1.3	65.3	66.3	0.50	421.74
0.533	0.37	0.9	65.2	66.2	0.50	421.74
0.550	0.18	0.6	64.8	65.8	0.50	421.73
0.567	0.00	0.2	63.9	64.9	0.50	421.72

POND-2 Version: 5.20 S/N:
EXECUTED: 04-30-2019 10:56:37 2 YEAR

Return Freq: 2 years

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E2 .HYD
Outflow Hydrograph: T:\PP092310\495PO2 .HYD

Starting Pond W.S. Elevation = 420.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	1.83 cfs
Peak Outflow	=	0.50 cfs
Peak Elevation	=	421.74 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	1,974 cu-ft
Total Storage in Pond	=	1,974 cu-ft

>>>>>> Warning, peak outflow = last ordinate point. <<<<<<

```
      >>>>>> Warning, peak outflow = last ordinate point. <<<<<<
POND-2 Version: 5.20 S/N:                                    Page 4
                                  2 YEAR          Return Freq:   2 years
Pond File:           T:\PP092310\495      .PND
Inflow Hydrograph:   T:\PP092310\495E2    .HYD
Outflow Hydrograph:  T:\PP092310\495PO2   .HYD
                                                 EXECUTED: 04-30-2019
                                                             10:56:37
Peak Inflow     =      1.83 cfs
Peak Outflow    =      0.50 cfs
Peak Elevation  =    421.74 ft
```

POND-2 Version: 5.20 S/N: Page 1
EXECUTED: 04-30-2019 10:56:37 10 YEAR Return Freq: 10 years

```
**************************
*                        *
* PROPOSED TOWNHOUSES    *
* Alpine,  New Jersey    *
*                        *
*                        *
*                        *
**************************
```

Inflow Hydrograph: T:\PP092310\495E10 .HYD
Rating Table file: T:\PP092310\495 .PND

----INITIAL CONDITIONS----
Elevation = 420.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
420.00	0.0	0
420.25	0.1	47
420.50	0.2	373
420.75	0.3	769
421.00	0.4	917
421.25	0.4	1,079
421.50	0.5	1,532
421.75	0.5	1,993
422.00	0.6	2,167
422.25	1.1	2,336
422.50	1.3	2,782
422.75	1.5	3,201
423.00	1.7	3,326
423.25	1.8	3,548
423.50	1.9	3,712
423.75	2.9	3,727
424.00	4.5	3,830
424.25	6.5	3,939

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
0.0	0.0
1.6	1.7
12.4	12.6
25.6	25.9
30.6	31.0
35.9	36.3
51.1	51.6
66.4	66.9
72.2	72.8
77.9	79.0
92.7	94.0
106.7	108.2
110.8	112.5
118.2	120.0
123.7	125.6
124.2	127.1
127.6	132.1
131.3	137.8

Time increment (t) = 0.017 hrs.

POND-2 Version: 5.20 S/N: Page 2
EXECUTED: 04-30-2019 10:56:37 10 YEAR Return Freq: 10 years

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E10 .HYD
Outflow Hydrograph: T:\PP092310\495PO10 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	420.00
0.017	0.30	0.3	0.3	0.3	0.02	420.05
0.033	0.60	0.9	1.0	1.2	0.07	420.18
0.050	0.90	1.5	2.3	2.5	0.11	420.27
0.067	1.20	2.1	4.2	4.4	0.13	420.31
0.083	1.50	2.7	6.6	6.9	0.15	420.37
0.100	1.79	3.3	9.5	9.9	0.17	420.44
0.117	2.09	3.9	13.0	13.4	0.21	420.51
0.133	2.39	4.5	17.0	17.5	0.24	420.59
0.150	2.69	5.1	21.5	22.1	0.27	420.68
0.167	2.99	5.7	26.5	27.2	0.33	420.81
0.183	2.99	6.0	31.7	32.5	0.40	421.07
0.200	2.99	6.0	36.9	37.7	0.41	421.27
0.217	2.99	6.0	42.0	42.9	0.44	421.36
0.233	2.99	6.0	47.0	48.0	0.48	421.44
0.250	2.99	6.0	52.0	53.0	0.50	421.52
0.267	2.99	6.0	57.0	58.0	0.50	421.60
0.283	2.99	6.0	62.0	63.0	0.50	421.69
0.300	2.99	6.0	66.9	67.9	0.52	421.79
0.317	2.99	6.0	71.7	72.9	0.61	422.00
0.333	2.69	5.7	75.4	77.3	0.97	422.18
0.350	2.39	5.1	78.2	80.5	1.12	422.28
0.367	2.09	4.5	80.4	82.7	1.15	422.31
0.383	1.79	3.9	82.0	84.3	1.17	422.34
0.400	1.50	3.3	82.9	85.3	1.18	422.35
0.417	1.20	2.7	83.2	85.6	1.19	422.36
0.433	0.90	2.1	82.9	85.3	1.18	422.36
0.450	0.60	1.5	82.1	84.4	1.17	422.34
0.467	0.30	0.9	80.7	83.0	1.15	422.32
0.483	0.00	0.3	78.7	81.0	1.13	422.28

POND-2 Version: 5.20 S/N: Page 3
EXECUTED: 04-30-2019 10:56:37 10 YEAR Return Freq: 10 years

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E10 .HYD
Outflow Hydrograph: T:\PP092310\495PO10 .HYD

Starting Pond W.S. Elevation = 420.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	2.99 cfs
Peak Outflow	=	1.19 cfs
Peak Elevation	=	422.36 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	2,532 cu-ft
Total Storage in Pond	=	2,532 cu-ft

```
POND-2 Version: 5.20 S/N:                                    Page 4
                                        10 YEAR      Return Freq:  10 years
Pond File:              T:\PP092310\495      .PND
Inflow Hydrograph:      T:\PP092310\495E10   .HYD
Outflow Hydrograph:     T:\PP092310\495PO10  .HYD

                                                     EXECUTED: 04-30-2019
                                                               10:56:37
Peak Inflow     =     2.99 cfs
Peak Outflow    =     1.19 cfs
Peak Elevation  =   422.36 ft
```

POND-2 Version: 5.20 S/N: Page 1
EXECUTED: 04-30-2019 10:56:37 25 YEAR Return Freq: 25 years

****
* *
* PROPOSED TOWNHOUSES *
* Alpine, New Jersey *
* *
* *
* *
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Inflow Hydrograph: T:\PP092310\495E25 .HYD
Rating Table file: T:\PP092310\495 .PND

----INITIAL CONDITIONS----
Elevation = 420.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
420.00	0.0	0	0.0	0.0
420.25	0.1	47	1.6	1.7
420.50	0.2	373	12.4	12.6
420.75	0.3	769	25.6	25.9
421.00	0.4	917	30.6	31.0
421.25	0.4	1,079	35.9	36.3
421.50	0.5	1,532	51.1	51.6
421.75	0.5	1,993	66.4	66.9
422.00	0.6	2,167	72.2	72.8
422.25	1.1	2,336	77.9	79.0
422.50	1.3	2,782	92.7	94.0
422.75	1.5	3,201	106.7	108.2
423.00	1.7	3,326	110.8	112.5
423.25	1.8	3,548	118.2	120.0
423.50	1.9	3,712	123.7	125.6
423.75	2.9	3,727	124.2	127.1
424.00	4.5	3,830	127.6	132.1
424.25	6.5	3,939	131.3	137.8

Time increment (t) = 0.017 hrs.

POND-2 Version: 5.20 S/N: Page 2
EXECUTED: 04-30-2019 10:56:37 25 YEAR Return Freq: 25 years

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E25 .HYD
Outflow Hydrograph: T:\PP092310\495PO25 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	420.00
0.017	0.48	0.5	0.4	0.5	0.03	420.07
0.033	0.95	1.4	1.6	1.9	0.10	420.25
0.050	1.43	2.4	3.8	4.0	0.12	420.30
0.067	1.91	3.3	6.8	7.1	0.15	420.37
0.083	2.38	4.3	10.7	11.1	0.19	420.47
0.100	2.86	5.2	15.5	16.0	0.23	420.56
0.117	3.33	6.2	21.2	21.7	0.27	420.67
0.133	3.81	7.1	27.6	28.3	0.35	420.87
0.150	4.29	8.1	34.9	35.7	0.40	421.22
0.167	4.76	9.1	43.1	44.0	0.45	421.38
0.183	4.76	9.5	51.6	52.6	0.50	421.52
0.200	4.29	9.1	59.7	60.7	0.50	421.65
0.217	3.81	8.1	66.7	67.8	0.51	421.78
0.233	3.33	7.1	72.5	73.9	0.69	422.04
0.250	2.86	6.2	76.5	78.7	1.08	422.24
0.267	2.38	5.2	79.5	81.8	1.14	422.30
0.283	1.91	4.3	81.5	83.8	1.16	422.33
0.300	1.43	3.3	82.4	84.8	1.18	422.35
0.317	0.95	2.4	82.5	84.8	1.18	422.35
0.333	0.48	1.4	81.6	83.9	1.17	422.33
0.350	0.00	0.5	79.8	82.0	1.14	422.30

POND-2 Version: 5.20 S/N:
EXECUTED: 04-30-2019 10:56:37 25 YEAR
Return Freq: 25 years

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E25 .HYD
Outflow Hydrograph: T:\PP092310\495PO25 .HYD

Starting Pond W.S. Elevation = 420.00 ft

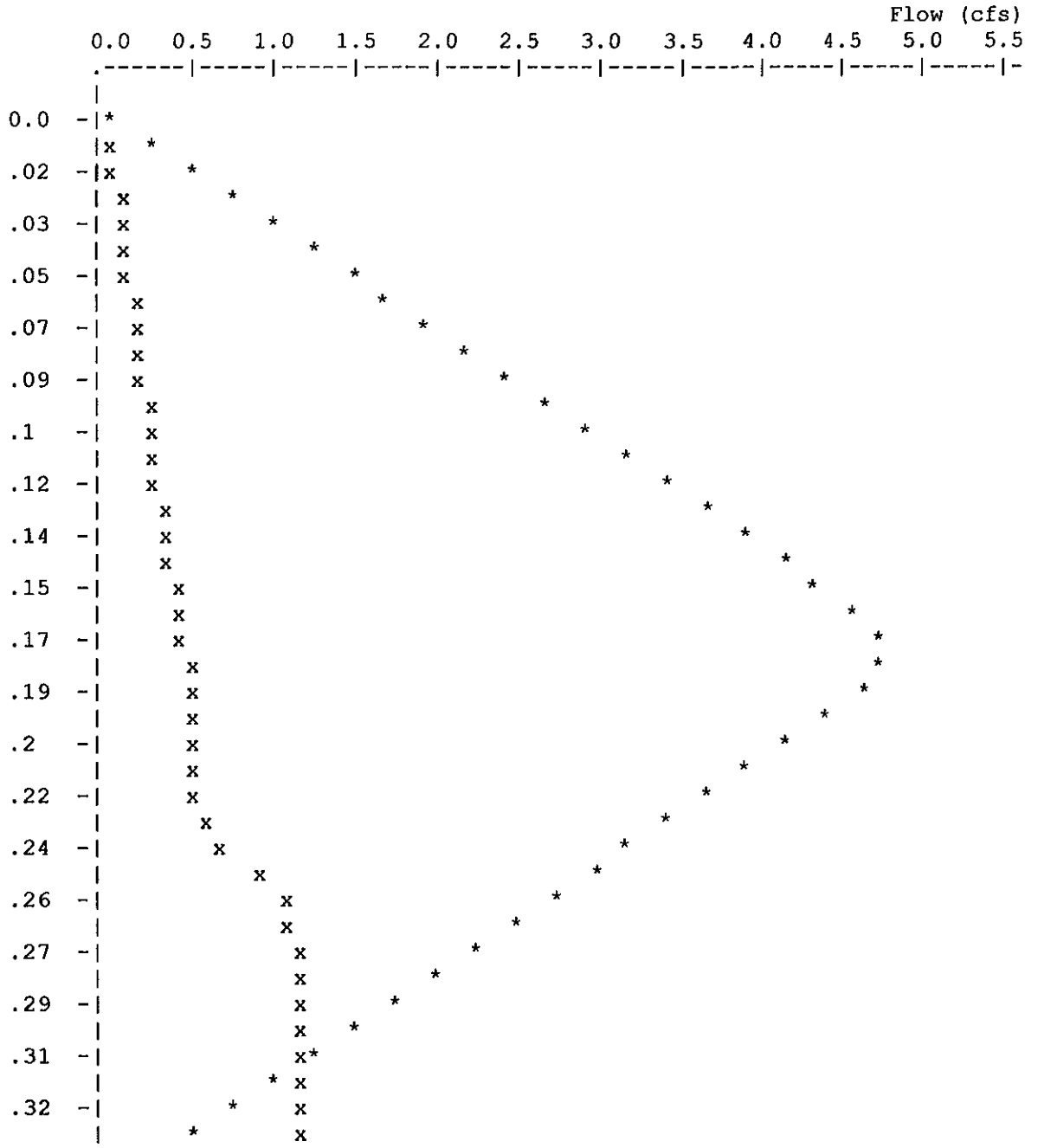
***** Summary of Peak Outflow and Peak Elevation *****

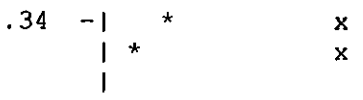
Peak Inflow	=	4.76 cfs
Peak Outflow	=	1.18 cfs
Peak Elevation	=	422.35 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	2,510 cu-ft
Total Storage in Pond	=	2,510 cu-ft

```
POND-2 Version: 5.20 S/N:                                    Page 4
                                        25 YEAR      Return Freq:  25 years
Pond File:           T:\PP092310\495     .PND
Inflow Hydrograph:   T:\PP092310\495E25  .HYD
Outflow Hydrograph:  T:\PP092310\495PO25 .HYD
                                                  EXECUTED: 04-30-2019
Peak Inflow    =     4.76 cfs                             10:56:37
Peak Outflow   =     1.18 cfs
Peak Elevation =   422.35 ft
```





x File: T:\PP092310\495PO25 .HYD Qmax = 1.2 cfs
* File: T:\PP092310\495E25 .HYD Qmax = 4.8 cfs

POND-2 Version: 5.20 S/N: Page 1
EXECUTED: 04-30-2019 10:56:37 100 YEAR Return Freq: 100 years

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*                        *
* PROPOSED TOWNHOUSES    *
* Alpine,  New Jersey    *
*                        *
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Inflow Hydrograph: T:\PP092310\495E100 .HYD
Rating Table file: T:\PP092310\495 .PND

----INITIAL CONDITIONS----
Elevation = 420.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
420.00	0.0	0	0.0	0.0
420.25	0.1	47	1.6	1.7
420.50	0.2	373	12.4	12.6
420.75	0.3	769	25.6	25.9
421.00	0.4	917	30.6	31.0
421.25	0.4	1,079	35.9	36.3
421.50	0.5	1,532	51.1	51.6
421.75	0.5	1,993	66.4	66.9
422.00	0.6	2,167	72.2	72.8
422.25	1.1	2,336	77.9	79.0
422.50	1.3	2,782	92.7	94.0
422.75	1.5	3,201	106.7	108.2
423.00	1.7	3,326	110.8	112.5
423.25	1.8	3,548	118.2	120.0
423.50	1.9	3,712	123.7	125.6
423.75	2.9	3,727	124.2	127.1
424.00	4.5	3,830	127.6	132.1
424.25	6.5	3,939	131.3	137.8

Time increment (t) = 0.017 hrs.

POND-2 Version: 5.20 S/N: Page 2
EXECUTED: 04-30-2019 10:56:37 100 YEAR Return Freq: 100 years

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E100 .HYD
Outflow Hydrograph: T:\PP092310\495PO100.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	420.00
0.017	0.45	0.5	0.4	0.5	0.03	420.07
0.033	0.89	1.3	1.5	1.7	0.10	420.25
0.050	1.34	2.2	3.5	3.8	0.12	420.30
0.067	1.79	3.1	6.4	6.7	0.15	420.36
0.083	2.23	4.0	10.0	10.4	0.18	420.45
0.100	2.68	4.9	14.5	14.9	0.22	420.54
0.117	3.13	5.8	19.8	20.3	0.26	420.64
0.133	3.58	6.7	25.9	26.5	0.31	420.78
0.150	4.02	7.6	32.7	33.5	0.40	421.12
0.167	4.47	8.5	40.3	41.2	0.43	421.33
0.183	4.47	8.9	48.3	49.2	0.48	421.46
0.200	4.47	8.9	56.2	57.2	0.50	421.59
0.217	4.47	8.9	64.2	65.2	0.50	421.72
0.233	4.47	8.9	71.9	73.1	0.62	422.01
0.250	4.47	8.9	78.5	80.8	1.12	422.28
0.267	4.47	8.9	85.1	87.5	1.21	422.39
0.283	4.47	8.9	91.4	94.0	1.30	422.50
0.300	4.47	8.9	97.6	100.3	1.39	422.61
0.317	4.47	8.9	103.5	106.5	1.48	422.72
0.333	4.02	8.5	108.7	112.0	1.68	422.97
0.350	3.58	7.6	112.8	116.3	1.75	423.12
0.367	3.13	6.7	115.9	119.5	1.79	423.23
0.383	2.68	5.8	118.1	121.7	1.83	423.33
0.400	2.23	4.9	119.3	123.0	1.85	423.38
0.417	1.79	4.0	119.6	123.3	1.86	423.40
0.433	1.34	3.1	119.0	122.7	1.85	423.37
0.450	0.89	2.2	117.6	121.2	1.82	423.30
0.467	0.45	1.3	115.4	118.9	1.79	423.21
0.483	0.00	0.5	112.3	115.8	1.74	423.11

POND-2 Version: 5.20 S/N: Page 3
EXECUTED: 04-30-2019 10:56:37 100 YEAR Return Freq: 100 years

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: T:\PP092310\495 .PND
Inflow Hydrograph: T:\PP092310\495E100 .HYD
Outflow Hydrograph: T:\PP092310\495PO100.HYD

Starting Pond W.S. Elevation = 420.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	4.47 cfs
Peak Outflow	=	1.86 cfs
Peak Elevation	=	423.40 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	3,643 cu-ft
Total Storage in Pond	=	3,643 cu-ft

```
POND-2 Version: 5.20 S/N:                                   Page 4
                                          100 YEAR      Return Freq: 100 years
Pond File:              T:\PP092310\495      .PND
Inflow Hydrograph:      T:\PP092310\495E100 .HYD
Outflow Hydrograph:     T:\PP092310\495PO100.HYD

                                                      EXECUTED: 04-30-2019
                                                                10:56:37
Peak Inflow     =     4.47 cfs
Peak Outflow    =     1.86 cfs
Peak Elevation  =   423.40 ft
```

SECTION 7

WQ STORM VOLUME STORMFILTER DESIGN

CONTECH ENGINEERED SOLUTIONS

StormFilter Design Summary

Proposed 7 Townhouses

Alpine, NJ

Information Provided by Engineer (Hubschman Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 0.50 cfs
- Peak storm bypass flow rate = 2.351 cfs
- Impervious drainage area = 0.35 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 18 inches (nominal)
- StormFilter cartridge surface area = 7.07 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 15 gpm
- **Hydraulic head required = 2.3 feet** (with 18 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flowrate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **15 cartridges** in order to meet the hydraulic load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends an 8' x 11' precast StormFilter.

$$N_{\substack{cartridges \\ Hyd.load}} = \frac{Q_{treat} \times 449\ {}^{gpm}/_{cfs}}{Q_{cartridge}} = \frac{0.50cfs \times 449\ {}^{gpm}/_{cfs}}{15\ {}^{gpm}/_{cartridge}} = 14.97 \Rightarrow (15)\ 18"\ Cartridges$$

$$N_{\substack{cartridges \\ Mass\ load}} = \frac{Area_{site}}{Max\ Area_{cartridge}} = \frac{0.35\ acre}{0.09\ {}^{acres}/_{cartridge}} = 3.9 \Rightarrow (4)\ 18"\ Cartridges$$

7037 Ridge Road, Suite 350 | Hanover, MD 21076
Office: 443-457-1500 Fax: 410-740-8492

CONTECH ENGINEERED SOLUTIONS

StormFilter Design Summary

Maintenance:

Maintenance of Stormwater best management practices is required per the New Jersey Administrative Code 7:8-5.8. Recommendations for maintenance are included in chapters 8 & 9 of the New Jersey Stormwater Best Management Practices Manual. To comply with requirements, CONTECH offers a network of Preferred Service Providers that have the capability to perform all necessary inspections, compliance reporting and cleaning services. CONTECH recommends inspecting the system annually and maintaining the system at the recommendation of the annual inspection. Full maintenance is typically required every 24-36 months. Disposal of material should be handled in accordance with local regulations. Please contact CONTECH's Maintenance Department for all questions regarding maintenance at (503) 258-3157 or visit our website at www.conteches.com/maintenance.

Thank you for the opportunity to present this information to you and your client. If you have any questions, please call me at (443-457-1508).

Sincerely,

Pat Valentine
Contech Engineered Solutions LLC

7037 Ridge Road, Suite 350 | Hanover, MD 21076
Office: 443-457-1500 Fax: 410-740-8492

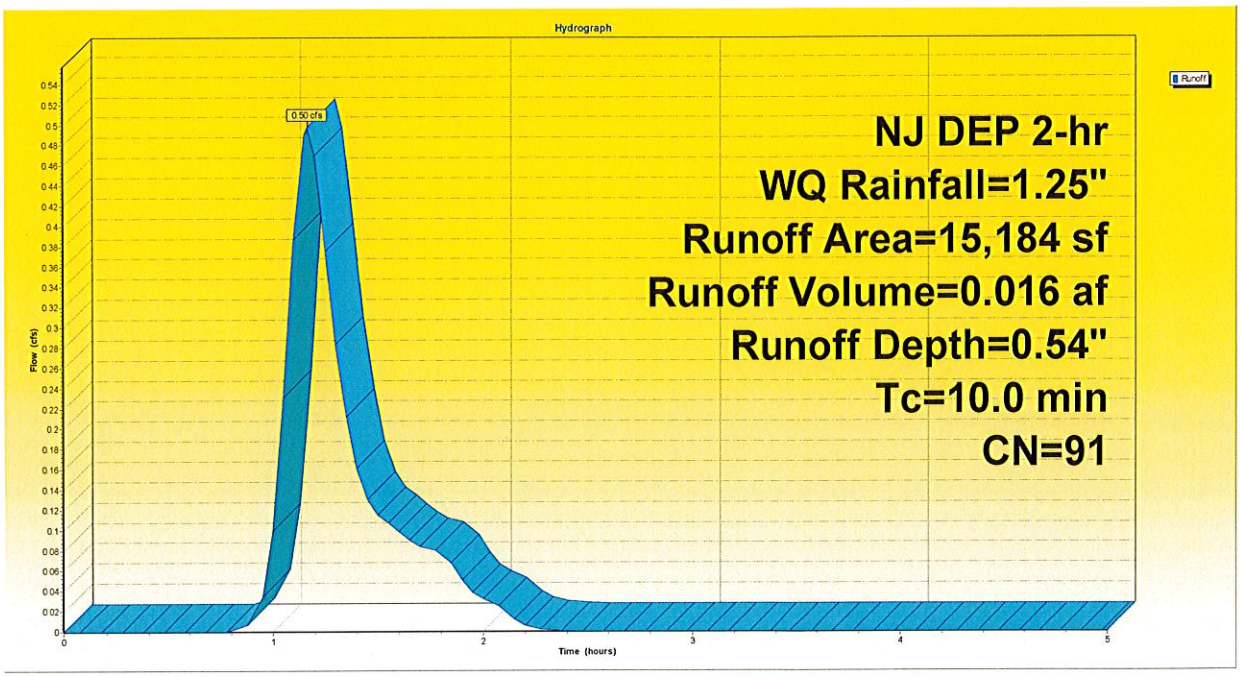
Summary for Subcatchment 4S: Driveway

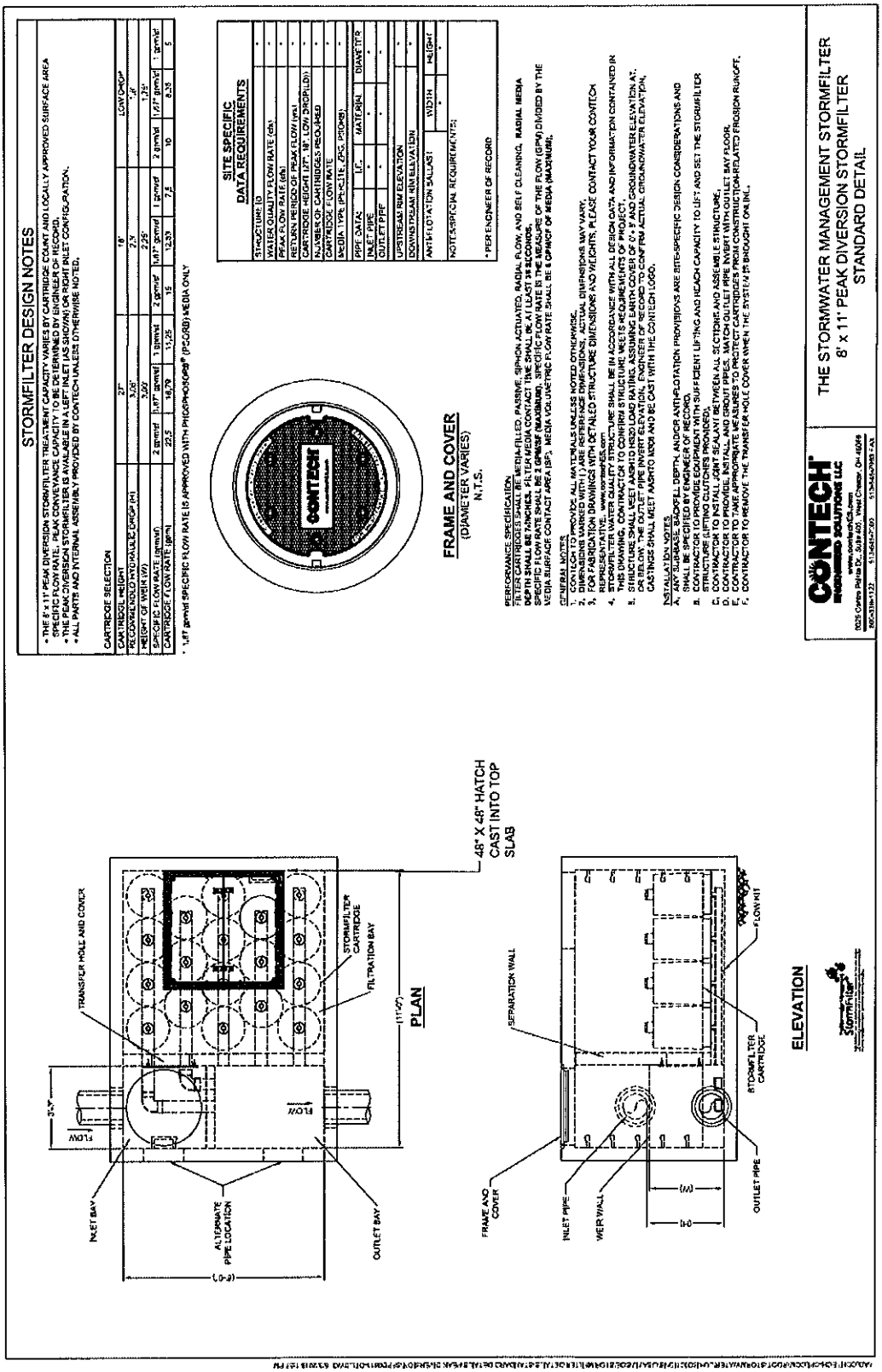
Runoff = 0.50 cfs @ 1.17 hrs, Volume= 0.016 af, Depth= 0.54"

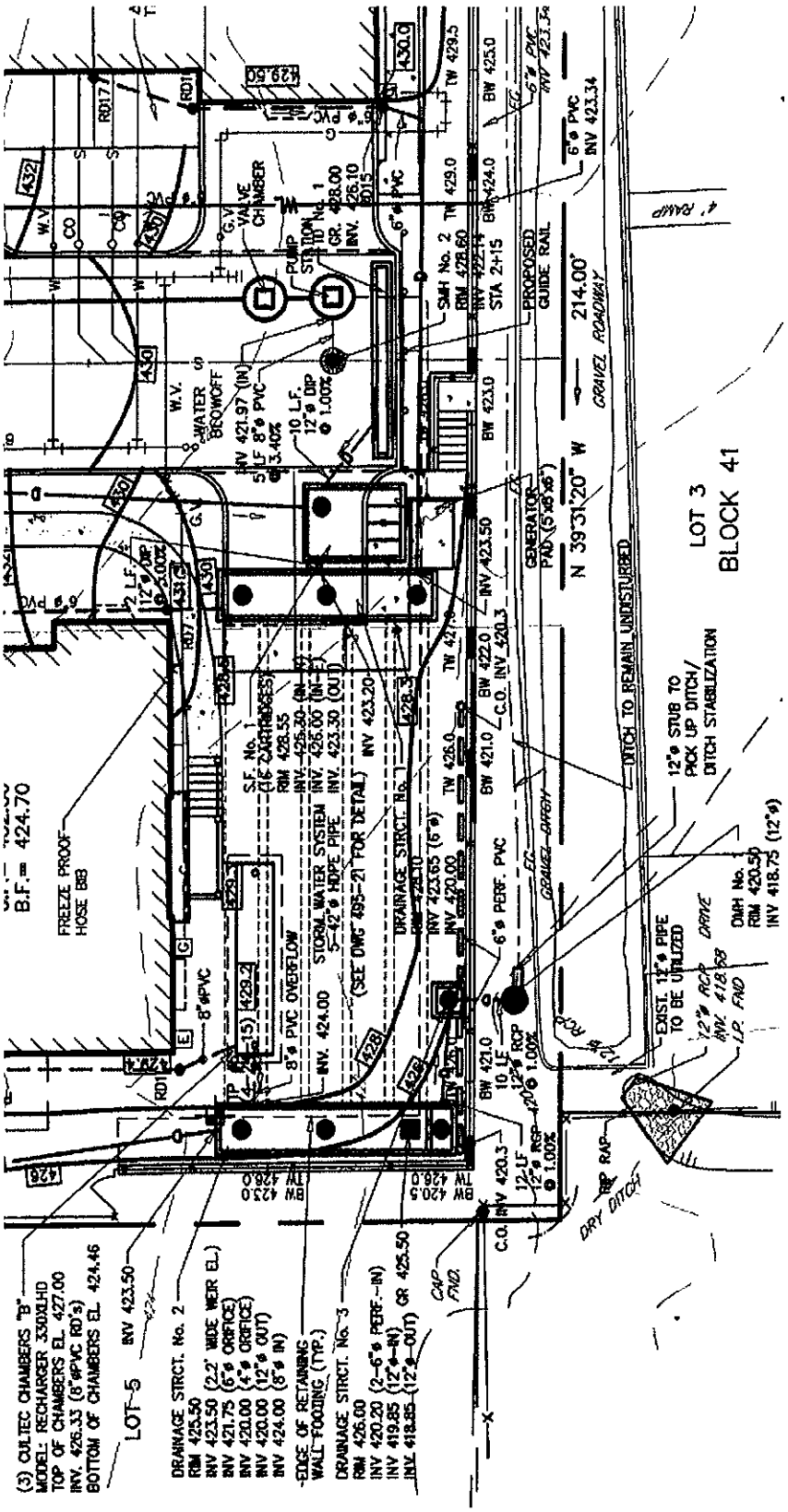
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr WQ Rainfall=1.25"

	Area (sf)	CN	Description
*	4,245	74	>75% Grass cover, Good, HSG C
*	7,671	98	Paved parking, HSG C
*	3,268	98	Paved parking, HSG C (Pervious pvmt)
	15,184	91	Weighted Average
	4,245		27.96% Pervious Area
	10,939		72.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,




STORMFILTER DESIGN NOTES
• THE 8' x 11' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
• THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
• ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.
CARTRIDGE SELECTION
CARTRIDGE HEIGHT
RECOMMENDED HYDRAULIC DROP (H)
HEIGHT OF WEIR (W)
SPECIFIC FLOW RATE (gpm/sf)
CARTRIDGE FLOW RATE (gpm)
LOW DROP
SITE SPECIFIC DATA REQUIREMENTS
STRUCTURE ID
WATER QUALITY FLOW RATE (cfs)
PEAK FLOW RATE (cfs)
RETURN PERIOD OF PEAK FLOW (yrs)
CARTRIDGE HEIGHT (27", 18", LOW DROP, LD)
NUMBER OF CARTRIDGES REQUIRED
CARTRIDGE FLOW RATE
MEDIA TYPE (PERLITE, ZPG, PHOSPHORUS)
PIPE DATA:
INLET PIPE
OUTLET PIPE
UPSTREAM RIM ELEVATION
DOWNSTREAM INVERT ELEVATION
ANTI-FLOTATION BALLAST
NOTES/SPECIAL REQUIREMENTS:
* PER ENGINEER OF RECORD
FRAME AND COVER
(DIAMETER VARIES)
N.T.S.
PERFORMANCE SPECIFICATION:
FILTER CARTRIDGES SHALL BE RADIAL MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7 INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 76 SECONDS.
SPECIFIC FLOW RATE SHALL BE 2 GPM/SF (MAXIMUM). SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE 6 GPM/CF OF MEDIA (MAXIMUM).
GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS, ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE.
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO H20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' AND GROUNDWATER ELEVATION AT OR BELOW THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
INSTALLATION NOTES
A. ANY SUBBASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE CITED ON CONTECH SHOP DRAWINGS.
B. CONTRACTOR TO COMPLETE EXCAVATION WITH SUFFICIENT LIFTING CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
F. CONTRACTOR TO REMOVE THE TRANSPORTATION HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.
CONTECH
STORMWATER SOLUTIONS LLC
www.contechES.com
1026 Crews Road Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX
THE STORMWATER MANAGEMENT STORMFILTER
8' x 11' PEAK DIVERSION STORMFILTER
STANDARD DETAIL
48" X 48" HATCH CAST INTO TOP SLAB
TRANSFER HOLE AND COVER
STORMFILTER CARTRIDGE
FILTRATION BAY
FLOW
INLET BAY
ALTERNATE PIPE LOCATION
OUTLET BAY
PLAN
SEPARATION WALL
FLOW HT
FRAME AND COVER
INLET PIPE
WEIR WALL
OUTLET PIPE
ELEVATION


LOT 3
BLOCK 41
LOT 5
N 39°31'20" W
214.00'
GRAVEL ROADWAY
PROPOSED GUIDE RAIL
GENERATOR PAD (5'x5'x6")
DITCH TO REMAIN UNDISTURBED
12"ø STUB TO PICK UP DITCH/ DITCH STABILIZATION
EXIST. 12"ø PIPE TO BE UTILIZED
DMH No. 1 RIM 420.50 INV 418.75 (12"ø)
SMH No. 2 RIM 428.60 INV 422.14
SMH No. 1 RIM 428.55 INV. 425.30 (IN) INV. 426.00 (IN) INV. 423.30 (OUT)
STORM WATER SYSTEM 5-42"ø HDPE PIPE
(SEE DWG 495-21 FOR DETAIL)
DRAINAGE STRCT. No. 1
INV 423.20
INV 423.65 (6"ø)
INV 424.00
INV 420.00
6"ø PERF. PVC
10 LF 12"ø RCP @ 1.00%
12 LF 12"ø RCP @ 1.00%
C.O. INV 420.3
C.O. INV 423.50
PUMP STATION No. 1
GR. 428.00
INV. 426.10
WATER BROWOFF
INV 421.97 (IN)
5 LF 8"ø PVC @ 3.40%
10 LF 12"ø DIP @ 1.00%
2 LF 12"ø DIP @ 3.00%
FREEZE PROOF HOSE BIB
B.F.= 424.70
8"ø PVC OVERFLOW
8"ø PVC
(3) CULTEC CHAMBERS "B"
MODEL: RECHARGER 330XLHD
TOP OF CHAMBERS EL. 427.00
INV. 426.33 (8"ø PVC RD's)
BOTTOM OF CHAMBERS EL. 424.46
DRAINAGE STRCT. No. 2
RIM 425.50
INV 423.50 (2.2' WIDE WEIR EL.)
INV 421.75 (6"ø ORIFICE)
INV 420.00 (4"ø ORIFICE)
INV 420.00 (12"ø OUT)
INV 424.00 (8"ø IN)
EDGE OF RETAINING WALL FOOTING (TYP.)
DRAINAGE STRCT. No. 3
RIM 426.00
INV 420.20 (2-6"ø PERF.-IN)
INV 419.85 (12"ø-IN)
INV 418.85 (12"ø-OUT)
GR 425.50
CAP FND.
DRY DITCH
RAP
CAP FND.

SECTION 8

GROUNDWATER RECHARGE CALCULATIONS

BMP AREA - A

Area for Eight (8) Cultec Recharger 330XLHD chambers with gravel:

Bed Details:

Bed Layout Information		
Number of Rows Wide	**1**	pieces
Number of Chambers Long	**8**	pieces
Chamber Row Width	**4.33**	feet
Chamber Row Length	**57.50**	feet
Bed Width	**6.33**	feet
Bed Length	**59.50**	feet
Bed Area Required	**376.83**	sq. feet
Length of Separator Row	**N/A**	feet

Total BMP Area = **376.83 S.F.**

Groundwater Recharge Conclusion:
The proposed townhouse development includes eight (8) Cultec Recharger 330XLHD chambers with a total BMP area of 376.83 square feet, exceeding the minimum required BMP area of 252.2 square feet.

Groundwater Recharge Analysis - Supporting Calculations:
BMP Effective Depth (dBMP): is calculated by dividing the volume of cultec chambers (791.2 cf. – see cultec chamber data sheets below) over the area of the cultec chambers (376.83 sf.) Thus; dBMP = 791.2 (cf.)/376.83 (sf.)*12 (in./ft.) = 25.2 (in.)

Upper level of the BMP surface (dBMPu): as shown in the cultec data , the overall height is 42.5 (in.) of which, the cultec chamber 30.5 (in.) and stone aggregate 6 (in.) top and bottom. Grading plan of the engineering drawings show the average grade elevation along the cultec chambers to be 436.0 and the top of stone invert of 433.09. Thus;

dBMPu = [436 – 433.09]*12 = 34.9 (in.)

Depth of lower surface of BMP dEXC; based on the aforementioned elevation and composite cultec chamber dimensions dEXC = (436-429.55)*12 (in./ft.) = 77.4 (in.)

BMP AREA - B

Area for three (3) Cultec Recharger 330XLHD chambers with gravel:

Bed Details:

Bed Layout Information		
Number of Rows Wide	**1**	pieces
Number of Chambers Long	**3**	pieces
Chamber Row Width	**4.33**	feet
Chamber Row Length	**22.50**	feet
Bed Width	**6.33**	feet
Bed Length	**24.50**	feet
Bed Area Required	**155.17**	sq. feet
Length of Separator Row	**N/A**	feet

Total BMP Area = **155.17 S.F.**

Groundwater Recharge Conclusion:
The proposed townhouse development includes three (3) Cultec Recharger 330XLHD chambers with a total BMP area of 130.66 square feet, exceeding the minimum required BMP area of 114.5 square feet.

Groundwater Recharge Analysis - Supporting Calculations:
BMP Effective Depth (dBMP): is calculated by dividing the volume of cultec chambers (320.5 cf. – see cultec chamber data sheets below) over the area of the cultec chambers (155.17 sf.) Thus; dBMP = 320.5 (cf.)/155.17 (sf.)*12 (in./ft.) = 24.8 (in.)

Upper level of the BMP surface (dBMPu): as shown in the cultec data , the overall height is 30.5 (in.) of which, the cultec chamber 30.5 (in.) and stone aggregate 6 (in.) top and bottom. Grading plan of the engineering drawings show the average grade elevation along the cultec chambers to be 429.2 and the top of stone invert of 427.5. Thus;

dBMPu = [429.2 – 427.5]*12 = 20.4 (in.)

Depth of lower surface of BMP dEXC; based on the aforementioned elevation and composite cultec chamber dimensions dEXC = (429.2-423.96)*12 (in./ft.) = 62.88 (in.)

New Jersey Groundwater Recharge Spreadsheet Version 2.0 November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
BERGEN CO., ALPINE BORO	46.0	1.49

Project Name:	495.1
Description:	PROPOSED TOWNHOUSES
Analysis Date:	03/20/20

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.03646	Impervious areas	Wethersfield	0.0	-
2	1.0526	Woods	Wethersfield	12.2	46,718
3	0				
4	0				
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	1.1			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				11.8	46,718

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.58887	Impervious areas	Wethersfield	0.0	-
2	0.5025	Open space	Wethersfield	12.2	22,189
3	0				
4	0				
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	1.1	Warning: make total area equal to Pre-Developed Conditions		Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				5.6	22,189

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	25,651
Post-Development Annual Recharge Deficit=	*24,529*	(cubic feet)	

Recharge Efficiency Parameters Calculations (area averages)

RWC=	4.47	(in)	DRWC=	0.00	(in)
ERWC =	1.14	(in)	EDRWC=	0.00	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
495.1	PROPOSED TOWNHOUSES	03/20/20	BMP AREA - A

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	252.2	sq.ft
BMP Effective Depth, this is the design variable	dBMP	25.2	in
Upper level of the BMP surface (negative if above ground)	dBMPu	34.9	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	77.4	in
Post-development Land Segment Location of BMP Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	1.31	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.99	in
Inches of Rainfall to capture	Pdesign	1.20	in
Recharge Provided Avg. over Imp. Area		30.7	in
Runoff Captured Avg. over imp. Area		30.7	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.04	unitless
BMP Volume	VBMP	530	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check—> OK
dEXC Check—> OK
BMP Location—> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	16,871	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	6,598	sq.ft
Root Zone Water Capacity	RWC	5.16	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.49	no units
Average Annual P	Pavg	46.0	in
Recharge Requirement over Imp. Area	dr	7.9	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		16,871	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		78.0%	%
%Runoff Infiltrated		85.6%	%
%Runoff Recharged		22.0%	%
%Rainfall Recharged		17.2%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
495.1	PROPOSED TOWNHOUSES	03/20/20	BMP AREA B

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	114.5	sq.ft
BMP Effective Depth, this is the design variable	dBMP	24.8	in
Upper level of the BMP surface (negative if above ground)	dBMPu	6.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	62.9	in
Post-development Land Segment Location of BMP . Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	1.31	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.99	in
Inches of Rainfall to capture	Pdesign	1.20	in
Recharge Provided Avg. over Imp. Area		30.7	in
Runoff Captured Avg. over imp. Area		30.7	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.04	unitless
BMP Volume	VBMP	237	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	7,658	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	2,995	sq.ft
Root Zone Water Capacity	RWC	5.16	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.49	no units
Average Annual P	Pavg	46.0	in
Recharge Requirement over Imp. Area	dr	3.6	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		7,658	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		78.0%	%
%Runoff Infiltrated		85.6%	%
%Runoff Recharged		10.0%	%
%Rainfall Recharged		7.8%	%

CALCULATION CHECK MESSAGES

Volume Balance--> OK
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion
of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are
sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land
Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by
the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

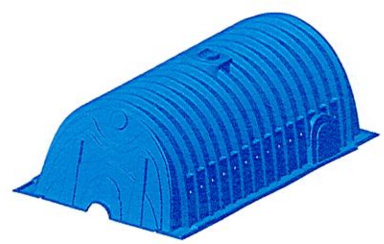
Project Information:
PROPOSED 7 TOWNHOUSES - CC A
CLOSTER DOCK ROAD
ALPINE
NJ

INPUT INFO

Calculations Performed By:	
NM/MJH	
HUBSCHMAN ENGINEERING	
263A S. WASHINGTON AVENUE	
BERGENFIELD	NJ
07621	

RECHARGER 330XLHD

Recharger 330XLHD Chamber Specifications		
Height	30.5	inches
Width	52.0	inches
Length	8.50	feet
Installed Length	7.00	feet
Bare Chamber Volume	52.21	cu. feet
Installed Chamber Volume	81.74	cu. feet

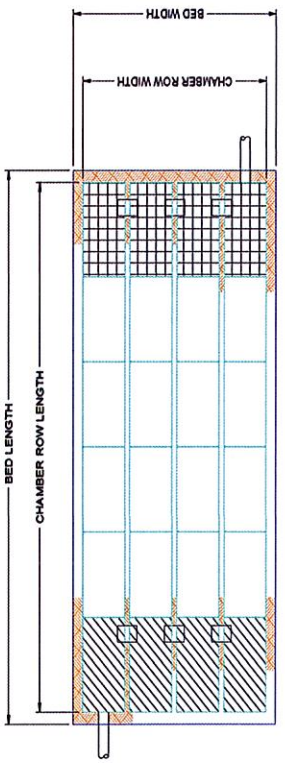


Breakdown of Storage Provided by Recharger 330XLHD Stormwater System		
Within Chambers	428.89	cu. feet
Within Feed Connectors	-	cu. feet
Within Stone	362.29	cu. feet
Total Storage Provided	**791.2**	**cu. feet**
Total Storage Required	700.00 cu. feet	

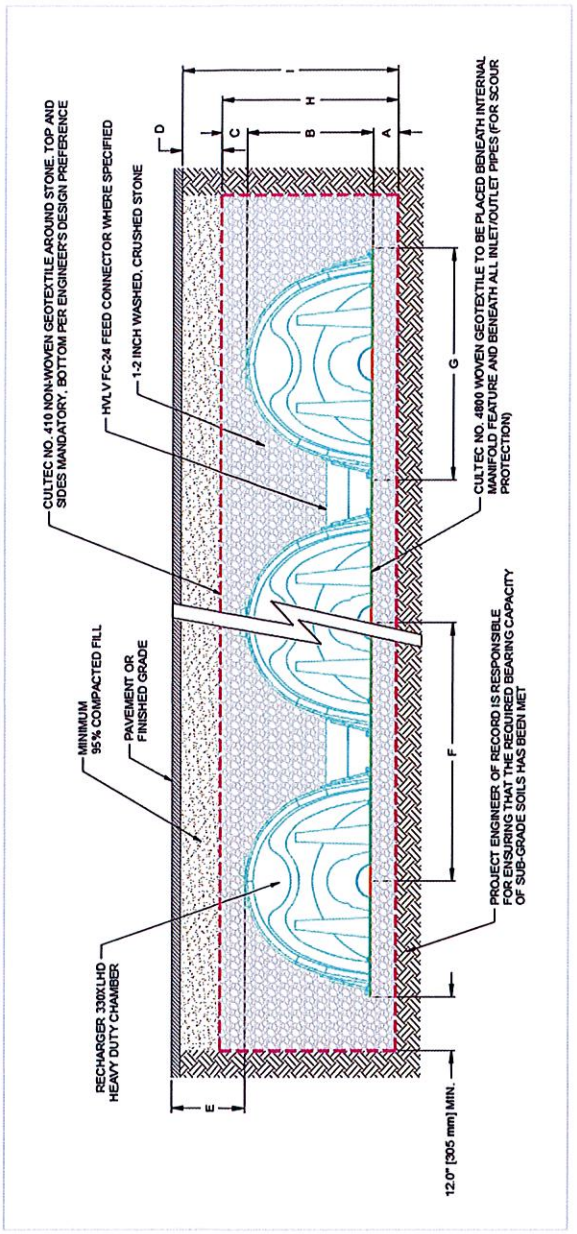
BMP AREA A

Bed Detail

Bed Layout Information		
Number of Rows Wide	1	pieces
Number of Chambers Long	8	pieces
Chamber Row Width	4.33	feet
Chamber Row Length	57.50	feet
Bed Width	6.33	feet
Bed Length	59.50	feet
Bed Area Required	376.83	sq. feet
Length of Separator Row	N/A	feet



Bed detail for reference only. Not project specific. Not to scale.



BMP AREA A

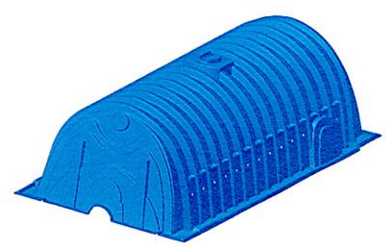
Date:	May 22, 2019

Project Information:

PROPOSED 7 TOWNHOUSES - CC B
CLOSTER DOCK ROAD
ALPINE
NJ

INPUT INFO

RECHARGER 330XLHD



Project Number:	495.1

Calculations Performed By:

NM/MJH
HUBSCHMAN ENGINEERING
263A S. WASHINGTON AVENUE
BERGENFIELD NJ
07621

Recharger 330XLHD Chamber Specifications

Height	30.5	inches
Width	52.0	inches
Length	8.50	feet
Installed Length	7.00	feet
Bare Chamber Volume	52.21	cu. feet
Installed Chamber Volume	81.74	cu. feet

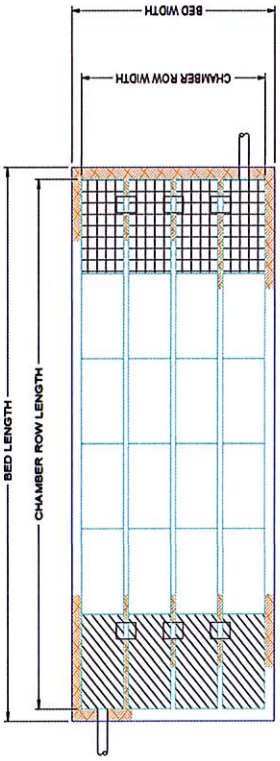
Breakdown of Storage Provided by Recharger 330XLHD Stormwater System

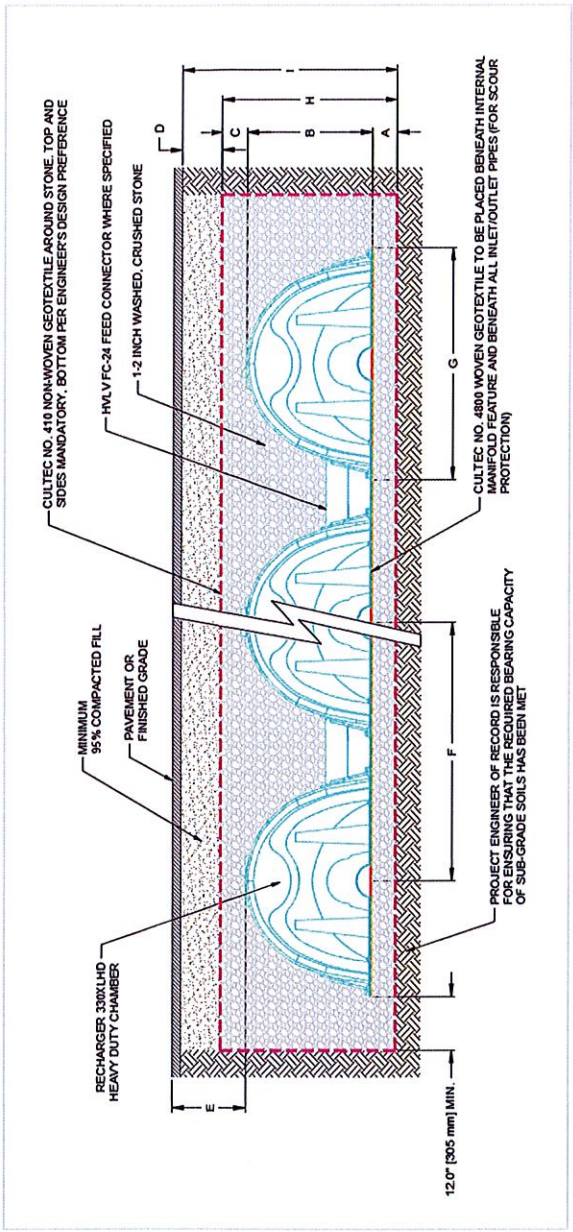
Within Chambers	167.83	cu. feet
Within Feed Connectors	-	cu. feet
Within Stone	152.69	cu. feet
Total Storage Provided	**320.5**	**cu. feet**
Total Storage Required	250.00	cu. feet

BMP AREA B

Bed Detail

Bed Layout Information		
Number of Rows Wide	1	pieces
Number of Chambers Long	3	pieces
Chamber Row Width	4.33	feet
Chamber Row Length	22.50	feet
Bed Width	6.33	feet
Bed Length	24.50	feet
Bed Area Required	155.17	sq. feet
Length of Separator Row	N/A	feet





Bed detail for reference only. Not project specific. Not to scale.

BMP AREA B

Groundwater mounding beneath BMP Structure:

Simulation of Groundwater Beneath Cultec Chambers (infiltration basin) is developed in compliance with the USGS Seintific Investigation Report 2010-2015.

The BMP recharge Area A recharge rate (R_a) of 0.7 (ft./day) is based on the requirements that the recharge basin should drain within 3-days. Thus; R=dBMP(ft.)/3(days)=[25.2 (in)/12 (in./ft.)]/3(days)=0.7 (ft./day).

The BMP recharge Area B recharge rate (R_b) of 0.69 (ft./day) is based on the requirements that the recharge basin should drain within 3-days. Thus; R=dBMP(ft.)/3(days)=[24.8 (in)/12 (in./ft.)]/3(days)=0.69 (ft./day).

On June 20, 2018 Johnson Soil Company (JSC) has conducted on-site soil testing (copy enclosed) in accordance with NJ BMP chapter 6. Based on the aforementioned, the groundwater elevation of 427.23 (ft.) was confirmed and the percolation rate of 6 (in./hr.) was established. Per NJBMP chapter 6 *"a factor of safety of two (2) must be applied when converting a tested permeability rate to a design rate"*. Thus, a design rate of 3 (in./hr.) is used. Conservatively the horizontal conductivity K_h is assumed to be equal to the aforementioned design rate of 3 (in./hr.) or 6 (ft./day).

In addition, based on field investigation by Thomas Dwyer (geotechnical engineer) the site has a specific yield S_{y1} = 0.02 and a base aquifer elevation of 404 (ft.) and groundwater elevation of 427.23 (ft.). Based on the aforementioned the saturated zone thickness of the aquifer of d_1=23.23 (ft.) is obtained by subtracting from the GW elevation of 427.23 (ft.) minus the base elevation of 404 (ft.). The unsaturated zone thickness of d_2=2.3 (ft.) is calculated by subtracting the GW elevation of 427.23 from the invert elevation of the BMP which is 429.55 (ft.). The unsaturated zone is assumed to have a specific yield S_{y2}=0.085. Since the spreadsheet does not accept more than one specific yield a weighted specific yield needed to be calculated.

The combined specific yield S_y is calculated; $S_y=(S_{y1}*d_1+S_{y2}*d_2)/(d_1+d_2)$ = 0.0259

Basin dimensions are shown on engineering drawings.

The aforementioned data is incorporated into the spreadsheet to calculate the mound heights at various location along the recharged flow path.

Conclusion:

The maximum recharge mound height of 0.83 ft occurs beneath, at the center of the Cultec Chamber infiltration area A and a maximum recharge mound height of 0.405 ft occurs beneath, at the center of the Cultec Chamber infiltration area B. The mound height of 0.248 (ft.) occurs approximately 100 feet away from the center of the infiltration basin A and the mound height of 0.245 ft occurs 33 feet away from the center of the infiltration basin B. These locations correspond to the downstream property line which is considered a boundary condition. Per NJDEP regulation *"a mound height of less than 0.25 (ft.) is considered insignificant"*. The basement structure of the proposed unit 5 will be waterproofed accordingly to address the presence of the groundwater.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0)), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days or inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

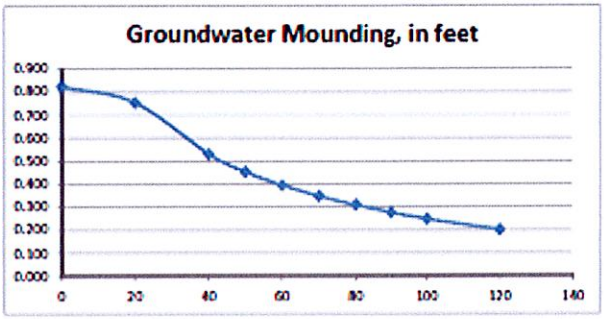
In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
0.7000	R	Recharge (infiltration) rate (feet/day)
0.026	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
6.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
29.750	x	1/2 length of basin (x direction, in feet)
3.165	y	1/2 width of basin (y direction, in feet)
3.000	t	duration of infiltration period (days)
23.230	hi(0)	initial thickness of saturated zone (feet)

24.051	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.826	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.826	0
0.755	20
0.531	40
0.453	50
0.395	60
0.348	70
0.309	80
0.276	90
0.248	100
0.201	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Mound beneath BMP AREA A

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi)(i, height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days or inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

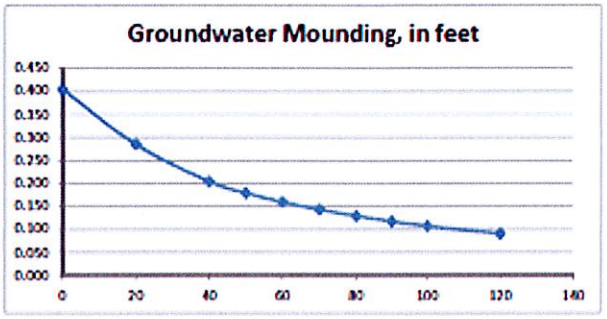
Is the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
0.6900	R	Recharge (infiltration) rate (feet/day)
0.026	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
6.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
11.250	x	1/2 length of basin (x direction, in feet)
3.165	y	1/2 width of basin (y direction, in feet)
3.000	t	duration of infiltration period (days)
23.230	hi(0)	initial thickness of saturated zone (feet)

23.633	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.403	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.403	0
0.285	20
0.204	40
0.173	50
0.160	60
0.143	70
0.130	80
0.118	90
0.107	100
0.090	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Mound beneath BMP AREA B

JOHNSON SOILS COMPANY

66 Glen Avenue
Glen Rock, NJ 07452
Telephone: 201-301-1045
Fax: 201-857-8002
Email: info@johnsonsoils.com

June 25, 2018

HUBSCHMAN ENGINEERING
263A South Washington Avenue
Bergenfield, NJ 07621

Attn: Michael J. Hubschman

Re: 982 Closter Dock Road
Alpine, NJ
JSC Job #: 15-092

Dear Sir:

The following test pit was inspected on June 20, 2018

The test pit log is as follows:

TP-1

0 – 18"	Topsoil
18" – 5'3"	7.5 YR brown fine/medium Sand, some Silt and Gravel
5'3"	Refusal on fractured rock
	Water seeping at 5'3"
	The percolation rate at a depth of 5' is 6 in/hr.

If you have any questions please call.

Very truly yours,

Lisa V. Mahle-Greco

Lisa V. Mahle-Greco, PE
Engineering Manager
NJ Lic. # 43197

William Sanchez

New Jersey Stormwater Best Management Practices Manual

Chapter 2: Low Impact Development Techniques

Nonstructural Stormwater Management Strategies

As described above, effective low impact development includes the use of both nonstructural and structural stormwater management measures known as LID-BMPs. Of the two, nonstructural LID-BMPs play a particularly important role. The proposed NJDEP Stormwater Management Rules at N.J.A.C. 7:8 require in Section 5.2(a) that the design of any development that disturbs at least 1 acre of land or increases impervious surface by at least 1/4 acre must incorporate nonstructural stormwater management strategies "to the maximum extent practicable." Such a development is defined in the Rules as a "major development." As such, nonstructural LID-BMPs are to be given preference over structural BMPs. Where it is not possible to fully comply with the Stormwater Management Rules solely with nonstructural LID-BMPs, they should then be used in conjunction with LID and standard structural BMPs to meet the Rules' requirements.

More precisely, to achieve the Rules' design and performance standards, Subchapter 5 of the NJDEP Stormwater Management Rules requires the maximum practical use of the following nine nonstructural strategies at all major developments:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction "time of concentration."
5. Minimize land disturbance including clearing and grading.
6. Minimize soil compaction.
7. Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.
8. Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.
9. Provide preventative source controls.

In addition, Subchapter 5 further requires an applicant seeking approval for a major development to specifically identify which and how these nine nonstructural strategies have been incorporated into the development's design. Finally, for each of those nonstructural strategies that were not able to be incorporated into the development's design due to engineering, environmental, or safety reasons, the applicant must provide a basis for this contention.

While the nonstructural stormwater management strategies listed above represent a wide range of both objectives and practices, Strategies 1 through 8 can be directly addressed through the use of specific nonstructural LID-BMPs that can be grouped into four general categories:

1. Vegetation and Landscaping;
2. Minimizing Site Disturbance;
3. Impervious Area Management; and
4. Time of Concentration Modifications.

Information on the specific nonstructural LID-BMPs included in each of these categories is presented below. A Nonstructural Stormwater Management Checklist is provided in Appendix A to assist applicants and reviewers in demonstrating that the Stormwater Management Rules' nine nonstructural stormwater management strategies have been utilized throughout the land development site to the maximum extent practicable.

Prior to utilizing any of the specific nonstructural LID-BMPs described below, applicants are urged to review the land development regulations of the municipality and/or agency from which they are seeking development approval. Despite low impact development being a relatively new aspect of stormwater management, many municipalities and agencies have already incorporated low impact development goals and strategies into their own regulations and, with the advent of the NJDEP Stormwater Management Rules, those that haven't will be required to do so. Therefore, additional nonstructural strategies and/or specific nonstructural LID-BMPs aside from those described in this chapter may have already been incorporated into a municipality's land development regulations or will be in the near future. In light of the site specific nature of LID-BMPs, these regulations may also discourage or prohibit the use of specific LID-BMPs for engineering, safety, or maintenance reasons. Consideration should also be given to having a pre-design meeting and/or site walk with pertinent regulators and technical reviewers to review local regulations and optimize the site's nonstructural stormwater management design.

Finally, engineers and site designers should recognize the importance of accurately computing existing or predeveloped runoff at a land development site. While this is an important computation at all development sites, it is particular important at those sites where nonstructural LID-BMPs will be utilized. This is because, to a large degree, these nonstructural measures will utilize and/or mimic the predeveloped site's rainfall- runoff response. As such, accurate computation of predeveloped hydrologic conditions is vital to successful LID-BMP use. It is recommended that engineers and site designers consult with regulatory entities, such as the State, municipality, or local soil conservation district, regarding predeveloped hydrologic conditions.

Conclusions:

Based on the quantitative analysis in the NJDEP Nonstructural strategies point system (NSPS) spread sheet; the proposed nonstructural measures in the design are adequate.

NJDEP Nonstructural Strategies Points System (NSPS)

Version: September 2, 2010
(See 'Revisions' Worksheet for Summary of Program Revisions)

Note: Input Values in Yellow Cells Only

Project:	Alpine Three, LLC
Date:	March 31, 2020
User:	NM/MJH
Notes:	

Step 1 - Provide Basic Major Development Site Information

A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 = 1.1 Acres

B. Specify by Percent the Various Planning Areas Located within the Development Site:

State Plan Planning Area:	PA-1	PA-2	PA-3	PA-4	PA-4B	PA-5	Total % Area
% of Each Planning Area within Site:	100.0%						100.0%

Note: See User's Guide for Equivalent Zones within Designated Centers and the NJ Meadowlands, Pinelands, and Highlands Districts

Step 2 - Describe Existing or Pre-Developed Site Conditions

A. Specify Existing Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG: HSG A	HSG B	HSG C	HSG D	Use/Cover Subtotals		Points
1	Wetlands and Undisturbed Stream Buffers			0.1		0.1		37
2	Lawn and Open Space					0.0		0
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous			0.9		0.9		264
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious					0.0		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious			0.1		0.1		17
	HSG Subtotals (Acres):	0.0	0.0	1.1	0.0		Total Area:	1.1
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		Total % Area:	100.0%
							Points Subtotal:	318
							Total Existing Site Points:	**318**

Step 3 - Describe Proposed or Post-Developed Site Conditions

A. Specify Proposed Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	HSG A	HSG B	HSG C	HSG D	Use/Cover Subtotals	Points
		Specify Land Use/Land Cover in Acres for Each HSG					
1	Wetlands and Undisturbed Stream Buffers					0.0	0
2	Lawn and Open Space			0.50		0.5	105
3	Brush and Shrub					0.0	0
4	Meadow, Pasture, Grassland, or Range					0.0	0
5	Row Crop					0.0	0
6	Small Grain and Legumes					0.0	0
7	Woods - Indigenous					0.0	0
8	Woods - Planted					0.0	0
9	Woods and Grass Combination					0.0	0
10	Ponds, Lakes, and Other Open Water					0.0	0
11	Gravel and Dirt					0.0	0
12	Porous and Permeable Paving			0.08		0.1	17
13	Directly Connected Impervious			0.25		0.3	0
14	Unconnected Impervious with Small D/S Pervious			0.04		0.0	3
15	Unconnected Impervious with Large D/S Pervious			0.23		0.2	38
	HSG Subtotals (Acres):	0.0	0.0	1.1	0.0	Total Area:	1.1
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%	Total % Area:	100.0%
						Points Subtotal:	163

B. Compare Proposed Impervious Coverage with Maximum Allowable Impervious Coverage:

Total Proposed Directly Connected Impervious Coverage =	27.3%	% of Site
Total Proposed Unconnected Impervious Coverage with Small D/S Pervious =	0.0%	% of Site
Total Proposed Unconnected Impervious Coverage with Large D/S Pervious =	18.2%	% of Site
Total Proposed Site Impervious Coverage =	45.5%	% of Site
Effective Proposed Site Impervious Coverage =	36.4%	% of Site
Specify Source of Maximum Allowable Impervious Coverage:	Table	(None or Table)
Allowable Site Impervious Cover from Maximum Impervious Cover Table:	65.0%	
Note: See Maximum Impervious Cover Table Worksheet for Details		

Points Subtotal: 20

C. Compare Proposed Site Disturbance with Maximum Allowable Site Disturbance Permitted by Municipal Ordinance:

Total Proposed Site Disturbance =	100%	% of Site
Does Municipality have a Maximum Site Disturbance Ordinance?	No	(Yes or No)
Number of Such Municipal Ordinance =		
Maximum Allowable Site Disturbance by Such Municipal Ordinance =		% of Site

Points Subtotal: 0

D. Describe Proposed Runoff Conveyance System:

Total Length of Runoff Conveyance System =	1269	Feet
Length of Vegetated Runoff Conveyance System =	350	Feet
% of Total Runoff Conveyance System That is Vegetated =	28%	

Points Subtotal: 26

E. Single Family Residential Lot Clustering:

Percent of Total Site Area that will be Clustered =		% of Site
Minimum Single Family Standard Lot Size per Zoning (Note: 1/2 Acre or Greater) =		Acres
Maximum Proposed Single Family Cluster Lot Size (Note:1/4 Acre or Less) =		Acres
Percent of Clustered Portion of Site to be Preserved as Vegetated Open Space =		% of Clustered Site Portion

Points Subtotal: 0

F. Will the Following be Utilized to Minimize Soil Compaction?

Total Proposed Vegetated Site Area		Acres
Proposed Vegetated Areas to Incorporate Soil Amendment as Necessary	Yes	(Yes or No)
% of Proposed Vegetated Areas to Incorporate Soil Amendment if Necessary: (Note: Do Not Include Area of Proposed Infiltration or Bioretention Basins)	9%	% of Proposed Lawn Areas

Points Subtotal:	1
Total Existing Site Points:	318
Total Proposed Site Points:	210
Ratio of Proposed to Existing Site Points:	66%
Required Site Points Ratio:	65%

Nonstructural Point System Results: Proposed Nonstructural Measures are Adequate

SECTION 10

REMAINING AREA RUNOFF
(FROM AREA B-1)

REMAINING AREA FLOWS

(FROM AREA B-1)

MODIFIED RATIONAL METHOD

Q=CiA

C LAWN	=	0.51
C IMPERVIOUS	=	0.99

RUNOFF COEFFICIENT

2 YEAR =	0.560
10 YEAR =	0.560
25 YEAR =	0.560
100 YEAR =	0.560

INTENSITY

From Section 4 pg. 4.13

2 YEAR INTENSITY=	2.36	IN/HR	24	min
10 YEAR INTENSITY=	3.85	IN/HR	19	min
25 YEAR INTENSITY=	6.13	IN/HR	11	min
100 YEAR INTENSITY=	5.23	IN/HR	23	min

FLOW

Q2	=	0.560	x	2.360	in/hr	x	0.112	Ac	=	0.148	cfs
Q10	=	0.560	x	3.850	in/hr	x	0.112	Ac	=	0.241	cfs
Q25	=	0.560	x	6.130	in/hr	x	0.112	Ac	=	0.384	cfs
Q100	=	0.560	x	5.230	in/hr	x	0.112	Ac	=	0.328	cfs

SECTION 11

RUNOFF TO CULTEC CHAMBERS

Groundwater Recharge Target Area Distribution

Target Area	Recharge Target Area (sf.)	
	Cultec Chambers A (8-330XLHD)	Cultec Chambers B (3-330XLHD)
A2	0.00	488.00
A4	1,044.00	0.00
A5	1,042.00	0.00
A7	954.00	0.00
A8	955.00	0.00
A10 (3/4 of the area)	783.00	0.00
A12 (Half)	521.00	0.00
A17	0.00	483.00
A18	0.00	471.00
A19	0.00	541.00
A20	0.00	546.00
A21	0.00	466.00
A22	566.00	0.00
A23	572.00	0.00
A24	422.00	0.00
Total Area	**6,859.00**	**2,995.00**

SECTION 12

PIPE CAPACITY CALCULATIONS

STRUCTURE TO STRUCTURE	TRIBUTARY AREAS	INVERT UP-STREAM	INVERT DOWN-STREAM	LENGTH (ft)	PIPE Ø (ft)	TYPE OF PIPE	SLOPE %	100 YEAR FLOW Q (CFS)	CAPACITY (cfs)	DESIGN CHECK	MEAN VELOCITY (FPS)
A INLET NO.1 TO DS NO.2	A16	424.50	423.50	43.0	12	PVC	2.33%	0.51	9.54	OK	12.07
RD6 TO RD5	A17	430.00	427.41	37.0	6	PVC	7.00%	0.09	1.75	OK	8.95
RD5 TO RD4	A17,A18	427.41	427.39	2.0	6	PVC	1.00%	0.18	0.66	OK	3.38
RD4 TO RD3	A17,A18,A19	427.39	426.97	42.0	6	PVC	1.00%	0.28	0.66	OK	3.38
RD3 TO RD2	A17,A18,A19, A20	426.97	426.95	2.0	6	PVC	1.00%	0.38	0.66	OK	3.38
RD2 TO RD1	A17,A18,A19, A20,A21	426.95	426.57	38.0	6	PVC	1.00%	0.47	0.66	OK	3.38
RD1 TO CC B	A2,A17,A18,A 19,A20,A21	426.57	426.50	7.0	8	PVC	1.00%	0.66	1.43	OK	4.09
CC B TO DS No.2	Overflow	424.25	424.0	5.0	8	PVC	5.00%	0.66	3.19	OK	9.15
RD14 TO RD13	A22	436.00	435.00	21.0	6	PVC	4.76%	0.10	1.45	OK	7.37
RD13 TO RD12	A22,A23	435.00	433.50	23.0	6	PVC	6.52%	0.20	1.69	OK	8.62
RD12 TO RD11	A22,A23	433.50	433.46	2.0	6	DIP	2.00%	0.20	0.86	OK	4.39
RD11 TO CO1	A22,A23	433.46	433.20	13.0	6	DIP	2.00%	0.20	0.86	OK	4.39
CO1 TO CC A	A22,A23,A24	433.20	431.00	47.0	6	DIP	4.68%	0.28	1.31	OK	6.70
RD10 TO RD9	A25	433.00	432.98	2.0	6	PVC	1.00%	0.08	0.66	OK	3.38
RD9 TO RD8	A25,A26	431.00	429.50	22.0	6	DIP	6.82%	0.18	1.59	OK	8.08
RD8 TO RD7	A25,A26,A27	429.50	428.00	22.0	6	PVC	6.82%	0.28	1.59	OK	8.08
RD7 TO DS No.1	A25,A26,A27	428.00	427.50	6.0	6	PVC	8.33%	0.28	1.91	OK	9.75
A Inlet NO.3 TO A Inlet NO.2	A3a	430.00	429.50	27.0	12	DIP	1.85%	0.70	5.24	OK	6.68
A Inlet NO.2 TO SF NO.1	A1a,A3a	429.50	425.60	60.0	12	DIP	6.50%	1.38	9.84	OK	12.53
TD NO.1 TO SF NO.1	A1b, A3b	426.10	426.00	10.0	12	DIP	1.00%	1.01	3.45	OK	4.40
SF NO.1 TO DS NO.1	A1a,A1b,A3a, A3b	423.30	423.10	4.0	12	DIP	5.00%	1.01	7.71	OK	9.82
RD28 RD 27	A4	435.91	434.11	22.5	6	PVC	8.00%	0.19	1.87	OK	9.55
RD27 TO RD25	A4	434.11	432.23	23.5	6	PVC	8.00%	0.19	1.87	OK	9.55
RD26 TO PIPE	A5	432.38	432.34	4.0	6	PVC	1.00%	0.19	0.66	OK	3.78
RD25 TO RD24	A4,A5	432.23	432.00	22.5	6	PVC	1.00%	0.38	0.66	OK	3.78
RD24 TO CC A	A4,A5	432.00	431.00	13.0	6	PVC	1.00%	0.38	1.83	OK	9.37
RD18 TO RD19	A10(3/4)	431.34	431.11	22.5	8	DIP	1.00%	0.14	1.31	OK	3.75
RD19 TO CC A	A10(3/4)	431.11	431.00	11.0	8	PVC	1.00%	0.14	1.42	OK	4.09
CC A OVERFLOW	A4,A5,A7,A8, A10(3/4), A12(1/2)A22, A23,A24	433.09	432.79	20.0	8	PVC	1.50%	1.25	1.75	OK	5.01
RD17 TO RD16	A11	424.91	424.79	12.0	8	PVC	1.00%	0.19	1.42	OK	4.09
RD16 TO RD15	A11	424.79	424.56	22.5	8	DIP	1.00%	0.19	1.31	OK	3.75
RD15 TO PIPE	A11	424.56	424.52	4.0	8	PVC	1.00%	0.19	1.42	OK	4.09

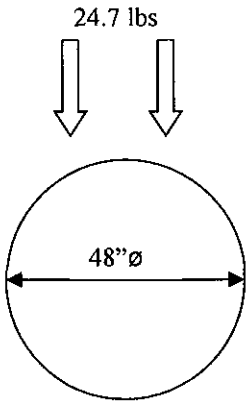
STRUCTURE TO STRUCTURE	TRIBUTARY AREAS	INVERT UP-STREAM	INVERT DOWN-STREAM	LENGTH (ft)	PIPE Ø (ft)	TYPE OF PIPE	SLOPE %	100 YEAR FLOW Q (CFS)	CAPACITY (cfs)	DESIGN CHECK	MEAN VELOCITY (FPS)
RD32 TO RD31	A7	436.76	434.24	31.5	6	PVC	8.00%	0.18	1.87	OK	9.55
RD31 TO RD30	A7	434.24	434.18	5.5	6	PVC	1.00%	0.18	0.66	OK	3.78
RD30 TO RD29	A7,A8	434.18	432.92	31.5	6	PVC	4.00%	0.36	1.32	OK	6.75
RD29 TO CC A	A7,A8	432.92	431.00	24.0	6	PVC	8.00%	0.36	1.87	OK	9.55
RD23 TO CC A	A12(1/2)	431.23	431.00	23.0	6	PVC	1.00%	0.09	0.66	OK	3.78
RD22 TO RD 21	A12(1/2)	426.59	426.53	5.5	6	PVC	1.00%	0.09	0.66	OK	3.38
RD21 TO RD20	A12(1/2),A13	426.53	426.21	31.5	6	PVC	1.00%	0.27	0.66	OK	3.38
RD20 TO PIPE	A12(1/2),A13	426.21	426.15	6.0	6	PVC	1.00%	0.27	0.66	OK	3.38
2X2 INLET NO.1 TO DS NO.1	A6,A9,A10(1/4) A11,A12(1/2), A13, A14	426.35	423.50	126.0	10	PVC	2.26%	1.09	3.89	OK	7.14
DS NO.2 TO DS NO.3	DEVELOPED DISCH.	420.00	419.85	12.0	12	RCP	1.25%	1.86	3.98	OK	5.07
DS NO.3 TO DMH NO1	DEVELOPED DISCH	418.85	418.75	10.0	12	RCP	1.00%	1.86	3.56	OK	4.54

Abbreviations: CC - Cultec Chambers; DMH - Drainage Manhole; DS - Drainage Structure; RD - Roof Drain; SF - Storm Filter

SECTION 13

BUOYANCY CALCULATIONS

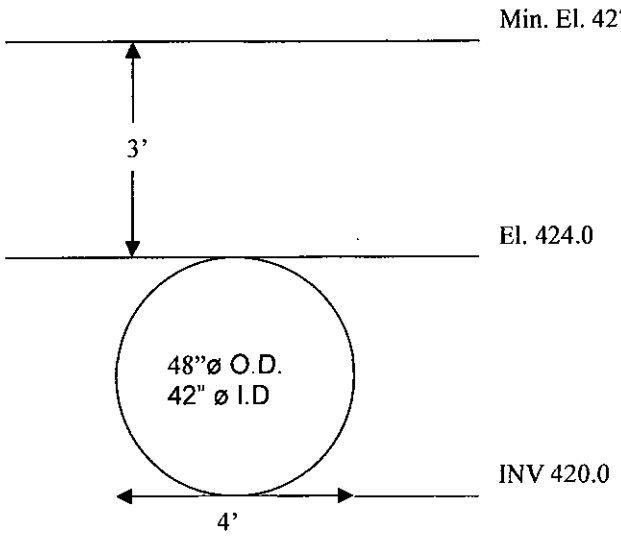
Buoyancy Calculations



Inner Diameter = 42"
Volume per Foot = (9.62 sf)*(1ft) = 9.62 cf
Outer Diameter = 48"

Weight of Pipe = 24.7 lbs/ft

Detention System Pipes: Maximum water Elev. 424.5 (pipes fully submerged)
Pipe Fully Submerged with 3' Soil above Pipe

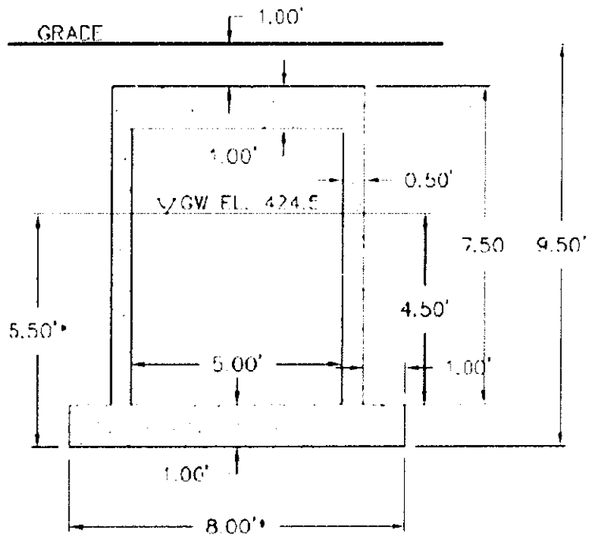


Uplift Force = (Volume)*(Unit Weight of Water)
= (9.62 cf)*(62.4 lb/cf) = 600.29 lbs

Opposing Force (4' soil) = (Volume above pipe spring line)*(Unit Weight of Soil) + (Weight of Pipe)
= (13.72 lb/cf.)*(100 lb/cf) + (24.7 lbs) = 1,396.7 lbs

Factor of Safety; = Opposing force/Uplift Force:
= 1,396.7/600.29 = 2.33 OK

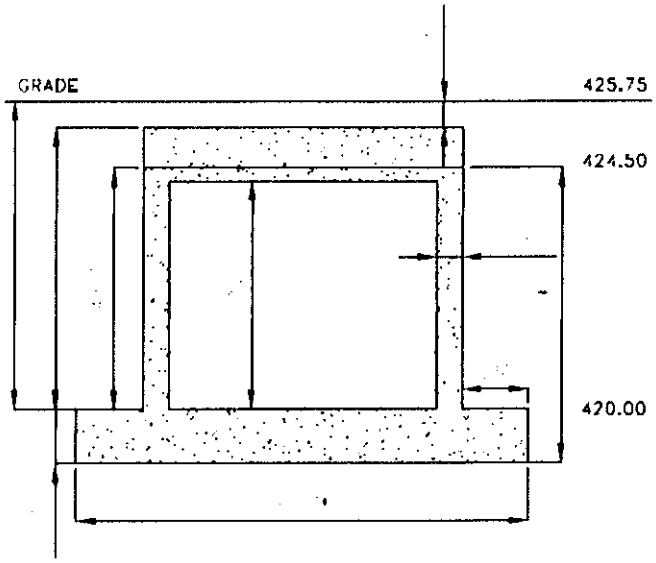
Drainage Structure No. 1: Max. Groundwater Elev. 424.5 (structure partially submerged)



DS No.1
NOT TO SCALE

Uplift Force pr foot	= 2,184 (lbs)
Area of Water	= 4.5 (ft.)*6(ft.) + 1(ft.)*8(ft.) = 35 (sf.)
Weight of water	= 62.4 (lb/cf.)
Weight of Structure per foot	= 3,075 (lbs)
Area of Structure	= 1(ft.)*[6(ft.)+8(ft.)]+2*0.5(ft.)*6.5(ft.)=20.5(sf.)
Weight of Concrete	= 150 lb/cf
Weight of Soil per foot	= 2,300 lbs
Area of Structure	= 1(ft.)*6(ft.)+2*1(ft.)*8.5(ft.)=23.0(sf.)
Weight of Concrete	= 100 (lb/cf)
Opposing Force	= (Weight of Soil) + (Weight of Structure)
	= 2,300(lbs) + 3,075(lbs) = 5,375(lbs)
Factor of Safety	= (Opposing) / Uplift
	= 5,375 (lbs) / 2,184 (lbs) = 2.46>2.0 OK

Drainage Structure No. 2: Max. Groundwater Elev. 424.5 (structure partially submerged)



DS NO.2
NOT TO SCALE

Uplift Force pr foot	= 2,215.2 (lbs)
Area of Water	= 4.5 (ft.)*6(ft.) + 1(ft.)*8.5(ft.) = 35.50 (sf.)
Weight of water	= 62.4 (lb/cf.)
Weight of Structure per foot	= 2,812.5 (lbs)
Area of Structure	= 1(ft.)*[6(ft.)+8.5(ft.)]+2*0.5(ft.)*4.25(ft.)=18.75(sf.)
Weight of Concrete	= 150 lb/cf
Weight of Soil per foot	= 1,737.5 lbs
Area of Structure	= 2.5*1(ft.)*5.75+0.5*1(ft.)*6(ft.)=17.375(sf.)
Weight of Concrete	= 100 (lb/cf)
Opposing Force	= (Weight of Soil) + (Weight of Structure)
	= 1,737.5(lbs) + 2,812.5(lbs) = 4.550 (lbs)
Factor of Safety	= (Opposing) / Uplift
	= 4,550 (lbs) / 2,215.2 (lbs) = 2.05>2.0 OK

SECTION 14

DRAINAGE AREA MAP & CAPACITY OF DITCH

DITCH DRAINAGE AREA AND FLOW

C PERVIOUS =	0.51
C IMPERVIOUS =	0.99
C PERVIOUS PAVING=	0.92
Tc =	19 MIN.

25 Year Intensity (in/hr) = 4.60

						C	Q (cfs)
AREA	PERVIOUS SF	IMPERVIOUS SF	PERVIOUS PAVING SF	TOTAL SF	TOTAL ACRES	25 Year	25 Year
C1	21,891	22,383	3,268	47,542	1.091	0.76	Outflow 1.564
C2	43,157	7,583	-	50,740	1.165	0.58	3.11
C3	37,520	4,151	-	41,671	0.957	0.56	2.47
GRAND TOTAL	102,568	34,117	3,268	139,953	3.213	0.63	6.96

Flow to Ditch (onsite) = $Outflow_{25}$ + C2 = (1.564 cfs) + (3.11 cfs) = 4.674 cfs
Flow to Downstream of Drainage Ditch = C1 + C2 + C3 = 6.96 cfs

Ditch Slope	Distance (ft)	Δ Elevation	Slope 1/1
0+16 to 0+42	26	0.89	0.034
0+42 to 0+71	29	1.15	0.040
0+71 to 0+97	26	0.35	0.013
0+97 to 1+23	26	0.35	0.013

0+16	4.5' Bottom Width		
	LT	1	:1
	RT	6	:1

(H:V)

0+42	3.5' Bottom Width		
	LT	1.5	:1
	RT	1.5	:1

0+71	3.5' Bottom Width		
	LT	1.5	:1
	RT	1	:1

Flow to Downstream Ditch = 6.96 cfs (25 year)

Manning's Roughness Coefficient from RSIS = 0.027

(for excavated channel, straight short grass, few weeds)

Results from Manning's Equation

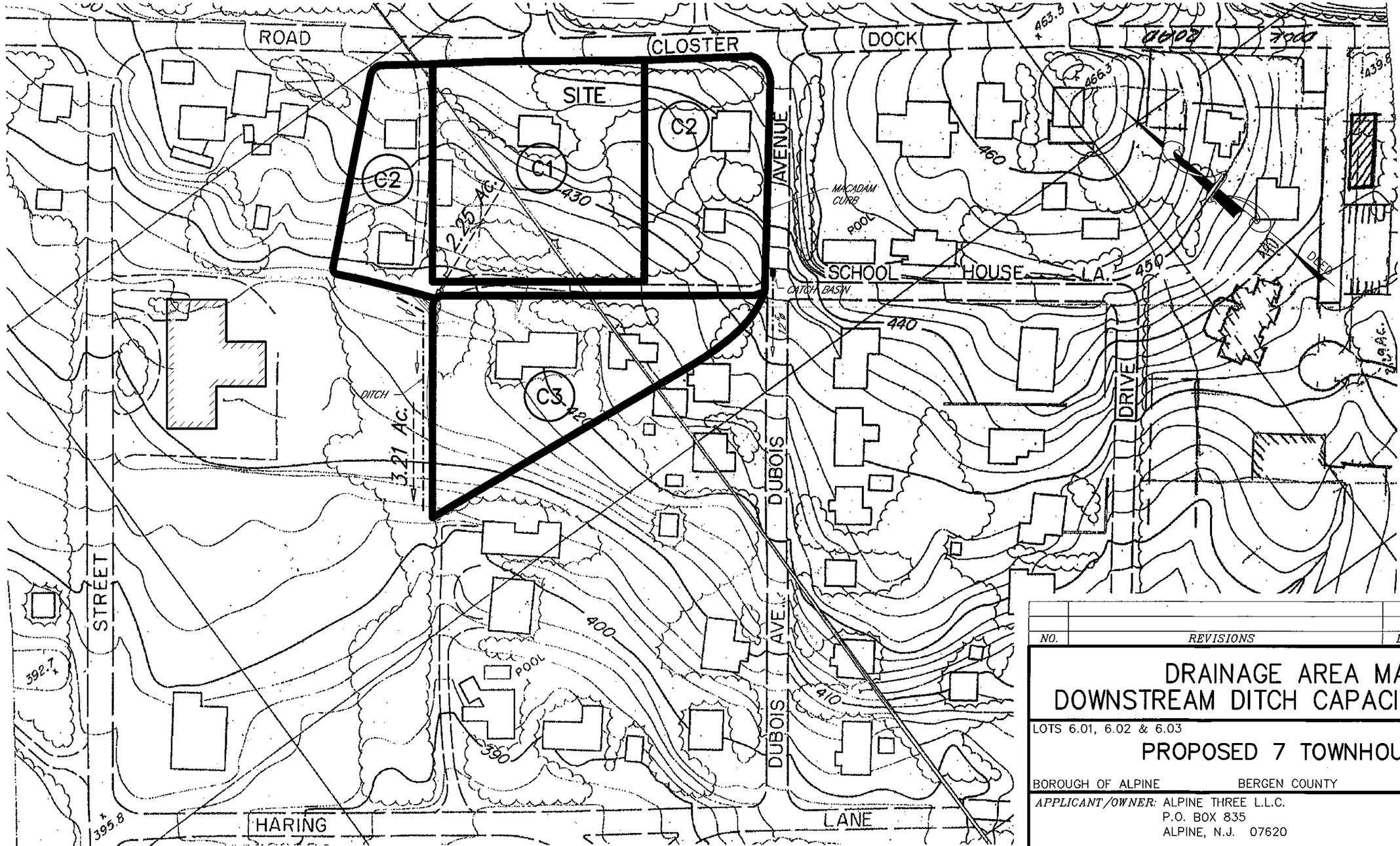
0+16		
	Depth =	0.23 ft
	Vel =	3.43 ft/sec

0+42		
	Depth =	0.27 ft
	Vel =	3.90 ft/sec

0+71		
	Depth =	0.37 ft
	Vel =	2.88 ft/sec

Conclusion:

Existing ditch has the capacity for the proposed flow from site.



AREA	PERVIOUS SF	IMPERVIOUS SF	PERVIOUS (GRAVEL) SF	TOTAL SF	TOTAL ACRES
C1	26,357	18,721	2,462	47,540	1.091
C2	43,157	7,583	-	50,740	1.165
C3	37,520	4,151	-	41,671	0.957
GRAND TOTAL	107,034	30,455	2,462	139,951	3.213

0 100 200

SCALE: 1"=100'

NO.	REVISIONS	DATE	BY	CHKD

DRAINAGE AREA MAP
DOWNSTREAM DITCH CAPACITY CALC.'S

LOTS 6.01, 6.02 & 6.03 BLOCK 43

PROPOSED 7 TOWNHOUSES

BOROUGH OF ALPINE BERGEN COUNTY NEW JERSEY

APPLICANT/OWNER: ALPINE THREE L.L.C.
P.O. BOX 835
ALPINE, N.J. 07620

MICHAEL J. HUBSCHMAN P.E., P.P.
PROFESSIONAL ENGINEER AND PLANNER
N.J.P.E. NO. 29497 N.J.P.P. NO. 3200

5-22-19
DATE

HUBSCHMAN ENGINEERING, P.A.
ENGINEERS – PLANNERS – SURVEYORS
263A S. WASHINGTON AVE., BERGENFIELD, NJ 07621
201-384-5666

DRAWN BY:	B.W.
CHKD BY	MJH
SCALE:	1"=100'
DRAWING NO.	REV.
495.1	-
1 OF 1	

SECTION 15

READINGS FOR 6" ø WEIR

6"ø PVC Weir Readings	
Date	GPD
3/5/2013	*Meeting with Gary VanderVeer
3/12/2013	21,861
3/13/2013	7,153
3/14/2013	8,806
3/15/2013	4,418
3/18/2013	3,032
3/19/2013	4,418
3/26/2013	2,440
4/10/2013	1,916

Max Flow = 21,861 GPD (1 day/24 hours) (1 hour/3600 seconds) (1CF/ 7.5 Gal) = **0.03 CF**

SECTION 16

CONDUIT OUTLET PROTECTION

Outlet protection improvements are not required since the post development flows for 2, 10- and 25-year design storms at this location have been reduced and no disturbance is proposed for the existing pipe or the headwall.

C-2 AREA FLOW CALCULATIONS $Q_i = C^*I_i^*A$

Design Storm	Weighted C	$I_{(i)}$ (in/hr)	A (ac)	Q (cfs)
Q_2	0.58	2.66	1.165	1.80
Q_{10}	0.58	3.86	1.165	2.61
Q_{25}	0.58	4.60	1.165	3.11

Intensities (See Point Precipitation Frequency Data)

Min	2-Year	10-Year	25-Year
15	2.9	4.21	5.02
19	**2.66**	**3.86**	**4.60**
30	2	2.89	3.45

Note:
Weighted C, Tc =19 min and area of C-2 from pg. 14.1 of this report.

POINT OF DISCHARGE
OUTLET PEAK FLOWS SUMMARIES
EXISTING 12" RCP OUTLET; 2, 10 AND 25-YEAR STORMS

2-YEAR DESIGN STORM

Tributary Area to Outlet	Existing 2-yr. peak flows (cfs)	Proposed 2-yr. peak flows (cfs)	Remarks
Project Site, Study Area (C-1)	1.72	0.648	Peak flow rate is reduced by 62%
C-2 (Offsite)	1.80	1.80	Peak flow rate remains unchanged
Total	3.52	2.448	Peak flow rate is reduced by 30%

10-YEAR DESIGN STORM

Tributary Area to Outlet	Existing 10-yr. peak flows (cfs)	Proposed 10-yr. peak flows (cfs)	Remarks
Project Site, Study Area (C-1)	2.62	1.431	Peak flow rate is reduced by 45%
C-2 (Offsite)	2.61	2.61	Peak flow rate remains unchanged
Total	5.23	4.041	Peak flow rate is reduced by 23%

25-YEAR DESIGN STORM

Tributary Area to Outlet	Existing 25-yr. peak flows (cfs)	Proposed 25-yr. peak flows (cfs)	Remarks
Project Site, Study Area (C-1)	3.13	1.56	Peak flow rate is reduced by 50%
C-2 (Offsite)	3.11	3.11	Peak flow rate remains unchanged
Total	6.24	4.67	Peak flow rate is reduced by 25%

Note:
Flow for Area C-1(Project Site, Study Area) is from Stormwater Management Summary Table on pg. ii; Present Runoff from Study Area.

SECTION 17

GRASSED WATERWAY CALCULATIONS

INTRODUCTION:

The site drainage collection system of the proposed development incorporates two Grass Lined Waterways (Swales) which, in the engineering drawings are identified as North West Grass and South East Grass Lined Swales. The North West (NW) Swale is approximately 120 lf long and the South East Grass Lined Swale is approximately 230 lf long.

Design Data for both swales are summarized in the following table:

Grass Lined Waterway Design Data Summary

Waterway (Swale) ID	Geometry				Slopes (%) [2]			Flows [1]				
	Base Width (ft)	Side Slopes H/V	Depth (ft)	Length (ft)	Max.	Avg.	Min.	Tributary Area ID	Q_2	Q_{10}	Q_{25}	Q_{100}
North West	2.0	4.0	1.0	120	11.24	7.50	5.70	A16	0.235	0.342	0.409	0.511
								Total Q	**0.235**	**0.342**	**0.409**	**0.511**
South East	2.0	4.0	1.0	230	9.08	6.57	4.80	A6	0.073	0.107	0.127	0.160
								A9	0.070	0.101	0.121	0.151
								A14	0.126	0.183	0.219	0.274
								Total Q	**0.269**	**0.391**	**0.467**	**0.585**

Notes:
1. Data obtained from pg. 3.3 of this report.
2. Data obtained from engineering drawing - 495-47.

EVALUATION:

Based on the design data table, a Hydraflow Express Extension for Autodesk computer program was utilized to calculate the maximum velocities. Conservatively, maximum flows are applied to the steepest section of the swale.

CONCLUSION:

As shown in the Hydraflow reports that follow, the maximum velocities for the 100-year design storm event for the North West (2.75 fps) and South East (2.78 fps) swales are below the maximum allowable velocities of 3.0 fps shown on NJ Standards for Soil Erosion and Sediment Control - Table 18-1 Maximum Allowable Velocities by Soil Texture (copy enclosed in Appendix 1) for sod applications.

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Mar 31 2020

495.1NORTH WEST GRASS LINED SWALE (100-YR. FLOW; MAX SLOPE)

Trapezoidal

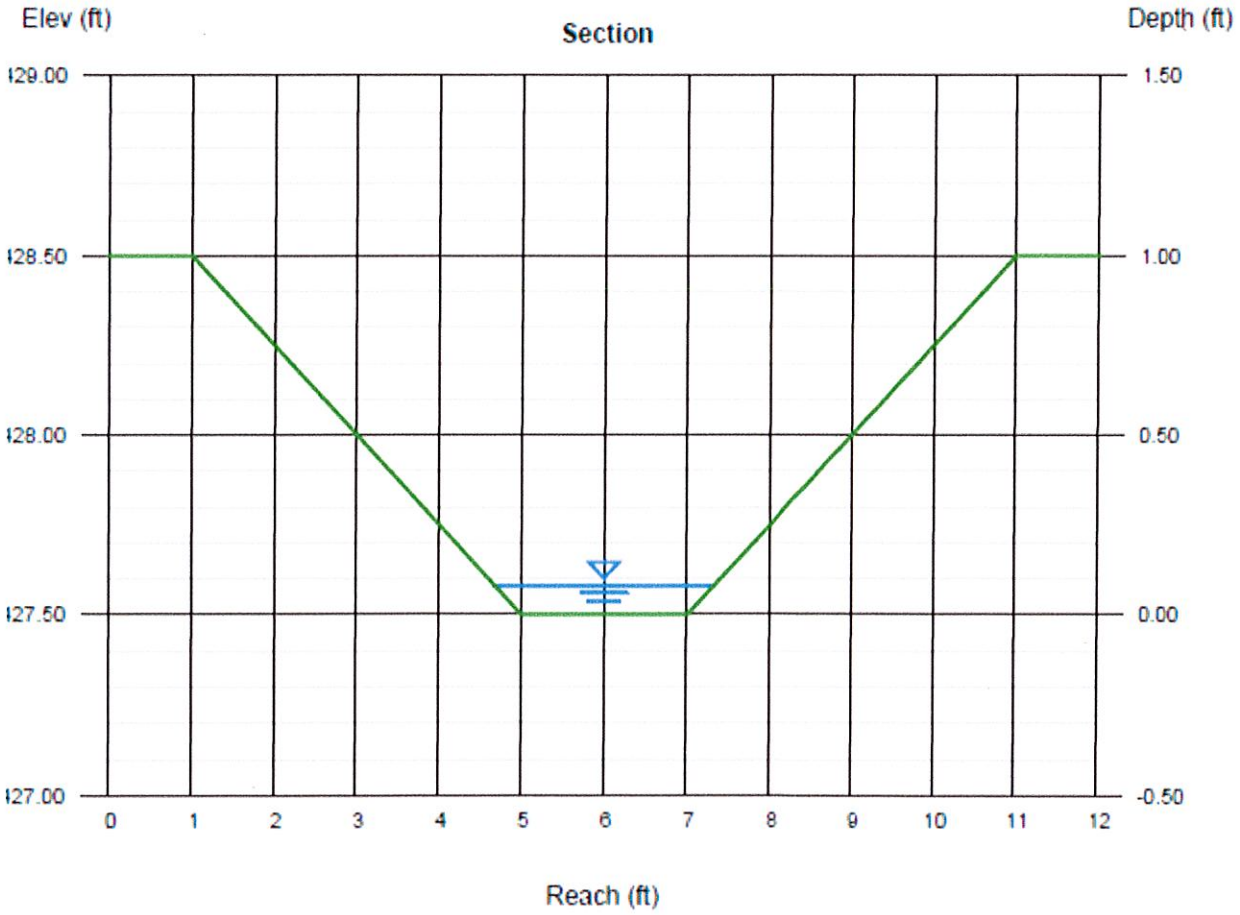
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 427.50
Slope (%)	= 11.24
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.51

Highlighted

Depth (ft)	= 0.08
Q (cfs)	= 0.510
Area (sqft)	= 0.19
Velocity (ft/s)	= 2.75
Wetted Perim (ft)	= 2.66
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 2.64
EGL (ft)	= 0.20



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Mar 31 2020

495.1 SOUTH EAST GRASS LINED SWALE (100-YR. FLOW; MAX SLOPE)

Trapezoidal

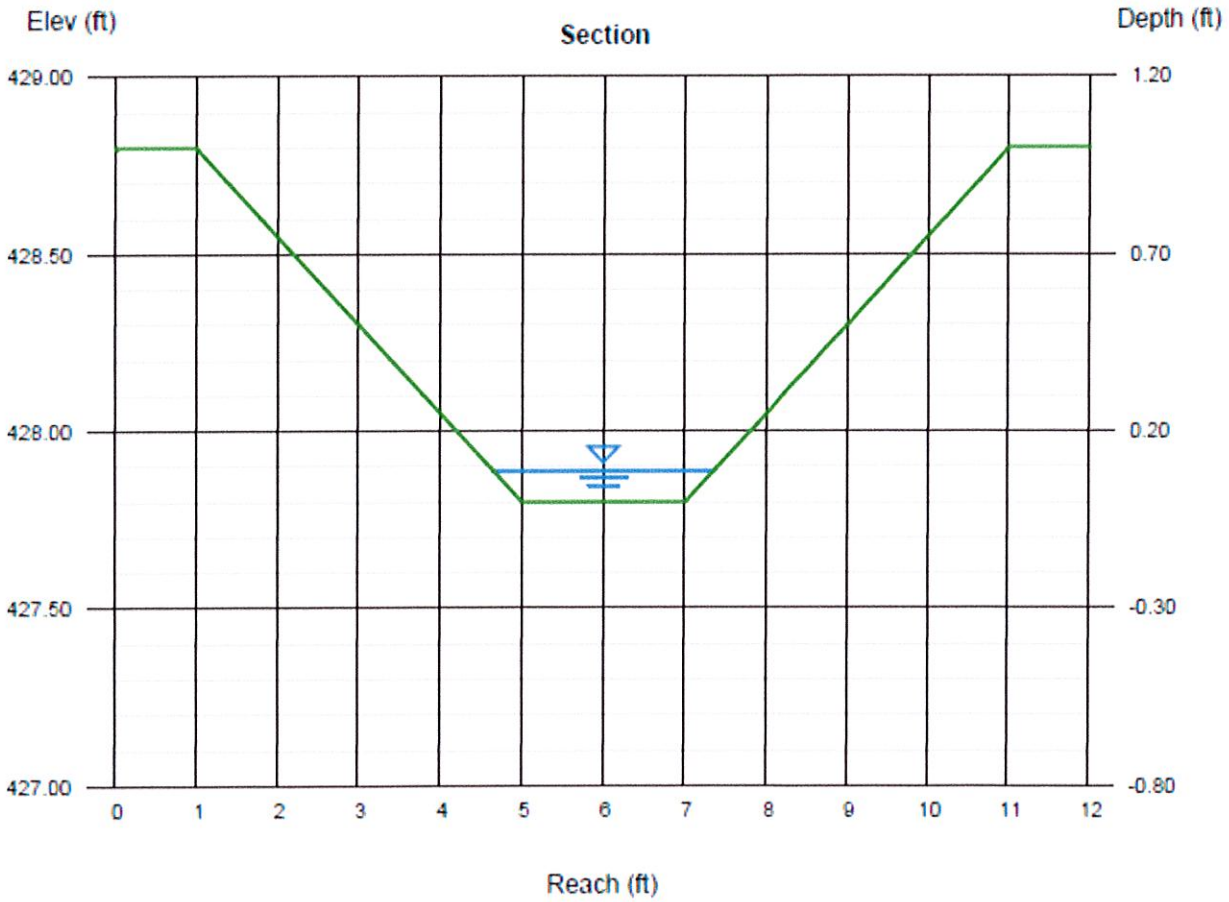
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 427.80
Slope (%)	= 9.08
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.59

Highlighted

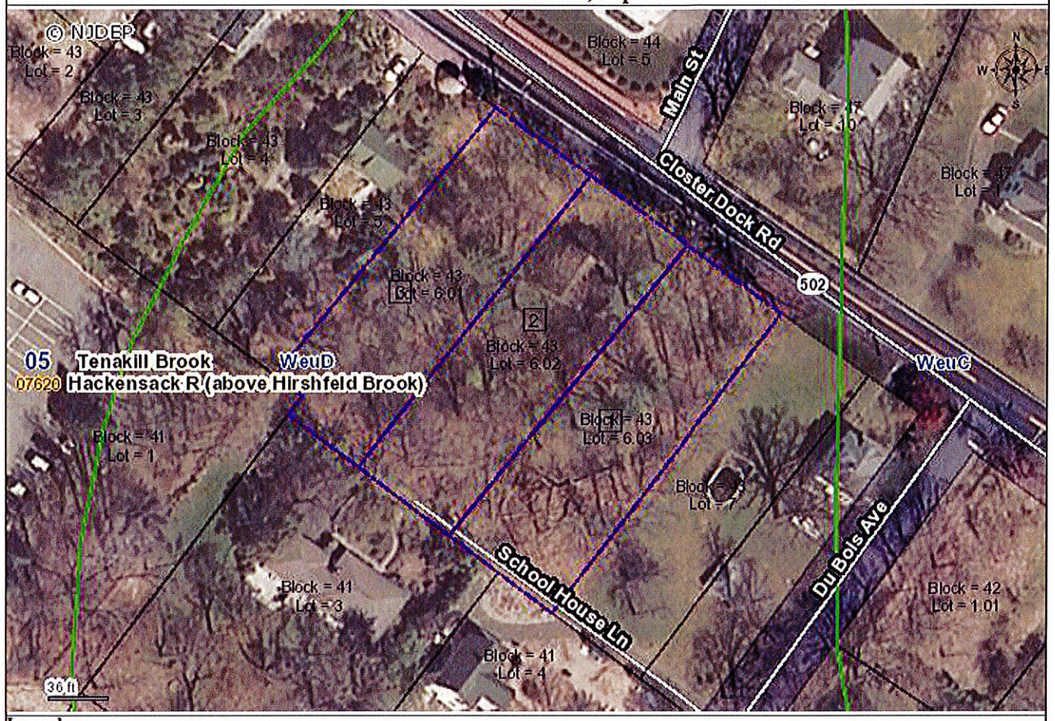
Depth (ft)	= 0.09
Q (cfs)	= 0.590
Area (sqft)	= 0.21
Velocity (ft/s)	= 2.78
Wetted Perim (ft)	= 2.74
Crit Depth, Yc (ft)	= 0.13
Top Width (ft)	= 2.72
EGL (ft)	= 0.21



APPENDIX 1

MISC. MATERIALS

Closter Dock Road, Alpine



Legend

GeoWeb
Streams
- Coastline
- Stream/River
- Artificial Path
- Connector
- Canal/Ditch
- Pipeline
- Category One Waters

Surface Water Quality Classification
- DRBC-Zone-1C
- DRBC-Zone-1D
- DRBC-Zone-1E
- DRBC-Zone-2
- DRBC-Zone-3
- DRBC-Zone-4
- DRBC-Zone-5
- FW1
- FW1-TM
- FW1-TP
- FW2-NT
- FW2-NT/SE1
- FW2-NT/SE2
- FW2-NT/SE3
- FW2-NTC1
- FW2-NTC1/SE1
- FW2-NTC1/SE1/SC
- FW2-TM
- FW2-TM/SE1
- FW2-TMC1
- FW2-TP
- FW2-TPC1
- PL
- PL-TM
- SE1
- SE1C1
- SE2
- SE3
- Water Bodies
- Watershed Management Areas
- Watersheds (HUC11)
- Sub-Watersheds (HUC14)
- Soils (SSURGO)
- Wetlands (2012)
- Upper Wetlands Boundary
- Parcels Data (Block and Lot)
- Roads NJ (Centerlines) (1:4999 to 1:999 scale)

Major Roads (1:200000 to 1:999 scale)
- Toll Road
- Interstate
- US Highway
- State Highway
- County 500 Series
- County 600 Series
- ZIP Codes (1:29999 to 1:999 scale)
- Counties

Map Printed On {2016-05-02 10:40}

Soils (SSURGO)

Rec	Map Unit Symbol	Map Unit Name
1	WeuD	Wethersfield-Urban land complex, 15 to 25 percent slopes

Recommended Coefficient of Runoff Values for Various Selected Land Uses

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land	without conservation treatment	0.49	0.67	0.81	0.88
	with conservation treatment	0.27	0.43	0.67	0.67
Pasture or Range Land Meadow	poor condition	0.38	0.63	0.78	0.84
	good condition	---	0.25	0.51	0.65
	good condition	---	---	0.41	0.61
Wood or Forest Land	thin stand, poor cover, no mulch	---	0.34	0.59	0.70
	good cover	---	---	0.45	0.59
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries					
Good Condition	grass cover on 75% or more	---	0.25	0.51	0.65
Fair Condition	grass cover on 50% to 75%	---	0.45	0.63	0.74
Commercial and Business Area	85% impervious	0.84	0.90	0.93	0.96
Industrial Districts	72% impervious	0.67	0.81	0.88	0.92
Residential	average % impervious				
Average Lot Size (acres)					
1/8	65	0.59	0.76	0.86	0.90
1/4	38	0.29	0.55	0.70	0.80
1/3	30	---	0.49	0.67	0.78
1/2	25	---	0.45	0.65	0.76
1	20	---	0.41	0.63	0.74
Paved Areas	parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and Roads	paved with curbs & storm sewers	0.99	0.99	0.99	0.99
	gravel	0.57	0.76	0.84	0.88
	dirt	0.49	0.69	0.80	0.84

NOTE: Values are based on NRCS (formerly the SCS) definitions and are average values.
Source: Technical Manual for Land Use Regulation Program, Bureau of Inland and Coastal Regulations, Stream Encroachment Permits, New Jersey Department of Environmental Protection

Table 18-1 Maximum Allowable Velocities by Soil Texture

SOIL TEXTURE	Maximum Allowable Velocity (fps)	
	Seeded Vegetation**	Sod***
Sand	2.0	3.0
Silt loam, sandy loam, loamy sand, loam, muck	2.0	3.0
Silty clay loam, sandy clay loam	2.5	4.0
Clay, clay loam, sandy clay, silty clay	3.0	5.0

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.

2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a StormFilter System.

   Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:
time of concentration = 10 minutes
i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c=0.99 (runoff coefficient for impervious)
Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:
1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR[1] (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area[2] (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:
1. MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.
2. Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

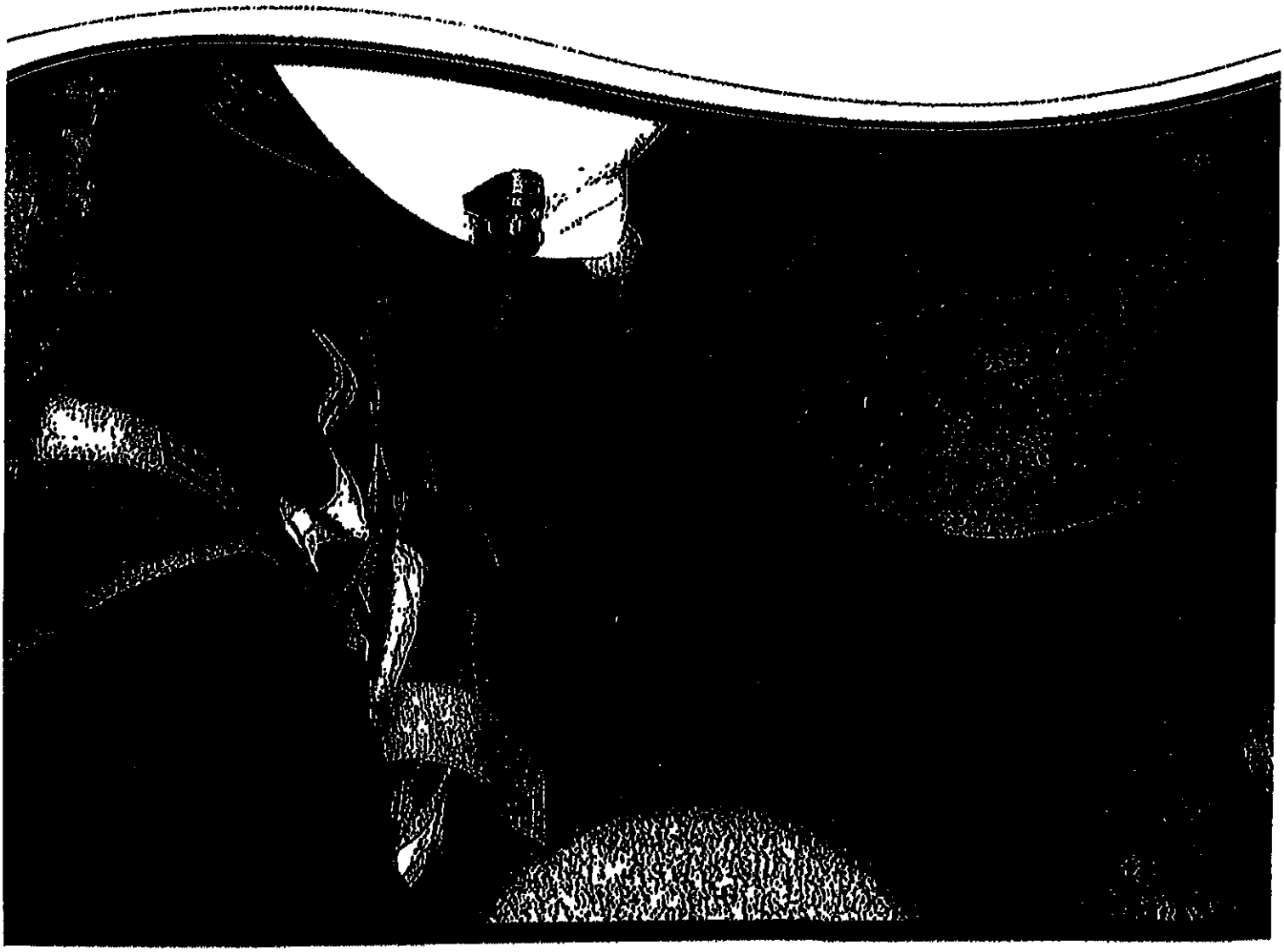
James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

CONTECH
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures



The Stormwater Management
StormFilter

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. Inspection
   - Inspection of the vault interior to determine the need for maintenance.
2. Maintenance
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

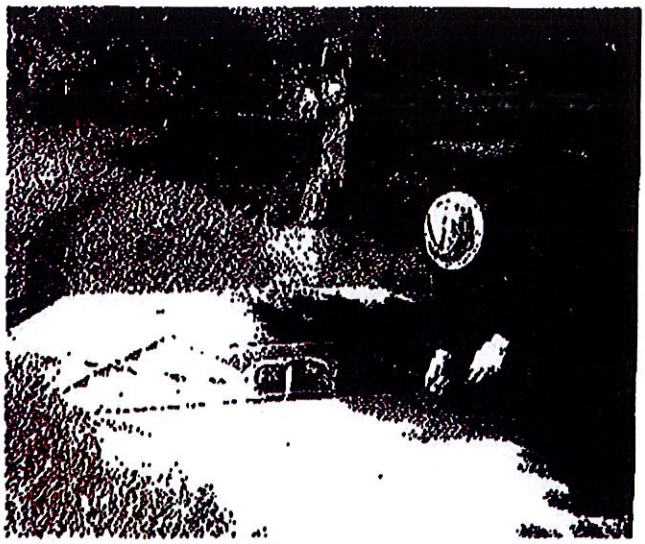
Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..



Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

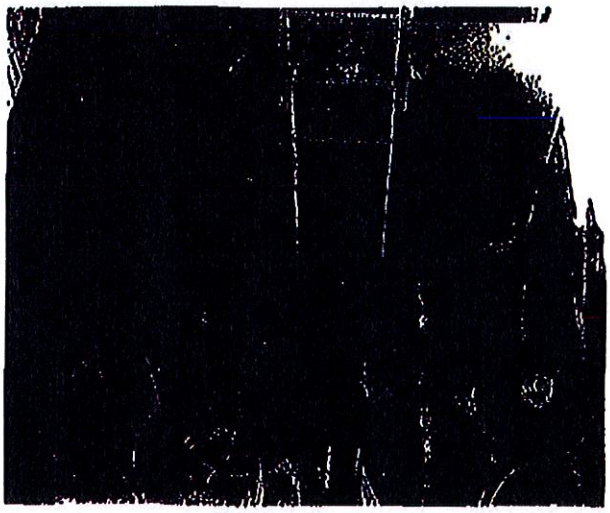
Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.



Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

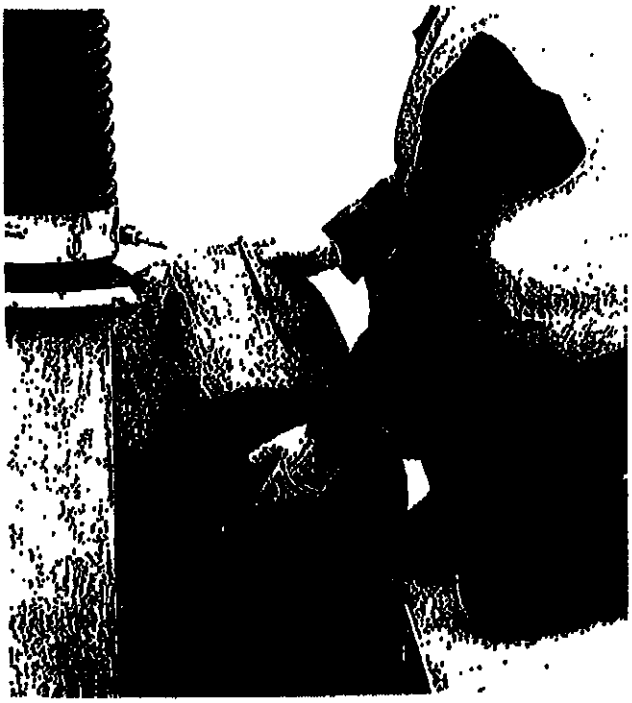
Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.



Inspection Report

Date: Personnel:

Location: System Size:

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: Date:

Sediment Depth on Vault Floor:

Structural Damage:

Estimated Flow from Drainage Pipes (if available):

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water:

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal:

☐ Minor Structural Repairs:

☐ Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source:

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source:

Erosion of Landscaped Areas: Yes ☐ No ☐ Source:

Items Needing Further Work:

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

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Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit *contech-cpi.com* or call 800.338.1122.

Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

APPENDIX 2

NOAA ATLAS 14 – POINT PRECIPITATION FREQUENCY DATA

NOAA Atlas 14, Volume 10, Version 3
Location name: Alpine, New Jersey, USA*
Latitude: 40.9491°, Longitude: -73.9291°
Elevation: 415.61 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.42 (3.47-5.60)	5.21 (4.09-6.60)	6.50 (5.08-8.27)	7.57 (5.88-9.68)	9.05 (6.78-12.0)	10.2 (7.45-13.8)	11.3 (8.02-15.8)	12.5 (8.46-18.0)	14.1 (9.18-21.1)	15.4 (9.76-23.5)
10-min	3.13 (2.46-3.97)	3.69 (2.89-4.68)	4.60 (3.60-5.86)	5.36 (4.16-6.86)	6.41 (4.80-8.51)	7.21 (5.27-9.76)	8.02 (5.68-11.2)	8.87 (5.99-12.8)	10.0 (6.51-15.0)	10.9 (6.91-16.6)
15-min	2.46 (1.93-3.11)	2.90 (2.27-3.67)	3.61 (2.82-4.59)	4.21 (3.27-5.38)	5.02 (3.76-6.68)	5.65 (4.14-7.65)	6.28 (4.45-8.79)	6.95 (4.70-10.0)	7.86 (5.10-11.7)	8.56 (5.42-13.0)
30-min	1.70 (1.33-2.15)	2.00 (1.57-2.53)	2.48 (1.94-3.16)	2.89 (2.24-3.70)	3.45 (2.58-4.58)	3.87 (2.84-5.25)	4.31 (3.05-6.03)	4.76 (3.22-6.87)	5.38 (3.49-8.03)	5.87 (3.71-8.93)
60-min	1.08 (0.851-1.37)	1.27 (0.998-1.61)	1.58 (1.24-2.01)	1.84 (1.43-2.35)	2.19 (1.64-2.91)	2.46 (1.80-3.34)	2.74 (1.94-3.83)	3.02 (2.04-4.36)	3.42 (2.22-5.10)	3.72 (2.36-5.67)
2-hr	0.726 (0.574-0.912)	0.840 (0.664-1.06)	1.03 (0.810-1.30)	1.18 (0.926-1.50)	1.40 (1.06-1.85)	1.56 (1.15-2.10)	1.73 (1.23-2.41)	1.91 (1.30-2.73)	2.15 (1.40-3.19)	2.34 (1.49-3.55)
3-hr	0.561 (0.446-0.703)	0.650 (0.515-0.815)	0.795 (0.628-1.00)	0.915 (0.719-1.16)	1.08 (0.820-1.42)	1.21 (0.894-1.62)	1.34 (0.957-1.86)	1.48 (1.00-2.11)	1.67 (1.09-2.47)	1.83 (1.16-2.76)
6-hr	0.350 (0.280-0.435)	0.411 (0.328-0.512)	0.510 (0.406-0.638)	0.593 (0.469-0.745)	0.706 (0.540-0.926)	0.792 (0.592-1.06)	0.882 (0.638-1.23)	0.984 (0.672-1.40)	1.13 (0.741-1.66)	1.25 (0.801-1.88)
12-hr	0.207 (0.166-0.255)	0.249 (0.200-0.308)	0.318 (0.255-0.395)	0.376 (0.299-0.469)	0.455 (0.351-0.595)	0.514 (0.388-0.688)	0.578 (0.423-0.804)	0.653 (0.447-0.921)	0.766 (0.503-1.12)	0.862 (0.552-1.28)
24-hr	0.119 (0.097-0.146)	0.146 (0.119-0.180)	0.191 (0.154-0.236)	0.228 (0.183-0.283)	0.279 (0.216-0.363)	0.317 (0.241-0.422)	0.358 (0.264-0.497)	0.407 (0.280-0.571)	0.483 (0.318-0.701)	0.548 (0.352-0.811)
2-day	0.068 (0.055-0.082)	0.083 (0.068-0.102)	0.109 (0.088-0.133)	0.130 (0.105-0.160)	0.159 (0.124-0.206)	0.181 (0.138-0.239)	0.204 (0.151-0.282)	0.233 (0.161-0.324)	0.276 (0.182-0.398)	0.313 (0.202-0.460)
3-day	0.049 (0.041-0.060)	0.060 (0.050-0.073)	0.078 (0.064-0.096)	0.093 (0.076-0.115)	0.114 (0.089-0.147)	0.129 (0.099-0.170)	0.146 (0.108-0.200)	0.166 (0.115-0.230)	0.196 (0.130-0.282)	0.222 (0.143-0.325)
4-day	0.040 (0.033-0.048)	0.048 (0.040-0.059)	0.062 (0.051-0.076)	0.074 (0.060-0.091)	0.090 (0.071-0.116)	0.102 (0.078-0.134)	0.115 (0.086-0.157)	0.130 (0.090-0.180)	0.154 (0.102-0.220)	0.174 (0.112-0.253)
7-day	0.027 (0.022-0.032)	0.032 (0.027-0.039)	0.041 (0.034-0.049)	0.048 (0.039-0.058)	0.058 (0.046-0.073)	0.065 (0.050-0.085)	0.073 (0.054-0.099)	0.082 (0.057-0.113)	0.096 (0.064-0.136)	0.107 (0.069-0.155)
10-day	0.022 (0.018-0.026)	0.026 (0.021-0.031)	0.032 (0.026-0.038)	0.037 (0.030-0.045)	0.044 (0.035-0.056)	0.050 (0.038-0.064)	0.055 (0.041-0.074)	0.062 (0.043-0.085)	0.071 (0.048-0.101)	0.079 (0.051-0.115)
20-day	0.015 (0.013-0.018)	0.017 (0.015-0.021)	0.021 (0.017-0.025)	0.024 (0.020-0.029)	0.028 (0.022-0.035)	0.031 (0.024-0.040)	0.034 (0.025-0.045)	0.038 (0.026-0.051)	0.042 (0.028-0.059)	0.046 (0.030-0.066)
30-day	0.013 (0.011-0.015)	0.014 (0.012-0.017)	0.017 (0.014-0.020)	0.019 (0.016-0.023)	0.022 (0.017-0.027)	0.024 (0.019-0.030)	0.026 (0.020-0.034)	0.029 (0.020-0.039)	0.032 (0.021-0.044)	0.034 (0.022-0.049)
45-day	0.010 (0.009-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.013-0.018)	0.017 (0.014-0.021)	0.019 (0.015-0.024)	0.020 (0.015-0.026)	0.022 (0.016-0.030)	0.024 (0.016-0.033)	0.025 (0.017-0.036)
60-day	0.009 (0.008-0.011)	0.010 (0.008-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.015)	0.014 (0.012-0.018)	0.016 (0.012-0.020)	0.017 (0.013-0.022)	0.018 (0.013-0.025)	0.020 (0.013-0.028)	0.021 (0.014-0.030)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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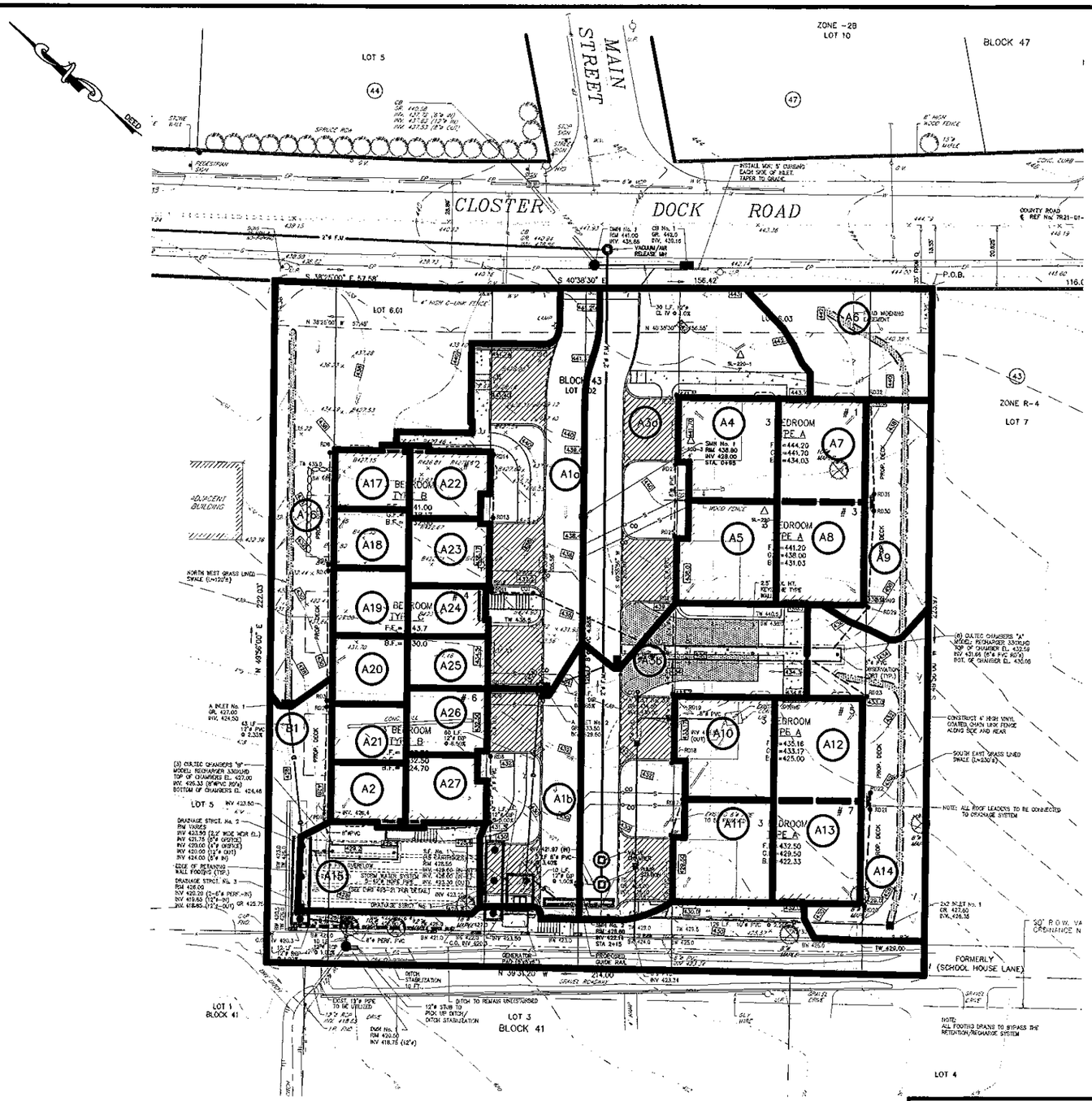
APPENDIX 3

PROPOSED DRAINAGE AREA MAP



LEGEND:

(A27) DRAINAGE SUB AREA ID

POROUS PAVEMENT

0 40 80

SCALE: 1"=40'

PROPOSED DRAINAGE AREAS

	AREA	PERVIOUS SF	IMPERVIOUS SF	PERVIOUS PAVING SF	TOTAL SF
TO DETENTION SYSTEM	A1a	611	2,232	1,184	4,027
	A1b	402	1,326	645	2,373
	A2	-	488	-	488
	A3a	1,913	2,127	743	4,783
	A3b	1,319	1,986	696	4,001
	A4	-	1,044	-	1,044
	A5	-	1,042	-	1,042
	A6	1,681	-	-	1,681
	A7	-	954	-	954
	A8	-	955	-	955
	A9	1,631	-	-	1,631
	A10	-	1,044	-	1,044
	A11	-	1,042	-	1,042
	A12	-	954	-	954
	A13	-	955	-	955
	A14	2,912	-	-	2,912
	A15	1,551	129	-	1,680
	A16	5,454	-	-	5,454
	A17	-	483	-	483
	A18	-	471	-	471
	A19	-	541	-	541
	A20	-	546	-	546
	A21	-	466	-	466
	A22	-	566	-	566
	A23	-	572	-	572
	A24	-	422	-	422
	A25	-	443	-	443
	A26	-	568	-	568
	A27	-	570	-	570
TO DETENTION		17,474	21,926	3,268	42,668
B1		4,415	457	-	4,872
GRAND TOTAL		21,889	22,383	3,268	47,540

NO.	REVISIONS	DATE	BY	CHKD
2.	PER ENGINEER'S COMMENTS DATED: 2-24-20 & 3-12--20	3-31-20	NM	MJH
1.	PER BCSCD COMMENTS DATED 9-18-19	9-23-19	NM	MJH

PROPOSED DRAINAGE AREA MAP

LOT 6.01, 6.02, 6.03 BLOCK 43

PROPOSED 7 TOWNHOUSES

BOROUGH OF ALPINE BERGEN COUNTY NEW JERSEY

APPLICANT/OWNER: ALPINE THREE L.L.C
P.O. BOX 835
ALPINE, N.J. 07620

MICHAEL J. HUBSCHMAN P.E., P.P.
PROFESSIONAL ENGINEER AND PLANNER
N.J.P.E. NO. 29497 N.J.P.P. NO. 3200

5-22-19
DATE

HUBSCHMAN ENGINEERING, P.A.
ENGINEERS - PLANNERS - SURVEYORS
263A S. WASHINGTON AVE., BERGENFIELD, NJ 07621
201-384-5666

DRAWN BY: N.M.
CHKD BY MJH
SCALE: AS NOTED
DRAWING NO.
495.1-DM
1 *OF* 1

APPENDIX 3

APPENDIX 4

DRAINAGE OUTLET INSPECTION REPORT

MICHAEL J. HUBSCHMAN, P.C.

Professional Engineer and Planner

263 A South Washington Ave.

Bergenfield, New Jersey 07621

voice (201) 384-5666

fax (201) 384-7968

DATE	JOB NO.
3/31/2020	495.1
PROJECT	
982 Closter Dock Road	
LOCATION	
Alpine NJ 07620	
CONTRACTOR	OWNER
	Alpine Three
WEATHER	TEMP/TIME
Cloudy	41° F/9:00:00 AM
PRESENT AT SITE	
Niko Marku, Hubschman Engineering	

TO:
Alpine Three
PO Box
Alpine NJ 07620

THE FOLLOWING WAS NOTED:

1. Scope of work : Inspection of the existing 12-inch diameter RCP drainage outlet pipe.

2. The drainage outlet pipe appears to be intact on both inlet and the outlet side.

3. There are no visible soil erosion signs.

4. Tree leaves and some shrubs are present. Leaves and shrubs are recommend to be removed as part of routine maintenance.

5. Pictures P1 to P4 taken during site inspection are attached

6. There is no need for repair or replacement of the 12-inch diameter RCP pipe as it appears that is in working conditions as designed.

COPIES TO _____

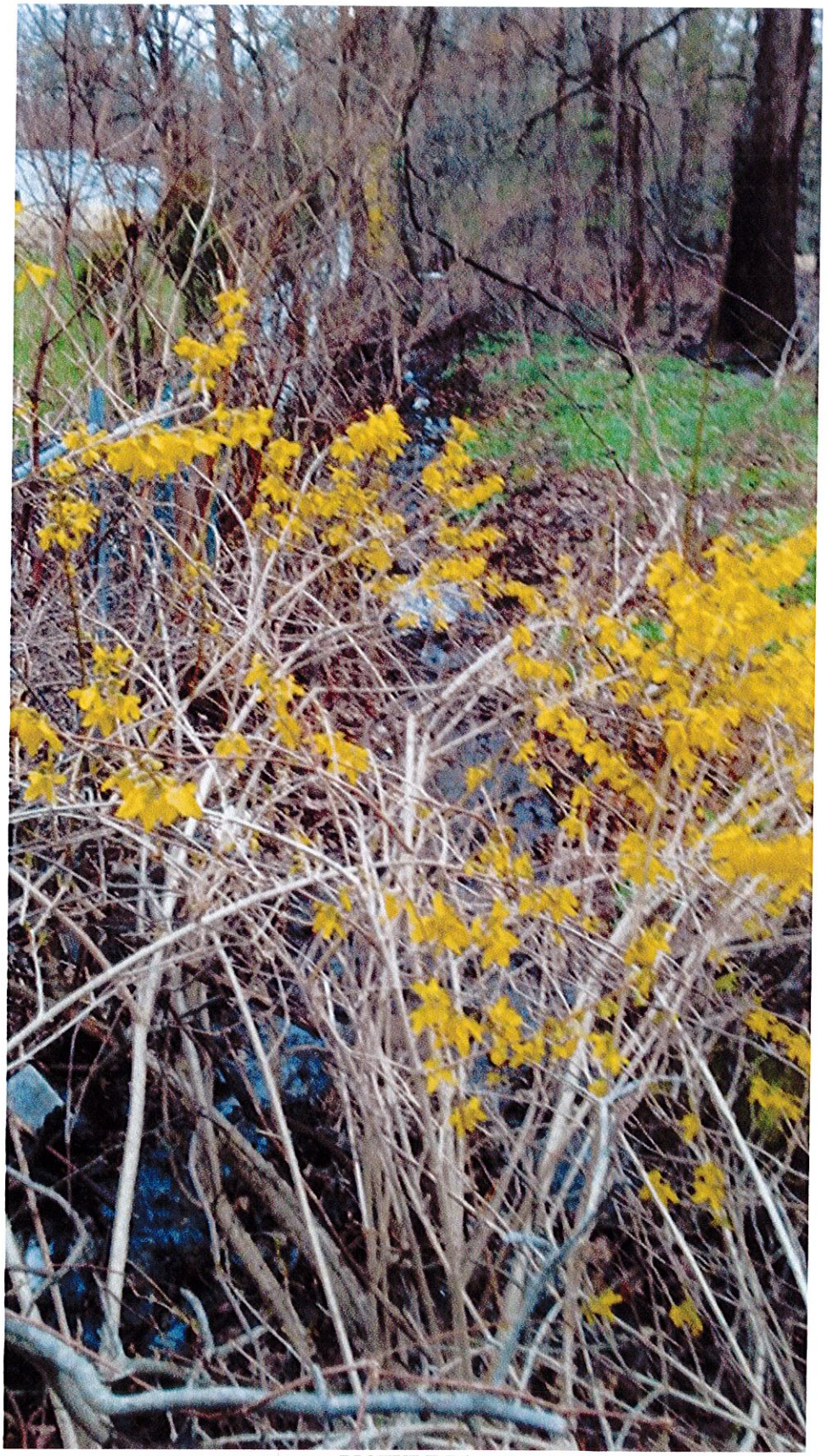
FIELD REPORT

SIGNED _____

PICTURE P1

PICTURE P2

PICTURE P3



PICTURE P4

APPENDIX 5

TEST PITS AND PIEZOMETER REPORT

JOHNSON SOILS COMPANY

66 Glen Avenue
Glen Rock, NJ 07452
Telephone: 201-301-1045
Fax: 201-857-8002
Email: info@johnsonsoils.com

March 31, 2020

Alpine Three, LLC
PO Box 835
Alpine, NJ 07620

Attn: Edward G. Norian

Re: Closter Dock Road
Lots 6.01, 6.02 & 6.03, Block 43
Alpine, NJ
JSC Job # 15-092.1

Dear Mr. Norian:

On March 17, 2020, Two (2) test pits were dug with a Mini Excavator, provided by JSC.

The Two (2) test pits were dug in the proposed storm water management area as was staked out by Hubschman Engineering.

One piezometer was installed in TP-9 and another was installed in TP-10 to monitor the ground water levels.

Rock was encountered in TP-9 at the followings depth from the existing grade.
Water was encountered in TP-10 at the followings depth from the existing grade.

Test Pit	Rock Depth	Water Level *
9	5'2"	Dry
10	--	5'6"

*At the time of the test pit investigation

Closter Dock Road
Lots 6.01, 6.02 & 6.03, Block 43
Alpine, NJ
JSC Job # 15-092.1

Piezometer readings *

	Test Pit 9	Test Pit 10
3/20/2020	Dry	10"**
3/25/2020	Dry	10"**

*From the existing ground surface.

****Additional readings are recommended due to rain runoff passing over Test Pit 10 at and before readings were taken.**

Attachments:
Log of Test Pits

Very truly yours,
JOHNSON SOILS COMPANY

Lisa V. Mahle-Greco

Lisa V. Mahle-Greco, P.E.
Engineering Manager
NJ Lic. No. 43197

Cc: Hubschman Engineering
263 A South Washington Avenue
Bergenfield, NJ 07621

JOHNSON SOILS COMPANY

ALPINE THREE, LLC
982 Closter Dock Road
Alpine, NJ
JSC Job #: 15-092.1

March 17, 2020
Inspector: Jim O'Dowd

Log of Test Pits

TP-9

0 – 9"	Topsoil
9" – 2'10"	Brown Silt, some Sand
2'10" – 5'2"	Brown Fine to Medium Sand, some Silt & Gravel
5'2"	Refusal on Rock

No Water
No Mottle

TP-10

0 – 1'4"	Topsoil
1'4" – 2'7"	Grayish Brown Silt, some Sand
2'7" – 6'	Brown Fine to Medium Sand, some Silt & Gravel

Water at 5'6"
No Mottle