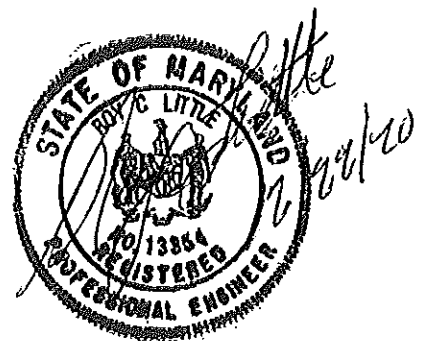


112826

Stormwater Management Report
for:
Parkwood
722 Springdale Avenue
Lot 80 & 2,000 SF of Parcel 2

September, 2019
Revised December, 2019
Revised January, 2020
Revised February, 2020
Revised April, 2020
Revised December, 2020



By:
TERRAIN, INC.
106 Old Solomons Island Road
Annapolis, MD 21401
(410) 266-1160
RCL/11.2826

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NARRATIVE

History

The site was the subject of a Record Plat (PB. 267, PG. 28, PLAT NO. 13904), in which created Lot 80 & 2,000 SF of Parcel 2. The site is located on Springdale Avenue in the City of Annapolis. The Site is currently a 0.21 Acre Vacant Lot, is zoned R2, and is in the Critical Area Zone (LDA) (Limited Development Area).

House Siting

The house has been sited in the middle of the lot and meets all average front setbacks from the right of way line.

SWM Design

In considering the Site Stormwater Management options, we evaluated several ESD applications/techniques but considered these were the best options:

1. The Site is approximately 9,500SF with slopes ranging from 3%-10%
2. Permeable pavement was chosen for the driveway pad and driveway strips.
3. Three Raingardens were chosen for the house and detached garage.

SWM Calculations

The first step in determining the ESD is to calculate the required PE. In this case, the site is approximately 35% impervious, which yields a PE of 1.6". Utilizing the site Rv (per State Manual), site area and PE x an addition 1.25(per city code), the target ESDv could be calculated (i.e. ESDv = 522 CF required).

Once the ESDv was obtained, devices needed to be evaluated which would address this volume. The attached computations utilize the permeable pavement, and Three Raingardens. (State Manual M-7).

Conclusion

The total ESD volume required of 522 C.F. was treated by implementation of nonstructural practices. The ESD volume provided was 533 C.F. Therefore, these practices address all runoff characteristics (i.e. water quality, recharge, and channel protection) on site achieved the goal of returning the site to an RCN of woods in good condition.

Statement No. 1

The following computations provide final design data for the ESD choices which compensate for 100% of the required ESD volume by Permeable Pavement, and three Rain Gardens.

OUTFALL STATEMENT

A FIELD INVESTIGATION OF THE SITE OUTFALL WAS PERFORMED BY TERRAIN INC. IN MARCH, 2019. THE SITE IS A VACANT RESIDENTIAL 0.21 AC LOT IN ANNAPOLIS, MARYLAND. THE PROPOSED DEVELOPMENT IS CONSTRUCTION OF A HOUSE, DETACHED GARAGE, DRIVEWAY TIRE STRIPS WITH PAD IN THE BACK, A DECK, A POOL, AND SWM. THE SITE BREAKS INTO TWO SITE OUTFALLS THAT GO DIRECTLY TO THE MIDDLE OF THE LOT AND CONTINUE ON TO THE NEIGHBORING LOTS. SITE OUTFALL#1 WAS REDIRECTED TOWARDS THE CITY ROAD (SPRINDALE AVENUE). IT STARTS NORTH A QUARTER WAY UP THE FRONT RIGHT CORNER OF THE LOT THEN DRAINS SOUTHWEST ACROSS THE FRONT YARD TOWARDS THE SOUTHWEST FRONT LEFT CORNER. THEN CONTINUES ALONGSIDE THE ROAD TO A STORM DRAIN SYSTEM. WITH THE ULTIMATE OUTFALL BEING BACK CREEK/SEVERN RIVER. SITE OUTFALL#2 STARTS IN THE BACK RIGHT CORNER OF THE LOT THEN RUNS SOUTH TOWARDS THE MIDDLE OF THE LOT. THEN DRAINS ALONG THE MIDDLE OF THE ADJACENT NEIGHBORING LOTS EVENTUALLY REACHING ITS ULTIMATE OUTFALL OF BACK CREEK/SEVERN RIVER. QP WAS ADDRESSED BY THE REDUCED RCN METHOD FOR THIS SITE OUTFALL. (SEE SWM DESIGN SHEET 6 OF 9). SWM SHALL BE PROVIDED FOR ALL PROPOSED IMPERVIOUS AREAS USING ESD METHODS TO ADDRESS WATER QUALITY, RECHARGE AND CPV. ALL AREAS ARE WELL VEGETATED AND STABLE. THE OUTFALL CONFIGURATION, SOIL TYPE AND VEGETATIVE COVERS ARE SUCH THAT EROSION OR SEDIMENTATION SHALL NOT OCCUR AS A RESULT OF THE PROPOSED DEVELOPMENT, IF ALL CONSTRUCTION IS IN ACCORDANCE WITH THESE PLANS AND THE AA.CO. DESIGN CRITERIA UTILIZING THE DETAILS AND SPECIFICATION STANDARDS.

SWM CONCEPT

SWM SHALL BE PROVIDED FOR THIS CRITICAL AREA NEW DEVELOPMENT BY ESD METHODS TO PROVIDE WATER QUALITY, RECHARGE AND CHANNEL PROTECTION. QP HAS BEEN ADDRESSED BY REDUCED RCN METHOD FOR SITE OUTFALL#2 AND SITE OUTFALL#1 DRAINS TO A PUBLIC RIGHT-OF-WAY (SPRINGDALE AVE), SO QP IS NOT REQUIRED. THE ESD METHODS USED WERE PERMEABLE PAVEMENT AND THREE RAIN GARDENS.

SWM DESIGN

SWM SHALL BE PROVIDED FOR THIS CRITICAL AREA NEW DEVELOPMENT BY ESD METHODS TO PROVIDE WATER QUALITY, RECHARGE AND CHANNEL PROTECTION. QP HAS BEEN ADDRESSED BY REDUCED RCN METHOD FOR SITE OUTFALL#2 AND SITE OUTFALL#1 DRAINS TO A PUBLIC RIGHT-OF-WAY (SPRINGDALE AVE), SO QP IS NOT REQUIRED. THE ESD METHODS USED WERE PERMEABLE PAVEMENT AND THREE RAIN GARDENS.

SITE AREA= 9,500 SF

EX. LC= 102 SF

PROP. LC= 2,963 SF

I= 2,954 / 9,500 = 31.1%

RV= 0.05+0.009I= 0.3299

SOILS: AuB-"C" I=35% TARGET PE= 1.6"

TARGET ESDV= (PERVA)/12= [1.6"(0.3299)9,500]/12 X 1.25=522 CF

PERMEABLE PAVEMENT (A-2)

USE 12" SUB BASE, SOILS-'C' DRIVEWAY STRIP+PAD-778 SF

ESDV (PROVIDED)= 778 SF X 0.16 ESDV/SF= 124 CF

ESD MAX TREATED ALLOWED= (2.7)(.95)(778)/12=166 CF

124 CF (PROVIDED) IS LESS THAN 166 CF (ALLOWED)

RAINGARDEN#1 (M-7)

AREA TO RAINGARDEN#1= 510 SF

SURFACE AREA=99 SF

STORAGE PROVIDED= 99X.5+99X.4X1.5=

50+59=109 CF

ESD MAX TREATED ALLOWED= (2.7)(.95)(510)/12=109 CF 94

109 CF (PROVIDED) IS EQUAL TO 109 CF (ALLOWED)

RAINGARDEN#2 (M-7)

AREA TO RAINGARDEN#2= 400 SF

SURFACE AREA=77 SF

STORAGE PROVIDED= 77X.5+77X.4X1.5=

39+46=85 CF

ESD MAX TREATED ALLOWED= (2.7)(.95)(400)/12=86 CF

85 CF (PROVIDED) IS LESS THAN 86 CF (ALLOWED)

RAINGARDEN#3 (M-7)

AREA TO RAINGARDEN#3= 1,007 SF

SURFACE AREA=195 SF

STORAGE PROVIDED= 195X.5+195X.4X1.5=

98+117=215 CF

ESD MAX TREATED ALLOWED= (2.7)(.95)(1,007)/12=215 CF

215 CF (PROVIDED) IS EQUAL TO 215 CF (ALLOWED)

TOTAL ESD BEING TREATED BY RAINGARDENS=109+85+215=409 CF

TOTAL ESD REQUIRED=522 CF

TOTAL ESD PROVIDED=533 CF

SITE OUTFALL#1 DRAINS TO PUBLIC RIGHT-OF-WAY

REDUCED RCN CALCULATIONS FOR SITE OUTFALL#2

SITE OUTFALL#2 DA= 0.14 AC (6,098 SF)

Q(EX)=1.33" (SEE TR-55 RUN)

Q(DEV)=1.98" (SEE TR-55 RUN)

EX. RCN= 77

DEV. RCN= 85

V(STORED)= 318 CF (RG#1&2, PERM PAVE)

Q(STORED)= 318 X 12 / 6,098 = 0.62

Q= Q(DEV)-Q(STORED)= 1.98"-0.62"= 1.36"

COMPUTE REDUCED RCN WHERE Q= 1.36" P=5.2"

RCN= 200 / [(5.2+2(1.36")+2]-√(5)(5.2)(1.36")+4(1.36")²

RCN= 200 / 9.92-6.54= 59.1

59<77 OK

EX. LOT COVERAGE	
EX. GRAVEL(T.B.R)	102 SF
EX. TOTAL	102 SF

PROP. LOT COVERAGE \triangle	
PROP. HOUSE	1,154 SF
PROP. GARAGE	440 SF
PROP. GARAGE REAR STAIRS	70 SF
PROP. DRIVEWAY PAD	462 SF
PROP. DRIVEWAY STRIPS	316 SF
PROP. FRONT PORCH	227 SF
PROP. POOL	192 SF
PROP. AREAWAY	57 SF
PROP. CONC. STEPS OFF PORCH	11 SF
PROP. DECK STEPS	25 SF
PROP. FIREPLACE	9 SF
PROP. TOTAL	2,963 SF

LOT COVERAGE (LDA) \triangle	
SITE AREA	9,500 SF
EX. LC (1%)	102 SF
PROP. LC (31.1%)	2,963 SF
MAX. ALLOWABLE (31.25%)	2,969 SF

** FOR WOODLANDS, CLEARING, MITIGATION ETC
SEE SHEETS L1-L2 BY DEB SCHWAB , LA

Statement No. 2

The Site splits into two Site Outfalls. Site Outfall#1 had an existing RCN of 74 and the developed RCN increased to 84 due to lot coverage increase. Site Outfall#2 had an existing RCN of 77 and the developed RCN increased to 85 due to lot coverage increase too. The TR-55 runs attached show the runoff associated with the curve numbers.

WinTR-55 Current Data Description

--- Identification Data ---

User: DB Date: 4/7/2020
 Project: #2826-Springdale Avenue Units: English
 SubTitle: EXISTING CONDITIONS Areal Units: Acres
 State: Maryland
 County: Anne Arundel
 Filename: \\SERVER-PC\Work\ENGINEERING-WORK\TR55\2826-Springdale Avenue\2822-EXTR55.w55

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
EX. SO#1	EX. SITE OUTFALL#1	Outlet	0.13	74	.14
EX. SO#2	EX. SITE OUTFALL#2	Outlet	0.08	77	.164

Total area: .21 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.3	4.3	5.2	5.9	6.5	7.4	2.7

Watershed Peak Table

Sub-Area Peak Flow by Rainfall Return Period

Sub-Area or Reach Identifier	10-Yr (cfs)	1-Yr (cfs)
SUBAREAS		
EX. SO#1	0.46	0.13
EX. SO#2	0.32	0.10

Hydrograph Peak/Peak Time Table

Sub-Area Peak Flow and Peak Time (hr) by Rainfall Return Period

Sub-Area or Reach Identifier	10-Yr (cfs) (hr)	1-Yr (cfs) (hr)
SUBAREAS		
EX. SO#1	0.46 11.96	0.13 12.01
EX. SO#2	0.32 11.98	0.10 12.01

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
EX. SO#1	.13	0.140	74	Outlet	EX. SITE OUTFALL#1
EX. SO#2	.08	0.164	77	Outlet	EX. SITE OUTFALL#2
Total Area:		.21 (ac)			

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
EX. SO#1							
SHEET	100	0.0300	0.150				0.137
SHALLOW	16	0.0100	0.050				0.003
						Time of Concentration	.14
							=====
EX. SO#2							
SHEET	74	0.0740	0.400				0.164
						Time of Concentration	.164
							=====

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
EX. SO#1	Open space; grass cover > 75%	(good) C	.11	74
	Woods - grass combination	(fair) C	.02	76
	Total Area / Weighted Curve Number		.13	74
			===	==
EX. SO#2	Open space; grass cover < 50%	(poor) C	.01	86
	Woods - grass combination	(fair) C	.07	76
	Total Area / Weighted Curve Number		.08	77
			===	==

STORM 10-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow			
				Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
EX. SO#1	0.200E-03		1.290		11.96	0.46	2323.44
EX. SO#2	0.130E-03		1.328		11.98	0.32	2483.34

STORM 1-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow			
				Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
EX. SO#1	0.200E-03		0.224		12.01	0.13	630.09
EX. SO#2	0.130E-03		0.263		12.01	0.10	754.38

WinTR-55 Current Data Description

--- Identification Data ---

User: DB Date: 4/7/2020
 Project: #2826-Springdale Avenue Units: English
 SubTitle: DEVELOPED CONDITIONS Areal Units: Acres
 State: Maryland
 County: Anne Arundel
 Filename: \\SERVER-PC\Work\ENGINEERING-WORK\TR55\2826-Springdale Avenue\2822-DEVTR55.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	To
DEV.SO#1	DEV. SITE OUTFALL#1	Outlet	0.07	84	.186
Dev. SO#2	DEV. SITE OUTFALL#2	Outlet	0.14	85	.15

Total area: .21 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.3	4.3	5.2	5.9	6.5	7.4	2.7

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period	
	10-Yr (cfs)	1-Yr (cfs)
SUBAREAS		
DEV.SO#1	0.32	0.12
Dev. SO#2	0.70	0.27

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period	
	10-Yr (cfs) (hr)	1-Yr (cfs) (hr)
SUBAREAS		
DEV.SO#1	0.32 12.00	0.12 12.00
Dev. SO#2	0.70 11.97	0.27 11.98

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
DEV.SO#1	.07	0.186	84	Outlet	DEV. SITE OUTFALL#1
Dev. SO#2	.14	0.150	85	Outlet	DEV. SITE OUTFALL#2
Total Area:		.21 (ac)			

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
DEV.SO#1 SHEET	85	0.0100	0.150				0.186
						Time of Concentration	.186 =====
Dev. SO#2 SHEET	66	0.0740	0.400				0.150
						Time of Concentration	.15 =====

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
DEV.SO#1	Open space; grass cover 50% to 75% (fair)	C	.05	79
	Paved parking lots, roofs, driveways	C	.02	98
Total Area / Weighted Curve Number			.07 ===	84 ==
Dev. SO#2	Open space; grass cover 50% to 75% (fair)	C	.07	79
	Paved parking lots, roofs, driveways	C	.05	98
	Woods - grass combination (fair)	C	.02	76
Total Area / Weighted Curve Number			.14 ===	85 ==

STORM 10-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow			
				Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DEV.SO#1	0.110E-03		1.662		12.00	0.32	2947.65
Dev. SO#2	0.220E-03		1.982		11.97	0.70	3172.30

STORM 1-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow			
				Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DEV.SO#1	0.110E-03		0.450		12.00	0.12	1102.8
Dev. SO#2	0.220E-03		0.596		11.98	0.27	1215.57

FAIRVIEW AVENUE
"SEVERN HOUSE CONDOS"
PARCEL 209
E 18/8
RESIDENCES

PROP. TEMPORARY SEDIMENT
FILTREXX SOXX 12" OR APPROVED EQUAL
(SEE SHEET 6 OF 9 FOR DETAIL)

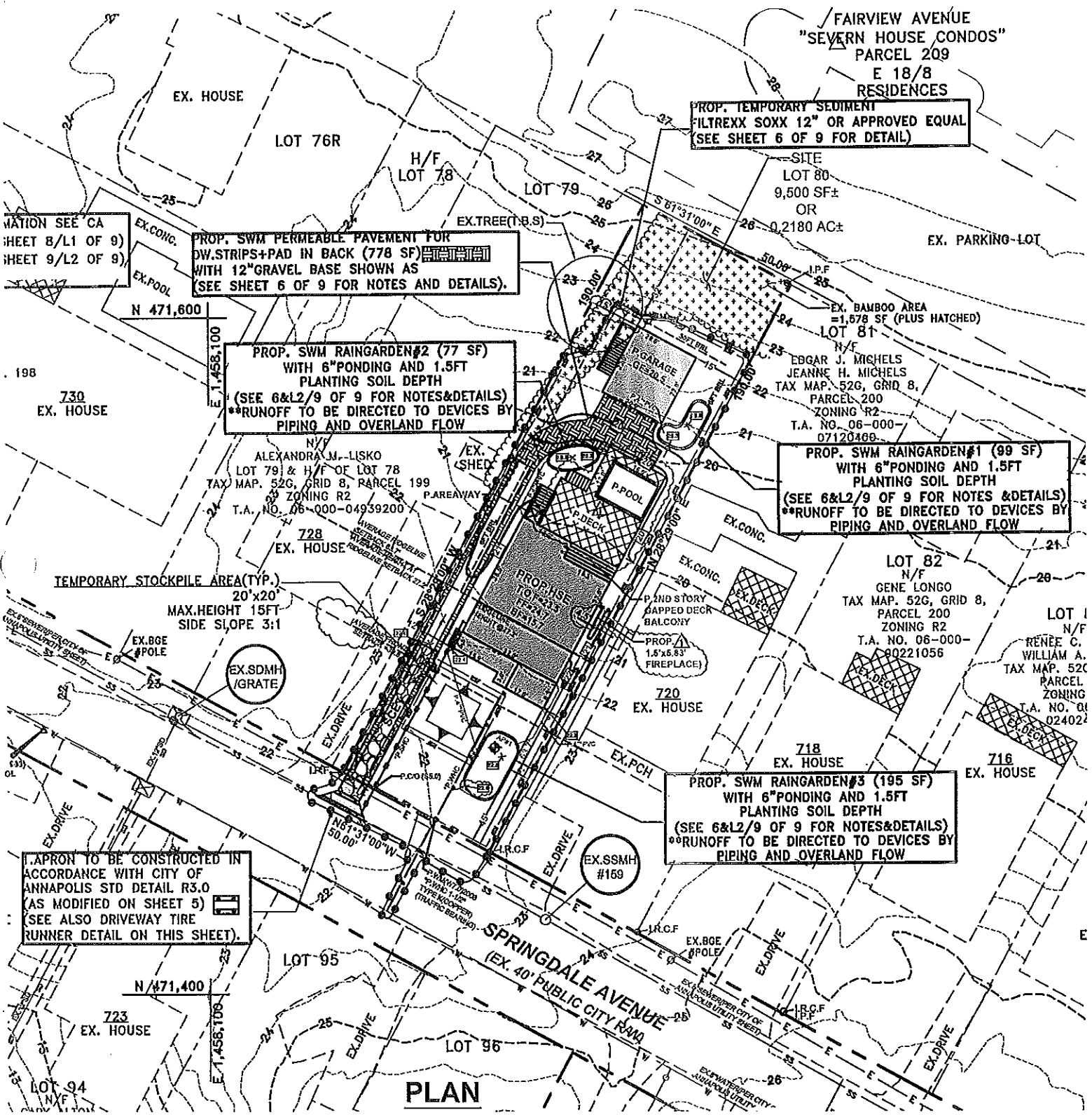
PROP. SWM PERMEABLE PAVEMENT FOR
D.W. STRIPS + PAD IN BACK (778 SF)
WITH 12" GRAVEL BASE SHOWN AS
(SEE SHEET 6 OF 9 FOR NOTES AND DETAILS).

PROP. SWM RAINGARDEN #2 (77 SF)
WITH 6" PONDING AND 1.5FT
PLANTING SOIL DEPTH
(SEE 6&L2/9 OF 9 FOR NOTES & DETAILS)
**RUNOFF TO BE DIRECTED TO DEVICES BY
PIPING AND OVERLAND FLOW

PROP. SWM RAINGARDEN #1 (99 SF)
WITH 6" PONDING AND 1.5FT
PLANTING SOIL DEPTH
(SEE 6&L2/9 OF 9 FOR NOTES & DETAILS)
**RUNOFF TO BE DIRECTED TO DEVICES BY
PIPING AND OVERLAND FLOW

PROP. SWM RAINGARDEN #3 (195 SF)
WITH 6" PONDING AND 1.5FT
PLANTING SOIL DEPTH
(SEE 6&L2/9 OF 9 FOR NOTES & DETAILS)
**RUNOFF TO BE DIRECTED TO DEVICES BY
PIPING AND OVERLAND FLOW

APRON TO BE CONSTRUCTED IN
ACCORDANCE WITH CITY OF
ANNAPOLIS STD DETAIL R3.0
(AS MODIFIED ON SHEET 5)
(SEE ALSO DRIVEWAY TIRE
RUNNER DETAIL ON THIS SHEET).



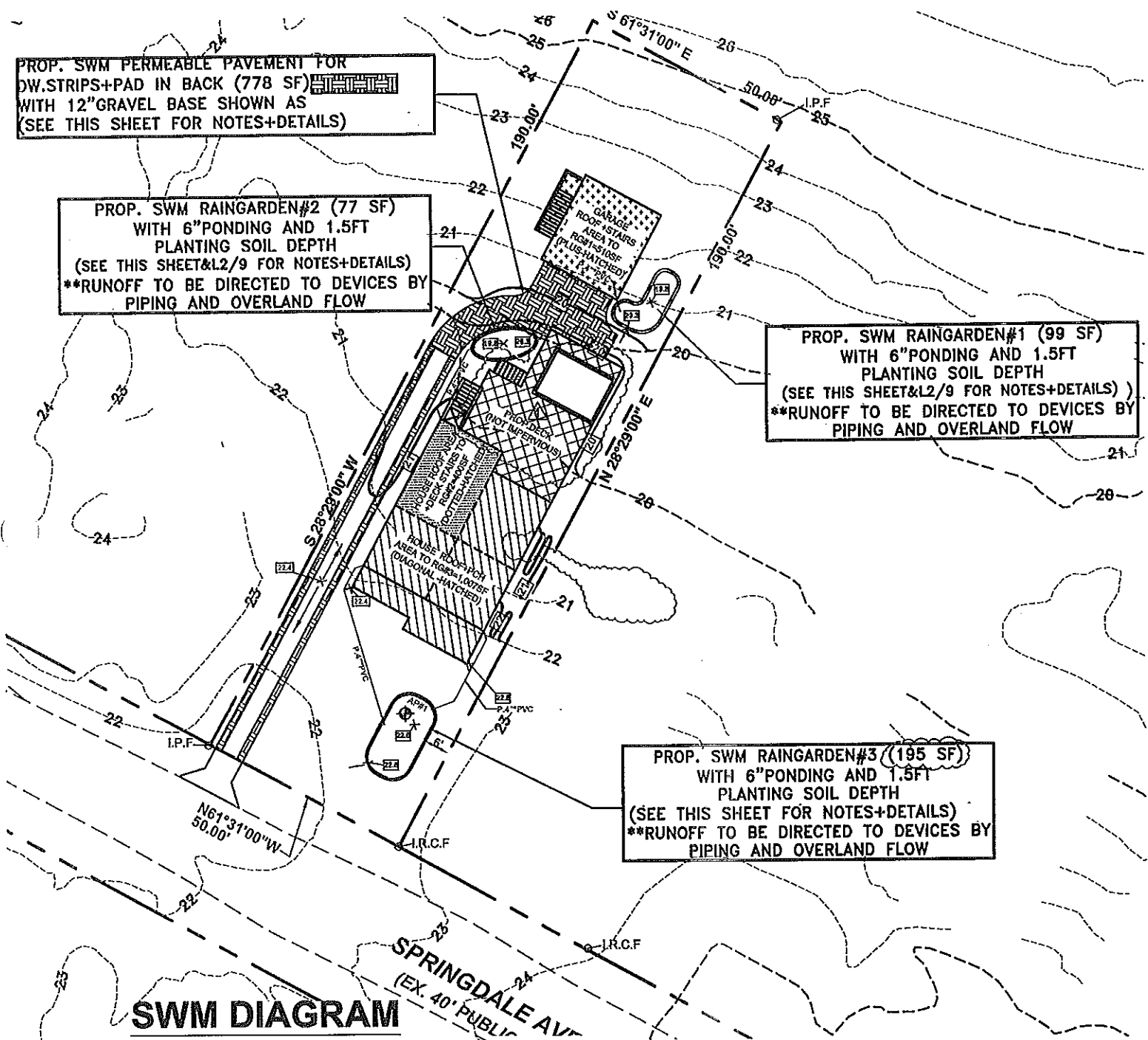
PLAN

PROP. SWM PERMEABLE PAVEMENT FOR DW. STRIPS+PAD IN BACK (778 SF) WITH 12" GRAVEL BASE SHOWN AS (SEE THIS SHEET FOR NOTES+DETAILS)

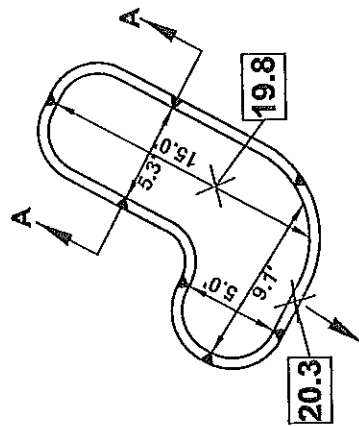
PROP. SWM RAINGARDEN#2 (77 SF) WITH 6" PONDING AND 1.5FT PLANTING SOIL DEPTH (SEE THIS SHEET&L2/9 FOR NOTES+DETAILS) **RUNOFF TO BE DIRECTED TO DEVICES BY PIPING AND OVERLAND FLOW

PROP. SWM RAINGARDEN#1 (99 SF) WITH 6" PONDING AND 1.5FT PLANTING SOIL DEPTH (SEE THIS SHEET&L2/9 FOR NOTES+DETAILS) **RUNOFF TO BE DIRECTED TO DEVICES BY PIPING AND OVERLAND FLOW

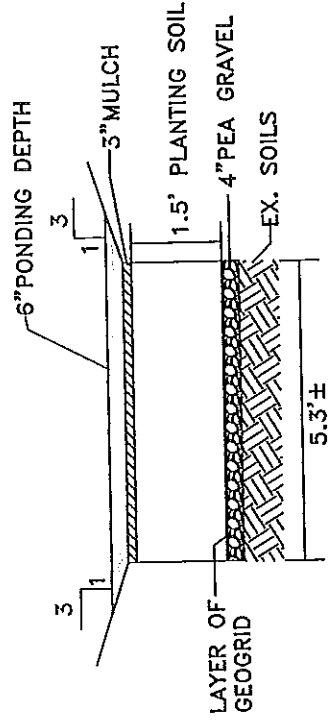
PROP. SWM RAINGARDEN#3 (195 SF) WITH 6" PONDING AND 1.5FT PLANTING SOIL DEPTH (SEE THIS SHEET FOR NOTES+DETAILS) **RUNOFF TO BE DIRECTED TO DEVICES BY PIPING AND OVERLAND FLOW



SWM DIAGRAM

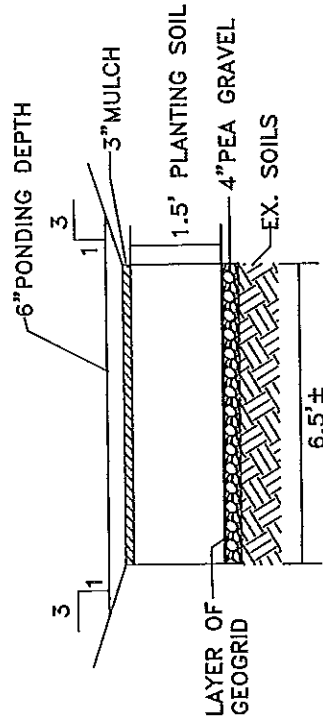


RAINGARDEN#1 PLANTINGS (TYP.) (99 SF)
 PLAN VIEW
 SCALE:NTS

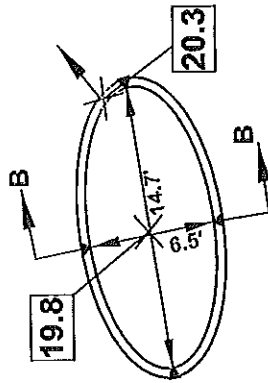


SECTION A-A (TYP.)
 PLAN VIEW
 SCALE:NTS

RAINGARDEN#1 PLANTING SCHEDULE (FOR 99 SF)
 **SEE CRITICAL AREA PLAN PREPARED BY DEB. SCHWAB SHEET 9/L2 OF 9)



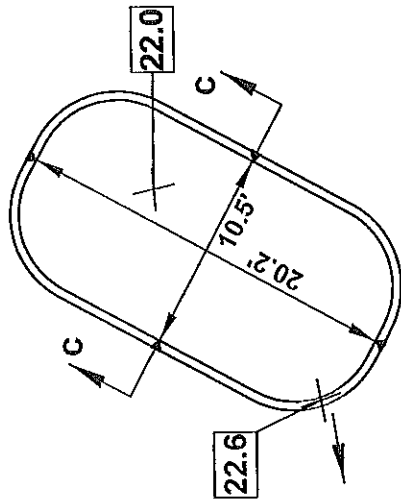
SECTION B-B (TYP.)
PLAN VIEW
SCALE: NTS



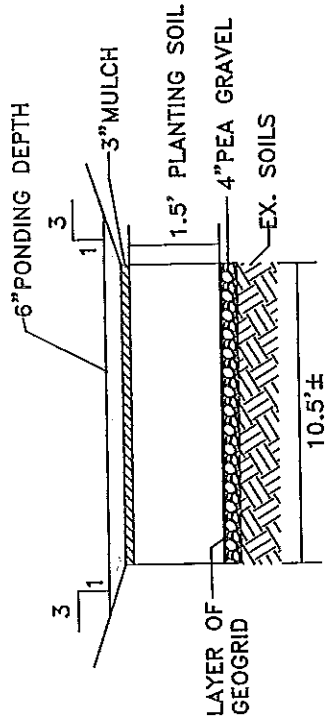
RAINGARDEN#2 PLANTINGS (TYP.) (77 SF)
PLAN VIEW
SCALE: NTS

RAINGARDEN#2 PLANTING SCHEDULE (FOR 77 SF)

**SEE CRITICAL AREA PLAN PREPARED BY DEB. SCHWAB SHEET 9/L2 OF 9)

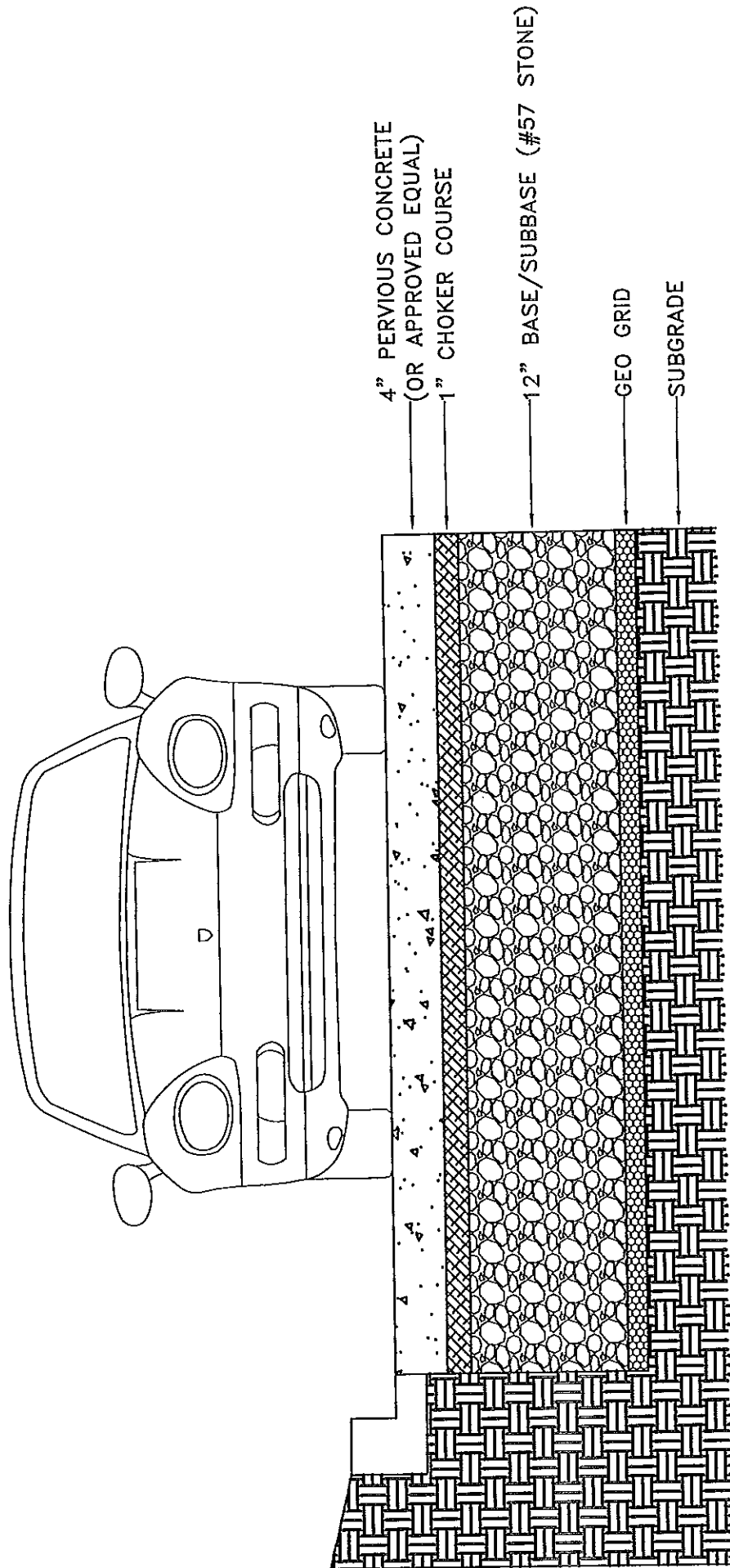


RAINGARDEN#3 PLANTINGS (TYP.) (195 SF)
 PLAN VIEW
 SCALE: 1/8" = 1'-0"



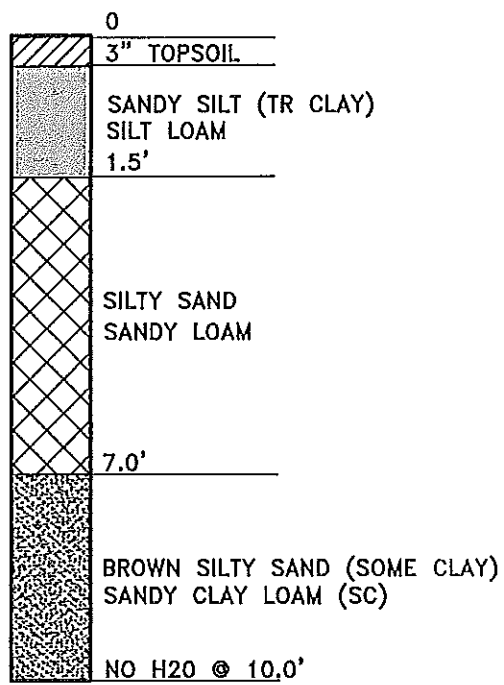
SECTION C-C (TYP.)
 PLAN VIEW
 SCALE: 1/8" = 1'-0"

RAINGARDEN#3 PLANTING SCHEDULE (FOR 195 SF)
 **SEE CRITICAL AREA PLAN PREPARED BY DEB. SCHWAB SHEET 9/L2 OF 9)



PERMEABLE PAVEMENT DETAIL

SCALE: 1/4" = 1'-0"



AP#1
N.T.S.