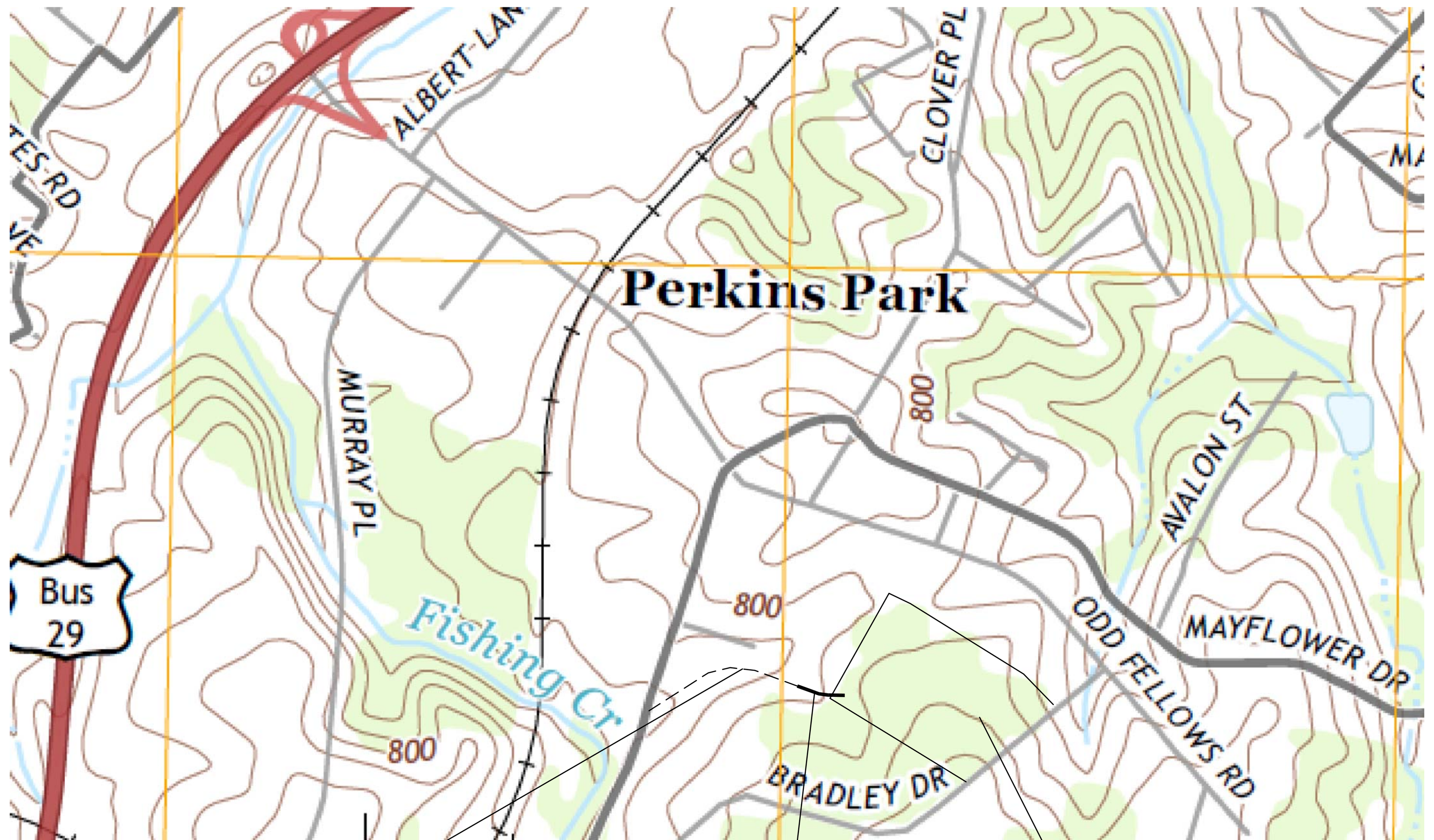

NTS

EXISTING DITCH/COLLECTION SYSTEM

PROPOSED CONNECTION TO EXISTING COLLECTION SYSTEM. PROPOSED 150 FOOT DITCH WILL MEET ADEQUATE CHANNEL REQUIREMENTS AND PRE DEVELOPMENT FLOW CONDITIONS. TEMPORARY EASEMENT WILL BE OBTAINED FROM PROPERTY OWNER FOR CONSTRUCTION OF DITCH.

GLTC SITE

RECEIVING STREAM
VA HU6 - JMII - FISHING CREEK (5.44 MILES)

THE FISHING CREEK WATERSHED AREA OF APPROXIMATELY 4,590 ACRES IS COMPRISED OF RESIDENTIAL/COMMERICIAL (54%), FOREST (38%), PASTURE/CROPLAND (7%), AND WATER/WETLAND (1%).

Energy Balance Calculations

Pre-Development Conditions	
ID	DA-3
Project Area	4.55 acres
Land Condition	Woods
Soil Type	B
Pre-Development Q=	2.1 cfs
1-yr rainfall	3.1 inches
CN	55
Runoff Volume	0.22 inches

Post Development	
ID	DA-4
Project Area	1.38 acres
Land Condition	0.90 acres Impervious
	0.48 acres Pervious (Grass)
Soil Type	B
1-yr Rainfall	3.1 inches
Adjusted CN	81

S=1000/CN-10
S = 1000/81 -10 = 2.34 inches

Q = (P-0.2S)^2/(P+0.8S)
Q= (3.10-(0.2*2.34)^2/(3.10+(0.8*2.34))
Q = 1.39 in Runoff depth
Use 1.40 from VRRM table

Vrpost1 = Q x A x 1/12
Vrpost1 = 1.40 x 1.38 x 1/12
Vrpost1 = 0.16 ac-ft

Vrpre1 = Q x A x 1/12
Vrpre1 = 0.22 x 4.55 x 1/12
Vrpre1 = 0.08 ac-ft

q1post <= q1pre (Vrpre1/Vrpost1)(IF)
q1post <= 2.1 (0.08/0.16)(0.8)
q1post <= 0.84 cfs

Post Development release rate cannot exceed 0.84 cfs

The Bioretention Area for DA-4 has an outflow of 0.49 cfs for the 1-year event with 1,816 cu-ft of storage

DA-3 - INFILTRATION CALCULTIONS
PERMEABLE PAVEMENT
INFILTRATION RATE TAKEN FROM REPORT PREPARED BY H&P.

INFILTRATION CALCULATOR

Project Name: Lynchburg Transit
Address:
State: **VA**
Project Size: **47,178** SF

Do you want to use the arch and gap spacing in PaveDrain for storage? Enter 1 = Yes, 0 = No: **1**

Employee Parking

Water Storage Factors	
Void space of #57 Clean Stone[1]	**35.00%**
Void space of #2 Clean Stone[1]	**40.00%**
Depth of #57 Clean Stone (inches)	**6.00**
Depth of # 2 Clean Stone (inches)	**12.00**
Rainwater per Year in State (inches)[2]	44.30
Gallons per Square Foot Factor ("GF")	0.62001
Gallons per Square Foot based on Above	27.47
Storage Space per Pavedrain Block[3]	0.095

Storage Calculation	
Storage (CF) [Clean Stone + Pavedrain]	**32,039.21**
Gallons per Cubic Feet	7.48
Total Storage In Gallons [Clean Stone + Pavedrain]	239,653.29
Total Storage: Infiltration [Rate x SF x GF)	97,112.76
Total Storage in Gallons	336,766.05
Maximum Rain Event Storage [Storage + Infiltration]	11.51

Rain Event Calculation & Annual Stormwater Infiltration		
State Capital Largest Daily Rainfall - 2011[4]	**Lynchburg 6.5**	Inches
Infiltration Rate per Hour Based on Soil		**3.32**
Target Rainfall Event (Inches/Hour)		**6.50**
Indicated Gallons of Water on Pavedrain		190,130.41
Excess (Deficit) of Water Storage (Gallons)		146,635.65
Hours to Infiltrate Event in Soil (Rain Event)		1.96
Annual Gallons Infiltrated of Runoff from Direct Rainfall		1,295,811.85
Hours to Infiltrate Direct Rainfall (Rainfall-Year/Infiltration Rate)		13.34

Supplemental Surface	
Roof (SF)	**23,537**
Impervious Surface (SF)	**11,613**
Total Supplemental Surface	35,150
Total Gallons for Year	965,456.46
Capacity Required during Targeted Rain Event	141,658.40
Capacity Required during 2" Inch/Hr Event	43,587.20

Overall Excess (Deficit) of Water Storage (Gallons)	4,977.25

[1] We have used accepted void percentages from local jurisdictions
[2] Based on NOAA Website figures
[3] See sheet "pavedrainvoid"
[4] Statistics on major cities from NOAA website

Notes & Warnings
-Hours to Infiltrate Event in Soil (Rain Event) Are Acceptable. (Cell H29)
-Overall Water Storage Is Acceptable. (Cell H49)

Energy Balance Calculations

Pre-Development Conditions	
ID	DA-1
Project Area	3.74 acres
Land Condition	Woods
Soil Type	B
Pre-Development Q=	1.9 cfs
1-yr rainfall	3.1 inches
CN	55
Runoff Volume	0.22 inches

Post Development	
ID	DA-1
Project Area	3.91 acres
Land Condition	3.29 acres Impervious
	0.62 acres Pervious (Grass)
Soil Type	B
1-yr Rainfall	3.1 inches
Adjusted CN	84

S=1000/CN-10
S = 1000/84 -10 = 1.90 inches

Q = (P-0.2S)^2/(P+0.8S)
Q= (3.10-(0.2*1.90)^2/(3.10+(0.8*1.90))
Q = 1.60 in Runoff depth
Use 1.59 from VRRM table

Vrpost1 = Q x A x 1/12
Vrpost1 = 1.59 x 3.91 x 1/12
Vrpost1 = 0.52 ac-ft

Vrpre1 = Q x A x 1/12
Vrpre1 = 0.22 x 3.74 x 1/12
Vrpre1 = 0.07 ac-ft

q1post <= q1pre (Vrpre1/Vrpost1)(IF)
q1post <= 1.9 (0.07/0.52)(0.8)
q1post <= 0.20 cfs

Post Development release rate cannot exceed 0.20 cfs

Energy Balance Calculations

Pre-Development Conditions	
ID	DA-2
Project Area	4.07 acres
Land Condition	Woods
Soil Type	B
Pre-Development Q=	2.0 cfs
1-yr rainfall	3.1 inches
CN	55
Runoff Volume	0.22 inches

Post Development	
ID	DA-2
Project Area	2.16 acres
Land Condition	1.81 acres Impervious
	0.35 acres Pervious (Grass)
Soil Type	B
1-yr Rainfall	3.1 inches
Adjusted CN	84

S=1000/CN-10
S = 1000/84 -10 = 1.90 inches

Q = (P-0.2S)^2/(P+0.8S)
Q= (3.10-(0.2*1.9)^2/(3.10+(0.8*1.9))
Q = 1.60 in Runoff depth
Use 1.59 from VRRM table

Vrpost1 = Q x A x 1/12
Vrpost1 = 1.59 x 2.16 x 1/12
Vrpost1 = 0.29 ac-ft

Vrpre1 = Q x A x 1/12
Vrpre1 = 0.22 x 4.07 x 1/12
Vrpre1 = 0.07 ac-ft

q1post <= q1pre (Vrpre1/Vrpost1)(IF)
q1post <= 2.0 (0.07/0.29)(0.8)
q1post <= 0.38 cfs

Post Development release rate cannot exceed 0.38 cfs

Summary for DA-1 and DA-2 Combined
Pre-Development DA = 7.83 acres
Post-Development DA = 6.99 acres
Vrpost1 = 1.59 x 6.99 x 1/12 = 0.93 ac-ft
Vrpre1 = 0.22 x 7.83 x 1/12 = 0.14 ac-ft
q1post <= 3.9 (0.14/0.93)(0.8)
q1post <= 0.47 cfs

The extended detention pond provides 3366 cu-ft of storage for the 1 year storm and does not discharge during that event.

DA-1 - INFILTRATION CALCULATIONS
BIORETENTION AREA

Device Information (overwrite data in shaded cells, other cells will be automatically calculated)

Controlling Area (Drainage Area)	3.91	acres	=	170280.5	sq.ft.
Site Condition	Commercial	DA#1			
device area	14897	sq.ft.	=	8.7%	of the site
device storage depth (above ground)	12	inches	=	1.00	ft.
infiltration porosity (volume fraction of soil pores)	0.3	***use 0 if you only want to count above-ground storage*			
soil depth	24	inches	=	2	ft.
device's total volume (above ground + soils)	**23835.2**	**cubic ft./day**			

Runoff Information (overwrite data in shaded cells, other cells will be automatically calculated)

Land Use: Impervious
CN: 89
S: 1.24

(a) Rainfall (P) (in/day)	(b) Runoff (Q) (in/day)	(c) Rainfall Volume (cu.ft. / day)	(d) Runoff Volume (cu.ft. / day)	(e) RunoffTreated (cu.ft. / day)	(f) Cumulative Frequency	(g) Probability/ Frequency	(h) (e) x (g) (cu.ft. / day)	(i) (d) x (g) (cu.ft. / day)	(j) (c) x (g) (cu.ft. / day)
0.05	0.000	709.50	0.00	0.00	0.259	0.259	0.00	0.00	183.41
0.10	0.000	1419.00	0.00	0.00	0.387	0.128	0.00	0.00	181.92
0.15	0.000	2128.51	0.00	0.00	0.463	0.076	0.00	0.00	161.77
0.20	0.000	2838.01	0.00	0.00	0.517	0.054	0.00	0.00	153.25
0.30	0.002	4257.01	30.71	30.71	0.620	0.103	3.16	3.16	438.47
0.40	0.017	5676.02	238.59	238.59	0.702	0.082	19.54	19.54	464.87
0.50	0.043	7095.02	609.18	609.18	0.765	0.063	38.32	38.32	446.28
0.60	0.078	8514.03	1111.74	1111.74	0.812	0.047	52.47	52.47	401.86
0.80	0.171	11352.03	2424.27	2424.27	0.875	0.063	153.21	153.21	717.45
1.00	0.285	14190.04	4043.62	4043.62	0.918	0.044	175.90	175.90	617.27
1.25	0.449	17737.55	6374.00	6374.00	0.954	0.036	228.83	228.83	636.78
1.50	0.631	21285.06	8948.90	8948.90	0.972	0.017	153.92	153.92	366.10
2.00	1.028	28380.08	14586.84	14586.84	0.990	0.019	272.77	272.77	530.71
3.00	1.900	42570.13	26958.61	23835.20	0.997	0.007	162.08	183.32	289.48
4.00	2.823	56760.17	40059.33	23835.20	0.999	0.002	54.82	92.14	130.55
5.00	3.772	70950.21	53523.83	23835.20	1.000	0.001	11.92	26.76	35.48
6.00	4.735	85140.25	67195.97	23835.20	1.000	0.000	4.77	13.44	17.03
					Total	1.000	**1331.71**	**1413.78**	**5772.65**
							Q Treated	**Q Total**	**P Total**

Percent of Total Runoff Infiltrated = 94.19%

DA-2 - INFILTRATION CALCULATIONS
BIORETENTION AREA

Device Information (overwrite data in shaded cells, other cells will be automatically calculated)

Controlling Area (Drainage Area)	2.16	acres	=	94068	sq.ft.
Site Condition	Commercial	DA#2			
device area	8246	sq.ft.	=	8.8%	of the site
device storage depth (above ground)	12	inches	=	1.00	ft.
infiltration porosity (volume fraction of soil pores)	0.3	***use 0 if you only want to count above-ground storage*			
soil depth	24	inches	=	2	ft.
device's total volume (above ground + soils)	**13193.6**	**cubic ft./day**			

Runoff Information (overwrite data in shaded cells, other cells will be automatically calculated)

Land Use: Impervious
CN: 89
S: 1.24

(a) Rainfall (P) (in/day)	(b) Runoff (Q) (in/day)	(c) Rainfall Volume (cu.ft. / day)	(d) Runoff Volume (cu.ft. / day)	(e) RunoffTreated (cu.ft. / day)	(f) Cumulative Frequency	(g) Probability/ Frequency	(h) (e) x (g) (cu.ft. / day)	(i) (d) x (g) (cu.ft. / day)	(j) (c) x (g) (cu.ft. / day)
0.05	0.000	391.95	0.00	0.00	0.259	0.259	0.00	0.00	101.32
0.10	0.000	783.90	0.00	0.00	0.387	0.128	0.00	0.00	100.50
0.15	0.000	1175.85	0.00	0.00	0.463	0.076	0.00	0.00	89.36
0.20	0.000	1567.80	0.00	0.00	0.517	0.054	0.00	0.00	84.66
0.30	0.002	2351.70	16.96	16.96	0.620	0.103	1.75	1.75	242.23
0.40	0.017	3135.60	131.80	131.80	0.702	0.082	10.79	10.79	256.81
0.50	0.043	3919.50	336.53	336.53	0.765	0.063	21.17	21.17	246.54
0.60	0.078	4703.40	614.16	614.16	0.812	0.047	28.99	28.99	222.00
0.80	0.171	6271.20	1339.24	1339.24	0.875	0.063	84.64	84.64	396.34
1.00	0.285	7839.00	2233.81	2233.81	0.918	0.044	97.17	97.17	341.00
1.25	0.449	9798.75	3521.18	3521.18	0.954	0.036	126.41	126.41	351.78
1.50	0.631	11758.50	4943.64	4943.64	0.972	0.017	85.03	85.03	202.25
2.00	1.028	15678.00	8058.20	8058.20	0.990	0.019	150.69	150.69	293.18
3.00	1.900	23517.00	14892.74	13193.60	0.997	0.007	89.72	101.27	159.92
4.00	2.823	31356.00	22129.96	13193.60	0.999	0.002	30.35	50.90	72.12
5.00	3.772	39195.00	29568.15	13193.60	1.000	0.001	6.60	14.78	19.60
6.00	4.735	47034.00	37121.05	13193.60	1.000	0.000	2.64	7.42	9.41
					Total	1.000	**735.94**	**781.02**	**3188.98**
							Q Treated	**Q Total**	**P Total**

Percent of Total Runoff Infiltrated = 94.23%

DA-4 - INFILTRATION CALCULATIONS
BIORETENTION AREA

Device Information (overwrite data in shaded cells, other cells will be automatically calculated)

Controlling Area (Drainage Area)	1.38	acres	=	60099	sq.ft.
Site Condition	Commercial	DA#4			
device area	5758	sq.ft.	=	9.6%	of the site
device storage depth (above ground)	12	inches	=	1.00	ft.
infiltration porosity (volume fraction of soil pores)	0.3	***use 0 if you only want to count above-ground storage*			
soil depth	24	inches	=	2	ft.
device's total volume (above ground + soils)	**9212.8**	**cubic ft./day**			

Runoff Information (overwrite data in shaded cells, other cells will be automatically calculated)

Land Use: Impervious
CN: 73
S: 3.70

(a) Rainfall (P) (in/day)	(b) Runoff (Q) (in/day)	(c) Rainfall Volume (cu.ft. / day)	(d) Runoff Volume (cu.ft. / day)	(e) RunoffTreated (cu.ft. / day)	(f) Cumulative Frequency	(g) Probability/ Frequency	(h) (e) x (g) (cu.ft. / day)	(i) (d) x (g) (cu.ft. / day)	(j) (c) x (g) (cu.ft. / day)
0.05	0.000	250.41	0.00	0.00	0.259	0.259	0.00	0.00	64.73
0.10	0.000	500.83	0.00	0.00	0.387	0.128	0.00	0.00	64.21
0.15	0.000	751.24	0.00	0.00	0.463	0.076	0.00	0.00	57.09
0.20	0.000	1001.65	0.00	0.00	0.517	0.054	0.00	0.00	54.09
0.30	0.000	1502.48	0.00	0.00	0.620	0.103	0.00	0.00	154.75
0.40	0.000	2003.30	0.00	0.00	0.702	0.082	0.00	0.00	164.07
0.50	0.000	2504.13	0.00	0.00	0.765	0.063	0.00	0.00	157.51
0.60	0.000	3004.95	0.00	0.00	0.812	0.047	0.00	0.00	141.83
0.80	0.001	4006.60	4.84	4.84	0.875	0.063	0.31	0.31	253.22
1.00	0.017	5008.25	85.70	85.70	0.918	0.044	3.73	3.73	217.86
1.25	0.062	6260.31	309.83	309.83	0.954	0.036	11.12	11.12	224.75
1.50	0.130	7512.38	649.23	649.23	0.972	0.017	11.17	11.17	129.21
2.00	0.320	10016.50	1604.10	1604.10	0.990	0.019	30.00	30.00	187.31
3.00	0.857	15024.75	4293.80	4293.80	0.997	0.007	29.20	29.20	102.17
4.00	1.527	20033.00	7649.86	7649.86	0.999	0.002	17.59	17.59	46.08
5.00	2.280	25041.25	11421.10	9212.80	1.000	0.001	4.61	5.71	12.52
6.00	3.089	30049.50	15468.49	9212.80	1.000	0.000	1.84	3.09	6.01
					Total	1.000	**109.56**	**111.92**	**2037.41**
							Q Treated	**Q Total**	**P Total**

Percent of Total Runoff Infiltrated = 97.90%

BMP INFORMATION

TYPE OF BMP	PERMEABLE PAVER INFILTRATION BASIN
OWNER OF BMP	GLTC
# OF TREATED ACRES	1.89 ACRES (DA-3)
MAINTENANCE REQUIRED	- QUARTERLY INSPECTIONS - REGULARLY CLEANING OF SURFACE WITH VACUUM SWEEPER
TYPE OF BMP	EXTENDED DETENTION AREA
OWNER OF BMP	GLTC
# OF TREATED ACRES	6.99 ACRES (DA-1 & DA-2)
MAINTENANCE REQUIRED	- REMULCHING, TREATING DISEASED TREES AND SHRUBS, AND MOWING TURF AREAS. - NEWLY PLANTED VEGETATION SHOULD BE WATERED REGULARLY UNTIL PROPERLY ESTABLISHED. - EROSION ISSUES SHOULD BE ADDRESSED IMMEDIATELY. - MOW SIDE SLOPES, PESTICIDE/NUTRIENT MANAGEMENT - LITTER/DEBRIS REMOVAL - REMOVE SEDIMENT WHEN POND VOLUME HAS BEEN REDUCED BY 25%
TYPE OF BMP	BIORETENTION
OWNER OF BMP	GLTC
# OF TREATED ACRES	1.38 ACRES (DA-4)
MAINTENANCE REQUIRED	- REMULCHING, TREATING DISEASED TREES AND SHRUBS, AND MOWING TURF AREAS. - NEWLY PLANTED VEGETATION SHOULD BE WATERED REGULARLY UNTIL PROPERLY ESTABLISHED. - EROSION ISSUES SHOULD BE ADDRESSED IMMEDIATELY. - WATER PLANTS THROUGHOUT PERIODS OF PERSISTANT DROUGHT. - REMOVAL OF TOP 2-3" OF DISCOLORED PLANTING MEDIUM AND REPLACEMENT WITH FRESH MIX WHEN PONDING LASTS MORE THAN 48 HOURS - ADD NEW MULCH YEARLY - REMOVE LITTER/PLANT DEBRIS
TYPE OF BMP	BIORETENTION FOREBAY
OWNER OF BMP	GLTC
# OF TREATED ACRES	3.91 ACRES (DA-1) 2.16 ACRES (DA-2)
MAINTENANCE REQUIRED	- REMULCHING, TREATING DISEASED TREES AND SHRUBS, AND MOWING TURF AREAS. - NEWLY PLANTED VEGETATION SHOULD BE WATERED REGULARLY UNTIL PROPERLY ESTABLISHED. - EROSION ISSUES SHOULD BE ADDRESSED IMMEDIATELY. - WATER PLANTS THROUGHOUT PERIODS OF PERSISTANT DROUGHT. - REMOVAL OF TOP 2-3" OF DISCOLORED PLANTING MEDIUM AND REPLACEMENT WITH FRESH MIX WHEN PONDING LASTS MORE THAN 48 HOURS - ADD NEW MULCH YEARLY - REMOVE LITTER/PLANT DEBRIS - CLEANOUT FOREBAY EVERY 5 YRS OR WHEN 50% OF THE FOREBAY CAPACITY HAS BEEN FILLED.
TYPE OF BMP	FLEXSTORM PERMANENT INLET FILTER (HOT SPOT)
OWNER OF BMP	GLTC
# OF TREATED ACRES	0.88 ACRES (GLTC-9)
MAINTENANCE REQUIRED	- INSPECTIONS SHOULD OCCUR 3 TIMES PER YEAR. - EMPTY THE SEDIMENT BAG IF MORE THAN HALF FILLED WITH SEDIMENT AND DEBRIS. - REMOVE ANY CAKED ON SILT FROM THE SEDIMENT BAG AND REVERSE FLUSH THE BAG. - REPLACE THE BAG IF TORN OR PUNCTURED TO 1/2" DIAMETER OR GREATER ON THE LOWER HALF OF THE BAG. - AT 50% SATURATION, THE AVG. 2'X2' ABSORB-IT LINED PC FILTER WILL RETAIN APPROX. 75OZ OF OIL AND SHOULD BE SERVICED. - THE SKIMMER STARTS YELLOW IN COLOR AND WILL GRADUALLY TURN BROWN AS THEY BECOME SATURATED, INDICATING TIME FOR REPLACEMENT.

GREATER LYNCHBURG TRANSIT COMPANY
1301 Kemper Street PO Box 797
Lynchburg, VA 24505-0797

PROJECT ADDRESS:
419 Bradley Dr.
Lynchburg, VA
24501-4901

Operations & Maintenance Facility

BID DOCUMENTS

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COMMONWEALTH OF VIRGINIA
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10/29/14
PROFESSIONAL ENGINEER

Revision Number	Issued by	Revision Description	Revision Date

DWG. TITLE
STORMWATER/DRAINAGE CALCULATIONS

DATE	10/29/2014		
SCALE	1:40		
DWN.	LLW	CHK.	WLW
PROJ. No.	444505		
DWG. No.	C303		

DATE/TIME PRINTED: 10/29/2014 1:03:28 PM

Virginia Runoff Reduction Method New Development Worksheet - v2.8 - June 2014
To be used w/ DRAFT 2013 BMP Standards and Specifications
Site Data

Project Name: GLTC Maintance Facility
Date: 7/8/14

(cyan)	data input cells
(gray)	calculation cells
(yellow)	constant values

1. Post-Development Project & Land Cover Information

Constants

Annual Rainfall (inches)	43		
Target Rainfall Event (inches)	1.00		
Phosphorus EMC (mg/L)	0.26	Nitrogen EMC (mg/L)	1.86
Target Phosphorus Target Load (lb/acre/yr)	0.41		
Pj	0.90		

Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	2.61	0.00	0.00	2.61
Impervious Cover (acres)	0.00	7.65	0.00	0.00	7.65
				Total	10.26

Rv Coefficients

	A soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Land Cover Summary

Forest/Open Space Cover (acres)	0.00		
Weighted Rv(forest)	0.00		
% Forest	0%		
Managed Turf Cover (acres)	2.61		
Weighted Rv(turf)	0.20		
% Managed Turf	25%		
Impervious Cover (acres)	7.65		
Rv(impervious)	0.95		
% Impervious	75%		
Total Site Area (acres)	10.26		
Site Rv	0.76		
Post-Development Treatment Volume (acre-ft)	0.65		
Post-Development Treatment Volume (cubic feet)	28,276		
Post_Development Load (TP) (lb/yr)	17.77	Post_Development Load (TN) (lb/yr)	127.09
Total Load (TP) Reduction Required (lb/yr)	13.56		

		1-year storm	2-year storm	10-year storm
Target Rainfall Event (in)		3.10	3.80	5.80

Drainage Area DA-1	
Drainage Area (acres)	3.91
Runoff Reduction Volume (cf)	9,437
Drainage Area DA-2	
Drainage Area (acres)	2.16
Runoff Reduction Volume (cf)	5,197
Drainage Area DA-3	
Drainage Area (acres)	1.89
Runoff Reduction Volume (cf)	2,793
Drainage Area DA-4	
Drainage Area (acres)	1.38
Runoff Reduction Volume (cf)	1,381
Drainage Area DA-5	
Drainage Area (acres)	0.00
Runoff Reduction Volume (cf)	0

Based on the use of Runoff Reduction practices in the selected drainage areas, the spreadsheet calculates an adjusted $RV_{Developed}$ and adjusted Curve Number.

Drainage Area DA-1

		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.62	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	3.29	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					92	0.87

	1-year storm	2-year storm	10-year storm
$RV_{Developed}$ (in) with no Runoff Reduction	2.26	2.92	4.87
$RV_{Developed}$ (in) with Runoff Reduction	1.59	2.26	4.21
Adjusted CN	84	85	86

Drainage Area DA-2

		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.35	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	1.81	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					92	0.87

	1-year storm	2-year storm	10-year storm
$RV_{Developed}$ (in) with no Runoff Reduction	2.26	2.92	4.87
$RV_{Developed}$ (in) with Runoff Reduction	1.59	2.26	4.21
Adjusted CN	84	85	86

Drainage Area DA-3

		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.24	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	1.65	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					93	0.75

	1-year storm	2-year storm	10-year storm
$RV_{Developed}$ (in) with no Runoff Reduction	2.35	3.03	4.99
$RV_{Developed}$ (in) with Runoff Reduction	1.94	2.62	4.58
Adjusted CN	88	89	89

Drainage Area DA-4

		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.48	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.90	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					85	1.76

	1-year storm	2-year storm	10-year storm
$RV_{Developed}$ (in) with no Runoff Reduction	1.67	2.28	4.11
$RV_{Developed}$ (in) with Runoff Reduction	1.40	2.00	3.84
Adjusted CN	81	82	82

RUNOFF REDUCTION CALCULTIONS

DRAINAGE AREA DA-1

Drainage Area A Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	0.00	0.62	0.00	0.00	0.62	0.20
Impervious Cover (acres)	0.00	3.29	0.00	0.00	3.29	0.95
				Total	3.91	

Post Development Treatment Volume (cf) 11796

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage DA-1

Practice	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
6. Bioretention													
6.a. Bioretention #1 or Urban Bioretention (Spec #9)	impervious acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00	
	turf acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00	
6.b. Bioretention #2 (Spec #9)	impervious acres draining to bioretention	80% runoff volume reduction	0.80	3.29	0	9076	2269	50	0.00	7.12	6.41	0.71	8.a. ED #1
	turf acres draining to bioretention	80% runoff volume reduction	0.80	0.62	0	360	90	50	0.00	0.28	0.25	0.03	8.a. ED #1

Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)
6. Bioretention				
40	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
60	0.00	50.94	46.86	4.08
60	0.00	2.02	1.86	0.16

TOTAL IMPERVIOUS COVER TREATED (ac)	3.29
TOTAL TURF AREA TREATED (ac)	0.62

AREA CHECK OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	13.56
TOTAL RUNOFF REDUCTION IN DA-1 (cf)	9,437
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-1 (lb/yr)	6.77
TOTAL RUNOFF REDUCTION IN DA-1 (cf)	9,437
NITROGEN REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-1 (lb/yr)	52.96

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

DRAINAGE AREA DA-2

Drainage Area B Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	0.00	0.35	0.00	0.00	0.35	0.20
Impervious Cover (acres)	0.00	1.81	0.00	0.00	1.81	0.95
				Total	2.16	

Post Development Treatment Volume (cf) 6496

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage DA-2

Practice	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
6. Bioretention													
6.a. Bioretention #1 or Urban Bioretention (Spec #9)	impervious acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00	
	turf acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00	
6.b. Bioretention #2 (Spec #9)	impervious acres draining to bioretention	80% runoff volume reduction	0.80	1.81	0	4993	1248	50	0.00	3.92	3.53	0.39	8.a. ED #1
	turf acres draining to bioretention	80% runoff volume reduction	0.80	0.35	0	203	51	50	0.00	0.16	0.14	0.02	8.a. ED #1

Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)
6. Bioretention				
40	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
60	0.00	28.02	25.78	2.24
60	0.00	1.14	1.05	0.09

TOTAL IMPERVIOUS COVER TREATED (ac)	1.81
TOTAL TURF AREA TREATED (ac)	0.35

AREA CHECK OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	13.56
TOTAL RUNOFF REDUCTION IN DA-2 (cf)	5,197
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-2 (lb/yr)	3.73
TOTAL RUNOFF REDUCTION IN DA-2 (cf)	5,197
NITROGEN REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-2 (lb/yr)	29.16

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

DRAINAGE AREA DA-3

Drainage Area C Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	0.00	0.24	0.00	0.00	0.24	0.20
Impervious Cover (acres)	0.00	1.65	0.00	0.00	1.65	0.95
				Total	1.89	

Post Development Treatment Volume (cf) 5864

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage DA-3

Practice	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
3. Permeable Pavement													
3.a. Permeable Pavement #1 (Spec #7)	acres of permeable pavement + acres of "external" (upgradient) impervious pavement	45% runoff volume reduction	0.45	0.00	0	0	0	25	0.00	0.00	0.00	0.00	
3.b. Permeable Pavement #2 (Spec #7)	acres of permeable pavement	75% runoff volume reduction	0.75	1.08	0	2793	931	25	0.00	2.34	1.90	0.44	

Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)
3. Permeable Pavement				
25	0.00	0.00	0.00	0.00
25	0.00	16.72	13.59	3.14

TOTAL IMPERVIOUS COVER TREATED (ac)	1.08
TOTAL TURF AREA TREATED (ac)	0.00

AREA CHECK OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	13.56
TOTAL RUNOFF REDUCTION IN DA-3 (cf)	2,793
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-3 (lb/yr)	1.90
TOTAL RUNOFF REDUCTION IN DA-3 (cf)	2,793
NITROGEN REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-3 (lb/yr)	16.72

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

DRAINAGE AREA DA-4

Drainage Area D Land Cover (acres)

	A soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	0.00	0.48	0.00	0.00	0.48	0.20
Impervious Cover (acres)	0.00	0.90	0.00	0.00	0.90	0.95
				Total	1.38	

Post Development Treatment Volume (cf) 3452

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage DA-4

Practice	Unit	Description of Credit	Credit	Credit Area (acres)	Volume from Upstream RR Practice (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed
6. Bioretention													
6.a. Bioretention #1 or Urban Bioretention (Spec #9)	impervious acres draining to bioretention	40% runoff volume reduction	0.40	0.90	0	1241	1862	25	0.00	1.95	1.07	0.88	
	turf acres draining to bioretention	40% runoff volume reduction	0.40	0.48	0	139	209	25	0.00	0.22	0.12	0.10	
6.b. Bioretention #2 (Spec #9)	impervious acres draining to bioretention	80% runoff volume reduction	0.80	0.00	0	0	0	50	0.00	0.00	0.00	0.00	
	turf acres draining to bioretention	80% runoff volume reduction	0.80	0.00	0	0	0	50	0.00	0.00	0.00	0.00	

Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)
6. Bioretention				
40	0.00	13.93	8.92	5.02
40	0.00	1.56	1.00	0.56
60	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00

TOTAL IMPERVIOUS COVER TREATED (ac)	0.90
TOTAL TURF AREA TREATED (ac)	0.48

AREA CHECK OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	13.56
TOTAL RUNOFF REDUCTION IN DA-4 (cf)	1,381
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-4 (lb/yr)	1.19
TOTAL RUNOFF REDUCTION IN DA-4 (cf)	1,381
NITROGEN REMOVAL FROM RUNOFF REDUCTION PRACTICES IN DA-4 (lb/yr)	15.50

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

Site Results

	DA-1	DA-2	DA-3	DA-4	DA-5	AREA CHECK
IMPERVIOUS COVER	3.29	1.81	1.65	0.90	0.00	OK.
IMPERVIOUS COVER TREATED	3.29	1.81	1.08	0.90	0.00	OK.
TURF AREA	0.62	0.35	0.24	0.48	0.00	OK.
TURF AREA TREATED	0.62	0.35	0.00	0.48	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	

Phosphorus

TOTAL TREATMENT VOLUME (cf)	28,276
TOTAL PHOSPHORUS LOAD REDUCTION REQUIRED (LB/YEAR)	13.56
RUNOFF REDUCTION (cf)	18807
PHOSPHORUS LOAD REDUCTION ACHIEVED (LB/YR)	13.59
ADJUSTED POST-DEVELOPMENT PHOSPHORUS LOAD (TP) (lb/yr)	4.17
REMAINING PHOSPHORUS LOAD REDUCTION (LB/YR) NEEDED	CONGRATULATIONS!! YOU EXCEEDED THE TARGET REDUCTION BY 0 LB/YEAR!!

Nitrogen (for information purposes)

TOTAL TREATMENT VOLUME (cf)	28,276
RUNOFF REDUCTION (cf)	18807
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	114.34
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TN) (lb/yr)	12.75

Virginia Runoff Reduction Method New Development Worksheet - v2.8 - June 2014

Update Summary Sheet | Print

Site Data Summary
Total Rainfall = 43 inches

Site Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	2.61	0.00	0.00	2.61	25.44
Impervious (acres)	0.00	7.65	0.00	0.00	7.65	74.56
					10.26	100.00

Site Rv	0.76
Post Development Treatment Volume (ft3)	28276
Post Development TP Load (lb/yr)	17.77
Post Development TN Load (lb/yr)	127.09
Total TP Load Reduction Required (lb/yr)	13.56

Total Runoff Volume Reduction (ft^3)	18807
Total TP Load Reduction Achieved (lb/yr)	14
Total TN Load Reduction Achieved (lb/yr)	114.34
Adjusted Post Development TP Load (lb/yr)	4.17
Remaining Phosphorous Load Reduction (Lb/yr) Required	0.00

Drainage Area Summary

	DA-1	DA-2	DA-3	DA-4	DA-5	Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.62	0.35	0.24	0.48	0.00	1.69
Impervious (acres)	3.29	1.81	1.65	0.90	0.00	7.65
						9.34

Drainage Area Compliance Summary

	DA-1	DA-2	DA-3	DA-4	DA-5	Total
TP Load Red. (lb/yr)	6.77	3.73	1.90	1.19	0.00	13.59
TN Load Red. (lb/yr)	52.96	29.16	16.72	15.50	0.00	114.34

Drainage DA-1 Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.62	0.00	0.00	0.62	15.86
Impervious (acres)	0.00	3.29	0.00	0.00	3.29	84.14
					3.91	

BMP Selections

Practice	Credit Area (acres)	Downstream Practice

Total Impervious Cover Treated (acres)	3.29
Total Turf Area Treated (acres)	0.62
Total TP Load Reduction Achieved in DA-1 (lb/yr)	6.77
Total TN Load Reduction Achieved in DA-1 (lb/yr)	52.96

Drainage DA-2 Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.35	0.00	0.00	0.35	16.20
Impervious (acres)	0.00	1.81	0.00	0.00	1.81	83.80
					2.16	

BMP Selections

Practice	Credit Area (acres)	Downstream Practice

Total Impervious Cover Treated (acres)	1.81
Total Turf Area Treated (acres)	0.35
Total TP Load Reduction Achieved in DA-2 (lb/yr)	3.73
Total TN Load Reduction Achieved in DA-2 (lb/yr)	29.16

Drainage DA-3 Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.24	0.00	0.00	0.24	12.70
Impervious (acres)	0.00	1.65	0.00	0.00	1.65	87.30
					1.89	

BMP Selections

Practice	Credit Area (acres)	Downstream Practice

Total Impervious Cover Treated (acres)	1.08
Total Turf Area Treated (acres)	0.00
Total TP Load Reduction Achieved in DA-3 (lb/yr)	1.90
Total TN Load Reduction Achieved in DA-3 (lb/yr)	16.72

Drainage DA-4 Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.48	0.00	0.00	0.48	34.78
Impervious (acres)	0.00	0.90	0.00	0.00	0.90	65.22
					1.38	

BMP Selections

Practice	Credit Area (acres)	Downstream Practice

Total Impervious Cover Treated (acres)	0.90
Total Turf Area Treated (acres)	0.48
Total TP Load Reduction Achieved in DA-4 (lb/yr)	1.19
Total TN Load Reduction Achieved in DA-4 (lb/yr)	15.50

Channel and Flood Protection

	Weighted CN	1-year storm Adjusted CN	2-year storm Adjusted CN	10-year storm Adjusted CN
Target Rainfall Event (in)		2.80	3.30	5.00
DA-1 CN	92	83	84	85
DA-2 CN	92	83	84	85
DA-3 CN	93	88	88	89
DA-4 CN	85	81	81	82

GREATER LYNCHBURG TRANSIT COMPANY
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PROJECT ADDRESS:
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24501-4901

Operations &
Maintenance Facility

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10/29/14
PROFESSIONAL ENGINEER

Revision Number	Issued by	Revision Description	Revision Date

DWG. TITLE
STORMWATER/DRAINAGE CALCULATIONS

DATE	10/29/2014
SCALE	1:40
DWN.	LLW
CHK.	WLW
PROJ. No.	444505
DWG. No.	C303A

Summary for Pond 5P: EXTENDED DETENTION

Inflow Area = 319,295 sf, 74.00% Impervious, Inflow Depth = 1.81" for 10-Year event
Inflow = 34.32 cfs @ 12.08 hrs, Volume= 48,186 cf
Outflow = 4.05 cfs @ 12.64 hrs, Volume= 29,731 cf, Atten= 88%, Lag= 33.7 min
Primary = 4.05 cfs @ 12.64 hrs, Volume= 29,731 cf
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 815.72' @ 12.64 hrs Surf.Area= 11,560 sf Storage= 34,348 cf

Plug-Flow detention time= 107.3 min calculated for 29,731 cf (62% of inflow)
Center-of-Mass det. time= 91.7 min (833.8 - 742.1)

Volume	Invert	Avail.Storage	Storage Description
#1	812.00'	140,948 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

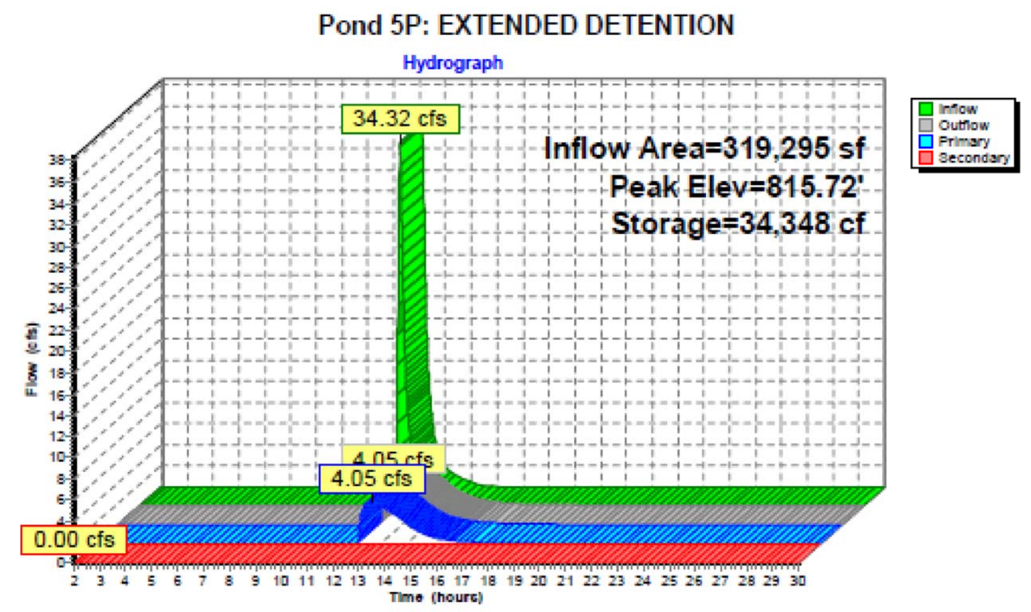
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
812.00	7,053	0	0
814.00	9,332	16,385	16,385
816.00	11,923	21,255	37,640
818.00	14,825	26,748	64,388
820.00	18,039	32,864	97,252
822.00	25,657	43,696	140,948

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	**12.0" Round Culvert** L= 77.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 812.00' / 811.60' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	815.50'	**14.0" Vert. 10 year orifice** C= 0.600
#3	Device 1	817.50'	**36.0" x 36.0" Horiz. Top Riser** C= 0.600 Limited to weir flow at low heads
#4	Secondary	818.50'	**15.0' long Emergency Spillway** Cv= 2.62 (C= 3.28)
#5	Device 1	814.20'	**12.0" Vert. 2 Year orifice** C= 0.600

Primary OutFlow Max=4.04 cfs @ 12.64 hrs HW=815.72' (Free Discharge)
└1=**Culvert** (Passes 4.04 cfs of 5.85 cfs potential flow)
 ├2=**10 year orifice** (Orifice Controls 0.22 cfs @ 1.60 fps)
 ├3=**Top Riser** (Controls 0.00 cfs)
 └5=**2 Year orifice** (Orifice Controls 3.82 cfs @ 4.86 fps)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=812.00' (Free Discharge)
└4=**Emergency Spillway** (Controls 0.00 cfs)

EXTENDED DETENTION POND
DRAINAGE AREA DA-1 AND DA-2 COMBINED



10 YEAR EVENT

Summary for Pond 5P: EXTENDED DETENTION

Inflow Area = 319,295 sf, 74.00% Impervious, Inflow Depth = 2.15" for 25-Year event
Inflow = 39.92 cfs @ 12.08 hrs, Volume= 57,272 cf
Outflow = 5.90 cfs @ 12.55 hrs, Volume= 38,808 cf, Atten= 85%, Lag= 28.2 min
Primary = 5.90 cfs @ 12.55 hrs, Volume= 38,808 cf
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 816.09' @ 12.55 hrs Surf.Area= 12,058 sf Storage= 38,754 cf

Plug-Flow detention time= 99.7 min calculated for 38,808 cf (68% of inflow)
Center-of-Mass det. time= 84.1 min (826.5 - 742.4)

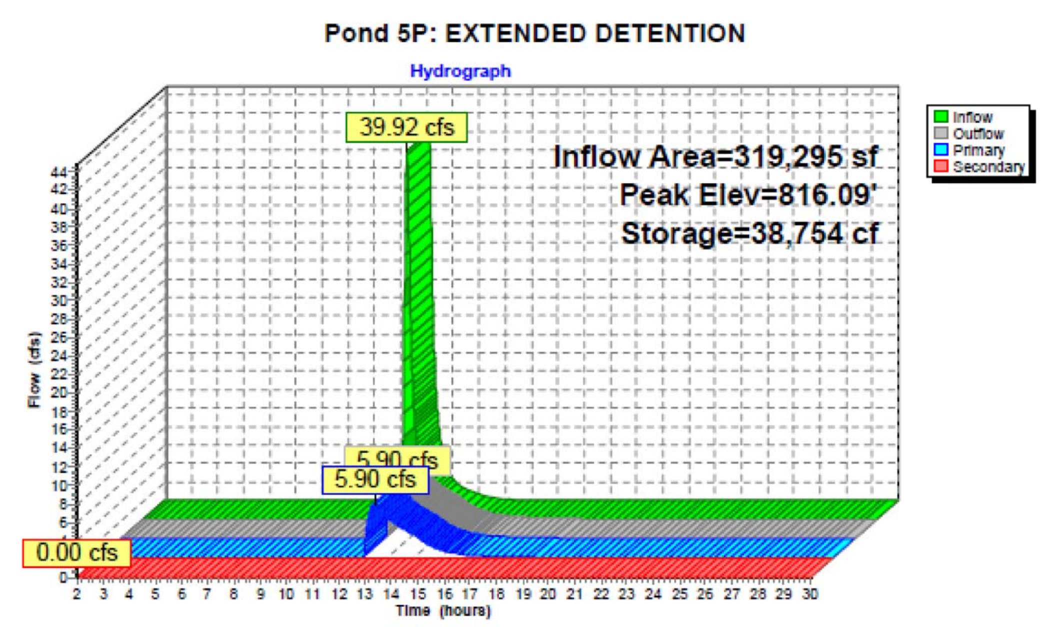
Volume	Invert	Avail.Storage	Storage Description
#1	812.00'	140,948 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
812.00	7,053	0	0
814.00	9,332	16,385	16,385
816.00	11,923	21,255	37,640
818.00	14,825	26,748	64,388
820.00	18,039	32,864	97,252
822.00	25,657	43,696	140,948

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	**12.0" Round Culvert** L= 77.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 812.00' / 811.60' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	815.50'	**14.0" Vert. 10 year orifice** C= 0.600
#3	Device 1	817.50'	**36.0" x 36.0" Horiz. Top Riser** C= 0.600 Limited to weir flow at low heads
#4	Secondary	818.50'	**15.0' long Emergency Spillway** Cv= 2.62 (C= 3.28)
#5	Device 1	814.20'	**12.0" Vert. 2 Year orifice** C= 0.600

Primary OutFlow Max=5.89 cfs @ 12.55 hrs HW=816.09' (Free Discharge)
└1=**Culvert** (Passes 5.89 cfs of 6.19 cfs potential flow)
 ├2=**10 year orifice** (Orifice Controls 1.43 cfs @ 2.62 fps)
 ├3=**Top Riser** (Controls 0.00 cfs)
 └5=**2 Year orifice** (Orifice Controls 4.46 cfs @ 5.68 fps)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=812.00' (Free Discharge)
└4=**Emergency Spillway** (Controls 0.00 cfs)



25 YEAR EVENT

Summary for Pond 5P: EXTENDED DETENTION

Inflow Area = 319,295 sf, 74.00% Impervious, Inflow Depth = 3.30" for 100-Year event
Inflow = 69.05 cfs @ 12.04 hrs, Volume= 87,914 cf
Outflow = 7.36 cfs @ 12.56 hrs, Volume= 69,419 cf, Atten= 89%, Lag= 31.0 min
Primary = 7.36 cfs @ 12.56 hrs, Volume= 69,419 cf
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 817.53' @ 12.56 hrs Surf.Area= 14,138 sf Storage= 57,532 cf

Plug-Flow detention time= 101.5 min calculated for 69,419 cf (79% of inflow)
Center-of-Mass det. time= 85.0 min (829.1 - 744.0)

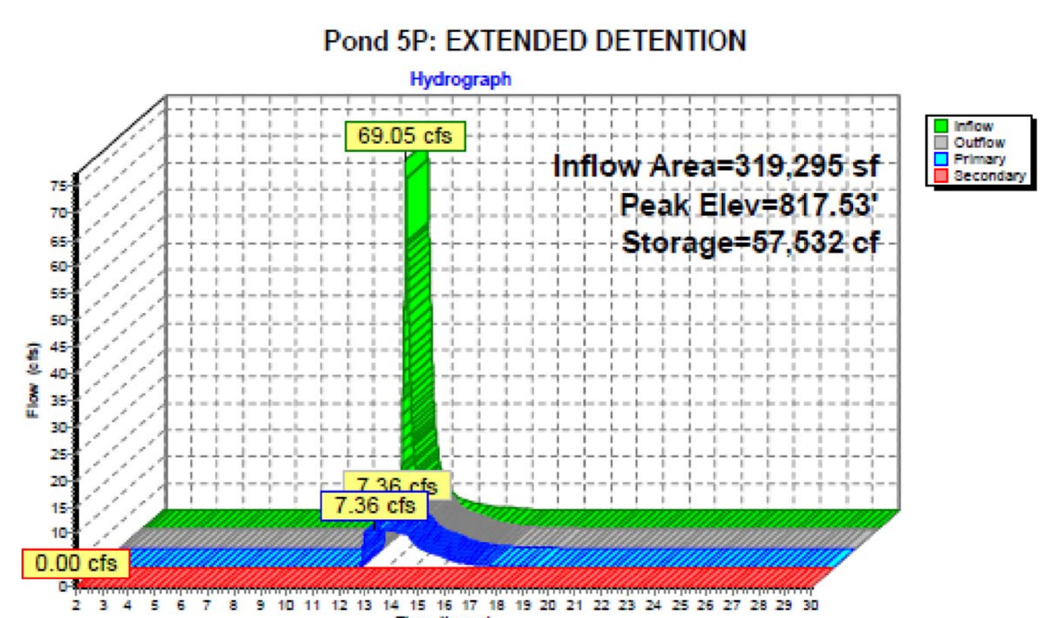
Volume	Invert	Avail.Storage	Storage Description
#1	812.00'	140,948 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
812.00	7,053	0	0
814.00	9,332	16,385	16,385
816.00	11,923	21,255	37,640
818.00	14,825	26,748	64,388
820.00	18,039	32,864	97,252
822.00	25,657	43,696	140,948

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	**12.0" Round Culvert** L= 77.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 812.00' / 811.60' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	815.50'	**14.0" Vert. 10 year orifice** C= 0.600
#3	Device 1	817.50'	**36.0" x 36.0" Horiz. Top Riser** C= 0.600 Limited to weir flow at low heads
#4	Secondary	818.50'	**15.0' long Emergency Spillway** Cv= 2.62 (C= 3.28)
#5	Device 1	814.20'	**12.0" Vert. 2 Year orifice** C= 0.600

Primary OutFlow Max=7.36 cfs @ 12.56 hrs HW=817.53' (Free Discharge)
└1=**Culvert** (Barrel Controls 7.36 cfs @ 9.36 fps)
 ├2=**10 year orifice** (Passes < 6.18 cfs potential flow)
 ├3=**Top Riser** (Passes < 0.17 cfs potential flow)
 └5=**2 Year orifice** (Passes < 6.36 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=812.00' (Free Discharge)
└4=**Emergency Spillway** (Controls 0.00 cfs)



100 YEAR EVENT

POND/OUTFALL SIZING CALCULATION

BIORETENTION AREA DA-4
10 YEAR EVENT

Summary for Pond 3P: BIOFILTER-4

Inflow Area = 60,113 sf, 74.00% Impervious, Inflow Depth = 3.21" for 10-Year event
Inflow = 8.14 cfs @ 11.96 hrs, Volume= 16,071 cf
Outflow = 3.10 cfs @ 12.06 hrs, Volume= 15,859 cf, Atten= 62%, Lag= 6.0 min
Discarded = 0.38 cfs @ 12.06 hrs, Volume= 867 cf
Primary = 2.73 cfs @ 12.06 hrs, Volume= 14,992 cf

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 809.13' @ 12.06 hrs Surf.Area= 5,416 sf Storage= 5,528 cf

Plug-Flow detention time= 67.2 min calculated for 15,854 cf (99% of inflow)
Center-of-Mass det. time= 59.3 min (880.8 - 821.5)

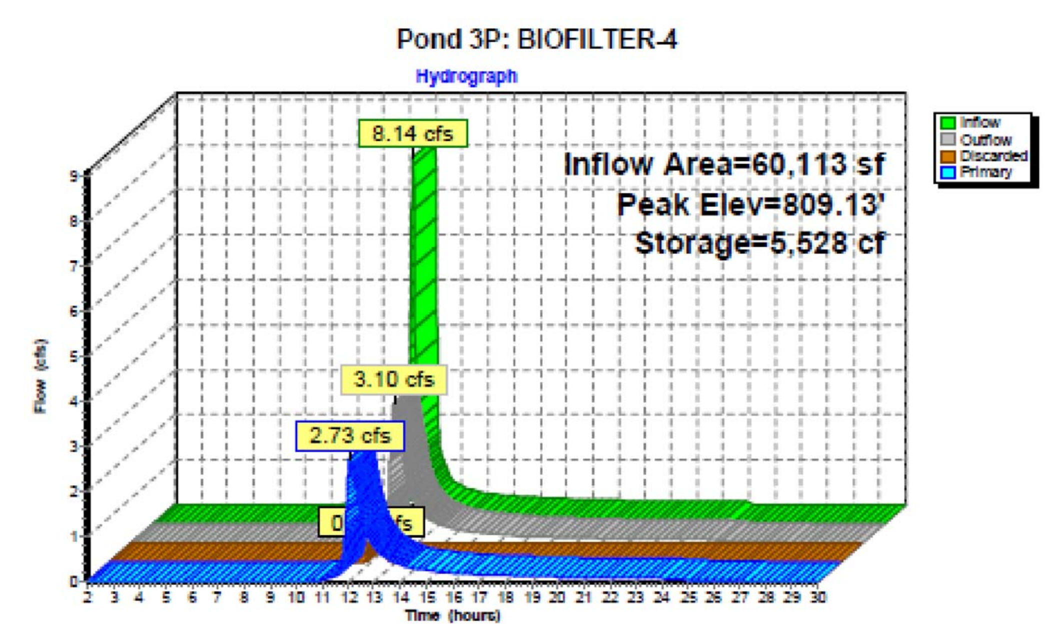
Volume	Invert	Avail.Storage	Storage Description
#1	808.00'	7,601 cf	**BIORETENTION (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
808.00	4,376	0	0
809.50	5,758	7,601	7,601

Device	Routing	Invert	Outlet Devices
#1	Discarded	808.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	808.00'	**12.0" Round Culvert** L= 37.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 808.00' / 807.80' S= 0.0054 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 1	808.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	809.30'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.38 cfs @ 12.06 hrs HW=809.13' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.38 cfs)
 ├3=**Orifice/Grate** (Passes 0.38 cfs of 1.40 cfs potential flow)
 └4=**Orifice/Grate** (Controls 0.00 cfs)

Primary OutFlow Max=2.73 cfs @ 12.06 hrs HW=809.13' (Free Discharge)
└2=**Culvert** (Barrel Controls 2.73 cfs @ 3.85 fps)



NOTE:
DRAINAGE AREA DA-3 DRAINS TO THE PERMEABLE PAVEMENT WHICH HAS BEEN DESIGNED TO STORE THE 25 YEAR/24 HOUR STORM EVENT.

Drainage

1. Contractor shall exercise care, especially at intersections and gutter lines, to provide positive drainage. Any areas where water is impounded shall be corrected by Contractor at no additional cost. Positive drainage of all roadway areas to the storm drain inlets or other acceptable drainage channels as noted on the plans is required.
2. Contractor shall maintain existing streams, ditches, drainage structures, culverts and flows at all times during the work. Contractor shall pay for all personal injury and property damage which may occur as a result of failing to maintain adequate drainage.
3. All pipes, DI's and other structures shall be inspected by the Engineer before being backfilled or buried. The Engineer may require Contractor, at no additional cost, to uncover and re-cover such structures if they have been backfilled or buried without such inspection.
4. All catch basins encompassed within new construction shall be converted to drop inlets.
5. Class I Rip Rap modifications allows for a reduction in stone depth from 2.0' to a minimum of 1.0' as directed by the Engineer.
6. Removed pipe shall be the property of Contractor and if not salvaged for re-use, shall be disposed of lawfully.
7. All storm sewer pipe and drop inlets shall be cleared of debris and eroded material prior to final acceptance.
8. All storm sewer pipe joints shall be seated and sealed in accordance with the manufacturer's specifications.
9. All existing roof drains and other drainage conduit tied into existing pipe shall be tied into new pipe. All existing roof drains and other drainage conduit blocked or disrupted from their pre-construction drainage patterns shall be shortened, extended or otherwise connected to the new work using materials approved by the Engineer, and in such a way that the new drainage patterns are acceptable to Engineer. Costs are to be included under the various unit bid items. No separate payment will be made.

GREATER LYNCHBURG TRANSIT COMPANY
1301 Kemper Street PO Box 797
Lynchburg, VA 24505-0797

PROJECT ADDRESS:
419 Bradley Dr.
Lynchburg, VA
24501-4901

Operations &
Maintenance Facility

BID DOCUMENTS

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www.wendelcompanies.com
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ALEXANDRIA ARCHITECTURE, ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

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COMMONWEALTH OF VIRGINIA
LYNETTE L. WUENSCH
Lic. No. 38710
10/29/14
PROFESSIONAL ENGINEER

Revision Number	Issued by	Revision Description	Revision Date

DWG. TITLE

STORMWATER/DRAINAGE CALCULATIONS

DATE	10/29/2014		
SCALE	1:40		
DWN.	LLW	CHK.	WLW
PROJ. No.	444505		
DWG. No.	C304		

FOREBAY SIZING COMPUTATIONS

Sediment Forebays

The volume of storage provided at each forebay will be 0.1" of runoff over the outfall's new contributing impervious area, with the sum of all forebay volumes not less than 10% of the total extended detention volume.

The storage volume in the sediment forebay is provided by separating the forebay from the rest of the basin. This separation is accomplished by means of riprap.

Summary of Pond Inflow Points		
Entrance Point 1 (DA-1)		
Acreage	New Impervious Acreage	Peak 10-Year Inflow (cfs)
1.88	1.88	11.6
Entrance Point 2 (DA-1)		
Acreage	New Impervious Acreage	Peak 10-Year Inflow (cfs)
1.41	1.41	6.7
Entrance DA-2		
Acreage	New Impervious Acreage	Peak 10-Year Inflow (cfs)
1.73	1.73	10.7
Entrance DA-4		
Acreage	New Impervious Acreage	Peak 10-Year Inflow (cfs)
0.5	0.35	3.08
0.59	0.59	3.63

First, the forebays will be sized to provide storage of 0.1" of runoff from the new impervious area contributing runoff to each entrance point:

Entrance Pt 1 (DA-1) V = 1.88 ac X (43560 ft^2/ac) X (0.1 in/12 in/ft) = **682 ft^3**
Entrance Pt 2 (DA-1) V = 1.41 ac X (43560 ft^2/ac) X (0.1 in/12 in/ft) = **512 ft^3**
(DA-2) V = 1.73 ac X (43560 ft^2/ac) X (0.1 in/12 in/ft) = **628 ft^3**
(DA-4) V = 0.50 ac X (43560 ft^2/ac) X (0.1 in/12 in/ft) = **182 ft^3** and 0.59 ac X (43560 ft^2/ac) x (0.1 in/12 in/ft) = **214 ft^3**

The project site water quality volume is 0.31 acre-feet.
The sum of all forebay volumes must be at least 10% of this volume, computed as follows:
0.10 X 0.31 ac-ft X (43560 ft^2/ac) = 1350 ft^3

DA-1 = 41% = 554 ft^3
DA-2 = 21% = 284 ft^3
DA-4 = 10% = 135 ft^3

DA-1 = V= 554 ft^3 < Vforebay = 682 ft^3 + 512 ft^3 = 1194 ft^3
DA-2 = V = 284 ft^3 < Vforebay = 512 ft^3
DA-4 = V = 135 ft^3 < Vforebay = 396 ft^3

POND SIZING COMPUTATIONS

Equation used for the Rational Hydrograph Method

$$V_{st} = 0.08264\, t_{ca}\,(q_{pa} - q_{pb})$$

(V_{st} will be in acre-ft, for t_{ca} in hr and q_{pa} & q_{pb} in cfs)

Inputs			Calculations		
Peak Runoff Rate			Vol. in acre ft, V_{st} =	0.177	acre-ft
(before), q_{pb} =	3.7	cfs			
Peak Runoff Rate					
(after), q_{pa} =	29.5	cfs	2 YEAR REQUIRED VOLUME EXTENDED DETENTION AREA		
Time of Concentration					
(after), t_{ca} =	0.083	hr			

Inputs			Calculations		
Peak Runoff Rate			Vol. in acre ft, V_{st} =	0.222	acre-ft
(before), q_{pb} =	5.1	cfs			
Peak Runoff Rate					
(after), q_{pa} =	37.5	cfs	10 YEAR REQUIRED VOLUME EXTENDED DETENTION AREA		
Time of Concentration					
(after), t_{ca} =	0.083	hr			

Inputs			Calculations		
Peak Runoff Rate			Vol. in acre ft, V_{st} =	0.253	acre-ft
(before), q_{pb} =	5.9	cfs			
Peak Runoff Rate					
(after), q_{pa} =	42.8	cfs	25 YEAR REQUIRED STORAGE VOLUME EXTENDED DETENTION BASIN		
Time of Concentration					
(after), t_{ca} =	0.083	hr			

Inputs			Calculations		
Peak Runoff Rate			Vol. in acre ft, V_{st} =	0.303	acre-ft
(before), q_{pb} =	7.3	cfs			
Peak Runoff Rate					
(after), q_{pa} =	51.5	cfs	100 YEAR REQUIRED STORAGE VOLUME EXTENDED DETENTION AREA		
Time of Concentration					
(after), t_{ca} =	0.083	hr			

Inputs			Calculations		
Peak Runoff Rate			Vol. in acre ft, V_{st} =	0.022	acre-ft
(before), q_{pb} =	3.1	cfs			
Peak Runoff Rate					
(after), q_{pa} =	6.3	cfs	Bioretention DA-4 storage requirements 10 Year		
Time of Concentration					
(after), t_{ca} =	0.083	hr			

STORMSEWER DESIGN COMPUTATIONS

GLTC BUS FACILITY
9/15/2014
INLET COMPUTATIONS

INLET NUMBER	INLET TYPE	DRAINAGE AREA (AC)	C	CA	Sum CA	I (IN/HR)	Q INCR (CFS)	Q CARRY-OVER (CFS)	Q_T GUTTER FLOW (CFS)	S GUTTER SLOPE (FT/FT)	S_X CROSS SLOPE (FT/FT)	T (SPREAD) (FT)	W (FT)	W/T	S_W (FT/FT)	S_W/S_X	E_O	Local Depression (in)	a=12W(Sw-Sx)+Local Depression
1	2	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20A	21
GLTC-2	DI-3C	0.66	0.89	0.59	0.59	6.92	4.06	0.00	4.06	0.3	0.0208	7.40	2.0	0.27	0.0833	4.00	0.76	2	3.5
GLTC-3	DI-3C	0.65	0.89	0.58	1.17	6.92	4.00	0.00	4.00	0.3	0.0208	7.36	2.0	0.27	0.0833	4.00	0.76	2	3.5
GLTC-4	DI-3B	0.57	0.89	0.51	1.67	6.92	3.51	0.00	3.51	0.3	0.0208	7.00	2.0	0.29	0.0833	4.00	0.78	2	3.5
GLTC-1	DI-7	0.71	0.89	0.63	0.63	6.92	4.37	0.00	4.37	0.3	0.0208	7.60	2.0	0.26	0.0833	4.00	0.60	2	3.5
GLTC-6	DI-7	0.70	0.89	0.62	1.25	6.92	4.31	0.08	4.39	0.3	0.0208	7.56	2.0	0.26	0.0833	4.00	0.60	2	3.5
GLTC-8	DI-3B	0.85	0.89	0.76	0.76	6.92	5.23	0.00	5.23	0.3	0.0208	8.13	2.0	0.25	0.0833	4.00	0.69	2	3.5
GLTC-9	DI-3B	0.88	0.89	0.78	1.54	6.92	5.42	0.22	5.64	0.3	0.0208	8.24	2.0	0.24	0.0833	4.00	0.69	2	3.5
GLTC-11	TRENCH	0.50	0.89	0.45	1.98	6.92	3.08	0.00	3.08	0.3	0.0208	6.67	2.0	0.30	0.0833	4.00	0.74	2	3.5
GLTC-17	RIPRAP	0.59	0.89	0.53	2.51	6.92	3.63	0.00											

INLET NUMBER	S'_W = a/(12W)	S_e (FT/FT) = S_X + $S'_W E_O$	Computed Length L_T (FT)	L, Specified Length (FT)	L/L_T	$E=1-(1-L/L_T)^{1.8}$	Qi, INTERCEPTED (CFS)	Qb, CARRYOVER (CFS)	SAG INLETS ONLY: d (FT)	h (FT)	d/h	Lr(ft), Required Length	T, SPREAD @ SAG (FT)	REMARKS
1	22	23	24	25	26	27	28	29	30	31	32	33	34	35
GLTC-2	0.1458	0.1316	12.41	12.00	1.00	1.00	4.06	0.00	0.17	0.46	0.37	6.55	7.40	Sag
GLTC-3	0.1458	0.1316	12.33	12.00	1.00	1.00	4.00	0.00	0.17	0.46	0.37	6.46	7.36	Sag
GLTC-4	0.1458	0.1346	11.52	10.00	0.87	0.97	3.42	0.09						
GLTC-1	0.1458	0.1083	14.39	12.80	0.89	0.98	4.29	0.08	0.17	0.46	0.37	7.05	7.60	Sag
GLTC-6	0.1458	0.1083	14.30	12.80	0.89	0.98	4.31	0.08	0.17	0.46	0.37	7.08	7.56	Sag
GLTC-8	0.1458	0.1214	14.49	12.00	0.83	0.96	5.01	0.22						
GLTC-9	0.1458	0.1214	14.70	12.00	0.82	0.95	5.37	0.27						
GLTC-11	0.1458	0.1287	11.20	26.00	1.00	1.00	3.08	0.00						
GLTC-17														

n= 0.013 | County Number 15 | Σ= | Rainfall ◉ 10 ○ 25 ○ 50

FROM POINT station	T0 POINT station	area "A" acres	C	CA	Sum CA	Tc min	I-10 in./ hr.	Q-2 cfs	Q-10 cfs	Invert Elevations: Upper end ft	COVER ft	Lower end ft	COVER ft	Length L ft	Slope S '/. ft./ ft.	Dia. inch	Capacity Q cfs	Velocity V-2 ft/sec	Velocity V-10 ft/sec	Flow Time Time 10 min	Remarks
GLTC-2	GLTC-3	0.660	0.89	0.59	0.587	5.0	6.92	3.1	4.1	823.100	3.50	822.400	4.20	126.0	0.006	24	16.86	4.1	4.4	0.5	
GLTC-3	GLTC-4	0.650	0.89	0.58	1.166	5.0	6.92	6.2	8.1	822.400	3.70	821.500	4.60	158.0	0.006	30	30.96	4.9	5.3	0.5	
GLTC-4	GLTC-5	0.570	0.89	0.51	1.673	5.0	6.92	8.9	11.6	821.500	4.60	820.000	0.00	266.0	0.006	30	30.80	5.4	5.8	0.8	
GLTC-1	GLTC-6	0.710	0.89	0.63	0.632	5.0	6.92	3.4	4.4	819.000	1.00	818.900	1.10	20.0	0.005	24	16.00	4.0	4.3	0.1	
GLTC-6	GLTC-7	0.700	0.89	0.62	1.255	5.0	6.92	6.7	8.7	818.800	1.20	818.000	0.00	161.0	0.005	24	15.95	4.8	5.2	0.6	
GLTC-8	GLTC-9	0.850	0.89	0.76	0.757	5.0	6.92	4.0	5.2	834.000	8.50	828.000	1.50	237.0	0.025	18	16.71	7.8	8.4	0.5	
GLTC-9	GLTC-10	0.880	0.89	0.78	1.540	5.0	6.92	8.2	10.7	825.500	3.50	825.000	0.00	47.0	0.011	24	23.33	6.8	7.3	0.1	
GLTC-11	TRENCH	0.500	0.89	0.45	0.445	5.0	6.92	2.4	3.1	813.000	0.00	812.000	0.00	26.0	0.038	12	6.99	8.0	8.6	0.1	

INLET REPORT

Inlet Station	Outlet Water Surface Elevation	D_o in	Q_o	L_o	Sf_o '/'	H_f	V_o	H_o	Q_i	V_i	Q_iV_i	$\frac{Vi^2}{2g}$	Hi	Angle	Hd	Ht	1.3 Ht	0.5 Ht	Final H	Inlet Water Surface Elevation	Rim Elevation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
GLTC-2	828.000	24	4.1	126.0	0.000	0.041	4.4	0.076	4.1	4.4	17.95	0.303	0.106			0.182	0.236	0.118	0.159	828.159	828.600
GLTC-3	828.000	30	8.1	158.0	0.000	0.061	5.3	0.109	8.1	5.3	42.77	0.437	0.153			0.262	0.341	0.170	0.231	828.231	828.600
GLTC-4	820.000	30	11.6	266.0	0.001	0.212	5.8	0.132	11.6	5.8	67.47	0.528	0.185	60	0.290	0.607	0.789	0.394	0.606	820.606	828.600
GLTC-1	822.000	24	4.4	20.0	0.000	0.007	4.3	0.073	4.4	4.3	18.97	0.292	0.102			0.175	0.228	0.114	0.122	822.122	822.000
GLTC-6	818.000	24	8.7	161.0	0.001	0.237	5.2	0.104	8.7	5.2	45.00	0.417	0.146			0.250	0.325	0.163	0.400	818.400	822.000
GLTC-8	831.000	18	5.2	237.0	0.002	0.588	8.4	0.272	5.2	8.4	43.79	1.087	0.381			0.652	0.848	0.424	1.012	832.012	844.000
GLTC-9	825.000	24	10.7	47.0	0.002	0.104	7.3	0.205	10.7	7.3	77.33	0.819	0.286			0.491	0.638	0.319	0.423	825.423	831.000
GLTC-11	808.000	12	3.1	26.0	0.007	0.194	8.6	0.288	3.1	8.6	26.53	1.153	0.404			0.692	0.900	0.450	0.644	808.644	814.000

OUTFALL DITCH FOR EXTENDED DETENTION POND

Trapezoidal
Botom Width (ft) = 3.00
Side Slope (z:1) = 3.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 802.00
Slope (%) = 0.07
N-Value = 0.030

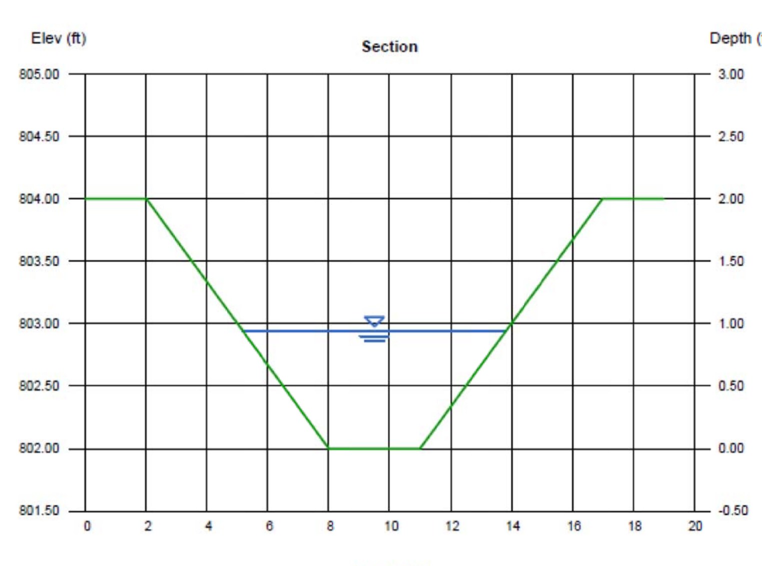
Calculations
Compute by: Known Q
Known Q (cfs) = 5.10

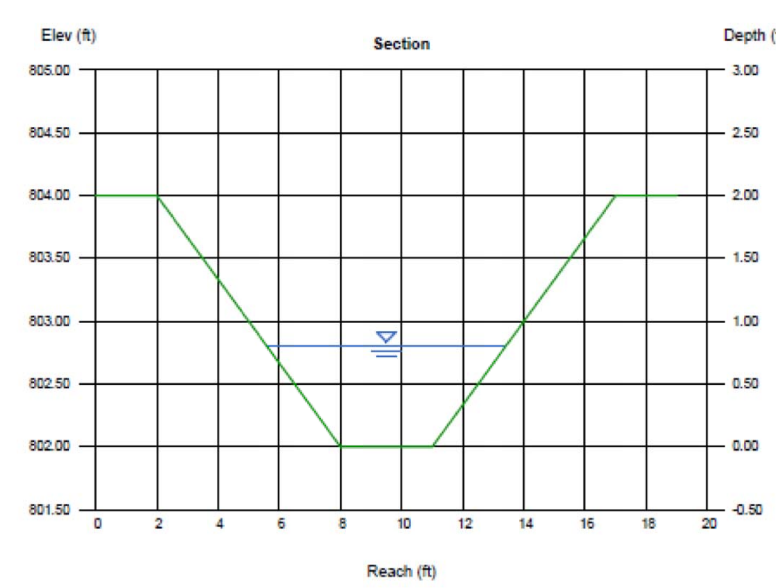
Highlighted
Depth (ft) = 0.94
Q (cfs) = 5.100
Area (sqft) = 5.47
Velocity (ft/s) = 0.93
Wetted Perim (ft) = 8.95
Crit Depth, Yc (ft) = 0.40
Top Width (ft) = 8.64
EGL (ft) = 0.95

Trapezoidal
Botom Width (ft) = 3.00
Side Slope (z:1) = 3.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 802.00
Slope (%) = 0.07
N-Value = 0.030

Calculations
Compute by: Known Q
Known Q (cfs) = 3.70

Highlighted
Depth (ft) = 0.80
Q (cfs) = 3.700
Area (sqft) = 4.32
Velocity (ft/s) = 0.86
Wetted Perim (ft) = 8.06
Crit Depth, Yc (ft) = 0.33
Top Width (ft) = 7.80
EGL (ft) = 0.81





OUTFALL DITCH
2 & 10-YEAR

GREATER LYNCHBURG TRANSIT COMPANY
1301 Kemper Street PO Box 797
Lynchburg, VA 24505-0797

PROJECT ADDRESS:
419 Bradley Dr.
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COMMONWEALTH OF VIRGINIA
LYNETTE L. WUENSCH
Lic. No. 38710
10/29/14
PROFESSIONAL ENGINEER

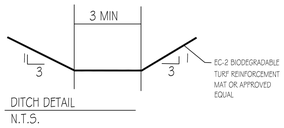
Revision Number	Issued by	Revision Description	Revision Date

DWG. TITLE

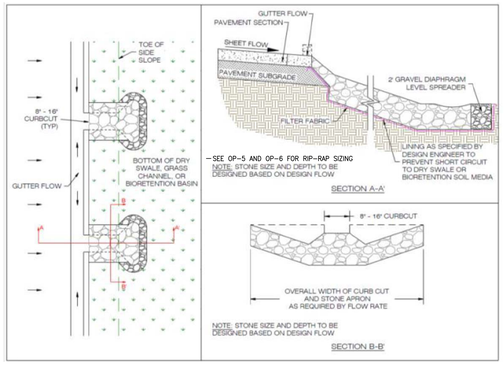
STORMWATER/DRAINAGE CALCULATIONS

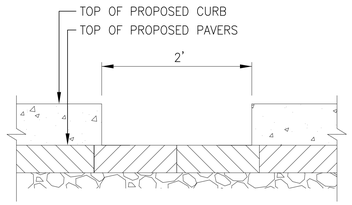
DATE	10/29/2014
SCALE	1:40
DWN.	LLW
CHK.	WLW
PROJ. No.	444505
DWG. No.	C304A

DATE/TIME PRINTED: 10/29/2014 11:47:18 AM FILEPATH: [illegible] BID SET_10_29_14



DITCH DETAIL
N.T.S.





CURB CUT EMERGENCY OVERFLOW DETAIL
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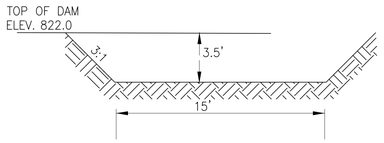
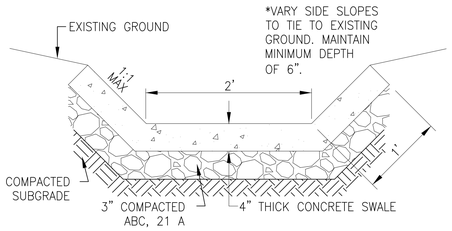


SPILLWAY: CROSS SECTION
AT CONTROL SECTION



PAVED EMERGENCY OVERFLOW SWALE DETAIL
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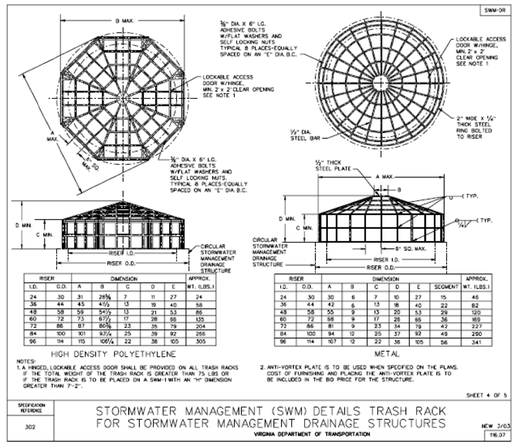
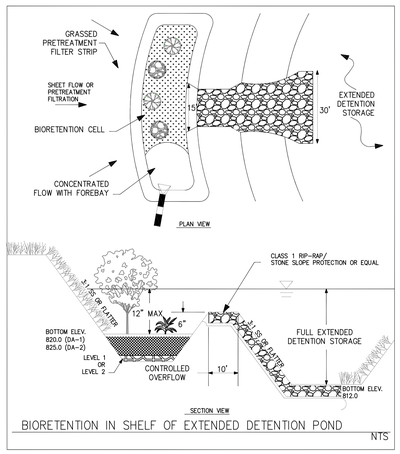
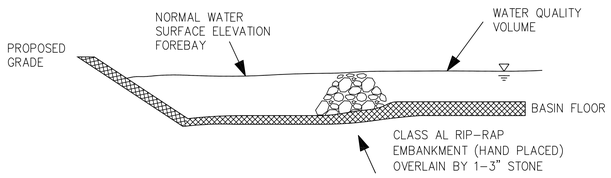


RISER I.D.	RISER O.D.	A	B	C	D	E	APPROX. WT. (LBS.)
24	30	31	25⅝	7	11	27	24
36	44	45	41½	13	19	40	58
48	58	59	54½	13	21	53	88
60	72	73	67½	17	28	66	135
72	86	87	80⅝	23	35	79	204
84	100	101	93¾	25	39	92	266
96	114	115	106¼	22	38	105	305

RISER I.D.	RISER O.D.	A	B	C	D	E	SEGMENT	APPROX. WT. (LBS.)
24	30	30	6	7	10	27	15	46
36	44	42	6	13	18	40	22	82
48	58	55	9	13	20	53	29	120
60	72	68	9	17	28	66	36	169
72	86	81	9	23	34	79	43	227
84	100	94	12	25	37	92	49	290
96	114	107	12	22	38	105	56	341



BIORETENTION IN SHELF OF EXTENDED DETENTION POND
NTS



CROSS-SECTION VIEW SEDIMENT FOREBAY
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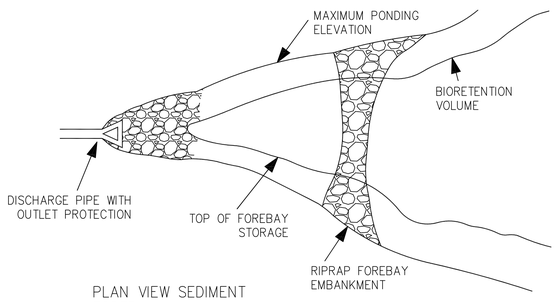
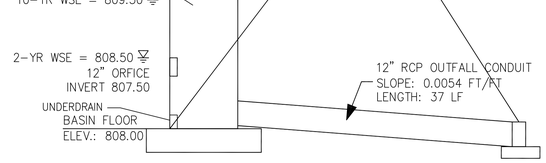
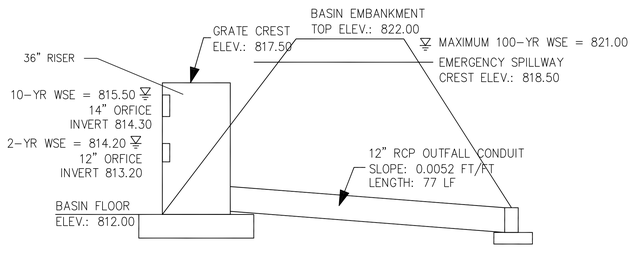


PLAN VIEW SEDIMENT
FOREBAY
N.T.S.



GLTC -15
SCHEMATIC ILLUSTRATION OF PRINCIPAL AND EMERGENCY SPILLWAY CONFIGURATION AND RESULTING WATER SURFACE ELEVATIONS
N.T.S.



GLTC-13
SCHEMATIC ILLUSTRATION OF PRINCIPAL EMERGENCY SPILLWAY CONFIGURATION AND RESULTING WATER SURFACE ELEVATIONS
N.T.S.

GREATER LYNCHBURG TRANSIT COMPANY
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COMMONWEALTH OF VIRGINIA
LYNETTE L. WUENSCH
Lic. No. 38710
10/29/14
PROFESSIONAL ENGINEER

Revision Number	Issued by	Revision Description	Revision Date

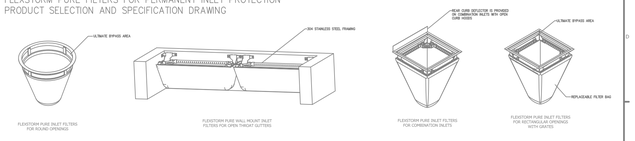
DWG. TITLE

STORMWATER/DRAINAGE SUPPORTING DETAILS

DATE 10/29/2014
SCALE 1:40
DWN. LLW CHK'D WLW
PROJ. No. 444505
DWG. No.

C501

FLEXSTORM PURE FILTERS FOR PERMANENT INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING



For Round Openings with Grates		Minimum Bypass Flow Rates (CFS)* Based on Nominal Frame Size with minimum 2" Bypass Flow gap
Drop Thru Opening Size Dia	Flexstorm Frame P/N	
Small: 16.0" - 18.0"	624SSR	1.5
Medium: 18.1" - 24.0"	624MSR	2.7
Large: 24.1" - 36.0"	624LSR	3.8

For Open Throat Curb Inlets - Mounted to Wall Beneath Curb Opening	
Curb Opening Size	Flexstorm Frame P/N
Up to 4' curb openings (3 Filters)	624SWMO
Between 4' and 8' curb openings (3 Filters)	624DWMO
Between 8' and 12' curb openings (3 Filters)	624DWMA
Between 12' and 16' curb openings (4 Filters)	624TWMA

For Rectangular/Square Openings with Grates			Minimum Bypass Flow Rates (CFS)* Based on Nominal Frame Size with minimum 2" Bypass Flow gap
Clear Drop Thru Opening Size (not grate or used size)	Flexstorm Frame P/N	Combination P/N	
Small: 12" x 12" up to 16" x 16" (256 in² max perimeter)	624SSR	624SSCB	1.5
Medium: 16" x 16" up to 24" x 24" (1n°96" max perimeter)	624MSR	624MSCB	3.5
Large: 24" x 24" up to 30" x 30" (n= 120" max perimeter)	624LSR	624LSCB	5.0
XL: 12" x 12" up to 48" x 48" (n= 192" max perimeter) up 2 pc set	624UXSCB	624UXSCB	7.2

CREATE YOUR ADS FLEXSTORM PART NUMBER BY COMBINING FRAME P/N AND BAG P/N

1. IDENTIFY YOUR FLEXSTORM FRAME PART NUMBER FROM TABLES ABOVE
2. SELECT YOUR BAG PART NUMBER BASED ON APPLICATION NEEDS

FLEXSTORM FILTER BAGS	(22" depth) STD Bag P/N	(12" depth) Short Bag P/N	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
FX- Standard Woven Bag	FX	FX-5	200	40
FXF- Woven w/ MyCelx	FXF	FXF-5	200	40
FXO- Woven w/ Oil Boom	FXO	FXO-5	200	40
PC- Pool Construction Bag	PC	PC-5	137	140
PCF- PC Bag w/ MyCelx	PCF	PCF-5	137	140
LL- Litter and Leaf Bag	LL	LL-5	High	3.5
IL- IDOT Non-Woven Bag	IL	IL-5	145	70

1. CREATE YOUR FLEXSTORM INLET FILTER PART NUMBER

Frame P/N from Step 1. | Filter Bag P/N from Step 2.

SPECIFICATIONS FOR STANDARD BAGS BY NOMINAL BAG / FRAME SIZE

Nominal Bag Size Matched to Frame Size	Solids Storage (Cu/ft)	Filtered Flow Rate at 50% Max (CFS) - FX (Woven)	PC (Post Consrt)	* PC Oil Retention (Oz.)	**PCx Oil Retention (Oz)	**FXx Oil Retention (Oz)
Small	1.6	1.2	0.8	0.9	79	168	89
Medium	2.1	1.7	1.2	1.3	115	204	89
Large	3.8	2.7	1.8	1.9	173	262	89
XL	4.2	3.6	2.4	2.6	230	319	178
Filtration Efficiency	82%	NA	Large scale 3rd party testing per ASTM D 7351 using 7% concentration USDA Sandy Loam				
TSS (total suspended solids rem)	NA	99%	Large Scale testing at WI-DPW with sand meter of at 243 mg/L measuring per EPA Method 1664A.				
TPH (tot petroleum hydrocarbons)	NA	96%					

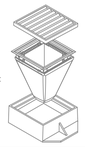
* PC Filter bag at 50% max adsorption capacity
** PC filter bag at 50% capacity and MyCelx skimmer at 100% capacity

NOTES:

1. ALL FRAMING IS CONSTRUCTED OF 304 STAINLESS STEEL FOR 25 YEAR SERVICE LIFE RATING
2. TOTAL BYPASS CAPACITY: BYPASS CAPACITY WILL VARY WITH EACH SIZE DRAINAGE STRUCTURE. FLEXSTORM DESIGNS' FRAMING BYPASS TO MEET OR EXCEED THE DESIGN FLOW OF THE PARTICULAR DRAINAGE STRUCTURE.
3. UPON ORDERING CONFIRMATION OF THE DOT CALLOUT, PRECAST OR CASTING MAKE AND MODEL, OR DETAILED DIMENSIONAL FORMS MUST BE PROVIDED TO CONFIGURE AND ASSEMBLE YOUR CUSTOMIZED FLEXSTORM INLET FILTER. PART NUMBER ALONE IS NOT SUFFICIENT.
4. FOR WRITTEN SPECIFICATIONS AND MAINTENANCE GUIDELINES VISIT WWW.INLETFILTERS.COM

INSTALLATION:

1. REMOVE GRATE
2. DROP FLEXSTORM INLET FILTER ONTO LOAD BEARING LIP OF CASTING OR CONCRETE STRUCTURE
3. REPLACE GRATE



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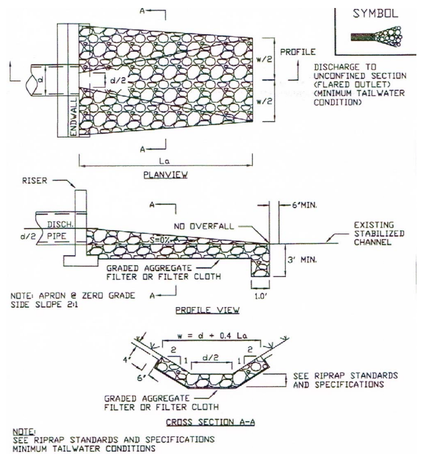
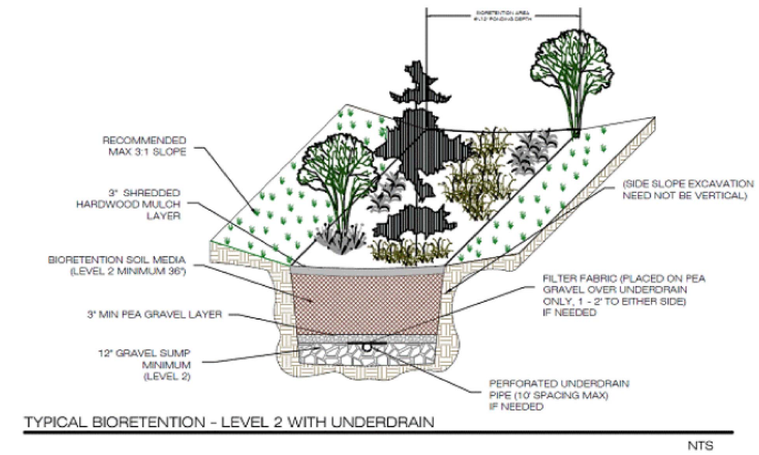
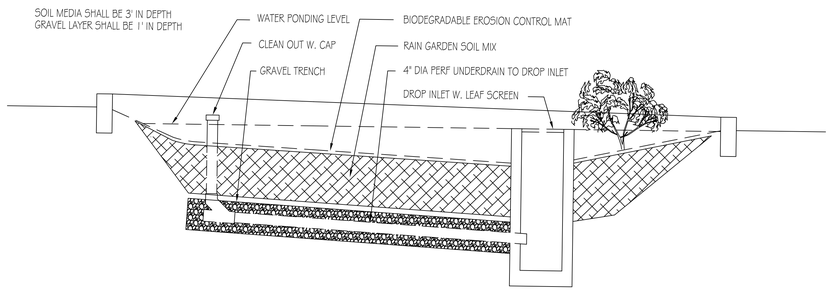
SIZE C | DWG NO IPP Flexstorm HD Specification | REV
SHEET 1 OF 1

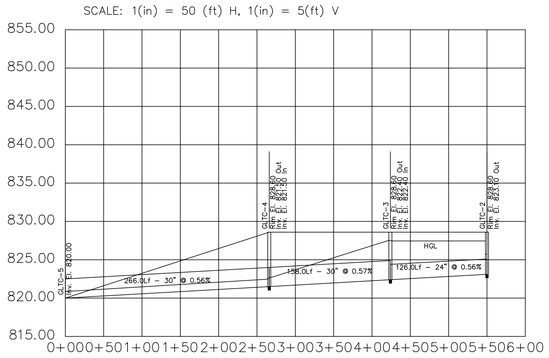


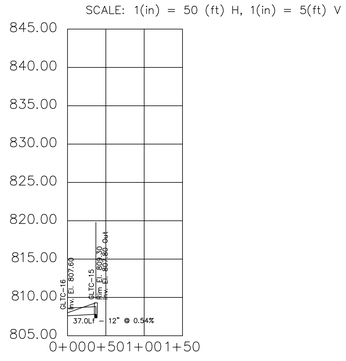


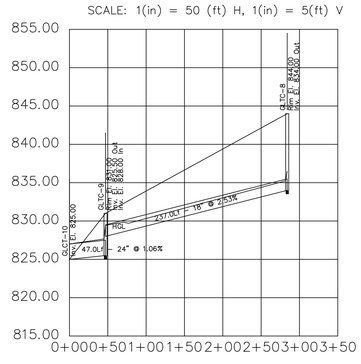
FOR ALL THREE BIORETENTION AREAS:

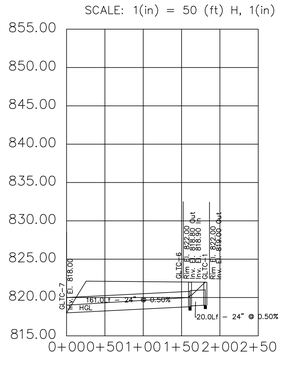


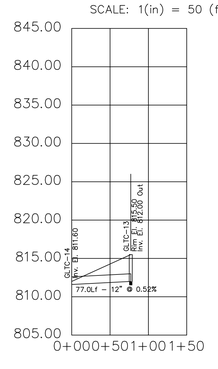
STORMSEWER PROFILES

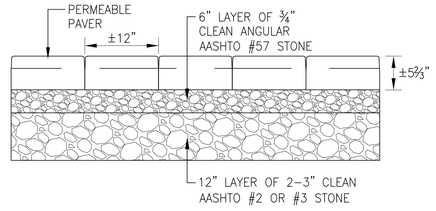




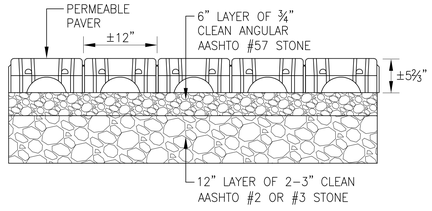








CROSS-SECTION
SIDE VIEW



CROSS-SECTION
END VIEW

PERMEABLE PAVER DETAIL
N.T.S.

GREATER LYNCHBURG TRANSIT COMPANY
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PROJECT ADDRESS:
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COMMONWEALTH OF VIRGINIA
LYNETTE L. WUENSCH
Lic. No. 38710
10/29/14
PROFESSIONAL ENGINEER

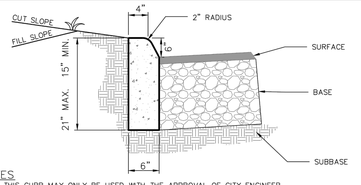
Rev/Addn Indicator	Issued by	Revision Description	Revision Date

DWG. TITLE

STORMWATER/DRAINAGE SUPPORTING DETAILS

DATE 10/29/2014
SCALE 1:40
DWN. LLW CHK. WLW
PROJ.No. 444505
DWG.No.

C501A

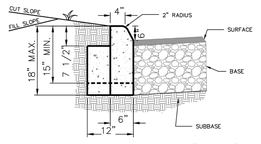


NOTES

1. THIS CURB MAY ONLY BE USED WITH THE APPROVAL OF CITY ENGINEER.
2. CONCRETE TO BE A3 IF CAST IN PLACE, 4000 PSI IF PRECAST.
3. THE DEPTH OF CURB MAY BE REDUCED AS MUCH AS 3" (15" DEPTH OR INCREASED AS MUCH AS 3" (21" DEPTH) IN ORDER THAT THE BOTTOM OF THE CURB WILL COINCIDE WITH THE TOP COURSE OF THE PAVEMENT SUBSTRUCTURE. OTHERWISE THE DEPTH IS TO BE 18" AS SHOWN.
4. THIS CURB IS TO BE USED WHEN DESIGN SPEED IS 45 MPH OR LESS IN DEVELOPED URBAN AND SUBURBAN AREAS.

25.04F – STANDARD VDOT 6" CURB (CG-2)*

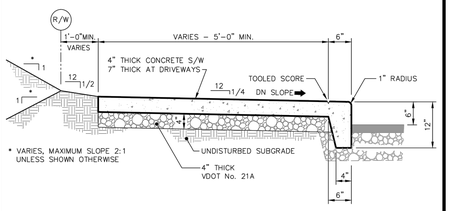
* PER 2001 VDOT ROAD AND BRIDGE STANDARDS OR LATEST REVISION



ALTERNATE 25.04F – STANDARD VDOT 6" CURB (CG-2)*

* PER 2001 VDOT ROAD AND BRIDGE STANDARDS OR LATEST REVISION

THE CITY OF LYNCHBURG		
CURB & GUTTER DETAILS	SCALE: NOT TO SCALE	DETAIL #: 25.04
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 5 OF 5

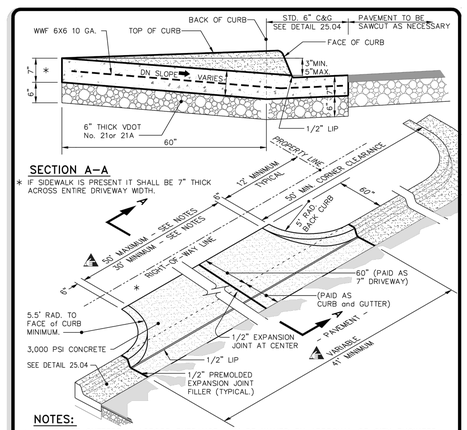


* VARIES, MAXIMUM SLOPE 2:1 UNLESS SHOWN OTHERWISE

NOTES:

1. PROVIDE 3/4" DEEP TOOLED SCORES AT 5'–0" O.C. PERPENDICULAR TO FACE OF CURB AND ALONG CURB LINE.
2. EXPANSION JOINTS TO BE PLACED 30'–0" O.C. LONGITUDINALLY, ADJACENT TO CURBS, AND WHEN BUTTING EXISTING STRUCTURES, CONCRETE, OR BUILDINGS.

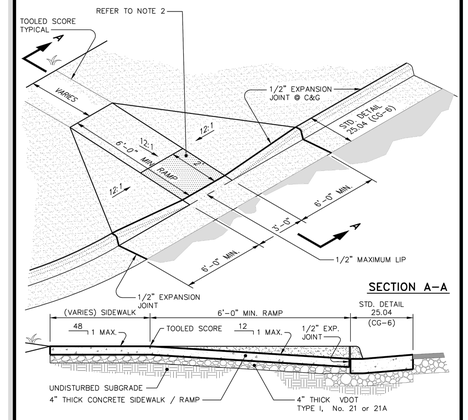
THE CITY OF LYNCHBURG		
FACEDOWN SIDEWALK	SCALE: NOT TO SCALE	DETAIL #: 25.06
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 1 OF 1



NOTES:

1. USE OF GUTTERPAN ACROSS ENTRANCE MAY BE WAVED BY APPROVAL OF CITY ENGINEER.
2. ENTRANCE WIDTH AND RADIUS SHALL BE SIZED TO ACCOMMODATE TURNING RADIUS OF PROPOSED TRUCKS TO/FROM SITE DEVELOPMENT.
3. VDOT STANDARDS MAY BE SUBSTITUTED IF APPROVED BY CITY ENGINEER.
4. GRAVEL DRIVEWAYS ON COLLECTOR AND ARTERIAL STREETS SHALL BE PAVED A MIN. OF 10 FEET FROM EDGE OF CURB OR TO THE RIGHT-OF-WAY LINE, WHICHEVER IS GREATER.
5. FOR ONE-WAY DRIVEWAY, THE WIDTH IS 15' MINIMUM and 24' MAXIMUM. ENTRANCE/EXIT SHALL BE MARKED ACCORDINGLY BY SIGN OR PAVEMENT ARROW.
6. ENTIRE ENTRANCE INCLUDING GUTTER AND APRON SHALL BE POURED MONOLITHICALLY.
7. WIDTH OF CURB & GUTTER SHALL MATCH WIDTH OF EXISTING CURB & GUTTER.
8. DRIVEWAY ENTRANCES TO BE APPROVED BY CITY ENGINEER PRIOR TO PLACEMENT OF CONC.

THE CITY OF LYNCHBURG		
COMMERCIAL DRIVEWAY ENTRANCE	SCALE: NOT TO SCALE	DETAIL #: 25.12
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 1 OF 1

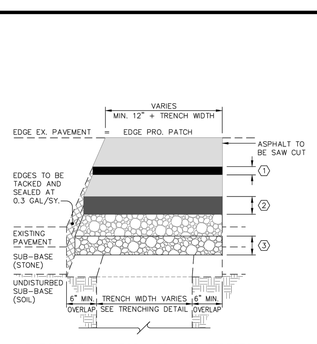


THE CITY OF LYNCHBURG		
TYPE 2 – HANDICAP RAMP for INTERSECTION without GRASS STRIP	SCALE: NOT TO SCALE	DETAIL #: 25.15
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 1 OF 2

NOTES:

1. CROSS AND SIDE RAMPS SHALL NOT EXCEED A SLOPE OF 12:1.
2. CROSS RAMP SHALL HAVE A TRUNCATED DOME PATTERN MEETING THE CURRENT AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG). THE TRUNCATED DOME PATTERN SHALL EXTEND THE FULL WIDTH OF THE CROSS RAMP BY 2 FEET IN LENGTH IN THE DIRECTION OF PEDESTRIAN TRAVEL. THE TRUNCATED DOME SURFACE SHALL BE RED IN COLOR TO PRODUCE A 70% CONTRAST WITH SURROUNDING CONCRETE SURFACES. RECOMMENDED MANUFACTURERS INCLUDE 2004 ADA COMPLIANT DETECTABLE WARNING PAVER BY PAVESTONE COMPANY AND STEP–SAFE BY TRANSPO INDUSTRIES, INC. DETECTABLE WARNING SURFACE SHALL BE INSTALLED WITH THE ELONGATED SIDE PARALLEL TO THE RAMP OPENING. PAVERS/ TILES SHALL BE RECESSED TO MOUNT FLUSH WITH THE SURROUNDING CONCRETE RAMP/SURFACE.
3. CURB RAMPS ARE TO BE LOCATED WHEREVER AN ACCESSIBLE ROUTE WITHIN THE RIGHT–OF–WAY OF A ROADWAY CROSSES AS SHOWN ON PLANS OR AS DIRECTED BY CITY ENGINEER AND SHOULD NOT BE LOCATED BEHIND VEHICLE STOP LINES, EXISTING LIGHT POLES, FIRE HYDRANTS, DROP INLETS, ETC.

THE CITY OF LYNCHBURG		
TYPE 2 – HANDICAP RAMP for INTERSECTION without GRASS STRIP	SCALE: NOT TO SCALE	DETAIL #: 25.15
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 2 OF 2



PATCH DESIGN FOR ASPHALT STREETS

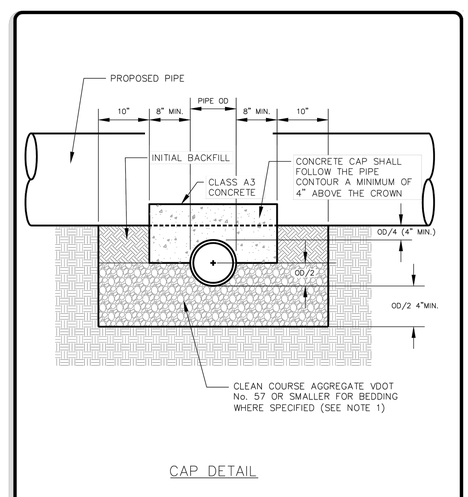
TYPE STREET / TYPE PATCH	ARTERIAL and INDUSTRIAL TYPE A	COLLECTOR TYPE B	RESIDENTIAL TYPE C
(1)	2" SM–12.5D	2" SM–12.5D	2" SM–12.5A
(2)	8" BM25	6" BM25	4" BM25
(3)	7" VDOT NO.21A	4" VDOT NO.21A	4" VDOT NO.21A
PATCH DEPTH	TOTAL = 17"	TOTAL = 12"	TOTAL = 10"

NOTES:

1. PAVEMENT SHALL BE AS SHOWN UNLESS OTHERWISE SPECIFIED.

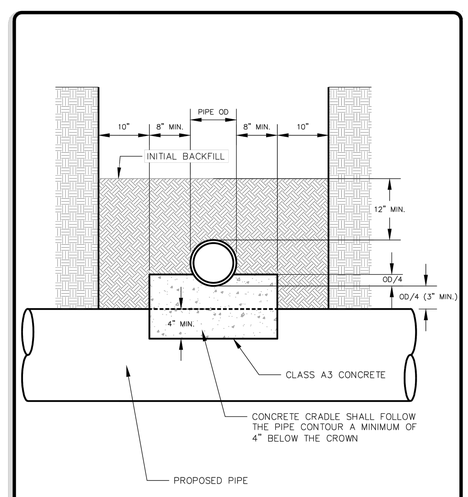
THE CITY OF LYNCHBURG		
TRENCH PATCH ASPHALT STREETS – TYPE A,B,& C	SCALE: NOT TO SCALE	DETAIL #: 25.18
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 1 OF 1

NOTE: CITY OF LYNCHBURG PATCH DETAIL TO BE USED IN PUBLIC RIGHT OF WAY.



CAP DETAIL

THE CITY OF LYNCHBURG		
CONCRETE CAP & CRADLE DETAIL	SCALE: NOT TO SCALE	DETAIL #: 25.26
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 1 OF 2



CRADLE DETAIL

THE CITY OF LYNCHBURG		
CONCRETE CAP & CRADLE DETAIL	SCALE: NOT TO SCALE	DETAIL #: 25.26
USE WITH THE CITY OF LYNCHBURG STANDARD SPECIFICATIONS ONLY	REVISION DATE: 12-14-2013	SHEET #: 2 OF 2

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Operations & Maintenance Facility

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Revision Number	Issued by	Revision Description	Revision Date

DWG. TITLE

DETAILS

DATE:	10/29/2014
SCALE:	AS NOTED
DWN.	MCT
CHK.	KDC
PROJ. No.	444505
DWG. No.	

C502

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