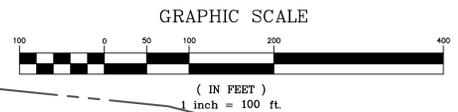




DATE	DESCRIPTION
2/11/2014	PER CHECKLIST COMMENTS
9/17/2014	PER TOWN COMMENTS
2/23/2014	PER TOWN COMMENTS
4/17/2015	PER TOWN COMMENTS
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DATE	DESCRIPTION
BBR DESIGN	CIM DRAWN
	H: AS NOTED
	V:

JOB No. 2616-06-001  
 DATE DEC. 23, 2013  
 FILE No. 2616-D-ZP-001



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DATE	DESCRIPTION
2/11/2014	PER CHECKLIST COMMENTS
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	SCALE: H: AS NOTED
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**STORMWATER QUANTITY CONTROL NARRATIVE**

THE SITE HAS ONE OUTFALL POINT, TUSCARORA CREEK. THE DRAINAGE AREA WAS ANALYZED TO DETERMINE THE FLOOD AND CHANNEL PROTECTION FLOWRATES.

**OUTFALL 1**  
 OUTFALL 1 IS LOCATED NEAR THE EASTERN CORNER OF THE SITE IN TUSCARORA CREEK. THE SITE WILL HONOR THE EXISTING DRAINAGE PATTERNS AND CONTINUE TO CONTRIBUTE 53.24 ACRES. FOUR (4) UNDERGROUND DETENTION FACILITIES ARE PROPOSED WITH THE DEVELOPMENT AND WILL PROVIDE ADDITIONAL DETENTION AS NECESSARY TO ENSURE THAT ADEQUATE OUTFALL CAN BE OBTAINED. THE FOUR (4) FACILITIES WILL PROVIDE AN APPROXIMATE VOLUME OF 5.93 AC-FT. NO WATER QUALITY CREDIT WILL BE TAKEN FOR THESE FACILITIES. THE UNDERGROUND FACILITIES HAVE BEEN PRELIMINARILY SIZED TO PROVIDE 1-, 10 AND 25 YEAR DETENTION. THE OUTFALL INVERT OF THE UNDERGROUND DETENTION FACILITIES FOR THE PURPOSES OF THIS PRELIMINARY DESIGN WERE SET AT THE 10 YEAR FLOODPLAIN ELEVATION OF TUSCARORA CREEK WITH AN ASSUMED DEPTH OF FLOW IN THE PIPE OF 0.8 TIMES THE DIAMETER OF A 15" PIPE.

**CHANNEL PROTECTION (EROSION)**  
 THE STORMWATER FLOW WILL DISCHARGE FROM THE SITE IN THE CONCENTRATED CONDITION INTO A NATURAL CHANNEL WITHIN THE 100 YEAR MAJOR FLOODPLAIN. THE PEAK FLOW FOR THE 2 YEAR 24 HOUR STORM CAN BE CONVEYED WITHIN THE SYSTEM FROM THE POINT OF DISCHARGE TO THE LIMITS OF ANALYSIS WITHOUT CAUSING EROSION. THEREFORE THE MAX PEAK FLOW RATE FOR THE 1 YEAR 24 HOUR STORM WAS CALCULATED USING THE STATE ENERGY BALANCE EQUATION TO BE 25.16 CFS.

$Q_{DEV} < 0.8 \times (F_{FOREST} \times R_{VFOREST}) / R_{VOEV}$   
 $Q_{DEV} < 0.8 \times (51.33 \times 2.985) / (4.872)$   
 $Q_{DEV} < 25.16 \text{ CFS}$

THE ACTUAL RELEASE RATE WAS CALCULATED TO BE 25.13 CFS WHICH IS LESS THAN THE CALCULATED PEAK. SEE NODE SUMMARY, 0-1 ON THIS SHEET.

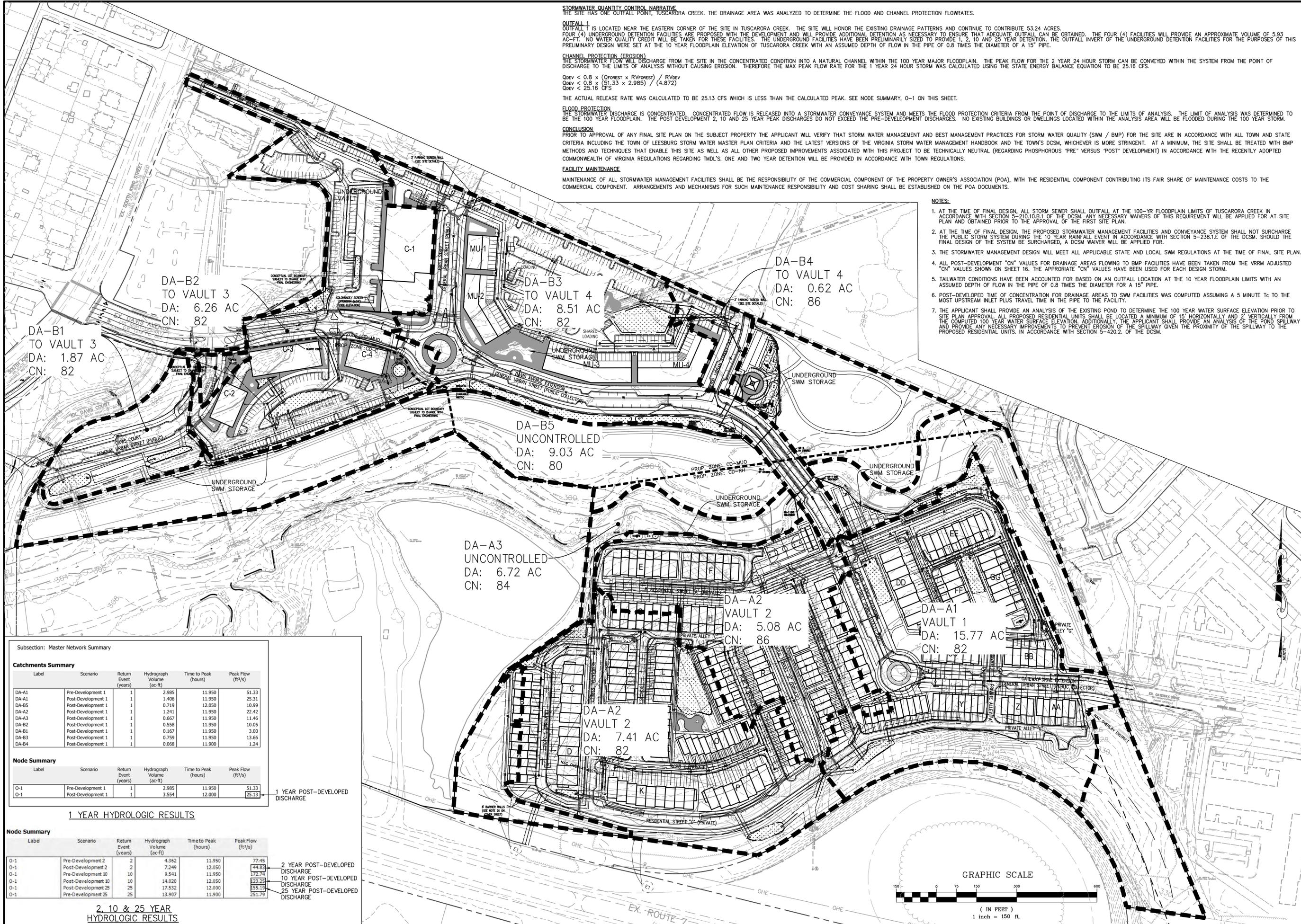
**FLOOD PROTECTION**  
 THE STORMWATER DISCHARGE IS CONCENTRATED. CONCENTRATED FLOW IS RELEASED INTO A STORMWATER CONVEYANCE SYSTEM AND MEETS THE FLOOD PROTECTION CRITERIA FROM THE POINT OF DISCHARGE TO THE LIMITS OF ANALYSIS. THE LIMIT OF ANALYSIS WAS DETERMINED TO BE THE 100 YEAR FLOODPLAIN. THE POST DEVELOPMENT 2, 10 AND 25 YEAR PEAK DISCHARGES DO NOT EXCEED THE PRE-DEVELOPMENT DISCHARGES. NO EXISTING BUILDINGS OR DWELLINGS LOCATED WITHIN THE ANALYSIS AREA WILL BE FLOODED DURING THE 100 YEAR STORM.

**CONCLUSION**  
 PRIOR TO APPROVAL OF ANY FINAL SITE PLAN ON THE SUBJECT PROPERTY THE APPLICANT WILL VERIFY THAT STORM WATER MANAGEMENT AND BEST MANAGEMENT PRACTICES FOR STORM WATER QUALITY (SWM / BMP) FOR THE SITE ARE IN ACCORDANCE WITH ALL TOWN AND STATE CRITERIA INCLUDING THE TOWN OF LEESBURG STORM WATER MASTER PLAN CRITERIA AND THE LATEST VERSIONS OF THE VIRGINIA STORM WATER MANAGEMENT HANDBOOK AND THE TOWN'S DCSM, WHICHEVER IS MORE STRINGENT. AT A MINIMUM, THE SITE SHALL BE TREATED WITH BMP METHODS AND TECHNIQUES THAT ENABLE THIS SITE AS WELL AS ALL OTHER PROPOSED IMPROVEMENTS ASSOCIATED WITH THIS PROJECT TO BE TECHNICALLY NEUTRAL (REGARDING PHOSPHOROUS "PRE" VERSUS "POST" DEVELOPMENT) IN ACCORDANCE WITH THE RECENTLY ADOPTED COMMONWEALTH OF VIRGINIA REGULATIONS REGARDING TMDL'S. ONE AND TWO YEAR DETENTION WILL BE PROVIDED IN ACCORDANCE WITH TOWN REGULATIONS.

**FACILITY MAINTENANCE**  
 MAINTENANCE OF ALL STORMWATER MANAGEMENT FACILITIES SHALL BE THE RESPONSIBILITY OF THE COMMERCIAL COMPONENT OF THE PROPERTY OWNER'S ASSOCIATION (POA), WITH THE RESIDENTIAL COMPONENT CONTRIBUTING ITS FAIR SHARE OF MAINTENANCE COSTS TO THE COMMERCIAL COMPONENT. ARRANGEMENTS AND MECHANISMS FOR SUCH MAINTENANCE RESPONSIBILITY AND COST SHARING SHALL BE ESTABLISHED ON THE POA DOCUMENTS.

**NOTES:**

- AT THE TIME OF FINAL DESIGN, ALL STORM SEWER SHALL OUTFALL AT THE 100-YR FLOODPLAIN LIMITS OF TUSCARORA CREEK IN ACCORDANCE WITH SECTION 5-210.10.B.1 OF THE DCSM. ANY NECESSARY WAIVERS OF THIS REQUIREMENT WILL BE APPLIED FOR AT SITE PLAN AND OBTAINED PRIOR TO THE APPROVAL OF THE FIRST SITE PLAN.
- AT THE TIME OF FINAL DESIGN, THE PROPOSED STORMWATER MANAGEMENT FACILITIES AND CONVEYANCE SYSTEM SHALL NOT SURCHARGE THE PUBLIC STORM SYSTEM DURING THE 10 YEAR RAINFALL EVENT IN ACCORDANCE WITH SECTION 5-238.1.E OF THE DCSM. SHOULD THE FINAL DESIGN OF THE SYSTEM BE SURCHARGED, A DCSM WAIVER WILL BE APPLIED FOR.
- THE STORMWATER MANAGEMENT DESIGN WILL MEET ALL APPLICABLE STATE AND LOCAL SWM REGULATIONS AT THE TIME OF FINAL SITE PLAN.
- ALL POST-DEVELOPMENT "CN" VALUES FOR DRAINAGE AREAS FLOWING TO BMP FACILITIES HAVE BEEN TAKEN FROM THE VRRM ADJUSTED "CN" VALUES SHOWN ON SHEET 16. THE APPROPRIATE "CN" VALUES HAVE BEEN USED FOR EACH DESIGN STORM.
- TAILWATER CONDITIONS HAVE BEEN ACCOUNTED FOR BASED ON AN OUTFALL LOCATION AT THE 10 YEAR FLOODPLAIN LIMITS WITH AN ASSUMED DEPTH OF FLOW IN THE PIPE OF 0.8 TIMES THE DIAMETER FOR A 15" PIPE.
- POST-DEVELOPED TIME OF CONCENTRATION FOR DRAINAGE AREAS TO SWM FACILITIES WAS COMPUTED ASSUMING A 5 MINUTE  $T_c$  TO THE MOST UPSTREAM INLET PLUS TRAVEL TIME IN THE PIPE TO THE FACILITY.
- THE APPLICANT SHALL PROVIDE AN ANALYSIS OF THE EXISTING POND TO DETERMINE THE 100 YEAR WATER SURFACE ELEVATION PRIOR TO SITE PLAN APPROVAL. ALL PROPOSED RESIDENTIAL UNITS SHALL BE LOCATED A MINIMUM OF 15' HORIZONTALLY AND 2' VERTICALLY FROM THE COMPUTED 100 YEAR WATER SURFACE ELEVATION. ADDITIONALLY, THE APPLICANT SHALL PROVIDE AN ANALYSIS OF THE POND SPILLWAY AND PROVIDE ANY NECESSARY IMPROVEMENTS TO PREVENT EROSION OF THE SPILLWAY GIVEN THE PROXIMITY OF THE SPILLWAY TO THE PROPOSED RESIDENTIAL UNITS. IN ACCORDANCE WITH SECTION 5-420.2 OF THE DCSM.



DA-B1  
 TO VAULT 3  
 DA: 1.87 AC  
 CN: 82

DA-B2  
 TO VAULT 3  
 DA: 6.26 AC  
 CN: 82

DA-B3  
 TO VAULT 4  
 DA: 8.51 AC  
 CN: 82

DA-B4  
 TO VAULT 4  
 DA: 0.62 AC  
 CN: 86

DA-B5  
 UNCONTROLLED  
 DA: 9.03 AC  
 CN: 80

DA-A3  
 UNCONTROLLED  
 DA: 6.72 AC  
 CN: 84

DA-A2  
 VAULT 2  
 DA: 5.08 AC  
 CN: 86

DA-A1  
 VAULT 1  
 DA: 15.77 AC  
 CN: 82

DA-A2  
 VAULT 2  
 DA: 7.41 AC  
 CN: 82

Subsection: Master Network Summary

**Catchments Summary**

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft <sup>3</sup> /s)
DA-A1	Pre-Development 1	1	2.985	11.950	51.33
DA-A1	Post-Development 1	1	1.406	11.950	25.31
DA-B5	Post-Development 1	1	0.719	12.050	10.99
DA-A2	Post-Development 1	1	1.241	11.950	22.42
DA-A3	Post-Development 1	1	0.667	11.950	11.46
DA-B2	Post-Development 1	1	0.558	11.950	10.05
DA-B1	Post-Development 1	1	0.167	11.950	3.00
DA-B3	Post-Development 1	1	0.759	11.950	13.66
DA-B4	Post-Development 1	1	0.068	11.900	1.24

**Node Summary**

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft <sup>3</sup> /s)
O-1	Pre-Development 1	1	2.985	11.950	51.33
O-1	Post-Development 1	1	3.554	12.000	25.13

1 YEAR POST-DEVELOPED DISCHARGE

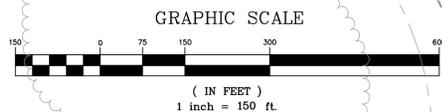
**1 YEAR HYDROLOGIC RESULTS**

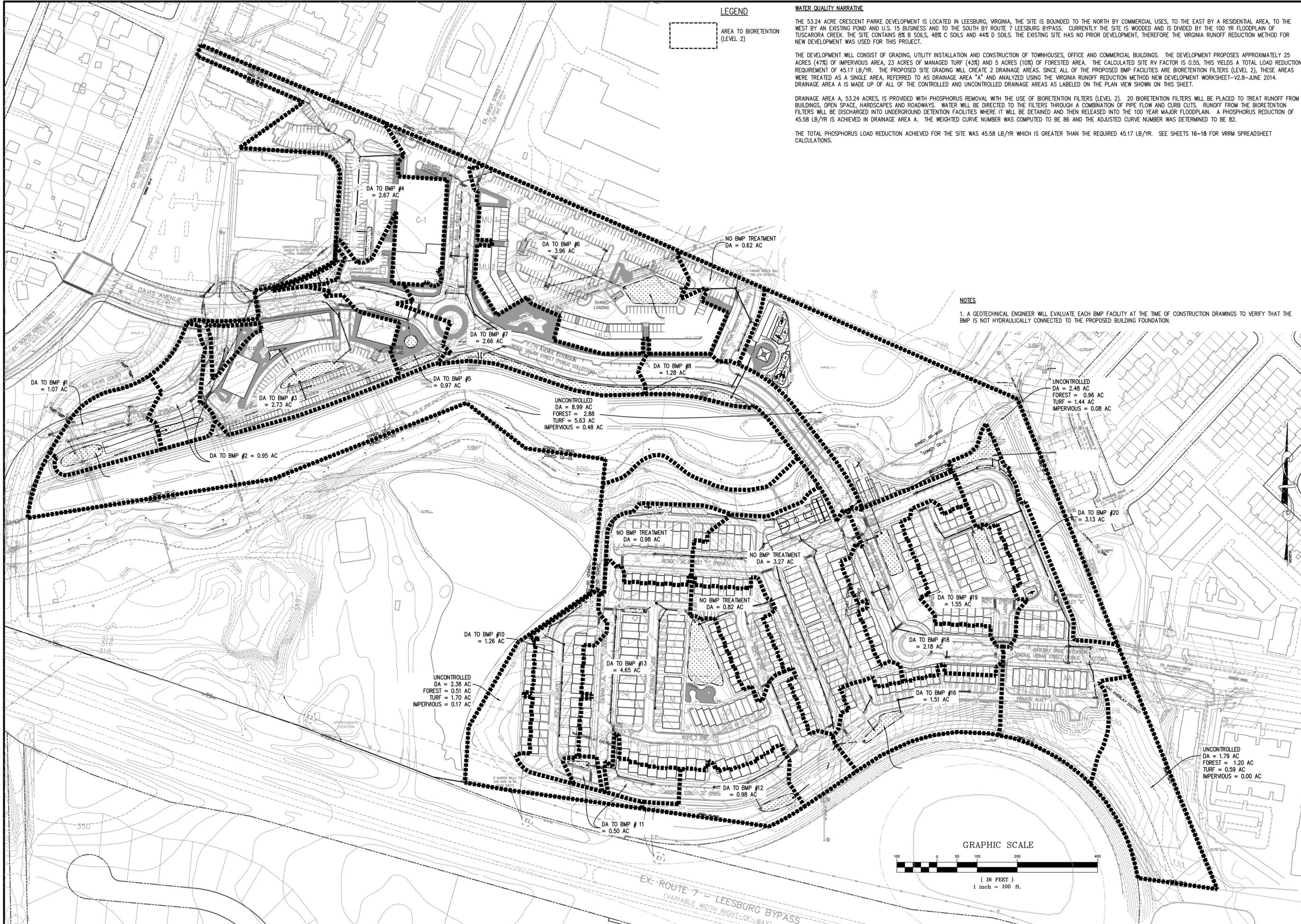
**Node Summary**

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft <sup>3</sup> /s)
O-1	Pre-Development 2	2	4.362	11.950	77.45
O-1	Post-Development 2	2	7.249	12.050	44.83
O-1	Pre-Development 10	10	9.541	11.950	172.74
O-1	Post-Development 10	10	14.920	12.050	83.33
O-1	Pre-Development 25	25	17.532	12.000	155.19
O-1	Post-Development 25	25	13.907	11.900	251.79

2 YEAR POST-DEVELOPED DISCHARGE  
 10 YEAR POST-DEVELOPED DISCHARGE  
 25 YEAR POST-DEVELOPED DISCHARGE

**2, 10 & 25 YEAR HYDROLOGIC RESULTS**





**LEGEND**

AREA TO BIORETENTION (LEVEL 2)

**WATER QUALITY NARRATIVE**

THE 53.24 ACRE CRESCENT PARKE DEVELOPMENT IS LOCATED IN LEESBURG, VIRGINIA, THE SITE IS BOUNDED TO THE NORTH BY COMMERCIAL USES, TO THE EAST BY A RESIDENTIAL AREA, TO THE WEST BY AN EXISTING POND AND U.S. 15 BUSINESS AND TO THE SOUTH BY ROUTE 7 LEESBURG BYPASS. CURRENTLY THE SITE IS WOODED AND IS DIVIDED BY THE 100 YR FLOODPLAIN OF TUSCARORA CREEK. THE SITE CONTAINS 8% B SOILS, 48% C SOILS AND 44% D SOILS. THE EXISTING SITE HAS NO PRIOR DEVELOPMENT, THEREFORE THE VIRGINIA RUNOFF REDUCTION METHOD FOR NEW DEVELOPMENT WAS USED FOR THIS PROJECT.

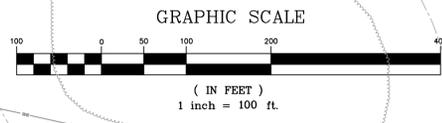
THE DEVELOPMENT WILL CONSIST OF GRADING, UTILITY INSTALLATION AND CONSTRUCTION OF TOWNHOUSES, OFFICE AND COMMERCIAL BUILDINGS. THE DEVELOPMENT PROPOSES APPROXIMATELY 25 ACRES (47%) OF IMPERVIOUS AREA, 23 ACRES OF MANAGED TURF (43%) AND 5 ACRES (10%) OF FORESTED AREA. THE CALCULATED SITE RV FACTOR IS 0.55, THIS YIELDS A TOTAL LOAD REDUCTION REQUIREMENT OF 45.17 LB/YR. THE PROPOSED SITE GRADING WILL CREATE 2 DRAINAGE AREAS. SINCE ALL OF THE PROPOSED BMP FACILITIES ARE BIORETENTION FILTERS (LEVEL 2), THESE AREAS WERE TREATED AS A SINGLE AREA, REFERRED TO AS DRAINAGE AREA "A" AND ANALYZED USING THE VIRGINIA RUNOFF REDUCTION METHOD NEW DEVELOPMENT WORKSHEET-V2.8-JUNE 2014. DRAINAGE AREA A IS MADE UP OF ALL OF THE CONTROLLED AND UNCONTROLLED DRAINAGE AREAS AS LABELED ON THIS SHEET.

DRAINAGE AREA A, 53.24 ACRES, IS PROVIDED WITH PHOSPHORUS REMOVAL WITH THE USE OF BIORETENTION FILTERS (LEVEL 2). 20 BIORETENTION FILTERS WILL BE PLACED TO TREAT RUNOFF FROM BUILDINGS, OPEN SPACE, HARDSCAPES AND ROADWAYS. WATER WILL BE DIRECTED TO THE FILTERS THROUGH A COMBINATION OF PIPE FLOW AND CURB CUTS. RUNOFF FROM THE BIORETENTION FILTERS WILL BE DISCHARGED INTO UNDERGROUND DETENTION FACILITIES WHERE IT WILL BE DETAINED AND THEN RELEASED INTO THE 100 YEAR MAJOR FLOODPLAIN. A PHOSPHORUS REDUCTION OF 45.58 LB/YR IS ACHIEVED IN DRAINAGE AREA A. THE WEIGHTED CURVE NUMBER WAS COMPUTED TO BE 86 AND THE ADJUSTED CURVE NUMBER WAS DETERMINED TO BE 82.

THE TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED FOR THE SITE WAS 45.58 LB/YR WHICH IS GREATER THAN THE REQUIRED 45.17 LB/YR. SEE SHEETS 16-18 FOR VRRM SPREADSHEET CALCULATIONS.

**NOTES**

1. A GEOTECHNICAL ENGINEER WILL EVALUATE EACH BMP FACILITY AT THE TIME OF CONSTRUCTION DRAWINGS TO VERIFY THAT THE BMP IS NOT HYDRAULICALLY CONNECTED TO THE PROPOSED BUILDING FOUNDATION.





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PRELIMINARY BMP PLAN - OVERALL

**CRESCENT PARKE**  
ZONING MAP AMENDMENT

TOWN OF LEESBURG      LOUDOUN COUNTY, VIRGINIA

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PLAN STATUS	
2/11/2014	PER CHECKLIST COMMENTS
9/17/2014	PER TOWN COMMENTS
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SCALE	H: AS NOTED
	V:

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JOB No. 2616-06-001  
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SHEET 15 OF 36

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

To be used w/ 2011 BMP Standards and Specifications

Site Data

Project Name: Crescent Parke  
Date: August 25, 2015

data input cells
calculation cells
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
Target Phosphorus Target Load (lb/acre/yr)	0.41
Pj	0.90
Nitrogen EMC (mg/L)	1.86

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	5.55	5.55
Managed Turf (acres) – disturbed, graded for yards or other turf to be mowed/managed	0.00	1.53	10.33	10.74	22.60
Impervious Cover (acres)	0.00	2.57	14.91	7.61	25.09
<b>Total</b>					<b>53.24</b>

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)	5.55
Weighted Rv(orest)	0.05
% Forest	10%
Managed Turf Cover (acres)	22.60
Weighted Rv(turf)	0.23
% Managed Turf	42%
Impervious Cover (acres)	25.09
Rv(impervious)	0.95
% Impervious	47%
<b>Total Site Area (acres)</b>	<b>53.24</b>
<b>Site Rv</b>	<b>0.55</b>
Post-Development Treatment Volume (acre-ft)	2.45
Post-Development Treatment Volume (cubic feet)	106,637
Post-Development Load (TP) (lb/yr)	67.00
Total Load (TP) Reduction Required (lb/yr)	45.17

Post-Development Load (TN) (lb/yr) 479.31

Target Rainfall Event (in)	1-year storm	2-year storm	10-year storm
	2.60	3.10	4.70

Drainage Area A	Drainage Area (acres)	Runoff Reduction Volume (cf)
Drainage Area A	53.24	64,555
Drainage Area B	0.00	0
Drainage Area C	0.00	0
Drainage Area D	0.00	0
Drainage Area E	0.00	0

Based on the use of Runoff Reduction practices in the selected drainage areas, the spreadsheet calculates an adjusted RV<sub>Developed</sub> and adjusted Curve Number.

Drainage Area A	A soils	B Soils	C Soils	D Soils
Forest/Open Space – undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	5.55
Managed Turf – disturbed, graded for yards or other turf to be mowed/managed	0.00	1.53	10.33	10.74
Impervious Cover	0.00	2.57	14.91	7.61
<b>Weighted CN</b>	<b>86</b>	<b>86</b>	<b>86</b>	<b>1.63</b>
<b>RV<sub>Developed</sub> (in) with no Runoff Reduction</b>	<b>1.33</b>	<b>1.75</b>	<b>3.19</b>	
<b>RV<sub>Developed</sub> (in) with Runoff Reduction</b>	<b>0.99</b>	<b>1.41</b>	<b>2.85</b>	
<b>Adjusted CN</b>	<b>80</b>	<b>81</b>	<b>82</b>	

Drainage Area B	A soils	B Soils	C Soils	D Soils
Forest/Open Space – undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00
Managed Turf – disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.00
Impervious Cover	0.00	0.00	0.00	0.00
<b>Weighted CN</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1000.00</b>
<b>RV<sub>Developed</sub> (in) with no Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>RV<sub>Developed</sub> (in) with Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Adjusted CN</b>	<b>43</b>	<b>#N/A</b>	<b>#N/A</b>	

Drainage Area C	A soils	B Soils	C Soils	D Soils
Forest/Open Space – undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00
Managed Turf – disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.00
Impervious Cover	0.00	0.00	0.00	0.00
<b>Weighted CN</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1000.00</b>
<b>RV<sub>Developed</sub> (in) with no Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>RV<sub>Developed</sub> (in) with Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Adjusted CN</b>	<b>43</b>	<b>#N/A</b>	<b>#N/A</b>	

Drainage Area D	A soils	B Soils	C Soils	D Soils
Forest/Open Space – undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00
Managed Turf – disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.00
Impervious Cover	0.00	0.00	0.00	0.00
<b>Weighted CN</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1000.00</b>
<b>RV<sub>Developed</sub> (in) with no Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>RV<sub>Developed</sub> (in) with Runoff Reduction</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>Adjusted CN</b>	<b>43</b>	<b>#N/A</b>	<b>#N/A</b>	

Site Results

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	AREA CHECK
IMPERVIOUS COVER	25.09	0.00	0.00	0.00	0.00	OK
IMPERVIOUS COVER TREATED	20.59	0.00	0.00	0.00	0.00	OK
TURF AREA	22.60	0.00	0.00	0.00	0.00	OK
TURF AREA TREATED	11.46	0.00	0.00	0.00	0.00	OK
AREA CHECK	OK	OK	OK	OK	OK	

Phosphorus

TOTAL TREATMENT VOLUME (cf)	106,637
TOTAL PHOSPHORUS LOAD REDUCTION REQUIRED (LB/YEAR)	45.17
RUNOFF REDUCTION (cf)	64,555
PHOSPHORUS LOAD REDUCTION ACHIEVED (LB/YR)	45.58
ADJUSTED POST-DEVELOPMENT PHOSPHORUS LOAD (TP) (lb/yr)	21.42
REMAINING PHOSPHORUS LOAD REDUCTION (LB/YR) NEEDED	CONGRATULATIONS!! YOU EXCEEDED THE TARGET REDUCTION BY 0.4 LB/YEAR!!

Nitrogen (for information purposes)

TOTAL TREATMENT VOLUME (cf)	106,637
RUNOFF REDUCTION (cf)	64,555
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	362.29
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TN) (lb/yr)	117.02



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BMP COMPUTATIONS  
CRESCENT PARKE  
ZONING MAP AMENDMENT  
TOWN OF LEESBURG  
LOUDOUN COUNTY, VIRGINIA

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