VIRGINIA STATE UNIVERSITY STORMWATER MASTER PLAN - ADDENDUM



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PREPARED FOR:

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VSU SWMP - ADDENDUM

Section 1.0 - Purpose

A Stormwater Master Plan (SWMP) was initially prepared for Virginia State University in 2013; the purpose of which was to be proactive in combining improvements for existing problems with planning for future development in a cost-effective manner. Three capital improvement projects and the creation of a nutrient credit bank were defined as the highest priority stormwater projects. The report also addressed the Chesapeake Bay TMDL. The 2013 SWMP was based on existing conditions, as of 2012, and ultimate development conditions defined in the 2007 Campus Master Plan and 20/20 Vision. Since implementation of the SWMP, the University has implemented several projects, and the Campus Master Plan has been updated (*Campus Master Plan Update*, November 2017). The purpose of this addendum report is to assess the effects of the *Campus Master Plan Update*, progress toward achieving the campus nutrient credit bank, and compliance status with stormwater regulations, specifically: the Virginia Stormwater Management Program (VSMP) regulations and the Chesapeake Bay TMDL.

Section 2.0 – VSMP Water Quality Calculations

A compliance plan for future development and implementation of the Campus Master Plan was developed in 2013 that was directly tied to the 'time limits of applicability' clause in the 2009-2013 Construction General Permit (GP). The GP defines the appropriate stormwater management design criteria for regulatory compliance for new and redevelopment consistent with the Virginia Stormwater Management Program (VSMP) regulations. The current Campus-wide Construction General Permit coverage (obtained 7/10/2012) can be renewed for up to two permit terms and will expire on June 30, 2024. By the expiration of GP coverage, the University should be complete with all improvements proposed in the initial six-year planning period presented in the **Campus Master Plan Update**. For this addendum, an updated pollutant removal requirement for ultimate development of the six-year planning period (RR_{6YR}) was determined, based on the following:

- 1. The overall site boundary has been updated to reflect a reduction in area, most notably along Chesterfield Avenue. The site boundary used in the 2013 SWMP was approximately 277 acres. The current site boundary presented in the *Campus Master Plan Update* is 258 acres, as presented in the Appendix A, Figure 1;
- 2. The proposed impervious land cover from the 2007 Campus Master Plan and 20/20 Vision used to develop removal requirements was 124.9 acres (45%). However, the proposed impervious area presented in the *Campus Master Plan Update* as the ultimate development condition for the six-year planning period is significantly reduced to 94.5 acres, which represents a 37% imperviousness, as illustrated in Appendix A, Figure 2; and
- 3. The treatment credit of existing BMPs as of the 2013 SWMP has been refined based on a more thorough knowledge and understanding of BMPs on campus as required through the University's MS4 Program. The BMP database, as of 2016, presented in Appendix B was used to update the credit for existing BMPs, based on installation dates prior to



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2012¹. The updated credit for existing BMPs on Campus as of 2012 is approximately 37 lb/yr versus 33 lb/yr previously reported in the 2013 SWMP.

The updated VSMP pollutant removal requirement calculations are presented in Attachment C. The pollutant removal requirement for the six-year planning period presented in the *Campus Master Plan Update*, RR_{6YR}, is 57.82 lb/yr, which is a 19.58 lb/yr reduction, from the previously recorded removal requirement for the 2007 Campus Master Plan and 20/20 Vision of 77.40 lb/yr. The reduction is primarily a result of the reduction in site boundary and proposed imperviousness of the ultimate conditions, as discussed above.

As stated in the 2013 SWMP, one of the high priority goals was to develop a nutrient credit bank; thus, once the removal requirement for the *Campus Master Plan Update* was calculated, the credit for existing BMPs brought online since 2012 was determined. All BMPs and corresponding locations are presented in Appendix A, Figure 3. Campus BMP Map. As presented below in Table 1, the following BMPs have been constructed on Campus since the 2013 SWMP, and were accounted for to determine the current nutrient credit bank quantity:

BMP ID ²	Location and Type	Total Area Treated (ac.)	TP removed (lb/yr)
35	University Bookstore Contech StormFilter	0.10	0.13
41-44	Dupuy Avenue Parking Lot Filterras	1.75	2.06
46	Multipurpose Center Extended Detention	32.00	29.63
47	College Ave, Parking Lot #28 Contech StormFilter	24.25	13.07
	Totals	58.10 acres treated	44.89 lb/yr TP removed

Table 1. Campus BMPs Brought Online since 2012.

² The following BMPs (and corresponding justification) were excluded from the determination for nutrient credit: #36 (quantity only); #45 (VDOT maintained to treat road and not Campus runoff); #48 & #49 (installed to replace existing Gateway Dining and Events Center BMP previously accounted for); and #50 (quantity only).



¹ The 2013 SWMP cited land cover as of 2012 as the existing condition, and documented existing BMPs in Table E.4. Table E.4 was cross-referenced with the 2016 BMP database to account for all BMPs, in the pollutant removal calculations. Note: BMPs 48/49 were converted to underground StormFilter in 2016, but had been previously accounted for as an enhanced extended detention facility; their removal credit was updated and included in the credit for BMPs as of 2013 SWMP.

As presented in Appendix C, the sum of pollutant removal achieved by all on-site BMPs as of January 2018 (L_{removed/total}) is 82.05 lb/yr. As presented previously, the pollutant removal requirement, RR_{6YR}, as determined based on the ultimate land cover presented in the November 2017 **Campus Master Plan Update** was determined to be 57.82 lb/yr. Therefore, the 2013 SWMP high priority goal of achieving a nutrient credit bank has been achieved through a combination of reduction in overall site boundary and impervious area in the ultimate conditions presented in the **Campus Master Plan Update**, as well as installation of Campus BMPs brought online since the 2013 SWMP. The total current Campus Nutrient Credit bank, as of January 2018 is **24.23 lb/yr TP**.

Section 3.0 – Chesapeake Bay TMDL Compliance

Timmons Group performed additional analyses to determine if the pollutant removal documented for the Campus Nutrient Credit Bank will meet VSU's Chesapeake Bay TMDL load reduction requirement mandated by the University's MS4 Permit.

According to the University's TMDL Action Plan (updated December 2015), the following total load reductions were determined to meet the Chesapeake Bay TMDL, as presented in Table 2.

POC, Pollutant of Concern	5% Load Reduction Requirement (by 6/30/2018)	35% Load Reduction Requirement (by 6/30/2023)	Total (100%) Load Reduction Requirement (by 6/30/2028)
TN, Ib/yr	6.15 lb/yr	45.31 lb/yr	129.13 lb/yr
TP, lb/yr	1.13 lb/yr	10.18 lb/yr	28.76 lb/yr
TSS, lb/yr	632 lb/yr	4,486 lb/yr	12,806.93 lb/yr

Table 2. Chesapeake Bay TMDL Load Reduction Requirements.

The Chesapeake Bay TMDL Special Condition Guidance (VA DEQ GM15-2005), Appendix V.E.: BMPs installed to Meet Development and Redevelopment Requirements, was followed to determine the total amount of pollutant reduction credit (TP, TN, TSS) from the existing campus BMPs for which VSU can take credit.

According to the Guidance, the University can take full credit for the excess TP removal presented above in Section 2 of 24.23 lb/yr. Thus, taking credit for the existing BMPs on campus could potentially achieve approximately 84% of the total TMDL load reduction requirement for TP.

The Guidance was further followed to determine associated TN and TSS credit for existing BMPs, as detailed below:



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Step 1. Determine the proportion of the installed BMPs' total TP reductions that may be applied towards the TMDL reduction requirements:

Creditable Reduction for TP / Total Reduction Achieved by BMPs = Proportion of the BMPs' Totals Reductions Available for each POC

24.23 lb/yr TP / 82.05 lb/yr TP = 0.295 = 30%

Step 2. Determine the total site loads for TN and TSS, calculated using Table 4 from the MS4 Permit:

TN: 228.75 lb/yr TP * 5.2 lbs TN/lb TP = 1,189.5 lb/TN/yr TSS: 228.75 lb/yr TP * 420.9 lb TSS/lb TP = 96,280.86 lb TSS/yr

Step 3. Determine the total BMP reductions for TN and TSS, refer to tabulated calculations in Appendix D. Chesapeake Bay TMDL Credits:

TN: 146.07 lb/yr TSS: 36,721.47 lb/yr

Step 4. Determine the credit the permittee may receive towards the TMDL reduction requirements for TN and TSS:

TN: Total TN reduction from Step 3 * 30% = 43.82 lb/yr TN TSS: Total TSS reduction from Step 3 * 30% = 11,016.44 lb/yr TSS

Thus, VSU could potentially make significant progress toward achieving their Chesapeake Bay TMDL requirement by taking credit for existing BMPs that were installed to meet the redevelopment criteria of the VSMP regulations; however, other projects are still required to achieve full compliance, as presented below in Table 3.

POC, Pollutant of Concern	Total (100%) Load Reduction Requirement (by 6/30/2028)	TMDL Credit Available from existing BMPs	Current Progress toward Achieving Chesapeake Bay TMDL
TN, Ib/yr	129.13 lb/yr	43.82 lb/yr	34%
TP, lb/yr	28.76 lb/yr	24.23 lb/yr	84%
TSS, lb/yr	12,806.93 lb/yr	11,016.44 lb/yr	86%

Table 3 Total Progress toward meeting	n Chesapeake Ba	v TMDL through	VSMP Credits
Table 0. Total Trogress toward meeting	y onesapeare ba	y impe unougi	i voim orcaito.



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Section 4.0 - Summary

Based on an updated analysis of ultimate development conditions presented in the *Campus Master Plan Update* (2017), the University achieves compliance with the water quality section of the VSMP regulations (9VAC25-870-96) with existing BMPs on campus. No further water quality controls, or BMPs, will be necessary to implement the projects proposed in the initial 6-yr planning period described in the *Campus Master Plan Update* if the University maintains coverage under its current General Construction Permit, and construction of all improvements is complete by June 30, 2024. Note, each project will still need to demonstrate compliance with the water quantity sections of the Part IIC Technical Criteria of the stormwater management regulations; stream channel erosion (9VAC25-870-97) and flooding (9VAC25-870-97).

Further, the University has achieved the 2013 SWMP goal of establishing a Campus Nutrient Credit Bank. The current bank is calculated as 24.23 lb/yr of total phosphorus removed. The University can claim credit for the BMPs installed to meet VSMP development and redevelopment criteria for Chesapeake Bay TMDL compliance, by following Guidance developed by DEQ in 2015. However, this approach falls short of meeting the 100% requirements, so other projects are still needed to achieve TMDL compliance.

Section 5.0 – Recommendations

As regulatory strategies and targets continually evolve through the various permit cycles and implementation of Campus projects is heavily contingent on funding allocations, Timmons Group recommends the University prioritize use of the Campus Nutrient Credit Bank for development and re-development projects through the expiration of the Construction General Permit coverage in 2024.

Further, as the Campus Nutrient Credit bank established through compliance with VSMP regulations does not achieve full compliance with the Chesapeake Bay TMDL, but the current strategy (Fleets Branch Stream Restoration) does, Timmons Group recommends the University continue implementation of the current strategy. If permit conditions happen to change and necessitate the need to explore additional TMDL compliance strategies after the expiration of the Construction GP (2024), but prior to the 2028 deadline for TMDL implementation, the University may consider re-examining the Campus Nutrient Credit Bank, at that time.



APPENDIX A

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VIRGINIA STATE UNIVERSITY STORMWATER MASTER PLAN Figure 1 - Updated Site Boundary Map



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VIRGINIA STATE UNIVERSITY STORMWATER MASTER PLAN

Figure 2 - Campus Master Plan Updated Land Cover Map (6-yr Planning Period)



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VIRGINIA STATE UNIVERSITY STORMWATER MASTER PLAN Figure 3 - Campus BMP Map



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APPENDIX B

DeMathemMarcentMar		BMP Database - 2016													
MODET Box Print Loss Multing D.7.2000/R000 D.7.2000/R0000 D.7.2000/R000 D.7.20	ID	ВМР Туре	Location	Approximate Latitude	Approximate Longitude	SWM Function	Total Area Treated (Ac.)	Pervious Area Treated (Ac.)	Impervious Area Treated (Ac.)	Date Brought Online	нис	Impaired Waters Within HUC	Ownership	Maintenance Aggrement?	Date of Last Inspection
IMEDBuffley 2Buffley 2	BMP 01	Roof Filterra 1	Gateway II Dorm Building	37.2423036445061	-77.41735229	Vater Quality	0.07	0.0	0.07	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
100001000000000000000000000000000000000000	BMP 02	Roof Filterra 2	Gateway II Dorm Building	37.2421660742903	-77.4173709	Vater Quality	0.04	0.0	0.04	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
WEPPSurface ASurface A	BMP 03	Roof Filterra 3	Gateway II Dorm Building	37.2420065771652	-77.41709411	Vater Quality	0.07	0.0	0.07	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMEPS 	BMP 04	Roof Filterra 4	Gateway II Dorm Building	37.2417307621922	-77.41743745	Vater Quality	0.11	0.0	0.11	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
by>by>by>by>by>by>by>by>by>by>by>by>by>	BMP 05	Roof Filterra 5	Gateway II Dorm Building	37.2417923135342	-77.41712939	Vater Quality	0.05	0.0	0.05	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
bmppmp int jpmp int jp	BMP 06	Roof Filterra 6	Gateway II Dorm Building	37.2415622710386	-77.41747207	Nater Quality	0.07	0.0	0.07	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
Bins 2	BMP 07	Filterra 1	Gateway II Dorm Parking Lot #30M	37.2420221022364	-77.41644732	Nater Quality	0.22	0.04	0.18	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
0Herol1Herol0Her	BMP 08	Filterra 2	Gateway II Dorm Parking Lot #30M	37.2416656734862	-77.41626813	Nater Quality	0.38	0.03	0.35	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 20 First 4 Genery 1, Dorn Paking, DI 2010, UL 2000, UL 2000, VIAC 4, Daving, Control G.D. G.D. 2012, UL 2000, Depending for the control of the control	BMP 09	Filterra 3	Gateway II Dorm Parking Lot #30M	37.2413212278914	-77.4163035	Nater Quality	0.40	0.02	0.38	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
Intern 5 Generay Loop Parking at 2000 21/2013/86/201 0.00 0.01 0.01 0.00 0.0000 0.0000 0.0000	BMP 10	Filterra 4	Gateway II Dorm Parking Lot #30M	37.2410375155774	-77.41640957	Nater Quality	0.34	0.03	0.31	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
M210Bitra 4Catacow 10 particular (LEVANC)C3241072787C34007240 (Code)C30C30C30C30C30C300700C3007000C3007000C3007000C30070000C30070000C30070000C30070000C30070000C300700000C300700000000C30070000000000000000000000000000000000	BMP 11	Filterra 5	Gateway II Dorm Parking Lot #30M	37.2410201846625	-77.41654759	Nater Quality	0.35	0.02	0.33	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
IMP 2Impart 2Cathowy 100m Parking Lat Park 2J 2232733777J 2243273377J A14922/J Ware Callyn0.010.010.010.010.010.00	BMP 12	Filterra 6	Gateway II Dorm Parking Lot #30M	37.2414927678435	-77.416913	Vater Quality	0.23	0.03	0.20	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP be BMP be BMP be BMP be 	BMP 13	Filterra 7	Gateway II Dorm Parking Lot #30M	37.2413273837876	-77.41697442	Vater Quality	0.18	0.06	0.12	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 1 Roof Tilerar 1 Hower 3 bill Guid Bieding 37.388881230 7.420364 Water Guidy Go Go Sign 201 Mol 8 Boorting Water Guidy Mol 8 Mol 71 Mol 8 Mol 71 Mol	BMP 15	Underground Storage Vault	Gateway II Dorm Parking Lot #30M	37.2412862783722	-77.41662269	Nater Quantity	0.00	0.00	0.00	06/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
NM11 Op/Internal Name Number of Mark Number of Mark <t< td=""><td>BMP 16</td><td>Roof Filterra 1</td><td>Howard Hall Quad II Building</td><td>37.2368858125369</td><td>-77.42220164</td><td>Vater Quality</td><td>0.5</td><td>0.0</td><td>0.5</td><td>01/2012</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>04/27/2016</td></t<>	BMP 16	Roof Filterra 1	Howard Hall Quad II Building	37.2368858125369	-77.42220164	Vater Quality	0.5	0.0	0.5	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
NPL 18 Op/Terms 3 Model III adding J 22488312880 Var Cuality 0.12 0.12 0.01 Apponntation RPM Ower-Operated N/A Op/T2/2018 RP 18 Soft Filters 4 Howard Hill adding 77.2328052828 Var Cuality 0.08 0.08 0.028 0.021 LAD Apponntation RPM Ower-Operated N/A 64727305 RP 2 Soft Filters 6 Howard Hill addit II Guality 77.2326852282 Var Cuality 0.08 0.03 0.0212012 LAD Apponntatos RPM Ower-Operated N/A 64727036 RAP 2 Contex NormHier 1 Howard Hill addit I Coultyrid 77.23268223282 Var Cuality 0.04 0.01 0.0212012 LAD Apponntatos RPM Ower-Operated N/A 64727036 RAP 2 Contex NormHier 1 Howard Hill addity ICoultyre 77.23268232827 77.2126920 M/A Contex NormHier 2 Add Apponntatos RPM Ower-Operated N/A 64727036 RAP 2 Indegrand InformSomare IRM 2000 Gallon RPM Howard Hill Coultyre 77.21269207444 Amaponta	BMP 17	Roof Filterra 2	Howard Hall Quad II Building	37.2365802066969	-77.42202559	Vater Quality	0.5	0.0	0.5	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
IMP 3 Implifying 3 Implifying 3 7.21242802 Mark Quart Implifying 3	BMP 18	Roof Filterra 3	Howard Hall Quad II Building	37.2366381184869	-77.42183987	Vater Quality	0.12	0.0	0.12	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BM2 7. Bool Filterna 5.	BMP 19	Roof Filterra 4	Howard Hall Quad II Building	37.2371309132816	-77.42142962	Vater Quality	0.09	0.0	0.09	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 1 Instrant filterine f Moder Hall Guad II Building 21223155423000 77.4218552 Muter Cuality D.0.7 D.0.7 <td>BMP 20</td> <td>Roof Filterra 5</td> <td>Howard Hall Quad II Building</td> <td>37.2369805691729</td> <td>-77.42174254</td> <td>Vater Quality</td> <td>0.08</td> <td>0.0</td> <td>0.08</td> <td>01/2012</td> <td>JA40</td> <td>Appomattox River</td> <td>Owner-Operated</td> <td>N/A</td> <td>04/27/2016</td>	BMP 20	Roof Filterra 5	Howard Hall Quad II Building	37.2369805691729	-77.42174254	Vater Quality	0.08	0.0	0.08	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 22 Control Stormfilter 1 How rd Fiel Quad I Courtyard 37.282/37/90 YF.24 Control 0.41 0.027 1.21 Q/2021 MA0 Apportants Kive Owner-Operated NA MU26/2015 MPF 3 Ontsol Sommilier 2 Mark Hail Quad I Courtyard 32.357/320902 YF.7.42160334 Mark Quality 0.00 0.00 0.00 0.00 <td>BMP 21</td> <td>Roof Filterra 6</td> <td>Howard Hall Quad II Building</td> <td>37.2371516389901</td> <td>-77.42128532</td> <td>Vater Quality</td> <td>0.27</td> <td>0.01</td> <td>0.26</td> <td>01/2012</td> <td>JA40</td> <td>Appomattox River</td> <td>Owner-Operated</td> <td>N/A</td> <td>04/27/2016</td>	BMP 21	Roof Filterra 6	Howard Hall Quad II Building	37.2371516389901	-77.42128532	Vater Quality	0.27	0.01	0.26	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 23 Contexts Starmilling 2 Contexts Starmilling 2 <th< td=""><td>BMP 22</td><td>Contech Stormfilter 1</td><td>Howard Hall Quad II Courtyard</td><td>37.2368542370496</td><td>-77.42129574</td><td>Vater Quality</td><td>0.14</td><td>0.02</td><td>0.12</td><td>01/2012</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>04/26/2016</td></th<>	BMP 22	Contech Stormfilter 1	Howard Hall Quad II Courtyard	37.2368542370496	-77.42129574	Vater Quality	0.14	0.02	0.12	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 24 Underground fungtion Storage (0.000 Galloon) Indow Apportation Rever Owner Operated N/A Op/A262/ADA BMP 25 Underground CMP Detention Pond 18) Howard Hall Quad I Courtyard 3724549230 Micro Quantity 0.00 0.000 <t< td=""><td>BMP 23</td><td>Contech Stormfilter 2</td><td>Howard Hall Quad II Courtyard</td><td>37.236752409992</td><td>-77.42160534</td><td>Vater Quality</td><td>0.46</td><td>0.05</td><td>0.39</td><td>01/2012</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>04/26/2016</td></t<>	BMP 23	Contech Stormfilter 2	Howard Hall Quad II Courtyard	37.236752409992	-77.42160534	Vater Quality	0.46	0.05	0.39	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 25 Underground CMP Determion (hord 1A) West Yard of Howard Hall Quad II. 72.4235833 [Water Quanity. 0.00 0.000 [V.2022 Mode Appointant Skine Portuge NA M/26/2016 BMP 26 Underground CMP Determion (hord 1B) Howard Hall Quad II Courtyard 72.4235831 [Water Quality and Quanity] 1.90 0.00 0.000 [V.2022 Mode Appointant Skine Portuge Name Operated NA AV26/2016 BMP 25 Underground CMP Determion (hord 1B) Howard Hall Quad II Courtyard 72.4245851 77.4215657 Name Quality and Quanity 1.90 0.00 0.000 [V.2012 Mod Appointant Skine Portuge Name Operated NA AV26/2016 BMP 25 Ended Detention Basin Sing Pulit Bendra See. Rolling (BIOT Sulfing) 72.23495815881 77.41457901 [Water Quality and Quanity 5.49 0.97 4.52 (0)/1994 Mod Appointant Skine Portuge Name Operated NA 6/2/172016 BMP 30 Detenter Sand Fifter Cooperative Exeruin April 2014300 77.41247507 Nater Quality and Quanity 3.8 0.01 0.32 (PV2011 Mod Appointant Skine Portuge Name Operated NiA 0/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2	BMP 24	Underground Irrigation Storage (50,000 Gallons)	Howard Hall Quad II Courtyard	37.2368604793737	-77.42169028	Vater Quantity	0.00	0.00	0.00	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 26 Underground CMP Detention (from 18) Howard Hall Qual (Curryard 32.3693.3997106 -77.4233.19 (Water Quantity 0.00 <t< td=""><td>BMP 25</td><td>Underground CMP Detention (Pond 1A)</td><td>West Yard of Howard Hall Quad II</td><td>37.2364242210143</td><td>-77.42195893</td><td>Vater Quantity</td><td>0.00</td><td>0.00</td><td>0.00</td><td>01/2012</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>04/26/2016</td></t<>	BMP 25	Underground CMP Detention (Pond 1A)	West Yard of Howard Hall Quad II	37.2364242210143	-77.42195893	Vater Quantity	0.00	0.00	0.00	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
SMP 2: Underground Detention Chamber w/Sand Filters Howard Hall Quad Lourtyerd 37236613982122 77.72116577 Water Quality and Quantity 1.07 0.58 04/2011 IAA Dependent Silter Water Quarted Killer Vice Comparison Water Quality and Quantity 0.00	BMP 26	Underground CMP Detention (Pond 1B)	Howard Hall Quad II Courtyard	37.2369329397106	-77.42153119	Vater Quantity	0.00	0.00	0.00	01/2012	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 28 Underground Irrigation Storage Vault Howard Hall Quard 1 37.236466095308 77.41218355 WaterQuantity 5.00 0.00	BMP 27	Underground Detention Chamber w/ Sand Filters	Howard Hall Quad I Courtyard	37.2366193821127	-77.42116577	Vater Quality and Quantity	1.90	1.07	0.83	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 29 Extended Detention Basin Physical Plant Building 37227498118811 77.41273201 Water Quality and Quantity 5.99 9.452 Splitty Main Operations Riskin Owner-Operated N/A 04/77/2016 BMP 30 Relevance Sand Filter Cooperative Extension Agriculture/Wilder Building 37.211394000801 77.41794307 Water Quality 0.32 0.85 05/1994 Add Appointations River Owner-Operated N/A 06/18/2015 BMP 31 Deleware Sand Filter Boisseus X. Farring Lot #30 37.24073990349 77.42274766 Water Quality 0.38 0.01 0.57 04/2011 IAdd Appointations River Owner-Operated N/A 04/76/2016 BMP 32 Sortive Filter 10C Lee 5t. Farring Lot #21 37.246194948017 77.422501 Vater Quality 0.40 0.01 0.90 04/2011 IAdd Appointato River Owner-Operated N/A 04/76/2016 BMP 32 Sortive Filter 10C Lee 5t. Farring Lot #21 37.23699494949 77.4157811Water Quality 0.10 0.01 0.90 04/2011 IAdd Appointato River Owner-Oper	BMP 28	Underground Irrigation Storage Vault	Howard Hall Quad I	37.2364660955308	-77.42124865	VaterQuantity	0.00	0.00	0.00	04/2011	JA40	Appomattox River	Owner Operated	N/A	04/26/2016
BMP 30 Retention Basin Type III Behind Isses R. Boiling (ROTC Building) 37.2394316061534 77.41552741 (Water Quality 20.99 10.14 10.85 [3/2002 I.M40 Appomattox River Owner-Operated N/A 04/27/2015 BMP 31 beleware Sand Filter Cooperative Extension Agriculture/Wider Building) 37.239534000001 -77.41294307 (Water Quality 0.88 0.01 0.31 06/31011 IAdd Appomattox River Owner-Operated N/A 04/25/2016 BMP 33 Sorbtive Filter 1C Boisseaus 5. Parking Lot #37 37.236599400073 77.422280607 Water Quality 0.38 0.03 0.36 04/2011 IAdd Appomattox River Owner-Operated N/A 04/25/2016 BMP 35 Contech Stormfilter University Bookstore 37.234994899 77.4228067 Water Quality 0.10 0.01 IAdd Appomattox River Owner-Operated N/A 04/25/2016 BMP 35 Contech Stormfilter University Bookstore 37.23499489 77.4228061 Water Quality 0.0 0 0/4/2011 IAdd Appoma	BMP 29	Extended Detention Basin	Physical Plant Building	37.2374968118811	-77.41437501	Vater Quality and Quantity	5.49	0.97	4.52	03/1994	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 31 Deleware Sand Filter Cooperative Extension Agriculture/Wilder Building 37.21139400001 77.41794007 Yater Quality 1.17 0.32 0.35 D5/1954 IA40 Appomattox River Owner-Operated N/A 06/18/2015 BMP 32 Sorbtive Filter 3C Boisseau St. Parking Lot # 37 37.2366/3498991 77.42247266 Water Quality 0.38 0.01 0.37 06/42/011 IA40 Appomattox River Owner-Operated N/A 04/26/2016 BMP 33 Sorbtive Filter 10C Lee St. Parking Lot # 37 37.2365/149849 77.41279313 Water Quality 0.44 0.02 0.42 [04/2011 JA40 Appomattox River Owner-Operated N/A 04/26/2016 BMP 35 Underground Storage Yault University Bookstore 37.235095049671 77.42205801 Water Quantity 0 0 04/2014 JA40 Appomattox River Owner-Operated N/A 04/27/2016 BMP 32 Underground Storage Vault Lee St. Parking Lot #37 37.23696948071 77.42208961 Water Quantity 0 0 04/2011 <t< td=""><td>BMP 30</td><td>Retention Basin Type III</td><td>Behind Jesse R. Bolling (ROTC Building)</td><td>37.2394816061634</td><td>-77.41552741</td><td>Vater Quality</td><td>20.99</td><td>10.14</td><td>10.85</td><td>03/2002</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>04/27/2016</td></t<>	BMP 30	Retention Basin Type III	Behind Jesse R. Bolling (ROTC Building)	37.2394816061634	-77.41552741	Vater Quality	20.99	10.14	10.85	03/2002	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 32 Sorbive Filter 2C Botseau St. Parking Lot # 36 32 236993990349 77.42247256 Water Quality 0.38 0.01 0.37 (4/2011 IA40 Appomattors River Owner-Operated NA 04/26/2016 BMP 33 Sorbitve Filter 1C Boisseau St. Parking Lot #37 37.2367614848991 -77.42215313 Water Quality 0.44 0.02 0.42 0/42 Dippomattors River Owner-Operated NA 04/26/2016 BMP 35 Sorbitve Filter 1C Lee St. Parking Lot #37 37.23618948073 -77.42215313 Water Quality 0.01 0.9 0/4/2014 IA40 Appomattors River Owner-Operated NA 04/26/2016 BMP 35 Contech Stormfliter University Bookstore 37.237698949567 -77.4221508 Water Quanity 0 0 0/4/2011 IA40 Appomattors River Owner-Operated NA 04/27/2105 BMP 35 Underground Storage Vault Lee St. Parking Lot #37 37.2366984720835 -77.422508 Water Quanity 0 0 0/4/2011 IA40 Appomattors River Owner-Operated <td>BMP 31</td> <td>Deleware Sand Filter</td> <td>Cooperative Extension Agriculture/Wilder Building</td> <td>37.2411394008091</td> <td>-77.41794307</td> <td>Vater Quality</td> <td>1.17</td> <td>0.32</td> <td>0.85</td> <td>05/1994</td> <td>JA40</td> <td>Appomattox River</td> <td>Owner-Operated</td> <td>N/A</td> <td>06/18/2015</td>	BMP 31	Deleware Sand Filter	Cooperative Extension Agriculture/Wilder Building	37.2411394008091	-77.41794307	Vater Quality	1.17	0.32	0.85	05/1994	JA40	Appomattox River	Owner-Operated	N/A	06/18/2015
BMP 33 Sorbitve Filter 1C Boisseau St. Parking Lot #37 37.236761484991 -77.4228067 Water Quality 0.33 0.03 0.36 0.42011 JA40 Appomattox River Owner-Operated N/A 04/26/2016 BMP 34 Sorbitve Filter 10C Lee St. Parking Lot #21 37.236189948073 -77.4220513 Water Quality 0.10 0.36 04/2014 JA40 Appomattox River Owner-Operated N/A 04/25/2016 BMP 35 Cincteh Stormfilter University Bookstore 37.2375069049674 -77.41870511 Water Quanity 0 0 0/4/2014 JA40 Appomattox River Owner-Operated N/A 04/25/2016 BMP 35 Underground Storage Vault Lee St. Parking Lot #37 37.236943 -77.4229823 Water Quantity 0 0 0/4/2011 JA40 Appomattox River Owner-Operated N/A 04/25/2016 BMP 34 Underground Storage Vault Boisseau St. Parking Lot #37 37.236698712083 -77.422982 Water Quanity 0 0 0/42011 JA40 Appomattox River Own	BMP 32	Sorbtive Filter 2C	Boisseau St. Parking Lot # 36	37.2369939903499	-77.42247266	Vater Quality	0.38	0.01	0.37	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 44 Sorbitve Filter 10C Lee St. Parking Lot #21 37.236199480737 -77.42215313 Water Quality 0.44 0.02 0.42 0/42011 JA40 Appomattox River Owner-Operated N/A 0/425/2016 BMP 35 Contech Stormfilter University Bookstore 37.237699494074 -77.41870911 Water Quality 0 0 0.4/2014 JA40 Appomattox River Owner-Operated N/A 0.4/27/27016 BMP 35 Underground Storage Vault Lee St. Parking Lot #32 37.236969335050 -77.4222392 Water Quantity 0 0 0.4/2011 JA40 Appomattox River Owner-Operated N/A 0.4/25/2016 BMP 38 Underground Storage Vault Boisseau St. Parking Lot #37 37.236943 -77.422532 Water Quantity 0 0 0.4/2011 JA40 Appomattox River Owner-Operated N/A 0.4/25/2016 BMP 40 Underground Storage Vault Boisseau St. Parking Lot #37.2427045765 -77.41641 Water Quantity 0.53 0.08 0.45 0.6/01/2016 JA40 Appomattox River	BMP 33	Sorbtive Filter 1C	Boisseau St. Parking Lot #37	37.2367614848991	-77.42286067	Vater Quality	0.39	0.03	0.36	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 35Contech StormfliterUniversity Bookstore37.237399486977.41870911Water Quanity0.100.010.900/4/2014J.400Appomattox RiverOwner-OperatedN/A0/4/27/2016BMP 36Underground Storage VaultLees 1. Parking Lot #2137.23706004957477.4185594Water Quantity000.04/2011J.400Appomattox RiverOwner-OperatedN/A0/4/27/2016BMP 37Underground Storage VaultBoisseau St. Parking Lot #3037.2360963120577.422520Water Quantity000.04/2011J.400Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 38Underground Storage VaultBoisseau St. Parking Lot #3737.23669831208577.422520Water Quantity000.04/2011J.400Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.24256984784-77.41641Water Quantity000.06/2016J.400Appomattox RiverOwner-OperatedN/A-BMP 41Filterra 1Dupuy Avenue Parking Lot37.2425698474-77.4164227Water Quality0.530.080.65/01/2016J.400Appomattox RiverOwner-OperatedN/A-BMP 41Filterra 3Dupuy Avenue Parking Lot37.242369871204577.4164219Water Quality0.470.030.400/6/01/2016J.400Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 3<	BMP 34	Sorbtive Filter 10C	Lee St. Parking Lot #21	37.2361899480737	-77.42215313	Water Quality	0.44	0.02	0.42	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 36Underground Storage VaultUniversity Bookstore37.2375069049674-77.41855594Water Quantity0000/4/2014JA40Appomattox RiverOwner-OperatedN/A0/A/27/2016BMP 37Underground Storage VaultBoisseau St. Parking Lot #3637.236095385105-77.4228963Water Quantity000/4/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 38Underground Storage VaultBoisseau St. Parking Lot #3737.2366987120835-77.42289637Water Quantity0000/4/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 40Underground Storage VaultBoisseau St. Parking Lot37.242506904874-77.416414Water Quantity0000/6/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.242737755-77.416414Water Quantity0.30.080.45J6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 41Filterra 2Dupuy Avenue Parking Lot37.2427367654206-77.41667317Water Quality0.470.150.3206/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 3Dupuy Avenue Parking Lot37.2427367564206-77.41667317Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A	BMP 35	Contech Stormfilter	University Bookstore	37.23743994869	-77.41870911	Nater Quality	0.10	.01	.09	04/2014	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 37Underground Storage VaultLee St. Parking Lot #2137.2360953385105-77.42208962Water Quantity00000/4/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 38Underground Storage VaultBoisseau St. Parking Lot #3737.236943-77.422582Water Quantity0000/4/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.242506904874-77.41641Water Quantity0000/6/01/2016JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 41Filterra 1Dupuy Avenue Parking Lot37.242506904874-77.41641Water Quantity0.330.080.450/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 2Dupuy Avenue Parking Lot37.242736765206-77.41667317Water Quality0.470.150.320/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.242736765206-77.41667317Water Quality0.470.150.320/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.242736755206-77.41667317Water Quality0.280.040.240/01/2016JA40Appomattox RiverOwner-OperatedN/A-<	BMP 36	Underground Storage Vault	University Bookstore	37.2375069049674	-77.41855594	Vater Quantity	0	0	0	04/2014	JA40	Appomattox River	Owner-Operated	N/A	04/27/2016
BMP 38Underground Storage VaultBoisseau St. Parking Lot #3637.236943-77.422522Water Quantity0000/4/2011JA40Appomattox RiverOwner-OperatedN/A04/26/2016BMP 39Underground Storage VaultBoisseau St. Parking Lot #3737.2369897120835-77.42289637Water Quantity0000/4/2011JA40Appomattox RiverOwner-OperatedN/A04/26/2016BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.242750765406-77.41641247Water Quantity0.530.080.450/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 2Dupuy Avenue Parking Lot37.242736765406-77.41667317Water Quality0.470.030.440/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 43Filterra 3Dupuy Avenue Parking Lot37.242736765406-77.41667317Water Quality0.470.030.440/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.242308901161-77.41667317Water Quality0.280.040.240/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.24275-77.42278Water Quality12.3000/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-	BMP 37	Underground Storage Vault	Lee St. Parking Lot #21	37.2360965385105	-77.42208962	Vater Quantity	0	0	0	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 39Underground Storage VaultBoisseau St. Parkign Lot #3737.2366987120835-77.42289637Water Quantity0000/4/2011JA40Appomattox RiverOwner-OperatedN/A0/4/26/2016BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.2425069094874-77.41641Water Quantity00006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 41Filterra 1Dupuy Avenue Parking Lot37.24272747565-77.41643427Water Quality0.470.150.3206/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 3Dupuy Avenue Parking Lot37.2427376542067-77.416571Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.242737654206-77.4165718Water Quality0.280.040.2406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.24275654206-77.4165718Water Quality0.280.040.2406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd, next to Fleets Branch37.24275-77.42023Water Quality2.3011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-	BMP 38	Underground Storage Vault	Boisseau St. Parking Lot #36	37.236943	-77.422522	Vater Quantity	0	0	0	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 40Underground Storage VaultDupuy Avenue Parking Lot37.2425069094874-77.41641Water Quantity00000/6/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 41Filterra 1Dupuy Avenue Parking Lot37.242727275755-77.41643427Water Quality0.530.080.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 2Dupuy Avenue Parking Lot37.2427367554206-77.41667317Water Quality0.470.150.3206/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 43Filterra 3Dupuy Avenue Parking Lot37.2423098901161-77.4164219Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.242308901161-77.416583Water Quality0.280.040.2406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.242705-77.412023Water Quality12.3006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.2412705-77.412085Water Quality32.2011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-	BMP 39	Underground Storage Vault	Boisseau St. Parkign Lot #37	37.2366987120835	-77.42289637	Vater Quantity	0	0	0	04/2011	JA40	Appomattox River	Owner-Operated	N/A	04/26/2016
BMP 41Filterra 1Dupuy Avenue Parking Lot37.2427272475765-77.41643427Water Quality0.530.080.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 42Filterra 2Dupuy Avenue Parking Lot37.2427367654206-77.41667317Water Quality0.470.150.3206/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 43Filterra 3Dupuy Avenue Parking Lot37.2423098901161-77.41667317Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.2418587443094-77.41615683Water Quality0.280.040.601/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.241755-77.4105833Water Quality13.2006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.241705-77.419085Water Quality32.0011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.419085Water Quality24.2515.88.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 49<	BMP 40	Underground Storage Vault	Dupuy Avenue Parking Lot	37.2425069094874	-77.41641	Vater Quantity	0	0	0	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 42Filterra 2Dupuy Avenue Parking Lot37.2427367654206-77.41667317Water Quality0.470.150.3206/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 43Filterra 3Dupuy Avenue Parking Lot37.2423098901161-77.41667317Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.2418587443094-77.41615683Water Quality0.280.040.2406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.24275-77.420233Water Quality12.3006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.239210-77.42227Water Quality32.0011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.41785236Water Quality24.2515.88.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 49Contech StormfilterDining & Events Center37.242028294099-77.41785236Water Quality24.4515.62.7906/01/2016JA40Appomattox RiverOwner-OperatedN/A-<	BMP 41	Filterra 1	Dupuy Avenue Parking Lot	37.2427272475765	-77.41643427	Vater Quality	0.53	0.08	0.45	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 43Filterra 3Dupuy Avenue Parking Lot37.2423098901161-77.4164219Water Quality0.470.030.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 44Filterra 4Dupuy Avenue Parking Lot37.2418587443094-77.41615683Water Quality0.280.040.2406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.24275-77.420233Water Quality12.3006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.239210-77.4227Water Quality32.0011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.419085Water Quality24.2515.88.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 48Contech StormfilterDining & Events Center37.2420288294099-77.4187836Water Quality2.480.911.5706/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 49Contech StormfilterDining & Events Center37.2420927893217-77.4184813Water Quality4.451.662.7906/01/2016JA40Appomattox RiverOwner-OperatedN/A-	BMP 42	Filterra 2	Dupuy Avenue Parking Lot	37.2427367654206	-77.41667317	Water Quality	0.47	0.15	0.32	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 44Filterra 4Dup Avenue Parking Lot37.2418587443094-77.41615683Water Quality0.280.040.2406/01/2016IA40Appomattox RiverOwner-OperatedN/ABMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.244275-77.420233Water Quality12.3006/01/2016IA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.249270-77.4227Water Quality32.0011.5620.4406/01/2016IA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.419085Water Quality24.2515.88.4506/01/2016IA40Appomattox RiverOwner-OperatedN/A-BMP 48Contech StormfilterDining & Events Center37.2420288294099-77.4178526Water Quality2.480.911.5706/01/2016IA40Appomattox RiverOwner-OperatedN/A-BMP 49Contech StormfilterDining & Events Center37.2420927893217-77.4184813Water Quality4.451.662.7906/01/2016IA40Appomattox RiverOwner-OperatedN/A-BMP 50Contech Underground Storage VaultDining & Events Center37.2419740066283-77.41813866Water Quality0.000.000.000.000/A/01/2016IA40Appomattox RiverOwner-Operated <t< td=""><td>BMP 43</td><td>Filterra 3</td><td>Dupuy Avenue Parking Lot</td><td>37.2423098901161</td><td>-77.4164219</td><td>Water Quality</td><td>0.47</td><td>0.03</td><td>0.44</td><td>06/01/2016</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>-</td></t<>	BMP 43	Filterra 3	Dupuy Avenue Parking Lot	37.2423098901161	-77.4164219	Water Quality	0.47	0.03	0.44	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 45Extended Detention PondNorth side of River Rd., next to Fleets Branch37.244275-77.42023Water Quality12.3006/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.239210-77.4222Water Quality32.0011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.419085Water Quality24.2515.88.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 48Contech StormfilterDining & Events Center37.2420288294099-77.41785236Water Quality2.480.911.5706/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 49Contech StormfilterDining & Events Center37.2420927893217-77.418433Water Quality4.451.662.7906/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 50Contech Underground Storage VaultDining & Events Center37.2419740066283-77.4184386Water Quality0.000.000.000.000.000/00/1/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 50Contech Underground Storage VaultDining & Events Center37.2419740066283-77.4184386Water Quality0.000.000.000.000.000.00	BMP 44	Filterra 4	Dupuy Avenue Parking Lot	37.2418587443094	-77.41615683	Vater Quality	0.28	0.04	0.24	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 46Extended Detention PondNext to Multi Purpose Center, along 3rd Ave.37.239210-77.4227Water Quality32.0011.5620.4406/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 47Contech Stormfilter 1College Ave. Parking Lot #2837.241705-77.419085Water Quality24.2515.88.4506/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 48Contech StormfilterDining & Events Center37.2420288294099-77.41785236Water Quality2.480.911.5706/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 49Contech StormfilterDining & Events Center37.2420927893217-77.4184813Water Quality4.451.662.7906/01/2016JA40Appomattox RiverOwner-OperatedN/A-BMP 50Contech Underground Storage VaultDining & Events Center37.2419740066283-77.41813866Water Quantity0.00 <td< td=""><td>BMP 45</td><td>Extended Detention Pond</td><td>North side of River Rd., next to Fleets Branch</td><td>37.244275</td><td>-77.420233</td><td>Vater Quality</td><td>12.30</td><td></td><td>512 1</td><td>06/01/2016</td><td>JA40</td><td>Appomattox River</td><td>Owner-Operated</td><td>N/A</td><td>-</td></td<>	BMP 45	Extended Detention Pond	North side of River Rd., next to Fleets Branch	37.244275	-77.420233	Vater Quality	12.30		512 1	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 47 Contech Stormfilter 1 College Ave. Parking Lot #28 37.241705 -77.419085 Water Quality 24.25 15.8 8.45 06/01/2016 JA40 Appomattox River Owner-Operated N/A - BMP 48 Contech Stormfilter Dining & Events Center 37.2420288294099 -77.41785236 Water Quality 2.48 0.91 1.57 06/01/2016 JA40 Appomattox River Owner-Operated N/A - BMP 49 Contech Stormfilter Dining & Events Center 37.2420927893217 -77.4184813 Water Quality 4.45 1.66 2.79 06/01/2016 JA40 Appomattox River Owner-Operated N/A - BMP 50 Contech Underground Storage Vault Dining & Events Center 37.2419740066283 -77.41813866 Water Quantity 0.00	BMP 46	Extended Detention Pond	Next to Multi Purpose Center, along 3rd Ave.	37.239210	-77.4227	Vater Quality	32.00	11.56	20.44	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 48 Contech Stormfilter Dining & Events Center 37.2420288294099 -77.41785236 Water Quality 2.48 0.91 1.57 06/01/2016 JA40 Appomattox River Owner-Operated N/A - BMP 49 Contech Stormfilter Dining & Events Center 37.2420927893217 -77.4184813 Water Quality 4.45 1.66 2.79 06/01/2016 JA40 Appomattox River Owner-Operated N/A - BMP 50 Contech Underground Storage Vault Dining & Events Center 37.2419740066283 -77.41813866 Water Quantity 0.00 0.0	BMP 47	Contech Stormfilter 1	College Ave. Parking Lot #28	37.241705	-77.419085	Water Quality	24.25	15.8	8.45	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-
BMP 49 Contech Stormfilter Dining & Events Center 37.2420927893217 -77.4184813 Water Quality 4.45 1.66 2.79 06/01/2016 JA40 Appointation Net operated N/A - BMP 50 Contech Underground Storage Vault Dining & Events Center 37.2419740066283 -77.41813866 Water Quantity 0.00	BMP 48	Contech Stormfilter	Dining & Events Center	37.2420288294099	-77.41785236	Vater Quality	2.48	0.91	1.57	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	1-
BMP 50 Contech Underground Storage Vault Dining & Events Center 37.2419740066283 -77.41813866 Water Quantity 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	BMP 49	Contech Stormfilter	Dining & Events Center	37.2420927893217	-77.4184813	Vater Quality	4.45	1.66	2.79	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	1-
	BMP 50	Contech Underground Storage Vault	Dining & Events Center	37.2419740066283	-77.41813866	Nater Quantity	0.00	0.00	0.00	06/01/2016	JA40	Appomattox River	Owner-Operated	N/A	-

APPENDIX C

Worksheet 1 Page 1 of 3

Step 1	Determine the applicable area (A) and the planned-developed impervious
	cover (I _{planned})

Applicable area $(A)^* = 258.05$ acres

planned-development impervious cover:

structures = <u>0</u> acres

parking lot = 0 acres

roadway = <u>0</u> acres

other = <u>94.51</u> acres

Total = 94.51 acres

I planned = (total planned-development impervious cover / A) x 37 %

<u>Step 2</u> Determine the average land cover condition (I watershed) <u>OR</u> the existing impervious cover (I existing).

If the locality has determined land cover conditions for individual watershed within its jurisdiction, use the watershed specific value determined by the locality as I watershed.

%

Otherwise, use the Chesapeake Bay default value. $\underbrace{16}_{\%}\%$

Worksheet 1 Page 2 of 3

Existing impervious cover (I existing):

Determine the existing impervious cover of the development site if present:

structures = 24.19 acres

parking lot = 28.1 acres

roadway = 16.9 acres

other = <u>15.25</u> acres

Total = 84.44 acres

I existing = (total existing impervious cover / A*) x 100 = 33 %

* The area should be the same as used in Step 1.

<u>Step 3</u> Determine the appropriate development situation.

The site information determined in STEP 1 and STEP 2 provide enough information to determine the appropriate development situation under which the performance criteria will apply. Check (X) the appropriate development situation as follows:

Situation 1: This consists of land development where the existing percent impervious cover (I existing) is less than or equal to the average land cover condition (I watershed) and the proposed improvements will create a total percent impervious cover (I_{planned}) which is less than or equal to the average land cover and the average land cover condition (I_{watershed})

I planned 37 % \leq I watershed 16 %

Worksheet 1 Page 3 of 3

Situation 2	: This consis cover (I exis (I watershed) impervious condition (This consists of land development where the existing percent impervious cover (I existing) is less than or equal to the average land cover condition I watershed) and the proposed improvements will create a total percent mpervious cover (I planned) which is greater than the average land cover condition (I watershed).						
	l existing	33	%	<u> </u>	watershed	16	% AND	
	l planned	37	%	>	watershed	16	_%	
Situation 3	: This consis cover (I _{exi}	sts of land o _{sting}) is <u>grea</u>	developme ater than th	nt where the e average la	existing percent nd cover condition	impervi on (I _{wate}	OUS ershed).	
	l existing	33	%	>	watershed	16	%	
X Situation 4	: This consis cover (I exist that addres	sts of land o sting) is serv ss(es) wate	developme ved by an e er quality.	nt where the xisting storm	existing percent water manager	: impervi nent BM	ous P(s)	

If the proposed development meets the criteria for development Situation 1, then the low density development is considered to be the BMP and no pollutant removal is required. The calculation procedure for Situation 1 stops here. If the proposed development meets the criteria for development Situations 2, 3, or 4, then proceed to STEP 4 on the appropriate worksheet.

Worksheet 4 : Situation 4 Page 1 of 6 Applicable area (A) = 258.05 acres I planned = (total planned-development impervious cover / A) x 100 = 37 % watershed = % OR watershed = 16 % I existing = (total existing impervious cover / A*) x 100 = % 33 33 % existing = I watershed = 16 % > Existing BMP drainage area (A_{existBMP}) = 42.36 acres I pre(BMP) = (total pre-development impervious cover / A existBMP) x 100 = 64 % EFF existBMP = documented pollutant removal efficiency of existing BMP (in decimal form)

Step 4 Determine the relative pre-development pollutant load (L pre)

1. Pre-development pollutant load based on the existing impervious cover:

L pre(existing) = $[0.05 + (0.009 \times I_{existing})] \times A \times 2.28$ (Equation 5-17)

where: L pre(existing) = relative pre-development total phosphorous load (pounds per year) I (existing) = existing site impervious cover (percent expressed in whole numbers) A = applicable area (acres)

> L pre(existing) = [0.05 + (0.009 x 33)] x 258.05 x 2.28 = 202.69 pounds per year

Performance-Based Water Quality Calculations Appendix 5D

	Worksheet 4 : Situation 4 Page 2 of 6
2. Calculate pr	e-development pollutant load to existing BMP:
	L pre(BMP) = $[0.05 + (0.009 \times I_{pre(bmp)})] \times A_{existBMP} \times 2.28$ (Equation 5-18)
where:	L _{pre(BMP)} = relative pre-development total phosphorous load to existing BMP (in pounds per year) I _{pre(BMP)} = existing impervious cover to existing BMP (percent expressed in whole numbers) A _{existBMP} = drainage area of existing BMP (acres)
	L pre(BMP) = $[0.05 + (0.009x 64)] \times 42.36 \times 2.28$
	= <u>60.03</u> pounds per year
3. Calculate pr	e-development pollutant load removed by existing BMP:

L removed(existing BMP) = L pre(BMP) x EFF exist BMP (Equation 5-19)

where: L removed(existingBMP) = relative pre-dev	elopment to	otal phosp	phorous load removed by
existing BMP (p	ounds per y	/ear)	
L _{pre(BMP)} = relative pre-dev	elopment to	tal phosp	horous load entering
existing BMP, E	quation 5-	18 (pound	ds per year)
EFF _{existBMP} = documented po	llutant remo	val efficie	ency of existing BMP
(expressed in d	ecimal form)	
L removed(existingBMP) =	60.03	х	0.62
	= 37.16	pounds p	ber year

Steps 2 and 3 are repeated for each existing BMP on the site.

L _{pre(BMP1-6)} =	0.89	L removed(existingBMP1-6) =	0.58
L _{pre(BMP7-13)} =	4.08	L removed(existingBMP7-13) =	2.65
$L_{pre(BMP16-21)} =$	3.36	L removed(existingBMP16-21) =	2.18
$L_{pre(BMP22)}$ =	0.26	L removed(existingBMP22) =	0.17
L _{pre(BMP23)} =	0.85	L removed(existingBMP23) =	0.55
L _{pre(BMP27)} =	1.92	L removed(existingBMP27) =	1.25
L _{pre(BMP29)} =	9.90	L removed(existingBMP29) =	4.95
$L_{pre(BMP30)} =$	24.66	L removed(existingBMP30) =	16.03

Worksheet 4 : Situation 4

Page 3 of 6

L pre(BMP31)	=	1.88	L removed(existingBMP31) =	1.22
L pre(BMP32)	=	0.80	L removed(existingBMP32) =	0.40
L pre(BMP33)	=	0.78	L removed(existingBMP33) =	0.39
L pre(BMP34)	=	0.91	L removed(existingBMP34) =	0.46
L pre(BMP48-49) =	9.74	L removed(existingBMP48-49) =	6.33
			total=	37.16
4. Calculate the pre-dev	elopment pollut	ant load while being	served by existing BMP(S):	
$L_{pre(existingBMP)} =$	- L _{pre(existing)} -	(L _{removed} (existingBMP1) Equ	+ L _{removed(existingBMP2)} +) ation 5-20	

where:	$L_{pre(existing BMP)} =$	relative pre-development total phosphorous load while being										
		served by an existing BMP (pounds per year)										
	L _{pre(existing)} =	 relative pre-development total phosphorous load based on existing site conditions, Equations 5-17 (pounds per year) 										
	EFF _{existBMP} =	 relative pre-development total phosphorous load based on existing (expressed in decimal form) 										
	L _{removed(existingBMP)} = relative pre-development total phosphorous load removed by											
	existing BMP, Equation 5-19 (pounds per year)											
	$L_{pre(existing BMP)} =$	<u>202.69</u> - (<u>0.58</u> + <u>2.65</u> +)										
Ston 5	= Determine the rel	165.53pounds per year ative planned-development pollutant load (I planned)										
01000	Determine the rel											
	L _{planned} =	$[0.05 + (0.009 \times I_{planned})] \times A \times 2.28$ (Equation 5-21)										
where:	L _{planned} =	relative planned-development total phosphorous load (pounds per year)										
	I _{planned} =	planned-development percent impervious cover (% in whole numbers)										
	A =	applicable area (acres)										
	L _{planned} =	[0.05 + (0.009 x <u>37</u>)] x <u>258.05</u> x 2.28										
	=	223.35pounds per year										

Step 6 Determine the relative pollutant removal requirement (RR).

RR = L _{planned} - L _{pre(existingBMP)}										
=	223.35	-	<u>165.53</u>							
RR =	57.82	pounds p	oer year							

Worksheet 4 : Situation 4 Page 4 of 6

2. Pre-development pollutant load based on the average land cover condition:

 $L_{pre(watershed)} = [0.05 + (0.009 \times I_{watershed})] \times A \times 2.28$ (Equation 5-16)

where: L_{pre(watershed)} = relative pre-development total phosphorous load (pounds per year)

I watershed = average land cover condition for specific watershed or locality or the Chesapeake Bay default value of 16% (percent expressed in whole numbers)

A = applicable area (acres)

 $L_{pre(watershed)} = [0.05 + (0.009 x 16)] x 258.05 x2.28$

= 114.14 pounds per year

STEP 7 Identify best management practice (BMP) for the site.

1. Determine the required pollutant removal efficiency for the site:

EFF = $(RR / L_{planned}) \times 100$ (Equation 5-22)

where:

EFF = required pollutant removal efficiency (% in whole numbers)

RR = pollutant removal requirement (pounds per year)

L_{planned} = relative planned-development total phosphorous load (pounds per year)

EFF =(<u>57.82</u> / <u>223.35</u>) x 100

= 25.89 %

2. Select BMP(s) from Table 5-15 and locate on the site:

BMP 1:	Contech Stormfilter - University Bookstore (BMP 35)
BMP 2:	Contech Stormfilter - College Ave. Parking Lot #28 (BMP 47)
BMP 3:	Filterra's - Dupuy Avenue Parking Lot (BMP 41-44)
BMP 4:	Extended Detention Pond - Multi-Purpose Center (BMP 46)

Worksheet 4 : Situation 4 Page 5 of 6

3. Determine the pollutant load entering the proposed BMP(s):

$L_{BMP} = [0.05 + (0.009 \times I_{BMP})] \times A \times 2.28$ (Equation 5-23)													
where: L _{BMP}	ere: L _{BMP} = relative planned-development total phosphorous load entering												
	proposed BMP (pounds per year)												
I _{BMP}	I_{BMP} = planned-development percent impervious cover of BMP drainage area												
	(percent expressed in whole numbers)												
A	$L_{BMP1} = [0.05 + (0.009 \text{ x} 90)] \text{ x} 0.10 \text{ x}2.28$												
►BMP1	= [0.05 + (0.009	X	90	_)]	х	0.10							
	= 0.20	_pounds	s per year										
L _{BMP2}	= [0.05 + (0.009	х	35)]	х	24.25	x2.28						
	= 20.10	pounds	s per year										
L _{BMP3}	= [0.05 + (0.009	х	83)]	х	1.75	x2.28						
	= 3.17	pounds	s per year										
L _{BMP4}	= [0.05 + (0.009	х	64)]	x	32.00	x2.28						
= 45.59 pounds per year 4. Calculate the pollutant load removed by the proposed BMP(s):													
L _{removed}	= Eff _{BMP} x L _{BMP}	(Equat	ion 5-24)										
where: L _{removed}	= planned-devel	opment	pollutant lo	ad re	mov	ed by proposed	BMP						
	(pounds per ye	ear)											
Ett _{BMP}	= pollutant remo	val effici	ency of BN	1P (e:	xpres	ssed in decimal f	orm)						
L _{BMP}	= relative planne proposed BMF	d-develo (pound	s per year)	al pho	ospho	orous load enter	ing						
L _{removed/BMP1}	= 0.65	x	0.20	_	=	0.13	_pounds per year						
L _{removed/BMP2}	= 0.65	_ x	20.10	_	=	13.07	_pounds per year						
L _{removed/BMP3}	= 0.65	x	3.17	_	=	2.06	_pounds per year						
L _{removed/BMP4}	=0.65	x	45.59	_	=	29.63	_pounds per year						

Worksheet 4 : Situation 4 Page 6 of 6

5. Calculate the total pollutant load removed by the existing and proposed BMP(s):

	L _{removed/total}	H = L _{removed/BM} + L _{removed(exi Equation 5-2}	1 _{P1} + L , istingBMP1 2 5)	removed/BMP2 + L r) + L removed(existi	emoved/BMP3 ngBMP2) + [3 + - removed(existingBMP3	3)
where:	L removed/total L removed/BMP1 L removed/BMP2 L removed/BMP3 L removed/BMP4	= total pollu = pollutant k = pollutant k = pollutant k = pollutant k	tant loa bad ren bad ren bad ren bad ren	ad removed by propo noved by propo noved by propo noved by propo noved by propo	oroposed sed BMP sed BMP sed BMP sed BMP	BMPs No. 1, Equation No. 2, Equation No. 3, Equation No. 4, Equation	1 5-24 1 5-24 1 5-24 1 5-24
	L removed(existingBMP1) L removed(existingBMP2) L removed(existingBMP3) L removed(existingBMP4)	= pollutant lo = pollutant lo = pollutant lo = pollutant lo	oad ren oad ren oad ren oad ren	noved by existir noved by existir noved by existir noved by existir	ng BMP N ng BMP N ng BMP N ng BMP N	lo. 1, Equation 5 lo. 2, Equation 5 lo. 3, Equation 5 lo. 4, Equation 5	5-19 5-19 5-19 5-19 5-19
L _{removed}	l/total =	0.13 29.63	+ +	13.07 37.16	+	2.06	+
		= <u>82.05</u> pc	ounds p	er year			
6. Verify Compliance	e:						
L removed/tot	al ≥ RR						

82.05 ≥ 57.82

APPENDIX D

APPENDIX D. CHESAPEAKE BAY TMDL CREDITS

ID	ВМР Туре	Total Area Treated (Ac.)	Pervious Area Treated (Ac.)	Impervious Area Treated (Ac.)	Percent Impervious (%)	TP Load (lb/yr)	TN Load (lb/yr)	TN Removal Efficiency (%)	TN Reduction (lbs TN/yr)	TN Credit (lb/yr)	TSS Load (lb/yr)	TSS Removal Efficiency (%)	TSS Reduction (lbs TSS/yr)	TSS Credit (lb/yr)
						Performance Based Water Quality Calculations	TN loading rate * TP conversion (5.2 lbs/acre)	Virginia Clearinghouse Efficiency	TN load * BMP Efficiency	TN Reduction * Excess Removal Credit (30%)	TSS loading rate * TP conversion (420.9 lbs/acre)	Table V.C.1 CBP BMP Established Efficiencies	TSS load * BMP Efficiency	TSS Reduction * Excess Removal Credit (30%)
BMP 01	Roof Filterra 1*	0.07	0.00	0.07	100	0.15	0.79	34	0.27	0.08	63.82	80	51.05	15.32
BMP 02	Roof Filterra 2*	0.04	0.00	0.04	100	0.09	0.45	34	0.15	0.05	36.47	80	29.17	8.75
BMP 03	Roof Filterra 3*	0.07	0.00	0.07	100	0.15	0.79	34	0.27	0.08	63.82	80	51.05	15.32
BMP 04	Roof Filterra 4*	0.11	0.00	0.11	100	0.24	1.24	34	0.42	0.13	100.28	80	80.23	24.07
BMP 05	Roof Filterra 5*	0.05	0.00	0.05	100	0.11	0.56	34	0.19	0.06	45.58	80	36.47	10.94
BMP 06	Roof Filterra 6*	0.07	0.00	0.07	100	0.15	0.79	34	0.27	0.08	63.82	80	51.05	15.32
BMP 07	Filterra 1*	0.22	0.04	0.18	82	0.39	2.05	34	0.70	0.21	166.02	80	132.82	39.84
BMP 08	Filterra 2*	0.38	0.03	0.35	92	0.76	3.96	34	1.35	0.40	320.52	80	256.42	76.93
BMP 09	Filterra 3*	0.40	0.02	0.38	95	0.83	4.29	34	1.46	0.44	347.39	80	277.92	83.37
BMP 10	Filterra 4*	0.34	0.03	0.31	91	0.67	3.51	34	1.19	0.36	284.06	80	227.25	68.17
BMP 11	Filterra 5*	0.35	0.02	0.33	94	0.72	3.73	34	1.27	0.38	301.81	. 80	241.45	72.43
BMP 12	Filterra 6*	0.23	0.03	0.20	87	0.44	2.27	34	0.77	0.23	183.77	80	147.02	44.11
BMP 13	Filterra 7*	0.18	0.06	0.12	67	0.27	1.39	34	0.47	0.14	112.28	80	89.82	26.95
BMP 16	Roof Filterra 1*	0.50	0.00	0.50	100	1.08	5.63	34	1.91	0.57	455.83	80	364.67	109.40
BMP 17	Roof Filterra 2*	0.50	0.00	0.50	100	1.08	5.63	34	1.91	0.57	455.83	80	364.67	109.40
BMP 18	Roof Filterra 3*	0.12	0.00	0.12	100	0.26	1.35	34	0.46	0.14	109.40	80	87.52	26.26
BMP 19	Roof Filterra 4*	0.09	0.00	0.09	100	0.19	1.01	34	0.34	0.10	82.05	80	65.64	19.69
BMP 20	Roof Filterra 5*	0.08	0.00	0.08	100	0.17	0.90	34	0.31	0.09	72.93	80	58.35	17.50
BMP 21	Roof Filterra 6*	0.27	0.01	0.26	96	0.56	2.93	34	1.00	0.30	237.51	80	190.01	57.00
BMP 22	Contech Stormfilter 1	0.14	0.02	0.12	86	0.26	1.36	30	0.41	0.12	110.36	80	88.29	26.49
BMP 23	Contech Stormfilter 2	0.46	0.07	0.39	85	0.85	4.43	30	1.33	0.40	358.91	80	287.13	86.14
BMP 27	Underground Detention Chamber w/ Sand Filters	1.90	1.07	0.83	44	1.92	9.98	30	2.99	0.90	808.03	80	646.42	193.93
BMP 29	Extended Detention Basin	5.49	0.97	4.52	82	9.90	51.48	10	5.15	1.54	4167.29	60	2500.37	750.11
BMP 30	Retention Basin Type III	20.99	10.14	10.85	52	24.66	128.22	30	38.47	11.54	10378.16	60	6226.89	1868.07
BMP 31	Delaware Sand Filter	1.17	0.32	0.85	73	1.88	9.76	30	2.93	0.88	790.27	80	632.22	189.67
BMP 32	Sorbtive Filter 2C	0.38	0.01	0.37	97	0.80	4.17	30	1.25	0.38	337.80	80	270.24	81.07
BMP 33	Sorbtive Filter 1C	0.39	0.03	0.36	92	0.78	4.07	30	1.22	0.37	329.64	80	263.71	79.11
BMP 34	Sorbtive Filter 10C	0.44	0.02	0.42	95	0.91	4.74	30	1.42	0.43	383.86	80	307.09	92.13
BMP 35	Contech Stormfilter	0.10	0.01	0.09	90	0.20	1.02	30	0.31	0.09	82.53	80	66.02	19.81
BMP 41	Filterra 1*	0.53	0.08	0.45	85	0.98	5.12	34	1.74	0.52	414.09	80	331.27	99.38
BMP 42	Filterra 2*	0.47	0.15	0.32	68	0.71	3.69	34	1.26	0.38	298.93	80	239.15	71.74
BMP 43	Filterra 3*	0.47	0.03	0.44	94	0.96	4.97	34	1.69	0.51	402.57	80	322.06	96.62
BMP 44	Filterra 4*	0.28	0.04	0.24	86	0.52	2.73	34	0.93	0.28	220.72	80	176.58	52.97
BMP 46	Extended Detention Pond	32.00	11.56	20.44	64	45.59	237.07	10	23.71	7.11	19189.20	60	11513.52	3454.06
BMP 47	Contech Stormfilter 1	24.25	15.80	8.45	35	20.10	104.54	30	31.36	9.41	8461.73	80	6769.39	2030.82
BMP 48	Contech Stormfilter	2.48	0.91	1.57	63	3.50	18.22	30	5.47	1.64	1474.99	80	1179.99	354.00
BMP 49	Contech Stormfilter	4.45	1.66	2.79	63	6.23	32.41	30	9.72	2.92	2623.21	80	2098.57	629.57
TOTALS		100.46	43.13	57.33		129.09	671.29		146.07	43.82	54,335.50)	36,721.47	11,016.44

*Total nitrogen (TN) removal efficiency is not provided in Virginia Clearinghouse. Refer to manufactures website for removal performance. http://www.conteches.com/products/stormwater-management/biofiltration-bioretention/filterra