

## Crab Creek Implementation Plan 8/25/2014

Table S-1. Residential septic and straight pipe practices

Control Measure	Units	Avg. Cost	# of BMPs			Costs		
			Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
<b>Failing Septic Systems</b>								
Septic Tank Pump-out	system	\$300	565		565	\$169,500	\$0	\$169,500
Connection to Public Sewer	system	\$5,000	7		7	\$35,000	\$0	\$35,000
Septic Tank System Repair	system	\$3,500	237		237	\$829,500	\$0	\$829,500
Septic Tank System Installation/ Replacement	system	\$7,500	79		79	\$592,500	\$0	\$592,500
Alternative On-site Waste Treatment System	system	\$15,000	36		36	\$540,000	\$0	\$540,000
<b>Straight Pipes</b>								
Septic Tank System Installation/ Replacement	system	\$7,500	2		2	\$15,000	\$0	\$15,000
Alternative On-site Waste Treatment System	system	\$15,000	2		2	\$30,000	\$0	\$30,000
<b>Total Cost</b>								<b>\$2,211,500</b>

Table S-2. Residential pet waste practices

Control Measure	Units	Avg. Cost	# of BMPs			Costs		
			Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
Pet Waste Management								
Pet Waste Stations	number	\$1,300	15		15	\$19,500	\$0	\$19,500
Pet Waste Composters	number	\$100	50		50	\$5,000	\$0	\$5,000
Pet Waste Education Program	program	\$4,000	1		1	\$4,000	\$0	\$4,000
Total Cost								\$28,500

Table S-3. Locations identified for future placement of pet waste stations.

Location	# Stations	Details <sup>1</sup>
Circle Park	1	Neighborhood park on Ellett Drive
Depot Park	1	On Depot St. with walking/jogging path
Downtown Park	1	Paved walking trail to library
Harkrader Sports Complex	1	Encircled by a 0.4 mile paved walking track
Kiwanis Park	1	Located off Roanoke Street, behind Southern States
Town and Country Park	1	Neighborhood park on Summit Ridge Road
Wall Street Park	1	Neighborhood park located on Wall Street, off Radford Street
Huckleberry Trail	3	Total = 10, 737 ft; Existing = 1,483 ft; Design = 9,254 ft
Trail near George Edward Via NW	1	Proposed walkway = 5,455 ft
Holmes St. NE to Mill Ln. NE	1	Proposed walkway = 2,491 ft
Aspen St. SE to Falling Branch	2	Proposed walkway = 6,578 ft
Dog Park	1	Proposed, no location
<b>Total</b>	<b>15</b>	

<sup>1</sup> Details derived from the Town of Christiansburg Parks and Recreation website and trail maps. Trail lengths are estimated.

Table S-4. Residential & urban stormwater practices

Control Measure	Units	Avg. Cost	# of BMPs			Costs		
			Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
<b>Stormwater</b>								
Rain Gardens (MS4)	acres treated	\$5,000	2	66	68	\$10,000	\$330,000	\$340,000
Rain Gardens (non-MS4)	acres treated	\$5,000		10	10	\$0	\$50,000	\$50,000
Bioretention Filters	acres treated	\$20,000	1.5	2	3.5	\$30,000	\$40,000	\$70,000
Bioswales	acres treated	\$15,000	1	6	7	\$15,000	\$90,000	\$105,000
Riparian Buffers - Forested	acres treated	\$3,500	0.5	60.5	61	\$1,750	\$211,750	\$213,500
Riparian Buffers - Grass/Shrubs (MS4)	acres treated	\$500		80	80		\$40,000	\$40,000
Riparian Buffers - Grass/Shrubs (non-MS4)	acres treated	\$500		20	20		\$10,000	\$10,000
Detention	acres treated	\$2,000	25	67	92	\$50,000	\$134,000	\$184,000
Extended Detention	acres treated	\$2,000	40	60	100	\$80,000	\$120,000	\$200,000
Manufactured BMPs	acres treated	\$15,000	2.5	0.5	3	\$37,500	\$7,500	\$45,000
Detention and Manufactured BMPs	acres treated	\$16,000	0.5	10	10.5	\$8,000	\$160,000	\$168,000
Constructed Wetlands/Wet Ponds	acres treated	\$8,000	0.5		0.5	\$4,000		\$4,000
Infiltration	acres treated	\$20,000	0.5	1	1.5	\$10,000	\$20,000	\$30,000
Vegetated Open Channels	acres treated	\$9,000	0.5	0.5	1	\$4,500	\$4,500	\$9,000
<b>Total Cost</b>								<b>\$1,468,500</b>

Table S-5. Agricultural practices

Control Measure	Unit	Avg. Unit Cost	# of BMPs		Total #	Costs		
			Stage 1	Stage 2		Stage 1	Stage 2	Total
<b>Livestock Exclusion</b>								
Livestock Exclusion with Riparian Buffers (SL-6T)	system	\$32,800	9	29	38	\$295,200	\$951,200	\$1,246,400
Livestock Exclusion with Reduced Setback (LE-2T)	system	\$20,000	1	3	4	\$20,000	\$60,000	\$80,000
Stream Protection System (WP-2T)	system	\$10,000	1	2	3	\$10,000	\$20,000	\$30,000
<b>Pasture</b>								
Grazing Land Management System (EQIP 528, SL-9)	acres	\$75	3,265		3,265	\$244,875		\$244,875
Reforestation of Erodeable Pasture (FR-1)	acres	\$600		28	28		\$16,800	\$16,800
Permanent Vegetative Cover on Critical Areas (SL-11)	acres	\$330		29	29		\$9,570	\$9,570
Heavy Use Area Protection (EQIP 561)	system	\$20,000		20	20		\$400,000	\$400,000
<b>Cropland</b>								
Continuous No-till (SL-15A)	acres	\$20	5		5	\$100		\$100
Small Grain Cover Crop (SL-8B)	acres	\$25	20		20	\$500		\$500
<b>Total Cost</b>								<b>\$2,028,245</b>

Table S-6. Channel erosion practices – streambank stabilization & restoration

Control Measure	Units	Avg. Unit Cost	# of Units Needed			Costs		
			Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
Streambank Stabilization	linear feet	\$150	11,254		11,254	\$1,688,100	\$0	\$1,688,100
<b>Total Cost</b>								<b>\$1,688,100</b>

Table S-7. Technical assistance costs

Control Measure	Unit	Avg. Unit Cost	# of Units Needed			Costs		
			Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
Residential Technical Assistance	years	\$60,000/year	6		6	\$360,000		\$360,000
Agricultural Technical Assistance	years	\$60,000/year	6	4	10	\$360,000	\$240,000	\$600,000
<b>Total Cost</b>								<b>\$960,000</b>

Table S-8. Total implementation cost for Crab Creek

	Agricultural BMPs	Residential BMPs	Channel BMPs	Technical Assistance	Total
<b>Stage 1</b>	\$570,675	\$2,490,750	\$1,688,100	\$720,000	\$5,469,525
<b>Stage 2</b>	\$1,457,570	\$1,217,750	\$0	\$240,000	\$2,915,320
<b>Total</b>	<b>\$2,028,245</b>	<b>\$3,708,500</b>	<b>\$1,688,100</b>	<b>\$960,000</b>	<b>\$8,384,845</b>

Table S-9. Water quality goals for bacteria in Crab Creek by implementation stage.

<i>E. coli</i> Measure	TMDL Stage 1	IP Stage 1	IP Stage 2
Percent Violations of the Geomean Standard	3.33%	0.00%	0.00%
Percent Violations of the Single Sample Standard	16.10%	12.80%	10.35%
Average Annual Load (cfu/yr)	4.83E+15	1.40E+15	9.44E+14

Table S-10. Percent reductions needed from sources to meet the bacteria water quality milestones in Crab Creek for each stage of implementation.

Stage	Cattle Direct Deposition	Residential/Urban	Pasture	Cropland	Straight Pipes/ SSOs
1	100	76	60	31	100
2	100	80	88	31	100

Table S-11. Percent reductions needed to meet sediment load goals in Crab Creek for each stage of implementation.

Sediment	Total % reduction	Average Annual Load (tons/yr)
Stage 1	55%	2,120.03
Stage 2	57%	2,046.21

Table S-12. Sediment source loads and reductions needed to meet sediment load goals in Crab Creek to restore the aquatic life community.

Sediment Source	Existing Condition	Allocations			
		Stage 1		Stage 2	
Categories	(T/yr)	(%)	(T/yr)	(%)	(T/yr)
LDR-PER	29.830	0	29.830	5	28.339
HDR-PER	0.083	0	0.083	0	0.083
COM-PER	7.074	0	7.074	0	7.074
Transitional	63.624	0	63.624	0	63.624
Forest	25.463	0	25.463	0	25.463
Disturbed Forest	84.852	0	84.852	0	84.852
Pastureland	1,276.101	32	867.749	37	803.944
Cropland	505.871	17	419.873	17	419.873
LDR-IMP	16.858	0	16.858	5	16.015
HDR-IMP	1.141	0	1.141	0	1.141
COM-IMP	0.005	0	0.005	0	0.005
Water	0.000	0	0.000	0	0.000
MS4-Existing (minus WLA of 55.14)	43.348	3	42.047	15	36.846
MS4-Future	20.652	3	20.032	15	17.554
Active Ag BMPs*	-281.96		-281.96		-281.960
Active Ag BMPs**	-84.60		-84.6		-84.600
Active Urban BMPs**	-22.28		-22.28		-22.280
<b>NPS Load</b>	<b>1,686.06</b>		<b>1,189.79</b>		<b>1,115.97</b>
Channel Erosion***	2,944.37	71	853.868	71	853.868
<b>Total</b>	<b>4,630.44</b>		<b>2,043.66</b>		<b>1,969.84</b>
<b>Target Allocation Load (TMDL - MOS - WLA)</b>					<b>1,971.26</b>
<b>Target In-stream Load (All Sources-MOS)</b>					<b>2,047.63</b>

\*Credited during TMDL development

\*\*Credited since TMDL development

\*\*\*Credited 2,233 linear ft of stream restoration- Diamond Hills project

Table S-13. VADEQ monitoring stations in the Crab Creek watershed

VADEQ Station ID	Station Type	Location
9-CBC001.00	Ambient, Biological	Route 663 Bridge, near Walton, Montgomery County
9-CBC004.38	Ambient, Biological	Route 660 bridge below Christiansburg STP
9-CBC006.35	Ambient, Biological	Old Route 661 Ford – Montgomery County
9-CBC008.78	Ambient, Biological	Route 460 bridge below Christiansburg
9-CBC009.81	Ambient	Route 111 in Downtown Christiansburg

Table S-14. Implementation priorities for implementation efforts in the Crab Creek watershed

Stage 1 Priorities	Stage 2 Priorities
<ul style="list-style-type: none"> <li>• Straight pipes</li> <li>• Failing septic systems</li> <li>• Pet waste</li> <li>• Urban stormwater</li> <li>• Livestock exclusion systems on perennial streams</li> <li>• Grazing land management systems</li> <li>• Cropland practices including continuous no-till, and small grain cover crops</li> <li>• Streambank stabilization</li> <li>• Outreach and education</li> <li>• Agricultural and residential technical assistance</li> </ul>	<ul style="list-style-type: none"> <li>• Residential stormwater</li> <li>• Livestock exclusion systems on intermittent streams</li> <li>• Grazing land management systems</li> <li>• Heavy use area protection</li> <li>• Permanent vegetative cover on critical areas</li> <li>• Reforestation of erodible pasture</li> <li>• Agricultural technical assistance</li> </ul>

#### Stakeholders identified in the Implementation Plan

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|---|--|
| <ul style="list-style-type: none"> <li>• Landowners</li> <li>• Montgomery County</li> <li>• Meadows Swim &amp; Golf Club</li> <li>• New River Conservancy</li> <li>• Skyline SWCD</li> <li>• NRCS</li> <li>• FSA</li> <li>• Save Our Streams</li> </ul> | <ul style="list-style-type: none"> <li>• Town of Christiansburg</li> <li>• VA Department of Agriculture</li> <li>• VA Department of Conservation and Recreation</li> <li>• VA Department of Environmental Quality</li> <li>• VA Department of Health</li> <li>• VA Department of Transportation</li> </ul> |
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*Additional opportunities for partnerships:* Montgomery County schools, Montgomery County Master Gardeners, Montgomery County Master Naturalists, New River Land Trust, Radford University, Trout Unlimited, VA Cooperative Extension, VA Department of Forestry, VA Department of Game and Inland Fisheries, Virginia Farm Bureau, Virginia Outdoors Foundation

## Potential Funding Sources

Funding sources that may be available to support implementation include:

- Federal
  - Clean Water Act 319 Incremental Funds
  - Conservation Reserve Program (CRP)
    - Conservation Reserve Enhancement Program (CREP)
  - Conservation Stewardship Program (CSP)
  - Environmental Quality Incentives Program (EQIP)
  - Agricultural Lands Easement Program
  - United States Fish and Wildlife Service grants
- State
  - Virginia Agricultural Best Management Practices (BMPs) Cost-Share Program
  - Virginia Agricultural Best Management Practices Loan Program
  - Virginia Agricultural Best Management Practices Tax Credit Program
  - Virginia Clean Water Revolving Loan Fund
  - Virginia Forest Stewardship Program
  - Virginia Outdoors Foundation and the Open Space Lands Preservation Trust Fund
  - Virginia Small Business Environmental Assistance Fund Loan Program
  - Virginia Stormwater Assistance Fund (SLAF)
  - Virginia Water Quality Improvement Fund (WQIF)
- Regional and Private Sources
  - Community Development Block Grants (CDBG)
  - Community Foundation of the New River Valley
  - National Fish and Wildlife Foundation
    - Five Star and Urban Waters Restoration Grant Program
  - Norcross Wildlife Foundation
  - Southeast Rural Community Assistance Project (SERCAP)
  - Virginia Environmental Endowment
  - Wetland and Stream Mitigation Banking