

# Residential Best Management Practices

Human population and number of housing units in each subwatershed were established using U.S. Census Bureau demographics data (Table 1). Septic systems are designed to filter septic tank effluent through the soil allowing removal of bacteria and nutrients from the wastewater. Septic system failure is manifested by the rise of effluent to the soil surface. During TMDL development, it was assumed treatment of effluent ceased once effluent containing fecal coliform reached the soil surface. Surface runoff can transport the effluent containing fecal coliform to receiving waters. Total septic systems were classified into one of three age categories based on U.S. Census Bureau demographics data. A failure rate was applied for systems in each age category to estimate total failed septic systems per subwatershed (Table 1). Straight pipes were estimated by identifying houses located within 150 feet of streams and sewage disposal method from Census data. Any houses within 150 ft of streams and within the "other" category were considered potential straight pipe dischargers. This method yielded houses listed in Table 1 that potentially could be classified as straight pipes in the Upper Rapidan River watershed. Figures 1 and 2 depict failing septic systems and straight pipes estimates per watershed, respectively. Potential corrective methods to fix failing septic systems and replace straight pipes are listed in Table 2. Applying the corrective measure percentages results in the totals listed in Table 3. Control measures with estimated cost-share program and landowner costs are shown in Table 4.

**Table 1. Estimated housing units, housing units with on-site sewage disposal systems, failing septic systems, and straight pipes in each watershed.**

	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	TOTAL
Total Housing Units	79	562	464	1,463	418	1,154	288	125	606	3,160	<b>8,319</b>
Housing Units with On-site Sewage Disposal Systems	79	525	449	1,122	413	704	183	125	505	2,649	<b>6,754</b>
Failing Septic Systems	26	142	136	214	141	71	17	44	87	665	<b>1,543</b>
Straight Pipes	11	3	11	38	20	14	4	5	7	57	<b>170</b>

**Table 2. Control measure and estimated percentage of corrective measure to fix or replace failing septic systems and straight pipes.**

Control Measure	Estimated Corrective Method	
	Failed Septic System	Straight Pipe
Septic Tank Pump-Out (RB-1)	100%	
Connection to Public Sewer (RB-2)	0%	0%
Septic Tank System Repair (RB-3)	70%	N/A
Septic Tank System Installation/Replacement (RB-4)	25%	80%
Septic Tank System Installation/Replacement w/ Pump (RB-4P)	3%	10%
Alternative On-site Waste Treatment System (RB-5)	2%	10%

**Table 3. Estimated control measure and implementation cost to fix failing septic systems and replace straight pipes.**

Control Measure	Garth Run	Rippin Run	Marsh Run	Blue Run	Beautiful Run	Poplar Run	UT to Rapidan River #1	UT to Rapidan River #2	Rapidan River #1	Rapidan River #2	Cost (\$)
Septic Tank Pump-Out (RB-1)	37	145	147	252	161	85	21	49	94	722	<b>513,900</b>
Connection to Public Sewer (RB-2)	0	0	0	0	0	0	0	0	0	0	<b>0</b>
Septic Tank System Repair (RB-3)	18	99	95	150	99	50	12	31	61	466	<b>3,783,500</b>
Septic Tank System Installation/Replacement (RB-4)	9	39	43	84	51	30	8	14	26	211	<b>3,090,000</b>
Septic Tank System Installation/Replacement w/ Pump (RB-4P)	8	4	5	10	6	3	1	2	4	26	<b>552,000</b>
Alternative On-site Waste Treatment System (RB-5)	2	3	4	8	5	2	0	2	3	19	<b>1,200,000</b>
<b>Total Cost</b>											<b>9,139,400</b>

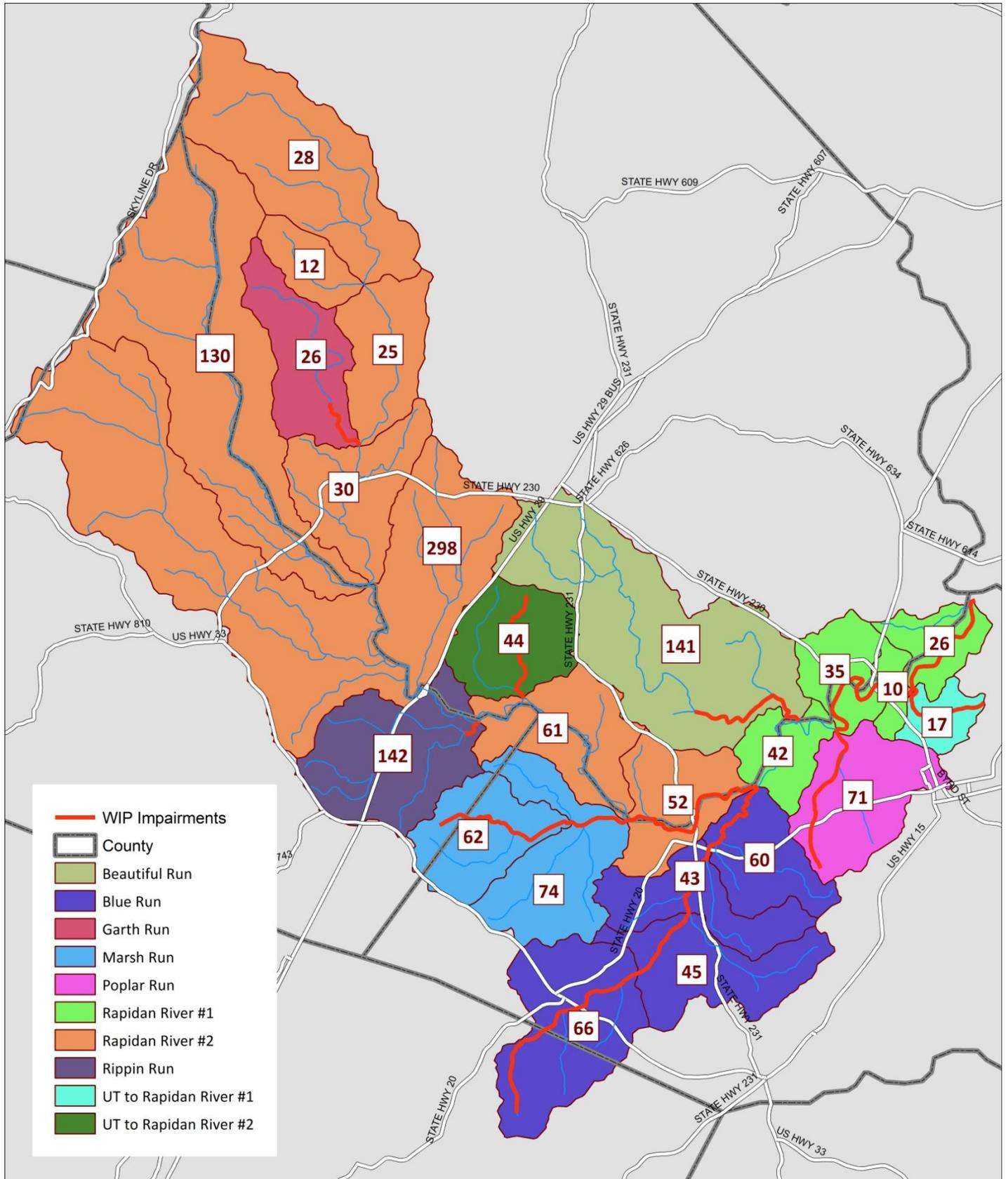


Figure 1. Failed septic system estimates per subwatershed.



**Table 4. Control measures with estimated cost-share program and landowner costs.**

Control Measure	Program Code	Unit	Average Unit Cost (\$)	Cost-share	Average Cost/Unit to State or Federal Program (\$)	Average Cost/Unit to Landowner (\$)¹
Septic Tank Pump-out	RB-1	System	300	50%	150	150
Connection to Public Sewer	RB-2	System	10,000	75% - 50%	7,500 – 5,000	2,500 - 5,000
Septic Tank System Repair	RB-3	System	3,500	75% - 50%	2,625 – 1,750	875 - 1,750
Septic Tank System Installation / Replacement	RB-4	System	6,000	75% - 50%	4,500 – 3,000	1,500 - 3,000
Septic Tank System Installation / Replacement w/ Pump	RB-4P	System	8,000	75% - 50%	6,000 – 4,000	2,000 - 4,000
Alternative On-site Waste Treatment System	RB-5	System	25,000	75% - 50%	18,750 – 12,500	6,250 - 12,500
Pet waste education program	N/A	Program	5,000	N/A	0	5,000
Pet waste digesters	N/A	System	50	N/A	0	50
Confined Canine Unit Waste Treatment System	N/A	System	20,000	N/A	0	20,000
Vegetated Buffers	N/A	Acres²	400	N/A	0	400
Bioretention	N/A	Acres³	15,000	N/A	0	15,000
Infiltration Trench	N/A	Acres³	11,300	N/A	0	11,300

¹ Does not include tax credit or in-kind service; ² Acres Installed; ³ Acres treated