6.0 Benefits of Plan Implementation

For the 10-year plan, projects that might have a measurable impact on the watershed hydrology (rate and timing of flows) or hydraulics (stream water level) were selected for additional modeling. For the Pohick Creek projects, only stormwater pond retrofit projects were assumed to have a measurable effect on the hydrology. Therefore, only the stormwater pond retrofit projects were modeled in the hydrologic model, SWMM. Once the projects had been modeled in SWMM, the resulting flows were input into the hydraulic model, HEC-RAS.

6.1 Hydrology

A total of 32 pond projects were modeled both individually in SWMM and in a combined model. There were a few locations where flows increased from the "future without proposed projects" to the "future with proposed projects" model scenarios. Some of these increases are due to modeling techniques. A detailed discussion of the hydrologic modeling can be found in Appendix B. An overview of the existing, "future without," and "future with projects" flows can be found in Table 6.1.

6.2 Hydraulics

Flows from the combined model, which included all relevant projects from the 10-year plan, were input into the hydraulic model for the watershed. The 100-year (a storm that has a 1 percent probability of occurring in a given year) and the 10-year (a storm with a 10 percent annual chance) floodplains were mapped. An analysis was performed to determine the affected structures located inside or within 15 feet of the floodplain boundaries.

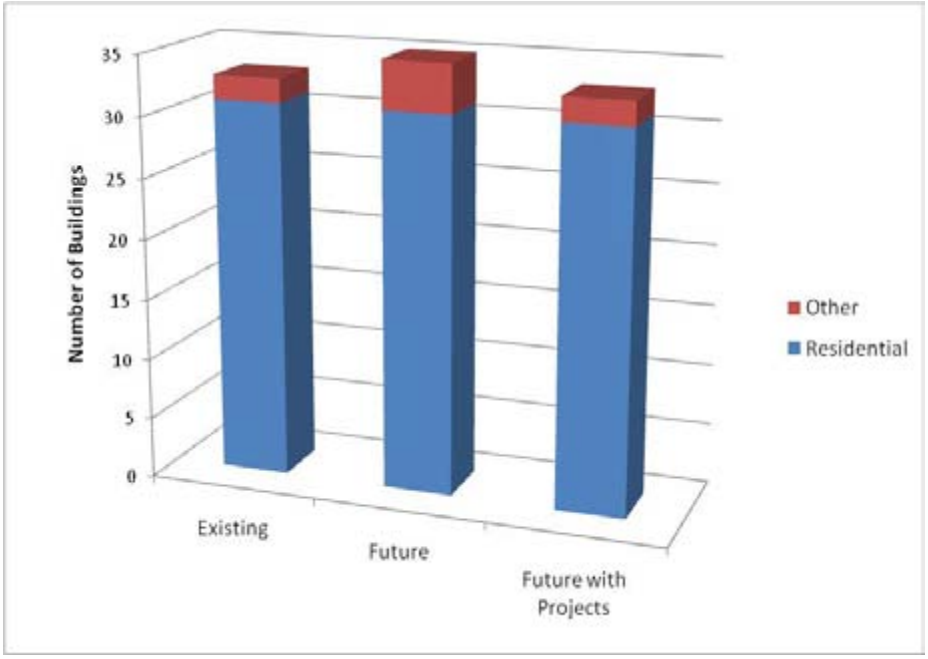

Figure 6-1: Buildings located in the 100-year floodplain

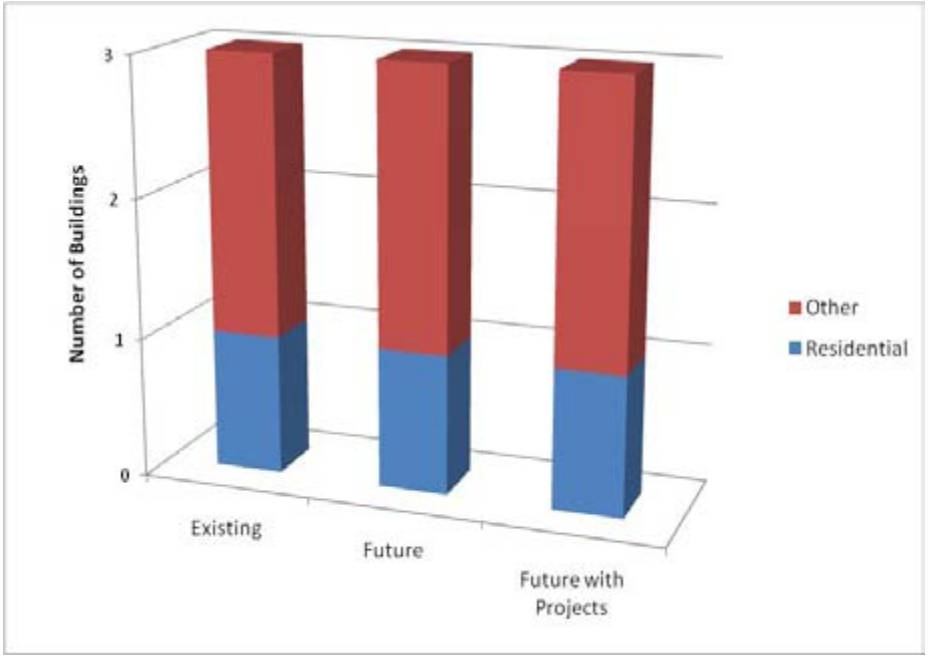

Figure 6-2: Buildings located within 15 feet of the 100-year floodplain

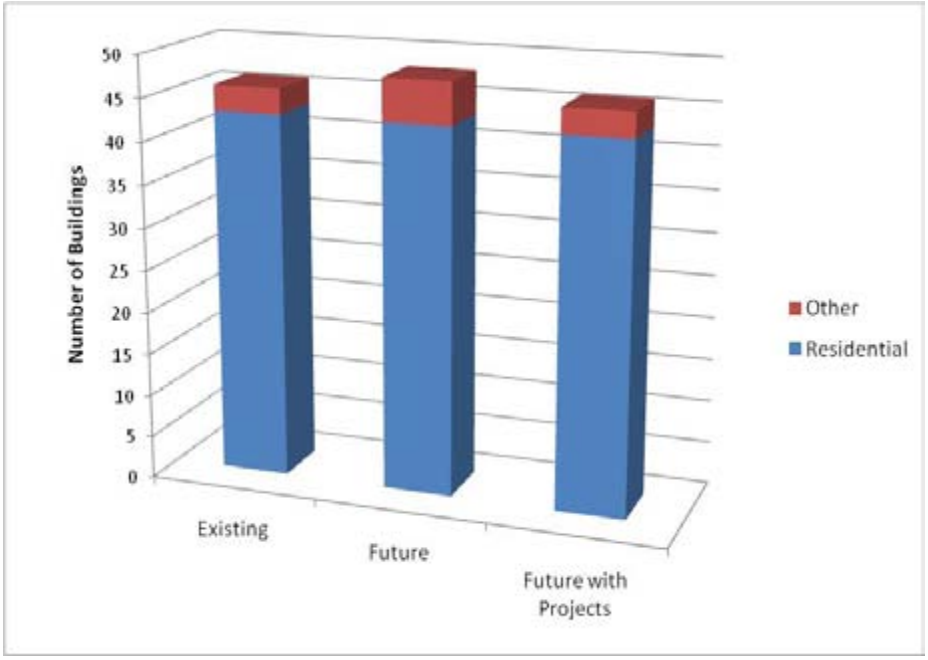

Figure 6-3: Buildings located within the 10-year floodplain

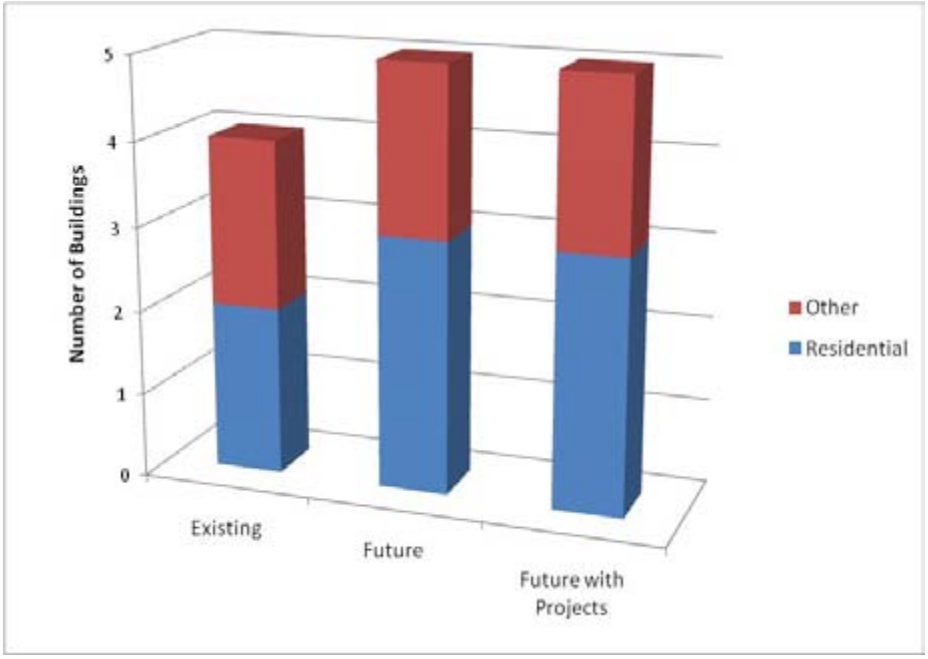

Figure 6-4: Buildings located within 15 feet of the 10-year floodplain

The analysis shows that the number of structures in or near the floodplain remains the same or slightly decreases between "future" conditions and "future with projects" conditions. A more detailed discussion of the hydraulic analysis can be found in Appendix B.

6.3 Pollutant Loading

Pollutant loads at the subwatershed level were estimated using STEPL, a water quality model. Additionally streambank erosion was calculated for affected reaches per guidance from the County. The streambank erosion pollutant loads were broken down into subwatershed loads and added to the STEPL subwatershed pollutant loads. The STEPL model generates estimated pollutant loads based on land use. Various types of stormwater treatment facilities can be modeled by applying reductions to these loads based on the treatment type and area treated. Detailed results from the STEPL model can be found in Appendix B. Table 6.1 includes a summary of the "existing," "future without," and "future with proposed projects" pollutant loadings by WMA.

6.4 Plan Costs and Benefits

The total cost of the 10-year plan (includes the 90 structural projects only) is $48 million. If implemented, the benefits to the county are wide-ranging. The yearly total suspended sediment load will be reduced by 1,200 tons. The yearly load of nitrogen will be reduced by 3,000 pounds, and the yearly load of phosphorus will be reduced by 1,000 pounds. This represents a 15.2% reduction in suspended sediment, a 2.4% reduction in nitrogen, and a 4.6% reduction in phosphorus. If the 64 structural projects in the 11-25 year plan are implemented as well, at a cost of $48 million, the suspended sediment load will be reduced by an additional 440 tons. The yearly load of nitrogen will be reduced by an additional 1,000 pounds, and the yearly load of phosphorus will be reduced by an additional 300 pounds. Implementation of the total group of 155 structural projects at a cost of $96 million will yield reductions of 1,700 tons of suspended sediment, 4,000 pounds of nitrogen, and 1,300 pounds of phosphorus yearly. This represents a 20.6% reduction in sediment, a 3.3% reduction in nitrogen, and a 6.2% reduction in phosphorus.

Additionally, the 41 non-structural projects will have water quality benefits as well, although the costs and benefits of these projects are less easily quantified. These benefits will help attain the goals set by the County to improve water quality in the Pohick Creek watershed.

Table 6-1: Pollutant Loading & Flow Reduction Table (Pohick - Lower)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Lower	2346.46	Existing Condition	1.456	3.282	0.261	0.665	482.81	5.69	0.89
		Future Without Projects	1.635	3.475	0.323	0.758	481.91	6.37	0.98
		Future With Projects (10-Yr)	1.623	3.454	0.306	0.734	474.42	6.36	0.97
		Future With Projects (25-Yr)	N/A	N/A	N/A	N/A	469.96	6.31	0.97
		Reduction (10-Year Plan)	0.012	0.021	0.017	0.024	7.49	0.01	0.00
		Reduction (25-Year Plan)	N/A	N/A	N/A	N/A	11.95	0.05	0.01

Table 6-2: Pollutant Loading & Flow Reduction Table (Pohick - Lower South Run)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Lower South Run	1947.69	Existing Condition	1.071	2.769	0.185	0.552	395.39	4.32	0.72
		Future Without Projects	1.090	2.791	0.190	0.552	394.98	4.38	0.72
		Future With Projects (10 yr)	1.091	2.800	0.190	0.553	382.32	4.35	0.71
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	382.28	4.35	0.71
		Reduction (10-year Plan)	-0.002	-0.009	0.000	-0.001	12.66	0.04	0.01
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	12.70	0.04	0.01

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions

Table 6-3: Pollutant Loading & Flow Reduction Table (Pohick - Middle)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Middle	3014.60	Existing Condition	1.118	2.863	0.219	0.509	1236.71	6.32	1.16
		Future Without Projects	1.139	2.887	0.225	0.513	1236.09	6.36	1.16
		Future With Projects (10 yr)	1.141	2.891	0.219	0.510	1077.52	6.22	1.11
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	1018.67	6.14	1.09
		Reduction (10-year Plan)	-0.002	-0.003	0.006	0.003	158.57	0.14	0.05
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	217.42	0.22	0.08

Table 6-4: Pollutant Loading & Flow Reduction Table (Pohick - Middle Run)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Middle Run	2540.17	Existing Condition	1.222	2.966	0.169	0.357	352.29	5.77	0.92
		Future Without Projects	1.246	2.996	0.177	0.371	352.43	5.83	0.92
		Future With Projects (10 yr)	1.240	2.988	0.175	0.368	342.21	5.81	0.92
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	339.96	5.80	0.91
		Reduction (10-year Plan)	0.005	0.008	0.002	0.003	10.22	0.02	0.01
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	12.47	0.03	0.01

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions

Table 6-5: Pollutant Loading & Flow Reduction Table (Pohick - Middle South Run)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Middle South Run	1889.12	Existing Condition	0.778	1.837	0.019	0.041	530.89	4.30	0.74
		Future Without Projects	0.778	1.838	0.019	0.041	530.82	4.30	0.74
		Future With Projects (10 yr)	0.772	1.821	0.019	0.041	484.63	4.25	0.72
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	440.58	4.22	0.71
		Reduction (10-year Plan)	0.006	0.017	0.000	0.000	46.18	0.05	0.02
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	90.23	0.08	0.03

Table 6-6: Pollutant Loading & Flow Reduction Table (Pohick - Potomac)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Potomac	1532.42	Existing Condition	1.031	2.736	0.134	0.430	292.77	1.36	0.32
		Future Without Projects	1.032	2.737	0.134	0.431	292.70	1.38	0.32
		Future With Projects (10 yr)	1.032	2.737	0.134	0.431	292.70	1.38	0.32
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	292.70	1.38	0.32
		Reduction (10-year Plan)	0.000	0.000	0.000	0.000	0.00	0.00	0.00
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0.00	0.00	0.00

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions

Table 6-7: Pollutant Loading & Flow Reduction Table (Pohick - Rabbit Branch)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Rabbit Branch	2524.90	Existing Condition	1.259	2.792	0.058	0.081	841.80	5.71	1.00
		Future Without Projects	1.248	2.788	0.058	0.082	841.67	5.73	1.01
		Future With Projects (10 yr)	1.294	2.871	0.058	0.080	766.69	5.51	0.95
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	671.86	5.43	0.91
		Reduction (10-year Plan)	-0.046	-0.083	0.000	0.001	74.98	0.22	0.06
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	169.81	0.30	0.09

Table 6-8: Pollutant Loading & Flow Reduction Table (Pohick - Sideburn Branch)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Sideburn Branch	2307.90	Existing Condition	1.290	2.949	0.117	0.240	1131.43	6.93	1.20
		Future Without Projects	1.306	2.984	0.126	0.252	1132.02	6.99	1.21
		Future With Projects (10 yr)	1.310	2.997	0.123	0.254	755.69	6.60	1.08
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	720.48	6.56	1.07
		Reduction (10-year Plan)	-0.003	-0.012	0.003	-0.002	376.33	0.39	0.13
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	411.54	0.42	0.14

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions

Table 6-9: Pollutant Loading & Flow Reduction Table (Pohick - Upper)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Upper	3104.70	Existing Condition	1.185	2.932	0.219	0.446	1003.60	6.36	1.11
		Future Without Projects	1.219	2.971	0.224	0.459	1004.37	6.44	1.12
		Future With Projects (10 yr)	1.213	2.949	0.222	0.455	760.71	6.19	1.04
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	715.81	6.15	1.02
		Reduction (10-year Plan)	0.006	0.022	0.002	0.004	243.65	0.25	0.09
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	288.55	0.29	0.10

Table 6-10: Pollutant Loading & Flow Reduction Table (Pohick - Upper South Run)

WMA	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick-Upper South Run	2040.74	Existing Condition	0.000	0.000	0.000	0.000	326.54	3.40	0.58
		Future Without Projects	0.776	2.274	0.178	0.364	324.03	3.46	0.59
		Future With Projects (10 yr)	0.797	2.296	0.172	0.359	292.56	3.39	0.57
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	221.74	3.31	0.54
		Reduction (10-year Plan)	-0.022	-0.021	0.006	0.005	31.47	0.08	0.02
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	102.29	0.15	0.05

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions

Table 6-11: Pollutant Loading & Flow Reduction Table (Pohick Creek Watershed)

Watershed	Area (ac)	Scenario[1]	Runoff Volume (in)[2]		Peak Flow (cfs/ac)[2]		TSS (lb/ac/yr)[3]	TN (lb/ac/yr)[3]	TP (lb/ac/yr)[3]
			2-Year	10-Year	2-Year	10-Year			
Pohick Creek	23248.71	Existing Condition	1.056	2.315	0.080	0.086	709.57	5.28	0.91
		Future Without Projects	1.127	2.461	0.083	0.227	709.29	5.39	0.92
		Future With Projects (10 yr)	1.132	2.464	0.083	0.204	601.25	5.26	0.88
		Future With Projects (25 yr)	N/A	N/A	N/A	N/A	563.33	5.22	0.87
		Reduction (10-year Plan)	-0.005	-0.003	0.000	0.023	108.05	0.13	0.04
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	145.97	0.18	0.06

[1] 25-year projects were not evaluated in the hydrologic model
[2] Flow is cumulative
[3] Loads are representative of individual land area contributions