Elks Run Watershed Based Plan

West Virginia Stream Code: WVP-1
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In the Potomac River Watershed
Jefferson County, WV

Prepared 2013

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Cover photo: Elk Branch with railroad track on right bank, by A. Hartman 2010

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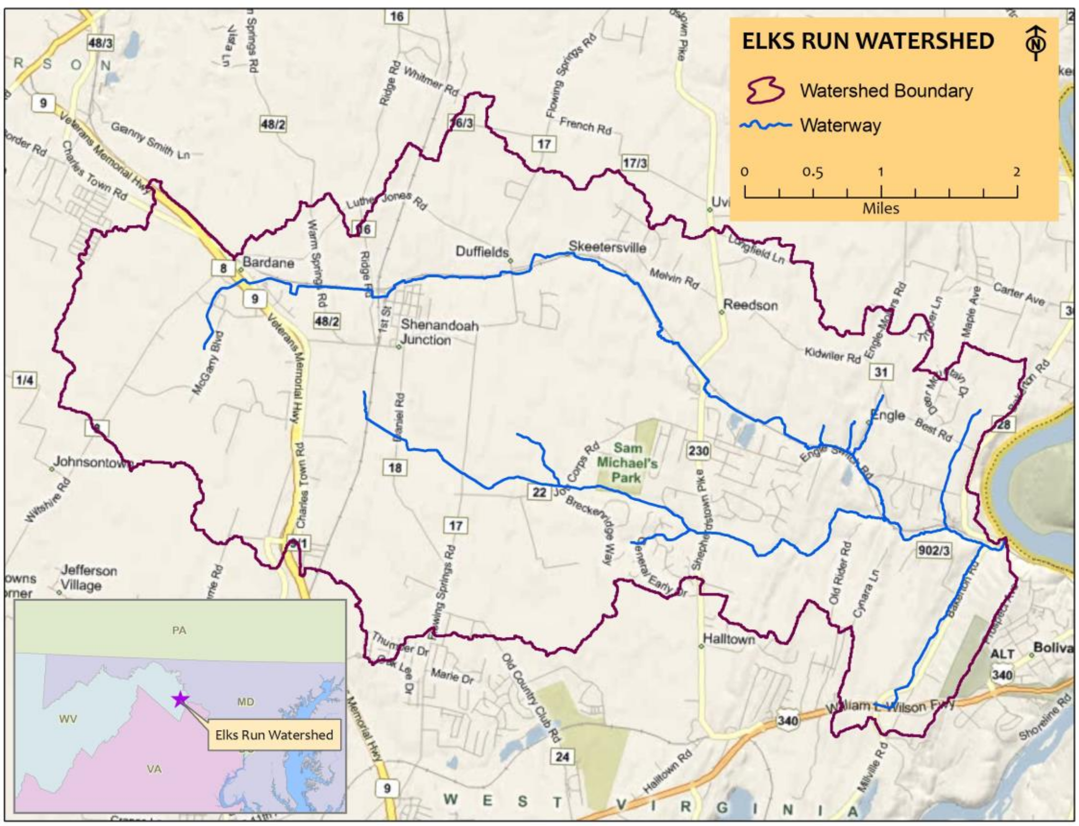
Introduction

This Elks Run Watershed Based Plan is a voluntary framework for achieving the nonpoint source aspects of the TMDL (mentioned later in this document). It is a starting point to focus restoration efforts and enable financial and technical assistance to facilitate improvement strategies and restoration projects in the Elks Run Watershed. This restoration process should be assisted by local agency representatives and stakeholders.

Elks Run is located in the eastern portion of the Potomac Direct Drains watershed. It drains approximately 18 square miles and is approximately 5.8 miles long (Fig. 1). There is one major tributary, Elk Branch, which is 5.2 miles long. Elks Run is a source of drinking water for the towns of Bolivar and Harpers Ferry. Along with the Potomac and Shenandoah Rivers, it is one of the only surface waters in Jefferson County that serves a municipal water supply.

Figure 1. Elks Run watershed area



This watershed is a priority area for West Virginia's efforts to reduce nutrients and sediment delivered to the Chesapeake Bay because of its high nitrogen delivery factor, the likelihood of landowner participation in agricultural Best Management Practice (BMP) programs, the high activity level of local watershed groups, and its role as one of the few surface water sources of drinking water in the Eastern Panhandle.

Geographical Extent and Land Use

Elks Run watershed is relatively flat; it lays in a low area of the Ridge and Valley physiographic province. It is located in what has been called the Great Limestone Valley, characterized by karst terrain. Springs, sinkholes and discontinuous drainage patterns are common. The soils are deep and medium textured, and are formed in material weathered from limestone and limy shale. These soils are suited to farming and orchards. They are further discussed in the sediment sources section. Wooded areas are only in small scattered patches on farms and fencerows. The watershed receives fairly adequate rainfall.

The Total Maximum Daily Load for Selected Streams in the Potomac Direct Drains Watershed (2008), or TMDL, includes acreage of various land uses in the watershed (Fig. 2). Almost 28% of the watershed is grassland, which is comprised of hay fields, residential yards, and other grassed areas. This category plus agricultural land uses make up the majority of the watershed.

Table 1. TMDL land use estimated percentages for Elks Run watershed (WV Div. of Water and Waste Management 2008)

Land Use Category	Percent	Land Use Category	Percent
Grassland	27.7	Urban impervious	2.3
Pasture	19.1	Orchards/golf courses	0.9
Cropland	16.0	Paved roads	0.8
Forest	14.0	Wetlands	0.5
Urban pervious	11.3	Un-paved roads	0.5
Stormwater construction	5.7	Water	0.3

Forests are the next largest category. The most common forest type is oak-hickory, but other hardwoods such as white ash, tulip poplar and black walnut are found in many areas. The productivity of the soil for growing trees is excellent.

“Urban pervious” and “construction stormwater” (land registered under the Construction Stormwater general permit) are the next largest uses according to the TMDL. There is presently much development in the Eastern Panhandle of West Virginia and no less in the Elks Run watershed. There continues to be a potential for growth in population. Urban pervious and impervious land uses occur in slightly higher percentages in Elks Run watershed than in the Potomac Direct Drains watershed overall (compare to TMDL Table 3-1). These developed areas occur mostly in the unincorporated town of Shenandoah Junction and within the many conjoined developments between Elk Branch and Elks Run. A railway closely follows the course of Elk Branch, crossing it approximately 11 times, and then crossing Elks Run three times.

Some of the other land use percentages differ greatly from the condition in the Potomac Direct Drains watershed at large, according to Table 3-1 of the TMDL. For example, forest makes up approximately 50% of the land use of the Potomac Direct Drains watershed area, but only about 14% of the Elks Run watershed. Pasture and cropland comprise about 4% of the Potomac Direct Drains watershed, each, but in Elks Run watershed they make up about 20% and 16%, respectively. These differences might simply reflect the existence of relatively flat land and good soil for agriculture in this area.

Note: In 2010 an analysis of Jefferson County's tree canopy was conducted by University of Vermont based on 2007 high resolution aerial imagery. By isolating the Elks Run watershed it was determined that tree canopy cover was approximately 26%. This takes into account forests and other tree cover in the watershed. This is compared to the 14% forests reported by the TMDL. The Elks Run analysis maintains that 66 % of the watershed is potential tree canopy.

A. Sources of impairments in Elks Run watershed

Elks Run and its major tributary, Elk Branch, were listed on the 303(d) list as impaired for biological criteria and fecal coliform bacteria. The Total Maximum Daily Load (TMDL) for Selected Streams in the Potomac Direct Drains Watershed, West Virginia (January 2008) addressed these impairments for Elks Run and Elk Branch (Tables 2 and 3). It linked the biological impairment to organic enrichment and sedimentation, and it listed the prescribed fecal coliform and sediment load reductions from various sources in each of the 11 subwatersheds. The TMDL was modeled based on source tracking, analysis of a Geographic Information System (GIS: maps and accompanying information), and monthly water quality monitoring of three sites in the watershed. The sites were 0.2 miles upstream of the mouth of Elks Run, just below the confluence of Elk Branch and Elks Run, and on Elk Branch near this confluence. Fecal coliform reduction can be considered a local priority, as well: "Microbial Pathogens: Total/Fecal Coliform, Viruses, Protozoa" was one category of potential contaminants listed in the 2006 SWAP's "Site Specific Contaminant Source Inventory" pp. 15-28.

Table 2. From Table A-4-2 of the TMDL, Significant stressors of biologically impaired streams in the Elks Run watershed

Stream	**Biological Stressors**	**TMDLs required**
Elks Run	Organic enrichment; Sedimentation	Fecal coliform; Sediment
Elk Branch	Organic enrichment; Sedimentation	Fecal coliform; Sediment

Table 3. From Tables A-4-3 and A-4-4 of the TMDL, Fecal coliform and Biological TMDLs for the Elks Run watersheds

Major watershed	Stream/Stream code	Parameter	Load Allocation	Wasteload Allocation	Margin of Safety	TMDL	Units
Elks Run	Elks Run/WVP-1	Fecal coliform	6.44×10^{10}	1.36×10^{08}	3.40×10^{09}	6.80×10^{10}	counts/day
Elks Run	Elks Run/WVP-1	Sediment	75.56	1.10	4.03	80.70	tons/day
Elks Run	Elk Branch/WVP-1-A	Fecal coliform	2.15×10^{10}	1.36×10^{08}	1.14×10^{09}	2.28×10^{10}	counts/day
Elks Run	Elk Branch/WVP-1-A	Sediment	17.48	0.82	0.96	19.26	tons/day

"Scientific notation" is a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10. The scientific notation of 10,492, for example, is 1.0492 × 104.

Fecal coliform impairment in Elks Run watershed

The categories of nonpoint sources of fecal coliform in Elks Run watershed include background sources, residential/urban sources, cropland, pasture, and onsite sewer systems (septic systems) (Table 3). Background sources are considered to include contributions from wildlife in forested areas, which are not significant in the Potomac Direct Drains watershed (TMDL p. 15).

Residential/urban: The TMDL prescribed a reduction of approximately 62% of the bacteria load from stormwater runoff from residential and urbanized areas in Elks Run watershed. Areas with lawns, streets, and sidewalks draining toward surface waters are likely the largest contributors. For example, a large drainage swale in Gap View Village appears to be an actual tributary of Elks Run in wet weather. The lush vegetation (although groomed) appearing in its “streambed” may indicate commercial fertilizer washing off from lawns, which is likely accompanied by pet waste (Fig 3). However, this swale channels runoff into a dry detention pond, where some treatment of contaminants may occur. Stormwater management systems in Jefferson County have been designed primarily to control the *quantity* of runoff. They may meet guidelines set by the county ordinances, while not providing treatment of the water *quality*. Furthermore, stormwater ponds and other treatment facilities in residential areas must handle runoff from agricultural land, in many cases.

Table 4. Estimated annual load allocations and reductions needed from nonpoint sources to achieve fecal coliform TMDL.

Source	[AC] Total amount of this source	Amount contributing to the load that must be reduced	Baseline load (counts/ year)	Allocated load (counts/ year)	Reduction needed (counts/ year)	Percent reduction needed
Background & other nonpoint sources	5705	n/a	$4.30x10^{12}$	$4.30x10^{12}$	0	0
Residential/urban	1726	not estimated	$1.78x10^{13}$	$6.81x10^{12}$	$1.10x10^{13}$	61.9
Cropland	1859	not estimated	$6.44x10^{12}$	$2.73x10^{12}$	$3.71x10^{12}$	57.6
Pasture	2309	616[A]	$8.46x10^{13}$	$9.68x10^{12}$	$7.49x10^{13}$	88.6
Onsite sewer systems	1273[B]	416[B] or 239[C]	$2.66x10^{15}$	0	$2.66x10^{15}$	100.0

[A] estimated by adding acreage of pastures recorded by WV DEP during source tracking, with high and moderate erosion potential rating; [B] as estimated during the TMDL process for modeling purposes; [C] as estimated by TCF-Freshwater Institute (see Table 5); [AC] acres

Figure 3. The drainage swale in Gap View Village, beginning in lower left of photo

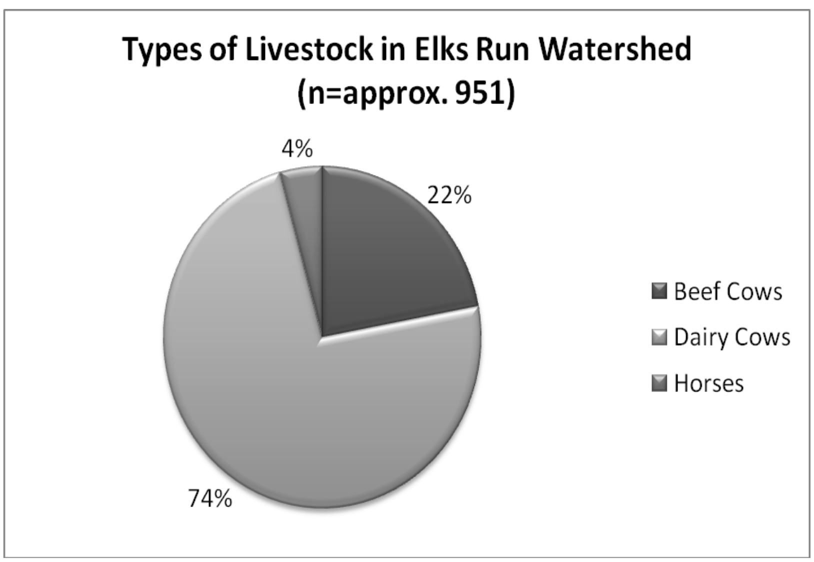
Pasture and cropland: Grazing livestock and land application of manure results in the deposition and accumulation of bacteria on land surfaces. These bacteria are then available for wash-off and transport during rain events. In addition, livestock with access to streams can deposit feces directly into the water (TMDL p. 15).

Source tracking identified 28 livestock operations in Elks Run watershed, including beef, dairy and horse farms, and pastures. They were characterized as dairies, boarding stables, and feedlots, and a total of approximately 951 cows and horses was observed. The number estimated to have access to streams was 234. The total number of dairy cows from the three dairies was approximately 700 (probably adjusted by adding attendant calves at a fraction of 1, each), making dairy cows the largest category of livestock animals in the watershed (see Fig. 4).

Four livestock operations were identified as having high or moderate "runoff potential," an index used as an input for the TMDL modeling. This index is based on the land slope, presence of buffer zones, and whether the animals appeared to have access to surface drainages (Fig. 5).

The total area of the four pastures with a "high" or "moderate" runoff potential rating is estimated to be 616 acres. This analysis can serve as a starting point for identifying pastures where nonpoint management measures can be implemented to achieve fecal coliform reductions. That is, owners of pastures with high or moderate runoff potential ratings can be interviewed to determine their awareness of federal or local agricultural cost-share programs and their willingness to participate in them. Several factors can be used to prioritize projects, including proximity to headwaters, proximity to a perennial stream, and landowner willingness.

Figure 4. Proportions of different kinds of livestock in Elks Run watershed, as estimated during TMDL source tracking, 2003-2004



Estimates of the baseline loads and allocated loads of fecal coliform from pasture and cropland are given in Table 3. Cow manure from the three dairies is used on nearby fields. Other livestock farmers in the area might also apply manure from their own operations on their crop fields. In addition, poultry layer litter is brought into the watershed from Pennsylvania by a few vendors. It is cheaper than commercial fertilizer when nitrogen, phosphorus, and potash are all needed on a crop field.

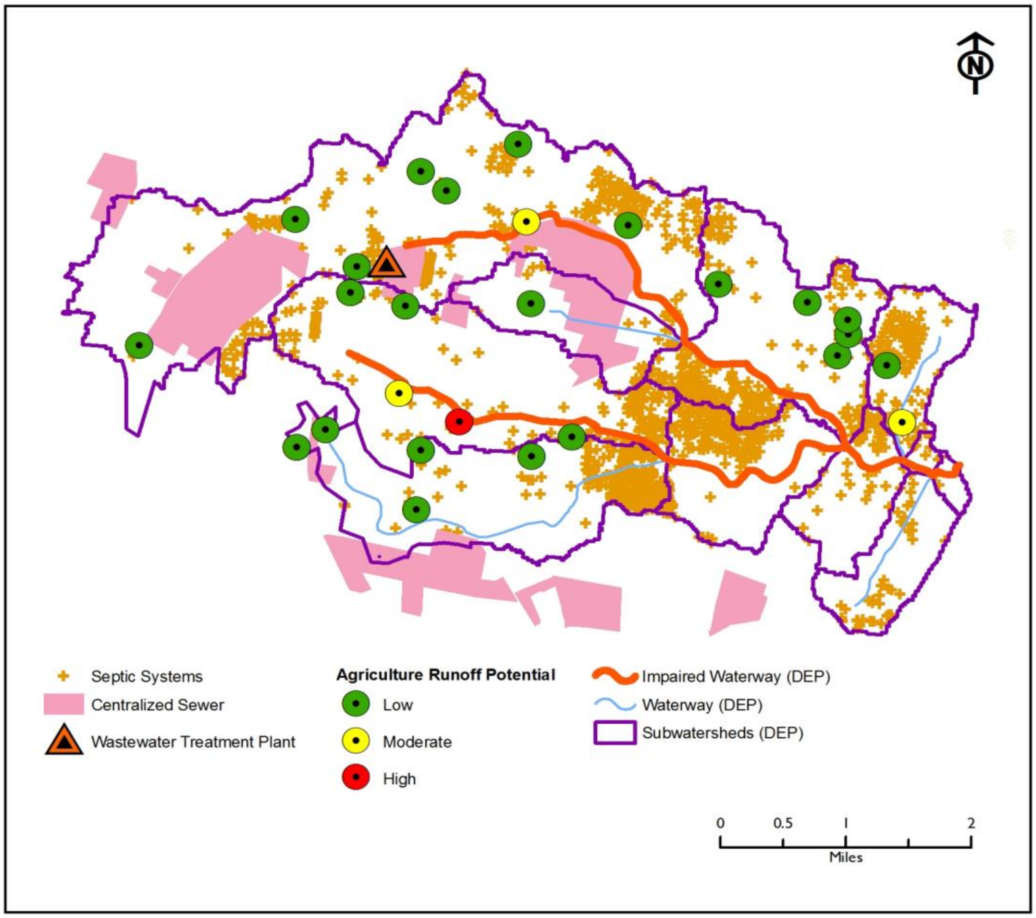
The TMDL's modeled Load Allocation of fecal coliform may be the best starting point for identifying opportunities for nonpoint management measures on cropland (Table 5).

Table 5. TMDL fecal coliform bacteria load allocations for cropland in Elks Run subwatersheds. The highest percent reductions are **indicated**.

Subwatershed	Cropland Area (Acres)	Cropland Baseline Load (counts/yr)	Cropland Allocated Load (counts/yr)	Cropland percent reduction
1001	0	0	0	0
1002	16.4	6.03E+10	4.67E+10	22.6

1003	0.6	2.34E+09	2.34E+09	0
1004	96.0	4.37E+11	4.37E+11	0
1005	6.1	2.26E+10	2.26E+10	0
1006	83.3	1.90E+11	1.25E+11	34.3
1007	0	0	0	0
1008	472.9	2.22E+12	7.18E+11	67.6
1009	233.9	1.17E+12	6.40E+11	45.1
1010	186.1	4.24E+11	1.33E+11	68.6
1011	763.8	1.92E+12	6.03E+11	68.6

Figure 5. Fecal coliform sources in Elks Run watershed



The prescribed load reduction was greater than 50% in three subwatersheds (subwatersheds are depicted in Figure 6). Implementation should begin in these watersheds, and then move to the remaining three subwatersheds for which reductions were prescribed. Within these two groups, other factors such as proximity to headwaters, proximity to a perennial stream, and landowner willingness can be used to prioritize projects.

Onsite sewer systems: Elks Run watershed includes scattered areas of high population density without access to public sewers. Human sources of fecal coliform bacteria in these areas include sewage discharges from failing septic systems and possible direct discharges of sewage from

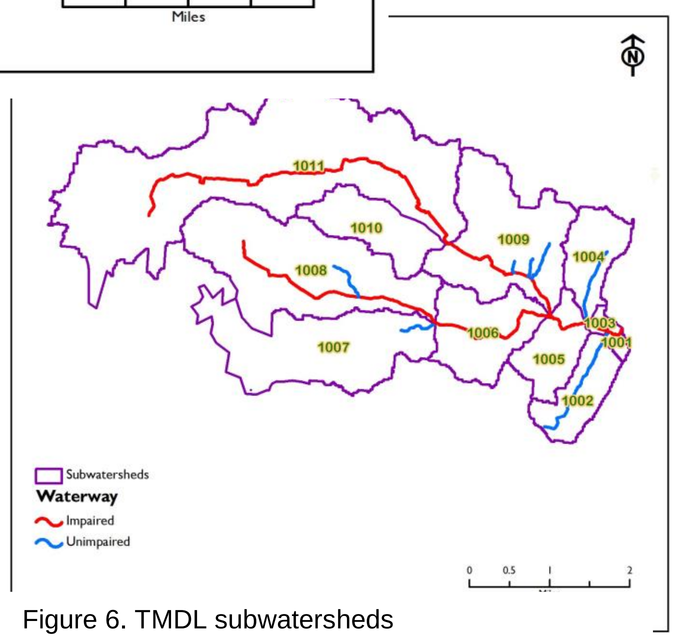
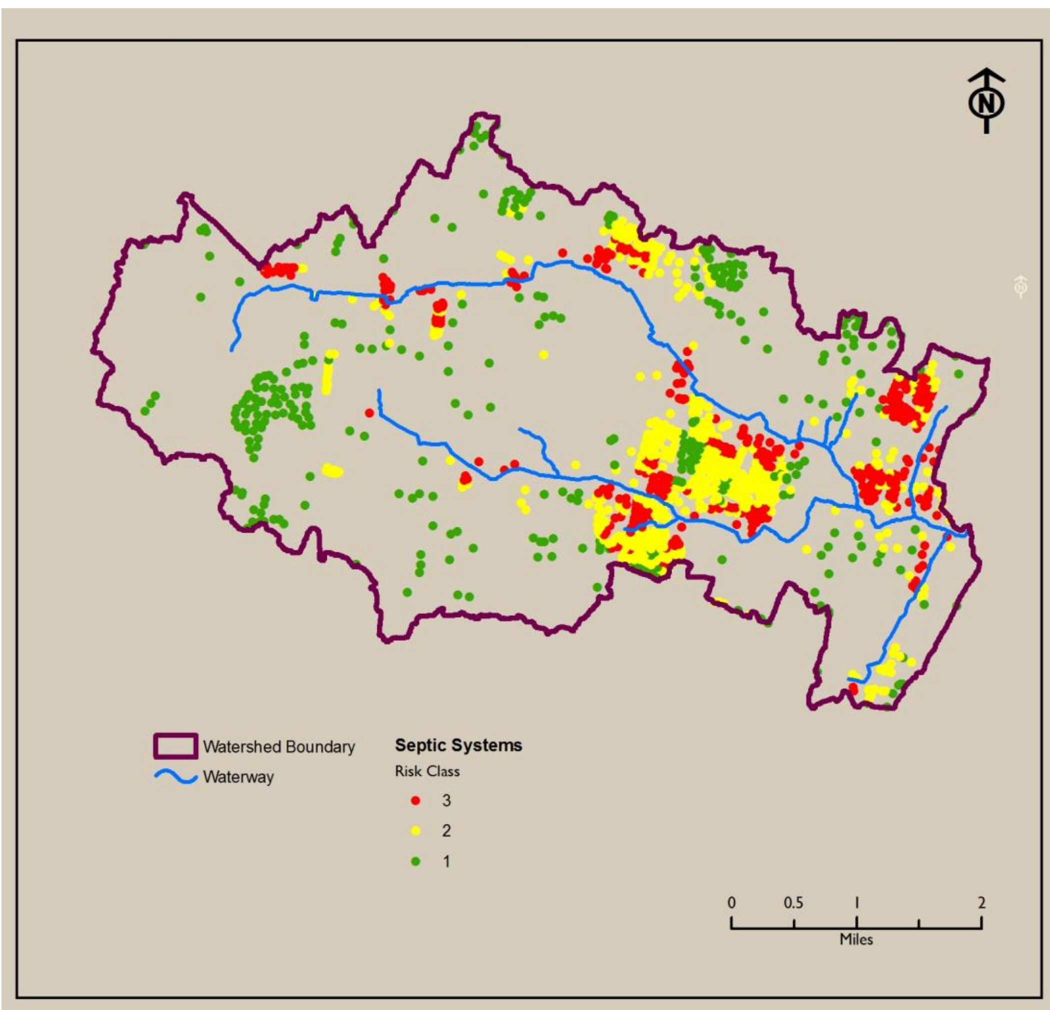


Figure 6. TMDL subwatersheds

residences (straight pipes). An analysis of 911 emergency response addressable structure data combined with WVDEP source-tracking information yielded an estimate of 1,273 unsewered homes in the Elks Run watershed (TMDL p. A4-4). A septic risk analysis performed by The Conservation Fund – Freshwater Institute (TCF-FI) yielded a total of 1155 unsewered homes, which is within 10% of the number used for the TMDL (Table 5). The decrease is likely due to better definition of the area served by a wastewater treatment facility in Shenandoah Junction.

An overlay index of intrinsic septic system risk for impairment of surface water quality was developed by TCF-FI that incorporated typical, and easily identified, hazards and threats associated with septic systems. The intent is to identify systems that may be underperforming (due to age or physical location) and contributing fecal coliform to the environment, not necessarily to only find those systems that are visibly failing to the surface. The index incorporated density of septic systems weighted by building age; distance to surface water, septic system suitability from the Natural Resources Conservation Service (NRCS) Jefferson County Soil Survey, and whether the system was located in the floodplain. Using GIS software, the attributes of the four layers were ranked from high to low relative to their potential impact on water quality, and combined into an overall risk value. This combined value was then classified into three risk classes to approximate the three septic zones (specifically, the flow rates associated with these zones) identified in the Elks Run watershed by WV DEP in the TMDL. Values developed by the WV DEP for complete and seasonal septic system failure were then transferred to these three classes, representing a finer spatial representation of potential septic failure than delineated in the TMDL (Fig. 7).

Figure 7. Septic risk classes in Elks Run Watershed



The number of systems needing improvement is estimated to be 239. The estimates were made using a seasonal failure rate of 3% and a complete failure rate of 5% in Zone 1, 7% and 10%, respectively, in Zone 2, and 13% and 24%, respectively, in Zone 3. For the most part, though, failing and underperforming septic systems are likely to continue contributing high levels of fecal coliform bacteria and nutrients to Elks Run and Elk Branch unless an effort is made to pump, repair, or replace them as appropriate. The number of systems needing improvement can also be estimated by subwatershed (Table 6).

The Conservation Fund – Freshwater Institute (TCF-FI) is currently revising and updating the septic risk analysis by making refinements to the septic risk model, reviewing septic system flows and fecal loads calculated in Elks Run Watershed Based Plan and recalculating if necessary, and mapping results indicating the pumping status and calculated load reductions from pumped septic systems by subwatershed. These revisions are expected to be completed by July 31, 2013. This may provide an opportunity to address the concerns of watershed residents that ground truthing of these estimates is needed.

Table 6. Estimates of failing septic systems by subwatershed; Septic failure zones are based on septic system risk index

TMDL Sub-watershed	# Septic Systems in Zone 1	Total # Failing Septic Systems (Zone 1)	# Septic Systems in Zone 2	Total # Failing Septic Systems (Zone 2)	# Septic Systems in Zone 3	Total # Failing Septic Systems (Zone 3)	Total # Septic Systems in Sub-watershed	Total # Failing Septic Systems in Sub-watershed
1001	0	0	1	0	1	0	2	1
1002	7	1	24	4	9	3	40	8
1003	0	0	4	1	3	1	7	2
1004	3	0	22	4	64	24	89	28
1005	14	1	13	2	21	8	48	11
1006	19	2	98	17	27	10	144	28
1007	45	4	115	20	39	14	199	38
1008	44	4	59	10	35	13	138	27
1009	68	5	87	15	52	19	207	39
1010	4	0	11	2	8	3	23	5
1011	89	7	85	14	84	31	258	53
Total	293	23	519	88	343	127	1155	239

Biological impairment in Elks Run watershed

Organic enrichment: Where organic enrichment was identified as a biological stressor, fecal coliform levels in the TMDL serve as a surrogate. See the previous section for a discussion of the sources of fecal coliform bacteria.

Sediment: Excess sediment is also a significant biological stressor of the benthic communities in Elks Run watershed. The categories of nonpoint sources of sediment include background sources, residential/urban sources, cropland, pasture, barren areas, and streambank erosion (Table 7). All of the above except streambank erosion are assumed to be driven by precipitation runoff. Background sources include non-pasture grassland, forested areas and forestry, and oil and gas production, none of which are considered to be significant sediment sources (TMDL p. A4-7).

Table 7. Estimated annual load allocations and reductions needed from nonpoint sources to achieve sediment TMDL

Source	Total amount of this source	Baseline load (tons/ year)	Allocated load (tons/ year)	Reduction needed (tons/ year)	Percent reduction needed
Background & other nonpoint sources	5,027.9 acres	2,856.7	2,856.7	0	0
Residential/urban	1,725.6	1,197.5	1,128.8	68.7	5.7
Cropland	1,859.2	4,203.8	1,744.4	2,459.4	58.5
Pasture	2,308.8	2,576.7	1,908.0	668.7	26.0
Barren areas	11.1	25	10.5	14.5	58.0
Streambank erosion	not given in TMDL	34,778.0	19,930.7	14,847.3	42.7

Residential/urban: These areas are not considered to be significant upland sediment sources, but the increased percentage of impervious area (hardened surface into which rain and snow melt cannot soak) associated with that land use can increase the volume and velocity of storm water runoff and accelerate streambank erosion (TMDL p. A4-7).

Pasture and cropland: Agricultural land uses are significant sediment nonpoint sources in Elks Run watershed (Table 7). Agricultural runoff can contribute excess sediment loads when farming practices allow soils to be washed into the stream. The erosion potential of cropland and overgrazed pasture is particularly high because of the lack of year round vegetative cover. Livestock traffic, especially along streambanks, disturbs the riparian buffer and reduces vegetative cover, causing an increase in erosion from these areas (TMDL, p. 18).

Barren areas: The TMDL prescribed a 58% sediment load reduction from this land use category, but only listed barren area acreage in subwatersheds 1009 and 1010, which are both part of the Elk Branch watershed.

Streambank erosion: The TMDL prescribed significant reductions of sediment from streambanks. To better understand streambank conditions, agency staff and volunteers took streambank measurements on March 25 and September 27, 2010 at three sites in the watershed: one near the mouth of Elks Run ("Site A": downstream of Bakerton Road, Fig. 8), one on Elks Run above the confluence with Elk Branch ("Site B": Route 230), and one on Elk Branch ("Site C": Engle Moler Road and Engle Switch Road). At sites A and B, both banks were measured. At site C, only the left bank was measured, because the very steep right bank is topped by a railroad, but it is also well stabilized with woody vegetation (see photo on front cover, taken just downstream of site C). Streambank height and four other bank profile measurements were recorded on each bank and compared between the two dates (six months apart) to estimate soil loss. The team also estimated the Bank Erosion Potential Rating (BEPR), which is an average score (1-10) of four visually-estimated factors: ratio of bankfull elevation to streambank height, bank angle, vegetative cover/root density, and bank composition. Scores of 1-3 are considered "high," having great amounts of erosion that contribute large amounts of sediment to the channel; scores of 4-7 are "moderate" and 8-10 are "low" (WV Nonpoint Source Program 2006).

Figure 8. Elks Run streambank erosion (Site A) near the confluence with the Potomac River

At Site A, active erosion was observed on the southern bank around an outside bend for about 360 ft., with bare banks 4.5-5.5 ft. high. The BEPR at this site near the mouth was “moderate to high” on the outside (right) bend, and “low” on the inside bend. At Site B above the confluence, streambanks were low (approx. 2.5 ft high), vegetated, and appeared to be fairly stable, with stream volume drastically reduced over the summer and during the September measurement day. The BEPR on both banks was “moderate,” bordering on “low” during the fall estimate. At Site C, the Elk Branch site, streambanks were high (8-8.5 ft.) but leaves and other debris on banks were be undisturbed by high water; very few bare areas were observed. The BEPR was “moderate.” The three sites’ BEPR results provided initial support for the TMDL’s indication that streambanks contribute significantly to sedimentation in Elks Run. Differences in measurements recorded between March and September indicate loss of streambank material at Sites A (right side, approx. 0.03 tons/yr/ft) and C (left side, approx. 0.01 tons/yr/ft) There was no indication of streambank loss at site B.

The changes in measurements at sites A and C indicate that downcutting, not widening, may be occurring. One hypothesis is that the ratio of bank height to bankfull height is too high in these areas, but well-buffered riparian areas keep widening to a minimum. Each of these sites, originally chosen for accessibility and a broad range of conditions, has factors that may confound estimation of erosion. At site A, wildlife or human disturbance may be causing unnatural changes in the streambank. At Site B, the water level decreased so much that the point at which the “stream bed” survey rod had been placed in March was dry in September. Also, the presence of road culverts immediately downstream of this site indicate that it is more of a sediment collection point than an area where natural processes can be accurately estimated. Finally, Site C was once a loading site for materials resulting from the processing of lime, so its “soils” likely have unique characteristics.

A walking stream assessment was performed on Elks Run (mainstem only) in the summer of 2010 (Appendices A and B). The assessment team recorded 91 sites as having notable erosion, considering the left and right banks separately. Of these, 32 sites conformed approximately to a “high” BEPR rating, totaling approximately 3770 feet of erosion. An additional 52 sites conformed approximately to a “moderate” BEPR rating, totaling approximately 6013 feet. Seven sites totaling approximately 815 feet conformed to a “low” BEPR rating.

Applying the rough erosion estimate from Site A (see above) to the 3770 feet of Elks Run given a “high” rating yields 113 tons/year lost. Applying the Site C estimate to the “moderate” rated lengths yields 60 tons/year lost. Since Elk Branch is approximately 90% the length of Elks Run, another 156 tons/year can be estimated to be lost from Elk Branch *if* conditions there are similar, for a total of 329 tons/year throughout the watershed. Even if all sites were remediated 100%, with these estimates, we would only reach 2% of the sediment reduction goal from this source. The gap in this estimated reduction potential and the reduction goal in the TMDL may be due to the confounding factors, outlined above, at the measured sites. It may also be due to the small magnitude of the streambank changes used to estimate and extrapolate sediment loss. Both of these issues might be overcome with future streambank measurements.

To achieve the TMDL reduction requirement of 14,847.3 tons/year from stream banks and given the 2lb sediment reduction per 1 foot of stream restoration used in NPS BMP Table 1.8, stream bank restoration projects would have to be implemented on approximately 14,847,300 ft (2,812 miles) of stream bank. This is an unachievable and unrealistic goal, considering that existing mileage of stream bank in the watershed is only a fraction of that.

A revised baseline load, allocated load, and reduction needs have been calculated based on the efficiency used for stream restoration in the NPS BMP Table 1.8: Non-Point Source Best Management Practices and Efficiencies currently used in Scenario Builder. According to this document, 2 lbs of sediment can be reduced, per foot of stream restoration. Using the studies outlined in the previous 2 paragraphs, it can be predicted that there is approximately 20,136 feet of eroding stream bank in the Elks Run Watershed (10,598 feet on Elks Run plus 90% or 9,538 feet on Elk Branch). Using these figures, the following loads were calculated (tons/year):

Source	*TMDL Baseline*	*TMDL Allocated Load*	*TMDL Proposed Reduction*	*Revised Baseline*[1]	*Revised Allocated Load*[2]	*Revised Reduction*
Streambank Erosion	34,778.0	19,930.7	14,847.3	*20.1*	*11.5*	*8.6*

1. Calculated with method detailed above, using the reduction efficiency for stream restoration along with measured erosion footage on Elks Run, and estimated erosion footage on Elk Branch.
2. The allocated load originally estimated by the TMDL is 57.3% of the estimated baseline given by the TMDL. The revised allocated load is calculated using 57.3% of the revised baseline.

With future streambank measurements, and further stream bank assessment on Elk Branch and tributaries, a revised, and more accurate sediment baseline load and allocated load will be recalculated for stream bank sources, using specific data and measurements gathered within the watershed.

In order to properly manage erosion and sedimentation, it is important to consider the soil type which must be managed. There are approximately 14 different soil types that comprise the stream banks of Elks Run and Elk Branch. Constituting roughly 48% of those soils are Holly loams, 34% are Lindside silt loams, 7% are Toms silt loams, and 4% are Fairplay silt loams. The remaining 7% consists of very small portions of approximately 10 different soils. Holly loams and Toms silt loams are poorly drained hydric soils, Lindside silt loams are moderately well drained, and Fairplay silt loams are very poorly drained. K factors (K factor is an erosion factor that indicates the susceptibility of a soil to sheet and rill erosion by water) for these soils indicate that Fairplay silt loams and Toms silt loams have moderately high susceptibility to sheet and rill erosion, while Holly loams and Lindside silt loam have moderate susceptibility. Based on slope and K factor, these four soils are unlikely to undergo significant erosion after disturbance activities under normal climatic conditions. Detailed descriptions of all soils in the watershed can be acquired from web soil survey. The area of interest used to gather this information was designated by creating a buffer of approximately 70 feet around Elks Run and Elk Branch.

Chesapeake Bay priority

As part of West Virginia's Chesapeake Bay drainage, Elks Run watershed represents an opportunity to reduce sources of nitrogen, phosphorus, and sediment. Jefferson Counties has a high nitrogen delivery factor, which means that practices done there will have more of a positive effect on the Bay compared to practices done in the rest of WV's Bay drainage.

Sediment is addressed in this Watershed Based Plan. Measures to reduce nitrogen and phosphorus are outlined in West Virginia's Chesapeake Bay TMDL Phase II Watershed Implementation Plan (WIP, March 2012). Nutrient loads from the developed lands sector, including septic systems and stormwater runoff from commercial and residential development, are prescribed by the WIP to stay the same, i.e. to not increase, even if new development occurs. In order to achieve this goal, however, stormwater retrofits, reforestation, denitrifying septic systems, and other practices may be needed in some places to offset any increased nutrients and sediment in other places. If voluntary efforts are not sufficient to maintain current levels, more regulation of runoff from developed lands may be required in the future.

According to the WIP, the agriculture sector is the only nonpoint source of nutrients and sediment prescribed to reduce its loading to the Chesapeake Bay. Numeric goals and 2-year milestones were set over broad geographic areas (e.g. county level) for several practices including installing livestock exclusion fencing and forest buffers along streams, cover crops, and nutrient management planning. This strategy emphasizes voluntary practices and programs available to assist landowners with the cost and technical expertise needed to implement them. Since the WIP did not allocate reductions to individual subwatersheds, the baseline analysis in Section 11 can be understood as an estimate of the level of effort likely required to reduce loads adequately from agriculture sources. This analysis revealed the need to reduce approximately 21% nitrogen and 29% phosphorus loads from agriculture sources, as portrayed in the Chesapeake Bay watershed model's "2010 No-Action Scenario."

Elks Run, itself, will benefit from nutrient reduction activities; the pre-TMDL monitoring data revealed an average NO_2-NO_3-N level of 4.5 mg/L at each of two sampling sites on Elks Run and one on Elk Branch, with several values in the 7-8 mg/L range. Average total nitrogen was 5.4 and 5.3 mg/L on Elks Run, and 5.5 mg/L on Elk Branch. Average total phosphorus levels were 0.05 and 0.07 mg/L at Elks Run sites, and 0.14 mg/L at the Elk Branch site. The 2006 SWAP listed nitrate/nitrite as a contaminant in its "Site Specific Potential Contaminant Source Inventory" (pp. 15-28).

Other information about pollutants and their sources in Elks Run watershed

Local residents also voiced concerns about the health of local streams during three public workshops held in preparation for the writing of this Watershed Based Plan on January 28, March 30, and June 1, 2010. Many of the nonpoint sources of pollution listed in the previous paragraphs were repeated at these meetings. Other concerns voiced included impacts from the railroads' many crossings and disposal of seepage or sludge on farm fields.

Recent efforts have been made in the fall of 2012 to involve residents in watershed projects. A meeting was held with stakeholders in the watershed on November 5, 2012. They wanted to make sure that it was noted in the plan that they lacked confidence that the high number of septic repairs prescribed in the TMDL could be achieved based on knowledge of their own neighborhoods. They expressed a desire to see ground truthing of pollution sources in the watershed and continuous water quality monitoring to determine more geographically specific pollutant loads.

B/C. Nonpoint Source Management Measures proposed to achieve load reductions and magnitude of load reductions expected

In 2006 the Harpers Ferry Water Works received a Source Water Assessment and Protection Plan (SWAP), outlining among other things, sources of potential contamination, assessment of possible threats, a management plan and recommendations for contingency planning. The management plan detailed needed outreach efforts to the public and water customers, and also included at least six recommended management "strategies" for addressing nonpoint source pollution (Appendix C). These largely address land use decisions, residential development site design, and proper management of stormwater structures, riparian areas and septic systems. However, no physical on-the-ground best management practices were specifically prescribed. The buffer zones surrounding the springs, sinkholes and surface streams as delineated in the SWAP could be considered priority areas for nonpoint source pollution reduction projects.

To achieve fecal coliform reductions

From residential/urban sources: The TMDL prescribed a reduction of approximately 62% of the bacteria load from stormwater runoff from residential and urbanized areas in Elks Run watershed. This will be achieved through a combination of the following practices:

- *Filtering practices*: the filtration BMPs are designed for reduction of urban runoff impacts, water quality control, stream channel protection, and peak discharge control for both small and large storms. They capture and temporarily store the water quality volume and pass it through a filter of sand, organic matter and vegetation, promoting pollutant treatment and recharge.

    - *Filters:* Filters capture and treat runoff by filtering through a sand or organic media. Effectiveness estimates: 60% (+/- 15%) TP, 40% (+/- 10%) TN, 80% (+/- 10%) TSS. (Simpson and Weammert 2009, p. 80).
    - *Vegetated Open Channels:* Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. Effectiveness estimates vary widely depending on soils and other factors: 10-45% (+/- 20%) TP and TN, 50-70% (+/- 30%) TSS. (Simpson and Weammert 2009, p. 343). Effectiveness estimate for bacteria is 83% for bioswales. (Boyer, p.2).

- Infiltration practices: the infiltration BMPs are designed for reduction of urban runoff impacts, groundwater recharge, water quality control, stream channel protection, and peak discharge control for both small and large storms. Performance information for all of these practices was derived from their use in urbanized/high impervious land use areas. Effectiveness estimates vary by soil type and other factors, and are described in Simpson and Weammert 2009, pp. 342-362. In the table "Non-point BMP practices and efficiencies used in scenario builder and updated February 2011 effectiveness estimates of urban infiltration practices are given as: 80-85% TN, 85% TP and 95% TSS. This source of effectiveness estimates will be referred to throughout this document as "NPS BMP Table 1.8."

- *Bioretention:* An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This includes rain gardens. Bacteria reduction through biofiltration practices are estimated to be greater than 99%. (Boyer, p.2). Effectiveness estimates vary according to soil type and use of an underdrain: 25-85% TN, 45-85% TP, 55-90% SED/TSS as stated in NPS BMP Table 1.8.
    - *Permeable Pavement and Pavers:* Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an under drain. Effectiveness estimates as stated in NPS BMP Table 1.8 vary depending on soil type and use of underdrains, sand, and vegetation. Estimates are as follows: 10-80% TN, 20-80% TP, 55-85% SED/TSS.
    - *Infiltration Trenches and Basins:* A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No under drains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. (Simpson and Weammert 2009, pp. 342-344). Effectiveness estimates are the same as those listed above for "Infiltration Practices."

- *Urban Wet Ponds:* depressions or basins created by excavation or berm construction that receive sufficient water via runoff, precipitation, and groundwater to contain standing water year-round at depths too deep to support rooted emergent or floating-leaved vegetation (in contrast with dry ponds, which dry out between precipitation events). Nutrients and suspended particles are removed via settling. Nitrogen is further removed primarily via plant and microbial uptake and nitrification-denitrification reactions, while phosphorus is further removed by soil sorption. Effectiveness estimates: 60% TSS, 20% TN, 45% TP (Simpson and Weammert 2009, p. 541). Bacteria reduction estimates are 44-99% (Boyer, P.2)

- *Urban Wetlands:* Wetlands have soils that are saturated with water or flooded with shallow water that support rooted floating or emergent aquatic vegetation (e.g. cattails). Nutrients and suspended particles are removed via settling. Nitrogen is further removed primarily via plant and microbial uptake and nitrification-denitrification reactions, while phosphorus is further removed by soil sorption. Effectiveness estimates: 60% TSS, 20% TN, 45% TP (Simpson and Weammert 2009, p. 541). Bacteria reduction estimates are 44-99% (Boyer, P.2)

- *Impervious surface reduction:* Practices that reduce the total area of impervious cover and practices that capture storm water and divert it to pervious areas, subsequently encouraging storm water infiltration; e.g. natural area conservation, disconnection of rooftop runoff, and rain barrels.

- *Pet waste runoff reduction campaign, possibly including:*
    - maintaining vegetative buffer areas between streams and areas where pets or wildlife defecate
    - distributing and promoting pet waste digesters
    - installing pet waste bag stations in common areas of subdivisions
    - conducting outreach about pet waste disposal, especially showcasing the above practices

- *Rehabilitation of drainage:* Using flow-splitters, level-spreaders, grass channels, dry swales or other methods, drainage conveyances that have been used to concentrate flow (Fig. 9) can be replaced with conveyances that provide treatment, spreading and slowing effects (Chesapeake Stormwater Network

2010). Stakeholders feel that this would be an excellent opportunity to achieve nonpoint pollution reduction, as so many instances exist in their subdivisions.

Figure 9. Concrete stormwater conveyance directing runoff downhill toward Elks Run

From pasture sources: To reduce 88.6% of this load, a suite of BMPs must be implemented to achieve 100% reductions on 2046 acres of pasture land. Pasture BMPs will be pursued mainly through federal cost-share programs (Conservation Reserve Enhancement Program [CREP], Environmental Quality Incentives Program [EQIP], and Wildlife Habitat Incentives Program [WHIP]) and the state's cost-share programs (Agriculture Enhancement Program and ERWWQIP [Appendix D]), including the following:

- *Grass buffer:* an area of grasses that is at least 35 feet wide on one side of a stream that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. For Valley and Ridge Marble Limestone, grass buffer efficiencies are 40% for Total Suspended Sediment (TSS), 24% for Total Nitrogen (TN) and 30% for Total Phosphorus (TP) (Simpson and Weammert 2009, p. 470). A reduction efficiency for fecal coliform similar to that for TP might be defensible, because of both pollutants' tendency to move with soil particles. However, this may be a low estimate. For example, in Appendix A of the Mill Creek (South Branch Potomac) Watershed Based Plan, a 70% efficiency for reducing fecal coliform was used for vegetated filter strips, as the lower end of the values typically reported (West Virginia Conservation Agency et al., 2007).

- *Riparian forest buffer:* an area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. For Valley and Ridge Marble Limestone, forest buffer efficiencies are listed as 40% for TSS, 34% for TN and 30% for TP (Simpson and Weammert 2009, p. 469). See Grass Buffers above for an estimate of the fecal coliform removal efficiency of vegetated filter strips.

- *Livestock fencing [Off stream watering with fencing]:* This BMP excludes animals from streams. It incorporates both alternative watering and installation of fencing that eliminates livestock access to narrow strips of land along stream. The implementation of stream fencing should substantially limit livestock access to streams, eliminating direct manure deposition to streambeds and banks and reducing erosion and nutrient deposition to riparian areas. Effectiveness estimates: 40% for TSS, 25% for TN and 30% for TP (Simpson and Weammert 2009, p. 414). In Appendix A of the Mill Creek (South Branch Potomac) Watershed Based Plan, a 70% efficiency for reducing fecal coliform was used for fencing an unknown number of livestock (West Virginia Conservation Agency et al., 2007). However, more current effectiveness estimates for fecal coliform reduction used by West Virginia Conservation Agency are 85%. There may be a need in Elks Run watershed for cost share funding for fencing close to, or at the top of, streambanks. Although this is not ideal, it provides an opportunity to reduce nonpoint pollution on lands whose owners have been resistant to existing cost-share programs. This opportunity would be especially helpful on headwaters areas where streams are narrow and may require less protection than 35 feet on both sides.

- *Alternative water sources* (can include trough, pipeline, and well): This BMP requires the use of alternative drinking water sources away from streams to reduce the time livestock spends near and in streams and streambanks, reducing direct manure deposition to streambeds and banks and also reducing erosion and nutrient deposition to riparian areas. When alternative watering practices are used in conjunction with fencing, see the discussion of pollutant removal efficiencies for Livestock Fencing, above. Without fencing, the Effectiveness Estimates are: 30% for TSS, 15% for TN and 22% for TP (Simpson and Weammert 2009, p. 414). Effectiveness estimates for fecal coliform reduction used by West Virginia Conservation Agency are 50%.

- *Armored stream crossing:* A stream crossing will be constructed to improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream and reduce stream bank and streambed erosion. The stream crossing will be constructed according to an engineering design based on NRCS standard and installed as indicated on the Conservation Plan Map. NRCS will be contacted prior to construction. Stream crossing will be maintained according to the Operation and Maintenance Plan in the design (description provided by FSA staff). This practice is not given its own pollutant reduction efficiencies, but is used in conjunction with Livestock Fencing and Alternative Watering.

- *Wetland Restoration:* Returning natural/historic functions to a *former* wetland. This results in a gain in wetland acres. Nutrients and suspended particles are removed via settling. Nitrogen is further removed primarily via plant and microbial uptake and nitrification-denitrification reactions, while phosphorus is further removed by soil sorption (Simpson and Weammert 2009, p. 599). Effectiveness estimates stated in NPS BMP Table 1.8 are as follows for this hydrogeomorphic region: 14% TN, 26% TP, and 8% SED/TSS. Effectiveness estimates for bacteria reduction are 90% (Boyer, p.2).

- *Wetland Creation:* Developing a wetland that did not previously exists on an upland or deepwater site. Results in a gain in wetland acres. Nutrients and suspended particles are removed via settling. Nitrogen is further removed primarily via plant and microbial uptake and nitrification-denitrification reactions, while phosphorus is further removed by soil sorption. Effectiveness estimates: approx. 20% for TN, 45% for TP, and 60% for SED (NPS BMP Table 1.8).

From cropland sources: A 57.6% reduction in bacteria from cropland was also prescribed, although the magnitude of that reduction is less than 1/10th that of pasture, and less than 1/100th that of septic systems. To achieve this reduction, the goal is to implement nutrient management plans on at least 1071 acres of cropland, in combination with other BMPs where appropriate. The allocations by subwatershed, (Table 4) indicate the reductions should occur in subwatersheds 1002, 1006, and 1008-1011. The GIS developed by TCF-FI will be used to identify crop fields adjacent to Elks Run and its tributaries, and programs can be offered to landowners to implement BMPs. Cropland BMPs will be pursued mainly through federal cost-share programs (Conservation Reserve Enhancement Program [CREP], Environmental Quality Incentives

Program [EQIP], and Wildlife Habitat Incentives Program [WHIP]) and the state's cost-share programs (Agriculture Enhancement Program and ERWWQIP), including the following:

- *Nutrient management plan:* Farm operators develop a comprehensive plan that describes the optimum use of nutrients (sometimes consisting of animal manures containing fecal coliform bacteria) to minimize nutrient loss while maintaining yield. According to local nutrient management planner, as of December 19, 2012, operations under nutrient management that have acreage within Elks Run totaled 2,178.6 acres. Broken down, this includes 1360 crop acres, 708.1 hay acres, and 110.5 pasture acres. It is important to note that 100% of the acreage a producer manages may not be in the same watershed. Acres are listed under the producer's control under the watershed where the main production and manure application will occur.

    - *Manure composting to reduce live bacteria:* see Composting Facility NRCS Practice Code 317
    - *Increased soil testing* – this will enable better precision in the application of nutrients, thus decreasing the cost of commercial fertilizer needed on a field. In Elks Run watershed the greatest need for this practice may be on farms with no livestock or poultry but to which litter or manure is applied (Yohn, personal communication).
    - *Manure storage structure* – as more nutrient management planning is accomplished in Elks Run watershed, the need may arise for covered structures in which to store animal waste that cannot be immediately applied to fields. Even agricultural producers who clearly document the need for these structures, along with their rotation schedule and manure analysis may have a difficult time applying for federal cost-share funds if they do not actually raise poultry or livestock on their operation. Local nutrient management planners have stated that most, if not all, of the operations in need of a manure structure have one. Many of these structures may be outdated, though, and need upgrades in order to function properly.
    - *Transport of manure to fields outside the watershed or further from streams-* relocating manure outside of the watershed will prevent the bacteria and nutrient content of that manure from entering the watershed. Table 4.1 of the Chesapeake Bay Program's "Estimates of County-Level Nitrogen and Phosphorus Data for use in Modeling Pollutant Reduction Documentation for Scenario Builder Version 2.4" indicates TN and TP content of of animal manure in lbs nutrient/lb of manure. Among dairy cattle, beef cattle, and horses, dairy manure has the lowest TP and TN content. When calculating potential nutrient reductions resulting from this practice, dairy manure TN and TP content was used. Dairy manure TN= .0052 lb TN/ lb manure, Dairy manure TP= .0011 lb TP/ lb manure.

- *Grass buffer: (see description above)*

- *Riparian forest buffer: (see description above)*

- *Wetland restoration and creation: (see descriptions above)*

From onsite sewer system sources: The TMDL prescribes 100% reductions from failing septic systems. Failing and underperforming systems will need to be identified and inspected to determine adequate solutions: pumping, repair, or replacement with an appropriate system. Pumping of solids from septic tanks in order to allow drainfields to recover could be encouraged with a coupon program, offering the homeowner a cost-share on the pumping bill. It must be acknowledged, however, that increased pumping throughout the community might result in pumping companies seeking additional fields on which to apply septage. Stakeholders at public meetings made it clear that land-application should be done under strict regulation so that bacteria and other pollutants would be minimized.

Upgrades or repairs might include drainfield rehabilitation, a new tank and/or drainfield, or the addition of treatment before the drainfield. Communities like mobile home parks or dense neighborhoods like Shenandoah Junction might be best served by cluster systems. Sewer line extensions are an option that will have to be weighed against septic system upgrade options.

To achieve sediment reductions

From residential/urban sources: A 5.7% reduction of sediment is required from this source. The BMPs used for this purpose are already included in those listed for fecal coliform reductions, above.

From cropland sources: A 58.5% reduction in sediment reaching surface waters from cropland was prescribed by the TMDL. Applying agricultural BMPs to control sediment runoff on 1088 acres of cropland will achieve the required reductions. These BMPs could include:

- *Conservation till:* involves the planting, growing and harvesting of crops with minimal disturbance to the soil surface through the use of minimum tillage, mulch tillage, ridge tillage, or no-till. Effectiveness estimates: 30% for TSS, 0-18% for TN and 22% for TP (Simpson and Weammert 2009, p. 69). Effectiveness estimates in NPS BMP Table 1.8 for continuous no-till alone for this hydrogeomorphic region are as follows: 15% TN, 40% TP, and 70% SED/TSS. Little opportunity likely exists for expanding these practices in Elks Run watershed, since no-till and mulch till have been practiced on the majority of cropland in Jefferson County for several decades. However, opportunity for environmental improvements may exist in the practice of aerial seeding and/or cover crops Yohn, pers. comm., 2010).

- *Cereal cover crops:* Non-harvested winter cereal cover crops, including wheat, rye and barley, designed for nutrient removal. This BMP also provides some benefit for sediment erosion control, particularly when established after low residue crops. The BMP is less effective in reducing phosphorus than sediment losses since some phosphorous is transported in water soluble forms in addition to particulate forms. Effectiveness estimates vary according to crop type and planting date (Simpson and Weammert 2009, p. 99, 101). Optimum reductions could be achieved using early drilled Rye, with effectiveness estimates of 45% TN, 15% TP, and 20% SED/TSS (NPS BMP Table 1.8).

- *Commodity cover crops:* Commodity cereal cover crops differ from cereal cover crops in that they may be harvested for grain, hay or silage and may receive nutrient applications, but only on or after March 1 of the spring following their establishment. The intent of the practice is to modify normal small grain production practices by eliminating fall and winter fertilization so that the crops scavenge available soil nitrogen similarly to cover crops for part of their production cycle.

See also above cropland BMPs for achieving fecal coliform reductions.

From pasture sources: A 26% reduction in sediment runoff from pasture was prescribed, representing 600 acres that will need to have BMPs applied. The dual benefit of some pasture BMPs should be emphasized, since practices like restricting livestock access to streams and providing alternative water sources can reduce both fecal coliform loads (discussed above) and sediment loads.

From barren areas: A 58% reduction in sediment from 11 acres of barren land was prescribed. Some of these sites might need to be stabilized with vegetation or treated with other sediment and erosion control BMPs like silt fencing. Some might have already been treated or might have naturally healed (with vegetative growth) since the time source tracking occurred. Project partners will attempt to ground-truth this source at the two locations identified in the TMDL.

From streambank erosion: A 42% reduction (14,847.3 tons/year) from a baseline of 34,778 tons/year was prescribed from streambank erosion. In addition, the assessment of Elks Run revealed that most of the lower part of the mainstem has a riparian forest buffer on both sides. Care will need to be taken to disturb the existing buffer as little as possible during streambank restoration projects, especially given the lack of forest cover in the watershed at large. The presence of the railroad along much of Elk Branch will further limit opportunities for re-shaping of streambanks. If downcutting is more of a problem than widening, elevation control structures and other tools that don't disturb riparian areas might be good options. Despite these challenges, an adaptive management approach can be taken to reduce sediment in Elks Run from streambanks. As each stabilization project is undertaken, the resulting load reduction will be calculated more accurately. Measures to increase forest cover in upland areas of the watershed should at least reduce the rate of streambank erosion. Efficiency estimates for urban and non-urban stream restoration are .02 lb/ft TN, .003 lb/ft. TP, and 2 lb/ft SED (NPS BMP Table 1.8).

To address Chesapeake Bay pollutants

Many of the BMPs appropriate for reducing nutrients and sediment have already been discussed above, with reduction efficiencies listed in some cases. An additional desirable BMP is:

- *De-nitrifying septic system:* Septic denitrification represents the replacement of traditional septic systems with more advanced systems that have additional nitrogen removal capabilities. There is currently no incentive program or local emphasis on conversion to these types of septic systems, but a plan to install two would be reasonable. In the table "Non-point source best management practices and efficiencies currently used in scenario builder," and updated February 2011, an effectiveness estimate of 50% TN is given.

To address the lack of forest cover

- *Afforestation:* Planting open areas or abandoned fields with high-quality hardwoods or evergreens will help to capture rainfall, reduce runoff, filter nutrients and sediment and stabilize soils. More forest land will ultimately increase watershed health. This results in a gain in forest acres. The working hypothesis for reducing streambank erosion in Elks Run watershed is that more upland area in the watershed needs to be converted to a forest-like condition to reduce the amount of runoff reaching surface streams during storms. The importance of this BMP cannot be overemphasized.

- *Land Conservation:* Permanently protect open space from conversion, possibly targeting newly-reforested areas, historic battlefields, or farms that are managed to protect water quality. Work with local governments, land trusts, or other local stakeholders to enhance or dedicate sources of funding for land conservation. This will help to slow the in-stream erosion.

D. Technical & financial assistance

Lead agency and contacts:

The West Virginia Conservation Agency (WVCA) will be the state agency coordinating the implementation of BMPs, reporting, and the management of 319- Incremental Grants. The Eastern Panhandle Conservation District (EPCD) will administer funds for this Watershed Based Plan, and sequential 319-Incremental Grants. Its role in outreach and education is outlined below. It is currently conducting a separate but complementary "Elks Run Watershed Water Quality Improvement Project," (ERWWQIP, Appendix D), using $250,000 to implement septic tank pumping and agricultural BMPs, as well as other technical and financial assistance to residential and agricultural landowners. This will give it an enhanced ability to recruit participants for projects included in this Watershed Based Plan. The ERWWQIP was designed to complement any proposed 319 Incremental project(s). Through the ERWWQIP, 80 homeowners have applied for septic pumping cost-share, and two landowners have applied for financial assistance with agricultural BMPs. By February 2011, 12 septic systems had been pumped through the program. WVCA staff sent a mailing to residents in the zone of critical concern, the streamside areas identified by the ERSC as a priority. Subsequently, a much larger mailing was done to introduce these project opportunities to residents of the entire watershed. EPCD and WVCA will work together to oversee future 319 Incremental project installation as well as work with the partnering organizations to ensure success of the project.

The West Virginia Department of Environmental Protection (DEP) will oversee the reporting for this project. The Potomac Basin Coordinator will provide support in the form of outreach, contacts, and familiarity with the TMDL.

The Jefferson County Health Department will inform citizens of septic pumping, repair or replacement programs when citizens are in eligible areas. Health Department staff will also inform citizens of West Virginia's Onsite Loan program to help them pay for the cost of these activities. Staff will also provide technical support to residents with septic system problems and will facilitate the use of additional technical support from outside service providers. Finally, the Health Department distributes literature and homeowner education materials in an effort to help them protect the environment while saving money.

The Conservation Fund-Freshwater Institute will use its Elks Run watershed GIS and Elks Run watershed septic risk model to help us determine where to implement these and other Best Management Practices (BMPs) with the most success, and to help calculate load reductions achieved by projects completed.

The USDA-Natural Resource Conservation Service will provide technical assistance to interested landowners, suggesting and designing the agricultural BMPs. Its staff will make agricultural operators aware of federal, state, and 319 programs that provide cost-share on BMPs appropriate for their operations.

West Virginia University Extension maintains contact with farmers in Elks Run watershed, and occasionally offers workshops on topics that could include nonpoint source pollution-reducing BMPs. Extension currently has a Conservation Innovation Grant that promotes the transfer of manure outside a farmstead, the soil sampling needed to prepare for the split application of nitrogen on crop fields, and the actual split-application of nitrogen on such fields in Jefferson, Berkeley and Morgan counties. Its staff along with other agencies will continue to make agricultural operators aware of federal, state, and 319 programs that provide cost-share on BMPs appropriate for their operations.

The West Virginia Department of Agriculture has nutrient management specialists available to write nutrient management plans for farmers, offers free manure testing, and promotes participation in BMP cost-share programs.

Cost estimates:

Septic pumping: Experience in the Eastern Panhandle of West Virginia has shown that a septic pumping cost-share program is a good way to reach out to new stakeholders and identify septic systems with the potential to contribute bacteria to the local surface water. In Elks Run watershed, a complementary program has already begun this activity, but funds are identified here to continue this type of cost-share service and keep the community engaged. The figure given is the average of recent pumping bills in this watershed.

Upgrade/fix failing septic systems: Assuming approximately half of the systems will require standard upgrades at $6000 each, and half will require Class II systems at $8000 each (estimates from Berkeley and Jefferson County Health Depts., pers. comm.), the average of both figures, $7000 is used. Homeowners should be expected to provide matching funds for a portion of the cost, plus any additional cost. State Revolving Loan funds are available to homeowners through the Onsite System Loan Program. It is assumed that cluster systems constructed to solve several problems at once will average to a similar cost as that shown per septic system, plus possibly the cost of land acquisition for a common drainfield.

Additional treatment for de-nitrifying: The cost of additional treatment, especially if that treatment provides for nutrient (mostly nitrogen) removal is approximately $12,000 per system. On the positive side, this additional treatment can renovate certain types of drainfield failure, so two fixes can be provided with one intervention, but some new drainfields may be required in addition to advanced treatment (Winant 2008).

Pasture and cropland BMPs costs: Unit cost estimates for pasture and cropland BMPs were primarily provided by the Natural Resources Conservation Service staff in Jefferson County. Forest buffer cost was estimated by WV Division of Forestry staff. Stream crossing cost estimates were taken from the Antietam Creek Watershed Restoration Plan (Antietam, 2012).

Urban/Residential BMPs costs: Cost estimates for drainage rehabilitation, rain gardens, wetland construction, pet waste campaign, and pervious paving were based on recent experience with similar projects in the Eastern Panhandle of West Virginia. Estimates for filters, bioswales, infiltration practices, and urban wet ponds and wetlands were based on the document "Stormwater Treatment in Maryland: Planning-Level County Cost Estimates by Dennis King and Patrick Hagan: University of Maryland Center for Environmental Science."

Natural Stream Design costs: The cost per foot from the Watershed Based Plan for Mill Creek (Opequon, 2008) was used, plus approx. 10% for increases in construction and supplies since 2008. Any streambank stabilization project should include replanting with cuttings, shrubs, and/or trees. E.g. a 500 ft. stabilization project would require approximately 180 plants, at a cost of $1500-1800, unless just cuttings or bare root stock are used.

Education/outreach costs: Canaan Valley Institute provided estimates of workshop costs for the Mill Creek Watershed Based Plan (Watershed Based Plan for Mill Creek 2008). The professional workshop estimate was based on a 2-day model. Cost estimate of rain barrel workshop was based on recent experience in the Eastern Panhandle.

Monitoring costs: Funding will be requested to develop a QAPP and more detailed monitoring plan. This is an area in which volunteers in the Eastern Panhandle of West Virginia have sought professional expertise. In Elks Run watershed, several entities' monitoring data must be synthesized effectively. Benthic macroinvertebrate samples will likely be collected at volunteer-driven events, and these will need to be analyzed by professionals. Estimates are given for these activities.

Table 10. Estimated cost of implementing nonpoint source TMDLs in the Elks Run watershed

Practice	Units	Planned units/ Treated acres	Cost/unit	Total
Septic systems				
Pumping	Systems	30	$266	$7,980
Upgrade/fix failing systems	Systems	239	$7,000	$1,673,000
Additional de-nitrifying treatment	Systems	2	$12,000	$24,000
Agricultural				
Residue management (no-till etc.)	Acres	750	$4.30/acre	3,225
Cover crop	Acres	700	$66.60/acre	46,620
Grass buffer establishment	Acres	700	$243/acre	170,100
Forest buffer establishment	Acres	700	$3,600/acre	2,520,000
Fencing	Feet	21,780	$3.50 - $5.00/foot	108,900
Stream crossing	Crossing	10	$15,000	$150,000
Alternative water systems	Feet	28	$7,000/350 ft	2,450,000
Nutrient management plans – Developed by WVDA or WVCA	Plan	As Needed	$0.00	$0.00
Litter composting facilities	Acres	1	$18/ ft^2	$784,080
Manure storage structures (Including upgrades to existing)	Acres	10	40,000/1500 ft^2	$11,617,090
Manure transport (cost-share)	Pounds	500 lbs	$10/loaded mile	$500
Wetland Restoration		1	$20,000	20,000
Residential/urban				
Drainage rehabilitation	Practice	8	$12,000	$96,000
Rain garden demonstrations	Garden	12	$20,000	$60,000
Residential rain gardens	Garden	35	$500	$5,000
Wetland construction	Wetland	5	$100,000	$100,000
Pet waste outreach campaign	Campaign	1	$5,000	$5,000
Filters	Acres	15	$56,000/ impervious acre treated	$840,000

Bioswales/Vegetated open channels	Acres	20	$44,000/ impervious acre treated	$880,000
Permeable pavement and pavers	Acres	11	$20,000/.12 acres	$1,833,333
Infiltration trenches and basins	Acres	22	$66,250/ impervious acre treated	$1,457,500
Urban wet ponds and wetlands	Acres	20	$65,998/impervious acre treated	$1,319,960
Eroding streambank projects				
NSCD implementation	Feet	8000	$130/ft	$1,040,000
500 ft of vegetation (project stabilization)	500 ft.	16	$1,650/500ft	$26,400
Armored streambank stabilization	Site	5	$5,000/site	$25,000
Education and outreach				
Impervious surface reduction campaign	Campaign	3	$5,000	$15,000
Rain barrel workshops (15 barrels each)	Workshop	2	$1,200	$2,400
Septic system workshops	Workshop	2	$2,500	$5,000
Monitoring				
QAPP and Monitoring Programs	1/ Incremental Project	4	$10,000	$40,000
Additional Benthic Sample Analysis	Sample analysis	10	$70	$700
			Total Cost	$27,326,788

Reduction Estimates

Practice	Fecal coliform (counts/year)	Sediment (tons/year)	N (tons/year)	P (tons/year)
Septic systems				
Pumping	-	-	-	-
Upgrade/fix failing systems	2.66E+15	-	-	-
Additional de-nitrifying treatment	-	-	-	-
Total reduction by source	2.66E+15	0	-	-
Agricultural				
Residue management (no-till etc.)	-	854.1	4.65E+07	6.98E+06
Cover crop	-	227.8	1.30E+08	2.44E+06
Grass buffer establishment	1.07E+13	455.5	6.94E+07	4.88E+06
Forest buffer establishment	1.07E+13	455.5	9.84E+07	4.88E+06
Fencing *(assuming 15 acres of buffer are fenced)*	2.78E+11	9.8	1.55E+06	1.05E+05
Stream crossing	-	-	-	-
Alternative water systems *(assuming systems result in stream exclusion at all facilities)*	4.23E+13	1126.9	1.43E+08	1.18E+-7

Nutrient management plans	-	-	-	-
Litter composting facilities	-	-	-	-
Manure storage structures *(assuming additional storage will store all of currently unstored waste)*	7.61E+13	-	-	-
Manure transport (cost-share)	-	-	2.7	-
Wetland Restoration	1.97E+10	.1	5.78E+04	.7
Total reduction by source	1.40E+14	3129.6	4.89E+08	3.11E+07
Residential/urban				
Drainage rehabilitation	-	-	-	-
Rain garden demonstrations	1.23E+11	7.5	157.9	8.3
Residential rain gardens	3.57E+11	21.9	460.6	24.2
Wetland construction	4.64E+10	2.1	16.5	1.8
Pet waste campaign	-	-	-	-
Filters	1.28E+11	8.3	98.7	7.3
Vegetated open channels (bioswales)	-	11.1	230.3	12.2
Permeable pavement and pavers	-	6.5	144.8	7.1
Infiltration trenches and basins	-	14.5	307.6	15.2
Urban wet ponds and wetlands	2.04E+11	8.3	65.8	7.3
Total reduction by source	8.59E+11	80.2	1482.3	83.4
Eroding streambank projects				
NSCD implementation	-	8.0	160.0	48.0
500 ft of vegetation (project stabilization)	-	-	-	-
Armored streambank stabilization	-	2.5	200.0	30.0
Total reduction by source	-	10.5	360.0	78.0
Total Reduction by All Sources	2.80E+15	3220.4	9.78E+08	6.22E+07

* Dashes (-) indicate that no reduction efficiency has been given to this practice at this time.

E. Outreach and education

Currently there is a newly forming watershed group in Elks Run. Titled “Elks Run Watershed Group” (ERWG), their mission is to act as an advocate and steward of the Elks Run watershed by undertaking projects that will lead to pollution reduction and connecting citizens to the watershed. State and local agencies envision this group as a key partner in implementing this plan and increasing community involvement in the process. ERWG puts a high emphasis on community engagement, for example encouraging HOA’s to be early adopters of stormwater BMP’s. They believe that the first step in achieving clean water is to educate residents. This can be achieved through water quality monitoring workshops, benthic macroinvertebrate workshops, homeowner BMP workshops, septic workshops, pet waste outreach campaigns, watershed walks, subdivision stormwater audits, etc.

The former Elks Run Study Committee (ERSC) performed outreach and coordinated education efforts regarding this Watershed Based Plan. During the writing of this plan, he ERSC met monthly, and was comprised of citizens from the towns of Bolivar and Harpers Ferry. These communities are actually outside Elks Run watershed, but the residents’ drinking water comes from Elks Run via the Harpers Ferry Water

Works. Members of ERSC were appointed by the councils of Harpers Ferry and Bolivar. The purpose of ERSC was to study the needs of the water supply of the Harpers Ferry Water Works and make recommendations to the water works manager; to provide advice to the mayors and town councils of the Towns of Harpers Ferry and Bolivar on protecting the quality and quantity of the Elks Run water supply; and to implement recommendations outlined in the 2006 West Virginia Source Water Assessment and Protection Plan. This committee began its outreach with a stream walk in fall 2008 and a developed a website shortly thereafter. The website shows a map of the watershed boundaries, emphasizes many sources of poor water quality including failing septic systems, and contains advice about good practices to promote safe drinking water, e.g. “Install rain gardens, rain barrels, permeable surfaces [instructive links follow]”.

Two brochures have been designed and mailed by ERSC to the appropriate audiences. One mailing was intended to raise citizen awareness of the importance of maintaining “healthy water” was mailed to the approximately 800 customers of Harpers Ferry Water Works. It contained information similar to that associated with the website, above, including the watershed map. The second mailing was intended to raise awareness about good practices for streamside property, and was mailed to residents along Elks Run and Elk Branch. These two outreach efforts were viewed by ERSC as Phases I and II of their activities since being appointed in 2007. During Phase III, ERSC worked with the Eastern Panhandle Conservation District to implement the water quality improvement project mentioned above (ERWWQIP). The writing of this Watershed Based Plan and proposal for 319 Incremental funds was viewed by ERSC to be the next logical step in their work: Phase IV. ERSC completed their work in the summer of 2012.

In the absence of the ERSC and in contrast to ERSC’s lack of representation from watershed residents, the aforementioned group, the Elks Run Watershed Group, will be the primary volunteer group in this effort.

The Eastern Panhandle Conservation District (EPCD) is committed to promoting nonpoint source pollution reduction in Elks Run watershed. It is currently conducting the water quality improvement project mentioned above (ERWWQIP), and will maintain a database of contacts acquired in meetings and through programs like septic pumping assistance. Using these contacts and building on these outreach and educational efforts, the staff and supervisors of EPCD will be experienced and ready to promote the activities in this Watershed Based Plan. Its outreach specialist is available to demonstrate watershed and groundwater models and other activities in classrooms and camp settings.

Elks Run watershed is home to five schools: C.W. Shipley Elementary, Driswood Elementary, T.A. Lowery Elementary, Wildwood Middle, and Jefferson High. Also in the watershed is the Harpers Ferry Job Corps Center, which is a career and technical training center for young people ages 16-24. Harpers Ferry and Wildwood Middle Schools are working in collaboration with the ERSC, WVCA and EPCD to study and advocate good stewardship of the local Elks Run Watershed. Several science teachers are incorporating the topic of watersheds into their curriculum. Trout Unlimited’s Potomac Headwaters Youth Education Initiative is also active in West Virginia and could provide leadership and continuity to teachers and students interested in monitoring local water quality and implementing related on-the-ground projects.

In addition, the Burr Business Park, Jefferson County Public Services Center, and Sam Michael’s Park (county owned and operated) all represent facilities that would likely participate in the outreach and education effort. For example, the ERSC used a WV Stream Partners grant to install a demonstration rain garden at a visible location within Sam Michael’s Park. The park owns significant stream frontage and might be encouraged to manage the riparian area as a demonstration, as well.

The role of NRCS and WVU Extension service in outreach to farmers is mentioned in the previous section.

F, G, H. Schedule for Implementing NPS management measures, Description of Milestones, and Measurable Goals

2010:

- Begin development of Elks Run Watershed Based Plan
- Develop and submit first Elks Run Project Proposal

2010, second half – 2011, first half:

- Submit Elks Run Watershed Based Plan to U.S. Environmental Protection Agency
- Begin communicating with septic system owners in the western tier of the watershed:
    - regarding low-interest loan program
    - and to identify any problems with septic systems and consider upgrade options

PHASE I: 2011, second half - 2016, first half

- Receive first and second Section 319 Incremental Grant
- Develop Elks Run watershed monitoring plan, identify partners for each component, and develop Quality Assurance Project Plan
- Continue assessing septic project priorities on a finer scale
- Professional workshop with septic installers, pumpers, etc. to provide technical support
- Public meeting in Shenandoah Junction or a high-priority subdivision regarding septic system loan program and proper septic maintenance
- Upgrade, pump, or account for 66 underperforming septic systems
- Outreach (including one field demonstration day) to cropland farmers in the priority subwatersheds, regarding nutrient management and other BMPs
- Outreach to 7 of the 13 medium & high erosion potential pastures, regarding fecal
- coliform and sediment BMPs
- 1 Rain Barrel workshop (~15 barrels each)
- **Reduce fecal coliform by 5.13E+13** (1.95E+13 cfu from septic upgrades, 2.5E+13 cfu from pasture [1/3 the needed load reduction], 3.1E+12 cfu from cropland in the 3 priority subwatersheds, and 3.67E+12cfus from residential land [1/3 the needed load reduction])
- 2-3 Streambank stabilization projects totaling 1500 feet
- **Reduce sediment by 1074 tons**
- Ongoing monitoring
- (by 2015, first half) submit 3rd Section 319 Incremental Project Proposal

PHASE II: 2016, second half – 2021, first half

- RE-EVALUATE THE WATERSHED BASED PLAN BASED ON PROJECT IMPLEMENTATION TO DATE AND MONITORING RESULTS
- Re-evaluate monitoring plan
- Receive 3rd Section 319 Incremental Project Grant
- repair 48 failing septic systems
- More of projects outlined in phase I, above, but in the next priority area of:
    - pasture
    - cropland

- eroding streambanks (another 3-4 projects totaling 2500 ft)
- **Reduce fecal coliform by 5.23E+13** (2.3E+13 cfu from septic upgrades, 2.5E+13 from pasture [1/3 the needed load reduction], 6.1E+11 cfu from cropland in the 3 remaining subwatersheds with prescribed reductions, and 3.67E+12 from residential land [1/3 the needed load reduction])
- Upgrade, pump, or account for 54 underperforming septic systems Outreach to medium & high erosion potential pastures, regarding fecal coliform and sediment BMPs
- **Reduce sediment by 1074 tons**
- Ongoing monitoring
- (by 2020, first half) submit 4th Section 319 Incremental Project Proposal

PHASE III: 2021, second half –2026, first half

- RE-EVALUATE THE WATERSHED BASED PLAN BASED ON IMPLEMENTATION TO DATE AND MONITORING RESULTS
- Re-evaluate monitoring plan
- Receive 4th Section 319 Incremental Project Grant
- More of what is in Phase I&II, but in:
  - remaining pasture (2.5E+13cfus, or 1/3 the needed load reduction from this source),
  - remaining cropland,
- **Reduce remaining fecal coliform by** 2.65E+15 (including 3.67E+12 from residential land)
- Stabilize eroding streambanks (~4-8 projects totaling 4000 feet)
- **Reduce sediment by 1074 tons**
- Upgrade, pump, or account for 125 underperforming septic systems
-

Evaluating achievement of pollutant load reductions

1) Spring-fed waters in such faulted karst are usually nutrient rich and relatively heavily laden with bacteria, metals, and other pollutants," (Ecological Assessment, p. 46). If long-term implementation is not resulting in sufficient reductions, the groundwater influence might have to be considered.

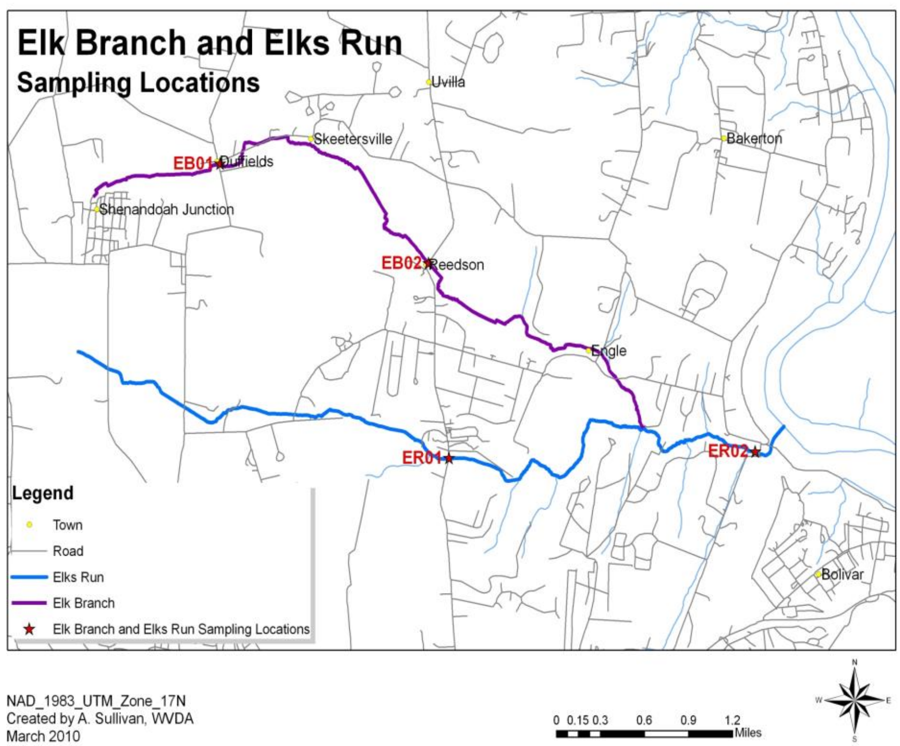
2) The watershed boundary used for the TMDL differs greatly, especially in the southwestern portion, from that derived from a more detailed elevation model in recent years. Additional septic systems, agricultural fields, etc. may need to be included in future analyses of progress and plans for implementation. However, there are no known major pollution sources, such as point sources or towns that would be encompassed by this new boundary.

I. Monitoring

The WV DEP will conduct its regular 5-year cycle sampling in the Potomac Direct Drains watershed in 2013. At that time, the two sites from the 2003-04 pre-TMDL sampling in Elks Run watershed will likely be re-tested. Parameters will include fecal coliform, nutrients, TSS, and possibly benthic macroinvertebrates. Occasionally, sites within the watershed may also be monitored as part of WV DEP's random sampling program.

The WV Dept. of Agriculture conducts monthly water quality testing on four sites in the Elks Run watershed, as part of its support of Potomac Tributary Strategy priority watersheds (see Figure 9). Two of these sites (ER01 and ER02) are the same as WV DEP's pre-TMDL monitoring sites. Parameters include pH, temperature, conductivity, dissolved oxygen, nitrate-N, ammonia-N, total phosphorus, turbidity, TSS, and fecal coliform bacteria.

Some volunteer sampling of benthic macroinvertebrates will also occur, using West Virginia's Save Our Streams protocol. In addition, students at Harpers Ferry and Wildwood Middle Schools are conducting water quality monitoring of two sites selected by ERSC. The data the students collect will be used to evaluate the success of BMPs being implemented by the EPCD ERWWQIP. The students' water monitoring fieldwork is a portion of their grade and is planned as an annual project for students at both schools.



Jefferson County Water Advisory Committee, in partnership with Jefferson County Watersheds Coalition, conducted a monitoring program in several watersheds including Elks Run, as well. They measured chloride, sulfate, nitrate, *E. coli* bacteria, and physical parameters at irregular intervals. One site near the mouth of Elks Run and a spring near the headwaters of Elks Run are sampled.

Figure 10. WV Dept. of Agriculture's monthly sampling sites in Elks Run watershed

Stakeholders have expressed a desire to see ground truthing of pollution sources in the watershed and continuous water quality monitoring to determine more geographically specific pollutant loads. Examples that they give are septic dye tracing to confirm septic failures, bacterial source tracking, more detailed streambank erosion studies, and collection of sediment data (TSS, turbidity, bed load sampling, etc.). They are interested in seeing community and local university involvement in monitoring efforts.

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Acknowledgments

Many entities within the community provided support to write this plan. Citizens of the Elks Run watershed and neighboring Bolivar and Harpers Ferry attended several public meetings and continue to alert partnering agencies to potential project opportunities. The Elks Run Study Committee allowed time on several meetings' agendas for coordinating this and related planning efforts. The Jefferson County Health Department and Jefferson County Public Service District all provided valuable information about septic systems and plans to extend sewer service in the county. Jefferson County offices of WVU Extension Service and Natural Resources Conservation Service and the Berkeley County Farm Service Agency provided insight into practices on local farm operations and costs of installing BMPs. The Environmental Protection Agency's Chesapeake Bay Program (2009 CBIG, Objective #10) supported TCF-FI's work on refining the land use map and gathering information relevant to prioritizing work on septic systems. The West Virginia Division of Forestry contributed forestry and land use insights. The Eastern Panhandle Conservation District and West Virginia Conservation Agency have prioritized outreach and BMPs in this watershed and have laid the groundwork for the successful implementation of this plan. Regina S. Lucas, then an intern with WV DEP, conducted a streambank assessment of Elks Run, input and organized the resulting data, and posted it to Google Maps in order to share the information with stakeholders. She further supported the writing of this plan by looking up references, performing calculations, creating charts and tables of data, and facilitating recent stakeholder meetings.

Appendix A. Streambank assessment

In the summer of 2010, a team hiked the length of Elks Run, observing impairments along the way. These observations were recorded & mapped. This table and the corresponding maps are a tools for those who wish to remediate Elks Run to use, so that they can identify & locate impairments, allocating their time, efforts & funds accordingly. Maps of all impaired sites can be viewed in the following appendix. Online, the maps have been broken into specific impairments, many sites falling under more than one. The maps consist of:

Cow/Horse access
http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=202038980097333507091.000495a9befb6d8e07866&z=15

Inadequate Buffers
http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=202038980097333507091.000495aa3172a084487cc&z=13

Erosion/Sedimentation maps:
http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=202038980097333507091.0004991aebf295c9e1aab&ll=39.338529,-77.757819&spn=0.011783,0.019076&z=16

http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=202038980097333507091.0004991b78d8ecdc44c87&z=15

http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=202038980097333507091.0004991bf0ab040d945c6&z=14

To understand the labeling of the sites ("ID" Column) refer to the following:

The first # refers to the reach (day the site was reached); the letters refer to the following:
CH= channelization, ES=erosion/sedimentation, TRIB=tributary, IB=inadequate buffer, UC=unusual condition, PO=pipe outfall, EC= encroachment/construction, FT= fallen trees(s), END= end of condition indicated.

The last number refers to the chronological order that specific impairments were recorded in one reach. The tables and aerial photos from this survey are available upon request.

Appendix B. Excerpt, Source Water Assessment and Protection Plan

p. 40 of "Source Water Assessment and Protection Plan for Harpers Ferry Water Works, Jefferson County." 2006. Sarin, Dalip. WV Rural Water Association. 71 pp.

Nonpoint Source Pollution: Non-point source pollution contributions are often difficult to assess or quantify. They can include sediment deposition from soil erosion, nutrient runoff from animal wastes and commercial fertilizers, herbicide and insecticide runoff, and oil or fuel waste runoff. Non-point source pollution can emanate from agricultural as well as urban lands. The regulatory control mechanisms now exist and these mechanisms if properly enforced can control and reduce nonpoint source pollution.

Recommended Management Strategy: The management of urban non-point sources can be addressed through effective land use planning, site design and proper implementation of sub division rules and guidelines. Those designs that incorporate less impervious area and more natural infiltration areas have proven effective in reducing urban non-point pollution.

Recommended Management Strategy: A setback distance and restricted use of land can provide protection to all sources of water. A minimal distance of 500 feet from a spring source is recommended. In the review of such plans submitted by developers, WVDEP and Jefferson County Planning Commission should condition the approvals and require adequate setback.

Recommended Management Strategy: The local planning and zoning authorities, and developers, should ensure that the site design requirements are implemented during and post construction to reduce non-point source contaminants. Site inspections must be performed by foremen, local and state agency officials to ensure that all operations and processes that can contaminate groundwater including oil leaks from vehicles, aboveground storage tanks and storm water facilities are properly maintained.

Recommended Management Strategy: On completion of construction, Jefferson County Commission and WVDEP should ensure that there is a management plan for maintenance of storm water ponds, conveyance channels and other fixtures in the permitted area. No performance bond should be released until a management plan has been established to maintain ponds and associated conveyance channels by permit holders or their maintenance company or the respective local homeowners association (in case of residential sub-divisions).

Recommended Management Strategy: Practicing the best management measures for nonpoint source pollution abatement should significantly reduce the sediment, nutrient, pesticide, and other pollutant contributions to water resources. The WVRWA can assist in developing a brochure on best management practices.

Recommended Management Strategy: Local stakeholders, in cooperation with state and federal agencies, should seek additional information on water quality concerns and issues addressed in this document and make that information available to the public. Additionally, the problems associated with septic failures, soil erosion, land use issues, and riparian zones can be emphasized through meetings, training sessions, and stakeholder group discussions. Field days are excellent ways to present information and encourage discussion. Use of experts with strong background knowledge coupled with local sponsors is an effective method to convey solutions to these problems.

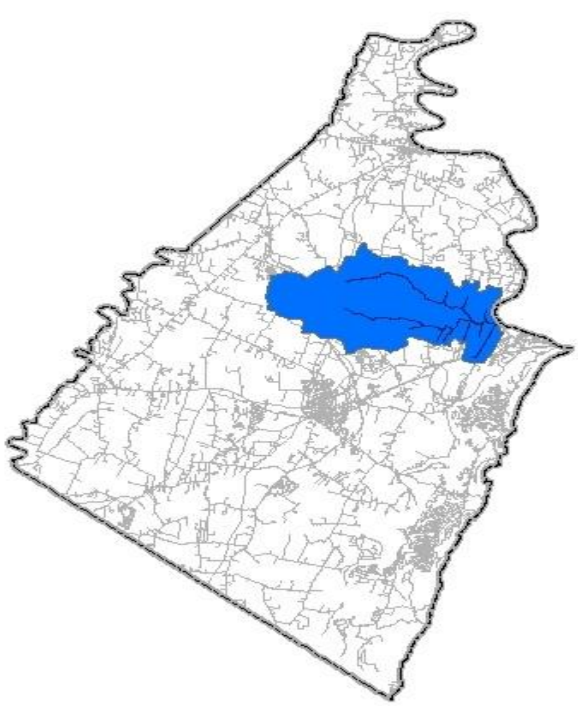
Appendix C. Elks Run Watershed Water Quality Improvement Project Synopsis

The Elks Run project is funded by a grant - awarded to the Eastern Panhandle Conservation District – that is aimed at reducing pollutants in the Elks Run watershed. Elks Run is located in Jefferson County, West Virginia. Elks Run begins near Shenandoah Junction and flows into the Potomac River at Harpers Ferry, and is the only surface water stream to provide municipal drinking water in Jefferson County. Studies conducted by state and local officials have identified agricultural practices and residential septic systems as two major contributors of pollutants that harm aquatic life and reduce water quality. Some common contaminants that impact the Elks Run Watershed include nitrogen, phosphorus, sediment, pesticides, and fecal coliform bacteria.

The Elks Run project will provide funding for residential homeowners and farmers to implement best management practices. Eligible landowners will receive reimbursement for 50% of the cost of their septic pumping project up to $150. A free septic inspection is included with the pumping. Farmers have the opportunity to receive 100% cost-shares on streambank fencing, stream crossings, and riparian buffer tree plantings. These practices will help to improve stream and groundwater quality for recreation and municipal drinking water. Other benefits include providing a healthy habitat for aquatic life, reducing erosion, reducing instances of water-borne illnesses in cattle, and improving grazing and fertilization efficiency.

This project is being implemented in partnership with the Town of Harpers Ferry and Town of Bolivar Elks Run Study Committee, Jefferson County Board of Health, West Virginia Department of Agriculture, West Virginia Department of Environmental Protection, West Virginia Conservation Agency, Eastern Panhandle Conservation District, and West Virginia Division of Forestry.

Landowners can pick up an application at the Eastern Panhandle Conservation District Office or download a form at www.wvca.us/districts/?page=epcd. Applications will be accepted until September 30. For more information about the project call 304-263-4376. Not sure if your property falls within the watershed? Give us a call and we'll let you know.



Jefferson County w/ Elks Run Watershed highlighted