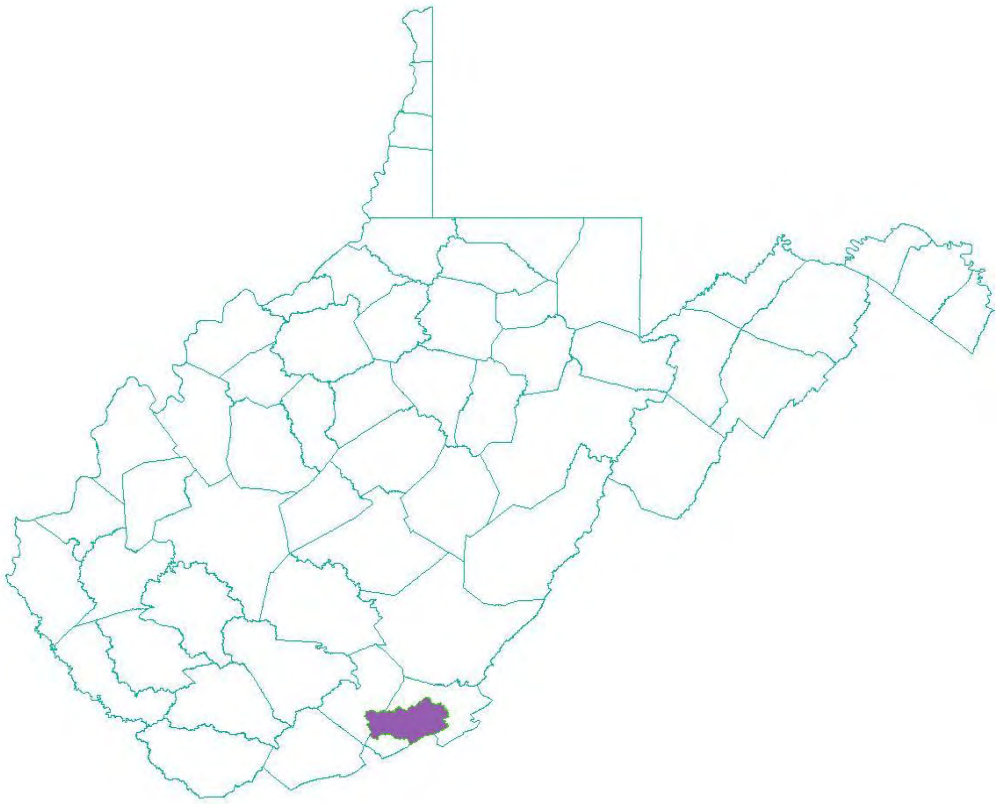
Indian Creek

WVKNG-51

Watershed Based Plan

HUC12 050500020701 Burnside Branch, HUC12 050500020702 Rock Camp Creek, HUC12 050500020703 Upper Indian Creek, HUC12 050500020704 Middle Indian Creek, HUC12 050500020705 Lower Indian Creek



Submitted by the

West Virginia Conservation Agency

2017

Watershed Based Plan for Indian Creek

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INTRODUCTION

The purpose of this watershed based plan (WBP) is to define the problems, resources, costs and course of action necessary to restore the impaired streams of the Indian Creek watershed to full compliance with water quality standards. Following this watershed based plan will implement the Total Daily Maximum Load (TMDL) set for these streams by the WV Department of Environmental Protection (DEP). It should be noted that this plan is larger in scope than normal, including 5 HUC-12 watersheds. This is due to the expected significant funding sources from USDA and the timeframes associated with them.

Indian Creek, stream code WVKNG-51, is a significant tributary to the New River. It and its tributaries start in the mountains of the karst region of Monroe County and enter the New River near the community of Forest Hill. The Indian Creek watershed is a rural watershed with the predominant land use being grazing based agricultural with small communities and farms scattered throughout. The watershed is 122,788 acres with over 45% being pasture and crop land. Karst geology is significant within the watershed and creates special challenges for producing a TMDL and for restoration efforts. Karst is a limestone geology typified by sink holes and underground streams which can allow pollutants to rapidly enter the groundwater and be transported to springs that enter surface streams. This geology comprises 21,278 acres of agricultural land, or over 46% of the agricultural land in the watershed and over 17% of the total watershed. Of the 23,454 acres of pasture land in the watershed 90% of it is in karst. Cropland comprises 6497 acres of the watershed and 97% is in the karst region.

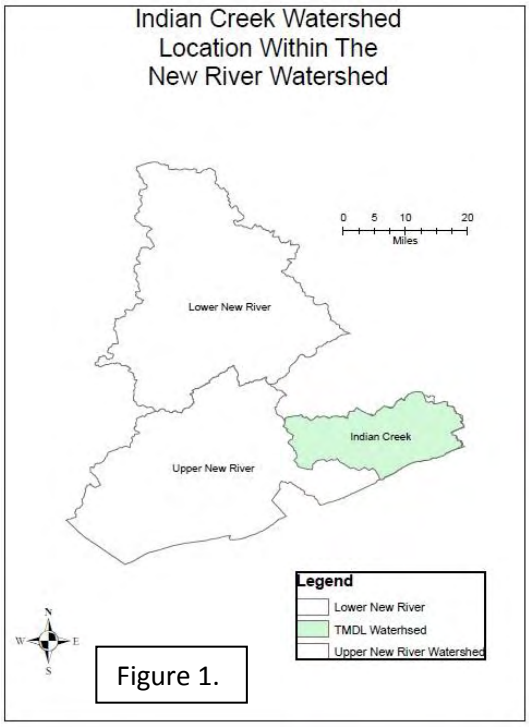


Figure 1.

The underground waterways typical in karst can transport water that originated outside the surface drainage of the watershed to Indian Creek itself. The Total Maximum Daily Load (TMDL) produced by the DEP has taken this into account. Underground drainages that have been proven by dye testing are shown in the watershed map and included in the TMDL.

Indian Creek has been listed in the 2008 303(d) list as being impaired by fecal coliform contamination. It is included in the 2008 Upper New River TMDL. The WV Conservation Agency (WVCA) working with and through the Greenbrier Valley Conservation District (GVCD) will be the lead agency on this project. The WVCA will work with the Monroe counties health departments on failing septic system issue and the National Resource and Conservation Agency (NRCS) on agricultural issues. The WVCA will also coordinate closely with the DEP's Nonpoint Source Program (NPS) with §319 grant applications and reporting. The only known threatened or endangered species known to may be inhabiting this watershed are the Indiana bat (*Myotis sodalist*), Small Whorled Pogonia (*Pogonia verticillata*), Running Buffalo Clover (*Trifolium stoloniferum*), and Shale Barren Rockcress (*Arabis serotine*) based on the NRCS

ICT Tool. This plan is not expected to have a negative impact on these species, additionally practice's such as riparian buffers and exclusion fencing should enhance habitat for these species.

Figure 2. Indian Creek sub-watersheds

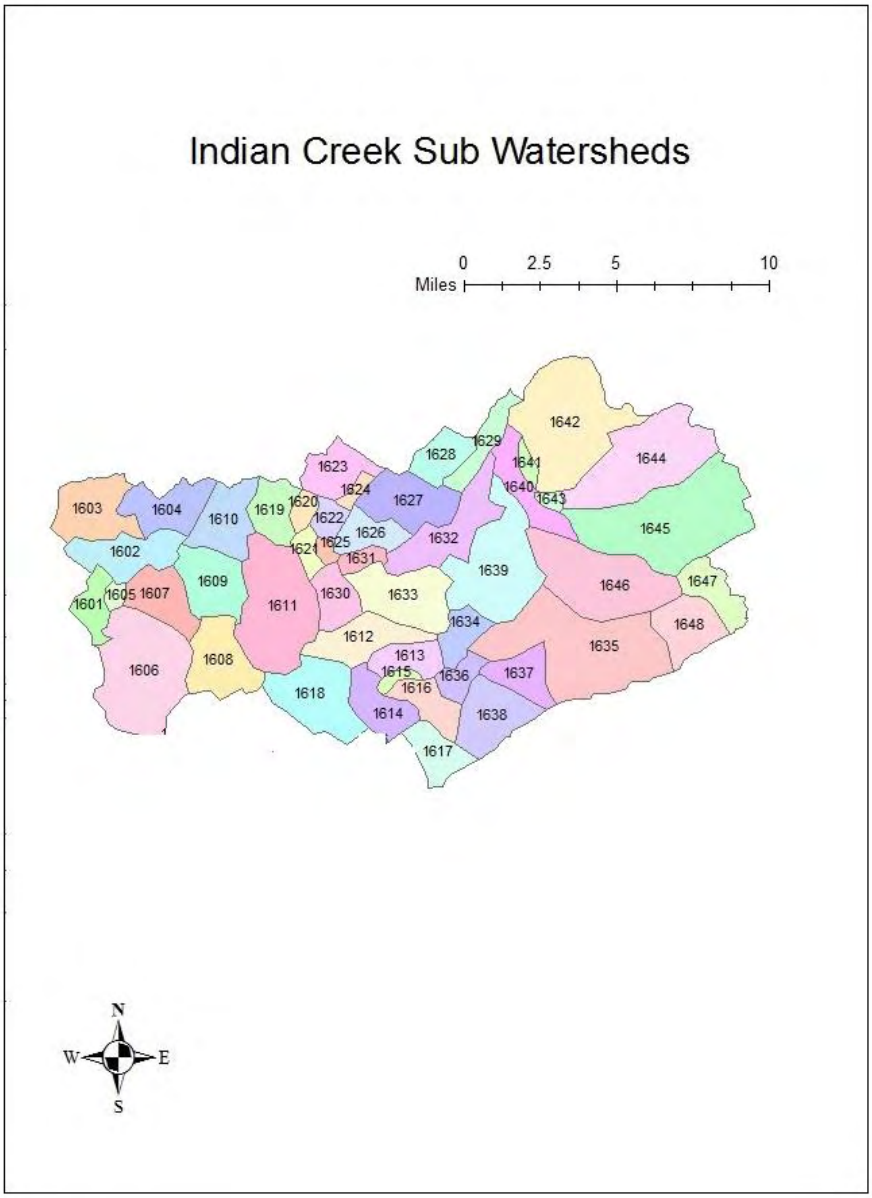


Figure 3. TMDL development in the Upper New River

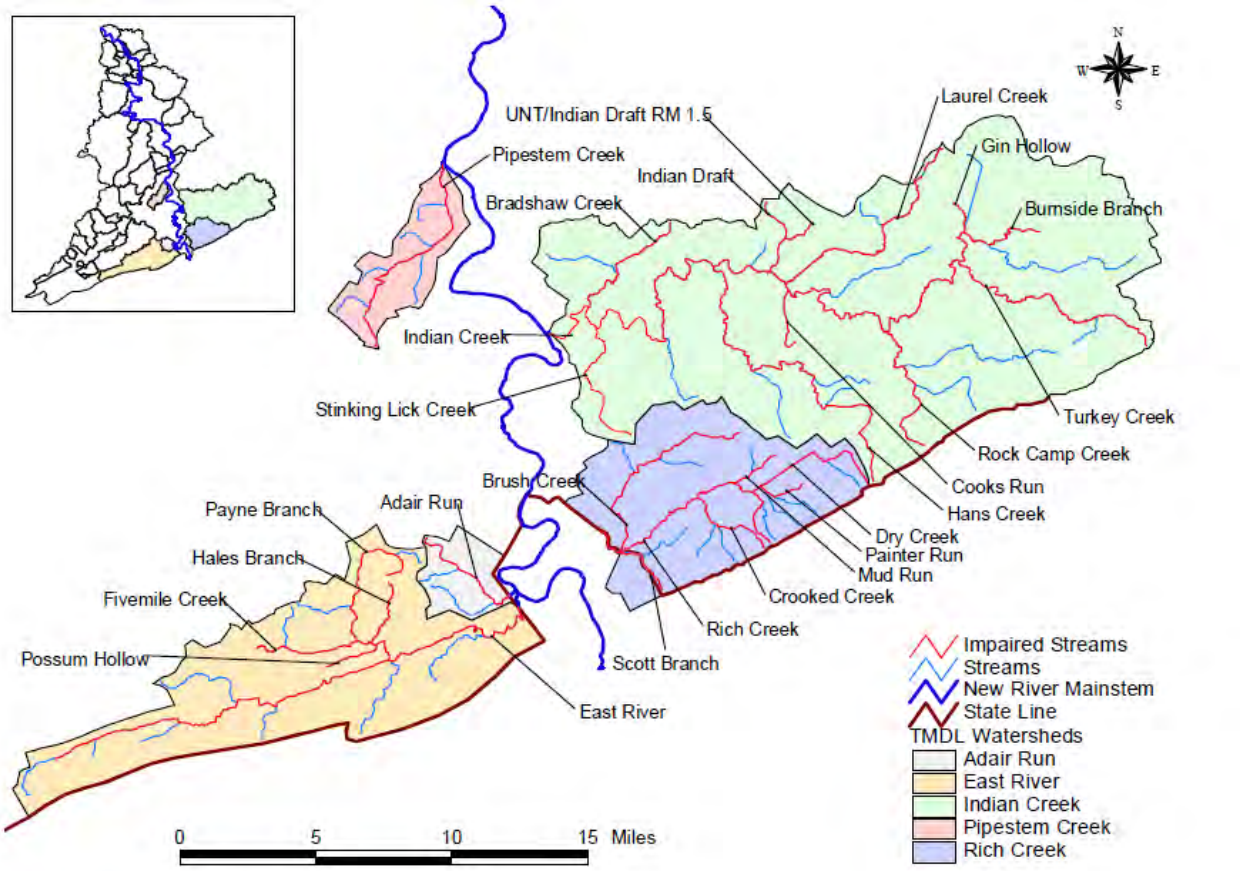
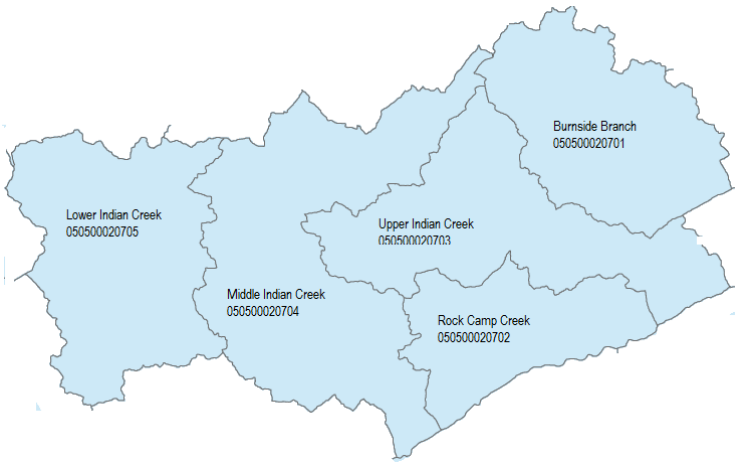


Figure 4. Indian Creek HUC 12 Watersheds



CAUSES AND SOURCES

Section 303(d) of the federal Clean Water Act requires states to identify waterbodies that do not meet water quality standards and to develop appropriate TMDLs. A Total Maximum Daily Load (TMDL) establishes the maximum allowable pollutant loading for a waterbody to achieve compliance with established water quality standards. It also distributes the load among pollutant sources establishing load reduction goals from each source.

The TMDL for New River watershed was approved by the U.S. Environmental Protection Agency (USEPA) in 2008. The TMDL model was based on extensive water quality monitoring from May 2004 through May 2005 by the DEP. The results of that monitoring were used to confirm the impairments to streams identified on previous 303(d) lists and to identify other impaired streams that were not previously listed. The TMDL identifies fecal coliform as the cause of impairment in the Indian Creek watershed.

Data obtained from pre-TMDL monitoring was compiled, and the impaired waters were modeled to determine baseline conditions and the gross pollutant reductions needed to achieve water quality standards. A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS) that accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving stream. TMDLs can be expressed in terms of mass per time or other appropriate units. TMDLs are calculated by the following equation:

TMDL = sum of WLAs + sum of LAs + MOS

The determination of impaired waters involves comparing instream conditions to applicable water quality standards. West Virginia's water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, titled *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards*. Water quality standards consist of three components: designated uses; narrative and/or numeric water quality criteria necessary to support those uses; and an antidegradation policy.

In the New River watershed, water contact recreation and public water supply are listed as the designated uses that have been impaired based on the water quality criteria for fecal coliform bacteria. The water quality standard for human health from 47 CSR, Series 2, *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards* is:

"**Human Health Criteria** Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month."

The New River TMDL shows that there are no point sources within Indian Creek so that all impairments come from nonpoint sources. The TMDL calls for a 42.63% reduction in fecal coliform levels for Indian

Creek (Table 1) from these sources. The TMDL identifies eleven basins in the Indian Creek watershed with 48 sub-watersheds numbers 1601 to 1648 assigned to identify them.

Table 1: Indian Creek TMDL (from the New River TMDL)

TMDL Watershed	Stream Code	Stream Name	Baseline LA (counts/yr)	LA (counts/yr)	Baseline WLA (counts/yr)	WLA (counts/yr)	MOS (counts/yr)	TMDL (counts/yr)	% Reduction
Indian Creek	WVKN-51	Indian Creek	5.40E+14	3.10E+14	2.72E+11	2.72E+11	1.63E+13	3.26E+14	42.63
Indian Creek	WVKN-51-A	Bradshaw Creek	5.69E+13	1.71E+13			9.02E+11	1.80E+13	69.86
Indian Creek	WVKN-51-B	Stinking Lick Creek	4.71E+13	1.43E+13	1.38E+10	1.38E+10	7.52E+11	1.50E+13	69.71
Indian Creek	WVKN-51-D	Hans Creek	1.22E+14	5.34E+13	9.68E+09	9.68E+09	2.81E+12	5.62E+13	56.29
Indian Creek	WVKN-51-G	Indian Draft	1.28E+13	8.17E+12			4.30E+11	8.60E+12	36.06
Indian Creek	WVKN-51-G-1	UNT/Indian Draft RM 1.5	2.93E+12	1.55E+12			8.13E+10	1.63E+12	47.18
Indian Creek	WVKN-51-H-(S)	Laurel Creek	3.21E+13	1.94E+13			1.02E+12	2.05E+13	39.53
Indian Creek	WVKN-51-I	Cooks Run	2.46E+12	2.31E+12			1.22E+11	2.43E+12	6.10
Indian Creek	WVKN-51-K	Rock Camp Creek	2.65E+13	2.12E+13			1.12E+12	2.23E+13	19.97
Indian Creek	WVKN-51-O	Turkey Creek	1.79E+13	1.68E+13			8.85E+11	1.77E+13	5.85
Indian Creek	WVKN-51-R	Gin Hollow	2.66E+12	1.49E+12			7.82E+10	1.56E+12	44.12
Indian Creek	WVKN-51-S-1-(S)	Burnside Branch	2.58E+13	2.14E+13			1.12E+12	2.25E+13	17.05

The TMDL identifies two land use sources for the fecal coliform pollution: agriculture and on-site wastewater treatment. The agricultural land use specifically identified as contributing to the contamination is pasture/cropland.

Table 2: Baseline loads from Pasture land use

TMDL Watershed	Sub watershed	Stream Name	Stream Code	Pasture/Cropland Baseline Load (counts/yr)	Pasture/Cropland Allocated Load (counts/yr)	Pasture/Cropland Percent Reduction
Indian Creek	1601	Indian Creek	WVKN-51	0.00E+00	0.00E+00	0.0
Indian Creek	1602	Bradshaw Creek	WVKN-51-A	1.59E+13	3.98E+12	75.0
Indian Creek	1603	Johnnycake Fork	WVKN-51-A-2	1.40E+13	3.56E+12	74.7
Indian Creek	1604	Bradshaw Creek	WVKN-51-A	2.25E+13	5.71E+12	74.7
Indian Creek	1605	Indian Creek	WVKN-51	0.00E+00	0.00E+00	0.0
Indian Creek	1606	Stinking Lick Creek	WVKN-51-B	4.35E+13	1.12E+13	74.2
Indian Creek	1607	Indian Creek	WVKN-51	2.72E+11	2.72E+11	0.0
Indian Creek	1608	Fitz Run	WVKN-51-B.5	4.06E+12	3.29E+12	18.9
Indian Creek	1609	Indian Creek	WVKN-51	2.27E+13	7.94E+12	65.0
Indian Creek	1610	Indian Creek	WVKN-51	1.77E+13	8.84E+12	50.0
Indian Creek	1611	Hans Creek	WVKN-51-D	3.46E+13	1.27E+13	63.3
Indian Creek	1612	Hans Creek	WVKN-51-D	1.32E+13	3.99E+12	69.9
Indian Creek	1613	Lick Run	WVKN-51-D-2	1.15E+13	4.60E+12	60.0

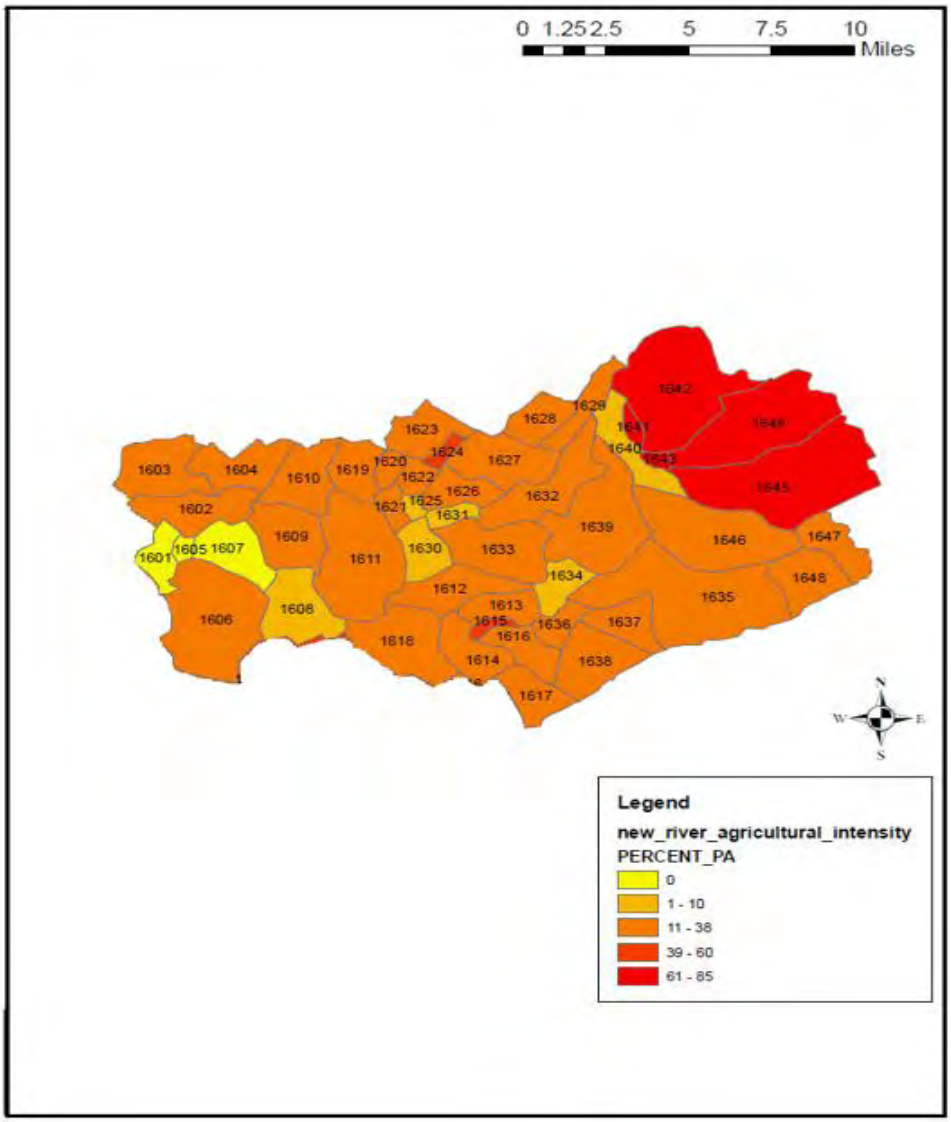
Indian Creek	1614	Hans Creek	WVKN-51-D	1.71E+13	6.93E+12	59.4
Indian Creek	1615	UNT/Hans Creek RM 11.33	WVKN-51-D-4	6.44E+12	1.61E+12	75.0
Indian Creek	1616	Hans Creek	WVKN-51-D	9.42E+12	4.84E+12	48.6
Indian Creek	1617	Hans Creek	WVKN-51-D	1.42E+12	1.42E+12	0.0
Indian Creek	1618	Blue Lick Creek	WVKN-51-D-1	1.82E+13	8.22E+12	54.8
Indian Creek	1619	Indian Creek	WVKN-51	1.17E+13	4.90E+12	58.3
Indian Creek	1620	Slate Run	WVKN-51-F	2.49E+12	1.62E+12	34.9
Indian Creek	1621	Indian Creek	WVKN-51	4.51E+12	1.86E+12	58.8
Indian Creek	1622	Indian Draft	WVKN-51-G	2.04E+12	1.44E+12	29.6
Indian Creek	1623	Indian Draft	WVKN-51-G	6.27E+12	3.80E+12	39.4
Indian Creek	1624	UNT/Indian Draft RM 1.5	WVKN-51-G-1	2.74E+12	1.37E+12	50.0
Indian Creek	1625	Indian Creek	WVKN-51	1.80E+11	1.80E+11	0.0
Indian Creek	1626	Laurel Creek (KN-51-H-(S)	WVKN-51-H-(S)	2.87E+12	2.43E+12	15.3
Indian Creek	1627	Laurel Creek (KN-51-H-(S)	WVKN-51-H-(S)	1.24E+13	6.59E+12	46.8
Indian Creek	1628	Sarton Branch	WVKN-51-H-1	7.67E+12	3.45E+12	55.0
Indian Creek	1629	Laurel Creek (KN-51-H-(S)	WVKN-51-H-(S)	4.45E+12	2.67E+12	40.0
Indian Creek	1630	Cooks Run	WVKN-51-I	1.43E+12	1.43E+12	0.0
Indian Creek	1631	Indian Creek	WVKN-51	1.85E+11	1.85E+11	0.0
Indian Creek	1632	Back Creek	WVKN-51-J	1.14E+13	4.64E+12	59.4
Indian Creek	1633	Indian Creek	WVKN-51	1.48E+13	1.05E+13	28.9
Indian Creek	1634	Rock Camp Creek	WVKN-51-K	6.30E+11	6.30E+11	0.0
Indian Creek	1635	Dropping Lick Creek	WVKN-51-K-1	1.19E+13	8.56E+12	28.3
Indian Creek	1636	Rock Camp Creek	WVKN-51-K	2.48E+12	1.76E+12	29.0
Indian Creek	1637	Wiseman Branch	WVKN-51-K-3	1.04E+11	1.04E+11	0.0
Indian Creek	1638	Rock Camp Creek	WVKN-51-K	2.67E+12	2.04E+12	23.6
Indian Creek	1639	Indian Creek	WVKN-51	2.18E+13	1.53E+13	29.8
Indian Creek	1640	Indian Creek	WVKN-51	8.42E+11	8.42E+11	0.0
Indian Creek	1641	Gin Hollow	WVKN-51-R	2.50E+12	1.33E+12	46.7
Indian Creek	1642	Earson Hollow (UG)	WVKN-51-R-2-A-(S)	2.51E+13	2.21E+13	12.0
Indian Creek	1643	Indian Creek	WVKN-51	7.30E+11	7.30E+11	0.0
Indian Creek	1644	Burnside Branch (UG)	WVKN-51-S-1-(S)	2.39E+13	1.97E+13	17.6
Indian Creek	1645	Taggart Branch	WVKN-51-S-(S)	2.37E+13	2.15E+13	9.3

Indian Creek	1646	Turkey Creek	WVKN-51-O	9.46E+12	8.78E+12	7.2
Indian Creek	1647	Turkey Creek	WVKN-51-O	1.49E+12	1.49E+12	0.0
Indian Creek	1648	UNT/Turkey Creek RM 7.55	WVKN-51-O-2	1.38E+12	1.16E+12	16.1

Agriculture

In the agricultural land use category, all but eleven of the sub-watersheds, 1601, 1605, 1607, 1617, 1625, 1630, 1631, 1634, 1637, 1640, 1643, and 1647, contribute fecal coliform to Indian Creek. The largest contributors are SWSs 1602, and 1615, the Johnnycake Fork and Hans Creek areas. The TMDL model looks at agricultural intensity zones and the run off potential of the land to determine the need for reductions. The most agricultural intensive area is in the upper most reaches of the watershed.

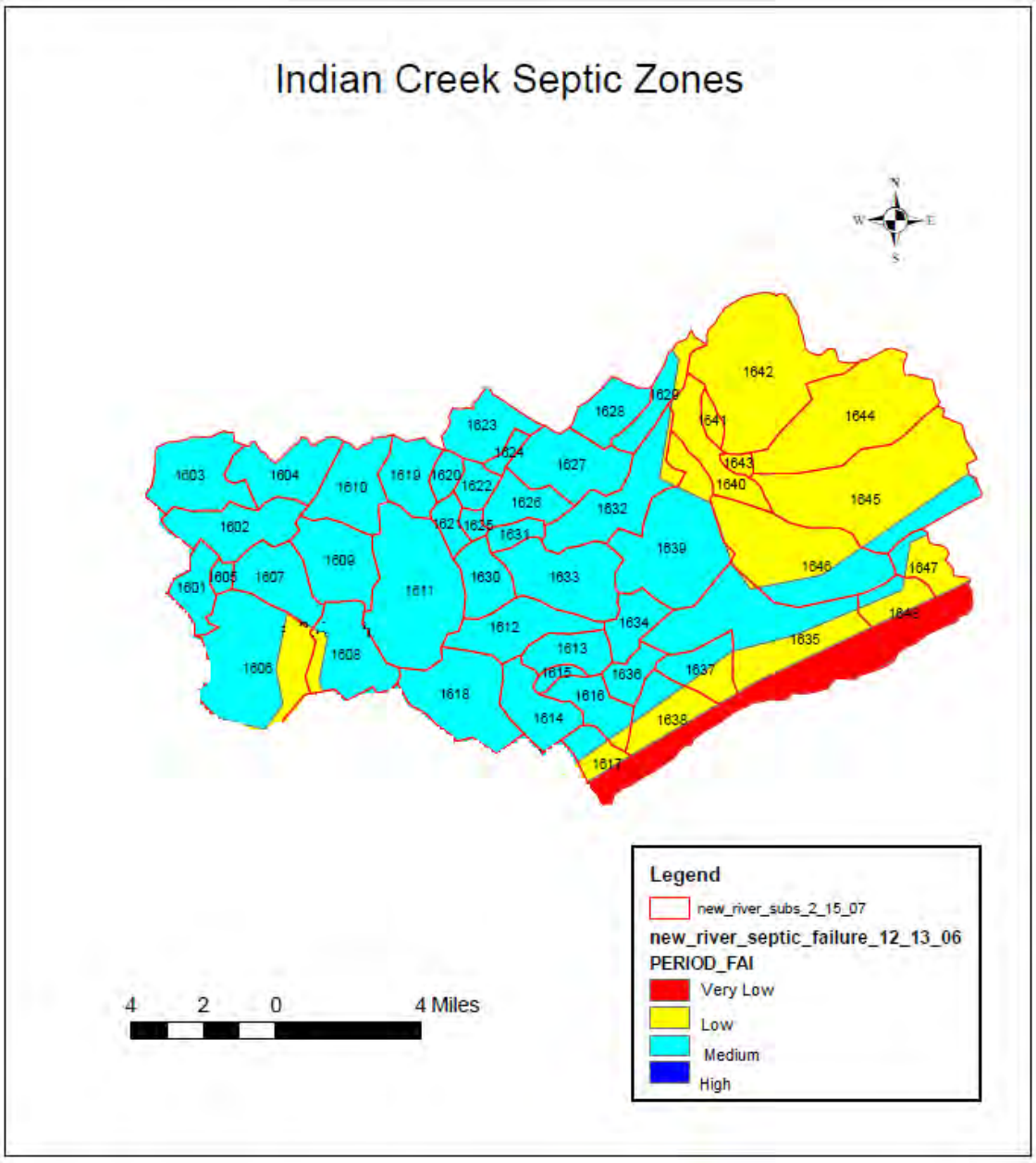
Figure 5: Agricultural Intensity Zones



On-site Wastewater Sewage Treatment

In the on-site wastewater category reductions are called for in all 48 sub-watersheds. The determination of the baseline contribution and reduction is based on several factors including residential density, soil porosity and proximity to the stream or underground drainage. These factors go into modeling the vulnerability to pollution from failing septic systems.

Figure 6: Failing Septic System Vulnerability Zones



To calculate failing septic wastewater flows, the watersheds were divided into four septic failure zones during the source tracking process. Septic failure zones were delineated by geology, and defined by rates of septic system failure. Two types of failure were considered: complete failure and periodic failure. In the model a complete failure was defined as 50 gallons per house per day of untreated sewage escaping a septic system as overland flow to receiving waters. Periodic failure was defined as 25 gallons per house per day of untreated sewage escaping a septic system as overland flow to receiving waters. A base concentration of 25,000 counts per 100 mL was used as a beginning concentration for failing septic. In the Indian Creek watershed, there are three identified septic failure zones: medium, low and very low.

The TMDL calculates the estimated number of residences with septic system failures in each vulnerability zone. The percentages of homes estimated to have failing septic systems are listed by zone in Table 3.

Table 3: Percentage of Homes with Failing Systems by Septic Zone

Seasonal Failure: Assume 25 gpd/home failing septic effluent reaching stream		
Complete Failure: Assume 50 gpd/home failing septic effluent reaching stream		
Type	**% homes with seasonal failure**	**% homes with complete failure**
Very Low	3.00	5.00
Low	7.00	10.00
Medium	13.00	24.00
High	19.00	28.00

The TMDL model estimates the number of residences with some form of septic system failure by sub-watershed. The calculations often end in a fraction but this can't exist, either a system is failing or it is not. Table 4 shows the whole number estimates of the number of periodic and complete failures in the watershed. The total number of septic failures are:

Modelled Periodic Failures	1,164
Modelled Complete Failures	2,366

Table 4: The Number of Failing Systems by SWS

SUBID	Total 911 Structures	Very Low	Low	Medium	High
1601	17	0	0	9.18	0
1602	157	0	0	84.78	0
1603	138	0	0	74.52	0
1604	173	0	0	93.42	0
1605	29	0	0	15.66	0
1606	647	0	172.8	176.58	0
1607	98	0	3.78	49.14	0
1608	305	0	14.58	150.12	0
1609	184	0	0	99.36	0
1610	124	0	0	66.96	0
1611	271	0	0	146.34	0
1612	181	0	0	97.74	0
1613	117	0	0	63.18	0
1614	134	0	0	72.36	0
1615	71	0	0	38.34	0
1616	86	0	0.54	45.9	0
1617	74	0	31.86	8.1	0
1618	200	0	0	108	0
1619	84	0	0	45.36	0
1620	16	0	0	8.64	0
1621	26	0	0	14.04	0
1622	68	0	0	36.72	0
1623	68	0	0	36.72	0
1624	8	0	0	4.32	0
1625	37	0	0	19.98	0
1626	100	0	0	54	0
1627	126	0	0	68.04	0
1628	130	0	0	70.2	0
1629	70	0	21.06	16.74	0
1630	132	0	0	71.28	0
1631	62	0	0	33.48	0
1632	103	0	4.86	50.76	0
1633	222	0	0	119.88	0
1634	59	0	0	31.86	0
1635	316	8.64	57.24	104.76	0
1636	69	0	0	37.26	0
1637	42	0	19.98	2.7	0
1638	159	1.62	60.48	23.76	0
1639	218	0	17.82	99.9	0
1640	80	0	43.2	0	0
1641	9	0	4.86	0	0
1642	357	0	192.78	0	0
SUBID	Total 911 Structures	Very Low	Low	Medium	High
1643	49	0	26.46	0	0
1644	383	0	206.82	0	0

1645	300	0	153.9	8.1	0
1646	142	0	70.74	5.94	0
1647	22	1.62	9.72	0.54	0
1648	94	16.74	22.68	11.34	0
Totals	6540	28.62	1136.16	2366.82	0

Expected development that may be of concern in the future is the construction of the Mountain Valley Pipeline. This pipeline will transport natural gas through the watershed and will cross Indian Creek and several tributaries. Prior to construction, landowners will be made aware of issues related to erosion and aided with development of erosion and sediment control plans.

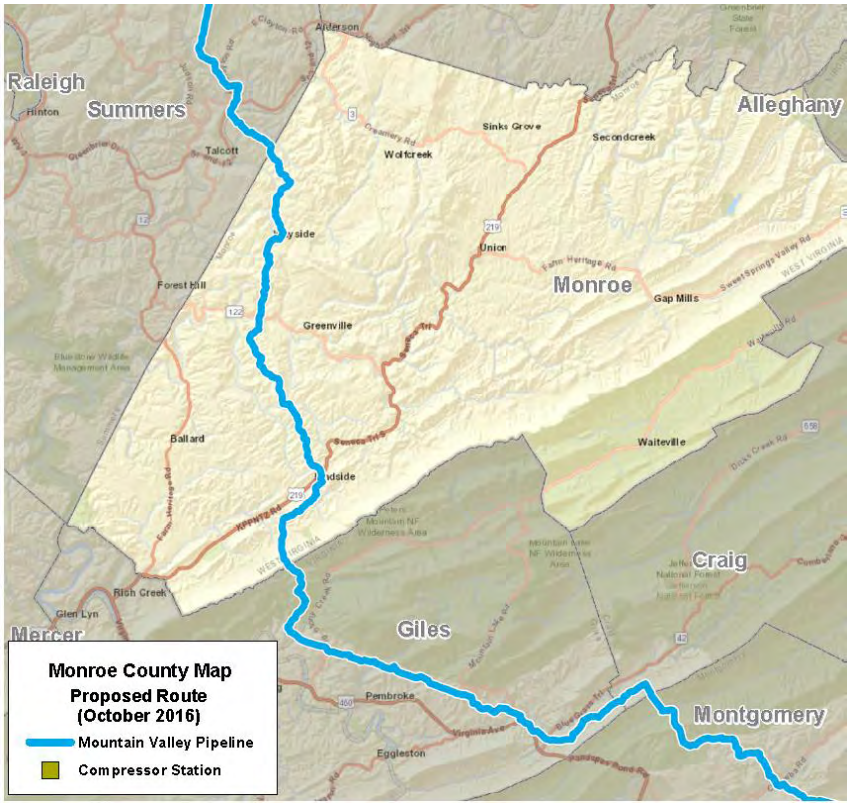


Figure 7. Proposed route of the Mountain Valley Pipeline through the Indian Creek Watershed in Monroe County West Virginia

LOAD REDUCTIONS REQUIRED

The load reductions being called for in this watershed based plan are based on the TMDL for the entire Upper New River Watershed. The TMDL is a load allocation that expresses what can enter the stream. Load reduction (LR) targets are determined by subtracting the TMDL from baseline load (BL) levels:

LR= BL – TMDL

LR is the accumulated reductions from practices installed during the implementation process. As such, it becomes the primary criteria for tracking environmental results.

In Indian Creek load allocations (LA) for the number of fecal coliforms that can be assimilated in the stream without impairment are assigned to the Pasture/Cropland and On-site Sewer Systems land uses. In the Pasture/Cropland (agriculture) category, most the reductions are required in the upper most reaches of the Indian Creek Watershed SWS 1642, 1644, and 1645. In the On-site Sewer Systems (failing septics) category all SWS have 100% reductions called for. This is because the West Virginia Bureau for Public Health regulations prohibits the discharge of sewage into the waters of the state. Assigning any allocation to this category would be condoning a violation of those regulations.

The TMDL calls for a reduction of fecal coliform of 2.24E+14 cfs/yr for agriculture and 1.41E+13 cfs/yr from failing septics for a total reduction of 2.381E+14 cfs/yr from the Indian Creek Watershed.

Table 5: Land use allocations in the TMDL

Sub watershed	Stream Name	Stream Code	Pasture Cropland Baseline Load (counts/yr)	Pasture Cropland Allocated Load (counts/yr)	Total Pasture and Crop Reduction Required (counts/yr)	Pasture Cropland Percent Reduction	Onsite Sewer Systems Baseline Load (counts/yr)	Onsite Sewer Systems Allocated Load (counts/yr)	Onsite Sewer Systems Percent Reduction
1601	Indian Creek	WVKN-51	0.00E+00	0.00E+00	0.00E+00	0.0	1.94E+10	0.00E+00	100
1602	Bradshaw Creek	WVKN-51-A	1.59E+13	3.98E+12	1.19E+13	75.0	1.79E+11	0.00E+00	100
1603	Johnnycake Fork	WVKN-51-A-2	1.40E+13	3.56E+12	1.05E+13	74.7	1.57E+11	0.00E+00	100
1604	Bradshaw Creek	WVKN-51-A	2.25E+13	5.71E+12	1.68E+13	74.7	1.97E+11	0.00E+00	100
1605	Indian Creek	WVKN-51	0.00E+00	0.00E+00	0.00E+00	0.0	3.30E+10	0.00E+00	100
1606	Stinking Lick Creek	WVKN-51-B	4.35E+13	1.12E+13	3.23E+13	74.2	5.58E+11	0.00E+00	100
1607	Indian Creek	WVKN-51	2.72E+11	2.72E+11	0.00E+00	0.0	1.07E+11	0.00E+00	100
1608	Fitz Run	WVKN-51-B.5	4.06E+12	3.29E+12	7.70E+11	18.9	3.30E+11	0.00E+00	100
1609	Indian Creek	WVKN-51	2.27E+13	7.94E+12	1.48E+13	65.0	2.09E+11	0.00E+00	100
1610	Indian Creek	WVKN-51	1.77E+13	8.84E+12	8.82E+12	50.0	1.41E+11	0.00E+00	100
1611	Hans Creek	WVKN-51-D	3.46E+13	1.27E+13	2.19E+13	63.3	3.09E+11	0.00E+00	100
1612	Hans Creek	WVKN-51-D	1.32E+13	3.99E+12	9.24E+12	69.9	2.06E+11	0.00E+00	100
1613	Lick Run	WVKN-51-D-2	1.15E+13	4.60E+12	6.90E+12	60.0	1.33E+11	0.00E+00	100
1615	UNT/Hans Creek RM 11.33	WVKN-51-D-4	6.44E+12	1.61E+12	4.83E+12	75.0	8.08E+10	0.00E+00	100
1616	Hans Creek	WVKN-51-D	9.42E+12	4.84E+12	4.58E+12	48.6	9.73E+10	0.00E+00	100
1617	Hans Creek	WVKN-51-D	1.42E+12	1.42E+12	0.00E+00	0.0	4.68E+10	0.00E+00	100
1618	Blue Lick Creek	WVKN-51-D-1	1.82E+13	8.22E+12	9.95E+12	54.8	2.28E+11	0.00E+00	100
1619	Indian Creek	WVKN-51	1.17E+13	4.90E+12	6.84E+12	58.3	9.56E+10	0.00E+00	100
1620	Slate Run	WVKN-51-F	2.49E+12	1.62E+12	8.70E+11	34.9	1.82E+10	0.00E+00	100
1621	Indian Creek	WVKN-51	4.51E+12	1.86E+12	2.65E+12	58.8	2.96E+10	0.00E+00	100

1622	Indian Draft	WVKN-51-G	2.04E+12	1.44E+12	6.05E+11	29.6	7.74E+10	0.00E+00	100
1623	Indian Draft	WVKN-51-G	6.27E+12	3.80E+12	2.47E+12	39.4	7.74E+10	0.00E+00	100
1624	UNT/Indian Draft RM 1.5	WVKN-51-G-1	2.74E+12	1.37E+12	1.37E+12	50.0	9.11E+09	0.00E+00	100
1625	Indian Creek	WVKN-51	1.80E+11	1.80E+11	0.00E+00	0.0	4.21E+10	0.00E+00	100
1626	Laurel Creek	WVKN-51-H-(S)	2.87E+12	2.43E+12	4.40E+11	15.3	1.14E+11	0.00E+00	100
1627	Laurel Creek	WVKN-51-H-(S)	1.24E+13	6.59E+12	5.80E+12	46.8	1.43E+11	0.00E+00	100
1628	Sarton Branch	WVKN-51-H-1	7.67E+12	3.45E+12	4.22E+12	55.0	1.48E+11	0.00E+00	100
1629	Laurel Creek	WVKN-51-H-(S)	4.45E+12	2.67E+12	1.78E+12	40.0	5.49E+10	0.00E+00	100
1630	Cooks Run	WVKN-51-I	1.43E+12	1.43E+12	0.00E+00	0.0	1.50E+11	0.00E+00	100
1631	Indian Creek	WVKN-51	1.85E+11	1.85E+11	0.00E+00	0.0	7.06E+10	0.00E+00	100
1632	Back Creek	WVKN-51-J	1.14E+13	4.64E+12	6.78E+12	59.4	1.12E+11	0.00E+00	100
1633	Indian Creek	WVKN-51	1.48E+13	1.05E+13	4.29E+12	28.9	2.53E+11	0.00E+00	100
1634	Rock Camp Creek	WVKN-51-K	6.30E+11	6.30E+11	0.00E+00	0.0	6.72E+10	0.00E+00	100
1635	Dropping Lick Creek	WVKN-51-K-1	1.19E+13	8.56E+12	3.38E+12	28.3	2.78E+11	0.00E+00	100
1636	Rock Camp Creek	WVKN-51-K	2.48E+12	1.76E+12	7.20E+11	29.0	7.86E+10	0.00E+00	100
1637	Wiseman Branch	WVKN-51-K-3	1.04E+11	1.04E+11	0.00E+00	0.0	2.43E+10	0.00E+00	100
1638	Rock Camp Creek	WVKN-51-K	2.67E+12	2.04E+12	6.30E+11	23.6	1.07E+11	0.00E+00	100
1639	Indian Creek	WVKN-51	2.18E+13	1.53E+13	6.50E+12	29.8	2.27E+11	0.00E+00	100
1640	Indian Creek	WVKN-51	8.42E+11	8.42E+11	0.00E+00	0.0	4.03E+10	0.00E+00	100
1641	Gin Hollow	WVKN-51-R	2.50E+12	1.33E+12	1.17E+12	46.7	4.54E+09	0.00E+00	100
1642	Earson Hollow (UG)	WVKN-51-R-2-A-(S)	2.51E+13	2.21E+13	3.00E+12	12.0	1.80E+11	0.00E+00	100
1643	Indian Creek	WVKN-51	7.30E+11	7.30E+11	0.00E+00	0.0	2.47E+10	0.00E+00	100
1644	Burnside Branch (UG)	WVKN-51-S-1-(S)	2.39E+13	1.97E+13	4.20E+12	17.6	1.93E+11	0.00E+00	100
1645	Taggart Branch	WVKN-51-S-(S)	2.37E+13	2.15E+13	2.20E+12	9.3	1.61E+11	0.00E+00	100
1646	Turkey Creek	WVKN-51-O	9.46E+12	8.78E+12	6.80E+11	7.2	7.85E+10	0.00E+00	100
1647	Turkey Creek	WVKN-51-O	1.49E+12	1.49E+12	0.00E+00	0.0	1.09E+10	0.00E+00	100
1648	UNT/Turkey Creek RM 7.55	WVKN-51-O-2	1.38E+12	1.16E+12	2.22E+11	16.1	5.26E+10	0.00E+00	100
		Total Reductions Required			2.24E+14		1.41E+13		

Agriculture

The TMDL calls for reductions from agriculture in all but 11 of the 48 SWS subwatersheds, 1601, 1605, 1607, 1617, 1625,1630,1631,1634, 1640, 1643, and 1647, the other subwatersheds contribute to the impairment of Indian Creek. Since Indian Creek is listed as impaired from mouth to headwaters agricultural projects should be considered in all subwatersheds with priority given to those in the high and very high agricultural intensity zones. To meet the TMDL load reduction of 2.24E+14 cts/yr fecal coliform

Per data from the USDA ARS (Agricultural Research Service), cattle produce between 5.4E+9 to 2.1E+10. The medium figure of 1.35E+10 of this range will be used in this watershed based plan for calculating potential load reductions of individual conservation plans.

Example calculation: if a conservation plan restricts 100 head of cattle from a stream and the plan is 95% efficient, then ⟹ 100 head X 1.35E+10 X .95 = 1.28E+12 counts per year load reduction.

USDA ARS Data Regarding Bacteria Production by Species Per Year				
Humans	2.0E+9		Pig	8.9E+9
Chickens	2.4E+8		Sheep	1.8E+10 to 3.7E+10
Cow	5.4E+9 to 2.1E+10		Lamb	1.5E+10
Calf	1.0E+10		Turkey	1.3E+8
Duck	1.1E+10			

It is impossible to develop a true load reduction for each management measure as these management measures must work together in a system to accomplish a single goal. For this reason, the load reductions calculated in this plan utilized a model developed for table 10 to determine how many management measures are necessary to accomplish the goals of the plan.

On-site Wastewater

The TMDL determines the fecal coliform loads by estimating the gallons per day (GPD) of contaminated flow entering the streams. The New River TMDL used a base concentration for raw sewage of 25,000 counts/100ml. To determine the counts per year of fecal coliform the TMDL used the formula:

*Counts/yr = concentration (25,000/100mL) *1000 mL/L*flow gal/day*3.785 L/gal*365day/yr*

The variable for each subwatershed is the flow so the formula becomes: *Counts/yr = Flow (GPD) * 345,381,250.* The TMDL technical document lists the flow for each subwatershed as shown in Table 6.

Table 6: Septic Flow per SWS

SUBID	VL_Flow (gpd)	L_Flow (gpd)	M_Flow (gpd)	H_Flow (gpd)	Total_Flow_gpd
1601	0	0	139.995	0	139.995
1602	0	0	1292.895	0	1292.895
1603	0	0	1136.43	0	1136.43
1604	0	0	1424.655	0	1424.655
1605	0	0	238.815	0	238.815
1606	0	1166.4	2692.845	0	3859.245
1607	0	25.515	749.385	0	774.9
1609	0	0	1515.24	0	1515.24
1610	0	0	1021.14	0	1021.14
1611	0	0	2231.685	0	2231.685
1612	0	0	1490.535	0	1490.535
1613	0	0	963.495	0	963.495
1614	0	0	1103.49	0	1103.49
1615	0	0	584.685	0	584.685
1616	0	3.645	699.975	0	703.62
1617	0	215.055	123.525	0	338.58
1618	0	0	1647	0	1647
1619	0	0	691.74	0	691.74
1620	0	0	131.76	0	131.76
1621	0	0	214.11	0	214.11
1622	0	0	559.98	0	559.98
1623	0	0	559.98	0	559.98
1624	0	0	65.88	0	65.88
1625	0	0	304.695	0	304.695
1626	0	0	823.5	0	823.5
1627	0	0	1037.61	0	1037.61
1628	0	0	1070.55	0	1070.55
1629	0	142.155	255.285	0	397.44
1630	0	0	1087.02	0	1087.02
1631	0	0	510.57	0	510.57
1632	0	32.805	774.09	0	806.895
1633	0	0	1828.17	0	1828.17
1634	0	0	485.865	0	485.865
1635	28.08	386.37	1597.59	0	2012.04
1636	0	0	568.215	0	568.215
1637	0	134.865	41.175	0	176.04
1638	5.265	408.24	362.34	0	775.845
1639	0	120.285	1523.475	0	1643.76
1640	0	291.6	0	0	291.6
1641	0	32.805	0	0	32.805
1642	0	1301.265	0	0	1301.265
1643	0	178.605	0	0	178.605
1644	0	1396.035	0	0	1396.035
1645	0	1038.825	123.525	0	1162.35
1646	0	477.495	90.585	0	568.08
1647	5.265	65.61	8.235	0	79.11

1648	54.405	153.09	172.935	0	380.43
			Total		43996.095

The total septic load equals the load reduction required in the TMDL as shown in Table 7.

Table 7: Septic Load and Reductions Required per SWS

SWS Sub Watershed Name	SWS Stream Code	SWS Sub Number	Total Flow Gal per Day	Baseline Load Counts Per Yr	Counts per Gallon	Load Reduction per system Seasonal Fail	Load Reduction per system Complete Fail	Total 911 Structures
Indian Creek	WVKN-51	1601	139.995	1.94E+10	3.79E+05	9.47E+06	1.89E+07	17
Bradshaw Creek	WVKN-51-A	1602	1292.895	1.79E+11	3.79E+05	9.47E+06	1.89E+07	157
Johnnycake Fork	WVKN-51-A-2	1603	1136.43	1.57E+11	3.79E+05	9.47E+06	1.89E+07	138
Bradshaw Creek	WVKN-51-A	1604	1424.655	1.97E+11	3.79E+05	9.47E+06	1.89E+07	173
Indian Creek	WVKN-51	1605	238.815	3.30E+10	3.79E+05	9.47E+06	1.89E+07	29
Stinking Lick Creek	WVKN-51-B	1606	3859.245	5.58E+11	3.96E+05	9.90E+06	1.98E+07	647
Indian Creek	WVKN-51	1607	774.9	1.07E+11	3.79E+05	9.47E+06	1.89E+07	98
Indian Creek	WVKN-51	1609	1515.24	2.09E+11	3.79E+05	9.47E+06	1.89E+07	184
Indian Creek	WVKN-51	1610	1021.14	1.41E+11	3.79E+05	9.47E+06	1.89E+07	124
Hans Creek	WVKN-51-D	1611	2231.685	3.09E+11	3.79E+05	9.47E+06	1.89E+07	271
Hans Creek	WVKN-51-D	1612	1490.535	2.06E+11	3.79E+05	9.47E+06	1.89E+07	181
Lick Run	WVKN-51-D-2	1613	963.495	1.33E+11	3.79E+05	9.47E+06	1.89E+07	117
Hans Creek	WVKN-51-D	1614	1103.49	1.53E+11	3.79E+05	9.47E+06	1.89E+07	134
UNT/Hans Creek RM 11.33	WVKN-51-D-4	1615	584.685	8.08E+10	3.79E+05	9.47E+06	1.89E+07	71
Hans Creek	WVKN-51-D	1616	703.62	9.73E+10	3.79E+05	9.47E+06	1.89E+07	86
Hans Creek	WVKN-51-D	1617	338.58	4.68E+10	3.79E+05	9.47E+06	1.89E+07	74
Blue Lick Creek	WVKN-51-D-1	1618	1647	2.28E+11	3.79E+05	9.47E+06	1.89E+07	200
Indian Creek	WVKN-51	1619	691.74	9.56E+10	3.79E+05	9.47E+06	1.89E+07	84
Slate Run	WVKN-51-F	1620	131.76	1.82E+10	3.79E+05	9.47E+06	1.89E+07	16
Indian Creek	WVKN-51	1621	214.11	2.96E+10	3.79E+05	9.47E+06	1.89E+07	26
Indian Draft	WVKN-51-G	1622	559.98	7.74E+10	3.79E+05	9.47E+06	1.89E+07	68
Indian Draft	WVKN-51-G	1623	559.98	7.74E+10	3.79E+05	9.47E+06	1.89E+07	68
Laurel Creek	WVKN-51-H-(S)	1626	823.5	1.14E+11	3.79E+05	9.47E+06	1.89E+07	100
Laurel Creek	WVKN-51-H-(S)	1627	1037.61	1.43E+11	3.79E+05	9.47E+06	1.89E+07	126

Sarton Branch	WVKN-51-H-1	1628	1070.55	1.48E+11	3.79E+05	9.47E+06	1.89E+07	130
Laurel Creek	WVKN-51-H-(S)	1629	397.44	5.49E+10	3.79E+05	9.47E+06	1.89E+07	70
Cooks Run	WVKN-51-I	1630	1087.02	1.50E+11	3.79E+05	9.47E+06	1.89E+07	132
Indian Creek	WVKN-51	1631	510.57	7.06E+10	3.79E+05	9.47E+06	1.89E+07	62
Back Creek	WVKN-51-J	1632	806.895	1.12E+11	3.79E+05	9.47E+06	1.89E+07	103
Indian Creek	WVKN-51	1633	1828.17	2.53E+11	3.79E+05	9.47E+06	1.89E+07	222
Rock Camp Creek	WVKN-51-K	1634	485.865	6.72E+10	3.79E+05	9.47E+06	1.89E+07	59
Dropping Lick Creek	WVKN-51-K-1	1635	2012.04	2.78E+11	3.79E+05	9.47E+06	1.89E+07	316
Rock Camp Creek	WVKN-51-K	1636	568.215	7.86E+10	3.79E+05	9.47E+06	1.89E+07	69
Wiseman Branch	WVKN-51-K-3	1637	176.04	2.43E+10	3.79E+05	9.47E+06	1.89E+07	42
Rock Camp Creek	WVKN-51-K	1638	775.845	1.07E+11	3.79E+05	9.47E+06	1.89E+07	159
Indian Creek	WVKN-51	1639	1643.76	2.27E+11	3.79E+05	9.47E+06	1.89E+07	218
Indian Creek	WVKN-51	1640	291.6	4.03E+10	3.79E+05	9.47E+06	1.89E+07	80
Gin Hollow	WVKN-51-R	1641	32.805	4.54E+09	3.79E+05	9.47E+06	1.89E+07	9
Earson Hollow (UG)	WVKN-51-R-2-A-(S)	1642	1301.265	1.80E+11	3.79E+05	9.47E+06	1.89E+07	357
Indian Creek	WVKN-51	1643	178.605	2.47E+10	3.79E+05	9.47E+06	1.89E+07	49
Burnside Branch (UG)	WVKN-51-S-1-(S)	1644	1396.035	1.93E+11	3.79E+05	9.47E+06	1.89E+07	383
Taggart Branch	WVKN-51-S-(S)	1645	1162.35	1.61E+11	3.79E+05	9.47E+06	1.89E+07	300
Turkey Creek	WVKN-51-O	1646	568.08	7.85E+10	3.79E+05	9.47E+06	1.89E+07	142
Turkey Creek	WVKN-51-O	1647	79.11	1.09E+10	3.79E+05	9.47E+06	1.89E+07	22
UNT/Turkey Creek RM 7.55	WVKN-51-O-2	1648	380.43	5.26E+10	3.79E+05	9.47E+06	1.89E+07	94

MANAGEMENT MEASURES

All management measures to be installed to restore these streams must come about with the voluntary cooperation of the landowners. To do this the project managers will offer a variety of practices which can be specifically designed or combined to suit the circumstances for each farm or residence. The two primary causes of impairment per the TMDL are inadequate on-site wastewater treatment (failing septic systems), cropland and livestock pasture.

On-site wastewater treatment:

Two categories of failing septic systems have been identified: completely and periodically failing systems. Experience has shown that completely failing systems usually indicates a lack of any system or one that is so antiquated or poorly maintained it fails on a year-round basis. Periodically failing systems are usually septic systems that are not being properly maintained so that the drain fields are not

functioning as they should and fail during the wet season. To determine the specific needs a field survey must be conducted first to identify problem sites. This will require the participation of the county Health Departments (HD). Once a problem site has been identified a specific project plan can be developed and must be approved by the HD.

Completely failing systems usually require the installation of a new or upgraded system. New or upgraded systems will be installed in compliance with HD regulations based on home size and soil porosity and must be approved by the HD Sanitarian. The average cost for such a project is about $7500 but can range widely due to specific circumstances. Similar efforts in other watersheds throughout the state have used a combination of Section 319 grants administered through DEP and low interest loans from the On-Site Loan Program (OSLP) to fund these system replacements

Periodically failing systems are usually systems where pumping the system combined with proper maintenance will solve the problem. One potential solution that has been used successfully in some Potomac watersheds is to offer residents partial payment coupons for septic tank pumping in combination with an educational effort to inform homeowners how to maintain their system in the future. In most cases this has cost less than $500 per home. Individual costs could be higher due to the remoteness of the residence. Due to the sparse population density in the watershed cluster systems would not be cost effective. However, if the survey shows a grouping of failures in one location such a system could be an option.

Assuming a new system for complete failures and pumping for periodic failures then this plan calls for 2,366 new systems and 1,164 pumping.

Livestock Pasture

To reduce fecal coliform pollution of these streams technicians with the WVCA and the NRCS will work closely with the farmers to develop conservation plans. The goal of these plans will be to install practices that will reduce the time livestock spend in or near a stream or ephemeral drainage. These practices will also have the intent of dispersing the livestock to avoid serious damage from trampling and manure build up. These management measures will be planned to assure they meet the overall load reduction required by the TMDL. These BMPs will be implemented through sound conservation planning and funded by various State and Federal Programs such as, Clean Water Act Section 319 grants USDA Environmental Quality Incentive Program (EQIP) funding for the National Water Quality Initiative (NWQI), EQIP Focused Conservation Approach, and landowner contributions. Where appropriate, these practices will be combined with the stream bank restoration. The result will be a comprehensive conservation plan for each farm.

The following BMP's are practices recommended by NRCS that are necessary to achieve the goals of the TMDL target reductions.

Conservation Plans: A record of landowners' decisions combined with a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality; the plan must meet agency technical standards. These plans include technical advice prepared by a certified

conservation planner. All practices included in the USDA Natural Resources Conservation Service Field Office Technical Guide are eligible to be included in a conservation plan.

Alternative watering sources, with fencing: To reduce occurrences of livestock coming into direct contact with a stream or other waterway, a narrow strip of land along the stream bank can be fenced off. Alternative watering sources, such as spring development and wells with pipelines and troughs, must then be provided for the livestock. This will prevent livestock form defecating in or close to the stream, and reduce stream bank erosion. This includes dry hydrants for any systems that have enough water to support them. Dry hydrants are needed in case of drought conditions. They aid in grass fire suppression and alternative water for livestock during a drought. This reduces erosion common after fires and eliminates the need to allow livestock into the riparian buffer zones for water. NRCS conservation practices that can accomplish this are: 378 Pond, 382 Fence, 516 Pipeline, 533 Pumping Plant for Water Control, 574 Spring Development, 587 Structure for Water Control, 614 Watering Facility, 636Water Harvesting Catchment, 642 Well, 472 Access Control. These practices correspond to BMP efficiencies in Table 12 for: off-site watering systems and fencing.

Heavy Use Area Protection: Practices that restore or put into proper use, areas that are or have been used by large numbers of areas for feeding, walking, loafing. NRCS conservation practices that can accomplish this are: 313 Waste Storage Facility, 342 Critical Area Planting, 484 Mulching, 512 Pasture & Hayland Planting, 528 Prescribed Grazing, 560 Access Road, 561 Heavy Use Area Protection, 575 Animal Trails and Walkways, 561 Heavy Use Area Protection., as well as various erosion and sediment control measures per the WV Erosion and Sediment Control Handbook. These practices correspond to BMP efficiencies in Table 12 for: Sediment Pond/Swale in combination with filter strip and fencing.

Nutrient Management Plans: Farm operators develop a comprehensive plan through traditional and maintaining yield and appropriate ground cover. NRCS conservation practices that can accomplish this are: 100 CNMP Development, 528 Prescribed Grazing, 512 Forage and Biomass Planting, 313 Waste Storage Facility, 316 Animal Mortality Composter, 328 Conservation Crop Rotation, 329 Residue Management, 340 Cover Crop, 590 Nutrient Management, 634 Manure Transfer. These practices correspond to BMP efficiencies in Table 12 for: Waste Stabilization Lagoon and fencing.

Animal Waste Management Systems: livestock and Poultry operators design practices for proper storage, handling, and use of wastes generated from confined animal operations. This includes a means of collecting, scraping, or washing wastes and contaminated runoff from confinement areas into appropriate waste storage structures. For poultry operations, litter sheds are typically used. Livestock feedlots and dairies commonly utilize waste lagoons or move animal feeding areas away from the streamside. NRCS conservation practices that can accomplish this are: 313 Waste Storage Facility, 359 Waste Treatment Lagoon, 651 Heavy Use Area Protection, 367 Roofs and Covers, 558 Roof Runoff Structures, 620 Underground Outlet, 606 Subsurface Drain. These practices correspond to BMP efficiencies in Table 12 for: waste stabilization lagoon and fencing.

Nutrient Relocation: Farm operators who manage waste storage facilities will retain the right to retain all the manure necessary for their own fertilization purposes, but will be willing to give excess manure to

other farmers to spread on hay, pasture, or cropland as an alternative source. NRCS conservation practices that can accomplish this are: 590 Nutrient Management, 634 Manure Transfer. These practices correspond to BMP efficiencies in Table 12 for: Waste Stabilization lagoon and fencing.

Land Use Covenants: These covenants would control or restrict certain land use activities in highly sensitive areas.

Conservation Easements: These easements compensate landowners for voluntarily restricting their activities in sensitive areas.

Riparian Buffer practices: Areas of vegetation (herbaceous or woody) that are tolerant of intermittent flooding or saturated soils and that are established or managed in the transitional zone between terrestrial and aquatic habitats. NRCS conservation practices that can accomplish this are: 314 Brush Management, 390 Riparian Herbaceous Cover, 412 Waterways, 468 Lined Waterways, 490 Tree/Shrub Site Prep, 612 Tree/Shrub Establishment, 391 Riparian Forest Buffer. These practices correspond to BMP efficiencies in Table 12 for: Buffer and fencing.

Filter Strip: A strip or area of herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forestland) and environmentally sensitive areas. NRCS conservation practices that can accomplish this are: 393 Filter Strip. These practices correspond to BMP efficiencies in Table 12 for: Filter Strip and fencing.

Erosion and sediment control: Practices that protect water resources from sediment pollution and increases in runoff associated with land development activities. By retaining soil on-site, sediment and attached nutrients are prevented from leaving disturbed areas and polluting streams. *Examples:* Silt fence, slope drain, permanent vegetation. NRCS conservation practices that can accomplish this are: 342 Critical Area Planting, 395 Stream Habitat Improvement and Management, 580 Streambank and Shoreline Protection, 362 Diversion, and 561 Heavy Use Area Protection. Other practices are available and located in the WV Erosion and Sediment Control Handbook. These practices correspond to BMP efficiencies in Table 12 for: sediment ponds/swale in combination with filter strip.

Looking at projects that we have been done within karst and surface flow landscape like that in Indian Creek watershed then the following types of BMPs are expected:

- Watering systems (pipelines, troughs, spring developments, wells, ponds, etc.)
- Fencing (exclusion for stream protection and divisional for rotation grazing)
- Roofed and un-roofed livestock waste storage facilities
- Nutrient management and Grazing planning

The TMDL calls for an average load reduction of 33.3% from all pasture and cropland in the greater Indian Creek Watershed, this would require 15,391 acres to be impacted by this plan. If farms in this watershed average 100 acres, then 154 farms must be impacted by this plan. To accomplish the required load reductions, the following types and numbers of agricultural BMPs are expected to be installed:

Number of Farms	154
Acres in Conservation/Nutrient Plans	15,391
Exclusion Fence (feet)	642,444
Division Fence (feet)	963,667
Pipeline (feet)	321,222
Water Troughs	923
Waste Storage Facility	2
Stream Crossings	50
Water Development	154

The conservation plans for the 154 farms will be developed to best suit the circumstances and problems for each farm and may include some or all the above mentioned BMPs.

Table 8. Estimated efficiency of specific BMP's for reducing bacteria.

	Conservation Practice System	**Expected Load Reduction**
1	Livestock Exclusion	85%
2	Buffer	85%
3	Buffer with First Flush Prevention	99%
4	Alternative Watering System, Continuous Grazing	50%
5	Alternative Watering System, Rotational Grazing	90%
6	Livestock Waste Storage Facility	90%
7	Fully Implemented Resource Management System	99%

Table 9. Estimated Number of Farms to be Impacted by this Watershed Based Plan by SWS

SUBBASIN	STREAM NAME	WVCODE	Total Pasture/Crop Land	Estimated Number of Farms	Estimated Number of Farms to be Impacted by WBP
1601	Indian Creek	WVKN-51	220.37	2	1
1602	Bradshaw Creek	WVKN-51-A	939.05	9	3
1603	Johnnycake Fork	WVKN-51-A-2	830.11	8	3
1604	Bradshaw Creek	WVKN-51-A	1327.33	13	4
1605	Indian Creek	WVKN-51	50.73	1	0
1606	Stinking Lick Creek	WVKN-51-B	2562.55	26	9
1608	Fitz Run	WVKN-51-B.5	867.20	9	3
1609	Indian Creek	WVKN-51	1337.52	13	4
1610	Indian Creek	WVKN-51	1039.32	10	3
1611	Hans Creek	WVKN-51-D	2193.00	22	7
1612	Hans Creek	WVKN-51-D	779.33	8	3
1613	Lick Run	WVKN-51-D-2	677.19	7	2
1614	Hans Creek	WVKN-51-D	1036.97	10	3
1615	UNT/Hans Creek RM 11.33	WVKN-51-D-4	240.42	2	1
1616	Hans Creek	WVKN-51-D	684.00	7	2

1617	Hans Creek	WVKN-51-D	300.71	3	1
1618	Blue Lick Creek	WVKN-51-D-1	1071.10	11	4
1619	Indian Creek	WVKN-51	692.34	7	2
1620	Slate Run	WVKN-51-F	146.87	1	0
1621	Indian Creek	WVKN-51	314.67	3	1
1622	Indian Draft	WVKN-51-G	337.45	3	1
1623	Indian Draft	WVKN-51-G	396.05	4	1
1624	UNT/Indian Draft RM 1.5	WVKN-51-G-1	215.33	2	1
1625	Indian Creek	WVKN-51	251.40	3	1
1626	Laurel Creek	WVKN-51-H-(S)	1035.09	10	3
1627	Laurel Creek	WVKN-51-H-(S)	1031.15	10	3
1628	Sarton Branch	WVKN-51-H-1	424.65	4	1
1629	Laurel Creek	WVKN-51-H-(S)	246.61	2	1
1630	Cooks Run	WVKN-51-I	423.31	4	1
1631	Indian Creek	WVKN-51	351.68	4	1
1632	Back Creek	WVKN-51-J	905.93	9	3
1633	Indian Creek	WVKN-51	1373.33	14	5
1634	Rock Camp Creek	WVKN-51-K	186.01	2	1
1635	Dropping Lick Creek	WVKN-51-K-1	982.20	10	3
1636	Rock Camp Creek	WVKN-51-K	187.77	2	1
1637	Wiseman Branch	WVKN-51-K-3	53.00	1	0
1638	Rock Camp Creek	WVKN-51-K	441.42	4	1
1639	Indian Creek	WVKN-51	1271.39	13	4
1640	Indian Creek	WVKN-51	419.37	4	1
1641	Gin Hollow	WVKN-51-R	122.28	1	0
1642	Earson Hollow (UG)	WVKN-51-R-2-A-(S)	4887.31	49	16
1643	Indian Creek	WVKN-51	170.80	2	1
1644	Burnside Branch (UG)	WVKN-51-S-1-(S)	4989.46	50	17
1645	Taggart Branch	WVKN-51-S-(S)	5000.11	50	17
1646	Turkey Creek	WVKN-51-O	1580.37	16	5
1647	Turkey Creek	WVKN-51-O	314.74	3	1
1648	UNT/Turkey Creek RM 7.55	WVKN-51-O-2	418.94	4	1
		Total	46221	462	154
		33.3% of Total	15392	154	

The below chart, table 10, models the total number of BMP's that will be required to implement this plan. It assumes that the average farm size in the watershed is 100 acres. 100 acres squared has four sides 2,087 feet long. This model assumes that each farm has a stream requiring each side excluded from livestock and runs the length of the farm. It also assumes that three division fences the length of

the farm will also be installed. The assumption for a watering system includes a pipeline the length of the farm, six water troughs and one water development. It is also assumed that 1% of all farms will require a waste storage facility and one third of the farms will require a stream crossing.

Table 10. BMP implementation

SUB	STREAM NAME	Estimated Number of Farms to be Impacted by WBP	Estimated Exclusion Fence	Estimated Division Fence	Estimated Water Pipeline	Estimated Water Troughs	Estimated Water Development	Estimated Waste Storage Facilities	Estimated Stream Crossings
1601	Indian Creek	0.73	3063.02	4594.52	1531.51	4.40	0.73	0.01	0.24
1602	Bradshaw Creek	3.13	13052.25	19578.38	6526.13	18.76	3.13	0.03	1.03
1603	Johnnycake Fork	2.76	11538.05	17307.07	5769.02	16.59	2.76	0.03	0.91
1604	Bradshaw Creek	4.42	18449.12	27673.68	9224.56	26.52	4.42	0.04	1.46
1605	Indian Creek	0.17	705.12	1057.68	352.56	1.01	0.17	0.00	0.06
1606	Stinking Lick Creek	8.53	35617.96	53426.94	17808.98	51.20	8.53	0.09	2.82
1607	Indian Creek	2.97	12412.88	18619.32	6206.44	17.84	2.97	0.03	0.98
1608	Fitz Run	2.89	12053.58	18080.37	6026.79	17.33	2.89	0.03	0.95
1609	Indian Creek	4.45	18590.75	27886.13	9295.38	26.72	4.45	0.04	1.47
1610	Indian Creek	3.46	14445.95	21668.92	7222.97	20.77	3.46	0.03	1.14
1611	Hans Creek	7.30	30481.43	45722.14	15240.71	43.82	7.30	0.07	2.41
1612	Hans Creek	2.60	10832.23	16248.35	5416.12	15.57	2.60	0.03	0.86
1613	Lick Run	2.26	9412.55	14118.82	4706.27	13.53	2.26	0.02	0.74
1614	Hans Creek	3.45	14413.28	21619.92	7206.64	20.72	3.45	0.03	1.14
1615	UNT/Hans Creek RM 11.33	0.80	3341.70	5012.55	1670.85	4.80	0.80	0.01	0.26
1616	Hans Creek	2.28	9507.20	14260.80	4753.60	13.67	2.28	0.02	0.75
1617	Hans Creek	1.00	4179.69	6269.54	2089.85	6.01	1.00	0.01	0.33
1618	Blue Lick Creek	3.57	14887.67	22331.50	7443.83	21.40	3.57	0.04	1.18
1619	Indian Creek	2.31	9623.12	14434.69	4811.56	13.83	2.31	0.02	0.76
1620	Slate Run	0.49	2041.41	3062.11	1020.70	2.93	0.49	0.00	0.16
1621	Indian Creek	1.05	4373.73	6560.60	2186.87	6.29	1.05	0.01	0.35
1622	Indian Draft	1.12	4690.36	7035.54	2345.18	6.74	1.12	0.01	0.37
1623	Indian Draft	1.32	5504.87	8257.30	2752.43	7.91	1.32	0.01	0.44
1624	UNT/Indian Draft RM 1.5	0.72	2992.96	4489.44	1496.48	4.30	0.72	0.01	0.24
1625	Indian Creek	0.84	3494.31	5241.47	1747.16	5.02	0.84	0.01	0.28
1626	Laurel Creek	3.45	14387.15	21580.73	7193.58	20.68	3.45	0.03	1.14
1627	Laurel Creek	3.43	14332.39	21498.58	7166.19	20.60	3.43	0.03	1.13
1628	Sarton Branch	1.41	5902.39	8853.58	2951.19	8.48	1.41	0.01	0.47

1629	Laurel Creek	0.82	3427.74	5141.60	1713.87	4.93	0.82	0.01	0.27
1630	Cooks Run	1.41	5883.76	8825.65	2941.88	8.46	1.41	0.01	0.47
1631	Indian Creek	1.17	4888.15	7332.22	2444.07	7.03	1.17	0.01	0.39
1632	Back Creek	3.02	12591.90	18887.85	6295.95	18.10	3.02	0.03	1.00
1633	Indian Creek	4.57	19088.49	28632.74	9544.25	27.44	4.57	0.05	1.51
1634	Rock Camp Creek	0.62	2585.43	3878.15	1292.72	3.72	0.62	0.01	0.20
1635	Dropping Lick Creek	3.27	13652.01	20478.02	6826.01	19.62	3.27	0.03	1.08
1636	Rock Camp Creek	0.63	2609.89	3914.84	1304.95	3.75	0.63	0.01	0.21
1637	Wiseman Branch	0.18	736.67	1105.00	368.33	1.06	0.18	0.00	0.06
1638	Rock Camp Creek	1.47	6135.48	9203.22	3067.74	8.82	1.47	0.01	0.49
1639	Indian Creek	4.23	17671.58	26507.38	8835.79	25.40	4.23	0.04	1.40
1640	Indian Creek	1.40	5829.00	8743.50	2914.50	8.38	1.40	0.01	0.46
1641	Gin Hollow	0.41	1699.62	2549.43	849.81	2.44	0.41	0.00	0.13
1642	Earson Hollow (UG)	16.27	67930.77	101896.16	33965.39	97.65	16.27	0.16	5.37
1643	Indian Creek	0.57	2374.02	3561.03	1187.01	3.41	0.57	0.01	0.19
1644	Burnside Branch (UG)	16.61	69350.60	104025.90	34675.30	99.69	16.61	0.17	5.48
1645	Taggart Branch	16.65	69498.63	104247.94	34749.31	99.90	16.65	0.17	5.49
1646	Turkey Creek	5.26	21966.23	32949.34	10983.11	31.58	5.26	0.05	1.74
1647	Turkey Creek	1.05	4374.70	6562.06	2187.35	6.29	1.05	0.01	0.35
1648	UNT/Turkey Creek RM 7.55	1.40	5823.02	8734.53	2911.51	8.37	1.40	0.01	0.46
Total		153.92	642444.81	963667.22	321222.41	923.50	153.92	1.54	50.79

TECHNICAL AND FINANCIAL RESOURCES

Technical Resources and Partners: The partnering state and federal agencies, and non-profit organizations may contribute a variety of services to projects associated with this plan. Some of these partners provide services with implementing conservation practices, monitoring, data evaluation, providing materials, planning assistance, general labor, etc. Their services are vital to the timely implementation of this plan allowing for faster action and more effective scheduling of Best Management Practice construction. When necessary, these contributing partners will be compensated for their expenses encored. Partners include but may not be limited to:

West Virginia Conservation Agency (WVCA) – The WVCA will be the applicant for CWA Section 319 grants on this effort and will provide the technical assistance needed for implementation. The WVCA coordinates statewide conservation efforts to conserve natural resources, control floods, prevent

impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife and assist farmers with conservation practices. The WVCA Conservation Specialists (CS) will coordinate with other agencies and work directly with landowners to implement the practices called for in this watershed based plan. The WVCA CS will also conduct monitoring to track the progress of projects throughout the implementation phase of the projects. They will also produce grant proposals and status reports.

The Natural Resources Conservation Service (NRCS) – The NRCS is the federal agency that works directly with farmers for designing and installing practices. In West Virginia, they work closely with the WVCA for engineering, funding, and installing BMPs. The NRCS also implements the Conservation Reserve Enhancement Program (CREP). NRCS will also seek NWQI funding as well as develop EQIP Focused Conservation Approach grants to implement agricultural best management practices.

The West Virginia Department of Environmental Protection (DEP) – The DEP is the agency with primary responsibility for protecting the environment including stream water quality. The Nonpoint Source Program (NPS) within the DEP administers the Section 319 grants and the Basin Coordinators in the program work closely with project managers to accomplish the approved watershed based plans including assistance, if needed, with monitoring. The NPS also has experience and materials for outreach, education and volunteer monitoring. The Watershed Assessment Branch (WAB) includes the programs that develop the integrated watershed report with the 303(d) list of impaired streams, the TMDL and conduct water quality monitoring around the state. After completion of the installation of practices it will be WAB that makes the final determination if the TMDL has been fully implemented.

The Monroe County Health Departments (HD) – The HD has the primary responsibility of inspecting and approving all on-site wastewater systems in their counties. The HD will have to conduct the initial survey to locate failing on-site systems. Through their contacts with homeowners the education of how to maintain an on-site system will be affected. The HD Sanitarian will have to select, inspect and approve all practices to be used in the treatment of failing septic systems.

The U.S. Fish and Wildlife Service (USF&W) – Working through their partners for fish and wildlife program, the USF&W maintain a cooperative agreement with Trout Unlimited (TU) to provide a conservation fencing crew which will install exclusion and division fence for projects at rates close to the cost share amount.

West Virginia University Institute for Water Security and Science (IWSS) – The IWSS provides services to monitor water quality from a scientific approach and help determine cause and sources of non-point pollution utilizing a scale nested watershed model approach.

Greenbrier Valley Conservation District – The (GVCD) provides a variety of services including education and outreach for conservation issues, technical assistance with forage, fecal, and water sampling, grassland management, and equipment rentals. The GVCD also maintains an engineering and environmental consulting firm on retainer for situations when outside assistance is necessary.

West Virginia Rivers Coalition – West Virginia Rivers Coalition administers the WV Water Quality Monitoring Program with partnership with Trout Unlimited. There are currently 7 monitoring sites in Indian Creek Watershed. The sites are monitored to collect baseline data including temperature, pH, conductivity and turbidity. WV Rivers also provides technical assistance on water quality issues to Indian Creek Watershed Association.

Indian Creek Watershed Association – The ICWA is a local non-profit citizens group that provides education and leadership to preserve and protect the water of the Indian Creek watershed

Financial Resources

Clean Water Act Section 319 Grants – 319 funds are provided to the state by the US Environmental Protection Agency (EPA). In West Virginia, these funds are distributed by the DEP for agencies or organizations who are conducting projects related to nonpoint source pollution.

The WVCA – provides matching funds by way of cost share and in-kind contributions for agricultural and septic practices associated with an approved Section 319 grant proposal. This match can be in the form of financial assistance for BMP's, but most often is in the form of in-kind technical assistance and staff time.

Conservation Reserve Enhancement Program (CREP) – CREP is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP addresses high-priority conservation issues in priority watersheds as designated by the NRCS State Conservationist.

Environmental Quality Incentive Program (EQIP) – EQIP is a voluntary conservation program that aids farmers who face threats to soil, water, air, and related natural resources on their land. The NRCS through EQIP offers financial and technical assistance to eligible participants to install or implement structural and management practices to promote agricultural production and optimize environmental benefits to help farmers meet environmental requirements on eligible agricultural land.

Budget

The following budget estimates the total cost of the Indian Creek TMDL implementation. The BMPs listed are a best estimate of the BMPs needed for enough comprehensive conservation plans and septic system improvements to reduce fecal coliform bacteria by the 33% called for in the TMDL.

The estimated total cost for agricultural practices is $7,134,430. Much of the agricultural funds for this would come from federal sources such as USDA EQIP NWQI and Focused Conservation approach. The WVCA will apply for CWA 319 funding to address the septic issues and funds for special agricultural projects that cannot fall under the NRCS programs. The total estimated cost for septic practices is $17,144,000. This makes the grand total cost of the watershed based plan $24,278,430

Complete Septic System Repair	2366	$7,000	$16,562,000
Septic System Pumping	1164	$500	$582,000
Total			$17,144,000

Table 11. Budget for agricultural practices

SUB	STREAM NAME	Estimated Cost of Exclusion Fence ($2.82 ft)	Estimated Cost of Division Fence($2.82 ft)	Estimated Cost of Pipeline ($2.45 ft)	Estimated Cost of Water Troughs ($1642 each)	Estimated Cost of Water Developments ($10,000 each)	Estimated Cost of Waste Storage Facilities ($10,000 Each)	Estimated Cost of Stream Crossings ($5,000 Each)	Total Per SWS
1601	Indian Creek	$8,638	$12,957	$3,752	$7,230	$7,338	$73	$1,211	$50,396
1602	Bradshaw Creek	$36,807	$55,211	$15,989	$30,808	$31,270	$10,000	$5,160	$224,438
1603	Johnnycake Fork	$32,537	$48,806	$14,134	$27,234	$27,643	$276	$4,561	$189,837
1604	Bradshaw Creek	$52,027	$78,040	$22,600	$43,546	$44,200	$442	$7,293	$303,545
1605	Indian Creek	$1,988	$2,983	$864	$1,664	$1,689	$17	$279	$11,601
1606	Stinking Lick Creek	$100,443	$150,664	$43,632	$84,070	$85,333	$853	$14,080	$586,025
1607	Indian Creek	$35,004	$52,506	$15,206	$29,298	$29,739	$297	$4,907	$204,230
1608	Fitz Run	$33,991	$50,987	$14,766	$28,450	$28,878	$289	$4,765	$198,319
1609	Indian Creek	$52,426	$78,639	$22,774	$43,880	$44,539	$445	$7,349	$305,875
1610	Indian Creek	$40,738	$61,106	$17,696	$34,097	$34,609	$346	$5,711	$237,680
1611	Hans Creek	$85,958	$128,936	$37,340	$71,946	$73,027	$730	$12,049	$501,514
1612	Hans Creek	$30,547	$45,820	$13,269	$25,568	$25,952	$260	$4,282	$178,224
1613	Lick Run	$26,543	$39,815	$11,530	$22,217	$22,550	$226	$3,721	$154,865
1614	Hans Creek	$40,645	$60,968	$17,656	$34,020	$34,531	$345	$5,698	$237,143
1615	UNT/Hans Creek RM 11.33	$9,424	$14,135	$4,094	$7,887	$8,006	$80	$1,321	$54,981
1616	Hans Creek	$26,810	$40,215	$11,646	$22,440	$22,777	$228	$3,758	$156,423
1617	Hans Creek	$11,787	$17,680	$5,120	$9,865	$10,014	$100	$1,652	$68,769
1618	Blue Lick Creek	$41,983	$62,975	$18,237	$35,140	$35,668	$357	$5,885	$244,948
1619	Indian Creek	$27,137	$40,706	$11,788	$22,714	$23,055	$231	$3,804	$158,330
1620	Slate Run	$5,757	$8,635	$2,501	$4,818	$4,891	$49	$807	$33,587
1621	Indian Creek	$12,334	$18,501	$5,358	$10,323	$10,479	$105	$1,729	$71,961
1622	Indian Draft	$13,227	$19,840	$5,746	$11,071	$11,237	$112	$1,854	$77,171
1623	Indian Draft	$15,524	$23,286	$6,743	$12,993	$13,188	$132	$2,176	$90,572
1624	UNT/Indian Draft RM 1.5	$8,440	$12,660	$3,666	$7,064	$7,170	$72	$1,183	$49,243
1625	Indian Creek	$9,854	$14,781	$4,281	$8,248	$8,372	$84	$1,381	$57,492
1626	Laurel Creek	$40,572	$60,858	$17,624	$33,958	$34,468	$345	$5,687	$236,713
1627	Laurel Creek	$40,417	$60,626	$17,557	$33,829	$34,337	$343	$5,666	$235,812
1628	Sarton Branch	$16,645	$24,967	$7,230	$13,932	$14,141	$141	$2,333	$97,113
1629	Laurel Creek	$9,666	$14,499	$4,199	$8,091	$8,212	$82	$1,355	$56,397
1630	Cooks Run	$16,592	$24,888	$7,208	$13,888	$14,096	$141	$2,326	$96,806
1631	Indian Creek	$13,785	$20,677	$5,988	$11,538	$11,711	$117	$1,932	$80,425
1632	Back Creek	$35,509	$53,264	$15,425	$29,721	$30,167	$302	$4,978	$207,176
1633	Indian Creek	$53,830	$80,744	$23,383	$45,055	$45,732	$457	$7,546	$314,065
1634	Rock Camp Creek	$7,291	$10,936	$3,167	$6,102	$6,194	$62	$1,022	$42,538
1635	Dropping Lick Creek	$38,499	$57,748	$16,724	$32,223	$32,707	$327	$5,397	$224,618
1636	Rock Camp Creek	$7,360	$11,040	$3,197	$6,160	$6,253	$63	$1,032	$42,941
1638	Rock Camp Creek	$17,302	$25,953	$7,516	$14,482	$14,699	$147	$2,425	$100,948
1639	Indian Creek	$49,834	$74,751	$21,648	$41,711	$42,337	$423	$6,986	$290,752
1640	Indian Creek	$16,438	$24,657	$7,141	$13,758	$13,965	$140	$2,304	$95,905
1641	Gin Hollow	$4,793	$7,189	$2,082	$4,012	$4,072	$41	$672	$27,964
1642	Earson Hollow (UG)	$191,565	$287,347	$83,215	$160,339	$162,747	$1,627	$26,853	$1,117,671
1643	Indian Creek	$6,695	$10,042	$2,908	$5,603	$5,688	$57	$938	$39,060
1644	Burnside Branch (UG)	$195,569	$293,353	$84,954	$163,690	$166,149	$1,661	$27,415	$1,141,032

1645	Taggart Branch	$195,986	$293,979	$85,136	$164,039	$166,504	$1,665	$27,473	$1,143,467
1646	Turkey Creek	$61,945	$92,917	$26,909	$51,847	$52,626	$526	$8,683	$361,412
1647	Turkey Creek	$12,337	$18,505	$5,359	$10,326	$10,481	$105	$1,729	$71,977
1648	UNT/Turkey Creek RM 7.55	$16,421	$24,631	$7,133	$13,744	$13,951	$140	$2,302	$95,807
Totals		$1,811,694	$2,717,542	$786,995	$1,516,379	$1,539,159	$25,079	$253,961	
					Grand Total for Agriculture	$7,134,430			

Socioeconomic

Monroe County of WV produces $8,757,500 of grassland pasture and crops annually per the National Agricultural Statistics Survey in 2015. Since Indian Creeks agricultural land makes up 31% of the total farmland in the county is can only be assumed that it is responsible for the same percentage of agricultural production. This means that the watershed produces $2,798,729 of the county's agricultural value. It has been found in adjacent watersheds with similar resource concerns that the implementation of Best Management Practices typically results in a minimum of 25% increase in production rates. This would indicate that with full implementation of this watershed based plan, there would be a total increase in annual production of $699,682 bringing the watersheds total contribution to the county's agricultural economy to $3,498,412. Table 12 shows these impacts of each individual sub-watershed in this situation. Additionally, the funds allocated to implementing this plan will be mostly paid to local venders and contractors, providing jobs and continued success to small businesses.

Table 12. Economic impacts

SUB	STREAM NAME	WVCODE	% of Monroe County Farmland	Current Contribution to Monroe County farm economy	Indian Creek Farm Economic Value With 25% Improvements Due to BMP Instillation	Total Net Increase in Economic Contribution to Monroe County GDP Post BMP Instillation
1601	Indian Creek	WVKN-51	0.15	$13,344	$16,679.55	$3,335.91
1602	Bradshaw Creek	WVKN-51-A	0.65	$56,860	$71,075.59	$14,215.12
1603	Johnnycake Fork	WVKN-51-A-2	0.57	$50,264	$62,830.05	$12,566.01
1604	Bradshaw Creek	WVKN-51-A	0.92	$80,371	$100,464.05	$20,092.81
1605	Indian Creek	WVKN-51	0.04	$3,072	$3,839.69	$767.94
1606	Stinking Lick Creek	WVKN-51-B	1.77	$155,165	$193,956.40	$38,791.28
1607	Indian Creek	WVKN-51	0.62	$54,075	$67,593.91	$13,518.78
1608	Fitz Run	WVKN-51-B.5	0.60	$52,510	$65,637.35	$13,127.47
1609	Indian Creek	WVKN-51	0.92	$80,988	$101,235.32	$20,247.06
1611	Hans Creek	WVKN-51-D	1.52	$132,788	$165,985.60	$33,197.12
1612	Hans Creek	WVKN-51-D	0.54	$47,189	$58,986.57	$11,797.31
1613	Lick Run	WVKN-51-D-2	0.47	$41,005	$51,255.72	$10,251.14
1614	Hans Creek	WVKN-51-D	0.72	$62,790	$78,487.04	$15,697.41
1615	UNT/Hans Creek RM 11.33	WVKN-51-D-4	0.17	$14,558	$18,197.11	$3,639.42
1616	Hans Creek	WVKN-51-D	0.47	$41,417	$51,771.16	$10,354.23
1617	Hans Creek	WVKN-51-D	0.21	$18,208	$22,760.39	$4,552.08
1618	Blue Lick Creek	WVKN-51-D-1	0.74	$64,856	$81,070.30	$16,214.06
1619	Indian Creek	WVKN-51	0.48	$41,922	$52,402.40	$10,480.48
1620	Slate Run	WVKN-51-F	0.10	$8,893	$11,116.42	$2,223.28
1621	Indian Creek	WVKN-51	0.22	$19,054	$23,817.00	$4,763.40
1622	Indian Draft	WVKN-51-G	0.23	$20,433	$25,541.19	$5,108.24
1623	Indian Draft	WVKN-51-G	0.27	$23,981	$29,976.56	$5,995.31
1624	UNT/Indian Draft RM 1.5	WVKN-51-G-1	0.15	$13,038	$16,298.08	$3,259.62
1625	Indian Creek	WVKN-51	0.17	$15,223	$19,028.17	$3,805.63
1626	Laurel Creek	WVKN-51-H-(S)	0.72	$62,676	$78,344.75	$15,668.95
1627	Laurel Creek	WVKN-51-H-(S)	0.71	$62,437	$78,046.53	$15,609.31
1628	Sarton Branch	WVKN-51-H-1	0.29	$25,713	$32,141.26	$6,428.25
1629	Laurel Creek	WVKN-51-H-(S)	0.17	$14,932	$18,665.62	$3,733.12
1630	Cooks Run	WVKN-51-I	0.29	$25,632	$32,039.84	$6,407.97

1631	Indian Creek	WVKN-51	0.24	$21,295	$26,618.25	$5,323.65
1632	Back Creek	WVKN-51-J	0.63	$54,855	$68,568.78	$13,713.76
1633	Indian Creek	WVKN-51	0.95	$83,157	$103,945.74	$20,789.15
1634	Rock Camp Creek	WVKN-51-K	0.13	$11,263	$14,078.88	$2,815.78
1635	Dropping Lick Creek	WVKN-51-K-1	0.68	$59,473	$74,341.57	$14,868.31
1636	Rock Camp Creek	WVKN-51-K	0.13	$11,370	$14,212.09	$2,842.42
1637	Wiseman Branch	WVKN-51-K-3	0.04	$3,209	$4,011.51	$802.30
1638	Rock Camp Creek	WVKN-51-K	0.31	$26,728	$33,410.56	$6,682.11
1639	Indian Creek	WVKN-51	0.88	$76,984	$96,230.02	$19,246.00
1640	Indian Creek	WVKN-51	0.29	$25,393	$31,741.62	$6,348.32
1641	Gin Hollow	WVKN-51-R	0.08	$7,404	$9,255.23	$1,851.05
1642	Earson Hollow (UG)	WVKN-51-R-2-A-(S)	3.38	$295,932	$369,914.76	$73,982.95
1643	Indian Creek	WVKN-51	0.12	$10,342	$12,927.65	$2,585.53
1644	Burnside Branch (UG)	WVKN-51-S-1-(S)	3.45	$302,117	$377,646.37	$75,529.27
1645	Taggart Branch	WVKN-51-S-(S)	3.46	$302,762	$378,452.46	$75,690.49
1646	Turkey Creek	WVKN-51-O	1.09	$95,693	$119,616.35	$23,923.27
1647	Turkey Creek	WVKN-51-O	0.22	$19,058	$23,822.30	$4,764.46
1648	UNT/Turkey Creek RM 7.55	WVKN-51-O-2	0.29	$25,367	$31,709.08	$6,341.82
Totals		Total	31.96	$2,798,729	$3,498,412	$699,682

Total economic impact of this plan must also consider the value of the resources that are being protected and conserved. This entire plan addresses 46221 acres of agricultural land that is subject to erosion, if 5 tons of soil are saved per acre then 231,105 tons of sediment will be prevented from entering the waterway. To re-establish this soil would cost $35 per ton, thus the in-kind value of sediment reductions and erosion control resulting from this plan is approximately $8,088,675. It is expected that the value of nutrients prevented from running off, and utilized for forage production in upland situations, along with the value of the bacteria reduction in the waterways (expressed as 2 X P2O4 in accordance to the Chesapeake Bay model) could exceed $500,000. This figure could only be calculated with extensive soil modeling of the watershed. This brings the annual sustained economic impact of this plan to be approximately $9,288,357. Combine this with $7,134,430 of BMP funding (projected value of this plan) stimulating the economy over 11 years ($648,584 annually), the total annual economic impact of this plan comes to $9,936,941.

Socially, the mass implementation of best management practices promotes a heightened awareness of water quality and environmental issues. It also provides an educational experience with the next generation of farmers. These future farmers will begin to understand that farming with BMP's is a new norm and should be firsthand knowledge for the farms of the future.

SCHEDULES AND MILESTONES

The Indian Creek restoration effort will be presented to the residents of the watershed as a three-way split effort divided by fecal coliform sources and program functions. Since the watershed is divided into 48 sub-watersheds, the effort will be phased in beginning with Upper Indian Creek, then Middle Indian Creek and finally Lower Indian Creek. This will allow effort will begin with the upper most karst region, then progress downstream from head to mouth over a 10-year period. USDA NRCS will begin the effort in the first quarter of 2017 with a public outreach campaign and concentrating Environmental Quality Incentive Program Funding through the National Water Quality Initiative (NWQI) in this area with a focus on conservation planning. Funding of these conservation plans will begin in 2018. Utilizing 319 grant

funding, the WVCA will follow this with completing the conservation plan implementation and installing additional water quality improvement practices such as buffer development, fencing, and stream restoration where needed to assure no holes will be left in the conservation effort. To continue this effort, USDA NRCS will either continuing utilizing its NWQI or its Focused Conservation approach to the EQIP to address efforts in the middle and lower section of the watershed. Participation in the effort is voluntary as there is no regulatory authority in implementing this effort.

The implementation schedule is set to coincide with the §319 grant funding cycle. After the submission of this WBP there will be periods of review, comment, editing and final approval. It is expected that the first opportunity to submit a §319 grant proposal will be in the third quarter of 2018. If approved funding should become available by the second quarter of 2019. Therefore, the implementation schedule is set to begin in the third quarter of 2019. The expectation is that 2018 and part of 2019 will be a period of introducing the residents to the effort with the first installation of BMPs not expected until the second or third quarter of 2019. Table 13 shows the expected timeframe for this restoration effort.

Table 13: Implementation Schedule

Upper Indian Creek, NWQI and 319
Middle Indian Creek, Focused Conservation and 319
Lower Indian Creek, Concentrated Conservation and 319
Post Monitoring, 319

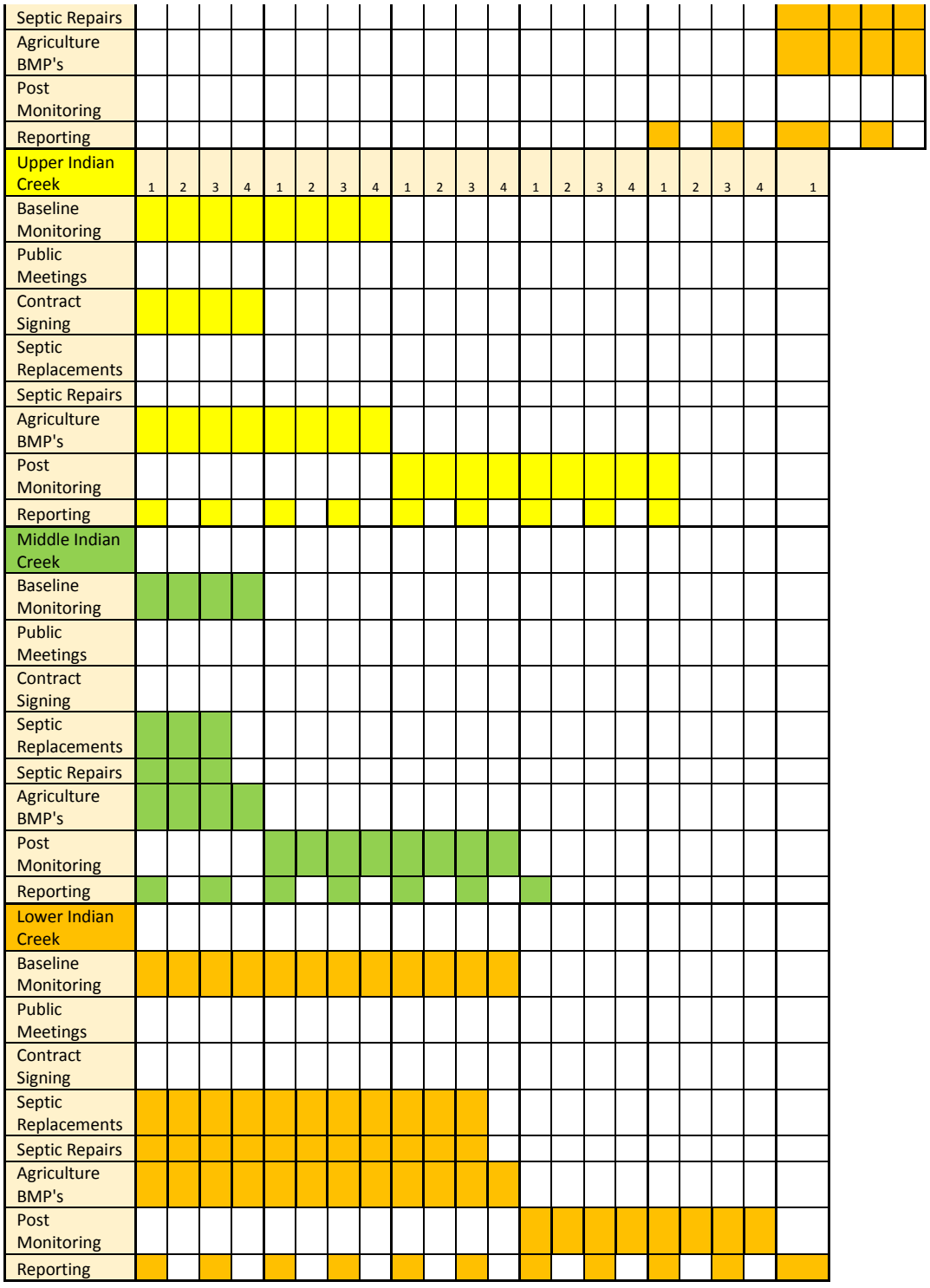
Stream Name	Sub watershed	Stream Code	Load Reduction Goal Agriculture	Load Reduction Goal Septic	Timeline for Project Implementation										
					2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Back Creek	1632	WVKN-51-J	6.8E+12	1.12E+11											
Blue Lick Creek	1618	WVKN-51-D-1	1.0E+13	2.28E+11											
Bradshaw Creek	1602	WVKN-51-A	1.2E+13	1.79E+11											
Bradshaw Creek	1604	WVKN-51-A	1.7E+13	1.97E+11											
Burnside Branch	1644	WVKN-51-S-1-(S)	4.2E+12	1.93E+11											
Cooks Run	1630	WVKN-51-I	0.0E+00	1.50E+11											
Dropping Lick Creek	1635	WVKN-51-K-1	3.4E+12	2.78E+11											
Earson Hollow	1642	WVKN-51-R-2-A-(S)	3.0E+12	1.80E+11											

Fitz Run	1608	WVKN-51-B.5	7.7E+11	3.30E+11										
Gin Hollow	1641	WVKN-51-R	1.2E+12	4.54E+09										
Hans Creek	1611	WVKN-51-D	2.2E+13	3.09E+11										
Hans Creek	1612	WVKN-51-D	9.2E+12	2.06E+11										
Hans Creek	1616	WVKN-51-D	4.6E+12	9.73E+10										
Hans Creek	1617	WVKN-51-D	0.0E+00	4.68E+10										
UNT/Hans Creek	1615	WVKN-51-D-4	4.8E+12	8.08E+10										
Indian Creek	1601	WVKN-51	0.0E+00	1.94E+10										
Indian Creek	1605	WVKN-51	0.0E+00	3.30E+10										
Indian Creek	1607	WVKN-51	0.0E+00	1.07E+11										
Indian Creek	1609	WVKN-51	1.5E+13	2.09E+11										
Indian Creek	1610	WVKN-51	8.8E+12	1.41E+11										
Indian Creek	1619	WVKN-51	6.8E+12	9.56E+10										
Indian Creek	1621	WVKN-51	2.7E+12	2.96E+10										
Indian Creek	1625	WVKN-51	0.0E+00	4.21E+10										
Indian Creek	1631	WVKN-51	0.0E+00	7.06E+10										
Indian Creek	1633	WVKN-51	4.3E+12	2.53E+11										
Indian Creek	1639	WVKN-51	6.5E+12	2.27E+11										
Indian Creek	1640	WVKN-51	0.0E+00	4.03E+10										
Indian Creek	1643	WVKN-51	0.0E+00	2.47E+10										
Indian Draft	1622	WVKN-51-G	6.1E+11	7.74E+10										
Indian Draft	1623	WVKN-51-G	2.5E+12	7.74E+10										
UNT/Indian Draft	1624	WVKN-51-G-1	1.4E+12	9.11E+09										
Johnnycake Fork	1603	WVKN-51-A-2	1.0E+13	1.57E+11										
Laurel Creek	1626	WVKN-51-H-(S)	4.4E+11	1.14E+11										
Laurel Creek	1627	WVKN-51-H-(S)	5.8E+12	1.43E+11										
Laurel Creek	1629	WVKN-51-H-(S)	1.8E+12	5.49E+10										
Lick Run	1613	WVKN-51-D-2	6.9E+12	1.33E+11										
Rock Camp Creek	1634	WVKN-51-K	0.0E+00	6.72E+10										
Rock Camp Creek	1636	WVKN-51-K	7.2E+11	7.86E+10										
Rock Camp Creek	1638	WVKN-51-K	6.3E+11	1.07E+11										
Sarton Branch	1628	WVKN-51-H-1	4.2E+12	1.48E+11										

Slate Run	1620	WVKN-51-F	8.7E+11	1.82E+10	
Stinking Lick Creek	1606	WVKN-51-B	3.2E+13	5.58E+11	
Taggart Branch	1645	WVKN-51-S-(S)	2.2E+12	1.61E+11	
Turkey Creek	1646	WVKN-51-O	6.8E+11	7.85E+10	
Turkey Creek	1647	WVKN-51-O	0.0E+00	1.09E+10	
UNT/Turkey Creek	1648	WVKN-51-O-2	2.2E+11	5.26E+10	
Wiseman Branch	1637	WVKN-51-K-3	0.0E+00	2.43E+10	

Table 14. Implementation continued

	2018				2019				2020				2021				2022				2023			
	Quarter				Quarter				Quarter				Quarter				Quarter				Quarter			
Upper Indian Creek	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Baseline Monitoring																								
Public Meetings																								
Contract Signing																								
Septic Replacements																								
Septic Repairs																								
Agriculture BMP's																								
Post Monitoring																								
Reporting																								
Middle Indian Creek																								
Baseline Monitoring																								
Public Meetings																								
Contract Signing																								
Septic Replacements																								
Septic Repairs																								
Agriculture BMP's																								
Post Monitoring																								
Reporting																								
Lower Indian Creek																								
Baseline Monitoring																								
Public Meetings																								
Contract Signing																								
Septic Replacements																								

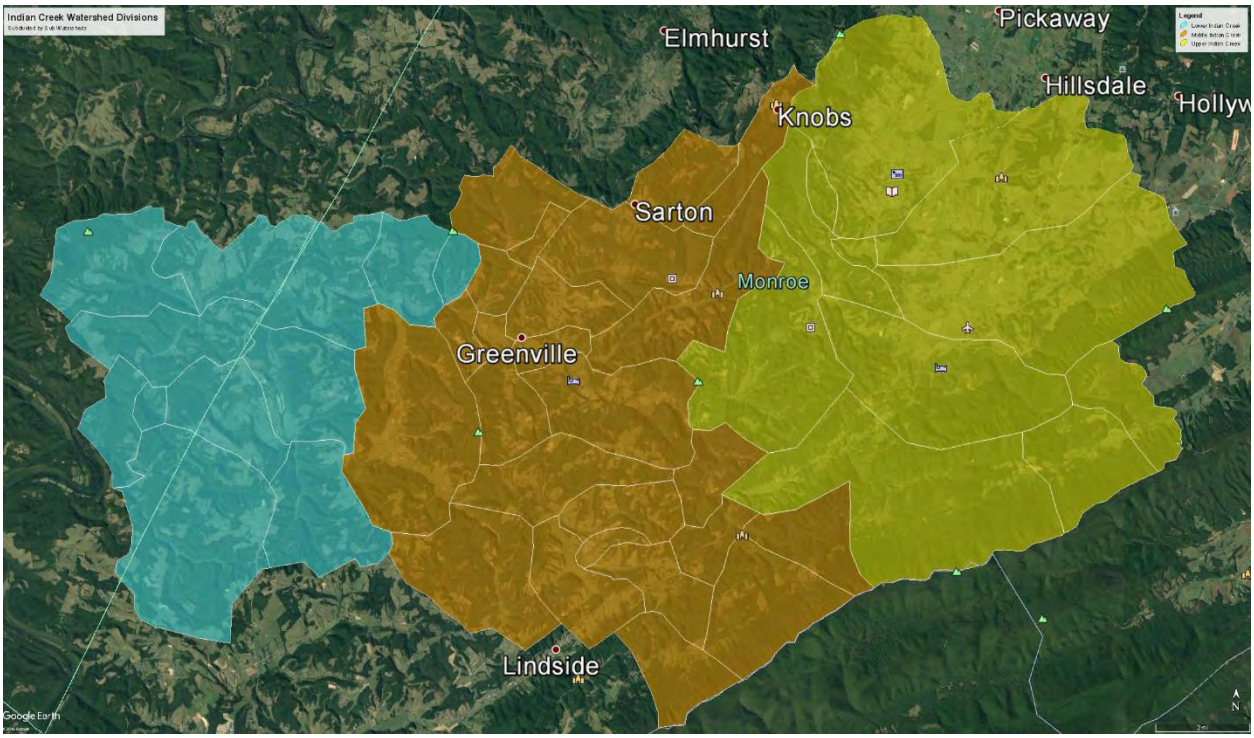


The implementation and environmental milestones estimates are based on the best professional judgement and experience from other restoration efforts. The primary focus will be on the greatest source of the contamination, where most practices will be installed. However, the remaining sub

watersheds will also be eligible for BMP installation since the entire length of Indian Creek is listed as impaired.

It should be noted that the implementation of this plan does not necessarily follow the HUC 12 watershed boundaries. This is because the TMDL watershed boundaries do not exactly match up with the HUC 12 watershed boundaries in the karst regions of the watershed. This plan will follow the TMDL watershed boundaries for calculating load reductions in an orderly manner. For this reason, the greater Indian Creek Watershed has been divided into three sections, upper, middle, and lower, for the purposes of implementing this plan only.

Figure 8. Watershed sub-divisions



MONITORING

The responsibility for monitoring will fall primarily on the WVCA who will enlist the assistance of DEP, WVU IWSS and any other state or federal agency as well as volunteers. The parameters to be monitored must fulfill the requirements of this plan and the reporting requirements of Section 319 grants reports. The parameters may include: temperature, flow, fecal coliform and any others that may be considered important. Monitoring stations will be located at the mouth of Indian Creek and other strategic sites to determine the success of individual projects. If other stations need to be established to locate sources or for any other reason, such as determining project success, they will be located strategically to accomplish that goal.

The timing of sampling will be up to the local project managers but should include monthly samples within a year during different flow regimes for establishing the baseline. Afterward, two a year during different seasons and after practices have been installed should provide adequate data for progress assessment. To determine if stream or stream segments have been returned to water quality standards WVCA work with WVU IWSS to implement a scale nested watershed model of sampling. The methods and location will correspond to DEP quality assurance standards and the data will be submitted to DEP.

Biological monitoring may be done as a part of the volunteer monitoring program WVSOS. The WVSOS program is an important educational tool for teaching citizens about the value of clean streams. It can also be a valuable monitoring tool. If suitable volunteer monitors are willing to sample these streams, then WVCA and DEP will facilitate their efforts. By using the WVSOS protocols a good biological assessment of the streams' conditions can be made. Another assessment will be made by WAB after project completion to determine final success or a need for further action.

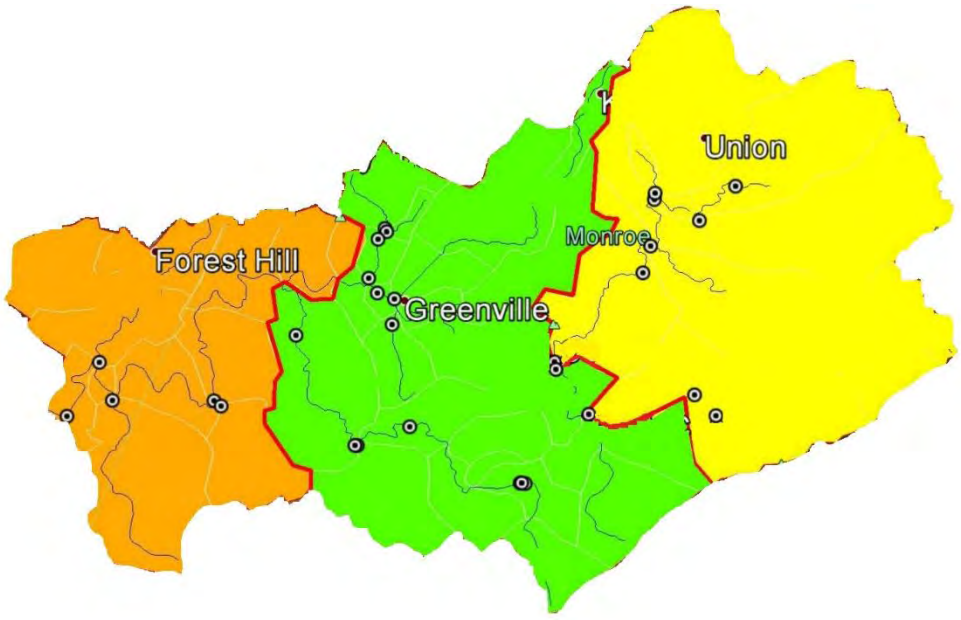
To assure the data being collected is of good quality and usable for determining progress, a Quality Assurance Project Plan (QAPP) will be developed for this effort. The QAPP will be submitted to the DEP Nonpoint Source Program Coordinator for review and approval. The Coordinator will then be responsible for submitting the QAPP to EPA for review, comment and approval. The QAPP will be submitted for review at least 60 days in advance of monitoring. No monitoring for this plan will begin until the QAPP receives final approval.

For maintaining consistency with monitoring and assuring that all data collected in association with this plan, the same water quality monitoring sites will be utilized as was in the past by the WVDEP to develop the TMDL. These sites our listed in Table 16 and mapped in Figure 9.

Table 16. Water Quality Monitoring Sites

Station ID	Mile Point	Sub ID	Stream	Code	Latitude	Longitude
Upper Indian Creek						
KNU-00078-1.6	1.6	1644	Burnside Branch (UG)	WVKN-51-S-1-(S)	37.574	-80.5318
KNU-00014-0	0	1640	Indian Creek	WVKN-51	37.5729	-80.5679
KNU-00085	33.5	1643	Indian Creek	WVKN-51	37.5728	-80.5678
KNU-00015-0	0	1645	Traggart Branch	WVKN-51-S-(S)	37.5636	-80.5489
KNU-00013-0.1	.1	1646	Turkey Creek	WVKN-51-O	37.5562	-80.5717
KNU-00085-30.6	30.6	1639	Indian Creek	WVKN-51	37.5468	-80.5757
KNU-00085-26.2	26.2	1639	Indian Creek	WVKLN-51	37.5189	-80.618
KNU-00012-0.2	0.2	1635	Dropping Lick Creek	WVKN-51-K-1	37.4996	-80.605
KNU-00012-3.8	3.8	1635	Dropping Lick Creek	WVKN-51-K-1	37.5027	-80.558
KNU-00208-0.5	0.5	1635	Dropping Lick Creek	WVKN-51-K-1	37.4948	-80.5496
Middle Indian Creek						
KNU-00011-0.1	0.1	1634	Rock Camp Creek	WVKN-51-K	37.5164	-80.6183
KNU-00007-12.1	12.1	1616	Hans Creek	WVKN-51-D	37.4774	-80.6379
KNU-00007-7.7	7.7	1612	Hans Creek	WVKN-51-D	37.5007	-80.6842
KNU-00081-0	0	1611	Hans Creek	WVKN-51-D	37.4961	-80.7085
KNU-00081-0.1	0.1	1618	Blue Lick Creek	WVKN-51-D-1	37.4961	-80.7085
KNU-00007-1.8	1.8	1611	Hans Creek	WVKN-51-D	37.5356	-80.7309
KNU-00009-0.3	0.3	1630	Cooks Run	WVKN-51-I	37.5369	-80.6881
KNU-00084-0.1	0.1	1626	Laurel Creek	WVKN-51-H-(S)	37.5453	-80.6861
KNU-00085-18.4	18.4	1625	Indian Creek	WVKN-51	37.5479	-806934
KNU-00083-0.15	0.15	1622	Indian Draft	WVKN-51-G	37.5534	-806967
KNU-00038-1.2	1.2	1622	Indian Draft	WVKN-51-G	37.5667	-80.691
KNU-00086-0	0	1624	UNT/Indian Draft RM 1.5	WVKN-51-G-1	37.5698	-80.6881
KNU-00083-1.5	1.5	1623	Indian Draft	WVKN-51-G	37.5699	-80.6881
Lower Indian Creek						
KNU-00085-8.5	8.5	1609	Indian Creek	WVKN-51	37.5157	-80.7696
KNU-00082-0	0	1608	Fitz Run	WVKN-51-B.5	37.5145	-80.7669
KNU-00006-0	0	1606	Stinking Lick Creek	WVKN-51-B	37.5197	-80.8148
KNU-00005-0.1	0.1	1602	Bradshaw Creek	WVKN-51-A	37.5326	-80.8187
KNU-00085-0.5	0.5	1601	Indian Creek	WVKN-51	37.5144	-80.837

Figure 9. Water Quality Monitoring Sites (Yellow- Upper Indian Creek, Green – Middle Indian Creek, and Orange – Lower Indian Creek)



INFORMATION AND EDUCATION

In any watershed restoration effort informing and educating the residents of the watershed and all other stakeholders is vital.

The stakeholders of this plan include the Greenbrier Valley Conservation District, West Virginia Conservation Agency, USDA Natural Resources Conservation Service, WV Department of Environmental Protection, West Virginia University Cooperative Extension Service, and the Residents and Farmers of the Indian Creek Watershed. In rural watersheds with a small population the most important form of that communication is done face to face. Face to face contacts between the involved agencies and landowners will be made to explain the problems and solutions. This will be conducted by the WVCA, NRCS, and residents/farmers. Public meetings to announce the project, the reasons for it, and provide educational materials on agricultural best management practices and septic system maintenance will be scheduled in the watershed. The WVDEP Basin Coordinator along with WVU Extension Service and the GVCD will lead this effort.

These outreach efforts will begin within a year prior to actual funding for BMP's will be available. USDA will provide outreach funding during that time to comply with the requirements of the NWQI. The WVU Cooperative Extension Service will provide annual winter dinner meetings to include information regarding the programs associated with this plan.

The WVCA works directly with farmers to educate them to the benefits of installing BMPs which includes an explanation of the benefits of a clean and properly functioning stream. In addition, the GVCD will offer field days to show farmers installed BMPs and explain how they work will be conducted.

COMMON ACRONYMS

TMDL	Total Maximum Daily Load
WLA	Waste load allocation
LA	Load allocation
LR	Load reduction
MOS	Margin of safety
BL	Baseline
USEPA or EPA	US Environmental Protection Agency
DEP	WV Department of Environmental Protection
WVCA	WV Conservation Agency
NRCS	USDA Natural Resources Conservation Service
HD	Health Department
BPH	Bureau of Public Health
WAB	Watershed Assessment Branch
OSLP	On-site Loan Program
BMP	Best management practice
WQ	Water quality
ES	Environmental Specialist
IWSS	Institute for Water Security and Science
WVU	West Virginia University
WVSOS	West Virginia Save Our Streams
ICT	Interagency Conservation Tool