REVISED

North Fork, South Fork and mainstem of the Rockfish River Bacteria TMDLs

Local Steering Committee Meeting Handout

February 1, 2011

Rockfish Valley Community Center
Nellysford, VA

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Revisions have been made to this handout since it was first distributed. The figures and tables have been revised to reflect the re-numbering of the Taylor Creek watershed. The original handout's NFR-8 sub-watershed is now labeled TC-1, and original TC-1, TC-2, TC-3, and TC-4 are now labeled TC-2, TC-3, TC-4, and TC-5, respectively.

Data Needs

The following list contains a brief description of the data needed for the project. More detailed information is provided within the handout.

Data Need	Source	Status
Weather information precipitation, temperature, wind speed	NOAA weather stations located at Montebello and Tye River	data collection complete
Stream information cross-section characteristics properties of any impediments (e.g., dams) locations and flow rates of any springs and ponds	field measurements and observations from watershed visits local stakeholders	some data collected, data still needed
Land use breakdown	VADCR RESAC data and verification by local stakeholders	verification needed
Permitted discharges	VADEQ Valley Regional Office	data collection complete
Future land use and discharger changes	Nelson County and Albemarle County Comprehensive Plans, VADEQ	data needed
Wildlife types of animals habitat areas time in streams population density	VDGIF, USFWS	verification needed
Houses and Human Populations house locations failing septic system locations (or rates of failure) straight pipe locations average population per house or total population for a given area pets per household	US Census, Local Government, VDH, Humane Society	verification needed

Data Need	Source	Status
Livestock numbers and practices Dairy cattle types of operations (cow-calf, confined, grass-based, etc.) number of animals fraction of animals with stream access time spent in confinement or loafing lots location of farms Beef cattle types of operations (cow-calf, stocker, etc.) number of animals fraction of animals with stream access time spent in confinement or loafing lots location of farms Poultry types of operations (chicken, turkey, pullet, etc.) number of birds per cycle number of cycles per year location of houses Other livestock types of livestock locations numbers Manure application rates, timing, receiving land uses, amount of cropland in no-till, typical crop rotation	SWCD, Virginia Cooperative Extension, NRCS, VADCR	some data collected, data still needed

General Watershed Characterization

Before beginning, it is important to note that this information provides a snapshot of the watershed characteristics at a given point in time. In order to complete the bacteria TMDLs, we will need to know of any major changes (for example, the beginning or ending of a large agricultural operation, a major effort to install BMPs, or a large change in land use) that have occurred historically or are planned, so that we may accurately calibrate the model for the watershed and predict future conditions.

Sub-watersheds

The sub-watersheds are defined with several issues in mind. The model we'll use for the bacteria impairment (Hydrological Simulation Program – FORTRAN (HSPF)) will only generate output at sub-watershed outlets. Therefore it was important to have a sub-watershed break at the water quality monitoring station so that the model predictions could be evaluated at that location. Another consideration in the sub-watershed delineation was the location of distinct pockets of land use. Finally, sub-watersheds were defined that preserved the continuity of the stream network (Figure 1): HSPF only allows one stream per sub-watershed, so some sub-watersheds had to be defined to isolate major streams for modeling.

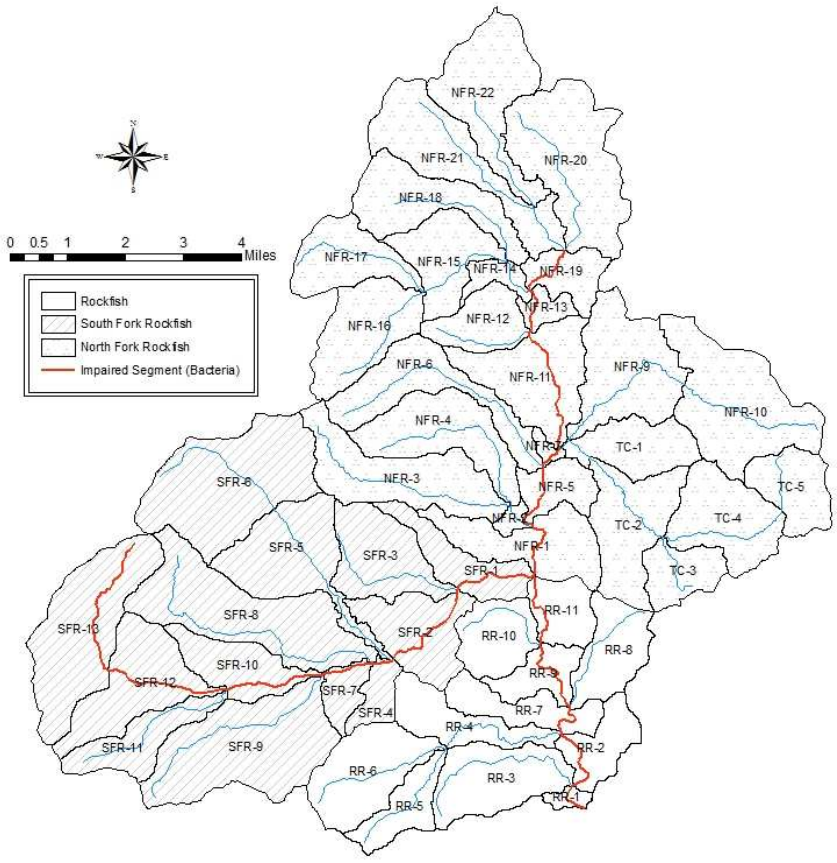

Figure 1. Rockfish River Sub-watersheds.

Land Use

Land Use Categories

Categorizing land uses helps to identify the distribution of bacteria loads from different nonpoint sources to appropriate areas within the watershed. Categorizing land uses also aids in the estimation of certain animal populations, particularly wildlife.

Land Use Estimate Methodology

The Mid Atlantic Regional Earth Science Applications Center (RESAC) data available through the Virginia Department of Conservation and Recreation was used to obtain the land use estimates. These data were current as of 2000. The RESAC is created based on interpretation of satellite imagery; therefore, some misinterpretations of land use may arise where the cover on the land poorly reflects the use (e.g., forested residential areas, large park areas). If you see any major discrepancies, please let us know. The detailed RESAC land use groups have been grouped into five main categories: forest, low density residential (LDR), high density residential (HDR), pasture, and cropland (Figure 2).

The Rockfish River study area is predominantly forest with some pasture, cropland and rural residential. Note that "High Density Residential" refers to any highly impervious area land use, including roads and industrial facilities. Table 1 presents a breakdown of each land use category in each sub-watershed.

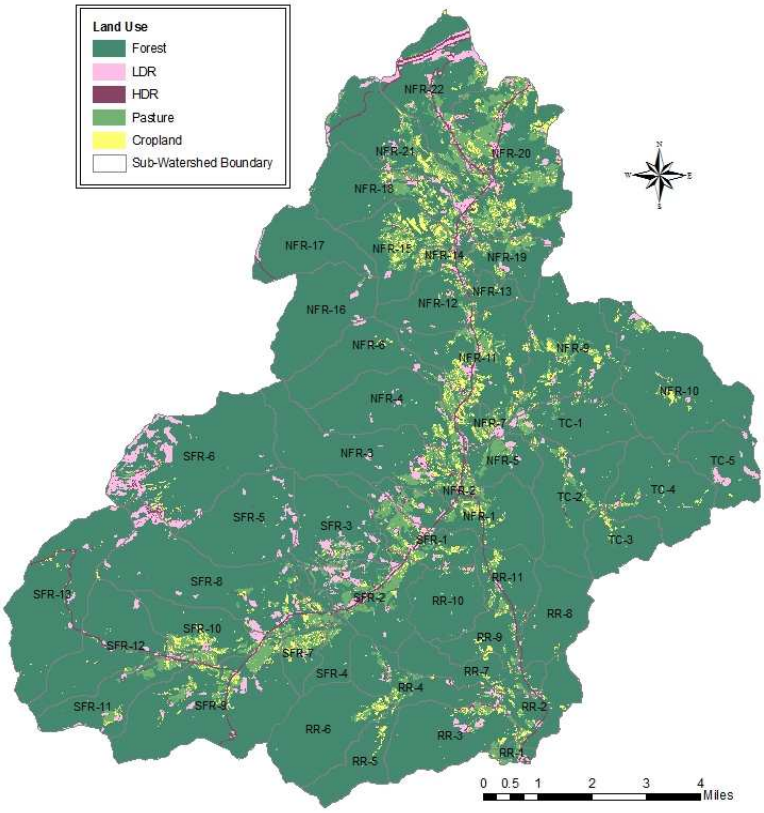

Figure 2. Land Use in the Rockfish River Study Area.

Table 1. Land Use Breakdown for Rockfish River Study Area (acres).

Sub-Watershed	Cropland		Forest		HDR*		LDR**		Pasture		Total
	acres	%	acres	%	acres	%	acres	%	acres	%	acres
RR-1	5	3	81	55	11	7	7	5	44	30	148
RR-2	35	4	686	85	21	3	15	2	47	6	804
RR-3	43	3	1391	90	13	1	38	2	67	4	1552
RR-4	26	2	919	85	13	1	29	3	88	8	1075
RR-5	18	2	743	96	1	0	1	0	10	1	774
RR-6	33	2	1552	95	1	0	0	0	44	3	1631
RR-7	32	3	825	90	13	1	6	1	37	4	912
RR-8	7	1	1077	97	11	1	6	1	8	1	1108
RR-9	31	5	595	88	8	1	4	1	35	5	673
RR-10	8	1	985	97	4	0	12	1	4	0	1013
RR-11	32	4	632	85	21	3	6	1	55	7	746
SFR-1	64	6	653	65	24	2	58	6	213	21	1011
SFR-2	29	2	925	66	49	4	122	9	270	19	1395
SFR-3	19	1	1248	83	20	1	111	7	99	7	1497
SFR-4	5	1	393	91	0	0	0	0	33	8	432
SFR-5	5	0	1850	95	6	0	73	4	14	1	1946
SFR-6	37	1	2599	85	35	1	348	11	27	1	3045
SFR-7	52	12	258	58	7	2	7	2	120	27	444
SFR-8	75	3	2372	84	51	2	178	6	152	5	2828
SFR-9	80	3	2481	85	62	2	71	2	240	8	2934
SFR-10	76	7	800	74	9	1	37	3	157	15	1078
SFR-11	19	2	842	82	12	1	35	3	115	11	1023
SFR-12	15	1	1671	93	33	2	32	2	44	2	1795
SFR-13	13	1	2451	96	45	2	42	2	2	0	2552
NFR-1	60	4	1210	80	33	2	44	3	159	11	1505
NFR-2	18	13	60	44	17	12	8	5	34	25	137
NFR-3	47	2	1835	89	17	1	64	3	104	5	2067
NFR-4	67	4	1501	87	23	1	38	2	102	6	1730

Sub-Watershed	Cropland		Forest		HDR*		LDR**		Pasture		Total
NFR-5	19	3	505	75	10	1	31	5	106	16	671
NFR-6	79	5	1411	85	16	1	44	3	117	7	1667
NFR-7	13	11	58	50	3	2	19	16	24	21	116
NFR-9	116	6	1714	84	13	1	34	2	157	8	2034
NFR-10	43	2	2512	95	5	0	23	1	49	2	2633
NFR-11	166	9	1365	74	35	2	47	3	230	12	1843
NFR-12	26	3	802	89	16	2	22	2	39	4	905
NFR-13	13	4	273	91	6	2	2	1	6	2	300
NFR-14	49	15	180	55	12	4	13	4	72	22	327
NFR-15	89	6	1232	78	29	2	57	4	182	11	1589
NFR-16	166	13	850	67	11	1	12	1	228	18	1267
NFR-17	0	0	1551	98	1	0	22	1	5	0	1578
NFR-18	0	0	1189	97	13	1	26	2	0	0	1228
NFR-19	34	5	539	79	2	0	16	2	95	14	687
NFR-20	208	8	1586	60	85	3	119	4	657	25	2655
NFR-21	166	8	1364	67	70	3	118	6	329	16	2046
NFR-22	53	3	1332	67	139	7	227	11	234	12	1985
TC-1	25	2	989	90	6	1	30	3	51	5	1101
TC-2	28	2	1556	93	8	0	15	1	67	4	1675
TC-3	17	2	747	96	1	0	0	0	10	1	775
TC-4	24	1	1526	96	6	0	8	1	25	2	1589
TC-5	4	0	930	93	3	0	56	6	4	0	997
Total	**2289**	**3**	**56846**	**84**	**1049**	**2**	**2332**	**3**	**5010**	**7**	**67526**

*HDR = High Density Residential
**LDR = Low Density Residential

Livestock Numbers

Cattle

Dairy Cow Estimate Methodology

The Virginia Department of Agriculture and Consumer Services (VDACS) and the 2007 Census of Agriculture from the USDA National Agricultural Statistics Service (NASS) report there are no dairies in Nelson County. If you can share knowledge of the existence of dairies in the watershed, it will be appreciated!

Beef Cattle Estimate Methodology

We will contact the extension office for Nelson County to inquire about the beef cattle population in the watershed. We may also contact the local NRCS and SWCD offices. If we are unable to obtain population estimates from local experts, we will use information from the NASS to estimate the beef cattle population; we have already summarized this information in Table 2.

Table 2. Livestock Estimates from the NASS 2007 Census of Agriculture.

Sub-Watershed	Beef (cows)	Goat	Horse	Sheep
RR-1	20	2	1	0
RR-2	21	2	1	0
RR-3	30	3	1	0
RR-4	40	4	1	1
RR-5	5	0	0	0
RR-6	20	2	1	0
RR-7	17	2	1	0
RR-8	4	0	0	0
RR-9	16	1	1	0
RR-10	2	0	0	0
RR-11	25	2	1	0
SFR-1	96	9	3	1
SFR-2	121	12	4	2
SFR-3	44	4	1	1
SFR-4	15	1	0	0
SFR-5	6	1	0	0
SFR-6	12	1	0	0
SFR-7	54	5	2	1
SFR-8	68	7	2	1
SFR-9	108	10	3	1
SFR-10	71	7	2	1
SFR-11	52	5	2	1
SFR-12	20	2	1	0
SFR-13	1	0	0	0
NFR-1	71	7	2	1
NFR-2	15	1	0	0
NFR-3	47	4	2	1

Sub-Watershed	Beef (cows)	Goat	Horse	Sheep
NFR-4	46	4	1	1
NFR-5	48	5	2	1
NFR-6	53	5	2	1
NFR-7	11	1	0	0
NFR-9	70	7	2	1
NFR-10	22	2	1	0
NFR-11	103	10	3	1
NFR-12	18	2	1	0
NFR-13	3	0	0	0
NFR-14	32	3	1	0
NFR-15	82	8	3	1
NFR-16	102	10	3	1
NFR-17	2	0	0	0
NFR-18	0	0	0	0
NFR-19	43	4	1	1
NFR-20	296	28	10	4
NFR-21	148	14	5	2
NFR-22	105	10	3	1
TC-1	23	2	1	0
TC-2	30	3	1	0
TC-3	4	0	0	0
TC-4	11	1	0	0
TC-5	2	0	0	0
Total	2252	216	73	30

Dairy and Beef Cattle Numbers Use

Manure from cattle can be directly deposited to the land surface (pasture or loafing lots), directly deposited to the stream (for pastures with stream access), or collected from animals in confinement. Manure collected in confinement is later spread on the land surface. Our traditional methodology uses the following application rates to calculate the amount of manure that is land-applied: 24,000 lb/ac-yr for solid cattle manure; 6,600 gal/ac-yr for liquid dairy manure to crops; and 3,900 gal/ac-yr for liquid dairy manure to pasture. From our experience, actual application rates vary quite a bit between watersheds, and so we would welcome more locally relevant application rates. The total manure produced is calculated as the product of the total number of cattle and their manure production rate; it is then apportioned to the aforementioned categories based on the percent of time the cattle spend in pastures, loafing lots, streams, and confinement.

Poultry

Poultry Number Estimate Methodology

We typically obtain poultry information from CAFO permits; and, at this time we do not know of any CAFO permits in the Rockfish River watershed.

Poultry Number Use

Poultry are assumed to be confined all the time. Therefore, the poultry litter is assumed to be stored and land applied or sold at a later date. Poultry litter is assumed to be land applied at a rate of 6000 lb/ac-yr. We are not aware of any permitted poultry litter transfers delivered to areas within the Rockfish River watershed.

Manure Application Characteristics (Cattle and Poultry Litter)

Information on the average length of time storage facilities can handle, the months of the year that manure is applied, how much manure is applied each month (as a fraction of the total applied in a year), how often the manure is tilled-in, and what a typical rotation is for this area (i.e., for a 10-year rotation, how many years of corn, rye, hay, etc. are there?) would also be very useful to us; although a windshield survey showed very little cropland within the watershed.

Other Livestock

Other Livestock Estimate Methodology

The USDA NASS provides inventories of pigs, horses, goats, and sheep (among others) on a county-wide basis in the 2007 Census of Agriculture. The fraction of pastured county area present in each sub-watershed is multiplied by the total animal population for the county to make these estimates (Table 2). These are quite uncertain estimates, as the animal populations reported in the NASS may come from only a couple farms in each county that may not even be located in the study area watershed. Local knowledge is essential to create accurate estimates of populations for these animals.

Other Livestock Numbers Use

These animals are assumed to occupy pasture with minimal fecal contributions to the stream. If horses, goats, or sheep have significant stream access in this watershed, please let us know.

Wildlife Numbers

Wildlife Population Estimate Methodology

The wildlife population estimates are obtained through an analysis of appropriate habitat area and surrounding waterbodies in the watershed. These estimates are based on habitat and population density estimates used in other TMDL watersheds, obtained from VDGIF, and reported in the literature, and include some adjustments we have made to create what we consider to be more reasonable estimates. The exact methods used are listed in Table 3. Wildlife population estimates based on Table 3 are shown in Table 4.

Wildlife Number Use

Wildlife are assumed to deposit feces on their appropriate habitat areas. Each type of wildlife is also assumed to spend a varying amount of time in the stream. The bacteria produced by each type of wildlife are distributed to the stream and to the land surface based on the fraction of time spent in the stream and the available land use areas.

Table 3. Habitat and Population Density Estimates and Wildlife Numbers.

Wildlife type	Habitat	Population Density (animal/ac-habitat)	Watershed-Wide Population
Deer	Entire watershed	0.055	3196
Raccoons	low density on forests not in high density area; high density on forest within 600 ft of a permanent water source or 0.5 mile of cropland; highest density in residential areas	Low density: 0.016 High density: 0.047 Highest density: 0.078	1393
Muskrats	16/mile of ditch or medium sized stream intersecting cropland; 8/mile of ditch or medium sized stream intersecting pasture; 10/mile of pond or lake edge; 50/mile of slow-moving river edge	--see habitat column--	94
Beavers	1/mile of perennial streams; and 3.8/mile of lake or pond shore	--see habitat column--	71
Geese	300 ft buffer around main streams	0.109 – peak season	556
Wood Duck	300 ft buffer around main streams	0.062 – off season	264
		0.094 – peak season	400
Wild Turkey	Forest; based on kill rate and population model per square mile of forest for each county, assuming the killed birds are 10% of the total population	0.008	444

Table 4. Wildlife Estimates Using Methods in Table 3.

Sub-Watershed	Deer	Raccoon	Muskrat	Beaver	Geese	Wood Duck*	Wood Duck+	Wild Turkey
RR-1	7	4	0	1	4	2	3	1
RR-2	38	17	1	1	10	5	7	5
RR-3	73	26	0	0	0	0	0	11
RR-4	51	18	0	0	0	0	0	7
RR-5	37	12	0	0	0	0	0	6
RR-6	77	25	0	0	0	0	0	12
RR-7	43	17	0	1	6	3	4	6
RR-8	53	19	0	0	0	0	0	8
RR-9	32	16	0	2	12	6	9	5
RR-10	48	17	0	0	0	0	0	8
RR-11	35	16	1	1	11	5	8	5
SFR-1	48	21	3	2	12	6	9	5
SFR-2	66	33	3	2	15	7	11	7
SFR-3	70	38	5	3	22	11	16	10
SFR-4	20	7	0	0	3	1	2	3
SFR-5	92	56	0	5	42	20	30	14
SFR-6	144	82	0	3	22	11	16	20
SFR-7	21	6	2	1	7	3	5	2
SFR-8	134	76	4	5	43	21	31	19
SFR-9	139	62	9	4	34	16	24	19
SFR-10	51	20	3	2	14	7	10	6
SFR-11	49	17	0	0	0	0	0	7
SFR-12	85	38	2	2	17	8	12	13
SFR-13	121	51	0	1	11	5	8	19
NFR-1	71	26	0	0	1	1	1	9
NFR-2	6	3	3	1	4	2	3	0
NFR-3	98	55	4	6	44	21	31	14
NFR-4	82	30	0	0	0	0	0	12
NFR-5	32	11	0	0	1	1	1	4
NFR-6	79	43	6	5	37	17	26	11
NFR-7	6	3	0	0	1	0	0	0
NFR-9	96	40	8	3	24	11	17	13
NFR-10	125	42	0	0	0	0	0	20
NFR-11	87	28	0	0	1	0	0	11
NFR-12	43	16	0	0	0	0	0	6
NFR-13	14	5	0	0	0	0	0	2
NFR-14	15	7	2	1	7	3	5	1
NFR-15	75	26	0	0	0	0	0	10
NFR-16	60	19	5	2	13	7	10	7
NFR-17	75	36	0	2	18	9	13	12
NFR-18	58	33	0	3	22	11	16	9

Sub-Watershed	Deer	Raccoon	Muskrat	Beaver	Geese	Wood Duck*	Wood Duck+	Wild Turkey
NFR-19	33	10	0	0	1	0	0	4
NFR-20	126	51	6	3	25	12	18	12
NFR-21	97	38	6	1	8	4	6	11
NFR-22	94	56	4	2	18	9	13	10
TC-1	52	20	3	1	5	3	4	8
TC-2	79	33	8	2	16	8	12	12
TC-3	37	12	0	0	0	0	0	6
TC-4	75	34	5	2	19	9	14	12
TC-5	47	22	1	1	6	3	5	7
Total	3196	1393	94	71	556	264	400	444

*off season
+peak season

Human Population

Human Population Estimate Methodology

Human population estimates are based on the US Census Block Group information and county structure data. Block groups provide population information on a scale much smaller than the county scale. However, although they are smaller than counties, block groups still present a difficulty because they are not drawn on watershed lines (Figure 3). We will request structure data from Nelson County and Albemarle County to refine the human population estimate on the people per house reported in the Census for the block groups in which the houses fall. County structure data and USGS 7.5-min quad sheets will be used to estimate house ages for sewage estimates.

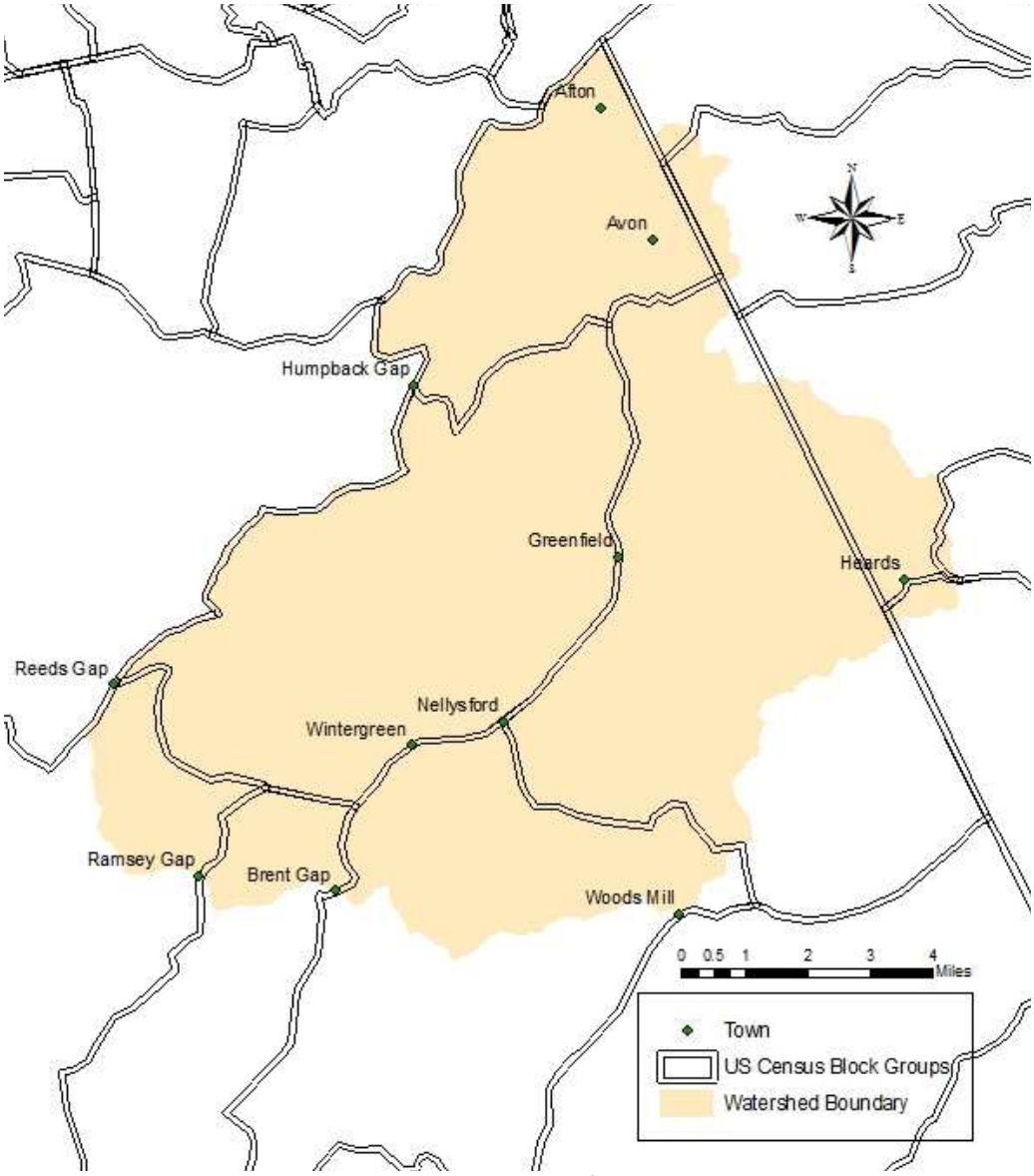

Figure 3. US Census Block Groups Intersecting the Rockfish River Study Area.

We have performed a preliminary and very rough analysis of the Census data; the results are presented in Table 5. These numbers will be modified when we have received structure data from both counties.

Table 5. Human Population Estimates from the US Census

Sub-Watershed	People	Houses
RR-1	7	4
RR-2	41	24
RR-3	73	43
RR-4	52	31
RR-5	37	22
RR-6	77	46
RR-7	50	29
RR-8	62	36
RR-9	37	22
RR-10	56	33
RR-11	42	25
SFR-1	71	42
SFR-2	92	54
SFR-3	124	73
SFR-4	20	12
SFR-5	160	95
SFR-6	250	148
SFR-7	21	12
SFR-8	228	135
SFR-9	135	80
SFR-10	88	52
SFR-11	28	17
SFR-12	89	52
SFR-13	109	64
NFR-1	95	56
NFR-2	9	5
NFR-3	171	101
NFR-4	143	85
NFR-5	37	22
NFR-6	132	78
NFR-7	6	4
NFR-9	113	67
NFR-10	158	93
NFR-11	120	71
NFR-12	75	44
NFR-13	17	10
NFR-14	27	16
NFR-15	166	98
NFR-16	172	102
NFR-17	170	101

Sub-Watershed	People	Houses
NFR-18	218	129
NFR-19	38	23
NFR-20	309	183
NFR-21	279	165
NFR-22	277	164
TC-1	61	36
TC-2	93	55
TC-3	43	26
TC-4	88	52
TC-5	56	33
Total	**5024**	**2972**

One 'unit pet' is assumed to occupy every house. This is equivalent to one dog or several cats. Acknowledging that many people do not have pets and that several people have many pets, this averages out to an accurate estimation in most watersheds. Additionally, it lines up well with estimates made by the American Pet Products Manufacturer's Association. Further detail may be available from local humane societies.

Human Number Use

Where sewer networks exist, the bacteria from humans is not considered as a nonpoint source load, but is instead represented by the effluent from a sewage treatment plant. Houses not connected to a sewer are referred to as 'unsewered.' Of these unsewered houses, any located within 150 ft of streams that fall into the middle or old age categories have the potential to discharge sewage directly into the stream via a straight pipe. We typically assume 10% of older houses and 2% of middle-age houses within 150 ft of streams have straight pipes. All sewage produced by humans occupying these houses is assumed to be directly deposited in the stream. The remaining houses are assumed to have septic systems. Of these septic systems, 40% of older (pre-1965) houses, 20% of middle-age (1965ish-1985) houses, and 3% of newer (post-1985) houses are assumed to have failing septic systems. For failing septic systems, sewage may rise to the land surface. This becomes a load to residential land surfaces. Bacteria from pet feces are also a load to residential land surfaces.

Permitted Facilities

DEQ has provided a list of any permitted facilities in the watershed. Typically, during calibration, the permitted facilities are represented according to their discharge monitoring reports. During allocation, the permitted facilities are represented according to their maximum allowable discharges and bacteria concentrations. There are two VPDES permits and six general permits in the Rockfish River study area. They will be included during allocation at their permitted limits, or if future changes are anticipated, at their projected permitted limits for future conditions.