FINES CREEK WATERSHED ACTION PLAN

HAYWOOD COUNTY, NC

Prepared by:
Lower Pigeon River Watershed Restoration Group
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Executive Summary

The purpose of the Fines Creek Watershed Action Plan (WAP) is to guide restoration efforts and improve surface water quality in the Fines Creek Watershed of Haywood County, North Carolina. It focuses on nonpoint source pollution and was created by the Lower Pigeon River Watershed Restoration Group, which is composed of agencies, organizations, and individuals with skills and/or interest in nonpoint source water quality issues. The WAP is a living document that will be updated by watershed stakeholders as additional information and opportunities become available.

The Fines Creek Watershed is 16,482 acres and completely contained within the County. Most of the land uses are in agriculture (crop and livestock) but forest is abundant and residential impacts are increasing. Paved and unpaved roads are abundant.

The watershed has many high quality streams for recreation residential, and agriculture uses. However, there are long-term nonpoint source pollution impacts associated with stormwater runoff, riparian conditions, pasture conditions, and row crop practices. These have resulted in Fines Creek being placed on the NC list of impaired waterways for a "Fish Community Fair" rating

Project partners have been collecting water quality data for many years. This data provides evidence of the most significant problem areas, helps prioritize restoration efforts, identify data gaps, justify grant applications and demonstrate measurable results from watershed improvement projects.

The primary stressors affecting the watershed are sediment, nutrients, and temperature. Other stressors may include bacteria, exotic/invasive species and litter. Sources include stormwater, eroding streambanks and unpaved roads, and inadequate riparian vegetation.

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Section 1. Overview

1.1 Purpose

The purpose of this Watershed Action Plan (WAP) is to guide water quality improvement and protection efforts in the Fines Creek watershed of Haywood County, North Carolina. It focuses on nonpoint source pollution and is a living document that will be updated as issues and solutions are identified.

1.2 Watershed Description

The Fines Creek Watershed (12-digit HUC = 060101060303; DWR sub basin 04-03-05) is in northern Haywood County (Figure 1) and is a major tributary in the Pigeon River Watershed (8-digit HUC = 06010106). The watershed has 19.5 miles of perennial streams; primary tributaries include Cove Creek, James Branch, Martins Creek, Morgan Creek, Tom's Branch, Turkey Creek, and Wesley Creek. It originates in the Pisgah National Forest in the northeastern mountains near the Buncombe and Madison county lines and travels 10.4 miles to its confluence with the Pigeon River near the Hepco Bridge (Exit 15 on U.S. Interstate 40).

The watershed contains 16,482 acres (25.8 mi^2); land uses include residential, commercial, cropland, pasture, and forest (Figure 2, Table 1). The watershed is mostly rural with abundant farmland though residential land is increasing. Agricultural practices include pasture, commercial livestock, dairy, and crop operations. Rural development has created many paved and unpaved roads; there are approximately 196 miles of roads (1 mile for every 86 acres).

Fines Creek carries a C classification from NC Division of Water Resources (DWR). As defined by DWR, these are "waters protected for secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival, and maintenance of biological integrity, agriculture and other uses suitable. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized or incidental manner".

Haywood County has abundant productive soils (USDA 1997), and combined with a moderate climate and ample precipitation, there is a great variety of vegetative growth. This mountainous area lies in the Southern Blue Ridge Ecoregion, which is one of the most biologically significant in the United States.

Further, the watershed is located in the Southern Crystalline Ridges and Mountains ecoregion of North Carolina. This region is characterized by narrow ridges, hilly plateaus, and high peaks, with
high-gradient and cold water streams typically having bedrock, boulder, gravel and cobble substrates. The underlying geology is primarily metamorphic rocks composed of gneiss and schist; soils are mostly acidic and loamy. Land slope is a major limiting factor affecting land use. Soil instability, depth to soft bedrock, and the presence of mica in some soils are limiting factors to some of the more intensive land uses.

1.3 Watershed Significance

Streams in the Fines Creek watershed provide aesthetic value and water for drinking, recreation, and agriculture. They also support trout populations, including native brook trout (*Salvelinus fontinalis*) in the forested upper elevations.

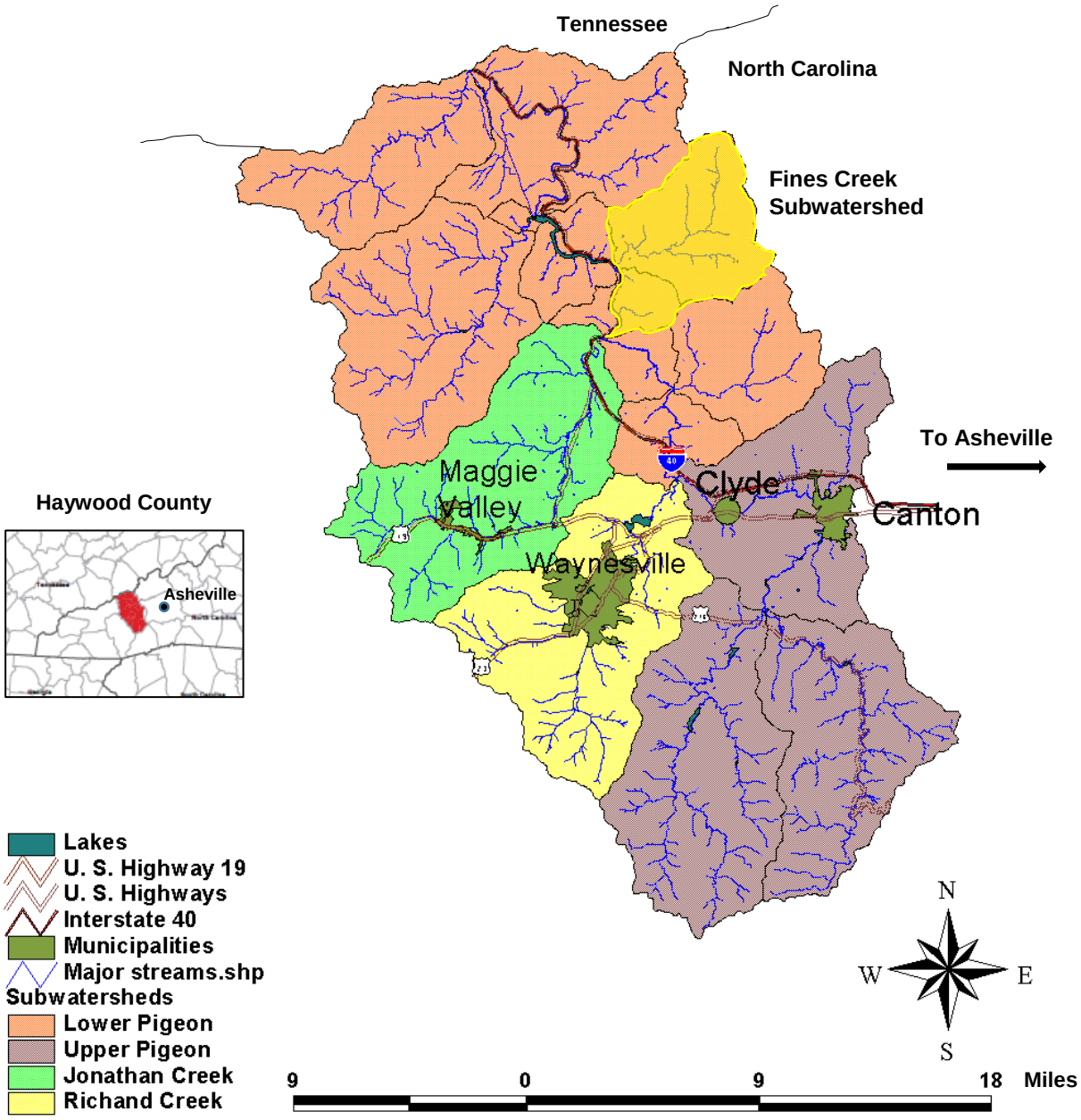

Figure 1. Fines Creek Watershed Location Map
Haywood County, NC

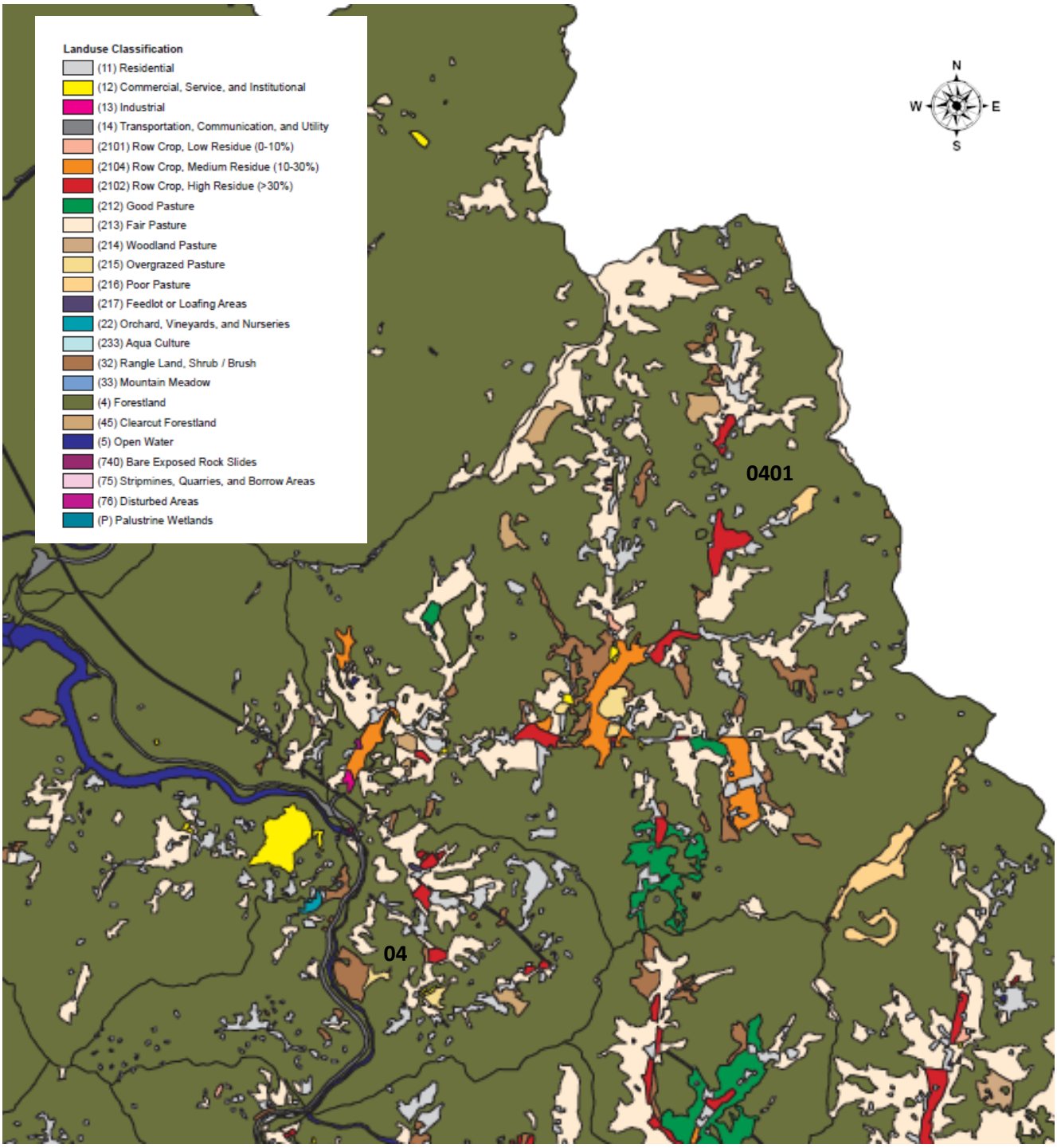

Figure 2. Land Use Classifications in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

Table 1. Land Uses Issues in the Fines Creek Watershed[1]

Land Use	Acres	% of Total Acres
Watershed Size	16,482.0	
Forest	12,439.5	75.47
Pasture	2,880.8	17.48
Row Crop	521.8	3.17
Residential	596.2	3.62
Commercial	16.1	0.10
Right of Way	14.5	0.09
Industrial	8.1	0.05
Open Water	3.1	0.01
Disturbed areas	2.3	0.02

[1]Source: TVA Integrated Pollutant Source Identification database.

The NC Division of Mitigation Services (DMS, formally Ecosystem Enhancement Program) identified Fines Creek as a Targeted Local Watershed with high need and opportunity for stream and wetland restoration efforts (DMS 2009). The division has given this watershed higher priority for implementation of restoration projects. A DMS Tier 1 project was implemented on Morgan Creek and included 3,900 linear feet of stream bank and 0.51 acres of wetland restoration.

Fines Creek is a tributary to the Pigeon River within the focus area of the Pigeon River Recovery Project. In the early 20th century a paper mill in Canton severely degraded the river's water quality and killed most of the native aquatic wildlife. After the mill improved its operations and water quality improved, the Pigeon River Recovery Project is working to restore native fish, mussels, and snails in that section of the river. Fines Creek provides a place of refuge and breeding grounds for those aquatic organisms being released. There remain issues with color and temperature from the mill; Fines Creek also serves to dilute those impacts.

1.4 Extent of Impairment

Fines Creek contains a number of streams of high water quality. However, there are long-term nonpoint source pollution impacts related to residential mountain development (home sites, paved and unpaved roads), stream modifications, removal of riparian vegetation, and agricultural (crop and livestock) activity. The stressors impacting the watershed are reducing the recreational and esthetic quality, degrading wildlife habitat, reducing land use by erosion of stream banks and incurring significant cost to users downstream. These have resulted in the 9.7 miles of Fines Creek being placed on the DWR list of impaired waterways due to a "Fish Community Fair" rating (Category 5, 2014 list). No TMDL has been developed for this watershed.

Some issues can be attributed to impervious surfaces and stormwater. There are 333.2 acres of impervious surfaces (Table 2, Figure 3), which is 2% of the total watershed. Most of these are in residential and road right-of-way land uses, with many of the roads having erosion issues (Figure 4). There are also abundant unpaved roads having erosion issues.

Table 2. Stressors in the Fines Creek Watershed

Land Use	Acres	% of Total Acres	Linear Feet	% of Total Linear Feet	Number
Watershed Size	16,482.0				
Impervious Surfaces	333.2	2.02			
Residential	58.7	0.36			
Commercial	3.9	0.02			
Industrial	1.6	0.01			
Roads	269.0	1.63			
Riparian Buffer Condition			197,663.1		
Adequate			41,549.3	21.0	
Marginal			52,186.4	26.4	
Inadequate			103,927.4	52.6	
Dump Sites					7

[1]Source: TVA Integrated Pollutant Source Identification database.

Fines Creek has a high percentage of riparian areas considered insufficient; the IPSI classifies these as "marginal" or "inadequate" (79%, Table 2, Figure 5 and 6). This amounts to roughly 29.6 miles of riparian corridor in less than adequate condition. Compounding these impacts is the fact that many of the streams have been channelized and are eroding (Figure 7).

This watershed has high nutrient and turbidity values; and water chemistry sampling indicates habitat degradation and sedimentation are major concerns for Fines Creek (DWR 2005).

There are seven unregulated dump sites in the watershed (Table 2); there is no information on what they contain. When it rains, they could leach hazardous chemicals into waterways and ground water. They also sources of trash, which can block storm drains and ditches and cause higher risk of flooding.

1.5 Responsible Parties & Stakeholders

The WAP was created by the Lower Pigeon River Watershed Restoration Group, a coalition of stakeholders with an interest in the health of the watershed (Table 3). Funds were provided through a grant from the Pigeon River Fund of the Community Foundation of Western North Carolina. The partnership already has extensive experience working together through the Hyatt Creek and Richland Creek watershed restoration projects, which have resulted in several stream sections being removed from the state list of impaired waterways. The Richland Creek Watershed Restoration Group continues to address water quality issues to work towards the goal of fully removing it from the impaired waterways list. The high degree of collaboration between local agencies, organizations, and all levels of government demonstrates what can be achieved when like-minded groups cooperate. It also provides the local support, professional and technical support from both local and regional agencies, stakeholder buy in and financial resources necessary to improve and protect degraded watersheds

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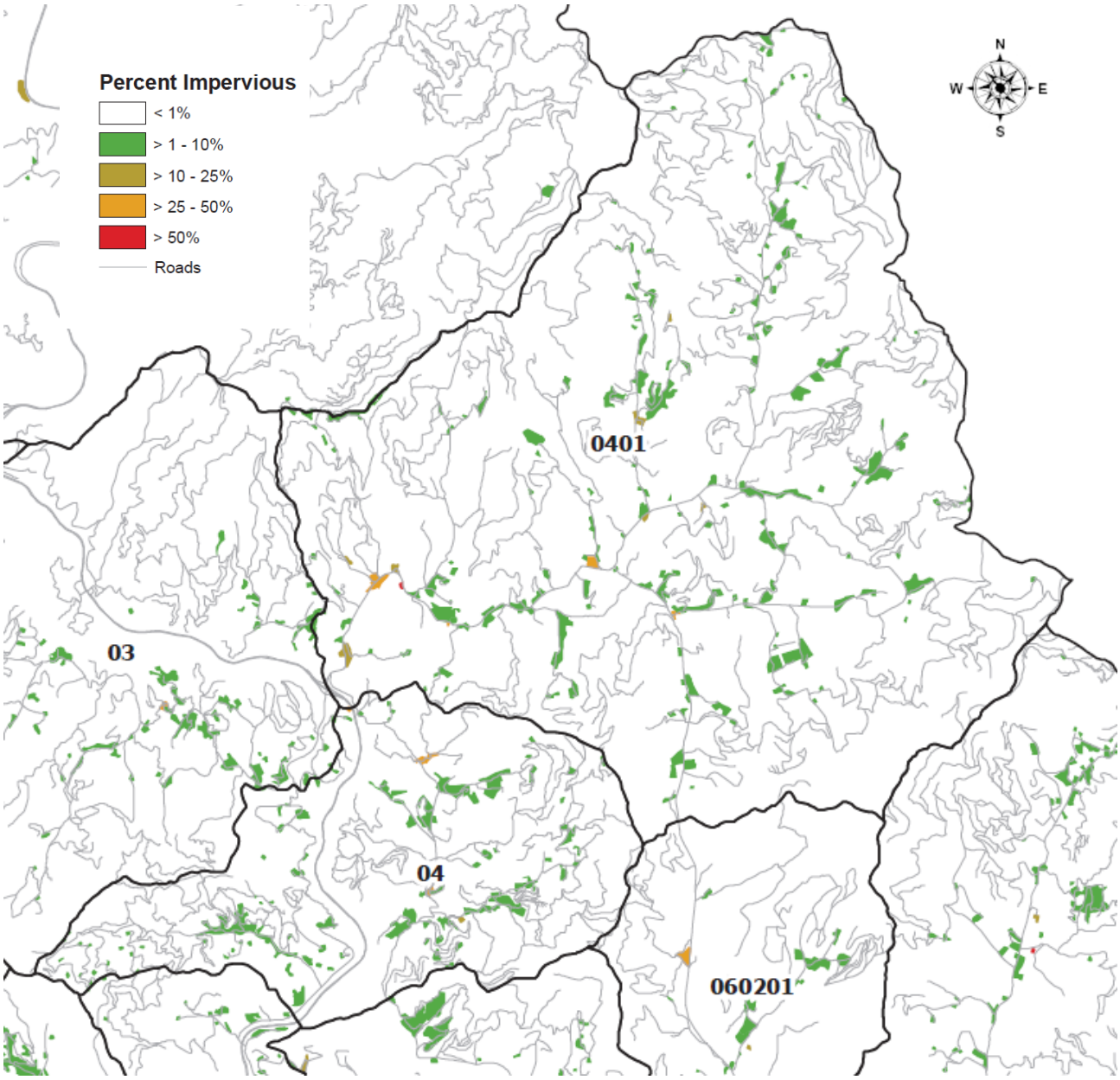

Figure 3. Percent Impervious Surfaces in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

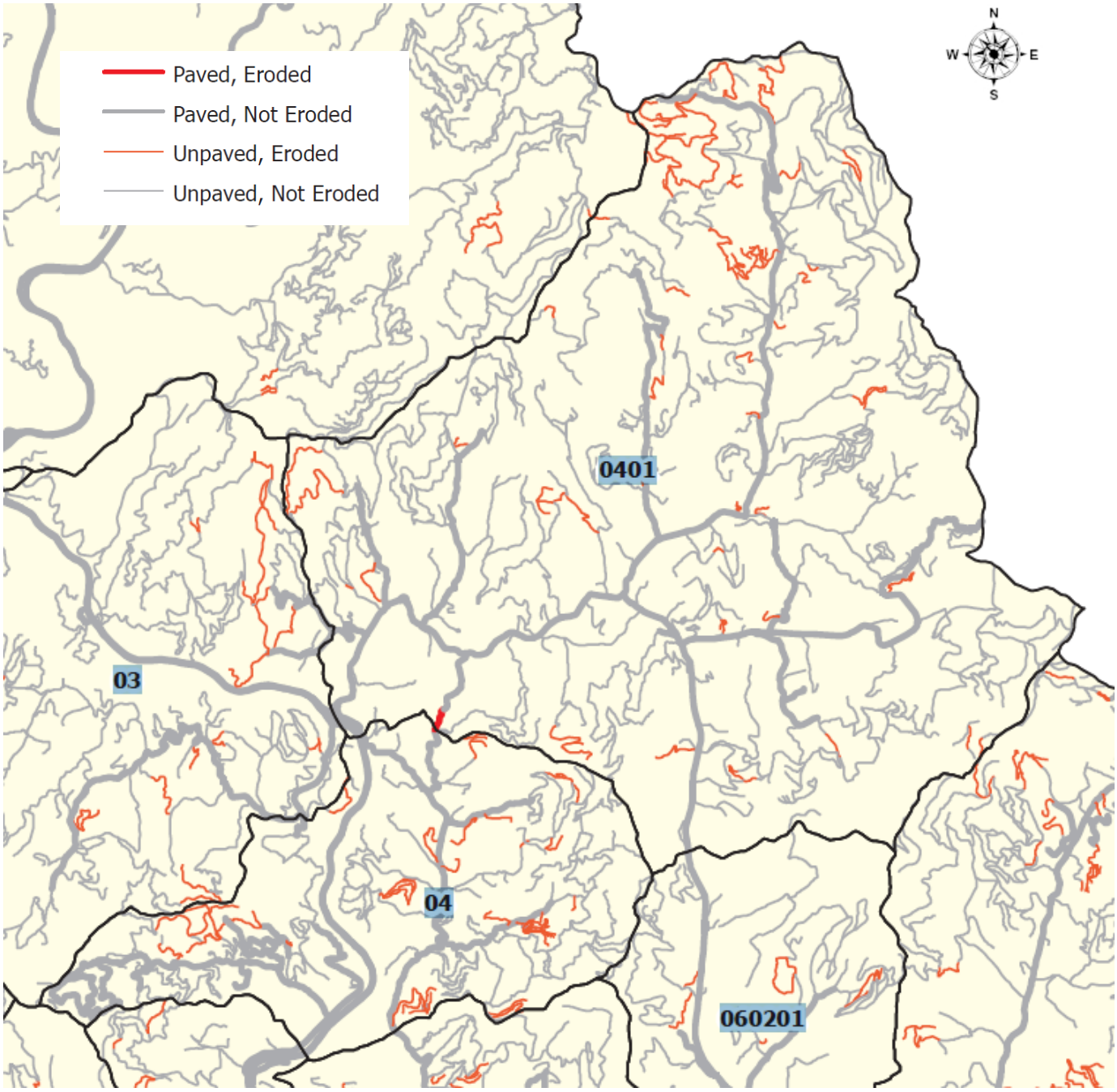

Figure 4. Eroding Roads in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

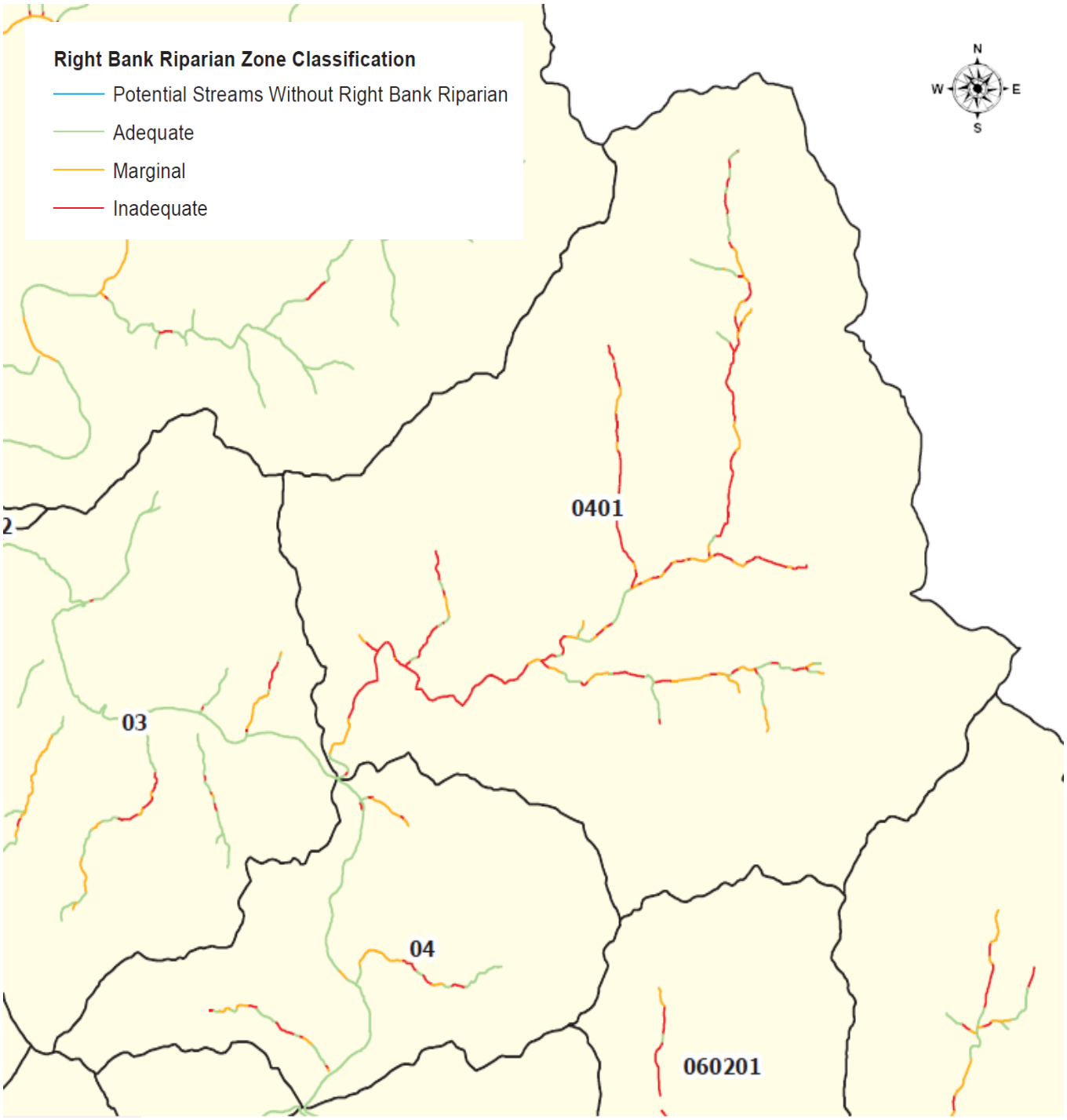

Figure 5. Right Bank Riparian Zone Classifications in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

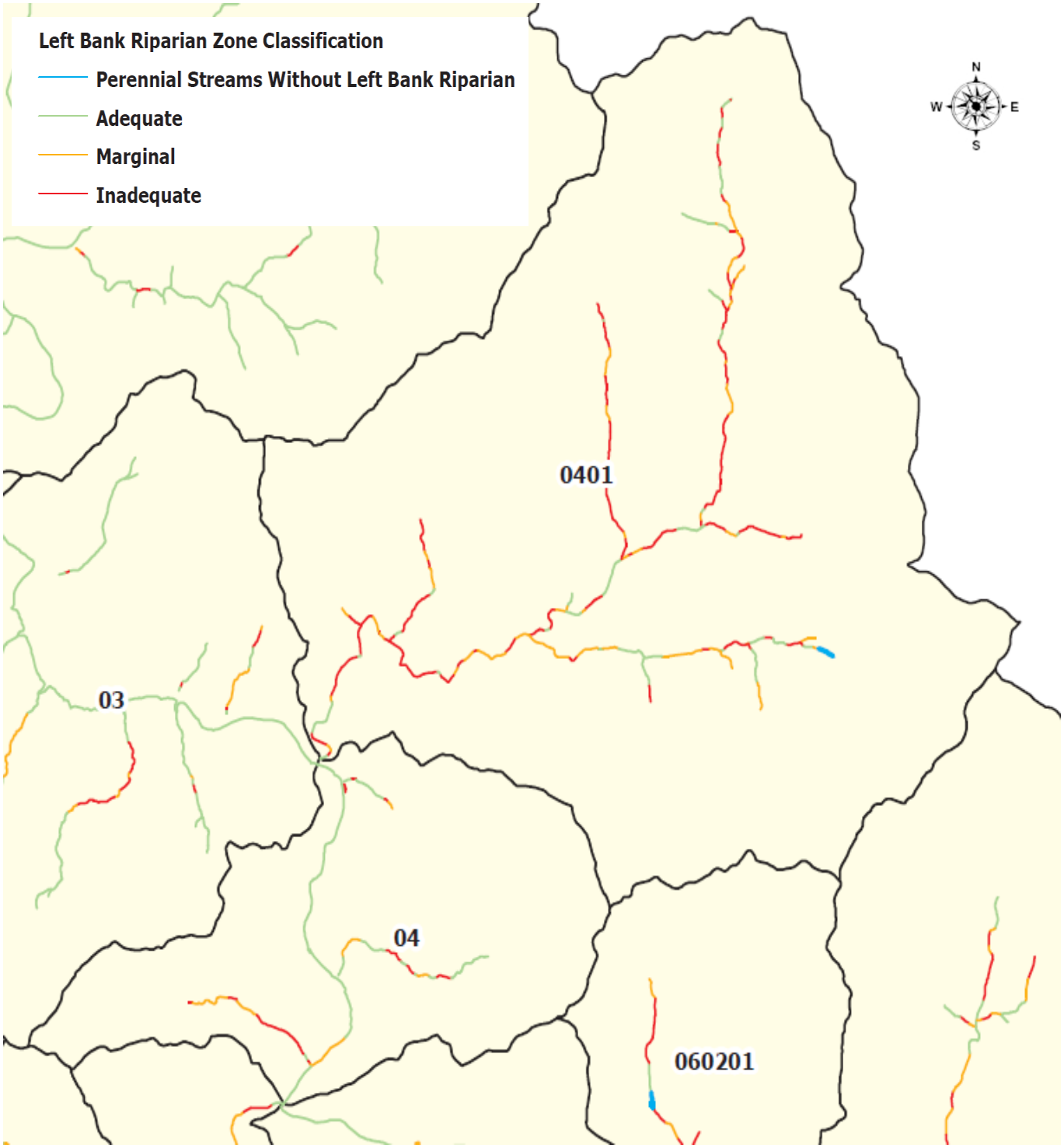

Figure 6. Left Bank Riparian Zone Classifications in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

Figure 7. Eroding Stream Banks in the Fines Creek Watershed (04, 0401). Source: Integrated Pollutant Source Identification dataset (Tennessee Valley Authority).

Table 3. Lower Pigeon River Watershed Restoration Group

Partner	Role
Haywood County Commissioners	Stakeholder
Haywood County Cooperative Extension Service	Education, technical assistance
Haywood County Environmental Health Department	Wastewater treatment
Haywood Soil and Water Conservation District	Technical assistance, grant writing
Haywood Waterways Association, Inc.	Education, outreach, monitoring, grant writing
Landowners	Stakeholder, matching funds
NC DEQ, Division of Water Resources	Monitoring, technical assistance
NC Department of Transportation	Technical assistance
NC Wildlife Resources Commission	Monitoring, technical assistance
Southwestern NC Resource Conservation & Development Council	Fiduciary agent, grant writing
Tennessee Valley Authority	Monitoring, funding agent
University of Tennessee-Knoxville	Monitoring, technical assistance
US Environmental Protection Agency	Technical assistance, funding agent
USDA Natural Resources Conservation Service	Technical assistance, funding agent

The long-term goals of the partnership are to: (1) improve water quality and restore uses to Haywood County's impaired waterways; (2) protect water quality for downstream landowner uses; (3) support fish populations; (4) reduce water quality and economic impacts to the Pigeon River and its' tributaries; and (5) provide clean water for recreation.

SECTION 2. CAUSE & SOURCE IDENTIFICATION

According to DWR's French Broad Basinwide Reports (2000, 2005), there are multiple stressors affecting water quality, including:

- Agricultural impacts, including livestock access to streams
- Nonurban development runoff
- Poor riparian condition
- Nutrient enrichment
- High conductivity
- Habitat degradation
- High turbidity

There have also been multiple agencies and organizations collecting water quality information throughout the watershed, either as part of a long-term study or for specific projects. The results from each of these data sources are summarized in this section. Load estimates are provided where available. Figure 8 shows locations.

Integrated Pollutant Source Identification (IPSI) - The IPSI database is a tool to help identify potential watershed restoration projects. It was created by Tennessee Valley Authority (TVA) and Haywood Waterways acquired two of them in 2000 and 2007. Due to the Fines Creek Watershed's rural landscape and the national economic recession in the late 2000s and early 2010s, the project partners believe the watershed has changed very little since 2007 and that the 2007 IPSI still has applicability for this WAP. The IPSI is a GIS-based dataset that includes such watershed features as land use/land cover, streams, impervious surfaces, eroding stream banks, riparian cover, livestock operations, and unpaved roads (Figures 4 to 9). It also estimates loads for sediment, nutrients, and other nonpoint source pollutants. Nutrient loads were estimated using the SIMPLE Method (Schueler 1987). The concentrations used in the model are from USEPA (2001) with values specific to North Carolina. The Universal Soil Loss Equation (USLE) was used to estimate pollutant loads from rural land uses and disturbed areas. The area District Conservationist (Natural Resources Conservation Service) provided factor values for each land use/land cover class. A factor of 0.7 was used to estimate total suspended solids (TSS). Nutrient load estimates were made by applying soil pollution coefficients (lbs. of pollutant per ton of soil) to the USLE. Pollution coefficients were developed by TVA. Nutrient load estimates from animal operations were calculated based on the estimated number of livestock, typical daily nutrient production and a delivery factor.

Volunteer Water Information Network (VWIN) – The VWIN Program is a volunteer-based water quality monitoring program managed by the Environmental Quality Institute (EQI). The program has sites throughout western NC. Haywood Waterways administers the program in Haywood County; they have monitored Fines Creek since 1996 and currently monitor four sites on two streams, Fines Creek (3 sites) and Cove Creek. Samples are analyzed by EQI for pH, conductivity, alkalinity, turbidity, TSS, and nutrients (orthophosphate, nitrate/nitrite, ammonia). Sites are rated as Excellent, Good, Average, Below Average, and Poor. The ratings are based on regional averages, scientific merit, and DWR water quality standards. The samples are not stormwater-dependent and primarily provide information from normal flow conditions.

In mid-2015, Haywood Waterways began monitoring stormwater-induced TSS loads. The main objective is to monitor sediment concentrations and to determine if ground disturbing activities were increasing loads. Although there is currently no standard to compare TSS readings, EQI considers any reading over 100 mg/L during normal flow as high. There is one sample site in mid- Fines Creek area and one in the lower reach just before the confluence with the Pigeon River. Samples are collected from bottles attached to a pole in the thalweg. Each site has between four and six bottles at varying heights but evenly spaced with each bottle representing a different discharge level. Stage A represents the lowest water level.

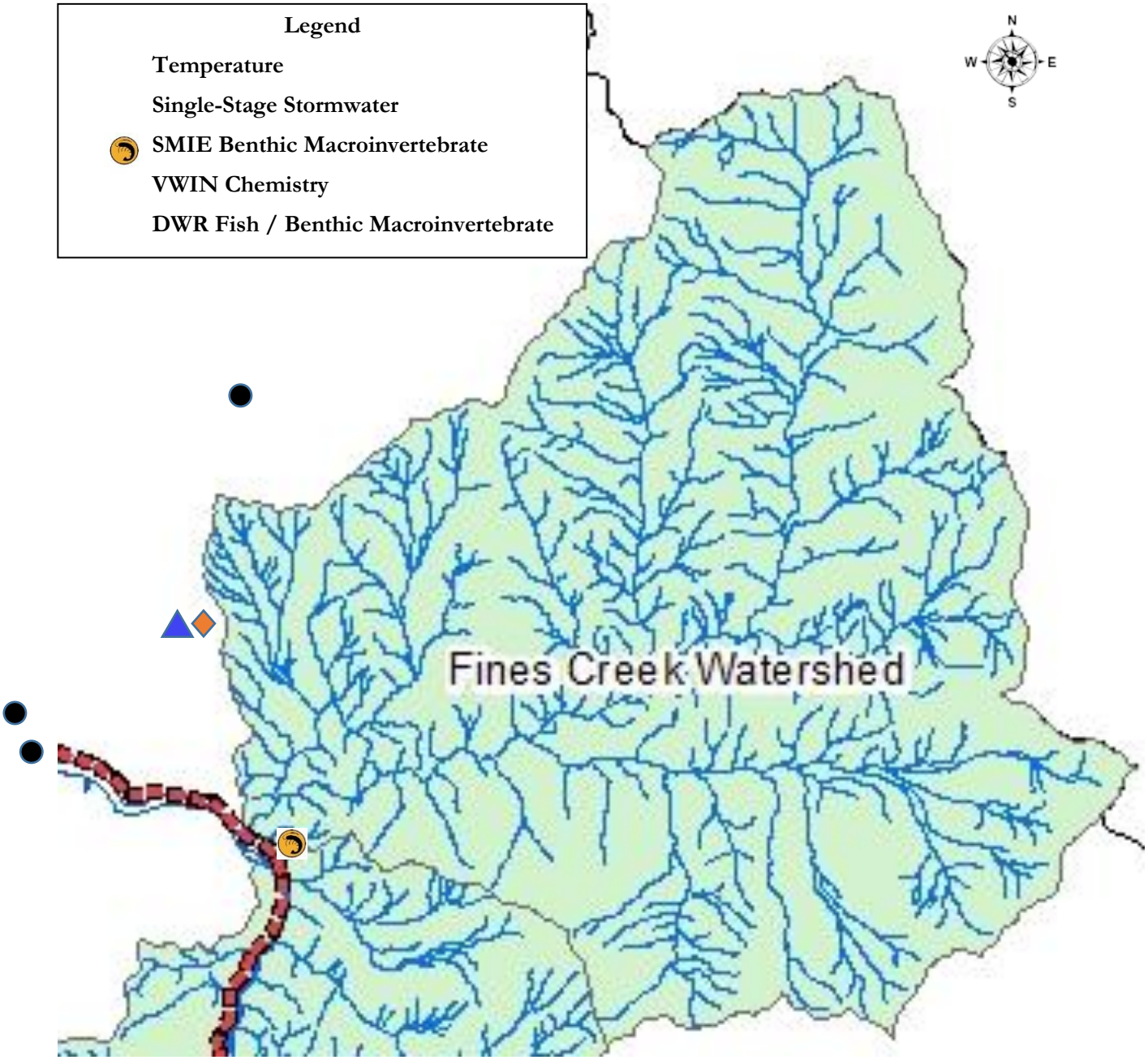

Figure 8. Fines Creek Monitoring Locations

Haywood Waterways is also collecting temperature data at the same sediment-induced TSS load sites. Data loggers monitor hourly; data are reported from July 2015 to November 2016.

The Stream Monitoring Information Exchange Program (SMIE) is a volunteer-based system of collecting water quality information based on benthic macroinvertebrates. The macroinvertebrates are collected, identified and water quality is graded based on a Biotic Index scale of poor, fair, good, and excellent. The number of mayflies, stoneflies, and caddisflies is also accounted for (EPT Richness); they are generally considered the most pollution intolerant and the higher diversity indicates better water quality. There is one Fines Creek site located near the confluence with the Pigeon River; it has been sampled in the spring and fall since 2005.

2.1 Temperature

Temperatures are frequently at or above the upper thresholds for coldwater fisheries (≥ 70°F; Table 4). Higher temperatures were observed between May and September, which may overlap with some fish spawning periods.

Table 4. Temperature Data

Site	Period	Range (°F)	Days ≥ 70°F	First and last days > 70 °F
Upper Fines Creek	7/2/2015 – 12/31/2015	33.1 – 74.9	43	7/07, 9/09
	1/1/2016 – 11/2/2016	33.2 – 79.1	78	6/10, 9/28
Lower Fines Creek	7/2/2015 – 12/31/2015	35.2 – 83.5*	62	7/07, 9/09
	1/1/2016 – 11/2/2016	33.0 - 79.6	105	6/10, 9/28

*Temperature probe was found emerged above the waterline; data are suspect

2.2 Basic Chemistry

According to VWIN results, pH measurements were within the normal range of water (6.5 to 7.2; Table 5). Alkalinity could be an issue in Upper Fines Creek and Cove Creek. Streams in western NC typically have low alkalinity because of thin soils and the underlying granitic bedrock does not have much acid-neutralizing capacity (i.e., low calcium carbonate; Westphal et al. 2009). If acid rain or other acid-type substance were to increase in those subwatersheds, there would likely be limited buffering capacity and the impacts of low pH would be significant.

The conductivity data indicate frequently high concentrations of dissolved ions in the Lower Fines Creek, Middle Fines Creek, and Cove Creek. The results are likely a result of clay and other dissolved solids (ex. chloride, nitrate, phosphate, calcium, iron) in the water column and are an indication of potential issues from erosion, wastewater discharge, and runoff (Westphal et al. 2009).

Table 5. VWIN Classification Grades Based on Parameters and Ranges[1, 2]

Site	Year	pH	Alkalinity	Turbidity	TSS	Conductivity	Ortho P	Ammonia-N	Nitrate-N	Copper	Lead	Zinc
7 - Lower Fines Creek	2009-2012	A	B	B	C	C	C	A	B	A	A	A
	2012-2014	A	B	C	C	C	C	A	B	-	-	-
	2015	A	B	C	D	C	C	A	B	-	-	-
15 - Middle Fines Creek	2009-2012	A	B	C	D	C	C	A	B	A	A	A
	2012-2014	A	B	C	D	C	D	A	B	-	-	-
	2015	A	B	D	D	C	D	A	B	-	-	-
19 - Upper Fines Creek	2009-2012	A	C	D	D	B	C	A	A	A	A	A
	2012-2014	A	B	D	D	B	C	A	B	-	-	-
	2015	A	C	D	D	B	C	A	B	-	-	-
20 - Cove Creek	2009-2012	A	C	C	D	D	C	A	C	A	A	A
	2012-2014	A	C	D	D	C	C	A	B	-	-	-
	2015	A	C	D	D	C	C	A	B	-	-	-

[1]Metals data collected from 2006 to 2009

[2]Grade scales defined:

pH: Grade A = never less than 6.0

Alkalinity: Grade A = median greater than 30 mg/L and little vulnerability to acidic inputs; Grade B = median 20-30 mg/L; Grade C = median 15-20 mg/L; Grade D = median less than 15 ppm

Turbidity: Trout standard = 10 NTU, general standard = 50 NTU; Grade A = median <5 NTU, >10 NTU in less than 10% of samples, never >50 NTU; Grade B = median <7.5 NTU, never >50 NTU; Grade C = median <10 NTU and >50 NTU in less than 10% of samples; Grade D = median >10 NTU or >50 NTU in more than 10% of samples

TSS: No standard but values <30.0 mg/l generally considered low and values >100 mg/l considered high; Grade A = median <5 mg/L and maximum <100 mg/L, land not measurably disturbed; Grade B = median <7.5 mg/L and >100 mg/L in less than 10% of samples, land disturbance low – moderate; Grade C = median <10 mg/L and >100 mg/L in less than 10% of samples, land disturbance moderate – high; Grade D = median >10 mg/L or maximum >100 mg/L in more than 10% of samples, high land disturbance

Conductivity: Grade A = median <30 uhmos/cm, never >100 umhos/cm; Grade B = median <50 umhos/cm, >100 umhos/cm in less than 10% of samples; Grade C = median >50 umhos/cm, >100 umhos/cm in less than 10% of samples; Grade D = >100 umhos/cm in more than 10% of samples

Orthophosphate: No legal standard but concentrations should be below 0.05 mg/L to prevent algal growths; Grade B = median >0.05 mg/L but <0.10 mg/L; Grade C = median >0.10 mg/L but <0.20 mg/L; Grade D = median >0.20 mg/L

Ammonia Nitrogen: Proposed standard to protect trout waters = 1.0 mg/l in summer and 2.0 mg/l in winter; Grade A = never >0.50 mg/L; Grade B = never >of 1 mg/L (proposed ambient standard for trout waters in the summer); Grade C = >1 mg/L in less than 10% of samples, but never >2 mg/L

Nitrate Nitrogen: Standard = 10mg/L; Grade A = median <0.3 mg/L, no sample >1 mg/L; Grade B = less than 10% of samples >1 mg/L, none >5 mg/L; Grade C = no samples >5 mg/L

Copper: Standard = 7 ppb; Grade A = never > 7 ppb; Grade B = >7 ppb in less than 10% of samples; Grade C = >7 ppb in 10 to 20% of samples

Lead: Standard = 10 ppb; Grade A = never >10 ppb

Zinc: Standard = 50 ppb; Grade A = median <5 ppb, never >50 ppb; Grade B = median <10 ppb, >50 ppb in less than 10% of samples; Grade D = median >10 ppb or concentration >50 ppb in more than 20% of samples

2.3 Soil Loss

According to the IPSI, the total soil loss from all land uses is estimated to be 28,910.7 tons per year (Table 6). The primary source is unpaved roads, though large contributions are also found in row crops and inadequate pasture conditions.

The VWIN and single-stage stormwater sediment data support the information from the IPSI model. Erosion and sedimentation are issues occurring throughout the watershed (Tables 7 and 8), but the highest appears to be coming from Cove Creek (among the four sample sites). Further, according to the VWIN turbidity results, all sites had a large number of samples that exceeded the 10 NTU trout standard and many were above the 50 NTU general standard.

Table 6. Soil Loss (IPSI data)

Source	Length/Area	Soil Loss (tons/year)	Percent of Total Soil Loss
Unpaved Road	837,377 lf (158.7 miles)	23,068.2	79.8
Eroding Road Banks	116,876 lf (22.1 miles)	90.0	0.3
Eroding Stream Bank	62,188 lf	146.6	0.5
Fair/Poor/Overgrazed Pasture Condition	2,658 acres	938.0	3.2
Row Crop	522 acres	4,056.0	14.0
Animal Operations Adjacent to Stream	29 operations / 3,675 lf	124.9	0.5
Forest / Meadow/ Scrub / Shrub	12,440 acres	487.0	1.7
Total		28,910.7	

2.4 Nutrients

The IPSI models estimates 21,800 lbs of nitrogen and 3,420 lbs of phosphorus are flushed into the Fines Creek Watershed each year (Table 9). The VWIN data indicate orthophosphate is an issue throughout the watershed (Table 4). According to Westphal et al. (2009), the most probable sources of nutrients are septic drainage, agricultural operations and residential fertilizers.

2.5 Metals

According to the VWIN data, metals are not a significant issue (Table 7). There is very little industrial influence in the watershed. There are no indications that the seven known dumpsites are leaching metals. Starting in 2010, metals were no longer included in VWIN sampling due to the lack of evidence of impacts.

Table 7. VWIN Results

Site		Rating[1]	Sediment Rating	% samples exceeding 10 NTU	Metals Rating[2]	Nutrient Rating	Issues[3]
Regional Average	2012 -	Average (79)	72	--	86	85	
	2014 -	Average (74)	65	--	--	83	
Lower Fines Creek	2012 -	Below Average (67)	58	25.9	88	75	Turbidity, TSS,
	2014 -	Below Average (63)	50	32.4	--	75	Conductivity, Ortho-P
Middle Fines Creek	2012 -	Poor (59)	42	41.7	88	75	Turbidity TSS,
	2014 -	Poor (54)	42	43.3	--	67	Conductivity, Ortho-P
Upper Fines Creek	2012 -	Below Average (63)	42	59.1	94	83	Alkalinity, turbidity,
	2014 -	Poor (58)	42	61.8	--	75	TSS, conductivity, Ortho-P
Cove Creek	2012 -	Poor (50)	33	54.5	81	67	Alkalinity, turbidity,
	2014 -	Poor (54)	33	60.9	--	75	TSS, conductivity, Ortho-P, Nitrate-N

[1]Ratings based on scale 0-100
2012 Ratings based on data from 2010 to 2012
2014 Ratings based on data from 2012 to 2014
Ratings have not been determined for 2015 or 2016 data

[2]Metals data collected from 2009 (Cu, Pb, Zn). Metals not sampled after that year due to no issues being detected in 14 year of sampling.

[3]Parameters considered a significant issue if it received a grade of C or D.

Table 8. Single-Stage Stormwater Sediment Data

	Upper Fines Creek	Lower Fines Creek
Total number of significant rain events	8	14
Stage A - Number of rain events	8	14
Average TSS concentration (mg/L)	599.0	3,799.7
TSS concentration range (mg/L)	44.4 – 1,928	29.2 – 21,307.1
Stage B - Number of rain events	4	10
Average TSS concentration (mg/L)	1,502.0	10,442.6
TSS concentration range (mg/L)	469.1 – 3,050.9	165.6 – 24,271.4
Stage C - Number of rain events	1	8
Average TSS concentration (mg/L)	918.4	4,330.7
TSS concentration range (mg/L)	--	209.2 – 26,000
Stage D - Number of rain events		3
Average TSS concentration (mg/L)		5,577.8
TSS concentration range (mg/L)		453.2 – 14,766.7

Table 9. Nutrient Load Estimates (IPSI data)

Total Nitrogen		Total Phosphorus	
Lbs/yr	lbs/acre/yr	Lbs/yr	lbs/acre/yr
21,800	1.33	3,420	0.21

2.6 Fish and Benthic Macroinvertebrates

Fish and macroinvertebrates play a critical role in aquatic ecosystems in terms of nutrient processing and as a food source for insects, fish, birds, and amphibians. Some species are more sensitive to poor water quality and DWQ uses the presence/absence of specific these organisms to identify potential issues. Fish also play an important human/economic role in terms of their use as food and recreation.

Benthic Macroinvertebrates: Data from the Stream Monitoring Information Exchange Program (SMIE) indicate water quality is Good-Fair to Excellent but it has varied over the years (Table 10). Sampling by DWR found a bioclassification of Good in 2012 (personal communication with Bryn Tracy).

Fish: In 2013, NC DWR found Fines Creek to have a rating of Fair, which is considered impaired (personal communication with Bryn Tracy). The low rating was attributed to a low abundance of fish, an absence of darters and other intolerant species, and a high percentage of tolerant fish. The total number of fish collected has declined from 754 to 222 to 174 during the last three sampling events. DWR partially attributes this to several high flow events between late fall 2009 and late fall 2011, which may have scoured the watershed. Most recent sampling found the dominant species to be the central stoneroller (*Campostoma anomalum*); three exotic fish species were also found that made up 11% of the population, including the brown trout (*Salmo trutta*). One species found was the Bigeye Chub, which is one of the species re-introduced as part of the Pigeon River Reintroduction Project by the NC Wildlife Resources Commission and DWR.

At the time of sampling, DWR considered instream habitat to be high quality. According to their description, "the watershed is gorge-like with high gradient plunge pools and waterfalls; fast and deep runs and riffles; *Podostemum*-covered rocks in the riffles; narrow riparian zone on the right due to the road; Total Habitat Score ranged from 88 to 90 (out of 100).

2.7 Other Issues

Exotic species

Stream corridors are ideal for many exotic and invasive species. The open canopy allows abundant sunlight to penetrate and support a variety of plants that out-compete native vegetation. There are multiple species prolific along Fines Creek Watershed streams, including multiflora rose (*Rosa multiflora*), kudzu (*Pueraria lobata*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and bamboo (*Bambusa* spp., *Phyllostachys* spp).

Table 10. Benthic Macroinvertebrate Community Data

Year	Biotic Index Score	Biotic Index Score	Biotic Index Rating[1]	Biotic Index Rating	EPT Taxa Richness[2]	EPT Taxa Richness
	Spring	Fall	Spring	Fall	Spring	Fall
2005	3.21	3.55	Good	Good	12	9
2006	3.11	3.01	Good	Excellent	9	7
2007	3.51	3.79	Good	Good-Fair	12	8
2008	3.39	3.51	Good	Good	9	8
2009	3.39	3.57	Good	Good-Fair	8	8
2010	3.03	--	Excellent	--	10	--
2011	--	3.70	--	Good-Fair	--	7
2012	3.41	3.44	Good	Good	12	10
2013	3.03	2.65	Excellent	Excellent	9	10
2014	3.18	3.74	Good	Good-Fair	10	5
2015	3.21	3.51	Good	Good	7	7
2016	3.76	--	Good-Fair	--	10	--

[1]Biotic Index Rating

- 2.0-3.0 Excellent
- 3.1-3.5 Good
- 3.6-4.0 Good-Fair
- 4.1-5.0 Fair
- >5.1 Poor

[2]EPT Richness: there are 19 possible EPT taxa in the SMIE system.

These species can cover and strangle native species and form an extremely dense understory that prevents any other species from growing. Vines like kudzu can cause trees to fall and when the canopy is open, it opens up new habitat for the invasive plants. Because wildlife is not adapted to exotic species, there is less food available for terrestrial and aquatic animals. Also, exotic species typically lack the deep, stabilizing root systems that help hold stream banks together during high water events.

Litter

Haywood Waterways Association started an Adopt-A-Stream program to help clean up Haywood County rivers and streams. Trash finds its way into waterways by way of stormwater runoff, wind action, and careless individuals. Trash can obstruct storm drains and cause flooding, clog intake pipes for water supplies and industry, and affect recreational uses, such as fishing, swimming, and paddling.

Since the Adopt-A-Stream program began in 2009, 17 organizations have adopted stream sections within the Richland Creek Watershed. In that time, over 1,100 volunteers have removed over 20 tons of trash. However, new trash loads are continuously added to local streams.

SECTION 3. MANAGEMENT MEASURES & EVALUATION CRITERIA

This section provides a series of strategies and action items to address watershed stressors. Tables 11 and 12 summarize the stressors, sources, management measures, restoration indicators and target goals.

If these measures are implemented, it is anticipated that Fines Creek could be a candidate for removal from the state list of impaired waterways within five years. They will also provide long-term protection of water quality throughout the watershed.

The common cause of pollution in all subwatersheds is stormwater. Impervious surfaces and poorly vegetated areas associated with human impact land uses contribute to stormwater impacts. As water flows over these surfaces, it picks up dirt, fertilizers, animal waste, bacteria, pesticides, oil, and other pollutants, all of which ultimately end up in streams. Also, the more impervious surfaces there are in an area the faster the rate of runoff will be, which can overwhelm a stream and cause significant bank erosion and flooding of downstream neighbors. Most of the sediment that washes into streams occurs during periods of high precipitation when stormwater runoff is at its greatest. The strategies addressed in this section all provide some level of stormwater control and treatment.

Erosion and sedimentation is a result of issues related to stormwater, development, and agricultural. Soil is getting into streams due to eroding stream banks, poorly designed and maintained road systems, inadequate riparian buffers, channelization, poor pasture conditions, impervious surfaces, and animal access to streams. There are many programs and best management practices available to address these issues; first and foremost they should focus on erosion prevention followed by sedimentation control.

Nutrients occur naturally in the environment. However, some human activities increase the nutrient concentrations to levels unsafe for humans and livestock. Nutrients are most commonly found in animal waste, septic waste, and fertilizers. When fertilizers are used too close to a water source and shortly before a rain event, heavy rains can wash the fertilizer into a waterway. Nutrification can lead to "blue baby syndrome, as well nuisance algal blooms, which, when the algae die, can lead to fish kills due to the decomposing bacteria robbing the water of oxygen.

High temperatures are another negative result of impervious surfaces and insufficient riparian cover. In the heat of summer an asphalt parking lot can 120 - 150°F. When it rains, that heat is transferred to the runoff, which travels downstream to the nearest waterways. The Fines Creek Watershed contains many coldwater streams supporting a high diversity of aquatic organisms, such as trout, darters, and stoneflies. Sudden temperature swings can cause severe stress on wildlife, which can result in death, reduced eating behavior, or impaired reproductive capabilities.

It is possible that bacteria may be affecting water quality though no project partners have collected that data. There are 29 known livestock access points to Fines Creek Watershed streams. There have also been many failing septic systems found throughout Haywood County. While very few have been found in the Fines Creek area, we anticipate more as the project is implemented. A failing system near a waterway can dump up to 360 gallons of untreated wastewater in to the stream every day. Some of the harmful materials possibly found in septic waste as well as animal waste in runoff include raw human feces, nutrients, pharmaceuticals, and household cleaners. Feces itself can contain bacteria and viruses that are a serious threat to human health. Hazards include ear infections, typhoid fever, hepatitis A, viral and bacterial gastroenteritis, and dysentery.

Table 11. Stressors, Sources, and Target Indicators to Achieve Management Measure Goals

Primary Stressors	Sources	Restoration Indicator and Target[1]	Five-Year Target
Sediment	• Stormwater • Unpaved roads • Row crops • Inadequate pasture • Eroding streambank • Livestock access • Land disturbing activities	Substrate = course materials TSS = <30 mg/L, <100 mg/L Turbidity <10 NTU Benthos community = Good/Fair Fish community = Good/Fair	Substrate = course materials TSS = 50% reduction in VWIN concentrations >100 mg/L TSS = 50% reduction in stormwater concentrations Turbidity: 50% reduction in samples exceeding 10 NTU standard Benthos community = Good/Fair Fish community = Good/Fair
Nutrients	• Poor riparian vegetation • Livestock waste • Fertilizers	Orthophosphorus <0.05 mg/L Benthos community = Good/Fair Fish community = Good/Fair	Orthophosphorus: 25% reduction in samples exceeding VWIN target of 0.10 mg/L Benthos community = Good/Fair Fish community = Good/Fair
Temperature	• Poor riparian vegetation • Impervious surfaces	Temperature <68° F Benthos community = Good/Fair Fish community = Good/Fair	Temperature: 25% reduction in samples exceeding 68° F Benthos community = Good/Fair Fish community = Good/Fair

[1]Basis for targets:

- Substrate composition: no standard, predominantly course materials ideal for biological communities
- TSS: no legal standard,
  - Non-stormwater <30.0 mg/l (Westphal et al. 2009)
  - Stormwater <100 mg/L (Westphal et al. 2009)
- Turbidity: DWQ standards (trout waters)
- Temperature: DWQ standard (trout waters)
- Phosphorus: no legal standard, <0.05 mg/L to prevent eutrophication (Westphal et al. 2009)
- Benthos community: DWQ standards
- Fish community: DWQ standards

Table 12. Management Measures, Load Reduction Parameters and Evaluation Measures

Management Measure	Target Stressor(s)	Parameter Targeted for Load Reduction	Evaluation Measures
Stormwater collection devices[1]	High flow Eroding streambanks	Discharge: ft^3/s Sediment: tons/yr	Discharge Streambed composition, TSS
Stormwater collection devices[1]	Excess nutrients, bacteria	Nutrients: lbs/yr Fecal coliform: colonies/100ml	Nitrogen, Phosphorus Fecal coliform
Stormwater collection devices[1]	High temperature	Temperature: degrees F	Temperature
Stormwater drainage controls[2]	High flow	Discharge: ft^3/s	Discharge
Revegetating exposed ground	Excess sediment	Sediment: tons/yr	Streambed composition, TSS
Instream modifications[3]	Eroding streambanks	Sediment: tons/yr	Streambed composition, TSS
Streambank modifications[4]	Eroding streambanks	Sediment: tons/yr	Streambed composition, TSS
Streambank modifications[4]	Excess nutrients, bacteria	Nutrients: lbs/yr Fecal coliform: colonies/100ml	Nitrogen, Phosphorus Fecal coliform
Streambank modifications[4]	High temperature	Temperature: °F	Temperature
Agricultural improvements[5]	Eroding row crops, pasture, streambanks	Sediment: tons/yr	Streambed composition, TSS
Agricultural improvements[5]	Excess nutrients, bacteria	Nutrients: lbs/yr Fecal coliform: colonies/100ml	Nitrogen, Phosphorus Fecal coliform
Wastewater treatment[6]	Excess nutrients, bacteria	Nutrients: lbs/yr Fecal coliform: colonies/100ml	Nitrogen, Phosphorus Fecal coliform

[1]Stormwater collection devices: devices that capture and treat pollution, and enable groundwater infiltration, including constructed wetlands, bioretention basins, retention/infiltration ponds, and storage tanks
[2]Stormwater drainage controls: devices that reduce runoff volume and velocity, including permeable surfaces, bioswales, level spreader, berms, drop box, diversion ditch, check dams, proper culvert spacing, undersized culvert replacement, and paving very steep roads
[3]Instream modifications: cross vanes, j-hook vanes, w-vanes, boulders, tree revetments
[4]Streambank modifications: riparian buffers, silt fences, slope enhancements, sinuosity, root wads, bank hardening
[5]Agricultural improvements: livestock fencing, designated stream crossings, pasture improvements, treatment lagoons, concentrated feeding and waste stations
[6]Wastewater treatment: septic system repair, municipal sewage treatment system upgrades

The strategies, or best management practices, outlined in this section will have significant benefits for the environment, community, and economy of Haywood County and help the partnership attain the long-term goals. Oftentimes, multiple action steps should be integrated approach to maximize effectiveness and address the many challenges of working in this mountainous region.

As the Fines Creek Watershed is developed, many landscape changes can cause expensive problems in the future. The management measures will also provide preventative steps to address future water quality issues. It is far more economical to prevent pollution and degradation of our waterways than it is to clean up after the damage has been done.

3.1 Continue and Improve Water Quality Monitoring

Monitoring is one of the primary strategies in this WAP. It is critical to maintain a comprehensive monitoring program to characterize current conditions, changing watershed conditions, identify restoration needs, justify grant applications and demonstrate measurable results from watershed improvement projects.

Action Steps:

1. Continue project partners monitoring programs for temperature, stormwater TSS, turbidity, substrate composition, VWIN, nutrients, and biological communities.
2. Use a comprehensive monitoring plan to document water quality improvements as management measures are implemented, as well as continue monitoring after project completion.
3. Expand temperature monitoring in Cove Creek.
4. Expand stormwater TSS monitoring in Cove Creek
5. Start bacteria monitoring program.
6. Make the data available to public officials and agencies and organizations working on water quality improvement projects.
7. Periodically review monitoring parameters, locations and frequency; modify as needed to ensure they represent the highest priority needs.
8. Acquire revised IPSI data sets every 5 years.
9. Share information about changing conditions and threats with stakeholders.
10. Include monitoring funds in grant requests.
11. Work with Haywood Waterway and other organizations to continue offering volunteer monitoring opportunities.

3.2 Continue and Expand Education Campaigns

There are many excellent educational and awareness efforts ongoing in Haywood County. Educating the public is one of the best strategies for the long-term benefit of water quality. It helps build community participation, giving citizens a vested interest in the health of their waterways. Much of the focus should be on youth to instill environmentally responsible behaviors at an early age. Public presentations should focus on the management measures and recommendations found in this section of the Watershed Action Plan, in part to recruit landowners to implement management measures. The key project partners working on education include Haywood Waterways Haywood Soil & Water Conservation District, Haywood Cooperative Extension Service, Wildlife Resources Commission, US Fish & Wildlife Service, and National Park Service, but there are many others that assist these organizations.

One of the most important education programs should be erosion control training, not only for developers and general contractors but for the equipment operators and staff working the shovels. The staff involved with actual construction are ultimately the ones responsible for implementing the plans as well as troubleshooting. They are the ones that need to identify issues in the field and relay that information to the developers, engineers, and other responsible for site planning. One training option is NCSU's Green Dozer

Program, but it is not offered frequently and may not be cost-effective. There is also Mountain H2OPro offered by the Regional Erosion and Sediment Control Initiative, an effort by the watershed organizations in the seven western-most counties to develop a training system that is affordable, on-going, and mountain specific. Another workshop option is the Roads Workshop for Landowners helping property owners build stable roads.

Action Steps: See Table 13.

Table 13. Recommended Education Action Steps

Program/Activity	Organization
Adopt A Stream (litter control)	HWA
Conservation Field Days	HSWCD
Conservation-Based Development Training (Mountainside Roads, Mountain H2OPro E&SC)	All
EnviroThon	HSWCD
Erosion & Sediment Control training	All
Kids in the Creek	HWA, Haywood County School System
Informational brochures	All
Leaders in the Creek	HWA
Newsletters	All
Newspaper columns and articles	All
Presentations to public	All
Presentations in schools	All
Public displays	All
Public meetings	All
Signs – stream and watershed	All
Social media – Facebook, Twitter	All
Surveys	HWA
Project tours	All
Websites	All
Y.E.S. Camp	HSWCD

3.3 Implement Stormwater Treatment and Control Systems

Stormwater is the number one cause of nonpoint source pollution to waterways. The primary concerns with stormwater are high stream flows and the transport of pollutants off the landscape into steams. To reduce risks associated with high flows, stormwater should be collected and retained on or near the point of origin. By keeping stormwater on-site, stream discharge is reduced which results in less stream bank erosion. It also allows water to seep into the groundwater supply. Any collection methods should also provide some measure of treatment to filter pollutants, including sediment, nutrients, and thermal pollution. Retaining runoff onsite allows water to cool.

If stormwater cannot be retained on site, then steps must be taken to avoid concentrating water flows. Concentrating flows greatly increases the erosive capacity of the water. Culvert spacing on roads illustrates this concept. If there are not enough culverts along road sections, the volume and velocity of the water will greatly accelerate erosion in the ditch line of the road and eventually the adjacent cut banks and roadbed. Intercepting the water with properly spaced and installed culverts, then dispersing the water from the culvert outlet so it can be readily absorbed into the ground, will reduce this problem.

Installing these planned stormwater practices before building construction begins may be one of the most effective ways to minimize impacts. This avoids having to play catch-up later during the project, which can lead to delays or additional expenditures.

It is also possible to retrofit existing sites, though it may take additional planning to accommodate utilities and other challenges. Working with Homeowners Associations should be one targeted group. These properties tend to have major issues due to lack of maintenance and changes in the landscape as new houses are constructed.

The following techniques should be considered for controlling and treating stormwater runoff:

- Stormwater collection devices: constructed wetlands, bioretention (rain gardens), retention ponds, and storage tanks (underground, above ground);
- Stormwater drainage controls: permeable surfaces, bioswale, level spreader, berms, drop box, diversion ditch, check dams, culvert spacing, culvert size, and paving very steep road sections;
- Streambank modifications: riparian buffers and silt fences;
- Revegetating exposed ground.

Action Steps:

1. Identify and prioritize properties in need of assistance.
2. Encourage developers, public officials, and others to install stormwater treatment and control techniques in all new construction.
3. Encourage property owners and public officials to retrofit existing sites.
4. Work with technical resource agencies to identify appropriate stormwater treatment and control devices for new construction or to retrofit existing sites.
5. Apply for financial resources to assist property owners.
6. Implement stormwater management measures.
7. Map storm drains throughout watershed to help identify illicit dischargers.

3.4 Stabilize Unpaved Roads, Row Crops, Pastures and Streambanks

Unpaved roads are the highest contributor of sediment to the watershed followed by row crops and inadequate pasture condition. Eroding streambanks also have high contributions in areas of poor riparian buffers and where livestock have access to streams. There are many techniques that can be used to stabilize these landscapes and prevent erosion. These may include:

- Unpaved roads: preventing concentration of stormwater, installing devices to control stormwater flow, no building on steep slopes;
- Instream modifications: cross vanes, j-hook vanes, w-vanes, boulders, and tree revetments;
- Streambank modifications: riparian buffers, slope enhancements, sinuosity, root wads, and bank hardening; and
- Agricultural operations: livestock fencing, alternative water sources, designated stream crossings, no-till farming, and pasture rotation.

Planting riparian vegetation is one of the most basic techniques yet gives great benefits for water quality. The buffer should consist of mixed, native vegetation, including trees, shrubs, and ground cover. DWQ recommends this strategy in their French Broad Basinwide Plan (2011). Having the mixed vegetation will reduce the erosive forces of rainfall and the deep roots will hold streambanks together during periods of high discharge. Additional benefits of buffer vegetation are filtration of sediment, nutrients, and bacteria; shading to reduce thermal stress; habitat for aquatic and terrestrial wildlife; food for wildlife; and retaining water during heavy rainfall to reduce floodwater levels. A recent initiative in western NC is the Shade Your Stream campaign (http://shadeyourstream.org/). The Campaign is working to encourage landowners to restore a healthy riparian buffer on their land.

Implementing these best management practices would greatly benefit stream habitat, which would improve fish community condition, which is what is ultimately needed to remove Fines Creek from the state list of impaired waterways. There is also a low-head dam in the watershed that should be removed to improve flow and basic stream ecology.

Action Steps:

1. Identify and prioritize properties in need of assistance.
2. Encourage property owners, developers, and agricultural operators to install erosion prevention measures.
3. Work with technical resource agencies to identify the appropriate stabilization management measures.
4. Remove exotic and invasive species and replace with native vegetation.
5. Apply for financial resources to assist property owners.
6. Implement stabilization management measures.
7. Work with NC Department of Transportation and NC Forest Service to install basic road improvements and address stormwater along Max Patch Road, Turkey Creek Road, Popular Cove Road, Sugar Cove Road, Price Town Road, and Martin's Creek Road.
8. Stabilize the streambank adjacent to the Fines Creek Community Center.
9. Remove Palmer Dam along Betsy Gap Road
10. Promote the Shade Your Stream Campaign.
11. Work with Haywood Waterway and other organizations to offer volunteer opportunities for riparian plantings.

3.5 Eliminate Sources of Bacteria

There remains a risk of bacteria pollution in the Fines Creek watershed due to livestock access to streams, inadequate management of pet and livestock waste, and potential failing septic systems. Fixing a failing septic system can eliminate up to 360 gallons of untreated wastewater from discharging into local waterways per day. It will eliminate fecal coliform bacteria, excess nutrients, gray water waste (soaps, grease), pharmaceuticals, household chemicals, and heated water from entering our cold-water streams. It will also ensure continued treatment of human waste.

There is great demand for financial assistance to repair failing septic systems. Many homeowners are low income. Haywood Waterways and the Haywood County Environmental Health Department have partnered

on a program to fix failing septic systems. Multiple grant sources have been found and they've had great success.

Between 2007 and 2011, the Wastewater Discharge Elimination Program was a state-run program within the Division of Environmental Health. They worked with Mountain Projects, Inc to identify and repair failing septic systems for low and very low income households. They provided 100% of repairs costs for qualifying households through a grant from the NC Clean Water Management Trust Fund. In that time they repaired over 45 failing systems. Many were found to be "blackwater to surface", or leaking raw sewage. In 2011, the state cut the program for financial reasons. If the program is ever considered for reinstatement, project partners should support the effort.

There are multiple steps that can be taken to reduce bacteria from livestock operations. Methods include livestock fencing, riparian buffers, treatment lagoons, concentrated feeding and waste stations, timing of manure applications, pasture improvements, and buyouts. Though not a major issue, stakeholders should encourage pet owners to pick up waste after their pets.

Action Steps:
1. Continue the septic repair program.
2. Identify and prioritize properties in need of assistance.
3. Encourage livestock operators to install wastewater treatment management measures.
4. Work with technical resource agencies to identify the appropriate wastewater treatment management measures.
5. Apply for financial resources to assist property owners.
6. Implement wastewater treatment management measures.
7. Encourage the public to pick up pet waste.
8. Encourage public officials to fund the WaDE Program and support the program if it returns.

3.6 Promote Conservation-Based Development Practices

Low impact development practices (LID) are construction techniques used to minimize stormwater runoff from sites transitioning from natural state to impervious surfaces. The first step in LID and the most effective tool to minimize pollutant loads is a good plan. A good plan will identify where the desired practices will best fit on the landscape and incorporate proven measures to minimize erosion. Avoiding problem areas and sites during the planning and design phase is one of the most cost-effective strategies for good project design and good conservation.

Haywood Soil & Water Conservation District, Natural Resource Conservation Service, Haywood Waterways, and Haywood Community College offer Resource Assessment for Mountainside Development projects as one planning tool. This approach provides up front assessments by resource professionals, such as soil scientists and geologists, to identify the most suitable areas for development as well as the most limited or hazardous areas.

Another planning tool will be Geologic Stability Maps created for the Fines Creek Watershed. The maps provide information on unstable soils that may require special engineering techniques or avoidance before construction starts.

Haywood County has ordinances to guide development. The planning and construction processes must take them into account. They are critical standards for protecting water quality as well as human safety. They set standards for building density, water supply protection, subdivision development, steep slopes, floodplains and floodways, stormwater and other protective measures. However, it's common for LID principles to go

beyond the standard requirements. One of the core principles of LID is building according to the site, which may differ from established ordinances.

Incentives can be effective tools for conservation-minded development. Incentives provide a means of making changes easier by focusing on a goal rather than a regulation. They may also help homeowners, developers, and farmers increase profits. They can provide recognition to conservation leaders, help defray costs, and reward new initiatives. Examples include certification programs, performance bonds, County and State recognition, fee offsets for important training, and providing materials to implement practices (such as grass seed and trees). Designing incentives in support of the most needed changes will provide additional publicity and provide affirmation to the individuals and corporations willing to be first.

When it comes time to implement the plans, there are many examples of contractors not following the plans, or contractors determining the plans won't work based on the landscape, both of which resulted in heavy erosion and sedimentation. There is a need to developers, designers, contractors, and property owners to attend workshops on proper erosion and sediment control techniques as well as best methods for constructing mountainside roads.

Action Steps:

1. Encourage developers and public officials use LID principles in all new construction
2. Encourage developers and landowners to participate in the Resource Assessment for Mountainside Development program.
3. Encourage developers and landowners to use information from the Geologic Stability Maps.
4. Work with technical resource agencies to identify the appropriate LID management measures.
5. Apply for financial resources to assist property owners.
6. Implement LID management measures.
7. Examples, principles, and practices associated with conservation-based development should be collected and distributed.
8. Develop and/or promote watershed protection incentives, such as "River Friendly Homeowner", "River Friendly Subdivision", "Clean Water Contractor", Professional Development Credits, and others.
9. Encourage grading contractors and landowners to attend a Mountain H2OPro Erosion & Sediment Control training and Roads Workshop for Landowners.
10. Contact stakeholders to determine the most effective form of incentives.

3.7 Support Improvements to Watershed Protection Ordinances

Several good ordinances exist for protecting water quality (e.g., the erosion control ordinance). However, as the population grows and the landscape changes, there will be a need periodically revisit current ordinances and revise as necessary. Another challenge is enforcement. One of the key positions in the effort to control nonpoint pollution is the County Erosion and Sedimentation Control Officer. However, there is often more work than one person can accomplish. This strategy includes sharing information, participating in the development of ordinances, publicly supporting key issues, lobbying for new ordinances, and lobbying for increased funding and staff.

Action Steps:

1. Understand and stay up to date with watershed protection ordinances
2. Encourage a consistent set of watershed protection ordinances for the county and municipality; this will make enforcement easier and may enable the hiring of additional staff.
3. Evaluate what state-wide ordinances don't work in the mountains and what holes exist in the current local ordinances.
4. Participate in the development of ordinances to protect water quality.

5. Determine if there are barriers to enforcement and implement strategies to remove those barriers.
6. Track local and state legislation, rule-making, and planning processes that have implications for water quality; submit comments and recommendations as needed.
7. Develop relationships with local, state, and federal officials whose decisions affect water quality.
8. Assist local governments with obtaining funds and skills to address nonpoint source pollution abatement opportunities.
9. Recognize and support initiatives by all levels of government that help keep our waters clean.
10. Support a new ordinance requiring developers and contractors to attend training workshops in erosion and sediment control.

3.8 Promote Conservation Easements

The value of conservation easements includes protecting special places; maintaining open spaces; protecting water quality, wildlife habitat, and viewsheds; providing recreation and educational opportunities; and maintaining prime farmland in agriculture. One of the key values is reducing development density on steep mountain slopes. Reducing development density means fewer roads, house sites, driveways, and associated runoff impacts from stormwater.

Conservation easements can be gifts that keep on giving. They provide a mechanism whereby a landowner can donate property rights to a public agency or qualifying nonprofit corporation. The rights they donate can insure that the property is maintained in its present use, whether that is agriculture, forestry, or limited residential. Easements can maintain certain desirable land uses and open space, reduce development pressure on sensitive watersheds, protect riparian areas, and perform many other functions. Since such gifts are considered to be in the public interest, the federal government and the State of North Carolina have enacted favorable tax laws for such gifts. Conservation easements can also provide substantial estate and inheritance tax advantages. An easement reduces the value of the taxable assets, therefore lowering the potential estate tax liability.

If developers or other landowners were encouraged to make such donations, either to the County/Towns or a qualifying nonprofit land trust, it would help protect riparian buffers, stormwater controls, and other mitigative techniques that protect and improve water quality. There are a number of ways to encourage such donations, ranging from public support to providing specialized skills to complete such transactions.

Action Steps:

1. Identify and prioritize properties for easements.
2. Link interested landowners with the appropriate agencies and organizations to facilitate the donation of appropriate easements.
3. Maintain a library of resources providing introductory information on the nature of easements; their structure, form, and function; and the federal and state tax implications.
4. Support efforts to obtain state, federal, and grant funding to acquire easements.
5. Establish conservation easements.

3.9 Promote Land Use Planning Efforts

As the population of Haywood County grows so does the degree of stress on water quality and other natural resources. Issues like eroding mountainside roads, construction on unstable soils and steep slopes, destruction of riparian buffers, replacement of pervious surfaces with impervious ones, and loss of prime agricultural lands will become more frequent unless proper protection measures are put in place. It will be critical for public leaders to address these growth issues through information gathering and planning. Recent programs include:

- Growth Readiness Roundtable - encouraging growth and development that is sensitive to both natural resources and quality of life. Implementing the many recommendations for ordinances, stormwater, and other key issues would provide many benefits for water quality.
- GROWNC - creating better use of natural and cultural resources in consideration of better quality jobs, efficient transportation systems, energy and financial savings, and healthier people and communities.
- Linking Lands and Communities - identifying opportunities that link natural systems through a Regional Green Infrastructure Network of Geographic Information System (GIS) models.

Action Steps:
1. Encourage public leaders and other stakeholders to participate in ongoing planning efforts.
2. Support public leaders in their efforts towards better planning and zoning.
3. Encourage public leaders and stakeholders to implement recommendations of planning efforts.
4. Encourage community leaders to contact technical resource agencies and organizations to determine what tools are available and to use them in planning efforts
5. Develop tools to help with planning efforts (ex. GIS maps).

3.10 Promote Local Water Quality Initiatives

Several organizations have already been working to improve the watershed. These projects work to control stormwater runoff, erosion, sedimentation, and non-point source pollutant loadings. They also protect riparian corridors and reduce landslide risks and septic system failures.

Pigeon River Recovery Project: Water quality has greatly improved over the years in the Pigeon River. NC Wildlife Resources Commission is working with several Tennessee partners to reintroduce native fish, snails, and mussels in order to bring back the community that was once present. Fines Creek is a tributary within the stretch of river they are focusing on.

Haywood Community College Natural Resource Management Department: Natural Resource Management is preparing students interested in wildlife and natural resources for careers in the public and private sector that require an understanding of geospatial technology, land planning, soils, site analysis, hydrology, geospatial technology, ecology, and environmental regulations.

Haywood Environmental Initiative: The Haywood Environment Initiative is a curriculum-based program that provides classroom and field activities for students in 5th, 8th and 9th grades to learn about water quality issues and their roles in protecting water quality. The initiative is comprised of several local agencies and organizations interested in water quality, include the Haywood County Schools, Haywood Waterways, National Park Service, and Lake Logan Episcopal Center. Programs in the Initiative include teacher training days, support of classroom lessons, native fish release from classroom aquariums, and coordination of resources across all schools in Haywood County. Though no longer active, if the program is ever considered for reinstatement, project partners should support the effort.

Haywood Greenways Advisory Council: The Haywood Greenways Advisory Council guides, plans, and promotes greenway opportunities for Haywood County. The Council consists of 13 members and includes the Haywood County Recreation and Parks Director and representatives from the Haywood County Health Department, the four incorporated towns in Haywood County, Lake Junaluska Assembly, Haywood Waterways Association, Blue Ridge Bicycle Club, Southwestern NC RC&D Council, and two appointed by the Board of Commissioners. Several greenways have been constructed or planned since the Council began.

Haywood Waterways Association: The mission of Haywood Waterways is to protect and conserve water resources by reducing non-point sources of pollution. They are known by local government and community

leaders as a valuable resource and credible advisor on resolving water resource issues. They partner with like-minded organizations to help willing landowners protect their land, reduce soil erosion, and improve water quality.

Southern Appalachian Highlands Conservancy: Land trusts work with landowners to protect critical lands for drinking water, recreation, tourism, healthy forests, and working farms. The mission of the Southern Appalachian Highlands Conservancy is to conserve the unique plant and animal habitat, clean water, farmland, and scenic beauty of the mountains of North Carolina and Tennessee for the benefit of present and future generations. Since 1974, they have protected over 70,000 acres from the Highlands of Roan to the Great Smoky Mountains National Park.

Action Steps:
1. Support local water quality initiatives.
2. Promote new initiatives as needed.

3.11 Provide Financial and Technical Incentives

Most landowners are conservation-minded and do not want to degrade water quality. In some cases, an individual or corporation may inherit problems when purchasing property. In both cases, the landowner may not fully recognize the nature of the problem, and may not have the experience, training, or resources to design and implement the most effective ways to maintain or improve water quality. Many forms of technical and financial assistance are available to help landowners in these situations. Table 14 provides estimates of cost for typical management measures along with technical resource contacts. Each measure will be considered ongoing as willing landowners are identified and financial and technical resources are available. Once Fines Creek is delisted; these actions will continue for the continued protection of water quality and ensure local streams remain off the list.

Sources of financial assistance include the Pigeon River Fund, the NC Clean Water Management Trust Fund, DWR Section 319 Program, TVA, and other grant-making organizations with conservation goals (Table 15). Some cover 100% of costs, while others offer cost-share assistance. Cost share payments are usually the case and can substantially reduce the cost to the landowner of implementing specific practices. One example is the Environmental Quality Incentives Program (EQIP). The program provides assistance with BMPs to landowners that have approved conservation plans. However, this program depends on federal appropriations. Increased awareness and support of such programs could result in increased appropriations for Haywood County. Other sources of funding and assistance, including state and federal appropriations, should be investigated.

Landowners interested in permanently protecting important riparian areas on their properties could benefit from conservation easement programs. Some programs provide cash payments for conservation easements or fee purchase of riparian areas. The State of North Carolina provides significant income tax credits for the donation of conservation easement to an appropriate entity. The federal government may provide income tax deductions for such donations. If so desired, easements can be written to maintain less intensive land uses—such as agriculture in lieu of subdivision development. Such easements may serve to reduce property and inheritance taxes, permitting a property to remain in the family.

Technical assistance, including engineering in some cases, is available through the Haywood Soil and Water Conservation District, the local offices of the Natural Resources Conservation Service, Haywood Cooperative Extension Service, and others (Table 16). These organizations work with landowners on a variety of programs and administer cost share programs addressing agriculture, stormwater, and stream bank issues. They provide help in analyzing land and water quality problems, help landowners select management

Table 14. Typical Management Measure Cost Estimates and Technical Resources

Management Measure	Cost	Technical Assistance
Monitoring	Depends on parameter	HSWCD, HCES, WRC, DWQ, HWA,
Education	Depends on type	HWSCD, HCES, WRC, HWA,
Conservation easement	State appraisal	HSWCD, RC&D Council
Storage tank	$50 - $100 rain barrel $1.00 per gallon cistern	HSWCD, NRCS
Permeable surface	$12 ft^2	HSWCD, HCES
Boulders	$77 ton	HSWCD
Tree revetments	$30 linear ft	HSWCD
Silt fence	$1.50 linear ft	HSWCD
Root wads	$80	HSWCD
Pasture renovation	$300 acre	HSWCD, NRCS
Revegetating exposed ground	$700 acre	HSWCD, NRCS
Livestock fencing	$3.24 linear ft	HSWCD, NRCS
Well	$13 linear ft	HSWCD, NRCS
Watering tank	$1,000	HSWCD, NRCS
Stream crossing	$1,100	HSWCD, NRCS
Septic system repair	$4,600 Average	Haywood County Environmental Health Dept
Resource Assessment for Mountainside Development	$7,000	HSWCD, HWA

DWR: NC Division of Water Resources
HCES: Haywood Cooperative Extension Service
HSWCD: Haywood Soil & Water Conservation District
HWA: Haywood Waterways Association
RC&D Council: Southwestern NC Resource Conservation & Development Council
WRC: NC Wildlife Resources Commission

measures best suited to their land, helping property owners maintain the BMPs once installed, and provide current information on the availability of program funds they administer.

Action Steps:

1. Maintain a current database of existing technical and financial programs, responsible agencies and local contacts, federal or state oversight and appropriation committees, funding history, and an estimate of qualifying projects.
2. Annually identify and focus efforts on those programs that have the greatest potential to substantially contribute to nonpoint pollution source reduction.
3. Annually contact our elected officials to inform them of the opportunities to assist Haywood County in addressing nonpoint pollution issues.

Table 15. Sources of Financial Assistance

Source	Grant Due Date	Website
Duke Energy Foundation Water Resources Fund	May, November	https://www.duke-energy.com/community/duke-energy-foundation/water-resources-fund
DWR 319 Program	May	www.deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/319-grant-program
Ecosystem Enhancement Program	Ongoing	www.deq.nc.gov/about/divisions/mitigation-services
Fund for Haywood County	September	www.nccommunityfoundation.org/section/haywood
National Fish & Wildlife Foundation, Five Star and Urban Waters Restoration Grant Program	February	www.nfwf.org/Pages/default.aspx
NC Agricultural Cost-Share Programs	Variable	www.ncagr.gov/SWC/costshareprograms/ACSP/index.html
NC Clean Water Management Trust Fund	February	www.cwmtf.net/
NC Dept. of Justice Environmental Grants	August	www.ncdoj.gov/EEG.aspx
NRCS Financial Assistance Programs	Variable	www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Pigeon River Fund	March, September	www.cfwnc.org/Nonprofits/PigeonRiverFund.aspx
TVA Ag & Forestry Fund	January	wnccommunities.org/index.php/2015/tva-ag-forestry-fund-2015/
TVA Community Relations Grant	Ongoing	www.tva.com/About-TVA/Community-Relations
Z Smith Reynolds Foundation	February, August	www.zsr.org/

Table 16. Sources of Technical Assistance

Source	Contact Information	Website
Haywood County Environmental Health Office	157 Paragon Parkway, Suite 200, Clyde, NC 28721, 828-452-6682	www.haywoodnc.net
Haywood County Planning Office	157 Paragon Parkway, Suite 200, Clyde, NC 28721, 828-452-6632	www.haywoodnc.net
Haywood County Erosion Control Program	157 Paragon Parkway, Suite 200, Clyde, NC 28721, 828-452-6706	www.haywoodnc.net
Haywood Soil & Water Conservation District	589 Raccoon Road Suite 203, Waynesville, NC 28786, 828 452-2741 x 3	www.haywoodnc.net
Haywood Waterways Association	PO Box 389, Waynesville, NC 28786, 828-476-4667, info@haywoodwaterways.org	www.haywoodwaterways.org
NC Cooperative Extension Service	589 Raccoon Rd, Suite 118, Waynesville, NC 28786, 828-456-3575	www.haywood.ces.ncsu.edu/
NC Forest Service	Haywood County, 88 Ed Greene Road, Clyde, NC 28721, 828-627-6551	www.ncforestservice.gov/index.htm
NC DEQ, Division of Water Resources	2090 US Highway 70, Swannanoa, NC 28778, 828-296-4500	www.deq.nc.gov/about/divisions/water-resources
NC DEQ, 401 & Buffer Permitting Branch	2090 US Highway 70, Swannanoa, NC 28778, 828-296-4500	www.deq.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/401-wetlands-buffer-permits
NC DEQ, Public Water Supply Section	2090 US Highway 70, Swannanoa, NC 28778, 828-296-4500	www.deq.nc.gov/about/divisions/water-resources/drinking-water
NC DEQ, Energy, Mineral, and Land Resources	2090 US Highway 70, Swannanoa, NC 28778, 828-296-4500	www.deq.nc.gov/about/divisions/energy-mineral-land-resources
NC Wildlife Resources Commission, Mountain Region	20830 Great Smoky Mountain Expressway, Waynesville, NC 28786, 828-452-6191	www.ncwildlife.org/
Southwestern NC Resource Conservation & Development Council	PO Box 1230, Waynesville, NC 28786, 828-452-2519	www.southwesternrcd.org/
US Army Corps of Engineers, Asheville Regulatory Field Office	151 Patton Avenue, Room 208, Asheville, NC, 28801-5006, 828-271-7980	www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/Contact.aspx
USDA, Natural Resources Conservation Service	589 Raccoon Rd., Suite 246, Waynesville, NC 28786, 828-456-6341 x5	www.nc.nrcs.usda.gov
US Fish & Wildlife Service, Asheville Field Office	160 Zillicoa Street, Asheville, North Carolina 28801, 828-258-3939	www.fws.gov/asheville/

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