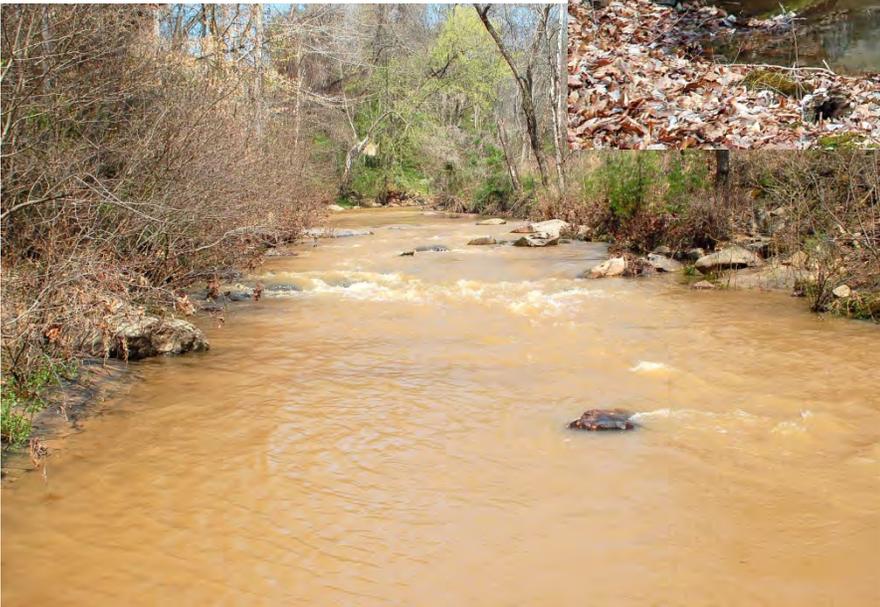


Eden Area Watershed Project Atlas



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Supported By



North Carolina Clean Water Management Trust Fund

February 2016

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INTRODUCTION

The Eden Area watershed focuses on the Dan and Smith Rivers of the Roanoke River Basin headwaters and covers approximately 225 square miles in central North Carolina and Virginia just east of the foothills of the Blue Ridge Mountains (Figures 3 & 4). The landscape is hilly, but resides entirely within the Piedmont, and presents challenges found throughout the ecoregion due to its soils, history, and local weather. It includes all of the waters draining to the Smith River downstream of the City of Martinsville, VA; to Matrimony Creek, a significant tributary to the Dan River; and to the Dan River between Stoneville and the exit of the river to Virginia in Caswell County, NC. It is bisected by the Virginia-North Carolina state boundary and a US EPA regional boundary (Mid-Atlantic (Region 3) & Southeastern (Region 4)).

The Dan River has been listed as impaired by the NC Department of Environment and Natural Resources (DENR), Division of Water Quality (NC DWQ, now titled the Division of Water Resources (DWR)) for aquatic life due to high turbidity levels since 2002 and high fecal coliform bacteria levels since 2008. Similarly, the Smith River has been listed by the NC DWR as impaired for biological habitat conditions due to high fecal coliform bacteria and copper levels since 2008 (NC DWQ 2013). The NC DWQ completed a Total Maximum Daily Load assessment (TMDL, aka “pollution diet”) for turbidity on the entire Dan River in 2005, concluding that the dominant sources of sediment are rural erosion sites (NC DWQ, 2012).

The Virginia Division of Environmental Quality (VA DEQ) lists the Smith River and many of its tributaries within this watershed as violating their water quality standard for *E. coli*, a measurement of fecal material. It conducted a TMDL for *E. coli* in 2007, and determined that its sources of pollution were non-point sources, primarily from rural areas in Virginia and North Carolina, though stormwater runoff from Martinsville was also attributed as a source (NC DWQ, 2009). The VA DEQ and the Division of Conservation and Recreation (VA DCR) completed a



Figure 1: Turbidity in Matrimony Creek Tributary

TMDL Implementation Plan for the Smith and Mayo River’s *E. coli* bacteria water quality standard violations. Within these two subbasins are two watersheds addressed in this study. Based upon their findings, the majority of inputs to these two watersheds are agricultural or from ill-maintained septic tanks (VA DCR, 2013).

The Upper Dan River Subbasin has been prioritized as an area of focus by the NC Watershed Restoration Improvement Team

(WRIT). The WRIT is comprised of representatives from different DENR and NC Department of Agriculture and Consumer Services (DACs) divisions and programs who are working to better coordinate watershed efforts across the state.

BACKGROUND

In 2009, the Piedmont Triad Regional Council (PTRC) was awarded a restoration planning grant from the NC Clean Water Management Trust Fund (NC CWMTF) to develop a plan to restore healthy water quality conditions to the Dan and Smith Rivers through the reduction of sediment and fecal inputs to the rivers, as well as the causes of impaired biological habitat conditions on the Smith River.

The first phase of this planning effort yielded the *Eden Area Watershed Assessment* in 2012. This watershed assessment analyzed watershed conditions, including assessments of current and past land use, local policies related to land use and development, water quality data, and field conditions recorded directly in the watershed. The *Eden Area Watershed Assessment* determined that long-term programmatic and policy-based solutions would achieve greater water quality improvements than most – but not all – structural improvements made to the watershed at this time. The need for action is immediate as the Dan and Smith are home to federally-endangered and –threatened fish and mussel species (Table 1). Due to landscape and soil constraints, the cost of retrofitting most sites was determined to be a less beneficial than agricultural practices and new policies could be to address sources of sedimentation and fecal input (Figure 5).

Table 1: Federally- and State-Listed Species known to reside within the Eden Area Watershed,

Federal	State	Common Name	Species Name
Endangered	Endangered	Roanoke logperch	<i>Percina rex</i>
Species of Concern	Endangered	Green floater	<i>Lasmigona subviridis</i>
Species of Concern	Significantly Rare	Roanoke bass	<i>Ambloplites cavifrons</i>
None	Threatened	Bigeye jumprock	<i>Moxostoma ariommum</i>
None	Special Concern	Riverweed darter	<i>Etheostoma podostemone</i>
None	Significantly Rare	Roanoke hogsucker	<i>Hypentelium roanokese</i>
None	Significantly Rare	Quillback	<i>Carpoides cyprinus</i>

Source: NC WRC 2014

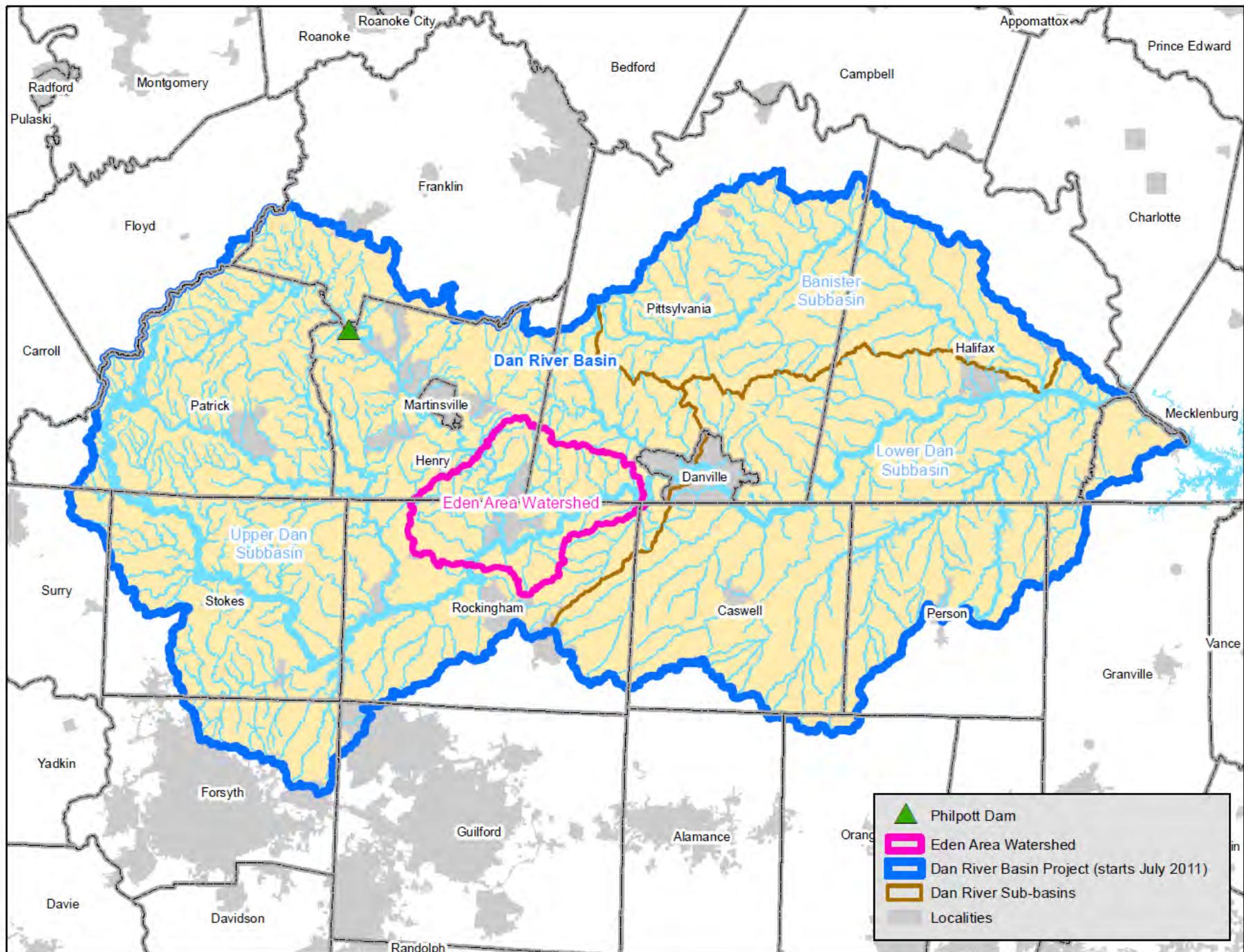


Figure 2: The Project Area in the Upper Dan River Subbasin

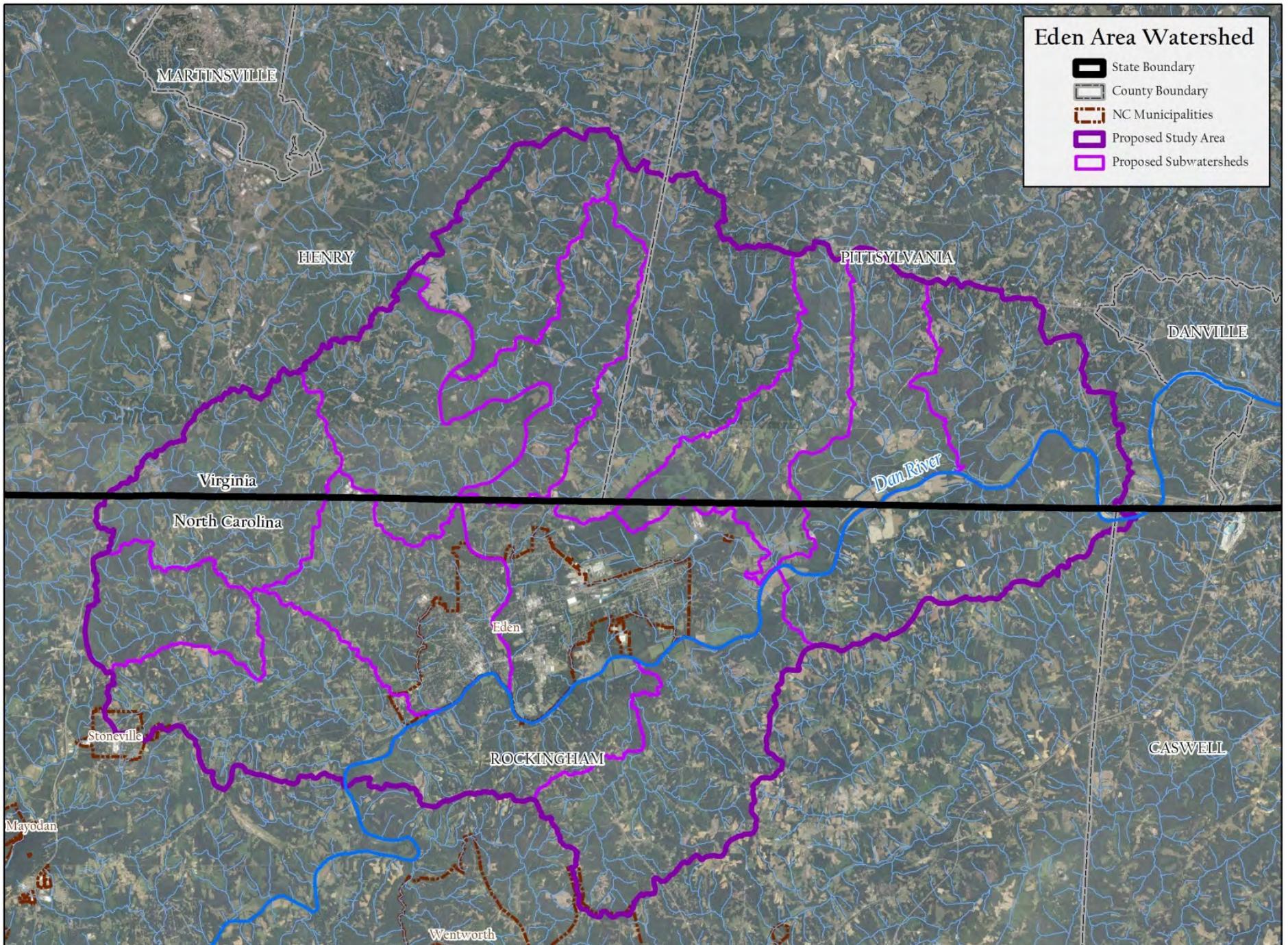


Figure 3: Eden Area Watershed Satellite Image

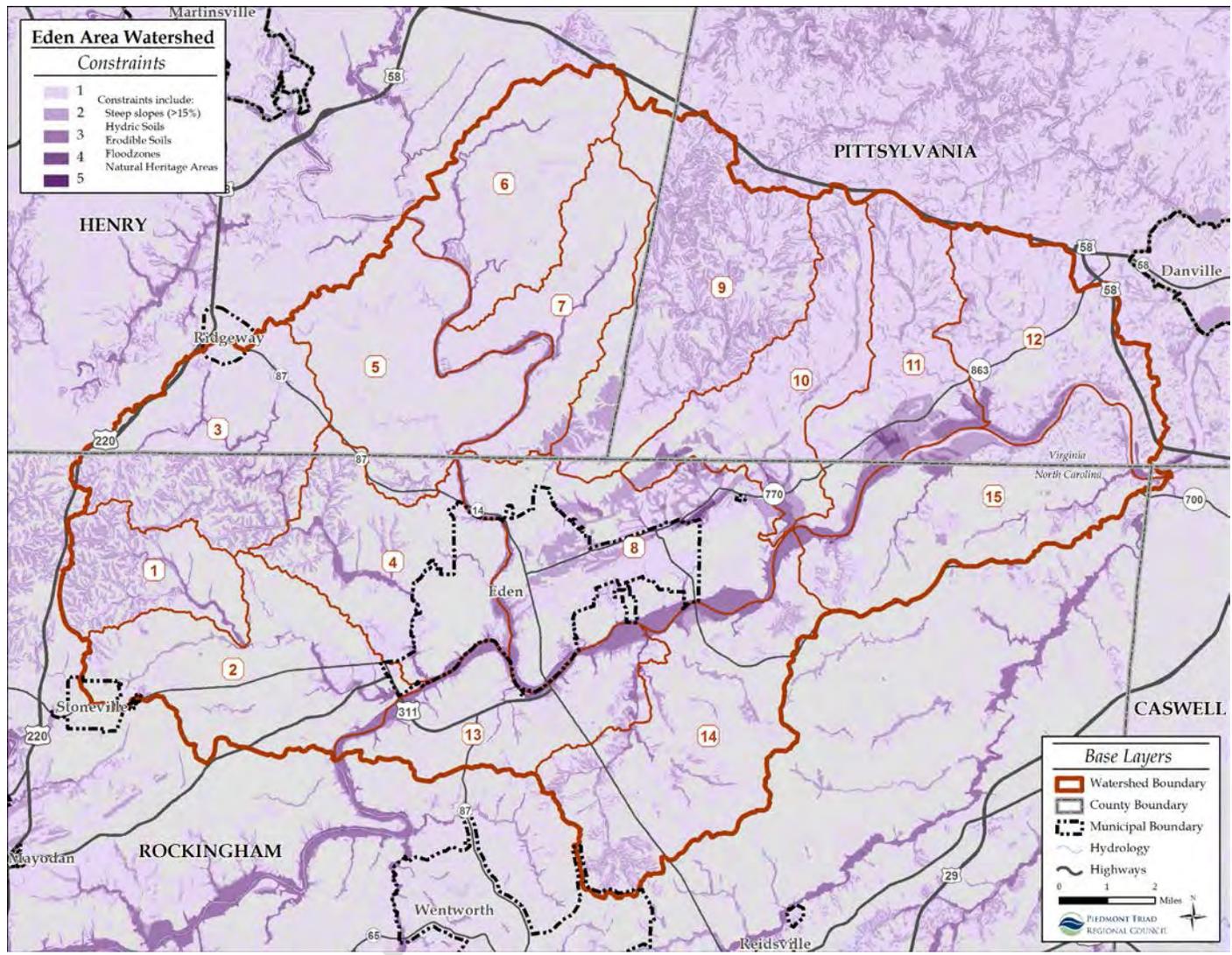


Figure 4: Eden Area Watershed Constraints

The *Assessment* also determined that the Dan and Smith Rivers have an untapped wealth. This wealth could be seen in the reclamation of the river systems for healthier ecological habitat conditions; in the growth of businesses and the residential sector, especially in the City of Eden, which has an underutilized infrastructure; in the ecotourism potential of the rivers paddling, hiking, and biking trails; and in its potential to be a state leader in balancing economic resiliency with environmental restoration.

Lastly, the watershed's water quality priorities shifted. On February 2, 2014, a 850-foot, 14-inch stormwater pipe at Duke Energy's retired Dan River power plant discharged 82,000 tons of coal ash residue to the Dan River, 1 mile downstream of the City of Eden's water intake and 20 miles upstream of the City of Danville, VA's, water intake. Coal ash contains a variety of potentially toxic metals including arsenic and lead.

This *Eden Area Watershed Restoration Plan* was published in February 2014. It featured seven policy initiatives, a special water quality modeling study by a team from the NC State University's (NCSU) Cooperative Extension that identified watershed priorities, and an Implementation Timeline for watershed stakeholders to use to aggressively improve water quality conditions in the next twenty years. These recommended projects, programs, and policies are aimed at reducing sediment and fecal inputs to the Dan and Smith Rivers as cost-effectively as possible. There are specific recommendations for the agricultural, timber, and municipal interests of this watershed, with hopes that some of the simpler practices can reduce sediment to levels of low concern for relatively little money.

The *Plan*, however, is couched within the reference of the coal ash spill and recognizes the economic hardships the city and county have endured in the twenty-first century. The need to reassure residents and users of the Dan River that water is clean and safe is imperative; action is necessary to demonstrate significant improvements in water quality conditions and the quality of life for Dan River basin residents. Only with such action will sustained stewardship be engendered.

The *Restoration Plan* has a project atlas, but it is fairly general, recommending practices like livestock exclusion for entire reaches or subwatersheds of the large, 225-square miles, bi-state watershed. It is very helpful for developing annual work plans for organizations like the Rockingham County Soil and Water Conservation District (SWCD) and the Piedmont Land Conservancy (PLC), but it does not identify specific areas for immediate action. This project atlas does just that, and can be considered a detailed appendix to the *Eden Area Watershed Restoration Plan*. It features thirty (30) priority catchments for immediate investments in restoration and protection actions and projects that will either improve or protect water quality conditions. An emphasis was placed upon using all available data, including the GWLF-produced

results from the work conducted by the NCSU Cooperative Extension research team. The potential projects were evaluated in a manner that is intended to qualify the *Eden Area Watershed Restoration Plan and Project Atlas* as an USEPA-approved local watershed plan that fulfills the “Nine Key Elements to Local Watershed Planning” and qualify it for 319(h) implementation funding.

The ultimate goal of the *Eden Area Watershed Restoration Plan* is to comprehensively address the sources of sediment and fecal coliform pollution that currently impair the aquatic life needs of the Dan and Smith Rivers, and to be a useful tool in improving and then sustaining watershed conditions for both its ecological and human populations. It is intended to be used both directly and as guidance in drafting and adopting new policies, reaching out to the public through diverse stewardship programs, and planning for restoration and conservation projects. The *Eden Area Watershed Restoration Plan* must be a living document that is periodically revisited so that it is used for maximum cost-effectiveness and environmental benefit.

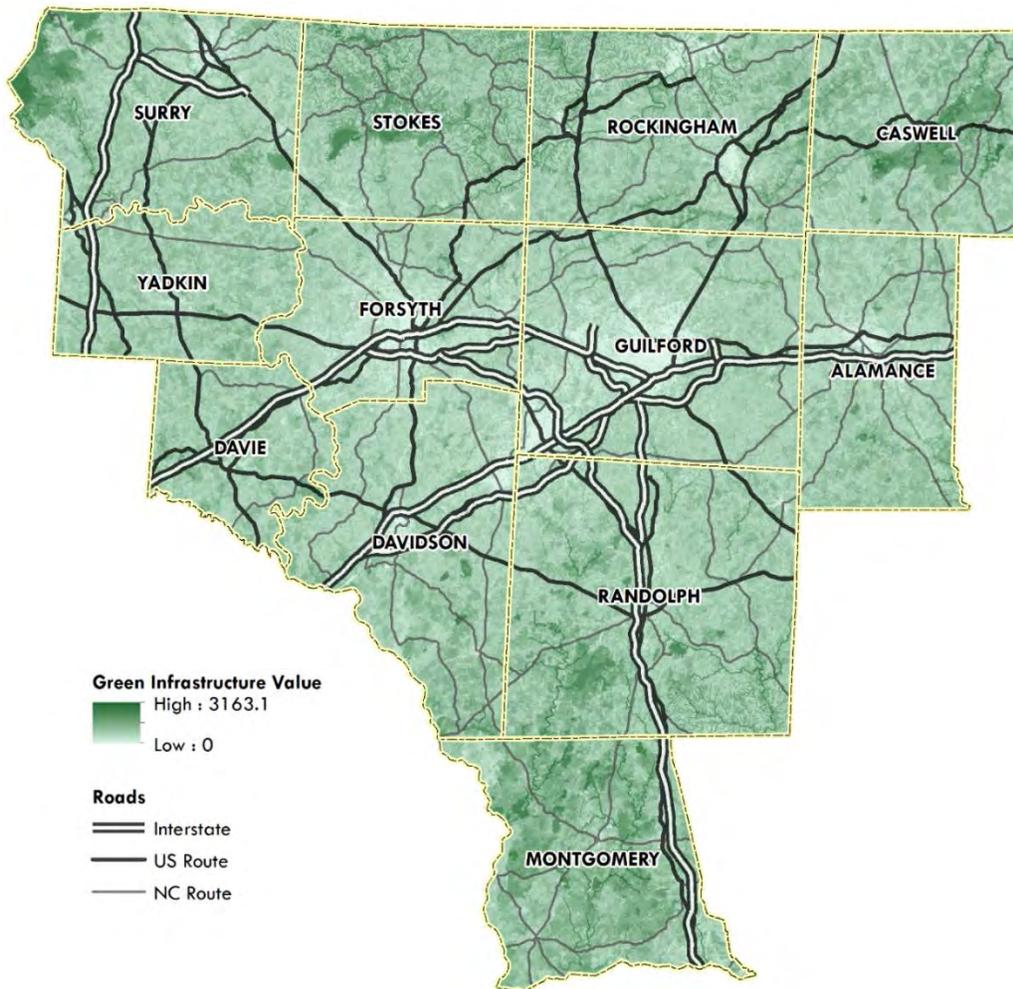
METHODOLOGY

CONSERVATION ASSESSMENT & RANKING SYSTEM

In creation of the Project Atlas, both the top fifteen restoration opportunity watersheds and the top fifteen conservation watersheds were selected using a GIS-based model.

The conservation analysis was based on the green infrastructure raster that was developed by the Piedmont Triad Regional Council (PTRC) Planning Department in 2014 for the *Piedmont Together* project. The green infrastructure raster was the foundation for the final green infrastructure network that identifies a physical network of the Region’s most valuable (1) natural systems including lands that provide water resources, (2) working lands (farms and forests) and (3) wildlife habitats. These three sublayers were combined to create the green infrastructure raster, a continuous dataset of values representing the green infrastructure impact across the landscape (see Map 1).

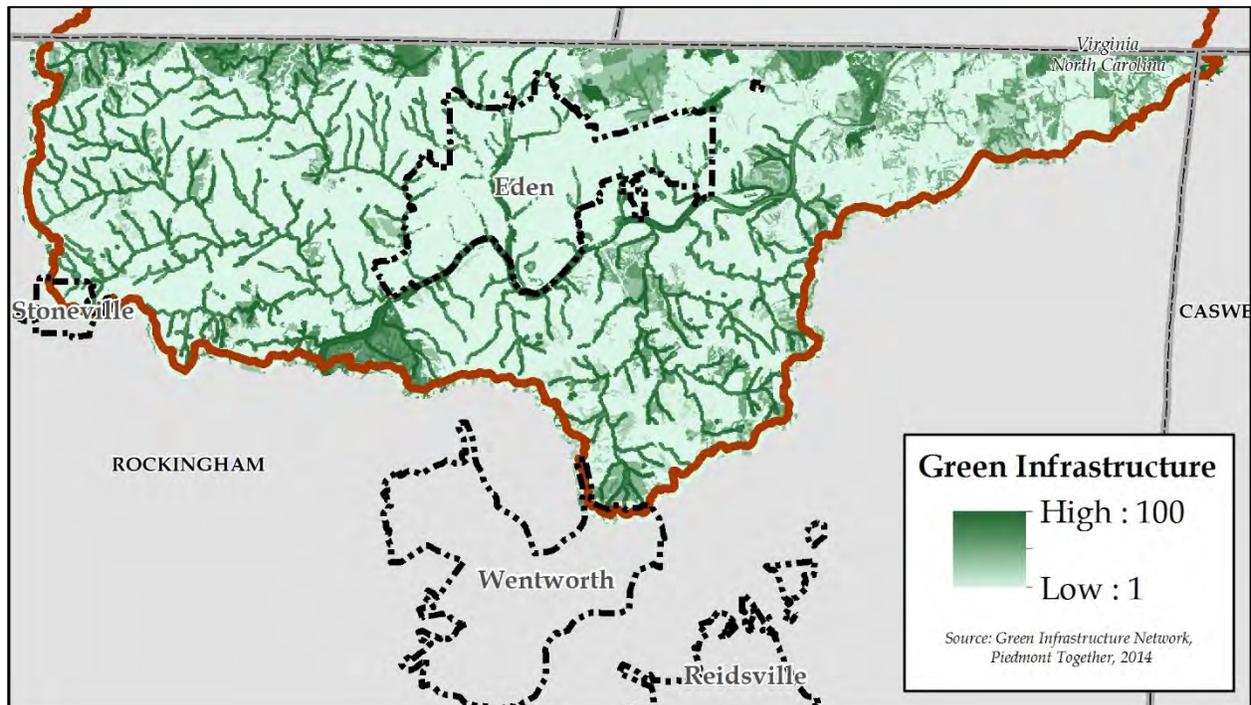
Map 1: Green Infrastructure Raster



Network hubs were then created by extracting the highest ranking lands. Corridors were also identified using a least cost path analysis to connect hubs in the shortest distance through the highest resource value land. Each hub was connected to at least one other hub. The final extraction of hubs and corridors represent the green infrastructure network for the Piedmont Triad. See the Green Infrastructure Network Report for more details on methodology (Piedmont Together, 2016).

Because a continuous data set across the watershed was needed to overlay with other input data layers, the green infrastructure raster was used in the watershed conservation assessment instead of the green infrastructure network itself. The raster was clipped to the North Carolina portion of the Eden Area Watershed boundary. Values ranged from 0 to 2,892.9. The clipped raster was rescaled so that values ranged from 1 to 100 (see Map 2). The mean value for this clipped and rescaled raster was 21.4 with a standard deviation of 29.7.

Map 2: Green Infrastructure Raster (Clipped and Rescaled)



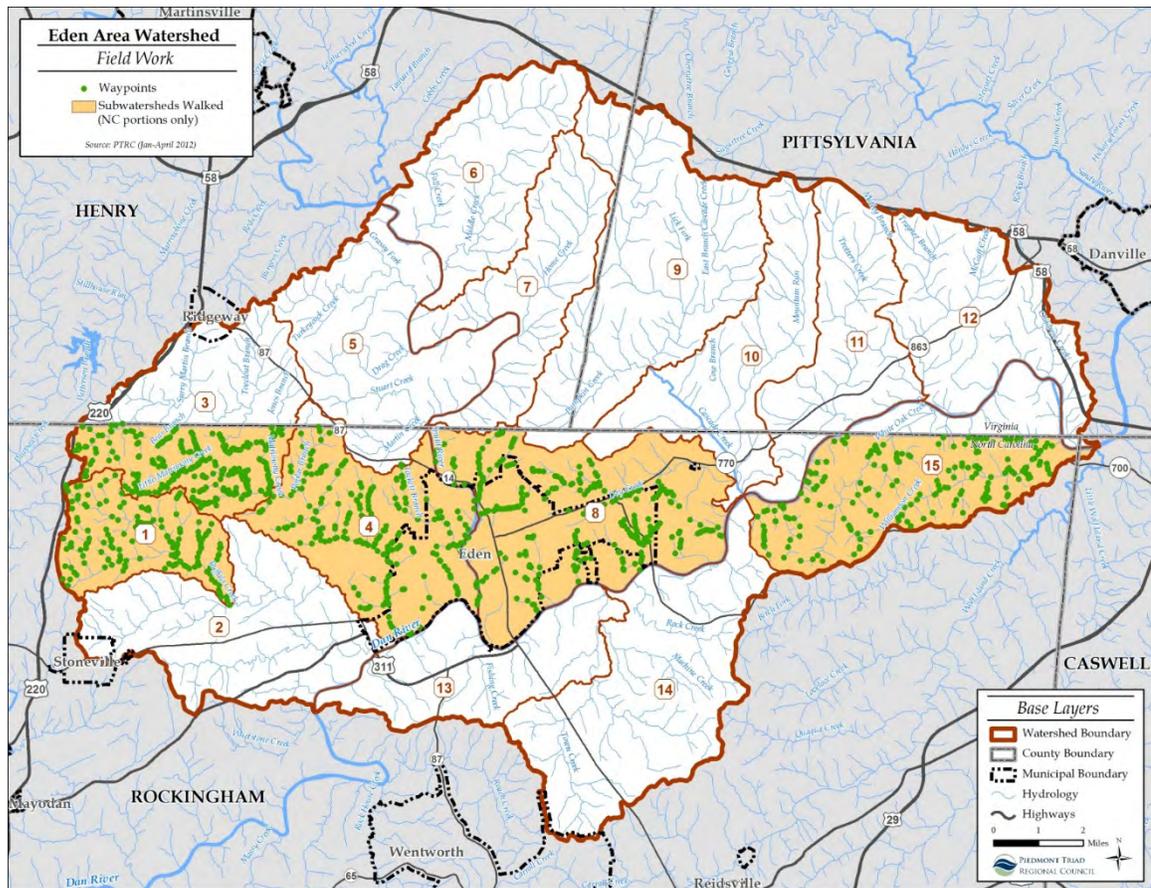
Five other data layers were combined with the green infrastructure raster to identify top conservation watersheds (see Table 2). These layers were given values of either 51 or 81. This point system was derived from taking the mean value (21.1) plus the standard deviation value (29.7) of the green infrastructure raster to find the lower point value (51). Another standard deviation was added for the higher point value ($51 + 29.7 = 81$).

Table 2: Input Conservation Assessment Data Layers and Ranking System

Criteria	Data Source	Factors	Possible Points
Agricultural BMPs	Rockingham County Soil & Water	Within parcel	51
PLC Priority Parcel	Piedmont Land Conservancy (PLC)	High Priority	81
		Medium Priority	51
Priority Field Identified Sites	PTRC	0.25 mile buffer	51
Stream Buffer Analysis	PTRC	1 - Pristine, complete cover	81
		2 - Impacted, majority cover with some human activity	51
Potential BMP GIS Analysis	NC State University	Logging sites	81
Green Infrastructure	Piedmont Together	See green infrastructure details	1-100
Total Possible Points			445
Maximum Points Received			330

- Agricultural BMPs** – A list of agricultural BMPs were provided by Rockingham County Soil and Water staff. The list came as an excel spreadsheet with each BMP listed by latitude & longitude, year enrolled, and conservation practice type. The coordinates were mapping in ArcGIS. The tax parcels containing these points were selected to form the agricultural BMP layer.
- PLC Priority Parcels** – The Piedmont Land Conservancy (PLC) developed the Dan River Watershed Protection Plan in 2006. High and medium priority parcels were provided as input into this analysis. These parcels represent areas of high conservation lands based on ability to maintain and improve water quality, parcel size, natural heritage value, wildlife value and threat of disturbance (Piedmont Land Conservancy, 2006).
- Priority Field Identified Sites** – The PTRC conducted field assessments between February and April of 2012 in several of the study area subwatersheds. Field teams collected 2,091 GPS points at 1,172 sites and categorized them into 21 types of conservation sites and/or restoration opportunities. 143 sites were also identified as priority sites. These points were given a quarter mile buffer. The polygon buffer was used as input into the conservation analysis to represent essential conservation areas in the watershed that must be maintained.

Map 3: Field Assessment GPS Points



- Stream Buffer Analysis** – PTRC conducted a stream buffer assessment, reviewing the vegetated cover within the 100-foot stream buffer zone throughout the watershed. These riparian buffers are critical to protecting water quality conditions and ensuring safe habitat conditions for ecology as well as clean conditions for drinking water (Piedmont Triad Regional Council, 2015). The process was based on the analysis from the Elkin and Jonesville Water Supply Protection Plan. PTRC ranked each stream buffer on a five-tiered system :

1. **Pristine** – completely untouched by human activity.
2. **Impacted** – mild to moderate human activity, including small roads, utility rights of ways, single-family homes and some farms.
3. **Managed** – human activity is actively degrading the stream buffer on at least one side of the stream. The stream buffer is completely absent on one side of the stream, but not both.
4. **Degraded** – buffers on both sides of the stream are absent with very little vegetation present.

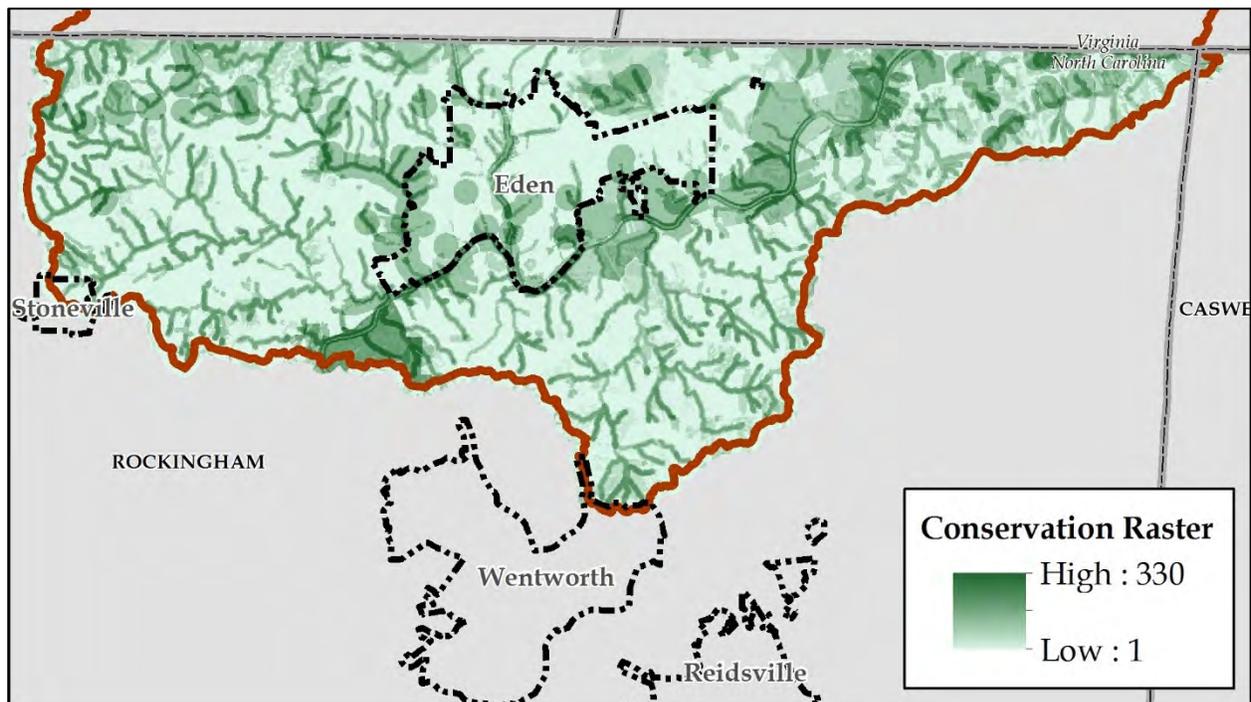
5. *Absent* – streams have no vegetated buffer at all due to agricultural practices, paving or piping.

Pristine and impacted stream buffers were selected for use in this conservation analysis.

- **Potential BMP GIS Analysis** – Potential BMPs were identified in the Eden Area Restoration Plan by N.C. State University. Logging site polygons were included in the conservation analysis because these are mature forested areas with logging potential that should be targeted with better forestry management practices as logging sites can be a primary source of watershed sediment loads (Piedmont Triad Regional Council, 2014).

Each of the five vector polygon data layers were converted into a raster layer with a 30-meter resolution to match the consistency and resolution of the green infrastructure raster. Cell values were assigned using the point system outlined in Table 2. All six conservation factor layers were input into the ArcGIS Weighted Sum Tool, which overlaid the rasters and summed the value of each cell into one output raster. This process attempted to identify areas within the watershed with the highest conservation value for watershed health. The output conservation raster had a range of values from 1 (least conservation potential) to 330 (most conservation potential). The maximum cell value possible in the conservation analysis was 445, but no areas attained this high of a value.

Map 4: Conservation Raster



NHDPlus Catchments were overlaid on top of the conservation raster. The NHDPlus is a geo-spatial, hydrologic framework dataset developed with support from the US Environmental Protection Agency and the US Geological Survey. NHDPlus is based on the medium resolution NHD (1:100,000-scale) and includes the stream network with value added attributes and elevation-derived catchments (Horizon Systems Corporation, 2016).

Catchments within the Eden Area Watershed were selected (370 catchments). These polygons were the result of a raster export, and the boundaries were therefore very jagged. The ArcGIS Simplify Polygon tool was executed to smooth the catchment polygons. The smoothed layer was then clipped to the North Carolina portion of the watershed. Some manual edits to the catchment layer were done to eliminate obvious errors in the dataset (see Figure 5) resulting in 160 catchments.

Figure 5: NHDPlus Catchment Polygons

A) Original Polygons

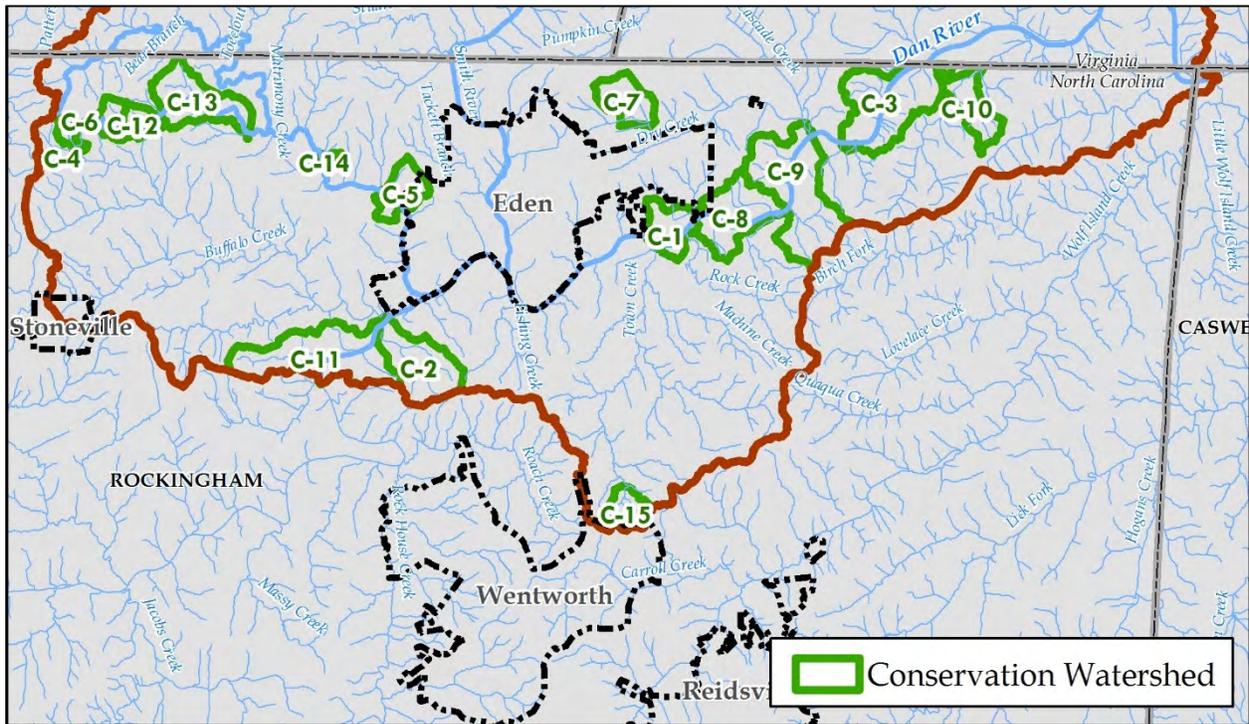
B) Simplified Polygons

C) Edited Polygons



The ArcGIS Zonal Statistics as Table Tool was then ran using the conservation raster as the input value raster and the 160 edited NHDPlus catchments as the feature zone data to calculate the mean conservation value for each catchment. Mean values ranged from 8.05 to 184.68. Values were ranked in descending order to select the top conservation catchments. Four catchments with flow draining into Virginia were discarded. Small, neighboring catchments with similar drainage points were also merged. Fifteen top conservation catchment areas were identified (see Map 5).

Map 5: Top Conservation Projects



RESTORATION ASSESSMENT & RANKING SYSTEM

Similar to the conservation assessment, the goal of the restoration assessment was to select the top fifteen restoration project areas using a GIS-based model. This model was based on the methods using in restoration assessment in the Lower Abbotts Creek Restoration Plan (Piedmont Triad Regional Council, 2011).

Fifteen input layers were used in the restoration analysis in attempt to identify areas of the watershed in most need of attention, such as areas with high impervious surface cover, low forest cover, ecologically sensitive soils, high impact land use and near headwater streams (see Table 3). The future growth analysis was a sub-analysis, using seven data layers input into the Weighted Sum Tool (see Table 4). The output raster was used as input into the restoration assessment.

Table 3: Input Restoration Assessment Data Layers and Ranking System

Criteria	Data Source	Factors	Possible Points	Weight
High Impervious Surface Cover	2011 NLCD	> 20%	3	1
		10-19%	2	
		5-9%	1	
Low Forest Cover	2011 NLCD	<50%	1	1
1st & 2nd Order Streams	NHD	Within 50 foot buffer	3	1
		Within 100 foot buffer	2	
		Within 330 foot buffer	1	
Wetlands	NWI		1	1
Hydric Soils	SSURGO	All Hydric	2	1
		Partially Hydric	1	
Erodibility (K factor)	SSURGO	0.24-0.39	1	1
Steep Slopes	USGS 1/3 Arc Second DEM	> 15% Gradient	1	1
500 Year Floodplain	NC Flood Map; Henry County; Pittsylvania County	Within Floodplain	1	1
Large Parcel Size	Counties	> 20 acres	3	2
		10-20 acres	2	
		5-10 acres	1	
High Impact Land Use	Counties	Commercial, Industrial	2	1
		Institutional, Multi-family Residential, Mobile Home Parks, Office, Utilities	1	
Publically Owned Land	Counties	City, County, or State	1	2
High Potential for Future Growth	PTRC	See Future Growth Analysis	0-15	0.25
Stream Buffer Analysis	PTRC	5 - Absent, no vegetated buffer	2	1
		4 - Degraded, buffer mostly absent on both sides	1	
Priority Field Identified Sites	PTRC	0.25 mile buffer	1	2
Potential BMP GIS Analysis	NC State University	Riparian Planting (330 foot buffer)	1	1
		Cattle Exclusion (330 foot buffer)	1	
		Wetland Restoration	1	
		Urban Stormwater (50 foot buffer)	1	
Total Possible Points			34.75	

Maximum Points Received	25.5
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Table 4: Future Growth Data Layers and Ranking System

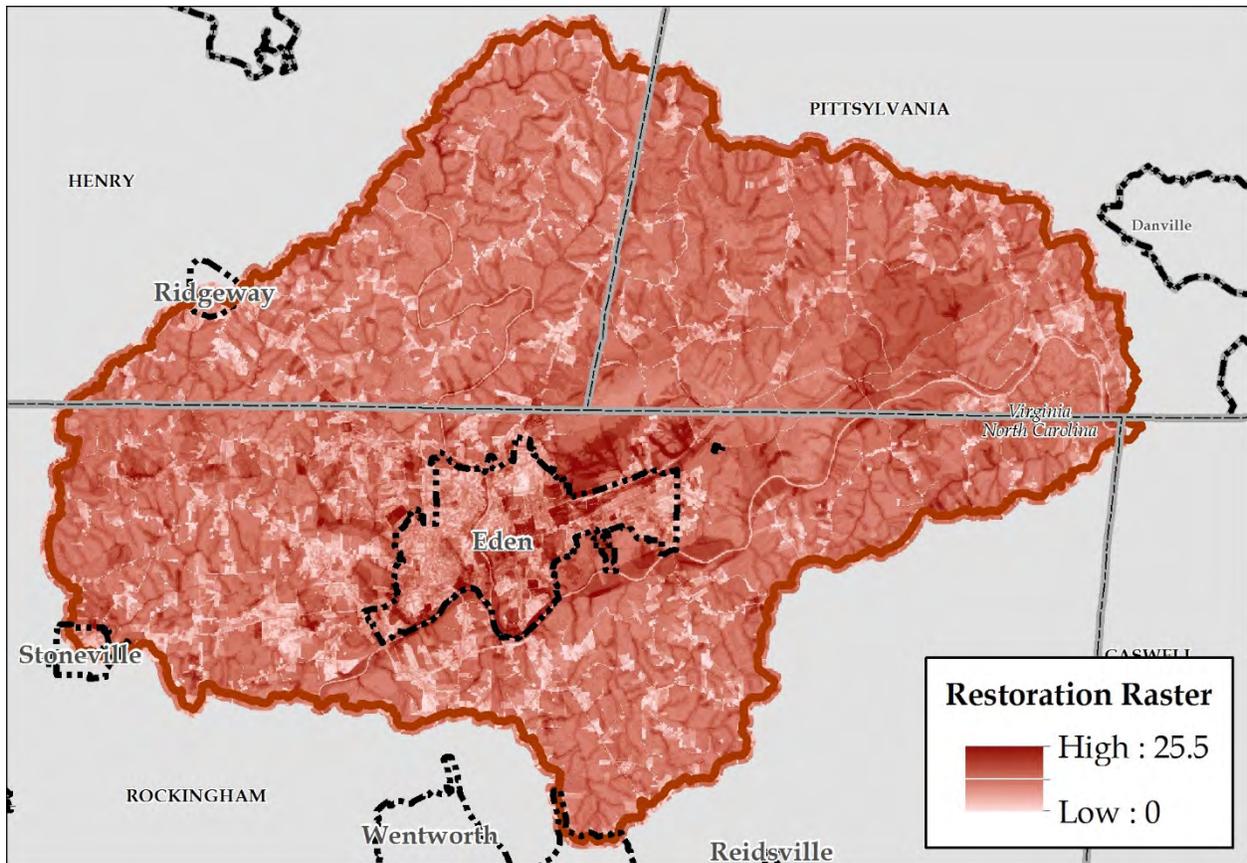
Criteria	Data Source	Factors	Possible Points	Weight
Boundary	Counties	ETJ	2	1
		Municipal	1	
Sewer	Counties	Current sewer service outside city	1	3
Water	Counties; NCCGIA	Current water service outside city	2	1
		Proposed water service	1	
Road Network	Rockingham County CTP, City of Eden CTP, WPPD 2035 Rural Long Range Transportation Plan, Danville - Pittsylvania Area Vision Plan Roadway Improvements Year 2035. Roads were buffered and assigned values were assigned by road type. Values from overlapping buffers were summed to produce a range from 0 to 17.	11-17	4	1
		7-10	3	
		4-6	2	
		1-3	1	
Population Density (Persons/Sq Mi)	2010 Census Blocks	1,927 - 18,519	4	1
		552 - 1,926	3	
		128 - 551	2	
		2 - 127	1	
Population Density Change	2000 & 2010 Census Tracts	10 - 65	2	1
		1 - 9	1	
Vacant Household Density (Vacant HH/Sq Mi)	2010 Census Blocks	183 - 8,046	4	1
		52 - 182	3	
		10 - 51	2	
		1 - 9	1	
Total Possible Points			21	
Maximum Points Received			15	

Each of the eleven vector polygon data layers were converted into a raster layer with a 30-meter resolution to match the consistency and resolution of conservation analysis. Three of the input rasters (impervious surface cover, forest cover and future growth) already existed with a 30-meter resolution. The remaining raster (steep slopes) was resampled to a 30-meter resolution.

Cell values were assigned using the point system outlined in Table 3. All fifteen restoration factor layers were input into the ArcGIS Weighted Sum Tool, which overlaid the rasters, weighted according to inputs, and summed the value of each cell into one output raster. This process attempted to identify areas within the watershed with the highest restoration value for

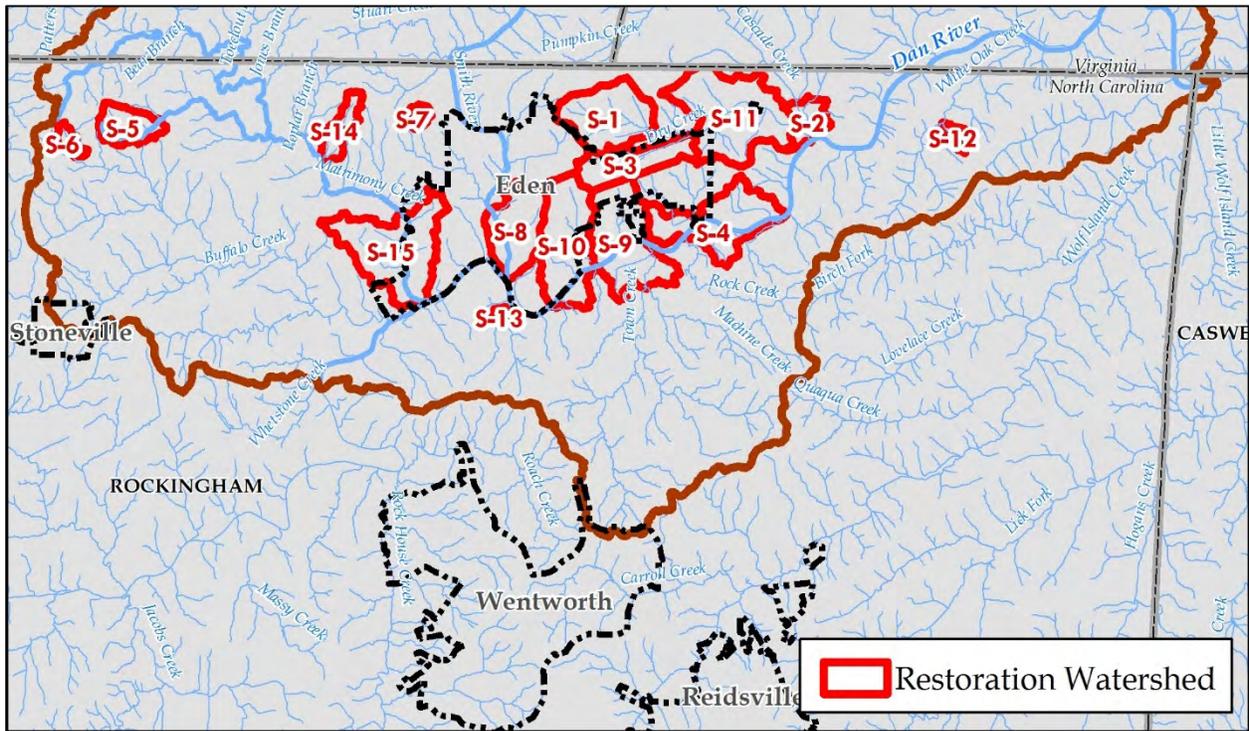
watershed need. The output restoration raster had a range of values from 0 (least restoration vulnerability) to 25.5 (most restoration vulnerability). The maximum cell value possible in the restoration analysis was 34.75, but no areas attained this high of a value (see Map 6).

Map 6: Restoration Raster



The ArcGIS Zonal Statistics as Table Tool was then ran using the restoration raster as the input value raster and the 160 edited NHDPlus catchments as the feature zone data to calculate the mean restoration value for each catchment. Mean values ranged from 5.42 to 12.63. Values were ranked in descending order to select the top restoration catchments. Five catchments with flow draining into Virginia were discarded. Small, neighboring catchments with similar drainage points were also merged. Fifteen top restoration catchment areas were identified (see Map 7). The fifteenth catchment was replaced with a catchment with a lower mean restoration value at the City of Eden’s request. The City owns land along Matrimony Creek, near the confluence with the Dan River, where flooding has occurred and many homes have had to be removed.

Map 7: Top Restoration Projects



Five of the top restoration projects overlapped with the top conservation projects.

- S-1 (part) coincides with C-7
- S-2 (part) coincides with C-9
- S-4 (part) coincides with C-1 and C-8
- S-5 coincides with C-6 and C-12
- S-6 coincides with C-4

POLLUTANT LOAD AND COST ESTIMATION

The values of the cumulative projects in each catchment were determined with two different tools. The current conditions and pollutant load reductions were calculated using the STEPL tool, developed by TetraTech and the US EPA. All soils are either Class C or D – they were determined using the SSURGO data display on ArcGIS. The following presumptions were made using the STEPL model:

- The septic tank failure rate is 30%;
- Wetland pollutant removal rates are as follows:
 - TN = 85%
 - TP = 80%
 - BOD = 95%
 - TSS = 85%
- All residential single-family home retrofits are rain barrels that retain 10% of the volume allotted;
- All commercial/industrial/institutional retrofits are either dry detention, bioretention, or constructed wetlands;
- All residential open space retrofits are either a wetland or bioretention;
- All residential “Urban-Cultivated” land is retrofitted to “bioretention”, with the presumption that this can include rain gardens;
- All practices on cropland are applied to half of the acreage;
- All practices on forest land are applied to half of the acreage;
- Manure is presumed to be applied to cropland for six months of the year;
- All croplands are presumed to be irrigated eighteen times a year;
- All “gullies” are presumed to have existed for 50 years.

The intent of these assumptions is to be conservative, as is the intent on the ambitious application of best management practices (BMPs) on all potential properties. The purpose is to demonstrate what is possible if all practices are adopted. All data is available in Excel format for each catchment with a thorough report and can be provided as a technical appendix. The values provided in this Project Atlas are the calculated pollutant reductions.

The costs were derived from the Maryland Department of Natural Resources’ “Tool 7: Estimated Costs”

(<http://dnr.maryland.gov/watersheds/pubs/planninguserguide/tools/Tool7EstimatedScopingandPracticeCosts.pdf>). These costs were presumed to be applicable to this watershed due to the similarities in geologies and soils of the Maryland and North Carolina piedmont regions. The following presumptions were made in calculating the total costs of BMP implementation in each catchment:

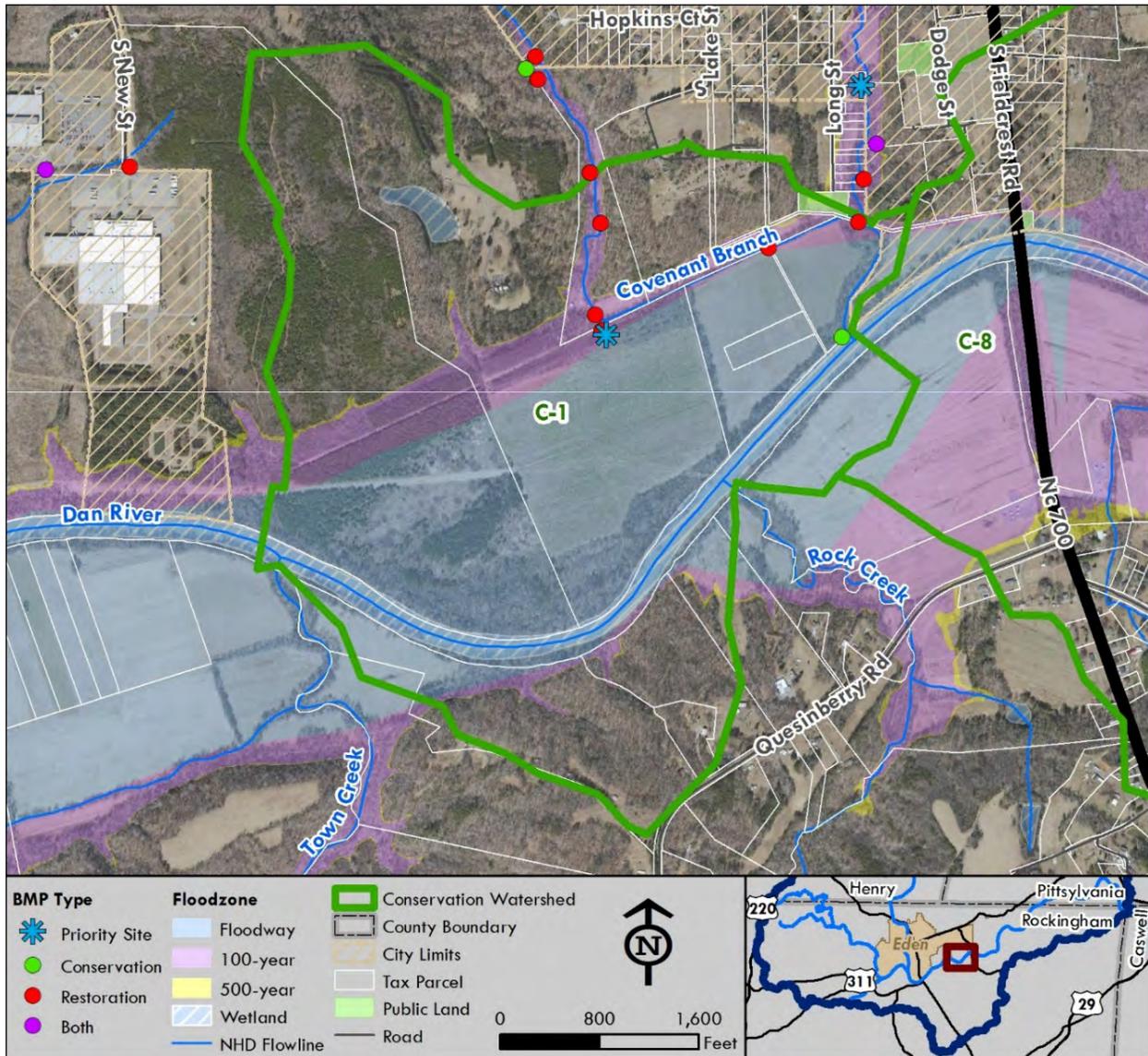
- When ranges of values were provided for practices, the median value was used;

- “Stream Enhancement” was presumed to cost half of “Stream Restoration”;
- All conservation stream projects were presumed to be enhancement projects and cost \$50/linear foot;
- All restoration stream projects were presumed to be restoration projects and cost \$100/linear foot;
- All wetlands in conservation catchments are regarded as assets that are adding value to the watershed;
- All wetlands in stress catchments are regarded as liabilities that must be restored with financial investment.

Otherwise, the financial reports in the catchment profiles reflect the ecosystem services being provided by existing green infrastructure (e.g. forest cover) and the cost associated to this asset is the estimated value of the cost that would be required to recover that asset. The values in red are the investments that need to be made to recover that full value of that asset, usually a stream or a wetland. This atlas does not estimate the value of reforestation of farmland or vacant land. The costs of most specific stormwater or agricultural BMPs are not included, but generally assessed. Septic tank replacements have been estimated at \$20,000 per system. All costs and pollutant reduction benefits are included in a table preceding the detailed project atlas for both conservation and restoration projects.

CONSERVATION WATERSHED PRIORITIES

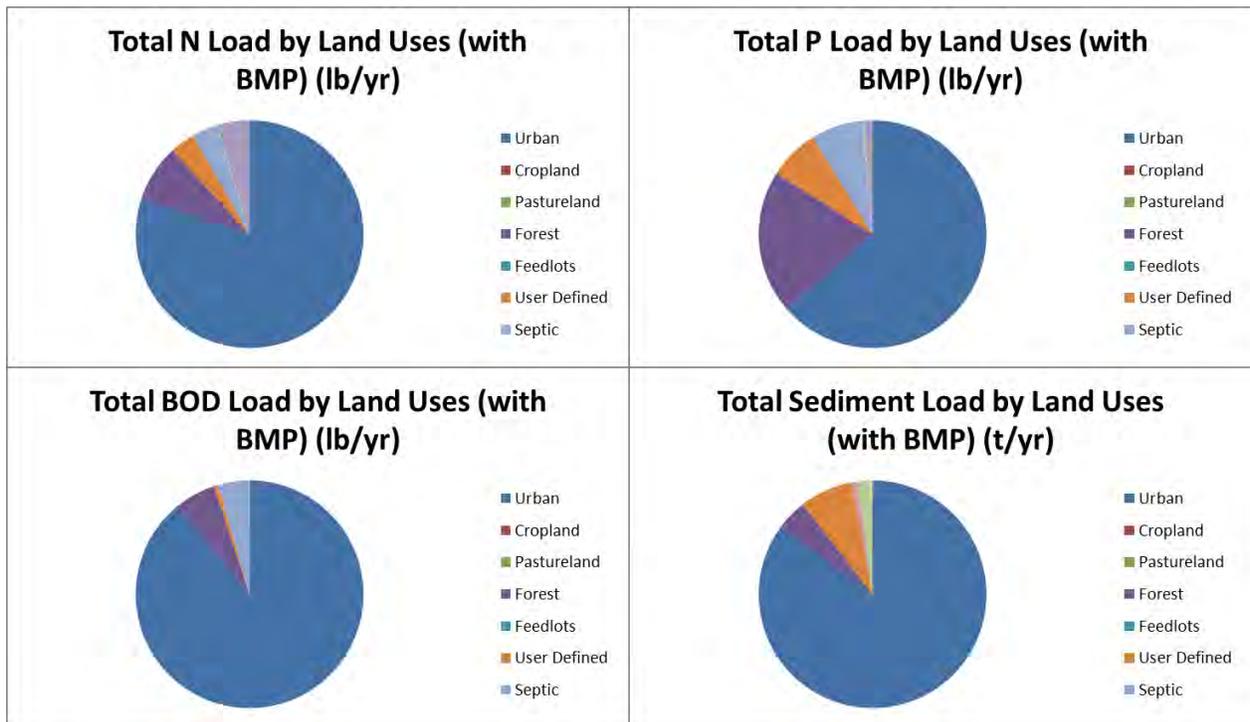
Map 8: Conservation Watershed C-01



Recommended Actions:

1. Rehabilitate any habitats and hydrology lost due to the Duke Energy coal ash spill of 2014.
2. Contact property owner(s) about placing a conservation easement on the floodplains of these properties.
3. Invest in stream enhancement/restoration on Covenant Branch.
4. Further develop natural path on Covenant Branch into a greenway or hiking trail.
5. Investigate the possibilities for paddle and/or hiking trails along river corridor.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-01	Wetland Protection – 28.26 ac		TN: 4,188 lb/yr (73%)
# Prop.	14	\$254,340	
PLC Priority Parcels	11	\$285,000	TP: 1135 lb/yr (75%)
	AVOIDED COSTS	\$539,340	BOD: 7,155 lb/yr (60%)
Area	483		TSS: 990 T/yr (88%)
	Residential BMPs – 0.52 ac	\$7,800	
	River Restoration – 8,328	\$832,800	
	Tributary Enhancement – 4,830 ft	\$241,500	
	RESTORATION COSTS	\$1,082,100	



The top-rated conservation catchment in the Eden Area watershed is this 483-acre area just east of the City of Eden's limits. It is immediately downstream of the Duke Energy Power Station, where nearly 39,000 tons of coal were spilled via a failing stormwater pipe in February 2014. This is essentially the ground zero of the coal ash spill and should a priority site for habitat and stream rehabilitation, especially due to its potential as Roanoke log perch and the green floater. The floodplain wetlands also offer 280 acres in wetland

enhancement opportunities to the NC DEQ Stream Mitigation Services program or private mitigation bankers. Most of these wetlands are currently either plowed or drained for agricultural and hunting purposes.

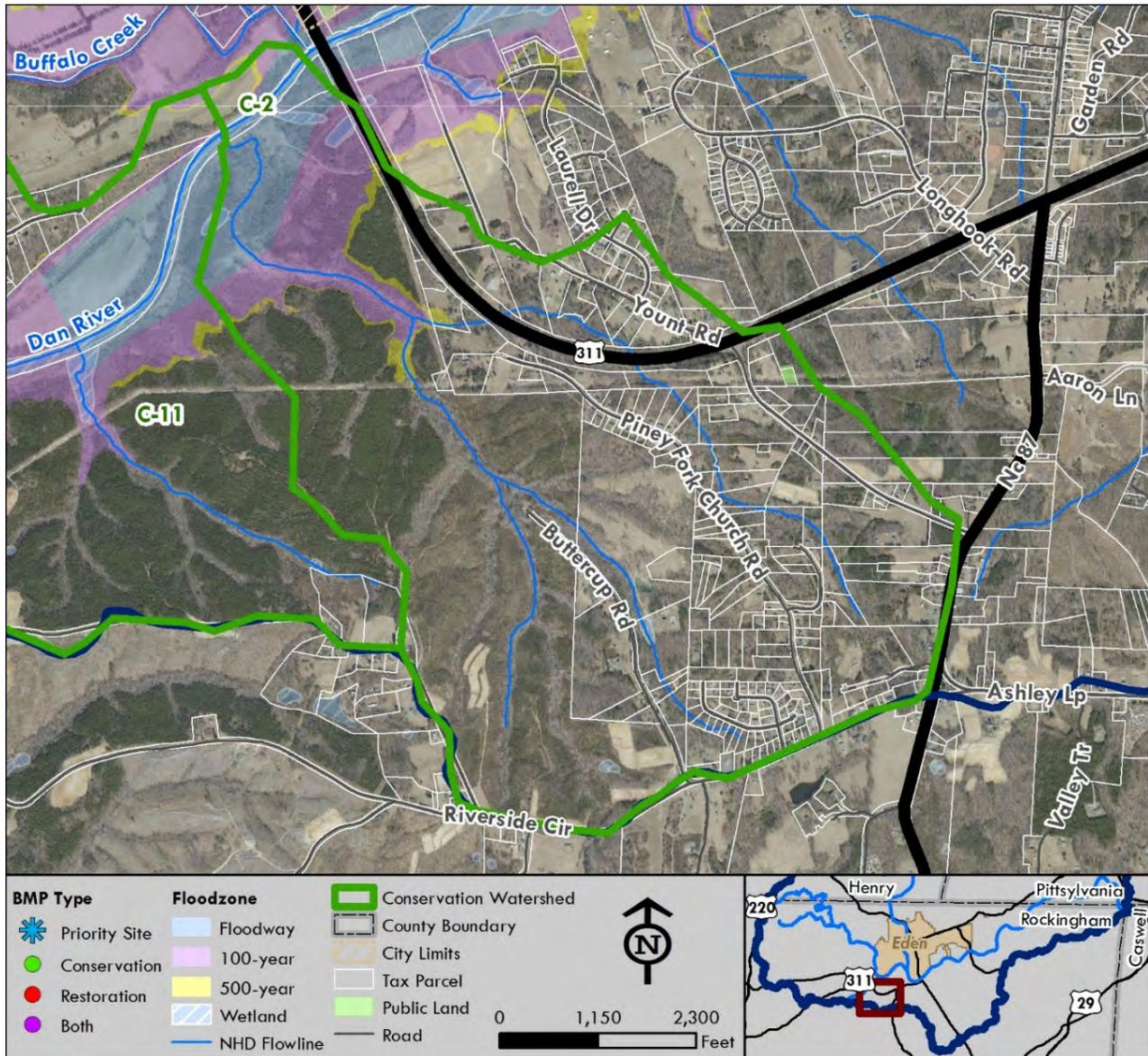
This catchment also originates at the confluence of Town Creek with the Dan River. Town Creek is one of the priority subwatersheds identified by the GWLF model NC State University used to assess hydrologic and water quality needs throughout the 225-square mile Eden Area watershed study area. It was determined to be a significant source of sediment and fecal material that has long degraded the Dan River, and it is recommended to be a priority site for agricultural cost-share investments. The enhanced condition and greater use of this catchment will heighten the attention upon this catchment and the urgency for upstream actions.

Lastly, this catchment offers a ready-made opportunity for recreation and access to the Dan River. The priority site in this catchment is a natural path lined by crabapple trees that does not appear to have a defined purpose. It may be used by local residents to access the Dan River and its floodplain already. It is highly recommended that immediate actions be taken to acquire either a recreation easement or the property outright for the development of passive or active recreation with the Dan River floodplain on these riverside properties. These uses could include a paddle access site, a greenway along Covenant Branch, a park, or athletic fields. This site a central location in the Piedmont Triad's green infrastructure network in Rockingham County as well as the Piedmont Land Conservancy's Dan River Conservation Corridor. As such, it could be a vital node for implementing and developing that project, bring recreation and conservation services to residents of the entire Dan River and Piedmont Triad regions.



Figure 6: Path along Covenant Branch, Catchment C-1

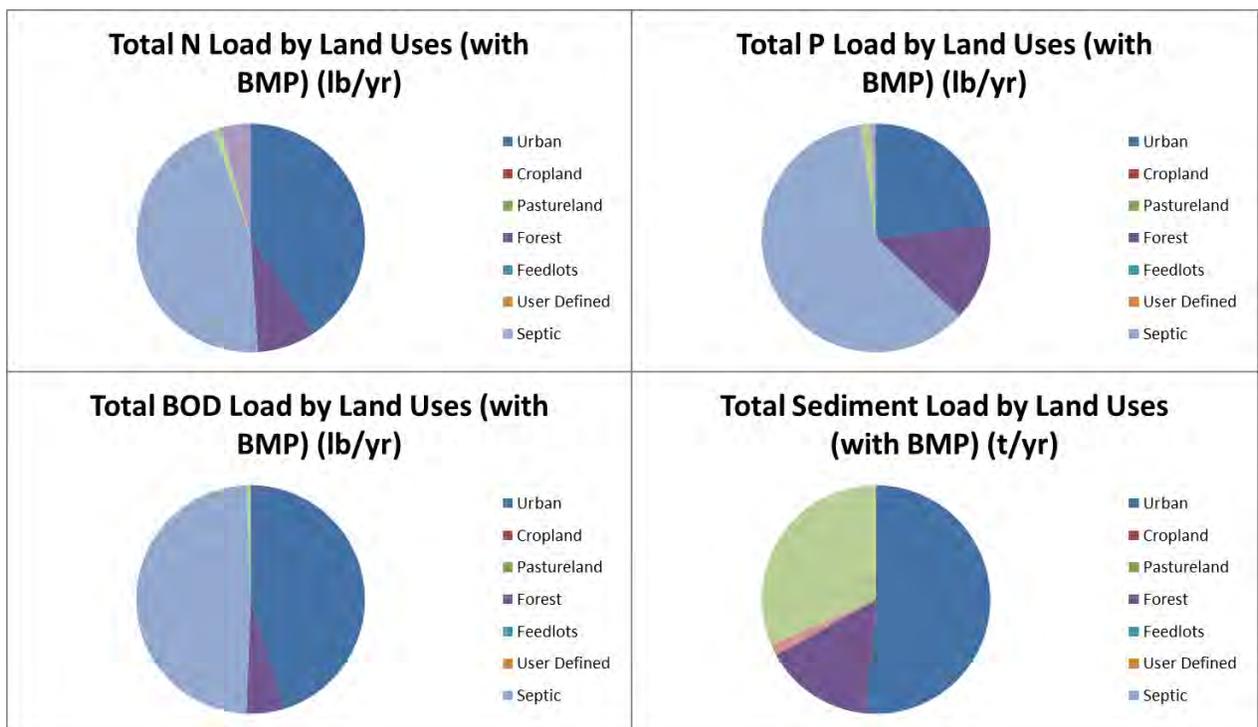
Map 9: Conservation Watershed C-02



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplains of these properties.
2. Initiate rain garden and rain barrel program for the residents in and around this watershed.
3. Invest in stream enhancement/restoration on these two unnamed tributaries.
4. Investigate the possibilities for paddle and/or hiking trails along river corridor, and connect these trails to nearby residences.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-02	Wetland Protection – 9 ac	\$49,500	TN: 1,135 lb/yr (18.5%)
# Prop.	248	Forest Protection – 530 ac	TP: 424 lb/yr (22%)
PLC Priority Parcels	1	AVOIDED COSTS	BOD: 2,390 lb/yr (11%)
Area	1,006	\$549,500	TSS: 573 T/yr (87%)
	Residential Retrofits – 14 ac	\$210,000	
	Septic Tank Replacements – 8%	\$1,640,000	
	River Restoration – 1,464 ft	\$146,400	
	Tributary Enhancement – 21,056 ft	\$1,052,800	
	Floodplain Preservation – 120 ac	\$120,000	
	RESTORATION COSTS	\$1,529,200	



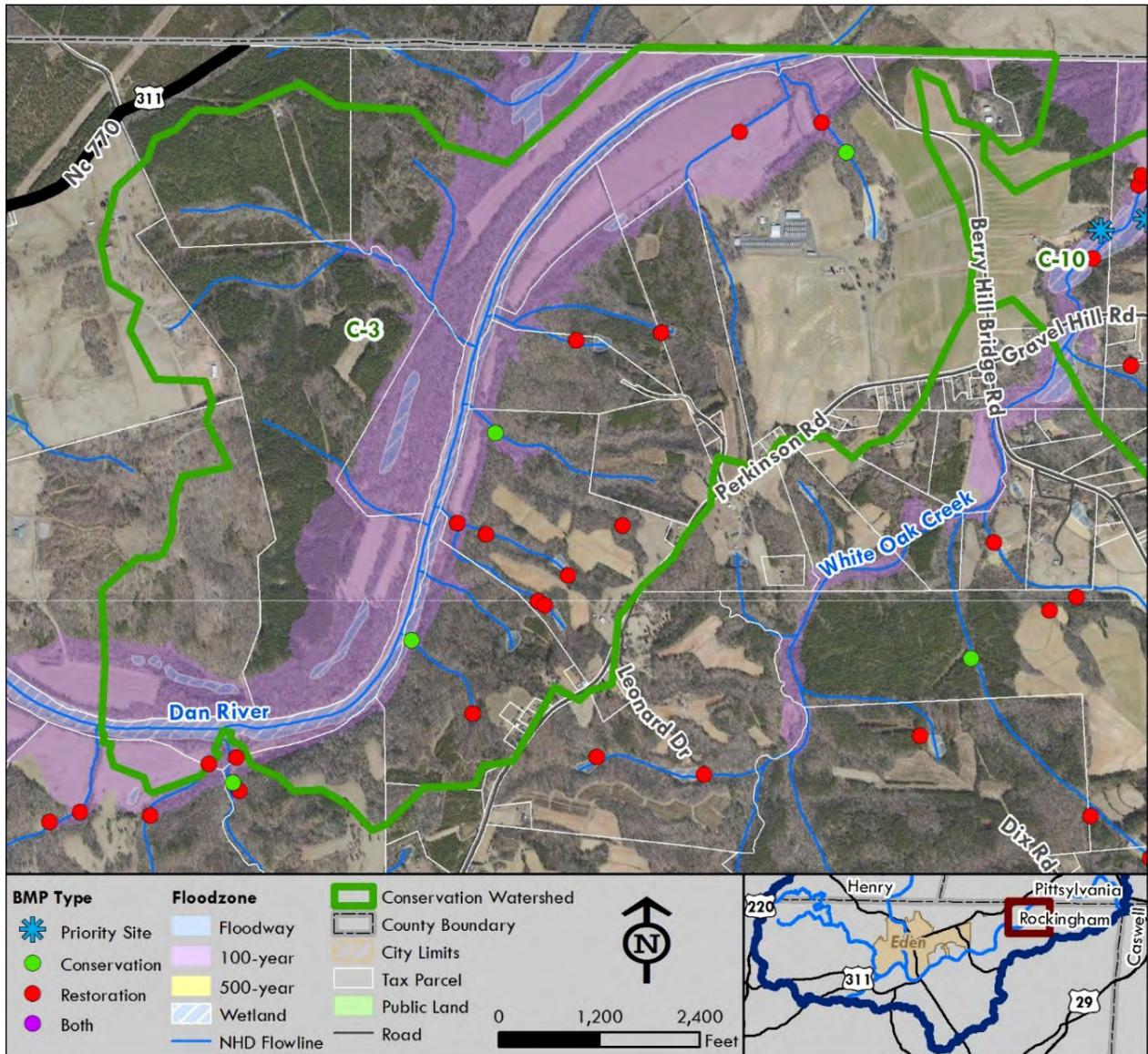
This large catchment is a perfect example of the needs for conservation and land protection in the Eden area. The 2.3-square mile forested property just east of the residential subdivision in this catchment offers both a buffer to further sprawling growth and a possible opportunity to invest in recreation and conservation along

the Dan River. This large property is buffering the river and its tributaries from runoff that would otherwise impact it with runoff pollution. It could also serve the recreation needs of the area, providing either active or passive recreation for Eden and Rockingham County with a hiking trail, paddle trail, park, and/or bridle trail. In turn, such investment could serve the economic development needs of the Eden area and possibly the entire Dan River Basin. The PLC has identified this property as a priority in its *Dan River Conservation Corridor Plan*, and it is recommended for immediate protection.

The presence of the residential subdivision in the rural area of the watershed shows the need for the application of low impact development principles and stormwater education to residents. Based upon this location, it is highly likely that these residents value the outdoors and access to nature. A comprehensive outreach and education program such as Stormwater SMART or those offered by the Dan River Basin Association could connect residents to the river and surrounding forests and farms. It could also provide a rain garden or rain barrel rebate or giveaway program, with a campaign or program on the value of such practices. Similar overtures need to be made to the larger rural landowners about the value of using a consulting forester and sustainable forestry practices for a timber harvesting they may invest in upon these wooded properties. The use of a consulting forester will ensure a conservation plan and forestry practice guidelines are used to protect waters and optimize profits.

This catchment is a self-contained headwater tributary of the Dan River and, as such, is highly sensitive to impacts to its hydrologic stability and function. Informing all future and current residents of the need to use sustainable practices in these areas will make a tremendous difference at retaining and preventing the loss of watershed and ecosystem services for the whole Eden area.

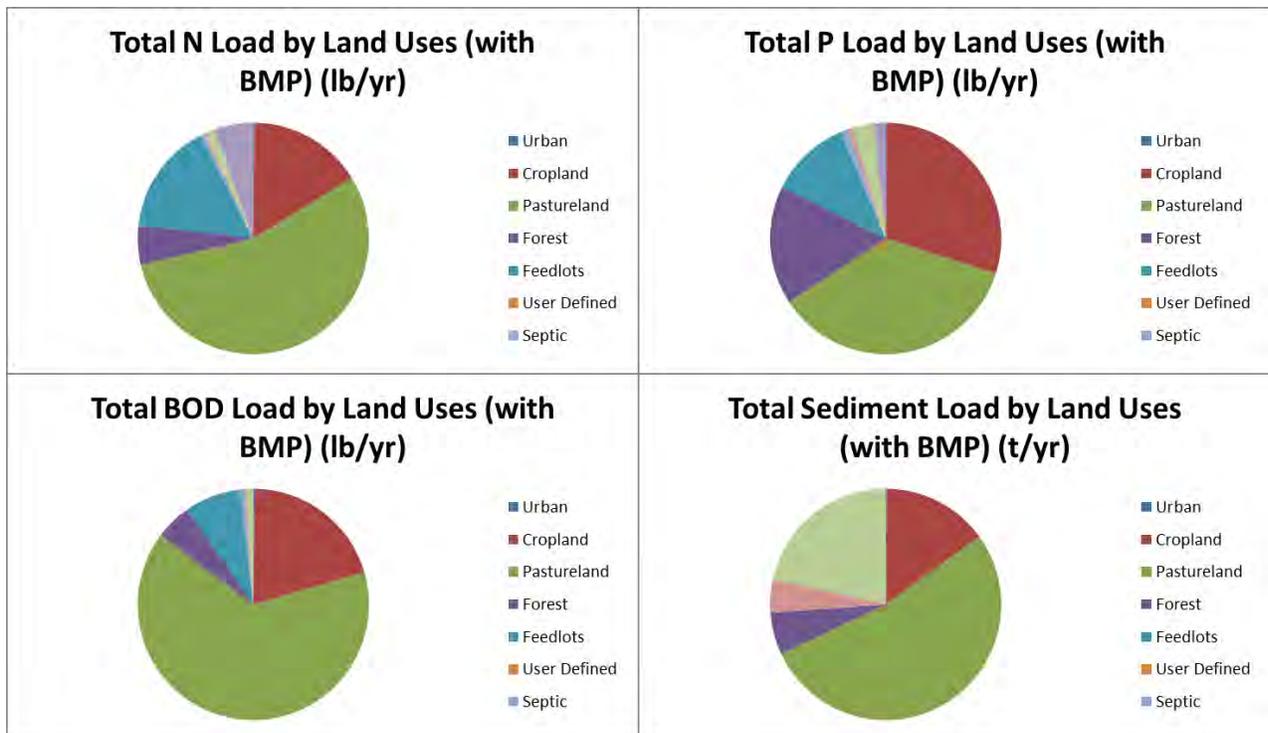
Map 10: Conservation Watershed C-03



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplains of these properties for possible use as paddle and/or hiking trails along river corridor.
2. Invest in best management practices and cost-share programs on farms.
3. Invest in stream enhancement/restoration on unnamed tributaries.
4. Coordinate with DRBA and PLC to develop area for stewardship and recreation.
5. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-03	Wetland Protection – 73 ac	\$40,150	TN: 5,874 lb/yr (36%)
# Prop.	35		
	Forest Protection – 927 ac	\$927,000	TP: 1,950 lb/yr (53%)
PLC Priority Parcels	10		
	AVOIDED COSTS	\$967,150	BOD: 8,055 lb/yr (22%)
Area	1,509		
	Residential Retrofits – 2.3 ac	\$34,500	TSS: 1,837 T/yr (84.5%)
	Septic Tank Replacements – 2	\$40,000	
	River Restoration – 12,939 ac	\$1,293,900	
	Tributary Enhancement – 31,181 ft	\$1,559,050	
	Stream Restoration – 12,495 ft	\$1,249,500	
	RESTORATION COSTS	\$3,209,200	



This catchment offers numerous opportunities to invest in agricultural protection and best management practices. The thirty-five properties within it are almost all active farms within the Dan River corridor. This is the last catchment before the Dan River exits North Carolina and flows to Virginia, and therefore offers a final opportunity for upstream investments to address Virginia's concerns about fecal material in the Dan River. This catchment is also a priority area for the PLC *Dan River Conservation Corridor* and has numerous restoration opportunities in the Dan River floodplain.

This catchment is an ideal hotspot for the investment of federal and state agricultural cost share programs as well as the NC Division of Mitigation Services. It has nearly 6 miles of tributaries in need of enhancement or restoration and 73 floodplain wetland acres identified by the NCSU GWLF model as restoration priorities. Any such investments need to also consider the development of a hiking or paddle trail along the Dan River that will link – at the least – Eden to Danville, Virginia. The floodplain certainly has the potential to host such a trail and the use of the river corridor for a vegetated buffer and trail network will provide the river with significant protection from runoff. It will also alleviate some physical stress to the river's small tributaries throughout this catchment, which are inundated with backflow during heavy precipitation event. Restoration of the historic floodplain to the Dan River will distribute the hydric energy more evenly along the corridor rather than focusing it into these few channels where it leads to erosion and habitat degradation (*see photo*).

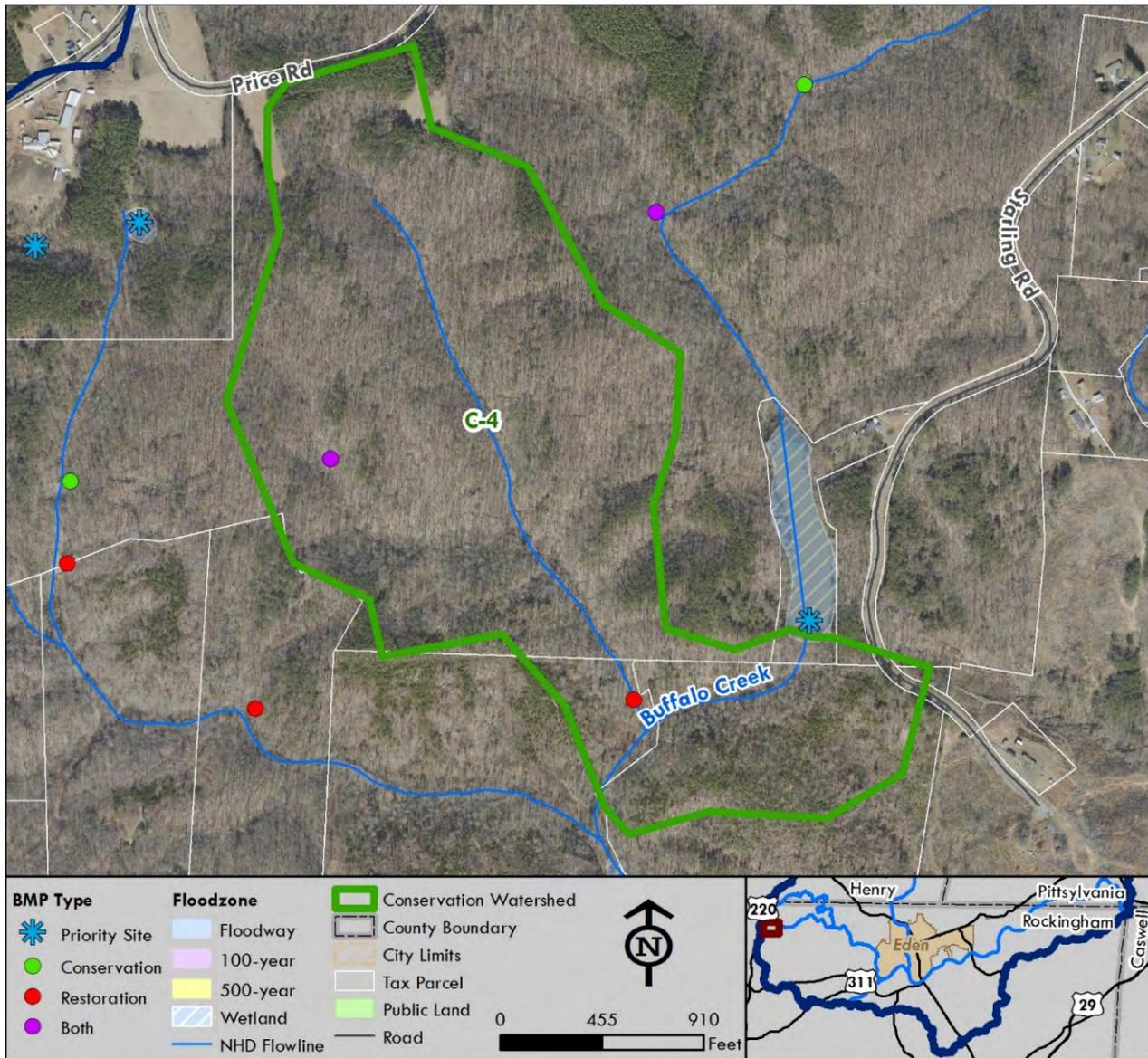


Figure 7: Agricultural BMP opportunity, Catchment 3



Figure 8: Eroded tributary resulting from Dan River backflow

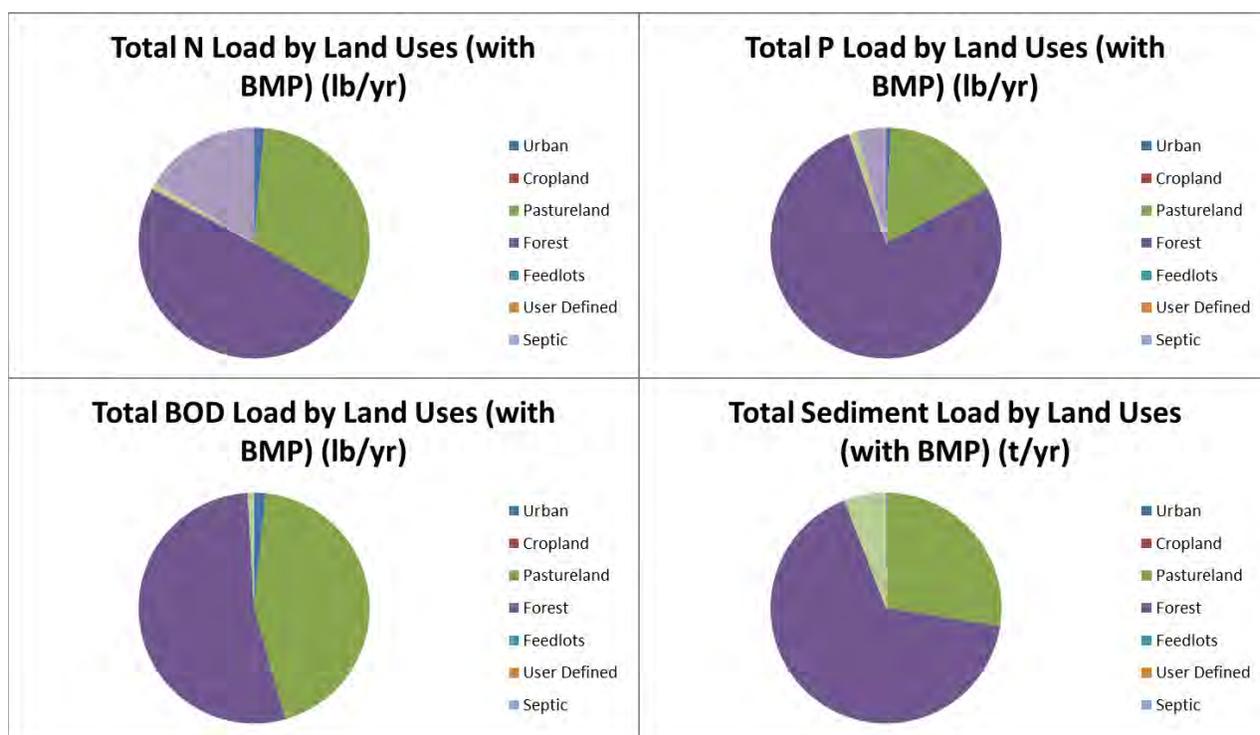
Map 11: Conservation Watershed C-04



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation or recreation uses.
2. Investigate opportunities to use streams for Rosgen reference streams for the western Piedmont region.
3. Communicate with landowners about using a consulting forester for timber harvesting.
4. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-04	Wetland Protection – 0.5 ac	\$550	TN: 26 lb/yr (15.5%)
# Prop.	1		TP: 10 lb/yr (19.5%)
PLC	0	\$212,800	BOD: 54.5 lb/yr (15%)
Priority			TSS: 14 T/yr (53%)
Parcels	Forest Protection – 110.5 ac	\$1,105,000	
Area	115		
	AVOIDED/TOTAL COSTS	\$1,318,350	



Catchment C-04 is one of the more valuable areas to ecological and environmental engineering community. It features outstanding stream conditions, with sinuous structures, floodplain access, good organic streambed layers, and healthy bank-to-height ratios. It could – and possibly should – be used as a reference stream for the western Piedmont ecoregion by Rosgen stream restoration program. There are few streams in the western Piedmont that are its equal. Naturally, the property will need to be protected through outright



Figure 9: Ideal reference stream, Catchment C-4

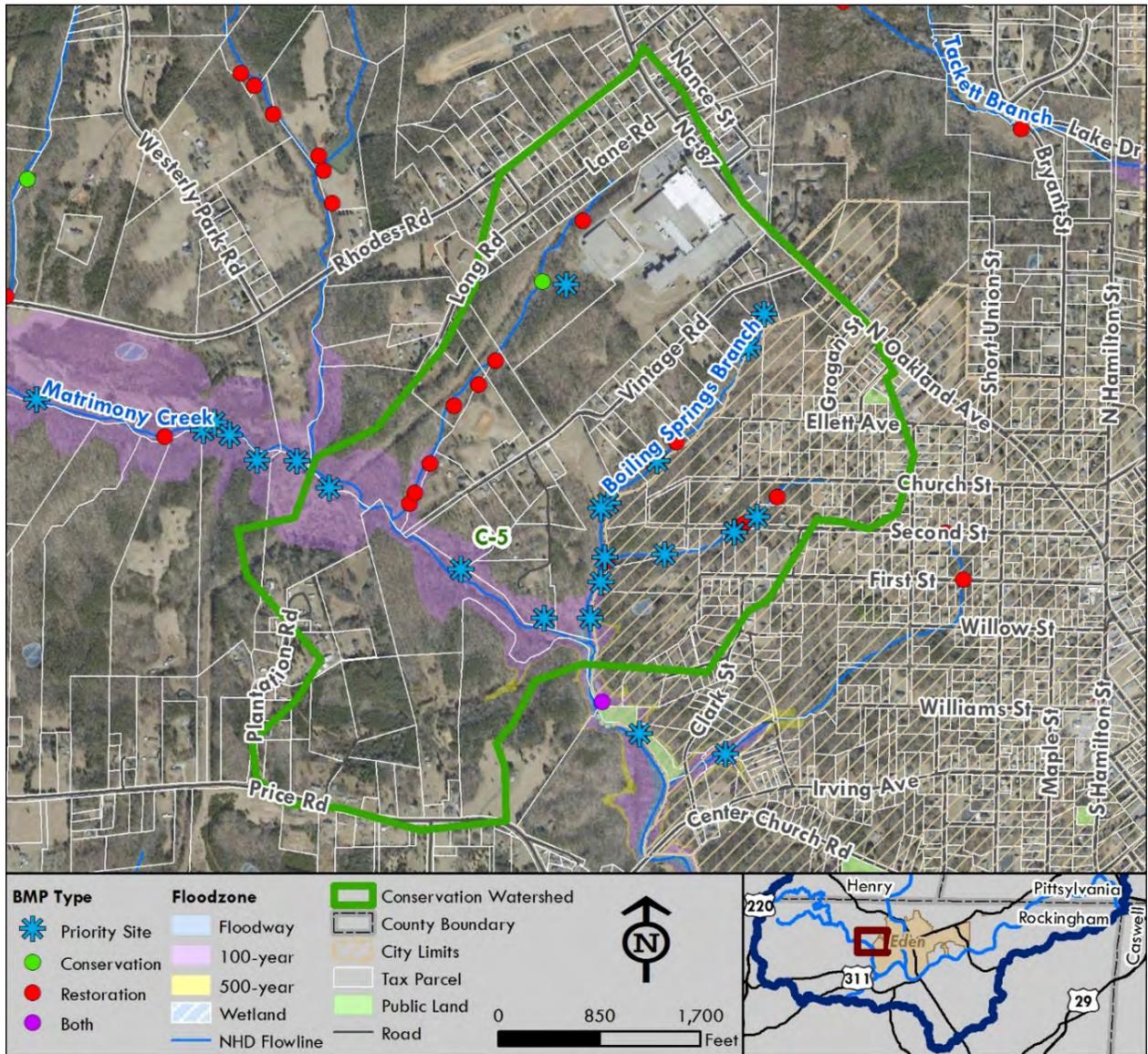
purchase or the placement of an easement upon the property, for both of which the landowner should be compensated fairly.

However, this catchment is also adjacent to a priority restoration site – a 4-acre farm pond with a failing earthen dam (*see photo*). The PTRC identified over seventy such farm ponds and dams throughout its field work, which covered less than half of the Eden area watershed. These dams collectively are holding potentially millions of tons of sediment that could be released if a natural disaster – namely a high-energy hurricane – hit the area. This would be devastating to the ecosystems of the river and places all downstream residents at great risk. The dams were built in the 1930's with Natural Resources Conservation Service funds and were constructed for a 50 – 75-year lifespan – they are at the end of this timeline. The risk that these dams pose to the communities of the Dan River are too great to ignore and must be acted upon immediately. Federal and state resources – especially from the NRCS – need to be invested in either the rehabilitation or removal of these aging and failing farm dams. It offers a challenge and great reward for farmers, engineers, ecologists, and all users of the river.



Figure 10: Failing farm dam spillway on Buffalo Creek

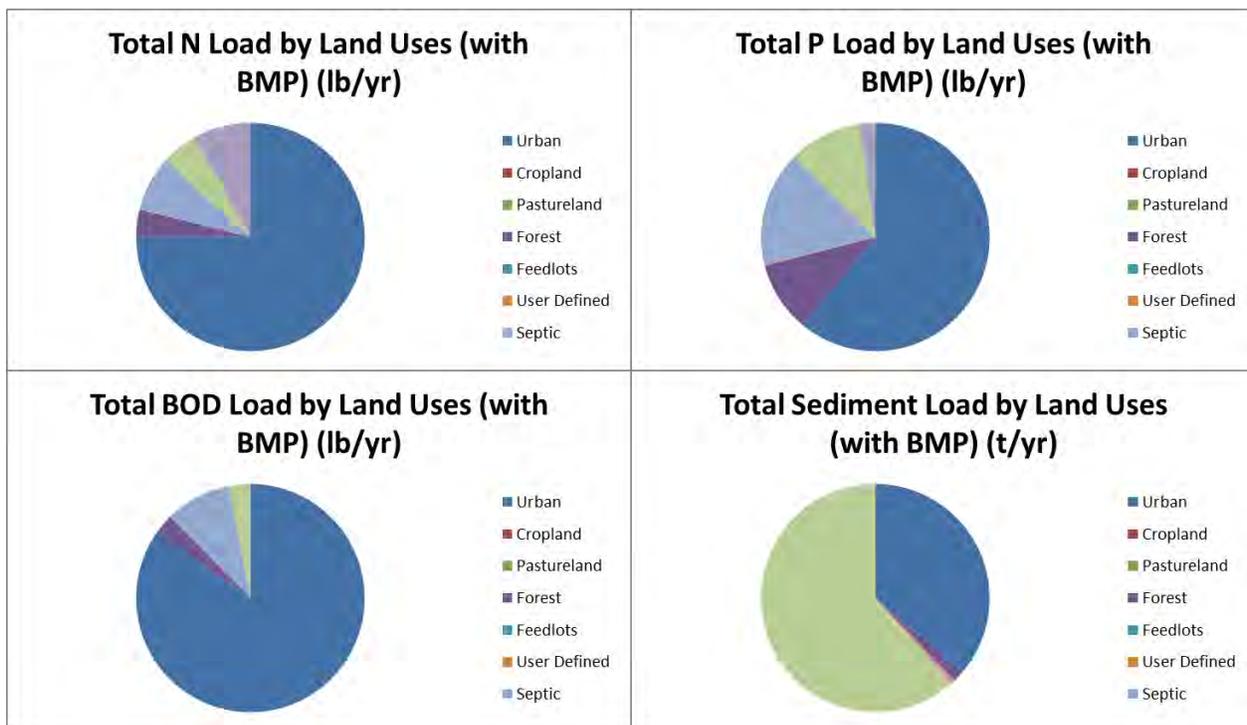
Map 12: Conservation Watershed C-05



Recommended Actions:

1. Restore Matrimony Creek and its tributaries to reduce pollution and flooding.
2. Stabilize or remove failing old farm pond.
3. Contact property owner(s) about placing a conservation easement on the floodplains of these properties for possible use as a park.
4. Initiate rain garden and rain barrel program for the residents in and around this watershed.
5. Assess area for stormwater education and retrofit opportunities.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-05	Wetland Protection – 0.38 ac	\$209	TN: 2,580.5 lb/yr (50.5%)
# Prop.	221		
PLC	0	\$225,000	TP: 982 lb/yr (67.5%)
Priority			BOD: 5,373.5 lb/yr (38.5%)
Parcels			TSS: 1,352 T/yr (95.5%)
Area	446	AVOIDED COSTS	
	Urban Retrofits – 39.5 ac	\$592,500	
	Floodplain Protection – 40 ac	\$40,000	
	Septic Tank Replacements - 7	\$140,000	
	River Restoration – 3,072	\$307,200	
	Tributary Enhancement – 9,078 ft	\$453,900	
	RESTORATION COSTS	\$1,533,600	



This catchment is a conservation priority due to the access of residents to both open space and the river, in this case the large tributary Matrimony Creek. It is also the site of sensitive soils and publicly-owned lands. Furthermore, it is immediately upstream of the flood-prone area of Matrimony Creek, and a site where retrofits and restoration efforts could make a significant difference. This catchment sits right on the eastern city limit of Eden, and is largely a residential area. The need for the presence of an outreach and education program like Stormwater SMART or DRBA is immediate. Such a program could promote best practices by the residents, including rain gardens and rain barrels that can assist with flood control.



Figure 11: Overflowing Sewer Outfall< Catchment C-05

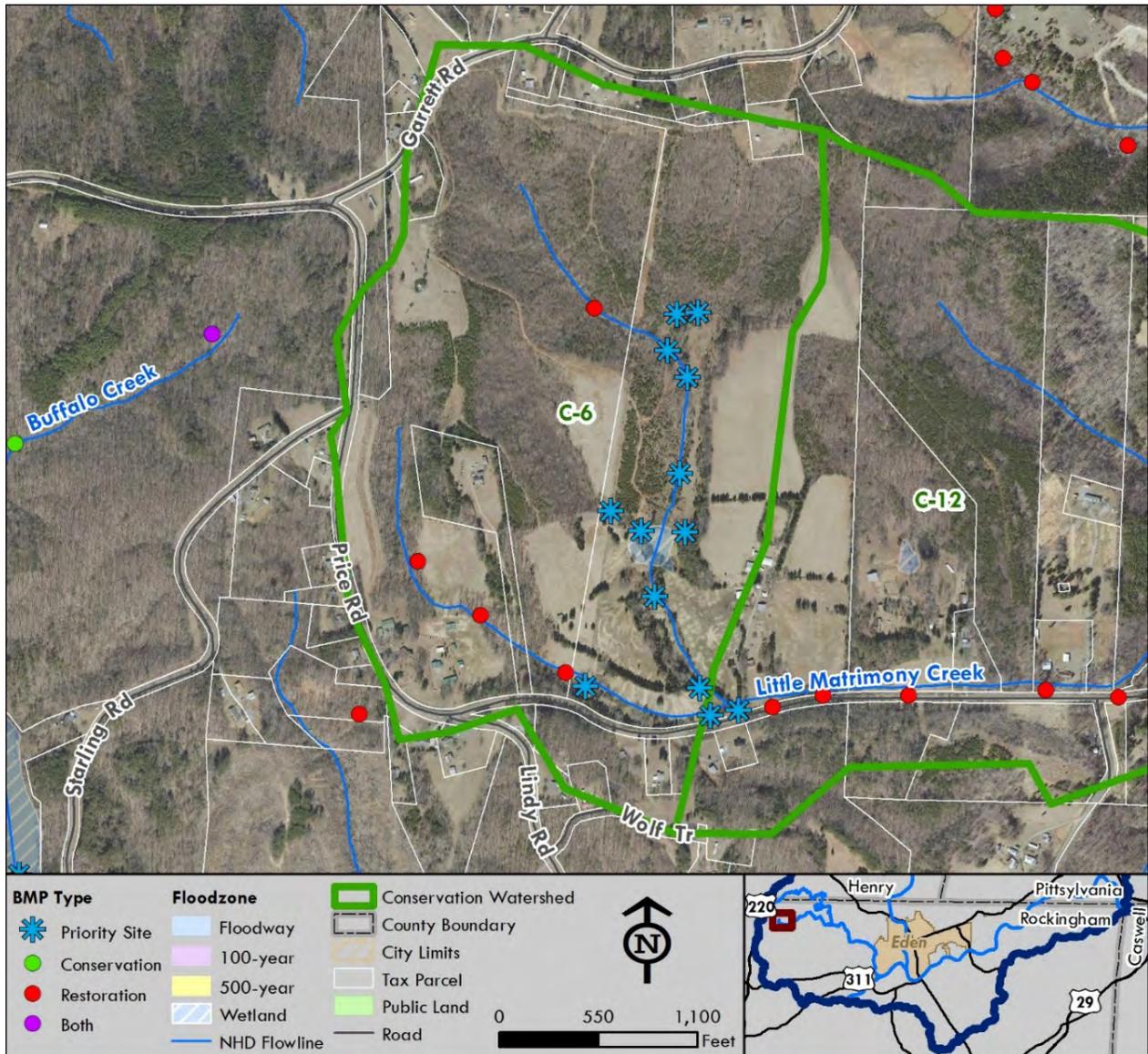
The industrial property and its surrounding open spaces also offer opportunities for stewardship and improvement for similar flood and pollutant control purposes. This is especially urgent due to the failure of sanitary sewer outfalls in this area (*see photo*). The City of Eden is spending about a third of its annual public funds on wastewater infrastructure improvements, and several system failures were noted and reported in this catchment. Watershed modeling shows that pollutant loads from such failures are not a significant contributor to pollution in the Dan and Smith Rivers, but they are the focus of an US EPA administrative order to reduce the overflows from occurring.

The industrial property is also the site of an old farm pond with a failing earthen dam. The overflows are using the emergency spillway and have eroded the soil down to the bedrock (*see photo*). This dam is in danger of failing and inundating Matrimony Creek with tons of sediment. Downstream residents are also in immediate risk of a potential flash flood from such a failure. This dam offers an opportunity for residents, engineers, and ecologists to engage a widespread and highly concerning potential risk for the entire Eden area watershed.



Figure 12: Incised Dam Spillway, Catchment C-05

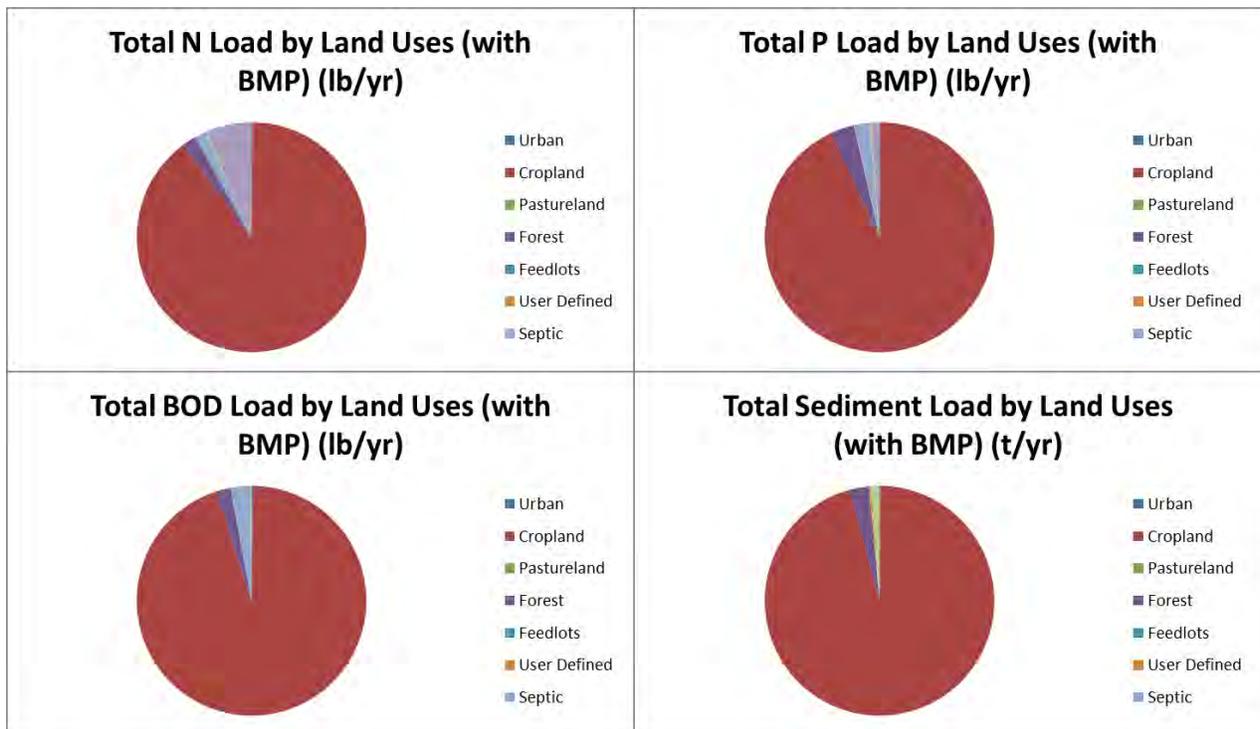
Map 13: Conservation Watershed C-06



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation or agricultural uses.
2. Stabilize or remove failing old farm pond.
3. Communicate with landowners about using a consulting forester for timber harvesting.
4. Invest in stream enhancement/restoration on unnamed tributaries.
5. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-06	Wetland Protection – 1.1 ac		TN: 2,348.5 lb/yr (43%)
# Prop.	9	\$6,050	TP: 602.5 lb/yr (41.5%)
PLC Priority Parcels	0	\$225,000	BOD: 2,289 lb/yr (25%)
	AVOIDED COSTS	\$225,209	TSS: 200.5 T/yr (45%)
Area	197		
	Urban Retrofits – 0.75 ac	\$11,250	
	Floodplain Protection – 73.2 ac	\$73,200	
	Septic Tank Replacements – 2	\$40,000	
	Stream Enhancement – 6,064 f	\$303,200	
	RESTORATION COSTS	\$427,650	



This catchment is occupied by a few farms that are either dedicated to timber or horses. It is also the headwaters of Little Matrimony Creek and therefore extraordinarily valuable to the entire watershed. With minor investments in agricultural best management practices, it could be enhanced to state where its conditions safeguard all downstream water quality and flooding concerns.

The streams flowing through the horse farm simply need to be better buffered with vegetation so that they do not erode and the horses have less general access. This need was documented as a priority in the NCSU GWLF model and will be one of the most cost-effective actions that could be taken to improve local and downstream water quality conditions. If the forested lots are to be harvested for timber, then efforts need to be made to ensure that the landowner is aware of the value of using a consulting forester to develop conservation plan, abide by it, and ensure that the harvest is down to optimize profits.

There is a 1-acre farm pond on the larger of the two tributaries. Like many of the farm ponds in Rockingham County, it is well over fifty years old and is beginning to fail, with its overflows using its emergency spillway rather than its weir for discharge. This farm pond is actually spilling over the earthen berm of the dam, a dangerous situation that can erode the structure and breach the dam. This dam's current conditions pose a significant risk to all residents and ecosystems immediately downstream – the entire Matrimony Creek system. Beyond its potential as endangered species habitat, this creek and its tributaries already provide value to the many farmers, residents, and ecosystems living there now. Stabilizing or removing this pond should be an immediate priority.



Figure 13: Stream Buffer Need, Catchment C-06

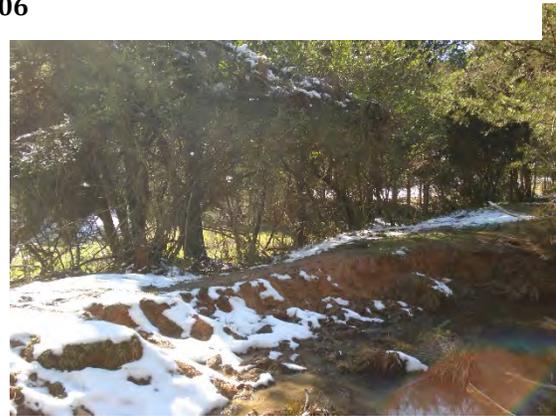
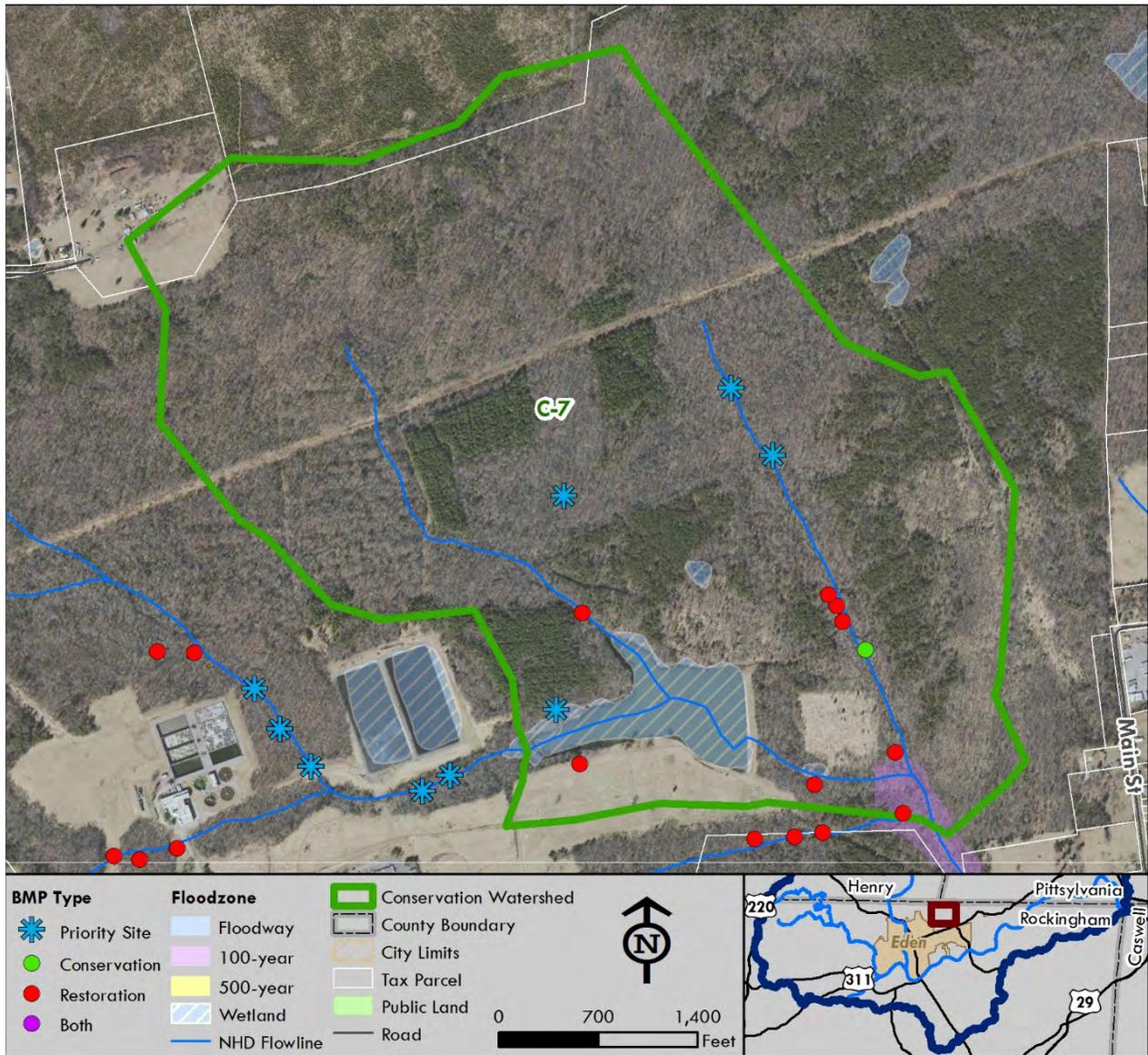


Figure 14: Failing Earthen Dam, Catchment C-06

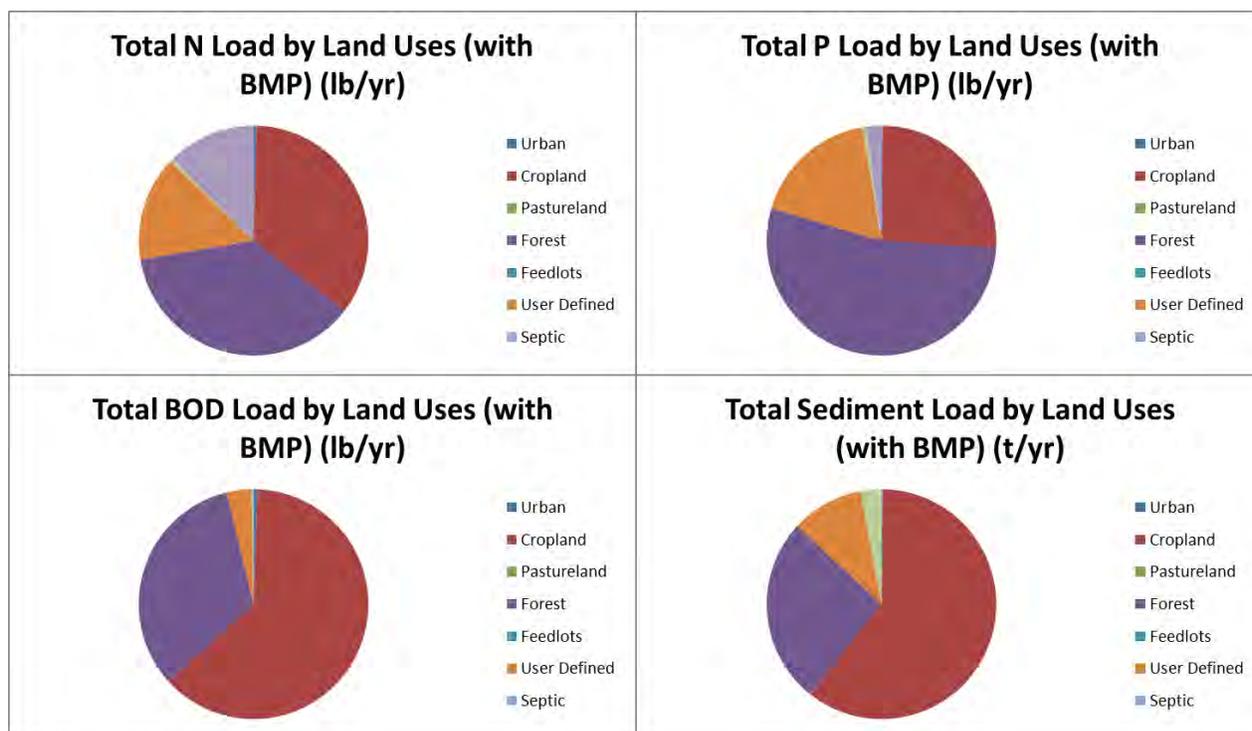
Map 14: Conservation Watershed C-07



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for conservation purposes.
2. Assess habitat enhancement opportunities for this G1S1 habitat.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-07	Stream Protection – 10,758 ft		TN: 1,572.5 lb/yr (67%)
# Prop.	1	\$537,900	
PLC	0	\$99,000	TP: 399.5 lb/yr (61.5%)
Priority Parcels	Floodplain Protection – 4.2 ac		BOD: 1,938.5 lb/yr (49%)
Area	500	\$4,200	
	Forest Protection – 440 ac	\$440,000	TSS: 137.5 T/yr (69.5%)
	AVOIDED COSTS	\$1,081,100	



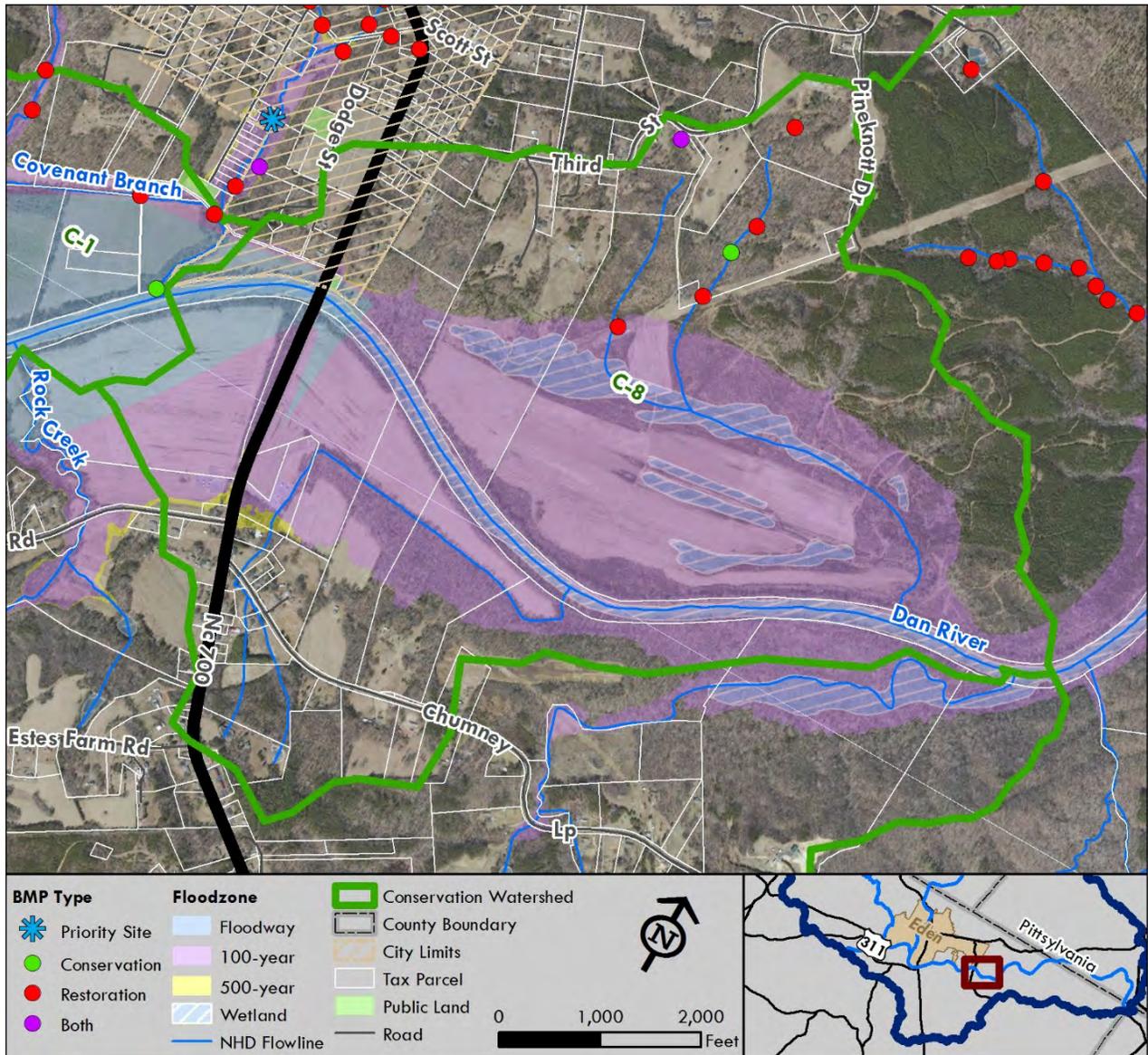
This property is perhaps this watershed’s most valuable asset to the environmental and ecological community. A G1S1 habitat, the upland woodland hardwood forest is literally found almost nowhere else on the planet. It is a unique habitat of Triassic Basin-derived soils, threaded streams, very little understory, and abundant wetlands that are home to uncommon liverworts and salamanders. As such, it is also a nurturing setting for a large headwaters tributary of Dry Creek, one of the Dan River’s larger tributaries and a priority subwatershed in this watershed. A thorough ecological assessment of the property has not yet been done, so more natural treasures may be present here. The property is currently unprotected from development, but it is also not heavily used outside of a few four-wheeler paths and some light hunting. These paths could be the

foundation of a future trails network that could be developed at this site with careful planning and investment in conservation. Urgent action is needed to more formally characterize this property and its ecosystem(s) and permanently protect it for future appreciation.



Figure 15: Pristine Wetlands on Upland Hardpan Forest (S1G1 Habitat), Catchment C-07

Map 15: Conservation Watershed C-08



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplains of these properties for conservation or recreation uses.
2. Investigate the potential to link residents to river corridor with trails.
3. Invest in stream enhancement/restoration on unnamed tributaries.
4. Initiate stormwater education programs in surrounding residential neighborhoods.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-08			TN: 11,270 lb/yr (64%)
# Prop.	72 Wetland Protection – 81 ac	\$445,500	TP: 3,128 lb/yr (65%)
PLC Priority Parcels	10 Forest Protection – 422 ac	\$422,000	BOD: 16,535.5 lb/yr (50%)
Area	989 AVOIDED COSTS	\$667,500	TSS: 569.5 T/yr (79%)
	Floodplain Protection – 524 ac	\$524,000	
	River Restoration – 10,746 ft	\$1,074,600	
	Stream Enhancement – 17,272 ft	\$863,600	
	Septic Replacements – 19	\$380,000	
	RESTORATION COSTS	\$2,842,200	

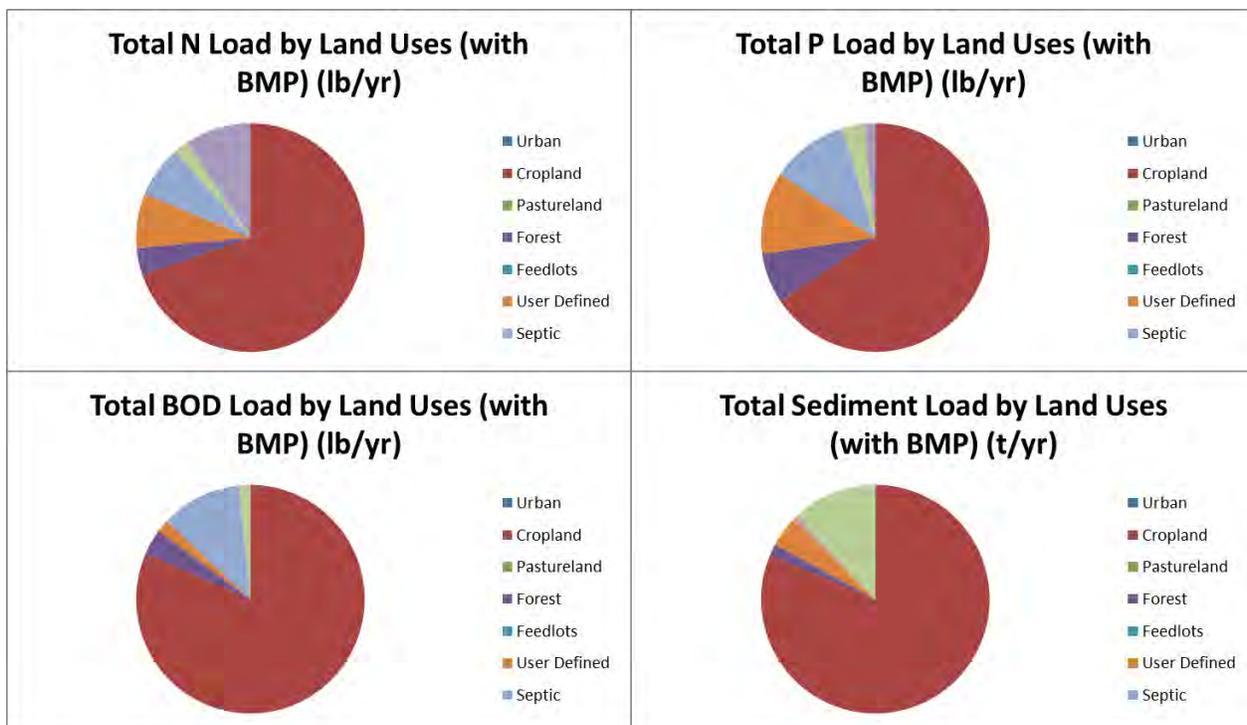




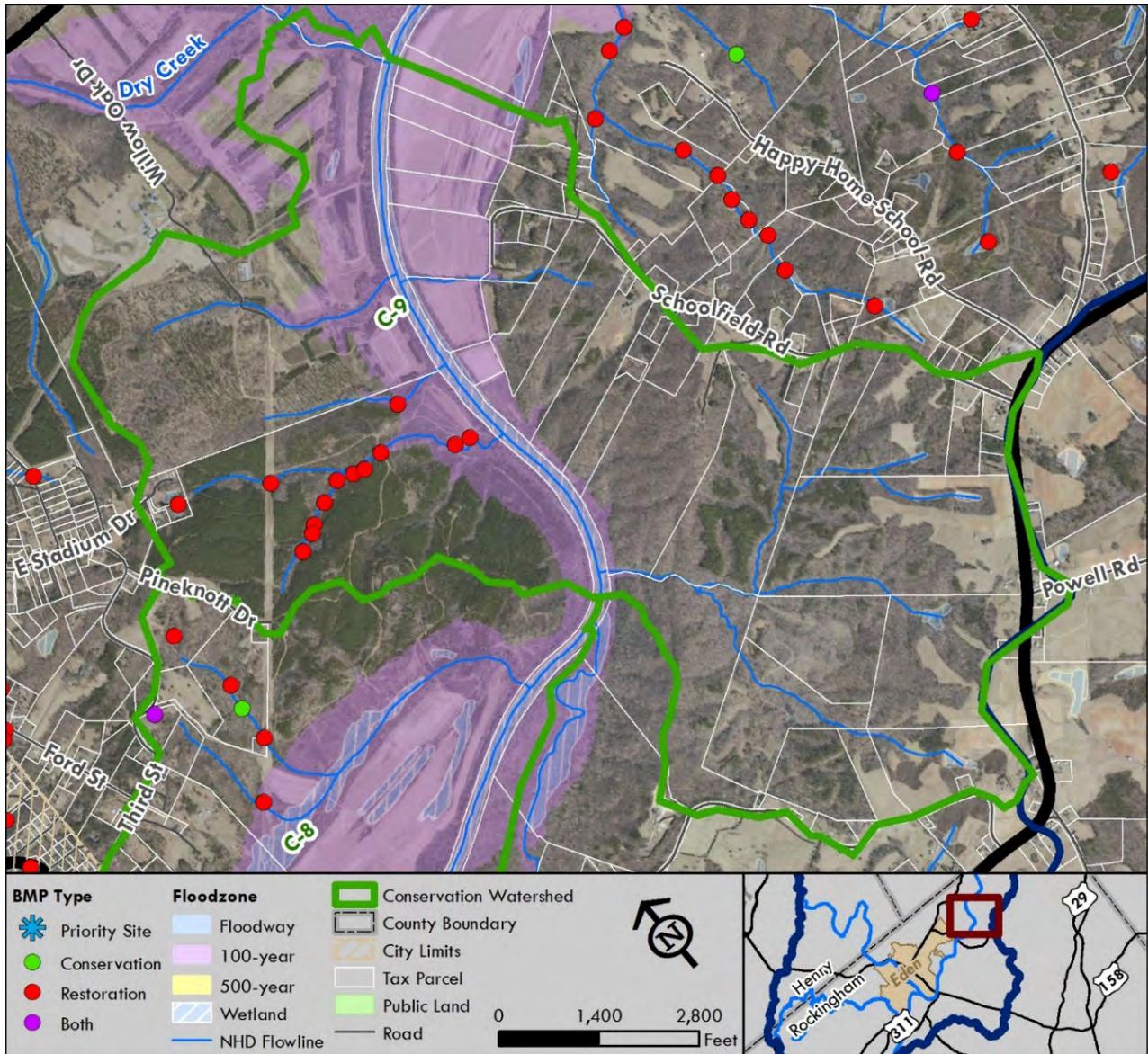
Figure 16: Plowed Floodplain Wetland, Catchment C-08

This catchment is a mixture of uses and recommended practices. Lying on the eastern city limits of Eden and the Dan River, it has multiple sites that need some form of remediation, whether it is the greater use of stormwater practices in the residential neighborhood in the northern part of the catchment or the plowed and pastured floodplains of the Dan River. These 81 acres of floodplains wetlands that could be enhanced or restored to healthier status. It is also a priority area for the PLC *Dan River Conservation Corridor*, and a great site for a greenway, paddling trail and access point, and/or a protected area for recreation. Based upon the experiences of the field work teams, it already appears to be used for hunting throughout much of the year, and the less boggy areas of the floodplains are plowed for crops.

This site is a prime candidate for investment at all levels. The 81 acres of wetlands and 3+ miles of tributaries all deserve attention from the NC Division of Mitigation Services. The wetlands and potential habitat restoration should also be of interest to PLC and other environmental groups that manage lands for conservation purposes.

This catchment is immediately downstream of the Duke Energy coal ash spill and is the most probable area for deposition of the coal ash in the Dan River. It is also has an old farm dam on one of its tributaries, and the dam is structurally failing. Rather than use its constructed weir for discharge, the dam is spilling over its earthen berm, which can quickly erode the entire structure and lead to failure. Failure of this and the other seventy-plus dams identified through field assessment of under half of the Eden Area watershed during a natural disaster like a high-intensity hurricane would load millions of tons of sediment to the Dan River, directly impacting endangered species habitat and endangering downstream residents. These dams need immediate and urgent attention to either be stabilized or removed – they pose a high risk as long as they are not attended to.

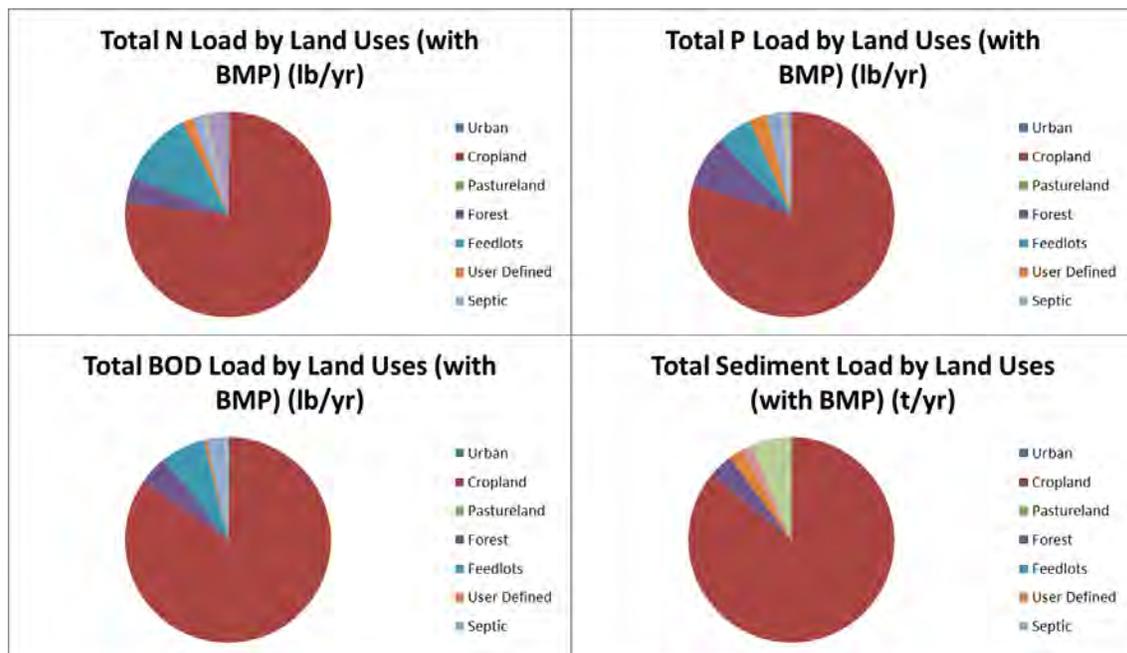
Map 16: Conservation Watershed C-09



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplains of these properties for possible conservation, agriculture, or recreation uses.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-09			TN: 14,566 lb/yr (45%)
# Prop.	58	Wetland Protection – 52 ac	\$286,000
PLC Priority Parcels	14	Forest Protection – 1,179 ac	\$1,790,000
Area	1,822	AVOIDED COSTS	\$2,076,000
		Floodplain Protection – 374 ac	\$374,000
		River Restoration – 10,746 ft	\$812,300
		Stream Enhancement – 35,802 ft	\$1,790,100
		Septic Replacements – 10	\$200,000
		Residential Retrofits – 5 ac	\$75,000
		RESTORATION COSTS	\$3,251,400
			BOD: 14,041 lb/yr (27%)
			TSS: 1,385 T/yr (69%)



This catchment lies immediately outside the limits of Eden, just upstream of the confluence of Dry Creek with the Dan River. It is downstream of the Duke Energy Power Station and site of the coal ash spill and may be habitat for Roanoke log perch and green floater. It includes the entirety of the tributary Cascade Creek, which has no recorded field data but was identified as a priority stream buffer restoration site by the NCSU GWLF model. It is also a priority area in the Piedmont Together GIN and the PLC Dan River Conservation Corridor.

This area should be of high interest to the NC DMS and environmental groups. The catchment features over six miles of streams that could be enhanced or restored, and 52 acres of Dan River floodplain wetlands that could be restored or enhanced. These assets could also be protected through conservation easements or ownership by PLC or DRBA. There is need for stream enhancement (*see photo*), and such work could also create a foundation for greenways and/or hiking trails in the Dan River Corridor. Such work could also include habitat enhancement for rare and endangered species in and along the streams.

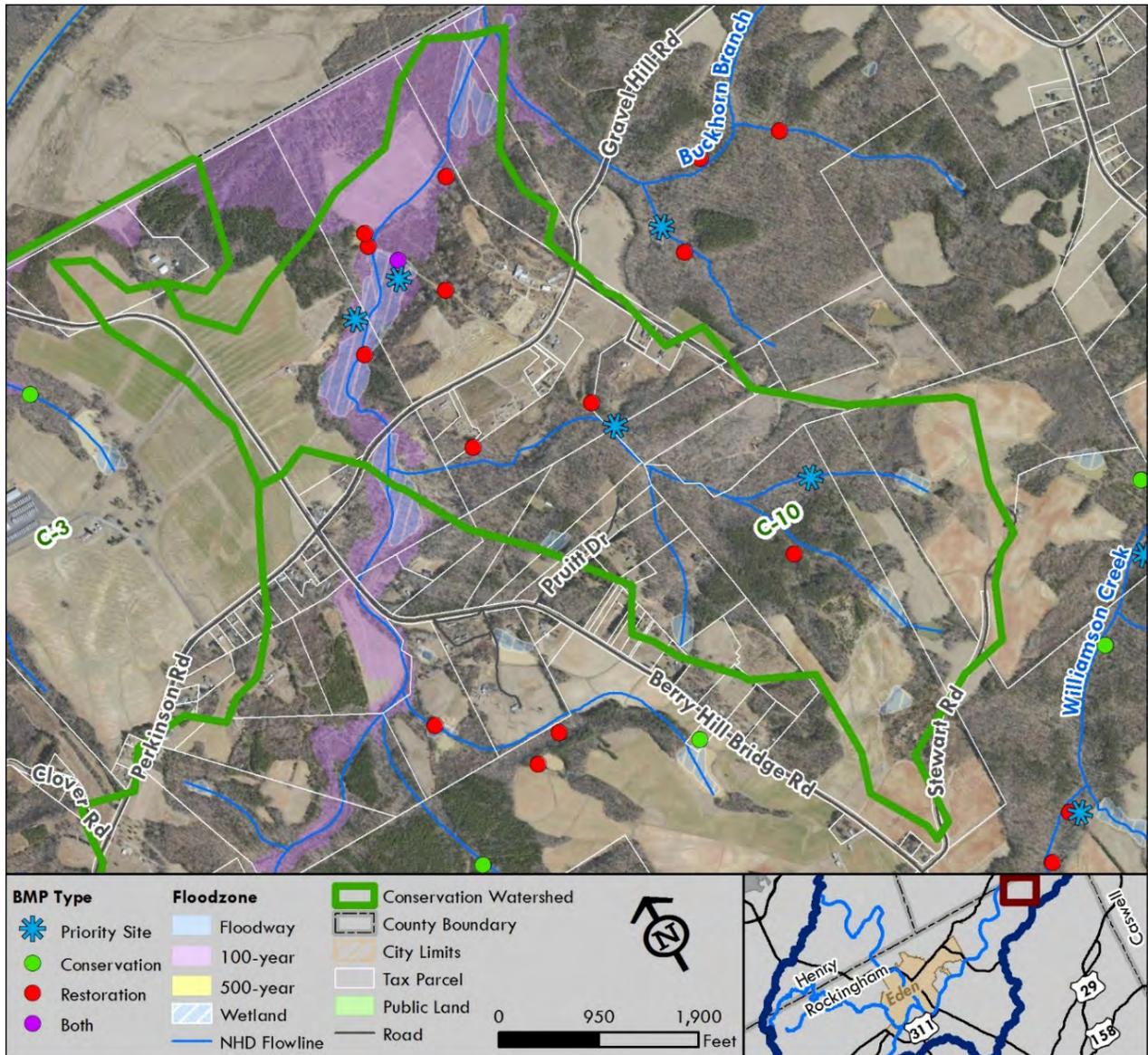


Figure 17: Stream Enhancement Site, Catchment C-09

This catchment offers opportunities to both restore and protect the Dan River. Many of the riverside properties are plowed and could be beneficiaries of agricultural cost-share programs through the SWCD. The large amount of forested properties also highlights the need for outreach to these landowners about the value and need for consulting foresters to manage any timber harvests here. Consulting foresters can assist landowners with developing a conservation plan, abiding by it, following forestry practice guidelines, and optimizing harvest profits.

Lastly, the headwaters of the catchment feature an old farm pond that is beginning to fail. Though not in as bad of shape as the other 70+ farm ponds documented by fieldwork in this watershed, the embankment is compromised and it is not using its discharge weir. Without immediate attention, it will continue to degrade until its risk to the Dan River is immediate. This dam should either be stabilized or removed.

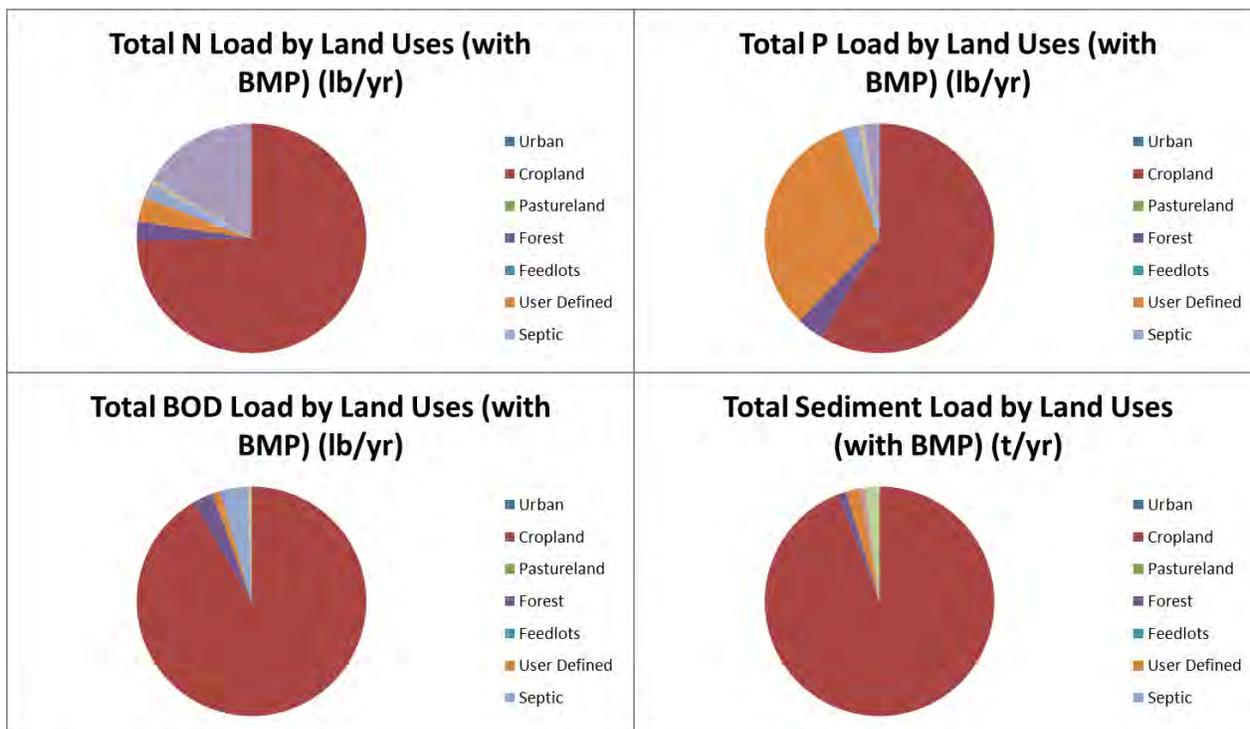
Map 17: Conservation Watershed C-10



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplains of these properties for possible agricultural, conservation, or recreation uses.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-10			TN: 4,198 lb/yr (51%)
# Prop.	26 Wetland Protection – 26.5 ac	\$145,700	TP: 2,613 lb/yr (66%)
PLC Priority Parcels	0 Forest Protection – 222 ac	\$222,000	BOD: 6,115 lb/yr (41%)
Area	536 AVOIDED COSTS	\$367,700	TSS: 571 T/yr (55%)
	Floodplain Protection – 66.5 ac	\$66,500	
	Stream Enhancement – 15,252 ft	\$762,600	
	Septic Replacements – 3	\$60,000	
	RESTORATION COSTS	\$889,100	





This catchment is a site for immediate conservation action. The 26.5 acres of wetlands within it are generally in excellent condition and home to salamanders (*see photos*). However, surrounding areas show high impact land uses that pose potential risks to these valuable systems that absorb water quality pollutants, buffer flooding impacts, stabilize watersheds, and provide critical habitat to many species. Protecting these wetlands should be an immediate priority for PLC and DRBA, as well as the Rockingham County SWCD.



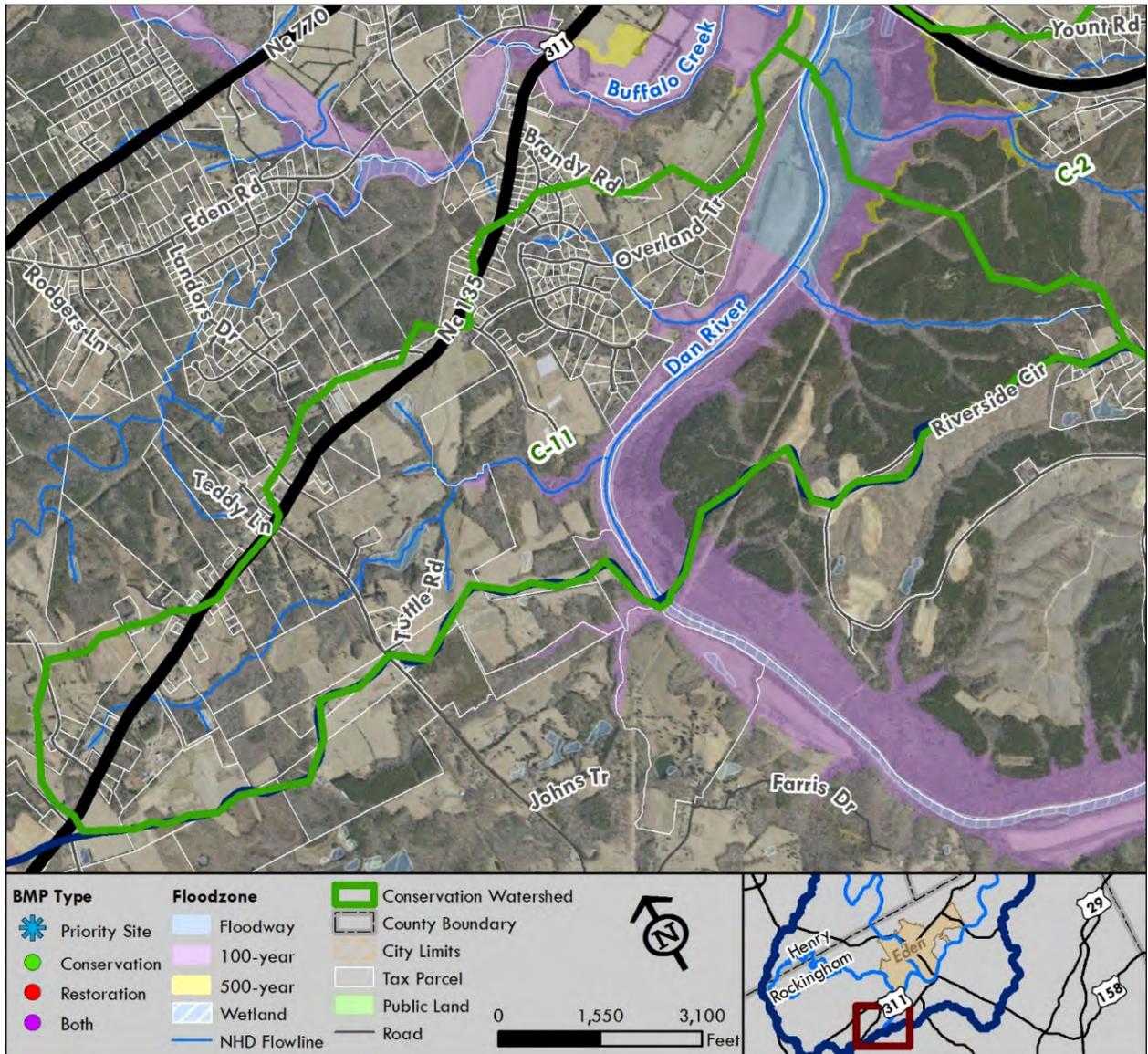
The impacts on surrounding properties largely appear to be due to tree clearance for timber harvesting and farming in the floodplain. Outreach from the SWCD regarding agricultural cost-share programs and best management practices that protect habitat while permitting a wide array of land uses by the property owner(s) could yield large rewards for this area. Paramount to these efforts will be stream and wetland protection – the NCSU GWLF model identifies the northern sector of this catchment as a priority area for both wetland restoration and stream buffer restoration. Promoting the skills and expertise of a consulting forester on these properties will also ensure that FPGs are abided by, a conservation is used, and

Figure 18: Protected and Plowed Wetland Sites, Catchment C-10

the property owners' profits are optimized.

This catchment is one of the last before the Dan River permanently leaves North Carolina. The state and local stakeholders have the opportunity to ensure that the river is in the best condition possible before it enters Virginia. The presence of rich habitats and natural resources gives all involved the opportunity not only to create a network of healthy water quality conditions but also ecological habitat conditions and recreational opportunities. Steps to do so should be taken as soon as possible.

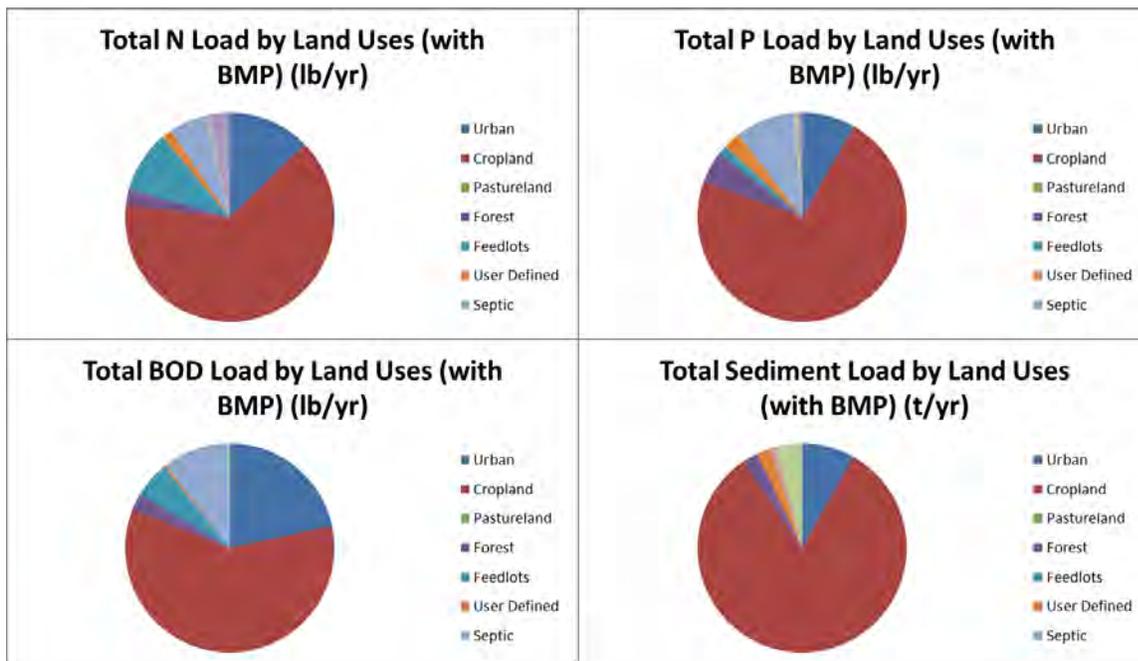
Map 18: Conservation Watershed C-11



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation, agriculture, or recreation uses.
2. Investigate potential of using trails to connect area residents with river corridor.
3. Initiate stormwater outreach program to surrounding residential areas, including a rain garden and/or rain barrel program.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-11			TN: 9,837 lb/yr (34%)
# Prop.	170	Wetland Protection – 53 ac	\$291,500
PLC Priority Parcels	3	Forest Protection – 827 ac	\$827,000
Area	1,584	AVOIDED COSTS	\$1,118,500
		Floodplain Protection – 263 ac	\$263,000
		River Restoration – 9,630 ft	\$963,000
		Stream Enhancement – 24,200 ft	\$1,210,200
		Septic Replacements – 40	\$800,000
		Residential Retrofits – 15 ac	\$225,000
		RESTORATION COSTS	\$3,461,200
			TP: 2,794.5 lb/yr (37%)
			BOD: 10,597 lb/yr (19%)
			TSS: 1,092 lb/yr (61.5%)

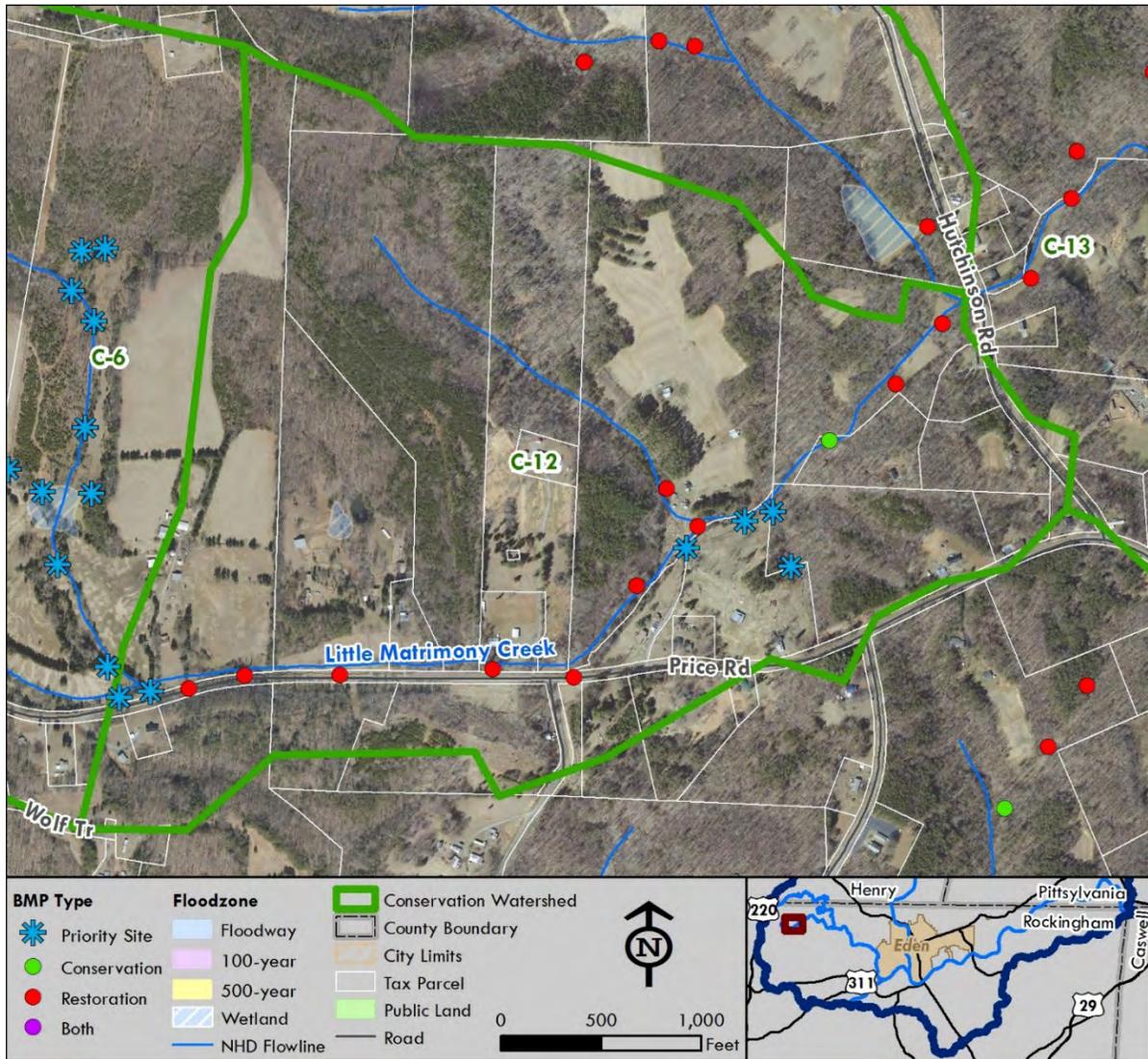


This catchment is the origin point of the Dan River in the watershed of study. It is representative of much of the entire watershed in both North Carolina and Virginia: rural areas being subdivided and converted to rural residential communities relying on septic systems and groundwater wells. Its headwater tributary is suffering from cattle impacts and a failing farm pond, and all of the stream and river corridors are identified as priorities by the Piedmont Together GIN and the PLC Dan River Conservation Corridor. The Dan River floodplains were identified as wetland restoration priorities by the NCSU GWLF model. Similar conditions are found throughout the 225-square miles Eden area watershed, and the pressing conservation, pollution, and restoration concerns are also the predominant issues throughout the watershed.

Concerted efforts should be made to coordinate efforts by the Rockingham County SWCD, PLC, and DRBA to promote conservation and best management practices on these properties, possibly for promotion as demonstration projects throughout the watershed, the county, and the river basin. There are opportunities to exclude livestock from the stream, restore stream buffers, stabilize or remove a failing farm pond, promote conservation farming and forestry, protect potentially valuable ecological habitat, and create a recreation network along the Dan River corridor in this catchment. Such a wealth of opportunities should not be taken for granted.

This catchment also offers opportunities to couple rural and residential outreach programs for a comprehensive approach to watershed stewardship and rehabilitation. The residential community within the catchment is disconnected from the City of Eden and therefore has less support for maintaining infrastructure – especially stormwater. An outreach program that discusses the practices that all residents can undertake at their homes may be a strategically useful way to reduce and minimize pollution and runoff from residences. In such a setting, rain barrels, rain gardens, and stream buffer programs may be appealing practices to promote to these homeowners, especially due to their potential to improve properties and their application to both rural and suburban homeowners.

Map 19: Conservation Watershed C-12

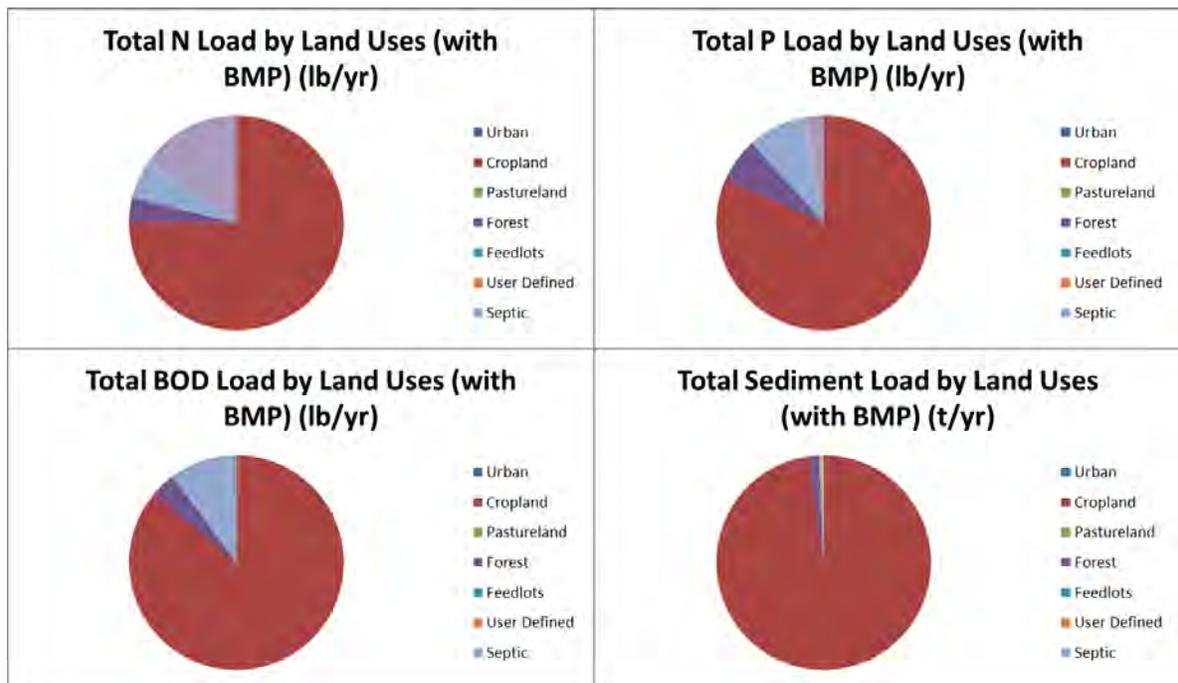


Properties 22 PLC Priority Parcels 0 Area (acres) 259

Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation or agriculture uses.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Invest in stream enhancement/restoration on unnamed tributaries.
4. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-12			TN: 1,270 lb/yr (41%)
# Prop.	22 Wetland Protection – 0.33 ac	\$1,815	TP: 312 lb/yr (40%)
PLC Priority Parcels	0 Forest Protection – 129 ac	\$129,000	BOD: 1,806 lb/yr (30%)
Area	259 AVOIDED COSTS	\$130,815	TSS: 165 lb/yr (42%)
	River Restoration – 5,365 ft	\$536,500	
	Stream Enhancement – 2,236 f	\$111,800	
	Septic Replacements – 4	\$80,000	
	RESTORATION COSTS	\$728,300	



This catchment of Little Matrimony Creek shows a water system building in complexity and volume. Its smaller stature and energy also offers stakeholders an opportunity to stabilize and restore watershed conditions so that the historic downstream flooding and pollution associated with the Matrimony Creek subwatershed of the Dan River are addressed and attenuated. This particular catchment is a mixture of healthy wooded areas that could be protected or conserved for open space and/or recreation and a general need for stream buffer restoration (*see photo*).



The Rockingham County SWCD and DRBA should partner to promote stream buffers in this area. The streams are small, so even modest buffers will make a significant difference. Many of the buffer areas are grassed – they just need to be planted with shrubs and/or trees, improving property appearances and values. Some of these streams lie clearly within the NC DOT right-of-way. The DOT should be promoting healthy buffers within their own road maintenance. Setting this example will establish a healthier norm for area residents.

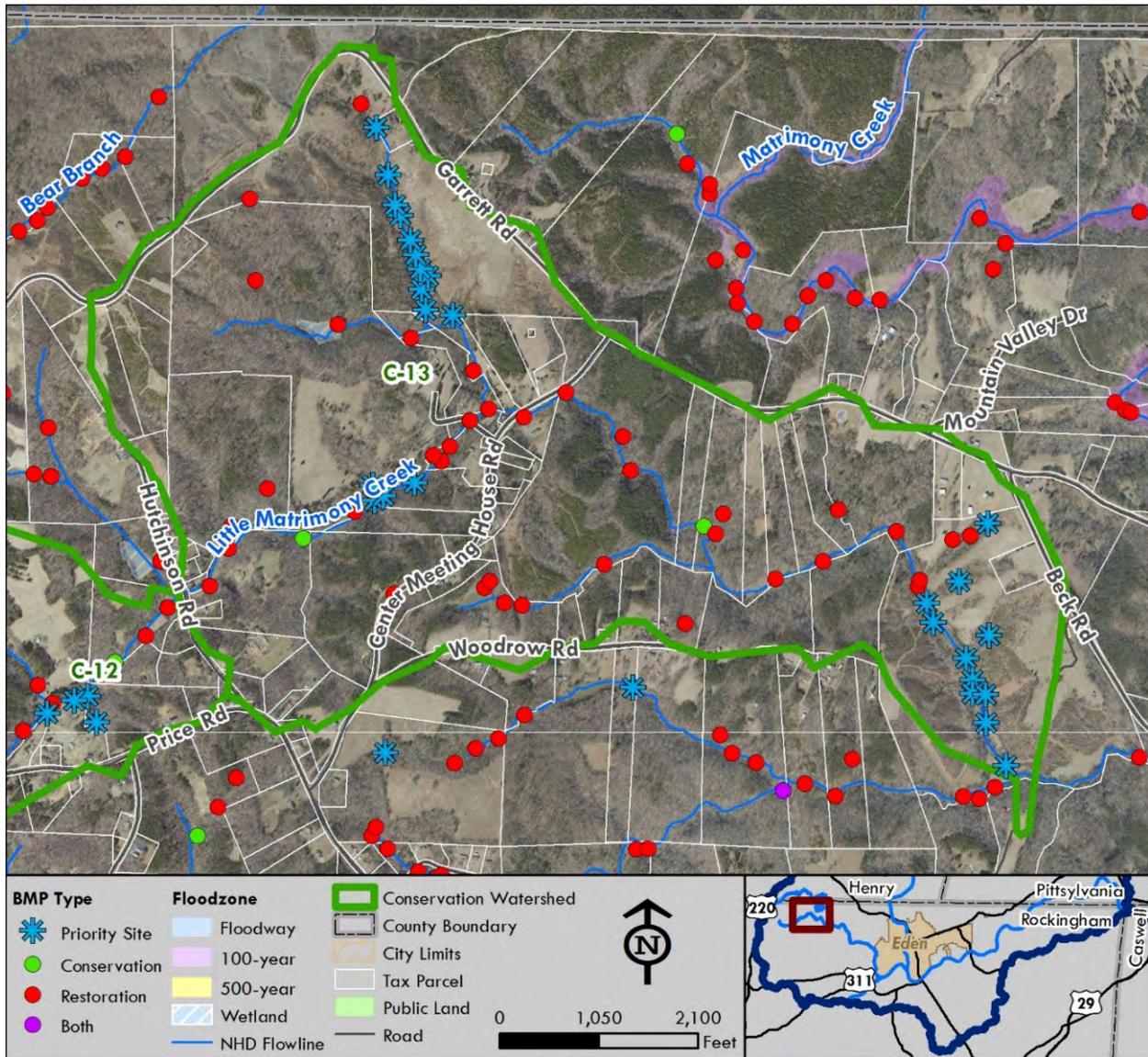


Figure 19: Stream Buffer Restoration Sites, Catchment C-11

Little Matrimony Creek is part of the Piedmont Together GIN. The network runs right along Price Road and the creek of this catchment. The creation of a multiuse path here will support the creation of a trails network throughout the Dan River, bringing in ecotourism dollars

from the Dan River, its tributaries, and their surrounding ecosystems and open space. PLC and DRBA should coordinate with the Rockingham County Economic Development office to assess the potential for realizing such a network, and integrating it with the existing Rockingham County Trails Network.

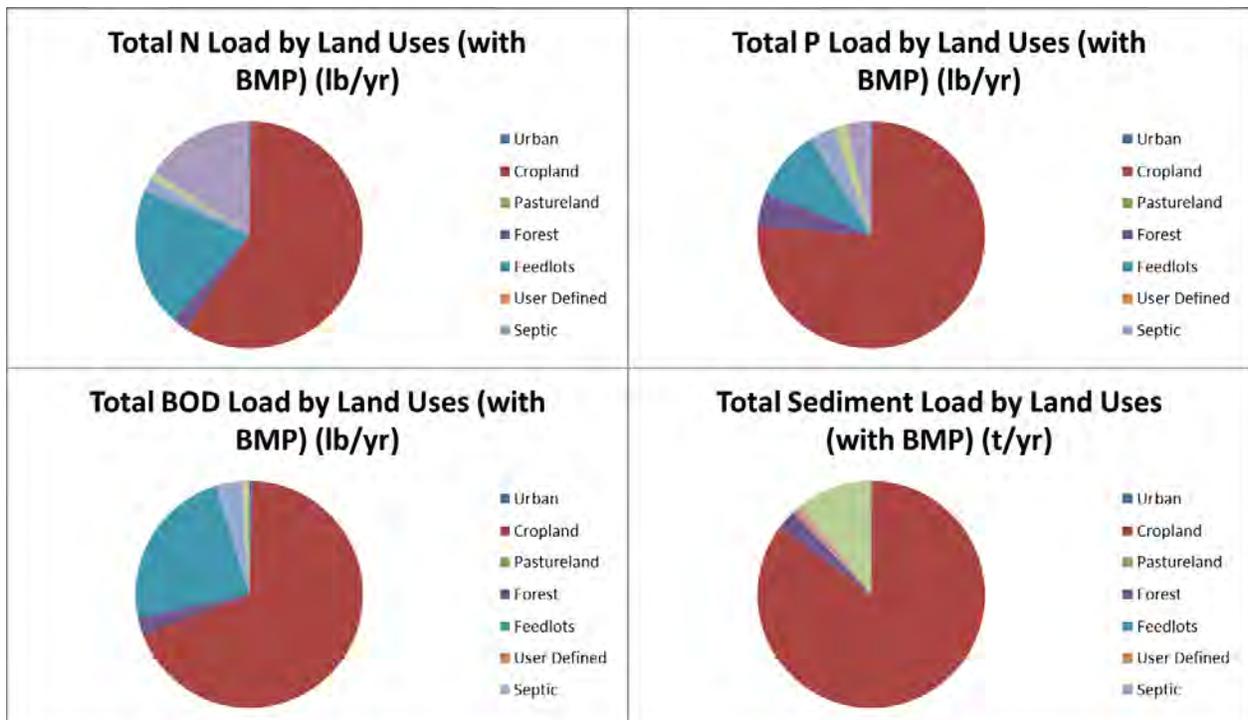
Map 20: Conservation Watershed C-13



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation or agriculture uses.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Invest in stream enhancement/restoration on unnamed tributaries.
4. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-13			TN: 363 lb/yr (67%)
# Prop.	67	Wetland Protection – 2 ac	\$11,000
PLC Priority Parcels	0	Forest Protection – 617 ac	\$617,000
Area	916	AVOIDED COSTS	\$629,000
		River Restoration – 13,376 ft	\$1,337,600
		Stream Enhancement – 9,558 f	\$427,950
		Septic Replacements – 1	\$20,000
		Residential Retrofits – 4 ac	\$60,000
		RESTORATION COSTS	\$1,845,550
			TP: 120 lb/yr (71%)
			BOD: 524 lb/yr (61%)
			TSS: 45 T/yr (82.5%)





Little Matrimony Creek is defined by this catchment, a wooded one with a large cattle farm that has a disproportionate impact upon the catchment and possibly the entire Matrimony Creek subwatershed. Several tributary streams of Little Matrimony Creek could serve as western Piedmont reference streams for Rosgen stream identification classes (*see photo*). They are sinuous and stable, with good buffers and substrate. There is no sampling data from these streams, so the condition of their resident ecology and chemistry is unknown. Most sites are east of Eden, but this western catchment has excellent candidates.

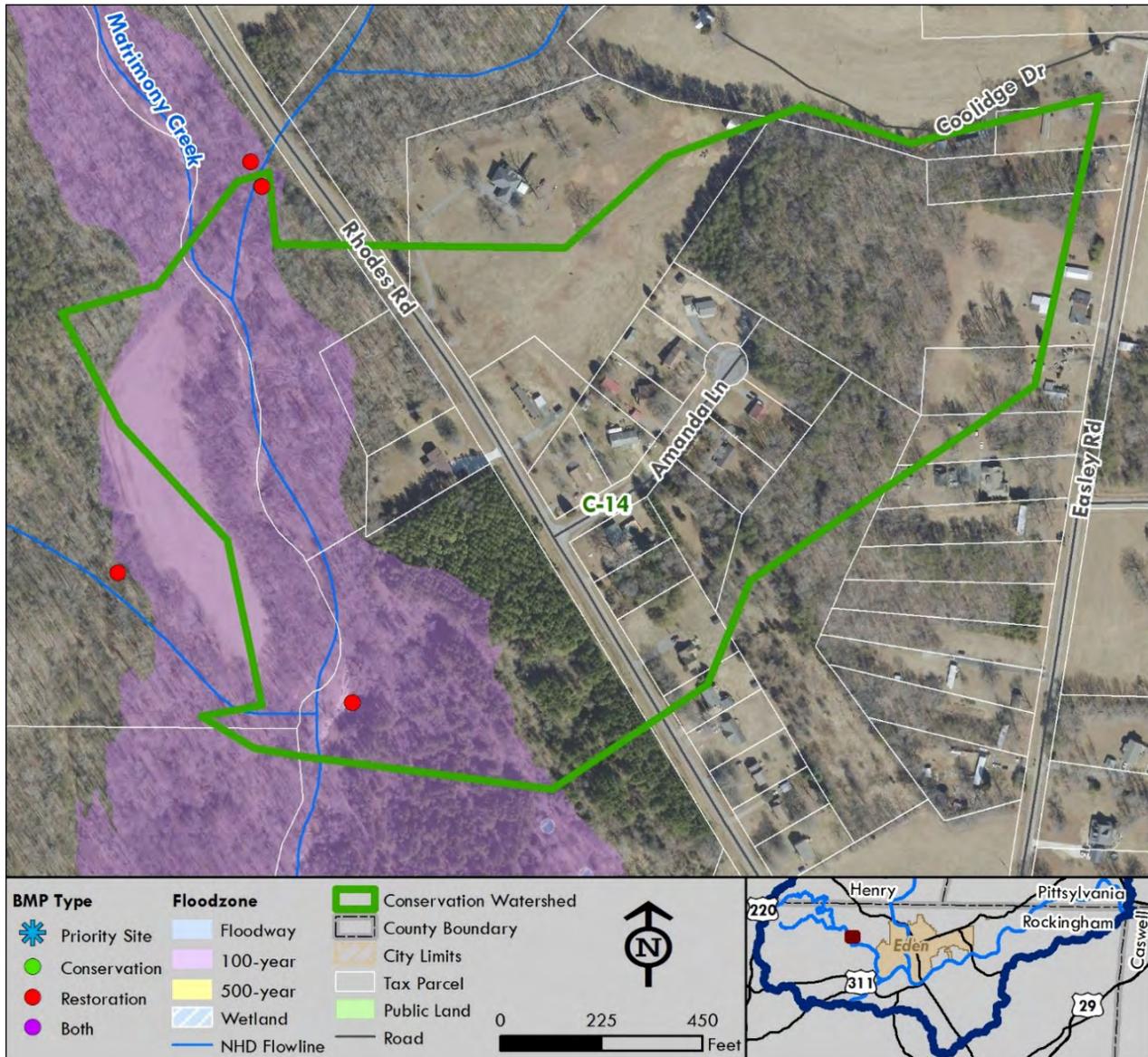


This catchment is an excellent demonstration of the value of livestock exclusion. Field assessments documented that many streams were fenced to exclude cattle and horses, the results being stable physical conditions and ideal downstream results. However, one large cattle farm off Garrett Road is not fencing its streams and the results are devastating to local and downstream conditions. Due to steep slopes on the farm, it appears that the farmer is encouraging cattle to congregate in the stream, resulting in eroded stream banks, manure piles in the middle of streams, a lack of stream buffers, and evidence of dumping into the stream. Downstream conditions – including odor – document the degrading impacts of this single use in this catchment,

Figure 20: Comparison of Stream Conditions, Catchment C-13

This farm could serve as a demonstration project in itself if the owner is willing to fence the stream. Many of the surrounding areas are in good shape and show use of BMPs. They also show the value of livestock exclusion fencing and open space protection. The farm not using such practices is a top candidate for agricultural cost-share investments to improve water quality conditions. Outreach should be made to them to take such steps. If they participate, the results should be documented – they are likely to show the watershed, herd health, and ecological benefits of best management practices.

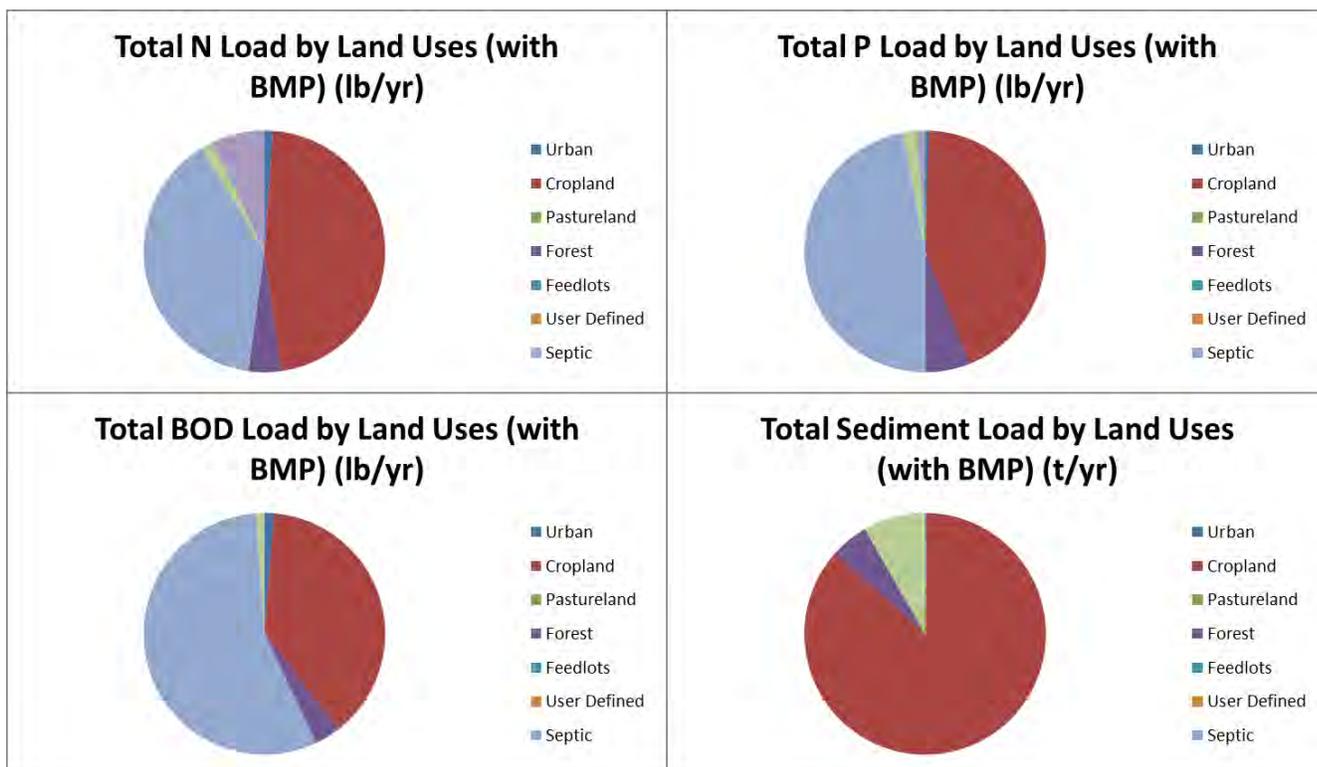
Map 21: Conservation Watershed C-14



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on the floodplain of these properties for flood control, conservation, or recreation uses.
2. Invest in stream enhancement/restoration on unnamed tributaries, especially for flood control.
3. Initiate a stormwater education program to surrounding residences, including a rain garden and/or rain barrel program.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-14			TN: 244 lb/yr (39%)
# Prop.	20 Floodplain Protection – 13 ac	\$13,000	TP: 79 lb/yr (39%)
PLC Priority Parcels	0 Forest Protection – 25 ac	\$25,000	BOD: 441 lb/yr (29%)
Area	47 AVOIDED COSTS	\$38,000	TSS: 84 T/yr (68%)
	Stream Enhancement – 1,709 f	\$85,450	
	Septic Replacements – 5	\$100,000	
	Residential Retrofits – 0.64 ac	\$9,600	
	RESTORATION COSTS	\$195,050	



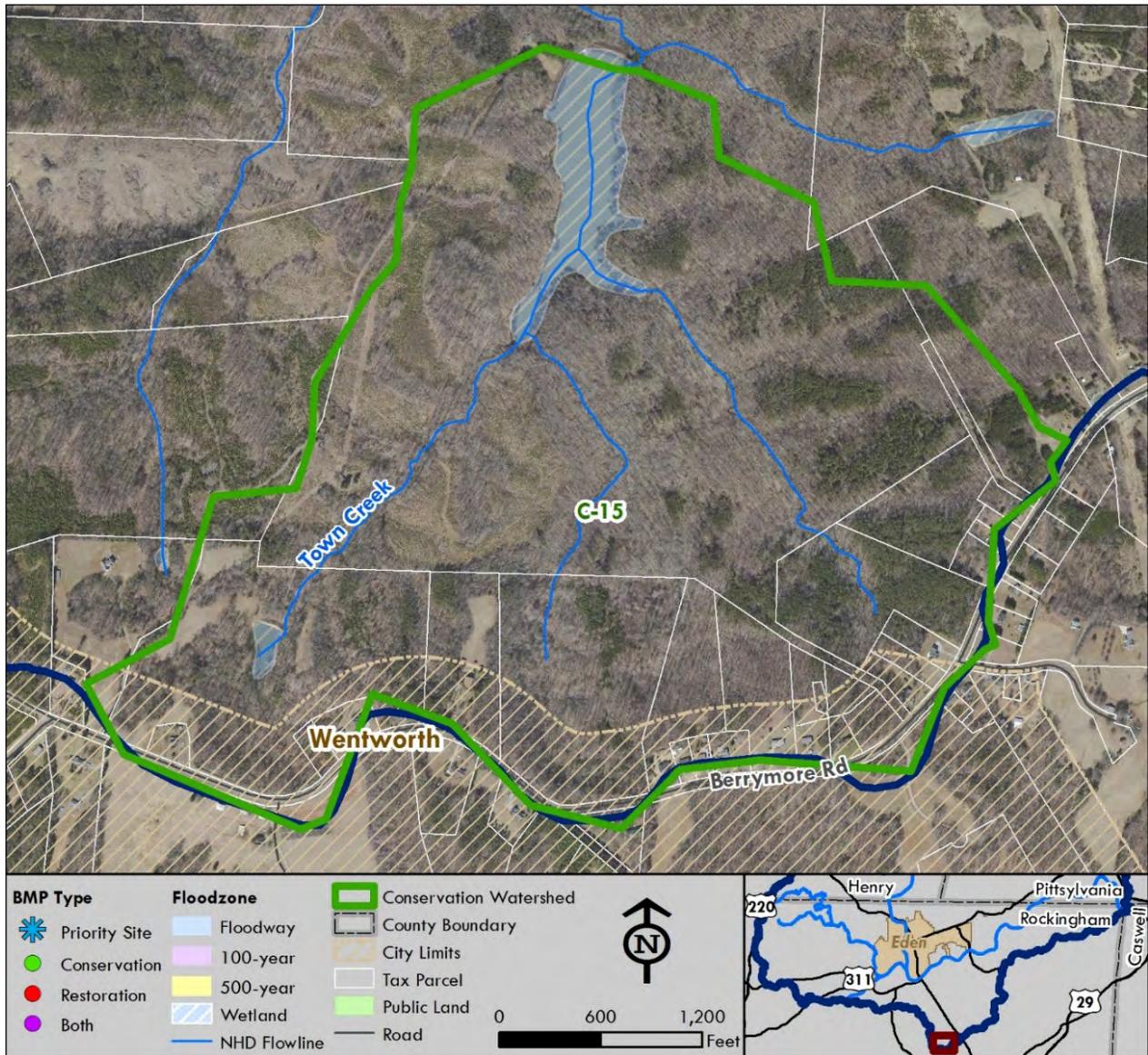
Nearly one-third of this catchment is occupied by floodplain wetlands and over half of it is forested. It is within a few miles of the Eden city limits and includes a residential area with a cul de sac. It is also a corridor in the Piedmont Together Green Infrastructure Network. It is an ideal site for recreational development and

stream enhancement that can directly alleviate the notorious flooding issues immediately downstream on Matrimony Creek.

The wooded floodplain of Matrimony Creek is generally within two properties on the eastern side of Rhodes Road. This land is not usable for most non-agricultural development, and its well-known flooding issues make it unlikely to be heavily used for farming. One patch on the edge of floodplain is cleared and plowed, but the stream corridor remains untouched. This is an ideal site for a partnership between Rockingham County SWCD, Rockingham County Economic Development, and PLC to use agricultural cost-share resources in combination with the Parks and Recreation Trust Fund to create a streamside park and trail. This site would be a great place for a passive recreation area and perhaps a playground. A hiking trail here could connect with the Dan River corridor and be a part of a larger network for the residents and visitors.

Investments in recreational development would need to be coupled with outreach to the surrounding residents about homeowner best management practices they can do to protect water quality and reduce flooding. Rain gardens, rain barrels, and perhaps even a constructed wetland could all improve the appearance and values of these properties as well as hydrologic conditions. It is important that any such outreach efforts also include communicating with the owners of the forested tracts about the value of using a consulting forester to ensure that timber operations are done with a conservation plan and optimize landowner profits. With such an approach, Matrimony Creek will be protected and better serve this community, reframing this troubled tributary of the Dan River as an asset that serves the health and recreation needs of a large community.

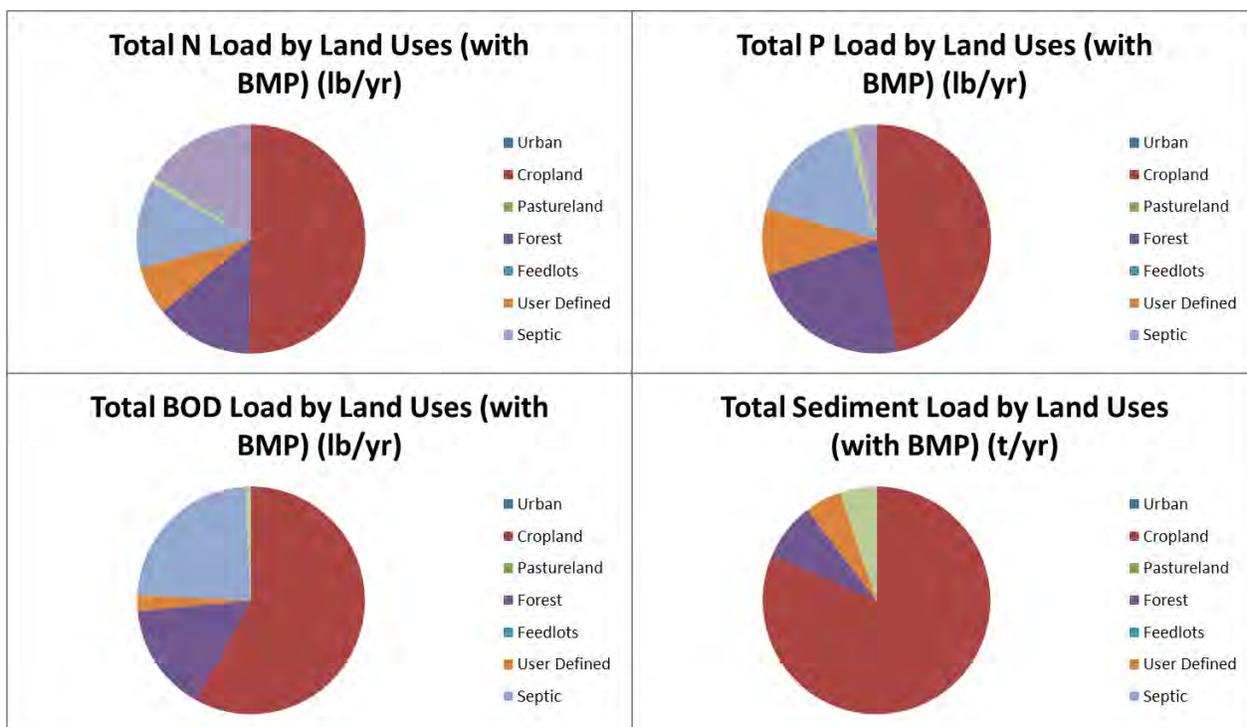
Map 22: Conservation Watershed C-15



Recommended Actions:

1. Contact property owner(s) about placing a conservation easement on these properties for possible conservation or agriculture uses.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Invest in stream enhancement/restoration on unnamed tributaries.
4. Rehabilitate or remove failing earthen dams.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
C-15			TN: 1,005 lb/yr (49%)
# Prop.	28	Wetland Protection – 14 ac	\$77,000
PLC Priority Parcels	0	Forest Protection – 261 ac	\$261,000
Area	363	Stream Protection – 9,858 ft	\$492,200
		AVOIDED COSTS	\$830,200
		Septic Replacements – 4	\$80,000
		RESTORATION COSTS	\$80,000



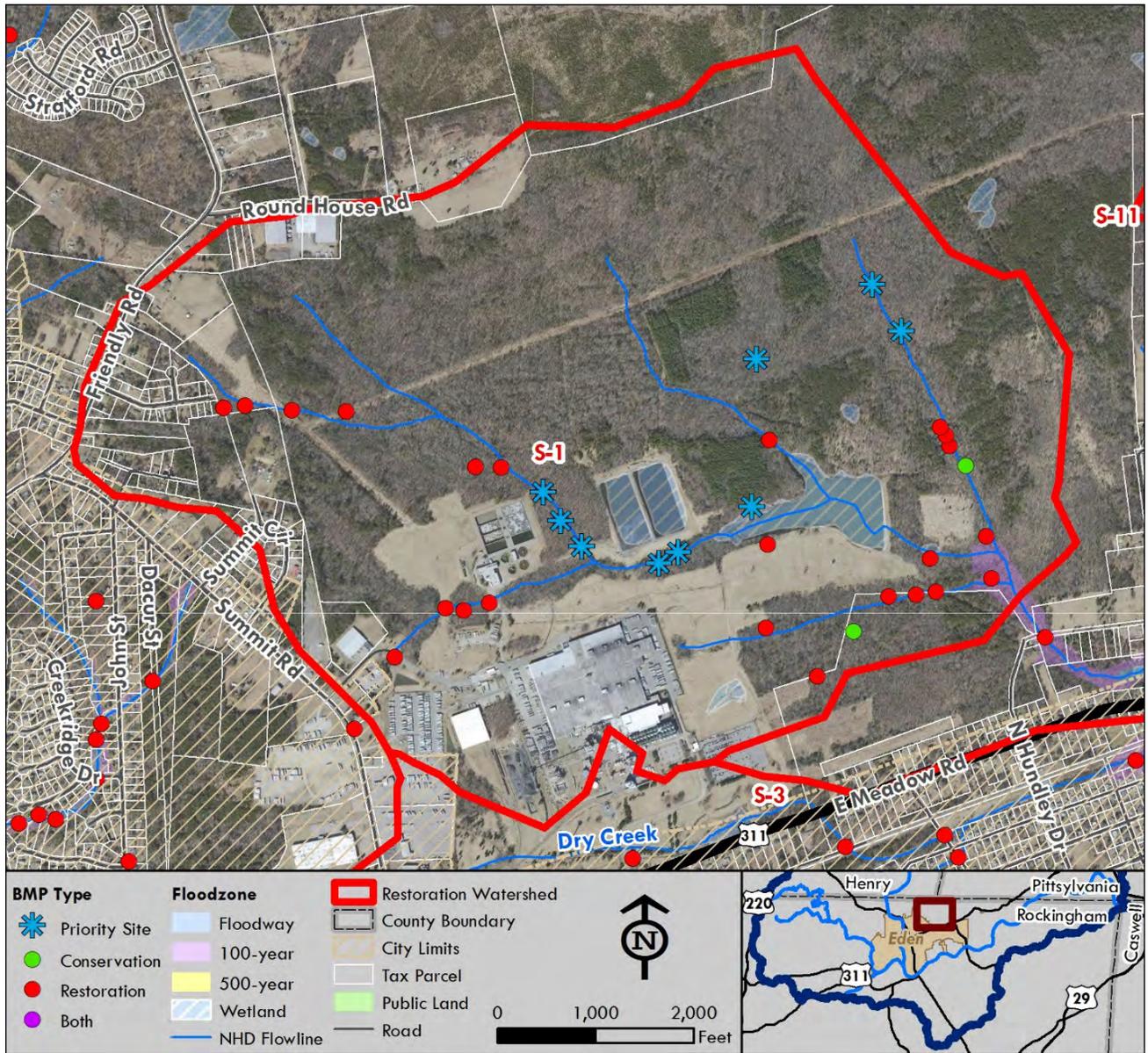
Town Creek is one of the three subwatersheds identified by the NCSU GWLF water quality model as a priority for restoration efforts. This conclusion was determined by the sediment and fecal pollutant loads these subwatersheds were estimated to be contributing to the Dan River and impairing its full use and validated through field data collection. This catchment captures the headwaters of Town Creek, or some of the most sensitive areas of one of the Eden area watershed’s priority tributaries. Fortunately, it is almost entirely open space and ponds. Unfortunately, both of these situations are insecure and should be addressed immediately through landowner outreach.

The majority of this catchment is occupied by one large wooded property. The Rockingham County SWCD and the NC Forest Service should reach out to this landowner immediately to ensure that they are aware of FPGs and local consulting foresters. Should the landowner wish to harvest the timber at this site, a consulting forester can develop a conservation plan that will minimize water quality impacts, ensure that it is followed, oversee the harvest, ensure FPGs are followed, and optimize the landowner's profits from a harvest. PLC also should reach out to this property owner to determine their interest in permanently conserving this property for open space and watershed purposes.

Regardless of the land management actions taken, immediate steps should be taken to assess the stability and performance of the two farm ponds in this catchment. It is likely that they are earthen dams but by the NRCS about the same time as the other 70+ dams identified by fieldwork. These dams are failing, using their emergency spillways to discharge water and weakening their embankments. Should these dams fail – especially due to a large natural disaster like a hurricane – they could release tons of sediment to the Dan River, degrading the river and directly impacting endangered species habitat. The release of this much sediment to Town Creek will effectively destroy its habitat or use as an agricultural water resource. Sediment from Town Creek will also be released to the Dan River at almost the exact same location as the Duke Energy coal ash spill, further compromising the recovery of river and its habitats at this site. These dams – especially the larger – should be investigated immediately for structural integrity. If it is failing, it should either be stabilized or removed. Either approach offers an interesting challenge to environmental engineers and water quality professionals of diverse interests and backgrounds, and could be a pilot project for such actions at similar dams of similar ages throughout North Carolina and the US Southeast.

RESTORATION WATERSHED PRIORITIES

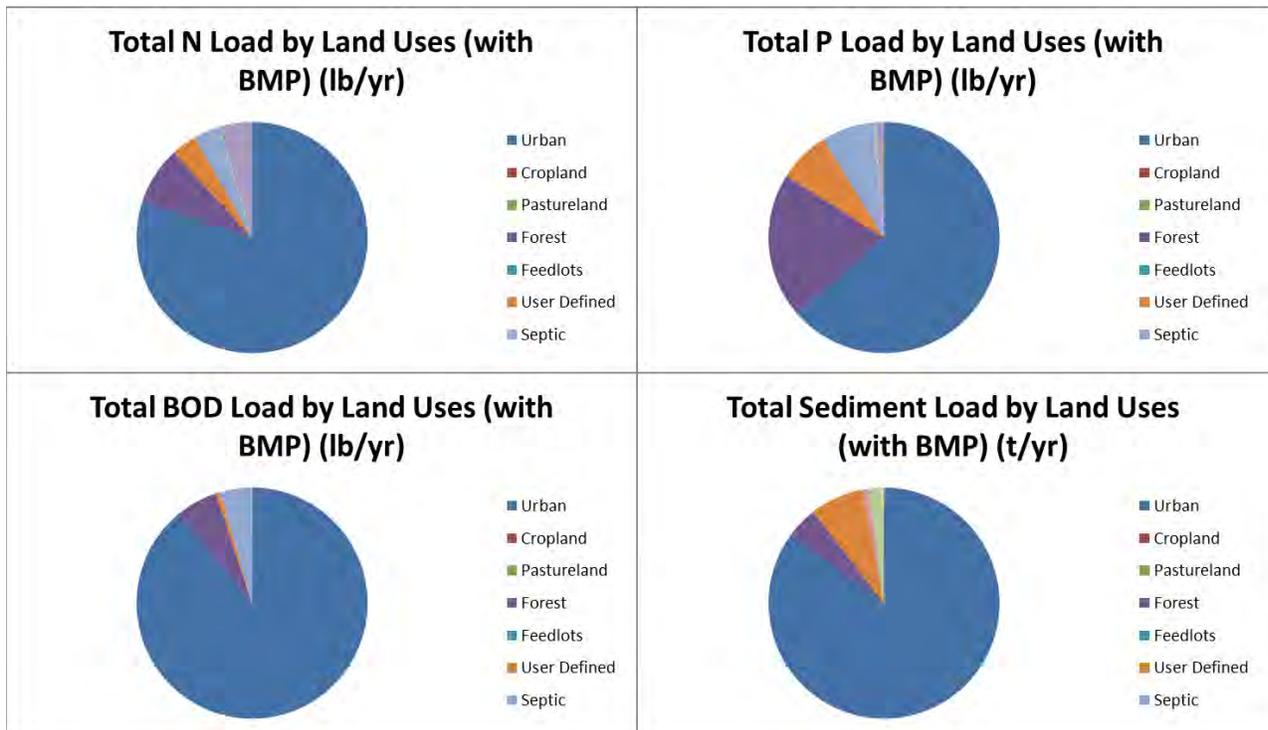
Map 23: Restoration Watershed S-01



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation purposes.
2. Assess habitat enhancement opportunities for this G1S1 habitat.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-01			TN: 1,337 lb/yr (21%)
# Prop.	86	Wetland Protection – 30 ac	\$16,500
PLC Priority Parcels	0	Forest Protection – 761.5 ac	\$761,500
Area	1,159	Floodplain Protection – 6 ac	\$6,000
		Stream Protection – 25,262 ft	\$2,526,200
		AVOIDED COSTS	\$3,310,200
		Commercial Retrofits – 113.5 ac	\$1,702,500
		Septic Tank Replacements – 7	\$140,000
		RESTORATION COSTS	\$1,842,500



This property is perhaps this watershed’s most valuable project to the environmental and ecological community. A G1S1 habitat, the upland woodland hardpan forest is literally found almost nowhere else on the planet. It is a unique habitat of Triassic Basin-derived soils, threaded streams, very little understory, and abundant wetlands. As such, it is also a nurturing setting for a large headwaters tributary of Dry Creek, one of the Dan River’s larger tributaries and a priority subwatershed in this watershed. A thorough ecological assessment of the property has not yet been done, so more natural treasures may be present here. The NC Natural Heritage Program should be contracted to survey the property as soon as possible.

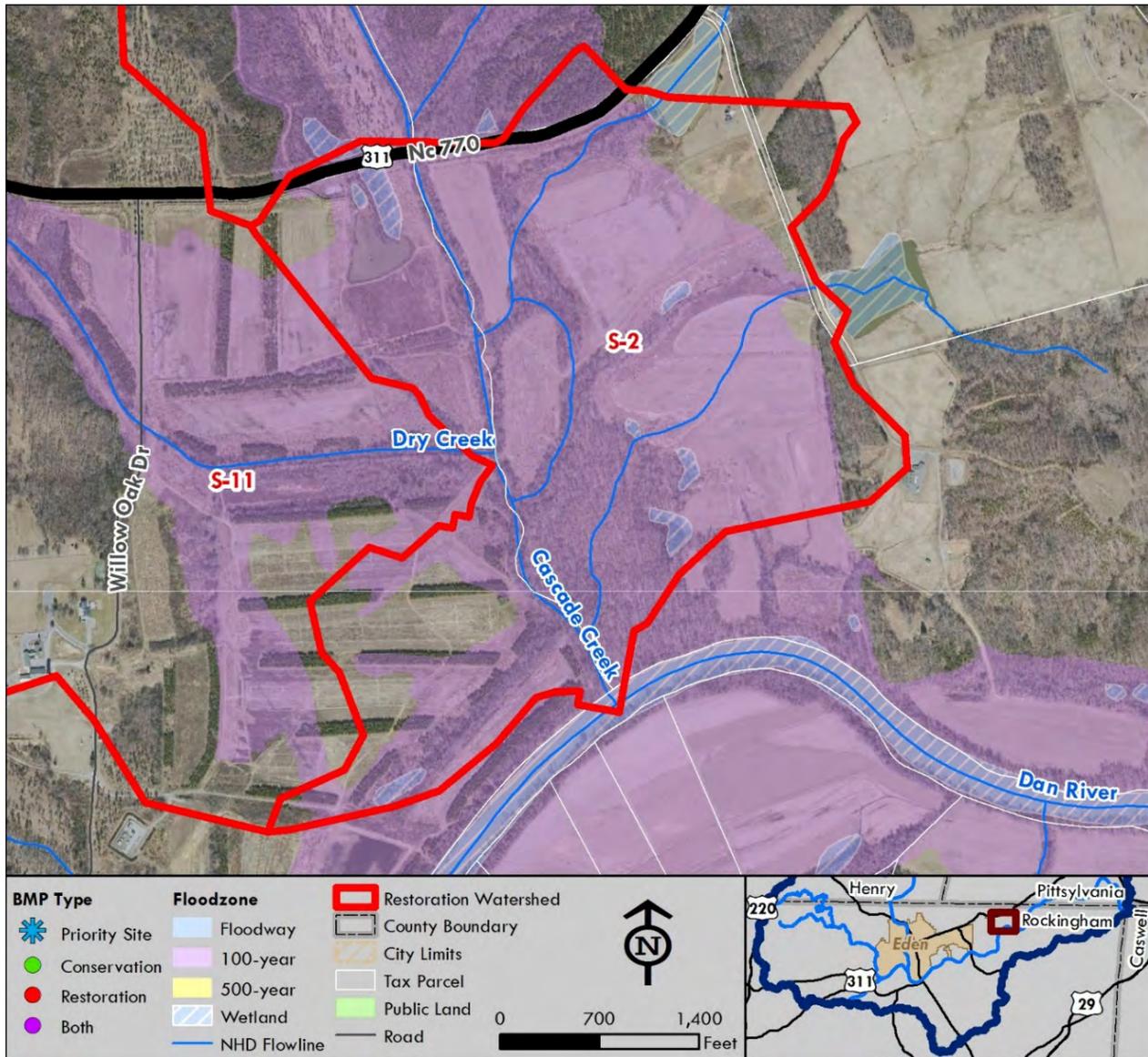
The property is currently unprotected from development, but it is also not heavily used outside of a few four-wheeler paths and some light hunting. These paths could be the foundation of a trails network that could be developed at this site with careful planning and investment in conservation. Urgent action is needed to more formally characterize this property and its ecosystem(s) and permanently protect it for future appreciation.

The southern part of this very large property shows a clear need for simple stream buffer restoration. In fact since the field assessments involved in this project were conducted, some of these streams have been converted into constructed wetlands. Similar steps to demonstrate best management practices to the larger community would be welcome and helpful for the heavily degraded Dry Creek subwatershed.



Figure 21: A Pristine Wetland and a Stream, Catchment S-01

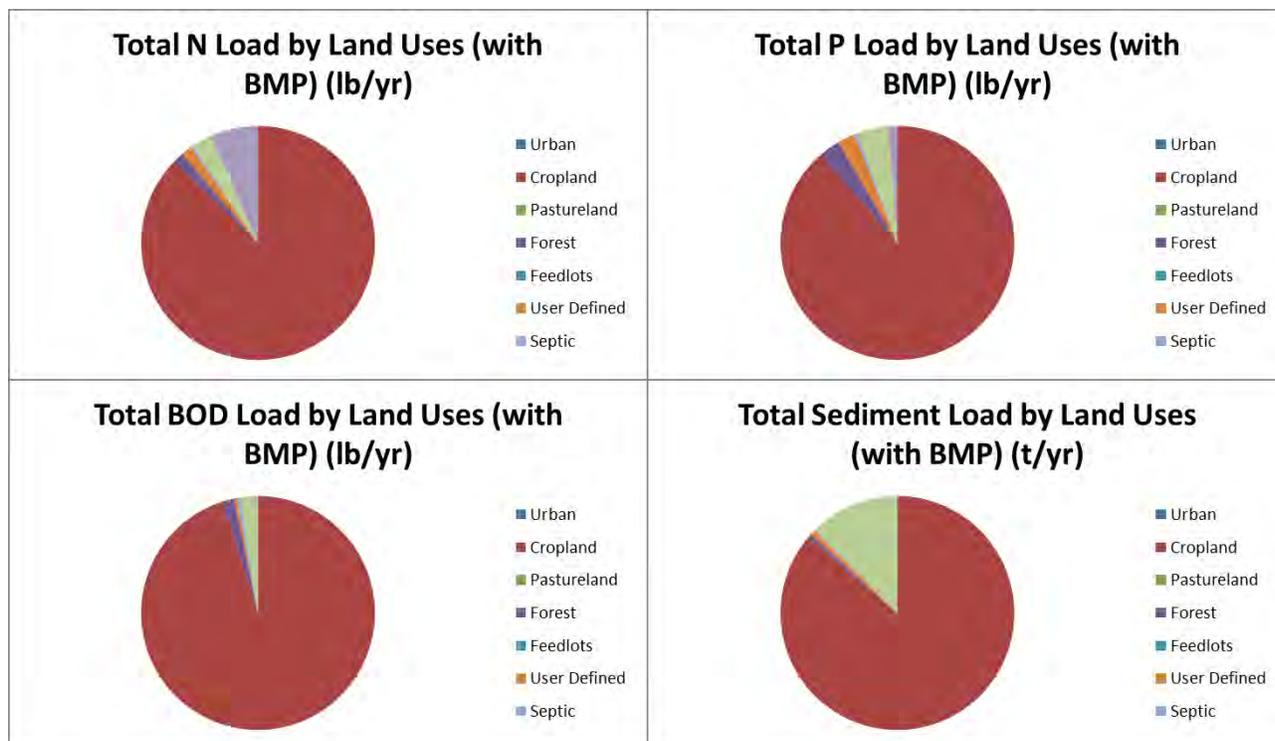
Map 24: Restoration Watershed S-02



Recommended Actions:

1. Contact property owner(s) about placing a easement on these properties for conservation and agricultural purposes and ensure that they are aware of cost-share programs.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-02			TN: 5,013 lb/yr (59%)
# Prop.	1 Forest Protection – 88 ac	\$88,000	TP: 1,404 lb/yr (62%)
PLC Priority Parcels	0 AVOIDED COSTS	\$88,000	BOD: 8,543 lb/yr (51%)
Area	314 Wetland Restoration – 8.5 ac	\$46,750	TSS: 1,264 T/yr (75%)
	Floodplain Protection – 251 ac	\$251,000	
	River Restoration – 4,481 ft	\$448,100	
	Stream Restoration – 7,781 ft	\$778,100	
	RESTORATION COSTS	\$1,523,950	



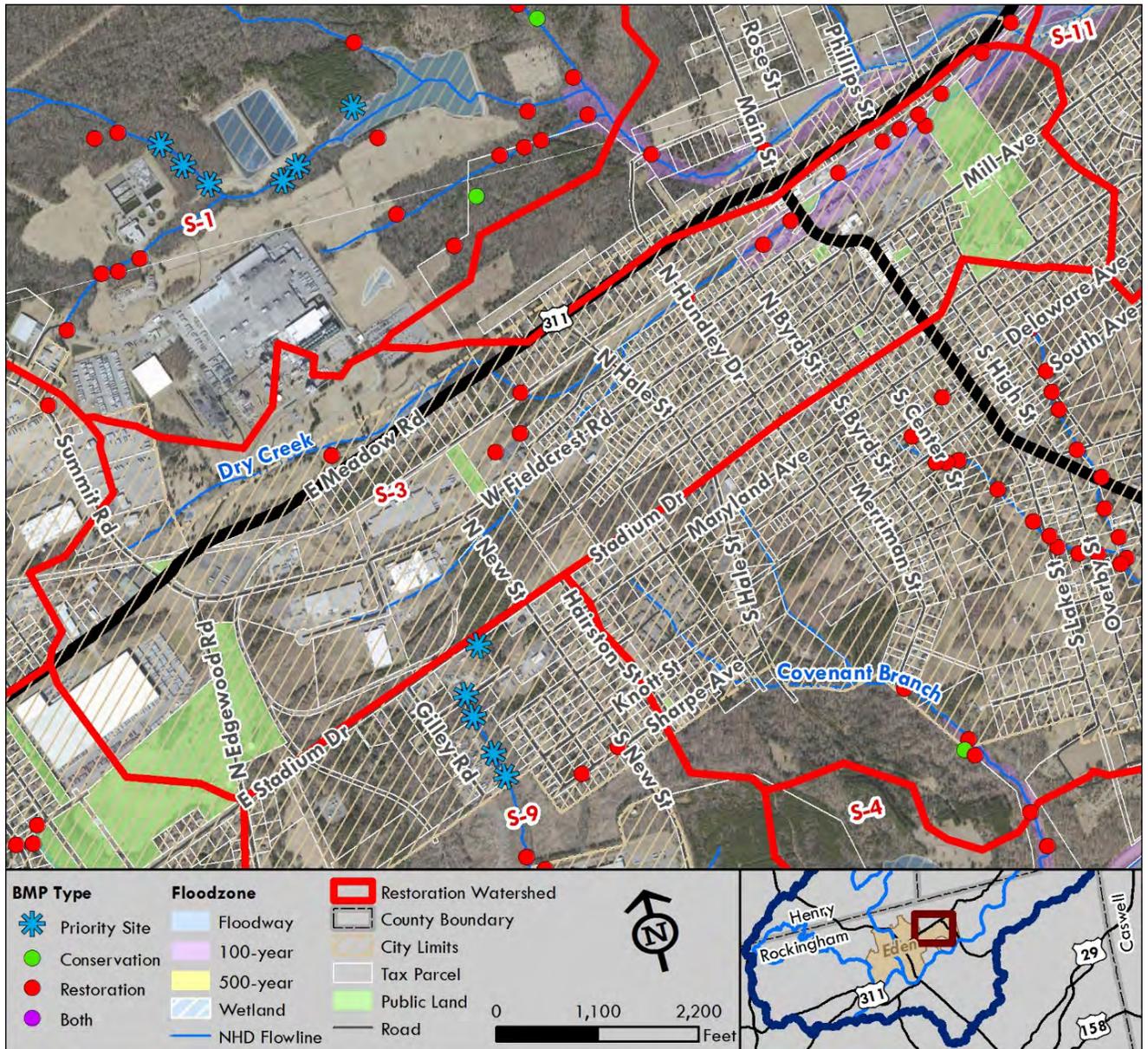
This catchment occupies a single agricultural property that should be a priority for all agricultural extension and soil and water conservation professionals in Rockingham County. The water quality model conducted by the team from NCSU Cooperative Extension shows this particular property and catchment as a high-need area – one of the most intensive sites of sediment loading in the entire 225-square mile Eden area watershed. The

landscape here is highly sensitive, lying in the Triassic Basin and having steep slopes and highly erodible soils. The plowing and pasturing of fields without the use of streamside buffers is creating almost a point source discharge of sediment directly to Cascade Creek and the Dan River. Efforts need to be made to reach out to this property owner to discuss the need(s) and benefit(s) of creating streamside buffers, and offering them whatever cost-share assistance possible to do so. Currently under half of the streams in this catchment are buffered – any improvements in this regard will make a significant difference for the health of the creek and the river.

Cascade Creek discharges to the Dan River in this catchment, making efforts for pollution reduction here more important than other areas where pollutants might settle or be absorbed by ecosystem services. Furthermore, it is important to protect and improve the floodplain wetlands present, both for water quality protection and public safety. During high flow events like thunderstorms, the Dan River will often backflow into its tributaries, often eroding and incising them to well over ten feet in height. Protecting that area as a forested area is ideal for these reasons and for a possible hiking or greenway trail.

This property is identified as a priority in PLC's Dan River Conservation Corridor and, at the least, efforts within the 500-foot riparian zone along the Dan River to acquire a conservation easement should be made. Similar efforts for floodplain restoration should be made along the impacted areas of Cascade Creek's floodplain. Similar to all farm ponds within this watershed, the resident farm ponds should be inspected for structural integrity and should be either stabilized or removed following inspection.

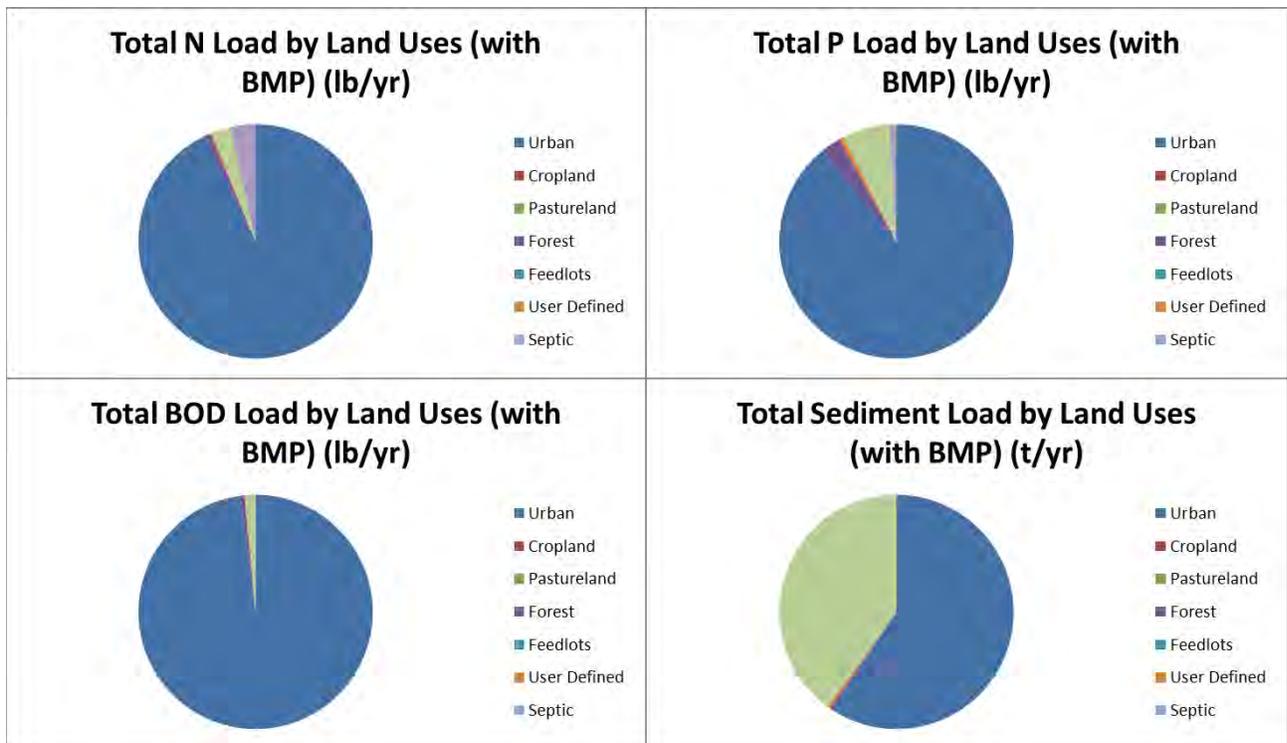
Map 25: Restoration Watershed S-03



Recommended Actions:

1. Initiate a stormwater outreach and education campaign in this neighborhood.
2. Restore Dry Creek.
3. Invest in a rain garden and rain barrel program for surrounding residences.
4. Investigate potential for demonstration projects on publicly-owned lands.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-03			TN: 3,876 lb/yr (35%)
# Prop.	606	Forest Protection – 114 ac	\$114,000
PLC Priority Parcels	0	AVOIDED COSTS	\$114,000
Area	779	Wetland Restoration – 3 ac	\$16,500
		Floodplain Protection – 33.5 ac	\$33,500
		River Restoration – 11,776 ft	\$1,177,600
		Stream Restoration – 4,640 ft	\$464,000
		Residential Retrofits – 234 ac	\$3,510,000
		RESTORATION COSTS	\$5,201,600
			TP: 1,457 lb/yr (57%)
			BOD: 8,078 lb/yr (24%)
			TSS: 1,968 T/yr (88.5%)



Dry Creek was identified by the NCSU GWLF water quality model as one of three high priority catchments in the Eden area watershed, meaning that it is disproportionately contributing pollutants to the Dan River than other subwatersheds. It is also the most urban subwatershed in the entire 225-square mile watershed. It is also home to one of the poorest communities in this entire watershed. Yet it is one of the least likely to be eligible for water quality improvement projects because it also an area with over 600 landowners.

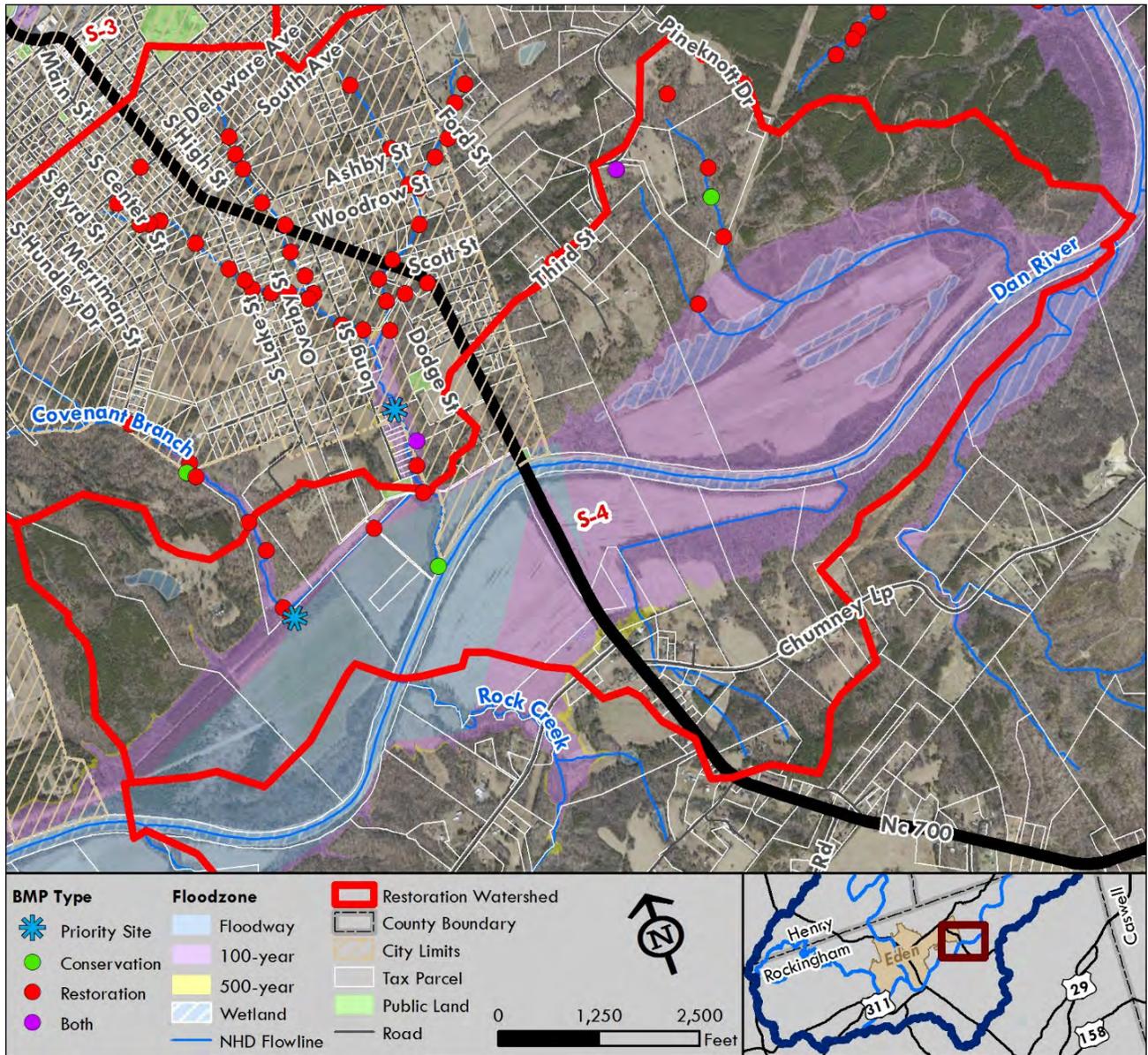
Concerted efforts need to be made to deliver both an outreach program and improvement projects to this catchment, which is the headwaters of Dry Creek. Outreach is needed to work with residents on the simple actions they can all take to improve water quality conditions. This is best served by PTRC's Stormwater SMART program, which has focused messaging on yard maintenance, pet waste disposal, rain gardens, oil changing, household hazardous waste, stream buffers, and proper fertilizer application.

However, this community also needs to benefit from water quality improvement projects. Dry Creek follows the railroad tracks through this community and is generally straightened, full of invasive weeds, and inaccessible. Restoring the creek will deliver over a mile of restored waters, which should be interesting to the NC DMS and mitigation bankers. The 3 acres of wetlands should also be enticing. The catchment offers many stormwater retrofit opportunities, especially on public and industrial properties. Constructed wetlands and bioretention cells could all be developed for stormwater runoff attenuation and interception. The athletic fields at the eastern edge of the catchment would be an ideal location for a demonstration project.



Figure 22: Stream Restoration Sites, Catchment C-03

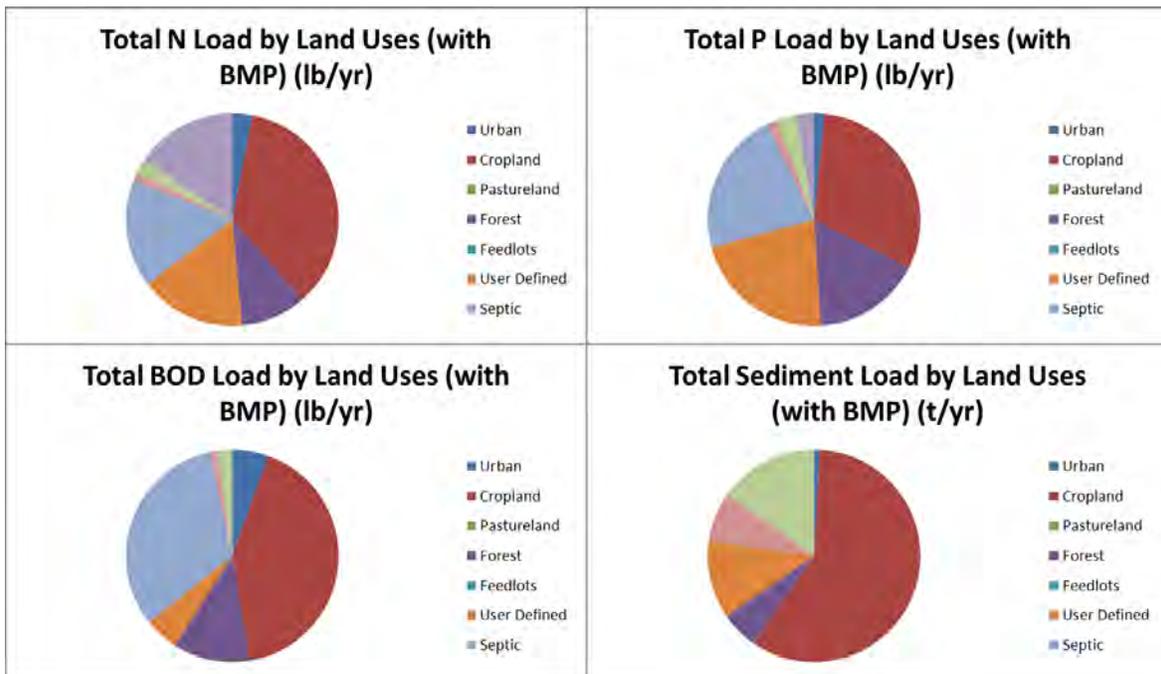
Map 26: Restoration Watershed S-04



Recommended Actions:

1. Contact property owner(s) about placing a easement on the floodplain of these properties for conservation and recreation purposes.
2. Invest in stormwater outreach and education programs for surrounding residences.
3. Invest in stream enhancement/restoration on unnamed tributaries, and including greenways/trail access to the Dan River corridor.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-04			TN: 5,786 lb/yr (67%)
# Prop.	83 Forest Protection – 600 ac	\$600,000	TP: 1,756 lb/yr (68%)
PLC Priority Parcels	19 AVOIDED COSTS	\$600,000	BOD: 9,481 lb/yr (62%)
Area	779 Wetland Restoration – 91 ac	\$500,500	TSS: 1,237 T/yr (84%)
	Floodplain Protection – 702 ac	\$702,000	
	River Restoration – 12,298 ft	\$1,229,800	
	Stream Restoration – 22,073 ft	\$2,207,300	
	Residential Retrofits – 11 ac	\$165,000	
	Septic Tank Replacements – 17	\$340,000	
	RESTORATION COSTS	\$5,144,600	



The Dan River's large floodplains offer many opportunities to recreation, economic development, and environmental restoration. This is especially true in this catchment, where the floodplains are primarily being used for crops. Riparian buffers are only spottily present along the river in this catchment, permitting sediment, fertilizers, and pesticides to discharge directly to the Dan River and its tributary Covenant Branch. It will benefit the river and its network to reduce this pollution load, and could be done with participation in any of the conservation programs offered through the state and federal cost-share assistance programs. It is recommended that the Rockingham County SWCD work with PLC and DRBA to reach out to these property owners and discuss the advantages and benefits of no-till agriculture, stream buffers, and the ecosystem services offered by wetlands. Some of these floodplains are used for hunting, so permanently managing them for this purpose may be appealing to some of the property owners.

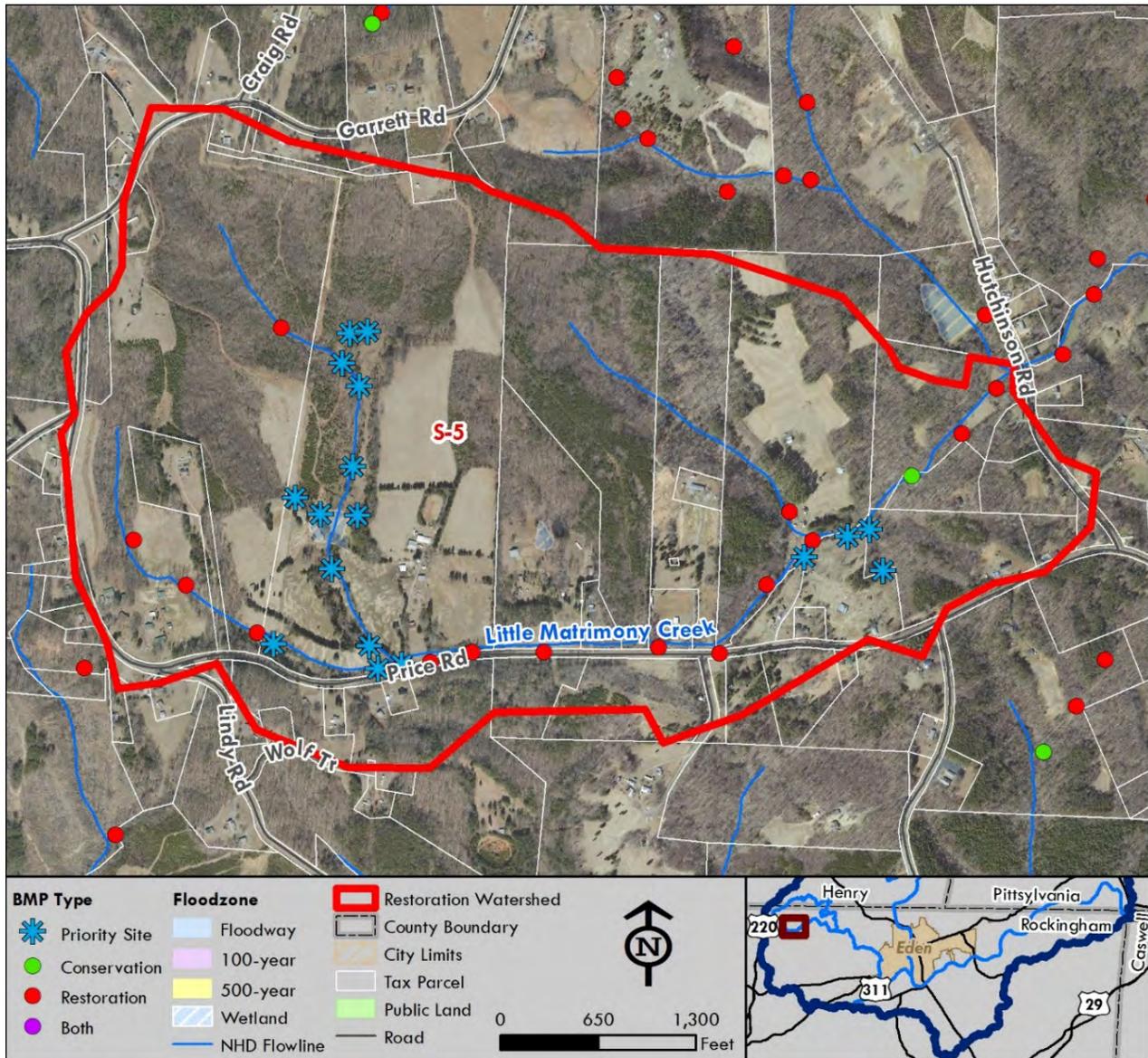


Figure 23: Stream Enhancement Site, S-04

The NC DMS should be very interested in this site. It offers about four miles in streams that need either restoration or enhancement, some of them on only one or two properties. It also offers 91 wetlands acres within the Dan River floodplain that need restoration. Investigating these potential assets to the river and for mitigation purposes will be of mutual benefit for all watershed stakeholders, including the landowners.

This catchment is almost entirely within the priority areas of the PLC Dan River Conservation Corridor. There are several opportunities for river access via the tributaries and for the development of a hiking trail. However, landowners must be willing to allow such access to their properties. Coupling such recreation and/or conservation efforts with investments in mitigation or agricultural cost-share services may be a more appealing strategy for landowner interest than a strict conservation easement.

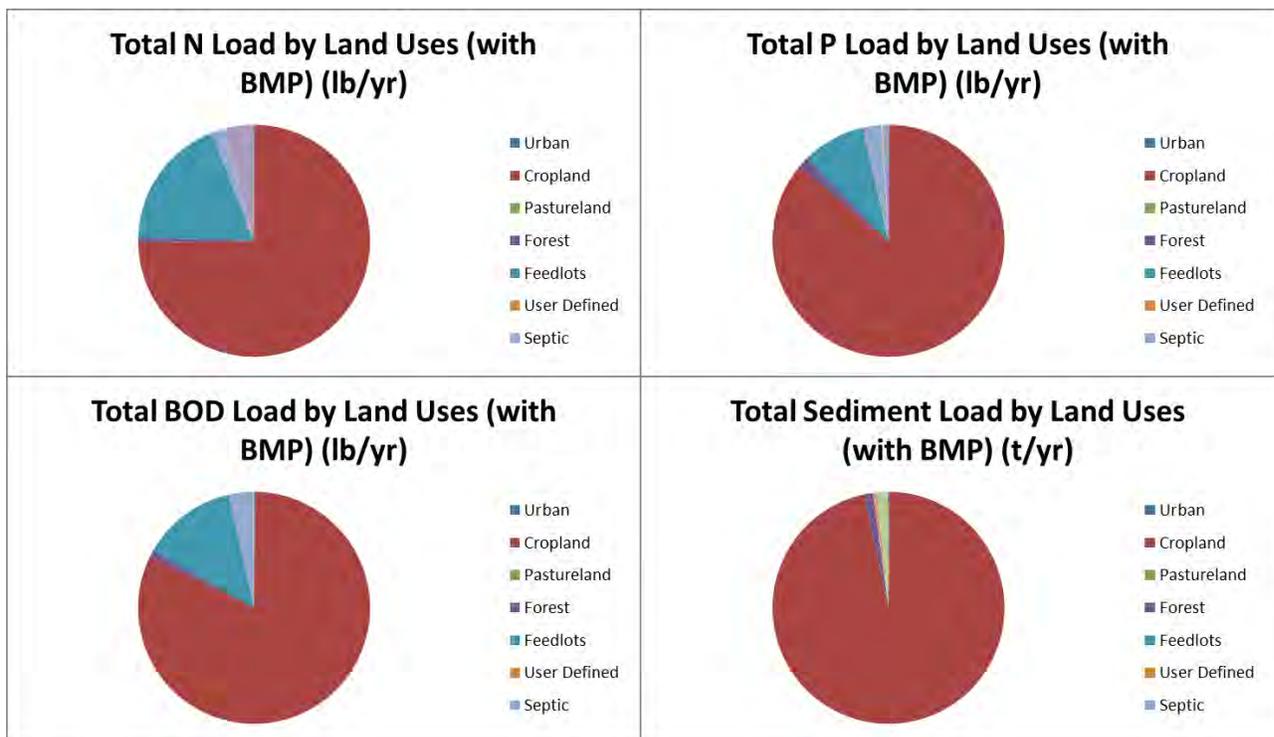
Map 27: Restoration Watershed S-05



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation and agricultural purposes and ensure that they are aware of cost-share programs.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-05			TN: 7,280 lb/yr (37%)
# Prop.	3 Forest Protection – 202 ac	\$202,000	TP: 1,730 lb/yr (36%)
PLC Priority Parcels	0 AVOIDED COSTS	\$202,000	BOD: 8,647 lb/yr (27%)
Area	456 Wetland Restoration – 1.5 ac	\$8,250	TSS: 394.5 T/yr (49.5%)
	River Restoration – 7,955 ft	\$795,500	
	Stream Restoration – 5,706 ft	\$570,600	
	Residential Retrofits – 2 ac	\$30,000	
	Septic Tank Replacements – 7	\$140,000	
	RESTORATION COSTS	\$1,544,350	



Agricultural cost-share programs make a significant difference for water quality conditions, keeping livestock out of streams, minimizing erosion through the use of low- and no-till cropping practices, and assisting farmers with less intensive but more productive techniques. This catchment shows the value of these

practices and could be held up as a leading example that other farmers and rural landowners in the Eden area watershed should use to better protect their shared water systems from sediment and fecal bacteria.

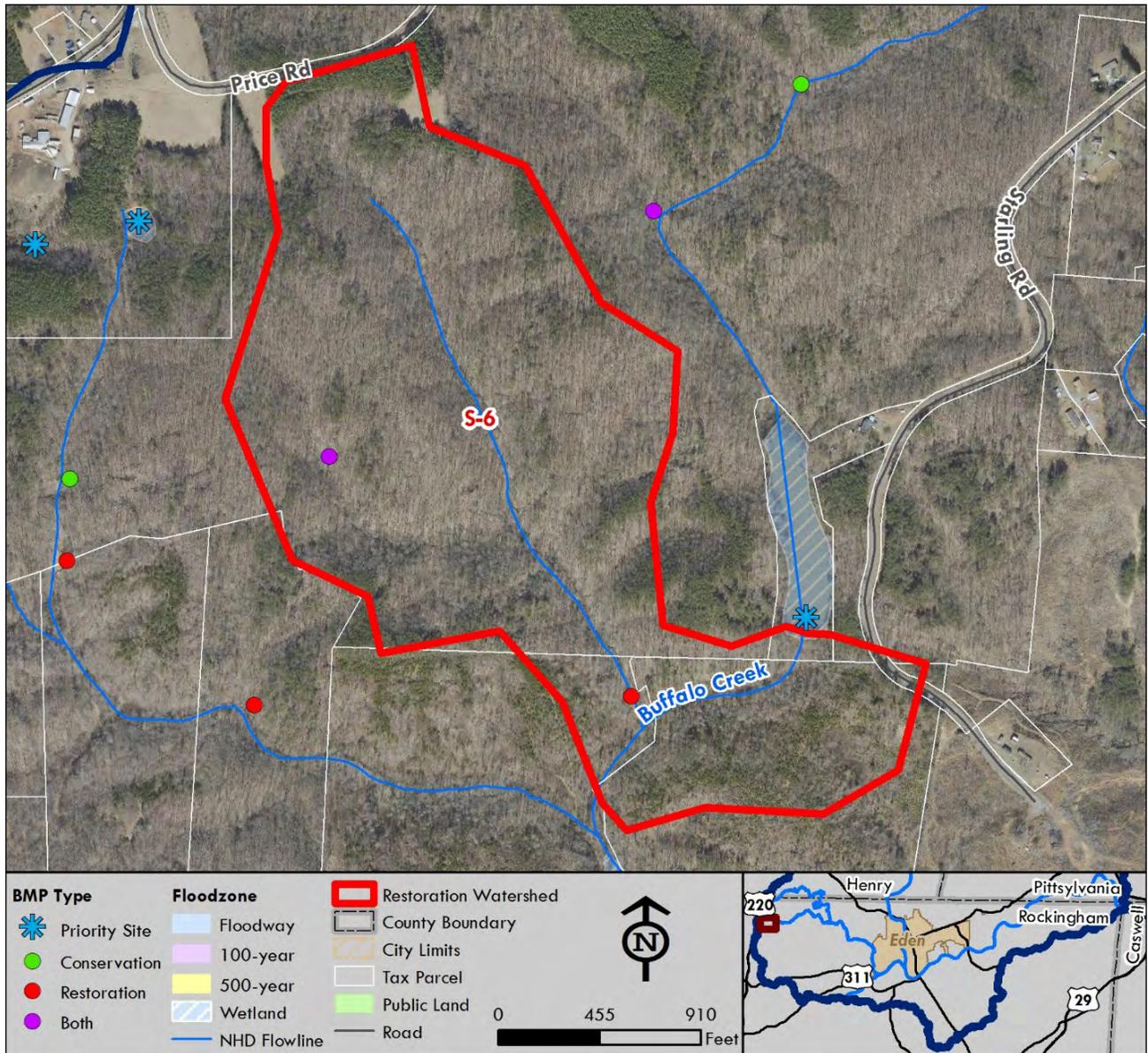
The practices seen on this farm are chiefly stream buffers and livestock exclusion fencing. The streams in this catchment are structurally sound, with stable banks and beds with healthy substrates. The water quality of these streams is unknown – no sampling has been done. Based upon physical appearance, these streams are excellent examples of the efficacy of agricultural BMPs and could be used as demonstration farms.

The NCFS and the Rockingham County SWCD should reach out about the value(s) a consulting forester can deliver for harvesting timber. A consulting forester can develop a conservation plan for a property, ensure it is followed, ensure compliance with NC FPGs, and optimize profits. There is also a farm pond here in need of either stabilization or removal. Like the other 70+ such ponds identified in this watershed, it is using its emergency spillway and spilling over its berm. Both situation compromise the structural stability of the dam and the pond, which will release – a t minimum – hundreds of tons of sediment to Little Matrimony Creek.



Figure 24: Comparison of Stream Conditions, Catchment S-05

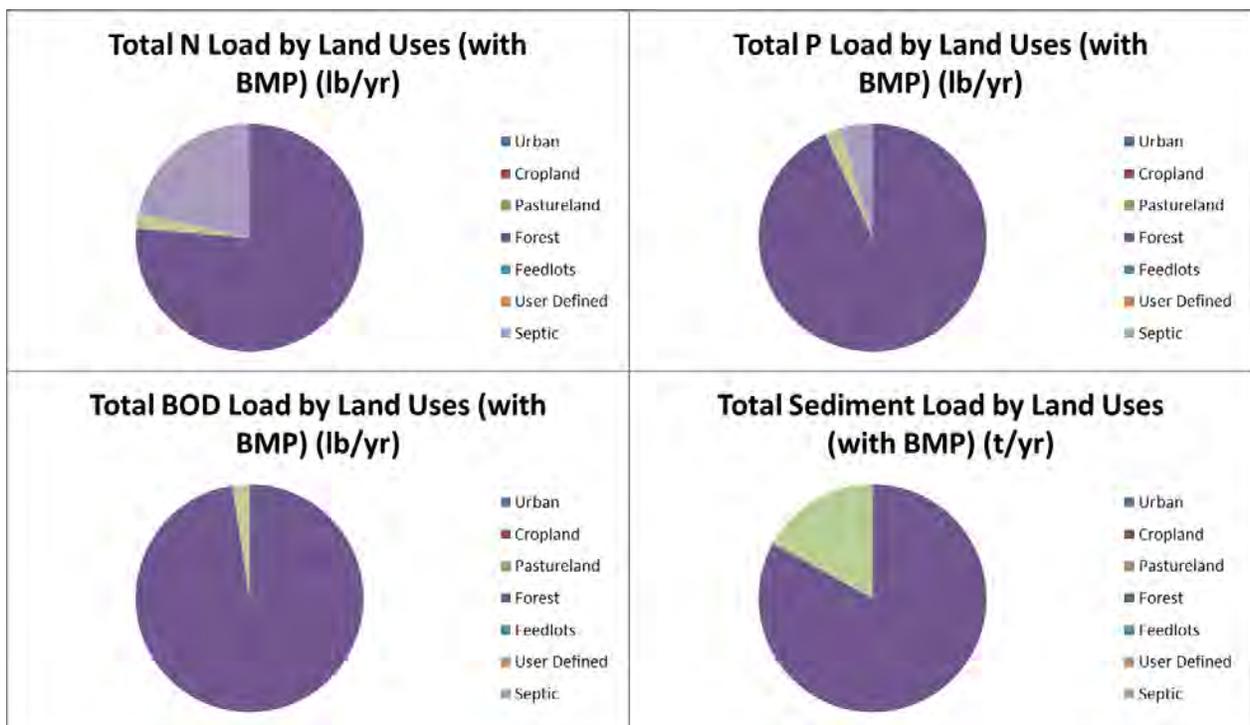
Map 28: Restoration Watershed S-06



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation and agricultural purposes and ensure that they are aware of cost-share programs.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-06	Wetland Protection – 0.5 ac		TN: 26 lb/yr (15.5%)
# Prop.	1	\$550	
PLC Priority Parcels	0	\$212,800	TP: 10 lb/yr (19.5%)
Area	115	\$1,105,000	BOD: 54.5 lb/yr (15%)
	AVOIDED/TOTAL COSTS	\$1,318,350	TSS: 14 T/yr (53%)



Catchment S-06 is one of the more valuable areas to ecological and environmental engineering community. It features outstanding stream conditions, with sinuous structures, access to the floodplain, good organic streambed layers, and healthy bank-to-height ratios. It could – and possibly should – be used as a reference stream for the western Piedmont ecoregion by the Rosgen stream restoration program. There are few streams in the western Piedmont that are its equal. The property



Figure 25: Ideal reference stream, Catchment S-06

will need to be protected through acquisition or the placement of an easement upon the property, for both of which the landowner should be compensated fairly.

However, this catchment is also adjacent to a priority restoration site – a 4-acre farm pond with a failing earthen dam (*see photo*). The PTRC identified over seventy such farm ponds and dams throughout its field work, which covered less than half of the Eden area watershed. These dams collectively are holding potentially millions of tons of sediment that could be released if a natural disaster – namely a high-energy

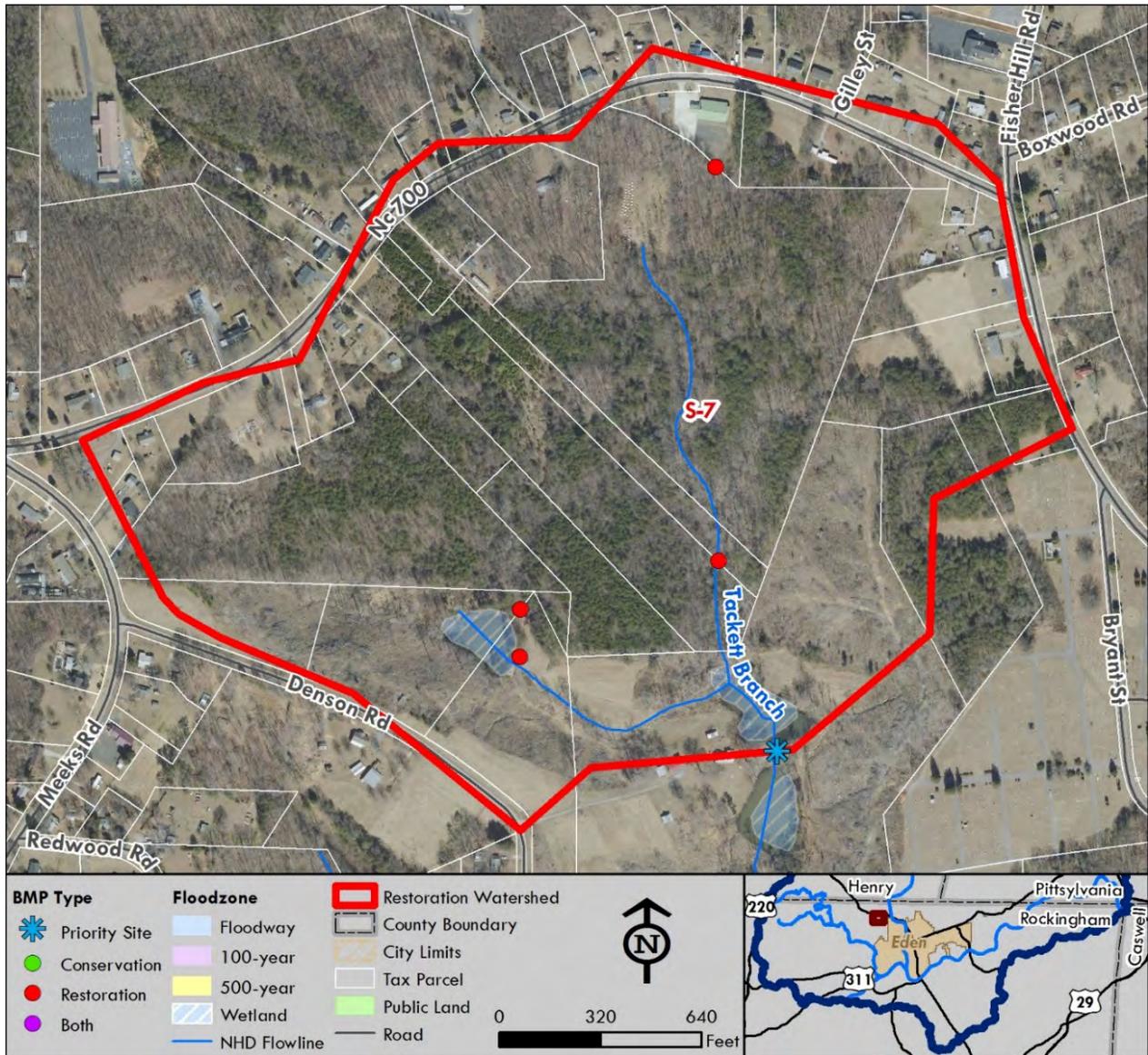


hurricane – hit the area. This would be devastating to the ecosystems of the river and places all downstream residents at great risk. The dams were built in the 1930's with Natural Resources Conservation Service funds and were constructed for a 50 – 75-year lifespan – they are at the end of this timeline. The risk that these dams pose to the communities of the Dan River are too great to ignore and must be acted upon immediately. Federal and state resources – especially from the NRCS – need to be invested in either the rehabilitation or removal of these aging and failing farm dams. It offers a challenge and great reward for farmers,

engineers, ecologists, and all users of the river.

Figure 26: Failing farm dam spillway on Buffalo Creek

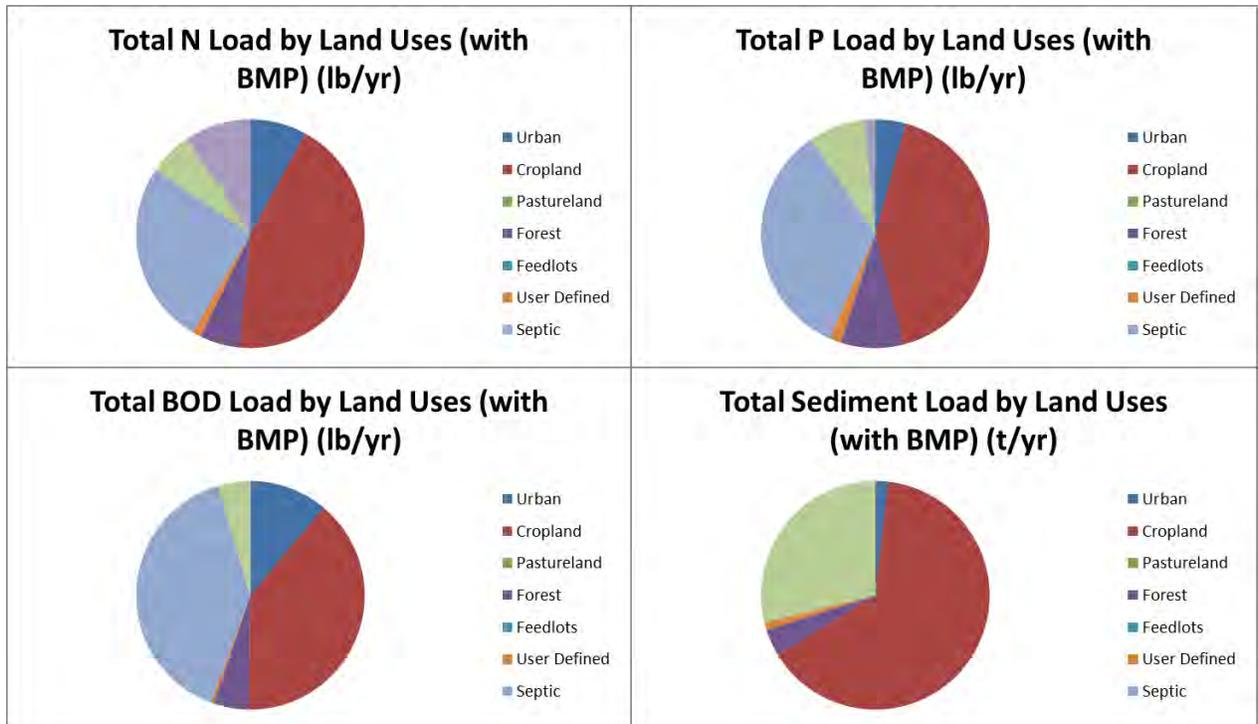
Map 29: Restoration Watershed S-07



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation, recreational, and agricultural purposes.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-07			TN: 1,172 lb/yr (62%)
# Prop.	32	Forest Protection – 75 ac	\$75,000
PLC Priority Parcels	0	Stream Protection – 1,066 ft	\$106,600
Area	106.5	Wetland Protection – 1.5 ac	\$8,250
		AVOIDED COSTS	\$189,850
		River Restoration – 1,732 ft	\$173,200
		Residential Retrofits – 3 ac	\$45,000
		Septic Tank Replacements – 7	\$140,000
		RESTORATION COSTS	\$358,200



This catchment shows the need for outreach and assistance in the Eden area watershed. This forested catchment is generally untouched but not in good condition. Besides receiving runoff from the surrounding area, it has several illegal dumps (*see photo*).

Timber harvesting on any of these parcels without the use of FPGs and/or a conservation plan could load tons of sediment to Tackett Branch, a headwater of Troublesome Creek. Speaking with these landowners about the value(s) a consulting forester can bring in terms of land management, profit optimization, and water protection should be an investment of either Rockingham County SWCD, PLC, and/or DRBA. This can be done through outreach or, better yet, by placing a conservation easement on these properties that still permits timber harvesting. Alternatively, any of these properties could be developed as a small park.



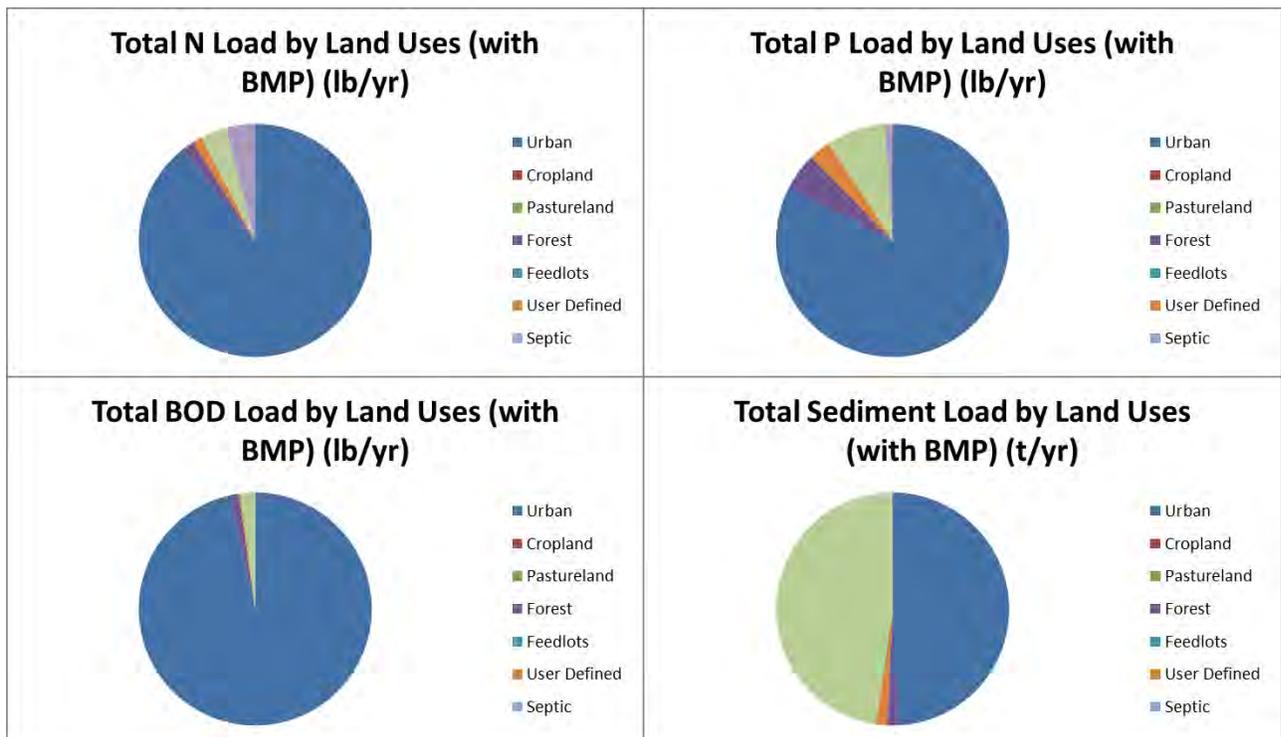
Figure 27: Trash Dump, Catchment S-07

The farm pond immediately downstream of this catchment is one of the highest concerns identified in the watershed. It is exclusively using its emergency spillway, which is incised down to the bedrock, carving a ravine with 20+ foot walls. It is in danger of structural failure and should be addressed as soon as possible.



Figure 28: Failing Dam Conditions, Catchment S-07

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-08			TN: 6,300 lb/yr (44%)
# Prop.	566	Forest Protection – 242 ac	\$242,000
PLC Priority Parcels	24	AVOIDED COSTS	\$242,000
Area	957	Wetland Restoration – 17 ac	\$93,500
		Stream Restoration – 7,423 ft	\$742,300
		River Restoration – 8,815 ft	\$881,500
		Residential Retrofits – 189 ac	\$2,835,000
		RESTORATION COSTS	\$4,552,300
			TP: 2,341 lb/yr (63%)
			BOD: 12,241 lb/yr (30%)
			TSS: 3,028 T/yr (90%)



The City of Eden has invested about a third of its annual funds in repairing its sewer and water systems for the past ten years. They have been required to do so by a Special Order by Consent with the NC DEQ and an administrative order from the USEPA, but they have also made an effort to effectively invest its resources. The City has also invested funds to improve parks and recreation, notably the Smith River Greenway. Both efforts meet in this catchment, perhaps the most urbanized of all those featured in this project atlas.

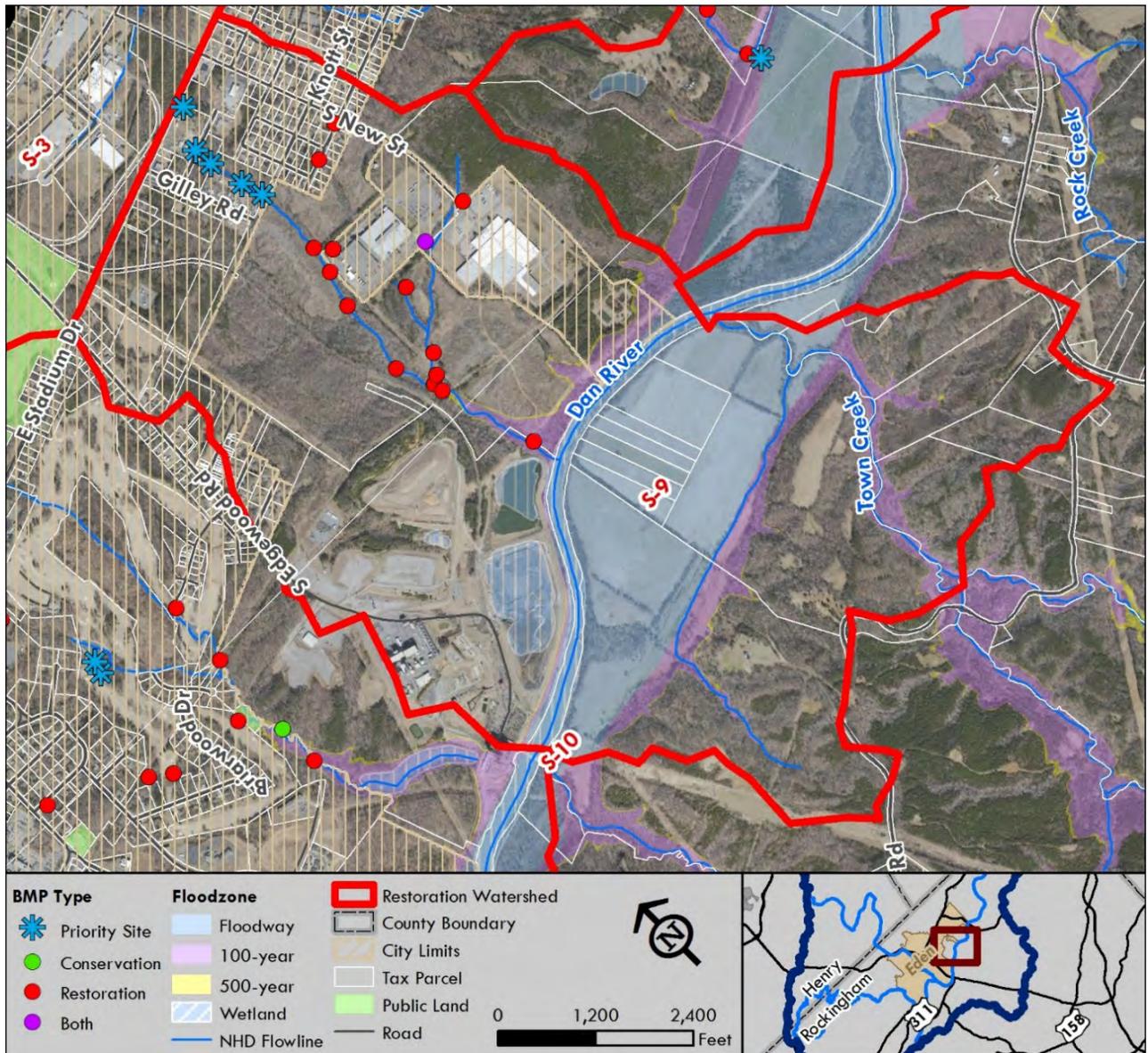
As detailed in the *Watershed Assessment*, the City of Eden is redressing decades of neglect to water and sewer infrastructure by the three separate towns that consolidated into Eden in 1968. Much of that infrastructure was built by the mills that were the focus of each towns' respective economies – when the mills left, the task of maintaining water and sewer infrastructures was politically unpalatable and unaddressed until the twenty-first century. Sanitary sewer overflows are still a regular occurrence in Eden and state and federal grants (rather than loans) are still needed to serve these needs that millions of local dollars have been poured into.

One strategy for rehabilitating these utilities has been constructing greenways upon their easements. The city has done so in this catchment (the green area along the Smith River in the map), and was matched by the NC Parks and Recreation Trust Fund. Linking this greenway farther upstream along utility easements is a way to buffer the Smith River and its tributaries from runoff and give city residents needed recreational resources.



Figure 29: Failing Sewer Outfall & Smith River Greenway, Catchment C-08

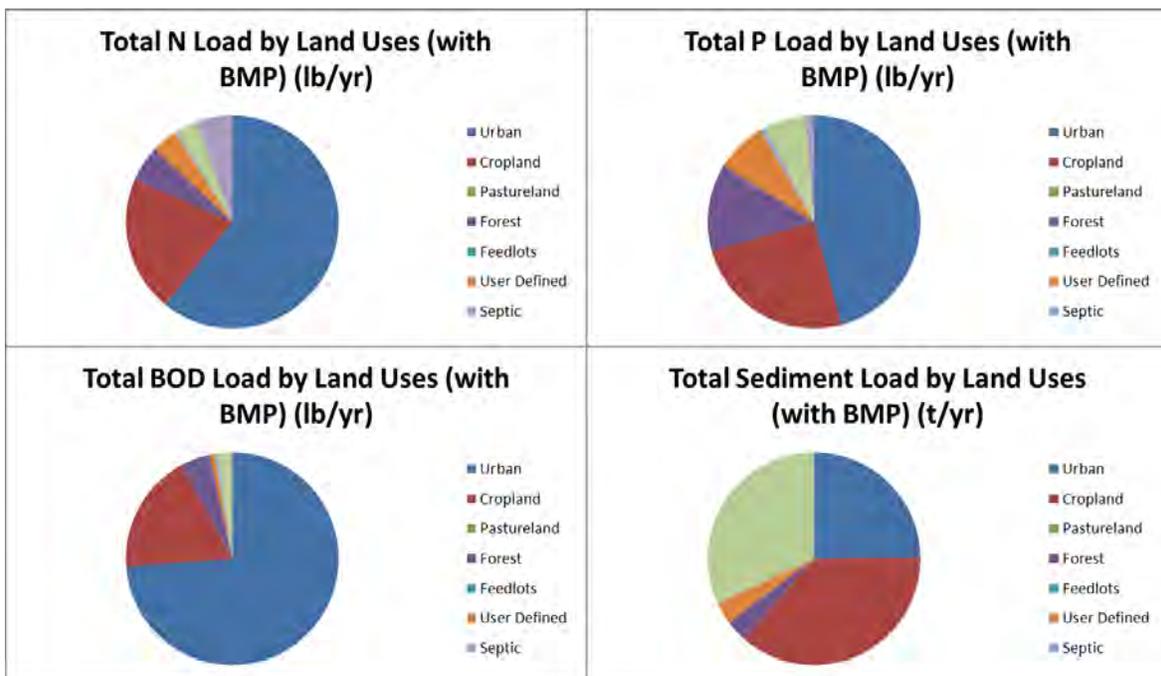
Map 31: Restoration Watershed S-09



Recommended Actions:

1. Secure Duke Energy coal ash ponds so they pose no significant risk to the Dan River or Eden residents
2. Restore and enhance the river and its tributaries and attempt to integrate greenway and hiking trails for resident access to the Dan River corridor.
3. Invest in a rain garden and rain barrel program for surrounding residences.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-09			TN: 9,005 lb/yr (52%)
# Prop.	189	Forest Protection – 693.5 ac	\$693,500
PLC Priority Parcels	9	AVOIDED COSTS	\$693,500
Area	1,499	Wetland Restoration – 55 ac	\$302,500
		Floodplain Protection – 340 ac	\$340,000
		River Restoration – 11,675 ft	\$1,167,500
		Stream Restoration – 16,547 ft	\$1,654,700
		Residential Retrofits – 112 ac	\$1,680,000
		Septic Tank Replacements – 1	\$20,000
		RESTORATION COSTS	\$5,164,700



This is the site of the Duke Energy Power Station, where a spill of nearly 39,000 tons of coal were spilled via a failing stormwater pipe in February 2014. This is essentially the ground zero of the coal ash spill and should be a priority site for habitat and stream rehabilitation, especially due to its potential as Roanoke log perch and the green floater. The floodplain wetlands also offer 55 acres and about three miles of wetland and stream enhancement opportunities to the NC DEQ Stream Mitigation Services program or private mitigation bankers. Most of these wetlands are currently either plowed or drained for agricultural and hunting purposes.

This catchment also features the confluence of Town Creek with the Dan River. Town Creek is one of the priority subwatersheds identified by the GWLF model NC State University used to assess hydrologic and water quality needs throughout the 225-square mile Eden Area watershed study area. It was determined to be a significant source of sediment and fecal material that has long degraded the Dan River, and it is recommended to be a priority site for agricultural cost-share investments. The enhanced condition and greater use of this catchment will heighten the attention upon this catchment and the urgency for upstream actions.

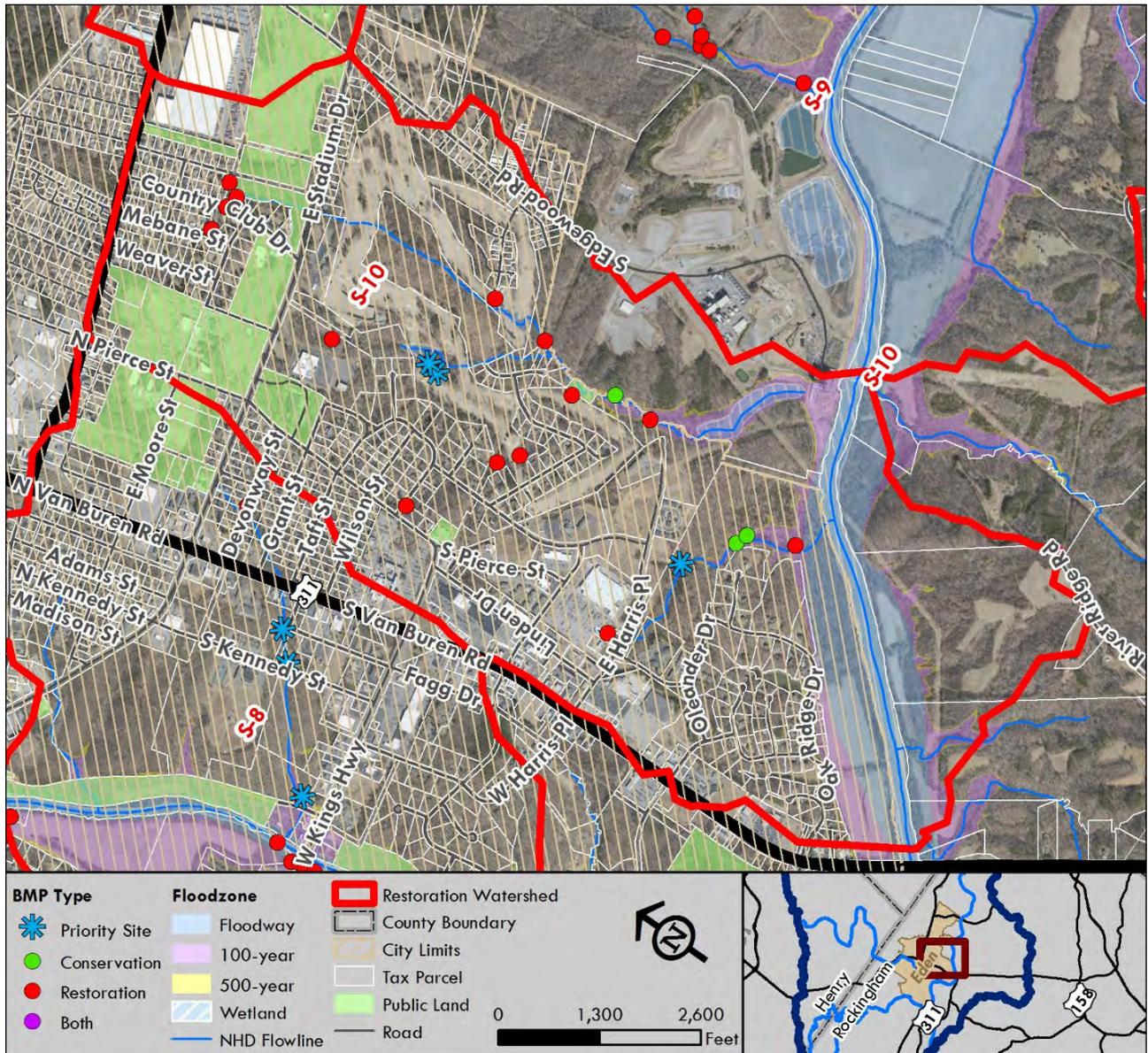


Figure 30: Trash Dump, Catchment S-09

Lastly, this catchment offer multiple opportunities for improvements in residential and agricultural practices. The residences in the headwaters of the creek that flows through the Duke Energy property are rife with illegal trash dumps and incised streams. Education to these landowners and the introduction of residential stormwater programs like buffer and rain garden installation programs would be welcome and beneficial for stream conditions.

Similarly, the farms along Town Creek and the Dan River are generally plowing and planting floodplain wetlands with crops. Not only is this harmful for water quality conditions in the Dan River, but it is not ideal conditions for most crops. The introduction of low- and no-till plant or the acquisition of the properties either under a conservation easement or outright by the PLC would be preferable to the current situation. While these non-point source measures are welcome, though, the emphasis should still be upon the immediate and focused remediation of habitat conditions on and in the Dan River.

Map 32: Restoration Watershed S-10



Recommended Actions:

1. Initiate a stormwater outreach and education campaign in this neighborhood.
2. Invest in a rain garden and rain barrel program for surrounding residences.
3. Investigate potential for demonstration projects on publicly-owned lands.
4. Invest in the restoration of unnamed tributary and connecting residences to the Dan River corridor with a greenway/hiking trail.

Stormwater and wastewater management are essential for watershed health. Stormwater is the main non-point source of pollution in cities, routing runoff into the few streams found in cities and loading them with pollutants and unnatural flow regimes. This creates polluted and incised streams.

Wastewater infrastructure must be maintained or it will discharge bacteria, sediment, and nutrients. Unfortunately for Eden, it was neglected for decades due to a lack of political leadership. Consequently, the City has been investing over a third of its funds annually to remedy these problems.

Perhaps most surprising in this catchment is the presence of good stream conditions. These are downstream of the headwaters, and are a testament to the values of open spaces and stream buffers. Preserving these spaces through acquisition by the city or PLC and/or placing a conservation easement upon them is recommended to preserve these Dan River tributaries' stability.

This catchment is immediately upstream of the Duke Energy Power Station and received polluted sediment in the aftermath of the coal ash spill. It is a priority for habitat reclamation and hydrologic restoration and should be of interest to the NC DMS due to its wetland (43.5 ac) and stream restoration (>3 mi) opportunities.

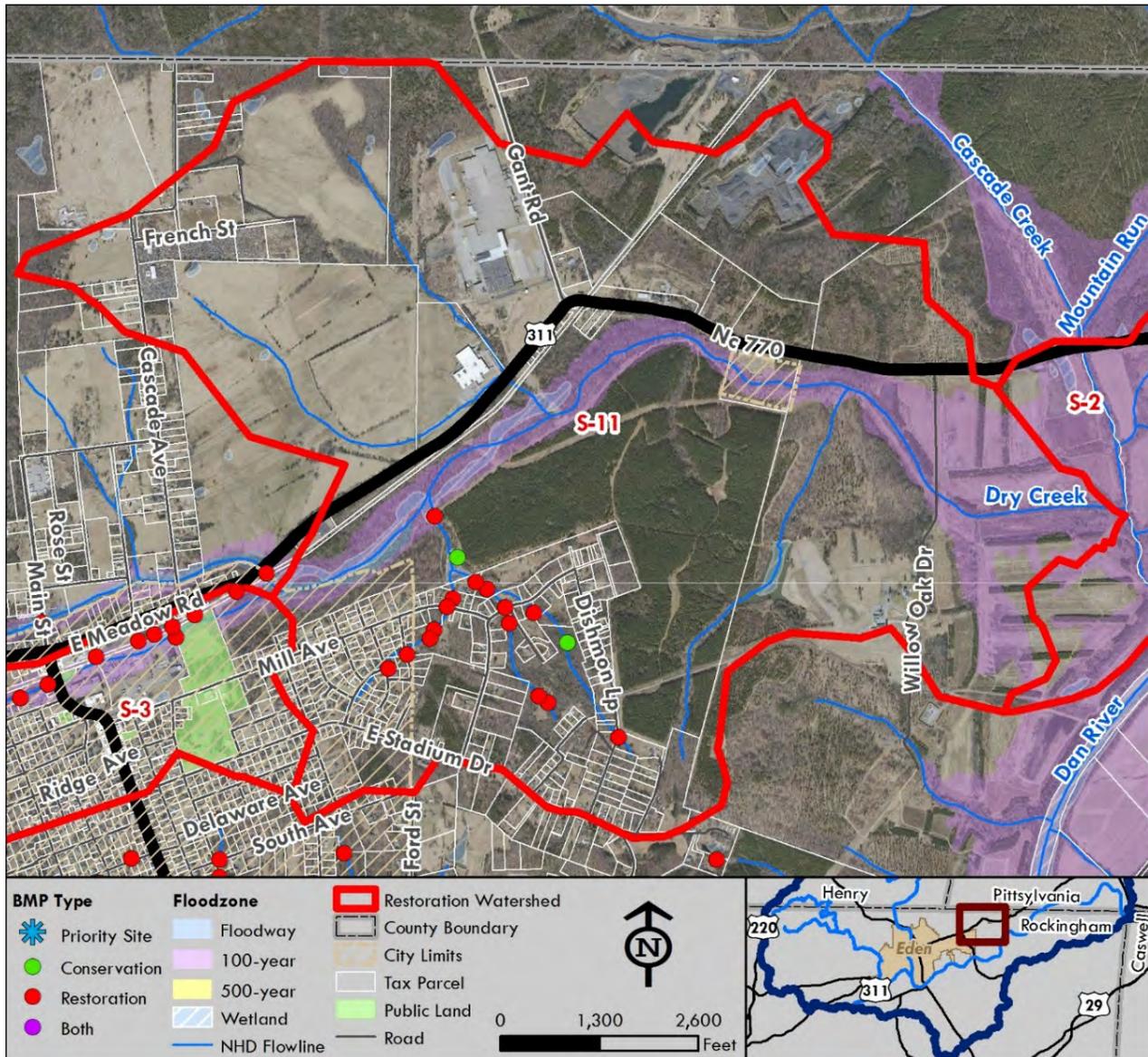


Figure 31: Stream Restoration Site, Catchment S-10



Figure 32: Stream Conditions, Catchment S-10

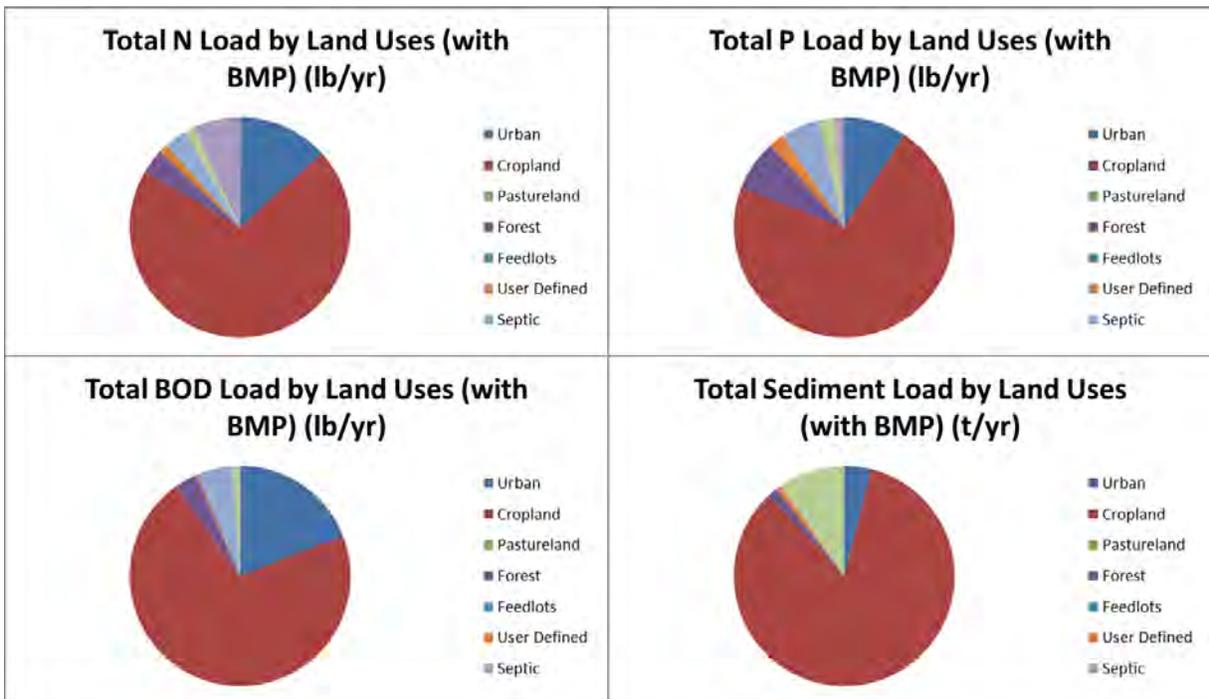
Map 33: Restoration Watershed S-11



Recommended Actions:

1. Invest in the restoration of Dry Creek, including a greenway or hiking trail along it and its tributaries.
2. Contact landowner(s) about placing an easement on the floodplains of these properties for conservation and recreation purposes.
3. Initiate a stormwater outreach and education campaign in this neighborhood.
4. Invest in a rain garden and rain barrel program for surrounding residences.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-11			
# Prop.	332	Forest Protection – 870 ac	TN: 20,317 lb/yr (59%)
PLC Priority Parcels	1	AVOIDED COSTS	TP: 4,590 lb/yr (58.5%)
Area	1,898		BOD: 35,834 lb/yr (49%)
		Wetland Restoration – 31 ac	TSS: 2,747 T/yr (71%)
		Floodplain Protection – 226.5 ac	
		River Restoration – 13,464 ft	
		Stream Restoration – 24,746 ft	
		Residential Retrofits – 89 ac	
		Septic Tank Replacements – 17	
		RESTORATION COSTS	
		\$5,892,000	



Riparian buffers mitigate flash flooding, provide wildlife habitat, prevent erosion, and protect water quality. They can only do this, though, if they are large enough. The NC Wildlife Resources Commission recommends buffers be 100 – 330 feet, depending upon their purpose. Many environmental groups promote buffers of 50 feet, based upon research that shows significant improvements in water quality conditions.

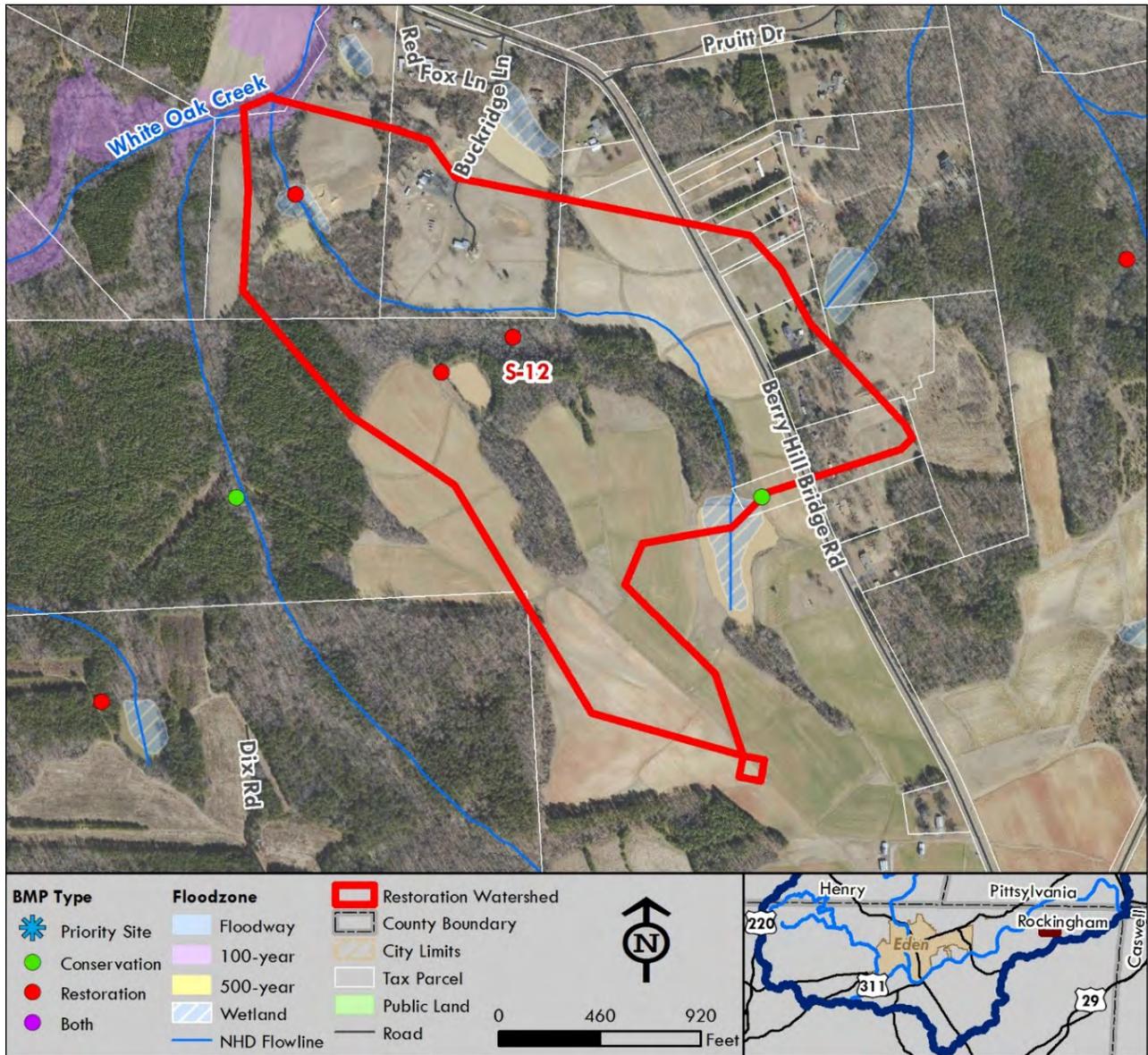
The primary recommendations for this large catchment are to implement buffers and promote the use of residential and agricultural BMPs. Dry Creek is one of the three priority subwatersheds identified by the NCSU GWLF model. Currently, most of the houses do not have stream buffers or residential stormwater management. There are also not any public stormwater practices here, though there are opportunities at the athletic fields immediately to the west of this catchment. The farms in the northern part of the catchment similarly show high-impact land use conditions, being cleared and plowed for crops all of the way down to the streamside. Outreach, education, and service programs that address the benefits of BMPs are needed and recommended for action by the Rockingham County SWCD, PLC, DRBA, and the City of Eden.

It is recommended that NC DMS prioritizes Dry Creek for their stream restoration and wetland enhancement programs. This catchment features over four miles and 31 acres, respectively, in opportunities. This includes some surprisingly excellent wetlands founds immediately outside city limits.



Figure 33: Degraded Stream and Wetland Enhancement Sites, Catchment S-11

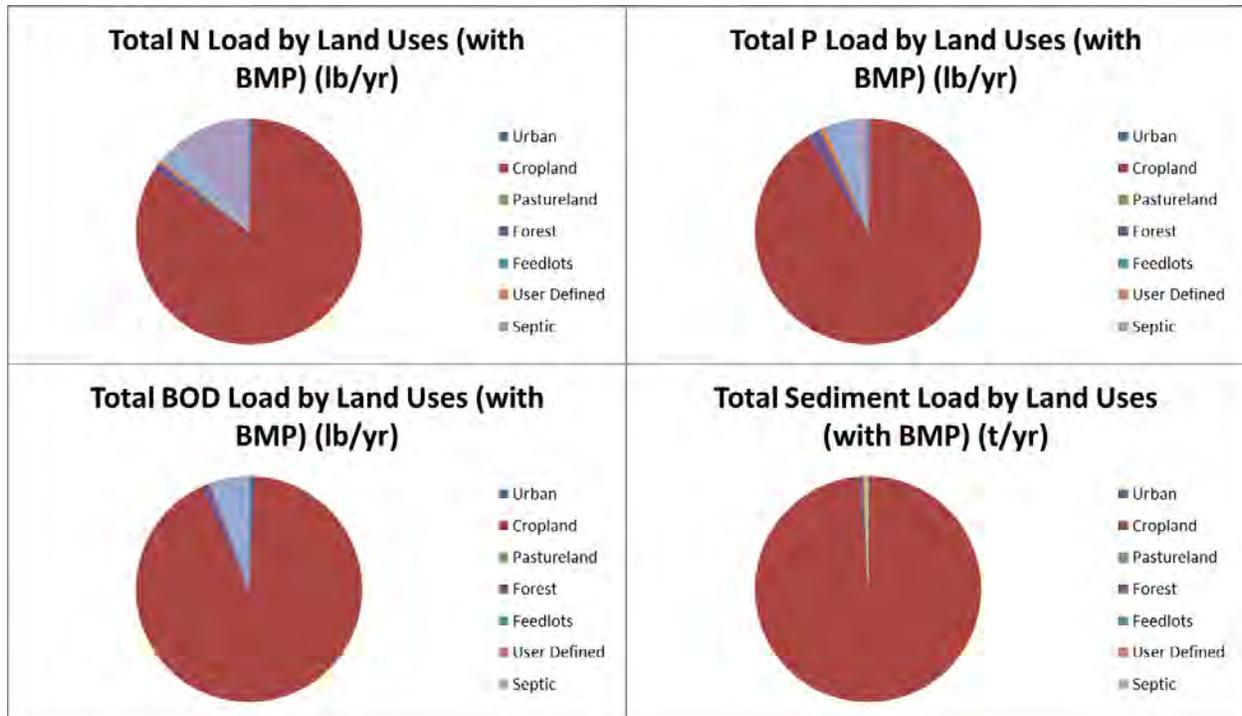
Map 34: Restoration Watershed S-12



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation, recreational, and agricultural purposes.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-12			
# Prop.	4	Forest Protection – 26 ac	\$26,000
PLC Priority Parcels	0	AVOIDED COSTS	\$26,000
Area	97	Wetland Restoration – 1 ac	\$5,500
		Stream Restoration – 3,558 ft	\$355,800
		Residential Retrofits – 1 ac	\$15,000
		Floodplain Protection – 1 ac	\$1,000
		Septic Tank Replacements – 1	\$20,000
		RESTORATION COSTS	\$397,300
			TN: 1,012 lb/yr (44%)
			TP: 248 lb/yr (42%)
			BOD: 1,680 lb/yr (37%)
			TSS: 132 T/yr (41%)



Despite being ranked as a restoration priority catchment, the streams of this catchment are well buffered and in decent – if not exceptional – condition. The landowner should be contacted to thank them for such

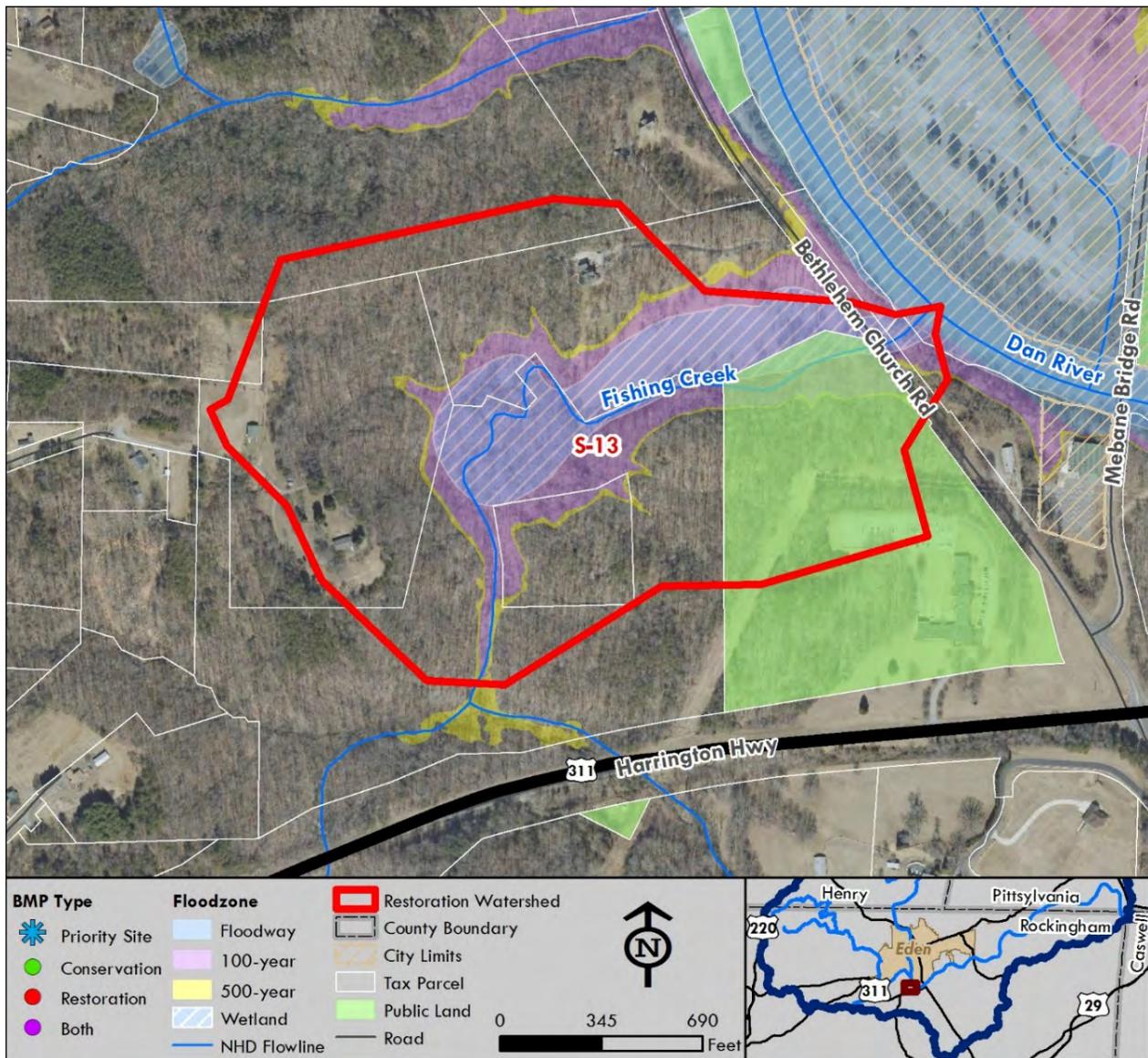
excellent stewardship and to ensure that they intend to continue such practices. Furthermore, they should be compensated for such management – at the least for maintaining riparian buffers. To do so will require the application of conservation easements on the property by PLC, but the tax benefits should make such an arrangement worth it for the property owner. Maintaining these conditions is important due to the proximity of this catchment at White Oak Creek to the Virginia state border – it is one of the final opportunities for North Carolina to invest in water quality protection before the Dan River leaves the state permanently.

However, this catchment is also adjacent to a priority restoration site – a 4-acre farm pond with a failing earthen dam (*see photo*). The PTRC identified 70+ such farm dams in its field work. These dams are collectively holding millions of tons of sediment that could be released if a natural disaster – namely a hurricane – hit the area. This would be devastating to the river’s ecosystems and places all residents at risk. The dams were built on the 1930’s with Natural Resources Conservation Service funds and were constructed for a 50 – 75 year lifespan – they are at the end of this timeline. Federal and state resources – especially from the NRCS – need to be invested in either the rehabilitation or removal of these failing dams.



Figure 34: Failing Dam Conditions, Catchment S-12

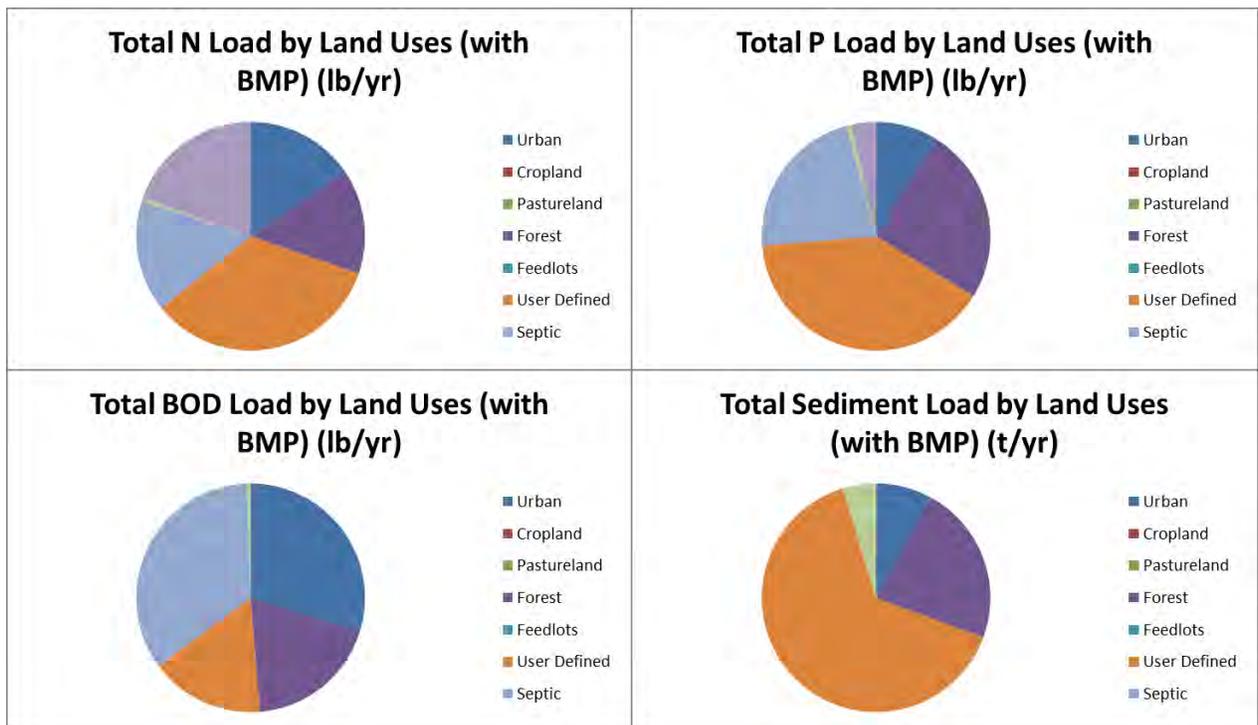
Map 35: Restoration Watershed S-13



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation, recreational, and agricultural purposes.
2. Outreach to landowners about the value of using a consulting forester for timber harvests.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.
5. Investigate potential for a demonstration project on the publicly-owned land.

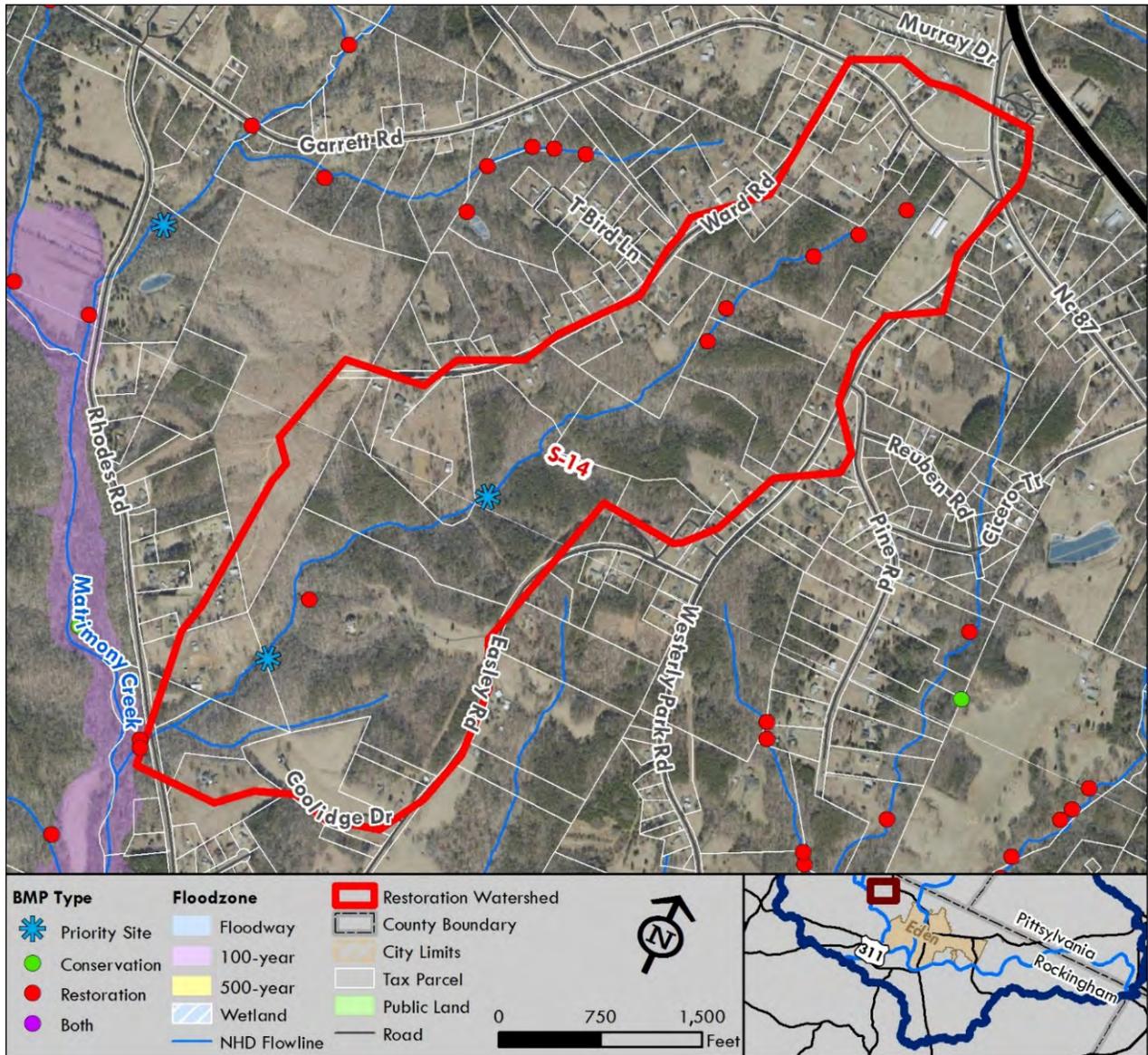
PROJECT NAME	RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-13 # Prop.	5	Wetland Protection – 10 ac	TN: 363 lb/yr (67%)
	0	Stream Protection – 2,868 ft	
	63	Forest Protection – 48 ac	
	AVOIDED/TOTAL COSTS		
PLC Priority Parcels Area		Residential Retrofits – 0.5 ac	TP: 120 lb/yr (71%)
		Septic Tank Replacements – 1	BOD: 524 lb/yr (61%)
			TSS: 45 T/yr (82.5%)
		RESTORATION COSTS	\$27,500



Fishing Creek is a significant tributary of the Dan River, which it drains to in this catchment. It offers an opportunity to buffer both water bodies from water quality degradation and is currently partly protected, with a park lying within the catchment. It is also immediately across the river from the city and within the Piedmont Together GIN, making more permanent protection of these parcels a priority.

A more urgent need is to ensure that the property owners are aware of the benefits of consulting foresters. The properties can potentially be harvested for timber at any time, which can have devastating impacts upon local and regional water quality conditions. However, a consulting forester will ensure that the properties have a conservation plan, that it is followed, that NC FPGs are abided by, and that harvest profits are optimized. NCFS and the Rockingham County SWCD should reach out to these property owners to ensure that they are aware of these benefits. PLC should reach out to these same property owners to gauge their interests in conservation easements for these properties. Conservation easements can yield significant tax savings for landowners and permanently protect the environment. They can – if the owners are willing – provide for recreational use, including greenway construction, paddle access, or hiking/birding/hunting. At the confluence of a tributary with the Dan River, such a protection would be invaluable.

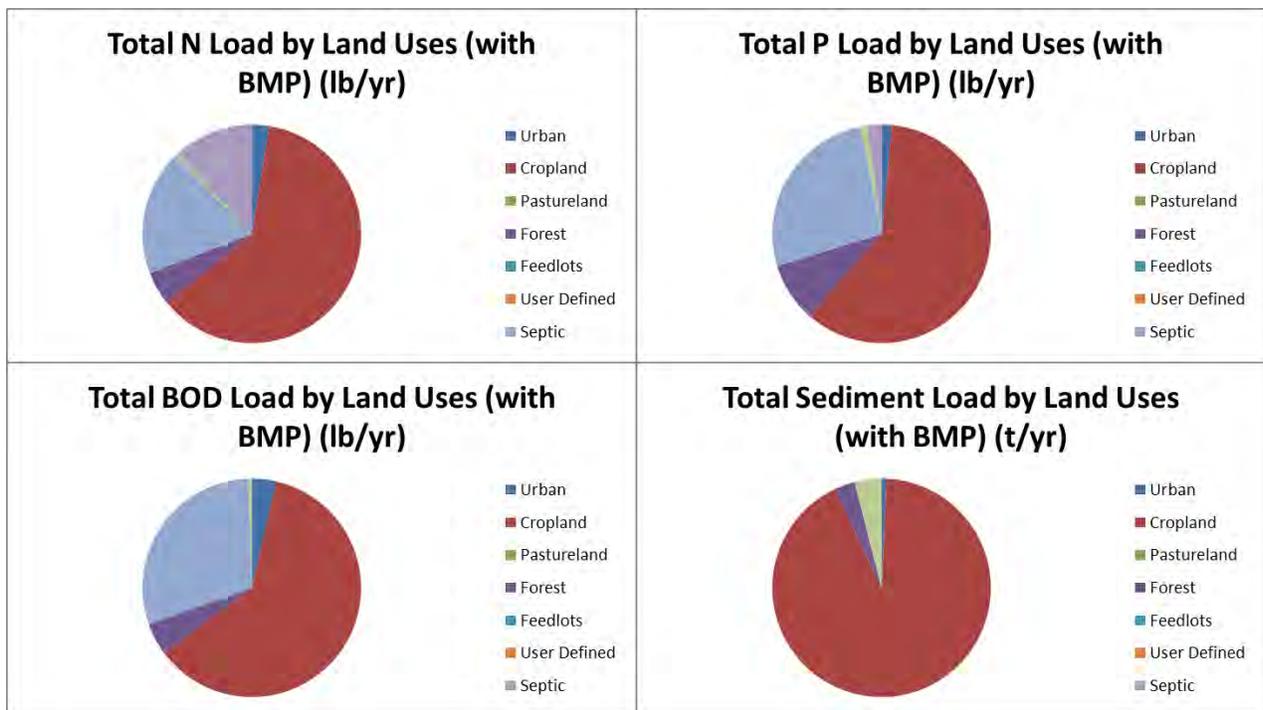
Map 36: Restoration Watershed S-14



Recommended Actions:

1. Contact property owner(s) about placing an easement on these properties for conservation, recreational, and agricultural purposes.
2. Communicate with landowners about the benefits of using a consulting forester for timber harvesting.
3. Rehabilitate or remove failing earthen dams.
4. Invest in stream enhancement/restoration on unnamed tributaries.

PROJECT NAME		RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-14				
# Prop.	50	Forest Protection – 205 ac	\$205,000	TN: 1,449 lb/yr (42%)
PLC Priority Parcels	0	AVOIDED COSTS	\$205,000	TP: 356.5 lb/yr (39.5%)
Area	312	Stream Restoration – 8,734 ft	\$873,400	BOD: 2,429 lb/yr (32%)
		Residential Retrofits – 7 ac	\$105,000	TSS: 246 T/yr (57%)
		Septic Tank Replacements – 13	\$26,000	
RESTORATION COSTS			\$1,004,400	



This headwater of Matrimony Creek affords an opportunity to better explore the heritage and history of Eden and Rockingham County. The field assessments in this rural catchment stumbled upon an old mill along this tributary to Matrimony Creek, a relic of the county's heritage as an agricultural community and a symbol of the stresses this watershed has faced for centuries. Waters have been heavily impacted by human uses of land and water for hundreds of years, including prior to European settlement of North America. In many ways, the Dan and Smith Rivers are healthier than they have been in a long time, now that water quality protections prevent the dumping of raw sewage and toxic chemicals to the nation's waters. This is the case throughout

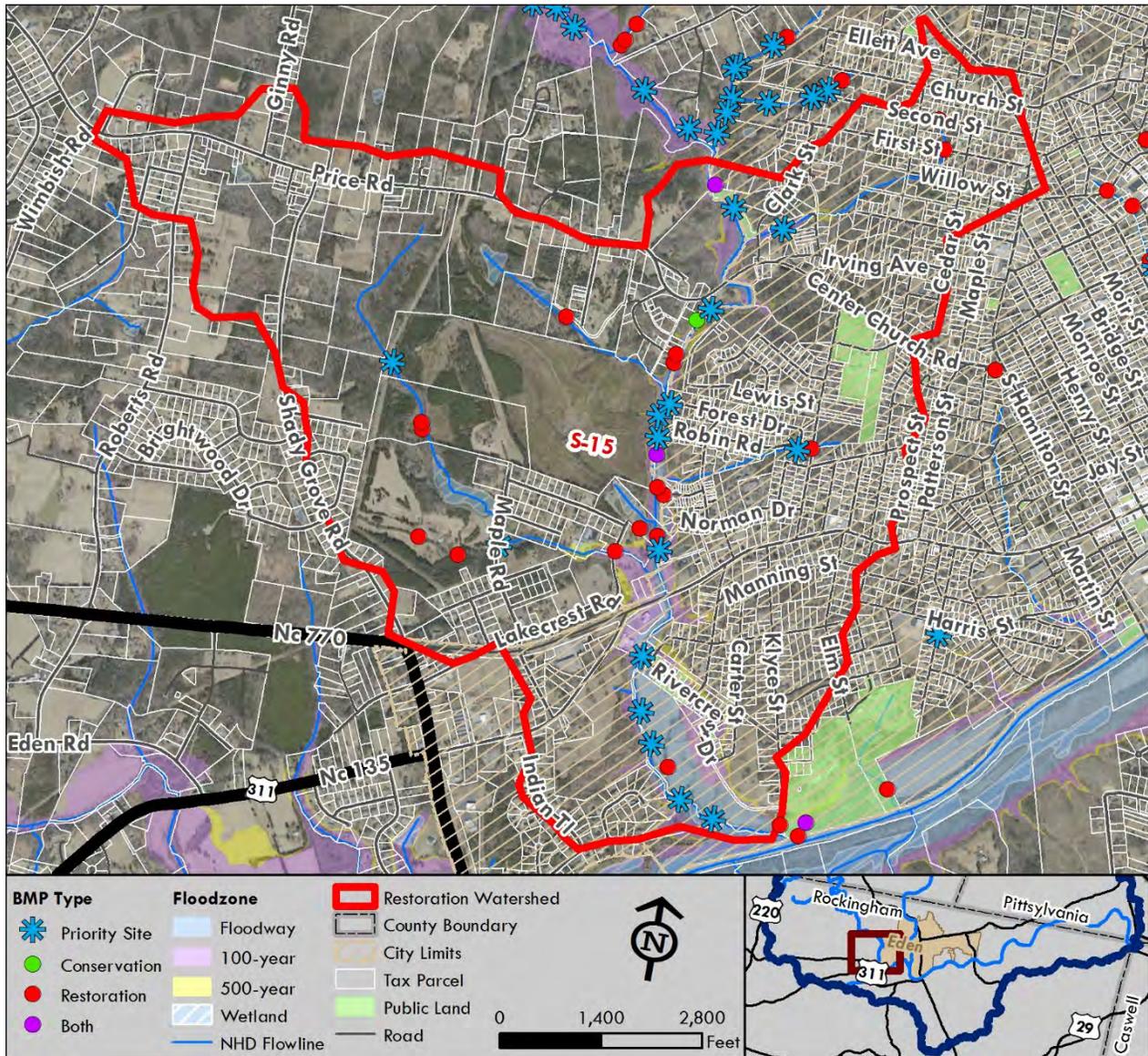
North Carolina and much of the United States. Conservation efforts by the PLC to protect and preserve this mill ruin could tell this story.

They could also enhance and restore much of the degraded tributary upstream of this mill site. The creek is in pretty good shape in many places, but equally in need of support and attention elsewhere. About 1.5 miles of stream bank stabilization and buffer restoration are needed along the creek and could be packaged with any historic preservation efforts farther downstream near the confluence with Matrimony Creek.



Figure 35: Historic Mill Ruins, Catchment S-14

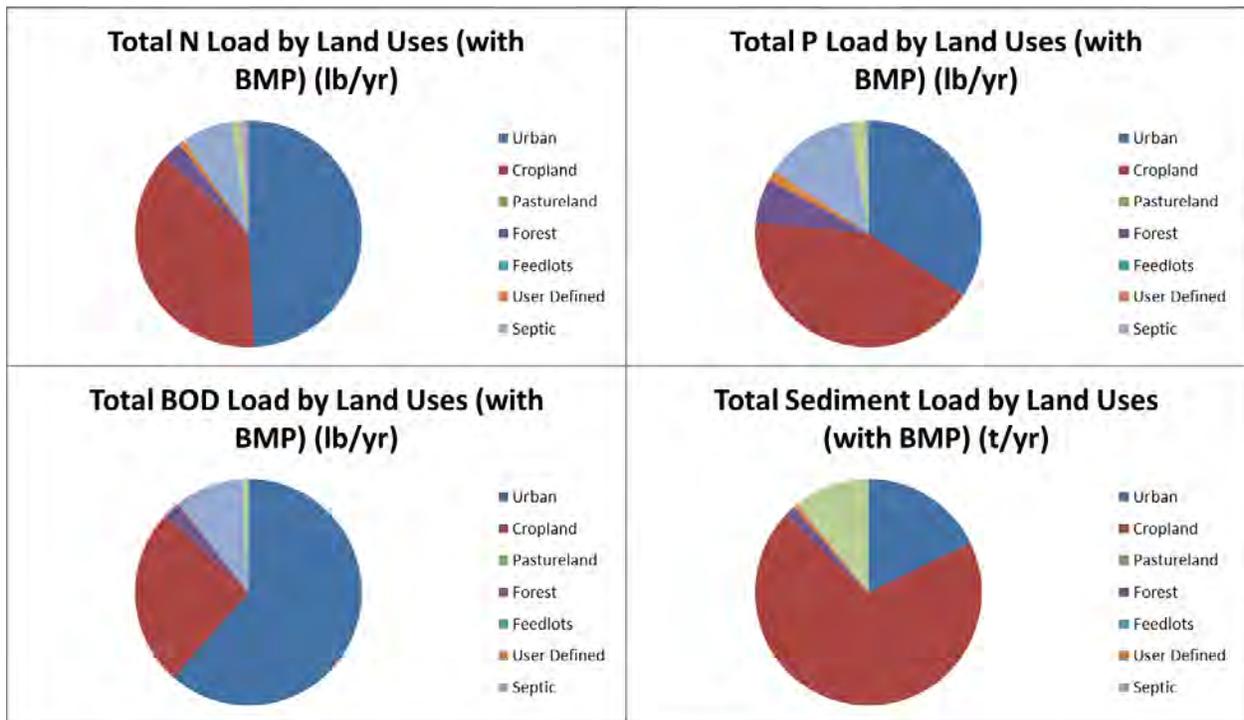
Map 37: Restoration Watershed S-15



Recommended Actions:

1. Initiate a stormwater outreach and education campaign in this neighborhood.
2. Invest in a rain garden and rain barrel program for surrounding residences.
3. Investigate potential for stormwater demonstration projects.
4. Invest in the restoration of unnamed tributary and connecting residences to the Dan River corridor with a greenway/hiking trail.

PROJECT NAME		RECOMMENDED PRACTICES	ESTIMATED COSTS	ESTIMATED BENEFITS
S-15				TN: 4,984.5 lb/yr (28%)
# Prop.	1,472	Forest Protection – 635 ac	\$635,000	TP: 1,625 lb/yr (37%)
PLC Priority Parcels	0	AVOIDED COSTS	\$635,000	BOD: 9,689 lb/yr (20%)
Area	1,689	Wetland Restoration – 17 ac	\$93,500	TSS: 1,795 T/yr (68%)
		River Restoration – 12,454	\$1,245,400	
		Stream Restoration – 18,147 ft	\$1,814,700	
		Residential Retrofits – 143 ac	\$2,145,000	
		Floodplain Protection – 152.5 ac	\$152,500	
		Septic Tank Replacements – 33	\$660,000	
RESTORATION COSTS			\$6,111,100	



The tributaries flowing through this urban catchment show the needs for stormwater management, wastewater infrastructure maintenance and repair, and surprisingly near-pristine conservation opportunities. As the creeks flow downstream to the Dan River, the stream banks steepen and erode, trash accumulates, and the water becomes cloudier. The need for stormwater management and mitigation is apparent. Eden does not have to have a stormwater permit through the USEPA's National Pollutant Discharge Elimination System. This makes all actions to address stormwater by the city voluntary. However, the benefits of such actions to the creeks, the river, and their potential added values to the city as recreational and aesthetic assets are huge.



Figure 36: Log Jam, Matrimony Creek, Catchment S-15

The City of Eden has been experiencing economic hardship for years, so spending money to address an issue that has no regulatory stick behind it may seem wasteful. However, there are many inexpensive steps it can take that can make a huge difference, including supporting an outreach or marketing program. The DRBA or the PTRC's Stormwater SMART program can partner with the city to interact with city residents on small things they can all do that make a huge difference for stormwater management if addressed collectively, such as pet waste pickup and fertilizer application. It can also partner with vendors such as Home Depot or Lowe's for rain barrel reverse auction programs, which can also encourage conservation.



Figure 37: Wastewater Infrastructure Needs, Catchment C-15

The City of Eden spends over a third of its annual budget on water and wastewater infrastructure. Due to years of inattention by political leaders, the system fell into disrepair and the NC DEQ and the USEPA recognized the failures with a Special Order by Consent and an Administrative Order, respectively. The City has invested millions of dollars in local funds to address these needs and maintain the infrastructure for the future, but issues still remain, including vulnerable infrastructure and failing infrastructure (*see photos*).

Lastly, the city has a wealth of natural resources that are underexplored and underutilized. Pristine wetlands were identified immediately off the wastewater utility easement in this catchment and can be found elsewhere in the city. The critically-threatened Virginia bluebell was identified behind a gas station in Eden. MillerCoors owns property that features habitats found almost nowhere else on Earth. The very challenges Triassic Basin soils confront nature and development with create fertile ground for unusual and rare species to thrive. Protecting open spaces – especially in urban catchments – can ensure that these valuable areas are

available for city residents and can be featured as a main attraction for visitors. The city has already demonstrated an interest and enthusiasm for such investments in its greenway and parks. While grey infrastructure has defined Eden's past in the twentieth century, such green infrastructure may define its future.



Figure 38: Pristine Wetland, Catchment C-15

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