Haskett Creek
Watershed Plan

JUNE 2020

Piedmont Triad Regional Council

Asheboro North Carolina

Randolph County, North Carolina 1779

City of Randleman

NC Environmental Quality

Version 1 [June, 2020]

Contributing Partners

City of Asheboro
Randolph County
City of Randleman
Randolph County Soil & Water
NC Cooperative Extension
Keep Randolph County Beautiful
North Carolina Zoo
Piedmont Land Conservancy
Piedmont Conservation Council
NC Wildlife Resources Commission
NC Division of Water Resources

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Guide to Nine Minimum Elements

This table serves as a quick reference guide to where the Environmental Protection Agency (EPA) Nine Minimum Elements are discussed within this watershed management plan.

	EPA Nine Minimum Elements	Location in Plan
1	Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan.	Section 2 – Watershed Conditions
2	An estimate of the load reductions expected from management measures.	Section 3.2 – Runoff Load Reduction Calculations Section 5.1 – Stormwater Control Measures
3	A description of the nonpoint source management measures that will need to be implemented to achieve load reductions, and a description of the critical areas in which those measures will be needed to implement this plan.	Section 5 – Management Strategies
4	Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.	Section 6.3 – Financial and Technical Needs
5	An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.	Section 5.5 – Outreach and Education
6	Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.	Section 4 – Goals and Objectives Section 6.1 – Implementation Schedule

7	A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.	Section 6.2 – Tracking Progress and Measuring Success
8	A set of criteria that can be used to determine whether load reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.	Section 4 – Goals and Objectives Section 6.2 – Tracking Progress and Measuring Success
9	A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the established criteria.	Section 6 – Implementation and Adaptive Management

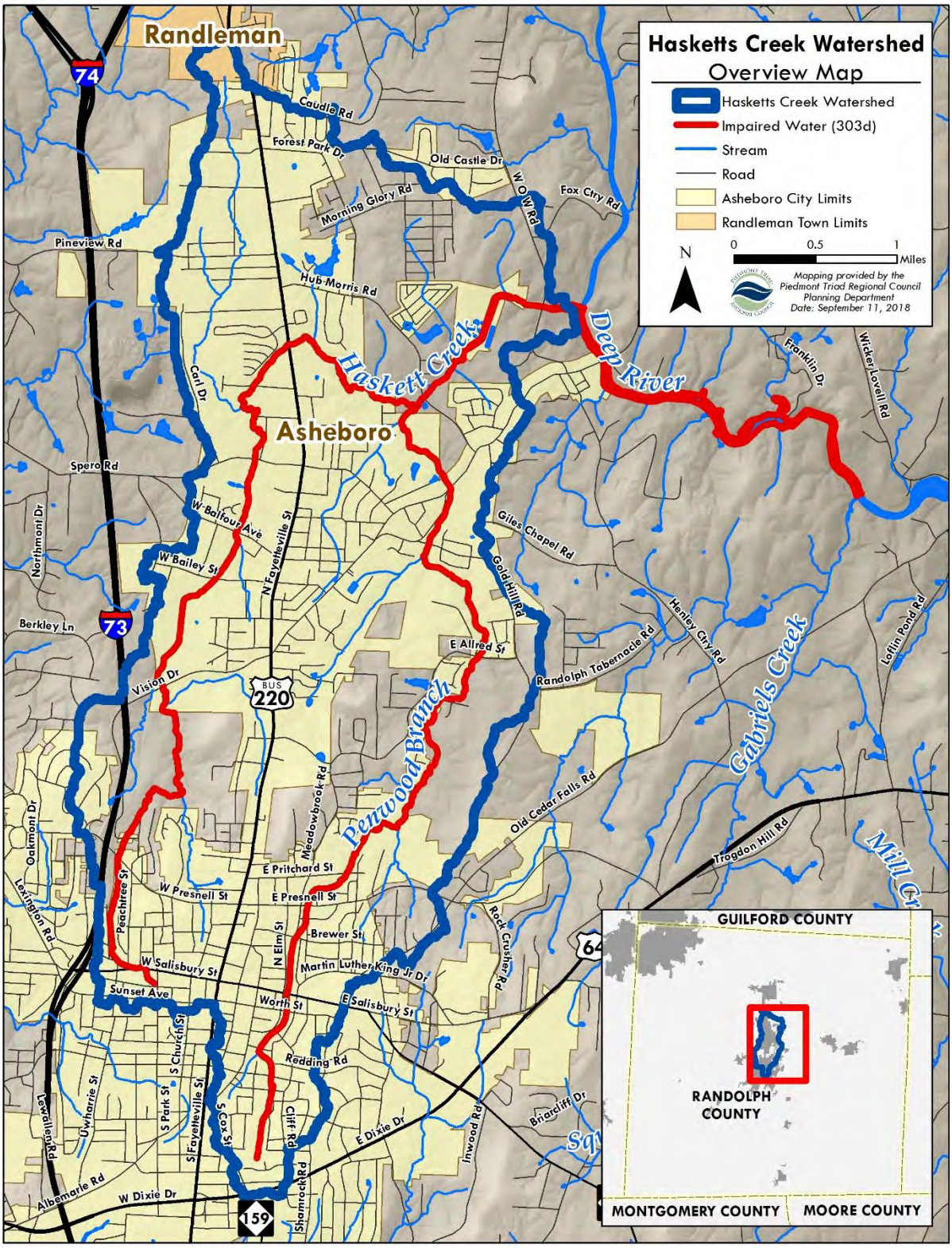
Introduction

Haskett Creek and its feeder stream Penwood Branch are tributaries of the Deep River in Randolph County, North Carolina. Both streams originate in the city center of Asheboro and flow northeast to their confluence with the Deep River just below the City of Asheboro's Wastewater Treatment Plant (WWTP). Their combined drainage area includes 7,834 acres of urban and rural land within the jurisdictions of the City of Asheboro, Randolph County, and the City of Randleman.

Haskett Creek and Penwood Branch, from their source to the Deep River, have been listed on the 303(d) list of impaired waters since 1998 and 2006 respectively due to their inability to adequately support aquatic organisms. Over the years, Haskett Creek has also periodically failed to meet water quality standards for dissolved oxygen, turbidity, and copper. Benthic macroinvertebrate surveys conducted by the North Carolina Division of Water Resources (DWR) in 2003 resulted in Poor and Fair biological assessment ratings, indicating that both streams were being negatively impacted by point and nonpoint sources of pollution. The initial stressor study suggested that drought and urban runoff were the primary cause of biological impairments, however, few studies have been conducted since that time to further investigate water quality issues. In addition, no total maximum daily load (TMDL) has been established for this watershed.

The *Haskett Creek Watershed Plan* was developed in consultation with local stakeholders to guide water quality improvements and coordinate restoration efforts. The plan investigates potential sources of pollution in the watershed and identifies collaborative, cost-effective strategies to enhance and protect surface waters. The ultimate goal is to restore aquatic habitat in Haskett Creek and Penwood Branch to support diverse benthic communities and meet water quality standards. The plan primarily focuses on nonpoint source pollution, since there is only one permitted point source discharger within the watershed. It is meant to be a living document and will be updated and revised as new information, challenges, or opportunities arise.

Map 1: Haskett Creek Watershed Overview Map



1 Watershed Description

1.1 Physical and Natural Features

1.1.1 Hydrology

The Haskett Creek watershed is made up of two main stream branches, Haskett Creek and Penwood Branch, and several unnamed tributaries. Both streams originate near downtown Asheboro and flow northeast for just over six miles before they converge. From there they continue northeast for another 1.4 miles, past the Asheboro WWTP to the Deep River. The watershed area delineated for the purposes of this project is smaller than the defined 12-digit hydrologic unit code (HUC) (030300030110 Haskett Creek–Deep River), and does not include the Deep River. Haskett Creek and Penwood Branch are headwaters of the Deep River, which is part of the larger Cape Fear River Basin.

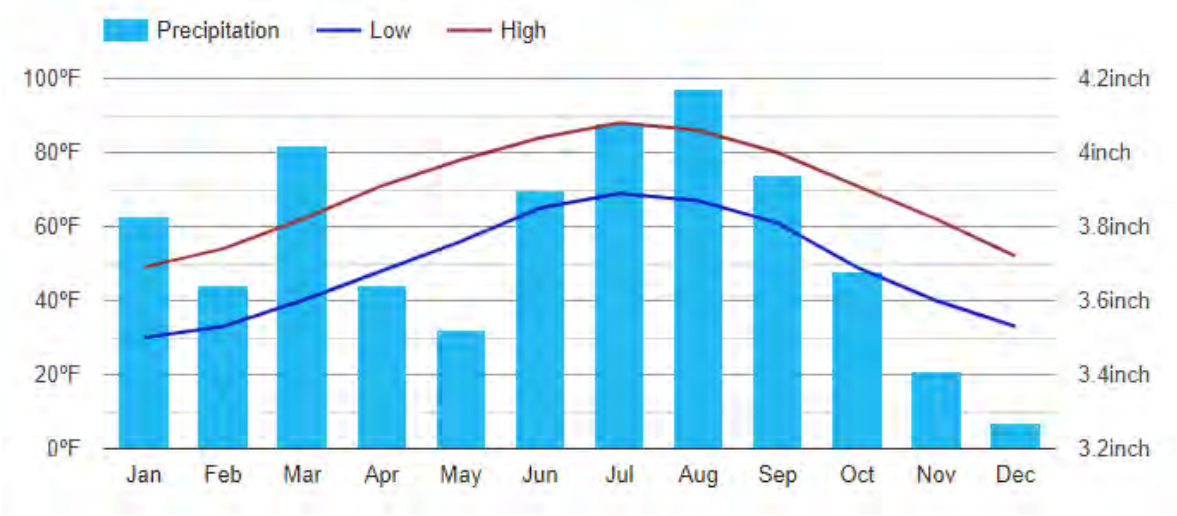
There are no active stream gauges within the watershed, so Tick Creek in Chatham County was used as a reference stream to better understand flow conditions in Haskett Creek. Tick Creek is located about 25 miles east of Asheboro near Siler City. Similar to Haskett Creek, it is impaired for benthos and has a total drainage area of 15.5 square miles, which is slightly larger than Haskett Creek's 12 square mile drainage area. According to USGS stream gauge data dating back to 1958, Tick Creek has an average discharge of 13.15 cubic feet per second (cfs), which fluctuates throughout the year depending on climate conditions and groundwater interactions.

Table 1: Average Monthly Stream Flow (1958-2020) for Tick Creek (USGS Gauge 02101800 near Mount Vernon Springs, NC)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
22	27	26	18	8.5	6.4	6.6	5.7	8.9	7.4	8.3	13

Randolph County has a temperate year-round climate with four seasonal changes. The average precipitation during this project was 3.8 inches/month. Summer precipitation is generally the highest of the year, with August being the wettest month followed closely by July and March. Summer rainfall is also the most variable, occurring mostly in connection with showers and thunderstorms. Winter is the driest season, and December the driest month, except in the event of a hurricane. All North Carolina's rivers and streams commonly have a maximum flow in late spring, with low flow in fall. It is rare for any but the very smallest streams to be dry at any time. Floods covering a wider area and extending into the Piedmont are most likely in winter, when traveling weather systems bring prolonged rain to a large portion of the state.

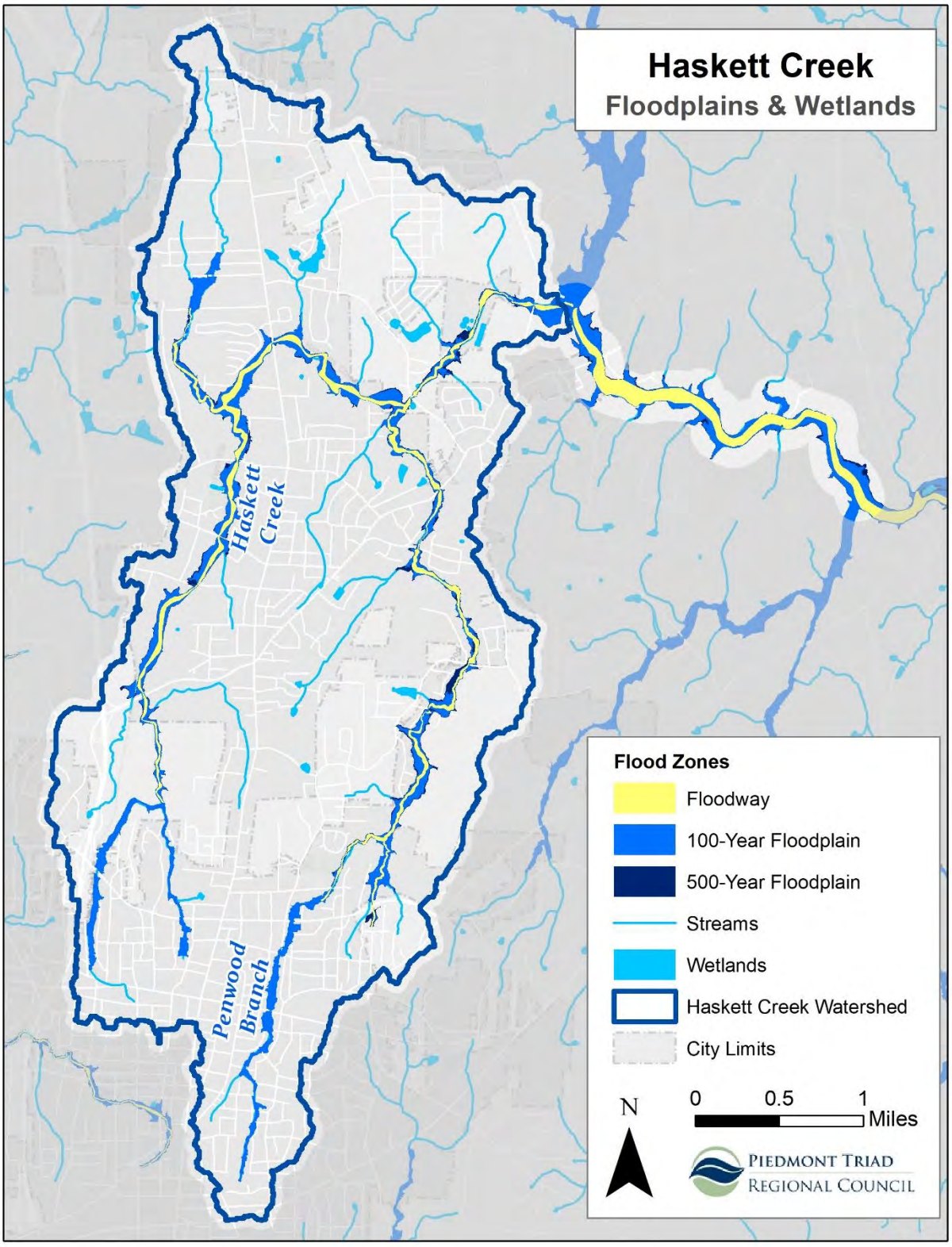
Figure 1: Average Temperature and Rainfall in Asheboro, NC from 1981-2010



Wetlands are areas where water covers the soil for least part of the year. They are highly productive and biologically diverse systems that enhance water quality, control erosion, maintain stream flows, sequester carbon, and provide a home to at least one third of all threatened and endangered species. Wetlands are typically delineated using three attributes: hydric soils, hydrophytic vegetation, and hydrology. While there are naturally occurring wetlands in the Haskett Creek watershed, many are manmade ponds, especially in the northern part of the watershed.

Floodplain data was obtained from the NC Floodplain Mapping Program and accurately represents the floodway, 100-year, and 500-year floodplains in the Haskett Creek watershed (see Map 2). The 100-year floodplains have a 1% chance of being flooded annually, given historical records, soil group, topography, and average rainfall, while the 500-year floodplains have a 0.2% chance of being flooded annually. Development is often highly restricted in floodplains, which is why they provide great opportunities for natural stream buffers, habitat, and recreation.

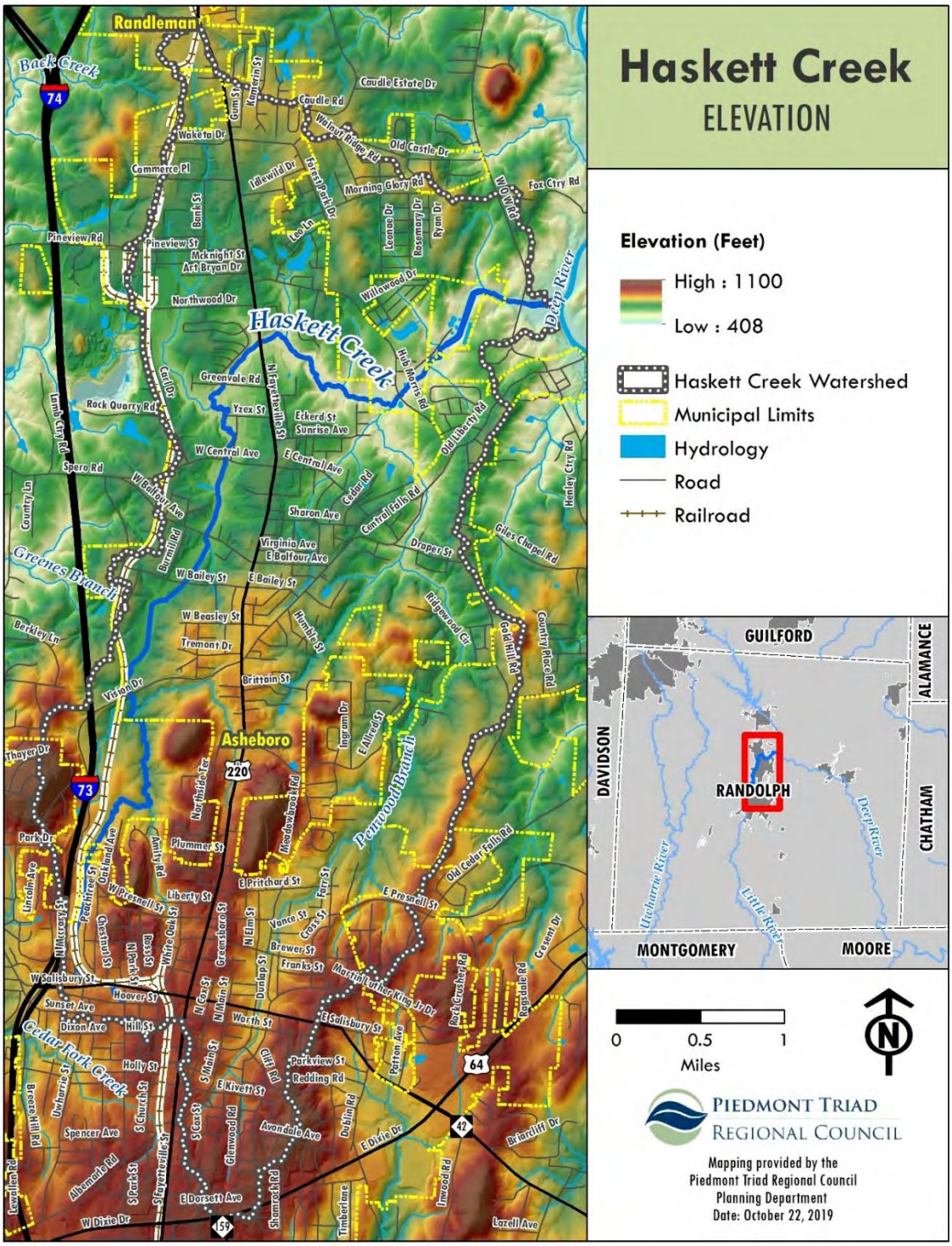
Map 2: Floodplains & Wetlands Map



1.1.2 Topography

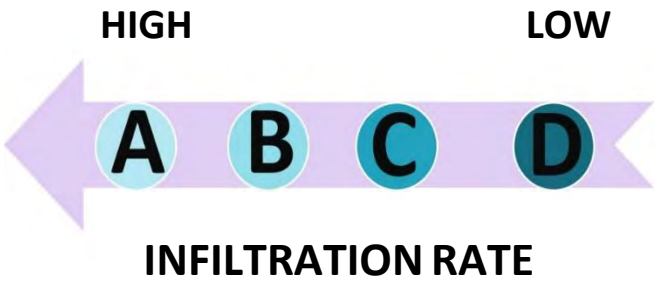
The topography of the watershed slopes northeast, ranging from a height of 1,100 feet at the peak of Oakie Mountain, to a low of 560 ft where Haskett Creek meets the Deep River.

Map 3: Elevation Map



1.1.3 Soils

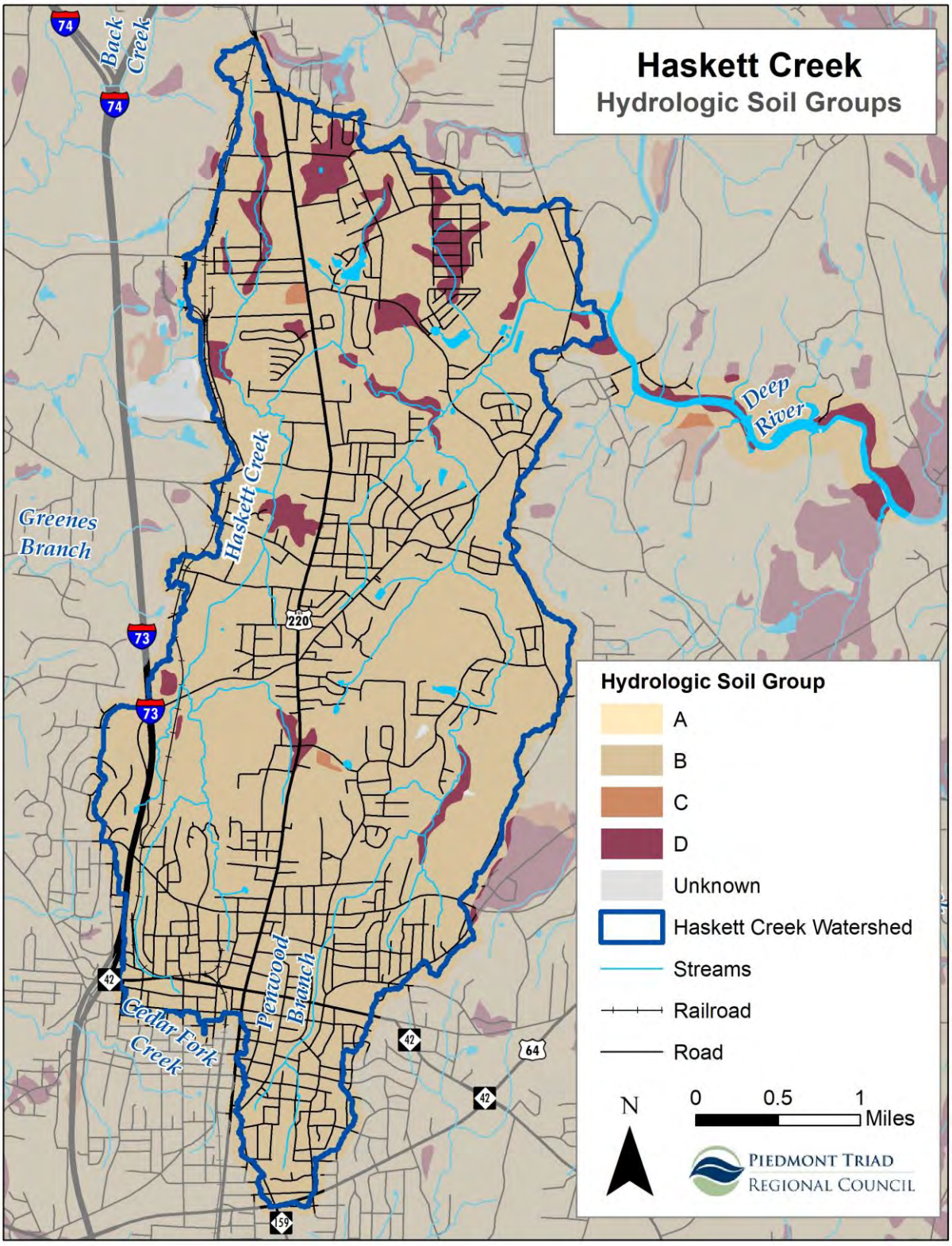
The U.S. Department of Agriculture Natural Resource Conservation Service's (NRCS) Web Soil Survey has designated four hydrologic groups (HSG; Groups: A, B, C, D) based on infiltration potential. Soils classified under Group A have the highest infiltration potential and are often the quickest draining soils, while soils classified under Group D have the highest runoff potential. It is possible to have a soil type that has characteristics from two hydrologic groups; for example, a soil can be designated as Group A/D, which means it has characteristics of both Group A and Group D. This is because of the changing nature of the soils when they are fully saturated by water. Once a hydraulic threshold is reached, the soil type converts to another hydrologic group because of the change of the available water capacity of the soil.



- **Group A** soils are sands, loamy sands, or sandy loams. These soils have high infiltration rates and consist of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
- **Group B** soils are silt loams or loams. These soils have moderate infiltration rates and consist of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
- **Group C** soils are sandy clay loams. These soils have low infiltration rates and consist of soils with a horizon that impedes downward movement of water and possess moderately fine to fine texture.
- **Group D** soils are clay loams, silty clay loams, sandy clays, silty clays, or clay. These soils have very low infiltration rates and consist of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material.

The Haskett Creek watershed is largely composed of Type B soils, which include silt loams and loams. These soils have moderate infiltration rates and are well suited for most stormwater control measures. There are also pockets of Type D soils, primarily in the northern part of the watershed. These soils have very low infiltration rates and the highest potential for runoff.

Map 4: Hydrologic Soil Group Map



1.1.4 Flora & Fauna

The NC Natural Heritage Inventory (NHI) lists no natural heritage areas of ecological significance within the Haskett Creek watershed but does list one Rare Plant Species as being identified within the watersheds boundaries. "Amorpha schwerinii" or the "Piedmont indigo-bush" is listed as -/SR under Federal/State Status. Though there is little to no published information about the Piedmont Indigo-bush, the Common Indigo-bush (*Amorpha fruticosa*), a close relative, is pollinated by most standard pollinator bees including *Andrena quintilis*, a specialist pollinator of *Amorpha* species. Gray Hairstreak, Silver-spotted Skipper, and Southern Dogface butterfly caterpillars, along with Black-spotted Prominent moth larvae, use Indigo-bush leaves as food. It is possible they also use other species of *Amorpha* as host plants.

1.2 DEVELOPMENT PATTERNS

1.2.1 Aerial Imagery

Historic aerials, dating back to 1957, were used to better understand how development has taken place over time in the watershed. Although a lot has changed in Asheboro over the past 50 years, much of the development has consistently been concentrated along the city's major thoroughfares, Fayetteville Street (Bus 220), Salisbury Street, and Highway 64. Development was fairly stagnant from 1957 through much of the 1960s. New residential housing was developed during this time, as well as the Asheboro WWTP, which was built in 1962. However, development did not really take off until the 1980s and 1990s, after the North Carolina Zoo was established in 1974. This growth was particularly evident in the northwest portion of the watershed, where much of Asheboro's industrial base is located. During this time, several manufacturing companies opened facilities in Asheboro, including Malt-O-Meal Cereals, the nation's largest family owned cereal manufacturer. During the 2000s, Asheboro, like many cities in the Piedmont, experienced an economic downturn due to a decline in textiles amid increasing competition from overseas. Since that time, development has begun to pick back up in Asheboro. Malt-O-Meal expanded their facility in 2012 and multiple businesses and residential developments have been built.

1.2.2 Land Cover

A majority of the Haskett Creek watershed is considered developed (57.9%), which includes developed open space (26.7%), low intensity development (18.8%), medium intensity development (7.9%), and high intensity development (4.5%). Developed land is mostly concentrated in the commercial and industrial centers and along major thoroughfares.

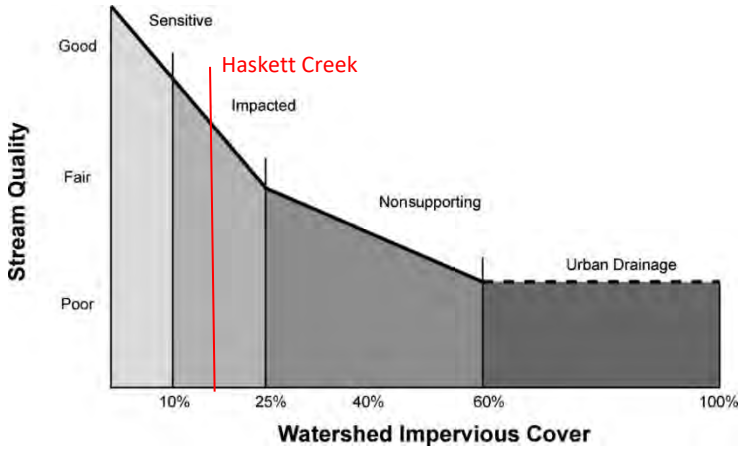
Forests are the second most common land cover type (34.3%) in the watershed and are primarily concentrated in the middle part of the watershed and in the northeast. The distribution of developed land and forest cover has stayed fairly consistent, only changing by about 1.5% over the past 15 years.

Table 2: Land Cover Change Between 2001-2016 in the Haskett Creek Watershed

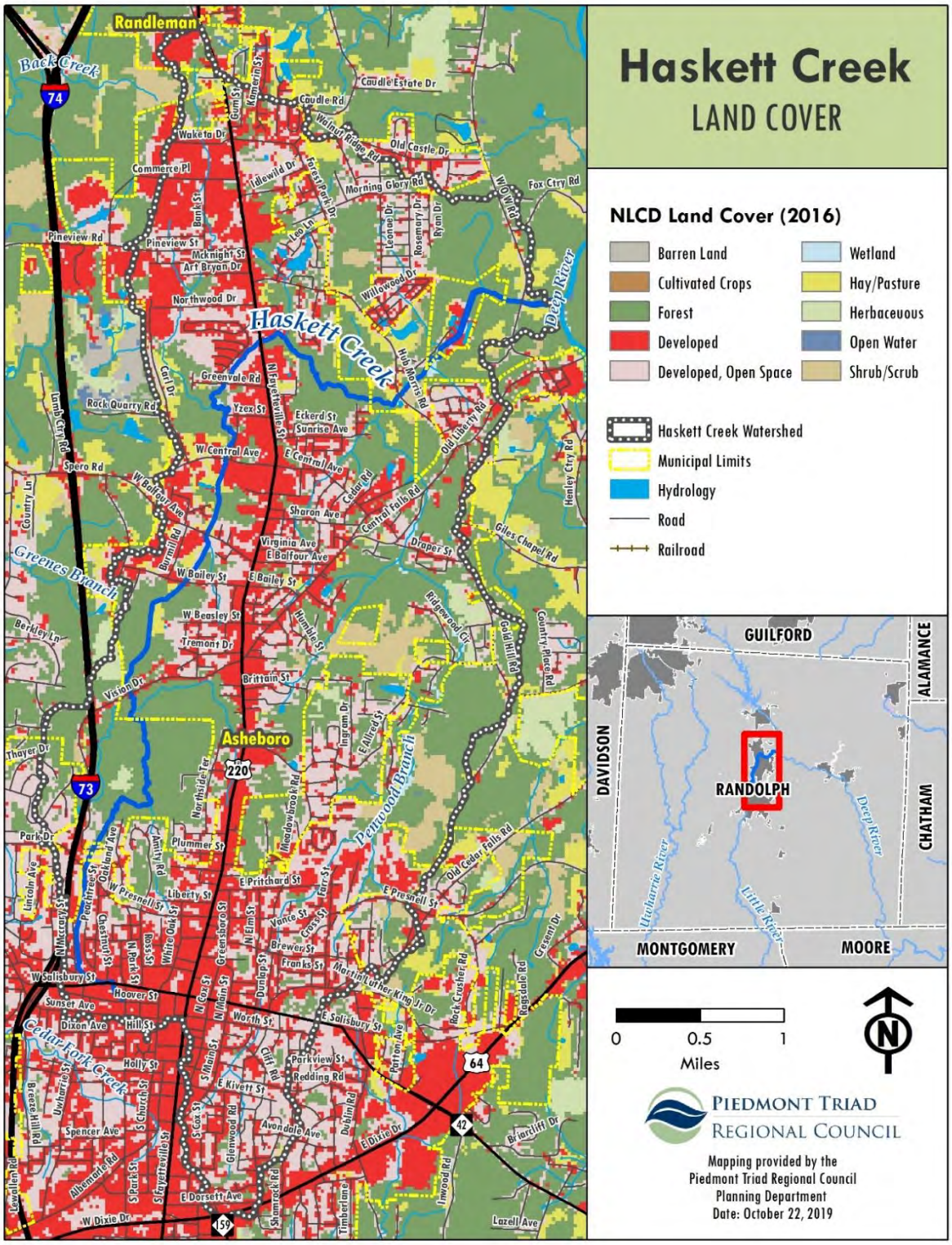
Land Cover	2001	2006	2011	2016	Change
Open Water	0.1%	0.1%	0.1%	0.1%	0.0%
Developed	56.1%	56.3%	58.2%	57.9%	1.8%
Forest	35.8%	35.4%	32.2%	34.3%	-1.5%
Herbaceous	0.8%	1.2%	3.0%	1.0%	0.2%
Shrub/Scrub	1.4%	1.3%	2.0%	2.8%	1.4%
Hay/Pasture	5.5%	5.3%	4.1%	3.5%	-1.9%
Wetlands	0.4%	0.4%	0.4%	0.3%	-0.1%

Impervious surfaces such as roads, parking lots, and roofs make up 17% of the watershed, which prevents water from soaking into the ground. Instead, water remains on the surface when it rains, resulting in a significant increase in the volume of stormwater that runs off the land. This can cause additional flooding, erosion, higher stream temperatures, and transport pollutants that can affect aquatic species. According to research from the Center for Watershed Protection, streams can be negatively impacted when impervious surfaces exceed just 10% of a watershed, and streams in watersheds where impervious surfaces cover 25% of the watershed area typically cannot support aquatic life. These ecological impacts can be offset by increasing greenspace, encouraging infill and low impact development, and through the use of stormwater control measures.

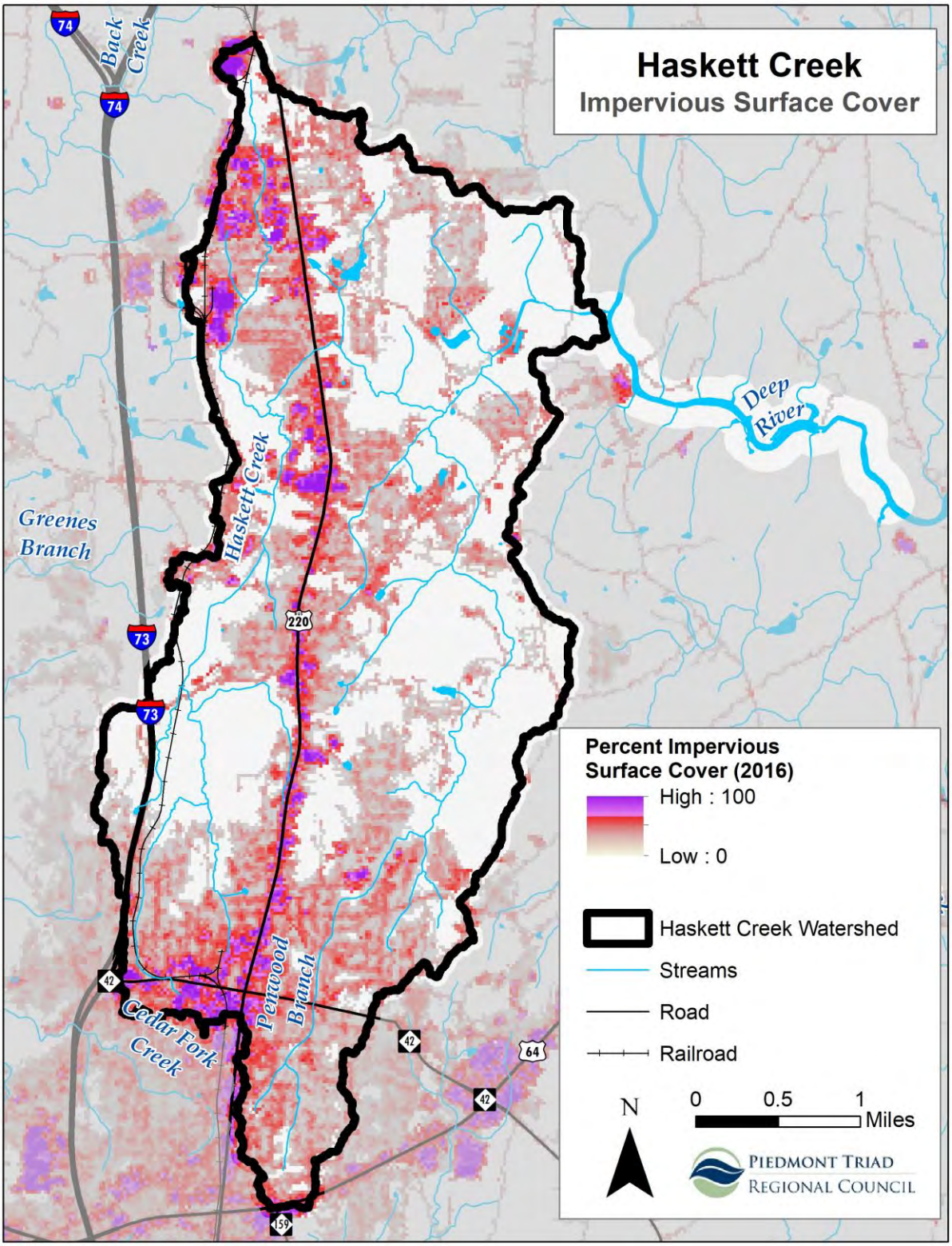
Figure 2: Impacts of Impervious Cover on Stream Quality



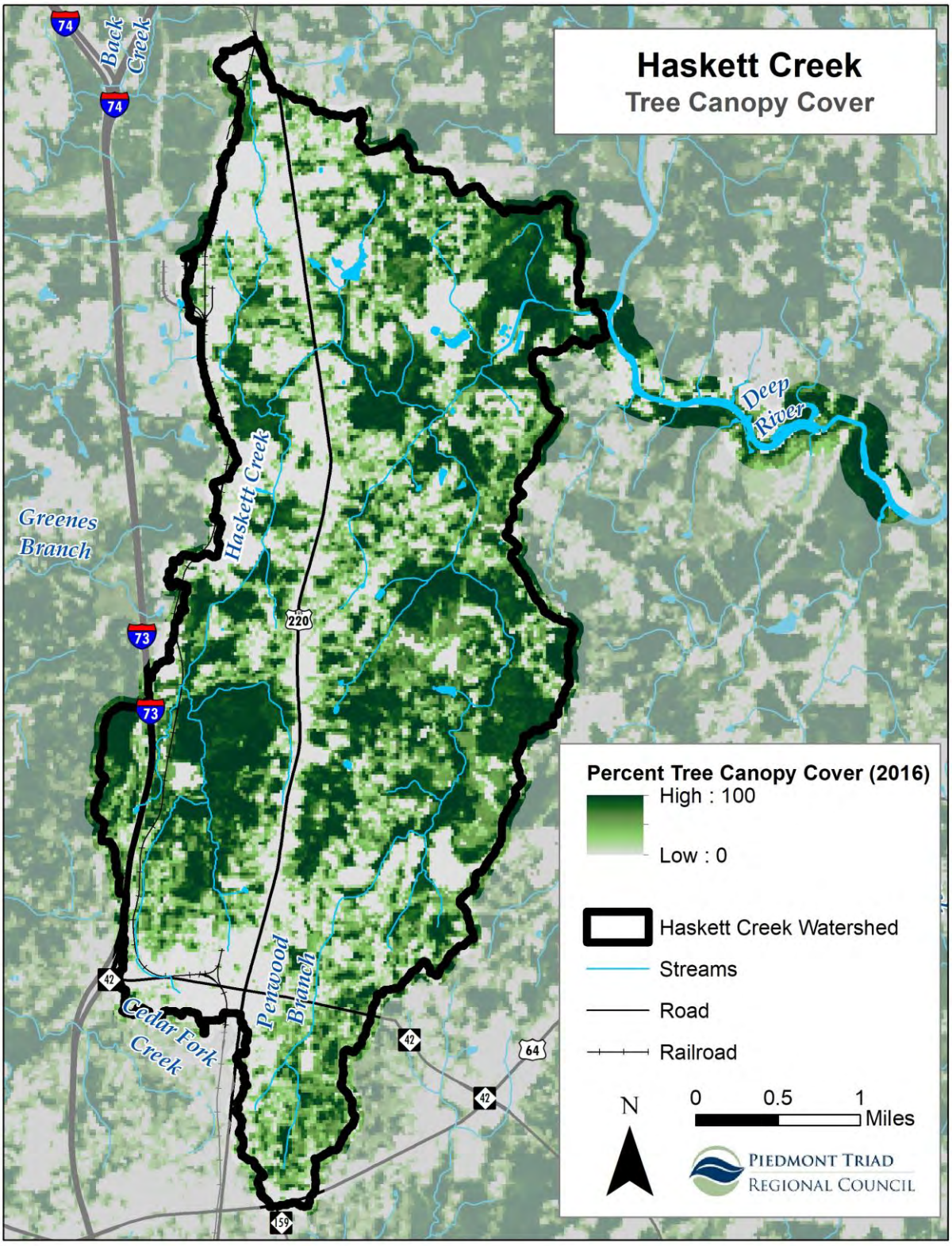
Map 5: Land Cover Map



Map 6: Impervious Cover Map



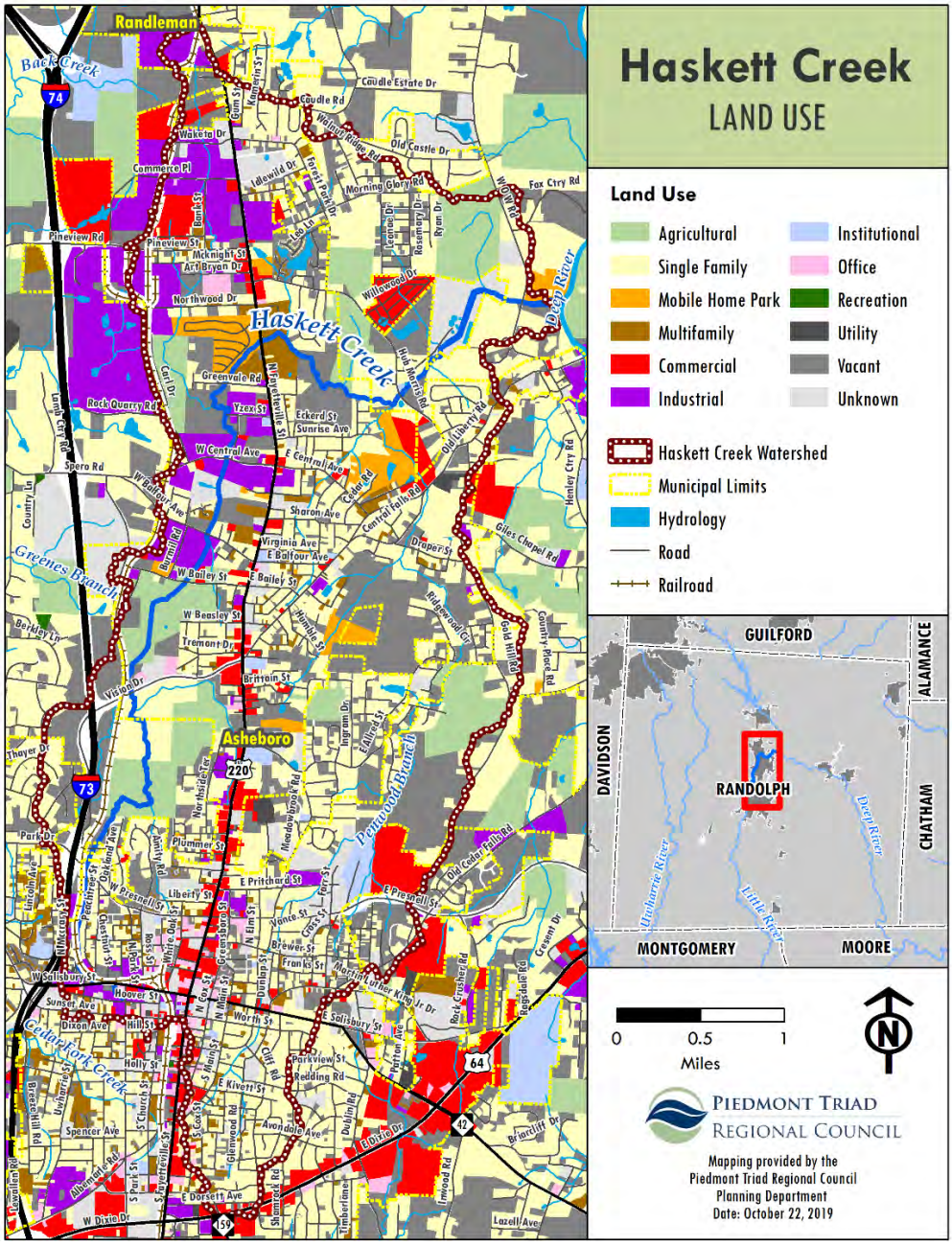
Map 7: Tree Canopy Cover Map



1.2.3 Land Use

Land uses in the Haskett Creek watershed include urban commercial, industrial, and residential areas, mixed with forests and some agriculture. Commercial uses are located along major thoroughfares and intersections, while industrial uses are primarily concentrated in the northwestern corner of the watershed. Single family housing is the most dominant housing type, however, there are a few multifamily and mobile home parks within the watershed. There are just a few agricultural properties in the watershed, which are mostly adjacent to Haskett Creek in the southwest and northeast part of the watershed.

Map 8: Land Use Map



1.3 REGULATORY LANDSCAPE

There are a number of federal, state, and local regulations that need to be considered when developing a watershed management plan for Haskett Creek, including the Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES) program, and local zoning, development, and watershed protection ordinances. These regulations work together to protect water quality and influence watershed management activities.

1.3.1 Federal & State

The Clean Water Act is the primary federal law in the United States governing water pollution. Through the CWA, the EPA establishes water quality standards and pollution control programs to protect surface waters for drinking, fishing and recreation. Every two years, states are required by Section 303(d) of the federal Clean Water Act to list and report those streams, rivers and other bodies of water that do not meet water quality standards. If monitoring and assessment data indicate that a waterbody or segment fails to meet one or more water quality standard and it is, therefore, placed on the 303(d) list, then the state is required to develop a TMDL, which determines the maximum amount of a pollutant that a body of water can withstand and still meet water quality standards. Haskett Creek and Penwood Branch are both listed on the 303(d) list, however, no TMDL has been developed yet.

In the event that a TMDL study has not yet been completed, it is possible to develop a watershed management plan that is comprehensive and can result in the waterbody being reclassified as Category 4b. Category 4b waters are those that are impaired but have pollution control measures in place to resolve the pollution problems and do not require a TMDL. The EPA reviews reclassification of waterbodies by state agencies on a case-by-case basis. State policies on the rationale to reclassify waterbodies are stringent to justify that pollution control requirements are capable of improving water quality in a reasonable amount of time. This report was prepared in conjunction with the NC Division of Water Resources to ensure that all requirements are met.

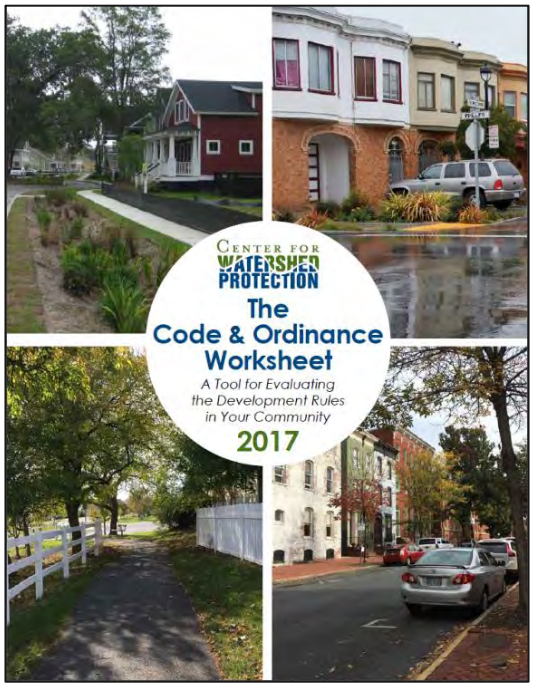
As part of the CWA, it is unlawful for anyone to discharge point source pollution into waterbodies without a permit under the NPDES program. Typical regulated point source dischargers include municipal wastewater treatment plants, industrial facilities, and Concentrated Animal Feeding Operations (CAFO). The intent of the permit is to quantify the amount of discharge than can occur without impairing water quality or human health. In North Carolina, the Division of Water Resources oversees NPDES permits. The Asheboro WWTP is the only permitted discharger within the Haskett Creek watershed.

The NPDES program also regulates stormwater from municipal separate storm sewer systems (MS4s), construction sites, and industrial sites. An MS4 is a public network of structures (including municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that conveys stormwater to a stream, lake, or other waterbody.

All cities or counties with MS4s in an urbanized area, as determined by the latest census, are required to obtain an NPDES MS4 permit. However, communities located outside of an urbanized area that have a population of at least 10,000 people may also be designated as an MS4 if the NC Division of Water Resources determines that stormwater discharges are causing significant water quality impacts. While certain portions of Randolph County fall under Phase II NPDES regulations, the City of Asheboro has not been designated as a Phase II community.

1.3.2 Local Ordinances

The Haskett Creek watershed is comprised of multiple jurisdictions, including the City of Asheboro, Randolph County, and the City of Randleman. Each jurisdiction has their own set of local ordinances to regulate development, land use, and natural resource protection. While there are slight differences between the jurisdictions, all three have fairly similar ordinances and policies in place. The City of Asheboro and Randleman each have a Zoning and Subdivision Ordinance that govern development and land use within city limits, a Flood Prevention Ordinance to limit development in the floodplain, and a Watershed Protection Ordinance, which limits certain land uses and built upon area in water supply watersheds. Similarly, Randolph County has a Unified Development Ordinance, which combines their Zoning, Subdivision, Flood Prevention, and Watershed Protection Ordinances in one document. All three jurisdictions also have Land Development or Growth Management Plans in place to guide long-term growth and development over the next several years. The City of Asheboro is currently in the process of updating their Land Development Plan for 2020-2040. Each jurisdiction should work to ensure that land development plans and regulations align with the watershed restoration goals outlined in this plan.



In order to better evaluate how well local ordinances currently protect natural resources and identify potential policy improvements, local ordinances were scored using the Center for Watershed Protection's *Code and Ordinance Worksheet* (COW). The COW is a set of questions and spreadsheet based tool that communities can use to systematically review local development regulations with the goal of reducing impervious cover, conserving natural areas, and preventing stormwater pollution. The Center for Watershed Protection recognizes that some of the COW questions are not relevant for certain types of communities, so there is a different set of questions for rural, suburban, urban, and highly urban areas.

Questions are categorized into four main topic areas: residential streets and parking lots, lot development, conservation and natural areas, and runoff reduction. For the purposes of this project, only the City of Asheboro and Randolph County's ordinances were scored using the COW, since the City of Randleman only makes up a small percentage of the watershed.

Based on the results of the Code and Ordinance Worksheet exercise, the City of Asheboro received 42.5 out of 126 points (34%), while Randolph County received 45 out of 111 points (41%). Combined, both jurisdictions achieved 87.5 out of a possible 237 points (37%). The Center for Watershed Protection generally recommends local governments to aim for a score of 80% or above, if possible. Both Asheboro and Randolph County have taken several initial steps to protect natural resources in their communities, but have room for improvement. This may reflect the fact that both communities do not fall under Phase II NPDES requirements or other state watershed management rules at this time. The Code and Ordinance Worksheet results are intended to provide a constructive assessment of the current development regulations and identify the top opportunities for improvement. Natural resources could be further protected by limiting impervious surface cover, conserving existing open space, and requiring stormwater control measures for new development over a certain size.

Table 3: Code and Ordinance Worksheet Results for Asheboro and Randolph County

			Asheboro		Randolph County	
	Category	Possible Points	Points Achieved	Percentage	Points Achieved	Percentage
Residential Streets and Parking Lots	Street Width	3|2	0	0%	0	0%
	Street Length	1|1	1	100%	1	100%
	Right-of-Way	3|2	2	67%	1	50%
	Cul-de-Sacs	5|5	0.5	10%	0	0%
	Vegetated Open Channels	2|1	1	50%	1	100%
	Parking Ratios	2|2	0	0%	0	0%
	Parking Codes	6|4	4	67%	0	0%
	Parking Lots	5|5	4	80%	2	40%
	Parking Lot Runoff	7|7	5	71%	0	0%
		34|29	17.5	51%	5	17%
Lot Development	Open Space Design	10|10	5	50%	9	90%
	Setbacks and Frontages	2|2	2	100%	2	100%
	Sidewalks	5|5	0	0%	0	0%
	Driveways	5|5	0	0%	2	40%
	Open Space Management	9|9	3	33%	7	78%
	Rooftop Runoff	7|0	1	14%	NA	NA
		38|31	11	29%	21	65%
Conservation and Natural Areas	Buffer Systems	9|9	5	56%	6	67%
	Buffer Management	5|5	1	20%	2	40%
	Clearing and Grading	5|5	1	20%	1	20%
	Tree Conservation	10|9	3	30%	2	22%
	Land Conservation Incentives	4|4	0	0%	4	100%
	Stormwater Outfalls	5|5	2	40%	2	40%
		38|37	12	32%	17	46%
Runoff Reduction	Stormwater Codes	8|8	2	25%	2	25%
	Installation and Maintenance of Practices	6|6	1	17%	1	17%
	Off-Site Compliance	2|0	0	0%	NA	NA
		16|14	3	19%	3	21%
	Total	**126|111**	**43.5**	**35%**	**45**	**41%**

2 Watershed Conditions

2.1 Water Quality

Haskett Creek and Penwood Branch are designated as class C waters. As defined by DWR, these are "waters protected for secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival, and maintenance of biological integrity, agriculture and other uses suitable. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized or incidental manner". Both streams are impaired from their source to the Deep River due to their inability to support aquatic life. The goal of this watershed plan is to improve water quality so that both streams can adequately support aquatic life and safely be used for recreation and fishing.

Table 4: Water Quality Impairments by Stream Segment

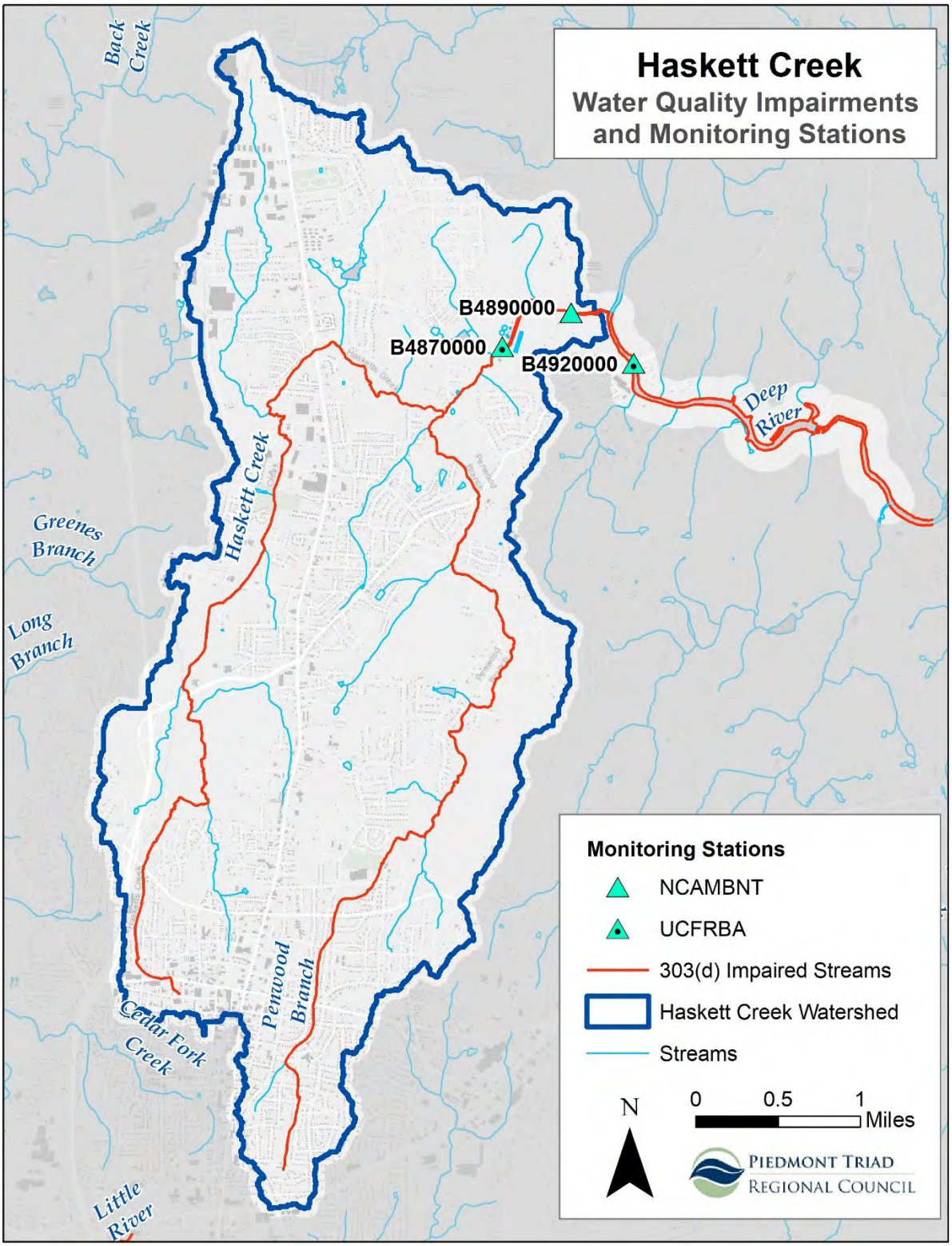
AU	Stream Name	Parameter	Category	Collection Year
17-12a	Haskett Creek (Source to SR 2149)	Benthos	4s	2003
17-12-1	Penwood Branch (Source to Haskett Creek)	Benthos	5	2003
17-12b1	Haskett Creek (SR 2149 to WWTP)	Benthos	5	2003
17-12b2	Haskett Creek (WWTP to Deep River)	Copper	5	2008
17-12b2	Haskett Creek (WWTP to Deep River)	Benthos	4s	2003

2.1.1 Monitoring Stations

There are three ambient monitoring stations near the project area. Two are located along Haskett Creek (above and below Asheboro's WWTP), while the third is located on the Deep River at Old Liberty Road near Central Falls. Station B4870000 and Station B4920000 are maintained by the Upper Cape Fear River Basin Association (UCFRBA). Asheboro is an active member of this association of local government and industrial dischargers who collectively monitor water quality in order to fulfill NPDES permit requirements. These two stations are monitored on a monthly basis for temperature, dissolved oxygen, pH, conductivity, turbidity, total suspended solids, and nutrients (nitrogen and phosphorus). Data from these stations is publicly available and can be accessed from www.capefearwq.com.

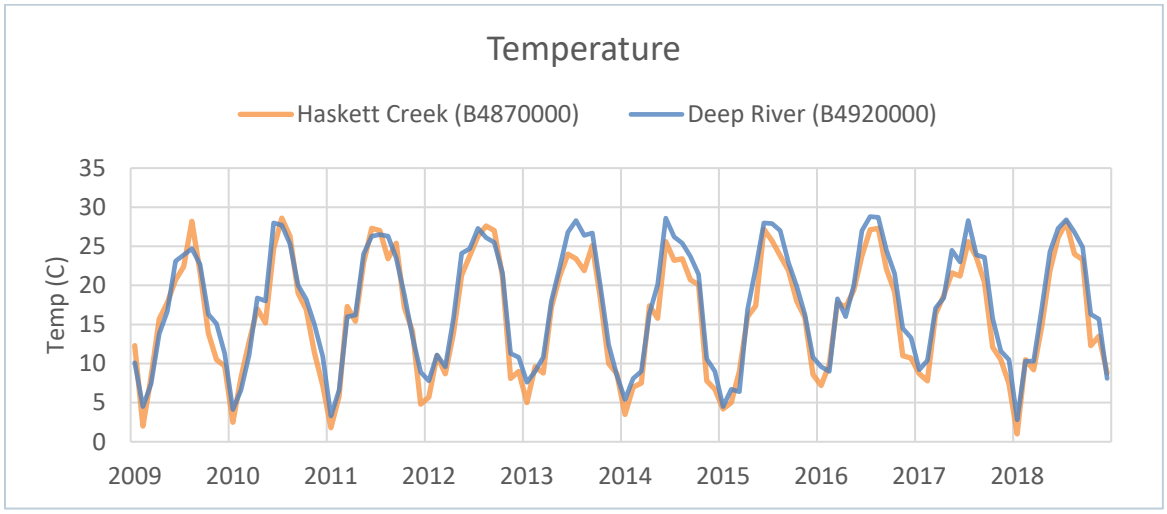
Station B4890000 is part of the NC DWR's Ambient Monitoring System (AMS), which is a network of stations established to provide site-specific, long-term water quality information on significant rivers, streams, and estuaries throughout the state. A basic core suite of indicators is measured at all AMS stations. These include water temperature, specific conductance, pH, turbidity, total suspended residue, DO, fecal coliform, and weather conditions. Additional indicators may be included depending on site-specific concerns such as stream classification, discharge types, and historical or suspected issues. All data collected as part of the AMS over the last 40+ years is readily available online from the U.S. EPA's Water Quality Portal. The warehouse currently contains over 5 million AMS results, and approximately 100,000 new records are added annually.

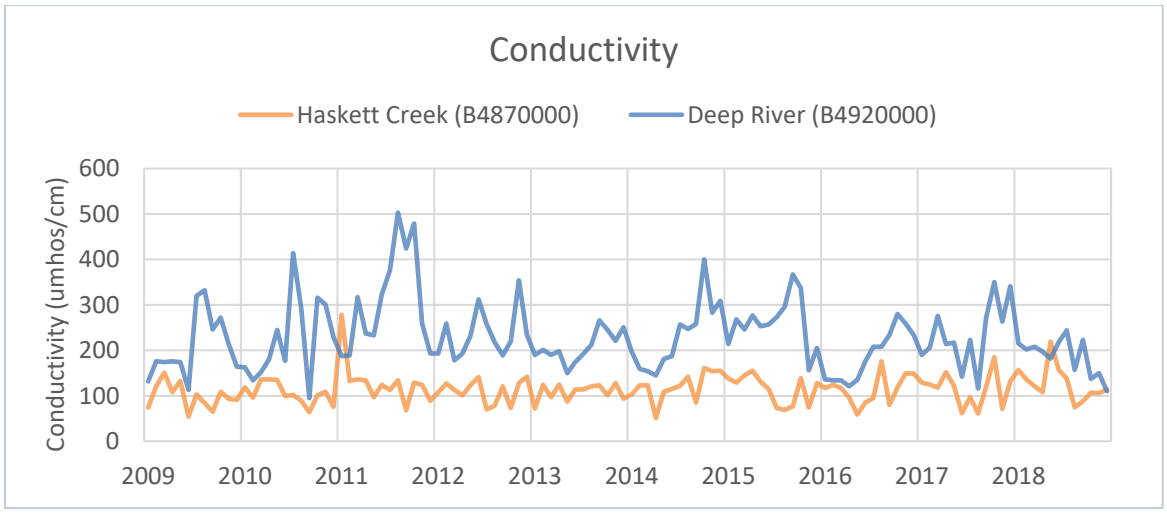
Map 9: Water Quality Impairments and Monitoring Stations Map



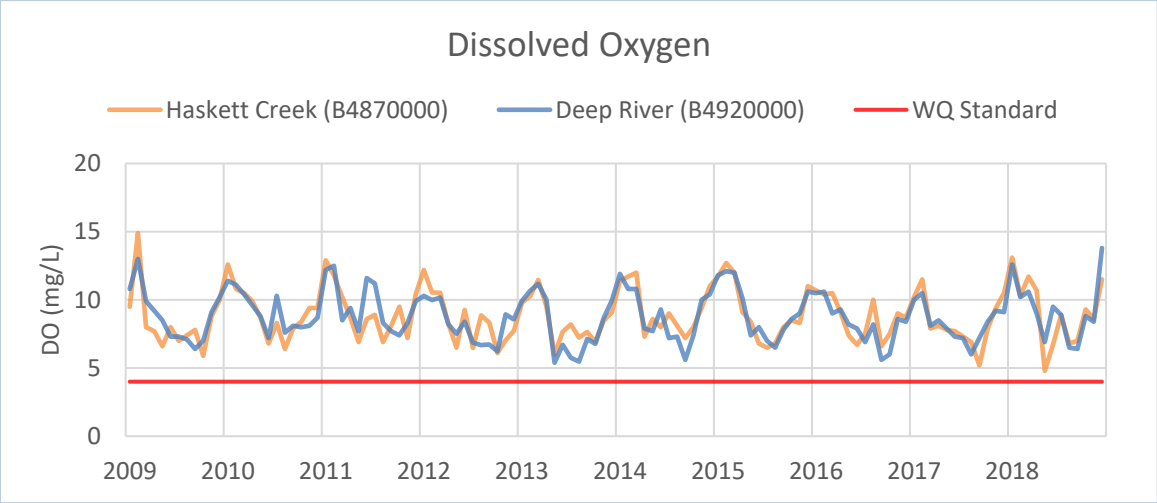
2.1.2 Water Quality Data

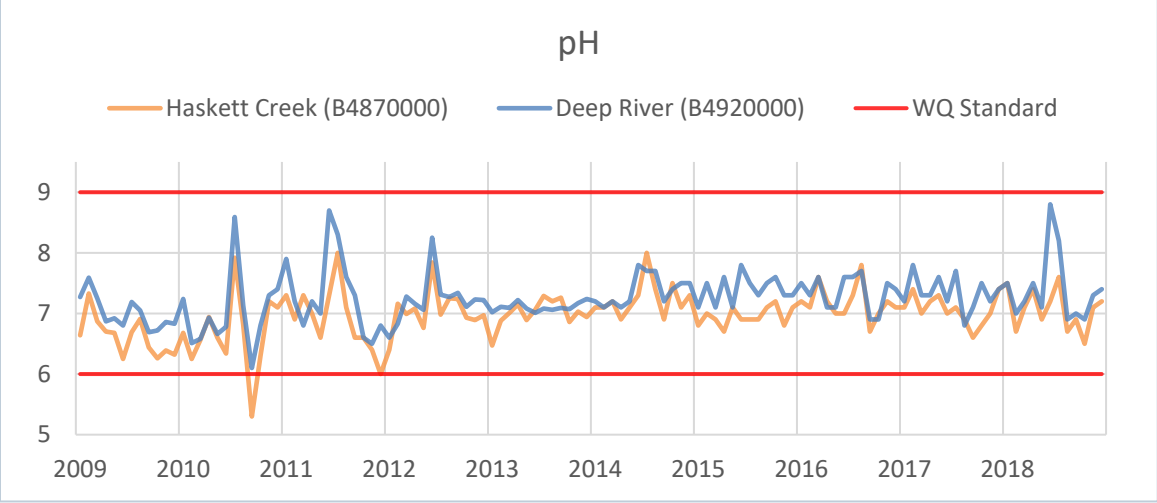
Chemical water quality data collected at stations B4870000 and B4920000 over the past 10 years was reviewed to evaluate current and historical water quality trends in Haskett Creek. These stations are located just above the Asheboro WWTP and along the Deep River at Old Liberty Road. Temperature readings within Haskett Creek showed little signs of concern, staying between 1 and 28 degrees Celsius with typical increases during the summer months. The highest reported temperature was 28.2°C, which is below the temperature criteria of 29° and 32°C for the upper and lower Piedmont. Temperature in streams is usually only a concern if there are rapid increases or decreases in temperature due to urban runoff, which more frequent sampling could help reveal. Conductivity in Haskett Creek during this time remained between 50 and 300 µS/cm. However, samples from the Deep River showed higher levels of conductivity, which could be caused by effluent from the Asheboro WWTP. There are currently no established thresholds for conductivity in NC. However, freshwater streams should ideally have a conductivity between 150 and 500 µS/cm to support diverse aquatic life.



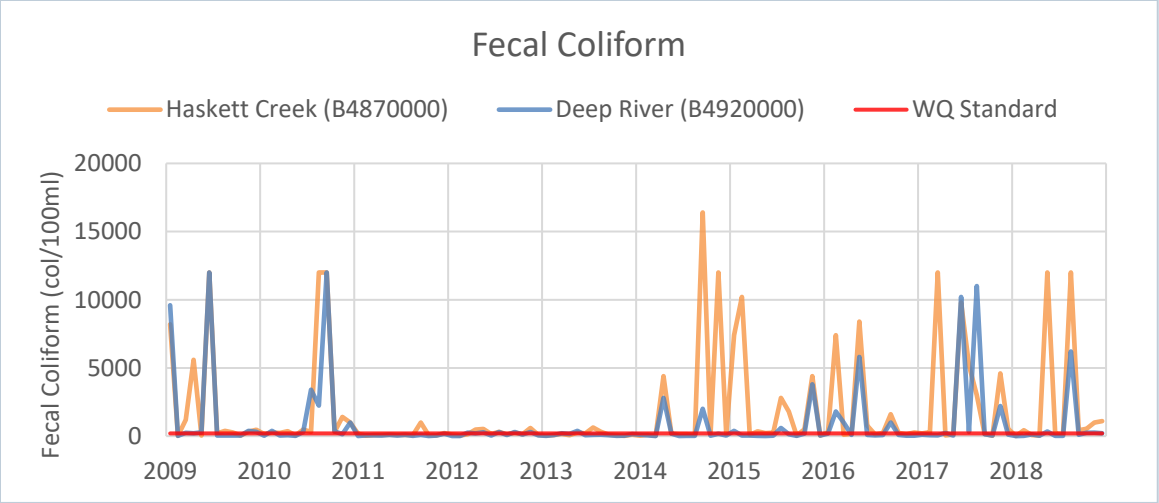


Haskett Creek has previously failed to meet water quality standards for dissolved oxygen (DO). However, only one sample in 2018 fell below the 5 mg/L threshold for healthy aquatic habitats, indicating that this is not a major concern above the Asheboro WWTP. Similarly, pH levels predominantly stayed well within NC DEQ's standards for freshwater pH, between 6 and 9, suggesting that acidity is not contributing to biological impairments.

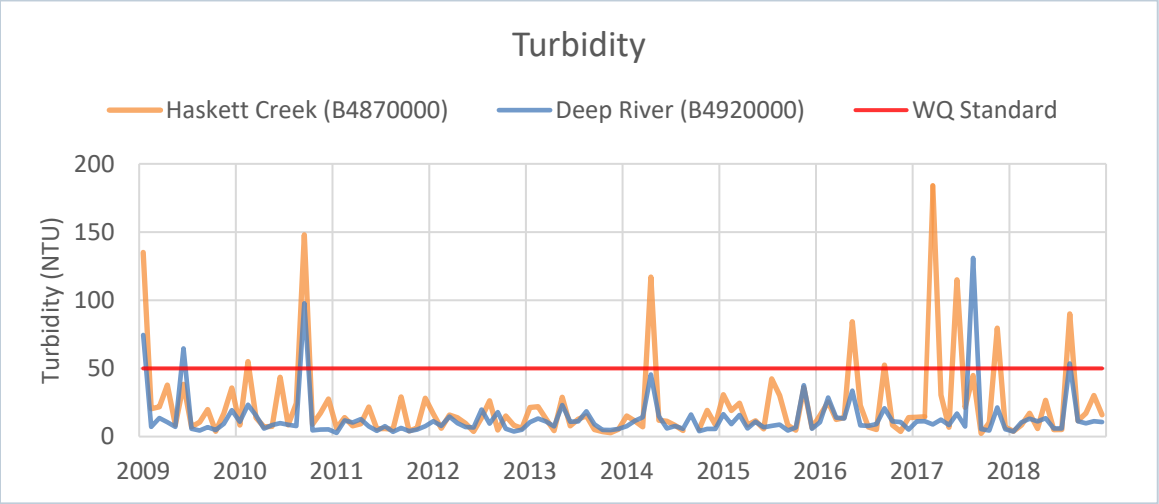


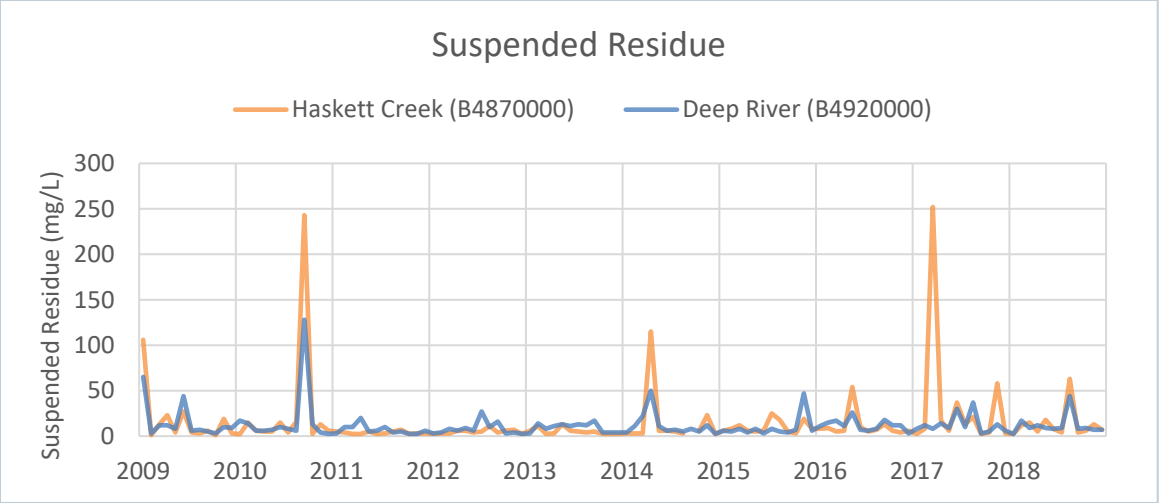


Fecal coliform is a form of bacteria that is present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals. While not all fecal coliform are pathogenic, some strains can cause serious health risks and are commonly found alongside other disease causing organisms. Fecal coliform is likely a parameter of concern in Haskett Creek, as 33% of the samples collected over the past 10 years have exceeded state water quality standards of 400/100ml. Since these samples were collected above the Asheboro WWTP, it is most likely that high fecal coliform concentrations are a result of stormwater runoff, pet or animal waste, or leaking sewage or septic systems.

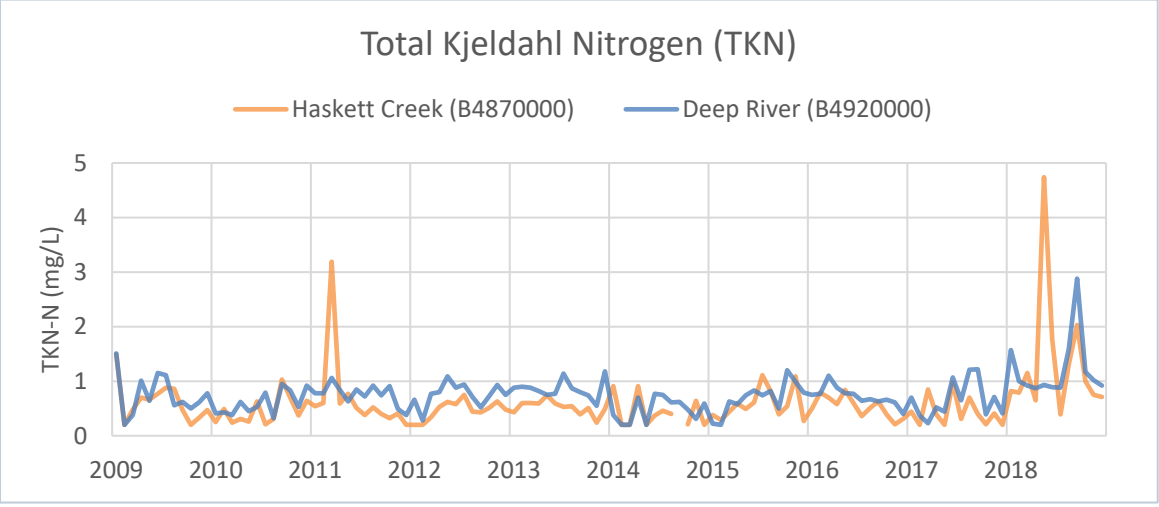


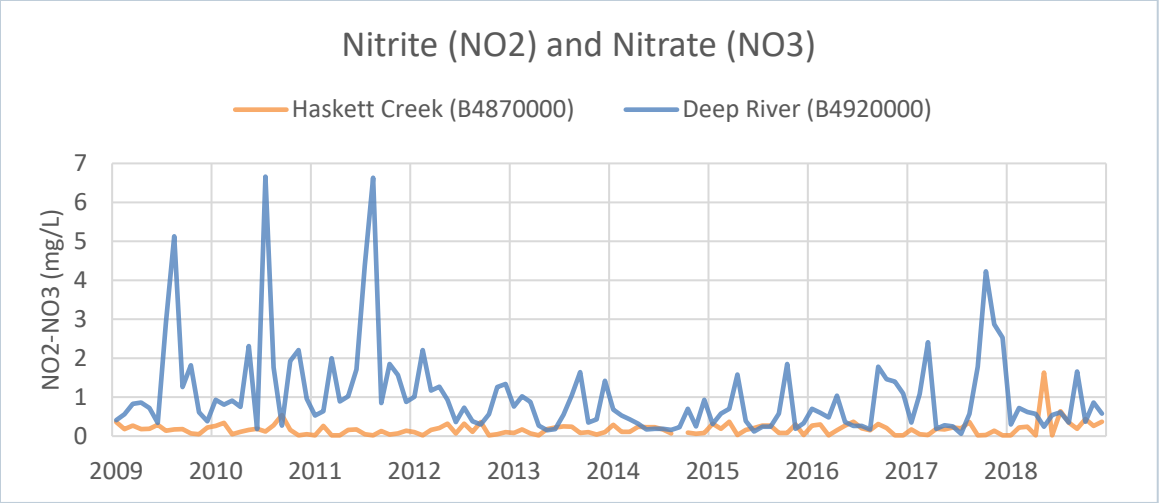
Another parameter of concern is Turbidity and Total Suspended Solids (TSS). Turbidity is an optical determination of water clarity, while suspended solids are particles that are larger than 2 microns that are found in the water column. Suspended solids and dissolved colored material reduce water clarity by creating an opaque, hazy or muddy appearance. This can kill algae which are a major food source for benthic macroinvertebrates. Excess silt, sediment, or sand can also smother benthic organisms and fish eggs. Out of the 132 turbidity samples collected in Haskett Creek over the past 10 years, 13 have exceeded state water quality standards of 50 Nephelometric Turbidity Units (NTU). These exceedances may be linked to larger storm events, as rainfall can increase stream volume and stream flow, which can resuspend settled sediments and erode riverbanks. Rain can also directly increase the level of total suspended solids through runoff.

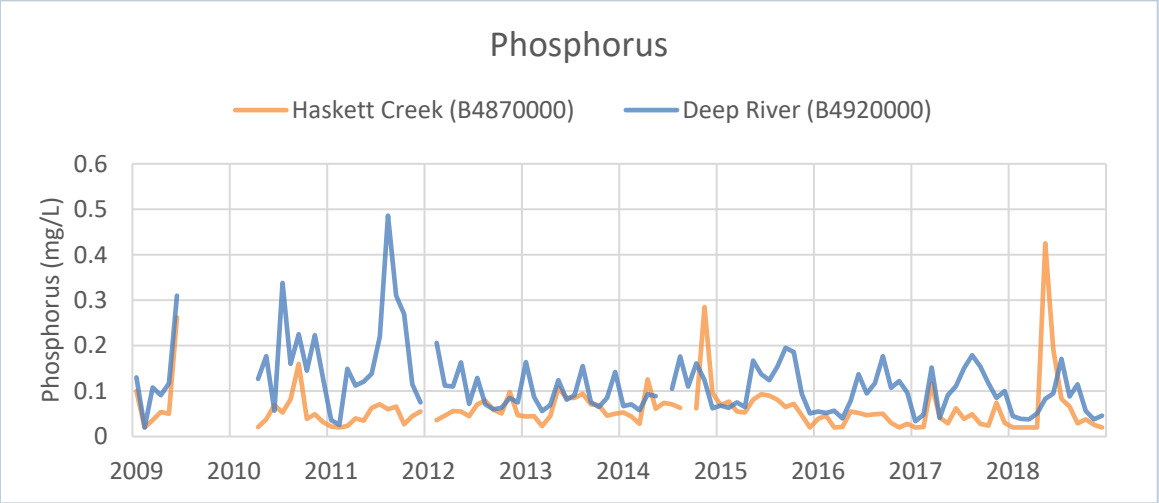




Nitrogen and phosphorus support the growth of algae and aquatic plants, which provide food and habitat for fish, shellfish and smaller organisms that live in water. However, too much nitrogen and phosphorus can cause algae to grow faster than ecosystems can handle. Significant increases in algae harm water quality, food resources and habitats, and decrease the oxygen that fish and other aquatic life need to survive. In general, nitrogen and phosphorus levels have remained fairly consistent in Haskett Creek, averaging around 0.59mg/L total kjeldahl nitrogen (TKN), 0.18mg/L nitrite (NO2) and nitrate (NO3), and 0.06 total phosphorus. There were only two noticeable spikes in TKN in 2011 and 2018, which were likely associated with large storm events and coincided with similar spikes in total phosphorus. There are currently no established thresholds for nutrients in NC, except for nitrates plus nitrites, which should not exceed levels of 10mg/L. All samples stayed well under this threshold.







Based on available water quality data, it is clear that stormwater runoff and other nonpoint sources of pollution are contributing to water quality impacts above the Asheboro WWTP. The two parameters of utmost concern are fecal coliform and turbidity, although high turbidity is likely leading to greater biological impacts. Potential sources of fecal coliform include stormwater runoff, pet or animal waste, or leaking sewage or septic systems, while high turbidity is most likely caused by stormwater runoff, soil erosion, and a lack of riparian vegetation.

Table 5: Summary Table of Water Quality Samples Collected at Station B4870000 (Haskett Creek) between 2009-2018

01/01/2009-12/31/2018 Summary Report

Station Id:	Haskett Crk at Asheboro WWTP Bridge nr Asheboro								
B4870000/UCFRBA_32			**Stream Class**	C				**Sub Basin**	CPF09
County	Randolph		**Latitude**	35.7647	**Longitude**	-79.7862		**HUC**	3030003

Parameter	Count	< DT	WQS	#Exceed	MIN	MAX	AVG	Median	Std Dev***
Temperature(C)	132	0	32	0	1	28.6	16.08	17.1	7.52
pH(su)	132	0	6~9	1	5.3	8	7	7	0.4
Diss. Oxy.(mg/L)	132	0	4	0	4.8	14.9	8.88	8.6	1.88
Conductivity(umhos/cm)	132	0	NA	0	51	278	114.82	117.5	32.76
Fecal Coliform(col/100ml)	132	0	400	44	9	16400	327.97*	220	3563.63
Lab Turbidity(NTU)	132	0	50	13	2.3	184	23.37	12.65	31.7
TSS(mg/L)	132	16	NA	0	1	252	15.11	6	34.78
NH3-N(mg/L)	132	97	NA	0	0.01	3.51	0.06	0.01	0.32
TKN-N(mg/L)	132	16	NA	0	0.1	4.74	0.59	0.51	0.54
NO2-NO3(mg/L)	132	10	NA	0	0.01	1.63	0.18	0.17	0.17
T. Phos.(mg/L)	122	9	NA	0	0.01	0.42	0.06	0.05	0.06
Total	1442			58					

(* Fecal Coliform Geomean)
(** The Aluminum standard comes from the EPA's 2006 recommended water quality criteria.)
(** Copper and Zinc and Iron are considered Action Levels and not NC state water quality standards.)
(*** Standard Deviation range of values is also affected by climate and storm events and etc.)

Table 6: Summary Table of Water Quality Samples Collected at Station B4920000 (Deep River) between 2009-2018

01/01/2009-12/31/2018 Summary Report

Station Id:	Deep Riv at SR 2261 Old Liberty Rd nr Central Falls								
B4920000/UCFRBA_35			**Stream Class**	C				**Sub Basin**	CPF09
County	Randolph		**Latitude**	35.7635	**Longitude**	-79.77213		**HUC**	3030003

Parameter	Count	< DT	WQS	#Exceed	MIN	MAX	AVG	Median	Std Dev***
Temperature(C)	187	0	32	0	2.8	29.9	19.6	21.5	7.35
pH(su)	187	0	6~9	0	6.1	8.8	7.3	7.2	0.44
Diss. Oxy.(mg/L)	187	0	4	0	5.39	13.8	8.48	8.2	1.73
Conductivity(umhos/cm)	187	0	NA	0	78	590	235.19	218	84.34
Fecal Coliform(col/100ml)	132	0	400	20	4	12000	120.31*	95	2246.44
Lab Turbidity(NTU)	132	0	50	5	2.7	131	13.38	9.05	16.7
TSS(mg/L)	132	7	NA	0	1.25	128	11.62	8	14.61
NH3-N(mg/L)	132	55	NA	0	0.01	0.31	0.06	0.03	0.06
TKN-N(mg/L)	132	3	NA	0	0.1	2.88	0.72	0.74	0.35
NO2-NO3(mg/L)	132	0	NA	0	0.06	6.66	0.98	0.63	1.1
T. Phos.(mg/L)	122	1	NA	0	0.01	0.49	0.11	0.1	0.07
Total	1662			25					

(* Fecal Coliform Geomean)
(** The Aluminum standard comes from the EPA's 2006 recommended water quality criteria.)
(** Copper and Zinc and Iron are considered Action Levels and not NC state water quality standards.)
(*** Standard Deviation range of values is also affected by climate and storm events and etc.)

2.1.3 Biological Assessment Ratings

Benthic (meaning "bottom-dwelling") macroinvertebrates (also known as benthos) are small aquatic bugs that can be seen without a microscope. They include dragonfly and stonefly larvae, snails, worms, and beetles, and are often found attached to rocks, vegetation, logs and sticks or burrowed in sand or sediment. Many benthic macroinvertebrates are not as mobile as fish and cannot move to avoid pollution. Therefore, the type and variety of benthos living in a stream are commonly used to indicate water quality conditions. Benthos are extremely diverse and have a wide range of sensitivity and responses to stressors such as metals, nutrients and sediments. They are also relatively easy to collect and identify which makes them attractive to agencies and organizations searching for a practical means of assessing water quality in streams.

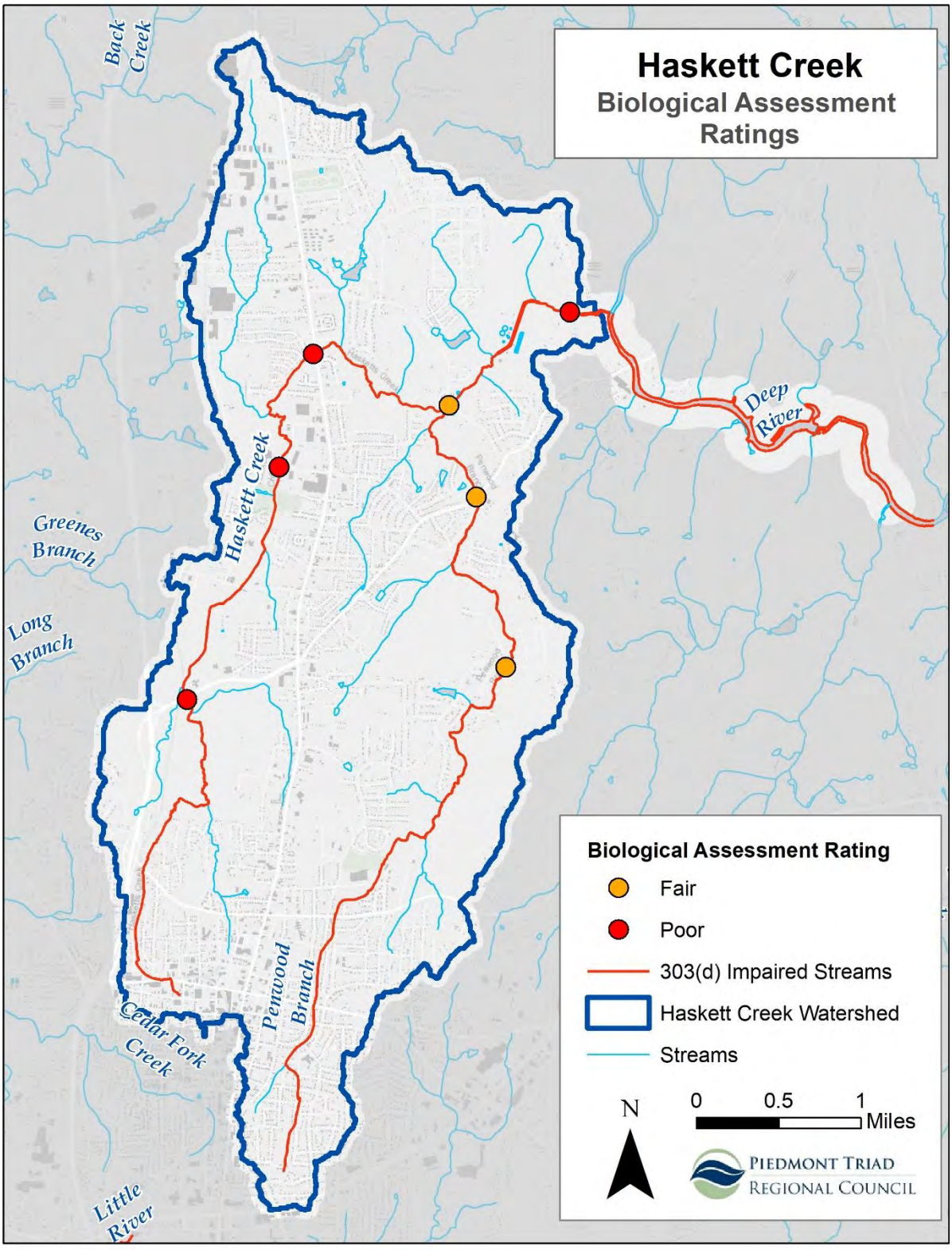
Generally, waterbodies that are healthy support a wide variety and high number of macroinvertebrate species, including many that are intolerant of pollution. Samples yielding only pollution–tolerant species or very little diversity or abundance may indicate a less healthy waterbody. Biological condition is the most comprehensive indicator of waterbody health. When the biology of a waterbody is healthy, the chemical and physical components of the waterbody are also typically in good condition. Factors that influence macroinvertebrate health typically include: temperature and seasons, dissolved oxygen, substrate composition, nutrients, pH (acidity), and a lack of riparian vegetation.

NC DWR's Biological Assessment Branch regularly conducts biological samples across the state to monitor water quality conditions. Each waterbody that is sampled is assigned a bioclassification rating of Excellent, Good, Good-Fair, Fair or Poor, depending on the amount and diversity of benthic species found. Waterbodies that have a Fair or Poor benthos community are considered impaired and are listed on the 303(d) list.

The most recent samples from Haskett Creek and Penwood Branch were collected in 2003 as part of a stressor study to determine sources of impairment. A total of eight sites were sampled in the watershed, including five Haskett Creek sites and two Penwood Branch sites. Two of the five sites along Haskett Creek received a Poor rating, and one site was rated Fair. The remaining two sites had drainage areas less than three square miles and were, therefore, considered Not Rated. However, the condition of the benthic communities at these sites were similarly Poor. Sites sampled along Penwood Branch received a Fair rating and had a slightly more diverse and robust community of species that are sensitive to pollution. Generally, the species found in Penwood Branch were similar to that found in Haskett Creek above the WWTP. Benthic macroinvertebrates were relatively scant and mostly tolerant species. This was consistent with historic samples, which had also resulted in Poor and Fair ratings.

Due to a lack of benthos found, the NC DWR was unable to determine a specific stressor. It was assumed that the two most likely contributors of stress to this system were water quantity (drought), especially in the upper portions of the watershed, and point-source discharge in the downstream portion. Water quality impacts from the Asheboro WWTP were indicated at that time by a decline in macroinvertebrates and high conductivity below the facility. Even though habitat scores were relatively high throughout the watershed, there was some evidence of habitat degradation, likely due to urban runoff. Segments of the stream exhibited eroding banks, altered hydrology, inadequate riparian areas, and channelization.

Map 10: Biological Assessment Ratings Map



2.2 SOURCE ASSESSMENT

2.2.1 Nonpoint Source Pollution

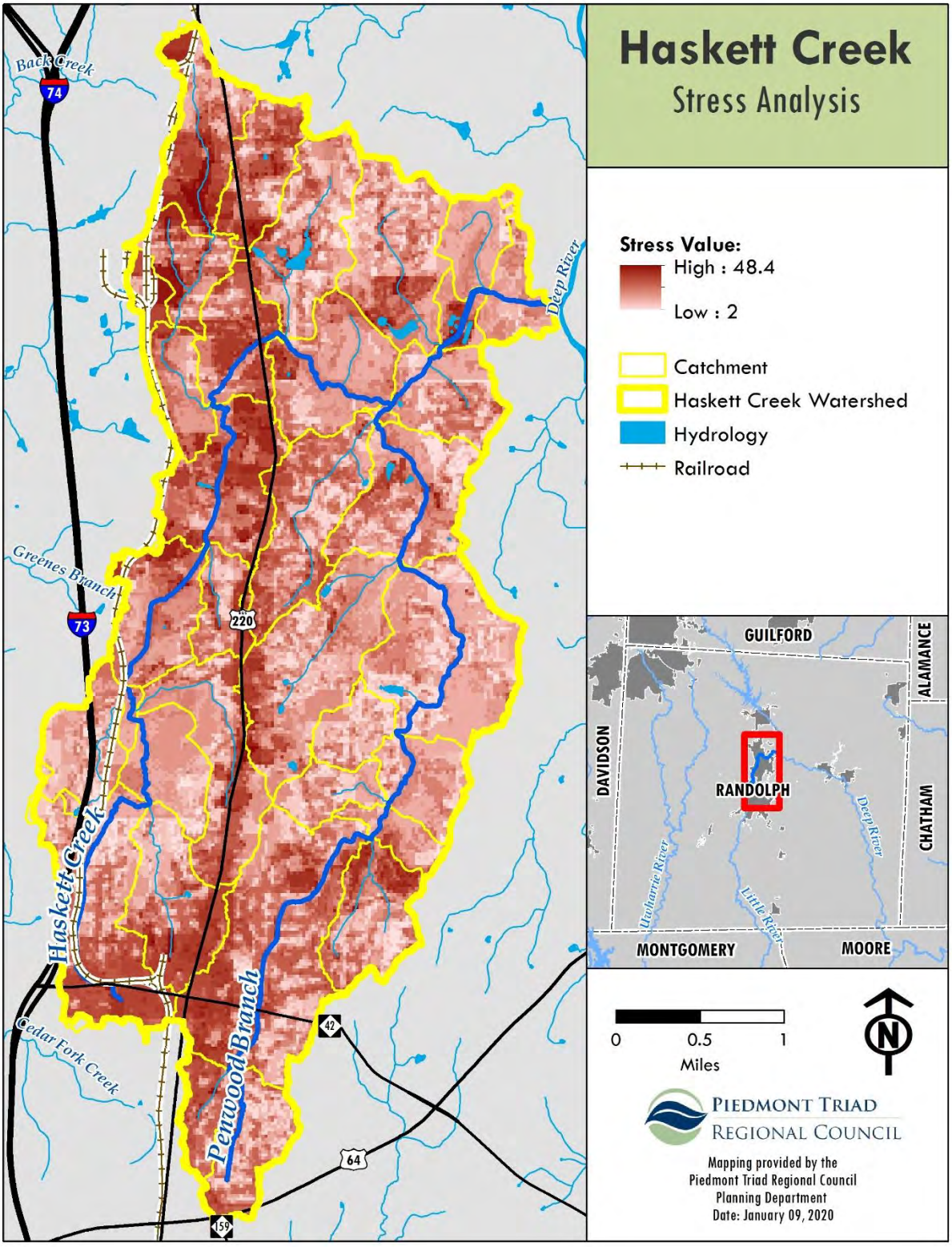
In order to determine where best to target and prioritize restoration efforts, the project team developed a watershed prioritization tool using GIS modeling technology. This model compares demographic, land use, and environmental characteristics in order to predict where water resources are under the greatest stress from non-point source pollution. In total, thirteen data layers were included within the model and overlaid, including impervious surface cover, stream buffers, parcel size, soil erodibility, hydric soils, tree canopy cover, impact sites, population density, steep slopes, publically owned lands, and zoning, streams and wetlands, and floodplain data. Individual catchments were then scored and ranked based on the combination of input data and environmental conditions. Catchments with higher concentrations of pollutant sources received a higher score and rank, while those in relatively pristine condition received lower scores and priority.

Table 7: Stress Model Layers and Weighting

Haskett Creek Stress Layers

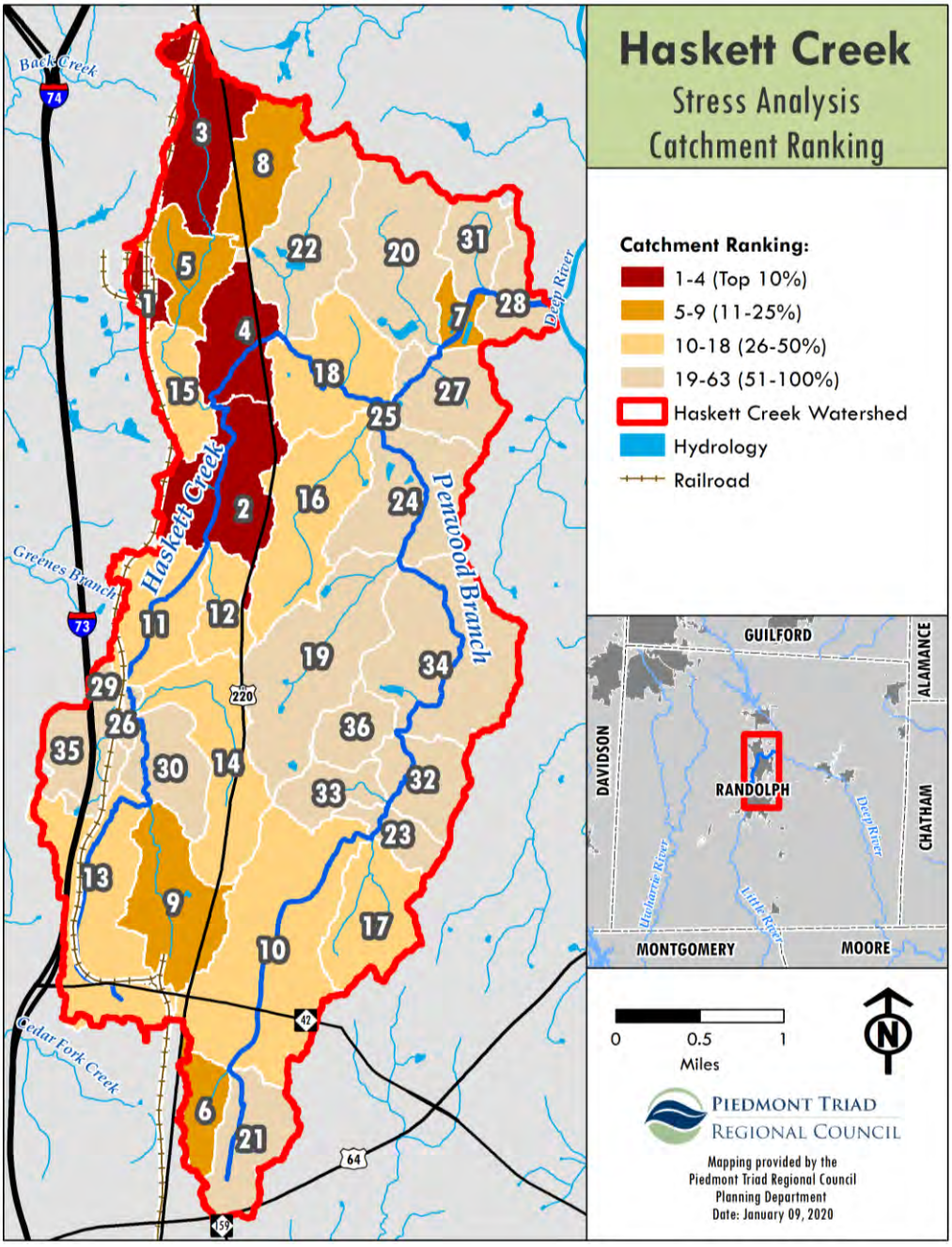
RANK	Criteria	Data Source	Factors	Value	Weight	Total Possible Points
1	High Impervious Surface Cover	NLCD 2016 Percent Developed Imperviousness	25% +	2	4	8
			10-24%	1		
2	Stream Buffer Analysis (100-Foot Buffer)	PTRC	5 - Absent	2	4	8
			4 - Degraded	1		
3	Large Parcel Size	County Data (Dissolved by owner name)	> 20 Acres	3	2	6
			10-19 Acres	2		
			5-9 Acres	1		
4	High Soil Erodibility	SSURGO (K factor)	0.40 - 0.49	2	3	6
			0.24 - 0.39	1		
5	Hydric Soils	SSURGO	All Hydric	2	3	6
			Partially Hydric	1		
6	Low Canopy Cover	NLCD 2016 Percent Canopy	< 50%	1	5.5	5.5
7	High Density of Impact Sites	NC DWQ (SWAP PCS)	High (3-6 per quarter square mile)	2	2.25	4.5
			Low (1-2 per quarter square mile)	1		
8	High Population Density (Persons Per Acre)	Census Bureau, 2010	High (3.0+)	3	1	3
			Med (1.0-2.9)	2		
			Low (0.1-0.9)	1		
9	Steep Slope	USGS NED (1 arc second)	> 15%	1	3	3
10	Publically Owned Lands	Tax Parcels	Public Parcel	2	1.3	2.6
11	High Impact Zoning	County Zoning Layer	Commercial, Industrial	2	1.2	2.4
			Institutional, Office, Multifamily	1		
12	Streams & Wetlands	NCDENR CPT	1 to 4 - CPT (Wetlands and streams)	1	1	1
13	Floodplain	NC Floodplain Mapping Program	Within 500 Year Floodplain	1	1	1
			Total Possible Points	24		**57**

Map 11: Stress Analysis Map



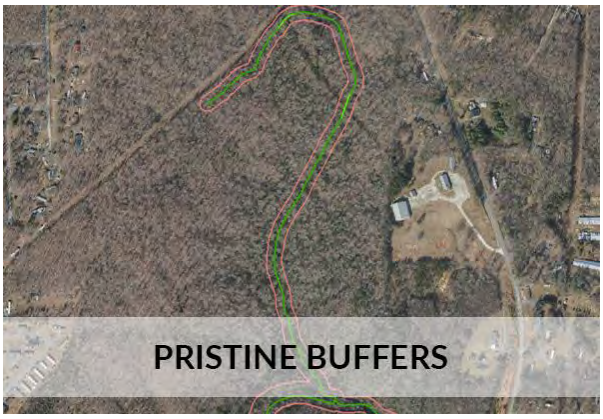
The top 10% of watersheds with the highest stress values are primarily located in the industrial district in the northeast part of the watershed. This reflects the high concentration of impervious surface cover and lack of riparian buffers in this area. However, other factors may be contributing to water quality impairments in these areas when examined in more detail at a local scale. Efforts to improve water quality conditions throughout the Haskett Creek watershed should prioritize watersheds with the highest stress values (see Map 12: Stress Analysis Catchment Ranking Map).

Map 12: Stress Analysis Catchment Ranking Map

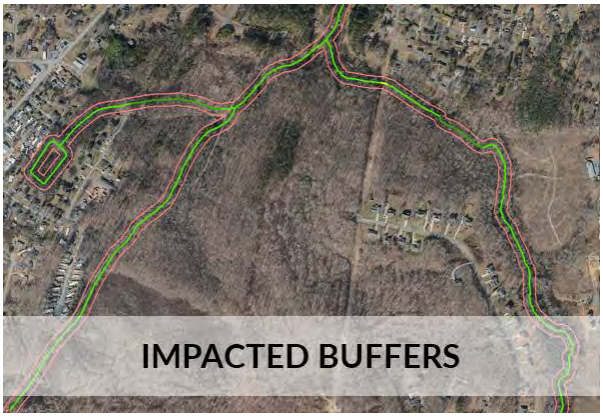


A riparian buffer is a vegetated area along a stream or other waterbody. These vegetated areas help shade and partially protect streams from the impact of adjacent land uses. Riparian buffers filter nutrients and other pollutants, lower water temperature, improve aquatic habitat, reduce flooding, stabilize streambanks, and enhance areas for recreation and wildlife. Riparian buffer conditions are often directly linked to the health of the waterway. Streams guarded by a forested riparian buffer run much cleaner and cooler and are more stable than streams without any kind of buffer. Over time, riparian buffers have proven to be one of the most efficient ways to improve water quality.

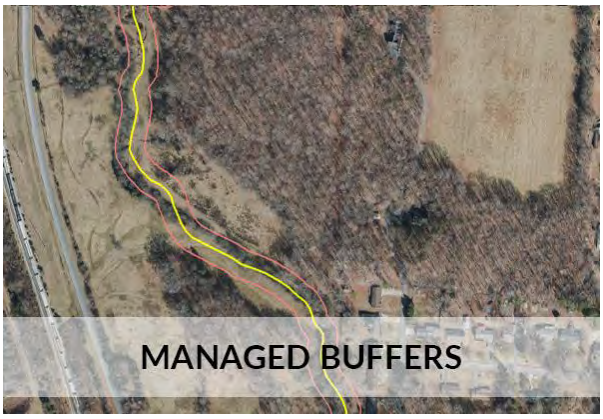
Riparian buffer conditions in the Haskett Creek watershed were evaluated using a combination of aerial imagery and tree canopy data from the National Land Cover Database (NLCD). Stream segments were classified as Pristine, Impacted, Managed, Degraded or Absent based on the level of vegetation present at each section. Based on the results of the riparian buffer assessment, only 20% of streams and tributaries in the watershed retain pristine riparian buffers, while 15% have degraded or absent buffers. This lack of riparian vegetation leads to greater impacts from stormwater runoff and contributes to aquatic habitat degradation.



1 | Pristine Buffers
The only streams that could qualify for this ranking are those that are completely untouched by present or recent human activity.

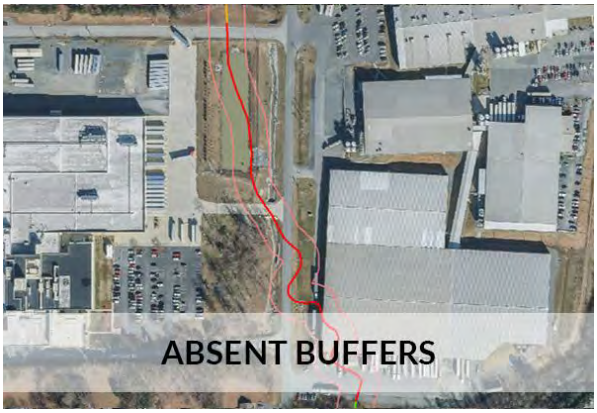


2 | Impacted Buffers
These streams have mild to moderate human activity, including small roads, utility rights of ways, single-family homes, and some farms.



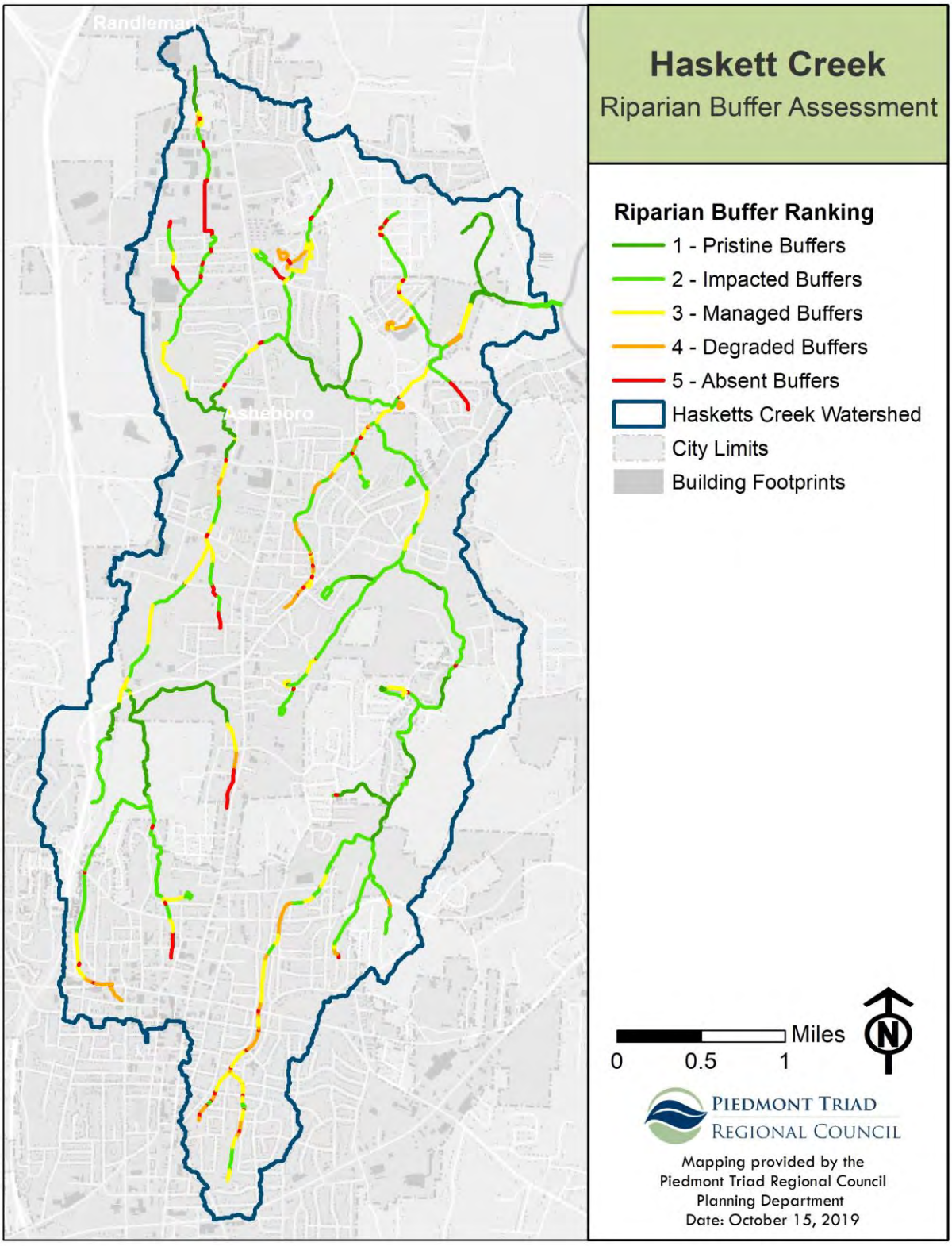
3 | Managed Buffers
These streams have human activity that is actively degrading the stream buffer on at least one side of the stream. The stream buffer must be consistently absent on one side of the stream – but not both – to qualify for this category.

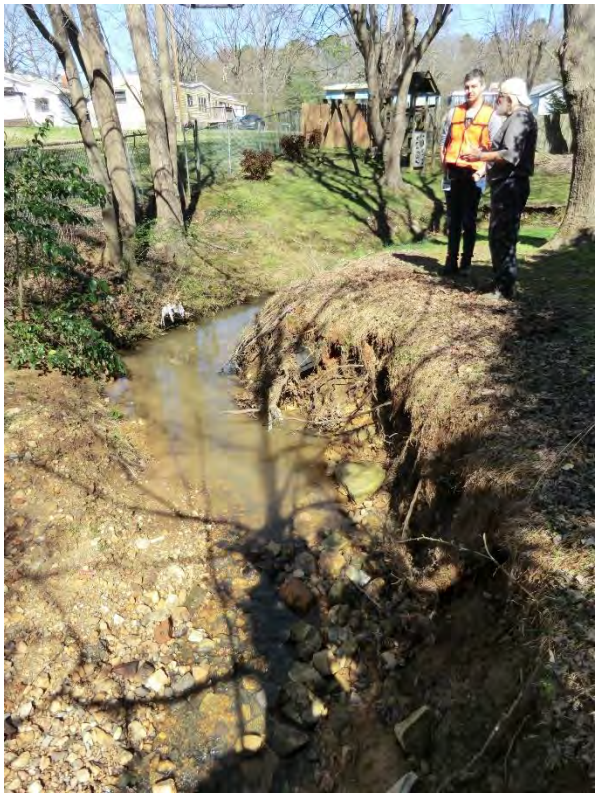
4 | Degraded Buffers
These streams have degraded buffers on both sides of the stream. There is very little healthy vegetation present for these streams.



5 | Absent Buffers
These streams have no vegetated buffer at all. Human activity has removed vegetation upon these streams either through agricultural practices, paving, or piping.

Map 13: Riparian Buffer Assessment Map





In order to ground truth results from the GIS model and riparian buffer assessment, the project team conducted two days of fieldwork in February 2020, targeting sites with absent or degraded buffers and near public land. Fieldwork also provided an opportunity to test watershed planning applications developed by the NC DWR and identify potential management measure projects. In total, the project team visited 19 locations throughout the watershed, collected 282 photographs, and identified 7 stormwater control measures and 14 stream buffer and restoration projects.

The Source and Conveyance Information Tracking System (SCITS) tool was used during fieldwork to map and document stormwater outfalls and sources of water leading into Haskett Creek, Penwood Branch, or their tributaries. This tool was developed by NC DWR to help local stakeholders more easily collect information on potential sources of water quality stressors. SCITS utilizes ESRI's Survey123 application, which can be accessed from any phone or tablet. Sources are mapped using GPS technology and tagged with a photo and description of the signal strength and surrounding land uses. In total, 47 outfalls were mapped using the SCITS tool (see Map 15: Source & Conveyance Identification (SCITS) Tool Map).

The four most prevalent issues that were discovered during fieldwork included: erosion, a lack of riparian buffers, channelization, and litter. Multiple stream segments throughout the Haskett Creek watershed have exposed stream banks that are eroding due to stormwater runoff and a lack of vegetation. In particular, there is a lack of woody vegetation to provide adequate buffers and shade. Stream channels have also been altered to protect property from erosion and accommodate roads and other development. This drastically alters the natural flow of the stream and destroys aquatic habitat. Despite these issues, there are also many healthy stream segments within the watershed.

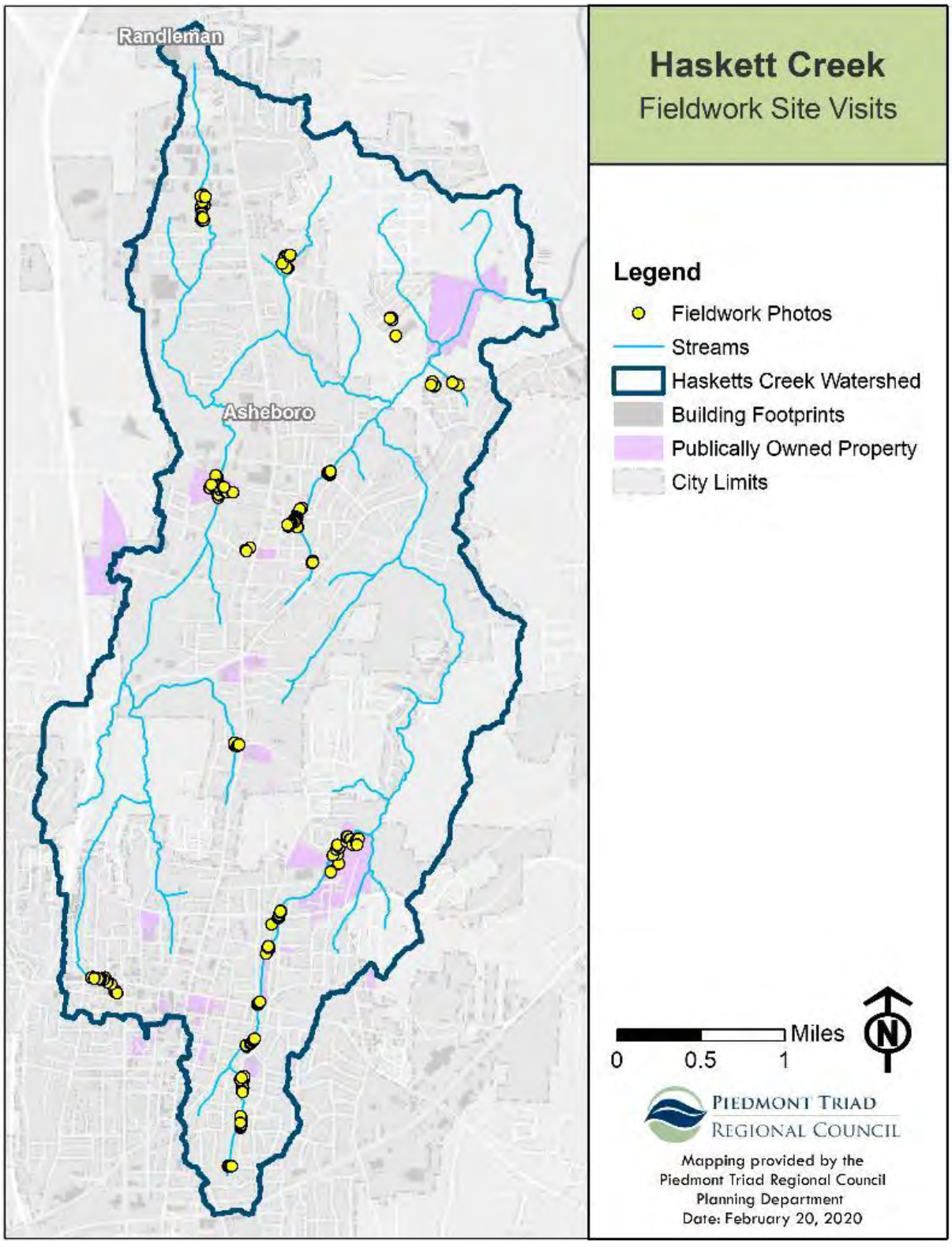
Erosion

Riparian Buffers

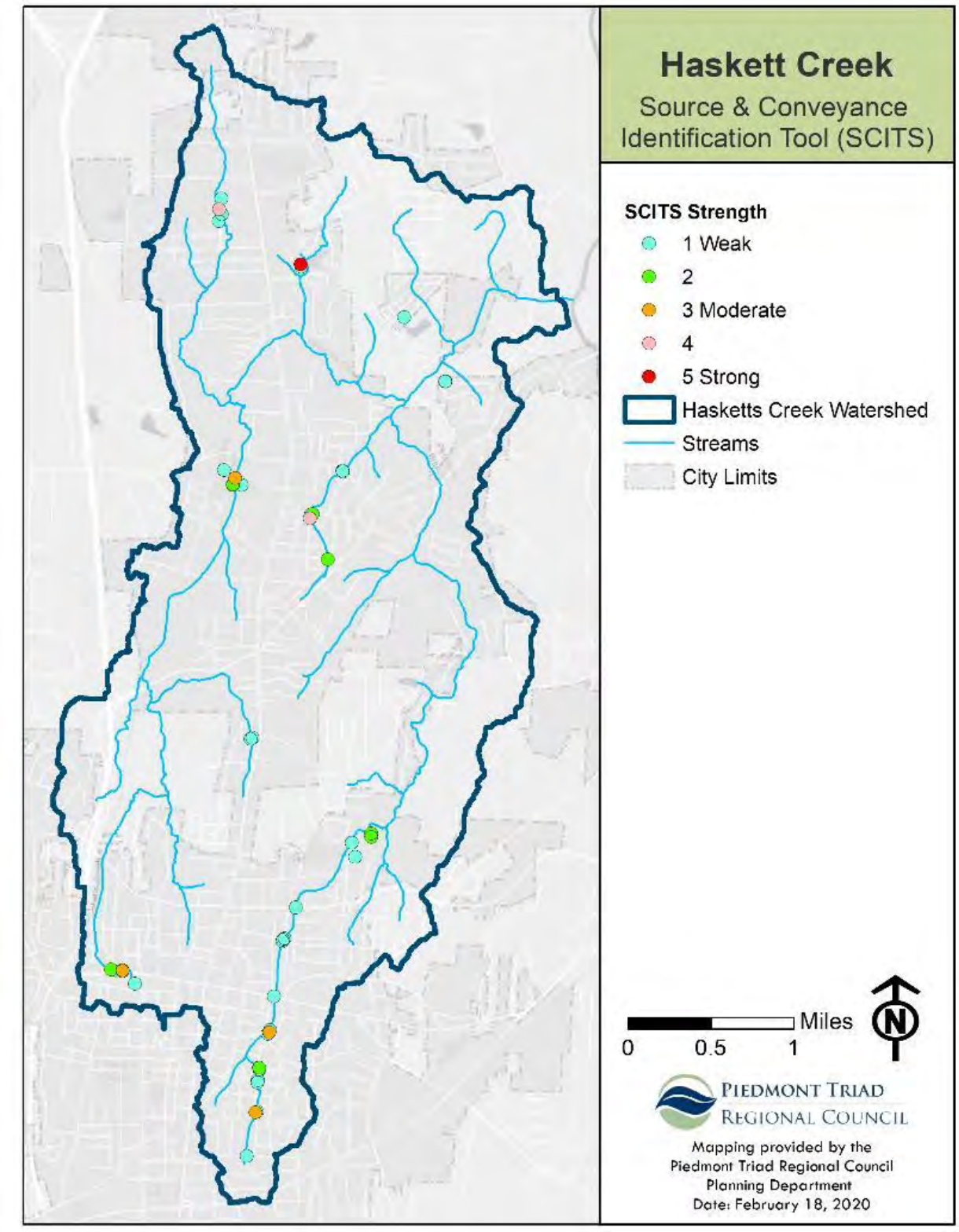
Channelization

Litter

Map 14: Fieldwork Site Visits Map



Map 15: Source & Conveyance Identification (SCITS) Tool Map



2.2.2 Point Source Pollution

There is only one permitted discharger within the Haskett Creek watershed. The City of Asheboro operates a 9.0 MGD (capacity) Trickling Filter / Nitrification Aeration type waste treatment facility at the terminus of Haskett's Creek, just before its confluence with the Deep River. This facility was originally built in 1962 and treats an average of 3.9 million gallons per day of wastewater. Staff at the treatment plant constantly monitor the system to ensure effective treatment. Even with some infrastructure that dates back more than 50 years, the Asheboro plant is on the leading edge of wastewater treatment.

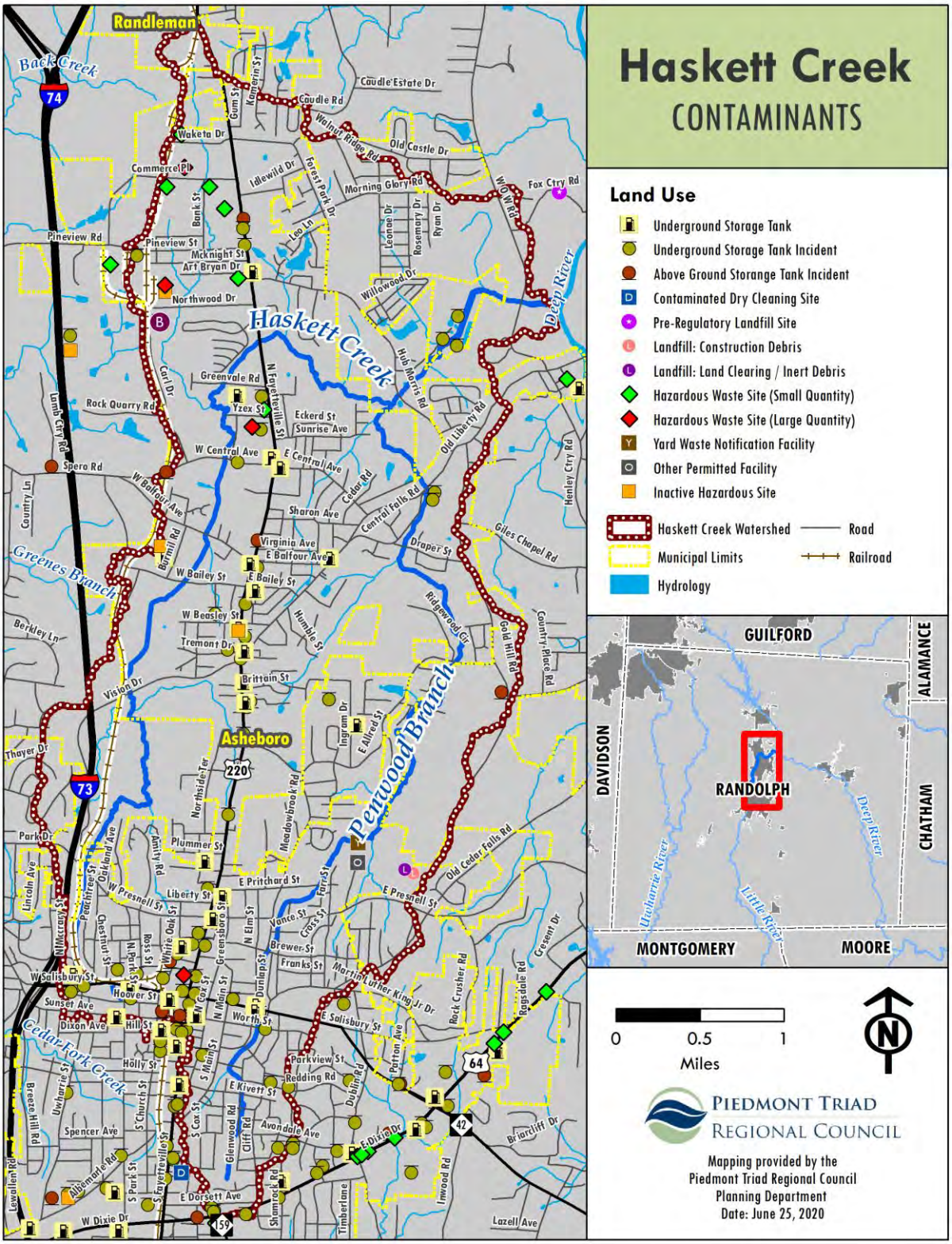
While point source pollution is not a major concern for the watershed, it is likely that this facility is contributing to some of the water quality impacts downstream. Water quality data collected below the wastewater facility typically shows higher levels of conductivity and copper than those collected above the plant. Biological assessment samples also indicated a noticeable decline of benthic macroinvertebrates below the WWTP.

The City of Asheboro is currently in the process of renewing their NPDES permit, which has been put on hold for several years as regulators decide how to best address an emerging contaminant called 1,4 dioxane. The City has plans to make upgrades to this facility within the next 10 years.

2.2.3 Additional Sources

Other potential sources of pollution within the watershed include waste management sites, such as underground and above ground petroleum storage tanks, active and inactive hazardous waste sites, and one landfill. According to data from the NC DEQ Division of Waste Management, these are primarily concentrated in downtown Asheboro, along Highway 220 and Salisbury St, and in the industrial district in the northwest part of the watershed. Hazardous waste sites must be properly managed to reduce any risks from stormwater runoff.

Map 16: Waste Management Sites Map

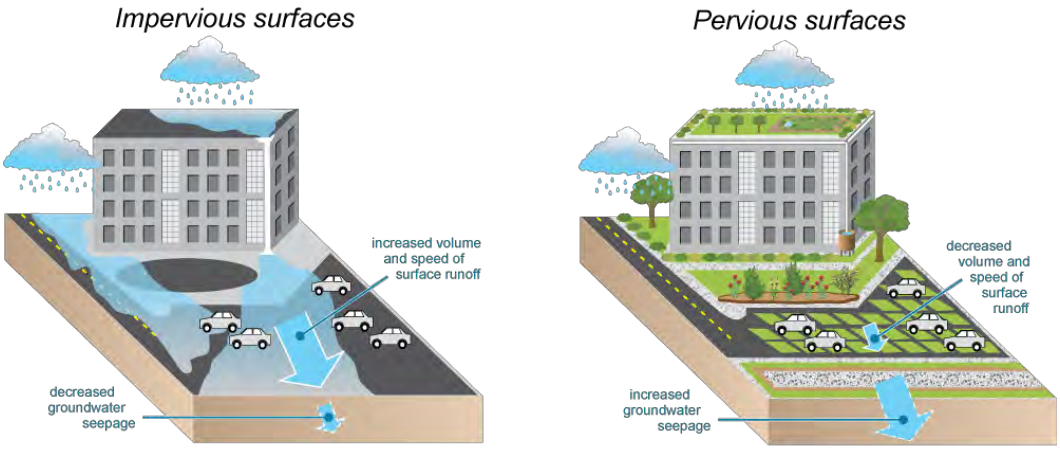


3 Stormwater Reduction

When rainwater is absorbed through the ground, bacteria and other pollutants are substantially filtered or eliminated through percolation. Conventional land use practices circumvent natural hydrologic processes. Stormwater runoff has increased as natural, vegetated environments have been developed, increasing the amount of impervious surface. Rainwater is transported rapidly over impervious surfaces through connected conveyance systems, including ditches, pipes, parking lots, and open grassy areas like yards that are circumventing natural hydrologic processes. This excess surface water from a rain event is known as stormwater. The result is that during and after storms, rainwater passes quickly over the landscape collecting bacteria, nutrients, chemical and physical pollution before flowing directly into nearby waterways. Polluted waterbodies negatively affect the environment, human health, and aquatic organisms. Restoration and management techniques that rely on stormwater reduction volume and that mimic or restore natural hydrology can reduce stormwater and pollutant loads.

Intensive land uses overwhelm the effectiveness of conventional stormwater treatment systems. Conventional methods rely on peak flow storage but do not mitigate pollution and cannot keep up with increased pressure from usage. As impervious surfaces and stormwater runoff increase, hydrology is altered and can lead to an increase in sedimentation and erosion, ecosystem degradation and loss of aquatic biodiversity, degradation of water quality, and increased flooding.

Rather than focusing on reducing sources of contamination or attempting to treat and remove bacteria and other pollutants from stormwater runoff, ***the management techniques used focus on reducing the overall volume of stormwater runoff to limit the conveyance from the land into surface waters***. Low impact development (LID) stormwater reduction practices can achieve this goal by replicating the natural hydrology and increasing infiltration of water into soils. LID practices are a form of land planning and engineering that primarily focus on mimicking natural hydrology of the area to limit stormwater runoff. These practices can help capture and treat stormwater onsite, reducing harmful pollutants that would otherwise have ended up in our waterways.



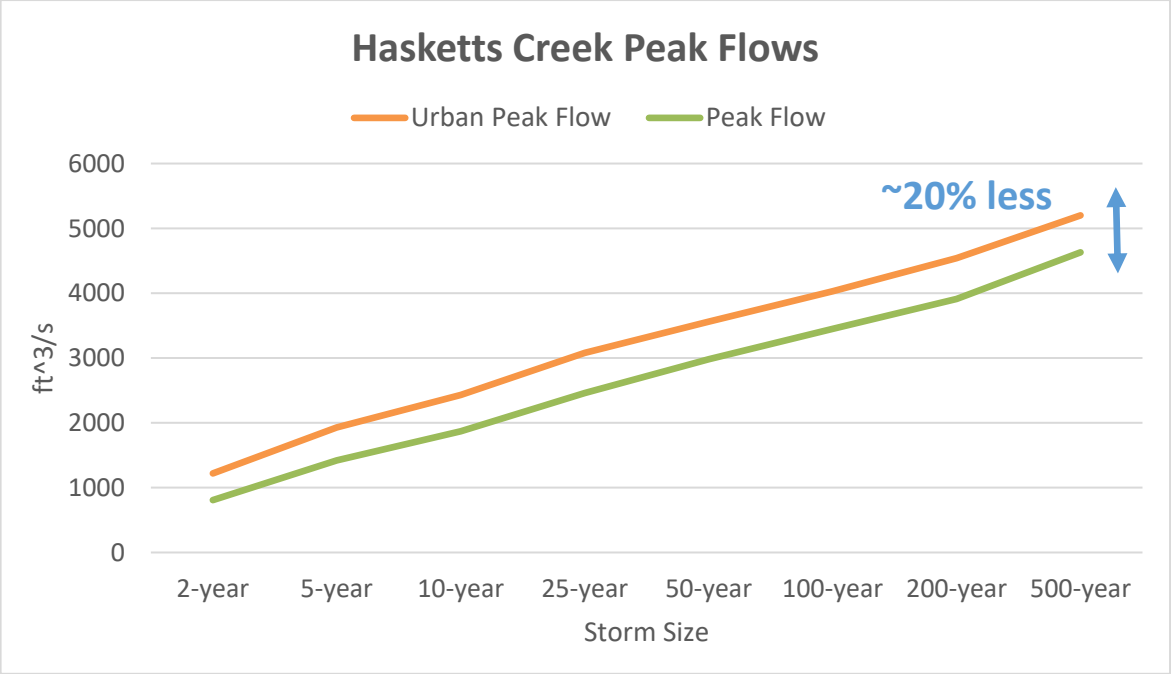
3.1 Calculation Method

In order to determine what level of stormwater load reductions are needed to improve water quality conditions in Haskett Creek and Penwood Branch, the project team used a tool called StreamStats, which was developed by the United States Geological Survey (USGS). StreamStats is a Web application that provides access to an assortment of Geographic Information Systems (GIS) analytical tools that are useful for water-resources planning and management, and for engineering and design purposes. The map-based user interface can be used to delineate drainage areas for user-selected sites on streams, and then get basin characteristics and estimates of flow statistics for the selected sites anywhere this functionality is available.

3.2 Runoff Reduction Load Calculations

StreamStats uses available land cover, soil, and precipitation data to predict peak stormwater flow and urban peak stormwater flow rates. These two rates were compared to determine how much more stormwater is being generated in urban areas. On average, urban peak stormwater flows are about 20% higher than average peak stormwater flows, which is primarily caused by the higher concentration of impervious surfaces in urban areas. Therefore, in order to address water quality concerns from stormwater runoff, it is recommended that local stakeholders reduce stormwater flows by at least 20%. The recommended management measures in this plan are intended to help meet this goal and are prioritized based on their ability to be implemented and reduce stormwater loads.

Figure 3: Urban vs. Non-Urban Peak Stormwater Flows in the Haskett Creek Watershed



4 Goals and Objectives

The ultimate goal of the *Haskett Creek Watershed Plan* is to meet water quality standards and improve aquatic habitat in Haskett Creek and Penwood Branch to support a wide range of benthic macroinvertebrates. The following section outlines the objectives and actions that will need to be taken to achieve this goal, as well as the timeframe, partners, resources, and evaluation criteria that are needed to accomplish each action and ensure the plan's success. Objectives and actions were identified by a team of local and regional stakeholders that will be responsible for the implementation of this plan, including the City of Asheboro, Randolph County, City of Randleman, Randolph County Cooperative Extension, Randolph County Soil & Water, Keep Randolph County Beautiful, Piedmont Land Conservancy, Piedmont Conservation Council, NC Wildlife Resources Commission, and NC Division of Water Resources. This chart should continue to be updated as the needs of the watershed change and action items are completed.

Primary Goal

Improve benthic community rating to good-fair or better in order to meet biological water quality standards

OBJECTIVES	
1	Reduce peak stormwater flows by at least 20%.
2	Protect and restore riparian buffers along creeks and tributaries.
3	Preserve existing open space to provide water quality benefits.
4	Continue and expand public outreach and education.

The implementation chart is organized as follows:

Timeframe – The period of time in which each task is to be completed. Actions are grouped into four categories, based on local priorities and feasibility: Ongoing (continuous), Short (1-3 years), Mid (3-5 years), or Long (5-10 years). Although this plan is meant to be a living document, a 10-year planning horizon was assumed for the purposes of implementation.

Partners – The organizations that are responsible for implementing each task. Organizations in **bold** have been assigned to lead this particular initiative.

Resources Needed – Assets that will need to be secured in order to complete each task. Resources are grouped into six main categories: Funding, Staff Capacity, Technical Assistance, Training, Public or Elected Official Support, and Educational Materials.

Evaluation Criteria – Specific indicators that will be used to track the progress and success of each action. It is recommended that local stakeholders regularly maintain this information using spreadsheets or other resources discussed in this plan.

Organization	Abbreviation
Asheboro/Randolph Chamber of Commerce	Commerce
City of Asheboro	Asheboro
City of Randleman	Randleman
Clean Water Management Trust Fund	CWMTF
Duke Energy	Duke
Keep Randolph County Beautiful	KRCB
Mountains-to-Sea Trail	MST
North Carolina Department of Transportation	NCDOT
North Carolina Division of Water Infrastructure	NCDWI
North Carolina Division of Water Resources	NCDWR
North Carolina Office of Recovery and Resiliency	NCORR
North Carolina Urban Forest Council	UFC
North Carolina Wildlife Resources Commission	WRC

Organization	Abbreviation
North Carolina Zoo	NC Zoo
Piedmont Conservation Council	PCC
Piedmont Land Conservancy	PLC
Piedmont Legacy Trails	PLT
Piedmont Natural Gas	PNG
Piedmont Triad Regional Council	PTRC
Piedmont Triad Rural Planning Organization	PTRPO
Randolph County	Randolph County
Randolph County Cooperative Extension	RCCE
Randolph County Soil & Water	RCSW
Stormwater SMART	SSMART
University of North Carolina School of Government	UNCSOG

4.1 OBJECTIVE 1: REDUCE STORMWATER RUNOFF

The primary cause of water quality impairments in Haskett Creek and Penwood Branch is stormwater runoff. Based on available data, peak stormwater flows need to be reduced by at least 20% in order to restore water quality conditions. Reducing stormwater runoff helps prevent erosion and the transport of pollutants and helps to maintain natural stream channel functions and habitat.

Objective 1: Reduce peak stormwater flows by at least 20%

Action #	Specific Action	Timeframe	Partners	Resources Needed	Evaluation Criteria
1-1	Implement identified stormwater control measure projects	Short-Mid	**Asheboro**, PART, Lindley Park Elementary, PTRC, RCSW, RCCE, NCDWR, CWMTF, engineering firms	Funding, technical assistance, & staff time	# of SCMs installed, stormwater reduced, water quality data, value added ($/ft/yr)
	Note: Utilize Project Atlas and WIPS tool. Apply for 319 or other grant funding to support.				
1-2	Identify additional stormwater retrofit opportunities on public properties	Short	**Asheboro**, Randolph County, Randleman, school system, RCSW, RCCE, KRCB, PTRC, engineering firms	Technical assistance & staff time	# of identified projects
	Note: Utilize SCM Suitability Model. Prioritize highly visible sites to promote education.				
1-3	Promote stormwater retrofits in future maintenance or redevelopment of publicly owned buildings, parks, parking lots and drainage systems	Ongoing	**Asheboro**, Randolph County, Randleman, RCSW, RCCE, WRC, PTRC, NCDWR, NCDWI, CWMTF, engineering firms	Staff time & training	# of SCMs installed, stormwater reduced, water quality data, value added ($/ft/yr)
	Note: Work with partners to provide trainings/information sessions.				
1-4	Develop street tree program and encourage stormwater reduction measures on City streets in future capital improvement projects	Mid	**Asheboro**, Randolph County, Randleman, RCSW, RCCE, PTRC, UFC, landscaping companies, nurseries	Funding, technical assistance, staff time, & training	# of street trees planted/SCMs, stormwater reduced, water quality data, value added ($/ft/yr)
	Note: Identify streets that are wide enough to accommodate SCMs. Adjust ordinances using Code & Ordinance worksheet to accommodate.				

1-5	Work with Department of Transportation to incorporate retrofits into highway upgrades	Mid-Long	Asheboro, Randolph County, Randleman, NCDOT, **PTRPO**	Staff time & technical assistance	# of SCMs installed, stormwater reduced, water quality data, value added ($/ft/yr)
	Note: Coordinate with Piedmont Triad RPO.				
1-6	Develop cost share/incentive program to encourage SCMs on private property	Mid	**Asheboro**, Randolph County, Randleman, RCSW, RCCE, WRC, SSMART, Commerce, businesses, & homeowners	Funding, technical assistance, educational materials, & staff time	# of SCMs installed, funding provided ($)
	Note: This could include financial assistance, development incentives, or recognition programs for both structural or non-structural SCMs.				
1-7	Map and inventory existing stormwater network	Short	Asheboro, Randolph County, Randleman, **PTRC**, engineering firms, NCDWR	Funding & technical assistance	# of outfalls/pipes mapped, # of maintenance needs detected
	Note: Use SCITs tool to mark outfalls. PTRC also has experience mapping stormwater infrastructure.				
1-8	Work with businesses and homeowners to disconnect roof drains	Mid	**Asheboro**, Randolph County, Randleman, SSMART, businesses, homeowners	Funding, educational materials, & staff time	# of roofs disconnected, volume of stormwater reduced
	Note: Identify neighborhoods with direct roof drain connections. City could provide this service at no-cost to homeowners to incentivize.				
1-9	Reduce sources of I/I	Mid-Long	**Asheboro**, Randolph County, Randleman, PTRC, NCDWI, NCDWR, engineering firms	Funding, technical assistance, & staff time	# of repairs made, volume of I/I reduced
	Note: Inventory stormwater and wastewater systems. Conduct testing to identify potential leaks, connections, or other maintenance needs.				
1-10	Consider establishing LID requirements for new development	Short	**Asheboro**, Randolph County, Randleman, RCSW, RCCE, PTRC, WRC, UNCSOG	Technical assistance, staff time, & elected official buy-in	N/A
	Note: Utilize Code & Ordinance Worksheet. UNC School of Governments also has a model Phase II ordinance.				
1-11	Incorporate watershed plan recommendations into other City/County plans	Short	**Asheboro, Randolph County, Randleman**, PTRC	Staff time	N/A
	Note: Asheboro in process of updating Future Land Development Plan. Coordinate with other departments as needed.				

4.2 Objective 2: Protect and Restore Riparian Buffers

Another factor contributing to water quality impairments in Haskett Creek and Penwood Branch is a lack of riparian buffers. Based on an analysis of riparian buffer conditions, about 34% of streams and tributaries within the watershed have moderately to severely degraded buffers. However, riparian buffers are one of the most effective means of protecting water resources. They filter nutrients and other pollutants, lower water temperature, improve aquatic habitat, stabilize stream banks, and enhance the area for recreation and wildlife. Objective 2 outlines the steps that are needed to protect and restore riparian buffers throughout the watershed.

Objective 2: Protect and restore riparian buffers along creeks and tributaries

Action #	Specific Action	Timeframe	Partners	Resources Needed	Evaluation Criteria
2-1	Implement identified riparian buffer improvement projects using native plants	Short-Mid	**Asheboro**, Randolph County, Randleman, PTRC, WRC, property owners, landscaping companies, nurseries, NCDWR, CWMTF	Funding, technical assistance, stakeholder buy-in, & staff time	Linear feet of buffers, stormwater reduced, water quality data, value added ($/ft/yr)
	Note: Utilize Project Atlas and WIPS tool. Apply for 319 or other grant funding to support.				
2-2	Stabilize eroding stream banks with native plants and materials	Mid	**Asheboro**, Randolph County, Randleman, PTRC, WRC, property owners, landscaping companies, nurseries, NCDWR, CWMTF	Funding, technical assistance, stakeholder buy-in, & staff time	Linear feet of stabilized streambank, water quality data, value added ($/ft/yr)
	Note: Replace hardened structures where feasible.				
2-3	Ground truth riparian buffer assessment to identify additional riparian buffer improvement and stream restoration projects	Short	**Asheboro**, Randolph County, Randleman, PTRC, RCSW, RCCE, KRCB	Technical assistance & staff time	# of identified projects
	Note: Utilize Riparian Buffer Assessment and WIPS tool.				

2-4	Extend water supply watershed buffer protections to impaired waters	Short	**Asheboro**, Randolph County, Randleman, PTRC	Staff time & elected offical buy-in	Linear feet of riparian buffers protected, stormwater reduced, water quality data, value added ($/ft/yr)
	Note:				
2-5	Identify buffers as a priority in other ordinances and plans	Short	**Asheboro**, Randolph County, Randleman, PTRC	Staff time	N/A
	Note: Subdivision, landscaping, future land use plan, recreation, etc.				
2-6	Develop cost share/incentive program to encourage businesses and homeowners to restore buffers on private property	Mid	**Asheboro**, Randolph County, Randleman, RCSW, RCCE, WRC, SSMART, Commerce, businesses, & homeowners	Funding, technical assistance, & staff time	# of participants, linear feet of buffers, funding provided ($)
	Note: This could include financial assistance or recognition programs.				
2-7	Coordinate buffer improvements with floodplain protection, utility easements, and trail programs	Mid-Long	**Asheboro**, Randolph County, Randleman, PTRC, PLC, PCC, PLT, MST, NCDOT, Duke, PNG, NCORR	Staff time	N/A
	Note:				

4.3 Objective 3: Preserve Existing Open Space

While restoration efforts play an important role in improving water quality, it can be far more cost effective to prevent impacts before they happen. A large portion of the Haskett Creek watershed has already been developed, but there are still several pristine forests and pastures that provide valuable ecological services. Vegetated open spaces help protect water quality by slowing down stormwater runoff, filtering pollutants, preventing erosion and flooding, and recharging groundwater. They also provide critical wildlife habitat and opportunities for outdoor recreation and tourism. Preserving existing open space will help prevent future degradation while protecting forests, farmland, and other lands that enhance the natural beauty of Randolph County.

Objective 3: Preserve existing open space to provide water quality benefits

Action #	Specific Action	Timeframe	Partners	Resources Needed	Evaluation Criteria
3-1	Work with Piedmont Land Conservancy, Wildlife Resources Commission, recreation departments, and other partners to prioritize and acquire land for conservation	Short-Mid	Asheboro, Randolph County, Randleman, PLC, WRC, PCC, RCSW, RCCE, **PTRC**, NCDWR, CWMTF, private landowners	Technical assistance, staff time, & willing property owners	Acres of land conserved, stormwater reduced, water quality data, value added ($/ft/year)
	Note: Prioritize land in critical areas that provides multiple benefits. Aim for ≤10% impervious cover in each catchment.				
3-2	Establish a maximum built upon area limit for new development within the watershed	Short	**Asheboro**, Randolph County, Randleman, PTRC	Technical assistance, staff time, & elected official buy-in	Acres of land conserved, stormwater reduced, water quality data, value added ($/ft/year)
	Note: The Center for Watershed Protection recommends maintaining a balance of ≤10% impervious cover throughout the watershed.				
3-3	Use Code & Ordinance Worksheet to identify other opportunities to improve open space protections in City/County ordinances	Short	**Asheboro**, **Randolph County**, Randleman, PTRC, WRC	Staff time	# of strengthened policies
	Note: Utilize the Green Growth Toolbox and trainings offered by WRC.				
3-4	Identify potential incentives to encourage open space preservation	Short	**Asheboro**, Randolph County, Randleman, PTRC, WRC	Technical assistance & staff time	Acres of land conserved, stormwater reduced, water quality data, value added ($/ft/year)
	Note: Utilize Green Growth Toolbox and Code & Ordinance Worksheet.				
3-5	Align conservation goals with Future Land Development Plan	Short	**Asheboro**, Randolph County, Randleman, PTRC	Staff time	N/A
	Note:				

3-6	Explore floodplain protection and trail opportunities to meet conservation goals	Mid-Long	**Asheboro**, Randolph County, Randleman, PTRC, PLC, PCC, PLT, MST, NCDOT, NCORR	Funding, technical assistance, & staff time	Acres of land conserved, miles of trail constructed
	Note: Identify floodplain buyout opportunities. Work with Piedmont Legacy Trails, MST, and other trail groups to expand trail access.				

4.4 Objective 4: Continue and Expand Public Outreach and Education

Public outreach and education is an essential part of any plan to reduce stormwater pollution, because the daily activities of thousands of people contribute significantly to non-point source pollution. As citizens learn about the impacts of their actions on local water resources, they become more likely to change their behaviors. Since 2004, the City of Asheboro, Randolph County, and City of Randleman have been active members of Stormwater SMART, which is a regional stormwater education program which was developed to help local governments meet MS4 permit requirements. The North Carolina Zoo and Keep Randolph County Beautiful also have extensive environmental education programs to protect wildlife and reduce litter. Objective 4 outlines how local and regional stakeholders can continue to strengthen these outreach and education programs through new program offerings, technology, and partnerships.

Objective 4: Continue and expand public outreach and education

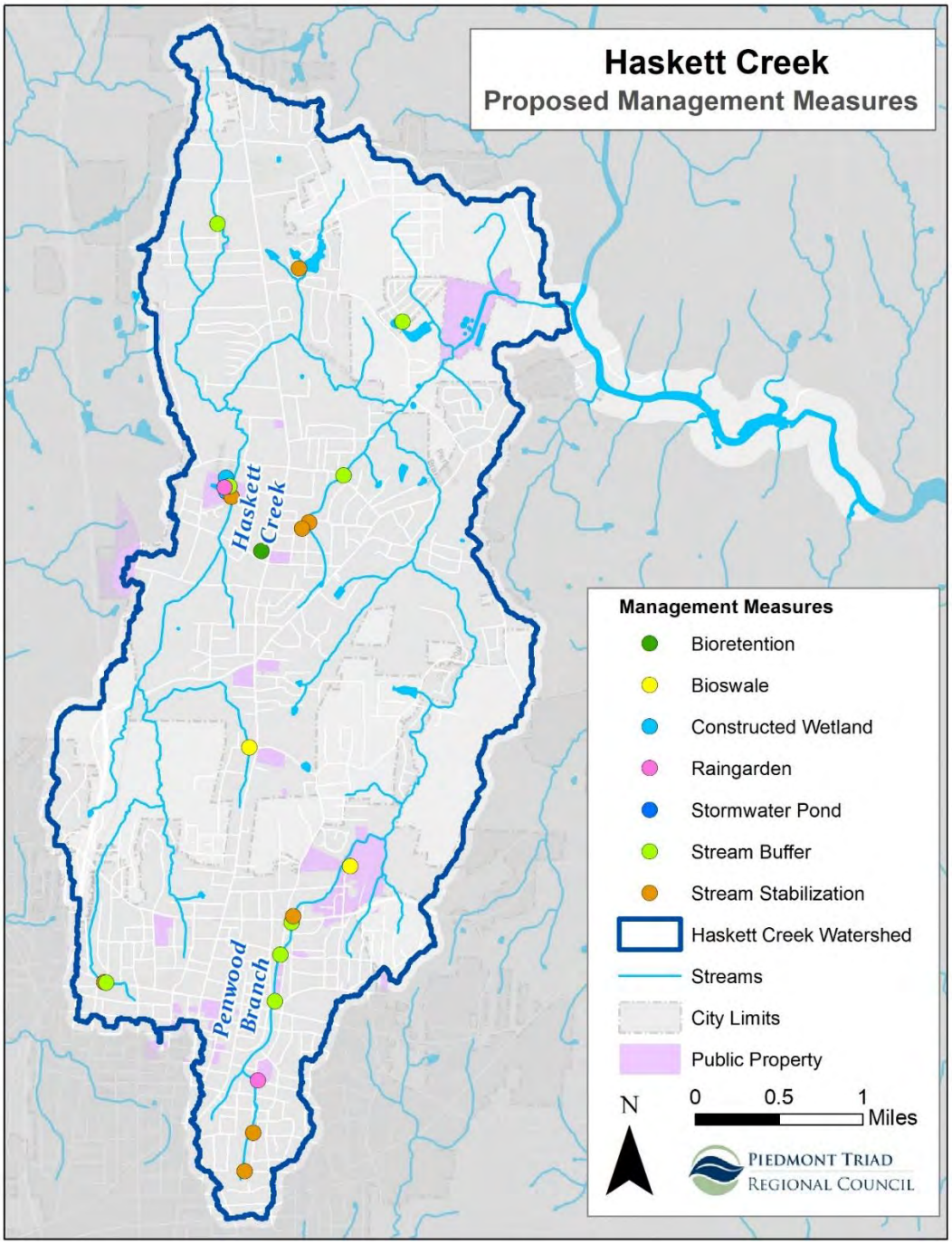
Action #	Specific Action	Timeframe	Partners	Resources Needed	Evaluation Criteria
4-1	Establish active Watershed Group to implement and monitor plan	Short	Asheboro, Randolph County, Randleman, PTRC, KRCB, PLC, PCC, WRC, NCDWR, **SSMART**, etc.	Staff time & stakeholder buy-in	# of milestones met
	Note: Determine organizational responsibilities and meeting frequency.				
4-2	Organize Stream Watch & Adopt a Stream volunteer groups	Short-Mid	Asheboro, Randolph County, Randleman, **SSMART**, KRCB, NC Zoo, NCDWR, afterschool programs, scouts, etc.	Technical assistance, staff time, & willing volunteers	# of volunteers, level of interest in program, # of streams monitored, citizen science data
	Note: Connect Stormwater SMART with local scout, afterschool, or other similar programs.				

4-3	Install educational signage at SCM project sites and stream crossings	Short-Mid	**Asheboro**, Randolph County, Randleman, PTRC, PTRPO, SSMART, NCDOT, NCDWR	Funding, technical assistance, & staff time	# of signs installed
	Note: 319 funding can be used for educational signage.				
4-4	Continue and expand direct education programs in coordination with Stormwater SMART and other partners	Ongoing	Asheboro, Randolph County, Randleman, **SSMART**, RCSW, RCCE, KRCB, schools	Technical assistance & staff time	# of programs/events, # of people reached, public buy-in
	Note:				
4-5	Tailor messaging and explore other forms of media to reach diverse audiences	Short	Asheboro, Randolph County, Randleman, **SSMART**, RCSW, RCCE, KRCB, schools	Technical assistance & staff time	# of new people reached
	Note:				
4-6	Work with Keep Randolph County Beautiful and other partners to reduce litter, pet waste, and pesticide/fertilizer use in watershed	Ongoing	Asheboro, Randolph County, Randleman, SSMART, **KRCB**	Technical assistance & staff time	Lbs of litter reduced, fecal coliform data, public buy-in
	Note:				
4-7	Increase stewardship of creeks through passive recreation opportunities	Mid-Long	**Asheboro**, Randolph County, Randleman, PTRC, PLC, PCC, PLT, MST	Funding, technical assistance, & staff time	# of new parks/trails
	Note:				
4-8	Schedule good housekeeping training/workshops	Short	**Asheboro**, Randolph County, Randleman, PTRC, NCDWR	Staff time & training	# of trainings/workshops, # of staff trained
	Note:				
4-9	Promote online StoryMap and watershed applications	Short	Asheboro, Randolph County, Randleman, **PTRC**, NCDWR	Technical assistance & staff time	# of website visits, use of watershed applications
	Note:				

5 Management Strategies

Restoring water quality in Haskett Creek and Penwood Branch will require a multi-pronged approach that includes on-the-ground projects, policy improvements, and educational programs. The following section outlines recommended management measures including seven stormwater control measures and fourteen stream buffer and restoration projects. These projects will be supplemented by conservation, policy improvements, and education programs.

Map 17: Proposed Management Measures Map



5.1 STORMWATER CONTROL MEASURES

The following section provides conceptual designs and cost estimates for seven initial stormwater control measures that the City of Asheboro and other community members can implement to begin making water quality improvements throughout the watershed. Final projects were selected based on their ease of implementation, level of feasibility, cost effectiveness, and proximity to public land. Each stormwater control measure was sized to capture and treat 1-inch, or the first flush, of runoff during storm events. All concept plans developed for this project are based on limited investigation and should not be used in lieu of engineering expertise. A detailed design process might uncover constraints or conditions that require a different SCM type or approach.

Water quality benefits (volume and nutrient reductions) were estimated for each SCM using the Stormwater Nitrogen and Phosphorus (SNAP) nutrient accounting tool developed by the North Carolina Department of Environmental Quality. This tool is calibrated to specific precipitation regions (Asheboro, NC in this case) and uses various inputs, such as impervious cover, drainage area, and soil types, to calculate anticipated total nitrogen (TN) and total phosphorus (TP) reductions. A summary table of water quality benefits has been provided on the following page that includes the SCM type, location, footprint area, drainage area, percent impervious cover, TN and TP reductions, and a cost estimate. These estimates may change depending on final project designs.

Cost estimates were developed using average costs per square foot for similar projects. Prices were researched from government and published sources, prioritizing costs for projects that were implemented in the Southeastern United States. It is important to note that stormwater control measures can range widely in costs depending on site conditions and designs. Estimates do not take into account design, property acquisition, or long term maintenance costs.

Table 8: Stormwater Control Measure Projects, Load Reductions, and Cost Estimates

Project Number	SCM Type	Location	Footprint (ft^2)	Drainage Area (ft^2)	Percent Impervious	Annual Runoff Volume (ft^3/yr)	Volume Reduction (%)	TN Reduction (lb/ac/yr)	TN Reduction (%)	TP Reduction (lb/ac/yr)	TP Reduction (%)	Cost Estimate
1	Rain Garden	Lindley Park Elementary School	859	111543	27.8%	113355	17%	3.30	30%	1.08	58%	$4,295 - $12,885
2	Bioswale	City Fields	387	69570	62.5%	144182	13%	2.30	29%	0.55	33%	$1,935 - $3,870
3	Rain Garden	North Asheboro Park	471	16181	100.0%	51996	19%	1.41	31%	0.25	44%	$2,355 - $7,065
4	Constructed Wetland	North Asheboro Park	1732	3392476	14.4%	237939	11%	6.40	30%	1.65	45%	$17,320 - $34,640
5	Constructed Wetland	North Asheboro Park	1732	315850	19.1%	237349	11%	7.39	33%	2.18	52%	$17,320 - $34,640
6	Bioretention	N. Asheboro Park & Ride	556	133172	59.1%	261983	19%	7.99	33%	2.07	55%	$2,780 - $8,340
7	Bioswale	W. Allred Street	248	40306	56.5%	76180	4%	1.31	20%	0.22	25%	$1,240 - $2,480

Project 1: Raingarden at Lindley Park Elementary School

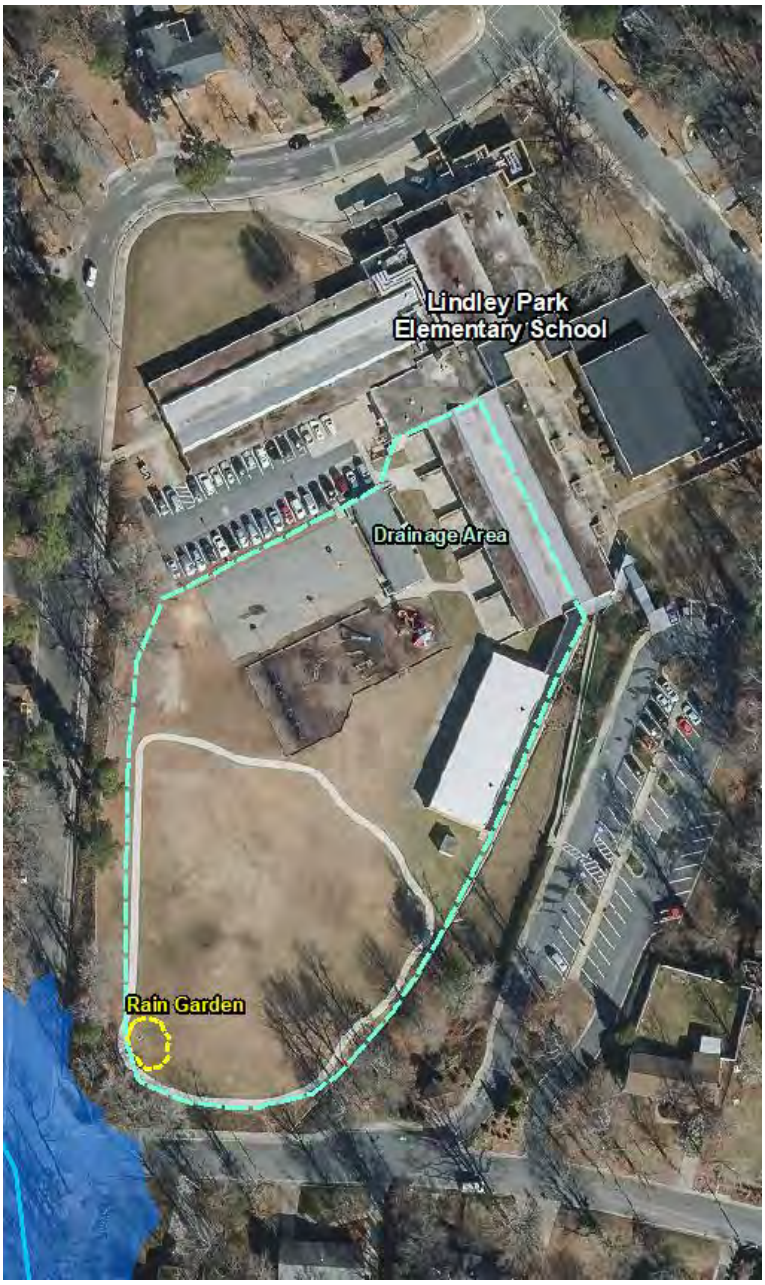
Project Description:
There is an existing storm drain on the southern side of Lindley Park Elementary School that drains directly to Haskett Creek. This area is well suited for a raingarden, which would help capture and treat runoff from the school's buildings, fields, and playground. It would also be a highly visible project that could be used as a tool to teach students about water, plants, and the environment.

Action Steps:

- Contact Lindley Park Elementary
- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$4,295-$12,885
Stormwater Reduction	17%
TN Reduction	30%
TP Reduction	58%



Project 2: Bioswale at City Fields

Project Description:
The parking lot and surrounding buildings at City Fields drain to a natural ditch between the ballfields and parking lot. This ditch regularly collects water before draining downhill to the west. This ditch could serve as a bioswale or raingarden if the proper vegetation was installed. This project would be highly visible and could be highlighted with educational signage.

Action Steps:

- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$1,935-$3,870
Stormwater Reduction	13%
TN Reduction	29%
TP Reduction	33%

Project 3: Raingarden at North Asheboro Park

Project Description:
The parking lot at North Asheboro Park drains to the northeast. There is existing riprap that leads to an open field. A raingarden could be installed along the edge of the parking lot to better capture and treat runoff onsite. This project would be highly visible and could be highlighted with educational signage.

Action Steps:

- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$2,355-$7,065
Stormwater Reduction	19%
TN Reduction	31%
TP Reduction	44%

Project 4: Constructed Wetland at North Asheboro Park (Option A)

Project Description:
A significant amount of water naturally collects between the parking lot and Haskett Creek at North Asheboro Park. This area is well suited for a constructed wetland, which would help capture, slow, and treat stormwater before reaching Haskett Creek. This project would be highly visible and could be highlighted with educational signage.

Action Steps:

- Have an engineer evaluate the feasibility of Options A & B
- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$17,320-$34,640
Stormwater Reduction	11%
TN Reduction	30%
TP Reduction	45%

Project 5: Constructed Wetland at North Asheboro Park (Option B)

Project Description:
Stormwater runoff from 237 W Central Ave. is channeled and discharged on the north side of North Asheboro Park. This area is well suited for a constructed wetland, which would help capture, slow, and treat stormwater before reaching Haskett Creek. This project would be highly visible and could be highlighted with educational signage.

Action Steps:

- Have an engineer evaluate the feasibility of Options A & B
- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$17,320-$34,640
Stormwater Reduction	11%
TN Reduction	33%
TP Reduction	52%

Project 6: Bioretention Cell at North Asheboro Park & Ride

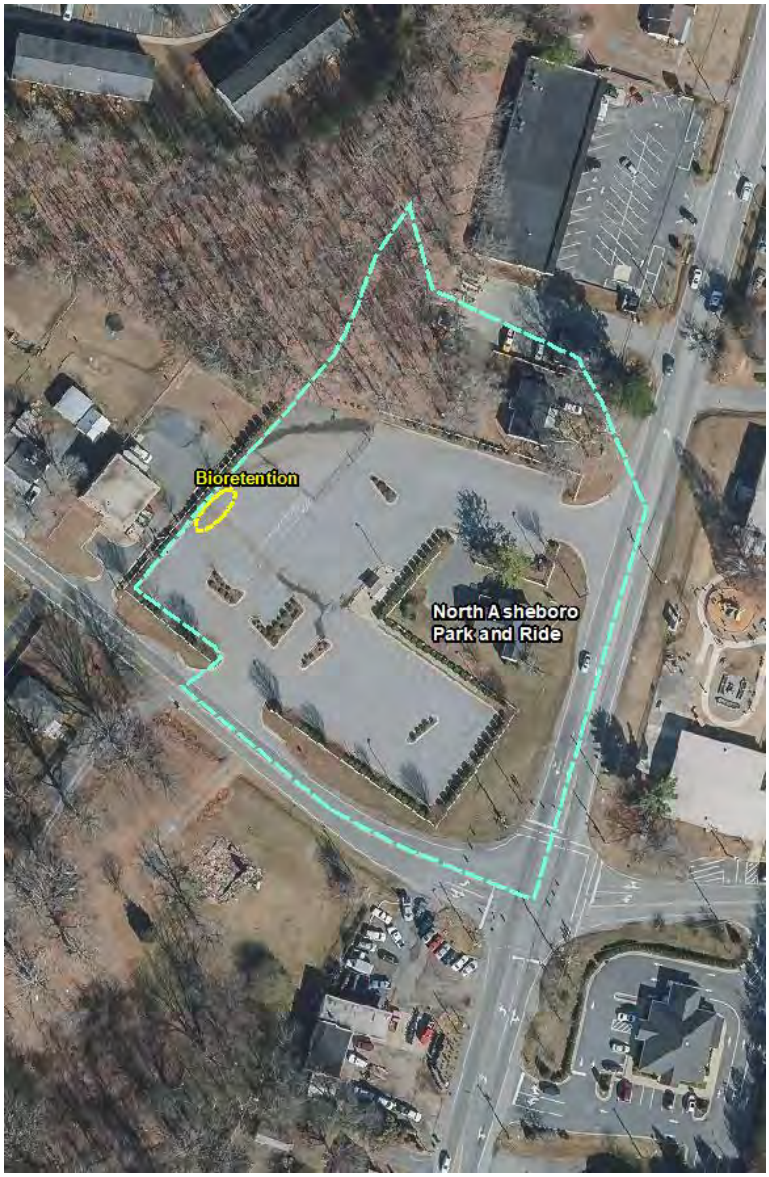
Project Description:
The North Asheboro Park and Ride lot generates a significant amount of stormwater runoff, which pools in the northwest corner of the lot. Although there are multiple landscaped islands, none of them have curb cuts that allow for stormwater capture or treatment. It is recommended that these islands be retrofit or a new bioretention cell be installed on the western edge of the lot. This project would be highly visible and could be highlighted with educational signage.

Action Steps:

- Have an engineer evaluate stormwater control options
- Secure funding
- Hire engineer for design/build
- Install educational signage

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$2,780-$8,340
Stormwater Reduction	11%
TN Reduction	33%
TP Reduction	52%



Project 7: Bioswale on W. Allred St near Misión Evángelica Pacto

Project Description:
Runoff from Highway 220 drains to the northwest and collects along an existing ditch on W. Allred Street. Installing vegetation at this location could improve stormwater retention and treatment and function as a stormwater bioswale. This project would be highly visible because it is next to a church. There are additional opportunities for a stormwater retention pond, just south of this project at the Advanced Auto Parts property.

Action Steps:

- Secure funding
- Hire engineer for design/build

Bioretention
Bioswale
Constructed Wetland
Rain Garden

Estimated Costs	$1,240-$2,480
Stormwater Reduction	11%
TN Reduction	33%
TP Reduction	52%

5.2 STREAM BUFFERS & RESTORATION

Fourteen stream buffer and restoration projects were identified over the course of the project through a combination of the riparian buffer assessment and fieldwork. These projects will help reduce sediment loads by stabilizing stream banks and reducing erosion. Riparian buffers also provide additional shade and habitat for aquatic organisms. Projects are listed in order based on their location in the watershed (upstream to downstream) and prioritized based on feasibility and need. Many of the projects are located on private property and will require partnerships with local businesses and residents.

Cost estimates were calculated using average costs per square foot for buffer projects, assuming a 50-foot buffer for the entire stream length, and average costs per linear foot for stream restoration projects. It is important to note that planting and construction costs can range widely depending on site conditions and designs. Estimates do not take into account design, property acquisition, or long term maintenance costs.

<table>
<tr><th colspan="3">Site 1: Erosion near 1018 Glenwood Road</th></tr>
<tr><td>Estimated Costs: $2,500</td><td>Priority: Low</td><td>Reach Length: N/A</td></tr>
<tr><td colspan="2">  </td><td>Project Description:

Runoff from Stowe Avenue flows west along the edge of the road before it is channeled into Penwood Branch. This has created significant erosion issues at the end of the street near Glenwood Road.

Action Steps:

• Contact property owner
• Secure funding
• Regrade streambank and plant vegetation to stabilize conditions</td></tr>
</table>

Site 2: Erosion near Hammer Park

Estimated Costs: $1,250	Priority: Low	Reach Length: N/A

Project Description:

Runoff from Glenwood Road is causing erosion on the north side of a brick culvert headwall at Hammer Park. The endwall seems to be in pretty good condition and likely only requires some minor patchwork or riprap to reduce erosion at this site.

Action Steps:

- Have Asheboro Public Works repair the site

Site 3: Riparian Buffer between Dunlap Street and N. Elm Street

Estimated Costs: $16,000	Priority: Medium	Reach Length: 950ft

Project Description:

There is a lack of riparian buffers on the eastern side of Penwood Branch near the intersection of Martin Luther King Jr. Drive and East Salisbury Street. Grass has been mowed up to the stream bank and there are no trees or woody vegetation. The bridge near the convenience store is also in poor condition and collects a significant amount of litter. The City of Asheboro could work with local residents to explore installing riparian buffers in their back yards to reduce flooding, erosion, and catch litter before it enters the stream.

Action Steps:

- Contact property owners to gauge interest in riparian buffers
- Secure funding
- Host community event to highlight project and install buffers

Site 4: Stream Buffer near Meadowbrook Road and Brewer Street		
Estimated Costs: $4,500	Priority: Low	Reach Length: 275ft

Project Description:

On the north and south side of Brewer Street near Meadowbrook Road, there is a lack of riparian buffers. Grass has been mowed to the edge of the streambank and there is little to no woody vegetation. The City of Asheboro should work with local homeowners to install native grasses, bushes, and trees along the eastern side of Penwood Branch south of Brewer Street and on both sides of the stream north of Brewer Street.

Action Steps:

- Contact property owners to gauge interest in riparian buffers
- Secure funding
- Host community event to highlight project and install buffers

Site 5: Stream Buffer near 502 E. Presnell Street		
Estimated Costs: $3,630	Priority: Low	Reach Length: 110ft

Project Description:
South of East Presnell Street near Meadowbrook Road, there is a lack of riparian buffers between surrounding residential uses. Grass has been mowed to the edge of the streambank and there is little to no woody vegetation. The City of Asheboro should work with local residents to plant native grasses, bushes, and trees.

Action Steps:

- Contact property owners
- Secure funding & install buffers

Site 6: Erosion near 509 E. Presnell Street		
Estimated Costs: $15,000	Priority: High	Reach Length: 60ft

Project Description:
Just north of East Presnell Streat near Meadowbrook Road, there is a section of Penwood Branch that is quickly eroding. This may be contributed to the lack of riparian vegetation in this area. There was also litter found in the stream at this location.

Action Steps:

- Contact property owners
- Secure funding
- Hire engineer to develop stream restoration plan
- Regrade streambank and plant vegetation to stabilize conditions

Site 7: Stream Buffer and Erosion at Intersection of Peachtree St and W. Salisbury Street		
Estimated Costs: $7,500 buffer, $16,250 erosion	Priority: High	Reach Length: 450ft buffer, 60ft erosion

Project Description:

Haskett Creek lacks riparian buffers at the intersection of Peachtree Street and West Salisbury Street, which is causing significant erosion along this section of stream. There are electric lines and railroad tracks that abut the northern edge of the stream, however, the parcel that the stream crosses is currently vacant. It is recommended that the City of Asheboro work with current or future property owners to install riparian buffers and stabilize streambanks at this location.

Action Steps:

- Contact property owners to gauge interest in riparian buffers and erosion control
- Secure funding
- Hire engineer to develop stream restoration plan
- Regrade streambank and plant vegetation to stabilize conditions

Site 8: Stream Buffer and Erosion at N. Asheboro Park		
Estimated Costs: $6,000 buffer, $25,000 erosion	Priority: High	Reach Length: 350ft buffer, 100ft erosion

Project Description:

The section of Haskett Creek that runs through North Asheboro Park has little to no riparian vegetation, which is causing erosion on the southern end of the park. Grass has been mowed to the edge of the streambank and there is no woody vegetation. It is recommended that the City of Asheboro install riparian buffers and stabilize streambanks at this location.

Action Steps:

- Establish a “no mow” zone and allow grass to grow along the stream
- Secure funding
- Hire engineer to develop stream restoration plans
- Regrade streambank and plant vegetation to stabilize conditions

Site 9: Stream Buffer near E Central Avenue between Walnut Street and Willow Road		
Estimated Costs: $6,600	Priority: Low	Reach Length: 200ft

Project Description:

An unnammed tributary passes under East Central Avenue between Walnut Street and Willow Road. On the northern side of the road, there is a lack of riparian buffer vegetation. Grass is mowed to the edge of the streambank on both sides, and there is only one tree on the west bank. In addition, there is nothing slowing stormwater runoff from roadside swales. It is recommended that local stakeholders work with property owners to plant additional vegetation at this site.

Action Steps:

- Contact property owners to discuss importance of riparian buffers
- Secure funding
- Plant riparian buffers

Site 10: Stream Buffer at North Meadows Mobile Home Community		
Estimated Costs: $7,500	Priority: Medium	Reach Length: 450ft

Project Description:

There is a large stormwater pond at the North Meadows Mobile Home Community that lacks any riparian buffer. Stormwater runoff from the road is channeled directly into the pond from an existing drain to the northeast side of the pond. Grass is mowed to the edge of the pond and there is little to no woody vegetation. There are also a significant number of waterfowl at this location, which may contribute to high concentrations of fecal coliform bacteria. It is recommended that the City of Randleman work with the property manager to install riparian buffers and redirect stormwater from the road into the grass so that it can be filtered before flowing downstream.

Action Steps:

- Contact property owners to discuss importance of riparian buffers
- Secure funding
- Plant riparian buffers
- Redirect stormwater runoff to flow through newly planted buffer
- Discourage waterfowl

Site 11: Stream Buffer along Bank Street

Estimated Costs: $12,500	Priority: Medium	Reach Length: 750ft

Project Description:

There is an unnamed tributary of Haskett Creek that runs along Bank Street in the northern part of the watershed. This stream has been highly channelized between the road and surrounding industrial uses and there are little to no riparian buffers between the road and the stream. It is recommended that the City of Asheboro contact Malt-O-Meal Cereals and TechniMark to see if they would be willing to partner with the City to protect local waterways. Simple riparian buffer plantings could help treat runoff from Bank Street and surrounding buildings.

Action Steps:

- Contact Malt-o-Meal and Technimark to gauge interest in riparian buffers
- Secure funding
- Host community event to install riparian buffers

Site 12: Stream Buffer and Erosion at 1832 Flint Street		
Estimated Costs: $3,300	Priority: Low	Reach Length: 100ft

Project Description:

A section of an unnamed tributary of Haskett Creek at 1832 Flint Street is eroding due to a lack of riparian buffers. It is evident that the property owner has taken significant steps to install riprap in other part of their yard to prevent erosion and stabilize stream banks. It is recommended that the City of Asheboro work with the property owner to install riparian buffers, which would slow stormwater before reaching the stream and improve aquatic habitat.

Action Steps:

- Contact property owner to gauge interest in riparian buffers
- Secure funding and install buffers

Site 13: Erosion behind 1829 Flint Street		
Estimated Costs: $5,000	Priority: High	Reach Length: 20ft

Project Description:

The property owner at 1829 Flint Street notified the project team about this project while conducting fieldwork. An unnamed tributary of Haskett Creek runs behind the property and is eroding a large section of the streambank. The property owner mentioned that this has not been a problem until the past few years and they are interested in finding a solution to stabilize streambanks and protect their property. It is recommended that the City of Asheboro work with this property owner to stabilize streambank conditions and reduce sediment loads.

Action Steps:

- Contact property owners to discuss the issue
- Secure funding
- Add riprap, vegetation, or other natural structures to stabilize streambank conditions

Site 14: Erosion at Richardson Lake

Estimated Costs: $15,000	Priority: High	Reach Length: N/A

Project Description:

Richardson Lake in the Waterford Villas community is contributing a significant amount of sediment to an unnamed tributary of Haskett Creek. It appears that an existing berm may have failed and now the lake is directly washing remaining soil into the stream. It is recommended that the City of Asheboro contact the HOA or developer and notify them of this issue. They may need to reconstruct the berm or modify the lake outfall so that it is not a sediment trap.

Action Steps:

- Contact the HOA or developer to notify them of this erosion issue
- If needed, consult the regional DEQ office

5.3 CONSERVATION PRIORITIES

While stormwater control measures and riparian buffers are critical to improve water quality throughout the watershed, it is also important to conserve undeveloped land to protect Haskett Creek and Penwood Branch from any further impacts associated with development. Land conservation helps protect water quality by capturing stormwater, filtering pollutants, preventing erosion and flooding, and recharging groundwater. A single tree can capture and filter up to 36,500 gallons of water per year. Conservation also protects critical wildlife habitat, agricultural lands, and provides opportunities for outdoor recreation and tourism.

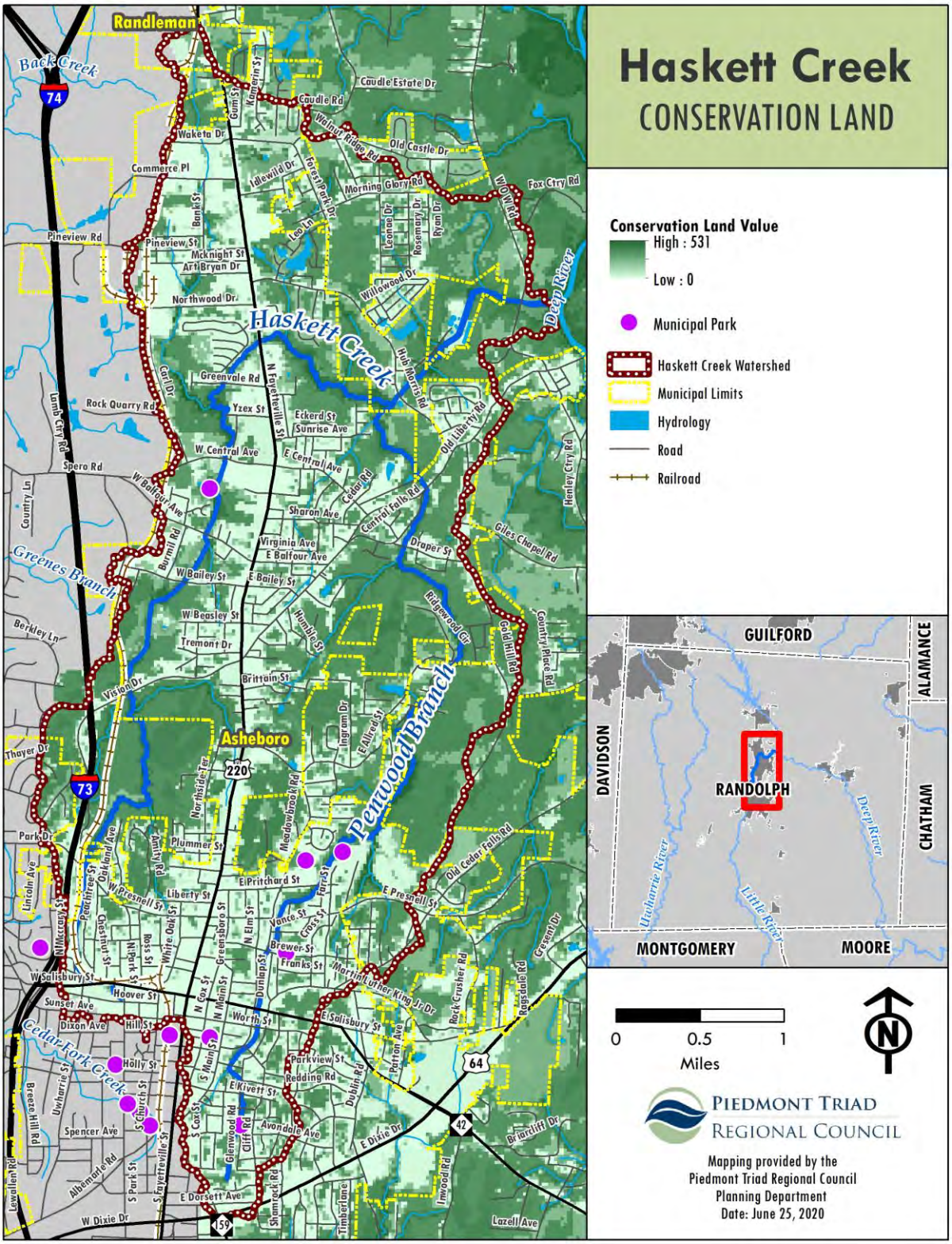
In order to help identify conservation priorities, the project team developed a GIS based model which overlays biodiversity/wildlife habitat, impervious surface cover, canopy cover, hydric soils, soil erodibility, floodplain, public land, population density, steep slopes, parcel size, and zoning data. In general, undeveloped areas near streams that had high biodiversity or wildlife habitat were ranked the highest, as these properties will likely provide the greatest environmental benefits. A map of conservation priorities in the Haskett Creek watershed has been provided on the following page.

Environmental conservation efforts are often most effective when they are coordinated with other local priorities, such as farmland preservation, outdoor recreation, or flood prevention. Local stakeholders should partner with Rockingham County Soil and Water and local parks departments to identify specific properties that align with agricultural, recreation, and environmental goals. Local land trusts like the Piedmont Land Conservancy can provide technical assistance when specific parcels or projects are identified.

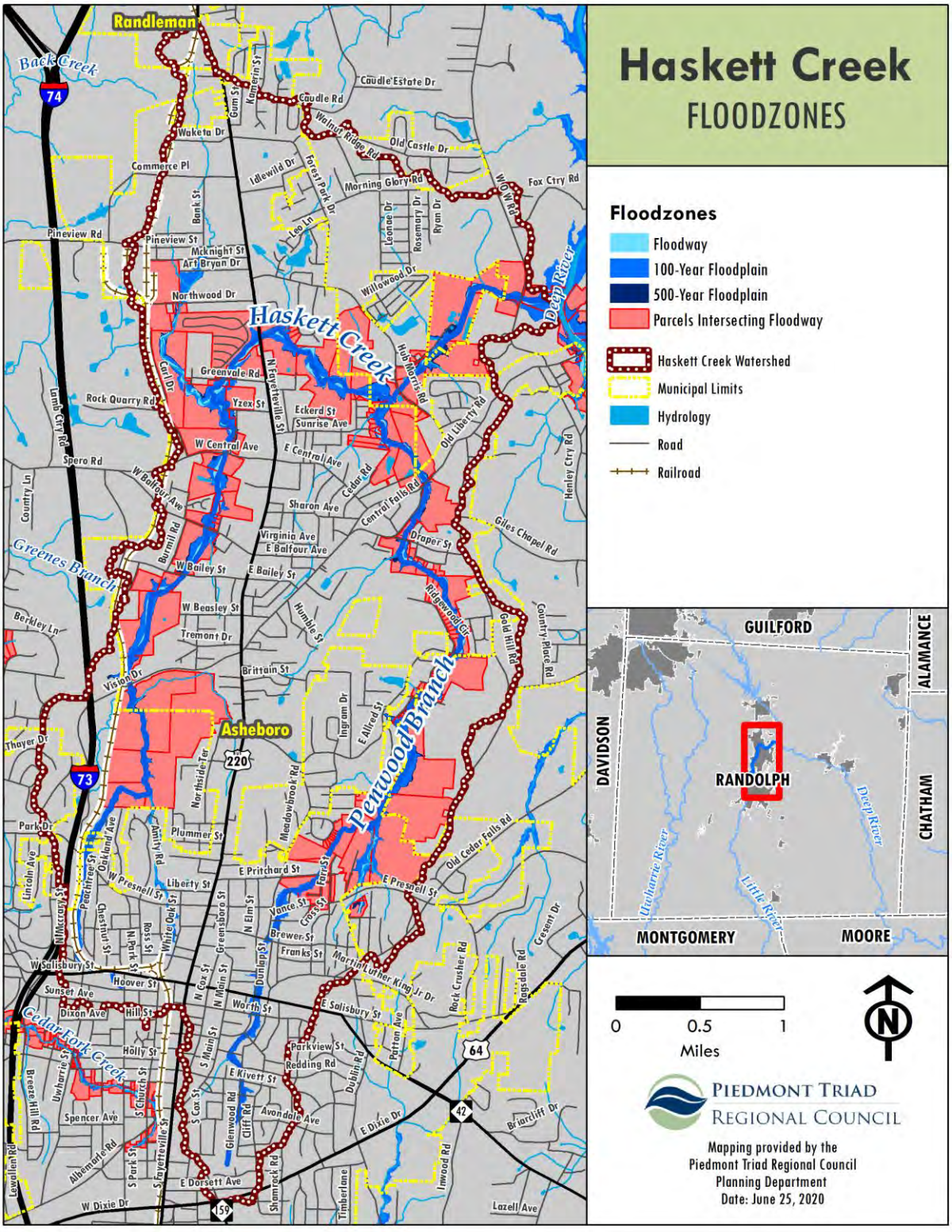
Several federal programs provide funding for voluntary floodplain buyouts. This funding can be used to purchase flood-damaged property and maintain it as open space to prevent future flood damage. Asheboro or Randolph County could potentially seek these funds to support conservation initiatives. Map 19 highlights all of the properties within the watershed that intersect the floodway. These properties are most likely to experience frequent flooding and would provide significant water quality benefits.

Local governments can also help conserve natural resources by encouraging or mandating land use practices such as cluster development, open space requirements, built upon area limits, or stormwater control measures.

Map 18: Prime Conservation Land Map



Map 19: Properties Intersecting Floodway Map



5.4 Other Reduction Measures

There are also a number of creative actions that individuals can take at their own homes to conserve natural resources. Simple acts, such as disconnecting downspouts that are directly connected to the storm drain system, installing rain barrels, or planting small raingardens can dramatically reduce stormwater loads. Some communities have established creative programs to incentivize homeowners to reduce stormwater, including awards programs that recognize homeowners that implement green practices or financial assistance or rebate programs. Other communities have held events such as rain barrel workshops/giveaways and storm drain markings to remind residents that anything entering the storm drains flows directly into our streams. Homeowners can also help protect water quality and prevent localized flooding by picking up after their pets, bagging their leaves and grass clippings, and limiting fertilizers and pesticide use.

5.5 Outreach and Education

Asheboro, Randolph County, and Randleman are active members of the Piedmont Triad Regional Council's Stormwater SMART program, which is a stormwater education program that was developed to help local governments meet NPDES educational requirements. Stormwater SMART uses a combination of direct education and mass media to teach children and adults of all ages about stormwater runoff, best management practices, habitat, and wildlife. The overall goal is to raise public awareness about water quality issues and increase local stewardship.

Over the course of this project, at least 1,978 residents of Randolph County engaged in hands-on programs related to pollution prevention, water quality monitoring, and litter cleanups. Educational programs refer to hands-on lessons lasting an hour or more that typically take place in K-12 schools, libraries, and summer camps, as well as professional development workshops for teachers and administrators. These programs are correlated with NC Science Essential Standards and are always interactive and experiential in nature.

Stormwater SMART partners with several organizations to offer educational programming in and near the Haskett Creek watershed, including Randolph County Public Schools, Randolph County Library, the Randleman Chamber of Commerce, the Piedmont Triad Regional Water Authority, and the NC Zoo. In the Spring of 2019, Stormwater SMART and Keep Randolph County Beautiful collaborated to hold the 1st Annual Randolph Creek Week, a weeklong series of events offering stewardship opportunities along the Deep River and its tributaries. Although several events were canceled due to severe weather in 2019, more than 300 area residents took part in cleanups and educational events, collecting more than 1,000 pounds of trash. Students at Randolph Community College designed marketing materials for the events, and local businesses donated more than $500 to cover the cost of a mobile classroom for Earth Day programming at the NC Zoo. Stormwater SMART and Keep Randolph County Beautiful intend to carry those funds forward to celebrate Randolph Creek Week and Earth Day 2021.

In winter of 2020, social distancing recommendations due to the coronavirus pandemic required a shift to online programming. In response, Stormwater SMART launched three pilot initiatives to allow the public to engage in environmental education from their own backyards: The #RandolphBeautiful Contest, Seeds for Surveys, and the iNaturalist Spring BioThon. The pilot programs resulted in 50 hours of at-home engagement and provided valuable information about how to increase involvement in the 2020-2021 fiscal year.

Initiative #1 - Randolph Beautiful Contest: Volunteers work towards improving water quality through cleanups and recycling projects and post their efforts on social media to inspire others. The 2019 winners (Uwharrie Trash Adventures and Southmont Elementary) received $100 gift cards donated by Walmart of Asheboro, which may be used for supplies, materials, or for a group celebration. Stormwater SMART envisions further fundraising in order to repeat the contest annually and extend into the summer and fall as funds allow.

Initiative #2 - Seeds for Surveys: Residents in Randolph County are alerted through a Facebook campaign about a 10-minute survey related to water quality. Survey participants follow a link to the Stormwater SMART website, and in exchange for providing their mailing address and thoughts about water quality, participants receive a packet of native NC wildflower seeds, a guide to backyard Rain Gardens, and a personal response based on the information they provided. This allows Stormwater SMART to gauge the community's knowledge of how stormwater systems work, identify target pollutants by neighborhood, and gather ideas for community projects that already have some buy-in from residents.

In total, Stormwater SMART received 21 surveys from Randolph County over the course of the two-week promotion; some examples of responses from residents in the Haskett Creek area are listed below. Due to a $100 donation from Keep Randolph County Beautiful, Stormwater SMART is able to extend this program into the fall of 2020, with a goal of reaching 100 survey responses by December 31.

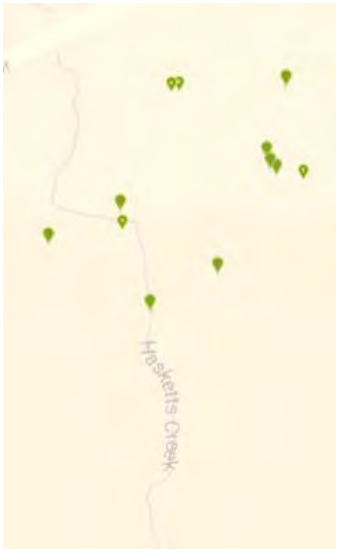
DATE, ZIP CODE:	STORM DRAINS LEAD TO:	POLLUTANTS IN YOUR NEIGHBROHOOD:
5/16/20, 27205	Creek or stream	Cigarette butts, litter/trash, motor oil
5/16/20, 27203	Creek or stream	Cigarettes, litter, pesticides, pet waste, motor oil
5/19/20, 27205	Creek or stream	litter/trash, pesticides, fertilizers,
5/19/20, 27203	Creek or stream	Cigarettes, litter, pesticides, fertilizers, pet waste
5/20/20, 27205	Treatment Plant	Litter & trash
5/31/20, 27203	Treatment Plant	Household hazardous waste

Initiative #3 – Spring iNaturalist BioThon: iNaturalist is an international online community that helps people to identify species of plants, animals, and fungi that they find in their environment. Participants create a free account on their smartphone and make observations by taking photos and/or recording audio. The BioThon started in Randolph County on April 16 and ran through June 19, 2020, with prizes awarded for the most species found. Stormwater SMART's educators engaged with participants on the iNaturalist website by adding identification suggestions and commenting on species that are bioindicators for water quality.

Residents in Randolph County recorded 127 different species during the BioThon. The winner, jmcar75 (a mother-daughter team), recorded more than 85 observations around Randleman and Asheboro, including a variety of amphibians, reptiles, and insects. Stormwater SMART highlighted these observations in comments to jmcar75, noting that dragonflies and crane flies in their larval form are bioindicators of water quality.

Other BioThon participants noted box turtles, snails, crayfish, and herons in the area, along with plants that have high "stormwater value"; such as the Christmas Fern, which helps to prevents the erosion of stream banks. Stormwater SMART educators also highlighted observations of NC native plants, such as goldenrod (perennial pollinator), St. John's Wort (thrives on banks and slopes), and "rain garden" trees like elm and red maple.

Beyond the scope of the BioThon, iNaturalist can provide information about any observation uploaded to iNaturalist, with a messaging application for contacting members of the online community. In the current year, there are 289 active observers in Randolph County, with dozens of observations recorded on Hasketts Creek and Richardson Lake, including water birds, frogs, turtles, snakes, dragonflies, native plants, insects, and spiders. Stormwater SMART's educational programming for the 2020-2021 fiscal year will focus on increasing the number of benthic macroinvertebrate observations along the accessible areas of Hasketts Creek and Penwood Branch.



Randolph County Spring BioThon Animal Species Observed, April 16 – June 19, 2020

American Toad
Anaxyrus americanus

Cope's Gray Tree Frog
Hyla chrysoscelis

Green Tree Frog
Hyla cinerea

Common Slider
Trachemys scripta

Common Box Turtle
Terrapene carolina

Common Snapping Turtle
Chelydra serpentina

Eastern Crayfish
Cambarus bartonii

Eastern Whitelip
Neohelix albolabris

Blue Corporal
Ladona deplanata

Outreach can include handing out materials at fairs and festivals, posting content on social media, and other forms of advertising. While hands-on citizen science projects have a greater impact on the environment over time, outreach can call attention to important issues around water quality that can be seasonal in nature, or affect one neighborhood more than another. Mass media has the added benefit of reaching a wide audience for the lowest cost, delivering the message and reminding everyone that, "Clean Water Starts with You and Me". Coupled with meaningful educational experiences, mass media can be a cost-effective way of keeping the message on everyone's mind throughout the year.

The City of Randleman and Randolph County subscribe to mass media services offered by Stormwater SMART, which included public service announcements (PSAs) related to radio, TV network, and cable campaigns in 2018, 2019, and 2020. The PSAs are short (15-30 seconds), with high quality animation and simple, straightforward voiceovers and captions. There are six videos, one for each target pollutant: Pick Up Litter, Scoop Poop, Mulch or Bag It (Yard Waste), Follow Directions (Pesticides and Fertilizers), Dispose of Properly (Household Hazardous Materials), and Clean Spills Promptly (Vehicle Maintenance).

In the 2018-2019 fiscal year, 14,517 internet users in Randleman and unincorporated areas of Randolph County viewed a 30-second video about pet waste ("Scoop the Poop") without navigating away. An additional 2,324 people clicked on a button to "Find Out More" after seeing a display ad which read, "Clean Water Starts with You and Me!"

The addition of television PSAs in the 2019-2020 fiscal is year is expected to result in more than 2 million views throughout the Piedmont Triad area. Radio copy on a variety of stations (included La Ley in Spanish), may reach another 1 million listeners or more.

Stormwater SMART is continually seeking new and creative ways to increase and expand its network of engaged community members. Over the course of the next few years, Stormwater SMART plans to work with local partners to organize active Stream Watch volunteer groups in the Haskett Creek watershed. These groups will receive hands on training and conduct citizen science to gather water quality data, which will help support the implementation of the *Haskett Creek Watershed Plan*. Stormwater SMART also plans to work with Keep Randolph County Beautiful and other partners to reduce litter, pet waste, and pesticide/fertilizer use through cleanups and educational programs.

6 Implementation and Adaptive Management

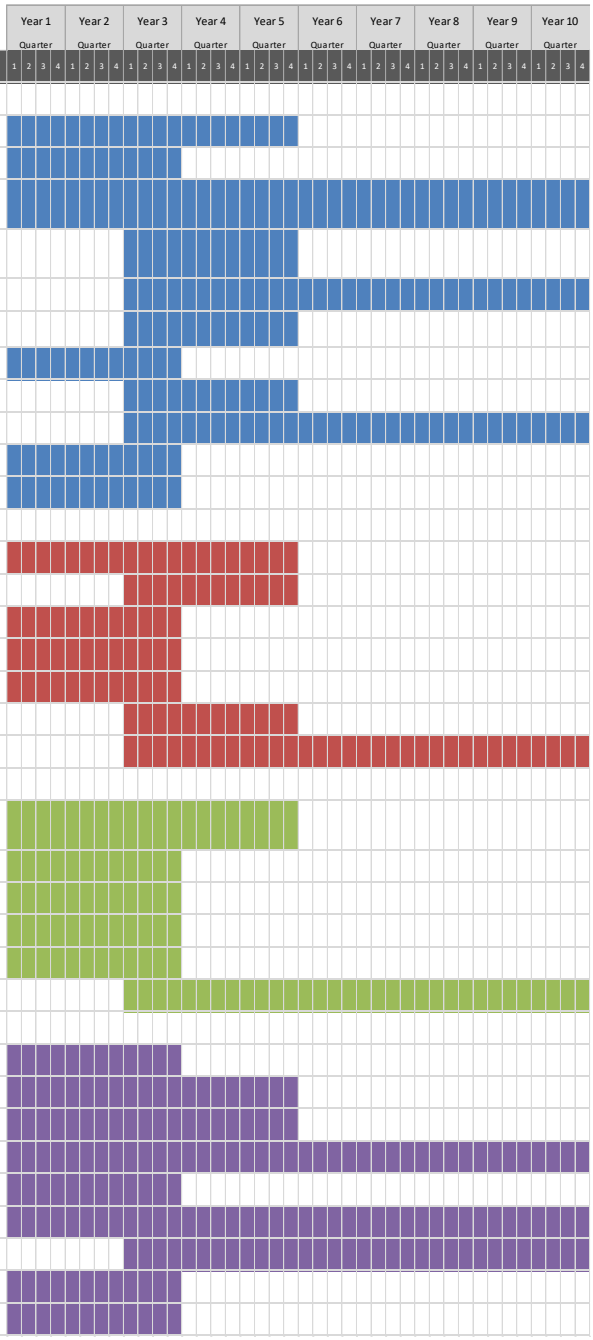
6.1 Implementation Schedule

The following implementation schedule was developed based on the Goals & Objectives table. During the watershed planning process, stakeholders identified realistic timeframes for each task or action. Actions are grouped into four categories, based on local priorities and feasibility: Ongoing (continuous), Short (1-3 years), Mid (3-5 years), or Long (5-10 years).

Haskett Creek Watershed Plan
Implementation Schedule

Project Start:
Display Week:

ACTION	DESCRIPTION	PROGRESS	START	END
Objective 1: Reduce peak stormwater flows by at least 20%.				
1-1	Implement identified stormwater control measure projects			
1-2	Identify additional stormwater retrofit opportunities on public properties			
1-3	Promote stormwater retrofits in future maintenance or redevelopment of publicly owned buildings, parks, parking lots and drainage systems			
1-4	Develop street tree program and encourage stormwater reduction measures on City streets in future capital improvement projects			
1-5	Work with Department of Transportation to incorporate retrofits into highway upgrades			
1-6	Develop cost share/incentive program to encourage SCMs on private property			
1-7	Map and inventory existing stormwater network			
1-8	Work with businesses and homeowners to disconnect roof drains			
1-9	Reduce sources of I/I			
1-10	Consider establishing LID requirements for new development			
1-11	Incorporate watershed plan recommendations into other City/County plans			
Objective 2: Protect and restore riparian buffers along streams and tributaries.				
2-1	Implement identified riparian buffer improvement projects using native plants			
2-2	Stabilize eroding stream banks with native plants and materials			
2-3	Groundtruth riparian buffer assessment to identify additional riparian buffer improvement and stream restoration projects			
2-4	Extend water supply watershed buffer protections to impaired waters			
2-5	Identify buffers as a priority in other ordinances and plans			
2-6	Develop cost share/incentive program to encourage businesses and homeowners to restore buffers on private property			
2-7	Coordinate buffer improvements with floodplain protection, utility easements, and trail programs			
Objective 3: Preserve existing open space to provide water quality benefits.				
3-1	Work with Piedmont Land Conservancy, Randolph County Soil & Water, recreation departments, and other partners to prioritize and acquire land for conservation			
3-2	Establish a maximum built upon area limit for new development within the watershed			
3-3	Use Code & Ordinance Worksheet to identify other opportunities to improve open space protections in City/County ordinances			
3-4	Identify potential incentivies to encourage open space preservation			
3-5	Align conservation goals with Future Land Development Plan			
3-6	Explore floodplain protection and trail opportunities to meet conservation goals			
Objective 4: Continue and expand public outreach and education.				
4-1	Establish active Watershed Group to implement and monitor plan			
4-2	Organize StreamWatch & Adopt a Stream volunteer groups			
4-3	Install educational signage at SCM project sites and stream crossings			
4-4	Continue and expand direct education programs in coordination with StormwaterSMART and other partners			
4-5	Tailor messaging and explore other forms of media to reach diverse audiences			
4-6	Work with Keep Randolph County Beautiful and other partners to reduce litter, pet waste, and pesticide/fertilizer use in watershed			
4-7	Increase stewardship of creeks through passive recreation opportunities			
4-8	Schedule good housekeeping training/workshops			
4-9	Promote online StoryMap and watershed applications			



6.2 TRACKING PROGRESS & MEASURING SUCCESS

Local stakeholders will track progress and measure the success of management strategies through a variety of sources. Overall water quality is regularly monitored by the Upper Cape Fear River Basin Association and NC DWR's Ambient Monitoring Program. This data will be pulled from publically available databases and reviewed on an annual basis to evaluate any improvements in water quality. Key parameters of interest include conductivity, dissolved oxygen, pH, fecal coliform, turbidity, and total suspended solids. Ideally, management measures will help reduce the number of exceedances for turbidity and fecal coliform, as well as peak flows. In addition, the UCFRBA summarizes water quality data at each of their stations as part of their annual reporting requirements to the state. This will be supplemented by citizen science data collected through Stream Watch, iNaturalist, or other educational programs.

Individual projects will be tracked using an assortment of watershed applications that were developed by the NC DWR to streamline the watershed planning and implementation process. The Watershed Improvements Project Tracker (WIPS) will be used to track the number and type of projects that are installed within the watershed. Through this application, local stakeholders are able to map and track information related to new restoration, protection, and education projects, including project costs, status, implementation date, size, funding sources, and return on investment. Particular metrics that will be tracked include the number of projects installed, linear feet of buffers, linear feet of stabilized streambanks, acres of land conserved, and amount of funding. Educational initiatives will also be tracked by PTRC's Stormwater SMART program, who annually reports the number of local residents that are engaged through educational programs and mass media per jurisdiction.

Information generated over the course of the project, including WIPS and other watershed planning tools, have been hosted through an interactive StoryMap to enable users to easily access plan information and simplify the implementation process. Local stakeholders can input new projects into the WIPS application from any device, which will automatically be updated on the StoryMap website. This website can be easily updated as progress is made or new challenges arise.

6.3 FINANCIAL AND TECHNICAL NEEDS

Like many small local governments, Asheboro, Randleman, and Randolph County have limited staff capacity and resources available. In order to implement elements of the *Haskett Creek Watershed Plan*, they will likely need to rely on an established network of local and regional partners (many of which were actively involved in the watershed planning process). The following tables provide a list of organizations that could provide technical assistance on various aspects of the plan and financial resources that are available to support restoration projects, conservation, and educational programs.

Table 9: Sources of Technical Assistance

Organization	Contact Information	Role
City of Asheboro Planning & Water Resources Departments	146 N. Church St, PO Box 1106 Asheboro, NC 27204. Phone: 336-626-1201 x223 or x258	Control infrastructure, land use, and zoning within watershed
City of Randleman Planning Department	204 S. Main St, Randleman, NC 27317. Phone: 336-495-7505	Control infrastructure, land use, and zoning within watershed
Randolph County Planning Department	204 E. Academy St, Asheboro NC 27203. Phone: 336-318-6555	Control infrastructure, land use, and zoning within watershed
Randolph County Soil & Water Conservation District	2222-A S. Fayetteville St., Asheboro, NC 27203. Phone: 336-318-6490	Provide technical assistance and funding for farmers/landowners, conservation, and BMPs
North Carolina Cooperative Extension	1003 S. Fayetteville St, Asheboro, NC 27203. Phone: 336-318-6000	Provide technical assistance and educational resources for farmers/landowners
Keep Randolph County Beautiful	4401 Zoo Pkwy, Asheboro, NC 27205. Phone: 336-879-7711	Host cleanups and other educational events to reduce litter and other waste
North Carolina Department of Environmental Quality Winston-Salem Regional Office	450 W. Hanes Mill Rd, Suite 300, Winston-Salem, NC 27105. Phone: 336-776-9800	Provide technical assistance and funding for water and waste management
North Carolina Wildlife Resources Commission	1701 Mail Service Center Raleigh, NC 27699. Phone: 919-630-3086	Provide technical assistance and funding for wildlife protection and habitat improvements
Piedmont Conservation Council	205 E. Main St, 5th Floor, Durham, NC 27701. Phone: 919-525-3037	Provide technical assistance, grant writing, and project management for projects that conserve natural resources
Piedmont Land Conservancy	PO BOX 4025, Greensboro, NC 27404. Phone: 336-691-0088	Provide technical assistance for conservation and trail projects
Piedmont Triad Regional Council	1398 Carrollton Crossing Dr, Kernersville, NC 27284. Phone: 336-904-0300	Provides technical assistance, grant writing, and project management for planning and water resource projects

Table 10: Sources of Financial Assistance

Funding Source	Activities Funded	Match Required	Eligibility
319 Grant Program (USEPA and NCDWR)	Implementation of approved nine element watershed restoration plan(s) with approved checklist	40% of Total Award	State and Local Governments, Nonprofits, Educational Institutions
Clean Water Management Trust Fund (NCDNCR)	Protect, improve, and/or restore surface water, acquire lands with ecological, cultural, and/or historical significance (including riparian buffers)	Varies	State Agencies, Local Governments, Nonprofits
205 (j) Planning Grant (USEPA and NCDWR)	Water Quality management and planning	Optional Match	Regional Councils of Governments
Z. Smith Reynolds Foundation	Improve, restore, protect water quality, and ensure access to all waters		501(c) 3 Organizations
Clean Water State Revolving Fund (USEPA and NCDWI)	Provides low interest loans to fund wastewater collection and treatment facilities as well as estuary and nonpoint source program projects	N/A	Local Governments
Five Star and Urban Waters Restoration Grant Program (NFWF)	Provide support for innovative job opportunities that expose young people, particularly urban and underserved youth to natural world and career opportunities in conservation	1:1	Non-profit 501(c) organizations, state and local government agencies, Indian tribes, and educational institutions
Flood Mitigation Assistance Grant Program (FEMA)	Help communities fund projects and planning that reduces or eliminates long-term risk to flood damage to structures insured under National Flood Insurance Program	varies	Most state, local governmental entities, nonprofits, federally recognized tribes, academic institutions
Parks and Recreation Trust Fund (NCDPR)	State park land acquisition and capital improvements, local government park and recreation purposes, and beach access	1:1	
NC Attorney General's Office - Environmental Enhancement Grant Program	Immediate or long term environmental enhancement projects that improve air, water, and/or land quality of NC.	Varies	Federal or State Agencies, Local Governments, Nonprofits
Community Conservation Assistance Program (NCDSWC)	Funds non-agricultural management measures	Up to 75%	Citizens

6.4 OTHER RESOURCES

6.4.1 Haskett Creek Watershed Plan StoryMap

ESRI StoryMaps are web applications that let authors combine maps with narrative text, images, and multimedia, including video. The applications are designed to be attractive and usable by anyone, which makes them great for education and outreach, either to the general public or to a specific audience.

In order to increase plan access and usability, all information generated over the course of the project has been uploaded and formatted as an ESRI StoryMap, which will be maintained by the NC Division of Water Resources. This website will be used to increase public awareness and track progress as new projects get underway. The complete StoryMap can be viewed at the following website:
https://ncdenr.maps.arcgis.com/apps/MapSeries/index.html?appid=680d54e61cf24977aaaff04af33ff519

6.4.2 Watershed Planning Applications

North Carolina is developing a process to restore and protect water resources using a set of planning and data development tools that leverage professional and citizen scientist. The main goal is to save staff time and financial resources so that they can be put towards on-the-ground projects that improve or protect water resources. The various tools can be used to find and prioritize potential projects in the plan area and track restoration and protection in a meaningful way.

Source and Conveyance Identification Tool (SCITS) – The SCITS tool is used to identify outfalls, tributaries, and other sources of water or pollution in the watershed.

Watershed Improvements Project Tracker (WIPS) – The WIPS tool is used to track restoration, protection, and education project information.

Water Resource Valuation Tool (WR Val) - The WR Val Tool assigns a dollar value to natural resources and projects so that return on investments can be analyzed and compared.

Trash Tracker - TrashTracker is a simple tool to collect information about trash and litter.

6.4.3 Green Growth Toolbox

The NC Wildlife Resources Commission (WRC) has developed a Green Growth Toolbox, which is a comprehensive set of resources that provides communities with tools to identify their natural assets and develop protections for them. The toolbox includes a technical assistance tool, a handbook on developing ordinances for protecting the environment, a GIS dataset, and a website developed by the NC WRC to assist communities in growing in ways that conserve the most valuable natural resources including streams and habitat. These resources, as well as additional information, can be found at http://www.ncwildlife.org/Conserving/Programs/Green-Growth-Toolbox.