JOHNSTON RUN

WATERSHED MANAGEMENT PLAN

JUNE 2014

PREPARED FOR

Mercersburg Borough
113 South Main Street
Mercersburg, Pennsylvania, 17236

PREPARED BY

KCI TECHNOLOGIES, INC.
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FUNDED BY

NATIONAL FISH AND WILDLIFE FOUNDATION

ACKNOWLEDGEMENTS

The Johnston Run Watershed Management Plan represents a collaborative effort between the Johnston Run Revitalization Council, Mercersburg Borough, and KCI Technologies, Inc.

The following individuals were instrumental in providing support for field assessments, outreach, mapping, data analysis, quality control, and reporting. The contributions of each were vital to the successful completion of the project and have furthered the protection and restoration of natural resources.

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Front cover photos (left to right): upper Johnston Run, green sunfish (*Lepomis cyanellus*), lower Johnston Run

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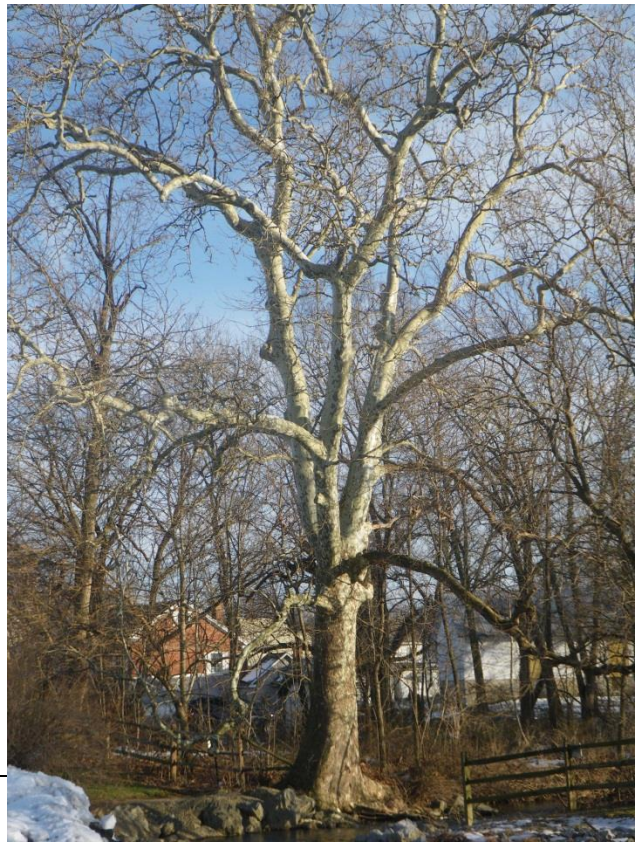
List of Acronyms

ALLARM	Alliance for Aquatic Resources Monitoring
BAT	Best Available Technology
BMP	Best Management Practice
CNHI	County Natural Heritage Inventory
CREP	Conservation Reserve Enhancement Program
CWP	Center for Watershed Protection
EQIP	Environmental Quality Incentives Program
FCB	Fecal coliform bacteria
FCCD	Franklin County Conservation District
FEMA	Federal Emergency Management Agency
FSA	Farm Service Agency
IBA	Important Bird Area
IDDE	Illicit Discharge Detection and Elimination
JRRC	Johnston Run Revitalization Council
KCI	KCI Technologies, Inc.
MPN	Most probable number
NFWF	National Fish and Wildlife Foundation
NMP	Nutrient Management Plan
NRCS	Natural Resources Conservation Service
PACD	PA Association of Conservation Districts
PADCNR	PA Dept. of Conservation and Natural Resources
PADEP	PA Dept. of Environmental Protection
PFBC	PA Fish and Boat Commission
PNHP	PA Natural Heritage Program
PSU	Penn State University
SCA	Stream Corridor Assessment
SPSC	Step Pool Storm Conveyance
TMDL	Total Maximum Daily Load
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USLE	Universal Soil Loss Equation
WC	Water Contact
WHIP	Wildlife Habitat Incentive Program
WWF	Warm Water Fishes

An American sycamore
holds the stream bank near the VFW Hall
Photo Michael Pieper



Limestone spring with dense watercress vegetation
Photo Wink Hasting

1 Introduction

This Watershed Management Plan for Johnston Run is developed to address key issues impacting natural resources in the watershed; specifically - improving in-stream water quality and habitat conditions, with an overarching goal of re-connecting residents and visitors to a restored and healthy waterway.

Located in Franklin County, Pennsylvania, the Johnston Run subwatershed drains directly into the West Branch Conococheague Creek. The West Branch confluences with the mainstem of the Conococheague, a tributary of the Potomac River, which ultimately drains to the Chesapeake Bay (Map 1). The Borough of Mercersburg is located in the south central portion of the watershed with State Route 16 (Buchanan Trail West) running from the northern extent of the watershed through Mercersburg. The Johnston Run subwatershed has a drainage area of approximately 8.5 square miles with approximately 15.6 miles of mapped stream channels. The watershed includes a mix of agricultural, urban, and industrial land uses.

The headwaters of Johnston Run originate at the foothills of the Cove Mountain located west of Charlestown Road and are largely fed by limestone springs. Limestone streams or “limestoners” as they are affectionately called can and should be great natural resources that support an abundance of aquatic wildlife and trout due to the clear, cold and mineral rich water that percolates up from the limestone spring to feed the stream. However, like many limestone streams in central Pennsylvania, Johnston Run is impacted by both urban and agricultural stressors.

Chief among these stressors are those associated with stormwater runoff that washes pollutants from both urban and rural landscapes into our streams and rivers. If these pollutants, which can include sediment, nitrogen, phosphorus, oils, bacteria, and metals among others, are delivered to the stream system in high enough concentrations the results can be very harmful to the fish, amphibians and insects that inhabitat the water, and to humans and livestock that come in contact with and rely on good water quality.

Johnston Run is currently listed on Pennsylvania’s 2012 Integrated Water Quality Monitoring and Assessment Report for streams with water quality impairments, although no Total Maximum Daily Loads (TMDL) have been established. Impairments in Johnston Run include:

- Water/Flow Variability – from urban runoff and storm sewers
- Siltation – from agriculture, urban runoff and storm sewers
- Nutrients - from agriculture, urban runoff and storm sewers

Other issues documented in the watershed (KCI, 2013) include elevated bacteria, periodic flooding, excessive stream bank erosion, degraded stream habitat, and a lack of riparian or stream side vegetation.

1.1 Goals and Objectives

These impairments, along with a desire to restore Johnston Run to a healthy living waterway, sparked a movement to action. In collaboration with Peters and Montgomery Townships, and with support from Franklin County, Mercersburg Borough and the Johnston Run Revitalization Council (JRRC) have initiated a series of efforts to achieve the long-term goal of health for the community and its citizens including the Johnston Run watershed. The Council's mission is as follows:

> *The Johnson Run Revitalization Council, in collaboration with MACWell and the local municipalities, is working to restore Johnston Run as a "Living Waterway," inspiring our local communities to be stewards of our natural habitats and becoming a model for other communities.*

A healthier Johnston Run and increased citizen stewardship are fostered by stronger connections between the community and the stream. To this end, the JRRC has initiated a parallel effort to construct a trail system along Johnston Run within the Borough. Through use of the streamside trail, the community will come in greater contact with Run and come to understand the problems affecting its health and its potential as a natural resource and community asset.

In addition to these local goals, implementation of the recommendations in this plan will assist Franklin County in meeting the pollutant load reduction goals for nitrogen, phosphorus, and sediment as outlined in the Pennsylvania's Phase 2 Chesapeake Watershed Implementation Plan (WIP) (DEP, 2012). The WIP was developed in response to the United States Environmental Protection Agency's Chesapeake Bay TMDL (USEPA, 2010) requirements which set pollutant loading limits to restore the Bay's health. Pennsylvania chose to sub-divide the required reduction in loads at the county level; therefore Franklin County has planning goals for reductions of 39% of nitrogen (as total nitrogen), 34% of phosphorus (as total phosphorus), and 37% of sediment (as total suspended solids). These goals represent reductions from calculated 2009 loads and final targets to be met by 2025.

Funded through a grant from the National Fish and Wildlife Foundation (NFWF), this Watershed Management Plan provides a key step in identifying key issues and real solutions to improve the health of the watershed.

The *Johnston Run Watershed Assessment Report* (KCI, 2013) completed in 2013 and included here as Appendix A, documents current watershed conditions through field investigations. The **Watershed Assessment** is a critical first step in understanding the problems affecting the watershed. Measured elements included water quality sampling and analysis of pollution levels, assessment of the biological community using fish and aquatic insects, and assessment of stream conditions identifying potential sources of watershed impact.

The **Watershed Management Plan**, builds from the results of the assessment and develops management strategies and restoration project recommendations to address the identified issues. The plan includes planning level cost estimates and a prioritized list of recommendations with a description of their benefits related to water quality and overall stream health. Following completion of the plan, the focus will shift to **Implementation** of the recommended strategies and restoration projects.

The activities of the JRRC and Mercersburg Borough to produce the assessment and this management plan are strictly voluntary, as would be the implementation of restoration projects and management strategies.

Figure 1 – Watershed Planning and Restoration Process

1.2 Readers Guide to the Plan

The following is intended to provide a brief description of the plan components and identify the linkage between the various assessments and plan sections.

1.2.1 Plan Components

Section 1. Introduction – Introduces the Watershed Management Plan, Goals and Objectives and the overall planning context.

Section 2. Watershed Characteristics - provides a detailed description of the watershed landscape, land use, living resources and regulatory environment. This section is largely based on research from existing data and reports.

Section 3. Current Condition Assessment – provides a summary of the field investigations and new data developed as part of the Watershed Assessment. The full Watershed Assessment Report is included in Appendix A. This section also introduces the calculation of existing conditions pollutant loading, which assists in identifying the sources of various pollutants.

Section 4. Implementation Plan – includes description of the recommended management strategies and restoration projects, an estimation of the water quality benefits that would be realized from plan implementation, and a schedule of future activities. This section includes cost estimates for strategy implementation, identifies potential funding sources, and describes schedules and monitoring programs to document plan implementation and changes in the watershed condition over time.

1.2.2 EPA Watershed Plan Elements

The U. S. Environmental Protection Agency has established a series of nine essential watershed elements (A – I criteria) which must be addressed in the watershed plan to be eligible for restoration funds under section 319 of the federal Clean Water Act. The plan was designed to satisfy these requirements. The elements are listed here with the plan sections that address each.

A. Identification of pollutant causes and sources to achieve load reductions addressed in watershed management plan. Sections 2 – Watershed Characteristics; 3.1 Watershed Assessment; and 3.2 Pollutant Loads.

B. Estimate of load reductions anticipated to be achieved through management measures specified below. Sections 3.2 – Pollutant Loads and 4.2.1 – Pollutant Load Reductions.

C. Description of non-point source management measures necessary to achieve load reductions. Section 4.1 Management Strategies.

D. Estimate of technical and financial assistance, cost, and authorities necessary to implement the watershed management plan. Section 4.3 Funding Requirements and Sources.

E. Information or education component to enhance public understanding of watershed management. Section 4.4 Community Engagement.

F. Schedule for implementing the non-point source management measures specified in plan. Section 4.5 Implementation Schedule.

G. Interim, measurable milestones to determine implementation of non-point source management measures. Section 4.5 Implementation Schedule

H. Criteria to determine if load reductions are being achieved. Section 4.5 Monitoring Program.

I. Monitoring component to evaluate effectiveness of implementation efforts. Section 4.6 Monitoring Program.

2 Watershed Characteristics

2.1 Watershed Delineation and Hydrology

Located in Franklin County, Pennsylvania, the Johnston Run watershed drains directly into the West Branch of the Conococheague Creek, a tributary of the Potomac River, which ultimately drains to the Chesapeake Bay (Map 1 and Map 2). The Borough of Mercersburg is located approximately south central portion of the watershed with State Route 16 (Buchanan Trail West) running from the northern extent of the watershed through Mercersburg. The headwaters of Johnston Run originate at the foothills of the mountains located west of Charlestown Road.

The Johnston Run watershed is approximately 5,434 acres (8.5 mi^2) in area and includes 15.6 miles of mapped stream channel.

2.2 Landscape

2.2.1 Climate

Climate influences soil formation and erosion processes, stream flow patterns, vegetation coverage and a significant part of the geomorphology of a watershed. Rainfall not only provides water to streams and vegetation, but the intensity, frequency and amount of rainfall can greatly influence watershed characteristics.

Franklin County is located in the Northeast climate region of the U.S. (Karl and Koss, 1984) and has a temperate climate with a mean monthly rainfall of 2.55 - 4.03 inches and a mean annual rainfall of 39.3 inches. Air temperature of the area ranges from an average low temperature of 23°F in January to an average high of 86°F in July.

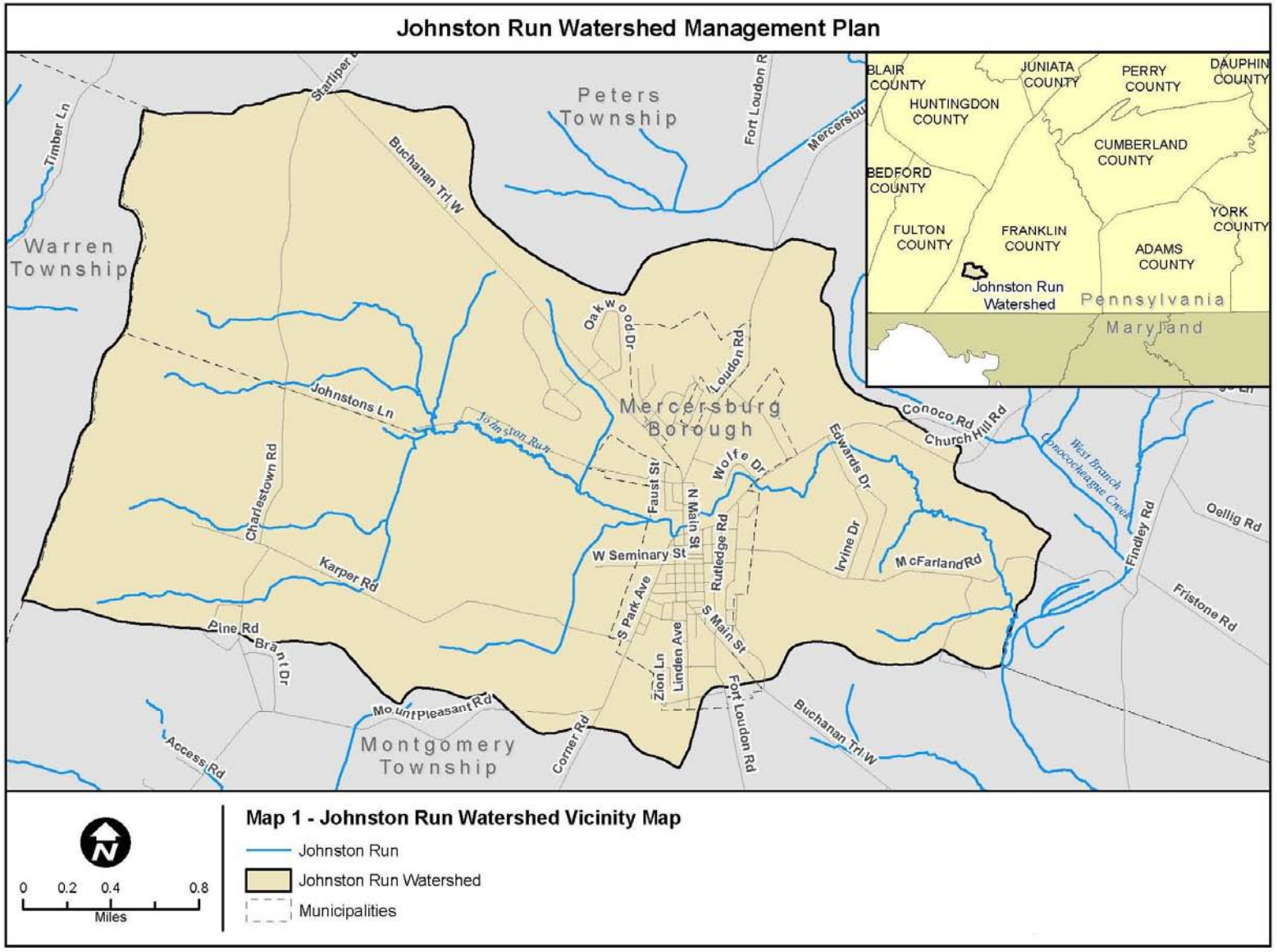
2.2.2 Physiography

The Johnston Run watershed is situated in the Great Valley Section, which lies to the south of Blue Mountain in southeastern Pennsylvania and consists of very broad lowland (PA DCNR, 2000). The Great Valley Section is a part of the Ridge

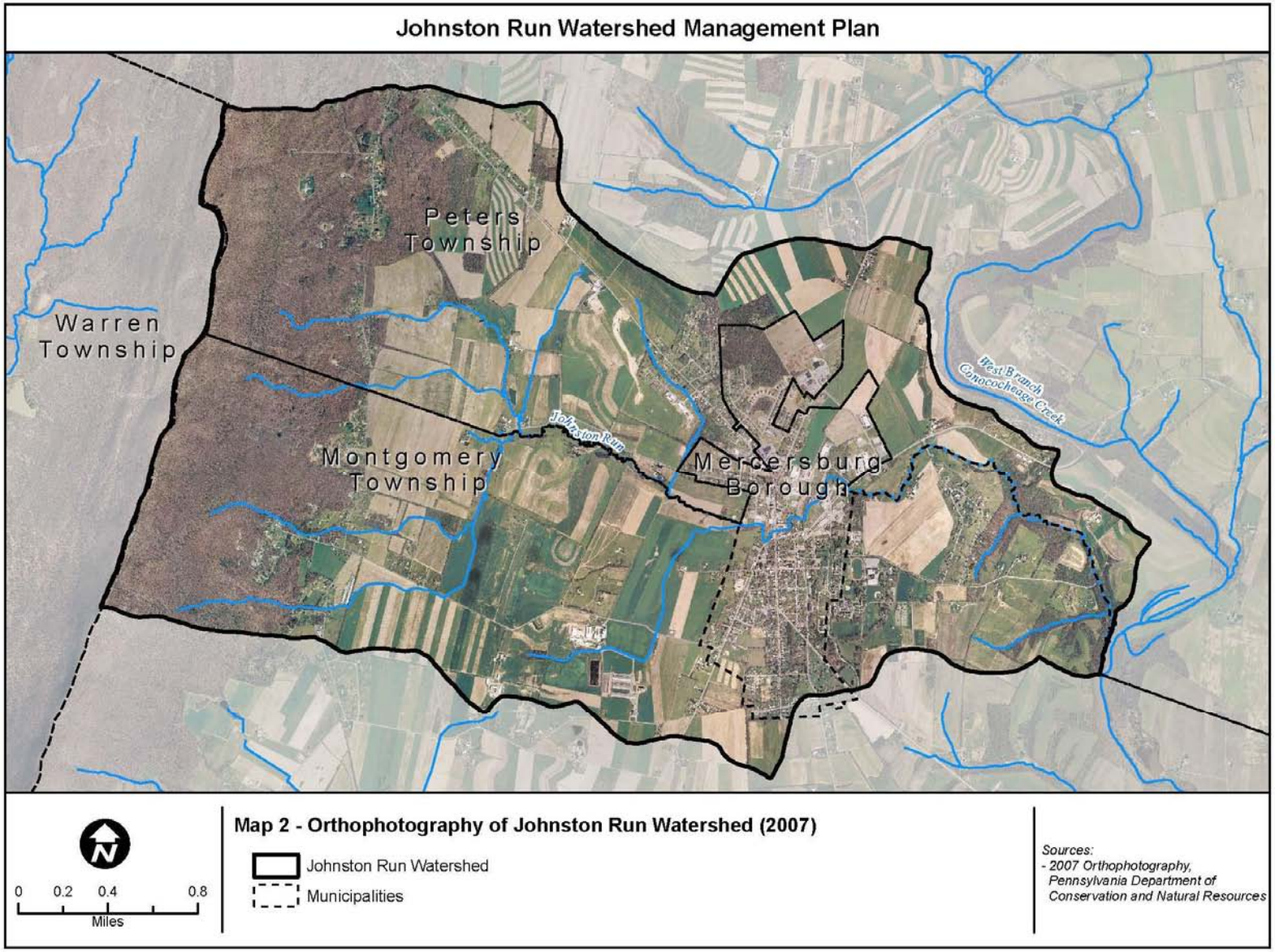
QUICK FACTS:

- Drains to the Conococheague Creek and ultimately the Chesapeake Bay
- Size:
  8.5 square miles
  4.0 sq mi in Montgomery
  3.5 sq mi in Peters
  0.9 sq mi in Mercersburg
  0.02 sq mi in Warren
  15.6 miles of stream
- Physiography:
  Situated at the foothills of Cove Mountain
- Land Use:
  Agriculture – 52%
  Forested – 30%
  Developed – 18%
- Biological Condition:
  Johnston Run Watershed is home to many sensitive species including the barn owl
- Important Wildlife Habitats:
  Charlestown Ponds
  Mercersburg Meadow
  Mercersburg Woods
- Water Quality:
  66% of streams impaired
  34% of streams non-impaired
- Designated Use:
  Aquatic Life - Warm Water Fishes
- Cause of Stream Impairments:
  Nutrients and siltation (sediment); 84% from agricultural sources and 16% from urban runoff/storm sewers
  (Source: PA DEP, 2010)

and Valley Province that extends through the center of Pennsylvania.



Map 1 – Watershed Vicinity Map


Johnston Run Watershed Management Plan
Peters Township
Warren Township
Montgomery Township
Mercersburg Borough
Johnston Run
West Branch Conococheague Creek
0 0.2 0.4 0.8
Miles
Map 2 - Orthophotography of Johnston Run Watershed (2007)
Johnston Run Watershed
Municipalities
Sources:
- 2007 Orthophotography, Pennsylvania Department of Conservation and Natural Resources

Map 2 - Orthophotography

2.2.3 Geology

The geologic formations underlying a watershed have a significant effect on the water resources. Geology is a major determinant of the type of topography and surface features, as discussed earlier. The chemical composition and minerals of the parent rock or unconsolidated sediments determines in large part the soil characteristics, including erodibility and infiltration rates.

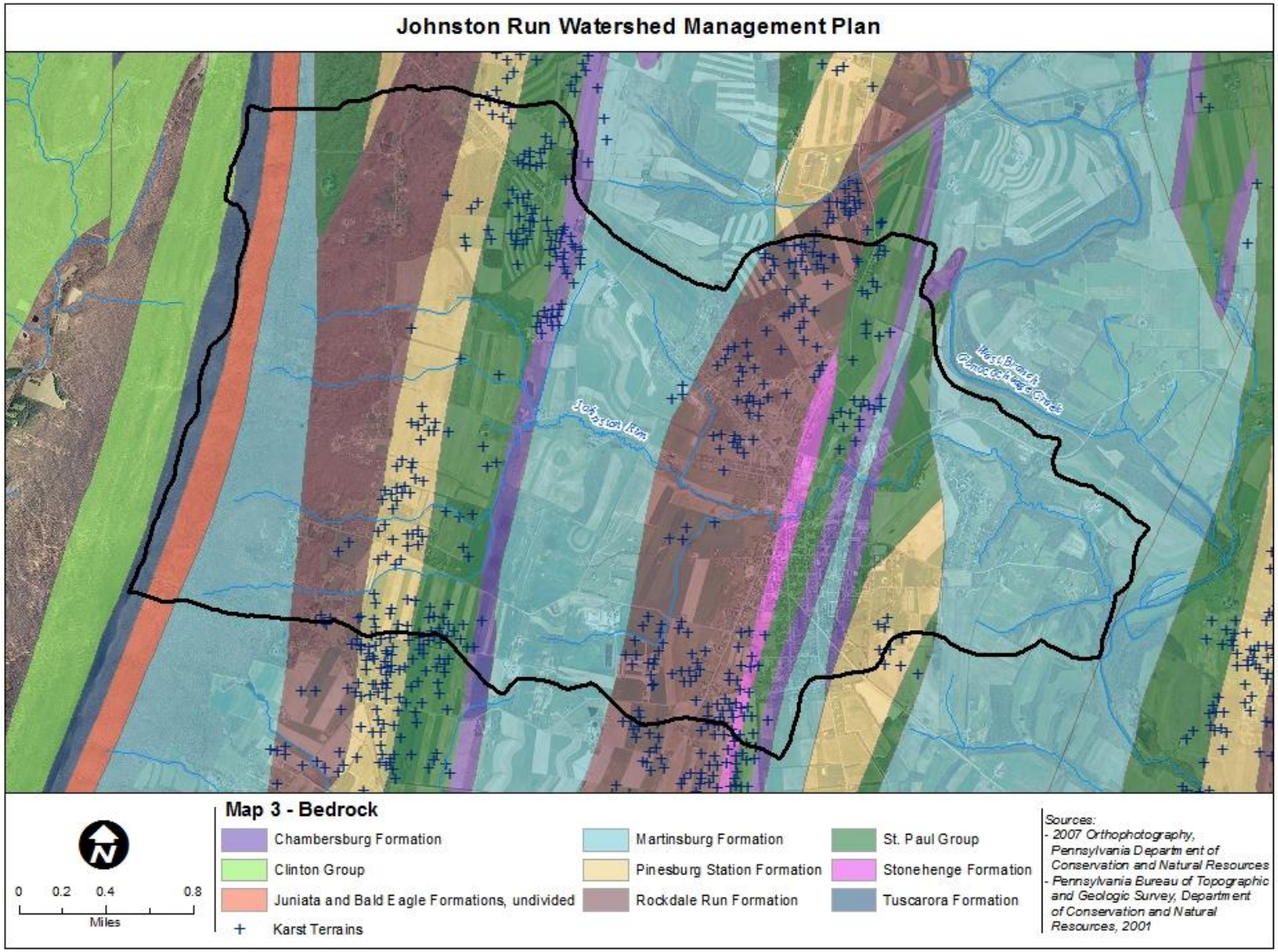
As shown in Map 3, bedrock geology of the watershed is dominated by the Martinsburg Formation of Ordovician shale and siltstone and Rockdale Run Formation of Ordovician limestone and dolostone (35 percent and 27 percent, respectively).

Karst terrains, shaped by the dissolution of weakly soluble bedrock (i.e. limestone), are present throughout the watershed, particularly in the St. Paul group and the Rockdale Run, Pinesburg Station, and Chambersburg formations (Map 3). Karst topography is found in regions with high-rainfall climate and abundant vegetation, limestone terrains, and appreciable hydraulic gradients (Grotzinger et al., 2007). Sinkholes, caverns, and underground drainage channels in place of surface streams are typical in karst regions.

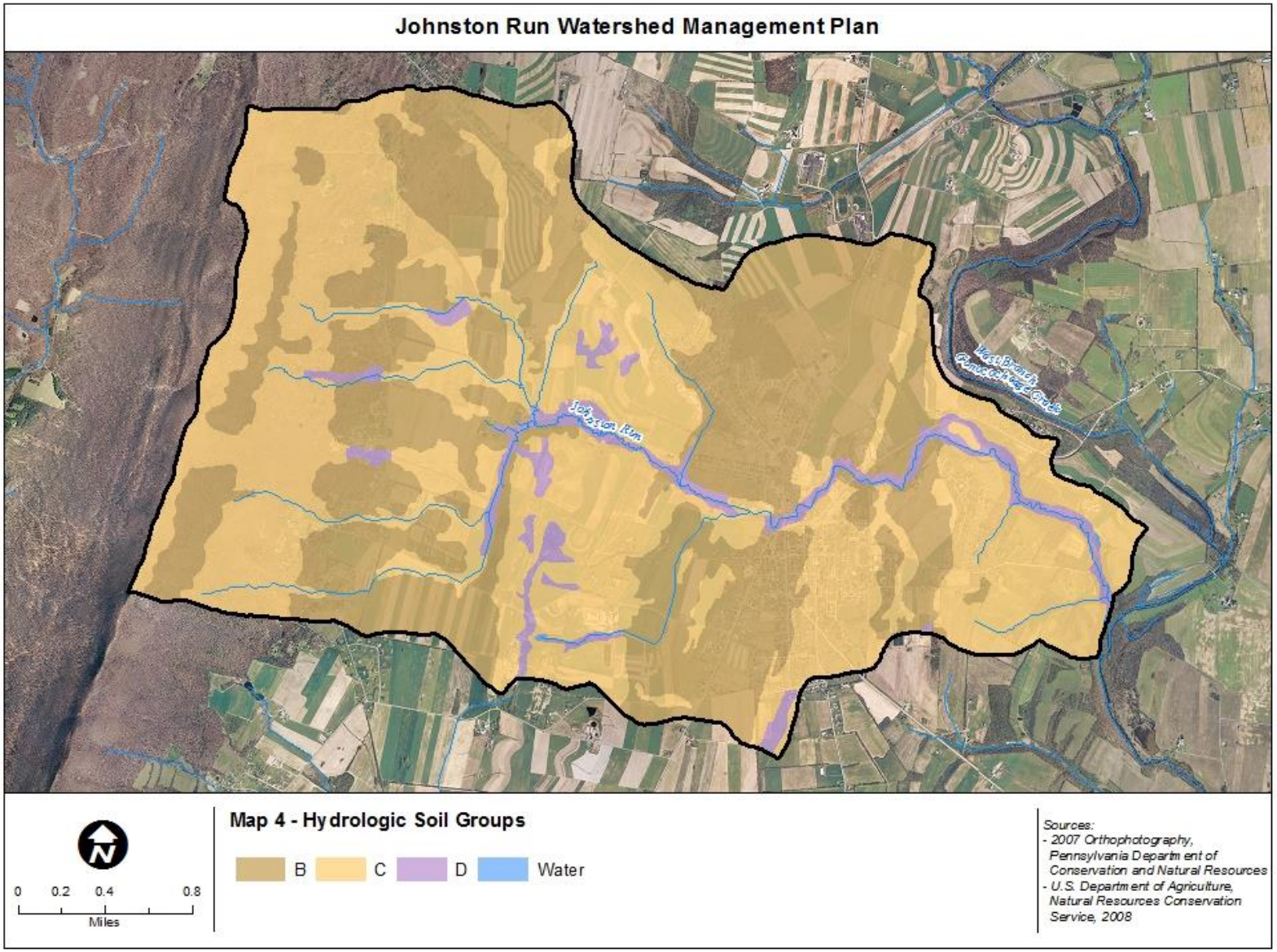
2.2.4 Soils

Soil conditions are an important factor when evaluating water quantity and quality in streams and rivers. Soil type and moisture conditions greatly impact the amount and quality of runoff. In addition, the magnitude of the runoff is affected by the combination of soil type and slope. Soils also affect how land may be used and its potential for vegetation and habitat. Soils are an important consideration in targeting projects aimed at improving water quality or habitat.

As shown in Map 4, the majority of soils (49.5 percent) are classified as hydrologic soil group C. These soils have relatively high runoff potential, meaning that water transmission, or infiltration, is somewhat restricted. Hydrologic soil group B also accounts for a large portion of the soils in the watershed (45.7 percent). Soils in group B have moderately low runoff potential with unimpeded water transmission through the soil. The remaining 4.9 percent of soils are of the soil group D, which have a high runoff potential with restricted or very restricted water movement through the soil.



Map 3 - Bedrock


Johnston Run Watershed Management Plan
Johnston Run
West Branch Conococheague Creek
Map 4 - Hydrologic Soil Groups
B
C
D
Water
0 0.2 0.4 0.8
Miles
Sources:
- 2007 Orthophotography, Pennsylvania Department of Conservation and Natural Resources
- U.S. Department of Agriculture, Natural Resources Conservation Service, 2008

Map 4 – Hydrologic Soil Groups

Murrill, Hagerstown, and Weikert soils make up close to half of the soils in the watershed (46.2 percent; 22.8, 14.3, and 9.1 percent, respectively). Murrill soils are well drained soils derived from acid sandstones and shales with some components of limestone or highly calcareous shales over residuum of limestone. Murrill soils are located on lower backslopes, footslopes, fans, and benches. Hagerstown soils are also well drained soils that are formed in residuum of hard gray limestone located on valley floors and adjacent hills. Located on gently sloping to very steep areas on uplands, Weikert soils are well drained soils formed in material that weathered from interbedded gray and brown acid shale, siltstone, and fine-grained sandstone (NRCS, 2013).

2.2.5 Soil Erodibility

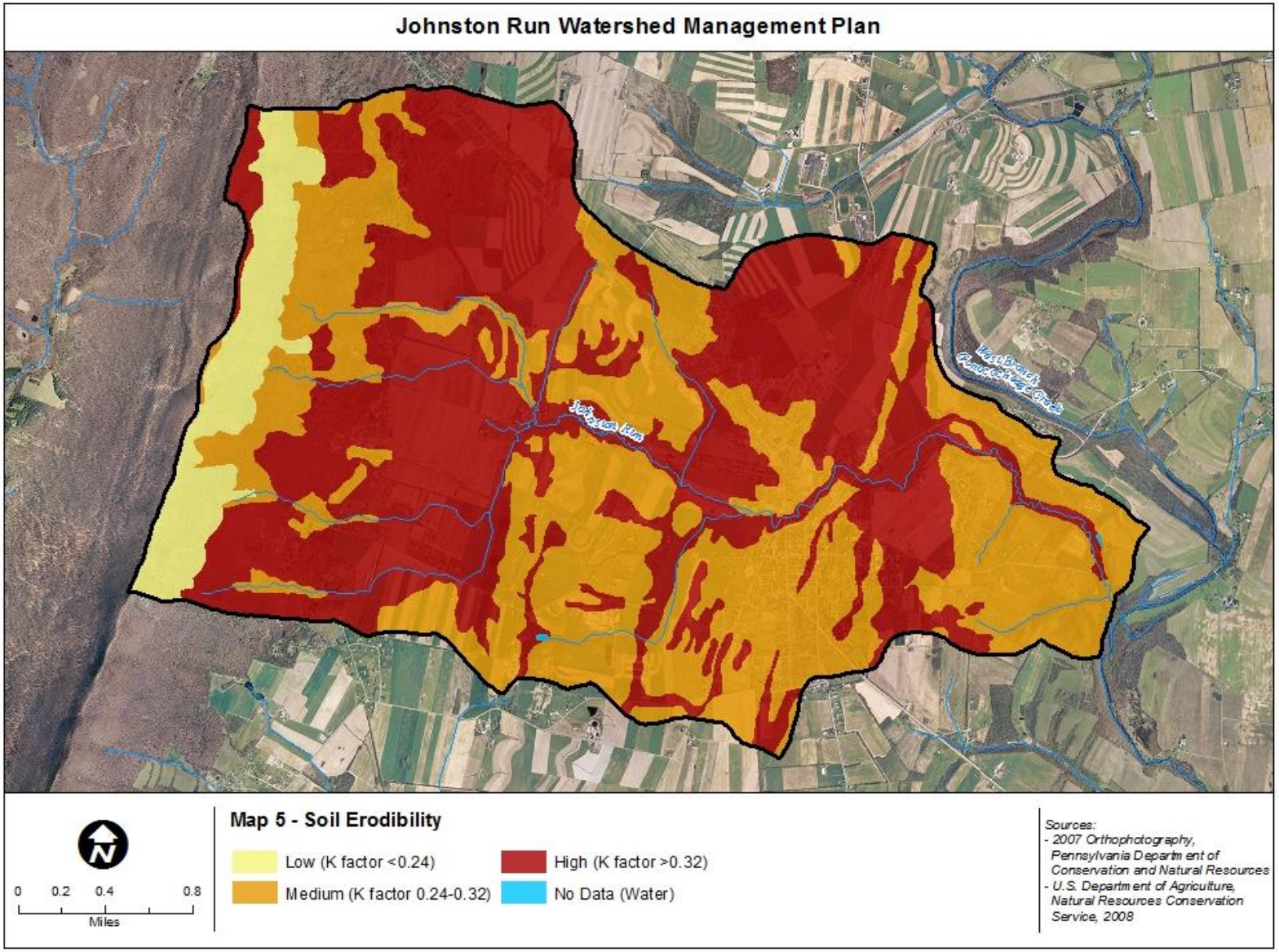
Soil erodibility is a measure of the soil's susceptibility to erosion. The Universal Soil Loss Equation (USLE) developed by the United States Department of Agriculture (USDA) Agricultural Research Service is a model used to describe soil erosion processes. In the USLE, erodibility is described quantitatively using the K factor, which represents both the susceptibility of soil to erosion and its contribution to the rate of runoff. For example, clay soils have low K values because they are resistant to detachment. Coarse soils such as sand can also have low K values because even though they are easily detached, they are less susceptible to runoff. Silts have the highest K values because they detach easily and produce high rates of runoff (Institute of Water Research, 2002).

Subwatersheds with the largest percentage of highly erodible soils offer the greatest potential for addressing soil conservation with best management practices (BMPs) aimed at maintaining topsoil, such as riparian buffer forestation. Combining this indicator with other information, such as cropland, slope steepness and distance to streams would help to determine where to retire highly erodible land from farming, a type of BMP. Additionally, a high K value helps to identify areas where urban development near streams, such as road construction or utility placement may have particularly adverse watershed impacts.

Soil erodibility was divided into four categories:

- No Data
- Low Erodibility (K factor <0.24)
- Medium Erodibility (K factor 0.24-0.32)
- High Erodibility (K factor >0.32)

Map 5 presents the soil erodibility categories based on K factor for Johnston Run watershed. The majority of the watershed consists of soils with medium erodibility or high erodibility (42.4 and 51.2 percent of the watershed, respectively) with 6.4 percent low erodibility.



Map 5 – Soil Erodibility

2.2.6 Forest Cover

Among land cover types, forest cover provides the greatest protection for soil and water quality. Johnston Run watershed is a moderately forested area with 1,627 acres of forest cover (deciduous, evergreen, and mixed forest); which comprises close to one-third of the watershed (30 percent).

2.2.7 Wetlands

Section 404 of the Clean Water Act (USEPA, 1972) defines wetlands as the following:

Wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Wetlands generally include swamps, marshes, bogs, and similar areas."

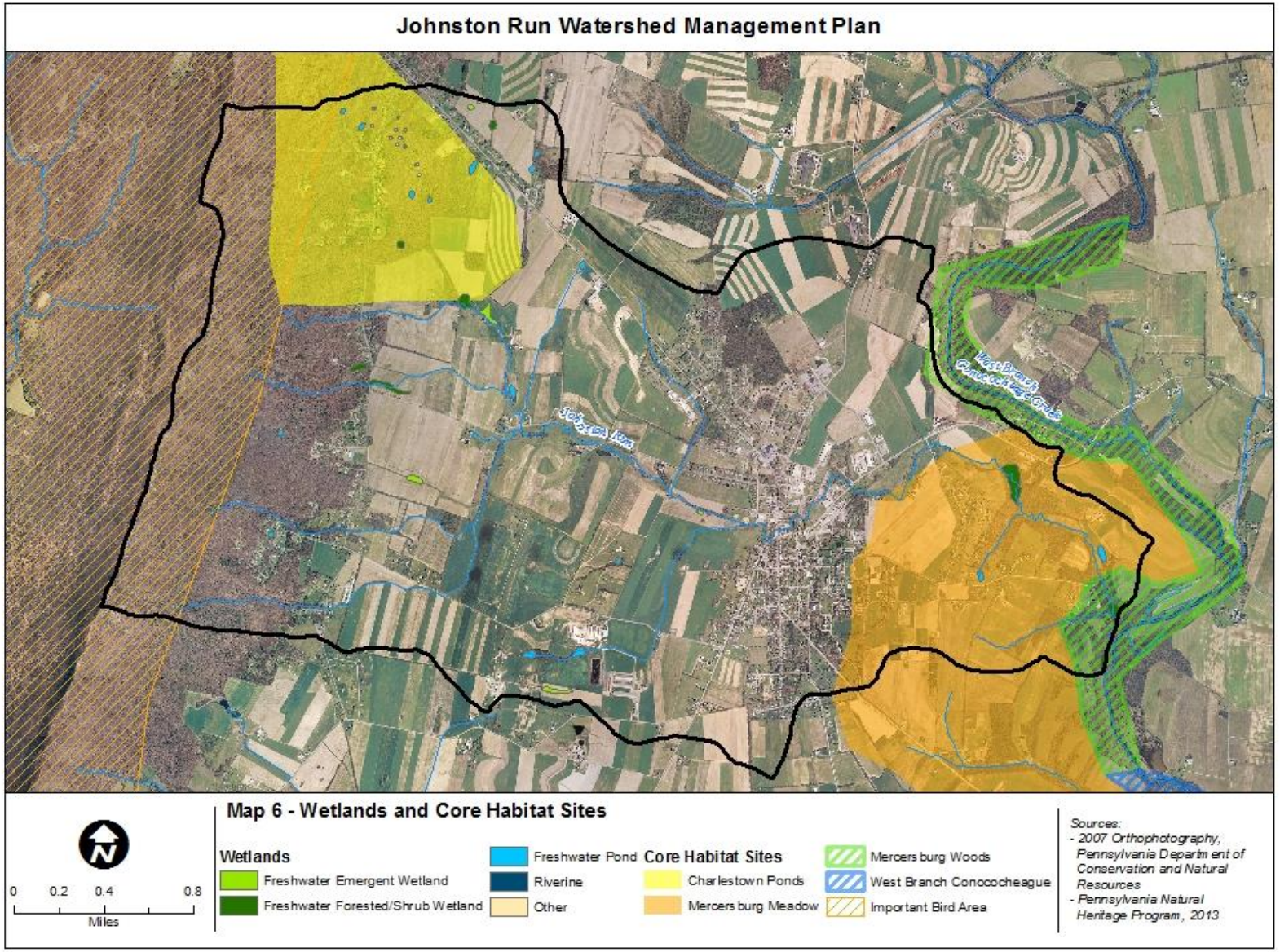
Wetlands are environmentally sensitive habitats that play an integral part in supporting the water quality and water storage of a watershed. These reservoirs help to control flooding by retaining surface runoff and releasing steady flows of water downstream. Wetlands also support biological diversity, erosion control, and sediment retention.

Based on the National Wetland Inventory, there are 30.2 acres of wetland habitat throughout the watershed (USFWS, 2010) the majority of which are freshwater forested/shrub wetlands (15.6 acres; Map 6). Freshwater pond and freshwater emergent wetlands cover 8.8 and 4.7 acres, respectively, with 0.1 acres of riverine wetlands and 0.9 acres classified as 'other'.

2.3 Sensitive Living Resources and Habitat

The Pennsylvania Natural Heritage Program (PNHP) has created the County Natural Heritage Inventory (CNHI) which maps critical biological resources throughout the Commonwealth of Pennsylvania. According to the CNHI, three portions of the Johnston Run watershed are considered Core Habitat Sites – one in the northern portion accounting for 560.7 acres and two sites in the eastern portion of the watershed, accounting for 687.4 acres. The PNHP defines Core Habitat as an area containing plant or animal species of concern at the state or federal levels, exemplary natural communities, or exception native diversity. These boundaries classify essential habitat that cannot absorb significant levels of disturbance without substantial impact to the plant or animal species of concern (PNHP, 2013).

The Franklin County Natural Areas Inventory was compiled and written by the Pennsylvania Science Office of The Nature Conservancy in 2004. This document describes locations of rare, threatened, and endangered species and of the highest quality natural areas in the county. This document identified the northern Core Habitat as Charlestown Ponds, which provide critical habitat for amphibians. This habitat is classified as Ephemeral/Fluctuating Natural Pool Communities and according to the PNHP ranking system, is considered rare or uncommon in the state. The eastern Core Habitats are identified as Mercersburg Meadow (622.1 acres) which contains an unknown quality population of Barn Owl (*Tyto alba*), a species of concern in the state, and Mercersburg Woods (65.3 acres), an area that contains several Pennsylvania plant species of concern (Map 6).



Map 6 - Wetlands and Core Habitat Sites

Important Bird Area (IBA) Number 51 crosses the western portion of the watershed along the ridgeline of the Cove Mountain (PNHP, 2013). The IBA program was initiated as an effort to identify and conserve areas of essential habitat for one or more species of bird.

According to the Pennsylvania Fish and Boat Commission, Johnston Run is not currently a trout stocked stream (PFBC, 2013), however both Conococheague Creek and the West Branch Conococheague Creek are trout waters and are stocked by the PA Fish and Boat Commission. Anecdotal evidence from residents indicates that it was stocked in recent history.

2.4 Water Quality

2.4.1 Use Designations

PA DEP has established water quality classifications of surface waters and groundwater throughout the state which are described in 25 PA Code – Water Quality Standards §93.9. Use designations of Johnston Run include Aquatic Life – Warm Water Fishes, which requires the maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat (PA DEP, 2009).

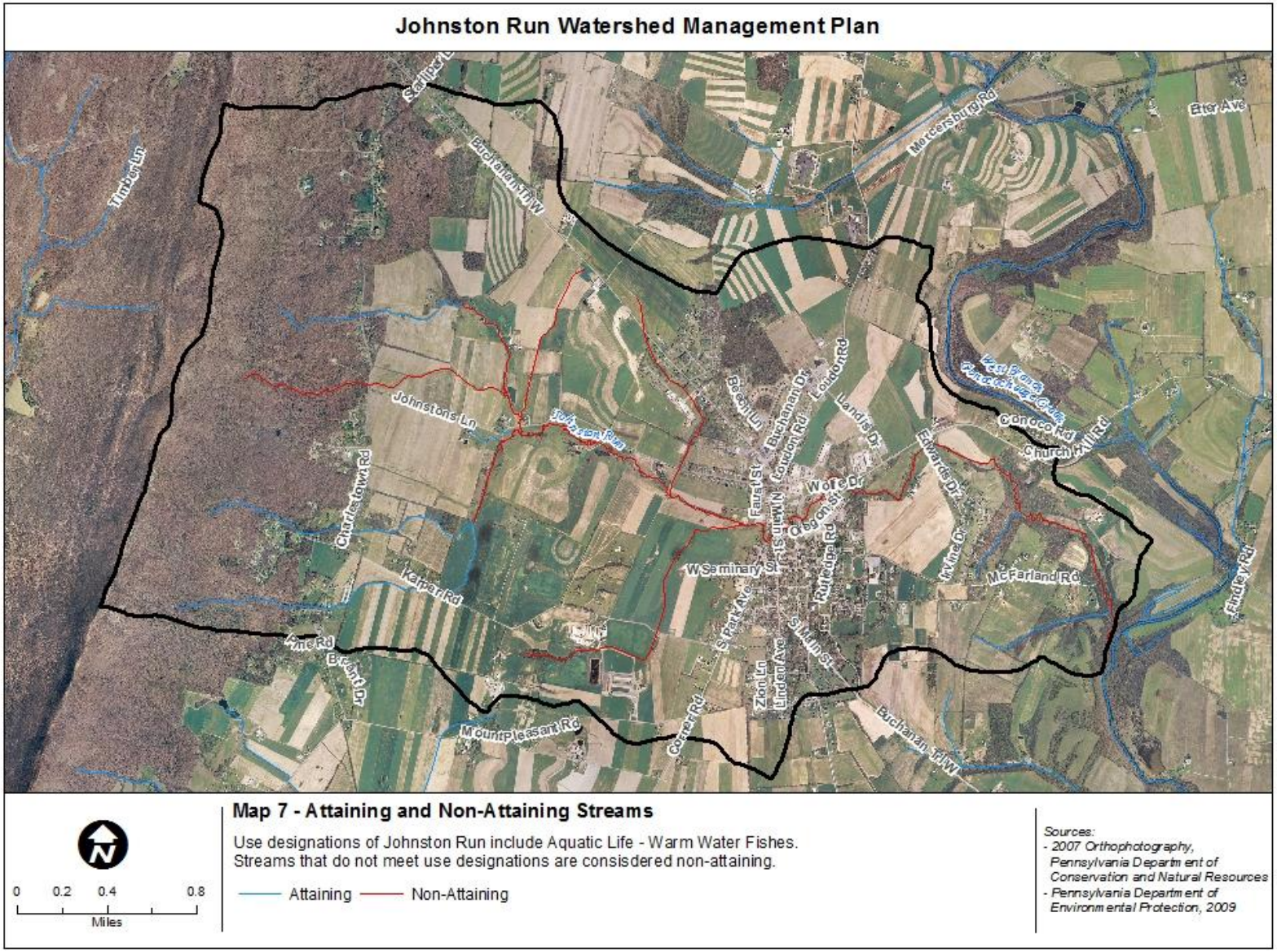
2.4.2 303(d) Impairments

Under the Federal Clean Water Act, the state of Pennsylvania is required to assess and report on the quality of waters throughout the state. Where designated uses are not fully supported, Section 303(d) requires states to list these water bodies as impaired waters. States are then required to develop a Total Maximum Daily Load (TMDL) for the listed impaired waters.

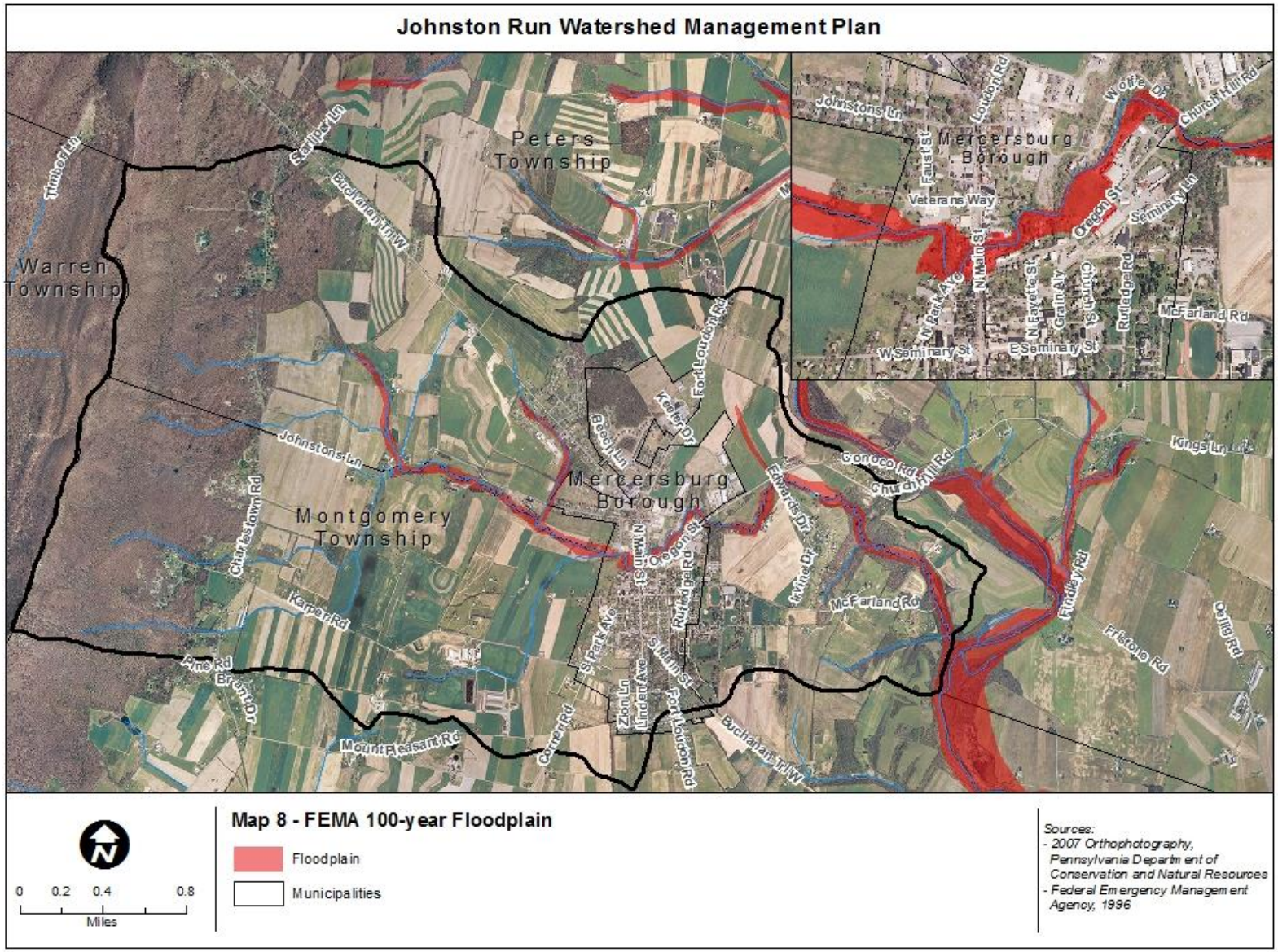
The Final 2012 Pennsylvania Integrated Water Quality Monitoring and Assessment Report, which includes both the 305(b) report and 303(d) List, currently classifies nine stream segments in the Johnston Run watershed as Category 5 waterbodies, requiring a TMDL (PA DEP, 2012). The listed stream segments account for over two-thirds (66.4%; 10.3 miles) of stream miles in the watershed leaving only 5.2 miles of stream that currently attain aquatic life use (Map 7). The majority of impairments (83.6%) are caused by agricultural sources, either siltation or nutrients. Additional nutrients and siltation originate from urban runoff and storm sewers and are responsible for the remaining listed impairments.

2.5 Flooding

Map 8 depicts the 100-year Federal Emergency Management Agency (FEMA) floodplain extent throughout the Johnston Run watershed. While no specific flooding study or modeling was conducted as part of this management plan, first-hand accounts from residents indicate that flooding is an issue on the upstream side of the Main Street crossing near the intersection with N. Park Avenue. It is clear from the mapping that this area along with many others, are within the 100-year floodplain. Causes of flooding concerns include structures and development built within the floodplain and undersized culverts and crossings. Culverts and road crossings are designed to safely pass various levels of flood flow. The specific design criteria depend on the type of roadway and the setting. It is unknown what flood event the Main Street culvert was designed to pass, but it is possible that the culvert may be undersized and is therefore backing up flow and causing localized flooding just upstream of Main Street. Another possibility is that the culvert is becoming filled with sediment which reduces capacity and can exacerbate flooding issues during smaller storm events.



Map 7 - Attaining and Non-Attaining Streams


Johnston Run Watershed Management Plan
Peters Township
Warren Township
Montgomery Township
Mercersburg Borough
Mercersburg Borough
Johnstons Ln
Buchanan Trl W
Ford Lougon Rd
Keefer Dr
Beech Ln
Conoco Rd
Church Hill Rd
Kings Ln
Edwards Dr
Mine Dr
McFarland Rd
Findley Rd
Fridrole Rd
Carrig Rd
Charlestown Rd
Kepner Rd
Pine Rd
Brewster Dr
Mount Pleasant Rd
Conard Rd
Zion Ln
Linden Ave
Fair Lawn Rd
S Park Ave
S Main St
Ruthledge Rd
N Main St
Oregon St
Veterans Way
N Park Ave
N Fayette St
Garlin Aly
S Fayette St
Seminary Ln
W Seminary St
E Seminary St
Faust St
London Rd
Wolfe Dr
Church Hill Rd
Timber Ln
Scallion Ln
Buchanan Trl W
0 0.2 0.4 0.8
Miles
Map 8 - FEMA 100-year Floodplain
Floodplain
Municipalities
Sources:
- 2007 Orthophotography, Pennsylvania Department of Conservation and Natural Resources
- Federal Emergency Management Agency, 1996

Map 8 - FEMA 100-year Floodplain

2.6 Land Use

The type and density of various land uses can have a dramatic effect on water quality and stream habitat. Forested areas slow stormwater flow and allow water to gradually seep into soils and drain into streams. Vegetation and soils bind nutrients and pollutants found within stormwater—improving water quality as it infiltrates the ground. Developed areas, with a high percentage of impervious surfaces (buildings, paved roads, parking lots, etc.), do not slow stormwater flow—increasing the amount of pollutants entering streams. Increased stormflow can negatively affect stream habitat by increasing bank erosion and decreasing instream and riparian habitat. Agricultural land, if managed incorrectly, can also increase nutrients and bacteria in streams.

Land use/land cover data was analyzed using the Anderson system (Anderson et al., 1976) and available through the PAMAP Program Land Cover for Pennsylvania, 2005, created by The Pennsylvania State University (PSU, 2007).

2.6.1 Existing Land Use and Land Cover

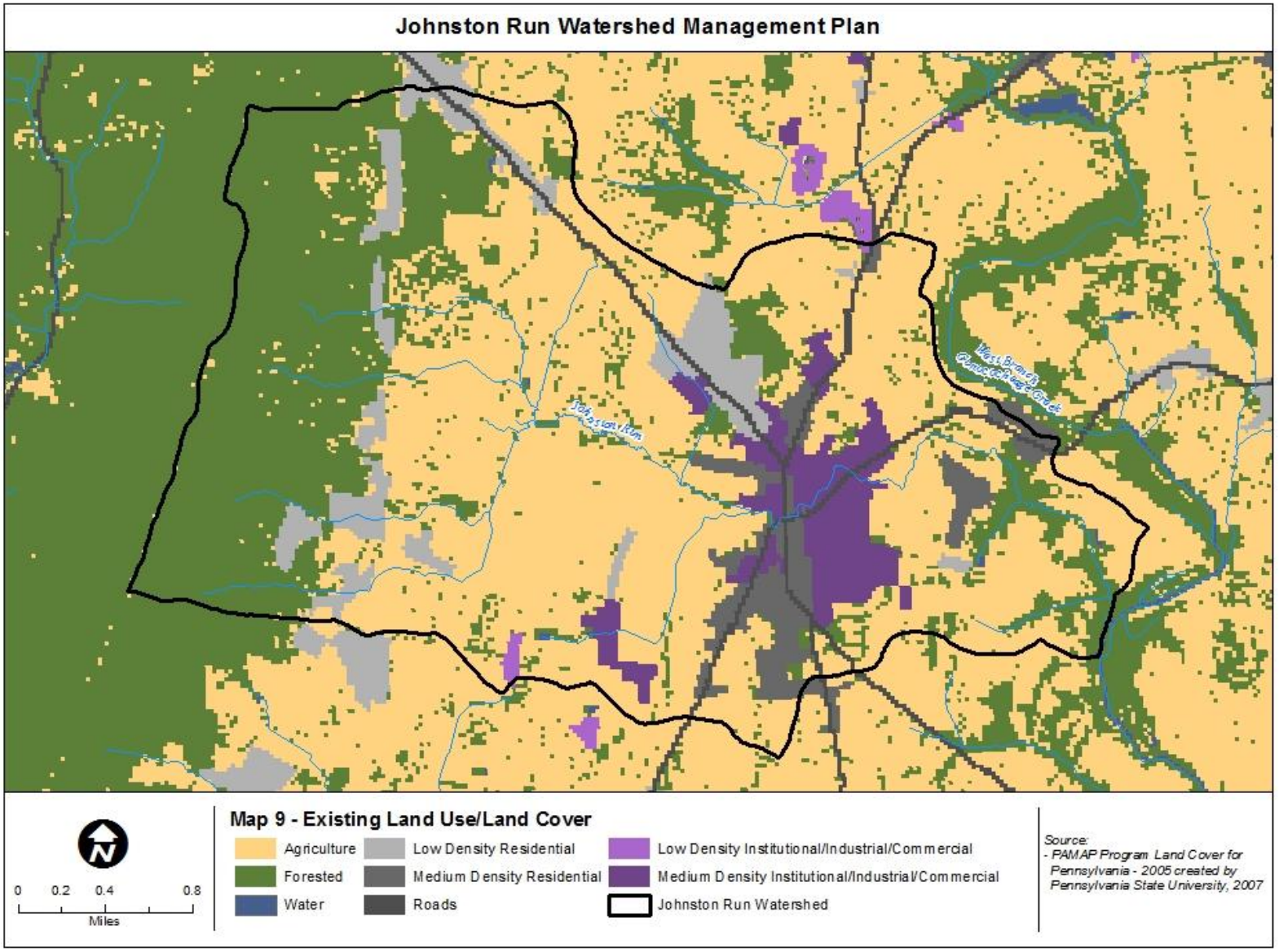
Over half of the 5,438 acre drainage area of the Johnston Run watershed is agricultural land (52 percent), the majority consisting of corn and hay (Map 9, Table 1 and Table 2). Close to one-third of the watershed is forested land (30 percent), mainly deciduous forest. Developed land accounts for 18 percent of the watershed.

Table 1 - 2005 Land Use for Johnston Run Watershed

Land Use	Acres	%
Agriculture	2817.9	51.8
Forested	1647.6	30.3
Developed	966.2	17.8
Open Space	6.5	0.1
Total Land Area	5438.1	100.0

Table 2 - 2005 Land Cover for Johnston Run Watershed Listed from Largest to Smallest

Land Cover	Land Use	Acres	%
Pasture/Grass	Agriculture	1937.0	35.6
Deciduous Forest	Forested	1549.2	28.5
Row Crops	Agriculture	880.9	16.2
Residential	Developed	540.9	9.9
Institutional/Industrial/Commercial	Developed	309.6	5.7
Roads	Developed	115.7	2.1
Mixed Deciduous and Evergreen	Forested	74.9	1.4
Forested Wetlands	Forested	17.4	0.3
Water	Open Space	6.5	0.1
Emergent Wetlands	Forested	3.7	0.1
Evergreen Forest	Forested	2.3	0.04
Total Land Area	-	5438.1	100.0



Map 9 - Existing Land Use / Land Cover

2.6.2 Imperviousness

Impervious surfaces are hard surfaces that do not allow water to infiltrate into the ground as they would normally in setting such as a forest, meadow, or open field which are pervious and allow rainfall to filter into the soil slowly. Examples of impervious surface include roadways, parking lots, driveways, sidewalks, and rooftops. These surfaces concentrate stormwater runoff, accelerating flow rates and directing stormwater to the receiving stream. This accelerated, concentrated runoff can cause stream erosion and habitat degradation. Runoff from impervious surfaces picks up and washes off pollutants (oil, metals, sediment etc.) and is usually more polluted than runoff generated from pervious areas. In general, undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and loadings in stormwater runoff.

The degree of imperviousness in a watershed also affects aquatic life. There is a strong relationship between watershed impervious cover and the decline of a suite of stream indicators. As imperviousness increases the potential stream quality decreases with most research suggesting that stream quality begins to decline at or around 10 percent imperviousness (Schueler, 1994; CWP, 2003). However, there is considerable variability in the response of stream indicators to impervious cover observed from 5 to 20 percent imperviousness due to historical effects, watershed management, riparian width and vegetative protection, co-occurrence of stressors, and natural biological variation. Because of this variability, one cannot conclude that streams draining low impervious cover will automatically have good habitat conditions and a high quality aquatic life.

The majority of the watershed does not contain impervious cover because of the high percentage of agricultural and forested land use. As shown in Table 3, close to 18 percent of the watershed (966 acres) consists of land uses associated with impervious surfaces – 9.9 percent of which is from Residential land use and 5.7 percent from Institutional/Industrial/Commercial land use, and 2.1 percent from Roads. However; even in these developed areas impervious surfaces do not cover every square foot of land area. The amount of actual impervious surface cover is less than the total area and not every land use category includes the same proportions of actual impervious cover. For example, as a percentage, low density residential use includes less impervious cover than commercial or institutional development.

The impervious cover estimate for the Johnston Run Watershed is 414.6 acres or, 7.6 percent.

Table 3 - Impervious Area in Johnston Run Watershed

Impervious Acres	Impervious Percent
414.6	7.6

2.7 Stormwater

As rainfall runs off of the landscape it is often directed to a stormwater system that conveys the concentrated flow to a receiving water such as a pond, lake, or stream, or to a stormwater management facility. Historically a stormwater system's primary focus was to move water from the landscape to receiving waters to avoid standing water and localized flooding, but in the last 20-30 years the focus has also been to hold and treat the water in a stormwater management facility such as a stormwater pond. These facilities allow pollutants to settle out and the stormwater captured is released cleaner and at a slower rate to the natural system. Modern stormwater management facilities treat both the stormwater quantity and quality.

Stormwater infrastructure (inlets, pipes, outlets, management facilities) mapping is not currently available for use in the Johnston Run watershed, and is outside of the scope of this project to develop; therefore this section will describe the current stormwater system in the watershed based on general field observations and aerial mapping.

2.7.1 Storm Drains

In the Johnston Run watershed the stormwater system is varied and dependent on the era of development, runoff patters, the size of the drainage, and the density of development within the drainage. Typically the amount of specific stormwater infrastructure will increase with more recent development and a higher density of development and impervious surface.

Along the more rural roadways outside of Mercersburg there is very little stormwater infrastructure. In many areas the stormwater simply sheet flows off of rooftops, driveways, and roadways to grassy areas along yards, fields, and the in the roadway right-of-way. This is adequate if the road is small and the roadway slope and side grades are generally flat. Roadside ditches and open swales are used in some areas to direct flow along the road to a low point, which in the Johnston Run watershed is usually a small tributary or the Johnston Run mainstem. This type of system is termed a 'disconnected' system.

Within the Borough where the density of development and the percentage of impervious surfaces are much higher, the stormwater must be managed more intensely and is termed a 'connected' system. Most of the Borough's streets are lined with curbs that elevate the sidewalks but also block and direct stormwater along the curb to inlets. Stormwater flowing into the inlets then flows through stormwater pipes downgrade to stormwater outfalls into Johnston Run (See Figures 2 and 3 below for examples). In both of these rural and more urban scenarios, the stormwater can enter the stream with little to no treatment.

During the Stream Corridor Assessment, crews observed 28 pipe outfalls, out of which 14 were identified to be stormwater outfalls. All of the stormwater outfalls were noted as low severity impacts due to their generally good physical condition; however the lack of stormwater treatment at each of these inputs creates long term chronic issues in terms of the volume and quality of stormwater entering the system.

Figure 2 – Example stormwater inlet along Main Street in Mercersburg. Note the downspout drainage connection to the roadway just to the left of the inlet.

Figure 3 – Example stormwater outfall located at N. Park Ave with direct untreated stormwater connection to Johnston Run.

2.7.2 Stormwater Management

The Pennsylvania Stormwater Act (Act 167) of 1978 requires counties to prepare and adopt watershed based stormwater management plans and required municipalities to adopt and implement ordinances to regulate development based on these plans. In Franklin County, stormwater management plans have been developed for the Act 167 watersheds in the County which are Conococheague Creek (2003), and Antietam Creek (1995) and very small portion of the Monocacy River (2002). Plans were also developed for the Conococheague by Montgomery and Peters Townships in 2003.

Although Johnston Run is in the larger Conococheague watershed, the planning unit scale that the Act 167 program is based on uses the smaller West Branch of the Conococheague which excludes the Johnston Run watershed from the planning area.

Updates to additions to Act 167, including Pennsylvania's Comprehensive Stormwater Management Policy of 2002 developed by the Department of Environmental Protection (PA DEP), and the Pennsylvania Stormwater Best Management Practices Manual which went into effect in 2006 stress the importance of comprehensive planning, better site design to reduce runoff in the first place, and stormwater management design that treats both runoff volume and water quality. The goal is to control post-development stormwater runoff rate, volume, and quality to replicate pre-development conditions.

Three stormwater facilities are known to exist in the watershed. They are located in the northern portion of the Borough in relatively newer commercial and residential development to the west of Fort Loudon Road (PA 75/416). Although design plans or reports have not been located for the facilities, they are assumed to be dry ponds based on observation from aerial photos. Dry ponds provide quantity (volume) control but not water quality treatment. The drainage area to the ponds is approximately 47

acres or less than 1% of the watershed. The ponds capture runoff from approximately 19 acres of impervious surface or approximately 22% of the impervious surface in the watershed.

2.7.3 Stream Crossings / Culverts

Stream crossings are critical components of local infrastructure both in terms of transportation connectivity and their potential impact on the stream system. Impacts can include presenting a barrier to aquatic organism passage, particularly fish, and crossings can also be locations where stream bank and stream bed erosion can occur due to the placement of bridge footers and culvert bottoms. Stream crossing flooding and the need to keep transportation corridors open during emergency events is a particularly important challenge in most watersheds including Johnston Run.

Crossings include the two culverts at Johnstons Lane in the upper watershed, one conveying groundwater spring flow and the other passing flow from the northwestern part of the watershed. A driveway crossing also occurs on the mainstem in the upper watershed. In the Borough, the Johnston Run mainstem crosses N. Main Street, just north of the N. Park Ave intersection. This box culvert was noted earlier in the report due to flooding issues at this crossing. The Main Street crossing does not appear to be an impediment to fish passage and aquatic organism movement. Further downstream the mainstem crosses Oregon Street/Church Hill Road and also Edwards Drive. The Oregon Street crossing is not noted for any particular impacts, however the Edwards Drive crossing appears to be undersized in comparison to the upstream crossings and based on a widened downstream channel observed through inspection of aerial photographs. The widening could indicate a localized increase in velocity as a result of the undersized culvert. Finally, the mainstem crosses McFarland Road at the downstream extent of the watershed. This crossing is a wide bottomless box culvert with only minor sediment deposition noted.

Overall, the stream crossings observed in the watershed do not appear to be significant impacts to the stability of the stream channel or to movement of aquatic organisms such as fish.

3 Current Condition Assessment

3.1 Watershed Assessment

During the Spring and Summer of 2013 a watershed assessment was conducted to document the existing stream conditions and to begin identification of restoration opportunities. The assessments were conducted only on properties where permission to conduct the survey was granted by the property owner. The results were documented in a full assessment report, the *Johnston Run Watershed Assessment Summary*, (KCI, 2013) which is included as Appendix A and is summarized here. The methods include:

- Biological Sampling
    - benthic macroinvertebrate sampling (4 sites in Spring 2013)
    - fish assemblage sampling (2 sites in Summer 2013)
    - physical habitat (4 sites in Spring 2013)
- Water Quality Sampling
    - physical parameters measured in-stream (4 sites in Spring 2013)
        - dissolved oxygen, pH, temperature, conductivity, turbidity
    - chemical parameters measured with grab samples and lab analysis (4 sites in Spring 2013)
        - total suspended solids, alkalinity, nutrients (nitrogen, phosphorus), zinc, iron, chloride, sulfate, fecal coliform bacteria, total organic carbon
- Stream Corridor Assessment (SCA)
    - Stream walk assessment of 2.5 miles of channel, documenting the location, type, and severity of stream corridor infrastructure and impacts to stream health.
    - Assessed features include:
        - stream bank erosion, riparian buffer, pipe outfalls, fish movement barriers, trash, channel alteration, active construction, exposed pipes and any unusual conditions
        - stream habitat assessment at representative locations

3.1.1 Biological Condition

Benthic macroinvertebrates are organisms that live in the stream channel, primarily on or in the stream bed material for either their full lifecycle or part of their lifecycle. They include adult and immature stage aquatic insects such as beetles and dragonflies, mayflies, stoneflies, caddisflies, aquatic worms, and snails. These organisms have predictable responses to changes in water quality and stream habitat with some types showing more sensitivity to stress than others. Therefore the type and diversity of the benthic macroinvertebrates found indicates the level of stream health or impairment.

Benthic macroinvertebrate sampling indicates that Johnston Run is impaired and is not fully meeting its aquatic life use potential. The most upstream sampling site located in the headwaters near Johnston

Lane was categorized as 'Moderately Impaired' while the three remaining sites were 'Impaired'. These sites were located just upstream of the Borough at the ball fields, just downstream of the Borough near Oregon Street, and at the downstream end of the watershed near McFarland Road. The samples in general were characterized by low diversity and a dominance of organisms that are tolerant of pollution.

Results from the fish assessment indicate a fish community that is less severely impacted than the benthic macroinvertebrate community based on the two reaches that were sampled, one just upstream of the Borough at the ball fields and the other at the downstream end of the Borough near Oregon Street. Pennsylvania does not currently have a fish index of biotic integrity, however using a Maryland based index for this physiographic region, the results indicate a generally intact fish population. The fish assemblage in Johnston Run includes eight species. Indicators of good quality included a good overall biomass (total mass of fish per square meter) and the presence of two benthic species (Potomac sculpin and fantail darter).

3.1.2 Water Quality

Results of the assessment confirm nutrient and siltation (sediment) impairments currently listed in the 2012 303d list (PADEP, 2012). Table 4 presents the results of the grab sample laboratory analysis of the water quality assessment. Pollutants that appear from the results to be issues including elevated bacteria levels, nitrogen, phosphorus, and sediment are described and presented in Figure 4.

Table 4 - Baseflow Grab Sample Concentration Results

Parameter	Method	Detection Limit	Units	JR-01	JR-02	JR-03	JR-04
Nitrite Nitrogen	SM 4500N02B	0.02	mg/l	<0.02	<0.02	0.02	0.04
Nitrate-Nitrite Nitrogen	SM 4500N03-H	0.05	mg/l	4.1	4.9	4.6	5.7
Kjeldahl Nitrogen (Total)	SM 4500NH3-C	0.5	mg/l	<0.5	<0.5	<0.5	1.5
Ammonia Nitrogen	SM 4500NH3-C	0.2	mg/l	<0.2	<0.2	<0.2	<0.2
Nitrogen (total)	TKN + NO3/NO2	NA	mg/L	4.35	5.15	4.85	7.2
Phosphorus (total)	SM 4500P-E	0.01	mg/l	0.02	0.02	0.05	0.21
Orthophosphate Phosphorus	SM 4500P-E	0.01	mg/l	<0.01	<0.01	0.04	0.14
Chloride	SM 4500-CL-E	1	mg/l	6.7	7.9	10	14
Sulfate	SM 4500SO4-D	10	mg/l	23	28	19	27
Zinc	EPA 200.8	0.02	mg/l	<0.02	<0.02	<0.02	0.04
Iron	EPA 200.7	0.05	mg/l	0.13	0.27	0.36	0.8
Solids (Suspended)	SM 2540 D	3	mg/l	6	8	12	27
TOC (Total Organic Carbon)	SM 5310B	5	mg/l	<5.0	<5.0	<5.0	<5.0
Alkalinity, total (as CaCO3)	SM 2320B	20	mg/l	190	200	200	220
MPN Fecal Coliforms (A1)	SM 9221 E	2	mpn/100ml	800	1300	1300	>=16000

Highlighted results indicate elevated levels (Frink, 1991; PADEP, 2009)

PADEP has established acceptable water quality standards for several of the sampled parameters for each critical stream use. Use designations for Johnston Run include Aquatic Life - Warm Water Fishes (WWF), which requires the maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat (PADEP, 2009b). Water quality standards for Pennsylvania are listed in *The Pennsylvania Code – Chapter 93. Water Quality Standards*.

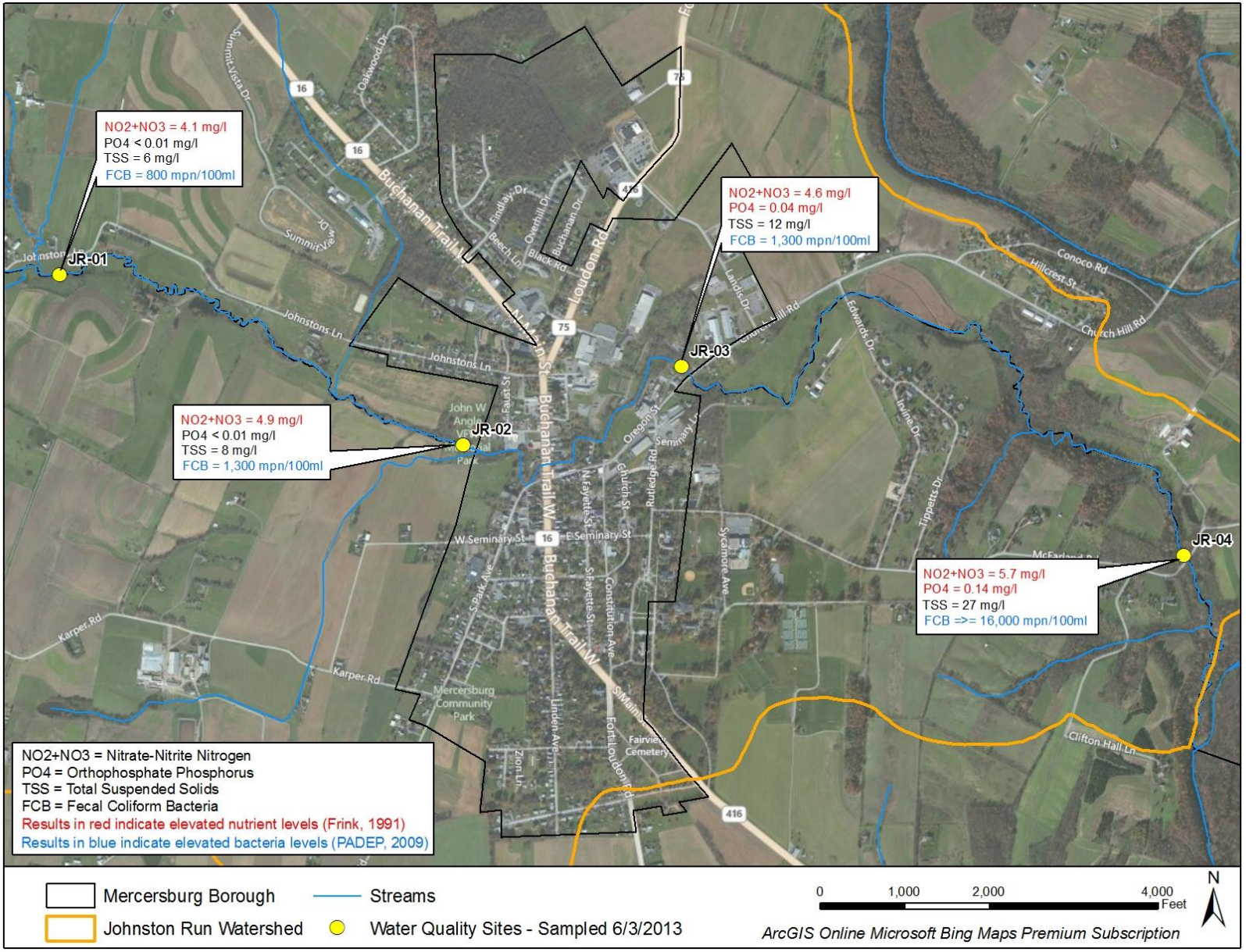


Figure 4 – Water Quality Results

Bacteria

Elevated levels of fecal coliform were measured at all sites (fecal coliform bacteria [FCB] values shown in Table 4). Although, PADEP currently does not have water quality criteria designated for WWF stream use for fecal coliform, there are specific numeric criteria for Water Contact (WC). Due to the accessibility of Johnston Run to community residents, it is important to compare grab sample results with WC criteria. Water quality standards for fecal coliform for WC uses are expressed as the geometric mean of multiple samples (maximum mean of 200mpn/100 ml; mpn = most probable number) and/or a fraction of results taken over a 30-day sampling period (10 percent of samples may exceed 400mpn/100 ml); however, the extent of sampling at Johnston Run consisted of one instantaneous sample. In spite of this, the fact that measured levels of fecal coliform ranged from 800mpn/100ml to >16,000mpn/100ml, well above 200 or 400mpn/100ml, may be an indicator of impaired conditions. Further bacteria sampling may prove that all sites would exceed PADEP water quality standards. Fecal coliform levels measured at JR-04 are 20-times greater than elevated levels measured upstream at JR-01 (>16,000 mpn/100ml and 800 mpn/100ml, respectively).

Nitrogen, Phosphorus, and Sediment

At this time, PADEP does not have specific numeric water quality criteria for nitrogen, phosphorus, or sediments for warm water fishes (WWF) use designations. Nutrient ranges and ratings for nitrate-nitrite and orthophosphate were derived from Frink (1991) and used to further analyze Johnston Run water quality results (Table 4). Elevated nitrate-nitrite levels were measured at all sites, with an 'Excessive' rating at JR-04 and 'High' ratings at sites JR-01, JR-02, and JR-03 (Table 4). In addition, elevated orthophosphate levels ('Excessive' rating) were measured at JR-03 and JR-04. Orthophosphate levels at JR-04 are 3.5-times greater than elevated levels measured upstream at JR-03 (0.04 mg/l and 0.14 mg/l, respectively; Table 4). Nitrate-nitrite (NO_2+NO_3) and orthophosphate (PO_4) levels are shown in Figure 4 with elevated levels highlighted in red.

3.1.3 Stream Corridor Assessment

Field crews walked approximately 2.5 miles of the total 15.6 miles of mapped stream channels in early April of 2013. The segment walked included the mainstem between Oregon Street at the downstream end up to the headwaters near Johnston Lane. A total of 67 data points were collected across the subwatershed. Pipe outfalls (28), riparian buffer breaks (13), and erosion sites (8) were the most widespread and frequent problems identified. A total of 1.8 miles of erosion were identified and 2.4 miles of buffer impact. With a total of only 2.5 miles assessed, these represent large percentages of the channel with 72% of stream banks having varying degrees of erosion and 96% of stream corridor lacking adequate vegetative cover for bank retention and/or shade for desirable fishes. Figure 5 below presents the locations of the erosion and buffer impacts.

A large majority of points were categorized as moderate to minor severity. Only three points received ratings of "severe," and there were no points that received a rating of "very severe". The sites indicated as "severe" included an eroded reach totaling 2,095 linear feet, and an inadequate riparian buffer

totaling 4,632 feet in the upper watershed. The second “severe” buffer was 360 feet in length and located where the stream flows adjacent to North Park Avenue within the Borough.

Additional areas of buffer impact can be seen from aerial photographs in the lower watershed downstream of Oregon Street and upstream and downstream of Edwards Drive but they have not been assessed or included in this analysis due to denials of access to private property.

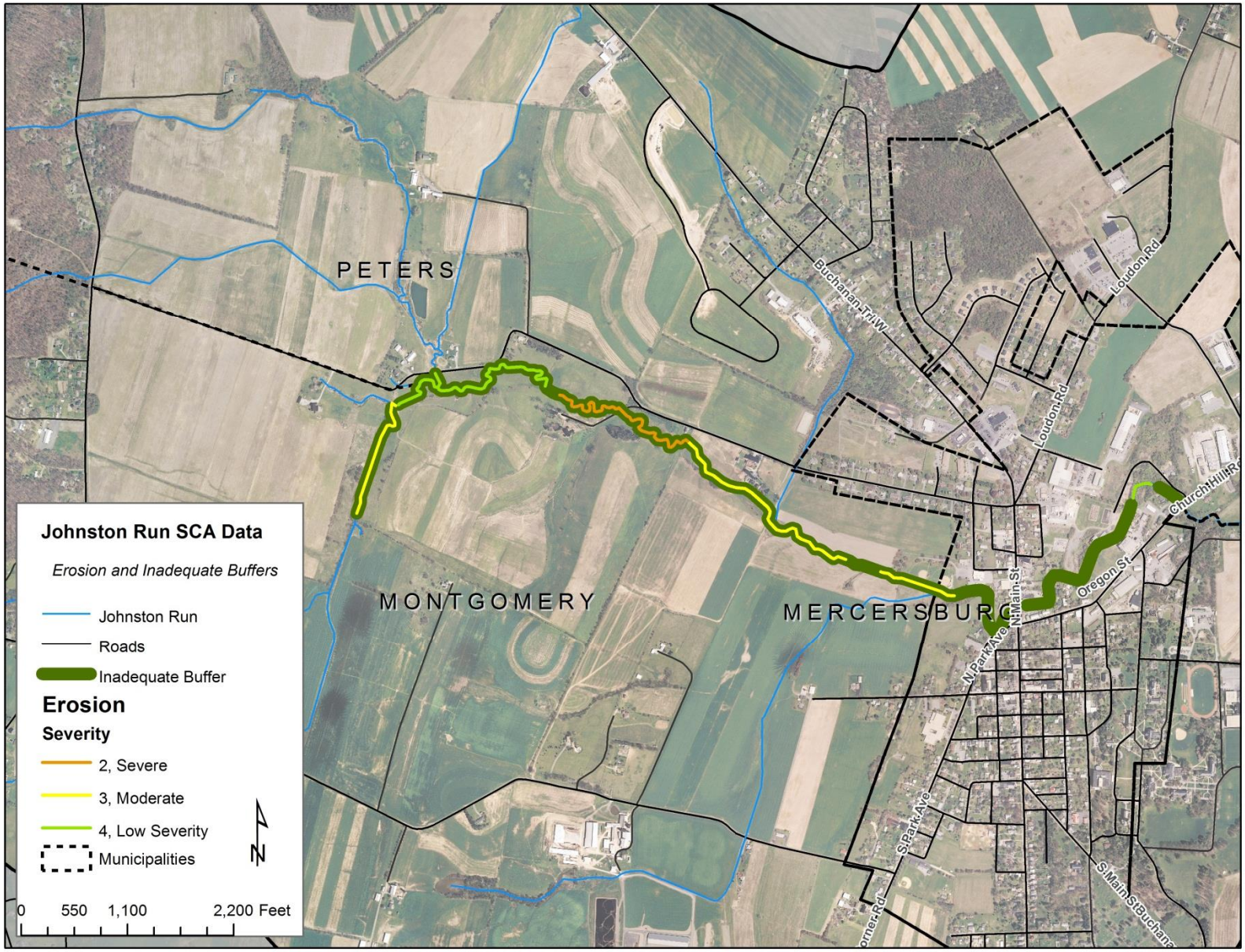


Figure 5 – SCA Results, Erosion and Inadequate Buffer

3.2 Pollutant Loads

Calculations of pollutant loads were developed for Johnston Run. The method selected is the Watershed Treatment Model (WTM) published by the Center for Watershed Protection in 2010. The method has been selected because it allows the watershed manager to assess loads from a wide range of wet weather and dry weather land uses found in urban and agricultural watersheds. It provides output on the sources of pollutants and estimates nitrogen, phosphorus, total suspended solids and bacterial loads in the watershed – which are the issues most effecting the watershed based on the water quality analysis described above.

The method is set up with calculations to report loads for three scenarios: Existing Conditions, as of the date of the watershed assessment; New Development Conditions, which is forecast from zoning, build out, or other land planning data; and Proposed Conditions, which includes proposed changes resulting from in stormwater management, stream restoration projects, or non-structural programs. For this project, only Existing Conditions and Proposed Conditions scenarios were used. This section describes existing loads. Loads and load reductions resulting from implementation of management strategies and restoration projects are discussed in later sections.

The loads are calculated using several input worksheets, as follows (Caraco, 2010):

Primary Sources These elements summarize the loads from sources that can be determined solely by land cover of land use. It requires basic land use information, and calculates surface runoff loads. In addition, it requires basic watershed data, such as annual rainfall, stream length, and soils distribution.

Secondary Sources Secondary sources are pollutant sources that cannot be calculated based on land use information alone such as septic systems, illicit connections, combined sewer overflows (CSO), sanitary sewer overflow (SSO), channel erosion, and livestock. Many of these sources, such as CSOs and SSOs, are at least partially composed of wastewater.

Existing Management Practices These elements reflects programs currently in place to control loads from urban land. Users need to input information about the effectiveness and level of implementation of various programs and practices.

Together these components calculate the existing loads and allow the user to determine the total annual load of each pollutant and quantify the proportional sources of loads among the various categories which for the Johnston Run watershed include urban land, channel erosion, rural land, livestock, and septic systems. Forest and open water are also included, as forest does supply a small percentage of load and open water captures atmospheric deposition of pollutants that are contributed directly to the water surface. Detailed descriptions of the method are included in Appendix B.

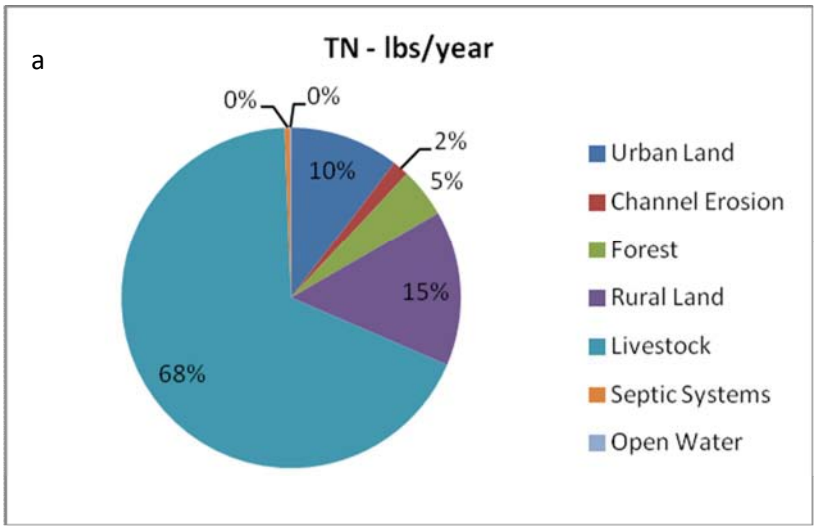
3.2.1 Existing Conditions

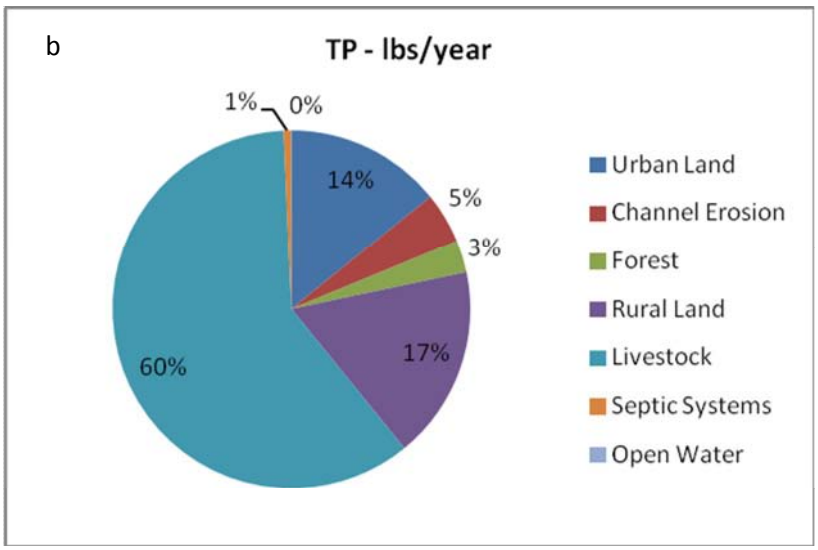
Table 5 and Figures 6a to 6d provide the results of the existing conditions pollutant load analysis.

Table 5 – Existing Loads per Source

Source	TN - lbs/year	TP - lbs/year	TSS - lbs/year	Fecal Coliform - billion/year
Urban Land	9,076	1,601	244,471	99,137
Channel Erosion	1,350	523	843,752	-
Forest	4,119	330	164,757	19,771
Rural Land	12,962	1,973	281,792	109,899
Livestock	59,352	6,808	-	281,427
Septic Systems	455	76	3,034	8,701
Open Water	83	3	1,005	-
Total Load	87,396	11,313	1,538,811	518,934

Figure 6a-d – Pollutant Loading Sources, Existing Conditions



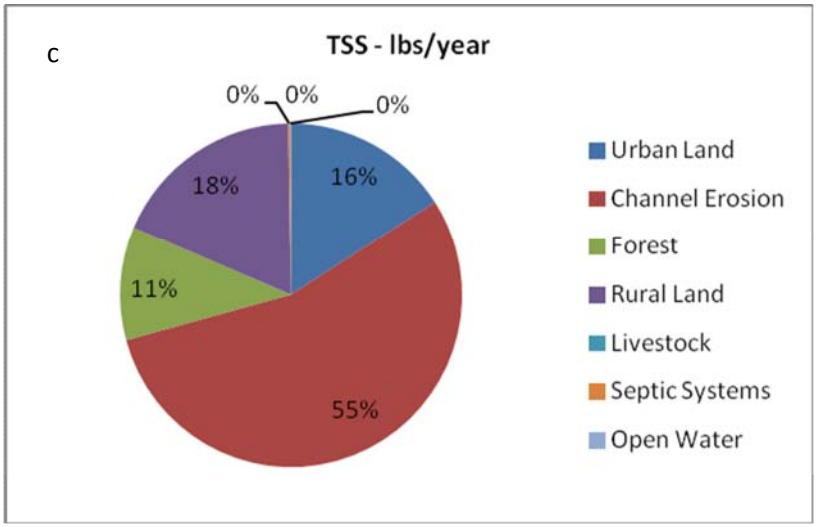


Primary sources of nitrogen in the watershed include runoff from rural land and livestock combining to account for 83% of the total nitrogen (see Figure 6a). Urban development accounts for 10% of the load and includes sources such as road and parking lot runoff, fertilizers, and pet waste.

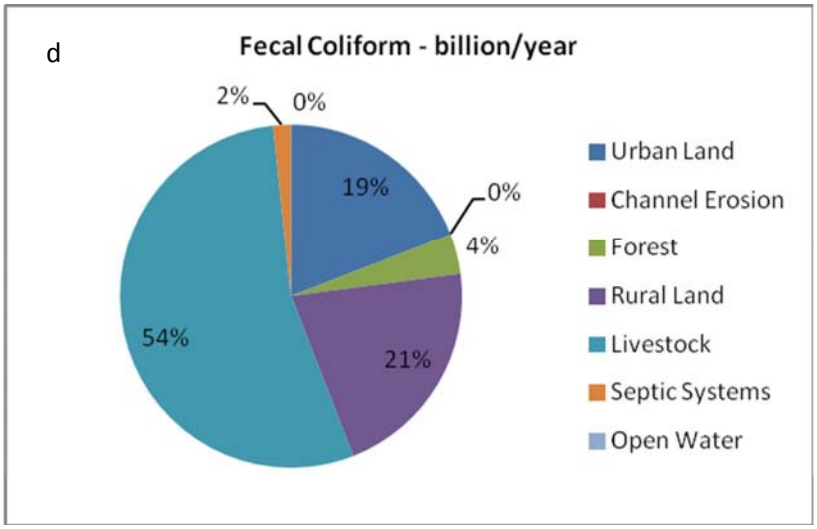
Phosphorus too is linked most directly in the watershed to rural sources (see Figure 6b). Urban land and channel erosion contribute almost 20% of the phosphorus. Phosphorus inputs from channel are erosion are due to phosphorus being bound to the sediment, and then being released and transported to the water column as the stream erodes.

Sediment, measured in the form of total suspended solids is primarily contributed by channel erosion (55%). Channel erosion

sediment loads were calculated from erosion data from SCA surveys and are estimated to be over 400 tons per year. Urban and rural land uses together combined for a total of 34% of the sediment.



Bacteria sources can include livestock, manure application for fertilizer, pet waste, septic systems, and potentially from illicit discharge from sewer systems and wastewater treatment facilities. Results of existing pollutant load modeling using WTM indicate that sources in the Johnston Run watershed are dominated by livestock manure (54%, Table 5). Urban and rural sources make up the majority of the remainder accounting for 40% of the inputs.



Although there are natural animal sources of bacteria, nitrogen and phosphorus in the watershed including deer, ducks, and geese, the load per animal for animals like dairy cattle, horses, and buffalo are hundreds of time greater than that of ducks and geese making their contribution negligible in a stream setting such as Johnston Run at the animal densities observed.

It is noted that the contribution of these pollutants from rural sources is quite dependent on the land area in the watershed in rural or agricultural use. Agricultural land makes up just over 50% of the land use, it therefore is a large overall contributor. However, when the contribution is normalized by area (acres) the contribution from urban sources is disproportionately high. Livestock data for the watershed were calculated with assistance from the Franklin County Conservation District (FCCD) and estimated at 2,200 dairy cattle, 30 buffalo and 40 horses.

Table 6 – Loading Rates

Land Use	TN - lbs/acre/year	TP - lbs/acre/year	TSS - lbs/acre/year	Fecal Coliform - billion/acre/year
Rural / Agriculture	4.60	0.70	100	39

Developed / Urban	9.39	1.66	253	102

3.3 Summary of Watershed Issues

Based on the results of the watershed characterization including desktop assessment, field assessments, and modeling – the following issues have been identified as primary factors in the watershed.

- Water Quality – elevated nitrogen, phosphorus, sediment and bacteria. Sources include agriculture, livestock, urban runoff, and streambank erosion. Can be improved with both urban and agricultural BMPs addressing water quality.
- Stream erosion – 72% of stream banks assessed have varying degrees of erosion. Erosion is addressed by streambank stabilization and stream restoration, stormwater BMPs to reduce peak flows, agricultural BMPs including livestock exclusion fencing and installation of riparian buffers.
- Riparian Buffer – 96% of the assessed channel is lacking adequate vegetative cover. Condition is addressed primarily through establishment of riparian buffers and proper management of streamside resources. Buffer management in agricultural settings should include livestock fencing to ensure success of planting efforts.

4 Implementation Plan

The Implementation Plan includes description of the recommended management strategies and restoration projects, and provides an estimation of the water quality benefits that would be realized from plan implementation. This section includes cost estimates for strategy implementation, identifies potential funding sources and partners, and describes monitoring programs to document plan implementation and changes in the watershed condition over time.

4.1 Management Strategies

To address the watershed impacts described in Section 2, a series of watershed management strategies have been reviewed for applicability in Johnston Run. The results are presented here and generally fall into three categories. *Restoration Projects* are being defined as those projects with a specific setting, typically located on one property, which may require the design and construction of a particular treatment method such as the installation of a stormwater management facility. *Community-wide programs* include education and outreach activities and implementation of dispersed programs that involve many community members such as a rain-barrel workshop to distribute rain-barrels and inform homeowners of their use and impact on watershed health. *Municipal programs* are programs that are typically implemented by a local municipality such as a Borough, County or Township, however some may be implemented by citizen groups and volunteers. *Agricultural programs* typically include agricultural BMPs and activities to reduce soil loss and runoff of nutrients.

4.1.1 Restoration Projects

Restoration projects for Johnston Run were identified primarily through the SCA completed in April of 2013. The types of projects recommended are listed in summary here. Full descriptions of the current conditions, restoration approach, project benefits, and potential project constraints for each project are

included in Appendix C along with a preliminary cost estimate. Currently 19 projects have been identified and included in the plan, more projects could certainly be identified particularly in areas of the watershed that were not assessed during the SCA; however this list provides the Council and Borough with a good starting point.

In many cases the recommended projects overlap in location and provide managers with options for the level of effort and type of project chosen for a site.

Participation from property owners in restoration projects identified on private property is completely voluntary.

Table 7 – Restoration Project Details

Project ID	Project Type	Details
AG1	Agriculture BMP	11,675 ft fencing, 1 watering facility and 1 stabilized crossing
AG2	Agriculture BMP	2 stablized crossings
A1	Reforestation	7,860 linear ft / 10.28 total acres of buffer plantings
A2	Reforestation	3,790 linear ft / 4.09 total acres of buffer plantings, 1.07 acres of natural regeneration
A3	Reforestation	700 linear ft / 0.51 total acres of buffer plantings
A4	Reforestation	340 linear ft / 0.23 total acres of buffer plantings
A5	Reforestation	226 linear ft / 0.15 total acres of buffer plantings
A6	Reforestation	165 linear ft / 0.12 total acres of buffer plantings
A7	Reforestation	340 linear feet / 0.20 total acres of buffer plantings
A8	Reforestation	850 linear feet / 1.11 total acres of buffer plantings
A9	Reforestation	292 linear feet / 0.13 total acres of buffer plantings
SWM1	Stormwater Retrofit	6.1 acres drainage area, 4.7 acres impervious
SWM2	Stormwater Retrofit	10.8 acres drainage area, 7.2 acres impervious
SWM3	Stormwater Retrofit	18.5 acres drainage area, 8.6 acres impervious
SWM4	Stormwater Retrofit	0.87 acres drainage area, 0.87 acres impervious
SR1	Stream Restoration	2,095 linear feet
SR2	Stream Restoration	2,274 linear feet
SR3	Stream Restoration	340 linear feet
SR4	Stream Restoration	292 linear feet

The following describes each practice in more detail.

Agricultural BMPs – There are many types of agricultural BMPs that can be implemented to reduce soil erosion, limit fertilizer runoff, and restore natural habitats. The focus for this study is on improving stream condition, and because livestock was found to be a major contributor of several pollutants, the recommended projects focus on the riparian corridor and reducing the impact of livestock. Two projects were identified in the upper watershed. The first includes livestock exclusion fencing coupled with a water trough for clean water access, and stabilized livestock crossings. The second project is at a site that is already fenced but could use

improvements to the stabilized crossing. Implementation of these projects allows natural vegetation to regenerate along the riparian corridor which provides habitat and also traps nutrients and bacteria that would otherwise runoff into the stream. The practice also reduces bank erosion, sedimentation, and instream habitat loss due to hoof shear.

Reforestation (Riparian Buffers) – Riparian forest buffers are linear wooded areas along rivers, streams and shorelines. Forest buffers help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. As identified in section 2, over 90% of the mainstem reach from Oregon Street to the headwaters lacks a complete riparian buffer. Riparian buffer projects are recommended for nine projects at a total 14,563 feet (2.75 miles) of stream. Most funders, particularly in the agricultural sector will require at least a 35 foot buffer to be eligible for grant and cost-share funds. The buffer width recommended by PADEP for riparian forest buffers is an average minimum of 100 feet. This average minimum applies to perennial and intermittent streams, rivers, lakes, and ponds and includes 100 feet on both sides of the waterbody (PADEP, 2010). Thirty-five feet is used in this plan for calculation of planting area, cost, and the pollutant removal benefit. It is always recommended to maximize the width of the buffer wherever possible.

Riparian buffer plantings can be accomplished with minimal cost when volunteers from the community are engaged to participate. Community plantings are great ways to introduce the community to watershed restoration and therefore are among the most effective restoration strategies.

Stormwater Retrofit – Stormwater retrofits include many types of projects that capture and treat stormwater runoff from impervious surfaces in existing development. The types of projects recommended in Johnston Run include bioretention (SWM1, SWM4), infiltration trenches (SWM2), and a step pool storm conveyance (SPSC)

Figure 7 – Example bioretention projects shown in planview (top), cross-section, with landscaping plan, and following one growing season (bottom

(SWM3) system. The four projects are proposed to capture a total area of 36.3 acres with treatment of runoff from 21.4 acres of impervious surface.

Bioretention — These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. The sites will be planted with attractive native vegetation and offer opportunities for community engagement in in the planting and maintenance of the garden.

Bioretention projects are proposed for the parking lot behind the VFW hall and adjacent to Johnston Run, and in the parking lot behind the property at 123 North Main Street.

Infiltration Trench — Trenches to provide water quality treatment are proposed in the grass swales along Oregon Street just to the west of the Johnston Run stream crossing. Runoff currently enters the stream untreated. The trenches are a depression to form an infiltration zone where sediment is trapped and water infiltrates into the soil. Typically no underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in the appropriate soil type therefore soil tests will be required to confirm if full infiltration will be achieved. Yearly inspections to determine if the basin or trench is still infiltrating runoff will be needed.

Step Pool Storm Conveyance (SPSC) – An SPSC system uses a series of riffle weirs to gradually transition the runoff from the outfall to the stream while also providing water quality improvement through filtering. The SPSC acts similarly to a sand filter, allowing runoff to infiltrate through the weirs. The SPSC system will also stabilize the outfall channel using boulders and cobbles for the riffle weirs that are designed to withstand the 100-year design discharge from the storm drain system. An SPSC is proposed for the outfalls along Oregon Street across from Church Street where 8.6 acres of impervious surface stormwater runoff enters the stream untreated.

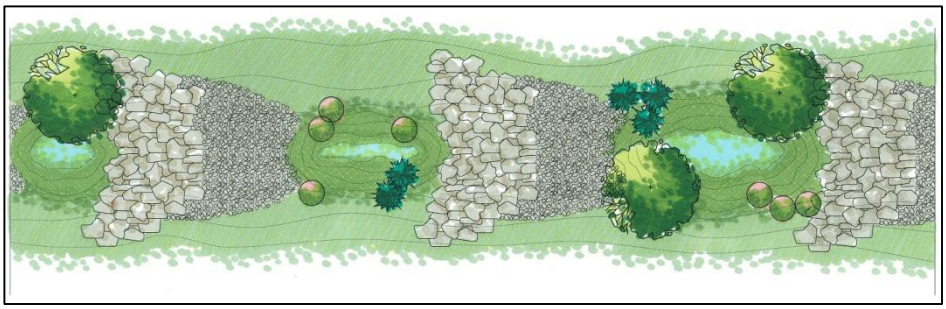


Figure 8 – Planview rendering of a Step Pool Storm Conveyance showing sequence of pools and riffle weirs

Stream Restoration – Stream restoration is used to restore both agricultural and urban stream ecosystems by restoring the natural landscape and channel form. Restoration also helps improve instream and habitat and water quality conditions in degraded streams by reducing erosion and sedimentation. The practice is recommended for two agricultural settings (SR1, SR2) in the upper watershed. In this setting the restoration is accompanied by livestock exclusion fencing, watering facilities and stabilized livestock stream crossings. Two sites within the Borough are also included (SR3 and SR4). Stream restoration in all cases is accompanied by restoration of a riparian buffer with plantings of native trees and shrubs. The four recommended projects include 5,000 linear feet of restoration.

Figure 9 – Example stream restoration project one year following restoration

Green Alleyway – The retrofit of alleys to incorporate stormwater treatment and green practices is becoming more and more common as both big cities and small towns seek new ways to use their spaces wisely. Mercersburg has many smaller alleys, side streets, and driveways that are currently impervious. These areas present an excellent opportunity to retrofit and to allow for treatment and infiltration of stormwater. Techniques commonly used include the following:

Pervious Pavement – Installation of pervious pavement, such as pervious concrete or permeable pavers, that allows water to pass through the roadway surface rather than running off into the stormwater system or directly to the stream. Pervious pavement can be used in the alley itself, and in adjacent driveways or parking pads.

Depending on the local soil type the system can be designed to infiltrate rainfall into the soil below or into an underdrain system. Use of pervious pavement reduces the rate and quantity of stormwater runoff, can recharge

Figure 10 – Example Green Alley project with pervious pavement and native vegetation. Photos from Green Garage, Detroit Michigan.

groundwater, and filters pollutants. Pavement with a high level of light reflectance (high albedo) can be used to reduce pavement temperatures and the urban heat island effect.

Bioretention — As described above, these are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and treated. Use of attractive native plants makes these systems community amenities. Depending on the layout of the alley, intersections, and parking areas, a bioswale, or vegetated swale can be used similarly to a bioretention. The bioswale is a more linear feature but provides similar treatment.

Community Involvement – The overall effectiveness of a Green Alley retrofit is enhanced with the cooperation and involvement of the residents that use and live alongside the alley. Techniques used to enhance the overall impact of the system include planting trees to provide shade and reduce runoff water temperature, installing native landscaping, and planting rain gardens to slow down runoff and filter pollutants from rooftops, driveways and sidewalks. Rain barrels and disconnection of downspouts from impervious areas are described below and provide excellent benefits for green alley projects.

Locations for these types of retrofits occur throughout the Borough. Of particular note is the alley running north to south between Park Avenue and Main Street. This alley is approximately 1,500 feet from the northern end at N. Park Ave. to the southern end at Mercer Avenue. This alley runs on top of an existing stormwater drainage network that currently contributes untreated stormwater directly to Johnston Run. The alley running west to east between California Street and Mercer Avenue could also be retrofit. It presents approximately 1,250 feet of available distance between its western end at Park Ave and its eastern terminus at Fayette Street. A shorter segment extends approximately 680 feet from Seminary Street to the east west alley described above between Main Street and Fayette. On the north side of the Borough, Ensminger Alley presents approximately 1,000 of alley that could be candidate for retrofit. Locations of underground and overhead utilities are generally the largest constraint to implementation.

A formalized concept plan and cost estimate for a Green Alleyways project in Mercersburg has not been developed, but should be as the JRRC moves forward identifying projects for implementation. Costs vary widely depending on the final engineering solution, the number and type of practices implemented and location of utilities. Plans are in development for a group of residents and students in Mercersburg to research the feasibility of the application in the Borough.

4.1.2 Community-wide Programs

Several recommendations are made to implement dispersed or community wide programs that are based on education and engaging the community. Participation by watershed residents in practices that they can implement at their homes, businesses, schools and places of worship is crucial. These programs

are generally referred to 'source control' strategies as they reduce or eliminate the pollutant at its source before it can enter the waterway.

Residential Lawn Care Education – Educate watershed residents on the impact of various lawn care practices on water quality. Excess fertilizer can runoff into waterways and be a significant source of nutrients, in addition to being potentially unnecessary and costly to the property owner. Topics would include soil testing, recommended fertilizer levels, non-phosphorus fertilizers, organic fertilizers, conversion of lawn to native vegetation, and mowing practices. Programs could be implemented or sponsored by the JRRC, Franklin County Conservation District (FCCD), or Penn State Cooperative Extension.

Pet Waste Education – In many neighborhoods pet waste not disposed of properly can be a source of fecal bacteria and nutrients, particularly from dogs. An outreach program to educate residents on the environmental and hygiene/health impacts of pet waste disposal can be implemented by the JRRC. The program should be coupled with pet waste disposal stations, signage in high traffic dog walking areas, and possibly a local ordinance for removal and proper disposal of pet waste.

Septic System Education, Maintenance, and Upgrade – Septic systems, or 'on-lot' systems can be contributors of viruses, pathogens, and nitrogen to the groundwater and eventually to surface waters. Regular maintenance of these systems is necessary to ensure long-term operation and safe water supplies. Educational materials and workshops can be developed to present recommendations and explain existing local ordinances for septic tank pumping, drain field care and percolation testing, proper disposal of household hazardous waste, and general best management practices for proper maintenance and operation. Outreach should also include information on septic system upgrades to nitrogen removing best available technology (BAT), which can effectively cut nitrogen load from septic systems in half. Programs could be organized by JRRC with support from the Franklin County Planning Department, PA DEP Regional office, and/or local departments of health.

Figure 11 – Example rain barrel installations (from Berks County Conservation District)

Rain Barrels / Downspout Disconnect – Mercersburg Borough, like many towns and cities across Pennsylvania have traditionally used to gutter and downspout systems to 'connect' stormwater from homes, businesses, schools to the stormdrain system. Disconnecting these systems to direct rainwater from roofs to open grassy areas or to rain barrels reduces the overall volume of stormwater runoff, conserves water use, reduces

pollutants entering the stream, and provides clean water for gardens and everyday outside use. An education program can include rain barrel workshops to distribute rain barrels and instruct on their installation and use. Programs can be implemented by JRRC and FCCD.

Johnston Run Trail – A streamside trail to run along Johnston Run within Mercersburg Borough is in development. The trail will connect users with the watershed and stream system and provide educational opportunities to make linkages between everyday actions and their impact on Johnston Run. By creating an increased awareness of both the issues affecting the Run and the potential for improvement and community benefits, citizens will be more engaged participants in other community based efforts.

4.1.3 Municipal Programs

Watershed management strategies that can be either implemented by the local municipalities including the Borough of Mercersburg, Franklin County, and Montgomery and Peters Townships are described here. The recommendations in this section focus on stormwater and elimination of illicit discharges. Illicit discharges are defined as water discharges to the municipal separate stormdrain system that are not entirely composed of stormwater. That is, they are harmful and often illegal connections to the stormwater system from business or commercial activities. In some cases the recommendation may be to build on or add frequency to existing programs.

Street Sweeping – Street sweeping at regular intervals (monthly) can be a very effective method for reducing the runoff of many pollutants including nitrogen, sediment, oils, grease, and metals typically found in stormwater runoff from roadways. Sweeping should be targeted to most heavily traveled roads and areas most connected to the stormdrain system.

Hot-Spot and Illicit Discharge Detection and Elimination (IDDE) – Dry weather flows discharging from stormdrain systems can contribute significant loads to stream systems. Inspection and testing of water quality from outfalls, or from upland 'hot-spots' during dry weather can assist in the detection of inappropriate discharge entering the stream both from stormdrains and from other pipes potentially conveying discharge. Hot-spots generally include commercial and industrial properties that may be specific sources of pollutants from poor housekeeping practices that allow pollutants to wash into the stormdrain system. When an illicit discharge is found it can be tracked to its source for resolution. Discharge types can include sewage and septage flows, washwater flows such as laundry and car washing discharge, liquid waste such as oils and paints, landscape irrigation, dumpster runoff, and tap water. Implementation of a detection and elimination program should be investigated by the Borough. Excellent instruction for establishing a program is provided by the Center for Watershed Protection (CWP) in their IDDE guidance manual (CWP, 2004).

4.1.4 Agricultural Programs

In addition to the site specific BMPs included in the restoration projects described earlier in the plan, it is recommended that FCCD, particularly the FCCD Watershed Specialist, continue to work with local farms to identify additional programs and management measures that would reduce the impact of

farming on the watershed. While JRRC will be responsible for conducting primary land-owner outreach and identifying willing owners, the FCCD is willing to assist JRRC if they find a farmer who would like more information on agricultural programs and/or is interested in installing BMPs on their property. Example programs and practices include:

Nutrient Management Program (Act 38) – provides statewide uniformity in manure management regulations. A Nutrient Management Plan (NMP) developed for each applicable farm provides an approach to utilizing nutrients (nitrogen and phosphorus) effectively from manure and fertilizer in an environmentally safe manner for crop production.

Erosion and Sediment Control Program (Chapter 102) – requiring all agricultural plowing and tilling and animal heavy use area to have a written agricultural E&S plan and implement agricultural BMPs.

Cost Share Programs – Cost share programs through agencies such as the United States Department of Agriculture (USDA) Farm Service Agency (FSA) and Natural Resources Conservation Service) should be utilized to develop and fund projects in the watershed. Example programs include the Conservation Reserve Enhancement Program (CREP), the Wildlife Habitat Enhancement Program (WHIP), and the Environmental Quality Incentives Program (EQIP).

4.1.5 Flood Strategies

Management strategies selected for inclusion in the plan were in large part selected for their water quality and habitat improvement capabilities. However many of the strategies also provide some level of flood mitigation. Taking a watershed based approach to reducing impacts from flooding is achieved be three general methods: 1. reduce runoff from both agricultural and urban land, 2. attenuate and store runoff and stream flow, and 3. provide flood capacity at critical infrastructure locations.

It is noted that these activities can be quite useful for smaller out of bank and flooding events associated with the 1 and 2 year return intervals; however approaches to control the 10, 50, and 100 year flood would likely require actual control devices such as levees and dams which is perhaps not warranted for Johnston Run. If flooding is determined to be a significant issue and needs to be dealt with more directly, a flooding study with a hydrologic and hydraulic model will be required.

Runoff Reduction – Reducing the runoff at the source is accomplished by several different strategies that attempt to hold the water on the upland landscape and provide infiltration. Urban practices include reforestation, conversion of impervious surfaces to pervious cover such as meadow or forest, installation of rain barrels, bioretention, dis-connection of downspouts, infiltration devices (trenches), and use of pervious pavers or concrete. Agricultural practices to reduce runoff are similar to those used to reduce soil loss and include cover crops, reducing overgrazing, incorporating contour swales to capture flow, reforestation, and riparian buffers. These practices are most useful for smaller rainfall events but can become overwhelmed by larger storms.

Attenuation and Storage – Projects that attenuate and store flood flow in the upper watershed are recommended for areas in which property and infrastructure will allow for the necessary changes in the landscape. Stream restoration projects that reconnect the stream to the floodplain will provide storage in the upper watershed and reduce peak flows downstream. Similarly creation of wetland systems can provide storage capacity as well as wildlife habitat. Riparian buffer plantings provide vegetation in the overbank zone that can slow and reduce flood flows.

Road Crossing Capacity – Based on the reported observations of flooding issues located just upstream of Main Street it is recommended that a flooding study review the capacity of the Main Street culvert in relation to the ranges of discharge. It is possible that the culvert is undersized and is backing up flows during storm events. The Oregon Street crossing should also be reviewed for its capacity. Monitoring of stream flow and floodstage in these areas is recommended.

The situation upstream of Main Street is likely exacerbated by the concrete wall along the stream at North Park Avenue which provides no flood relief and a constricted channel cross-section. Additionally there are two stormwater outfalls that discharge uncontrolled stormwater to the stream in the same location. No stormwater mapping is available for the Borough but observation in the area indicates one outfall drains North Park Avenue and the other the alley between Park and Main Street. Little room is available for full attenuation and storage facilities in this area however runoff reduction measures such as downspout disconnect and pervious pavers could help reduce the volume of flow delivered to the stream.

4.2 Benefits

Each management strategy has its own set of watershed benefits. Benefits include estimated pollutant reductions, improvements to aquatic and riparian habitat, and community benefits such as improved aesthetics or access to recreational opportunities. Benefits for the *Restoration Projects* described above are explained in more detail in the concept plans that have been developed for each project. These have been included as Appendix C. Table 8 below presents the relative benefit of each practice as it relates to major benefit categories. The following section addresses the overall impact that the suite of management measures will have on water quality in terms of the pollutants that the practice reduces.

Table 8 – Watershed Benefits per Practice

Practice	Water Quality	Runoff Reduction	Channel Protection	Flood Control	Instream Habitat	Community Aesthetics	Community Engagement
Livestock Exclusion Fencing	●		●		○		
Stabilized Crossing	●		●		○		
Stream Restoration	○		●	○	●	○	

Practice	Water Quality	Runoff Reduction	Channel Protection	Flood Control	Instream Habitat	Community Aesthetics	Community Engagement
Reforestation / Riparian Buffers	○		●		●	●	○
Bioretention	●	○	○	○		●	
Infiltration Trench	●	●		○			
Step Pool Storm Conveyance	●	●	○	○	●		
Green Alleyway	●	●	○	○		●	○
Lawn Care Education	●				○	○	●
Pet Waste Education	●				○	●	●
Stream Clean Up					○	●	●
Septic System Education	●				○	○	●
Rain Barrels / Downspout Disconnect	○	●	○	○	○	●	●
Street Sweeping	●					●	
Hot Spot and IDDE	●					●	
Nutrient Management Plan	●				○	○	
Erosion and Sediment Control	●	○		○	○		
Culvert Upgrade			●	●	○		
Key: ● Primary benefit ○ Secondary benefit							

4.2.1 Pollutant Load Reductions

The Watershed Treatment Model (WTM), described in earlier sections, was used to calculate reductions for the four primary pollutants of concern – total nitrogen (TN), total phosphorus (TP), sediment as total suspended solids (TSS), and fecal coliform bacteria. The reductions are organized based on the major source categories listed in Table 9 below.

A scenario with future management strategies included was developed using watershed specific information and assumptions regarding the level of implementation for the each of the management strategies described above. In brief, the scenario includes complete implementation of the restoration projects, and implementation of the community-wide programs and municipal programs with assumptions based on participation. The results are presented in Tables 9 and 10 and in Figure 12.

Table 9 – Reduction of Pollutants with Implementation of Plan

Source	TN - lbs/year	TP - lbs/year	TSS - lbs/year	Fecal Coliform - billion/year
Urban Land	388	77	6,756	2,840
Channel Erosion	1,000	340	271,304	0
Forest	0	0	0	0
Rural Land	73	14	2,250	760
Livestock	11,616	1,330	0	44,031
Septic Systems	30	5	201	576
Open Water	0	0	0	0
Total Load	13,106	1,766	280,511	48,207

Table 10 – Percent Reduction of Pollutants with Implementation of Plan

Source	TN - lbs/year	TP - lbs/year	TSS - lbs/year	Fecal Coliform - billion/year
Urban Land	4%	5%	3%	3%
Channel Erosion	74%	65%	32%	NA
Forest	0%	0%	0%	0%
Rural Land	1%	1%	1%	1%
Livestock	20%	20%	NA	16%
Septic Systems	7%	7%	7%	7%
Open Water	0%	0%	0%	NA
Total Load	15%	16%	18%	9%

NA – not applicable – the source category is not a significant source of the pollutant

Reductions based on the current scenario indicate overall reductions of 15%, 16%, 18% and 9% for TN, TP, TSS, and fecal bacteria. Some specific results are described here:

Urban - the urban sources are controlled by stormwater retrofits and outreach programs for pet waste, lawn care, rain barrels, street sweeping, and IDDE. Implementation of the four stormwater retrofits will have the greatest impact and is estimated to reduce TN by 237.6 lbs/year, TP by 44.1 lbs/year, TSS by 6477.8 lbs/year and bacteria by 2157.4 billion/year.

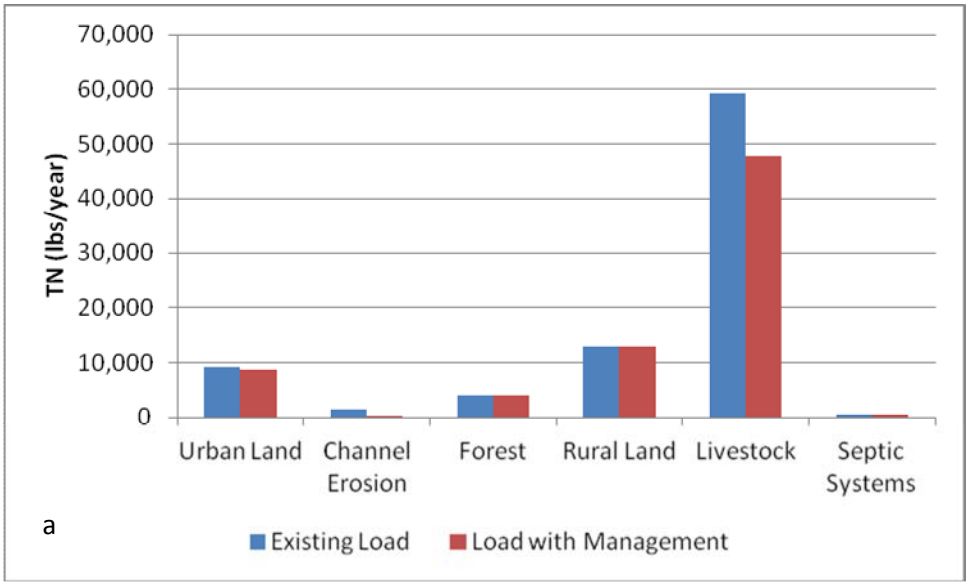
Channel Erosion – The largest percent reductions were estimated for the loads associated with stream channel impairment and improvements through stream restoration. In addition, the largest overall reductions in sediment are attributed to stream restoration by stabilizing eroding

banks. Stream restoration has the added benefit of also improving instream and riparian habitat.

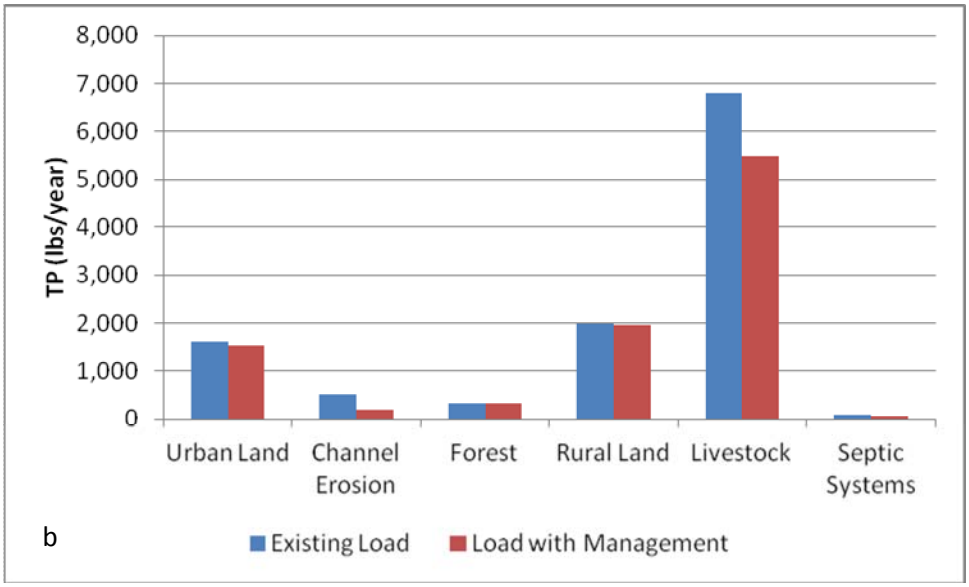
Rural Land – Load reductions attributed to rural lands were minimal as the focus of recommendations has been on livestock. Additional agriculturally based BMPs such as no-till farming practices, rotational grazing, and cover crops can be added to make additional reductions in pollutants.

Livestock - For nitrogen, phosphorus, and fecal coliform, livestock was determined to be the single largest contributor. The reductions in livestock impacts in Table 9 are a result of implementing riparian buffers and stream exclusion fencing along with water troughs to remove livestock from the immediate stream corridor. The practices are assumed to be established in the future on the two properties identified in the upper watershed. Additional implementation of these practices across the entire watershed would generate additional improvements.

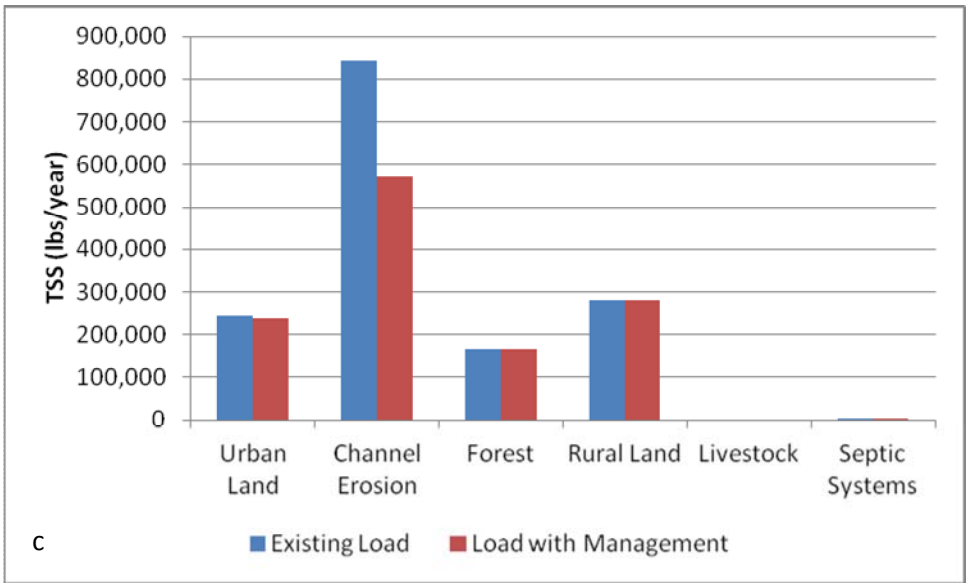
Figure 12 (a-d) – Pollutant Loading Reduction Results per Source



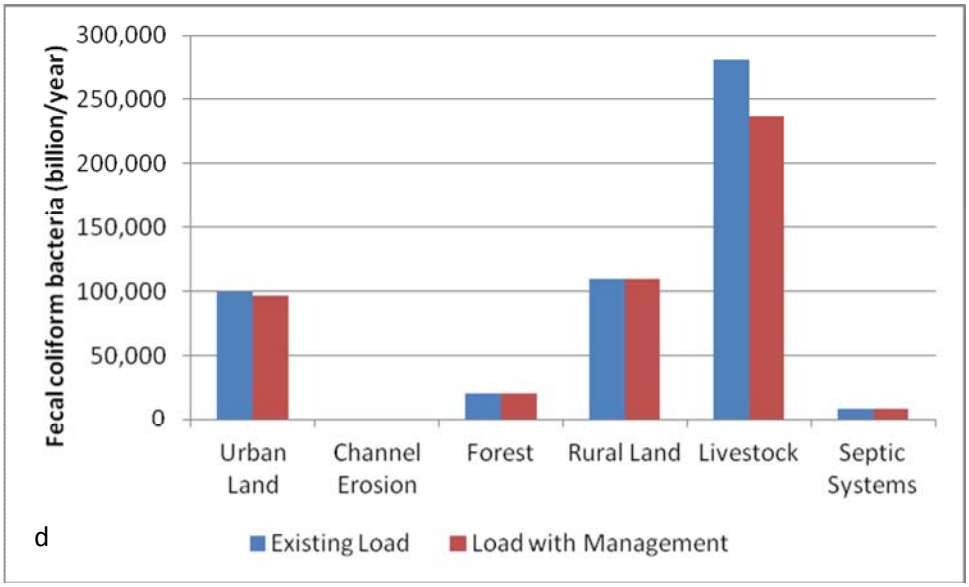
a


8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
TP (lbs/year)
Urban Land
Channel Erosion
Forest
Rural Land
Livestock
Septic Systems
Existing Load
Load with Management

b


900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
TSS (lbs/year)
Urban Land
Channel Erosion
Forest
Rural Land
Livestock
Septic Systems
Existing Load
Load with Management

c


Fecal coliform bacteria (billion/year)
300,000
250,000
200,000
150,000
100,000
50,000
0
Urban Land
Channel Erosion
Forest
Rural Land
Livestock
Septic Systems
Existing Load
Load with Management

d

4.3 Funding Requirements and Sources

4.3.1 Costs of Plan Implementation

Implementation of the recommendations included in the plan will require funding for program development, and for completion of the necessary design, permitting and constructions costs associated with each strategy.

Detailed cost breakdowns for the proposed restoration projects are included in Appendix C. A summary is provided here in Table 11. Costs for restoration projects include the planning, design, surveying, environmental permitting, agency review, and construction costs. Costs are provided for each project and subtotaled for each project category.

Table 11 – Summary Restoration Project Costs

Project ID	Project Type	Details	Cost
AG1	Agriculture BMP	11,675 ft fencing, 1 watering facility, 1 stabilized crossing	$52,343
AG2	Agriculture BMP	2 stabilized crossings	$10,725
		Ag BMP subtotal	$63,068
A1	Reforestation	7,860 linear ft / 10.28 total acres of buffer plantings	$75,107
A2	Reforestation	3,790 linear ft / 4.09 total acres of buffer plantings, 1.07 acres of natural regeneration	$29,882
A3	Reforestation	700 linear ft / 0.51 total acres of buffer plantings	$4,792
A4	Reforestation	340 linear ft / 0.23 total acres of buffer plantings	$2,190
A5	Reforestation	226 linear ft / 0.15 total acres of buffer plantings	$1,410
A6	Reforestation	165 linear ft / 0.12 total acres of buffer plantings	$1,142
A7	Reforestation	340 linear ft / 0.20 total acres of buffer plantings	$1,879
A8	Reforestation	850 linear ft / 1.11 total acres of buffer plantings	$10,567
A9	Reforestation	292 linear ft / 0.13 total acres of buffer plantings	$1,238
		Reforestation subtotal	$128,207
SWM1	Stormwater Retrofit	6.1 acres drainage area, 4.7 acres impervious	$288,930
SWM2	Stormwater Retrofit	10.8 acres drainage area, 7.2 acres impervious	$198,468
SWM3	Stormwater Retrofit	18.5 acres drainage area, 8.6 acres impervious	$86,242
SWM4	Stormwater Retrofit	0.87 acres drainage area, 0.87 acres impervious	$122,090
		Stormwater retrofit subtotal	$695,730
SR1	Stream Restoration	2,095 linear feet	$389,674
SR2	Stream Restoration	2,274 linear feet	$418,412
SR3	Stream Restoration	340 linear feet	$107,296
SR4	Stream Restoration	292 linear feet	$89,773
		Stream restoration subtotal	$1,005,155
		Restoration Project Total	**$1,892,160**

Developing cost estimates for the community based programs is difficult as projects can vary widely in scope, available resources, and necessary project elements. The Center for Watershed Protection (CWP) has derived unit costs for community outreach techniques and unit costs for neighborhood stewardship practices (CWP, 2005). The costs have been modified for specificity to Johnston Run and adjusted by 20 percent to account for inflation. To determine the extended cost, the median value of the cost range was used. It is assumed that meeting space to hold the various workshops would be a minimal cost (or even free), staff to prepare and run the workshop would be volunteers, and any necessary technical support from FCCD, the Chesapeake Bay Foundation or local or state governments would be available at no cost.

Table 12 – Community Based Programs Cost

Project Type	Cost	Unit	Quantity	Extended Cost
Workshop (general cost)				
printed materials (fliers)	$0.72-$1.01	Per flier	200	$173
printed materials (tri-fold brochure)	$1.60-$2.40	Per brochure	200	$480
printed materials (maps / posters)	$6.00-$40.00	Per map	5	$115
newspaper ad in local paper	$312-$540	Per advertisement	1	$426
workshop space	$200	Per workshop	1	$200
workshop staff	No cost	Per workshop	-	-
workshop supplies and food	$100-$200	Per workshop	1	$150
		Per workshop		**$1,544**
Residential Lawn Care Education				
Lawn Care Advice	$2.10-$3.84	Per household	100	$297
Soil Testing	$9.60-$14.40	Per household	100	$1,200
Workshop	$1,543.80	Per workshop	1	$1,544
			Practice total	**$3,041**
Pet Waste Education				
Bag stations	$400	Per station	2	$800
Waste pick-up signage	$100	Per sign	2	$200
Workshop	$1,543.80	Per workshop	1	$1,544
			Practice total	**$2,544**
Rain barrel / Downspout Disconnect				
Rain barrel distribution	$50-$60	Per barrel	50	$2,750
Workshop	$1,543.80	Per workshop	1	$1,544
			Practice Total	**$4,294**
Septic System Education				
Septic System Inspections	$180-$312	Per household	50	$12,300
Workshop	$1,543.80	Per workshop	1	$1,544
			Practice Total	**$13,844**

For the recommended municipal programs, Tables 13 and 14 provide cost estimation for implementation. For street sweeping, the Mercersburg Borough provides via their website an hourly rate of $50.00 per hour. Assuming an average rate of 10 miles per hour and approximately 6 miles of roadway (12 curb miles) the total cost for monthly street sweeping over one year is $7,200 as shown in Table 13 below.

Table 13 – Street Sweeping Cost

Project Type	Cost	Unit	Quantity	Cost	Frequency Per Year	Cost Per Year
Street Sweeping	$50.00	Per hour	12 curb miles	$600	12	$7,200

Cost to implement various components of hot-spot and IDDE programs are provided in Table 14. Cost data for hot-spots are from CWP guidance (CWP, 2005). Data for IDDE inspection are derived from KCI Technologies, Inc. experience with implementing similar programs. If issues are identified during the investigation there would be additional time and possibly municipal support required to correct the issue. CWP projects costs incurred to correct issues at approximately $2,500 per occurrence.

Table 14 – Hot Spot Investigations and IDDE Program Costs

Project Type	Unit	Cost
Hot Spot Investigations		
Regular site inspections	Per facility	$75 - $175
Commercial lawn care/landscaping/power-washing contractors	Per individual	$25-$75
Local ordinance to pick up non-regulated Hotspots	Per ordinance	$13,000-$15,000
On-site illicit discharge investigations	Per facility	$220-$900
Outreach materials to target business groups	Per hour	$30-$45
Presentations to business groups	Per hour	$40-$60
Non-regulatory site inspections	Per facility	$30-$80
Business recognition programs	Per facility	$40-$75
Discounted spill response kits, stormdrain plugs, drip pans, tarps	Per facility	$60-$250
IDDE Program		
Outfall Inspections – staff time, prep, field work, reporting	20 outfalls	$3,800
Field Equipment - Test kit	1 test kit	$500

4.3.2 Funding Sources

The funding necessary to implement components of the plan will vary. Funding sources include current program resources, local and state government funding, and a variety of grants, cost share programs and private programs that focus on water quality, agricultural sustainability, and environmental restoration.

MACWell and JRRC has partnered with the Environmental Finance Center (EFC) to develop both long term and short term funding strategies. Examples of grant funding sources and the types of projects they may serve are listed below in Table 15. A more detailed list including the types of projects and services that funding can be applied to, recipient eligibility, funding levels, timeline for applications, and matching funds requirements can be found in Appendix D – Funding Matrix.

While project-specific funding will be critical to the successful implementation of this plan and is the focus of the following discussion, it should be noted that operating funds for MACWell and JRRC will be equally critical to ensuring there is an organization in place to manage implementation of the watershed plan and other projects into the future. Appendix D offers a suggested fund raising strategy for sustaining the organization.

Table 15 – Funding Programs Summary

Program	Organization	Agricultural	Trail Design, Construction, Amenities	Stream Restoration	Reforestation & Riparian Buffers	Stormwater Retrofits & Green Infrastructure	Outreach & Education	Monitoring	Septics	Organzational Capacity	Other
Local Programs											
Tourism and Quality of Life Enhancement Program	Franklin County		☑								
State Programs											
Watershed Restoration & Protection Program	PA DCED	☑		☑	☑	☑		☑			economic development angle
Multimodal Transportation Fund	PS DCED		☑								economic development angle
Greenways, Trails and Recreation	PA DCED		☑								economic development angle
Growing Greener Watershed Protection Grants	PA DEP	☑		☑	☑	☑					
Nonpoint Source Implementation Program Grants	PA DEP	☑		☑	☑	☑					
Environmental Education Grants	PA DEP						☑				
Recreational Trails Program	PA DCNR		☑								
Land Trust Program	PA DCNR										Open space planning for land trusts
Community Recreation and Conservation Program	PA DCNR		☑								
Partnerships Program	PA DCNR									☑	
Rivers Conservation Program	PA DCNR										Watershed and river corridor protection plans

Program	Organization	Agricultural	Trail Design, Construction, Amenities	Stream Restoration	Reforestation & Riparian Buffers	Stormwater Retrofits & Green Infrastructure	Outreach & Education	Monitoring	Septics	Organzational Capacity	Other
Peer-to-peer program	PA DCNR								☑		
Circuit Rider Program	PA DCNR								☑		
On-Lot Sewage Disposal Funding Program	PENNVEST								☑		
Federal Programs											
Conservation Reserve Program	USDA - FSA	☑									
Conservation Reserve Enhancement Program	USDA - FSA	☑									
Environmental Quality Incentives Program	USDA - NRCS	☑		☑	☑						
Wildlife Habitat Incentive Program	USDA - NRCS	☑		☑	☑						
Safe Routes to School	US DOT through PA DOT		☑								
TIGER Discretionary Funds	US DOT		☑								
Foundation Programs											
South Mountain Partnership Mini-Grants	South Mountain Partnership						☑			☑	
Franklin County Foundation Grants	The Foundation for Enhancing Communities						☑				tourism angle
Chesapeake Bay Small Watershed Grants	NFWF			☑	☑	☑					nutrient reduction angle
Innovative Nutrient and Sediment Reduction Program	NFWF			☑	☑	☑					nutrient reduction angle
Local Government Capacity Building	NFWF									☑	

Program	Organization	Agricultural	Trail Design, Construction, Amenities	Stream Restoration	Reforestation & Riparian Buffers	Stormwater Retrofits & Green Infrastructure	Outreach & Education	Monitoring	Septics	Organzational Capacity	Other
Five Star & Urban Waters Restoration Program	NFWF			☑	☑						
Green Streets, Green Jobs, Green Towns	Chesapeake Bay Trust					☑					
Community Investment Grants	CSX Transportation			☑	☑	☑	☑				
Water Resource Education Network (WREN)	League of Women Voters of Pennsylvania						☑				

Agency Acronyms
CBT = Chesapeake Bay Trust
FCCD = Franklin County Conservation District
FSA = Farm Service Agency
NFWF = National Fish and Wildlife Foundation
NRCS = Natural Resource Conservation Service
PADCNR = Pennsylvania Department of Conservation and Natural Resources
PADCED = Pennsylvania Department of Community and Economic Development
PADEP = Pennsylvania Department of Environmental Protection
PENNVEST = Pennsylvania Infrastructure Investment Authority
SWCD = Soil and Water Conservation District
USDA = United States Department of Agriculture

4.3.3 Financing Mechanisms and Timelines

While KCI has identified a series of stream restoration and trail development activities that will advance the goals of the Johnston Run Revitalization Council. The EFC, in a parallel effort, has identified a number of potential funding programs and financing mechanisms that could support the implementation of these activities. The following suggests which of these might be appropriate pursuits in the near, mid, and long-term based on a number of factors including the timing of the opportunity, the project(s) it could support, and the organizational capacity needed to pursue it. All grant programs mentioned are described in greater detail in Appendix D of this report.

It should be noted that these are EFC's recommendations which have been informed by JRRC discussions over the past 18 months, as well as watershed management plan findings. They are intended as a guide based on current conditions and will likely require revision and adaptation as conditions such as local social, political, environmental, and economic priorities evolve over time. In addition, while these recommendations attempt to outline an initial timeline for implementation, we do not suggest that these are completely independent phases of activity and would anticipate a good deal of overlap between phases.

Immediate Term Recommendations

Immediate term financing recommendations focus on currently available opportunities to support the implementation of projects identified as priorities given JRRC's current organizational capacity, and to promote the initiative in a way that broadens the community's understanding of the need and value of these efforts and expands the volunteer core. These are envisioned as efforts that could begin now and, outside of the activities that should be ongoing efforts, could be completed in less than two years.

The Pennsylvania Department of Conservation and Natural Resources' Recreational Trails grant program. The Recreational Trails grant program is currently open through April 16, 2014 and would be appropriate for the immediate design and construction needs identified for the proposed waterway trail to be located on Borough property. Project partners support the pursuit of this funding opportunity, and previously drafted proposals contain language that can easily be adapted for this opportunity. In addition, moving forward with trail design and construction will enable project partners to maintain momentum and will provide a tangible example of the JRRC's mission which can be used to facilitate community engagement and expand support for the organization's activities.

Franklin County Tourism and Quality of Life Enhancement Grant Program. The newly established Franklin County Tourism and Quality of Life Enhancement Program is currently open to municipalities and nonprofits in Franklin County for projects that support the County's tourism efforts and develop local quality of life assets. Proposals are due June 2, 2014 with a proposal workshop scheduled for May 1, 2014. This program is designed to fund projects that enhance tourism, connect attractions, or promote overnight stays in Franklin County, as well as projects that enhance the quality of life for residents and benefit the broader community, making it appropriate for a number of the activities identified in the watershed management plan, particularly those tied to trail design and construction.

Identify and pursue funding opportunities for branding. As the JRRC becomes a more visible influence in the community, having a recognizable brand and a clearly defined relationship with MACWell and MPMC will become increasingly important. A well-established JRRC/MPMC/MACWell brand will be needed for outreach materials, interpretive displays, way-finding markers, and trailhead kiosks. Cohesive imaging will improve organizational recognition; create critical linkages between public, environmental and economic health for the broader community; and increase opportunities for local support of the organizations' mission(s).

The South Mountain Partnership focuses on sustaining the region's sense of place by protecting and promoting the natural, cultural, recreational and economic assets of the region. While an application to the organization's mini-grant program for survey work was not successful, and there has been a fair amount of debate over whether branding is of interest to the foundation, efforts so closely tied to showcasing community resources might be a better fit for the funding program's priorities. A direct conversation with current South Mountain Leadership prior to any application will determine if this is a suitable funding source for these activities. Much of the previous proposal's language around how the efforts of the JRRC promote the region's sense of place could serve as a basis for a 2014 proposal. While these awards are capped at $25,000, past grant distribution suggests that the Partnership prefers to spread their funds across a number of smaller awards rather than a few large ones, so a request in the $10,000 range would be more likely to be successful. The program is not currently accepting proposal but traditionally releases a Request for Proposals in the spring, with proposals due mid-summer, awards announced mid-fall, and projects to be completed by the end of the following year.

As an alternative, MACWell may want to consider pursuing a Causality Brand Grant, a grants program that offers technical assistance to "do good" organizations. Full grants and matching grants in the range of $1,000 to $40,000 are available and can cover a variety of marketing and creative services including development of a brand and marketing materials, fundraising communications, and web-based communications integration. The next round of proposals will be accepted beginning in early May 2014. The only disadvantage of this approach would be that MACWell would not have the option to select a designer of their choice, Causality would serve as the service provider.

Leverage existing state and federal resources for BMPs on private property. There are a host of programs, sponsored by the USDA and others, designed to assist private property owners implement watershed protection and restoration activities on their land. These opportunities can cover projects such as agricultural, flood, and runoff management best management practices, as well as riparian buffer plantings. There are also a number of agencies and organizations in the watershed, such as the Franklin County Conservation District, the Chesapeake Bay Foundation, Alliance for the Chesapeake Bay, and others, whose mission and/or projects focus on promoting landowner participation in these programs. The JRRC can serve a critical role in facilitating the dialogue between willing property owners in the watershed and the agencies and organization that can connect these property owners with implementation funding.

Formally establish and expand the volunteer program. While JRRC has a solid following and serves an important need in the community, the recommendations of the watershed management plan and the

activities identified as goals for MACWell's Johnston Run initiative will require a much greater level of capacity than the Council currently can support. There is an immediate need to actively expand the core team of voluntary support. Moving forward, each project embarked upon should be viewed as an opportunity to recruit additional volunteers, as well as to educate the broader community on the connection between personal, environmental, and economic health.

Mid-Range Recommendations

Mid-range activities may be grouped as such for a number of reasons. It could be because these activities have not been viewed as the most pressing priority, because currently available capacity is better focused elsewhere, or because there is no currently available funding opportunity creating a sense of urgency. In most cases, a combination of these factors are at play. We would anticipate that these activities could overlap in timeline with some of the immediate term activities, particularly as new funding opportunities and additional volunteer capacity become available.

Leverage existing environmental education resource materials. A number of the education activities identified in the watershed management plan are core issues that other agencies and organizations have developed outreach tools around. The community can be engaged on topics including lawn care, pet waste, rain barrels, and rain gardens rather easily as a part of existing JRRC and MACWell events and activities using existing outreach resources. Again, coordinating with supporting agencies and organizations such as the Franklin County Conservation District, Chesapeake Bay Foundation, and Alliance for the Bay and others will reduce the cost of implementing these types of activities, which can prove to be valuable for community engagement and volunteer recruitment.

If JRRC would prefer to mount an outreach campaign on these issues under their own brand, a Water Resources Education Network (WREN) grant from the League of Women Voters of Pennsylvania would be a good fit. These grants are open annually in the late winter/early spring, offer awards of up to $5,000, and are designed to support local partnerships that raise awareness, implement demonstration projects, and encourage runoff reducing behavior changes.

Leverage existing state and local plans, particularly as they relate to transportation. The JRRC should examine existing plans for efforts such as local capital improvements, state roads projects , and special events. Weaving restoration activities, trail development, and outreach and education activities into the timeline for other local projects and activities will create efficiencies that can reduce implementation costs and tap into the capacity of other agencies and organizations. For example, pending plans for road resurfacing might pose an opportunity to engage PennDOT in completing on-road portions of the trail network identified in the concept plan.

Long-Range Recommendations

Diversify the types of grants pursued. Pennsylvania's Department of Environmental Protection (DEP) manages the Watershed Protection Grants program designed to promote watershed protection and restoration activities. These grants take two forms, Pennsylvania's Growing Greener grants established by the Environmental Stewardship and Watershed Protection Act, and Section 319 Nonpoint Source

federal grants which are authorized by US EPA's Water Pollution Control Act. The Watershed Protection grants are intended to advance local watershed-based planning, restoration and protection efforts that address nonpoint sources of pollution, such as urban and agricultural runoff, atmospheric deposition, on-lot sewage systems, earthmoving, stream modifications and timber harvesting.

The 319 program requires that the projects submitted be a part of a local watershed implementation plan. KCI has specifically included the required elements of the 319 program to ensure the wtareshed management activities identified will be eligible for these funds. Assuming that KCI's watershed management plan is approved by DEP and EPA, essentially any of the non-trail projects outlined in the plan should be eligible for funding. Growing Greener grants would be appropriate for these kinds of projects as well; however, 319 grants would likely be less competitive since only projects contained within a watershed implementation plan would be eligible. A single application for these two programs is typically issued late spring/early summer with applications due in mid-August.

While the initial phase of the trail focuses on the existing Borough property, expanding the trail as suggested by the work of the MPMC and connecting to other existing routes is a sensible long term goal. Discretionary funding from the US Department of Transportation in the form of Transportation Investment Generating Economic Recovery (TIGER) grants would be an appropriate fit for some sections of the expansion. While there is an open round of funding for these grants now, the JRRC would be better positioned for a winning proposal once they have a more well-established reputation and can point to successfully completed trail phases as a demonstration of their capacity to make these types of projects happen.

In addition, segments of the trail that would support access to local schools could be appropriate projects for the Safe Routes to Schools program. The Safe Routes' Infrastructure grants program is designed to support projects sidewalk improvements, traffic calming, crosswalk improvements, and construction of bicycle facilities, which could be particularly appropriate for the deteriorating sidewalk area at the intersection of Route 75 and N Park Street that leads to the Mercersburg Elementary School or segments that lead out to the Buchanan Middle School and High School campuses. The Safe Routes program also offers non-infrastructure mini-grants for activities that promote, educate, encourage, or enforce safe walking/biking activities, which may fit well with some of MPMC and MACWell's other initiatives.

Because of the "main street" character and layout of the Borough, there has also been some discussion of an interest in developing a network of green alleyways to potentially address runoff and water quality issues. These types of project could be appropriate for Chesapeake Bay Trust Green Streets, Green Jobs, Green Towns funds. While the majority of the Trust's funding programs are tied to activities in Maryland, Pennsylvania communities within the Chesapeake Bay watershed are eligible for the Green Streets program. These grants to support the design and implementation of practices that enhance local green space through stormwater management practices, tree canopy expansion, or porous paving projects. Projects that incorporate walkability and bikeability elements are encouraged. Nonprofit organizations are eligible to apply for up to $50,000 for design projects and up to $250,000 for

implementation projects. The most recent round of proposals to this program were due in February 2014.

Finally, community foundations can be an important source of support for increasing organizational capacity. Community foundations are charities that provide grants to organizations dedicated to improving the lives of people in a specific geographic area. They often consolidate the resources of individuals, families, and businesses to support local scale nonprofits. In the Johnston Run area, the Franklin County Foundation operates as a part of the Foundation for Enhancing Communities. They make small-scale grants to nonprofit organizations that work to improve the quality of life for local residents through arts and culture, community development, education, environment, and health and human services . MACWell and/or JRRC would seem like a good fit for this type of opportunity. The next round of applications is due August 25, 2014; application materials will be posted to the Foundation's website eight weeks prior.

Consider regionalizing efforts to include neighboring municipalities. One of the strengths of the Borough's initial proposal to NFWF for technical assistance was the demonstrated coordination of efforts with Mercerburg's neighbors in Montgomery and Peters Townships, particularly through the work of MPMC. As the trail network is developed and the linkages identified in the MPMC feasibility study are advanced, the municipalities may want to investigate the DCNR Partnership Local Capacity Building program. These grants can be used to hire a dedicated staff person to expand local capacity and better serve the recreation, park, greenways, open space and/or resource management and conservation needs of collaborating communities. These grants would require the municipalities enter into a formal intergovernmental agreement, and applications for this program are accepted at any time. If successful, this would result in a four year funding commitment covering 100% of the new coordinator's salary in year one, 75% in year two, 50% in year three, and 25% in year four. Limited funds for training and peer-to-peer mentorship are included as well.

Consider developing locally supported dedicated, yet voluntary, revenue streams. While many of the funding programs suggested here can be critical in supporting initial efforts and demonstration projects, grants are a finite resource. In looking at the long term, JRRC will want to consider the feasibility of developing local revenue streams that generate support for future activities, as well as the maintenance of early-stage projects. Pursuit of these types of financing mechanisms will require greater community recognition and support for JRRC goals, expanded capacity within the organization, and a certain level of political support from the Borough Council and neighboring municipalities.

Developing some type of unrestricted discretionary fund could prove valuable to the organization on a number of fronts. These funds could be budgeted for use over time for organizational capacity or project implementation, or used as matching funds for future grants. There are a number of ways that organizations develop this type of reserve fund, but most rely on a collection of fundraising activities. A detailed projection of organizational funding needs, suggested fundraising tactics, and revenue projects over the next three years is currently being developed by JRRC and partners.

4.4 Community Engagement

Development of the plan has included positive community engagement efforts to both inform the public about watershed issues and also to engage them to participate. The following sections describe efforts in place throughout the assessment and planning process, and the strategies for future outreach.

4.4.1 Advisory Group

An advisory group termed the Johnston Run Revitalization Council (JRRC) was formed in early 2013 as the assessment phase of the plan got underway. Participation in the JRRC is open to all interested parties and community members. The JRRC met monthly from January 2013 to the present and has had regular representation from the local government, Borough Council and Borough Manager, County Planning Department and the Franklin County Conservation District. The JRRC regularly invites guests from local and regional groups to attend and discuss how they can support the JRRC's mission. These groups include the Chesapeake Bay Foundation and the Alliance for the Chesapeake Bay among others.

The JRRC will continue to serve as the advisory group as efforts transition to implementation and monitoring.

4.4.2 Outreach Strategies

The following strategies have been used successfully to inform the community of the JRRC's mission and goals and to engage them in the process. These strategies will continue to be used to gain additional community support and involvement.

Website – MACWell maintains a website (mac4wellness.org) that since late 2012 has included information on watershed health and the development of the plan. JRRC activities and meeting information is posted on the website. A section dedicated to the Johnston Run Revitalization Program has links to the watershed brochure, the assessment methods and results, local media coverage, and on-going activities.

Factsheets – A fact sheet on *Watershed Basics* was developed to introduce the public to the Johnston Run watershed, the issues it faces, and what they can do to help and get involved. The fact sheet has been distributed at community meetings and is linked on the website.

Media Coverage – Several articles have been published in the Mercersburg Journal to get the word out on the current activities and to invite people to participate. Articles included "A Limestone Stream – A Valuable Resource" by Elizabeth George MD and Michael Pieper. And "Johnston Run Waterway Assessment – A Fascinating Process" by Elizabeth George MD. Community meetings have also been advertised in the Journal.

Community Meetings – Community meetings included two large scale events and one smaller more targeted meeting. The first Community Workshop was held on February 7, 2013 at the VFW hall in Mercersburg. The purpose was to introduce the assessment and watershed plan and to begin discussion of the plans for the Johnston Run trail. Presentations included background, the vision, watershed basics, and an open forum for questions and comments. Maps of the

watershed and planned trail area were available for review. Attendees included 60 Mercersburg residents as well as residents of nearby towns and boroughs.

The second Community Workshop was held on February 6, 2014 at the United Methodist Church in Mercersburg. The purpose was to present the results of the assessment and the draft management plan for review and comment. The draft Johnston Run trail plan was also presented to 65 attendees. Videos, maps, and copies of the various reports were used to deliver the workshop messages. The JRRC engaged many local and regional partners who attended and presented information for their respective organizations. These included MACWell, the Franklin County Conservation District, the Chesapeake Bay Foundation, and the Alliance for Aquatic Resource Monitoring.

A third more targeted meeting was held on December 6, 2013. The purpose of the meeting was to increase communications and build support and relationships between MACWell, JRRC, and the farming community. Attendees included eight farmers, the Chamber of Commerce Executive Director, three MACWell Board members, and a representative from the JRRC.

Individual Outreach – JRRC has reached out to individual property owners through email, phone calls, and property visits to build support for both the general watershed plan, and for strategies specific to their properties.

4.4.3 Continuing Engagement

The strategies listed above will continue to be used to engage the community in the Johnston Run revitalization. Key among these will be the individual outreach. Working with landowners willing to participate in restoration activities such as stream restoration, riparian buffer plantings, and agricultural BMPs is a crucial link between the planning and implementation phases.

Workshops related to specific measures that residents can implement on their property will both build support and provide the tools for individual action. Potential workshop topics are many and varied and can include lawn care, pet waste, septic system maintenance, native and invasive vegetation, and rain gardens.

The JRRC has engaged many local and regional partners during the development of the watershed plan. These partners are listed in following sections under ‘Partnerships”.

4.5 Implementation Schedule

A schedule for implementation will provide a general roadmap for activities in the near-term (1-2 years), mid-term (3-5 years), and long term (5-10 years). Chief factors influencing the schedule include funding, willing participation from landowners, and priorities.

4.5.1 Priorities

Determination of priorities also substantially aids local organizations with limited resources such as JRRC in selecting the type and timing of restoration actions to be taken.

Ranking of restoration priorities was completed using the analytical hierarchy process which is particularly useful for group decision making where options are numerous and varied (a variety of restoration actions, activities, and programs). This process provides a logical framework for a systematic way to evaluate choices, simplify problem solving, and arrive at a consensual decision. A "paired" approach (frequently called *paired-comparison*) was used where decision makers compare one component to another until all components have been compared to each other. A survey form (Figure 13) was prepared and then completed by Council members and resource managers. Those completing the survey were asked to indicate the degree to which one action is preferred over the other by writing a numeric score where 1 is somewhat preferred, 2 is moderately preferred, and 3 is highly preferred. The completed surveys thus record individual preferences and once compiled indicate the relative importance for the restoration actions, activities and programs. The rankings are displayed in Table 16 in three categories; preferences of Council members, preferences of resource managers, and stakeholders (Council members and resource managers).

Figure 13 – Survey Form to Record Preferences for Restoration Actions

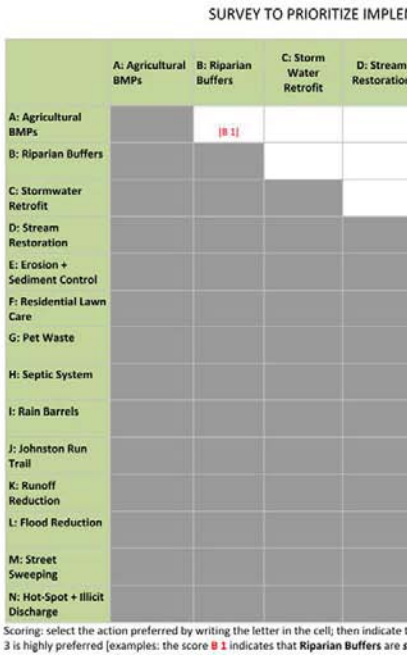


Table 16 – Summary of Restoration Preferences by Participant Category

ACTION CATEGORY	Council Members	Resource Managers	Stakeholders
Agricultural BMPs	**5**[1]	2	**2**
Riparian Buffers	**2**	1	**1**
Storm Water Retrofit	3	6	7
Stream Restoration	**6**	3	**3**
Erosion and Sediment Control	7	4	4
Residential Lawn Care	13	11	10
Pet Waste	14	13	14
Septic System	11	10	12
Rain Barrel	12	12	11
Johnston Run Trail	**1**	9	**6**
Runoff Reduction	**4**	5	**5**
Flood Reduction	9	7	8
Street Sweeping	10	14	13
Hot-Spot and Illicit Discharge	8	8	9

In summarizing the preferences indicated by the three categories of participants (Johnston Run Revitalization Council members, resource managers, and stakeholders), there was consensus for the top

[1] Priority rankings in **red** indicate consensus of Johnston Run Revitalization Council Members and Stakeholders among the highest ranked categories.

six actions among Council members and stakeholders. These restoration priorities are generally consistent with the practices listed in Tables 7 and 8, and address many of the watershed issues identified in section 3.2 Pollutant Loads. Based on this conclusion, the following actions, activities and programs will be the highest priority for implementation:

- Agricultural Best Management Practices (BMP)
- Riparian Buffers
- Stream Restoration
- Johnston Run Trail
- Runoff Reduction
- Outreach programs[2] (workshops for lawn care, pet waste, septic systems etc.)

In terms of geographic priority, the philosophy held by many resource managers, including the partner agencies of FCCD and the DCNR, is to seek opportunities in the headwaters first and then move progressively further downstream. In this manner the benefits achieved in the most upstream portions of the watershed are realized through the entire length of the stream system moving downstream. Headwaters, because of their close connection to upland stressor sources are often the most impacted by development and by corollary may receive the most benefit from restorative actions. In general restoration in headwater and tributary areas can be less expensive than projects further downstream simply because the stream channel is smaller. For Johnston Run this philosophy would indicate that a geographic priority would be placed on the reaches upstream of Main Street. The reach beginning with the headwater limestone springs at to the upstream end of the mainstem should be a primary focus for restoration. These reaches are impacted by agricultural activities. A secondary focus would be the reaches through the Borough that are subject to direct and untreated urban runoff.

4.5.2 Schedule and Milestones

A proposed implementation is included below as Figure 14. For each project type the schedule identifies the organization with lead responsibility to implement the project or program. The timing is broken into near-term activities from 2014 to 2015, mid-term activities from 2016 to 2018 and long-term activities from 2019 to 2024. Overall the schedule provides a 10-year planning horizon.

At this stage, specific project sites are not identified for each project type. JRRC will continue to conduct land-owner outreach to identify willing property owners from the projects currently identified in this plan, and from new project sites identified in the future. JRRC's land-owner outreach efforts are being enhanced through partnerships with the FCCD and the CBF. FCCD's preferred approach to identifying and prioritizing projects is to work from the headwaters down to the mainstem and then down to the lower watershed. In this manner, projects accomplished in the headwaters will have the most impact throughout the stream corridor.

[2] Although not ranked highly, outreach programs provide an opportunity for Council members and volunteers to inform residents and business owners of activities that can measurably reduce pollution while increasing awareness of water resources.

Projects with construction components are generally laid out over three year periods and will typically follow a planning (year 1), design and permitting (year 2) and construction (year 4) phasing. JRRC will take project timing into account to ensure as best as possible that implementation of one project at or adjacent to any other project site does not interfere with the other project. Whenever possible, in-stream work should take place before any top of bank or floodplain work to ensure that the stream is accessible to construction crews. For example, a riparian tree planting project should ideally not be followed in quick succession by a stream restoration project that would need to relocate and otherwise disturb the tree planting. Likewise, projects located adjacent to the Johnston Run Trail alignment should be coordinated with the timing of the trail constriction. In this manner, several project efficiencies can be gained including overall cost savings, particularly if one contractor can be complete both project elements simultaneously, and reduced frequency of disturbance at the site.

Figure 14 – Proposed Implementation Schedule

Project Type	Lead Responsibility	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Notes
		Near term		Mid			Long						
Fundraising													
Capital Campaign													
General Fundraising													
Agricultural													
Livestock Exclusion Fencing/Stabilized Crossing	JRRC, FCCD												
Project 1	JRRC, FCCD	P	D	C									
Project 2	JRRC, FCCD		P	D	C								
Nutrient Management Plan	JRRC, FCCD												On-going program, seek to obtain maximum participation
Erosion and Sediment Control	JRRC, FCCD												
Stream Restoration													
Project 1	JRRC, FCCD		P	D	C								
Project 2	JRRC, FCCD				P	D	C						
Project 3	JRRC, FCCD						P	D	C				
Project 4	JRRC, FCCD								P	D	C		
Reforestation / Riparian Buffers													
Project 1 and 2	JRRC, CBF, FCCD, ACB												
Project 3 and 4	JRRC, CBF, FCCD, ACB												
Project 5 and 6	JRRC, CBF, FCCD, ACB												
Project 7, 8 and 9	JRRC, CBF, FCCD, ACB												
Identify more sites	JRRC, CBF, FCCD, ACB												Repeat 2-3 projects annual per year, 1 in Spring 1 in Fall
Stormwater Retrofit													
Project 1	JRRC/Borough		P	D	C								
Project 2	JRRC/Borough				P	D	C						
Infiltration Trench	Borough/County		P	D	C								
Step Pool Storm Conveyance	JRRC/Borough												
Green Alleyway	JRRC/Borough		S	P	D	C							
Community Wide Programs													
Lawn Care Education Workshop	JRRC	W		W		W		W		W		W	Alternate workshop series every other year
Pet Waste Education Workshop	JRRC	W		W		W		W		W		W	
Stream Clean Up	JRRC												Repeat annually each spring
Septic System Education Workshop	JRRC		W		W		W		W		W		
Rain Barrels / Downspout Disconnect Workshop	JRRC		W		W		W		W		W		
Johnston Run Trail	JRRC	F	D	C	C								
Municipal (source control and flooding)													
Street Sweeping	Borough												Regular interval to be determined
Hot Spot and IDDE	Borough												Biannual inspections
Culvert Upgrade	Borough/PennDOT		S	P	D	C							
Monitoring													
Implementation tracking	JRRC												Track success on-going; provide annual report
Monitoring	JRRC - ALLARM	P											Monitoring project success and watershed health (water quality - nutrients, bacteria, sediment; biology; forest resources)
	S, P, F, D, C, W	**S**tudy, **P**lanning, **F**unding, **D**esign, **C**onstruction, **W**orkshop											
		Three year general implementation for each major project that requires funding (YR1), design and permitting (YR2) and construction (YR3).											
		For on-going activities that will generally continue through the implementation period											
	—	Regular Inspection, Maintenance, and Monitoring											

4.6 Monitoring Program

4.6.1 Implementation Tracking

The JRRC will develop a program and process for tracking projects from study and planning, through design and implementation. Important data collected and maintained for each project will allow JRRC both to quantify the impact that their efforts are having on the watershed, and also be better equipped to communicate their successes to the public, potential funders, local governments, and volunteers.

For constructed projects, JRRC will want to document the type of practice, cost of various design and construction aspects, size of the project (linear feet, area), drainage area, and estimates of the project impact. The impact should be based on the goals of the project and should ultimately be tied to the monitoring results, however estimates of pollutant removal, flow reduction, habitat improved or other project metrics will be useful to demonstrate progress toward broader water quality and watershed improvement.

For community based projects with public outreach components such as workshops or rain barrel installations, JRRC will want to document cost, number of installations, number of people reached, and other metrics based on the impact of the messaging. Follow-up surveys are useful to determine if behavior modifications results from attending the workshops.

4.6.2 Monitoring

Monitoring data for any water-body is a crucial element that can assist in determining current conditions, developing targeted management strategies, and tracking progress over time. Data available for Johnston Run is limited to DEP rapid stream assessments conducted in 1999 and 2006 and the most recently completed assessment conducted in 2013 in support of the watershed management plan. It is recommended that additional monitoring be conducted to better pin-point sources of pollutants, to establish solid baseline of conditions and to track progress and changes in stream and watershed condition as implementation of restoration projects occurs. Some specific recommendations are provided here:

Volunteer Monitoring – The JRRC is currently initiating a partnership with the Alliance for Aquatic Resource Monitoring (ALLARM) to develop and implement a monitoring program for Johnston Run. ALLARM will provide technical assistance and training to volunteer stream monitors.

Stream Monitoring – The stream sampling conducted by DEP in 1999 and 2006, and by KCI in 2013 can be repeated regularly to track trends in baseflow water quality and biological condition. Sampling followed PA DEP's *Instream Comprehensive Evaluation* Survey protocols including benthic macroinvertebrate sampling, fish sampling, physical habitat assessment and collection and analysis of water quality grab samples.

Microbial Source Tracking – Sources of the extremely high fecal coliform bacteria counts throughout the watershed, but particularly in the lower watershed where counts were 20-times

higher than upstream is cause for concern. Implementing a Microbial Source Tracking effort can identify the source of the bacteria (e.g. human, pets, livestock, and wildlife) which will then help managers control the problem. An Antibiotic Resistance Analysis of *Enterococcus* bacteria can be used to identify if cattle is a major source.

Hot-Spot and IDDE Monitoring – As recommended in earlier sections as a management strategy, conducting hot-spot and stormwater outfall surveys will identify issues and provide follow-up data to determine issue resolution. The Stream Corridor Assessment conducted in 2013 identified 28 pipe outfalls, 14 of which were stormwater, four were draining agricultural land, nine were of an unknown type, and one was an industrial outfall at the wastewater treatment plant. Outfalls should be assessed for the color, clarity, and odor of any potential flow, and tested parameters to could include bacteria, pH, detergents/surfactants, conductivity, hardness, fluorine, potassium, ammonia, and fluorescence. More data related to the discharge type and quality at these pipes will help managers target restoration activities.

Stream Discharge Gaging – Stream gages are recommended at the Main Street and Oregon Street crossings to gage flow and develop a record of flooding events. The data will inform any future flooding studies and help target management efforts.

4.7 Partnerships

Implementation of the plan and meeting the goals and objectives of the JRRC will require participation and support from many different groups including citizens, volunteer organizations and local government. Through the assessment and planning process, many strong partnerships have developed that will carry into the implementation phase. Existing and potential partners include:

Community, Volunteer Groups

- Johnston Run Revitalization Council
- Alliance of Aquatic Resource Monitoring
- Tuscarora Wildlife Education Project
- Tuscarora School District

Local Government Partners

- Borough of Mercersburg
- Franklin County Conservation District
- Franklin County Planning Department
- Montgomery Township
- Peters Township

State Agency Partners

- Pennsylvania Department of Environmental Protection – Bureau of Point and Non-Point Source Management
- Pennsylvania Department of Conservation and Natural Resources – Bureau of Forestry

Federal Partners

- Natural Resources Conservation Service, United States Department of Agriculture
- National Park Service

State Agency Partners

- Pennsylvania Department of Environmental Protection – Bureau of Point and Non-Point Source Management

Regional Partners

- Alliance for the Chesapeake Bay
- Chesapeake Bay Foundation
- Pheasants Forever
- National Fish and Wildlife Foundation (NFWF)
- The Nature Conservancy
- Trout Unlimited

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APPENDIX A – WATERSHED ASSESSMENT REPORT

APPENDIX B – POLLUTANT LOAD CALCULATION METHODS

APPENDIX C – RESTORATION CONCEPT PLANS

APPENDIX D – FUNDING MATRIX