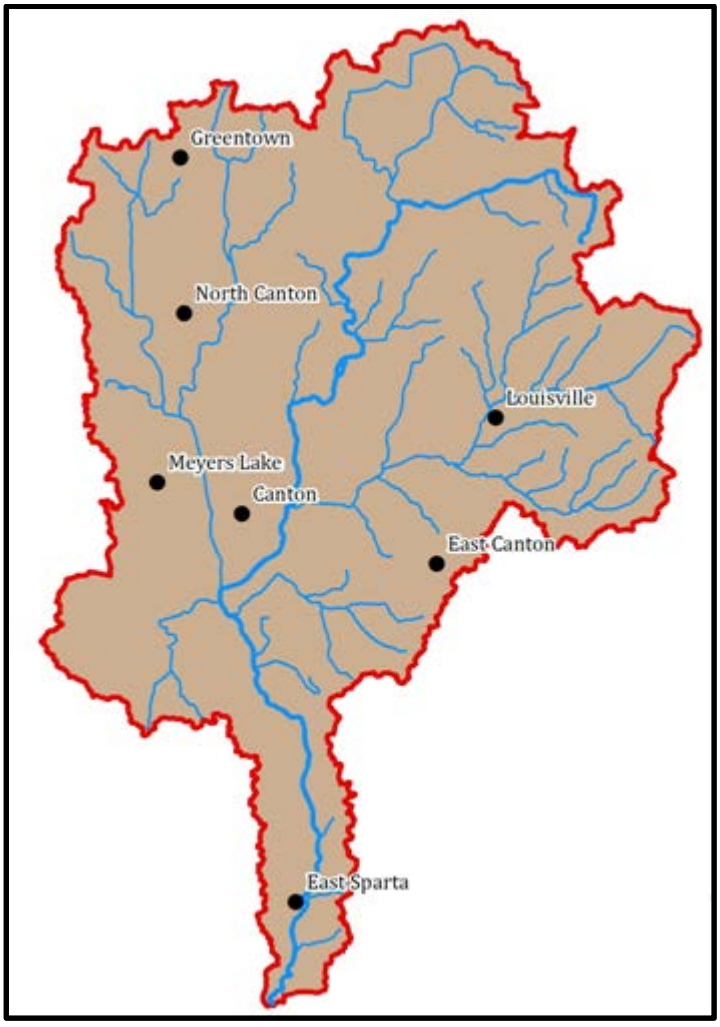
Section 729
Final Watershed Assessment and Watershed Management Plan

Nimishillen Creek Watershed
Ohio



U.S. Army Corps of Engineers
Huntington District
April 2015

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Executive Summary

The Section 729 Nimishillen Creek Final Watershed Assessment (FWA) was completed under the authority of Section 729 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), which later was amended by Section 202 of WRDA 2000 and Section 2010 of WRDA 2007. It was a follow on study to the Section 729 Initial Watershed Assessment (IWA) for the Muskingum River Basin prepared by the Huntington District in 2011.

The Nimishillen Creek Watershed is part of the Muskingum River Basin, which lies in the eastern portion of Ohio. Nimishillen Creek is 23.5 miles long, and drains approximately 187 square miles, including the entire City of Canton. The watershed covers portions of Stark, Summit and Tuscarawas Counties.

The goal of the FWA was the development of a Watershed Management Plan (WMP) for the Nimishillen Creek Watershed which addresses water resource related issues pertaining to flooding, water quality, stormwater management and floodplain management. These issues were identified through extensive stakeholder involvement, including meetings and workshops held with local officials such as mayors, city managers and city and county engineers, as well as representatives from various State of Ohio resource agencies, and the project cost share partner, the Muskingum Watershed Conservancy District (MWCD).

Once these issues were identified, the Huntington District Project Delivery Team (PDT), in continued partnership with the stakeholders, began to identify potential solutions for each issue. The Huntington District developed each potential solution and finally developed a series of recommendations for implementation. While 21 recommendations were made, 10 were identified as the most critical, including[1]:

- **Flood Risk Management Recommendations**
    - Installation of Additional Rain/Stream Gages
    - Flood Warning System
    - Flood Warning Emergency Evacuation Plan
    - Hydrologic and Hydraulic Modeling Update
- **Water Quality Recommendations**
    - Addressing Sewage Treatment in the Watershed
    - Addressing Inundated Manholes
    - Improvements to Local Land Use Zoning
- **Stormwater Management Recommendations**
    - Connect Hydrologic Network of Streams & Adjoining Floodplains
    - Establish Consistency in Stormwater Management Regulations
- **Floodplain Management Recommendations**
    - Consolidation of Floodplain Management Duties

Several of these recommendations have already been initiated. These include the installation of additional rain and stream gages throughout the watershed, connecting hydrologic networks between stream channels and adjoining floodplains by acquiring and razing structures and associated pavements built in the floodway, and the consolidation of floodplain management duties in the watershed.

The WMP describes a comprehensive plan for managing land and water resources within the watershed via a holistic process which reflects the interdependency of land owners and water users, competing demands on water resources and desires of the stakeholders.

[1] Please see Table 9.5 for a description of the recommendation and how it may help the watershed.

Section 729
Final Watershed Assessment and Watershed Management Plan

Nimishillen Creek Watershed
Ohio

Table of Contents

1.0 Introduction 1-1
1.1 Study Purpose and Scope **1-1**
1.2 Study Authority **1-1**
1.3 Background **1-1**
1.4 Process **1-2**
1.5 Stakeholder Involvement **1-3**
1.6 Funding **1-4**
2.0 Description of Study Area 2-1
2.1 Study Area **2-1**
2.2 Congressional Districts **2-5**
2.3 Study Baseline Data **2-6**
3.0 Identified Water Resources Issues 3-1
4.0 Flooding 4-1
4.1 Historical Flooding **4-1**
4.2 Estimated Flood Damage **4-3**
4.3 Factors Contributing to Flood Risk Management Issues **4-5**
4.3.1 Lack of Sufficient Precipitation/Stream Gages. 4-5
4.3.2 Stream Sedimentation 4-7
4.3.3 Undersized Culverts and Bridge Abutments 4-8
4.3.4 Climate Change 4-8
4.3.5 Urban Growth and Development 4-9
4.4 Future Conditions with Regard to Flooding Issues 4-10
4.5 Potential Flood Risk Management Solutions 4-10
4.5.1 Installation of Additional Rain/Stream Gages 4-10

4.5.2 Hydrologic and Hydraulic Modeling Update 4-12
4.5.3 Flood Warning System 4-14
4.5.4 Flood Warning and Emergency Evacuation Plan 4-15
4.5.5 Addressing Undersized Bridges and Culverts 4-15
4.5.6 Construction of Flood Water Detention Basins 4-16
4.6 Summary of Flood Risk Management Recommendations 4-18
5.0 Water Quality 5-1
5.1 Ohio EPA, the Clean Water Act and Total Maximum Daily Loads 5-1
5.1.1 Section 303(d) Total Maximum Daily Loads 5-1
5.1.2 Section 402 - National Pollutant Discharge Elimination System 5-2
5.1.3 Section 404 – Discharge of Dredged and/or Fill Material 5-2
5.2 Specific Water Quality Issues Identified by Stakeholders 5-3
5.2.1 Loss of Aquatic Habitat/Riparian Zone/Water Quality Issues 5-3
5.2.2 Failing Home Sewage Treatment Systems (HSTS) 5-8
5.2.3 Inundated Manholes During High Water Events 5-8
5.2.4 Agriculture and Water Quality Issues 5-9
5.3 Future Conditions with Regard to Water Quality 5-9
5.4 Potential Water Quality Solutions 5-9
5.4.1 Addressing Sewage Treatment in the Watershed 5-9
5.4.2 Addressing Inundated Manholes 5-10
5.4.3 Improvements to Local Land Use Zoning 5-11
5.4.4 Preserving/Restoration of Riparian/Wetland Areas 5-11
5.4.5 Education on Land Management Practices 5-12
5.4.6 Bioretention Options 5-12
5.5 Summary of Water Quality Recommendations 5-12
6.0 Stormwater Management 6-1
6.1 Stormwater and Urban Flooding 6-1
6.2 Stormwater and Water Quality 6-2
6.3 Managing Stormwater 6-3
6.4 Future Conditions with Regard to Stormwater Management 6-4
6.5 Potential Stormwater Management Solutions 6-4

6.5.1 Establish Consistency in Stormwater Management Regulations 6-4
6.5.2 Connect Hydrologic Network of Streams & Adjoining Floodplains 6-5
6.5.3 Mitigating Stormwater via Green Infrastructure 6-6
6.4.4 Bioretention Basins 6-13
6.5.5 Utilization of the EPA's Stormwater Management Model (SWMM) 6-14
6.6 Summary of Stormwater Management Recommendations 6-14
7.0 Floodplain Management 7-1
7.1 Floodplain Management at the Federal Level 7-2
7.2 Floodplain Management in the State of Ohio 7-4
7.3 Floodplain Management in the Nimishillen Creek Watershed 7-4
7.4 The Role of Local Floodplain Managers 7-7
7.5 Community Rating System Participation in the Nimishillen Creek Watershed 7-7
7.6 Future Conditions with Regard to Floodplain Management 7-9
7.7 Potential Floodplain Management Solutions 7-10
7.7.1 Consolidation of Floodplain Management Duties 7-10
7.7.2 Designation of a Floodplain Restoration Lead 7-14
7.8 Summary of Floodplain Management Recommendations 7-15
8.0 General Recommendations 8-1
8.1 Educational Outreach 8-1
8.2 Central Repository for Watershed Data 8-1
9.0 Prioritization of Recommendations 9-1
9.1 Prioritization of Recommendations 9-1
9.2 Potential Funding Sources 9-5
9.2.1 Potential Flood Risk Management Funding Sources 9-5
9.2.2 Potential Water Quality Funding Sources 9-7
9.2.3 Potential Stormwater Management Funding Sources 9-8
9.2.4 Potential Funding Sources for Educational Outreach 9-9
10.0 Conclusions and Summary 10-1

List of Appendices

Appendix A – Acronyms
Appendix B – Study Authorities
Appendix C – Stakeholder Meeting Notes
Appendix D – Technical Information on Recommended H&H Analysis
Appendix E – Additional Information
Appendix F – USACE Fact Sheets and Sample Letters of Intent
Appendix G – Previous Reports
Appendix H – Quality Control

Introduction

1.1 Study Purpose and Scope

The primary purpose of this Final Watershed Assessment (FWA) is the development of a Watershed Management Plan (WMP) for the Nimishillen Creek Watershed. The scope of this FWA is as follows:

- Further refine problems and opportunities within the Nimishillen Creek Watershed, as defined by the Muskingum River Basin Initial Watershed Assessment (IWA), through stakeholder engagement and agency collaboration;
- Inventory and forecast existing conditions;
- Evaluate potential solutions to address identified water resources issues (both those identified by the IWA and those identified by further stakeholder involvement); and
- Recommend strategies and/or broad plans based on the shared vision of the stakeholders and partners which can be implemented in the future.

1.2 Study Authority

The authority to study issues related to water resources within the Nimishillen Creek Watershed is derived from Section 729 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), which later was amended by Section 202 of WRDA 2000 and Section 2010 of WRDA 2007 (see **Appendix B**).

In general terms, Section 729, as amended, allows the U.S. Army Corps of Engineers (USACE) to assess the water resources needs of entire river basins and watersheds of the United States, in consultation with appropriate federal, state and local agencies and stakeholders:

> *"The Secretary may assess the water resources needs of river basins and watersheds of the United States, including needs relating to ecosystem protection and restoration; flood damage reduction; navigation and ports; watershed protection; water supply; and drought preparedness."*

1.3 Background

The Ohio River Basin Comprehensive Reconnaissance Report, which examined the entire Ohio River Basin, was completed in December of 2009 and the Great Lakes and Ohio River Division Commander approved the implementation of its recommendations. The report identified problems, issues, and opportunities throughout the Basin, formulated numerous alternatives for future studies, and recommended 20 separate actions. The report also recommended development of a programmatic management

plan as well as an unspecified number of Section 729 Watershed Assessments throughout the Ohio River Basin. One of those watershed assessments was recommended for the Muskingum River Basin within the Huntington District of the Corps of Engineers (USACE).

The Huntington District prepared a Section 729 IWA for the Muskingum River Basin in accordance with Engineering Circular (EC) 1105-2-411, Watershed Plans. Several recommendations were made at the conclusion of the IWA. Among them was a recommendation to pursue a FWA for the Nimishillen Creek Watershed.

The Huntington District reached out to the Muskingum Watershed Conservancy District (MWCD) as a potential cost-share partner and developed a scope of work for the FWA. As part of the scoping process, extensive stakeholder involvement was undertaken, as described in **Section 1.5**. The scope of work for the FWA was determined to be a WMP for the Nimishillen Creek Watershed which would allow for the holistic and comprehensive management of water resources within the watershed.

1.4 Process

EC 1105-2-411, *Watershed Plans*, served as the foundation for applying a comprehensive watershed approach in the preparation of this assessment. Watershed planning (1) addresses problems, needs, and opportunities within a watershed or regional context; (2) strives to achieve integrated water resources management (IWRM); and (3) generally results in non-project specific, holistic plans or strategies to address watershed needs. Additionally, EC 1105-2-411 broadens the planning horizon to address issues pertaining to both land and water resources as well as the multiple, interconnected systems which frequently come into play within watersheds. Watershed planning may consider:

- river and drainage systems;
- geomorphic and subterranean systems;
- weather (including climate change);
- transportation systems;
- power grids;
- water supply and wastewater systems;
- economic systems;
- recreation systems;
- institutional systems and legal frameworks;
- regulatory frameworks;
- floodplain management;

- ecosystems;
- water management systems;
- navigation systems;
- human resources; and
- any other system pertinent to the needs of the watershed effort.

Two report phases lead to the development of a WMP. The first phase involves the development of an IWA. An IWA serves as a general assessment of a watershed and identifies water resource related issues based on existing information. The second phase (documented in this report), involves development of a FWA. The FWA takes a more in depth look at water resource related problems and makes a series of recommendations on how to address the issues identified in the IWA.

It is important to note that while this FWA was developed by USACE, the goal was to go beyond the evaluation of a specific USACE project and move towards a more comprehensive and strategic plan for managing land and water resources, and addressing problems through a holistic process. This process reflects the interdependency of land and water uses, competing demands of the stakeholders, and the desires of a wide range of those stakeholders. Such integrated watershed approaches often span diverse political, geographic, physical, institutional, technical, and stakeholder considerations and are valuable to both project planning and watershed planning.

1.5 Stakeholder Involvement

Stakeholder involvement is critical to the success of the development of a FWA and WMP. Local stakeholders have a working knowledge of the watershed and deal with watershed issues on a day to day basis. Therefore, to best define the problems, needs and opportunities, a broad spectrum of stakeholders were engaged. These ranged from federal, state and local government entities to nonprofit watershed associations. Two distinct stakeholder groups were identified to best represent local interests. The first was an advisory group consisting of elected officials and other similar stakeholders. The second group consisted of local and regional technical experts such as engineers, scientists, planners, floodplain managers and others. Both of these groups provided a wide range of input from various perspectives which served to focus and prioritize development of a FWA and WMP.

A series of stakeholder meetings were held throughout the development of the FWA and WMP. During these stakeholder meetings, problems and opportunities were evaluated and discussed, allowing the Project Delivery Team (PDT) to narrow its focus on the water resource related issues most pressing to the communities. The meetings

were well attended and played a vital role in the development of the WMP. **Appendix C** contains notes from the meetings.

Many of the groups represented in the stakeholder meetings were familiar with each other. However, the stakeholder meetings allowed participants to gain a better understanding of the missions of the various groups represented, and consequently allowed these groups to begin to partner together more effectively. These improved relationships are evidenced in the recommendations made by this assessment. As an example, during an early stakeholder meeting, it was shown that there is overlap of duties and a lack of coordination between designated floodplain managers in the watershed. One of the recommendations is for the consolidation of floodplain manager duties across the watershed. The stakeholders played a significant role in the development of the plan for consolidation.

1.6 Funding

Per EC 1105-2-411, the IWA was completed at full federal expense. The FWA is cost shared 75% federal and 25% non-federal. The non-federal cost share partner for the FWA is MWCD, a regional agency with a long-standing relationship with the federal government. The total project cost for the FWA is $280,000. The non-federal portion is $68,000. The MWCD is providing approximately $33,000 in cash and $35,000 as in-kind services.

2.0 Description of Study Area

2.1 Study Area

The Nimishillen Creek Watershed (as shown below in **Figure 2.2**) is a part of the Muskingum River Basin. The Muskingum River Basin lies in the eastern portion of Ohio, covering about 1/5 of the state. The Muskingum River is the longest stream in the state and drains approximately 8,000 square miles. The drainage area, classified as a HUC-4[2] (Hydrologic Unit Code) sub-basin (henceforth referred to as "Basin"), has an extreme width of about 100 miles from east to west and a length of 120 miles from north to south. See **Figure 2.3** below.

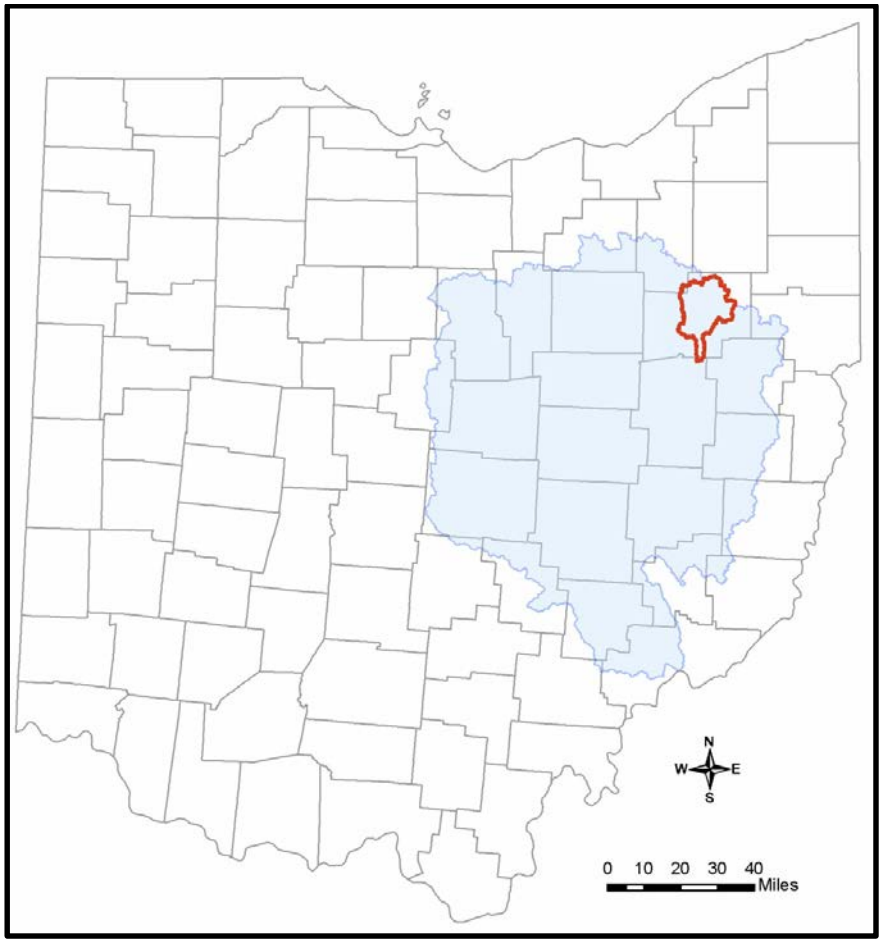

Figure 2.1 - Location of the Muskingum River Basin

[2] The United States is divided and subdivided into hydrologic units. These units nest within each other, each unit being smaller than the one it is contained within. Each watershed is assigned a unique HUC code, for identification purposes. The smaller the HUC code, the larger the watershed. For more information on the HUC classification system please visit the following website: http://water.usgs.gov/GIS/huc.html

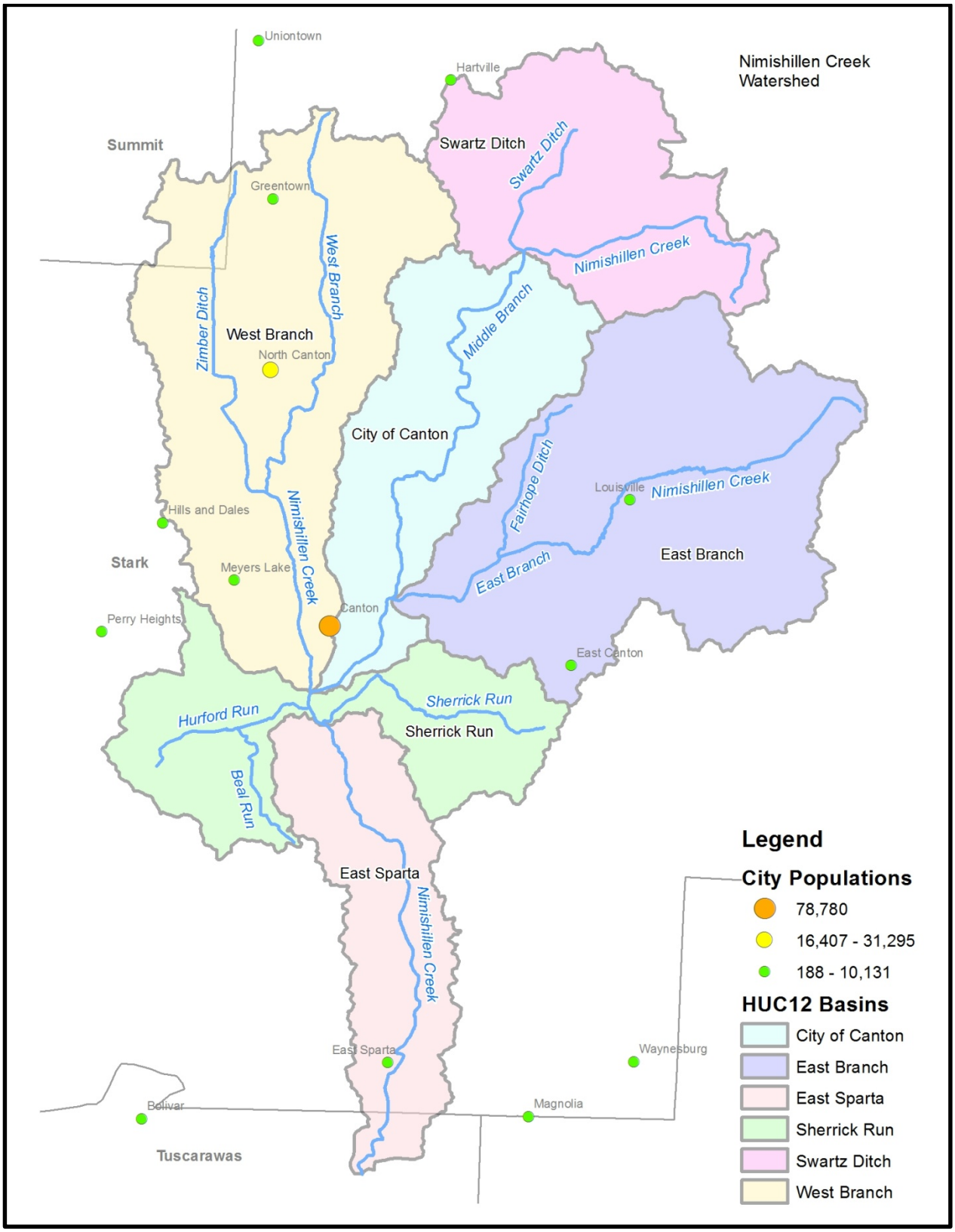

Figure 2.2 - Nimishillen Creek Watershed and Counties Included in Watershed

Nimishillen Creek is 23.5 miles long, and drains approximately 187 square miles, including the entire City of Canton. It flows on both glaciated and unglaciated portions of the Allegheny Plateau through Stark and Tuscarawas counties. It is formed in Canton by the confluence of the East Branch of Nimishillen Creek and the Middle Branch of Nimishillen Creek. The East Branch is 10.4 miles long and the Middle Branch 16.6 miles long. Downstream of its confluence, the stream collects the West Branch of Nimishillen Creek, which flows mostly through agricultural areas. The West Branch is 9 miles long and flows through North Canton, and Canton itself. South of Canton, Nimishillen Creek flows generally southward past East Sparta and into northern Tuscarawas County, where it flows into Sandy Creek.


Figure 2.3 - Nimishillen Creek

The Nimishillen Creek Watershed is a HUC-10 watershed which encompasses six individual HUC-12 sub-watersheds within its boundaries. These are detailed below in **Table 2.1** and above in **Figure 2.1**)

Table 2.1 - HUC 12 Sub-Watersheds within the Nimishillen Creek Watershed

East Sparta	050400010501	16,192
City of Canton	050400010504	16,640
East Branch	050400010502	29,824
West Branch	050400010503	29,888
Sherrick Run	050400010505	14,592
Swartz Ditch	050400010506	13,184

The two dominant types of land use in the watershed are urban and agriculture. As shown in **Figure 2.4** below, the western portion of the watershed is highly urbanized, and while the eastern portion of the watershed is dominated by agricultural land.

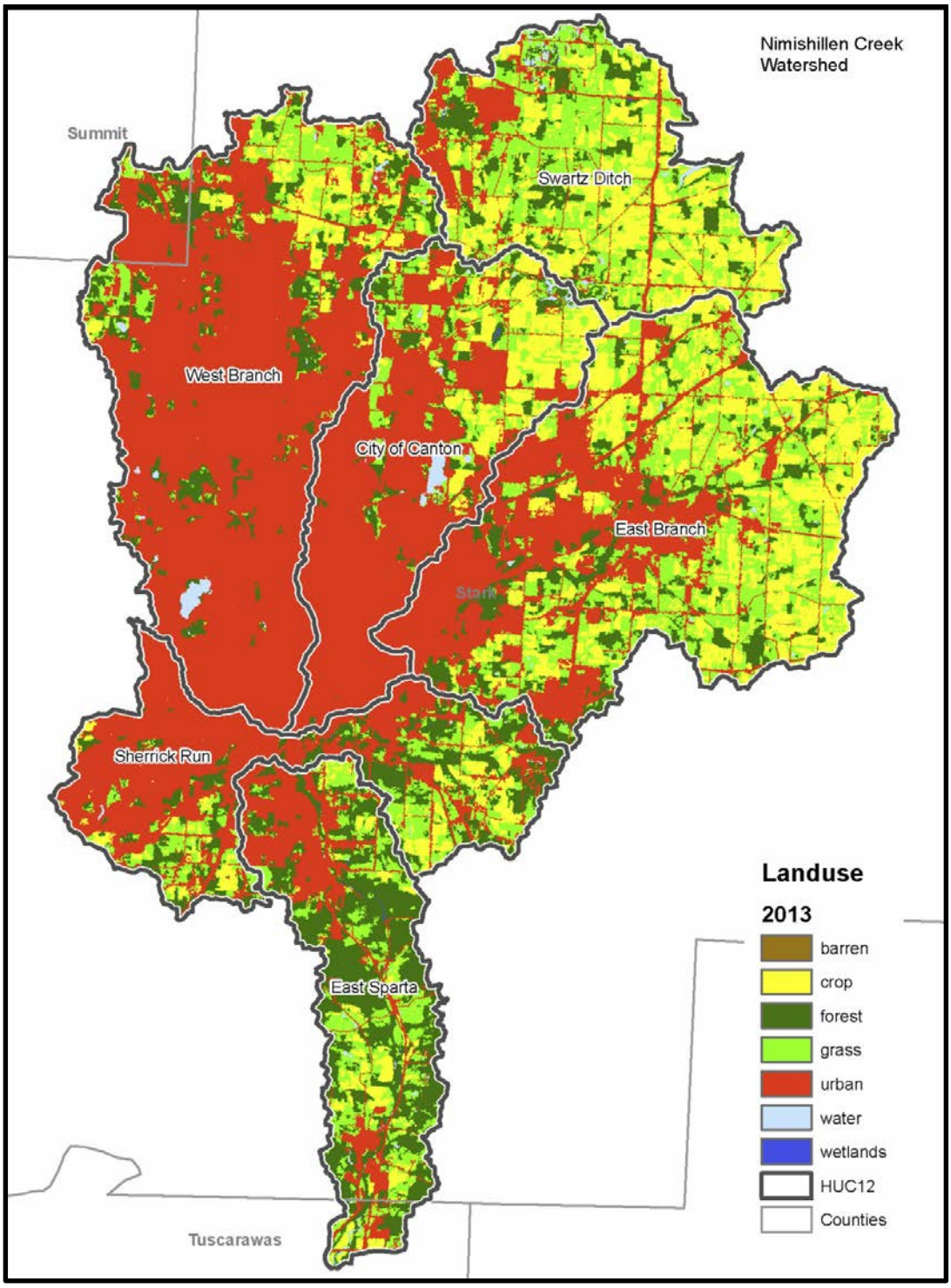

Figure 2.4 - Land Use in the Nimishillen Creek Watershed

The boundaries of the Watershed also encompass (either partially or in full) the townships, cities and villages shown below in **Table 2.2** below.

Table 2.2 – Cities, Village and Townships in the Watershed

Cities, Villages and Townships	Population (2013 Census)
Canton	72,535
Green	25,943
North Canton	17,496
Louisville	9,156
East Canton	1,591
East Sparta	819
Hartville	2,944
Hills and Dales	221
Meyers Lake	569
Canton Township	13,095
Jackson Township	40,587
Lake Township	30,093
Marlboro Township	4,362
Nimishillen Township	9,676
Osnaburg Township	5,619
Paris Township	5,714
Perry Township	28,419
Pike Township	9,937
Plain Township	52,657
Sandy Township	3,668
Washington Township	4,630

2.2 Congressional Districts

The study area lies within the U.S. Congressional Districts as shown below in **Table 2.3** and **Figure 2.5**.

Table 2.3 - Congressional Districts

Sherrod Brown	1-888-896-OHIO	http://www.brown.senate.gov/
Robert Portman	1-513-684-3265	http://www.portman.senate.gov/public/
Bob Gibbs (OH-07)	1-202-225-6265	http://gibbs.house.gov/
Jim Renacci (OH-16)	1-202-225-3876	http://renacci.house.gov/

For more information on other studies completed in the area, please reference **Appendix G**.

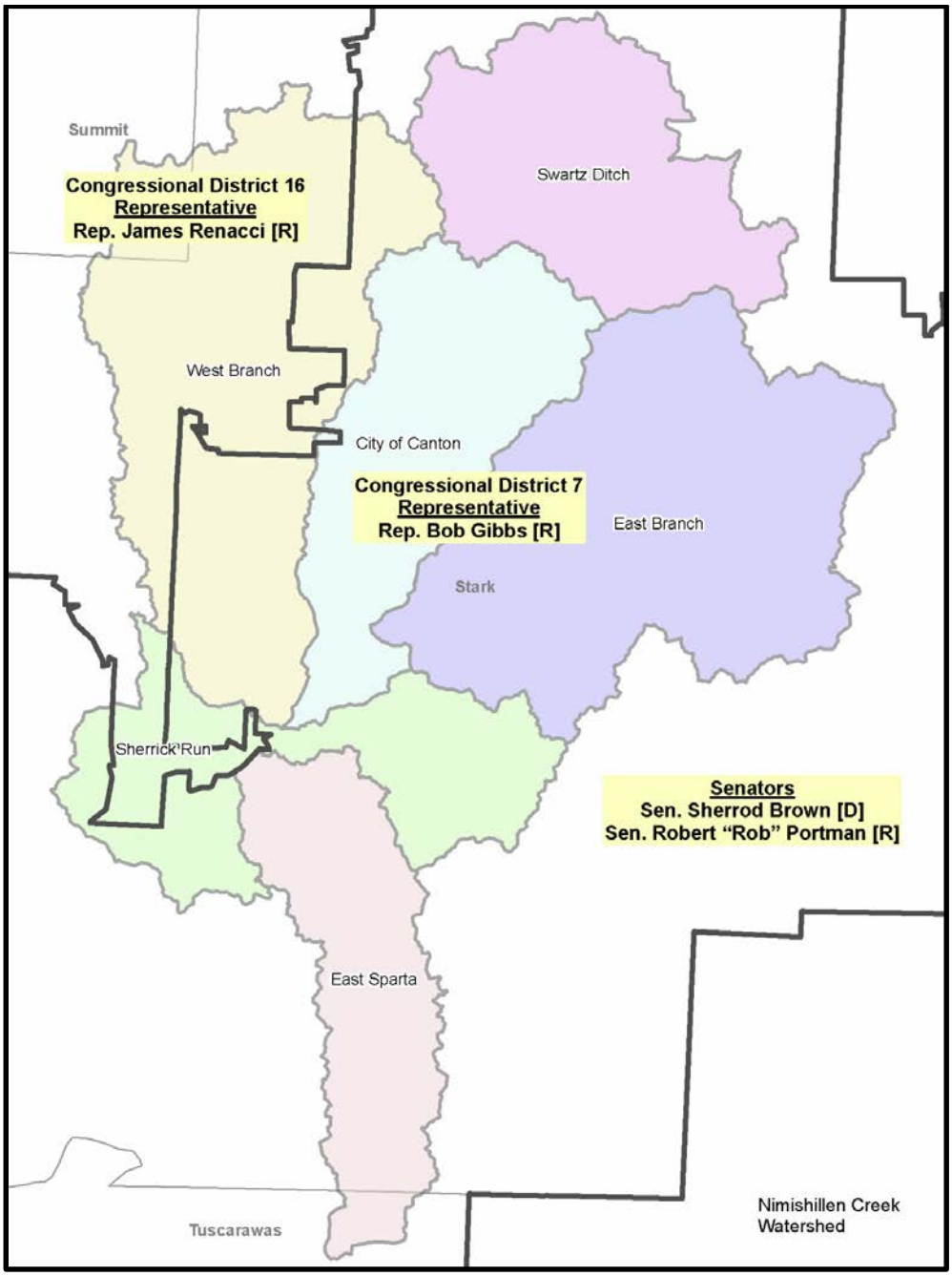

Figure 2.5 - Congressional District in the Nimishillen Creek Watershed

2.3 Study Baseline Data

Most of the PDT research and data gathering done for this study was conducted via the stakeholder involvement process. In terms of the four water resources issues identified in the next chapter, the stakeholders are only now beginning the process of gathering data to needed to address the identified issues. The recommendation of installation of additional precipitation and steam gages discussed in **Section 4.5.1** is an example of the data gathering process needed to address flooding and other issues.

Therefore, the "data" gathered as part of this study was done anecdotally through conversations with the Technical Group. This group consisted of city and county engineers, city consultants and city managers who are well aware of the water resource issues present in the watershed. For decision makers in the watershed, this FWA/WMP is the first step which will hopefully lead to the collection and analysis of data which will help to make efficient and effective water resource management decisions in the future.

Specifically, for flooding issues (as discussed in **Chapter 4**), the information the PDT received was marked on maps, and/or identified via site visits led by Advisory Group members, but generally lacked any photo documentation. For water quality (as discussed in **Chapter 5**), TMDLs (as available) were utilized in the development of the plan. Stormwater management (see **Chapter 6**) at a regional scale has had the least amount of consideration in the watershed to date. Locally proposed stormwater "fixes" had concentrated on individual intersection drains or undersized culverts. With the limited amount of data available specific to the project area and a budget constrained by partner and program limits, the best the PDT was able to do with the information available was to make broad and overarching suggestions concerning methods to manage stormwater runoff.

Finally, in terms of floodplain management (see **Chapter 7**), there was not much quantifiable data available. Unfortunately, it was recognized early in the study that there were individuals identified as floodplain coordinators who were unaware they held this title. Coincidentally, this made collecting data on floodplain management very difficult. As previously stated, this FWA/WMP is a first step in terms of making water resources decisions on a holistic scale.

The exception would be existing H&H models and data. During the literature review and meetings with stakeholders, several studies in which H&H information had been generated were identified. Extensive coordination between the stakeholders, their contractors and the District has failed to unearth any previously developed detailed modeling data, just summaries. The stakeholders continue to try to locate this model data.

3.0 Identified Water Resources Issues

The IWA identified two main sources of water resource concerns in the Nimishillen Creek Watershed: flooding and water quality degradation. The initial step in the FWA process was to engage local stakeholders to collaboratively define these issues and ascertain if there were other water resource concerns they were interested in addressing.

The initial collaborative meeting was well attended with a large number of groups represented. Participants ranged from mayors and county commissioners to city and county engineers. There were also participants from various State of Ohio resource agencies and other federal agencies. The stakeholders in attendance were very interested in participating in the FWA process as it moved forward. The group decided to separate into two previously mentioned sub-groups: an advisory group and a technical group. The advisory group would serve as a steering committee for the FWA, and the technical group would give input on the technical analysis and decisions made for inclusion in the WMP.

Through continued involvement with the stakeholders, it was determined there was significant interest in including floodplain and stormwater management with the other two previously identified problems. The final list of issues to be considered in this assessment is as follows:

- Flooding problems
- Water quality issues
- Stormwater management issues
- Floodplain management issues

4.0 Flooding

Flooding has long been a problem in the State of Ohio. The largest flood to date was the Great Flood of 1913[3], which occurred between March 23 and March 26. Five major rivers in the central and eastern United States flooded from several days of heavy rain and resulting in excessive runoff. Loss of life and property damage was extensive. The official death toll for the State of Ohio for this flood was estimated at between 422 and 470. It was this flood which led to the creation of the Muskingum River Basin system of dams, built by the USACE in partnership with the MWCD in the 1930's.

The Muskingum River Basin system of dams consists of a total of 16 flood risk management dams. However, the study area is located in the headwaters of the Muskingum River Basin, upstream of all of the flood risk management dams. There are several smaller, non-federal dams located within the Nimishillen Creek Watershed, including: Meadow Lake Dam, Pleasant Acres Lake Dam and Fry Lake Dam. These dams were designed for municipal water supply, not flood risk management.

4.1 Historical Flooding

Seven Presidential Disaster Declarations have been issued for Stark and/or Tuscarawas Counties Ohio since 1964. They are listed in **Table 4.1** below.

Table 4.1 - Presidential Disaster Declarations

Disaster Resolution (DR) Number	Date	Description
DR 167	March 24, 1964	Severe Storms and Flooding.
DR 266	July 15, 1969	Tornadoes, Severe Storms and Flooding
DR 1227	June 30, 1998	Severe Storms, Flooding and Tornadoes
DR 1484	August 1, 2003	Tornadoes, Flooding, Severe Storms and High Winds
DR 1519	June 3, 2004	Severe Storms and Flooding
DR 1556	September 19, 2004	Severe Storms and Flooding
DR 1651	July 2, 2006	Storms, Tornadoes, Straight Line Winds and Flooding

[3] The Great Flood is responsible for changing the way the country managed its waterways. This event increased congressional support for flood control measures After subsequent major floods in the middle part of the 20th century the National Flood Insurance Program (NFIP) was created in 1968, followed by the Federal Emergency Management Agency (FEMA) in 1979.

Numerous other floods, which have not resulted in a federally-declared disaster, have also occurred across the watershed. For a sample of some of these flood events, see **Table 4.2** below.

Table 4.2 - Other Flood Events Impacting the Nimishillen Creek Watershed[4]

Flood Date	Property Damage	Event Narrative
4-3-2000	0	"Showers and thunderstorms dumped one to two inches of rain on already saturated ground causing Niminshillen Creek at North Industry to go into flood on the evening of the 3rd. The creek crested at 8.9 feet early on the 4th. Flooding was confined to lowland areas along Ross Avenue and Ninth Street in Canton. Flooding also forced the closure of several roads in Massillon."
4-8-2000	0	"Niminshillen Creek at North Industry went into flood around midday and crested late in the afternoon. Lowland flooding occurred from just north of Blecker Place east to Ross Avenue and south to Ninth Street in Canton."
7-23-2003	100K	"Thunderstorms moved across northeastern Ohio and dumped one to two inches of rain on already saturated ground. Widespread urban and lowland flooding continued across the area. Many streams and small creeks remained in flood and dozens of roads had to be closed. Basement flooding damaged hundreds of homes."
7-27-2003	0	"Thunderstorms dumped two to four inches of rain on most of Stark County. A maximum of 4.50 inches of rain was measured at Louisville with 4.00 inches at both Massillon and in Lake Township. 3.5 inches of rain was measured at the Canton Water Plant. Significant flash flooding occurred along the east and west branches of Nimishillen Creek. The creek left its banks during the evening hours after rising six feet in two hours and crested at an all time high of 14.07 feet at North Industry at 6:35 a.m on the 28th. The creek went back below flood stage during the late afternoon hours of the 28th. Communities, located along the river including North Canton, Canton and Louisville, were devastated by flooding. The previous highest crest was 11.3 feet on January 22, 1959. Record keeping began at North Industry in 1941."
8-5-2003	15M[5]	"Heavy rains fell on Stark County. Lowland flooding occurred across the county and several small streams and creeks left their banks. Several roads had to be

[4] According to the National Climatic Data Center and the National Oceanic and Atmospheric Administration's (NOAA's) Satellite and Information Service

[5] Updated figure provided by the Ohio Emergency Management Agency

		briefly closed."
9-9-2004	572K[6]	"Heavy rains from the remnants of Tropical Storm Frances caused Nimishillen Creek to go into flood during the early morning hours of September 9th. The creek at North Industry crested at 8.98 feet during the early afternoon hours and fell back below the flood stage of 8.0 feet by early evening. Many homes and businesses along the creek experienced flooding. Damage to most of these buildings was minor, but a few did sustain significant damage. Several roads along the creek had to be briefly closed."
1-1-2005	469K[7]	"January 2005 was the fifth wettest January ever at the Akron-Canton Airport with 5.62 inches of rain for the month. Cooperative observers in Louisville measured 7.05 inches during the month. In addition to this rain, extensive snowpack existed over Stark County at the beginning of the month. Temperatures in the 50s the first three days of the month caused a rapid snowmelt and brought area streams and creeks to a bankfull condition just in time for a significant winter storm on the 5th and 6th. Then, just as things began to return to normal, heavy rains fell on the area on the 11th, 12th and 13th causing conditions to once again worsen. Major flooding occurred on streams and rivers, especially in southern Stark County. Nimishillen Creek at North Industry crested around a foot above flood stage on the 12th."

4.2 Estimated Flood Damage

In an effort to determine the current condition of flooding, the technical group chose to use the HAZUS program as the analytical tool. The HAZUS program was used to compute flood damages induced by an array of statistically probable storms for the Nimishillen Creek Watershed. HAZUS is a GIS based loss estimation software package developed by FEMA which can be used to estimate the physical, economic and social impacts from four types of events: floods, hurricanes, coastal surge and earthquakes. It does this via a three step process: 1) calculating the people and contents of the study area using the latest census data; 2) characterizing the intensity of the event on the study area; and 3) using the study area census data and the event to calculate the economic losses.

HAZUS is widely used by federal, state, and local governments and emergency managers for mitigation and recovery as well as for emergency planning and response. HAZUS can also be used during the assessment step in mitigation planning, which is

[6] Updated figure provided by the Ohio Emergency Management Agency
[7] Updated figure provided by the Ohio Emergency Management Agency

the foundation for a community's long term strategy to reduce disaster losses and eliminate repetitive damages.

For this FWA, HAZUS was used to estimate flood damages for the following: 10-year flood, 25-year flood, 50-year flood, 100-year flood and 500-year flood. The results are presented below in **Table 4.3**.

Table 4.3 - Expected Flood Damages Per Flood (x1000)

Residential Damage	$60.83	$71.67	$79.31	$90.28	$114.44
Commercial	$79.38	$95.75	$105.45	$119.18	$145.70
Industrial	$47.48	$54.48	$59.62	$64.30	$77.94
Agricultural	$20.63	$22.90	$24.40	$27.01	$30.18

Flood-prone areas identified during the stakeholder involvement meetings include Zimber Ditch, the East Branch of Nimishillen Creek, the Middle Branch of Nimishillen Creek through Canton, and Fair Hope Ditch in Louisville (See **Figure 4.1** below). The causes of flooding and flood damages are numerous. They include issues such as increased sedimentation in waterways, inadequate culverts and bridges, and upstream development which generates excessive runoff resulting in downstream out-of-bank flood flows. Additionally, there is a lack of stream and rain gages in the watershed. Such gages could be used as a part of a Flood Warning System (FWS), potentially decreasing flood damages. Current studies indicate future changes in regional climate could exacerbate watershed flood damages due to increased precipitation and more intense rainfall events.

Figure 4.1 - Nimishillen Waterways with Historic Flood Damages

4.3 Factors Contributing to Flood Risk Management Issues

4.3.1 Lack of Sufficient Precipitation/Stream Gages.

To date, there is one precipitation gage and two stream gages located within the Nimishillen Creek Watershed. The National Oceanic and Atmospheric Administration (NOAA) precipitation gage is located in the West Branch sub-basin at the Akron-Canton regional airport. The two stream gages are located on the Nimishillen Creek at North Industry and on the Middle Branch Nimishillen Creek at Canton. Gage locations are shown below on **Figure 4.2**. It should be noted that there are no stream gages located on the East or West Branches. The lack of stream gages for those sub-basins makes it difficult to forecast flooding conditions and proactively respond to flood threats. Increased warning time would allow residents and business owners to move at-risk items, decreasing property damages associated with flood events.

Figure 4.2 - Existing Stream Gages in the Watershed

4.3.2 Stream Sedimentation

The northeastern part of the Nimishillen Creek Watershed is dominated by agriculture. Poor land management practices are typically responsible for sedimentation issues encountered downstream of agricultural land. These practices include cultivation encroachment on riparian zones and allowing grazing animals access to the streams. When the stream channel becomes clogged with sediment, there can be an increase in bank erosion and stream meandering, both of which contribute to not only flooding issues but also water quality issues, as discussed in **Chapter 5**.

4.3.3 Undersized Culverts and Bridge Abutments

Undersized culverts and constricting bridge abutments and roadway embankments (including railroad bridges and crossings) can significantly contribute to flooding issues. Many of the bridges and culverts in the Nimishillen Creek Watershed were constructed when the area was much less developed, and consequently cannot accommodate the amount of flow that is now generated during high water events. Increased development leads to increased runoff, rendering many of the existing culverts and open channels between bridge abutments undersized. When these features are undersized flood levels upstream of the feature are increased due to the creation of a restriction in the stream. This can also lead to bank erosion and loss of floodplain as the restriction creates greater flow velocities and turbulence. These structures also gather stream-borne debris which further restricts channel flow and leads to further flooding and stream bank erosion.

4.3.4 Climate Change

Generally speaking, the climate for the Nimishillen Creek Watershed has not changed substantially for many decades (at least since 1952) although there have been some recorded increases NOAA in the mean annual temperature and seasonal precipitation mainly in the late summer and early fall throughout parts of the Ohio River Basin. Generally these small annual and seasonal changes have not altered the everyday weather patterns in the watershed to an extent that floods or severe droughts have occurred any more or less often than have been experienced in the past.

The Huntington District of USACE is currently conducting a study of climate change effects on basin infrastructure and ecosystems that will include downscaled climate modeling data for the Ohio River Basin, which also includes the Muskingum River Basin. The study, entitled “Strategies for Adaptation to Climate Change Effects on Operating Infrastructure and Ecosystem Resources/Services,” is scheduled for completion in October 2014 and after peer review by staff at the USACE Institute for Water Resources (IWR), the study (and supporting data) will be available for public review and use. The study will include suggested adaptation strategies for attenuating potential effects of climate change (precipitation, temperature and river flow changes) in

many parts of the basin including the Muskingum River Basin and Nimishillen Creek Watershed.

International studies of climate change based upon Global Climate Models have suggested future mean annual temperatures may increase through the next several decades and parts of the nation may experience greater amounts of rainfall or drought conditions depending upon the specific location. Other studies have suggested individual rainfall events may become more intense (inches per hour) although such events will be less frequent. Initial modeling data from the Ohio River Basin Study does not identify any significant changes in mean annual precipitation, river flows or temperature increases through 2040 within the Muskingum River Basin.

4.3.5 Urban Growth and Development

Rapid urban development has increased the frequency and severity of flooding in the watershed. The schematic graph below shows the relative increases in stream discharge (discharge volume versus time to peak discharge during a rainfall event) as a result of urban development over and above other land uses. Urbanization increases stream flow volume and the time to peak discharge is dramatically shortened resulting in flash flooding episodes. As the land use within the watershed has transitioned from previously rural or agricultural uses to urban uses (urban sprawl), the watershed and its streams' responses to rainfall and snowmelt have changed dramatically.

Urban streams have become unstable due to higher water volumes resulting in more erosion of riparian zones. Armoring of the streams banks has reduced native vegetation which provide shade on the water surface thus increasing stream temperatures. In less developed rural areas, precipitation is absorbed and transpired by vegetation, infiltrated into the soil, and temporarily stored in surface depressions awaiting evaporation. However, in developed urban areas, where much of the land is covered by impermeable surfaces such as parking lots, roads and buildings, there is minimal infiltration or storage available. These surfaces do not store water, and they reduce infiltration of water into the ground and accelerate overland runoff. This often results in increased frequency and severity of out-of-bank flooding. Smaller watersheds, such as the Nimishilllen Creek Watershed, are more likely to experience flooding impacts as a result of development than larger watersheds. In larger watersheds, undeveloped and water-absorbing floodplains are more extensive, development is spread out and natural land cover is more likely to be retained.

Urban growth and development has also adversely affected natural functioning of hydrologic networks and floodplain vegetation systems within the watershed. Over 58% of current housing units in Stark County were built before 1969 and great numbers of

those were located within the floodplain prior to the advent of the 1968 National Flood Insurance Program. Most of that older development was grandfathered into the flood insurance program when Stark County entered the regular program. These older floodplain structures have deteriorated in quality and value, but many remain habitable despite repeated flood events. Floodplain structures were constructed on fills that encroached upon the floodway and disrupted hydrologic functions and vegetation communities normally associated with a stream corridor. Removal of these structures and associated development would help to restore these natural functions of the floodplain, reduce flood damages and improve water quality through filtering of surface flow stormwater.

4.4 Future Conditions with Regard to Flooding Issues

As previously discussed, flooding is a significant issue in the Nimishillen Creek Watershed. Given the ongoing growth and development in the watershed, it is likely without intervention flooding will continue to be an issue in the future. The placement of additional impervious surface will continue to increase the amount of runoff in the watershed, which will likely exacerbate ongoing issues with undersized bridges and culverts in terms of being able to pass higher flows. Lack of sufficient rain and stream gages will continue to make it difficult to make accurate forecasts during high water events. Finally, with no change in land management practices in the north, (in the agricultural portion of the watershed) stream sedimentation will continue and possibly worsen.

4.5 Potential Flood Risk Management Solutions

4.5.1 Installation of Additional Rain/Stream Gages

As previously discussed, there are only a limited number of rain/stream gages in the watershed. Installation of additional gages in key locations should be among the top water resource related priorities in the watershed. They could provide substantial information for the development of the Hydrologic and Hydraulic Modeling Update, Flood Warning System (FWS) and Flood Warning Emergency Evacuation Plan (FWEEP0 discussed in subsequent sections. Additionally, the installation of new rain/stream gages could help with the implementation of the FWS as discussed in the next section.

The appropriate number of rain gages required for a given watershed will depend to a large extent on the rainfall variability in the local area. Therefore, to adequately depict rainfall over a basin, mountainous areas usually will require more gages than flat lands. Areas subject to local convective storms will require more gages than areas which generally experience larger-scale, frontal-type storms. Obviously, availability of funds

must also be factored in when determining the number of gages to be installed. **Table 4.4** below suggests the minimum number of gages per river basin area (in square miles).

Table 4.4 - Minimum Number of Rain Gages Based on River Basin Size[8]

Number of Gages	River Basin Area(mi^2)
3	<40
4	100
6	400
8	1000

Rain gages should be located on level ground and should not be located close to isolated obstructions, such as trees and buildings which may cause erratic turbulence that affects the accuracy of the gage. Gages should also not be located in wide-open spaces or on elevated sites. The best location is where the gage is uniformly protected in all directions, such as an opening in a grove of trees. If a precipitation gage is near an object, then the distance between the gage and the object should be at least twice the height of the object.

Stream gages provide information about the current state of the stream. In small watersheds, typically of those associated with FWSs, streamflow observations are used to calibrate watershed models, verify forecasts from models, or trigger alarms when flooding is impending or occurring. The locations of stream gages in a FWS are guided by one or both of the following factors: (1) downstream public warning requirements, and (2) forecast model requirements. Gages used for stage alarms should be located above key points of potential damage, far enough upstream to yield enough warning time for downstream locations.

During the stakeholder collaboration meetings several of the MWCD and local representatives from several of the cities and villages began working together to install more stream and rain gages. In consultation with the USGS, the MWCD and stakeholders have decided upon the installation of a total of seven new gages – five stream gages and two rain gages. Potential locations of these gages are shown below on **Figure 4.4.**

[8] Source: NOAA

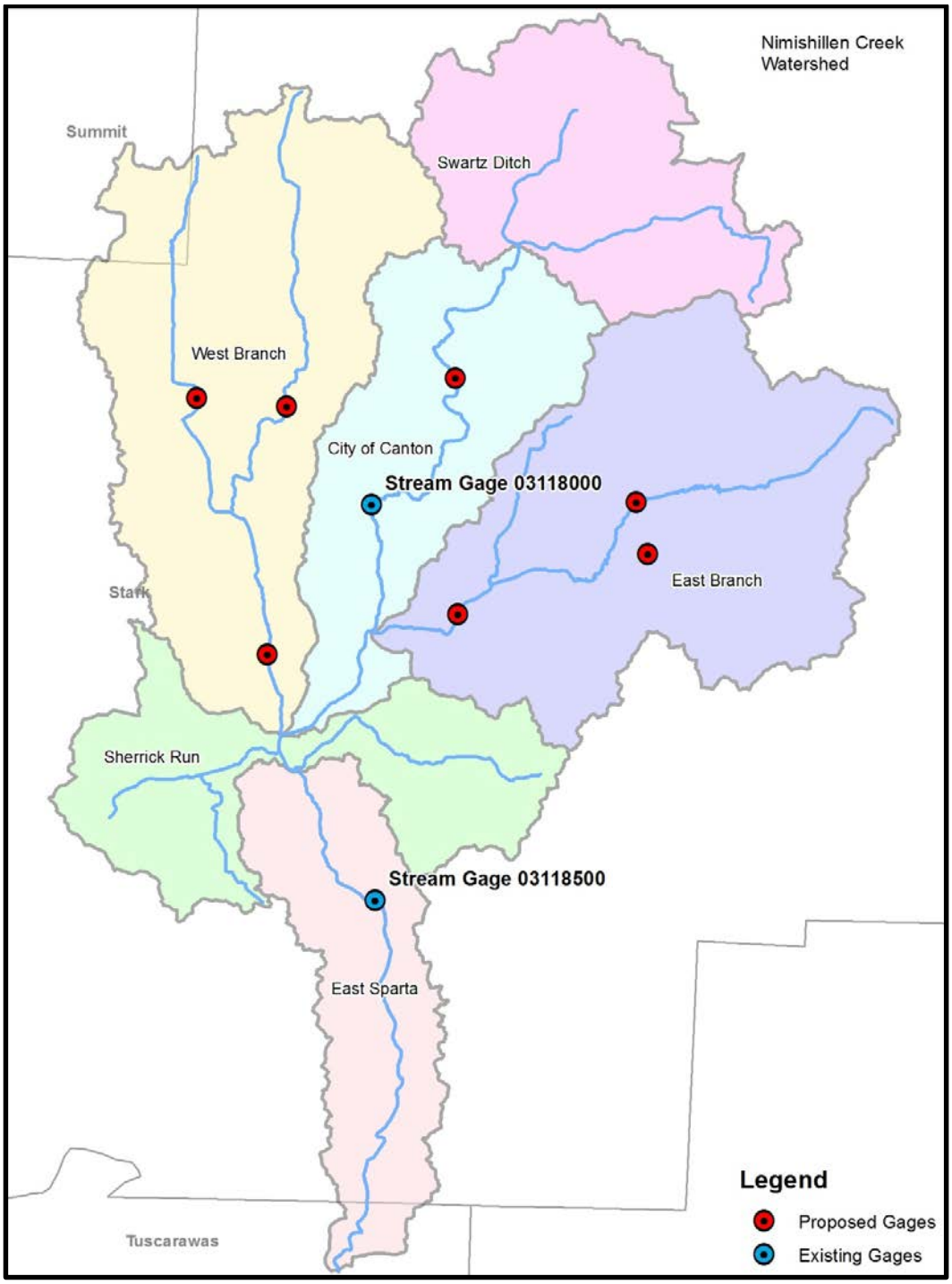

Figure 4.4 – Proposed Location of Additional Rain/Stream Gages

4.5.2 Hydrologic and Hydraulic Modeling Update

A Floodway[9] Update is needed for the Nimishillen Creek Watershed. Current models of the watershed are out of date and do not consider recent development. A Hydrologic

[9] A floodway is the portion of the stream and adjacent land which is set aside per FEMA regulations to pass the 1% chance (per year) flood event. Federal regulations prohibit any development in this area.

and Hydraulic Modeling Update would entail creating a new hydrologic and hydraulic model of the watershed. It would take into account the changes which have taken place since the last time the floodway in the watershed was modeled. Having this updated model would benefit the watershed in several ways.

First, as land use in the watershed changes and additional development occurs, the floodway and floodplain are changed as well. Significant encroachment upon the floodway has occurred along with recent development. Development in the floodway is a significant source of flooding in urban areas. The Hydrologic and Hydraulic Modeling Update would clearly delineate the floodway associated with the Nimishillen Creek Watershed and its tributaries, as well as the associated 100-year floodplain. This would allow for better floodplain management by ensuring that new construction does not occur in the 100-year floodplain, especially the floodway portion of the floodplain. It would also help to identify structures which are currently located within the 100-year floodplain so that they can be bought and removed as funding becomes available, in turn ending the costly cycle of repetitive damage.

Also, the Hydrologic and Hydraulic Modeling Update could potentially be used to update FEMA's Flood Insurance Rate Maps (FIRMs) as part of the National Flood Insurance Program (NFIP). Coordination with the Ohio NFIP coordinator through the Ohio Silver Jackets Program prior to this modeling effort could enhance opportunities to update the county FIS and current FIRM's in this watershed. As previously mentioned this would be helpful in terms of more effective floodplain management. Additionally, this would ensure that owners have adequate flood insurance coverage for their homes and businesses.

In addition to helping with issues related to the NFIP, a Hydrologic and Hydraulic Modeling Update would serve as the foundation for many of the other recommendations made in this WMP. A Hydrologic and Hydraulic Modeling Update would provide models which accurately represent the watershed as it stands today. It could also reflect projected new urban development as well as new infrastructure which impacts the way water moves throughout the watershed. This should be one of the first steps taken to begin addressing not just flood related issues, but all water resource related issues addressed in this assessment.

Encroachment occurs when obstructions, such as fills and buildings are placed in the floodway. Floodplain is an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding. Communities will allow construction of business and homes in the floodplain but typically require flood insurance."

FEMA is agency responsible for Hydrologic and Hydraulic Modeling Updates, as they use this information in the administration of the NFIP. However, it is unknown when FEMA may have the resources available to update their models and mapping for the Nimishillen Creek Watershed. Therefore, the Hydrologic and Hydraulic Modeling Update may need to be completed by the local communities within the watershed. Officials could work with FEMA to ensure the update they undertake meets FEMA's standards, and eventually the update could be adopted by FEMA and used to update their FIRMs, as previously mentioned.

Technical information on the analysis needed to undertake a Hydrologic and Hydraulic Modeling Update is available in **Appendix D** of this report.

4.5.3 Flood Warning System (FWS)

Installation of a FWS should also be among the top priorities for decision makers in the Nimishillen Creek Watershed. A FWS is used to provide the National Weather Service (NWS) with information on rainfall, stream levels and other hydrometerological data, allowing public warnings of potential flood danger to the public. Most FWSs are based on a system of rain and stream gages which report the data that makes it possible to develop this information[10]. The largest benefit associated with a FWS is the increased warning time for flood watches and warnings for areas which may be at risk due to high water events. It also allows for predictions on flood crest times and flooding severity. Once the flood warning or watch is issued individuals can then take action to protect themselves and their property.

Many communities realize additional benefits from the FWS by using the data generated for other applications. For example, data generated by a FWS can be used in the management of reservoirs; allocation of water for municipal, irrigation, and agricultural purposes; and water management and water-quality forecasting. In addition, FWSs are used to provide weather data during the spring and summer months when dry conditions make some areas vulnerable to fire. Many automated FWSs include other meteorological sensors which assist in determining direction and extent of potential burns.

[10] Flood warning dissemination provides critical linkage between recognition of an impending flood and execution of emergency response actions. The process consists of the following primary functions: provisions for decision on whether or not to issue a warning (usually determined by present criteria for a flood threat); formulation of the warning message; and identification of the appropriate audience and means (radio, television, sirens, etc.,) of the distribution of the warning message.

It should be noted that FWSs are expensive in terms of implementation and operations and maintenance (O&M). The NWS states that, "those with the most success have proactive, energetic staff members; strong long term operational funding; and a good rapport with the local NWS forecast office.[11]" The best source of information on the installation and O&M of a FWS can be found in *NOAA's National Weather Service Flood Warning Systems Manual*. More information on the technical aspects of FWSs can be found in **Appendix D** of this report.

4.5.4 Flood Warning and Emergency Evacuation Plan (FWEEP)

Following the implementation of a FWS, a FWEEP should be prepared for the Nimishillen Creek Watershed. A FWEEP builds on an existing FWS to dictate certain actions which should be taken during high water events to help protect life and property from flooding. A typical evacuation plan consists of five parts:

- Preparedness – activities required prior to a flood event to ensure participants have a sufficient level of readiness;
- Flood Threat Recognition – procedures to guide city officials in defining the appropriate level of flood threat and selection of the appropriate emergency response options;
- Warning Dissemination – procedures to notify everyone involved in responding to a flood event of the level of the threat, and the need for implementation of emergency response activities;
- Emergency Response Actions – delineation of emergency preparedness actions for implementation, specification of general guidelines for selection of emergency response action(s), and determination of the organizational structure and procedures for implementation of each emergency response action; and
- Post Flood Recovery Recognition – identification of activities to assure an orderly and timely re-establishment of pre-flood condition, to the extent possible.

The primary goal of a FWEEP is to reduce the threat to life and maintain the safety of residents within a community or watershed. Reducing damages to personal property including homes, vehicles, livestock and other various personal belongings is a secondary goal of a FWEEP.

4.5.5 Addressing Undersized Bridges and Culverts

Addressing undersized bridges and culverts which become restrictions during high water events would be need to be a collaborative process on behalf of all the municipalities in the watershed, as well as the Ohio Department of Transportation

[11] Source: *NOAA's National Weather Service Flood Warning Systems Manual*

(ODOT) and affected railroad companies. Developing site-specific plans to correct such issues would work well for remediating flooding problems caused by existing bridges and culverts, while a programmatic approach would be more appropriate for the installation and/or construction of future bridges and culverts.

The first step to addressing this problem should include the development of a list of problematic bridges and culverts. In addition to using the list to develop site specific plans for correction, the list could also be used to develop a schedule for routine inspections and maintenance. Routine maintenance on undersized culverts could reduce the amount of debris which has accumulated near the openings, allowing for greater flow (and less chance of flooding) during high water events. It should be noted that every situation would be unique, as the stakeholders would have to work with an array of individuals, from private landowners, to businesses, counties, railroad companies and/or ODOT.

A programmatic approach to allow for appropriately sized bridges and culverts should be undertaken in the immediate future. This will require extensive coordination between decision makers and officials in the watershed. Steps will need to be taken to ensure all future bridges and culverts are sized so they do not create additional flow restrictions.

4.5.6 Construction of Flood Water Detention Basins

There are numerous detention basins located throughout the Nimishillen Creek Watershed. These include regional basins such as the Zimber Ditch Basins A and B (see **Figure 4.5** below), as well as basins which are built to handle the runoff from subdivisions, and site-specific basins to handle the runoff from businesses and parking lots. However, the storage capacity of existing basins is insufficient to handle the amount of runoff being generated by large storm events. Further, how these separate detention basins work together as a system is not clearly understood. Throughout the stakeholder involvement process, there was discussion of the potential for the construction of additional basins. There are several areas in the City of Canton which have been identified as potentially suitable sites.

Figure 4.5 - Existing Retention Basins

There are two caveats placed on this recommendation. First, this recommendation should be prioritized below other smaller, more localized solutions. This is because funding for the construction of new detention bases may be hard to find, and in the meantime smaller recommendations could be implemented which collectively may make such an impact that the detention basins would no longer be needed. Secondly, the construction of additional retention basins should not be undertaken until the

aforementioned Hydrologic and Hydraulic Modeling Update is completed. The completion of the Hydrologic and Hydraulic Modeling Update will allow for the most effective and efficient placement and sizing of any future detention structures.

The modeling undertaken as part of that effort would provide information about where the best locations to site new basins would be, as well as data to help with the sizing of new basins and regulating their outflows after high water events.

4.6 Summary of Flood Risk Management Recommendations

The following is a summary of Flood Risk Management recommendations made for the Nimishillen Creek Watershed:

- Hydrologic and Hydraulic Modeling Update
- Installation of New Rain/Stream Gages
- Installation of a FWS
- Development of a FWEEP
- Address Undersized Bridges and Culverts
- Construction of Additional Floodwater Detention Basins

As previously stated, the first step towards addressing flooding issues in the watershed should be the development of a Hydrologic and Hydraulic Modeling Update. This would lay the groundwork for future actions. However, it may be the first step in the Hydrologic and Hydraulic Modeling Update is the installation of additional rain and/or stream gages for data collection purposes. The recommendations for a Hydrologic and Hydraulic Modeling Update and for the installation of additional rain/stream gages could be seen as interchangeable. The installation of new rain/stream gages will lay the groundwork for the FWS, which will in turn lay the groundwork for the FWEEP. The construction of additional detention basins should only be considered after the other measures have been exhausted and flooding continues to be an issue. Addressing the undersized bridges and culverts in the watershed can be done concurrently with the other recommendations, with the exception of the Hydrologic and Hydraulic Modeling Update. The Hydrologic and Hydraulic Modeling Update would help to accurately forecast flows and therefore determine the priority and sizing requirements for new bridges, culverts, and detention basins.

5.0 Water Quality

During the stakeholder involvement process, water quality was frequently mentioned as being an issue in the watershed. The following sections describe pertinent laws and regulations and monitoring protocol regarding water quality; specific water quality issues raised by stakeholders; future conditions for water quality in the watershed; potential water quality solutions; and a summary of the water quality recommendations.

5.1 Ohio EPA, the Clean Water Act and Total Maximum Daily Loads

5.1.1 Section 303(d) Total Maximum Daily Loads

US waters are threatened by different sources and types of pollution. Under the Clean Water Act (CWA), every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the goal of "swimmable/fishable" waters. Water quality standards are ambient standards as opposed to discharge-type standards. These ambient standards, through a process of back calculation procedures known as total maximum daily loads (TMDLs) or waste-load allocations form the basis of water quality based permit limitations that regulate the discharge of pollutants into the waters under the National Pollutant Discharge Elimination System (NPDES) permit program.

Ohio's water quality standards, set forth in Chapter 372-1 of the Ohio Administrative Code (OAC), include four major components: beneficial use designations, narrative "free froms,"[12] numeric criteria, and anti-degradation provisions.

Streams not meeting state water quality standards are placed on the EPA's 303(d) Impaired Waters List. Of the 188 miles of stream in the Nimishillen Creek Watershed, 175.22 miles are listed on the EPA's 303(d)[13] list of impaired streams. The Ohio EPA's "Total Maximum Daily Loads for the Nimishillen Creek Watershed" lists organic enrichment, nutrients, flow alterations, metals and pathogens as the primary causes of impairment. It lists major sources of impairment as municipal and industrial point sources, septic tanks and crop production. Other potential sources are described below:

[12] Narrative "free froms," located in rule 3745-1-04 of the Ohio Administrative Code, are general water quality criteria that apply to all surface waters. These criteria state that all waters shall be free from sludge; floating debris; oil and scum; color- and odor-producing materials; substances that are harmful to human, animal, or aquatic life; and nutrients in concentrations that may cause algal blooms.
[13] 2009 listing

- Organic enrichment/low dissolved oxygen — usually resulting from human activities that introduce large quantities of biodegradable organic materials into surface waters.
- Nutrients — resulting from fertilizer application, livestock waste, atmospheric deposition and various point sources.
- Flow alterations — primarily from the introduction of manmade structures such as dams, bridge supports/abutments, and agricultural stream crossings.
- Metals — primarily from industrial processes and mining operations.
- Pathogens — primarily from human and animals wastes, including runoff from agricultural land and feedlots, seepage or discharge from septic tanks, sewage treatment facilities and natural soil and plant bacteria.

5.1.2 Section 402 - National Pollutant Discharge Elimination System (NPDES)

Storm water discharges are generated by runoff from land and impervious areas such as paved streets, parking lots, and building rooftops during rainfall and snow events. Storm water often contains pollutants in quantities that could adversely affect water quality. Most storm water discharges are considered point sources and require coverage by a NPDES permit under Section 402 of the CWA. In Ohio, the NPDES permit program is implemented by the Ohio Environmental Protection Agency (OEPA).

The primary method to control storm water discharges is through the use of best management practices (BMPs). BMP is a term used to describe a type of water pollution control. Storm water BMPs are techniques, measures or structural controls used to manage the amount and improve the quality of the water runoff. The goal is to prevent these pollutants from entering the waterways because once the characteristics of the waterway has been altered it is more expensive and difficult to restore. Effective management of storm water runoff provides a multitude of benefits including: flood control, public health benefits, protection of water resources including streams and wetlands, and overall water quality improvement[14].

5.1.3 Section 404 – Discharge of Dredged and/or Fill Material

The Corps of Engineers is directed by Congress under Section 404 of the CWA to regulate the discharge of dredged and fill material into all waters of the United States, including wetlands. The intent of the law is to protect the nation's waters from the indiscriminate discharge of material capable of causing pollution and to restore and maintain their chemical, physical and biological integrity. State Water Quality Certification (administered by the OEPA) under Section 401 of the CWA is also required in association with the federal permit. Therefore, the discharge of dredged and fill

[14] Source: Ohio EPA Storm Water Program

material requires a permit from the Corps of Engineers and the State Water Quality Agency.

Applicants often must provide compensatory mitigation to offset unavoidable impacts due to the discharge of fill material into waters of the United States in order to obtain a permit. Compensatory mitigation in the form of Mitigation Banking, In-lieu Fee mitigation, or Permittee responsible mitigation are forms of compensatory mitigation. Both Bank and ILF Sponsors must follow a defined process that is established by the 2008 Federal Rule on Compensatory Mitigation (33 CFR 332) to obtain an approved Instrument (procedural agreement).

5.2 Specific Water Quality Issues Identified by Stakeholders

Several specific water quality issues were raised by the technical group during stakeholder engagement. They are discussed in detail below.

5.2.1 Loss of Aquatic Habitat/Riparian Zone/Water Quality Issues

Canton and Stark County developed into an important agricultural and industrial center due to the American Civil War. Canton, along with Akron, emerged as the leading agricultural implement manufacturers in northeastern Ohio in the years leading up to and following the Civil War. During the twentieth century, many Canton businesses continued to be iron and steel manufacturers, but other businesses also emerged. Following World War II, Canton experienced some difficult times as these various industries declined in importance to the American economy.

Stark County remains heavily rural, with urban areas comprising just five percent of the county's land mass. With 1,300 farms existing in the county, many residents find employment in agriculture, but manufacturing establishments, sales positions, and service industries are the county's largest employers.

Stream and habitat modification as a result of urbanization, agricultural ditching practices, and channelization in areas of the watershed have contributed to several waterbodies in the Nimishillen watershed being designated as Limited Resource Water (LRW), and significant portions of the watershed being classified as Modified Warmwater Habitat (MWH). Since the late 1800s, ditching practices have been common in the upper portions of the Middle Branch and also in portions of the West Branch for purposes of improving agricultural drainage. Channelization efforts and ditching to an extent within the watershed have been performed to direct and convey water, consequently impacting habitat quality in many instances. **Table 5.1** below taken from the *2012 Draft, Nimishillen Creek Watershed – State Action Plan* lists the aquatic life use designations for surface waters within the watershed as listed in the OAC, Chapter 3745-1-24.

Table 5.1 - Aquatic Life Use Designations for Nimishillen Creek Watershed

Nimishillen Creek Segment	WWH	MWH	LRW	Comments
Nimishillen Creek Mainstem - all segments	X			
Hurford Run: Headwaters to River Mile (RM) 1.71 (Domer Ditch)			X	Small Drainage Way Maintenance
Hurford Run: RM 1.71 (Domer Ditch) to RM 0.8 (Harrison Ave.)		X		Channel Modifications
Hurford Run: RM 0.8 to mouth	X			
Hurford Run: Domer Ditch	X			
Sherrick Run: Headwaters to RM 5.2 (Osnaburg Ditch)			X	Small Drainage Way Maintenance
Sherrick Run: RM 5.2 to Mouth	X			
Sherrick Run: Osnaburg Ditch		X		Channel Modifications
West Branch: McDowell Ditch: Headwaters to RM 2.3 (Zimber Ditch)		X		Channel Modifications
West Branch: McDowell Ditch: RM 2.3 to Mouth		X		Channel Modifications
West Branch: Zimber Ditch: Headwaters to RM 1.2 (Rettig Ditch)	X			
West Branch: Zimber Ditch: RM 1.2 to Mouth		X		Channel Modifications
West Branch: Hoover Ditch			X	Small Drainage Way Maintenance
West Branch: All Other Segments	X			
Middle Branch: Swartz Ditch		X		Channel Modifications
Middle Branch: Guiley Ditch		X		Channel Modifications
Middle Branch: All Other Segments	X			
East Branch: All Segments	X			

RM = River Mile; WWH = Warmwater Habitat; MWH = Modified Warmwater Habitat; LRW = Limited Resource Water
Source: Ohio Administrative Code, Chapter 3745-1-24

The OEPA Total Maximum Daily Loads (TMDLs) Report 2009 cites nutrients, metals, sediment, organic enrichment, flow alteration, and thermal modifications as the primary causes of water quality impairment within the watershed. Principal sources of pollutants include; municipal and industrial point sources, agriculture and crop production, septic tanks, and stormwater runoff in developed areas. Stream surveys conducted revealed impairments for biological communities as well as elevated levels of

phosphorus, nitrates, and bacteria. As a result TMDLs were developed for phosphorus, habitat, and bacteria. The TMDL for habitat has a focus on sediment control.

The *2012 Draft, Nimishillen Creek Watershed – State Action Plan* produced by the Northeast Ohio Four County Regional Planning and Development Organization (NEFCO) and the *2009 TMDLs Report for the Nimishillen Creek Watershed* published by OEPA contain further detailed assessment information for waterbodies within the watershed. Stream surveys utilizing the three biocriteria methodologies used by OEPA to evaluate waterbodies and QHEI methodology were conducted throughout the entire watershed in 2003, 2004, and 2005. These surveys served as the primary baseline data for the 2009 TMDLs Report. Biological criteria scores for all three methodologies were calculated at 33 sampling points throughout the six assessment units within the watershed. The vast majority of segments, over 90%, were classified as WWH waterbodies. The attainment status for sampling points within each assessment unit varied considerably. The chart in **Figure 5.1** below depicts an overview of the aquatic life attainment status for 32 of the 33 sites sampled. Over 50% of the sites sampled were in nonattainment and only 12.5% of the sites samples were in full attainment. One site sampled was classified as a LRW and biological criteria scores were not calculated but the condition was notated as “very poor” for that location.

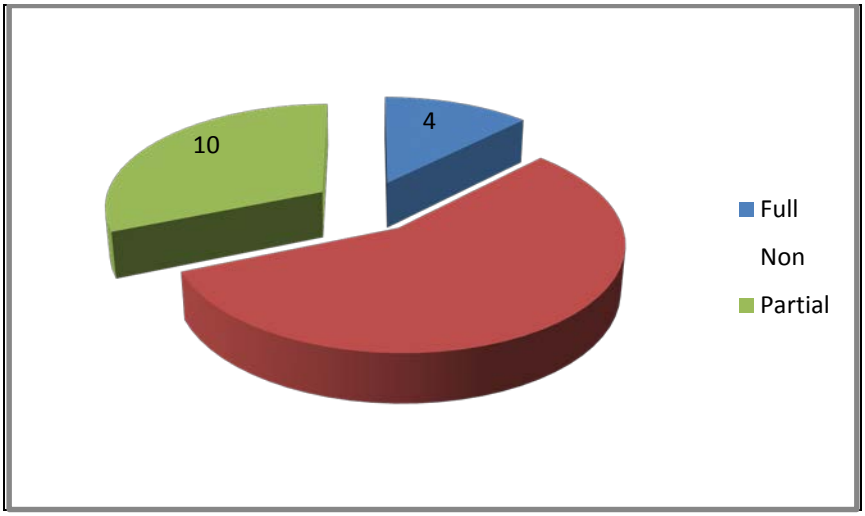

Figure 5.2 - Breakdown of Attainment Status for Aquatic Life Use Designation for Waterbodies Sampled within the Nimishillen Creek Watershed from 2009 OEPA TMDLs Report

Table 5.2 below (taken from the 2012 Draft NEFCO Report) provides a more detailed synopsis of the 33 sites sampled throughout the six assessment units within the watershed. The table contains biological criteria scores for all three methodologies.

Table 5.2 - Biological Criteria Scores from Nimishillen Creek Watershed

Creek Segment (HUC Number)	Location - (Lower/Upper River Mile)	Use Designation	Attainment Status	Biological Criteria Scores		
				IBI	Mlwb	ICI
Nimishillen Creek Mainstem (05040001 05 05 & 05040001 05 06)	Farber Rd. - (2.7)	WWH	Partial	34*	6.5*	34
	Howenstien Rd. – (6.7/6.7)	WWH	Non	32*	5.4*	38
	Faircrest Rd. - (9.2/9.6)	WWH	Non	31*	6.5*	26*
	Upstream of Canton WWTP – (9.9)	WWH	Non	32*	6.9*	--
	Upstream of Sherrick Run - (11.1)	WWH	Partial	30*	6.1*	38
	Eighth St. - (14.2/14.3)	WWH	Partial	40	7.1*	38
Sherrick Run (05040001 05 05)	Allen Ave. - (0.1)	WWH	Non	34*	--	Poor*
Hurford Run (05040001 05 05)	At Mouth - (0.1)	WWH	Non	24*	--	Poor*
	Downstream Ashland Oil - (1.8)	LRW	--	Very Poor*	--	--
West Branch (05040001 05 03)	Market St. - (0.1)	WWH	Non	36	5.8*	Fair*
	Upstream Gregory Galvanizing - (0.4/0.3)	WWH	Non	31*	6.7*	Fair*
	Downstream Fulton Rd. - (3.2)	WWH	Non	22*	5.1*	--
	Upstream Fulton Rd. - (3.5/3.4)	WWH	Partial	32*	6.6*	40
	Upstream McDowell Ditch - (4.6/4.7)	WWH	Non	28*	--	Fair*
	Applegrove St. - (9.3/9.0)	WWH	Non	26*	--	Fair*
	Mr. Pleasant St. - (10.5/10.4)	WWH	Partial	40	--	Fair*
McDowell Ditch (05040001 05 03)	Everhard Rd. - (1.9/1.8)	MWH	Full	24	--	High
Zimber Ditch (05040001 05 03)	Applegrove St. – (2.4)	WWH	Partial	40	--	Low

Table 5.2 (Continued) - Biological Criteria Scores from Nimishillen Creek Watershed

Creek Segment (HUC Number)	Location - (Lower/Upper River Mile)	Use Designation	Attainment Status	Biological Criteria Scores		
				IBI	MIwb	ICI
Middle Branch (05040001 05 01 & 05040001 05 04)	12th Street - (0.1/0.2)	WWH	Non	32*	6.7*	Fair*
	Martindale Park - (2.7/2.6)	WWH	Full	36	8.0	34
	Easton St. - (6.8)	WWH	Partial	30*	6.3*	38
	State St. - (10.4)	WWH	Non	28*	5.6*	42
	Immel Ave. - (11.4)	WWH	Full	40	--	--
	State Route 44 - (13.6)	WWH	Non	24*	--	Poor*
Swartz Ditch (05040001 05 01)	Tyro St. - (0.2)	MWH	Full	24	--	40
	Nimishillen Church Rd. - (1.2)	MWH	Partial	26	--	Poor*
East Branch (05040001 05 02)	Cook Park - (0.1)	WWH	Non	34*	6.2*	Fair*
	Harmont Ave. - (1.9)	WWH	Partial	30*	5.9*	40
	Beck Rd. - (4.2)	WWH	Non	28*	5.2*	44
	Upstream Louisville WWTP - (5.9)	WWH	Non	26*	4.8*	48
	State Route 153 - (6.4)	WWH	Non	22*	--	38
	Meese Rd. - (8.6)	WWH	Partial	28*	--	50
Tributary to East Branch (05040001 05 02)	State Route 44 - (0.3)	WWH	Non	28*	--	Fair*

* Indicates significant departure for applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).
Underlined scores are in the Poor or Very Poor range.
Source: Nimishillen Creek TMDL, Ohio EPA, 2009.

Despite the large amount of point source discharges, nonpoint source pollution poses a more daunting and challenging threat to water quality in the watershed and thus also threatens to degrade the aquatic habitat. Major nonpoint sources include failing home sewage treatment systems, agricultural and land use practices, construction practices, resource extraction and production, and runoff from impervious areas. Large sectors of the watershed are developed and contain significant amounts of impervious surfaces including roadways, parking areas, sidewalks, and rooftops. Large quantities of impervious surface have the potential to negatively impact groundwater recharge processes, limiting the amount of water for infiltration. While undeveloped areas and areas of limited development within the watershed do not contain high percentages of impervious surfaces, they are not without nonpoint source issues. Additionally, areas of limited development within the watershed often coincide with agricultural land use. Fallow fields during non-growing seasons without cover crops exacerbate levels of

sediment and nutrients in runoff. Agricultural areas are also potential sources of nutrient loading from fertilizer application, which contains nitrogen, phosphorus, and potassium. Other potential pollutants from agricultural practices include pesticides, herbicides, and wastes from livestock. Resource exploration and extraction (oil and gas) activities also have potential to contribute to nonpoint pollution. Earthwork to create access roads, well pads, and conveyance lines often leads to increases in sediment in runoff and erosion. The linear nature of such projects oftentimes requires streams to be crossed for access and conveyance lines, increasing impact potential to waterbodies.

5.2.2 Failing Home Sewage Treatment Systems (HSTS)

As reported in the Nimishillen Creek Action Plan, over 50% of the watershed is not served by municipal sewer collection and treatment. The vast majority of the watershed that is not served is in rural or undeveloped areas. These areas have a high incidence of failing or inadequate sewage treatment systems that negatively impact groundwater and surface water. These home systems are normally septic tanks with leach fields or aeration/digestion systems. In time, these individual systems without adequate maintenance can fail to adequately filter effluent materials leading to a non-point source of largely untreated sewage entering streams and groundwater.

There are no regulations for a schedule of inspections for these HSTSs. They typically are inspected when a home is built and whenever they are sold. However, if a home remains in a single owners hands for twenty or thirty years, the HSTS can go the same amount of time with no inspection. If the HSTS is not working properly, it can be leaching pathogens (including bacteria, parasites and viruses) into groundwater and nearby streams for long periods of time without notice. These pathogens can not only harm the aquatic habitat of species living in the water, but also impact terrestrial species which depend on the stream for a source of water. Additionally, humans which come into contact with contaminated surface water may also become ill, exhibiting symptoms such as diarrhea, fever, gastritis and vomiting.

5.2.3 Inundated Manholes During High Water Events

During some high water events, there have been reports of sewer manholes being inundated. When this occurs, untreated sewage can be released from the sewer system to mix with stormwater or out-of-bank flood waters. Once escaping from the sewer system, this mixture of stormwater with its inherent contamination and untreated sewage flow into area streams, negatively impacting water quality.

5.2.4 Agriculture and Water Quality Issues

The USEPA stated, “Agriculture has a greater impact on stream and river contamination than any other nonpoint source.” Inappropriate cultivation techniques and improper grazing practices along riparian areas contribute to water quality issues such as increased sedimentation and all of the causes of impairments listed above. Cultivation practices that extend tilling to the edge of the stream channel virtually eliminate the riparian zone and remove any opportunities for filtering eroded soil, herbicides or pesticides that may be applied to crops or silage. These “non-point” pollution sources on a watershed scale can affect miles of downstream aquatic habitat and water quality.

Animals have grazed along and around bodies of water for thousands of years; however, the original grazing animals were roamers such as bison, moose, and deer. Their intermittent use allowed riparian areas to re-grow following grazing periods. Today, however, the majority of grazers are domestic livestock (such as horses, cows, and sheep), which graze continually in the same area. Livestock tend to congregate along streams, where temperatures are cooler and lush riparian vegetation grows — trampling the stream bank and overgrazing the surrounding vegetation. This continual-use pattern leaves no period of renewal and re-growth for the riparian areas. Further, livestock tend to stand in cool streams and ponds during hot weather, thus adding nutrients and pathogens to the water through feces and urine.

5.3 Future Conditions with Regard to Water Quality

Without future intervention, water quality and habitat will continue to degrade within the watershed. As with flooding issues, urban growth and development in the watershed will continue to be a driving factor associated with loss of habitat. As development encroaches on the floodplain there could be continued loss of the riparian zone habitat. Alternatives to stream channel modifications should incorporate natural stream channel design. Failing HSTSs, gone unchecked, will continue to leach pollutants into groundwater and nearby surface waters. Likewise, sanitary sewer manholes which are inundated during high water events will also continue to release pollutants into nearby surface waters. Finally, (as with flooding issues) with no change in land management practices in the northern agricultural area of the watershed, water quality will continue to be adversely affected by pollution sources such as (but not limited to): increased sedimentation, organic enrichment, nutrients, metals and flow alterations.

5.4 Potential Water Quality Solutions

5.4.1 Addressing Sewage Treatment in the Watershed

There are two potential ways to address water quality issues stemming from substandard sewage treatment in the watershed. A potential short term solution would be to ensure adherence with the HSTS Plan prepared by the Stark County Health

Department in conjunction with NEFCO. A long term solution would be to establish sanitary sewer systems in currently unsewered areas or extend collection lines into these areas. Both are discussed in subsequent sections.

5.4.1.1. (Short Term) NEFCO Home Sewage Treatment System (HSTS) Plan

The Stark County Health Department, in conjunction with NEFCO has prepared a HSTS Plan as part of the (updated) September 2011 Nimishillen Creek Watershed Action Plan in order to facilitate the correction of failing HSTS in the watershed. The HSTS Plan: "Identified target areas of impairment caused by failing HSTSs, outlines current and long-term inspection and monitoring programs and goals; and offers a comprehensive educational and outreach program[15]."

The HSTS Plan focused on decreasing water quality impacts associated with failing HSTSs, as well as set up a long term O&M plan to serve the county (and therefore much of the watershed) in the long term. It should be noted there are some areas of the watershed to which it would be difficult to extend sewer service. Utilization of this HSTS Plan over the long run would effectively help to manage water quality impacts in areas which may never receive sanitary sewer service.

5.4.1.2 (Long Term) Establishment of Sanitary Sewers in Unsewered Areas

Providing extension of sanitary sewer service to previously unsewered areas would help alleviate water quality issues caused by leaking and malfunctioning septic systems. Once a sanitary sewer service is made available, it may be necessary to utilize ordinances establishing mandatory sewer connection requirements and sewer service changes to ensure residents and businesses are utilizing the new system, which will in turn, lend to improved water quality within the watershed.

Again, it should be noted that there may be areas in which (due to cost of installation versus the number of customers served) it may not be practical to extend sanitary sewer. In those cases, the HSTS Plan described above, should continue to be followed indefinitely. It may be necessary to develop a schedule for regular inspections of HSTSs which are forecasted to be in operation for the foreseeable future, or life of the structure to which it is attached.

5.4.2 Addressing Inundated Manholes

The first step in addressing inundated manholes would be to map all of the existing manholes in the watershed that are shown to be located in potential inundation zones (either by out-of-bank flooding or stormwater). The second step would consist of either

[15] Source: Draft Update – September 2011 Nimishillen Creek Watershed – State Action Plan. Full text available at: http://nefcoplanning.org/nim_creek_wap.html

installing locking lids on the manholes to prevent them from overflowing during high water events or raising the top of the manhole structure above flood elevations. Locking manhole covers are available commercially from a wide range of distributers.

It should be noted maps of existing manholes must be updated whenever new manholes are installed. It should also be codified that all new manholes have locking, waterproof covers.

5.4.3 Improvements to Local Land Use Zoning

To address water quality impairments stemming from land development practices, the communities and local governments in the watershed should establish more effective land-use zoning ordinances. These land use control practices could take the form of identifying and protecting green space along stream corridors, to promote a healthy riparian corridor for filtering pollutants and to stabilize stream flow and habitat. Some existing stream corridor investigations completed by NEFCO and Stark County Parks could form the basis for ordinance modifications. These green corridors potentially could (1) lessen stream-bank erosion and downstream water quality impairments and (2) protect the floodplain from unnecessary encroachment, reducing flooding issues for the community.

It is recognized that zoning for specific types of development can be a difficult and contentious process. This is a recommendation which may take years to implement, slowly rezoning as current land use changes over time. Focus should be placed on the northern part of the watershed, which has been trending more toward urbanized development. Properly zoning these new areas of development could decrease impacts associated with non-point source sedimentation and runoff.

5.4.4 Preserving/Restoration of Riparian/Wetland Areas

Wetlands and riparian areas typically occur as natural buffers between uplands and adjacent water bodies. They act as natural filters of nonpoint source pollutants, including sediment, nutrients, pathogens, and metals, to waterbodies, such as rivers, streams, lakes, and coastal waters. It is important to preserve and restore damage to wetlands and riparian areas because these areas can play a significant role in managing adverse water quality impacts. Often, these natural buffers are damaged or destroyed by agricultural practices that promote soil tilling to the stream channel edges. Maintaining or restoring the riparian buffer and associated wetlands can greatly help water quality.

5.4.5 Education on Land Management Practices

Educating the public on water quality threats associated with urban development and agricultural practices could go a long way towards enlisting residents, business owners and farmers' help to improve water quality. This information can be developed at a local level and made available through a wide variety of venues, such as chambers of commerce, county fairs, 4-H clubs, and local feed stores. Existing programs offered through USDA (see **Section 10.2** below) can be presented to the agricultural community through local conservation offices. More urban users could be reached via school programs, and by the creation of local environmental and/or watershed groups.

5.4.6 Bioretention Options

An effective method of reducing the introduction of pollutants and sedimentation into area streams is to capture those contaminants on individual building sites or within community scale bioretention facilities. These small-scale retention options can effectively remove pollutants from surface flow or drainage ditches by increasing the retention time of the runoff where sediments and contaminants can be sequestered and either removed to safe disposal areas or absorbed through phytoremediation[16] techniques. See **Chapter 6** of this document for a more detailed description of bioretention methods.

5.5 Summary of Water Quality Recommendations

The following is a summary of Water Quality recommendations made for the Nimishillen Creek Watershed:

- Address Sewage Treatment in the Watershed
- Address Inundated Manholes
- Improvements to Local Land Use Zoning
- Preservation/Restoration of Riparian/Wetland Areas
- Education on Land Use Management Practices
- Bioretention

The first steps to addressing water quality issues in the watershed should be addressing sewage treatment needs and inundated manholes. Ensuring that HSTSs are working properly and not leaching contaminants into area waterbodies, as well as making sure that raw sewage is not being released from manholes during high water events would be two of the most effective ways of positively impacting water quality.

[16] Phytoremediation refers to the planting of certain plant species in bioretention areas or on brownfields that are highly effective in absorbing certain contaminants from retained water and sediments.

6.0 Stormwater Management

Stormwater management issues were frequently discussed by the local stakeholders with the knowledge that there is a correlation between urban growth in the watershed and the frequency and intensity of flooding. Increased urban expansion means the placement of impervious surfaces. An impervious surface is anything rain cannot penetrate. Impervious surfaces range from rooftops and driveways, to parking lots, streets and buildings. As stormwater runs across these surfaces it is impacted in two ways. First, the quantity of the water is increased as there is nowhere for the water to infiltrate into the ground. Then the surface flow is concentrated to a few locations due to surface grading and the water picks up numerous pollutants (from contact with roads [vehicle and/or road maintenance residues] and structures). These pollutants negatively impact the water quality of the receiving stream.

6.1 Stormwater and Urban Flooding

Under natural conditions, absent developed land and impervious surfaces, the amount of runoff is less than 10% of the volume of rainfall from a vegetated site. Of the remaining rainfall approximately 50% seeps into the ground and 40% is evaporated[17]. In altered conditions, such as those found in urban areas, approximately 55% of the volume of rainfall flows quickly across impervious surfaces and is directed through storm sewers into nearby waterways. (See **Figure 6.1** below.) This can be costly to downstream communities, which must deal with the increased volume and velocity of floodwaters.

[17] U.S. Environmental Protection Agency: Nonpoint Source Control Branch (2003). "Protecting Water Quality from Urban Runoff," EPA 841-F-03-003

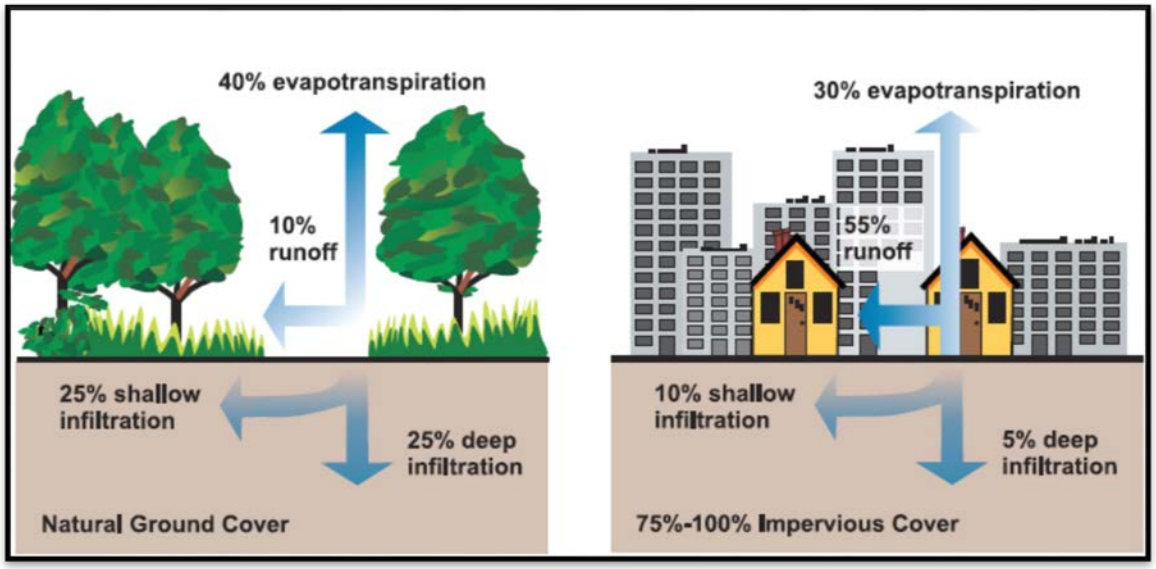

Figure 6.1 - Illustrations of Runoff on Natural Ground Cover vs. Impervious Cover[18]

Additional runoff increases flow velocity in stream channels and may erode streambanks and increase sedimentation, which in turn decreases the area of conveyance available in a waterway. Repeated bankfull flow conditions normally result in high rates of channel erosion and destabilization of the channel course. Given the increased rate of urbanization and resulting runoff, stormwater is considered a major cause of urban flooding. It tends to be repetitive and costly, perpetuating a cycle of damage and repair to buildings and infrastructure. The repetitive nature of flooding caused by stormwater can harm local real estate markets, especially when structures with basements are repeatedly subjected to flooding.

6.2 Stormwater and Water Quality

As previously discussed, as excess runoff flows across impervious surfaces it picks up many pollutants, including fertilizers, bacteria, pathogens, animal waste, metals, vehicle fluids and oils. **Table 6.1** below shows some of the pollutants found in urban stormwater and their sources. These pollutants eventually end up in nearby streams, negatively impacting water quality in the watershed.

[18] Source: EPA

Table 6.1 - Pollutants in Urban Runoff[19]

Pollutant	Source
Bacteria	Pet waste, wastewater, collection systems
Metals	Automobiles, roof shingles
Nitrogen and Phosphorus	Lawns, gardens, atmospheric deposition
Oil and grease	Automobiles
Oxygen depleted substances	Organic matter, trash
Sediment	Construction sites, roadways
Toxic chemicals	Automobiles, industrial facilities
Trash and debris	Multiple sources

Since 1987, stormwater discharges have been regulated through individual states, via permitting authorities, and also through the NPDES program under the CWA. Under these regulations, most storm water discharges are labeled as point sources and require a NPDES permit. However, the usual treatment used for most point source discharges is not sufficient to treat the pollutants found in stormwater runoff, resulting in the discharge of pollutants into receiving streams.

Many NPDES permits require communities to enact a storm water management plan and to use Best Management Practices (BMPs) to keep pollutants from entering streams. Some of these BMPs include construction site runoff controls, post-construction storm water controls, educational outreach and a variety of pollution prevention programs.

6.3 Managing Stormwater

Managing stormwater, both in quality and quantity, demands challenging decision making as community leaders balance the need for economic growth and expansion against the need to protect existing buildings, infrastructure and the natural environment. Traditionally, stormwater management has focused on the engineering of collection and conveyance systems. This approach focuses on moving the water away from what it might damage as quickly as possible, with no concern for damage the water might cause to the receiving stream or those living downstream. Controlling stormwater runoff onsite has been proven to reduce expensive downstream infrastructure costs, which are shared by all members of the community. However, developers tend to resist using valuable urban land to capture and store excess runoff. Stormwater management facilities and stormwater mitigation were not typically part of urban planning during the rise of urbanization in the nation. It has only been with a growing awareness of the environmental impacts to urban waterways and repeated

[19] Source: U.S. Environmental Protection Agency, Protecting Water Quality from Urban Runoff, Nonpoint Source Control Branch, EPA841-F-03-003, February 2003; and U.S. EPA, Report to Congress: Impacts and Control of CSOs and SSOs, Office of Water, EPA-833-R-04-001, August 2004.

damages due to out-of-bank flooding that officials have realized the need for comprehensive stormwater management and mitigation.

With this realization, many cities and communities are looking toward watershed-based planning, which utilizes a mix of remedial and preventative measures. Remedial measures may consist of floodproofing[20], building retention/detention basins, buy-outs of repetitive-loss structures, restoring floodplains, or enacting flood warning and evacuation plans. Preventative measures are more aimed toward preserving undeveloped floodplains by restrictive ordinances and regulation, as well as returning previously encroached upon floodplain to its natural condition.

6.4 Future Conditions with Regard to Stormwater Management

Without future intervention, stormwater within the Nimishillen Creek Watershed will likely continue to contribute to flooding issues. The runoff generated by precipitation events will likely increase with the amount of development and impervious surfaces places. This runoff, as explained above, will continue to negatively impact water quality and aquatic habitat. Additionally, without future intervention, stormwater management within the watershed will continue to be disjointed and inconsistent as each municipality enforces separate ordinances.

6.5 Potential Stormwater Management Solutions

6.5.1 Establish Consistency in Stormwater Management Regulations

Stormwater management, in most cases, is a task undertaken at the city or municipality level. In municipalities where there are no appropriate zoning ordinances in place, there may be little or no ongoing stormwater regulation. Uniformity in stormwater management regulations between municipalities promotes consistent management and protection of local waterways and creates a “community of practice” between stormwater management regulators within the watershed. It also creates an atmosphere for more strict enforcement when it comes to future development. Decision makers in the watershed need to move towards consistent stormwater management regulations across all of the municipalities.

Though management uniformity may be the ultimate goal, it is important to understand every city and municipality is unique. Therefore, stormwater management regulations need to take into account the variability between the communities involved, while attempting to integrate individual actions in the watershed as a whole. Section 3, “Stormwater Management Principles, Goals and a Management Model,” of the

[20] FEMA defines floodproofing as “Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.”

Pennsylvania Stormwater Best Management Practices Manual prescribes regulations which are effective, equitable and flexible. Effective regulations set forth guidelines which are achievable on a site by site and watershed-level basis. Equitable regulations are those which are enforced in essentially the same way for all users. Allowing for flexibility in the stormwater management regulations acknowledges the diversity between communities within the watershed, as well as the differences in types of land development.

6.5.2 Connect Hydrologic Network of Streams & Adjoining Floodplains

Water related networks can take many forms, including the hydrologic networks of surface and groundwater movement within a floodplain as well as institutional networks that emphasize research and data collection for publication and water-related educational networks that provide information and training to residents and professionals on the attributes of floodplain restoration. Institutional networks such as the University of Akron, the Northeast Ohio Four County Regional Planning and Development Organization (NEFCO) and educational networks like the McKinley Museum in downtown Canton, Ohio have been conducting research activities within the Nimishillen Creek watershed (primarily data collection and mapping) and much of that research has been provided for public use on the Internet (www.nefcoplanning.org) and other educational programs at the museum. Publication of these research results and free forums at the museum has brought the issues of the watershed to the public's attention and has supported various initiatives to address those public concerns.

Among the water-related networks currently operating at varying levels in the watershed, the hydrologic reconnection of stream channels to their adjoining floodplains has been started in the watershed by a well-supported county agency. Stark Parks has been working to implement its Stark County Trail & Greenway Plan since 1998. This comprehensive plan targets sensitive ecosystems found along stream corridors and potential greenways. Through voluntary acquisition of properties in the floodway and floodplain, the plan is attaining its goals of improving water quality, reconnection of the surface and groundwater hydrologic system between streams and their floodplains, reducing flood damages and providing recreational corridors that benefit Stark County residents. Removal of encroaching structures, impervious pavements, subsurface impediments to groundwater flow and some floodplain fills allows natural restoration of these physical systems. To date Stark Parks has acquired 7 properties (6 residential and 1 commercial) which have been set aside in accordance with the aforementioned Greenway Plan.

Stark Parks has utilized a number of funding sources for this purpose, including Clean Ohio Funds, Hazard Mitigation funds from FEMA and OEMA, and local funds for

wetland and stream mitigation programs. Specifically, Stark Parks has partnered with the City of North Canton, MWCD and the Stark County Commissioners to secure $1.5M million grant from FEMA in Hazard Mitigation Grant Program (HMGP) funding for the purchase and demolition of 10 residential structures along the Zimber Ditch. As of the date of this report, Stark Parks has received the first $750,000 of these funds to acquire the identified properties. The structures will be demolished and the land restored to natural floodplain (not to be built upon again per HMGP requirements), with the ultimate goals of reconnecting the hydrologic system between the restored floodplain and the stream channel and providing for additional flood storage capacity. At the completion of the first phase of acquisition, the remaining funds will be provided to continue the acquisition program.

The Stark Parks Greenway Plan is a positive step forward and a model program for floodplain restoration in the region. This program is being used by LRH as an example of floodplain restoration during coordination with other Ohio watershed groups involved in Section 729 IWA discussions.

6.5.3 Mitigating Stormwater via Green Infrastructure

Over the past decade there has been an increase in research and development in the field of “green” infrastructure used to help mitigate stormwater damage and reduce impacts to water quality. Green infrastructure (in the sense of stormwater management) refers to application of on site management measures and/or techniques which seek to reduce the overall volume of runoff flowing over impervious surfaces. Essentially, these measures strive to manage the water where it hits the ground, allowing it to infiltrate into the soil, evaporate into the air or be absorbed through evapotranspiration (vegetation). Some examples include porous pavement, green roofs, rain gardens and grassy swales.

Green infrastructure can be implemented on large or small scales. A large scale approach would take into consideration the entire watershed or a sub-watershed and include connecting networks of streams, wetlands and riparian areas with measures such as greenways, riparian corridors, and conservation easements. At this level, planning should address more than just stormwater management, and account for other water resource related issues including (but not limited to) riverine flooding, floodplain management and ecosystem restoration.

On a smaller scale, site-specific approach green infrastructure could consist of activities such as constructing rain gardens, utilizing porous pavement, grassy swales and site and/or roadside plantings. This level of green infrastructure could help with issues such as mitigating the amount of runoff generated by the construction of a new shopping

mall, school or residential buildings. Placing grassy swales landscaped with water-tolerant plant species within parking lot medians and using porous pavement could result in a no net increase in runoff from the new facility without hampering area economic growth. **Table 6.2** below shows some of the benefits of applying various methods of green infrastructure measures and techniques. **Figure 6.2** below shows how several management measures and techniques may be utilized in a given urban space.

Table 6.2 - Benefits of Various Green Infrastructure Practices[21]

Practice	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding
Green Roofs	Y	Y	Y	Y
Tree Planting	Y	Y	Y	Y
Bioretention and Infiltration	Y	Y	Y	Y
Permeable Pavement	Y	Y	Y	Y
Water Harvesting	Y	Y	Y	Y

[21] Source: Center for Neighborhood Technology (CNT) and American Rivers, The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental and Social Benefits (Chicago: CNT, 2011), p3. Available at cnt.org.

Figure 6.2 - Green Infrastructure in a Community[22]

Local officials in the watershed should consider mitigating stormwater runoff with green infrastructure features as a priority in terms of stormwater management. This is because there are so many types, methods and funding sources available (all of which are further discussed in subsequent sections). Features could be installed as opportunities and funding becomes available. Over time, as the number of features increases, larger reductions in stormwater runoff will be evident; this may reduce the need for other stormwater management methods.

What follows is a discussion of several green infrastructure measures available to help mitigate storm water runoff on a small-scale, or site specific, level.

[22] Source: Philadelphia Water Department: Green Stormwater Infrastructure Tools

Porous pavement


Figure 6.3 - Porous Pavement

As the name suggests, porous pavement consists of materials which allow for infiltration of precipitation. This can be used for the construction of roads, paths, parking lots, sidewalks and driveways. Porous pavement comes in a variety of materials including, but not limited to: concrete, asphalt and masonry pavers. Some porous pavements look virtually indistinguishable from traditional pavement, while others have a more distinct appearance (known in the industry as “Grasscrete”, “Grassblock”, or “Turfstone”) as shown in the figure below. Porous pavement can cost two to three times the amount of traditional paving materials; however, the initial installation cost should be weighed against future cost-savings (reduced damages due to stormwater flooding) which could be achieved through its use. The economic and environmental impacts of not addressing stormwater runoff on-site are, at best, not accounted for and at their worst assigned to a third party such as neighboring residents and businesses, city and/or county government and sometimes the nation, if federal emergency funds are made available in the wake of a flood related disaster. Additionally, in a municipality where ordinances require no net stormwater runoff for new construction, the costs of porous pavement installation can be substantially less than installation of a stormwater retention pond or equivalent stormwater management measures.


Figure 6.4 - "Grasscrete"

Rain Gardens


Figure 6.5 - Rain Gardens

A rain garden is a shallow depression planted with native species (typically a selection of wetland edge vegetation). Rain gardens are constructed near a run-off source (roof downspouts) and are used to reduce storm water runoff volumes from individual or multiple sites after rain events. The vegetation in the garden reduces the water volume through transpiration and the garden soils help to reduce the contaminants which are typically found in storm-water through absorption. These two processes help protect water quality of receiving streams, and also improve area aesthetics compared to traditional storm-water infrastructure.

Rain gardens can be utilized on a large or small scale, such as adjacent to a shopping center parking lot, or in any residential back yard. Typically, the cost for a rain garden ranges between $12-$25 per square foot, depending upon the size, complexity and location[23].

Green roofs


Figure 6.6 - Green Roof

Green roofs may also be referred to as "living" roofs. It is simply a vegetative layer grown on a building's roof. Green roofs can be used to decrease the volume of runoff, as they provide for infiltration and evapotranspiration. They are also considered more aesthetically pleasing than typical roof tops. They can be installed on nearly any type of building, from an industrial facility to a private residence.

[23] Source: Applied Ecological Services: Rain Garden Design and Installation

Green roofs can be constructed in two ways. One is an intensive roof, meaning it supports larger and denser vegetation, requiring a considerable depth of planting medium. This type of green roof supports a wide variety of plants including trees and shrubs, but requires a lot of space and extensive maintenance including irrigation. Also, the supporting structure for this roof planting must be more robust to handle the additional weight. The second type is an extensive roof. This type of green roof requires a much shallower planting medium and is lighter, using primarily groundcovers, small shrubs and perennials which can survive dry conditions to transpire rainwater. They require minimal maintenance after establishment. In addition to helping alleviate stormwater issues, they also provide some of the following non-water related benefits:

- reduce the cooling load on a building substantially;
- creates natural habitat in an urban area;
- filters air pollutants; and
- insulates a building against sound.

Costs for the installation of a green roof start at roughly $10 per square foot for extensive roofing and $25 for intensive roofing. Annual maintenance ranges from $.75 - $1.50 per square foot[24]. While this seems expensive at first glance, a green roof often provides enough benefits to offset the initial cost over its lifetime. For example, a University of Michigan study compared the expected costs of conventional roofs with the cost of a 21,000-square-foot (1,950 m^2) green roof and all its benefits, such as stormwater management and improved public health from the absorption of nitrogen oxides. The green roof would cost $464,000 to install versus $335,000 for a conventional roof in 2006 dollars. However, over its lifetime, the green roof would save about $200,000. Nearly two-thirds of these savings would come from reduced energy needs for the building with the green roof.[25]"

[24] Source: EPA Heat Island Effect
[25] Liu, K. and B. Baskaran. 2003. Thermal Performance of Green Roofs through Field Evaluation (PDF) (11 pp, 401K). National Research Council of Canada. Report No. NRCC-46412.

Stormwater Planters


Figure 6.7 - Stormwater Planters

A storm water planter is installed in a sidewalk area and is designed to capture runoff from sidewalks and streets. The excavated trench is lined with a permeable fabric and filled with gravel or stone and finished with soil (separated from the stone by a permeable liner), shrubs, perennials and/or trees. The top of the planter is lower than the sidewalk, allowing for storm water storage during rain events and is separated by a curb with slots for water entry. The vegetation reduces stormwater volume by absorption and transpiration. The planters can greatly reduce the volume and velocity of the water, naturally treat the pollutants collected in the water, and improve the aesthetic appeal of the urban streetscape.

Storm water planters are extremely versatile and may be easier to implement and construct than some of the other green infrastructure techniques discussed. They can be modified for nearly any setting and are optimal for use in spaces where there is no room for features such as a full rain garden. The planters are typically designed to drain within 36 hours for a typical storm (80-90% of annual storms). The initial cost of a planter is typically $8.00 per square foot, however the cost will vary on the location and type of planter. Maintenance costs are typically in the $400-$500 per year range for a 500-square foot planter[26].

Vegetative Swales

A vegetative swale is a broad, shallow channel covered in dense vegetation (consisting of mainly grass species). Generally, they promote infiltration and reduce the flow velocity of storm water runoff. They are also useful for treating pollutants captured in the runoff through use of bioretention design parameters. They can be used to replace curbs, gutters and storm sewer systems.


Figure 6.8 - Vegetative Swales

They are typically designed in a trapezoidal or parabolic shape with gentle side slopes to enable safe mowing and are most effective when treating runoff from areas which are

[26] Source: Green Building Alliance: Stormwater Planters, 2013

five acres or less. The cost of swales varies based on width, depth, side slopes and plant material. However, they are much more cost effective to place than traditional storm sewer pipe systems. Maintenance varies depending upon design. Grassy swales need mowing on a regular basis, but naturalized swales using native grasses and perennials may only need to be mowed once per season. To that end, swales can be designed for minimal O&M, generating considerable cost savings over time. There are other factors to take into consideration before the implementation of this technique. Please see the EPA's Storm Water Technology Fact Sheet: Vegetated Swales located in **Appendix E** of this report for more information.

6.4.4 Bioretention Basins

Bioretention basins can be used to remove contaminants and sedimentation from stormwater runoff. Storm water is collected in the basin, which typically consists of a vegetated buffer strip, sand bed, ponding area and an organic material (such as mulch) layer, as well as additional vegetation. The stormwater runoff flows first through a sand bed, which slows the water's velocity, and then into the ponding area covered with an organic layer. From there the water can evaporate into the air or infiltrate into the ground.

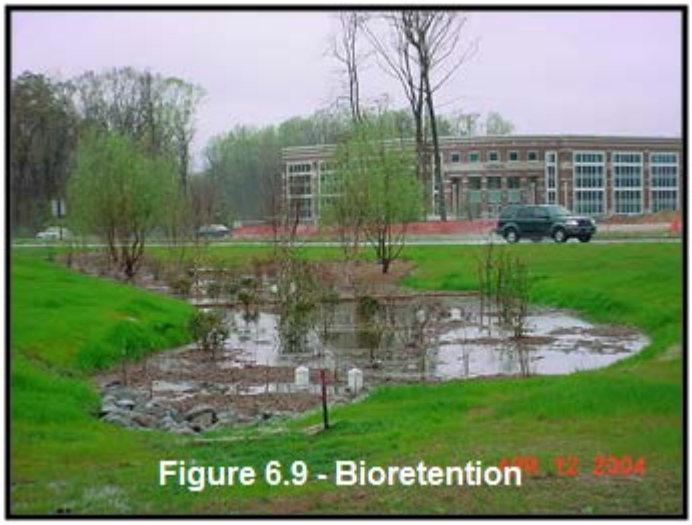

Figure 6.9 - Bioretention

It should be noted that bioretention basins are not appropriate in areas where the water table is within 6 feet of the ground surface. Clogging may also be an issue if the sedimentation in the stormwater is excessive. Overall, bioretention basins provide stormwater treatment which enhances the quality of downstream flows.

Bioretention basin installation requires more upfront site work costs when compared to traditional stormwater management practices. However, these costs can be offset by future, reduced infrastructure costs. "Costs per acre of development range from $5,000 to $10,000 for larger areas and costs per square foot range from $3 to $15 (not including real estate costs).[27]" It is estimated that bioretention basins can result in a 50% savings over traditional management practices in the long run.

[27] "Florida Field Guide to Low Impact Development." University of Florida.

6.5.5 Utilization of the EPA's Stormwater Management Model (SWMM)

To help understand stormwater in the Nimishillen Creek Watershed and help formulate management measures to mitigate for its impacts, it is recommended that stakeholders utilize the EPA's SWMM model[28]. This is a dynamic rainfall-runoff simulation model used for simulation of runoff quantity and quality from primarily urban areas. "SWMM tracks the quantity and quality of runoff, and the flow rate, flow depth, and quality of water in pipes and channels during a simulation period. SWMM is widely used throughout the world for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas, with many applications in non-urban areas as well." Unlike the hydrologic and hydraulic models previously discussed, SWMM can be utilized to analyze complex storm water runoff scenarios, including overland and underground systems, in densely populated urban areas consisting of complex piping networks to determine arrival time and ponding elevations with relative ease. SWMM should be used in conjunction with standard hydrologic and hydraulic modeling approaches.

This tool would be useful in quantifying the benefits associated with the implementation of various green infrastructure techniques described in subsequent sections. The SWMM model(s) as well as the other hydrologic and hydraulic models should be kept in a centralized location, possibly at the same location as the repository of data for the basin, and kept up-to-date by the same entity overseeing the repository. These models are tools for the present watershed assessment and should be utilized for future expansion and development.

6.6 Summary of Stormwater Management Recommendations

The following is a summary of stormwater management recommendations made for the Nimishillen Creek Watershed:

- Establish Consistency in Stormwater Management Regulations
- Connect Water Related Networks
- Provide Stormwater Mitigation via Green Infrastructure
- Utilize the EPA's Stormwater Management Model

Unlike the flood risk management recommendations made previously, all four of these recommendations can move forward concurrently. Establishing consistency in stormwater management regulations will likely be an effort which will take some time, as decision makers from all the municipalities must work together to come up with regulations which work for each of them. In the meantime decision makers, specifically

[28] More information on this tool can be found at: http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/

Stark Parks, should continue to watch for opportunities to purchase land in the floodplain which can be reconnected to the riparian zone. There are numerous opportunities for grant money for the installation of green infrastructure features. In order to expedite the grant application process, it would benefit municipalities interested in applying for such grants to prepare a list of potential sites in their communities which would benefit from such a feature.

7.0 Floodplain Management

The Federal Interagency Floodplain Management Task Force describes floodplain management as “a decision-making process that aims to achieve the wise use of the nation’s floodplains,” including reducing losses from flooding and protecting natural resources and functions of floodplains. Floodplain management can involve combining structural and non-structural measures. Structural measures such as dams, levees, or detention basins change how water flows, while non-structural measures such as establishing building codes, elevating houses, or acquiring structures change how people are impacted by the flooding. FEMA’s desk reference for Floodplain Management Requirements (FEMA 480) specifies four primary strategies of floodplain management and describes potential tools to accomplish those strategies.

Strategy 1: Modify human susceptibility to flood damage and reduce disruption by avoiding hazardous, uneconomic or unwise use of floodplains. Tools include:

- Regulating floodplain use by using zoning codes to steer development away from hazardous areas or natural areas deserving preservation, establishing rules for developing subdivisions, and rigorously following building, health and sanitary codes.
- Establishing development and redevelopment policies on the design and location of public services, utilities and critical facilities.
- Acquiring land in a floodplain in order to preserve open space and permanently relocate buildings or remove buildings and relocate their occupants.
- Elevating or floodproofing new buildings and retrofitting existing ones.
- Preparing people and property for flooding through forecasting, warning systems and emergency plans.
- Restoring and preserving the natural resources and functions of floodplains.

Strategy 2: Modify the impact of flooding and assist individuals and communities to prepare for, respond to, and recover from a flood. Tools include:

- Providing information and education to assist self-help and protection measures.
- Executing flood emergency measures during a flood to protect people and property.
- Reducing the financial impact of flooding through disaster assistance, flood insurance and tax adjustments.
- Preparing post-flood recovery plans and programs to help people impacted by flooding and implement mitigation measures to protect against future floods

Strategy 3: Modify flooding itself by developing projects that reduce flood impacts. Tools include:

- Building dams and reservoirs that store excess water upstream from developed areas.
- Building dikes, levees and floodwalls to keep water away from developed areas.
- Altering channels to make them more efficient, so overbank flooding will be less frequent.
- Diverting high flows around developed areas.
- Treating land to hold as much rain as possible where it falls, so it can infiltrate the soil instead of running off.
- Storing excess runoff with on-site detention measures.
- Protecting inland development with shoreline protection measures that account for the natural movement of shoreline features.
- Controlling runoff from areas under development outside the floodplain.

Strategy 4: Preserve and restore natural resources and renew the vitality and purpose of floodplains by reestablishing and maintaining floodplain environments in their natural state. Tools include:

- Floodplain, wetlands and coastal barrier resources or land use regulations, such as zoning, can be used to steer development away from sensitive or natural areas.
- Development and redevelopment policies on the design and location of public services, utilities and critical facilities.
- Land acquisition; open space preservation; permanent relocation of buildings; restoration of floodplains and wetlands, and preservation of natural functions and habitats.
- Information and education to make people aware of natural floodplain resources and functions and how to protect them.
- Tax adjustments to provide a financial initiative for preserving lands or restoring lands to their natural state.

7.1 Floodplain Management at the Federal Level

The federal government became heavily involved in flood protection after the Great Mississippi River Flood of 1927. The Flood Control Acts of 1928 and 1936 authorized a tremendous amount of structural flood control projects such as dams and levees. By the 1960's studies were finding that damages from flooding and disaster relief costs were increasing in spite of the structural projects, primarily because the flood control projects provided an incentive for people to continue to build structures close to rivers

and coasts. At the same time, natural hazard researchers and experts were beginning to develop the holistic concept of floodplain management.

In 1968 Congress passed the National Flood Insurance Act which made federally backed flood insurance available to homeowners. In addition to flood insurance, the program sought to encourage state and local governments to manage the development of areas at risk of flooding in a way which would minimize damage and create a unified national program for floodplain management. The Flood Disaster Protection Act of 1973 broadened the reach of the insurance program by requiring insurance for any at-risk property under a federally-backed mortgage. This basically meant all homes in a flood hazard area mortgaged by a bank with Federal Deposit Insurance Corporation (FDIC) backing would be required to have flood insurance. FEMA would be responsible for providing flood hazard maps to communities participating in the NFIP program.

The NFIP is the cornerstone of the federal government's involvement in floodplain management. Through it, flood insurance is only available to communities who voluntarily participate in the program. However, in order to participate in the NFIP these communities must enact and enforce floodplain regulations which meet standards developed by FEMA. In this way, the federal government has delegated floodplain management to local communities and has made it a mandatory condition for obtaining federally backed flood insurance. A community can choose not to participate in the NFIP, but citizens will be unable to obtain FDIC-insured mortgages for any structure in a flood hazard area and the community will be ineligible for some grant programs and disaster assistance funding. It should also be noted that communities which do not participate in the NFIP are not eligible to participate in federally cost-shared flood risk management projects.

Although the federal government has delegated floodplain management duties to the state and local government level, it has taken a lead role in developing the technical resources used in floodplain management. In addition to undertaking the technical modeling and mapping of flood hazard areas, FEMA provides training opportunities for local officials and works with states and local communities to manage flood risks. It also has a program called the Community Rating System (CRS), which gives community flood insurance policy holders discounts on insurance premiums when the community goes above the minimum standards in floodplain management. CRS is a point based system meant to promote enhanced floodplain management with insurance discounts providing an incentive.

7.2 Floodplain Management in the State of Ohio

As part of the NFIP, FEMA has requested each state appoint an agency to coordinate floodplain management activities in the state and act as liaison between the federal and local governments. The State of Ohio houses their State Floodplain Management Program in the Ohio Department of Natural Resources' (ODNR) Division of Soil and Water Resources. In this role, ODNR is responsible for coordinating NFIP activities throughout the state and assisting communities to establish and maintain effective floodplain management programs. ODNR has developed model ordinances compliant with minimum NFIP standards to assist communities with their own ordinances. In addition to coordination and community assistance, the State Floodplain Management Program has created several resources for use by local floodplain managers including internet resources and publications such as Ohio Floodplain Regulation Criteria (2002), National Flood Insurance Program Substantial Damage Determinations: A Guide for Local Officials (1998), and the Ohio Floodplain Management Handbook (2005).

Ohio is a home rule state, meaning municipalities are not limited to authorities granted by specific statute, but instead have authority to adopt and enforce a wide range of regulations as long as they are not in conflict with state or federal law. Communities in Ohio which can participate in the NFIP include villages, cities, and counties (unincorporated areas). Townships do not have the authority for independent participation in the NFIP so they are covered automatically under the umbrella of the county. However, some townships do have some regulatory authority over building and zoning which can support county NFIP participation.

7.3 Floodplain Management in the Nimishillen Creek Watershed

The majority of the Nimishillen Creek Watershed is in Stark County, and the largest population center is Canton, Ohio. Stark County participates in the NFIP, so all of the unincorporated areas of the county, including townships, participate under the county umbrella. There are 14 municipalities within the county which also individually participate in the NFIP. Five of those municipalities are within the Nimishillen watershed (Canton, North Canton, East Canton, East Sparta, and Louisville). They are shown below in **Figure 7.1**.

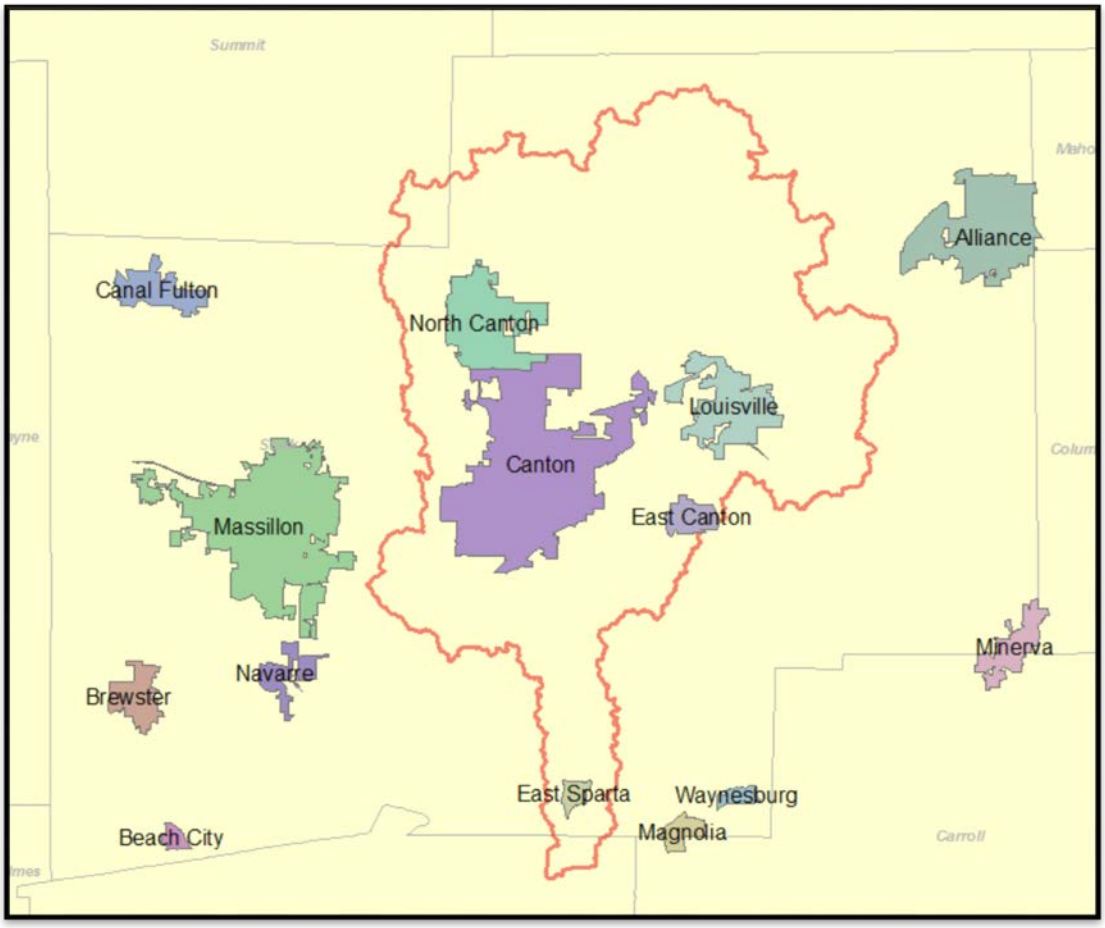

Figure 7.1 - NFIP Participating Communities in Stark County

While counties and municipalities have separate floodplain ordinances, most are based on the model ordinance developed by the Ohio State Floodplain Management Program. Each ordinance identifies a position designated as the floodplain manager responsible for enforcing the regulations. For Stark County, the Chief Building Official from the County Building Inspection Department is designated as the floodplain manager. This department has contracts to provide permitting services for Brewster, East Canton, Magnolia, Meyers Lake, Minerva, and Waynesburg. This department is also staffed by the chief official, a plan examiner, three electrical inspectors, two building/heating inspectors, and three office clerks. Floodplain permitting is considered a relatively infrequent task delegated to one or more of the inspectors as needed, and the inspectors have little or no training in floodplain management. The inspector with Stark County delegated to floodplain permitting estimated it was approximately 5% of her time. There are similar situations in the municipalities, who have designated floodplain management duties to village or city engineers, city managers, service directors, or even mayors.

Delegating floodplain management responsibilities to both county and municipality governments creates an issue because from a regulatory standpoint none of the local governments can justify creating a full time floodplain management position. Each government is only responsible for the floodplain regulation of a small percentage of the total county population, with the result that there is not enough demand for each government to devote the necessary resources to floodplain management. In the case of Stark County, there is not enough demand for floodplain permitting in only the unincorporated areas of the county to justify devoting a well-trained and appropriately paid employee to conduct floodplain management; instead, it is just a side duty of the building inspectors. The result is while each government entity accomplishes the minimum standards necessary for continued participation in the NFIP, they are not able to devote the appropriate resources to the other aspects of a holistic floodplain management program.

Table 7.1 below shows the most recent insurance policy information for the NFIP participating communities within the Nimishillen Creek Watershed.

Table 7.1 – Insurance Policy Information for NFIP Participating Communities in Stark County

Community Name	Policies In-force	Insurance In-force	Written Premium In-force	Calculated Average Premium Cost
Stark County – Unincorporated	385	$79,781,000	$323,171	$839
North Canton	80	$13,121,900	$88,084	$1,101
Canton	46	$8,884,700	$43,173	$939
Louisville	37	$6,788,700	$26,716	$722
East Canton	8	$988,200	$5,511	$689
Massillon	21	$2,136,400	$13,413	$639
Navarre	11	$2,579,500	$14,372	$1,307
Canal Fulton	6	$1,442,100	$3,161	$527
Waynesburg	3	$327,000	$1,737	$579
Beach City	1	$1,000,000	$4,807	$4,807
Brewster	1	$140,000	$346	$346
Total	599	$117,189,500	$524,491	$876

* NFIP Statistics as of 02/28/2014

FEMA keeps track of Repetitive Loss (RL) structures within the area. A RL property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP. Currently there are over 122,000 RL properties nationwide. Within Stark County there are 37 RL properties, 23 of which are located

within the Nimishillen Creek Watershed. Specific locations of these can be obtained from federal or state official resources.

7.4 The Role of Local Floodplain Managers

By its very nature, floodplain management is a collaborative process involving multiple stakeholders. If a community participates in the NFIP, they are required by FEMA to have a community floodplain ordinance which meets the minimum requirements set by the program. The local floodplain manager typically has the responsibility of implementing the local floodplain ordinance. FEMA does not require a full time floodplain manager. It only requires that the floodplain management ordinance be legally enforceable and applied uniformly throughout the community and that a person or office be responsible for the ordinance. For this reason, floodplain management in many communities is a part-time duty delegated to a local official with other responsibilities. Examples include building inspectors, city engineers, and small town mayors.

The typical duties of a floodplain manager include permitting and enforcement of the local floodplain ordinance, educating stakeholders on development requirements, maintaining records for community participation in the NFIP and the CRS, review updates and revisions to the FIRMs, review and coordination of floodplain related protection and mitigation projects, and representing the community floodplain considerations to federal and state agencies and representatives. For participation in the NFIP, only enactment and enforcement of the floodplain ordinance is required. However, ordinances only address a few of the multiple aspects of floodplain management.

7.5 Community Rating System (CRS) Participation in the Nimishillen Creek Watershed

The CRS program is designed to encourage more comprehensive floodplain management and reduce flood damages through such activities as clearing floodplain development, establishing stricter floodplain regulations, providing education to landowners on the benefits of flood insurance, maintaining accurate floodplain management records and increasing freeboard requirements for new construction or structure elevation. Among the many benefits provided by these activities to the watershed, such as reducing flood damages and restoring floodplain functioning, is the discounting of insurance premiums to policyholders in communities which actively participate and go above and beyond minimum regulation requirements. Each of these actions discussed in more detail below can earn individual communities more points in the CRS system. The CRS program has 10 classes and every community starts as a class 10 community until they apply to enter the program. Credit points are assigned for

actions and programs which address the goals of the CRS program. Each class receives a different percentage of premium discounts (see **Table 7.2** below).

Table 7.2 – CRS Reduction Overview

Credit Points	Class	Premium Reduction SFHA*	Premium Reduction Non-SFHA**
4,500+	1	45%	10%
4,000 – 4,499	2	40%	10%
3,500 – 3,999	3	35%	10%
3,000 – 3,499	4	30%	10%
2,500 – 2,999	5	25%	10%
2,000 – 2,499	6	20%	10%
1,500 – 1,999	7	15%	5%
1,000 – 1,499	8	10%	5%
500 – 999	9	5%	5%
0 – 499	10	0	0

*Special Flood Hazard Area
**Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage.

Within Ohio, only 14 communities participated in the CRS as of May 1, 2013. None of these were within Stark County.

Based on Ohio state laws and the model ordinance approved by the state, each community in Ohio will automatically be eligible for approximately 275 CRS credit points. If the community has higher standards, such as freeboard requirements above the Base Flood Elevation (BFE) or prohibiting development in flood prone areas, it is likely they will already have enough points to join the CRS program as a class 9 community. Stark County, Canton, Canal Fulton, and Alliance (not in the Nimishillen Creek Watershed) all likely have enough points because their regulations go above and beyond FEMA's minimum standards. However, Alliance and Canal Fulton have very few policies so the incentive is not as strong to join CRS.

There are additional credits which are also likely applicable to several of the communities. Credit is given for floodplain areas which are used as parks and open space, and Stark County Parks has made significant progress in this area. Many credits are simple to obtain, such as credit for maintaining records of elevation certificates, obtaining Certified Floodplain Manager certification, or providing data and links on local websites. **Table 7.3** below shows the communities within Stark County which have regulations above the minimum standards, how they exceed, and an estimate of how many CRS points those higher standards might provide in addition to the 275 applicable to every community in Ohio.

Table 7.3 – Communities in Stark County with Regulations Above Minimum Standards

1.5 foot zone AE freeboard 2 ft zone A freeboard New non-res/residential site shall have direct access to walkway, driveway, or roadway whose surface is above BFE No new construction of critical facilities in SFHA No new construction of res/non-res structures in floodway No storage of hazardous, flammable, or explosive material in SFHA No storage of materials or equipment in floodway that could become buoyant and hinder flow during base flood	2 foot regular freeboard 2 foot A zone freeboard Compen-satory storage Material storage Access (ingress/egress) Fill	2 foot regular freeboard 2 foot A zone freeboard	2 foot regular freeboard 2 foot A zone freeboard	1 foot regular freeboard 1 foot A zone freeboard	1 foot AE zone freeboard 2 foot A zone freeboard
Estimate of 225 CRS credits	Estimate of 400 credits	Estimate of 225 credits	Estimate of 225 credits	Estimate of 100 credits	Estimate of 100 credits

7.6 Future Conditions with Regard to Floodplain Management

Without future intervention, floodplain management within the Nimishillen Creek Watershed will likely continue to be a disjointed effort managed by an inefficient number of designated floodplain managers. This piece-meal approach reduces the likelihood that funding to support necessary FEMA training for a single (or few) effective and efficient floodplain manager(s) will be budgeted. While municipalities may continue to be eligible to participate in the NFIP, they will not be able to devote the appropriate resources to the other aspects of a holistic floodplain management program.

7.7 Potential Floodplain Management Solutions

7.7.1 Consolidation of Floodplain Management Duties

7.7.1.1 Background

The concerns associated with floodplain management and enforcement of floodplain ordinances were discussed by the technical group early in the collaborative process. The problem appears to stem from overlapping floodplain management responsibilities among numerous municipalities (five in the Nimishillen Creek Watershed) and the county using local floodplain ordinances, which are not consistent and are applied by a largely untrained staff whose skill in applying the ordinances may be lessened by infrequent use. No single entity has the regulatory permitting demand necessary to justify having fully-trained personnel devoted primarily to the floodplain management.

Despite a steady number of building permits for development in the area and the number of structures estimated to be located within the 1% annual chance of exceedence zone, the responsibility for issuing permits for development and subsequent oversight and enforcement is scattered among six jurisdictions and therefore is highly inefficient and inconsistent in its application. The scattering of responsibilities also reduces the likelihood that funding to support necessary training through FEMA will be budgeted by the individual entities.

Given the amount of floodplain encroachment which has occurred over recent years within the watershed, and the impact the encroachment has had on both flooding and water quality, it would benefit the watershed to have floodplain management responsibilities consolidated into one role. This would help to ensure the consistent and efficient enforcement of floodplain management ordinances, to the maximum benefit of the watershed. Consolidating these duties into one role would also help the person(s) responsible build a working knowledge of floodplain management, which would in turn lead to more efficient and effective decision making in the future.

7.7.1.2 Formulation of Consolidation Alternatives

Following discussions between the advisory and technical groups at the stakeholder involvement meetings, two changes were considered to make floodplain management more effective at preventing flood damages and adverse water quality impacts. A secondary benefit of these changes would be the program would be easier for potential developers and private landowners to use and be more efficient in terms of financial requirements. The alternatives are discussed below:

Alternative A - The first option is for the municipal governments to contract their floodplain management duties to a single entity within the county through local collaborative agreements. Local intergovernmental agreements have long been seen as a method for increasing the geographical base for government services. Agreements for local government cooperation have seen increasing demand and they can create significant cost savings while providing more efficient services. One specific benefit which can be accomplished through local cooperation is sharing skilled resources such as engineers. Building code inspections and enforcement already has a history of being subject to resource sharing through local government cooperation. If the municipalities and county government used an intergovernmental cooperative agreement to pool both the demand and resources of floodplain management into a single unit, they could have more effective and unified floodplain management. For Stark County, the Chief Building Official from the County Building Inspection Department is designated as the floodplain manager, and the department already has existing contracts to provide permitting services for communities of Brewster, East Canton, Magnolia, Meyers Lake, Minerva, and Waynesburg.

Alternative B - The second option is for both jurisdiction levels (Stark County and the five municipalities) to stand up an independent office which would centralize the NFIP process for the entire Nimishillen Creek Watershed (and potentially the entire county) administering the program responsibilities of both the municipalities and the county. This office would perform all of the necessary functions of the current individual offices and would be supported by the county and municipal governments using a contribution formula based upon calculated runoff amounts, acres of impervious cover, population, acres of regulatory floodplain or geographic coverage.

Under either option, a centralized office would maintain the existing floodplain mapping (FIRM's) and elevation certificates for each property in one central location and could revise the individual floodplain ordinances to assure consistency across the watershed and increase their effectiveness. This office would address specific questions from landowners and mortgage banking institutions regarding the flood insurance program and necessary flood elevations for elevation certificates and provide enforcement of the ordinances through a watershed surveillance program. This office could provide full time coordination with the emergency management offices in each municipality and the county to assure assistance in disseminating post disaster funding to the affected areas and landowners.

This centralized management approach could resolve several existing issues and allow for the following benefits: 1) FEMA sponsored training for a floodplain management officer and staff; 2) increased capability to maintain a high degree of knowledge and

awareness of current ordinances plus awareness of important changes in the NFIP (which is undergoing continual reform); 3) opportunities to bring multiple ordinances into a single updated and functional watershed ordinance that assures consistency of permit actions within the watershed and reduces confusion about the NFIP processes among developers and landowners; and 4) reduction of overall costs to the various jurisdictions for floodplain management by dividing the costs to support an office and staff among all jurisdictions in the watershed.

7.7.1.3 Tentative Option Selected by the Technical Group

A joint meeting between the Corps of Engineers and the technical group was convened on May 28, 2014 to review the Nimishillen Creek Watershed preliminary draft report and to make changes to the report as necessary. During the meeting, the two alternatives identified above were discussed by the participants. After much discussion of the merits of centralization, the technical group members decided tentatively to move the floodplain management function for Stark County and five municipalities into the Stark County Regional Planning Office. From this office the floodplain management functions mentioned above could be managed for the watershed. This tentative decision will be coordinated with the Advisory Group prior to the next joint meeting and discussed at that meeting before being finalized as a recommended action in the plan. Implementation of this decision would require approval by the individual jurisdictions in the watershed and coordination with FEMA.

7.7.1.4 Application for CRS

With unified and dedicated resources, the communities will have the opportunity to participate in the CRS program and undertake the documentation, reporting, and verification requirements that go along with participation. Simply by ensuring all state requirements are implemented and the Ohio model ordinance is used, the communities in Stark County could potentially have the first 500 points required to be CRS class 9 communities. In addition to the resulting 5% premium discount on all existing flood insurance policies, meeting state requirements and using the Ohio model ordinance would immediately reduce future flood damages to new growth, make floodplain residents more aware of their flood risks (thereby encouraging more participation in the NFIP) and support the process of clearing floodplains and restoring natural functions of those stream corridors.

7.7.1.5 Implementation

The Code of Federal Regulations (CFR) for the NFIP: 44 CFR Parts 59, 60, 65, and 70 does not prohibit the establishment of a centralized administrative or enforcement entity. This entity is normally a local jurisdiction (municipality or county government) as are the

applicants entering the regular NFIP program, but nothing prohibits the Stark County Regional Planning Office from being that centralized authority.

Given that there are currently a number of separate ordinances and offices in the watershed through which the NFIP is administered and enforced, several administrative steps would likely have to be taken by individual municipalities and the county to change to a central floodplain management and enforcement system for the Nimishillen Creek watershed. Those steps would likely include some form of local intergovernmental agreement between the county and municipalities agreeing to unify their individual NFIP operations and agreeing to support the Stark County Regional Planning Office as the central office for administering floodplain regulations and maintaining formal communications with FEMA. Another step would entail formal communication with FEMA of the proposed change in administration and enforcement of the many local ordinances under NFIP and proposed integration of the many ordinance documents into one enforceable regulatory document serving the watershed. Other procedures may be required by FEMA to enable this process to be put into operation in an efficient manner.

7.7.1.6 Floodplain Management in the Future

The tentative decision described above could centralize the functions of floodplain management and ordinance maintenance and enforcement across the watershed under the Stark County Regional Planning Office. This single action, if approved by the individual jurisdictions could increase the efficiency and effectiveness of floodplain management services to the region and facilitate additional staff training opportunities through FEMA resources. The Regional Planning Office could be used as the repository of all past and future floodplain documentation including elevation certificates, floodplain permit variances, floodplain building permits, floodplain ordinances, enforcement actions and other documents. Eventual digitizing of this documentation would enable quick reference for staff and the public. Future coordination with FEMA following a flood event could be handled through this centralized location for determining public and individual assistance needs.

Future NFIP audits conducted by FEMA could be accomplished with a single visit to the Regional Planning Commission office and potential developers and investors could experience “one-stop shopping” for permit information at this centralized office thereby streamlining the permitting process for new watershed development. Future initiatives to enter the CRS process could be handled though this office as well.

7.7.2 Designation of a Floodplain Restoration Lead

Restoration of the floodplains in the Nimishillen Creek watershed back to their natural functioning from a hydrologic and ecological standpoint will require a well-coordinated and long-term commitment by either a public or private agency (or a partnership of both sectors) that has local support and demonstrated capability to implement long-range development and maintenance plans. This effort will also require a substantial and sustained investment over a long period of time. Those financial resources will need to support both the removal of improvements from the floodplain as well as long-term maintenance of the restored resources. As shown in Figure 2.1, the majority of the watershed and its floodplains are contained within Stark County's jurisdiction.

Among the various institutions and organizations that are active in the watershed (see Section 6.4.2 above), the Stark County Park District (Stark Parks) was established in 1967 and has proceeded with public funding (provided through county tax levy's as recent as 1997) to successfully establish and maintain a 7,000 acre county-wide park system featuring trails and recreation facilities at 13 individual parks including 25 miles of the nationally-significant Ohio and Erie Canal Tow Pathway. Stark Parks provides the county population of 375,432 (US Census 2012 est.) with quality outdoor experiences, preserves thousands of acres of quality wildlife habitat and provides over 700 educational programs to 36,000 participants annually. Other institutions and organizations showing interest in the watershed have concentrated on data collection and mapping of the floodplain areas to date, but have not initiated any other restoration activities due to lack of funding and human resources for either clearing of development or long-term maintenance of the restored areas.

In accordance with the Stark County Trail & Greenway Plan approved for implementation in 1998, Stark Parks has been acquiring floodplain properties, clearing developments and converting those floodplain properties to open space for recreation such as walking trails and other passive pursuits. Stark Parks has utilized a number of funding sources for this purpose, including Clean Ohio Funds, Hazard Mitigation funds from FEMA and OEMA, and local funds for wetland and stream mitigation programs. Recently, Stark Parks (partnering with the City of North Canton, MWCD and the Stark County Commissioners) secured a $1.5M million grant from FEMA in Hazard Mitigation Grant Program (HMGP) funding for the purchase and demolition of 10 residential structures in addition to the 7 structures previously removed from the floodplain as part of this Greenway Plan. Stark Parks also received a SWMM grant which allowed them to undertake wetland restoration to help filter runoff prior to entering Sippo Lake.

Based upon the alignment of the Stark Parks Trail & Greenway Plan program goals with recommended actions in this watershed management plan, the ongoing successes of

the Stark Park program and their apparent ability to leverage funds from multiple Federal, state, regional and local resources, this FWA recommends future floodplain restoration activities be led by Stark Parks through the approved Greenway Plan. Some minor changes in restoration and land management that would promote future naturalization of the stream edges through plantings of native species and increased connectivity between the stream and wetlands could be instituted by the park system to further enhance the productivity and diversity of this important community asset[29]. It is likely that future successes by this county-wide program will lead to other local organizations becoming more involved in restoration and preservation of the watershed's resources.

7.8 Summary of Floodplain Management Recommendations

The following is a summary of floodplain management recommendations made for the Nimishillen Creek Watershed:

- Consolidation of Floodplain Management Duties
- Designation of a Floodplain Restoration Lead

Both of these recommendations are extremely important to the watershed. However, consolidating floodplain management duties should be prioritized above designating a floodplain restoration lead for several reasons. First, there is a significant advantage (in terms of cost savings and effectiveness) to be gained from the consolidation of floodplain management duties. Secondly, and as previously mentioned, there is more being done in the Nimishillen Creek Watershed in terms of floodplain restoration than in most other watersheds in the Muskingum River Basin. It is expected that this level of effort will continue with or without a designated lead. However, in order to formalize how floodplain restoration in handled in the watershed, it would still be beneficial to designate who the lead agency for this effort will be.

[29] Reference Stark Park's Master Plan

8.0 General Recommendations

8.1 Educational Outreach

Many communities are beginning to understand the importance of educating the public on water resource related topics discussed in this FWA, including, but not limited to: stormwater management, floodplain management and flooding. Involving and educating the public on measures which communities and individuals can undertake to address water resource issues on a small scale, can make a positive impact in the long run, if individuals are willing to do their part.

There are several unique educational tools within the Nimishillen Creek Watershed. The McKinley Museum staff, as well as Stark Parks, have been active in the preparation of the FWA and have expressed interest in playing a role in future educational efforts associated with the FWA. This may take the form of a display or exhibit at the McKinley Museum, or a local library, or a traveling display (particularly of the rainfall/runoff/flooding process) which could be taken to area schools and community events.

In addition to exhibits and displays, it would also be prudent to distribute “take aways” or printed materials. Pamphlets or fliers could be developed specifically for the Nimishillen Creek Watershed, or general information could be obtained from organizations such as federal and state resource agencies, or non-profits like The Nature Conservancy. Samples of such materials can be found in **Appendix E** of this report.

8.2 Central Repository for Watershed Data

During the development of this assessment, the team discovered a large amount of information pertaining to various aspects of the Nimishillen Creek Watershed. From water quality data, to previous studies and action plans, there has been a significant amount of work accomplished. It would be beneficial to all stakeholders in the watershed for this information to be made available to all users. Such a feature could allow stakeholders to leverage watershed information for multiple purposes, reducing redundancy in study and costs associated with producing new data.

The recommendation for development of a central repository for watershed data was supported at each stakeholder meeting. Establishment of such a repository would most likely be gradual, with additions being added overtime. Ideally, the final product would be an online database housing electronic copies of documents including but not limited to: watershed studies, TMDLs, action plans, geospatial files and raw data.

Development of the central repository should be managed by local stakeholders who best understand the needs of potential users and who can shape it into a useful tool for watershed management. Stakeholders would need to work together to decide who would ultimately operate the website housing the repository and the proper method of submitting new products for inclusion. Use of the repository could be limited to area decision makers, or open to the broader public. It was suggested several times that the appropriate party for management of the repository would be NEFCO, as they already maintain a vast amount of information pertaining to the Nimishillen Creek Watershed.

9.0 Prioritization of Recommendations

9.1 Prioritization of Recommendations

Many potential solutions to the identified water resource related issues were identified during the development of this assessment. Any and all of the solutions would be beneficial for the watershed. However, the solutions have been prioritized, so that as opportunities and resources become available, decision makers will be able to pursue recommendations which make the biggest impact on the watershed. The recommendations were originally prioritized by the Huntington District PDT in the draft version of this report.

The two most critical recommendations made by the WMP in pursuit of reducing flood damages are the development of a Hydrologic and Hydraulic Modeling Update and the installation of additional rain/stream gages. The implementation of these two recommendations will provide information which will help with the efficient and effective implementation of the other recommended alternatives.

The recommendations for each identified water resource related issues are presented in **Tables 9.1** through **9.4**.

Table 9.1 – Prioritization of Flood Risk Management Recommendations

Recommendation	Potential Lead for this Action
Installation of Additional Rain/Stream Gages	MWCD; Municipalities; NOAA; NWS; USGS
Hydrologic and Hydraulic Modeling Update for the Nimishillen Creek Watershed	FEMA; Municipalities; USACE; USGS
Flood Warning System (FWS)	Municipalities; NWS; USACE; USGS
Flood Warning Emergency Evacuation Plan	USACE
Addressing Undersized Bridges and Culverts	Combined effort on behalf of the municipalities in the watershed, and private, state, and federal owners as applicable.
Construction of Flood Water Detention Basins	Municipalities; USACE

Table 9.2 – Prioritization of Water Quality Recommendations

Addressing Sewage Treatment in the Watershed	Various municipalities; USACE; State of Ohio; USDA
Addressing Inundated Manholes	Municipalities
Improvements to Local Land Use Zoning	Combined effort on behalf of the municipalities in the watershed
Preservation/Restoration of Riparian/Wetland Areas	Municipalities; Stark Parks; USDA; State of Ohio;
Education on Land Management Practices	Combined effort on behalf of the municipalities in the watershed
Bioretention	Municipalities

Table 9.3 – Prioritization of Stormwater Management Recommendations

Establish Consistency in Stormwater Management Regulations	Combined effort on behalf of the municipalities in the watershed
Connect Hydrologic Network of Streams & Adjoining Floodplains	Stark County Parks District through currently funded floodplain clearing and restoration program
Mitigation Stormwater via Green Infrastructure	Municipalities; U.S. Forest Service; EPA; Appalachian Regional Commission; USACE
Utilization of the EPA's Storm water Management Model (SWMM)	EPA; Municipalities

Table 9.4 – Prioritization of Floodplain Management Recommendations

Consolidation of Floodplain Management Duties	Combined effort on behalf of the municipalities in the watershed.
Designation of a Floodplain Restoration Lead	Stark Parks

While there have been some 21 recommendations made in this FWA, 10 stand out as the most critical. After consultation with the Advisory and Technical Group it was decided the most critical recommendations (as shown below in Table 9.5) would be

listed in order of those which are currently underway, those which may be implemented in the near term and those which may be implemented in the long term[30].

Table 9.5 – Top Recommendations

Recommendation	Water Resource Issues Addressed	Benefit to the Watershed
Flood Risk Management Recommendations		
Installation of New Rain/Stream Gages	Flooding	Will aid in more accurate flood forecasting, and will provide data to help with the development of the Hydrologic and Hydraulic Modeling Update.
Flood Warning System (FWS)	Flooding	Will allow for more accurate flood forecasting, and will give more credible warning times, reducing the risk to life and property.
Flood Warning Emergency Evacuation Plan	Flooding	Will build on the FWS to allow for the development of a specific evacuation plan, reducing the risk to life and property.
Hydrologic and Hydraulic Modeling Update	Flooding, Floodplain Management	Will develop an up to date hydrologic and hydraulic model of the watershed which will allow for accurate delineation of the floodway and floodplain, the development of accurate FIRMs and aid decision makers in the development of future water resource projects.
Water Quality Recommendations		
Addressing Sewage Treatment in the Watershed	Water Quality	Would ensure sewage in the watershed was properly treated either on site via properly functioning Home Sewage Treatment Systems or at a Wastewater Treatment facility. It would prevent untreated sewage from contaminating nearby streams and causing potentially significant health

[30] Recommendations in green font are those currently underway as the date of this report. Recommendations in orange font are those which may be implemented in the near future, and recommendations in purple font are those which may be implemented in the long term.

		issues with backwater during flooding events.
Addressing Inundated Sanitary Manholes	Water Quality	Would ensure manholes are properly sealed so that sewage is not released into nearby streams during inundation of manholes.
Improvements to Local Land Use Zoning	Flooding, Water Quality, Floodplain Management, Stormwater Management	Would help to protect the floodplain from encroachment, protect the function of streams in the watershed by ensuring a proper riparian zone adjacent to the waterway, and allow for flood storage alongside streams without risk of property damage.
Connecting Floodplain Hydrologic Networks	Flooding, Water Quality, Floodplain Management	Would help to foster the natural relationship between stream, riparian area, floodplain and upland development. This would reduce flooding issues, improve water quality and protect the natural function of the floodplain.
Establish Consistency in Stormwater Management Regulations	Stormwater Management	Will allow for consistent management and protection of local waterways and creates a “community of practice” between stormwater management regulators within the watershed. It also promotes an atmosphere for more strict enforcement of regulation for future development across the watershed.
Consolidation of Floodplain Management Duties	Floodplain Management	Will consolidate the activities of floodplain management into one office. This will allow for consistent floodplain management throughout the watershed.

9.2 Potential Funding Sources

9.2.1 Potential Flood Risk Management Funding Sources

9.2.1.1 Hydrologic and Hydraulic Modeling Update

Section 5.4.2 describes the need for a Hydrologic and Hydraulic Modeling Update for the Nimishillen Creek Watershed. This would allow for much more efficient watershed planning in the future in terms of forming a solid foundation from which decisions could be made (i.e. managing the floodplain and siting future flood risk management features).

There are several ways a Hydrologic and Hydraulic Modeling Update for the Nimishillen Creek Watershed could be accomplished. The Hydrologic and Hydraulic Modeling Update could be developed by FEMA. This type of update would typically be undertaken when FEMA is updating the FIRMs for the area. Coordination with the state NFIP coordinator through the Ohio Silver Jackets Program regarding this modeling update could favorably influence FEMA priorities for a FIS update in this watershed. Additionally, there are two possible ways USACE could assist with this effort. One would be through the Floodplain Management Services (FPMS) Program, and the other would be through Planning Assistance to States (PAS).

Floodplain Management Services - The authority for FPMS comes from Section 206 of the 1960 Flood Control Act (PL 86-645), as amended. The program's objective is to foster public understanding of the options for dealing with flood hazards and to promote productive use and management of the nation's floodplains. The program develops or interprets site-specific data on obstructions to flood flows, flood formation and timing; and the extent, duration and frequency of flooding. The program can also provide assistance and guidance in the form of "Special Studies" on all aspects of floodplain management planning. Some examples include: Floodplain Delineation/Flood Hazard Evaluation Studies, Flood Warning/Preparedness Studies, Comprehensive Floodplain Management Studies, and Stormwater Management Studies. For more information on the FPMS program, please refer to the fact sheet located in **Appendix A** of this report.

Planning Assistance to States - The PAS program authority stems from Section 22 of the Water Resources Development Act of 1974, as amended. It allows the Corps to assist states, local governments and other non-federal entities in the preparation of comprehensive plans for the development and conservation of water and related land resources. Typically, studies are only undertaken at the planning level of detail utilizing existing information. However, in some cases (such as the preparation of a Hydrologic and Hydraulic Modeling Update) new data collection is necessary. Some examples of typical PAS studies include: Water Supply and Demand Studies, Water Quality Studies, Floodplain Management Studies and Environmental Conservation/Restoration Studies.

For more information on the PAS program, please refer to the fact sheet located in **Appendix F** of this report.

9.2.1.2 USACE Section 205 Projects

Section 205 of the Flood Control Act of 1948, as amended, provides authority to the USACE to plan and construct small flood damage reduction projects not specifically authorized by Congress. A project is accepted for construction only after detailed investigation clearly shows its engineering feasibility, environmental acceptability, and economic justification. Each project must be complete within itself, not a part of a larger project. The maximum federal expenditure per project is $10,000,000, which includes both planning and construction costs. Costs of lands, easements, and operation and maintenance must be non-federal.

There are two types of projects: structural and nonstructural. Structural projects may include levees, flood walls, diversion channels, pumping plants, and bridge modifications. Nonstructural alternatives, which have little or no effect on water surface elevations, might include measures such as floodproofing, relocation of structures, and FWSs.

After a state or local agency requests federal assistance, the Corps will conduct a feasibility study pending potential federal interest and available funding. The feasibility study begins at federal expense. Study costs in excess of $100,000 are shared 50/ 50 with the non-federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA).

The recommendations of this study that fit the Section 205 authority are listed below. See **Appendix F** of this report for more information.

<u>Section 205 Flood Warning System/Flood Warning Emergency Evacuation Plan -</u>
Sections 5.5.3 and 5.5.4 above outline the need for a FWS and/or FWEEP for the Nimishillen Creek Watershed.

<u>Section 205 Floodwater Retention/Detention Basins -</u>
Section 5.4.6 above describes the need for additional floodwater retention/detention basins in the watershed.

9.2.1.3 FEMA's Hazard Mitigation Grant Program

The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable

mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Eligible applicants include states, local governments, Indian tribes and private, non-profit organizations. Individual homeowners and businesses may not apply directly to the program; however an eligible applicant may apply on their behalf.

9.2.2 Potential Water Quality Funding Sources

9.2.2.1 Sewer Line Extension

Funded by Watershed Cities, Villages and Municipalities –

The most costly option for providing sanitary sewer service to currently unsewered areas would be for the local municipalities to fully fund construction and implementation. If funds were on hand, it would also be the fastest way possible to put a sewer system in place. However, in most cities and towns resources like those needed to fund such an initiative are scarce. Other options for securing additional funding are discussed below.

State of Ohio's Residential Public Infrastructure Program –

This program provides water and/or sanitary sewer service to residential users. Eligible on-site improvements include service laterals[31], septic tanks and well abandonment, and Community Development Block Grant-eligible-related fees. Eligible applicants include non-entitlement counties, cities and villages. Counties must apply on behalf of unincorporated areas and villages that do not have a demonstrated capacity to operate a public water or wastewater system. For more information on this program visit: *http://development.ohio.gov/cs/cs_rpi.htm*

Water and Waste Disposal Systems for Rural Communities –

The USDA Rural Utilities Service program supports rural areas by constructing new water and waste water facilities, and improving existing plants. Funds may be used for the installation, repair, improvement, or expansion of a rural water facility including costs of distribution lines and well pumping facilities. Funds also support the installation, repair, improvement, or expansion of a rural waste disposal facility, including the collection and treatment of sanitary waste, stormwater, and solid wastes.

9.2.2.2 Section 594 for Sewer Line Extension.

Section 6.4.1.2 above discusses the need to extend sanitary sewer service into currently unsewered areas. This could improve water quality in the watershed, as

[31] A service lateral is where a structure's sanitary sewer line connects to the municipality's sanitary sewer line.

broken and malfunctioning HSTSs could be leaching pollutants into ground and surface water. USACE could help with this effort utilizing the Section 594 program. It is authorized by WRDA 1999 to allow USACE to provide assistance in the form of design and construction for water related environmental infrastructure and resource protection and development projects in Ohio. Examples of type of projects that can be initiated under this authority include waste water treatment systems, environmental restoration and surface water resource protection and development projects.

9.2.2.3 Potential Funding Sources for Preserving, Restoring and Maintaining Riparian/Wetland Areas

USDA Natural Resources Conservation Service (NRCS) Wetlands Reserve Program (WRP) –

A voluntary conservation program that offers landowners the means and opportunity to protect, restore, and enhance wetlands on their property through perpetual easements, 30-year easements, or Land Treatment Contracts. NRCS manages the program and provides technical and financial support to participating landowners.

Ohio's Agricultural Pollution Abatement Program (APAP) –

Provides farmers with cost share assistance to develop and implement BMPs to protect Ohio's streams, creeks, and rivers. This program has been successful in helping to alleviate concerns associated with agricultural production and silvicultural operations which can create soil erosion and manure runoff.

Conservation Reserve Enhancement Program (CREP) –

A federal/state natural resource conservation program targeted to address state and nationally significant agricultural related environmental problems. Through CREP, program participants receive financial incentives from USDA to voluntarily enroll in the Conservation Reserve Program (CRP) in contracts of a minimum 14 to 15 years. Participants remove cropland from agricultural production and convert the land to native grasses, trees and other vegetation. CRP is authorized by the Food Security Act of 1985, as amended. Several watersheds in Ohio have already been enrolled in the CREP and CRP programs.

9.2.3 Potential Stormwater Management Funding Sources

9.2.3.1 Potential Green Infrastructure Funding Sources

National Urban and Community Forestry Challenge Cost-Share Program –

The U.S. Forest Service's Urban and Community Forestry Challenge Cost-Share Grant Program seeks to establish sustainable urban and community forests by encouraging communities to manage and protect their natural resources. The program supports an

ecosystem approach to managing urban forests for their benefits to air quality, stormwater runoff, wildlife and fish habitat, and other related ecosystem concerns.

Science to Achieve Results (STAR) –
The USEPA enacted a program to improve the quality of science used in EPA's decision-making process. STAR funds are provided for research in several priority areas, including: community-based approaches to stormwater management using green infrastructure and performance and effectiveness of green infrastructure stormwater management approaches in the urban context.

Appalachian Regional Commission (ARC) –
A regional economic development partnership of federal, state, and local governments, the Commission has a competitive grant program for projects involving infrastructure developments to improve local stormwater and sewer systems. Terms and conditions of each grant vary and may require matching funds by the applicant.

9.2.3.2 USACE PAS for Green Infrastructure Planning.
Section 7.4.4 describes the effectiveness of utilizing green infrastructure to mitigate stormwater runoff. There are a variety of features that can be implemented under the green infrastructure umbrella, including but not limited to: rain gardens, porous pavement and green roofs. The Corps could become involved with this process via a PAS study as discussed above in Section 10.2.1. The Corps could work with local decision makers to identify the locations where green infrastructure features could make the biggest impact and help to design a plan for implementation.

9.2.4 Potential Funding Sources for Educational Outreach
ODNR - Nonpoint Source Pollution Education Grants –
Soil and Water Conservation Districts, along with schools and other local organizations are eligible for these grants. These “mini” grants are for projects such as educator workshops, student field days, water festivals, storm drain stenciling, landowner and developer seminars and other watershed awareness initiatives.

ODNR – Wetland Restoration Assistance –
Eligibility is to individuals and/or organizations to assist with costs associated with wetland restoration projects on private land in Ohio. Examples of projects include tile cuts[32] and/or construction of small, low level dikes to restore or enhance hydrology.

[32] Tile drains are a agricultural tool that removes excess water from the soil subsurface.

Ohio Environmental Protection Agency (OEPA) – Ohio Environmental Education Fund (OEEF) –

The OEEF grants provide up to $50,000 for programs that help small businesses and farmers understand environmental regulations; teach Ohio residents what they can do to project Ohio's air, water and land; and provide science supplies and opportunities for Ohio students to monitor air and water quality, explore careers and interact with professional scientists and engineers working to solve environmental problems.

ODNR – Watershed Coordinators Grant –

Non-profit organizations, local and regional municipalities are eligible for these grants. They provide up to $35,000 a year for up to four years to support local employment of a watershed coordinator. A watershed coordinator for the Nimishillen Creek Watershed could help to manage the data in the Central Repository (see Section 8.2), as well as oversee updates to the Hydraulic and Hydrologic Model. The watershed coordinator could play a crucial role in public outreach, in terms of the education recommendation made above in Chapter 8. Overall, a watershed coordinator could serve a point person for joint efforts on water resources projects in the watershed.

10.0 Conclusions and Summary

Generally, the goal of watershed planning is to addresses problems, needs, and opportunities and plan for IWRM within a watershed. Watershed planning can result in non-project specific, holistic plans and strategies, as well as agency-specific potential projects to address water resources needs.

Specifically, the goal of this FWA and WMP was to:

- Further refine problems and opportunities within the Nimishillen Creek Watershed, as defined by the IWA, through continued stakeholder engagement and agency collaboration;
- Inventory and forecast existing conditions;
- Evaluate alternative approaches to address identified water resource issues; and
- Select strategies and/or broad plans based on the shared vision of the stakeholders and partners which can be implemented in the future.

Chapters 4 through **8** of this report document the problems identified by stakeholders within the watershed, including the existing conditions, possible causes and potential solutions which may be implemented by local decision makers, watershed groups, state resource agencies and/or federal agencies. **Chapter 9** provides a prioritized list of potential solutions so that as funding and opportunities become available local decision makers can quickly determine which solutions can make the most positive impact on the watershed. Utilization of the Nimishillen Creek Watershed Management Plan should allow for a comprehensive plan for managing land and water resources within the watershed via a holistic process which reflects the interdependency of land owners and water users, competing demands on water resources and the desires of the stakeholders.