Nine-Element Nonpoint Source Implementation Strategy (NPS-IS) for North Turkeyfoot Creek HUC-12 (04100009 04 02)

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Cover photo: North Turkeyfoot Creek. Photo courtesy of Civil & Environmental Consultants, Inc.

Acronyms and Abbreviations

The acronyms and abbreviations below are commonly used by organizations working to restore Ohio's watersheds and are found throughout this NPS-IS document.

Numbers	
§319	Section 319 of the Clean Water Act
A	
ALU	Aquatic Life Use
B	
BMP	Best Management Practice
C	
CAFF	Confined Animal Feeding Facility
CAFO	Concentrated Animal Feeding Operation
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSA	Critical Sewage Area
D	
DAP	Domestic Action Plan
DO	Dissolved Oxygen
E	
ECHO	Enforcement Compliance History Online (database)
EPT	*Ephemeroptera, Plecoptera* and *Trichoptera* – sensitive macroinvertebrate species
EQIP	Environmental Quality Incentives Program
F	
FLS	Federally Listed Species
FOTG	Field Office Technical Guide
FSA	Farm Service Agency
G	
GLC	Great Lakes Commission
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
H	
H2Ohio	H2Ohio Initiative (Ohio state funding mechanism for water quality improvement)
HAB	Harmful Algal Bloom
HELP	Huron-Erie Lake Plains Ecoregion
HSTS	Home Sewage Treatment System
HUC	Hydrologic Unit Code

I

IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
IJC	International Joint Commission

M

MIwb	Modified Index of Well Being
MGD	Million Gallons per Day
MHC	Mobile Home Court
MS4	Municipal Separate Storm Sewer System
MTA	Metric Tons per Annum
MWH	Modified Warmwater Habitat

N

NH_3	Nitrogen as Ammonia
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NPS-IS	Nonpoint Source-Implementation Strategy
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory

O

ODA	Ohio Department of Agriculture
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
OpTIS	Operational Tillage Information System
OLEC	Ohio Lake Erie Commission
OSU	Ohio State University

P

PAD-US	Protected Areas Database of the United States

Q

QHEI	Qualitative Habitat Evaluation Index

R

RM	River Mile

S

SAFE	State Acres for Wildlife Enhancement
SNC	Significant Noncompliance
SWCD	Soil and Water Conservation District

T

TMACOG	Toledo Metropolitan Area Council of Governments
TMDL	Total Maximum Daily Load
TSD	Technical Support Document

U

USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

V

VNMP	Voluntary Nutrient Management Plan
VRT	Variable Rate Technology

W

WAP	Watershed Action Plan
WLEB	Western Lake Erie Basin
WQS	Water Quality Standards (Ohio Administrative Code 3745-1)
WRP	Wetlands Reserve Program
WTP	Water Treatment Plant
WWH	Warmwater Habitat
WWTP	Wastewater Treatment Plant

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CHAPTER 1: INTRODUCTION

The **North Turkeyfoot Creek Hydrologic Unit Code (HUC)-12 (04100009 04 02)** is located in southcentral Fulton County and northcentral Henry County, Ohio. It contains a watershed of 50.01 square miles (Figure 1). The **North Turkeyfoot Creek HUC-12** contains the entirety of North Turkeyfoot Creek, a direct tributary to the Maumee River, which begins north of Wauseon in Fulton County. The watershed is primarily rural, and the dominant land use is cultivated cropland (~82%). The **North Turkeyfoot Creek HUC-12** lies within the Western Lake Erie Basin (WLEB) watershed, which currently is the focus of state funding for nutrient reduction efforts due to the estimated loadings of total phosphorus and dissolved reactive (soluble) phosphorus that flows into the tributaries of the Maumee River and eventually, Lake Erie.

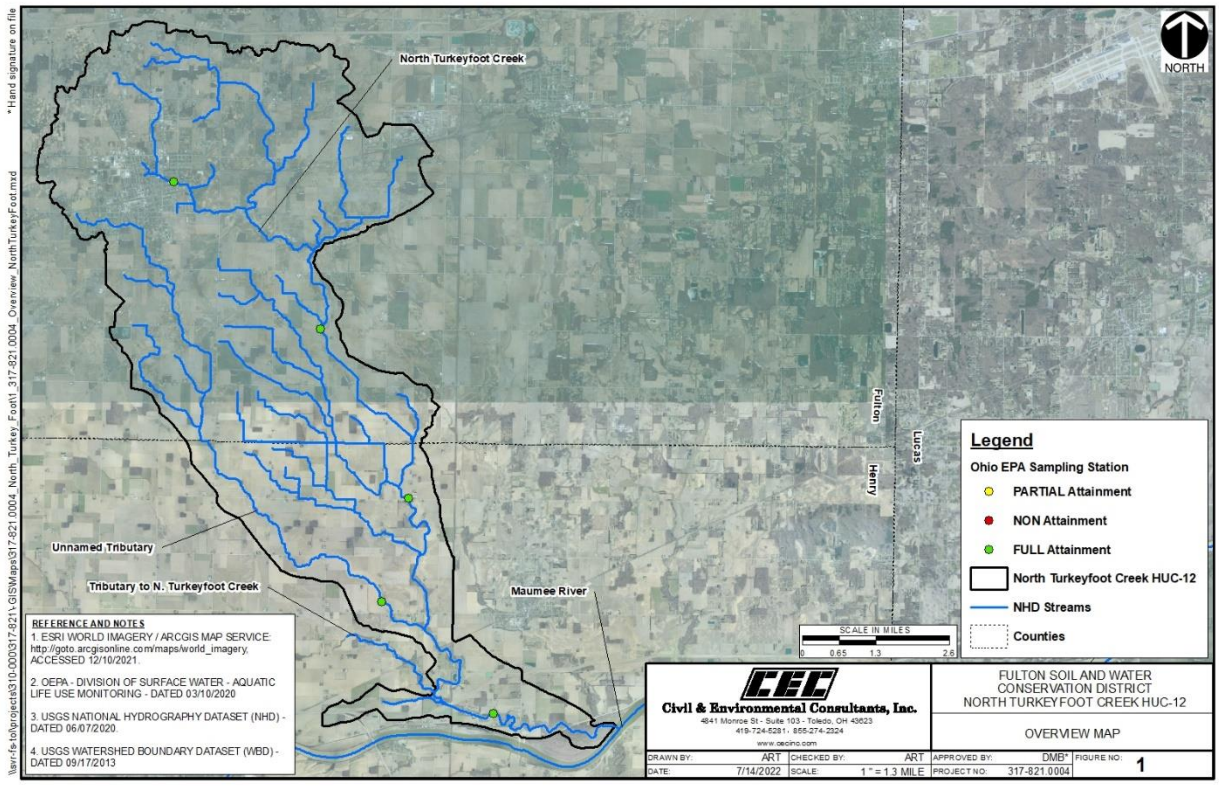

Figure 1: North Turkeyfoot Creek HUC-12 Overview

1.1 Report Background

While watershed plans could be all-inclusive inventories, the US Environmental Protection Agency (USEPA) identified nine critical elements to include in strategic planning documents for impaired waters (Table 1). To ease implementation of projects addressing nonpoint source (NPS) management and habitat restoration, current federal and state NPS and habitat restoration funding opportunities require strategic watershed plans incorporate these nine key elements, concisely to HUC-12 watersheds.
The Ohio Environmental Protection Agency (Ohio EPA) has historically supported watershed-based planning in many forms (Ohio EPA, 2016).

Table 1: Nine Elements for Watershed Plans and Implementation Projects

Element	Description
a	Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve load reductions
b	Load reductions expected from management measures described under element (c) below
c	Description of the NPS measures that need to be implemented to achieve load reductions estimated under element (b) above and an identification of the critical areas in which those measures will be needed to implement this plan
d	An estimate of the amounts of technical and financial assistance needed, associated costs and/or sources and authorities that will be relied upon to implement this plan
e	An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing and implementing the NPS management measures that will be implemented
f	A schedule for implementing the NPS measures identified in this plans that is reasonably expeditious
g	A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented
h	A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards
i	A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element (h) above

(Source: USEPA, 2008)

In 1997, Ohio EPA issued guidance for the development of Watershed Action Plans (WAP), which typically covered larger watersheds (HUC-10 to HUC-8 size). The WAPs included an outline and checklist to ensure USEPA's nine elements were included within each plan. The USEPA issued new guidance in 2013 and concluded Ohio's interpretation for WAP development did not adequately address critical areas, nor did it include an approach that detailed the nine elements at the project level (Ohio EPA, 2016). In response, Ohio EPA developed a new template for watershed planning in the form of a Nonpoint Source-Implementation Strategy (NPS-IS), ensuring NPS pollution is addressed at a finer resolution and that individual projects listed within each plan include each of the nine elements. The first NPS-IS plans were approved in 2017. Over time, these plans have evolved to not only address in-stream (near-field) water quality impairment from NPS pollution, but they also address reductions in nutrient loadings to larger bodies of water (far-field).

State of Ohio Domestic Action Plan

The state of Ohio has had a long history of identifying problems and combating Harmful Algal Blooms (HABs) within Lake Erie (OLEC, 2020). After successfully abating nutrient enrichment in the 1980s, the occurrence and severity of HABs within Lake Erie began to increase in the mid-1990s. Building on efforts initiated by the Ohio Phosphorus Task Force, Ohio participated at the federal level in the Great Lakes Water Quality Agreement (GLWQA) of 2010. Along with Michigan and Ontario, Ohio committed to a goal of reducing phosphorus loadings to Lake Erie by 40% in both 2015 and in 2019 through signing the Lake Erie Collaborative Agreement, leading to the precursor of Ohio's Domestic Action Plan (DAP).

In 2018, all sub-watersheds (HUC-12s) within the Ohio portions of the Auglaize HUC-8 (including the Ottawa River, Little Auglaize River and Little Flatrock Creek), the Blanchard HUC-8 (including Eagle Creek), the St. Marys HUC-8 and the Platter Creek HUC-12 were recommended for designation as a "Watershed in Distress". This recommendation was due to relatively higher concentrations of phosphorus in surface waters contributing to HAB occurrence in Lake Erie. These waterways were found to have flow-weighted mean concentrations of phosphorus two or more times the phosphorus loading goals set forth by the GLWQA and the subsequent DAP developed by the State of Ohio (ODA, 2018). As a result, nutrient loadings were modeled and reduction targets were set for these priority areas, as well as all sub-watersheds within the WLEB, including those located within the Lower Maumee HUC-8. The coordination of this NPS-IS for the **North Turkeyfoot Creek HUC-12** is a continued effort on behalf of the Fulton Soil and Water Conservation District (SWCD) to develop NPS-IS for all HUC-12s within the county and builds upon formal watershed planning efforts that have occurred within the eastern and central portions of the Lower Maumee watershed and other parts of the Tiffin watershed.

North Turkeyfoot Creek HUC-12 NPS-IS

The development of NPS-IS is critical to the efforts focused on implementing Ohio's DAP to reduce total spring nutrient loadings to Lake Erie by 40% by the year 2025, with aspirations to reach a 20% reduction by 2020 (OLEC, 2018). The development of NPS-IS across the entire WLEB will address NPS pollution by accounting for both near-field (within stream/watershed) and far-field (loadings to Lake Erie) effects. The *North Turkeyfoot Creek HUC-12 NPS-IS* is sponsored and developed by the Fulton SWCD through a grant received from Ohio EPA.

Sediments and nutrients flow within tributaries to eventually reach the Maumee River and Lake Erie

Removal of NPS impairments and reduction in overall nutrient loss within the **North Turkeyfoot Creek HUC-12** is crucial to the attainment and maintenance of aquatic life use (ALU) standards within North Turkeyfoot Creek and its tributaries. Furthermore, removal of NPS impairments and reduction in overall nutrient loss will reduce the severity, extent and occurrence of HABs within the WLEB. Within the **North Turkeyfoot HUC-12**, North Turkeyfoot Creek is in *Full Attainment* of its Warmwater Habitat (WWH) designation at four locations. One location has been identified as in *Full Attainment – Threatened*. An unnamed tributary to North Turkeyfoot Creek at river mile (RM) 6.68 is also in *Full Attainment* of the WWH designation. Nutrient loadings from the **North Turkeyfoot Creek HUC-12** contribute to large-scale impairment within Lake Erie. This NPS-IS will be used to strategically identify and outline key projects that should be implemented within the **North Turkeyfoot Creek HUC-12** to facilitate management of NPS issues that have both near-field and far-field impacts.

1.2 Watershed Profile & History

The WLEB is composed of approximately 7,000,000 acres across the tri-state area of Ohio, Indiana and Michigan (Figure 2). The largest direct tributary to the WLEB is the Maumee River, flowing 137 miles through 18 counties in Indiana and Ohio. The WLEB watershed is broken into several sub-basins at the

HUC-8 level, including the Auglaize, St. Joseph, St. Marys, Blanchard, Tiffin, Ottawa-Stony, River Raisin, Cedar-Portage, Upper Maumee and Lower Maumee watersheds. The Lower Maumee HUC-8 drains approximately 1,081.3 square miles (692,038 acres) of northwest Ohio, including the urbanized area of the City of Toledo. The Lower Maumee HUC-8 (04100009) contains the lower 65.76 miles of the Maumee River, beginning in Defiance, Ohio to the mouth of the river in Maumee Bay in Lake Erie.

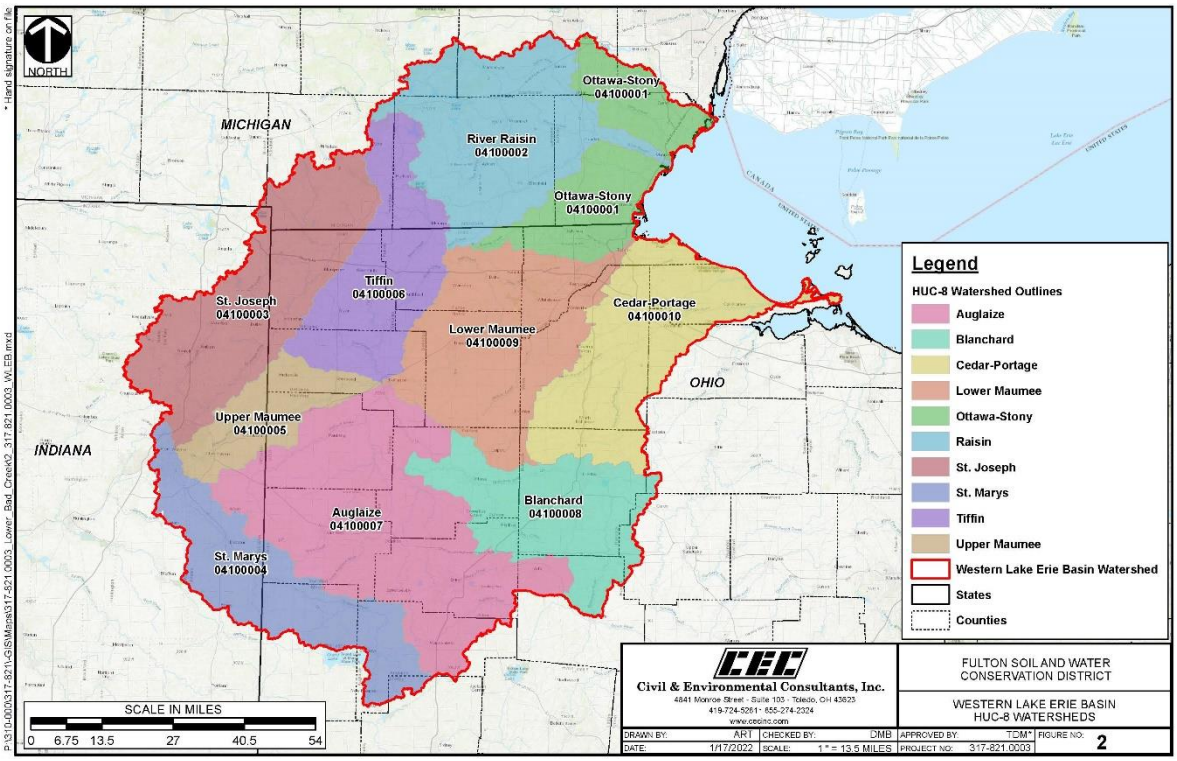

Figure 2: Western Lake Erie Basin Watershed

The Maumee River is officially formed by the confluence of the St. Joseph and St. Marys Rivers in Fort Wayne, Indiana, and flows easterly to drain all or part of 17 Ohio counties, two counties in Michigan, and five counties in Indiana (American Rivers, 2021). Larger direct tributaries to the Maumee River include the Auglaize, St. Joseph, St. Marys and Tiffin Rivers and Swan Creek, which is the only large tributary located in the Lower Maumee HUC-8. Other notably-sized direct tributaries located within the Lower Maumee HUC-8 include Bad Creek, Beaver Creek, and South Turkeyfoot Creek. The Lower Maumee HUC-8 can be broken down into nine main HUC-10 watersheds: the *Bad Creek HUC-10, Upper Swan Creek HUC-10*, *Lower Swan Creek HUC-10*, *Grassy Creek-Maumee River HUC-10*, *Tontogany Creek-Maumee River HUC-10, Beaver Creek-Maumee River HUC-10, South Turkeyfoot Creek HUC-10, Garret Creek-Maumee River HUC-10* and the *North Turkeyfoot Creek-Maumee River HUC-10* (Figure 3).

The *North Turkeyfoot Creek-Maumee River HUC-10* has a drainage area of 102.58 square miles (65,655.65 acres) (Table 2). Land use within the *North Turkeyfoot Creek-Maumee River HUC-10* is mainly agricultural and rural. The largest community found within the *North Turkeyfoot Creek-Maumee River HUC-10* is Wauseon, Ohio which is residence to approximately 7,568 people (US Census Bureau, 2020).

The *North Turkeyfoot Creek-Maumee River HUC-10* is further divided into three HUC-12 watersheds, one of which is the **North Turkeyfoot Creek HUC-12.** The **North Turkeyfoot Creek HUC-12** contains the entirety of North Turkeyfoot Creek, a direct tributary to the Maumee River at RM 37.92 (Figure 3). The **North Turkeyfoot Creek HUC-12** is similar in land use characteristics as the greater HUC-10 watershed and supports mainly agricultural activities. Formerly, lands in this region formed a large wetland complex known as the Great Black Swamp. Once drained, the Great Black Swamp yielded the fertile soils that are cultivated today.

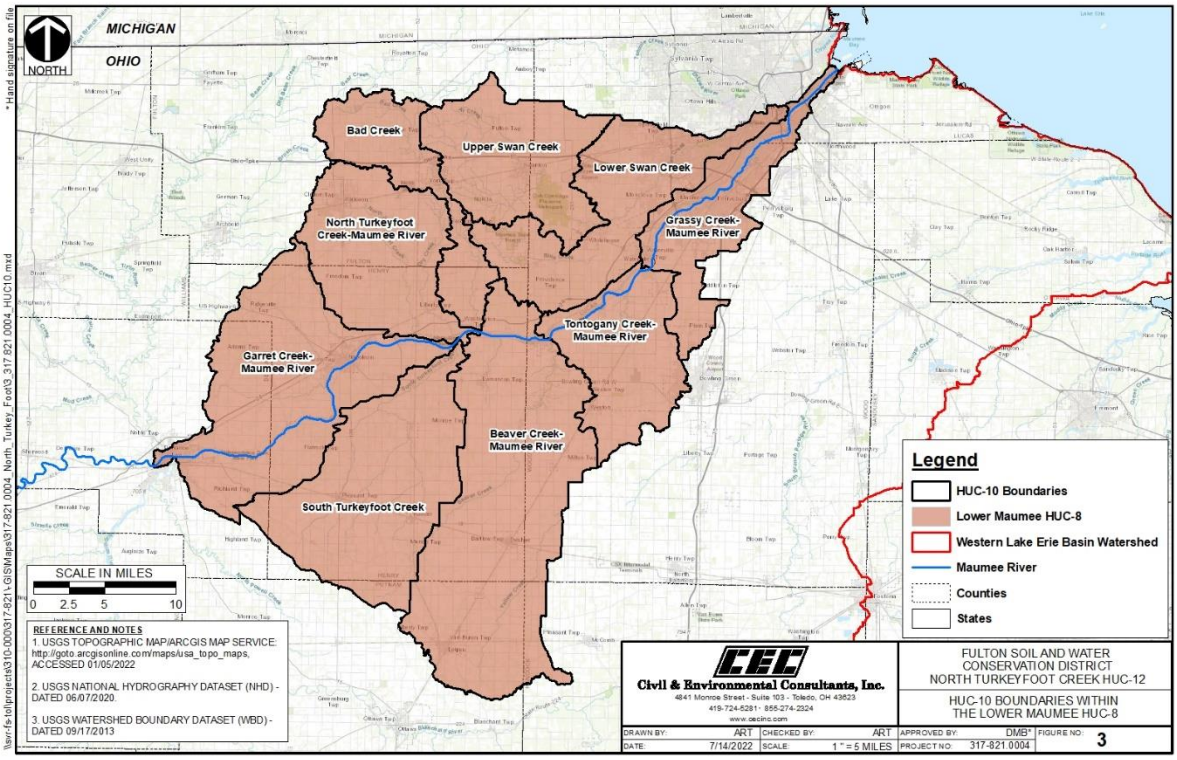

Figure 3: HUC-10 Watersheds of the Lower Maumee HUC-8

Table 2: Sub-watersheds in the North Turkeyfoot-Maumee River HUC-10

North Turkeyfoot – Maumee River HUC-10 (04100009 04)		
HUC-12	**Area (Square miles)**	**Area (Acres)**
Konzen Ditch (01)	25.21	16,136.78
North Turkeyfoot Creek (02)	50.01	32,006.08
Dry Creek – Maumee River (03)	27.36	17,512.79

(Source: Ohio EPA, 2020a)

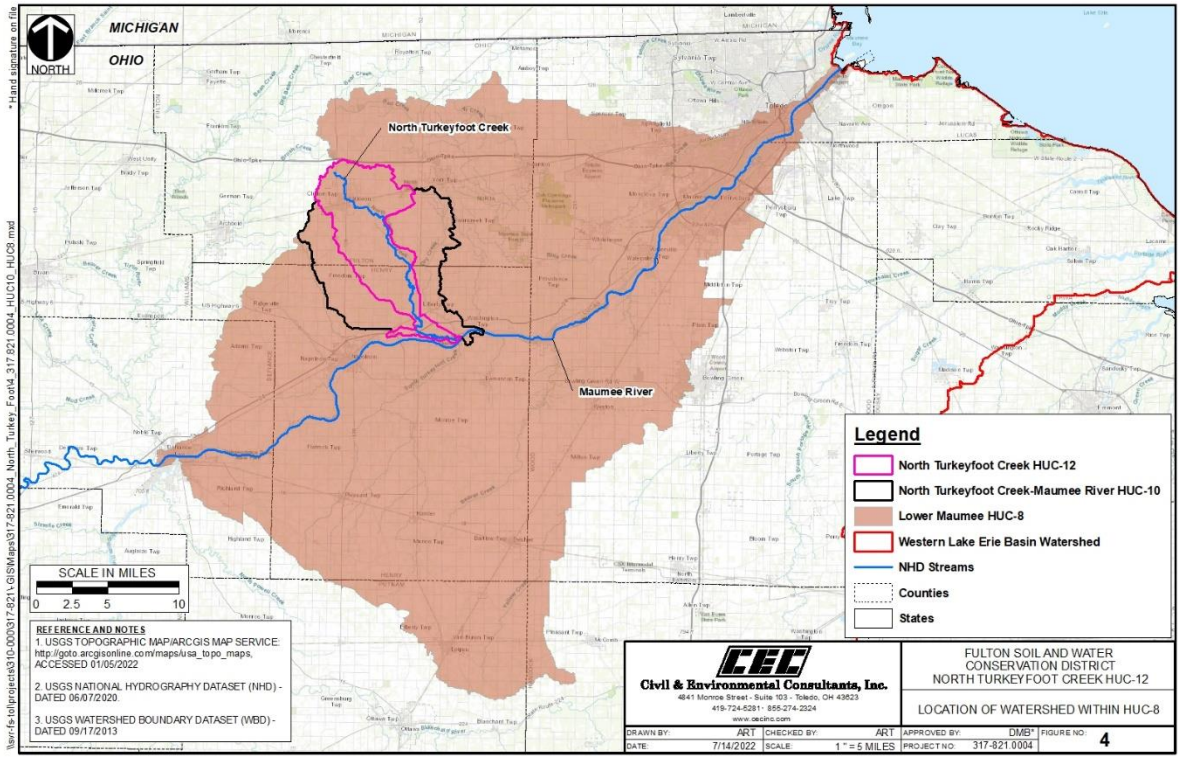

Figure 4: Location of the North Turkeyfoot Creek HUC-12

The Great Black Swamp

Large parts of the Maumee River, Maumee Bay and Lake Erie drainage areas were once covered by the Great Black Swamp, an area approximately 120 miles long by 40 miles wide (Figure 5). This swamp, formed more than 20,000 years ago by retreating glaciers, was dominated by clay-rich soils with low permeability and dense vegetation. The difficulty associated with travel through the dense, swampy, insect-populated terrain left this one of the last areas of Ohio to be developed. In 1859, a law provided for the installation of public ditches, and by 1900, a vast system of ditches had drained the majority of the area to allow crop production on this fertile land. Estimates suggest there are three times as many man-made ditches as there are natural streams (by length) throughout this region. Ditches that do not have adequate buffer space or are in direct contact with farmland provide a means for sediment and nutrient runoff to enter tributaries that flow to Lake Erie. Low permeability soils and a flat landscape result in flooding during average rain events, which accelerates runoff into ditches, resulting in an area that would benefit from floodplain expansion and wetland restoration (Maumee RAP, 2006).

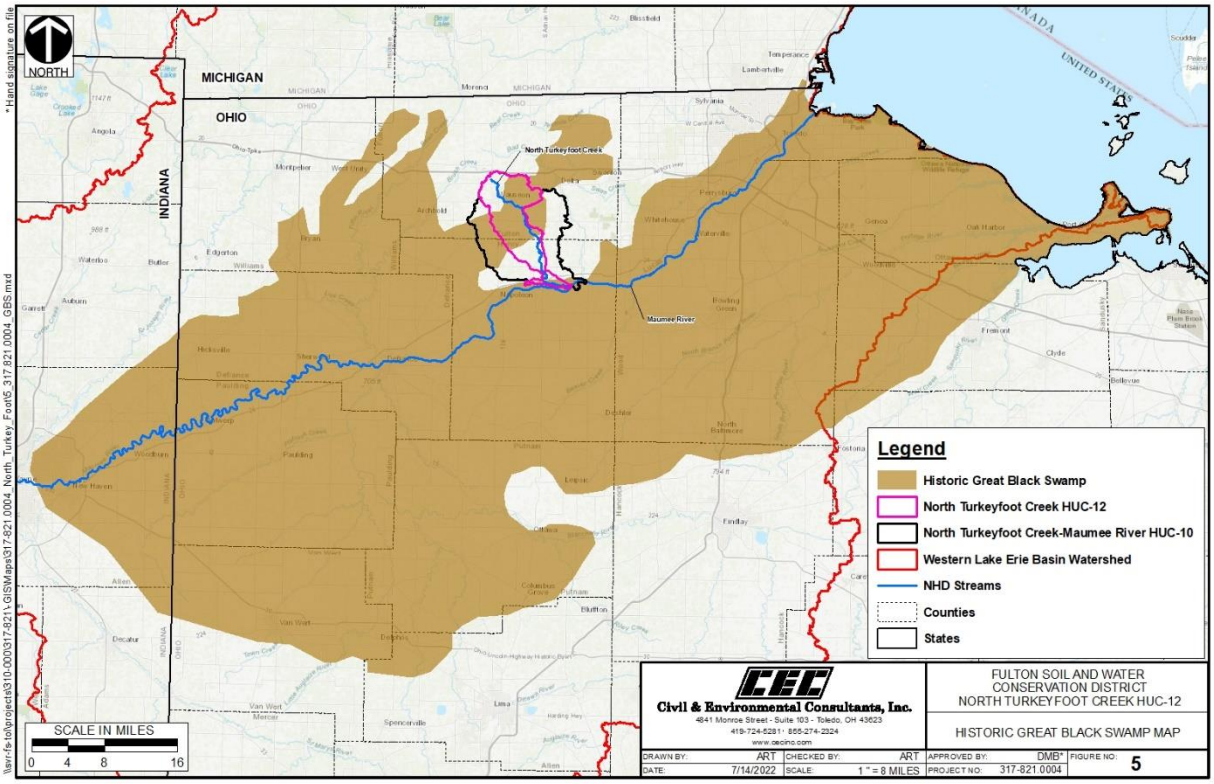

Figure 5: Historic Great Black Swamp

1.3 Public Participation and Involvement

Watershed planning is best accomplished by collaboration and input from a diverse group of entities, including governmental agencies, private businesses, academia, non-profit groups, neighborhood organizations and the public at large. Fulton County agencies, municipal leaders and regional water quality partners often come together to work on various projects throughout the Tiffin River and Lower Maumee watersheds. The Fulton SWCD works to meet the goal of maintaining a quality environment through education and public outreach. The district provides technical assistance, cost-share opportunities, equipment rental and programming to the residents of Fulton County. The Fulton SWCD serves as a vehicle for bringing local governments and residents together to address natural resource conservation challenges.

Chapters 1, 2 and 3 of this NPS-IS were primarily prepared using the *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016, Technical Report AMS/2015-MAUMT-2* (Ohio EPA, 2020b) and the *2020 Ohio Integrated Report* (Ohio EPA, 2020a). Project information for Chapter 4 was compiled by collaborative meetings and phone calls with organizational stakeholders, community partners and local landowners. Organizational input was solicited from stakeholders within the **North Turkeyfoot Creek HUC-12**, such as the Fulton County Engineers Department, Henry SWCD, Village of Wauseon, Natural Resources Conservation Service (NRCS) and the Ohio Department of Natural Resources (ODNR). Landowner input for the plan was solicited through personal contacts with local landowners through the Fulton SWCD staff, partners and supervisors.

CHAPTER 2: HUC-12 WATERSHED CHARACTERIZATION AND ASSESSMENT SUMMARY

2.1 Summary of HUC-12 Watershed Characterization

2.1.1 Physical and Natural Features

The **North Turkeyfoot Creek HUC-12** is a sub-watershed within the greater *North Turkeyfoot Creek-Maumee River HUC-10*. The *North Turkeyfoot Creek-Maumee River HUC-10* is comprised of three HUC-12 watersheds that drain directly to the Maumee River; this document focuses on the #02 hydrologic unit—the **North Turkeyfoot Creek HUC-12**. The largest waterbody in the **North Turkeyfoot Creek HUC-12** is North Turkeyfoot Creek, a 21.6 mile-long[1] stream originating south of the Fulton County Fairgrounds in Wauseon, Ohio. North Turkeyfoot Creek has an average fall of 6 ft/mile, drains an area of 75.22 square miles (48,142.86 acres), which includes drainage from the *Konzen Ditch HUC-12* and meets the Maumee River at RM 37.92 in northeast Henry County, just south of US Route 24 in the North Turkeyfoot Wildlife Area (ODNR, 2001; Ohio EPA, 2020a; Ohio EPA, 2022b). A notable tributary to North Turkeyfoot Creek enters at RM 6.68. This Unnamed Tributary is 12.0 miles long and drains a 10.3 square mile area (Ohio EPA, 2022b; USGS, 2022) . Approximately 88 miles of stream segments flow through the **North Turkeyfoot Creek HUC-12**.

The **North Turkeyfoot Creek HUC-12** is located in the Huron-Erie Lake Plains (HELP) ecoregion. The HELP ecoregion is characterized by a broad and nearly level lake plain, with extensive lacustrine and still-water deposits (Ohio EPA, 2018a). Stream gradients within the HELP ecoregion are typically low, and adjacent lands are typically poorly drained. Settlement in this poorly drained area prompted the necessity for a vast system of drainage networks. Nearly 70% of streams within the HELP ecoregion have been channelized or hydrologically modified to varying degrees for drainage conveyance (Ohio EPA, 2018a). Elm-ash swamp and beech forests were typical in the HELP ecoregion prior to settlement (USEPA, 2013). Today, the ecoregion is characterized by extensive corn, soybean, vegetable, and livestock production.

Stream gradients are low in the HELP Ecoregion

The HELP ecoregion can be classified into five smaller (Level IV) ecoregions with distinct characteristics. The **North Turkeyfoot Creek HUC-12** spans two of these ecoregions (Figure 6). The majority of the sub-watershed lies in the Maumee Lake Plain, a poorly drained region containing clayey lake deposits, water-worked glacial till, and fertile soils. A small portion of the northwestern part of the sub-watershed lies in the Oak Openings ecoregion, an area characterized by low, often wooded, sand dunes, and paleobeach

[1] The *Gazetteer of Streams* (ODNR, 2001) lists North Turkeyfoot Creek with a length of 14.9 miles; however, the *Ohio River Miles Index* (Ohio EPA, 2021b) shows North Turkeyfoot Creek to have a length of approximately 21.6 miles. Biological sampling stations utilize the river mile locations in the *River Mile Index*.

ridges that are situated among broad nearly flat agricultural plains. Streams in these ecoregions are sluggish with low gradients and have high suspended sediment loads that endanger aquatic life (USEPA, undated map). Streams that drain various moraines and beach ridges throughout the ecoregion may also receive cold groundwater inputs, which may help ameliorate negative water chemistry and poor habitat effects (Ohio EPA, 2020b).

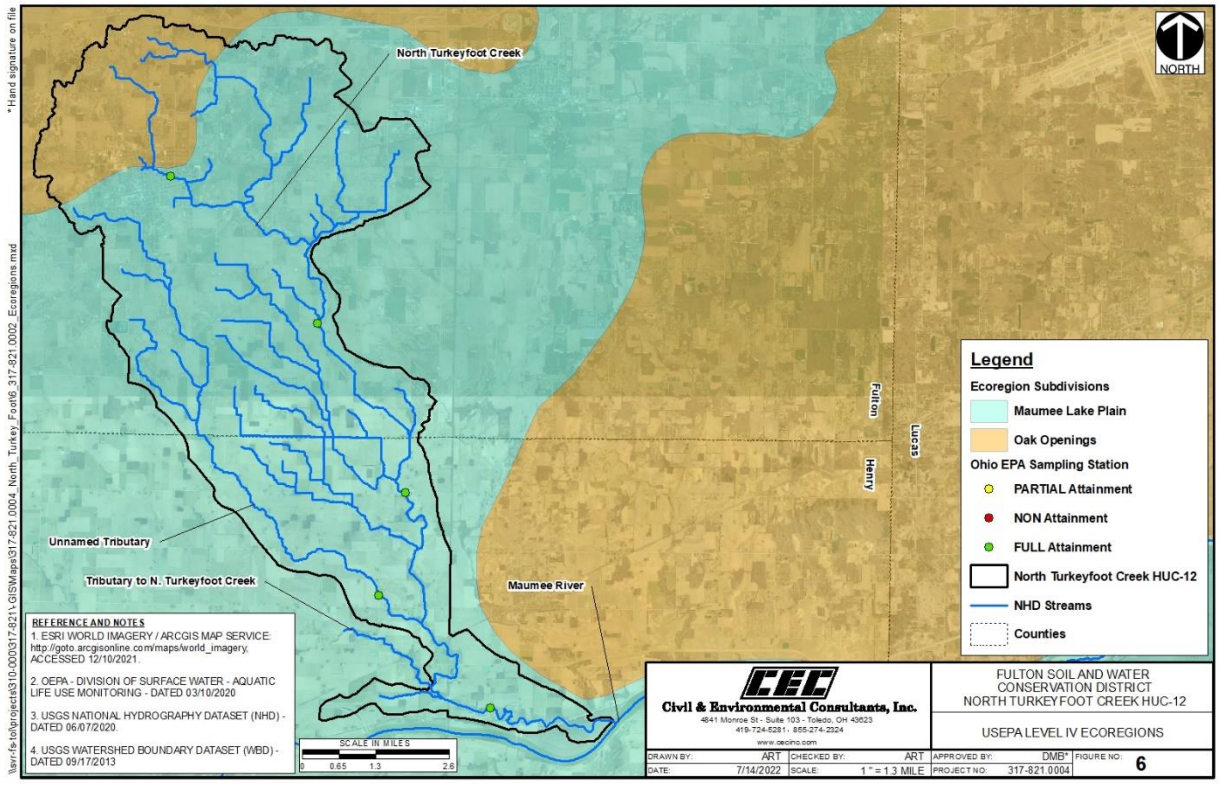

Figure 6: US Level IV Ecoregions

Soils within the **North Turkeyfoot Creek HUC-12** are dominated by fine grained soils, with interspersed pockets of loamy soils (Figure 7). In the Oak Openings area of the watershed the soils tend to be sandier and much better drained. Throughout the sub-watershed, lacustrine soils overlay Devonian limestone and dolomite bedrock in thicknesses ranging between 120 and 210 feet thick (ODNR, 2004; ODNR 2006a). These poorly draining soils were a driving factor for the existence of the Great Black Swamp. Artificial drainage was installed within this swamp to utilize the highly productive land in the watershed for agricultural purposes. The replacement of these ecoregions by productive farmland has contributed to low gradient rivers with high suspended sediment loads endangering biota. Natural wetland areas shown in the US Fish and Wildlife (USFWS) National Wetlands Inventory (NWI) throughout the **North Turkeyfoot Creek HUC-12** today are sparse (Figure 8).

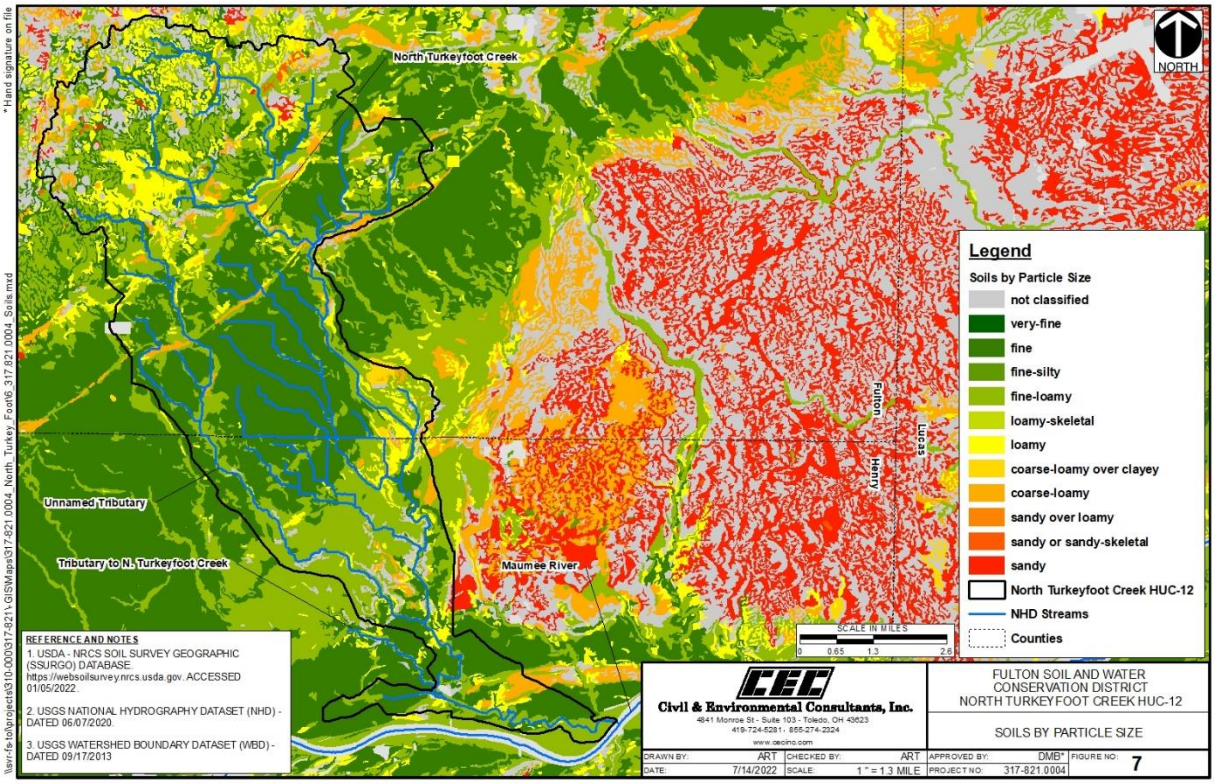

Figure 7: Soils Classified by Particle Size

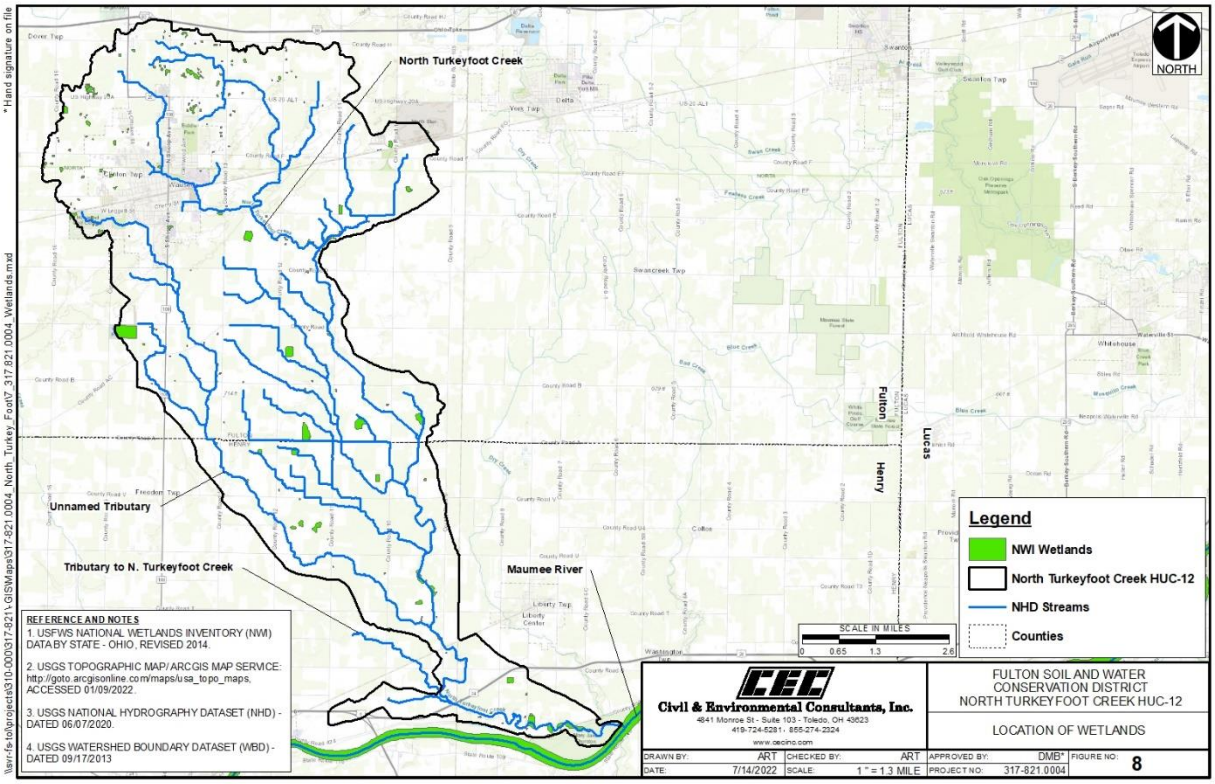

Figure 8: Wetlands in the North Turkeyfoot Creek HUC-12

The largest population concentration in the **North Turkeyfoot Creek HUC-12** is primarily rural except for the city of Wauseon (Figure 9). Wauseon is home to approximately 7,568 people across its 5.35 square mile (3,422 acres) footprint (U.S. Census Bureau, 2020). Approximately 98% of the city is contained within the **North Turkeyfoot Creek HUC-12** boundaries. Wauseon operates its own wastewater treatment plant (WWTP), which began operations in 1989. The WWTP covers more than 11 acres of land and has sufficient capacity to expand to a peak flow of 4.4 million gallons per day (MGD) (Wauseon, 2022). The system is a partially combined system, receiving storm and sanitary flows. Wauseon does not operate under a Municipal Separate Storm Sewer System (MS4). The City's water treatment plant (WTP) is supplied by two aboveground reservoirs that draw water from two area creeks and a raw line from Napoleon that draws water from the Maumee River (Wauseon, 2022). In the event the water from the Maumee River is not suitable for treatment, Wauseon has the ability to send it to Napoleon for treatment.

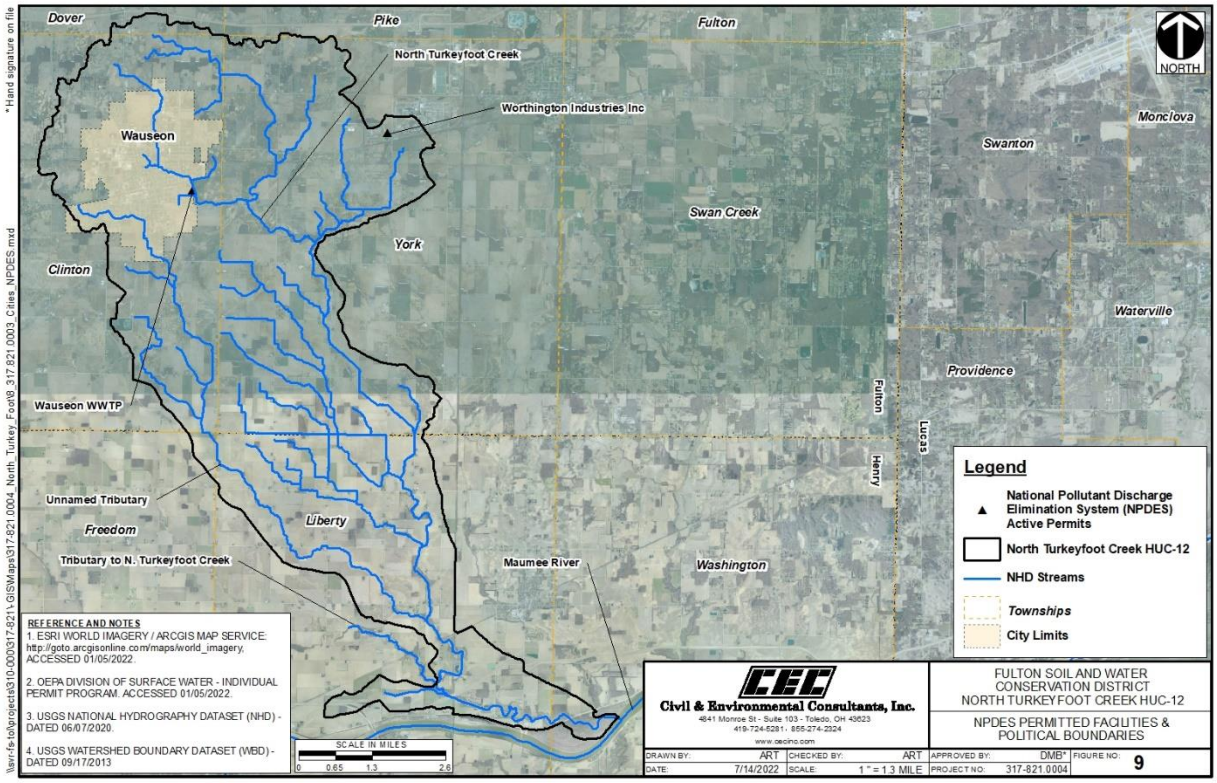

Figure 9: NPDES Permitted Facilities and Political Boundaries in the North Turkeyfoot Creek HUC-12

Currently, there are two National Pollutant Discharge Elimination System (NPDES)-permitted facilities located within the **North Turkeyfoot Creek HUC-12** (Table 3). The USEPA documents NPDES permit compliance through the Enforcement and Compliance History Online (ECHO) database (USEPA, 2022). Results discussed here cover the three-year (12 quarters) compliance history from April 1, 2019 through March 31, 2022. The Wauseon WWTP has had reported effluent exceedances in low level mercury, nitrogen as ammonia (NH_3), dissolved oxygen (DO) and pH. Worthington Industries is located in the southeastern section of the sub-watershed, in an industrial corridor bordered by Delta. Worthington

Industries is a galvanized steel processing facility, which is then used to manufacture automotive parts and materials for construction, including culverts, decking and grain bins (Coehrs, 2016).

Table 3: National Pollutant Discharge Elimination System Permits in the North Turkeyfoot Creek HUC-12

Facility Name	Permit Number	Receiving Waterbody
Wauseon WWTP	2PD0016*LD	North Turkeyfoot Creek
Worthington Industries Inc.	2ID00014*FD	Maumee River

(Source: Ohio EPA, 2022a)

NOTES
WWTP Wastewater Treatment Plant

Within the **North Turkeyfoot Creek HUC-12**, the rural population is estimated to be 3,016 with 1,236 housing units in unsewered areas. In the rural landscape, residences and small businesses use Home Sewage Treatment Systems (HSTS), which are a potential source of NPS pollution for bacteria and nutrients. Studies conducted by the Ohio Department of Health (ODH) across Ohio have shown an average HSTS failure rate of 39% within the WLEB (ODH, 2013). The Toledo Metropolitan Area Council of Governments (TMACOG) conducted a study of locations and densities of HSTS throughout the WLEB in 2018. Within Fulton and Henry Counties, 16 and 9 areas, respectively, were identified as Critical Sewage Areas (CSAs), in which larger-scale efforts should be initiated to address failing HSTS and/or potentially establish sewer service. No CSAs were identified within the **North Turkeyfoot Creek HUC-12**, though total phosphorus and nitrogen loads from HSTS in the **North Turkeyfoot Creek HUC-12** are estimated to be 0.83 metric tons annum (MTA) and 8.09 MTA, respectively, based on mass.

Specific landmarks and features within this watershed include:

- American Winery & American Brewery;
- Berkbile Cemetery;
- Buckeye Estates Mobile Home Court (MHC);
- Floral Farms and Greenhouse;
- Fulton County Health Center;
- Fulton County Sportsman's Club;
- Ironwood Golf Course;
- Westbarre Cemetery;
- Wauseon Reservoir;
- Wauseon High School; and
- Wauseon Primary School.

2.1.2 Land Use and Protection

Land use within the **North Turkeyfoot Creek HUC-12** is fairly homogenous (Figure 10). Approximately 82% of land use is cultivated cropland (Table 4). The 2017 United States Department of Agriculture (USDA) Census of Agriculture lists soybeans as the largest field crop harvested in both Fulton and Henry Counties (≥ 45%), while corn accounts for 35-44% of crops in Fulton County and 25-34% of crops in Henry County. In general, farms are of medium size in Fulton County and Henry Counties, with the average operation covering 250 and 279 acres, respectively (USDA, 2019). While livestock operations do exist in the sub-watershed, estimated counts of animals are generally low and smaller farms are scattered throughout the sub-watershed (Table 5). No large Concentrated Animal Feeding Operations (CAFOs) or Ohio Department of Agriculture (ODA)-permitted Confined Animal Feeding Facilities (CAFFs) are located within the sub-watershed.

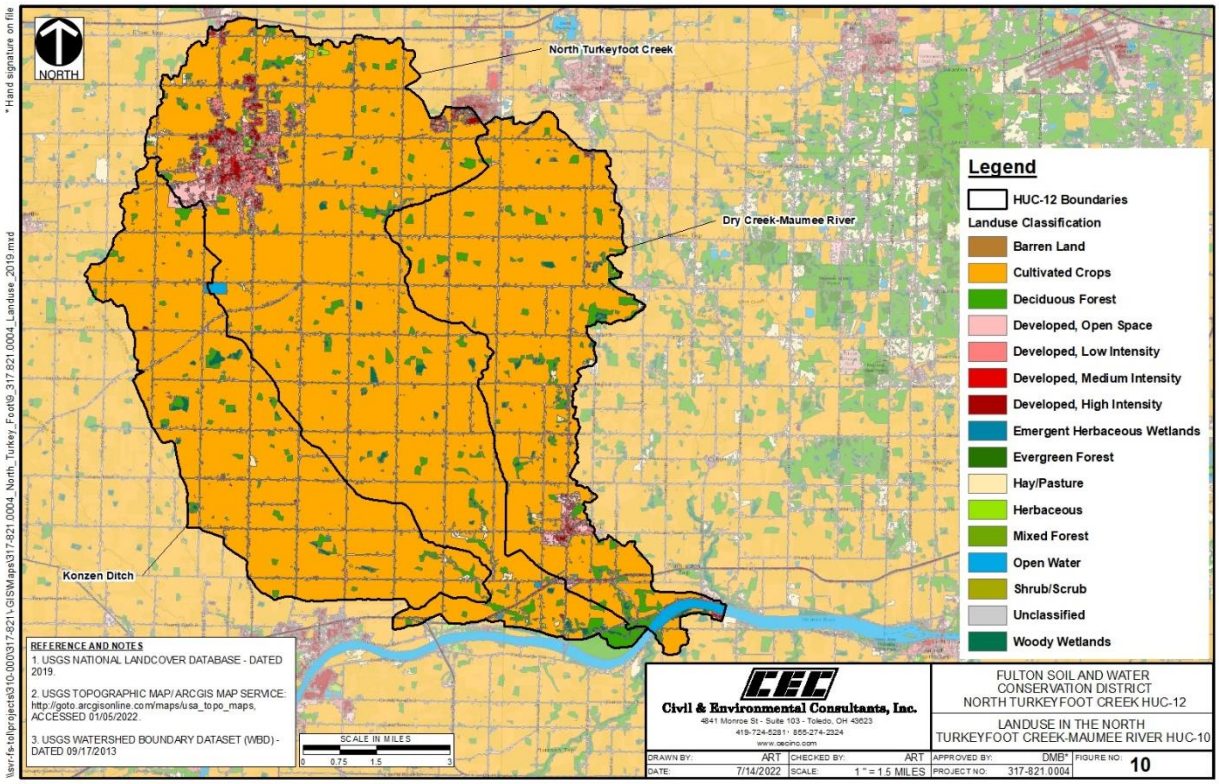

Figure 10: Land Use in the North Turkeyfoot Creek-Maumee River HUC-10

Table 4: Land Use Classifications in the North Turkeyfoot Creek HUC-12

Land Use	North Turkeyfoot Creek HUC-12 (04100009 04 02)		
	Area (mi^2)	Area (acres)	% Watershed Area
Barren Land	0.07	41.61	0.13%
Cultivated Crops	40.86	26,150.59	81.71%
Deciduous Forest	2.00	1,282.64	4.01%
Developed, High Intensity	0.64	407.35	1.27%
Developed, Low Intensity	2.15	1,374.18	4.29%

Land Use	North Turkeyfoot Creek HUC-12 (04100009 04 02)		
	Area (mi^2)	Area (acres)	% Watershed Area
Developed, Medium Intensity	1.23	785.71	2.45%
Developed, Open Space	2.03	1,299.28	4.06%
Emergent Herbaceous Wetlands	0.01	5.59	0.02%
Hay/Pasture	0.29	187.85	0.59%
Herbaceous	0.17	111.55	0.35%
Mixed Forest	0.03	20.48	0.06%
Open Water	0.14	87.65	0.27%
Shrub/Scrub	<0.01	0.22	0.001%
Woody Wetlands	0.39	251.38	0.79%
Total	**50.01**	**32,006.08**	**100.00%**

(Source: Homer et al., 2020)

Table 5: Estimated Animal Counts in the North Turkeyfoot Creek HUC-12

Livestock Type	Animal Units
Beef	1,814
Dairy	162
Swine	2,365
Sheep	56
Horse	24
Chicken	89
Turkey	4
Duck	1

(Source: USDA Census of Agriculture, 2012, as presented in the STEPL Input Data Server (Tetra Tech, 2017))

Only a small portion of lands and parklands are listed for this sub-watershed in the United States Geological Survey's (USGS) Protected Areas Database of the United States (PAD-US) (Figure 11). Two listings are noted within the PAD-US; both are associated with the same land—the North Turkeyfoot Wildlife Area (WA). The WA totals 458 acres of land managed by the ODNR; however, only 183 acres (40%) of the WA is located in the **North Turkeyfoot Creek HUC-12**. A two acre access point sits to the north of the WA. The WA is open for public hunting, fishing, trapping, wildlife watching and hiking (ODNR, 2022b). In early 2022, funding from the H2Ohio Initiative facilitated the acquisition of an additional 86 acres of forested bottomland wetland to the WA. This new tract of land lies to the north of the current property (ODNR, 2022a). While not listed in the PAD-US, the City of Wauseon operates several recreational parks and facilities (Table 6).

Table 6: City of Wauseon Parks

Name	Acres	Amenities
Depot Park	4	Historic depot building, restored rail car, playground, horseshoe pits
Dorothy Biddle Park	72	Eight baseball diamonds, two batting cages three basketball courts, three volleyball courts, nine soccer fields
Homecoming Park	36	Gazebo, playground, running track, sledding hill, covered picnic and pavilion, soccer field

Name	Acres	Amenities
North Park	3	Playground, half-court basketball, grills
Reighard Park	21	Three shelter houses, tennis facility, basketball court, volleyball court
Rotary Park	4	Fishing pond, shelter house, grill pit, Goodwin Preserve-wooded walking path, playground
South Park	2	Gazebo, two lighted basketball courts, playground
Wabash Park	5	Skate park, half-court basketball, playground, connection to the Cannonball Trail

(Source: Wauseon Downtown Association, 2022)

These protected lands within the **North Turkeyfoot Creek HUC-12** may provide critical habitat for the four threatened or endangered species listed for Fulton and Henry Counties by the USFWS (Table 7). The Henry County portion of North Turkeyfoot Creek is listed as a Group 1 stream in Appendix A of the *Ohio Mussel Survey Protocol*, indicating that it is a small to mid-sized stream, but no Federally Listed Species (FLS) of mussels are expected to be found (ODNR, 2022c).

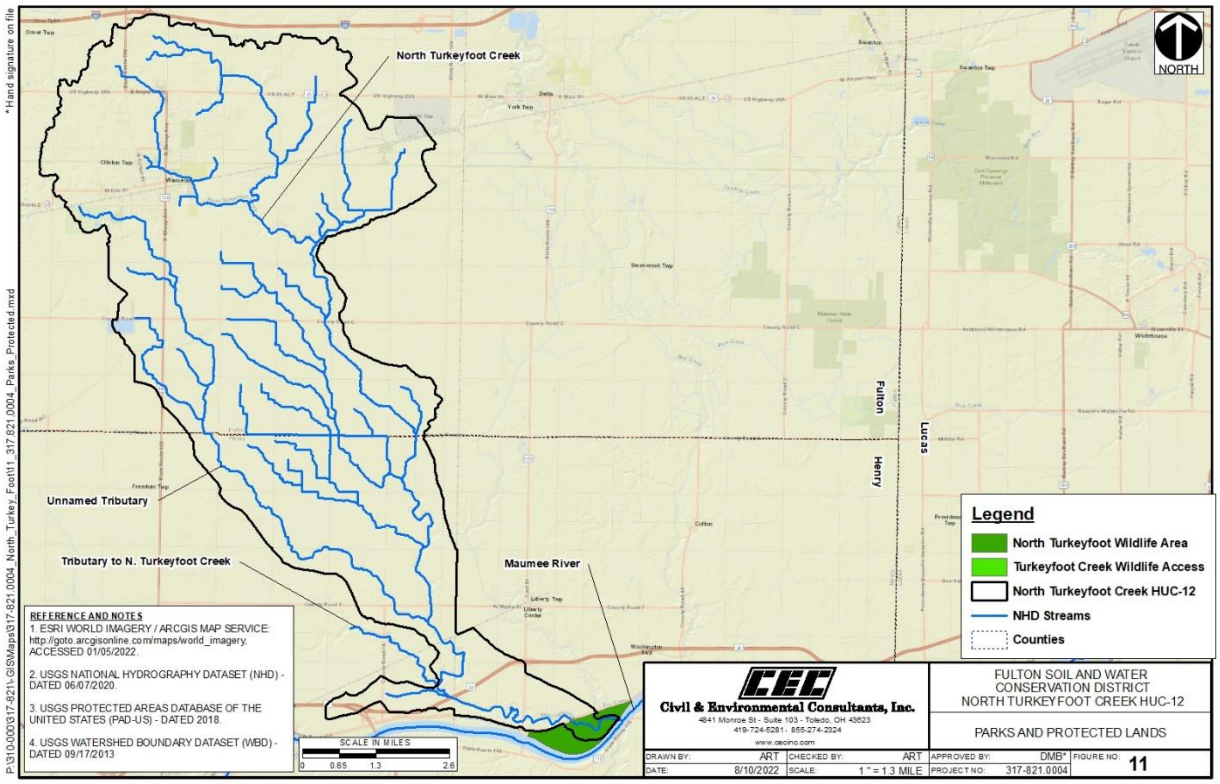

Figure 11: Parks and Protected Lands

Table 7: Threatened and Endangered Species in Fulton and Henry Counties

Species	Status	Habitat Characteristics
Clubshell* (*Pleurobema clava)*	Endangered	Found in clean, coarse sand and gravel in runs, often just downstream of a riffle
Indiana bat *(Myotis sodalis)*	Endangered	Hibernates in caves and mines and forages in small stream corridors with well-developed riparian woods, as well as upland forests
Northern long-eared bat *(Myotis septentrionalis)*	Threatened	Hibernates in caves and mines and swarms in surrounding wooded areas in autumn; roosts and forages in upland forests during late spring and summer

Species	Status	Habitat Characteristics
Rayed Bean (*Villosa fabalis*)	Endangered	Mostly found in smaller, headwater creeks, but sometimes in large rivers

(Source: USFWS, 2018)

NOTES
** Listed only in Henry County*

Most land within the **North Turkeyfoot Creek HUC-12** is privately owned; therefore, knowledge of conservation practices may be limited. Some conservation practices, such as the use of conservation tillage, can be estimated from remote sensing techniques used within the Operational Tillage Information System (OpTIS). From 2014-2018, OpTIS estimated an average of 34.5% of crop fields in the Lower Maumee HUC-8 watershed were under no-till conditions, 53.8% were under some form of reduced tillage and 11.8% were under traditional tillage regimes (Dagan, 2019). OpTIS also estimated average cover crop usage across the Lower Maumee watershed to be 9.1% of fields employing a winter commodity crop, while 2.0% employing a winter cover crop over the same five-year period.

According to summary data provided by the Ohio EPA regarding the use of the Environmental Quality Incentives Program (EQIP) within the **North Turkeyfoot Creek HUC-12,** 25 conservation practices were certified between November 21, 2017 and mid-2019 (Table 8). In total, agricultural best management practices (BMPs) were employed on over 907 acres and several structures related to animal/manure management were installed in the Fulton County portion of the sub-watershed. Additional data provided by the Farm Service Agency (FSA) on current contracts within Fulton and Henry Counties are found in Table 9.

Table 8: Environmental Quality Incentives Program Practices Within the North Turkeyfoot Creek HUC-12

Practice	Number of Contracts	Acreage/Number Certified
Cover Crops	5	258.3 acres
Residue and Tillage Management, No-Till	12	547.1 acres
Conservation Crop Rotation	2	100.7 acres
Conservation Cover	1	1 acre
Roofs and Covers	1	1 structure
Access Road	1	210 linear feet
Roof Runoff Structure	1	1 structure
Heavy Use Protection Area	1	800 square feet

(Source: USDA-NRCS, 2018)

Table 9: Conservation Reserve Program (CRP) Contract Acreage in Fulton and Henry Counties

Practice	Acres*	
	Fulton	Henry
Establishment of Permanent Introduced Grasses and Legumes	55.37	6.45
Vegetative Cover – Grass – Already Established	22.10	--
Wildlife Food Plot	6.84	--
Establishment of Permanent Vegetative Cover	--	1.40
Establishment of Permanent Native Grasses	194.98	9.44
Filter Strips	989.89	1,735.64

Riparian Buffer	171.78	57.68
Wetland Restoration	424.25	49.95
Wetland Restoration, Non-Floodplain	84.18	11.20
Rare and Declining Habitat	415.96	328.86
Marginal Pastureland and Wildlife Habitat Buffer	--	9.70
Tree Planting	19.40	--
SAFE Projects for Trees: Rare and Declining Habitat, Primarily Trees	12.30	--
SAFE Projects for Grasses, Native Grasses and Legumes	50.94	--
Upland Habitat Buffers	81.78	343.21
Wildlife Habitat for Pheasants	122.32	2.69
Hardwood Tree Planting	40.69	21.86
Pollinator Habitat	21.47	17.09
Permanent Wildlife Habitat (Corridors) – Noneasement	9.70	--
Permanent Wildlife Habitat – Noneasement	62.44	29.51
Field Windbreak Establishment – Noneasement	189.83	168.32
Grassland Wildlife Plan	4.00	--
Grass Waterways – Noneasement	34.82	19.12

(Source: USDA-NRCS, 2018)

NOTES
**Acres reported at the county level and may not necessarily fall within the Lower Maumee watershed boundaries.*
SAFE State Acres for Wildlife Enhancement

The Fulton SWCD is also an active administrator of the H2Ohio Initiative, a water quality initiative with a focus on phosphorus reduction, particularly within the WLEB. This program provides economic incentives to producers who develop voluntary nutrient management plans (VNMPs) for their fields and implement effective and cost-efficient BMPs that include: soil testing, variable rate technology (VRT) fertilization, subsurface nutrient application, manure incorporation, conservation crop rotation, cover crops, drainage water management structures, two-stage ditch construction, edge of field buffers and headwaters and coastal wetlands that reduce agricultural runoff (H2Ohio, 2019). Enrollment within the **North Turkeyfoot Creek HUC-12** for the 2021 crop year includes over 3,095 acres (*personal communication with Hannah Boger (Herr), District Technician on February 17, 2022)*. The Henry SWCD is also an active administrator of the H2Ohio Initiative and was recognized for leadership and promotion of the program in 2022 by receiving the H2Ohio Lifetime Conservation Advocate Award (Baumgartner, 2022).

2.2 Summary of HUC-12 Biological Trends

Ohio EPA sampled the **North Turkeyfoot Creek HUC-12** in 2015, as documented in the *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016, Technical Report AMS/2015-MAUMT-2* (Ohio EPA, 2020b). This report serves as the Technical Support Document (TSD) for the Total Maximum Daily Loads (TMDL) study for select tributaries (those in the Upper Maumee HUC-8 and upper section of the Lower Maumee HUC-8) to the Maumee River, which is still under agency preparation. All sample sites of this assessment unit were verified to be WWH segments.

A summary of the sample locations and their biological status in the **North Turkeyfoot Creek HUC-12** is provided in Table 10. For reference, water quality standards (WQS) for the HELP ecoregion are presented in Table 11.

Table 10: Biological Indices Scores for Sites in North Turkeyfoot Creek HUC-12

North Turkeyfoot Creek HUC-12 (04100009 04 02)							
River Mile	**Drainage Area (mi^2)**	**IBI**	**MIwb[a]**	**ICI[b]**	**QHEI**	**Attainment Status**	**Location**
North Turkeyfoot Creek (WWH)							
19.06[H]	4.50	36	N/A	34	44.50	Full	Reighard Park
17.85[H]	5.80	50	N/A	42	50.00	Full - Threatened	County Road 13
13.79[H]	19.60	41	N/A	40	66.25	Full	County Road C
9.67[W]	31.00	34	8.70	46	52.00	Full	County Road V
3.40[W]	73.00	37	9.16	42	54.00	Full	County Road 8
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)							
1.02[H]	9.94	40	N/A	MG[ns]	31.00	Full	County Road 10

(Source: Ohio EPA, 2020a; Ohio EPA, 2020b)

NOTES
IBI Index of Biotic Integrity
a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).
ICI Invertebrate Community Index
b Narrative evaluation used in lieu of ICI (G=Good; MG=Marginally Good; H Fair =High Fair; F=Fair; L Fair=Low Fair; P=Poor; VP=Very Poor).
QHEI Qualitative Habitat Evaluation Index
** Significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the poor to very poor range.*
ns Nonsignificant departure form biocriteria (≤4 IBI or ICI units or ≤0.5 MIwb units)
H Headwater sample
W Wading sample
N/A Not applicable
Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

Table 11: Water Quality Standards for the Huron-Erie Lake Plains Ecoregion

HELP Ecoregion	WWH WQS			MWH WQS		
	Headwater	**Wading**	**Boat**	**Headwater**	**Wading**	**Boat**
IBI	28	32	34	20	22	20
MIwb	N/A	7.3	8.6	N/A	5.6	5.7
ICI	34	34	34	22	22	22
QHEI[a]	55	60	60	43.5	43.5	43.5

(Source: Ohio EPA, 2013)

NOTES
WWH Warmwater Habitat
MWH Modified Warmwater Habitat
WQS Water Quality Standards
a QHEI is not criteria included in Ohio WQS; however, it has been shown to be highly correlated with the health of aquatic communities. In general, sites scoring 60 or above (or above 55 for headwater sites)

support healthy aquatic assemblages indicative of WWH (Ohio EPA, 2013). Sites scoring 75 or above support Exceptional Warmwater Habitat assemblages (Ohio EPA, 1999).

N/A MIwb not applicable to headwaters sampling locations with drainage areas ≤ 20 mi^2.

Fishes (Modified Index of Well-Being (MIwb] & Index of Biotic Integrity [IBI])

Fish communities were evaluated at five locations in North Turkeyfoot Creek and one location in the unnamed tributary to North Turkeyfoot Creek at RM 6.68. Communities at all locations achieved applicable fish biocriteria for the HELP ecoregion and have shown slight improved performance over sampling conducted in 1997; although the increase in performance is attributed to basin-wide recovery realized from diminished silt load to streams through the implementation of modern tillage practices (Ohio EPA, 2020b). Habitat stressors in North Turkeyfoot Creek include reduced riparian shading and simplified habitat due to channelization. These stressors, combined with inputs from the Wauseon WWTP, which dominates stream baseflow during low-flow conditions, contributes to nutrient enrichment that could potentially threaten attainment in the stream.

Generally, fish performance was slightly higher in the headwater sampling locations of North Turkeyfoot Creek in comparison to the wading sampling locations in the lower ten miles of the stream. Fish performance at RM 17.85 was anomalous compared with communities throughout North Turkeyfoot Creek, facilitated by over-enriched conditions that attracted stoneroller minnows that feed almost exclusively on algae and detritus (Ohio EPA, 202b). Pollution tolerant species were found throughout the entirety of North Turkeyfoot Creek and constituted the predominant species at each sampling location, which was similar to sampling results in 1997. Logperch and greenside darters, both sensitive species, were absent from North Turkeyfoot Creek in 1997 but were found at nearly every sampling location in 2015. In 2015, the first records of golden redhorse and shorthead redhorse (sensitive, simple lithophilic round bodied suckers) were collected from RM 3.40 (Ohio EPA, 2020b).

Macroinvertebrates (Invertebrate Community Index [ICI])

Overall trends in macroinvertebrate community performance were mixed. North Turkeyfoot Creek was one of nine streams sampled in 2015 to display elevated enrichment signatures, but of these nine, was the only stream to display declines in biological performance relative to sampling conducted in 1997 (Ohio EPA, 2020b). Community performance has improved in the upper segment of the stream above the Wauseon WWTP; however, ICI scores in the lower 16 miles of the stream have declined an average of 10 points over 18 years. These decreases appear to be related more to far-field nutrient impacts rather than near-field, poorly treated effluent (Ohio EPA, 2020b).

Despite declining community trends, *Ephemeroptera, Plecoptera* and *Trichoptera* (EPT) taxa and sensitive taxa were observed at every location. The numbers of these species observed increased along a downstream gradient substantially, ranging from eight EPT in the upper reach to 16 in the most downstream location and one sensitive taxa in the upper reach to 16 sensitive taxa at RM 3.40.

Habitat (via Qualitative Habitat Evaluation Index [QHEI])

Ohio EPA sampling crews documented various water quality and habitat attributes during the QHEI assessment during the summer of 2015 (Table 12). With the exception of RM 13.8 in North Turkeyfoot Creek, no sampling location reached QHEI thresholds for WWH designated streams. Despite lower habitat scores, WWH communities were still supported in North Turkeyfoot Creek and its unnamed tributary.

Table 12: QHEI Matrix with WWH and MWH Attribute Totals for Sites in the North Turkeyfoot Creek HUC-12

North Turkeyfoot Creek HUC-12 (04100009 04 02)																																		
Key QHEI Components			**WWH Attributes**											**MWH Attributes**																				
														High Influence						**Moderate Influence**														
River Mile	**QHEI Score**	**Gradient (ft/mi)**	**Not Channelized or Recovered**	**Boulder/Cobble/Gravel Substrate**	**Silt Free Substrates**	**Good/Excellent Development**	**Moderate/High Sinuosity**	**Extensive/Moderate Cover**	**Fast Current/Eddies**	**Low/Normal Embeddedness**	**Max Depth >40 cm**	**Low/Normal Embeddedness**	**WWH Attributes**	**Channelized/No Recovery**	**Silt/Muck Substrates**	**No Sinuosity**	**Sparse/No Cover**	**Max Depth <40 cm**	**High Influence Modified Attributes**	**Recovering Channel**	**Heavy/Moderate Silt Cover**	**Sand Substrate (Boat)**	**Hardpan Substrate Origin**	**Fair/Poor Development**	**Low Sinuosity**	**Only 1 or 2 Cover Types**	**Intermediate/Poor Pools**	**No Fast Current**	**High/Moderate Embeddedness**	**High/Moderate Riffle Embeddedness**	**No Riffle**	**Moderate Influence MWH Attributes**
North Turkeyfoot Creek (WWH)																																		
19.06[H]	44.5	8.00		•							•		**2**				•		**1**	•	•			•	•		•	•	•	•		**8**
1785[H]	50.0	11.43		•		•		•	•		•		**5**	•			•		**2**	•	•			•	•		•		•	•		**7**
13.79[H]	66.3	4.62	•	•		•	•	•			•		**6**						**0**		•			•				•	•	•		**5**
9.67[W]	52.0	6.33		•				•			•		**3**	•			•		**2**	•	•			•	•			•	•	•		**7**
3.40[W]	54.0	2.04	•	•			•	•			•		**5**						**0**	•	•			•	•			•	•	•		**7**
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)																																		
1.02[H]	31.0	6.67											**0**		•		•	•	**3**	•	•			•	•	•		•	•		•	**8**

(Source: Ohio EPA, 2020b)

NOTES
QHEI Qualitative Habitat Evaluation Index
WWH Warmwater Habitat
MWH Modified Warmwater Habitat
H Headwater site
W Wading site
Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

Generally, streams that have QHEI scores of at least 60 are capable of supporting WWH assemblages (55 for headwaters locations). Strong correlations exist between habitat attributes and a stream's ability to support healthy aquatic assemblages (Ohio EPA, 1999). The presence of certain attributes are shown to

have a larger negative impact on fish and macroinvertebrate communities. Streams designated as WWH should exhibit no more than four total Modified Warmwater Habitat (MWH) attributes; additionally, no more than one of those four should be of high-influence (Ohio EPA, 2013). Despite the overall adequate performance of fish and macroinvertebrate communities in North Turkeyfoot Creek and its unnamed tributary, no sampling location met this habitat criteria. The number of total MWH attributes ranged from 5-11, with most sites exhibiting at least one high-influence MWH attribute.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

As listed in the 2020 *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016,* four biological sampling sites in North Turkeyfoot Creek and one sampling site in an unnamed tributary are reaching attainment of the WWH designation (Table 13). One sampling site in North Turkeyfoot Creek is in *Full Attainment* of the WWH designation; however, this location has been identified as *Threatened* due to nutrient enrichment attributed to row crop agriculture and municipal point source input.

Loss of sediments from the surrounding landscape may also imply loss of nutrients, as a fraction of these nutrients introduced to the landscape through fertilization techniques and other sources bind to soil particles. As soil particles are lost to local waterways, additional nutrients can become available for microorganism uptake, and in situations where nutrients concentrate and are overabundant, eutrophication occurs and drives HAB formation. This can occur both in-stream as well as in far-field, receiving waterbodies, such as Lake Erie. Ohio EPA has estimated spring phosphorus loadings from individual sub-watersheds throughout the greater WLEB watershed. These estimates also include a breakdown of estimated loads from contributing sources of NPS pollutants, such as agricultural lands/activities, developed/urban lands, failing HSTS and natural sources (Table 14). Efforts to reduce nutrients from each of these contributing sources will focus on reaching the 40% reduction goal outlined by Annex 4 of the GLWQA and the Ohio DAP.

Table 13: Sampling Locations in the North Turkeyfoot Creek HUC-12

North Turkeyfoot Creek HUC-12 (04100009 04 02)				
River Mile	**Primary Cause(s)**	**Primary Source(s)**	**Attainment Status**	**Location**
North Turkeyfoot Creek (WWH)				
19.06[H]	--	--	Full	Reighard Park
17.85[H]	Nutrient enrichment	Row crop agriculture; municipal point source	Full - Threatened	County Road 13
13.79[H]	--	--	Full	County Road C
9.67[W]	--	--	Full	County Road V
3.40[W]	--	--	Full	County Road 8
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)				
1.02[H]	--	--	Full	County Road 10

(Source: Ohio EPA, 2020b)

NOTES
W Wading sample

H Headwater sample

Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

Table 14: Estimated Spring Total Phosphorus Loadings from Contributing NPS Sources in the North Turkeyfoot Creek HUC-12

	Agricultural Load (lbs)	Developed/Urban Load (lbs)	Natural Load (lbs)	HSTS Load (lbs)	NPS Total (lbs)
Current Estimates*	21,000	1,400	130	760	23,000
Target Loadings	13,000	840	80	460	14,000

(Source: OLEC, 2020)

NOTES

**Estimated using two significant figures*

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

Assessment data from the 2015 sampling event and data referenced in the 2020 *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016, Technical Report AMS/2015-MAUMT-2* and the *2020 Integrated Report* were used in the development of this NPS-IS (Ohio EPA, 2020b; Ohio EPA, 2020a). Any additional documents and/or studies created by outside organizations that were used as supplemental information to develop this NPS-IS are referenced in Chapter 5 (Works Cited), as appropriate.

CHAPTER 3: CRITICAL AREA CONDITIONS & RESTORATION STRATEGIES

3.1 Overview of Critical Areas

Overall, five sampling sites are located in North Turkeyfoot Creek and one sampling site is located within an unnamed tributary to North Turkeyfoot Creek in the **North Turkeyfoot Creek HUC-12**. All locations are in *Full Attainment* of the WWH designation; however attainment at RM 17.9 has been identified as *Threatened.* Despite the sub-watershed's *Full Attainment* status, improvements are important for the continued maintenance of water quality standards and for the reduction of nutrient loss to far-field waterbodies. Excessive nutrient loss may be decreased by the implementation of agricultural BMPs that manage surface flow and stabilize soil loss from row crop fields. In addition, BMP implementation that reduces soil loss also simultaneously helps reduce nutrient loss, as nutrients are adsorbed to soil particulates. In the **North Turkeyfoot Creek HUC-12**, enrichment signatures have been identified in North Turkeyfoot Creek, and the Wauseon Reservoir has been put on a watch list due to high in-stream nitrate-nitrite levels in North Turkeyfoot Creek near the back-up intakes.

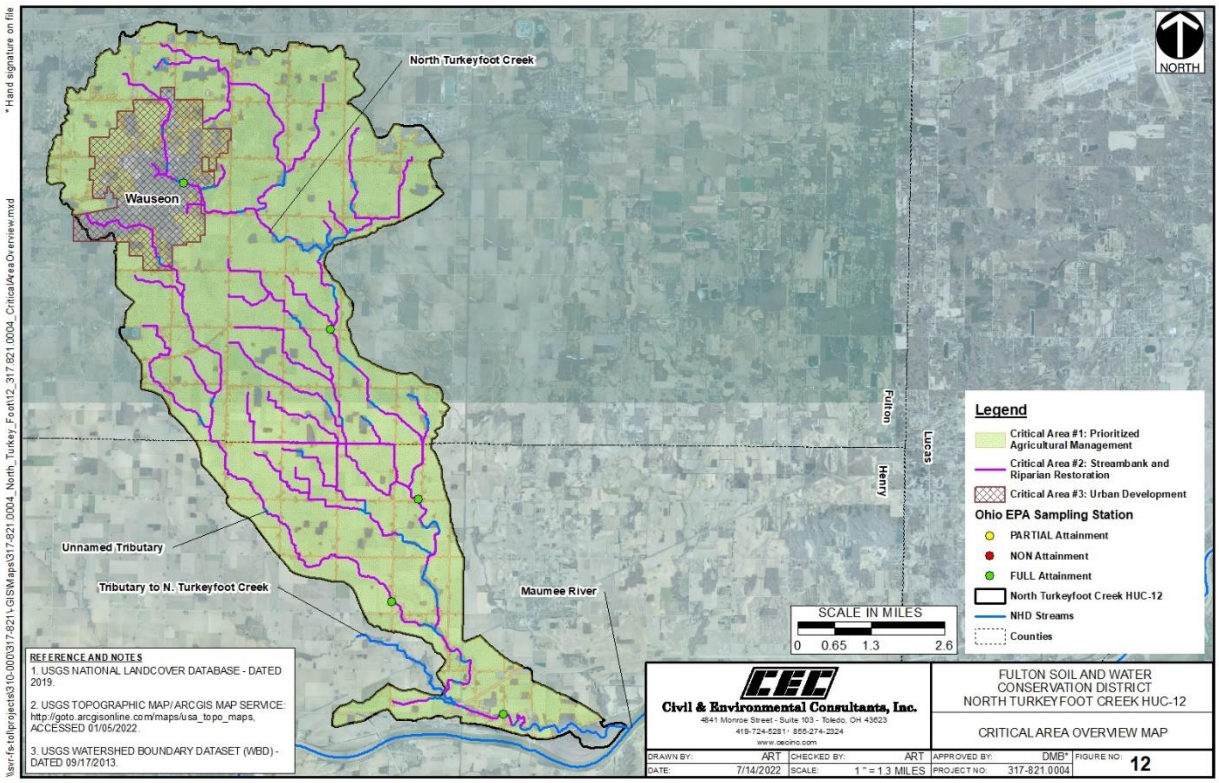

Figure 12: North Turkeyfoot Creek HUC-12 Critical Area Overview[2]

Three critical areas have been identified within the **North Turkeyfoot Creek HUC-12** (Figure 12). Two critical areas will address far-field effects of nutrients in Lake Erie, the end receiving waterbody of drainage from the **North Turkeyfoot Creek HUC-12** (Table 15). However, many BMP implementation

[2] Critical area maps developed with the most recently available digital geographic data and may not reflect current land use or existing conditions that have changed since digital publication.

activities nested within this watershed also simultaneously benefit near-field effects in North Turkeyfoot Creek and its tributaries through sediment reduction. Because many of these BMPs offer dual benefits of nutrient and sediment reduction and agricultural land prioritization is not substantially different for nutrient and sediment reduction within this sub-watershed, only one critical area is identified to address impacts from agricultural lands. One critical area has been developed to address near-field impairment for siltation. It is expected that projects developed for this critical area will also contribute to far-field benefits in sediment and nutrient reduction. Additional critical areas may be developed in subsequent versions of this NPS-IS.

Table 15: North Turkeyfoot Creek HUC-12 Critical Area Descriptions

Critical Area Number	Critical Area Description	Impairments Addressed
1	Nutrient Reduction in Prioritized Agricultural Lands	Far-field (Lake Erie), with near-field benefits
2	Streambank and Riparian Restoration	Near-field
3	Urban Nutrient Reduction	Far-field (Lake Erie), with near-field benefits

3.2 Critical Area #1: Conditions, Goals & Objectives for Nutrient Reduction in Prioritized Agricultural Lands

3.2.1 Detailed Characterization

Ohio's *Nutrient Mass Balance Study* (Ohio EPA, 2020d) estimated 90% of the nutrient loadings to Lake Erie via the Maumee River were primarily from nonpoint sources, related to land use activities, with only small contributions from failing HSTS and NPDES-permitted facilities. This estimate is consistent with several other studies. Given the dominance of agricultural land use throughout the greater WLEB watershed, the use of BMPs is recommended for agricultural operations to minimize nutrient and associated sediment loss to local waterways and drainage ditches through surface and tile flow.

While BMPs are encouraged on all agricultural lands, certain lands are more prone to nutrient loss than others and are prioritized for BMP implementation. Lands maintained under conventional agricultural production or managed as pasture are prone to contribute excessive sediment and nutrient loadings to adjacent waterways that eventually flow to the WLEB. Lands that are proximal to streams and ditches or do not currently implement specific BMPs are most vulnerable to excessive nutrient and sediment loss, and these lands are also prioritized as critical within this watershed. *Critical Area #1* contains prioritized agricultural lands throughout the **North Turkeyfoot Creek HUC-12** (Figure 13).

Of the 26,302 agricultural acres in the **North Turkeyfoot Creek HUC-12**, prioritized lands are operations that meet one or more of the following criteria:

- Lands directly adjacent to streams or drainage waterways;
- Lands with recurrent gully erosion;
- Lands with uncontrolled or unfiltered subsurface drainage water;

- Lands without a current (<3 years) nutrient management plan or soil test; or,
- Lands with high soil phosphorus levels (>40 ppm Mehlich).

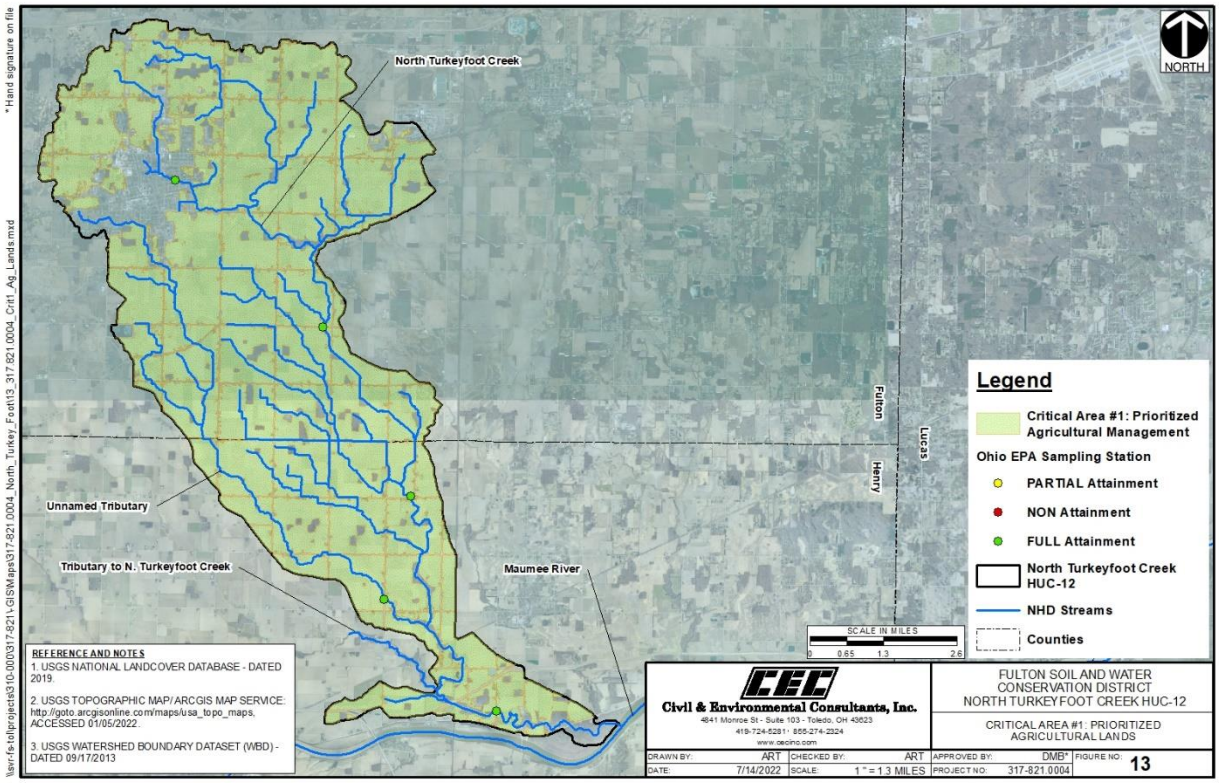

Figure 13: North Turkeyfoot Creek HUC-12 Critical Area #1

3.2.2 Detailed Biological Conditions

Fish community data for the six sampling locations within the **North Turkeyfoot Creek HUC-12** are summarized below (Table 16). Analysis of the abundance, diversity and pollution tolerance of existing fish species found by Ohio EPA at each sampling location, in relation to the corresponding QHEI score, aids in the identification of causes and sources of impairment. Substantial change in community performance over historical sampling was not observed, and fish communities at all locations achieved applicable fish biocriteria (Ohio EPA, 2020b). Pollution tolerant species, such as bluntnose minnow and creek chub were dominant at all sampling locations, though the presence of sensitive species has increased substantially over time. Logperch and greenside darters, both sensitive species, were absent from North Turkeyfoot Creek in 1997 but were found at nearly every sampling location in 2015. In 2015, the first records of golden redhorse and shorthead redhorse (sensitive, simple lithophilic round bodied suckers) were collected from RM 3.4 (Ohio EPA, 2020b). Despite healthy fish assemblages, excessive siltation, simplified habitat and lack of riparian shading are documented habitat stressors throughout the sub-watershed.

Table 16: Critical Area #1 – Fish Community and Habitat Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
North Turkeyfoot Creek (WWH)							
19.06[H]	4.50	15	44.50	36	N/A	Creek chub (34%), common shiner (17%), bluntnose minnow (13%)	Marginally Good
17.85[H]	5.80	21	50.00	50	N/A	Central stoneroller (48%), bluntnose minnow (12%), common shiner (12%)	Exceptional
13.79[H]	19.60	22	66.25	41	N/A	Bluntnose minnow (26%), common shiner (15%), central stoneroller (12%)	Good
9.67[W]	31.0	17	52.00	34	8.70	Bluntnose minnow (31%), central stoneroller (18%), common shiner (13%)	Marginally Good – Good
3.40[W]	73.0	30	54.00	37	9.16	Bluntnose minnow (36%), sand shiner (28%), spotfin shiner (7%)	Marginally Good – Very Good
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)							
1.02[H]	9.94	17	31.00	40	N/A	Bluntnose minnow (28%), blackstripe topminnow (16%), central stoneroller (14%)	Good

(Source: Ohio EPA, 2020b)

NOTES
IBI Index of Biotic Integrity
a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).
QHEI Qualitative Habitat Evaluation Index
** Significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the poor to very poor range.*
H Headwater sample
W Wading sample
Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

Characteristics of the aquatic macroinvertebrate community for the **North Turkeyfoot Creek HUC-12** sampling locations in *Critical Area #1* are summarized below (Table 17). Analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at these sampling locations, related to QHEI scores, can aid in the identification of causes and sources of impairment. Macroinvertebrate communities within North Turkeyfoot Creek and the unnamed tributary met HELP WWH expectations; however, macroinvertebrate community performance has shown a substantial decrease over time. Nutrient enrichment indicators, along with habitat stressors, may threaten the maintenance of WQS within the sub-watershed. All sampling locations exhibited heavy/moderate silt cover and high overall and riffle embeddedness. Poor substrate conditions, exacerbated by poor water chemistry, may continue to negatively impact these communities.

Table 17: Critical Area #1 – Macroinvertebrate Community Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species (Tolerance Categories)**
North Turkeyfoot Creek (WWH)			
19.06[H]	34 – Good 1 sensitive taxa	Moderate qualitative density/846 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F), *Sphaerium* sp. clams, damselflies (F, T)
17.85[H]	42 – Very Good 1 sensitive taxa	High qualitative density/1,733 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F)
13.79[H]	40 – Good 9 sensitive taxa	Moderate – High qualitative density/1,701 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F, MI), *Polypedilum* spp. (F) and tanytarsini (F) midges
9.67[W]	46 – Exceptional 11 sensitive taxa	Moderate – High qualitative density/4,870 organisms per ft^2	Tanytarsini and *Polypedilum flavum* midges (F), hydropsychid caddisflies (F, MI), baetid mayflies (MI, F), damselflies (F, T)
3.40[W]	42 – Very Good 16 sensitive taxa	Moderate – Low qualitative density/848 organisms per ft^2	Baetid mayflies (*Acerpenna pygmaea* (MI) and *Baetis intercalaris* (F)), midges (F, MT, T)
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)			
1.02[H]	MG^{ns} – Marginally Good 1 sensitive taxa	Moderate qualitative density	Damselflies (F, T), flatworms (F), hydropsychid caddisflies (F)

(Source: Ohio EPA, 2020b)

NOTES
a Narrative evaluation used in lieu of ICI quantitative value in some cases
H Headwater sample
W Wading sample
N/A Not applicable
ns Nonsignificant departure form biocriteria (≤4 IBI or ICI units or ≤0.5 MIwb units)
Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant
Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

3.2.3 Detailed Causes and Associated Sources

All six sites within the **North Turkeyfoot Creek HUC-12** are in *Full Attainment* of the WWH designation, though one site is threatened due to nutrient enrichment caused by row crop agriculture and municipal point source inputs. While sites are meeting WWH standards, many of the habitat attributes found during the QHEI sampling event (i.e., heavy/moderate silt cover, substrate embeddedness, etc.) are likely a result of land use activities, which are mainly agricultural operations within the watershed.

Silty substrates can inhibit macroinvertebrate community performance.

From a far-field perspective, agricultural land use activities contribute to excessive nutrient loadings to Lake Erie that result in eutrophication and the formation of HABs. The use of a variety of BMPs on private agricultural lands, at both in-field and edge-of-field locations can help reduce the amount and concentration of nutrient-laden surface runoff and tile drainage. Many BMPs can not only address reduction of nutrients in surface and drainage water, but they can also simultaneously address the loss of sediment from agricultural lands, which contributes to sediment-covered substrates in local waterways. In addition, a reduction of sediment loss to local waterways can also reduce nutrient loss to near-field and far-field waterbodies, as nutrients will also adsorb to sediment particles, potentially becoming dissolved at a later time. The implementation of BMPs on agricultural lands that are prone to sediment and nutrient loss serves as a benefit for both near-field and far-field waterbodies.

3.2.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores or meet nutrient reduction goals in order to remove a waterbody's impairment status. Agricultural land use activities in *Critical Area #1* may threaten the maintenance of WQS for the aquatic communities in Bad Creek, and they also contribute to far-field impairment through excessive nutrient loss (phosphorus) to local waterways that flow to Lake Erie. Through the GLWQA Annex 4 and the subsequent DAP for the State of Ohio, nutrient target loads have been set for the Maumee River, which is the largest contributing waterbody to the WLEB; Bad Creek is a direct tributary to the Maumee River. These phosphorus target loads have been set at levels that are 40% lower than the current estimated loadings. Ohio's *Nutrient Mass Balance Study* has also shown that a large portion of the nutrient load to Lake Erie occurs during springtime rains (Ohio EPA, 2018b; Ohio EPA, 2020d).

Many objectives within the **North Turkeyfoot Creek HUC-12** align with the priorities of the H2Ohio Initiative, a water quality initiative with a focus on phosphorus reduction. Enrollment through this program will also help make incremental progress towards nutrient reduction goals.

Goals

Ohio EPA has modeled nutrient loadings associated with various land uses and sources within each HUC-12 in the Maumee River Basin, and has set phosphorus reduction goals for each associated source, based upon springtime load estimates. To achieve the desired phosphorus reduction from agricultural land use in the **North Turkeyfoot Creek HUC-12**, the following goal has been established:

Goal 1. Reduce springtime phosphorus loading contributions in *Critical Area #1* to a level at or below 13,000 lbs/year (40% reduction).
NOT ACHIEVED: Current estimated load contribution is 21,000 lbs/year.

Simultaneous goals relate to the improvement of siltation conditions within North Turkeyfoot Creek and its unnamed tributary, in order to improve the health of aquatic communities and maintain WQS attainment. Implementation of BMP objectives geared towards nutrient reduction efforts will generally also help make incremental progress towards the following goals:

Goal 2. Maintain IBI score at or above 28 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 36.

Goal 3. Maintain ICI score at or above 34 (Good) at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 34.

Goal 4. Achieve QHEI score at or above 55 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
NOT ACHIEVED: Site currently has a score of 44.5.

Goal 5. Maintain IBI score at or above 28 at County Road 13 in North Turkeyfoot Creek (RM 17.85).
✓ ACHIEVED: Site currently has a score of 50.

Goal 6. Maintain ICI score at or above 34 (Good) at County Road 13 in North Turkeyfoot Creek (RM 17.85).
✓ ACHIEVED: Site currently has a score of 42.

Goal 7. Achieve QHEI score at or above 55 at County Road 13 in North Turkeyfoot Creek (RM 17.85).
NOT ACHIEVED: Site currently has a score of 50.

Goal 8. Maintain IBI score at or above 28 at County Road C in North Turkeyfoot Creek (RM 13.79).
✓ ACHIEVED: Site currently has a score of 41.

Goal 9. Maintain ICI score at or above 34 (Good) at County Road C in North Turkeyfoot Creek (RM 13.79).
✓ ACHIEVED: Site currently has a score of 40.

Goal 10. Maintain QHEI score at or above 55 at County Road C in North Turkeyfoot Creek (RM 13.79).
✓ ACHIEVED: Site currently has a score of 66.25.

Goal 11. Maintain IBI score at or above 32 at County Road V in North Turkeyfoot Creek (RM 9.67).
✓ ACHIEVED: Site currently has a score of 34.

Goal 12. Maintain MIwb score at or above 7.3 at County Road V in North Turkeyfoot Creek (RM 9.67).
✓ ACHIEVED: Site currently has a score of 8.7.

Goal 13. Maintain ICI score at or above 34 (Good) at County Road V in North Turkeyfoot Creek (RM 9.67).
✓ ACHIEVED: Site currently has a score of 46.

Goal 14. Achieve QHEI score at or above 60 at County Road V in North Turkeyfoot Creek (RM 9.67).
NOT ACHIEVED: Site currently has a score of 52.

Goal 15. Maintain IBI score at or above 32 at County Road 8 in North Turkeyfoot Creek (RM 3.40).
✓ ACHIEVED: Site currently has a score of 37.

Goal 16. Maintain MIwb score at or above 7.3 at County Road 8 in North Turkeyfoot Creek (RM 3.40).
✓ ACHIEVED: Site currently has a score of 9.16.

Goal 17. Maintain ICI score at or above 34 (Good) at County Road 8 in North Turkeyfoot Creek (RM 3.40).
✓ ACHIEVED: Site currently has a score 42.

Goal 18. Achieve QHEI score at or above 60 at County Road 8 in North Turkeyfoot Creek (RM 3.40).
NOT ACHIEVED: Site currently has a score of 54.

Goal 19. Maintain IBI score at or above 28 at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).
✓ ACHIEVED: Site currently has a score of 40.

Goal 20. Achieve ICI score at or above 34 (Good) at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).
NOT ACHIEVED: Site currently has a score of Marginally Good (~33).

Goal 21. Achieve QHEI score at or above 55 at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).
NOT ACHIEVED: Site currently has a score of 31.

Objectives

In order to make substantive progress toward the achievement of the springtime phosphorus load reduction goal of 8,000 lbs for the **North Turkeyfoot Creek HUC-12**, efforts must commence on more widespread implementation, according to the following objectives within *Critical Area #1.* Additionally, actions taken within *Critical Area #1* to address nutrient reduction will also help control NPS pollution and siltation that impacts North Turkeyfoot Creek and its tributaries.

Objective 1: Implement nutrient management (planning and implementation through soil testing and VRT) on at least 5,000 additional acres[3].

Objective 2: Plant cover crops on at least 3,600 additional acres annually.[4]

Objective 3: Implement conservation tillage (30-50% residue) on at least 3,500 additional acres[5].

[3] Current estimates indicate enrollment of ~3,000 acres in the North Turkeyfoot Creek HUC-12 in the H2Ohio program, which initiates the development of VNMPs.

[4] Current estimates indicate cover crops may be planted on up to 500 acres annually, based upon OpTis data (Dagan, 2019). Cover crop plantings may be implemented in the absence of grant funding.

[5] Current estimates indicate reduced tillage occurs on approximately 13,900 acres in the North Turkeyfoot Creek HUC-12, based upon OpTis data (Dagan, 2019).

Objective 4: Reduce nutrient loss from subsurface tile drainage through the installation of drainage water management structures that drain at least 900 acres.

Objective 5: Reduce nutrient loss from subsurface tile drainage through the installation of blind inlets that drain at least 180 acres.

Objective 6: Reduce erosion and nutrient loss through the installation of grassed waterways (as a standalone practice or coupled with erosion control structures/other drainage management practices) that receive/treat surface water from at least 3,300 acres.

Objective 7: Reduce erosion and nutrient loss through the installation of filter strips/buffers (of at least a 50 ft setback), potentially with erosion control structures or designed to be saturated buffers, that receive/treat surface water from at least 2,400 acres.

Objective 8: Reduce erosion and nutrient loss through the installation of forested riparian buffers (of at least a 100 ft setback) that receive/treat surface water from at least 20 acres.

Objective 9: Create, enhance and/or restore at least 150 acres of wetlands and/or water retention basins for treatment of agricultural runoff and/or nutrient reduction purposes from 3,750 total agricultural acres.

Objective 10: Reduce erosion from agricultural streambanks and drainage conveyances through natural channel design or two-stage ditch design stabilization techniques to at least 21,600 linear feet (4.1 miles).

Objective 11: Increase the retirement of marginal and highly vulnerable lands by enrolling at least 20 acres into programs such as the CRP, Lake Erie Conservation Reserve Enhancement Program (CREP) or the Wetlands Reserve Program (WRP).

These objectives will be directed towards implementation on prioritized agricultural lands and are estimated to reach 92% of the phosphorus spring load reduction goal (Table 18). Additional conservation activities within the **North Turkeyfoot Creek HUC-12**, both on priority and secondary lands, may also make incremental progress towards phosphorus reduction goals. The implementation of BMPs included in these objectives, as well as BMPs implemented through Federal and State programs and other voluntary efforts will be tracked to monitor progress towards phosphorus reduction goals within the watershed.

Table 18: Estimated Nutrient Loading Reductions from Each Objective

Objective Number	Best Management Practice	Total Acreage Treated	Estimated Annual Phosphorus Load Reduction (lbs)	Estimated Spring Phosphorus Load Reduction (lbs)
1	Nutrient Management (Planning and Implementation through Soil Testing and VRT)[a]	5,000	2,160	1,400
2	Cover Crops	3,600	330	210
3	Conservation Tillage (30-50% Residue)	3,500	1,560	1,010
4	Drainage Water Management Structures	900	300	200
5	Blind Inlets[b]	180	150	100
6	Grassed Waterways with Erosion Control Structures[c]	3,300	1,750	1,140
7	Filter Strips/Buffers (of at least 50 ft)[d]	2,400	1,360	880
8	Forested Buffers (of at least 100 ft)	20	10	10
9	Wetlands[e] and/or Water Retention Basins	3,750[f]	2,270	1,480
10	Stream Stabilization and/or Two-Stage Ditch	2,800 (21,600 linear feet)[g]	2,170	1,410
11	Land Retirement	20	20	10
	TOTAL	**25,470***	**12,080**	**7,850**

(Source Model: Spreadsheet Tool for Estimating Pollutant Loads (STEPL), Version 4.4, (USEPA, 2020))

NOTES

a Nutrient Management consists of "managing the amount (rate), source, placement (method of application) and timing of plant nutrients and soil amendments to budget, supply and conserve nutrients for plant production; to minimize agricultural nonpoint source pollution of surface and groundwater resources; to properly utilize manure or organic byproducts as a plant nutrient source; to protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen) and the formation of atmospheric particulates; and/or to maintain or improve the physical, chemical and biological condition of soil," as defined by the STEPL guidance documents (Tetra Tech, 2018).

b Blind inlet phosphorus reduction efficiency estimated from values listed in Gonzalez, Smith and Livingston, 2016.

c Grassed waterway phosphorus reduction efficiency estimated from values listed in OSU Extension, 2018. Erosion control structure phosphorus efficiency estimated from values in Minks et al., 2015 and combined efficiency modeled in STEPL.

d Concentrated flow must be distributed so the area can slow, filter, and/or soak in runoff. Design specifications will be FOTG 393 Filter strips/area, and/or CREP CP-11 or CP2 Filter recharge areas. Conservation Cover (FOTG 327 and CREP CP-21) would not be designed to treat contributing runoff.

e Phosphorus load reduction for wetlands was calculated using data tables found in Ohio's DAP (OLEC, 2020).

f If drainage water is routed through restored/created wetlands, it is assumed a 50% reduction in phosphorus from total nutrient yield for the drainage area, with a 25:1 ratio of drainage area to receiving wetland. For this objective of 150 wetland acres, total drainage area is 3,750 acres.

g One linear foot of stream is estimated to treat 0.074 acres.

** Total acreage treated exceeds number of agricultural land acres. More than one BMP may be implemented within fields.*

The stakeholders of the **North Turkeyfoot Creek HUC-12** recognize a gap between the total estimated springtime phosphorus reduction realized from these objectives and the stated phosphorus reduction goal. Stakeholders in this watershed acknowledge that additional and/or altered objectives may be needed in future versions of this NPS-IS, but underscore the exigence in beginning to implement projects that incrementally make progress towards achieving the aforementioned objectives as soon as possible. The objectives, as written, are reflective of what stakeholders gage as reasonable and implementable in the **North Turkeyfoot Creek HUC-12** incrementally, over time.

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (Ohio EPA, 2020c) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

3.3 Critical Area #2: Conditions, Goals & Objectives for Streambank and Riparian Restoration

3.3.1 Detailed Characterization

Sampling in 2015 showed North Turkeyfoot Creek and its tributaries are impacted by simplified habitat from historic channelization and ditch maintenance activities, including a lack of riparian shading and poor development (Ohio EPA, 2020b). While regional improvement to in-stream siltation is attributed to modern tillage practices, all sampling locations within the **North Turkeyfoot Creek HUC-12** exhibited heavy to moderate silt cover and high overall and riffle embeddedness (Ohio EPA, 2020b). In addition, nutrient enrichment from the surrounding agricultural land use compounds these effects, and attainment of WQS within North Turkeyfoot Creek has been identified as potentially threatened. Historically, substantial declines in macroinvertebrate performance are occurring, and may continue if in-stream conditions do not improve. In-stream and riparian restoration and streambank stabilization is needed throughout the **North Turkeyfoot Creek HUC-12** to address substrate, channel and riparian conditions. Aerial analysis indicates ~80% of the stream segments within this sub-watershed have little to no riparian corridor, which can contribute to excessive streambank erosion and failure. *Critical Area #2* contains approximately 72 miles of stream length and associated riparian corridors throughout the **North Turkeyfoot Creek HUC-12** (Figure 14).

Using the rationale described in the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (USEPA, 2008)(Section 10.3.4): "In general, management practices are implemented

immediately adjacent to the waterbody or upland to address the sources of pollutant loads."— *Critical Area #2* includes the riparian and in-stream segments of approximately 72.4 miles of waterways, and a 75-foot buffer width on each side. The potential for restoration of approximately 1,300 acres of riparian corridor exists in *Critical Area #2*.

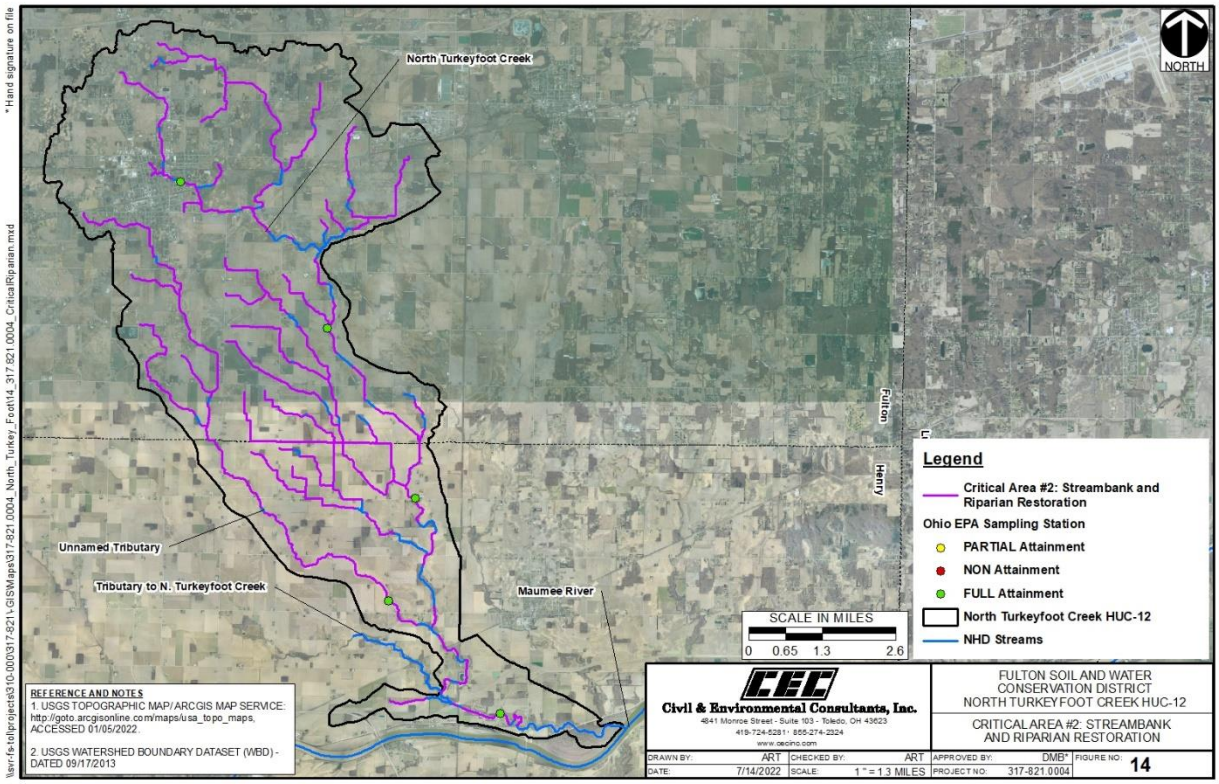

Figure 14: North Turkeyfoot Creek HUC-12 Critical Area #2

3.3.2 Detailed Biological Conditions

Fish community data for the six sampling locations within the **North Turkeyfoot Creek HUC-12** are summarized below (Table 19). Analysis of the abundance, diversity and pollution tolerance of existing fish species found by Ohio EPA at each sampling location, in relation to the corresponding QHEI score, aids in the identification of causes and sources of impairment. Substantial change in community performance over historical sampling was not observed, and fish communities at all locations achieved applicable fish biocriteria (Ohio EPA, 2020b). Pollution tolerant species, such as bluntnose minnow and creek chub were dominant at all sampling locations, though the presence of sensitive species has increased substantially over time. Logperch and greenside darters, both sensitive species, were absent from North Turkeyfoot Creek in 1997 but were found at nearly every sampling location in 2015. In 2015, the first records of golden redhorse and shorthead redhorse (sensitive, simple lithophilic round bodied suckers) were collected from RM 3.40 (Ohio EPA, 2020b). Despite healthy fish assemblages, excessive siltation, simplified habitat and lack of riparian shading are documented habitat stressors throughout the sub-watershed.

Table 19: Critical Area #2 – Fish Community and Habitat Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
North Turkeyfoot Creek (WWH)							
19.06[H]	4.50	15	44.50	36	N/A	Creek chub (34%), common shiner (17%), bluntnose minnow (13%)	Marginally Good
17.85[H]	5.80	21	50.00	50	N/A	Central stoneroller (48%), bluntnose minnow (12%), common shiner (12%)	Exceptional
13.79[H]	19.60	22	66.25	41	N/A	Bluntnose minnow (26%), common shiner (15%), central stoneroller (12%)	Good
9.67[W]	31.0	17	52.00	34	8.70	Bluntnose minnow (31%), central stoneroller (18%), common shiner (13%)	Marginally Good – Good
3.40[W]	73.0	30	54.00	37	9.16	Bluntnose minnow (36%), sand shiner (28%), spotfin shiner (7%)	Marginally Good – Very Good
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)							
1.02[H]	9.94	17	31.00	40	N/A	Bluntnose minnow (28%), blackstripe topminnow (16%), central stoneroller (14%)	Good

NOTES

IBI Index of Biotic Integrity

a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).

QHEI Qualitative Habitat Evaluation Index

** Significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the poor to very poor range.*

H Headwater sample

W Wading sample

Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

Characteristics of the aquatic macroinvertebrate community for the **North Turkeyfoot Creek HUC-12** sampling locations in *Critical Area #2* are summarized below (Table 20). Analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at these sampling locations, related to QHEI scores, can aid in the identification of causes and sources of impairment. Macroinvertebrate communities within North Turkeyfoot Creek and the unnamed tributary met HELP WWH expectations; however, macroinvertebrate community performance has shown a substantial decrease over time. Nutrient enrichment indicators, along with habitat stressors, may threaten the maintenance of WQS within the sub-watershed. All sampling locations exhibited heavy/moderate silt cover and high overall and riffle embeddedness. Poor substrate conditions, exacerbated by poor water chemistry, may continue to negatively impact these communities.

Table 20: Critical Area #2 – Macroinvertebrate Community Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species (Tolerance Categories)**
North Turkeyfoot Creek (WWH)			
19.06[H]	34 – Good 1 sensitive taxa	Moderate qualitative density/846 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F), *Sphaerium* sp. clams, damselflies (F,T)
17.85[H]	42 – Very Good 1 sensitive taxa	High qualitative density/1,733 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F)
13.79[H]	40 – Good 9 sensitive taxa	Moderate – High qualitative density/1,701 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F, MI), *Polypedilum* spp. (F) and tanytarsini (F) midges
9.67[W]	46 – Exceptional 11 sensitive taxa	Moderate – High qualitative density/4,870 organisms per ft^2	Tanytarsini and *Polypedilum flavum* midges (F), hydropsychid caddisflies (F, MI), baetid mayflies (MI, F), damselflies (F, T)
3.40[W]	42 – Very Good 16 sensitive taxa	Moderate – Low qualitative density/848 organisms per ft^2	Baetid mayflies (*Acerpenna pygmaea* (MI) and *Baetis intercalaris* (F)), midges (F, MT, T)
Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (WWH)			
1.02[H]	MG[ns] – Marginally Good 1 sensitive taxa	Moderate qualitative density	Damselflies (F, T), flatworms (F), hydropsychid caddisflies (F)

(Source: Ohio EPA, 2020b)

NOTES
a Narrative evaluation used in lieu of ICI quantitative value in some cases
H Headwater sample
W Wading sample
N/A Not applicable
ns Nonsignificant departure form biocriteria (≤4 IBI or ICI units or ≤0.5 MIwb units)
Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant
Sites shown in tan are not listed in the Ohio Integrated Report, but are detailed in the TSD.

3.3.3 Detailed Causes and Associated Sources

The data summarized previously in Table 12 (p.20) reveal a direct link between the presence of attributes in the watershed that have moderate to high influence on the aquatic communities throughout North Turkeyfoot Creek and its tributaries in *Critical Area #2*. These contributing attributes in *Critical Area #2* include:

- Recovering Channel Conditions;
- Heavy/Moderate Silt Cover;
- Fair/Poor Development;
- Low Sinuosity;

Aerial view of sloughing streambanks in Fulton County.

- Lack of Fast Current;
- Sparse/No Cover;
- High Overall Embeddedness; and,
- High Riffle Embeddedness.

Habitat, as scored by the QHEI, is not a WQS; however, habitat is highly correlated with the performance of aquatic communities. In general, sites that score at least 60 (or 55 for headwater streams) are successful at supporting WWH aquatic assemblages. Habitat scores for MWH-designated streams generally are higher than 43.5 for successful biological performance. Habitat within North Turkeyfoot Creek and its unnamed tributary performed below recommended thresholds at five of the six sampling locations. Most sites exhibited qualitatively Fair habitat in North Turkeyfoot Creek, while habitat in the unnamed tributary was qualitatively rated as Poor., qualitatively scoring in the High Fair to Low Good range. Projects that address the above described habitat-related attributes (e.g., heavy silt cover, embeddedness, etc.) through in-stream and riparian restoration and streambank stabilization will have a positive effect in the QHEI scoring index. As the habitat score (QHEI) becomes better, IBI and ICI index scores are also expected to improve.

3.3.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores or meet nutrient reduction goals in order to remove a waterbody's impairment status. For *Critical Area #2,* addressing in-stream, streambank and riparian habitat conditions within the watershed will help ameliorate stresses from land use and maintain or boost index values for aquatic communities.

The remaining goals for *Critical Area #2* of the **North Turkeyfoot Creek HUC-12** are to at least maintain, if not improve, the aquatic scores within the North Turkeyfoot Creek and unnamed tributary sampling locations through the improvement of stabilizing streambanks and restoring riparian corridors and in-stream conditions. These goals are to specifically:

Goal 1. Maintain IBI score at or above 28 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 36.

Goal 2. Maintain ICI score at or above 34 (Good) at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 34.

Goal 3. Achieve QHEI score at or above 55 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
NOT ACHIEVED: Site currently has a score of 44.5.

Goal 4. Maintain IBI score at or above 28 at County Road 13 in North Turkeyfoot Creek (RM 17.85).
✓ ACHIEVED: Site currently has a score of 50.

Goal 5. Maintain ICI score at or above 34 (Good) at County Road 13 in North Turkeyfoot Creek (RM 17.85).

✓ ACHIEVED: Site currently has a score of 42.

Goal 6. Achieve QHEI score at or above 55 at County Road 13 in North Turkeyfoot Creek (RM 17.85).
NOT ACHIEVED: Site currently has a score of 50.

Goal 7. Maintain IBI score at or above 28 at County Road C in North Turkeyfoot Creek (RM 13.79).

✓ ACHIEVED: Site currently has a score of 41.

Goal 8. Maintain ICI score at or above 34 (Good) at County Road C in North Turkeyfoot Creek (RM 13.79).

✓ ACHIEVED: Site currently has a score of 40.

Goal 9. Maintain QHEI score at or above 55 at County Road C in North Turkeyfoot Creek (RM 13.79).

✓ ACHIEVED: Site currently has a score of 66.25.

Goal 10. Maintain IBI score at or above 32 at County Road V in North Turkeyfoot Creek (RM 9.67).

✓ ACHIEVED: Site currently has a score of 34.

Goal 11. Maintain MIwb score at or above 7.3 at County Road V in North Turkeyfoot Creek (RM 9.67).

✓ ACHIEVED: Site currently has a score of 8.7.

Goal 12. Maintain ICI score at or above 34 (Good) at County Road V in North Turkeyfoot Creek (RM 9.67).

✓ ACHIEVED: Site currently has a score of 46.

Goal 13. Achieve QHEI score at or above 60 at County Road V in North Turkeyfoot Creek (RM 9.67).
NOT ACHIEVED: Site currently has a score of 52.

Goal 14. Maintain IBI score at or above 32 at County Road 8 in North Turkeyfoot Creek (RM 3.40).

✓ ACHIEVED: Site currently has a score of 37.

Goal 15. Maintain MIwb score at or above 7.3 at County Road 8 in North Turkeyfoot Creek (RM 3.40).

✓ ACHIEVED: Site currently has a score of 9.16.

Goal 16. Maintain ICI score at or above 34 (Good) at County Road 8 in North Turkeyfoot Creek (RM 3.40).

✓ ACHIEVED: Site currently has a score 42.

Goal 17. Achieve QHEI score at or above 60 at County Road 8 in North Turkeyfoot Creek (RM 3.40).
NOT ACHIEVED: Site currently has a score of 54.

Goal 18. Maintain IBI score at or above 28 at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).

✓ ACHIEVED: Site currently has a score of 40.

Goal 19. Achieve ICI score at or above 34 (Good) at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).
NOT ACHIEVED: Site currently has a score of Marginally Good (~33).

Goal 20. Achieve QHEI score at or above 55 at County Road 10 in the Unnamed Tributary to North Turkeyfoot Creek @RM 6.68 (RM 1.02).
NOT ACHIEVED: Site currently has a score of 31.

Objectives

The implementation of these objectives, partnered with implementation throughout *Critical Area #1* will help ameliorate negative impacts from excessive nutrients and sediments, improve in-stream habitat stream conditions and make positive gains towards maintaining near-field attainment and removing far-field impairments in the **North Turkeyfoot Creek HUC-12**. In order to achieve the overall NPS restoration goal of maintaining *Full Attainment* in the **North Turkeyfoot Creek HUC-12**, the following objectives need to be achieved within *Critical Area #2.*

Objective 1: Stabilize at least five miles (26,400 linear feet) of degraded or downcut streambanks through a two-stage ditch or natural channel design approach and/or bio-engineering techniques[6].

Objective 2: Restore at least three miles (15,840 linear feet) of in-stream channel habitat through natural channel design methods and bioengineering, including, but not limited to, constructed riffles, habitat rocks/boulders, root wads, mud sills and tree revetments.

Objective 3: Create, enhance or restore at least 50 acres[7] of woody riparian corridor and/or riparian floodplain wetlands in tributary locations.

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (Ohio EPA, 2020c) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;

[6] Stabilization may be independent of in-channel work; however, bank armoring and excessive use of stone, concrete or other unnatural hardening agents is discouraged (Ohio EPA, 2020c).

[7] With a 75 foot buffer on one river side, this equates to riparian corridor restoration along ~29,040 linear feet (~5.5 miles).

- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

3.4 Critical Area #3: Conditions, Goals & Objectives for Nutrient Reduction from Urban Lands

3.4.1 Detailed Characterization

In urban environments, NPS contributions to stormwater runoff can come from a variety of sources, including fertilizers, detergents, leaves and detritus, wild and domesticated animal excrement, lubricants, sediment erosion, and organic and inorganic decomposition processes (Carpenter *et. al*, 1998; Burton and Pitt, 2001). Urbanization and development often leads to increased pollutant availability, runoff, peak flows, stream "flashiness" and stream instability, along with decreased stream function, storage and retention capabilities and pollutant assimilation in soils (ODNR, 2006b). Many of these effects have a direct impact on aquatic life. Degradation to stream ecosystems has been shown even in areas of low amounts of urbanization (5-10% imperviousness) (Schueler, 1994).

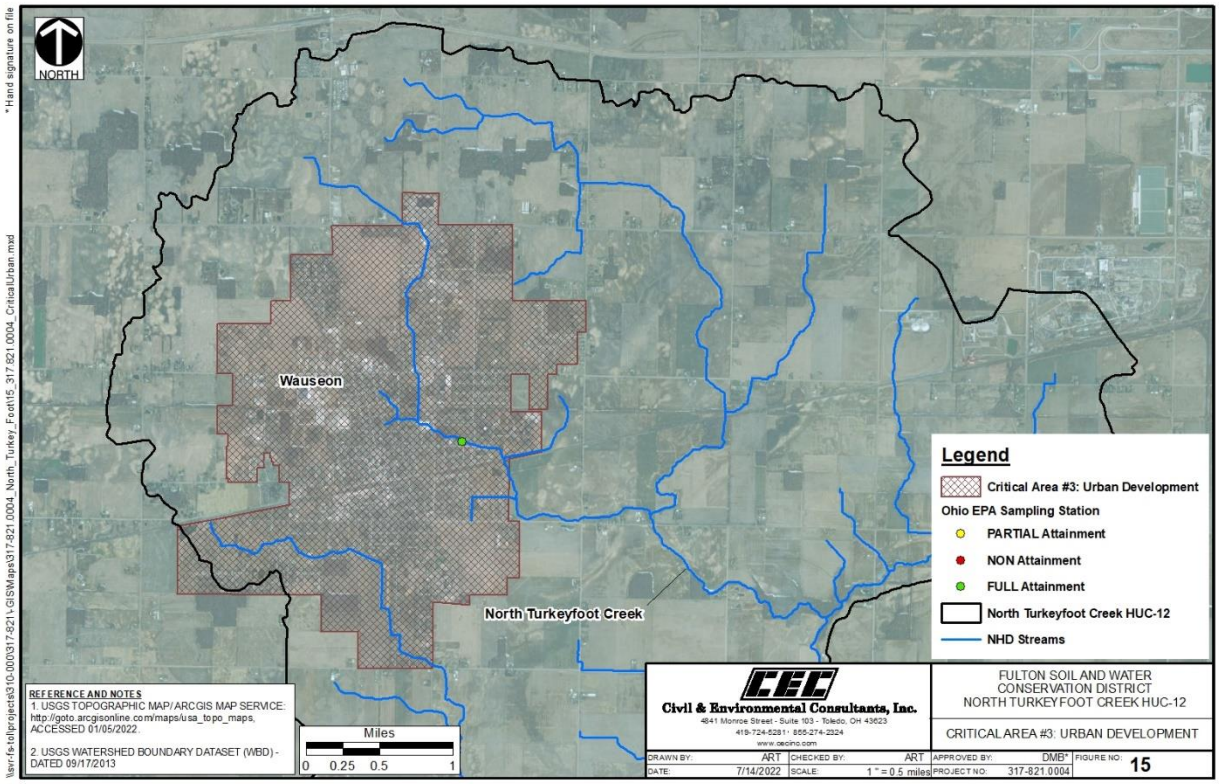

Figure 15: North Turkeyfoot Creek HUC-12 Critical Area #3

Critical Area #3 contains the concentration of developed land in the City of Wauseon (Figure 15). Wauseon is home to approximately 7,568 people (U.S. Census Bureau, 2020) and spans 3,422 acres, mostly contained (98%) within the **North Turkeyfoot Creek HUC-12** boundaries. The remaining 2% lies to the western adjacent sub-watershed, the *Konzen Ditch HUC-12*. Approximately 2.6 miles of North

Turkeyfoot Creek, from RM 21.00 to RM 18.43, as well as 2.0 miles of the Unnamed Tributary to North Turkeyfoot Creek @ RM 6.68, from its rise to RM 10.00, flow directly through Wauseon. *Critical Area #3* contains these lands of concentrated urban use to reduce urban sources of nutrients and sediments from entering North Turkeyfoot Creek and thus, the Maumee River.

3.4.2 Detailed Biological Conditions

Fish community data for the North Turkeyfoot sampling location *Critical Area #3* is summarized below (Table 21). Analysis of the abundance, diversity and pollution tolerance of existing fish species found by Ohio EPA at this sampling location, in relation to the corresponding QHEI score, aids in the identification of causes and sources of impairment. Substantial change in community performance over historical sampling was not observed, and fish communities at all locations achieved applicable fish biocriteria (Ohio EPA, 2020b). Pollution tolerant species, such as bluntnose minnow and creek chub were dominant at this location, though the presence of sensitive species , including logperch and greenside darters, was detected at this location in 2015 over historical sampling events in 1997. Despite fish assemblages that are meeting WQS, excessive siltation, simplified habitat and lack of riparian shading are documented habitat stressors throughout the headwaters of North Turkeyfoot Creek.

Table 21: Critical Area #3 – Fish Community and Habitat Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
North Turkeyfoot Creek (WWH)							
19.06[H]	4.50	15	44.50	36	N/A	Creek chub (34%), common shiner (17%), bluntnose minnow (13%)	Marginally Good

(Source: Ohio EPA, 2020b)

NOTES
IBI Index of Biotic Integrity
a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).
QHEI Qualitative Habitat Evaluation Index
** Significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the poor to very poor range.*
H Headwater sample

Characteristics of the aquatic macroinvertebrate community for the **North Turkeyfoot Creek HUC-12** sampling locations in *Critical Area #3* are summarized below (Table 22). Analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at this sampling location, related to QHEI score, can aid in the identification of causes and sources of impairment. Macroinvertebrate communities within North Turkeyfoot Creek at RM 19.60 met HELP WWH expectations; however, community performance has shown a substantial decrease over time. Nutrient enrichment indicators, along with habitat stressors, may threaten the maintenance of WQS within the sub-watershed.

Table 22: Critical Area #3 – Macroinvertebrate Community Data

North Turkeyfoot Creek HUC-12 (04100009 04 02)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species (Tolerance Categories)**
North Turkeyfoot Creek (WWH)			
19.06[H]	34 – Good 1 sensitive taxa	Moderate qualitative density/846 organisms per ft^2	Hydropsychid caddisflies (F, MI), baetid mayflies (F), *Sphaerium* sp. clams, damselflies (F,T)

(Source: Ohio EPA, 2020b)

NOTES
a Narrative evaluation used in lieu of ICI quantitative value in some cases
H Headwater sample
N/A Not applicable
Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant

3.4.3 Detailed Causes and Associated Sources

Though RM 19.06 in North Turkeyfoot Creek in the **North Turkeyfoot Creek HUC-12** is in *Full Attainment* of its WWH designation, the data summarized previously in Table 1 (p.20) reveal a direct link between the presence of attributes in the watershed that have moderate to high influence on the aquatic communities throughout North Turkeyfoot Creek and its tributaries in *Critical Area #3*. These contributing attributes in *Critical Area #3* include:

- Sparse/No Cover;
- Recovering Channel Conditions;
- Heavy/Moderate Silt Cover;
- Fair/Poor Development;
- Intermediate/Poor Pools;
- Low Sinuosity;
- Lack of Fast Current;
- High Overall Embeddedness; and,
- High Riffle Embeddedness.

Many of the negative habitat attributes found during the QHEI sampling event result from land use activities, including impacts from urban development within the watershed. From a far-field perspective, urban land use activities contribute to excessive nutrient loadings to North Turkeyfoot Creek and its tributaries, eventually reaching the Maumee River and Lake Erie. Reductions in nutrients in urban areas and management of stormwater inputs can help decrease overall NPS pollution and improve aquatic communities. Reductions in nutrients in urban areas through the use of green infrastructure for the retention, detention and filtration of urban pollutants can also help decrease overall NPS pollution and improve aquatic communities. Compared with natural land cover, shallow and deep infiltration and evapotranspiration decreases while surface runoff increases in urban lands (USEPA, 2003). When

watersheds have as little as 10% impervious surface, studies have shown that not only does runoff increase substantially, but pollutant loads also increase (CWP, 1998).

3.4.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores in order to remove a waterbody's impairment status or protect quality areas to maintain attainment status. Urban land use activities in *Critical Area #3* not only contribute to stress on aquatic communities in North Turkeyfoot Creek and its tributaries, but also far-field impairment through excessive nutrient loss to local waterways that eventually flow to Lake Erie. Ohio EPA has modeled nutrient loadings associated with various land uses and sources within the WLEB, and has set phosphorus reduction goals for each associated source, based upon springtime load estimates. To achieve the desired phosphorus reduction from urban land use in the **North Turkeyfoot Creek HUC-12**, the following goal has been established:

Goal 1. Reduce springtime phosphorus loading contributions in *Critical Area #3* to a level at or below 840 lbs/year (40% reduction).
NOT ACHIEVED: Current estimated load contribution is 1,400 lbs/year.

Simultaneous goals relate to the improvement of siltation conditions within North Turkeyfoot Creek, in order to improve the health of aquatic communities and achieve WQS attainment. Implementation of BMP objectives geared towards nutrient reduction efforts will generally also help make incremental progress towards the following goals:

Goal 2. Maintain IBI score at or above 28 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 36.

Goal 3. Maintain ICI score at or above 34 (Good) at Reighard Park in North Turkeyfoot Creek (RM 19.06).
✓ ACHIEVED: Site currently has a score of 34.

Goal 4. Achieve QHEI score at or above 55 at Reighard Park in North Turkeyfoot Creek (RM 19.06).
NOT ACHIEVED: Site currently has a score of 44.5.

Objectives

In order to make substantive progress toward the achievement of the urban phosphorus load reduction goal of 560 lbs for the **North Turkeyfoot Creek HUC-12**, efforts must commence on more widespread implementation, according to the following objectives within *Critical Area #3.* Additionally, actions taken to address nutrient reduction will also help reduce stressors on aquatic communities within North Turkeyfoot Creek, its tributaries and to far-field receiving waterbodies.

Objective 1: Reduce stormwater inputs and impacts in the sub-watershed by implementing green infrastructure projects within *Critical Area #3* to retain, detain, and/or treat runoff from at least 700 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.).

Objective 2: Reduce stormwater inputs and impacts in the sub-watershed by restoring and/or creating floodplain and wetland detention/storage basins to retain, detain and/or treat urban drainage from at least 100 acres.

Depending on the specific green infrastructure approach chosen, reduction efficiencies for these objectives may not reach the intended nutrient reduction goals for urban lands in this sub-watershed. Stakeholders in this watershed acknowledge that additional and/or altered objectives may be needed in future versions of this NPS-IS, but underscore the exigence in beginning to implement projects that incrementally make progress towards achieving the aforementioned objectives as soon as possible. The objectives, as written, are reflective of what stakeholders gage as reasonable and implementable in the **North Turkeyfoot Creek HUC-12** incrementally, over time.

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (Ohio EPA, 2020c) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

CHAPTER 4: PROJECTS AND IMPLEMENTATION STRATEGY

Projects and evaluation needs identified for the **North Turkeyfoot Creek HUC-12** are based upon identified causes and associated sources of NPS pollution. Over time, these critical areas will need to be reevaluated to determine progress towards meeting restoration, attainment and nutrient reduction goals. Time is an important variable in measuring project success and overall status when using biological indices as a measurement tool. Some biological systems may show fairly quick response (i.e., one season), while others may take several seasons or years to show progress towards recovery. In addition, reasons for the impairment other than those associated with NPS sources may arise. Those issues will need to be addressed under different initiatives, authorities or programs that may or may not be accomplished by the same implementers addressing the NPS issues.

Implementation of practices described in this NPS-IS will also contribute to nutrient load reduction (specifically the 40% reduction in phosphorus load) to protect and restore use attainment in Lake Erie. Nutrient load reduction efforts are consistent with the Lake Erie Collaborative Agreement through the International Joint Commission (IJC) and Ohio's DAP (OLEC, 2018).

For the **North Turkeyfoot Creek HUC-12** there are three *Project and Implementation Strategy Overview Tables* (subsection 4.1, 4.2 and 4.3). Future versions of this NPS-IS may include subsequent sections as more critical areas are refined and more projects become developed to meet the requisite objectives within a critical area. The projects described in the *Overview Table* have been prioritized using the following three-step prioritization method:

Priority 1 — Projects that specifically address one or more of the listed Objectives for the Critical Area.

Priority 2 — Projects where there is land-owner willingness to engage in projects that are designed to address the cause(s) and source(s) of impairment or where there is an expectation that such potential projects will improve water quality in the **North Turkeyfoot Creek HUC-12**.

Priority 3 — In an effort to generate interest in projects, an information and education campaign will be developed and delivered. Such outreach will engage citizens to spark interest by stakeholders to participate and implement projects like those mentioned in Priority 1 and 2.

Project Summary Sheets (PSS) follow the *Overview Tables*, if projects were identified; these provide the essential nine elements for short-term and/or next step projects that are in development and/or in need of funding. As projects are implemented and new projects developed, these sheets will be updated. Any new PSS created will be submitted to the state of Ohio for funding eligibility verification (i.e., all nine elements are included).

4.1 Critical Area #1 Project and Implementation Strategy Overview Table

Table 23: North Turkeyfoot Creek HUC-12 (04100009 04 02) — Critical Area #1							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
1-13	7	1	Filter Strip and Headwall Structure Implementation	Fulton SWCD	Short (1-3 yrs)	$7,000	Ohio EPA §319, GLRI, GLC, USDA-NRCS EQIP, USDA-FSA CRP
1-13	4,6,7,10	2	Fulton County Four Watershed Conservation Program	Fulton SWCD	Short (1-3 yrs)	$283,740	GLO, Ohio EPA §319, GLRI, USDA-NRCS EQIP, USDA-FSA CRP
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

4.1.1 Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on the actions or activities needed to achieve nutrient reduction targets in the **North Turkeyfoot Creek HUC-12**. These projects are considered next step or priority/short term projects and are considerably ready to implement. Medium and longer-term projects will not have a Project Summary Sheet, as these projects are not ready for implementation or need more thorough planning.

Table 24: Critical Area #1 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Filter Strip and Headwall Structure Implementation
criteria d	Project Lead Organization & Partners	Fulton SWCD
criteria c	HUC-12 and Critical Area	North Turkeyfoot Creek HUC-12 (04100009 04 02) – *Critical Area #1*
criteria c	Location of Project	Private landowner – exact location not disclosed
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Implementation of filter strips on private lands
criteria g	Project Narrative	One private landowner is in need of a 1.5-acre filter strip (FOTG 393), to provide adequate buffers between agricultural land and receiving waterways. In addition, two headwall structures will be installed to reduce further erosion occurring near the proposed filter strip area. The filter strip will treat 60 acres of drainage.
criteria d	Estimated Total cost	$7,000
criteria d	Possible Funding Source	Ohio EPA §319, GLRI, GLC, USDA-NRCS EQIP, USDA-FSA CRP
criteria a	Identified Causes and Sources	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	The overall goal in *Critical Area #1* is to reduce estimated springtime phosphorus loads. Current estimates indicate the agricultural contribution to the springtime load is 21,000 lbs. of phosphorus. In order to meet the GLWQA and DAP nutrient reduction goals, annual loads must be reduced by 40%, or 8,000 lbs. of phosphorus.

Table 24: Critical Area #1 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	It is expected that this project will cause a decrease in springtime phosphorus loadings by 24 lbs. (0.3% progress) through incremental progress made towards Objective 7: Reduce erosion and nutrient loss through the installation of filter strips/buffers (of at least a 50 ft setback), potentially with erosion control structures or designed to be saturated buffers, that receive/treat surface water from at least 60 acres of 2,400 acres (2.5%).
	Part 3: Load Reduced?	Estimated annual reduction: 106 #N/year; 37 #P/year; 8.0 tons sediment/year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	The Fulton SWCD will assist in the design of structures and will conduct follow-up activities, as deemed necessary, to document installation and proper planting. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as Ohio EPA, National Oceanic and Atmospheric Administration (NOAA), and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	Information and Education	The Fulton SWCD will highlight project components through the annual meeting, newspapers and social media outlets, as well as through social media postings. Local and state officials will be informed annually through an annual grant report. Once every three years (once during the grant period), a public officials tour will be held to showcase project success. Also, grant materials will be provided at all conservation workshops and field days held by the Fulton SWCD during the grant period. Project signage will be placed as appropriate or necessary, depending on funding agency requirements.

Table 25: Critical Area #1 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Fulton County Four Watershed Conservation Program (FWCP)
criteria d	Project Lead Organization & Partners	Fulton SWCD
criteria c	HUC-12 and Critical Area	North Turkeyfoot Creek HUC-12 (04100009 04 02) – *Critical Area #1* Lower Bad Creek HUC-12 (04100009 03 02) – *Critical Area #1* Upper Bad Creek HUC-12 (04100009 03 01) – *Critical Area #1* Old Bean Creek HUC-12 (04100006 02 03) – *Critical Area #1*
criteria c	Location of Project	Private landowners – exact location not disclosed
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Conservation program for structural best management practices (BMPs) in four watersheds in Fulton County
criteria g	Project Narrative	The FWCP focuses on five practices: grassed waterways, grade stabilization/erosion control structures, filter strips, water control structures and streambank protection/bank stabilization. The overall goal is to increase landowner involvement in best management practices by providing cost-share for reducing phosphorus and sedimentation within the four HUC-12 watersheds. In total, the FWCP will install 20 acres of grassed waterways (FOTG 412), which will treat an estimated 1,500 acres; 28 erosion control structures (FOTG 410); 40 acres of filter strips (FOTG 393), estimated to treat 1,600 acres; 20 water control structures (FOTG 587), estimated to treat 400 acres; and bank stabilization along ~300 linear feet. Cost share amounts will be paid as flat rates at the following pay schedule: $4,000 per acre of grassed waterway installed, $2,500 per erosion control structure, $550 per acre for seeding grass filter strips, $1,900 per water control structure and $100 per linear foot of bank stabilized.
criteria d	Estimated Total cost	$283,740
criteria d	Possible Funding Source	GLC, Ohio EPA §319, GLRI, USDA-NRCS EQIP, USDA-FSA CRP
criteria a	Identified Causes and Sources	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities

Table 25: Critical Area #1 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	The overall goal in *Critical Area #1* in each of the four watersheds is to reduce estimated total spring phosphorus loads. Current estimates indicate 60,000 lbs. of phosphorus in the spring load is attributed to agricultural land use activities in these four watersheds combined. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 23,600 lbs across the four watersheds. Specific to *Critical Area #1* within the North Turkeyfoot Creek HUC-12, the overall goal is to reduce estimated total spring phosphorus loads. Current estimates indicate the spring load is 21,000 lbs. of phosphorus. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 8,000 lbs.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	It is expected that this project will cause a decrease in spring phosphorus loadings by 1,471 lbs, or 6.2% across the four watersheds. Specific to the North Turkeyfoot Creek HUC-12, this will cause a decrease in spring phosphorus loadings by 364 lbs (4.6%), through incremental progress made towards Objectives #4: Reduce nutrient loss from subsurface tile drainage through the installation of drainage water management structures that drain at least 100 acres of 900 acres (11.1%); Objective #6: Reduce erosion and nutrient loss through the installation of grassed waterways (as a standalone practice or coupled with erosion control structures/other drainage management practices) that receive/treat surface water from at least 375 acres of 3,300 acres (11.4%); Objective #7: Reduce erosion and nutrient loss through the installation of filter strips/buffers (of at least a 50 ft setback), potentially with erosion control structures or designed to be saturated buffers, that receive/treat surface water from at least 400 acres of 2,400 acres (16.6%); and Objective #10: Reduce erosion from agricultural streambanks and drainage conveyances through natural channel design or two-stage ditch design stabilization techniques to at least 70 linear feet of 21,600 linear feet (0.3%).
	Part 3: Load Reduced?	Estimated annual reduction: 6,833 #N/year; 2,263 #P/year; 559 tons sediment/year Within the North Turkeyfoot Creek HUC-12: 1,650 #N/year; 560 #P/year; 125.5 tons sediment/year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	The Fulton SWCD will assist in the design of structures and will conduct follow-up activities, as deemed necessary, to document installation and proper planting. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as Ohio EPA, NOAA and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.

Table 25: Critical Area #1 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
criteria e	Information and Education	The Fulton SWCD staff will directly call landowners who have recently expressed a need to address erosion issues, but have not yet identified cost-share assistance[8]. The Fulton SWCD will highlight project components through the annual meeting, newspapers and social media outlets, as well as through social media postings. Local and state officials will be informed annually through an annual grant report. Once every three years (once during the grant period), a public officials tour will be held to showcase project success. Also, grant materials will be provided at all conservation workshops and field days held by the Fulton SWCD during the grant period. Project signage will be placed as appropriate or necessary, depending on funding agency requirements.

[8] Additional outreach may need to occur prior to pursuit of grant funds, dependent upon funding source and program.

4.2 Critical Area #2 Project and Implementation Strategy Overview Table

Table 26: North Turkeyfoot Creek HUC-12 (04100009 04 02) — Critical Area #2							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

At this time, no short-term projects have been identified for *Critical Area #2*; therefore, no Project Summary Sheets are included.

4.3 Critical Area #3 Project and Implementation Strategy Overview Table

Table 27: North Turkeyfoot Creek HUC-12 (04100009 04 02) — Critical Area #3							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

At this time, no short-term projects have been identified for *Critical Area #3*; therefore, no Project Summary Sheets are included.

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