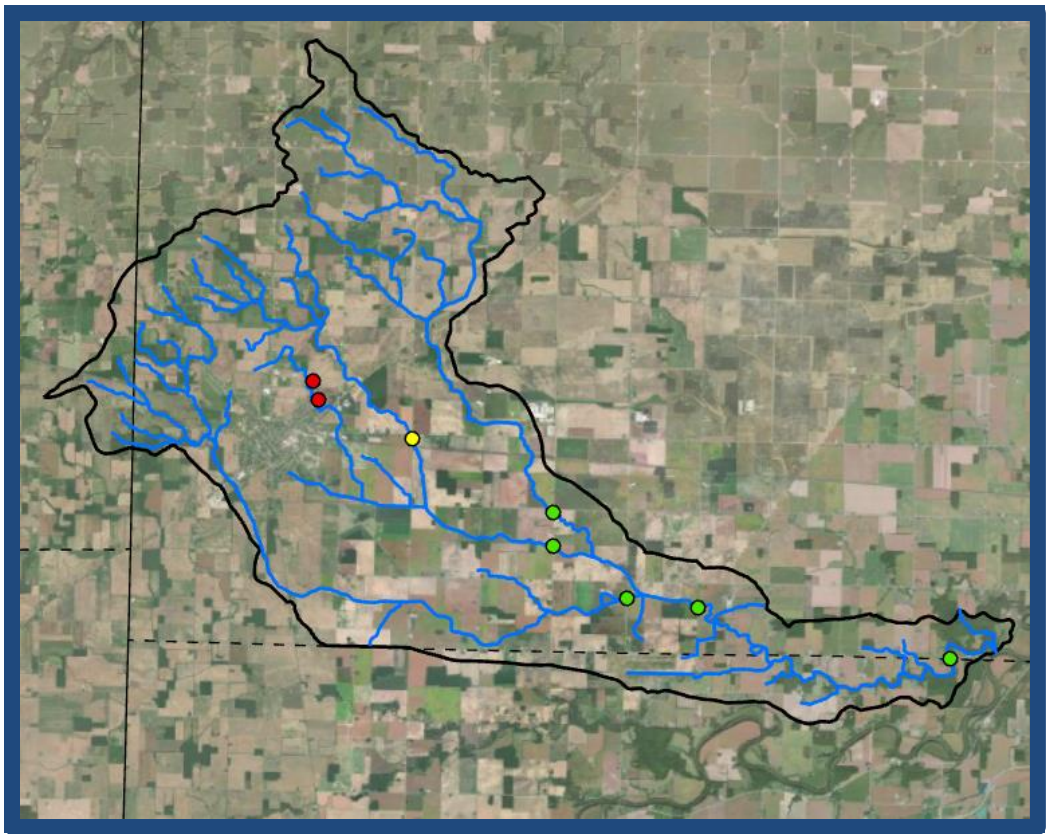
Nine-Element Nonpoint Source Implementation Strategy (NPS-IS) for Gordon Creek HUC-12 (04100005 02 04)



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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	
ACPF	Agricultural Conservation Planning Framework
ALU	Aquatic Life Use
B	
BMP	Best Management Practice
C	
CAFF	Confined Animal Feeding Facility
CAFO	Concentrated Animal Feeding Operation
$cBOD_{5\text{-}day}$	Carbonaceous Biological Oxygen demand (5-day)
CDL	Crop Data Layer
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSA	Critical Sewage Area
CSO	Combined Sewer Overflow
D	
DAP	Domestic Action Plan
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
E	
E. coli	*Escherichia coli*
ECBP	Eastern Corn Belt Plains
ECHO	Enforcement and Compliance History Online
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	
GIS	Geographic Information System
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
MRBLPG	Maumee River Basin Partnership of Local Governments
MS4	Municipal Separate Storm Sewer System
MTA	Metric Tons per Annum
MWH	Modified Warmwater Habitat
MWH-C	Modified Warmwater Habitat - Channelized

N

NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NPS-IS	Nonpoint Source-Implementation Strategy
NRCS	Natural Resources Conservation Service

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
PCR	Primary Contact Recreation

Q

QHEI	Qualitative Habitat Evaluation Index

R

RM	River Mile

S

SAFE	State Acres for Wildlife Habitat
SCR	Secondary Contact Recreation
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
TSS	Total Suspended Solids

U

UMWP	Upper Maumee Watershed Partnership
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
WASCOB	Water and Sediment Control Basin
WLEB	Western Lake Erie Basin
WQS	Water Quality Standards (Ohio Administrative Code 3745-1)
WRP	Wetlands Reserve Program
WWH	Warmwater Habitat
WWTP	Wastewater Treatment Plant

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CHAPTER 1: INTRODUCTION

The **Gordon Creek Hydrologic Unit Code (HUC)-12 (04100005 02 04)** is located mainly in southwestern Defiance County, Ohio, with small portions crossing into northern Paulding County, Ohio and eastern DeKalb County, Indiana. It contains a watershed of 44.10 square miles (Figure 1). The **Gordon Creek HUC-12** contains all branches of Gordon Creek, a direct tributary to the Maumee River. The watershed is primarily rural, and the dominant land use is agricultural (~82% cultivated crops and hay/pasture lands). The **Gordon 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.

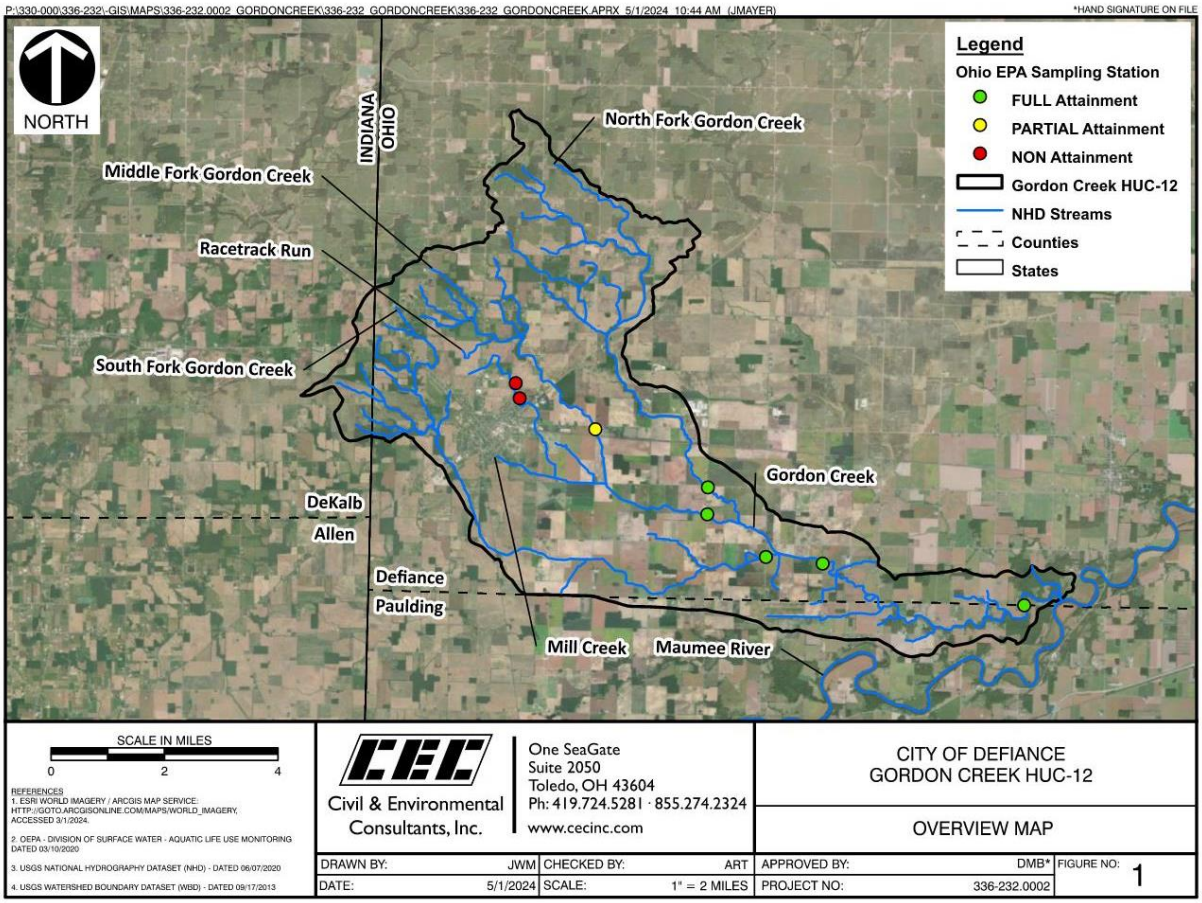


Figure 1: Gordon Creek HUC-12 Overview

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 (WAPs), which typically covered larger watersheds (HUC-10 to HUC-8 size). The plans 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 watershed plan 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

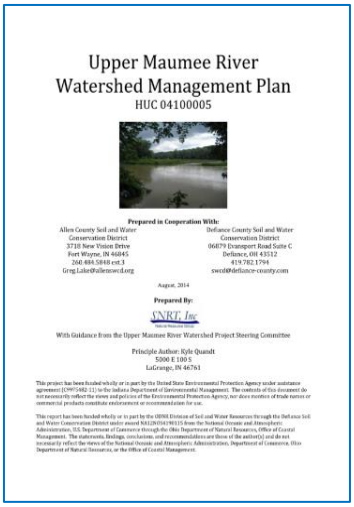
goal of reducing phosphorus loadings to Lake Erie by 40% in both 2015 and in 2019 through signing the Lake Erie Collaborative Agreement, leading to the precursor of Ohio's Domestic Action Plan (DAP).

In 2018, all sub-watersheds (HUC-12s) within the Ohio portions of the Auglaize HUC-8 (including the Ottawa River (Lima), 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 the **Gordon Creek HUC-12**.

In 2019, the proposal to designate these watersheds as distressed was removed from state consideration. Focus is now on developing NPS-IS for these sub-watersheds in preparation for basin-wide targeted nutrient reduction efforts. The *Gordon Creek HUC-12 NPS-IS* serves as an update to the *Upper Maumee River Watershed Management Plan* for just the **Gordon Creek HUC-12**, ensuring that the projects needed for implementation of nutrient reduction efforts are eligible for state and federal NPS funding.

The Upper Maumee Watershed Partnership and Management Plan

The Upper Maumee Watershed Partnership (UMWP) formed in 2009 due to growing concern over the increasing occurrences and severity of algal blooms and hypoxic zones within the WLEB. Through a grant from the Maumee Valley Resource Conservation and Development Organization, members of the Defiance Soil and Water Conservation District (SWCD) Board and staff spearheaded the establishment of a formal steering committee consisting of representation from SWCDs in both Indiana and Ohio, local governments, academia and private citizens and businesses.


Upper Maumee River
Watershed Management Plan
HUC 04100005

The Upper Maumee River Watershed Action Plan

The *Upper Maumee River Watershed Management Plan* was created to address sediments and nutrients entering Lake Erie via the Maumee River, Lake Erie's largest contributor, and other perennial streams in the watershed, specifically in response to the algal blooms and hypoxic zones in the WLEB (UMWP, 2014). designed to identify areas of concern in the Upper Maumee River watershed and develop an action register, guided by local stakeholders, to reduce the amount of pollution entering the river system, and improve overall water quality and the quality of life for those that live around and rely on the river. The plan has outlined several goals as a part of management in the Upper Maumee River watershed:

- Reduce nitrogen loading;
- Reduce total phosphorus loading;
- Reduce dissolved reactive phosphorus;

- Reduce sediment loading;
- Reduce *Escherichia coli* (*E. coli*) loading;
- Increase knowledge regarding on-site waste management;
- Reduce the amount of polluted stormwater due to imperviousness;
- Mitigate runoff from animal feeding operations;
- Promote recreation and water quality on the Maumee River;
- Increase the use of riparian buffers/filter strips; and,
- Reduce and, eventually eliminate, exceedances from National Pollutant Discharge Elimination System (NPDES)-permitted facilities.

Together, the steering committee developed the *Upper Maumee River Watershed Management Plan*, which received full endorsement by the state of Ohio in 2014.

Ohio Department of Agriculture Regional Watershed Program: Watershed Plan, Region 1

The Ohio Department of Agriculture (ODA) has created seven watershed plans, focused on a larger regional scale, that were developed to initiate implementation of Ohio House Bill 7. Ohio House Bill 7 requires the Director of Agriculture to administer a statewide watershed planning and management program that aims to improve and protect Ohio watersheds. These plans focus primarily on addressing nonpoint source pollution and have four main objectives:

- Delineating local water quality impairment and nutrient sources by local watersheds of the region;
- Developing and strengthening organizational networks through which assistance may be provided and state agency collaboration may occur;
- Providing context, content, and references essential for effective local "nine-element" and other watershed-based planning within the watershed region; and,
- Serving as the first and foundational annual water quality report to Director of Agriculture.

Region 1 focuses on northwest Ohio, including the WLEB, where the **Gordon Creek HUC-12** is located (ODA, 2023). Information from this report was used to build the *Gordon Creek HUC-12 NPS-IS.*

Gordon 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 *Gordon Creek HUC-12 NPS-IS* is sponsored and developed by the City of Defiance, in partnership with the Defiance SWCD.

Removal of NPS impairments and reduction in overall nutrient loss within the **Gordon Creek HUC-12** is crucial to the attainment and maintenance of aquatic life use (ALU) standards within Gordon 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 **Gordon Creek HUC-12**,

Gordon Creek is in *Full Attainment* of its Warmwater Habitat (WWH) designation at two locations. North Fork Gordon Creek is in *Full Attainment* of its WWH designation at one location, and South Fork Gordon Creek is in *Full Attainment* of the WWH designation in one location. Middle Fork Gordon Creek is in *Full Attainment* of the WWH designation at one location and in *Partial Attainment* in one location due to direct habitat alterations and siltation from channelization and row crop agriculture. Merritt Ditch is in *Non-Attainment* at two locations, likely due to direct habitat alterations from channelization and active maintenance. Within the **Gordon Creek HUC-12**, Gordon Creek is in *Non-Attainment* of the Primary Contact Recreation (PCR) use and Mill Creek is in *Full Attainment* of the Secondary Contact Recreation (SCR) use. Nutrient loadings from the **Gordon Creek HUC-12** also 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 **Gordon Creek HUC-12** to address management of NPS issues that have both near-field and far-field impacts.

1.2 Watershed Profile & History

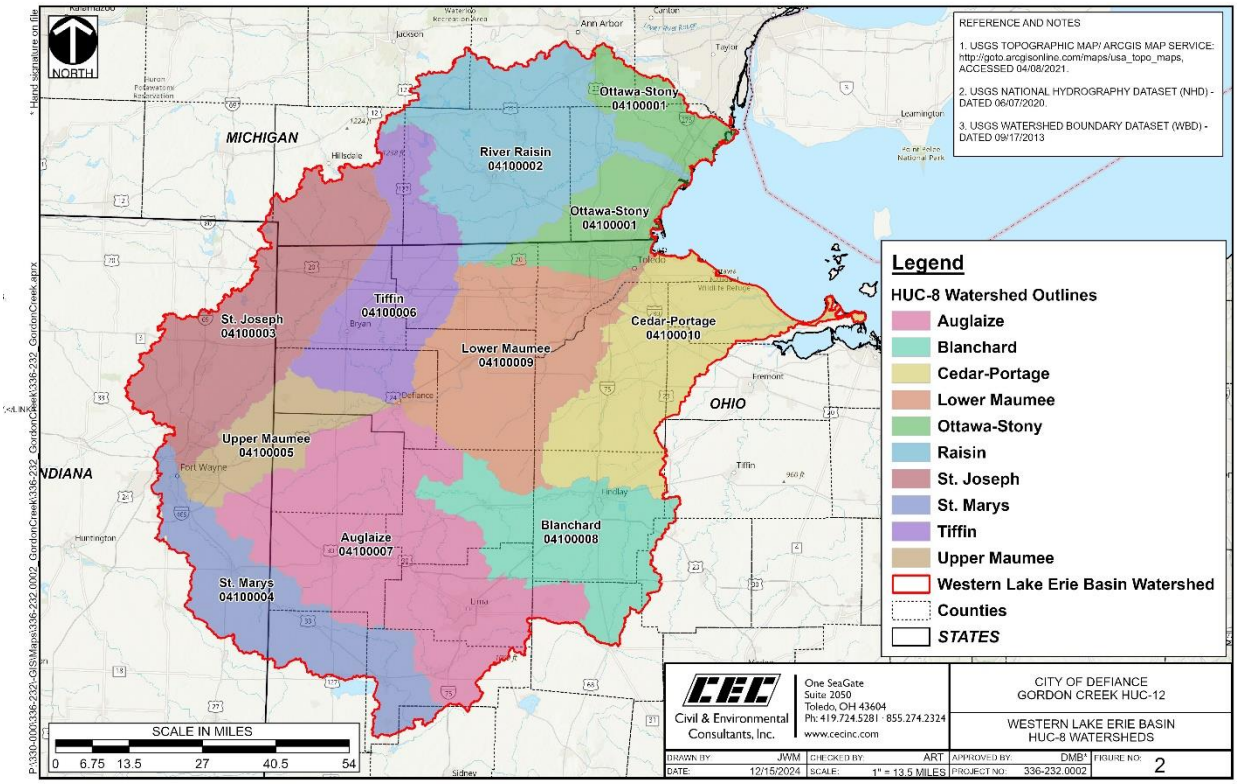


Figure 2: Western Lake Erie Basin Watershed

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 Upper Maumee HUC-8 (04100005) contains the Maumee River from its headwaters in Fort Wayne, where the St. Joseph and St. Marys

rivers join, to its most downstream terminus at RM 65.7. Approximately 430 miles of tributaries exist within the Upper Maumee HUC-8 (UMWP, 2014). The HUC-8 can be further divided into two smaller sub-watersheds at the HUC-10 level—the *Headwaters Maumee River (04100005 01)* and the *Gordon Creek- Maumee River HUC-10 (04100005 02)* (Figure 3).

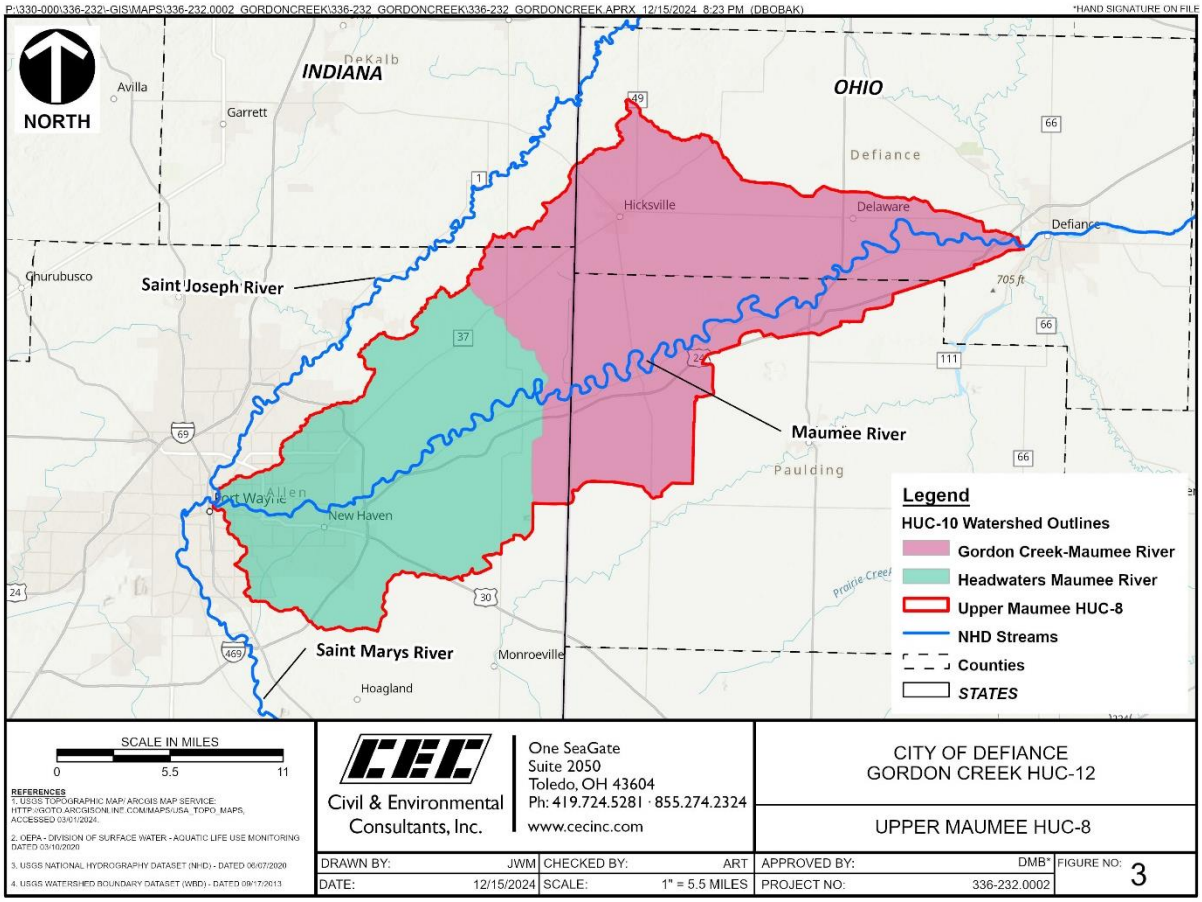


Figure 3: Upper Maumee HUC-8

The WLEB is characterized as mostly rural with small municipalities scattered throughout. Over 17,000 miles of streams flow across once-forested lands that have since been converted into agricultural production. This region has strong ties with its water resources, as they play an integral role in not only personal and industrial use, but also transportation, culture and economic development (ODA, 2023).

The *Gordon Creek-Maumee River HUC-10* has a drainage area of 228.8 square miles or 146,450 acres (Figure 4). Approximately 44 miles of the Maumee River are contained within the *Gordon Creek-Maumee River HUC-10* from approximately RM 110.5 in Indiana to RM 65.7, where the Tiffin River joins at the City of Defiance. Land use within the *Gordon Creek-Maumee River HUC-10* is mainly agricultural and rural, and communities within the watershed typically range from a few hundred to a few thousand people (US Census Bureau, 2010). The *Gordon Creek-Maumee River HUC-10* is further divided into eight HUC-12 watersheds, which contain smaller tributaries to the mainstem Maumee, one of which is the **Gordon Creek HUC-12** (Table 2). The **Gordon Creek HUC-12** completely contains all branches of Gordon

Creek: the Gordon Creek mainstem, as well as North, Middle and South Forks. North and Middle Fork Gordon Creek converge to create the Gordon Creek mainstem, while South Fork Gordon Creek is a tributary to Gordon Creek at River Mile (RM) 7.54. Gordon Creek is the principal stream of the sub-watershed and is 8.35 miles long. The **Gordon Creek HUC-12** is similar in land use setting and characteristics as the overall larger HUC-10 watershed, supporting mostly agricultural land use within the fertile landscape known formerly as the Great Black Swamp.

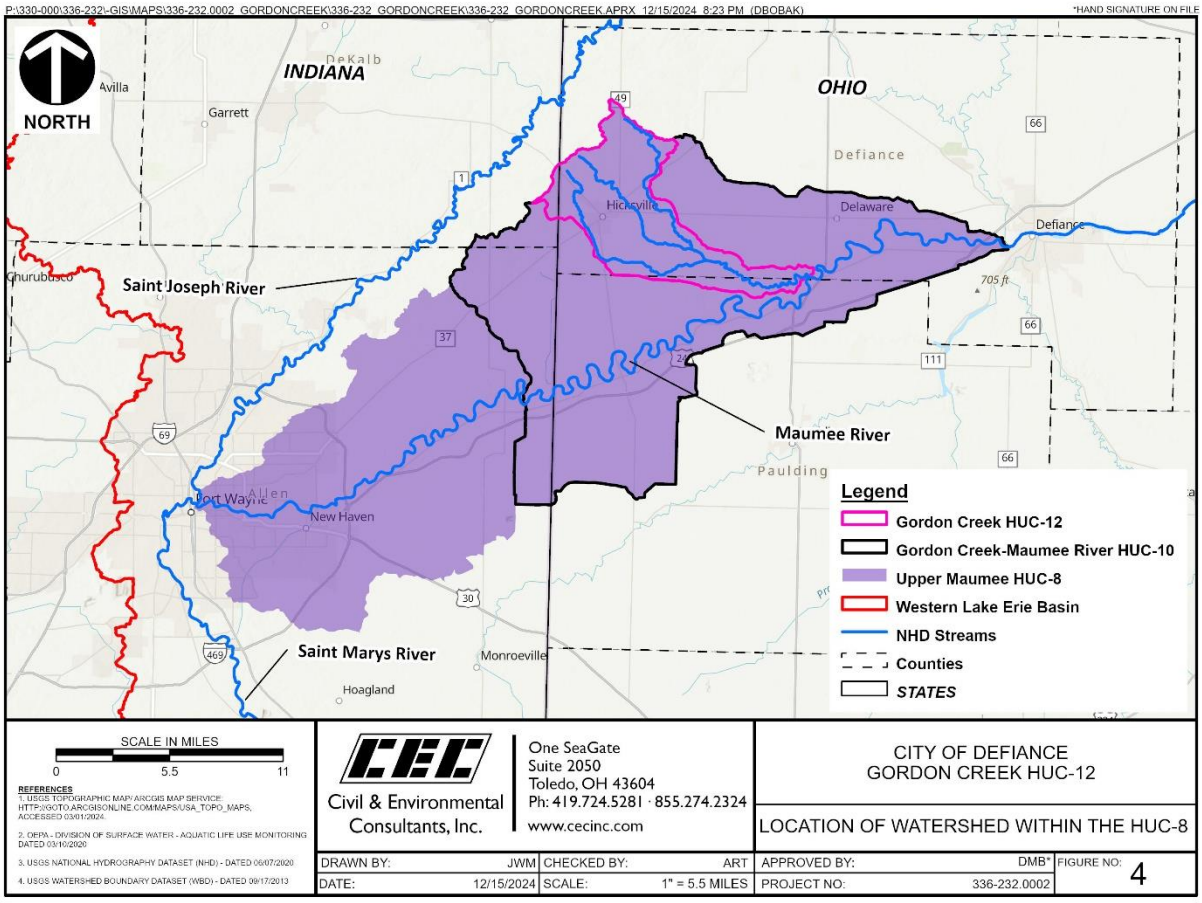


Figure 4: Location of the Gordon Creek HUC-12

Table 2: Sub-watersheds in the Gordon Creek-Maumee River HUC-10

Gordon Creek-Maumee River HUC-10 (04100005 02)		
HUC-12	**Area (Square miles)**	**Area (Acres)**
Zuber Cutoff HUC-12 (01)	36.82	23,564.80
North Chaney Ditch-Maumee River HUC-12 (02)	18.42	11,788.80
Marie DeLarme Creek HUC-12 (03)	48.99	31,353.60
Gordon Creek HUC-12 (04)	44.10	28,224.00
Sixmile Cutoff-Maumee River HUC-12 (05)	15.68	10,035.20
Platter Creek HUC-12 (06)	21.66	13,862.40
Sulphur Creek-Maumee River HUC-12 (07)	18.19	11,641.60
Snooks Run-Maumee River HUC-12 (08)	24.92	15,948.80

(Source: Ohio EPA, 2024)

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.

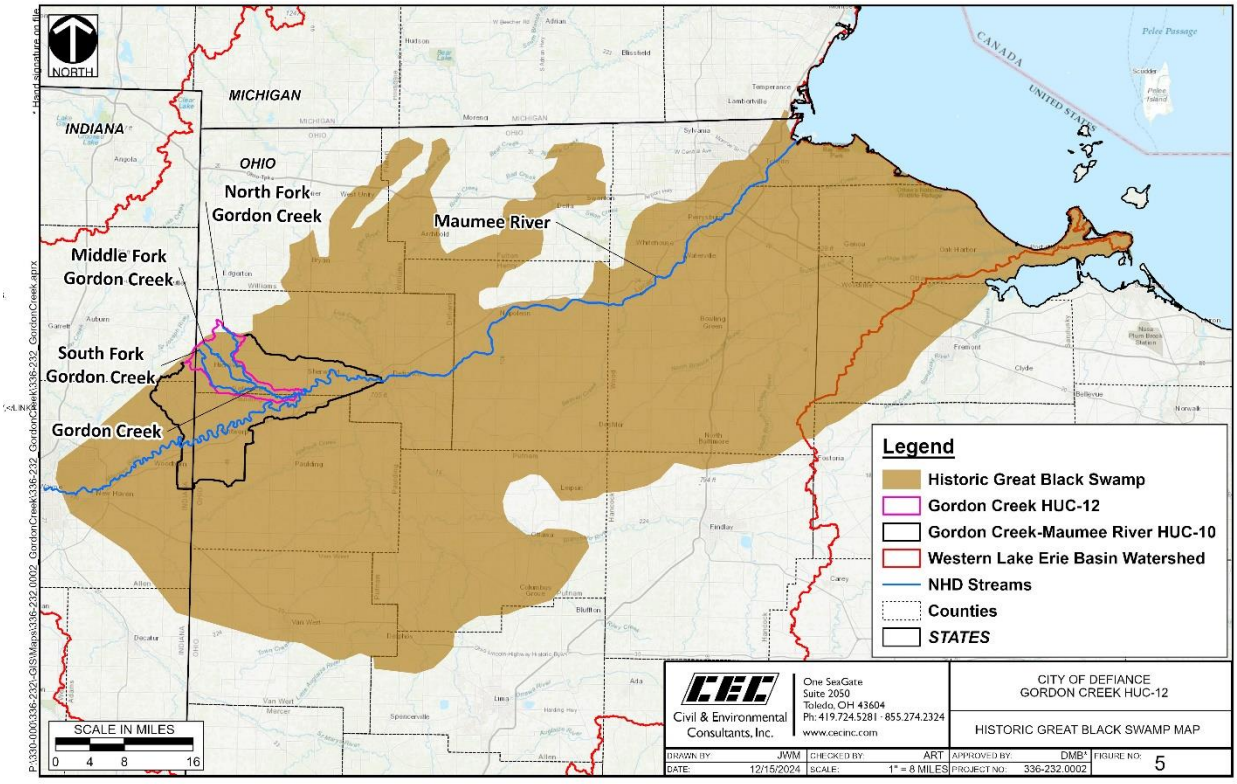


Figure 5: Historic Great Black Swamp

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).

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. Several watershed groups and governmental collaboratives, such

as the UMWP, Tri-State Watershed Alliance, St. Joseph Watershed Initiative and the Maumee River Basin Partnership of Local Governments (MRBPLG) have been involved in addressing water quality and nutrient reduction efforts within the **Gordon Creek HUC-12** and the tri-state regional area for the Upper Maumee HUC-8, including contributing watersheds for the St. Joseph and St. Marys rivers.

The City of Defiance is a vibrant and progressive community—the confluence of rich history, small town experiences and innovative opportunities (City of Defiance, 2024). The City's mission is to unite the community through learning, service and culture. The City of Defiance seeks to manage water resources through an integrated approach, leveraging technical and financial resources to simultaneously maximize environmental benefits in their operation and maintenance of the City's wastewater treatment plant (WWTP) and collection system, the implementation of their Combined Sewer Overflow (CSO) Long Term Control Plan and the employment of stormwater reduction efforts developed through the Municipal Separate Storm Sewer System (MS4) program.

The Defiance SWCD brings people, governmental agencies, and private interests together to manage America's natural resources and environmental challenges (Defiance SWCD, 2024). The agency provides technical assistance for:

- Soil erosion inventorying and conservation planning on cropland, pastureland and woodland;
- Conservation tillage and crop residue management;
- Survey and design for agricultural drainage and erosion control structures;
- Individual residential site reviews in cooperation with township trustees;
- Trees and tree planting equipment; and,
- Educational programming, including pond clinics, Envirothon, Farm Fair, Public Official Tours, school programs, conservation talks to civic and nonprofit groups, poster and photo contests and natural resources pamphlets and brochures.

Both the City of Defiance and Defiance SWCD recognize the importance of a broad, regional approach to water quality to meet goals for source water protection, sustainable recreational opportunities and healthy aquatic communities not only within the mainstem of the Maumee River, but within its upstream tributaries and downstream receiving waterbody, Lake Erie. In 2014, the City of Defiance and Defiance SWCD launched the *Land to Lake* website, announcing an initiative designed to promote community involvement in water resource protection throughout Defiance County. In addition, both entities contribute active leadership to the UMWP, the partnership responsible for the drafting of the *Upper Maumee River Watershed Management Plan*, the original document to which this NPS-IS serves to update.

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, 2020a), the *2022 Ohio Integrated Report* (Ohio EPA, 2022a) and the *Upper Maumee River Watershed Management Plan* (UMWP, 2014). Project information for Chapter 4 was compiled by collaborative meetings with organizational stakeholders, community partners and local landowners.

Additionally, the Agricultural Conservation Planning Framework (ACPF) tool was developed for the **Gordon Creek HUC-12**. This tool utilizes detailed terrain analysis to determine potential locations for specific in-field best management practices (BMPs). Results of the tool output are discussed in Chapter 3, and output maps will be used as part of ongoing conservation discussions with local landowners.

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 *Gordon Creek-Maumee River HUC-10* is comprised of eight HUC-12 watersheds; this document focuses on the #04 hydrologic unit—the **Gordon Creek HUC-12**. Gordon Creek is an 8.35 mile-long stream formed from the confluence of North Fork Gordon Creek and Middle Fork Gordon Creek that flows to the Maumee River at RM 81.49. Gordon Creek has an average gradient of 5.6 feet/mile and drains 44.10 square miles (Ohio EPA, 2022a; ODNR, 2001). Named tributaries in the sub-watershed are found in Table 3. In total, approximately 86.03 miles (454,238.40 linear feet) of stream segments flow throughout the sub-watershed.

Table 3: Named Tributaries within the Gordon Creek HUC-12

Gordon Creek HUC-12 (04100005 02 04)				
Stream Name	**Flows Into (RM)**	**Length (mi)**	**Drainage Area (mi^2)**	**Gradient (ft/mi)**
North Fork Gordon Creek	Gordon Creek (8.35)	10.7	10.8	5.9
Middle Fork Gordon Creek	Gordon Creek (8.35)	8.7	25.6	4.2
South Fork Gordon Creek	Gordon Creek (7.54)	12.1	14.2	13.4
Racetrack Run	Middle Fork Gordon Creek (1.50)	0.9	0.19	N/A
Mill Creek	Middle Fork Gordon Creek (2.80)	2.1	5.35	N/A

(Source: ODNR, 2001; Ohio EPA, 2024; USGS, 2019b)

The **Gordon Creek HUC-12** is mostly contained within the Huron-Erie Lake Erie Plains (HELP) ecoregion. This ecoregion is described as "Fine, poorly-drained, water-worked glacial till and lacustrine sediment; also coarser end moraine and beach ridge deposits" (Maumee RAP, 2006). The northwestern section of the **Gordon Creek HUC-12** falls within the Eastern Corn Belt Plains (ECBP), an ecoregion defined by rolling till plains and local end moraines. Soils within the ECBP are typically loamier and better drained than those in the HELP Ecoregion (USEPA, 2013).

The HELP and ECBP can be classified into smaller (Level IV) ecoregions with distinct characteristics (Figure 6). The **Gordon Creek HUC-12** spans three of these ecoregions: the Maumee Lake Plains and Paulding Plains in the HELP, as well as the Clayey High Lime Till Plains in the ECBP. The Maumee Lake Plains covers the middle portion of the sub-watershed and is a poorly drained region containing clayey lake deposits, water-worked glacial till, and fertile soils. The Paulding Plains occupies the eastern portion of the sub-watershed and is characterized by clayey lacustrine sediment and extensive, very poorly drained soils (USEPA, 2013). The Clayey High Lime Till Plans in the northwestern portion of the sub-watershed is a region characterized by moderate productivity and higher amounts of artificial drainage. Influenced by glaciation, it is a broad, nearly level glacial till plain with low gradient streams.

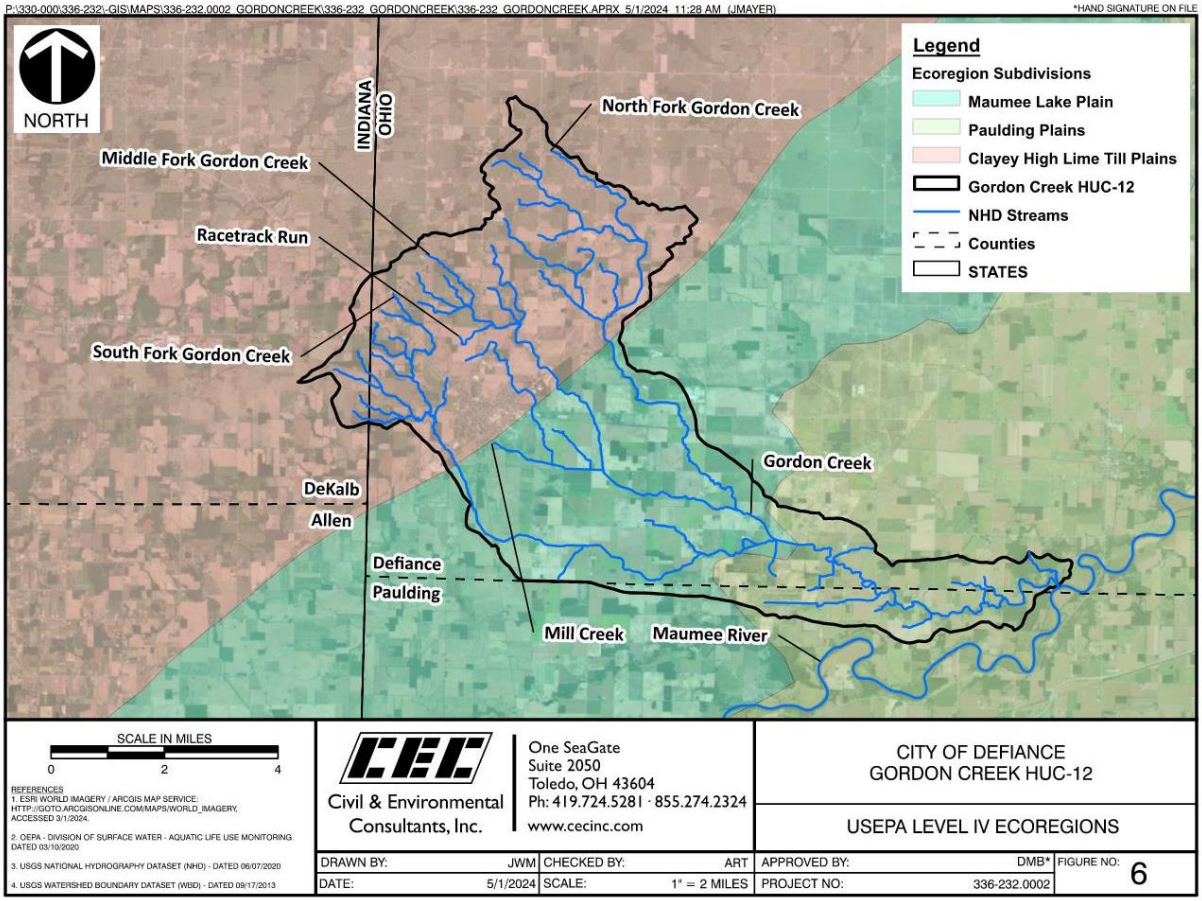


Figure 6: USEPA Level IV Ecoregions

The bedrock of the Upper Maumee watershed is Devonian, dating to approximately 400 million years ago. Shales, dolomite and limestone dominate the bedrock throughout the Upper Maumee. The landscape of the Upper Maumee watershed was influenced by the Wisconsin Glaciation, occurring over 14,000 years ago. Glaciers during this time both flattened hills and filled and dammed rivers to create lakes, including Lake Erie (UMWP, 2014). As these glaciers melted, they deposited rock, dirt and sand. A sequence of deposits, called the Lagro Formation form the surficial geology of the area today. A silt and clay mixture overlies the bedrock at a depth approximately 20 to 100 feet thick and forms the parent materials for the clay-rich soils of the area today (UMWP, 2014).

The **Gordon Creek HUC-12** is largely covered by finer-grained soils that are described as very poorly to somewhat poorly drained (Figure 7). These soils, when drained and managed, are highly productive for agriculture, which is the dominant land use throughout the area. Topography of the area is generally flat, with slopes averaging less than 5% percent.

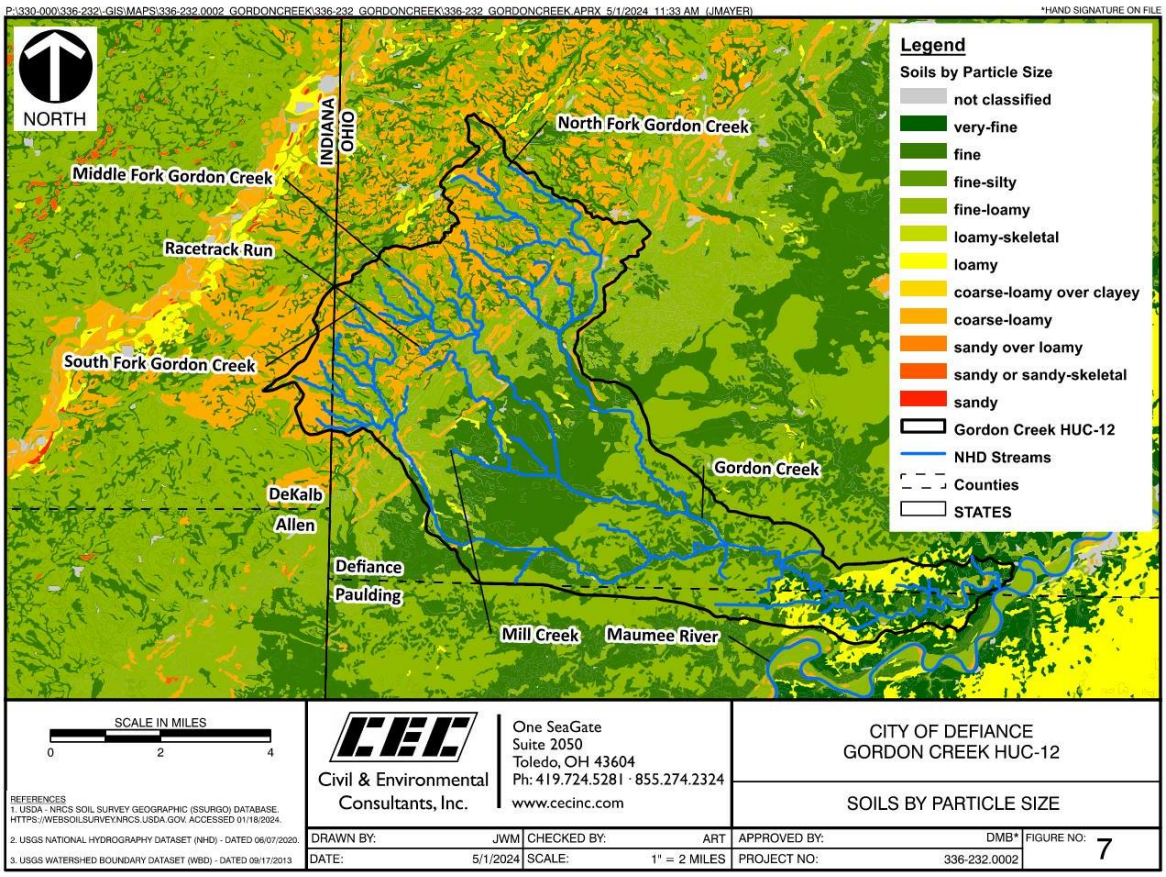


Figure 7: Soils Classified by Particle Size

The *Upper Maumee River Watershed Management Plan* listed the vast majority of soils within the HUC-8 watershed as hydric, including those within the **Gordon Creek HUC-12**. While most land within the **Gordon Creek HUC-12** is currently in agricultural production, the presence of hydric soils indicates a strong potential for wetland restoration opportunities. While mostly located within the boundaries of the former Great Black Swamp, very few wetland areas currently exist within the **Gordon Creek HUC-12** (Figure 8). The absence of wetlands, especially those along riparian corridors and within floodplains, limits the natural ability of a stream to attenuate sediments and nutrients.

Absence of floodplains and wetlands along streams bisecting agricultural land use. Photo courtesy of Civil & Environmental Consultants, Inc.

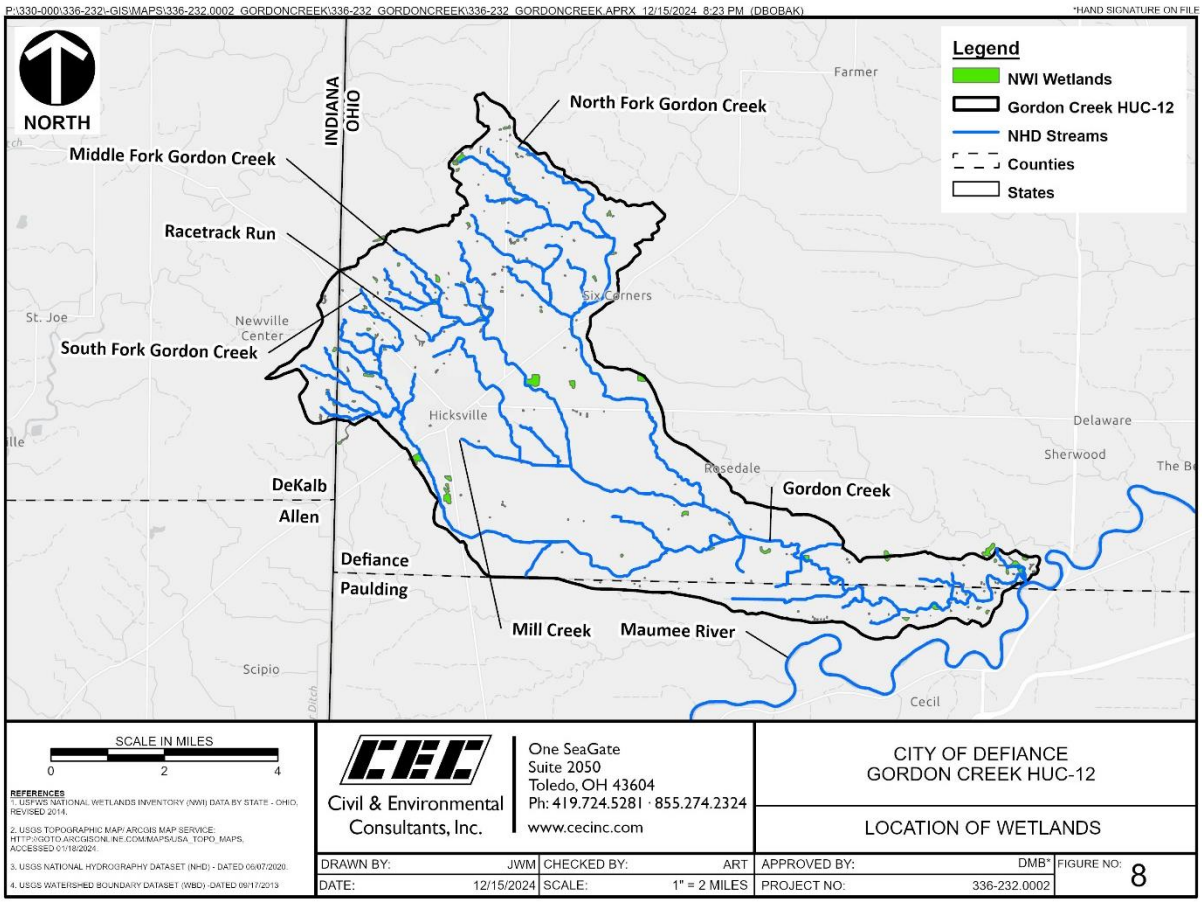


Figure 8: Wetlands in the Gordon Creek HUC-12

2.1.2 Land Use and Protection

Land use within the **Gordon Creek HUC-12** is fairly homogenous (Figure 9). Seventy-one percent (~71%) of land use is cultivated cropland and ~10% is dedicated to hay/pasture use (Table 4). The 2017 United States Department of Agriculture (USDA) Census of Agriculture lists soybeans as the largest field crop harvested in Defiance, Paulding (Ohio) and DeKalb (Indiana) Counties (≥ 45%). Corn makes up a major portion of crop production in these areas, accounting for 15-24% of crops in Defiance and Paulding counties and 25-35% in DeKalb County. Wheat accounts for 5-9% of planted crops in Defiance and DeKalb Counties and 10-24% in Paulding County. In general, farms are of medium size in all counties, with the average operation covering 180-499 acres (USDA, 2019).

While livestock operations do exist in the sub-watershed, estimated counts of animals are generally low (Table 5). Livestock operations are generally smaller and scattered throughout the sub-watershed. No large Concentrated Animal Feeding Operations (CAFOs) are located in the sub-watershed, but there is one Ohio Department of Agriculture (ODA)-permitted Confined Animal Feeding Facility (CAFF) located on the periphery of Hicksville. Fox Tail is a farm facility permitted for 3,675 head of swine weighing over 55 pounds (PRR, 2023). Paulding County realized a slight increase in the inventory of hogs and pigs from 2012 to 2017.

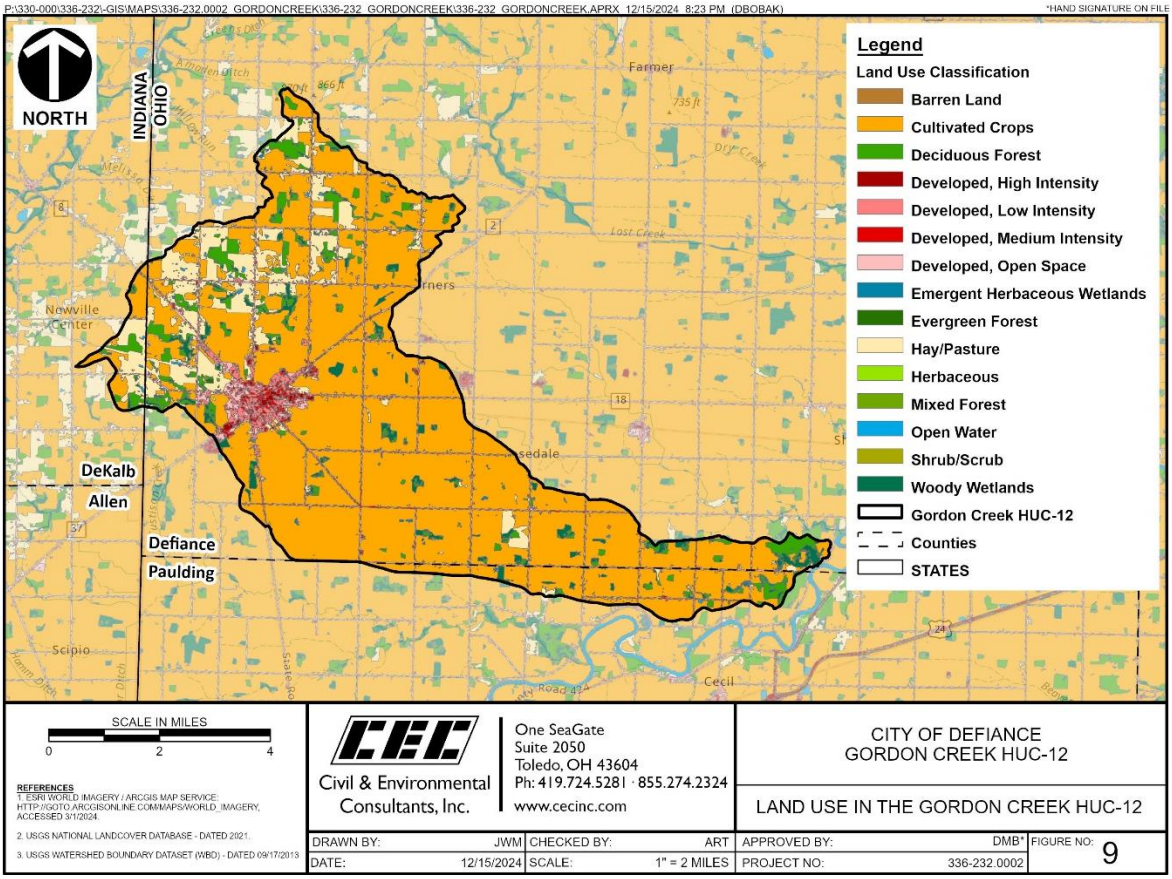


Figure 9: Land Use in the Gordon Creek HUC-12

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

Land Use	Gordon Creek HUC-12 (04100005 02 04)		
	Area (mi^2)	Area (acres)	% Watershed Area
Barren Land	0.01	6.69	0.02%
Cultivated Crops	31.49	20,152.30	71.40%
Deciduous Forest	2.66	1,703.26	6.03%
Developed, High Intensity	0.19	122.78	0.44%
Developed, Low Intensity	1.55	990.16	3.51%
Developed, Medium Intensity	0.67	424.34	1.50%
Developed, Open Space	1.38	885.53	3.14%
Emergent Herbaceous Wetlands	0.13	83.63	0.30%
Evergreen Forest	0.02	11.81	0.04%
Hay/Pasture	4.52	2,894.85	10.26%
Herbaceous	0.01	4.98	0.02%
Mixed Forest	0.03	18.31	0.06%
Open Water	0.07	47.43	0.17%
Shrub/Scrub	0.00	0.25	<0.01%
Woody Wetlands	1.37	877.68	3.11%
Total	**44.10**	**28,224.00**	**100.00%**

(Source: Homer et al., 2020)

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

Livestock Type	Animal Units
Beef	1,890
Dairy	1,262
Swine	3,777
Sheep	161
Horse	107
Chicken	484
Turkey	1
Duck	7

(Source: USDA Census of Agriculture, 2012, as presented in the PLET Input Data Server (USEPA, 2022))

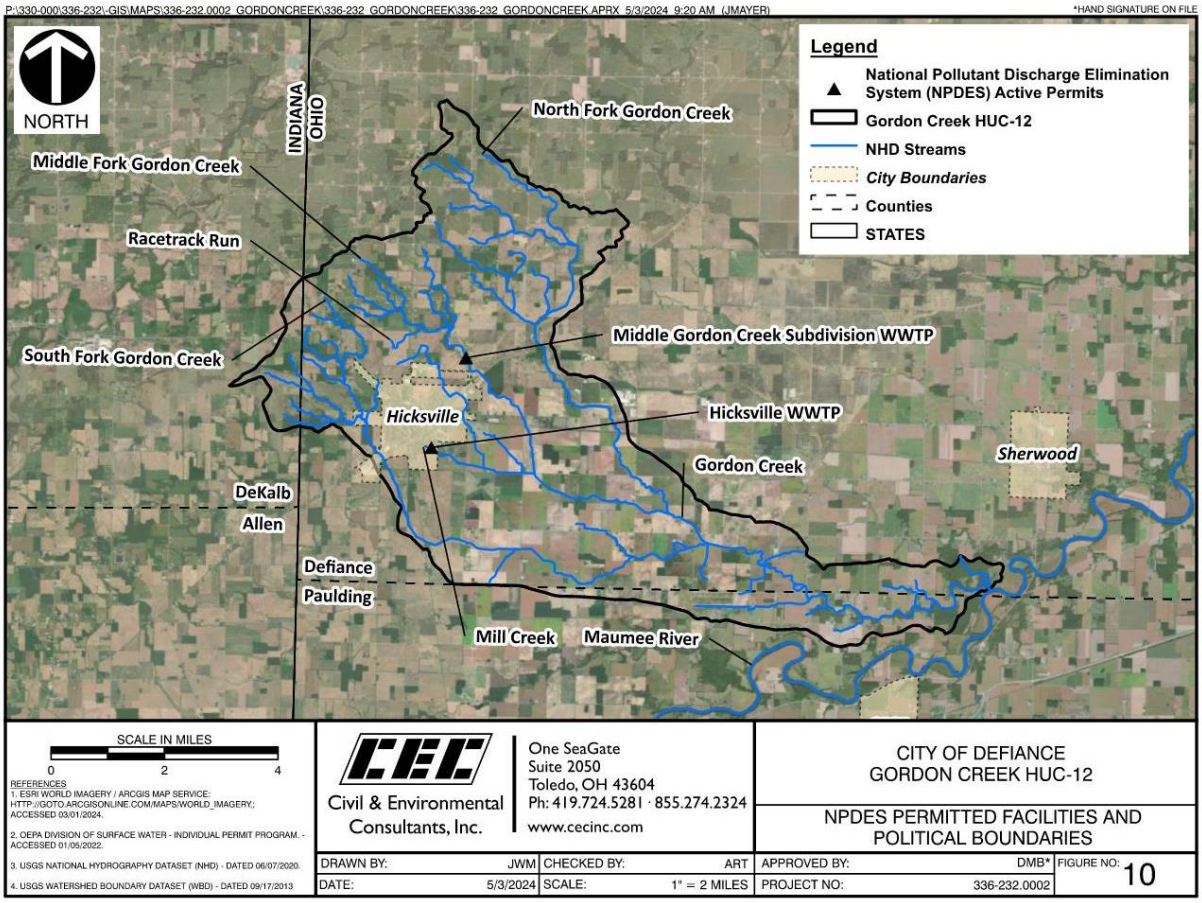


Figure 10: Political Boundaries and NPDES Facilities in the Gordon Creek HUC-12

Developed areas are sparse within the **Gordon Creek HUC-12,** making up approximately 9% of the sub-watershed (Figure 10). The **Gordon Creek HUC-12** is located predominantly in Hicksville Township in Defiance County, Ohio. In Paulding County, the sub-watershed is contained within Crane Township and in DeKalb County, Indiana, it is Newville Township. The largest concentration of developed area in the **Gordon Creek HUC-12** is around the Village of Hicksville, Ohio in Defiance County, which has a population of 3,431 (US Census Bureau, 2020). Hicksville operates 25 miles of storm, sanitary and

combined sewers (Village of Hicksville, 2017). These lines serve approximately 1,200 people and treat an average of 0.3 Million Gallons per Day (MGD).

Currently, there are two National Pollutant Discharge Elimination System (NPDES)-permitted facilities located within the **Gordon Creek HUC-12** (Table 6).

Table 6: NPDES-Permitted Facilities in the Gordon Creek HUC-12

Facility	Permit Number	Receiving Waterbody
Hicksville Wastewater Treatment Plant (WWTP)	2PB00042*SD	Mill Creek
Middle Gordon Creek Subdivision WWTP	2PG00049*ID	Middle Fork Gordon Creek

(Source: USDA Census of Agriculture, 2012, as presented in the PLET Input Data Server (USEPA, 2022)

NOTES
WWTP Wastewater Treatment Plant

The USEPA documents NPDES permit compliance through the Enforcement and Compliance History Online (ECHO) database (USEPA, 2024). Results discussed here cover the three year (12 quarters) compliance history from October 1, 2021 through September 30, 2024. The Hicksville Wastewater Treatment Plant (WWTP) has been in violation in 11 of 12 of the last quarters, seven of which were in Significant Noncompliance (SNC). Exceedances were reported for carbonaceous Biological Oxygen Demand ($cBOD_{5\text{-}day}$), *Escherichia coli (E. coli),* low level mercury, phosphorus and Total Suspended Solids (TSS). The Middle Gordon Creek Subdivision WWTP has been in violation in nine of the last 12 quarters for late or missing Discharge Monitoring Reports (DMRs).

Within unsewered areas in the **Gordon Creek HUC-12**, there is an estimated 2,166 people within 866 housing units (TMACOG, 2018). 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) concluded a study of locations and densities of HSTS throughout the WLEB in 2018. Within Defiance County, six areas were identified as Critical Sewage Areas (CSAs) and 13 CSAs were identified in Paulding County, in which larger-scale efforts should be initiated to address failing HSTS and/or potentially establish sewer service. None of these CSAs were identified in the **Gordon Creek HUC-12**. Total phosphorus and nitrogen loads from HSTS in the **Gordon Creek HUC-12** are estimated to be 0.60 metric tons per annum (MTA) and 5.81 MTA, respectively, based on mass.

In addition, the Natural Resources Conservation Service (NRCS) has designated most of the soils (96.4%) within the Upper Maumee watershed as “very limited” for septic system usage, meaning that the soils are not naturally inclined to properly disperse and absorb liquid sewage effluents in a traditional leach bed system, and modifications to the site or septic system itself in these areas is impractical or impossible (UMWP, 2014). Improper function of HSTS could potentially impact the **Gordon Creek HUC-12**.

There is little land specifically designated for recreation and greenspace within the **Gordon Creek HUC-12** (Figure 11). Approximately 375 acres of land within the sub-watershed is listed in the United States Geological Survey's (USGS) Protected Areas Database of the United States (PAD-US). This land is split over four parcels, mainly dedicated to recreational facilities (Table 7). These protected lands can contribute to conserved habitat for the nine federally threatened or endangered species listed by the United States Fish and Wildlife Service (USFWS) for Defiance and Paulding Counties in Ohio and DeKalb County in Indiana (Table 8). Gordon Creek in both Defiance and Paulding Counties, as well as Middle and South Fork Gordon Creek in Defiance County are currently listed as Group 1 streams in Appendix A of the *Ohio Mussel Survey Protocol*, indicating that the stream has the potential for mussels but the Federally Listed Species (FLS) on USFWS's listing are not expected to be found (ODNR, 2024a).

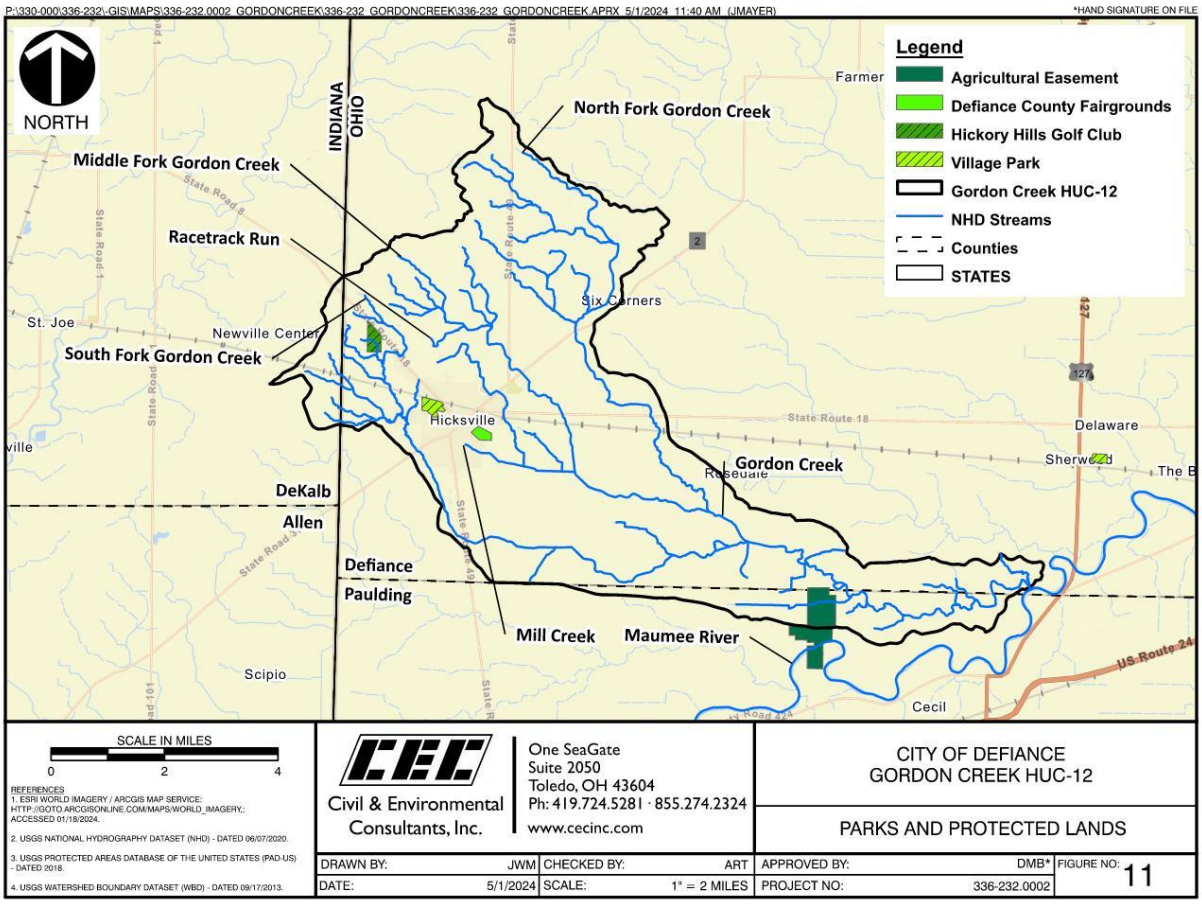


Figure 11: Parks and Protected Lands

Table 7: Parks and Protected Lands in the Gordon Creek HUC-12

Name	Acreage	Owner/Manager	Description
Clean Ohio Farmland	214*	Three Vally Conservation Trust	Agricultural Easement
Fairgrounds	36	Defiance County	Defiance County Fairgrounds
Golf Course	66	Private	Hickory Hills Golf Club
Local Park	56	Private - City	Village Park

(Source: USGS, 2019a)

NOTES

**These acres are approximately 52% of the whole Agricultural Easement. The remaining area is located in an adjacent HUC-12.*

Table 8: Threatened and Endangered Species in Defiance and Paulding Counties, OH, and DeKalb County, IN

Species	Status	Habitat Characteristics	County
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	All
Northern long-eared bat (*Myotis septentrionalis*)	Endangered	Hibernates in caves and mines and swarms in surrounding wooded areas in autumn; roosts and forages in upland forests during late spring and summer	All
Copperbelly water snake (*Nerodia erythrogaster neglecta*)	Threatened	Found in wooded and permanently wet areas (oxbows, sloughs, brushy ditches, floodplain woods)	All
Clubshell (*Pleurobema clava*)	Endangered	Found in coarse sand and gravel areas of runs and riffles within streams and small rivers	Defiance, DeKalb
Northern riffleshell (*Epioblasma torulosa rangiana*)	Endangered	Found in firm sand of riffle areas in large streams and small rivers, as well as Lake Erie	Defiance, DeKalb
Rayed bean (*Villosa fabalis*)	Endangered	Mostly found in smaller, headwater creeks, but sometimes in large rivers	Defiance, DeKalb
White cat's paw pearlymussel (*Epioblasma obliquata perobliqua*)	Endangered	Found in firm sand or gravel riffles in small streams and medium-large rivers	Defiance, DeKalb
Round hickorynut (*Obovaria subrotunda*)	Threatened	Sand and gravel in riffle, run, pool habitats in streams and rivers.	DeKalb
Eastern prairie fringed orchid (*Platanthera leucophaea*)	Threatened	Wet to mesic prairie habitats with open sun.	Paulding, DeKalb

(Source: ODNR, 2024b)

Additional points of interest throughout the **Gordon Creek HUC-12** include:

- Spindler Cemetery;
- Old Forest Cemetery; and,
- Hicksville High School.

Prevention of NPS pollution can also occur on private agricultural lands through conservation practices. Some current conservation practices on agricultural lands, such as the use of conservation tillage, can be estimated at a larger watershed scale (HUC-8) from remote sensing techniques used within the Operational Tillage Information System (OpTIS) (Table 9). Summary data provided by Ohio EPA regarding

the use of the Environmental Quality Incentives Program (EQIP) within the **Gordon Creek HUC-12** indicated no practices were certified or installed between March 30, 2017 and the end of 2018 (USDA-NRCS, 2018). Additional data provided by the Farm Service Agency (FSA) on current contracts within Defiance, Paulding and DeKalb counties are found in Table 10.

Table 9: OpTIS Countywide Conservation Practice Averages for 2015-2021 for the Upper Maumee HUC-8

Conservation Practice	% Usage
No-till conditions	32.89
Reduced till conditions	44.93
Conventional till	14.81
Cover crop	3.80

(Source: CTIC, 2024)

Table 10: Conservation Reserve Program (CRP) Contract Acreage in Defiance and Paulding Counties (OH) and DeKalb County (IN)

Practice	Defiance Co. Acres*	Paulding Co. Acres*	DeKalb Co. Acres*
Establishment of Permanent Introduced Grasses and Legumes	188.47	87.40	826.93
Vegetative Cover – Grass – Already Established	15.91	-	211.99
Vegetative Cover – Grass/Trees – Already Established	-	-	214.80
Wildlife Food Plot	8.47	3.77	17.03
Establishment of Permanent Vegetative Cover (Contour Grass Strips), Noneasement	-	9.71	0.80
Establishment of Permanent Native Grasses	128.99	360.04	203.24
Filter Strips	3,026.87	2,131.82	1,082.63
Riparian Buffer	485.52	137.74	7.09
Wetland Restoration	201.07	332.53	62.01
Wetland Restoration, Non-Floodplain	227.37	65.33	23.11
Rare and Declining Habitat	5.40	132.64	-
Marginal Pastureland and Wildlife Buffer	3.40	-	-
Tree Planting	3.40	4.90	-
Bottomland Hardwood Trees	-	-	1.80
Upland Habitat Buffers	395.88	153.91	49.50
SAFE Projects for Trees: Rare and Declining Habitat, Primarily Trees	-	-	2,252.05
SAFE Projects for Grasses, Native Grasses and Legumes	84.59	-	--
Wildlife Habitat for Pheasants	3,131.71	1,041.52	--
Constructed Wetland	20.61	-	-
Hardwood Tree Planting	159.33	98.17	564.79
Pollinator Habitat	75.05	51.39	3.8
Prairie Strips	-	30.84	-
Permanent Wildlife Habitat, Noneasement	545.71	144.97	274.50
Field Windbreak Establishment, Noneasement	256.18	265.54	38.71
Grassland Wildlife Plan	-	5.96	-
Grass Waterways, Noneasement	158.71	21.86	73.74
Shallow Water Areas for Wildlife	7.71	30.67	18.74

(Source: USDA-NRCS, 2021)

NOTES

**Acres reported at the county level and may not necessarily fall within the Gordon Creek watershed boundaries.*

SAFE State Acres for Wildlife Habitat

Additionally, the H2Ohio Initiative, a comprehensive water quality initiative, was launched in 2019. Administered by three different departments: Ohio EPA, ODA and ODNR, the program aims to strategically address serious water issues that have been building in Ohio for decades (H20hio, 2023). The portion administered by ODA 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 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, 2023). Enrollment for various practices in Defiance and Paulding Counties during 2021 and 2022 is listed in Table 11.

Table 11: H2Ohio Enrollment in Defiance and Paulding Counties

Practice	Defiance County Enrollment (Acres)*		Paulding County Enrollment (Acres)*	
	2021	2022	2021	2022
VNMP Development	50,348	3,229	106,743	344
VNMP Implementation	51,633	56,304	71,293	53,515
VRT Phosphorus Application	26,396	20,257	20,793	6,133
Subsurface Phosphorus Placement	13,572	13,087	26,627	13,471
Manure Incorporation	3,839	3,644	11,427	13,011
Conservation Crop Rotation – Small Grains	3,938	2,799	6,446	5,083
Conservation Crop Rotation - Forage	564	865	63	84
Overwintering Cover Crop	17,210	14,597	24,608	22,343

(Source: Data Ohio, 2024)

NOTES
**Acres reported at the county level and may not necessarily fall within the Gordon Creek watershed boundaries.*
VNMP Voluntary Nutrient Management Plan
VRT Variable Rate Technology

2.2 Summary of HUC-12 Biological Trends

The Ohio EPA sampled the **Gordon Creek HUC-12** in 2015 and 2016, 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, 2020a). This report serves as the Technical Support Document (TSD) for the Total Maximum Daily Loads (TMDL) study for selected Maumee River Tributaries, which is still under agency preparation. Gordon Creek, North Fork Gordon Creek, Middle Fork Gordon Creek and South Fork Gordon Creek were all recommended for the WWH designation, an upgrade in expected aquatic community performance from the existing Modified Warmwater Habitat – Channelized (MWH-C) designation.

Merritt Ditch was sampled in 2008 as part of a special study for projects funded through the Section 319(h) Program, as documented in the *Biological and Habitat Studies: 11 River and Stream Projects* (Ohio EPA, 2009). Merritt Ditch is undesignated for ALU, but the sample sites were evaluated to HELP Ecoregion WWH standards.

A summary of the sample locations and their biological status in the **Gordon Creek HUC-12** is provided in Table 12. For reference, water quality standards (WQS) for the HELP ecoregion are presented in Table 13.

Table 12: Biological Indices Scores for Sites in Gordon Creek HUC-12

Gordon Creek (04100005 02 04)							
River Mile	**Drainage Area (mi^2)**	**IBI**	**MIwb[a]**	**ICI[b]**	**QHEI**	**Attainment Status**	**Location**
Gordon Creek (WWH)							
6.67[W]	37.0	33	8.67	44	41.50	Full	Wonderly Road
1.12[W]	43.4	38	8.39	42	70.50	Full	Countyline Road
North Fork Gordon Creek (WWH)							
1.25[H]	11.1	46	N/A	Good	48.8	Full	Rosedale Road
Middle Fork Gordon Creek (WWH)							
3.80[H]	5.3	[34]	N/A	[Fair]*	[31.3]	Partial	Lake Road
0.76[H]	13.0	46	N/A	44	44.3	Full	Rosedale Road
South Fork Gordon Creek (WWH)							
0.23[H]	10.9	48	N/A	Good	43.3	Full	Breininger Road
Merritt Ditch (undesignated)[1]							
2.30[H]	0.5	20*	N/A	Poor*	31.0	Non	Adjacent Hicksville Industrial Park
1.90[H]	0.9	34	N/A	Poor*	26.0	Non	Adjacent Hicksville Community Hospital

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

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 (E=Exceptional; 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

H Headwater site

W Wading site

ns Nonsignificant departure from ecoregion biocriteria (≤4 IBI or ICI units, ≤0.5 MIwb units).

** 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.*

N/A Not applicable

WWH Warmwater Habitat

[ ] Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.

1 Data collected in 2008.

Table 13: Water Quality Standards for the Huron-Erie Lake Plains (HELP) 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 Administrative Code 3745-1)

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 assemblages within the sub-watershed were sampled in 2015 and 2016. Almost 95,000 fish representing 61 species and four hybrids were collected from 89 locations across the study area. These samples indicated that the overall study area, on average, ranged from *Marginally Good* to *Good*, whereas individual sites ranged from *Poor* to *Exceptional*. Two state listed species were collected during this sampling, along with several other intolerant or rare species. Most sites met both IBI and MIwb thresholds for the HELP Ecoregion. While historical data is limited, improvements have been seen across the study area; scores have increased from areas near or just below attainment to well-above attainment standards. More rare or intolerant species, as well as individual numbers, were also observed cumulatively across the larger area. Much of this improvement is attributed to returning modified channels to their more natural state, reducing siltation and improving water quality (Ohio EPA, 2020a). Fish performance within the **Gordon Creek HUC-12,** as a whole, greatly exceeded thresholds for IBI and MIwb for the MWH-C designation, great improvement over historical sampling and prompting an upgrade in designation to WWH. Trends in the sub-watershed are reflective of the general study area as a whole, and include better species assemblages and numbers. Diversions from these trends occurred at two sampling locations in 2008 in Merritt Ditch, an undesignated stream.

Macroinvertebrates (Invertebrate Community Index [ICI])

Macroinvertebrate assemblages within the sub-watershed were sampled in the summer of 2015 and 2016 at 90 sites within 50 streams. These sites, overall, demonstrated good quality benthic communities. Of the sampled locations, 90% met attainment thresholds of their assigned ALUs. Sampling indicated that quality has improved compared to historical sampling. The most common moderately-intolerant species sampled within the study area, *Acerpenna spp.,* was documented in 78% of samples, up from 21% in past evaluations. Generally, *Ephemeroptera, Plecoptera* and *Trichoptera* (EPT) and sensitive taxa have also increased in prevalence (Ohio EPA, 2020a). Macroinvertebrate

performance within the **Gordon Creek HUC-12** reflects the larger study area with most streams within the sub-watershed meeting or exceeding ALU standards, with some scores falling into the *Very Good* category. All sites in the Gordon Creek mainstem and North and South Forks exceeded WWH thresholds. Community performance within Middle Fork Gordon Creek exceeded the MWH threshold, but did not reach WWH levels. Communities within Merritt Ditch performed poorly in 2008.

Habitat (via Qualitative Habitat Evaluation Index [QHEI])

Ohio EPA sampling crews documented various water quality and habitat attributes during the QHEI assessment within the sub-watershed in 2015 and 2016 (Table 14). Scores ranged from *Very Poor* to *Excellent* with wading sites overall having good habitat, while headwater sites trended toward the *Fair* range. Most sites met the expected thresholds for their designations. Generally, correlation was noted between drainage area and habitat quality, with sites with larger drainage areas having better habitat. Overall, habitat characteristics that are limiting within the study area include low relief, naturally poor draining soils, and hydrologic modification. Specifically, stream modifications include realignment, dredging and removal of vegetation for the purpose of supporting human land uses and improving drainage. Much of this modification occurred in the past, yet maintenance occurs in the present (Ohio EPA, 2020a).

Table 14: QHEI Matrix for Sites in the Gordon Creek HUC-12

Gordon Creek (04100005 02 04)																																	
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/No Riffle/Run Embeddedness	WWH Attributes	Channelized/No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth <40 cm	High-Influence MWH 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
Gordon Creek (WWH)																																	
6.67[W]	41.5	2.30				•					•		2				•		1	•	•			•	•		•	•	•	•		8
1.12[W]	70.5	1.43	•	•		•	•	•	•	•	•		8						0		•			•				•		•		4
North Fork Gordon Creek (WWH)																																	
1.25[H]	48.8	4.29					•	•				•	3				•	•	2	•	•			•	•			•	•		•	7
Middle Fork Gordon Creek (WWH)																																	
3.80[H1]	31.3	9.80						•			•		2	•	•				2		•			•	•			•	•		•	6
0.76[H]	44.3	5.95							•			•	2				•	•	2	•	•			•	•				•	•	•	7
South Fork Gordon Creek (WWH)																																	
0.23[H]	43.3	6.00	•					•					2				•	•	2	•	•			•	•			•	•	•		7

Gordon Creek (04100005 02 04)																																		
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/No Riffle/Run Embeddedness	WWH Attributes	Channelized/No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth <40 cm	High-Influence MWH 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
Merritt Ditch (undesignated)[2]																																		
2.30[H]	31.0	25.00											**0**	•	•	•	•	•	**5**		•			•			•	•	•		•	**6**
1.90[H]	26.0	17.54											**0**	•	•	•	•	•	**5**		•			•		•		•	•		•	**6**

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

NOTES
QHEI Qualitative Habitat Evaluation Index
H Headwater site
W Wading site
WWH Warmwater Habitat
1 Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.
2 Data collected in 2008

Habitat quality within the **Gordon Creek HUC-12** ranged from *Fair* to *Poor* in the middle and upper reaches of the sub-watershed's streams, but increased to *Excellent* near the mouth of Gordon Creek (Ohio EPA, 2020a). Middle and South Fork, as well as all but the lowermost mile of Gordon Creek are actively managed through the County's ditch maintenance program. Despite periodic maintenance activities and persisting habitat limitations, biological performance generally exceeded WWH thresholds (Ohio EPA, 2020a).

Generally, streams that have QHEI scores of at least 60 are capable of supporting WWH assemblages. 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). No sites within the **Gordon Creek HUC-12** met these criteria.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

As listed in the *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016, Technical Report AMS/2015-MAUMT-2* (Ohio EPA, 2020a), two biological sampling sites in the Gordon Creek mainstem, one site in North Fork Gordon Creek, one site in Middle Fork Gordon Creek and one site in South Fork Gordon Creek are reaching attainment of the WWH designation. One site in Middle Fork Gordon Creek is in *Partial Attainment* of the WWH designation due to underperforming macroinvertebrate communities impacted by siltation and direct habitat alterations from habitat modification (Table 15). Sampling in 2008 documented in the *Biological and Habitat Studies: 11 River and Stream* Projects showed Merrit Ditch to be in *Non-Attainment* of the WWH designation, although the stream is currently undesignated. Both fish and biological communities are negatively impacted by direct habitat alteration caused by channelization and active maintenance programs.

Table 15: Causes and Sources of Impairments in the Gordon Creek HUC-12

Gordon Creek (04100005 02 04)				
River Mile	**Primary Cause(s)**	**Primary Source(s)**	**Attainment Status**	**Location**
Gordon Creek (WWH)				
6.67[W]	--	--	Full	Wonderly Road
1.12[W]	--	--	Full	Countyline Road
North Fork Gordon Creek (WWH)				
1.25[H]	--	--	Full	Rosedale Road
Middle Fork Gordon Creek (WWH)				
3.80[H1]	Direct habitat alterations; siltation	Habitat modification	Partial	Lake Road
0.76[H]	--	--	Full	Rosedale Road
South Fork Gordon Creek (WWH)				
0.23[H]	--	--	Full	Breininger Road
Merritt Ditch (undesignated)[2]				
2.30[H]	Direct habitat alterations*	Channelization*	Non	Adjacent Hicksville Industrial Park
1.90[H]	Direct habitat alterations*	Channelization*	Non	Adjacent Hicksville Community Hospital

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

NOTES
WWH Warmwater Habitat
H Headwater site
W Wading site
1 Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.
2 Data collected in 2008.
** Assumed based on narrative provided in Ohio EPA, 2009.*

Efforts made in the agricultural landscape to mitigate NPS pollution can help offset other impacts. Agricultural operations can have a substantial impact on water quality due to the extent of farm activities on the landscape, the soil-disturbing nature of those activities and associated impacts from sediment, nutrients and other crop-related chemicals (USEPA, 2023b). Soil erosion, nutrient loss,

bacteria from livestock manure and pesticides are primary stressors to water quality that unbalance both water chemistry and habitat. Additionally, channelization diminishes the quality and diversity of streamside habitats by altering water temperatures, flows and channel-forming processes. When the riparian ecosystem functionality is altered, impacts to water quality can be seen in increased sedimentation, nutrient loads and temperatures that lead to algal blooms or eutrophication (California State Water Board, 2018). Floodplains and riparian habitats that are disconnected from their floodwaters through channelization lose their ability to attenuate sediments and associated nutrients on the land.

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. Over 1,681 feet of eroding streambank across 11 sites were observed within the **Gordon Creek HUC-12** during a windshield survey conducted in the Upper Maumee watershed in 2012 (UMWP, 2014). 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.

Nutrient sampling conducted in 2015-2016 and subsequent analysis evaluating the potential for nutrient driven impairment was conducted in Gordon Creek at RM 1.12. Despite biological performance reaching WWH attainment, the stream was listed as "ALU attaining, aquatic life potentially threatened" (Ohio EPA, 2020a). The 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 16). 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. It should be noted that a very small portion of the **Gordon Creek HUC-12** urban nutrient load is regulated and is therefore allocated as a point source in the *Maumee Watershed Nutrient Total Maximum Daily Load* study (Ohio EPA, 2023). Reductions to this load will also make progress toward total urban reduction targets.

Table 16: Estimated Spring Total Phosphorus Loadings from Contributing NPS Sources in the Gordon Creek HUC-12

	Agricultural Load (lbs)	Developed/Urban Load (lbs)	Regulated Urban Load (lbs)[a]	Natural Load (lbs)	HSTS Load (lbs)	NPS Total (lbs)
Current Estimates*	19,000	880	10	180	550	21,000
Target Loadings	11,000	530	10^	110	330	13,000

(Source: OLEC, 2020a; OLEC, 2023)

NOTES

* *Estimated using two significant figures*

a *Calculated from the difference between urban values reported in OLEC, 2020a and OLEC, 2023.*

^ *Negligible amount*

Gordon Creek has a PCR designation for which it is in *Non-Attainment* (Table 17). Mill Creek has a SCR designation for which it is currently in *Full Attainment*. Statewide standards for the Recreational Beneficial Use are in Table 18. The TSD noted potential sources of *E. coli* could be HSTS, livestock pasture runoff, agricultural runoff, CSO/cross-connections and wildlife accumulations (Ohio EPA, 2020a). Many streams within heavily agricultural landscapes such as the **Gordon Creek HUC-12** had drastically reduced riparian buffers, making them more susceptible to surface runoff.

Table 17: Recreational Water Quality Data

Gordon Creek (04100005 02 04)					
River Mile	**Location**	**Number of Samples**	**Geometric Mean (CFU per 100 ml)**	**Attainment Status**	**Potential Sources**
Gordon Creek (PCR)					
1.12	County Line Road	5	246	Non	Agricultural, HSTS
Mill Creek (SCR)					
0.10	Fountain Street Road	5	1,029	Full	--

(Source: Ohio EPA, 2020a)

NOTES
HSTS Home Sewage Treatment Systems
CFU Colony Forming Unit
ml Milliliters

Table 18: Statewide Numerical Criteria for Recreational Use Protection

Recreation use	*E. coli* (CFU per 100 ml)	
	90-day geometric mean	**Statistical threshold value[1]**
Bathing water	126	410[a]
Primary contact recreation	126	410
Secondary contact recreation	1,030	1,030

(Source: Ohio Administrative Code 3745-1-37)

NOTES
1 These criteria shall not be exceeded in more than ten percent of the samples taken during any 90-day period.
a A beach action value of 235 E. coli colony counts per 100 ml shall be used for the purpose of issuing beach and bathing water advisories.
CFU Colony Forming Units
ml Milliliters

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

Assessment data from the 2008 and 2015-2016 sampling events referenced in the *Biological and Habitat Studies: 11 River and Stream Projects* (Ohio EPA, 2009), the *Biological and Water Quality Study of the Minor Great Black Swamp Tributaries, 2015-2016, Technical Report AMS/2015-MAUMT-2* (Ohio EPA, 2020a), the *2022 Ohio Integrated Report* (Ohio EPA, 2022a) and the *Upper Maumee River Watershed Management Plan* (UMWP, 2014) were used in the development of this NPS-IS. 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

Eight sampling sites are located in the **Gordon Creek HUC-12**. Two locations within Gordon Creek are in *Full Attainment* of the WWH designation. One location within North Fork Gordon Creek and one location in South Fork Gordon Creek are also in *Full Attainment* of the WWH designation. Middle Fork Gordon Creek has one site in *Full Attainment* of the WWH designation and one site in *Partial Attainment* due to direct habitat alterations and siltation from habitat modifications. Merritt Ditch currently has no ALU designation , but two sites in the stream were evaluated with WWH standards. Both sites in Merritt Ditch are in *Non-Attainment*, likely due to direct habitat alterations as a result of channelization and active maintenance activities.

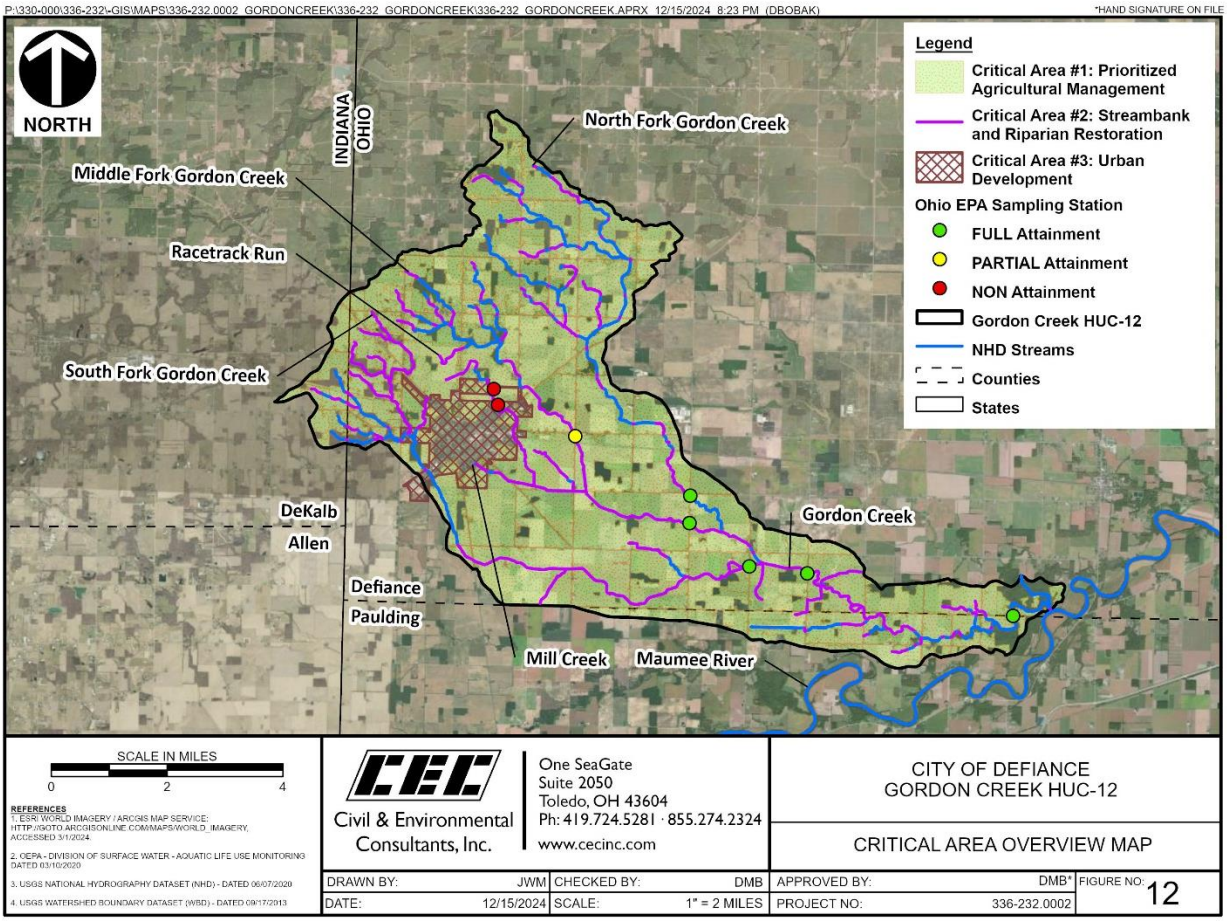


Figure 12: Gordon Creek HUC-12 Critical Area Overview[1]

Three critical areas have been identified within the **Gordon Creek HUC-12** (Table 19). Two critical areas will address far-field impacts of nutrients and sediments eventually flowing to Gordon Creek, as well as to the Maumee River and Lake Erie, the end receiving waterbody of drainage from the **Gordon Creek**

[1] 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.

HUC-12. A third critical area will address habitat alterations and channelization effects that contribute to near-field impairment (Figure 12)**.**

Table 19: Gordon Creek HUC-12 Critical Area Descriptions

Critical Area Number	Critical Area Description	Impairments Addressed
1	Nutrient Reduction in Prioritized Agricultural Lands	Far-field, with near-field effects
2	Streambank and Riparian Restoration	Near-field, with far-field effects
3	Urban Runoff Reduction	Far-field, with near-field effects

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

3.2.1 Detailed Characterization

Ohio's *Nutrient Mass Balance Study* (Ohio EPA, 2022b) estimated 90% of the phosphorus nutrient loadings and 89% of the nitrogen nutrient loading 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. Given the dominance of agricultural land use throughout the greater WLEB watershed, the use of BMPs are recommended for agricultural operations to minimize nutrient and associated sediment loss to local waterways and drainage ditches through surface and tile flow.

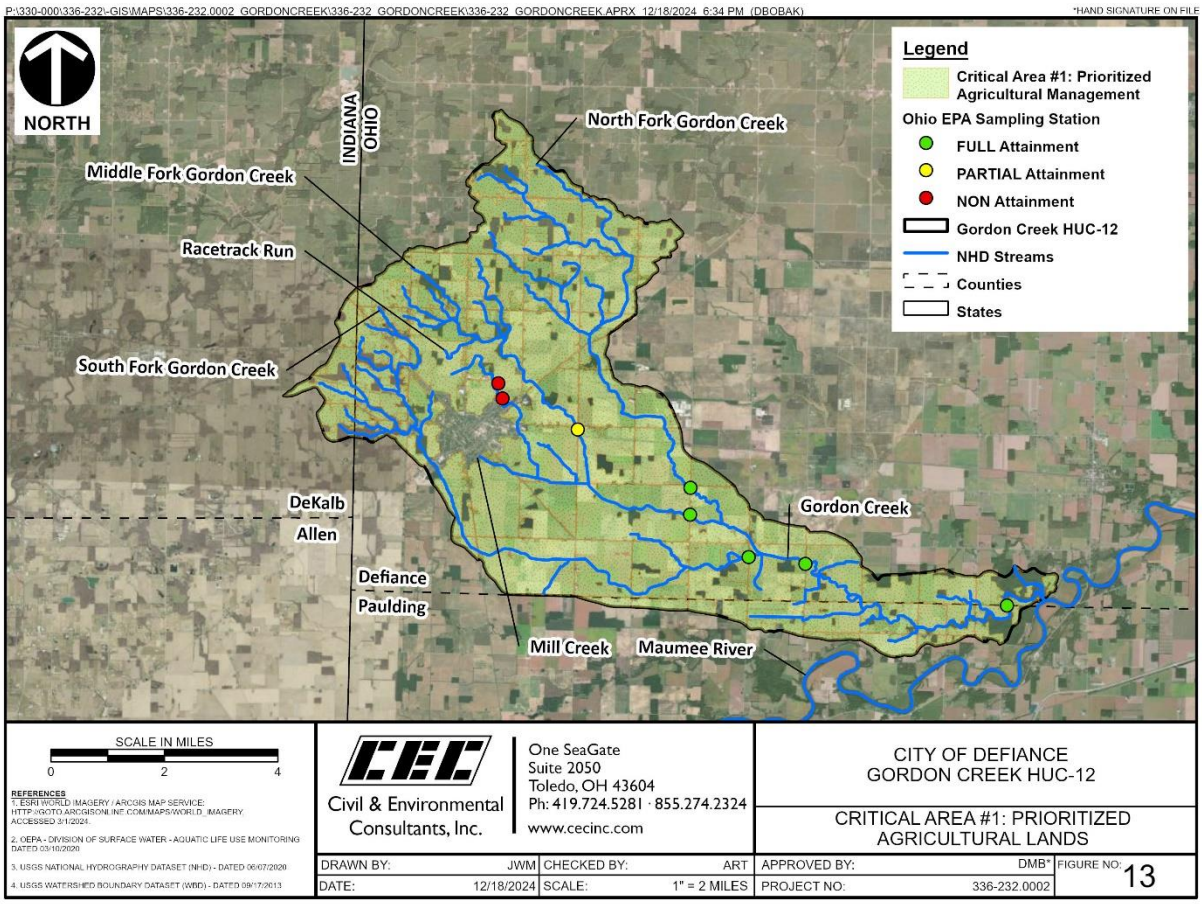


Figure 13: Gordon Creek HUC-12 Critical Area #1

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 Lake Erie. 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 **Gordon Creek HUC-12** (Figure 13).

An ACPF database was assembled for the **Gordon Creek HUC-12.** The Geographic Information System (GIS)-based tool utilizes input data including a high resolution digital elevation model (DEM), the National Cropland Data Layer (CDL), parcel boundary details and detailed soil surveys to identify potential areas for conservation practices. Results from this tool informed the prioritization of critical lands and objective building (Table 20). The ACPF identified 3,385 acres of high-runoff risk fields (very high + high), which accounts for approximately 15% of all agricultural lands within the sub-watershed. Output maps are in Appendix A.

Table 20: Agricultural Conservation Planning Framework Results

Gordon Creek (04100005 02 04)			
Critical Runoff Risk (acres)*			
Very High	**High**	**Moderate**	**Low**
491	2,894	7,538	9,847
Best Management Practice Output			
Best Management Practice	**Number of Potential Locations**	**Total Size**	**Treated Acreage**
Grassed waterways	413	30.1 miles	--
Contour buffer strips	25	4.6 acres	--
Drainage water management structures	266	--	9,988
Bioreactors	113	--	5,653
Nutrient removal wetlands	58	289 acres (pool) 700 (vegetated buffer)	85,172^
WASCOBs	23	--	199
Saturated buffers	189	24.2 miles	7,208
Two-stage ditch	297	--	1,279

(Source: ACPF model run for the City of Defiance by CEC, Inc.)

NOTES

* *The ACPF model analyzes drainage area based upon high-resolution imagery. Watershed boundaries may be redrawn based upon drainage patterns and extend beyond current USGS HUC-12 boundaries; therefore, acreage may not be equal to acreage calculated for the USGS HUC-12s.*

^ *Treated wetland acres may overlap, based on placement of nutrient removal wetlands or may contain acreage outside of the HUC-12 watershed boundaries.*

3.2.2 Detailed Biological Conditions

Fish community data for the eight sampling locations within the **Gordon Creek HUC-12** are summarized below (Table 21). 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. Within the **Gordon Creek HUC-12,** fish assemblages performed well during the 2015-2016 sampling event. Community performance observed during this sampling event showed substantial improvements over historical sampling. Native species at all locations and sensitive species in the Gordon Creek mainstem were observed in greater numbers, as well as an increase in insectivorous fish and decrease in pollution-tolerant species. Additionally, the first brindled madtom, a relatively intolerant species to pollution, was recorded in Gordon Creek for the first time since 1887 (Ohio EPA, 2020a). Despite high community performance, habitat scores were relatively low across the sub-watershed, except at RM 1.12 in Gordon Creek.

Table 21: Critical Area #1 – Fish Community and Habitat Data

Gordon Creek (04100005 02 04)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Gordon Creek (WWH)							
6.67[W]	37.0	27	41.5	33	8.67	Bluntnose minnow (27%), central stoneroller (20%), sand shiner (16%)	Fair – Good
1.12[W]	43.4	32	70.5	38	8.39	Sand shiner (37%), bluntnose minnow (17%), spotfin shiner (17%)	Marginally Good – Good
North Fork Gordon Creek (WWH)							
1.25[H]	11.1	18	48.8	46	N/A	Central stoneroller (30%), johnny darter (11%), bluntnose minnow (10%)	Very Good
Middle Fork Gordon Creek (WWH)							
3.80[H]	5.3	[18]	[31.3]	[34]	N/A	Green sunfish (36%), white sucker (23%), bluegill sunfish (16%)	Marginally Good
0.76[H]	13.0	24	44.3	46	N/A	Central stoneroller (22%), yellow bullhead (12%), green sunfish (11%)	Very Good
South Fork Gordon Creek (WWH)							
0.23[H]	10.9	19	43.3	48	N/A	Central stoneroller (33%), blackstripe topminnow (22%), bluntnose minnow (12%)	Very Good
Merritt Ditch (undesignated)[1]							
2.30[H]	0.5	3	31.0	20*	N/A	Fathead minnow (77%), creek chub (20%), johnny darter (3%)	Poor
1.90[H]	0.9	6	26.0	34	N/A	Fathead minnow (61%), johnny darter (15%), creek chub (10%)	Fair

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

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*
H *Headwater site*
W *Wading site*
ns *Nonsignificant departure from ecoregion biocriteria (≤4 IBI or ICI units, ≤0.5 MIwb units).*
* *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.*
N/A *Not applicable*
WWH *Warmwater Habitat*
[ ] *Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.*
1 *Data collected in 2008.*

Community performance in Merritt Ditch, which was sampled as part of a monitoring effort for a Section 319(h) Program grant in 2008, was lacking. This headwater stream is currently undesignated, but was evaluated using WWH standards. Near the Hicksville Industrial Park (RM 2.30), fish communities did meet the expected thresholds for WWH headwater sites; however, near the Hicksville Community Hospital (RM 1.90), community performance scored in the *Poor* range. Severe habitat alterations were the limiting factors within Merritt Ditch (Ohio EPA, 2009).

Characteristics of the aquatic macroinvertebrate community for the **Gordon Creek HUC-12** sampling locations in *Critical Area #1* are summarized below (Table 22). 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.

Within the **Gordon Creek HUC-12**, benthic communities generally performed well during the 2015-2016 sampling event. Of the six sampling locations collected throughout the Gordon Creek mainstem and its branches during this event, three had quantitative scores falling into the Very Good range and two sampling locations had qualitative scores of Good. Macroinvertebrate communities currently are either similar or better than those of historic sampling. The number of EPT taxa near the mouth of the Gordon Creek mainstem was similar to historic sampling; however, the number of sensitive taxa observed increased. Additionally, several species of freshwater mussels were observed at the downstream sample sites in Gordon Creek in 2015 (Ohio EPA, 2020a).

Community performance in Middle Fork Gordon Creek was *Fair.* Only a qualitative score could be obtained from this site due to suspected disturbance or vandalism that removed the artificial substrates in the stream. Tolerant midges and moderately tolerant mayflies dominated the macroinvertebrate communities at this site, which are indicative of excess nutrients, organic inputs, periodic low dissolved oxygen (DO) levels and sedimentation (Ohio EPA, 2020a). Macroinvertebrate community performance has decreased in quality as compared to historic sampling conducted in 2000 that yielded an ICI score of 50 (Exceptional). Conditions during the 2015-2016 sampling event revealed reduced overall flow/interstitial conditions, pooled conditions and excessive siltation (Ohio EPA, 2020a). Communities in Merritt Ditch were *Poor* at two locations. Severe habitat alterations were the limiting factors within Merritt Ditch (Ohio EPA, 2009).

Table 22: Critical Area #1 – Macroinvertebrate Community Data

Gordon Creek (04100005 02 04)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of QI./Qt.)**	**Predominant Species**
Gordon Creek (WWH)			
6.67[W]	44 – Very Good 12 sensitive taxa	Moderate-high density/2,665 organisms per square foot	Hydropsychid caddisflies (F, MI), *Polypedilum flavum, Dicrotendipes neomodestus*, and tanytarsini midges (F), baetid mayflies (F, MI), *Petrophila* moth larvae (MI)
1.12[W]	42 – Very Good 13 sensitive taxa	Moderate density/555 organisms per square foot	Hydropsychid and *Hydroptila* caddisflies (F)
North Fork Gordon Creek (WWH)			
1.25[H]	N/A – Good 4 sensitive taxa	Moderate density	Baetid mayflies (F), Hydropsychid caddisflies (F, MI), *Sphaerium* sp. (fingernail clams) (F)
Middle Fork Gordon Creek (WWH)			
3.80[H]	N/A – [Fair]* [2 sensitive taxa]	[Moderate density]	[Midges (mostly *Chironomus (C.) decorus gr.* with others) (T, F), baetid mayflies (mainly *Callibaetis sp*. with others) (MT, F, MI)]
0.76[H]	44 – Very Good 9 sensitive taxa	Moderate-high density/2,092 organisms per square foot	Hydropsychid and *Hydroptila* caddisflies (F, MI), midges (mostly *Polypedilum flavum* and tanytarsini midges with others) (F, MT, T, MI)
South Fork Gordon Creek (WWH)			
0.23[H]	N/A – Good 4 sensitive taxa	Moderate density	Fingernail clams (*Sphaerium* sp.) (F)
Merritt Ditch (undesignated)[1]			
2.30[H]	N/A – Poor*	--	--
1.90[H]	N/A – Poor*	--	--

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

NOTES

W Wading site

H Headwater site

a Narrative evaluation used in lieu of ICI

ns Nonsignificant departure from ecoregion biocriteria (≤4 IBI or ICI units, ≤0.5 MIwb units).

** 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.*

N/A Not applicable

Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant

[ ] Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.

1 Data collected in 2008.

-- Data not available.

3.2.3 Detailed Causes and Associated Sources

Eight sampling sites are located in the **Gordon Creek HUC-12.** Two locations within Gordon Creek are in *Full Attainment* of the WWH designation. One location within North Fork Gordon Creek and one location in South Fork Gordon Creek are also in *Full Attainment* of the WWH designation. Middle Fork Gordon Creek has one site in *Full Attainment* of the WWH designation and one site in *Partial Attainment* due to direct habitat alterations and siltation as a result of habitat modification. While Merritt Ditch is currently undesignated, two sites in Merritt Ditch are considered to be in *Non-Attainment,* likely due to direct habitat alterations as a result of channelization and active maintenance. The data summarized previously in Table 14 (p.24) may reveal a direct link between the presence of attributes in the sub-watershed that have influence on the aquatic communities throughout Gordon Creek and its tributaries in *Critical Area #1*. These contributing attributes in *Critical Area #1* include:

- Channelization or a Recovering Channel;
- Silt/Muck Substrates;
- Sparse Cover;
- Heavy/Moderate Silt Cover;
- Fair/Poor Development;
- Low to No Sinuosity;
- Lack of Fast Current;
- High/Moderate Substrate and Riffle Embeddedness; and,
- Lack of Riffle.

Many habitat attributes found during the QHEI sampling event (i.e., channelization, heavy/moderate silt cover, substrate embeddedness, etc.) are likely a result of land use activities, which are mainly agricultural operations within the watershed. 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 and reach attainment of WQS for the WAU[2]. Agricultural land use activities in *Critical Area #1* contribute to not only near-field impairment and stressed aquatic communities in Gordon Creek and its tributaries, but also far-field impairment through

[2] Defined as the HUC-12.

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 sub-watersheds within the WLEB. 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, 2022b; OLEC, 2023).

Many objectives within the **Gordon Creek HUC-12** align with the priorities of the H2Ohio Initiative, a water quality initiative with a focus on phosphorus reduction that provides economic incentive for nutrient management and associated BMP implementation. Additional funding sources that may serve to incentivize BMP implementation include the Lake Erie Conservation Reserve Enhancement Program (CREP) and CRP administered by FSA and EQIP and other Farm Bill programs administered by the USDA-NRCS.

Goals

The 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 **Gordon Creek HUC-12**, the following goal has been established:

Goal 1. Reduce springtime nitrogen loading contributions in the **Gordon Creek HUC-12** to a level at or below 11,000 lbs/year (20% reduction).
NOT ACHIEVED: Current estimated load contribution is 19,000 lbs/year.

Simultaneous goals relate to the improvement of in-stream conditions within Gordon Creek and its tributaries, in order to improve the health of aquatic communities. Implementation of BMP objectives geared toward nutrient reduction efforts will generally also help make incremental progress toward the following goals:

Goal 2. Maintain IBI score at or above 32 at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 33.

Goal 3. Maintain MIwb score at or above 7.3 at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 8.67.

Goal 4. Maintain ICI score at or above 34 (Good) at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 44.

Goal 5. Achieve QHEI score at or above 60 at Wonderly Road in Gordon Creek (RM 6.67).
NOT ACHIEVED: Site currently has a score of 41.5.

Goal 6. Maintain IBI score at or above 32 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 38.

Goal 7. Maintain MIwb score at or above 7.3 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 8.39.

Goal 8. Maintain ICI score at or above 34 (Good) at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 42.

Goal 9. Maintain QHEI score at or above 60 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 70.5.

Goal 10. Maintain IBI score at or above 28 at Rosedale Road in North Fork Gordon Creek (RM 1.25).
✓ ACHIEVED: Site currently has a score of 46.

Goal 11. Maintain ICI score at or above 34 (Good) at Rosedale Road in North Fork Gordon Creek (RM 1.25).
✓ ACHIEVED: Site currently has a score of Good (~37).

Goal 12. Achieve QHEI score at or above 55 at Rosedale Road in North Fork Gordon Creek (RM 1.25).
NOT ACHIEVED: Site currently has a score of 48.8.

Goal 13. Maintain IBI score at or above 28 at Lake Road in Middle Fork Gordon Creek (RM 3.80).
✓ ACHIEVED: Site currently has a score of 34.

Goal 14. Achieve ICI score at or above 34 (Good) at Lake Road in Middle Fork Gordon Creek (RM 3.80).
NOT ACHIEVED: Site currently has a score of Fair (~21).

Goal 15. Achieve QHEI score at or above 55 at Lake Road in Middle Fork Gordon Creek (RM 3.80).
NOT ACHIEVED: Site currently has a score of 31.3.

Goal 16. Maintain IBI score at or above 28 at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
✓ ACHIEVED: Site currently has a score of 46.

Goal 17. Maintain ICI score at or above 34 (Good) at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
✓ ACHIEVED: Site currently has a score of 44.

Goal 18. Achieve QHEI score at or above 55 at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
NOT ACHIEVED: Site currently has a score of 44.3.

Goal 19. Maintain IBI score at or above 28 at Breininger Road in South Fork Gordon Creek (RM 0.23).
✓ ACHIEVED: Site currently has a score of 48.

Goal 20. Maintain ICI score at or above 34 (Good) at Breininger Road in South Fork Gordon Creek (RM 0.23).
✓ ACHIEVED: Site currently has a score of Good (~37).

Goal 21. Achieve QHEI score at or above 55 at Breininger Road in South Fork Gordon Creek (RM 0.23).
NOT ACHIEVED: Site currently has a score of 43.3.

Goal 22. Achieve IBI score at or above 28 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 20.

Goal 23. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 24. Achieve QHEI score at or above 55 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 31.

Goal 25. Maintain IBI score at or above 28 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
✓ ACHIEVED: Site currently has a score of 34.

Goal 26. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 27. Achieve QHEI score at or above 55 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of 26.

Additionally, attainment of the respective recreational use in Gordon Creek and maintenance of the attainment in Mill Creek in the **Gordon Creek HUC-12** would occur through management of livestock operations and manure in agricultural areas and routine repair and replacement of failing HSTS and connection of residences to local sewer lines. The following goals have been set to achieve this for the sub-watershed:

Goal 28. Achieve a 90-day geometric mean value for *E. coli* below 126 colony counts per 100 mL at County Line Road in Gordon Creek (RM 1.12).
NOT ACHIEVED: Site currently has a geometric mean of 246 colony counts per 100 mL.

Goal 29. Maintain a 90-day geometric mean value for *E. coli* below 1,030 colony counts per 100 mL at Fountain Street Road in Mill Creek (RM 0.10).
✓ ACHIEVED: Site currently has a geometric mean of 1,029 colony counts per 100 mL.

Objectives

In order to make substantive progress toward the achievement of the springtime phosphorus load reduction goal of 8,000 lbs for the **Gordon Creek HUC-12**, efforts must commence on more widespread implementation, according to the following objectives within *Critical Area #1.*

Objective 1: Implement nutrient management (planning and implementation through soil testing and Variable Rate Technology (VRT)) on at least 10,500 additional acres[3].

Objective 2: Plant cover crops on at least 5,000 additional acres annually[4].

Objective 3: Implement conservation tillage (of at least 30% residue) on at least 6,100 additional acres[5].

Objective 4: Reduce nutrient loss from subsurface tile drainage through the installation of drainage water management structures that drain at least 1,400 acres.

Objective 5: Reduce nutrient loss from subsurface tile drainage through the installation of blind inlets that drain at least 400 acres.

Objective 6: Reduce erosion and nutrient loss through the installation or rehabilitation 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 1,000 acres.

Objective 7: Reduce erosion and nutrient loss through the installation of filter strips/buffers (of at least a 35 ft setback) or saturated buffers that receive/treat surface water from at least 1,500 acres.

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

Objective 9: Reduce erosion and nutrient loss through the installation of water and sediment control basins (WASCOBs) that receive/treat surface water from at least 80 acres.

[3] Assumes an increase in implementation of 10,500 acres from baseline of plan approval. No data are currently available for the number of nutrient management plans and VRT implementation in the **Gordon Creek HUC-12**. The H2Ohio Program initiates the development of VNMPs. Acres enrolled in the H2Ohio program in Defiance and Paulding counties may be contained within the **Gordon Creek HUC-12**; however, this data source does not report at the sub-watershed level.

[4] Cover crop usage is estimated to occur on approximately 760 acres, based upon OpTIS data (Dagan, 2019). To reach and maintain the desired nutrient reduction level for this objective on a year over year basis, at least 5,760 acres of cover crops (estimated baseline of 760 + 5,000 more) would need to be planted each year throughout the **Gordon Creek HUC-12.** Cover crop plantings may be implemented in the absence of grant funding.

[5] Current estimates indicate reduced tillage occurs on approximately 9,000 acres, based upon OpTis data (Dagan, 2019). To reach and maintain the desired nutrient reduction level for this objective on a year over year basis, at least 15,100 acres of land would need to be maintained under conservation tillage regimes (estimated baseline of 9,000 + 6,100 more) throughout the **Gordon Creek HUC-12.**

Objective 10: Create, enhance and/or restore at least 20 acres of wetlands and/or water retention basins for treatment of agricultural runoff and/or nutrient reduction purposes from 500 total agricultural acres.

Objective 11: Stabilize and reduce erosion from agricultural streambanks and drainage conveyances through the installation of conservation ditches (overwide or two-stage design)[6] on at least 20,000 linear feet (3.80 miles).

Objective 12: Increase the retirement of marginal and highly vulnerable lands by enrolling at least 30 acres into programs such as CRP, CREP and the Wetlands Reserve Program (WRP).

Objective 13: Prevent excessive erosion and nutrient loss from at least 280 acres of pasture/livestock areas through the installation of structures that address and protect heavy use areas, provide alternative water sources and properly store and manage manure.

Objective 14: Install at least 4,000 linear feet of livestock exclusion fencing.

These objectives will be directed toward implementation on prioritized agricultural lands and are estimated to reach the phosphorus spring load reduction goal (Table 23). Additional conservation activities within the **Gordon Creek HUC-12**, both on priority and secondary lands, may also make incremental progress toward 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 toward phosphorus reduction goals within the watershed.

Table 23: Estimated Spring 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]	10,500	5,360	3,480
2	Cover Crops	5,000	480	310
3	Conservation Tillage (30-50% Residue)	6,100	2,930	1,910
4	Drainage Water Management Structures	1,400	560	360
5	Blind Inlets[b]	400	360	240
6	Grassed Waterways with Erosion Control Structures[c]	1,000	440	290
7	Filter Strips/Buffers (of at least 35 ft)[d]	1,500	870	570
8	Forested Buffers (of at least 100 ft)	20	10	10
9	WASCOBs	80	30	20
10	Wetlands[e] and/or Water Retention Basins	500[f]	330	220
11	Conservation Ditches	1,000	710	460

[6] Conservation ditch construction should be avoided in areas where streams are naturally recovering in form and function.

Objective Number	Best Management Practice	Total Acreage Treated	Estimated Annual Phosphorus Load Reduction (lbs)	Estimated Spring Phosphorus Load Reduction (lbs)
12	Land Retirement	30	30	20
13	Pasture/Livestock Management Structures	280[g]	60	40
14	Livestock Exclusion Fencing	200	120	80
	TOTAL	**28,010***	**12,290**	**8,010**

(Source Model: Pollution Load Estimation Tool (PLET), Version 1.0, (USEPA, 2022))

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 PLET guidance documents (USEPA, 2023a).*

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

c *Grassed waterway nitrogen reduction efficiency estimated from urban grass swale efficiency in PLET and phosphorus reduction efficiency from Ohio State University Extension, 2018.*

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

e *Phosphorus load reduction for wetlands was calculated using the estimated annual phosphorus loading estimated form springtime loads referenced in OLEC, 2023.*

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 (Woltemade, 2000). For this objective of 20 wetland acres, total drainage area is 500 acres.*

g *One linear foot of stream is estimated to drain 0.05 acres in this sub-watershed.*

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

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 toward 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 toward 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, 2020b) 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

The *Upper Maumee River Watershed Management Plan* identified riparian buffer widths within the greater Upper Maumee watershed, of which over 70% of streams have a riparian buffer of 60 feet or less. Like the greater watershed, streams in the **Gordon Creek HUC-12** were also estimated to have a riparian corridor width of 60 feet or less. Stream habitat within the sub-watershed was generally low. While many aquatic communities are reaching WQS for the WWH designation, habitat stressors are likely causing impairment within Middle Fork Gordon Creek and Merritt Ditch.

In the absence of forested riparian corridors, streams erode downward and develop a narrow, steeply sloped bed (Montgomery County, 2006). The changing of the natural channel shape not only reduces habitat for aquatic ecosystems and causes water chemistry stress within the stream (i.e., rising temperatures within the stream due to lack of shade, DO regime swings, promotion of algal growth, etc.), but downcutting combined with large flow events often causes bank undercutting, exacerbating bank failure and streambank erosion.

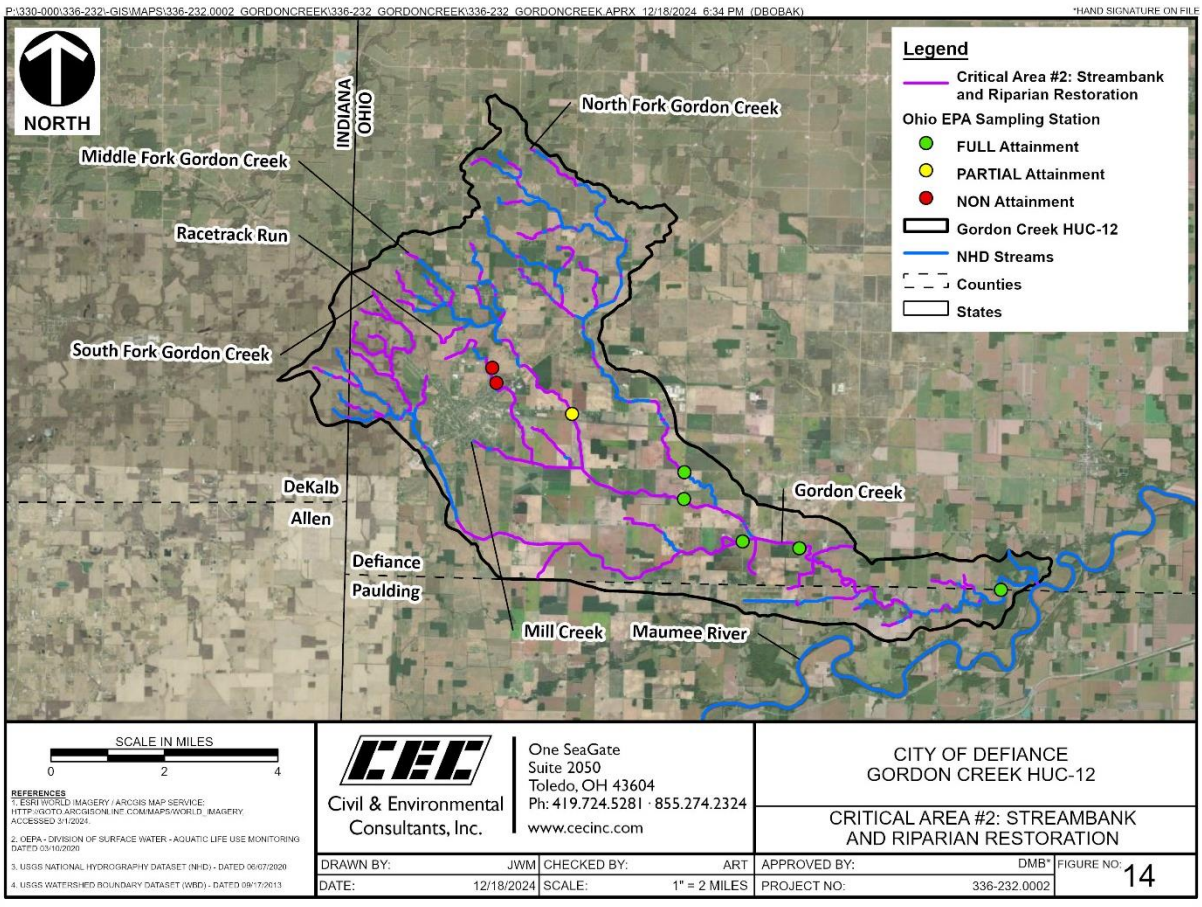


Figure 14: Gordon Creek HUC-12 Critical Area #2

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 approximately 249,533 linear feet (47.3 miles) of stream length and a 50-foot buffer width on each side (Figure 14). The potential for restoration of approximately 570 acres of riparian corridor and floodplain exists in *Critical Area #2*.

The ACPF Riparian Function Assessment matches riparian buffer design to functional opportunities each landscape setting provides to intercept runoff, influence shallow groundwater, and stabilize streambanks with vegetation. Results from this analysis are provided in Table 24.

Table 24: Riparian Function Assessment Results

Classification	Locations Identified	Contributing Acres
Critical zone	10	623
Deep rooted vegetation	293	2,136
Multi-species buffer	55	687
Stiff stemmed grasses	75	9,056
Stream bank stabilization	325	1,715

(Source: ACPF model run for the City of Defiance by CEC, Inc.)

3.3.2 Detailed Biological Conditions

Fish community data for the eight sampling locations within the **Gordon Creek HUC-12** are summarized below (Table 25). 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. Within the **Gordon Creek HUC-12,** fish assemblages performed well during the 2015-2016 sampling event. Community performance observed during this sampling event showed substantial improvements over historical sampling. Native species at all locations and sensitive species in the Gordon Creek mainstem were observed in greater numbers, as well as an increase in insectivorous fish and decrease in pollution-tolerant species. Additionally, the first brindled madtom, a relatively intolerant species to pollution, was recorded in Gordon Creek for the first time since 1887 (Ohio EPA, 2020a). Despite high community performance, habitat scores were relatively low across the sub-watershed, except at RM 1.12 in Gordon Creek.

Table 25: Critical Area #2 – Fish Community and Habitat Data

Gordon Creek (04100005 02 04)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Gordon Creek (WWH)							
6.67^{W}	37.0	27	41.5	33	8.67	Bluntnose minnow (27%), central stoneroller (20%), sand shiner (16%)	Fair – Good
1.12^{W}	43.4	32	70.5	38	8.39	Sand shiner (37%), bluntnose minnow (17%), spotfin shiner (17%)	Marginally Good – Good

Gordon Creek (04100005 02 04)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
North Fork Gordon Creek (WWH)							
1.25[H]	11.1	18	48.8	46	N/A	Central stoneroller (30%), johnny darter (11%), bluntnose minnow (10%)	Very Good
Middle Fork Gordon Creek (WWH)							
3.80[H]	5.3	[18]	[31.3]	[34]	N/A	Green sunfish (36%), white sucker (23%), bluegill sunfish (16%)	Marginally Good
0.76[H]	13.0	24	44.3	46	N/A	Central stoneroller (22%), yellow bullhead (12%), green sunfish (11%)	Very Good
South Fork Gordon Creek (WWH)							
0.23[H]	10.9	19	43.3	48	N/A	Central stoneroller (33%), blackstripe topminnow (22%), bluntnose minnow (12%)	Very Good
Merritt Ditch (undesignated)[1]							
2.30[H]	0.5	3	31.0	20*	N/A	Fathead minnow (77%), creek chub (20%), johnny darter (3%)	Poor
1.90[H]	0.9	6	26.0	34	N/A	Fathead minnow (61%), johnny darter (15%), creek chub (10%)	Fair

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

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
H Headwater site
W Wading site
ns Nonsignificant departure from ecoregion biocriteria (≤4 IBI or ICI units, ≤0.5 MIwb units).
** 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.*
N/A Not applicable
WWH Warmwater Habitat
[ ] Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.
1 Data collected in 2008.

Community performance in Merritt Ditch, which was sampled as part of a monitoring effort for a Section 319(h) Program grant in 2008, was lacking. This headwater stream is currently undesignated, but was evaluated using WWH standards. Near the Hicksville Industrial Park (RM 2.30), fish communities did meet the expected thresholds for WWH headwater sites; however, near the Hicksville Community Hospital (RM 1.90), community performance scored in the *Poor* range. Severe habitat alterations were the limiting factors within Merritt Ditch (Ohio EPA, 2009).

Characteristics of the aquatic macroinvertebrate community for the **Gordon Creek HUC-12** sampling locations in *Critical Area #1* are summarized below (Table 26). 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.

Within the **Gordon Creek HUC-12**, benthic communities generally performed well during the 2015-2016 sampling event. Of the six sampling locations collected throughout the Gordon Creek mainstem and its branches during this event, three had quantitative scores falling into the Very Good range and two sampling locations had qualitative scores of Good. Macroinvertebrate communities currently are either similar or better than those of historic sampling. The number of EPT taxa near the mouth of the Gordon Creek mainstem was similar to historic sampling; however, the number of sensitive taxa observed increased. Additionally, several species of freshwater mussels were observed at the downstream sample sites in Gordon Creek in 2015 (Ohio EPA, 2020a).

Community performance in Middle Fork Gordon Creek was *Fair.* Only a qualitative score could be obtained from this site due to suspected disturbance or vandalism that removed the artificial substrates in the stream. Tolerant midges and moderately tolerant mayflies dominated the macroinvertebrate communities at this site, which are indicative of excess nutrients, organic inputs, periodic low dissolved oxygen (DO) levels and sedimentation (Ohio EPA, 2020a). Macroinvertebrate community performance has decreased in quality as compared to historic sampling conducted in 2000 that yielded an ICI score of 50 (Exceptional). Conditions during the 2015-2016 sampling event revealed reduced overall flow/interstitial conditions, pooled conditions and excessive siltation (Ohio EPA, 2020a). Communities in Merritt Ditch were *Poor* at two locations. Severe habitat alterations were the limiting factors within Merritt Ditch (Ohio EPA, 2009).

Table 26: Critical Area #2 – Macroinvertebrate Community Data

Gordon Creek (04100005 02 04)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species**
Gordon Creek (WWH)			
6.67[W]	44 – Very Good 12 sensitive taxa	Moderate-high density/2,665 organisms per square foot	Hydropsychid caddisflies (F, MI), *Polypedilum flavum, Dicrotendipes neomodestus*, and tanytarsini midges (F), baetid mayflies (F, MI), *Petrophila* moth larvae (MI)
1.12[W]	42 – Very Good 13 sensitive taxa	Moderate density/555 organisms per square foot	Hydropsychid and *Hydroptila* caddisflies (F)
North Fork Gordon Creek (WWH)			
1.25[H]	N/A – Good 4 sensitive taxa	Moderate density	Baetid mayflies (F), Hydropsychid caddisflies (F, MI), *Sphaerium* sp. (fingernail clams) (F)
Middle Fork Gordon Creek (WWH)			
3.80[H]	N/A – [Fair]* [2 sensitive taxa]	[Moderate density]	[Midges (mostly *Chironomus (C.) decorus gr.* with others) (T, F), baetid mayflies (mainly *Callibaetis sp*. with others) (MT, F, MI)]
0.76[H]	44 – Very Good 9 sensitive taxa	Moderate-high density/2,092 organisms per square foot	Hydropsychid and *Hydroptila* caddisflies (F, MI), midges (mostly *Polypedilum flavum* and tanytarsini midges with others) (F, MT, T, MI)

Gordon Creek (04100005 02 04)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species**
South Fork Gordon Creek (WWH)			
0.23[H]	N/A – Good 4 sensitive taxa	Moderate density	Fingernail clams (*Sphaerium* sp.) (F)
Merritt Ditch (undesignated)[1]			
2.30[H]	N/A – Poor*	--	--
1.90[H]	N/A – Poor*	--	--

(Source: Ohio EPA, 2009; Ohio EPA, 2020a)

NOTES

W *Wading site*

H *Headwater site*

a *Narrative evaluation used in lieu of ICI*

ns *Nonsignificant departure from ecoregion biocriteria (≤4 IBI or ICI units, ≤0.5 MIwb units).*

*** *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.*

N/A *Not applicable*

Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant

[ ] *Data collected in 2016; all other Gordon Creek mainstem and branch data collected in 2015.*

1 *Data collected in 2008.*

-- *Data not available.*

3.3.3 Detailed Causes and Associated Sources

Eight sampling sites are located in the **Gordon Creek HUC-12.** Two locations within Gordon Creek are in *Full Attainment* of the WWH designation. One location within North Fork Gordon Creek and one location in South Fork Gordon Creek are also in *Full Attainment* of the WWH designation. Middle Fork Gordon Creek has one site in *Full Attainment* of the WWH designation and one site in *Partial Attainment* due to direct habitat alterations and siltation as a result of habitat modification. While Merritt Ditch is currently undesignated, two sites in Merritt Ditch are considered to be in *Non-Attainment,* likely due to direct habitat alterations as a result of channelization and active maintenance. The data summarized previously in Table 14 (p.24) may reveal a direct link between the presence of attributes in the sub-watershed that have influence on the aquatic communities throughout Gordon Creek and its tributaries in *Critical Area #2*. These contributing attributes in *Critical Area #2* include:

- Channelization or a Recovering Channel;
- Silt/Muck Substrates;
- Sparse Cover;
- Heavy/Moderate Silt Cover;
- Fair/Poor Development;
- Low to No Sinuosity;
- Lack of Fast Current;
- High/Moderate Substrate and Riffle Embeddedness; and,
- Lack of Riffle.

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. Projects that address the above described habitat-related attributes (e.g., low sinuosity, substrate/riffle development, etc.) through streambank stabilization and in-stream and riparian restoration will have a positive effect in the QHEI scoring index. As the habitat score (QHEI) becomes better, IBI, MIwb 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 streambank and riparian habitat conditions within Gordon Creek and its tributaries will help ameliorate stresses from land use and boost index values for aquatic communities. Secondarily, nutrient load reductions for phosphorus associated with these objectives can also make progress toward far-field nutrient reduction goals.

Goals

The remaining goals for *Critical Area #2* of the **Gordon Creek HUC-12** are to reduce sedimentation (and associated nutrient) effects to improve the aquatic scores through stabilizing streambanks and restoring floodplains and riparian corridors. These goals are to specifically:

Goal 1. Maintain IBI score at or above 32 at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 33.

Goal 2. Maintain MIwb score at or above 7.3 at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 8.67.

Goal 3. Maintain ICI score at or above 34 (Good) at Wonderly Road in Gordon Creek (RM 6.67).
✓ ACHIEVED: Site currently has a score of 44.

Goal 4. Achieve QHEI score at or above 60 at Wonderly Road in Gordon Creek (RM 6.67).
NOT ACHIEVED: Site currently has a score of 41.5.

Goal 5. Maintain IBI score at or above 32 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 38.

Goal 6. Maintain MIwb score at or above 7.3 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 8.39.

Goal 7. Maintain ICI score at or above 34 (Good) at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 42.

Goal 8. Maintain QHEI score at or above 60 at Countyline Road in Gordon Creek (RM 1.12).
✓ ACHIEVED: Site currently has a score of 70.5.

Goal 9. Maintain IBI score at or above 28 at Rosedale Road in North Fork Gordon Creek (RM 1.25).
✓ ACHIEVED: Site currently has a score of 46.

Goal 10. Maintain ICI score at or above 34 (Good) at Rosedale Road in North Fork Gordon Creek (RM 1.25).
✓ ACHIEVED: Site currently has a score of Good (~37).

Goal 11. Achieve QHEI score at or above 55 at Rosedale Road in North Fork Gordon Creek (RM 1.25).
NOT ACHIEVED: Site currently has a score of 48.8.

Goal 12. Maintain IBI score at or above 28 at Lake Road in Middle Fork Gordon Creek (RM 3.80).
✓ ACHIEVED: Site currently has a score of 34.

Goal 13. Achieve ICI score at or above 34 (Good) at Lake Road in Middle Fork Gordon Creek (RM 3.80).
NOT ACHIEVED: Site currently has a score of Fair (~21).

Goal 14. Achieve QHEI score at or above 55 at Lake Road in Middle Fork Gordon Creek (RM 3.80).
NOT ACHIEVED: Site currently has a score of 31.3.

Goal 15. Maintain IBI score at or above 28 at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
✓ ACHIEVED: Site currently has a score of 46.

Goal 16. Maintain ICI score at or above 34 (Good) at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
✓ ACHIEVED: Site currently has a score of 44.

Goal 17. Achieve QHEI score at or above 55 at Rosedale Road in Middle Fork Gordon Creek (RM 0.76).
NOT ACHIEVED: Site currently has a score of 44.3.

Goal 18. Maintain IBI score at or above 28 at Breininger Road in South Fork Gordon Creek (RM 0.23).
✓ ACHIEVED: Site currently has a score of 48.

Goal 19. Maintain ICI score at or above 34 (Good) at Breininger Road in South Fork Gordon Creek (RM 0.23).
✓ ACHIEVED: Site currently has a score of Good (~37).

Goal 20. Achieve QHEI score at or above 55 at Breininger Road in South Fork Gordon Creek (RM 0.23).
NOT ACHIEVED: Site currently has a score of 43.3.

Goal 21. Achieve IBI score at or above 28 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 20.

Goal 22. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 23. Achieve QHEI score at or above 55 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 31.

Goal 24. Maintain IBI score at or above 28 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
✓ ACHIEVED: Site currently has a score of 34.

Goal 25. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 26. Achieve QHEI score at or above 55 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of 26.

Objectives

The implementation of these objectives, partnered with implementation throughout other identified critical areas will help ameliorate negative impacts from sedimentation and excessive nutrient loss within the **Gordon Creek HUC-12**, and positive gains will be made toward maintaining/achieving near-field attainment and removing far-field impairments. In order to achieve the overall NPS restoration goals of maintaining *Full Attainment* at all sites within Gordon Creek and its tributaries, the following objectives[7] need to be achieved within *Critical Area #2.*

Objective 1: Stabilize and restore at least four miles (21,120 linear feet) of degraded/downcut streambanks and channel habitat through natural channel design methods and bioengineering techniques[8].

Objective 2: Create, enhance or restore at least 40 acres[9] of woody riparian corridor and/or riparian floodplain wetlands.

[7] These objectives may occur at the agricultural or urban interface and may make progress toward goals listed across multiple critical areas.

[8] The focus of this objective should be in improvement of channel form. While it is recognized that healthy streams are in a state of dynamic equilibrium and require adequate space for fully functioning systems, land use constraints may exist that limit the amount of improvement that can be made to channel design and form in an effort to provide stability to the system. 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, 2020b).

[9] With a 50 foot buffer on one river side, this equates to riparian corridor restoration along ~34,840 linear feet (~6.6 miles).

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 toward 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 toward 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, 2020b) will be utilized as a reevaluation tool, as well as other state and federal agency resources for its listing of all eligible NPS management and nutrient reduction 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.

3.4 Critical Area #3: Conditions, Goals & Objectives for Urban Runoff Reduction

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, 2006). 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).

A small concentration of developed land is located within the Village of Hicksville. Almost all of Hicksville's 1,626 acres are located within the **Gordon Creek HUC-12.** The Gordon Creek mainstem skirts the northeast boundary, while South Fork Gordon Creek crosses the southwestern portion of the Village. Merritt Ditch flows through the central portion of the Village. Hicksville maintains stormwater regulations to protect local water resources from degradation (Village of Hicksville, 2008).

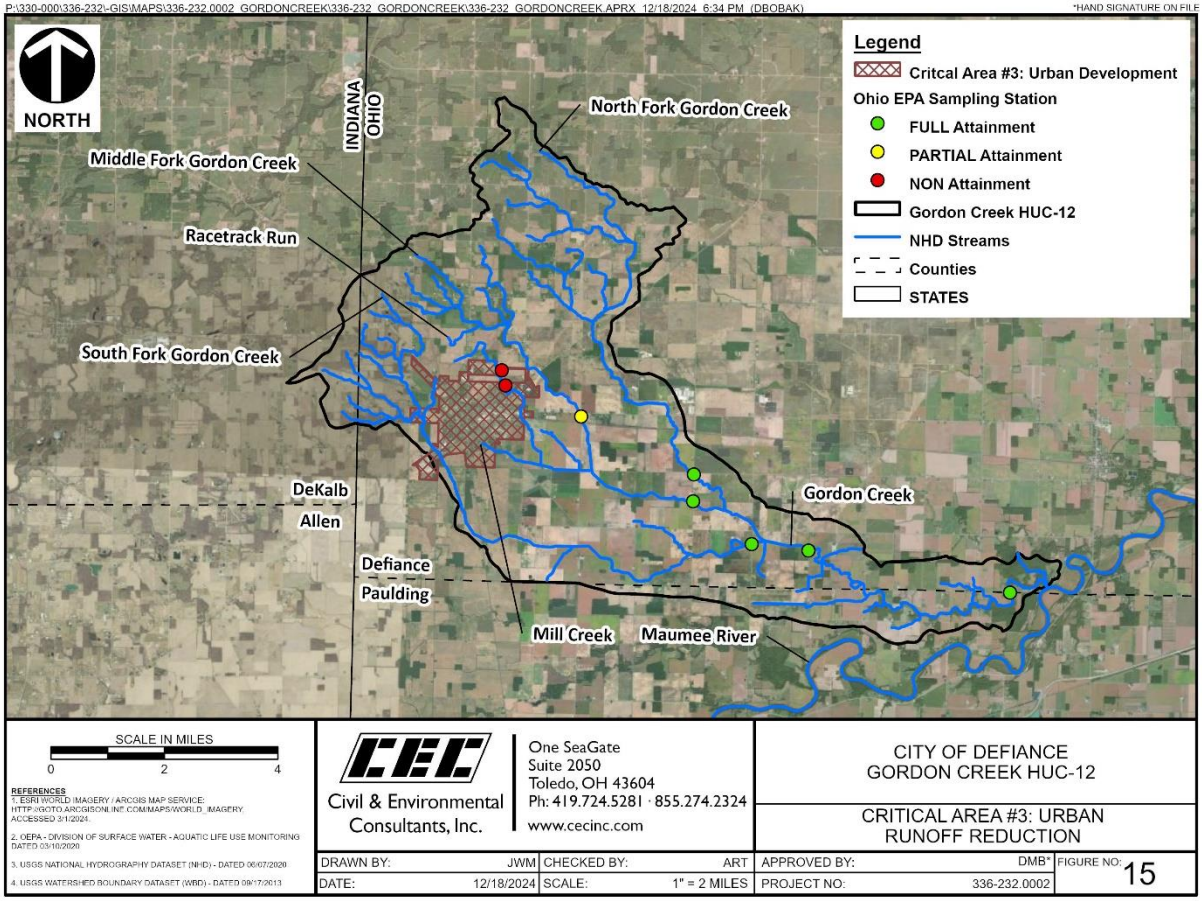


Figure 15: Gordon Creek HUC-12 Critical Area #3

3.4.2 Detailed Biological Conditions

Fish community data for the eight sampling locations within the **Gordon Creek HUC-12** are summarized below (Table 27). 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. Community performance in Merritt Ditch, which was sampled as part of a monitoring effort for a Section 319(h) Program grant in 2008, was lacking. This headwater stream is currently undesignated, but was evaluated using WWH standards. Near the Hicksville Industrial Park (RM 2.30), fish communities did meet the expected thresholds for WWH headwater sites; however, near the Hicksville Community Hospital (RM 1.90), community performance scored in the *Poor* range. Severe habitat alterations were the limiting factors within Merritt Ditch (Ohio EPA, 2009).

Table 27: Critical Area #3 – Fish Community and Habitat Data

Gordon Creek (04100005 02 04)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Merritt Ditch (undesignated)[1]							
2.30[H]	0.5	3	31.0	20*	N/A	Fathead minnow (77%), creek chub (20%), johnny darter (3%)	Poor
1.90[H]	0.9	6	26.0	34	N/A	Fathead minnow (61%), johnny darter (15%), creek chub (10%)	Fair

(Source: Ohio EPA, 2009)

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
H Headwater site
** 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.*
N/A Not applicable
WWH Warmwater Habitat
1 Data collected in 2008.

Characteristics of the aquatic macroinvertebrate community for the **Gordon Creek HUC-12** sampling locations in *Critical Area #3* are summarized below (Table 28). 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. Communities in Merritt Ditch were *Poor* at two locations. Severe habitat alterations were the limiting factors within Merritt Ditch, as demonstrated by the display of all five high-influence MWH attributes and six moderate-influence MWH attributes at both sampling locations (Ohio EPA, 2009).

Table 28: Critical Area #3 – Macroinvertebrate Community Data

Gordon Creek (04100005 02 04)			
River Mile	**ICI Score-Narrative[a]**	**Notes (Density of Ql./Qt.)**	**Predominant Species**
Merritt Ditch (undesignated)[1]			
2.30[H]	N/A – Poor*	--	--
1.90[H]	N/A – Poor*	--	--

(Source: Ohio EPA, 2009)

NOTES
H Headwater site
a Narrative evaluation used in lieu of ICI
** 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.*
N/A Not applicable
1 Data collected in 2008.
-- Data not available.

3.4.3 Detailed Causes and Associated Sources

While Merritt Ditch is currently undesignated, two sites in Merritt Ditch are considered to be in *Non-Attainment,* likely due to direct habitat alterations as a result of channelization and active maintenance. The data summarized previously in Table 14 (p.24) may reveal a direct link between the presence of attributes in the sub-watershed that have influence on the aquatic communities throughout Gordon Creek and its tributaries in *Critical Area #3*. These contributing attributes in *Critical Area #3* include:

- Channelization;
- Silt/Muck Substrates;
- No Sinuosity;
- Sparse Cover;
- Shallow Depth;
- Heavy/Moderate Silt Cover;
- Fair/Poor Development;
- Limited Cover Types;
- Intermediate or Poor Pools;
- Lack of Fast Current;
- High/Moderate Substrate Embeddedness; and,
- Lack of Riffle.

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 Merritt Ditch, reaching the Maumee River and eventually, the WLEB via Gordon Creek. Reductions in nutrients in urban areas and management of stormwater inputs can help decrease overall NPS pollution and improve aquatic communities. Reduction 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 or meet nutrient reduction goals in order to remove a waterbody's impairment status and reach attainment of WQS for the WAU. Urban land use activities in *Critical Area #3* not only contribute to stress on aquatic communities in Merritt Ditch and its receiving waters (Gordon Creek), but also far-field impairment through excessive nutrient loss to local waterways that flow to the WLEB. The Ohio EPA has estimated nutrient loadings associated with various land uses and sources within sub-basins in the WLEB and has set phosphorus reduction goals for agricultural and urban sources.

Goals

To achieve the desired phosphorus reduction from urban land use in the **Gordon Creek HUC-12**, the following goal has been established:

Goal 1. Reduce springtime urban phosphorus loading contributions in the **Gordon Creek HUC-12** to a level at or below 530 lbs/year (40% reduction).
NOT ACHIEVED: Current estimated load contribution is 880 lbs/year.

Simultaneous goals relate to the attainment or maintenance of WQS for aquatic communities within Merritt Ditch. Implementation of BMP objectives geared toward nutrient reduction efforts will generally also help make incremental progress toward the following goals:

Goal 2. Achieve IBI score at or above 28 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 20.

Goal 3. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 4. Achieve QHEI score at or above 55 adjacent to the Hicksville Industrial Park in Merritt Ditch (RM 2.30).
NOT ACHIEVED: Site currently has a score of 31.

Goal 5. Maintain IBI score at or above 28 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
✓ ACHIEVED: Site currently has a score of 34.

Goal 6. Achieve ICI score at or above 34 (Good) adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of Poor (~10).

Goal 7. Achieve QHEI score at or above 55 adjacent to the Hicksville Community Hospital in Merritt Ditch (RM 1.90).
NOT ACHIEVED: Site currently has a score of 26.

Objectives

In order to make substantive progress toward the achievement of the springtime urban phosphorus load reduction goal of 350 lbs for the **Gordon 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 Gordon Creek and its branches to maintain WQS.

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 1,000 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/riparian areas and wetland detention/storage basins to retain, detain and/or treat urban drainage from at least 500 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 toward achieving the aforementioned objectives as soon as possible. The objectives, as written, are reflective of what stakeholders gage as reasonable and implementable in the **Gordon 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 toward 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 toward 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, 2020) 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 **Gordon 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 toward 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 toward 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 **Gordon 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 **Gordon 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 29: Gordon Creek HUC-12 (04100005 02 04) — 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	10	TBD	Wetland Restoration	Defiance County Fish & Game/Defiance SWCD	TBD	TBD	Ohio EPA §319, GLRI, H2Ohio, GLC
1	6	TBD	Grassed Waterway	Defiance SWCD	TBD	TBD	Ohio EPA §319, GLRI, GLC
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 #1*; therefore, no Project Summary Sheets are included.

4.2 Critical Area #2 Project and Implementation Strategy Overview Table

Table 30: Gordon Creek HUC-12 (04100005 02 04) — 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 31: Gordon Creek HUC-12 (04100005 02 04) — 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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APPENDIX A – ACPF OUTPUTS

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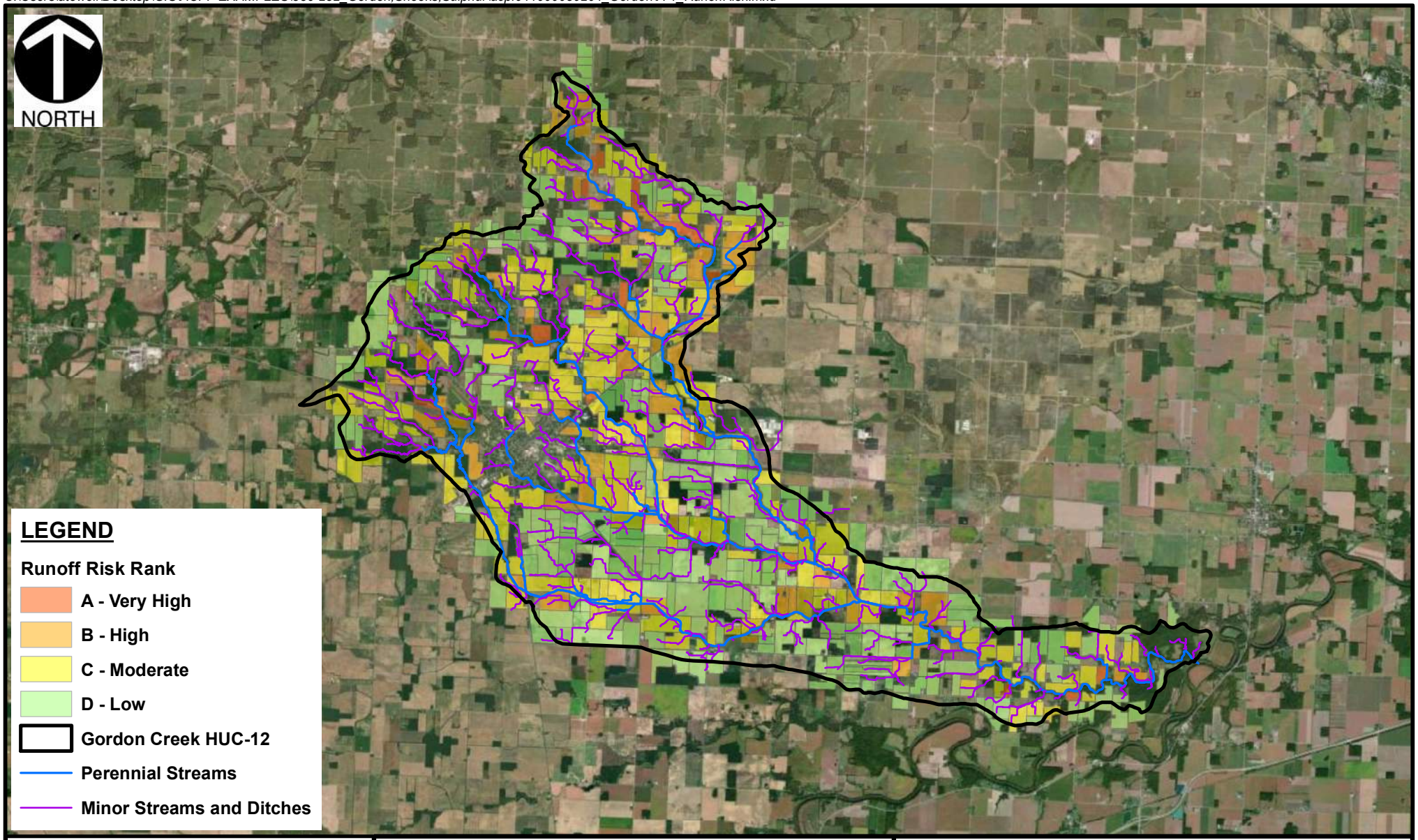

Miles
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REFERENCE

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CITY OF DEFIANCE
GORDON CREEK HUC-12

FIELD RUNOFF RISK

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-1
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

* Hand signature on file

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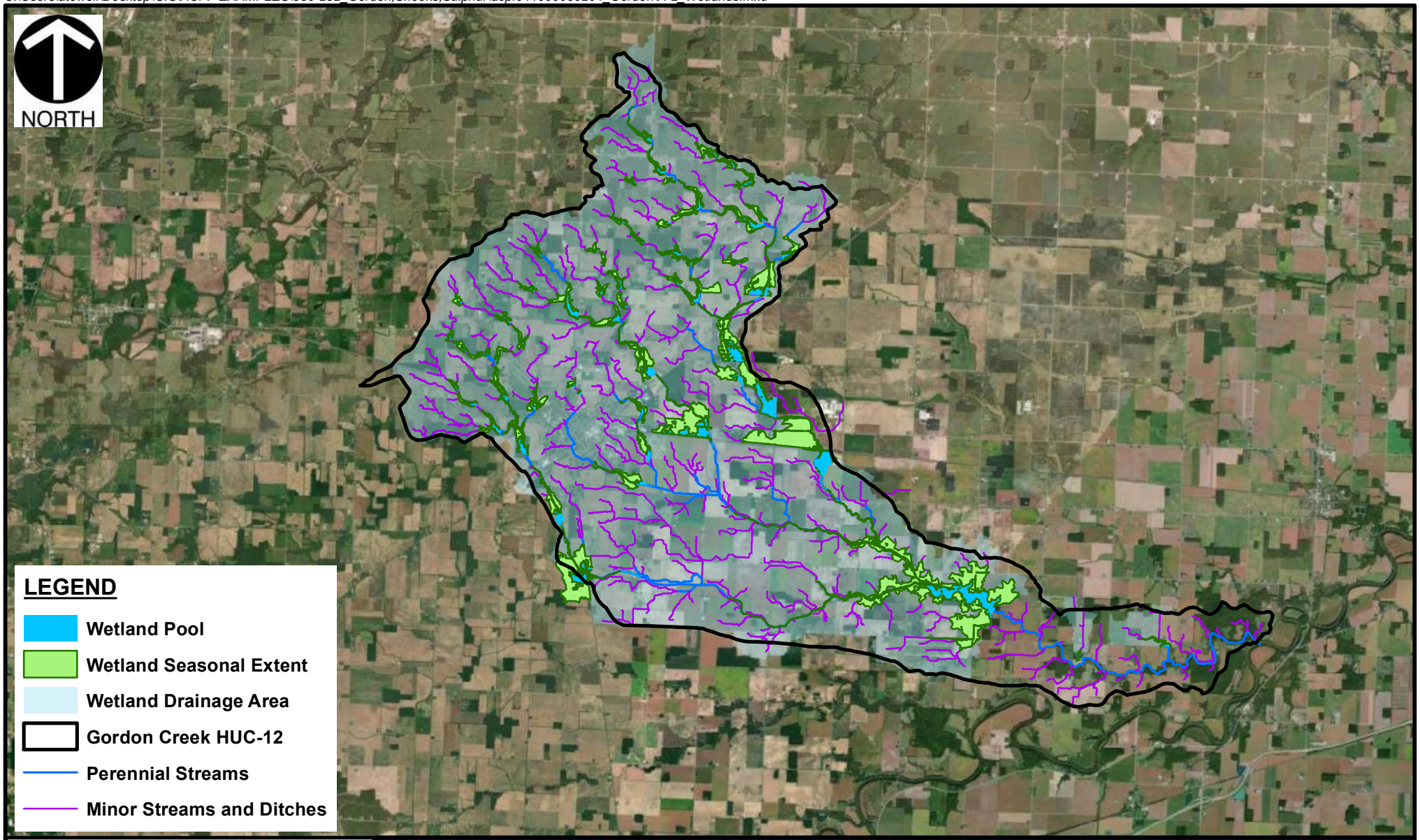

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POTENTIAL WETLANDS LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-2
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

* Hand signature on file

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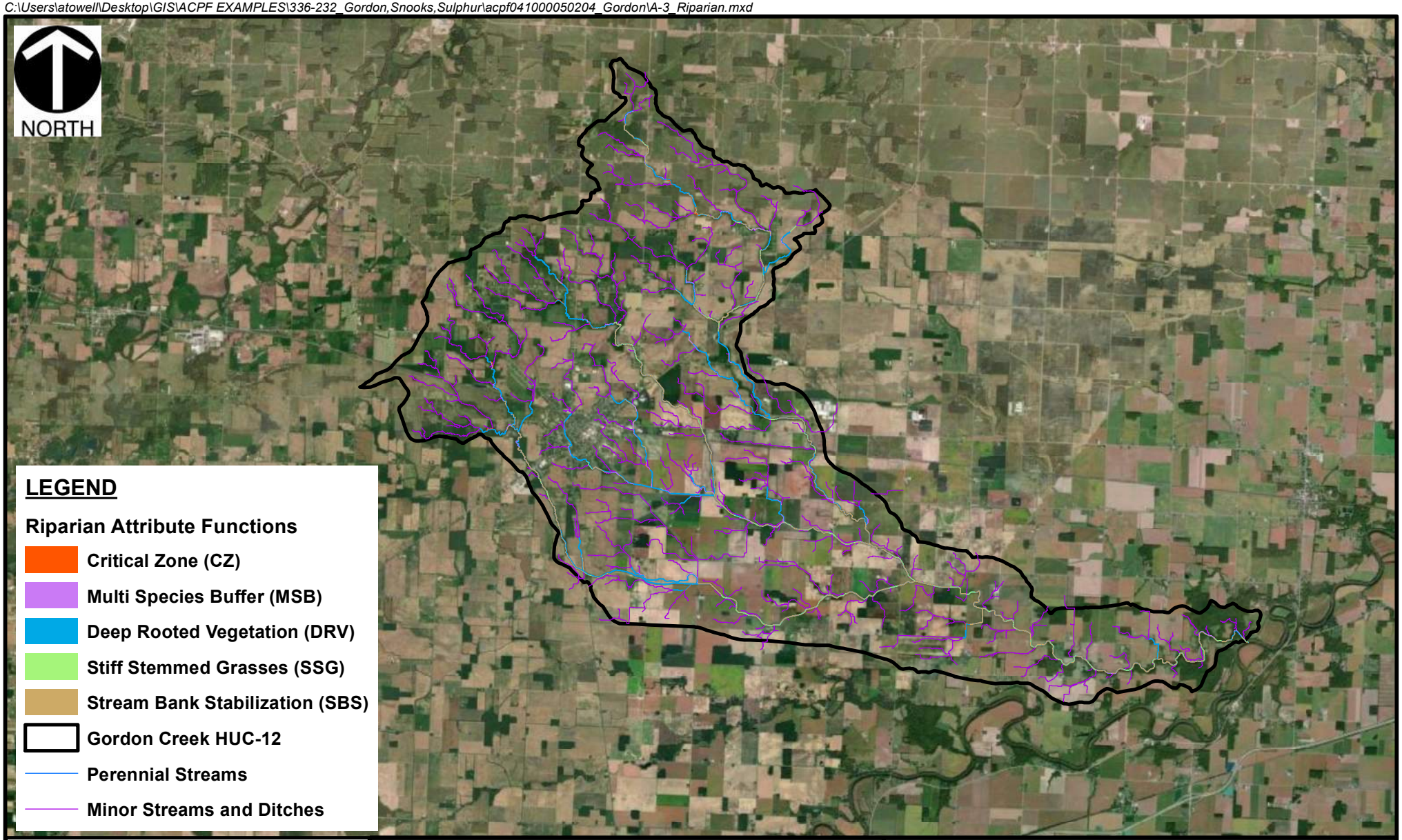

Miles
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RIPARIAN FUNCTION MAP

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-3
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

* Hand signature on file

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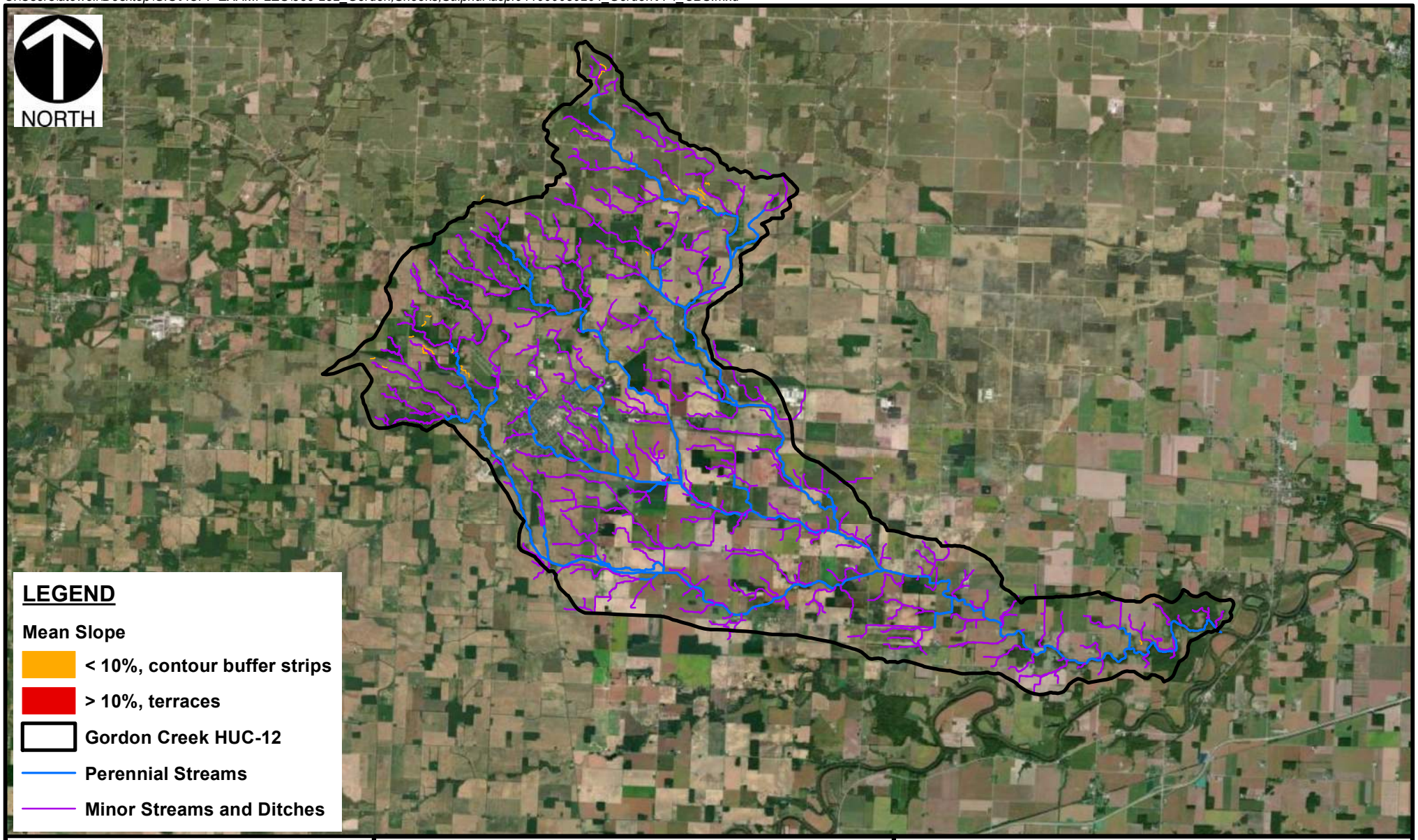

Miles
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POTENTIAL CONTOUR BUFFER STRIP LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-4
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

* Hand signature on file

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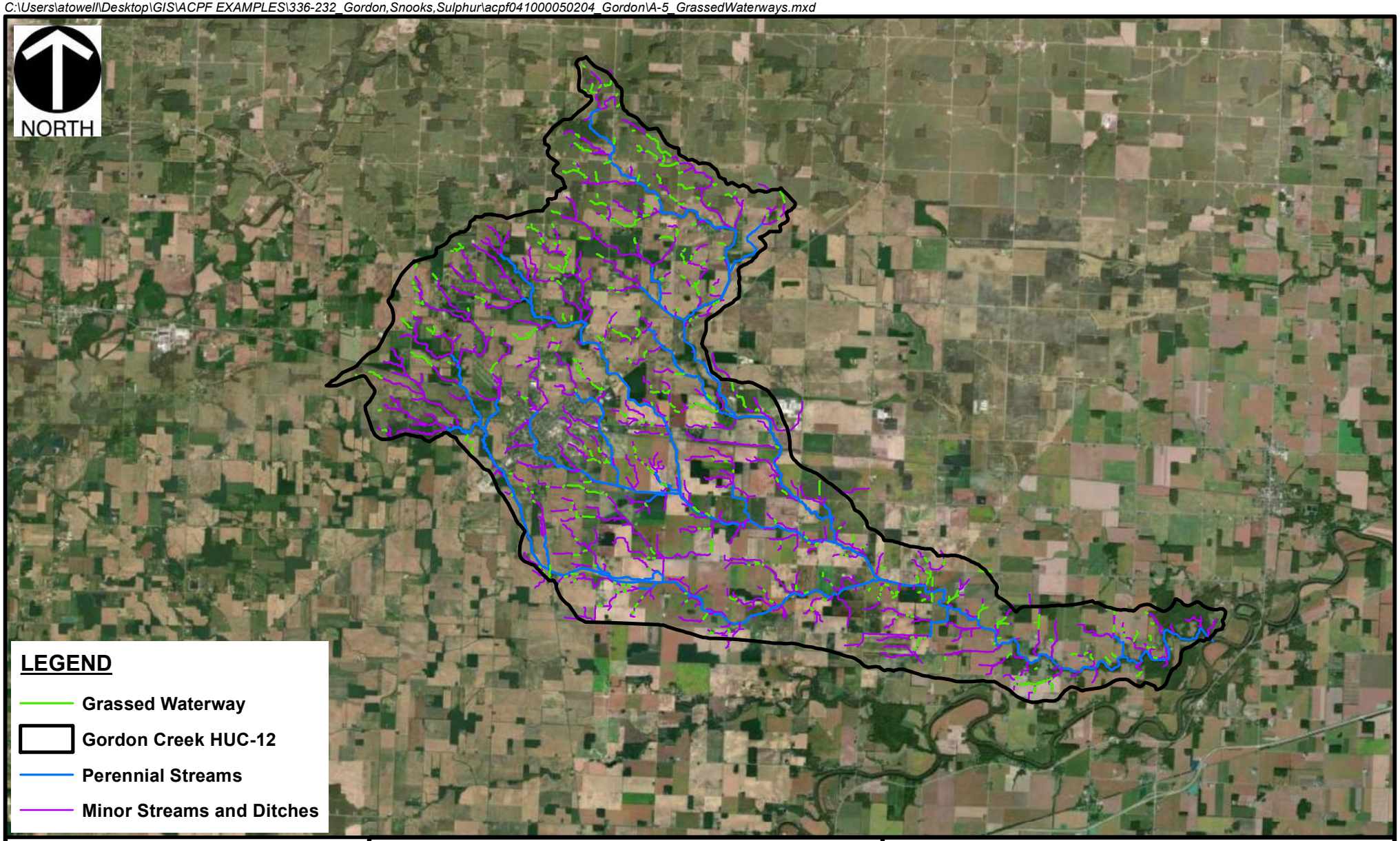

Miles
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REFERENCE

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POTENTIAL GRASSED WATERWAY LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-5
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

* Hand signature on file

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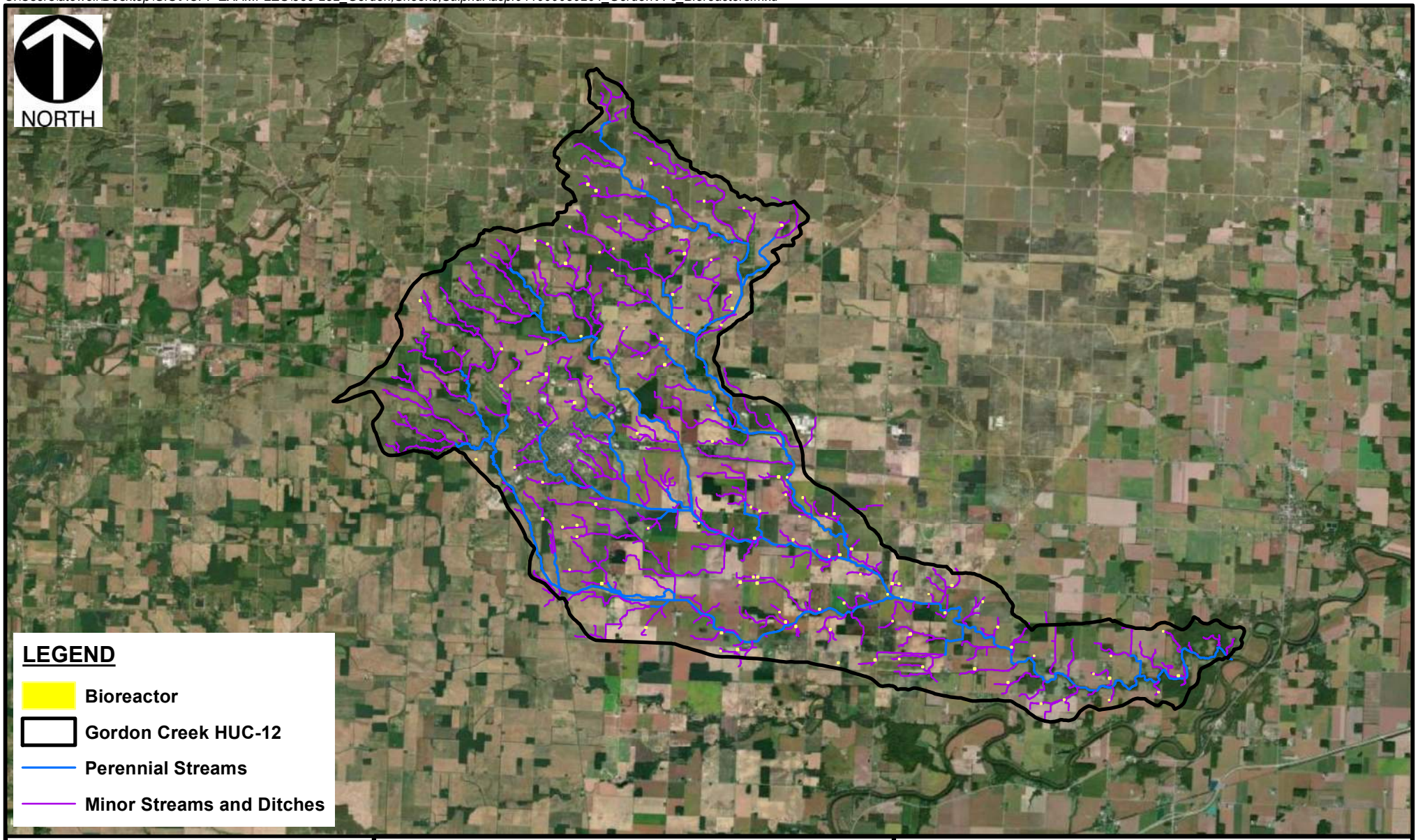

Miles
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POTENTIAL BIOREACTOR LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-6
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

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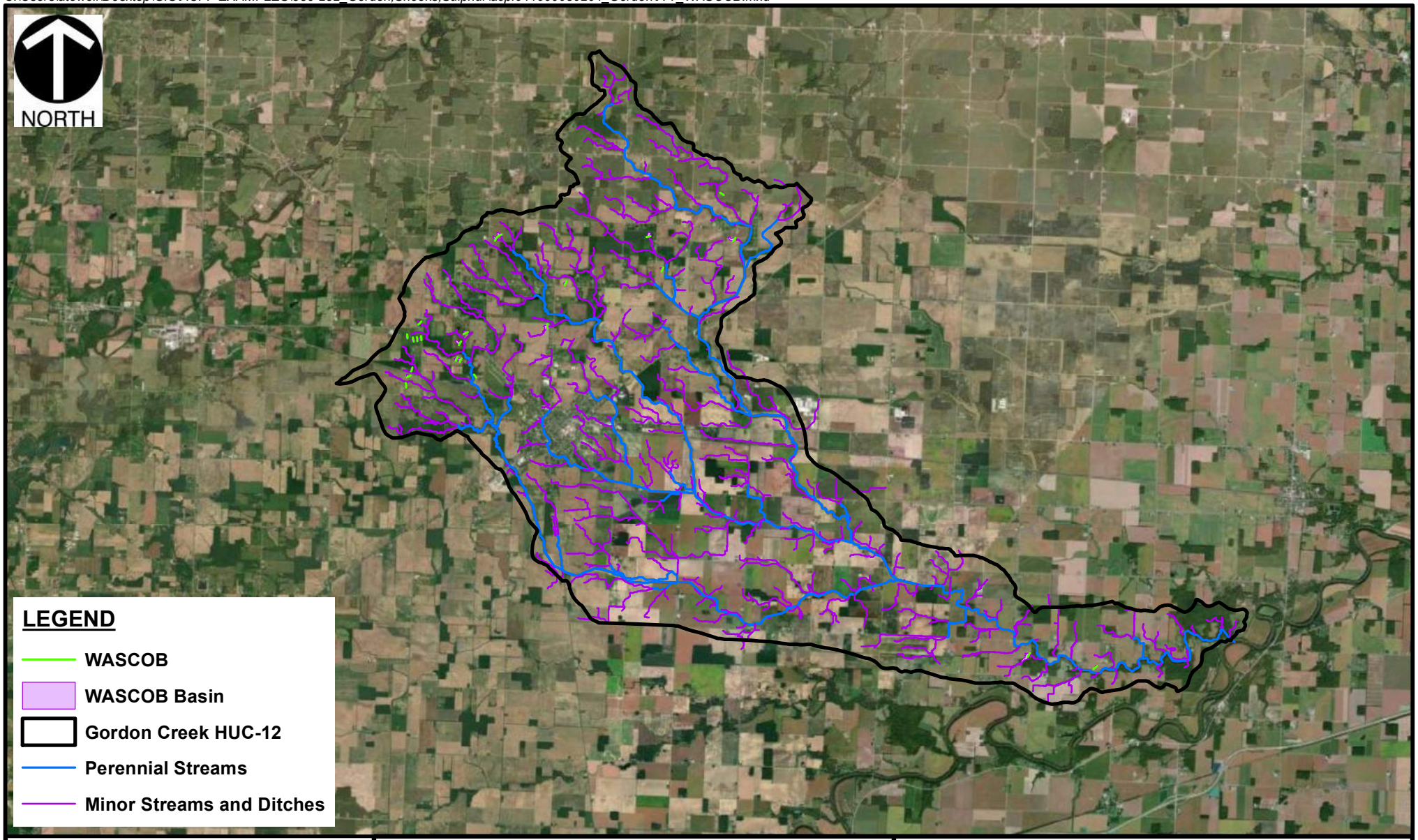

Miles
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POTENTIAL WASCOB LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-7
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

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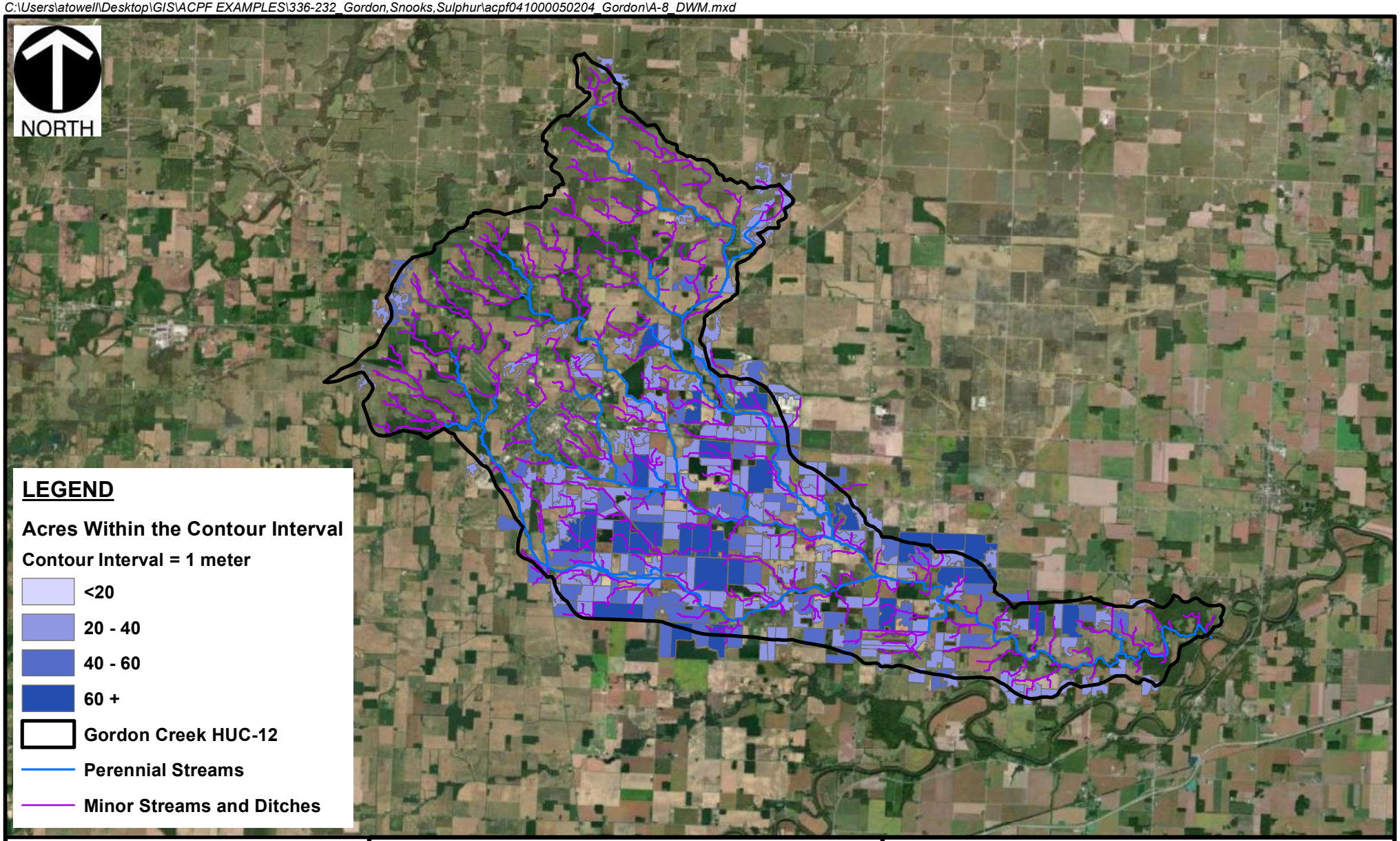

Miles
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POTENTIAL DRAINAGE WATER MANAGEMENT LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-8
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

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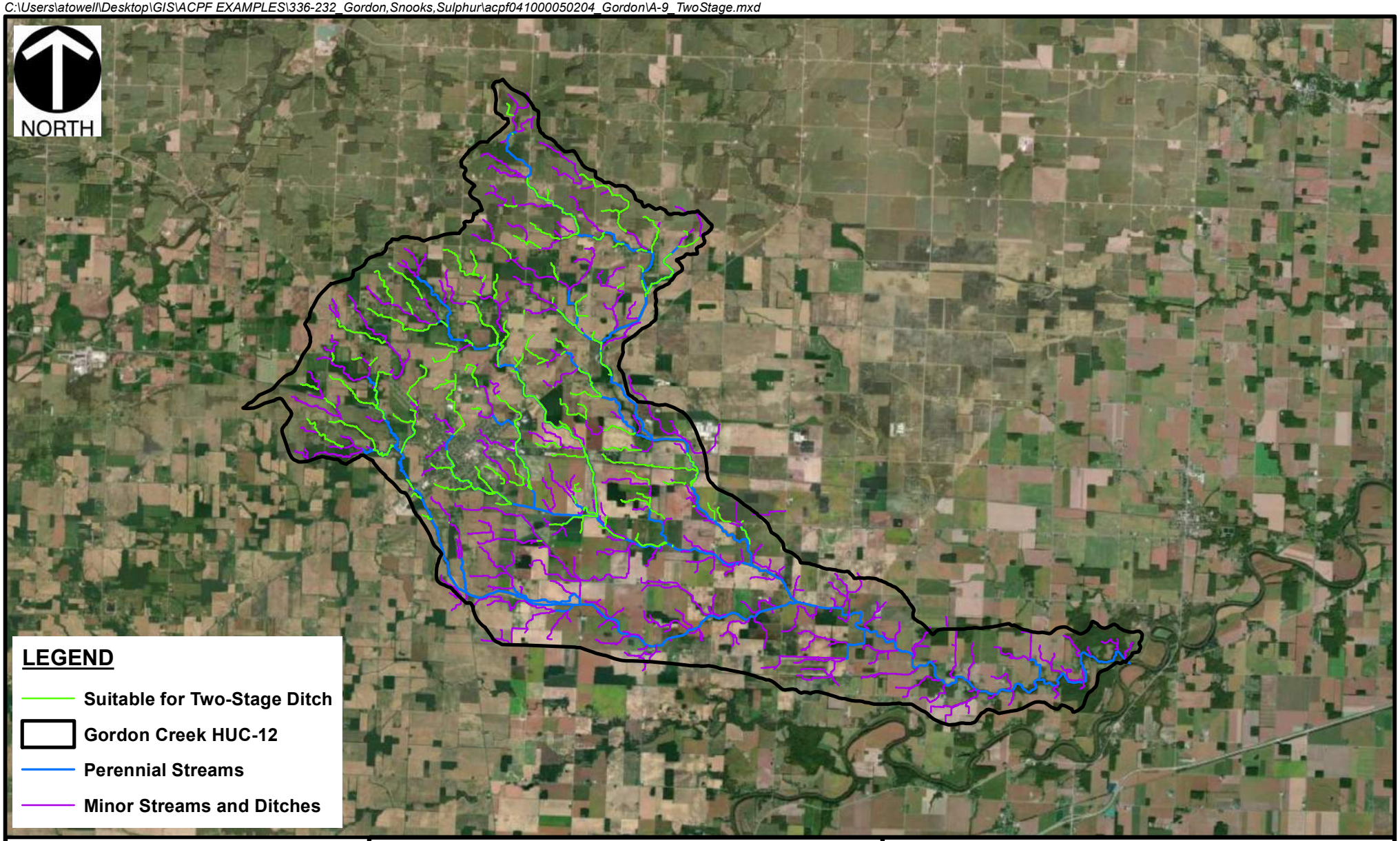

Miles
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POTENTIAL TWO-STAGE DITCH LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-9
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

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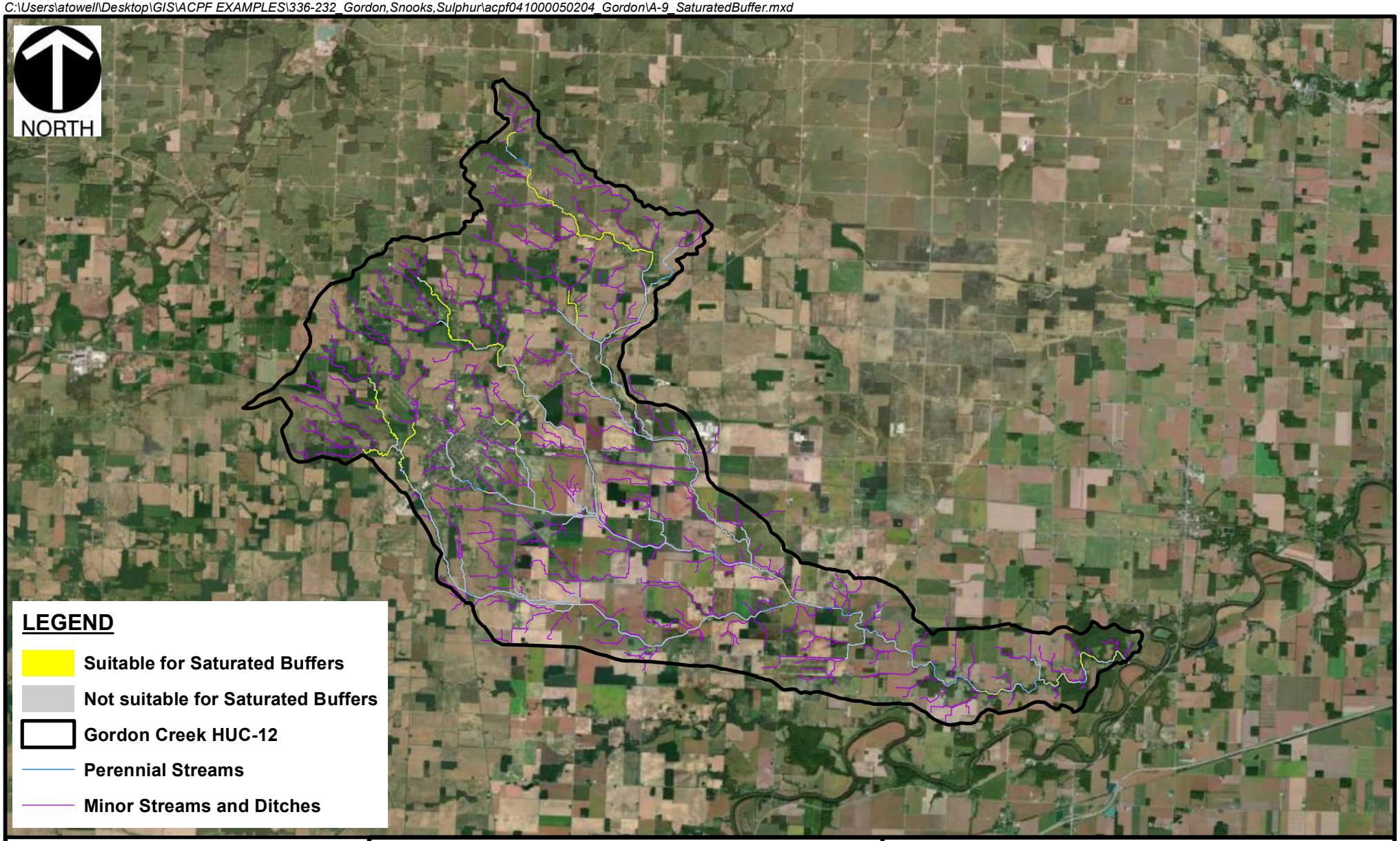

Miles
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POTENTIAL SATURATED BUFFER LOCATIONS

DRAWN BY:	ART	CHECKED BY:	DMB	APPROVED BY:	DMB*	FIGURE NO:	A-10
DATE:	6/11/2024	SCALE:	1 " = 2 miles	PROJECT NO:	336-232		

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