Nine-Element Nonpoint Source Implementation Strategy (NPS-IS) for the Hebble Creek/Mad River Watershed

Huffman Dam-Mad River HUC-12 (05080001 19 03)

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Cover photo: Hebble Creek; photo courtesy of Civil & Environmental Consultants, Inc.

Acronyms and Abbreviations

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

Numbers

§319	Section 319 of the Clean Water Act

A

AFB	Air Force Base
ALU	Aquatic Life Use
AWQMP	Areawide Water Quality Management Plan

B

BMP	Best Management Practice

C

CAFF	Confined Animal Feeding Facility
CAFO	Confined Animal Feeding Operation
cBOD	Carbonaceous Biological Oxygen Demand
CRP	Conservation Reserve Program
CSO	Combined Sewer Overflow
CWH	Coldwater Habitat

D

DO	Dissolved Oxygen
DMR	Discharge Monitoring Report

E

E. coli	*Escherichia coli*
ECBP	Eastern Corn Belt Plains
ECHO	Environmental Compliance History Online
EPT	*Ephemeroptera, Plecoptera and Trichoptera* – sensitive macroinvertebrate species
EQIP	Environmental Quality Incentives Program
EWH	Exceptional Warmwater Habitat

F

FLS	Federally Listed Species
FOTG	Field Office Technical Guide
FSA	Farm Service Agency

G

GCPT	Greene County Parks & Trails
GIS	Geographic Information Systems

H

HTF	Hypoxia Task Force
HSTS	Home Sewage Treatment System
HUC	Hydrologic Unit Code

I

IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index

L

LULC	Land Use Land Cover

M

MARB	Mississippi/Atchafalaya River Basin
MCD	Miami Conservancy District
MHP	Mobile Home Park
MIwb	Modified Index of Well Being
MS4	Municipal Separate Storm Sewer System
MVRPC	Miami Valley Regional Planning Commission
MWH	Modified Warmwater Habitat

N

NH_3	Nitrogen, as Ammonia
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NPS-IS	Nonpoint Source-Implementation Strategy
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory

O

ODA	Ohio Department of Agriculture
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
OLEC	Ohio Lake Erie Commission
OpTIS	Operational Tillage Information System
ORB	Ohio River Basin
ORBA	Ohio River Basin Alliance

P

PAD-US	Protected Areas Database of the United States
PLET	Pollutant Load Estimation Tool
PSS	Project Summary Sheet

Q

QHEI	Qualitative Habitat Evaluation Index

R

RM	River Mile

S

SNC	Significant Non-Compliance
SWCD	Soil and Water Conservation District

T

TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

U

USACE	United States Army Corps of Engineers
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

VRT	Variable Rate Technology

W

WAP	Watershed Action Plan
WQS	Water Quality Standards (Ohio Administrative Code 3745-1)
WRP	Wetlands Reserve Program
WRRSP	Water Resource Restoration Sponsor Program
WWH	Warmwater Habitat

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CHAPTER 1: INTRODUCTION

The Hebble Creek/Mad River watershed is known to local individuals as the area draining Hebble Creek and other small tributaries to the Mad River, upstream from Huffman Dam and downstream from Mud Run. This watershed is formally classified by the United States Geological Survey (USGS) as the **Huffman Dam-Mad River Hydrologic Unit Code (HUC)-12 (05080001 19 03)**. For the purposes of this document, the official HUC-12 name will be used in reference to this area, but it should be noted that this plan does not propose to alter, change, remove or otherwise implicate the infrastructure of Huffman Dam.

The **Huffman Dam-Mad River HUC-12** is located in northwestern Greene County and northeastern Montgomery County and contains an area of 28.59 square miles (Figure 1). The **Huffman Dam-Mad River HUC-12** contains a segment of the Mad River, a tributary to the Great Miami River, from its confluence with Mud Run at River Mile (RM) 10.07, to the Huffman Dam at RM 5.99 (Ohio EPA, 2023c). It also contains the entirety of Hebble Creek, from its headwaters in the easternmost point of the sub-watershed through intense channelization and piping underground to its confluence with the Mad River. The watershed is primarily developed (~62%), with approximately 23% of land in agricultural production. The **Huffman Dam-Mad River HUC-12** has been identified as an area of focus within the Ohio River Basin (ORB) due to the estimated loading of total nitrogen and total phosphorus that flows into the tributaries of the Ohio River, to the Mississippi River and its end-receiving waterbody, the Gulf of Mexico.

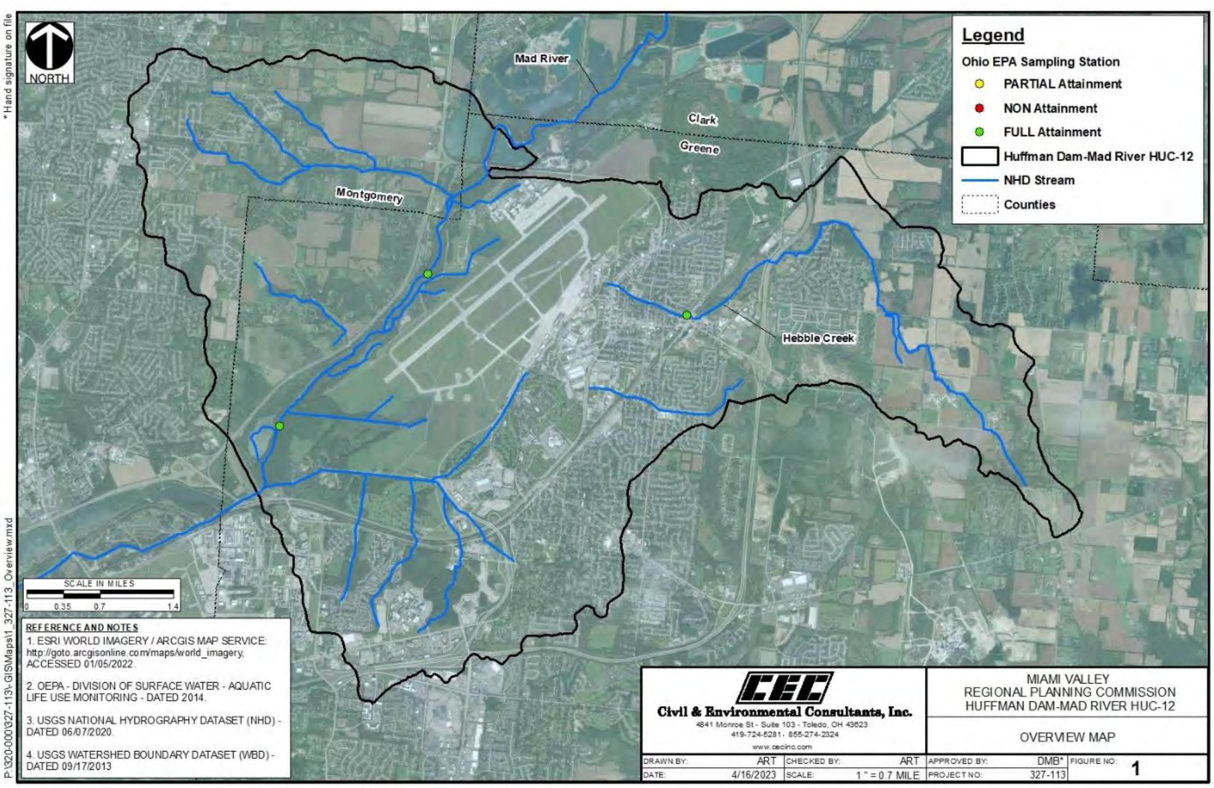


Figure 1: Huffman Dam-Mad River HUC-12 Overview

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

Hypoxia Task Force

The State of Ohio is an active participant in the Mississippi River/Gulf of Mexico Hypoxia Task Force (HTF), a multi-state agency effort established in 1997 to understand the causes and effects of eutrophication in the Gulf of Mexico and coordinate activities throughout the Mississippi/Atchafalaya River Basin (MARB) to reduce the size, severity and duration and ameliorate the effects of hypoxia within the Gulf (USEPA, 2020). The 2007 Mississippi River Basin Science Advisory Committee recommended a reduction in total nitrogen and total phosphorus from baseline values calculated from 1980 to 1996 by 45% to reduce the hypoxic zone within the Gulf of Mexico to a five-year running average of 5,000 km^2 (USEPA, 2007). The HTF has accepted this recommendation and outlined an interim goal to reduce nutrient loading from major sources of nitrogen and phosphorus in the MARB by 20% by 2025 and 45% by 2035 (HTF, 2014; USEPA, 2017). Ohio EPA's *Nutrient Mass Balance Study for Ohio's Major Rivers* (2022) has identified high nitrogen and phosphorus loads within the Ohio portion of the ORB, particularly from the Scioto River and Great Miami River watersheds, citing 80% and 82% of the nitrogen load and 71% and 66% of the phosphorus load, respectively, in these two watersheds is from NPS contributions (Ohio EPA, 2022).

Through the *State of Ohio's Domestic Action Plan*, state agencies modeled and estimated nutrient loads for NPS classifications (agricultural, home sewage treatment system (HSTS) and urban contributions) at the HUC-12 level within the northwestern portion of the state, underlining the state's commitment to nutrient reduction from all landscapes (OLEC, 2020). While this level of modeling has not yet occurred within the ORB, approximate loads from agricultural and urban landscapes, based upon nutrient loss literature and *Mass Balance* results, have been estimated for select watersheds within the ORB, including those in the Scioto, Great Miami and Muskingum watersheds as a beginning step in setting reduction targets to make progress towards HTF goals (Ohio EPA, 2021).

Huffman Dam-Mad River HUC-12 NPS-IS

The development of NPS-IS in watersheds contained within the ORB is critical to the efforts focused on implementing the HTF's goal to reduce nutrient loadings from major sources of nitrogen and phosphorus to the Gulf, as well as to meet state water quality standards and local goals. Development of NPS-IS within Ohio's portion of the ORB also aligns with goals established by the Ohio River Basin Alliance (ORBA) for abundant clean water and healthy and productive ecosystems in the Ohio River (USACE, 2020). The *Huffman Dam-Mad River HUC-12 NPS-IS* will address NPS pollution by accounting for both near-field (within stream/watershed) and far-field (loadings to the Ohio River) effects. The development of this NPS-IS is sponsored by the Miami Valley Regional Planning Commission (MVRPC) as a part of the organization's 208 Areawide Water Quality Workplan.

Removal of NPS impairments and reduction in overall sediment and nutrient loss, particularly in the urban environment; restoration and reconnection of streambanks, floodplains and wetlands; and management and treatment of stormwater within the **Huffman Dam-Mad River HUC-12** is crucial to the attainment and maintenance of aquatic life use (ALU) standards within not only the Mad River, but also within the Great Miami watershed, and on a greater scale, within the context of the Ohio River watershed, the Mississippi River and its end-receiving waterbody, the Gulf of Mexico. Within the

Huffman Dam-Mad River HUC-12, two biological sample locations were established in the mainstem of the Mad River during a sampling event conducted in 2003. These sites, designated as Warmwater Habitat (WWH), were in *Full Attainment* of their ALU. An additional biological sample was collected in Hebble Creek, a highly channelized and modified urban tributary to the Mad River. Hebble Creek was designated as Modified Warmwater Habitat (MWH) and is also in *Full Attainment* of its ALU.

Land use activities in a highly developed landscape have the potential to be substantial stressors on aquatic life through changes in habitat attributes and contributions of high sediment and nutrient loadings that potentially threaten water quality locally in the Mad River and its tributaries, as well as within the Great Miami River and larger, end-receiving waterbodies. This NPS-IS will be used to strategically identify and outline key projects that should be implemented within the **Huffman Dam-Mad River HUC-12** to address management of NPS pollution to not only maintain Water Quality Standards (WQS) within the sub-watershed boundaries, but to also make progress towards far-field watershed goals on a larger scale within the greater ORB, MARB and Gulf of Mexico.

1.2 Watershed Profile & History

The land area contained within the **Huffman Dam-Mad River HUC-12** is contained within the Great Miami watershed (05080001) (Figure 2). The Great Miami River is located in southwestern Ohio and is approximately 160 miles in length[1], flowing from its headwaters in northwestern Logan County at the outlet of Indian Lake southwesterly to empty into the Ohio River west of Cincinnati. The Great Miami River drains an area of 3,802 square miles and is divided into 20 sub-basins at the HUC-10 level, including tributary watersheds for the Stillwater River, Twin Creek, Fourmile Creek, Indian Creek and the Mad River (Figure 2).

The Mad River is approximately 65.9 miles long[2] and drains an area of 657 square miles. The watershed spans west-central Ohio, rising in Logan County northeast of Bellefontaine, flowing southerly though Champaign and Clark counties, turning southwest near Springfield, Ohio to flow through Fairborn in Greene County and Riverside in Montgomery County to then enter the Great Miami River at RM 81.48 in Dayton. The Mad River watershed is divided into five HUC-10s: the *Headwaters Mad River HUC-10, Nettle Creek-Mad River HUC-10, Buck Creek HUC-10, Donnels Creek-Mad River HUC-10,* and the *Mud Run-Mad River HUC-10*, of which the **Huffman Dam-Mad River HUC-12** belongs (Figure 3). In total the *Mud Run-Mad River HUC-10* drains 99.94 square miles (63,959 acres) of the most urbanized portion of the Mad River watershed (Table 2).

[1] The *Ohio Gazetteer of Streams* (ODNR, 2001) lists the Great Miami River as 170 miles in length; however, the *River Mile Index* (Ohio EPA, 2023c) shows the Great Miami River with a length of ~159.7 miles. Biological sampling stations utilize the river mile locations in the *River Mile Index*.

[2] The *Ohio Gazetteer of Streams* (ODNR, 2001) lists the Mad River as 60.2 miles in length; however, the *River Mile Index* (Ohio EPA, 2023c) shows the Mad River with a length of at least 63.90 miles, with additional intermittent stream length shown on basemaps. Biological sampling stations utilize the river mile locations in the *River Mile Index*.

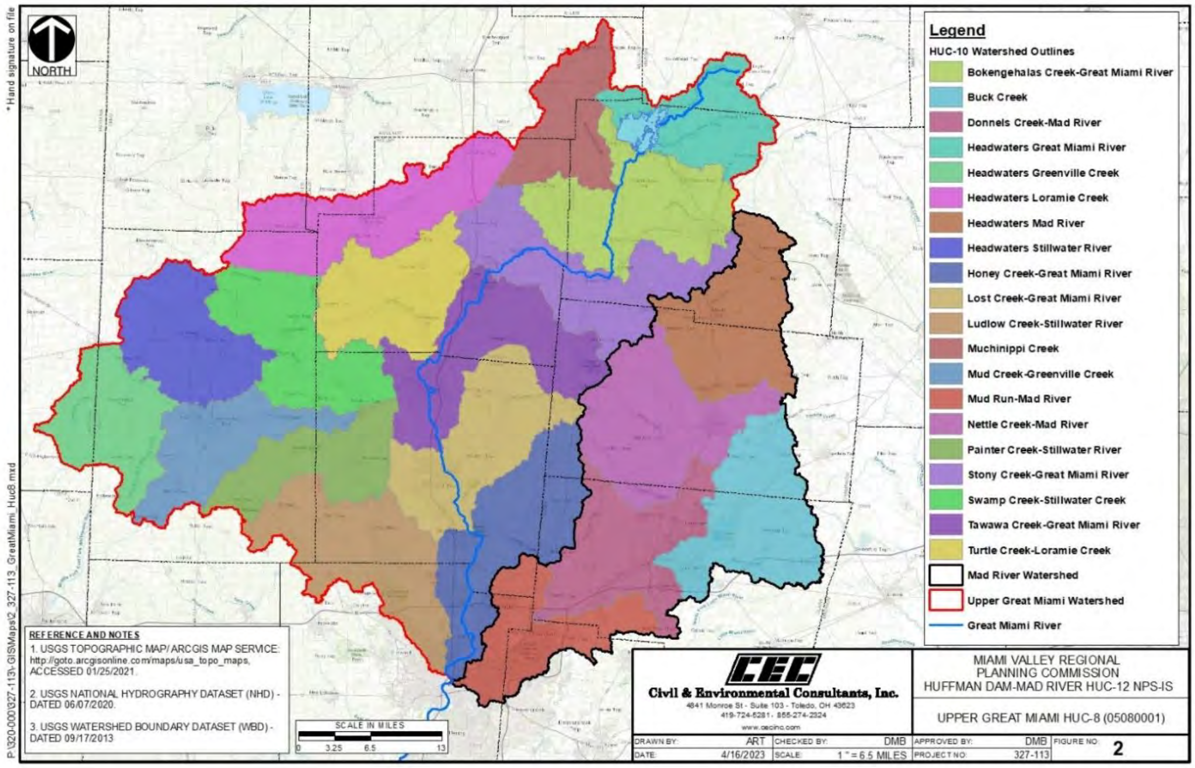


Figure 2: Great Miami Watershed

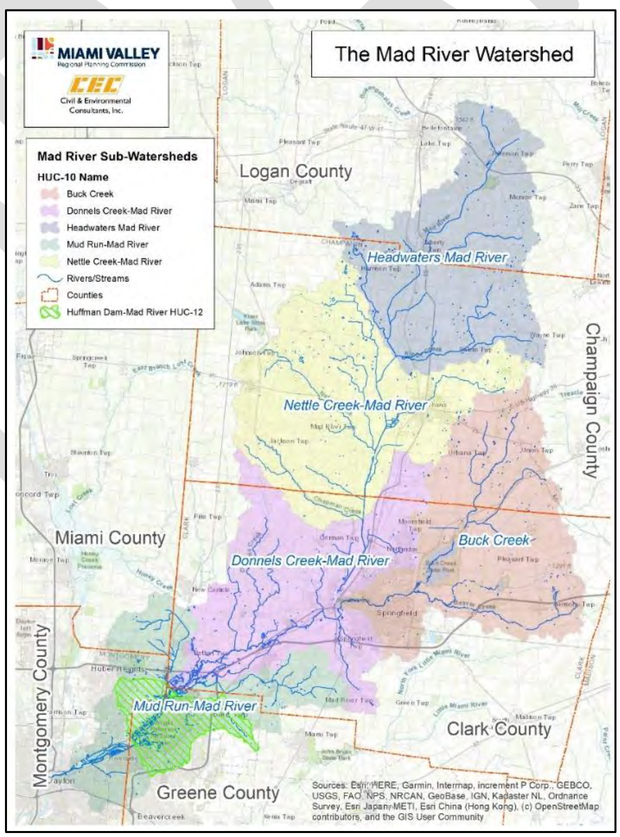


Figure 3: Mad River Watershed

Table 2: Sub-watersheds in the Mud Run-Mad River HUC-10

Mud Run-Mad River HUC-10 (05080001 19)		
HUC-12	**Area (Square miles)**	**Area (Acres)**
Mud Creek HUC-12 (01)	22.60	14,464
Mud Run HUC-12 (02)	26.17	16,748
Huffman Dam-Mad River (03)	28.59	18,297
City of Dayton-Mad River (04)	22.58	14,450

(Source: Ohio EPA, 2023e)

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. The MVRPC promotes collaboration among communities, stakeholders, and residents to advance regional priorities, including water quality. The MVRPC is the Designated Water Quality Planning Agency for five counties: Drake, Preble, Miami, Montgomery and Greene, and continually maintains the Areawide Water Quality Management Plan (AWQMP). This plan describes the region's water resources, identifies sources of pollution and outlines solutions to address them. The MVRPC also assists jurisdictions that have a Municipal Separate Storm Sewer System (MS4), evaluates and aids in the development of wastewater management plans for unsewered communities and plays a vital role in watershed planning.

The MVRPC is an active sponsor of NPS-IS development, providing mapping and data support, and initiating and facilitating stakeholder and public engagement activities and meetings. The MVRPC is the leading agency for the development of the *Huffman Dam-Mad River HUC-12 NPS-IS* and has coordinated engagement with local organizations. In addition, a draft of the *Huffman Dam-Mad River HUC-12 NPS*-IS was released for public review on April 20, 2023, with a follow-up virtual comment meeting held on May 11, 2023.

Input from the following organizations was solicited to help guide and formulate critical areas and potential projects within the **Huffman Dam-Mad River HUC-12** during the planning process:

- Bath Township;
- City of Fairborn;
- City of Huber Heights;
- Miami Conservancy District (MCD);
- B-W Greenway Community Land Trust;
- Wright-Patterson Air Force Base (AFB);
- Wright State University;
- Greene County Engineer's Office;
- Greene Soil and Water Conservation District (SWCD);
- Montgomery SWCD;
- Tecumseh Land Trust;
- Five Rivers MetroParks;

- Ohio EPA; and,
- Ohio Department of Agriculture (ODA).

Chapters 1, 2 and 3 were primarily prepared using the *2023 Water Quality and Hydrologic Units in Ohio Interactive Map* (Ohio EPA, 2023e), *Biological and Water Quality Study of the Mad River Basin, 2003* (Ohio EPA, 2005) and the *Total Maximum Daily Loads (TMDL) for the Mad River Watershed* (Ohio EPA, 2009). Project information for Chapter 4 was compiled by collaborative outreach with organizational stakeholders and community partners through the organizational stakeholder meeting held on January 20, 2023 and numerous follow up calls and emails. A site visit to potential project locations was held on April 5, 2023.

Huffman Dam: watershed tour stop on January 20, 2023. Photo courtesy of CEC, Inc.

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 *Mud Run-Mad River HUC-10* is comprised of four HUC-12 watersheds; this document focuses on the #03 hydrologic unit—the **Huffman Dam-Mad River HUC-12**. The Mad River is the primary stream within the sub-watershed, flowing from its confluence with Mud Run at the upstream terminus of the sub-watershed (RM 10.07) to Huffman Dam at the downstream terminus of the sub-watershed (RM 5.99) before entering the *City of Dayton-Mad River HUC-12*. The Mad River is approximately 65.9 miles long, has an average gradient of 8.5 feet/mile and drains approximately 657 square miles (Ohio EPA, 2023c, ODNR, 2001). The lower 18.4 miles of the Mad River, from its confluence with Donnels Creek to its mouth, are considered to be a Large River Assessment Unit (LRAU), with a drainage area that exceeds 500 square miles. The Mad River is designated as a WWH stream within the segment contained within the **Huffman Dam-Mad River HUC-12**; however, it supports Coldwater Habitat (CWH) from its headwaters to RM 26.15, due to a heavy groundwater influence. Studies have indicated that approximately 60-80% of the base flow in the Mad River may consist of groundwater derived from the Silurian and Devonian carbonate aquifer below (Sheets and Yost, 1994). Approximately one-third of the Mad River, from RM 34.2 to RM 11.4, has been proposed for designation as an Ohio Recreational River (Ritter, 2013).

Hebble Creek is a small tributary to the Mad River at RM 6.07. The *Ohio River Miles Index* shows Hebble Creek to be over 10 miles long with headwaters rising just to the southeast of Pearl's Fen; however, over time, the creek has been highly modified, channelized and piped underground (Ohio EPA, 2023c). Its drainage area is estimated to be 10.5 square miles (6,720 acres) (Ohio EPA, 2005). Sampling in 1994, and again during the 2003 TMDL study, confirmed the MWH designation for Hebble Creek. In addition, approximately 20.22 miles (106,761 linear feet) of tributary stream segments flow throughout the sub-watershed (USGS, 2016).

Pearl's Fen.
Photo courtesy of CEC, Inc.

The entire **Huffman Dam-Mad River HUC-12** is located in the Eastern Corn Belt Plains (ECBP) ecoregion. The ECBP consists of a rolling till plain with local end moraines (USEPA, 2013). Wisconsinan glacial deposits are extensive across the ecoregion, with drift thicknesses up to 300 feet thick, overlaying bedrock of Ordovician through Devonian age (ODNR, 2022a; MRWSPJBS, 2009). More specifically, the **Huffman Dam-Mad River HUC-12** is contained within the Mad River Interlobate Area, which has received concentrated outwash deposits that have filled preglacial valleys. Originally, this area was covered by beech and mixed oak forests, interspersed with extensive freshwater fens and wet prairies (USEPA, 2013). Approximately 50% of the soils in the **Huffman Dam-Mad River HUC-12** are hydric and could support wetland features (Figure 4). Major soil series include the Miamian, Sloan and Warsaw, consisting of silt-loams and land complexes (USDA-NRCS, 2022).

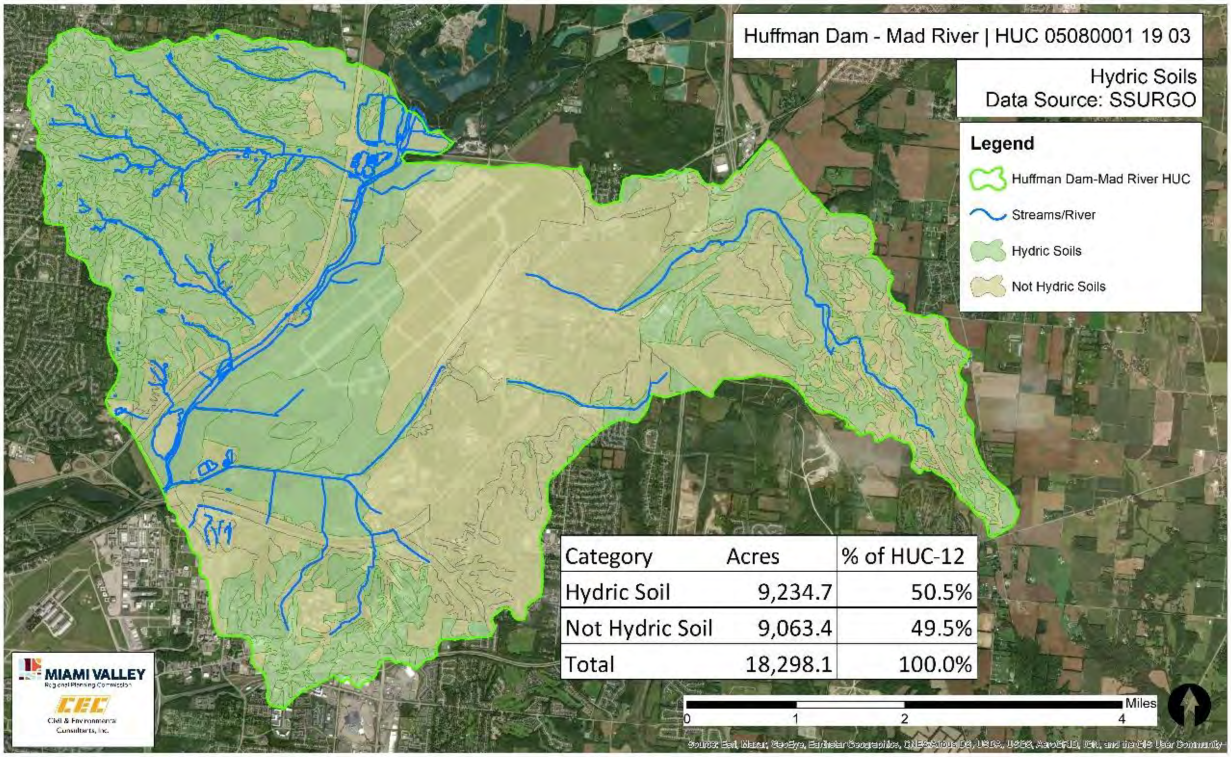
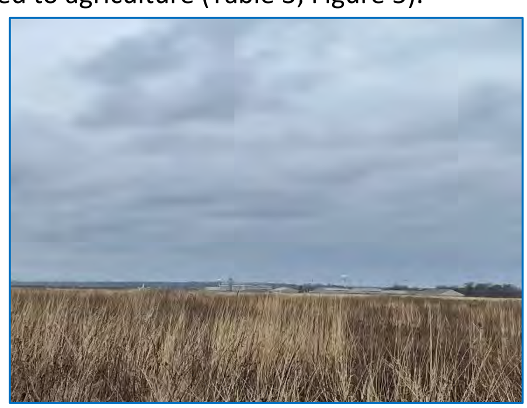


Figure 4: Soils in the Huffman Dam-Mad River HUC-12

2.1.2 Land Use and Protection

The **Huffman Dam-Mad River HUC-12** is located between northeastern Montgomery County and northwestern Greene County, with the majority of the sub-watershed residing within Bath Township and the City of Fairborn in Greene County and the City of Huber Heights in Montgomery County. Negligible portions of the sub-watershed are contained within the City of Dayton, City of Riverside and City of Beavercreek. Land use within the **Huffman Dam-Mad River HUC-12** is primarily urban development, with most of the remaining land being dedicated to agriculture (Table 3; Figure 5).

Within the urban landscape, land use is mainly developed open space, attributed to the layout of Wright-Patterson AFB (Table 4). Low, medium and high-intensity development is interspersed throughout the central portion of the sub-watershed to the east of the AFB. The amount of impervious surface within a watershed has a direct impact on the quality of stream habitat and the health and well-being of the aquatic communities in urban streams. Within the **Huffman Dam-Mad River HUC-12**, the average imperviousness is over 20%, though in the highly



Wright-Patterson AFB.
Photo courtesy of CEC, Inc.

urbanized areas, the range approaches 100% (Figure 6). Generally, degradation in stream health is seen in watersheds with greater than 10% impervious surface (Schueler, 1994). The City of Huber Heights has been identified as an area for urban growth and is currently immersed in a comprehensive planning process to balance commercial and residential development within the sub-watershed. Within the City of Fairborn, historical development did not always consider best stormwater management practices and riparian setbacks, and as a result, the City encounters frequent flooding in areas. The City is actively trying to retrofit its drainage systems and identify opportunities to optimize stormwater capacity.

Table 3: Land Use Classifications in the Huffman Dam-Mad River HUC-12[3]

Land Use	Huffman Dam-Mad River HUC-12 (05080001 19 03)		
	Area (mi^2)	Area (acres)	% Watershed Area
Agriculture, cultivated crops	5.31	3,400.93	18.57%
Agriculture, pasture/hay	2.38	1,523.41	8.32%
Barren land	0.07	44.68	0.24%
Developed, urban	17.45	11,169.94	61.04%
Forest, tree canopy	2.53	1,616.15	8.85%
Open water	0.55	350.44	1.92%
Undergrowth, grassland/herbaceous	0.12	79.45	0.42%
Wetlands	0.18	112.60	0.64%
Total	**28.59**	**18,297.60**	**100.00%**

(Source: Homer et al., 2020)

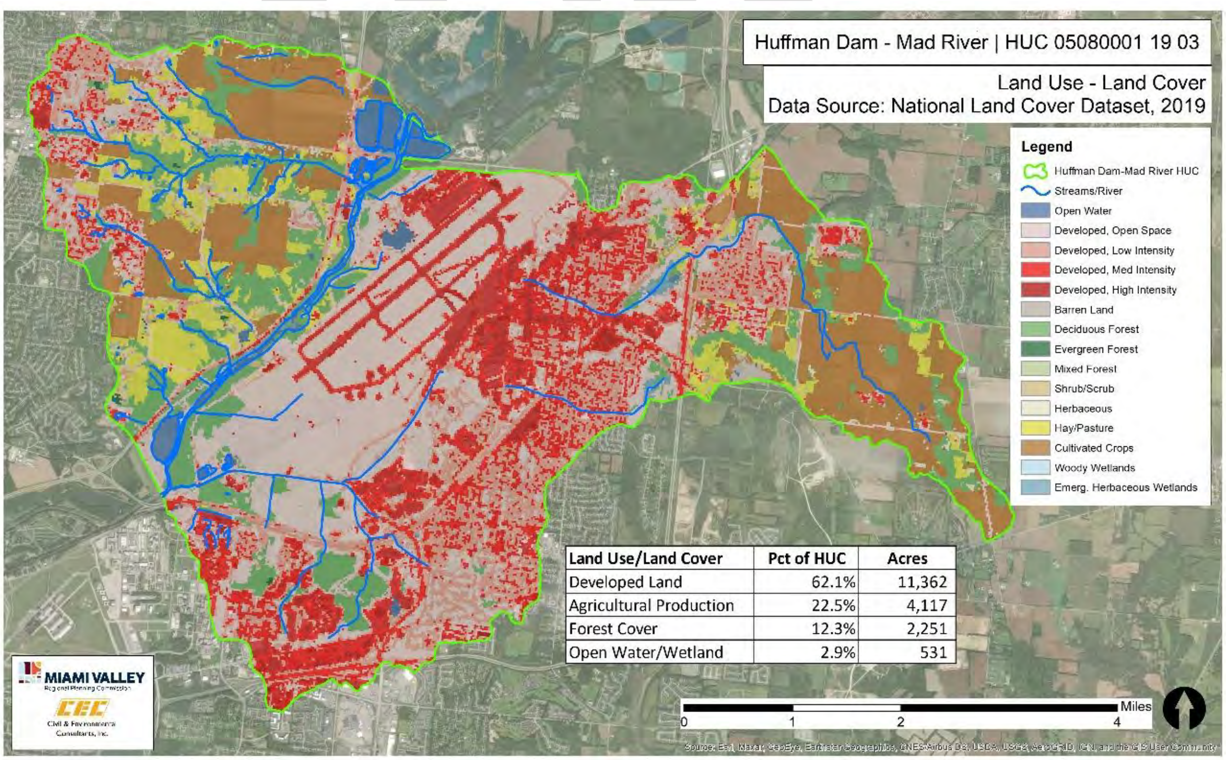


Figure 5: Land Use in the Huffman Dam-Mad River HUC-12

[3] Total land use percentages may vary slightly between Table 3 and Figure 5 due to GIS processing and rounding.

Table 4: Urban Land Cover

Huffman Dam-Mad River HUC-12 (05080001 19 03)			
Type	**Description**	**Area (Acres)**	**Percentage of Total Land Cover**
Developed, open	Mostly vegetation as lawn grass; impervious surface is below 20%	5,345.81	29.22%
Developed, low-intensity	Mix of constructed materials and vegetation; Impervious surface ranges from 20-49%	3,786.81	20.70%
Developed, medium-intensity	Mix of constructed materials and vegetation; Impervious surface ranges from 50-79%	1,332.10	7.28%
Developed, high-intensity	Highly developed areas; impervious surface ranges from 80-100%	704.53	3.85%

(Source: MRLC, 2022)

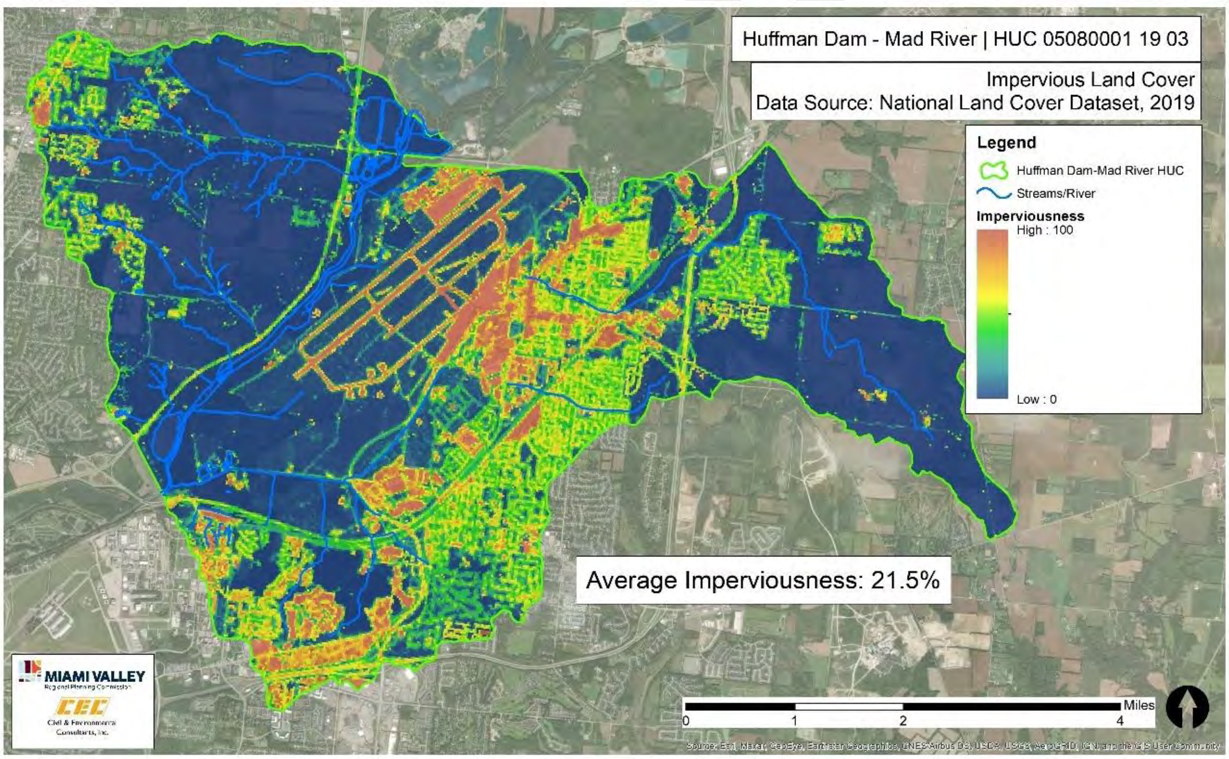


Figure 6: Impervious Surface Percentage in the Huffman Dam-Mad River HUC-12

Tree canopy within the urban landscape is sparse, accounting for approximately 13.3% of the total land cover, with higher canopy percentages found in the riparian corridor of the Mad River (Figure 7). As shown in the National Wetland Inventory (NWI), little of this tree canopy is attributed to woody wetlands, though historically, the Mad River entered Greene County in wetlands that have since been converted to gravel mining operations (Ohio EPA, 2009). Wetland coverage throughout the entire sub-watershed is very low and occurs in small pockets, mainly in protected parks and reserves, such as Cemex Reserve, Pearl's Fen and the Huffman MetroPark (Figure 8).

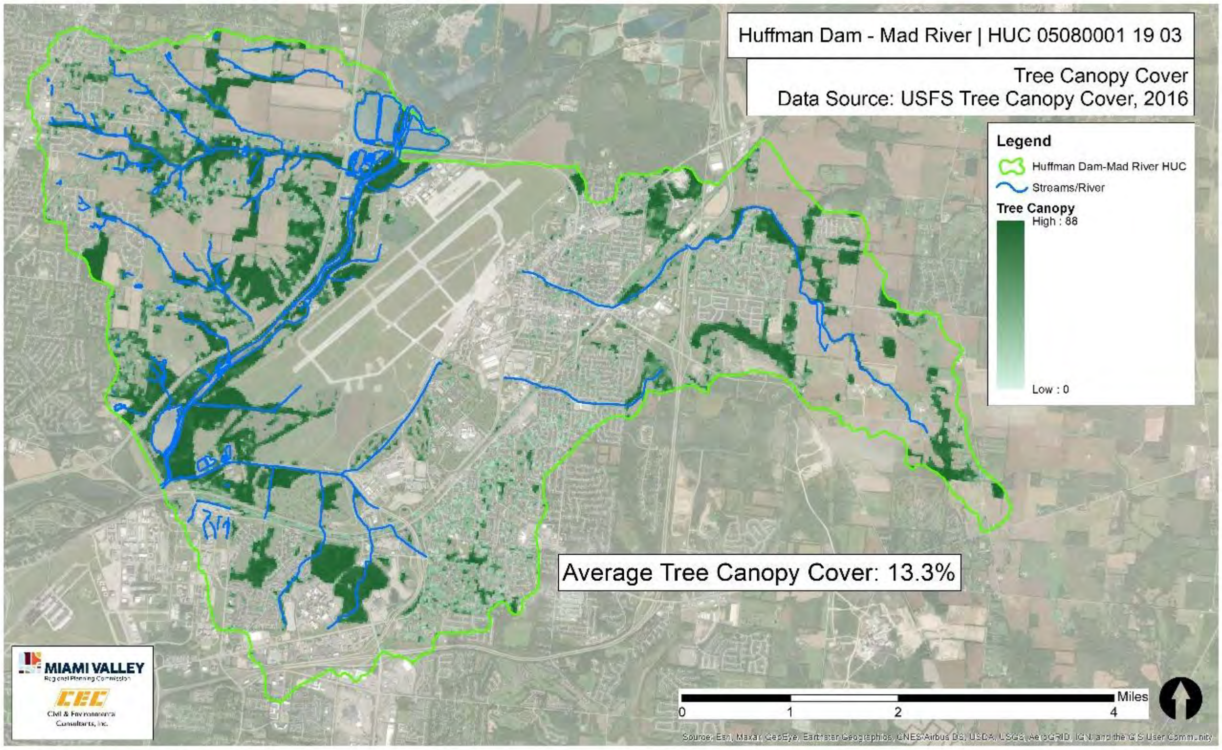


Figure 7: Tree Canopy in the Huffman Dam-Mad River HUC-12

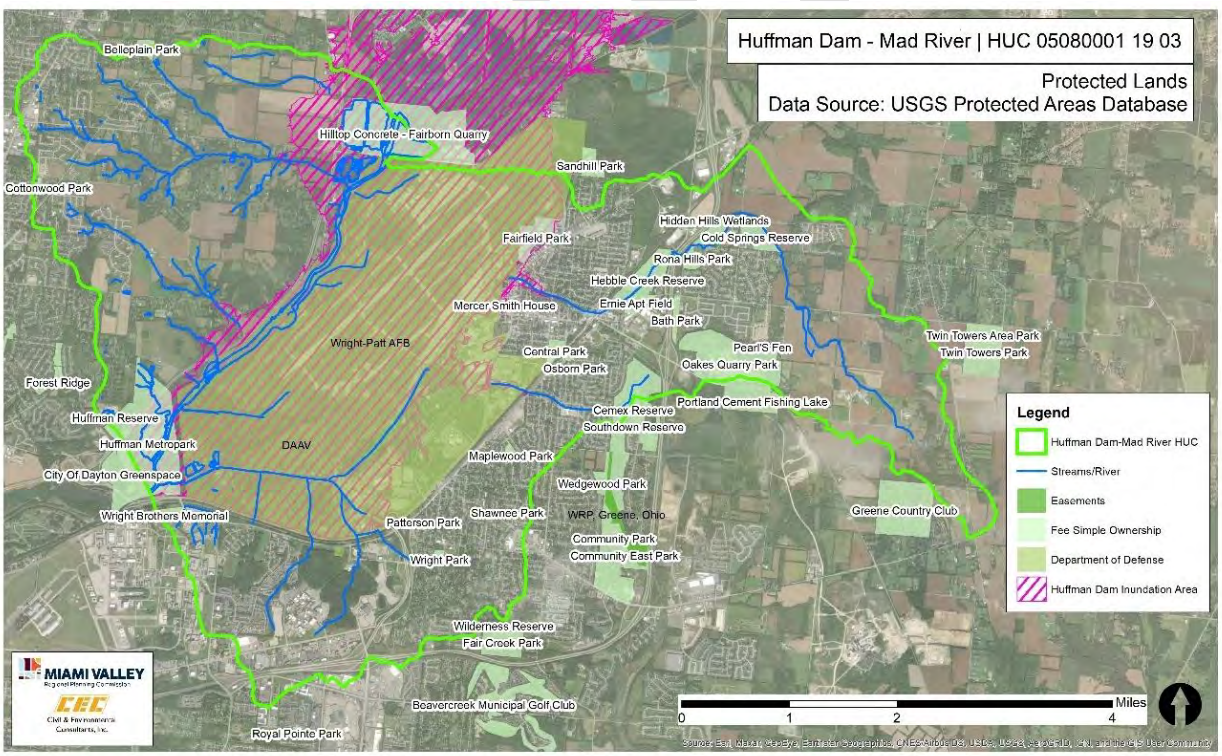


Figure 8: Protected Parks and Lands in the Huffman Dam-Mad River HUC-12

Municipalities and other organizations in the **Huffman Dam-Mad River HUC-12** are dedicated to the preservation of land for recreation and greenspace. Over 1,019 acres of land are listed within the USGS Protected Areas Database of the United States (PAD-US) within the **Huffman Dam-Mad River HUC-12**, including parcels owned and managed by the City of Fairborn, the City of Huber Heights, the National Park Service, Greene County Parks & Trails (GCPT) and Five Rivers MetroParks (Table 5).

Table 5: Parks and Protected Lands in the Huffman Dam-Mad River HUC-12

Name	Acreage	Owner/Manager	Description
Bath Township Park	12	Bath Township	Township park with basketball courts, baseball diamond, volleyball courts, soccer field, picnic shelters
Cemex Reserve	164	Greene County Parks & Trails	Walking trail through wetlands, wet prairie and meadow
Central Park	15.5	City of Fairborn	City park with playgrounds and equipment, shelter, fitness court
Cold Springs Reserve	38.7	City of Fairborn	City park that is mostly undeveloped with trails
Cottonwood Park	5	City of Huber Heights	City park with baseball field, basketball court, grill, picnic shelters, playground
Fairfield Park	44	City of Fairborn	City park with baseball fields, pickleball courts, playground and equipment, softball fields
Hebble Creek Reserve	78	Greene County Parks & Trails	Private reserve of riparian wetland habitat
Hidden Hills Wetland	29.2	City of Fairborn	City park; currently undeveloped
Huffman MetroPark	316	Five Rivers Metroparks	Metropark surrounding Huffman Dam with mountain biking rails, prairie and a swimming lake
Maplewood Park	12.6	City of Fairborn	City park with basketball courts, playground, shelter, soccer field, tennis courts
Mercer Smith House	0.2	City of Fairborn	City park with historic log home available for tours
Oakes Quarry Park	207.6	City of Fairborn	City park with fishing, trails
Osborn Park	8	City of Fairborn	City park with basketball courts, playground, shelter, skate park, soccer fields
Patterson Park	0.4	City of Fairborn	City park with a playground
Pearl’s Fen	15	Greene County Parks & Trails	Wetland area with walking trail and boardwalk
Rona Hills Park	17	City of Fairborn	City park with basketball courts, playgrounds, shelters, soccer fields, tennis courts
Shawnee Park	1.4	City of Fairborn	City park with a playground
Strautman Landing Park	16.1	City of Fairborn	City park adjacent to Oakes Quarry Park
Tecumseh Park	1.4	City of Fairborn	City park with basketball court, playground, shelter
Wright Brothers Memorial	20	National Park Service	Memorial field at Huffman Prairie
Wright Park	11.9	City of Fairborn	City park with basketball court, playground, shelter, trails
Wright Brothers Huffman Prairie Bikeway	5.9	City of Fairborn	Bikeway

(Source: USGS, 2019; Fairborn, 2022; GCPT, 2022; NPS, 2023, Huber Heights, 2023)

Additionally, a flood inundation area is maintained behind the Huffman Dam. Owned and maintained by the MCD, Huffman Dam is one of five dams providing flood protection to the Great Miami River. The flood protection system is a dry system, meaning there is no permanent pool or reservoir behind it, and it is designed to manage a storm the size of the Great 1913 Flood (9-11 inches of rain) plus 40%. The earthen dam has large openings (conduits) that allow base flow through the structure unimpeded. As water levels in the Mad River rise above the conduit elevations, the dam retains water in the retarding basin. During high flow conditions, the conduits only allow enough flow through that the downstream channel can handle during flood stage. The MCD has easements and restrictions on land contained within the dam's inundation area, and much of it is used for passive recreation and agriculture (MCD, 2023).

Huffman Dam.
Photo courtesy of CEC, Inc.

These parks and protected lands may serve as habitat for the six federally threatened or endangered species listed by the United States Fish and Wildlife Service (USFWS) for Greene and Montgomery counties (Table 6). The Mad River and Hebble Creek are both listed in Appendix A of the *Ohio Mussel Survey Protocol* as "Group One" streams, indicating that each stream has the potential for mussels but the Federally Listed Species (FLS) on USFWS's listing are not expected to be found (ODNR, 2022b).

Table 6: Threatened and Endangered Species in Greene and Montgomery Counties

Species	Status	Habitat Characteristics
Indiana bat *(Myotis sodalis)*	Endangered	Hibernates in caves and mines and forages in small stream corridors with well-developed riparian woods, as well as upland forests
Northern long-eared bat[1] *(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
Eastern massasauga *(Sistrurus catenatus)*	Threatened	Wetlands and adjacent uplands
Clubshell *(Pleurobema clava)*	Endangered	Found in coarse sand and gravel areas of runs and riffles within streams and small rivers
Rayed bean[2] *(Villosa fabalis)*	Endangered	Smaller, headwater creeks, but they are sometimes found in large rivers
Snuffbox Mussel *(Epioblasma triquetra)*	Endangered	Found in sand, gravel, or cobble substrates in small and medium-sized rivers

(Source: ODNR, 2022c)

NOTES

1 Listed in Greene County only

2 Listed in Montgomery County only

Many of these parks are connected through local bikeways and greenways, and additional recreational facilities and entertainment venues are located throughout the sub-watershed (Figure 9). Other points of interest throughout the **Huffman Dam-Mad River HUC-12** include:

- Twin Base Golf Course;
- Wright State University;
- Mercer Smith House;
- Wright-Patterson AFB;
- Wright Brothers-Huffman Prairie Bikeway;
- Buckeye Trail and The North Country Trail;
- Fairborn Bikeway Connector; and,
- Numerous cemeteries and schools.

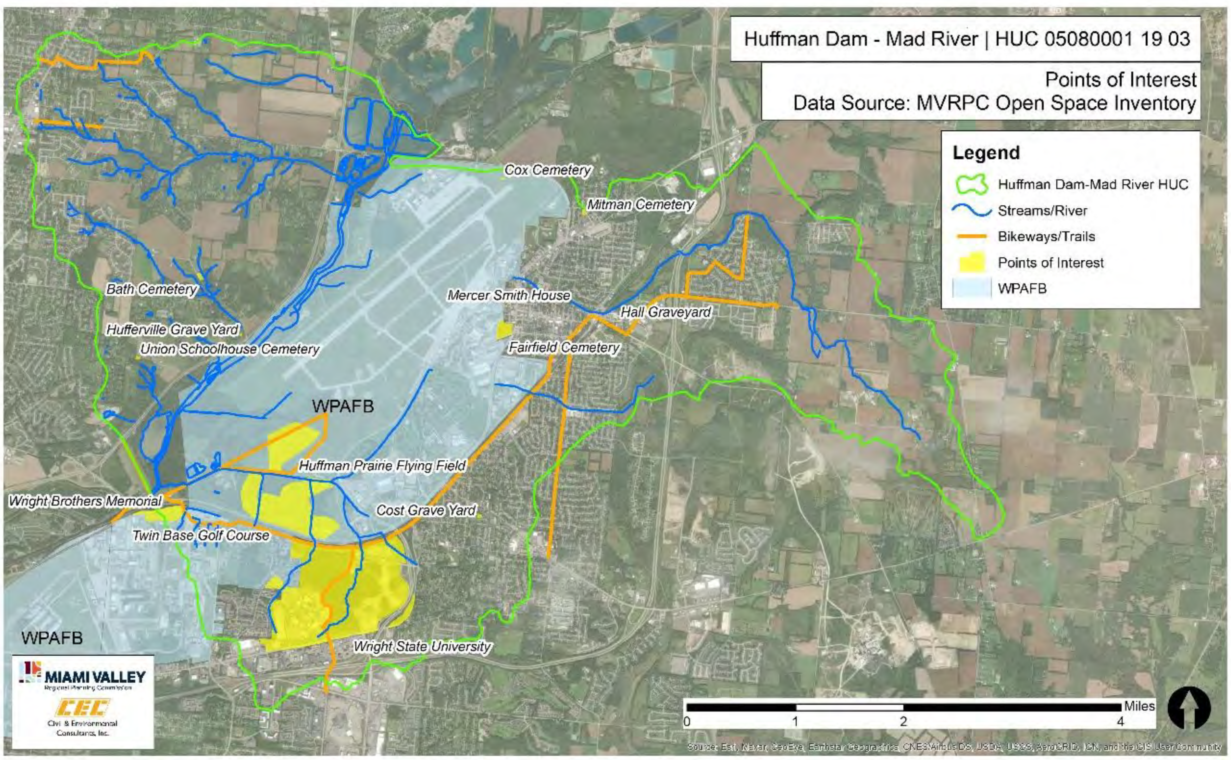


Figure 9: Points of Interest

Approximately half of the sub-watershed falls within the Municipal Separate Storm Sewer System (MS4) regulated area for the City of Dayton. In an MS4, stormwater is collected in a system of conveyances and is discharged directly to surface waters (untreated) by a public entity. Many municipalities and larger entities in this sub-watershed are responsible for their own MS4, while Bath Township is a co-permittee under the Greene County Commissioners permit (Table 7).

Table 7: MS4 Permits in the Huffman Dam-Mad River HUC-12

Permittee	Permit Number	Size
City of Dayton	1PI00003*DD	Phase I
City of Fairborn	1GQ00005*DG	Phase II
Wright State University	1GQ00028*EG	Phase II
Wright-Patterson AFB	1GQ00033*DG	Phase II
City Of Huber Heights	1GQ00050*DG	Phase II
Greene County Commissioners (Bath Township)	1GQ00058*DG	Phase II

(Source: Ohio EPA, 2023d)

NOTES
MS4 Municipal Separate Storm Sewer System
AFB Air Force Base

All municipalities and entities in the **Huffman Dam-Mad River HUC-12** are considered to be small MS4s (Phase II communities), serving populations less than 100,000, except Dayton (Phase I community) (Ohio EPA, 2023d). Stormwater from urban areas is a concern due to the high concentration of pollutants, including pesticides, fertilizers, oils, salt, litter, sediment and other debris that can enter surface waters during a storm event and discharge to surface waters (Ohio EPA, 2002). Additionally, illicit connections of sanitary sewers may contribute biological contaminants, such as bacteria to surface waters. There are no permitted combined sewer overflow (CSO) locations in the **Huffman Dam-Mad River HUC-12** (Ohio EPA, 2023a).

In rural, outlying landscapes, residences and small businesses use HSTS, which are a potential source of NPS pollution for bacteria and nutrients. Greene County Public Health offers assistance to homeowners with HSTS to aid in the operation and maintenance of on-site systems for the prevention of NPS pollution, contamination to groundwater and public health nuisances (Greene County Health Department, 2021), while the Dayton & Montgomery County Public Health runs a similar program to ensure that septic systems and private wells are designed and installed under permit and in accordance with state and local regulations (DMCPH, 2023). Using National Small Flows Clearinghouse Data from 1992 and 1998, 1,672 HSTS were estimated to be within the **Huffman Dam-Mad River HUC-12** (Tetra Tech, 2022). Studies conducted by the Ohio Department of Health (ODH) across Ohio have shown an average HSTS failure rate of 31% (ODH, 2013). The TMDL published in 2009 did note impairment in the Mad River LRAU for bacteria; however, this was not addressed within the document. Though the amount of NPS pollution from HSTS in the **Huffman Dam-Mad River HUC-12** is likely relatively small, repair or replacement of failing HSTS or connection to sanitary sewer lines reduces the potential for NPS pollution from this source.

Five National Pollutant Discharge Elimination System (NPDES)-permitted facilities are located within the **Huffman Dam-Mad River HUC-12** (Ohio EPA, 2023b) (Figure 10; Table 8). The USEPA documents NPDES permit compliance through the Enforcement and Compliance History Online (ECHO) database (USEPA, 2023). Results discussed here cover the three-year (12 quarter) compliance history from January 1, 2020 through December 31, 2022. The Fairborn Water Reclamation Center has no reported exceedances for recent quarters. The permit issued for the northern part of Wright-Patterson AFB (1IN90011*BD) was in Significant Noncompliance (SNC) for one quarter for Failure to Report a Discharge Monitoring Report (DMR), which was resolved during the following quarter. The permit issued for the southern part of the base (1IN00156*HD) reported one exceedance for chlorine over the three-year timeframe.

The Dovetail Energy LLC, Anaerobic Digestion Facility has been in violation in all previous 12 quarters, four of which were in SNC for Failure to Report a DMR. Violations for Reportable Noncompliance were cited during the remaining quarters. The facility has received a Notice of Violation (NOV) from the USEPA for improper operation of facility engines and flares, excessive air emissions, and failure to report required parameters. The facility has been subject to two lawsuits and numerous complaints from residents in relation to its operations (Halasz, 2022).

The Huber Mobile Home Park (MHP) has been in SNC in eight of the last 12 quarters, with violations identified during the remaining quarters. The facility has reported exceedances for carbonaceous biological oxygen demand (cBOD), *Escherichia coli* (*E. coli)*, nitrogen as ammonia (NH_3), dissolved oxygen (DO) and total suspended solids (TSS.) The facility has had recurring issues over time, paying civil penalties in 2010 (Bennish, 2010).

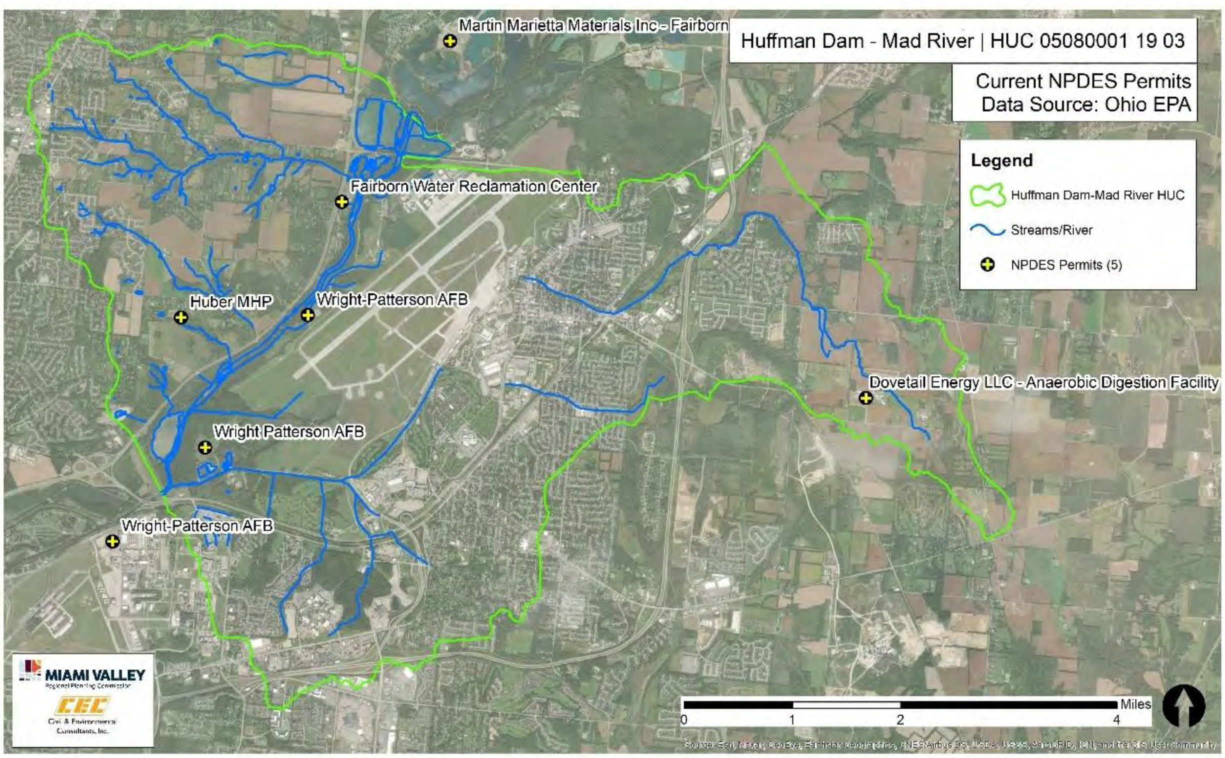


Figure 10: NPDES Permits in the Huffman Dam-Mad River HUC-12

Table 8: National Pollutant Discharge Elimination System Permits in the Huffman Dam-Mad River HUC-12

Facility Name	Permit Number	Receiving Waterbody
Fairborn Water Reclamation Center	1PD00002*OD	Mad River
Huber MHP	1PV00088*FD	Unnamed tributary to the Mad River
Wright-Patterson AFB	1IN90011*BD	Unnamed tributary to the Mad River
Wright Patterson AFB	1IN00156*HD	Mad River and Twin Lakes (interconnected to the Mad River)
Dovetail Energy LLC – Anaerobic Digestion Facility	1IN00305*AD	Hebble Creek

(Source: Ohio EPA, 2022b)

NOTES
MHP Mobile Home Park
AFB Air Force Base

Over 26% of land contained within the **Huffman Dam-Mad River HUC-12** is used for agriculture, and of this, ~18% is in traditional row-crop production, while the remaining ~8% is maintained as pasture/hay lands. Data reported for agriculture are often reported at the county level and estimated for watersheds based upon relative percentages. The USDA Census of Agriculture (2017) lists soybeans as the largest field crop harvested in Montgomery and Greene Counties (≥45%), while corn accounts for 35-44% of crops (USDA, 2019). In general, livestock operations are smaller in Montgomery County (145 acres) compared to Greene County (205 acres). Greene County did realize a significant increase in inventory of hogs and pigs in 2017 over 2012 (USDA, 2019). No Concentrated Animal Feeding Operations (CAFOs) or Ohio Department of Agriculture (ODA)-permitted Confined Animal Feeding Facilities (CAFFs) are located within the sub-watershed. An estimate of the animals existing in the **Huffman Dam-Mad River HUC-12** is listed in Table 9.

Table 9: Estimated Animal Counts in the Huffman Dam-Mad River HUC-12

Livestock Type	Animal Units
Beef	311
Dairy	29
Swine	1,026
Sheep	53

Livestock Type	Animal Units
Horse	85
Chicken	262
Turkey	5
Duck	10

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

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 10). Summary data provided by Ohio EPA regarding the use of the Environmental Quality Incentives Program (EQIP) within the **Huffman Dam-Mad River 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 the counties of the **Huffman Dam-Mad River HUC-12** are found in Table 11.

Table 10: OpTIS Countywide Conservation Practice Averages for 2014-2018 for the Upper Great Miami Watershed

Conservation Practice	% Usage
No-till conditions	37.9
Reduced till conditions	51.9
Conventional till	10.2
Winter commodity cover crop	3.0
Winter cover crop	2.5

(Source: Dagan, 2019)

Table 11: Conservation Reserve Program (CRP) Contract Acreage by County

Conservation Practice	Acres*	
	Montgomery	Greene
Establishment of Permanent Introduced Grasses and Legumes	12.00	--
Wildlife Food Plot	--	1.80
Establishment of Permanent Native Grasses	85.77	132.10
Filter Strips	31.88	218.25
Riparian Buffer	1.36	53.97
Wetland Restoration	--	3.70
Wetland Restoration, Non-Floodplain or Tree Planting	12.71	--
Rare and Declining Habitat	--	3.50
Farmable Wetland Program	2.80	--
Upland Habitat Buffers	170.01	184.78
Permanent Wildlife Habitat for Pheasants	18.25	35.47
Hardwood Tree Planting	1.00	24.94
Pollinator Habitat	10.81	160.03
Permanent Wildlife Habitat, Noneasement	--	44.35
Field Windbreak Establishment, Noneasement	--	2.47
Grassland Wildlife Plan	--	28.41
Grass Waterways, Noneasement	261.51	165.67
Shallow Water Areas for Wildlife	1.80	26.48

(Source: USDA-NRCS, 2018)

NOTES

**Acres reported at the county level and may not necessarily fall within the Huffman Dam-Mad River HUC-12 boundaries.*

2.2 Summary of HUC-12 Biological Trends

Ohio EPA sampled the Mad River watershed in 2003 as the basis for a TMDL study. The TMDL for the Mad River was released in 2009. In the lower portion of the Mad River, including the mainstem, TMDL targets were calculated for habitat to address flow and habitat alterations. Throughout the headwaters of the Mad River, TMDLs also included nitrate, sediment, and fecal coliform (bacteria). Samples were obtained for ALU analysis from two sample locations in the Mad River and one sample location in Hebble Creek. A summary of sample locations is provided in Table 12. For reference, WQS for the ECBP ecoregion are presented in Table 13. The watershed is slated to be sampled again 2023.

Table 12: Biological Indices Scores for Sites in Huffman Dam-Mad River HUC-12

Huffman Dam-Mad River HUC-12 (05080001 19 03)							
River Mile	**Drainage Area (mi^2)**	**IBI**	**MIwb[a]**	**ICI[b]**	**QHEI**	**Attainment Status**	**Location**
Mad River, LRAU (WWH)							
8.6[B]	616.0	40[ns]	9.0	G	82.0	Full	Downstream Fairborn WWTP
6.0[B]	619.0	43	9.0	40	78.0	Full	Upstream Huffman Dam, Downstream Confluence Hebble Creek
Hebble Creek (MWH)							
5.0[H]	5.4	30*	N/A	F*	34.0	Full	Dayton Avenue

(Source: Ohio EPA, 2005)

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*
LRAU *Large River Assessment Unit*
B *Boat site*
H *Headwater 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*
MWH *Modified Warmwater Habitat*
WWTP *Wastewater Treatment Plant*

Table 13: Water Quality Standards for the Eastern Corn Belt Plains (ECBP) Ecoregion

ECBP Ecoregion	**EWH**			**WWH**			**MWH**		
	Headwater	**Wading**	**Boat**	**Headwater**	**Wading**	**Boat**	**Headwater**	**Wading**	**Boat**
IBI	50	50	48	40	40	42	24	24	24
MIwb	N/A	9.4	9.6	N/A	8.3	8.5	N/A	6.2	5.8
ICI	46	46	46	36	36	36	22	22	22
QHEI[a]	75	75	75	55	60	60	43.5	43.5	43.5

(Source: Ohio EPA, 2014)

NOTES

EWH *Exceptional Warmwater Habitat*
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 EWH assemblages (Ohio EPA, 1999).

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

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

In general, fish assemblage scores in the Mad River watershed (including the **Huffman Dam-Mad River HUC-12**) have remained consistent with historical sampling results (Ohio EPA, 2009). The majority of sites (79.4%) of the 110 sampled throughout the TMDL study met standards for their designated ALU, including the sampling locations in Hebble Creek and the Mad River in this sub-watershed. Depressed fish scores occurred in the LRAU segment of the Mad River due to persistent remnant headwater community characteristics (Ohio EPA, 2009). The LRAU is more urban/industrialized than upper reaches of the Mad River, and within this section, fish communities demonstrated a gradual transition that involved a decline in coldwater components with an increase in more typical WWH structural and compositional attributes (Ohio EPA, 2009).

Macroinvertebrates (Invertebrate Community Index [ICI])

Similar to fish assemblages, macroinvertebrate community scores in the Mad River watershed (including the **Huffman Dam-Mad River HUC-12**) have been consistent or seen slight improvement compared to historical sampling (Ohio EPA, 2009). In the LRAU, numbers of *Ephemeroptera, Plecoptera and Trichoptera* (EPT) taxa were similar among sites, ranging from 11-16. While meeting the ALU for a MWH stream, urban runoff in Hebble Creek may potentially impact communities.

Habitat (via Qualitative Habitat Evaluation Index [QHEI])

Ohio EPA sampling crews documented various water quality and habitat attributes during the QHEI assessment in 2003 (Table 14). Within the Mad River watershed, stream habitat was generally of higher quality, supporting CWH species at many locations upstream of the **Huffman Dam-Mad River HUC-12**. The **Huffman Dam-Mad River HUC-12** contains some of the most intensely developed areas within the Mad River watershed, and as a result of high impervious surface and historically channelized flows, does not support as highly performing communities as in upstream segments. While habitat reached recommended thresholds for WWH sites within the Mad River in this sub-watershed, persistent habitat attributes from historical channelization and modification exists. Attainment within the LRAU occurred despite potential impacts from urban runoff, upstream point sources and habitat modifications (Ohio EPA, 2005). In Hebble Creek, habitat did not reach recommended levels for MWH streams, and high influence MWH attributes were dominant throughout the stream.

The presence of certain attributes is shown to have a larger negative impact on fish and macroinvertebrate communities. Streams designated as WWH should exhibit no more than four total MWH attributes; additionally, no more than one of those four should be of high-influence (Ohio EPA, 2013). Within the boundaries of the **Huffman Dam-Mad River HUC-12**, MWH attributes were present in abundance at two of the three sampling locations.

Table 14: QHEI Matrix with WWH and MWH Attribute Totals for Sites in the Huffman Dam-Mad River HUC-12

Huffman Dam-Mad River HUC-12 (05080001 19 03)																																
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
Mad River, LRAU (WWH)																																
8.6[B]	82.0	N/A	•	•		•	•	•	•	•	•	•	**9**				•		**1**	•					•					•		**3**
6.0[B]	78.0	N/A		•		•		•	•		•	•	**6**						**0**	•	•	•			•				•			**5**
Hebble Creek (MWH)																																
5.0[H]	34.0	N/A											**0**	•	•	•	•	•	**5**		•			•				•	•	•		**5**

(Source: Ohio EPA, 2009)

NOTES
QHEI Qualitative Habitat Evaluation Index
WWH Warmwater Habitat
MWH Modified Warmwater Habitat
LRAU Large River Assessment Unit
B Boat site
H Headwater site
N/A Not available

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

As shown in the 2005 *Biological and Water Quality Study of the Mad River Basin,* the two biological sampling sites in the Mad River in the **Huffman Dam-Mad River HUC-12** are in *Full Attainment* of the WWH designation (Table 15). The sampling location within Hebble Creek is in *Full Attainment* of the MWH designation.

The **Huffman Dam-Mad River HUC-12** drains one of the most intensely developed portions of the Mad River watershed. High percentages of impervious surface within a watershed greatly increases the impact of urban runoff on stream quality and biological performance. Lacking the ability to infiltrate into the ground, runoff within an urban catchment has a higher velocity when entering a downstream reach, which increases the erosive potential of a “flashy” system. An increase in water velocity not only increases the erosive power within a stream reach, but also increases the amount of sediment that can be carried, exacerbating excessive siltation downstream (USEPA, 2003). Surface runoff in urban landscapes is more likely to carry large amounts of sediments and other urban pollutants to streams, and it typically has a higher temperature from the impervious surfaces over which it flows, which can be harmful to aquatic life. Excessive inputs of nutrients, including nitrogen and phosphorus, can stimulate excessive growth of algae and plants, causing eutrophication. Nutrient enrichment in streams directly changes nutrient cycling processes that can affect ecosystem structure and function, leading to impairment of ALU, drinking water sources or recreational uses (Paul and Meyer, 2001). While the sampling locations within the **Huffman Dam-Mad River HUC-12** are currently in *Full Attainment*, reductions in runoff through an increase in retention and detention, as well as treatment of runoff, can assist in the maintenance of WQS and the reduction of far-field effects to receiving waterbodies.

Table 15: Causes and Sources of Impairments for Sampling Locations in the Huffman Dam-Mad River HUC-12

Huffman Dam-Mad River HUC-12 (05080001 19 03)				
River Mile	**Primary Cause(s)**	**Primary Source(s)**	**Attainment Status**	**Location**
Mad River, LRAU (WWH)				
8.6[B]	--	--	Full	Downstream Fairborn WWTP
6.0[B]	--	--	Full	Upstream Huffman Dam, Downstream Confluence Hebble Creek
Hebble Creek (MWH)				
5.0[H]	--	--	Full	Dayton Avenue

(Source: Ohio EPA, 2005)

NOTES
WWH Warmwater Habitat
MWH Modified Warmwater Habitat
LRAU Large River Assessment Unit
B Boat site
H Headwater site

In addition to the near-field impairments that exist in this sub-watershed, the presence and persistence of the hypoxic zone within the Gulf of Mexico has shown the need for reduced NPS pollution, particularly in regard to nitrogen, and to a lesser extent phosphorus, throughout the entire MARB, of which the Ohio River is a main tributary. Nitrogen and phosphorus loss within the **Huffman Dam-Mad River HUC-12** contributes to this far-field impairment. Ohio EPA has estimated nitrogen and phosphorus loadings in targeted areas of the ORB. These estimates include a breakdown of estimated loads from contributing sources of NPS pollutants, including agricultural lands/activities and developed/urban lands (Table 16). Efforts to reduce nutrients from each of these contributing sources will focus on reaching the 20% reduction goal by 2025, as outlined by the HTF in 2014.

Table 16: Estimated Nutrient Loadings from Contributing NPS Sources in the Huffman Dam-Mad River HUC-12

	Developed/Urban Load (lbs/yr)		Agricultural Load (lbs/yr)	
	Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Current Estimates*	81,000	4,900	71,000	4,400
Target Loadings	65,000	3,900	57,000	3,500

(Source: Ohio EPA, 2021)

NOTES
**Estimated using two significant figures*

Water chemistry data collected by MCD between 2003-2019 in the Mad River at Huffman Dam indicate nutrient concentrations have remained relatively stable, but above, target values for nitrate-nitrite for small rivers in Ohio (1.5 mg/L)[4], averaging 2.7 mg/L as the long-term trend *(personal communication, Mike Ekberg, MCD, December 20, 2022)*. A similar trend is shown for phosphorus, averaging 0.23 mg/L, over the target value of 0.17 mg/L[5] for phosphorus for small rivers in Ohio. Volunteer sampling in Hebble Creek conducted by the B-W Greenway Community Land Trust in 2006 and 2007 yielded nitrate concentrations above the target value for nitrate-nitrite in headwater streams (> 1.0 mg/L), averaging 2.7 mg/L (*personal communication from Bob Jurick, B-W Greenway Community Land Trust, January 4, 2023)*.

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

Assessment data from the *Biological and Water Quality Study of the Mad River Basin, 2003,* the *TMDL for the Mad River Watershed* and data referenced in the *2023 Water Quality and Hydrologic Units in Ohio Interactive Map* were used in the development of this NPS-IS (Ohio EPA, 2005; Ohio EPA, 2009; Ohio EPA, 2023e). 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.

Stakeholder Input

Stakeholder input was received during the Organizational Stakeholder Meeting held on January 20, 2023. Problem areas were visually represented on a map (Figure 11). Corresponding descriptions of these problem areas were detailed and evaluated for potential inclusion in the NPS-IS. If a potential project was identified, additional follow up was made with the respective organizational stakeholder to collect information related to potential project timing, viability and alignment with the NPS-IS goals and objectives (Table 17). Most identified concerns were related to flooding, erosion or potential restoration opportunities. From this process, four potential projects were visited on April 5, 2023 to further discern project viability and collect information regarding site constraints, presence of utilities, localized problem areas, infrastructure considerations, site access and potential ingress and egress routes,

[4] As outlined in Ohio EPA, 1999.
[5] As outlined in Ohio EPA, 1999.

general stream morphology and other existing conditions. Organizational stakeholders were able to provide additional information regarding each potential project site with a restoration ecologist and grant specialist to best determine project feasibility and fundability.

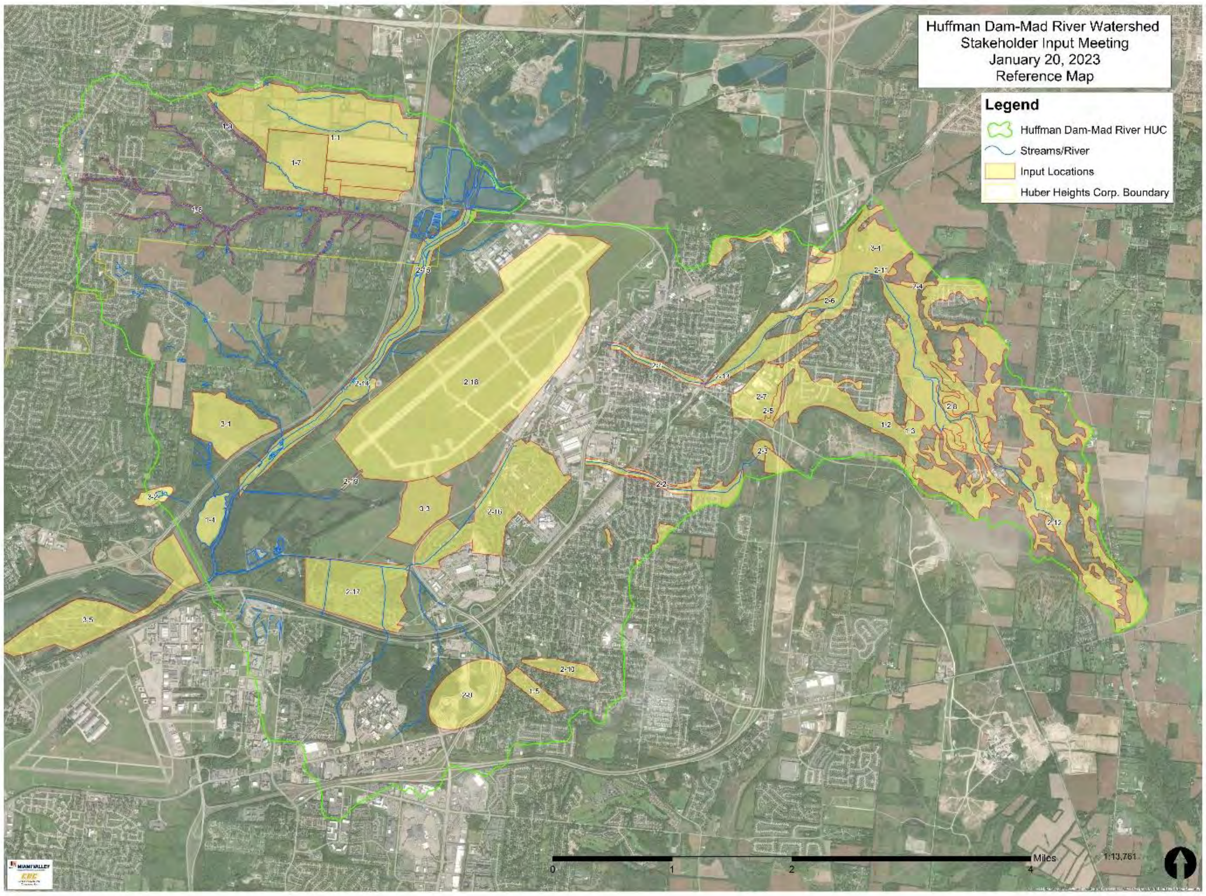


Figure 11: Stakeholder Areas of Concern

Table 17: Stakeholder Input

Number	Type of Concern	Comment*
1-1	Land Development	Future Comprehensive Plan for this area will show mix of commercial and residential development.
1-2	Water Quality	Pearl's Fen: recent sampling by Central State University shows high nitrogen from an unknown source.
1-3	Agricultural Runoff	Sheet flow west off agricultural land across Byron Road into residential yards.
1-4	Sedimentation	Huffman Lake is filling with sediment; dredging the lake is not an option due to proximity to Huffman Dam.
1-5	Erosion	Ravenwood: erosion caused by storm waters.
1-6	Water Quality	Monitoring of Henry Creek would be valuable as headwaters are rapidly developing.
1-7	Project Site	Area of past SWCD cooperators. May be opportunities for cover crop or nitrogen management projects

Number	Type of Concern	Comment*
1-8	Storm Water	City of Huber Heights MS4 program could be assisted by the SWCD.
2-1	Flooding	Flooding along Hebble Creek due to channelization and obstructions along creek.
2-2	Flooding	Flooding in Redbank Ditch due to excessive sedimentation and excessive overgrowth.
2-3	Hydromodification	Pearl's Fen tributary was re-routed from Beaver Creek watershed to Mud Run watershed
2-4	Erosion	Large amount of ditch erosion along Armstrong Road (south side).
2-5	Wetland Study	A wetland delineation is needed for property where Sheetz is coming in.
2-6	Design Project	Rona Hills Park and Hidden Hills Wetland: city is evaluating existing detention infrastructure in an effort to alleviate flooding downstream on Hebble Creek.
2-7	Flooding	Chapelgate Detention Design: Industrial corridor at Yellow Springs-Fairfield Rd. lacks adequate detention. City is working with businesses to establish basins & mitigate flooding by using Hebble Creek Reserve.
2-8	Water Quality	Need goundwater monitoring/wells along eastern section of Hebble Creek east of Armstrong Rd., particularly through farmland.
2-9	Water Quality	Area with really high coliform from WSU students doing samples and study.
2-10	Erosion	Ditch erosion between Kathy and Dorothyland toward Wright Park.
2-11	Stream Protection	A larger buffer needed on the north side of Armstrong Road and near Black Lane.
2-12	Wetland	There are 2 wetlands at the source of Hebble Creek. Can 319 funds cover the 25% local match for a Clean Ohio application for a conservation easement?
2-13	Storm Water	When Xenia Dr. was widened, storm water was diverted to Hebble Creek. Could the Hebble Creek Reserve be expanded to provide more retention area?
2-14	Species	Woods along Mad River on Base are Threatened & Endangered species habitat. Riparian Corridor is clogged with invasive species.
2-15	Erosion	Erosion occurring along stream bank, but not bad—across from Fairborn WWTP.
2-16 and 2-17	Project Site	Could consider restoration projects on golf course portions of the Base. Twin Base Golf Course has public access.
2-18	Project Factor	Consider bird strike hazard around airfield.
2-19	Hydromodification	This section of creek is now underground.
3-1	Project Site	Potential restoration area.
3-2	Project Site	Potential restoration area, quarry.
3-3	Preservation Site	Huffman Prairie is a high-quality prairie for preservation.

Number	Type of Concern	Comment*
3-4	Project Site	Hydric Soils in the east of the watershed would be good places for wetland restoration.
3-5	Water Quality	PFAS is a concern in drinking water.

NOTES
**Organizational stakeholder name withheld.*

CHAPTER 3: CRITICAL AREA CONDITIONS AND RESTORATION STRATEGIES

3.1 Overview of Critical Areas

Three sampling locations are within the **Huffman Dam-Mad River HUC-12**. Both sampling locations within the Mad River are in *Full Attainment* of the WWH designation, and the single sampling location within Hebble Creek is in *Full Attainment* of the MWH designation. While all locations are in *Full Attainment*, actions taken to reduce nutrients and sediments and improvement aquatic habitat are important for the maintenance of WQS locally. Nutrient and sediment loss from land use activities can also contribute to far-field impairment. Implementing stormwater management through the use of green infrastructure in urban areas and best management practices (BMPs) within or adjacent to agricultural fields, as well as addressing localized, unstable streambanks and areas of degraded habitat can alleviate the risk of watershed degradation that threatens attainment. These activities help to manage surface flow and stabilize soil loss from surrounding lands. In addition, green infrastructure components and agricultural BMPs that reduce soil loss simultaneously help reduce nutrient loss, as nutrients can be adsorbed to soil particulates or leach through soil profiles.

Three critical areas have been identified within the **Huffman Dam-Mad River HUC-12** (Table 18). Two critical areas will address far-field effects of nutrients flowing to the Great Miami River, Ohio River, Mississippi River and Gulf of Mexico, the end receiving waterbody of drainage from the **Huffman Dam-Mad River HUC-12**, based on land use type. However, many implementation activities nested within this sub-watershed also simultaneously benefit near-field effects in Hebble Creek and the Mad River through sediment reduction. Because many of these activities offer dual benefits of nutrient and sediment reduction and agricultural and urban land prioritization is not substantially different to realize these reductions within this sub-watershed, only one critical area for each land use type is identified to address impacts from agricultural and urban lands. One critical area has been developed to address habitat alterations and channelization effects that may also pose a risk to near-field attainment. It is expected that projects developed for this critical area will also contribute to far-field benefits in sediment and nutrient reduction. Additional critical areas may be developed in subsequent versions of this NPS-IS.

Table 18: Huffman Dam-Mad River HUC-12 Critical Area Descriptions

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

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

3.2.1 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, increased runoff, increased peak flows and stream "flashiness", stream instability, decreased stream function, decreased storage and retention capabilities and decreased pollutant assimilation in soils (ODNR, 2006). Many of these effects have a direct impact on aquatic life. Even in areas of low amounts of urbanization (5-10% imperviousness), stream ecosystems can rapidly decline (Schueler, 1994).

The **Huffman Dam-Mad River HUC-12** is primarily urban, and therefore, has a high potential of contributing excessive nutrients and sediments from urban runoff into local streams and far-field receiving waterbodies. Opportunities to reduce nutrient and sediment inputs to the Mad River and Hebble Creek should be identified to not only manage erosive stormwater flows, but to also offset the amount of overall nutrient loading to the streams. While nutrient and sediment reduction from all urbanized lands is beneficial, a study conducted by MVRPC in 2020 in a nearby sub-watershed (*Little Beaver Creek HUC-12*) concluded that sewershed land use land cover (LULC) can be indicative of expected pollutant loads. In general, light industrial and parking lot land uses contributed higher nitrogenous compounds, total phosphorus and sediment than commercial or single-family residence properties. *Critical Area #2* contains these LULCs as prioritized urban lands (Figure 12).

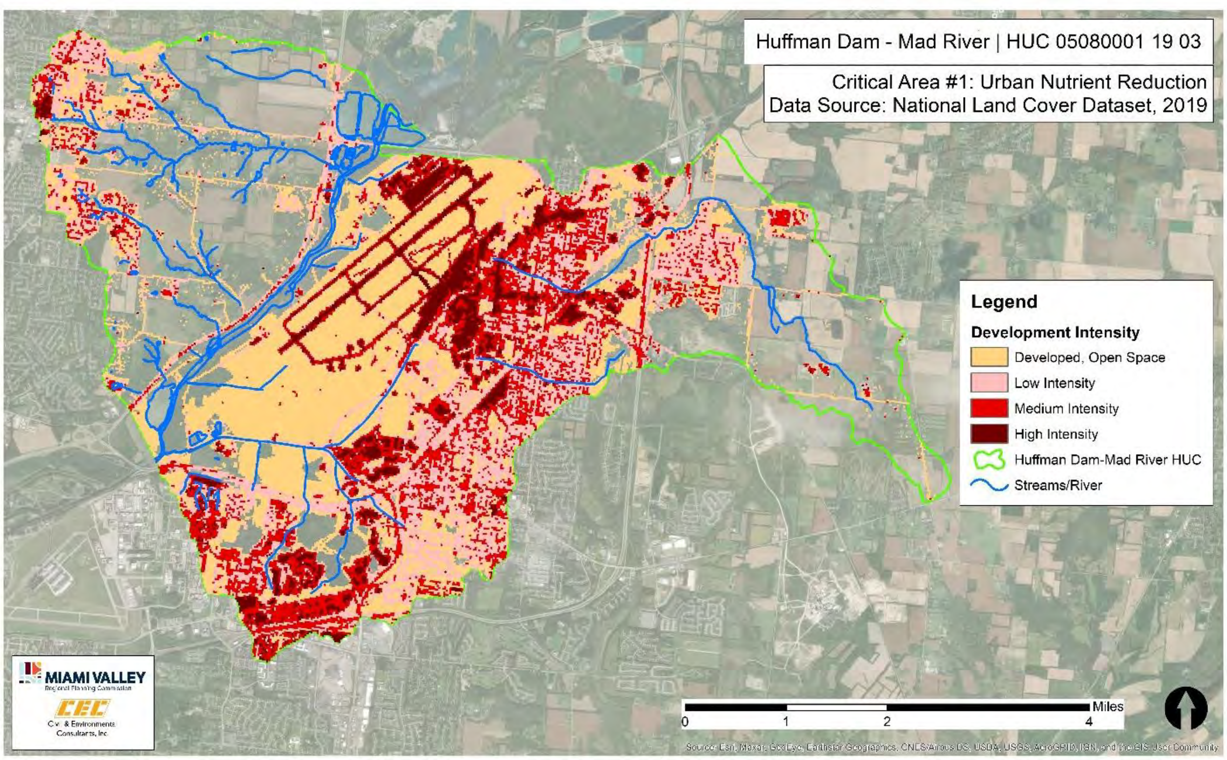


Figure 12: Huffman Dam-Mad River HUC-12 Critical Area #1

3.2.2 Detailed Biological Conditions

Fish community data for the Mad River and Hebble Creek sampling locations are summarized below (Table 19). Analysis of the abundance, diversity and pollution tolerance of existing fish species found by

Ohio EPA at each sampling location, in relation to the corresponding QHEI score, aids in the identification of causes and sources of impairment. Fish communities in Mad River are listed in *Full Attainment*, though communities at RM 8.6 were meeting attainment marginally, falling within the nonsignificant departure range. Habitat at both locations scored relatively high, though persistent MWH effects from historical channelization were observed. Communities within Hebble Creek met thresholds for a MWH stream; however, diversity was low compared to other Mad River tributaries.

Table 19: Critical Area #1 - Fish Community and Habitat Data

Huffman Dam-Mad River HUC-12 (05080001 19 03)							
River Mile	**Drainage Area (mi²)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Mad River, LRAU (WWH)							
8.6[B]	616.0	22	82.0	40[ns]	9.0	Central stoneroller (33%), northern hog sucker (21%), sand shiner (9%)	Marginally Good
6.0[B]	619.0	27	78.0	43	9.0	Northern hog sucker (28%), central stoneroller (11%), golden redhorse (9%)	Good
Hebble Creek (MWH)							
5.0[H]	5.4	4	34.0	30*	N/A	Central stoneroller (62%), green sunfish (33%), creek chub (5%)	Fair

(Source: Ohio EPA, 2005)

NOTES
IBI *Index of Biotic Integrity*
a *The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi²).*
QHEI *Qualitative Habitat Evaluation Index*
WWH *Warmwater Habitat*
LRAU *Large River Assessment Unit*
MWH *Modified Warmwater Habitat*
B *Boating site*
H *Headwater 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*

Characteristics of the aquatic macroinvertebrate community for the **Huffman Dam-Mad River HUC-12** are summarized below (Table 20). Analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates found by Ohio EPA at these sampling locations, related to QHEI scores, can aid in the identification of causes and sources of impairment. Compared to historical sampling, macroinvertebrate communities have remained consistent or exhibited a slight increase in performance and maintained expected thresholds for WWH in the Mad River and MWH in Hebble Creek. Habitat in the Mad River supported diverse communities with 15 and 11 EPT taxa at RM 8.6 and 6.0, respectively. This diversity was limited in Hebble Creek, with only 4 EPT taxa observed, likely due to degraded habitat and the highly modified nature of the stream. Urban runoff was cited as a potential impact to the stream (Ohio EPA, 2005).

Table 20: Critical Area #1 - Macroinvertebrate Community Data

Huffman Dam-Mad River HUC-12 (05080001 19 03)		
River Mile	**ICI Score-Narrative[a]**	**Predominant Species**
Mad River, LRAU (WWH)		
8.6[B]	N/A – Good	*Turbellaria, Oligochaeta, Mooreobdella microstoma, Lirceus sp, Crangonyx sp, Orconectes (Procericambarus) rusticus, Hydrachnidia, Baetis flavistriga, Baetis intercalaris, Nixe sp, Stenacron sp, Stenonema exiguum, Stenonema femoratum, Stenonema pulchellum, Stenonema terminatum, Tricorythodes sp, Nyctiophylax sp, Cheumatopsyche sp, Ceratopsyche morosa group, Protoptila sp, Hydroptila sp, Helicopsyche borealis, Petrophila sp, Peltodytes sp, Psephenus herricki, Ancyronyx variegate, Macronychus glabratus, Stenelmis sp, Conchapelopia sp, Cardiocladius obscurus, Corynoneura "celeripes", Cricotopus (C.) bicinctus, Cricotopus (C.) tremulus group, Cricotopus (C.) trifascia, Thienemanniella taurocapita, Paratendipes albimanus or P. duplicatus, Polypedilum (Uresipedilum) flavum, Stenochironomus sp, Rheotanytarsus pellucidus, Rheotanytarsus sp, Myxosargus sp, Elimia sp, Corbicula fluminea*
6.0[B]	40 – Good	*Ceratopsyche morosa group, Cheumatopsyche sp, Turbellaria*
Hebble Creek (MWH)		
5.0[H]	N/A – Fair	*Turbellaria, Plumatella sp, Oligochaeta, Erpobdella punctata punctata, Lirceus sp, Orconectes (Procericambarus) rusticus, Baetis flavistriga, Baetis intercalaris, Calopteryx sp, Anax junius, Somatochlora sp, Cheumatopsyche sp, Hydropsyche depravata group, Dubiraphia quadrinotata, Optioservus sp, Simulium sp, Helopelopia sp, Corynoneura lobata, Cricotopus (C.) sp, Nanocladius (N.) crassicornus or N. (N.)"rectinervis", Parametriocnemus sp, Polypedilum (P.) illinoense, Rheotanytarsus pellucidus, Physella sp, Gyraulus (Torquis) parvus, Corbicula fluminea*

(Source: Ohio EPA, 2005)

NOTES
B Boating site
H Headwater site
LRAU Large River Assessment Unit
WWH Warmwater Habitat
MWH Modified Warmwater Habitat
a Narrative evaluation used in lieu of ICI.
N/A Not applicable

3.2.3 Detailed Causes and Associated Sources

The three sampling sites within the **Huffman Dam-Mad River HUC-12** are in *Full Attainment* of their respective designations. While meeting WQS on a near-field level, reduction of sediments and nutrients and improvement of habitat in critical areas will help alleviate potential stressors to aquatic communities for maintenance of attainment levels and contribute to progress towards far-field goals. The presence and persistence of the hypoxic zone within the Gulf of Mexico has shown the need for reduced NPS pollution, particularly regarding nitrogen and phosphorus, throughout the entire MARB, in which the **Huffman Dam-Mad River HUC-12** is located. Ohio EPA has estimated nitrogen and phosphorus loadings from various land uses, including urban land use, within individual sub-watersheds in targeted areas of the ORB. Efforts to reduce nutrients from each of these contributing sources will focus on reaching the 20% reduction goal by 2025, as outlined by the HTF in 2014.

The data summarized previously in Table 14 (p.22) may reveal a direct link between the presence of attributes in the watershed that have influence on the aquatic communities throughout the Mad River and Hebble Creek in *Critical Area #1*. These contributing attributes in *Critical Area #1* include:

- Channelization or Recovering Channel;
- Low Sinuosity;
- Heavy/Moderate Silt Cover;
- Sparse/No Cover;
- High/Moderate Substrate Embeddedness; and
- Sparse/Lack of Cover.

Hebble Creek in the urban landscape. Photo courtesy of CEC, Inc.

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 Hebble Creek and the Mad RIver, eventually reaching the Ohio River. Reductions in nutrients in urban areas and management of stormwater inputs can help decrease overall NPS pollution and improve aquatic communities. Reductions in nutrients in urban areas through the use of green infrastructure for the retention, detention and filtration of urban pollutants can also help decrease overall NPS pollution and improve aquatic communities. Compared with natural land cover, shallow and deep infiltration and evapotranspiration decreases, while surface runoff increases in urban lands (USEPA, 2003). When watersheds have as little as 10% impervious surface, studies have shown that not only does runoff increase substantially, but pollutant loads also increase (CWP, 1998).

3.2.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores in order to remove a waterbody's impairment status or protect quality areas to maintain attainment status. Urban land use activities in *Critical Area #1* can contribute to not only stressed aquatic communities in the Mad River and Hebble Creek, but also far-field impairment through excessive nutrient loss to local waterways that flow to the Great Miami and, eventually, the Ohio River. Ohio EPA has estimated nutrient loadings associated with various land uses and sources within targeted HUC-12s in the ORB and has set nitrogen and phosphorus reduction goals for agricultural and urban sources. To achieve the desired nitrogen and phosphorus reduction from urban land use in the **Huffman Dam-Mad River HUC-12**, the following goals have been established:

Goal 1. Reduce nitrogen loading contributions in the **Huffman Dam-Mad River HUC-12** to a level at or below 65,000 lbs/year (20% reduction).
NOT ACHIEVED: Current estimated load contribution is 81,000 lbs/year.

Goal 2. Reduce phosphorus loading contributions in the **Huffman Dam-Mad River HUC-12** to a level at or below 3,900 lbs/year (20% reduction).
NOT ACHIEVED: Current estimated load contribution is 4,900 lbs/year.

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

Goal 3. Achieve IBI score at or above 42 downstream from the Fairborn WWTP in the Mad River (RM 8.6).
NOT ACHIEVED: Site currently has a score of 40.

Goal 4. Maintain MIwb score at or above 8.5 downstream from the Fairborn WWTP in the Mad River (RM 8.6).
✓ ACHIEVED: Site currently has a score of 9.0.

Goal 5. Maintain ICI score at or above 36 (Good) downstream from the Fairborn WWTP in the Mad River (RM 8.6).
✓ ACHIEVED: Site currently has a score of Good.

Goal 6. Maintain QHEI score at or above 60 downstream from the Fairborn WWTP in the Mad River (RM 8.6).
✓ ACHIEVED: Site currently has a score of 82.

Goal 7. Maintain IBI score at or above 40 upstream of Huffman Dam in the Mad River (RM 6.0).
✓ ACHIEVED: Site currently has a score of 43.

Goal 8. Maintain MIwb score at or above 8.3 upstream of Huffman Dam in the Mad River (RM 6.0).
✓ ACHIEVED: Site currently has a score of 9.0.

Goal 9. Maintain ICI score at or above 36 (Good) upstream of Huffman Dam in the Mad River (RM 6.0).
✓ ACHIEVED: Site currently has a score of 40.

Goal 10. Maintain QHEI score at or above 60 downstream upstream of Huffman Dam in the Mad River (RM 6.0).
✓ ACHIEVED: Site currently has a score of 78.

Goal 11. Maintain IBI score at or above 24 at Dayton Avenue in Hebble Creek (RM 5.0).
✓ ACHIEVED: Site currently has a score of 30.

Goal 12. Maintain ICI score at or above 22 (Fair) at Dayton Avenue in Hebble Creek (RM 5.0).

✓ ACHIEVED: Site currently has a score of Fair.

Goal 13. Achieve QHEI score at or above 55 at Dayton Avenue in Hebble Creek (RM 5.0).

NOT ACHIEVED: Site currently has a score of 34.

Objectives

In order to make substantive progress toward the achievement of the urban nitrogen load reduction goal of 16,000 lbs and phosphorus load reduction goal of 1,000 lbs for the **Huffman Dam-Mad River HUC-12**, efforts must commence on more widespread implementation, according to the following objectives within *Critical Area #1.*

Objective 1: Reduce stormwater inputs and impacts in the sub-watershed by implementing green infrastructure projects within *Critical Area #1* that retain, detain, and/or treat runoff from at least 2,600 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.).

Objective 2: Reduce stormwater inputs and impacts in the sub-watershed by restoring and/or creating floodplain and wetland detention/storage basins to retain, detain and/or treat urban drainage from at least 3,000 acres.

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

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. Habitat within the Mad River reached expected thresholds at each sampling location; however, attributes of the stream that have a negative impact to aquatic communities include a recovering channel, low sinuosity, heavy to moderate silt cover and substrate embeddedness. Hebble Creek did not reach expected habitat thresholds, and the stream exhibited many high-influence attributes that are negatively affecting aquatic community performance, including channelization, silt/muck substrates, heavy to moderate silt cover, sparsity of cover, and both riffle and substrate embeddedness.

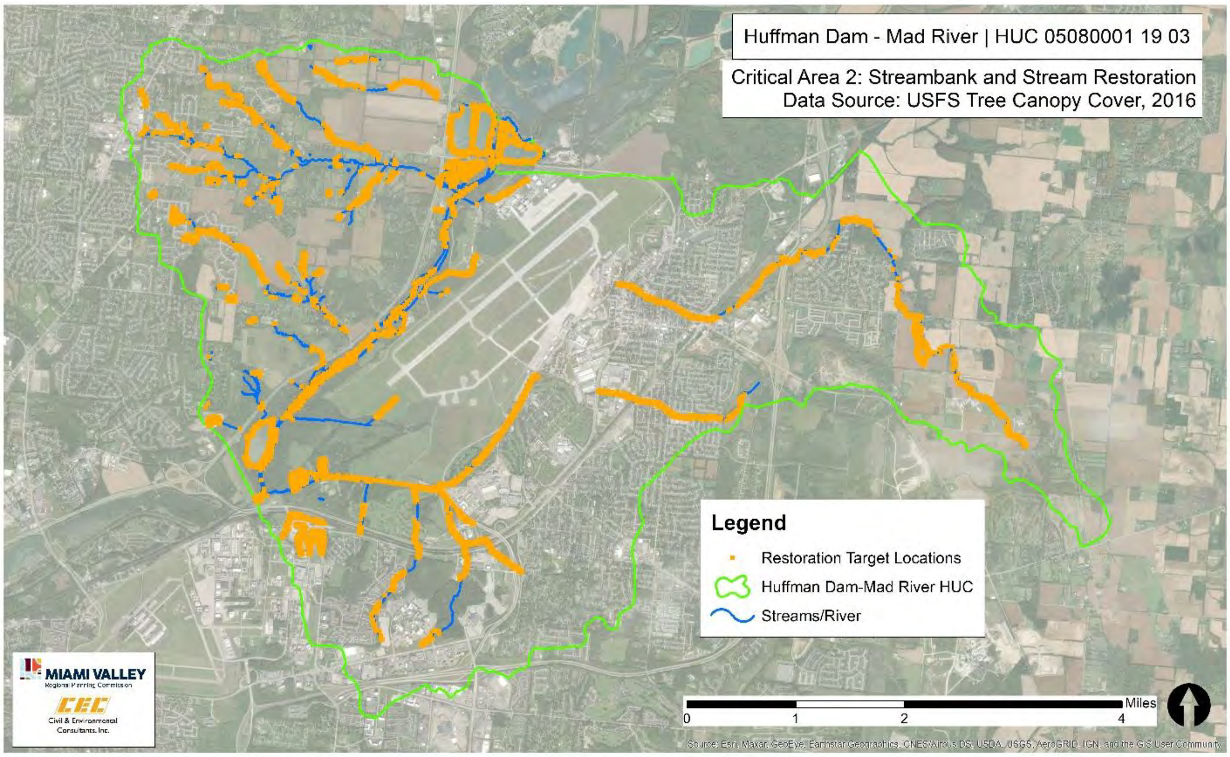


Figure 13: Huffman Dam-Mad River HUC-12 Critical Area #2

Actions that promote the restoration of banks, riparian areas, floodplains, streams and wetlands is needed throughout the **Huffman Dam-Mad River HUC-12** in areas where land use has resulted in bare/denuded banks that are now susceptible to erosion and where perennial streams have been disconnected from their floodplains. Flashiness in stream flow, caused by heavy amounts of urbanization exacerbates erosional issues in the sub-watershed's streams. Specific actions suggested for this sub-watershed include restoring streambanks by planting native grasses, trees and shrubs throughout riparian areas; restoring floodplains and stream channels; installing in-stream structures; constructing two-stage channels; reconnecting wetlands to streams and constructing and restoring riparian wetlands.

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 151,538 linear feet (28.7 miles) of stream length and a 75-foot buffer width on each side (Figure 13). The potential for restoration of approximately 175 acres of riparian corridor and floodplain exists in *Critical Area #2*.

Urban stream modification. Photo courtesy of CEC, Inc.

3.3.2 Detailed Biological Conditions

Fish community data for the Mad River and Hebble Creek sampling locations 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. Fish communities in Mad River are listed in *Full Attainment*, though communities at RM 8.6 were meeting attainment marginally, falling within the nonsignificant departure range. Habitat at both locations scored relatively high, though persistent MWH effects from historical channelization were observed. Communities within Hebble Creek met thresholds for a MWH stream; however, diversity was low compared to other Mad River tributaries.

Table 21: Critical Area #2 - Fish Community and Habitat Data

Huffman Dam-Mad River HUC-12 (05080001 19 03)							
River Mile	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Mad River, LRAU (WWH)							
8.6[B]	616.0	22	82.0	40[ns]	9.0	Central stoneroller (33%), northern hog sucker (21%), sand shiner (9%)	Marginally Good
6.0[B]	619.0	27	78.0	43	9.0	Northern hog sucker (28%), central stoneroller (11%), golden redhorse (9%)	Good
Hebble Creek (MWH)							
5.0[H]	5.4	4	34.0	30*	N/A	Central stoneroller (62%), green sunfish (33%), creek chub (5%)	Fair

(Source: Ohio EPA, 2005)

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*

WWH — *Warmwater Habitat*

LRAU — *Large River Assessment Unit*

MWH — *Modified Warmwater Habitat*

B — *Boating site*

H — *Headwater 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*

Characteristics of the aquatic macroinvertebrate community for the **Huffman Dam-Mad River HUC-12** are summarized below (Table 22). Analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates found by Ohio EPA at these sampling locations, related to QHEI scores, can aid in the identification of causes and sources of impairment. Compared to historical sampling, macroinvertebrate communities have remained consistent or exhibited a slight increase in performance and maintained expected thresholds for WWH in the Mad River and MWH in Hebble Creek. Habitat in the Mad River supported diverse communities with 15 and 11 EPT taxa at RM 8.6 and 6.0, respectively. This diversity was limited in Hebble Creek, with only 4 EPT taxa observed, likely due to degraded habitat and the highly modified nature of the stream. Urban runoff was cited as a potential impact to the stream (Ohio EPA, 2005).

Table 22: Critical Area #2 - Macroinvertebrate Community Data

Huffman Dam-Mad River HUC-12 (05080001 19 03)		
River Mile	**ICI Score-Narrative[a]**	**Predominant Species**
Mad River, LRAU (WWH)		
8.6[B]	N/A – Good	*Turbellaria, Oligochaeta, Mooreobdella microstoma, Lirceus sp, Crangonyx sp, Orconectes (Procericambarus) rusticus, Hydrachnidia, Baetis flavistriga, Baetis intercalaris, Nixe sp, Stenacron sp, Stenonema exiguum, Stenonema femoratum, Stenonema pulchellum, Stenonema terminatum, Tricorythodes sp, Nyctiophylax sp, Cheumatopsyche sp, Ceratopsyche morosa group, Protoptila sp, Hydroptila sp, Helicopsyche borealis, Petrophila sp, Peltodytes sp, Psephenus herricki, Ancyronyx variegate, Macronychus glabratus, Stenelmis sp, Conchapelopia sp, Cardiocladius obscurus, Corynoneura "celeripes", Cricotopus (C.) bicinctus, Cricotopus (C.) tremulus group, Cricotopus (C.) trifascia, Thienemanniella taurocapita, Paratendipes albimanus or P. duplicatus, Polypedilum (Uresipedilum) flavum, Stenochironomus sp, Rheotanytarsus pellucidus, Rheotanytarsus sp, Myxosargus sp, Elimia sp, Corbicula fluminea*
6.0[B]	40 – Good	*Ceratopsyche morosa group, Cheumatopsyche sp, Turbellaria*
Hebble Creek (MWH)		
5.0[H]	N/A – Fair	*Turbellaria, Plumatella sp, Oligochaeta, Erpobdella punctata punctata, Lirceus sp, Orconectes (Procericambarus) rusticus, Baetis flavistriga, Baetis intercalaris, Calopteryx sp, Anax junius, Somatochlora sp, Cheumatopsyche sp, Hydropsyche depravata group, Dubiraphia quadrinotata, Optioservus sp, Simulium sp, Helopelopia sp, Corynoneura lobata, Cricotopus (C.) sp, Nanocladius (N.) crassicornus or N. (N.)"rectinervis", Parametriocnemus sp, Polypedilum (P.) illinoense, Rheotanytarsus pellucidus, Physella sp, Gyraulus (Torquis) parvus, Corbicula fluminea*

(Source: Ohio EPA, 2005)

NOTES

B *Boating site*

H *Headwater site*

LRAU *Large River Assessment Unit*

WWH *Warmwater Habitat*
MWH *Modified Warmwater Habitat*
a *Narrative evaluation used in lieu of ICI.*
N/A *Not applicable*

3.3.3 Detailed Causes and Associated Sources

All sampling sites in the **Huffman Dam-Mad River HUC-12** are currently in *Full Attainment* of the either the WWH designation (Mad River) or MWH designation (Hebble Creek). The data summarized previously in Table 14 (p.22) may reveal a direct link between the presence of attributes in the watershed that have influence on the aquatic communities throughout the Mad River and Hebble Creek in *Critical Area #2*. These contributing attributes in *Critical Area #2* include:

- Channelization or Recovering Channel;
- Low Sinuosity;
- Heavy/Moderate Silt Cover;
- Sparse/No Cover;
- High/Moderate Substrate Embeddedness; and
- Sparse/Lack of Cover.

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., sinuosity, embeddedness, 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 the Mad River, Hebble Creek and their tributaries will help ameliorate stresses from land use and boost index values for aquatic communities.

The remaining goals for *Critical Area #2* of the **Huffman Dam-Mad River 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. Achieve IBI score at or above 42 downstream from the Fairborn WWTP in the Mad River (RM 8.6).
NOT ACHIEVED: Site currently has a score of 40.

Goal 2. Maintain MIwb score at or above 8.5 downstream from the Fairborn WWTP in the Mad River (RM 8.6).
✓ ACHIEVED: Site currently has a score of 9.0.

Goal 3. Maintain ICI score at or above 36 (Good) downstream from the Fairborn WWTP in the Mad River (RM 8.6).

✓ ACHIEVED: Site currently has a score of Good.

Goal 4. Maintain QHEI score at or above 60 downstream from the Fairborn WWTP in the Mad River (RM 8.6).

✓ ACHIEVED: Site currently has a score of 82.

Goal 5. Maintain IBI score at or above 40 upstream of Huffman Dam in the Mad River (RM 6.0).

✓ ACHIEVED: Site currently has a score of 43.

Goal 6. Maintain MIwb score at or above 8.3 upstream of Huffman Dam in the Mad River (RM 6.0).

✓ ACHIEVED: Site currently has a score of 9.0.

Goal 7. Maintain ICI score at or above 36 (Good) upstream of Huffman Dam in the Mad River (RM 6.0).

✓ ACHIEVED: Site currently has a score of 40.

Goal 8. Maintain QHEI score at or above 60 downstream upstream of Huffman Dam in the Mad River (RM 6.0).

✓ ACHIEVED: Site currently has a score of 78.

Goal 9. Maintain IBI score at or above 24 at Dayton Avenue in Hebble Creek (RM 5.0).

✓ ACHIEVED: Site currently has a score of 30.

Goal 10. Maintain ICI score at or above 22 (Fair) at Dayton Avenue in Hebble Creek (RM 5.0).

✓ ACHIEVED: Site currently has a score of Fair.

Goal 11. Achieve QHEI score at or above 55 at Dayton Avenue in Hebble Creek (RM 5.0).
NOT ACHIEVED: Site currently has a score of 34.

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 **Huffman Dam-Mad River HUC-12**, and positive gains will be made towards removing both near-field and far-field impairments. In order to achieve the overall NPS restoration goals of maintaining *Full Attainment* at all sites within the Mad River and Hebble Creek, the following objectives need to be achieved within *Critical Area #2:*

Objective 1: Stabilize at least two miles (10,560 linear feet) of degraded or downcut streambanks through a two-stage ditch or natural channel design approach and/or bio-engineering techniques[6].

Objective 2: Restore at least one mile (5,280 linear feet) of in-stream channel habitat through natural channel design methods and bioengineering, including, but not limited to, constructed riffles, habitat rocks/boulders, root wads, mud sills and tree revetments.

Objective 3: Create, enhance or restore at least 15 acres[7] of woody riparian corridor and/or riparian floodplain wetlands in tributary locations.

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

3.4 Critical Area #3: Conditions, Goals & Objectives for Prioritized Agricultural Lands

3.4.1 Detailed Characterization

Ohio's *Nutrient Mass Balance Study* (Ohio EPA, 2022) estimated 82% of the nitrogen nutrient loading and 66% of the phosphorus nutrient loading to the Ohio River via the Great Miami River was primarily from nonpoint sources, related to land use activities, with much smaller contributions from failing HSTS and NPDES-permitted facilities. Given the substantial percentage of agricultural land use within the **Huffman Dam-Mad River HUC-12**, the use of BMPs is recommended for agricultural operations to minimize nutrient and associated sediment loss to local waterways and drainage ditches through surface and tile flow.

While BMPs are encouraged on all agricultural lands, certain lands are more prone to nutrient loss than others and are prioritized for BMP implementation. Lands maintained under conventional agricultural production or managed as pasture are prone to contribute excessive sediment and nutrient loadings to adjacent waterways that eventually flow to the ORB. Lands that are proximal to streams and ditches or

[6] Stabilization may be independent of in-channel work; however, bank armoring and excessive use of stone, concrete or other unnatural hardening agents is discouraged (Ohio EPA, 2020b).
[7] With a 50-foot buffer on one river side, this equates to riparian corridor restoration along ~13,068 linear feet (~2.5 miles).

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 #3* contains prioritized agricultural lands throughout the **Huffman Dam-Mad River HUC-12** (Figure 14).

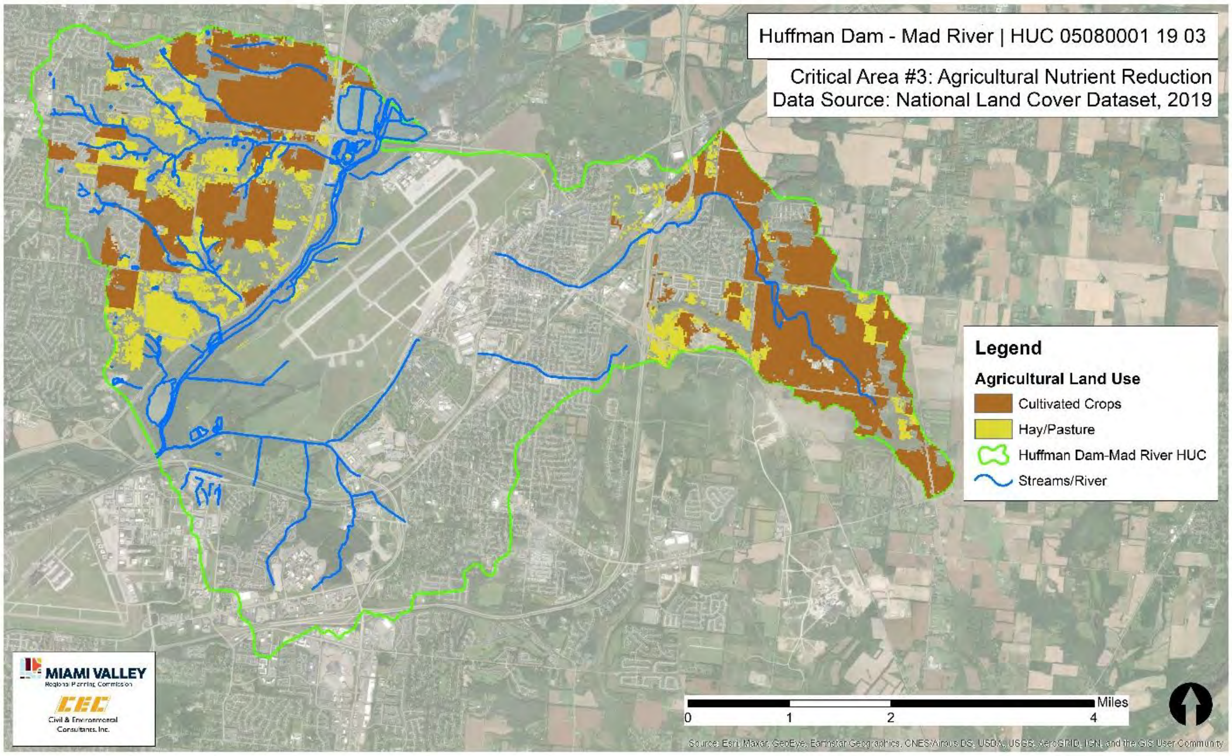


Figure 14: Huffman Dam-Mad River HUC-12 Critical Area #3

Of the 4,923 agricultural acres in the **Huffman Dam-Mad River HUC-12**, prioritized lands are operations that meet one or more of the following criteria:

- Lands directly adjacent to streams or drainage waterways;
- Lands in need of surface water management for runoff retention or erosion reduction;
- Lands without a current (<3 years) nutrient management plan or soil test; and,
- Lands in need of pasture, livestock and manure management.

3.4.2 Detailed Biological Conditions

No Ohio EPA stream biological sampling stations are contained within or directly adjacent to *Critical Area #3*.

3.4.3 Detailed Causes and Associated Sources

From a far-field perspective, agricultural land use activities contribute to excessive nutrient loadings to the Ohio River, eventually reaching the Mississippi River and then the Gulf of Mexico, contributing to its extensive hypoxic zone. 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 the 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.

3.4.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores in order to remove a waterbody's impairment status or protect quality areas to maintain attainment status. Agricultural land use activities in *Critical Area #3* contribute to far-field impairment through excessive nutrient loss to local waterways that flow to the Ohio River and may potentially exacerbate conditions within local waterways that have been stressed by the effects of urban development. The Ohio EPA has estimated nutrient loadings associated with various land uses and sources within targeted HUC-12s in the ORB and has set nitrogen and phosphorus reduction goals for agricultural and urban sources. To achieve the desired nutrient reductions from agricultural land use in the **Huffman Dam-Mad River HUC-12**, the following interim goals have been established:

Goal 1. Reduce nitrogen loading contributions in the **Huffman Dam-Mad River HUC-12** to a level at or below 57,000 lbs/year (20% reduction).
NOT ACHIEVED: Current estimated load contribution is 71,000 lbs/year.

Goal 2. Reduce phosphorus loading contributions in the **Huffman Dam-Mad River HUC-12** to a level at or below 3,500 lbs/year (20% reduction).
NOT ACHIEVED: Current estimated load contribution is 4,400 lbs/year.

Objectives

In order to make substantive progress toward the achievement of the annual nutrient load reduction goals of 14,000 lbs of total nitrogen and 900 lbs of total phosphorus for the **Huffman Dam-Mad River 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 the Mad River, Hebble Creek and other tributaries.

Objective 1: Implement nutrient management (planning and implementation through soil testing and Variable Rate Technology (VRT)) on at least 550 additional acres.

Objective 2: Plant cover crops on at least 500 additional acres annually[8].

[8] Cover crop usage is estimated to occur on approximately 85 acres, based upon OpTIS data (Dagan, 2019). Cover crop plantings may be implemented in the absence of grant funding.

Objective 3: Implement conservation tillage (of at least 30% residue) on at least 140 additional acres[9].

Objective 4: 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 250 acres.

Objective 5: Reduce erosion and nutrient loss through the installation of filter strips/buffers (of at least a 50 ft setback) or saturated buffers that receive/treat surface water from at least 120 acres.

Objective 6: Reduce erosion and nutrient loss through the installation of forested riparian buffers (of at least a 100 ft setback) that receive/treat surface water from at least 10 acres.

Objective 7: Create, enhance and/or restore at least 25 acres of wetlands and/or water retention basins for treatment of agricultural runoff and/or nutrient reduction purposes from 625 total agricultural acres.

Objective 8: Reduce erosion from agricultural streambanks and drainage conveyances through stream stabilization and/or two-stage ditch design techniques on at least 5,900 linear feet (1.10 miles).

Objective 9: Increase the retirement of marginal and highly vulnerable lands by enrolling at least 10 acres into programs such as the Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP).

These objectives will be directed towards implementation on prioritized agricultural lands and are estimated to make progress towards the HTF's interim and final nutrient reduction goals (Table 23). Additional conservation activities within the **Huffman Dam-Mad River HUC-12**, both on priority and secondary lands, may also make incremental progress towards nutrient reduction goals. The implementation of BMPs included in these objectives, as well as BMPs implemented through federal and state programs and other voluntary efforts may be tracked to monitor progress towards nutrient reduction goals within the watershed.

Table 23: Estimated Annual Nutrient Load Reductions from Each Objective

Objective Number	Best Management Practice	Total Acreage Treated*	Estimated Annual Nitrogen Load Reduction (lbs)	Estimated Annual Phosphorus Load Reduction (lbs)
1	Nutrient Management (Planning and Implementation through Soil Testing and VRT)[a]	550	1,060	20
2	Cover Crops	500	1,330	40
3	Conservation Tillage (at least 30% residue)	140	380	50

[9] Current estimates indicate reduced tillage occurs on approximately 1,700 acres, based upon OpTis data (Dagan, 2019).

Objective Number	Best Management Practice	Total Acreage Treated*	Estimated Annual Nitrogen Load Reduction (lbs)	Estimated Annual Phosphorus Load Reduction (lbs)
4	Grassed Waterways[b]	250	1,270	130
5	Filter Strips/Buffers (of at least 35 ft)[c]	120	640	50
6	Forested Buffers (of at least 100 ft)	10	70	10
7	Wetlands[d] and/or Water Retention Basins	625[e]	4,480	280
8	Two-Stage Ditch and/or Streambank Stabilization and Fencing	530[f]	5,300	310
9	Land Retirement	10	130	10
TOTAL		**2,740***	**14,660**	**900**

(Source Model: Pollutant Load Estimation Tool (PLET); 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, 2023).*

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

c *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.*

d *Nitrogen load reduction for wetlands was calculated using estimates of 14.35 lbs/acre nitrogen and 0.89 lbs/acres phosphorus for the Great Miami River watershed (Ohio EPA, 2021).*

e *If drainage water is routed through restored/created wetlands, it is assumed a 50% reduction in nitrogen and phosphorus from total nutrient yield for the drainage area, with a 25:1 ratio of drainage area to receiving wetland (Hoffmann et al., 2012; Woltemade, 2000). For this objective of 25 wetland acres, total drainage area is 625 acres.*

f *One linear foot of stream is estimated to drain 0.10 acres in this sub-watershed.*

* *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 towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (Ohio EPA, 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.

CHAPTER 4: PROJECTS AND IMPLEMENTATION STRATEGY

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

Implementation of practices described in this NPS-IS may also contribute to nutrient load reduction (specifically the interim 20% reduction in nitrogen and phosphorus loading in the MARB). Nutrient load reduction efforts are consistent with the HTF Action Plan and New Goal Framework (HTF, 2014).

For the **Huffman Dam-Mad River 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 **Huffman Dam-Mad River 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 24: Huffman Dam-Mad River HUC-12 (05080001 19 03) — 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							
1,2, 11-13	2	TBD	Hidden Hills Wetland	City of Fairborn	Short (1-3 years)	TBD	Ohio EPA §319, H2Ohio
1,2, 11-13	2	TBD	Rona Hills Park Retention Basin/Wetland	City of Fairborn	Short (1-3 years)	TBD	Ohio EPA §319, H2Ohio
1,2, 11-13	2	TBD	Chapelgate Detention	City of Fairborn	Short (1-3 years)	TBD	Ohio EPA §319
Altered Stream and Habitat Restoration Strategies							
1-2	2	1	Cemex Reserve Channel Reconnection and Restoration	City of Fairborn	Short (1-3 years)	$1,900,000	Ohio EPA §319, H2Ohio, WRRSP
Agricultural Nonpoint Source Reduction Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

4.1.1 Project Summary Sheet(s)

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

Table 25: Critical Area #1 – Project #1

Nine Element Criteria	Information needed	Explanation
n/a	**Title**	Cemex Reserve Channel Reconnection and Restoration
criteria d	**Project Lead Organization & Partners**	Lead: City of Fairborn Partner: Greene County Parks & Trails
criteria c	**HUC-12 and Critical Area**	Huffman Dam-Mad River HUC-12 (05080001 19 03) – *Critical Area #1*
criteria c	**Location of Project**	39.809599, -84005763
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	Restoration of hydrology, natural channel restoration and floodplain wetland creation
criteria g	**Project Narrative**	Historically, the headwaters of Beaver Creek flowed through Pearl's Fen, and then southerly to the mainstem of Beaver Creek (outside of the Huffman Dam-Mad River HUC-12 boundaries). The headwaters segment was cut off and redirected westerly from Cemex Reserve to flow to Red Bank Ditch. Stormwater frequently creates flashy conditions within this drainage conveyance, scouring the incised banks and flooding adjacent residential properties. The project will reconnect this headwaters segment to Beaver Creek through channel realignment of 4,200 linear feet and restore hydrology to Beaver Creek (which is subject to low flow, stagnant conditions), while alleviating flooding in Red Bank Ditch. Approximately 15.5 wetland acres will be re-established along the stream's floodplain through the preserve property. The drainage area to this project is approximately 900 acres of mixed land use—urban and agricultural and will not only reduce ongoing scour, erosion and flooding in Red Bank Ditch, but will create wetland detention for sequestration of nutrients and enhance habitat in Cemex Preserve.
criteria d	**Estimated Total cost**	$1,900,000
criteria d	**Possible Funding Source**	Ohio EPA §319, H2Ohio, WRRSP
criteria a	**Identified Causes and Sources**	Cause: Sedimentation/siltation; nutrient enrichment Source: Urban runoff/storm sewers

Table 25: Critical Area #1 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	The overall goal in *Critical Area #1* is to reduce estimated annual total nitrogen and total phosphorus loads. Current estimates indicate the urban contribution to the annual load is 81,000 lbs. of nitrogen and 4,900 lbs. of phosphorus. In order to meet the HTF nutrient reduction goals, annual loads must be reduced by 20%, or 16,000 lbs. of nitrogen and 1,000 lbs. of phosphorus.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	It is expected that this project will cause a decrease in annual nitrogen loadings by 1,912 lbs. (12.0% progress) and annual phosphorus loadings by 146 lbs. (14.6% progress) through incremental progress made on Objective 2: Reduce stormwater inputs and impacts in the sub-watershed by restoring and/or creating floodplain and wetland detention/storage basins to retain, detain and/or treat urban drainage from at least 900 of 3,000 acres. This project meets 30% of this objective.
	Part 3: Load Reduced?	Estimated annual reduction: 1,912 #N/year; 146 #P/year; 111.6 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Staff from the Ohio EPA-DSW Ecological Assessment Unit will perform both pre- and post-project monitoring.
criteria e	**Information and Education**	The City of Fairborn and partners will promote the project through several media outlets with press releases, news articles, website and social media postings. Additionally, partnering organizations will use the site for future educational programming and tours. Appropriate project signage will be placed at the project site.

4.2 Critical Area #2 Project and Implementation Strategy Overview Table

Table 26: Huffman Dam-Mad River HUC-12 (05080001 19 03) — 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							
TBD	TBD	TBD	Ravenwood Ditch Stabilization	Bath Township	Medium (3- 5 years)	TBD	TBD
Agricultural Nonpoint Source Reduction Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

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

4.3 Critical Area #3 Project and Implementation Strategy Overview Table

Table 27: Huffman Dam-Mad River HUC-12 (05080001 19 03) — 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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