



**Maumee AOC Coordinator Report  
for the Maumee AOC Advisory Committee  
May 2, 2024**

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- **WildMAPs (BUI 14b: Wildlife Habitat)**
  - ODNR continues to work toward completing the final WildMAP in 2025.
  - No updates to the Summary Table of the WildMAPs provided at the last meeting (dated 1/29/24)
  - A detailed narrative tracking of the WildMAPs is available upon request.
- **AquaMAPs (BUI 3a, 6, 14a: Fish Pops, Benthic Pops, Fish Habitat)**
  - Four projects were under construction this winter/spring; three are substantially complete with earthmoving and are working on establishment of vegetation and managing invasive species.
  - Several projects are expected to go through federal tribal consultation this summer for fall construction.
  - One project is reviewing Design/Build proposals, and two others are expected to release calls for construction bids soon.
  - Three to four projects are expected to be in construction this summer with 5-10 more in the fall.
  - The Lower Ottawa River project was allocated funding in December. Toledo has submitted a workplan and is working through the award process for the engineering/design phase.
  - No updates to the Summary Table of the AquaMAPs provided at the last meeting (dated 1/31/24)
  - A narrative tracking of the AquaMAPs is available upon request.
- **SedMAPs (BUIs vary by project site, GLLA contaminated sediment)**
  - Ohio continues to work with federal partners to make progress on these sediment projects.
  - A Value Engineering Study was conducted in March for the *Swan Creek Focused Feasibility Study (FFS)*. Before the Swan FFS is finalized there will be a public comment period and an open house/information session. (Hopefully later this summer) I will keep you posted.
  - The Toledo/Lucas County Port Authority has received a grant from GLNPO to lead the remedial design for the two Lower Maumee River GLLA sites (Sway Bridge, WWTP). There was a PMT kickoff meeting last week. The TLCPA expects to release an RFQ for a design consultant in May.
  - No updates to the Summary Table of the SedMAPs provided at the last meeting (dated 1/31/24)
  - A narrative tracking of the SedMAPs is available upon request.
- **Misc. MAPs (BUIs 4, 7, 8, 10)**
  - **BUI 4: Deformities & Tumors** – US FWS will be conducting bullhead sampling for liver tumors in Otter Creek during May. This is the last area that is impaired for liver tumors. Once the data is available, a full status evaluation of this BUI will be done to see if it can be removed .
  - **BUI 7: Dredging** – Draft removal document is in development and being reviewed in-agency and with TRL/TFL. Below is the proposed timeline:
    - **June:** Draft to MAAC for review
    - **July:** Public comment period
    - **August:** Finalize document, request MAAC Letter of Support (via email)
    - **Sept:** Submit to GLNPO for approval
  - **BUI 10a: Beach Closings (advisories)** – Project is in progress.
  - **BUI 8b: Eutrophication** – I will update the committee at a future meeting.
- **AOC Program Updates**
  - U.S AOC Conference: will be in the MAUMEE AOC in fall of 2025 – Save some time next summer to help plan/implement the event and tours. Let’s make it the best AOC Conference --- EVER!! 😊
  - Resource/Material sharing sheet: TPS may be sharing harvested tree branches and root wads with Toledo’s Bandore Park project, pending the hiring/confirmation of Toledo’s project construction contractor. Let me know if you have materials to share or if you have a need for your project.



Wolf Creek Stream  
Restoration at Oregon  
Recreation Complex (BD –  
2.0)

Otter Creek Stream  
Restoration in Maumee  
AOC (OC – 3.2, OC –  
3.3)

AquaMAP Project  
Updates

MAAC Quarterly Meeting  
May 2<sup>nd</sup> 2024

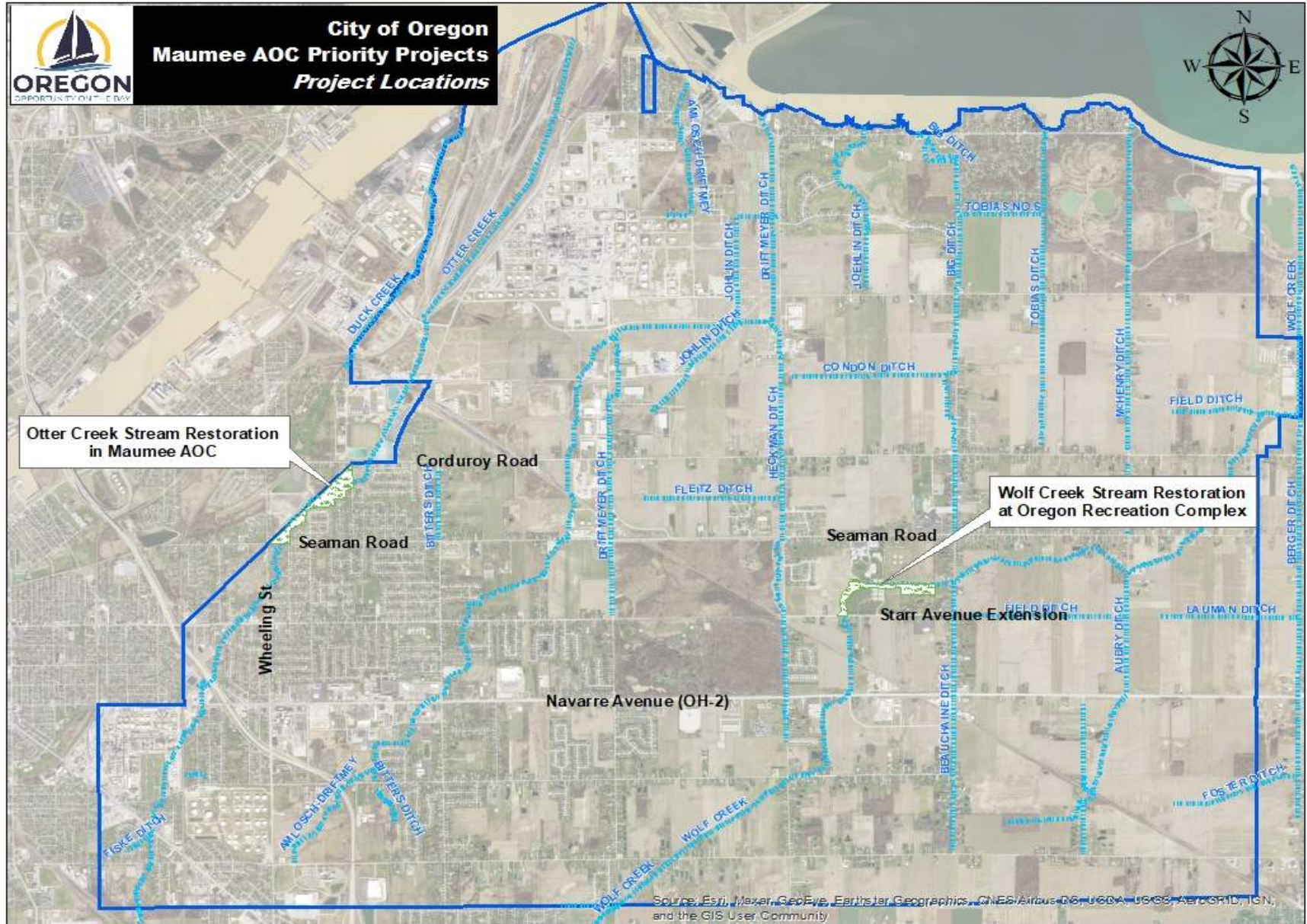
Don Nelson  
Environmental Specialist  
City of Oregon



# Project Locations – City of Oregon



## City of Oregon Maume AOC Priority Projects Project Locations



Otter Creek Stream Restoration  
in Maume AOC

Wolf Creek Stream Restoration  
at Oregon Recreation Complex

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus, DigitalGlobe, GeoEye, IGN, and the GIS User Community



# Stream Restoration at Oregon Recreation Complex – Conditions Prior to Project

- Oregon Recreation Complex
  - Soccer and Baseball
- OEPA monitoring completed in 2017 just downstream of project site (Stadium Road)
- Wolf Creek found to be in non-attainment for BUI 6 – Degradation of Benthos and BUI 14a – Loss of Fish Habitat
- QHEI of 29 poor, ICI invertebrate community score of 6 (very poor) for benthic communities
- Steep almost vertical stream banks, active erosion, silt cover and embeddedness, no floodplain
- More or less has become an ag drainage ditch – invasives, etc



*Channelized and steep banks, Wolf Creek flows through the City of Oregon's Recreation Complex, located off of Starr Avenue Extension*



# Plan of Restoration

- Large enhanced floodplain adjacent and connected to Wolf Creek
- Regrade stream banks to 3:1 side slope for stability (7,100 LF total)
- Restore approximately 4 ac of floodplain and assoc. habitat
- Install approximately 10 acres of riparian upland area
- Intercept ex. field tile and route through created 2.1 ac wetland system prior to discharge to Wolf Creek
- Public Access & Education
  - Oregon Recreation Complex
  - Tens of Thousands of Visitors Annually







**Wolf Creek Stream Restoration at Oregon Recreation Complex**  
*Project Site Plan*

**Legend**

- Header Tile
- Boardwalk
- Proposed Bike Path
- Vernal Pool
- Stone Walking Path
- Mound
- Existing / Proposed Stream Channels
- Enhanced Floodplain
- Bank Regrading
- Tree Shrub Plantings
- Pollinator/Meadow Planting

**Project Improvements**

- 3:1 Streambank Regrading
- East & West Floodplain Areas
- Field Tile Interceptor & Wetland
- Extensive Native Planting & Seeding



**SOME ITEMS SHOWN ARE ALTERNATE BID ITEMS**



# Wolf Creek – Project Funding

- Maumee AOC USEPA GLNPO Funding - \$1,344,000 – Design and Construction
- Final Design revealed construction funding shortfall
  - Project conceptually estimated in early 2020
- Some project components separated as alternate bids
  - Constructed Wetland
  - Header Tile
  - Bioretention Cell
- Identified and received additional funding from ODNR H2Ohio Program
  - Initial \$85,000
  - Add-on \$19,339
- Able to construct the selected alternates





# Wolf Creek – Project Construction

## Fall 2023 - Ongoing

- Construction Bids were received in April of 2023
- Project was awarded in May 2023
- Field work began in October 2023
- Floodplains – East side of Project
  - Were completed by January 2024
- Salt Dome Area
  - Completed in February 2024
- Dormant Seeding in Stages
- Planting – March 2024
- Relocated Bike Path Paving – May 2024
- Grant period ends December 2024







*Construction of North Floodplain, Wolf Creek Stream and Floodplain Restoration Project, October 2023*





*Construction of South Floodplain, Wolf Creek Stream and Floodplain Restoration Project, December 2023*





*Streambank Regrading and Stabilization, Wolf Creek Stream and Floodplain Restoration Project, December 2023*





*West Floodplain Area, Wolf Creek Stream and Floodplain Restoration Project, March 2024*





*West Floodplain Area, Wolf Creek Stream and Floodplain Restoration Project, March 2024*





*Constructed Wetland (South Side), Wolf Creek Stream and Floodplain Restoration Project, March 2024*



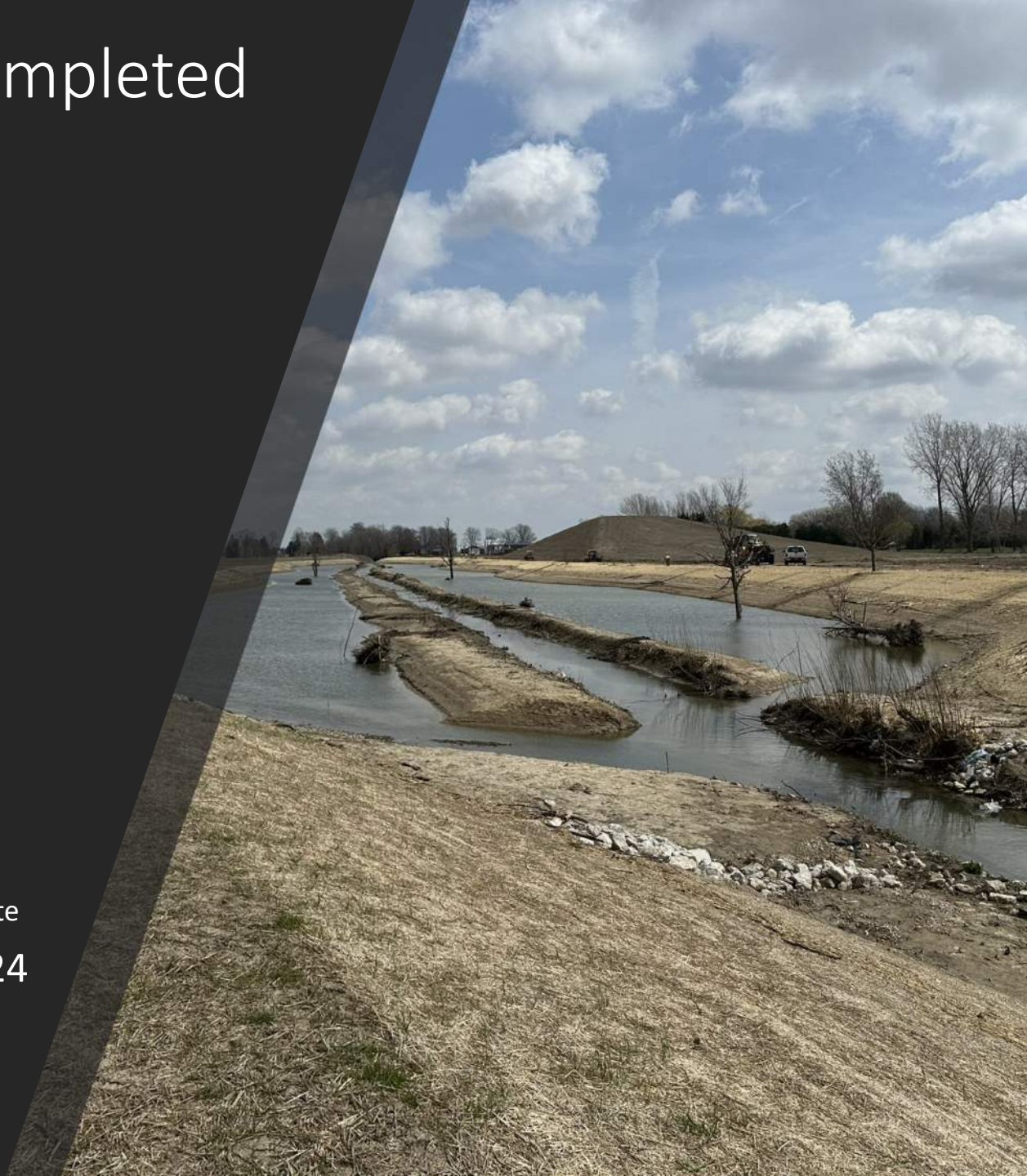


*Looking South from Floodplain Area, Wolf Creek Stream and Floodplain Restoration Project, April 2024*



# Wolf Creek – Completed (Almost)

- Planting –
  - A few sections remain to be planted
  - Warranties
- Punch List
  - Some bank erosion
  - Adding Surface drains
  - Field Tile repair
- Project Monitoring
  - Warranty period
  - Keeping soccer balls out of creek
  - Trash in west wetland area
    - Future Clean Your Streams site
- Grant period ends Dec 2024





# Wolf Creek – Project Challenges & Solutions

- Funding Shortfall
  - Identified and were able to receive additional funding (H2Ohio)
- Sheer Volume of Dirt
  - 45,000 CY
  - Sledding Hill
- Other Construction Challenges
  - Field Tile damage
    - Dirt Hauling (Heavy Haul Trucks)
  - Site Flooding
  - Contractor familiarity with restoration projects
  - Site foreman familiarity with restoration projects
- Some Construction solutions
  - Full time project inspection
  - Site visits daily by City PM





# Otter Creek Stream Restoration in Maumee AOC – Existing Conditions

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OEPA monitoring completed in 2017 just downstream of project site (Corduoy Road)

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Otter Creek found to be in non-attainment for BUI 6 – Degradation of Benthos and BUI 14a – Loss of Fish Habitat

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QHEI of 41.5 below 43 goal, ICI invertebrate community score of 6 (very poor) for benthic communities

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Active stream bank erosion, silt cover and embeddedness, lack of instream structure, riffles etc., flashy flows

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Disconnected floodplain with multiple MS4 outfalls in area, draining 53 acres of urban area, no detention or retention

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*Streambank erosion and bare stream banks contributing to sediment loading and silt cover of channel bottom*



# Proposed Plan of Restoration – Five Major Goals

- Streambank stabilization
  - Reduce erosion of streambanks
- Provide instream fish and benthic habitat features
  - Riffles
- Restore Otter Creek Floodplain Connections
  - Floodplains provide benthic diversity and abundance benefits
  - Fish habitat and spawning areas
  - Water quality benefits
- Improve existing Forested Upland and Wetland Areas
  - Add additional Trees / Plants
  - Debris and trash removal
- Intercept Existing Storm Sewer Runoff





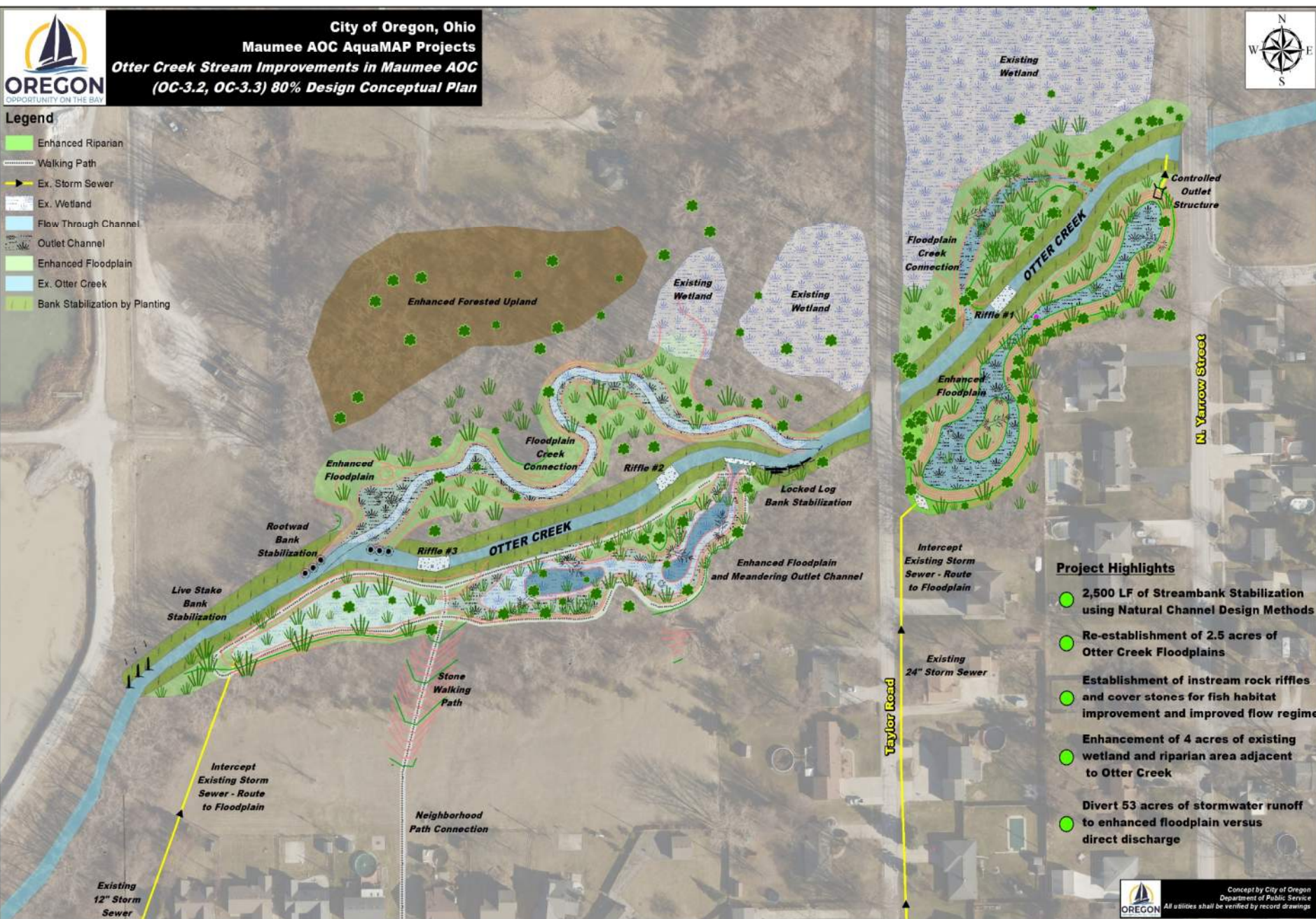


**City of Oregon, Ohio**  
**Maumee AOC AquaMAP Projects**  
**Otter Creek Stream Improvements in Maumee AOC**  
**(OC-3.2, OC-3.3) 80% Design Conceptual Plan**



**Legend**

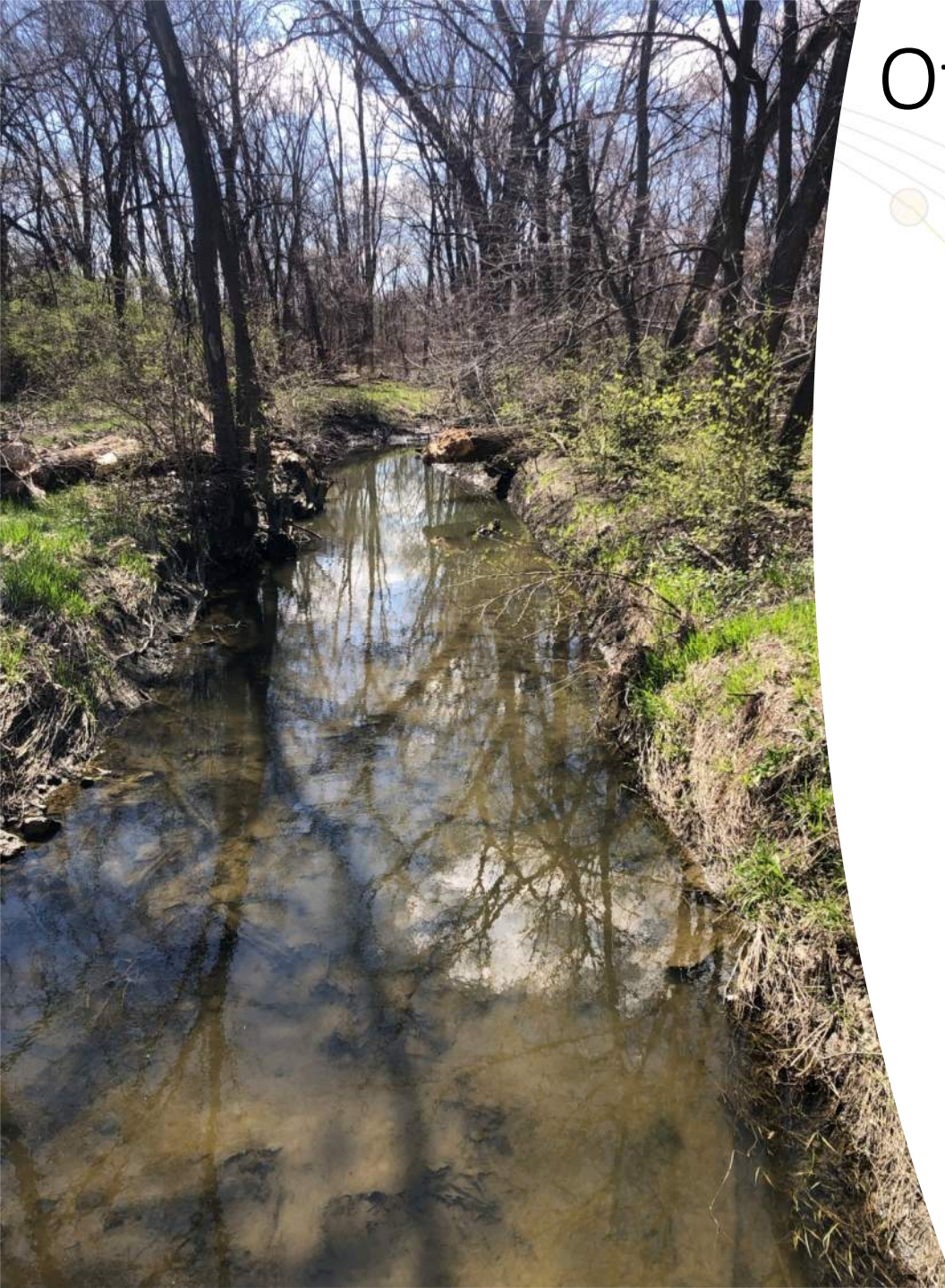
- Enhanced Riparian
- Walking Path
- Ex. Storm Sewer
- Ex. Wetland
- Flow Through Channel
- Outlet Channel
- Enhanced Floodplain
- Ex. Otter Creek
- Bank Stabilization by Planting



**Project Highlights**

- 2,500 LF of Streambank Stabilization using Natural Channel Design Methods
- Re-establishment of 2.5 acres of Otter Creek Floodplains
- Establishment of instream rock riffles and cover stones for fish habitat improvement and improved flow regime
- Enhancement of 4 acres of existing wetland and riparian area adjacent to Otter Creek
- Divert 53 acres of stormwater runoff to enhanced floodplain versus direct discharge





# Otter Creek - Current Project Status

- City Received \$1,389,510 from USEPA GLNPO – For Property Acquisition, Final Design, and Construction – August 2022
- Property Acquisition Completed
  - 12.5 acres of FEMA Floodplain / Floodway Properties
- Received USACE Nationwide 27 Permit – March 2024
- Final Design 80% Completed
- Public Meeting Held 4/18/2024
  - Mostly Positive comments
- Project to be advertised for construction bids in July 2024
- Construction to begin in Fall 2024 through Summer of 2025
- Grant Period ends December 2025



# Thanks!!

Don Nelson  
Environmental Specialist  
City of Oregon  
Email: [dnelson@oregonohio.org](mailto:dnelson@oregonohio.org)  
419-690-7309 - Office





Maumee Area of Concern

Aquatic Biological and Habitat  
Beneficial Use Impairments and  
Needed Management Actions:  
**SECOND addendum to update  
progress on large river TBD projects,  
substantially modified projects,  
and newly non-viable projects**

*An Explanation of the Conditions and a Rationale for the Projects  
Necessary to Achieve Restoration Targets for Beneficial Use  
Impairments 3a, 6, and 14a*

Maumee AOC Advisory Committee Biological Subcommittee Report to the  
Maumee AOC Advisory Committee  
**April 25, 2024**



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## Acronyms, Abbreviations, and Select Definitions

AOC	Area of Concern
ALU	Aquatic Life Use
BGSU	Bowling Green State University
BMP	Best Management Practices
BUI	Beneficial Use Impairment
DMDS	Data Management and Delisting System
GLLA	Great Lakes Legacy Act
HU	Hydrologic Unit (Code)
HUC-10	Hydrologic Unit Code-10 (Watershed)
HUC-12	Hydrologic Unit Code-12 (Subwatershed)
IBI	Index of Biological Integrity
ICI	Invertebrate Community Index
LRW	Limited Resource Waters (an aquatic life use class; waters that have been found to lack the potential for any resemblance of any other aquatic life habitat.)
mi <sup>2</sup>	Square Miles
MIwb	Modified Index of Well Being
MWH	Modified Warmwater Habitat (an aquatic life use class; waters that have been found to be incapable of supporting and maintaining a balanced, integrated, adaptive community of warmwater organisms due to irretrievable modifications of the physical habitat.)
LRAU	Large River Assessment Unit
NWR	National Wildlife Refuge
Ohio EPA	Ohio Environmental Protection Agency
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
QHEI	Qualitative Habitat Evaluation Index
RM	River Mile
SWCD	Soil & Water Conservation District
TBD	To be determined



TMDL	Total Maximum Daily Load
US ACE	U.S. Army Corps of Engineers
UT	University of Toledo
WWH	Warmwater Habitat (an aquatic life use class; waters capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms.)



## Introduction to the **SECOND Addendum**: Updated progress on large river TBD projects, substantially modified projects, and newly nonviable projects.

After the first addendum to the *Aquatic Biological and Habitat Beneficial Use Impairments and Needed Management Actions* document, two “To Be Determined (TBD)” projects in the Maumee and Ottawa rivers remained. These TBD projects were included in the Aquatic Management Action list approved by the MAAC in April 2020. This second addendum provides an update regarding the outcome of the large river TBD project development effort, as well as other substantive changes to projects on the Aquatic Management Action Project List. To remind the reader of the BUIs in the affected HUs and to provide context for the TBD projects, the original hydrologic unit (HU) reports are included in this addendum. Portions of the document that are no longer relevant are included with strikethrough and added or modified text appears in dark red text. Text from the original document remains in black type and relevant text from the first addendum remains in green text.

The hydrologic units with changes addressed in this second addendum include:

- **Sibley Creek – Ottawa River:** Recent sampling efforts have indicated fish and benthic habitat restoration projects are still needed in the Lacustrary portion of the Ottawa River. The TBD project (SiC-13.0) has changed to SiC-13.1, a restoration project near river mile (RM) 2.5 that will improve nearshore aquatic habitat.
- **Maumee River – Large River Assessment Unit:** The TBD project has changed from MR-14.0 to two separate island restoration projects in the Maumee River, MR-14.1 Audubon State Nature Reserve Islands Restoration and MR-14.2 Delaware Islands Complex Restoration.
- **Maumee Bay within the Maumee AOC:** The proposed wetland restoration at Cullen Park is not moving forward. There are no longer any projects moving forward in Maumee Bay.
- **Otter Creek – Frontal Lake Erie:** OC-3.2 and OC-3.3 projects have been combined into one continuous project site and a much larger area is now being protected and restored.
- **Turtle Creek – Frontal Lake Erie:** The TuC-2.0 stream restoration project proposed at Nissen Road is no longer viable and no viable replacement project could be identified. The scope of TuC-18.0 in the lacustrary of Turtle Creek has been scaled-back. To compensate for this loss, this project now includes work on the 69.7-acre Kontz unit of the Ottawa NWR. The Kontz unit site will provide similar benefits to those no longer available from the TuC-18.0 project to restore BUIs in this waterway.
- **Packer Creek:** PC-2.0 is now three separate project sites in the same general vicinity as the originally identified project(s). Each project has separate goals and approaches necessitated by unique constraints at each project site, but all projects will work to improve fish habitat in Packer Creek.



**HUC-12: Sibley Creek – Ottawa River (SiC) ([Sibley Creek Map](#))**

The Sibley Creek – Ottawa River HU contains the most downstream and lacustuary sections of the Ottawa River, as well as Sibley Creek proper, a small tributary; the HU covers a 22.0 mi<sup>2</sup> drainage area. The portion of the Ottawa River included in this HU is highly urbanized, with little to no riparian cover. Contaminated sediment hot spots were dredged from approximately the I-75/I-475 interchange to the I-75 downstream bridge in this unit under a Great Lakes Legacy Act (GLLA) remediation project; dredging was completed in 2010. Sibley Creek proper is a small, one-mile-long tributary emerging from a culvert just east of N. Detroit Avenue and entering the Ottawa River from the north, about two-thirds of the length of the HU. Sibley Creek flows along a highly urbanized, industrial landscape.

**Impairment status and sampling results:**

Impaired for BUIs 3a, 6, and 14a

There are 23 sample locations in this HU, and all but three sites are on the Ottawa River mainstem. Seven sites are riverine and 16 are lacustuary. The three sites on Sibley Creek are designated Limited Resource Waters (LRW); the remaining sites in the HU are WWH. Note: Only four of the sites were sampled (and only for fish populations) since the remedial dredging to remove contaminated sediments was completed in 2010. ~~A 10-year post-remedy effectiveness study is planned for the summer 2020. It is expected that by 2020, sufficient time will have passed to understand whether issues related to contaminated sediment have been remedied.~~ **Post-remedy effectiveness study sampling was completed between 2020 and 2023. The resulting data have some quality control issues and consequently should not be considered official, but results clearly indicate sediment remediation efforts have not eliminated the fish, benthic, and fish habitat beneficial use impairments in the lacustuary portion of the Ottawa River.**

METRIC	LWR RIVERINE (HEADWATERS)	WWH RIVERINE (WADING)	WWH RIVERINE (BOAT)	WWH LACUSTUARY
IBI	122% (3)	<b>98% (3)</b>	<b>83% (1)</b>	<b>65% (15)<sup>1</sup></b>
MIWB	NA	106% (3)	104% (1)	<b>80% (15)</b>
ICI	NA	<b>78% (4)</b>	NA	<b>47% (11)<sup>2</sup></b>
QHEI	NA	101% (4)	NA	<b>77% (11)</b>

<sup>1</sup>Two sites at ≤ 50% attainment; <sup>2</sup>One site at ≤ 50% attainment

**Degradation of Fish Populations (BUI 3a): Impaired in all river types in Ottawa River, Not Impaired in Sibley Creek**–

Except for the most upstream site, IBI scores of sites in Ottawa River indicate impairment, and most MIwb scores indicate impairment. The IBI scores at sample sites are highly variable (24% to 114% of target IBI), but typically decrease moving downstream, until near the rivermouth where average IBI and MIwb scores for the two sites are respectively 88% and 100% of target. Fish are particularly impaired at sites downstream of the I-75 bridge. Although a few sensitive species were observed, no intolerant species were present. Consistently high omnivore metric scores suggest impact of physical and chemical stressors and the high percentages of pioneering species suggest an unstable environment affected by anthropogenic stress. **Fish samples collected in 2023 show some improvement in IBI and MIwb scores but remain below AOC targets for delisting this BUI.** On average, the fish community in LWR Riverine Headwaters of Sibley Creek proper is not impaired.



**Degradation of Benthos (BUI 6): Impaired in all river types in Ottawa River; Target does not apply in Sibley Creek** – The ICI scores in Sibley Creek – Ottawa River vary considerably among sites sampled, and specific causes of impairment (e.g., too many tolerant species, absence of sensitive species, etc.) also vary by site. Except for the most upstream site, no site in the Ottawa River is greater than 80% of the target ICI value. Six sites in the Ottawa River were below 50% of the target prior to dredging, which could require direct restoration projects at these sites (P11K57, P11S48, P11K56, P11K55, P11A13, and 54220). Conditions generally decrease from upstream to the river mouth. **Benthic samples collected in 2020 continue to indicate impairment of benthic communities as all L-ICI scores are well below BUI targets. Diversity overall continues to be low, with a benthic community dominated by Chironomidae and Oligochaeta.** Because Sibley Creek proper is designated LRW and measured with a narrative assessment, the target does not apply. However, the invertebrate community in Sibley Creek was of poor condition with few taxa overall and no sensitive taxa.

**Loss of Fish Habitat (BUI 14a): Impaired in WWH Lacustrary in Ottawa River** – Within the Ottawa River portion of the HU, siltation is moderate to heavy, substrate embeddedness is moderate to extensive, and cover is negligible to sparse. There are no areas of fast current with silt-free substrates. The QHEI scores range from 77%-101% of the index target. **QHEI assessments completed in 2020, 2021, and 2023 suggest a slight decrease in average QHEI scores in the lacustrary portion of the Ottawa River. Although this decrease may initially appear alarming, some of the lower QHEI scores are at sites where landfills have been closed and capped. This closure/capping required the addition of riprap that hardened the shoreline. This condition allows for limited vegetation and limited habitat, therefore, yielding lower QHEI scores.** Because Sibley Creek proper is designated LWR, targets for QHEI values are not established. However, data gathered during sampling of Sibley Creek indicate very poor habitat conditions with high levels of sedimentation, extensive embeddedness of substrate, and sparse cover.

### **Recommended projects and anticipated results:**

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

#### **To be completed with AOC funding:**

- **SiC-3.0 (Restoration of the Ottawa River within Jermain Park; [DMDS Project Link]):** Jermain Park is located on the riverine section of the Ottawa River, approximately 3.5 miles upstream from its confluence with Sibley Creek. The Park is one of the few undeveloped, forested areas adjacent to the lower reaches of the Ottawa River. As such, there are opportunities to reduce sediment loading downstream and enhance habitat for fish and macroinvertebrates. Proposed work includes creating/enhancing 2.7 acres of wetland, stabilizing 2,300 feet of eroding streambank, creating 50 feet of instream riffle habitat, and enhancing 750 feet (1.5 acres) of riparian buffer. Fish and invertebrate communities are impaired at two sample sites within 0.5 miles downstream of Jermain Park, and adding instream and wetland habitat should improve aquatic communities.
- **SiC-13.0 (Instream and Nearshore Projects in the Lacustrary of Ottawa River (TBD)):** ~~The lacustrary of Ottawa River was significantly impaired for all three BUIs. Because the GLLA~~



dredging project in 2009–2010 took place after some of the data used to summarize attainment percentages in the table above was collected, the Maumee AOC Subcommittee recognizes that dredging/removal of contaminated sediment should have improved the area's habitat and aquatic community. Resampling scheduled for 2020 should demonstrate effects of the dredging program on habitat and aquatic communities throughout this section of the Ottawa River. Once these data are considered, the Subcommittee will target proposed restoration projects to more effectively address BUIs in the lacustrine portion of the Ottawa River, provided any impairments remain. As such, the Subcommittee proposes this as a TBD project(s) for instream improvements and/or shoreline restoration if needed. ~~Update: This project remains TBD as anticipated resampling was delayed due to COVID-19 in 2020. Biological sampling was completed in September 2020 and sediment sampling was completed in Oct 2020. Data from these sampling activities are expected in mid- to late 2021. The AOC subcommittee suggests working collaboratively with and leveraging the resources and expertise of the Great Lakes Fishery Commission and the Lake Erie Committee to develop these projects. This project has been updated from TBD to SiC-13.1 (as voted on by the MAAC in December 2023).~~

- **SiC-13.1 (Improvements to Nearshore Aquatic Habitat in the Lower Ottawa River; [DMDS Project Link])**: This project includes project areas at two separate but nearby sites across from each other at RM 2.5 of the Ottawa River. Projects at both sites are currently in the conceptual phase with a concept design having been developed for the site near Harry Kessler Park. Ideas and budget considerations from the Harry Kessler Park concept plan are also applicable to the site at the Howard Pinkley Landing, with the expectation that the project could be expanded to include that site. Project goals near Kessler Park include the construction of 200 linear feet of vegetated shoals, 100 linear feet of un-vegetated shoals, treatment of invasive species within the project area, and installation of 300 square feet of floating wetland. At Pinkley Landing, it is anticipated that similar offshore shoals and possibly some wetland restoration could occur. Both project sites are owned by the City of Toledo. Restoration elements at both locations will increase habitat heterogeneity, provide important habitat within the water column, and help to protect river shorelines.

To be completed with external/partner funding:

- No specific projects in this HU are currently proposed.

#### Summary of anticipated results and caveats:

Sibley Creek proper is a LRW and lacks the potential for recovery of the fauna to the level characteristic of any other aquatic life habitat due to natural background conditions or irretrievable human induced conditions. As such, no restoration projects are proposed on Sibley Creek, but the Chloride Reduction Plan (AOC-2.0) may yield some beneficial results. Restoration efforts at Jermain Park will not only improve aquatic conditions in the Ottawa River, it will also provide an opportunity for the public to see stream restoration techniques first-hand.

~~Although r~~Restoration efforts at Jermain Park, ~~placeholder project(s) in the lacustrine of Ottawa River,~~ **improvements to nearshore aquatic habitat in the lower Ottawa River near Harry Kessler Park and Howard Pinkley Landing,** and the Chloride Reduction Plan (AOC-2.0) will improve existing aquatic habitat and possibly improve aquatic community health in the Sibley Creek HU. ~~For example, nearshore habitat improvements near RM 2.5 in the Ottawa River should provide hard, within water column substrate for~~



benthos and small fish to colonize. Unfortunately, it is unlikely these projects alone will address impairments in full. This portion of the Ottawa River is heavily urbanized with legacy contamination, which may be too much for the current suite of proposed restoration projects to overcome. We suggest partners/programs continue to work to identify areas ideal and available in this HU for restoration. However, we recognize this task remains difficult. Possible restoration sites in the lower Ottawa River are limited, and substantial access issues may make restoration at other locations exceedingly expensive or even impossible.

## Maumee River – Large River Assessment Unit (MR) ([Maumee River LRAU Map](#))

The Maumee River Large River Assessment Unit (LRAU) consists only of the river and its immediate riparian zone, not the surrounding watershed. Only the lower 15 miles of the Maumee River (below Perrysburg) are impaired. The HU receives Swan Creek (agricultural, forested, suburban, and urban) from the north as a major tributary, and Grassy Creek (mixed agricultural and urban) from the south as another major tributary. The lower half of the LRAU, approximately 7 miles, is routinely dredged as a shipping channel.

Historically, water quality violations of fecal coliform from combined and sanitary sewer overflows were common in the lower Maumee River. In 2002 the City of Toledo launched the Toledo Waterways Initiative to eliminate most of these overflows and reduce water pollution. In 2020, the Initiative is nearing completion and the combined and sanitary sewer overflows have been greatly reduced and water quality standards for fecal coliforms are now being met. In 2019, Hintz et al. (2019; [DMDS Link to Hintz et al.](#)) observed low dissolved oxygen, high water temperature, and high turbidity conditions in RMs 15 to 7 in the Maumee River LRAU.

### Impairment status and sampling results:

Impaired for BUI 3a, 6, and 14a

Sample sites are WWH of type riverine or lacustrary. Samples from Ohio EPA are mostly from 2012 and may not reflect recent improvements in ecological condition resulting from the Toledo Waterways Initiative.

#### **Degradation of Fish Populations (BUI 3a): Impaired in Lacustrary, Not Impaired in Riverine –**

Fish were sampled at considerably more sites than for habitat and benthos. There are 16 sample sites for fish within 17 river miles. Only the lacustrary, (i.e., the lower 15 miles downstream of Perrysburg) is impaired. This 15-mile stretch is 90% of target (range: 68%-110%) for the fish IBI. The stretch is 98% of target (range: 73%-116%) for the fish MIwb. There are very few intolerant fish species and proportionally too many sunfish species. Consistently high omnivore metric scores suggest impact of physical and chemical stressors and the high percentages of pioneering species suggest an unstable environment affected by anthropogenic stress. Impaired fish metrics reflect the urban landscape, dredging of the federal shipping channel, and the impounded nature of the lacustrary.

#### **Degradation of Benthos (BUI 6): Impaired in Lacustrary, Not Impaired in Riverine –**

The riverine section in this LRAU includes two sites, neither of which are impaired for benthos (113% of target). Only the lacustrary portion is impaired for benthos. This 15-mile portion includes four sites and averages 34% of target (range: 17%-41%). The two highest scores are from the dredged section of the lacustrary (both at 41%), but samples are taken from outside of the shipping channel. The lowest ICI score (17% of target) is near Rossford. For the AOC program, all sample sites that fall below 50% of target should be remedied directly, if reasonable. The ICI at impaired sites scored particularly poor for the metrics assessing sensitive taxa, percent gatherers, mayfly taxa, Diptera, and percent taxa other than Diptera. The most impaired site near Rossford is dominated by tolerant Diptera.



**Loss of Fish Habitat (BUI 14a): Impaired in Lacustrary, Not Impaired in Riverine** – There are seven sample sites for habitat within 17 RMs. Only the five lacustrary sample sites in the lower 15 miles are impaired. The lower 15 miles averages 83% (range: 63%-95%) of target. Only a summary QHEI scores is available from the sample sites; a detailed assessment of the reasons for impairment is not available.

In addition to standard, broad-scale sampling by Ohio EPA in the Maumee River, the University of Toledo (UT) and Bowling Green State University (BGSU) in partnership with USGS, were directed by the Maumee AOC Subcommittee in 2019 to undertake an intensive, finer-scale study of the lower Maumee River from RM 15 to RM 7, Maumee-Perrysburg Bridge to the I-75-DiSalle Bridge. This was completed to recognize high-quality habitat areas for preservation and to help set the benchmark for restoration replication in other locations, to identify areas conducive for restoration activities, and to propose specific restoration opportunities and approaches in this river segment for further evaluation. The specific reach (RMs 15 to 7) was chosen by the Maumee AOC Subcommittee following input received from experts during the first workshop. This reach was selected because of the potential for restoration activities in this reach and the lack of potential for restoration activities from RMs 7 to 0. The UT/BGSU team reviewed literature from other comparable river systems, generated an extensive biological and environmental dataset, and made general recommendations for restoration (Hintz et al. 2019). The U.S. Army Corps of Engineers (US ACE), Buffalo District prepared rough cost estimates for these recommendations. In 2020, the UT/BGSU team will refined their recommendations, prepared more detailed concept designs, initiated stakeholder involvement, and completed other activities to prepare for work described below in MR-14.0, MR-14.1, and MR-14.2. ([\[DMDS Link\]](#) to pre-feasibility study data and materials).

Beginning in May 2021, the BUI 3a, 6, 14a subcommittee focused on developing projects in the lower Maumee River by implementing a Feasibility Study (FS) across four of the potential project areas. These areas were identified in "design concepts" generated in 2020 by the University of Toledo (UT) and Hull & Associates, LLC, and selected as potential project areas by the Maumee AOC Advisory Committee (MAAC) on May 13, 2021. The FS was designed to finalize determination of property ownership, conduct landowner and public outreach, receive feedback from interested tribes, conduct initial hydraulic analyses, identify potential impacts to existing high-quality aquatic and terrestrial habitat, generate "preliminary designs," and ultimately assess project viability and develop more precise cost estimates. A multi-agency/organization team, funded by the Great Lakes Restoration Initiative, came together to carry out the numerous aspects of the FS in a coordinated fashion. Three of the four proposed project areas appeared viable. In early 2022, projects at the Audubon State Nature Preserve (MR-14.1) and the Delaware Island Complex (MR-14.2) were selected as replacements for MR-14.0, the TBD placeholder project. ([\[DMDS Link\]](#) to FS materials).

### **Recommended projects and anticipated results:**

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

To be completed with AOC funding:

- MR-14.0: (Restoration Projects in Maumee RMs 15 to 7 (TBD)): The Maumee AOC Subcommittee used the general recommendations found in the 2019 UT/BGSU study, in addition to the US ACE rough cost estimates, to identify the magnitude of investment needed to exceed index score targets in the lower Maumee River. Leveraging the work of the UT/BGSU team in 2020, the MAAC will refine the general recommendations into specific management actions needed in the lower Maumee River. The final suite of management actions will likely include engineering & design of several projects throughout the reach, as well as implementation of one or more projects as demonstration projects. These projects will potentially include the addition of woody debris, dikes and/or wooden palisades, sediment dredging, river training, island preservation and/or accretion, and/or plantings of submerged aquatic vegetation. **Update:** This section of the Maumee River has a history of use by Native Americans and contains known historically important sites. The UT-BGSU team has developed a suite of draft restoration recommendations. The US EPA GLNPO is assessing the interest of tribal entities in the region in further consultation. When this assessment is complete, the team will finalize the recommendations for consideration by the Subcommittee and ultimately the MAAC. This project has been updated from TBD to projects MR-14.1 and MR-14.2.
- MR-14.1: (Audubon State Nature Preserve Islands Restoration; [DMDS Project Link]):** The Audubon Islands are a nature preserve and are located approximately 13 miles upstream of the mouth of the Maumee River near Maumee, Ohio. The preserve is a set of two islands (Grape and Ewing Islands) separated by a narrow channel and totaling 192 acres in size. The Audubon Islands have been decreasing in area since at least the 1970s. The Audubon State Nature Preserve Islands Restoration project strives to protect the islands footprint and edges, enhance habitat along the island edges, and control invasive species. Additionally, this project will increase habitat heterogeneity by adding rock barrier reefs, stone shelves, riparian and wetland plantings, cove contouring, and submerged/emergent logs.
- MR-14.2: (Delaware Islands Complex Restoration; [DMDS Project Link]):** The Delaware/Horseshoe complex is a set of islands approximately nine miles upstream of the mouth of the Maumee River near the City of Toledo's Walbridge Park Boat Launch, Toledo Sailing Club, and Maumee River Yacht Club. This island complex lost an estimated 40% of its land mass from 1963 to 2020 due to erosion. The project is designed to protect and enhance the eroded islands. These early plans include improving habitat along island edges, in coves, and in newly protected submerged areas, controlling *Phragmites*, and increasing habitat heterogeneity. Recommended features are a continuous rock barrier reef, vegetated stone sill, barrier islands, protected lagoon, cove contouring, submerged logs, woody habitat structures, and submerged aquatic vegetation.

Note: MR-14.2 is being completed in coordination with H2Ohio-funded activities at Clark Island [DMDS Project Link], immediately downstream of the project area for MR-14.2. The Clark Island project footprint includes the downstream portion of Delaware/Horseshoe Island and the entirety of Clark Island. This project "recreates" Clark Island, an island that is currently a shadow of its former size, and the project includes approximately 13.6-acres with around 6.9 acres of wetlands. Although the primary goal of the Clark Island restoration is to reduce nutrient and sediment loads in the Maumee River, the project uses many of the same restoration elements as MR-14.2. Therefore, the Clark Island project is expected to provide similar benefits to fish and benthic populations and fish habitat as those described for MR-14.2.



To be completed with external/partner funding:

- **MR-1.0: (Penn 7 Wetland Restoration; [\[DMDS Project Link\]](#))**: This project is located approximately 2 miles from the confluence of the Maumee River with Maumee Bay in an industrialized section of Toledo. The project is also located between two sample sites that reported reaching 81% and 86% of the IBI target value and two sample sites that reported reaching 82% and 95% of the QHEI target value. Additionally, an ICI sample site, approximately one mile upstream, reached only 41% of the target value. Project goals are to construct/restore 8.5 acres of emergent coastal wetland and 6.7 acres of submerged coastal wetlands along the Maumee River. Emergent and submerged coastal wetlands should provide additional habitat and habitat diversity for river fauna.

**Summary of anticipated results and caveats:**

In RMs 7 to 0, the Penn 7 Project improves and increases availability of wetland habitat and thus may benefit nearby invertebrate and fish communities. It is likely additional projects will be needed to address impairments in this section; however, no other feasible opportunities were identified due to the heavily urbanized and altered landscape. Regardless, the Maumee AOC Subcommittee suggests partners/programs continue to work to identify areas available for restoration in the lower 7 miles. Since dredging in the lower seven river miles will continue, it is unlikely impairments in the lower river can be completely addressed. Dredging has both direct and indirect effects on river habitat and fauna. Instream removal of substrate affects the physical and flow characteristics of the river as the channel is modified, creating relatively homogenous, deep stretches. Habitat structure for invertebrates and fish in the middle of the channel is lost because gravel, rocks, coarse woody debris, and other structure are removed from the river.

In one pre-feasibility study, Shane et al. (2021) found that shallow water habitats in the Maumee River, especially areas around islands, were associated with higher numbers and diversity of fish and benthic species. Unfortunately, islands within the Maumee River have also been shrinking over the past 50 years due to larger and more variable river flows and higher lake levels. Projects at the Audubon and Delaware Islands complexes will protect these important island habitats from continued loss and dramatically increase habitat heterogeneity around the island complexes. This increased variety of available substrate and woody/wetland vegetation will provide important habitat to fish and benthos. In combination with the restoration of Clark Island, these projects are some of the most ambitious projects in the Maumee AOC.

~~It is anticipated that the projects identified by the UT/BGSU team will help address the impairments in RMs 15 to 7.~~ No projects specifically address the causes of low dissolved oxygen conditions the UT/BGSU team found in their study area of the Maumee River LRAU. Low oxygen conditions are, at minimum, physiologically stressful and can be deadly for fish and benthos. Habitat improvement projects in areas with continued significant abiotic stressors may fail to achieve full potential benefits.

## Maumee Bay (MB) (within the Maumee AOC) ([Maumee Bay Map](#))

The Maumee Bay assessment unit includes 14.8 mi<sup>2</sup> of nearshore habitat. Maumee Bay is the direct receiving body for water flowing from the Maumee River. The Bay also receives water directly from multiple other HUC-12s, including Detwiler Ditch, Otter Creek, Berger Ditch, and Wolf Creek – Frontal Lake Erie. Land immediately surrounding Maumee Bay includes public parks, (e.g., Cullen Park and Maumee Bay State Park), heavy urban development and ports, harbors and industrial areas, and Facility 3, a large Confined Disposal Facility for dredged material.

### Impairment status and sampling results:

Impaired for BUI 14a

The Maumee Bay (within the Maumee AOC) assessment unit includes four nearshore sample sites. The sites are between Bayview Park and Cullen Park (only fish data), off Cullen Park Causeway, offshore near Immergrun (in City of Oregon), and offshore near the west shore of Cedar Point National Wildlife Refuge (NWR) along the west shore. All sites are soft-bottom nearshore.

**Degradation of Fish Populations (BUI 3a): Not Impaired** – The HU averaged 132% attainment. However, improvement to the fish community in the Bay may contribute to improvement of the impaired fish community in the lower Maumee River.

**Degradation of Benthos (BUI 6): Not Impaired** - The impairment in the bay is not measured by the ICI used in the rest of the Maumee AOC, but by the condition of the *Hexagenia* mayfly population. *Hexagenia* populations were not impaired.

**Loss of Fish Habitat (BUI 14a): Impaired** - On average, the unit reaches 97% of the nearshore QHEI target score. The site near Cedar Point NWR exceeds the habitat target (108%) while the sites near Cullen Park and near Immergrun are close to attainment at 97% and 86%, respectively. Site scores indicate that poor vegetation quality, and to a lesser extent poor substrate quality, are driving the scores below attainment. Cover, shoreline morphology, riparian zone and bank erosion are not major concerns at the sample sites.

### Recommended projects and anticipated results:

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

#### To be completed with AOC funding:

- No specific projects in this HU are currently proposed.

#### To be completed with external/partner funding:

- **MB-2.0: (Cullen Park Wetland Restoration; [\[DMDS Project Link\]](#))**: The objective of this project is to create a 75-acre coastal wetland in the embayment near the mouth of the Maumee River, along Toledo's shoreline between Bayview Park and Cullen Park. The project is being led by Toledo-Lucas County Port Authority and the City of Toledo and is being funded through Ohio's H2Ohio program. This wetland may enhance the overall QHEI scores for the HU through trapping of sediment and the addition of fish spawning/feeding habitat. Additionally, there is the potential for this project to enhance fish and invertebrate communities in the lower



~~Maumee River. Aquatic communities established in the wetland would be near the Maumee River rivermouth and could travel upstream into the river mainstem.~~

In September 2021, ODNR announced that they would not continue with MB-2.0 as scoped. As a result, all work on the Cullen Park Wetland Restoration project stopped at a preliminary design phase. Although this project will not be constructed as planned, there is hope that one day the preliminary designs will be revived, and the project finished. Until then, there is no AOC-related project remaining in the Maumee Bay assessment unit.

### **Summary of anticipated results and caveats:**

~~The Cullen Park Wetland Restoration project focuses on creating wetland habitat, which directly improves fish habitat and specifically the quality of vegetation available to fish in the assessment unit. Restored wetlands should be monitored for establishment of invasive *Phragmites* and management plans should include actions necessary to maintain high quality wetlands. The site for project MB-2.0 is near the two sample sites with impaired fish habitat and is well located to address habitat impairments at these two sites. Coastal wetland habitats could also serve as a nursery area for juvenile migratory fish as well as ideal habitat for non-migratory fish. Such improvements in the fish habitat and fish community in Maumee Bay also has the potential to improve fish communities in the lower Maumee River.~~

The Maumee Bay assessment unit is not impaired for benthic or fish communities and is very near attainment of the fish habitat target (at 97% of QHEI target score). Stoppage of the Cullen Park Wetland Restoration project suggests these conditions will persist. Potential indirect improvements to the fish community in the lower Maumee River will also be lost. A less costly and scaled-down wetland restoration project in Maumee Bay could still provide aquatic benefits to the Bay and lower river.

## HUC-12: Otter Creek – Frontal Lake Erie (OC) ([Otter Creek Map](#))

The Otter Creek – Frontal Lake Erie HU contains Duck Creek (which empties into the Maumee River) and Otter Creek (which empties into Maumee Bay). It also contains several maintained drainage ditches in the eastern portion of the HU that have been modified in recent years in several locations. Both Duck Creek and Otter Creek are influenced by Lake Erie seiche events from their mouths to RM 2.0 at Millard Ave. The HU is heavily industrialized (approximately 70% of the land is developed) although the eastern portion of the HU contains some agricultural land.

Historically, land around Otter and Duck Creeks was known for its natural oil deposits. Because of these deposits there have been oil-related industries and manufacturing facilities located in this HU for over 100 years. Both streams have experienced oil spills and hazardous waste contamination. Some of the sediment contaminants of concern in the HU recorded in the 2012 TMDL report include lead and other heavy metals (e.g., PCBs, PAHs, metabolites of the insecticide DDT, and chlordane, which was used in pesticides in the second half of the twentieth century before being banned).

### Impairment status and sampling results:

Impaired for 3a, 6, and 14a

This HU contains five Ohio EPA sample sites—two sites on Duck Creek and three on Otter Creek. Both sites on Duck Creek are WWH with the upstream site riverine headwaters and the downstream site lacustuary. All three sites on Otter Creek are MWH with the two upstream sites riverine headwaters and the downstream site lacustuary. Therefore, there are four sets of targets that must be reached before Otter Creek – Frontal Lake Erie HU can be considered not impaired. No MIwb metrics area available for this HU and not all sites are sampled for all metrics.

METRIC	WWH RIVERINE (HEADWATERS)	WWH LACUSTUARY	MWH RIVERINE (HEADWATERS)	MWH LACUSTUARY
IBI	50% (1)	37% (1)	145% (2)	107% (1)
ICI	20% (1)	94% (1)	27% (1)	82% (1)
QHEI	36% (1)	71% (1)	97% (1)	No target

**Degradation of Fish Populations (BUI 3a): Impaired in WWH Lacustuary, Not Impaired in MWH Lacustuary, Impaired in WWH Riverine Headwaters, Not Impaired in MWH Riverine Headwaters** – Duck Creek is impaired for fish community health as measured by IBI scores in the WWH lacustuary reach of Duck Creek (currently at 37% of its target) and in the WWH headwaters reach of Duck Creek (50% of its target). Both sample sites located on Duck Creek are at or below 50% of their target value. Unless these sites can be improved to over 50% of their targets, the HU could remain impaired for fish community health. Only pollution tolerant fish were observed at these locations, and only two individual fish were observed at the upstream Duck Creek sample site in 2017 (both were the pollution-tolerant species central mudminnow). Otter Creek proper is not impaired for fish community health, partly because its MWH ALU designation allows for lower IBI target scores.

**Degradation of Benthos (BUI 6): Impaired in all ALUs and river types** – The headwaters of Duck and Otter Creeks are impaired for ICI and received the lowest possible score (a narrative score



of very poor). Unless these sites can be improved to over 50% of their targets, the HU could remain impaired for benthic community health. Impairment is likely a result of contaminated sediments and urban runoff. The 2010 TMDL report stated that macroinvertebrate community improvements would require prevention of further pollutants from industrial landfills, contaminated sediment dredging, and restored channel design.

**Loss of Fish Habitat (BUI 14a): Impaired in all sampled ALUs and river types** – The QHEI scores were below target scores at all sample sites in the HU, with the exception of the downstream Otter Creek site which is not assigned a target QHEI score due to its lacustrary MWH designation. The rest of Otter Creek is slightly impaired, the lacustrary segment of Duck Creek is moderately impaired and the headwaters severely impaired. Unless the Duck Creek headwaters site can be improved to over 50% of its target, the whole HU will remain impaired for aquatic habitat. Low QHEI scores are driven by extensive embeddedness, heavy siltation, lack of diversity in substrate material, channelization, and lack of cover.

### **Recommended projects and anticipated results:**

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

#### **To be completed with AOC funding:**

~~Note: The City of Oregon is considering combining projects OC 3.2 and OC 3.3 to maximize efficiency and efficacy, and likely reduce expenses. Since a 30% design concept is complete for OC 3.3 and no concept was developed for OC 3.2, the projects remain separate for now.~~

- **OC-3.2: (Berlin Avenue Floodplain and Stream Improvements; [\[DMDS Project Link\]](#)):** This project area is located in the WWH riverine headwaters of Otter Creek, approximately 3.5 miles from its mouth. Data from a site roughly 0.5 miles downstream of the project area indicates very poor invertebrate community and fish habitat conditions. This project includes the acquisition of four parcels (total of 6.5 acres) within the floodway of Otter Creek. The acquired area is adjacent to land already owned by the cities of Toledo and Oregon. Combined with OC-3.3 these projects will restore and preserve 2,200 linear feet of Otter Creek floodway. Expected results in metric scores would be similar to those expected for OC-3.3.
- **OC-3.3: (Taylor Rd. and Yarrow St. Floodplain and Stream Improvements; [\[DMDS Project Link\]](#)):** This project area is located in the WWH riverine headwaters of Otter Creek, approximately 3.2 miles from its mouth. Data from a site roughly 1,000 feet downstream of the project area indicates very poor invertebrate community and fish habitat conditions. The project will include the acquisition of approximately 4 acres of wooded floodplain adjacent to Otter Creek, the restoration of vernal pool and riparian wetland habitat, the improvement of instream cover, the enhancement of 900 feet of riparian buffer, the addition of hydraulic cover stones to increase instream habitat diversity, and the capture of storm water runoff from a 31-acre sewershed. The potential measurable improvements suggested in the 30% design include an increase of 8-12 in QHEI score, an increase of 2-4 in IBI score, and a shift from very poor to low fair in ICI narrative assessment.

**Note:** Additional property acquisition has allowed these two projects to far exceed their original expectations. Twelve properties have been acquired and recorded into the City of Oregon's

name and a conservation easement has been placed on a portion of one additional parcel that was not acquired. The acquisition of these properties has resulted in a larger project area, physical continuity between the two project sites, and expanded opportunities for floodplain, riparian, and wetland restoration.

- **OC-5.0:** (Collins Park Municipal Golf Course Improvements on Duck Creek; [\[DMDS Project Link\]](#)): This project is located in the Riverine Headwaters of Duck Creek, in the City of Toledo's Collins Park Municipal Golf Course. The project area is approximately 2 miles upstream of its confluence with Maumee Bay and near a sample site where fish habitat and fish and invertebrate community metrics area all below target values. Primary project goals include regrading and creating streambank benches in stream reaches between culverts to allow Duck Creek to occupy the floodplain. These benches will be vegetated and create habitat for fish and invertebrates. A 2.5-acre area will also be excavated at the upstream end of Duck Creek to create a wetland with a shallow water area and a meandering, vegetated channel. This new wetland will act as a sediment trap, allowing lime residuals to settle out and be removed at regular intervals. These actions will provide recreation for the community while improving the ability of the creek and riparian corridor to function more effectively as an ecological unit.

To be completed with external/partner funding:

- **OC-8.0:** (Urban Runoff Capture and Otter Creek Restoration Project; [\[DMDS Project Link\]](#)): The City of Oregon is leading this project along Otter Creek; approximately 6 miles upstream of its mouth. The nearest sample site is approximately 2 miles downstream of the project area; conditions at this site indicate poor invertebrate community conditions. Project goals include the creation of 800 feet of stream channel, 1,350-feet of bank stabilization, the restoration of 2.1-acres of wetland, and the creation of 0.49-acre of upland habitat on Otter Creek.

### Summary of anticipated results and caveats:

Because of its extensive urban development and industrial legacy, the Otter Creek HU is impaired and may continue to be impaired even if all the proposed projects are implemented. The four projects proposed in the Otter Creek HU provide opportunities for residents to see stream restoration techniques up close and explore the natural landscapes that are in their own backyards.

Because of industrial development, we were not able to identify any viable projects to address impaired fish in the lacustrine of Duck Creek. However, the proposed improvements in the headwaters of Duck Creek in the Collins Park Municipal Golf Course may also improve ecological conditions downstream. The addition of wetland and benches will restore a more natural channel and floodplain, trap lime residuals and sediment, and improve both habitat and invertebrate metrics in Duck Creek's headwaters.

Proposed projects OC-3.2 and OC-3.3 both address specific erosion and outfall issues and maximize use of undeveloped land to restore 2,200 linear feet of Otter Creek's floodplain and dramatically improve fish habitat conditions. Because these projects also include instream restoration targeted to improve the quality and diversity of habitat, ICI scores could also improve. OC-3.2 and OC-3.3 also complement restoration efforts of the urban runoff capture program (OC-8.0) upstream in Otter Creek and ongoing efforts through the GLLA to remove contaminated sediments in the 2 miles of lacustrine habitat in Otter Creek.



## HUC-12: Turtle Creek – Frontal Lake Erie (TuC) ([Turtle Creek Map](#))

The Turtle Creek – Frontal Lake Erie HU contains North Branch Turtle Creek, South Branch Turtle Creek, and the main branch of Turtle Creek that forms at their confluence. These three streams generally flow from west to east and eventually into Lake Erie. The HU also contains a network of approximately 135 miles of agricultural and roadside ditches that drain upland areas. Land use is predominantly agricultural (67% cultivated crop production). Turtle Creek flows along the Ottawa NWR and Magee Marsh State Wildlife Area for the last 2.5 miles until it outlets to Lake Erie. These natural areas contain a series of emergent coastal marshes and associated upland habitat that provide habitat for migratory birds and other wildlife. However, these marshes are not hydrologically connected to Turtle Creek and are separated by dikes.

Almost the entire Turtle Creek – Frontal Lake Erie HU falls within Ottawa County, which received funding from Ohio EPA in 2016 to implement a cost-sharing program for failing septic system replacement. Causes and sources of impairment have not yet been determined post-2017 sampling, so it is unknown whether this project eliminated this source of impairment. Other causes and sources of impairment in the HU include sedimentation from agricultural land use and stream channelization.

### Impairment status and sampling results:

Impaired for 3a, 6, and 14a

The Turtle Creek HU includes five WWH sites: two riverine headwater sites (one each in the North and South branches of Turtle Creek), one riverine site, and two downstream lacustuary sites. The upstream lacustuary site was only sampled for fish.

METRIC	WWH RIVERINE HEADWATERS	WWH RIVERINE	WWH LACUSTUARY
IBI	79% (2)	86% (1)	64% (2)
MIWB	NA	87% (1)	97% (2)
ICI	NA	52% (3) <sup>1</sup>	41% (1) <sup>2</sup>
QHEI	82% (2)	61% (1)	80% (1)

<sup>1</sup>Two sites at ≤ 50% attainment; <sup>2</sup>One site at ≤ 50% attainment

**Degradation of Fish Populations (BUI 3a): Impaired in all river types** – All sample sites in the HU are impaired for IBI, and fish community diversity (as measured by MIwb) is impaired along the main branch of Turtle Creek. Scores are consistently low across the HU, but a larger improvement is necessary in the lacustuary zone due to higher target IBI scores at these locations. In general, IBI scores decreased across the HU between the previous sampling period in 2008 to 2017. Impairment is mainly driven by lack of high-quality habitat. Heavy siltation, high embeddedness, and channel modifications all contribute to pollution-tolerant fish populations. Two percent of the fish captured at the South Branch Turtle Creek sample site and the riverine sample site located just downstream of the confluence with North Branch Turtle Creek in 2017 had DELTs.

**Degradation of Benthos (BUI 6): Impaired in all river types** – All of the four sampled sites in the Turtle Creek – Frontal Lake Erie HU are impaired for benthic community health. In addition, three sample sites are at less than 50% of their target scores. Unless these sites can be improved

to over 50% of their targets, the HU could remain impaired for benthic community health. Scores have generally remained the same, or slightly increased, since 2008, with the exception of the South Branch Turtle Creek sample site that decreased from a narrative score of fair in 2008 to low fair in 2017. Macroinvertebrate populations in the HU are generally composed of facultative taxa and few sensitive species. Impairment is likely a result of poor habitat quality caused by siltation, high embeddedness, and lack of riffles.

**Loss of Fish Habitat (BUI 14a): Impaired in all river types** – The QHEI scores were below target scores at all sample sites in the HU. The site on the North Branch Turtle Creek is just slightly impaired (96% of its target value). The lowest QHEI scores correspond to the sample site along South Branch Turtle Creek and the site just downstream of the confluence. These two sample locations show signs of extensive embeddedness, heavy siltation, sparse riparian cover, and low stream development.

### Recommended projects and anticipated results:

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

#### To be completed with AOC funding:

- **TuC-2.0: (Turtle Creek North Nissen Road Restoration); [DMDS Project Link]**: The project site is located on the riverine section of Turtle Creek, approximately 10 miles from its mouth. The nearest sample site is roughly 0.5 miles upstream of the project site; data from this location describe fish habitat quality and fish/invertebrate communities all well below target conditions. This project includes regrading and stabilizing 1,100 feet of incised streambank, improving stream sinuosity, installing instream cover, creating 50 feet of riffle habitat, and creating 0.75-acre of floodplain wetland. The potential measurable improvements suggested in the concept design include an increase of 12 to 16 in QHEI score, an increase of 2 to 6 in IBI score, and an increase in 2 to 4 ICI score.

In July 2021, the landowner decided not to move forward with the Nissen Road stream restoration project. Ideas for other projects in the riverine headwaters or riverine portions of Turtle Creek were thoroughly explored by Black Swamp Conservancy, Ottawa SWCD, Ohio EPA, and the MAAC Subcommittee. However, no replacement project was identified. TuC 2.0 was removed from the AquaMAP list in November 2021 and no future projects in this area of the HUC will be pursued.

- **TuC-17.0: (Wetland Enhancement in the Riverine of Turtle Creek)**: This 13-acre project site is located on the riverine section of Turtle Creek, approximately 4.4 miles from its mouth. Data collected from the nearest sample site at the mouth of the Creek indicates poor fish habitat conditions as well as impaired fish and invertebrate communities. Current project recommendations include redirecting a channelized drainage way into an excavated floodway on the north end of the property that would direct the flow into the existing wetland on the south half of the property. All areas of the property could be enhanced with native vegetation plantings and habitat installations. These restoration actions will reestablish the hydrologic connection between Turtle Creek and instream wetlands and provide high-quality habitat for fish and invertebrates.



- **TuC-18.0:** (Oxbow Channel Addition and Wetland Enhancement/Reconnection in the Lacustuary of Turtle Creek; [\[DMDS Project Link\]](#)): The project area is located approximately 2.5 miles upstream of the mouth of Turtle Creek in the lacustuary and comprises three parcels that includes a variety of habitat types. Data collected from the nearest sample site at the mouth of the Creek indicates poor fish habitat conditions as well as impaired fish and invertebrate communities. The project recommends enhancing 17 acres of wetland habitat, increasing the connectivity of the floodplain between Turtle Creek and adjacent wetlands, and creating 1,730 feet of backwater habitat.

The TuC-18.0 project has changed from the initial description provided in this document. Based on conversations with the original landowner, the area to be acquired has been reduced. To compensate for this loss, this project now includes work within the 69.7 acre Kontz unit of the Ottawa NWR. This site is already in FWS ownership and is less than one mile downstream of the original project location. This site will provide similar benefits to restore BUIs to those no longer available from the reduced scope of the original TuC-18.0 project. A detailed description of the rationale for and proposed work at the Kontz unit follows.

**Ottawa National Wildlife Refuge Kontz Unit Coastal Reconnection;** [\[DMDS Project Link\]](#): The Kontz unit is isolated from Turtle Creek by an earthen dike and Bodi Road divides the Kontz unit. Bodi Road acts as a levee cutting off the natural surface hydrology connecting coastal wetland and the lake plain prairie habitats to the west to the natural surface hydrology. The proximity of Turtle Creek offers the opportunity for a direct fish passage connection between the Kontz unit and Turtle Creek. The project will increase connectivity to Turtle Creek. Ottawa National Wildlife Refuge proposed the following to restore and enhance wetland function and fish and wildlife habitats: 1) In order to increase hydrologic connectivity between the unit and Turtle Creek, a fish passage water control structure will be installed within the outer dike connecting the ~30-acre emergent wetland to Turtle Creek. A fish passage will allow for passive wetland management when lake levels are at or near the long-term average. The fish passage will be equipped with carp exclusion, 2) Collaborate with Carroll Township and Ottawa County to replace the culvert under Bodi Road to restore the surface hydrology and backwater floodplain habitats across the entire unit to benefit water quality, shallow water macroinvertebrates, and other wetland dependent wildlife and their habitats, and 3) Improve earthen dikes along Turtle Creek and around the adjacent landowner property to ensure maximum long-term sustainable wetland connectivity under varying lake levels.

- ~~**TuC-21.0:** (Turtle Creek Lacustuary Wetland Restoration): The project area is in the lower Turtle Creek lacustuary area. This project focuses on identifying and designing new "instream" wetland habitat for the improvements of biological use impairments. Based on results of hydrological and hydrodynamic modeling, as well as landowner willingness, strategic locations within Turtle Creek's estuary will be restored from open water habitat to native emergent and submergent wetlands. This currently proposed project consists of the hydrological modeling, permitting, and engineering and design work only; the implementation phase will be conducted per the results of these initial activities. (Subcommittee chose to withdraw this project before MAAC vote)~~

To be completed with external/partner funding:

- **TuC-19.0: (Turtle Creek Nutrient Trapping Program; [\[DMDS Project Link\]](#)):** The Ottawa SWCD is working with landowners and producers to offer cost-share on eligible acres for a variety of BMPs (riparian buffer strips, wetland installations, wetland connections, etc.). These are intended to “intercept and hold water, nutrients, and sediments in and on farms fields to lower the chances of loss to the Lake Erie Watershed (i.e., Turtle Creek sub-watershed).” The specific locations along Turtle Creek are to be determined with input provided by the Maumee AOC Subcommittee, and the Subcommittee is encouraging projects in the riverine headwaters.
- **TuC-20.0: (Magee Marsh Turtle Creek Bay Wetland Reconnection):** The project area is located at the mouth of Turtle Creek. Sampling data collected at sites from the project area to the mouth of Turtle Creek indicate area of poor fish habitat and impaired fish and invertebrate communities. The goal of the project is to add two new water control/fish passage structures on the east and southwestern portions of this site. These structures will allow for a hydrological reconnection and permit fish passage to/from the wetland as Lake Erie water levels permit.

### **Summary of anticipated results and caveats:**

The Turtle Creek HUC-12 is impaired for all metrics, in all river types, thus restoration projects are needed throughout the HU. Aside from TuC-19.0, where specific locations are still to be determined, there are no proposed projects in the headwaters of Turtle Creek proper. Targeting headwater areas in TuC-19.0 would remedy this and may address BUIs in the headwaters.

The spatial arrangement of proposed projects at regular intervals along the riverine and lacustrine sections of Turtle Creek has the potential to create a long ecological corridor with pockets of high-quality aquatic habitat. This may facilitate dispersal of invertebrates and fish throughout Turtle Creek. Projects TuC-2.0 and TuC-17.0 is in the riverine section of Turtle Creek and reduce erosion of streambanks, add instream habitat, and will create and improve wetland habitat and access to wetland habitat. TuC-18.0 and TuC-20.0 focus on wetland restoration, hydrologic reconnection, and wetland management, and add fish passage connections. Although these projects should improve fish communities and fish habitat, it is unclear whether they will also fully address the highly impaired invertebrate community in the lacustrine of Turtle Creek.



## HUC-12: Packer Creek (PC) ([Packer Creek Map](#))

The Packer Creek HU includes Packer Creek, a 26-mile stream that flows northeast into Toussaint River at RM 6.5. The HU is primarily agricultural (83%) with an extensive agricultural ditch network. Impairment is mainly driven by silty runoff and low gradient streams that carry high sediment loads into downstream waters. Agricultural land use has resulted in decreased historic wetland coverage and degraded instream and riparian habitat through channelization and woody plant removal.

Critical areas delineated in the NPS-IS (9-Element Plan) suggest the lower two miles of lacustuary need improved sinuosity and protection of downstream wetland habitat while the upstream headwaters are impaired due to agriculture and channelization. For both critical areas, restoration objectives include restoring and protecting riparian buffers, restoring natural channel morphology, reducing agricultural nutrient and sediment loading, and restoring wetlands.

### Impairment status and sampling results:

Impaired for 3a, 6, and 14a

There are five WWH sample sites on Packer Creek; the two upstream are riverine headwaters, the middle site is riverine wading, and the two downstream sites are lacustuary. Metric scores for lacustuary ICI and QHEI metrics are from only one of the two lacustuary sites.

**Degradation of Fish Populations (BUI 3a): Impaired for Lacustuary, Not Impaired for Riverine Headwaters or Riverine** – In the lacustuary, attainment was at 88% for IBI and 97% for MIwb. Only 14 fish species were collected, and all were pollution tolerant. In the riverine headwaters (IBI 104% of target) and riverine wading sites (IBI 136% of target, MIwb 124% of target) fish were not impaired.

**Degradation of Benthos (BUI 6): Impaired for Lacustuary, Not impaired for Riverine** – Percent attainment of ICI scores are 41% in the lacustuary and averaging 104% in the riverine. Because the lacustuary site was less than 50% of its target, the HU could remain impaired for benthic community health unless ICI scores in the lacustuary are improved.

**Loss of Fish Habitat (BUI 14a): Impaired for all river types** – The QHEI scores were below target at all river types in Packer Creek. The lacustuary portion is at 79% of its target, the riverine portion is at 78% of its target, and the headwaters sites are averaging 67% of their target. The QHEI scores decrease the farther upstream the sample site is located. The upstream sample sites are characterized by extensive embeddedness, heavy siltation, sparse amounts of cover, and low development. The two riverine headwater sites have no riparian cover and are straightened channels.

### Recommended projects and anticipated results:

To achieve the aquatic biological BUI Restoration Targets for this assessment unit, the following projects are recommended.

To be completed with AOC funding:

- **PC-2.0:** (Packer Creek Stream Restoration near Genoa-State Route 163; [[DMDS Project Links: Site A, Site B, and Site C](#)]): The 2-mile project area is located in the riverine headwaters of Packer

Creek, immediately upstream of Genoa. Sampling data from a site within this stretch of Packer Creek indicate fish habitat conditions are impaired. The project plans are to regrade and vegetate 13,000 feet of incised streambank and install 13,000 feet of riparian buffer on this straightened portion of Packer Creek (N. Fosteria Rd to Reiman Rd.), with the option to improve sinuosity as well. These actions would dramatically improve fish habitat conditions at the site and may reduce siltation and embeddedness downstream. The project site is also along Route 163 near Genoa and could serve as a demonstration project, encouraging more two-stage ditch conversion in the area. The potential measurable improvements suggested in the concept design include an increase of 15 to 20 in QHEI score, an increase of 2 to 6 in IBI score, and continuation of a good ICI narrative.

Unfortunately, reluctance of private landowners has substantially reduced the anticipated length of stream available to convert to two-stage channel. However, through the relentless efforts of Mike Libben (Ottawa Soil and Water Conservation District), two additional sites near the original location have been added to this project. Each project site has specific approaches necessitated by particular constraints at the site, although the overall goal of improving fish habitat applies across all sites. Moving from upstream to downstream, Site A will include a stream reroute to increase sinuosity, connect to enhanced wetlands, and possibly include some restoration within a barrow pit pond. Site B now includes 0.6 miles of one-sided two stage ditch. Site C will focus on adjacent wetland and riparian restoration because bedrock outcroppings limit the ability to work within the channel. All three projects will improve fish habitat, increase water holding capacity, and reduce bank erosion in Packer Creek.

- **PC-6.0:** (Packer Creek Stream and Riparian Restoration; [[DMDS Project Link](#)]): The project site, located on Packer Creek, is a previously farmed agricultural parcel on the east side of Genoa. The closest sample site (four miles downstream) was shown to have poor fish habitat and invertebrate community conditions. Project goals include the restoration of approximately 900 linear feet of instream habitat (enhanced fish habitat and sinuosity) and the installation of 150-foot-wide forested riparian buffer adjacent to the south side of this Creek segment. Additionally, 25 feet of native grass buffer will be placed between the riparian buffer and the upland farm field to further aid in water quality improvements.

To be completed with external/partner funding:

- No specific projects in this HU are currently proposed.

### Summary of anticipated results and caveats:

Because no opportunities emerged, no projects are proposed in the lacustuary section of Packer Creek. There may be some upstream benefits for fish and fish habitat associated with LTC-13.0, a wetland restoration project in the Lower Toussaint Creek HU right at the mouth of Packer Creek. PC-6.0 is in the riverine section of Packer Creek and addresses the fish habitat BUI through increased sinuosity and enhanced riffle habitat, as well as the addition of a wide riparian buffer. The proposed area for PC-2.0 includes the headwaters sample site that is impaired for fish habitat and should improve habitat in a very long stretch of the headwaters of Packer Creek. Although no longer a continuous project area, the three restoration sites in PC-2.0 will improve fish habitat, increase water holding capacity, and reduce bank erosion in Packer Creek. This project should also have downstream effects through reduced siltation and substrate embeddedness.



## References

Maumee AOC Advisory Committee Biological Subcommittee Report to the Maumee AOC Advisory Committee. Aquatic Biological and Habitat Beneficial Use Impairments and Needed Management Actions. An Explanation of the Conditions and a Rationale for the Projects Necessary to Achieve Restoration Targets for Beneficial Use Impairments 3a, 6, and 14a. First distributed in April 2020 and minor grammatical edits completed in May 2020.

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