Nine-Element Nonpoint Source Implementation Strategy

Lower Swan Creek: Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)

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Chapter 1: Introduction

The Heilman Ditch-Swan Creek HUC-12 (04100009 08 04) is located in northern Lucas County, OH, and contains a watershed of 36.83 square miles (Figure 1). This HUC-12 contains the downstream segment of Swan Creek from the convergence with Blue Creek to the mouth, where it empties into the Maumee River. Several ditches flow to Swan Creek throughout the HUC-12; the two largest are Blystone Ditch and Heilman Ditch (Figure 2)¹. The HUC-12 is immediately downstream of the Gale Run-Swan Creek HUC-12 (04100009 07 03), containing the main stem of Swan Creek, as well as the Lower Blue Creek HUC-12 (04100009 08 02), containing the downstream segment of Blue Creek. Land use within the watershed is primarily developed, with approximately one-third of it dedicated to cultivated cropland in the uppermost reach.



FIGURE 1: LOCATION OF THE HEILMAN DITCH-SWAN CREEK HUC-12 WITHIN THE MAUMEE AOC.



FIGURE 2: **RIVER MILE MAP OF HEILMAN DITCH-SWAN CREEK HUC-**12.

While watershed plans could be all-inclusive inventories, this NPS-IS is developed to address nonpoint source restoration strategies. The U.S. EPA identified nine critical elements to include in strategic planning documents for impaired waters, and to ease implementation of projects addressing nonpoint source management, current federal and state nonpoint source funding opportunities require strategic watershed plans incorporate these nine key elements, concisely to HUC-12 watersheds. Partners within the larger Maumee Area of Concern (AOC) are collaborating to develop Nine-**Element Nonpoint Source Implementation** Strategic Plans (NPS-IS plan) for all the HUC-12 watersheds within the Maumee AOC. This NPS-IS plan for the Heilman Ditch-Swan Creek HUC-12 is one of three being authored by the University of Toledo, in conjunction with the City of Toledo, Partners for Clean Streams and the Lucas County Sustainability Committee.

Report Background 1.1.

In 1987, the Maumee AOC was created under the Great Lakes Water Quality Agreement. With this, a committee formed to develop the Maumee Remedial Action Plan (RAP). In 2006, the Maumee RAP committee created the Maumee Area of Concern (AOC) Stage 2 Watershed Restoration Plan. This document served to be a comprehensive clearinghouse for restoration of the watersheds within the Maumee AOC to meet requirements for many programs under the International Joint Commission, U.S. EPA and Ohio governmental agencies at the

¹It should be noted that the river mile maps used in this document were created using data digitized by TMACOG (made available from the PCS DMDS online system) utilizing 2004 aerial photography and may not represent current stream lengths or correlate to other river mile data sets, notably they do not precisely align with Ohio EPA river mile delineations.

time (Partners for Clean Streams, 2016). As part of the Swan Creek watershed, the **Heilman Ditch-Swan Creek HUC-12** was included in this report.

The *Stage 2 Watershed Restoration Plan* was submitted to the Ohio Department of Natural Resources and Ohio EPA; however, full endorsement was pending inclusion of a Coastal Nonpoint Source Pollution Management Measures section (Ohio EPA, 2009b). Since programs have more recently aligned with the U.S. EPA's nine-element plans, the inclusion of this section was abandoned, and focus is now present on updating this watershed plan by developing NPS-IS plans for the individual HUC-12 watersheds within the greater Maumee AOC. This NPS-IS plan for the **Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)** is being written to address nonpoint source pollution issues specifically within its drainage area, as opposed to a comprehensive watershed plan for all issues found within the region.

Removal of nonpoint source impairments in the **Heilman Ditch-Swan Creek HUC-12** is crucial to the attainment of designated aquatic life uses (AQLs) and further removal of beneficial use impairments not only within this subwatershed, but also within the greater Maumee AOC. In this HUC-12, Swan Creek is in partial attainment of its AQLs, due to excessive bacterial levels, high nitrate/nitrate concentrations, heavy sedimentation/siltation, heavy metal contamination, or as a result of direct habitat alterations. Two larger tributaries to Swan Creek, Blystone Ditch and Heilman Ditch, are also in partial attainment of their AQLs. Blystone Ditch has excessive strontium, ammonia, phosphorus, nitrate/nitrite and bacterial levels. This NPS-IS plan will be used to strategically identify and outline key projects within the HUC-12 that address management of the nonpoint source issues affecting this watershed.

1.2. Watershed Profile & History

Swan Creek is approximately 40 miles long, and is fed by over 200 miles of creeks and ditches, draining an area of 205 square miles (TMACOG, 2001). Its headwaters begin in Fulton County and flow in a southeasterly direction to join with Ai Creek near the northwestern edge of Oak Openings Metropark in Lucas County. The stream flows through the park to join with Blue Creek and switches course to a northeasterly direction through the city of Toledo into the Maumee River at River Mile (RM) 4.75. In addition to Ai Creek and Blue Creek, major tributaries include Wolf Creek, Cairl Creek, Stone Ditch, Drennan Ditch, Blystone Ditch and Heilman Ditch (TMACOG, 2009). The Heilman Ditch-Swan Creek HUC-12 drains an area of only 36.83 square miles, but it contains over half the main stem length of Swan Creek from the convergence with Blue Creek (RM 23) to the mouth. Swan Creek maintains a gradient similar to that of the Maumee River, approximately 2.1 feet per mile (Maumee RAP, 2006).

The HUC-12 is immediately downstream of the Gale Run-Swan Creek HUC-12 (04100009 07 03), containing the

main stem of Swan Creek, and the Lower Blue Creek HUC-12 (04100009 08 02), containing the downstream reach of Blue Creek. The HUC-12 is located within the Huron-Erie Lake Plains (HELP) ecoregion, specifically the Lake Plain, which is a broad, fertile, nearly flat plain formed from retreating glacial lakes, characterized by slowlydraining silt and clay soils. It is important to note that portions of the HUC-12 include or are buffered by small, remnant sections of the ecologically important Oak Openings ecosystem (Figure 3).



FIGURE 3: THE HEILMAN DITCH-SWAN CREEK HUC-12 IN RELATION TO THE HISTORIC OAK OPENINGS REGION AND HISTORIC GREAT BLACK SWAMP.

Oak Openings

Briefly, the Oak Openings region covers 130 square miles throughout the Swan Creek and Ottawa River watersheds and includes oak savanna and wet prairie habitats. This area, representative of a former beach, reflects historically higher lake levels in ancestral Lake Erie near the end of the last ice age. As water levels dropped, the sand was reworked to form sand dunes over broad areas. Also at about this time, rivers began to dig themselves into the landscape as glacial waters drained away (The Nature Conservancy, 2016).

Early pioneers approached the Oak Openings region after days of trekking through the sticky mud and dense woods of the Great Black Swamp. The high sandy dunes and dry open woodland appealed to them as a land for farming; however, the sandy soils did not provide easy yields. Today, over 70% of the Oak Openings land has been developed or is in agricultural production, leaving less than 30% in natural cover. Natural floodplain corridors occur between the Oak Openings region and Lake Erie along Swan Creek.

The Oak Openings region is known for its rare and unique flora; five of its six natural plant communities are considered globally rare (Figure 4). Since the first rare plant list, Lucas County has led the state with more rare plant species than any other Ohio county, mainly due to the Oak Openings



FIGURE 4: PRAIRIE RESTORATION AT THE OLANDER PARK SYSTEM'S SYLVAN PRAIRIE PARK. PHOTO COURTESY OF THE OLANDER PARK SYSTEM.

region. Due to the sensitivity of its globally rare species, conservation actions should be targeted to efficiently protect the unique plants and animals (The Nature Conservancy, 2016).

Swan Creek is described as having three major reaches, based upon dominant stream characteristics (TMACOG, 2001). This HUC-12 encompasses all three. From approximately RM 23 to 19, this reach is primarily in agricultural use. From RM 19 to 6, the watershed is primarily residential and is considered a rapidly developing area. Blystone Ditch and Heilman Ditch empty into Swan Creek at approximately RM 17.5 and RM 9, respectively. From RM 6 to the mouth, the watershed is highly urbanized and composed of developed land in residential, commercial and industrial lots with little vacant space available.

1.3. Public Participation and Involvement

Watershed planning and restoration plans should include involvement from a diverse group of entities, including governmental agencies, private businesses, academia, non-profit groups, neighborhood organizations and the public at large. Many partners have been working over time in the Swan Creek watershed towards ecological restoration and water quality goals.

Several watershed groups have been involved with the Swan Creek watershed, including ClearWater and the Maumee RAP. In 2007, after working under the umbrella of Toledo Metropolitan Area Council of Governments (TMACOG) for almost twenty years, the Maumee RAP merged with Partners for Clean Streams, and ClearWater was dissolved. Most restoration efforts in the Swan Creek watershed are now led by or closely partnered with Partners for Clean Streams. Nonprofit groups, such as the Metroparks of the Toledo Area, the Toledo Metropolitan Area Council of Governments, governmental agencies, academia, citizen action groups and watershed organizations have been interested and involved in the improvement and protection of the Swan Creek watershed.

Each reach of the stream is affected by the varying characteristics of the watershed. In the **Heilman Ditch-Swan Creek HUC-12**, efforts have been focused on the remediation of contaminated sediments in the lower reaches and enhancement and restoration of natural habitat across the entire watershed. Previous projects have focused on mitigating the effects of the low-head dam located at Highland Park, creating an inventory of wetland and riparian restoration sites, and establishing a balanced growth model for land use within the entire Swan Creek watershed.

The University of Toledo, Department of Environmental Sciences, is an interdisciplinary group of ecologists and geologists dedicated to research addressing human impacts on the environment, earth system processes and ecosystem science (University of Toledo, 2017). Faculty in this department utilize research facilities at the Lake Erie Center, established in 1998, and help fulfill its mission to discern the linkages between land-use practices, water quality, habitat, economics, natural resources, sustainability, and environmental and public health. Faculty members have long been partners in local and regional task forces that investigate water quality issues in the Maumee Area of Concern. The University of Toledo is one of the principal authors of this NPS-IS plan for the Heilman Ditch-Swan Creek HUC-12.

The City of Toledo, Department of Environmental Services is another key partner in the development of this document and is dedicated to balanced, responsible environmental protection for safe air and water for the Toledo Metropolitan Area (City of Toledo, 2017). This department governs over stormwater and pre-treatment programs, as well as collaborates with other agencies for the protection, restoration and enhancement of natural and human environments. The City of Toledo has engaged in water quality improvement in the Swan Creek watershed through the Toledo Waterways Initiative, their CSO Long Term Control Plan and their Streamkeeper bacterial sampling program.

Additional key partners within this HUC-12 and the greater Swan Creek watershed include: Partners for Clean Streams, the Lucas County Sustainability Commission, Metroparks of the Toledo Area, Lucas County Soil and Water Conservation District, the City of Maumee, the Lucas County Office of the Engineer, American Rivers and Toledo Metropolitan Area Council of Governments (TMACOG).

Chapters 1, 2 and 3 were primarily authored by the University of Toledo using the Biological and Water Quality Study of Swan Creek and Selected Tributaries, 2009, Ohio EPA Technical Report EAS/2008-12-11 (Ohio EPA, 2009a), Total Maximum Daily Loads for the Swan Creek Watershed (Ohio EPA, 2009b) and the Swan Creek Watershed Plan of Action (TMACOG, 2001). Project information for Chapter 4 was compiled from the on-line Maumee AOC Data Management and Delisting System (DMDS) (Partners for Clean Streams, 2017) and by collaborative meetings with stakeholders and community partners.

Chapter 2: Heilman Ditch-Swan Creek HUC-12 Watershed Characterization and Assessment Summary

2.1. Summary Watershed Characterization for Heilman Ditch-Swan Creek HUC-12

2.1.1. Physical and Natural Features

The entire Swan Creek watershed is comprised of two HUC-10 watersheds: Upper Swan Creek (04100009 07) and Lower Swan Creek (04100009 08), covering an area of 94.95 and 108.66 square miles, respectively. *The Lower Swan Creek HUC-10* watershed is comprised of four HUC-12 watersheds. This document is focusing on the #04 HU of the **Lower Swan Creek HUC-10**—**Heilman Ditch-Swan Creek HUC-12** (04100009 08 04). The *Lower Swan Creek HUC-10*—**Heilman Ditch-Swan Creek HUC-12** (04100009 08 04). The *Lower Swan Creek HUC-10* is oriented in a northeasterly-southwesterly direction, and the **Heilman Ditch-Swan Creek HUC-12** trends along the southern end from its most northeasterly point to midway through the HUC-10. Swan Creek is the principal stream in this HUC-12. In the Upper Swan Creek watershed, its headwaters begin in the Fewless Creek-Swan Creek HUC-12 (04100009 07 02) and meet Ai Creek at the upstream node of the Gale Run-Swan Creek HUC-12 (04100009 0703). Flowing through Oak Openings Metropark, the main stem converges with Blue Creek at the upstream node of the Heilman Ditch-Swan Creek HUC-12, Blystone Ditch and Heilman Ditch are the largest tributaries to Swan Creek.

The Swan Creek watershed (*Upper Swan Creek HUC-10* and *Lower Swan Creek HUC-10*) is wholly contained within the Huron/Erie Lake Plains (HELP) ecoregion. U.S. EPA describes this region as "Fine, poorly-drained, water-worked glacial till and lacustrine sediment; also coarser end moraine and beach ridge deposits" (Maumee RAP, 2006). Swan Creek is described as having three major reaches, based upon dominant stream characteristics and

land use (TMACOG, 2001). This HUC-12 encompasses all three. From approximately RM 23 to 19, the upper reach is primarily in agricultural use. From RM 19 to 6, the watershed is primarily residential and is considered a rapidly developing area. From RM 6 to the mouth, the watershed is highly urbanized, composed of developed land in residential, commercial and industrial lots with little vacant space available.

The watershed's underlying geology consists of primarily lake deposits and wave-planed moraines (OEPA, 2009b). The soils in this area are level to gently sloping and are very poorly to somewhat poorly drained. They formed in clayey and loamy lake-laid sediment and water-reworked glacial till on broad flats of an old glacial lake (OEPA, 2009a).



FIGURE 5: PUBLICLY OWNED PARKS AND PROTECTED LANDS IN THE SWAN CREEK WATERSHED.

Swan Creek Metropark is located within the Heilman Ditch-Swan Creek HUC-12, and covers 441 acres, as well as an additional 154 acres along the Swan Creek Corridor (RM 10.5 to ~RM 6.75) (Figure 5). The park provides crucial feeding and resting grounds for migratory birds and is an active nesting area for resident species (Metroparks of the Toledo Area, 2017). This preserved land is probably the best example of preserved floodplain habitat in the region (Ohio EPA, 2009a) (Figure 6). Further upstream from the Metropark (RM 15.65), a mussel bed was discovered to contain a large population of the Rayed Bean, a state endangered freshwater mussel, as well as ten other species (Grabarkiewicz and Crail, 2008) (Figure 7).



FIGURE 7: PICTURE OF FLOODPLAIN IN SWAN CREEK METROPARK. PHOTO COURTESY OF METROPARKS OF THE TOLEDO AREA.



FIGURE 6: RAYED BEAN FOUND IN SWAN CREEK. PHOTO COURTESY OF JEFF GRABARKIEWICZ.

Specific landmarks and features in this watershed include:

- Active quarry—Shelley Materials (formerly Stoneco, Inc. Maumee Quarry)—NPDES Permit #2IJ00048 to Heilman Ditch via storm sewer
- Numerous small, closed landfills and brownfields (Maumee RAP, 2002)
- Two golf courses
- Swan Creek Metropark, as well as several other Metroparks of the Toledo Area parcels
- University of Toledo Medical Campus
- Highland Park and Sterling Field, two City of Toledo-owned recreational parks
- Mainly agricultural fields in upstream section of the HUC-12
- Mixed commercial/business and residential housing in mid- to downstream section of the HUC-12

The Stoneco, Inc./Shelley Materials Quarry is an active quarry that discharges to Heilman Ditch via a storm sewer along Ford Street. Total suspended solids are cited as a potential contribution towards impairments in this waterway (U.S. EPA, 2017). Documented violations occurred in 2012 and 2015. During stream assessment sampling in 2006, water clarity was observed as turbid colored a milky gray, likely resulting from inputs of industrial pollution and urban runoff (Ohio EPA, 2009a).

A low-head dam is located at approximately RM 4.2. Constructed in 1926, the dam encases a 36inch sewer main and is believed to be protecting the 3-lane roadway bridge immediately upstream (JFNew, 2009). A 2009 dam mitigation project attempted to address the barrier to fish passage created by the dam's height and its associated large scour hole, with an additional objective to restore flow integrity to the lower 11 miles of Swan Creek. Two large engineered rocked riffles were installed and meandering fish bypass low flow channels were integrated into the design (Figure 8). Improvements to aquatic habitat and communities in nearby sampling locations may be shown in the next Ohio EPA sampling event in Swan Creek, scheduled to occur in summer 2017.



FIGURE 8: HIGHLAND PARK DAM (~RM 4.3).

The U.S. Army Corps of Engineers has noted significant nonpoint pollution issues associated with erosion and sedimentation. Sediments deposited in drainage and stream channels must be removed for stream functionality and water quality improvements, and wetlands that filter runoff and trap sediment and associated nutrients/contaminants need to be conserved and restored where possible. Multiple agencies have recognized the importance of 1) restored hydrology and flow regimes, 2) conservation of wetlands, floodplains, and vegetative buffers, and 3) the importance of sediment reduction programs to decrease flood peaks and sediment transport to Lake Erie (U.S. Army Corp of Engineers, 2009). The Swan Creek Plan of Action listed the highest priority objectives for the watershed as conservation of wetlands and floodplains, enhanced regulation and education for home sewage disposal, increased management of land use and zoning, and implementation of best management practices for agricultural runoff (TMACOG, 2001).

Streams in the lower Swan Creek watershed are heavily impacted by bank erosion and "flashy" flows from increased runoff in urban and developing areas upstream (Ohio EPA, 2009b). While actions may be taken upstream to prevent runoff, water flowing through a modified channel with little to no riparian vegetation may reduce the effects of any upstream improvements. Urban and industrial runoff has also negatively impacted the streams in this HUC-12 by the transport and accumulation of chemical contaminants. Swan Creek, from RM 3.75 to its mouth, is listed as a site in the Assessment phase (2011-2015) for the Great Lakes Area of Concern Sediment Management Plan (U.S. EPA, 2017). Partners are currently being recruited for project development in this area.

2.1.2. Land Use and Protection

Land use within the Heilman Ditch-Swan Creek HUC-12 is varied between upstream and downstream segments (Figure 9). Cropland dominates onethird of the HUC-12 (31%), primarily in the upstream segment of the watershed (Table 1). From approximately RM 15, the landscape progressively becomes more urbanized, accounting for the majority of land use within the HUC-12 (57%). A wooded riparian corridor and protected parklands (Swan Creek Metropark) account for an additional 7.5% of land use in the HUC-12. In all, stream habitat quality mirrors the surrounding land use. In the agricultural reach (RM 23-19), channel substrates consist primarily of sand and silt, and banks are unstable. Swan



FIGURE 9: LAND USE IN THE SWAN CREEK WATERSHED: UPPER SWAN CREEK (HUC-10: 04100009 07) AND LOWER SWAN CREEK (HUC-10: 04100009 08).

Creek is actively eroding its channel in the residential/urban reach (RM 19-6), with high, unstable banks and detached floodplains. Bedrock at RM 19 prevents the erosion from extending further upstream. In the most urbanized reach (RM 6-mouth), Swan Creek is actively silting in its channel. This reach is under the seiche effect from Lake Erie from the mouth to RM 2.6 (Maumee RAP, 2006). Land use upstream of the Heilman Ditch-Swan Creek HUC-12 may have an influence within the HUC-12 as well. While much of the Gale Run-Swan Creek HUC-12 is protected land in the Oak Openings Metropark, the remainder of its land use, in addition to land use within the Lower Blue Creek HUC-12 is largely agricultural. A more detailed breakdown of the Heilman Ditch-Swan Creek HUC-12 and the adjacent upstream HUC-12s (*Gale Run-Swan Creek HUC-12 and Lower Blue Creek HUC-12*) that may have an influence on the Heilman Ditch-Swan Creek HUC-12 are also listed for reference in Error! Reference source not found. (Homer, 2015).

Cover classification	% watershed area	Area (mi²)	Cover classification	% watershed area	Area (mi²)	Cover classification	% watershed area	Area (mi²)
Heilman D (0410	itch-Swan Cre 0009 08 04)	ek	Lowe (0410	r Blue Creek 00009 08 02)		Gale Ru (0410	in-Swan Creek 00009 07 03)	
Barren	0.42%	0.15	Barren	0.06%	0.01	Barren	0.14%	0.02
Crop	31.06%	11.38	Crop	76.19%	18.64	Crop	9.76%	1.65
Hay/Pasture	1.56%	0.57	Hay/Pasture	0.72%	0.18	Hay/Pasture	15.41%	2.60
Deciduous Forest	7.55%	2.77	Deciduous Forest	8.44%	2.06	Deciduous Forest	46.25%	7.81
Evergreen Forest	0.08%	0.03	Evergreen Forest	1.01%	0.25	Evergreen Forest	7.44%	1.26
Mixed Forest	0.00%	0.00	Mixed Forest	0.01%	0.00	Mixed Forest	0.00%	0.00
Herbaceous	0.84%	0.31	Herbaceous	1.52%	0.37	Herbaceous	4.36%	0.74
Herbaceous Wetlands	0.28%	0.10	Herbaceous Wetlands	0.02%	0.00	Herbaceous Wetlands	0.11%	0.02
Woody Wetlands	1.10%	0.40	Woody Wetlands	0.56%	0.14	Woody Wetlands	1.76%	0.30
Shrub/Scrub	0.00 %	0.00	Shrub/Scrub	0.00%	0.00	Shrub/Scrub	0.03%	0.01
Developed, High Intensity	6.86%	2.51	Developed, High Intensity	0.29%	0.07	Developed, High Intensity	0.62%	0.10
Developed, Medium Intensity	14.17%	5.19	Developed, Medium Intensity	0.76%	0.19	Developed, Medium Intensity	0.79%	0.13
Developed, Low Intensity	22.65%	8.30	Developed, Low Intensity	3.50%	0.86	Developed, Low Intensity	3.59%	0.61
Developed, Open Space	13.32%	4.88	Developed, Open Space	6.75%	1.65	Developed, Open Space	8.80%	1.49
Water	0.11%	0.04	Water	0.17%	0.04	Water	0.94%	0.16
Total	100.00%	36.63	Total	100.00%	24.46	Total	100.00%	16.88

TABLE 1. LAND USE CLASSIFICATIONS FOR SELECTED SWAN CREEK WATERSHEDS (HOMER, 2015).

Approximately 68% of the **Heilman Ditch-Swan Creek HUC-12** is located within the NPDES regulated Municipal Separate Storm Sewer System (Figure 10). One Phase I MS4 permit (City of Toledo) exists throughout this watershed, along with several Phase II municipalities and agencies, including Monclova Township, the City of Maumee, the Village of Holland, the Village of Waterville, the Ohio Department of Transportation and the Ohio Turnpike Commission. These storm water systems do not connect with water treatment systems; therefore, oil, grease, pesticides, herbicides, dirt and grit are carried directly to waterways and have a high potential to negatively impact water quality (Ohio EPA, 2009b). In addition, the City of Toledo operates eight combined sewer overflow (CSO) outfalls on Swan Creek, which can be sources of elevated suspended solids, bacteria and nutrient levels that negatively impact stream health and aquatic communities. The Toledo Waterways Initiative implemented a long-term, 18-year project in 2002 to reduce CSOs and eliminate water pollution in Swan Creek, the Ottawa River and the Maumee River (Toledo Waterways Initiative, 2017). Upon completion, this project is expected to reduce overflow volume to the Swan Creek watershed by 25%, or approximately 16 million gallons/year (Cousino, 2017).



FIGURE 10: TOLEDO URBANIZED AREA AS DEFINED BY THE 2010 CENSUS.

2.2. Summary of Biological Trends for Heilman Ditch-Swan Creek HUC-12

Ohio EPA sampled the entire Swan Creek watershed in 2006, as documented in the *Biological and Water Quality Study of the Swan Creek Watershed, Technical Report EAS/2008-12-11.* This report was the Technical Support Document for the Swan Creek TMDL study. The *Total Maximum Daily Loads for the Swan Creek Watershed* was released in 2009. Both documents were used extensively in the preparation of this *Lower Swan Creek: Heilman Ditch-Swan Creek HUC-12 NPS-IS Plan.* Habitat and biological communities in the **Heilman Ditch-Swan Creek HUC-12** will be sampled again as part of routine state monitoring in the summer of 2017. Fish communities and populations were assessed at select sampling locations in 2012. These values are reported, where applicable. All segments of this assessment unit were designated and/or confirmed as warmwater habitat (WWH) aquatic life use, with the exception of Heilman Ditch, which is listed as a limited resource waterway (LRW) (Ohio EPA, 2009a).

RM (Drain. area mi ²)	IBI/ MIwb ^a	ICI ^b	Status	QHEI	Location							
Heilman Ditch-Swan Creek HUC-12 (04100009-08-04) (WWH) (Swan Creek, downstream of confluence with Blue Creek)												
21.60 ^w (140.0)	36/6.5*	36	Partial	41	Stitt Rd.							
18.50 ^w (146.0)	41/6.4*	38	Partial	66.5	Albon Rd.							
15.30 ^w (160.0)	42/7.5	38	Full	38	Salisbury Rd.							
10.84 ^w (192.0)	40/7.5	36	Full	63	St. Rt. 20/ Reynolds Rd.							
4.40 ^B (200.0)	31 ^{ns} /8.7	16*	Partial	43.5	Upst. South Ave.							
4.20 ^w (200.0)	42/8.2	22*	Partial	74.5	Dst. South Ave.							
1.58 ^B (203.0)	39 ^M /8.7 ^M	16*	Partial	34	City Park Ave.							

 TABLE 2.
 Overall Biological Indices Scores for Selected Sites in Heilman Ditch-Swan Creek HUC-12 and Upstream Watersheds (Ohio EPA, 2009a; Partners For Clean Streams, 2017).

RM (Drain. area mi²)	IBI/ MIwb ^a	ICI ^b	Status	QHEI	Location							
Heilman Ditch-Swan Creek HUC-12 (04100009-08-04)												
(WWH) (Blystone Ditch)												
0.54 ^H (6.5)	34/H	F ^b	Partial	46	Monclova Rd.							
Heilman Ditch-Swan Cre	ek HUC-12 (0410	0009-08-04)										
(LRW) (Heilman Ditch)												
3.0 ^H (1.0)	-/H	VP ^b	-	-	St. Rt.20/Conant Rd.							
Gale Run-Swan Creek HU	JC-12 (04100009-	-07-03)	-	-								
(WWH) (first site upstrea	am of Heilman Di	itch-Swan Creek	HUC-12)									
24.7 ^w (89.0)	(35/7.1 ^{ns}) ^S	(18*) ^s	Partial	51 ^s	Spencer Rd.							
Lower Blue Creek HUC-1	2 (04100009-08-0	02)										
(WWH) (first site upstrea	am of Heilman Di	itch-Swan Creek	HUC-12)									
0.7 ^w (44.5)	32/4.8*	30 ^{ns}	Non	24	Finzel Rd.							

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (\leq 4 IBI or ICI units; \leq 0.5 MIwb units).

a The MIwb (Modified Index of well-being) is not applicable to headwater sites (<20mi²).

b Narrative evaluation used in lieu of ICI (Good; MG=Marginally Good; Fair; L Fair=Low Fair; Poor; VP=Very Poor).

W Wading site.

H Headwater site, MIwb is not applicable.

B Boat site.

M IBI and MIwb data from 2012 sampling event, Midwest Biodiversity Institute Level III Data (Partners for Clean Streams, DMDS, 2017).

S IBI, MIwb, ICI and QHEI data from 2012 sampling event, Ohio EPA Division of Surface Water (Partners for Clean Streams-DMDS, 2017).

A summary of the sample locations and their biological status in the Heilman Ditch-Swan Creek HUC-12 are provided in Table 2. For reference, sample locations and biological status from sampling sites immediately upstream from the HUC-12 are included as well. Figure 11 details sampling points and attainment status. The quality of habitat, affected by land use, in Swan Creek is a critical factor in attainment scores for fish and macroinvertebrate communities. Overall, silty substrates, high embeddedness, and low sinuosity related to tiled fields, channelized ditches and urbanization have contributed to degradation caused by flashy storm water and torrent flows, scoured substrates and the filling of interstitial spaces with silt (Ohio EPA, 2009a). In the uppermost sampling locations in the **Heilman Ditch-Swan Creek HUC-12**, the stream lacked sufficient habitat to support diverse fish communities, while silt substrates, impoundment and channel morphology in the lower reaches inhibited macroinvertebrate densities.



FIGURE 11: SAMPLING LOCATIONS AND ATTAINMENT STATUS IN SELECTED LOCATIONS IN THE HEILMAN DITCH-SWAN CREEK WATERSHED AND UPSTREAM WATERSHEDS.

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

Historically, IBI scores have shown improvement over time in Swan Creek. For the 2006 sampling event, IBI scores increased linearly from upstream to downstream² which is attributed to the dilution of nonpoint source pollution over a larger drainage area. Performance of the fish community was most affected by high numbers of pollution tolerant fish. Between RM 30.9 (located in the *Gale Run-Swan Creek HUC-12*) and RM 18.5, only one intolerant species (*Noturus flavus*) was found, which has been described as a stray only occurring at sites where habitat alterations have eliminated chutes and silted over gravel bars (Trautman, 1981). This agricultural stretch of Swan Creek was characterized as "lacking sufficient habitat to support diverse fish communities" (Ohio EPA, 2009a).

Despite having reached full biological attainment at sampling locations RM 15.3 and 10.8, habitat and chemical water quality were degraded at these sites. Cool groundwater and shade may have been a mitigating factor for impacts associated with elevated nutrient levels in the attainment of biological AQLs at RM 15.3 (Ohio EPA, 2009a). All downstream sites are in partial attainment. Poor homogenous habitat associated with the dam located at RM 4.4 limited urban fish populations. However, improvements made in 2009 to fish passage and habitat at this site may have mitigated this issue. Sampling in 2017 may reflect impact from the Highland Dam Mitigation Project. In this stretch of Swan Creek, the river is confined to its channel and is unable to deposit silt and other pollutants along its floodplain, contributing to heavy silt cover and high embeddedness. This stretch is also heavily impacted by stormwater and CSOs, further exacerbating stress from degraded habitat.

² Except RM 4.4, located near the low-head dam.

The fish population achieved attainment status in Blystone Ditch despite overall poor habitat and macroinvertebrate community scores. Blystone is most likely affected by agricultural runoff (OEPA, 2009b). Fish populations were not assessed in Heilman Ditch in 2006.

Macroinvertebrates (Invertebrate Community Index [ICI])

Macroinvertebrate community scores were in attainment throughout the agricultural and developing sections of the HUC-12, commonly associated with good riffle quality, natural channel morphology and a nearly closed canopy (Ohio EPA, 2009). In the densely urbanized sections of Swan Creek (RM 4.4 to the mouth), overall densities were low. EPT taxa were highest throughout the upstream segments of the watershed, and were low throughout the downstream, highly urbanized sampling sites. From RM 10.9 to the mouth, sampling sites were dominated mostly by facultative taxa of baetid, heptageniid, *Caenis* mayflies and hydropsychid and hydroptilid caddisflies. Sampling locations within the most urban stream segment of Swan Creek attained ICI scores of low-fair to fair, consistent with some limiting aspects of habitat, such as high embeddedness and heavy silting.

The macroinvertebrate community in Blystone Ditch was low to moderate in density and diversity. Historic channelization and absence of riffle development contributed to an attainment score of fair. Predominant taxa included midges, damselflies and beetles, and only one sensitive EPT taxa was found at the sampling site. In Heilman Ditch, the aquatic community was rated as very poor. Of the eight taxa found here, four were very tolerant midges. Upstream from the sampling site, the stream flows underground through a culvert, and the channelized banks are lined with rip-rap. The water quality here was compromised, likely from industrial pollution and runoff.

Habitat (via Qualitative Habitat Evaluation Index [QHEI])

Ohio EPA sampling crews documented various water quality and habitat attributes during the QHEI assessment in the summer of 2006. Habitat attributes (i.e., channelization, silty substrates, etc.), related to agricultural land use, in the watersheds above the **Heilman Ditch-Swan Creek HUC-12** are likely impacting upstream sampling locations within the HUC-12 and are included for reference in Table 3. These sites exhibited eroded and incised banks from torrential flows, as well as high embeddedness and poor riffle development. These upstream effects can be seen at RM 21.6, evidenced by silty substrates and lack of instream cover.

Further downstream, bedrock located at RM 18.5 likely contributed to the high QHEI score at this site. Slabs, boulders, cobble and gravel were also present, along with a moderate to narrow riparian corridor that persisted upstream from the site. This site also exhibited Water Willow, *Dianthera Americana L.*, indicative of clean substrates and considerable flows (Ohio EPA, 2009a). While fish and macroinvertebrate populations scored well at the next two downstream sites, these segments exhibited characteristics common to urbanization. Scoured streambeds, heavily eroded banks, channel confinement and poor substrates were also present. In this reach, Blystone Ditch exhibited a strong riparian corridor in excess of 50 meters wide on each bank, featuring many mature cottonwoods, though subdivisions and tiled fields in the vicinity have contributed to flashy storm water discharges, which have extensively embedded the stream substrates with silt (Ohio EPA, 2009a).

The impoundment existing at RM 4.4 has an impact on the habitat score at this location. The low-head dam located at RM 4.2 exhibited silt-settling properties; thus, the habitat score at this site was fairly high (QHEI=74.5). However, those effects were not far-reaching, as moderate silt amounts were found at the downstream end of this site. The worst habitat throughout all of Swan Creek was found at RM 1.58, lacking in all six QHEI habitat categories.

Key Q	HEI					bt.	~~							M٧	VH /	\ttri	but	es														
Comp	onents		www.r.Accibacco					_	Hig	h In	flue	nce			Мо	dera	ate I	nflu	ienc	е												
River Mile	QHEI Score	Gradient (ft/mi)	Not Channelized or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Development	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low/Normal Embeddedness	Max Depth >40 cm	Low/Normal Riffle Embeddedness	WWH Attributes	Channelized/No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth <40 cm	Hi-Influence Modified Attributes	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrate (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1 or 2 Cover types	Intermediate/Poor Pools	No Fast Current	High/Moderate Embeddedness	High/Moderate riffle Embeddedness	No Riffle	M.I. MWM Attributes
Heilman Ditch-Swan Creek HUC-12 (04100009-08-06=4) (WWH) (downstream of confluence with Blue Creek to the mouth)																																
Swan	Cree	k																-														
21.6	41	1.46	•				•				•		3		•		•		2		•			•	•	•		•	•		•	7
18.5	66.5	1.46	•		•	•	•	•	•	•	•	•	9				•		1													0
15.3	38	1.75	•				•				•		3		•		•		2		•			•	•			•	•		•	6
10.8	63	2.69	•	•			•	•			•		5						0		•			•				•	•	•	•	6
4.4	43.5	0.10						•			•		2	•	•				2		•			•	•			•	•		•	6
4.2	74.5	2.01	•	•			•	•	•	•	•	•	8						0					•	•							2
1.4	34	0.10	•								•		2		•		•		2		•			•	•			•	•		•	6
Blyst	one D	itch																														
0.5	46	11.63	•					•			•		3		•	•			2		•			•				•	•		•	5
Gale (WW	Run-S 'H) (fir	wan C st site	reel ups	k H stre	UC- am	-12 of	(04 Hei	100 ilma	000 an I	9-0 Dito	7-0 :h-Չ	3) Swa	ın C	cree	ek F	IUC	-12	2) ^s														
Swan	Cree	k																-														
24.7	51	4.50					•	•			•		3		•				1	•	•		•	•				•	•	•		7
Lowe	er Blue	Creek	HU	JC-1	L2 (041	100	009	-08	-02	2)	DI.			1-)																	
(reco	mmer Crock	nded IV	W	H) (TIRS	τSI	τει	ibs	trea	am	on	BIU	e C	ree	к)																	
Biue	Creek	1 70											2						2													7
0.7	29	4.76	•								•		2		•		•		2		•			•	•	•		•	•		•	/

TABLE 3. QUALITATIVE HABITAT EVALUATION INDEX (QHEI) MATRIX WITH WARMWATER HABITAT (WWH) AND MODIFIED WARMWATER (MWH) ATTRIBUTE TOTALS IN SELECTED SWAN CREEK WATERSHEDS (OHIO EPA, 2009A).

S IBI, MIwb, ICI and QHEI data from 2012 sampling event, Ohio EPA Division of Surface Water (Partners for Clean Streams-DMDS, 2017).

2.3. Summary of NPS Pollution Causes and Associated Sources for Heilman Ditch-Swan Creek HUC-12

As listed in the 2016 Integrated Water Quality Monitoring and Assessment Report, Ohio EPA has determined that the biological impairments in the **Heilman Ditch-Swan Creek HUC-12** are from multiple causes including sedimentation/siltation, threshold-exceeding sediment screening values, priority organics, nitrate/nitrite levels and direct habitat alterations (Table 4). Sources of these impairments include urban runoff/storm sewers, upstream impoundments, crop production with subsurface drainage, sewage discharges in unsewered areas, combined sewer overflows, channelization and dams/impoundments throughout the HUC-12. Those sites located within the upstream portions of the **Heilman Ditch-Swan Creek HUC-12** are in *Partial Attainment*, due to land use practices associated with agricultural operations. Stream segments located in the "middle" portion of the **Heilman Ditch-Swan Creek HUC-12** are in *Full Attainment*, with much land in this section dedicated to parks, developing

residential sections and a modest riparian cover. The lower portion of the **Heilman Ditch-Swan Creek HUC-12** is in partial attainment due to the effects of impoundment and urbanization. Major tributaries to Swan Creek in this HUC-12 are in *Partial Attainment*, also due to adjacent land use practices, both in agricultural and industrial settings.

				/ /						
RM (Drain. area mi ²) [w =wading site, H=headwater site]	Primary Cause(s)	Primary Source(s)	Status	Location						
Heilman Ditch-Swan Cre	ek HUC-12 (04100009 08 04)	-	-						
(WWH) (downstream of	confluence with Blue Creek	to the mouth)								
21.60 ^w (140.0)	Sedimentation/siltation, habitat alterations	Crop production with subsurface drainage	Partial	Stitt Rd.						
18.50 ^w (146.0)	Nitrate/nitrite	Crop production with subsurface drainage	Partial	Albon Rd.						
4.40 ^в (200.0)	Direct habitat alterations, sedimentation/siltation	Impoundment, urban runoff/storm sewers	Partial	Upst. South Ave.						
4.20 ^w (200.0)	Nitrate/nitrite, sedimentation/siltation	Urban runoff/storm sewers, upstream impoundment	Partial	Dst. South Ave.						
1.58 ^B (203.0)	Sedimentation/siltation, direct habitat alterations	Channelization, urban runoff/storm sewers	Partial	City Park Ave.						
Heilman Ditch-Swan Creek HUC-12 (04100009-08-04) (WWH) (Blystone Ditch)										
0.54 ^н (6.5)	Sedimentation/siltation, direct habitat alterations	Crop production with subsurface drainage, channelization	Partial	Monclova Rd.						
Heilman Ditch-Swan Cre (LRW) (Heilman Ditch)	ek HUC-12 (04100009-08-04	1)								
3.0 ^H (1.0)	Strontium, ammonia	Urban and industrial runoff, channelization	-	St. Rt.20/ Conant Rd.						
Gale Run-Swan Creek H (WWH) (first site upstre	UC-12 (04100009-07-03) am of Heilman Ditch-Swan (Creek HUC-12; on Swan Creek)								
24.7 ^w (89.0)	Sedimentation/siltation, direct habitat alterations	Crop production	Partial	Spencer Rd.						
Lower Blue Creek HUC-1 (WWH) (first site upstre	2 (04100009-08-02) am of Heilman Ditch-Swan (Creek HUC-12; on Blue Creek)								
0.7 ^w (44.5)	Sedimentation/siltation, direct habitat alterations	Channelization, crop production with subsurface drainage	Non	Finzel Rd.						

TABLE 4. CAUSES AND SOURCES OF NPS IMPAIRMENTS FOR SELECTED SWAN CREEK SAMPLING LOCATIONS (OHIO EPA, 2009A).

2.4. Additional Information for Determining Critical Areas and Developing Implementation Strategies for Heilman Ditch-Swan Creek HUC-12

Several organizations and agencies, including Metroparks of the Toledo Area, Toledo Metropolitan Area Council of Governments, Maumee Area of Concern Committee, Partners for Clean Streams and the University of Toledo focus on improving habitat and water quality within the **Heilman Ditch-Swan Creek HUC-12**. Documents and/or plans created by these organizations were used as supplemental information to prepare this NPS-IS plan and are referenced in the Works Cited section, as appropriate. Assessment data from the 2006 TMDL sampling event and data referenced in the 2016 Integrated Water Quality Monitoring and Assessment Report were used in the creation of this NPS-IS plan (Ohio EPA, 2009a; Ohio EPA 2009b; Ohio EPA, 2016). Additional Level 3 data were obtained from the Partners for Clean Streams Data Management Delisting System and were denoted, where applicable.

Chapter 3: Conditions & Restoration Strategies for Heilman Ditch-Swan Creek HUC-12 Critical Areas

3.1. Overview of Critical Areas

Overall, nine sampling sites are located in the **Heilman Ditch-Swan Creek HUC-12** (Figure 12). Seven are located in Swan Creek, one is located in Blystone Ditch near the confluence with the Swan Creek main stem, and one is located in the headwaters of Heilman Ditch. Five of the seven sampling locations in Swan Creek are in *Partial Attainment*. The sampling location in Blystone Ditch is in *Partial Attainment*, and the sampling location in Heilman Ditch does not meet expectations for LRWs. With the exception of the sampling locations at RM 4.4 and 4.2, the remainder of the partial attainment points are remote enough from each other and their respective sources of impairment are so varied, that it is likely that each point and its requisite segment has its own associated critical area (Table 5). At this time, specific restoration strategies and projects have been identified for three critical areas to address the nonpoint source pollution issues that are believed to be causing the impaired state in the **Heilman Ditch-Swan Creek HUC-12.** Additional critical areas will be developed in subsequent versions of this NPS-IS plan.



FIGURE 12: HEILMAN DITCH-SWAN CREEK HUC-12 CRITICAL AREAS.

Sample site (OEPA, 2009)	Critical Area Description	Critical Area #	Critical Area Status
Swan Creek RM 21.6	Extends into upstream watersheds, due to proximity to HUC-12 terminus		Suggested: not delineated in this version, but recommended for future versions
Swan Creek RM 18.5	Sub-watershed of Swan Creek between RM 21.6 and 18.5	1	Included in this version
Swan Creek RM 4.4, 4.2	Sub-watershed of Swan Creek between RM 6.75 and 4.2	2	Included in this version
Swan Creek RM 1.58	Sub-watershed of Swan Creek between RM 4.2 and 1.58		Suggested: not delineated in this version, but recommended for future versions; recommend action from Great Lakes Legacy Act projects first before implementing in- stream or riparian restoration
Blystone Ditch RM 0.54	Sub-watershed of Blystone Ditch from headwaters to RM 0.54	3	Included in this version
Heilman Ditch RM 3.0	Sub-watershed of Heilman Ditch from headwaters to confluence with Dry Creek; potential to include Dry Creek watershed for passive treatment wetlands for LRW effects		Suggested: not delineated in this version, but recommended for future versions

TABLE 5. Heilman Ditch-Swan Creek HUC-12 Critical Area Identification.

3.2. Critical Area 1: Conditions, Goals & Objectives for the Upper Reach of Heilman Ditch-Swan Creek HUC-12

3.2.1. Detailed Characterization

The Swan Creek sampling site located at RM 18.5 (Albon Rd.) is located within a transition zone from relatively high agricultural land use density to an area of rapidly developing residential and urban land uses in the **Heilman Ditch-Swan Creek HUC-12**. Tributaries through this section still flow through relatively dense agricultural land. The sampling location is listed in *Partial Attainment* of the Warmwater Habitat aquatic life use designation, caused by excessive nitrate/nitrite levels sourced from crop production with subsurface drainage. Due to its centralized location within the HUC-12, impairment in this segment is likely attributed to land use characteristics of the watershed of Swan Creek and its contributing waterways between Stitt Rd. and Albon Rd. (Table 6). None of these tributaries are currently included in the Lucas County Ditch Maintenance Program, and maintenance to date has been handled privately. Van Fleet Ditch is undergoing the petition process, as of April 2020, and will be improved and maintained by Lucas County with two-stage ditch design. Upstream segments beyond RM 21.6 that are in *Partial Attainment* are likely also contributing to the *Partial Attainment* status at Albon Rd.

Using the rationale described in the Handbook for Developing Watershed Plans to Restore and Protect Our Waters (U.S. Environmental Protection Agency, 2008) (Section 10.3.4): "In general, <u>management practices are</u> <u>implemented immediately adjacent to the waterbody or upland</u> to address the sources of pollutant loads." — *Critical Area 1* includes the sub-watershed area of Swan Creek, its riparian corridor and its tributaries that contribute runoff or drainage waters to this reach between the Stitt Rd. (RM 21.6) and Albon Rd. (RM 18.5) sampling locations (Figure 13).

Heilman Ditch-Swan Creek HUC-12 Swan Creek (RM 21.6- RM 18.5) J. Eber Ditch Needles Ditch • • **Buchman Ditch** Morrison Ditch • ٠ Van Fleet Ditch • Milewski Ditch Nachtrab Ditch Grzegorzewski Ditch • ٠ Wicks Ditch McFillen Ditch •





FIGURE 13: HEILMAN DITCH-SWAN CREEK HUC-12 CRITICAL AREA 1.

3.2.2. Detailed Biological Conditions

Fish community data is summarized below for the Albon Rd. sampling site in *Critical Area 1* (Table 7). Analysis of the abundance, diversity, and pollution tolerance of existing fish species found by Ohio EPA at this sampling location in relation to QHEI scores aids in identification of causes and sources of impairment. The Albon Rd. sampling site is currently meeting the WWH standard for IBI score (41, goal is 32); and is not meeting the WWH standard for MIwb (6.4, goal is 7.3). Habitat scores at the Albon Rd. sampling site are meeting WWH expectations (66.5, goal is 60), mainly due to bedrock as the predominant substrate at this location.

TABLE 7. CRITICAL AREA 1 - FISH COMMUNITY AND HABITAT DATA (OHIO EPA, 2009A).

Stream/RM	D.A. (mi²)	Total Species	QHEI	MIwb	IBI	Predominant Species (percent of catch)	Narrative Evaluation				
Heilman Ditch-Swan Creek (WWH) (Partial Attainment)											
Swan Creek 18.5 ^w	146.0	15	66.5	6.4*	41	Greenside darter (47%), rock bass (23%), central stoneroller (9%)	Good-Fair				

Characteristics of the aquatic macroinvertebrate community for the Albon Rd. sampling site in *Critical Area 1* are summarized below (Table 8). Once again, analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at this sampling location, related to QHEI scores can aid in the identification of causes and sources of impairment. The Albon Rd. sampling site is currently maintaining the WWH standard for ICI score (38, goal is 34).

TABLE 8. CRITICAL AREA 1 - MACROINVERTEBRATE COMMUNITY DATA (OHIO EPA, 2009A).

Stream/ RM	ICI ScoreNarrative	Notes	Predominant Species								
Heilman Ditch-Swan Creek (WWH) (Partial Attainment)											
Swan Creek 18.5 ^w	38—Good 16 sensitive taxa	Low-Moderate Qualitative density	Caddisflies (F, MI), mayflies (F), midges (MT, F)								

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤ 4 IBI or ICI units; ≤ 0.5 MIwb units).

w Wading site.

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

3.2.3. Detailed Causes and Associated Sources

The Albon Rd. (RM 18.5) sampling site is listed as in *Partial Attainment* of the Warmwater Habitat aquatic life use designation (Table 9). The cause for the *Partial Attainment* listing is high nitrate/nitrite with a primary source being crop production with subsurface drainage. Habitat attributes at this sampling location consistently meet Warmwater Habitat Attributes, with only minor negative influence from lack of adequate cover or pool development.

TABLE 9.	SUMMARY DATA FOR C	CRITICAL AREA 1	(Оню ЕРА,	2009A).
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RM	IBI	MIwb	ICI	QHEI	Status	Primary Cause	Primary Cause Primary Source					
Heilman Ditch-Swan Creek HUC-12 (04100009 08 04) Swan Creek												
18.5 ^w	41	6.4*	38	66.5	Partial	Nitrate/nitrite	Crop production with subsurface drainage	Albon Rd.				

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
 W Wading site.

While the bedrock at RM 18.5 contributed to a relatively silt-free environment and high QHEI score, land use practices within the reach upstream of this site are impacting Swan Creek—"The pollution and decimation of habitat through these reaches can be attributed to tiled fields and channelized ditches, as well as the urbanization of the watershed. These activities have led to flashy storm water and torrent flows scouring the stream substrates of parent materials and filling interstitial spaces with silts from unbuffered fields and eroded stream banks" (Ohio EPA, 2009a). Projects that address the negative effects of tiled field drainage and its subsequent impact on nutrient loading in waterways will help decrease sediment and nutrient loss from tiled fields, helping to increase fish diversity of sensitive species in this reach.

3.2.4. Outline Goals and Objectives for the Critical Area

Critical Area 1 is primarily impaired based upon excessive nitrate/nitrite levels associated with crop production with subsurface drainage. Some of these impacts are coming from the upstream segment of Swan Creek, as well as from contributions from tributaries like Buchman Ditch and Van Fleet Ditch, and the smaller ditches they drain. Artificial drainage is prevalent throughout this sub-watershed. *Critical Area 1* is 7.10 square miles in area (4,544 acres), with approximately 71% of that area (3,213 acres) used for cultivated cropland and hay/pasture purposes. Approximately 15.75 miles of ditch feet exist in this critical area, with an additional 3.3 miles of mainstem Swan Creek; with a riparian setback of 75 feet each side, approximately 346 acres of riparian area could be targeted for restoration. Notably, population growth in parts of this critical area, especially within the limits of Monclova Township (92% of *Critical Area 1*) is occurring at a rapid rate (83.6% growth from 2000-2010 census figures) (U.S. Census Bureau, 2017). Potential land use change and increased development may further exacerbate stress on the aquatic communities in this area.

Goals

The overarching nonpoint source restoration goal of any NPS-IS plan is to improve IBI, MIwb, ICI, and QHEI scores so that the *partial* or *non-attainment* status can achieve full attainment of the designated aquatic life use for that waterbody. The **Heilman Ditch-Swan Creek HUC-12** is in *Partial Attainment* of its designated Warmwater Habitat aquatic life use. This attainment status is due to several different reasons across the hydrologic unit; however, the segment upstream and containing the sampling site at Albon Rd. is in *Partial Attainment* due to the fish community only partially achieving its criteria, while the macroinvertebrate community and habitat scoring reached targeted values. The remaining goals for *Critical Area 1* of the **Heilman Ditch-Swan Creek HUC-12** are to improve the MIwb score at the Albon Rd. sampling site on Swan Creek (RM 18.5) so that the *Partial Attainment* status for this sampling site can be changed to full attainment of the designated WWH aquatic life use. These goals are to specifically:

Maintain IBI score at or above of 32 at Albon Road sampling site on Swan Creek (RM 18.5).

• ACHIEVED: Site currently has a score of 41.

Achieve MIwb score of 7.3 at Albon Road sampling site on Swan Creek (RM 18.5).

• NOT ACHIEVED: Site currently has a score of 6.4.

Maintain ICI score at or above 34 at Albon Road sampling site on Swan Creek (RM 18.5).

• ACHIEVED: Site currently has a score of 38.

Maintain QHEI score at or above 60 at Albon Road sampling site on Swan Creek (RM 18.5).

• ACHIEVED Site currently has a score of 66.5.

3.2.5. Objectives

In order to achieve the overall nonpoint source restoration goal of restoring *Full Attainment* to the **Heilman Ditch-Swan Creek HUC-12**, the following objectives need to be achieved within *Critical Area 1*. These practices address not only the restoration goals for this HUC-12, but also may help improve water quality in the Lake Erie basin.

Objective 1. Increase the retirement of marginal and highly vulnerable lands.

• Enroll at least 5% of current agricultural land (≥ 160 acres) in *Critical Area 1* into programs such as the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), and Conservation Reserve Enhancement Program (CREP).

Objective 2. Install 2-stage ditches for the creation of functional floodplain bench.

• Install at least 0.5 miles of 2-stage ditches in existing floodplain areas, representing ≥ 3% of ditch length in *Critical Area 1.*

Objective 3. Install drainage control structures for reduced erosion and nutrient loss.

• Control drainage from at least 300 acres of row crops.

Objective 4. Reduce erosion and nutrient loss through installation of grassed waterways.

• Install at least 9 acres of grassed waterways (at least 25 ft. width each side) along ditches.

Objective 5. Plant cover crops for long-term conservation crop rotations.

• Plant at least 1500 acres of cover crops on row-crop fields.

Objective 6. Establish forested riparian barrier along impacted or barren stretches of Swan Creek and tributaries within the critical area.

• Re-establish at least 9 acres of riparian buffer, representing ≥ 3% of the available riparian area along Swan Creek and tributaries in *Critical Area 1*.

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). 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 goals, or altered, as a systems approach of multiple best management practices (BMPs) can accelerate the improvement of water quality conditions. The Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) 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 the Upper-Urbanized Reach of Heilman Ditch-Swan Creek HUC-12

3.3.1. Detailed Characterization

The Swan Creek sampling site locations at RM 4.4 (Upstream South Avenue) and RM 4.2 (Downstream South Avenue) are located within the most heavily urbanized area of the **Heilman Ditch-Swan Creek HUC-12**. Both sampling locations are listed in *Partial Attainment* of the Warmwater Habitat aquatic life use designation from the effects of urban runoff/storm sewers and impoundment, causing altered habitat, high siltation/sedimentation and excess nitrate levels. This reach is most affected by the impacts of urbanization.



FIGURE 14: SWAN CREEK AT ~RM 6.25.

Sampling points upstream (RM 15.30 and 10.84)

are both in full-attainment. Beyond RM 10.84, Swan Creek flows through Swan Creek Metropark, a high-quality preserved floodplain. The park boundaries end at ~RM 6.75. Between RM 6.75 and the South Ave. sampling points, the creek is actively eroding its banks, relatively contained to its channel, and interspersed with detached floodplains (Figure 14). The low-head dam located near these sampling points cannot be removed due to existing sewer and roadway infrastructure. A large-scale project was implemented in 2009 to mitigate fish passage through the dam during periods of low flow, restore floodplain function, and improve the aquatic health and water quality in Swan Creek. Sampling in the summer of 2017 may show improvements in the biological indices from this project at these locations.



FIGURE 15: HEILMAN DITCH-SWAN CREEK HUC-12 CRITICAL AREA 2.

Using the rationale described in the Handbook for Developing Watershed Plans to Restore and Protect Our Waters (U.S. Environmental Protection Agency, 2008) (Section 10.3.4): "In general, <u>management practices are</u> <u>implemented immediately adjacent to the waterbody or upland</u> to address the sources of pollutant loads."— *Critical Area 2* includes the sub-watershed area of Swan Creek that contributes runoff or drainage waters to this reach, between RM 6.75 and RM 3.75 (Figure 15).

3.3.2. Detailed Biological Conditions

Fish community data is summarized below for the South Ave. sampling sites in *Critical Area 2* (Table 10). Analysis of the abundance, diversity, and pollution tolerance of existing fish species found by Ohio EPA at these sampling locations in relation to QHEI scores aids in identification of causes and sources of impairment. The Upstream South Ave. sampling site (RM 4.4) is just marginally achieving attainment status due to the score falling within the nonsignificant departure range (31, goal is 34). The Downstream South Ave. sampling site (RM 4.2) is currently meeting the WWH standard for IBI score (42, goal is 32). The MIwb scores at both sites (RM 4.4 and 4.2) are reaching attainment status (8.7 and 8.2, respectively; goal is 8.6 and 7.3, respectively). The habitat score at the Upstream South Ave. site is low (43.5, goal is 60), mainly due to existing impoundment, while the Downstream South Ave. site scored well (74.5), due to silt-settling properties of the dam.

Stream/RM	D.A. (mi²)	Total Species	QHEI	I MIwb IBI Predominant Species (percent of catch)		Narrative Evaluation	
Heilman Ditch-Swan Creek (WWH) (Partial Attainment)							
Swan Creek 4.4 ^B	200.0	33	43.5	8.7	31 ^{ns}	white sucker (21%), bluegill sunfish (19%), spotted sucker (6%)	Good- Fair
Swan Creek 4.2 ^w	200.0	29	74.5	8.2	42	greenside darter (31%), emerald shiner (26%), logperch (9%)	Good

TABLE 10. CRITICAL AREA 2 - FISH COMMUNITY AND HABITAT DATA (OHIO EPA, 2009A).

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤ 4 IBI or ICI units; ≤ 0.5 MIwb units).

w Wading site.

B Boat site.

Characteristics of the aquatic macroinvertebrate community for the South Ave. sampling sites in *Critical Area 2* are summarized below (Table 11). Once again, analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at this sampling location, related to QHEI scores can aid in the identification of causes and sources of impairment. The South Ave. sampling sites (RM 4.4 and 4.2) are both below attainment values for the WWH standard for ICI score (16 and 22, respectively; goal is 34 both sites).

TABLE 11. CRITICAL AREA 2 - MACROINVERTEBRATE COMMUNITY DATA (OHIO EPA, 2009A).

Stream/RM	ICI Score Narrative	Notes	Predominant Species
Heilman Ditc	h-Swan Creek (WV	VH) (Partial Attainment)	
Swan Creek	16 — Fair	Moderate	Damselflies (F), sow bugs (MT), fingernail clams (F)
4.4 ^B	7 sensitive taxa	Qualitative density	
Swan Creek	22—Fair	Low-Moderate	Hydropsychid caddisflies (F), baetid mayflies (F), midges (F, MI)
4.2 ^w	12 sensitive taxa	Qualitative density	

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤ 4 IBI or ICI units; ≤ 0.5 MIwb units).

w Wading site.

B Boat site.

3.3.3. Detailed Causes and Associated Sources

The South Ave. (RM 4.4 and 4.2) sampling sites are listed as in *Partial Attainment* of the Warmwater Habitat aquatic life use designation (Table 12). The causes for the *Partial Attainment* listing include direct habitat alterations, siltation/sedimentation and high nitrate/nitrite levels (RM 4.2 only), all attributed to impoundment and urban runoff/storm sewers. Habitat attributes at the downstream (RM 4.2) location benefit from the silt-settling properties of the dam and consistently meet Warmwater Habitat Attributes, with the exception of poor pool development and low sinuosity. Habitat attributes at the upstream sampling location (RM 4.4) reflect the highly urbanized landscape, mainly due to impoundment at that location. The data summarized previously in **Error! Reference source not found.** from the Ohio EPA Technical Support Document (Ohio EPA, 2009a) reveal a direct link between the presence of attributes that have moderate to high influence on the *Partial Attainment* listing at the Upstream South Ave. sampling site (i.e., non-attainment of QHEI and ICI goals).

These contributing attributes from the adjacent watershed of Critical Area 2 include:

- Channelization
- Silt and Muck Substrates
- Heavy or Moderate Silt Cover
- Fair/Poor Development
- Low Sinuosity
- Slow Current
- High to Moderate Embeddedness
- Absence of Riffles

Projects that address the above described habitat-related attributes (e.g., embeddedness) will positively affect the QHEI scoring index. It is expected that as the habitat (QHEI) score becomes better, the IBI, MIwb and ICI indices scoring will also improve.

TABLE 12. SUMMARY DATA FOR CRITICAL AREA 2 (OHIO EPA, 2009A).

RM	IBI	MIwb	ICI	QHEI	Status	Primary Cause(s)	Primary Source(s)	Location
Heilmai	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)							
Swan C	reek							
4.40 ^в	31 ^{ns}	8.7	16 [*]	43.5	Partial	Direct habitat alterations, sedimentation/siltation	Impoundment, urban runoff/storm sewers	Upstream South Ave.
4.20 ^w	42	8.2	22*	74.5	Partial	Nitrate/nitrite, sedimentation/siltation	Urban runoff/storm sewers, upstream impoundment	Downstrea m South Ave.

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).

W Wading site.

B Boat site.

3.3.4. Outline Goals and Objectives for the Critical Area

Critical Area 2 is approximately 972 acres, of which 87% is developed land. As explained in detail above, *Critical Area 2* is impaired based upon direct effects of urbanization —mainly direct habitat alterations and associated impacts of urban runoff. Impoundment at RM 4.4 and a low-head dam upstream of RM 4.2 pose infrastructure challenges that negatively affect aquatic communities. Restorative efforts just upstream of these sites may mitigate exacerbation of stress on communities already caused by the infrastructural limitations of these sites.

Goals

The overarching nonpoint source restoration goal of any NPS-IS plan is to improve IBI, MIwb, ICI, and QHEI scores so that the *partial* or *non-attainment* status can achieve full attainment of the designated aquatic life use for that waterbody. The **Heilman Ditch-Swan Creek HUC-12** is in *Partial Attainment* of its designated Warmwater Habitat aquatic life use. This attainment status is due to several different reasons across the hydrologic unit; however, the segment upstream and containing the sampling sites at South Ave. are in *Partial Attainment* due to macroinvertebrate communities not reaching targeted values, as well as low habitat scores surrounding impoundment. The remaining goals for *Critical Area 2* of the **Heilman Ditch-Swan Creek HUC-12** are to improve ICI scores at both sites, while increasing the habitat score at the Upstream South Ave. location so that the *Partial Attainment* status for both sampling sites can be changed to full attainment of the designated WWH aquatic life use. These goals are to specifically:

Achieve IBI score of 34 at Upstream South Avenue sampling site on Swan Creek (RM 4.4).

• NOT ACHIEVED: Site currently has a score of 31.

Maintain IBI score at or above 32 at Downstream South Avenue sampling site on Swan Creek (RM 4.2).

• ACHIEVED: Site currently has a score of 42.

Maintain MIwb score at or above 8.6 at Upstream South Avenue sampling site on Swan Creek (RM 4.4).

• ACHIEVED: Site currently has a score of 8.7.

Maintain MIwb score at or above 7.3 at Downstream South Avenue sampling site on Swan Creek (RM 4.2).

• ACHIEVED: Site currently has a score of 8.2.

Achieve ICI score of 34 at Upstream South Avenue sampling site on Swan Creek (RM 4.4).

• NOT ACHIEVED: Site currently has a score of 16.

Achieve ICI score of 34 at Downstream South Avenue sampling site on Swan Creek (RM 4.2).

• NOT ACHIEVED: Site currently has a score of 22.

Achieve QHEI score of 60 at Upstream South Avenue sampling site on Swan Creek (RM 4.4).

• NOT ACHIEVED: Site currently has a score of 43.5.

Maintain QHEI score at or above 60 at Downstream South Avenue sampling site on Swan Creek (RM 4.2).

• ACHIEVED: Site currently has a score of 74.5.

3.3.5. Objectives

In order to achieve the overall nonpoint source restoration goal of restoring *Full Attainment* to the **Heilman Ditch-Swan Creek HUC-12**, the following objectives need to be achieved within *Critical Area 2*. These practices address not only the restoration goals for this HUC-12, but also may help improve water quality in the Lake Erie basin.

Objective 1. Restore eroding streambank within Critical Area 2.

• Stabilize at least 1000 feet of eroding streambank of Swan Creek between RM 6.75 and RM 4.4.

Objective 2. Create in-stream habitat for fish and macroinvertebrate populations.

• Restore at least 500 linear feet of in-stream habitat in Swan Creek between RM 6.75 and RM 4.4.

Objective 3. Restore floodplain connectedness and functionality.

• Restore at least 50 acres of riparian floodplain habitat.

Objective 4. Reduce stormwater inputs and impacts in the subwatershed.

• Implement green infrastructure projects within *Critical Area 2* that retain, detain, and/or treat runoff from at least 85 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.), accounting for approximately 10% of the impermeable surface of *Critical Area 2*.

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). 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 goals, or altered, as a systems approach of multiple best management practices (BMPs) can accelerate the improvement of water quality conditions. The Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) 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 Blystone Ditch in the Heilman Ditch-Swan Creek HUC-12

3.4.1. Detailed Characterization

The sampling location in Blystone Ditch at Monclova Rd. (RM 0.54) is listed in *Partial Attainment* of the Warmwater Habitat aquatic life use designation, due to sedimentation/siltation and direct habitat alterations, associated with the effects of crop production with subsurface drainage and channelization. Due to its location in a highly agricultural section of the watershed, impairment within this section is likely attributed to land use characteristics of its entire subwatershed, from its headwater tributaries in the most southern portion of the **Heilman Ditch-Swan Creek HUC-12** to its lower reaches near the confluence with Swan Creek.

Using the rationale described in the Handbook for Developing Watershed Plans to Restore and Protect Our Waters (U.S. Environmental Protection Agency, 2008) (Section 10.3.4): "In general, <u>management practices are</u> <u>implemented immediately adjacent to the waterbody or upland</u> to address the sources of pollutant loads." — *Critical Area 3* (Figure 16) includes the watershed and riparian areas of Blystone Ditch and its tributaries that contribute runoff or drainage waters to Blystone Ditch from the headwaters to RM 0.54 (Table 13).



FIGURE 16: HEILMAN DITCH-SWAN CREEK HUC-12 CRITICAL AREA 3.

TABLE 13.	WATERWAYS	INCLUDED IN	CRITICAL	AREA 3
			0.	

Heilman Ditch-Swan Creek HUC-12					
Blystone Ditch	Farnsworth Ditch				
Stebbins Ditch	Moser Ditch				
Meyer Ditch					

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (\leq 4 IBI or ICI units; \leq 0.5 MIwb units).

H Headwater site.

3.4.2. Detailed Biological Conditions

Fish community data is summarized below for the Monclova Rd. sampling site in Blystone Ditch in *Critical Area 3* (Table 14). Analysis of the abundance, diversity, and pollution tolerance of existing fish species found by Ohio EPA at this sampling location in relation to QHEI score aids in identification of causes and sources of impairment. The Monclova Rd. sampling site is currently meeting the WWH standard for IBI score (34, goal is 28). MIwb is not applicable at this site, due to its designation as a headwater site. Habitat scores at the Monclova Rd. sampling location are not meeting WWH expectations (46, goal is 60), likely due to the predominance of agricultural land practices.

TABLE 14. CRITICAL AREA 3 - FISH COMMUNITY AND HABITAT DATA (OHIO EPA, 2009A).

Stream/RM	D.A. (mi²)	Total Species	QHEI	MIwb	IBI	Predominant Species (percent of catch)	Narrative Evaluation
Heilman Ditch-Swan Creek (WWH) (Partial Attainment)							
Blystone Ditch 0.54 ^w	6.5	16	46	NA	34	Bluegill sunfish (23%), green sunfish (16%), creek chub (15%),	Marginally Good

Characteristics of the aquatic macroinvertebrate community for the Monclova Rd. sampling site in Blystone Ditch in *Critical Area 3* are summarized below (Table 15). Once again, analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by Ohio EPA at this sampling location, related to QHEI scores can aid in the identification of causes and sources of impairment. The Monclova Rd. sampling site is currently not meeting the WWH standard for ICI score (Fair).

TABLE 15. CRITICAL AREA 3 - MACROINVERTEBRATE COMMUNITY DATA (OHIO EPA, 2009A).

Stream/ RM	ICI Score Narrative	Notes	Predominant Species		
Heilman Ditch-Swan Creek (WWH) (Partial Attainment)					
Blystone Ditch 0.54 ^w	NA — Fair [*] 3 sensitive taxa	Low-Moderate Qualitative density	Midges (T, F, MI)		

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

NA ICI narrative score only assigned.

w Wading site.

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

3.4.3. Detailed Causes and Associated Sources

The Monclova Rd. (RM 0.54) sampling site in Blystone Ditch is listed as in *Partial Attainment* of the Warmwater Habitat aquatic life use designation (Table 16). The cause for the *Partial Attainment* listing is sedimentation/siltation and direct habitat alterations with listed sources being crop production with subsurface drainage and channelization.

TABLE 16. SUMMARY DATA FOR CRITICAL AREA 3 (OHIO EPA, 2009A).

Mlwb ^a	ICI	QHEI	Status	Primary Cause	Primary Source	Location	
Heilman Ditch-Swan Creek HUC-12 (04100009 08 04) Blystone Ditch							
NA	F ^b	46	Partial	Sedimentation/siltation, direct	Crop production with	Albon	
i	Mlwb ^a tch-Swan <i>itch</i> NA	Miwb ^a ICI tch-Swan Cree <i>itch</i> NA F ^b	Miwb ^a ICI QHEI tch-Swan Creek HUC-1 <i>itch</i> NA F ^b 46	Miwb ^a ICI QHEI Status tch-Swan Creek HUC-12 (04100 <i>itch</i> NA F ^b 46 Partial	Miwb ^a ICl QHEI Status Primary Cause tch-Swan Creek HUC-12 (04100009 08 04) itch NA F ^b 46 Partial Sedimentation/siltation, direct habitat alterations	Miwb ^a ICl QHEI Status Primary Cause Primary Source tch-Swan Creek HUC-12 (04100009 08 04) itch Sedimentation/siltation, direct Crop production with subsurface drainage	

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).

a The MIwb (Modified Index of well-being) is not applicable to headwater sites (<20mi²).

b Narrative evaluation used in lieu of ICI (Good; MG=Marginally Good; Fair; L Fair=Low Fair; Poor; VP=Very Poor). W Wading site.

Approximately 69% of the land in *Critical Area 3* is currently used for cultivated cropland. Habitat attributes at this site reflect the highly agricultural landscape. The data summarized previously in **Error! Reference source not found.** from the Ohio EPA Technical Support Document (Ohio EPA, 2009a) reveal a direct link between the presence of attributes that have moderate to high influence on the *Partial Attainment* listing at the Blystone Ditch- Monclova Rd. sampling location (i.e., non-attainment of QHEI and ICI goals).

These contributing attributes from the adjacent watershed of Critical Area 3 include:

- Channelization
- Silt and Muck Substrates
- Heavy or Moderate Silt Cover
- Fair/Poor Development
- Slow Current
- High to Moderate Embeddedness
- Absence of Riffles

While Blystone Ditch was the only Swan Creek tributary cited as having a relatively strong riparian buffer, extensive siltation is caused by flashy storm water discharges from neighboring communities and tiled agricultural fields (Ohio EPA, 2009a). Smaller ditches flowing to Blystone Ditch have little to no riparian buffer.

3.4.4. Outline Goals and Objectives for the Critical Area

Critical Area 3 is primarily impaired based upon sedimentation/siltation and direct habitat alterations associated with crop production with subsurface drainage and channelization. Artificial drainage is prevalent throughout this sub-watershed. *Critical Area 3* is 6.85 square miles in area (4,384 acres), with approximately 69% of that area (3,024 acres) used for cultivated cropland. Approximately 12.80 miles of ditch feet exist in this critical area, with a riparian setback of 75 feet each side; thus, approximately 233 acres of riparian area could be targeted for restoration. Population growth in this critical area is increasing, though not quite as quickly as in *Critical Area 1*. Approximately 50% of *Critical Area 3* lies within Waterville Township limits, which is experiencing growth of approximately 20% over the last 10 year census (2000-2010) (U.S. Census Bureau, 2017).

Goals

The overarching nonpoint source restoration goal of any NPS-IS plan is to improve IBI, MIwb (not applicable at headwater sites), ICI, and QHEI scores so that the *partial* or *non-attainment* status can achieve full attainment of the designated aquatic life use for that waterbody. The **Heilman Ditch-Swan Creek HUC-12** is in *Partial Attainment* of its designated Warmwater Habitat aquatic life use. This attainment status is due to several different reasons across the hydrologic unit; however, the segment upstream and containing the sampling site at Monclova Rd. in Blystone Ditch is in *Partial Attainment* due to the macroinvertebrate community and habitat scores being below targeted values. The remaining goals for *Critical Area 3* of the **Heilman Ditch-Swan Creek HUC-12** is to improve the ICI and QHEI score at the Monclova Rd. sampling site on Blystone Ditch at RM 0.54 so that the *Partial Attainment* status for this location can be changed to full attainment of the designated WWH aquatic life use. These goals are to specifically:

Maintain IBI score at or above 28 at Monclova Road sampling site on Blystone Ditch (RM 0.54).

• ACHIEVED: Site currently has a score of 41.

Achieve ICI score of 34 (Good) at Monclova Road sampling site on Blystone Ditch (RM 0.54).

• NOT ACHIEVED: Site currently has a narrative score of Fair.

Achieve QHEI score of 60 at Monclova Road sampling site on Blystone Ditch (RM 0.54).

• NOT ACHIEVED: Site currently has a score of 46.

3.4.5. Objectives

In order to achieve the overall nonpoint source restoration goal of restoring *Full Attainment* to the **Heilman Ditch-Swan Creek HUC-12**, the following objectives need to be achieved within *Critical Area 3*. These practices address not only the restoration goals for this HUC-12, but also may help improve water quality in the Lake Erie basin.

Objective 1. Increase the retirement of marginal and highly vulnerable lands.

• Enroll at least 5% of current agricultural land (≥ 160 acres) in *Critical Area 1* into programs such as the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), and Conservation Reserve Enhancement Program (CREP).

Objective 2. Install 2-stage ditches for the creation of functional floodplain bench.

• Install at least 0.4 miles of 2-stage ditches in existing floodplain areas, representing ≥ 3% of ditch length in *Critical Area 3*.

Objective 3. Install drainage control structures for reduced erosion and nutrient loss.

• Control drainage from at least 300 acres of row crops.

Objective 4. Reduce erosion and nutrient loss through installation of grassed waterways.

• Install at least 7 acres of grassed waterways (at least 25 ft. width each side) along ditches.

Objective 5. Plant cover crops for long-term conservation crop rotations.

• Plant at least 1500 acres of cover crops on row-crop fields.

Objective 6. Establish forested riparian barrier along impacted or barren stretches of Swan Creek and tributaries within the critical area.

• Re-establish at least 7 acres of riparian buffer, representing ≥ 3% of the available riparian area along Blystone Ditch and tributaries in *Critical Area 3*.

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). 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 goals, or altered, as a systems approach of multiple best management practices (BMPs) can accelerate the improvement of water quality conditions. The Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) 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

4.1. Overview Tables and Project Sheets for Critical Areas

Projects and evaluation needs are identified for the **Heilman Ditch-Swan Creek HUC-12** based upon identified causes and associated sources of nonpoint source pollution. Over time, these critical areas will need to be reevaluated to determine progress towards meeting restoration and attainment 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 nonpoint source pollution sources may arise. Those issues will need to be addressed under different initiatives, authorities or programs which may or may not be accomplished by the same implementers addressing the nonpoint source pollution issues.

For the **Heilman Ditch-Swan Creek HUC-12** there are three *Project and Implementation Strategy Overview Tables* (subsections 4.2.1, 4.3.1, 4.4.1). Future versions of this NPS-IS will 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 **Heilman Ditch-Swan Creek HUC-12**.
- Priority 3 In an effort to generate interest in projects, an information and education campaign will be developed and delivered. Such outreach will engage citizens to spark interest by stakeholders to participate and implement projects like those mentioned in Priority 1 and 2.

Project Summary Sheets (PSS) are in subsections 4.2.2, 4.3.2 and 4.4.2. These PSS 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 PPS created will be submitted to the state of Ohio for funding eligibility verification (i.e., all nine elements are included).

4.2. Critical Area 1: Overview Table and Project Sheet(s) for the Upper Reach of Heilman Ditch-Swan Creek HUC-12

The information included in the *Critical Area 1 Overview Table* is a condensed overview of all identified projects needed for nonpoint source restoration of the **Heilman Ditch-Swan Creek HUC-12** *Critical Area 1*. Project Summary Sheets are included for short-term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

4.2.1. Critical Area 1: Project and Implementation Strategy Overview Table

The **Heilman Ditch-Swan Creek HUC-12** *Critical Area 1* is based on *Partial Attainment* status of the aquatic life use designation at the Albon Rd. sampling site (RM 18.5). The Critical Area 1 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This Overview Table is intended to show a prioritized path toward the restoration of the **Heilman Ditch-Swan Creek HUC-12**.

Critical Area 1: Project Overview Table for Heilman Ditch-Swan Creek HUC-12 (04100009 08 04))								
Goal	Objective	Project #	Project Title (EPA Criteria g)	Lead Organization (criteria d)	Time Frame (EPA Criteria f)	Estimated Cost (EPA Criteria d)	Potential/Actual Funding Source (EPA Criteria d)	
Urban Se	diment and	Nutrient F	Reduction Strategies*		-	-	-	
Altered S	tream and H	labitat Re	storation Strategies*			1		
1-4	2,6	3	Two-Stage Ditch Restoration in Van Eleet Ditch	PergirEerTED	short (1-3 years, GLR	I ^{\$,73} 20020-	200 2 F2 §319, GLRI	
1-4	2,6	4	Two-Stage Ditch Restoration in Van Fleet Ditch: Phase 2	Lucas County Penginger ED	Short (1-3 y ca rs <mark>) E P</mark>	Â ^{395,903} 9; 2	$0^{hi2} \overline{0}^{PA} \overline{0}^{8319} \overline{2}^{CLPI} \overline{2}^{2}$	
1-4	2,6	5	Two Stage Ditch Restoration in Morrison Ditch	Lucas County Engineer	Short (1-3 years)	\$213,050	Ohio EPA §319	
1-4	1,6	-	Forested Buffer Installation	Lucas County SWCD	Long (7+ years)	\$50,000	Ohio EPA §319, GLRI, CRP and CREP Programs	
1-4	6	-	Van Fleet Restoration	Metroparks of Toledo Area	Short (1-3 years)	\$60,000	Ohio EPA §319, GLRI, SOGL	
Agricultu	Agricultural Nonpoint Source Reduction Strategies*							
1-4	3,5	1	Best Management Practices Incentive Program FUN	Lucas County	Short (=3 Pe As) 3	\$55,000 19:2018	Ohio EPA §319, GLRI, €2 0 2 0	
1-4	3,5	2	Peer Education Best Management F U N Practices F U N	DVED DUNTY	C(E3PeA) 3	1 ^{\$} 9 ^{\$50} 2 0 1 8	Ohio Environmental	
1-4	2,6	3	Two-Stage Ditch Restoration in Van Fleet Ditch	Deficiency (Short (1-3 July Ear R I; 2	0 ⁷²⁵⁰⁰⁰ 202	2hio EPA §319, GLRI	
1-4	2,6	4	Two-Stage Ditch Restoration in Van Fleet Ditch: Phase 2 FUN	Lucas County	Short (1-3	1 ^{\$?} 9 ⁵ ; ⁹⁰ 2020	0 ^{ch} 2 ⁶ 2 ⁸ 2 ^{19, GLRI}	
1-4	2,6	5	Two Stage Ditch Restoration in Morrison Ditch	Lucas County Engineer	Short (1-3 years)	\$213,050	Ohio EPA §319	
1-4	1,4	-	Grass Buffer Installation	Lucas County SWCD	Medium (3-7 years)	\$25,000	Ohio EPA §319, GLRI, CRP and CREP Programs	
1-4	1,6	-	Forested Buffer Installation	Lucas County SWCD	Long (7+ years)	\$50,000	Ohio EPA §319, GLRI, CRP and CREP Programs	
High Qua	lity Waters I	Protection	Strategies*					
Other NF	Other NPS Causes and Associated Sources of Impairment							

*Ohio EPA, 2013

4.2.2. Critical Area 1: Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on the actions or activities needed to restore the RM 18.5 sampling site to attainment of the aquatic life use designation. These projects are considered next step or priority/short term projects and are considerably ready to implement. Medium and longer-term projects will most likely not have a Project Summary Sheet or will not have a complete Project Summary Sheet, as these projects are not ready for implementation or need more thorough planning.

Critical A	rea 1: Project 1	
Nine Element Criteria	Information needed	Explanation
n/a	Title	Agricultural BMP Incentive Program
criteria d	Project Lead Organization & Partners	Lucas County Soil and Water Conservation District
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek 3JC-12 (04100009 08 04)- Critical Area 1
criteria c	Location of Project	Various locations (privately owned lands) throughout Critical Area 1
n/a	Which strategy is being addressed by this project?	Agi cultural Nonpoint Source Reduction
criteria f	Time France M	Short (1-3 Years)
criteria g	Short Description	Establish a program to share costs for agricultural best management practices.
criteria g	Project Narrative	The Lucas County SWCD will contract with farmers in the critical area to plant overwintering cover crops on 1500 acres and install drainage water management structures to control water from 300 acres. Project funds will be used to reimburse the landowners at a rate of \$25 per acre for cover crops and \$1800 per structure for drainage water management.
criteria d	Estimated Total cost	\$55,000
criteria d	Possible Funding Source	Ohio EPA §319, GLRI, EQIP
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective 3: Control drainage from 300 acres through drainage water control structures. Objective 5: Plant 1500 acres of cover crops on row-crop fields.

Nine Element Criteria	Information needed	Explanation
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective 3: Drainage water controlled from 300 acres of 300 acres (100%). Objective 5: 1500 acres of 1500 acres planted with cover crops (100%). Goals: There is recognition that there is lag tipe associated with nonpoint source-related projects and measured stream response. With respect to the goals in Critical Area 1, the main drive as MIWb. Current data shows that the stream in Critical Area 1 is at 6.4-Owhich is 0.9 points below the attainment index score of 7.3. It is expected that this project will cause an incremental increase the MIWb scoring by 0.15 points (or 17% progress toward the goal).
	Part 3: Load reduced?	At the MSUE estimate rates (http://msuc.akr.msu.edu/news/cover_crops_impact_on_water_quality) The cover roots would reduce sedimentation runoff by 1,380 tons per year. The drainage water management would reduce nitrogen runoff by 2,600# per rev. (http://www.soil.ncsu.edu/publications/BMPs/drainage.html)
criteria i	How will the effectiveness of this project to addressing the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017. In addition, the establishment of cover crops and the proper installation of the structures will be verified by Lucas County SWCD staff.
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations to area landowners. The Lucas County SWCD will host field days, coordinate media outreach and develop material (farm signs, barn signs and media kits) for 'peer advertising' from farmers who have adopted BMPs to encourage wider adoption in the critical area.

Critical Area 1: Project 1

Critical Ar	rea 1: Project 2	
Nine Element Criteria	Information needed	Explanation
n/a	Title	Agricultural BMP Peer Education Program
criteria d	Project Lead Organization & Partners	Lucas County Soil and Water Conservation District
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)- Critical Area 1
criteria c	Location of Project	Various locations (privately owned lands) throughout Critical Area 1
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 Years)
criteria g	Short Description	Create an education ampaign targeted to the adoption of agricultural best management practices.
criteria g	Project Narrative	The Lucas County SWCD will host field days, coordinate media outreach and developmeterial (farm signs, barn signs and media kits) for 'peer advertising' from farmers who have adopted BMPs to encourage wider adoption in the oitical area.
criteria d	Estimated Total The cost	\$3,850
criteria d	Provine Funding Source	Ohio Environmental Education Council Funding
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective 3: Control drainage from 300 acres through drainage water control structures. Objective 5: Plant 1500 acres of cover crops on row-crop fields.

Nine		
Element Criteria	Information needed	Explanation
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	The proposed educational project will support progres towards objectives listed in <i>Critical Area 1: Project 1</i> (listed below): Objective 3: Drainage water controlled from 300 acres of 300 acres (100%). Objective 5: 1500 acres of 1500 acres clanted with cover crops (100%). Goals: There is recognition that there is lag time associated with nonpoint source-related projects and measured stream response. With respect to the <i>goals</i> in Critical Area 1, the main driver is MIwb. Current data shows that the stream in Critical Area 1 is at 6.4—which is 0.9 points below the attainment index score of 7.3. It is expected that this project will cause an incremental increated in the MIwb scoring by 0.15 points (or 17% progress toward the goal).
	Part 3: Load PLI reduced? MPLI	At the MSUE estimated rates <u>http://msue.anr.msu.edu/news/cover_crops_impact_on_water_quality</u>) The cover crops would reduce sedimentation runoff by 1,380 tons per year. The drainage water management would reduce nitrogen runoff by 2,600# per year. (<u>http://www.soil.ncsu.edu/publications/BMPs/drainage.html</u>)
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017. In addition, the Lucas Co. SWCD will follow-up with targeted audiences to estimate adoption rate.
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations to area landowners.

Critical Area 1: Project 2

Critical Area 1: Project 3			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Two-Stage Ditch Restoration in Van Fleet Ditch	
criteria d	Project Lead Organization & Partners	Lucas County Office of the Engineer	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (CO.00009 08 04)- Critical Area 1	
criteria c	Location of Project	Van Fleet Ditch, between network and Keener Rds.; Latitude: 41.554863, Longitude: -83.764841	
n/a	Which strategy is being addressed by this project?	Altered Stream and Habitat Restoration; Agricultural Nonpoint Source Reduction	
criteria f	Time Frame	ohert (1-3 Years)	
criteria g	Short Description	Planning, design and installation of a two-stage ditch along 0.75 miles of Van Fleet Ditch	
criteria g	Project Narrative	Van Fleet Ditch is a highly channelized, agricultural drainage ditch within a sub-basin of the Maumee River. This project includes the planning, engineering, design and construction of a two-stage channel along a 0.75 mile stretch of Van Fleet Ditch, creating a two-sided floodplain bench along 3,050 linear feet and a one-sided floodplain bench along an additional 730 linear feet. Native shrubs and grasses will be used to create 3.9 acres of riparian buffer. Two-stage channel implementation is expected to reduce sediment and nutrient loads flowing to the Maumee River, which empties directly into Lake Erie and contributes to algal blooms occurring in the Western Basin.	
criteria d	Estimated Total cost	\$735,000	
criteria d	Possible Funding Source	Ohio EPA §319, GLRI	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage	
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	There is recognition that there is lag time associated with nonpoint source- related projects and measured stream response. With respect to the <i>goals</i> in Critical Area 1, the main driver is MIwb. Current data (2018 Integrated Report) shows that the stream in Critical Area 1 is at 6.4—which is 0.9 points below the attainment index score of 7.3.	

Critical Area 1: Project 3			
Nine Element Criteria	Information t Explanation needed		
	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 an incremental increase in the MIwb scoring by 0.25 points (or 27% progress toward the goal) through progress made towards the long-term objectives listed below: Objective 2. Install at least 0.75 miles of 5 fulles of 2-stage ditches in existing floodplain areas, representing 2.3% of ditch length in <i>Critical Area 1</i> (150%). Objective 6. Re-establish at least 3.9 of 9 acres of riparian buffer, representing \geq 3% of the available riparian area along Swan Creek and tributaries in <i>Critical Area 1</i> . (43%)	
	Part 3: Load reduced?	Estimated 240 #N/year, 93 #P/year, 51 tons of sediment/year.	
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	The Swan Creek sampling site at the mouth of Van Fleet Ditch will be monitored (as part of the State's ongoing surface water monitoring program cycle) to determine progress (through IBI, ICI, and QHEI) from partial attainment to full attainment.	
criteria e	Information and Education	Lucas County will promote the project through press releases, online newsletters, websites and social media, both through county outreach outlets, as well as those of partnering organizations. In addition, signage about the project and its benefits will placed on Monclova Township property near the project site.	

Critical Area 1: Project 4			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Two-Stage Ditch Restoration in Van Fleet Ditch: Phase 2	
criteria d	Project Lead Organization & Partners	Lucas County Office of the Engineer	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)- Critical Area 1	
criteria c	Location of Project	Van Fleet Ditch, between Keener Rd and the Wabash Cannonball Trail; Latitude: 41.553819, Longitude: -83.752356	
n/a	Which strategy is being addressed by this project?	Altered Stream and Habitat Restoration; Grieultural Nonpoint Source Reduction	
criteria f	Time Frame	Short (1-3 Years)	
criteria g	Short Description	Planning, design and isallation of a two-stage ditch along 0.42 miles of Van Fleet Ditch	
criteria g	Project Narrative	Van Fleet bick is a highly channelized, agricultural drainage ditch within a sub-basil of the Maumee River. Van Fleet is currently privately maintained, but landowners have actively been engaged in the petition process to bring its length under formal maintenance by Lucas County. Once included in the County's Ditch Maintenance Program, segments of the ditch will be improved with functional floodplain bench and two-stage design where possible. This project includes the planning, engineering, design and construction of a two-stage channel along a 0.42 mile stretch of Van Fleet Ditch, creating a two-sided floodplain bench and using native shrubs and grasses to create two acres of riparian buffer. The project builds upon Project #3, in which it will help form a contiguous stretch of two-stage channel in Van Fleet Ditch. Two-stage channel implementation is expected to help reduce sediment and nutrient loads flowing to the Maumee River, which empties directly into Lake Erie and contributes to algal blooms occurring in the Western Basin.	
criteria d	Estimated Total cost	\$395,903 (\$295,903 requested; \$100,000 cash match)	
criteria d	Possible Funding Source	Ohio EPA §319, GLRI	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage	

Critical Area 1: Project 4			
Nine Element Criteria	Information needed	Explanation	
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	There is recognition that there is lag time associated with nonpoint source- related projects and measured stream response. With respect to the <i>goals</i> in Critical Area 1, the main driver is MIwb. Current data (2018 Integrated Report) shows that the stream in Critical Area 1 is at 6.4—which is 0.9 points below the attainment index score of 7.3.	
	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 an incremental increase in the MIwb scoring by 0.25 points (or 27% progress toward the goal) through progress made towards the long-term objectives listed below: Objective 2. Install at least 0.42 of 0.5 miles of 2-stage ditches in existing floodplain areas, representing \geq 3% of ditch length in <i>Critical Area 1</i> (84%). Objective 6. Spectablish at least 2 of 9 acres of riparian buffer, representing \geq 3% of the valiable riparian area along Swan Creek and tributaries in <i>Critical Area 1</i> . (22%)	
	Part 3: Load reduced?	Famated: 120 #N/year, 47 #P/year, 25.4 tons of sediment/year.	
criteria i	How will the effective evof this project in addressing the NPS impairment be measured?	The Swan Creek sampling site at the mouth of Van Fleet Ditch will be monitored (as part of the State's ongoing surface water monitoring program cycle) to determine progress (through IBI, ICI, and QHEI) from partial attainment to full attainment.	
criteria e	Information and Education	Lucas County will promote the project through press releases, online newsletters, websites and social media, both through county outreach outlets, as well as those of partnering organizations. In addition, signage about the project and its benefits will placed on Monclova Township property near the project site.	

Critical Area 1: Project 5			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Two Stage Ditch Restoration in Morrison Ditch	
criteria d	Project Lead Organization & Partners	Lucas County Office of the Engineer	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04) - Critical Area 1	
criteria c	Location of Project	Morrison Ditch, between Weckerly Rd. and Monclova Rd.; Latitude: 41.560772, Longitude: -83.761557	
n/a	Which strategy is being addressed by this project?	Altered Stream and Habitat Restoration; Agricultural Nonpoint Source Reduction	
criteria f	Time Frame	Short (1-3 Years)	
criteria g	Short Description	Planning, design and installation of a two-stage ditch along 0.35 miles of Morrison Ditch	
criteria g	Project Narrative	Morrison Ditch, a tributary to Van Fleet Ditch, is a highly channelized, agricultural drainage ditch within a sub-basin of the Maumee River. This project includes the planning, engineering, design and construction of a two- stage channel along a 0.35 mile stretch of Morrison Ditch (0.23 miles will be two-sided two-stage channel and 0.12 miles will be a one-sided two-stage channel) and the installation of approximately 1.0 acre of riparian buffer. Two-stage channel implementation is expected to reduce sediment load by 18 tons annually and nutrient (nitrogen by 83 lbs annually & phosphorus by 32 lbs annually) loads flowing to the Maumee River, which empties directly into Lake Erie and contributes to algal blooms occurring in the Western Basin.	
criteria d	Estimated Total cost	\$213,050	
criteria d	Possible Funding Source	Ohio EPA §319	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage	
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	There is recognition that there is lag time associated with nonpoint source- related projects and measured stream response. With respect to the <i>goals</i> in Critical Area 1, the main driver is Mlwb. Current data (2018 Integrated Report) shows that the stream in Critical Area 1 is at 6.4—which is 0.9 points below the attainment index score of 7.3.	

Critical Area 1: Project 5			
Nine Element Criteria	Information needed	Explanation	
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be	It is expected that this project will cause an incremental increase in the MIwb scoring by 0.17 points (or 19% progress toward the goal) through progress made towards the long-term objectives listed below: Objective 2. Install at least 0.35 of 0.5 miles of 2-stage ditches in existing floodplain areas, representing \geq 3% of ditch length in <i>Critical Area 1</i> (70%).	
	accomplished by this project?	Objective 6. Re-establish at least 1 acre of 9 acres of riparian buffer, representing \geq 3% of the available riparian area along Swan Creek and tributaries in <i>Critical Area</i> 1. (11%)	
	Part 3: Load reduced?	Estimated: 83 #N/year, 32 #P/year, 18 tons of sediment/year.	
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	The Swan Creek sampling site at the mouth of Van Fleet Ditch will be monitored (as part of the State's ongoing surface water monitoring program cycle) to determine progress (through IBI, ICI, and QHEI) from <i>Partial</i> <i>Attainment</i> to <i>Full Attainment</i> .	
criteria e	Information and Education	Lucas County will promote the project through press releases, online newsletters, websites and social media, both through county outreach outlets, as well as those of partnering organizations. Public meetings and a site tour will also be conducted. In addition, signage about the project and its benefits will placed on Monclova Township property near the project site.	

4.3. Critical Area 2: Overview Table and Project Sheet(s) for the Upper Urbanized Reach of Heilman Ditch-Swan Creek HUC-12

The information included in the *Critical Area 2 Overview Table* is a condensed overview of all identified projects needed for nonpoint source restoration of the **Heilman Ditch-Swan Creek HUC-12** *Critical Area 2*. Project Summary Sheets are included for short-term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

4.3.1. Critical Area 2: Project and Implementation Strategy Overview Table

The Heilman Ditch-Swan Creek HUC-12 Critical Area 2 is based on Partial Attainment status of the aquatic life use designation at the Upstream and Downstream South Ave. sampling sites (RM 4.4 and 4.2, respectively). The Critical Area 2 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This Overview Table is intended to show a prioritized path toward the restoration of the Heilman Ditch-Swan Creek HUC-12.

<i>Critical Area 2</i> : Project Overview Table for Heilman Ditch-Swan Creek HUC-12 (04100009 08 04))							
Goal	Objective	Project #	Project Title (EPA Criteria g)	Lead Organization (criteria d)	Time Frame (EPA Criteria f)	Estimated Cost (EPA Criteria d)	Potential/Actual Funding Source (EPA Criteria d)
Urban Se	diment and Nu	utrient Red	uction Strategies*			-	
1-8	1,2,3	1	Swan Creek Habitat Restoration and Bank Stabilization	University of Toledo	Short (1-3 years)	\$577,664	Ohio EPA §319, GLRI, SOGL
1-8	4	2	Urban Runoff Reduction at UT Health Science Campus	University of Toledo	Short (1-3 years)	\$750,000	Ohio EPA §319, GLRI, SOGL
Altered S	Altered Stream and Habitat Restoration Strategies*						
1-8	1,2,3	1	Swan Creek Habitat Restoration and Bank Stabilization	University of Toledo	Short (1-3 years)	\$577,664	Ohio EPA §319, GLRI, SOGL
Agricultu	ral Nonpoint S	ource Redu	uction Strategies*				
High Quality Waters Protection Strategies*							
Other NPS Causes and Associated Sources of Impairment							

* Ohio EPA, 2013

4.3.2. Critical Area 2: Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on the actions or activities needed to restore the RM 4.4 and RM 4.2 sampling sites to attainment of the aquatic life use designation. These projects are considered next step or priority/short term projects and are considerably ready to implement. Medium and longer-term projects will most likely not have a Project Summary Sheet or will not have a complete Project Summary Sheet, as these projects are not ready for implementation or need more thorough planning.

Critical Area 2: Project 1			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Swan Creek Habitat Restoration and Bank Stabilization	
criteria d	Project Lead Organization & Partners	University of Toledo	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)- Critical Area 2	
criteria c	Location of Project	Swan Creek, parcels adjacent east to Swan Creek Metropark, bordered by Arlington Avenue to the south (41°37′19.3692″N, 83°36′45.7776″W)	
n/a	Which strategy is being addressed by this project?	Urban Sediment & Nutrient Reduction Altered Stream and Habitat Restoration	
criteria f	Time Frame	Short (1-3 Years)	
criteria g	Short Description	Stabilize 500' of streambank and restore 25 acres of natural floodplain.	
criteria g	Project Narrative	This project will stabilize ~500 ft of highly eroded streambank on the southern edge of Swan Creek, restore ~500 ft of in-stream habitat and include the installation of a bioswale to capture and treat stormwater runoff from Arlington Avenue. Invasive species removal and replanting of native species will occur on an additional 25 acres of the northern and southern floodplain of Swan Creek.	
criteria d	Estimated Total cost	\$577,664	
criteria d	Possible Funding Source	Ohio EPA §319, GLRI, SOGL	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation Source: Urban runoff/storm sewers	

Critical Area 2: Project 1

Nine Element Criteria	Information needed	Explanation
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective 1: Stabilize at least 1000 feet of eroding streambank. Objective 2: Restore at least 500 linear feet of in-stream habitat. Objective 3: Restore at least 50 acres of riparian floodplain habitat.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective 1: Stabilize 500 feet of 1000 feet of streambank (50%). Objective 2: Restore 500 linear feet of 500 linear feet of in-stream habitat (100%). Objective 3: Restore 25 acres of 50 acres of riparian floodplain habitat (50%). Goals: There is recognition that there is lag time associated with nonpoint source-related projects and measured stream response. With respect to the goals in Critical Area 2, the main driver is QHEI. Current data shows that the stream in Critical Area 2 is at 43.5—which is 16.5 points below the attainment index score of 60. It is expected that this project will cause an incremental increase in the QHEI scoring by 8 points (or 50% progress toward the goal), with comparable increases in IBI, MIwb and ICI scores.
	Part 3: Load reduced?	180 #P/year, 1800#N/year, 112 tons of sediment/year.
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. In addition, the South Ave. sampling sites will also be monitored (as part of the State's ongoing surface water monitoring program cycle) to determine progress (through IBI, ICI, and QHEI) from partial attainment to full attainment. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017.
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations at research and practitioner venues. The project will also provide educational opportunities for University of Toledo students as a demonstration restoration project, as well as a field site to monitor post-restoration activities.

Critical Area 2: Project 2			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Urban Runoff Reduction at UT Health Science Campus	
criteria d	Project Lead Organization & Partners	University of Toledo	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)- Critical Area 2	
criteria c	Location of Project	University of Toledo Health Science Campus (41.619320, -83.615549)	
n/a	Which strategy is being addressed by this project?	Urban Sediment & Nutrient Reduction	
criteria f	Time Frame	Short (1-3 Years)	
criteria g	Short Description	Parking lot runoff will be treated using green stormwater infrastructure before release to Swan Creek. Flow will be treated and diverted by infiltration.	
criteria g	Project Narrative	Approximately 20 acres of parking lot at UTHSC will be improved to include green stormwater infrastructure. Runoff from the parking lots will be diverted to green stormwater infrastructure rather than traveling directly to the storm sewer. Green infrastructure will include bioretention through tree/vegetation filters, vegetated swales, and rain gardens along the edge of parking areas.	
criteria d	Estimated Total cost	\$750,000	
criteria d	Possible Funding Source	Ohio EPA §319, GLRI, SOGL	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation Source: Urban runoff/storm sewers	
Criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective #4: Reduce stormwater inputs and impacts in the subwatershed with green infrastructure projects that retain, detain, and/or treat runoff from at least 85 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.).	

Nine Element Criteria	Information needed	Explanation		
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective 4: Green infrastructure project treating 20 acres of 85 acres of impermeable surface (24%). Goals: There is recognition that there is lag time associated with nonpoint source-related projects and measured stream response. With respect to the <i>goals</i> in Critical Area 2, the main driver is QHEI. Current data shows that the stream in Critical Area 2 is at 43.5—which is 16.5 points below the attainment index score of 60. It is expected that this project will cause an incremental increase in the QHEI scoring by 1 point (or 6.25% progress toward the goal), with comparable increases in IBI, MIwb and ICI scores.		
	Part 3: Load reduced?	39#/year of suspended solids, 2.4# P/year, 24# N/year, 1.5 tons of sediment/year		
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. In addition, the South Ave. sampling sites will also be monitored (as part of the State's ongoing surface water monitoring program cycle) to determine progress (through IBI, ICI, and QHEI) from partial attainment to full attainment. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017. In addition, performance sampling will be carried out by University of Toledo students. Changes in total suspended solids concentration in runoff from the UTHSC site will be measured by field sampling. Performance (infiltration volumes and contaminant removal) of green stormwater infrastructure will also be quantified.		
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations at research and practitioner venues. Conceptual designs for the projects will be developed as part of both graduate level and undergraduate level engineering courses at the University of Toledo. Signage will be included at the sites for education of UT Health Science Campus tours and visitors.		

Critical Area 2: Project 2

4.4. Critical Area 3: Overview Table and Project Sheet(s) for Blystone Ditch in the Heilman Ditch-Swan Creek HUC-12

The information included in the *Critical Area 3 Overview Table* is a condensed overview of all identified projects needed for nonpoint source restoration of the **Heilman Ditch-Swan Creek HUC-12** *Critical Area 3*. Project Summary Sheets are included for short-term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

4.4.1. Critical Area 3: Project and Implementation Strategy Overview Table

The **Heilman Ditch-Swan Creek HUC-12** *Critical Area 3* is based on *Partial Attainment* status of the aquatic life use designation at the Monclova Rd. sampling site in Blystone Ditch (RM 0.54). The Critical Area 3 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This Overview Table is intended to show a prioritized path toward the restoration of the **Heilman Ditch-Swan Creek HUC-12**.

<i>Critical Area 3</i> : Project Overview Table for Heilman Ditch-Swan Creek HUC-12 (04100009 08 04))							
Goal	Objective	Project #	Project Title (EPA Criteria g)	Lead Organization (criteria d)	Time Frame (EPA Criteria f)	Estimated Cost (EPA Criteria d)	Potential/Actual Funding Source (EPA Criteria d)
Urban Se	diment and Nu	utrient Red	uction Strategies*	-	-		-
Altered S	tream and Hal	bitat Restor	ration Strategies*				
1-4	1,6	4	Forested Buffer Installation	Lucas County SWCD	Long (7+ years)	\$50,000	Ohio EPA §319, GLRI, CRP and CREP Programs
Agricultu	ral Nonpoint S	ource Redu	action Strategies*				
1-4	3,5	1	Best Management Practices Incentive Program COMPLETED	Lucas County	Short $(1-3 \text{ years})$	$0^{10^{50}}$ 202	Ohio EPA §319, GLRI, EQIP
1-4	3,5	2	Peer Education Best Management Practices COMPLETED	Lucas County	$A^{\text{Short}(1-2)} = 20$	³ ³ ⁸ ⁵⁰ 2020	Ohio Environmental Education Council
1-4	1,4	3	Grass Buffer Installation	Lucas County SWCD	Medium (3-7 years)	\$19,500	Ohio EPA §319, GLRI, CRP and CREP Programs
1-4	1,6	4	Forested Buffer Installation	Lucas County SWCD	Long (7+ years)	\$50,000	Ohio EPA §319, GLRI, CRP and CREP Programs
High Quality Waters Protection Strategies*							
Other NPS Causes and Associated Sources of Impairment							

* Ohio EPA, 2013

4.4.2. Critical Area 3: Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on the actions or activities needed to restore the RM 0.54 sampling site in Blystone to attainment of the aquatic life use designation. These projects are considered next step or priority/short term projects and are considerably ready to implement. Medium and longer-term projects will most likely not have a Project Summary Sheet or will not have a complete Project Summary Sheet, as these projects are not ready for implementation or need more thorough planning.

Critical Area 3: Project 1			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Agricultural BMP Incentive Program	
criteria d	Project Lead Organization & Partners	Lucas County Soil and Water Conservation District	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (0410000000804)- Critical Area 3	
criteria c	Location of Project	Various locations (privately owned lands) throughout Critical Area 3	
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoin Picturce Reduction	
criteria f	Time Frame	Short (13 Years)	
criteria g	Short Description	Republish a program to share costs for agricultural best management practices.	
criteria g	Project Netrative	The Lucas County SWCD will contract with farmers in the critical area to plant overwintering cover crops on 1500 acres and install drainage water management structures to control water from 300 acres. Project funds will be used to reimburse the landowners at a rate of \$25 per acre for cover crops and \$1800 per structure for drainage water management.	
criteria d	Estimated Total cost	\$55,000	
criteria d	Possible Funding Source	Ohio EPA §319, GLRI, EQIP	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage	
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective 3: Control drainage from 300 acres through drainage water control structures. Objective 5: Plant 1500 acres of cover crops on row-crop fields.	

Critical Area 3: Project 1

Nine Element Criteria	Information needed	Explanation
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective 3: Drainage water controlled from 300 acres of 300 acres (100%). Objective 5: 1500 acres of 1500 acres planted with cover crops (100%). Goals: There is recognition that there is lag time associated with nonpoint source-related projects and measured stream esponse. With respect to the goals in Critical Area 1, the main driver With b. Current data shows that the stream in Critical Area 1 is at 6.4—which is 0.9 points below the attainment index score of 7.3. It is expected this project will cause an incremental increase the MIWb scoring by 0.15 points (or 17% progress toward the goal).
	Part 3: Load reduced?	At the MSUE estimated lates (http://msue.archite.edu/news/cover_crops_impact_on_water_quality) The cover crops would reduce sedimentation runoff by 1,380 tons per year. The dramate water management would reduce nitrogen runoff by 2,600# per year (http://www.soil.ncsu.edu/publications/BMPs/drainage.html)
criteria i	How will the effectiveness of this project addressive the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017. In addition, the establishment of cover crops and the proper installation of the structures will be verified by Lucas County SWCD staff.
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations to area landowners. The Lucas County SWCD will host field days, coordinate media outreach and develop material (farm signs, barn signs and media kits) for 'peer advertising' from farmers who have adopted BMPs to encourage wider adoption in the critical area.

Critical Area 3: Project 2			
Nine Element Criteria	Information needed	Explanation	
n/a	Title	Agricultural BMP Peer Education Program	
criteria d	Project Lead Organization & Partners	Lucas County Soil and Water Conservation District	
criteria c	HUC-12 & Critical Area	Heilman Ditch-Swan Creek HUC-12 (04100009 08 04)- Critical Area 3	
criteria c	Location of Project	Various locations (privately owned lands) throughout Critical Area 3	
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction	
criteria f	Time Frame	Short (1-3 Years)	
criteria g	Short Description	Creases on education campaign targeted to the adoption of agricultural best	
criteria g	Project Noralive	The Lucas County SWCD will host field days, coordinate media outreach and develop material (farm signs, barn signs and media kits) for 'peer advertising' from farmers who have adopted BMPs to encourage wider adoption in the critical area.	
criteria d	Estimated Total cost	\$3,850	
criteria d	Possible Funding Source	Ohio Environmental Education Council Funding	
criteria a	Identified Causes and Sources	Cause: Sedimentation/Siltation, Nitrate/Nitrite Source: Crop production with subsurface drainage	
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?	Objective 3: Control drainage from 300 acres through drainage water control structures. Objective 5: Plant 1500 acres of cover crops on row-crop fields.	

Nine Element Criteria	Information needed	Explanation
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	The proposed educational project will support progress towards objectives listed in <i>Critical Area 3: Project 1</i> (listed below): Objective 3: Drainage water controlled from 30 cres of 300 acres (100%). Objective 5: 1500 acres of 1500 acres placed with cover crops (100%). Goals: There is recognition that there is lag time associated with non point source-related projects and recognized stream response. With respect to the <i>goals</i> in Critical Area 1, the main driver is Mlwb. Current data shows that the stream in Critical Area 1, is at 6.4—which is 0.9 points below the attainment index score of 13, t is expected that this project will cause an incremental increase in the Mlwb scoring by 0.15 points (or 17% progress toward the goal).
	Part 3: Load reduced?	At the MSUE estimated rates <u>At the MSUE estimated rates</u> <u>At the MSUE estimated rates</u> <u>The cover crops would reduce sedimentation runoff by 1,380 tons per year</u> . The drainage water management would reduce nitrogen runoff by 2,600# per <u>year</u> . (<u>http://www.soil.ncsu.edu/publications/BMPs/drainage.html</u>)
criteria i	How cilctle effectiveness of this project in addressing the NPS impairment be measured?	Staff from the OEPA-DSW Ecological Assessment Unit will perform both pre- and post- project monitoring. The Ohio EPA Ecological Assessment Unit has scheduled basin-wide watershed chemical and biological assessment for the summer of 2017. In addition, the Lucas Co. SWCD will follow-up with targeted audiences to estimate adoption rate.
criteria e	Information and Education	This project will be promoted with press releases, newspaper articles and presentations to area landowners.

Critical Area 3: Project 2

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Appendix A: Acronyms and Abbreviations

The acronyms and abbreviations below are commonly used by organizations working to restore Ohio's watersheds; many of which are included in this NPS-IS plan.

A AOC	Area of Concern
B BMP BOD	Best Management Practice Biochemical Oxygen Demand
c CSO	Combined Sewer Overflow
D DELT DNR	Deformities, Eroded Fins, Lesions, and Tumors Department of Natural Resources
E EOLP EWH	Erie-Ontario Lake Plain Ecoregion Exceptional Warmwater Habitat
G GIS	Geographical Information System
H HELP Hg HUC	Huron-Erie Lake Plain Ecoregion Mercury Hydrologic Unit Code
I IBI ICI	Index of Biotic Integrity Invertebrate Community Index
L LRW	Limited Resource Water
M Mg/I MGD MIwb MWH	Milligrams per Liter Million Gallons per Day Modified Index of Well Being Modified Warmwater Habitat
N	

NPDES National Pollutant Discharge Elimination System

PPAH PAH PCBPolycyclic Aromatic Hydrocarbons Polychlorinated BiphenylsQQualitative Habitat Evaluation IndexRQualitative Habitat Evaluation IndexRRemedial Action PlanSSSO Soil and Water Conservation DistrictTTotal Maximum Daily Load Limits Technical Support DocumentUμg/kg USACEUMicrograms per Kilogram USACEUSACEUnited States Army Corps of Engineers USDAUUnited States Department of Agriculture USEPAUSACEUnited States Fish and Wildlife Service USGSUSSCUnited States Policy CommitteeVVAPVVoluntary Action Program	
Q QHEIQualitative Habitat Evaluation IndexR RAPRemedial Action PlanS SSOSanitary Sewer Overflow Soil and Water Conservation DistrictT TMDL TSDTotal Maximum Daily Load Limits Technical Support DocumentU µg/kgMicrograms per Kilogram USACEU USPAUnited States Army Corps of Engineers USDAUSDAUnited States Department of Agriculture USEPAUSPCUnited States Environmental Protection Agency USFWSV USPCVoluntary Action Program	
R RAPRemedial Action PlanS SSOSanitary Sewer Overflow Soil and Water Conservation DistrictT TMDL TOtal Maximum Daily Load Limits TSDTotal Maximum Daily Load Limits Technical Support DocumentU µg/kgMicrograms per Kilogram USACEU USPAUnited States Army Corps of Engineers USDAUSACE USEPAUnited States Department of Agriculture USEPAUSFWS USFWSUnited States Fish and Wildlife Service USGSV USPCUnited States Policy CommitteeV VAPVoluntary Action Program	
SSSOSanitary Sewer OverflowSWCDSoil and Water Conservation DistrictTTotal Maximum Daily Load LimitsTSDTotal Maximum Daily Load LimitsTSDTechnical Support DocumentUµg/kgMicrograms per KilogramUSACEUnited States Army Corps of EngineersUSDAUnited States Department of AgricultureUSEPAUnited States Environmental Protection AgencyUSFWSUnited States Fish and Wildlife ServiceUSGSUnited States Policy CommitteeVVAPVOluntary Action Program	
T TMDL TSDTotal Maximum Daily Load Limits Technical Support DocumentUψg/kgMicrograms per Kilogram USACEUSACEUnited States Army Corps of Engineers USDAUSDAUnited States Department of Agriculture USEPAUSEPAUnited States Environmental Protection Agency USFWSUSGSUnited States Geological Survey USPCV VAPVoluntary Action Program	
Uμg/kgMicrograms per KilogramUSACEUnited States Army Corps of EngineersUSDAUnited States Department of AgricultureUSEPAUnited States Environmental Protection AgencyUSFWSUnited States Fish and Wildlife ServiceUSGSUnited States Geological SurveyUSPCUnited States Policy CommitteeVVAPVoluntary Action Program	
V VAP Voluntary Action Program	
WWAPWatershed Action PlanWBPWatershed Based PlanWCWatershed CharacterizationWQWater QualityWQSWater Quality Standards (Ohio Administrative Code 3745WRASWatershed Restoration Action StrategyWWHWarmwater HabitatWWTPWastewater Treatment Plant	-1)

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