Nine-Element Nonpoint Source Implementation Strategic Plan (NPS-IS Plan)
East Fork Little Miami River - Fivemile Creek HUC-12 (050902021102)
Version 1.0, Approved on July 31, 2017

Prepared by

Clermont Soil and Water Conservation District

Sustainable Streams, LLC

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Acknowledgements

Many agencies and organizations were involved with the development of this NPS-IS plan. Specifically, Clermont Soil and Water Conservation District (SWCD) would like to acknowledge the U.S. EPA Office of Research and Development National Risk Management Laboratory Water Supply and Water Resources Division Experimental Stream Facility for providing Soil and Water Assessment Tool (SWAT) model results specific to the Fivemile HUC-12 Watershed; Brown SWCD and USDA's Natural Resource Conservation Service for assistance with identifying project opportunities in the Critical Areas; and the Clermont County Water Resources Department for providing GIS data. Additionally, the Clermont SWCD would like to thank the Clermont County Office of Environmental Quality and all project partners involved through the East Fork Watershed Collaborative, as this group of water quality professionals continues to provide valuable insights to the entire East Fork Little Miami River Watershed.

CHAPTER 1

Fivemile Creek Watershed Introduction

East Fork Little Miami River- Fivemile Creek
Nine-Element NPS-IS Plan

Prepared by
Clermont Soil and Water Conservation District
& Sustainable Streams, LLC
May 2017

Chapter 1: Introduction

Fivemile Creek HUC-12 Watershed includes a 10-mile segment of the East Fork Little Miami River and 4 major tributaries.

The Fivemile Creek-EFLMR Watershed (HUC-12: 050902021102) is located upstream of William H. Harsha Lake and encompasses areas in Clermont and Brown counties. This HUC-12 watershed is 42.56 square miles in total area and includes a 10-mile segment of the East Fork Little Miami River (EFLMR) through and upstream of the Village of Williamsburg. The EFLMR is designated as Exceptional Warmwater Habitat (EWH) by the Ohio Environmental Protection Agency (OEPA) and is a tributary to the Little Miami State and National Scenic River. Significant tributaries in the Fivemile Creek HUC-12 watershed include Fivemile Creek, Fourmile Creek, Crane Run, and Pleasant Run, all of which are designated as Warmwater Habitat (WWH). Land use is primarily row-crop agriculture, followed by forested land, pasture and residential.

The East Fork Watershed Collaborative (EFWC), an informal agency-citizen based watershed group formed in 2001, has taken on the responsibility of watershed planning and implementation in the EFLMR watershed. Due to the size of the EFLMR watershed (>500 square miles and 18 HUC-12s), five separate planning units were created. Each planning unit has a state-endorsed watershed action plan to address causes and sources of impairment. The EFWC is now updating the watershed action plans according to USEPA's Nine-Element Nonpoint Source Implementation Strategic Plan (NPS-IS plan) for each individual HUC-12. The Fivemile Creek plan is the first watershed planning unit to be updated.

1.1 Report Background

As stated, this NPS-IS plan is an update to the existing East Fork Lake and Tributaries Watershed Action Plan (WAP) which was endorsed by the Ohio Department of Natural Resources (ODNR) and the OEPA in 2006. The original East Fork Lake and Tributaries planning unit included 25 miles of the EFLMR and ten significant tributaries (Figure 1-1). The East Fork Lake and Tributaries WAP was developed to provide a comprehensive approach to watershed restoration and protection, particularly for Harsha Lake, which is a source of drinking water for over half of Clermont County's residents. In response to USEPA's re-focusing watershed planning and implementation on HUC-12 planning units, the EFWC is revising the five existing state-endorsed WAPs with Fivemile Creek being the first.

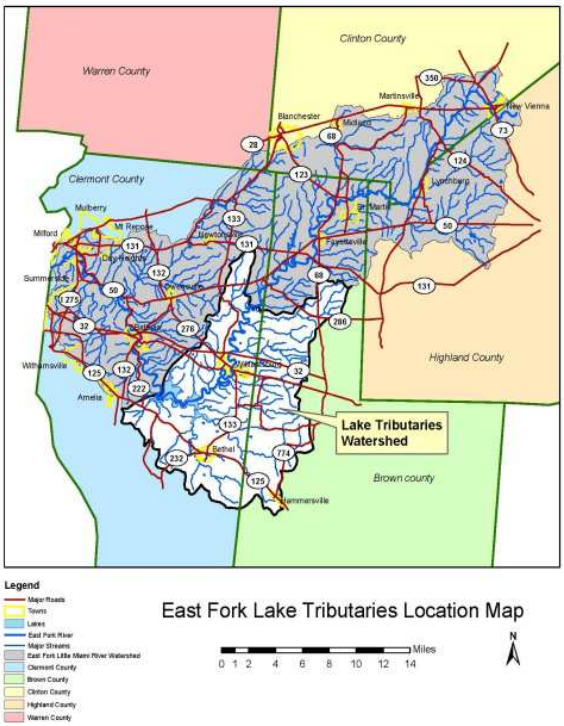

Figure 1-1: East Fork Lake & Tributaries original planning unit location map (EFWC, 2006)

1.2 Watershed Profile & History

The EFLMR is a subwatershed of the Little Miami River Basin located in southwest Ohio (Figure 1-2). The Little Miami River Basin drains an area of 1,756 square miles and the main stem flows 105 miles southwest to its confluence with the Ohio River in Hamilton County. The EFLMR watershed is approximately 540 square miles in total area and encompasses areas of Highland, Clinton, Brown, Warren, and Clermont counties. The EFLMR flows 80 miles from its origin in Clinton and Highland counties southwest to its confluence with the Little Miami in Clermont County. Clermont County occupies the largest area in the watershed, covering approximately 390 square miles (49%).

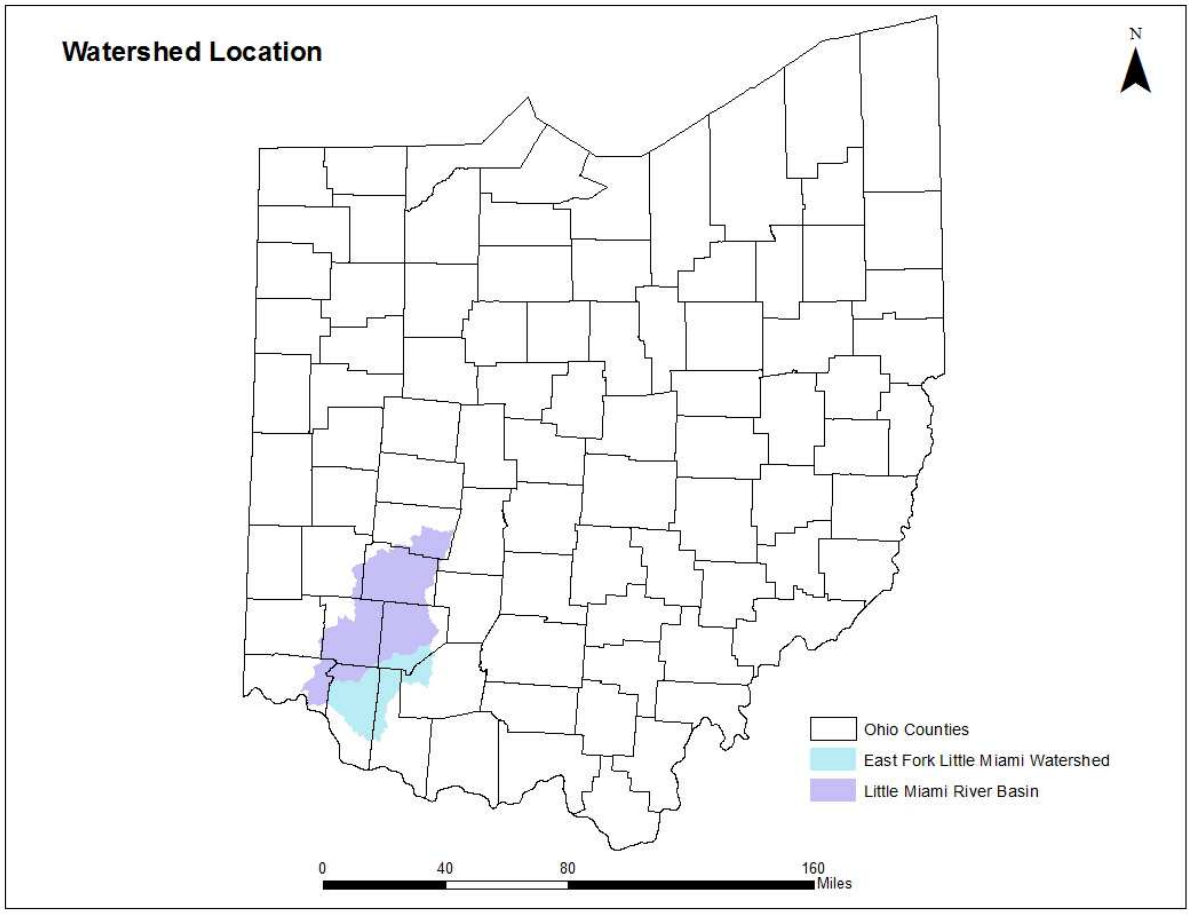

Figure 1-2: East Fork Little Miami River watershed location

The EFLMR is designated as Exceptional Warmwater Habitat (EWH) from the mouth to river mile 75 in Clinton County. The only other stream in the watershed with a EWH designation is Dodson Creek in Highland County. The remaining streams in the watershed have an aquatic life use designation of Warmwater Habitat (WWH). The EFLMR is also designated as a Public Water Supply (PWS) at rive mile 22.6 due to the Clermont County Water intake in the William H. Harsha Reservoir. With a few exceptions, the streams in the watershed are also designated for Agricultural and Industrial Water Supply (AWS, IWS) and Primary Contact Recreation (PCR) (OEPA, 2014).

The EFLMR watershed includes eighteen 12-digit Watershed Assessment Units (WAUs). The Fivemile Creek HUC-12 includes four major tributaries: Fivemile Creek, Fourmile Creek, Crane Run and Pleasant

Run. Approximately 10 miles of the EFLMR flow through the Fivemile Creek HUC-12 watershed, beginning at the confluence with the Fivemile Creek tributary and flowing downstream through the Village of Williamsburg. Portions of the Fivemile Creek HUC-12 are located in Jackson Township, Green Township, Sterling Township, and Williamsburg Township (Figure 1-3). The mainstem of the EFLMR drops 115 feet from its the confluence with Fivemile Creek to Harsha Lake 14 miles downstream, for an average slope (or drop) of 8.2 feet per mile upstream of the reservoir. Land use in the watershed is primarily row-crop agriculture and forested land, with low-medium density residential areas.

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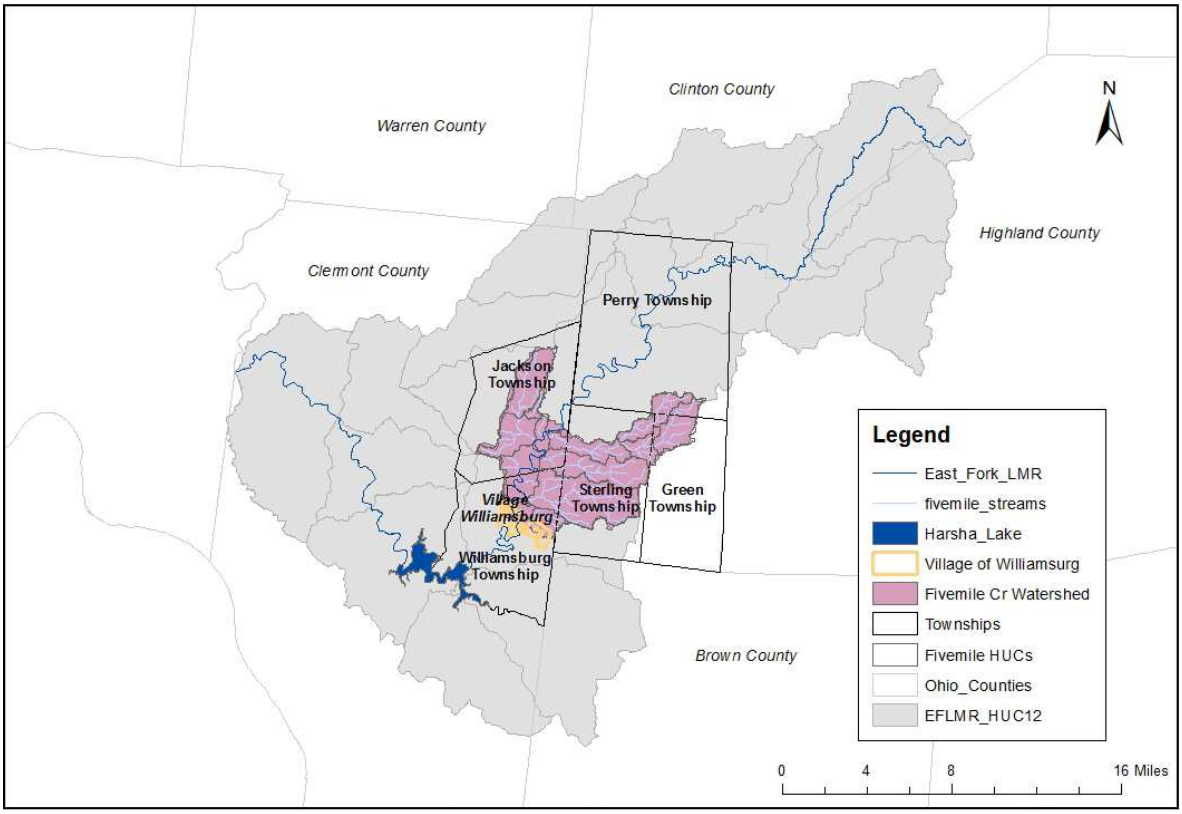

Figure 1-3: Fivemile Creek HUC-12 location

The CECOS International Incorporated-Aber Road Facility is located in Jackson Township (Clermont County) within the Pleasant Run subwatershed. The site is comprised of approximately 1,200 acres, of which 208 acres were permitted for hazardous waste activities. The site and facility are located in an agricultural area about four miles north of the Village of Williamsburg. Pleasant Run and the EFLMR drain the facility. The EFLMR feeds Harsha Lake which is the source of drinking water for many of Clermont County's residents. Reference chapters 2 and 3 of this NPS-IS plan for more information on the CECOS site and hazardous waste facility.

In regards to threatened and endangered species, several state endangered and federally endangered species have been found in the watershed, including the rayed bean (*Villosa fabalis*), the sheepnose

(*Plethobasus cyphyus*), and the fanshell (*Cyprogenia stegaria*), among others. Diverse mussel populations historically thrived in the EFLMR, and while some stream reaches have retained mussel diversity, the EFLMR mussel population as a whole is determined to be aging and less diverse (Hoggarth and Goodman, 2007). In-stream habitat degradation is contributing to the decline of mussel species. Therefore, restoration of degraded habitat is an important goal of the EFWC and included in chapters 3 and 4 of this NPS-IS plan.

While urbanization is most localized in the eastern portion of the EFLMR watershed, development may begin to encroach upon the Fivemile Creek HUC-12 in future years, particularly as the Village of Williamsburg, which is located on the southern extents of the Fivemile Creek HUC-12, expands. Clermont County communities, including Williamsburg, are trying to keep pace with the pressures that attend growth including provision of water and sewage services. Development seems to follow the transportation corridors along SRs 32, 125, and US 50. The County has an effective stormwater management program for new development but problems were created prior to the start of the program. Developed areas with more impervious surfaces increase the rate and volume of runoff. The lower reaches of streams show the effects of excess runoff shown by down-cutting and channel widening. As the County continues to develop, protection of the river and stream corridors remains a priority for watershed protection and restoration.

In addition to the urbanized and suburbanized areas, stream impacts from agricultural land use occur in the upper reaches of the Fivemile Creek HUC-12 watershed. Again, row-crop agriculture is the primary land use in the watershed. In areas where farm fields are adjacent to waterways, many fields on the EFLMR and its tributaries are farmed to the edge of the stream bank (Figure 1-4). In these areas, riparian buffers and other agricultural Best Management Practices (BMPs) are a priority and included with the goals and objectives listed throughout chapters 3 and 4 of this NPS-IS plan.

Figure 1-4: East Fork farm fields with little riparian buffer

1.3 Public Participation and Involvement

Public participation and involvement is critical to the success of any NPS-IS plan. As previously mentioned, the EFWC was formed in 2001 to provide local agencies, groups and individuals the opportunity to collaboratively plan and implement water quality improvement projects throughout the EFLMR watershed. The EFWC's mission is "to enhance the biological, chemical and physical integrity of the EFLMR and its tributaries." The EFWC is an informal agency-citizen based organization (i.e., no application has been made for legal non-profit status) established to provide a cohesive approach to watershed management amongst the 32 townships and 21 villages in the EFLMR watershed. Although Clermont Soil and Water Conservation District (SWCD) is the lead agency for the

The EFWC provides a cohesive approach to watershed management amongst 32 townships and 21 villages in the EFLMR watershed.

EFWC, the EFWC Steering Committee defines the scope and direction for the watershed program. The Steering Committee includes representatives from four counties and five subwatersheds within the EFLMR watershed. Four of the Steering Committee members are directly appointed by the Board of Commissioners for Clermont, Brown and Highland Counties. Four additional members represent the Soil and Water Conservation Districts of Brown, Clermont, Highland and Clinton counties. The final five Steering Committee members represent the five subwatershed planning areas and contribute knowledge about agriculture, industry, and other community resources and activities in the region.

The EFWC has accepted the responsibility for developing and implementing the watershed protection plans for the entire EFLMR watershed. These planning efforts provide a forum for the jurisdictions to discuss watershed issues across political boundaries.

Specific to the development of this NPS-IS plan, the EFWC conducted a Focus Group meeting on March 14, 2017 to obtain feedback from stakeholders and guide the development of the plan. Local land owners and partners such as Brown SWCD, Clermont SWCD, and the Natural Resources Conservation Service (NRCS) were in attendance. Many of the projects provided in chapter 4 of the NPS-IS plan were identified during this meeting.

The EFWC works closely with community interest groups as well as environmental organizations and agencies.

Furthermore, the EFWC has worked closely with several environmental organizations and agencies, including the USEPA Office of Research and Development (USEPA – ORD), the U.S. Army Corps of Engineers, Clermont County's Office of Environmental Quality, Soil and Water Conservation Districts of Brown and Clermont Counties, the Little Miami Conservancy and others to understand the existing conditions of this watershed and develop strategic solutions to bring ecological lift to these streams. Furthermore, the local interest in water quality in this region is unmatched, as groups such as the Water Quality Monitoring and Modeling Cooperative meet regularly to discuss issues impacting water quality, coordinate sampling efforts, review important findings from the previous month, and plan future work.

Lastly, Clermont SWCD is dedicated to public involvement through education and outreach activities. From publishing newsletters and regularly updating social media outlets such as Facebook and Twitter to participating in regional conservation/stormwater organizations and hosting annual workshops/field days (Figure 1-5), the Clermont SWCD already works to engage the local community, as its mission is "promoting the wise use of our natural resources through service and education."

Figure 1-5: Clermont SWCD hosts a field day with local producers

CHAPTER 2

Fivemile Creek Watershed Characterization & Assessment Summary

East Fork Little Miami River - Fivemile Creek
Nine-Element NPS-IS Plan

Prepared by
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May 2017

Chapter 2: Fivemile Creek Watershed Characterization and Assessment Summary

The Fivemile Creek HUC-12 watershed includes Fivemile Creek, Fourmile Creek, Crane Run, Pleasant Run, and a 10-mile reach of the EFLMR main stem through and upstream of the Village of Williamsburg. OEPA's 2016 Integrated Water Quality Report revealed six of the nine sites assessed in the unit were impaired and partially attaining EWH and WWH status due primarily to organic enrichment, marginal habitat, and low stream flow. Various studies conducted by the EFWC, which includes USEPA's Office of Research and Development, the U.S. Army Corps of Engineers, Clermont County's Office of Environmental Quality and others, indicate that the Fivemile Watershed, relative to other Upper LMR tributaries, is contributing high nutrient loads to the EFLMR and Harsha Lake during storm events, contributing to the increased incidence of harmful algal blooms (HABs).

OEPA has classified 3 of the 9 monitoring sites in the Fivemile Creek HUC-12 as being in full attainment, with the remaining 6 in partial attainment.

2.1 Summary of Watershed Characterization for Fivemile Creek HUC-12

2.1.1 Physical and Natural Features

The underlying geology of the Fivemile Creek HUC-12 watershed is primarily interbedded shale and limestone of Ordovician age (450 million years ago). This bedrock is overlain by glacial cover and a relatively shallow layer of loess from a few to as much as 40 inches depth. The glacial cover is a clayey till of Illinoian Age. This clay layer is situated above the bedrock but below the soil, often creating an impermeable layer preventing infiltration into the bedrock below. The glacial cover of the Illinoian till plains is generally 10 to 30 feet thick, covered with a loess cap of 18-40 inches in depth. The levelness and poor permeability of the Illinoian till plain soils create an ideal environment for crayfish, and this area is sometimes called the "Crawdad Flats."

Soil plays an extremely important role in watershed management. For example, in many watersheds soils act as natural water filters. Certain soil types are prone to flooding or erosion, affecting runoff rates and sedimentation. An understanding of soil types, with their benefits and limitations, leads to more effective land use management. Much of the Fivemile Creek HUC-12 watershed includes hydric soils (i.e., Clermont silt loam) which are generally unsuitable for agricultural production, septic systems, and urban/residential development. The following figure (Figure 2-1) and table (Table 2-1) provide a summary of the most common soils found in Fivemile Creek HUC-12 watershed (East Fork Lake Tributaries Watershed Management Plan, 2006).

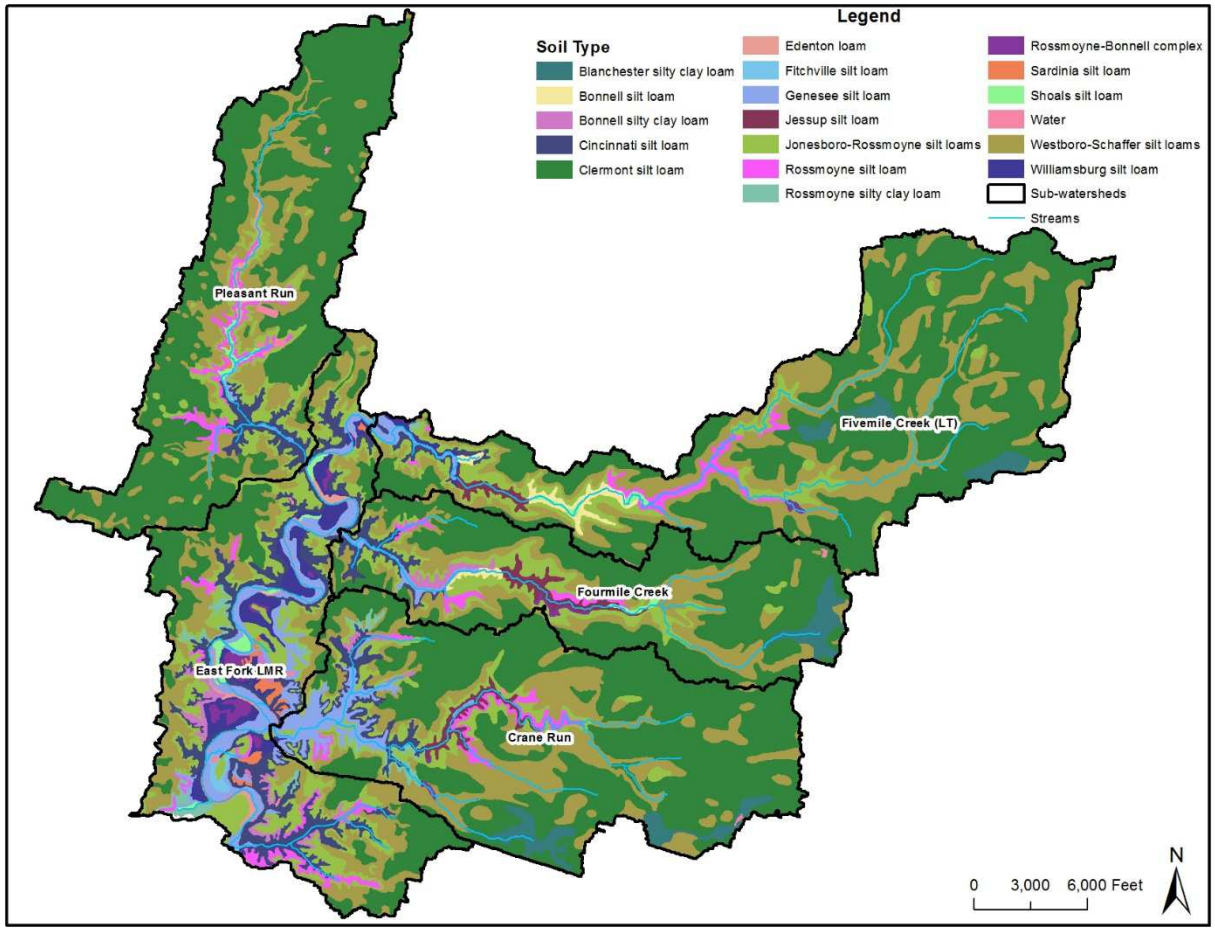


Figure 2-1: Fivemile Creek HUC-12 watershed soil types (Lerch *et al.*, 1975; Lerch, 1992)

Soil Series	Topography	Permeability	Drainage	Seasonal High Water Table	Runoff	Erosion Risk
Clermont (Blanchester) Silt Loam	Nearly level	Very Slow	Poorly Drained	0-1 ft or ponded	Slow	Low
Westboro-Schaffer Silt Loam	Nearly level to gently sloping	Slow	Somewhat poorly drained	.5-1.5 ft.	Slow-Medium	Low
Jonesboro-Rossmoyne Silt Loam	Nearly level to moderately steep	Moderately slow to slow	Moderately drained	1.5-3 ft	Slow to rapid	Low - High

2.1.2 Land Use and Protection

The Fivemile Creek HUC-12 watershed is 42.56 mi^2 in total area. Row-crop agriculture is the most prominent land use, accounting for approximately 56% of the land use in the watershed. Forest land accounts for 27%, followed by 10% grass/pasture and 7% developed land (urban and light/medium density residential) (Figure 2-2). A significant portion of the Village of Williamsburg, which has a population of approximately 2,700 residents, is located in the southwest corner of the watershed and is where the majority of the more developed areas are.

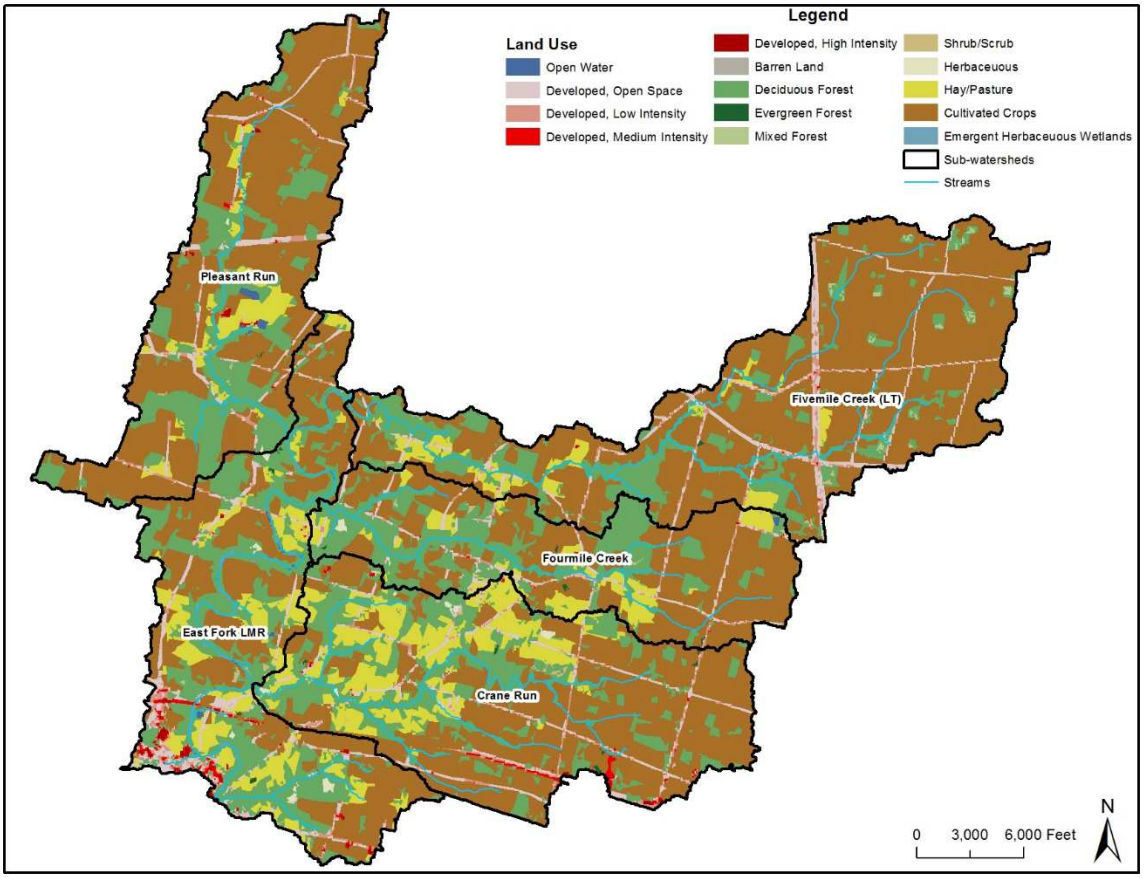


Figure 2-2: Fivemile Creek HUC-12 watershed landuse (Homer *et al.*, 2015)

The Williamsburg Low-Head Dam is a significant feature in the watershed. The dam was constructed in the 1940s by the Village of Williamsburg to supply drinking water to Village residents. Removal of the defunct dam and pump station is a priority action for watershed restoration along the EFLMR main stem. Reference chapter 4 of this NPS-IS plan for more information regarding this priority project.

The native vegetation of the Fivemile Creek HUC-12 watershed is deciduous hardwood forest, though species composition varies based on soil moisture. The flatter areas of the watershed are characterized by seasonal wetness. The dominant species in these areas are pin oak, soft maples, ash, elm, and swamp oak with beech and sweetgum also present. In the better drained areas, white and red oak, beech, sugar maple and hickory are dominant, with elm, ash, black

walnut, honey locust, and blackgum also present. Sycamore, boxelder, hackberry, willow and cottonwood are common in bottom-land forests.

The main stem of the EFLMR has sufficient forested riparian buffer throughout much of the watershed; however, there are segments along the river and major tributaries where riparian protection can be improved. Particularly in the headwaters of the watershed, many farm fields lack adequate buffers to maintain stream quality. Riparian protection along the EFLMR main stem and tributaries is a priority for watershed restoration and protection.

2.1.3 Biological Features

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves maintains a list of rare, threatened and endangered species in the State of Ohio, including endangered species of fish and macroinvertebrates. Species found in the Fivemile Creek HUC-12 watershed considered to be endangered, threatened or of special concern are summarized in Table 2-2. This includes endangered freshwater mussels (Figure 2-3). It is important to note that these are confirmed occurrences of these species, and other rare plant and animal species are likely present in the watershed, but haven't been identified. There are no federally listed species found in the Fivemile Creek HUC-12.

Figure 2-3: Rayed bean; endangered freshwater mussel found in the EFLMR (EFWC, 2006)

Table 2-2: Rare, threatened, and endangered species in the Fivemile Creek HUC-12 watershed

Common Name	Scientific Name	Federal Status	State Status	Location
Rare Plant List				
Blue False Indigo	*Baptisia australis*		Endangered	East Fork State Park
Potatos-dandelion	*Krigia dandelion*		Endangered	East Fork State Park
Netted Chain Fern	*Lorinseria areolata*		Threatened	East Fork State Park
Bulbosa woodrush	*Luzula bulbosa*		Threatened	East Fork State Park
Spring Coral Root	*Corallorhiza wisteriana*		Threatened	East Fork State Park
Floating Pondweed	*Potamogeton natans*		Potentially Threatened	East Fork State Park
Few-Flowered tick-trefoil	*Desmodium pauciflorum*		Potentially Threatened	East Fork State Park
Prairie wake-robin	*Trifolium stoloniferum*		Potentially Threatened	East Fork State Park

Common Name	Scientific Name	Federal Status	State Status	Location
Rare Animal List				
Little Spectaclecase	*Villosa lienosa*		Endangered	East Fork Little Miami River
Rayed Bean	*Villosa fabalis*	Proposed for Listing	Endangered	East Fork Little Miami River
Northern Harrier	*Circus cyaneus*		Endangered	East Fork State Park
Southern Woodthrush	*Hylocichla mustelina*		Threatened	East Fork State Park
Rough Green Snake	*Opheodrys aestivus*		Species of Concern	East Fork State Park
Salamander Mussel	*Simpsonaias ambigua*	Proposed for Listing	Species of Concern	East Fork Little Miami River
Slenderhead Darter	*Percina phoxocephala*		Species of Concern	East Fork Little Miami River

Numerous invasive plant species occur throughout the EFLMR watershed. Common invasives include bush honeysuckle (*Lonicera species*), Japanese honeysuckle (*Lonicera japonica*), multi-flora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*). Other known invasives include the Autumn and Russian Olive (*Elaeagnus spp.*) and the Tree of Heaven (*Ailanthus altissima*). There are other invasive species, such as the Purple Loosestrife (*Lythrum salicaria*), which are not yet prevalent in the watershed; however still pose a threat of proliferating and dominating the landscape.

Invasive plants have negative impacts on native vegetation and animals within the watershed. Bush and Japanese honeysuckle out-compete and displace native plants and alter natural habitats by decreasing light availability and depleting soil moisture and nutrient content. Exotic bush honeysuckle competes with native plants for pollinators, resulting in a reduced seed set for native species. Unlike native shrubs, the fruits of exotic bush honeysuckle are carbohydrate-rich and do not provide migrating birds with the high-fat content needed for long flights. Multiflora rose forms dense thickets, excluding most native shrubs and herbs from establishing, and may be detrimental to nesting of native birds. This species was once suggested by Soil and Water Conservation Districts for living fences and wildlife habitat, however it is no longer encouraged. Garlic mustard invades areas disturbed by human activities and appears to be aided by white-tailed deer that prefer to eat native wildflowers and leave garlic mustard untouched. Garlic mustard displaces many native spring wildflowers such as spring beauty, wild ginger, bloodroot, Dutchman's breeches, toothworts and trilliums that occur in the same habitat. It is also credited with the decline of the West Virginia white butterfly because chemicals in garlic mustard appear to be toxic to the butterfly's eggs.

Figure 2-4: Asian Longhorned Beetle (ODA, 2011)

Invasive plant species are not the only threat to the EFLMR watershed. The Emerald Ash Borer (*Agrilus planipennis,* EAB) is an invasive wood-boring insect that threatens native North American ash trees throughout Ohio and elsewhere across the Midwest by infesting saplings and fully mature ash trees (*Fraxinus spp.*). In addition, the Asian Longhorned Beetle (ALB, *Anoplophora glabripennis*) (Figure 2-4) was discovered in Tate Township in Clermont County in 2011. This invasive beetle has no known natural predators and poses a threat to Ohio's hardwood forests. Restricted areas are now in effect for Tate Township and parts of Batavia, Monroe and Stonelick Townships in Clermont County, as well as for East Fork State Park.

Zebra mussels *(Dreissena polymorpha*) are another invasive species rapidly spreading throughout the Midwest. Zebra mussels and a related species, the quagga mussel (*Dreissena bugensis*), are small, fingernail-sized mussels native to the Caspian Sea region of Asia. They are tolerant of a wide range of environmental conditions and have now spread to parts of all the Great Lakes, the Mississippi River, and the Ohio River. Zebra mussels clog water-intake systems of power plants and water treatment facilities, as well as irrigation systems, and the cooling systems of boat engines. They have severely reduced, and may eliminate, native mussel species. No zebra or quagga mussels have been found in the EFLMR watershed. It is important, however, to continue to monitor the watershed for the presence of these aquatic invasives.

In addition to the threat of invasive species, research has shown that poor water quality and habitat loss are contributing to the decline of the EFLMR mussel population (Hoggarth and Goodman, 2007). Research done between 1990-91 and 2006-07 on 10 sites in the EFLMR yielded a decline in the Mussel-Index of Biological Integrity (M-IBI) scores). While some reaches retained their mussel diversity, the EFLMR population as a whole was determined to be aging and less diverse. It appears that the former mussel community is being replaced by a few opportunistic mussel species that use the freshwater drum as a host (*L. fragilis, P. alatus, T. truncate).*

2.2 Summary of Biological Trends for Fivemile Creek HUC-12

Ohio EPA's 2014 Technical Report, *Biological and Water Quality Study of the East Fork Little Miami River and Select Tributaries*, which summarizes the results of its 2012 interdisciplinary monitoring program, served as the foundation for understanding existing conditions throughout the Fivemile Creek HUC-12 watershed. Ohio EPA's program provides the basis for evaluating whether streams throughout the state

are meeting existing use designations and if any changes to biological, chemical, or physical indicators are evident. Ohio's 2016 Integrated Water Quality Monitoring and Assessment Report also used data from this technical document to report upon the aquatic life use, monitoring results, and attainment status of each monitoring site. This information ultimately determines if regulatory actions need to be taken, as the findings and conclusions inform NPDES permits, Ohio Water Quality Standards, biennial Integrated Water Quality Monitoring and Assessment Reports, TMDLs, etc.

The main stem of the East Fork Little Miami River is designated as Exceptional Warmwater Habitat and the tributaries are designated as Warmwater Aquatic Habitat

With the exception of the main stem of the EFLMR, which has an aquatic use designation of EWH, the streams throughout the Fivemile Creek HUC-12 have an aquatic use designation of WWH. Therefore, the primary metrics by which these streams are characterized as supporting/not supporting their designated use is through biological indices associated with fish sampling, macroinvertebrate sampling, and habitat assessments. The monitoring and assessment results are compared to thresholds associated with supporting typical warmwater assemblages of aquatic organisms for Ohio rivers and streams, and classified as fully supporting, partially supporting, or not supporting the typical aquatic assemblages.

In regards to non-aquatic life uses, streams in the Fivemile Creek HUC-12 are designated for Primary Contact Recreation (PCR), Agricultural Water Supply (AWS), and Industrial Water Supply (IWS). At river mile 22.6 a portion of the EFLMR main stem is designated for Public Water Supply (PWS) because the Clermont County Water Department operates a water intake downstream of the Fivemile Creek HUC-12 at the William H. Harsha Reservoir. None of these non-aquatic life uses are discussed in terms of benchmarks/standards in the sections below; however, it is clear that pollutants that have the potential to impact the attainment of aquatic life uses can also have the potential to impact the non-aquatic life uses. For example, as a result of excess nutrients, Harsha Lake has experienced HABs, leading to warnings against contact with the water and posing a risk to both aquatic life uses (WWH) and the ability of the waterway to meet recreational (PRC) and water supply (PWS) uses. This underscores why it is important to manage nutrient loadings in the stormwater runoff from the Fivemile Creek HUC-12 in order to meet both the aquatic and human uses of the receiving waters. More specifically, the Ohio 2016 Integrated Water Quality Monitoring and Assessment Report lists that the Harsha Lake public water system, which is part of the Lucy Run-EFLMR HUC-12 watershed (050902021203), is impaired for high algae levels, with multiple raw water samples exceeding the microcystins threshold (maximum concentration observed was 190 ug/L in June 2014) and saxitoxins were detected but below the threshold (OEPA, 2016). With Harsha Lake being impaired, it is possible that the critical areas, objectives, and opportunities outlined in chapters 3 and 4 of this NPS-IS plan will in the future be cross-referenced in addressing this downstream impairment of the Lucy Run-EFLMR HUC-12 watershed.

There are nine monitoring locations throughout the Fivemile Creek HUC-12 (Figure 2-5). While three of these sites are in full attainment (EFLMR main stem (M04S09), Crane Run (301897), and Fourmile Creek (301896)), the remaining six sites, located on the EFLMR main stem and throughout the Pleasant Run and Fivemile Creek subwatersheds, are listed as Partial Attainment. Table 2-3 presents a summary of the

scores of the biological indices for all of the sites within the Fivemile Creek HUC-12 based on fish samples, macroinvertebrate samples, and habitat assessments (described in detail in the sections below). Red text in this table denotes scores that do not meet the criterion for EWH and WWH streams, and the green text in this table denotes scores that exceed the criterion for EWH and WWH streams. At several of the sites listed as partial attainment by OEPA, the fish (IBI), macroinvertebrate (ICI), and habitat (QHEI) indices fall below OEPA's threshold for full attainment, suggesting that most of the site impairments tend to be substantial enough to impact both types of aquatic life. Two sites on the EFLMR, at Williamsburg Main Street (M04S08) and Upstream of Williamsburg at Jackson Pike (M04S10), are supportive for macroinvertebrates but not quite supportive for fish, making the overall status for each site partial support. One site on Pleasant Run (M04S22) is supportive for fish but not supportive for macroinvertebrates (rated as low fair), making its overall status partial support. The other site on Pleasant Run (M04S46) was not supportive for fish, macroinvertebrates, or habitat, with an overall status of partial support. Both sites in the Fivemile Creek (301895 and M04S49) were not supportive for fish, macroinvertebrates, or habitat, and these sites have an overall status of partial support as well.

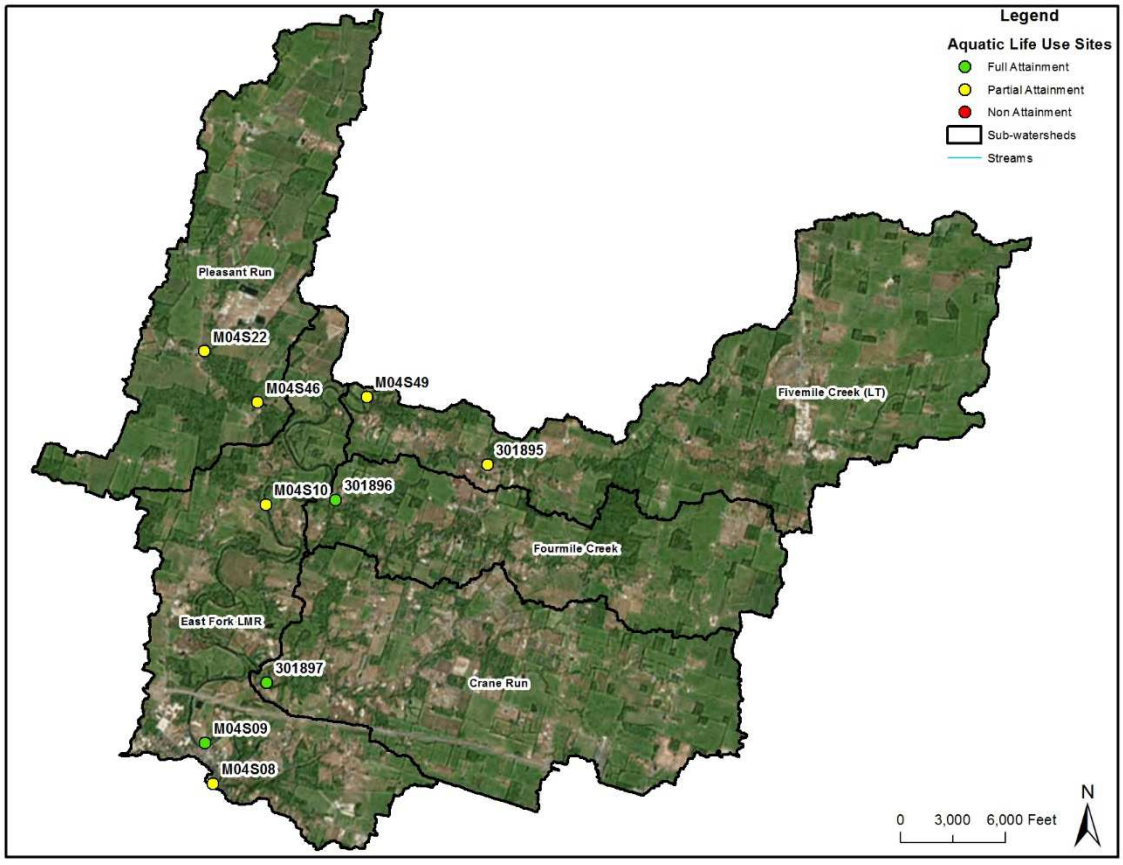


Figure 2-5: Attainment Status of Aquatic Life Use Monitoring Sites (OEPA, 2016)

Table 2-3: Biological index scores for sites in the Fivemile Creek HUC-12 Watershed (OEPA 2016) based on fish samples (IBI and MIwb), macroinvertebrate samples (ICI), and habitat (QHEI)

Exceptional Warmwater Habitat Sites

Station ID	Station Name	RM (DA[a])	IBI[b]	MIwb[c]	ICI[d]	Status	QHEI[e]
East Fork Little Miami River (EWH)							
M04S10	EFLMR Upstream Williamsburg @ Jackson Pike	41.07 (221)	45 Good	8.7019 Good	46 Exceptional	Partial	77.8
M04S09	EFLMR Williamsburg @ Mckeever Road	35.87 (235)	51 Exceptional	9.9153 Exceptional	46 Exceptional	Full	81.3
M04S08	EFLMR Williamsburg @ Main Street	34.91 (237)	46 Very Good	8.7595 Good	50 Exceptional	Partial	70.5

[a] Drainage areas are reported in square miles.

[b] IBI criterion is 50 for EWH streams.

[c] MIwb criterion is 9.4 for EWH wadeable streams and 9.6 for EWH boatable streams.

[d] ICI criterion is 46 for EWH streams.

[e] QHEI scores from streams across the state indicate that values greater than 75 represent habitat conditions which could have the ability to support exceptional warmwater faunas (OEPA, 2014).

Warmwater Habitat Sites

Station ID	Station Name	RM (DA[a])	IBI[b]	MIwb[c]	Invertebrates Assessed	Status	QHEI[d]
Crane Run (WWH)							
301897	Crane Run @ Mckeever Road	0.2 (8.9)	44 Good	NA	- Good	Full	72.8
Fourmile Creek (WWH)							
301896	Fourmile Creek @ Jackson Pike	0.3 (5.5)	46 Very Good	NA	- Good	Full	60
Pleasant Run (WWH)							
M04S22	Pleasant Run North of Williamsburg @ Blue Sky Park Road	1.35 (5.3)	42 Good	NA	- Low Fair	Partial	67.5
M04S46	Pleasant Run @ Glancy Corner @ Marathon Road	0.42 (7.8)	38 Marginally Good	NA	- Fair	Partial	62.5
Fivemile Creek (WWH)							
301895	Fivemile Creek @ Blue Sky Park Road (Upper Crossing)	2.3 (8.3)	32 Fair	NA	- Marginally Good	Partial	54.3
M04S49	Fivemile Creek @ Blue Sky Park Road (Lower Crossing)	0.5 (10.6)	36 Marginally Good	NA	- Fair	Partial	51.5

[a] Drainage areas are reported in square miles.

[b] IBI criterion is 40 for WWH headwater/wadeable streams.

[c] MIwb criterion is NA for headwater streams. The criterion is 8.1 for WWH wadeable streams and 8.7 for WWH boatable.

[d] QHEI scores from streams across the state indicate values > 64 are generally conducive of supporting warmwater faunas (OEPA, 2014).

***Fish**: Modified Index of Well-Being (MIwb) & Index of Biotic Integrity (IBI)*

The MIwb and IBI scores quantify the integrity of the fish community at each monitoring location. The field and laboratory procedures utilized by OEPA for the fish sampling, which involved pulsed DC electrofishing methods, are outlined in the document titled *Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities* (OEPA, 1989) and the more recent updated document (OEPA, 2008). On the main stem of the EFLMR these scores ranged from good to exceptional. Comparing the electrofishing sampling results from the 2012 monitoring program to previous years (1982 and 1998), there is an increase in species richness and reduction in pollution tolerant species such as carp. The increase in richness is likely a combination of decreased organic enrichment and improved management of nonpoint sources of pollution (OEPA, 2014). The IBI for the tributaries throughout the Fivemile Creek HUC-12 indicates good to very good conditions in Crane Run and Fourmile Creek, marginally good to good conditions in Pleasant Run, and only fair to marginally good conditions in Fivemile Creek.

The Index of Biotic Integrity indicates only fair to marginally good conditions in Fivemile Creek and portions of Pleasant Run.

***Macroinvertebrates:** Invertebrate Community Index (ICI)*

The ICI is a measure of the macroinvertebrate community integrity at each monitoring location. Similar to the fish sampling, the field and laboratory procedures utilized by OEPA for the macroinvertebrate sampling is outlined in the document titled *Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities* (OEPA, 1989) and the more recent updated document (OEPA, 2008). The macroinvertebrate sampling results somewhat mimic the results of the fish sampling, with exceptional scores on the main stem of the EFLMR, good scores in Crane Run and Fourmile Creek, and low fair/fair to marginally good scores in Pleasant Run and Fivemile Creek.

***Habitat:** Qualitative Habitat Evaluation Index (QHEI)*

OEPA assessed the habitat characteristics through the Qualitative Habitat Evaluation Index (QHEI), which provides an understanding of existing habitat features important to fish communities and is based upon methodologies established by Rankin's habitat assessments (Rankin 1989, Rankin 1995, OEPA 2006). During this evaluation, several habitat characteristics are assessed on the stream reach, such as type/quality of substrate, amount/quality of in-stream vegetative cover, channel morphology, extent/quality of riparian vegetation, pool/run/riffle quality, etc. Review of hundreds of QHEI scores from streams across the state indicate that values greater than 64 are generally conducive of supporting warmwater faunas and scores greater than 75 represent habitat conditions which could have the ability to support exceptional warmwater faunas (OEPA, 2014). With that, the quality of the physical stream habitat

With QHEI scores ranging from 51.5 – 54.3, habitat conditions in Fivemile Creek are not adequate for supporting typical warmwater aquatic assemblages.

throughout much of the main stem EFLMR and Crane Run appear to be of sufficient quality to support typical warmwater aquatic assemblages, with good/excellent QHEI scores ranging from 70.5 – 81.3 and ranking the highest of all the sites in the HUC-12 watershed. The QHEI scores for Fourmile Creek and Pleasant Run rated as good (60-67.5), with the Fivemile Creek subwatershed rated as fair (51.5-54.3). Table 2-4 illustrates the QHEI scores as well as the warmwater habitat and modified warmwater habitat attribute results.

Water Quality

In addition to the biological and physical monitoring discussed above, OEPA employs chemical monitoring to understand existing conditions throughout the EFLMR watershed. As indicated by the red box in Figure 2-6, the Fivemile Creek HUC-12 watershed had elevated ammonia (NH_3), total Kjeldahl nitrogen (TKN) and low dissolved oxygen (DO) to the extent that they could be stressful to aquatic assemblages. Within the Fivemile Creek HUC-12, the OEPA (2014) report documented that organic enrichment/low DO was a particular concern in Fivemile Creek and Pleasant Run.

Table 2-4: Qualitative Habitat Evaluation Index (QHEI) Matrix with Warmwater Habitat (WWH) and Modified Warmwater Habitat (MWH) Attribute Totals in the Fivemile Creek HUC-12 (OEPA, 2014)

		Exceptional Warmwater Habitat			Warmwater Habitat					
		East Fork Little Miami River			Crane Run	Fourmile Creek	Pleasant Run		Fivemile Creek	
Key QHEI Elements	Station ID	M04S10	M04S09	M04S08	301897	301896	M04S22	M04S46	301895	M04S49
	River Mile	41.07	35.87	34.91	0.2	0.3	1.35	0.42	2.3	0.5
	QHEI Score	77.8	81.3	70.5	72.8	60	67.5	62.5	54.3	51.5
	Gradient (ft/mi)	5.56	6.13	12.5	14.29	20.83	14.71	25	10.1	4.92
WWH Attributes	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	8	8	6	7	7	7	7	6	6
MWH Attributes – Hi Influence	Channelized/No Recovery									
	Silt/Muck Substrates									
	No Sinuosity									
	Sparse/No Cover					•		•	•	•
	Max Depth <40 cm								•	
	Hi-Influence Modified Attributes					1		1	2	1
MWH Attributes – Moderate Influence	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	1	1	2	2	6	3	4	3	6
MWH H.I.+1/WWH+1 Ratio		0.11	0.11	0.14	0.13	0.25	0.13	0.25	0.43	0.29
MWH M.I.+1/WWH+1 Ratio		0.22	0.22	0.43	0.38	0.88	0.5	0.63	0.57	1

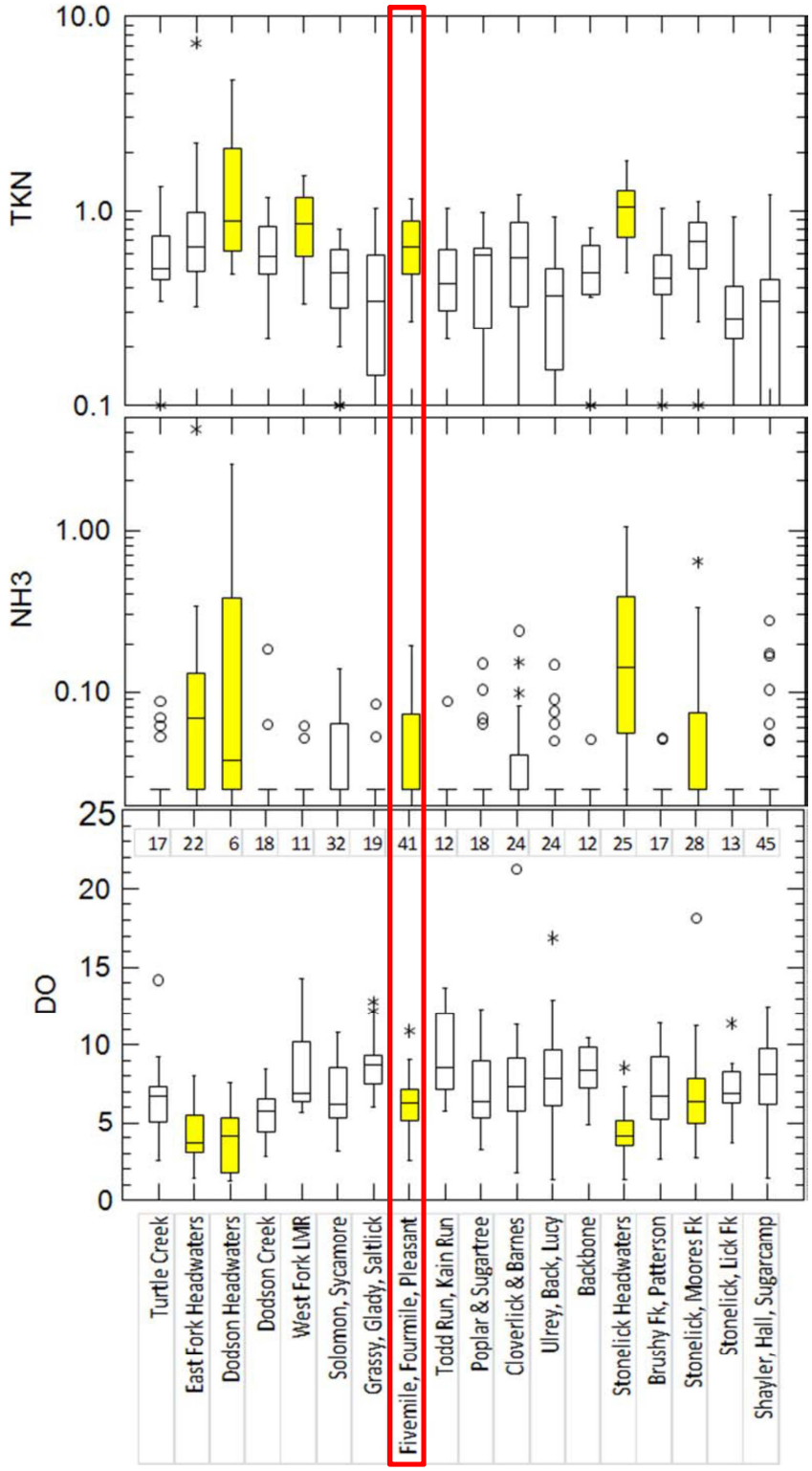


Figure 2-6: Distributions of total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH_3) and dissolved oxygen (DO) stratified by 12-HUCs within the EFLMR basin. Yellow-shaded boxes show distributions containing values that are potentially stressful to aquatic life. Data from the Fivemile Creek HUC-12 are highlighted by the red box. Data from the EFLMR main stem downstream from Fayetteville are excluded. (OEPA, 2014 – page 47)

2.3 Summary of Potential Pollution Causes and Associated Sources for Fivemile Creek HUC-12

OEPA used the results of its multidisciplinary monitoring program to not only determine the attainment status of the streams within the Fivemile Creek HUC-12 watershed, but also to assign probable causes and sources of impairment. As previously mentioned, the Ohio 2016 Integrated Report lists six of the nine sampling locations as partial attainment status. Crane Run, Fourmile Creek, and one site on the main stem of the EFLMR were in full attainment. However, biological monitoring in Pleasant Run and Fivemile Creek indicated that these sites do not meet the WWH biocriterion and two sites on the main stem of the EFLMR do not meet the EWH biocriterion. As reported by OEPA, organic enrichment/low DO during low flow was most evident in Fivemile Creek and Pleasant Run. Additionally, marginal habitat conditions were documented in Fivemile Creek. While many sources are unknown, agriculture is suspected as a probable source in the Fivemile Creek subwatershed. Organic enrichment was also listed as a probable cause for the partial attainment status at the most downstream site on the main stem (M04S08), with the Williamsburg WWTP as the primary source. Table 2-5 presents the causes and sources reported by OEPA.

Table 2-5: Causes and Sources of Impairment for Fivemile Creek HUC-12 Sampling Locations with Partial Attainment Status (OEPA, 2014)

Station ID	RM (DA)	Primary Cause	Primary Source	Location
East Fork Little Miami River				
M04S10	41.07 (221)	Unknown		Upstream Williamsburg @ Jackson Pike
M04S08	34.91 (237)	Organic enrichment	Williamsburg WWTP	Williamsburg @ Main Street
Pleasant Run				
M04S22	1.35 (5.3)	No well-defined cause		North of Williamsburg @ Blue Sky Park Road
M04S46	0.42 (7.8)	Low DO, organic enrichment		Glancy Corner @ Marathon Road
Fivemile Creek				
301895	2.3 (8.3)	Organic enrichment, condition exacerbated by low flow and marginal habitat	Unknown, agriculture	Blue Sky Park Road (Upper Crossing)
M04S49	0.5 (10.6)	Low DO, organic enrichment, condition exacerbated by low flow	Unknown, agriculture	Blue Sky Park Road (Lower Crossing)

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

The EFWC, a group comprised of water quality professionals from USEPA's Office of Research and Development, U.S. Army Corps of Engineers, the USDA Natural Resources Conservation Service (NRCS), OEPA, the Clermont County Water Resources Department, and others, have been combining resources and efforts to monitor the EFLMR watershed upstream of Harsha Lake, including the Fivemile Creek HUC-12 subwatershed, due to increasing concerns over nutrient loads to Harsha Lake (Figure 2-7). Two of the primary interests of the group are the annual HABs that have been occurring on Harsha Lake, and the relationships between watershed activities and the quality of water entering the Bob McEwan Drinking Water Treatment Plant from Harsha Lake.

Figure 2-7: Harsha Lake, which is downstream of the Fivemile Creek HUC-12 watershed, experiences annual harmful algal blooms (EFWC, 2006)

Water quality data collected by EFWC partners suggest that nutrient loads from both the watershed and the lake sediments are driving the toxin-producing cyanobacteria blooms in the lake. The first HAB in Harsha Lake was detected by the EFWC in 2011, and in each year from 2013-2016, recreational public health advisories have been issued for the lake, with the first public beach closure occurring in 2016.

Additional EFWC goals include:

1. Identify the sources of predominant pollutant loadings to the EFLMR and Harsha Lake.
2. Develop and couple a watershed model (SWAT) and lake model (CE QUAL W2).
3. Use the watershed model to determine the locations of high pollutant load sources to enable effective placing of agricultural BMPs in the watershed.
4. Link best management practice performance to effectiveness on a watershed scale.
5. Define costs of drinking water treatment and source water pollutant load reductions.
6. Couple modeling and monitoring programs to aid in drinking water treatment decision support.
7. Determine the feasibility of developing a watershed trading model in the upper EFLMR between the agricultural landowners and unconventional trading partners such as the Bob McEwan Drinking Water Treatment Plant.

2.4.1 Fivemile Creek HUC-12 Soil and Water Assessment Tool

The USEPA – ORD – National Risk Management Research Laboratory's Sustainable Technology Division, Sustainable Environments Branch and the U.S. National Science Foundation have sponsored a robust monitoring and modeling effort, which involved the development and calibration of a Soil and Water Assessment Tool (SWAT) model of the Upper East Fork Watershed. The goal of this research was to understand the potential effectiveness and feasibility of a water quality trading program to achieve nutrient reduction goals and meet water quality standards. In collaboration with the USEPA – ORD for the development of this nine element NPS-IS plan, SWAT model runs were completed at the 12-digit HUC scale for the Fivemile Creek Watershed in order to estimate nutrient pollutant loadings and help identify critical areas to focus implementation efforts. The SWAT model is built upon several elements, including a detailed watershed configuration. This involves a breakdown of subbasins, reach/main channel segments, point sources, and Hydraulic Response Unit codes (HRUs), which are based on land cover characteristics, soil type, and slope. The Fivemile Creek HUC-12 SWAT model has a total of 13 subbasins and 1,934 HRUs.

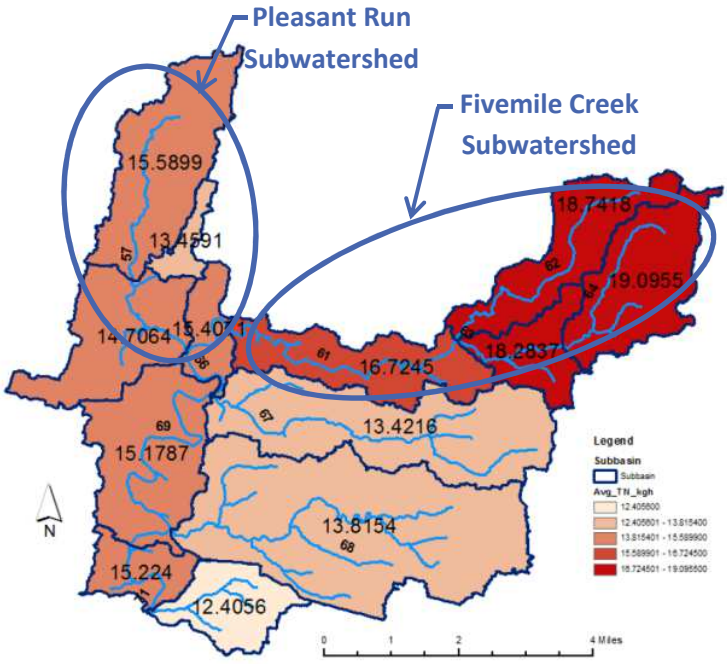


Figure 2-8: SWAT Model Results – Average Annual TN Loads (kg/ha)

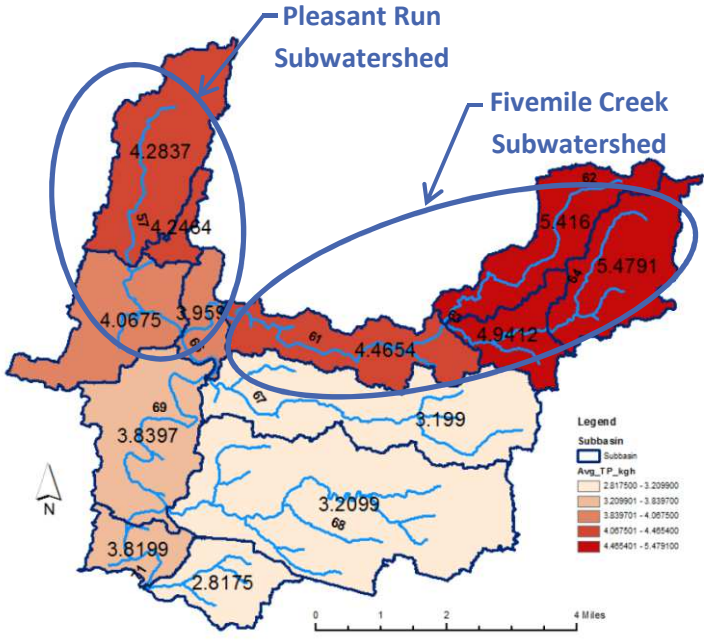


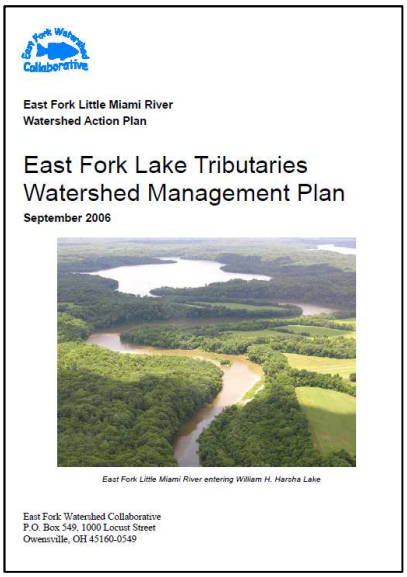
Figure 2-9: SWAT Model Results – Average Annual TP Loads (kg/ha)

As evident in Figures 2-8 and 2-9, which represent the projected Total Nitrogen (TN) and Total Phosphorus (TP) unit loadings from each subbasin of the SWAT model, several areas have particularly high loadings, represented by the dark red color. The

subwatersheds with the highest nutrient loadings correspond to the Fivemile Creek subwatershed and Pleasant Run subwatershed, which also correspond to the streams with some of the lowest fish and macroinvertebrate index scores. As such, the EPA SWAT model offers another line of evidence suggesting that the Fivemile Creek and Pleasant Run subwatersheds are good candidates for the critical areas and focus for this nine-element NPS-IS plan. Reference Appendix A for additional information regarding the development and results of the Fivemile Creek HUC-12 SWAT model provided by USEPA – ORD.

2.4.2 East Fork Lake Tributaries Watershed Management Plan

In September of 2006 the East Fork Watershed Collaborative published the East Fork Lake Tributaries Watershed Management Plan (Figure 2-10). This document includes a watershed action plan for the East Fork drainage area downstream of Fivemile Creek and upstream of Harsha Lake Dam, which covers approximately 147 square miles. The Fivemile Creek HUC-12 Watershed comprises approximately 29% of this total area. This comprehensive Watershed Management Plan provides a watershed inventory focusing on geology, soil, biological features, water resources, land use, point sources and non-point sources of pollution, and alterations to natural habitat; a summary of water resource quality in the EFLMR and its tributaries; a summary of community water management goals and interests; a discussion of watershed impairments, including an identification and quantification of potential pollutant sources and recommended watershed restoration and protection goals. This document uses several data resources to report on existing stream conditions, including Ohio EPA's 2000 Ohio Water Resource Inventory 305(b) Report and the 1998 assessment. The more focused Nine Element NPS-IS Plan for the Fivemile Creek HUC-12 presented herein builds on the successes of this previous plan and is consistent with its findings and recommendations. That is, within the Fivemile Creek HUC-12 watershed, which has historically had elevated nutrient concentrations and low DO levels, this Nine Element NPS-IS Plan shows that the Fivemile Creek and Pleasant Run subwatersheds, in particular, have the highest nutrient loadings and the poorest aquatic communities according to the USEPA SWAT model and OEPA data, respectively.


East Fork Watershed Collaborative

East Fork Little Miami River
Watershed Action Plan

East Fork Lake Tributaries
Watershed Management Plan
September 2006

East Fork Little Miami River entering William H. Harsha Lake

East Fork Watershed Collaborative
P.O. Box 349, 1000 Locust Street
Owensville, OH 45160-0349

Figure 2-10: East Fork Lake Tributaries Watershed Management Plan

CHAPTER 3

Conditions & Restoration Strategies for Fivemile Creek HUC-12 Critical Areas

East Fork Little Miami River - Fivemile Creek
Nine-Element NPS-IS Plan

Prepared by
Clermont Soil and Water Conservation District
Sustainable Streams, LLC
May 2017

Chapter 3: Conditions & Restoration Strategies for Fivemile Creek HUC-12 Critical Areas

3.1 Overview of Critical Areas

Fivemile Creek and Pleasant Run are impaired and have been prioritized as critical areas with several BMP strategies.

Several critical areas have been identified throughout the Fivemile Creek HUC-12 watershed. Specifically, the Fivemile and Pleasant Run subwatersheds are impaired, with only partial attainment status at their monitoring locations (OEPA, 2016), making these subwatersheds important target regions for implementing several different BMP strategies and working to improve instream conditions. These two subwatersheds are dominated by agricultural land use, with several stream segments exhibiting degraded habitat conditions, such as poor pool-riffle sequences, siltation, and lack of riparian cover, and several other segments potentially impacted by septic systems (Figure 3-1).

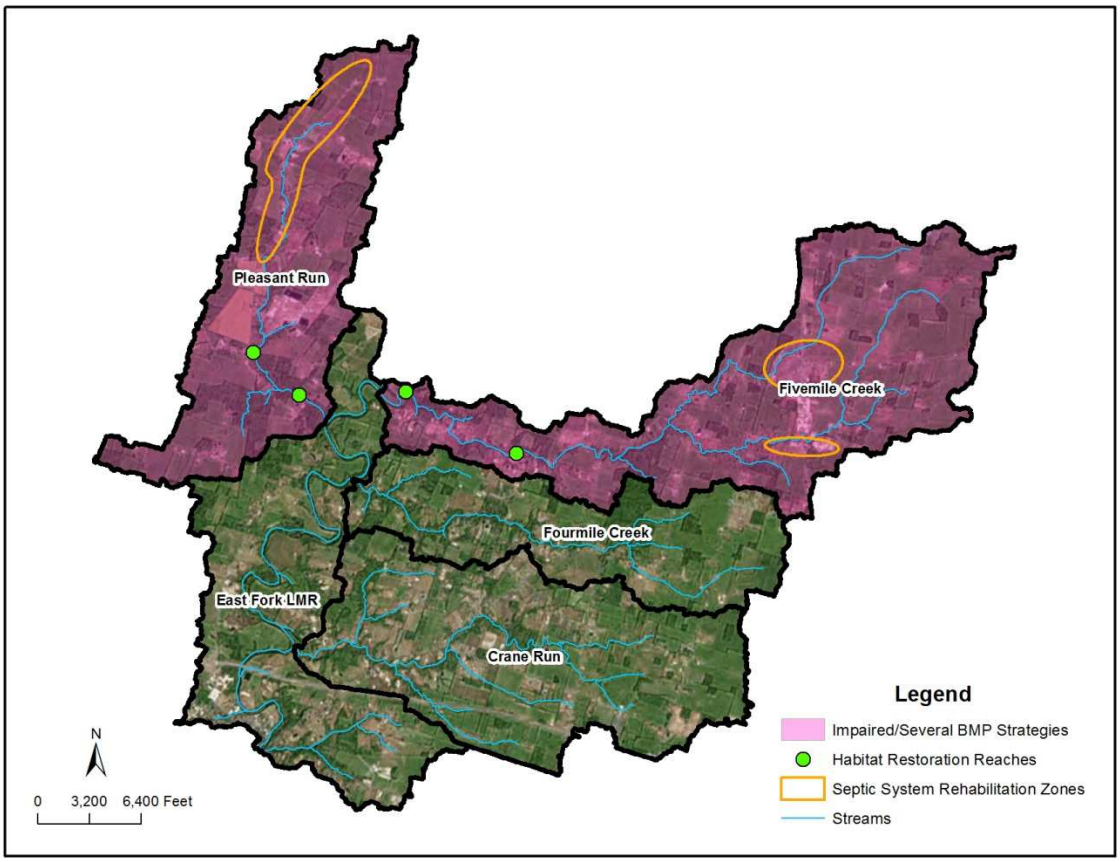


Figure 3-1: Fivemile Creek HUC-12 critical areas and BMP strategies

3.2 Critical Area 1: Conditions, Goals, & Objectives for the Fivemile subwatershed of the Fivemile Creek HUC-12.

3.2.1 Detailed Characterization

Critical Area 1 includes the streams and tributaries within the Fivemile subwatershed of the Fivemile Creek HUC-12. The OEPA 2016 Integrated Report indicates that the sites within this 10.6-square mile subwatershed are impaired and only meet partial attainment status with fish samples, macroinvertebrate assessments, and habitat assessments not meeting acceptable values for streams with warmwater aquatic habitat (WWH) designation. Furthermore, collaboration with the USEPA – ORD and its Soil and Water Assessment Tool (SWAT) model of the Fivemile Creek HUC-12 watershed has determined that this subwatershed is contributing high nutrient loads to the system. Figure 3-2 illustrates an aerial of this area as well as the two sampling sites in partial attainment on the Fivemile subwatershed (Fivemile Creek @ Blue Sky Park Road Upper Crossing – 301895, RM 2.3 and Fivemile Creek @ Blue Sky Park Road Lower Crossing - M04S49, RM 0.5).

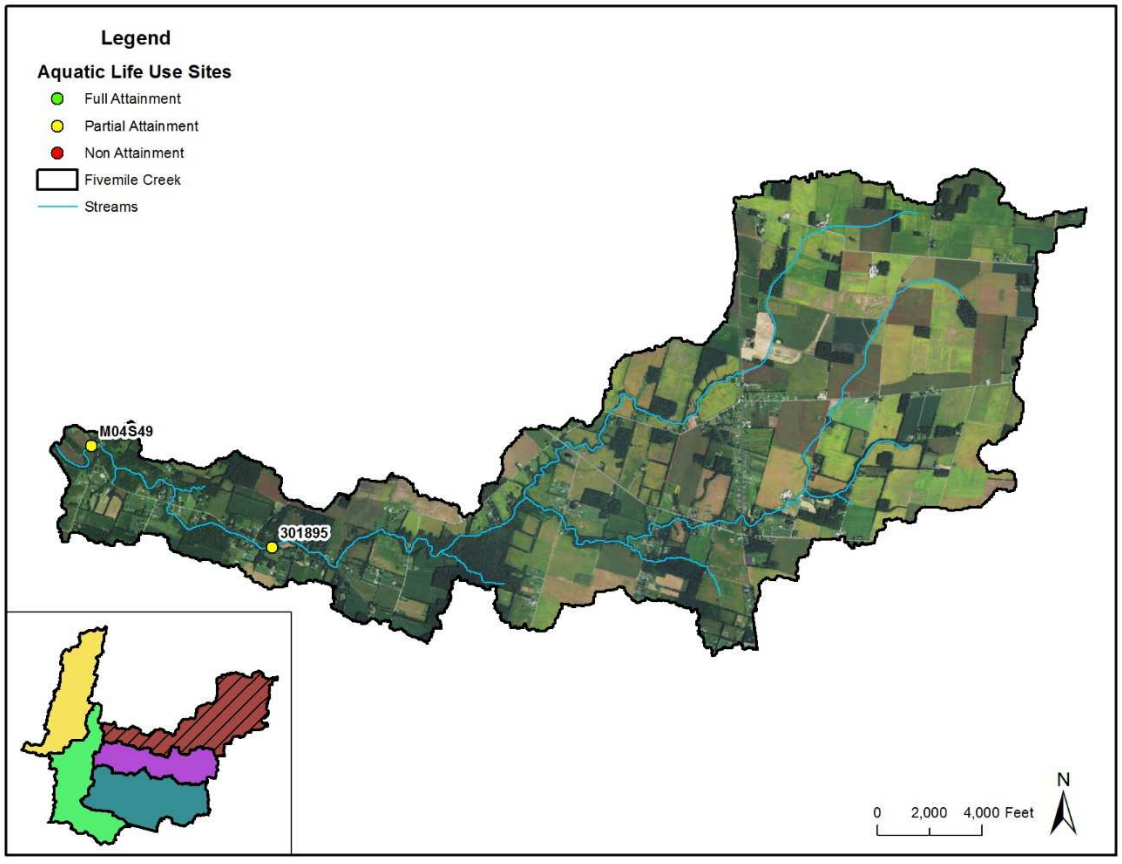


Figure 3-2: Aquatic life use monitoring sites in the Fivemile Critical Area

Review of the 2011 National Land Cover Database (NLCD) indicates that the majority of the watershed is comprised of agricultural land dominated by cultivated crops (70%) with less than a fifth of the watershed covered by deciduous forest (18%) (Figure 3-3).

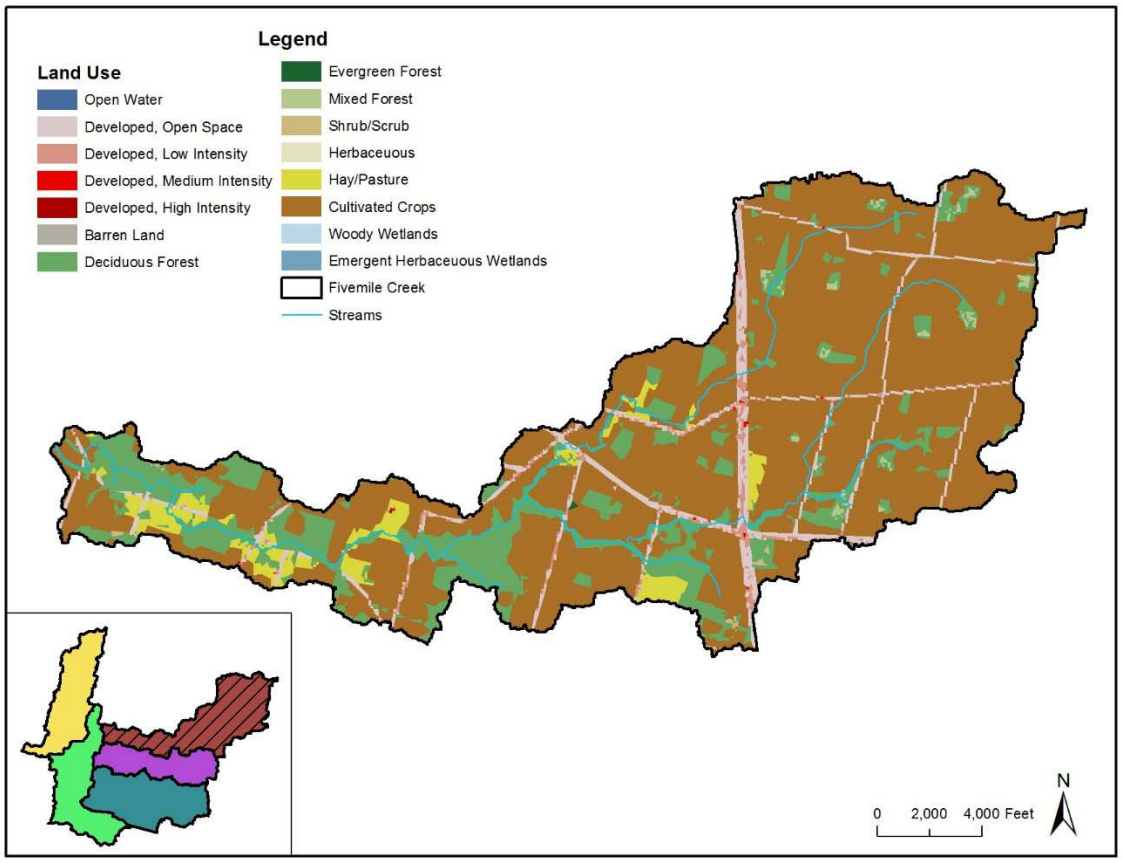


Figure 3-3: Fivemile Critical Area landuse (Homer *et al.*, 2015)

USEPA – ORD's SWAT model is based upon a more detailed breakdown of landuse, illustrated in Figure 3-4. This characterizes the agricultural land into more specific categories, with various crop rotations based on number of years and types of crops per rotation. For example, categories defined as 5-yr Rotation: Soybean-Corn-Soybean (3) represents a five-year rotation, with the land farmed as soybeans in year 1, corn in year 2, and soybeans again in years 3 to 5 before starting the rotation over with another year of soybeans. Corn and soybean production is the most prevalent. These agricultural landuse classifications, coupled with the existing soils (Figure 3-5) and slope conditions, was important for developing the hydrologic response unit (HRU) values input into the SWAT model. Notice much of the watershed is comprised of silt loams, with slow infiltration rates and high runoff potential (hydrologic soil groups C and D). These soil types and the agricultural land use impact the pollutant loadings impairing the streams in Fivemile Creek.

The combination of agricultural landuse and poor soils impacts the pollutant loadings impairing the streams.

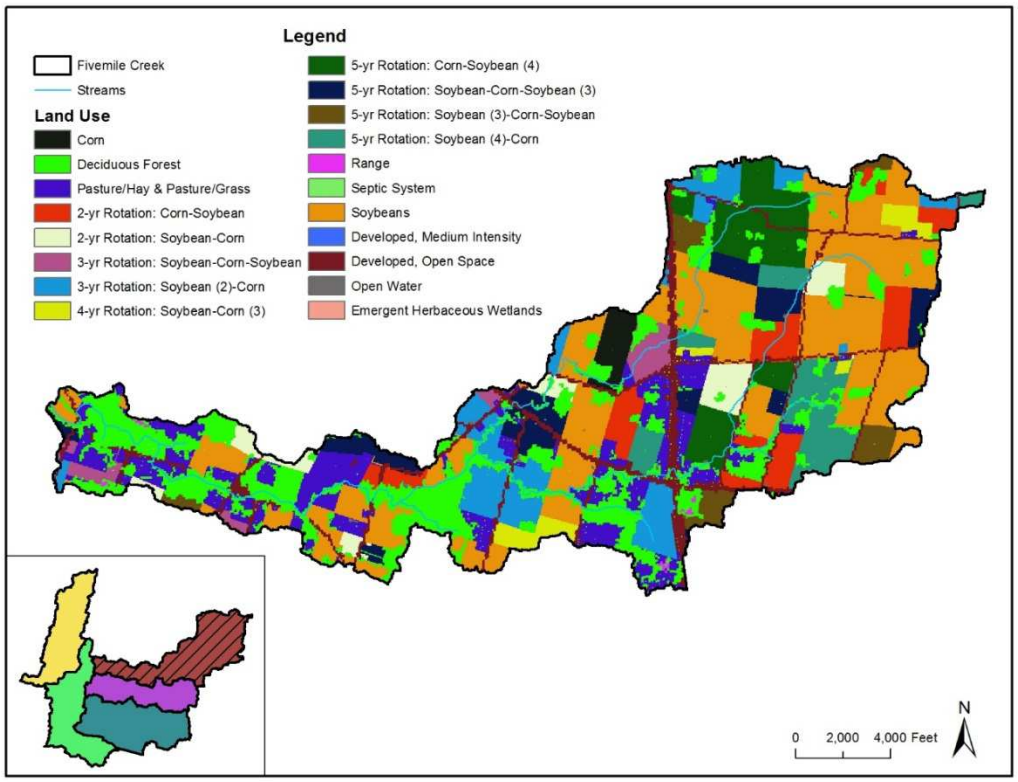


Figure 3-4: Fivemile Critical Area landuse characteristics for SWAT model

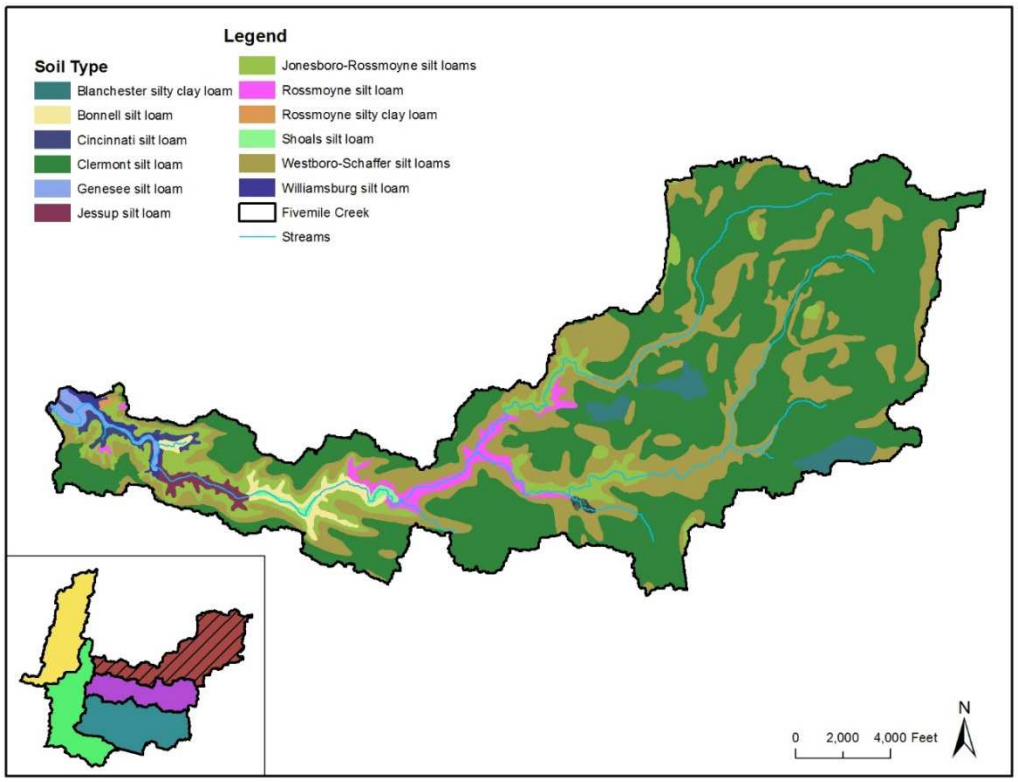


Figure 3-5: Fivemile Critical Area soil characteristics (Lerch *et al.*, 1975; Lerch, 1992)

3.2.2 Detailed Biological Conditions

The 2012 sampling conducted by OEPA in this subwatershed indicates that conditions are not suitable for supporting warmwater aquatic habitat. Table 3-1 illustrates the attributes of the fish sampled in 2012 at each monitoring location, resulting in IBI scores of 32 at the upstream site (301895) and 36 at the downstream site (M04S49). The IBI criterion is 40 for WWH headwater/wadeable streams. Table 3-1 also includes the habitat assessment scores, represented by QHEI values. OEPA reports that QHEI scores from streams across the state indicate that values greater than 64 are generally conducive of supporting warmwater faunas (OEPA, 2014). The habitat assessment at the upstream site (301895) scored 54.3. It was lacking fast current/eddies, instream cover, and appropriate riffle-pool habitat. The habitat assessment at the downstream site (M04S49) scored 51.5 with issues such as sparse/no instream cover, low sinuosity, poor riffle-pool development, and moderate to heavy silt.

Next, Table 3-2 presents the 2012 macroinvertebrate community data at each site in the Fivemile subwatershed. The dominant taxa at the upstream site (301895) include *Helicopsyche* & *Acerpenna* (MI), *Hydropsychids*, and *Elimia* sp. (MI). The dominant taxa at the downstream site (M04S49) include crayfish & *Heptageneids* (F), *Elimia* sp. & *Polycentropus* (MI) (OEPA, 2014). The ICI assessment at these sites reports fair to marginally good conditions.

Table 3-1: Attributes of fish samples and QHEI assessments collected from the Fivemile monitoring locations. Fish attribute values are averages except in cases where sampling method different between passes (OEPA, 2014).

Station ID	RM	QHEI	Drainage Area (mi^2)	Mean # of Species	Rel. # Minus Tol.	Relative Number (all)	IBI	Narratives
301895	2.3	54.3	8.3	13.0	128.0	418.0	32	Fair
M04S49	0.5	51.5	10.6	9.5	102.0	160.0	36	Marginal

Table 3-2: Macroinvertebrate community attributes for the Fivemile monitoring locations (OEPA, 2014).

Station ID	RM	Total Taxa	Qual Taxa	Total EPT	Qual EPT	Total Sens.	Qual Sens.	Qual Tolerant	Density	ICI[a]	Flow
301895	2.3	34	34	7	7	5	5	13	Low	MG	Low
M04S49	0.5	20	20	4	4	3	3	6	Moderate	F	Interstitial

[a]ICI assessment of F indicates fair conditions and an ICI assessment of MG indicates marginally good conditions.

Furthermore, OEPA also conducted water quality sampling as part of its 2012 monitoring of the watershed. This sampling concluded that dissolved oxygen levels were low and the Kjeldahl nitrogen (TKN) and ammonia (NH_3) levels were elevated. This information, coupled with the fair to marginal habitat conditions, is likely the primary reason for the failing ICI and IBI scores.

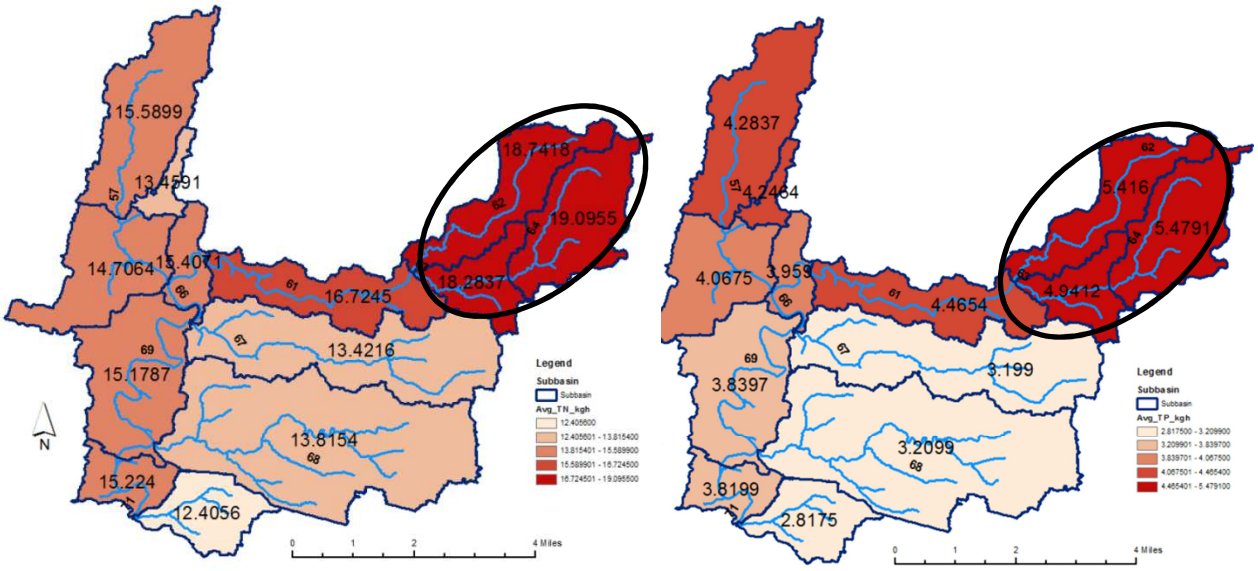


Figure 3-6: The USEPA-ORD SWAT model estimates the highest nutrient loads to be coming from the upper regions of the Fivemile subwatershed

In addition to the data provided by OEPA's 2012 monitoring program, the USEPA – ORD SWAT model results estimate average annual loads of 46,142 kg of TN and 12,320 kg of TP from the Fivemile subwatershed (reference the results included in Appendix A). Furthermore, review of the unit loads reported by the USEPA-ORD SWAT model indicates the upper regions of the subwatershed are likely contributing the highest amount of nutrients to the system (Figure 3-6).

3.2.3 Detailed Causes and Associated Sources

Results of the 2012 monitoring effort indicate several causes of impairment in the Fivemile subwatershed, including organic enrichment – exacerbated by low flow conditions, low dissolved oxygen levels, and poor habitat quality (OEPA, 2014). In regards to habitat conditions, the following attributes from the habitat assessment have an influence on the partial attainment status at these monitoring sites:

Poor instream habitat conditions and agricultural landuse are primary sources of impairment to the Fivemile Creek.

- Sparse/no cover
- Max pool depth less than 40 cm
- Heavy siltation
- Low sinuosity
- Intermediate/pool pools
- No fast current
- No riffle

In addition to poor habitat conditions, agriculture is suspected to be a primary source of pollution in this subwatershed. Stormwater runoff from agricultural fields is typically high in

nutrients; and therefore, some of the primary objectives listed in the next section focus on agricultural land management techniques as well as BMPs to provide pollutant filtration. Finally, aging/unmaintained septic systems are another suspected source of nutrients and bacteria to several reaches (Figure 3-1) based on data from Brown County Board of Health.

3.2.4 Outline Goals and Objectives for the Critical Area

As previously explained, Fivemile Creek is primarily impaired due to poor habitat conditions and organic enrichment. The high nutrient loads are likely attributed to agricultural land use.

Goals

Improving the biological and habitat conditions through an increase in the IBI, MIwb, ICI, and QHEI scores is the overall nonpoint source restoration goal of all NPS-IS plans, with the ultimate goal of bringing the watercourses into full attainment with its designated aquatic life use. In order to bring the Fivemile subwatershed into full attainment, the following goals have been set:

Fivemile Creek @ Blue Sky Park Road (Upper Crossing) RM 2.3:

- Goal 1 – Achieve IBI score of 40 → NOT ACHIEVED: Site currently has a score of 32 (Fair).
- Goal 2 – Achieve ICI value of Good → ACHIEVED: Site currently assessed as Marginally Good.
- Goal 3 – Achieve QHEI score of 64 → NOT ACHIEVED: Site currently has a score of 54.3.

Fivemile Creek @ Blue Sky Park Road (Lower Crossing) RM 0.5:

- Goal 1 – Achieve IBI score of 40 → NOT ACHIEVED: Site currently has a score of 36 (Marginally Good).
- Goal 2 – Achieve ICI value of Good → NOT ACHIEVED: Site currently assessed as Fair.
- Goal 3 – Achieve QHEI score of 64 → NOT ACHIEVED: Site currently has a score of 51.5.

Objectives

The following objectives have been set to improve the conditions in Critical Area 1 - Fivemile Creek subwatershed.

Objective 1: Mitigate the loss of sediment and/or nutrients from the agricultural landscape.

- Implement the following agricultural nonpoint source reduction strategies on approximately 25% of the land in the Upper Fivemile region - 1,040 acres adjacent to watercourses are targeted. Approximately 4,150 acres (~50 parcels) have been identified in this region.
    - Cover crops (USDA NRCS Practice 340)
    - Fertilizer injection
    - Conservation crop rotation (USDA NRCS Practice 328)
- Install 2,000 linear feet of grassed waterways (USDA NRCS Practice 412) where existing ditches contribute high sediment and nutrient loads directly to the stream. Approximately 30,000 linear feet have been mapped as potential opportunities for this strategy.

Objective 2: Establish riparian buffers (USDA NRCS Practice 391), grass filter strips (USDA NRCS Practice 393), or "no-plow" zones along streams currently lacking riparian buffer zones. Approximately 7.3 miles of stream in the Fivemile subwatershed have been mapped as potential opportunities for these strategies, as the land is currently plowed or cultivated up to the edge of the stream. This objective is to restore 3.5 acres of riparian corridor with native plantings of trees and shrubs and includes a 75-foot buffer for approximately 2,000 linear feet.

Objective 3: Restore 1,000 total feet of impaired stream section(s) where there is altered aquatic habitat using bioengineering methods and materials (USDA NRCS Practice 395). Potential project locations include:

- Fivemile Creek @ Blue Sky Park Road (Upper Crossing) RM 2.3 - Sta ID 301895
    - 500-foot habitat restoration project, including 75-foot riparian buffers on either side of the stream and in-stream habitat enhancement/creation.
- Fivemile Creek @ Blue Sky Park Road (Lower Crossing) RM 0.5 - Sta ID M04S49
    - 500-foot habitat restoration project, including 75-foot riparian buffers on either side of the stream and in-stream habitat enhancement/creation.

Objective 4: Rehabilitate septic systems. Initially, failing septic systems will be targeted along US-68 just north of Upper Five Mile Road, along US-68 just south of SR-286, and along Five Mile Road and SR-286 on either side of US-68. Approximately 25% of the properties, or 23 systems, are included as the initial focus, as the Brown County Board of Health estimates that 25% of the systems may be failing or partially failing.

This NPS-IS plan presents an adaptive watershed planning approach and is anticipated to be dynamic as these objectives are implemented, other objectives identified, and both project-related and regularly scheduled monitoring is completed. The monitoring efforts will verify progress towards meeting the goals of the plan (i.e., water quality standards). The objectives, projects and implementation strategies presented herein will be reevaluated and modified if determined necessary, as several versions of this NPS-IS plan are expected – ultimately working towards full attainment of the aquatic health designation.

Details regarding the adaptive management approach for watershed planning is also included in the beginning of chapter 4 of this NPS-IS plan. As objectives and implementation projects are reevaluated, the OEPA Nonpoint Source Management Plan Update (OEPA, 2013), which includes a full list of non-point source management strategies, will be utilized. Strategies, as presented in the overview tables of chapter 4, are classified into the following descriptions:

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

Furthermore, it is important to note that the objectives and practices listed in this NPS-IS plan will likely be cross-referenced to address downstream impairments. Specifically, the implementation strategies included herein should have a positive impact on mitigating the HABs impairing Harsha Lake, and therefore, this NPS-IS plan will be referenced in the future when the Lucy Run-EFLMR HUC-12 NPS-IS Plan, which includes Harsha Lake, is completed.

3.3 Critical Area 2: Conditions, Goals, & Objectives for the Pleasant Run subwatershed of the Fivemile Creek HUC-12.

3.3.1 Detailed Characterization

Pleasant Run subwatershed, which includes 7.7 square miles of land on the northwest region of the Fivemile Creek HUC-12, is prioritized as Critical Area 2 of this NPS-IS plan. Similar to the Fivemile subwatershed discussed above, the OEPA 2016 Integrated Report indicates that the monitoring sites within this subwatershed are impaired and only meet partial attainment status with biological and habitat indices below that which is acceptable for streams with warmwater aquatic designation. Additionally, review of the USEPA – ORD SWAT model indicates elevated nutrient loads coming from this region of the Fivemile Creek HUC-12. An aerial of this critical area as well as the two sampling sites in partial attainment in the Pleasant Run subwatershed (Pleasant Run North of Williamsburg @ Blue Park Sky Park Road – M04S22, RM 1.4 and Pleasant Run @ Glancy Corner @ Marathon Road - M04S46, RM 0.4) is included in Figure 3-7. This figure also illustrates the location of Clermont County's Office of Environmental Quality's (CC-OEQ) permanent, Level 3

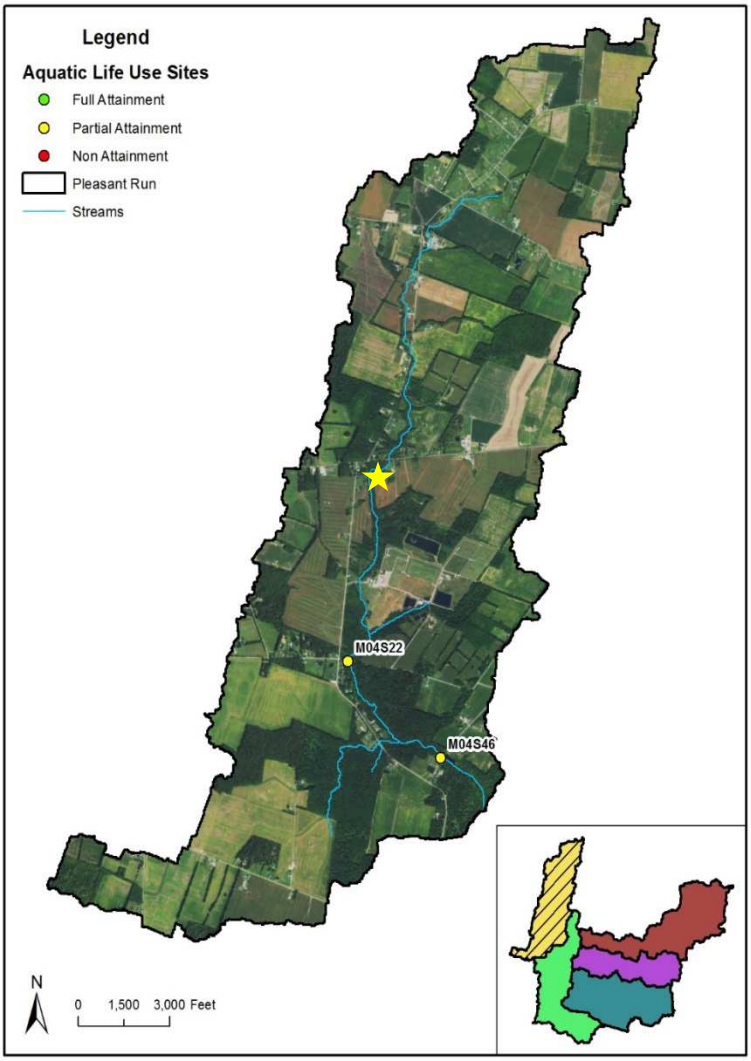


Figure 3-7: Aquatic life use monitoring sites in the Pleasant Run subwatershed. Additionally, the Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US 50, illustrated by a star.

monitoring station, just south of US 50 near RM 2.7, which has the ability to monitor and document future stream conditions.

Review of the 2011 NLCD indicates that the majority of the watershed is comprised of agricultural land dominated by cultivated crops (63%), with only a quarter of the watershed deciduous forest (25%) (Figure 3-8). Furthermore, USEPA-ORD's SWAT model, which again is based upon a more detailed breakdown of landuse, is illustrated in Figure 3-9. The soil characteristics of this critical area are illustrated in Figure 3-10. Similar to the Fivemile Critical Area, Pleasant Run's landuse is primarily agricultural and the soil is primarily silt loams with slow infiltration rates and high runoff potential, ultimately impacting pollutant loads in the stream system.

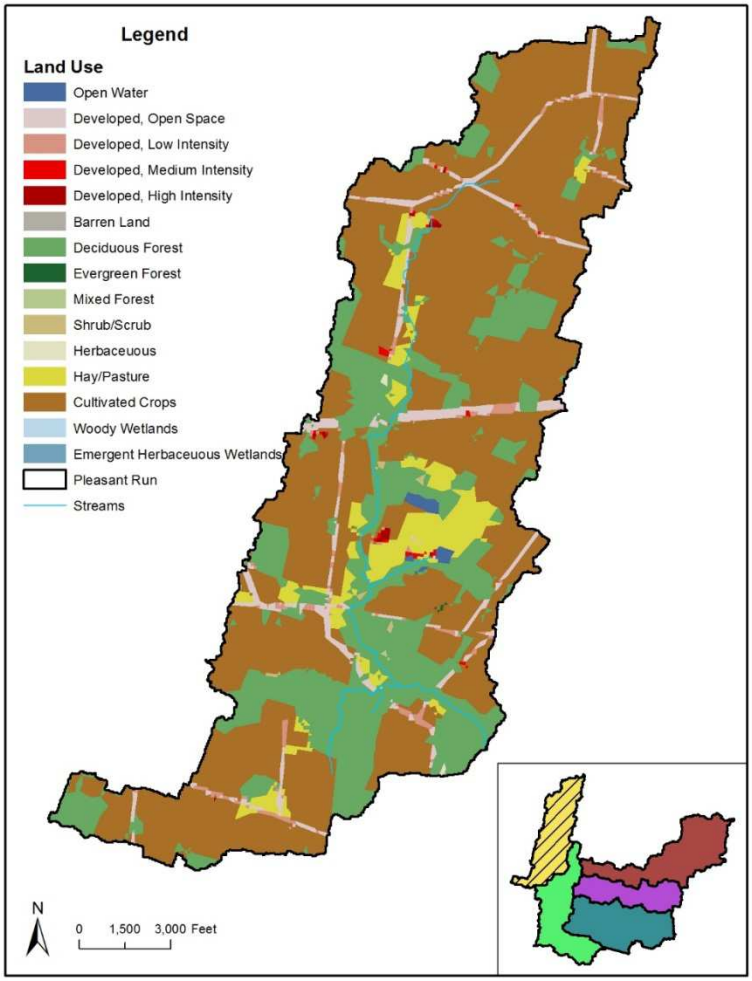


Figure 3-8: Pleasant Run Critical Area Landuse (*Homer et al., 2015*)

Furthermore, the CECOS Hazardous Waste Landfill facility, which was operated in the 1970s and 1980s, is located in the Pleasant Run subwatershed on Aber Road south of US-50. While no immediate water quality problems have been associated with this facility to date (EFWC, 2006), it is closely monitored due to the hazardous nature of the materials at the site (e.g., polychlorinated biphenyls).

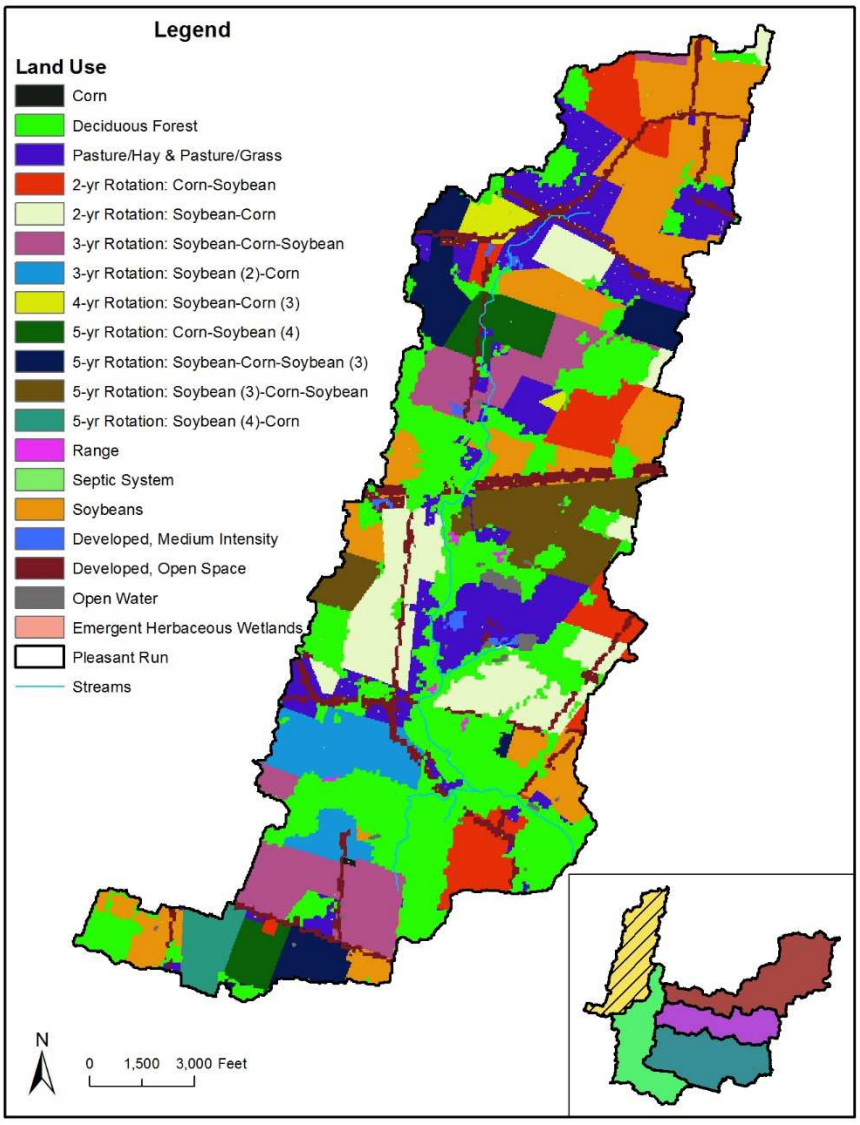


Figure 3-9: Pleasant Run Critical Area landuse characteristics for SWAT model

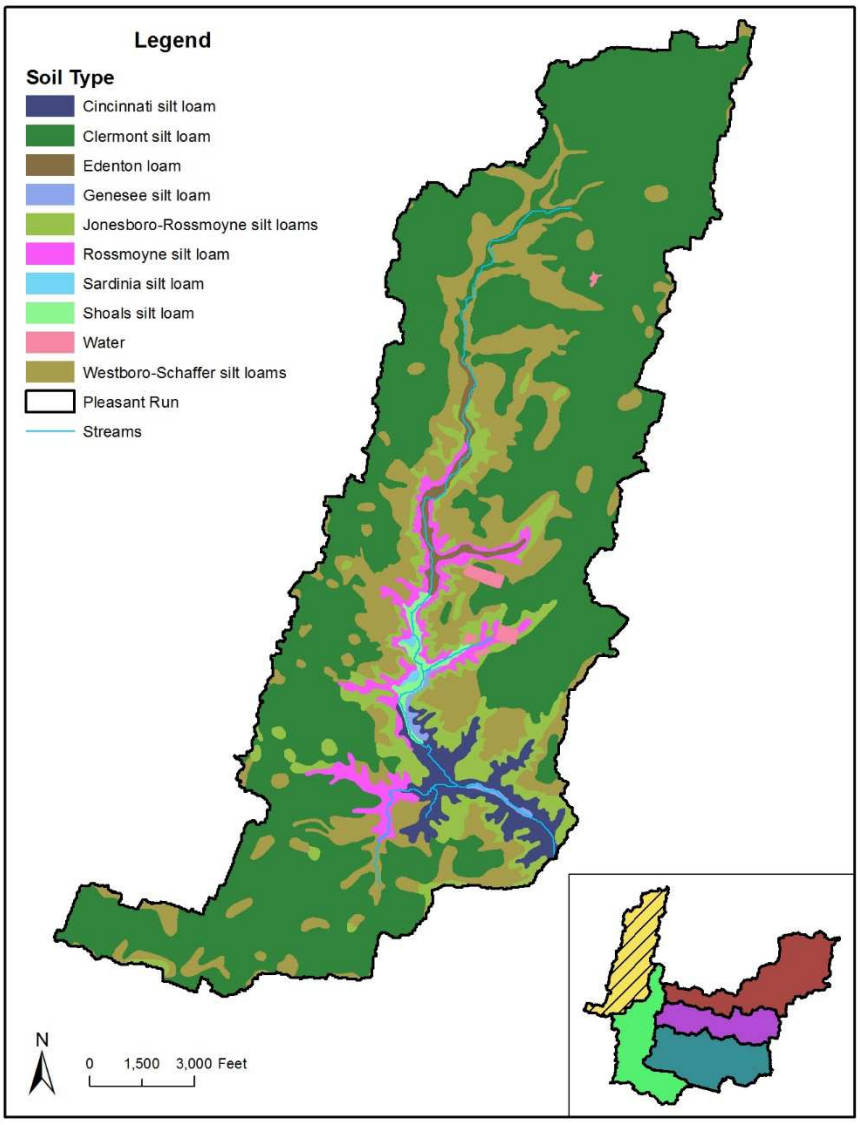


Figure 3-10: Pleasant Run Critical Area soil characteristics (Lerch *et al.*, 1975; Lerch, 1992)

3.3.2 Detailed Biological Conditions

The 2012 sampling conducted by OEPA in this subwatershed indicates that conditions are not suitable for supporting warmwater aquatic habitat. The attributes of the fish sampled at each monitoring location are included in Table 3-3. The IBI scores were generally good in this subwatershed, with the upstream site (Pleasant Run North of Williamsburg @ Blue Park Sky Park Road (M04S22)) having a good IBI score of 42, the downstream site (Pleasant Run @ Glancy Corner @ Marathon Road (M04S46)) having a marginally good IBI score of 38. The IBI criterion is 40 for WWH headwater/wadeable streams. The habitat assessment scores, which are represented by the QHEI values, are also included in Table 3-3. OEPA reports that QHEI scores from streams across the state indicate values greater than 64 are generally conducive of supporting warmwater faunas (OEPA, 2014). The habitat assessment at the upstream site (M04S22) scored 67.5, which surpasses the goal of 64 to support warmwater faunas (OEPA,

2014). Despite the good QHEI score, the habitat assessment at this location documented a lack of riffle habitat and fast current/eddies. The habitat assessment at the downstream site (M04S46) scored 62.5 with issues such as sparse/no instream cover, poor riffle-pool habitat, and low sinuosity.

While the fish monitoring results were somewhat positive, the 2012 macroinvertebrate community data in the Pleasant Run subwatershed presents poor to fair conditions (Table 3-4). Macroinvertebrate sampling was also conducted at the CC-OEQ permanent monitoring station at RM 2.7 during the 2012 monitoring effort, and the results are also included in Table 3-4. The dominant taxa at the CC–OEQ site were flatworms (F) and midges (F, MT, T). The dominant taxa at the OEPA upstream site (M04S22 – RM 1.4) include fingernail clams (F) and flatworms (F,MT). Lastly, the dominant taxa at the downstream site (M04S46 – RM 0.4) include *Hydropsychids*, riffle beetles, H*eptageneids* (F), and water-penny (MI).

Table 3-3: Attributes of fish samples and QHEI assessments collected from the Pleasant Run monitoring locations. Fish attribute values are averages except in cases where sampling method different between passes (OEPA, 2014).

Station ID	RM	QHEI	Drainage Area (mi^2)	Mean # of Species	Rel. # Minus Tol.	Relative Number (all)	IBI	Narratives
M04S22	1.4^E	67.5	5.3	15.0	220.0	630.9	42	Good
M04S46	0.4^E	62.5	7.8	13.0	152.0	558.0	38	Marginal

Table 3-4: Macroinvertebrate community attributes for the Pleasant Run monitoring locations (OEPA, 2014).

Station ID	RM	Total Taxa	Qual Taxa	Total EPT	Qual EPT	Total Sens.	Qual Sens.	Qual Tolerant	Density[b]	ICI[c]	Flow
CC-OEQ[a]	2.7	17	17	0	0	0	0	10	Low	P	Interstitial
M04S22	1.4	21	21	2	2	1	1	8	M-Low	LF	Low
M04S46	0.4	29	29	3	3	2	2	8	M-Low	F	Low

[a] Clermont County Office of Environmental Quality maintains a permanent monitoring station at RM 2.7.

[b] M-Low = Moderate-Low.

[c] ICI assessment of P indicates poor conditions, LF indicates low-fair conditions, and F indicates fair conditions.

Furthermore, OEPA also conducted water quality sampling as part of its 2012 monitoring of the watershed. This sampling concluded that dissolved oxygen levels were low and the Kjeldahl nitrogen (TKN) and ammonia (NH_3) levels were elevated. This information, coupled with the fair to marginal habitat conditions, is likely the primary reason for the failing ICI and IBI scores.

In addition to the data provided by OEPA's 2012 monitoring program, the USEPA – ORD SWAT model results estimate average annual loads of 29,339 kg of TN and 8,115 kg of TP from the Pleasant Run subwatershed (reference the results included in Appendix A). Furthermore, review of the unit loads reported by the USEPA – ORD SWAT model indicates the upper regions of the subwatershed are likely contributing the highest amount of nutrients to the system (Figure 3-11).

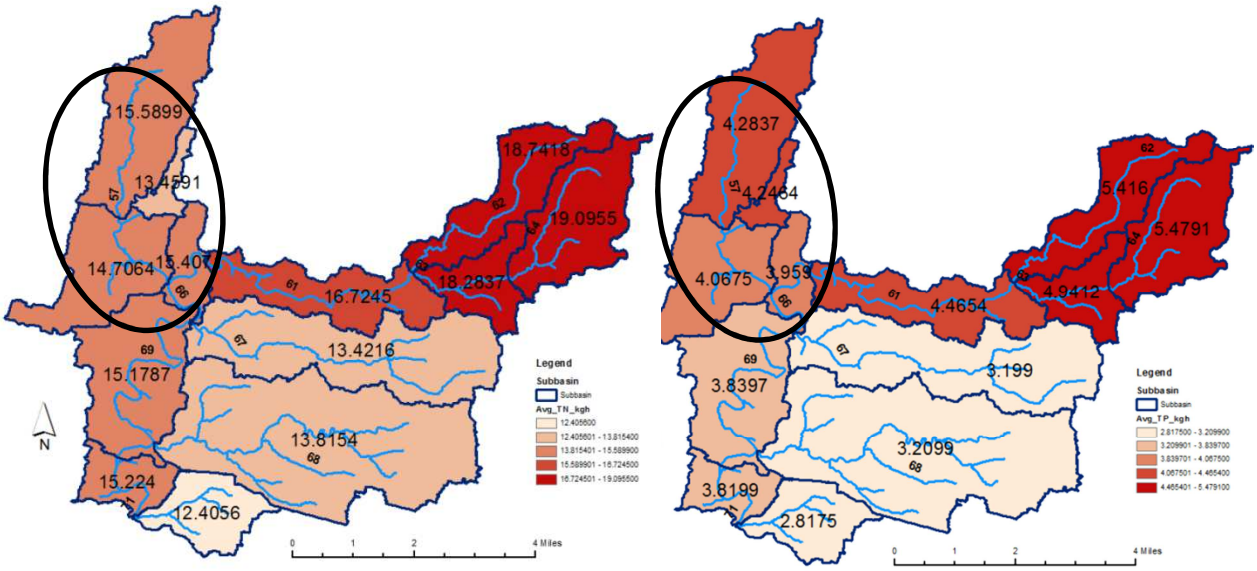


Figure 3-11: The USEPA-ORD SWAT model estimates the highest nutrient loads to be coming from the upper regions of the Pleasant Run subwatershed

3.3.3 Detailed Causes and Associated Sources

While OEPA does not report a well-defined cause of impairment for the upstream site in Pleasant Run (M04S22), low dissolved oxygen levels and organic enrichment are documented as primary reasons for the failing ICI assessment at the downstream site (M04S46). In regards to habitat conditions, the following attributes from the habitat assessment have an influence on the partial attainment status at these monitoring sites:

- Sparse/no cover
- Siltation
- Low sinuosity
- Intermediate/poor pools
- No fast current
- No riffle

Similar to the Fivemile subwatershed, agriculture is suspected to be a primary source of pollution, in addition to poor habitat conditions. Stormwater runoff from agricultural fields is typically high in nutrients; and therefore, some of the primary objectives listed in the next section focus on agricultural land management techniques as well as BMPs to provide pollutant filtration. Furthermore, aging/unmaintained septic systems are another suspected source of nutrients and bacteria to several reaches (Figure 3-1) based on data from Clermont County Public Health.

3.3.4 Outline Goals and Objectives for the Critical Area

As previously explained, Pleasant Run is primarily impaired due to poor habitat conditions, low dissolved oxygen, and organic enrichment. The high nutrient loads are likely attributed to agricultural land use and failing septic systems. Excess stormwater runoff from well-drained agricultural fields could also be impacting the natural flow regime of the watershed, such that hydrologically restorative agricultural BMPs or other practices, such as wetland re-establishment, could be beneficial to receiving stream integrity as well.

Goals

Improving the biological and habitat conditions through an increase in the IBI, MIwb, ICI, and QHEI scores is the overall nonpoint source restoration goal of all NPS-IS plans, with the ultimate goal of bringing the watercourses into full attainment with its designated aquatic life use. In order to bring the Pleasant Run subwatershed into full attainment, the following goals have been set:

Pleasant Run North of Williamsburg @ Blue Sky Park Road RM 1.4

- Goal 1 – Achieve IBI score of 40 → ACHIEVED: Site currently has a score of 42 (Good).
- Goal 2 – Achieve ICI value of Good → NOT ACHIEVED: Site currently assessed as Low-Fair.
- Goal 3 – Achieve QHEI score of 64 → ACHIEVED: Site currently has a score of 67.5.

Pleasant Run @ Glancy Corner @ Marathon Road RM 0.4:

- Goal 1 – Achieve IBI score of 40 → NOT ACHIEVED: Site currently has a score of 38 (Marginally Good).
- Goal 2 – Achieve ICI value of Good → NOT ACHIEVED: Site currently assessed as Fair.
- Goal 3 – Achieve QHEI score of 64 → NOT ACHIEVED: Site currently has a score of 62.5.

Objectives

The following objectives have been set to improve the conditions in Critical Area 2 – Pleasant Run subwatershed.

Objective 1: Mitigate the loss of sediment and/or nutrients from the agricultural landscape.

- Implement the following agricultural nonpoint source reduction strategies on approximately 25% of the land in the Upper Pleasant Run region - 363 acres adjacent to watercourses are targeted.
  - Cover crops (USDA NRCS Practice 340)
  - Fertilizer injection
  - Conservation crop rotation (USDA NRCS Practice 328)
- Install 500 linear feet of grassed waterways (USDA NRCS Practice 412) where existing ditches contribute high sediment and nutrient loads directly to the stream. Approximately 5,200 linear feet have been mapped as potential opportunities for this strategy.

Objective 2: Establish riparian buffers (USDA NRCS Practice 391), grass filter strips (USDA NRCS Practice 393), or "no-plow" zones in riparian along 1,475 linear of streams currently lacking riparian buffer zones. Approximately 2.8 miles of stream in the Pleasant Run subwatershed have been mapped as potential opportunities for these strategies, as the land is currently plowed or cultivated up to the edge of the stream. This objective is to restore 2.5 acres of riparian corridor with native plantings of trees and shrubs and includes a 75-foot buffer.

Objective 3: Restore 1,000 total feet of impaired stream section(s) where there is altered aquatic habitat using bioengineering methods and materials (USDA NRCS Practice 395). Potential project locations include:

- Pleasant Run North of Williamsburg @ Blue Sky Park Road RM 1.4 - Sta ID M04S22
    - 500-foot habitat restoration project, including 75-foot riparian buffers on either side of the stream and in-stream habitat enhancement/creation.
- Pleasant Run @ Glancy Corner @ Marathon Road RM 0.4 - Sta ID M04S46
    - 500-foot habitat restoration project, including 75-foot riparian buffers on either side of the stream and in-stream habitat enhancement/creation.

Objective 4: Constructed wetlands (USDA NRCS Practice 656). Ideally, the property owned by CECOS and Jackson Township along Pleasant Run in the central portion of the subwatershed (204 acres) will be targeted for implementation.

Objective 5: Rehabilitate septic systems. Initially, failing septic systems will be targeted along Bucktown Trails, Bucktown Road, and Moore-Marathon Road. Approximately 25% of the properties, or 16 systems, will be the initial focus.

Again, this NPS-IS plan presents an adaptive watershed planning approach and is anticipated to be dynamic as these objectives are implemented, other objectives identified, and both project-related and regularly scheduled monitoring is completed. The monitoring efforts will verify progress towards meeting the goals of the plan (i.e., water quality standards). The objectives, projects and implementation strategies presented herein will be reevaluated and modified if determined necessary, as several versions of this NPS-IS plan are expected – ultimately working towards full attainment of the aquatic health designation. Details regarding the adaptive management approach for watershed planning is also included in the beginning of chapter 4 of this NPS-IS plan.

As objectives and implementation projects are reevaluated, the OEPA Nonpoint Source Management Plan Update (OEPA, 2013), which includes a full list of non-point source management strategies, will be utilized. Strategies, as presented in the overview tables of chapter 4, are classified into the following descriptions:

- Urban Sediment and Nutrient Strategies;
- Altered Stream and Habitat Restoration Strategies;

- Agricultural Nonpoint Source Reduction Strategies; and
- High Quality Waters Protection Strategies

Furthermore, it is important to note that the objectives and practices listed in this NPS-IS plan will likely be cross-referenced to address downstream impairments. Specifically, the implementation strategies included herein should have a positive impact on mitigating the HABs impairing Harsha Lake, and therefore, this NPS-IS plan will be referenced in the future when the Lucy Run-EFLMR HUC-12 NPS-IS Plan, which includes Harsha Lake, is completed.

CHAPTER 4

Projects and Implementation Strategy

East Fork Little Miami River - Fivemile Creek
Nine-Element NPS-IS Plan

Prepared by
Clermont Soil and Water Conservation District
Sustainable Streams, LLC
May 2017

Chapter 4: Projects and Implementation Strategy

This chapter of the Fivemile HUC-12 NPS-IS Plan includes an action plan to mitigate the impairments discussed in detail throughout Chapter 3. It brings together the goals, objectives, and anticipated projects by summarizing the "who, what, when, and where" of several implementation opportunities throughout the critical areas. This plan includes projects that incorporate numerous strategies outlined in Ohio's Nonpoint Source Management Plan (Update) (OEPA, 2013) and is intentionally dynamic (Figure 4-1) as more information is garnered, projects are implemented, and new projects are developed. Once projects are implemented and as funding allows, monitoring will be conducted in coordination with the OEPA-DSW Ecological Assessment Unit and Clermont County Office of Environmental Quality, a Level 3 Quality Data Collector, to understand improvements and guide future watershed planning efforts, including consideration for additional critical areas.

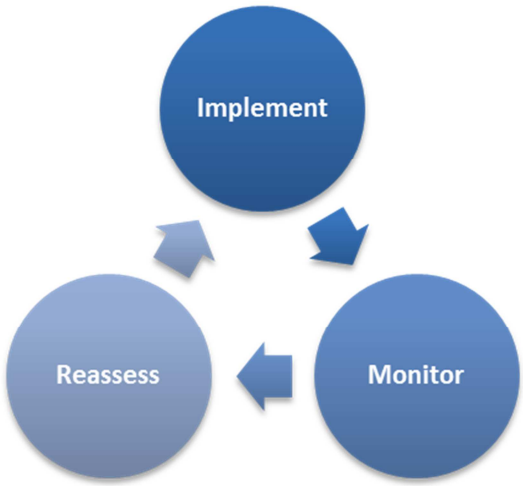


Figure 4-1: Dynamic Watershed Planning Approach

4.1 Overview Tables and Project Sheets for Critical Areas

Two overview tables (subsections 4.2.1 and 4.3.1) and associated project summary sheets (subsections 4.2.2 and 4.3.3) for each of the critical areas, Fivemile subwatershed and Pleasant Run subwatershed, are included within this chapter of the NPS-IS plan. Project opportunity figures (included in Appendix B – *Critical Area 1: Fivemile Subwatershed BMP Strategy Maps* and Appendix C – *Critical Area 2: Pleasant Run Subwatershed BMP Strategy Maps*) have also been included to provide supplemental information regarding each proposed project. The opportunities presented throughout this chapter provide concept level opportunities to be further vetted as land owners provide additional feedback on the projects and each project is adequately funded. With that, the estimated project costs and the time frame (short to medium), are both heavily dependent upon funding opportunities and coordination with property owners and project partners. Understanding the importance of including projects of interest to local producers, a Focus Group meeting was conducted on March 14, 2017 to obtain feedback from these stakeholders and guide the strategies to be included within. Several local producers and partners such as Brown SWCD, Clermont SWCD, and NRCS were in attendance, and many of the projects detailed throughout this chapter were obtained from this productive meeting.

Project summary sheets and opportunity figures present an action plan for the Fivemile and Pleasant Run critical areas.

In addition to the detail provided in previous chapters, the project summary sheets outline how the nine minimum elements of watershed planning are being met by each opportunity, as shown in the first

column of each table. Furthermore, as mentioned above, this is a dynamic NPS-IS plan that is inherently flexible to respond to additional monitoring/stakeholder/project opportunity feedback (Figure 4-1) such that funds can continue to be invested in the Fivemile HUC-12 to provide the greatest chances for improvements in aquatic communities and habitat for the least cost. Additionally, if a future critical area(s) is identified within the Fivemile HUC-12, supplemental information will be provided as funding allows.

4.1.1 Education and Outreach Strategies

One important element of NPS-IS nine element plans is the education and outreach activities that will be conducted while implementing the plan. Clermont and Brown SWCDs are dedicated to engaging the public and informing them of important events and projects, but also educating them about the existing condition of the streams, how to improve impairments, and conserve the high quality areas. Four times a year, Clermont SWCD sends out both electronic and paper copies of a newsletter titled *Clermont Environmental Quarterly*. This newsletter includes important project updates and information regarding environmental conditions. The SWCD's website, www.clermontswcd.org, has dedicated pages regarding the East Fork Watershed Programs and will include detailed information relating to this NPS-IS plan. Clermont SWCD also uses several social media outlets to inform and engage the local community, such as Facebook (www.facebook.com/ClermontSWCD), Twitter (@ClermontSWCD), and YouTube (http://www.youtube.com/channel/UCr-xLSlP-iejIVvbA2NoxiA). Brown SWCD also maintains a web site (www.brownswcd.org), a Facebook Page (www.facebook.com/BrownCountySWCD), and a Twitter account (@BrownSWCD).

The East Fork Watershed Collaborative, which includes several local agencies, works to educate the community to better understand water quality and stormwater management issues.

Furthermore, as an active member of groups such as the East Fork Watershed Collaborative and the Greater Cincinnati Regional Stormwater Collaborative, Clermont SWCD works to educate the local community to better understand water quality and stormwater management issues. The East Fork Watershed Collaborative, which was formed in 2001, allows local agencies, groups, and individuals within the East Fork Little Miami River watershed to work together to plan and implement water quality improvement projects, organize work groups to accomplish specific tasks, and ultimately work to "enhance the biological, chemical, and physical integrity of the East Fork Little Miami River and its tributaries" (EFWC, 2006). The Greater Cincinnati Regional Stormwater Collaborative, which includes organizations such as local storm water districts, municipalities, townships, and soil and water conservation districts in Southwest Ohio and Northern Kentucky, works to raise awareness about water quality issues in the Ohio River Valley. More information about the Greater Cincinnati Regional Stormwater Collaborative is available on its website at www.savelocalwaters.org.

Full-time educational specialists are employed at both Clermont and Brown SWCDs, who present at local schools and special interest groups, completing hundreds of presentations each year. In regards to agricultural education and outreach, both SWCDs host annual workshops and field days where local producers come together to discuss relevant topics. In the past these workshops have focused on cover crops. Lastly, both SWCDs conduct one-on-one meetings with landowners. As the opportunities included in this NPS-IS plan are further vetted and implemented in the watershed, the SWCDs will utilize these avenues to engage the public and educate the community about pollutants of concern, potential sources of pollutants, and solutions to improve the condition of the streams within the Fivemile HUC-12.

4.1.2 Priority Project Funded and Moving Towards Implementation

Outside the critical areas, at the most downstream extents of the Fivemile Creek HUC-12 watershed, the Village of Williamsburg, in partnership with the Clermont SWCD, is working to remove the Williamsburg Low-Head Dam (Figure 4-2). With a total project budget of $670,000, this project is funded through a principal forgiveness loan from OEPA's Agency Division of Environmental and Financial Assistance and the Water Resource Restoration Sponsor Program. While flow alteration and excess nutrients are the leading cause of impairment on the main stem, this project will restore more natural and stable flow characteristics, allow for better fish passage and improved biological diversity, provide instream habitat, eliminate a public safety hazard, and educate the local citizens about dam removal and stream restoration projects.

Figure 4-2: Williamsburg Low-Head Dam to be removed, allowing for better fish passage and biological diversity, improved instream habitat, and safer conditions for recreational uses (Rivers Unlimited, 2007).

4.2 Critical Area 1: Overview Table and Project Sheet(s) for the Fivemile Subwatershed of the Fivemile Creek HUC-12.

4.2.1 Critical Area 1: Project and Implementation Strategy Overview Table

The Project Overview Table on the next page presents a summary of each strategy identified for Critical Area 1: Fivemile Subwatershed. These BMP strategies are divided into several categories, including altered stream and habitat restoration strategies, agricultural nonpoint source reduction strategies, and other nonpoint source causes and associated sources of impairment (OEPA, 2013). As discussed in chapters 2 and 3, the monitoring stations in the Fivemile subwatershed are in partial attainment of the warmwater aquatic life use designation in these locations. These projects will help to mitigate the pollutant loads coming from the land, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.

These projects will help mitigate pollutant loads and begin to improve the conditions in Fivemile Creek, ultimately working towards full attainment.

Critical Area 1 (Fivemile Creek Subwatershed): Project Overview Table for Fivemile Creek HUC-12 (050902021102))							
Goals	**Obj. No.**	**Proj. No.**	**Project Title (criteria g)**	**Lead Organization (criteria d)**	**Time Frame[b] (criteria f)**	**Estimated Cost[c] (criteria d)**	**Potential/Actual Funding Source (criteria d)**
Urban Sediment and Nutrient Reduction Strategies[a]							
			Not Applicable for this Critical Area at this time.				
Altered Stream and Habitat Restoration Strategies[a]							
1, 2, 3	3	1	Fivemile Creek Habitat Restoration Near RM 2.3	Clermont SWCD	Medium	$65,000	OEPA 319, WRRSP, WHIP
, 2, 3	3	2	Fivemile Creek Habitat Restoration Near RM 0.5	Clermont SWCD	Medium	$65,000	OEPA 319, WRRSP, WHIP
Agricultural Nonpoint Source Reduction Strategies[a]							
1, 2, 3	1	3a	Cover Crops	Brown SWCD	Short	$273,000	Ohio 319, EQIP, CSP, RCPP, Five Mile National Water Quality Initiative (NWQI)
1, 2, 3	1	3b	Fertilizer Injection	Brown SWCD	Medium	$160,000	Ohio 319, EQIP, CSP, RCPP, Five Mile NWQI
1, 2, 3	1	3c	Conservation Crop Rotation	Brown SWCD	Short	$4,500	Ohio 319, EQIP, CSP, RCPP, Five Mile NWQI
1, 2, 3	1	4	Grassed Waterways	Brown SWCD	Short	$25,000	OEPA 319, CRP, EQIP, RCPP, Five Mile NWQI
1, 2, 3	2, 4	5	Riparian Zone Improvement	Brown SWCD	Medium	$130,000	OEPA 319, CRP, EQIP, RCPP, Five Mile NWQI, WRRSP, Clean Ohio Fund
High Quality Waters Protection Strategies[a]							
			Not Applicable for this Critical Area at this time.				
Other NPS Causes and Associated Sources of Impairment[a]							
1, 2, 3	5	6	Septic System Rehabilitation	Brown County Board of Health	Medium	$100,000	SSRFP, CWSRF, USDA-Rural Development

[a] OEPA, 2013
[b] All time frames are subject to project funding availability and property owner coordination, with short being 1-3 years and medium being 3-7 years.
[c] Estimated cost presents rough planning-level implementation costs.

4.2.2 Critical Area 1: Project Summary Sheet(s)

These project summary sheets present the next step toward implementation and improving the conditions of Fivemile Creek. The opportunities listed were garnered from the NPS-IS plan focus group meeting on March 14, 2017. Reference Appendix B – *Critical Area 1: Fivemile Subwatershed BMP Strategy Maps* for additional information regarding each BMP opportunity.

Critical Area 1: Project 1		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Fivemile Creek Habitat Restoration Near RM 2.3
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Private property owners
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	OEPA monitoring station ID 301895: Fivemile Creek @ Blue Sky Park Road (Upper Crossing) RM 2.3
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Restore ~500 linear feet of degraded stream (USDA NRCS Practice 395)
criteria g	**Project Narrative**	Restore the instream habitat and a 75-foot riparian buffer zone along ~500 linear feet of impaired stream at RM 2.3. Fivemile Creek has impaired habitat at OEPA's monitoring location ID 301895. With a 2012 QHEI of 54.3, some of the issues include no instream cover and lack of defined pool-riffle habitat. This habitat restoration project includes one Newbury riffle, invasive species removal, live stakes, and riparian plantings.
criteria d	**Estimated Total Cost**	$65,000
criteria d	**Possible Funding Source**	OEPA 319, WRRSP, WHIP
criteria a	**Identified Causes and Sources**	Cause: Impaired habitat Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To increase IBI score above 40 (currently 32), to raise the ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3). One reasonable objective includes habitat restoration at the monitoring location using bioengineering methods and materials. This, coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	500 feet of the 1,000 foot objective (50%) will be accomplished through implementation of this project.
	Part 3: Load Reduced[a]:	Estimated: 78 tons sediment/year, 100 lbs TN/year, and 34 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA's 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using an implementation goal of 500 linear feet of stream restoration and pollutant load removal rates reported by the Chesapeake Bay Stormwater Network and Center for Watershed Protection. Stream restoration pollutant load removal rates include a TN removal rate of 0.2 lb/ft/yr, a TP removal rate of 0.068 lb/ft/yr, and a TSS removal rate of 310 lb/ft/yr (Schueler & Stack, 2012).

Critical Area 1: Project 2		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Fivemile Creek Habitat Restoration Near RM 0.5
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Private property owners
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	OEPA monitoring station ID M04S49: Fivemile Creek @ Blue Sky Park Road (Lower Crossing) RM 0.5
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Restore ~500 linear feet of impaired stream (USDA NRCS Practice 395)
criteria g	**Project Narrative**	Restore the instream habitat and a 75-foot riparian buffer zone along ~500 linear feet of impaired stream at RM 0.5. Fivemile Creek has impaired habitat at OEPA's monitoring location ID M04S49. With a 2012 QHEI of 51.5, some of the issues include no instream cover, lack of defined pool-riffle habitat, and moderate-heavy siltation. This habitat restoration project includes one Newbury riffle, invasive species removal, live stakes, and riparian plantings.
criteria d	**Estimated Total Cost**	$65,000
criteria d	**Possible Funding Source**	OEPA 319, WRRSP, WHIP
criteria a	**Identified Causes and Sources**	Cause: Impaired habitat Source: NPS agricultural runoff
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To increase IBI score above 40 (currently 36), to raise the ICI score (from fair to good), and to raise QHEI score (from 51.5 to 64) at Lower Blue Sky Park Road Sampling Site on Fivemile Creek (RM 0.5) One reasonable objective includes habitat restoration at the monitoring location using bioengineering methods and materials. This, coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.

criteria b & h (cont.)	**Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?**	500 feet of the 1,000 foot objective (50%) will be accomplished through implementation of this project.
	Part 3: Load Reduced[a]:	Estimated: 78 tons sediment/year, 100 lbs TN/year, and 34 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA's 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using an implementation goal of 500 linear feet of stream restoration and pollutant load removal rates reported by the Chesapeake Bay Stormwater Network and Center for Watershed Protection. Stream restoration pollutant load removal rates include a TN removal rate of 0.2 lb/ft/yr, a TP removal rate of 0.068 lb/ft/yr, and a TSS removal rate of 310 lb/ft/yr (Schueler & Stack, 2012).

Critical Area 1: Project 3a		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Cover Crops
criteria d	**Project Lead Organization & Partners**	LEAD: Brown SWCD PARTNERS: Clermont SWCD, Local producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Fivemile subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~1,000 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c).
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Cover crop implementation (USDA NRCS Practice 340)
criteria g	**Project Narrative**	Implement cover crops in highly erodible areas, particularly focused on field edges, versus whole field plantings, for a five-year cycle. Additionally, this project could include the means for subsidizing specialized equipment, such as vertical tillage tools specific to cover crops, to efficiently implement cover crops in this region.
criteria d	**Estimated Total Cost**	$273,000
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP, Five Mile NWQI
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This cover crop project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 4,150 acres (~50 parcels) of agricultural land have been identified in this region as potential opportunities for implementing this type of BMP. Approximately 1,000 acres (25%) will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 3,150 lbs TN/year and 2,030 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 1,000 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

Critical Area 1: Project 3b		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Fertilizer Injection
criteria d	**Project Lead Organization & Partners**	LEAD: Brown SWCD PARTNERS: Clermont SWCD, Local producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Fivemile subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~1,000 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c).
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Fertilizer injection equipment loan/rental program
criteria g	**Project Narrative**	This project provides funding to the SWCD to provide subsidies to farmers within the critical area to purchase specialized equipment for injecting fertilizer on agricultural fields. Once the producers have an affordable means of accessing the proper equipment, this can become a continual practice, versus a set contract period like many other programs. One of the primary advantages of injecting fertilizer is the precise application of nutrients to reduce the amount of losses to NPS runoff.
criteria d	**Estimated Total Cost**	$160,000
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP, Five Mile NWQI
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This fertilizer injection project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 4,150 acres (~50 parcels) of agricultural land have been identified in this region as potential opportunities for implementing this type of BMP. Approximately 1,000 acres (25%) will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 2,750 lbs TN/year and 3,100 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 1,000 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The "no till-reduce fertilizer by 60%" scenario was utilized to estimate these pollutant loads. The 50th percentile results were utilized for this calculation.

Critical Area 1: Project 3c		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Conservation Crop Rotation
criteria d	**Project Lead Organization & Partners**	LEAD: Brown SWCD PARTNERS: Clermont SWCD, Local producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Fivemile subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~1,000 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c).
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Conservation crop rotation practices (USDA NRCS Practice 328)
criteria g	**Project Narrative**	While some producers in the region already implement conservation crop rotation practices, this project will encourage participation from producers directly adjacent to watercourses. During the NPS-IS plan Focus Group meeting, strategies such as rotating high-residue producing crops (corn or wheat) in the rotation with low-residue producing crops (soybeans) is a preferred approach to the producers in this region. This implementation project, which will follow NRCS Standard 328, will allow the producers some flexibility to maximize benefits to both the producer and the NPS runoff quality.
criteria d	**Estimated Total Cost**	$4,500
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP, Five Mile NWQI
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This conservation crop rotation project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 4,150 acres (~50 parcels) of agricultural land have been identified in this region as potential opportunities for implementing this type of BMP. Approximately 1,000 acres (25%) will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 1,110 lbs TN/year and 1,070 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 1,000 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The "no till-reduce fertilizer by 20%" scenario was utilized to estimate these pollutant loads. The 50th percentile results were utilized for this calculation.

Critical Area 1: Project 4		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Grassed Waterways
criteria d	**Project Lead Organization & Partners**	LEAD: Brown SWCD PARTNERS: Clermont SWCD, Local producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Agricultural ditches in the upper regions of the Fivemile subwatershed, including the north and south forks.
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Install 2,000 linear feet of grassed waterways (USDA NRCS Practice 412)
criteria g	**Project Narrative**	Over 5.5 miles of agricultural ditches exist in the upper regions of the Fivemile Critical Area. This project will convert 2,000 linear feet of ditches to grassed waterways. Grassed waterways reduce gully erosion and help provide filtration of pollutants of concern.
criteria d	**Estimated Total Cost**	$24,150
criteria d	**Possible Funding Source**	OEPA 319, CRP, EQIP, RCPP, Five Mile NWQI
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: Conversion of headwater streams to drainage ditches
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. This grassed waterways project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.

criteria b & h (cont.)	**Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?**	Approximately 30,000 linear feet of agricultural ditches have been identified throughout this region. This project represents ~7% of them.
	Part 3: Load Reduced[a]:	Estimated: 266 lbs TN/year and 163 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 2,000 linear feet of grassed waterways, and an average drainage area of 0.03 acres of land/linear foot of proposed grassed waterway. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

Critical Area 1: Project 5		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Riparian Zone Improvement
criteria d	**Project Lead Organization & Partners**	LEAD: Brown SWCD PARTNERS: Clermont SWCD, Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Upper regions of the Fivemile subwatershed, including the north and south forks.
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Installation of riparian buffer zones or grass filter strips (USDA NRCS Practice 391)
criteria g	**Project Narrative**	Over 7 miles of streams throughout the north and south forks of the Upper Fivemile Creek have been identified as lacking adequate riparian buffers. This project will target 10% of those areas (~3,700 feet), with the ultimate goal of installing a 75-foot wide buffer zone that provides filtration of the NPS pollutants. Depending on the property owner, the specific opportunities, and amount of available funding, these buffers will range from grass filter strips or native vegetation zones to forested buffers.
criteria d	**Estimated Total Cost**	$130,000
criteria d	**Possible Funding Source**	OEPA 319, CRP, EQIP, RCPP, Five Mile NWQI, WRRSP, Clean Ohio Fund
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: Impaired riparian habitat and agricultural NPS runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. This riparian zone improvement project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 7 miles of streams have been identified as lacking adequate riparian buffers. This project will improve ~10% of these regions.
	Part 3: Load Reduced[a]:	Estimated: 249 lbs TN/year and 153 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 3,700 linear feet of 75-foot wide riparian zone improvement, and an average drainage area of 64 acres of land treated. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results for "filter strips" were utilized for this calculation.

Critical Area 1: Project 6		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Septic System Rehabilitation
criteria d	**Project Lead Organization & Partners**	LEAD: Brown County Board of Health PARTNERS: Property Owners, Brown SWCD, USDA
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 1: Fivemile Subwatershed
criteria c	**Location of Project**	Homes along US-68 just north of Upper Five Mile Rd and just south of SR-286, and homes on Upper Five Mile Rd and SR-286 on either side of US 68 (Target ~23 systems).
n/a	**Which strategy is being addressed by this project?**	Other NPS Causes and Associated Sources of Impairment
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Septic System Rehabilitation Assistance
criteria g	**Project Narrative**	Many septic systems in this region are not providing adequate treatment due to a variety of reasons (~25% per the Brown County Board of Health). Stormwater runoff from failing systems can carry untreated sewage with high concentrations of bacteria and nutrients into streams causing elevated pathogen levels, organic enrichment, excessive algal growth, and loss of dissolved oxygen (EFWC, 2006). This septic system rehabilitation project will target ~23 systems in the Fivemile Creek Critical Area, ultimately providing financial subsidies to homeowners who cannot afford such rehabilitation measures.
criteria d	**Estimated Total Cost**	$100,000
criteria d	**Possible Funding Source**	SSRFP, CWSRF, USDA-Rural Development
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads Source: Failing septic systems

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 32), to raise ICI score (from marginally good), and to raise QHEI score (from 54.3 to 64) at Upper Blue Sky Park Road Sampling Site on Fivemile Creek (RM 2.3)) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Failing septic systems are a threat to public health and the natural resources. This septic system rehabilitation project will help to mitigate pollutant loads, and when coupled with the other recommended BMP strategies, will improve conditions in Fivemile Creek.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 90 septic systems exist in this region of the Critical Area and ~25% of them are expected to be failing. This project targets the failing systems.
	Part 3: Load Reduced:	Estimated: 44 lbs TN/year and 0.14 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Both pre and post project monitoring would determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 23 properties, and a median septic parcel size of 2.38 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

4.3 Critical Area 2: Overview Table and Project Sheet(s) for the Pleasant Run Subwatershed of the Fivemile Creek HUC-12.

4.3.1 Critical Area 2: Project and Implementation Strategy Overview Table

The Project Overview Table on the next page presents a summary of each strategy identified for Critical Area 2: Pleasant Run Subwatershed. Similar to the Project Overview Table for Critical Area 1, these BMP strategies are divided into several categories, including altered stream and habitat restoration strategies, agricultural nonpoint source reduction strategies, and other nonpoint source causes and associated sources of impairment (OEPA, 2013). As discussed in chapters 2 and 3, the monitoring stations in the Pleasant Run subwatershed are in partial attainment of the warmwater aquatic life use designation in these locations. These projects will help to mitigate the pollutant loads coming from the land, and when coupled with the other recommended BMP strategies, will improve conditions in the Fivemile Creek HUC-12.

These projects will help mitigate pollutant loads and begin to improve the conditions in Pleasant Run and throughout the Fivemile Creek HUC-12, ultimately working towards full attainment.

Critical Area 2 (Pleasant Run Subwatershed): Project Overview Table for Fivemile Creek HUC-12 (050902021102))							
Goals	**Obj. No.**	**Proj. No.**	**Project Title (criteria g)**	**Lead Organization (criteria d)**	**Time Frame[b] (criteria f)**	**Estimated Cost[c] (criteria d)**	**Potential/Actual Funding Source (criteria d)**
Urban Sediment and Nutrient Reduction Strategies[a]							
			Not Applicable for this Critical Area at this time.				
Altered Stream and Habitat Restoration Strategies[a]							
1, 2, 3	3	1	Pleasant Run Habitat Restoration Near RM 1.4	Clermont SWCD	Short	$65,000	OEPA 319, WRRSP, WHIP
1, 2, 3	3	2	Pleasant Run Habitat Restoration Near RM 0.4	Clermont SWCD	Short	$85,000	OEPA 319, WRRSP, WHIP
Agricultural Nonpoint Source Reduction Strategies[a]							
1, 2, 3	1	3a	Cover Crops	Clermont SWCD	Short	$100,000	Ohio 319, EQIP, CSP, RCPP
1, 2, 3	1	3b	Fertilizer Injection	Clermont SWCD	Medium	$160,000	Ohio 319, EQIP, CSP, RCPP
1, 2, 3	1	3c	Conservation Crop Rotation	Clermont SWCD	Short	$1,700	Ohio 319, EQIP, CSP, RCPP
1, 2, 3	1	4	Grassed Waterways	Clermont SWCD	Short	$6,000	OEPA 319, CRP, EQIP, RCPP
1, 2, 3	1, 2	5	Riparian Zone Improvement	Clermont SWCD	Medium	$51,000	OEPA 319, CRP, EQIP, RCPP, WRRSP, Clean Ohio
1, 2, 3	4	6	Constructed Wetlands	Clermont SWCD	Medium	$200,000	OEPA 319, WRRSP, WHIP
High Quality Waters Protection Strategies[a]							
			Not Applicable for this Critical Area at this time.				
Other NPS Causes and Associated Sources of Impairment[a]							
1, 2, 3	5	7	Septic System Rehabilitation	Clermont County Public Health	Medium	$73,000	SSRFP, CWSRF, USDA-Rural Development

[a] OEPA, 2013
[b] All time frames are subject to project funding availability and property owner coordination, with short being 1-3 years and medium being 3-7 years.
[c] Estimated cost presents rough planning-level implementation costs.

4.3.2 Critical Area 2: Project Summary Sheet(s)

These project summary sheets present the next steps toward implementation and improving the conditions of Fivemile Creek HUC-12. The opportunities listed were garnered from the NPS-IS plan focus group meeting on March 14, 2017. Reference Appendix C –*Critical Area 2: Pleasant Run Subwatershed BMP Strategy Maps* for additional information regarding each BMP opportunity.

Critical Area 2: Project 1		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Pleasant Run Habitat Restoration Near RM 1.4
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Private property owners
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	OEPA monitoring station ID M04S22: Pleasant Run North of Williamsburg @ Blue Sky Park Road RM 1.4
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Restore ~500 linear feet of degraded stream
criteria g	**Project Narrative**	Restore the instream habitat and a 75-foot riparian buffer zone along ~500 linear feet of impaired stream at RM 1.4. Pleasant Run has decent habitat at OEPA's monitoring location ID M04S22. The 2012 habitat assessment reported issues such as no lack of defined pool-riffle habitat. This habitat restoration project includes one Newbury riffle, invasive species removal, live stakes, and riparian plantings.
criteria d	**Estimated Total Cost**	$65,000
criteria d	**Possible Funding Source**	OEPA 319, WRRSP, WHIP
criteria a	**Identified Causes and Sources**	Cause: Impaired habitat Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To increase the ICI score (from low-fair) and raise QHEI score at Pleasant Run North of Williamsburg @ Blue Sky Park Road (RM 1.4). One reasonable objective includes habitat restoration at the monitoring location using bioengineering methods and materials. This, coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	This project represents 50% of the aquatic habitat restoration projects in this Critical Area.
	Part 3: Load Reduced[a]:	Estimated: 78 tons sediment/year, 100 lbs TN/year, and 34 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using an implementation goal of 500 linear feet of stream restoration and pollutant load removal rates reported by the Chesapeake Bay Stormwater Network and Center for Watershed Protection. Stream restoration pollutant load removal rates include a TN removal rate of 0.2 lb/ft/yr, a TP removal rate of 0.068 lb/ft/yr, and a TSS removal rate of 310 lb/ft/yr (Schueler & Stack, 2012).

Critical Area 2: Project 2		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Pleasant Run Habitat Restoration Near RM 0.4
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Private property owners
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	OEPA monitoring station ID M04S46: Pleasant Run @ Glancy Corner @ Marathon Road RM 0.4
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Restore ~500 linear feet of impaired stream
criteria g	**Project Narrative**	Restore the instream habitat and a 75-foot riparian buffer zone along ~500 linear feet of impaired stream at RM 0.4. Pleasant Run has impaired habitat at OEPA's monitoring location ID M04S46. With a 2012 QHEI of 62.5, some of the issues include no instream cover, lack of defined pool-riffle habitat, and low sinuosity. This habitat restoration project includes increased sinuosity, one Newbury riffle, invasive species removal, live stakes, and riparian plantings.
criteria d	**Estimated Total Cost**	$85,000
criteria d	**Possible Funding Source**	OEPA 319, WRRSP, WHIP
criteria a	**Identified Causes and Sources**	Cause: Impaired habitat Source: NPS agricultural runoff
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4). One reasonable objective includes habitat restoration at the monitoring location using bioengineering methods and materials. This, coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.

	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	This project represents 50% of the aquatic habitat restoration projects identified in this Critical Area.
	Part 3: Load Reduced[a]:	Estimated: 78 tons sediment/year, 100 lbs TN/year, and 34 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using an implementation goal of 500 linear feet of stream restoration and pollutant load removal rates reported by the Chesapeake Bay Stormwater Network and Center for Watershed Protection. Stream restoration pollutant load removal rates include a TN removal rate of 0.2 lb/ft/yr, a TP removal rate of 0.068 lb/ft/yr, and a TSS removal rate of 310 lb/ft/yr (Schueler & Stack, 2012).

Critical Area 2: Project 3a		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Cover Crops
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Pleasant Run subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~363 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c)
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Cover crop implementation (USDA NRCS Practice 340)
criteria g	**Project Narrative**	Implement cover crops in highly erodible areas, particularly focused on field edges, versus whole field plantings, for a five-year cycle. Additionally, this project could include the means for subsidizing specialized equipment, such as vertical tillage tools specific to cover crops, to efficiently implement cover crops in this region.
criteria d	**Estimated Total Cost**	$100,000
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This cover crop project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 1,450 acres (~25 parcels) of agricultural land has been identified in this region as potential opportunity for implementing this type of BMP. Approximately 363 acres will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 1,143 lbs TN/year and 737 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US-50 (Reference Figure 3-7). This could also provide both pre and post project monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 363 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

Critical Area 2: Project 3b		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Fertilizer Injection
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Pleasant Run subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~363 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c)
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Fertilizer injection equipment rental program
criteria g	**Project Narrative**	This project provides funding to the SWCD to purchase specialized equipment for injecting fertilizer on agricultural fields and renting this equipment to local producers. Once the producers have an affordable means of accessing the proper equipment, this can become a continual practice, versus a set contract period like many other programs. One of the primary advantages of injecting fertilizer is the precise application of nutrients to reduce the amount of losses to NPS runoff.
criteria d	**Estimated Total Cost**	$160,000
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This cover crop project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 1,450 acres (~25 parcels) of agricultural land has been identified in this region as potential opportunity for implementing this type of BMP. Approximately 363 acres will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 998 lbs TN/year and 1,125 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US-50 (Reference Figure 3-7). This could also provide both pre and post project monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 363 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The "no till-reduce fertilizer by 60%" scenario was utilized to estimate these pollutant loads. The 50th percentile results were utilized for this calculation.

Critical Area 2: Project 3b		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Agricultural Land Management Strategies - Conservation Crop Rotation
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Agricultural land in the upper regions of the Pleasant Run subwatershed (Target is 25% of agricultural land adjacent to watercourses, or ~363 acres. Implementation goal to be included with other agricultural land management strategies - Projects 3a - 3c)
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Conservation crop rotation practices (USDA NRCS Practice 328)
criteria g	**Project Narrative**	While some producers in the region already implement conservation crop rotation practices, this project will encourage participation from producers directly adjacent to watercourses. During the NPS-IS plan Focus Group meeting, strategies such as rotating high-residue producing crops (corn or wheat) in the rotation with low-residue producing crops (soybeans) is a preferred approach to the producers in this region. This implementation project, which will follow NRCS Standard 328, will allow the producers some flexibility to maximize benefits to both the producer and the NPS runoff quality.
criteria d	**Estimated Total Cost**	$1,700
criteria d	**Possible Funding Source**	Ohio 319, EQIP, CSP, RCPP
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: NPS agricultural runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Agricultural land management strategies are important for keeping nutrients on the land. This cover crop project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 1,450 acres (~25 parcels) of agricultural land has been identified in this region as potential opportunity for implementing this type of BMP. Approximately 363 acres will be targeted.
	Part 3: Load Reduced[a]:	Estimated: 403 lbs TN/year and 388 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US 50 (Reference Figure 3-7). This could also provide both pre and post project monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and an implementation goal of 363 acres. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The "no till-reduce fertilizer by 20%" scenario was utilized to estimate these pollutant loads. The 50th percentile results were utilized for this calculation.

Critical Area 2: Project 4		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Grassed Waterways
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Agricultural ditches in the upper regions of the Pleasant Run subwatershed
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Short (1-3 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Install 500 linear feet of grassed waterways (USDA NRCS Practice 412)
criteria g	**Project Narrative**	Approximately 1 mile of agricultural ditches exists in the upper regions of the Pleasant Run Critical Area. This project will convert 500 linear feet of ditches to grassed waterways. Grassed waterways reduce gully erosion and help provide filtration of pollutants of concern.
criteria d	**Estimated Total Cost**	$6,000
criteria d	**Possible Funding Source**	OEPA 319, CRP, EQIP, RCPP
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: Conversion of headwater streams to drainage ditches
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. This grassed waterways project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.

	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 5,280 linear feet of agricultural ditches have been identified throughout this region. This project represents ~10% of them.
	Part 3: Load Reduced[a]:	Estimated: 66 lbs TN/year and 41 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US-50 (Reference Figure 3-7). This could also provide both pre and post project monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 500 linear feet of grassed waterways, and an average drainage area of 0.03 acres of land/linear foot of proposed grassed waterway. Reference Table 1 in *Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results* for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

Critical Area 2: Project 5		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Riparian Zone Improvement
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Upper regions of the Pleasant Run subwatershed
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Installation of riparian buffer zones or grass filter strips (USDA NRCS Practice 391)
criteria g	**Project Narrative**	Approximately 2.8 miles of streams throughout the upper region of the Pleasant Run Critical Area have been identified as lacking adequate riparian buffers. This project will target 10% of those areas (~1,475 feet), with the ultimate goal of installing a 75-foot wide buffer zone that provides filtration of the NPS pollutants. Depending on the property owner, the specific opportunities, and amount of available funding, these buffers will range from grass filter strips or native vegetation zones to forested buffers.
criteria d	**Estimated Total Cost**	$51,000
criteria d	**Possible Funding Source**	OEPA 319, CRP, EQIP, RCPP, WRRSP, Clean Ohio
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: Impaired riparian habitat and agricultural NPS runoff

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. This riparian zone improvement project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 2.8 miles of streams have been identified as lacking adequate riparian buffers. This project will improve ~10% of these regions.
	Part 3: Load Reduced[a]:	Estimated: 99 lbs TN/year and 61 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US-50 (Reference Figure 3-7). This could also provide both pre and post project monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 1,475 linear feet of 75-foot wide riparian zone improvement, and an average drainage area of 25 acres of land treated. Reference Table 1 in Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results for "filter strips" were utilized for this calculation.

Critical Area 2: Project 6		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Constructed Wetlands
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont SWCD PARTNERS: Local Producers, NRCS
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	The properties owned by CECOS and Jackson Township along Pleasant Run in the central portion of the subwatershed
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration Strategies Agricultural Nonpoint Source Reduction Strategies
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Installation of constructed wetlands (USDA NRCS Practice 656)
criteria g	**Project Narrative**	Approximately 208 acres of land owned by CECOS and Jackson Township in the central portion of the Pleasant Run subwatershed will be targeted for constructed wetlands. The project will increase riparian wetland retention areas along the Pleasant Run main stem as well as the tributaries in this region.
criteria d	**Estimated Total Cost**	$200,000
criteria d	**Possible Funding Source**	OEPA 319, WRRSP, WHIP
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads and sedimentation Source: Impaired instream habitat and agricultural NPS runoff
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. This riparian zone improvement project will help to mitigate the pollutants, and when coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.

	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	This project represents 100% of the constructed wetland BMPs proposed for this Critical Area.
	Part 3: Load Reduced[a]:	Estimated: 1,557 lbs TN/year and 477 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	If the project is funded through OEPA 319 program, staff from the OEPA-DSW Ecological Assessment Unit can perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results and planning level estimate of 200 acres of land treated. Reference Table 1 in Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results for "wetlands" were utilized for this calculation.

Critical Area 2: Project 7		
Nine Element Criteria	**Information Needed**	**Explanation**
criteria g	**Project Title**	Septic System Rehabilitation
criteria d	**Project Lead Organization & Partners**	LEAD: Clermont County Public Health PARTNERS: Property Owners, Clermont SWCD, USDA
criteria c	**HUC-12 & Critical Area**	Fivemile HUC-12 HUC (050902021102) Critical Area 2: Pleasant Run Subwatershed
criteria c	**Location of Project**	Homes along Bucktown Trails, Bucktown Road, and Moore-Marathon Road (Target ~16 systems).
n/a	**Which strategy is being addressed by this project?**	Other NPS Causes and Associated Sources of Impairment
criteria f	**Time Frame**	Medium (3-7 years) *Depends on interest (through promotion and buy-in) by land owners and adequate funding opportunities.*
criteria g	**Short Description**	Septic System Rehabilitation Assistance
criteria g	**Project Narrative**	Many septic systems in this region are not providing adequate treatment due to a variety of reasons. Stormwater runoff from failing systems can carry untreated sewage with high concentrations of bacteria and nutrients into streams causing elevated pathogen levels, organic enrichment, excessive algal growth, and loss of dissolved oxygen (EFWC, 2006). This septic system rehabilitation project will target ~16 systems in the Pleasant Run Critical Area, ultimately providing financial subsidies to homeowners who cannot afford such rehabilitation measures.
criteria d	**Estimated Total Cost**	$73,000
criteria d	**Possible Funding Source**	SSRFP, CWSRF, USDA-Rural Development
criteria a	**Identified Causes and Sources**	Cause: Elevated nutrient loads Source: Failing septic systems

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment associated with this Critical Area?**	Goals: To bring the downstream monitoring locations into attainment (i.e., to increase IBI score above 40 (currently 38), to raise the ICI score (from fair to good), and to raise QHEI score (from 62.5 to 64) at Pleasant Run @ Glancy Corner @ Marathon Road (RM 0.4) and reduce the nutrient pollutant loads estimated by the USEPA-ORD SWAT model. Failing septic systems are a threat to public health and the natural resources. This septic system rehabilitation project will help to mitigate pollutant loads, and when coupled with the other recommended BMP strategies, will improve conditions in Pleasant Run.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Approximately 65 septic systems exist in this region of the Critical Area and ~25% of them are expected to be failing. This project targets the failing systems.
	Part 3: Load Reduced[a]:	Estimated: 31 lbs TN/year and 0.14 lbs TP/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Both pre and post project monitoring would determine progress (through IBI, ICI, and QHEI). The next OEPA-DSW comprehensive watershed-scale ecological and chemical assessment in this watershed is scheduled for 2022. Additionally, Clermont County Office of Environmental Quality maintains a permanent, Level 3 monitoring station just south of US-50 (Reference Figure 3-7). This could also provide both pre and post project monitoring. Clermont OEQ, as a Level 3 QHEI and Water Chemistry Quality Data Collector, can also conduct assessment monitoring.
criteria e	**Information and Education**	This project will be promoted through newsletters, the SWCD website, social media, and other educational outreach opportunities. Reference section 4.1.1 for additional information regarding these initiatives.

[a] Pollutant load reduction estimates were calculated using SWAT model results, an implementation goal of 16 properties, and a median septic parcel size of 2.38 acres. Reference Table 1 in Appendix A – USEPA-ORD Fivemile HUC-12 SWAT Model Results for additional information regarding pollutant load removal rates, which were derived from 100 SWAT model runs for each BMP type. The 50th percentile results were utilized for this calculation.

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