NINE-ELEMENT NONPOINT SOURCE IMPLEMENTATION STRATEGIC PLAN (NPS-IS) AUKERMAN CREEK WATERSHED HUC-12 (50800020302)

VERSION 1.0: MAY 26, 2021

APPROVED: MAY 26, 2021

Preble Soil & Water Conservation District

Conserving our Natural Resources

Chapter 1: **Introduction**

The Nine-Element Nonpoint Source Implementation Strategies Plan (NPS-IS) is a strategic document that provides assurance to nonpoint source grant programs and institutions (i.e., U.S. EPA) that a proposed water quality improvement project meets the nine essential elements per U.S. EPA §319 Program Guidance (April 2013). The NPS-IS ensures that potentially funded projects are scientifically evaluated, that they are located in areas that will address the worst problems; and that that they have the administrative, evaluation, and educational components needed to ensure that the water resources will achieve as much long-term benefit as possible. The NPS-IS is a living strategic planning document that summarizes causes and sources of impairment, establishes critical areas, identifies quantifiable objectives to address causes and sources of impairment, and describes projects designed to meet those objectives.

The Aukerman Creek HUC-12 (50800020302) (Figure 1-1) has been identified as a one of the priority watersheds where USDA models suggest there is high contribution of nutrient loading from agricultural lands. Aukerman Creek is located within the Great Miami River watershed which is a major contributor of nutrients to the Gulf of Mexico (OEPA, 2020a; Goolsby et al., 1999). The Great Miami River basin watershed had the highest soluble reactive phosphorus concentrations and the highest time-weighted average total P concentration amongst 10 streams studied in Ohio (Baker, 2006). As of May 13, 2021, no other Nine-Element NPS-IS has been approved in the Great Miami River watershed.

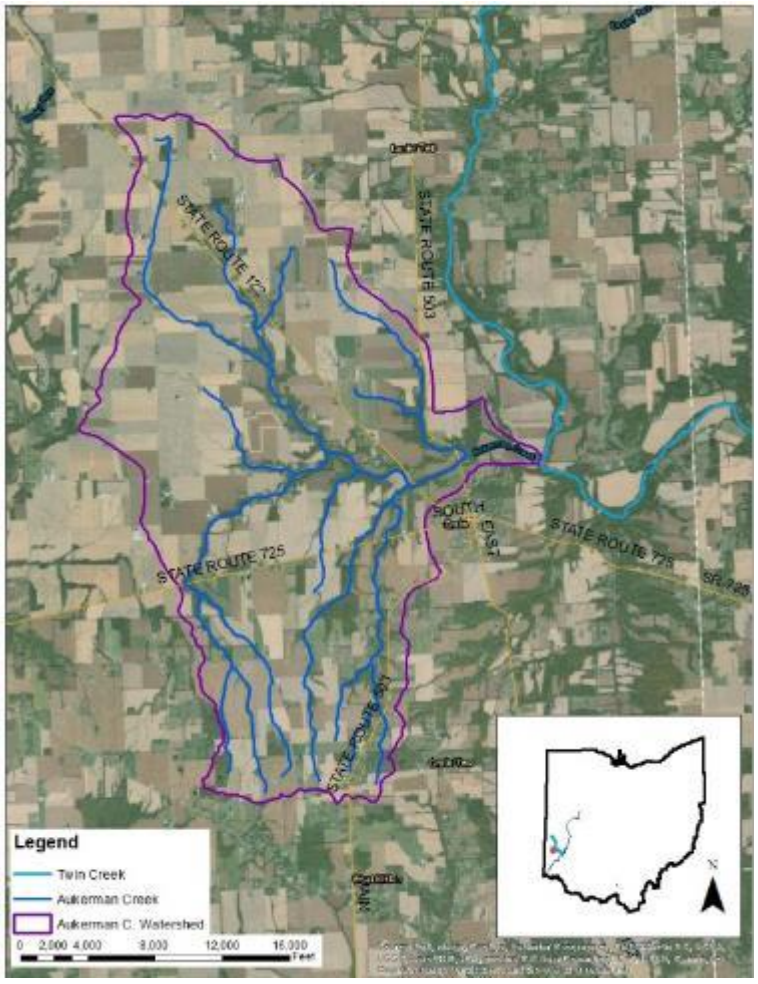

FIGURE 1-1: AUKERMAN CREEK IS LOCATED IN SOUTHWEST OHIO WITHIN THE OHIO RIVER BASIN

The Preble Soil and Water Conservation District (SWCD) has partnered with Environmental Solutions AQ, a local environmental consultant, for the preparation of this Nine-Element NPS-IS for Aukerman Creek HUC-12 watershed. This is the first Nine-Element NPS-IS prepared in Preble County, Ohio.

One important element of Nine Element NPS-IS is the education and outreach activities that will be conducted while implementing the plan. Preble SWCD is dedicated not only engaging the

public and informing them of important events and projects, but also to educating them about the existing condition of the streams, about managing nutrient loads by implementing BMPs and about preserving high quality streams such as Aukerman Creek.

A full-time Outreach Coordinator is employed at the SWCD, who presents at local schools and special interest groups, completing over 12 presentations each year. The Preble SWCD hosts annual workshops and field days where local producers come together to discuss relevant topics. In the past these workshops have focused on forestry, invasive weeds, pollinator habitat, soil testing, manure management, and pesticide application. In addition, the SWCD conducts one-on-one meetings with landowners to look at drainage and erosion issues on their properties. A quarterly newsletter is published that reaches over 1600 local residents with relevant conservation updates. As the opportunities included in this NPS-IS are further evaluated and implemented in the watershed, the Preble SWCD will utilize these opportunities to engage the public about additional conservation practices.

1.1. Report Background

Ohio has been leading Watershed Based Planning (WBP) for a long time. It is a process that often results in a document used to guide projects within a geographic area defined by the flow of water. WBP is used to coordinate activities related to water resources including: water quality and/or quantity management, ecological protection and restoration, or the strategic guidance of development, infrastructure improvement, transportation, and recreation among others. WBP is an effective approach to solving difficult water-related problems because it is locally led, collaborative, data driven, and consensus based (OEPA, 2016a).

Ohio EPA developed the Ohio Guide for Development of Watershed Action Plans in 1997 and in 2016, in collaboration with Ohio Department of Agriculture, the Nine-Element NPS-IS template was issued to guide the completion of a state and federal approvable Nine-Element NPS-IS (OEPA, 2016b).

A Nine-Element NPS-IS is a specific type of watershed-based planning that will allow local entities to effectively propose and implement nonpoint source pollution projects utilizing funding made available through the Clean Water Act Section 319 (§319), H2Ohio or the Great Lakes Restoration Initiative. In Ohio, eligibility for these grant programs is restricted to projects delineated within a critical area of an approved NPS-IS.

Nine Elements of NPS-IS
Source: OEPA, 2016a

a) An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan.

b) An estimate of the load reductions expected for the management measures described under paragraph (c) below.

c) A description of the NPS management measures (solutions) that will need to be implemented to achieve the load reductions estimated under paragraph (b) above and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.

d) An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan.

e) An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

f) A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.

g) A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

h) A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.

i) A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.

Aukerman Creek Watershed (a subwatershed of Twin Creek) was characterized in the 2010 endorsed Twin Creek Watershed Action Plan (WAP). The Twin Creek WAP concluded that although much of the watershed was very high quality, portions of Twin Creek and its tributaries

were not meeting aquatic life and recreational use standards (IES, 2010). In the 2010 Twin Creek Watershed TMDL report, OEPA concluded that fecal coliform and sediment are the pollutants that need to be reduced. In addition, the TMDL reported that the biotic community was impacted by poor habitat and siltation as a result of excessive sediments in the streams (OEPA, 2010). Noted in both WAP and TMDL, stream and streambank erosion at Aukerman Creek has been a significant problem for decades.

The Aukerman Creek HUC-12 Nine-Element NPS-IS has been prepared based on knowledge from the WAP and TMDL documents and follows the OEPA Nine-Element NPS-IS template (OEPA, 2016b).

1.2. Watershed Profile & History

The Aukerman Creek HUC-12, located in Preble County, Ohio is one of the subwatersheds of the Twin Creek River Basin located in southwest Ohio (Figure 1-2). The Twin Creek watershed drains an area of 316 mi^2 in southwestern Ohio. Twin Creek, 47.03 miles long, originates in Darke County and flows southeast into Preble County and generally south through the eastern portion of the county, then southeast through the southwest corner of Montgomery County, and then into Warren County, Franklin Township, where it meets the Great Miami River. The Aukerman Creek and Twin Creek watersheds are part of the Lower Great Miami Watershed HUC 05080002 (Figure 1-3).

The main stem of Aukerman Creek is 5.6 miles long and the HUC- 12 watershed is 13,327 acres in size. Significant tributaries in the Aukerman Creek HUC-12 watershed include Sandy Run and several unnamed tributaries.

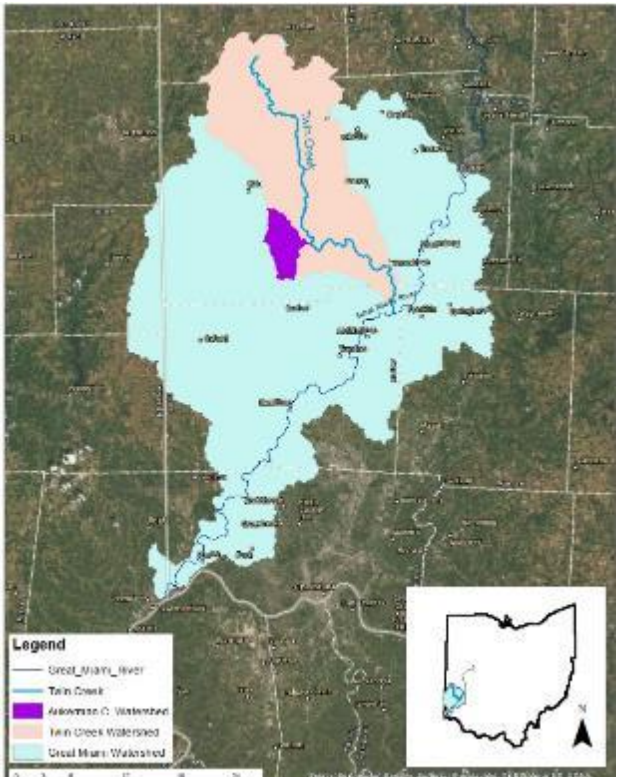

FIGURE 1-2: AUKERMAN CREEK WATERSHED LOCATION

The Aukerman Creek watershed is primarily a rural, agricultural watershed in Preble County. There are no cities or populated areas within the Aukerman Creek HUC-12. There are no housing developments, industrial, or large-scale commercial facilities within the watershed. There are no permitted NPDES facilities within the Aukerman Creek HUC-12 watershed.

Most of the watershed is composed of farmland that is owned by private landowners. One natural preserve and nonprofit entity, the Preble County Historical Society and Nature Preserve, is protected from development and is open to the public.

According to the 2010 Twin Creek WAP, the Aukerman Creek HUC-12 was designated as Warmwater Habitat (WWH) which defined as the "typical" warm water assemblage of aquatic organisms for Ohio rivers and streams. The designation was based on the Biological and Water Quality Study of Twin Creek and Selected Tributaries conducted by Ohio EPA in 2005 (OEPA,

2007). OEPA collected samples from three locations along Aukerman Creek and one from a tributary of Aukerman Creek.

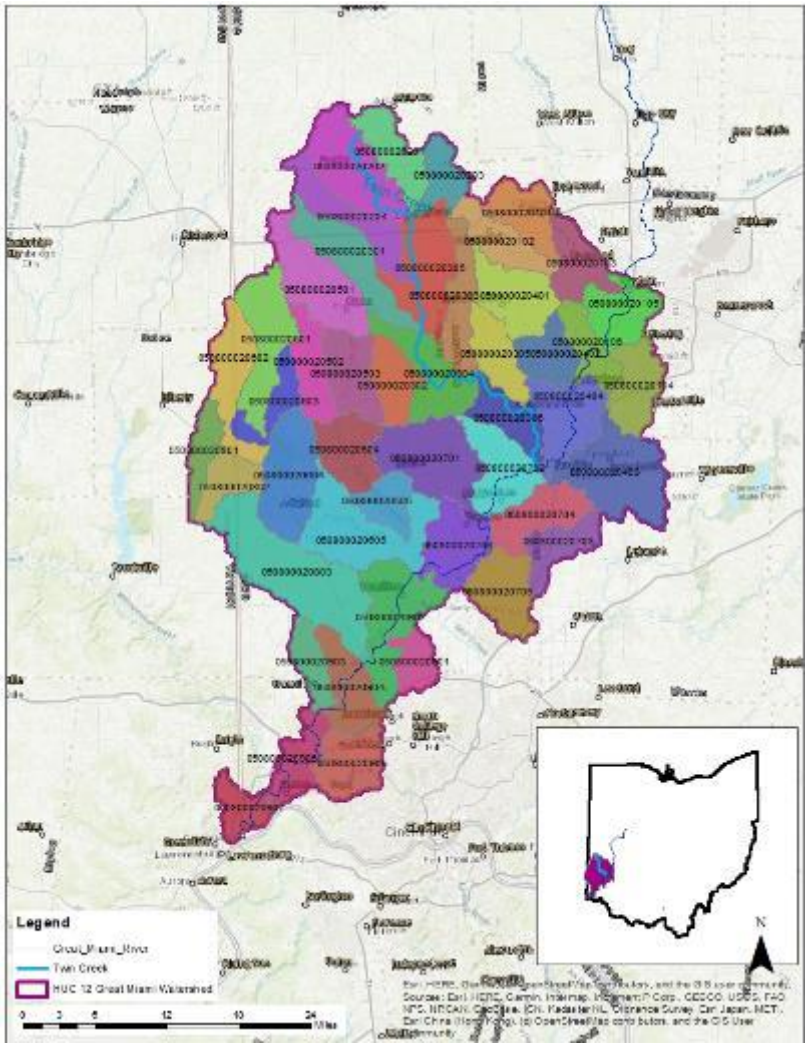

FIGURE 1-3: LOWER GREAT MIAMI WATERSHED

WWH is defined in the State water quality standards as follows (Ohio Administrative Code 3745-1-07(B)(1)(a)):

> "…these are waters capable of supporting and maintaining a balanced, integrated, adaptive community of warm water aquatic organisms having a species composition, diversity, and functional organization comparable to the twenty-fifth percentile of the identified reference sites within each of the following ecoregions: the interior plateau ecoregion, the Erie/Ontario lake plains ecoregion, the western Allegheny plateau ecoregion and the eastern corn belt plains ecoregion. For the Huron/Erie lake plains ecoregion, the comparable species composition, diversity and functional organization are based upon the ninetieth percentile of all sites within the ecoregion. For all ecoregions, the attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as

> defined in "Biological Criteria for the Protection of Aquatic Life: Volume II, User's Manual for Biological Field Assessment of Ohio Surface Waters," as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code."

1.3. Public Participation and Involvement

Public participation and involvement are critical to the success of any NPS-IS. In 2007, the Twin Creek Advisory Committee was formed, and meetings were held regularly to collaborate in the preparation of the Twin Creek WAP and review of the OEPA prepared Twin Creek TMDL. The Twin Creek watershed projects were operated as a collaborative group of organizations, individuals, and agencies with a goal of protecting and improving water quality in Twin Creek and its tributaries. Various partners engaged in the decision-making process, documentation and plan strategy endorsements, and events including education, public outreach, and stream monitoring. The decision-making process was informal, but consensus driven. The public involvement for the Aukerman Creek HUC 12 Nine-Element NPS-IS development is built on this already established working relationship and trust.

On November 7, 2020, Preble SWCD issued the first press release regarding the Aukerman Creek HUC-12 NPS-IS development in the local newspaper (Figure 1-4). The announcement got immediate positive responses from landowners and producers in Aukerman Creek HUC-12. Preble SWCD received emails and phone calls inquiring about the project. The progress of the plan preparation was posted on social media and Preble SWCD website. Two stakeholder letters were sent to all the landowners who reside in the Aukerman Creek HUC-12. The first letter dated December 30th, 2020 was to inform the residents about the project and background information about the Nine-Element NPS-IS. The second letter, sent on February 20, 2021 was to invite the public to the March 9, 2021 public meeting.

R-A 11-7-2020

Preble SWCD receives grant for Aukerman Creek

Submitted by Preble Soil and Water Conservation District

The Preble Soil and Water Conservation District (SWCD) is pleased to announce that we have received a grant to prepare a 9-Element Nonpoint Source Implementation Strategy (NPS-IS) plan for the Aukerman Creek watershed in Preble County.

Aukerman Creek empties into Twin Creek northeast of Gratis and drains an area extending northwest from Gratis to the vicinity of Yost Road and S.R. 122, and extending southwest from Gratis as far as Platt Road. This highly competitive grant, funded by the Ohio Environmental Protection Agency (EPA), is one-of-a-kind exclusively for the watersheds in the Ohio River basin.

The purpose of the 9-Element NPS-IS Plan is to improve water quality by identifying and evaluating sources of impairment such as: agricultural runoff, stream channel modification, sedimentation, and excessive nutrients; and determine what water quality goals, restoration methods, and conservation practices are needed.

The 9-Element Plan will identify and prioritize the watershed critical areas and describe restoration and management measures to address those areas. To ensure the success of the plan, the Ohio EPA encourages cooperation with local community members who can help to develop and implement the watershed restoration and protection strategies.

Preble SWCD will partner with Environmental Solutions AQ, a local environmental consultant, in drafting the plan. The project timeframe will be from Nov. 1, 2020, to May 31, 2021. Interested parties are also encouraged to visit https://epa.ohio.gov/dsw/nps/index#120843254-319-grants for additional information about the program and details of a 9-Element plan. You can contact Preble SWCD at (937) 456-5159 for more information.

FIGURE 1-4: PUBLIC ANNOUNCEMENT IN LOCAL NEWSPAPER

On March 9, 2021, a public meeting was held at the cafeteria of the local high school. A total of 18 landowners participated in the in-person public meeting. During the meeting, a presentation was given and after the presentation, the public discussed the scope of the Nine-Element NPS-IS.

FIGURE 1-5: PUBLIC MEETING ON MARCH 9, 2021

At the public meeting, landowners asked questions and discussed the water quality issues at Aukerman Creek HUC-12 as wells as potential funding opportunities for implementing conservation and restoration projects. In addition, landowners were invited to complete a 10-item questionnaire. Seven completed questionnaires were collected after the meeting. In summary, the landowners were most concerned about the erosion problem along Aukerman Creek, nutrient loss from the fields, and agricultural runoff. If funding were available, the landowners would participate in installing grassed waterways, streambank protection to control erosion and cover crops. On April 9, 2021 a follow-up field visit was conducted to meet several of the landowners and discuss possible conservation practices at their properties.

FIGURE 1-6: WHOLE FARMING CONSERVATION PLANNING STAKEHOLDER MEETING APRIL 13, 2021

The announcement of the project and public meeting have prompted more landowners' interest and inquiries about implementing conservation practices. One of the more significant and exciting developments is the incorporation of whole farm conservation planning to the long-term conservation management plan for the Preble County Historical Society and Nature Preserve (PCHS). A field day with invited stakeholders took place on April 13, 2021 to tour the property and discuss the concept of whole farm conservation planning at the PCHS (Figure 1-6; additional discussions in Chapter 2).

Preble SWCD has a long history of collaboration with PCHS including the Annual Conservation Day Camp which draws nearly 140 attendees for three days each June. Each spring, the Preble SWCD assists with nature tours when local school Districts take field trips to the PCHS. The PCHS whole farm conservation planning will provide invaluable outreach opportunities to local producers by demonstrating the conservation practices during field tours.

A second press release was issued on May 12, 2021 informing the public that the Draft Nine-Element NPS-IS is complete. The public is encouraged to request a copy of the plan, review it and provide comments. Once comments are received and reviewed, the next version of the Aukerman Creek HUC-12 Nine-Element NPS-IS will be updated to incorporate the comments.

Preble SWCD is dedicated to continuing to promote conservation practices with public involvement through education and outreach activities. Preble SWCD engages with the public in several ways, including publishing newsletters, in-person farm visits and regularly updating social media outlets such as Facebook and its website.

Chapter 2: **Watershed Characterization and Assessment Summary**

The Aukerman Creek HUC-12 watershed includes five unnamed tributaries and Sandy Run (Figure 1-1). In 2005, Ohio EPA conducted the Biological and Water Quality Study of Twin Creek and Selected Tributaries which included Aukerman Creek (OEPA, 2007). The report stated that all three sampling locations from Aukerman Creek and one unnamed tributary to Aukerman Creek met the WWH aquatic life use and all the sites obtained full attainment status. Therefore, it is vital to protect the high-quality water resources in this agricultural watershed.

FIGURE 2-1: AUKERMAN CREEK

The Aukerman Creek HUC-12 is located within the Eastern Corn Belt Plains (ECBP) ecoregion (Figure 2-2). The ECBP ecoregion is primarily a rolling till plain with local end moraines that were associated with glacial deposits of Wisconsinian age (7,500 to 11,000 years ago).

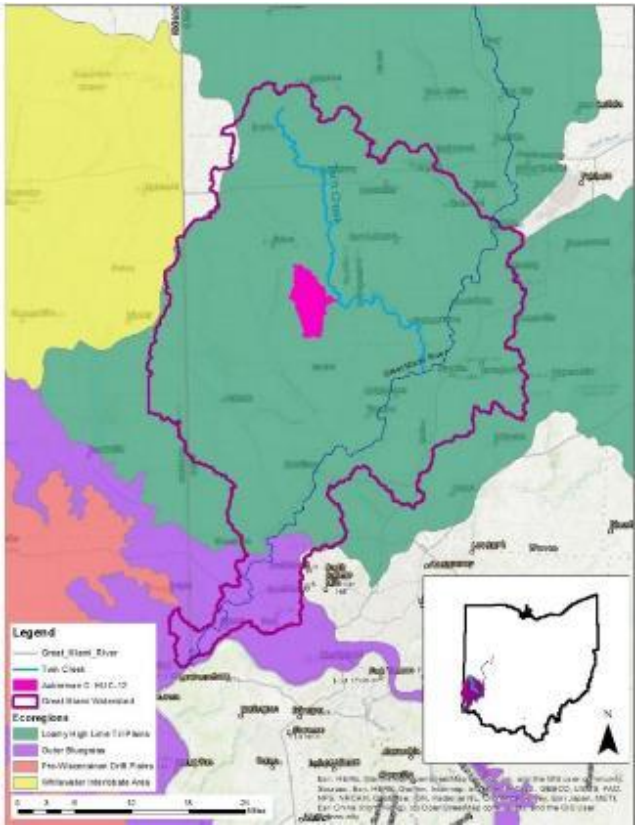

FIGURE 2-2: ECOREGION OF AUKERMAN CREEK HUC-12

2.1. Summary of Watershed Characterization for Aukerman Creek HUC-12

2.1.1. Physical and Natural Features

In the Aukerman Creek HUC-12 watershed, deposits of glacial till composed of cobbles, gravel, sand, silts, and clays overlay sedimentary bedrock of limestone and shale formations or interbedded limestones and shales. Glacial till, visible as moraines or depositional ridges of glacial outwash, formed lobate ridges according to glacial advance and retreat. Wisconsinian Era end moraine and ground moraine compose most of the unconsolidated sediments in the watershed (Ohio Geological Survey, 2005). Drift thickness, the amount of glacial deposition that occurs above bedrock, varies from as thin as 20 feet in the watershed's uplands to as thick as 200 feet in the outwash areas and bedrock cut valleys that cover ancient river valleys (Ohio Geological Survey, 2005).

Upland soils in the watershed are primarily loamy glacial till that are generally high in fertility and have poor to moderate drainage. Over 70% of the watershed is very limited in drainage (NRCS, 2020). The dominant upland soil association consists of Celina and Kokomo silt loams which belong to hydrologic soil groups C and D (Table 2-1). These soil groups represent soils that have slow and very slow infiltration when thoroughly wet. These soils have a very slow rate of water transmission (Figure 2-3).

These soils are cultivated in large acreages and are important to farming in this watershed. The control of runoff and soil erosion are the main concern in managing these soils for farming while moderately slow permeability and slope are the dominant limitations to many nonfarm uses (NRCS, 2020). Soils along the Aukerman Creek primarily are derived from fine to coarse-grained floodplain deposits that overlie older alluvial or outwash sediments. Such floodplain soils tend to be fertile and well-drained (Figure 2-4). It appears that there is not an abundance of wetlands in the Aukerman Creek HUC-12 (Figure 2-5). Most natural wetlands in the Aukerman Creek HUC-12 watershed were likely lost with the installation of field drainage systems that began as long ago as the early to mid-19th century. Wetland restoration on declining agricultural land can improve habitat for native species, reduce flooding, and improve water quality.

The slope appears to be gentle in the northern portion of the Aukerman Creek HUC-12 but there is higher relief in the southern portion of the watershed. The riparian corridor appears to have moderate to high relief and some of the streambanks have as high as 73-to-90-degree slopes which may be the cause of some of the severe streambank erosion observed in the watershed (Figure 2-6).

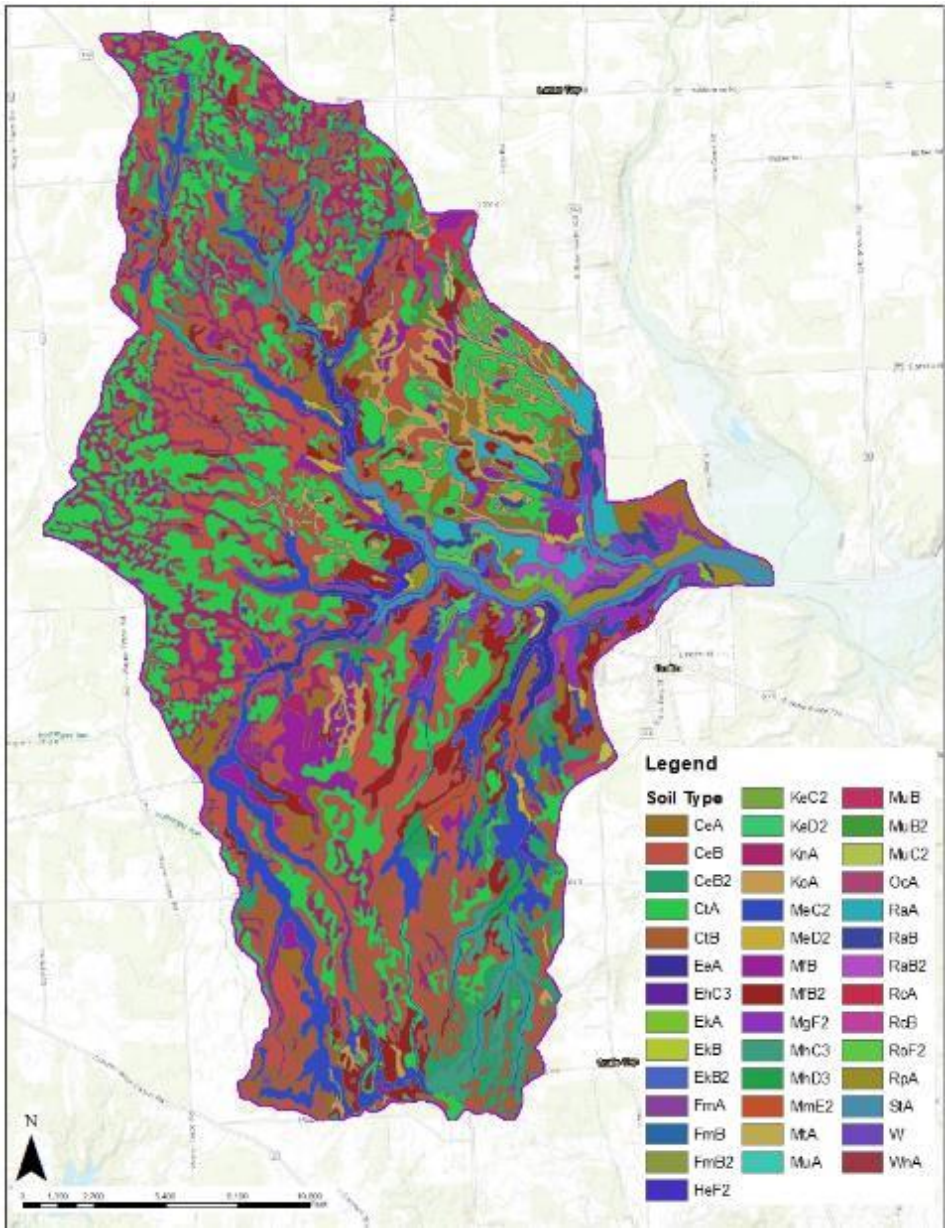

FIGURE 2-3: SOILS MAP OF AUKERMAN CREEK HUC-12 (NRCS, 2020)

Table 2-1: Common soil types in the Aukerman Creek HUC-12 watershed (NRCS, 2020)

Soil Name	Soil Description	Acreage	% of Watershed
CeA	Celina silt loam, 0 to 2 percent slopes	541.8	4.10%
CeB	Celina silt loam, 2 to 6 percent slopes	2,299.40	17.20%
CeB2	Celina silt loam, 2 to 6 percent slopes, eroded	522.6	3.90%
CtA	Crosby-Celina silt loams, 0 to 2 percent slopes	2,745.10	20.60%
CtB	Crosby-Celina silt loams, 2 to 4 percent slopes, eroded	737.3	5.50%
EeA	Eel silt loam, gravelly substratum, 0 to 1 percent slopes, occasionally flooded	121.6	0.90%
EhC3	Eldean gravelly clay loam, 6 to 12 percent slopes, severely eroded	39.5	0.30%
EkA	Eldean loam, 0 to 2 percent slopes	4.8	0.00%
EkB	Eldean loam, 2 to 6 percent slopes	9.4	0.10%
EkB2	Eldean loam, 2 to 6 percent slopes, eroded	17.8	0.10%
FmA	Fox silt loam, till substratum, 0 to 2 percent slopes	47.4	0.40%
FmB	Fox silt loam, till substratum, 2 to 6 percent slopes	5.9	0.00%
FmB2	Fox silt loam, till substratum, 2 to 6 percent slopes, eroded	1.6	0.00%
HeF2	Hennepin-Miamian silt loams, 25 to 50 percent slopes, eroded	170.1	1.30%
KeC2	Kendallville-Eldean silt loams, 6 to 12 percent slopes, eroded	45	0.30%
KeD2	Kendallville-Eldean silt loams, 12 to 18 percent slopes, eroded	24.5	0.20%
KnA	Kokomo silt loam, 0 to 1 percent slopes	1,378.00	10.30%
KoA	Kokomo silty clay loam, 0 to 1 percent slopes	596.7	4.50%
MeC2	Miamian silt loam, 6 to 12 percent slopes, eroded	962.9	7.20%
MeD2	Miamian silt loam, 12 to 18 percent slopes, eroded	52.1	0.40%
MfB	Miamian-Celina silt loams, 2 to 6 percent slopes	449.6	3.40%

Table 2-1: Common soil types Continued

Soil Name	Soil Description	Acreage	% of Watershed
MfB2	Miamian-Celina silt loams, 2 to 6 percent slopes, eroded	804.3	6.00%
MgF2	Miamian-Kendallville silt loams, 25 to 50 percent slopes, eroded	252.7	1.90%
MhC3	Miamian-Losantville clay loams, 6 to 12 percent slopes, severely eroded	297.2	2.20%
MhD3	Miamian-Losantville clay loams, 12 to 18 percent slopes, severely eroded	152.7	1.10%
MmE2	Miamian-Hennepin silt loams, 18 to 25 percent slopes, eroded	126.3	0.90%
MtA	Millsdale silty clay loam, 0 to 2 percent slopes	5.4	0.00%
MuA	Milton silt loam, 0 to 2 percent slopes	4.4	0.00%
MuB	Milton silt loam, 2 to 6 percent slopes	47.3	0.40%
MuB2	Milton silt loam, 2 to 6 percent slopes, eroded	42.3	0.30%
MuC2	Milton silt loam, 6 to 12 percent slopes, eroded	16.3	0.10%
OcA	Ockley silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes	6	0.00%
RaA	Rainsville silt loam, 0 to 2 percent slopes	199.8	1.50%
RaB	Rainsville silt loam, 2 to 6 percent slopes	80.4	0.60%
RaB2	Rainsville silt loam, 2 to 6 percent slopes, eroded	69.5	0.50%
RcA	Randolph silt loam, 0 to 2 percent slopes	13.9	0.10%
RcB	Randolph silt loam, 2 to 6 percent slopes	9.1	0.10%
RoF2	Rodman-Kendallville complex, 25 to 50 percent slopes, eroded	35.4	0.30%
RpA	Rossburg silt loam, moderately wet, sandy substratum, 0 to 1 percent slopes, occasionally flooded	101.6	0.80%
StA	Stonelick loam, gravelly substratum, 0 to 1 percent slopes, frequently flooded	272.5	2.00%

Source: USDA, 2020

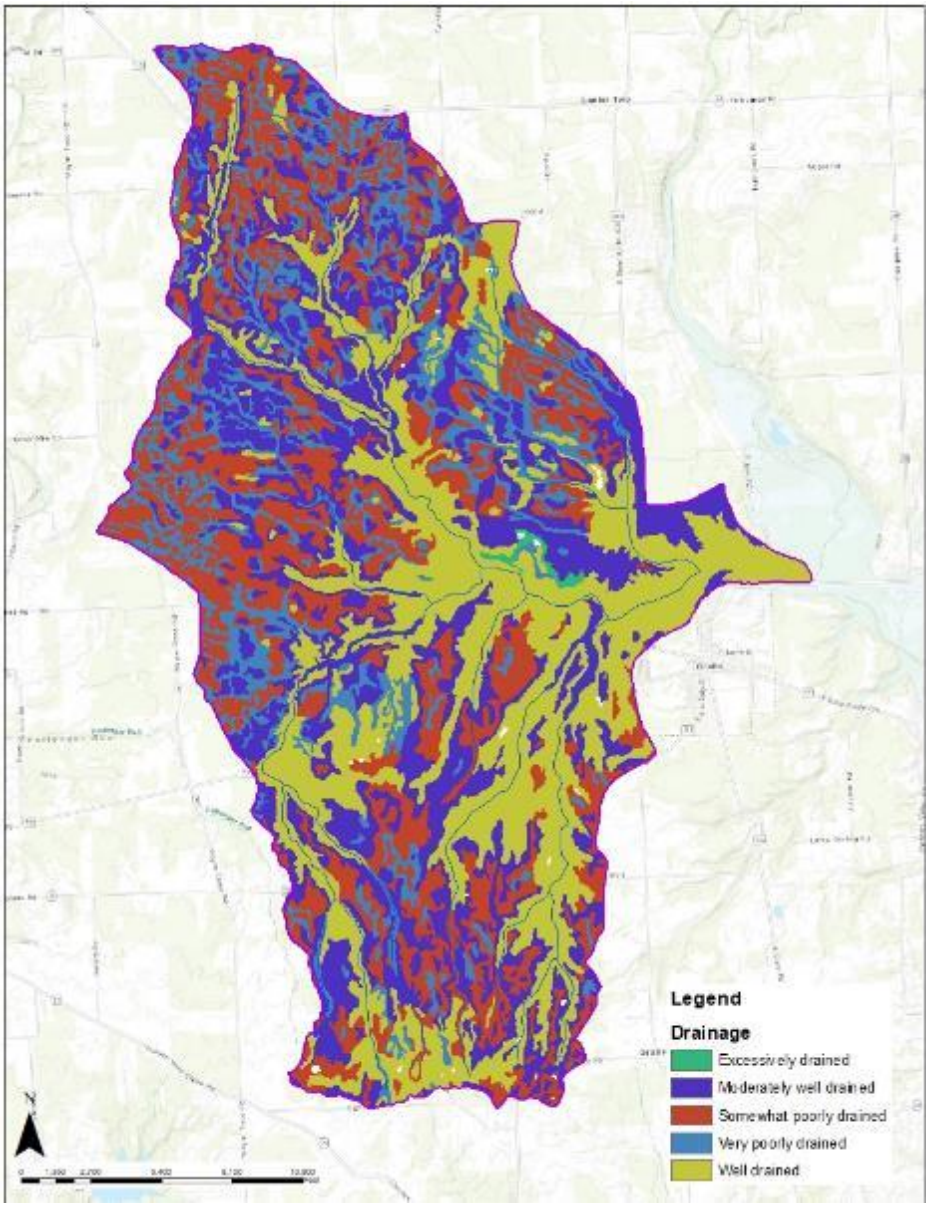

FIGURE 2-4: DRAINAGE CLASS WITHIN THE AUKERMAN CREEK HUC-12 (NRCS, 2020)

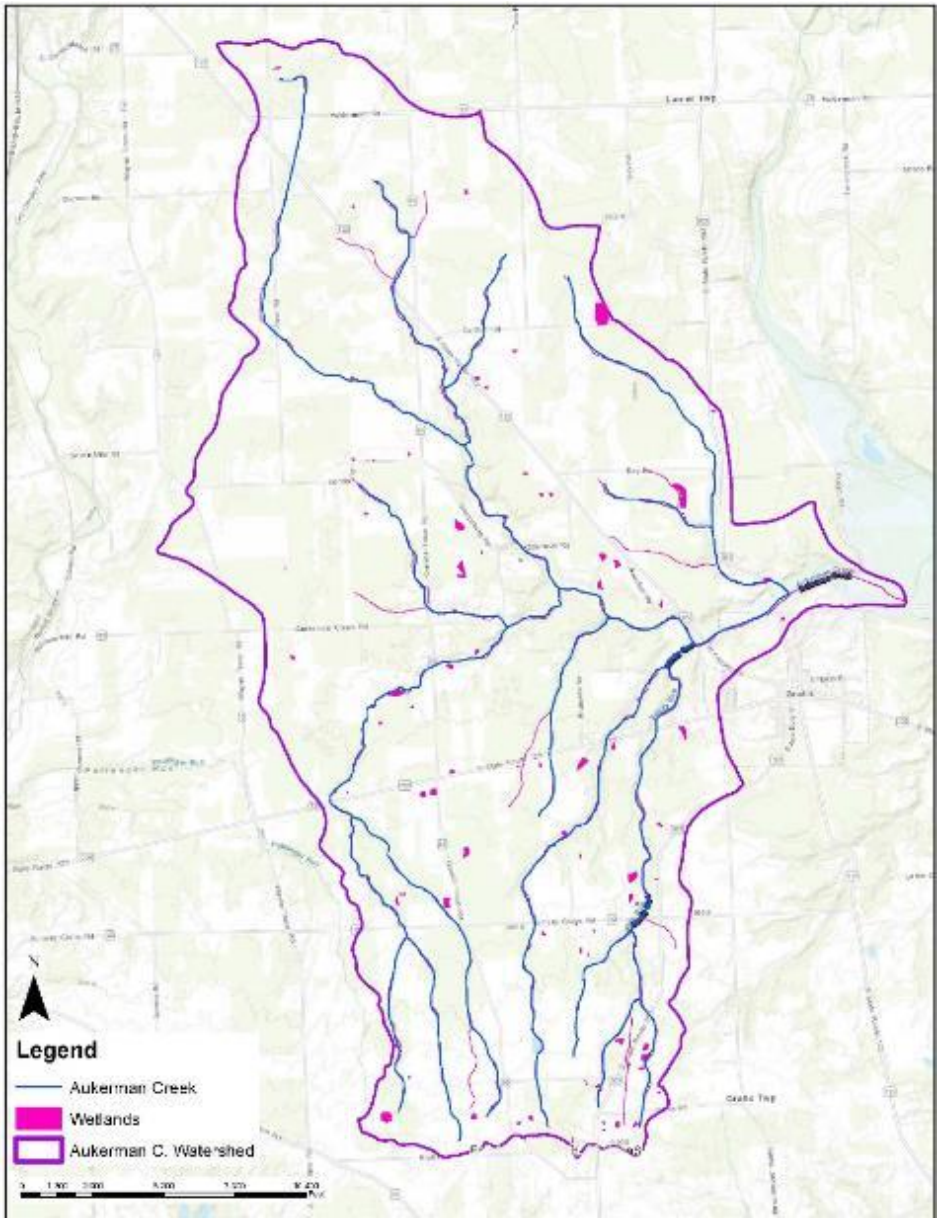

FIGURE 2-5: WETLANDS WITHIN THE AUKERMAN CREEK HUC-12 (NRCS, 2020)

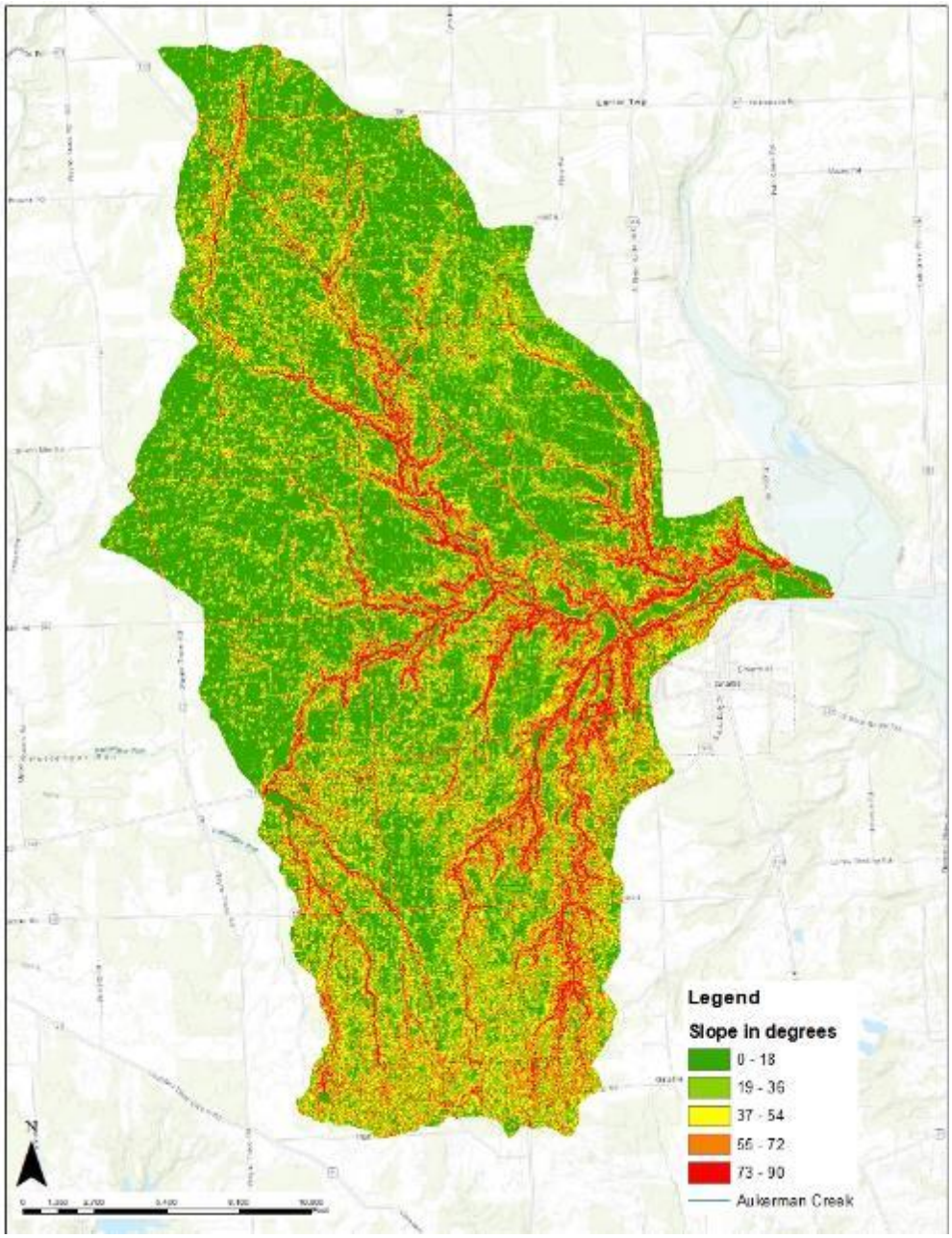

FIGURE 2-6: SLOPES IN DEGREES OF THE AUKERMAN CREEK HUC-12. (USDA, 2020)

2.1.2. Land Use and Protection

Agriculture is the predominant land use in the Aukerman Creek HUC-12 watershed and will continue to be for the foreseeable future (Figure 2-7). Table 2-2 indicates 75% of the watershed land use is agricultural, 7% in hay and pasture, 13.5% is forested and less than 1% is development (NLCD, 2011). There are no cities or communities with the watershed. Gratis is the closest community and it is located downstream of the Aukerman Creek HUC-12 watershed. Because of the lack of communities, household sewage treatment systems (HSTS) are not

considered a major nutrient contributor in this watershed. The 2020 report on management of onsite systems showed that better septic system management is recommended for the entire Twin Creek Watershed (OKI, 2020) but the main source of nutrient impairment in this watershed is agriculture (OEPA, 2020). The OKI study did not report the number of failing home systems in this watershed. In addition, the management of HSTS is currently not a high priority for the Preble County Health Department (PCHD). Once more information is available for the HSTS/urban loading and improved collaboration with PCHD, the next version of the Nine-Element NPS-IS will be updated to include an urban load estimate and reduction.

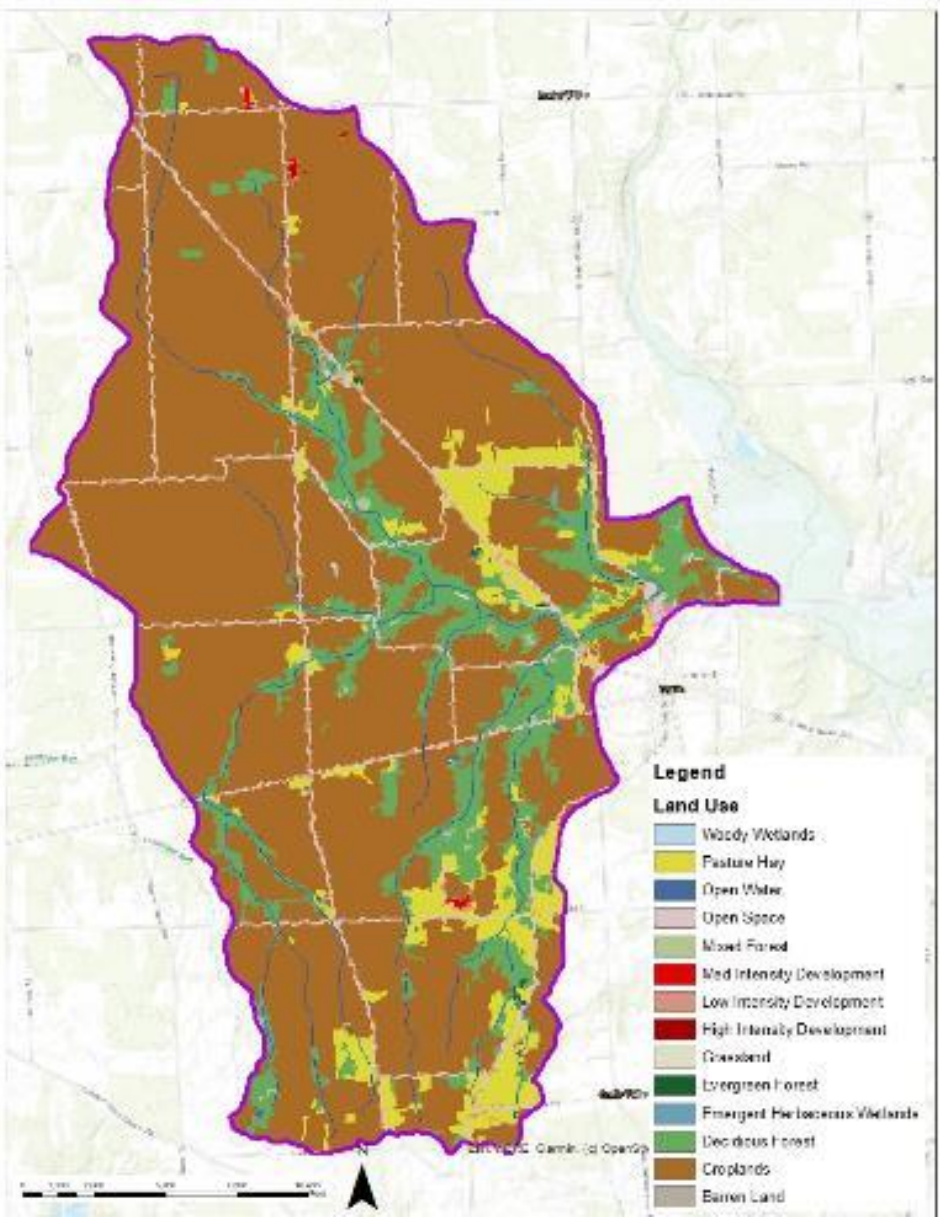

FIGURE 2-7: LAND USE MAP OF AUKERMAN CREEK HUC-12 (NLCD, 2011)

Table 2-2. Land use at the Aukerman Creek HUC-12

(NLCD, 2011)

LAND USE	AREA %
Open Water	0.1
Open Space	4.1
Low Intensity Development	0.7
Med Intensity Development	0.1
Deciduous Forest	13.1
Evergreen Forest	0.1
Mixed Forest	0.3
Pasture Hay	6.7
Croplands	74.9
Total	100

The deciduous forests in the Aukerman HUC-12 watershed are primarily located in the riparian zone of Aukerman Creek and its tributaries. The riparian area is also where the steepest slopes are within this watershed (Figure 2-6). The quality of the riparian zone is moderate with a mixture of high-quality native trees and grasses as well as the dominant invasive such as bush honeysuckle.

Corn and soybeans were the major crops produced in the Aukerman Creek HUC-12 watershed. In between 2014 and 2020 there was a combined average of approximately 8,500 acres of corn and soybeans produced in this watershed each year.

Table 2-3: Cropland areas in acreage in the Aukerman Creek HUC-12

	2014	2016	2018	2020
Corn	4,080	3,540	3,996	4417
Soybean	4,580	5,078	4,654	4216
Winter wheat	144	235	396	196
Alfalfa	106	182	214	363
Hay/grassland	1,537	1,437	1,353	896

Source: USDA NASS Cropscap, 2021

Several rare, threatened, and endangered plant and animal species are known to live in the Aukerman Creek HUC-12 watershed and have some level of state or federal protection or concern (Table 2-4).

Table 2-4: Rare, threatened, and endangered species in Preble County

Species	Status	Habitat Characteristics
Indiana bat (*Myotis sodalis*)	Endangered	Hibernates in caves and mines and forages in small stream corridors with well-developed riparian woods, as well as upland forests
Northern long-eared bat (*Myotis septentrionalis*)	Threatened	Hibernates in caves and mines and swarms in surrounding wooded areas in autumn; roosts and forages in upland forests during late spring and summer
Eastern massasauga *(Sistrurus catenatus)*	Threatened	Live in wet areas including wet prairies, marshes and low areas along rivers and lakes. In many areas massasaugas also use adjacent uplands during part of the year. They often hibernate in crayfish burrows but may also be found under logs and tree roots or in small mammal burrows.

Source: US Fish and Wildlife Service, 2017

Numerous invasive plant species occur throughout the Aukerman Creek HUC-12 watershed. Common invasive species include bush honeysuckle (*Lonicera species*), Japanese honeysuckle (*Lonicera japonica*), multi- flora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*), These 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. Multiflora rose forms dense thickets, excluding most native shrubs and herbs from establishing, and may be detrimental to nesting of native birds. Garlic mustard invades areas disturbed by human activities and displaces many native wildflowers.

LIVESTOCK OPERATIONS

No concentrated animal feeding facility (CAFF) and no permitted concentrated animal feeding operations (CAFOs) are in the Aukerman Creek HUC-12. Nine small-sized livestock operations were identified (Table 2-5), and no medium-sized operations were identified.

Table 2-5. Livestock operations in the Aukerman Creek HUC 12

Livestock Species	No. of *small* operations	No. of animal per *small* operation
Beef cattle	8	<300
Sheep/goal	1	<300

Most land within the Aukerman Creek HUC-12 watershed is privately owned; therefore, agency knowledge of the individual conservation practices may be limited. Some conservation practices can be estimated through program enrollment initiated through the SWCD/NRCS and Farm Service Agency, as well as the annual crop tillage survey performed by Miami University, Oxford OH. Current and recent past (0-5 years) estimates of several practices within the Aukerman Creek HUC-12 are provided in Table 2-6. With half of the watershed currently implementing conservation tillage, this watershed has already made good progress in nutrient management. The total estimate of nitrogen load reduction when combining all of the current and recent past conservation practices is 52,780 lb/yr using STEPL tool (Table 2-6).

Table 2-6: Current and Recent Past Conservation Practice Estimates using STEPL*

Practice Type	Estimated Acreage Treated/ Number of Structures Installed	Estimated Nitrogen Load (lb/yr)	Estimated Nitrogen Load Reduction (%)
Conservation Tillage (no till, reduced till)	6,500 acres	34,016	12.7
Cover Crops[1]	1,000 acres	5,102	1.9
Buffer - Whole-Field Warm Season Grass, Cool Season Grass Filter Strip, Warm Season Grass Field Border, Grassed Waterways[1]	286 acres	1,821	0.7
Grade Stabilization Structure[1]	25	NA	NA
Gypsum Application	500 acres	NA	NA
Nutrient Management (Variable Rate Fertilization)[1]	2,500 acres	10,150	3.8
Land Retirement (WRP easement)	103 acres	1,691	0.6

**Estimates calculated using Spreadsheet Tool for Estimating Pollutant Loads (STEPL), Version 4.4 (USEPA, 2019) and further calibrated using nitrogen load estimate provided by R. Wilson in 2020.*

[1] The practices presented here are between current and the past 5 years. Therefore, the estimated nitrogen load maybe outdated. New load estimate will be updated in the next version of this plan when more current data are available.

PROTECTED LAND

CONSERVATION EASEMENT

One 12-acre property located within the Aukerman Creek HUC-12 is protected from development with the Three Valley Conservation Trust through the easement program.

PREBLE COUNTY HISTORICAL SOCIETY

Found in 1974, the PCHS, located within the Aukerman Creek HUC-12, is a nonprofit organization dedicated to preserving and protecting the heritage, artifacts, memories, and ideas of Preble County. Through year-round programs, exhibits, educational and special events, library and archives, PCHS serves and educates the public about the local and natural history. In addition, the PCHS highlights the natural landscape with walking trails, an open-air amphitheater, reestablished prairies, and a thriving 15-acre restored wetland (Figure 2-7). Annual attendance at PCHS is about 20,000 visitors.

The PCHS owns and operates 255 acres of land that includes 108 tillable acres of farmland, 11 acres of museum grounds, over six miles of hiking trails, several miles of wagon paths, native grasslands, miles of forested riparian area, 104 acres of land in perpetual wetland conservation easement (NRCS-WRP) and 3,656 feet of Aukerman Creek. Aukerman Creek flows through the PCHS property and currently the only direct access to the west side of the PCHS property is by crossing the creek during the low flow period.

Countless environmental, educational and outreach events have occurred at the PCHS property through the years. In 2008, Ohio EPA performed an electrofishing demonstration at Aukerman Creek during one of the PCHS outreach events. The electrofishing equipment caught 18 species of fishes included 3 sunfishes, largemouth bass, 3 suckers, a mottled sculpin, 5 darters and 6 different minnows. Aukerman Creek is one of the most important water resources at PCHS and the high-quality habitat and stream health must be protected.

FIGURE 2-7 RECENT EVENT AT PCHS AMPHITHEATER WITH THE WETLAND AS THE BACKDROP

Streambank erosion is an ongoing problem at PCHS. Large sections of stream bank sediments are observed to be eroding off the steep banks into Aukerman Creek during and after high rainfall events. Chronic erosion problems at Aukerman Creek within the PCHS property have caused three bridges to be washed away or damaged beyond repair in the past three decades. A functioning bridge is critical to the PCHS operation because it is necessary to connect the east and west sides of the property for farming, recreational and educational use. In 2013, a historic steel truss bridge, made by the Ohio Brookville Bridge Works, was donated to the PCHS by the Ohio Department of Transportation. Because of the historical significance, this bridge would be an invaluable asset and bring

recognition to PCHS and southwest Ohio. However, the persistent stream erosion problem must be addressed prior to the design, siting, and installation of the historic bridge.

In 2014, the Surface Water Improvement Fund (SWIF) grant was awarded to PCHS to address 500 feet of the severe erosion on Aukerman Creek. As of Spring of 2021, the restored section was partially stabilized but another reach just upstream of the restored section is currently destabilizing the streambank at a rapid pace, causing a large quantity of sediment to be deposited into the creek and leading to large woody debris accumulating in the channel. The Preble SWCD estimated that streambank erosion has led to the bank retreating by over 60 feet in the past 20 years. A Bank Erosion Hazard Index (BEHI) revealed that the erosion at this reach is extreme and 1,890 ft3/year, or 91 tons/year of sediment is releasing into Aukerman Creek and will continue if this section of streambank is not stabilized. Therefore, it is critical to address this streambank erosion immediately.

FIGURE 2-8: STREAMBANK EROSION AND LARGE WOODY DEBRIS AT THE PREBLE COUNTY HISTORICAL SOCIETY.

2.2. Summary of Biological Trends for Aukerman Creek HUC-12

Ohio EPA Biological and Water Quality Study of the Twin Creek and selected Tributaries 2005 was the only comprehensive sampling data of Twin Creek and Aukerman Creek HUC-12 watershed. Using the data from this report, OEPA prepared the TMDL for the Twin Creek Watershed. This section summarizes the findings of the 2005 OEPA sampling report (OEPA, 2007) and the OEPA TMDL Report (OEPA, 2010).

Four sampling locations were selected in the Aukerman Creek HUC-12 during the 2005 OEPA sampling event (Figure 2-9 Table 2-7). Three of the sampling locations are located along Aukerman Creek and the fourth one was located at one of the unnamed tributaries. Table 2-8 shows the biological indices scores for the four sampling sites in Aukerman Creek HUC-12.

Table 2-7: 2005 OEPA Sampling location within Aukerman Creek HUC-12
***tributary to Aukerman Creek @RM2.88**

Stream Mile	Drainage Area (mi2)	Cross Road	Latitude	Longitude
3.3	5.2	Ketterman Road	39.6637	-84.5625
1.8	13.7	Adj. Swartzel Road,Run	39.6544	-84.5410
0.5	20.7	Fudge Road	39.6602	-84.5205
0.5*	4.5	Aukerman Creek Road	39.6554	-84.5651

Table 2-8: Biological Indices Scores for the four sampling sites

Aukerman Creek Stream Mile	IBI	MIwb	ICI	QHEI	Aquatic Life Use Designation	Attainment Status
3.3	50	N/A	VG	82	WWH	Full
1.8	52	N/A	G	75.5	WWH	Full
0.5	46	8.0	52	70.5	WWH	Full
0.5*	48	N/A	VG	73.5	WWH	Full

Source: OEPA, 2007

*Unnamed Tributary to Aukerman Creek @RM 2.88

IBI Index of Biotic Integrity

The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi2).

ICI - Invertebrate Community Index (G=Good; MG=Marginally Good; H Fair =High Fair; F=Fair; L Fair=Low Fair; P=Poor; VP=Very Poor).

QHEI - Qualitative Habitat Evaluation Index

WWH Warmwater Habitat – ECBP Ecoregion

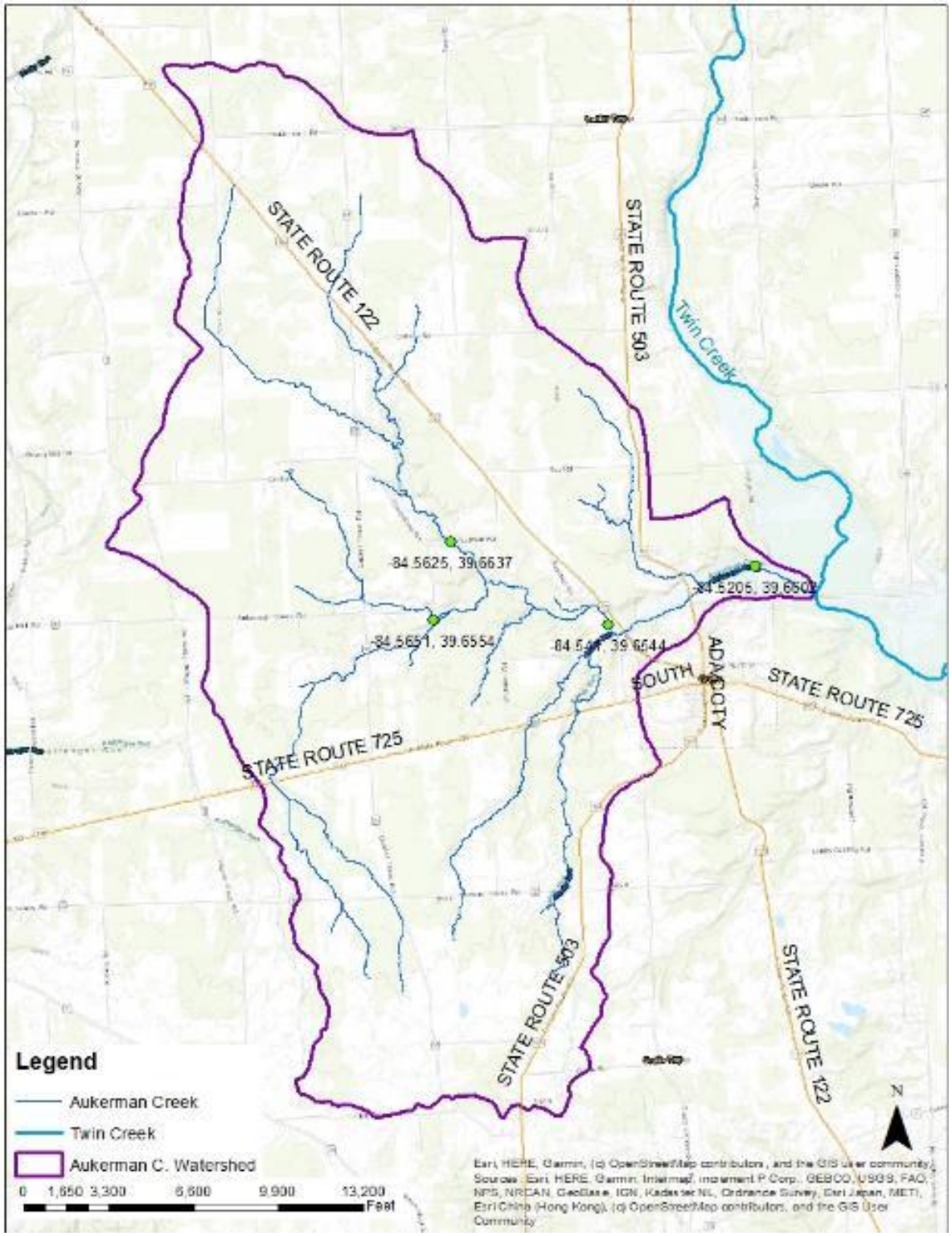

FIGURE 2-9: 2005 OEPA SAMPLING LOCATIONS

2.2.1. Biological Assessment: Fish Assemblages

The fish assemblages of Twin Creek and its tributaries which included Aukerman Creek were surveyed and assessed by OEPA in 2005. A total of 35,596 fish comprising 42 species and six hybrids was collected from all Twin Creek tributaries, between July and September 2005. Based on aggregated catch statistics from all tributaries, numerically predominant species (No./0.3km) included Central stoneroller (30.0%), Northern creek chub (16.1%), white sucker (7.2%), rainbow darter (6.1%), mottled sculpin (5.1%), and striped shiner (3.6%). In terms of relative biomass (kg/0.3km), dominant species were, Central stoneroller (30.2%), Northern creek chub (23.6%), white sucker (14.1%), striped shiner (6.4%), rockbass (3.6%), and mottled sculpin (3.2%). In terms of ranked abundance and biomass measures, these dominant species are typical associates of headwater or brook environments. Community indices and accompanying narrative evaluations from these waters ranged between exceptional (IBI=56/MIwb=9.8) and marginally good (IBI=36/MIwb=8.0). Taken together with the entire Twin Creek tributaries, the fish assemblages were collectively characterized in the narrative as very good. The Twin Creek tributaries including Aukerman Creek were found to support fish assemblages fully consistent with the biocriteria applicable to existing and recommended Aquatic Life Uses.

Table 2-9. Fish community and descriptive statistics

Stream River Mile	Mean Number Species	Cumu-lative Species	Mean Rel. No. (No./km)	Mean Rel. Wt. (Wt./km)	Mean IBI	Mean MIwb	QHEI	Narrative Evaluation
3.3	16.0	16	1160.00	12.66	50	NA	82	Exceptional
1.8 H	16.0	16	3954.00	24.85	54	NA	75.5	Exceptional
0.5 W	20.0	20	2398.50	9.35	46	8.0[ns]	70.5	Very Good/M.Good
0.5 H	12.0	12	3204.00	11.56	48	NA	73.0	Very Good

Source: OEPA 2007

2.2.2. Biological Assessment: Macroinvertebrate Community

Samples collected from the lower segment of Twin Creek received exceptional scores meeting the EWH aquatic life use. ICIs in the lower Twin Creek which include Aukerman Creek were consistent, with a mean near 50. Overall, 146 total taxa were collected from the lower Twin Creek and tributaries, of which 68 are considered pollution-sensitive. Rare, intolerant, or infrequently collected taxa that were encountered in this catchment included the mayflies *Acentrella turbida*, *Plauditus cestus*, and *Paracloeodes* sp. 3; and the midges *Thienemanniella similis, Cladotanytarsus vanderwulpi* group Type 1, *Sublettea coffmani*, and *Tanytarsus* glabrescens group sp 4. The lower Twin Creek and tributaries found healthy populations of organisms which thrive in fast, flowing waters replete with oxygen, such as the dobsonfly *Corydalus cornutus* and the aquatic moth *Petrophila*.

Table 2-10 Macroinvertebrate sampling results

Stream RM	Dr. Area (Sq. mi.)	Data Codes	Qual. Taxa	EPT Ql/Total	Sensitive Taxa Ql./Total	Density Ql. Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
Aukerman Creek										
3.3	5.2	-	50	17	23	M-L	2	Net-spinning caddisflies (F,MI), mayflies (F,MI,I), Water penny beetles (MI), midges (T,MT,F,MI)	-	Very Good
1.8	13.7	1	47	13	21	M-L	0	Net-spinning caddisflies (F,MI), mayflies (F,MI), midges (T,MT,F,MI)	-	Good
0.4	20.7	15	63	20/24	30/41	M	3	Net-spinning caddisflies (F,MI), *Rheotanytarsus*midges (MI), mayflies (F,MI,I), midges (MT,F,MI,I)	52	Exceptional
Trib to Aukerman Creek @RM 2.88 (14-520)										
0.7	4.5	-	38	19	21	L	0	Net-spinning caddisflies (F,MI), Helicopsyche caddisflies (MI), Elimia Snails (MI), mayflies (F,MI), midges (T,MT,F,MI)	-	Very Good

Source: OEPA. 2007
RM: River Mile.
Dr. Ar.: Drainage Area
Data Codes: 8=Non-Detectable Current, 9=Intermittent or Near-Intermittent Conditions, 12=Suspected High Water Influence/Disturbance, 13=Suspected Disturbance by Vandalism, 15=Current >0.0 fps but <0.3 fps, 29=Primary Headwater Habitat Stream.
Ql.: Qualitative sample collected from the natural substrates.
Sensitive Taxa: Taxa listed on the Ohio EPA Macroinvertebrate Taxa List as MI (moderately intolerant) or I (intolerant).
Qt.: Quantitative sample collected on Hester-Dendy artificial substrates, density is expressed in organisms per square foot.
Qualitative sample relative density: L=Low, M=Moderate, H=High.
CW: Coolwater/Coldwater
EPT: Benthic macroinvertebrates from the Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, and caddisflies)

2.2.3. Physical 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. Mean QHEI values from rivers or river segments equal to or greater than 60.0 generally indicate a level of macrohabitat quality sufficient to support an assemblage of aquatic organisms fully consistent with the WWH aquatic life use designation. Average reach values at greater than 75.0 are generally considered adequate to support fully exceptional (EWH) communities (Rankin 1989 and Rankin 1995). Values between 55 and 45 indicate limiting components of physical habitat are present and may exert a negative influence upon ambient biological performance. However, due to the potential for compensatory stream features (e.g., strong ground water influence) or other watershed variables, QHEI scores within

this range do not necessarily exclude WWH or even EWH assemblages. Values below 45 indicate a higher probability of habitat derived aquatic life use impairment. From the 2005 OEPA sampling results, the QHEI scores (70.5 to 82) at Aukerman Creek and the unnamed tributary were determined to support the WWH aquatic life use designation.

Table 2-11: QHEI Matrix and Scores

			Aukerman Creek			Trib to Aukerman Creek (RM 2.88)
Key QHEI Elements		**River Mile**	3.3	1.8	0.5	0.5
		QHEI Score	**82**	**75.5**	**70.5**	**73**
		Gradient (ft/mi)	29.41	23.26	15.63	22.22
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	9	7	5	8
MWH Attributes	Hi Influence	**Channelized/No Recovery**				
		Silt/Muck Substrates				
		No Sinuosity		•		
		Sparse/No Cover		•	•	•
		Max Depth <40 cm				
		Hi-Influence Modified Attributes	0	2	1	1
		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		3	5	5	2
MWH H.I.+1/WWH+1 Ratio		0.1	0.38	0.33	0.22
MWH M.I.+1/WWH+1 Ratio		0.4	1.00	1.17	0.44

Source: OEPA, 2007

All three communities sampled at Aukerman Creek in 2005 met or exceeded WWH biocriteria. All included healthy, abundant populations of pollution-sensitive taxa on the natural substrates and showed good diversity of qualitative EPT, ranging from 13-20 taxa. The community sampled at RM 0.4, downstream of Fudge Road, scored an exceptional ICI of 52. Its 63 qualitative taxa were the highest collected in all of Twin Creek's tributaries. The mayfly *Baetis tricaudatus*, a coldwater species, was identified only at this location in the entire survey.

At the unnamed tributary to Aukerman Creek, the community was found to be very good, comprised of 19 EPT and 21 sensitive taxa, which meets the recommended WWH aquatic life use. Noteworthy of the collected fauna were three different case-building caddisfly species from the family *Leptoceridae*, all of which are pollution-sensitive organisms; and the intolerant mayflies *Acerpenna macdunnoughi* and *Diphetor hageni*.

2.2.4. Water Quality

In addition to the biological and physical monitoring discussed above, OEPA collected water samples from Twin Creek and selected tributaries and analyzed the water quality to understand existing conditions in 2005. Results from the study indicated conventional water chemistry was good and almost all samples taken for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium or zinc were below the detection limit (BDL) in water column samples. Water column calcium, iron, manganese, magnesium, hardness, BOD5, chloride, and sulfate were within acceptable ranges. Strontium detected in Aukerman Creek and the unnamed tributary to Aukerman Creek were above the Tier II Water Quality Standard. Strontium is a naturally occurring metal found in celestite (SrSO4) and strontinite (SrCO3) deposited in valley fill from Silurian aged carbonates. This detection in the unnamed tributary to Aukerman Creek had the highest strontium levels (maximum 9610 µg/l; median 8140µg/l) documented on the entire Twin Creek and selected tributaries survey.

All water column samples were below the 90th percentile background level for total phosphorus, NH3-N and NO3-N in the Aukerman Creek samples.

Table 2-12: Nutrient sampling results

Stream (RM)	area mi^2	Frequency of Phosphorus >90^{th} Percentile	Phosphorus Median (mg/l)	Frequency of NH_3>90^{th} Percentile	NH_3 Median (mg/l)	Frequency of NO_3 >90^{th} Percentile	NO_3 Median (mg/l)
Aukerman Creek (3.30)	5.2	0/5	0.119	0/5	0.057	0/5	0.052
Aukerman Creek (1.80)	13.7	0/5	0.025	0/5	0.063	0/5	.0.65
Aukerman Creek (0.50)	20.7	0/5	0.016	0/5	0.05	0/5	1.34
Trib Aukerman Creek (0.50)	4.5	0/5	0.022	0/5	0.069	0/5	0.37

Source: OEPA 2007

2.3. Summary of TMDL

The Twin Creek watershed TMDL was required because portions of the Twin Creek and its tributaries did not attain their water quality goals for aquatic life and recreation (OEPA, 2010). However, the OEPA sampling results in 2005 did not find the Aukerman Creek to be impaired and therefore, no action was required for the Aukerman Creek HUC-12 watershed. The Twin Creek TMDL Report did not include Aukerman Creek.

2.3.1. Baseline Load Estimates

Estimated baseline nutrient loads and estimated target load reduction for the Aukerman Creek HUC-12 was provided by Rick Wilson, OEPA (Table 2-13). The goal loads presented are 20 percent of the total estimated baseline loads for annual Nitrogen contribution in the Aukerman Creek watershed.

The 2020 report on management of onsite systems did not report the number of failing home systems at this watershed (OKI, 2020). Since there are no populated areas and communities, the main source of nutrient impairment in this watershed is primarily agriculture (OEPA, 2020). Water quality modeling of the Lower Great Miami River Basin was performed by Miami Conservancy District in 2017 and provided great insights into the significant nutrient loadings and reduction scenarios and single point sampling limitation in this watershed (MCD, 2017).

Information about urban loading is limited since there are no communities in this agricultural watershed and this is not the top priority issue at the PCHD. This version of the Nine-Element NPS-IS for Aukerman Creek HUC-12 will be focusing on reducing agricultural nutrient loads. Once more information is available for the urban loading, the next version of the plan will be updated to include them.

Recent conservation practices (Table 2-6) provided a starting point of the nitrogen reduction load estimates within the watershed. The total estimate of combined current and recent past conservation practices is 52,780 lb/yr and the target goal is 54,000 lb/yr.

Table 2-13: Estimated Nitrogen Loadings from Contributing NPS Sources in Aukerman Creek HUC-12

	Agricultural Load (lbs Nitrogen/acre)	**Developed/Urban Loads (lbs Nitrogen /acre)**
Current Estimates*	267,762	7,550
Target Reduction Goals*	54,000	1,510
Current load reduction estimates based on SWCD inventory**	52,780	NA

*Estimate provided by Rick Wilson, OEPA in November 2020.
** See Table 2-6 for conservation practices. Estimate using STEPL, 2019
NA – Not Available at this time

2.4. Summary of Pollution Causes and Sources

Aukerman Creek HUC-12 and Twin Creek were surveyed in 2005 and the results showed that these streams had excellent water quality and were able to support WWH. With the high-quality biological indicators, it is essential to protect and maintain the high-quality stream and habitats in Aukerman Creek and its tributaries and promote BMPs in the upland for conservation and nutrient management. At the Aukerman Creek HUC-12, row crop agriculture is the main source of impairment locally. Nitrogen loss from row-crop agriculture in rural watersheds which drain to the Gulf of Mexico is also the primary source of Gulf Hypoxia -- caused by excess nutrient (Nitrogen) loading, siltation/sedimentation from cropland, and intense runoff delivery via drainage tiles to the waterbodies. Streambank erosion is a persistent cause of water quality degradation and siltation/sedimentation is common throughout the watershed (Figure 2-10).

FIGURE 2-10: EXPOSED BASE OF POWERLINE POLE AND ERODED STREAMBANK

2.5. Additional Information for Determining Critical Areas and Developing Implementation Strategies

2.5.1. Agricultural Conservation Planning Framework

The Agricultural Conservation Planning Framework (ACPF) is an agricultural watershed management tool using high-resolution spatial data and ArcGIS to identify opportunities for installing conservation practices within a watershed (Tomer et al., 2013). Developed by the US Department of Agriculture, the ACPF is being used in hundreds of watersheds to inform and engage local communities in agricultural conservation. The program spatially combines high resolution terrain, drainage, soils, land use and crop land data, and identifies and prioritizes potential areas for conservation (ARS, 2019). ACPF can engage stakeholders in the watershed planning process by proposing conservation solutions. The program is not prescriptive but provides various options and scenarios that can be evaluated at watershed and farm levels including in-field, below-field and in the riparian zone (Tomer et al., 2013). The following ACPF conservation practices -- both for in-field and below-field -- and riparian buffers are found applicable in our region:

Grassed Waterway – NRCS Practice code 412
Nutrient Removal Wetlands – NRCS Practice code 658
Water and Sediment Control Basin (WASCOB) – NRCS Practice code 638
Riparian Buffer – NRCS Practice code 391
Streambank Stabilization – NRCS Practice code 580
Buffer Contour Strip – NRCS Practice code 332

Filter Strip – NRCS Practice code 393 - Filter Strips are not specifically identified in the ACPF but it is very applicable in this region. This practice would be situated parallel to a perennial stream and consists of a strip of dense perennial cool-season or warm-season grasses, often with additional broadleaf species mixed in. The thick vegetation removes nutrients and sediment from overland flow and stabilizes floodplains when out-of-bank-flow occurs. This has been a very effective nutrient removal and treatment practice in Preble County and will replace the Contour Buffer Strips identified in the ACPF.

One of the important outputs generated by the ACFP is the riparian assessment. The ACPF riparian assessment (riparian buffer and streambank stabilization) utilizes a matrix of two variables: the width of the riparian zone and runoff delivery. This analysis provides better options to improve the effectiveness of riparian conservation planting where field runoff occurs. The output further provides specific riparian design types based on the cross-classification matrix which include critical zone for sensitive sites, multi-species buffer for water uptake, nutrient and sediment trapping, stiff-stemmed grasses for trapping runoff and sediment, deep-rooted vegetation tolerant of saturated soil, and sections emphasize streambank stability because the narrow buffer width. The purpose of this riparian management assessment is to provide the most water quality benefits by identifying segments to install permanent vegetation specifically designed to intercept surface runoff, protect shallow groundwater in low-lying areas and stabilize stream banks. This type of treatment is especially applicable in this watershed since the riparian zone is steep (Figure 2.6) and many bare and exposed banks are the source of stream erosion and siltation/sedimentation.

2.5.2. ACPF modeling for Aukerman Creek HUC-12

The ACPF model was performed for the Aukerman Creek HUC-12 using a 2.5 ft LIDAR DEM from Ohio Geographically Referenced Information Program (OGRIP) and a file geodatabase provided by ARS (USDA, 2020). The tool was run using cropland data layers representing the years 2010 through 2019.

The ACPF model identified a number of possible in-field conservations practices, below-field practices and also riparian zone designs in the Aukerman Creek HUC-12. At the Aukerman Creek HUC-12, 10.7% of the fields are considered high and very high runoff risks and 75% of the watershed is tile-drained agricultural fields as estimated by the ACPF.

Outputs from the ACPF model were presented and discussed with the stakeholders at the Nine-Element NPS-IS public meeting on March 9, 2021 as well as at follow up field visits and ground verification at selected locations. The output has been beneficial in engaging discussions with landowners about potential conservation practices. The ACPF maps provide a visual tool for the landowners, making field visits and discussions more effective and efficient. Although the ACPF recommended contoured buffer strips, it is not a practice that is common in the region. Therefore, instead of contoured buffer strips, the in-field practice of riparian filter strips is more appropriate.

Table 2-14 Conservation Practices at Aukerman Creek HUC-12 suggested by the ACPF
(ACPF maps and estimates are only for planning purposes)

	Unit	Length	Area
In-Field Practices (Figure 2-11)			
Grassed Waterways	1,300 Segments	118 Miles	464 Acres*
Contoured Buffer Strips/Filter Strips***	147 Strips	30 Miles	27 Acres*
Below-Field (Figure 2-12)			
Nutrient Removal Wetlands	38 Wetlands	NA	75 Acres
WASCOBs	111 Basins	NA	1,167 Acres**
Riparian Zone (Figure 2-13)			
Streambank Stabilization	NA	45 Miles	272 Acres (assuming avg. 50 feet wide)
Riparian Buffers (various plants)	NA	24 Miles	145 Acres (assuming avg. 50 feet wide)

*Assuming 30 feet wide
**Contributing area
***Instead of Contour Buffer Strips, filter strips are deemed more practical in the region (Section 2.5.1).
Note: All measurements are rounded up to the nearest number.

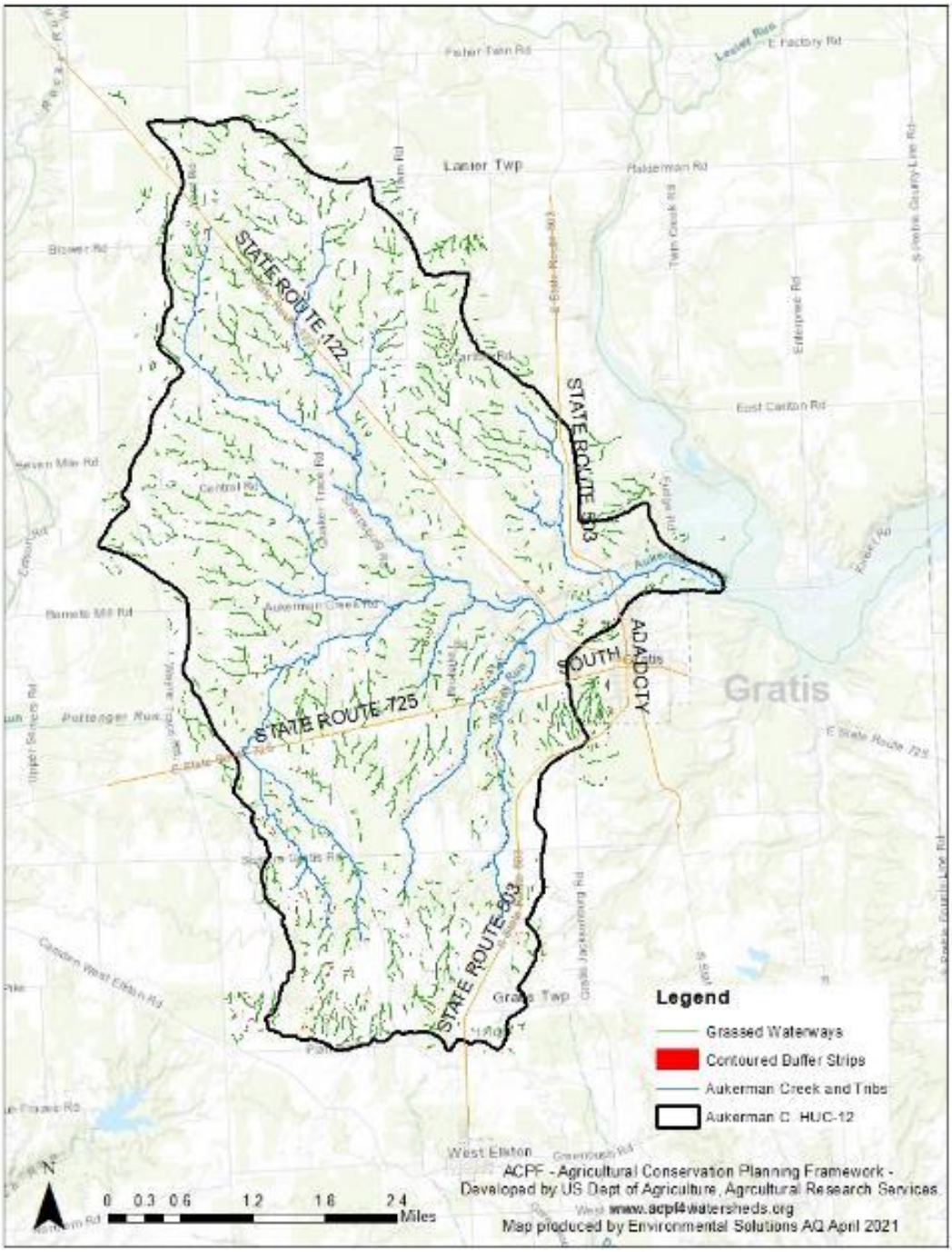

FIGURE 2-11: IN-FIELD PRACTICES SUGGESTED BY ACPF

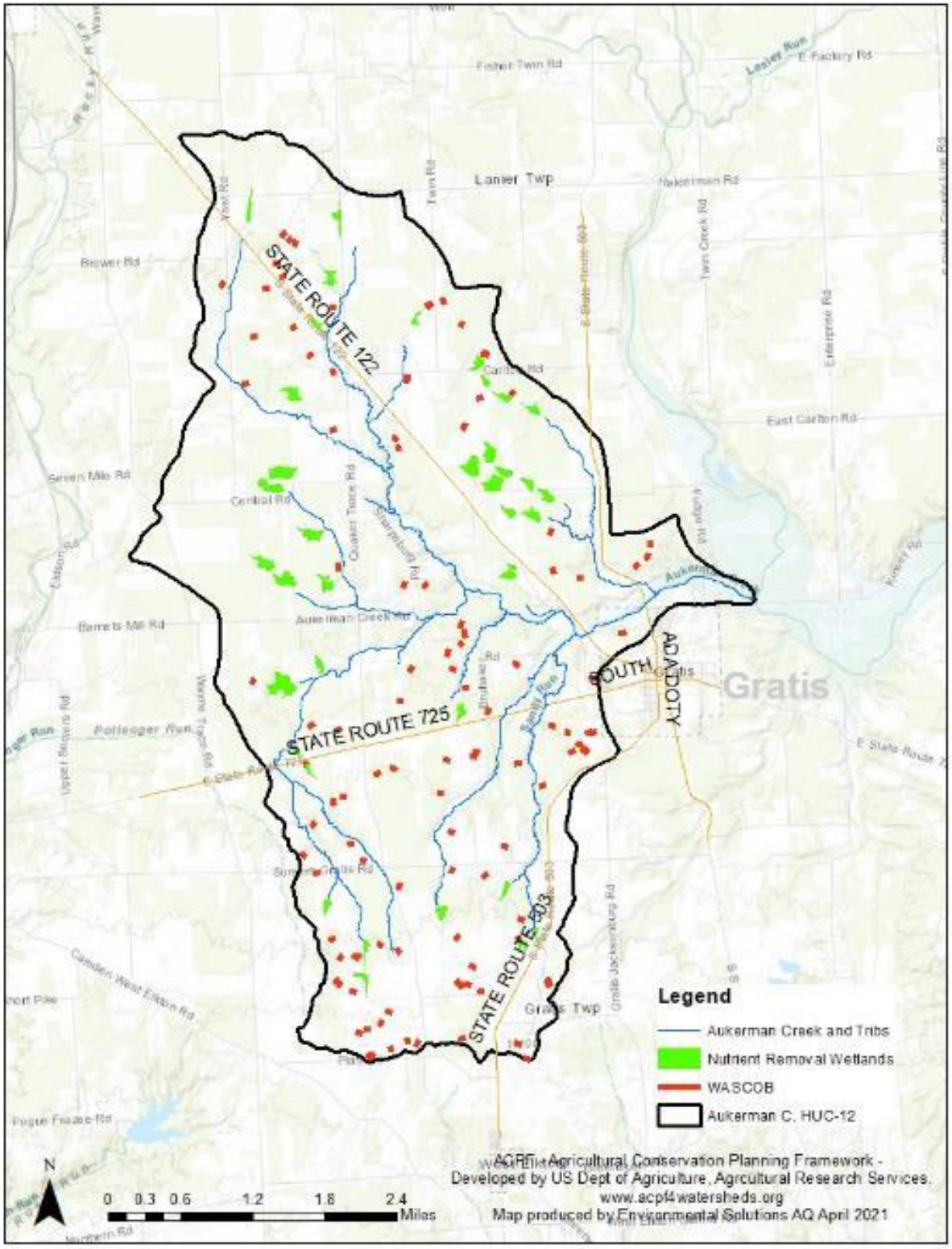

FIGURE 2-12: BELOW-FIELD PRACTICES SUGGESTED BY ACPF

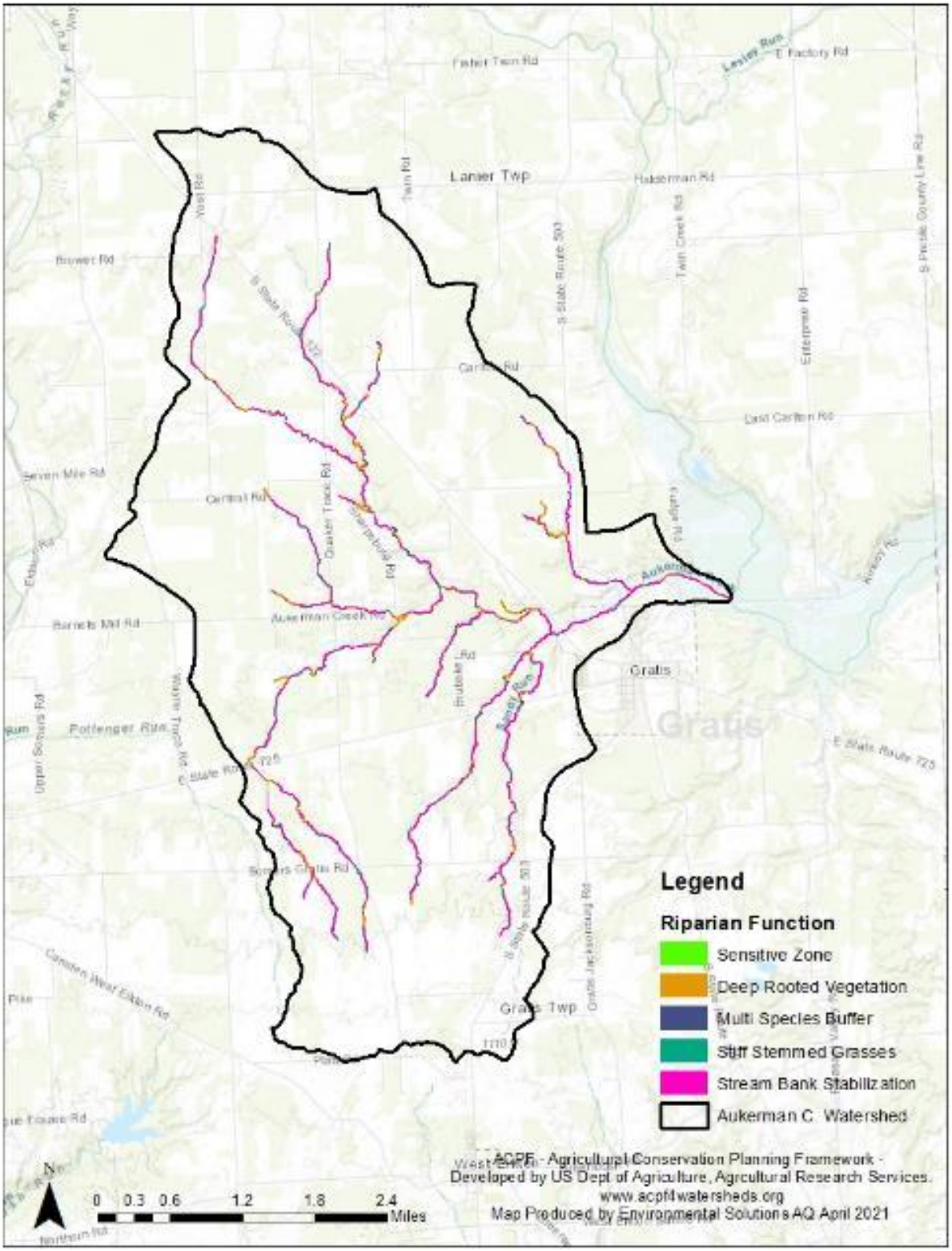

FIGURE 2-13: RIPARIAN FUNCTIONS SUGGESTED BY ACPF

2.5.3. Whole Farm Conservation Planning

Whole farm conservation planning is one of the strategies that was strongly encouraged in the 2020 OEPA NPS Management Plan Update to maximize nutrient reduction and fully consider all the potential conservation practices (OEPA, 2020c). During the process of developing the Nine-Element NPS-IS and the ACPF modeling at Aukerman Creek HUC-12, PCHS expressed interest in working with Preble SWCD, NRCS and other local stakeholders to explore the whole farm conservation planning concept to holistically plan for nutrient management for the entire property. The results of the ACPF model for the PCHS were shared and discussed at the public meeting on March 9, 2021 and also follow up discussions were held during the PCHS Field Day on April 13, 2021 (Figure 1-6). During the field day, stakeholders toured the entire property, explored the practical and educational values of conservation practices, and discussed limitations on the compatible use restrictions of the NRCS WRP easement. Additional conservation initiatives such as forestry, prairie and wetland maintenance, pollinator habitat establishment, invasive plant species removal and trail building were also considered during the field day.

PCHS intends to incorporate whole farm conservation planning into their long-term management plan. With 103 acres of land already protected under the NRCS WRP, there are opportunities to expand on conservation practices at the non-WRP fields. The education and outreach opportunities include providing conservation tours/demonstrations to promote learning about the conservation practices in place. Using the ACPF model output as a guide, PCHS and Preble SWCD have identified the possible conservation practice placements and are cooperating to maximize and explore the conservation and outreach opportunities.

Table 2-15 Conservation Practices suggested by the ACPF at Preble County Historical Society. Some of the units are located with the NRCS WRP easement

	Unit	Length	Area
In-Field Practices			
Grassed Waterways	12 Segments	8,202 feet	5.7 Acres*
Contoured Buffer Strips/Filter Strips	4 Strips	3,700 feet	0.6 Acres
Drainage Management	3 fields		59 Acres
Below-Field Practices			
Nutrient Removal Wetlands	2 Wetlands		1.4 Acres***/357 Acres**
WASCOBs	5 Basins		50 Acres**
Riparian Zone			
Streambank Stabilization	40	30,042 feet	34 Acres (avg 50" width)
Riparian Buffers (various plants)	38	29,235 feet	33 Acres (avg 50' width)

*Assuming 30 feet wide

**Contributing area

*** Wetland Pool Area

.

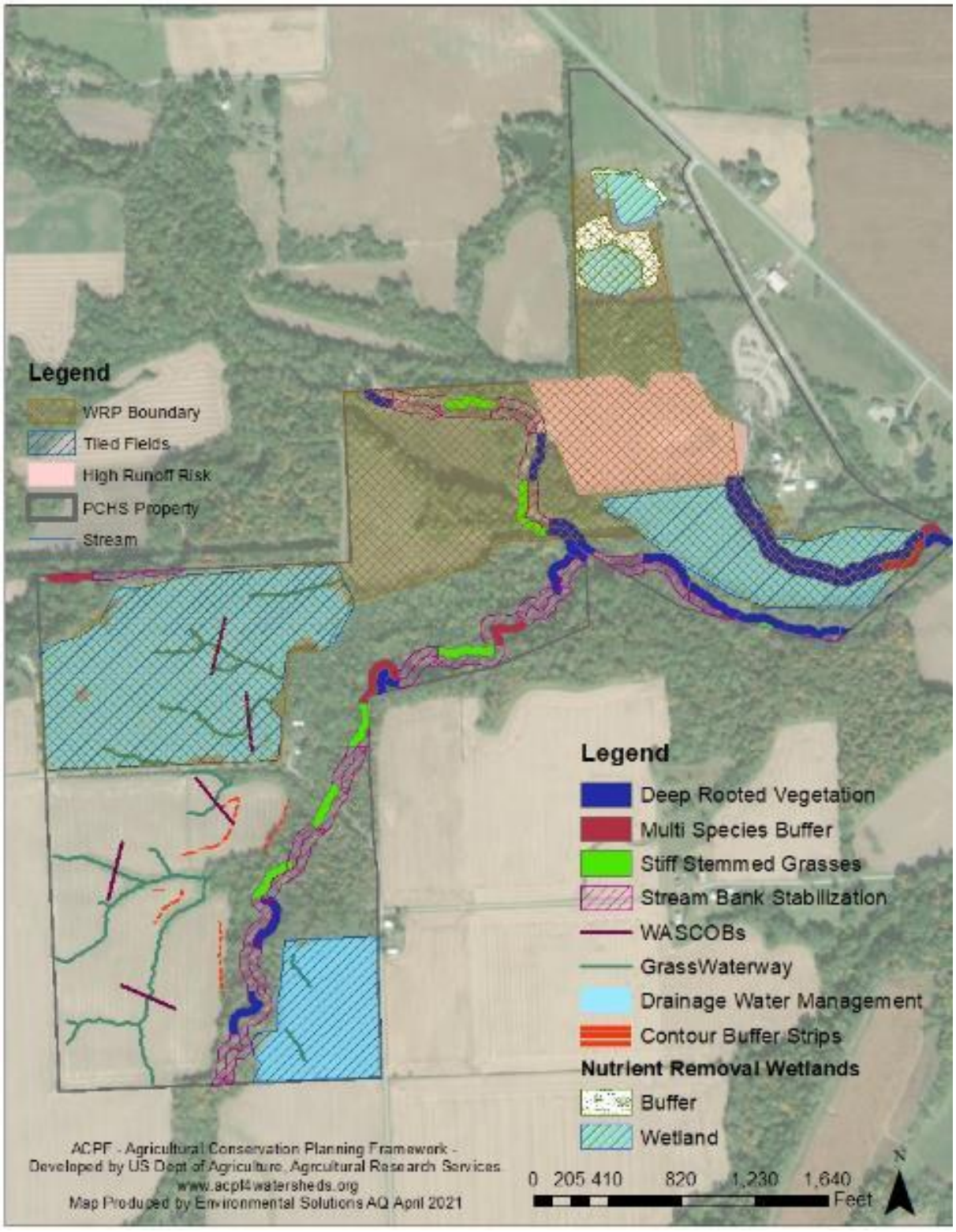

FIGURE 2-14: WHOLE FARM CONSERVATION PLANNING FOR PREBLE COUNTY HISTORICAL SOCIETY

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

3.1 Overview of Critical Areas

Two critical areas have been identified within the Aukerman Creek HUC-12 (Figure 3-1). All the critical areas were identified to address the in-field and below-field nutrient management as well as contributing to positive impacts on reducing siltation/sedimentation into the streams. Additional critical areas may be identified in subsequent versions of this Nine-Element NPS-IS.

Aukerman Creek and an unnamed tributary were assessed during Ohio EPA's 2005 Twin Creek and selected tributaries survey (OEPA, 2007). Of the four samples taken in the Aukerman Creek HUC-12, all were in full attainment and no action was required in the Twin Creek TMDL. Given the high quality of Aukerman Creek and tributaries, it is crucial to continue to protect the habitats and maximize the conservation practices in the upland agricultural fields to their full potential. Meeting the goal of nutrient reductions requires targeted programs that expand existing partnerships and build new partnerships while supporting education and outreach to promote on-the-ground implementation (USEPA, 2014). Implementation of effective actions and progress must be verified with improved tracking mechanisms and watershed monitoring, and modeling tools (USEPA, 2014).

Aukerman Creek HUC-12 is dominated by tile-drained agricultural fields and landowners have voiced their concerns about nutrient loss and severe stream erosion during the public meeting and through other forms of communication. To address the nutrient management and riparian functions, Critical Area 1 is identified to reduce nutrient loading from tile-drained croplands, and Critical Area 2 targets improving the riparian zone.

Table 3-1. Critical Areas of Aukerman Creek HUC-12

Critical Area	Area Description	Impairment Being Addressed	Size
1	Tile-drained agricultural fields as determined by ACPF	Nutrient management using specific conservation practices (N and P reduction)	10,045 Acres
2	Riparian Zone (both sides of the stream)	Maintain high quality habitat scores(IBI, ICI, QHEI) and improve stream health by reducing siltation/sedimentation; (Sediment, N, and P reduction)	68.6 miles

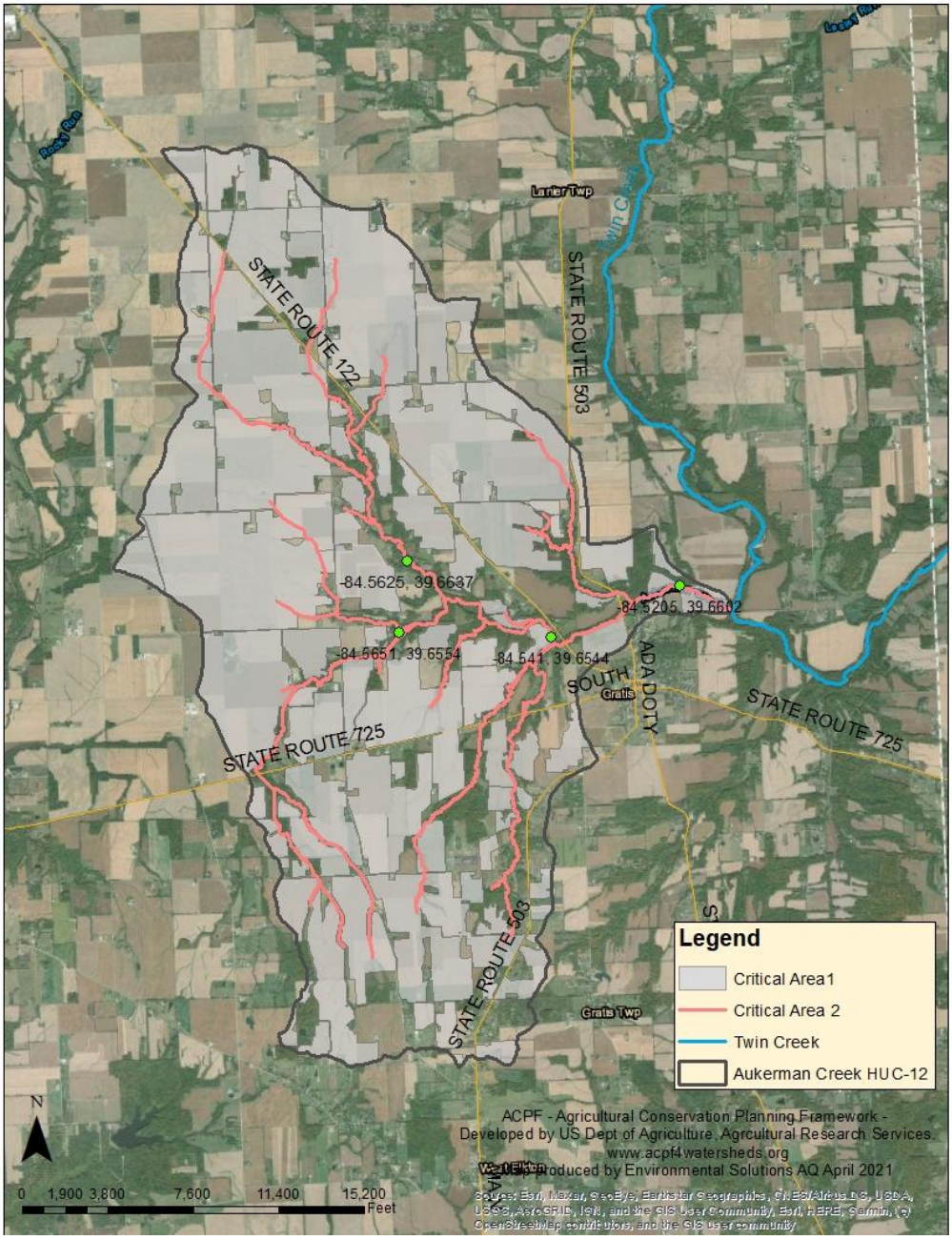

FIGURE 3-1: CRITICAL AREAS AT AUKERMAN CREEK HUC-12 WITH 2005 OEPA SAMPLING LOCATIONS

3.2. Critical Area 1: Conditions, Goals, &Objectives for Nutrient Reduction and Management in Aukerman Creek HUC-12 tiled agricultural fields.

3.2.1. Detailed Characterization

The Great Miami River basin in Ohio is one of the major nutrient contributors to the Gulf of Mexico according to the Ohio's Nutrient Mass Balance Study for Ohio's Major Rivers 2020 (OEPA, 2020). In the past 7 years between 2013 to 2019, there has been no reduction or

change in the loadings for total phosphorus (P) or total nitrogen (N) and the data demonstrated that the nonpoint source is the largest proportion of the total P and total N load in the Great Miami River at 66 and 83 percent, respectively (OEPA, 2020). As of May 13, 2021, there has not been any Nine-Element NPS-IS approved for any HUC-12 within the Great Miami River watershed. An approved Nine-Element NPS-IS is a prerequisite for implementation grant applications such as for a Federal Section 319 grant.

Given the dominance of agricultural land use in the Aukerman Creek HUC-12, nutrient management with the use of BMPs is the best way to reduce nutrient loss from high runoff fields to the nearby waterways. Critical Area 1 is comprised of all tile-drained agricultural fields as determined by the ACPF model (Figure 3-2). ACPF also determined the specific high runoff fields based on slope steepness and the fields' close proximity to the stream.

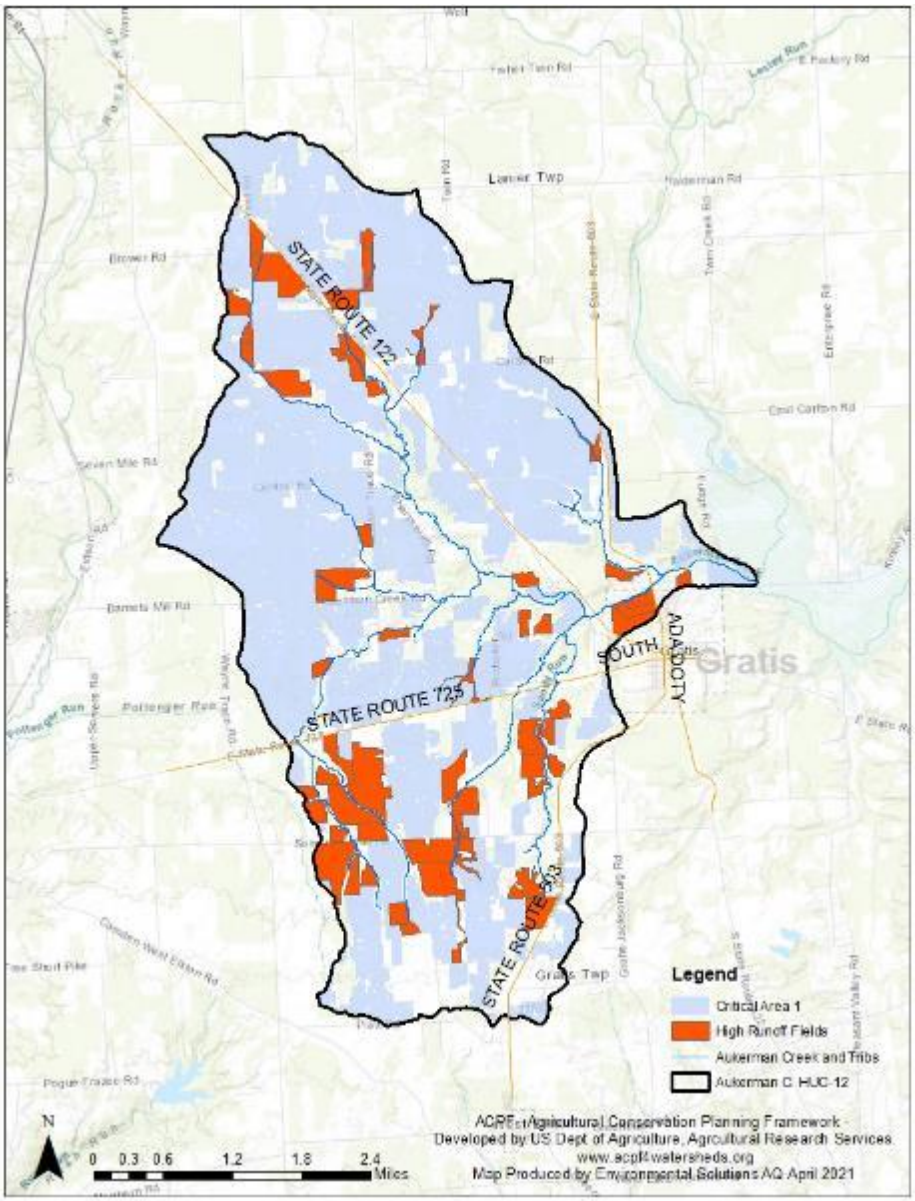

FIGURE 3-2: CRITICAL AREA 1

Using soil characterization and slopes, the ACPF determined that a total of 10,045 acres of agricultural fields within the HUC-12 are tile-drained. Using the ACPF, 1,429 acres (10.7%) of the tile-drained fields are determined to be high runoff risk. Based on stakeholder inputs, the prioritized areas and potential projects may meet the following criteria:

- Areas located near the high runoff fields determined by ACPF
- Areas in close proximity to Aukerman Creek or its tributaries
- Areas with limited use or underutilization of BMPs at the tile-drained agricultural fields

3.2.2. Detailed Biological Conditions

The 2005 sampling conducted by OEPA at four sampling points in this HUC-12 indicates that conditions were suitable for supporting WWH. Table 3-2 illustrates the attributes of the fish sampled in 2005 at each monitoring location, resulting in IBI scores of 50 at the upstream site and 46 at the downstream site. Table 3-2 also includes the habitat assessment scores, represented by QHEI values.

Table 3-2, Fish community and habitat Data

RM	QHEI	Drainage Area (mi^2)	Mean # of Species	Predominant species (% of catch) *	IBI	Narratives
3.3	82	5.2	16	Central Stoneroller (30%), Northern Creek chub (16.1%), white sucker (7.2%), rainbow darter (6.1%), mottled sculpin (5.1%) and Striped shiner (3.6%).	50	Very Good
1.8	75.5	13.7	16		52	Good
0.5	70.5	20.7	20		46	Exceptional
0.5**	73.5	4.5	12		48	Very good

*only aggregate sampling results from the tributaries were reported (OEPA, 2007)
** Unnamed tributary to Aukerman Creek
Source: OEPA, 2007

OEPA reports that QHEI scores from streams across the state indicate that values greater than 55 are generally conducive of supporting warmwater faunas (OEPA, 2007). The habitat assessment at the upstream site scored 82 and downstream site scored 73.5. The 2005 macroinvertebrate community data at each sampling site show the dominant taxa at the upstream site include net-spinning caddisflies, mayflies, water penny beetles and midges and the dominant taxa at the downstream site include net-spinning caddisflies, *Rheotanytarsus*, midges, mayflies and midges. The ICI assessment at these sites range from good to exceptional conditions.

Table 3-3. Macroinvertebrate Data

Stream RM	Dr. Area (Sq. mi.)	Density Ql. Qt.	Predominant Organisms on the Natural Substrates with Tolerance Category(ies) in Parentheses	ICI	Narrative Evaluation
3.3	5.2	Moderate -low	Net-spinning caddisflies (F,MI), mayflies (F,MI,I), Water penny beetles (MI), midges (T,MT,F,MI)	-	Very Good
1.8	13.7	Moderate -low	Net-spinning caddisflies (F,MI), mayflies (F,MI), midges (T,MT,F,MI)	-	Good
0.4	20.7	Moderate	Net-spinning caddisflies (F,MI), *Rheotanytarsus*midges (MI), mayflies (F,MI,I), midges (MT,F,MI,I)	52	Exceptional
0.5*	4.5	Low	Net-spinning caddisflies (F,MI), Helicopsyche caddisflies (MI), Elimia Snails (MI), mayflies (F,MI), midges (T,MT,F,MI)	-	Very Good

* Unnamed tributary to Aukerman Creek
Source: OEPA, 2007
Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant.

In 2005, OEPA also collected water quality data. All water column samples were below the 90th percentile background level for total phosphorus, NH3-N and NO3-N in the Aukerman Creek samples (OEPA, 2007). In summary, the biological and chemical indicators in 2005 demonstrated the water quality and habitats were high and therefore, it is important to maintain and protect these high-quality streams.

3.2.3. Detailed Causes and Associated Sources

The 2005 OEPA survey demonstrated that the streams in this HUC-12 were of high quality, therefore nutrient management is necessary to protect and maintain stream health. Cropland activities in the Great Miami River basin can contribute to excessive nutrient loadings to local streams and small tributaries and ultimately contributing to in Gulf Hypoxia. Practical and property specific BMPs can help reduce the amount and concentration of nutrient-laden surface runoff. These BMPs can also address the loss of sediment /topsoil from agricultural lands and retain and maximize the nutrients in the fields. The implementation of BMPs on tiled agricultural lands can address the causes of sediment/topsoil and nutrient loss in the fields and reduce the sources of this excess nutrient and sediment into the waterways.

3.2.4. Outline Goals and Objectives for the Critical Area

The goal of the NPS-IS is to improve water quality, meet nutrient reduction goals, and improve impairment status. In Critical Area 1, the samples collected in 2005 showed the Aukerman Creek and an unnamed tributary to be in full attainment and the met all biological indicators. However, over 80% of the Critical Area 1 is tile-drained agricultural fields. Drain tiles can act as conduits and directly transport nutrients to waterways. They must be well-managed to reduce risk of nutrient loss and to maximize fertilizer use efficiency. This plan and future funding will provide opportunities to promote BMPs that are appropriate and cost effective in this region.

GOALS

To achieve the nutrient loading goals at the Aukerman Creek HUC-12, the following goal and objectives have been established:

Goal 1 – Reduce nitrogen loading contributions in Critical Area 1 by 20%. Current total nitrogen load is estimated to be 270,000 lb and the reduction goal is 54,000 lb.

NOT ACHIEVED: Based on the STEPL calculation using the combined current and recent past conservation practices, the load reduction is currently 52,780 lb/yr (see page 20 for practices and estimated loads). We will need an additional 1,220 lb/yr to meet the nitrogen reduction goal. Future target load reductions may also include phosphate when appropriate baselines are provided by OEPA.

OBJECTIVES

In order to reach the load reduction goal of 20% within the Aukerman Creek HUC-12, effort will include implementing a variety of appropriate BMPs within Critical Area 1. However, the effort must also balance resources and willing landowners. With the ACPF output, a number of in-field and below-field practices are identified that are applicable in this region (Table 3-4).

Objective 1: Implement an additional 2,000 acres of conservation tillage to add to the current 6,500 acres. Plant 3,000 acres of cover crops to augment the 1,000 acres that have already been planted.

Objective 2: Reduce nutrient loss through the installation of in-field BMPs such as grassed waterways and filter strips (NRCS code 393, see page 32 for description) on at least 200 acres at locations suggested by the ACPF model. These practices are deemed most effective in removing and treating nutrient runoff in this region.

Objective 3: Reduce nutrient loss from subsurface tile drainage or below-field practices through the installation of drainage water management structures such as WASCOBs and nutrient removal wetlands on at least 100 acres at locations suggested by the ACPF model.

Table 3-4: Estimated Nutrient Loading Reductions from Each Objective

Objective Number	Best Management Practice	Total Acreage Treated	Estimated Nitrogen (N)/Phosphorus (P) Load Reduction (lbs/yr)*
1	Conservation Tillage	8,500	43,541 lb/yr (N)/5,878 lb/yr (P)
1	Cover Crops	4000	16,799 lb/yr(N)/413 lb/yr (P)
2	In-field BMPs: Grassed Waterway and Filter Strips	200	1,242 lb/yr (N)/92 lb/yr (P)
3	Below-field BMPs: Nutrient removal wetlands and WASCOBs	100	839 lb/yr(N)/19 lb/yr (P)
	TOTAL	14,000	62,421 lb/yr (N)/6,402 lb/yr (P)

**Estimates calculated using Spreadsheet Tool for Estimating Pollutant Loads (STEPL), Version 4.4 (USEPA, 2019)*

These objectives will be directed towards implementation on prioritized tile-drained agricultural lands using the stakeholders/landowners agreed criteria. The implementation of BMPs included in these objectives, as well as BMPs implemented through federal and state programs and other

voluntary efforts will be recorded to track progress towards nutrient reduction goals within Aukerman Creek HUC-12.

The practices of nutrient removal wetlands and WASCOBs are uncommon in this region due to the soils and drainage conditions and the lack of examples in the area. Extra outreach effort will be required in the coming years to promote these water management practices.

Currently there is no routine monitoring or sampling in the Aukerman Creek HUC-12. But the future project-specific monitoring efforts will verify progress towards meeting the goals identified in the plan. The objectives, projects and implementation strategies presented herein will be reevaluated and modified if determined necessary, as several versions of this NPS-IS are expected.

This Aukerman Creek NPS-IS presents an adaptive and living watershed planning approach and is anticipated to be dynamic as critical areas are identified and objectives are implemented, and other objectives recognized. The objectives listed above will be reevaluated, fine-tuned and modified as necessary when more information become available or conditions change. Additional objectives may also be included to make progress towards further reduction goals, as new and additional BMPs can improve nutrient reduction.

The OEPA Nonpoint Source Management Plan Update, which includes a full list of nonpoint source management strategies, will be utilized. Strategies, as presented in the overview tables of Chapter 4, include the following:

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

3.3. Critical Area 2: Conditions, Goals, & Objectives for Nutrient Reduction and Management in Aukerman Creek and Tributaries Riparian Zones.

3.3.1. Detailed Characterization

There are a total of 69 miles/418 acres of riparian area within the Aukerman Creek HUC-12. Most of the riparian area is vegetated with deciduous forests and very steep slopes. In 2005, four samples were collected from the stream and sampled for biological indices and water quality (previously presented). The four samples showed that the stream was in full attainment and had very good water quality. However, stakeholders, landowners and field personnel throughout the watershed have noted that severe stream erosion is common and causing siltation/sedimentation in the local streams.

Because of the tile-drained agricultural fields, nutrients from upland are transported directly into the streams and in high speed and volume during and after storms which appear to be more intense in recent years. The erosive power combined with steep riparian slopes in this watershed may cause severe bank erosion in many locations. Some of the stream erosion is

causing loss of land, gully formation, threatening utility poles and roads, and leading to large woody debris collecting in the stream channels.

At many of the eroding stream reaches, they are a symptom of systemic channel widening and meander migration. Channel widening occurs through mass wasting of stream banks, as the channel banks exceed critical bank height and fail catastrophically. Toe scour gradually erodes soil away from the toe of the slope, prompting cantilevered bank failures and mass wasting. As the stream begins to aggrade sediment from adjacent eroded reaches, the deposits occur as channel bars, which can redirect flow and initiate adjustments in planform geometry.

Adjustments in planform geometry influence the stability of open channel systems and, ultimately, affect the security of adjacent property and infrastructure. If the appropriate channel shape and structure is not implemented and stabilized, ongoing channel widening, sediment deposition, and subsequent meander migration will be enduring problems and will have an adverse effect in these streams or even the entire watershed.

In this Critical Area 2, siltation/sedimentation through streambank erosion are addressed based on the ACPF riparian assessments. The ACPF offers riparian design using the two variables of runoff delivery and width of the shallow water table zone. By applying these strategies, the riparian zone will have better function in nutrient removal and will stabilize eroding streambanks.

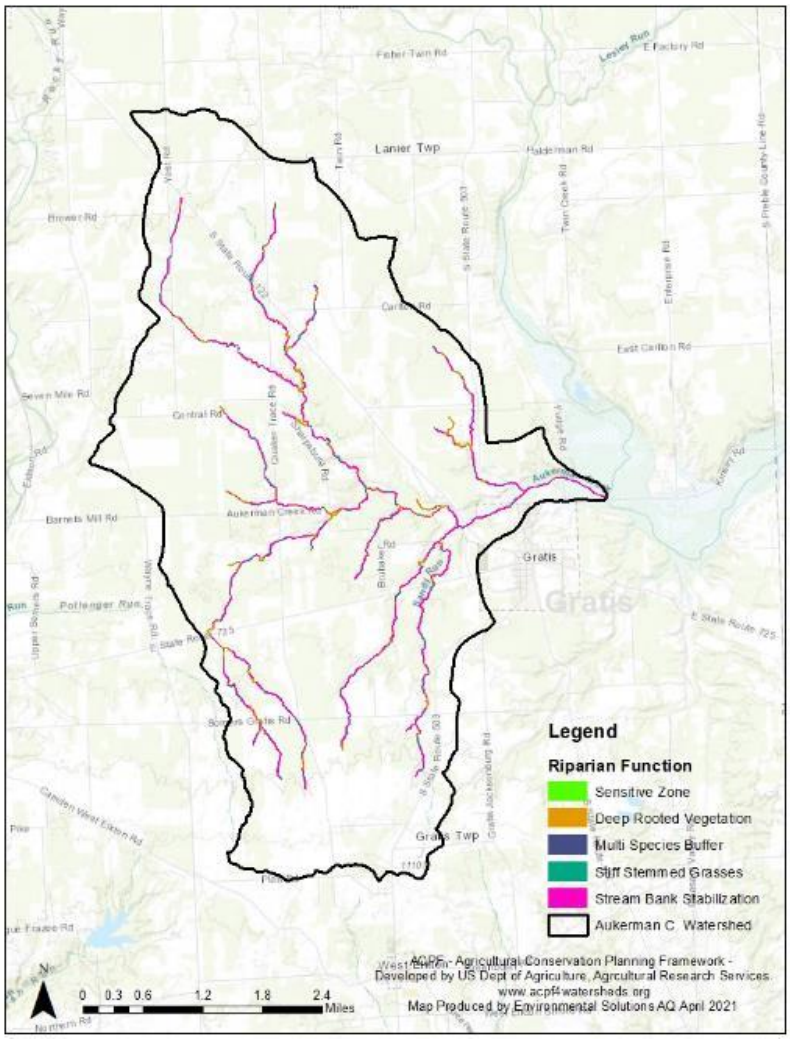

FIGURE 3-2: CRITICAL AREA 2 – AUKERMAN CREEK HUC-12 RIPARIAN ZONE

Based on inputs from landowners and stakeholders, the prioritized areas and potential projects in Critical Area 2 may meet the following criteria:

- Riparian area of Aukerman Creek and tributaries near the high runoff fields
- Riparian area with extreme severe erosion threatening land and properties
- Riparian area with limited application or underutilization of BMPs (i.e. riparian buffer/streambank stabilization)

3.3.2 Detailed Biological Conditions

As previously shown in Tables 3-2 and 3-3, the 2005 sampling conducted by OEPA at four sampling points in this HUC-12 indicates that conditions were suitable for supporting warmwater aquatic habitat with the QHEI scores of 82 at the upstream site and 73.5 at the downstream. The 2005 water quality data showed the streams were below the 90th percentile background level for total phosphorus, NH3-N and NO3-N in the Aukerman Creek samples (OEPA, 2007).

The biological and chemical indicators in 2005 demonstrated that the water quality and habitats were high and therefore, it is important to maintain and protect these high-quality streams.

3.3.3 Detailed Causes and Associated Sources

The biological indices, habitat and water quality data collected in 2005 showed Aukerman Creek and one of its unnamed tributaries to be of very good quality. The QHEI scores ranged from 70.5 to 82. For these high-quality riparian zones, it is important to maintain the quality level by ensuring the riparian area is protected and buffers are vegetated with the appropriate plant species. For areas with severe streambank erosion, large amounts of sediments are washed down from the banks during and after intense storms. Many of the banks are bare, steeply cut and not protected. The implementation of streambank stabilization and planting of riparian buffers can reduce the erosion and siltation/sedimentation into the streams.

3.3.4 Outline Goals and Objectives for the Critical Area

The goal of the NPS-IS is to improve water quality and meet nutrient reduction goals and improve impairment status. In Critical Area 2, the samples collected in 2005 showed the Aukerman Creek and an unnamed tributary to be in full attainment and met all biological indicators (IBI: 46-50; ICI: 52; QHEI: 70.5-82). However, severe stream erosion is common, and siltation/sedimentation causes water quality degradation and contributes to Gulf Hypoxia. Currently BMPs are underutilized in most of the Aukerman Creek HUC-12. To maintain and improve the habitat, stream segments need to be stabilized and buffers need to be planted for specific and effective plant species. Riparian buffer planting will provide great benefits to maintain and improve stream health and aquatic life attainment. Streambank stabilization projects are costly and require extensive resources and expertise to properly implement. There has only been one streambank stabilization project of 500 feet of severe erosion implemented in the Aukerman Creek HUC-12, completed in 2015.

Goal 1 – To maintain or improve the IBI score above 46, ICI score above 52 and QHEI score above 70.5 at the 2005 sampling locations.

ACHIEVED: Aukerman Creek HUC-12 was in full attainment in 2005. However, stream erosion and excess sedimentation are common due to the steep slopes in the riparian zone and may adversely impact the habitat scores.

Objectives

Aukerman Creek and its tributaries comprise of a total of 69 miles of riparian corridor. The streams were supporting excellent habitats; however, stream erosion is severe throughout the watershed. Streambank stabilization and riparian buffer will help reduce the sedimentation from the steep streambanks and prevent potential impairments.

Objective 1: Stabilize 45 miles of the severe streambank erosion at Aukerman Creek and tributaries.

Objective 2: Create, enhance and/or restore floodplain/riparian buffer for at least 24 miles.

Table 3-5: Estimated Nutrient Reductions from Each Objective

Objective Number	Best Management Practice	Total Length/Acreage Treated	Estimated Load Reduction using STEPL*

1	Streambank stabilization/restoration	45 miles/272 Acres (avg 50 feet wide)	3,516 lb/yr (N)/188 lb/yr (P) and sediment of 85 tons/yr
2	Riparian Buffer as designed using ACPF modeling based on the width of the riparian zone and runoff delivery (see Section 2.5.1).	24 miles/145 Acres (avg 50 feet wide)	1,254 lb/yr (N)/73 lb/yr (P) and sediment of 37 tons/yr

*Estimated using Spreadsheet Tool for Estimating Pollutant Loads (STEPL), Version 4.4 (USEPA, 2019)
N-Nitrogen; P-Phosphate

Currently there is no routine monitoring or sampling in the Aukerman Creek HUC-12. But the future project specific monitoring efforts will verify progress towards meeting the goals identified in the plan. The objectives, projects and implementation strategies presented herein will be reevaluated and modified if determined necessary, as several versions of this NPS-IS are expected.

This NPS/IS will employ an adaptive management process. As objectives and implementation projects are reevaluated, objectives listed above will be reevaluated, fine-tuned and modified as necessary when more information become available or conditions change. Additional objectives may also be included to make progress towards further reduction goals or water quality improvement goals, as new and additional BMPs can improve nutrient reduction and sedimentation in streams.

The OEPA Nonpoint Source Management Plan Update, which includes a full list of nonpoint source management strategies, will be utilized. Strategies, as presented in the overview tables of Chapter 4, include the following:

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

Chapter 4: Projects and Implementation Strategy

The Great Miami River Basin is one of the major nutrient contributors to Ohio River and Gulf Hypoxia (OEPA, 2020). It is important and beneficial for the NPS-IS initiatives to be implemented in this region as soon as possible. Aukerman Creek HUC-12 is an agricultural watershed and implementation of proposed conservation practices is targeted to reduce nutrient load reduction by 20%. Based on the 2005 OEPA sampling, the Aukerman Creek HUC-12 was a high-quality stream and therefore, the goal is to maintain and protect its high quality and its stream health.

The Project and Implementation Strategy of the Aukerman Creek HUC-12 NPS-IS includes an action plan based on the cause and source of NPS pollution which are described in the previous Chapter. Chapter 3 presented the two Critical Areas and their goals, objectives, and potential projects. These critical areas will be reevaluated through time to monitor progress towards

meeting their NPS goals and objectives. Some of the positive impacts may be slow and take years to show progress towards recovery.

4.1 Overview Tables and Project Sheets for Critical Areas

Two Project and Implementation Strategy Overview tables and associated project summary sheets for each of the critical areas (Tile-drained agricultural fields and riparian areas of Aukerman Creek and tributaries) are presented in this Chapter. The presented opportunities provide a general concept and will be further evaluated as landowners provide additional feedback on the projects and each project is adequately funded. The estimated project costs and the time frame are both dependent upon funding opportunities and coordination with landowners and project partners.

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. Moreover, this NPS-IS will be updated periodically to address stakeholder input and additional project opportunities may be added. If a future critical area is identified (e.g. urban loading) within the Aukerman Creek HUC-12, supplemental information will be provided as funding allows.

4.2 Project Tables

The Project Overview Table for each Critical Area presents a summary of each strategy identified for each critical area. BMP strategies are divided into several categories, including urban storm water runoff management, altered stream and habitat restoration strategies, and other nonpoint source causes and associated sources of impairment.

TABLE 4-1 AUKERMAN CREEK NINE-ELEMENT CRITICAL AREA TABLES

For Aukerman Creek HUC-12 (050800020302) Critical Area 1							
Goal	**Objective**	**Project**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA Criteria f)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Funding/Actual Sources (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
1	1	1	Agricultural BMPs – 1,000 Acres Cover Crops	Preble SWCD	Short (1-3 years)	$30,000	Ohio EPA §319, H2Ohio, USDA-NRCS EQIP
1	2	2	Agricultural BMPs – 25 Acres Grassed Waterways & Filter Strips	Preble SWCD	Short (1-3 years)	$202,000	Ohio EPA §319, H2Ohio, USDA-NRCS CRP, EQIP
1	2 & 3	3	Agricultural BMPs – 3 Acres Grassed Waterways, 0.5 acres filter strips, 1 WASCOB at PCHS	Preble SWCD	Short (1-3 years)	$42,500	Ohio EPA §319, H2Ohio, USDA-NRCS CRP, EQIP
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

For Aukerman Creek HUC-12 (050800020302) Critical Area 2							
Goal	**Objective**	**Project**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA Criteria f)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Funding/Actual Sources (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
High Quality Waters Protection Strategies							
1	1	1	800 feet of Streambank Stabilization	Preble SWCD	Short (1-3 yrs)	$270,000	Ohio EPA §319, H2Ohio
1	2	TBD	Riparian Buffer	TBD	TBD	TBD	TBD
Other NPS Causes and Associated Sources of Impairment							

TABLE 4-2 AUKERMAN CREEK NINE-ELEMENT PROJECTS SHEETS

Project #1 – Aukerman Creek HUC-12 Critical Area 1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Agricultural BMPs – Cover Crops
criteria d	Project Lead Organization & Partners	Preble Soil and Water Conservation District
criteria c	HUC-12 and Critical Area	Aukerman Creek HUC-12 (050800020302) – Critical Area 1
criteria c	Location of Project	Private landowner – exact location not disclosed
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Administer cost-share program for cover crop plantings
criteria g	Project Narrative	Preble SWCD will administer a cost-share program to local landowners in prioritized agricultural lands to plant cover crops on at least 1,000 acres annually. Landowners will enroll no less than 10 acres, and the maximum amount enrolled by one operation will not exceed 400 acres. Cost-share will pay out at $30 per acre. Preble SWCD has a list of willing landowners prepared to implement this project if funds are available.
criteria d	Estimated Total cost	$30,000
criteria d	Possible Funding Source	Ohio EPA §319, H2Ohio, USDA-NRCS EQIP
criteria a	Identified Causes and Sources	Cause: Nutrient loadings Source: Agricultural land use activities
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Currently NPS impairments has not been identified in Critical Area 1. However, implementing agricultural BMPs will maintain and protect the overall water quality and stream health in this watershed.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective #1: Plant at least 1,000 acres of cover crops, resulting in plantings of 2,000 additional acres. Goal: The goal in Critical Area#1 is to reduce nitrogen and phosphate loads by 20%. The baseline load reduction is estimated to be 54,000 lb for nitrogen. With the current and recent conservation practices, the estimated loads are 52,780 lb/yr (N) and 6,095 lb/yr (P).
	Part 3: Load Reduced?	Estimated 3,360 lb/yr(N)/83 lb/yr (P)/43 tons sediment per year of load reduction based on STEPL 4.4.
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	It is generally not possible to determine load reduction from individual agricultural practices; Some agencies periodically conduct sampling such as Miami Conservancy District or OEPA. Preble SWCD will conduct follow-up activities with landowners if appropriate, to document and track progress of cover crop planting.
criteria e	Information and Education	Project information will be shared at the Preble SWCD annual meeting and at applicable field days. Project highlights will also be shared on social media and/or Preble SWCD's website.

Project #2– Aukerman Creek HUC-12 Critical Area 1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Agricultural BMPs – Grassed Waterways & Filter Strips
criteria d	Project Lead Organization & Partners	Preble Soil and Water Conservation District
criteria c	HUC-12 and Critical Area	Aukerman Creek HUC-12 (050800020302) – Critical Area 1
criteria c	Location of Project	Private landowner – exact location not disclosed
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Administer cost-share program for grassed waterways installation
criteria g	Project Narrative	Preble SWCD will administer a cost-share program to local landowners in prioritized agricultural lands to install about 20 acres of grassed waterways and 5 acres of filter strips at areas identified by ACPF. Grassed waterways and filter strips will receive cost share according to the current CRP cost list. Preble SWCD has a list of willing landowners that are prepared to implement the project if funds are available.
criteria d	Estimated Total cost	$202,000
criteria d	Possible Funding Source	Ohio EPA §319, H2Ohio, USDA-NRCS CRP, EQIP
criteria a	Identified Causes and Sources	Cause: Nutrient loadings Source: Agricultural land use activities
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Currently NPS impairments has not been identified in Critical Area 1. However, implementing agricultural BMPs will reduce nutrient loads and maintain and protect the overall water quality and stream health in this watershed
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective #2: Reduce nutrient loss through the installation of in-field BMPs such as grassed waterways and filter strips at locations as suggested by the ACPF model. Goal: The goal in Critical Area#1 is to reduce nitrogen and phosphate loads by 20%. The baseline load reduction is estimated to be 54,000 lb for nitrogen. With the current and recent conservation practices, the estimated loads are 52,780 lb/yr (N) and 6,095 lb/yr (P).
	Part 3: Load Reduced?	Estimate of 166 lb/yr (N)/12 lb/yr (P) load reduction based on STEPL 4.4.
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	It is generally not possible to determine load reduction from individual agricultural practices; Some agencies periodically conduct sampling such as Miami Conservancy District or OEPA. Preble SWCD will conduct follow-up activities with landowners if appropriate, to document and track progress of installing the in-field practices.
criteria e	Information and Education	Project information will be shared at the Preble SWCD annual meeting and at applicable field days. Project highlights will also be shared on social media and/or Preble SWCD's website.

Project #3– Aukerman Creek HUC-12 Critical Area 1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Agricultural BMPs – whole farm conservation planning
criteria d	Project Lead Organization & Partners	Preble Soil and Water Conservation District
criteria c	HUC-12 and Critical Area	Aukerman Creek HUC-12 (050800020302) – Critical Area 1
criteria c	Location of Project	Preble County Historical Society (PCHS)
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Administer cost-share program for installing 5 segments/3 acres of grassed waterways, 2 filter strips (0.5 acre) and one WASCOB with 10 acres of contributing area.
criteria g	Project Narrative	Preble SWCD will administer a cost-share program with PCHS to install the grassed waterways, filter strips and WASCOB. The practices will receive cost share according to the current CRP cost list. PCHS is a willing partner and ready to implement the project when funds are available.
criteria d	Estimated Total cost	$42,500 ($30,000 for grassed waterway, $500 for filter strips and $12,000 for WASCOB)
criteria d	Possible Funding Source	Ohio EPA §319, H2Ohio, USDA-NRCS CRP, EQIP
criteria a	Identified Causes and Sources	Cause: Nutrient loadings Source: Agricultural land use activities
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Currently NPS impairments has not been identified in Critical Area 1. However, implementing agricultural BMPs will reduce nutrient loads and maintain and protect the overall water quality and stream health in this watershed.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objectives #2 and #3: Reduce nutrient loss through the installation of in-field BMPs such as grassed waterways, filter strips and below field BMP such as WASCOBs at locations as suggested by the ACPF model. Goal: The goal in Critical Area#1 is to reduce nitrogen and phosphate loads by 20%. The baseline load reduction is estimated to be 54,000 lb for nitrogen. With the current and recent conservation practices, the estimated loads are 52,780 lb/yr (N) and 6,095 lb/yr (P).
	Part 3: Load Reduced?	Estimate of 167 lb/yr (N) and 8 lb/yr (P) load reduction based on STEPL 4.4.
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	It is generally not possible to determine load reduction from individual agricultural practices; Some agencies periodically conduct sampling such as Miami Conservancy District or OEPA. Preble SWCD will conduct follow-up activities with landowners if appropriate, to document and track progress of installing the in-field practices.
criteria e	Information and Education	This project will reach many groups of people such as farmers, students, and visitors near and afar because PCHS is a highly visible venue. PCHS offers field tours/activities/ initiatives/events aiming on demonstrating conservation practices or even experimental practices in the future. This is also being promoted as the whole farm conservation planning and will be a significant education and outreach effort in this region. Project information will be shared at the Preble SWCD annual meeting and at applicable field days. Project highlights will be also shared on social media and/or Preble SWCD's website.

Project #1 – Aukerman Creek HUC-12 Critical Area 2		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	Title	Stabilize 800' of severely eroding streambank
criteria d	Project Lead Organization & Partners	Preble Soil and Water Conservation District
criteria c	HUC-12 and Critical Area	Aukerman Creek HUC-12 (050800020302) – Critical Area 2
criteria c	Location of Project	Preble County Historical Society
n/a	Which strategy is being addressed by this project?	High Quality Water Protection Strategies
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	To re-establish equilibrium conditions along the 800-foot stream reach using a combination of in-stream structures and bioengineered bank treatments that replicate the natural stabilization processes in order to regain channel stability and restore the lost functions and values of a robust stream system. The project partner, PCHS, is eager to implement the project and stop any further erosion and sedimentation into Aukerman Creek.
criteria g	Project Narrative	Aukerman Creek and its tributaries are high quality streams and must be protected to maintain their stream health, habitats, and water quality. This project is to stabilize 800 feet of severely eroding streambanks. Approximately 60 feet of stream bank has been eroded off into Aukerman Creek in the last two decades based on historical aerial photographs review. The bank height is measured 9 feet above the stream bed. The BEHI determined that the erosion rate is 1,890 ft^3/yr and this segment of the stream is releasing 91 tons/yr of agricultural sediment into Aukerman Creek.  The existing pattern of streambank erosion along Aukerman Creek at PCHS is a symptom of systemic channel widening and meander migration. Channel widening occurs through mass wasting of stream banks, as the channel banks exceed critical bank height and fail catastrophically. It is critical at this stage to restore stable meander geometry to the project reach. If the appropriate channel shape and structure is not implemented, ongoing channel widening, sediment deposition, and subsequent meander migration

		will be enduring problems for the project reach and downstream and have an adverse effect elsewhere in the watershed, as well. The proposed work will follow Ohio EPA §319 project requirements.
criteria d	Estimated Total cost	$270,000
criteria d	Possible Funding Source	Ohio EPA §319, H2Ohio
criteria a	Identified Causes and Sources	Cause: Streambank erosion Source: Unprotected and steep streambank, channel widening and migration and also recent intense storm events
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Aukerman Creek HUC-12 was in full attainment in 2005. However, stream erosion and excess sedimentation is common due to the steep slopes in the riparian zone and may adversely impact the habitat scores. The 68.6 miles of riparian corridor should be improved with streambank stabilization or riparian species planting.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective 1: Stabilize 45 miles of the severe streambank erosion at Aukerman Creek and its tributaries. This project will stabilize 800 feet of most severe streambank erosion at Aukerman Creek (at RM 2.5) within Critical Area 2. Goal: To maintain or improve the IBI score above 46, ICI score above 52 and QHEI score above 70.5 at the 2005 sampling locations.
	Part 3: Load Reduced?	Estimate of 1,890 ft^3/year or 90 tons/year of sediment load reduction if the bank is stabilized based on BEHI. Using the 90 tons/year as input, an estimated of as high as 3,600 lb/yr of N and 200 lb/yr of P load reductions using STEPL 4.4.
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	As indicated in the previous 319 grant application, Ohio EPA will conduct the project-appropriate environmental monitoring for all funded sub-grant projects using staff from the Division of Surface Water's Ecological Assessment Section or by a contract provider.
criteria e	Information and Education	This is a highly visible project at the PCHS property. PCHS will promote this project in their website and other social media outlets and will offer tours and site visits. This is also being promoted as the whole farm conservation planning and will be a significant education and outreach effort in this region.

APPENDIX – References

Agricultural Research Service. 2019. *Using Watershed Information to Power Conservation*. U.S. Department of Agriculture, Agricultural Research Service, National Laboratory for Agriculture and the Environment. Ames, Iowa. April 2019. http://acpf4watershets.org. Accessed January 2021.

Agricultural Research Service. 2020. ACPF formatted geodatabase for Aukerman Creek HUC-12.

Baker, D.B., R.P. Richards, and J.W. Kramer. 2006. "Point source-nonpoint source trading: applicability to stream TMDLs in Ohio." *Proceedings – Innovations in Reducing Nonpoint Source Pollution.* (November 28 – November 30, 2006), 328-327.

Goolsby, D.A., W.A Battaglin, G.B. Lawrence, R.S. Artz, B.T. Aulenback, R.P. Hooper, D.R. Keeney, and G.J. Stensland. 1999. "Flux and sources of nutrients in the Mississippi-Atchafalaya River Basin: Topic 3 report for the integrated assessment on hypoxia in the Gulf of Mexico." *NOAA Coastal Ocean Program Decision Analysis Series No. 17.*

IES Miami University, 2010. Updated Twin Creek Watershed Action Plan, April 2010.

Miami Conservancy District, 2017. Lower Great Miami River Nutrient Management Project, February, 2017.

National Land Cover Database, 2011 (NLCD 2011). Multi-Resolution Land Characteristics Consortium (MRLC). https://data.nal.usda.gov/dataset/national-land-cover-database-2011-nlcd-2011. Accessed January 2021.

Natural Resources Conservation Service Web Soil Survey. 2020. Preble County OH, June 2020. Accessed January 2021.

OEPA, 2007. Biological and water quality study of Twin Creek and select tributaries 2005. Darke, Preble, Montgomery, and Warren Counties, Ohio. Ecological Assessment Section, Division of Surface Water, Columbus, OH.

OEPA 2010. Total Maximum Daily Loads for the Twin Creek Watershed, Final Report January, 2010. OEPA Division of Surface Water.

OEPA, 2016a. Guide to Developing Nine-Element Nonpoint Source Implementation Strategic Plans in Ohio, August 2016.

OEPA, 2016b. Template with Descriptions for Ohio's Nonpoint Source Pollution Implementation Strategies. Final. July 2016.

OEPA, 2020a. Nutrient Mass Balance Study for Ohio's Major Rivers 2020, December, 2020, OEPA Division of Surface Water.

OEPA, 2020b. Ohio 2020 Integrated Water Quality Monitoring and Assessment Report, Final Report, May 2020.

OEPA 2020c. *Nonpoint Source Management Plan Update*. Ohio EPA, Division of Surface Water, Nonpoint Source Program.

OKI, 2020. Amendment #45, Water quality Management Plan for Butler, Clermont, Hamilton and Warren Counties. September 2020.

Ohio Division of Geological Survey, 2005. Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI), rationale, methods, and application. Ohio Environmental Protection Agency, Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, OH.

Rankin, E. T. 1995. Habitat indices in water resource quality assessments, pp. 181- 208 in Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Davis, W.S. and Simon, T.P. (eds.), Lewis Publishers, Boca Raton, FL.

Rosgen, D.L. 2001. A Practical Method of Computing Streambank Erosion Rate. Proceedings of the Seventh Federal Interagency Sedimentation Conference, Vol. 2, pp. II - 9-15, March 25-29, 2001, Reno, NV. Available on the Wildland Hydrology website: http://www.wildlandhydrology.com/html/references_.html

Tomer, M.D., S.A. Porter, D.E. James, K.M.B. Boomer, J.A. Kostel, and E. McLellan. 2013. Combining precision conservation technologies into a flexible framework to facilitate agricultural watershed planning. *Journal of Soil and Water Conservation* 68 (5): 113A-120A.

USDA, 2020 – Aukerman Creek geodatabase

USDA National Agricultural Statistics Service Cropland Data Layer 2014-2020. Published crop-specific data layer. Available at http://nassgeodata.gmu.edu/CropScape/ USDA-NASS, Washington, DC. accessed February 2021.

US Fish and Wildlife Service, 2017. Ohio County Distribution of Federally-Listed Endangered, Threatened, and Proposed Species. Accessed February 2021.

U.S. EPA, 2012. Ecoregion Download Files by State - Region 5. https://www.epa.gov/eco-research/ecoregion-download-files-state-region-5. Accessed March 2021

U.S. EPA, 2013. Nonpoint Source Program and Grants Guidelines for States and Territories, §319 Program Guidance (April 2013).

U.S.EPA, 2014, Mississippi River Gulf of Mexico Watershed Nutrient Task Force New Goal Framework, December 3, 2014.

U.S.EPA. 2019. Spreadsheet Tool for Estimating Pollutant Load (STEPL), Version 4.4. http://it.tetratech-ffx.com/steplweb/. Accessed April 2021