Town of Kirkersville- South Fork Licking River HUC-12 (5040006 0405)

Nine-Element Nonpoint Sources Implementation Strategic Plan (NPS-IS Plan)

Approved August 29, 2023

Version 1.0

LICKING COUNTY SOIL&WATER CONSERVATION DISTRICT

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Acronyms

ACPF- Agricultural Conservation Planning Framework

BMP- Best Management Practice

BOD- Biological Oxygen Demand

CREP -Conservation Reserve Enhancement Program

CRP- Conservation Reserve Program

E. coli- Escherichia coli

ECBP- Eastern Corn Belt Plains *(Ecoregion)*

EOLP- Erie Ontario Lake Plain (*Ecoregion)*

IBI- Index of Biotic Integrity

ICI- Invertebrate Community Index

HSTS- Home Sewage Treatment System

HUC- Hydrologic Unit Code

Miwb- Modified Index of Well-Being

MWCD- Muskingum Watershed Conservancy District

MWH- Modified Warmwater Habitat

NOI- Notice of Intent

NPDES- National Pollutant Discharge Elimination System

NPS- Nonpoint Source

ODA- Ohio Department of Agriculture

OEPA- Ohio Environmental Protection Agency

PCR- Primary Contact Recreation

QHEI-Qualitative Habitat Evaluation Index

RM- River Mile

SLWCD- South Licking Watershed Conservancy District

TMDL- Total Maximum Daily Load

USDA NRCS- United States Department of Agriculture Natural Resources Conservation Service

WWH- Warm Water Habitat

Chapter 1: Introduction to Town Kirkersville- South Fork Licking River HUC-12

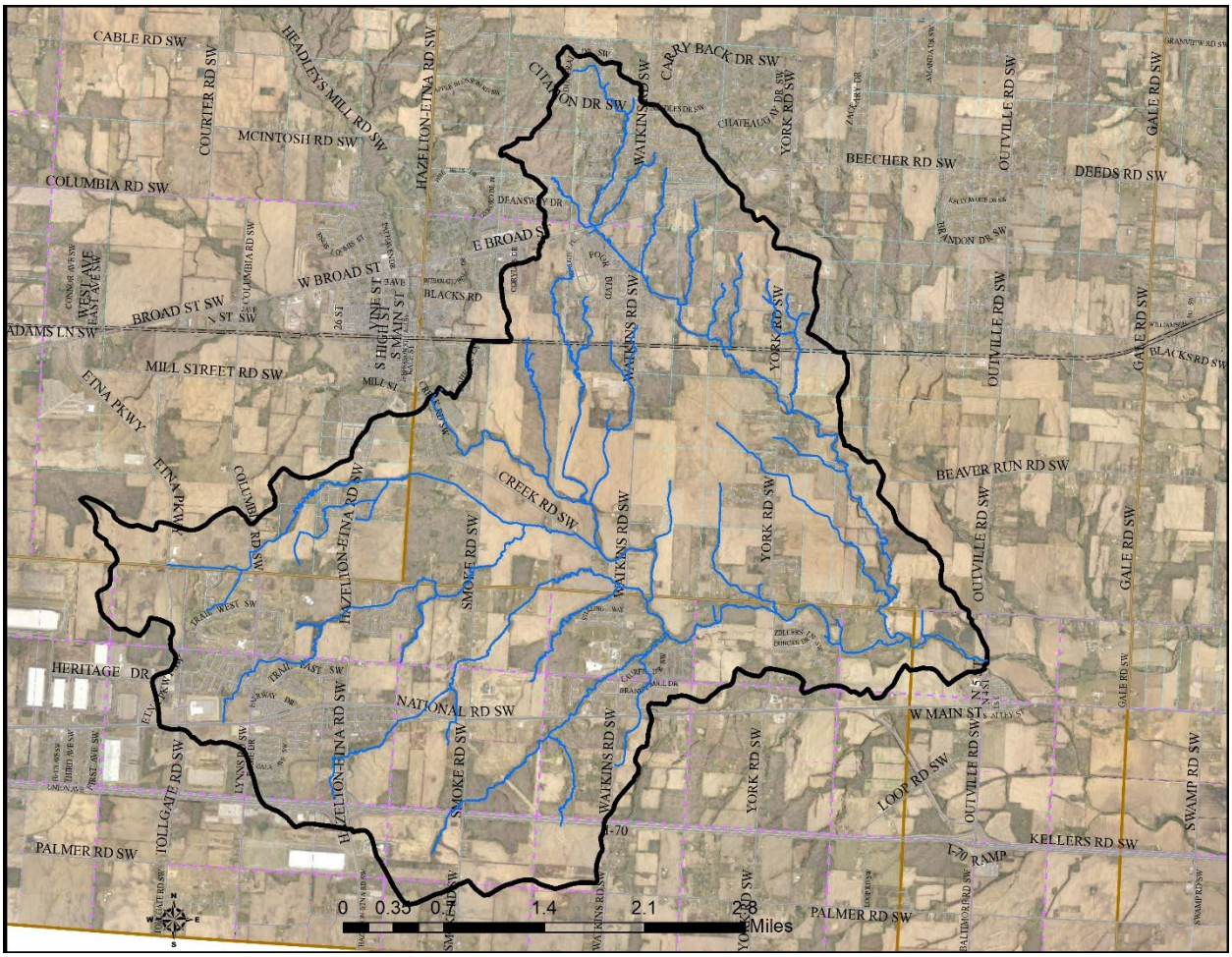
The Town of Kirkersville – South Fork Licking River HUC-12 (050400060405) is located within southwestern Licking County, east of Columbus. The watershed is abutted to the north by the City of Pataskala and to the east by the Town of Kirkersville, with the majority encompassed within Harrison and Etna townships. The land use of this watershed is divided between the following: row crop, pasture field, urbanized area, and forest/natural areas. This watershed is located within three United States census-determined urbanized area: Pataskala, Etna Township, and Harrison Township. Centrally located within the watershed will be a large-scale industrial solar facility roughly 500 acres. Ohio EPA stated in their 2008 assessment that this watershed showed potential for rapid urban expansion. Evidence shows that their estimate of 15% development has remained constant and poses a further threat to the watershed's health (See Table 1) (OEPA, 2012.)

Much like the neighboring watersheds to the west, Kirkersville HUC is experiencing substantial urban expansion, with suburban neighborhoods replacing agricultural fields. The proximity to Columbus and I-70 to the south makes the southern portion of this HUC ideal for all types of urban development.

Table 1: *US Census Licking County Population*

Year	Census Population	Percent Increase
1990	128,828	NA
2000	146,268	13.5
2010	166,492	13.8
2020	178,519	7.2

Map 1:Map of major tributaries with 2021 aerial imagery taken from Licking County Auditors GIS server.



1.1 Report Background

With the increased urbanization comes a new regime of hydrology. Impervious surfaces lead to impairments such as sediment pollution, inorganic compounds, nutrient enrichment, and even increased temperature. The landscape is forced to deal with less infiltration, as well as quicker runoff from impervious surfaces. All of these, combined with the existing land use challenges the agricultural community presents, can have a high potential for degradation.

In addition to the urban land use changes, the farming community has the potential for ongoing impairments. In-field soil erosion, lack of stream riparian corridor, and biological contamination from livestock are among the potential sources of impairments in the watershed. Additionally, lack of assimilative capacity affects habitat and biology in various ways that will be covered in later sections. Finally, HSTS are clustered throughout the watershed and, when not well maintained, can cause nutrient and bacterial contamination to both surface and groundwater.

With these threats looming, the protection of the watershed takes precedence. Identifying the sources of future impairment and unlocking funding options through 319 grants are the primary purposes of this NPS-IS plan. This changing landscape increases the potential for degradation; creating this document will allow watershed managers agile and adaptable responses.

Flooding is another issue in the South Fork Licking River (HUC-10 0504000605). Much of the southern and central portion of the watershed were historically wetlands and carry a legacy of periodic inundation. Table 1 shows some of the most recent flooding events in that region. The nutrient-rich soils and regular flooding add to the nutrient pollution. Except for the Buckeye Lake region, habitat and biology have not shown signs of these impacts as of the 2008 OEPA study of the watershed.

Table 2: *South Fork Licking River Gauge Station Heights, various dates*

River Gauge	Date	Peak Gauge Height (ft)
South Fork Licking River a Kirkersville	6/14/2022	9.1
South Fork Licking River a Kirkersville	3/20/2020	14
South Fork Licking River a Kirkersville	5/9/2021	9.13
South Fork Licking River a Kirkersville	5/6/2022	9.93

The South Licking Watershed Conservancy District actively supports this NPS-IS plan's nonpoint source pollution planning efforts as part of a holistic look at watershed health. Though the focus of the Conservancy District is flood reduction (water quantity), water quality is also affected by flooding, and pollutant removal methods such as wetlands, bioretention, cover crops, and riparian buffers are endorsed by the Conservancy District for their stormwater attenuation potential. One of the goals of SLWCD is to complete NPS-IS plans for all HUC-12s within their service area, including the South Fork Licking River and Raccoon Creek watersheds.

This plan was funded by Leeward Energy, owner of Union Ridge Commercial Solar development, in association with a 500-acre utility-scale solar development being constructed within the center of the Kirkersville HUC-12. They have contracted with Licking County Soil and Water Conservation District to perform water quality testing (Biological, Chemical, and Habitat) for the tributary area. The goal is to allow for a baseline of their watershed reach. The development will have a vegetative and stormwater management plan and stormwater retention facilities to lessen stormwater runoff.

1.2 Watershed Profile & History

The Town of Kirkersville- South Fork Licking River HUC-12 is situated on the southwestern edge of the South Fork Licking River HUC-10 (050400006) and is directly adjacent to three connected HUC-12 and one unconnected. Muddy Fork (050400060401) and Headwaters South Fork Licking River (050400060402) are situated north of the Town of Kirkersville- South Fork Licking River and converge slightly upstream of the start of Town of Kirkersville-South Fork Licking River. Bell Run- South Fork Licking River (050400060406) is situated east of the Town of Kirkersville- South Fork Licking River and is drained by the Town of Kirkersville. Southeast of Kirkersville HUC is the Buckeye Lake Reservoir Feeder (050400060404), which does not drain to the South Fork Licking River but the Buckeye Lake Reservoir Feeder and into Buckeye Lake instead. All four above HUC-12 are nested within the larger South Fork Licking River HUC-10 (0504000604). The South Forking Licking River flows mostly west to east and converges with the North Fork Licking River east of Newark, creating the Licking River. From there, it flows east into Muskingum County and joins the Muskingum River.

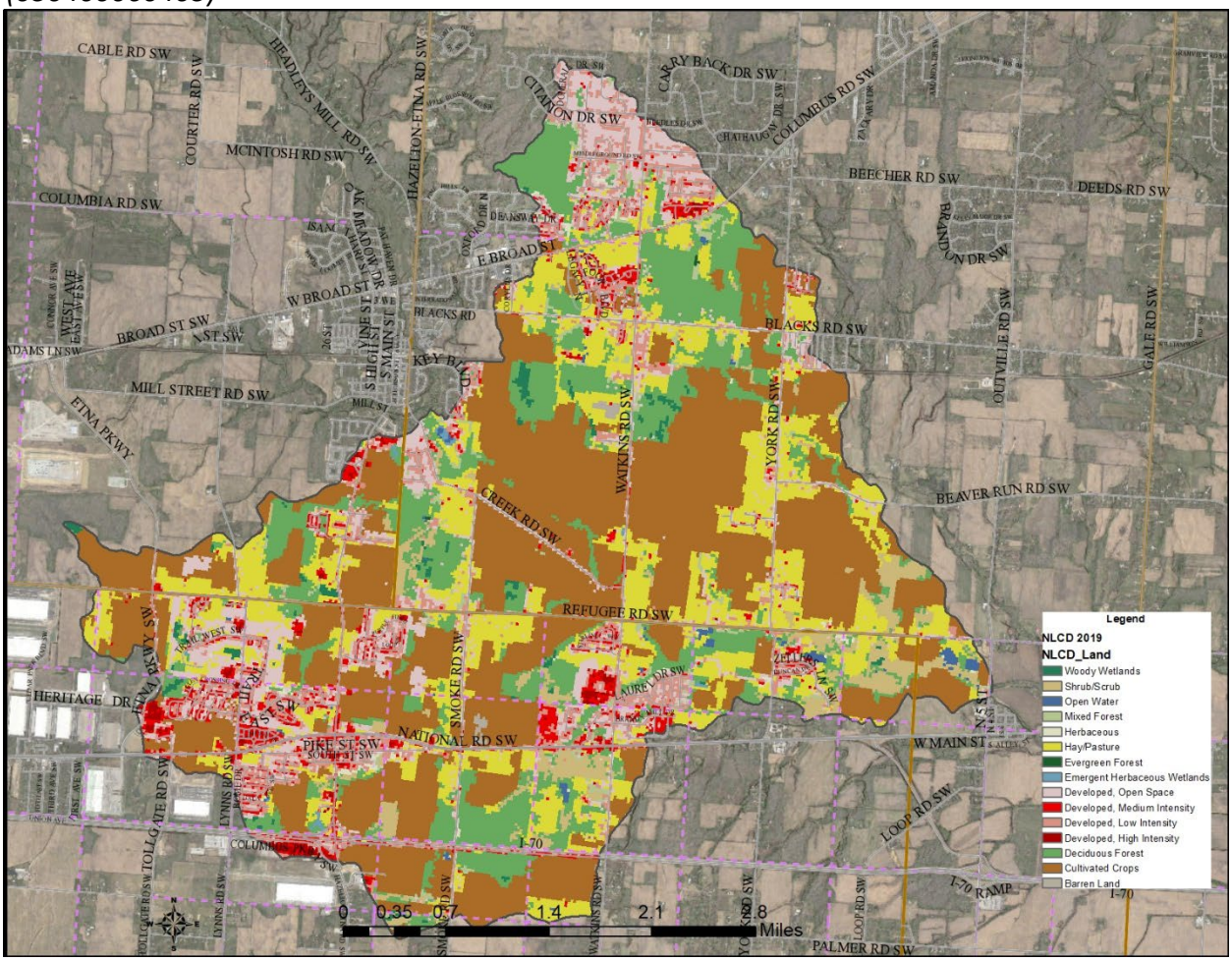
Town of Kirkersville- South Fork Licking River HUC represents a roughly 10,980 acres drainage area (44km2) in southwestern Licking County. The land use is broken down into four major groups: Agriculture, including pasture and row crops; forested or natural cover, development and other. Table 3 displays the breakdown for each land use type. Most of this HUC's land consisted of agricultural or forested/natural cover. However, a consistently increasing portion of the land use is devoted to urban development.

Table 3: *Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) Land Use-National Land Cover Database, 2019*

Type	***Area (km²)***	***Coverage (%)***
Open Water	*0.16*	*0.36*
Developed, Open Space	*4.14*	*9.35*
Developed, Low Intensity	*4.07*	*9.18*
Developed, Medium Intensity	*2.01*	*4.53*
Developed, High Intensity	*0.3*	*0.67*
Barren Land (Rock/Sand/Clay)	*0.08*	*0.18*
Deciduous Forest	*6.86*	*15.49*
Evergreen Forest	*0.01*	*0.02*
Mixed Forest	*0.5*	*1.12*
Shrub/Scrub	*1.48*	*3.35*
Grassland/Herbaceous	*0.12*	*0.28*
Pasture/Hay	*7.75*	*17.49*
Cultivated Crops	*16.48*	*37.2*
Woody Wetlands	*0.3*	*0.68*

Emergent Herbaceous Wetlands	*0.05*	*0.11*
Total	*44.3*	*100*

Map 2: *NLCD, 2019 land cover map, Town of Kirkersville – South Fork Licking River HUC-12 (050400060405)*



The OEPA has assessed the health of the watershed (HUC-8 Licking River 05040006) twice in recent years. Both 1993 and 2008 evaluations show high species diversity in macroinvertebrate and fish communities, adequate water chemistry parameters, and habitat quality. The trend of land use in this watershed has moved increasingly towards impervious surface coverage, bringing with it all the water quality challenges associated with such a change.

The history of this watershed is deeply agricultural. Licking County was initially founded in 1808, and for the first 100 years, the landscape was nearly entirely forests and wetlands but was cleared for agriculture (Ohio History Central, n.d.). The county is still predominantly agricultural, with almost 80 percent of the county's land use consisting of either row crop agriculture or hay/ pasture (NLCD, 2019). Pressure is mounting from developed areas to further encroach on the areas traditionally used for agriculture.

Agriculture has also been the historically dominant land use in this HUC, with portions converted from forest in the 1800s corresponding with the building of National Road (Schaff, 1912). The HUC today has a mix of land uses ranging from row crop and pasture land to high-density urban use. The interior offers the highest density of agricultural land use (see Map 2). The northern, southwestern, and south central represent the highest concentration of urban land use corresponding to Harrison and Etna townships.

These urban areas are a mix of development, predominantly single-family residences, and manufacturing/ warehousing. Some notable features within this HUC are the Southwest Licking School system, Pataskala Waste Water Treatment Facility, and South West Licking Community Water and Sewer District Water Treatment Plant. The southern reach is bisected by Interstate 70, a major national thoroughfare.

The urbanized areas in this HUC-12 comprise the Village of Pataskala and the urbanized areas in Harrison and Etna Townships. As of July 18, 2023, there are 23 active construction NOI within the Kirkersville HUC, with many more in the process (OEPA, n.d.). This trend is common throughout the South Fork Licking River Watershed, earning it the OEPA Rapidly Developing Watershed distinction and several watersheds in Columbus and Cleveland. With the region's projected growth, impacts from urban stormwater will become a potential source of impairment (OEPA, n.d.).

One major development site will encompass ~500 acres of farmland in the watershed's center. Leeward Energy will operate a 107-megawatt utility-scale solar array. Licking County Soil and Water, Licking County Planning Commission, and Licking County Engineers Office have been working closely with the developers to ensure all construction and decommissioning plans will protect the environment as well as the viability of these crop fields to return to agricultural production after the leasing period. The long-term effects of this installation are unknown; future interest should remain on this site to ensure no NPS pollution concerns arise.

1.3 Public Participation and Involvement.

Input for this document was collaboratively collected from multiple stakeholder groups, including Harrison Township, Village of Pataskala, USDA-NRCS, Gregg Nageotte with ODA, Rick Wilson with OEPA, and many others.

Stakeholder meetings with township and city officials were held throughout the process and helped inform project selection. A special thanks to Valerie Hans, Harrison Township Zoning inspector, for meeting and discussing her knowledge of the watershed, resource concerns, and potential cooperative landowners.

This process has been happening nearly simultaneously with the South Licking Watershed Conservancy District's revitalized efforts in the region. Updates have been given monthly to the Conservancy District Directors on the progress of this document, of which they are in full support. Likewise, in creating a comprehensive watershed plan for the Conservancy District, discussions have started at various meetings to inform landowners and local leaders of this plan's efforts and the importance of nonpoint source pollution planning across the county.

Chapter 2 HUC-12 Watershed Characterization and Assessment Summary

2.1 Summary of HUC-12 Watershed Characteristics

2.1.1 Physical and Natural Features

This HUC contains roughly 64.45 km2 of rivers and streams flowing to the South Fork Licking River. There are four size classifications present in this HUC. Approximately 40.4 km of these river stretches consist of first-order streams, 14.1 km of second-order streams, 0.1 km of third-order streams, and 9.7 km of fourth-order streams.

The Kirkersville HUC is fed by the Headwaters South Fork Licking River HUC-12 (050400060402) and the Muddy Fork HUC-12 (050400060401). Their confluence occurs slightly northwest of the Kirkersville HUC. The South Fork Licking River's main water course flows south-easterly until it crosses the lowhead dam east of the Village of Kirkersville and becomes Bell Run HUC-12 (050400060406). The predominant land use for the watershed is agriculture, consisting primarily of row crops and hay/ pasture.

This HUC is mainly comprised of the Eastern Corn Belt Plains ecoregion. This ecoregion is mostly rolling till plain with local end moraines (Ecoregions of Indiana and Ohio, n.d.). Furthermore, it is subclassified as type B, which contains loamy, limy glacial deposits of the Wisconsinan age. This area once supported beech forests, oak-sugar maple forests, and elm-ask swamp forests. These soils support predominantly corn and soybean production with livestock and pasture.

A small portion is in the Erie-Ontario Lake Plain ecoregion as well. The EOLP designation can be further broken down into Low Lime Drift Plain, categorized as a "rolling landscape composed of low rounded hills with scattered end moraines…urban industrial activity, as well as dairy, livestock, corn, and soybean forming, are common." (Ecoregions of Indiana and Ohio, n.d.)

The bedrock geology of the region consists of the Logan and Cuyhoga Formations dating back to the Mississippian age. Also present within the watershed Sunbury and Bedford Formations, and Ohio and Olentangy Shales (from the Devonian Age). The bedrock geology of the watershed demonstrates the relative age of the region, but the soils indicate more recent events.

The soils in the HUC are mostly silt loam or silt clay loam. The three most abundant soils in the watershed are Bennington Silt Loam, Centerburg Silt Loam, and Cardington Silt Loam. The water

retention potential is high with the silt and clay content of the soil types within the watershed. Over 70% of the soils in the watershed are described as having "slow" or "very slow" infiltration rates (Table 4). With saturated soils, these areas restrict the amount of water that can infiltrate, leading to increased runoff potential. With increased runoff comes the potential for sediment and other pollutants to transfer to waterways.

Table 4: *Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) USDA SSURGO Hydrologic Soil Groups (HSG)*

Type	Area (km^2)	Coverage (%)
A - High Infiltration	0	0
A/D - High/Very Slow Infiltration	0	0
B - Moderate Infiltration	3.82	8.63
B/D - Medium/Very Slow Infiltration	3.16	7.13
C - Slow Infiltration	18.25	41.19
C/D - Medium/Very Slow Infiltration	19.07	43.05
D - Very Slow Infiltration	0	0
Total	44.3	100

(USDA gSSURGO, 2016)

Wetlands in the HUC are not as common as in the nearby Bell Run HUC-12 but are regular parts of the landscape. Land cover data from 2019 suggest that less than 1% of the landscape comprises wetlands (combined forested and emergent wetlands, Table 3). Areas that housed historic wetlands have since been systematically tiled and drained, leading to a loss of assimilative capacity. Wetland construction can be an effective tool for nutrient filtration and will be utilized whenever possible.

2.2 Summary of Biological Trends

The OEPA is tasked through the Federal Clean Water Act with assessing the health of water resources in the state. The health of the waterway is measured with life use attainment status tied to the biological, chemical, and habitat attributes of the sampled surface water. The South Fork Licking River- Town of Kirkersville HUC was sampled in three years: 1984, 1993, and 2008. Sampling took place at multiple locations through the watershed; in 1984, two sites were sampled (RM 27.6 and RM26.2); in 1993, three sites were sampled (RMs 28.3, 27.6, and 24.5), and in 2008, three sites were sampled (same as 1993).

2.2.1 Fish Community

The general trend for the fish community is upward, with IBI scores increasing from 1984 to 1993. There is only one shared location for all three years. The IBI scores are represented in Table 5 below. The trend shows a modest decrease in IBI scores from 1993 to 2008. The scores do not drop below the Eastern Corn Belt Plains ecoregion threshold for “Good” community

evaluations, except for RM 28.3 in 2008, falling at the max range of marginally good (IBI=39). The scoring criteria for ecoregions can be found in Table 6.

2.2.2 Macroinvertebrate Community

The macroinvertebrate community characteristic is less defined than the fish community. Only two sites were assessed for macroinvertebrates in 2008, with one having a narrative description of "good" and the other scoring in the "marginally good" category (RM 27.6 ICI=32). That site has seen a consistent drop in ICI scores each year it has been assessed (1984 ICI = 42, 1993 ICI = 36, 2008 ICI = 32). The macroinvertebrate community has room for improvement, considering the decline over time.

Table 5: *Summary OEPA ALU Status and supporting data for various years.*

Location (RM)	Ecoregions	Year	IBI	Miwb	ICI	QHEI	Status	Mi^2
28.3	ECBP	2008	39	8	Good	76.5	full	30
	ECBP	1993	47	9.4	32	64.5	full	30
27.6	ECBP	2008	45	9.4	32	73.5	full	32
	ECBP	1993	49	9.6	36	83	full	32
	ECBP	1984	37	9.9	42	69	full	32
26.2	ECBP	1984	36	8.2	NA	68	full	38
24.5	ECBP	2008	47	8.9	NA	75.5	full	43
	EOLP*	1993	46	9.4	40	83	full	43

**RM 24.5 was designated in 1993 as EOLP and ECBP in 2008.*

Table 6: *Narrative ranges for ALU designation by Ecoregion within Town of Kirkersville- South Fork Licking River HUC-12 (050400060405)*

Headwater IBI	Wading IBI	Wading Miwb	ICI	Narrative Evaluation
50-60	50-60	≥9.4	46-60	Exceptional
46-49	46-49	8.9-9.3	42-44	Very Good
Eastern Corn Belt Plains				
40-45	**40**-45	**8.3**-8.8	**36**-40	Good
36-39	36-39	7.8-8.2	32-34	Marginally Good
28-35	28-35	5.9-(*6.2*)-7.7	14-(*22*)-30	Fair
Erie-Ontario Lake Plain				
40-45	**38**-45	**7.9**-8.8	**34**-40	Good
36-39	34-38	7.4-7.8	30-32	Marginally Good
28-35	28-33	5.6-(*6.2*)-7.3	14-28	Fair
18-(*24*)-27	18-(*24*)-27	4.5-5.8	8-12	Poor
12-17	12-17	0-4.4	≤6	Very Poor

Narrative Ranges, **WWH,** and *(MWH)* biocriteria for Eastern Corn Belt Plans and Erie-Ontario Lake Plains ecoregions. Exceptional (EWH biocriteria), very good (EWH nonsignificant departure), poor, and very poor evaluations are common statewide. For WWH, the ranges of marginally good and nonsignificant departure are the same.

2.2.3 Threatened and Endangered Wildlife

According to USFWS (Information for Planning and Consultation) IPaC online app, this watershed has the historic presence of the endangered Indian Bats (*Myotis sodalist)*, Threatened Northern Long-eared Bat (*Myotis septentrionalis)*, Proposed Endangered Tricolored Bat (*Perimyotis subflavus*) and Candidate Monarch Butterfly (*Dandus plexippus*). It does not contain critical habitat designation for any of the above species. This watershed also contains bird species covered under the Migratory Birds Treaty Act (1918) and the Bald and Golden Eagle Protection Act (1940). Listed below in Table 7 are the species and associated breeding seasons. (USFWS, n.d)

Table 7: *Avian Species within the watershed and associated breeding seasons*

Species	Breeding Season
American Golden-Plover (*Pluvailis dominica*)	Breeds Elsewhere
Bald Eagle (*Haliaeetus leucocephalus)*	Breeds October 15 to August 31st
Black-billed Cuckoo (*Coccyzuz erthropthalmus)*	Breeds May 15th to October 10th
Bobolink (*Dolichonyx oryzivorus)*	Breeds May 20th to July 31st
Cerulean Warbler (*Dendroica cerulea)*	Breeds April 21st to July 20th
Chimney Switf (*Chaetura pelagica)*	Breeds March 15th to August 25th
Kentucy Warbler (*Oporornis formosus)*	Breeds April 20th to August 20th
Lesser Yellowlegs (*Tringa flavipes)*	Breeds Elsewhere

2.2.4 Habitat

The main stem South Fork Licking River habitat has remained consistently high throughout the three years assessed. Habitat scores range from 68 at RM 26.2 in 1984 to 83 at RMs 24.5 and 27.6 in 1993. However, there has been a trend of decreasing scores over time across the watershed. At RMs 24.5 and 27.6, scores have dropped from 1993 to 2008 (RM24.5, 1993-83, 2008- 75.5; RM 27.6, 1993-83, 2008-73.5). This trend has likely continued in the time since the last assessment. More frequent assessment is needed to judge the rate of decline in the watershed.

Likewise, the tributaries to the South Fork within the Town of Kirkersville HUC have yet to be assessed by any known EPA efforts. Judging from land use and historical areal coverage, habitat alteration is persistent throughout the tributaries. Agricultural land use has channelized the once free-flowing streams and reduced its riparian area drastically throughout the watershed. Along with the prevalence of subsurface drainage, the hydrology and, thus, the flow regimes have shifted drastically from the natural state.

Urban land use has also altered the physical characteristics of the tributaries in the HUC-12. Most notable is the use of tile and subsurface drainage for stormwater flows. Using impervious piping to convey water reduces the amount of infiltration and increases the peak discharge volumes. Higher volumes destabilize the stream channel through downcutting, erosion, and substrate scouring. In addition, landowners dealing with these increases in erosivity have begun to “armor” the stream banks on their properties to protect against future erosion. This armoring may exacerbate the erosion downstream if not done correctly.

With the status of the biological community largely unknown in these tributary areas, cues must be taken from the physical characteristics of the stream and its surrounding land use to assess the potential impairments. Working with private landowners, Cities, and Townships to identify stream restoration, stormwater retention, and land protection areas to protect the health of the South Fork is essential.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources.

The Kirkersville HUC has no specified pollution causes identified in the 2008 assessment. All sample locations met the minimum attainment criteria for WWH. The only pollutant identified was directly related to PCR waters and was associated with E. coli concentrations. Though there were no direct pollution causes then, the watershed is a dynamic, ever-changing system. The watershed's landscape continues to shift, the population continues to increase, and urban sources are incipient. This document will focus on the current and anticipated stressors that a shifting landscape will bring.

In 2008, OEPA assessed the Licking River watershed for use attainment. The South Fork Licking River watershed, on the whole, struggled with bacterial contamination, with all Class A and most Class B sites not meeting attainment status. Class A requires a geometric mean concentration ($gm\bar{x}$) of <126 colony forming units per 100 millimeters (CFU/100ml) with a max concentration on individual samples of ≤ 298 CFU/100ml. Class B requires a $gm\bar{x}$ <161 (cfu/100ml) and a max value of ≤ 523 (cfu/100ml). With these limits, only two locations on the South Fork Licking River fall under the threshold. RM 27.6, downstream of the Pataskala Wastewater treatment plant, fell below the Class B criteria, as did RM 22.4 at Outville Road.

Within the Kirkersville HUC, three sampling locations were assessed. Of the three locations, only one was found out of attainment. RM 28.3 falls downstream of the confluence of the South Fork Licking River and Muddy Forks. This location had a $gm\bar{x}$ of 290 (cfu/100ml) and a measured max of 2900 (cfu/100ml). Figure 8 shows the results of this assessment. The OEPA explained in this report, "Sources of bacteria include mainly wet weather sources including sanitary and combined sewer overflows at many of the wastewater treatment facilities in addition to runoff from agricultural sources, urban and rural stormwater, and home sewage treatment systems." (OEPA, 2012)

Table 8: *2008 OEPA E. coli sampling locations on South fork Licking River. Measured in cfu/100ml*.

RM	N	gmx̄	Max.	STATUS	Location
PCR Class B					
31.5	7	586	2100	NON	Cable Rd
28.3	7	290	2900	NON	Key Blvd.
27.6	7	143	490	FULL	Dst Pataskala
22.4	9	63	220	FULL	Outville Rd.
21.6	7	202	630	NON	Ust Gale Rd.
19.1	7	596	12000	NON	US 40
15.3	7	288	760	NON	SR 79/360
13.0	7	204	360	NON	SR 79
8.8	9	332	2500	NON	Ridgely Tract
PCR Class A					
1.8	7	239	25000	NON	Hopewell Dr.
0.3	8	239	25000	NON	2nd St.

The OEPA has created a document to address the bacterial exceedances on a state-wide basis in place of a traditional watershed TMDL. *Loading Analysis Plan-Recreation/ E. coli TMDLs in selected Watersheds around the State of Ohio* has called out the larger HUC 8 (05040006) that contains Kirkersville as included in this project and will need TMDLs for E coli. Strategies to control E. coli watershed-wide will be needed to attain recreational use status.

Nutrient load reductions are not directly named as sources of impairment locally. However, far-field goals outlined in the *Mississippi River Gulf of Mexico Watershed Nutrient Task Forces New Goal Framework* set "an Interim Target of a 20% reduction of nitrogen and phosphorus loading by 2025" as "a milestone for immediate planning and implementation actions, while continuing to develop future actions strategies to achieve the final goal through 2035." (HTF, 2014). With this goal in mind, all nutrient reduction goals will be implemented to reduce phosphorus and nitrogen loading by a minimum of 20%.

The watershed has two NPDES-permitted facilities: Pataskala Waste Water Treatment Plant (PWWTP) between RMs 28.3 and 27.6 and Pataskala Water Treatment Plant (PWTP) around RM 25.9. The compliance status of the PWWTP over the last three years has been mixed. Over the last 13 quarters, violations have been recorded on eight noncompliance for various parameters, including BOD, total ammonia, suspended solids, and copper. A stretch of six (fourth quarter of 2020 to first quarter of 2022) quarters resulted in significant noncompliance. These significant noncompliance statuses were primarily due to the construction of the facility upgrade project. The plant was upgraded to handle higher capacity, but during that time, the plant was largely offline, relying on settling ponds and less direct treatment methods. The new improvements to the plant were completed in early 2022 and will likely halt the noncompliance status moving forward (Personal Communication with Pataskala Utility Director).

Likewise, PWTP has also had noncompliance issues over the past three years. Of 12 reported quarters, PWTP had either "Violation Identified" or "Significant Noncompliance" in eight. Quarter 3 (1/20-3/20) and Quarter 4 (4/20- 6/20) had identified violations, while quarters 5-10 (7/20- 12/21) constituted "Significant Noncompliance." These deficiencies are from strontium and iron (only quarter 6) and are related to the water-softening process used at the plant. (Personal Communication with Pataskala Utility Director).

In their 2008 assessment, OEPA stated the following about the Kirkersville HUC-12. "The diminished margin of assimilative capacity in the Kirkersville- South Fork AU can be affected in various ways. Proactive measures to buffer stormwater flash flows, conservative practices to retard soil erosion, and increasing the width of riparian corridors can make a significant difference. Aerial photography reveals several places where encroachment on the stream margin facilitates soil runoff and bank erosion and contributes to stream instability. Enhancement of the stream assimilative capacity through improvements of the riparian corridor is encouraged." (OEPA, 2012)

Table 9: *Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes and sources*

HUC	Area (mi^2)	Cause(s)	Sources
Town of Kirkersville- South Fork Licking River **50400006 0405**	17.16	- *E. Coli* - Nutrients - Sediment - Flow alteration	- Urban Development - Home Sewage Treatment Systems - Crop land erosion - Agricultural Runoff

Chapter 3: Critical Areas Conditions and Restoration Strategies.

3.1 Overview of Critical Areas.

Assessment of the critical areas of the Town of Kirkersville- South Fork Licking River HUC-12 focused on current and future pollution sources throughout the watershed and protecting high-quality waters. First, shifting from agricultural to urban/suburban landscapes leads to more impervious surfaces and more significant potential for pollution and in-stream erosion. Next, the remaining agricultural landscapes are sources of nutrient runoff and soil erosion

contamination. Home sewage treatment system failure and disrepair can cause nutrient and E. coli contamination.

The three critical areas that will be presented are sources of sediment, nutrient and habitat alteration from the urbanized landscape, sources of sediment, nutrient, and habitat alteration from the agricultural landscape, and nutrient and bacterial contamination from failing or malfunctioning HSTS.

Table 10: *Average annual baseline nonpoint source load.*

Land Use	Acreage	Total Phosphorus	Total Nitrogen
Agricultural	6,004	4,926	87,512
Urban	2,607	1,069	18,999
Natural	2,350	193	3,425
Total	10,961	6,188	109,937

3.2 Critical Area 1: Condition Goals and Objectives for Urban Land Use.

3.2.1 Detailed Characterization: Urban Land Use

Critical area 1 consists of the drainage area impacted by urban runoff (Map 3). The Kirkersville HUC contains approximately 24% developed land, with the areas of Etna and Harrison townships and the City of Pataskala experiencing considerable growth since 2008. A comprehensive study of the Licking River (HUC 8) has yet to be done since the 2008 assessment, making the current status of the South Licking River unknown. Furthermore, no recorded EPA biological data exists on the tributaries that feed this South Fork Licking River stretch. The primary concern is the runoff velocity and volume increase from imperviousness on over-developed headwaters. *Ohio's Nonpoint Sources Management Plan Update* states, "Ohio communities face many traditional waters resources challenges related to aging stormwater management infrastructure…older impervious surfaces without adequate stormwater detention and resulting flooding and eroding stream channels "(OEPA 2020) and this area of the county is no exception.

Licking County's population has expanded dramatically in the past two decades (Table 11). Increased development pressure has also been expanding rapidly in the watershed. As of March 2023, there are 20 active construction sites within the watershed (OEPA, n.d.). These projects include new schools, housing subdivisions, and commercial warehouses. Etna Township houses the greatest concentration of construction activity in the unincorporated county.

Table 11: Census Populations for Licking County and associated percent increases.

Year	Census Population	Percent Increase
1990	128828	NA
2000	146268	13.5
2010	166492	13.8
2020	178519	7.2

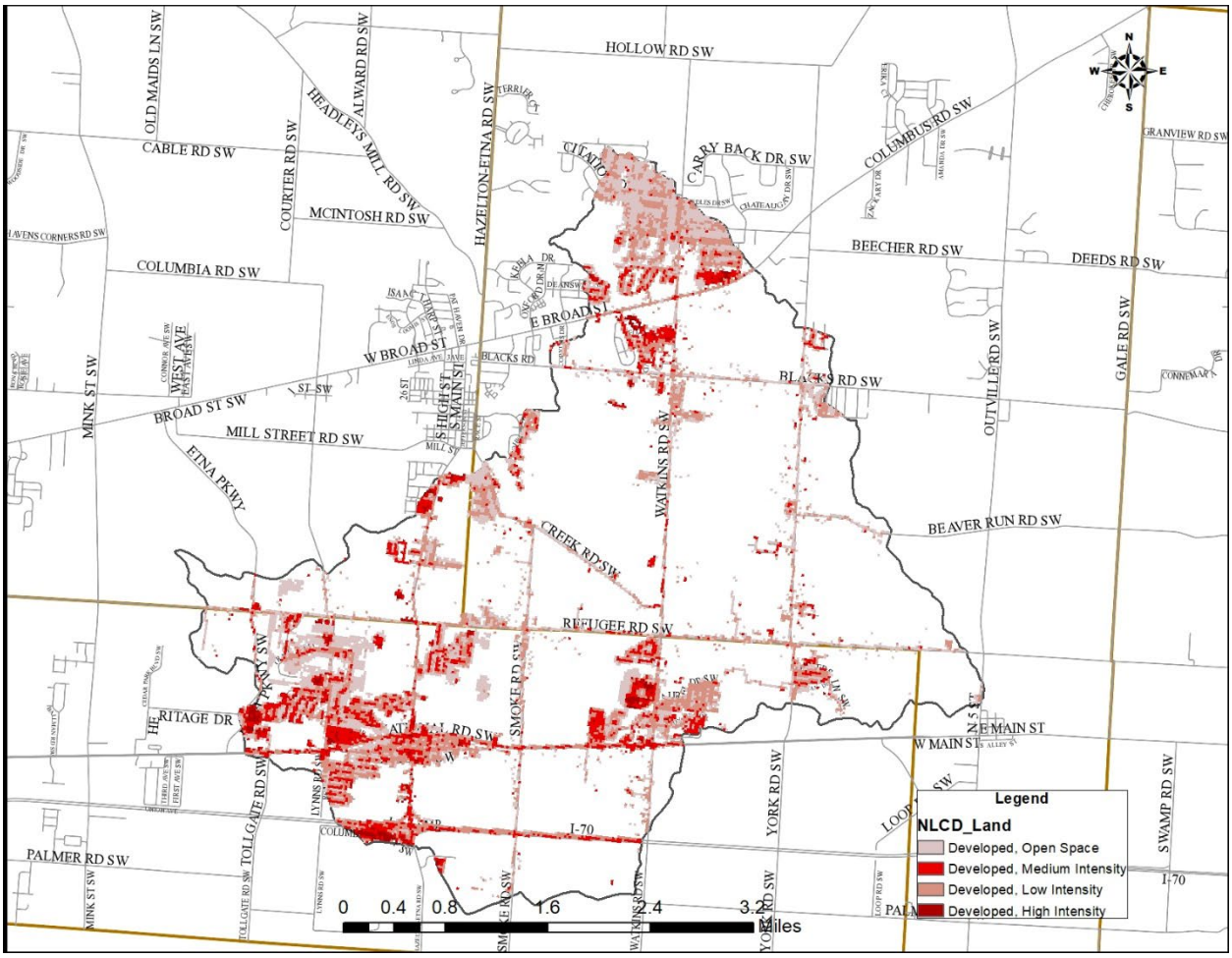
The increased flow in the smaller headwater streams leads to sediment transport, stream bank erosion, and declining habitat scores. All watersheds in the southwestern corner of the county (HUC-12s Headwaters of Blacklick Creek-050600011503, Sycamore Creek- 050600011704, and the entire South Fork Licking River 050400060401, 050400060402, 050400060405, 050400060406, 050400060409) are designated "Rapidly Developing Watersheds". This is determined by looking at the "current attainment status, evidence of stress to water quality, habitat and aquatic life and high rates of forecasted population growth within a significant portion of the watershed and a high probability of high-density development occurring within the next several years" (OEPA, n.d.).

Etna Township and associated urbanized areas will constitute the first section of *Critical Area 1*. Increased impervious surfaces must be managed to lower peak discharges and extend discharge time. Management practices such as bioretention, filter areas, and wetland retention called for in *Ohio's Nonpoint Source Management Plan Update* would help improve infiltration from impervious areas and slow down water discharge to stream.

The second focus area for *critical area 1* is the northern reaches of the watershed consisting of the Beachwood Trails neighborhood. Built in the 1960s and continually expanded through the years, this community lacks stormwater retention facilities. Storm sewers are sporadic and poorly connected, causing localized flooding and increased erosion in the stream that drains it. Stormwater flows from Beachwood Trails have detrimental effects downstream. Effects from uncontained stormwater flow lead landowners to reinforce stream sections with concrete or stone, exacerbating the problem.

Streamside riparian areas and stream banks were assessed using aerial imagery. Areas of stream banks with noticeable erosion were investigated for several years with aerial images to gauge the rate and severity of bank erosion. South Fork Licking River bank erosion was addressed independently with the left and right banks, while smaller tributaries incorporated both sides as one unit. Similarly, the riparian area was examined on individual banks on the SFLR. Smaller tributaries often lacked riparian buffers on both sides and were grouped as one unit. Map 5 shows prioritized stream channels within the Town of Kirkersville-South Fork Licking River HUC-12

Map 3: *NLCD, 2019 land cover map-Developed land from low to high intensity*



Focus for this critical area will be on stormwater retention and stream stabilization. Prioritizing the areas with the greatest potential for high volume erosive flows and pairing them with stream bank restoration and flood plain reconnection to improve the water, habitat and ecological community quality downstream.

3.2.2 Detailed Biological Characterization: Urban Land Use

A biological assessment of the watershed was most recently performed in 2008, and results were published in 2012. These results show that the water quality is consistent with WWH in the HUC. Below is a table (12) comparing the scores for various testing criteria through time. All testing sites were on the South Fork Licking River from River Mile 28.3 (Upstream of Pataskala Wastewater Treatment plant) to RM 24.5 (West of York Road Bridge).

3.2.2.1 Detailed Biological Characterization: Habitat

All sites assessed in 2008 were in full attainment for WWH. Habitat scores did show signs of degradation/modification through time. A previous assessment occurred in 1993, which allows for comparison over time. Three sample locations were shared between 2008 and 1993. Two of these three locations (RMs 27.6 and 24.5) showed lower QHEI scores in 2008 (RM 27.6; 1993-83, 2008-73.5, RM 24.5; 1993-83, 2008-75.5). These drops indicate possible habitat alteration, sedimentation, or other unknown impacts (Ohio EPA, 2012).

Two of the three sampling locations in the 2008 assessment (RMs 27.6 and 24.5) had moderate habitat-influencing attributes consistent with MWH. Both locations had extensive to moderate riffle embeddedness, and RM 27.6 had severe to moderate substrate embeddedness. These illustrate an increased sediment load and are detrimental to macroinvertebrates and fish. Sediment load reduction from urban development construction and increased impervious surfaces lead to increased peak flows, bank instability, and sediment discharge.

These declines do not drop the attainment status but could worsen over time. Implementing BMPs to slow water and allow suspended sediment to settle could help reverse damages from stormwater runoff. In addition to the contaminants stormwater can carry, the increased volume of stormwater causes issues to the stream structure in the form of downcutting and bank erosion.

As previously stated, the status of the many tributaries that feed the South Fork in this watershed is unknown. Headwaters within the HUC have been highly impacted by urban development, particularly in the northern and southwestern reaches. Continued pressure from active construction, impervious surfaces, and riparian corridor reductions could drastically impact the habitat quality of these headwater streams.

3.2.2.2 Detailed Biological Characterization: Fish and Macroinvertebrates

Like the habitat assessment, fish communities meet attainment criteria for WWH. Evidence of impacted fish assemblages are at RMs 28.3 and 27.6. Scores dropped from 47 to 39 and 49 to 45, respectively. This could be indicative of a downward trend. Without current assessments, the status of the fish assemblages within the South Fork Licking River is unknown. Likewise, the

status of the assemblages within the many tributaries in the watershed is also unknown. Improvement to the instream habitat, nutrient and sediment reductions, and buffer protection will preserve the integrity of sensitive taxa found in the watershed.

The macroinvertebrate community within the watershed has not suffered the same decline across the watershed. Except for RM 27.6, there were no declines in macroinvertebrate communities within the watershed. However, RM 27.6 has seen a consistent decline from 1984 to 2008, starting at a narrative description of "very good" to "marginally good."

Ohio EPA mirrors this sentiment. "…Aquatic community performance declined slightly in the reach between the two surveys (1993 and 2008). Very good performance (IBI $\bar{x}$= 47.3, MIwb $\bar{x}$=9.4, ICI $\bar{x}$=36, n=3) declined to a good community performance in 2008 (IBI $\bar{x}$=43.7, MIwb $\bar{x}$=8.8, n=3, ICI $\bar{x}$=good, n=2). The decline results from the absence of one or two species in all samples. Pollution-sensitive minnows were absent or less abundant in 2008." (Ohio EPA, 2012, pg. 82)

Table 12: *Summary OEPA ALU Status and supporting data for various years*

Location (RM)	Year	IBI	Miwb	ICI	QHEI	Status	Mi^2
28.3	2008	39	8	Good	76.5	full	30
	1993	47	9.4	32	64.5	full	30
27.6	2008	45	9.4	32	73.5	full	32
	1993	49	9.6	36	83	full	32
	1984	37	9.9	42	69	full	32
26.2	1984	36	8.2	NA	68	full	38
24.5	2008	47	8.9	NA	75.5	full	43
	1993	46	9.4	40	83	full	43

3.2.3 Detailed Causes and Associated Sources: Urban Land Use

Potential causes of impairments in the HUC (Table 13) include nutrient and sediment loading, stream flow, and habitat alteration. Urban development, impervious surfaces, and uncontrolled stormwater flows are all sources of pollution, specifically, poorly managed construction site runoff, older developed areas, landowner stream bank armoring, and stream bank and bed erosion. Adequate storage and treatment of stormwater runoff will ameliorate these sources.

Urban development in the southern and southwestern portions of the AU has played a significant role in the potential for pollution and habitat alteration. The Construction General Permit (OHC000005) and Small Municipal Separate Storm Sewer System (MS4) General Permit (OHQ000004) regulate many aspects of stormwater flow within the area. These alone are not enough, however, to protect the integrity of our waterways in the face of heightened development pressure. Additional long-term BMS, designed to promote infiltration and reduce peak stormwater discharges, will need to be added. These practices will also ameliorate the effects of increased impervious surfaces throughout that portion of AU.

Table 13: *Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes for Urban Development*

HUC	Area (mi^2)	Cause(s)	Sources
Town of Kirkersville-South Fork Licking River 5040006 0405	17.16	- Nutrients - Sediment - Flow/ Habitat alteration	- Urban Development - Imperviousness - Stormwater flows

3.2.4 Outlined Goals and Objectives for the Critical Areas: Urban Land Use

Nutrient goals are based primarily on the Gulf of Mexico Hypoxia task force's 20% recommendations. Habitat and sediment goals are in response to the development pressure and existing urban development and will be tied to MWH influencing characteristics.

Table 14*: Annual pollutant loads, targets and needed reduction (Estimates from OEPA Nutrient Mass Balance Study)*

	Agricultural Load (lbs/yr)		**Developed/ Urban Loads (lbs/yr)**	
	Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Current Estimates	76,099	4,790	17,680	1,110
Target Loadings	60,879	3,832	14,144	888
Loading Reduction Needed (20%)	15,220	958	3,536	222

Goals:

Sediment and Nutrient Reductions
Goal 1. Reduce nutrient loading (3,536 lbs/yr Nitrogen, 222lbs/yr Phosphorus) by 20% in accordance with the Hypoxia Task Forces (2014) recommendations for immediate planning purposes. Not Achieved: Reduction Needed
Maintain IBI/Miwb scores
Goal 2. Improve IBI/Miwb scores at RM 28.3 to 1993 levels (47/9.4) corresponding to prior high-quality fish community. Not Achieved: 2008 IBI/Miwb Score @RM 28.3 = 39/8
Goal 3. Improve IBI/Miwb scores at RM 27.6 to 1993 levels (49/9.6) corresponding to prior high-quality fish community. Not Achieved: 2008 IBI/Miwb Scores @ RM 27.6 = 45/9.4
Goal 4. Maintain IBI Scores at RM 24.5 of 46 or greater consistent with very good narrative evaluation range for wadable IBI scores. Achieved: 2008 IBI Scores @ RM 24.5 = 47
Maintain ICI Scores
Goal 5. Maintain ICI score at RM 28.5 consistent with minimum narrative description "Good" for ECBP ecoregion or 36. Achieved: 2008 ICI Scores @ RM 28.5 = Good
Goal 6. Improve ICI scores at RM 27.6 to 42 or greater consistent with narrative description "Very Good" achieved previously in 1984 sampling. Not Achieved: 2008 ICI Scores @ RM 27.6 = 32
Goal 7. Maintain ICI score at RM 24.5 to 36 or greater consistent with narrative description "Good" as achieved in 1993 sampling. Unknown
Maintain QHEI Scores
Goal 8. Maintain QHEI Scores at Rm 28.3 of 75 or greater consistent with high quality habitat Achieved: 2008 QHEI Scores @ RM28.3 = 76.5
Goal 9. Maintain QHEI Score of RM 27.6 to above 75 or greater consistent with high quality habitat and past QHEI scores (1993 QHEI= 83.0) Not Achieved: 2008 QHEI Scores @ RM 27.6 =73.5
Goal 10. Maintain QHEI Score of RM 24.5 to above 75 or greater consistent with high quality habitat and past QHEI scores (1993 QHEI= 83.0) Achieved: 2008 QHEI Scores @ RM24.5 = 75.5

Objectives for this section are designed to abate increased velocity stormwater flows due to impervious surfaces, lack of adequate stormwater detention, and urban encroachment/ reduced assimilative capacity. With the goals listed above, this section will focus on stormwater retention, impervious surface disconnection and reduction, and improved buffering capacity in the urban landscape.

Objectives:

Objective 1 Create a 3.4 stormwater wetland to treat a 1.4 square mile drainage area of medium-density housing.

Objective 2 Install ~400,000 square feet of riparian buffer along prioritized urban stream corridors. Estimates based on a calculation of 75% implementation referenced in Bell Run-South Fork Licking River HUC-12 (050400060406) NPS IS plan.

Objective 3 Restore 3,560 linear feet of eroded urban stream and river bank with bioengineered solutions. Estimates based on a calculation of 75% implementation referenced in Bell Run- South Fork Licking River HUC-12 (050400060406) NPS IS plan.

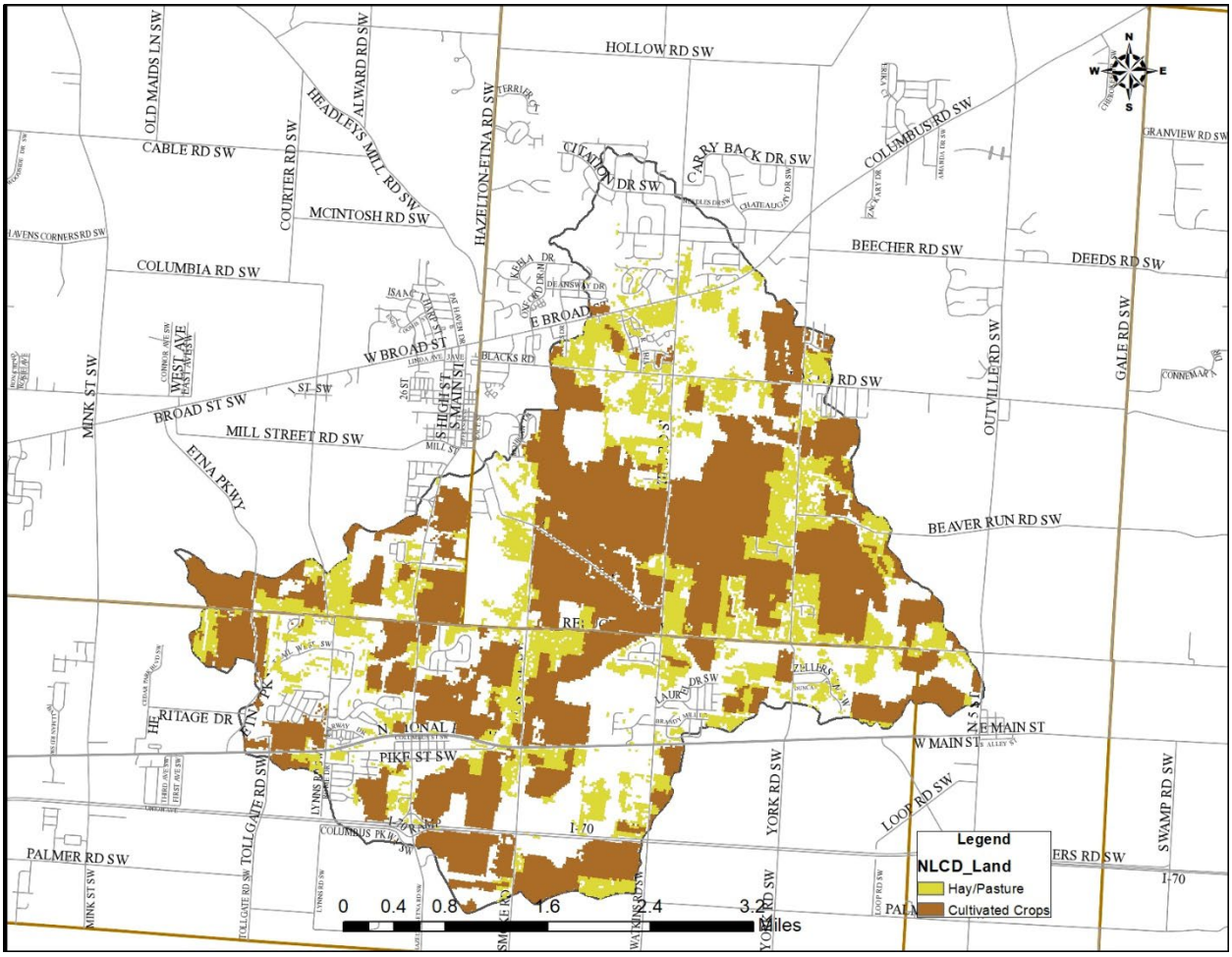
3.3 Critical Area 2: Condition Goals and Objectives for Prioritized Agricultural Land.

3.3.1 Detailed Characterization: Prioritized Agricultural Land

Critical Area 2 consists of agricultural land use, which takes up the largest portion of the watershed, approximately 55% (Map 4). Despite the looming advance of development pressures, agricultural land use constitutes nearly 6,000 acres in the Town of Kirkersville- South Fork Licking River HUC with 2,779 acres of active river area (NLCD, 2019). The water quality, according to the most recent OEPA Biological Assessment in 2008, meets ALU attainment, but the watershed still poses pollution threats. Soil erosion, nutrient runoff, and stream bank buffering are the greatest threats to the waterways in the HUC. As discussed by OEPA in their 2012 Biological Assessment, “Proactive measures to buffer storm water flash flows, conservation practices to retard soil erosion, and increase the width of the riparian corridor can make a significant difference (increase assimilative capacity)” (OEPA, 2012).

Livestock production is not as prevalent in this watershed as in downstream watersheds. Comparing similar nearby watersheds estimates from the Town of Kirkersville- South Fork Licking River are around 1,300 overall animals. Nearby Bell Run (HUC-12 050400060406) and Buckeye Lake Reservoir Feeder (050400060404) are 1,800 and 1,700, respectively (PLET, 2023). With the relatively low concentration of livestock in the watershed, this plan will not focus on livestock pollution at this time. If further data is identified illustrating the water quality impacts in the watershed, this assumption will be revisited.

Map 4: *NLCD, 2019 land cover map- Agricultural land use (Hay/Pasture, and Cultivated Crops)*



Agricultural land will be prioritized based on two criteria:

1) Land with evidence of active erosion (gully) in recent (past five years) aerial photography.

2) Land that is directly adjacent to stream ditches or other waterways.

Historically, the prevalence of conservation practices in the watershed has been lacking. According to USDA records, Etna and Harrison Townships have less than 100 acres of conservation contracts combined (USDA FSA, Personal communication). Grass waterways

comprise the bulk of the conservation ground of those acres. This allows the opportunity to increase the conservation acreage within the region.

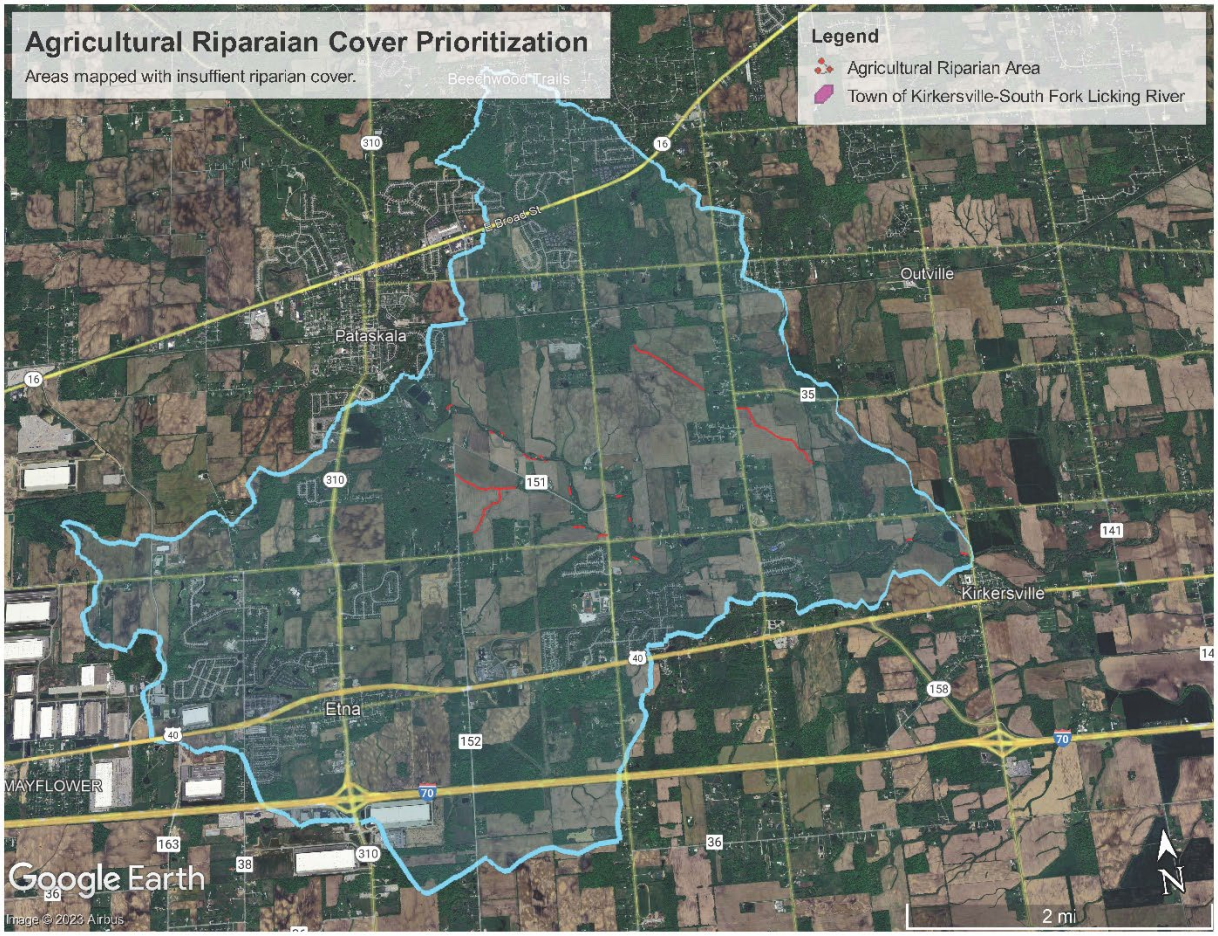
Practices such as saturated buffers, riparian buffers, nutrient management, grass waterways, two-stage ditches, cover crops, and water and sediment control basins can be used in tandem to multiply BMP efficiencies on the fields. Fields should be evaluated for all potential practices with water quality improvement and determine the most efficient combinations of practices on a field-by-field basis.

A whole field perspective should be utilized when assessing nonpoint source pollution in an agricultural setting. Ohio EPA advocates for the whole farm Conservation Plan to assess all aspects of the farm. When resources become available, ACPF should be utilized to guide agricultural planning efforts in the watershed.

Stream bank stabilization with the addition of riparian cover will be prioritized along the South Fork Licking River adjacent to agriculture fields. Aerial imagery has been assessed over several years to determine the most aggressive erosion spots. These locations are on map 5. Sites were assessed for incised stream bank erosion and lack of riparian cover.

The Leeward Energy solar site is slated for construction in 2024. With this site being geographically central to the HUC-12, abutting the SFLR for roughly half a mile, and containing approximately 500 acres of currently farmed land, this is a large portion of the watershed. The developer, with input from LCSWCD, created a vegetative management plan that will help stabilize the site with native vegetation for the life of the project. The site will be planted with a native pollinator-friendly mix that will offer erosion control increased biodiversity, and will not interfere with energy generation. For these reasons, adherence to the specification of the vegetative management plan will be a critical part of reducing nutrient runoff from this long-term fixture of the landscape.

Map 5: *Map of agricultural land with insufficient riparian buffer.*



3.3.2 Detailed Biological Characterization: Prioritized Agricultural Land

The Kirkersville HUC is predominantly an agriculture watershed, with 37% of land use devoted to row crop production. Sediment and nutrients are the primary pollutants of concern from the agricultural landscape. As discussed in Section 3.1.2, habitat impacts from sediment are evident in the 2008 Water Quality Report. In addition to the embeddedness of substrate and riffle areas, nutrient loading is a significant concern locally and afar. The South Fork Licking River flows into the main steam Licking River east of Newark and then to Dillion Dam. Dillon Dam area has impairments from nutrients and ammonia, according to the OEPA Water Quality Report (OEPA, 2012). Far-field impacts include nutrient enrichment in the Gulf of Mexico and the associated hypoxic dead zones.

Nutrient and sediment pollution will be the primary concern of this plan; however, in the future, if more data becomes available for more impairments, they can also be addressed through this plan. All BMPs have been selected to reduce or eliminate sediment and nutrient runoff for the agricultural landscape, specifically traditional row crop agriculture. Although there may be issues with pasture land pollution, no data supports the prioritization of pasture land BMPs at this time.

3.3.3 Detailed Causes and Associated Sources: Prioritized Agricultural Land

The causes and sources of impairment in the watershed are summarized below (Table 15). Causes of pollution in the watershed include nutrient, sediment, and habitat and flow alteration. The corresponding sources are lack of riparian buffer, gully and rill erosion from unprotected row crop fields, nutrient runoff as a component of the surface gully and rill erosion or as subsurface (dissolved nutrient) runoff, and habitat alteration from channelization and dredging of maintain agricultural ditches.

Table 15: *Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes for Agricultural Land Use.*

HUC	Area (mi^2)	Cause(s)	Sources
Town of Kirkersville-South Fork Licking River 50400006 0405	17.16	- Nutrients - Sediment - Flow/ Habitat alteration	- Lack of Riparian buffer - Soil erosion (Gully) - Nutrient runoff, surface and subsurface - Habitat alteration, channelization

3.3.4 Outlined Goals and Objectives for the Critical Areas: Prioritized Agricultural Land

Goals:

Goal 1. Reduce nutrient loads by 20% (15,220 lbs/yr Nitrogen, 958lbs/yr Phosphorus) of the overall nitrogen and phosphorus loading to the watershed • Not Achieved: Reduce nutrient transport through BMP installation
Goal 2. Maintain QHEI Scores at Rm 28.3 of 75 or greater consistent with high quality habitat • Achieved: Site currently has a score of 76.5
Goal 3. Maintain QHEI Score of RM 27.6 to above 75 or greater consistent with high quality habitat and past QHEI scores (1993 QHEI= 83.0) • Not Achieved: Site currently has a score of 73.5
Goal 4. Maintain QHEI Score of RM 24.5 to above 75 or greater consistent with high quality habitat and past QHEI scores (1993 QHEI= 83.0) • Achieved: Site currently has a score of 75.5

Objectives:
Sediment loads reductions are to be 20%, corresponding with the Gulf of Mexico Hypoxia Task Force Recommendations.

Objective 1. Install 1100 linear feet of grassed waterways on agricultural land with evidence of consistent rill/gully erosion in the watershed

Objective 2. Apply 600 (10% of 6000 acres) acres of cover crops annually to actively farmed land in the watershed.

- Utilize the MWCD cover crop cost-share program to expand cover crops.
- No current tracts of land within the Town of Kirkersville- South Fork Licking River utilize MWCD cost share programs.
- CRP in Harris on and Etna Townships constitute less than 100 acres.

Objective 3. Install the permanent vegetative cover over 490 acres of Leeward Energy's commercial solar field in accordance with the accepted Vegetative Management Plan.

Objective 4. Reforest 30.5 acres of riparian corridor with native trees and shrubs. Acreage based on 75% implementation of prioritized agricultural land described in Bell Run- South Fork Licking River HUC-12 (050400060406) NPS IS plan

Objective 5. Restore 2.1 miles of eroded stream with a stable 2-stage ditch or equivalent water conveyance. Length based on 75% implementation called for in Bell Run- South Fork Licking River HUC-12(050400060406) NPS IS plan.

Objective 6. Develop and implement a Voluntary Nutrient Management Plan (VNMP) for 600 acres of active farmland using the MWCD VNMP cost share program, or NRCS EQIP VNMP.

Reduce phosphorus and nitrogen loads by 20% to correspond with the Gulf of Mexico Hypoxia Task Force Recommendations.

3.4 Critical Area 3: Condition Goals and Objectives for HSTS

3.4.1 Detailed Characterization: HSTS

The watershed has a legacy of agricultural and low-density development. The high-density urban areas get sanitary sewer; the low-density areas require onsite sewage treatment. It is unknown at this time how much of the watershed has active HSTSs, but internal estimation is as high as 70 units. Communications with the Licking County Health Department and the City of Pataskala indicate that there are legacy HSTS within the central core of the watershed that are outside of the sanitary sewer service range.

As of 2008, most of the HUC 12's in this area do not meet attainment for PRC for E coli. E coli. can have a variety of sources, one of them being failing HSTSs. One way to bring the Kirkersville HUC back into compliance is to identify and replace/repair these failing systems.

Regular maintenance and observation are necessary for the long-term functionality of the system as well as the health of the related waters. Maintenance can be costly if the system is monitored regularly. Licking County Health Department offers an annual program to assist landowners without the financial means to fix or replace failing HSTS. This program is funded through an OEPA grant on a first-come, first-serve basis. In 2022, the program funded nine system replacements and two repairs totaling $153,154.44 (personal Communication LCHD, 12/19/22.) With the nature of the program, they cannot serve all those in need who apply. Table 16 shows the annual funding and number of systems the Licking County Health Department serviced.

Table 16: *HSTS repairs and replacement costs, loans, and numbers facilitated through Licking County Health Department from 2016 to 2022*

Year	Number of Upgrades Completed	Funding Required to Complete Upgrades	Funding Available through Ohio EPA Loan Program
2016	20	$347,696.68	-
2017	22	$307,708.60	$300,000
2018	13	$200,000	$200,000
2019	15	$147,636	$150,000
2020	15	$179,371.44	$150,000
2021	20	$310,098	$300,000
2022	11	$153,153.44	$150,000

Source: Communications with Licking County Health Department

3.4.2 Detailed Biological Characterization: HSTS

HSTS are likely a contributor of E. coli in this watershed. Identifying and eliminating the failing, leaking, or illicitly connected HSTS in the watershed will be part of the plan moving forward, to repair or replace HSTS that have been proven to impact water quality. Targeting aerator systems will take priority as they require the most maintenance and upkeep.

Data is not readily available to quantify the effects of failing HSTS on the aquatic habitat and biological community indices. However, a correlation between failing HSTS and increased E. coli numbers in the watershed can be drawn. The OEPA *Biological and Water Quality Study of the Licking River and Selected Tributaries, 2008* suggests that the Pataskala WWTP's downstream locations (RM 27.6 and RM 22.4) may be influencing the E. coli regime. Immediately upstream of Pataskala WWTP (RM 28.3) and downstream of Kirkersville HUC (Upstream of Gale Road RM 21.6) remain in nonattainment (gmx = 260cfu/100ml) for PRC Class B standards (<161 cfu/100ml.) In addition, all sampling locations on the main stem of South Fork Licking River

except those immediately downstream of Pataskala WWTP (RM 27.6 and RM 22.4) were outside attainment standards from RM 31.5 in the headwaters to RM 8.8 in Hebron. All E. coli data is summarized in Table 8 above (Section 2.3).

However, not impacting the biological community directly, nutrients associated with failing HSTS systems can contribute to eutrophication for receiving water bodies. Estimates from *Ohio EPA's Nutrient Mass Balance Study, 2020* put annual nutrient loading from HSTS at 9% for phosphorus and 7% for nitrogen. Based on 2019 water year load estimates, 199 metric tons annually (mta) of phosphorus and 2059 mta of nitrogen can be accounted for by HSTS within the Muskingum Watershed.

The effects on aquatic life by nutrient enrichment can be seen locally in Buckeye Lake, which receives an unknown portion of the flow from the South Fork Licking River via the Reservoir Feeder. The remainder runs to the Licking River and eventually into Dillon Lake in Muskingum County. Like Buckeye Lake, Dillion is a eutrophic system plagued with increased nutrient loads. Ultimately, the Licking River flows into the Muskingum River, into the Ohio River, to the Mississippi River, and into the Gulf of Mexico, which has an anoxic dead zone fueled by nutrient runoff from the massive drainage area upstream.

3.4.3 Detailed Causes and Associated Sources: HSTS

As stated in the OEPA *Biological and Water Quality Study of the Licking River and Selected Tributaries, 2008,* HSTS can be a contributor to nutrient pollution as well as bacterial contamination. There is no readily available data on the status of HSTS systems in the watershed. The regional water and wastewater entity in the area have taken many systems offline, but many regions remain under HSTS with unknown condition.

According to the ODA Draft Watershed plan for the Muskingum River Watershed, HSTS failure can have high failure rates. “In 2012, the Ohio Department of Health reported an average failure rate of Household Sewage Treatment Systems throughout each district in Ohio at 31%” (Ohio Department of Agriculture, 2023). Furthermore, taken from that same ODH report, the central region failure rate is 37% (Ohio Department of Health, 2012). The latter figure was used in this report as the failure rate, with the relatively high urbanization rate.

The first step will be to identify neighborhoods or streets that currently are not offered sanitary sewer service from the regional authority and determine probable failure areas based on the following:
1. Age of house

2. Time between inspections.

3. Feasibility of connection to Sanitary Sewer

Areas with the highest probability of failure will be prioritized for projects. These priority areas will be recommended to the Licking County Health Department for additional funding through OEPA's WPCLF. If additional funding sources become available, this critical area will be considered.

3.5.4 Outlined Goals and Objectives for the Critical Area HSTS

Goals and objectives are derived from nutrient reduction goals from the Gulf of Mexico Hypoxia Task Force 20% reduction and Ohio EPA PCR Class B criterion.

Goal:

Reduce E. coli geometric mean of 290cfu/100ml to consistently less than 161 cfu/100ml at RM 28.3 to meet PCR Class B criterion for recreational water quality. • Unknown
Maintain E. coli concentrations below 161 cfu/100ml at River Miles 27.6 and 22.4 • Unknown
Reduce failing HSTS phosphorus loading by 46 lb/year and nitrogen by 84 lb/year in accordance with Gulf of Mexico Hypoxia Task Force 20% reduction. • Reductions needed

Objectives:

1. Identify and repair or replace three failing HSTS in Town of Kirkersville HUC-12 annually
    - In accordance of State law, County Health departments are required to create and maintain an Operation and Maintenance program to find and repair failing, aging or malfunctioning HSTS in the county.

Chapter 4: Projects and Implementation Strategy

4.1 Projects and Implementation Strategy Overview Tables

Nutrient load reduction targets were set to match the Mississippi Gulf of Mexico Watershed Nutrient Task Force (HTF, 2014). "An interim Target of a 20% reduction of nitrogen and phosphorus loading by 2025 is a milestone for immediate planning and implementation actions while continuing to develop future action strategies to achieve the final goal through 2025. Federal agencies, States, Tribes, and other partners will work collaboratively to plan and implement specific, practical, and cost-effective actions to achieve both Interim Targets and the updated Costal Goal" (HTF, 2014).

Load reduction calculations were based on an Ohio EPA-provided spreadsheet of NPS loads (agricultural, developed, and natural land uses) to the HUC-12 scale based on the Ohio Nutrient Mass Balance Study for the 2020 report. (Rick Wilson, 2023)

Table 17 : *Overview Table for Town of Kirkersville-South Fork Licking River HUC 12*

Overview Table for Town of Kirkersville-South Fork Licking River HUC 12								
Applicable Critical Area	Goal	Objective	Project #	Project Title (EPA criteria g)	Lead Organization (criteria d)	Time Frame (EPA criteria f)	Estimated Cost (EPA criteria d)	Potential / Actual Funding Source (EPA criteria d)
Urban Sediment and Nutrient Reduction Strategies								
1,2	1,8,9,10	1	NA	Beechwood Trail Wetland	LCSWCD	3-7 years	$TBD	319, H2Ohio
1	1-11	2	NA	Riparian Buffer (Urban Stream Bank)	LCSWCD, Harrison TWP	3-7 years	$22,917	LCSWCD
1	1-11	3	NA	Stream Bank Restoration South Bank @RM 25.6	LCSWCD	3-7 years	$TBD	LCSWCD & MWCD
Agricultural Sediment and Nutrient Reduction Strategies								
2	1,2,3,4,5	2	1	Cover Crops (Prioritized Ag Land)	LSWCD, USDA NRCS	1-3 years	$6,000	MWCD, LSWCD, USDA NRCS
2	1,2	3	2	Riparian Buffer (Prioritized Area)	Licking SWCD, USDA NRCS	1-3 years	$53,400	MWCD, Licking SWCD, USDA NRCS
2	1-5	5	NA	2-stage Ditch Bennington Parcel	NRCS, LCSWCD	3-7 years	$60,000	NRCS, H2Ohio
Home Sewage Treatment System Repair and Replacement								
4	1,2,3	1	NA	Upgrade Failing HSTS	LCHD, MWCD	3-7 years	$150,000	Local Sources, OEPA DEAF

4.2 Project Summary Sheets

Critical Area 2 Agricultural Pollution: Project 1		
Nine Element Criteria	Information Needed	Explanation
n/a	Title	**Agricultural BMP: Cover Crops**
criteria d	Project Lead Organization & Partners	MWCD, Licking SWCD, USDA NRCS
criteria c	HUC-12 and Critical Area	Town of Kirkersvile- South Fork Licking River (HUC-12 050400060405) Critical area 2:prioritized agricultural land use
criteria c	Location of Project	Town of Kirkersville- South Fork Licking River Watershed, various locations with active row cropping
n/a	Which Strategy is being addressed by this project	Agricultural Nonpoint Source Reduction Strategies
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Lack of BMPs on agricultural lands contributes to sediment and increased flow, which leads to stream habitat alteration. Implementing BMPs on actively cropped land minimizes this impact downstream
criteria g	Project Narrative	Of the over 44 square kilometer watershed, ~37% are active row crop land. LCSWCD has no data for cover crop cost-share being utilized in this HUC. Adding cover crops to vulnerable agricultural land will reduce the sediment in the stream, thereby reducing the embeddedness of the substrate and increasing macroinvertebrate habitat. Additionally, cover crops can slow down peak flows in significant rain events, which can help protect stream banks from erosion and further incision. Finally, plant growth throughout the year can help hold nutrients in the soil for the year's crop cycle. 600 acres (~10%) will be targeted for cover crops.
criteria d	Estimated Total Cost	$6,000

criteria d	Possible Funding Source	MWCD, Licking SWCD, USDA NRCS
criteria a	Identified Causes and Sources	Causes: Sedimentation, Nutrients, Habitat alteration Sources: Agricultural Field runoff, eroding stream banks, substrate embeddedness, lack of buffer vegetation near streams and ditches.
criteria b & h	Part 1: How Much improvement is needed to remove the NPS impairment for the Critical Area?	Nitrogen Reduction needed from Agricultural Sources: 15,220 lbs/year Phosphorus Reductions needed from Agricultural Sources: 958 lbs/year
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	This project will reduce: Nitrogen loads by 98 lbs/year (~1%%) Phosphorus loads by 35 lbs/year (3.6%)
	Part 3: Load reduction	1% Nitrogen reduction and 3.6% Phosphorus
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Landowner interest will determine the success rate for this practice. LCSWCD will continually engage landowners in the watershed and encourage the use of cover crops whenever appropriate. Ohio EPA will collect TSS and nutrient data on the South Fork Licking River.
criteria e	Information and Education	The Projects will be promoted to landowners and other stakeholders with public meetings, newsletters, social media, and personal contacts from LCSWCD.

Critical Area 2: Project 2		
Nine Element Criteria	Information Needed	Explanation
n/a	Title	**Riparian Buffer, Agricultural Ditch (NE of York and Refugee)**
criteria d	Project Lead Organization & Partners	LCSWCD, NRCS, MWCD
criteria c	HUC-12 and Critical Area	Town of Kirkersvile- South Fork Licking River (HUC-12 05 04 00 06 0405) Critical area 2: agricultural land use
criteria c	Location of Project	3,905-foot-long agricultural drainage ditch located in the center of the watershed, draining approximately 2.4 square miles.
n/a	Which Strategy is being addressed by this project	Agricultural Nonpoint Sources Reduction Strategy- Nutrient Reduction
criteria f	Time Frame	Short term
criteria g	Short Description	This ditch has a shallow buffer area throughout the length of the ditch. Adding riparian planed buffers will help slow and capture stormwater flows and retain nutrients.
criteria g	Project Narrative	This agricultural area has been prioritized for issues with surface drainage from aerial imagery over the past five years. In addition, it has a buffer area along the ditch's length and typical drainage ditch geometry. This project would add ~6.7 acres of native grass buffer to slow sheet flow and disperse concentrated flow. This will be combined with a proposed 2-stage dich to replace the 3,905 ft existing ditch and 1,143 feet of grassed waterway in future phases.
criteria d	Estimated Total Cost	$17,000
criteria d	Possible Funding Source	H2Ohio, 319, EQIP, MWCD
criteria a	Identified Causes and Sources	Causes: Sediment, Nutrients and Habitat alteration. Sources: Stream bank erosion from cropping near unstable river area.

criteria b & h	Part 1: How Much improvement is needed to remove the NPS impairment for the Critical Area?	Nitrogen Reduction needed from Agricultural Sources: 15,220 lbs/year Phosphorus Reductions needed from Agricultural Sources: 958 lbs/year
	Part 2: How much of the needed improvement for the whole Critical area is estimated to be accomplished by this project?	47 lbs/year Phosphorus reduction 113.9 lbs/year Nitrogen reduction This project will cover approximately 5% of the needed load for phosphorus and >1% of the needed nitrogen load reduction.
	Part 3: Load reduction	Nitrogen Reduction: 70.7 lb/year Phosphorus Reduction: 35.4 lbs/ year
criteria i *criteria e*	How Will the effectiveness of this project in addressing the NPS impairment be measured? Information and Education	The effectiveness of this project will be measured through the OEPA Aquatic Life use assessment for the Licking River HUC-8 and by other assessments meeting Level Three QDC requirements. The Projects will be promoted to landowners and other stakeholders with public meetings, newsletters, social media, and personal contacts from LCSWCD.

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Appendices

Tables and Maps

Map 1 Map of major tributaries with 2021 aerial imagery taken from Licking County Auditors GIS server.

Map 2 NLCD, 2019 land cover map, Town of Kirkersville – South Fork Licking River HUC-12 (050400060405)

Map 3 NLCD, 2019 land cover map-Developed land from low to high intensity.

Map 4 NLCD, 2019 land cover map- Agricultural land use (Hay/Pasture, and Cultivated Crops)

Map 5 Map of agricultural land with insufficient riparian buffer.

Map 6 Mainstem South Fork Licking river and unnamed tributaries of Town of Kirkersville-South Fork Licking River HUC-12 (050400060405)

Table 1- Licking County Census population from 1990-2020

Table 2- South Fork Licking River Gauge Station Heights, various dates.

Table 3-Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) Land Use-National Land Cover Database, 2019

Table 4 -Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) USDA SSURGO Hydrologic Soil Group

Table 5- Summary OEPA ALU Status and supporting data for various years.

Table 6- Narrative ranges for ALU designation by Ecoregion within Town of Kirkersville- South Fork Licking River HUC-12 (050400060405).

Table 7- Avian Species within the watershed and associated breeding seasons.

Table 8 - 2008 OEPA E. coli sampling locations and associated PCR Status on South Fork Licking River. Measured in cfu/100ml

Table 9 - Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes and sources.

Table 10 – Average annual baseline nonpoint source load.

Table 11- Licking County Census population from 1990-2020

Table 12- Summary OEPA ALU Status and supporting data for various years.

Table 13 - Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes for Urban Development.

Table 14 – Annual pollutant loads, targets and needed reduction (Estimates from OEPA Nutrient Mass Balance Study)

Table 15- Town of Kirkersville- South Fork Licking River HUC-12 (050400060405) associated NPS causes for Agricultural Land Use.

Table 16 – HSTS repairs and replacement costs, loans, and numbers facilitated through Licking County Health Department from 2016 to 2022.

Table 17 - Overview Table for Town of Kirkersville-South Fork Licking River HUC 12