Nine-Element Nonpoint Source Implementation Strategic Plan (NPS-IS plan)

Euclid Creek Watershed
HUC-12 (04110003 05 03)

Version 1.2

January 29, 2020

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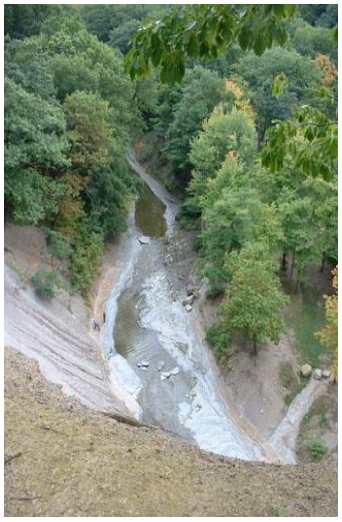


Euclid Creek Watershed Program:
Euclid Creek Watershed Council
Friends of Euclid Creek
Cuyahoga Soil & Water Conservation District

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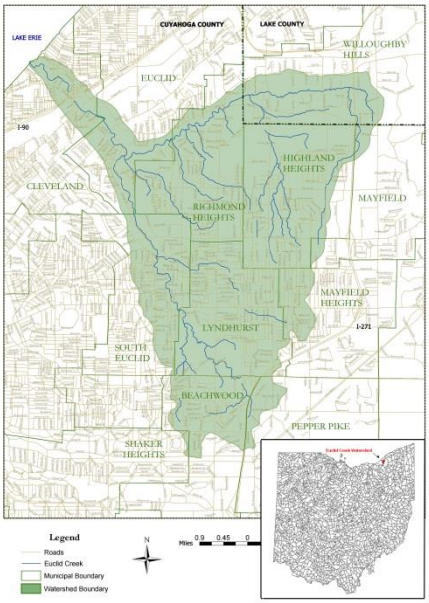
Acknowledgements

The Euclid Creek Watershed Program partners would like to thank the many agency, nonprofit and community partners who helped compile the information, maps and projects needed to create this document. This NPS-IS plan will help direct projects that address nonpoint source impairments in the **Euclid Creek HUC-12 watershed**.

Chapter 1: Introduction

The Euclid Creek Watershed HUC 12 (04110003 05 03) is located in northeast Ohio at the northeastern edge of Cuyahoga County, Ohio. Euclid Creek is a headwater tributary to Lake Erie and is in the Central Lake Erie Basin. Euclid Creek is 23.3 square miles in size and is a highly urbanized watershed along the Ohio Lake Erie coastline.



State and federal nonpoint source funding is now closely tied to strategic implementation-based planning that meets U.S. Environmental Protection Agency's (EPA's) nine minimum elements of a watershed plan for impaired waters. Cuyahoga Soil & Water Conservation District (CSWCD), the Euclid Creek Watershed Council (ECWC) and Friends of Euclid Creek (FOEC) are taking the lead in authoring this NPS-IS.

There are three existing guidance documents for the Euclid Creek Watershed:

- Euclid Creek Watershed Action Plan (ECWAP) Authored by Euclid Creek Watershed Council, Cuyahoga SWCD, and Friends of Euclid Creek, 2006
- Euclid Creek Watershed Planning Guide (ECWPG) Authored by Cuyahoga County Planning Commission, 2005
- Total Maximum Daily Loads for the Euclid Creek Watershed (Euclid Creek TMDL) Authored by Ohio EPA, 2005

We are working with numerous other groups, agencies and municipalities who participated in the original Euclid Creek Watershed Action Plan (EC WAP) development; all of which have agreed to collaborate toward the development of Nine-Element Nonpoint Source Implementation Strategic Plan (NPS-IS) for Euclid Creek.

1.1 Report Background

This NPS-IS report was created as an update to the EC WAP, which was endorsed by the State of Ohio Department of Natural Resources (ODNR) and Ohio EPA's watershed plan program in July 2006. The EC WAP was created as a twenty year plan toward restoring the watershed based on EPA and ODNR standards with the goal of protecting and restoring the Euclid Creek and its Lake Erie shoreline and to sustain its water resources and enhance the quality of life for the future.

Today, the plan is over ten years old and in need of an update. In addition, U.S. EPA is now requiring that groups with WAP's endorsed before 2010 update their plans in the new NPS-IS format to provide more succinct detail related to identifying critical areas and projects that are more easily implementable, versus the voluminous and general nature of the WAP. Additional updates to the EC WAP will address other impairments that need attention from a holistic watershed perspective in order to restore the area to fishable, swimmable and drinkable waters that meet water quality standards (e.g. point source issues).

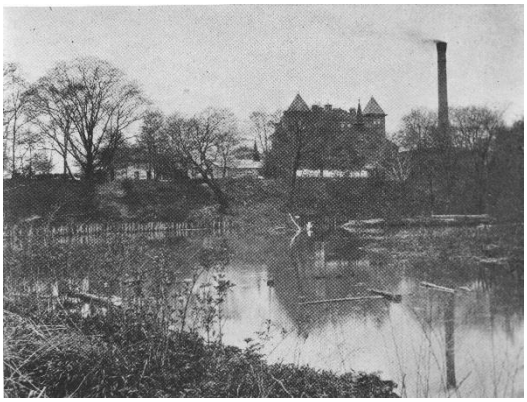
1.2 Watershed Profile & History

The Euclid Creek watershed is located within the counties of Cuyahoga and Lake and is within twelve municipal communities; the Cities of Beachwood, Cleveland, Euclid, Highland Heights, Lyndhurst, Mayfield Heights, Pepper Pike, Richmond Heights, Shaker Heights, South Euclid, Willoughby Hills, and Village of Mayfield. The East Branch of Euclid Creek begins in Mayfield Village, Highland Heights and Willoughby Hills and runs through Richmond Heights to the confluence with the West Branch in Euclid. The West Branch begins in Mayfield Heights, Pepper Pike, Beachwood, Shaker Heights, Lyndhurst and South Euclid and joins the East Branch in Euclid where the Main Branch continues through Euclid and Cleveland to the mouth of Euclid Creek at Lake Erie.

The history of Euclid Creek exemplifies the settlement patterns associated with Watershed conditions today as well as provides a glimpse in the community prosperity Euclid Creek experienced in the early years of settlement. Most of the watershed lies in old Euclid Township, created as the largest Connecticut Western Reserve survey unit in 1796 and was completely platted in June, 1797 and settlement began forthwith. Pioneers build grist and sawmills on the creek's

numerous high gradient headwater branches. By 1840, the sizable estuary at the mouth, served as an important Great Lakes boatyard and localized fishing port. These early activities foreshadowed substantial manufacturing during the early twentieth century.

Five historical landscape periods of time illustrate the historical progression of development in the watershed, a landscape approach is presented within five periods.



Estuary near mouth of Euclid Creek, ~ 1900

1. Water & Wind, 1796-1851. In September 1796, Moses Cleaveland completed the initial Connecticut Western Reserve survey. It was a troubled month as most of the field crew threatened not to return in 1797. To solve the labor dispute, Cleaveland create a very large township just east of capital settlement (Cleveland) The 41 "protestors" bought the township and dedicated it and its major watercourse to Euclid, the classical geometer. Three features drew settlers to Euclid Creek. First the waterfalls on the main and headwater branches provided numerous mill sites for processing wood and grain. Second, the Cleveland-Buffalo Road crossed Euclid Creek at a deep chasm. Businesses catering to travelers thus grew at Euclid Creek village. Third, with its lake access, the Euclid Creek estuary saw the earliest industrial development. By 1820, clay was being imported to establish a stoneware kiln and, by 1840, a significant boatyard was launching schooners of up to 400 tons.
2. Steam and Rails, 1852-1894. In 1852, the CP&A RR gave Cleveland rail links with Chicago and New York City. Euclid Creek bluestone became a prime export, and the watershed's tempered climate produced exportable table fruit and wine. These labor-intensive industries attracted a wave of northern European immigrants. After the Civil Water, the CP& A gave wealthy Clevelanders a means to seek summer refuge along Lake Erie. In addition, the first significant advance in road transport came as today's Euclid Avenue and Mayfield Road were "planked" during the 1870's.
3. Electrification, 1890-1919. Interurban railroads helped transform a relatively rural Euclid township into a number of trendy eastern suburbs. The watershed became the realm of both exclusive private estates and middle class resorts, the latter including the famed Euclid Beach amusement park. Electrification also brought manufacturing and burgeoning population to Euclid Creek. Nottingham Village seceded from Euclid Township in 1899.
4. Early Automobiles, 1920-1962. By the mid-1920s, the old Indian trails constituted an extensive road system. And in putting in scores of residential streets, the watershed's new municipalities completed a truly dense transportation network. The stage was set for rapid development. Amidst the rush to create municipalities out of old Township in the late 1910s, the Cleveland Metropolitan Park Board purchased the west branch gorge lands to create the Euclid Creek Reservation. The late 1940s, brought thousands of postwar bungalows to the watershed, while the 1950s brought expansion of ranch house subdivisions.
5. Interstate Exurbia, 1963-2016. By 1960, local industrial production had peaked and the region began a slow but steady decline in building. Ironically, industrial decline coincided with the arrival of the Interstate Highway System. I-90/Ohio Route 2 (1963) and I-271 (1965), the two major highways within the watershed, quickly drew development to the watershed's east and south fringes. By the late 1990s, the last rural tracts in eastern Cuyahoga and western Lake counties had been fully built-out. Beyond housing, building in the new cities concentrated toward retail consumption. In 1966, Richmond Mall in Richmond Heights was built. In the 1970's, Beachwood Place and LaPlace Mall and retail center rose in Beachwood. And most recently, Legacy Village was built in 2003 on the former Bolton Estate as Northeast Ohio's first "lifestyle center". This progression of development demonstrates how quickly patterns evolved in Euclid Creek and great experiences that have occurred across the landscape over the past 100 years.

1.3 Public Participation and Involvement

The Euclid Creek Watershed Program is made up of the Friends of Euclid Creek, the grassroots non-profit watershed group, the Euclid Creek Watershed Council, the nine communities that govern the program, and the Euclid Creek Watershed Coordinator, the program's full time staff housed at Cuyahoga Soil & Water Conservation District. The program partners have been working together since 2001 and we have relationships with many citizens, businesses, governmental agencies and other non-profit groups working to restore Euclid Creek.

The NPS-IS document has been put together through institutional knowledge about the watershed by the Watershed Program Manager. Through monthly Friends of Euclid Creek meetings, Watershed Council meetings, Technical Committee meetings, Public Involvement and Public Education Committee meetings, and volunteer stream monitoring efforts, the Watershed Program Manager has a thorough understanding of issues and opportunities in the Euclid Creek Watershed. This document is undergoing updates to expand upon critical areas and projects identified. A draft version of the updated document was given to partner communities and agencies for review and input before submittal to Ohio EPA.

Public input meetings were held on October 18, 2018 in Euclid; December 4th and 6th, 2018 in Mayfield Village; and December 10th, 2018 in Beachwood. Figure 3 summarizes issues brought up during the public input process. Residents expressed flooding, invasives species, trash, and erosion were priority issues to address in the Euclid Creek watershed.

Public Input Gathered at Public Open Houses, One on One Meetings, as well as Calls and Emails to the Watershed Program

- Beachwood - flooding at Cedar opposite Lynnway - Church of Good Shepherd, flood control basin retrofit opportunities
- Cleveland Metroparks – Erosion areas, invasive management areas, opportunities for daylighting creeks, acquisition opportunities, retrofit opportunities, tree canopy improvement areas
- Communities/cities need to update invasive plant ordinances and allow for natural gardening
- Concern that HOAs are not maintaining stormwater basins
- Concern that HOAs don't allow for invasive species management
- Concern about Highway I-271 runoff and downstream flooding
- Euclid - Large pipe behind Cavottas hanging in stream, litter
- Highland Heights – Concern with HOA/Landscapers mowing to the edge of the stream, localized basement flooding, litter, dumping of natural materials
- Localized behavior change campaign
- Landscaper targeted behavior change campaign
- Lyndhurst – Richmond road dam, localized litter issues, erosion
- Mayfield Village and Mayfield Heights – green infrastructure maintenance/sustainability concerns
- Need "Do not Litter" signs and education campaign targeting everyone from residents to businesses
- Encourage communities to develop and enforce anti-litter ordinances and encourage litter pick-up events.
- Pepper Pike - creek erosion/flooding issues the past few years
- Richmond Heights - Dumbarton Blvd – Erosion downstream of culvert added in 1972, Mayfair Lake Dam, Community retrofit opportunities, geese waste at mall, green infrastructure maintenance/sustainability concerns
- Richmond Heights Dumbarton Blvd – Erosion downstream of culvert added in 1972
- South Euclid – Localized weekend litter, localized litter at Ramblewood condos, Concern with dumping of landscaping debris in stream
- Willoughby Hills - Concern about Highway I-271 runoff and downstream flooding

Quotes from residents received during the public input process:

"In light of the ongoing increase in development and sprawl in the area, I believe that protection of the watershed should involve all the residents the live here. Protection should start with practices we follow in our own yards as more and more open space is being snatched up by developers and less land is being left as open, natural space with wildflowers, trees, etc. Beside residents, the education will need to involve city planners, the press, real estate planners and developers." – Pepper Pike Resident

“Business owners, especially fast food places, could help with “Do Not Litter” signage in and around their buildings and on their food packaging.” - Euclid Resident

“Business owners, especially fast food places, could help with “Do Not Litter” signage in and around their buildings and on their food packaging.” - Euclid Resident Figure 3: Map of the Euclid Creek Watershed indicating issues that have been brought to our attention by stakeholders and residents of the communities at public meetings.

“Business owners, especially fast food places, could help with “Do Not Litter” signage in and around their buildings and on their food packaging.” - Euclid Resident

The Euclid Creek Watershed Council has a Technical Committee that provides input on project prioritization, and development of the NPS-IS. The main community and partner agency participation and involvement process for the NPS-IS took place in 2018-2019. The Watershed Program Manager will continue to request information from communities in the watershed to evaluate new challenges and opportunities that have arisen since the WAP development took place over 10 years ago. In addition, meetings with agency partners like the local park district and regional sewer district will took place.
Additional Problems Identified at August 1st 2019 Euclid Creek Watershed Council Meeting

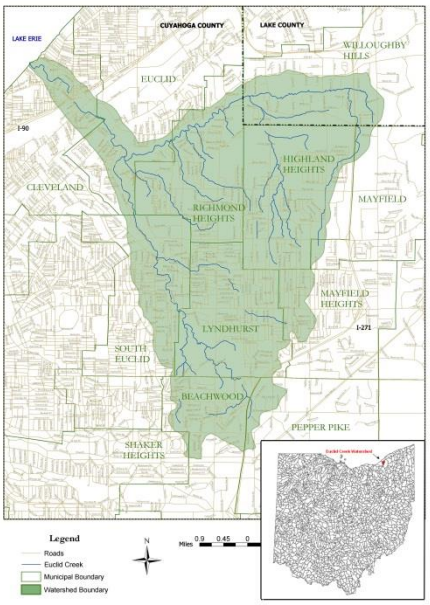
- Built up Yards – Residences that have been built up over time creating neighborhood drainage issues.
- Filling of bioswales and stormwater control measures/lack of swale maintenance
- Lack of communication to new residents about existing drainage infrastructure on their property
- Ordinances for allowance of low mow grasses – having to mow = barrier to maintaining and creating new green spaces.
- Deer Population Explosion – Deer are causing safety issues as well as watershed issues by not allowing regrowth of understory in steep ravines
- Aging Infrastructure
- Fish Passage Barriers - Dams

Chapter 2: HUC-12 Watershed Characterization and Assessment Summary

2.1 Summary of HUC-12 Watershed Characterization

2.1.1 Physical and Natural Features

This document focuses on the Euclid Creek Watershed, HUC 12 (04110003 05 03). The Euclid Creek is 43 miles long with a drainage basin of 23.3 square miles and drains directly to Lake Erie. Of the 43 miles of stream, 10.4 miles is culverted or buried and 30.1 miles is open channel. The watershed sits at the confluence of three physiographic regions significant to Northeast Ohio, the Appalachian Plateau, the Lake Plains and the Portage Escarpment (Figure 1). The watershed consists of lowland coastal areas with lake effect zones, steep slope bedrock ravines and upland areas with a network of headwater streams entering the two main branches, the east and west branches. Euclid Creek consists of two main stems, the West Branch, which drains approximately 10 square miles and the East Branch which drains approximately 12 square miles.



Due to the relative small size of the watershed, the watershed has been sub-divided into seven smaller sub-watersheds to present their descriptions and examine the conditions.

The geology, formed over 300 million years ago, has influenced settlement and development patterns for over two centuries and continues to exemplify Euclid Creek's unique landscape. Because of its gradient and size, many geologic rock formations including Chagrin and Cleveland Shale and Bedford and Cleveland bedrock can be observed in a short expanse of distance, which is rare to Cuyahoga County. Euclid Creek is considered a very high gradient stream with an average gradient of 55 feet per mile. The mouth of Euclid Creek at Lake Erie enters at an elevation of 570' with it rising to over 1,200' near the headwaters in Beachwood (Figure 2).

The soils of the watershed consist of 58% of Hydrologic Soil Group C soils, 31% D type soils and 11% of B type soils. The soils in the Euclid Creek have an average range of K factor from .28 to .43, hence the soils have a moderate range of erosion. Due to the flashy flows of the stream both by geologic and land use contributions, erosion of soil continues to be a problem in the watershed (Figures 3-5).

Euclid Creek Watershed has largely been developed over the last 150 years and is currently over 80% developed. The watershed is principally urbanized with single family residential as the primary land use, covering 47% of the watershed's land area. Other significant land uses include commercial, institutional, open space and light industrial/warehousing. Due to its proximity to the central city of Cleveland, the density of housing is considerably high compared to other watersheds along Lake Erie. Also due to this proximity is the continuing pressure to develop the few remaining areas of undeveloped land in the exurbs. This continuing development pattern will increase flows in Euclid Creek exacerbating erosion, sedimentation, and urban runoff issues present today while reducing habitat. Maintaining remaining forest cover and protecting intact headwater streams and wetland systems will prevent further impacts to the watershed.

Figure 1 – Physiographic Regions of Ohio

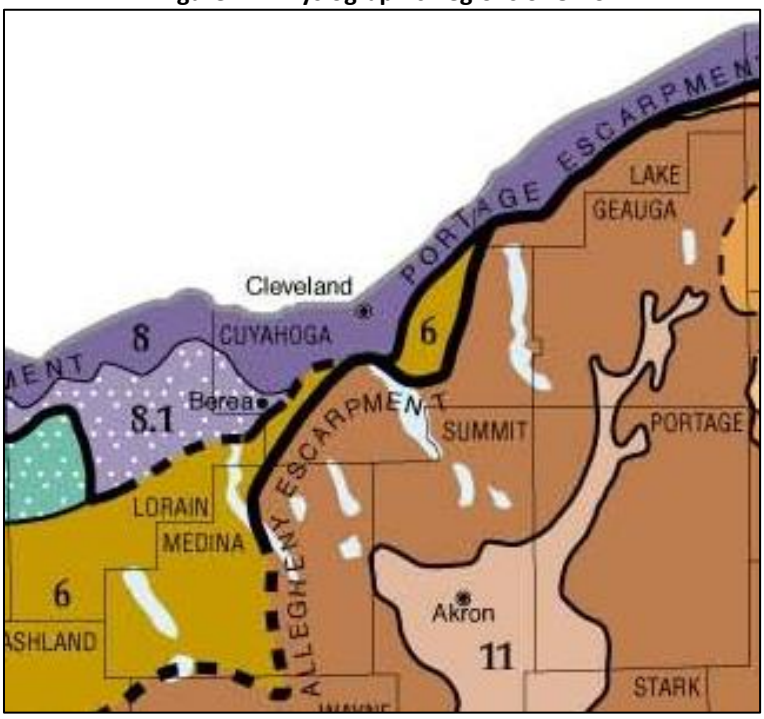


Figure 2 – Topography: Elevation Change in Euclid Creek Watershed

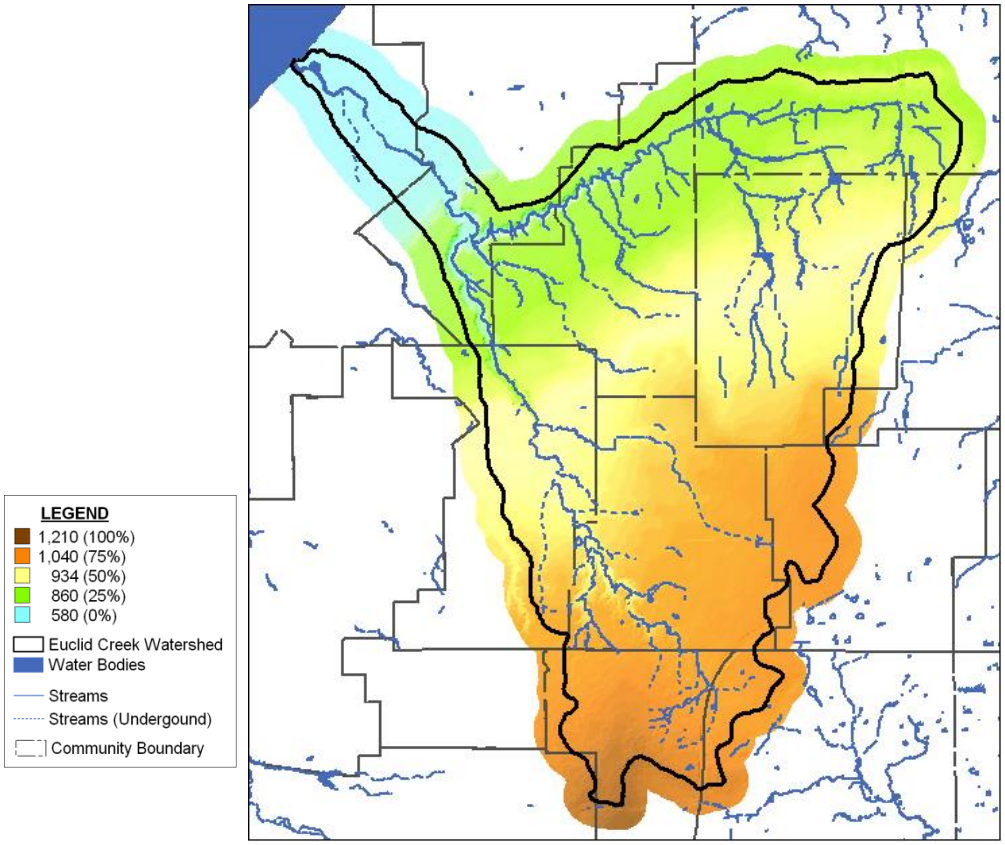


Figure 3 - Soils of Euclid Creek (USDA Soil Survey)

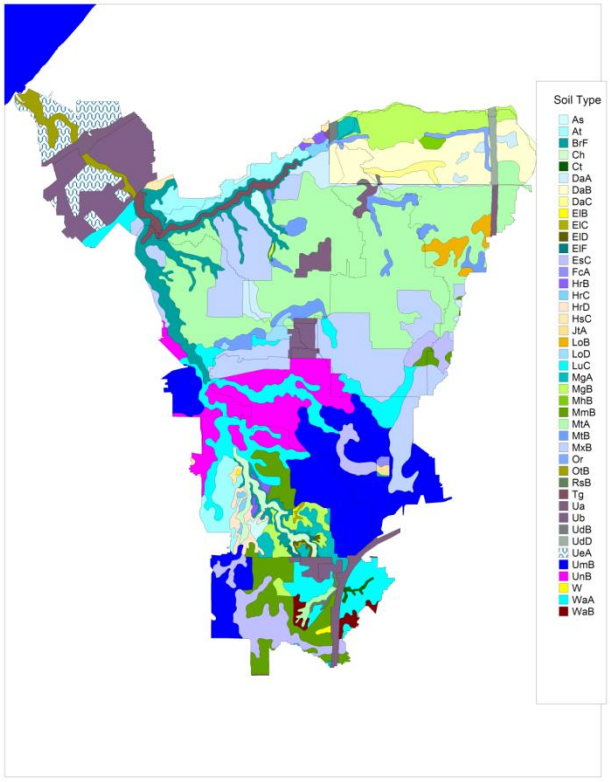


Figure 4 - Hydric Soils of Euclid Creek **(USDA Soil Survey, Cuyahoga County)**

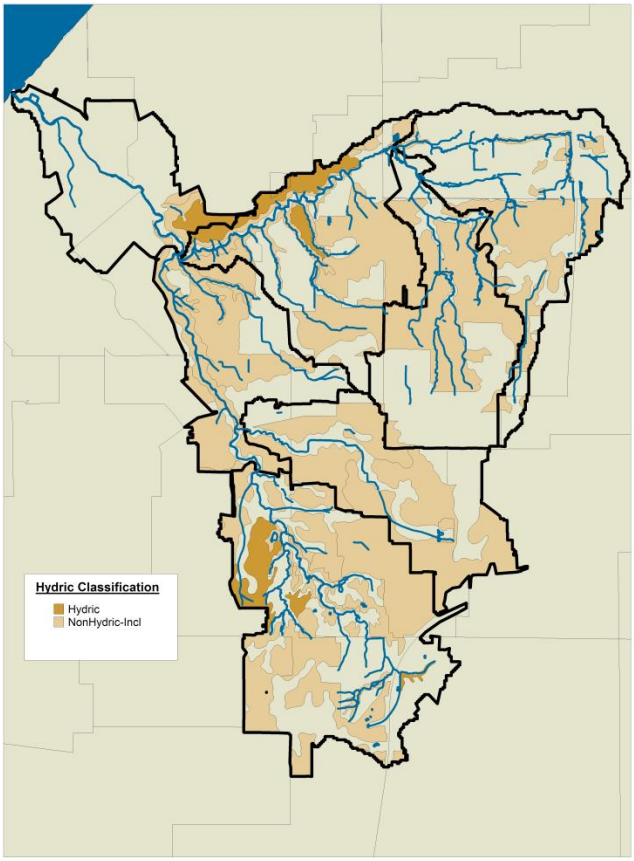
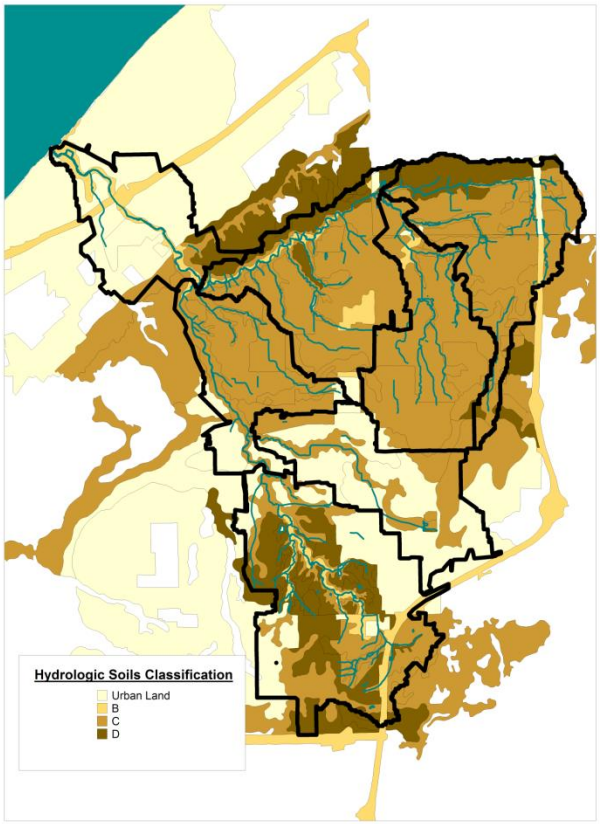


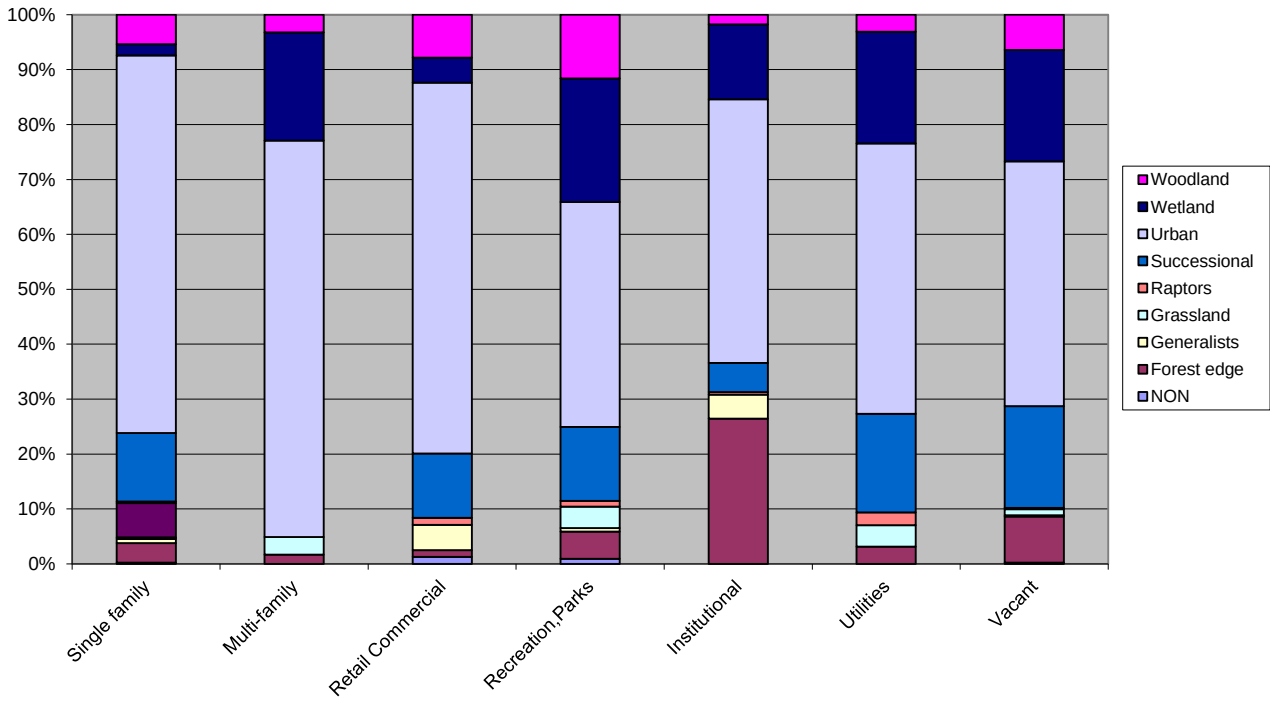
Figure 5 - Hydrologic Soils of Euclid Creek (USDA Soil Survey, Cuyahoga County)



The hydrologic component of these soils outlines the infiltration characteristics within the watershed to consider in future best management practices and development activities.

The wildlife in Euclid Creek is typical of urban areas with greenspace corridors. The species include white tailed deer, sitings of mink, muskrat, blue heron, beaver, red fox, wild turkey. There are also sitings of coyote in the upper and lower watershed, specifically at Acacia Reservation on the upper West Branch and at Wildwood Park, located at the mouth of Euclid Creek and Lake Erie. During the month of June, 2003, Friends of Euclid Creek together with the Kirtland Bird Club conducted a Nesting Bird Survey in the area of the Euclid Creek watershed. The goal of the survey is to collect information about density and species diversity of the nesting birds and provide valuable information about bird population and importance of different habitats inside the watershed. The survey found over 150 bird species in Euclid Creek covering many different landscape types including forest edges, urban, wetlands, woodlands and successional areas. The study also examined the distribution of the different types of birds based on their migratory characteristics that was distinguished by neotropical migrants, shorter distance migrants and local birds.

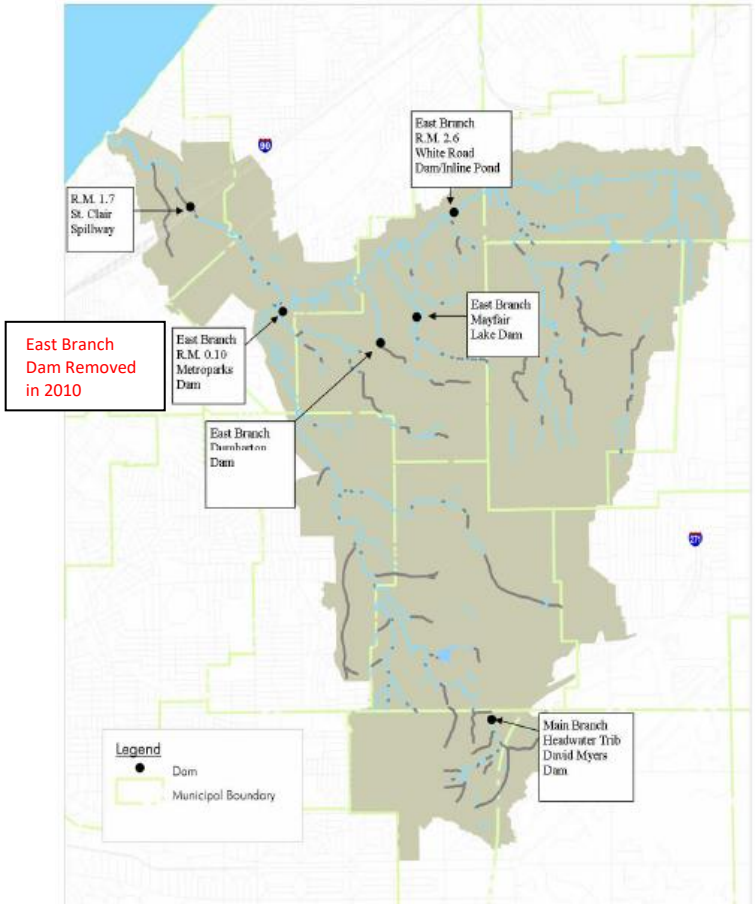
Percentage of bird guilds in different land use types (Kirtland Bird Club, 2004)



There are a variety of fish that enter Euclid Creek through Lake Erie as well as species within the upper reaches in the headwaters of the watershed. In the lower creek, fish travel into Euclid Creek that include steelhead. The upper portions of the creek typically include pollution tolerant species such as creek chub, blacknose dace, and central stoneroller. More diverse species such as darters in the upper reaches of the creek are not found and limit the habitat capacity within the stream itself as a result of this absence of species.

In addition to the local fish resources, Euclid Creek is used for recreational fishing purposes by local anglers in the lower reaches of the creek from the East 185th Street dam to Lake Erie. The Ohio Department of Natural Resources has conducted CREEL surveys along twelve fishing locations in the Cuyahoga and Lorain counties, and according to the 1993 CREEL survey, Wildwood State Park accounts for 8.17% of anglers fishing at these locations and 3% of the harvest. The E. 185th Spillway and dam, the primary impediment to fish passage at the lower ends of the creek, continues to prohibit greater fishing opportunities within the Creek itself. Six major dams in the watershed inhibit fish passage (Figure X); one has been removed in 2010 (East Branch Dam) and the primary impediment is under feasibility study for fish passage options in 2017 (E. 185th Spillway and Dam).

Figure 6 - Dam Locations in Euclid Creek Watershed



There are no known records of any rare, endangered or threatened species of fish, invertebrates, mammals or amphibians within Euclid Creek and its shoreline. However, most of these areas have not been extensively surveyed to identify the presence of these species.

From a plant perspective, the *Solidago puberula*, dusty goldenrod, listed endangered by ODNR, was found in the Highland Heights community park and is the only known location in Ohio to support a stable population of this species. The *Hypericum gentianiodes*, and the *Phynchospora capitellata*, found in the wet portion of Highland Heights Community Park, is the only known place within the county to support this species.

The ODNR Division of Natural Areas and Preserves has compiled a list of more than 60 invasive plants that are currently impacting natural areas, parks and forests throughout the state. Some of the top invasive non-native plants include: phragmites, bush honeysuckles, buckthorn, garlic mustard, purple loosestrife, common reed grass, reed canary grass, autumn and Russian olive, multiflora rose, Japanese honeysuckle, narrow-leaved cattail, Canada thistle and tree-of-heaven. The presence of these invasives and non-natives are no exception in Euclid Creek. The Euclid Creek watershed has had a history of land disturbance which has created a breeding ground for the proliferation of invasive and nonnative species both in its natural and built landscapes. The areas most disturbed with invasives exist along the channelized portions of the creek along the main branch and in the disturbed areas where land alteration has occurred around the headwater tributaries. One of the most abundant invasives present within the Watershed is phragmites, mostly in the lower portions of the creek and disturbed areas throughout the watershed. Japanese knotweed and garlic mustard are also prevalent particularly in the lower three miles of the creek. Re-introducing native plant species and invasive removal in future restoration projects can enhance stream habitat areas and biodiversity within the stream corridor as well as provide ecological benefits. A very disturbing recent finding in a watershed adjacent to Euclid Creek to the west, is that Kudzu was able to flower and fruit near the shores of Lake Erie, the first time in our region the plant had taken hold. It is thought seed was spread from a nearby rail line and that conditions did not get cold enough to kill the plant. We are watching for Kudzu, but know this could become a problem with warming and changing weather patterns from climate change on our local region. From an aquatic invasive standpoint, *Hydrilla verticillata*, is an

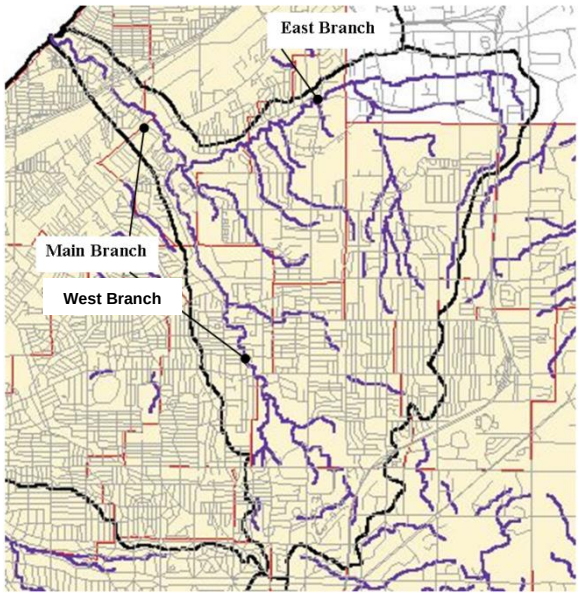
aggressive invasive found to be most problematic in our region and is found as nearby as the North Chagrin Reservation in Willoughby, so keeping an eye out for this invasive is a high priority in Euclid Creek.

2.1.2 Land Use and Protection

The Euclid Creek watershed is unique to the majority of Ohio watersheds in that is does not contain agricultural lands as part of its land use coverage and is over 80% developed. In Euclid Creek, land use is the main factor influencing the restoration or degradation of the water resources in the future.

Main Branch / West Branch

The main branch travels north-south within the densest land use areas of the watershed as well as the Wildwood State Park and Cleveland Metroparks Euclid Reservation from Lake Erie to the confluence with the East Branch, where the West Branch begins extending to the central region of the Beachwood community.



The main and west branches have been heavily encroached upon by urban development with few remaining areas of floodplain or intact streambank to maintain natural flow regime. Due to the geologic conditions and urban nature of the branches, the flows are flashy and prohibit a diverse fish and aquatic insect population to sustain itself within the creek.

East Branch

The East Branch mainly travels east-west along the escarpment through a deep ravine of the suburban communities within the watershed. While the east branch remains intact, the tributaries and headwaters that drain to it continue to be encroached upon by suburban development.

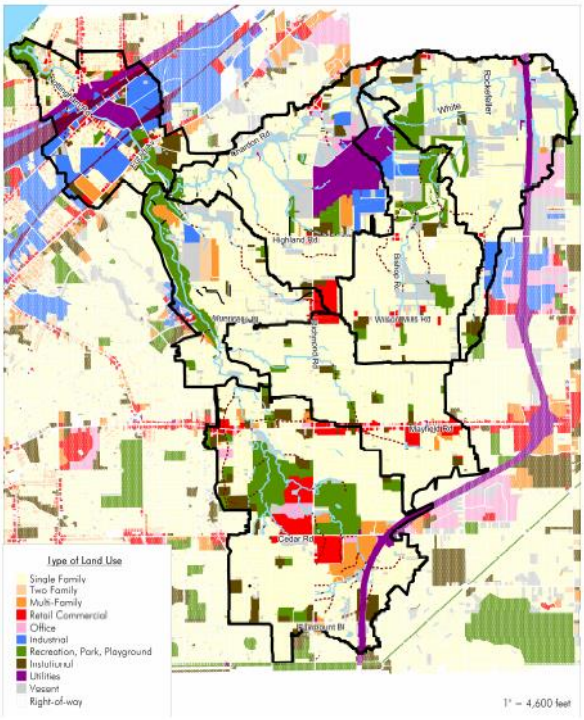
Land Use Acreage Distribution in Euclid Creek

Land Use	Acres	Percent of Watershed
Commercial Office/Retail	649.90	4%
Residential Single Family	7,114.60	47.6%
Residential Multi-Family	441.11	2%
Industrial	539.30	3%
Institutional	635.822	4%
Undeveloped Land	2,199.034	14%
Protected Open Space	1403.08	9.3%
Utilities/Highways/Roads/ROW	1,904.84	12.7%

Source: Cuyahoga County Planning Commission, 2005

While commercial office/retail is only 4% of the watershed land coverage, commercial corridors and regional malls and their parking lots have an adverse effect on the health of Euclid Creek, both from a water quality, water quantity and temperature standpoint in summer months. Of the 165 acres of mall (Beachwood Place, Legacy Village, Richmond Town Centre), they area nearly 95% impervious cover and are located at the headwaters of the watershed, therefore, they have a large impact. Residential property is nearly 50% of the watershed, so education and outreach related to managing stormwater runoff and water quality infiltration practices are strongly promoted throughout the watershed to help decrease peak flows. While little land remains available for development, sensitive areas are being developed as they are the last remaining parcels left, so protecting these sensitive areas is a high priority in the watershed. To date 24 acres of steep-sloped land and ecologically sensitive areas with wetlands and headwater tributaries have been protected from development.

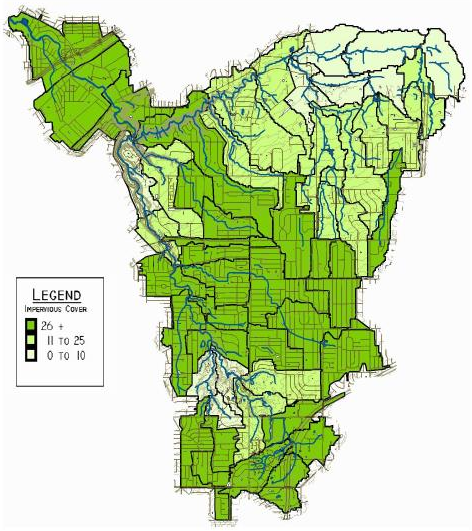
Figure 7 - Land Use (Cuyahoga County Planning Commission, 2005)



In 2013, Cuyahoga County Planning Commission studied urban tree canopy in Cuyahoga county, which makes up 90% of the Euclid Creek Watershed (Lake County data not available). The environmental and stormwater benefits a healthy tree canopy provide is crucial for watershed health. From this report, 35% of Euclid Creek was deemed as having an established tree canopy with 31.9% vegetated and possible for planting trees and 13.8% impervious surface that could be removed and planted with trees. Of the riparian area in the Cuyahoga County portion of Euclid Creek, roughly 62% has tree canopy, with roughly 20% of that land area available for plantings. Planting trees and revegetating riparian buffers is a high priority action in watershed for reducing nonpoint source runoff and for improving water quality.

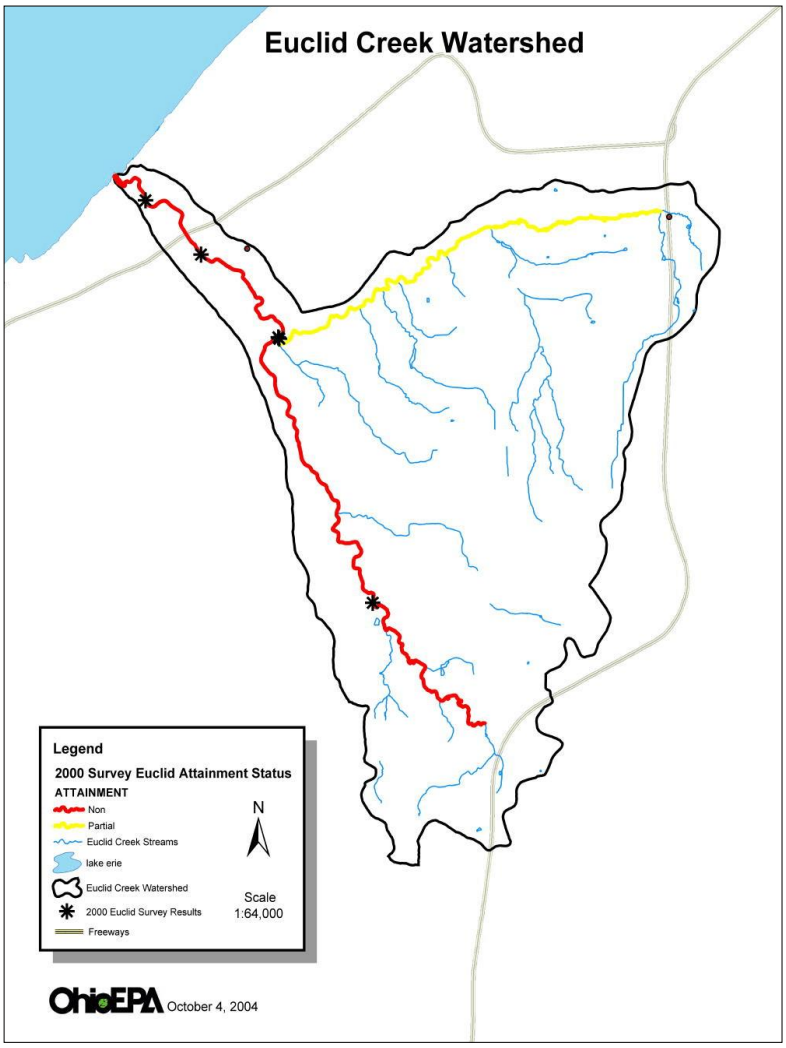
As one of the most densely populated and developed watersheds along the Ohio Lake Erie coastline, the Euclid Creek watershed is approximately 32.6% **impervious surface area** (TMDL) which seriously reduces the streams aquatic species diversity and channel morphology is highly unstable.

Figure 8 - Impervious Cover in Euclid Creek (Data from NEORSD 2004 RIDE Study Draft)



The effects of stormwater on the watershed are critical to understanding the watershed as 100% of the watershed communities are NPDES regulated Municipal Separate Storm Sewer System (MS4) communities. Polluted stormwater runoff is one of the most significant causes of water quality problems as nutrients, road salt, sediment and chemicals are carried through the storm sewer system and discharge in the creeks and streams that make up Euclid Creek. The main sources from the stormwater runoff are from urban and suburban activities.

Figure 9 – Euclid Creek Attainment Status / Sampling locations



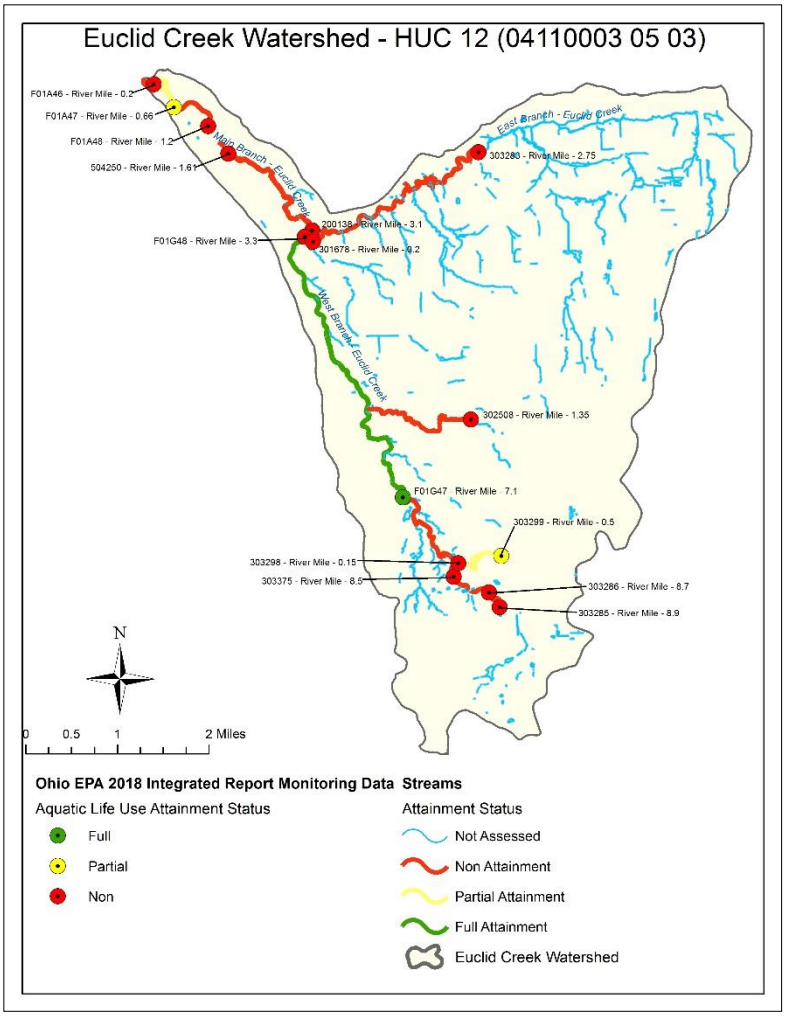
2.2 Summary of HUC-12 Biological Trends

Use Designation and Attainment Status

In 2015, Ohio EPA surveyed Euclid Creek and found that the aquatic life use designations that apply to various segments are Warmwater Habitat (WWH) and Limited Resource Water (LRW). Based upon these standards, Euclid Creek does not meet attainment of these standards within the Main and East Branches as well as the headwaters of the West Branch (Table 1).

Currently the only site in full attainment within the Euclid Creek Watershed is located downstream of Mayfield Golf Course on the West Branch at River Mile 7.1. While invertebrate community data and habitat monitoring data show attainment at this site, no fish sampling has occurred at this location since 2014 to verify that the fish population is healthy (Given the gradient of the West Branch and the many natural and man-made fish barriers we would not expect a diverse headwater fish assemblage at this location). Other factors like water chemistry would also affect fish assemblage at this location. Northeast Ohio Regional Sewer District (NEORSD) IBI data from 2013 and 2014 were both poor (22 and 20 respectively).

The following is a summary of data from the Euclid Creek TMDL Plan, Ohio EPA sampling, and NEORSD sampling. A summary of sample locations and their biological status in the Euclid Creek are provided in **Error! Reference source not found.**. A map of the most current Ohio EPA sampling information is shown in **Error! Reference source not found.**. Fish species (**Error! Reference source not found.**) appear to be more impacted in Euclid creek than macroinvertebrates (**Error! Reference source not found.**).



Euclid Creek Watershed Ohio EPA 2018 Aquatic Life Use Attainment

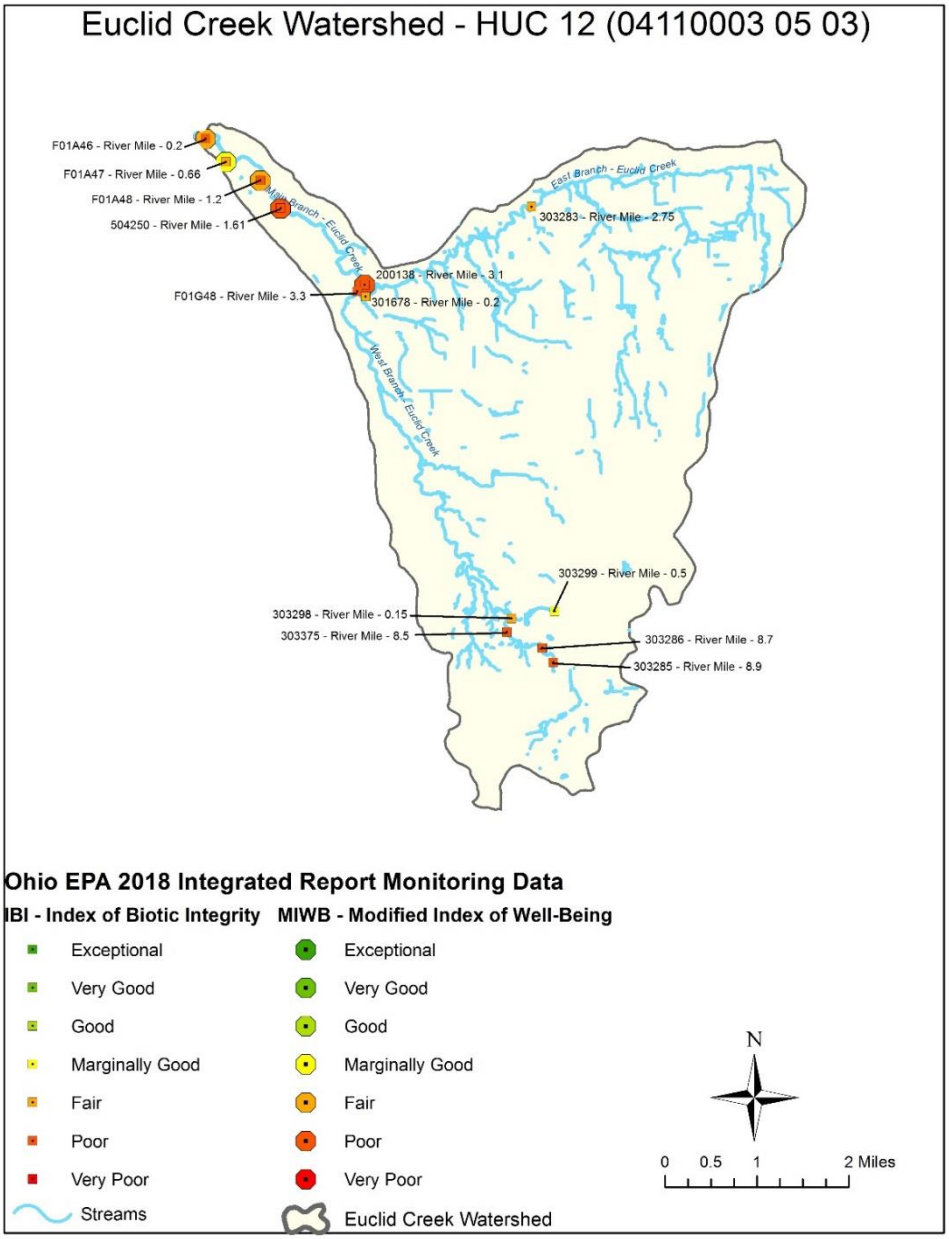
Euclid Creek Biological Attainment Table (2018 Ohio EPA Integrated Report Data)

Station ID	River Mile	Sampling Year Fish/Invert.	IBI	Miwb	ICI	Invert Narrative	QHEI	Status	Comment
Euclid Creek (19-041-000) - West Branch									
					WWH Use Designation (Existing)				
303285	8.90	2016/2015	24			Poor	69.5	**Non**	Euclid Creek Dst. Cedar Rd. Within 319 Project Area
303286	8.70	2015/2015	20			Poor	53.5	**Non**	Euclid Creek Dst. 319 Project Area
303375	8.50	2015/NA	20				53.0	**Non**	Euclid Creek Dst Richmond Rd
F01G47	7.10	NA/2014			34		67.0	Full	Euclid Creek Dst. Mayfield Golf Course @ Mayfield Rd.
F01G48	3.30	2015/2015	24			Fair	66.0	**Non**	Euclid Creek @ Euclid Park Blvd.
Euclid Creek (19-041-000) - Main Branch									
					WWH Use Designation (Existing)				
200138	3.10	2014/2014	25	5.25	36		63.0	**Non**	Euclid Creek Near Euclid @ Highland Rd. (Upper Crossing)
504250	1.61	2016/2016	25	4.90	38		77.8	**Non**	Euclid Creek @ St. Clair Ave.
F01A48	1.20	2014/2014	26	5.96	28		64.0	**Non**	Euclid Creek Dst. Villaview Rd.
F01A47	0.66	2016/2016	35	7.98	16		65.3	Partial	Euclid Creek @ Lake Shore Blvd.
F01A46	0.20	2016/2016	24	7.59	20		63.0	**Non**	Euclid Creek Near Mouth @ Wildwood Park
East Branch Euclid Creek (19-041-001)									
					WWH Use Designation (Existing)				
303283	2.75	2015/2015	30			Fair	53.5	**Non**	East Branch Euclid Cr @ Sr 175/Us 6
301678	0.20	2015/2015	32			Fair	68	**Non**	E. Br. Euclid Creek Near Mouth, Upst. Old Dam (Free-Flowing)
Tributary to West Branch Euclid Creek (19-041-003)									
					WWH Use Designation (Existing)				
302508	1.35	NA/2014			18	Low Fair	59.5	**Non**	Trib. To Euclid Creek (5.49) At Lyndhurst @ Richmond Rd.
Tributary to West Branch Euclid Creek (19-041-004)									
					WWH Use Designation (Existing)				
303299	0.50	2016/2015	36			Low Fair	62	Partial	Tributary to Euclid Creek (Rm 8.1) Off Golfway Lane
303298	0.15	2016/2015	28			Very Poor	54.8	**Non**	Tributary to Euclid Creek (Rm 8.1) @ Sand Ridge Golf Course

Biological

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

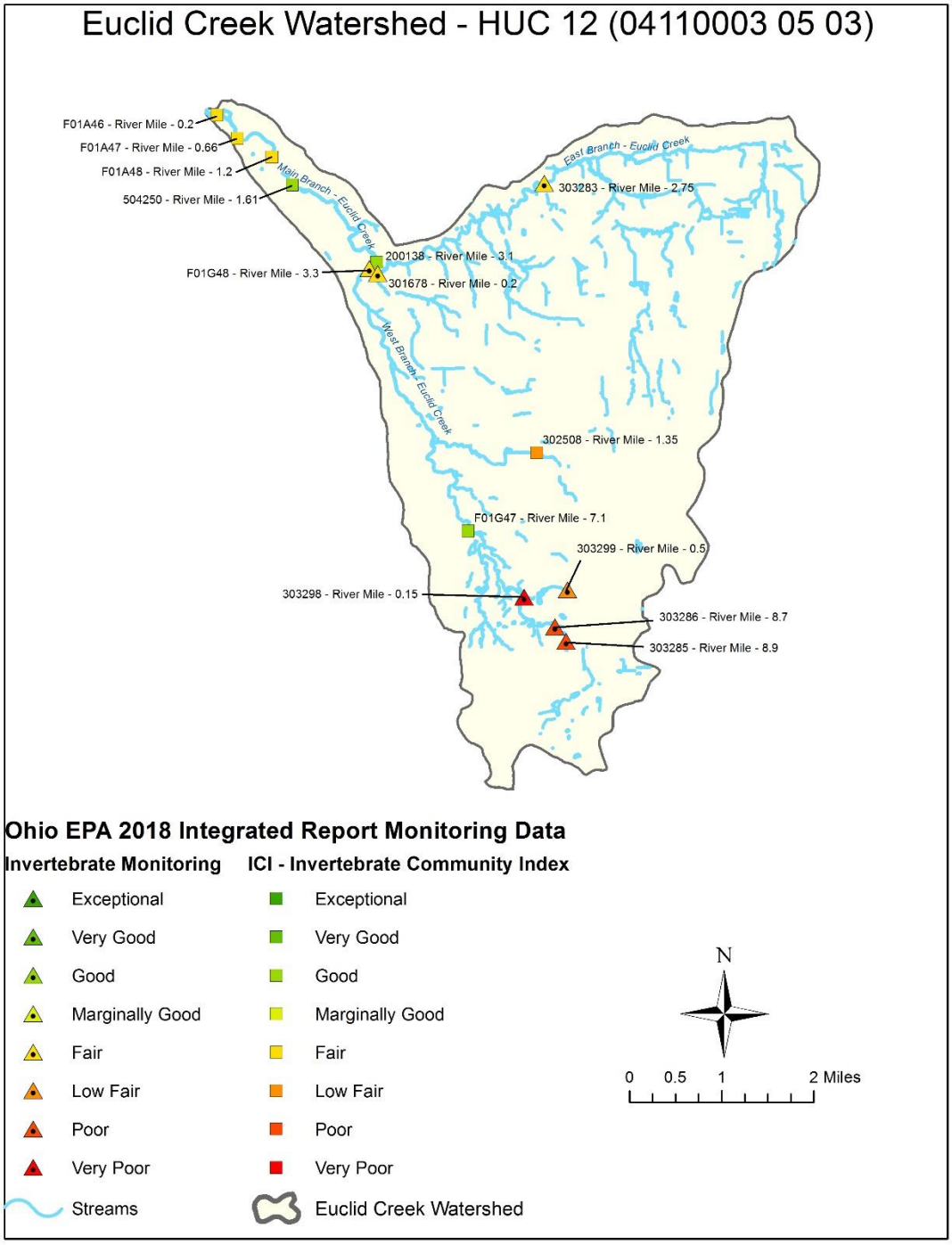
Fish IBI scores range from 20 to 36 within the basin, all are below the applicable biocriteria standard. The modified index of well-being (Miwb), used to evaluate functional stability of the fish community, also show scores below applicable standards (scores ranged from 5.25-7.98). Euclid Creek is considered a headwater stream (<20 mi2 drainage area) for most of its watershed. The MIwb was not utilized for headwater streams. Fish communities exhibited low diversity and a high percent composition of tolerant species. Top carnivores were generally absent from sampling sites, a sign of disturbed systems. Darters and sculpins were also absent in Euclid Creek, which are normally found in healthy streams. It should be noted that the number of species collected downstream of a dam located on the mainstem near St. Clair Avenue, was consistently greater than the number of species located above the dam in previous cycles of monitoring.



Euclid Creek Ohio EPA 2018 Integrated Report Fish Monitoring Map

Macroinvertebrates (Invertebrate Community Index (ICI))

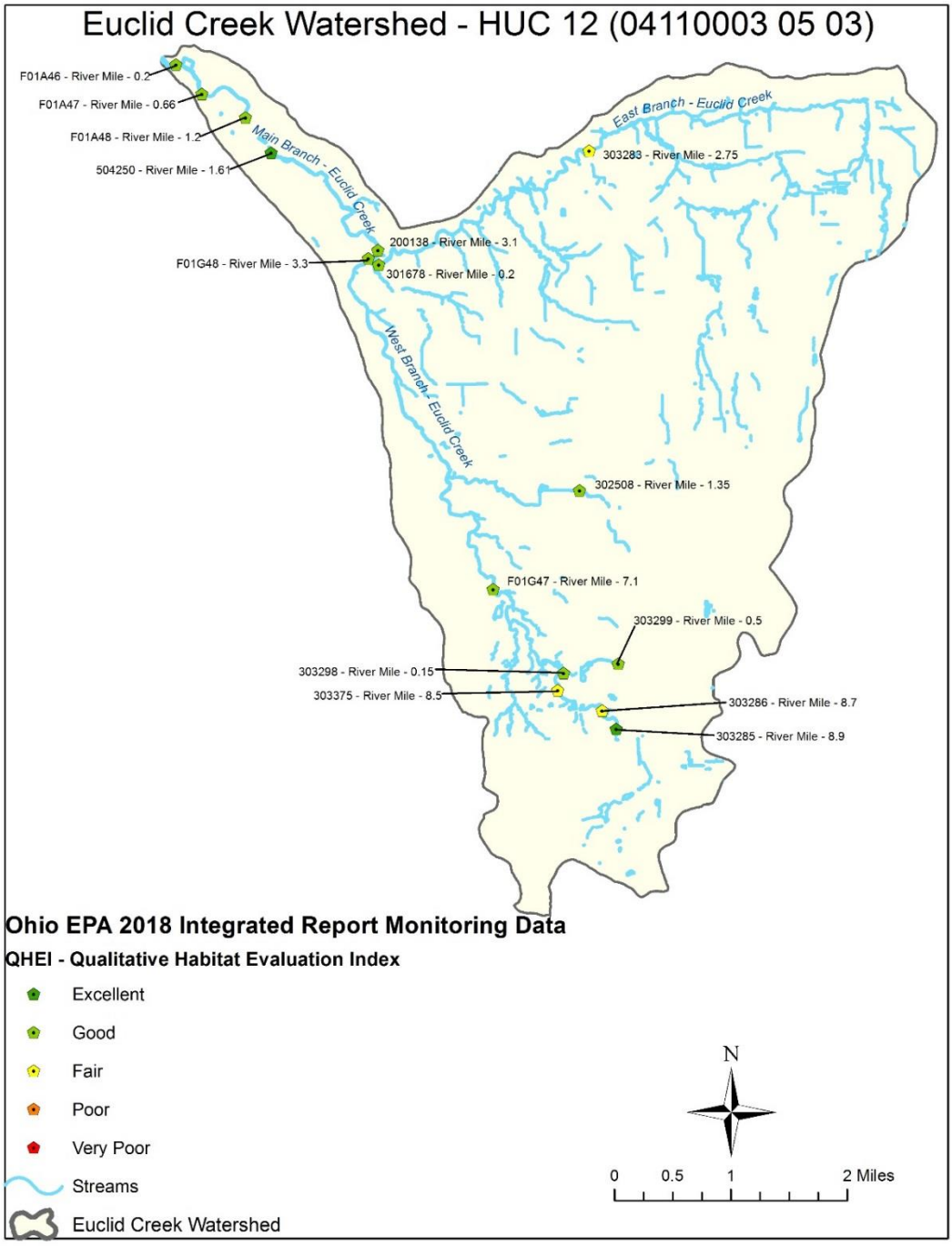
While the fish communities remain impaired, macroinvertebrate communities show signs of potential attainment in some locations. The lower three sites on the Main Branch (RM 0.2, RM 0.66 and RM 1.2) are not meeting the water quality standard of 34 (Invertebrate Community Index, ICI). The Saint Clair site on the Main Branch (RM 1.61) had a score of 38. The Mayfield Road site on the West Branch (RM 7.10) had an ICI of 34. Macroinvertebrate communities are still a concern in the headwaters of the East Branch and West Branch with narrative scores ranging from Very Poor to Fair.



Euclid Creek Ohio EPA 2018 Integrated Report Invertebrate Monitoring Map

Habitat (Qualitative Habitat Evaluation Index (QHEI))

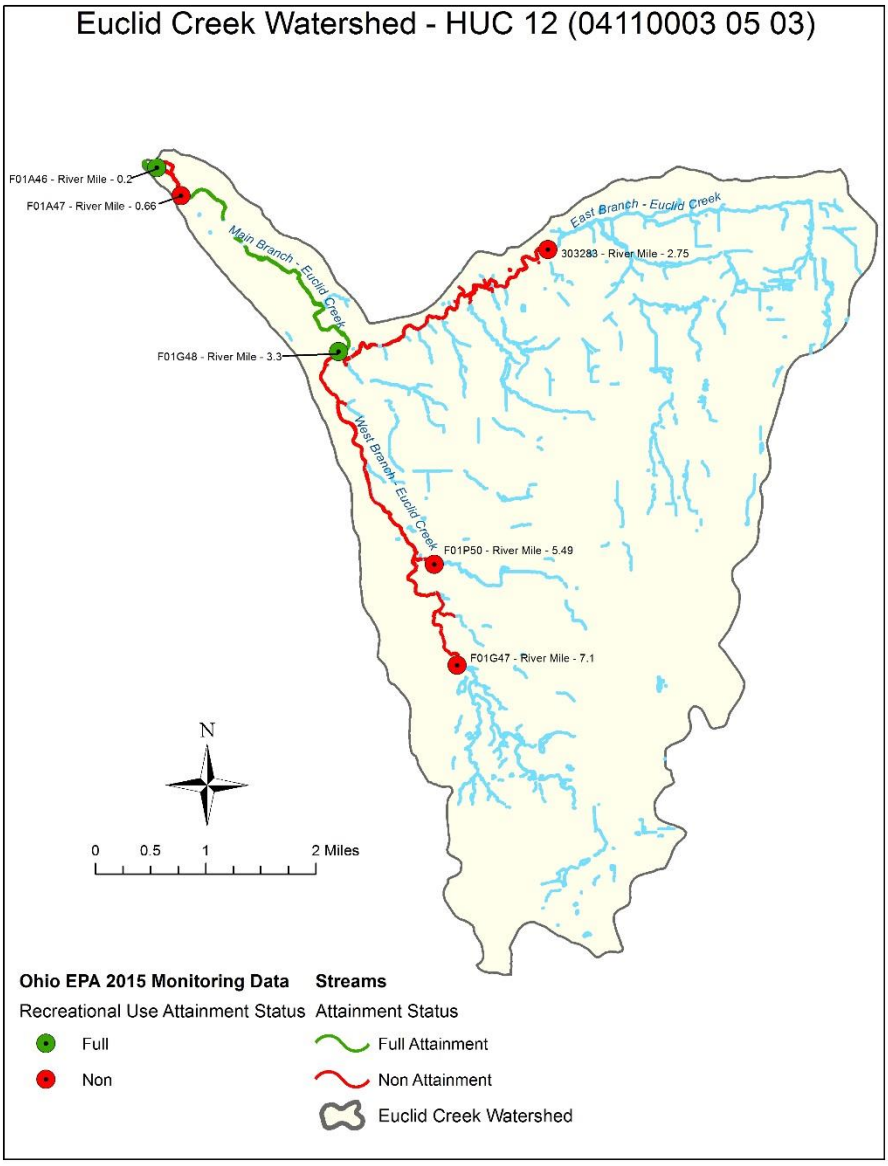
Habitat loss has been identified as a cause of impairment in Euclid Creek. The WWH use designation QHEI target is 60. Sections of Euclid Creek have had habitat impacts associated with dredging, bank hardening and culverting, along with bedrock substrate impacting scores. Many QHEI scores in the creek have improved since 2000 and 2005 monitoring, but three sites are still below the QHEI target: East Branch River Mile 2.75 (53.5), West Branch River Mile 8.7 (53.5), and West Branch River Mile 8.5 (53).



Euclid Creek Ohio EPA 2018 Integrated Report Habitat Monitoring Map

Bacteria & Recreational Use Attainment

In 2015 Ohio EPA sampled bacteria at six stations in the Euclid Creek watershed to determine recreational use attainment. Recreational use attainment is based on comparing the geometric mean of E. coli in colony forming units per 100 ml of water to the Primary Contact Recreation (PCR) Classes A or B geometric mean water quality criterion of 126 or 161 cfu/100 ml (Ohio Administrative Code 3745-1-07). Two locations sampled met full recreational use attainment: East Branch Euclid Creek near the mouth (RM 0.2) and Euclid Creek at Euclid Park Boulevard (RM 3.3). The other four sampling stations did not meet recreational use attainment: East Branch Euclid Creek at SR 175/US 6 (RM 2.75), Euclid Creek at Lake Shore Boulevard (RM 0.66), Euclid Creek at Mayfield Road (RM 7.1), and Tributary to Euclid Creek at Anderson Road (RM 5.49).



Euclid Creek Ohio EPA 2015 Recreational Use Attainment Map

Euclid Creek Recreation Use Attainment Table (2015 Ohio EPA Sampling Data)

Site Location	RM	# of Samples	Recreation Use	Geometric Mean*	Max*	Recreational Attainment Status
Euclid Creek Watershed - HUC 041100030503						
East Branch Euclid Creek near mouth	0.2	5	PCR-B	97.58	280	FULL
East Branch Euclid Creek @ SR 175/ US 6	2.75	5	PCR-B	505.26	1100	NON
Euclid Creek @ Euclid Park BLVD	3.3	5	PCR-B	137.15	2600	FULL
Euclid Creek @ Lake Shore BLVD	0.66	8	PCR-B	729.23	2300	NON
Euclid Creek @ Mayfield Rd	7.1	5	PCR-B	881.75	3700	NON
Trib. to Euclid Cr (5.49) @ Anderson Rd	5.49	4	PCR-B	287.10	580	NON

*All values are expressed in colony forming units (cfu) per 100 ml of water. Shaded values exceed the applicable PCR Class A or B geometric mean criterion.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

The impairments within the Euclid Creek watershed have been identified through the Ohio EPA TMDL planning process, Ohio EPA watershed surveys, field assessments within the Watershed Action Plan process, assessment of the beneficial uses administered by the Great Lakes Water Quality Agreement, and through community input. The Euclid Creek TMDL used sampling conducted by Ohio EPA, NEORSD, Cuyahoga County Board of Health and John Carroll University to examine the conditions and determine causes and sources of the limited water quality within Euclid Creek. The TMDLs addressed in the Euclid Creek TMDL plan are phosphorus, habitat and siltation. The Ohio EPA 2018 Integrated Report utilized monitoring data to reassess causes and sources within the watershed. The causes and sources of impairment for the watershed are summarized below.

Causes of Impairment in the Euclid Creek Watershed

Causes	Reference Information
Bacteria Counts	Euclid Creek TMDL
Cause Unknown	Ohio EPA 2018 Integrated Report
Dissolved Oxygen	Euclid Creek TMDL
Flow Alteration/Flow Regime Modification	Euclid Creek TMDL & Ohio EPA 2018 Integrated Report
Habitat Alterations	Euclid Creek TMDL & Ohio EPA 2018 Integrated Report
Loss of Riparian Zone	Euclid Creek TMDL
Organic Enrichment	Euclid Creek TMDL
Phosphorus Loads	Euclid Creek TMDL
Pollutants in Urban Stormwater	Ohio EPA 2018 Integrated Report
Suburbanization	Euclid Creek TMDL
Urbanization	Euclid Creek TMDL

Sources of Impairment in the Euclid Creek Watershed

Sources	Reference Information
Accelerated Erosion/Sedimentation	Euclid Creek TMDL
Channelization	Ohio EPA 2018 Integrated Report
Combined Sewer Overflows (lower 1.6 miles)	Euclid Creek TMDL
Culverts	Cuyahoga SWCD Watershed Planning Process
Dams & Inline Basins	Euclid Creek TMDL
Municipal (urbanized high-density area)	Ohio EPA 2018 Integrated Report
Riparian/Floodplain Development	Cuyahoga SWCD Watershed Planning Process
Sediment resuspension (contaminated sediment)	Ohio EPA 2018 Integrated Report
Septic systems (Household Sewage Treatment Systems – HSTS)	Euclid Creek TMDL
Source unknown	Ohio EPA 2018 Integrated Report
Spills	Euclid Creek TMDL
Urban Runoff/Storm Sewers	Euclid Creek TMDL & Ohio EPA 2018 Integrated Report

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

There are several organizations and agencies that work in the Euclid Creek Watershed to improve habitat and water quality. The most active groups are the Northeast Ohio Regional Sewer District (NEORSD), the Cleveland Metroparks (CMP) and Cuyahoga County Board of Health (CCBH). NEORSD has a watershed-based Stormwater Management Program that officially started in 2016 and they are inventorying and identifying problem areas in the watershed from erosion and channel stability issues to assisiting with maintenance by clearing debris jams impacting infrastructure. NEORSD's master planning for Euclid Creek will begin in 2018. CMP also owns the largest portion of public parklands in the watershed and they have developed reservation-specific plans. Lastly, Cuyahoga County Board of Health collects data on bacteria / organic enrichment.

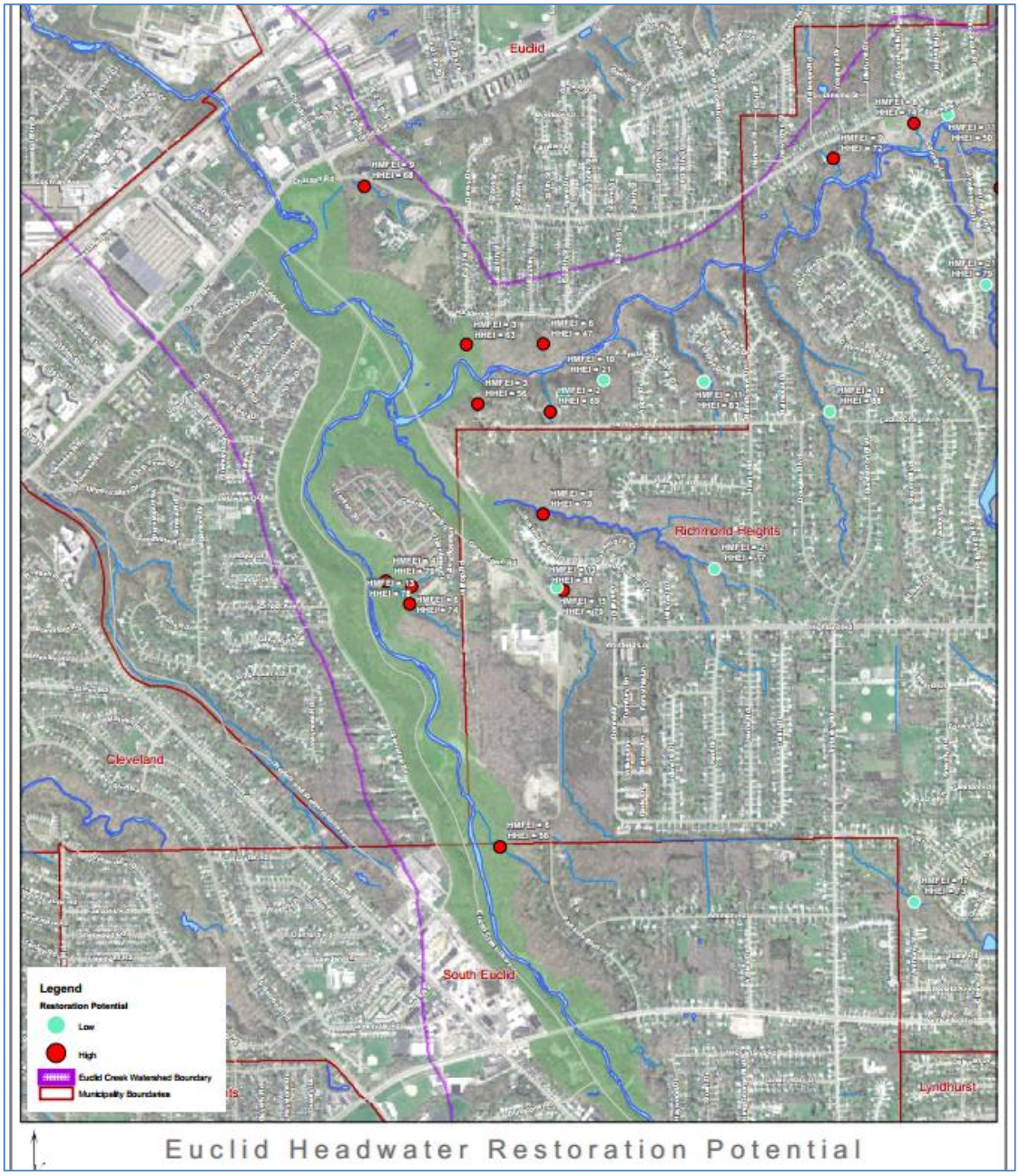
2.4.1 Euclid Creek Watershed Headwater Stream Assessment, 2004 – Cleveland Metroparks

In 2004, the Cleveland Metroparks surveyed a total of 73 sites using OEPA Headwater Habitat Evaluation Index (HHEI) forms and protocol during the summer months. The data was used to help prioritize areas for protection and restoration and for overall land management decisions. And for long term monitoring of watershed health, impacts and areas of special interest. 23 sites were sampled in the Main Branch of Euclid Creek and 50 were sampled in the East Branch.

As part of the monitoring, habitat scoring was collected using OEPA's Headwater Habitat Evaluation Index (HHEI) and macroinvertebrate data was collected using Headwater Macroinvertebrate Field Evaluation Index (HMFEI) protocols. These scores were then used to identify the stream classes of the headwater streams. Of the headwater streams monitored, 9% were classified as Class I; 56% were Class II and 35% were Class III. Overall, scores in Euclid Creek confirmed that the system suffers from the impacts of high urbanization and development displayed by the overall lower HHEI and HMFEI scores. Upstream impacts affect water quality downstream as is evidenced by garbage, channelization of the stream and debris from construction.

With the data, we then compared the HHEI and HMFEI scores to get restoration potential in order to help prioritize projects. If sites are 'red' (Figure 10), this means that the HHEI/habitat conditions are good, but the HMFEI/macroinvertebrate diversity is low, meaning that there is a localized water quality issue that could be fixed by a targeted restoration project. If sites are 'green', while the area still might be prime for a restoration project, it is of lesser priority in the Watershed than the red sites.

Figure 10

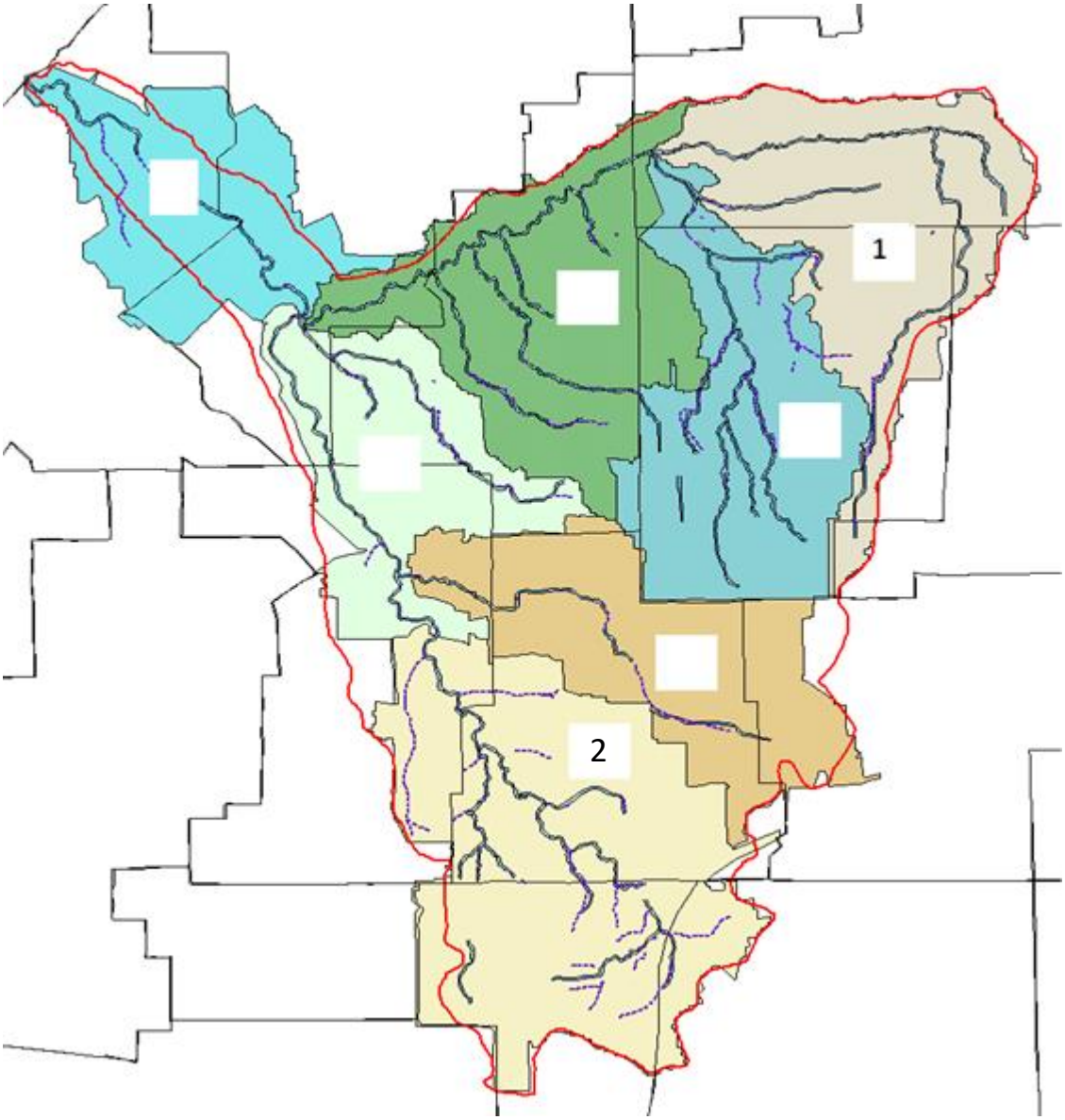

Euclid
Richmond Heights
Cleveland
South Euclid
Lyndhurst
Legend
Restoration Potential
Low
High
Euclid Creek Watershed Boundary
Municipality Boundaries
Euclid Headwater Restoration Potential

Chapter 3: Critical Area Conditions & Restoration Strategies

3.1 Overview of Critical Areas

Euclid Creek was divided into 7 subwatersheds as part of the WAP process. For the NPS-IS, we will use the subwatershed boundaries to demarcate and detail 7 critical areas in the Euclid Creek HUC-12 (Figure 11). The sub-watersheds were developed as a result of using the Northeast Ohio Regional Sewer District's RIDE Study Draft delineation comprised of drainage areas ranging from 1,400-3,000 acres in size. According to the 2016 Ohio EPA Integrated Report, of the 12 sampling locations, 8 are in non attainment, 3 are in partial attainment and 1 is in full attainment. For this report, we are focusing on Critical Area 1 and Critical Area 2. Critical Area 1 has one sampling point that is in Non-Attainment, located just downstream of the CA-1 western boundary. Critical Area 2 has one sampling point that is in Non-Attainment, located in the middle of the subwatershed.

Figure 11 –Critical Areas Map, Euclid Creek Watershed



3.2 Critical Area 1-East Branch (CA1-EB): Conditions, Goals & Objectives for Upper East Branch – Chagrin Plateau Subwatershed of Euclid Creek HUC-12

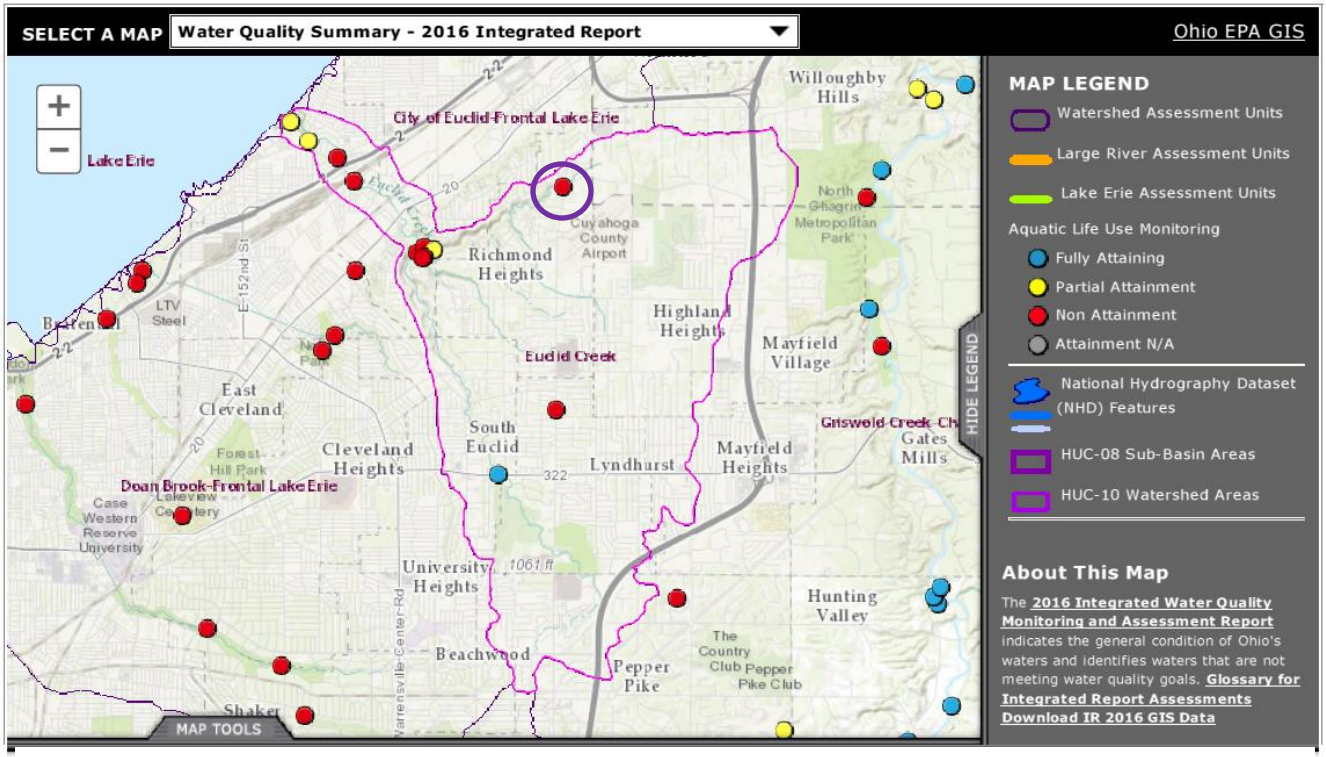
3.2.1 Detailed Characterization

According to the Ohio EPA 2016 Integrated Report (Figure 12), the Upper East Branch-Chagrin Plateau Critical Area (CA-1), was sampled at River Mile (RM) 2.7 at Richmond Road and the East Branch of Euclid Creek, where the site is listed in Non Attainment of the Warmwater Habitat aquatic life use designation. Causes of impairment for the overall watershed according to the Ohio EPA Integrated Report are sedimentation/siltation, organic enrichment/DO, flow alteration and direct habitat alterations and the sources of impairment are urban runoff/storm sewers, municipal (urbanized high density area) and combined sewer overflows (which does not apply in Euclid Creek's headwaters).

Using the rationale from the Handbook for Developing Watershed Plants to Restore and Protect our Waters (US EPA, 2008, Section 10.3.4): "In general, management practices are implemented immediately adjacent to the waterbody or upland to address the sources of pollutant loads".

Critical Area 1 is located in the northeastern most corner of the watershed at the headwaters of the East Branch of Euclid Creek (Figure 11). CA-1 is one of the least densely developed areas of the watershed with lot sizes being closer to one acre in size and little commercial development. The East Branch traverses through single family developments that range from the 1960's to present day. Several largescale residential developments occurred between 2000 and 2013 in Highland Heights and Willoughby Hills that appear to have impacted the water resource as was shown with the East Branch degrading from Partial Attainment to Non Attainment over this period of time. In addition to the single family development, I-271 and the Progressive Campus (office use) exists where the stream travels as it makes its journey to the deep valley of the Lower East Branch.

Figure 12 – Ohio EPA 2016 Integrated Report



Aquatic Life Use Assessment Details:

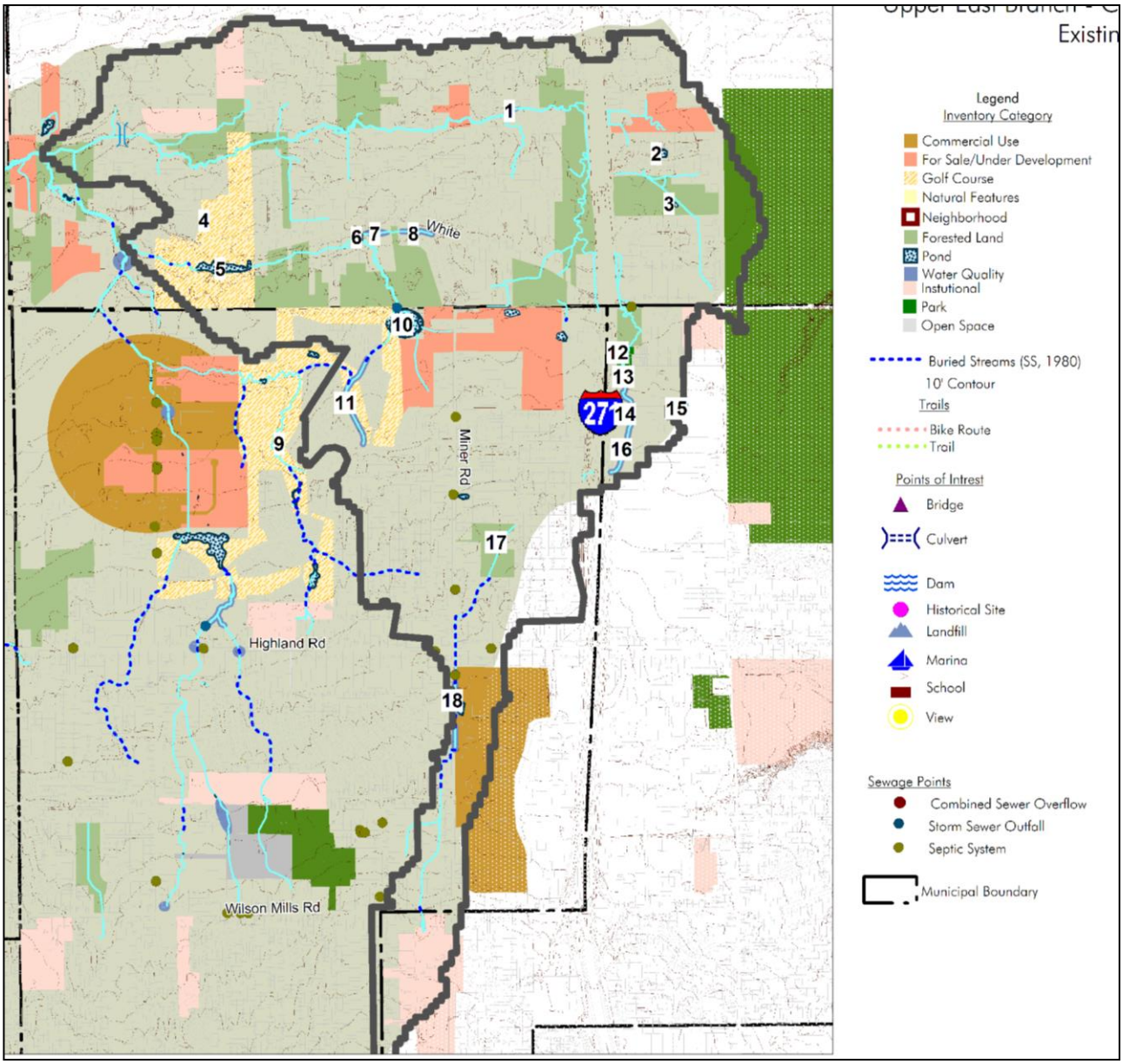
Most Recent Data:

Year	Station Name	Attainment Status	Beneficial Uses	River Mile	Drainage Area (sqm)
2014	EUCLID CREEK NEAR MOUTH @ WILDWOOD PARK	Partial	Warmwater Habitat	0.20	23.2
2014	EUCLID CREEK @ LAKE SHORE BLVD.	Partial	Warmwater Habitat	0.66	23.0
2014	EUCLID CREEK DST. VILLAVIEW RD.	Non	Warmwater Habitat	1.20	22.7
2014	EUCLID CREEK @ ST. CLAIR AVE.	Non	Warmwater Habitat	1.61	22.0
2014	EUCLID CREEK NEAR EUCLID @ HIGHLAND RD. (UPPER CROSSING)	Non	Warmwater Habitat	3.10	21.3
2014	EUCLID CREEK @ EUCLID PARK BLVD.	Non	Warmwater Habitat	3.30	8.8
2014	EUCLID CREEK DST. MAYFIELD GOLF COURSE @ MAYFIELD RD.	Full	Warmwater Habitat	7.10	3.4
2011	E. BR. EUCLID CREEK @ MOUTH, DST. DAM	Non	Warmwater Habitat	0.10	12.5
2011	E. BR. EUCLID CREEK NEAR MOUTH, UPST. OLD DAM (FREE-FLOWING)	Non	Warmwater Habitat	0.20	12.5
2009	E. BR. EUCLID CREEK NEAR MOUTH, UPST. FROM IMPOUNDED REACH	Partial	Warmwater Habitat	0.25	10.8
2014	E. BR. EUCLID CREEK AT RICHMOND HEIGHTS @ RICHMOND RD.	Non	Warmwater Habitat	2.70	2.7
2014	TRIB. TO EUCLID CREEK (5.49) AT LYNDHURST @ RICHMOND RD.	Non	Warmwater Habitat	1.35	1.2

Causes of Impairment:
sedimentation/siltation
organic enrichment/DO
impairment unknown
flow alteration
direct habitat alterations

Sources of Impairment:
urban runoff/storm sewers (NPS)
source unknown
municipal (urbanized high density area)
combined sewer overflows

Figure 13 - Upper East Branch – Chagrin Plateau Subwatershed / Critical Area 5



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Selected Sites and Issues

1. Stream Segment (West of Lamplight) – Gabions on both banks of stream
2. Pond (On Rosewood Trail) – Pond located on residential properties
3. Pond (On wooded property off SOM Center Rd.) – Pond located adjacent to stream on wooded property
4. Airport Greens Golf Course – Mowing to stream, potential water quality contributions
5. Inline Pond (On Airport Greens Golf Course) – Place for Aesthetics
6. Inline Pond (South of White Rd.) – Pond located on residential properties
7. Stream Segment (South of White Rd.) – Some vegetation present on stream banks
8. Stream Segment (South of White Rd.) – Located on residential property – mowed to edge of stream
9. Stonewater Golf Club – mowing to stream – potential water quality contributions
10. Detention Basin (South of Highland Road) – Stormwater wet pond
11. Stream Segment (Through Stonewater Golf Course) –Mowed to edge of stream
12. Conservation Easement (Progressive Property) – Easement held by Cuyahoga Soil & Water Conservation District
13. Inline Pond (on Progressive Property – North) – Stormwater wet pond
14. Inline Pond (on Progressive Property – South) – Stormwater wet pond
15. Pond (Industrial Property in Mayfield Heights) – Stormwater wet pond
16. Stream Segment (on Property South of Progressive) – Mowed to stream
17. Pond (on East of Miner Road) – Pond located adjacent to stream on wooded property
18. Stream Segment (Located on Phillips Property) – Straightened and mowed to stream edge
19. Stream Segment (Located on Willoughby-Eastlake School Board Property) – Channel incised and eroding, opportunity for floodplain reconnection and stream restoration

3.2.2 Detailed Biological Conditions

Figure 13 above shows that the one sampling site just downstream of CA-1 is in Non Attainment. Monitoring details are unavailable. Likewise, for the draft 2015 Ohio EPA Survey for Attainment, monitoring at RM 2.75 was also deemed in Non Attainment. At this location (Table 2), fish-IBI scored a 30, well below the target of 40; macroinvertebrates-ICI was considered Fair; and habitat/QHEI scored at 53.5, below the target of 60. Once data is available, analysis of fish, macroinvertebrate and habitat will be added to this section. The specific cause of impairment at this site is 'other flow regime alterations' and the source is 'urban runoff/storm sewers'.

3.2.3 Detailed Causes and Associated Sources

The specific cause of impairment at the East Branch RM 2.75 site according to Ohio EPA's 2015 sampling is 'other flow regime alterations' and the source is 'urban runoff/storm sewers'. From Ohio EPA's Integrated Report which includes data from 2014 at this location (RM 2.70), the causes of impairment for the overall watershed that apply to CA-5 according to the Ohio EPA Integrated Report are sedimentation/siltation, organic enrichment/DO, flow alteration and direct habitat alterations and the sources of impairment are urban runoff/storm sewers, and municipal (urbanized high density area).

Projects that improve habitat are anticipated to have a positive effect on QHEI scoring and as habitat improves, it is expected that the IBI, MIwb and ICI scoring will also improve.

3.2.4 Outline Goals and Objectives for the Critical Area

As described above, the primary reasons for impairments in this area are from sedimentation/siltation, organic enrichment/DO, flow alteration and direct habitat alterations. Due to the suburban nature of this Critical Area, nonpoint source runoff is a major contributor to impairments. Goals and objectives that address the impairments are:

Goals:

Goal 1: Achieve QHEI score of 60 at East Branch sampling site (RM 2.7)

- NOT ACHIEVED : Site currently has a score of 53.5

Objectives:

Objective 1: Restore 3,450 linear feet of stream or eroded sections of streambank using natural stream design in Critical Area 1.

Objective 2: Protect 50 acres of forested riparian habitat

As these objectives are implemented, water quality monitoring (project related) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards and established metrics). These objectives will be reevaluated and modified if determined to be necessary. When reevaluating, the Euclid Creek Watershed Program partners will reference the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013), which has a complete listing of all eligible NPS management strategies to consider including:

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

3.3 Critical Area 2-Headwaters (CA2-HW): Conditions, Goals & Objectives for Headwaters – Cedar and Mayfield Roads Subwatershed of Euclid Creek HUC-12

3.3.1 Detailed Characterization

According to the Ohio EPA 2018 Integrated Report (Figure 14), the Headwaters – Cedar and Mayfield Roads Subwatershed (CA-2), was sampled at River Mile (RM) 8.7 at Euclid Creek dst. 319 project area where the site is listed in non attainment of the Warmwater Habitat aquatic life use designation. Three other sampling stations in the subwatershed were listed in non-attainment of the Warmwater Habitat aquatic life use designation, and one was listed in partial attainment (Figure 14). The most downstream sampling station in the watershed at Mayfield Road (RM 7.1) is in attainment of the Warmwater Habitat aquatic life use designation. Causes of impairment for the overall watershed according to the Ohio EPA Integrated Report are flow regime modification, pollutants in urban stormwater, habitat alterations, and unknown causes. The sources of impairment are urban runoff/storm sewers, municipal (urbanized high density area), channelization, sediment resuspension (contaminated sediment), and combined sewer overflows (which does not apply in Euclid Creek's headwaters).

Critical Area 2 is in the southwestern corner or the watershed at the headwaters of the West Branch of Euclid Creek (Figure 16). CA-2 headwaters have been largely modified by past development patterns. Many areas along the stream have been channelized with gabion systems due to the proximity of structures to the stream. There are a few remaining floodplain areas north of Mayfield Road adjacent from South Euclid-Lyndhurst Library and smaller areas north of Liberty Road. Despite recent restoration of Acacia Golf course to a naturalized area, aquatic life use impairments still exist downstream of Acacia.

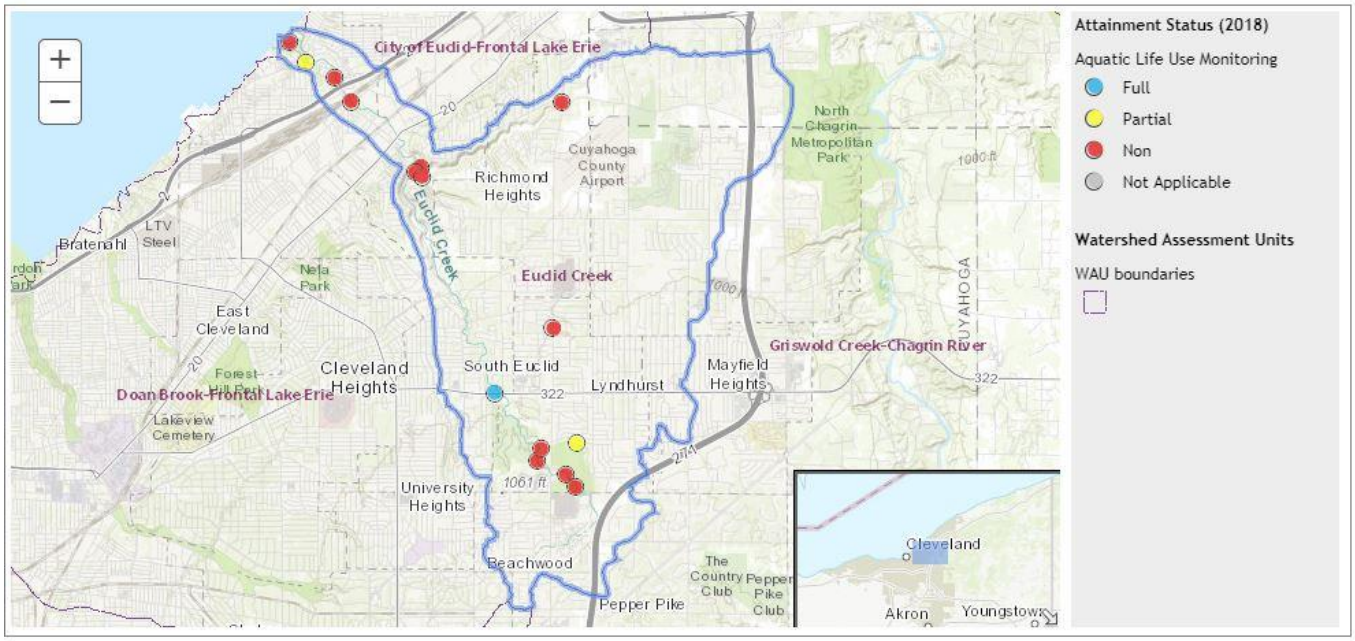
The subwatershed has a high density of single family residential areas and a high concentration of commercial areas present in the I-271, Mayfield, and Cedar Road thoroughfares. Mayfield Sands golf course lies south of Mayfield road and is managed by a private club organization. Acacia, Mayfield Sands Golf Course, and areas of the Cleveland Clinic campus have areas of naturalized stream, but erosion and entrenchment exist.

Figure 14 – Ohio EPA Integrated Water Quality Report for 2018

Integrated Water Quality Report for 2018
Ohio Environmental Protection Agency

Watershed Assessment Unit Summary 04110003 05 03

Euclid Creek 23.31 square miles



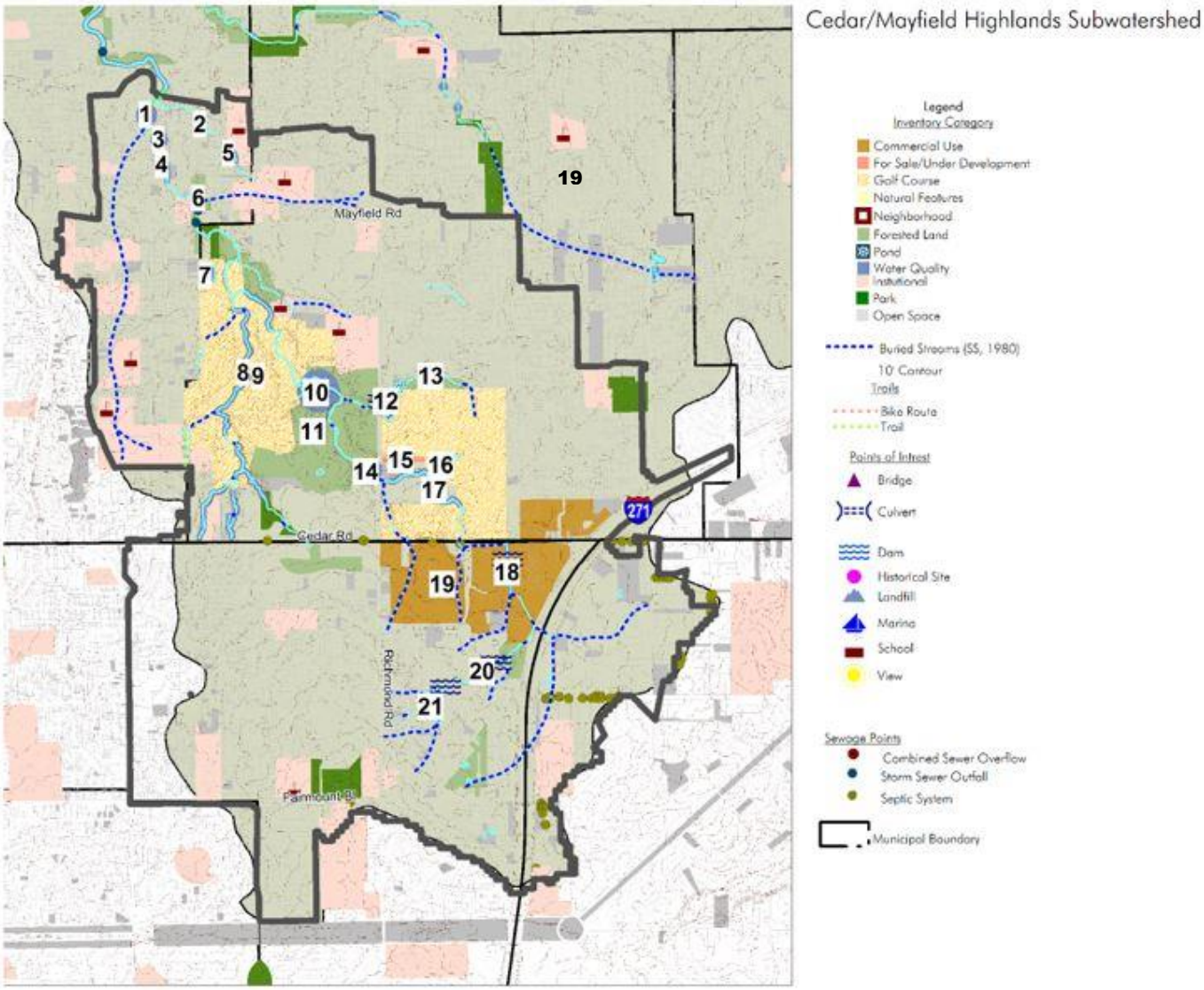
Aquatic Life Use Assessment Details:
Most Recent Data:

Year	Station Name	Attainment Status	Beneficial Uses	River Mile	Drainage Area (sqm)
2014	TRIB. TO EUCLID CREEK (5.49) AT LYNDHURST @ RICHMOND RD.	Non	Warmwater Habitat	1.35	1.2
2014	EUCLID CREEK DST. VILLAVIEW RD.	Non	Warmwater Habitat	1.20	22.7
2016	Tributary to Euclid Creek (RM 8.1) @ Sand Ridge Golf Course	Non	Warmwater Habitat	0.15	0.3
2016	Tributary to Euclid Creek (RM 8.1) off Golfway Lane	Partial	Warmwater Habitat	0.50	0.1
2015	EUCLID CREEK DST RICHMOND RD	Non	Warmwater Habitat	8.50	1.5
2015	E. BR. EUCLID CREEK NEAR MOUTH, UPST. OLD DAM (FREE-FLOWING)	Non	Warmwater Habitat	0.20	12.5
2014	EUCLID CREEK DST. MAYFIELD GOLF COURSE @ MAYFIELD RD.	Full	Warmwater Habitat	7.10	3.4
2015	Euclid Creek dst. 319 project area	Non	Warmwater Habitat	8.70	1.5
2014	EUCLID CREEK NEAR EUCLID @ HIGHLAND RD. (UPPER CROSSING)	Non	Warmwater Habitat	3.10	21.3
2016	EUCLID CREEK NEAR MOUTH @ WILDWOOD PARK	Non	Warmwater Habitat	0.20	23.2
2016	EUCLID CREEK @ ST. CLAIR AVE.	Non	Warmwater Habitat	1.61	22.0
2016	Euclid Creek dst. Cedar Rd. within 319 project area	Non	Warmwater Habitat	8.90	1.5
2015	EUCLID CREEK @ EUCLID PARK BLVD.	Non	Warmwater Habitat	3.30	8.8
2015	East Branch Euclid Cr @ SR 175/US 6	Non	Warmwater Habitat	2.75	7.0
2016	EUCLID CREEK @ LAKE SHORE BLVD.	Partial	Warmwater Habitat	0.66	23.0

Causes of Impairment:
FLOW REGIME MODIFICATION
POLLUTANTS IN URBAN STORMWATER
HABITAT ALTERATIONS
CAUSE UNKNOWN

Sources of Impairment:
source unknown
channelization
municipal (urbanized high density area)
sediment resuspension (contaminated sediment)
urban runoff/storm sewers

Figure 15 - Headwaters – Cedar and Mayfield Roads Subwatershed (Critical Area-2)



Selected Sites and Issues

1. Stream Segment (Liberty Road) – Gabions on streambanks
2. Future Development (Liberty Road) – Liberty Court Condominiums
3. Stream Segment (Edmond Road) – Streambanks Channelized
4. Stream Segment (Condo Complex) – Forested Streambanks, bridge over stream to recreation area
5. Stream segment (North of Farnhurst Road) – Vegetation on streambanks
6. Open Space (North of Mayfield Road) – Forested vacant land & backyards, floodplain intact
7. Pond (on Mayfield Golf Course) – part of golf course aesthetics
8. Stream Segments – Forested streambanks
9. Mayfield Golf Course – mowing to stream, potential water quality contributions
10. Stream segment – stream restoration in progress
11. Potential Development site (off Cedar road) – Room for Stream to Develop a floodplain
12. Inline Pond (on Golf Course) – River has been dammed to build this pond
13. Private Community Park – common open space
14. Stream Scouring – stream entrenched, disconnected from floodplain, detention basin adjacent to stream
15. Future Development (off Richmond Road) – River Creek Condominiums
16. Acacia Golf Course – Possible water quality contributor
17. Stream Segment – Good habitat natural stream channel conditions
18. Stream Segment (West of 271) – Channel is open but is altered and confined
19. Commercial development – High concentration of impervious surface due to parking lots and rooftops
20. Inline Pond (North End of Condo Complex) – River has been dammed to build this pond.
21. Inline Pond (South End of Condo Complex) – River has been dammed to build this pond

3.3.2 Detailed Biological Conditions

Figure 14 above shows that four sampling sites within CA-2 are in in Non Attainment. At the Euclid Creek (19-041-000) 8.7 – downstream project area location (Table 2), fish-IBI scored a 20, well below the target of 40; macroinvertebrates-ICI was considered Poor; and habitat/QHEI scored at 53.5, below the target of 55. Once data is reviewed in detail, analysis of fish, macroinvertebrate and habitat will be added to this section. The specific cause of impairment at this site is 'other flow regime alterations' and the source is 'urban runoff/storm sewers'.

3.3.3 Detailed Causes and Associated Sources

The specific cause of impairment at the Euclid Creek (19-041-000) 8.7 – downstream project area site according to Ohio EPA's 2015 sampling is 'other flow regime alterations' and the source is 'urban runoff/storm sewers'. From Ohio EPA's Integrated Report which includes data from 2015 at this location (RM 8.70), the causes of impairment for the overall watershed that apply to CA-2 according to the Ohio EPA Integrated Report are flow regime modification, habitat alterations, pollutants in urban stormwater, and unknow causes. The sources of impairment are channelization, sediment resuspension (contaminated sediment), municipal (urbanized high density area), urban runoff/storm sewers, and unknown sources.

Projects that improve habitat are anticipated to have a positive effect on QHEI scoring and as habitat improves, it is expected that the IBI, MIwb and ICI scoring will also improve.

3.3.4 Outline Goals and Objectives for the Critical Area

As described above, the primary reasons for impairments in this area are from channelization, sediment resuspension (contaminated sediment), municipal (urbanized high density area), and urban runoff/storm sewers. Due to the suburban nature of this Critical Area, nonpoint source runoff is a major contributor to impairments. Goals and objectives that address the impairments are:

Goals:

Goal 1: Achieve QHEI score of 55 at West Branch sampling site (RM 8.7)

- NOT ACHIEVED: Site currently has a score of 53.5

Objectives:

Objective 1: Restore 7,000 linear feet of stream or eroded sections of streambank using natural stream design in Critical Area 2.

Objective 2: Protect 235 acres of forested riparian habitat

Objective 3: Increase permeability of land cover - Achieve 18% effective imperviousness (Add green infrastructure to existing and new development sites, retrofit existing BMPs)

As these objectives are implemented, water quality monitoring (project related) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards and established metrics). These objectives will be reevaluated and modified if determined to be necessary. When reevaluating, the Euclid Creek Watershed Program partners will reference the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013), which has a complete listing of all eligible NPS management strategies to consider including:

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

Chapter 4: Projects and Implementation Strategy

4.1 Overview Table and Project Sheet for Critical Area

Below is a project and evaluation needs believed to be necessary to remove the impairments to the Euclid Creek HUC-12, Critical Area 1 and 2, as a result of the identified cause and associated sources of nonpoint source pollution. Because the attainment status is based on biological conditions, it will be necessary to periodically re-evaluate the status of the critical area to determine if the implemented projects are sufficient to achieve restoration. Time is an important factor to consider when measuring project success and overall status. Biological systems in some cases can show response fairly quickly (months); others may take longer (years) to show recovery. There may also be reasons other than nonpoint source pollution for the impairment. Those issues will need to addressed under different initiatives, authorities or programs which may or may not be accomplished by the same implementers addressing the nonpoint source pollution issues.

For the Euclid Creek HUC-12 there will be one *Project and Implementation Strategy Overview Table* for each critical area. Future versions of this NPS-IS will include subsequent sections as more Critical Areas are refined and submitted. If another nonpoint source impairment is identified for one of the existing critical area, it will be explained and added to that critical area's table. If a new impairment is determined that has a different critical area, a new table will be created for that new critical area. The project described in the Overview Tables have been prioritized using the following three step prioritization method:

Priority 1: Projects that specifically address one or more of the listed Objectives for the Critical Area.

Priority 2: Projects where there is landowner willingness to engage in projects that are designed to address the causes and sources of impairment or where there is an expectation that such potential projects will improve water quality in Euclid Creek.

Priority 3: Input from the public on water quality issues and/or project ideas gathered from a permanent online survey and periodic stakeholder meetings will be evaluated for correlation between known causes and sources and potential for inclusion in the NPS-IS.

Project Summary Sheets are in subsection 4.2.2 and 4.3.2. These summary sheets provide the essential nine elements for short-term and/or next step projects that are in development and/or in need of funding. As projects are implemented and new projects developed, these sheets will be updated. Any new summary sheets created will be submitted to the state of Ohio for funding eligibility verification (i.e., all nine elements are included).

4.2 Critical Area 1: Overview Table and Project Sheet(s) for Euclid Creek HUC-12

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

4.2.1 Critical Area 1: Overview Table and Project Summary Sheet(s)

The Euclid Creek HUC-12 Critical Area 1 is based on non-attainment status of aquatic life use designation at the East Branch sampling site (RM 2.7). The Critical Area 1 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This Overview Table is intended to show a prioritized path toward the restoration of the Euclid Creek HUC-12.

For Euclid Creek Watershed HUC-12 (04110003 05 03)—Critical Area #1								
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								

Altered Stream and Habitat Restoration Strategies								
CA-1, EB	1	1, 2	EB1.1	East Branch of Euclid Creek, School of Innovation Stream	Cuyahoga SWCD	Completed 2019	$264,000	319, WRRSP
Agricultural Nonpoint Source Reduction Strategies								
High Quality Waters Protection Strategies								
Other NPS Causes and Associated Sources of Impairment								

Section 4.2.2 Critical Area 1: Project Summary Sheet

Critical Area 1: Project 1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	*East Branch of Euclid Creek, School of Innovation Stream Restoration Project*
criteria d	**Project Lead Organization & Partners**	*Cuyahoga SWCD (lead) & FOEC, City of Willoughby Hills, Willoughby-Eastlake School Board and School of Innovation, Lake County Stormwater Management Department, and Lake County SWCD (partners)*
criteria c	**HUC-12 and Critical Area**	*04110003 05 03 —Critical Area 5*
criteria c	**Location of Project**	*32500 Chardon Road, Willoughby Hills, Ohio 44094*
n/a	**Which strategy is being addressed by this project?**	*Passively Treat Stormwater Runoff – Strategy: Protect and restore effective riparian buffers*
criteria f	**Time Frame**	*Short-Term (Priority) (1-3 yr)*
criteria g	**Short Description**	*Cuyahoga Soil & Water Conservation District (CSWCD) through the Euclid Creek Watershed Coordinator is proposing the following restoration project in the City of Willoughby Hills on Willoughby-Eastlake Board of Education property. The East Branch of the Euclid Creek subwatershed draining into the project area is approximately 1.43 square miles. The watershed is composed of a mix of dense residential development, open land with light commercial development, and woodland. The restoration of the East Branch of Euclid Creek will address the largest causes of impairments identified in the Euclid Creek Watershed Action Plan (WAP) and the Total Maximum Daily Load (TMDL) Report which include habitat alteration, phosphorus and siltation. By reducing erosion rates and flooding, and restoring hydrology and water quality protection, we will address these three primary impairments.*
criteria g	**Project Narrative**	*CSWCD proposes to restore and stabilize one primary and one headwater creek which will result in measurable improvements in the stream, floodplain, and riparian habitat. Approximately 700 feet of stream channel will be restored and stabilized, ~1,600 feet (two banks) of poor quality stream bank will be regraded or relocated and stabilized using native plants and bioengineering techniques, ~0.8 acres of existing degraded forest will be converted to native floodplain shrub land and native riparian forest, ~3.3 acres of existing riparian forest will be enhanced, 0.6 acres will be treated for invasives and restored with natives, and 0.1 acres of floodplain wetland will be created. Raising the QHEI score to 60 within ten years after the restoration has been completed is the goal of the project.* *Within the reach to be restored there are areas of bank erosion, channel incision (downcutting), invasive species, an undersized culvert and, due to the entrenched condition, the absence of a functioning riparian floodplain. These conditions limit the biological communities and ecological services provided by the stream. The riparian vegetation consists of mostly mature trees intermixed with snags and*

		vernal pools with patches of phragmites in more open areas. If left in their current condition, the creeks will likely continue to downcut and erode stream banks until reaching a point of equilibrium, but this channel evolution will come at the cost of further erosion, habitat loss, increased sedimentation downstream, and reduced water quality, and will further jeopardize infrastructure such as the undersized culverts, potentially causing other debris jams and culvert bypass events. *Once the project is complete, Cuyahoga SWCD will have brought 1,600 linear feet of the East Branch of Euclid Creek into attainment of its WWH aquatic life use designation, created 0.8 acres of floodplain and 3.3 acres of enhanced riparian forest area. These restoration activities are expected to improve stream habitat and water quality on site and benefit downstream segments of Euclid Creek that are currently not attaining their designated WWH aquatic life use.*
criteria d	**Estimated Total cost**	*Planning and Design - $45,000* *Habitat Restoration - $193,000* *Construction Oversight - $10,000* *Personnel/Fringe - $10,000* *Misc (Legal, Signage) - $6,000* ***Total Cost - $264,000***
criteria d	**Possible Funding Source**	*Section 319, WRRSP*
criteria a	**Identified Causes and Sources**	*Cause: Other Flow Regime Alterations and Direct Habitat Alterations* *Source: Urban runoff/storm sewers*
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*It is estimated that 3,450 linear feet of stream is in need of restoration in CA1 and that 50 acres of riparian habitat is in need of protection.*
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	*This project will help us reach 20% of the stream restoration goal (700 lf) and 3% of the riparian protection goal (1.4 acres).* *Once 100% of the goals for CA1 are met, we anticipate that progress toward a QHEI of 60 at RM 2.7 will be reached within 10 years of implementation.*
	Part 3: Load Reduced?	*Estimated 225 pounds/year nitrogen, 87 pounds/year phosphorus, and 140 tons/year sediment*
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	*If this project is funded through 319 funding, Ohio EPA will conduct monitoring. If funded through an alternate source, CSWCD will coordinate with agency partners like Northeast Ohio Regional Sewer District and Ohio EPA to assist with monitoring.*
criteria e	**Information and Education**	*2 public meetings, design charrette with students, press release, project webpage with regular updates*

4.3 Critical Area 2: Overview Table and Project Sheet(s) for Euclid Creek HUC-12

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

4.3.1 Critical Area 2: Overview Table and Project Summary Sheet(s)

The Euclid Creek HUC-12 Critical Area 2 is based on non-attainment status of aquatic life use designation at the West Branch sampling site (RM 8.7). The Critical Area 2 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This Overview Table is intended to show a prioritized path toward the restoration of the Euclid Creek HUC-12.

For Euclid Creek Watershed HUC-12 (04110003 05 03)—Critical Area #2								
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								
Altered Stream and Habitat Restoration Strategies								
CA-2, WB	1	1, 2	WB1.1	West Branch of Euclid Creek, Cleveland Clinic Lyndhurst Campus Stream Restoration	Cuyahoga SWCD	1-2 years	$600,500	319, WRRSP
CA-2, WB	2	1,2	WB1.2	West Branch of Euclid Creek, Mayfield Sand Ridge Euclid Creek Stream Restoration Project	Cuyahoga SWCD	1-2 years	$2,237,000	GLRI, 319, Local Partners
CA-2, WB	3	1.3	WB1.3	West Branch of Euclid Creek, Mayfield Sand Ridge Tributary to Euclid Creek Stream Restoration Project	Cuyahoga SWCD	1-5 years	$2,546,000	GLRI, 319, Local Partners
Agricultural Nonpoint Source Reduction Strategies								
High Quality Waters Protection Strategies								
Other NPS Causes and Associated Sources of Impairment								

Section 4.3.2 Critical Area 2: Project Summary Sheet

Critical Area 2: Project 1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	*West Branch of Euclid Creek, Cleveland Clinic Lyndhurst Campus Stream Restoration Project*
criteria d	**Project Lead Organization & Partners**	*Cuyahoga SWCD (lead) & FOEC, City of Lyndhurst, Cleveland Clinic, Northeast Ohio Regional Sewer District (partners)*
criteria c	**HUC-12 and Critical Area**	*04110003 05 03 —Critical Area 2*
criteria c	**Location of Project**	*1950 Richmond Rd, Lyndhurst, OH 44124*
n/a	**Which strategy is being addressed by this project?**	*Passively Treat Stormwater Runoff – Strategy: Protect and restore effective riparian buffers, reconnect stream to floodplain*
criteria f	**Time Frame**	*Short-Term (Priority) (1-3 yr)*
criteria g	**Short Description**	*The project proposes restoration and stabilization of 700 feet of stream channel and 1,110 feet (two banks) of stream bank in the West Branch of Euclid Creek to address habitat alteration, phosphorus and siltation. The project aims to reduce erosion rates and flooding and restore hydrology and water quality protection. 1.8 acres of maintained lawn and low-quality forest will be replaced with native riparian forest; 6.0 acres of existing riparian forest will be enhanced and treated for invasives; and, 0.1 acres of wetland will be created.*
criteria g	**Project Narrative**	*CSWCD proposes to rehabilitate Euclid Creek by relocating the channel away from a failing hillslope to a large lawn area and excavate a significant portion of the floodplain along both new banks to create a new floodplain with stable slopes. The project would also establish native riparian woody vegetation along the floodplain to slow overland flow, capture woody debris, and process nutrients and sediment from the channel. Within the stream channel, numerous pools and rifles would be constructed to improve habitat for both fish and macroinvertebrates. A low-head dam would be modified into a series of rock steps to allow passage of aquatic organisms. Metrics associated with the project are to restore and stabilize approximately 700 feet of stream channel; regrade and/or relocate and stabilize nearly 1,100 feet (two banks) of poor quality stream bank using native plants and bioengineering techniques; roughly 1.8 acres of maintained lawn and low quality forest will be replaced with native riparian forest; 6.0 acres of existing riparian forest will be enhanced and treated for invasives; and, 0.1 acres of wetland will be created. The goal is to raise the QHEI score to 55 within five years after the restoration is completed.* *Within the reach to be restored there are areas of bank erosion, failing bank stabilization practices, channel incision (downcutting), maintained lawn, low-head dam, invasive species, and, due to the entrenched condition, the absence of a functioning riparian floodplain. These conditions limit the biological communities and ecological services provided by the stream and are aesthetically unappealing. The riparian vegetation consists of mostly young trees and shrubs with*

		herbaceous vegetation within a narrow riparian corridor bordered by an expanse of maintained lawn. *Past and current human activities – including channelization of the stream against the right hillslope- have left the stream morphology, riparian vegetation, habitat and streambanks in a disturbed state, while ongoing stormwater runoff, streambank erosion, a low-head dam, and mowing continue to negatively impact the stream and riparian habitat. Downcutting has also left the floodplain mostly disconnected from the Creek, while invasive plants such as phragmites, have taken hold on a low floodplain bench at the downstream end of the reach.* *If left in its current condition, the Creek will likely continue to downcut and erode stream banks until reaching a point of equilibrium, but this will come at a cost of further erosion, habitat loss, increased sedimentation downstream, reduced water quality, and further jeopardizing infrastructure such as a pedestrian trail at the top of the slope.* *Once the project is complete, Cuyahoga SWCD will have brought 1,100 linear feet of the West Branch of Euclid Creek into attainment of its WWH aquatic life use designation, restored 1400 feet of floodplain and 1.8 acres of enhanced riparian forest area. These restoration activities are expected to improve stream habitat and water quality on site and benefit downstream segments of Euclid Creek that are currently not attaining their designated WWH aquatic life use.*
criteria d	**Estimated Total cost**	*Planning and Design - $100,000* *Stream and Floodplain Restoration - $475,000* *Construction Oversight - $10,000* *Personnel/Fringe - $10,000* *Misc (Legal, Signage) - $5,500* ***Total Cost - $600,500***
criteria d	**Possible Funding Source**	*Section 319, WRRSP*
criteria a	**Identified Causes and Sources**	*Cause: Other Flow Regime Alterations and Direct Habitat Alterations* *Source: Urban runoff/storm sewers*
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*It is estimated that 7,000 linear feet of stream is in need of restoration in CA2 and that 235 acres of riparian habitat is in need of protection.*
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	*This project will help us reach 15% of the stream restoration goal (1,100 lf) and 0.77% of the riparian protection goal (1.8 acres).* *Once 100% of the goals for CA2 are met, we anticipate that progress toward a QHEI of 55 at RM 8.7 will be reached within 10 years of implementation.*
	Part 3: Load Reduced?	*Estimated 163 pounds/year nitrogen, 62 pounds/year phosphorus, and 98 tons/year sediment*
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	*If this project is funded through 319 funding, Ohio EPA will conduct monitoring. If funded through an alternate source, CSWCD will coordinate with agency partners like Northeast Ohio Regional Sewer District and Ohio EPA to assist with monitoring.*
criteria e	**Information and Education**	*2 public meetings, press release, project webpage with regular updates*

Critical Area 2: Project 2		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	*West Branch of Euclid Creek, Mayfield Sand Ridge Euclid Creek Stream Restoration Project*
criteria d	**Project Lead Organization & Partners**	*Cuyahoga SWCD (lead), Ohio Lake Erie Commission, US EPA, Cuyahoga AOC & Northeast Ohio Regional Sewer District (partners)*
criteria c	**HUC-12 and Critical Area**	*04110003 05 03 — Critical Area 2*
criteria c	**Location of Project**	*1545 Sheridan Rd, Lyndhurst, OH 44124*
n/a	**Which strategy is being addressed by this project?**	*Passively Treat Stormwater Runoff – Strategy: Protect and restore effective riparian buffers, reconnect stream to floodplain* *Restore and Protect Riparian Habitat – Strategy: Stabilize severely eroding stream banks, Increase native shrub and tree plantings in riparian areas, Restore and protect riparian habitat*
criteria f	**Time Frame**	*Short-Term (Priority) (1-3 yr)*
	Short Description	*This project proposes 3 phases to restore and stabilize 2,950 feet of West Branch Euclid Creek on the Mayfield Campus Golf Course using several methods as applicable: creating a low flow channel with floodplain bench, floodplain grading, and stream realignment. Upon completion of all three phases, 5,950 feet (two banks) of poor-quality streambank will be regraded or relocated and stabilized using native plants and bioengineering techniques. Roughly 10.7 acres of existing riparian forest will be enhanced and treated for invasives, roughly 3.7 acres of rough will be converted to native riparian forest or meadow.* *The restoration and stabilization of these reaches of Euclid Creek will result in measurable improvements in the stream, floodplain, and riparian habitat.*

criteria g	**Project Narrative**	*This project will specifically meet the goals and objectives for GLRI Focus Area 1: Areas of Concern in meeting the management actions set forth for the Cuyahoga Area of Concern. Additionally, the project will contribute to GLRI Focus Area 4- Habitat and Species, as it will further improve and enhance habitat conditions within the Great Lakes.* *At the watershed scale, this site is in the Cuyahoga River Area of Concern (AOC), which is one of 43 Great Lakes AOCs under Annex 1 of the Great Lakes Water Quality Agreement as their ability to support aquatic life or beneficial uses has been impaired. Currently, the Cuyahoga AOC is limited to meet beneficial uses to support aquatic life. Each AOC has developed a remedial action plan and management action plan focused on remediation or removal of Beneficial Use Impairments (BUIs) that degrade water quality, negatively impact fish populations or restrict uses of waterways. Those BUIs that will be targeted as part of this project include Degradation of Fish Populations, Degradation of Benthos, and Loss of Fish & Wildlife Habitat as they are addressed by restoring instream and riparian habitat and reducing sedimentation.* *While the West Branch of Euclid Creek is currently meeting Aquatic Life Use attainment goals just downstream of the Mayfield Campus, the sections of stream on campus do not meet habitat targets. The stream is experiencing high rates of erosion, lacks access to the floodplain, and lacks a functioning riparian zone. Riffle structure in these reaches are unstable, and the slow water areas consist mostly of long shallow glides, lacking any true pool habitat. Without restoration, embeddedness of existing substrate is likely to increase.* *This project will provide a unique opportunity to build on upstream restoration efforts at Acacia Reservation. Restoration efforts at Acacia Reservation have been made to daylight areas of the stream, reconnect wetlands, and restore a functioning floodplain. These projects will help improve instream habitat, floodplain reconnection, and riparian buffer enhancement which is key to meeting habitat goals in the Cuyahoga River AOC.* *Initial concept plans at 30% design have been completed for the project site. The concept plan identified six potential phases and project areas to improve habitat conditions within this reach of Euclid Creek. The goal for all 6 phases is to restore and stabilize 5,850 feet of West Branch Euclid Creek and a tributary to the West Branch of Euclid Creek on the Mayfield Golf Course Campus using several methods as applicable: creating a low flow channel with floodplain bench, floodplain grading, and stream realignment. Upon completion of all six phases, 10,850 feet (two banks) of poor-quality streambank will be regraded or relocated and stabilized using native plants and bioengineering techniques. Roughly 27 acres of existing riparian forest will be enhanced and treated for invasives, roughly 8.7 acres of rough will be converted to native riparian forest or meadow.* *Cuyahoga SWCD has been awarded funding from Ohio Lake Erie Commission to complete 100% design for the three phases on the mainstem of Euclid Creek along the Mayfield Campus. It is anticipated 100% designs will be completed by the end of October 2020.* *The restoration and stabilization of these reaches of Euclid Creek will result in measurable improvements in the stream, floodplain, and riparian habitat. Specific outputs are listed below:* *•Approximately 5,850 feet of stream channel will be restored and stabilized.*

Critical Area 2: Project 2		
Nine Element Criteria	**Information needed**	**Explanation**
		•Nearly 10,850 feet (two banks) of poor-quality stream bank will be regraded or relocated and stabilized using native plants and bioengineering techniques. *•Roughly 0.7 acres of existing degraded forest and existing rough will be converted to native floodplain shrub land and native riparian forest.* *•Roughly 26.9 acres of existing riparian forest will be enhanced and treated for invasives, 8.7 acres of existing rough will be converted to native riparian forest or native meadow.* *•Removal of one major debris jam.* *•Raising the QHEI score to 60 within five years after the restoration has been completed.* *The ultimate outcome is for the West Branch of Euclid Creek to meet QHEI attainment scores >60 and assist with removal of the Cuyahoga AOC Habitat BUI.* *•Raising the QHEI score to 60 within five years after the restoration has been completed.*
criteria d	**Estimated Total cost**	***Total Cost - $2,237,000***
criteria d	**Possible Funding Source**	*GLRI, 319, Local Match*
criteria a	**Identified Causes and Sources**	*Cause: Other Flow Regime Alterations and Direct Habitat Alterations* *Source: Urban runoff/storm sewers*
criteria *b & h*	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*It is estimated that 7,000 linear feet of stream is in need of restoration in CA2 and that 235 acres of riparian habitat is in need of protection.*
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	*This project will help us reach 42% of the stream restoration goal (2,950 lf) and 4.5% of the riparian protection goal (10.7 acres).* *Once 100% of the goals for CA2 are met, we anticipate that progress toward a QHEI of 55 at RM 8.7 will be reached within 10 years of implementation.*
	Part 3: Load Reduced?	*Estimated 331 pounds/year nitrogen, 124 pounds/year phosphorus, and 196 tons/year sediment*
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	*CSWCD will coordinate with agency partners like Northeast Ohio Regional Sewer District and Ohio EPA to assist with pre and post project monitoring.*
criteria e	**Information and Education**	*press release, field tour, project fact sheet, project webpage with regular updates*

Critical Area 2: Project 3		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	*West Branch of Euclid Creek, Mayfield Sand Ridge Tributary to Euclid Creek Stream Restoration Project*

Critical Area 2: Project 3		
Nine Element Criteria	**Information needed**	**Explanation**
criteria d	**Project Lead Organization & Partners**	*Cuyahoga SWCD (lead), Ohio Lake Erie Commission, US EPA, Cuyahoga AOC & Northeast Ohio Regional Sewer District (partners)*
criteria c	**HUC-12 and Critical Area**	*04110003 05 03 — Critical Area 2*
criteria c	**Location of Project**	*1545 Sheridan Rd, Lyndhurst, OH 44124*
n/a	**Which strategy is being addressed by this project?**	*Passively Treat Stormwater Runoff – Strategy: Protect and restore effective riparian buffers, reconnect stream to floodplain* *Restore and Protect Riparian Habitat – Strategy: Stabilize severely eroding stream banks, Increase native shrub and tree plantings in riparian areas, Restore and protect riparian habitat*
criteria f	**Time Frame**	*Short-Term (Priority) (1-3 yr)*
	Short Description	*This project proposes 3 phases to restore and stabilize ,2900 feet of a tributary to the West Branch of Euclid Creek on the Mayfield Campus Golf Course using several methods as applicable: creating a low flow channel with floodplain bench, floodplain grading, and stream realignment. Upon completion of all three phases, 4,900 feet (two banks) of poor-quality streambank will be regraded or relocated and stabilized using native plants and bioengineering techniques. Roughly 16 acres of existing riparian forest will be enhanced and treated for invasives, roughly 5 acres of rough will be converted to native riparian forest or meadow.* *The restoration and stabilization of these reaches of Euclid Creek will result in measurable improvements in the stream, floodplain, and riparian habitat.*

criteria g	**Project Narrative**	*This project will specifically meet the goals and objectives for GLRI Focus Area 1: Areas of Concern in meeting the management actions set forth for the Cuyahoga Area of Concern. Additionally, the project will contribute to GLRI Focus Area 4- Habitat and Species, as it will further improve and enhance habitat conditions within the Great Lakes.* *At the watershed scale, this site is in the Cuyahoga River Area of Concern (AOC), which is one of 43 Great Lakes AOCs under Annex 1 of the Great Lakes Water Quality Agreement as their ability to support aquatic life or beneficial uses has been impaired. Currently, the Cuyahoga AOC is limited to meet beneficial uses to support aquatic life. Each AOC has developed a remedial action plan and management action plan focused on remediation or removal of Beneficial Use Impairments (BUIs) that degrade water quality, negatively impact fish populations or restrict uses of waterways. Those BUIs that will be targeted as part of this project include Degradation of Fish Populations, Degradation of Benthos, and Loss of Fish & Wildlife Habitat as they are addressed by restoring instream and riparian habitat and reducing sedimentation.* *While the West Branch of Euclid Creek is currently meeting Aquatic Life Use attainment goals just downstream of the Mayfield Campus, the sections of stream on campus do not meet habitat targets. The stream is experiencing high rates of erosion, lacks access to the floodplain, and lacks a functioning riparian zone. Riffle structure in these reaches are unstable, and the slow water areas consist mostly of long shallow glides, lacking any true pool habitat. Without restoration, embeddedness of existing substrate is likely to increase.* *This project will provide a unique opportunity to build on upstream restoration efforts at Acacia Reservation. Restoration efforts at Acacia Reservation have been made to daylight areas of the stream, reconnect wetlands, and restore a functioning floodplain. These projects will help improve instream habitat, floodplain reconnection, and riparian buffer enhancement which is key to meeting habitat goals in the Cuyahoga River AOC.* *Initial concepts plans at 30% design have been completed for the project site. The concept plan identified six potential phases and project areas to improve habitat conditions within this reach of Euclid Creek. The goal for all 6 phases is to restore and stabilize 5,850 feet of West Branch Euclid Creek and a tributary to the West Branch of Euclid Creek on the Mayfield Golf Course Campus using several methods as applicable: creating a low flow channel with floodplain bench, floodplain grading, and stream realignment. Upon completion of all six phases, 10,850 feet (two banks) of poor-quality streambank will be regraded or relocated and stabilized using native plants and bioengineering techniques. Roughly 27 acres of existing riparian forest will be enhanced and treated for invasives, roughly 8.7 acres of rough will be converted to native riparian forest or meadow.* *The restoration and stabilization of these reaches of Euclid Creek will result in measurable improvements in the stream, floodplain, and riparian habitat. Specific outputs are listed below:* *•Approximately 2,900 feet of stream channel will be restored and stabilized.* *•Nearly 4,900 feet (two banks) of poor-quality stream bank will be regraded or relocated and stabilized using native plants and bioengineering techniques.* *•Roughly 5 acres of existing degraded forest and existing rough will be converted to native floodplain shrub land, forest and/or native riparian meadow.*

Critical Area 2: Project 3		
Nine Element Criteria	**Information needed**	**Explanation**
		•Roughly 16 acres of existing riparian forest will be enhanced and treated for invasives *•Raising the QHEI score to 55 within five years after the restoration has been completed.* *The ultimate outcome is for the West Branch of Euclid Creek and it's tributary on Mayfield Campus to meet QHEI attainment scores >60 and assist with removal of the Cuyahoga AOC Habitat BUI.* *•Raising the QHEI score to 55 within five years after the restoration has been completed.*
criteria d	**Estimated Total cost**	***Total Cost - $2,546,000***
criteria d	**Possible Funding Source**	*GLRI, 319, Local Partners*
criteria a	**Identified Causes and Sources**	*Cause: Other Flow Regime Alterations and Direct Habitat Alterations* *Source: Urban runoff/storm sewers*
criteria *b & h*	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*It is estimated that 7,000 linear feet of stream is in need of restoration in CA2 and that 235 acres of riparian habitat is in need of protection.*
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	*This project will help us reach 41% of the stream restoration goal (2,900 lf) and 2.12% of the riparian protection goal (5 acres).* *Once 100% of the goals for CA2 are met, we anticipate that progress toward a QHEI of 55 at RM 8.7 will be reached within 10 years of implementation.*
	Part 3: Load Reduced?	*Estimated 331 pounds/year nitrogen, 124 pounds/year phosphorus, and 196 tons/year sediment*
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	*CSWCD will coordinate with agency partners like Northeast Ohio Regional Sewer District and Ohio EPA to assist with pre and post project monitoring.*
criteria e	**Information and Education**	*press release, field tour, project fact sheet, project webpage with regular updates*