Mill Creek (3)
HUC-12: 041100040602
Nine-Element
Nonpoint Source Implementation
Strategy (NPS-IS)

Version 1.0 Draft

December 10, 2019

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Chapter 1: Introduction

1.1 Report Background

The Mill Creek (3) Nonpoint Source Implementation Strategy (NPS-IS) brings Lake, Geauga and Ashtabula County communities together to protect the Grand River, address water quality issues in the watershed and manage stormwater runoff. This plan was created to restore and maintain the physical and biological integrity of water bodies within the watershed and to access funding from USEPA, Ohio EPA and other granting entities for these purposes.

1.2 Watershed Profile & History

The Mill Creek (3) Watershed is located in southeastern Lake County and north central Geauga County and western Ashtabula County (Figures 1 and 2). It is called Mill Creek (3) to distinguish it from the two other Mill Creek watersheds in the Upper Grand River. The Mill Creek (3) Watershed 12-digit Hydrologic Unit Code (HUC) is 041100040602; the watershed drains approximately 20.75 square miles. It is located in within the 10-digit HUC known as the Lower Grand River Watershed. 15% of the watershed is in Lake County, 42% is in Geauga County and 43% is in Ashtabula County. The Grand River, including both upper and lower, drains 705.5 square miles as it flows through portions of Ashtabula, Trumbull, Geauga, Portage and Lake Counties.

Mill Creek (3) is a tributary that drains into the Grand River Mainstem in the Lower Grand Watershed. It collects water from parts of Thompson Township in Geauga County, parts Madison Township in Lake County, and parts of Harpersfield and Trumbull Townships in Ashtabula County (Figure 3).

"Flow in the Grand River is fed primarily by rainfall and snow melt, with very little base flow sustained by ground water because of the river's glacial and bedrock geology. Consequently, discharge becomes quite small in the summer (relative to the drainage area) resulting in the Grand River and its tributaries having limited assimilative capacity. The Grand River is sustained by the many coldwater tributaries that continually discharge groundwater into the river. Those coldwater tributaries and other sources of base flow are essential to the overall health of the Grand River." (Ohio EPA Total Maximum Daily Loads for the Grand River (Lower) Watershed. Final Report, January 31, 2012; p. 15.)

The Mill Creek (3) Watershed supports exceptionally high-quality macroinvertebrate communities, including many infrequently collected sensitive taxa. Two of the three sites that the EPA sampled in 2004 were in Full Attainment of Coldwater Habitat. Mill Creek and its headwater tributaries have habitat conducive to supporting till-plain stream fish communities. These tributaries to the Grand River have high gradients, discontinuities in bedrock and are subject to scouring flows that result in long bedrock glides, cascades and waterfalls. (Ohio EPA Biological and Water Quality Study of the Grand River Basin 2003-2004.)

The most significant threat to the Grand River and its tributaries is changing land use through suburbanization. Research has documented that when the impervious area exceeds 5%, streams begin to deteriorate and may fall below Clean Water Act goals. Once impervious cover exceeds

25%, irreparable damage occurs. Data from 2011 showed 5.32% of the watershed as developed and 0.76% imperviousness.

51.6% of the Mill Creek Watershed is covered by forest, an important factor for good water quality.

Figure 1. Location of the Watershed

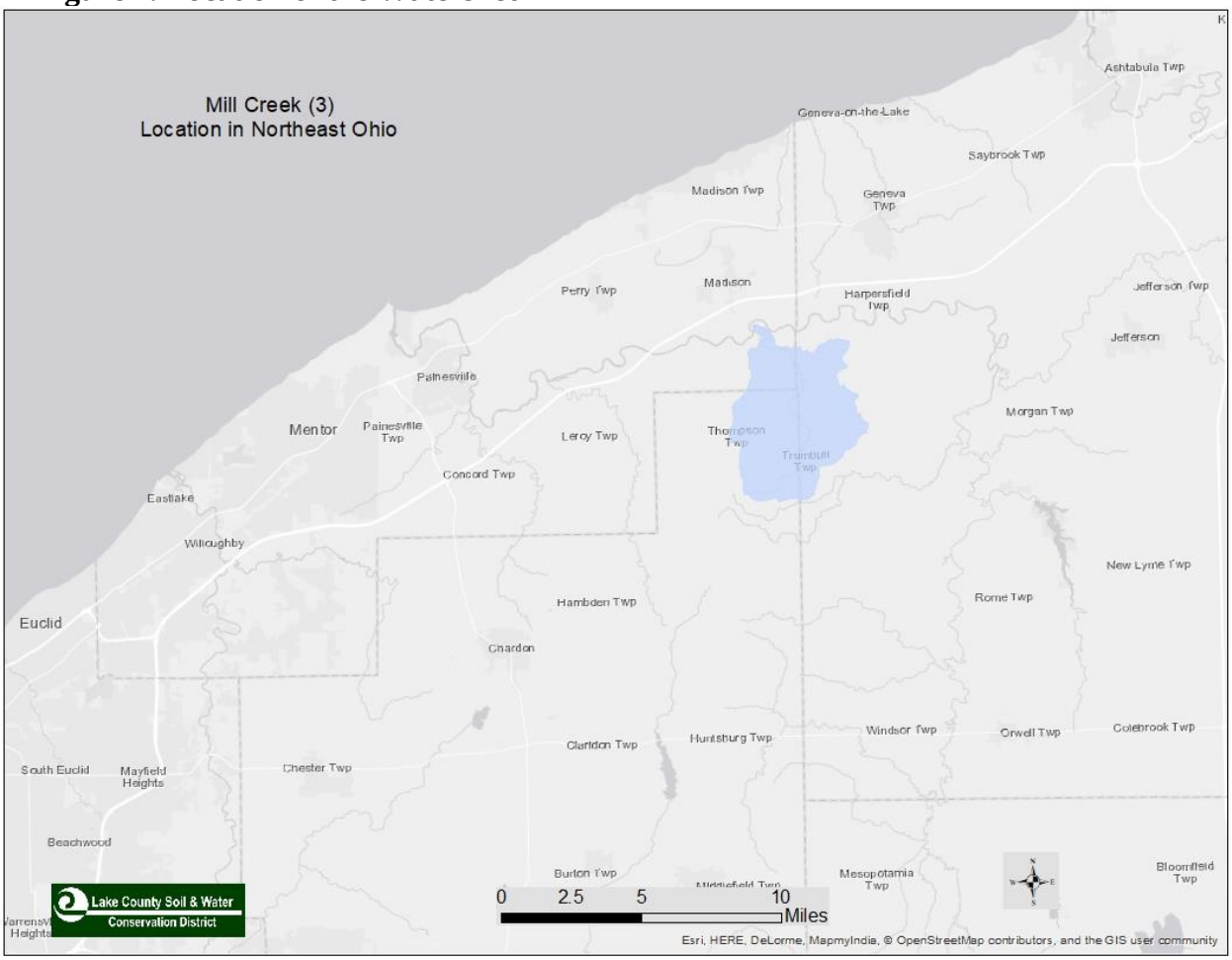


Figure 2. Location in the Lower Grand Watershed

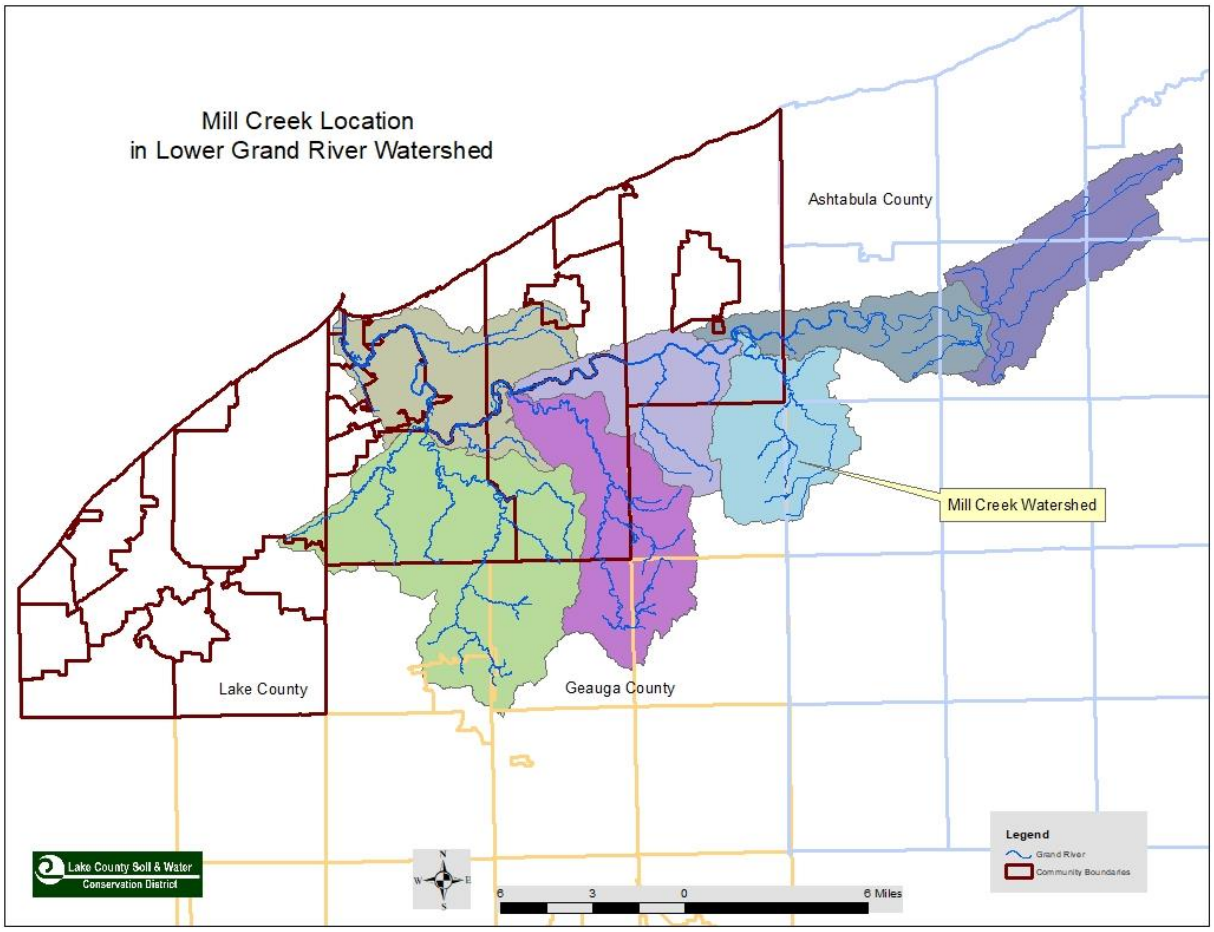


Figure 3. Watershed Communities

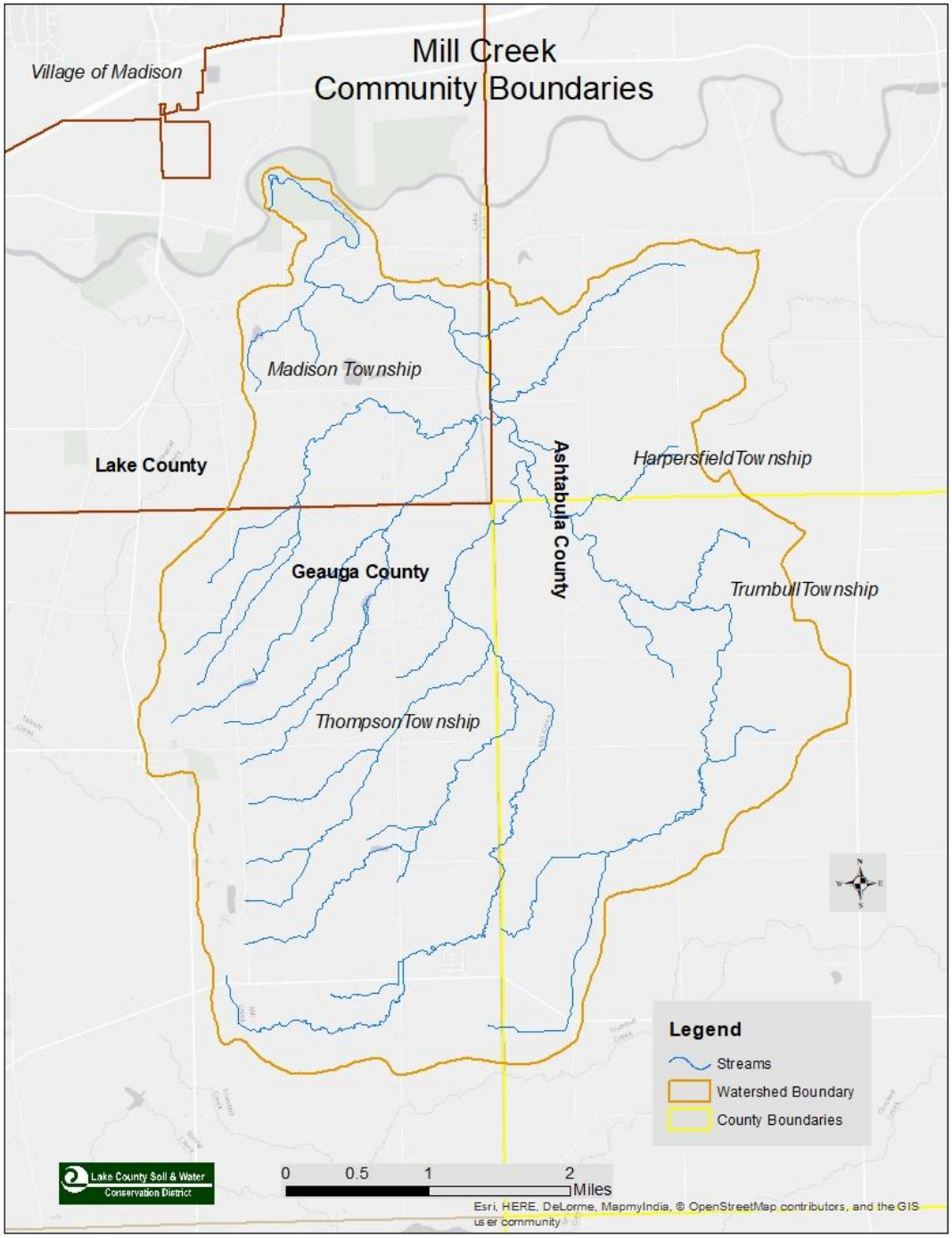
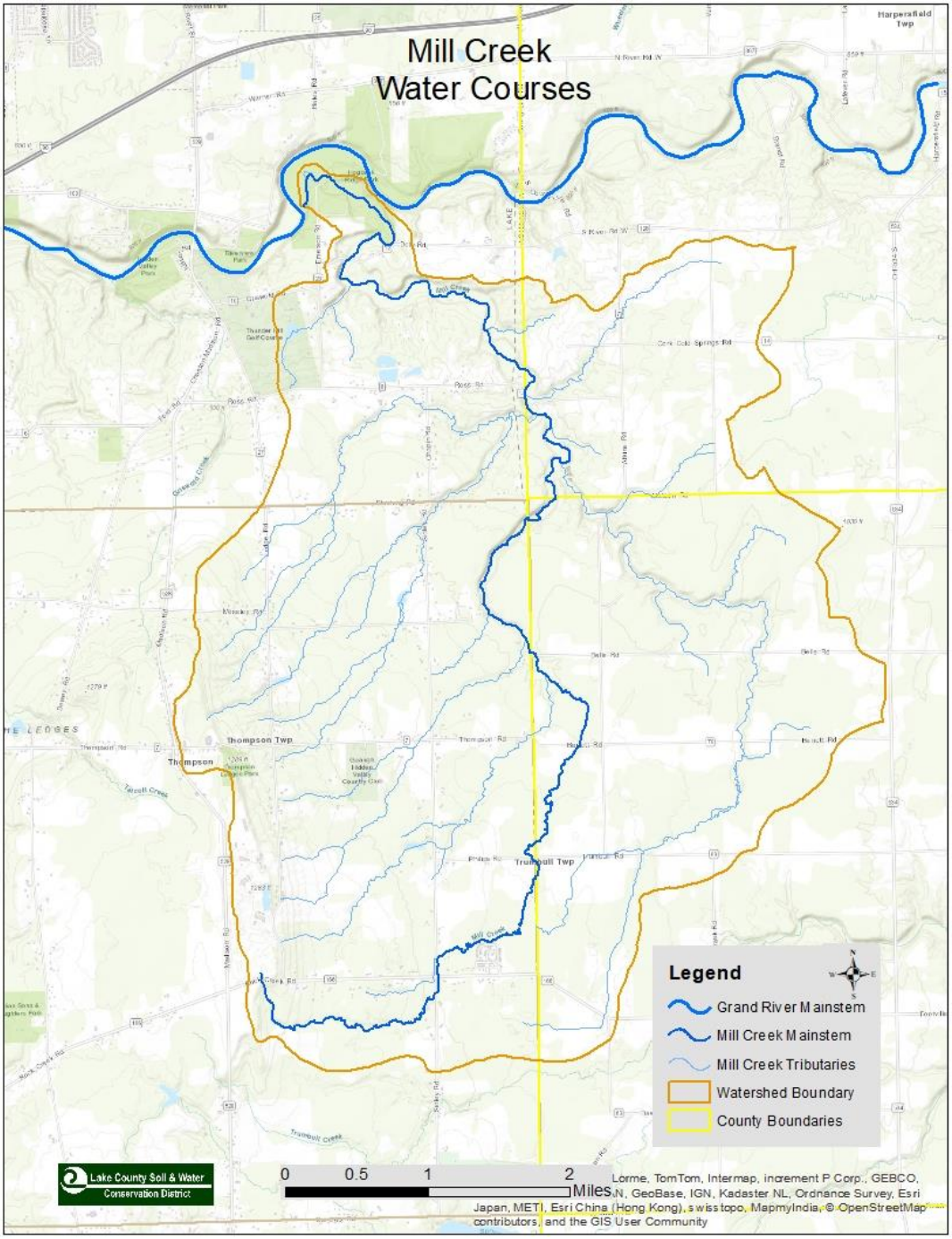


Figure 4. Watersheds within the HUC 12



The Mill Creek Watershed is bisected by the Mill Creek Mainstem, which is the only named watercourse in the watershed (Figure 4). The eastern half of the watershed is drained by one larger watercourse and several smaller ones; the western half is drained by four similarly-sized watercourses.

1.3 Public Participation and Involvement

A stakeholder meeting was held on May 24, 2019 in Thompson in Geauga County to solicit the input of members of the community, local officials and state and local agencies. Those invited to participate included Ashtabula County Park District, Harpersfield Trumbull and Austinburg Township Trustees, Ashtabula County Auditor, Ashtabula SWCD, Ashtabula Planning & Community Services, Ashtabula County Engineer, Geauga County SWCD, Geauga Park District, Geauga Planning Commission, Thompson Montville and Hambden Township Trustees, Lake County Metroparks, Madison Leroy and Perry Township Trustees, Lake County Planning and Community Development, Lake County General Health District, Cleveland Museum of Natural History, The Nature Conservancy, ODNR Division of Forestry, ODNR Division of State Parks & Watercraft- Scenic Rivers Program, Chagrin River Watershed Partners, the Natural Resources Conservation Service and Western Reserve Land Conservancy. The stakeholder meeting was a facilitated process to engage the attendees in a discussion of issues in the watershed.

Attendees included:

The Nature Conservancy
Ashtabula County Metroparks
Natural Resources Conservation Service
Chagrin River Watershed Partners
Ashtabula County Soil & Water Conservation District
Lake Metroparks
Lake County Planning and Community Development
Ashtabula County Auditor
Thompson Township Trustee

Chapter 2: HUC-12 Watershed Characterization and Assessment Summary

2.1 Summary of HUC-12 Watershed Characterization

2.1.1 Physical and Natural Features

Topography

The Mill Creek Watershed's elevation ranges from 1270 feet in the headwaters to 692 feet where it empties into the Grand River mainstem, an elevation change of 578 feet (Figure 5).

The watershed is located in the Allegheny Plateau physiographic region, which is characterized by mid-elevation hills separated by numerous narrow stream-cut valleys, and an abundance of rivers and streams. The watershed is at the northernmost extent of the Allegheny Plateau; the Lake Plain region begins below the mouth of the watershed. This region of the Plateau was glaciated.

A portion of Thompson Ledges is in the west-southwest corner of the watershed. Thompson Ledges is a geologic feature consisting of Sharon Conglomerate sandstone, sandstone with embedded quartz pebbles. It was formed at the bottom of a very wide and shallow river over 300 million years ago. Later glaciation exposed massive ledges of the Sharon Conglomerate to

weathering. The porousness of the rock (which underlies much of Geauga County) supplies most of Geauga's drinking water. Tributaries originating from the Ledges are important to maintaining base flow to the Grand River, and should be targeted for protection.

The headwaters of the tributaries in the western half of the watershed originate in the Thompson Ledges formation. The stream channels become deeply incised in the northern half of the watershed (Figures 5, 6 and 7).

Figure 5. Topography

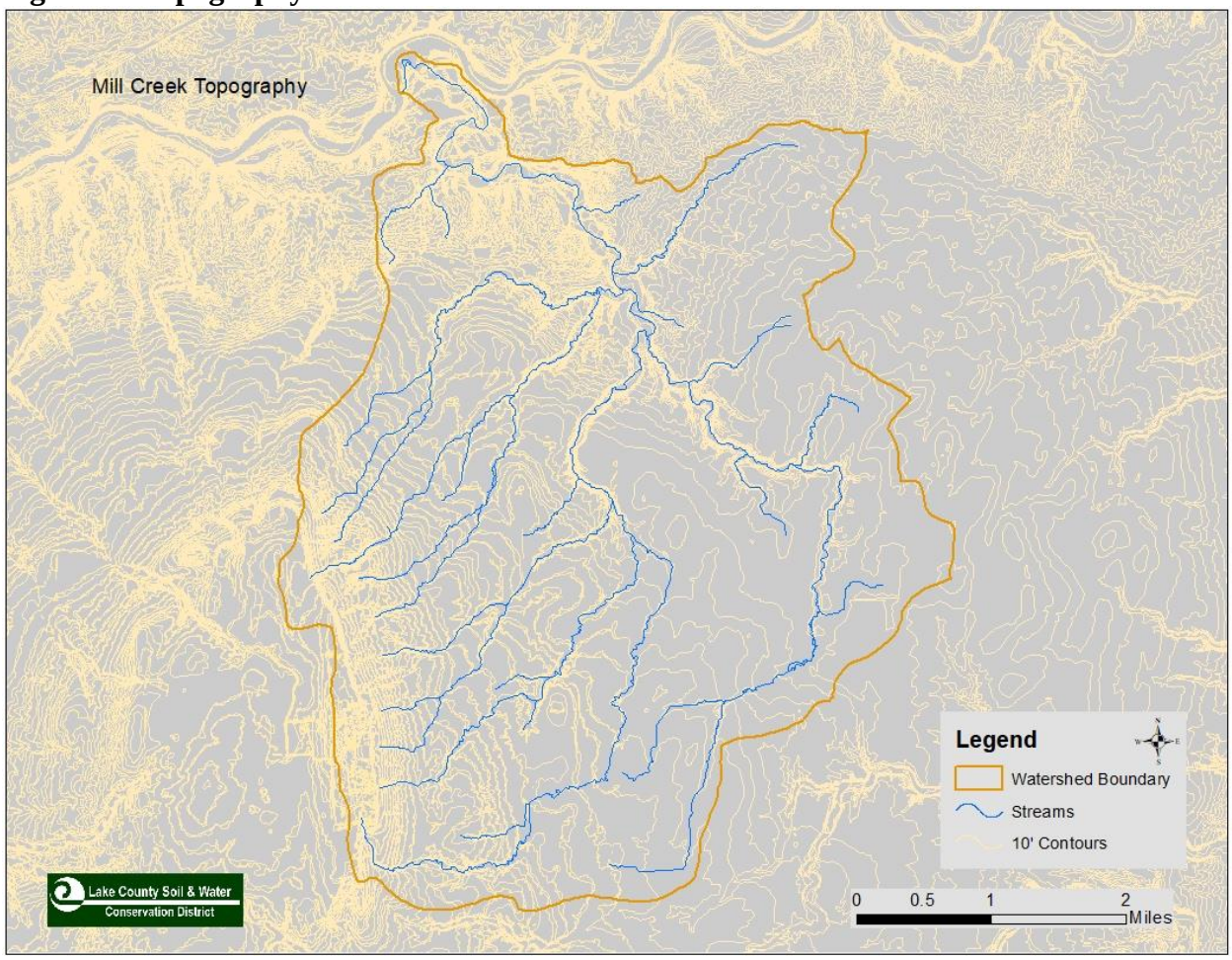
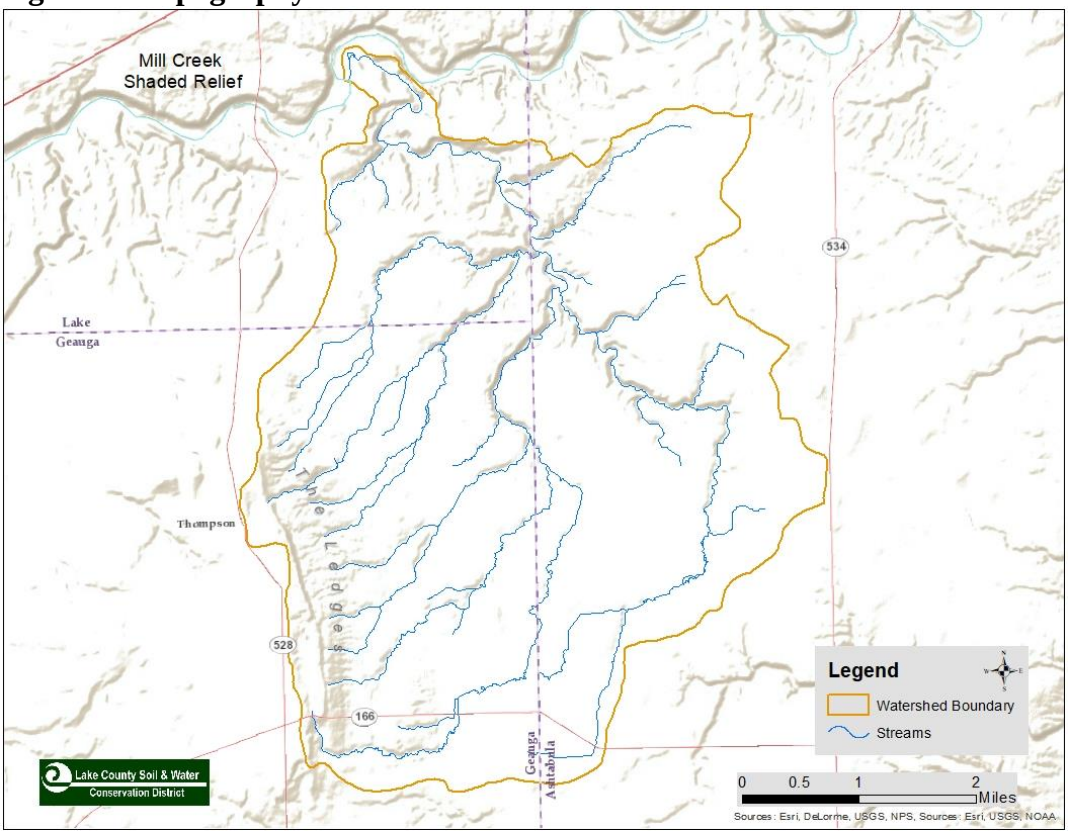


Figure 6. Steep Banks

Figure 7. Topography- Shaded Relief View



Geology & Glacial History

Four glacial features are found in the watershed (Figure 8):

1. End moraine
2. Ground moraine
3. Alluvium and Alluvial terraces
4. Outwash

88% of the watershed area is ground moraine, which is flat to gently undulating and is found in the southern half of the watershed. Approximately 10% is end moraine, which occurs as hummocky ridges north of the ground moraine. The tributaries in the end moraine have carved small ravines on their way down to the mainstem. Alluvium and Alluvial terraces are in the present and former floodplain of the Grand River mainstem and comprise a small portion of the lower watershed along with small pockets of outwash deposited in front of glacial ice.

Figure 8. Glacial Geology

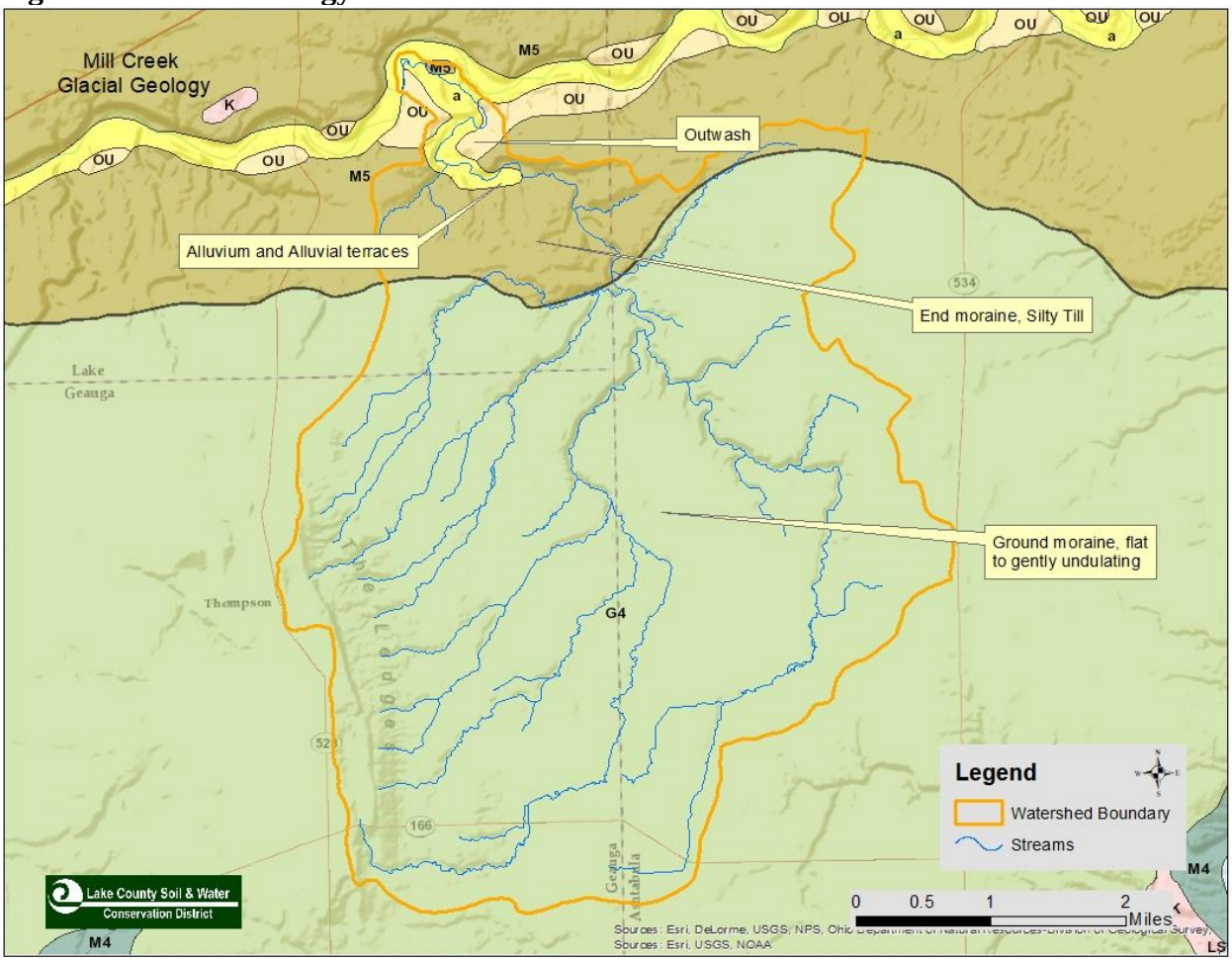


Figure 9. Soil Drainage Characteristics

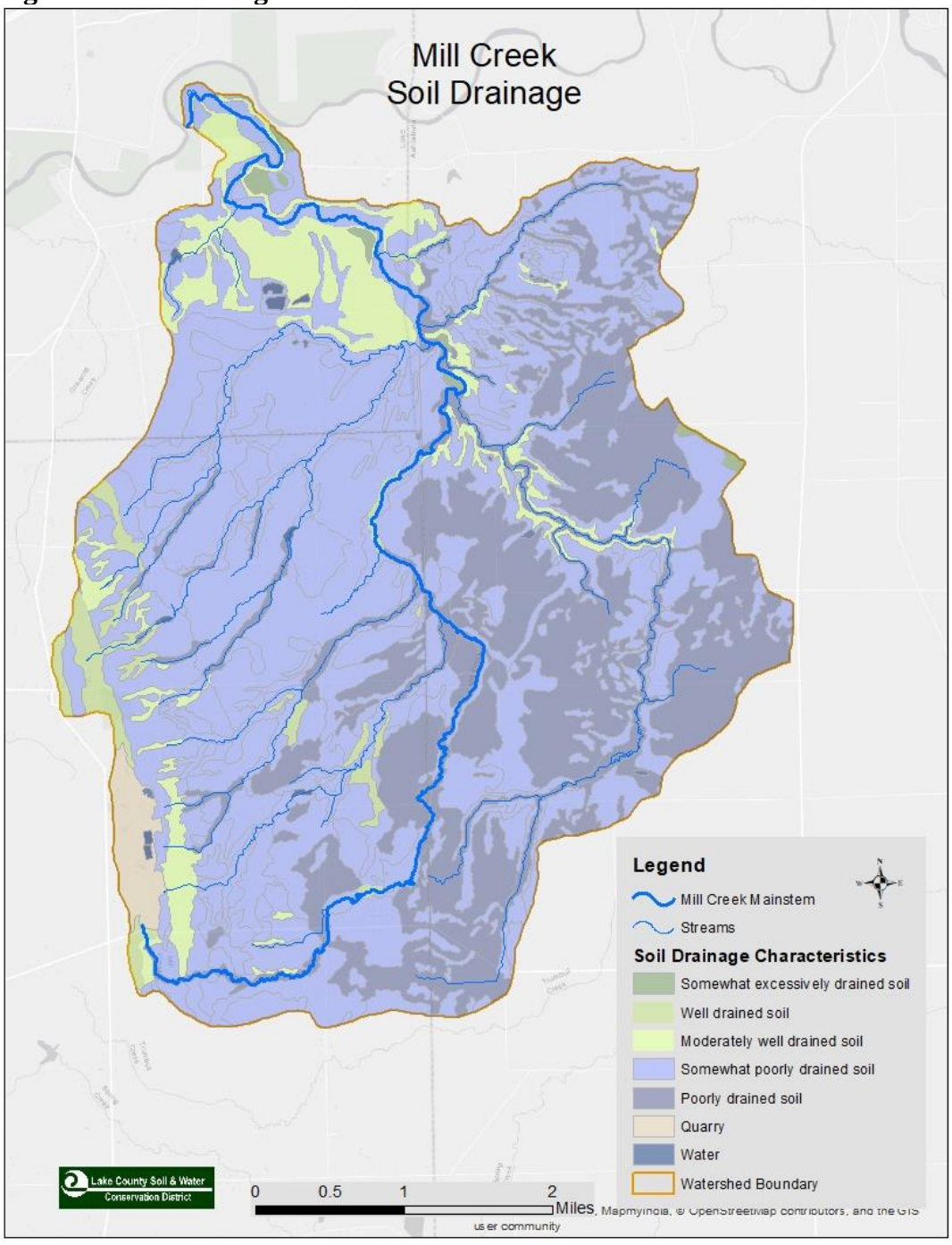


Figure 10. Soil Drainage Characteristics

Drainage Characteristic	Acreage	%
Somewhat excessively well drained	59.2	0.4
Well drained	330.5	2.5
Moderately well drained	1009.6	7.6
Somewhat poorly drained	7840.3	58.9
Poorly drained	3843.8	28.9
Water	50.0	0.4
Pits-Quarry	179.7	1.3

88% of the soils are poorly or somewhat poorly drained (Figure 10). These soils are associated with the glacial ground moraine (Figure 8). Pits-Quarry are found in the southwest corner of the watershed, where the Sharon Conglomerate is mined.

Soil drainage characteristics information is essential for siting Best Management Practices (BMPs) so that they will work properly. BMPs such as rain gardens and pervious pavers that are based on infiltration are best suited for well drained soils (in shades of green, Figure 9), whereas wetlands and on-site storage BMPs should be utilized in hydric soils (in shades of blue, Figure 9).

Refer to the Soil Surveys of Ashtabula, Geauga and Lake County for more information about the soils and their properties.

Wetlands

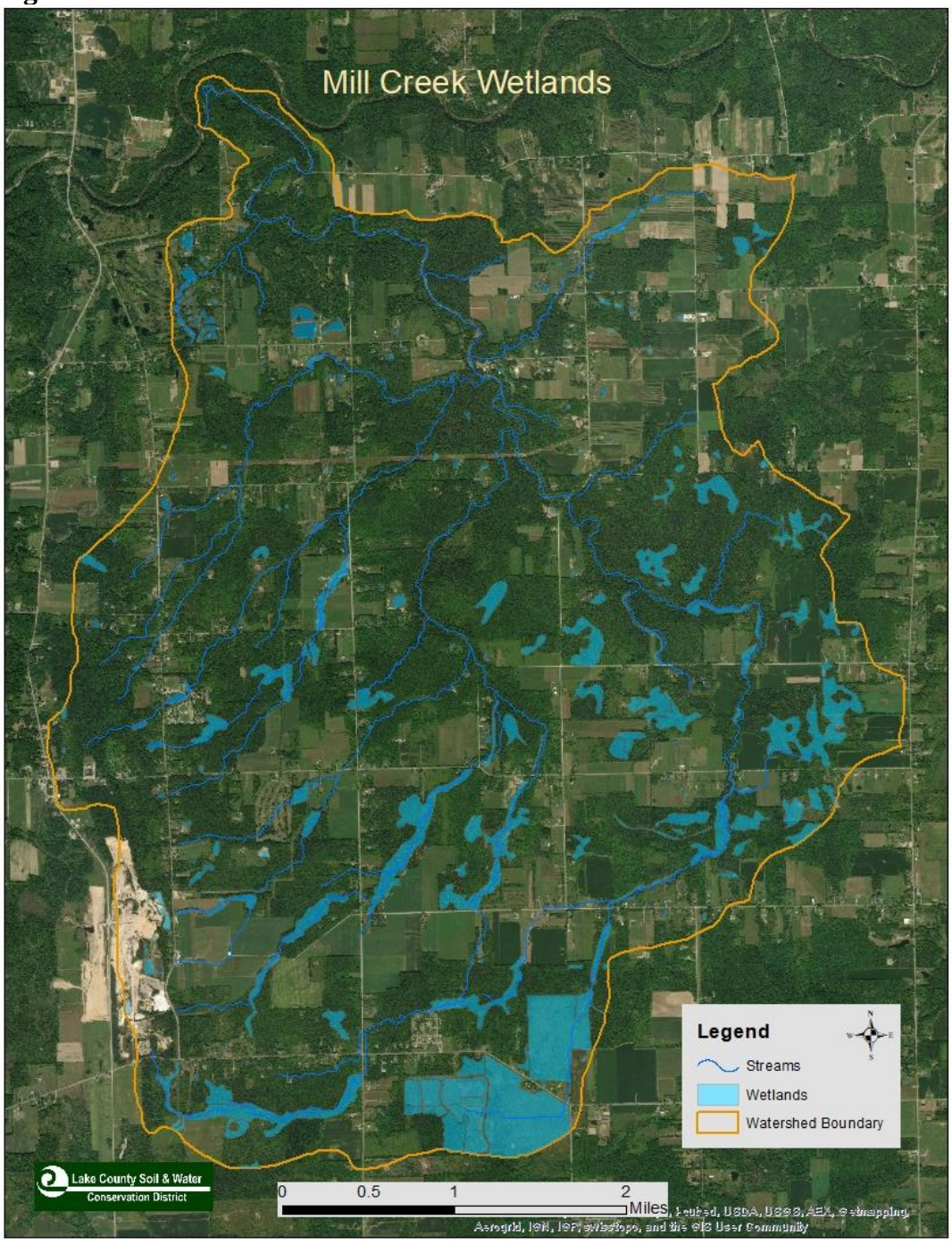
8.8% of the land in the watershed is covered by water and wetlands (Figure 11). (Federal Geographic Data Committee Wetland Mapping Standard for the conterminous United States (CONUS)). The majority is forested wetland, particularly in the southeast section of the watershed, and many small ponds dot the landscape.

Wetlands provide valuable ecosystem services. They are reservoirs of biodiversity; they provide flood control, replenish groundwater, purify surface waters of nutrients and sediments and act as a carbon sink.

The breakdown of wetland type is as follows:

- Forested/shrub wetland 64.2%
- Emergent wetland 24.5%
- Pond 11.2%

Figure 11. Wetlands



2.1.2 Land Use and Protection

The National Land Cover Database (NLCD 2011) delineated 75.7% of the land use as agricultural in 2011, 1.2% of the land use as forest and 7.1% of the land use as urban (Figure 12).

Figure 12. Land Use Data

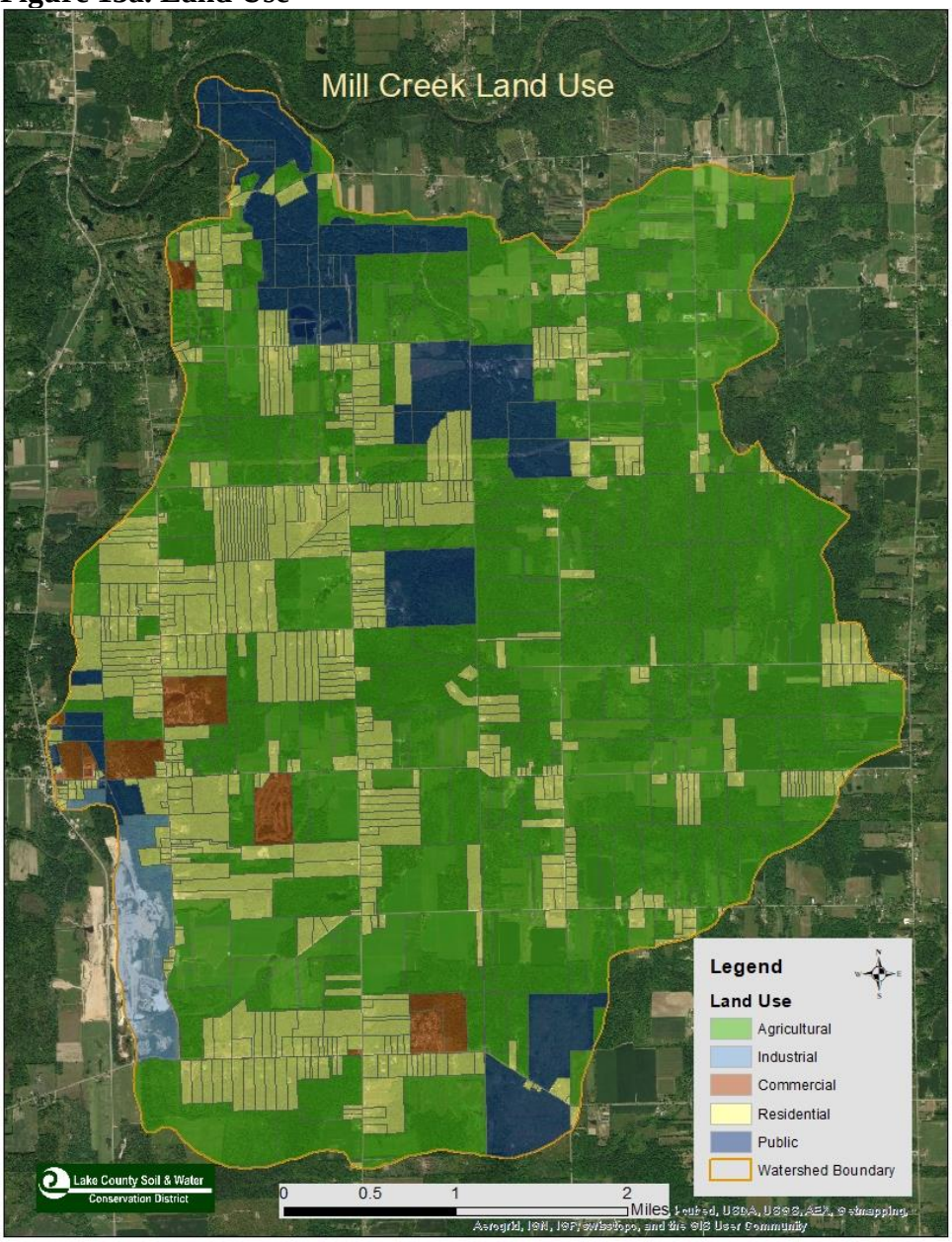
Barren	0.99%
Crop	23.73%
Hay/Pasture	51.98%
Deciduous Forest	0.03%
Evergreen Forest	1.12%
Mixed Forest	0.08%
Herbaceous	4.07%
Herbaceous Wetlands	0.03%
Woody Wetlands	0.48%
Shrub/Scrub	8.58%
Developed, High Intensity	5.51%
Developed, Medium Intensity	0.04%
Developed, Low Intensity	0.67%
Developed, Open Space	0.91%
Water	1.77%
Total	100.00%

Land Use data is taken from the 2019 Lake County parcel data, 2018 Geauga County parcel data and 2015 Ashtabula parcel data (Figure 12). The data from each county is shown separately and as a whole because there are notable differences. Ashtabula has the highest percentage of land in agricultural uses, Geauga has the highest percentage of land in residential uses and Lake has the highest percentage of public land (Figures 13, 13a and 14).

Figure 13. Land Use from Parcel Data

Land Use	Acreage in Lake	%	Acreage in Geauga	%	Acreage in Ashtabula	%	Total %
Agriculture	942.2	47.1	2530	45.8	4666.0	81	61.3
Industrial			261.3	4.7			2
Commercial	16.1	0.8	283.7	5.1			2.2
Residential	407.1	20.0	2215.7	40	610.0	10.6	24.3
Public	634.8	31.7	227.5	4.1	444.6	7.7	9.8
TOTALS	**2000.2**		**5518.3**		**5765.7**		

Figure 13a. Land Use



The following land use information was written by David Radachy, Director of the Lake County Planning and Community Development office.

The development potential for lots in Mill Creek watershed is limited. The economics of building in areas with large lot sizes, large frontages, no sanitary sewer or central water make developing very difficult with thin profit margins. 93.2% of the land in watershed has lots 2 acres or larger with 43.9% of the lots being five-acre minimum lot size and 41.8% being two-acre minimum lot size.

The area around Thompson Square has sanitary sewer service available and it has the potential to develop because of the new service. The majority of the watershed is not served by central sanitary sewer. Most the homes and businesses need to be served by on site systems.

Ohio Revised Code (ORC) 519 is the section that allows townships to regulate land use through zoning. This section does not allow the townships to prohibit agriculture, but they may limit it. Agriculture is by right, so it can be done in the entire watershed. One of the most profitable agriculture businesses is wineries. Mill Creek is part of the Grand River Micro Climate, making it ideal to grow grapes and make wine. There is one winery in the watershed. This winery, which includes food preparation, is operating in residential districts because of the agriculture exemption.

One of the more unusual uses in the watershed is the area owned by Sidley Sand and Gravel. This is an area of mineral extraction. Sidley is mining sand and gravel for their cement and pre-cast businesses.

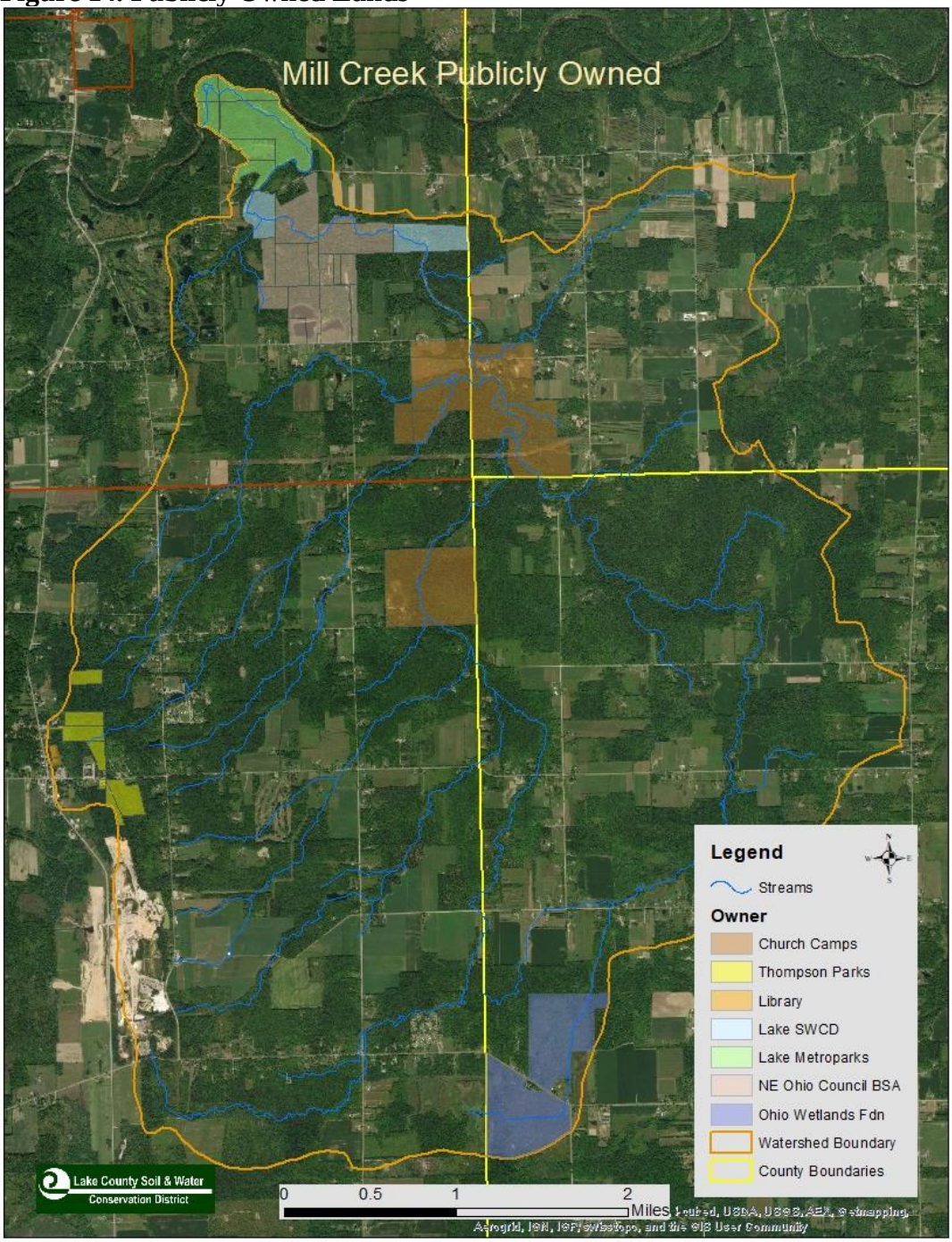
Zoning:
94.4% of the Talcott Creek Watershed is zoned residential. 43.9% of the watershed has a minimum lot size of five acres or 0.20 of a unit per acre. 41.8% of the watershed has minimum lot size of two acres, but that lot size can be reduced to 1 acre if there is sanitary sewer present. 7.5% has a minimum lot size of three acres per unit or 0.34 of a unit per acre. There are limited areas of 20,000 square feet minimum lot size. The 20,000 square foot minimum lot size is located in Madison Township.

4.2% of the watershed is zoned for commercial and industrial uses. Most of the uses are the standard industrial and commercial uses of retail, manufacturing, offices and hotels, but there is a commercial recreation zone in watershed. This zoning classification includes commercial campgrounds, canoe liveries, gun and rod clubs, golf courses, and fields and facilities for soccer, football, baseball and archery.

The entire watershed is considered unincorporated or township.

- Five Acre Zoning: 43.9%
- Two Acre Zoning: 41.8%
- Three Acre Zoning: 7.5%
- River Protection: 0.7%
- 20,000 SF Zoning: 0.6%
- Industrial Zoning: 1.9%
- Recreation Commercial: 1.8%
- Park Zoning: 0.7%
- Commercial Zoning: 0.6%
- Mineral Resources: 0.5%

Figure 14. Publicly Owned Lands



About 10%, or 445 acres of the land is publicly owned (Figure 14). The Stream and Wetlands Foundation owns wetlands in the southeast corner of the watershed, which is also notable on the Wetlands map (Figure 11). Lake Metroparks has protected other properties along the Grand River outside of the Mill Creek Watershed (Figure 15). Figure 16 shows a section of Mill Creek on Lake Metroparks property by Doty Road (note 2 small waterfalls).

Figure 15. Lake Metroparks Property Outside of Mill Creek Watershed

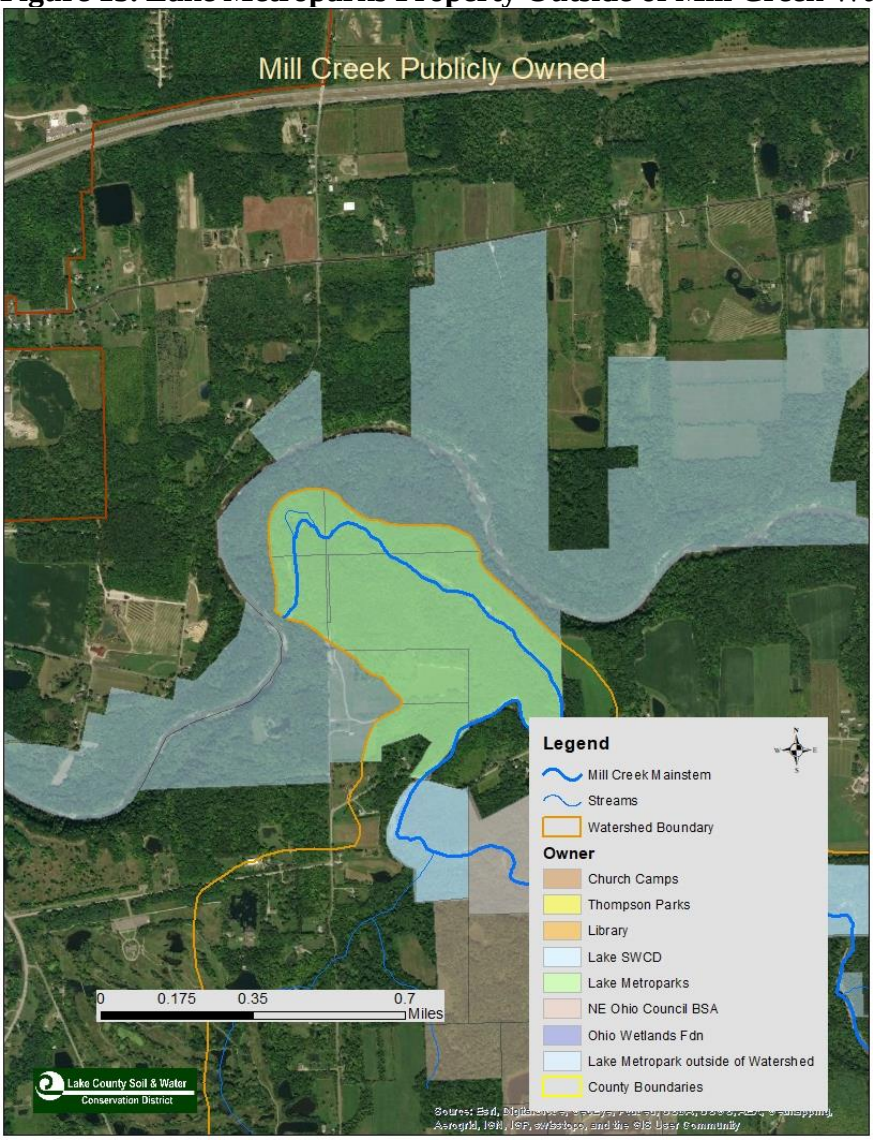
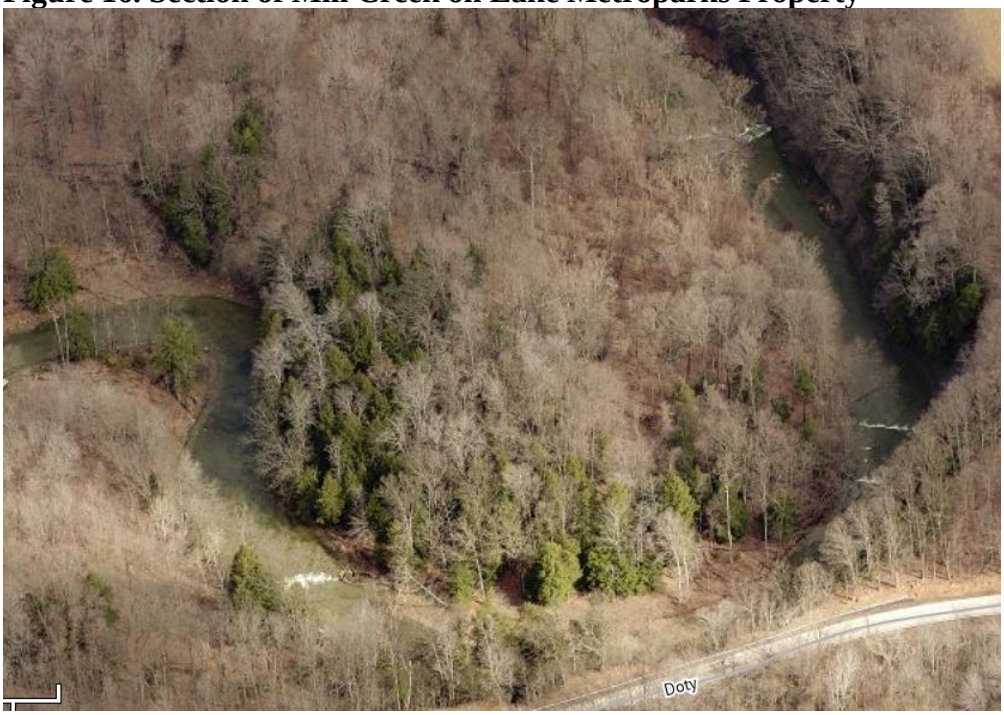


Figure 16. Section of Mill Creek on Lake Metroparks Property



Imperviousness of a watershed has an effect on the physical and biological characteristics of a stream. Increases in impervious cover cause decreases in conditions. Channel instability will occur when the impervious area is greater than 10%. Sharp declines in macroinvertebrate diversity occur when imperviousness is greater than 8%. According to the Center for Watershed Protection's Watershed Vulnerability Analysis report, "…certain zones of stream quality exist, most notably at about 10% impervious cover, where the most sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious cover, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality and habitat scores)." (Center for Watershed Protection, 2002.)

U.S. Geological Survey StreamStats data shows the imperviousness in the Mill Creek Watershed (Figure 17):

Figure 17. Imperviousness

Mill Creek	Percent Forested	Percent Developed	Percent Impervious	Drainage Area-Sq Miles
	51.6	5.32	0.76	20.7

As a watershed develops, increased impervious areas will decrease the physical, chemical and biological characteristics of the creeks. "A non-structural method to counter increased impervious surfaces is riparian setbacks. As the amount and velocity of stormwater runoff increases in the watershed the stream banks will begin to erode. If setbacks are put in place then the tree roots will help to protect the streambanks. In areas where tree roots are not capable of

maintaining channel stability the setback will allow room for the stream to meander without causing undue problems with nearby structures." (Edgar. 2004.)

As with adjacent HUC-12s in the upper Lower Grand, the high percentages of forested land and the low percentages of developed and impervious land have helped to maintain the water quality in this watershed.

2.2 Summary of HUC-12 Biological Trends

Ohio EPA uses biological assessments to support the use attainability in the state, basing the relationship between biology, habitat and the potential for water quality improvement. OEPA has made three Aquatic Life Use designations in the watershed: Coldwater Habitat (CWH), Warmwater Habitat (WWH) and Seasonal Salmonid Habitat (SSH). 17.5 miles are designated as CWH, 14.5 as SSH and 1.7 miles as WWH.

The WWH use designation defines the "typical" warmwater assemblage of aquatic organisms for Ohio rivers and streams, and represents the principal restoration target for the majority of the water resource management efforts in Ohio. The SSH attributes are that they support lake run steelhead trout fisheries.

The CWH designation is intended for waters which support assemblages of cold-water organisms and/or those which are stocked with salmonids with the intend of providing a put-and-take fishery on a year-round basis which is further sanctioned by the Ohio Department of Natural Resources, Division of Wildlife; this use should not be confused with the SSH use which applies to the Lake Erie tributaries that support periodic seasonal "runs" of salmonids. (Ohio EPA Biological and Water Quality Study of the Grand River Basin 2003-2004; Ohio EPA Division of Surface Water, November 1, 2006; p. xi-xii.)

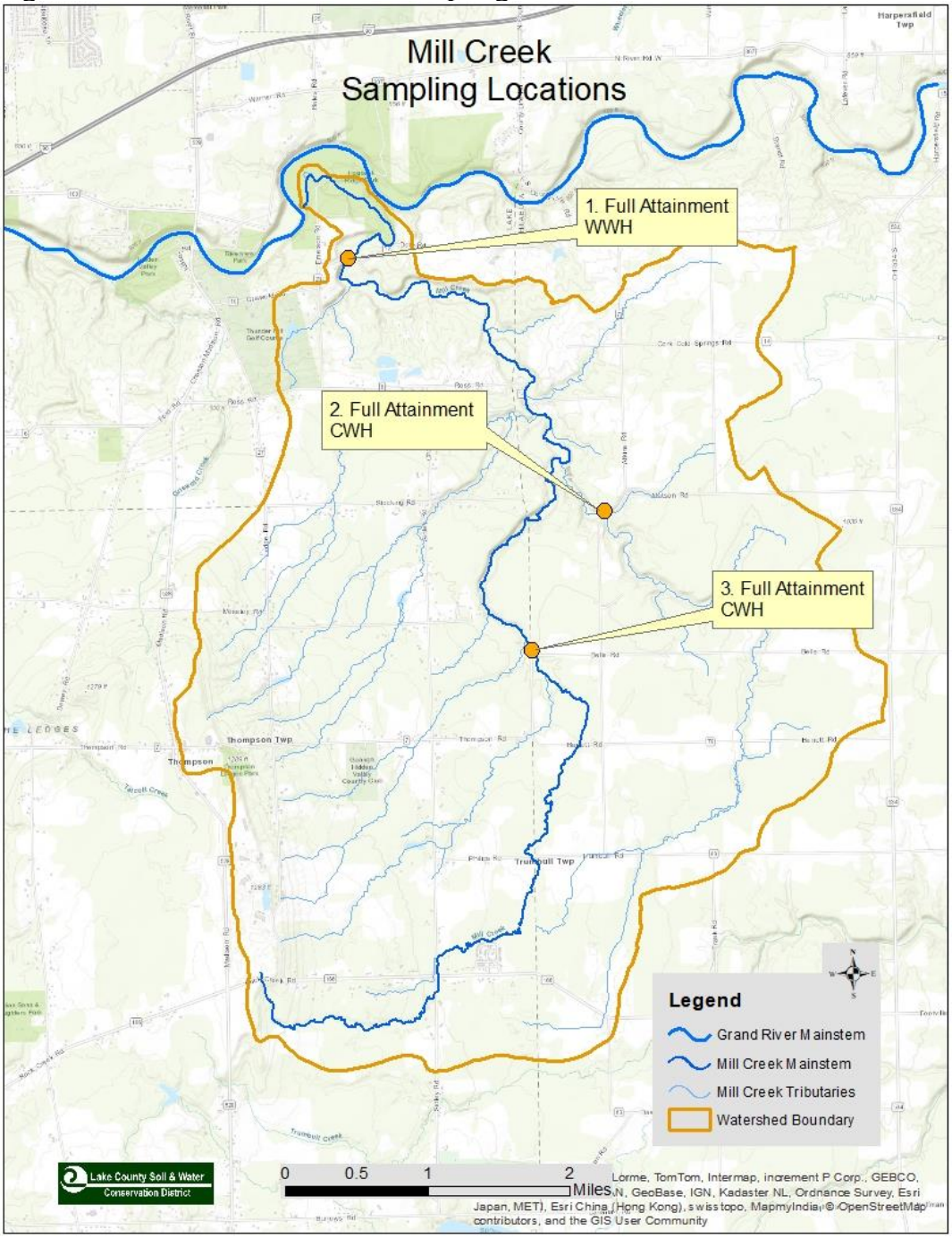
The OEPA sampled 3 sites in 2004 (Figures 18 and 19) for aquatic life use attainment, updating the data found in the Biological and Water Quality Study of the Grand River Basin 2003-2004. All were in Full Attainment of their Aquatic Life Use designations: 2 for Coldwater Habitat and 1 for Warmwater Habitat. No causes and sources of impairments were listed. (Ohio Environmental Protection Agency. 2014. *Water Quality: Assessment Unit Summary*. Ohio EPA, Division of Surface Water, Columbus, Ohio. https://oepa.maps.arcgis.com/apps/webappviewer/index.html?id=af9b57fe031d4eea8937f474c00f97f3)

Figure 18. 2004 Sampling Data

Location Number	Location	IBI/Rating	MIwb*	ICI/Rating	QHEI/ Rating	Aquatic Life Use Desig.	Attainment Status
1	Mill Creek at Doty Road	34/Marginally Good	7.7/ Marginally Good	48/ Exceptional	54.5/ Narrative was Exceptional	WWH	FULL
2	Mill Creek Dst. Of Adkins Road	34/Fair	-	-	74.5/ Narrative was Exceptional	CWH	FULL
3	Trib to Mill Creek @ Moseley Road	40/Good	-	-	79/Narrative was Exceptional	CWH	FULL

*MIwb (Modified Index of well-being for fish): not applicable to drainage areas with headwater streams <20 mi2.

Figure 19. Attainment and 2004 Sampling Locations



Headwater Habitat Evaluation Index

Lake SWCD worked with the EPA to develop the Headwater Habitat Evaluation Index (HHEI) protocol for use in drainage areas that are less than one square mile. Lake SWCD has used the HHEI to assess and establish a baseline database of existing conditions in many Lake County watersheds. HHEI data was collected for 60 sites by Lake SWCD staff in the Mill Creek Watershed between 2001 and 2006. There is no HHEI data for Ashtabula or Geauga County.

The Class is determined by the assessment of the biological community and the presence or lack of indicator species. See Figure 22 and the subsequent text for a description of the three classes of Primary Headwater Habitat (PHWH) streams found in Ohio. By HHEI class, 36.6% of the streams in the lower Mill Creek Watershed are Class I, 21.6% are Class II and 41.6% are Class III (Figures 20 and 21). Only one site was modified, which may be due to the steeper gradients in that section of the watershed.

Figure 20. HHEI Stream Class for the Lake County Section

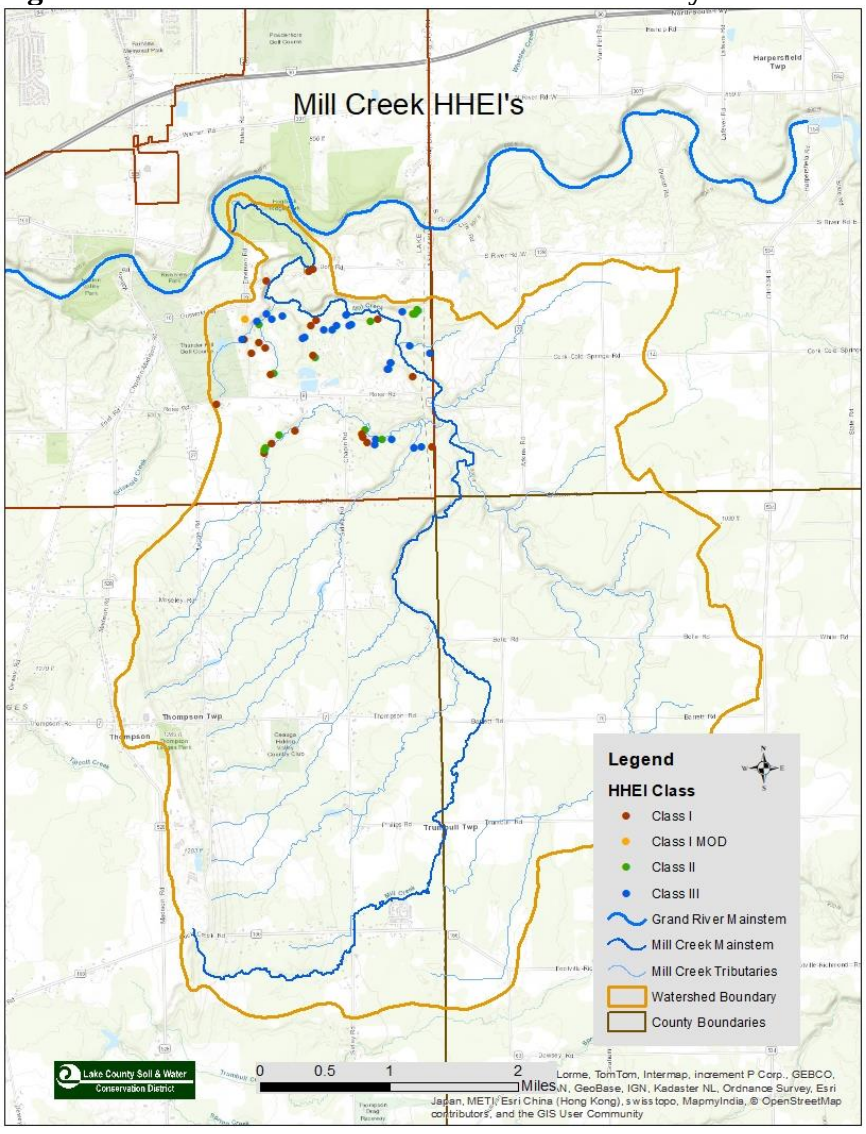
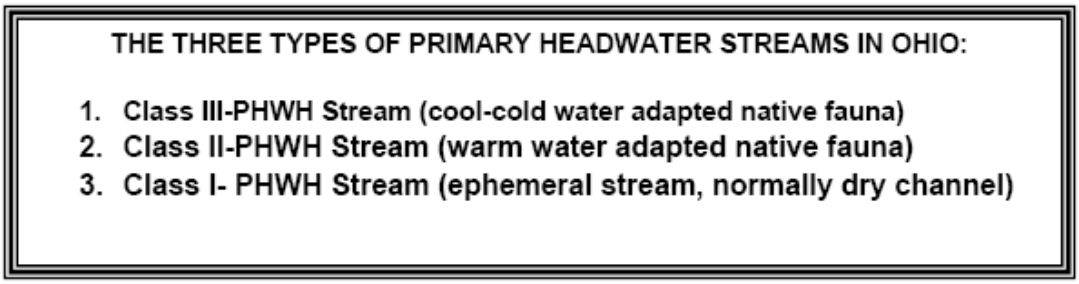


Figure 21. HHEI Stream Class

Class	Number	%
Class I	21	35
Class I Modified	1	1.6
Class II	13	21.6
Class III	25	41.6

Figure 22: Three Types of Primary Headwater Streams in Ohio (OEPA. 2009.)



Class III-PHWH (Primary Headwater Habitat) streams have a diverse population of native fauna adapted to cool-cold perennial flowing water, with larval stages continuously present in the stream.

Class II-PHWH streams have a moderately diverse population of warm-water adapted native fauna on a seasonal or annual basis.

Class I-PHWH streams are ephemeral, with water present for short periods of time, from snow melt or rainwater runoff. Since they are normally dry, there is little or no aquatic life present.

The primary physical habitat distinction between Class I and Class II- PHWH streams is that Class II-PHWH streams are watered- either with the presence of flowing water or isolated pools during the summer months, and Class I-PHWH steams are dry. The primary biological habitat distinction is that Class I-PHWH streams have either no species of aquatic life present or the biological community has poor diversity.

A natural "stream channel is characterized by the presence of riffles and pools, heterogeneous substrate deposition, the presence of point bars or other evidence of floodplain sediment deposition, appropriate stream channel sinuosity for the setting of the stream in the landscape, varied water depths and current velocity (when flowing), no obvious evidence of current or past bank shaping or armoring activities is present. Natural wooded or wetland riparian vegetation dominates the stream margin."

When channels have been historically altered by man, they are categorized as "Modified". This can include a status of "Recovered", where the stream shows evidence of channel alteration, but has fully recovered many of the natural stream channel characteristics listed

above; “Recovering”, where there is evidence of alteration and the stream is in the process of adjusting, channel sinuosity is lacking and riparian vegetation is in early stages of re-growth; and “Recent or No Recovery”, where alteration is evident and few if any natural characteristics are present. Highly modified streams are characterized by uniform depths, over-wide channels, homogeneous substrates, embeddedness of substrates and low sinuosity.

The Ohio EPA Division of Surface Water’s Biological and Water Quality Study of the Grand River Basin 2003-2004 addresses the characteristics of the watershed:

- Generally, Mill Creek and an unnamed tributary are cooler than the Grand River.
- These cold-water tributaries contribute cold ground water base flow to the Grand River.
- Being a direct high quality coldwater tributary to the Grand River, protecting the existing hydrology of Mill Creek is important to sustaining base flows and maintaining the long-term health of the Grand River.
- The tributaries in the Mill Creek Watershed have high gradients, discontinuities in bedrock and are subject to scouring flows that result in long bedrock glides, cascades and water falls. Because of this, it is not surprising that the fish sample in Mill Creek only marginally met the IBI biocriterion.
- The fish sampled at Atkins Road inexplicably scored Fair; no impairment is suspected.
- Streams showing the highest degree of chemical integrity include Mill Creek and its tributaries.
- The headwaters of Mill Creek have habitat conducive to supporting till-plain stream fish communities.
- Mill Creek supports exceptionally high-quality macroinvertebrate communities including many infrequently collected sensitive taxa and three state-listed taxa.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

On the Ohio EPA Division of Surface Water’s website, the Water Quality: Assessment Unit Summaries (2014) identifies the causes and sources of impairment for all subwatersheds of the Talcott Creek-Grand River HUC-12.

Causes of impairment:

- No impairment

Sources of impairment:

- No impairment

2.4 Additional Information Determining Critical Areas and Developing Implementation Strategies

2.4.1 Lake County Soil & Water Conservation District (SWCD)

Lake SWCD was formed in 1946 to provide leadership and technical expertise to guide the protection and conservation of the unique soil and water resources of Lake County.

The District was honored in 2009 with the Ohio Federation of Soil and Water Conservation Districts President's Award "For Distinctive Leadership and Visionary Governance Fostering the Development and Implementation of the Headwater Habitat Evaluation Index". In 2003, District staff began using the EPA's Headwater Habitat Evaluation Index (HHEI) in the central and eastern watersheds to assign aquatic life use designations to unclassified streams in order to gather data to assist with their protection and conservation.

Over a ten-year period, staff collected data throughout Lake County and compiled a unique database of HHEI and QHEI (Qualitative Habitat Evaluation Index) information on local watersheds. The District utilized this data to assist communities in Lake County in establishing riparian setback ordinances and monitoring erosion and sediment control programs that would meet the goals of the USEPA Phase 2 and Lake Stormwater Management Department programs. The data was also used to evaluate and prioritize resource values for conservation easements, and to develop baseline and monitoring information for restoration assessments.

2.4.2 Lake County Stormwater Management District

Lake County's Stormwater Management District (SMD) provides treatment of stormwater and addresses the National Pollution Discharge Elimination System (NPDES) for Phase II mandated member communities. The SMD can assist with funding to improve the stormwater infrastructure and is a good source for match for grants for member communities. Leroy Township is not a Phase II mandated community and is not a member of the SMD. Geauga County does not have a stormwater utility, and funding/match for stormwater management projects can come from the local community, and private landowners.

2.4.3 Biological and Water Quality Survey of the lower Grand River Basin, 2003-2004; Ohio EPA

The main objectives of the survey (as they apply to the Mill Creek Watershed) were to:

1. Assess the overall quality of surface waters within the hydrologic units
2. Monitor for trends or changes in biological or water quality
3. Assign aquatic life uses to unassessed waters
4. Provide information for completion of a Total Maximum Daily Load Study

The results of the survey showed that the Grand River and its tributaries "continue to harbor a rich and diverse biological assemblage containing many rare and threatened species, and several state endangered species. This exceptional biological richness is the direct result of the fact that the physical habitat of the Grand River and most of its tributaries has, by dint of isolation from the surrounding uplands, been minimally altered and therefore remains largely intact. Also, land preservation through park land acquisition and conservation easements, and

the numerous woodlots dotting the watershed, has maintained forest cover along much of the riparian zone, the adjacent valley slopes, and in the uplands; consequently, the water resource is, with few exceptions, very good and approaches pristine in a few cases."

2.4.4 Total Maximum Daily Loads for the Grand River (lower) Watershed; Ohio EPA, January 31, 2012.

In 2003 and 2004, the Ohio EPA collected data related to water, sediment quality, aquatic biological communities and habitat in the lower Grand River Watershed to determine if quality criteria for designated beneficial uses were being met.

Two sites in the HUC-12 were found to be in full attainment of their aquatic life use designations, however the are threatened by future development pressure.

The report outlined protection strategies as follows:

- Impervious cover target of 6%
- Riparian buffer targets

Stream	Target riparian width (ft)	Minimum vegetated width (ft)
Mill Creek	183	92

The report concluded that watersheds that retain relatively large areas of forest are better able to mitigate the impacts of increasing imperviousness associated with development than those with little forest cover. Procuring conservation easements and establishing parks and nature preserves can help to retain some of the forest cover. Land preservation alone is not likely to mitigate the impacts of development, but can augment other measures such as green infrastructure and on-site stormwater management.

Protecting streams from degradation due to land use changes will be critical to ensure that unimpaired streams are protected. Stormwater management, infiltration, wastewater management, using better site design practices and agricultural Best Management Practices are all applicable and recommended.

2.4.5 Grand River Riparian Corridor Protection Plan (Davey Resource Group, March 1998)

Initiated by the Grand River Partnership, a consortium of public agencies and private organizations in Ashtabula, Geauga, Lake and Trumbull Counties, the protection plan identified three targeted "critical areas" for acquisition of conservation easements in the riparian corridor of the Grand River.

The goals of the project were to:

1. Protect the water quality and aquatic habitat, wetlands and associated forest communities of the Grand River watershed
2. Provide education for landowners on the ecological and economic benefits of riparian buffers, wetlands, floodplains and steep slopes
3. Assist elected officials, public servants, decision makers and concerned citizens in making the right choices for watershed protection

Twenty benefits of riparian buffers were listed as very beneficial to the Grand River:

1. Reduces watershed imperviousness by 5 percent
2. Distances areas of impervious cover from the stream
3. Reduces small drainage problems and complaints
4. Stream "right-of-way" allows for lateral movement
5. Effective flood control
6. Protects from streambank erosion
7. Increases property values
8. Increases pollutant removal
9. Foundation for present or future greenways
10. Provides food and habitat for wildlife
11. Mitigates stream warming
12. Protects associated wetlands
13. Prevents disturbance to steep slopes
14. Preserves important terrestrial habitat
15. Corridors for conservation
16. Essential habitat for amphibians
17. Fewer barriers to fish migration
18. Discourages excessive storm drain enclosures/channel hardening
19. Provides space for stormwater ponds
20. Allows for future restoration

2.4.6 Grand River Watershed Riparian Corridor Protection Guide (prepared by Davey Resource Group for Grand River Partners, Inc.; 1999)

This publication was financed in part by a grant through the Ohio EPA 319 program and in part by funds from the James P. Storer Foundation, with assistance from the Western Reserve Resource Conservation and Development Council and Grand River Partners, Inc. It describes the natural wealth of the Grand River, lists the many benefits of riparian corridors and states that the destruction of the riparian corridor is often the first step in the death of a river.
The benefits that riparian areas provide include:

- Absorbing and removing pollutants from runoff
- Reducing temperature extremes of waters
- Supplying organic matter to provide carbon nutrients (the most basic link in the food chain of a river ecosystem)

Preserving or restoring riparian areas along the Grand River and its tributaries was stated as key objectives for protecting the watershed. The guide enumerated ways to "save a river" as follows:

- Regulatory efforts for monitoring industrial and wastewater treatment facilities
- Community planning and tools to manage development in a sustainable manner and provide legal defenses to preserve the landscape
    - Comprehensive planning and natural resource analysis
    - Zoning and subdivision regulations
    - Growth Management

- Easements and acquisition
- Land trust efforts

2.4.7 Harpersfield Township Zoning Resolution

Harpersfield Township does not have any riparian or wetland setbacks.

2.4.8 Trumbull Township Zoning Resolution

Trumbull Township does not have any riparian or wetland setbacks.

2.4.9 Thompson Township Zoning Resolution

Thompson Township has adopted riparian and wetland setbacks within its zoning resolution. Designated watercourses include those draining an area greater than or equal to one-half square mile or those draining less than one-half square mile and having a defined bed and bank.

Riparian setbacks are required as follows:

1. A minimum of 75 feet on each side of designated watercourses draining an area equal to or greater than one-half square mile and up to 20 square miles
2. A minimum of 25 feet on each side of designated watercourses draining an area less than one-half square mile and having a defined bed and bank

Wetland setbacks are required as follows:

1. Where a wetland is wider than the minimum riparian setback on either or both sides of a designated watercourse, the minimum riparian setback shall be extended to include the outermost boundary of the wetland, plus the following additional setback widths based upon the wetland category.
    a. An additional minimum setback of 50 feet extending beyond the outermost boundary of a category 3 wetlands
    b. An additional minimum setback of 30 feet extending beyond the outermost boundary of a category 2 wetlands
    c. No additional setback shall be required beyond the outermost boundary of a category 1 wetlands

2.5.0 R. W. Sidley, Inc.

R. W. Sidley, Inc. is a mining and manufacturing facility that has mined sand and gravel in Thompson, Ohio since 1933. As an industrial activity it must develop and implement a Storm Water Pollution Prevention Plan (SWPPP) to minimize or eliminate the potential for contamination of stormwater. Under the purview of the Ohio EPA and the General Permit, Sidley's is authorized to discharge stormwater in accordance with the conditions specified in the Permit. The EPA requires the permittee to select, design, implement and install best management practices to minimize the pollutants in stormwater discharges. The practices include the following:

- Minimize exposure
- Good housekeeping
- Maintenance

- Spill prevention and response procedures
- Erosion and sediment control
- Management of runoff
- Employee training
- Best management practices for the production of Glass, Clay, Cement, Concrete, and Gypsum Products
- Control of waste, garbage and floatable debris
- Minimizing of dust and vehicle tracking of industrial materials
- Monitoring to ensure compliance

Chapter 3: Critical Area Conditions & Restoration Strategies

3.1 Overview of Critical Area

The Critical Area for the Mill Creek (3) Watershed is the upper headwaters area as shown in Figure 23. Two locations in the Critical Area are in Full attainment of their CWH aquatic life use and maintaining that status is the paramount strategy of this plan. The lower sections of the Mill Creek mainstem have good blocks of protection by public entities (Figure14).

The strategies in this NPS-IS are focused on maintaining the aquatic life use attainment, rather than relying on restoration projects to bring the watershed into attainment. Protecting wooded and riparian wetlands and buffers in this area, and achieving proper forest management is essential to the health of the coldwater and warmwater biology of the entire watershed.

3.2.1 Critical Area: Detailed Characterization

The Critical Area (Figure 23) drains 10.8 square miles, in Trumbull Township in Ashtabula County and Thompson Township in Geauga County.

The land use is 71% agricultural and 20% residential (Figures 24 and 25).

Much of the agricultural land is wooded and the residential land has good forest cover as well. There is very little industrial or commercial land use and imperviousness in the watershed is minimal. The biggest threats to the watershed are loss of wooded riparian corridors.

Thompson Township has riparian setbacks; Trumbull Township does not. Most of the riparian corridors are wooded and drain through agricultural land uses. Maintaining a riparian buffer on the waterways is a critical practice for the health of the watershed. A portion of Thompson Ledges is in the southwest corner of the watershed.

Figure 23. Critical Area

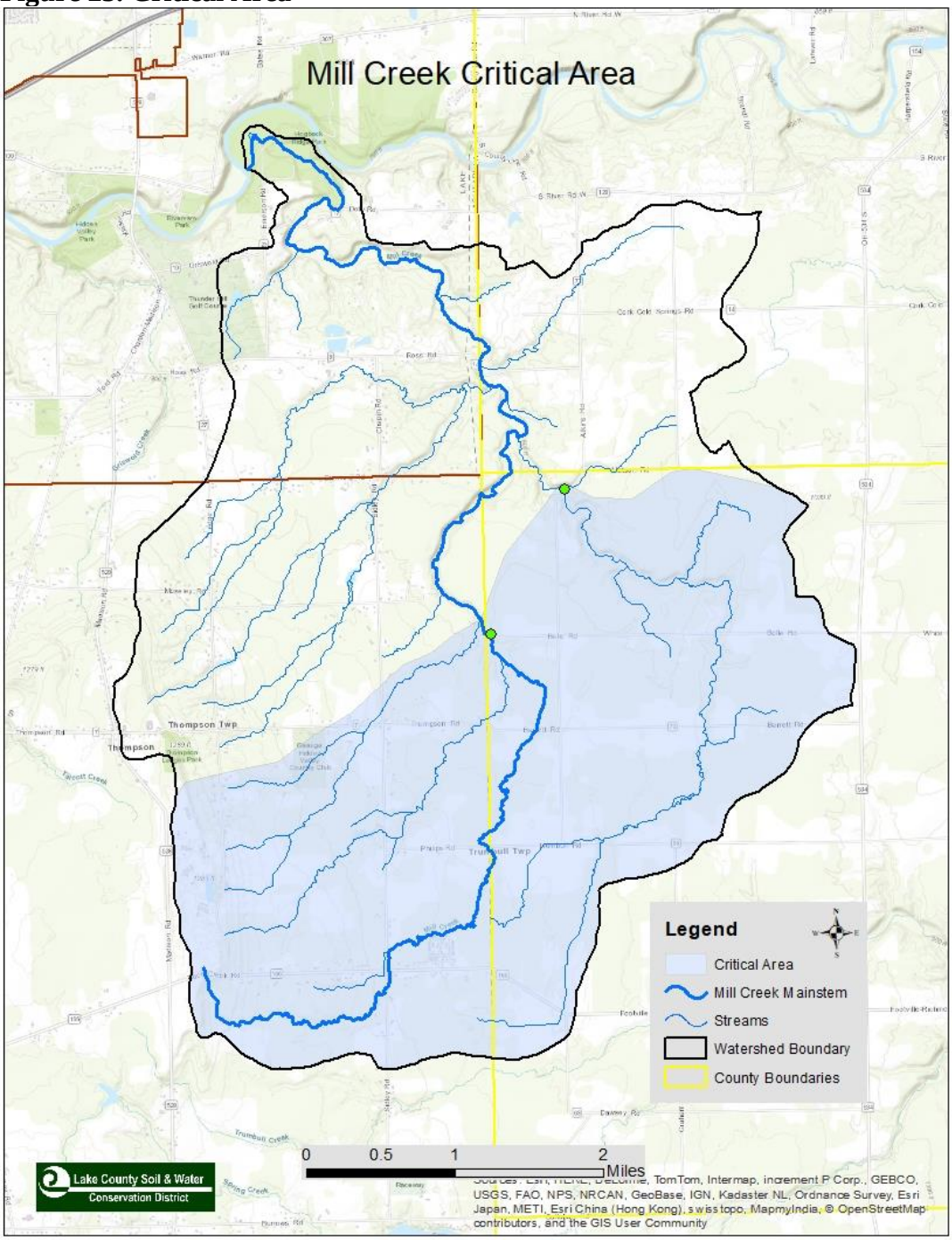


Figure 24. Critical Area Land Use

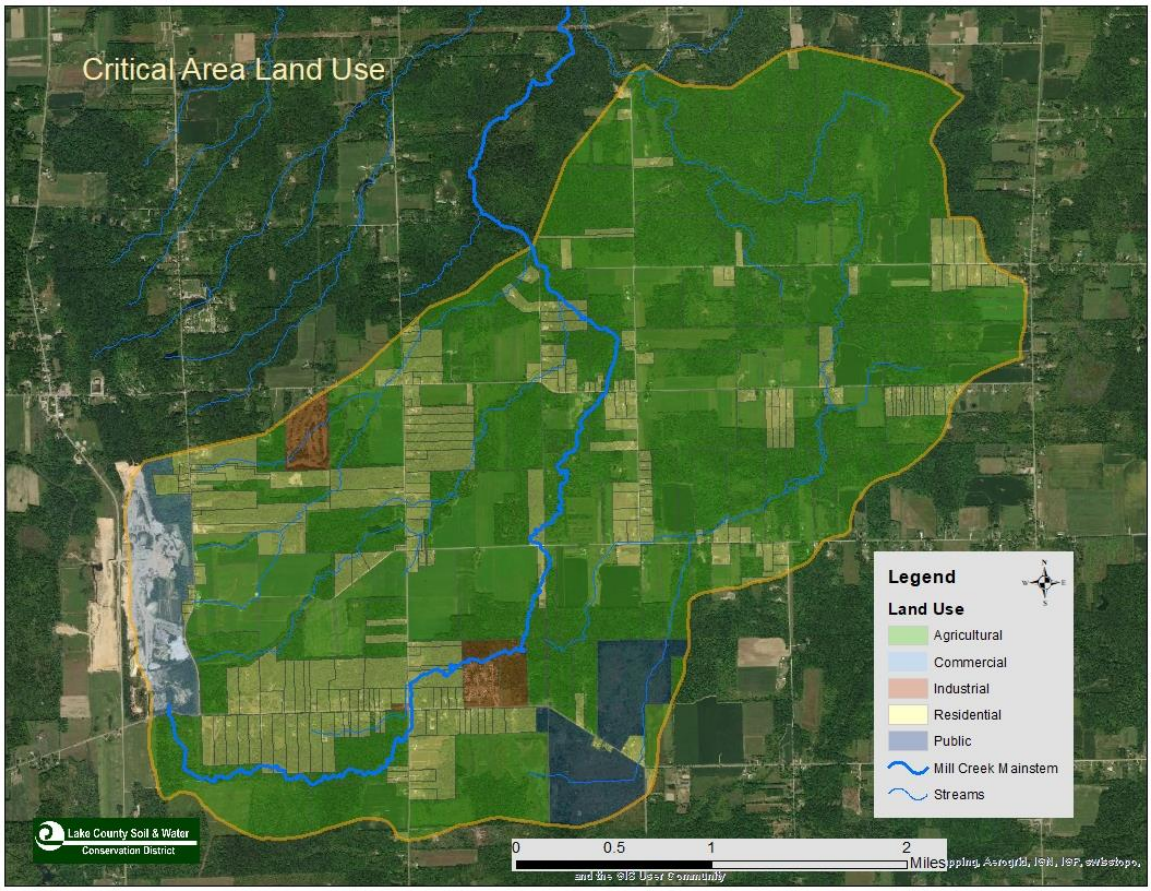


Figure 25. Critical Area Land Use Data

Land Use	Acres	%
Agricultural (green)	4925.6	71
Industrial (blue)	229.3	3.3
Commercial (red)	125	1.8
Residential (yellow)	1398.3	20
Public (navy)	243.5	3.5

The predominant land use is agricultural land, at 71%; 20% of the critical area is in residential land use. In the southeast corner, approximately 420 acres of wetlands are owned by the Stream and Wetlands Foundation. The Foundation owns more acreage of wetlands outside of this watershed, so there is a good potential that a large area of wetlands in this portion of the Lower Grand River Watershed can be permanently protected to perform filtering and infiltration functions in perpetuity.

Conservation Development should be encouraged to help keep the CWH attainment status from declining. Conservation Developments allow developers to have smaller lots in exchange for land being preserved. This method of development usually is created though a planned unit development (PUD) and the developments are normally served by sanitary sewer and central water. Lot sizes for this type of development can be as small

as ¼ of an acre. Conservation development can also work in areas where there is no sanitary sewer or central water, but lot sizes this small would not be able to contain a septic system and/or water well.

A conservation development could utilize lot sizes that are 50% or 33% of normal lot size in exchange for conservation of land so long as the lot size would have space for a septic system and/or water well. A one- or 1.5-acre lot with the right soil conditions could handle a septic system and/or well. In area of 3 acre lots, a community could approve lots that are 2 acres, 1.5 acres or 1 acre in exchange for preserved land.

Figure 26. Soil Drainage Characteristics

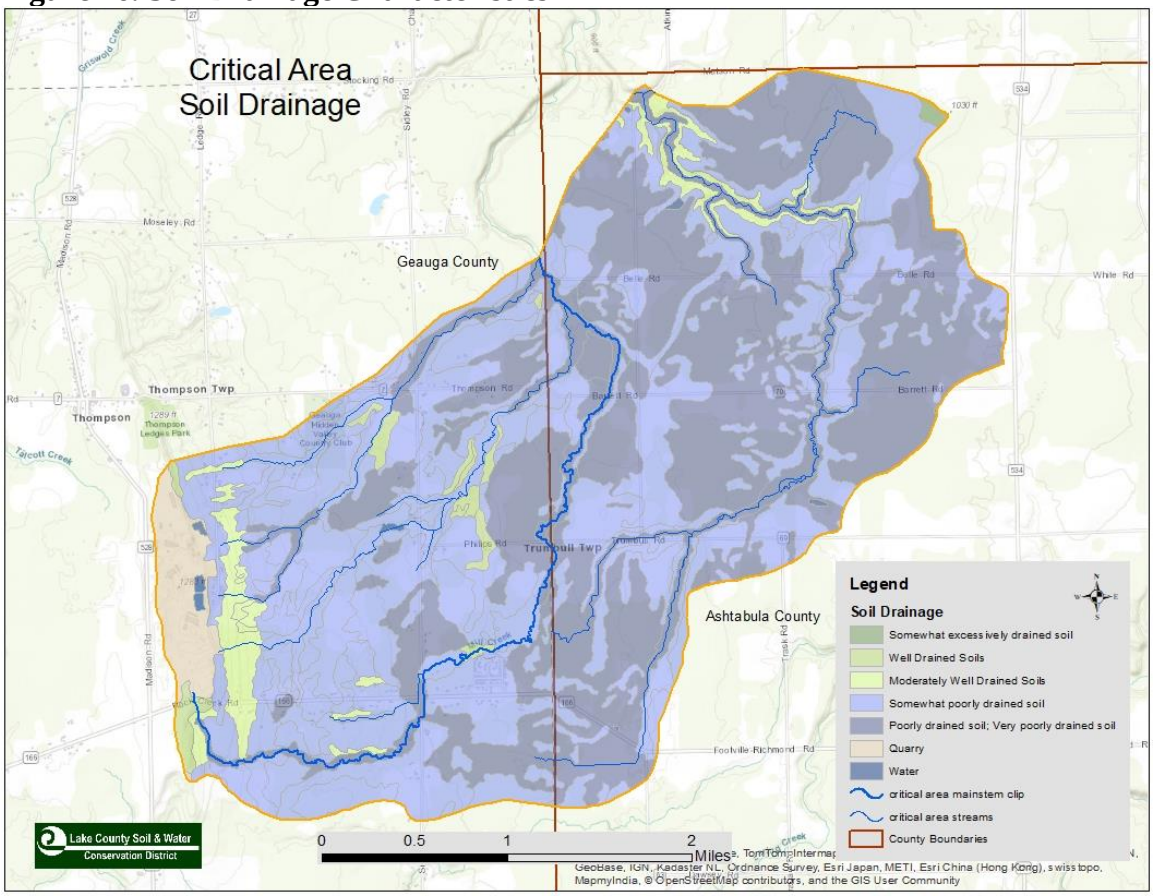
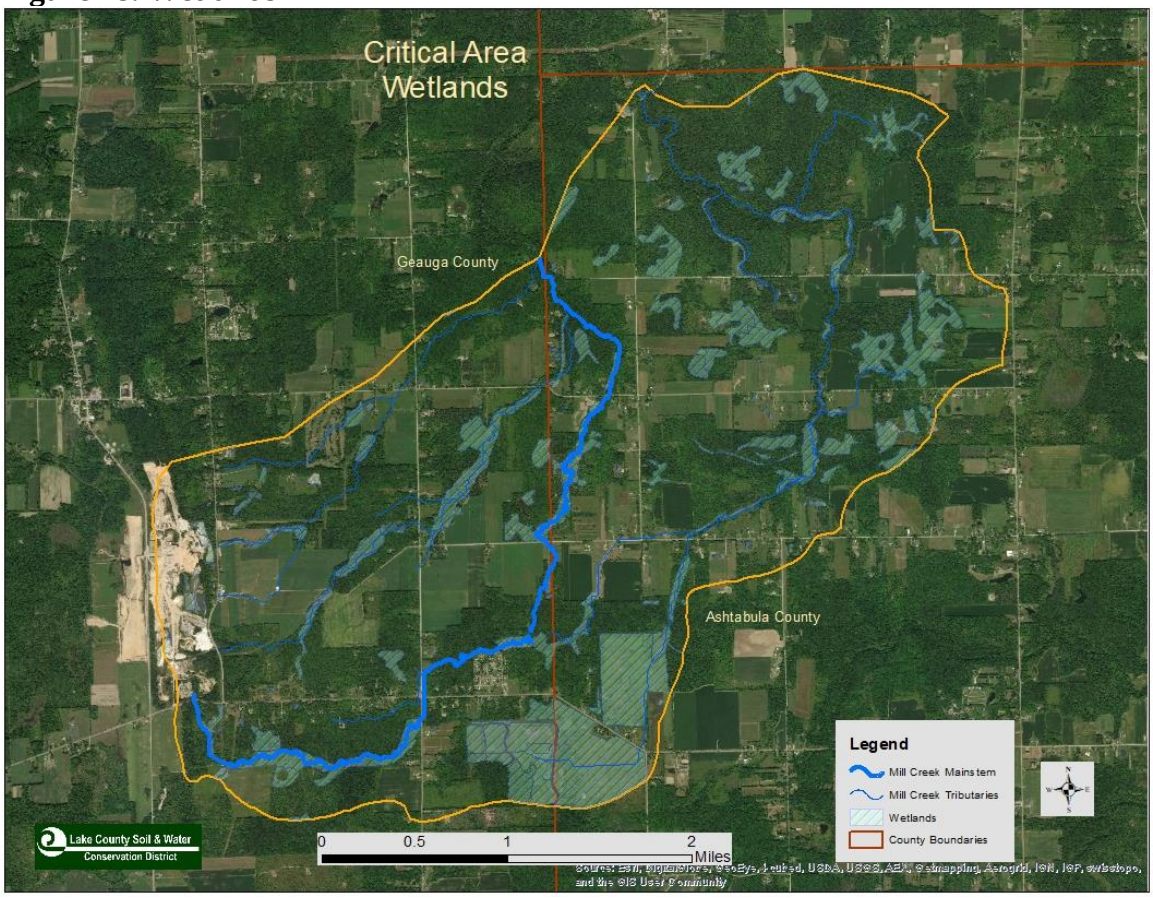


Figure 27. Soil Drainage Characteristics

Soil Drainage Characteristics	Acres	%
Somewhat Excessively Well Drained	9	0.1
Well Drained	100.7	1.5
Moderately Well Drained	243.7	4.7
Somewhat Poorly Drained	3369.5	48.6
Poorly Drained	3008.3	43.4
Water	18.9	0.3
Pits-Quarry	179.6	2.3

92% of the soils are somewhat poorly drained and poorly drained. 180 acres of the R.W. Sidley sand and gravel quarry in Thompson are in the western corner of the critical area.

Figure 28. Wetlands



14.3% of the critical area is wetland (Figure 28). One-third of the wetlands in the critical area are located in the southeast corner; most of those wetlands are owned and have been restored by the Stream and Wetlands Foundation (Figure 29).

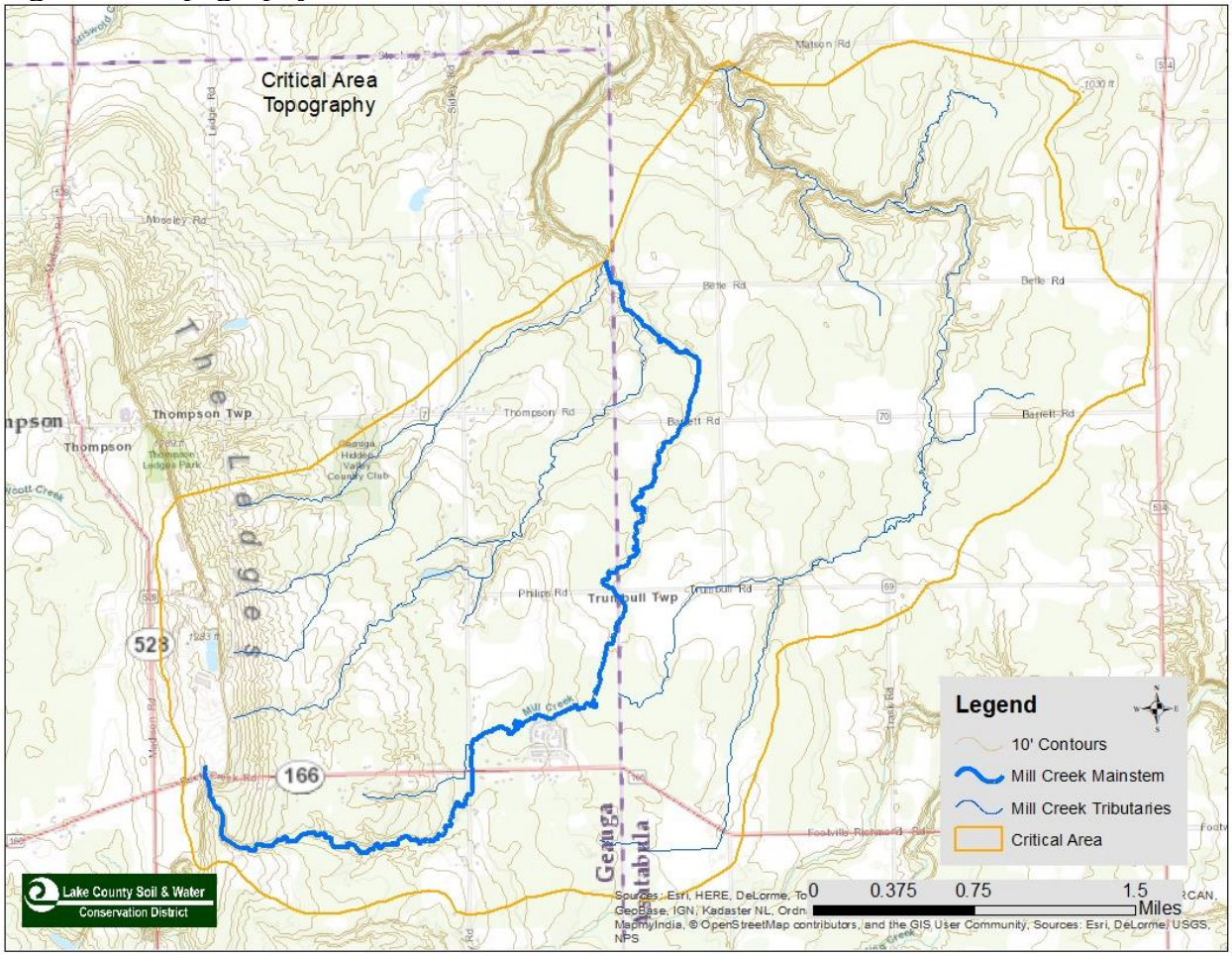
Deforestation of the wetlands can lead to increased erosion and sedimentation, warmer water temperatures and a decrease in water quality and aquatic use habitat. Wetlands Best Management Practices should be used to supplement upland forestry best management practices to reduce the potential adverse impacts of forest management activities on wetlands. (Forested Wetlands; Functions, Benefits and the Use of Best Management Practices. USDA # NA-PR-01-95)

The breakdown of wetland type is as follows:

- Forested/shrub wetland 67.1%
- Emergent wetland 28.7%
- Pond 4.1%

Figure 29. Restored Wetland

Figure 30. Topography



The topography drops from the flat ledges top and levels into the gradual slope of the ground moraine; steep ravines begin in the lower portion of the eastern tributary as the water cuts down to the Grand River valley (Figure 30).

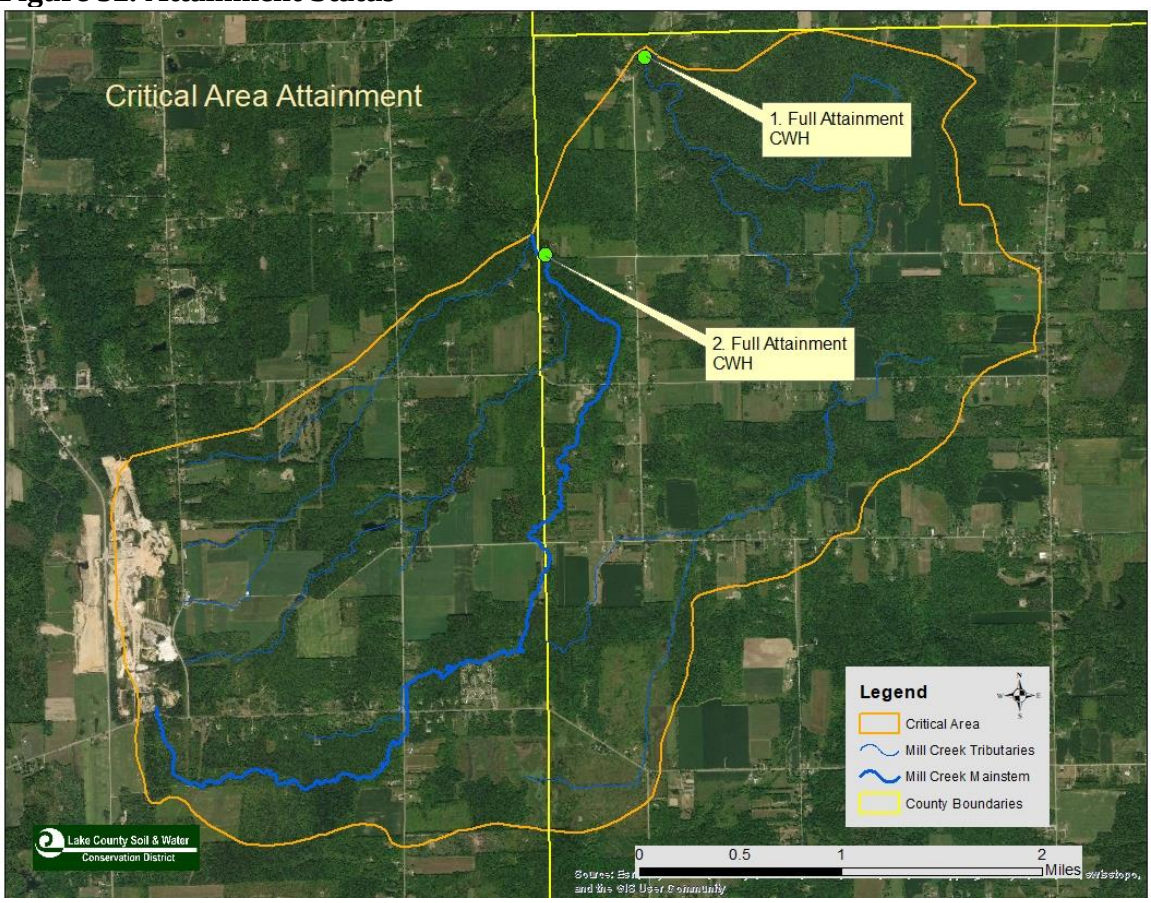
3.2.2 Detailed Biological Conditions

Two locations were sampled by the OEPA in 2004 in the critical area: downstream of Atkins Road and at Moseley Road (Figure 32). Both were in Full Attainment of Coldwater Habitat Aquatic Life Use (Figure 31).

Figure 31. EPA 2004 Sampling Data

Sampling Location	Macro-invertebrates	IBI/Narrative	ICI/ Narrative	QHEI/Status	Attainment Status
1	Exceptional	34/Fair	-	74.5	Full
2	Exceptional	40/Good	-	79	Full

Figure 32. Attainment Status



3.2.3 Detailed Causes and Associated Sources

The causes and sources of impairment in Critical Area are listed in the Ohio EPA online Water Quality Assessment Unit Summaries (2004) for the HUC-12 watershed.

Cause	Source
None listed	None listed

In 2006, the Ohio EPA stated for Mill Creek:

- Being a direct high-quality tributary to the Grand River, protecting the existing hydrology of Mill Creek is important to sustaining base flows and maintaining the long-term health of the Grand River.
- Streams showing the highest degree of chemical integrity include Mill Creek and its tributaries.

(OEPA Biological and Water Quality Study of the Grand River Basin 2003-2004; November 1, 2006.)

3.2.4 Outline Goals and Objectives for Critical Area

Goals

The nonpoint source goal is to maintain the FULL Attainment of the Coldwater Aquatic Life Use designations. This will include protecting the riparian corridors, protecting wetlands and appropriately managing the forest resources. In addition, the HHEI data will be updated.

Lake County SWCD conducted over 1200 assessments on primary headwater streams in northeast Ohio from 2000-08 in an attempt to better understand ways to protect these vital resources. As part of a small pilot study in 2018 and 2019 the Lake SWCD undertook a new effort to assess changes and trends in over 100 headwater habitats in the East Branch of the Chagrin River and the Grand River watersheds. This effort followed the same methodology and was conducted in the same locations as the original assessment effort.

The Headwater Habitat Evaluation Index (HHEI) developed by the Ohio Environmental Protection Agency described in detail in the "Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams" was used to complete an extensive baseline inventory of the biological integrity of headwater streams throughout Lake County. Primary headwater stream habitats are defined as having less than 1 mi2 (2.59 km2) of drainage area and pools <40cm. HHEI assessments are ranked into five designations based on their physical, biological and chemical measurements. Important information like flooding potential, riparian corridors and chemistry is collected with reference to the amount of development, wetlands, and proximity to structures.

The original inventory unveiled the wide distribution of several obligate salamander and macroinvertebrate species which could be used to monitor long term trends in water quality impairment. The original study showed that statewide predictions for the amount of coldwater primary headwater streams within individual watersheds may be underestimated in some cases as the Grand River watershed contains twice the statewide predicted amount of coldwater streams in its watershed. Obligate salamanders of the Plethodontidae family have proven to be good predictors of habitat quality in urban, suburban and rural watersheds. Data collected from this study also provided useful information on key dragonfly larvae and salamander habitats.

Statistical analysis of the data updated in 2018 and 2019 is ongoing to determine trends and significant departures from initial data. However, early analysis suggests that stream designations (ie. Class III, Class II, Class I, etc.) have not changed significantly. Physical scoring metrics like substrate types, stream width and stream depth have predominately stayed the same. This trend stays the same for chemical parameters of temperature, conductivity, pH and salinity. Biological indicator species like salamander and dragonfly larvae ranges appear to stable. The majority of streams with previously recorded populations maintained those populations. However, abundance of individuals in each stream appears to have decreased. The most notable changes between the 2000-2008 effort and the 2018-2019 effort was the change in the flow regime in certain streams.

While discharge was not physically measured in the original assessments, a notation is made during baseflow as to each individual stream's flow regime. The following regime choices are available for selection: 1. Perennial/Flowing, 2. Interstitial/Subsurface flow with isolated pools, 3. Intermittent/Moist channel with isolated pools (no flow) and 4. Ephemeral/Dry channel with no water. Approximately 22% of the streams had a reduction in the flow regime ranking. For example, a reduction in flow regime would be changing from Interstitial flow to Intermittent flow. Additional streams should be assessed to determine if this departure is significant across the entire data set. However, an early hypothesis is that the amount of groundwater infiltration feeding baseflow in these streams has been reduced. This reduction is the result of more intense, but infrequent, storm events; changes in soil texture from non-native earthworm activity; and lastly changes in evapotranspiration rates correlating to forest composition.

HHEI data supports many programs such as:

- TMDL development
- 401/404 water quality permits
- Acquisition of conservation easements
- Strengthening local planning commission and zoning board riparian setback resolutions.

Conservation of primary headwater streams and the surrounding natural areas that contain these unique habitats is essential to maintaining the function and value of downstream water quality.

Goal 1. Maintain or increase the QHEI score of 74.5 at Atkins Road and 79 at Moseley Road

- ACHIEVED: Sites currently have QHEI scores of 74.5 and 79, respectively.

Objectives

Objective 1. Maintain pervious cover in the riparian corridor

- Implement CRWP model ordinances and regulations in Trumbull Township to protect 13 stream miles

Objective 2. Protect wetlands

- Permanently protect 420 acres of wetlands
- Enhance 20 acres of Vernal Pools

Objective 3. Protect and manage forest resources

- Conduct Timber Stand Improvement on 45 acres of young forest areas
- Develop 3 forest management plans
- Establish riparian buffers on 1500 feet of previously clear-cut woods
- Establish another park for the Geauga Park District in Thompson

Objective 4. Update HHEI data

- Re-assess 61 HHEIs in the Lake County portion of the HUC-12

As the objectives are implemented, water quality monitoring will be conducted (both project related and regularly scheduled monitoring) to determine progress toward meeting the identified water quality goals. These objectives will be reevaluated and modified or added to if determined to be necessary. Reevaluation will utilize the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) which lists all the eligible NPS management strategies to address:

- Urban sediment and nutrient reduction
- Altered stream and habitat restoration
- Nonpoint source reduction
- High quality waters protection

Chapter 4. Projects and Implementation Strategy

4.1 Projects and Implementation Strategy Overview Table

The projects and evaluation needs that are believed to be appropriate to remove the impairments to the Mill Creek HUC-12 are listed below. They were determined by evaluating the identified causes and associated sources of nonpoint source pollution. Because the attainment status is based upon biological conditions, it will be necessary to periodically re-evaluate whether or not the implemented projects are sufficient to achieve attainment. The response of biological systems may take some time following project implementation. If issues other than nonpoint source pollution are causing impairments, they will need to be addressed under different initiatives, authorities or programs.

The Project and Implementation Strategy Overview Table addresses the Critical Area goals and objectives. The Critical Area goals aim to address the sources of impairment, including loss of riparian habitat, urban runoff, channelization and agriculture through increased infiltration of stormwater runoff and restoration of natural flow conditions and habitat.

The projects described in the Overview Table have been prioritized using the following three step prioritization method:

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

Priority 2. Projects where there is land-owner willingness to engage in projects that are designed to address the cause(s) and source(s) of impairment or where there is an expectation that such potential projects will improve water quality in the Mill Creek HUC-12 Watershed.

Priority 3. In an effort to generate interest in projects, an information and education campaign will be developed and delivered. Such outreach will engage citizens to spark interest as stakeholders to participate and implement projects like those mentioned in Priority 1 and 2.

Project Summary Sheets (PSS) are in subsection 4.2. These PSS provide the essential nine elements for short-term and/or next step projects that are in development and/or in need of funding. As projects are implemented and new projects developed these sheets will be updated. Any new PSS created will be submitted to the State of Ohio for funding eligibility verification (i.e., all nine elements are included).

4.1 Project and Implementation Strategy Overview Tables

For ***Mill Creek HUC-12*** (***041100040602***) — Critical Area								
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)*
Recommend that your critical areas be numbered or coded for reference.That number/code listed here comes from Chapter 3 section 3.1	*It is recommended that your goals and objectives be numbered or coded for easy reference. The number/code listed here comes from Chapter 3 section 3.x.4.*		*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*
High Quality Waters Protection Strategies								
1	1	2	1	Stream and Wetland Foundation Permanent Protection	Geauga, Lake & Ashtabula SWCDs	1-3 years	$1,500,000	Landowner donation
1	1	3	2	Sawdust Tract Protection	Ashtabula SWCD	Medium		GLRI, Clean Ohio
	1	4	3	Update HHEIs	Lake SWCD	1-3 years	$25,500	CMAG

4.2 Critical Area 1: Project Summary Sheet

Nine Element Criteria	Information needed	Explanation
n/a	**Title**	Stream and Wetland Foundation Permanent Protection
criteria d	**Project Lead Organization & Partners**	Lake, Geauga and Ashtabula SWCDs
criteria c	**HUC-12 and Critical Area**	HUC 12: 041100040602 Mill Creek (3) Critical Area Subwatershed
criteria c	**Location of Project**	6900 Madison Road, Thompson OH 44086
n/a	**Which strategy is being addressed by this project?**	High Quality Waters Protection Strategies
criteria f	**Time Frame**	Short-Term Priority (1-3 yr)
criteria	**Short Description**	Permanently protect 420 acres of restored wetlands on State Route 166 in Geauga and Ashtabula Counties in the headwaters of Mill Creek.
criteria g	**Project Narrative**	The Stream and Wetland Foundation owns approximately 420 acres of wetlands in Geauga and Ashtabula Counties. Beginning in 2001, the Foundation has developed and implemented habitat restoration plans through mitigation. The microtopography and vegetation have been restored to create Category 2 and Category 3 wetlands on the property. The Foundation will permanently protect these wetlands either through a conservation easement or environmental covenant, which will protect the wetlands and the wetland functions of water infiltration and filtration in the uppermost reaches of the watershed.
criteria d	**Estimated Total cost**	Estimated project cost: $2,500 per acre easement value for 420 acres = $1,500,000.
criteria d	**Possible Funding Source**	Landowner donation
criteria a	**Identified Causes and Sources**	Sources of impairment: none listed Causes of impairment: none listed

criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	The Critical Area is in attainment.
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	This project will protect 420 acres of wetland in the headwaters of Mill Creek. It addresses Objective 2 in the Critical Area.
	Part 3: Load Reduced?	Zero
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	The success of the project will be evaluated through continuing attainment of the CWH attainment.
criteria e	**Information and Education**	The Mill Creek NPS-IS is on the Lake SWCD website. Projects will be featured on the District websites and in the District newsletter as they are completed.

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Soil Survey of Ashtabula County, Ohio. In cooperation with Ohio Department of Natural Resources, Division of Soil and Water Conservation; Ohio Agricultural Research and Development Center; Ohio State University Extension; Ashtabula County Commissioners; and Ashtabula Soil and Water Conservation District

Soil Survey of Geauga County, Ohio; United States Department of Agriculture Soil Conservation Service, in cooperation with Ohio Department of Natural Resources Division of Lands and Soil and Ohio Agricultural Research and Development Center

Soil Survey of Lake County, Ohio; United States Department of Agriculture Soil Conservation Service, in cooperation with Ohio Department of Natural Resources Division of Lands and Soil and Ohio Agricultural Research and Development Center

United States Geological Survey, StreamStats in Ohio.
http://water.usgs.gov/osw/streamstats/ssinfo.html

Appendix A. Acronyms

BMPs	Best Management Practices
CONUS	Conterminous United States
CRWP	Chagrin River Watershed Partners
CWH	Cold Water Habitat
EPA	Environmental Protection Agency
HHEI	Headwater Habitat Evaluation Index
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
MIwb	Modified Index of Well-Being
NLCD	National Land Cover Data
NOACA	Northeast Ohio Areawide Coordinating Agency
NPDES	National Pollution Discharge Elimination System
NPS-IS	Nonpoint Source Implementation Strategy
NRCS	Natural Resources Conservation Service
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
PHWH	Primary Headwater Habitat
PUD	Planned Unit Development
PSS	Project Summary Sheets
QHEI	Qualitative Habitat Evaluation Index
SMD	Stormwater Management Department
SSH	Seasonal Salmonid Habitat
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WWH	Warmwater Habitat