

Talcott Creek-Grand River
HUC-12: 041100040605
Nine-Element
Nonpoint Source Implementation
Strategy (NPS-IS)



Version 1.1
April 30, 2024

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Acknowledgements

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With gratitude for the assistance from:

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Jonathan Mauk, District Conservationist, NRCS
Erwin Leffel, Thompson Township Trustee
Tim Miller, Director, Lake County Stormwater Management Department
Josh Myers, Chagrin River Watershed Partners
Nathan Paskey, District Manager, Ashtabula SWCD
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This report was prepared by the Lake County Soil and Water Conservation District using federal funds under award NA18NOS4190096 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Ohio Department of Natural Resources, Office of Coastal Management. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Ohio Department of Natural Resources, or the Office of Coastal Management.

Chapter 1: Introduction

1.1 Report Background

The Talcott Creek-Grand River Nonpoint Source Implementation Strategy (NPS-IS) brings Lake and Geauga 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 Talcott Creek-Grand River Watershed is located in southeastern Lake County and north central Geauga County (Figures 1 and 2). The Talcott Creek-Grand River Watershed 12-digit Hydrologic Unit Code (HUC) is 041100040605; the watershed drains approximately 19.5 square miles. It is located in within the 10-digit HUC known as the Lower Grand River Watershed. 66% of the watershed is in Lake County and 33% is in Geauga 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.

The watershed contains a length of the Grand River mainstem and collects water from parts of Thompson Township in Geauga County and parts of Leroy, Madison and Perry Townships in Lake County (Figure 3). The Grand River mainstem constitutes the boundary between Perry and Leroy Townships.

“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 Talcott Creek subwatershed supports exceptionally high-quality macroinvertebrate communities, including many infrequently collected sensitive taxa and is characterized by coolwater/coldwater macroinvertebrate communities. The unusually high-quality macroinvertebrate communities is likely due to the streams flowing through highly wooded ravines with continuous groundwater flow and limited development. The relatively high percent forest cover and low intensity of agriculture within the Lower Grand hydrologic unit are also important factors explaining good water quality. Talcott Creek is a snow-belt stream, and fish communities are subject to natural limitations of torrential scouring flows, lengthy stretches of shallow bedrock and low summer flows; not surprisingly the fish samples did not meet the IBI biocriterion. (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 7.55% of the watershed as developed and 1.49% imperviousness.

63.2% of the Talcott Creek-Grand River Watershed is covered by forest, which is a very important factor for good water quality.

Figure 1. Location of the Watershed

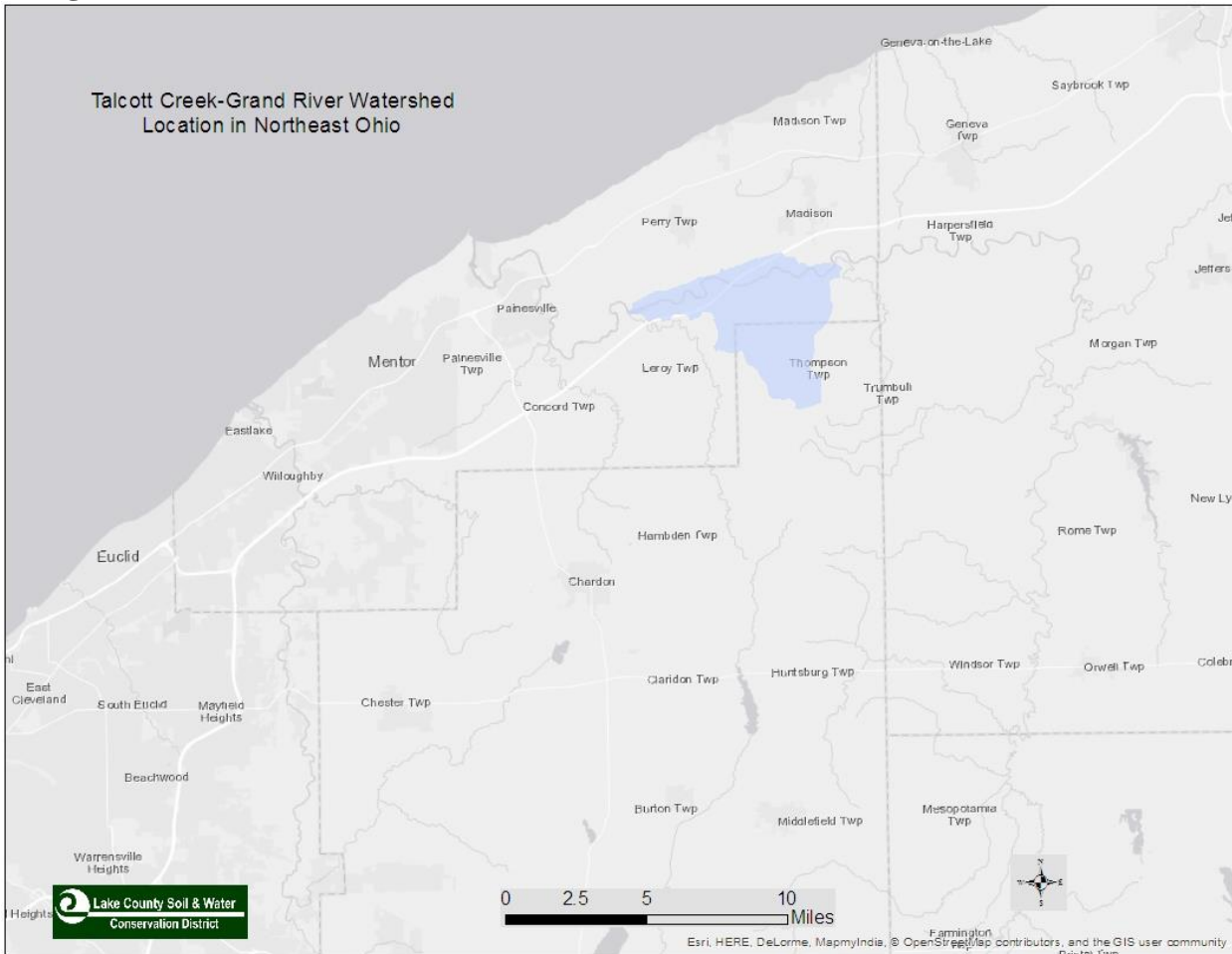


Figure 2. Location in the Lower Grand Watershed

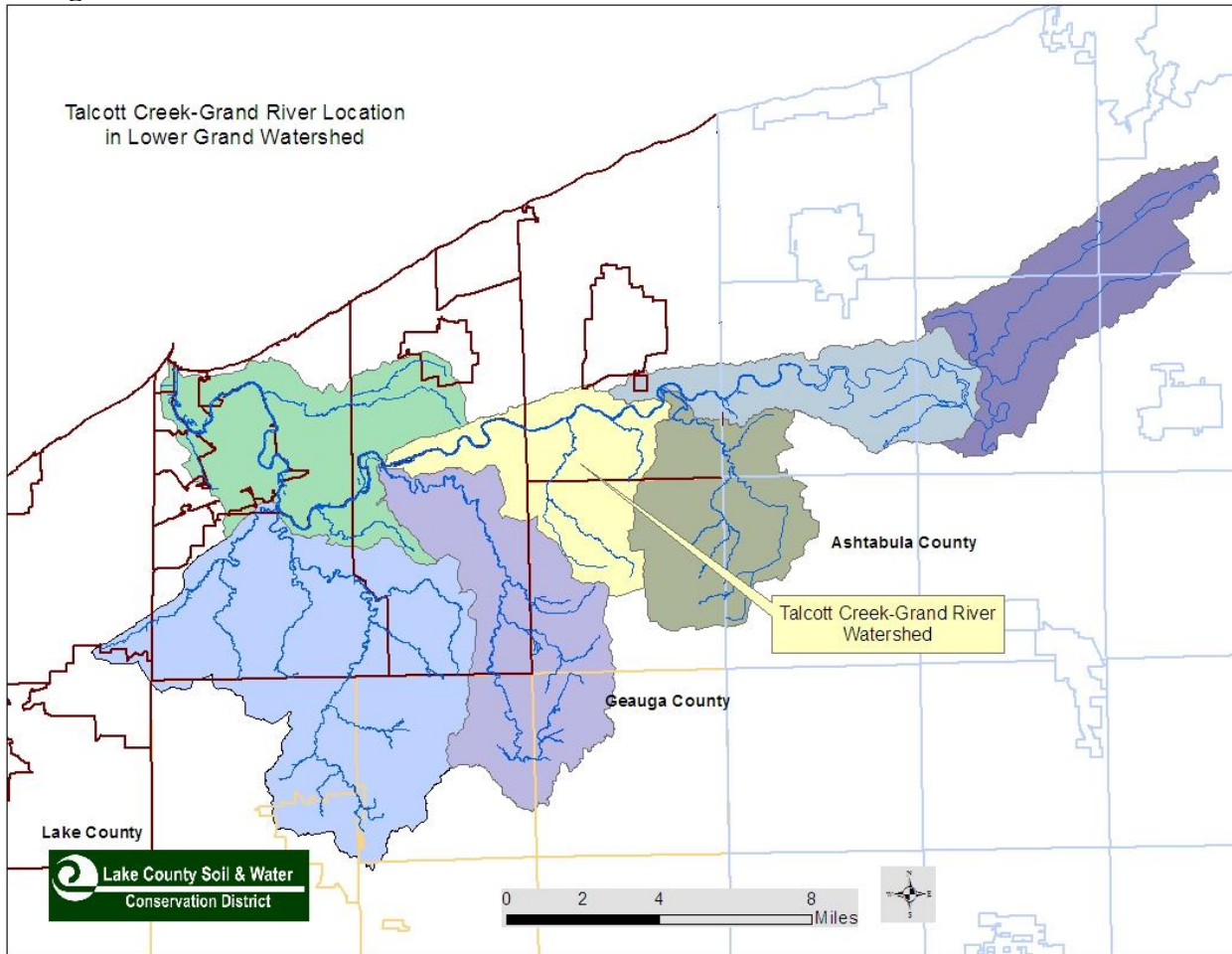


Figure 3. Watershed Communities

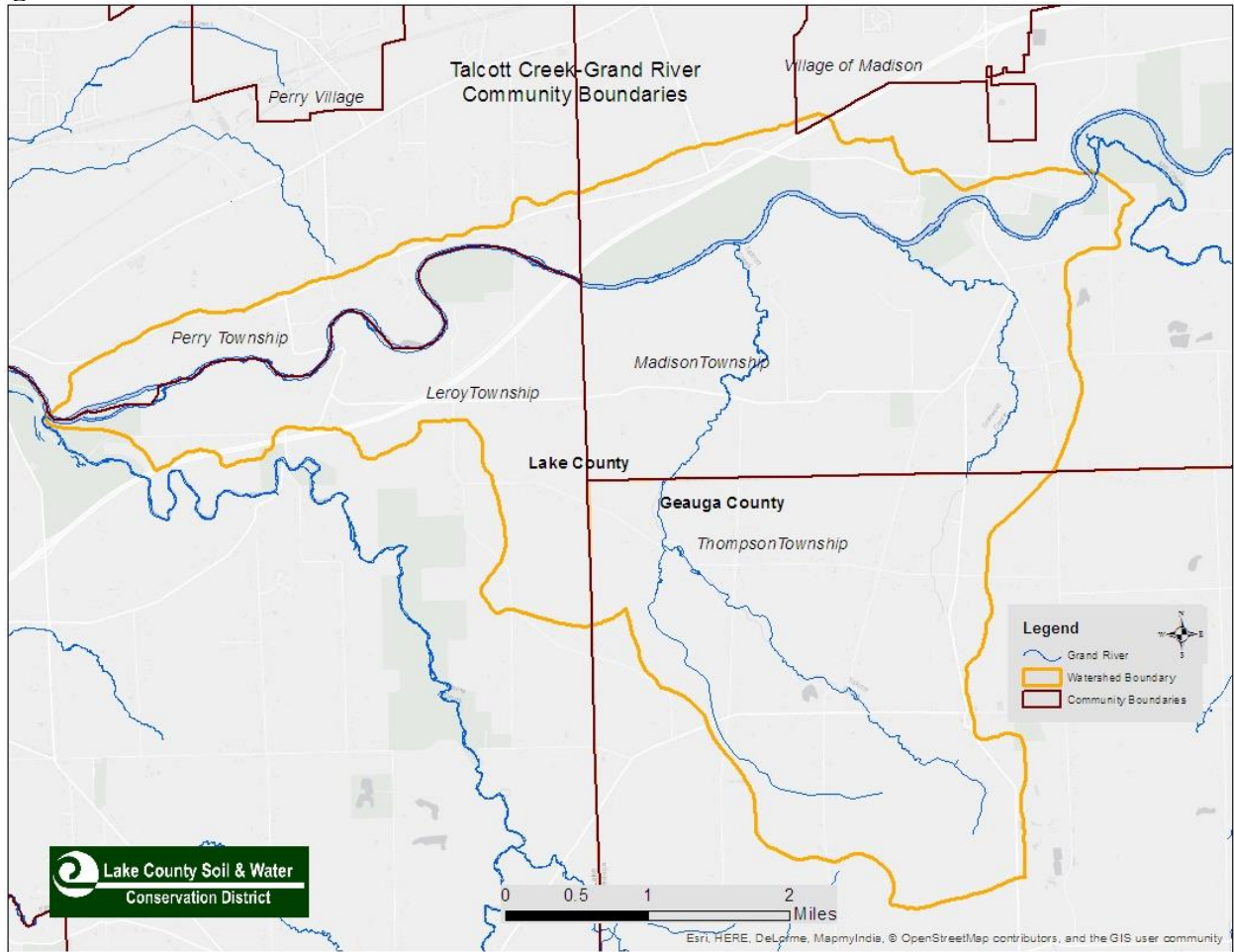
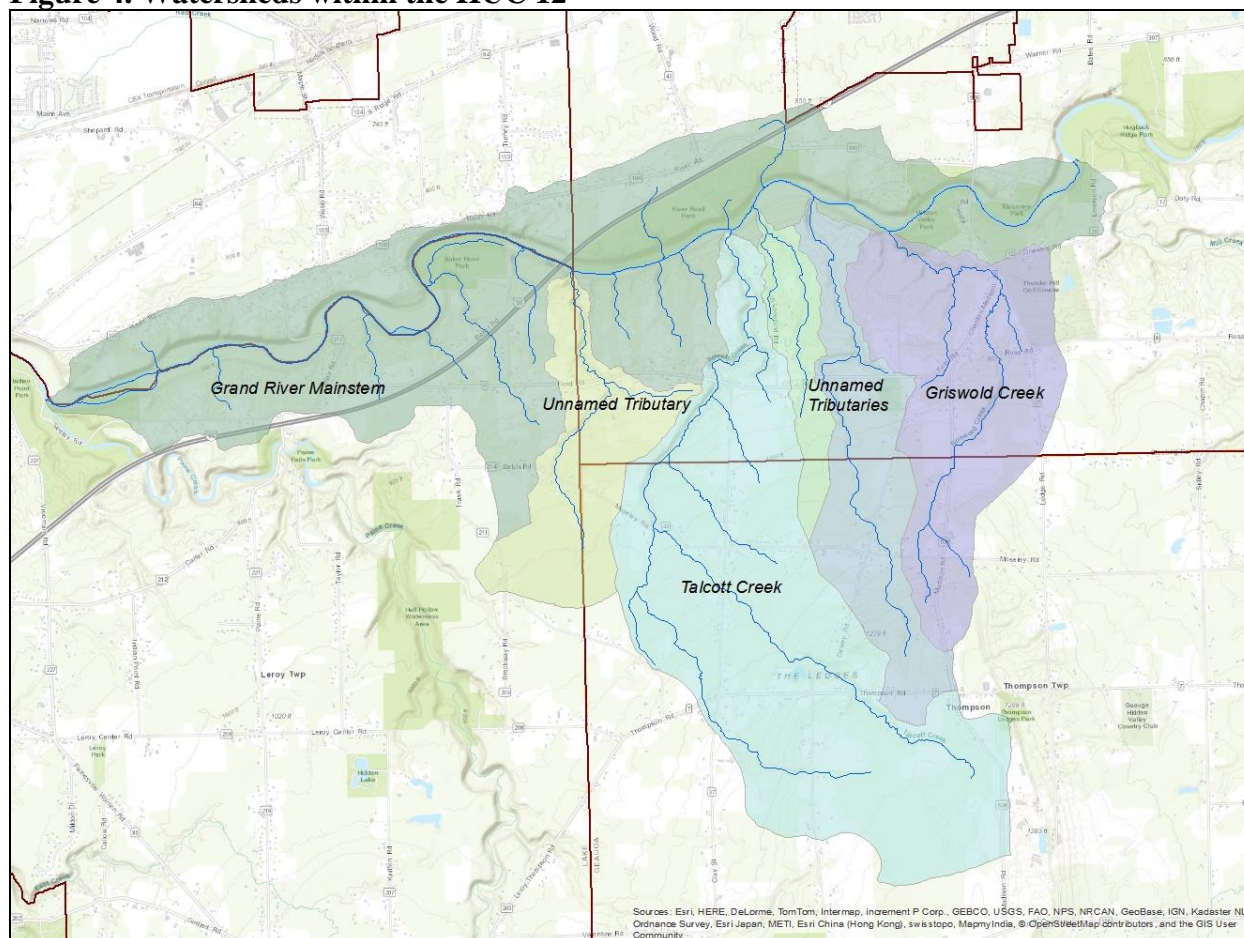


Figure 4. Watersheds within the HUC 12



The Talcott Creek-Grand River Watershed has six subwatersheds: Talcott Creek, Unnamed Tributary, Grand River Mainstem, Griswold Creek and two Unnamed Tributaries, listed in a clockwise direction from the headwaters of the Watershed (Figure 4).

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 Talcott Creek-Grand River Watershed's elevation ranges from 1286 feet in the headwaters to 666 feet where it empties into the Grand River mainstem, an elevation change of 620 feet (Figure 5). The elevation in the Grand River mainstem ranges from 690 to 630, a drop of 60 feet. The Grand River mainstem has carved a deep channel through some sections, with 140-foot-tall banks (Figure 6).

Figure 5. Topography

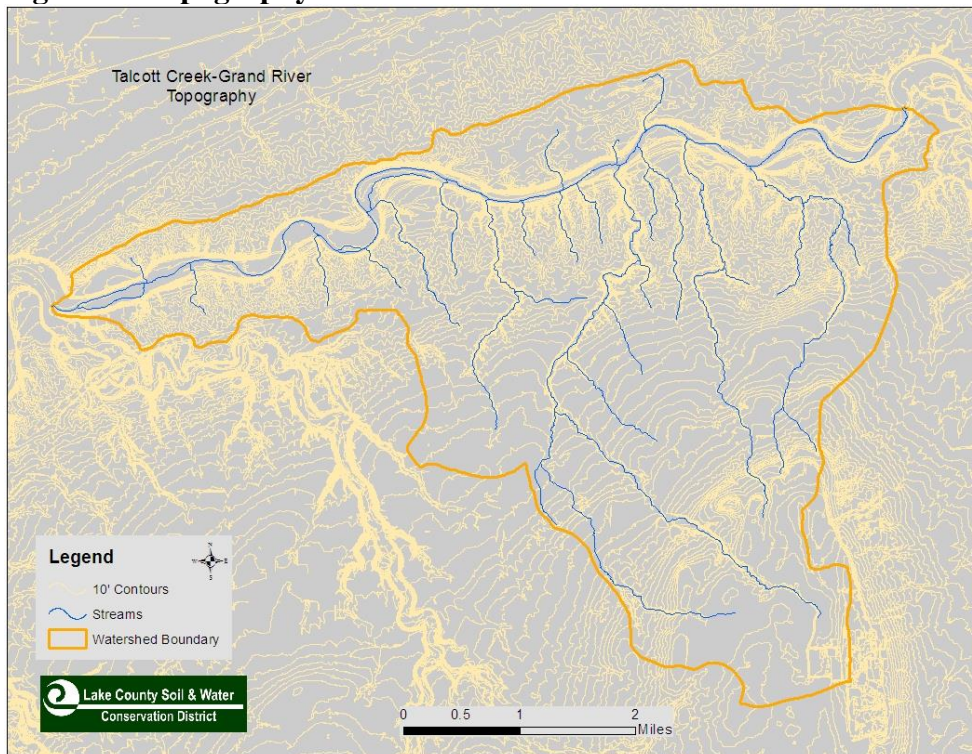
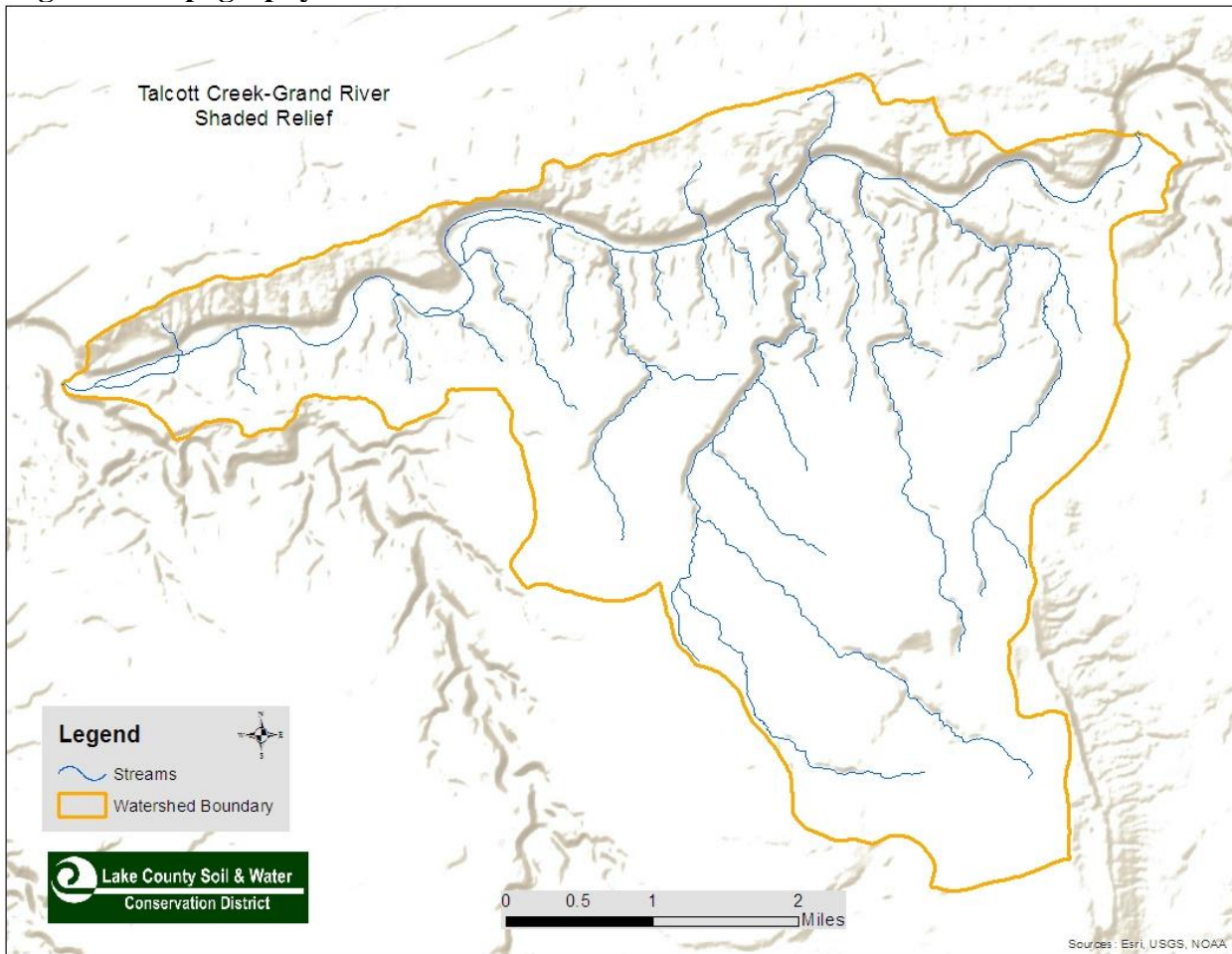


Figure 6. Steep Banks



It 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 at the mouth of the Talcott Creek-Grand River watershed. This region of the Plateau was glaciated.

Figure 7. Topography- Shaded Relief View



Geology & Glacial History

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

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

Almost half of the watershed area is ground moraine, which is flat to gently undulating and is found in the southern half of the watershed. Approximately 43% is end moraine, which occurs as hummocky ridges north of the ground moraine and on either side of the Grand River valley. Many tributaries in the end moraine have carved small ravines on their way down to the mainstem, particularly on the south side. Alluvium and Alluvial terraces are in the present and former floodplain of the Grand River mainstem and comprise about 7.5% of the watershed. Small pockets of outwash deposited in front of glacial ice are found adjacent to the Alluvial terraces.

Figure 8. Glacial Geology

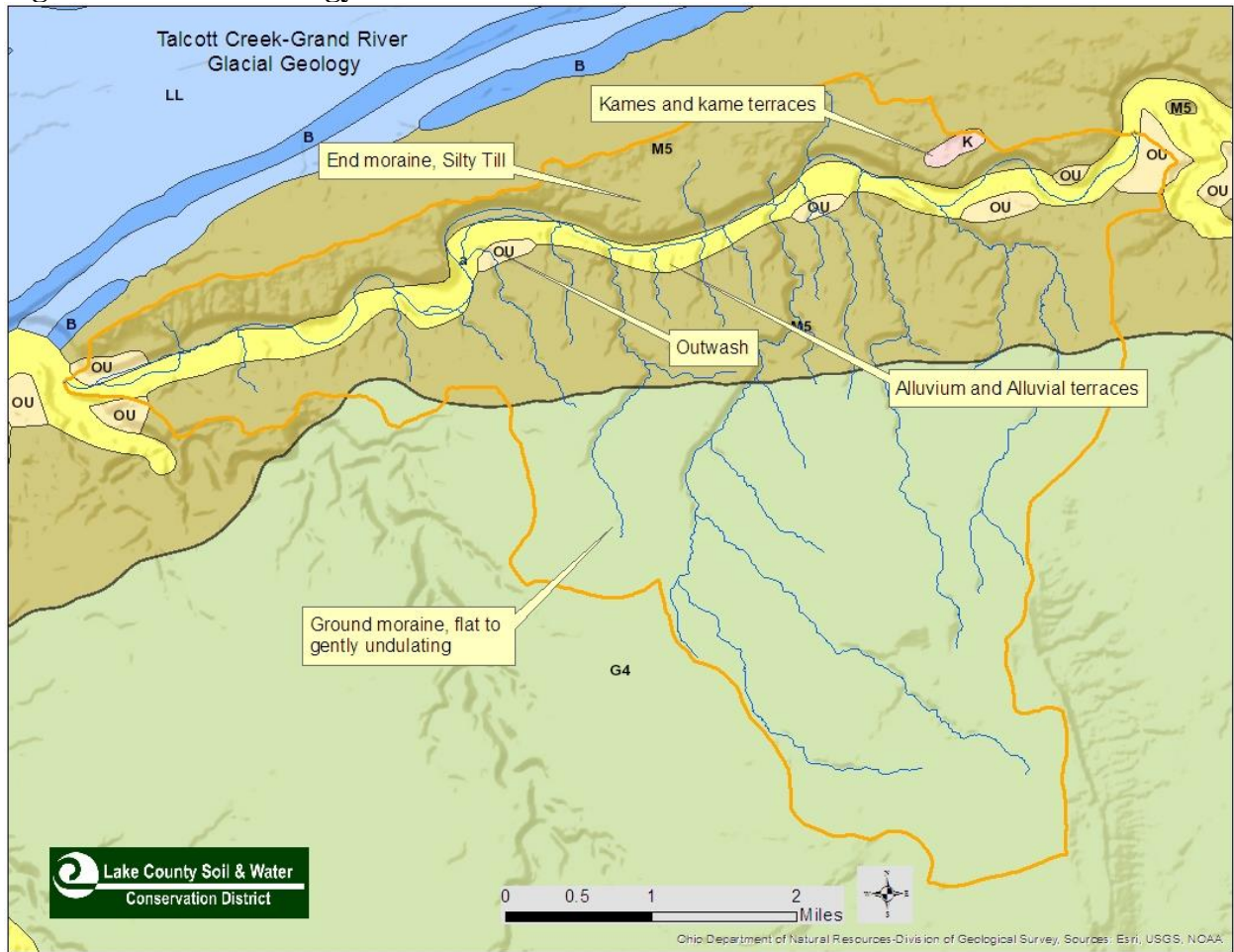


Figure 9. Soil Drainage Characteristics

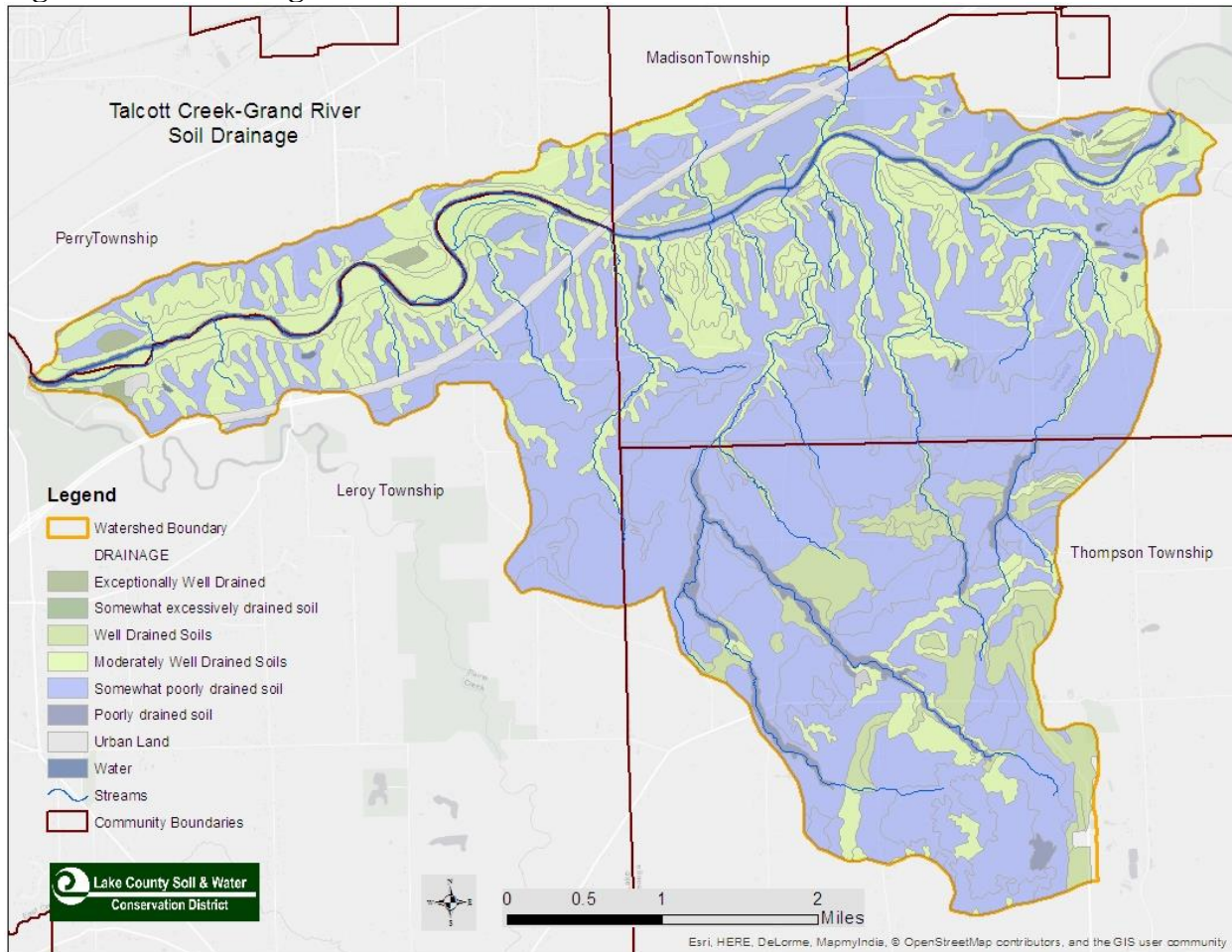


Figure 10. Soil Drainage Characteristics

Drainage Characteristic	Acreage	%
Excessively well drained	52.8	.4
Well drained	705.2	5.6
Moderately well drained	3592.4	28.5
Somewhat poorly drained	7571.3	60.1
Poorly drained	210.6	1.7
Urban	219.4	1.7
Water	218.9	1.7
Pits-Quarry	24.4	.2

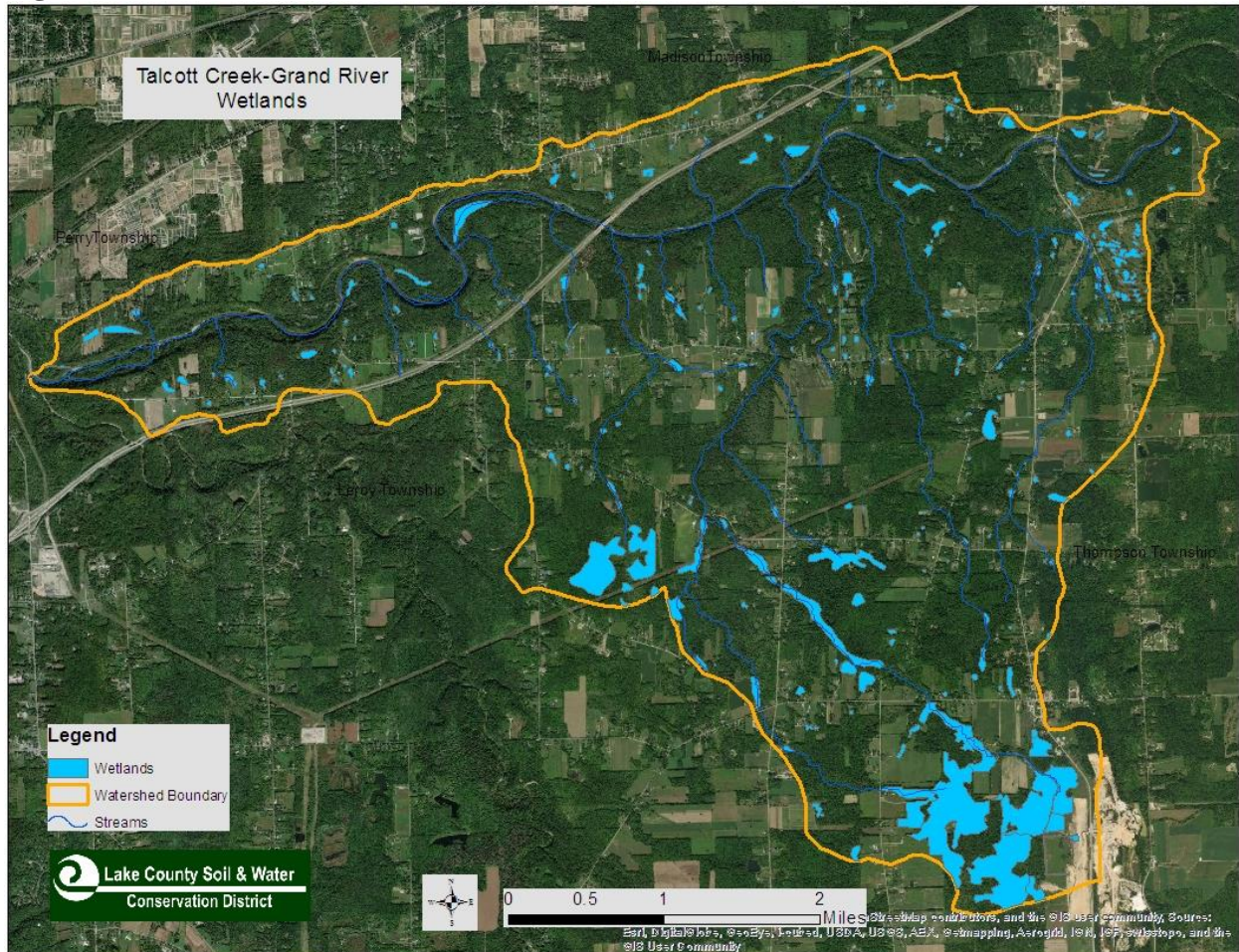
60% of the soils are somewhat poorly drained (Figure 9). The somewhat poorly drained soils are associated with the glacial ground moraine and the demarcation of the ground and end moraine features and soil transition can be clearly seen in Figure 8.

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).

The Urban soils are associated with the Interstate 90 corridor in the northern section of the watershed; Water is mostly comprised of the Grand River mainstem that flows through the northern section; Pits-Quarry are found in the southeast corner of the watershed, where the Sharon Conglomerate is mined.

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

Figure 11. Wetlands



Wetlands

5.8% 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 southwest corner of the

watershed, and there are many small ponds dotting 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 73.6%
- Pond 24.0%
- Emergent wetland 1.2%

2.1.2 Land Use and Protection

The National Land Cover Database (NLCD 2011) delineated 56% of the land use as forest in 2011, 25.6% of the land use as agriculture and 7.6% of the land use as urban (Figure 12).

Figure 12. Land Use Percentage

Open Water	319.2	2.60%
Developed, Open Space	542.3	4.40%
Developed, Low Intensity	371.2	3%
Developed, Medium Intensity	31.4	0.25%
Barren Land	61.4	0.49%
Deciduous Forest	6768	55.70%
Evergreen Forest	33.3	0.27%
Mixed Forest	21.1	0.17%
Shrub/Scrub	178.8	1.45%
Herbaceous	776	6.30%
Hay/Pasture	869.7	7.00%
Cultivated Crops	2293.2	18.60%
Woody Wetlands	63.8	0.50%
Emergent Herbaceous Wetlands	6.7	0.05%

Land Use data is taken from the 2019 Lake County parcel data and the 2018 Geauga County parcel data (Figure 13a). The data from each county is shown separately and as a whole because there are notable differences. Geauga has a higher percentage of land in agricultural and residential uses; Lake has a much higher percentage of public land due to Lake Metroparks' and other organizations preserving property adjacent to the mainstem of Talcott Creek and more commercial land (Figures 13 and 13a). See the Publicly Owned Lands section below for more details (Figure 14).

Figure 13. Land Use

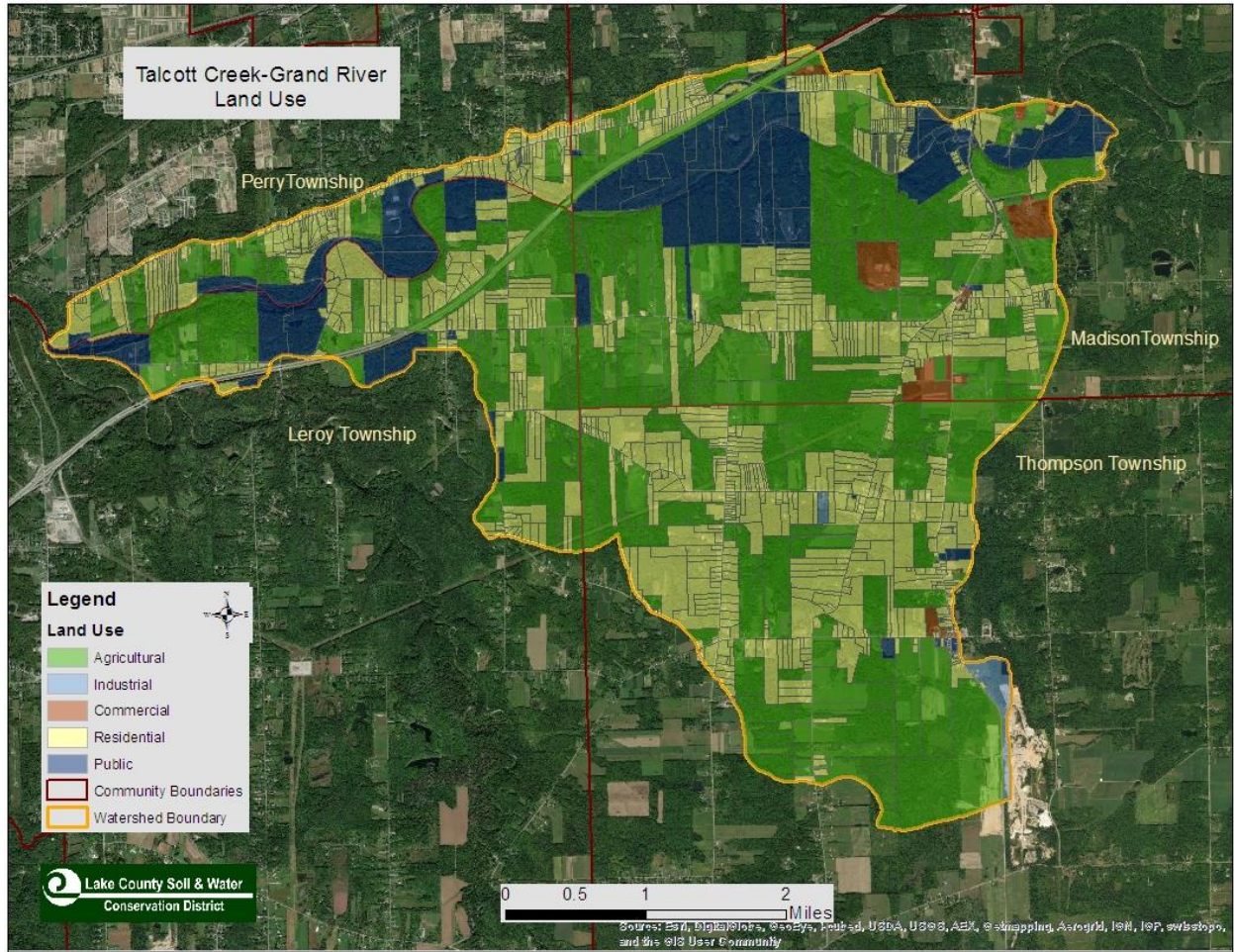


Figure 13a. Land Use from Parcel Data

Land Use	Acreage in Lake	%	Acreage in Geauga	%	Total %
Agriculture	3568.7	44	2326.5	55	47.4
Industrial			74.0	1.7	.6
Commercial	200.8	2.4	17.4	.4	1.7
Residential	2556.8	31.2	1781.6	42	34.9
Public	1700.4	21	34.0	.8	13.9
I-90	160.1	1.9			1.3
TOTALS	8186.9		4233.52		

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 Talcott Creek watershed is limited. The economics of buildings in areas with large lot sizes, large frontages, no sanitary sewer or central water make developing very difficult with thin profit margins. 96% of the land in watershed is lots 2 acre or larger with 47% of the lots being five-acre minimum lot size.

Development can also be subject to availability of sanitary sewer service. 92.5% of the watershed is recommended by the NOACA 208 plan to be serviced by on-site systems. 6.4% of the watershed is recommended to be served by central sewer to a large plant and 1.1% of the watershed is be served by a smaller, package sanitary sewer plant. While 6.4% of the watershed is recommended to go to a large central plant at this time, those areas do not currently have infrastructure available to move the sanitary waste to the plant are not expected to have the infrastructure for another 20 years.

The area around Thompson Square has sanitary sewer service available and it has the potential to develop because of the new service.

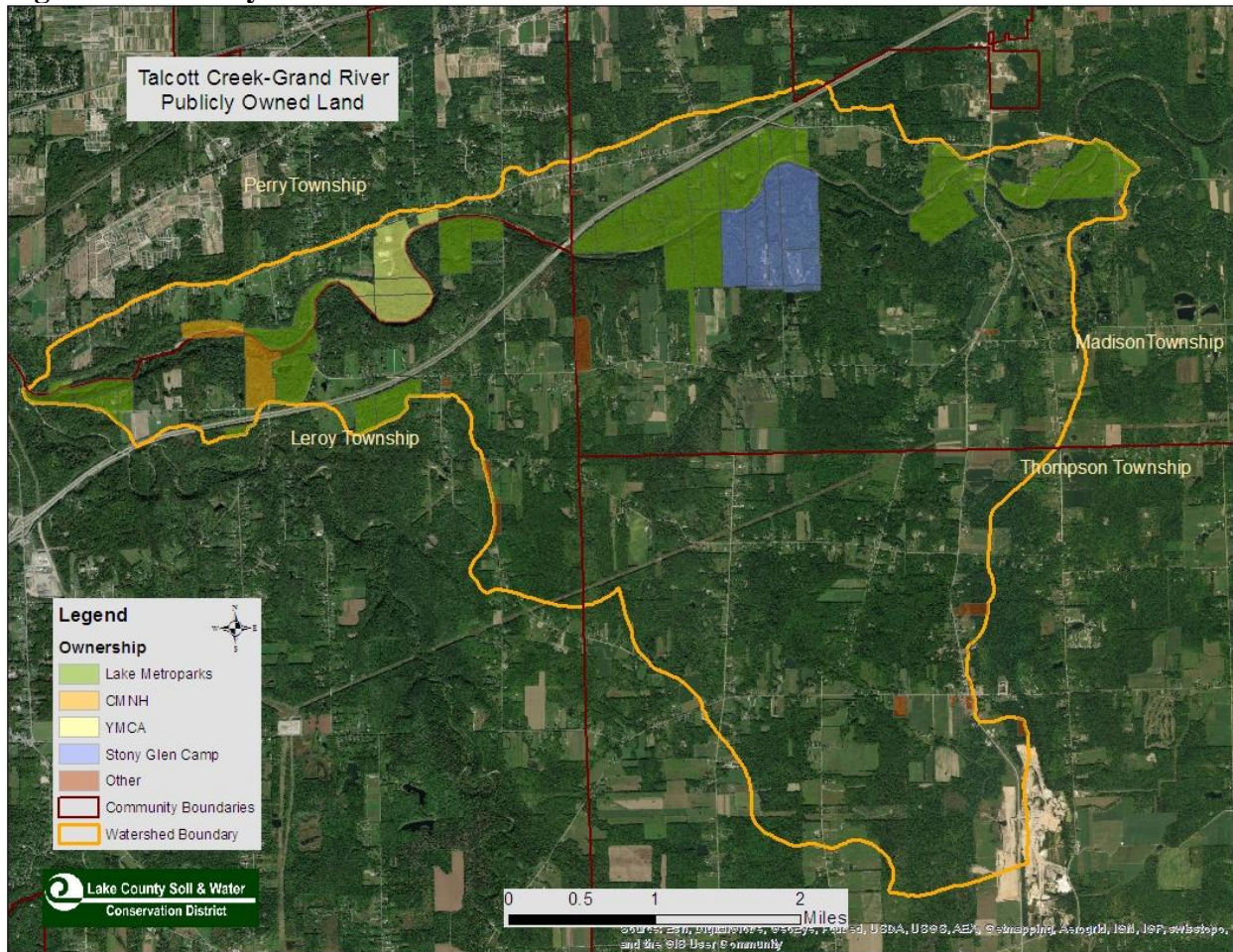
ORC 519 of the Ohio Revised Code allows townships to regulate land use through zoning; this section does not allow the townships to prohibit agriculture, but they may limit it. Agriculture is by right, so it can be done in the entire watershed. One of the most profitable agricultural businesses is the wineries. Talcott Creek is part of the Grand River Micro Climate, making it ideal to grow grapes and make wine. There are four wineries in the watershed. These wineries, some with food preparation, are operating in residential districts because of the agriculture exemption.

Zoning:

95.5% of the Talcott Creek Watershed is zoned residential. 47% of the watershed has a minimum lot size of five acres or 0.20 of a unit per acre. 32% has a minimum lot size of three acres per unit or 0.34 of a unit per acre. There are limited areas of 2-acre minimum lot size and 20,000 square feet minimum lot size. The 20,000 square foot minimum lot size is located in Madison Township, along I-90. Central sanitary sewer service is available in this part of the watershed. The entire watershed is considered unincorporated or township.

- Five Acre Zoning: 47%
- Three Acre Zoning: 32%
- River Protection 9.4%
- 20,000 SF Zoning: 6.4%
- Two Acre Zoning: 0.53%
- Mineral Resources: 3.0%
- Commercial Zoning: 0.97%
- Industrial Zoning: 0.33%
- Park Zoning: 0.26%

Figure 14. Publicly Owned Lands



About 13.6% of the land is protected (Figure 14), with most of it on the Grand River mainstem corridor. 1,099.1 acres are owned by Lake Metroparks, 89.5 acres are owned by the Cleveland Museum of Natural History, 311.4 owned by Stony Glen Camp and 155.5 owned by the YMCA. A close-up view of the Grand River gorge on Lake Metroparks property on Talcott Creek is shown below (Figure 15).

Figure 15. Section of Talcott 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 (Center for Watershed Protection, 2002), “...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).”

U.S. Geological Survey StreamStats data shows the imperviousness in selected subwatersheds (Figure 16):

Figure 16. Imperviousness

Subwatershed	Percent Forested	Percent Developed	Percent Impervious	Drainage Area-Sq Miles
Grand River mainstem	58.3	13	2.98	6.39
Talcott Creek subwatershed	65.4	4.27	0.98	5.51
Unnamed tributary West of Griswold	68.2	5.68	0.74	1.65
Griswold Creek	53.8	11	1.31	2.31

As the watershed develops, the 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 two Aquatic Life Use designations in the watershed: Exceptional Warmwater Habitat (EWH), Coldwater Habitat (CWH). 9.7 miles are designated as EWH and 6.3 miles are designated CWH.

EWH use designation is reserved for waters which support “unusual and exceptional” assemblages of aquatic organisms which are characterized by a high diversity of species, particularly those which are highly intolerant and/or rare, threatened, endangered or special status (i.e. declining species); this designation represents a protection goal for water resource management efforts dealing with Ohio’s best water resources.

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 2 sites in 2004 (Figures 17 and 18) for aquatic life use attainment, updating the data found in the Biological and Water Quality Study of the Grand River Basin 2003-2004. Of the 2 sites, 1 was in Full Attainment of Aquatic Life Use for Exceptional Warmwater Habitat and the other was in Full Attainment of Coldwater Habitat. The causes and sources for the sites in Partial Attainment were not 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>)

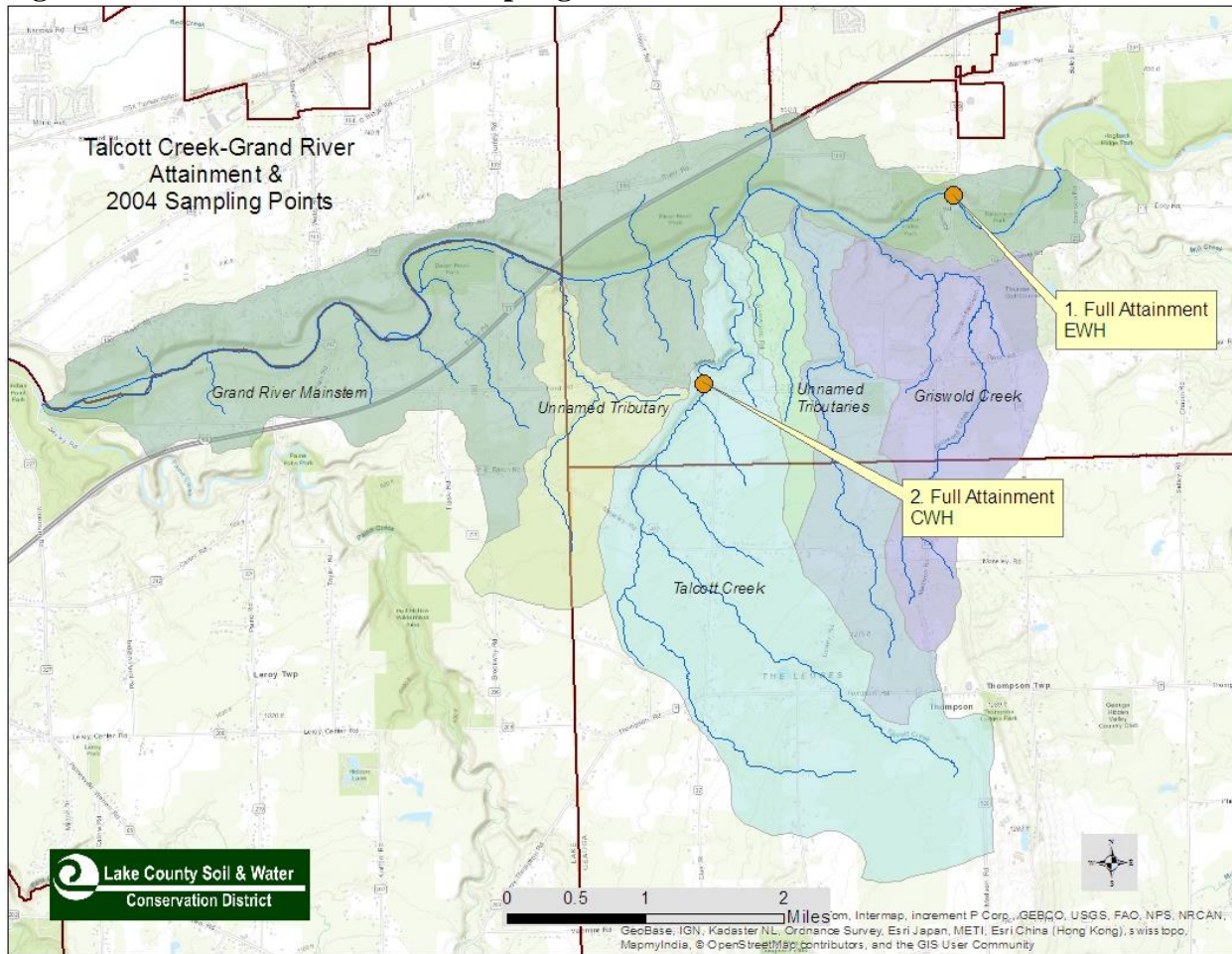
In several locations, and at different sampling intervals, state threatened and species of concern macroinvertebrates were observed.

Figure 17. 2004 Sampling Data

Location Number	Location	IBI/Rating	MIwb*	ICI/Rating	QHEI/Rating	Aquatic Life Use Desig.	Attainment Status
1	Grand River at SR 528	54/Exceptional	10.4/ Very Good	48/ Exceptional	80	EWH	FULL
2	Talcott Creek at Ford Road	22/Poor	-	-	61/ Narrative was Exceptional	CWH	FULL

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

Figure 18. 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 by Lake SWCD staff in the Talcott Creek-Grand River Watershed between 2001 and 2006. 178 sites were assessed in Lake County. There is no HHEI data for Geauga County.

The Class is determined by the assessment of the biological community and the presence or lack of indicator species. See Figure 21 and the subsequent text for a description of the three classes of Primary Headwater Habitat (PHWH) streams found in Ohio. By HHEI class, 41.3% of the streams in the Talcott Creek Watershed are Class I, 25.8% are Class II and 32.6% are Class III (Figures 19 and 20).

Figure 19. HHEI Stream Class for the Lake County Section

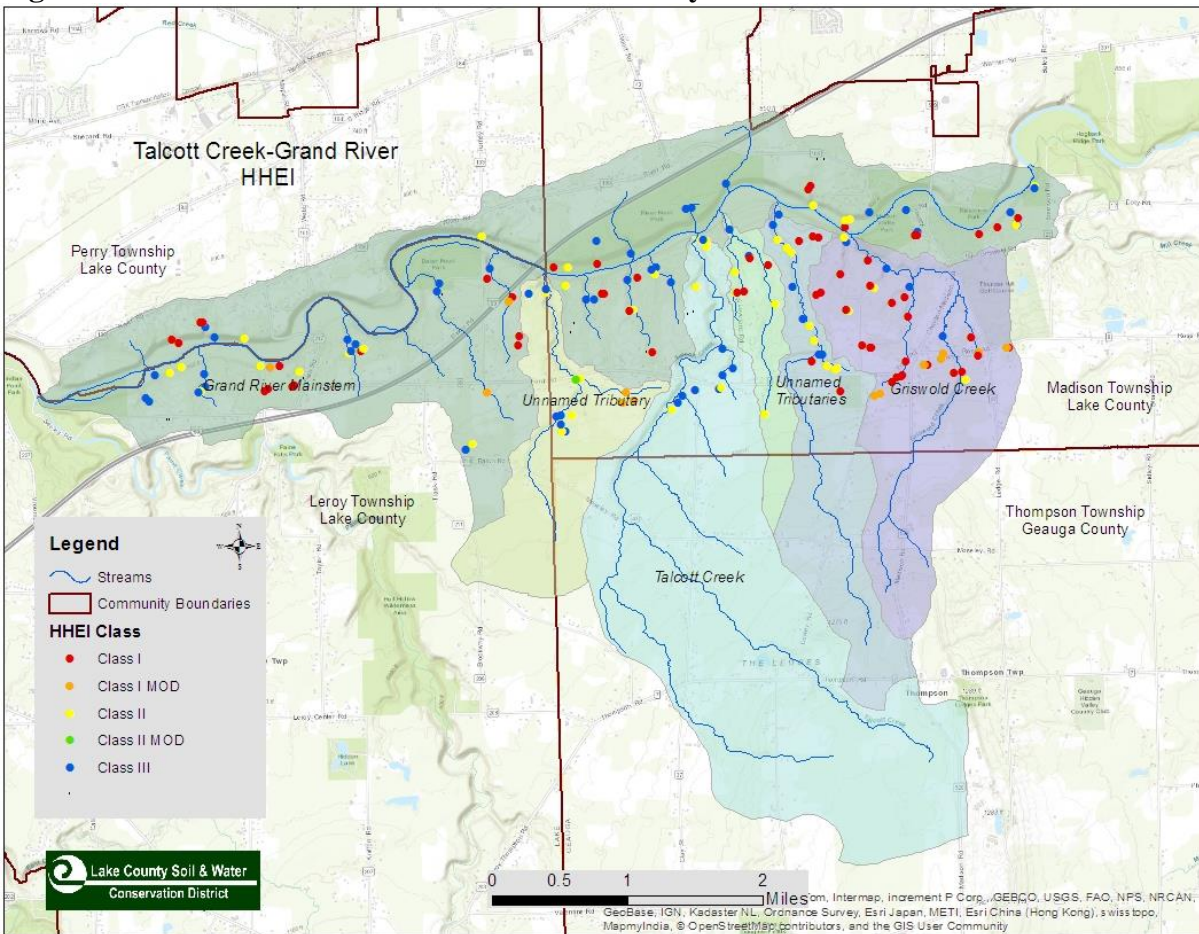


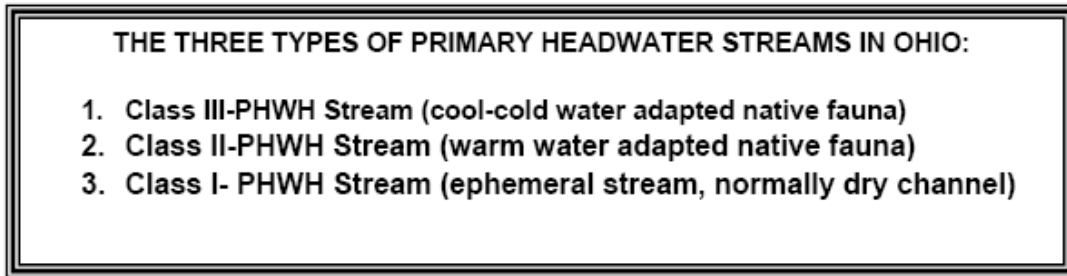
Figure 20. HHEI Stream Class

Class	Number	%
Class I	61	34
Class I Modified	13	7.3
Class II	45	25.3
Class II Modified	1	.5
Class III	58	32.6

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:

- Talcott Creek is recommended for a CWH aquatic life use based on the presence of eight coldwater macroinvertebrate taxa.
- Being a direct coldwater tributary to the Grand River, protecting the existing hydrology of Talcott Creek is important to maintaining the long-term health of the Grand River.
- Talcott Creek shows a high degree of chemical integrity; the protection of much of the riparian corridor and adjacent slopes running to the uplands is largely responsible for the high degree of chemical integrity.
- The relatively high percent of forest cover and low intensity of agriculture are also important factors explaining good water quality.
- As a snow-melt stream, fish communities in Talcott Creek are subject to the natural limitations of torrential scouring flows, lengthy stretches of shallow bedrock and low summer flows. It is not surprising that the fish sample from Talcott Creek did not meet the IBI criterion.
- The tributaries in the Talcott Creek-Grand River Watershed have high gradients, discontinuities in bedrock and are subject to scouring flows that result in long bedrock glides, cascades and water falls.
- The unusually high-quality macroinvertebrate communities in Talcott Creek are probably due to the stream flowing through highly wooded ravines with continuous groundwater flow and limited development.
- Talcott Creek is a coldwater tributary which contributes cold ground water base flow to the Grand River.

Figure 21: 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 streams 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.

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- natural limitations to fish community

Sources of impairment:

- None listed

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 Talcott 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 they 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)
Talcott Creek	190	95

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 Comprehensive Planning in Leroy Township

Chapter 10 of the 2018 Comprehensive Plan for Leroy Township addresses ways to protect its natural resources as the community develops through larger lot requirements than in other developing areas, stormwater management for new developments and riparian and wetland setbacks to maintain riparian area and wetland functions.

Riparian setbacks are required on all land adjacent to designated watercourses. The setback distance is determined by the size of the watershed that the watercourse drains, as follows:

1. A minimum of 120 feet on each side of all designated watercourses draining an area equal to or greater than 20 square miles.
2. A minimum of 75 feet on each side of all designated watercourses draining an area equal to or greater than 1 square mile and up to 20 square miles.
3. A minimum of 25 feet on each side of all designated watercourses draining an area less than 1 square mile and having a defined bed and bank as determined in the regulations.
4. A minimum of 50 feet on each side of all designated watercourses determined to be a Class III primary headwater habitat stream.

Wetlands delineated by U. S. Army Corps of Engineers protocols are required to have the following setbacks as measured from the jurisdictional boundary:

1. 50 feet extending beyond the outermost boundary of a category 3 wetland.
2. 30 feet extending beyond the outermost boundary of a category 2 wetland.
3. 10 feet extending beyond the outermost boundary of a category 1 wetland.

2.4.8 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

2.4.9 Madison Township Zoning Resolution

Madison Township has adopted a Riparian Setback Zoning Code to protect the riparian headwater streams and wetlands in the Township. The setback distances are as follows:

Riparian Setbacks

- a. A minimum of 120feet on each side of all watercourses draining an area greater than or equal to 20 square miles.
- b. A minimum of 75 feet on each side of all watercourses draining an area greater than or equal to one square mile and up to 20 square miles.
- c. A minimum of 25 feet on each side of all watercourses draining an area less than one square mile and having a defined bed and bank.
- d. A minimum of 75 feet on each side of all watercourses designated as Class III Primary Headwater Habitat streams.

Wetland Setbacks

- a. 50 feet extending beyond the outmost boundary of a Category 3 wetland.
- b. 30 feet extending beyond the outermost boundary of a Category 2 wetland.
- c. 10 feet extending beyond the outermost boundary of a Category 1 wetland.

2.5.0 Perry Township Zoning Resolution

Perry Township has established riparian setbacks to preserve them in their natural state as follows:

- a. Riparian setbacks shall be measured from the centerline of the designated watercourse.
- b. Where the one hundred-year floodplain is wider than the minimum riparian setback on either or both sides of a designated watercourse, the minimum riparian setback shall be extended to the outermost boundary of the FEMA one hundred-year floodplain.
- c. Riparian setbacks on designated watercourses shall be established as follows:
 1. A minimum of 150 feet on each side of the Grand River
 2. A minimum of 30 feet on each side of Red Mill Creek, Red Creek, and Arcola Creek.

2.5.1 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 Areas

The Critical Area for the Talcott Creek-Grand River Watershed is the Talcott Creek Subwatershed (Figure 22). Talcott Creek is in Full attainment of its CWH aquatic life use. Although much of the Grand River mainstem has been protected by Lake Metroparks and others, that is not the case in this critical headwater area. Maintaining the wooded riparian buffer in the headwaters is an integral component for the health of coldwater and warmwater habitat biology of the entire watershed.

The findings for Talcott Creek in the OEPA Biological and Water Quality Study of the Grand River Basin 2003-2004 lead to its' being selected as the critical area:

- Talcott Creek is recommended for a CWH aquatic life use based on the presence of eight coldwater macroinvertebrate taxa.
- Being a direct coldwater tributary to the Grand River, protecting the existing hydrology of Talcott Creek is important to maintaining the long-term health of the Grand River.
- Talcott Creek shows one of the highest degrees of chemical integrity in the Lower Grand tributaries.
- As a snow-melt stream, fish communities in Talcott Creek are subject to the natural limitations of torrential scouring flows, lengthy stretches of shallow bedrock and low summer flows, which is why the fish sample from Talcott Creek did not meet the IBI criterion.
- The unusually high-quality macroinvertebrate communities in Talcott Creek are probably due to the stream flowing through highly wooded ravines with continuous groundwater flow and limited development.
- Talcott Creek is a coldwater tributary which contributes cold ground water base flow to the Grand River.
- The tributaries originating from Thompson Ledges are important to maintaining base flow to the Grand River and should be targeted for protection.

The Grand River Technical Support Document (OEPA 2006, p. 3) identifies the greatest threat to the rich biological diversity of the Grand River basin as suburbanization. It calls for the following strategies to maintain the biological integrity of the Grand River:

- Regional planning
- Stream protection policies
- Comprehensive construction site management plans
- Defined limits to growth

The strategies in this NPS-IS are focused on maintaining the aquatic life use attainment, rather than relying on restoration projects to bring the subwatersheds into attainment.

3.2.1 Critical Area: Detailed Characterization

The Talcott Creek Subwatershed (Figure 22) drains 5.5 square miles, in Madison Township in Lake County and Thompson Township in Geauga County. The average percentage of impervious area is 4.27% (StreamStats from 2011 data).

The land use is 57% agricultural and 38% residential (Figures 23 and 24). 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, so imperviousness in the watershed is minimal. The biggest threats to the subwatershed are development and loss of wooded riparian corridors.

Madison Township and Thompson Township both have riparian setbacks. Most of the riparian corridors are wooded in both agricultural and residential 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 southeast 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.

Figure 22. Critical Area- Talcott Creek

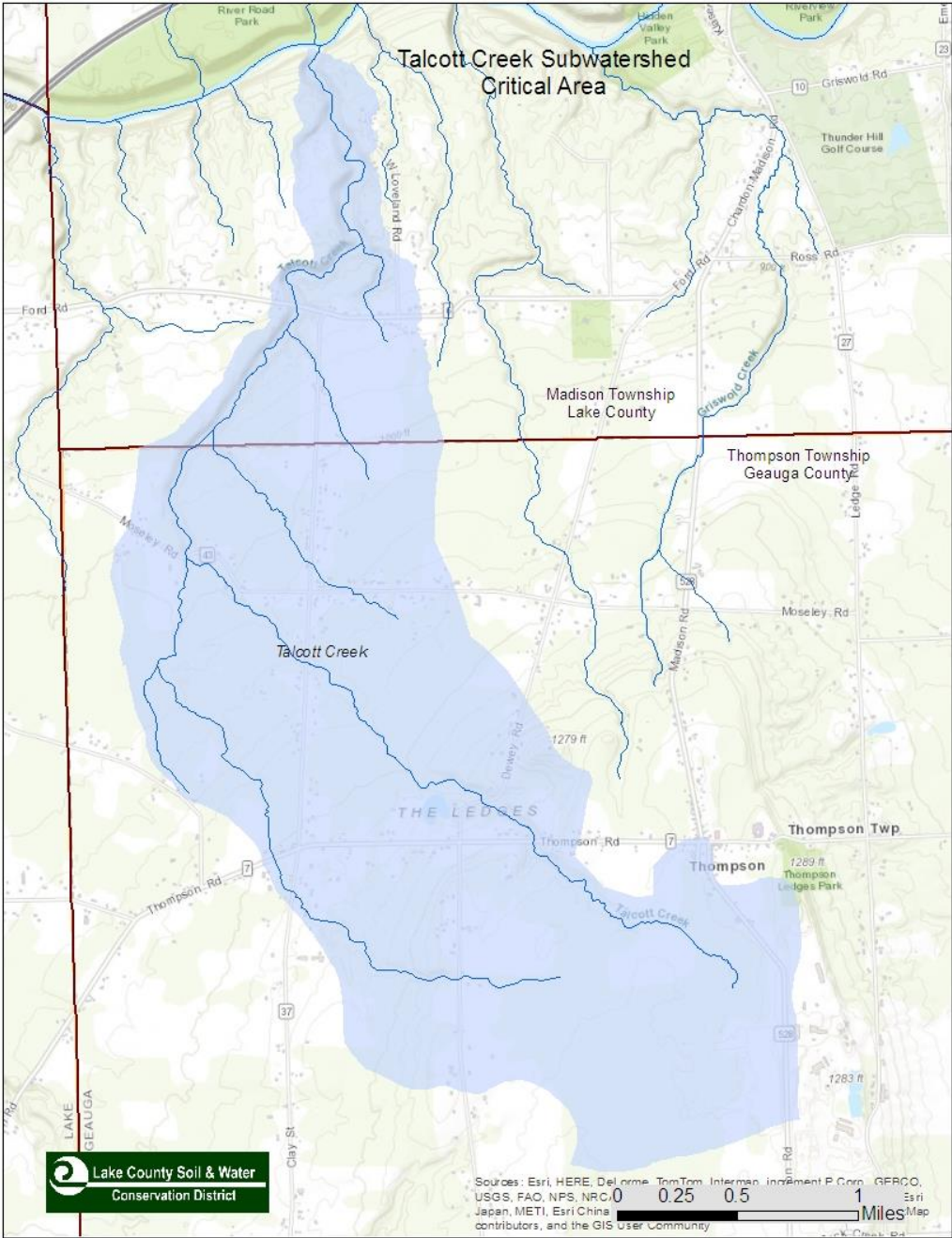


Figure 23. Talcott Creek Land Use

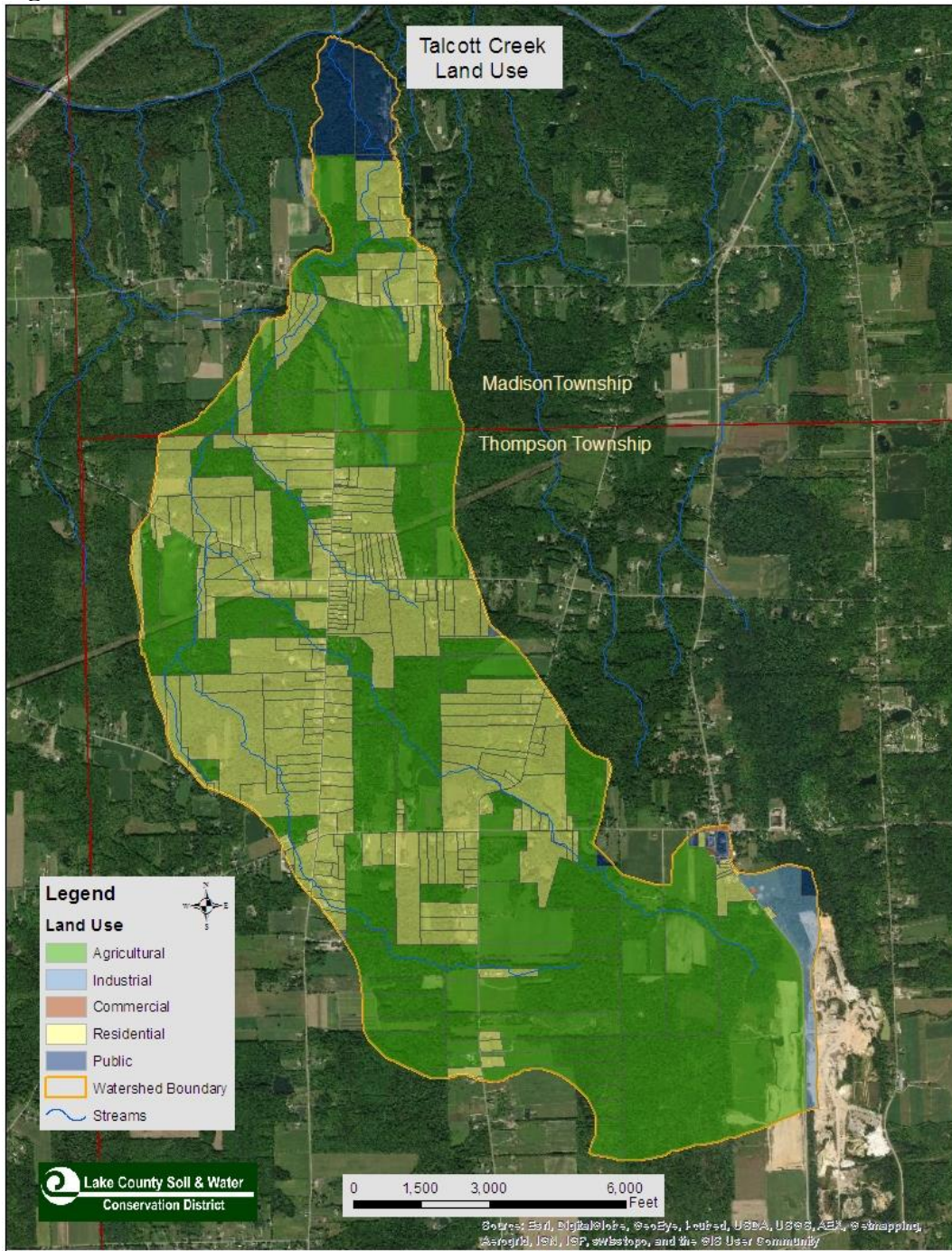


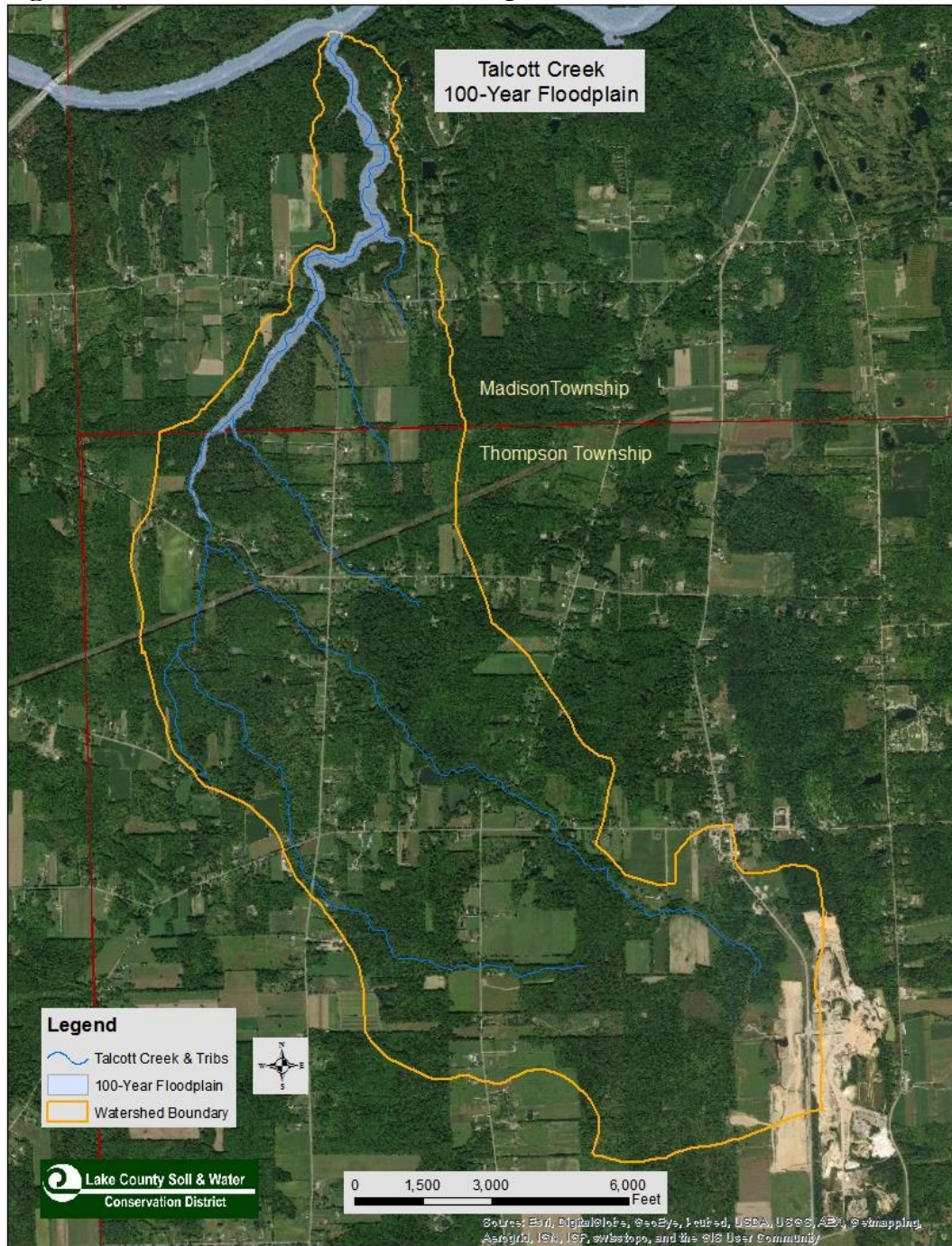
Figure 24. Talcott Creek Land Use Data

Land Use	Acres	%
Agricultural (green)	2011.9	57
Industrial (blue)	63.8	2
Commercial (red)	2.1	.06
Residential (yellow)	1330.2	38
Public (black)	106.4	3

Conservation Development should be encouraged to help keep the CWH and EWH attainments status from declining. Conservation Developments allow developers to have smaller lots in exchange for land being preserved. This method of development usually is created through 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 $\frac{1}{4}$ 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 25. Talcott Creek 100-Year Floodplain



23% of the Talcott Creek subwatershed is in the 100-Year Floodplain, at the lower end of the subwatershed (Figure 25).

Figure 26. Talcott Creek Soil Drainage Characteristics

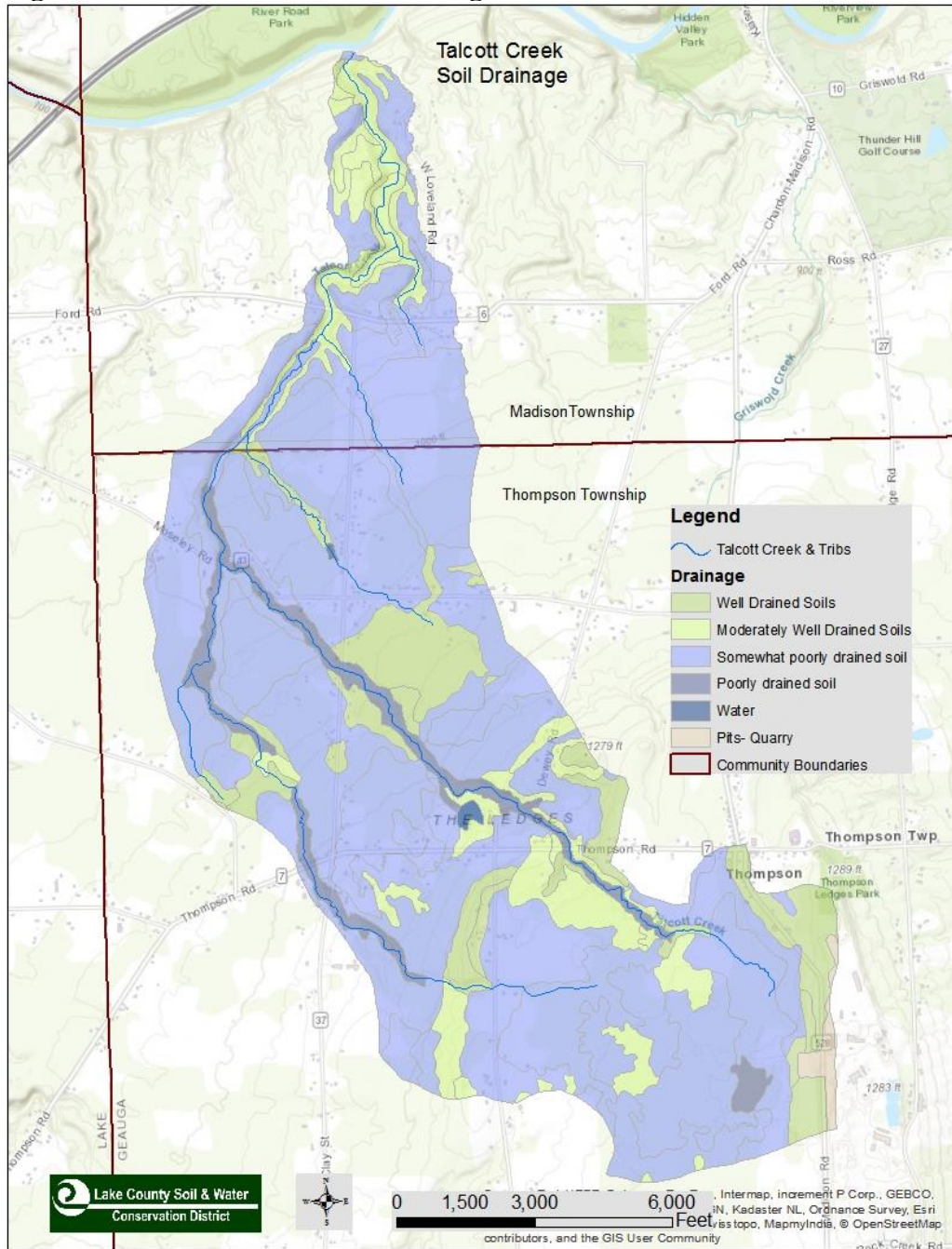
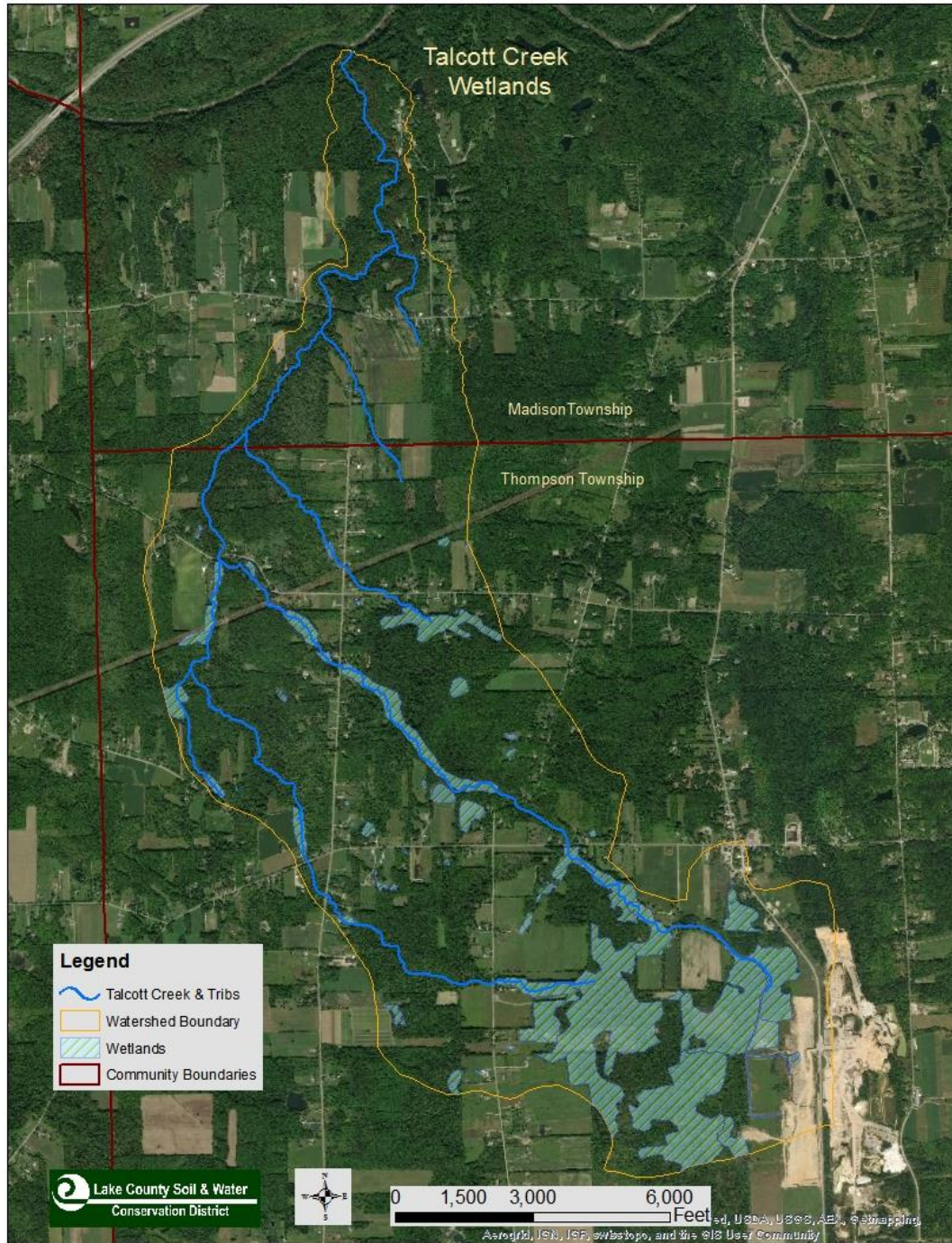


Figure 27. Talcott Creek Soil Drainage Characteristics

Soil Drainage Characteristics	Acres	%
Well Drained	413	11.6
Moderately Well Drained	398	11.2
Somewhat Poorly Drained	2526.1	71.2
Poorly Drained	177.1	5
Water	7	.2
Pits-Quarry	24.3	.7

76.2% are somewhat poorly drained and poorly drained and 22.8% of the soils are well or moderately well drained (Figures 26 and 27). 24.3 acres of the R.W. Sidley sand and gravel quarry in Thompson is in the southeast corner of the critical area.

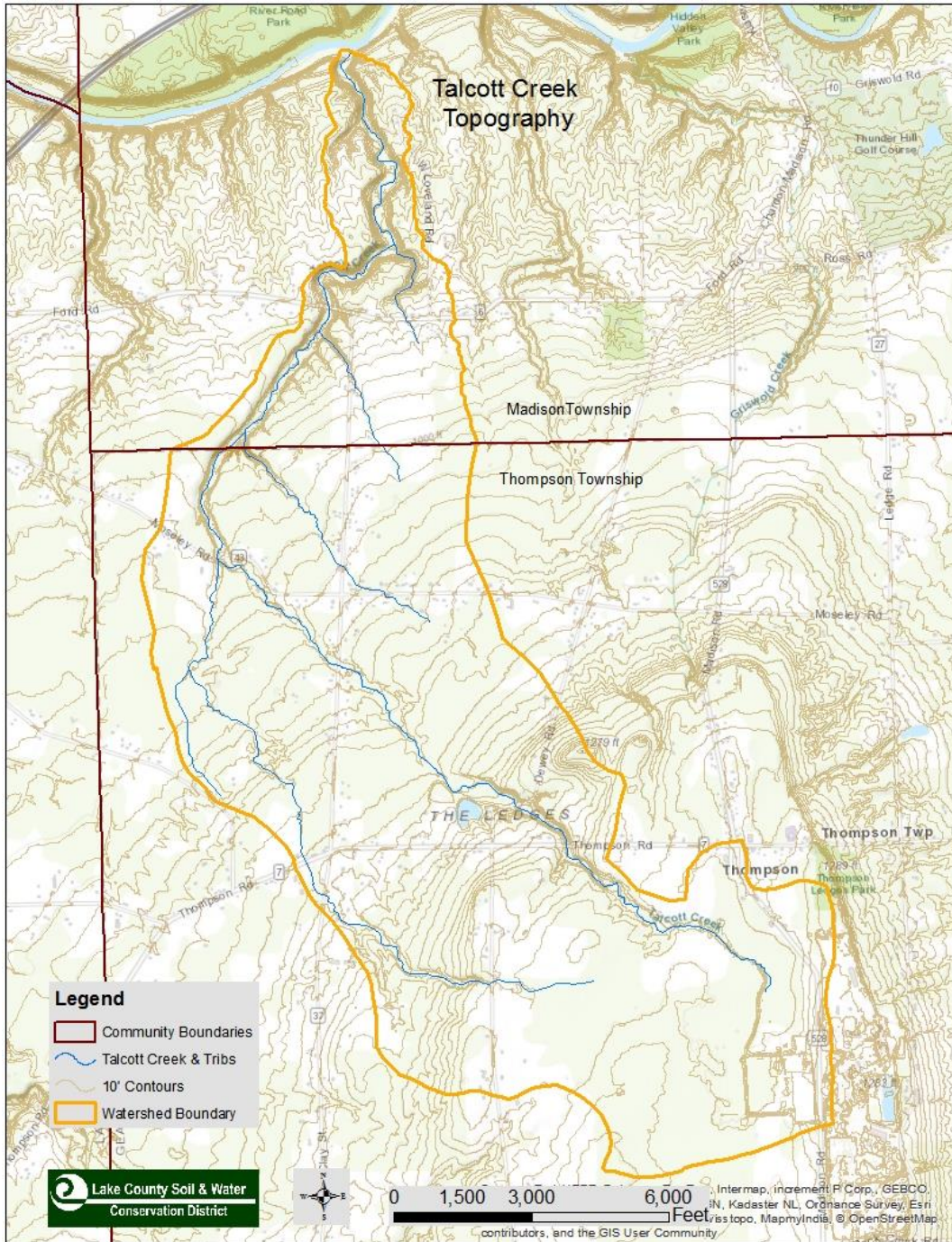
Figure 28. Talcott Creek Wetlands



89% of the Talcott Creek subwatershed wetlands is forested/shrub wetlands, which are located in the southeast corner (Figure 28). A small portion is streamside wetlands. 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)

Figure 29. Talcott Creek Topography



The topography from the headwaters to the mouth consists of an excavated high wall quarry, the flat ledges top, steeper northwest-facing slopes coming off the ledges, the gradual slope of the ground moraine to the steeper slopes of the end moraine ending with the steep ravines as the water has cut down to the Grand River valley (Figure 29).

Figure 30. Talcott Creek Ravine near mouth at the Grand River



3.2.2 Detailed Biological Conditions

One point was sampled by the OEPA in 2004 in the Talcott Creek subwatershed upstream of Ford Road (Figure 33). It was in Full Attainment Coldwater Habitat Aquatic Life Use (Figure 31). The Macroinvertebrate Narrative from the 2004 sampling was “Exceptional”; the IBI score of 22 scored “Poor” and QHEI score of 61 was “Good”. The QHEI metrics that scored the highest were Channel Morphology and Substrate. The lowest scoring metrics were In-stream Cover and Gradient.

Figure 31. EPA 2004 Sampling Data

Sampling Location	Macro-invertebrates	IBI/Narrative	ICI/Narrative	QHEI/Status	Attainment Status
1	Exceptional	22/Poor	-	61/Good	Full

Lake SWCD assessed the HHEI in Talcott Creek (Lake County only) in 2004 and 2006 (Figure 32 and 34). 43% of the streams were Class II and 57% were Class III. It is important to update this data to measure changes in headwater habitats in the 15 years since then.

Figure 32. HHEI Classification

HHEI Classification	%
Class II	43
Class III	57

Figure 33. Talcott Creek Attainment Status

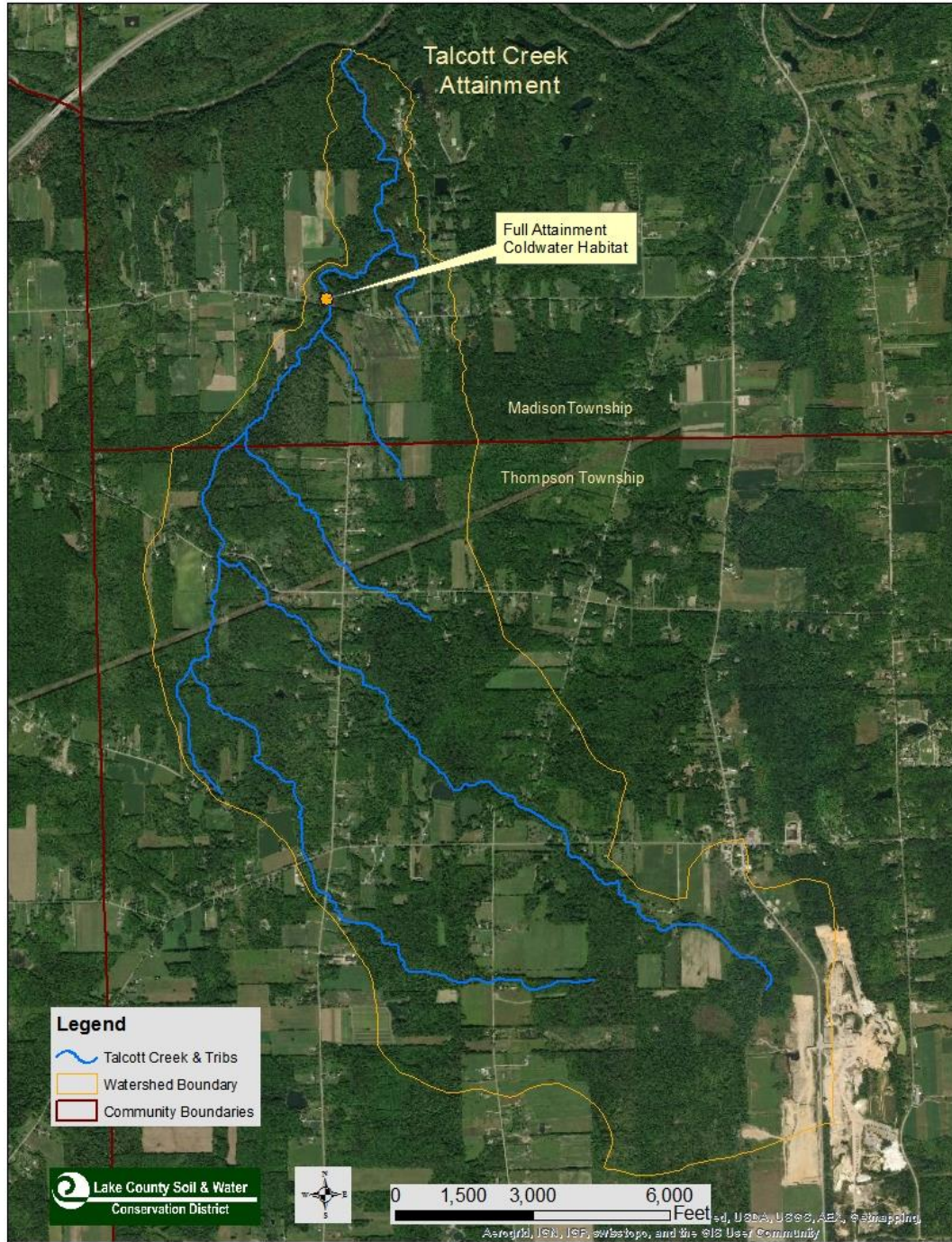
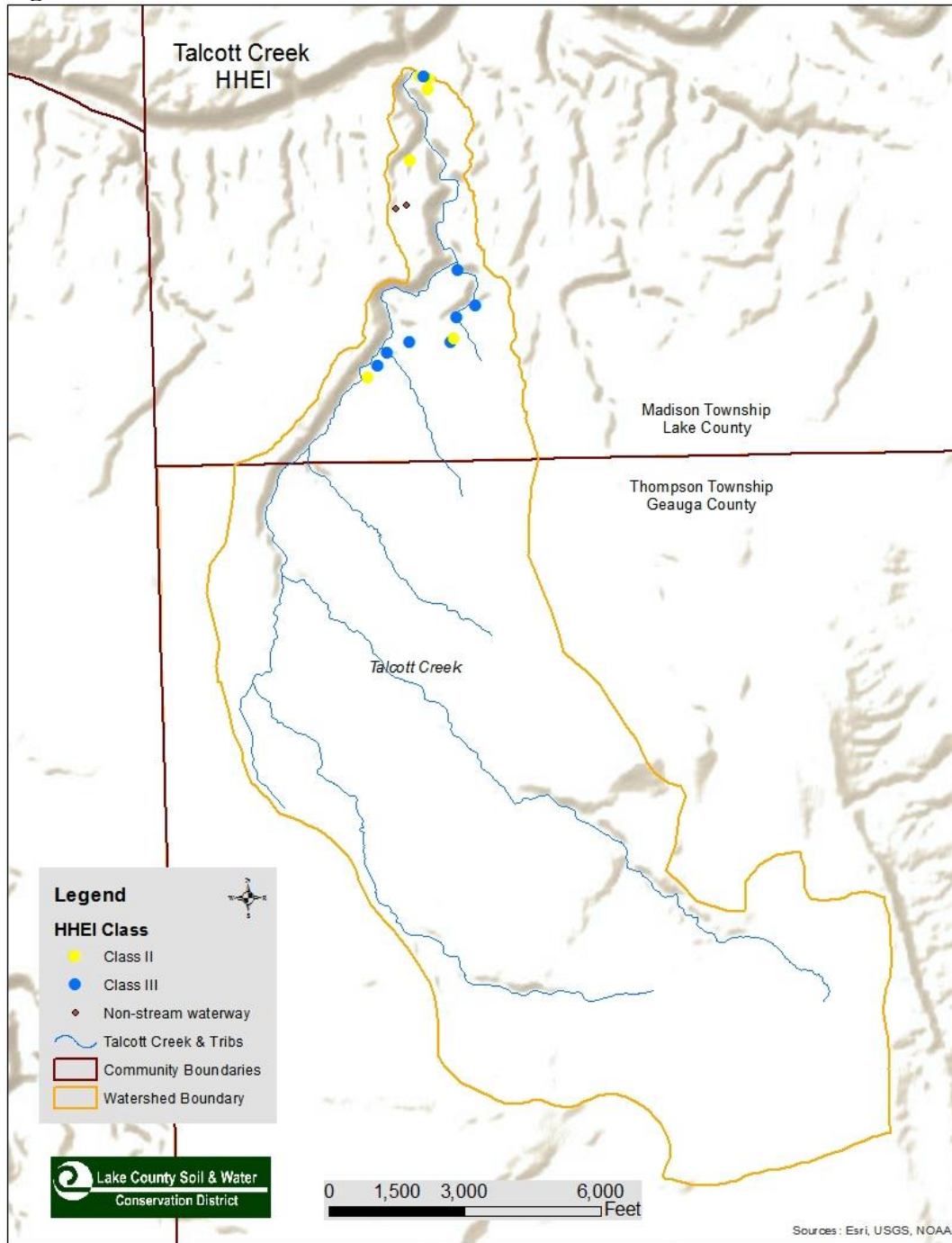


Figure 34. Talcott Creek HHEIs



3.2.3 Detailed Causes and Associated Sources

The causes and sources of impairment in Critical Area 1 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 Talcott Creek: “no impairment- natural limitations to fish community”. Other descriptions from the same document address the water quality of Talcott Creek:

- “Being snow-belt streams, fish communities in Talcott Creek ...are subject to the natural limitations of torrential scouring flows, lengthy stretches of shallow bedrock, and low summer flows.”
- “It cannot be overstated that much of the riparian lands and adjacent slopes running to the uplands are protected and forested is largely responsible for the high degree of chemical integrity. The relatively high percent forest cover and low intensity of agriculture within the hydrologic unit are also important factors explaining good water quality.”
- The unusually high-quality macroinvertebrate communities in these streams was probably due to the streams flowing through highly wooded ravines with continuous groundwater flow and limited development.”

(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 Aquatic Life Use designation, the Exceptional Invertebrate Narrative and the Good QHEI scores. This will be accomplished through the protection and restoration of the riparian, wetland and forested resources. The HHEI data will also 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 IBI score of 2 and QHEI score of 61 at upstream of Ford Road

- ACHIEVED: Site currently has an IBI of 22 and QHEI score of 61

Objectives

Objective 1. Maintain 95% pervious cover in the riparian corridor

- Follow riparian buffer targets:
 - Riparian width of 190 feet
 - Minimum vegetated width of 95 feet
- Assess changes in headwater habitat since 2004

Objective 2. Protect and restore streams and wetlands

- Protect 150 acres of wooded and riverine wetlands with a conservation easement
- Restore 150 acres of wetlands with invasive species removal

Objective 3. Protect land from development

- Protect 75 acres of woodlands and wooded ravines with conservation easements and fee simple purchase of riparian corridors

Objective 4. Update HHEI data

- Re-assess 184 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 Talcott 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 goals and objectives for the Critical Area. 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 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 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 Talcott 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

4.2 Critical Area 1: Project Summary Sheet

Nine Element Criteria	Information needed	Explanation
<i>n/a</i>	Title	Sidley Thompson Restoration
<i>criteria d</i>	Project Lead Organization & Partners	West Creek Conservancy
<i>criteria c</i>	HUC-12 and Critical Area	<i>Talcott Creek-Grand River Watershed 12-digit Hydrologic Unit Code (HUC) is 041100040605;</i>
<i>criteria c</i>	Location of Project	16515 Leroy Thompson Rd, Thompson Ohio 44086
<i>n/a</i>	Which strategy is being addressed by this project?	<ul style="list-style-type: none"> • Altered stream and habitat restoration • Nonpoint source reduction • High quality waters protection (cold water)
<i>criteria f</i>	Time Frame	Short (1-3 years)
<i>criteria</i>	Short Description	Talcott Creek has been channelized and ditched creating an adverse water quality, habitat and morphologic condition. Agricultural fields will be converted to wetland, forest and meadow habitats.
<i>criteria g</i>	Project Narrative	<p>The overwide ditch will be restored using a combination of a Priority 1 (raise grade) and a Priority 2 (Floodplain Expansion). In addition, 13.63 acres of wetland will be restored in former agricultural fields. 6.0 acres of invasive species removal from wetlands. Restored wetlands will be flanked by 17.54 acres of reforestation and 15.27 acres of meadow habitat.</p> <p>The project will address the following objectives of the plan. Objective 1. Maintain 95% cover in riparian corridor. Objective 2. Protect and restore streams and wetlands. Objective 3. Protect land from development.</p>
<i>criteria d</i>	Estimated Total cost	\$1,760,000
<i>criteria d</i>	Possible Funding Source	OEPA 319 ODNR H2Ohio Great Lakes Sediment & Nutrient Reduction Program
<i>criteria a</i>	Identified Causes and Sources	Causes: Hydromodification / Ditching / Agriculture Sources: Agricultural run-off and prior agriculture field development

<i>criteria b & h</i>	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Significant improvement is necessary to meet water quality standards: Despite a drainage area of 0.85 sq.miles a QHEI assessment made b/c ditching has created deeper pools and wider stream, HHEI not applicable. QHEI scored 44 out of 100. Only 1 riffle in project area.
	Part 2: How much of the needed improvement for the whole Critical Area is <i>estimated</i> to be accomplished by this project?	<p>This project will achieve 100% of Objective 1.</p> <p>Objective 2. Protect and restore streams and wetlands</p> <ul style="list-style-type: none"> • Protect 130 acres including wooded area and riverine wetlands under ownership of WCC (and subsequent environmental covenant and/or declaration of restrictions – An estimate 63 acres of wooded wetlands exist on the northside of Talcott Creek that will be protected. (4.2% of objective) • Restore 130 acres of land with creation of wetlands with invasive species removal- Project will restore a total of 13.63 acres of wetland of which 6.0 acres (4% of objective) will be restored by invasive species removal. <p>Objective 3. Protect land from development</p> <ul style="list-style-type: none"> • Protect 75 acres of woodlands and wooded ravines with conservation easements/environmental covenant and fee simple purchase of riparian corridors – Project will protect ~15.7 acres of existing woodlands (~21% of objective)
	Part 3: Load Reduced?	<p>Reducing the impacts from agriculture run-off and stormwater will increase the IBI and ICI.</p> <p>Annual load reductions of the stream and wetland restoration is estimated (using PLET) to result in load reductions of: 121 lb./yr. TP, 256.62 lb./yr. TN, and 141.63 T/yr. TSS.</p>
<i>criteria i</i>	How will the effectiveness of this project in addressing the NPS impairment be measured?	IBI, ICI, and QHEI will be assessed before and after project implementation. West Creek Conservancy will monitor effectiveness and post-restoration effectiveness (internally completed by West Creek, as well as consultant contracted)
<i>criteria e</i>	Information and Education	Interpretive signage will be installed at the project site. WCC will publish the project on their website, social platforms, newsletter, and annual report. WCC also hosts guided hikes, tours, birding outings, photography sessions and additional stewardship activities and volunteerism (e.g. invasive control, vegetation management, access management, and other scientific research programs).

Works Cited

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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
CWH	Cold Water Habitat
EPA	Environmental Protection Agency
EWH	Exceptional Warmwater Habitat
GLRI	Great Lakes Restoration Initiative
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 Database
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
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WWH	Warmwater Habitat