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TINKER'S CREEK

04110002 05 01 Pond Brook

Version 1.0

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

Developed by:

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Acknowledgements

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Chapter1: Introduction

This planning document addresses **Pond Brook HUC-12 (04110002 05 01)**. Tinker's Creek is the largest tributary to the Cuyahoga River with a watershed drainage area of 96.4 square miles. The main stem of Tinker's Creek is approximately 30-miles long and its watershed traverses across four (4) counties in northeast Ohio (Portage, Geauga, Summit and Cuyahoga).

Pond Brook has a watershed drainage area of 16.62 square miles. The smallest of the 3 HUC-12 watersheds for Tinker's Creek, Pond Brook HUC-12 falls within 4 counties, Portage, Geauga, Summit and Cuyahoga.

As State and Federal nonpoint source funding now relies upon the development of an NPS-IS plan, this NPS-IS plan must be accepted by both the USEPA and Ohio EPA as meeting the 9-minimum element requirements as outlined in the USEPA's *Handbook for Developing Watershed Plans to Restore and Protect our Waters*. Tinker's Creek Watershed Partners and its collaborators including watershed members and communities, local agencies and other conservation organizations recognize the importance of strategic project implementation as we seek to address the impairments within Tinker's Creek watershed.

1.1 Background

This NPS-IS is an update to the fully endorsed *Tinker's Creek Watershed Action Plan June 2010* which incorporates all 3 HUC-12 watersheds. This document has provided a starting point for initial project implementation to improve and protect the waters of Tinker's Creek with an emphasis on critical areas within each HUC-12.

1.2 Watershed Profile & History

Tinker's Creek headwaters (Headwaters Tinker's Creek 04110002 05 02) begins in Franklin Township, Portage County meandering north to its confluence with the Cuyahoga River (Town of Twinsburg – Tinker's Creek 04110002 05 04) in the Village of Valley View. As it flows north the main stem of Tinker's Creek is fed by several tributary streams. One tributary, **Pond Brook (HUC 12 - 04110002 05 01)** begins in the City of Aurora at Pond Brook Lake flowing through Reminderville and heading south to its confluence with the main stem at the municipal boundary between the City of Twinsburg and Twinsburg Township.

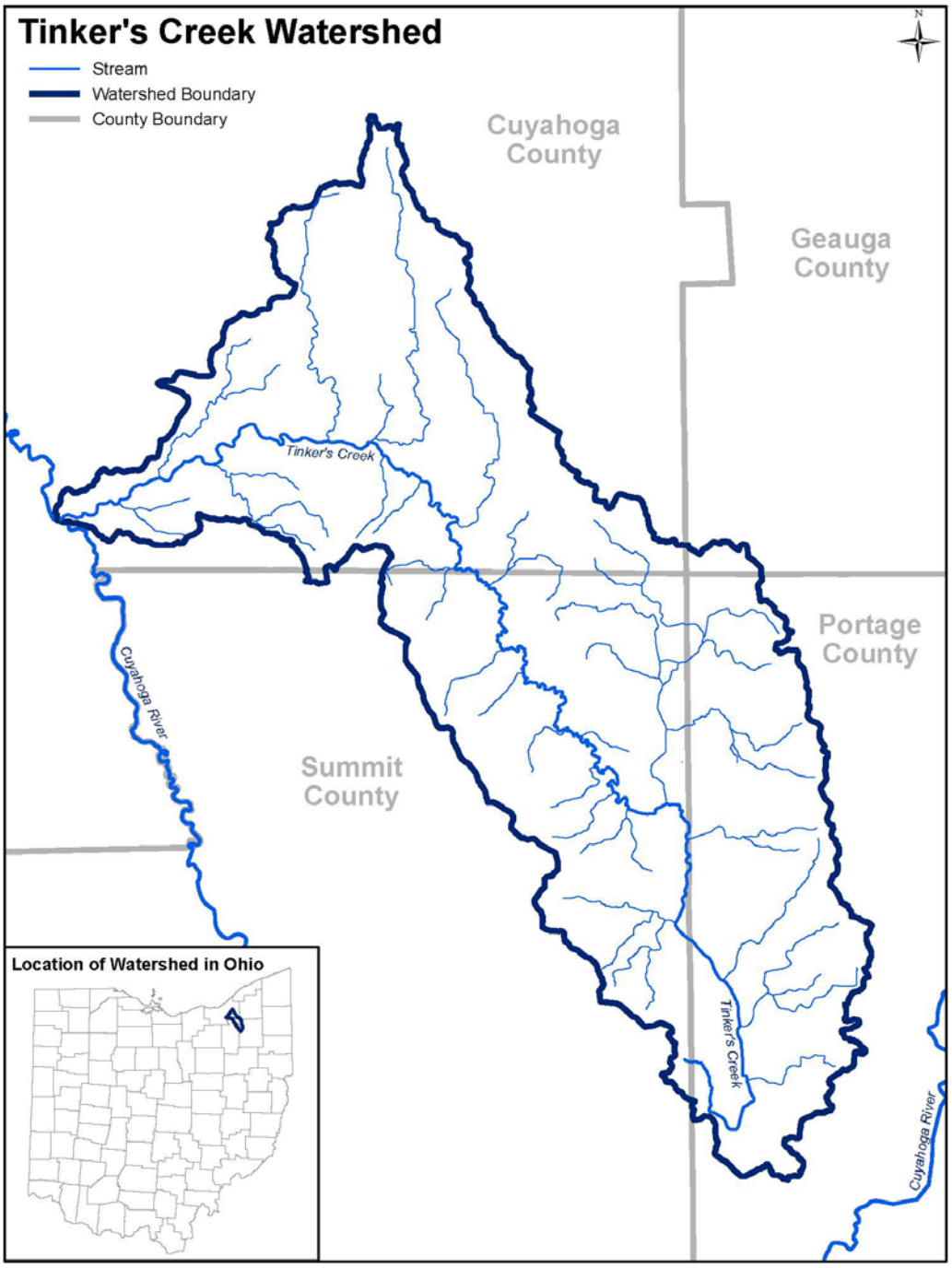

Figure 1: Tinker's Creek Watershed Location Map

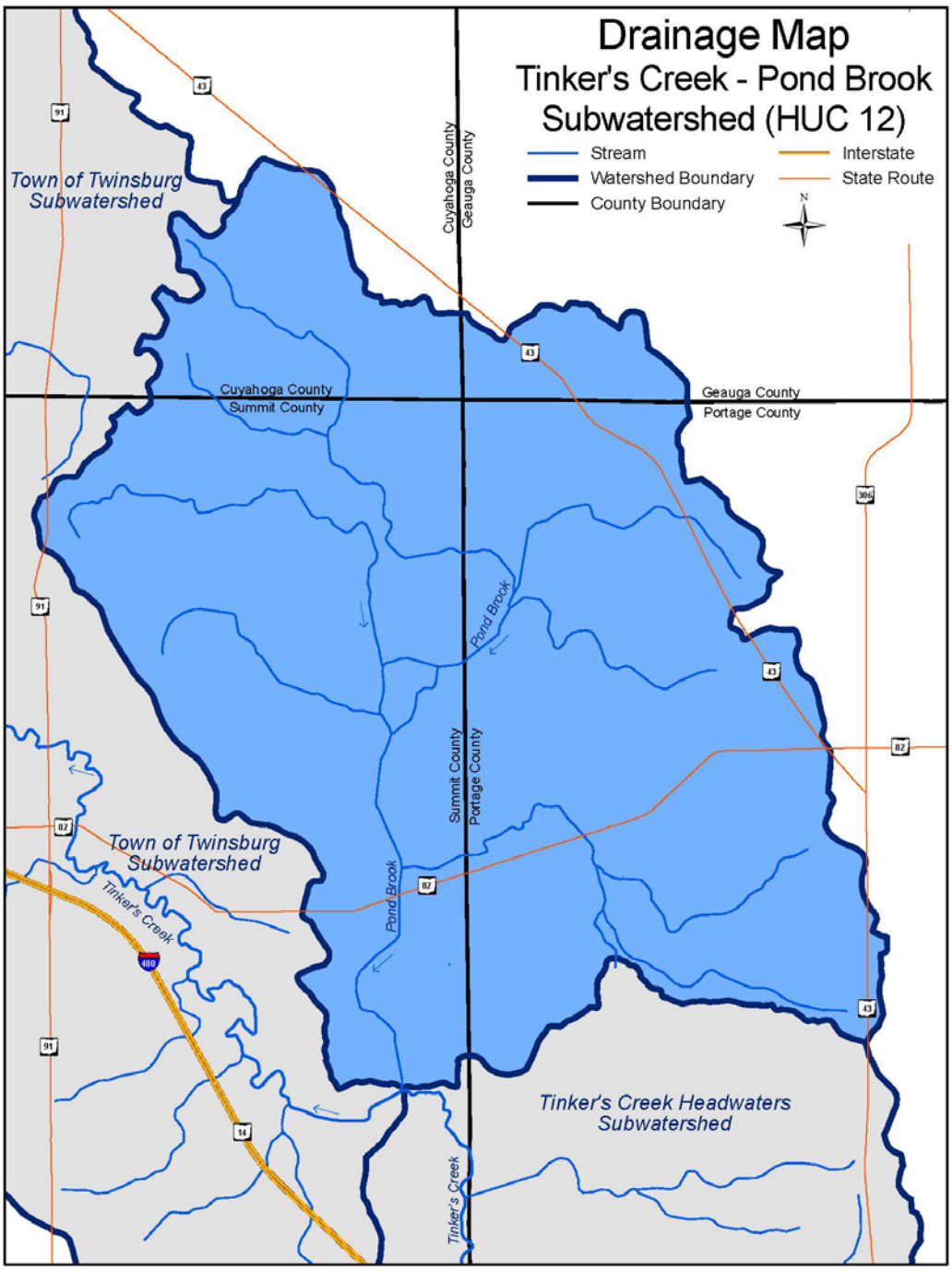

Figure 2: Pond Brook HUC-12 Watershed Location Map

Figure 3: Photograph of Pond Brook looking upstream north of State Route 82; Twinsburg Township, Summit County

Prior to 1786, Ottawa Indians inhabited the watershed, specifically along the ridges adjacent to Tinker's Creek Road in Walton Hills and Valley View. However, as settler encroachment and westward expansion ensued, those Ottawa settlements disappeared. Shortly thereafter, a Moravian mission established itself. The pilgrims called it Pilgerruh or "Pilgrims Rest." In 1797, the Connecticut Western Reserve Land Company began to survey the land. A gentleman named Moses Cleveland lead the survey crew along with a Principal Boatman named Joseph Tinker. Because no convenient communication technology existed then, all documents and recordings were meant to be hand delivered. On a journey back to Connecticut, Joseph Tinker drowned in a boating accident. Out of homage to him and his dedicated work, Pilgerruh was renamed Tinker's Creek.

In 1987, the Great Lakes Water Quality Agreement formed to reverse the devastation from industrial pollution, dedicating 43 Areas of Concern (AoC) across the Great Lakes. In 1988, the Cuyahoga Remedial Action Plan Coordinating Committee determined the boundaries of the Cuyahoga AoC, which included the Tinker's Creek watershed. The Great Lakes Water Quality Agreement calls for Remedial Action Plans (RAPs) to restore and protect 10 beneficial uses in the Cuyahoga AoC. An impaired beneficial use means a change in the chemical, physical, or biological integrity of the Great Lakes system to which the Cuyahoga River flows too. Therefore, the Tinker's Creek watershed is an integral part of the process to "delist" the Cuyahoga River as an AoC.

Four (4) park districts have conserved land within the watershed, including the Ohio Department of Natural Resources Tinker's Creek State Park. In addition Cuyahoga Valley National Park and Cleveland Metroparks Bedford Reservation meet at the confluence of the Cuyahoga River and Tinker's Creek. Bedford Reservation is the largest protected area within the watershed and contains a National Natural Landmark named Tinker's Creek Gorge, which includes a Scenic Overlook, Bridal Veil Falls, and the Great Falls of Tinker's Creek.

All 24 communities within the Tinker's Creek watershed are considered Phase 2 communities. This requires those communities to submit and perform requirements for stormwater management under the National Pollution Discharge Elimination System program (NPDES). Tinker's Creek Watershed Partners are working with many of those communities to assist them with Public Involvement Public Education (PIPE) to help satisfy those requirements set forth in the permit.

1.3 Public Participation and Involvement

The original watershed action plan was finalized by TCWP and endorsed by the state in 2010. Extensive input from community representatives, consultants, and agencies was utilized to identify water quality issues throughout the watershed. The WAP has been the organization's guiding document to implement planned projects and to help identify new projects. As projects were completed, TCWP remained in contact with communities to address arising concerns. At least once each year, TCWP met with each community to inquire about issues and followed up with them throughout the year. To further address needs within the watershed, TCWP has been communicating with agencies such as Ohio EPA, ODNR, and several park districts on water quality, protected lands, and potential projects.

In 2014, TCWP worked with community partners to solicit and identity new projects. These efforts included meeting with community leaders and consultants to identify problem areas in communities and possible solutions. Seven new projects were identified and conceptual plans were added to the WAP.

In order to ascertain the key challenges going forward and update the WAP to a Nine-Element Plan, TCWP utilized a survey that went out to community representatives and project partners throughout the watershed. The survey was sent to 154 individuals that ranged from municipal employees, project consultants, park districts, and local government agencies that work within the watershed. Along with the survey, TCWP requested potential project ideas from community members. Phase II updates were sent to the community watershed representatives each month from September 2016 to March 2017 with important information about the NPS-IS update process.

TCWP held our annual Mayors' Breakfast in March of 2017 where we solicited additional input from the attendees on issues in their communities. In attendance included mayors, city managers, stormwater representatives, and engineers from the watershed communities. Information on critical areas, issues in the watershed, and potential projects were confirmed and/or provided at this meeting.

All this input from watershed partners has helped us to establish critical areas and projects that will help bring these areas into attainment. As the Nine-Element Plan is intended to be a working document, we will continue to work with our partners in the watershed to update the document and add additional projects that will help us reach our attainment goals and objectives.

Chapter 2: Tinker's Creek Watershed Characterization and Assessment Summary

2.1 Watershed Characterization

2.1.1 Physical and Natural Features

Tinker's Creek is the largest tributary to the Cuyahoga River with a watershed drainage area of 96.4 square miles. The main stem of Tinker's Creek is approximately 30-miles long and the watershed traverses across four (4) counties in northeast Ohio (Portage, Geauga, Summit and Cuyahoga).

Elevations in the watershed vary, with the highest elevation point being 1,200 feet above mean sea level and the lowest point lying at 620 feet above mean sea levels where Tinker's Creek flows into the Cuyahoga River.

The physiographic features of the watershed are those characteristics related to both the topography and geology of the basin. Tinker's Creek is located within the Glaciated Appalachian Plateau physiographic region, which consists predominately of silty loam and clayey loam soils. Portions of the stream are on bedrock, which forms waterfalls that act as a natural barrier to the passage of fish. Lower stream portions have carved the Tinker's Creek Gorge, which is listed as a National Natural Landmark within the National Park Service's program(Source: Ohio EPA, Division of Surface Water), (Source: *Kerr + Boron (Tinker's Creek Watershed Conservation Priority Plan*). Carved by glaciers and ancient streams, this region is less hilly and lacks the rugged quality of the unglaciated landscape.

Slopes vary greatly within the Tinker's Creek watershed, ranging from steep gorge areas where the river has cut its way down through bedrock to gentle slopes, flat areas, marshes, and wetlands. Rock outcroppings exist in several areas. The pattern of slopes within the watershed is gentle, with the steepest gradients found along the stream banks and where Tinker's Creek flows into the Cuyahoga River. Deeply incised and steep slopes define the valley and gorges nearer this confluence point, partially as a result of increased downstream erosion due to higher water flows and dredging of the 6.5 mile Cuyahoga Shipping Channel. Steep slopes generally have the highest erosion potential from runoff or from channel undercutting of the stream banks. Identifying the steepest slope areas that either would contribute to higher erosion potential or offer the most value for sensitive and unique habitats is a focus. For example, many portions of the middle Tinker's have steep slopes that create waterfalls and other unique topographic areas.

Soils are also assigned to hydrologic soil groups. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration soils. Only the soils that is in their natural condition and are in Group D are assigned to dual classes. The predominant soil series in the Pond Brook HUC-12 areas are as follows:

- Mahoning series – deep soils that are somewhat poorly drained and slowly or very slowly permeable; slope ranges from 0 to 6%
- Caneadea series – deep soils that are somewhat poorly drained and slowly permeable; slopes 0 to 2%
- Canadice series - deep soils that are poorly drained and very slowly permeable; slopes 0 to 2%

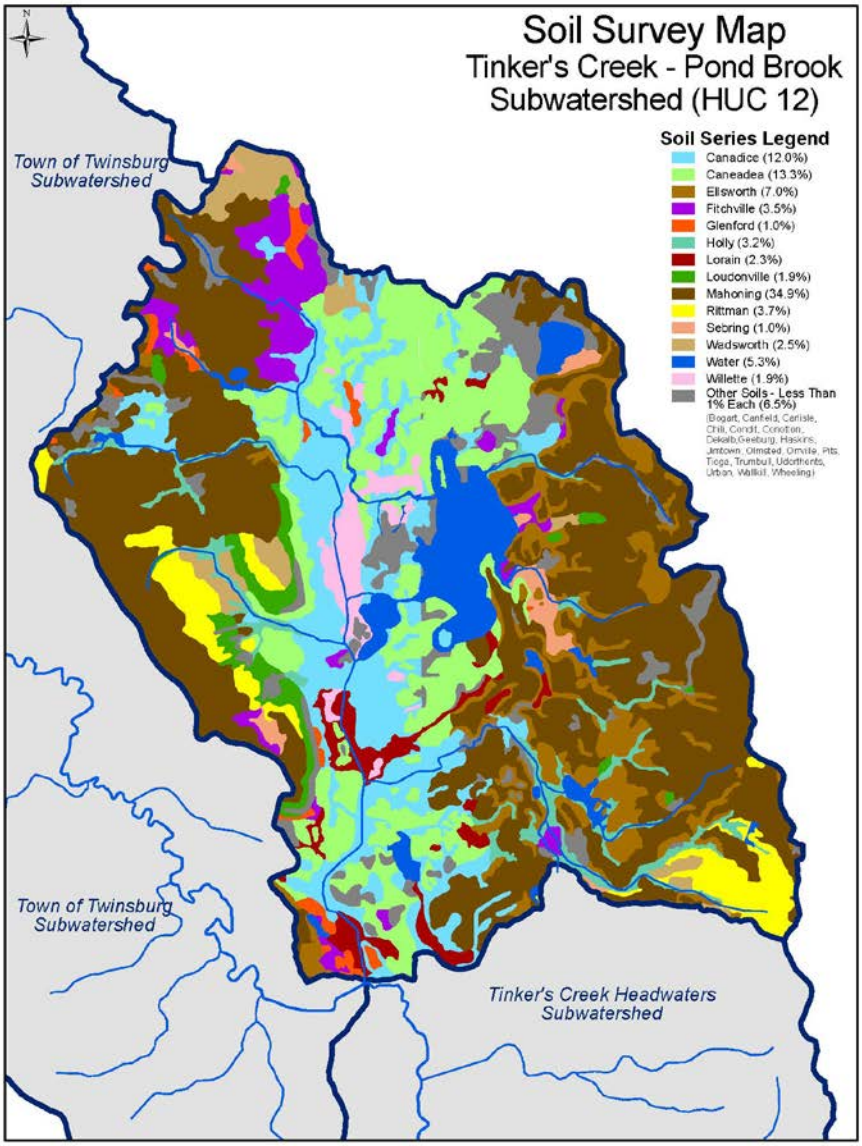

Figure 4: Pond Brook HUC-12 Underlying Soil Series Map

Tinker's Creek has a greater number and acreage of wetlands when compared to any other tributary in the lower Cuyahoga River area. Tinker's Creek contains approximately 951 wetlands or 3,917 acres of wetlands throughout the three (3) HUC 12 sub-watersheds in Tinker's Creek watershed. Like most other impacted watersheds, the range of wetland quality depends on the location within the watershed.

The more urbanized locations in Tinker's Creek contain lower quality wetlands than areas that are currently developing or have not been developed yet. ORAM scores were deduced from previous field investigations performed by the Cuyahoga RAP, Davey Resource, and Enviroscience Inc. Clearly, a significant amount of moderate to high quality wetlands exists in the watershed; according to acres and number. Tinker's Creek has a relatively rich wetlands inventory, and consequently, a need to protect these important water resources.

In addition, the Tinker's Creek Wetland Prioritization Plan 2007/2008, shows all 951 wetlands have been identified. Of those wetlands, 421 are thought to be non-forested. Of the non-forested wetlands in the watershed, the total acreage for those identified is 2,224 acres.

The U.S. Fish and Wildlife Service is the principal federal agency tasked with providing information to the public on the status and trends of wetlands within the United States. This data is shared via the National Wetlands Inventory (NWI). The following Figure indicates wetland areas within the Pond Brook watershed as identified by the NWI.

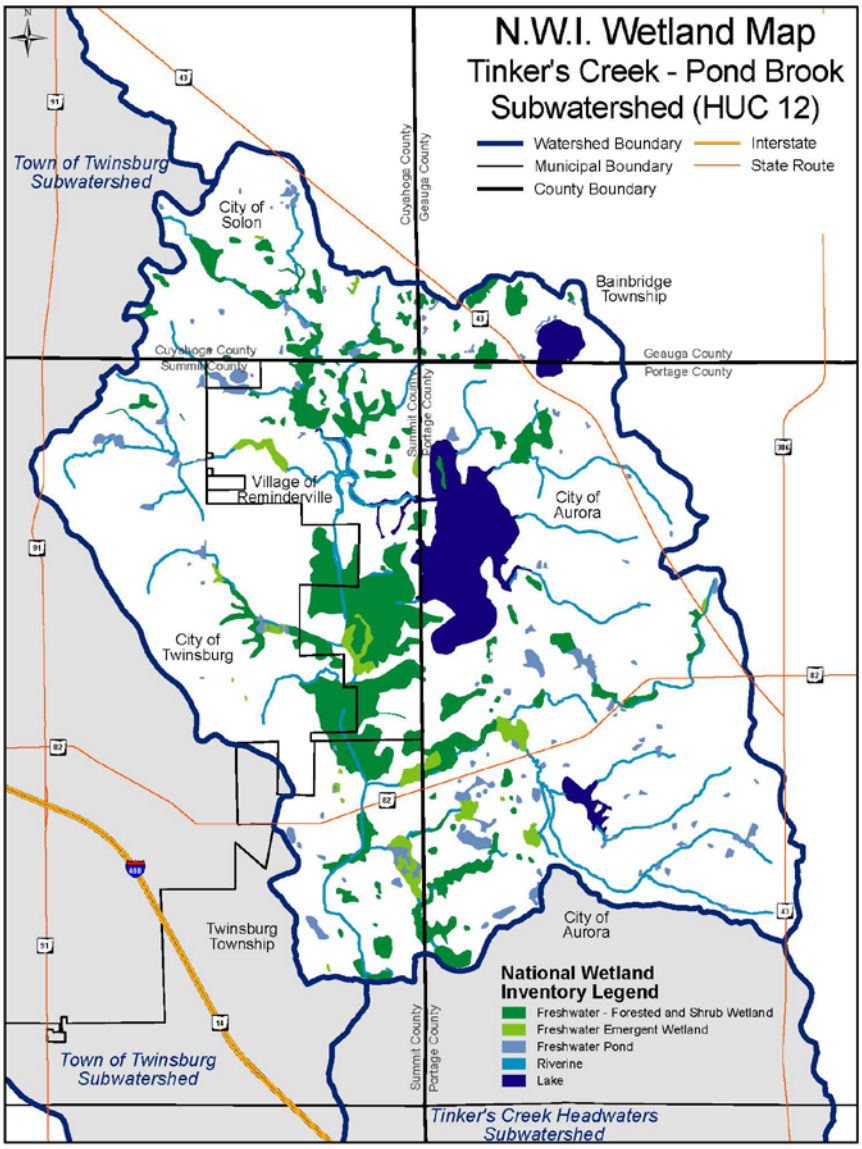

Figure 5: Pond Brook HUC-12 National Wetland Inventory Map

The Ohio Department of Natural Resources (ODNR), Division of Wildlife (DOW) maintains the Natural Heritage Database. A review of this database indicates there are 14 animals and 57 plants listed within the Tinker's Creek HUC 10 watershed (see Tables 1 and 2).

Table 1: State Listed Animal Species in Tinker's Creek watershed

Scientific Name	Common Name	State Status
Catocala gracilis	Graceful Underwing	Endangered
Childonias niger	Black Tern	Endangered
Myotis sodalis	Indiana Bat	Endangered
Opheodrys vernalis	Smooth Green snake	Endangered
Clemmys guttata	Spotted Turtle	Threatened
Gomphaeschna furcillata	Harlequen Darner	Threatened
Condylura cristata	Star-nosed Mole	Species of Concern
Etheostorna exile	Iowa Darter	Species of Concern
Hemidactylium scutatum	Four-toed Salamander	Species of Concern
Porzana carolina	Sora Rail	Species of Concern
Rallus limicola	Virginia Rail	Species of Concern
Gallinago (delicata)	(Wilson's) Common Snipe	Special Interest
Troglodytes	Winter Wren	Special Interest

Scientific Name	Common Name	State Status	Scientific Name	Common Name	State Status
Carex arctata	Drooping Wood Sedge	Endangered	*Carex lasiocarpa*	Slender Sedge	Potentially Threatened
Cornus canadensis	Bunchberry	Endangered	*Carex pallescens*	Pale Sedge	Potentially Threatened
Cypripedium parviflorum var. *parviflorum*	Small Yellow Lady's-slipper	Endangered	*Carex straminea*	Straw Sedge	Potentially Threatened
Galium labradoricum	Bog Bedstraw	Endangered	*Castanea dentata*	American Chestnut	Potentially Threatened
Hypnum pretense	Wrinkled-leaved Marsh Hypnum	Endangered	*Chamaedaphne calyculata*	Leather-leaf	Potentially Threatened
Juniperus communis	Ground Juniper	Endangered	*Corallorhiza maculate*	Spotted Coral-root	Potentially Threatened
Melampyrum lineare	Cow-wheat	Endangered	*Cornus rugosa*	Round-leaved Dogwood	Potentially Threatened
Myrica pensylvanica	Bayberry	Endangered	*Deschampsia flexuosa*	Crinkled Hair Grass	Potentially Threatened
Tomentypnum nitens	Fuzzy Hypnum Moss	Endangered	*Equisetum sylvaticum*	Woodland Horsetail	Potentially Threatened
Carex bushii	Bush's Sedge	Threatened	*Eriophorum viridicarinatum*	Green Cotton Grass	Potentially Threatened
Carex diandra	Lesser Panicled Sedge	Threatened	*Gentianopsis crinite*	Fringed Gentian	Potentially Threatened
Calopogon tuberosus	Grass-pink	Threatened	*Gentianopsis procera*	Small Fringed Gentian	Potentially Threatened
Corydalis sempevirens	Rock-harlequin	Threatened	*Geum rivale*	Water Avens	Potentially Threatened
Cypripedium reginea	Showy Lady's-slipper	Threatened	*Larix larcina*	Tamarack	Potentially Threatened
Elymus trachycaulus	Bearded Wheat Grass	Threatened	*Persicaria robustior*	Coarse Smartweed	Potentially Threatened
Epilobium strictum	Simple Willow-herb	Threatened	*Phegopteris connectilis*	Long Beech Fern	Potentially Threatened
Melanthium virginium	Bunchflower	Threatened	*Platanthera flava*	Tubercled Rein Orchid	Potentially Threatened
Potentilla palustris	Marsh Five-finger	Threatened	*Poa paludigena*	Marsh Spear Grass	Potentially Threatened
Rhododendron periclymenoides	Northern Rose Azalea	Threatened	*Potamogeton natans*	Floating Pondweed	Potentially Threatened
Salix candida	Hoary Willow	Threatened	*Prenanthes racemosa*	Prairie Rattlesnake Root	Potentially Threatened
Sisyrinchium mucronatum	Narrow-leaved Blue-eyed Grass	Threatened	*Rhynchospora alba*	White Beak-rush	Potentially Threatened
Solidago squarrosa	Leafy Goldenrod	Threatened	*Salix myricoides*	Blue-leaved Willow	Potentially Threatened
Sparganium androcladum	Keeled Bur-reed	Threatened	*Salix serissima*	Autumn Willow	Potentially Threatened
Viburnum alnifolium	Hobblebush	Threatened	Shepherdia canadensis	Canada Buffalo-berry	Potentially Threatened
Viburnum opulus var. *americanum*	Highbush Cranberry	Threatened	*Sphenopholis pensylvanica*	Swamp-oats	Potentially Threatened
Calla palustris	Wild Calla	Potentially Threatened	*Triantha glutinosa*	False Asphodel	Potentially Threatened
Carex alata	Broad-winged Sedge	Potentially Threatened	*Triglochin palustris*	Marsh Arrow Grass	Potentially Threatened
Carex bebbii	Bebb's Sedge	Potentially Threatened	*Zigadenus elegans*	White Wand-lily	Potentially Threatened
Carex flava	Yellow Sedge	Potentially Threatened			

Table 2: State Listed Plant Species within Tinker's Creek watershed

The U.S. Fish and Wildlife Service (USFWS) maintains a database of federally listed species that can occur within Ohio by County. For the four (4) Counties (Cuyahoga, Summit, Geauga and Portage) that Tinker's Creek watershed is present in. The USFWS indicates as follows: federally endangered - Piping Plover (*Charadrius melodus*), Kirtland's Warbler (*Dendroica kirtlandii*), Indiana Bat (*Myotis sodalis*), and Mitchell's Satyr Butterfly (*Neonympha mitchellii mitchellii*); federally threatened - Northern Monkshood (*Acotinum noveboracense*), Rufa Red Knot (*Calidris canutus rufa*), Northern Long-eared Bat (*Myotis septentrionalis*) and Eastern Massasauga (*Sistrurus catenatus*).

Although the Bald Eagle (*Haliaeetus leucocephalus*) has been de-listed as an endangered species, it is still protected under the Migratory Bird Act, the Bald and Golden Eagle Act, as well as the Lacey Act. USFWS includes the Bald Eagle for all counties in Ohio as a Species of Concern.

Inventories of invasive species have not been conducted for the Tinker's Creek watershed in its entirety (HUC-10). The Ohio EPA has identified the two most common invasive fish species in collections from 2000-2008 as gizzard shad and carp. To date, there have been no reports of any of the Eurasian goby species in the watershed. Other potentially harmful invasive aquatic animal species include zebra mussels, not yet noted in the watershed, and the rusty crayfish (*Orconectes rusticus*), most likely in the watershed. Negative impacts on the watershed associated with the rusty crayfish are not known at this time.

In addition, a number of plant species have invaded the aquatic/semi aquatic habitat which may have negative impacts on the watershed and its associated wetlands. In general invasive plant species out-compete native plants, resulting in decreased plant diversity, as well as choking off habitat niches, along with chemical impacts associated with decaying biomass. Plant species which fit this classification include reed canary grass (*Phalaris arundinacea*), narrow-leaved cattail (*Typha angustifolia*), buckthorn (*Frangula alnus*), common reed (*Phragmites australis*), garlic mustard (*Alliaria petiolata*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*), purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*) and Eurasian water milfoil. While present in the watershed, large scale impacts attributable to these species have not yet been investigated.

Other physical characteristics notable within the Tinker's Creek watershed are Class 2 & 3 impoundments and dams, most of which are privately maintained. Three (3) are located within Pond Brook HUC-12. See Table 3.

Name	Permit #	Class	Owner/ Type	Owner	Location	Receiving Stream	Date Built	Purpose	Impoundment Type	Dam Type
Colebrook Lake No. 1 Dam	Exempt	3	Private	Jack L. Colebrook	Aurora	Tributary To Tinker's Creek	1966	Recreation, Private	Dam And Spillway	Earthfill
Aurora Pond Dam	N/A	2	Private	Aurora Shores Homeowner's Assoc.	Aurora	Pond Brook	Rebuilt In 1985	Recreation, Private	Natural Lake	Earthfill
Walden Lake Dam	73-064	2	Private	The Walden Company	Aurora	Tributary To Pond Brook	1975	Recreation, Private	Dam And Spillway	Earthfill

Table 3: Tinker's Creek Watershed Dams

2.1.2 Land Use and Protection

Pond Brook HUC-12 has a watershed drainage area of 16.62 square miles and drains areas in four (4) counties (Cuyahoga, Geauga, Summit and Portage) including the following communities: Solon (Cuyahoga County); Bainbridge Township (Geauga County); Village of Reminderville, Twinsburg, Twinsburg Township (Summit County); Aurora (Portage County). See Figure 6.

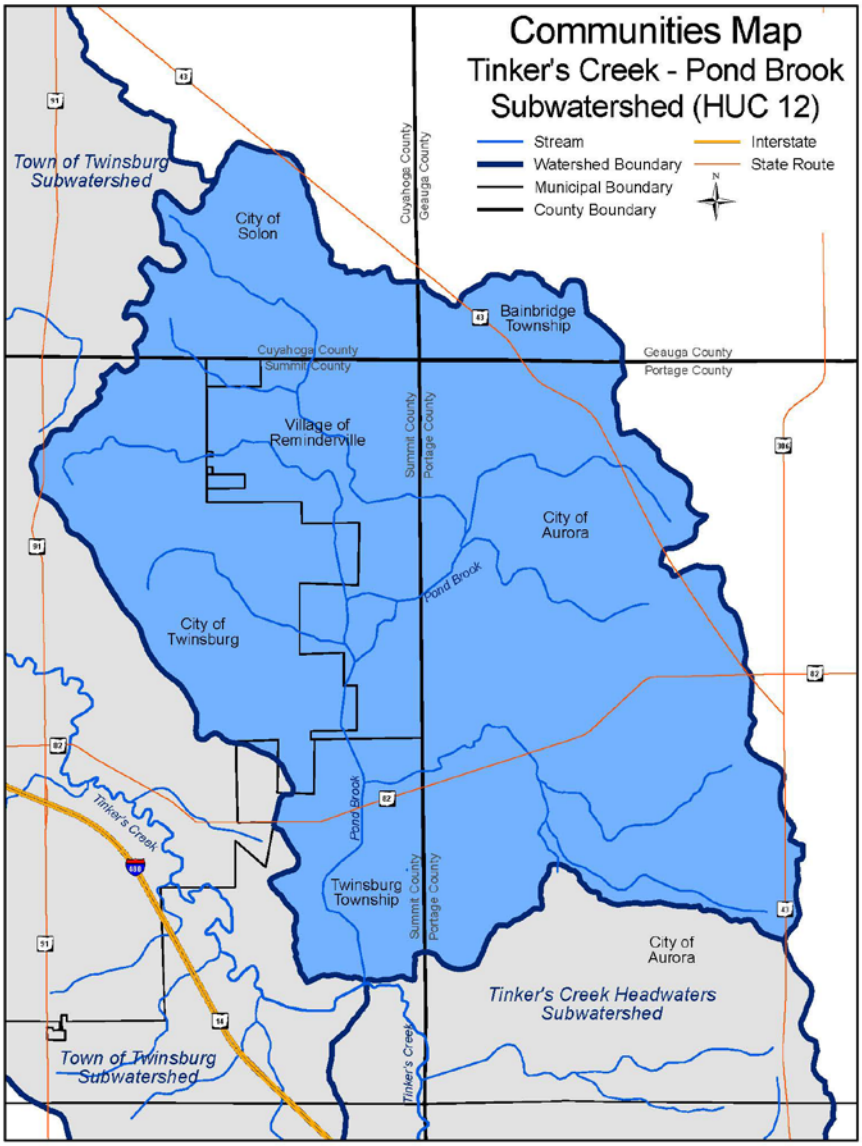

Figure 6: Pond Brook Community Map (04110002 05 01)

The late 1990s and 2000s saw significant residential development within the outlying suburbs of both the Cleveland and Akron including the municipalities of Twinsburg and Aurora. The Tinker's Creek watershed is fortunate in that it has protected lands at the federal, state, county, and local levels. Summit Metro Parks has protected 3,000 acres, including the Pond Brook Conservation Area the within the Pond Brook HUC-12. It should also be noted that the City of Twinsburg is an active partner with Summit Metro Parks through the creation of Liberty Park. There is approximately 43,288 centerline linear feet of Tinker's Creek within the City of Twinsburg. Of which, 81.85% of the eastern bank is adjacent to City-owned land or Western Reserve Land Conservancy property or is covered by a conservation easement. On the western bank, 74% is adjacent to City-owned or Conservancy land or is covered by a conservation easement. The remaining percentage on both banks is adjacent to privately owned lands. Land use within this HUC-12 is characterized as the following: 58.2% developed, 33.4% forest, 3.3% grass/pasture, 0.8% row crop and 4.1% other (water) (National Land Cover Database, 2011). See Figure 7.

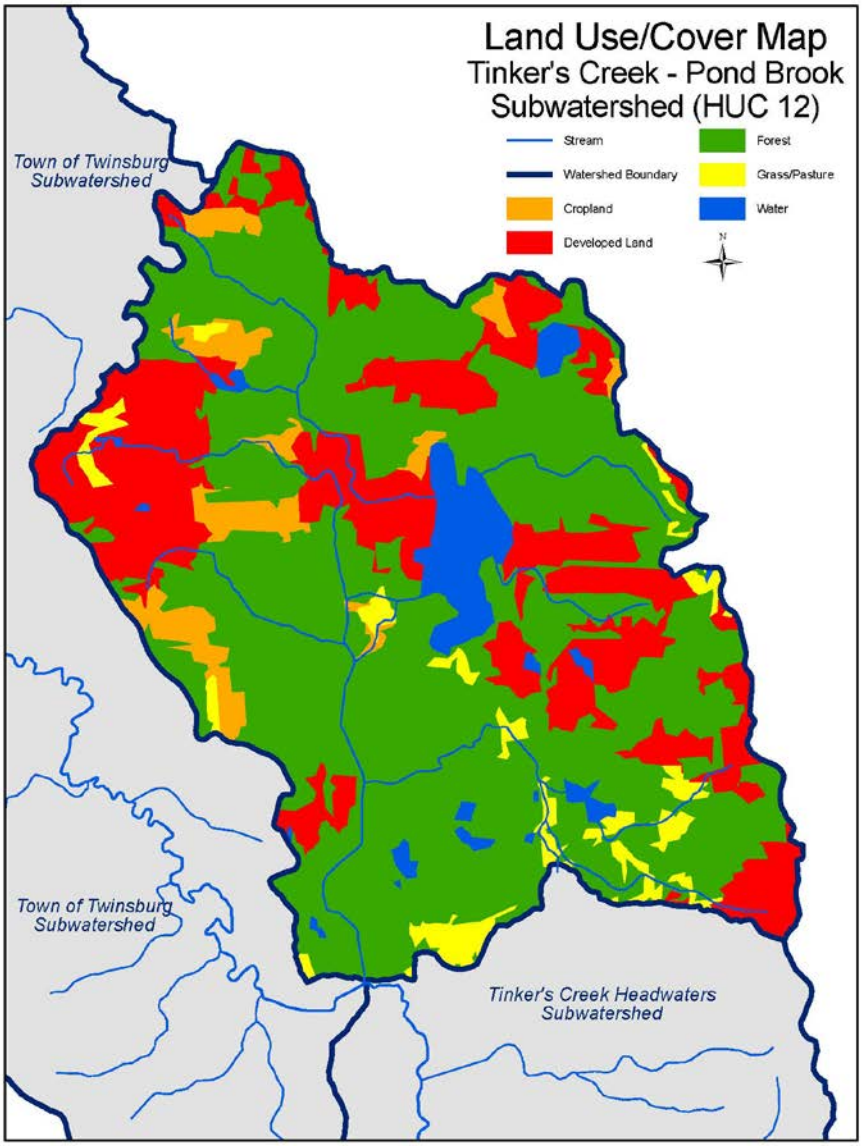

Figure 7: Pond Brook Land Use Map (04110002 05 01)

Figure 8: Tinker's Creek within commercial/retail district (N of St. Rte. 91, looking upstream); Twinsburg, Summit County.

Figure 9: Un-named tributary within residential development (at Pirates Trail, view looking downstream); Reminderville, Summit County.

2.2 Summary of Pond Brook Biological Trends

The Ohio EPA completed a TMDL for the Lower Cuyahoga River basin and it was approved by the US EPA in September 2003. Within the Tinker's Creek Watershed portion of the TMDL, several water quality issues were identified. Sedimentation, organic enrichment, low in-stream dissolved oxygen, nutrient enrichment, toxicity, habitat alteration, as well as yet to be determined impairments, were considered the main water quality issues facing Tinker's Creek. These unknown impairments could be contributed to the two (2) waste water treatment plant's (WWTP) both of which are located in the city of Aurora (Aurora, Aurora Westerly) which discharge into this watershed. Please see Figure 12: Tinker's Creek HUC-10 Qualitative Habitat Evaluation Index Scores, Figure 13: Tinker's Creek HUC-10 Invertebrate Index Scores and Figure 14: Tinker's Creek HUC-10 Index of Biological Integrity Scores.

Pond Brook was designated in the Ohio EPA's 2000 305(b) report as Modified Warmwater Habitat (MWH) based on its low habitat quality and ongoing channel maintenance. The stream is mostly pooled, and receives drainage from adjacent wetlands, suburban development, and effluent from two (2) WWTPs. 2006-2007 studies showed hardly any change to the IBI and QHEI scores.

The Ohio EPA collected intensive biological community, chemical water quality, and physical habitat data in the assessment unit from 2006 to 2008. This undertaking was in support of ongoing efforts to determine effects of trace pharmaceuticals on biological communities and aquatic life use attainment status in the Tinker's Creek basin. Further monitoring was conducted on Pond Brook in 2011 and 2012 in support of a stream channel restoration project undertaken by Summit Metro Parks. Studies conducted in 2012 on Pond Brook focused on stream channel morphology and physical substrate conditions. The results determined Pond Brook to still be in the process of recovery and stabilization. However IBI and as well as QHEI scores had improved from previous samplings. Scores and attainment uses from the Ohio EPA's 2016 Integrated Water Quality Monitoring and Assessment Report can be found in the following table (Table 4).

Sample Station Name	River Mile	ALU Type	Sampling Year	IBI Score	QHEI Score
Pond Brook @ Proposed site of Aurora Westerly WWTP	0.80	Full MWH	2006	30	28
Pond Brook near Aurora @ ST RT 82	1.41	Partial MWH	2012	22	32.5
Pond Brook just DST. Of Trib.	2.39	Partial MWH	2012	20	38
Pond Brook in Restoration Area	2.59	Non MWH	2011	34	45.5
Pond Brook DST. Aurora & Geauga WWTPs	3.40	Full MWH	2012	32	35
Pond Brook @ Tradewind Cove Rd	3.70	Non MWH	2012	38	25.8
Pond Brook @ Glenwood Rd	4.30	Full MWH	2006	38	44.5
Channel 25 (Pond Brook Trib. @2.54) near Mouth	0.20	Full WWH	2011	28	58
Trib to Pond Brook (3.90) At Reminderville @ Outriggers Cove	0.01	Non WWH	2014	26	41.8
Trib to Pond Brook (3.90) At Reminderville @ Glenway Drive	0.50	Non WWH	2014	28	70.3

Table 4: Pond Brook Tinker's Creek HUC-12, OEPA Aquatic Life Use Monitoring Sites

Figure 10: Tinker's Creek State Park, Pond Brook HUC-12; Photo Credit: Monnie Ryan

Figure 11: Example in Pond Brook HUC-12 showing stream morphology

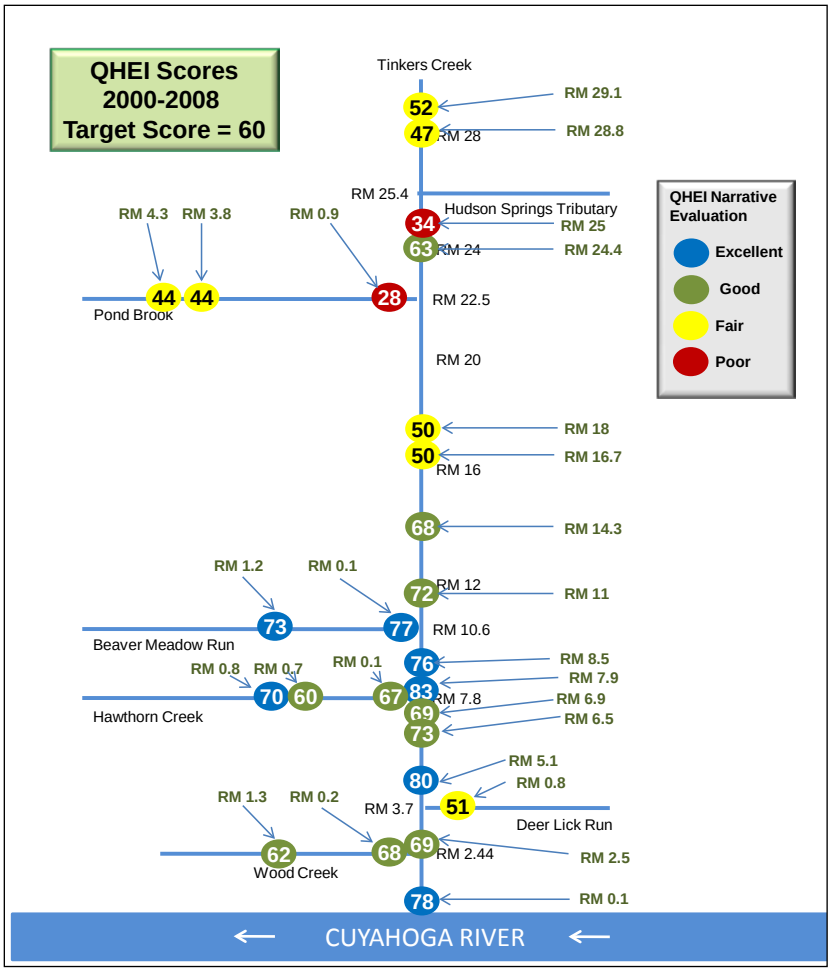

Figure 12: Tinker's Creek HUC-10 Qualitative Habitat Evaluation Index Scores

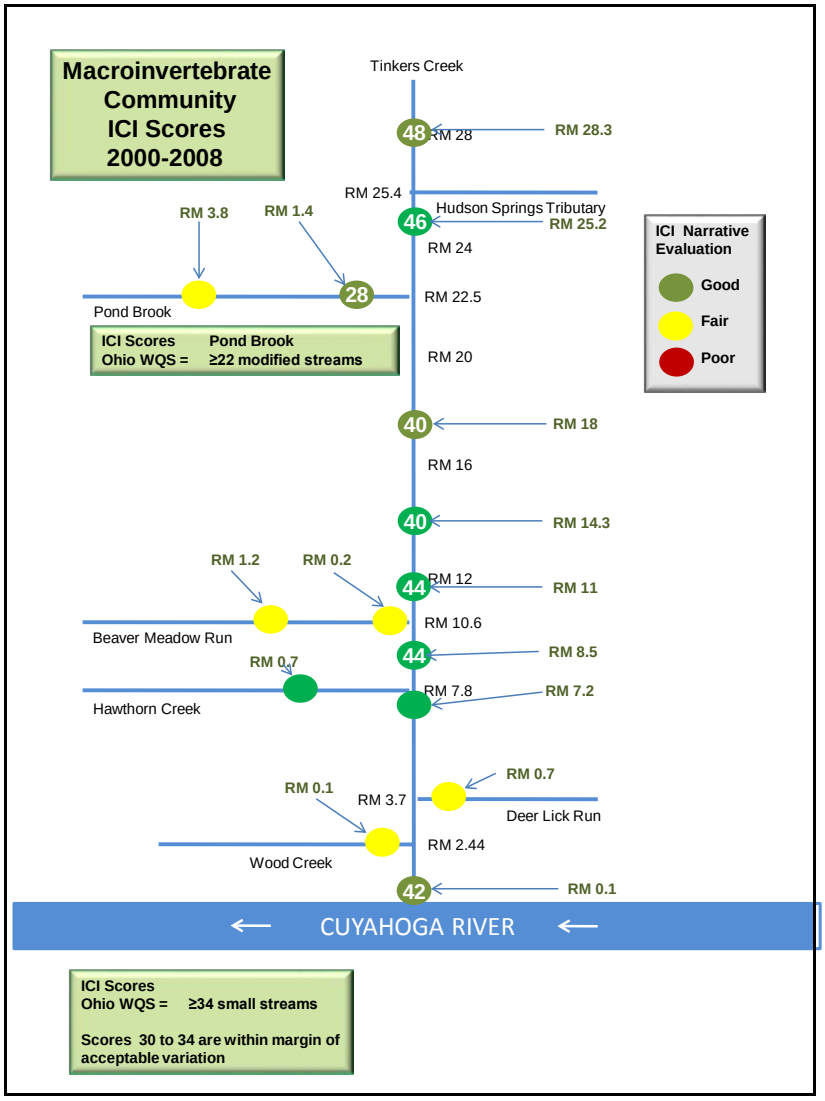

Figure 13: Tinker's Creek HUC-10 Invertebrate Index Scores

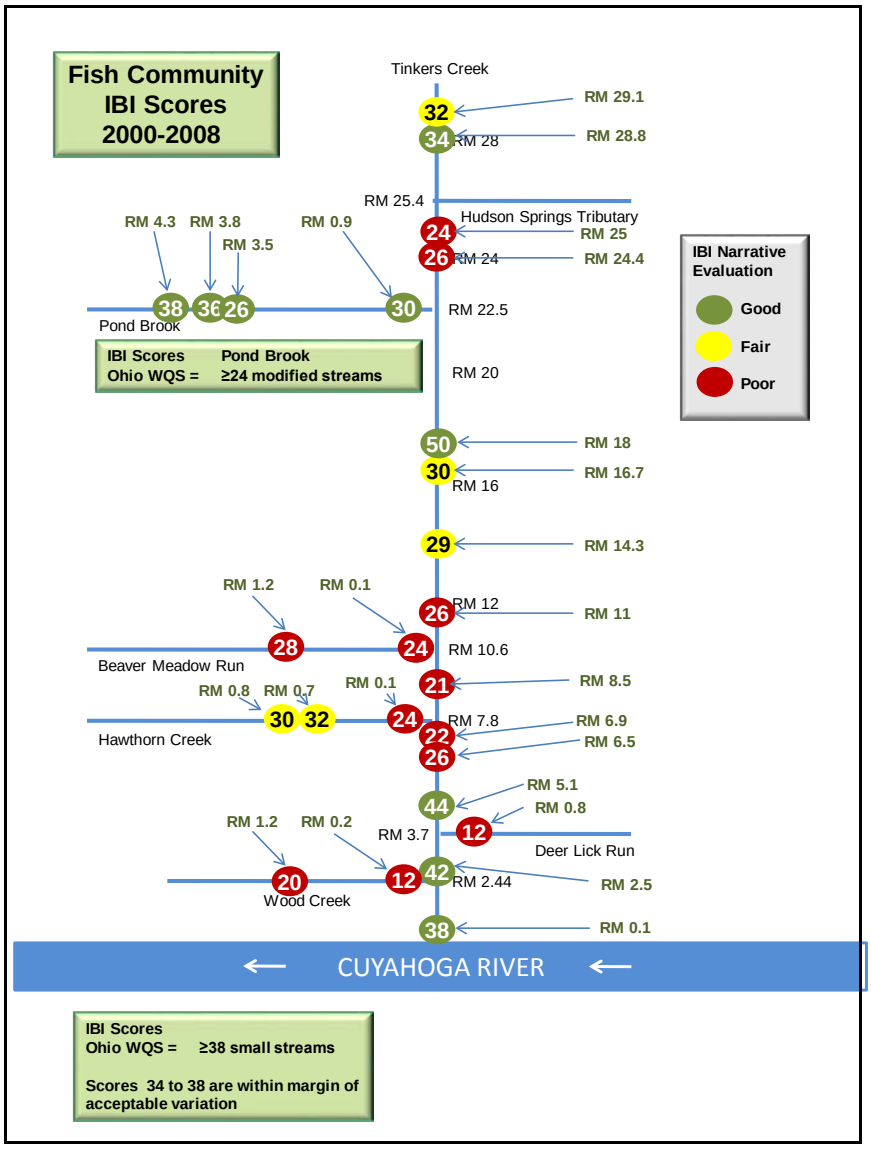

Figure 14: Tinker's Creek HUC-10 Index of Biological Integrity Scores

2.3 Summary of Pollution Causes and Associated Sources

The Ohio EPA's 2016 Integrated Water Quality Monitoring and Assessment Report has determined the cause(s) of impairment within Pond Brook as follows:

- Direct habitat alterations
- Particle distribution (embeddedness)
- Sedimentation/ siltation

The major nonpoint source impacts in the watershed are a result of suburbanization and urbanization. Impacts associated with these sources include an increased sediment load to the streams, which result in decreased substrate heterogeneity and overall habitat quality.

This is observed in many smaller tributaries and the Tinker's Creek main stem from its headwaters into Twinsburg. Increases in impervious surface area also results in flashier stream flows which are partially responsible for channel incision and bank destabilization, both noted as occurring in the watershed.

Total Maximum Daily Load (TMDL) Pollutant Load Allocations – The following information provided is from the Lower Cuyahoga River TMDL, which was completed and finalized in September 2003. *Flows in the lower section of Tinker's Creek are highly influenced by the discharge of treated wastewater from upstream WWTPs. In 1991, the combined effluent had a median discharge of 11.623 mgd or 17.9 cubic feet per second (cfs). The 1996 Tinker's Creek water chemistry data collected at RM 0.1 showed no exceedances of WQS criteria. However, nitrate concentrations continue to be markedly elevated with a mean 6.81 mg/l compared to the 1991 mean of 7.6 mg/l. In contrast to lower Tinker's Creek, the median nitrate concentration from similarly sized reference streams in the EOLP ecoregion is 0.425 mg/l (n=298) (Ohio EPA 1999c). The excessive nitrates reflect the effluent dominated nature of the creek and improved ammonia nitrification at the major municipal WWTPs in the basin. These levels could limit biological potential in Tinker's Creek. Other factors, such as barriers to fish migration (i.e. waterfalls located downstream at RM 5.6), excessive turbidity, or other unknown causes and sources of impairment may contribute to the non-attainment.*

Eight (8) watershed stressors have been identified through the TMDL report: organic enrichment, nutrient enrichment, low in-stream dissolved oxygen, toxicity, sedimentation, habitat degradation, bacteria, and yet unknown impairments. Increased amounts of organic material in the system stem from loss of the riparian area, lawn clippings, and yard waste. Increased nutrients are speculated to be caused by loss of the riparian area, urbanization, use of lawn fertilizers, pet and wildfowl waste, and loss of a consistent tree canopy. Low levels of dissolved oxygen can cause a reduction in biological diversity. Decomposing organic material and high nutrient levels cause both algal blooms and corresponding decay when those plants die off, each of which depletes the water of oxygen – especially in the summer months. The input of non-point source pollution from the surrounding landscape coupled with the effluent discharges has created toxic conditions for biological species as well. The combination of several water quality degraders produces these toxic conditions.

In addition, Tinker's Creek experiences very high sediment loading caused from significant increases in storm water loading, which is correlated to the high amounts of impervious cover in the watershed (21%). Tinker's Creek watershed, like most urban watersheds, continues to experience a net loss of habitat both for terrestrial and aquatic species alike. Low QHEI scores throughout most of the watershed are caused by loss of riparian areas, poor water quality, loss of connectivity to green corridors, and urbanization.

The high bacterial levels in the watershed are caused by failing septic systems, Combined Sewer Overflows (CSOs), and non-point source pollution from impervious land cover. The "yet unknown impairments" allude to a water quality degrader which is of unknown composition. Evidence of pharmaceutical compounds negatively influencing aquatic biology is being studied as a direct cause of the unknown impairments.

Tinker's Creek is an effluent dominated stream and can consist of over 75% effluent during low-flow periods in the summer. The WWTP are the largest contributors of flow to the stream; other dischargers exist in the basin but are not included in this evaluation. Between 1960 and 1970, the basin saw an 83% increase in median stream flows, most likely due to population increases in the suburban communities, which resulted in increased flows to the wastewater treatment plants.

Over the years, many improvements have been made at the individual plants, which have resulted in the high level of treatment and excellent compliance records seen today. This has resulted in improved macroinvertebrate communities generally meeting goals of the Clean Water Act. Fish communities in the watershed, namely tributaries and Tinker's Creek upstream of the natural waterfall, continue to show signs of

impairment. In this case, the discharges from the plants are one of several factors considered responsible for the impairment.

The Ohio EPA in conjunction with USGS and the local communities with discharging WWTP's to Tinker's Creek have partnered to study the impact of effluent outputs from the plants to Tinker's Creek. Because Tinker's Creek has seven WWTP's within its drainage basin, it makes the watershed a unique study area for the impact of pharmaceuticals on aquatic species and biological diversity. The data is currently being analyzed and may provide insight into a growing issue which many water bodies will ultimately face. The study focuses on why fish populations are showing no improvement in the upper main stem while QHEI scores remain relatively stable. The increase of pharmaceutical and personal care products usage, and a growing population makes this study and future studies even more important to water quality initiatives. Elevated nutrients and turbidity are also being evaluated as possible stressors to this system.

Figure 15: Pond Brook HUC-12, example of outfall/outlet in-stream structure

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

Tinkers Creek Watershed Partners have used several studies and survey feedback in order to determine the critical areas within the Pond Brook watershed. The groundwork for the critical area was derived from the attainment and targeted delisting recommendation information from the Tinker's Creek Watershed Action Plan (2010) and the Lower Cuyahoga Total Daily Maximum Load (September. 2003) documents. Although the data in these documents is older, TCWP used them to help narrow down known issues in the watershed.

The Ohio EPA's Water Quality Summary 2016 Integrated Report also provided relevant data and helped TCWP identify attainment issues and associated areas that had similar attainment issues. This information was paired with local knowledge of problem areas gathered from community interactions and through a survey sent to

watershed communities and partners that work in the watershed. This helped to identify causes of impairments and potential projects.

Ohio EPA's *Support for the Development of Management Actions in Cuyahoga Area of Concern*, January 2017 by Tetra Tech was also utilized to determine the critical areas. The objective of this study was to develop lists of prioritized proposed management actions for the Cuyahoga AOC. The lists of proposed management actions within this document are considered "living documents". Ohio EPA plans to make revisions as data gaps are filled, new data becomes available, and as additional management actions are identified and implemented. Town of Twinsburg – Tinker's Creek HUC-12 does not meet the beneficial use impairment (BUI) for degradation of fish populations (#3a) and degradation of benthos (#6) but does meet for loss of fish habitat (#14a). Pond Brook HUC-12 meets the BUI for both degradation of fish populations and loss of fish habitat but does not meet the BUI for degradation to benthos. Headwaters Tinker's Creek HUC-12 does not meet any of the BUI (3a, 6, 14a). The proposed management actions to remedy these impairments include removal of the barrier or impoundment, restore habitat (in-stream) and/or reconnect water resource and associated floodplain.

Chapter 3: Critical Area Conditions & Restoration Strategies

3.1 Overview of Critical Area

Critical Area 1 is an area that has been improving due to restoration efforts. Continued success of these previous projects depends on future protection and restoration. Pond Brook has been heavily modified by dredging, reflected in Ohio EPAs MWH classification, both the habitat and fish community reflect this disturbance. Continued restoration efforts have helped to reduce localized and upstream issues with sedimentation and turbidity. Significant development has occurred over the last 20 years and has drastically increased urban runoff into the Pond Brook stream itself. Historically, fine sediments and glacial till are commonly found in this area and substantially increase the amount of sediment flowing into the Pond Brook system. Turbidity and sedimentation continue to cause habitat degradation throughout the watershed, as well as, channelization of the system. Much of the turbidity down stream of Pond Brook in the main stem of Tinker's Creek has been attributed to this tributary. Further, this area is dominated by wetlands and the terrain is fairly flat. Continuing restoration efforts to replant riparian areas, preserve the integrity of the remaining wetlands, and stabilize stream banks of Pond Brook will assist in reducing the amount of sediment entering the system and therefore help stabilize habitat loss in the watershed.

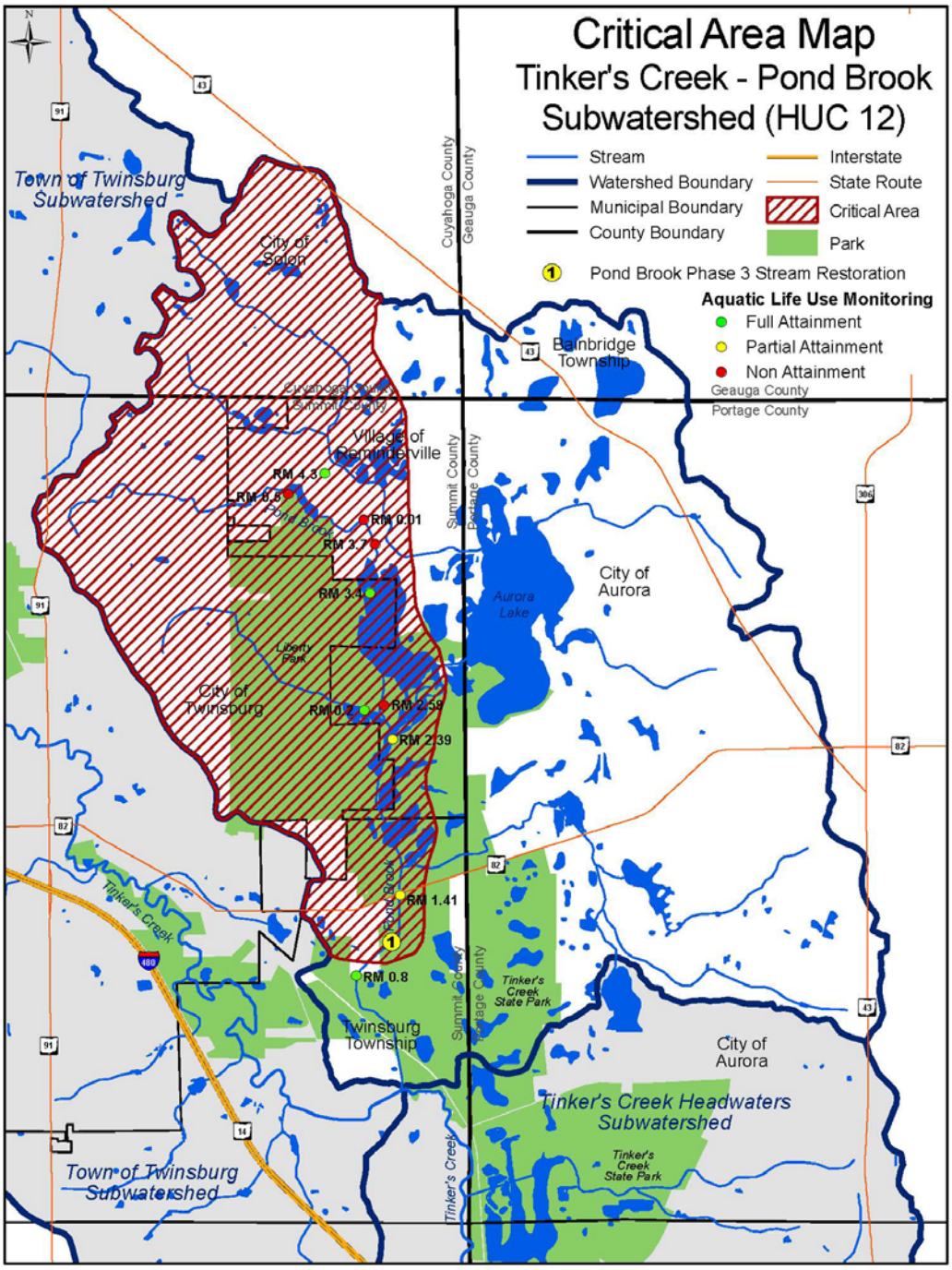

Figure 16: Critical Area #1, Pond Brook HUC-12, including potential projects and OEPA attainment monitoring sites

3.2 Critical Area 1: Conditions, Goals & Objectives

3.2.1 Detailed Characterization

Critical Area 1 encompasses the HUC-12 Pond Brook watershed. Within this critical area, the major causes of impairment are bacteria. A TMDL has not yet been developed for this sub watershed. Land use within this watershed is divided as follows: 58.20% developed, 33.40% forested, 3.30% grass/pasture, 0.80% row crops, and 4.20% other. This critical area contains the Pond Brook AoC.

The Pond Brook sub watershed drains an area of 16.62 mi^2 and contains 10.37% impervious cover. This sub watershed contains a total of 219 wetlands, two of which are Category 1, 12 Category 2, and 16 Category 3. Pond Brook is a channelized, wetland stream designated MWH based on its low habitat quality and ongoing channel maintenance under the Ohio Drainage Law (ORC 6131) (1991 survey results). The stream is mostly pooled, and receives drainage from adjacent wetlands, suburban development, and effluent from two WWTPs. Fish and macro-invertebrates were fair but met the designated MWH use. This sub watershed is now in full attainment of its designated use based on 2000 survey results.

Figure 17: Pond Brook HUC-12, example 'typical' of Critical Area, from Summit Metroparks Pond Brook Phase III Plan

3.2.2 Detailed Biological Conditions

The Aquatic Life use (WWH and MWH-C) for this critical area is impaired. Intensive biological community, chemical water quality, and physical habitat data were collected in the assessment unit from 2006 to 2008 in support of ongoing efforts to determine effects of trace pharmaceuticals on biological communities and aquatic life use attainment status in the Tinker's Creek basin. Pond Brook monitoring in 2011 and 2012 was in support of a stream channel restoration project. During 2012, stream channel morphology and physical substrate conditions were still in the process of recovery and stabilization.

This sub watershed has been monitored through sampling efforts from 2006-2014. In 2006, two sampling sites scored IBIs of 30-38 (fair to marginally good) and QHEIs of 28-44.5. In 2011, two different sampling sites scored IBIs of 28-34 (fair), poor for invertebrates, and QHEIs of 45.5-58. In 2012, four sites were sampled with IBIs ranging from 20-38 (poor-marginally good), poor to fair invertebrates, and QHEIs of 25.8-45.5. Two sites were sampled in 2014 with IBIs of 26-28 (poor-fair), invertebrates between poor and low fair, and QHEIs of 41.8 and 70.3.

3.2.3 Detailed Causes and Associated Sources

Critical Area 1: Cause and Source of Impairments

Causes of Impairment:	**Sources of Impairment:**
Direct habitat alterations	residential districts
Particle distribution (embeddedness)	channelization
Sedimentation/ siltation	

Pond Brook is a modified stream which has both habitat and ecological characteristics of a disturbed system, reflected in its Ohio EPA classification as a modified warm water habitat. The dominant habitat impairments indicate a stream with too much sediment input, both from within the stream and from nonpoint sources in its watershed. Excessive sediment loads overwhelm the stream's processing ability, resulting in poor substrate conditions and a turbid water column. The stream is also a major source of sediment to the lower Tinker's Creek HUC.

The dominant habitat impairments in this critical area include a lack of riffles, high/moderate riffle embeddedness, high/moderate overall embeddedness, no fast current, fair/poor development, hardpan substrate origin, heavy/moderate silt, recovering channel, max depth < 40 cm, sparse/no cover, no sinuosity, silt/muck substrate, and channelized/no recovery.

3.2.4 Outline Goals and Objectives for the Critical Area #1

Pond Brook HUC-12: Erie-Ontario Lake Plain (EOLP) Warmwater Habitat, 16.62 mi^2.

The overall nonpoint source restoration goals for any NPS-IS plan are to improve IBI, ICI and QHEI scores so that the partial or non-attainment sites can achieve full attainment of the WWH designated aquatic life use for the respective water body. Specific goals applicable to non-attainment sites are outlined below:

Goal 1: Raise and Maintain IBI score of at least 24 at Pond Brook near Aurora @ St. Rt. 82 (RM 1.41).

ACHIEVED (But at risk)* Site currently has an IBI score of 22 (which is no significant departure from meeting biocriterion standard of 24).

Goal 2: Achieve QHEI score of at least 50 at Pond Brook near Aurora @ St. Rt. 82 (RM 1.41).

NOT ACHIEVED: Site currently has a *QHEI score of 32.5.*

Goal 3: Achieve IBI score of at least 24 at Pond Brook just DST. Of Trib (RM 2.39).

NOT ACHIEVED: Site currently has an *IBI score of 20.*

Goal 4: Achieve QHEI score of at least 50 at Pond Brook just DST. Of Trib (RM 2.39).

NOT ACHIEVED: Site currently has a *QHEI score of 38.*

Goal 5: Maintain IBI score of at least 24 at Pond Brook in Restoration Area (RM 2.59).

ACHIEVED: Site currently has an *IBI score of 34.*

Goal 6: Achieve QHEI score of at least 50 at Pond Brook in Restoration Area (RM 2.59).

NOT ACHIEVED: Site currently has a *QHEI score of 45.5.*

Goal 7: Maintain IBI score of at least 24 at Pond Brook @ Tradewind Cove Rd. (RM 3.70).

ACHIEVED: Site currently has an *IBI score of 38.*

Goal 8: Achieve QHEI score of at least 50 at Pond Brook @ Tradewind Cove Rd. (RM 3.70).

NOT ACHIEVED: Site currently has a *QHEI score of 25.8.*

Goal 9: Achieve IBI score of at least 36 at Trib to Pond Brook (3.90) at Reminderville @ Outrigger's Cove (RM 0.01).

NOT ACHIEVED: Site currently has an *IBI score of 26.*

Goal 10: Achieve QHEI score of at least 55 at Trib to Pond Brook (3.90) at Reminderville @ Outrigger's Cove (RM 0.01).

NOT ACHIEVED: Site currently has a *QHEI score of 41.8.*

Goal 11: Achieve IBI score of at least 36 at Trib to Pond Brook (3.90) at Reminderville @ Glenway Dr. (RM 0.50).

NOT ACHIEVED: Site currently has an *IBI score of 28.*

Goal 12: Maintain QHEI score of at least 55 at Trib to Pond Brook (3.90) at Reminderville @ Glenway Dr. (RM 0.50).

ACHIEVED: Site currently has a *QHEI score of 70.3.*

To achieve these goals for Critical Area 1, the following objectives need to be achieved:

Objective 1: Maintain 150 acres of previously restored areas through invasive species management plans and removal of large obstructions when beneficial.

Objective 2: Maintain and monitor 15,000 linear feet of previously restored areas for adequate vegetation cover.

Objective 3: Restore a minimum of 7,300 linear feet of stream and riparian corridor utilizing natural channel design and bio-engineering techniques to help create habitat and floodplain connectivity to support aquatic life and healthy riparian corridors.

Objective 4: Encourage stormwater control measures (SCMs) to be implemented in the 4 communities located within the HUC-12 which will reduce polluted runoff, including nutrients, temperature and sediment, and increased flows in streams.

Objective 5: Conduct annual planning meeting with "NPS-IS planning team" where well-reasoned NPS-IS objectives are developed in order to accomplish goals 3-12 in this strategy (Version 1.1).

As these objectives are implemented, water quality monitoring (both project related and regularly scheduled monitoring) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards). These objectives will be reevaluated and modified if determined to be necessary. For instance; many agricultural BMPs can be "stacked" (a systems approach) that will also incrementally improve the quality and quantity of runoff and drainage waters and in-stream water quality.

When reevaluating, the committee will reference the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013), which has a complete listing of all eligible NPS management strategies to consider including:

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

Chapter 4: Projects and Implementation Strategy

4.1 Projects and Implementation Strategy Overview Table(s) (Overview Table)

Below are the projects and evaluation needs currently believed to be necessary to remove the impairments to the Pond Brook HUC-12 as a result of the identified causes and associated sources of nonpoint source pollution. Because the attainment status is based on biological conditions, it will be necessary to periodically re-evaluate the status of the critical area to determine if the implemented projects are sufficient to achieve restoration. Time is an important factor to consider when measuring project success and overall status. Biological systems in some cases can show positive or negative response in a reasonable time frame. But others may take longer to show recovery. There may also be reasons other than nonpoint source pollution for the impairment. Those issues well need to be addressed under different initiatives, authorities or programs which may or may not be accomplished by the same implementers addressing the nonpoint source pollution issues.

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

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

Priority 2: Project where there is landowner willingness to engage in the project that is designed to address the causes and sources of impairment or where there is an expectation that such potential projects will improve water quality in the Pond Brook HUC-12.

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

For ***Pond Brook (HUC-12)*** **(041100020501)**								
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)*
Altered Stream and Habitat Restoration Strategies								
1	1 & 2	3	1	Pond Brook Phase 3 Stream Restoration	Summit Metro Parks	1 – 3 years	$1,442,496.88	319; WRRSP; Local Match
High Quality Waters Protection Strategies								
1	1 & 2	3	1	Pond Brook Phase 3 Stream Restoration	Summit Metro Parks	1 – 3 years	$1,442,496.88	319; WRRSP; Local Match

4.2 Project Summary Sheet

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

Nine Element Criteria	Information needed	Explanation
n/a	**Title**	Pond Brook Phase 3 Stream Restoration
criteria d	**Project Lead Organization & Partners**	Summit Metro Parks
criteria c	**HUC-12 and Critical Area**	04110002 05 01 Critical Area #1
criteria c	**Location of Project**	Mostly within Liberty Park in Twinsburg at 9385 Liberty Rd, Twinsburg, OH 44087.
n/a	**Which strategy is being** **addressed by this project?**	Urban sediment and nutrient reduction, restore streams using natural design methods, daylighting culverted and severely modified streams, strategies for restoring and protecting habitat, restoring natural flow, riparian management strategies, manage invasive species
criteria f	**Time Frame**	Short-term (2 years) construction with ongoing monitoring and public education and outreach
criteria	**Short Description**	As a result of dredging and channelization, the un-restored sections of Pond Brook are barely, and perhaps not, achieving MWH status and their biological communities have suffered greatly as a result. The dredging and channelization activities have resulted in a largely stagnant stream channel that is highly turbid with primarily pollution-tolerant species. Invasive and pollution-tolerant species, especially the common carp and canary reed grass, contribute significantly to Pond Brook's ongoing impairments. As a result, Pond Brook has a poor biologic community and does not attain WWH status. It also contributes greatly to Tinker's Creek water quality impairment due to high sediment loads associated with Pond Brook. The goals of the Pond Brook Phase 3 Restoration are to return Pond Brook and its tributaries to functional streams with accessible floodplains and to provide an ecosystem that will meet the Warm Water Habitat (WWH) water quality criteria. This will greatly decrease pollutant loading, especially sediments and nutrients, in order to improve Tinker's Creek and Cuyahoga River water quality. Restoration activities will include

		re-meandering of the stream to achieve a more natural channel morphology, in-stream habitat improvement (i.e. rootwad installation, boulders and overhanging vegetation), the development of riffles and some riffle/pool sequences, and significant riparian plantings. A new floodplain will be created for the re-meandered stream; however, the work will primarily occur within the prism of the previously dredged stream channel. Some wetlands will likely be created within the new floodplain area; however, wetland creation is not the primary goal of this project.
criteria g	**Project Narrative**	Pond Brook, flowing approximately 3 miles and compromising a watershed of over 10,000 acres, is a major tributary to Tinker's Creek, which is the largest of the Cuyahoga River sub-watersheds. Pond Brook, which has been severely impaired due to historic hydromodification and dredging, contributes significantly to Tinker's Creek water quality impairment. Enormous quantities of sediment flow from Pond Brook directly into Tinker's Creek. According to the Tinker's Creek Watershed Action Plan, Pond Brook is barely achieving Modified Warmwater Habitat (MWH) status; however, according to more recent studies by Enviroscience, Pond Brook is not in attainment of MWH goals. Pond Brook was previously dredged and channelized in order to drain wetlands within the Pond Brook sub-watershed for development. Due to the dredging, Pond Brook is little more than a ditch that averages 10 feet in depth and 30-to-40 feet in width with very steep slopes and little to no sinuosity. The dredging resulted in a biological community primarily of invasive species, especially common carp and canary reed grass, and other pollution and sediment-tolerant species. Sedimentation, exacerbated by large carp populations that forage in the muck and continuously stir-up and suspend sediment particles, is a large contributor to Pond Brook's poor water and biological community, but also to Tinker's Creek water quality impairment. Pond Brook's existing channel condition results in a stagnant pool of water much of the time and because there is little over-hanging vegetation, water within the channel is highly susceptible to thermal modification. The primary invasive species present within the proposed restoration area include narrow leaf cattail, glossy buckthorn, reed canary grass, and *Phragmites*. There are also two upstream wastewater treatment facilities (a package plant and a Summit County wastewater treatment facility), which contribute to some of the nutrient issues (however, as noted further in the application, the previously restore section of Pond Brook saw nutrient levels decrease significantly). Finally, non-point urban run-off from upstream development also contributes to Pond Brook's nutrient and sedimentation problems. The goals of the Pond Brook Phase 3 Restoration are to return Pond Brook and its tributaries to functional streams with accessible floodplains and to provide an ecosystem that will meet the Warm Water Habitat (WWH) water quality criteria. This will greatly decrease pollutant loading, especially sediments and nutrients, in order to improve Tinker's Creek and Cuyahoga River water quality. Approximately, three-quarters of Pond

		Brook is within ownership of Summit Metro Parks. Summit Metro Parks has purchase agreements signed for the remaining two parcels needed for this proposed stream restoration; and should be acquired by the end of 2016. Summit Metro Parks (SMP) has already restored approximately 2 miles of the Pond Brook channel and some small tributaries (stream channels 25 and 40). SMP has also restored several acres of floodplain wetlands along the Upper Pond Brook adjacent to the stream restoration areas. The restored sections of Upper Pond Brook fully attains MWH goals and is in partial attainment of WWH goals. With construction fully complete of Pond Brook north of State Route 82, we believe the restored channel section will achieve full WWH Status. Worthy of particular note is that the restored section has drastically decreased sediment loading, which will be more fully discussed below and is a significant success. This restoration project will restore an additional 7,300 linear feet of Pond Brook from the end of Phase II (south of State Route 82) to just north of the confluence with Tinker's Creek. A management plan has been prepared for a WRRSP application and is available upon request. The previous restoration work on Pond Brook has had significant improvement to the waterway and watershed. Approximately 2 miles of Upper Pond Brook has already been fully restored, along with 2 tributaries and over 100 acres of wetlands. The results of the Upper Pond Brook restoration are dramatic even though restoration activities were only completed one year ago. Preliminary monitoring results from the restored sections of Pond Brook indicate the following achievements: invasive cover is less than five percent; sinuosity was restored to the stream channel; QHEI scores are in the upper 50's; and planted species are surviving at an 80 percent rate or better. Dissolved oxygen has significantly increased, nutrient levels have decreased, as have siltation. The restoration features appear to be holding up very well. The restoration is already having a significant impact on native biologic communities. For instance, we have already seen a very vast decrease in the number of common carp occupying the restored sections of stream, and those carp that were identified are juvenile in nature. Native fish species are increasing and pollution-tolerant species are beginning to decrease. These results are anticipated to amplify over time as the restoration site matures and begins to adjust to the positive features, such as the riffle/pool sequences, enhanced floodplain and riparian connection, and decreased thermal modification. Both fish (IBI) and macroinvertebrate (ICI) scores have surpassed target criteria and are nearing attainment of Warmwater Habitat (WWH). Due to the enormous decrease in common carp, especially mature carp, which do not prefer the sinuous and natural channel morphology, sedimentation within the restored section of stream channel has decreased greatly. Nutrient levels have decreased significantly within the

		restored section of stream, which indicates that the restored vegetation and connected floodplain are assisting in the removal of those nutrients, while dissolved oxygen has increased and impacts from thermal modification have decreased due to the increased riparian zone vegetation. These results are expected to further improve as the native vegetation proliferates. We fully anticipate that the outstanding results achieved as part of the previously completed Upper Pond Brook restoration projects will be duplicated by the restoration project proposed within this grant application, if funded. This project is expected to reduce nitrogen loads by 1391 lbs. /yr., phosphorus by 1182 lbs. /yr., and sediment by 2365 tons/yr. The proposed Pond Brook Phase III restoration project is located entirely within SMP's Liberty Metro Park. As such, surrounding land use will be protected in perpetuity. Three State-listed species have been identified within the general vicinity of the proposed restoration area by SMP biologists and include: Least flycatcher (*Empidonax minimus*), Bush's sedge (*Carex bushii*) and Four-toed salamander (*Hemidactylium scutatum*). The Indiana bat (*Myotis sodalis*), a federal listed species, has also been identified in close proximity to the restoration area by SMP officials. After completion of restoration work, it is anticipated that the site will be amenable to numerous other State-listed species that are or have the ability to exist within the Liberty Park area. If Section 319 Grant funds are awarded, it is anticipated that the site assessment and design package would be completed by the end of 2016. Restoration activities would begin in the spring of 2017 and be completed by the end of the calendar year. Design of the Phase III project is already underway and is being funded entirely by Metro Parks. Funds requested in this grant application will be applied only to construction and will supplement a previously awarded WRRSP grant. Contractors will be selected by SMP from our approved list and provided to Ohio EPA for final approval. Quality assurance will be provided by SMP personnel, including professional biologist, civil engineer, construction coordinator and planning staff. SMP staff will conduct extensive public education efforts for the project, including conducting project tours, field days and workshops, clean-ups and press releases. The site will be utilized as a part of our volunteer Citizen Science programs and it will be featured in the "Green Islands" (SMP publication) article and on the stream restoration section of the SMP website (www.summitmetroparks.org).
criteria d	**Estimated Total cost**	Design Services (contracted): $74,610 Invasive Species Management (in-kind): $15,000 Construction: $1,352,886.88 **Project Total: $1,442,496.88**

		WRRSP Grant: $868,500 Section 319 (Request): $200,000 Grant Total: $1,068,500 Summit Metro Parks Match (in kind and cash): $373,996.88
criteria d	**Possible Funding Source**	WRRSP Grant and Section 319 Grant
criteria a	**Identified Causes and Sources**	*Causes of impairment:* • *Nutrients* • *Direct habitat alterations* • *Siltation* • *Flow alteration* *Sources of impairment:* • *Streambank modification* • *Land development/suburbanization* • *Urban runoff/stormwater* • *Removal of riparian vegetation*
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	Goal 2 being to achieve QHEI score of at least 50 at Pond Brook near Aurora @ St. Rt. 82 (RM 1.41). The site currently has a *QHEI score of 32.5.* Objective 1: Maintain 150 acres of previously restored areas through invasive species management plans and removal of large obstructions when beneficial. Objective 3: Restore a minimum of 7,300 linear feet of stream and riparian corridor utilizing natural channel design and bio-engineering techniques to help create habitat and floodplain connectivity to support aquatic life and healthy riparian corridors
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	The project area is Phase III of the restoration work that have been done on Pond Brook. This project will be the last section of the restoration as Pond Brook runs through the Summit Metro Parks. By having this last 7,300 feet section restored and under permanent management by Summit Metro Parks we are confident that Goal 2 will be met and Goal 1 will be maintained. That the area will achieve Ohio EPA Water Quality Attainment within 2 to 3 years from completion of the project.
	Part 3: Load Reduced?	Based on the U.S. EPA Region 5 model, the restoration will remove an estimated; Nitrogen: 1391 lbs./year; Phosphorus: 1182 lbs./year; Sediment: 2365 lbs./year.
criteria i	**How will the effectiveness of this project in addressing**	Pond Brook South is already encumbered by an Ohio EPA Environmental Covenant. Any new property acquired in conjunction with this restoration project where restoration activities occur will also be encumbered by an

	the NPS impairment be measured?	Ohio EPA-approved Environmental Covenant. Metro Parks staff will perform the monitoring for this project. Monitoring activities will begin the first full year after construction activities have been completed and will continue annually for a total of five years. After that five-year period Metro Parks will monitor the stream restoration area on a periodic basis. Metro Parks intends to use a full suite of biocriteria analyses for monitoring purposes. These include QHEI, IBI and ICI analyses. Full attainment of WWH aquatic life use as determined by a minimum QHEI score of 64 is the goal for the Pond Brook South restoration project. Metro Parks park managers and rangers will conduct monitoring of the Environmental Covenant (i.e. looking for encroachment or other natural resource damage issues) at least annually and likely on a more frequent schedule. Metro Parks maintains a full-time staff at Liberty Park for such activities.
criteria e	**Information and Education**	The public outreach and information plan for this project will involve the creation of one project fact sheet, one press release, one website, and one newsletter. Information will also be shared via the following: installation of a project sign, development of an informational display, two tours, two field days, and one workshop.

Works Cited

Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354

Appendix A: Acronyms and Abbreviations

A

ALU	Aquatic Life Use
AoC	Area of Concern

B

BEHI	Bank Erosion Hazard Index

D

DSW	Division of Surface Water

E

EOLP	Erie-Ontario Lake Plains
EPA	Environmental Protection Agency

G

GPM	Gallons Per Minute
GLRI	Great Lakes Restoration Initiative

H

HSTS	Home Sewage Treatment Systems
HUC	Hydrologic Unit Codes

I

IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index

M

MIwb	Modified Index of Well-being

N

NLCD	National Land Cover Data
NWI	National Wetlands Inventory
NPS	Non Point Source
NPS-IS	Nonpoint Source Implementation Strategic Plan

O

ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method

Q

QHEI	Qualitative Habitat Evaluation Index

R

RM	River Mile

S

SWCD	Soil and Water Conservation District
SR	State Route

T

TMDL	Total Maximum Daily Load
TSD	Technical Support Document
TCWP	Tinker's Creek Watershed Partner. Inc.

U

USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Services

W

WAP	Watershed Action Plan