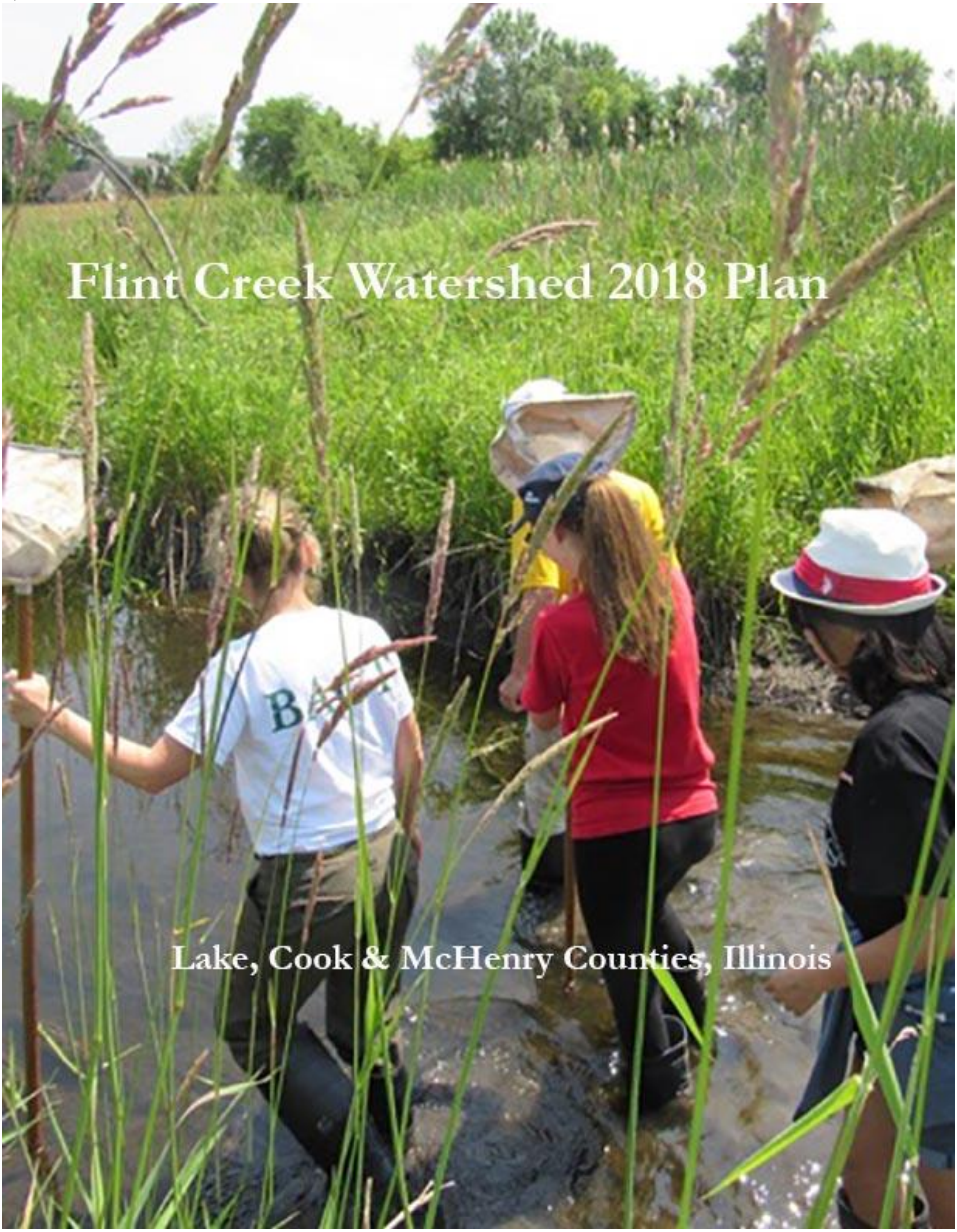

Flint Creek Watershed 2018 Plan
Lake, Cook & McHenry Counties, Illinois

Flint Creek Watershed Plan, 2018 Update

Table of Contents

Appendices

NB: There is no Appendix J

Index of Tables

Index of Figures

1.0 INTRODUCTION

In Illinois, villages, townships and counties have been established using a variety of criteria, such as social, cultural, political, time frame of development, generally influenced by geography, but not determined by it. As a consequence, there is very little consistency across government agencies as it relates to how these units of government came into being. Watersheds, however, have an internal consistency, as it is the area of land where all of the water that falls on it and drains off of it goes to a common outlet or larger body of water. Since the late '80s, federal, state and local agencies have focused on watersheds as an effective framework for managing water resource quality and quantity within a specific area – the area that the watershed defines. Like most effective continuous improvement strategies, the watershed planning process works by using a series of collaborative, iterative steps and stages to define current conditions, identify and prioritize problems, define objectives, develop strategies, evaluate successes and failures, learn, adjust, and go through the process again. These processes are documented in what is known as the Watershed Plan.

A Watershed Plan brings together stakeholders with a common interest – the health and effectiveness of the watershed, whether those stakeholders are totally aware of extent of their common bond, or their part in it, or not. If they are not aware of their common interest, and the part their actions play, the Plan outlines ways to inform and educate. The goals are objective, supported by the best current science, and buttressed by assessments of the current and recent status of the Watershed, prioritized and measureable, as is appropriate in these times of limited resources.

The Flint Creek Watershed Plan is funded by its partners, along with donations of volunteer hours and a small grant for technical assistance provided by the Barrington Area Community Foundation. For more information, please visit www.barringtonareacommunityfoundation.org. Special thanks belongs to our partners: The Villages of Barrington, North Barrington, Lake Barrington, Deer Park, South Barrington, Barrington Township, Cuba Township and Lake Zurich, Fox Point Homeowners Association, Barrington Area Development Council, Barrington Area Council of Governments, Citizens for Conservation, our fiscal agent, and the Barrington Area Conservation Trust. Additional credit belongs to Casey Sebetto, our graduate student who provided exceptional assistance in accomplishing our updates. Special thanks and recognition as well to Mike Adam, and his team at the Lake County Health Department for their excellent studies of area lakes, and to Cecily Cunz of Applied Ecological Services (AES) for her services and consideration for our small budget.

Section 1.1 USEPA Watershed-Based Plan Requirements

The purpose of this project is to update the 2007 comprehensive watershed management plan for the Flint Creek watershed, and to change the format to conform to the Nine Point Watershed Planning Framework, specifically:

A.) Causes and sources of water pollution, and estimates of existing pollutant loads

B.) Water quality goals, load reduction targets, and expected load reductions

C.) Management measures to achieve load reduction targets

D.) Technical and financial assistance and relevant authorities

E.) Information and education component

F.) Schedule for implementing identified management issues

G.) Interim, measurable milestones

H.) Interim benchmarks to measure progress

I.) Monitoring component

This project updates information, recommendations, and projects found within the original Flint Creek plan; identifies additional projects and recommendations not in the original plan; and outlines work and projects that have been completed since the release of the 2007 Plan.

Section 1.2 Planning Process

The Flint Creek Watershed Partnership (FCWP) held regular, public meetings throughout the last half of 2016 and all of 2017 to guide the watershed planning process and to encourage participation of stakeholders in the projects.

Table 1. Flint Creek/Spring Creek Watershed Partnership meeting schedule:

Mtg #	**Date**	**Agenda**	**Topic(s)**
1	7/28/2016	Discussion of local projects	Discussion on updating the plan; Data Requirements
2	9/29/2016	Continued discussion of local projects	Discussion on FC Partnership and outreach to original stakeholders
3	11/16/2016	Call for completed projects	Partial Summary of Projects. Presentation on Projects for the Watersheds
4	1/10/2017	Status of priority projects	Map Work
5	3/14/2017	Ongoing call for completed projects	Filling in Charts instruction; Map Work
6	4/11/2017	Workbooks from Partners	Continued Work on Filling in Charts
7	5/9/2017	Filling in Charts Map Work	Impact of Municipal and Pvt. Raingardens; Worksheets from Partners
8	7/11/2017	Continued work on Completing Plan Charts	Intern Assistance Availability; Status of project reports
9	9/12/2017	Map Work: Filling in the Charts	Status of Partnership Reports
10	11/14/2017	Accomplishments and plan update and processes	Summary of progress to date; Working Session on Future Plans

11	2/13/2018	Status of Plan: Evaluation	Update; Review of evaluation process compared to 2007's 5 year update; More update plan additions
12	3/13/2018	Review of FSWP Goals & Objectives; Discussion of Target Reductions; Concerns or Consensus to Move Forward	Discussion of Goals, and Information and Education Components, and Expected Load Reductions

The primary goal of FCWP is to educate while building partnerships for projects to improve water quality, reduce flooding, and preserve and restore wetlands, prairies, and other natural features for future generations.

Section 1.3 Goals and Objectives

Six goals were established for the Flint Creek watershed to address the issues and opportunities raised by the FCWP. These goals include those listed in the 1994 Watershed Plan prepared by the Lake County Stormwater Management Commission (LCSMC) as well as additional goals discussed during the first watershed planning meetings. For the Plan Update, the goals are the same, although five objectives have been added

- **Goal A:** Protect surface and groundwater resources and enhance overall water quality in the lakes and streams of the watershed.
  Objectives:

  1) Lakes and streams shall at a minimum attain state water quality standards to fully support designated uses.
  2) Reduce sediment and nutrient accumulation in lakes and streams by restoring eroded streambanks and lake shorelines using bioengineering practices.
  3) Maintain and expand high quality native riparian buffers and restore native riparian buffers along those stream reaches identified as having poor buffer quality.
  4) Educate landowners on the environmental dysfunction caused by invasive buckthorn and support efforts for its eradication in the Flint Creek Watershed.
  5) Retrofit existing stormwater management structures and design new structures using BMP green infrastructure wherever feasible within developed areas to specifically reduce nutrient and sediment loading.
  6) Publicize the impacts of road salt usage on water quality and aquatic life and develop recommendations for education, alternatives, and use reduction.
  7) Identify open space parcels appropriate for implementation of best management practices (BMPs) to reduce pollutants originating from known pollutant loading hotspots.
  8) Reduce point source pollutant loading.
  9) Research best green infrastructure practices and work with government agencies to encourage best green management practices in ordinances and codes
  10) Educate the public about protecting shallow aquifer water quality, particularly in recharge areas.
  11) Implement stormwater BMPs throughout the watershed to improve water quality and reduce runoff.

12) Reduce phosphorus, nutrient & other pollution by educating land-owners and landscape contractors on the effectiveness of native buffers and porous pavements.
13) Continue to educate landowners and developers about the dangers of high Polycyclic Aromatic Hydrocarbon surface sealers, and their impact on water quality and aquatic life.
14) Work with the LCSMC, BACOG and local villages and government agencies to educate well and septic owners on best maintenance practices.

- **Goal B:** Identify and protect important natural areas/open space in the watershed and provide appropriate passive recreational benefits.
  Objectives:

  1) Permanently protect all sites with high quality natural areas or threatened and endangered species.
  2) Identify buffer parcels for potential acquisition, protection, and/or restoration adjacent to sites with high quality natural communities and/or threatened and endangered species.
  3) Adopt conservation design standards for all new development in designated high priority open space to maximize protection of natural areas and open space in new developments.
  4) Identify and protect open space that provides important green infrastructure (conservation) corridor connections and provide passive recreation opportunities.

- **Goal C:** Reduce existing flood damage in the watershed and prevent flooding from worsening downstream.
  Objectives:

  1) Inventory undeveloped floodplain that is not currently protected from development and protect it as open space.
  2) Mitigate for existing flood damage at all flood damage sites by identifying open space parcels suitable for wetland restoration or stormwater storage basins.
  3) Reconnect ditched stream reaches to historic floodplain where feasible.
  4) Implement multi-objective stormwater management best management practices (BMPs) within high priority open space and new developments that help reduce runoff and increased stream flows through infiltration of rainwater.

- **Goal D:** Improve aquatic and terrestrial habitat in the watershed.
  Objectives:

  1) Identify opportunities for habitat improvement on identified open space; improve habitat in degraded stream reaches using natural stream design approaches and improve habitat in degraded terrestrial communities by removing non-native plants and replacing with native plant communities.
  2) Develop and implement short and long-term management and monitoring plans for all natural areas.
  3) Encourage the development of lake management plans among stakeholders and HOAs.
  4) Encourage native plantings in stakeholder landscapes.

- **Goal E:** Increase communication and coordination among municipal decision-makers and other stakeholders within the watershed.
  Objectives:

1) Ensure that municipalities adopt updated Flint Creek Watershed-Based Plan.
2) Encourage municipalities and stakeholders to participate in Flint Creek Watershed Partnership.
3) Encourage adoption of municipal comprehensive plans, codes and ordinances supportive of watershed plan goals and objectives and climate change adaptation
4) Develop a planning, funding, and implementation mechanism to provide stream channel maintenance across multiple jurisdictions using environmentally friendly practices.
5) Encourage collaboration for water quality testing resources, locations and protocols

- **Goal F:** Foster appreciation and stewardship of the watershed through education.
  Objectives:

  1) Provide watershed stakeholders with an education plan that promotes the knowledge, skills, and motivation needed to take action on implementing the watershed plan.
  2) Encourage Volunteer Scientist Programs, such as RiverWatch and the Volunteer Lake Monitoring Program.
  3) Educate the public on the benefits and goals of native plants and natural area restoration.
  4) Identify open space parcels adjacent to public facilities such as schools that would be appropriate for outdoor education, butterfly gardens or rain gardens, and so on.
  5) Implement environmental interpretation/education signage throughout greenway (conservation) corridors.
  6) Educate the public on the value of ecosystem services provided by healthy natural systems.

Section 1.4 Using This Plan

Watershed Plans are largely useless without watershed stakeholders who are committed to managing and improving the watershed. The context of "watershed" is important, as it demonstrates clearly that our individual actions impact collectively the experience of all who live in the watershed, as well as downstream on the Fox River. While municipal and county agencies along with elected officials may be responsible for using the information in this document to help manage the watershed, each community member can play a part. Not only can each community member influence the actions of their elected officials, but their individual actions – e.g. use of fertilizers, water use, careful disposal of pollutants, buffer plantings, and so on – impact the health of their watershed.

We are all connected, and so are our water systems. There are three components to our water service infrastructure: drinking – from either our own wells or municipal wells (in our area), wastewater – to septics or sewers, and stormwater. These systems are ultimately interconnected, and looking at water through the lens of a watershed helps us understand.

This Watershed Plan should provide:

- a common basis for area residents to understand the challenges our Watershed currently faces;
- opportunities to become more involved and gain more knowledge;
- appreciation and support for the importance of protecting our water systems for our own enjoyment, economic growth and the ongoing vitality of the natural areas that attracted so many to our towns.

Given our current social landscape, in which municipal and governmental agency budgets are stretched, the prospects are for fewer, large projects publicly funded. Given the importance of developing more climate resiliency, the probabilities are that developing effective detention areas and mitigating floods will increase in priority. At the same time, given potential future water quality and quantity challenges, and the extent to which rivers and lakes are located on private properties, it will become more and more critical to invite our citizenry to step up, engage, and help protect and restore this invaluable common resource. This plan should help our communities understand the current state of our watershed and the positive and very impactful steps they can take with their neighbors.

Section 1.5 Completed Projects

A number of watershed Best Management Practices (BMPs) have been completed in the Flint Creek Watershed by many of the member jurisdictions and conservation groups. A list of projects completed from 2007 is listed below:

Table 2. Projects Completed Since 2007.

Location	Original Map Figure	Project Type	Original Page #	BMP #
Barrington				
Whitney Dr., Garlands completed in 2008	Figure 65	Detention Basins	211	139
Public Safety Basin maintenance	Figure 65	Detention Basins	211	140
Dam repairs south of Baker's Lake	Figure 65	Detention Basins	211	200, 201
Flooding on Elm Road, Work on Rte 14 at CN	Figure 66	Flood Mitigation	213	#9-19
Storm sewer replacement to reduce flooding	Figure 66	Flood Mitigation	213	FPA 6
Russel/Summit/Lincoln/Miller	Figure 66	Flood Mitigation	213	FPA 7
Flooding on Elm Road, Work on Rte 14 at CN	Figure 68	Regional storage	217	#9-19
Working on Dreamway project	Figure 70	Stream Reaches	221	FC 10
Hart Rd, improvements and underpass	Figure 70	Stream Reaches	221	FC09
Adopted SMC ordinance	Table 52	Programmatic Action Item	191	Goal A, Item 8
Installed rain garden at Barrington Area Library	Table 52	Programmatic Action Item	194	Goal C, Item 6
Barrington Hills				
Veterans Bridge repair	Figure 71	Stream reach	223	FC06

Location	Original Map Figure	Project Type	Original Page #	BMP #
Paganica Stabilization project on basin	Figure 69	Detention Basins	211	197
Adopted SMC ordinance	Table 52	Programmatic Action Item	191	Goal A, Item 8
Barrington Township				
Installed rain garden at Barrington Township Hall	Table 52	Programmatic Action Item	194	Goal C, Item 6
College Streets flood zone working on grants	Figure 66	Flood Mitigation	213	3
Cuba Township				
Highland Road	Figure 66	Flood Mitigation; Detention Basin	213	158, 159, 160, 161
See Figure 66	Figure 66	Flood Mitigation	213	FPA 9.04
Salt trucks computer controlled; also use Liquid Thermal Point R, applied to salt as released, reducing salt usage by 25%	Table 52	Programmatic Action Item	190	Goal A, Item 5
Prestwick Drive area	Figure 66	Flood Mitigation	213	FPA 8
Deer Park				
Squires Park study of options	Figure 65	Detention Basins	211	127
BMP for ponds in the community 2017	Table 52	Programmatic Action item	190	Goal A, 2, 4, 5
Ela Township				
Salt trucks computer controlled, reducing salt usage	Table 52	Programmatic Action Item	190	Goal A, Item 5
Fox Point HOA				
Improvement with 319 grants of channels into Lake Louise	Figure 70, 71	Stream Reaches	221, 223	FC 13, 14, 15
Lake Louise Shoreline and Dredging Study	Table 52	Programmatic Action Item	190	Goal A, Item 5
Lake Barrington				
Village Hall Detention Basin retrofit	Figure 65	Detention Basins	211	15

Onion Pub Pepper Road shoreline retrofit on old Quarry	Figure 65	Detention Basins	211	20
Low impact development	Figure 68	Regional Storage	217	35
Stonehenge Golf course partnership	Figure 68	Regional Storage	217	38
Flint Creek Savanna/woodland restoration	Figure 68	Regional Storage	217	40
Freier Farm acquisition, restoration, recreation	Figure 68	Regional Storage	217	41
Grassy Lake Preserve restoration	Figure 68	Regional Storage	217	42
Partnership with LCFPD restoration. Trails	Figure 68	Regional Storage	217	43
Partnership with LCFPD restoration. Trails	Figure 68	Regional Storage	217	44
Freier Farm improvements	Figure 69	Wetland Restoration	219	2
Partnership with LCFPD restoration. Trails	Figure 69	Wetland Restoration	219	4
Gibbs Acquisition	Figure 69	Wetland Restoration	219	14
Stream reach restoration with Hurd Farm, trails, restoration	Figure 70	Stream Reaches	221	FC01
Septic Maintenance Ordinances passed	Table 52	Programmatic Action Item	191	Goal A, Item 10
Lake Zurich				
Amherst Oaks	Figure 65	Detention Basins	211	47
Miller Road improvements	Figure 66	Flood Mitigation	213	#9-12
Stabilization of Lake Zurich shoreline	Figure 67	Lake Shoreline Restoration	215	Lake
Replaced damaged outlet with post 1992 release restrictor	Figure 65	Detention Basin Retrofit	250	64
Whitney Rd: Planted natives on side slope and detention bottom to promote water quality; repaired disconnected pipes; removed shopping carts	Figure 65	Detention Basin Retrofit	250	30
Pleasant Rd: Removed turf grass and rip-rap slopes and replaced with native vegetation	Figure 65	Detention Basin Retrofit	250	32
Rand Rd (Park); Vista Rd; Interlaken Drive replaced turf grass with native vegetation	Figure 65	Detention Basin Retrofit	250	35, 39

Lorie Ln. Replace turf grass slopes with native vegetation	Figure 65	Detention Basin Retrofit	250	43, 44, 45
Lions Drive: Converted to wet bottom detention basin planted with native vegetation	Figure 65	Detention Basin Retrofit	250	47
Rand/Ela Rd. Repair bare soils using native vegetation; control invasives and non-natives; located w/in pollutant loading hotspot SMU	Figure 65	Detention Basin Retrofit	250	77, 78
Berkshire Ln; Yorkshire Ln: Replaced turf grass buffers with native vegetation; controlling invasive and non-native species. (located w/in pollutant loading hotspot SMU	Figure 65	Detention Basin Retrofit	251	79, 80
Memory Ln; Replaced turf grass buffers with native vegetation	Figure 65	Detention Basin Retrofit	251	79, 80
Rosehall Dr. (Mews): Maintain newly contructed basin by controlling invasives and non-natives.	Figure 65	Detention Basin Retrofit	251	98, 99
Rand/Ela Rd: Replace turf grass buffers with native vegetation (also located in pollutant loading hotspot SMU	Figure 65	Detention Basin Retrofit	251	121
Echo Lake shoreline stabilization of 587 linear feet of severely eroded shoreline on SW parcels, including minor regrading and installation of native plants	Figure 67	Lake Shoreline Restoration	252	Lake
Rugby Ln to Rt. 12; 4,400 ft. 1) Increase native plant buffer width along residential areas and remove other non -native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install rootwads, boulders, and logs to improve habitat; Installing structure to increase flow velocity and transport moderate sediment; repair problematic hydraulic structures & discharge points Multi-year phased project beginning in 2018	Figure 71 & 71	Stream channel maintenance and monitoring	252	FC26
Lake Zurich permit structure for shoreline	Figure 67	Lake Shoreline Restoration	215	Lake
North Barrington				
Overall study and summary of detention basins in community	Figure 65	Detention Basins	211	
Improvements at Wynstone HOA private	Figure 65	Detention Basins	211	113

Miller Road improvements/removal of Oxford Rd	Figure 66	Flood Mitigation	213	#9-17
Signal Hill pipe improvements	Figure 66	Flood mitigation	213	#9-22
Wynstone HOA work private	Figure 67	Lake Restoration	215	Dogbone
Miller Road improvements/removal of Oxford Rd	Figure 68	Regional Storage	217	#9-17
Eton Park improvements/restoration	Figure 69	Wetland Restoration	219	18
Grassmere Farms improvements restoration	Figure 69	Wetland Restoration	219	20
Stream restoration 1700 feet	Figure 70	Stream reaches	221	FC25
Working on debris jams through entire reaches	Figure 70	Stream reaches	221	
Stream restoration 1700 feet	Figure 71	Stream reach restoration	223	FC25
Coal Tar Sealant ban passed 2016	Table 52	Programmatic Action Item	198	Goal E, Item 5
BMP manual for residents	Table 52	Programmatic Action Item	190	Goal A, Items 2,4,5
Macro-invertebrate assessment, Flint Creek Water Quality Monitoring	Table 52	Programmatic Action Item	196	Goal A, Item 7, Goal B Item 2 & Goal D, Item 6
Implement regular clearing of debris jams in streams	Table 52	Programmatic Action	194	Item 5
Septic Maintenance Ordinances passed 2010	Table 52	Programmatic Action Item	191	Goal A, Item 10
Drainage Program to assess and rank Village stormwater systems	Table 52	Programmatic Action Item	195	Goal C, Item 9, 11
Conservation Partners				
Barrington Area Conservation Trust				
Pederson Preserve, Lake Cook/Hart Rd; also assisting Pepsico restore floodplain	Figure 69	Wetland Restoration	219	not on map

Far Field Preserve, prairie installation	Figure 69	Wetland Restoration	219	not on map
Partnership with High School students & Curriculum	Table 52	Programmatic Action Item	190	Goal A, Item 4
36 Monarch gardens (100 sqft each) planted around communities in 2017	Table 50	Programmatic Action Item	196	Goal D Item 12
Citizens for Conservation				
Cuba Marsh Restoration project	Figure 69	Wetland Restoration	219	17
CFC has adult and youth education programs on the natural world, and annual native plant sales; 3 Community Education programs every spring, plus annual meeting program and seasonal youth programs annually; CFC elementary curriculum	Table 52	Programmatic Action Item	190 & 201	Goal A, Item 4; Goal F, Item 2
CFC provides homeowner visits to encourage native landscaping	Table 50	Programmatic Action Item	196	Goal D Item 12
Hurd Farm, Wetland work with LCFPD	Figure 69	Wetland Restoration	219	15
CFC headquarters	Figure 69	Wetland Restoration	219	20
CFC Flint Creek Savanna	Figure 69	Wetland Restoration	219	16
Bird Walks, Spring Summer, Fall in partnership with Audubon	Table 52	Programmatic Action Item	190	Goal A, Item 4
Bakers Lake Work	Figure 70	Stream reaches	221	FC 16
Lake County Forest Preserve				
Grassy Lake Preserve	Figure 69	Wetland Restoration	219	18
Cuba Marsh Restoration project	Figure 69	Wetland Restoration	219	17
Education Components Relating to Watershed Goals				
Ancient Oaks Foundation				
Monthly Outdoor Education Programs, via the Parks Dept., Ela Library, and the Garden Club of Lake Zurich ("Buckthorn Busters") and as Ancient Oaks.	Table 52	Programmatic Action items	200	Goal F, Items 2, 4, 6
Habitat restoration at the Oak Ridge Marsh Nature Park, 500 Lions Drive, LZ. Various Eagle projects have occurred at this site as well: a butterfly garden, bridge, boardwalk over wet area, announcement board.	Table 52	Programmatic Action Item	200	Goal F, Items 2, 4

Habitat restoration at an unnamed oak woodland parcel across from the Nature Park,. The address is 351 Lions Drive. Secured a ComEd Openlands grant to clear this area and the Foundation is now planting native seeds. weeding etc.	Table 51	Programmatic Action Item	193	Goal B, Item 2
Wetland restoration at the Community Services building (formerly Public Works) at 505 Telser Road. Included removal of phragmites, buckthorn and reseeding with native wetland species. Installation of bird boxes and informational signage(Eagle project).	Table 51	Programmatic Action Item	191	Goal A, Item 14
Manor Park, Miller Rd. entrance is a detention pond that had been planted with a grant years ago but had been neglected. We just started clearing phragmites and replanting this last fall but have not added it to our website yet. We run a wetland exploration program there in summer.	Table 51	Programmatic Action Item	200	Goal F, Items 2, 4
"Prairie Patch" at Breezewald Park, 125 N. Old Rand Rd. This small site had been planted with natives about 15 years ago but had been neglected so we cleared it, and replanted with pollinator friendly species.	Table 51	Programmatic Action Item	197	Goal D, Item 12
Barrington Area Council of Governments				
Groundwater education and resource information; Groundwater curriculum module for elementaries.	Table 52	Programmatic Action items	191	Goal A, item 4
Monitoring wells installed and operational for several municipalities	Table 52	Programmatic Action items	191	Goal A, item 6
Salt reduction initiatives implemented throughout communities	Table 52	Programmatic Action items	190	Goal A, Item 2
Coal Tar and/or high PAH ordinances passed in multiple communities	Table 52	Programmatic Action items	198	Goal E, Item 5
Flint Creek/Spring Creek Watersheds Partnership				
Plan approval adopted by partners	Table 52	Programmatic Action items	198	Goal E, Item 1
Six public rain gardens in Barrington, Barrington Township and Lake Zurich and 16 FCWP-sponsored private rain gardens that received free plants	Table 50	Programmatic Action Item	196	Goal D Item 12
Form a partnership to support grant proposals	Table 52	Programmatic Action items	198	Goal E, Item 2

Continue to recruit partners to participate in the plan	Table 52	Programmatic Action items	198	Goal E, Item 3
Implement a watershed wide water monitoring program	Table 52	Programmatic Action items	191	Goal A, Item 7
Assemble a team for a watershed council	Table 52	Programmatic Action items	198	Goal E, Item 4
Incorporate watershed goals in local planning	Table 52	Programmatic Action items	198	Goal E, Item 5
Multiple Jurisdictions share in the cost of watershed planning	Table 52	Programmatic Action items	198	Goal E, Item 7
Hire a watershed implementation coordinator	Table 52	Programmatic Action items	199	Goal E, Item 8
Provide training and watershed education for local government	Table 52	Programmatic Action items	199	Goal E, Item 10

2.0 Flint Creek Watershed Planning Area

2.1 Flint Creek Watershed Size

The Flint Creek watershed drains approximately 36.5 square miles (23,374 acres) of land in Lake, Cook, and McHenry Counties, Illinois. The watershed is a sub-unit of the larger Upper Fox River Basin that drains large portions of Jefferson, Kenosha, Racine, Walworth, and Waukesha counties in Wisconsin and McHenry, Lake, Kane, and Cook Counties in Illinois. The Lower Fox River Basin extends south and west through DeKalb, DuPage, Grundy, Kendall, LaSalle, Lee, and Will Counties. The Fox River joins the Illinois River in Ottawa, Illinois. The Illinois River flows southwest across the heart of Illinois before joining the Mississippi River just north of St. Louis, Missouri.

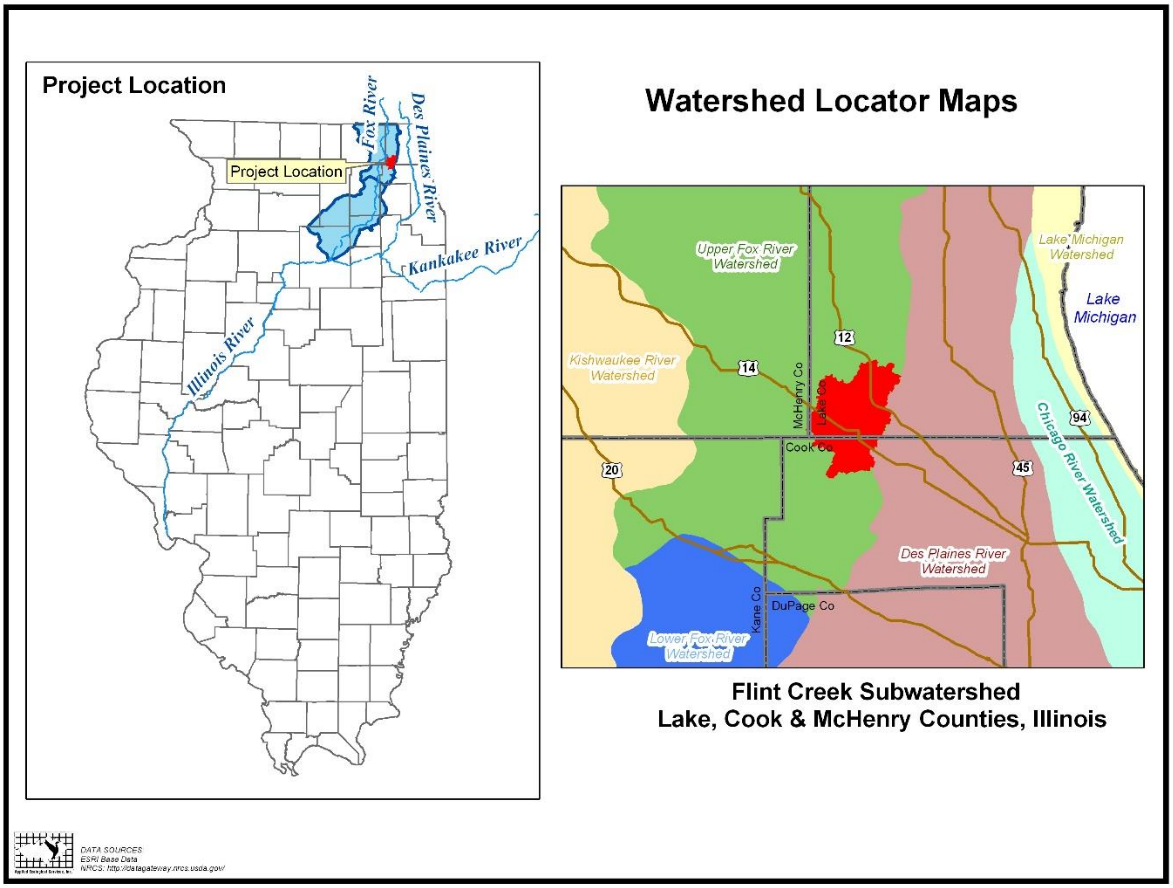


Figure 1: The Flint Creek Watershed lies in southwest Lake County, northwest Cook Count, and a small portion of southeast McHenry County in northeastern Illinois

Three primary tributaries drain the Flint Creek watershed (Figure 2). The north tributary is known locally as North Flint Creek and flows west for 15.8 miles across the northern half of the watershed draining approximately 10.7 square miles. The second and largest tributary is the main stem of Flint Creek which generally flows northwest for 18.6 miles draining 17.3 square miles of the western and southern portions of the watershed. The third tributary is the east branch of Flint Creek that flows for 10.8 miles and drains 8.5 square miles in the southeastern portion of the watershed before it joins the main stem of Flint Creek northwest of Barrington. The main stem of Flint Creek and north branch converge in the northwest part of the watershed at Flint Lake before flowing another 1.7 miles north to the Fox River. In addition to the major stream branches, the watershed is also comprised of many lakes and wetland resources (Figure 2). Available data indicates over 1,300 acres of open water and nearly 4,400 acres of wetlands are present.

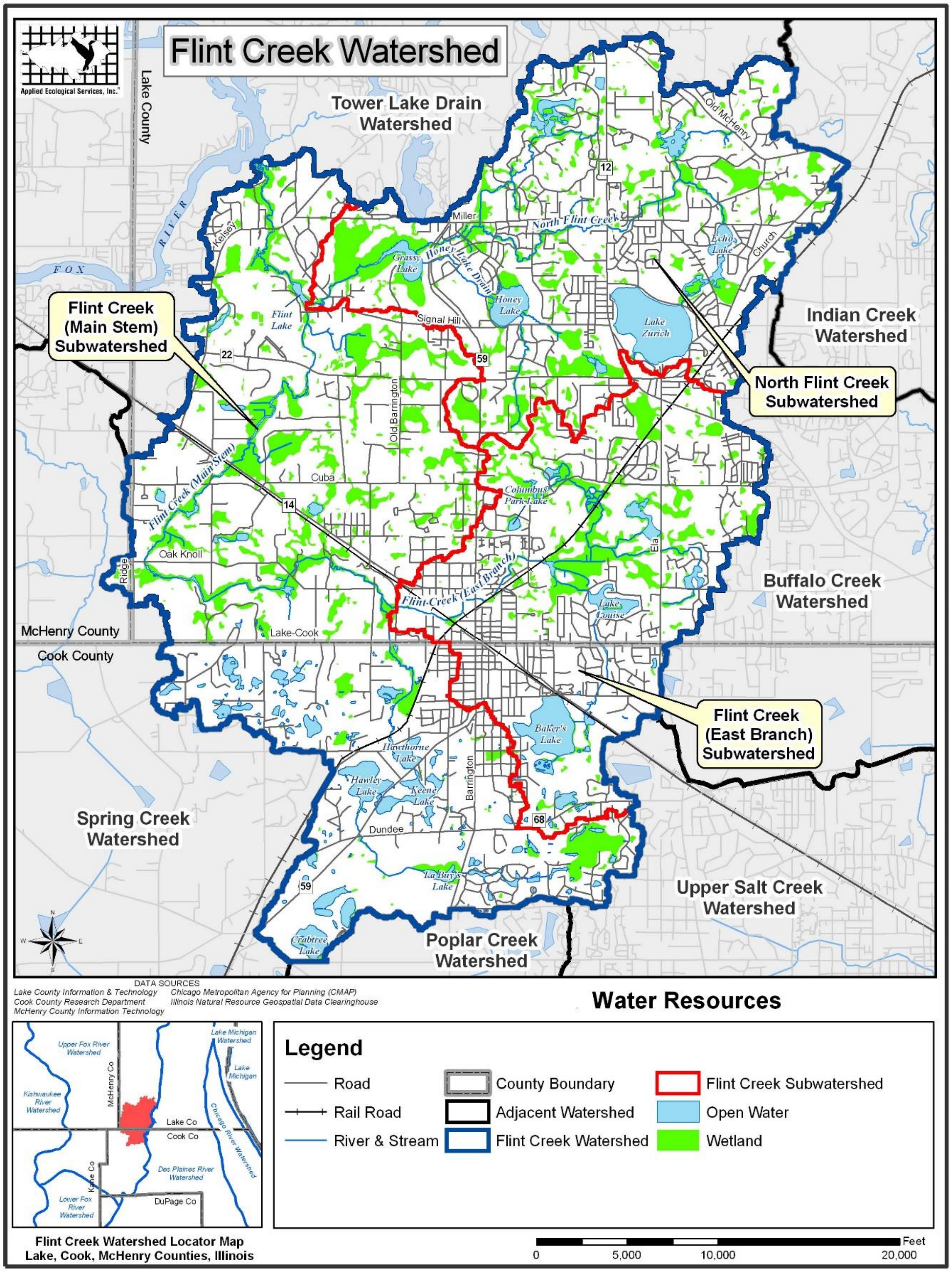


Figure 2: Water Resources

The main watershed use is residential development, large lot single family, village lot single family, and multi-family. There are also commercial zones, generally clustered around the major thoroughfares, and industrial areas. Other uses include park districts, forest preserves, conservation lands, golf courses, and a hospital.

2.2 Topography and Geology

For the Flint Creek Watershed, available 2-foot topography data was input into a GIS model (Arc Hydro) that generated a Digital Elevation Model (DEM) used to delineate watershed, subwatershed, and Subwatershed Management Unit (SMU) boundaries. Discrepancies in the model's delineation were altered to more accurately depict hydrologic boundaries. Most of these discrepancies occurred in areas divided by roads or drained by known features that were not accounted for in the model. Figure 3 depicts the DEM and outer boundary of the Flint Creek watershed.

The DEM forms the backbone for many of the watershed analysis features included in this report. Specifically, elevation data was used to develop a pollutant loading analysis, flood mitigation recommendations, delineation of SMU's, and examination of potential wetland/regional storage locations.

The terrain of the area was formed by repeated glaciation. The most recent glacial event was known as the Wisconsin Episode and ended about 14,000 years ago. As the Earth's temperature warmed and the ice retreated, it left behind moraines and glacial ridges (Hansel, 2005). A tundra-like environment covered by spruce forest was the first ecological community to colonize after the glaciers retreated. As temperatures continued to rise, tundra was replaced by cool moist deciduous forests and eventually by Oak-hickory forests, Oak savannas, marshes, fens, seeps and prairies.

The Lake Michigan lobe of the last Wisconsin glaciation and the deposits left by the lobe shaped much of the landscape found in the watershed. The landform created by these conditions is called a moraine. Common topographic features left on moraine landscapes include knobby hills, ridges, and kettle holes (wetlands, ponds, and lakes)

The composition of the soils in the watersheds is also a remnant of the ancient ice and movement. Above the bedrock lies a layer of deposits left behind from the glaciers, consisting of unconsolidated materials such as clay, silt, sand, gravel and limestone cobbles. Groundwater, within these deposits, is the main source of water for the residents of the Barrington area.

The Flint Creek watershed generally drains northwest to the Fox River. The highest point (916 feet above sea level) is located in the southernmost tip of the watershed near Crabtree Lake. The lowest point in the watershed (731 feet above sea level) is Flint Creek's confluence with the Fox River. The difference in the highest and lowest points reflects a 185-foot change in elevation. The watershed's eastern boundary is formed by a ridgeline separating the watershed from adjacent watersheds to the east (Indian Creek, Buffalo Creek, and Upper Salt Creek) that drain to the Des Plaines River. Glacial deposits also determine sediment deposition and composition of stream channels. A stream inventory conducted by the Lake County Stormwater Management Commission (LCSMC) indicates the streambanks of Flint Creek and its tributaries are largely comprised of fine-grained cohesive sediments such as clays and silts while the bottom of the channels are a combination of silts, clays, sands, and gravels.

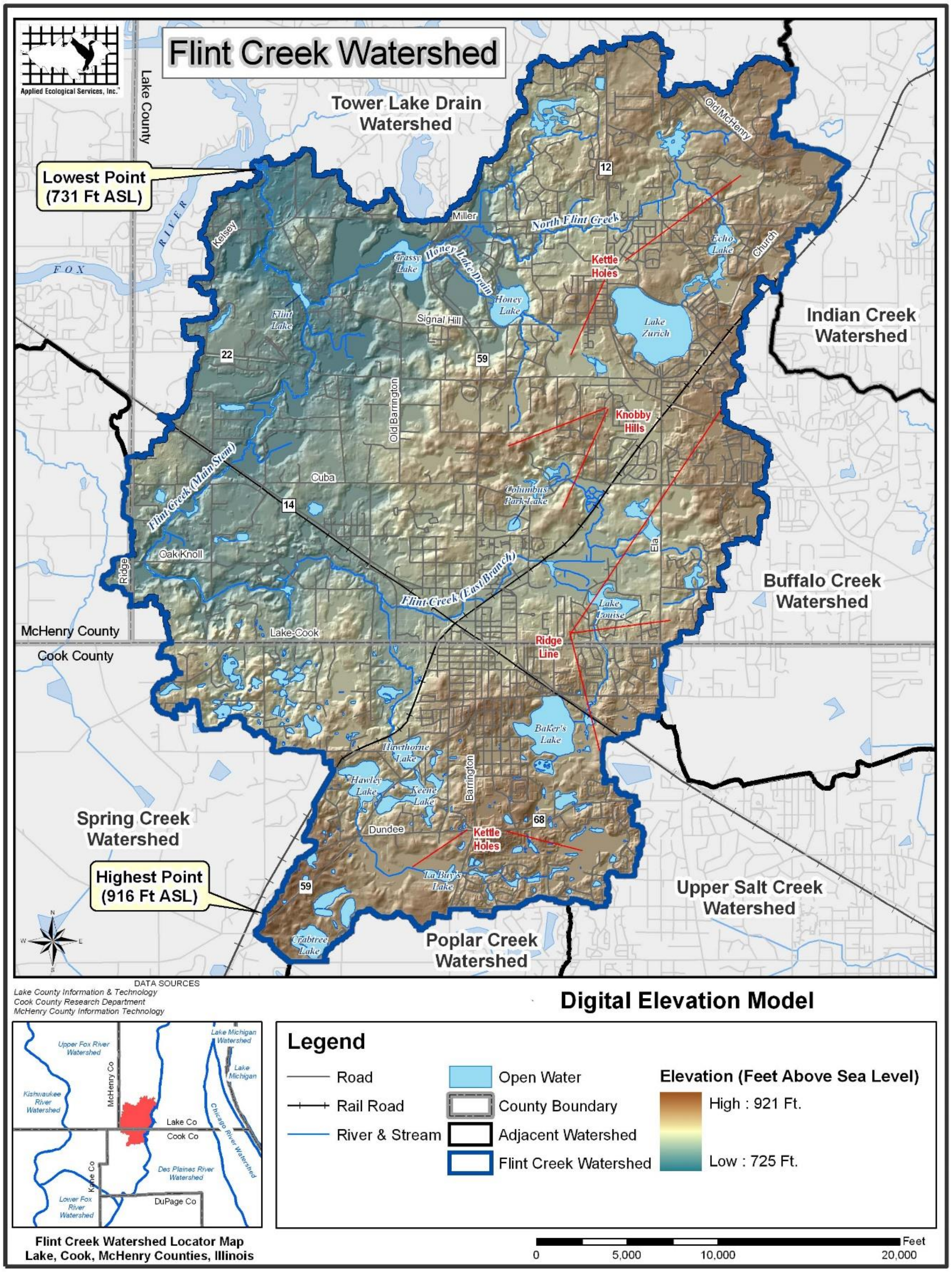


Figure 3: Digital Elevation Model

2.3 Soils

Deposits left by glaciers that covered the Flint Creek watershed approximately 14,000 years ago are the raw materials of present soil types. These raw materials, also known as drift, include till (debris) and outwash. A combination of physical, biological, and chemical variables such as topography, drainage patterns, climate, and vegetation, have interacted over centuries to form the complex variety of soils found in the watershed. Most soils formed under wetland, forest, and prairie vegetation communities.

Soil properties are a key component to consider when designing and implementing Best Management Practices (BMPs) in watersheds. Some soils that are saturated for extended periods throughout the year become what are called hydric soils because they generally hold water or infiltrate water very slowly. These soils provide the key to wetland restoration potential. Often, drain tiles are found in areas that exhibit hydric soil but because the water is diverted, wetlands that were once present no longer exist. By breaking these tiles, wetland hydrology can often be restored and a high quality wetland created with additional planting with native species. Soils also exhibit differences in erodibility depending on their composition (i.e. clay vs. silt) and slope. Erodibility of soils is especially important on construction sites where improper installation or maintenance of erosion control devices can lead to detrimental amounts of turbid water entering a waterway. Soils exhibit different infiltration capabilities. Knowing how a soil will hold water ultimately affects the type and location of infiltration BMPs such as wetland restorations and detention basins. The 2005 Lake County, 2004 McHenry County, and DRAFT 2007 Cook County Natural Resources Conservation Services' (NRCS) soil surveys were used to conduct a soil analysis for the Flint Creek watershed. The data was used to map the extent of hydric soils, soil susceptibility to erosion, and the infiltration capacity.

Hydric Soils

Hydric soils are important because they indicate the presence of existing or drained wetlands and are an extremely useful indicator of depressional areas and potential wetland restoration sites.. Historically, wetland soils formed over poorly drained clay material associated with wet prairies and other wetlands and accumulated organic matter from decomposing surface vegetation. Table 3 and Figure 4 list acreages and map the location of hydric and non-hydric soils in the watershed respectively. Hydric soils comprise 5,738 acres or 25% of the watershed and are comparable with other adjacent watersheds. 16,342 acres (70%) of upland soils comprise the remainder of the watershed. Approximately 1,282 acres of land are not classified (water & urban land).

Table 3. Percent coverage of hydric soils and non-hydric soils within the watershed.

Soil	Total Area (acres)	Percentage of Watershed
Hydric Soil	5,738	25%
Non-Hydric Soil	16,342	70%
Not Classified (Water & Urban Land)	1,282	5%
Totals	***23,362**	**100%**

* 0.05% of watershed (12 acres) is missing data (slivers) between 2,500 soil polygons

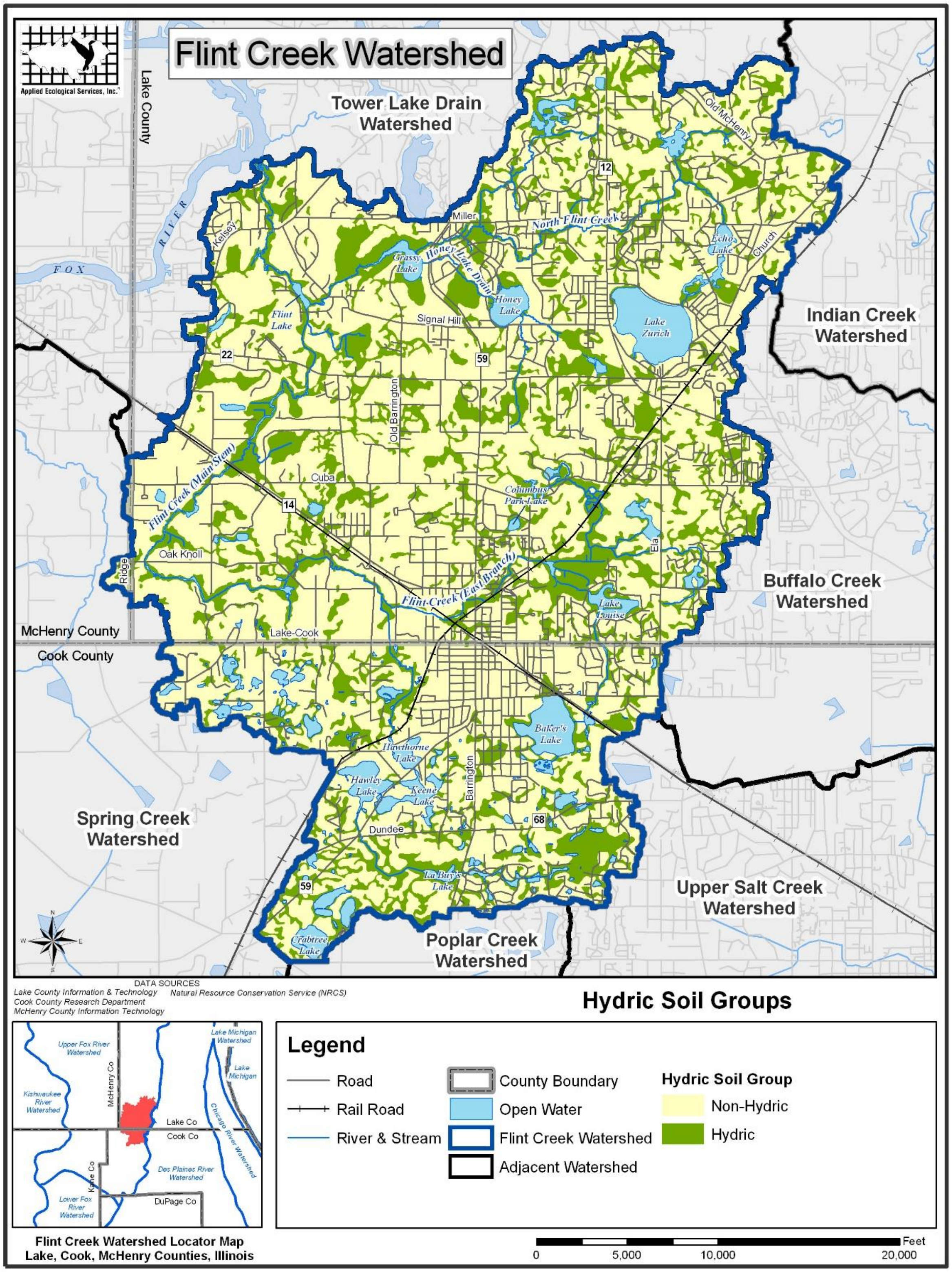


Figure 4: Hydric Soil Groups

Soil Erodibility

Soil erosion and sedimentation can have drastic effects on water quality. Soil erosion is the process whereby soil is removed from its original location by flowing water, wave action, wind, and other factors. Sedimentation is the process that deposits eroded soils on other ground surfaces or in bodies of water such as streams and lakes. Soil erosion and sedimentation reduces water quality by increasing total suspended solids (TSS) in the water column and by carrying attached pollutants such as phosphorus, nitrogen, and hydrocarbons. When soils settle in streams and lakes they often blanket rock, cobble, and sandy substrates needed by fish and macroinvertebrates for habitat, food, and reproduction.

A highly erodible soils map was created by selecting soils with particular attributes such as soil type and the percent slope on which a soil is located. These attributes were provided by the Lake, McHenry, and Cook County NRCS offices. It is important to map highly erodible soils because they represent areas that have the highest potential to degrade water quality. Based on the mapping, 4,951 acres (21% of watershed) exhibit highly erodible soils (Figure 5). A good percentage of these are located in the southern and eastern portions of the watershed where the topography exhibits more sand and gravel ridges and knobby hills typical of glacial areas. Streambank and lake shoreline erosion are not chronic problems in the watershed based on studies completed by the Lake County Stormwater Management Commission (LCSMC) and Lake County Health Department- Lakes Management Unit (LCHD-LMU) and agricultural land is still not a significant land use in the watershed. For these reasons, soil erosion and sediment control practices should be emphasized on new development sites. Acute problem areas of streambank/shoreline erosion should be identified in the site-specific action plan and targeted for restoration/stabilization.

National Pollution Discharge Elimination System (NPDES) Phase II Stormwater Regulations were implemented by the Illinois Environmental Protection Agency (IEPA) in 2003 to address potential erosion on all construction sites in the state that disturb greater than one acre. The regulations specifically require developers to issue a Notice of Intent (NOI) to begin construction, create a Stormwater Pollution Prevention Plan (SWPPP) to control erosion during construction, and submit a Notice of Termination (NOT) when the site is stabilized. NPDES regulations and the Lake County Watershed Development Ordinance (WDO) require that a Designated Erosion Control Inspector (DECI) conduct site visits on a weekly basis and after every 0.5-inch or greater rain event to monitor the construction site and work with the developer to implement erosion controls.

Lake County and McHenry County have taken additional steps to control erosion on construction sites. Both counties adopted stormwater management ordinances that address erosion and sedimentation as part of the overall stormwater management plan for a site. Cook County finally has a watershed ordinance. The Lake and McHenry County ordinances specify standards, methods, maintenance, inspections, and notification procedures that shall be used within their jurisdiction. Lake County takes the seriousness of erosion and sedimentation to another level. Any community that adopts a separate "Stormwater Quality Runoff Ordinance" may set turbidity or Total Suspended Solid limits for any construction site that discharges to wetlands, streams, and lakes. When this type of limit is established, the DECI is responsible for collecting water samples at the outlet point of the construction site to test turbidity of TSS. When limits are exceeded a violation and fine follows until the problem is addressed.

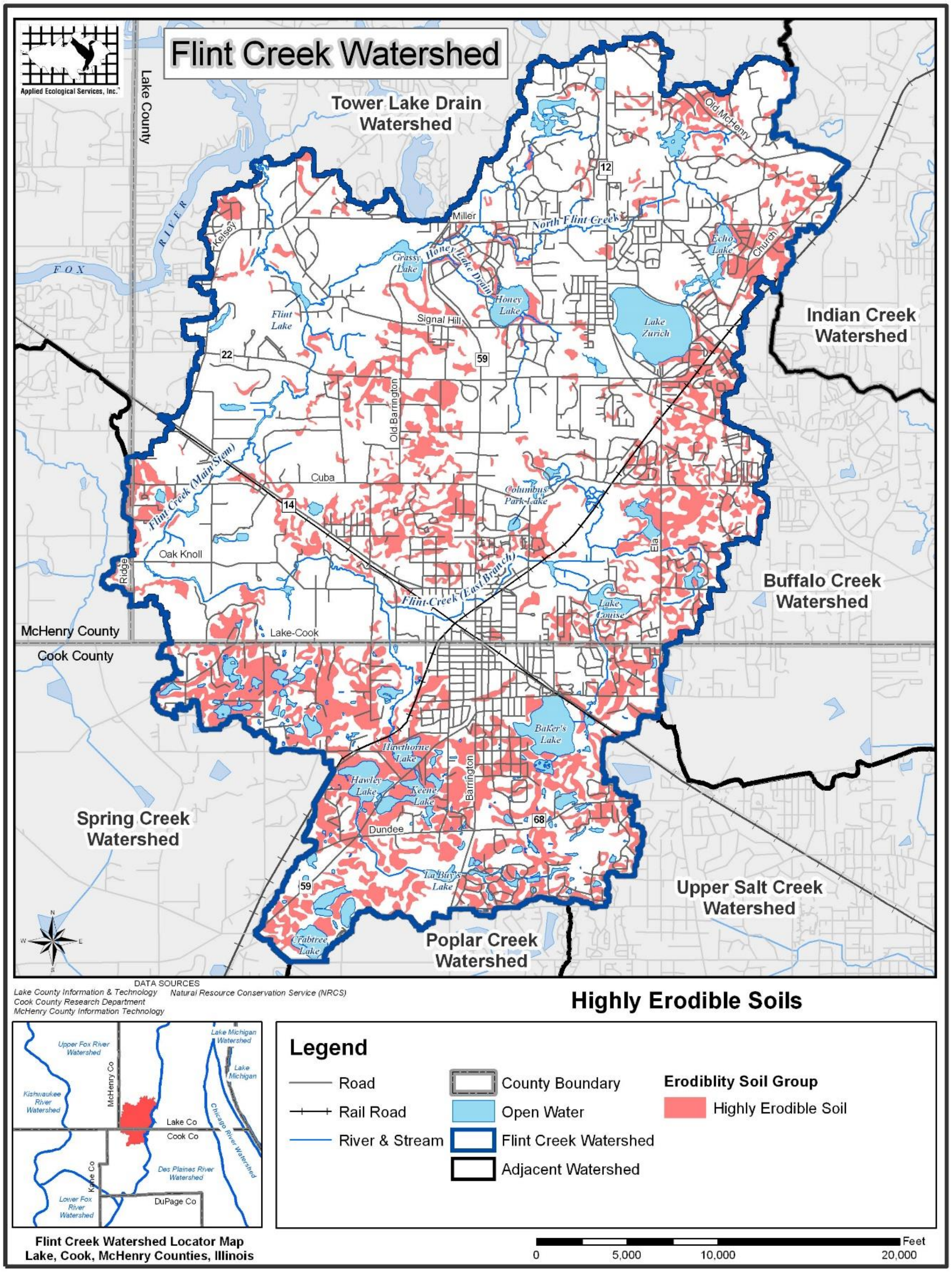


Figure 5: Highly Erodible Soils

Hydrologic Soil Groups

Hydrologic Soil Groups (HSGs) are based on a soil's infiltration and transmission (permeability) rates and are used primarily by engineers to estimate runoff potential related to how development sites should be designed and constructed to control stormwater runoff. HSG's are classified into four primary categories; A, B, C, and D, and three dual classes, A/D, B/D, and C/D.

- Group A is composed of the most permeable soil types and have the lowest runoff potential. These soils consist of mainly deep, well drained to excessively drained sands or gravelly sands. Group A soils have a high rate of water transmission.
- Group B soils have moderate infiltration rates and are moderately deep, moderately well drained, or well drained with fine texture to moderately course texture (silt and sand). Transmission rate for these soils is moderate.
- Group C soils exhibit slow infiltration rates because of a fine texture soil layer comprised of silt and clay that impedes downward movement of water. Transmission rate is slow for Group C soils.
- Group D soils have the slowest infiltration rate (high runoff potential). These soils are typically clays and exhibit very slow rates of transmission.
- Dual hydrologic groups (A/D, B/D, or C/D) are classified differently. The first letter is for artificially drained areas and the second is for undrained areas. Only soils that are rated D in their natural condition are assigned to dual classes.

Best Management Practices (BMPs) are often recommended based on infiltration and permeability rates of a particular HSG. The HSG categories and their corresponding soil texture, drainage description, runoff potential, infiltration rate, and transmission rate are shown in Table 4. Figure 6 depicts the location of each HSG found in the watershed while Table 5 summarizes the acreage and percent of watershed for each HSG. Poorly drained areas (Group A/D, B/D, C/D and D) account for about 23% of the watershed. Excessively and moderately drained (Group B and C) areas make up an additional 69% of the watershed. Urban areas and open water comprise the remaining 8% of the watershed.

Table 4. Hydrologic Soil Groups and their corresponding attributes.

HSG	Soil Texture	Drainage Description	Runoff Potential	Infiltration Rate	Transmission Rate
A	Sand, Loamy Sand, or Sandy Loam	Well to Excessibly Drained	Low	High	High
B	Silt Loam or Loam	Moderately Well to Well Drained	Moderate	Moderate	Moderate
C	Sandy Clay Loam	Somewhat Poorly Drained	High	Low	Low
D	Clay Loam, Silty Clay Loam, Sandy Clay Loam, Silty Clay, or Clay	Poorly Drained	High	Very Low	Very Low

Table 5. Hydrologic Soil Groups including acreage

Hydrologic Soil Group	Total Acreage	Percent of Watershed
A	0.0	0%
A/D	1,151	5%
B	3,182	14%
B/D	1,452	6%
C	12,886	55%
C/D	1,892	8%
D	964	4%
Open Water & Urban Land	1,835	8%
Totals	***23,362**	**100%**

* 0.05% of watershed (12 acres) is missing data (slivers) between 2,500 soil polygons

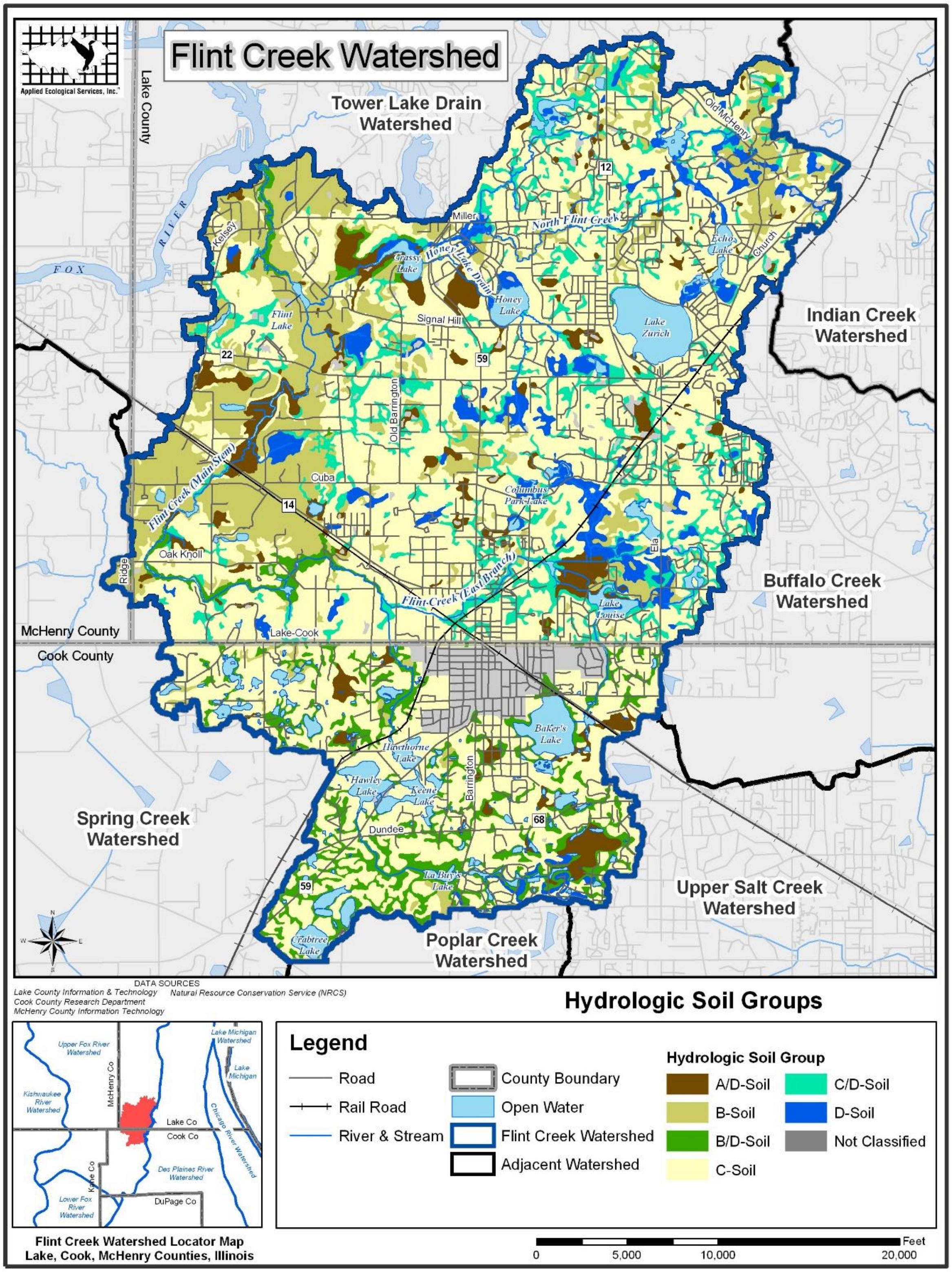


Figure 6: Hydrologic Soil Groups

2.4 Climate

"The region's present-day climate is typically continental with cold winters, warm summers, and frequent short fluctuations in temperature, humidity, cloudiness, and wind direction. Four factors control the climate of northeastern Illinois: 1) the sun, 2) weather systems, 3) urban areas, and 4) Lake Michigan. The first two are the most significant. The sun, which is the primary energy source for virtually all weather phenomena, in large part, determines air temperatures and seasonal variations. Solar energy is three to four times greater in early summer than in early winter at Chicago's mid-latitude location, which results in warm summers and cold winters. The second major factor is weather systems, which result from varying air masses and passing storm systems. The polar jet stream, which is the focal point for the creation and movement of low-pressure systems that bring clouds, winds, and precipitation, is often located near or over Illinois.

"The other two controls are of lesser significance but they influence local climate conditions….

"Lake Michigan influences the climate of northeastern Illinois. The large thermal mass of the lake tends to moderate temperatures, causing cooler summers and warmer winters. The lake also tends to increase cloudiness in the area and suppress summer precipitation. In the winter, precipitation is enhanced by lake-effect snows that occur when winds blow from the north or northeast."
(http://www.cmap.illinois.gov/documents/10180/14193/Appendix+A+-+Primary+Impacts+of+Climate+Change+in+the+Chicago+Region.pdf/2a85b021-f3bd-4b98-81d1-f64890adc5a7, pp. 2, downloaded 2/21/2018)

The scientific consensus is that global climate change is occurring, and that a review of the results of recent years show that changes have occurred in some variables, such as temperature and rainfall, over the last few decades in our region. Climate projections suggest further changes are in store.

The major trends are that it is very likely that:

- Annual temperatures will increase by mid-century or later
- There will be higher overnight minimum temperatures, especially in the summer
- The region will experience higher dew points in the future, leading hot days feeling even hotter due to higher humidity
- The region will experience fewer days with a minimum temperature below 32° F
- There is an increasing trend in annual precipitation with seasonal differences expected, although some models project that there could be a decrease
- The intensity of precipitation events is expected to continue to increase in the future
- Both floods and droughts will increase in frequency in the Midwest, with a possibility of longer periods of dry conditions in between wet precipitation events
- As winter temperatures increase, more winter precipitation is likely to fall as rain instead of snow, and there appears to be a steady upward trend in the intensity of snowfall events
- Plant Hardiness Zones will move northward as regional temperatures warm
- There is a greater potential for a decline in Lake Michigan-Huron levels due to increased evaporation and less ice with higher average temperatures

(Source: http://www.cmap.illinois.gov/documents/10180/14193/Appendix+A+-+Primary+Impacts+of+Climate+Change+in+the+Chicago+Region.pdf/2a85b021-f3bd-4b98-81d1-f64890adc5a7)

The climate within the Flint Creek watershed is suited for human comfort and activities. The Weather Channel and WorldClimate provide excellent summaries of climate statistics including monthly averages and records for most locations in Illinois. Data for Barrington represents the climate and weather patterns experienced in the Flint Creek Watershed. The average summer temperatures in July range from 63° F to 82° F while winter temperatures in January range from 13° F to 28° F. This depicts slightly cooler winter lows and summers that are hotter with bigger range between highs and lows. Both the highest recorded temperature and the lowest were unchanged since the 2007 plan was written with the highest being 103° F while the lowest temperature was -26° F (The Weather Channel 2017).

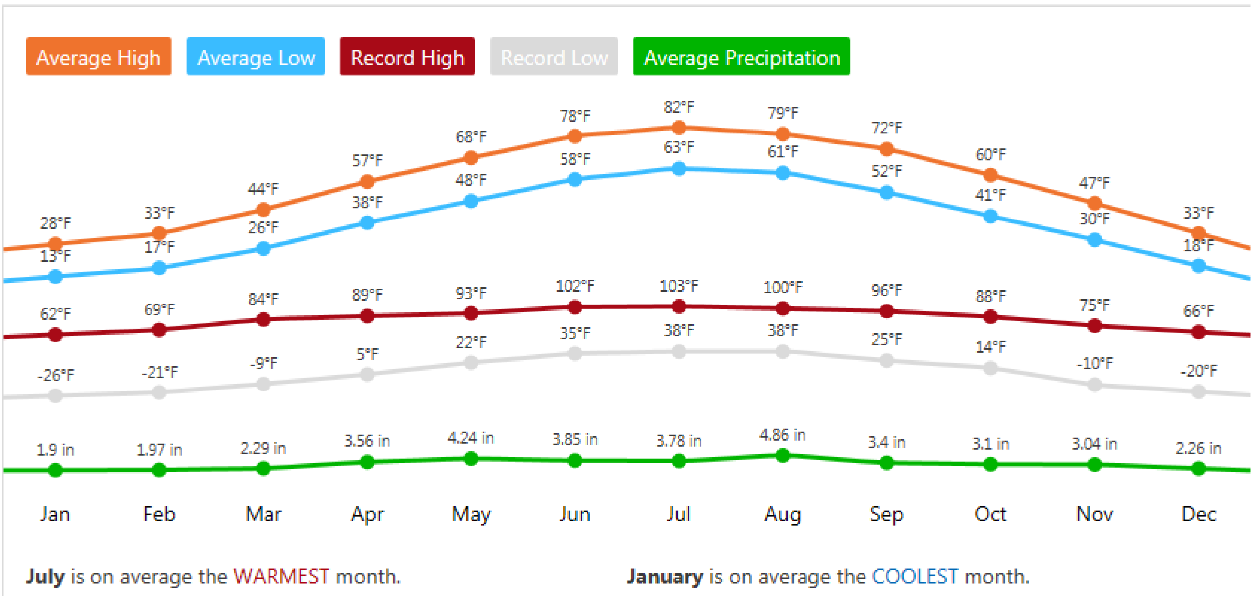


Figure 7. Monthly average temperatures and precipitation for Barrington, IL.

Fairly typical for the Midwest, the current climate of the watershed consists of an average precipitation around 38.1 inches annually (WorldClimate 2017). According to data collected in Barrington, the most precipitation on average occurs in August (4.86 inches) while January receives the least amount of precipitation with 1.9 inches on average (The Weather Channel 2017). Since the plan was first written in 2007, the average annual precipitation has shown an increase of over 3 inches.

Climate ultimately affects terrestrial and aquatic animal and plant populations more than any other factor. Conditions such as moisture, wind, and slope orientation determine which plants will comprise an ecosystem. Temperature and wind strongly influence bird migration patterns, emergence of hibernating reptiles, and bloom times for spring ephemeral flowers. Aquatic systems are affected by climate more than any other environment. Seasonal warming and cooling trends cause mixing and layering of water in deeper lakes. This annual process serves to mix nutrients and oxygen throughout the water column. In addition, thick ice and snow cover during winter months or extreme heat during summer months reduces photosynthesis by aquatic plants causing depletion of oxygen and fish kills.

2.5 Wetlands

Historical Hydrology

Prior to the late 1830's, many small prairie streams of the Midwest did not have conspicuous channels and were not as readily identifiable as they are today. In fact, smaller streams were identified as vegetated swales, wetlands, wet prairies, and swamps in the original land survey records of the U.S. General Land Office. European settlement land use changes resulted in clearing, tilling, draining, and development that altered the overland flow of surface water following rain events. The historic slow overland flows that promoted infiltration changed to concentrated flows where water is rushed to receiving streams and lakes. The result is increased runoff that increases sediment loads and other pollutant loading.

Typical historic stream channel and wide buffer

Typical altered stream channel and narrow buffer

Stream data collected in the Flint Creek watershed suggests that significant changes in hydrology have occurred since European settlement. Historical landscapes in the watershed and surrounding area "managed" stormwater very differently than humans manage stormwater today. Historical data for many watersheds indicates that a relatively small percentage of the precipitation in a healthy natural community actually results in measurable runoff and water leaving the watershed because precipitation that falls on the land is used by plants and animals or infiltrated into groundwater aquifers. Present-day stormwater management strategies involve collecting, concentrating, and managing the release of water via curb/gutters, stormdrains, and ditches to streams, lakes, and wetlands to improve drainage.

The natural drainage system in the Flint Creek watershed began to experience changes as community expansion resulted in more residential, commercial, and industrial land uses. With increased impervious surface and extensive stormsewer networks, flash hydrology is now common. Flashy stream conditions result when a rapid increase in the stream water level occurs followed by a rapid decrease after a significant rain event. As a result, streambank and streambed erosion and pollutant loading occurs. Degradation to streams results in degraded aquatic habitat vital to the health of a stream ecosystem. Increased impervious surfaces also decrease groundwater recharge, decreasing water tables, and ultimately reducing base flow to streams. This condition causes baseflow levels that are below predevelopment conditions. Additional changes in the natural hydrology occurred as portions of major stream branches were dammed to create lakes, ponds, and other impoundments. Figure 8 below depicts the effects of reduced groundwater recharge on streamflow. In addition to building dams, some lakes were created from wetland areas to create in-channel impoundments. Hawley, Hawthorn, Keene Lakes, Crabtree, LeBuy and some other small lakes south of Rt. 14 were created to accommodate the EJ&E Railroad (now owned by the CN Railway). Honey Lake is also an in-channel impoundment.

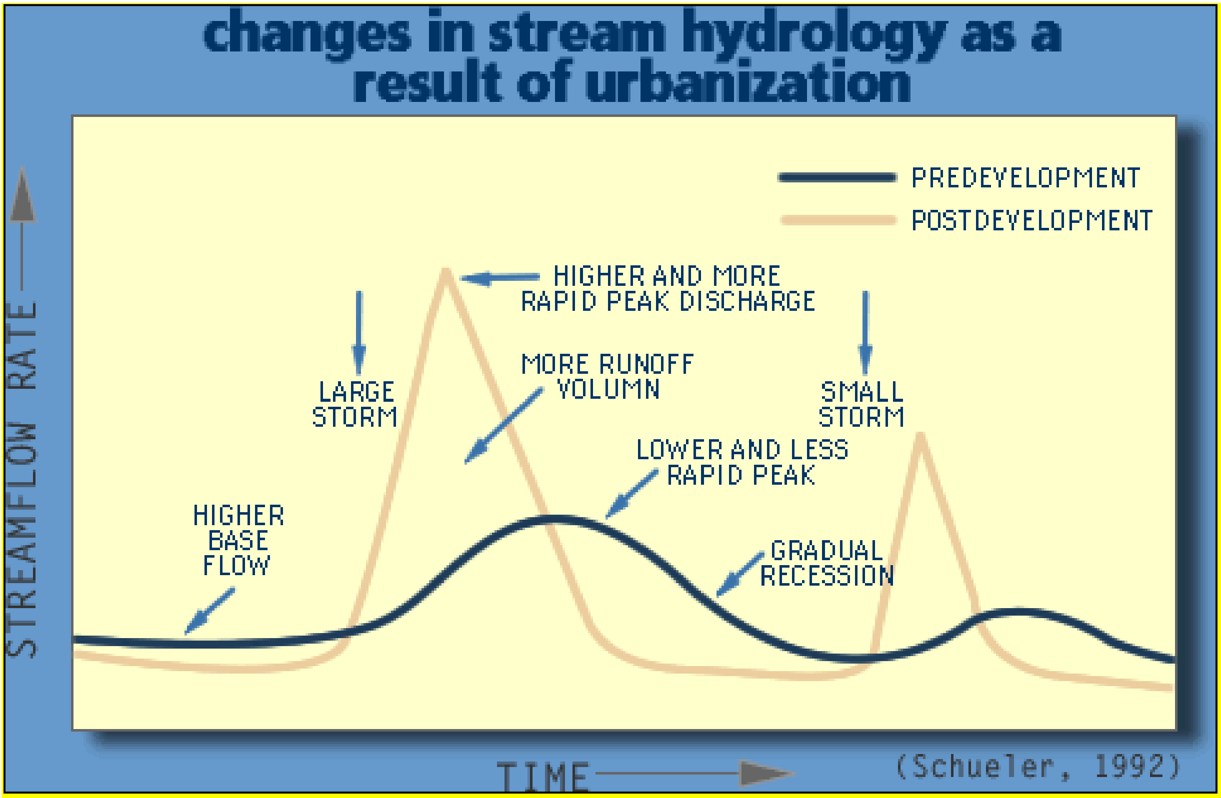


Figure 8. The effect of reduced groundwater recharge on streamflow

Baker's Lake was a peat wetland drained for farming. When the peat caught fire in the early 20th century, creating substantial air pollution in the Village of Barrington, the then owner, a Mr. Baker, paid men to locate the drainage tiles and fill them with concrete to stop the drainage, create the lake, and quench the fire.

Ecologically Significant Areas

High quality wetlands (ADID wetlands), Illinois Natural Area Inventory (INAI) sites, nature preserves, forest preserves, and private natural land are all considered ecologically significant areas in the Flint Creek watershed because they provide habitat for threatened & endangered (T & E) species and often contain high quality natural communities. These areas also provide large greenway corridors that *interconnect land and waterways, support native species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life for communities and people.* Several ecologically significant areas are located in the watershed including 10 ADID wetlands, portions of 4 INAI sites, 1 village preserve, 4 forest preserves that include a nature preserve, 4 private preserves owned by Citizens for Conservation, and 2 private preserves owned by the Barrington Area Conservation Trust (Figure 9, below).

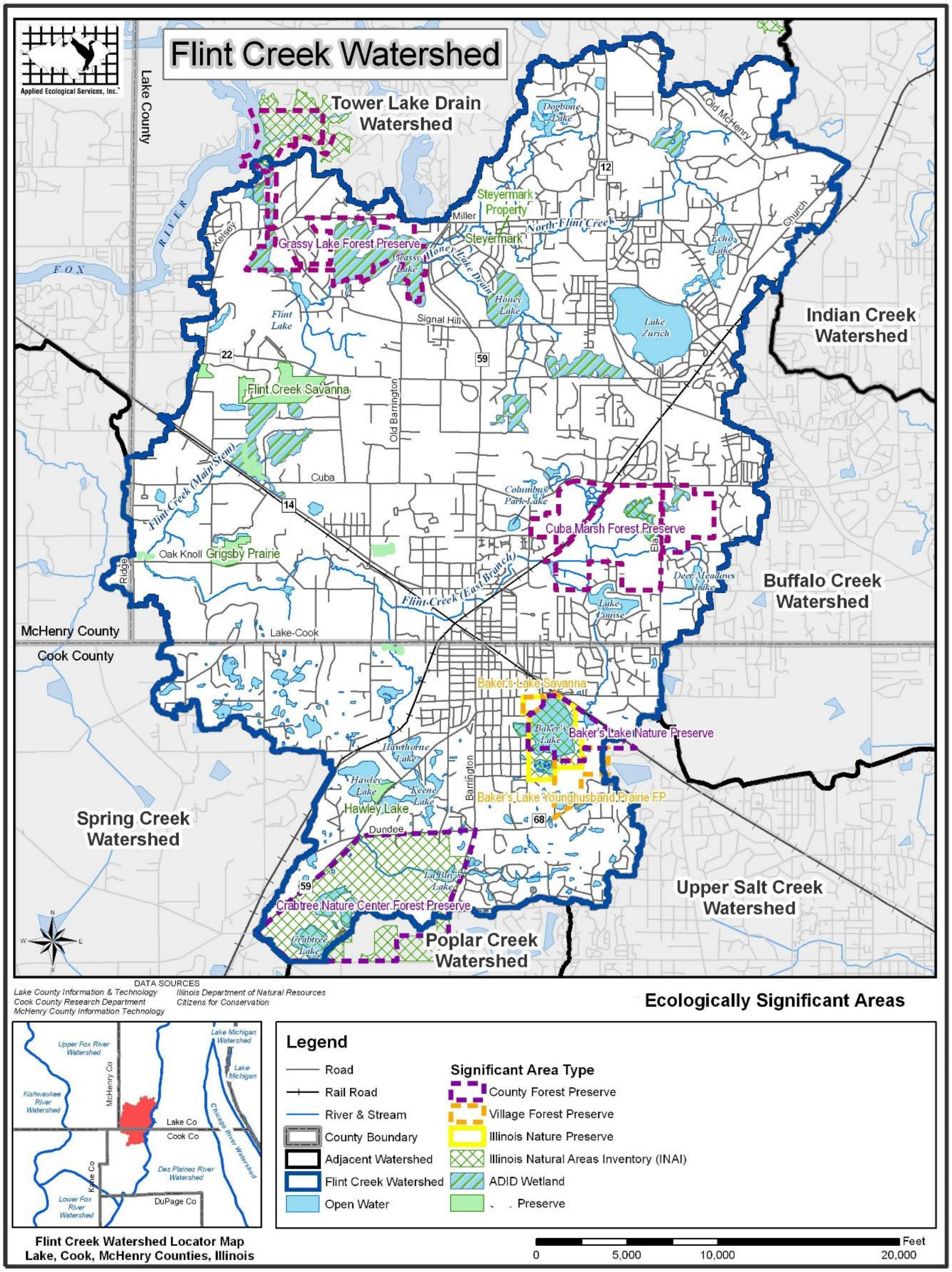


Figure 9: Ecologically Significant Areas

ADID Wetlands

The Advanced Identification (ADID) process involves collecting information on the values and functions of wetlands identifying those of high value based on their habitat, water quality, and stormwater storage functions. The EPA conducts the process in cooperation with the U.S. Army Corps of Engineers (USACE). Designation as an ADID wetland results in a more rigorous permitting review when drainage or filling alteration is proposed. Alteration of ADID wetlands is strongly discouraged as a result. Local communities can use the ADID inventory to help them better understand the values and functions of wetlands under their jurisdiction and to help permit applicants know in advance if a wetland can or cannot be filled. The ten ADID wetlands located in the watershed are mapped on Figure 27. A separate map of these wetlands and more detailed description of their ecological significance are found in Section 3.9 (Wetlands Inventory).

INAI Sites

Illinois Natural Areas Inventory (INAI) sites is a designation established in the 1970's by the Illinois Nature Preserves Commission (INPC) to identify "high quality" areas of the natural features found in Illinois. Included in the INAI inventory was a system to classify natural communities based on a grading scale related to the quality of natural areas. Portions of 4 INAI sites are located in the watershed. These include areas in Cuba Marsh Forest Preserve, Grassy Lake Forest Preserve, Crabtree Nature Center, and Baker's Lake Nature Preserve .These INAI sites are home to the majority of the T&E species and natural communities in the watershed.

Open and Partially Open Space Relative to Hydric Soils and Wetlands

Greater than 75% of the original wetlands in the Flint Creek watershed are still present according to the wetland inventory and analysis of drained hydric soils. The watershed has an extensive network of existing wetlands and areas of drained wetlands that now remain only as hydric soils. Figure 10 maps these areas in relation to open and partially open parcels. As expected, nearly all the existing wetlands and hydric soils are directly associated with open or partially open parcels, especially along stream corridors.

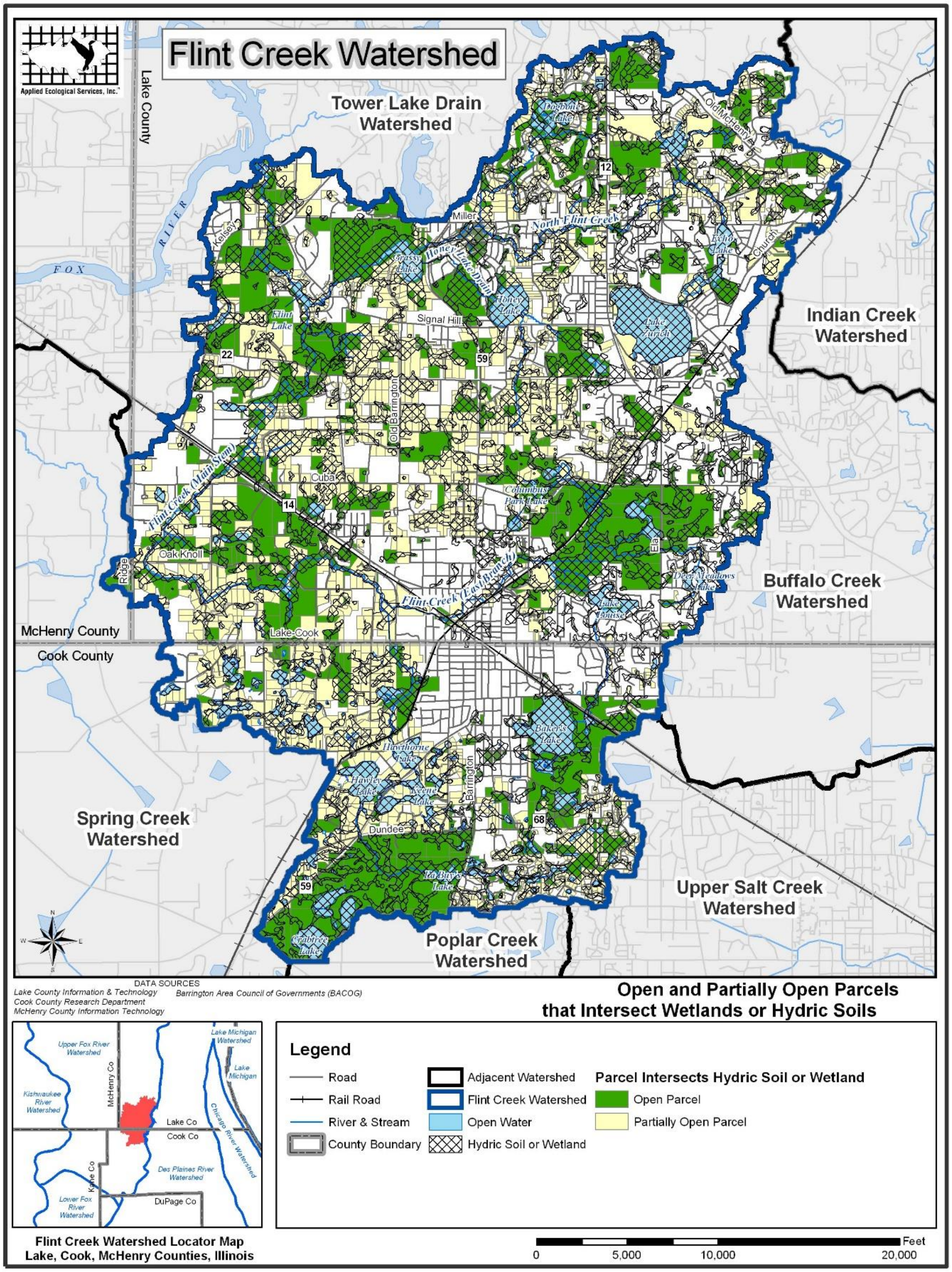


Figure 10: Open and Partially Open Parcels Intersecting Wetlands or Hydric Soils

2.6 Watershed Demographics

Population Projections

Municipal comprehensive plans are available for the Village of Barrington (2010), Village of Barrington Hills (2008), Village of Deer Park (2017), Village of Hawthorn Woods (2014), Village of Lake Barrington (2012), Village of Lake Zurich (2003), and Village of North Barrington (2015).

2015 Chicago Metropolitan Area Planning (CMAP) studies show demographics in Barrington and Cuba Township ageing. (Cuba and Barrington Townships with 16 to 27.3% of the population aged 65 and over). Cook County has seen a shift of its population out to the collar counties. Lake County has seen a 4% increase in the area's total population since 1980, whereas Cook County has seen a 12% decrease in its share. The CMAP (Chicago Metropolitan Area) as a whole has seen an 18% increase. Many of the new populations range in diversity. These changes are due to international immigration, especially Asian and Hispanic. These changes in population and demographics present different demands on development patterns, transportation and public services infrastructure.

According to CMAP's GO TO 2040 forecasts of population, number of households, and employment opportunities, all three counties (Lake, Cook, and McHenry) are expected to experience varying levels of growth (Tables 6 and 7). A closer look at the county-level data indicates most growth will occur in the outlying counties of McHenry and Lake as well as western portions of Cook. Growth in McHenry County will likely not influence the watershed because of its small size contribution within the watershed. Growth in Lake County and Cook County however, will likely impact watershed conditions primarily through changes in land uses associated with housing developments.

For general observations, the area population shows an increase in average age, and there are a number of multifamily developments in village central business districts (Barrington and Lake Zurich). There have been a significant number of teardowns and rebuilding. In all probability, the economic meltdown of 2007-2008 negatively affected development, with areas only recently recovering.

Table 6. CMAP GO TO 2040 projection data for Lake, Cook, and McHenry Counties (2014).

County	Population		Households		Employment	
	2010	**2040**	**2010**	**2040**	**2010**	**2040**
Lake	682,753	896,341	241,712	318,170	314,717	401,748
Cook	5,104,393	5,960,242	1,966,356	2,304,045	2,379,923	2,814,972
McHenry	307,113	201,805	109,199	179,215	88,947	153,389

Source: Chicago Metropolitan Agency for Planning *2040 Forecast of Population, Households and Employment* (CMAP 2014)

Table 7 includes CMAP's population, households, and employment forecast changes between 2010 and 2040 for the Flint Creek watershed area only. The data is generated by Township, Range, and quarter Section and is depicted on Figures 11-13. The combined population of the watershed is expected to increase from 44,934 in 2010 to 50,866 by 2040 with most of this growth occurring in the eastern half of the watershed. A detailed look at Figures 11 and 12 indicates that the heaviest population and household changes will occur in Barrington, Inverness, and the Lake Zurich area.

Projected employment is expected to increase by 4,166 jobs (Table 6, Figure 12). Most of this change is likely to occur in areas already developed as commercial and/or retail along major arterial roads such as Route 68, Lake-Cook Road, and Route 12. **Note: AES used GIS to overlay the Flint Creek Watershed Boundary onto CMAP's quarter section data for population, households, and employment. If any part of a quarter section fell inside the watershed boundary, the statistics for the entire quarter section were included in the analysis. Therefore, the numbers in Table 6 are overstated.**

Table 7. CMAP GO TO 2040 projection data for the Flint Creek watershed (2014).

Data Category	2010	2040	Change (2010-2040)
Population	44,934	50,866	5,932
Households	16,357	18,613	2,256
Employment	22,969	27,135	4,166

Source: Chicago Metropolitan Agency for Planning *2040 Forecast of Population, Households and Employment* (CMAP 2014)

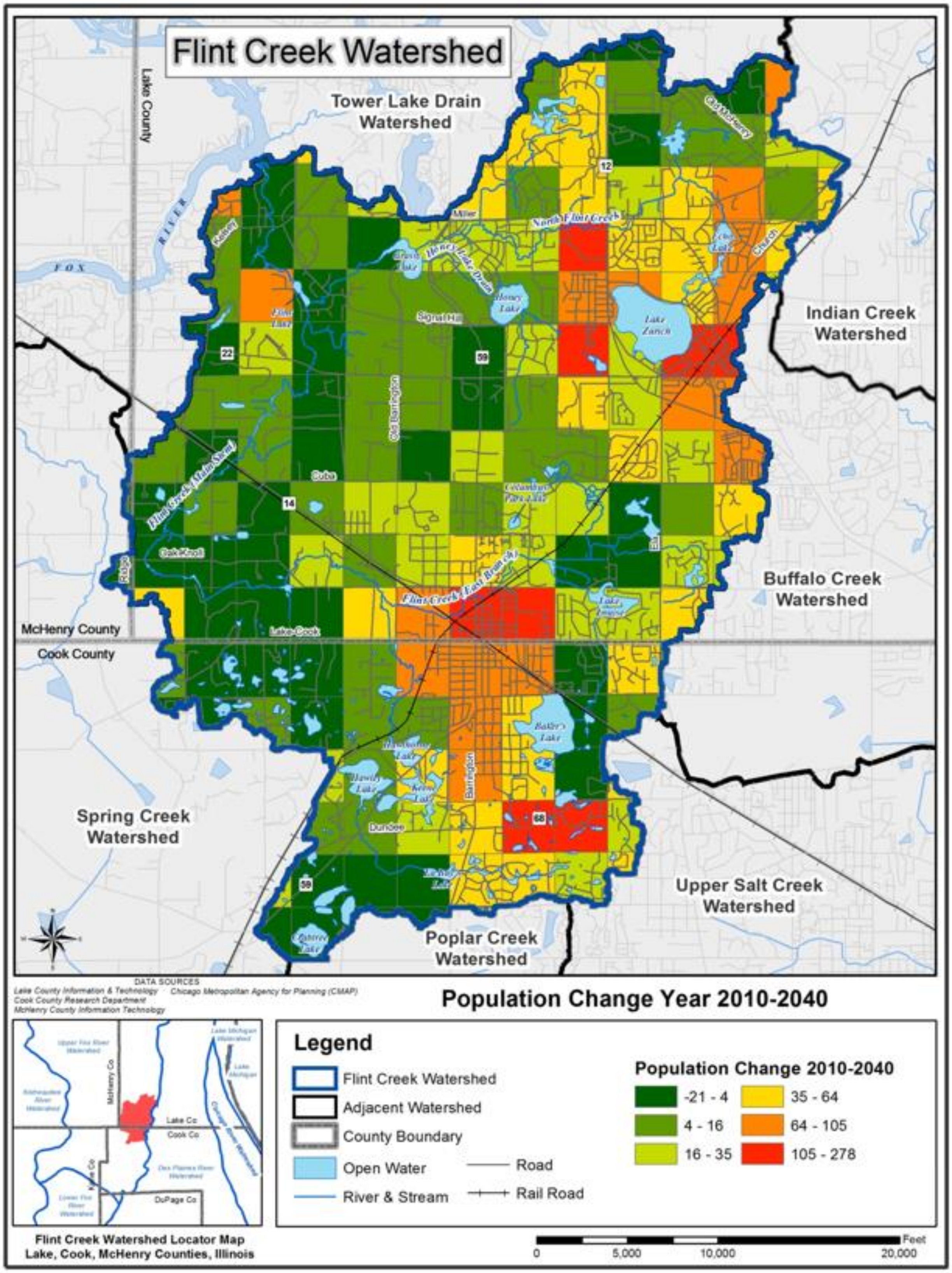


Figure 11: Population Change Year 2010-2040

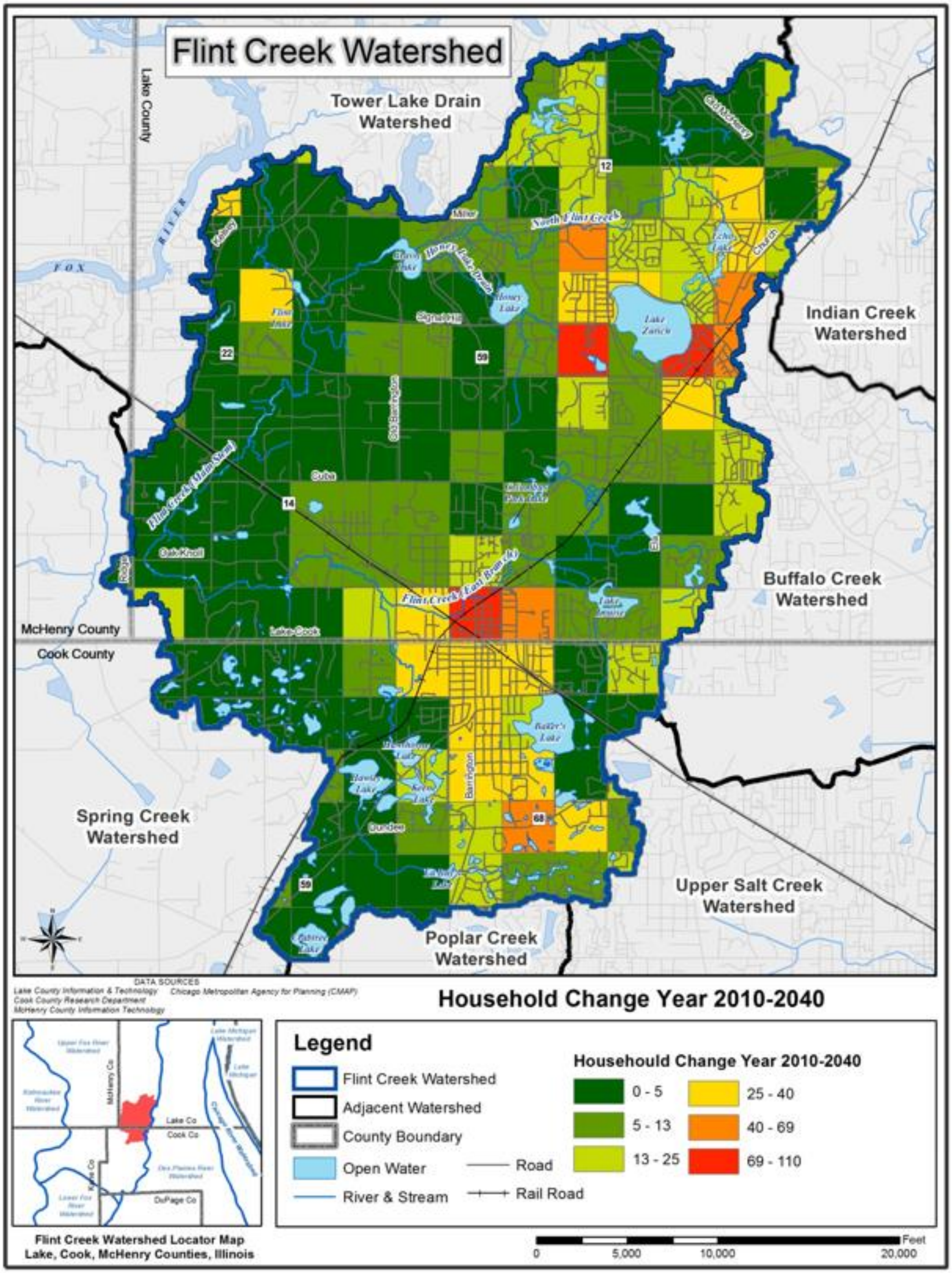


Figure 12: Household Change Year 2010-2040

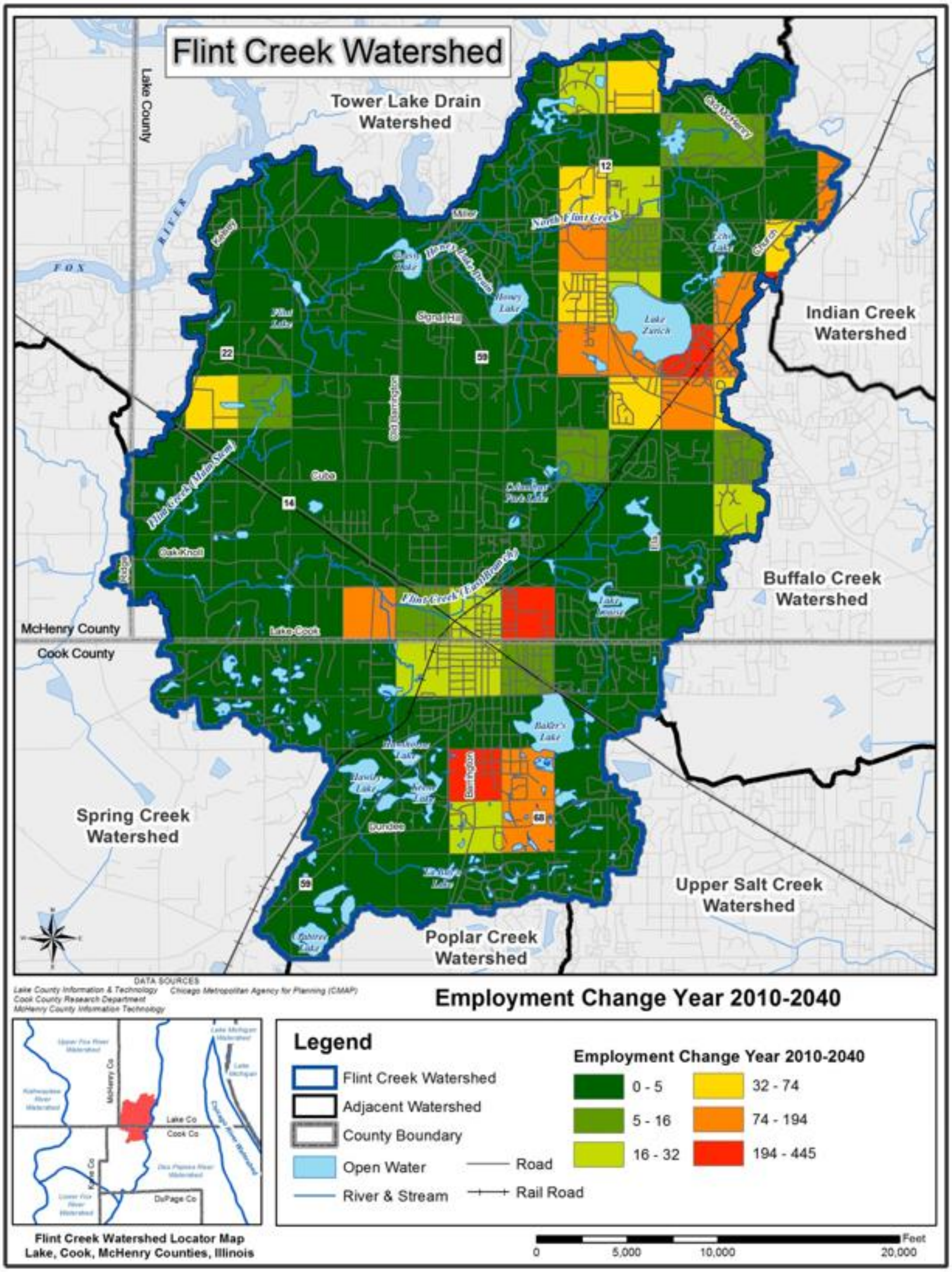


Figure 13: Employment Change Year 2010-2040

2.7 Watershed Jurisdictions

Portions of 3 counties, 10 municipalities, and 5 townships comprise the Flint Creek watershed (Table 5, Figure 11). The majority (17,364 acres/74%) of the watershed is located in Lake County. Approximately 5,952 acres (25%) is located in Cook County. A small portion (58 acres) is located in McHenry County. The municipalities that occupy the largest portions of the watershed are Barrington Hills (4,428 acres/19%), Barrington (2,919 acres/12%), North Barrington (2,825 acres/12%), and Lake Zurich (2,479 acres/11%). Fox River Grove and Tower Lakes occupy only 3 acres each. All remaining land in the watershed (3,756 acres) is Unincorporated and under the jurisdiction of Cuba and Ela Townships in Lake County, Barrington and Palatine Townships in Cook County and Algonquin Township in McHenry County. Additional entities with jurisdiction in the watershed include Lake and Cook County Forest Preserve Districts.

Table 8. County, municipal, and township jurisdictions in the Flint Creek watershed.

Jurisdiction	Acres	Percent of Watershed
Counties	**23,374**	**100%**
Cook	5,952	25%
Lake	17,364	74%
McHenry	58	0%
Municipalities	**17,231**	**73%**
Barrington	2,919	12%
Barrington Hills	4,428	19%
Deer Park	1,177	5%
Fox River Grove	3	0%
Hawthorn Woods	604	3%
Inverness	897	4%
Lake Barrington	1,896	7%
Lake Zurich	2,479	11%
North Barrington	2,825	12%
Tower Lakes	3	0%
Unincorporated Areas	**6,143**	**17%**
Townships	**23,374**	**100%**
Algonquin Township	58	0%
Barrington Township	4,773	20%
Cuba Township	10,450	45%
Ela Township	6,895	30%
Palatine Township	1,198	5%

Source: Lake County Department of Information and Technology, Cook County Research Department, and McHenry County Information Technology

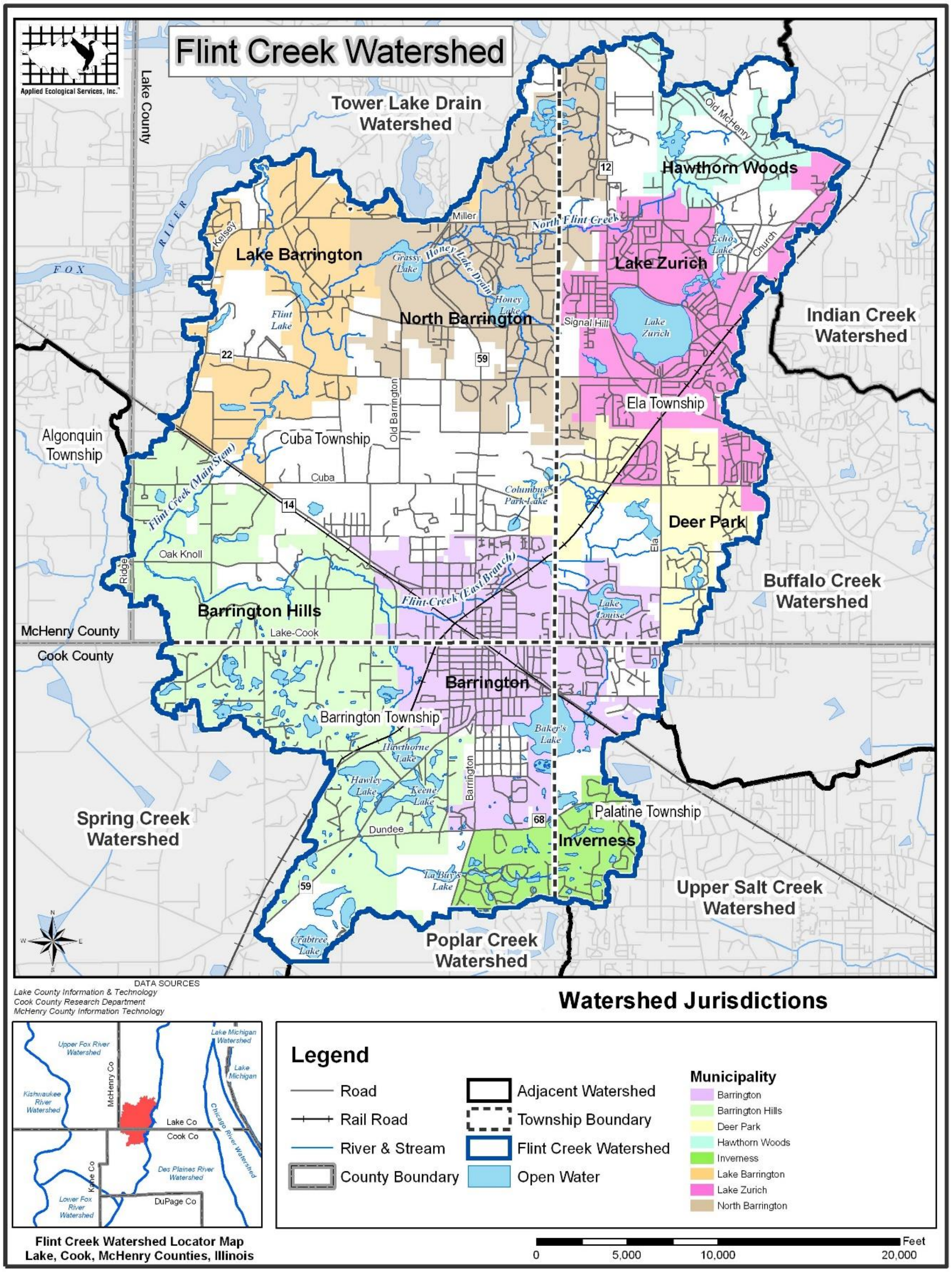


Figure 14: Watershed Jurisdictions

Many types of natural resources throughout the United States are protected to some degree under federal, state, and/or local law. In the Chicagoland region, the U.S. Army Corps of Engineers (USACE) and surrounding counties regulate wetlands through Section 404 of the Clean Water Act and county Stormwater Ordinances respectively. The U.S. Fish and Wildlife Service (USFWS),

Illinois Department of Natural Resources (IDNR), Illinois Nature Preserves Commission (INPC), and Forest Preserve Districts protect natural areas and threatened and endangered species. Local municipalities also have ordinances that address other natural resource issues. The Illinois EPA Bureau of Water regulates wastewater and stormwater discharges to streams and lakes. Watershed protection in Lake, Cook and McHenry Counties is primarily the responsibility of county and municipal level government.

Land development affecting water resources (rivers, streams, lakes, wetlands, and floodplains) is regulated by the USACE when "Waters of the U.S." are involved. These types of waters include any wetland or stream/river that is hydrologically connected to navigable waters. The USACE primarily regulates filling activities and requires buffers or wetland mitigation for developments that impact jurisdictional wetlands.

Development that affects water resources (rivers, streams, lakes, isolated wetlands, and floodplains) in the Lake County Portion of the Flint Creek watershed and the Barrington area within Cook County is regulated by the Lake County Watershed Development Ordinance (WDO) and enforced either by the LCSMC or Certified Communities. The WDO applies to projects that create a wetland impact within Waters of the United States (WOUS), Isolated Waters of Lake County (IWLC) or occur in buffer areas adjoining those waters. WOUS are those water bodies and wetland areas that are under USACE jurisdiction as determined by a jurisdictional determination. IWLC are all waters such as lakes, ponds, streams (including intermittent streams), farmed wetlands, and wetlands that are not under USACE jurisdiction.

In October 2013 the Metropolitan Water Reclamation District of Greater Chicago (MWRD) adopted the Cook County Watershed Management Ordinance. Ordinances are enforced by county agencies or by "Certified Communities" or "Authorized Municipalities."

Watershed development within the McHenry County portion of the watershed is regulated by the McHenry County Stormwater Management Ordinance and enforced either by the McHenry County or Certified Communities. As of 2015, Barrington Hills is partially certified under the Ordinance.

With the exception of Barrington Hills, all other Lake County municipalities in the Flint Creek watershed (Barrington, Deer Park, Hawthorn Woods, Lake Barrington, Lake Zurich, and North Barrington) are "Certified" by LCSMC to administer portions of the Lake County Watershed Development Ordinance. Barrington Hills is located in the southwest portion of the watershed and is divided by Lake and Cook Counties. Barrington Hills also occupies all of the 58 acres located in McHenry County but is not currently a Certified Community in either county. Instead, Barrington Hills administers its own village code with ordinances related to stormwater management and restoration/landscaping and is partially certified in Lake and McHenry. Inverness is the only jurisdiction located entirely with the Cook County portion of the watershed. Like Barrington Hills, Inverness administers its own ordinance related to stormwater management and landscape restoration. In the near future, Inverness will likely become a Certified Community and will administer the Cook County Watershed Management Ordinance when that ordinance is completed. While the Village of Barrington is divided in two by the Cook/Lake County line along Lake-Cook Road, the Village is a Certified Community of Lake County and administers the Lake County Watershed Development Ordinance for all areas within its jurisdiction.

Other governments and private entities with watershed jurisdictional or technical advisory roles include the USFWS and IDNR, County Board Districts, and the Lake, North Cook and McHenry County Soil and Water Conservation Districts (SWCD). The USFWS and IDNR play a critical role in natural resource protection, particularly for rare or high quality habitat and threatened and endangered species. They protect and manage land that often contains wetlands, lakes, ponds, and streams. County Boards oversee decisions made by respective county governments and therefore have the power to override or alter policies and regulations. The SWCDs provide technical assistance to the public and other regulatory agencies. Although the SWCDs have no regulatory authority, they influence watershed protection through soil and sediment control and pre and post-development site inspections

Water resources on unincorporated land within Lake, Cook, and McHenry Counties are ultimately regulated by the Lake County Planning, Building and Development Office, Cook County Department of Building and Zoning, and McHenry County Department of Planning and Development respectively. Unincorporated areas include portions of Cuba, Ela, Barrington, and Palatine Townships. Development affecting water resources in these townships must be reviewed by the agencies listed above. For Lake and McHenry Counties, wetland and other water related issues may be coordinated with LCSMC, MCSC, or MWRD.

Other governments and private entities with watershed jurisdictional or technical advisory roles include the Lake and Cook County Forest Preserve Districts (FPD), County Board Districts, and the Lake, Cook, and McHenry County Soil and Water Conservation Districts (SWCD). The Forest Preserve Districts play a critical role in natural resource protection, particularly for rare or high quality habitat and threatened and endangered species. They protect and manage land that often contains wetlands, lakes, ponds, streams, and detention facilities. The County Board oversees decisions made by county governments and therefore has the power to override or alter policies and regulations. The SWCD provides technical resource assistance to the public and other regulatory agencies. Although the SWCD has no regulatory authority, it influences watershed protection through soil and sediment control and pre-development site inspections.

Municipalities in the watershed may or may not provide additional watershed protection above and beyond existing watershed ordinances under local Village Codes. Most Village Codes provide ordinances covering businesses regulations, building regulations, zoning regulations, new subdivision regulations, stormwater management, streets, utilities, landscaping/restoration, tree removal, etc.

NPDES Phase II Stormwater Permit Program

The Illinois EPA Bureau of Water regulates wastewater and stormwater discharges to streams and lakes by setting effluent limits, and monitoring/reporting on results. The Bureau oversees the National Pollutant Discharge Elimination System (NPDES) program. The NPDES program was initiated under the federal Clean Water Act to reduce pollutants to the nation's waters. This program requires permits for discharge of: 1) treated municipal effluent; 2) treated industrial effluent; and 3) stormwater from municipal separate stormsewer systems (MS4's) and construction sites.

The Illinois EPA's NPDES Phase I Stormwater Program began in 1990 and applies only to large and medium-sized municipal separate stormsewer systems (MS4's), several industrial categories, and construction sites hydrologically disturbing 5 acres of land or more. The NPDES Phase II program began in 2003 and differs from Phase I by including additional MS4 categories, additional industrial coverage, and construction sites hydrologically disturbing greater than 1 acre of land. More detailed descriptions can be viewed on the Illinois EPA's web site.

Under NPDES Phase II, all municipalities with small, medium, and large MS4's are required to complete a series of Best Management Practices (BMPs) and measure goals for six minimum control measures:

1) Public education and outreach
2) Public participation and involvement
3) Illicit discharge detention and elimination
4) Construction site runoff control
5) Post-construction runoff control
6) Pollution prevention and good housekeeping

The Phase II Program also covers all construction sites over 1 acre in size. For these sites the developer or owner must comply with all requirements such as completing and submitting a Notice of Intent (NOI) before construction occurs, developing a Stormwater Pollution Prevention Plan (SWPPP) that shows how the site will be protected to control erosion and sedimentation, completing final stabilization of the site, and filing a Notice of Termination (NOT) after the construction site is stabilized.

Existing Policies and Ordinance Review

Protection of natural resources and green infrastructure during future urban growth will be important for the future health of Flint Creek watershed. To assess how future growth might further impact the watershed, an assessment of local municipal ordinances was performed to determine how development currently occurs in each municipality. In this way, potential improvements to local ordinances can be identified. As part of the assessment, municipal governments were asked to compare their local ordinances against model policies outlined by the Center for Watershed Protection (CWP) in a publication entitled "*Better Site Design: A Handbook for Changing Development Rules in Your Community.* (CWP, 1998)"

Each municipality in the watershed was invited to complete a self-assessment of their community's ordinances. Barrington and Lake Barrington provided completed worksheets while Barrington Hills, Deer Park, Hawthorn Woods, Inverness, Lake Zurich, and North Barrington, did not. The results of the review for each municipality can be found in Appendix M.

CWP's recommended ordinance review process involves assessments of three general categories including "Residential Streets & Parking Lots," "Lot Development," and "Conservation of Natural Areas." Various questions with point totals are examined under each category. The maximum score is 100. CWP also provides general rules based on scores. Scores between 60 and 80 suggest that it may be advisable to reform local development ordinances. Scores less than 60 generally mean that local ordinances are not environmentally friendly and serious reform may be needed. Municipal scores ranged from 47 to 53 (Figure 15). Lake Barrington scored the highest with 53 points followed by Barrington with 47 points, while the remaining municipalities did not return completed worksheets. Although scores are generally low, it should be noted that this assessment is meant to be a tool to local communities to help guide development of future ordinances. Various policy recommendations are included in the Action Plan section of the report to address general ordinance deficiencies.

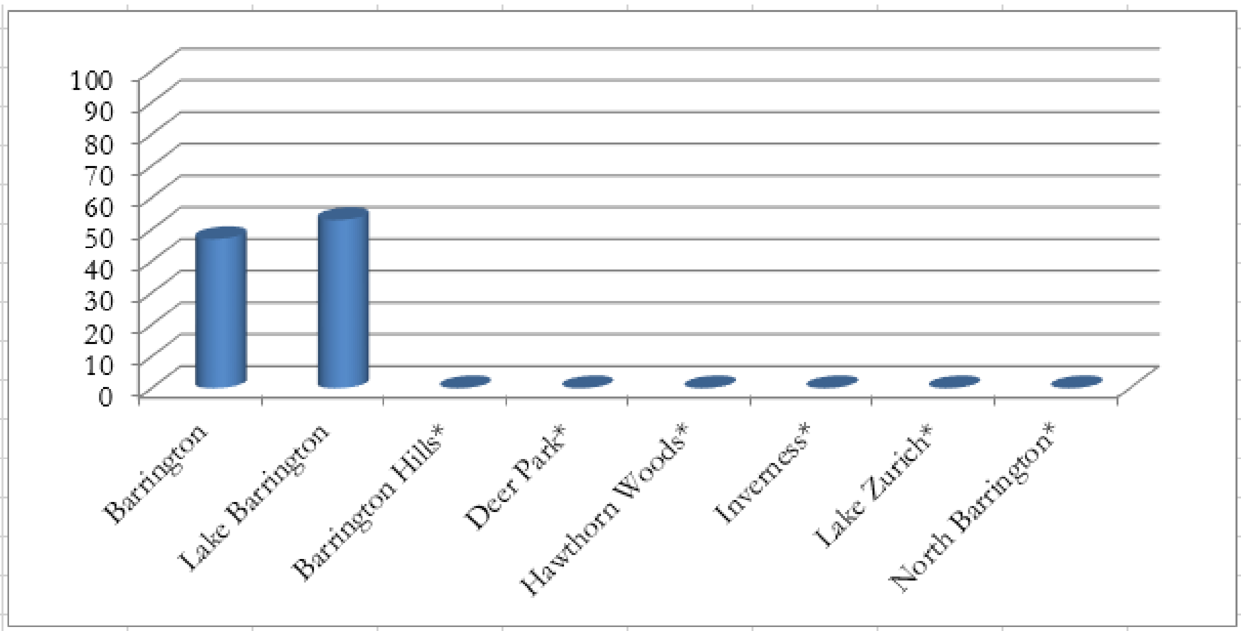
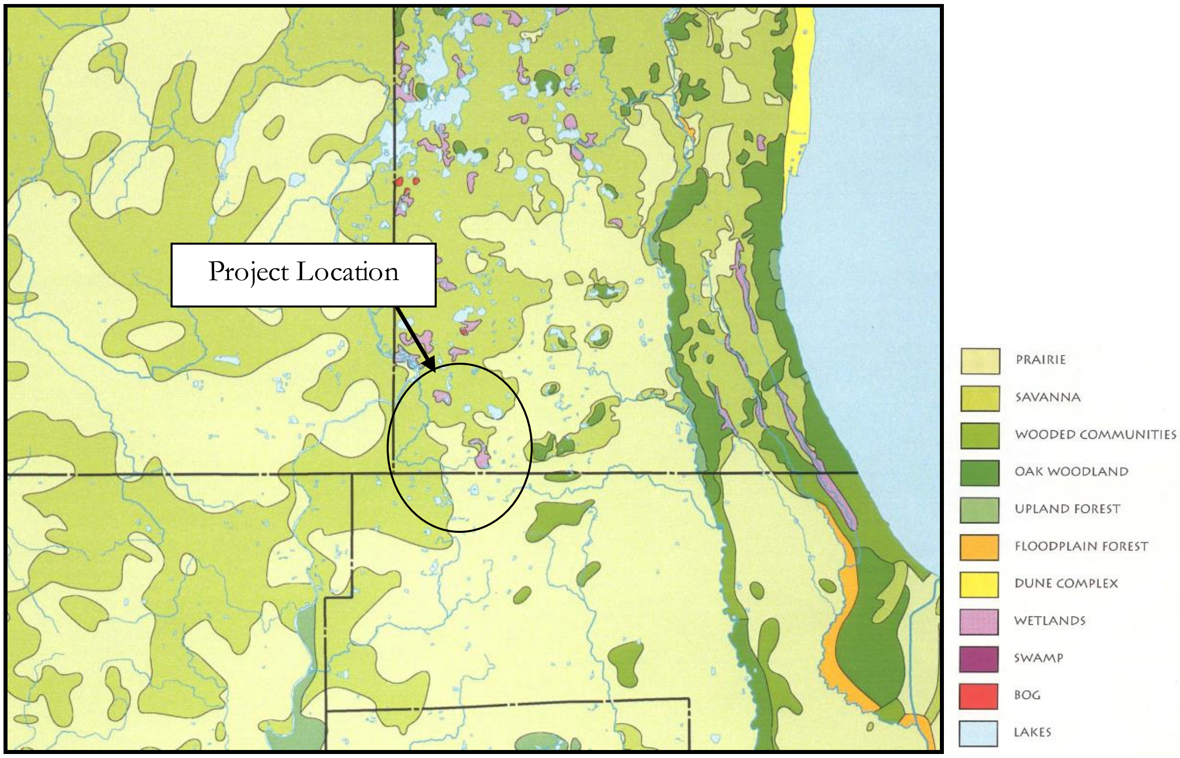


Figure 15. Center for Watershed Protection ordinance review results for local municipalities.

2.8 Land Use/Land Cover

Land Use/Land Cover

Prior to European settlement in the 1830's, the Flint Creek watershed contained a complex interaction between many natural communities including prairies, savannas, and wetlands (Figure 16). The Flint Creek watershed was comprised mostly of savanna and upland prairie communities. Wetlands communities such as marsh, sedge meadows, and wet prairies were present around lake and stream corridors.



Source: Chicago Wilderness: An Atlas of Biodiversity

Figure 16: Pre-settlement natural communities of northeast Illinois.

Today, the land cover is very different due to human induced land use changes. European settlement resulted in large tracts of savanna being cleared, prairies tilled for farmland or developed, wetlands drain-tiled and drained, and streams straightened for agricultural purposes. Many natural areas still exist but many have become degraded as natural processes such as fire are lost and invasive species such as buckthorn and reed canary grass displace native species.

The 2007 land use/land cover is depicted on Figure 16 with acreages for each land use/land cover displayed in Table 8. While there have been changes, especially the conversion of farmland into large lot single family, the financial crisis of 2008/9 slowed the progress of large developments. There has been infill, growth near village centers of multifamily units, and tear-downs and upgrades within the existing residential footprint. Hence, the determination is that Figure 16 is still useful and relevant.

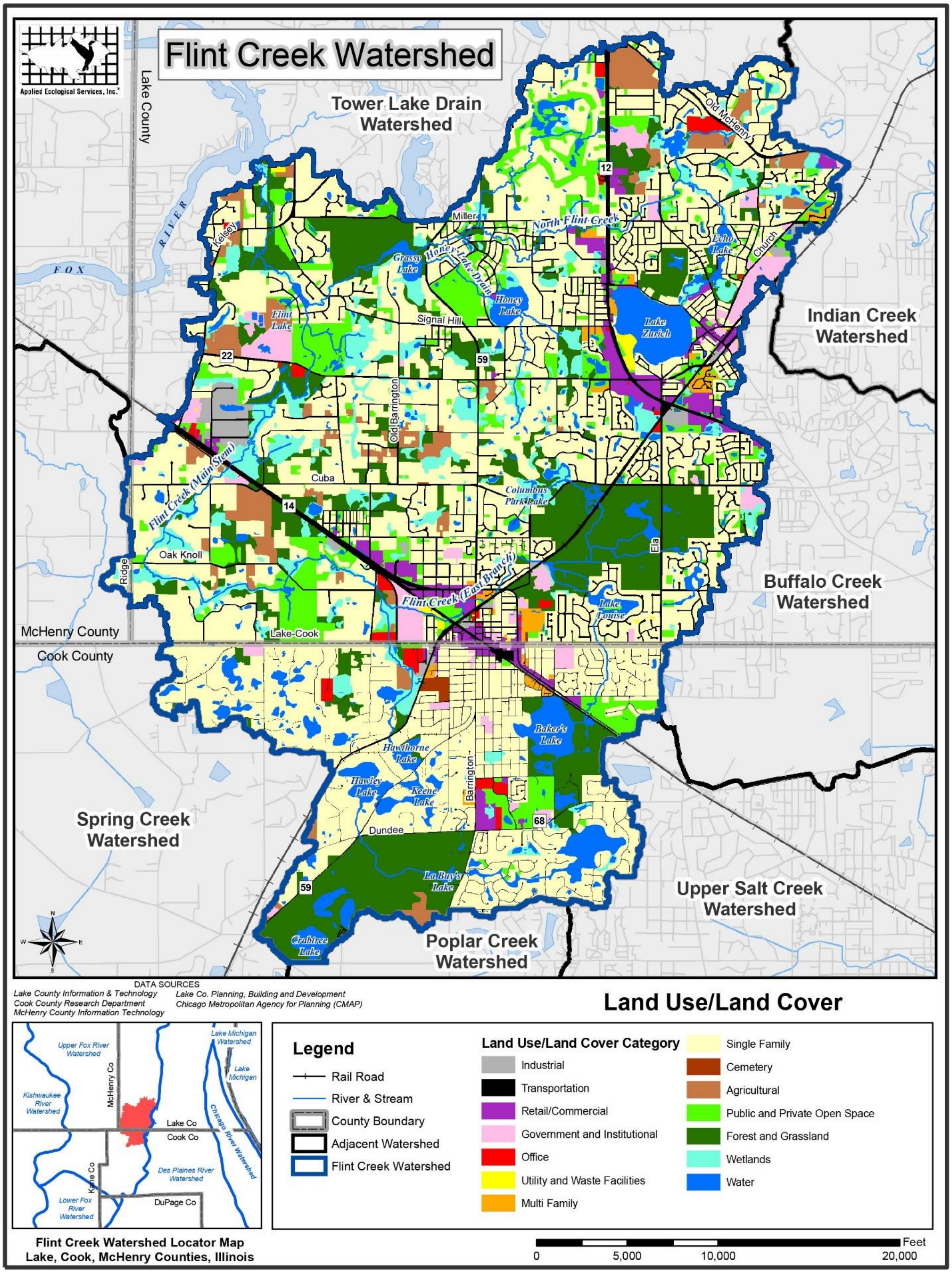


Figure 17: 2007 Land Use/Land Cover

Table 9. Land use/land cover classifications and acreage for the Flint Creek watershed

Land Use	Area (acres)	Percent of Watershed
Agricultural	756	3
Cemetery	33	0
Forest and Grassland	3,298	14
Government and Institutional	570	2
Industrial	206	1
Multifamily Residential	149	1
Single Family Residential	10,820	46
Office Space	171	1
Public and Private Open Space	1,759	7
Retail/Commercial	505	2
Transportation	1,965	8
Utility/Waste Facilities	53	0
Water	1,507	6
Wetlands	1,582	7
Total	**23,374**	**100%**

Single family residential development dominates the watershed at 46% of the total acreage, followed by forest and grassland (14%), and transportation (8%). Other important land uses include public/private open space (7%), wetlands (7%), and water (6%). Total open space including agricultural lands, water resources, forest/grassland, and public/private open space comprise approximately 8,902 acres or 38% of the watershed. Total developed land including residential, commercial, industrial, government/institutional, office space, cemetery, utility, and transportation accounts for approximately 14,505 acres or 62% of the watershed. The GIS land use/cover data used for the analysis attributed no data to the remaining 12 acres of the watershed. These areas showed up as small slivers of unclassified use located among the known data.

2020-2030 Future Land Use/Land Cover Projections

Information on future built out land use for the Lake County portion of the watershed was obtained from the Lake County Planning and Building Department. Additional information was obtained from each municipality's comprehensive plan where available: Village of North Barrington 2004, Village of Barrington Hills 2005, Lake Barrington 2006, Lake Zurich 2003, Barrington 2010, Deer Park 2001, and Hawthorn Woods 2004. No comprehensive plan was available from the Village of Inverness in the Cook County portion of the watershed. The data was analyzed and GIS used to map the land use/land cover based on 20-30 year projections (Figure 17).

Table 10 compares existing land use/land cover to future land use/land cover projections. The most obvious change occurs with open space land cover types (Agriculture, Forest & Grassland, and Public/Private Open Space). These land cover types are projected to decrease by approximately 1,527 acres; Agriculture: 725 acres, Forest and Grassland: 580 acres, and Public/Private Open Space: 222 acres. These decreases are the result of development including Single Family Residential (additional 899 acres), transportation (additional 393 acres) Government & Institutional (additional 132 acres), and Retail/Commercial (additional 107 acres). While some of the development change is projected to occur in the western half of the watershed where primarily large lot single family residential development will replace existing agriculture and other private or public open space, there is also significant infill redevelopment within the main villages.

Land Use/Land Cover	Current Area (acres)	Current % of Watershed	Projected Area (acres)	Projected % of Watershed	Change (acres)	Change (%)
Agriculture	755	3	30	0	-725	-3
Cemetery	33	0	33	0	0	0
Forest and Grassland	3,298	14	2,718	12	-580	-2
Government & Institutional	570	2	702	3	+132	+1
Industrial	206	1	150	1	-56	0
Multifamily Residential	149	1	151	1	+2	0
Single Family Residential	10,820	46	11,720	50	+899	+4
Office Space	171	1	219	1	+48	0
Public and Private Open Space	1,759	7	1,537	7	-222	0
Retail/Commercial	505	2	612	3	+107	+1
Transportation	1,965	8	2,358	10	+393	+2
Utility/Waste Facilities	53	0	59	0	+6	0
Water	1,507	6	1506	6	-1	0
Wetlands	1,582	7	1579	7	-3	0

Table 10. 20-30-year projected land use/land cover, including percent change for each land use/land cover category (not updated)

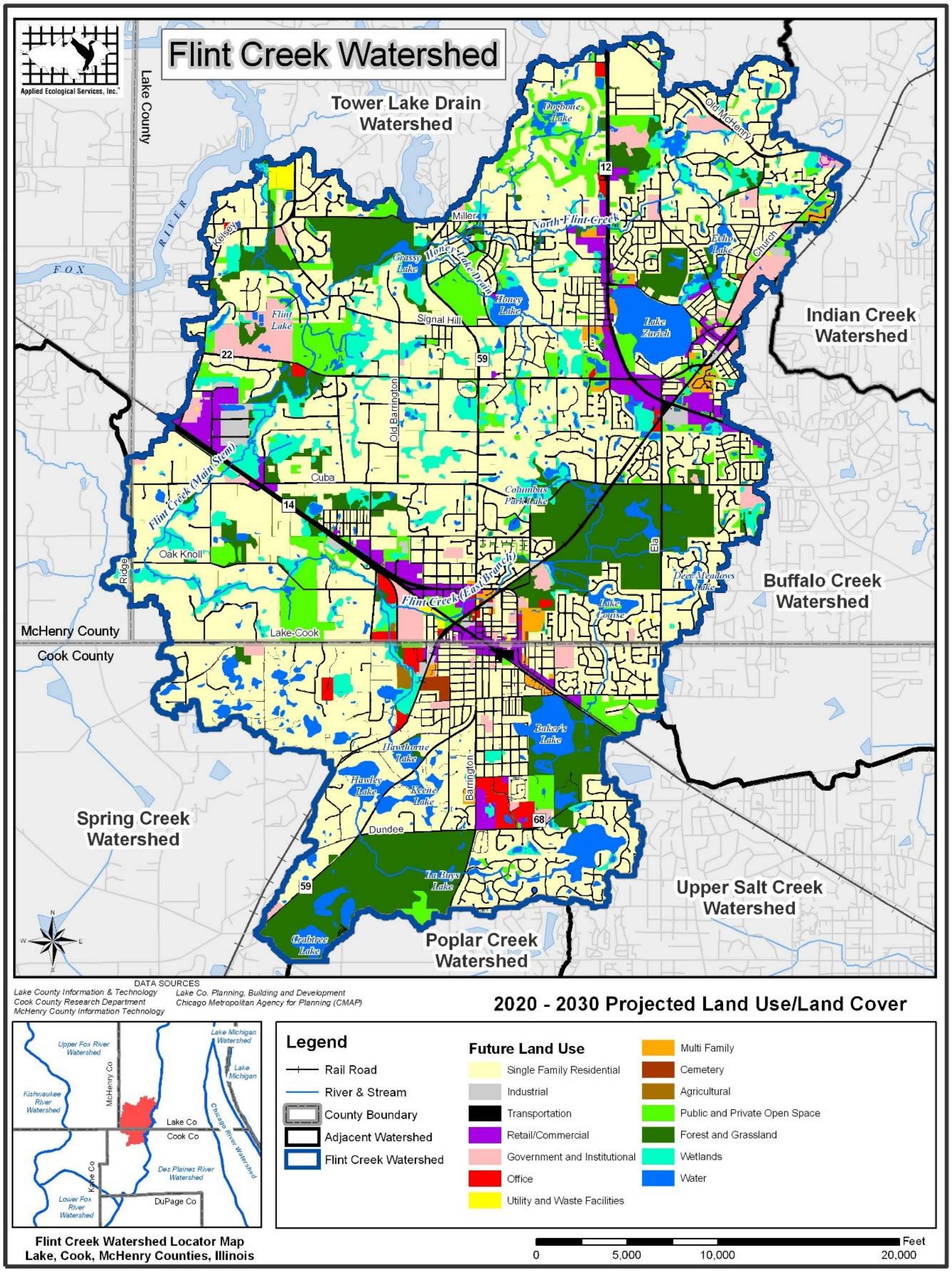


Figure 18: 2020 – 2030 Projected Land Use/Land Cover

Land Use Impacts on Watershed

Land use by humans generally increases the amount of impervious cover for a given area and reduces the amount of open space for infiltrating and storing precipitation. Imperviousness is an excellent indicator used to measure the impacts of urban land uses on aquatic systems. Specifically, increases in imperviousness have negative implications on the natural functions of streams including water quality, hydrology and flows, flooding and depressional storage, and habitat. The following paragraphs describe the implications of increased imperviousness on natural stream functions.

Water Quality

Imperviousness affects water quality in streams and lakes by increasing pollutant loads and water temperature. Impervious surfaces accumulate pollutants from the atmosphere, vehicles, roof surfaces, lawns and other diverse sources. During a storm event, pollutants such as excess nutrients (nitrogen and phosphorus), metals, oil and grease, and bacteria are delivered to streams and lakes. According to monitoring and modeling studies, increased imperviousness is directly related to increased urban pollutant loads (Schueler 1994). Furthermore, impervious surfaces can increase stormwater runoff temperature as much as 12 degrees compared to vegetated areas (Galli, 1990). According to the Illinois Pollution Control Board (IPCB), water temperatures exceeding 90°F (32.2°C) can be lethal to aquatic fauna. During summer months heated runoff could cause water temperatures to exceed lethal levels.

Hydrology and Flows

Hydrology and flows are severely altered by the amount of impervious cover in a watershed. More impervious cover generally translates to more water entering drainage systems such as streams, greater runoff volumes, and if unmitigated, will result in higher floodplain elevations (Schueler 1994). In fact, studies have shown that even relatively low percentages of imperviousness (5% to 10%) can cause peak discharge rates to increase by a factor of 5 to 10, even for small storm events. Impervious areas come in two forms: disconnected and directly connected. Disconnected impervious areas are represented primarily by rooftops, so long as the rooftop runoff does not get funneled to impervious driveways or the stormsewer system. Significant portions of runoff from disconnected surfaces usually infiltrate into soils more readily than directly connected impervious areas that typically end up as stormwater runoff directed to a stormsewer system that discharges directly to a waterbody.

Flooding and Depressional Storage

Flooding is an obvious consequence of increased flows resulting from high impervious cover. As stated under *Hydrology and Flows*, increased impervious cover leads to higher water levels, greater runoff volumes, and high floodplain elevations. Higher floodplain elevations usually result in more flood problem areas. Furthermore, as development increases, wetlands and other open space decrease. A loss of these areas increases flows because wetlands and open space typically soak up and capture rainfall and release it slowly to streams and lakes. Detention basins can and do minimize flooding in highly impervious areas by regulating the discharge rate of stormwater runoff, but detention basins do not reduce the overall increase in runoff volume.

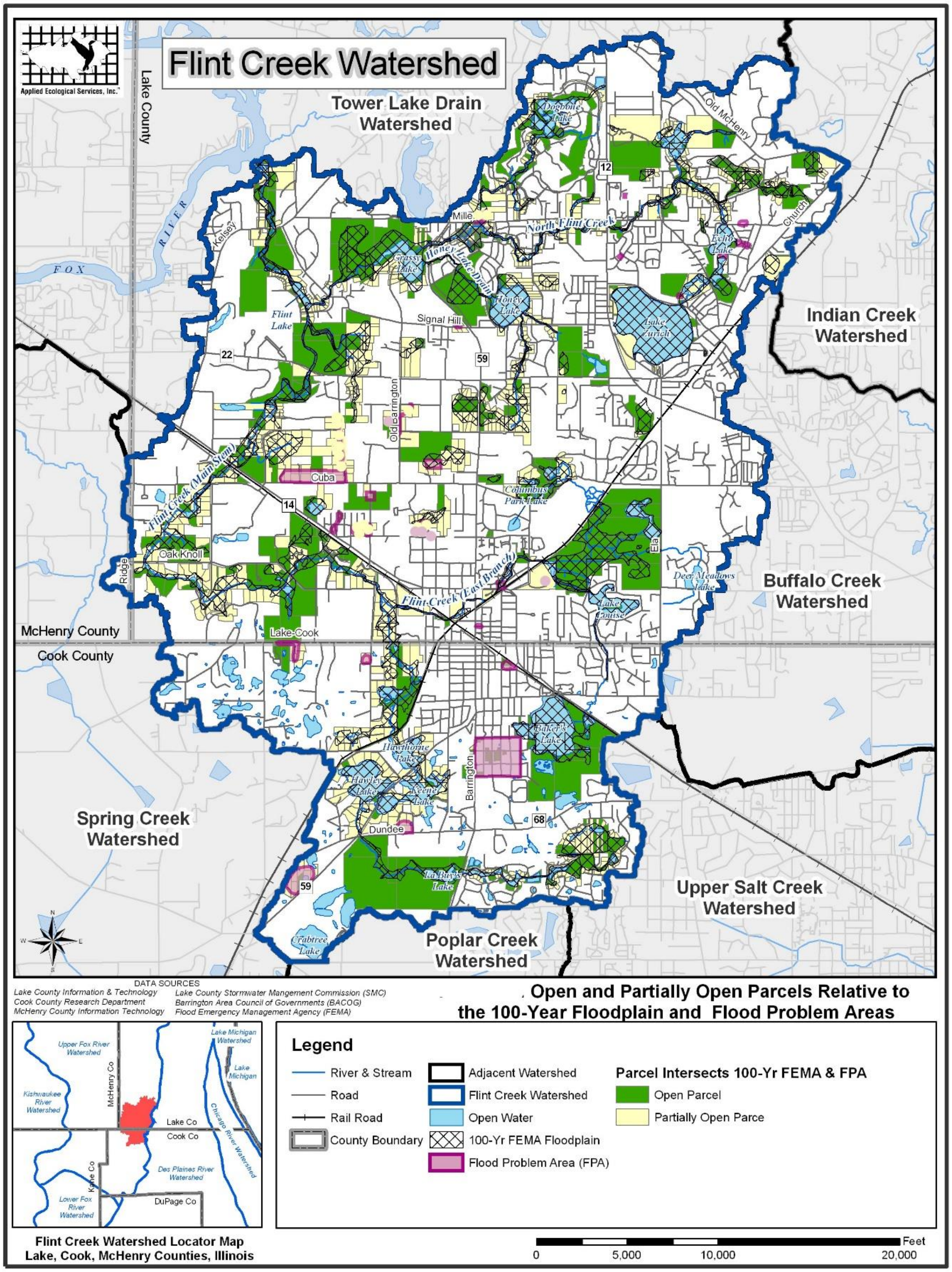


Figure 19: Open Partially Open 100 Year Flood Plain

Habitat

Increased impervious cover negatively impacts stream habitat and its associated biological communities. When a stream receives more severe and frequent runoff volumes compared to historical conditions, channel dimensions often respond through the process of erosion by widening, downcutting, or both, thereby, enlarging the channel to handle the increased flow. Channel instability leads to a cycle of streambank erosion and sedimentation resulting in physical habitat degradation (Schueler 1994). Streambank erosion is one of the leading causes of sediment suspension and deposition in streams. Sediment suspension causes turbid conditions that may result in undesirable changes to aquatic life (Waters 1995). Sediment deposition alters habitat for aquatic plants and animals by filling interstitial spaces in substrates important to macroinvertebrates and some fish species. Physical habitat degradation also occurs when high and frequent flows result in loss of riffle-pool complexes, loss of overhead cover, and decreased in-stream structures. Booth and Reinelt (1993) found that a threshold in habitat quality exists at approximately 10% to 15% imperviousness.

Impervious Cover Estimate

Imperviousness is generally defined as the sum of roads, parking lots, sidewalks, rooftops, and other surfaces of an urban landscape that prevent infiltration of precipitation (Scheuler 1994). Imperviousness is an indicator used to measure the impacts of urban land uses on water quality, hydrology and flows, flooding and depressional storage, and habitat related to streams. Studies from several geographic areas yield a similar result: streams begin to degrade when the watershed reaches approximately 10% impervious cover. As a result of increased impervious surface, runoff increases and groundwater recharge decreases. Stream channel shape responds to increased runoff by widening, downcutting, and losing riffle-pool sequences. Runoff over impervious surfaces also collects pollutants and warms the water before it enters a stream. As a result, biological communities shift from sensitive species to ones that are more tolerant of pollution and hydrologic stress.

Calculating the 2007 and projected (2020) impervious cover in the watershed began with an analysis of each individual land use/land cover shown on Figure 17. Existing (2007) impervious cover is calculated by assigning an impervious cover percentage for each land use/land cover category based upon the Environmental Protection Agency (EPA) TR55 paper (Table 11). The TR55 paper provides estimates of impervious cover based on land use categories. GIS analysis is used to estimate the percent impervious cover for various areas in the watershed using the 2007 and 2020 land use/land cover maps. We also note that Lake County updated and strengthened its Watershed Development Ordinance in 2013, and all of the Flint Creek Watershed municipalities are certified or partially certified communities.

Based on several studies and other background data, Scheuler (1994) and the Center for Watershed Protection (CWP) developed an Impervious Cover Model used to classify streams in subwatersheds into three stream quality categories based on percent of impervious cover. These categories are Sensitive, Impacted, and Non-Supporting (Table 12). In general, Sensitive subwatersheds have less than 10% impervious cover, stable channels, good habitat, good water quality, and diverse biological communities whereas streams in Non-Supporting subwatersheds generally have greater than 25% impervious cover, highly degraded channels, degraded habitat, poor water quality, and poor-quality biological communities.

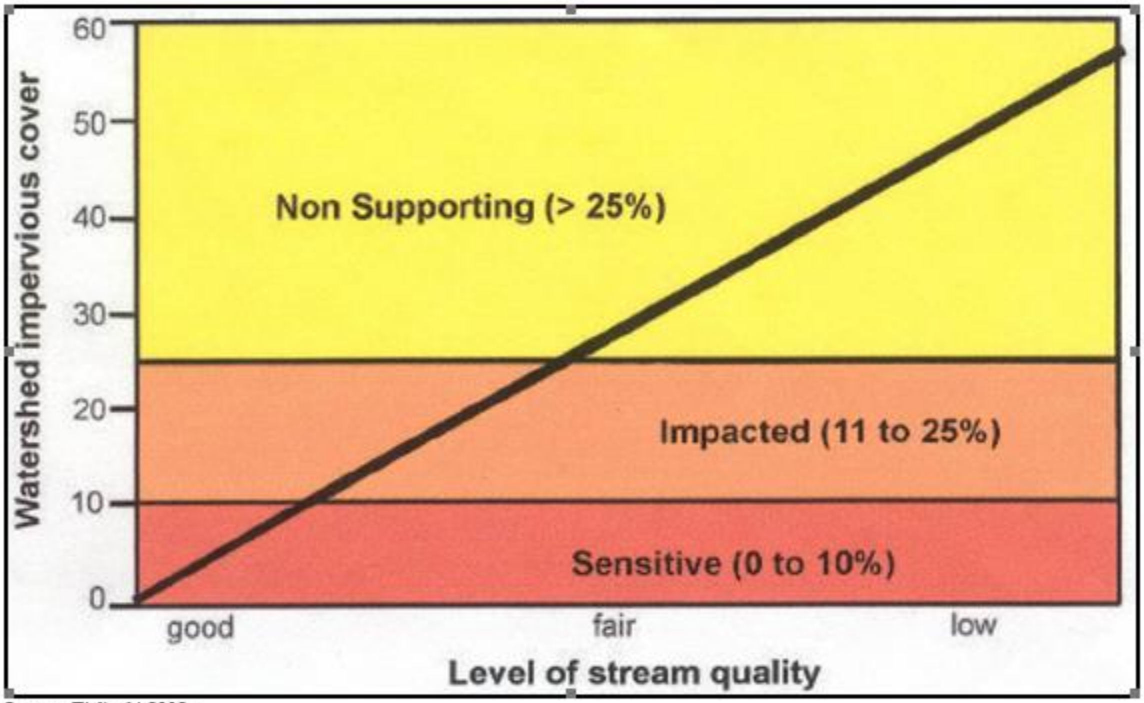
Table 11. Summary of EPA's TR55 land uses and associated imperviousness.

Land Use/Projected Land Use Classification	Percent Impervious
Agriculture	0
Cemeteries	20
Commercial	85
Government	72
Industrial	72
Institutional	72
Office Campus	72
Open Space	0
Residential	
<1/8 acre lot size or less	65
1/4 acre lot size	38
1/3 acre lot size	30
1/2 acre lot size	25
1 acre lot size	20
2 acre lot size	12
> 2 acre lot size	5
Transportation (includes ROW)	75
Utilities	10
Vacant Forest Grassland	0
Water	*100
Wetland	0

Table 12. Impervious categories and descriptions based on the CWP's Impervious Cover Model.

Category	% Impervious Cover	Description
Sensitive	10% or less	Subwatershed generally exhibits very little impervious cover (≤10%), stable stream channels, excellent habitat, good water quality, and diverse biological communities.
Impacted	Greater than 10% and less than 25%	Subwatershed generally possesses moderate impervious cover (11-25%), and somewhat degraded stream channels, altered habitat, decreasing water quality, and fair-quality biological
Non-Supporting	Greater than 25%	Subwatershed generally has high impervious cover (>25%), and highly degraded stream channels, degraded habitat, poor water quality, and poor-quality biological communities.

Source: (Zielinski 2002)



Source: Zielinski 2002.

Figure 20: Impervious cover relationship to levels of stream quality

According to the 2007 existing impervious cover analysis, the entire Flint Creek watershed is estimated to have approximately 21% impervious cover or has stream channels considered "Impacted" by surrounding land uses.

2.9 High Quality Natural Resources and Green Infrastructure

Natural Resources
Important natural resources and threatened & endangered species locations in the Flint Creek watershed were gathered from several sources. Illinois Natural Areas Inventory (INAI) database, Illinois Nature Preserves, and some information from the Illinois Natural Heritage Database (INHD). The Flint Creek Watershed is fortunate to have as much protected lands as it does, although there are some additional significant wetlands areas that are attractive targets for protection.

Portions of 4 INAI sites are located in the watershed: areas in Cuba Marsh Forest Preserve and Grassy Lake Forest Preserve (Lake County Forest Preserves), Crabtree Nature Center and Baker's Lake Nature Preserve (Cook County Forest Preserve). T&E bird sightings include those reported on Cornell's Lab of Ornithology's eBird application.

Baker's Lake Nature Preserve
The Baker's Lake Nature Preserve was designated in 1984 and is the only nature preserve in the watershed. It is part of the Forest Preserve District of Cook County's 330-acre Baker's Lake Younghusband Prairie Preserve. The nature preserve includes a 112-acre lake with a small island that supports a rookery with black-crowned night-heron, great egret, great blue heron and double-crested cormorant nests. Other rare birds such as common moorhen, yellow-headed blackbird, and black

tern have also been observed nesting in and around the lake. Baker's Lake Savanna, a 17-acre restored savanna that supports nearly 100 native plant species is located adjacent to the nature preserve. This restored savanna is owned by the Village of Barrington and managed by Citizens for Conservation.

Cuba Marsh Forest Preserve

Cuba Marsh Forest Preserve is one of two forest preserves in the Lake County portion of the watershed. This site includes nearly 800 acres of marsh, prairie, woodland, and savanna that was preserved in the in the 1970's when a group of local residents banded together to encourage the Lake County Forest Preserve District to preserve the land. Like other preserves in the watershed, Cuba Marsh supports several T&E species, such as black-crowned night-heron, osprey, American Bittern, black-billed Cuckoo, northern harrier, Forster's tern, cerulean warbler, black tern, and king rail.

Grassy Lake Forest Preserve

Grassy Lake Forest Preserve is one of two forest preserves in the Lake County portion of the watershed. It is located in the northwest corner of the watershed and extends outside the watershed to the north along the Fox River. The preserve includes over 550 acres of rolling hills, oak woodlands, marshes, and fens. A long reach of Flint Creek downstream of Flint Lake and the reach between Flint Lake and Grassy Lake flow through the preserve. Grassy Lake is also part of the preserve and harbors several T&E bird species.

Crabtree Nature Center

A large portion of Crabtree Nature Center is located in the southern tip of the Flint Creek watershed and is owned by the Forest Preserve District of Cook County. The once highly agricultural land was purchased by the forest preserve in the 1960's. Since that time natural processes and management have resulted in a slow return of nearly 1,000 acres of land to a more natural state. The site now contains expanses of wetlands, wet prairies, small lakes, and a large headwater reach of Flint Creek's main stem. Black-crowned night-heron, black tern, Forster's tern, the black-billed cuckoo, cerulean warbler, American bittern, least bittern, yellow-headed blackbird, and osprey have been seen there.

Citizens for Conservation Preserves

Citizens for Conservation (CFC) formed in 1970 when a group of concerned Barrington area residents met to discuss the negative impacts of suburban growth on the natural resources of the area. In 1971, CFC was incorporated as a non-profit organization whose mission is "Saving Living Space for Living Things"- through protection, restoration, and stewardship of land, conservation of natural resources, and education. Since the 1970's, CFC has promoted conservation efforts in the Barrington area through education and volunteer work. Additional information about CFC can be obtained by viewing their website: www.citizensforconservation.org/. Some of CFC's many achievements include:

- Protecting over 2,000 acres of public land;
- Owning 12 preserves, 7 of which are located in the Flint Creek Watershed (Figure 27);
- Stewardship and education for local villages, forest preserves, and schools;
- Nature watching and monitoring events;
- Native seed collection and restoration of natural areas.

Grigsby Prairie

Grigsby Prairie was once part of the historical Grigsby Estate. Beginning in the mid 1980's, CFC began restoring native prairie to a 38-acre fallow farm field located near Oak Knoll and Buckley Roads donated by a private resident (Figure 27). Today, the prairie restoration extends beyond the preserve and includes almost 50 acres with more than 150 native plant species. This prairie was restored by volunteers who collected native seed from nearby prairie remnants. The rich prairie habitat is now home to many forms of wildlife, especially declining grassland birds such as bobolinks, grasshopper sparrows, Henslow's sparrows, and meadowlarks.

Hawley Lake Marsh

In 1974, a private land owner donated approximately 17 areas of marsh adjacent to Hawley Lake in the Village of Barrington Hills to CFC (Figure 27). The wetland area is kept in its natural state.

Steyermark

The 1-acre Steyermark property was donated by a private resident in 1986 and includes a forested ravine and floodplain on the north branch of Flint Creek (Figure 27). The ravine exhibits a diverse display of spring woodland wildflowers. CFC actively removes garlic mustard, brush, and logjams, and also conducts annual stream monitoring for RiverWatch there since 1996.

Flint Creek Savanna

Citizens for Conservation purchased a portion of the property now known as Flint Creek Savanna in 1988. At that time, the site consisted of eroded banks along Flint Creek, degraded streamside woodlands, and adjacent agricultural land. The site was purchased primarily because of its potential to restore several interacting ecosystems to pre-settlement condition, creating habitat that harbors a variety of native plant and animal species. Recent additional land purchases create a preserve that now totals over 100 acres with nearly a mile of Flint Creek, four oak/hickory woodlands, several acres of wetlands, and prairie. Flint Creek Savanna is ultimately a place preserved as open space for wildlife but also as a place for adults and children to learn about biological diversity and the benefits of preserving and restoring open space. An additional small parcel was recently donated, such that the preserve now extends across R. 22. Restoration is actively proceeding.

In 2009, the Lake Barrington purchased 30 acres commonly known as the Gibbs parcel for $1,100,000, and rezoned it from Manufacturing to Conservation. They then entered into a Purchase Option Agreement with Citizens for Conservation for a 20 year period that gives CFC the right to purchase portions of the site, which they are restoring, and which also contains significant wetlands. This land lies along Flint Creek South. Thus far, CFC has purchased several acres, and plans to purchase more 2018. CFC is restoring the acreage they purchase, as well as working on the Lake Barrington parcels. Restoration activities are active, removing reed canary grass and planning wetland sedges, as well as clearing buckthorn. Nearby is the formerly Abbate property, 13.3 acres, donated to CFC by Barrington Bank. Near term efforts mirror that of the Gibbs property.

CFC is also restoring recently donated property west of Hart and south of Cuba, the 22 acres Craftsbury Preserves. It is also wetland, and still in raw shape. CFC is removing significant buckthorn and reseeding with native plants.

Citizens for Conservation continues restoration of the Barrington Bog, which is a graminoid or grassy bog, acidic with a peat base on the west side of Rt. 59. This is also a quaking bog. Maintenance is a consistent challenge, as the bog is difficult to access and the weather not always cooperative.

The Stewards of Grassy Lake, along Miller Road and Kelsey, and Rt. 59, have cleared over 70 acres of buckthorn over the last 7 years. That Fen is called by many as not only a rare fen, but one of the best in the whole of Lake County. This property is part of the Lake County Forest Preserves, and is noted here due to the substantial removal of buckthorn, a persistent invasive. Restoration continues.

CFC continues restoration of the other properties they have acquired over the years, such as the fine Grigsby Prairie and ongoing work with the Lake County Forest Preserves in Cuba Marsh and the Hurd property.

This year, Citizens for Conservation announced a **Barrington Greenway Initiative** (BGI) to restore and expand existing greenways and to encourage contiguous landowners to restore parts of their properties to more natural conditions to provide more natural pathways for wildlife and plants. In addition to volunteers working on restoration, there will be a significant community education outreach focusing on the value of ecosystem services. Partners in this endeavor include Citizens for Conservation, Lake County Forest Preserves, Audubon Great Lakes, the Forest Preserves of Cook County, Friends of the Forest Preserve and the Bobolink Foundation. This effort is in alignment with FCSCWP goals and objectives.

Indeed, this is an important element in FCWP's consideration of "green infrastructure." Green infrastructure not only publicly protected lands (e.g. Forest Preserves), conservation lands (e.g. lands administered by groups such as Barrington Area Conservation Trust and Citizens for Conservation, but also privately owned lands whose owners invest not only in rain gardens and monarch gardens, but also invest in significant buffers to protect strategic and sensitive lands, stream banks, lakes, flood plains, wetlands,. The objective is to construct protected wildlife and biotic corridors.

Green infrastructure is best defined as an interconnected network of natural areas and other open space that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife (Benedict, 2006). Natural features such as stream corridors, wetlands, floodplain, woodlands, and grassland are the primary components of green infrastructure. Working lands such as mini-estates, hayfields, organic farms, horse farms, other agricultural fields and so on, and partially developed areas including any school grounds, golf courses, detention basins, parks, ball fields, large residential parcels, and developed lots that include a stream corridor are also considered components of a Green Infrastructure Network. It is important to note that since parts of the Flint Creek Watershed are highly developed, existing green infrastructure is somewhat fragmented. (See Figure 75, p. 192).

<u>Barrington Area Conservation Trust Preserves</u>
The Barrington Area Conservation Trust (BACT) has added 144 acres since 2007 in both the Spring Creek and the Flint Creek Watersheds, that are permanently protected through both donations and conservation easements. They curate 11.7 acres in the Flint Creek Watershed (Pederson and

Thomas) through which significant sections of Flint Creek runs, thereby providing water retention capacity and natural wetland filtration.

BACT has three easements (Bradford-White, Bialas-Heiberg and Dworsky, totaling 12.9 acres which also provide water filtration and retention ecosystem services.

In December, 2016, BACT received 6.7 acres of wetlands at the corner of Oak Knoll and Ridge Roads in Barrington Hills. Named Katie's Marsh, and once used as a garden which included native plants and sedges, BACT will work to enhance its wetland functions to Flint Creek.

Other Open Space Additions

North Barrington recently purchased property needed for Haverton on the Pond to access Route 59, in order to restore and repair historic drainage tiles from Haverton East underneath 59, north to Honey Lake to West Flint Creek, which has seen regular flooding. This flooding regularly inundates Rt. 59, and had become a public safety hazard.

The Barrington Park District recently swapped part of their Miller Park with the Village of Barrington for land contiguous to the west and south sides of Miller Park, by Summit and Concord Streets, where there will be a new Park. The Village of Barrington is using the part of the old Miller Park that they acquired to construct a significant detention basin to reduce frequent flooding in the East Lincoln and South Summit Street area.

Many of the municipalities of Flint Creek are supportive of bike paths and routes. While many of these paths are space allocations on existing roads and shoulders, there are also bike paths that are shared with foot traffic. Cuba Marsh has delightful walking trails also suitable for biking, and the Villages of Barrington and Deer Park have designated roads marked to share with bicycle riders. This network is expected to expand over the next ten to fifteen years.

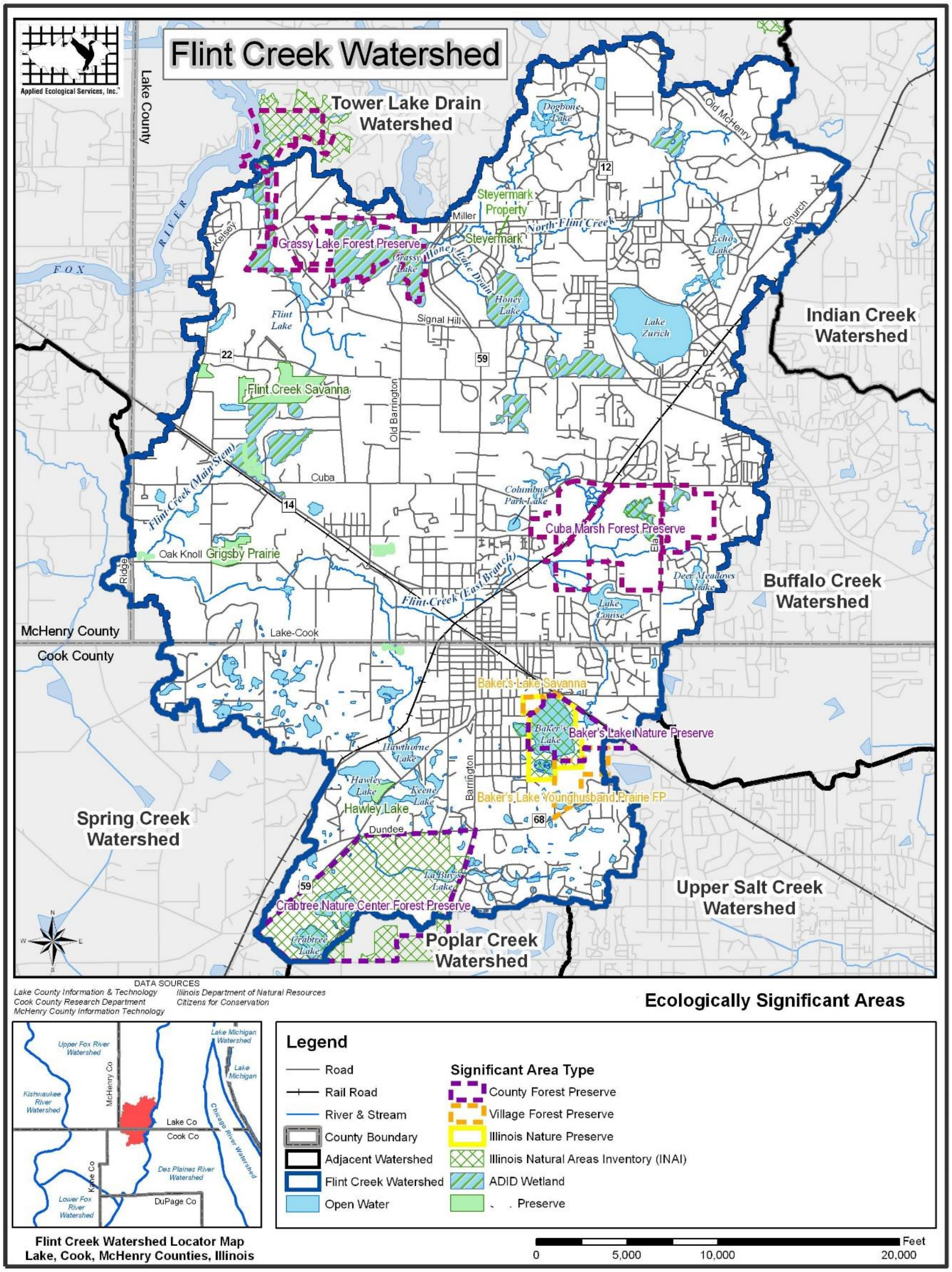


Figure 21: Ecological Significant Areas

Other Open Space Considerations

A key objective of the 2007 plan was to examine open space and determine how each parcel could best be utilized as part of a green infrastructure network to meet general watershed goals, including:

- water quality improvement
- natural resource protection and enhancement
- flood prevention and reduction

Prioritizing open space parcels for the green infrastructure network began by first identifying all open and partially open parcels in the watershed. Next, 14 prioritization criteria that address each of the three general watershed goals were applied. The 14 selected criteria are as follows:

- Open or partially open parcels that intersect with the 100-year FEMA floodplain.
- Open or partially open parcels located within 0.5 miles of any headwater stream.
- Open or partially open parcels that intersect with a wetland.
- Open or partially open parcels that contain a potential wetland restoration site identified in Section 3.9.4 (Wetlands Inventory).
- Open or partially open parcels located in a Subwatershed Management Unit (SMU) where less than 10% of the SMU is existing wetland.
- Open or partially open parcels within a 0.5 mile radius of a Flood Problem Area (FPA).
- Open or partially open parcels that are within 100 feet of a watercourse or lake.
- Open or partially open parcels that are adjacent to developed but undetained areas.
- Open or partially open parcels located within a non-point source pollutant loading SMU "hotspot" identified in Section 4.2 (Water Quality Problems).
- Open or partially open parcels located in a "Highly Vulnerable" Land Use/Land Cover SMU identified in Section 4.1 (Land Use Impacts).
- Open or partially open parcels within 100 feet of or including high quality (ADID) wetlands.
- Open and partially open parcels adjacent to or including Ecologically Significant Areas.
- Open or partially open parcels adjacent to or including Threatened & Endangered (T&E) species locations
- Open or partially open parcels that are adjacent to or contain a potential Regionally Significant Storage Location (RSSL) identified in Section 3.10 (Flooding and Flood Storage).
- Open or partially open parcels that are located in critical recharge areas for groundwater

Figure 22 shows the results. Parcels meeting 6 to 9 of the criteria are designated high priority for meeting project goals, while parcels meeting 4-5 criteria are designated medium priority. Parcels with a combined value of 1-3 are low priority. Parcels with a score of 0 are not a priority or were already developed.

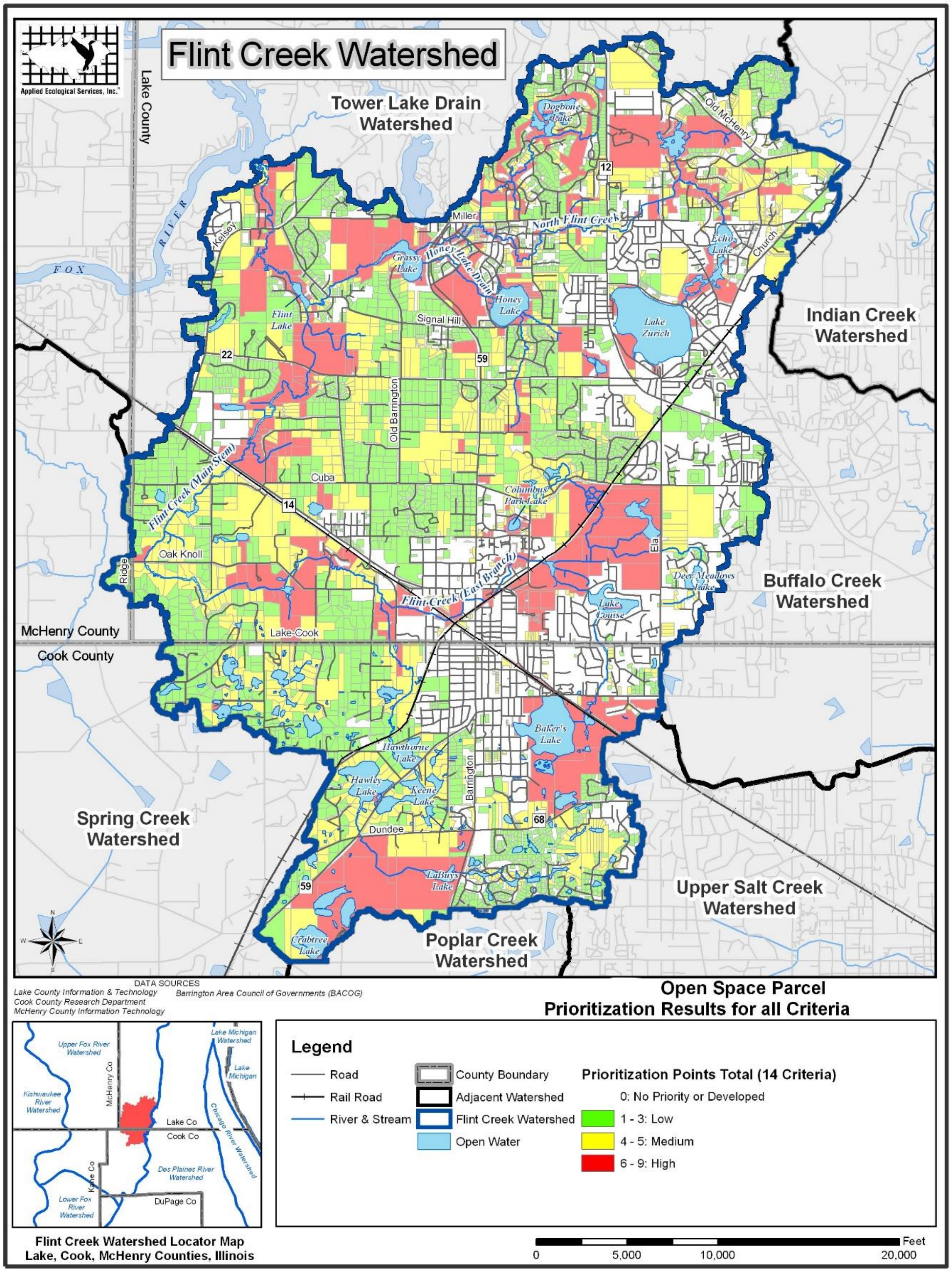


Figure 22: Open Space Prioritization Results for all Criteria

3.0 Watershed Issues

3.1 Detention Basins and Flood Plain Data

Existing 100-Year Floodplain

Floodplains along stream and river corridors perform a variety of benefits. Some of these benefits include aesthetic value, flood storage, water quality, and plant and wildlife habitat. The most important function however is the capacity of the floodplain to hold water during significant rain events to minimize flooding issues. The 100-year floodplain is defined as the area that would be inundated during a flood event (100-year flood) that has a one percent chance of occurring in any given year. However, 100-year floods can and do occur more frequently. The 100-year flood has become the accepted national standard for floodplain regulatory purposes and was developed in part to guide floodplain development to lessen the damaging effects of floods. The 100-year floodplain also includes the floodway. The floodway is the portion of the stream or river channel that comprises the adjacent land areas that must be reserved to discharge the 100-year flood without increasing the water surface. Figure 22 below depicts the 100-year floodplain and floodway in relation to the stream channel.

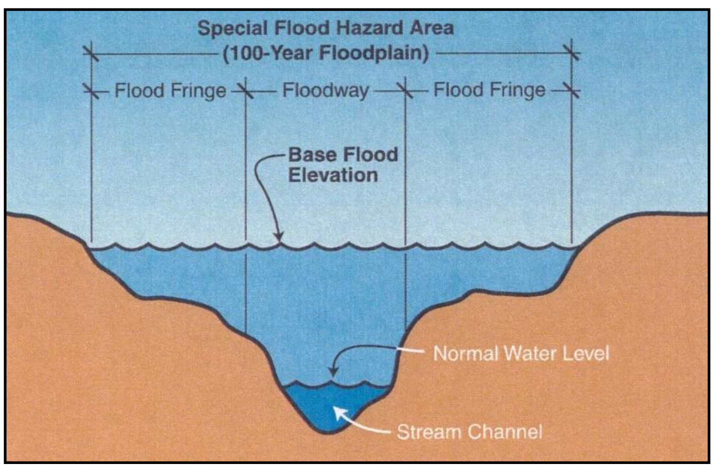


Figure 23: Depiction of 100-year floodplain and floodway.

Studies conducted by the Federal Emergency Management Agency (FEMA) to determine areas that have the highest probability for flooding are called Flood Insurance Studies (FIS). Flood Insurance Rate Maps (FIRM) are produced from the studies and used to determine the level of risk to people and structures in a certain area with respect to the dangers of flooding. FIRM maps are also used to determine the cost and requirements for the purchase of flood insurance.

Figure 23 includes a map of the existing 100-year floodplain. According to the mapping, the 100-year floodplain occupies 2,682 acres, or 12% of the watershed: 1,073 acres in North Flint Creek subwatershed, 1,083 acres in Flint Creek (main stem) subwatershed, and 526 acres in Flint Creek (east branch) subwatershed.

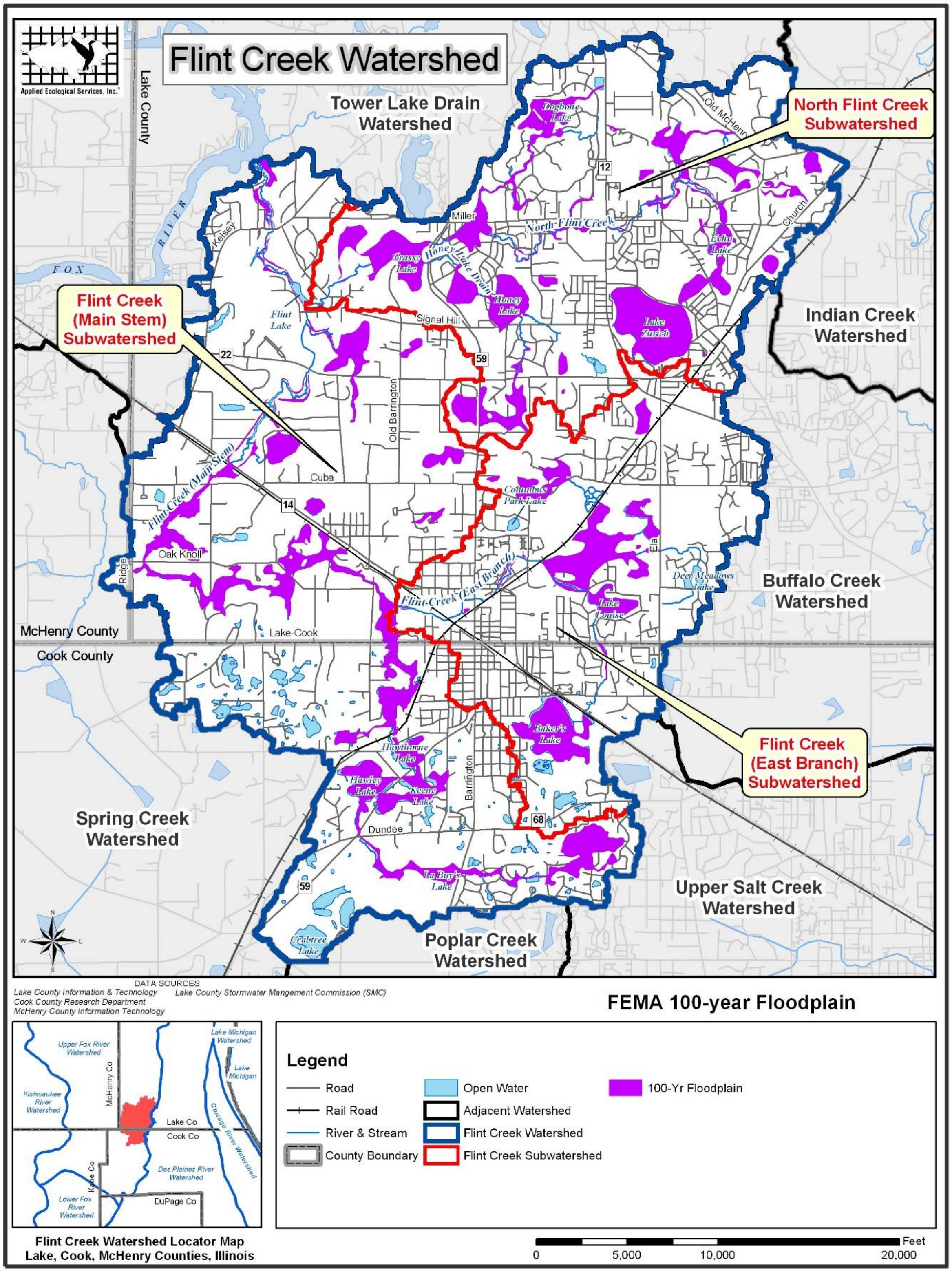


Figure 24: FEMA 100 Year Floodplain

Flood Problem Areas Inventory

In 2001, the Lake County Stormwater Management Commission (LCSMC) updated the original (1995-1996) Flood Problem Areas Inventory (FPAI) for all of Lake County (Table 13, Figure 25). A Flood Problem Area (FPA) is one or more structures that are damaged by flooding. The inventory was completed by conducting personal interviews with cities, villages, townships, homeowners associations, county agencies, county board members, and private organizations and individuals. Each identified FPA is categorized under one of the following; 1) overbank flooding, 2) local drainage problem, 3) depressional flooding, 4) sewer back-up, 5) septic problem, and/or 5) erosion problem. LCSMC identifies each FPA by using a watershed sequence number (Flint Creek watershed = 9) followed by a second identifier number (i.e. 9-01). Other FPAs were identified by contacting Village and Township staff, particularly for the Cook County portion of the watershed where little to no flood damage data was available. Personal contacts were also made to verify that some of the original LCSMC FPA's have been addressed. Information about addressed FPA's is not included in this report, except in the cases of FPA's that have been addressed since 2007. The Flood Problem Area inventory resulted in 20 areas exhibiting flooding problems. Information about each FPA and a map are included below. Detailed information for each LCSMC-identified FPA can be obtained by contacting the LCSMC and filing a FOIA request

Table 13. Flood Problem Areas identified during LCSMC's Flood Problem Areas Inventory and other known flood problem areas.

Flood Problem Area	Cause of Flooding	Location/Description	Known Mitigation Measures
LCSMC FPAs			
9-01	Depressional Flooding	Subdivision north of Route 14 in Cuba Township	Partial fix – Drainage replaced and revisited 2017
9-03	Local Drainage Problem	Harbor Rd. and Cuba Rd.	
9-04*	Local Drainage Problem	Corner of Old Barrington Rd. and N. Edgemond Rd.	Drainage fixed and Old Barrington Road Raised
9-10	Depressional Flooding	Areas near Lake Zurich and Echo Lake	None
9-11	Local Drainage Problem	Route 12 and Miller Rd.	Major work along Miller Road; fixed
9-12	Local Drainage Problem	Unincorporated subdivision east of Echo Lake	Minor work along N. Lakewood Ln.
9-14	Local Drainage Problem	Corner of Pine Tree Row and Golf View Rd.	None
9-17	Depressional Flooding	Miller Rd.	Fixed
9-19	Overbank Flooding	Elm Rd.	Partially addressed; part of planned CN related work
9-21	Depressional Flooding	N. Hart Road South of Cuba Rd.	Partial fix-culverts replaced
9-22	Local Drainage Problem	Signal Hill Rd.	None
Other FPAs			
1	Local Drainage Problem	Drainage problem on Lake-Cook Road between Brinker Rd. and Caesar Dr.	None
2	Depressional Flooding	Depressional flooding at northwest corner of Oakdene Road and Hart Hills Road.	None
3	Depressional Flooding	Depressional flooding in subdivision southwest of Baker's Lake	Proposed mitigation plan
4	Depressional Flooding	Depressional flooding at northwest corner of Route 68. and Lakeview Ln.	None
5	Depressional Flooding	Depressional flooding between Route 59/68 and Old Dundee Rd.	None
6	Local Drainage Problem	Flooding on Washington St. between Route 59 and N. Cook St.	Replacement of storm sewers
7	Local Drainage Problem	Flooding on E. Lincoln Ave., S. Summit St., E. Russell St., and Miller Park	Detention basin Construction 2017-18
8	Local Drainage Problem	Pond off Prestwick Dr. drains to road and approaches houses including on Merton	Partially fixed
9	Depressional Flooding	Several residential yards/basements in Fox Point Subdivision flooding during most rain events greater than 1 inch	None

Data Source: DRAFT 2001 Lake County Flood Hazard Mitigation Plan (LCSMC 2001).
* Flooding Hot Spot in DRAFT 2001 Lake County Flood Hazard Mitigation Plan

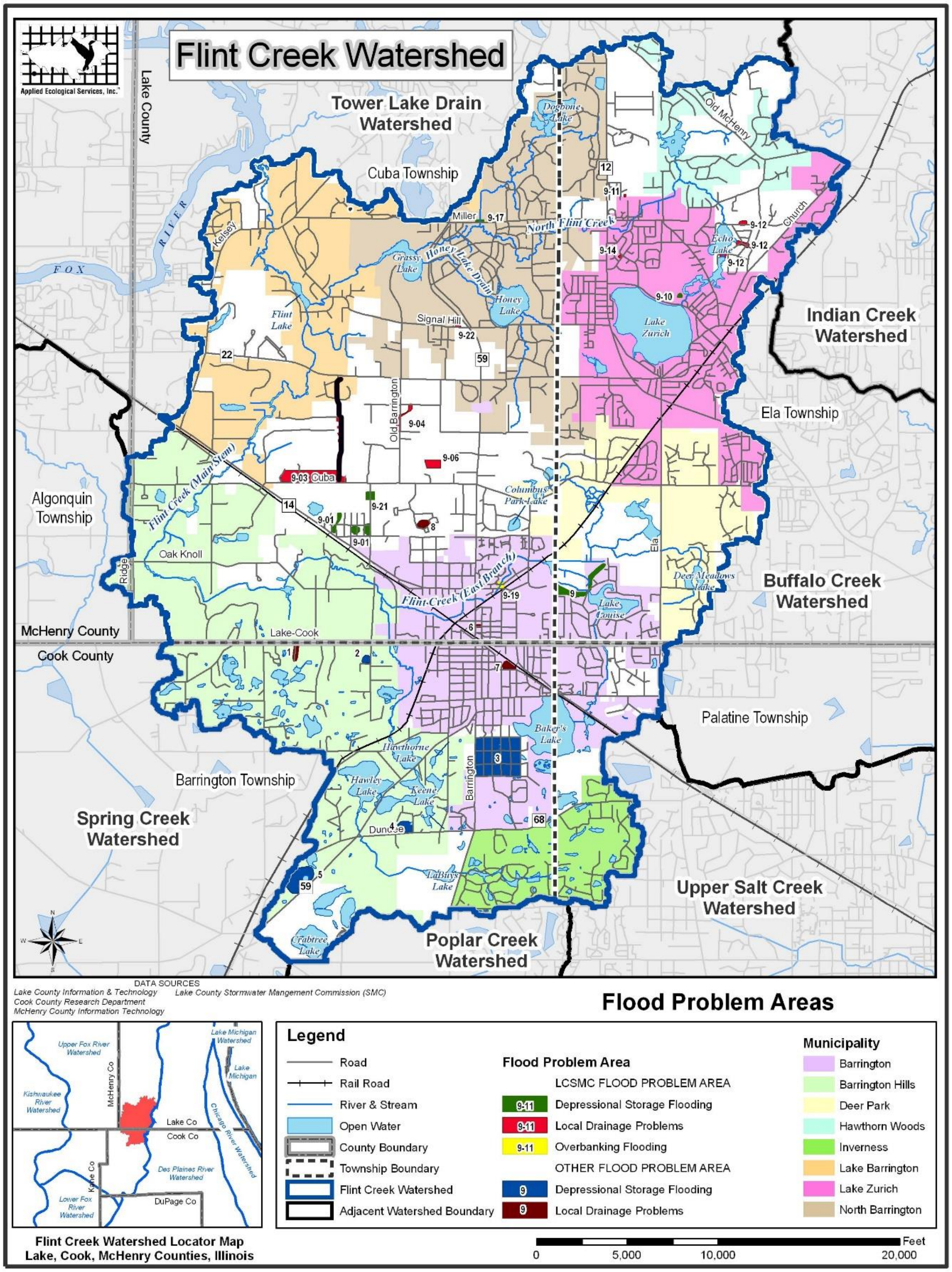


Figure 25: Flood Problem Areas

Table 14. Additional Flood Problem Areas identified in the Flint Creek Watershed

Flood Problem Area	Cause of Flooding	Location/Description	Known Mitigation Measures
10	Local Drainage Problem	In subdivision northwest of Ela and Cuba Rd – flooding along Hearthside Dr and Farthingdale Ct	None
11	Local Drainage Problem	Southwest of Rt 59 and 22 – flooding occurs along Haverton Way and along Route 59	None
12a	Local Drainage Problem	In subdivision south/southwest of Prestwick, In the Merton area with drainage to Rt.14	None
12b	Local Drainage Problem	In the area by the lake by Elizabeth Lane, sometimes blocking the road	None

<u>Open and Partially Open Space Relative to the 100-Year Floodplain and Flood Problem Areas</u>

The Federal Emergency Management Agency (FEMA) 100-year floodplain and known Flood Problem Areas (FPAs) were mapped relative to surrounding or intersecting open and partially open parcels on Figure 26. A clear open and partially open space parcel trend is noticeable along the majority of the Flint Creek (main stem), and western portion of North Flint Creek. Smaller partially open space parcels (generally larger residential lots), are located in the 100-year floodplain along North Flint Creek in Lake Zurich, Hawthorn Woods, and the eastern portion of North Barrington. Open or partially open space parcels are not common along Flint Creek (east branch) as it flows through Barrington. Open space is critical along streams/floodplains because it forms greenways for wildlife, flood storage during heavy rain events, is good for general ecological processes, and improves the quality of life for people. As human development encroaches on stream corridors, flood problems arise, corridors become smaller, and wildlife becomes less abundant.

Open and partially open parcels are also important when trying to mitigate for known flood problem areas (FPAs) because they provide open space that can potentially be used to create stormwater storage or other flood mitigation practices. A detailed discussion on FPAs can be found later. Figure 26 depicts the location of open and/or partially open parcels near or intersecting FPAs. Generally speaking, FPAs located in highly developed areas are not surrounded by open or partially open parcels. Flood mitigation on these parcels will likely occur onsite and include smaller scale BMPs such as rain gardens. FPAs located in rural areas are generally associated with open space. Larger scale flood mitigation such as creation of large storage areas/wetlands is more likely feasible for these sites. The Action Plan section of this report includes site-specific recommendations to mitigate for existing FPAs.

<u>Open and Partially Open Space Relative to Hydric Soils and Wetlands</u>
Greater than 75% of the original wetlands in the Flint Creek watershed are still present according to the wetland inventory and analysis of drained hydric soils. The watershed has an extensive network of existing wetlands and areas of drained wetlands that now remain only as hydric soils. Nearly all

the existing wetlands and hydric soils are directly associated with open or partially open parcels, especially along stream corridors.

Wetlands in the watershed exhibit a fair amount of protection against development through County and U.S. Army Corps of Engineers (USACE) regulations. Wetlands located in protected areas such as forest preserves are completely protected. Wetlands that are connected to stream systems are considered "Waters of the U.S." and are therefore regulated by the USACE. Effective January 1, 2005 developments are allowed to impact no more than 0.10-acre of USACE jurisdictional wetland without a permit and required mitigation.

Isolated wetlands, or wetlands that are not hydrologically connected to "Waters of the U.S.," are under the jurisdiction of the county in which they are located. McHenry County and Lake County each have Watershed Development Ordinances that require mitigation for wetland impacts greater than 0.1 acres to isolated wetlands that are high-quality and greater than 0.25 acres for isolated wetlands that are not considered high quality. Cook County now has an ordinance.

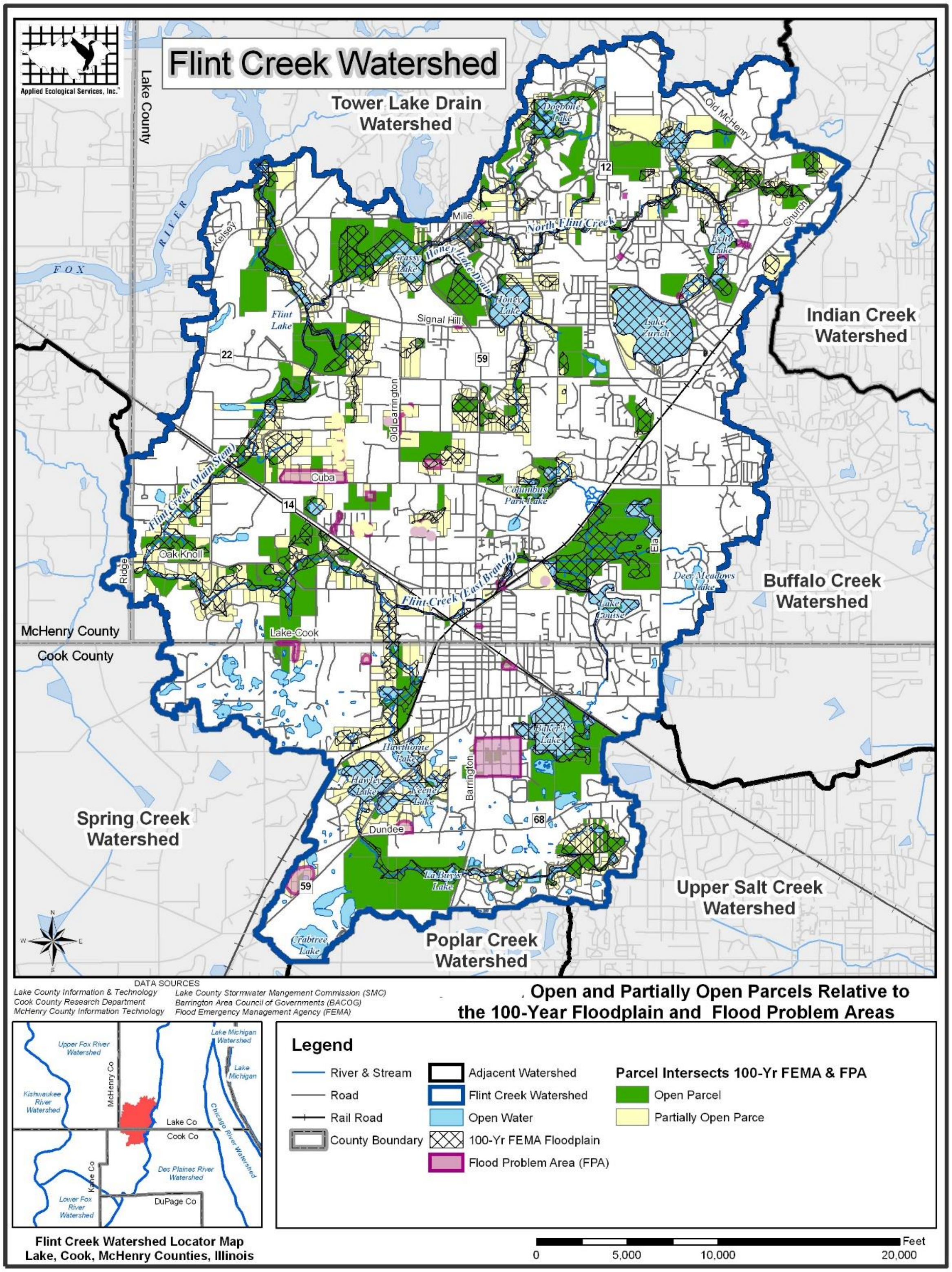


Figure 26: Open and Partially Open Parcels and Floodplain and Flood Problem Areas

Constructed Drainage System

The natural drainage system began to experience changes as residential, commercial, industrial, and transportation land uses increased. Early urban development was constructed without detention basins with stormwater directed to streams and lakes via ditches and stormsewer systems. The goal was to remove runoff from developed areas as quickly as possible. Without detaining stormwater originating from increased amounts of impervious surface and extensive stormsewer networks, flashy hydrology becomes common. Flashy hydrology results when the water level in streams rises quickly during a storm event and falls quickly following the storm event. This causes channel degradation such as downcutting and channel widening as well as flooding and unstable conditions that are not suitable to most fish and invertebrates. More recently, land planners and engineers have realized the benefits of storing stormwater runoff in detention basins that are designed to capture stormwater runoff from a surrounding development and release the water slowly over a given amount of time. If designed with native plants and other features, detention basins can also provide wildlife habitat and improve water quality.

Detention Basins

In 1992 (revised in 2015), Lake County adopted a comprehensive stormwater management ordinance (the Watershed Development Ordinance (WDO)) governing the entire County, which restricted stormwater release rates for all new development within the County.. The WDO limited release rates from the 2-year recurrence interval design storm to 0.04 cubic feet per second (cfs)/acre of development area and limited release rates from the 100-year recurrence interval design storm to 0.15 cfs per development acre. Limited release from the more frequent storms more closely approximated the bankfull capacity of stream channels in Lake County. In Lake County, detention basins constructed prior to 1992 and all detentions in Cook County with oversized outlets are often good candidates for retrofitting with restrictors that release stormwater more slowly. It should be noted that rainfall calculations are based on consistent rate patterns of precipitation, rather than the uneven rate patterns experienced during an average storm.

In 2007, the Lake County Stormwater Management Commission (LCSMC) conducted an inventory for all known detention basins in the entire Flint Creek watershed. Appendix F contains the results for 201 detention basins inventoried. Twenty four (24) of these basins are either located outside the watershed boundary and/or are not actually detention basins. The inventory includes observations and measurements of:

- basin size and drainage area characteristics;
- basin design features (type, vegetation, slopes, inlet/outlets, etc.);
- maintenance/design problems;
- potential retrofit opportunities.

The location of all detention basins within the watershed is shown on Figure 27. Several surveyed basins are not located in the watershed. These basins are not discussed in this plan. Site specific detention basin retrofit opportunities to improve water quality, improve wildlife habitat, and decrease flooding are identified in the Action Plan. These retrofits include:

- convert dry basins to wet or wetland basins;
- repair short-circuiting using berms or other measures;

- replace turf grass and rip rap with native vegetation for improved filtration and habitat;
- repair inlets/outlets and remove excess wood debris;
- clean up litter;
- treat excess algae.

Most newly constructed basins are designed to be wet bottom with side slopes and an emergent zone that is planted with native vegetation to help clean stormwater, promote infiltration, and improve habitat for wildlife. These types of basins are usually referred to as naturalized detention basins, and are significantly more effective at filtering runoff, when well designed and constructed with appropriate native plantings, than dry basins.

Stormsewers

In most cases, detention basins take on water from the surrounding stormsewer networks (stormsewersheds). The location of all known stormsewer networks were delineated by reviewing municipal and stormsewer maps where available. AES used 2006 aerial photography and available 2-foot contour topography data to map detention areas where existing data was not available. Figure 28 identifies:

- all areas in the watershed that are not developed (Lake, Cook, and McHenry County),
- areas developed and sewered/detained prior to 1992 (Lake County only),
- areas developed and sewered/detained after 1992 (Lake County only),
- areas that are developed and not sewered/detained (Lake, Cook, and McHenry County),
- all areas that are detained in Cook County.

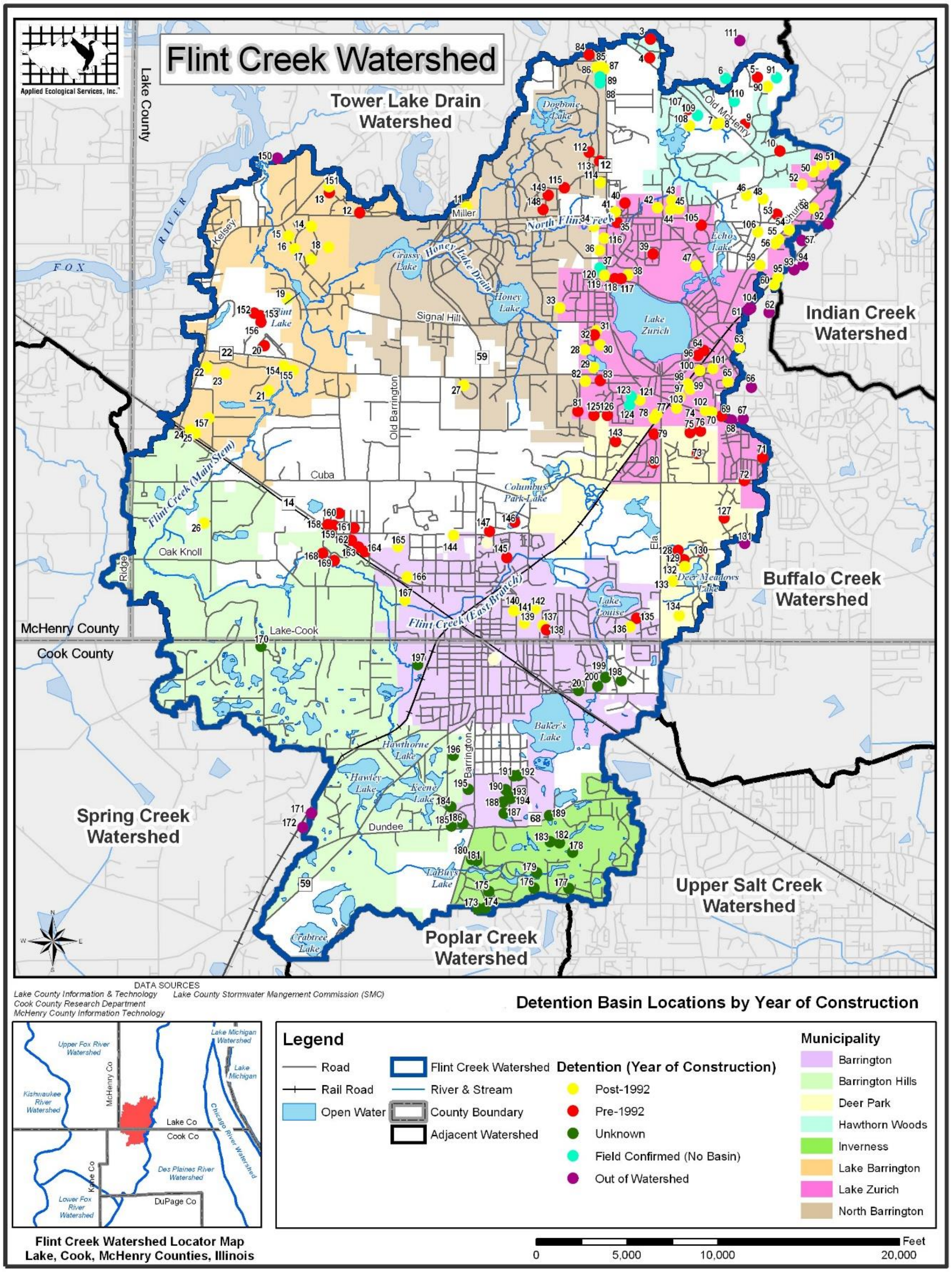


Figure 27: Detention Basin Location by Year of Construction

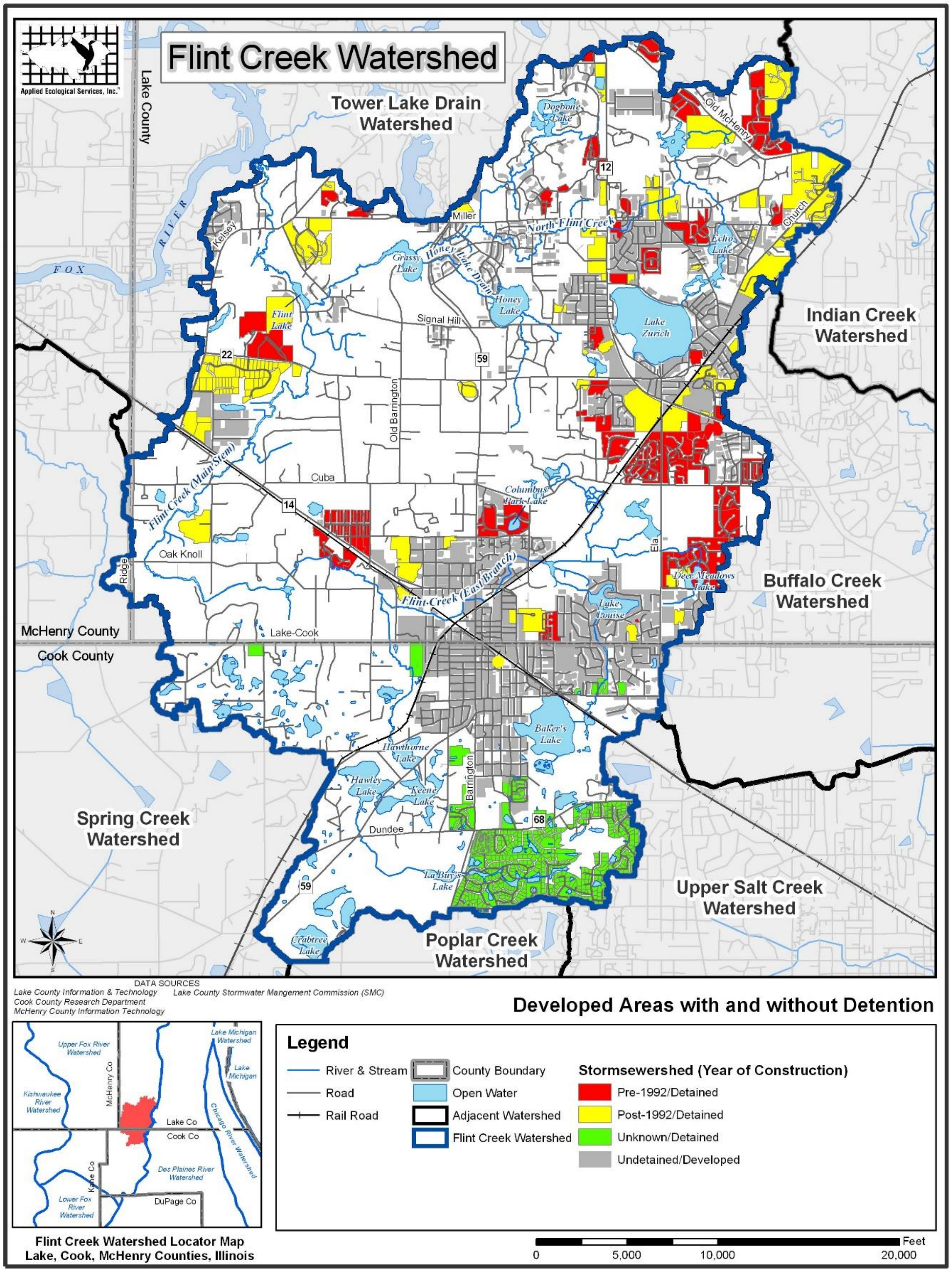


Figure 28: Developed Areas with and without Detention

Regionally Significant Storage Locations

Regionally Significant Storage Locations (RSSLs) are defined as existing or created depressional areas that are presently storing, or potentially could store, stormwater runoff to decrease flooding in the Flint Creek watershed. In many cases, potential storage locations coincide with potential wetland restoration sites and could be created to mitigate for wetland losses occurring via development. More importantly, existing and potential storage areas present opportunities to mitigate for Flood Problem Areas (FPAs). The criteria used to identify existing and potential storage locations in the watershed are summarized below.

Existing Storage Areas

- include all detention basins, 100-year floodplains, open water (streams and lakes), hydric soils, and wetlands;
- exclude parcels less than 1/3 acre, transportation, and building footprints;
- use 2-foot boundary elevation (assumes 2 feet of storage for each location and provides appropriate hemi-marsh wetland creation dimensions and water depths).

Potential Storage Areas

- include all areas with 1% slope or less and merge with hydric soils and 100-year floodplain;
- exclude transportation, building footprints, and existing storage locations;
- only include locations greater than 5 acres and assume 2 feet of storage for each location.

The location of each existing regional storage sites is shown on Figure 29. The larger storage areas are existing lakes, large wetland areas such as Cuba Marsh, and 100-year floodplain areas along Flint Creek. Note: FEMA has recently released updated Flood Maps. (https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd)

Ninety-seven (97) initial potential storage locations were identified using the criteria listed above. However, the initial 97 sites were reduced to 50 following a rigorous review using a 2006 aerial to identify potentially feasible sites (Figure 30). The majority of the omitted sites were located in areas that are currently developed. The 50 potential sites could store an estimated 1,326 additional acre-feet of stormwater assuming each exhibits an average of 2 feet of storage volume. Two feet of storage can be created by constructing a 2-foot tall berm at the lowest elevation along each identified potential storage area. A 2-foot berm was selected because it can potentially hold back enough water to provide the optimum depth to support a functioning hemi-marsh-type wetland that has the potential to harbor various wetland plant and animal species as well as store significant amounts of stormwater. Water surface fluctuations greater or less than 2 feet in a hemi-marsh encourage growth of non-native/invasive species such as cattails in areas that are designed to be open water.

The largest potential storage locations are outlined in red, orange, and yellow on Figure 29 and Table 14. Smaller sites are shown in two shades of green. Generally speaking, potential sites located on open space or agricultural land are the most feasible and easiest to implement. Site 39 was the largest identified storage area but has limited feasibility because it is located on a golf course. The next three largest sites (4, 14, and 35) have high potential because they are largely located on open space or agricultural land where opportunities are greater and easier to implement. With climate change, governmental agencies will need to re-examine their capabilities and options to retain floodwaters.

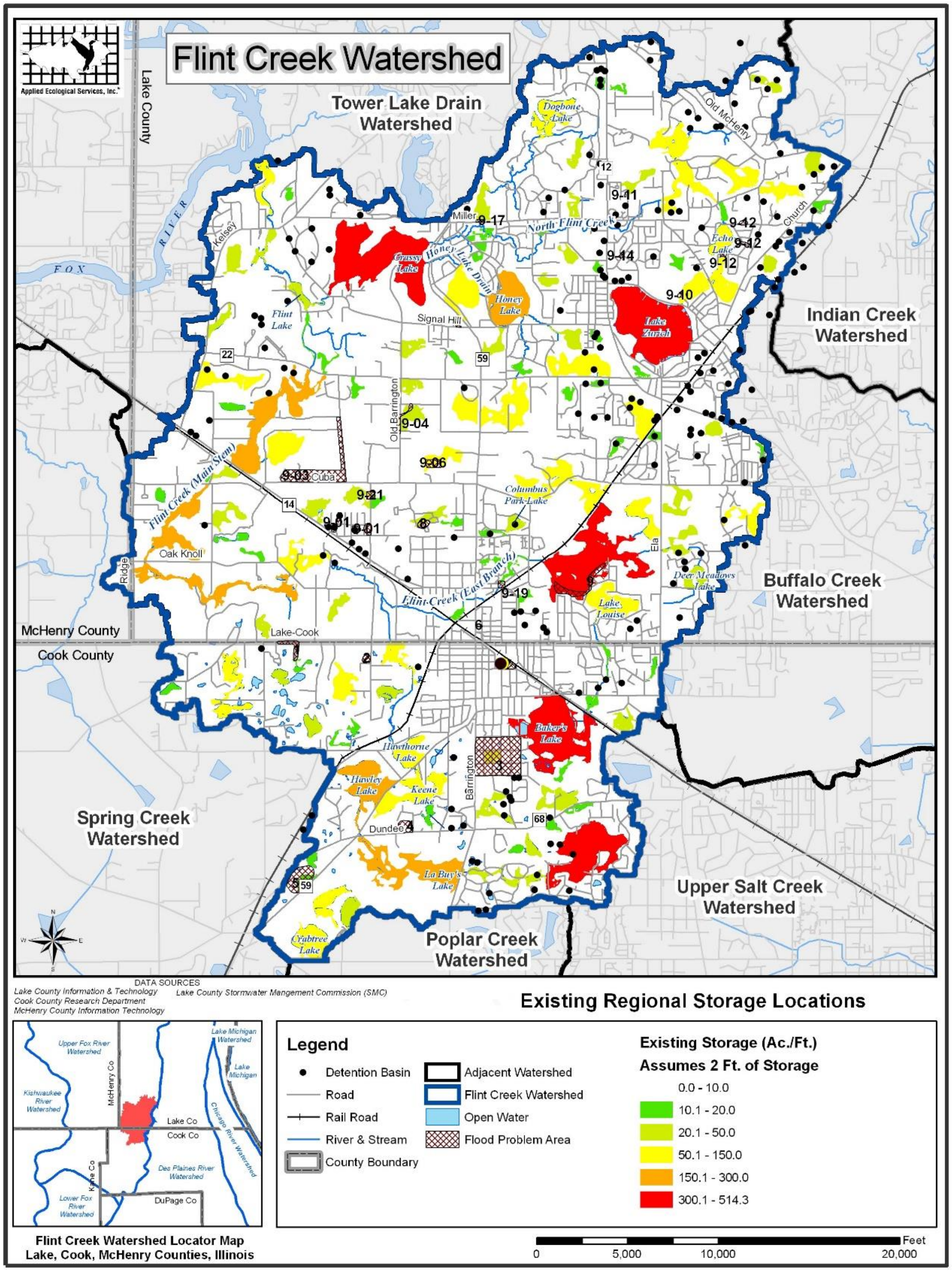


Figure 29: Existing Regional Storage Locations

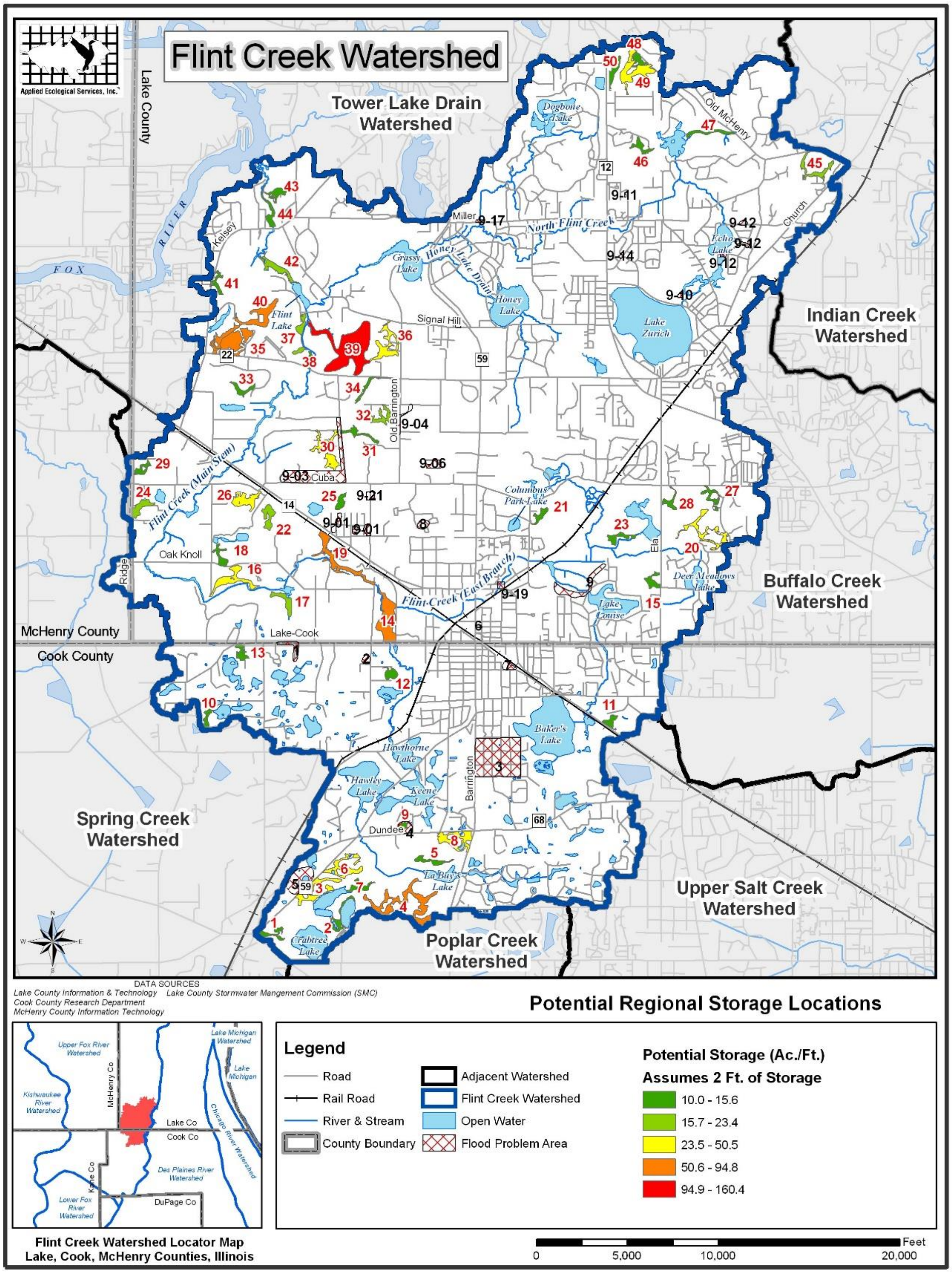


Figure 30: Potential Regional Storage Locations

Table 15. Ranking of potential significant storage locations by 2-foot depressional storage volume

Rank	Map ID	Acres	2-foot Depressional Volume (acre-feet)	Existing Feasibility
1	39	80.1	160.4	*Limited:* west half on golf course; existing wetland on east half
2	4	47.3	94.8	*Potential:* open space and agricultural land
*3	14	35.9	72.0	*Potential:* open space, existing wetland, stream/floodplain; development starting
4	35	31.6	63.4	*Potential:* agricultural land
5	40	27.9	56.0	*Limited:* treatment plant and agricultural land
6	19	27.4	54.9	*Limited:* online with stream/ wetland/ floodplain
7	49	25.2	50.5	*Potential:* agricultural land
8	30	19.8	39.6	*Limited:* large lot residential
9	36	18.5	37.0	*Limited:* existing wetland surrounded by residential
10	3	17.8	35.7	*Potential:* open space
11	16	17.6	35.3	*Limited:* large lot residential in close proximity
12	20	17.4	34.9	*Potential:* open space
13	8	17.1	34.2	*Potential:* open space
14	6	15.5	31.0	*Potential:* open space
15	26	14.9	29.9	*Potential:* agricultural land
16	42	11.7	23.4	*Limited:* online with stream/floodplain
17	45	10.5	21.0	*Limited:* surrounded by agriculture, residential, and commercial
18	22	9.9	19.9	*Potential:* agricultural land
19	32	9.7	19.5	*Potential:* open space and agricultural land
20	24	9.5	19.1	*Limited:* close proximity to large lot residential
21	17	8.8	17.7	*Limited:* existing golf course
22	37	8.6	17.2	*Limited:* existing golf course
23	2	7.8	15.6	*Potential:* open space
24	50	7.6	15.3	*Potential:* agricultural land
25	44	7.6	15.2	*Limited:* online with stream/floodplain
26	7	7.5	15.1	*Potential:* open space
27	27	7.4	14.8	*Limited:* partially developed
28	43	7.3	14.7	*Potential:* open space
29	31	7.3	14.6	*Limited:* close proximity to large lot development
30	23	7.2	14.5	*Potential:* open space
31	47	7.1	14.2	*Limited:* existing ditch between agricultural and commercial development

32	18	7.0	14.1	*Potential:* open space
33	5	6.8	13.7	*Potential:* open space
34	15	6.7	13.5	*Potential:* open space
35	1	6.5	13.1	*Potential:* open space
36	13	6.5	13.1	*Potential:* open space
37	46	6.3	12.7	*Potential:* agricultural and commercial open space
38	12	6.2	12.4	*Potential:* agricultural land
39	34	6.1	12.2	*Limited:* existing wetland surrounded by large lot residential
40	33	6.0	11.9	*Potential:* open space north of industrial area
41	48	5.8	11.6	*Potential:* agricultural land
42	25	5.7	11.5	*Potential:* open space
43	9	5.7	11.4	*Limited:* close proximity to large lot development
44	29	5.6	11.3	*Limited:* close proximity to large lot development
45	21	5.4	10.7	*Potential:* open space
46	41	5.2	10.4	*Potential:* open space
47	10	5.2	10.3	*Potential:* open space
48	11	5.2	10.3	*Limited:* existing golf course
49	28	5.1	10.3	*Limited:* existing wetland
50	38	5.0	10.0	*Limited:* existing golf course
		661.7	**1325.9**	

*Documented in LCSMC 1994 Flint Creek Watershed Management Plan

3.2 Condition of Sub Watersheds and Lakes

As noted earlier, the Flint Creek Watershed consists of three subwatersheds:

1. North Flint Creek subwatershed includes several major lakes: Lake Zurich, Echo Lake, Honey Lake, Grassy Lake, Dogbone Lake and Flint Lake. This entire area is located within Lake County. North Flint Creek is on-line with all of these lakes except Flint (which it feeds), Honey (on-line of a tributary), and Dogbone Lakes (on-line of a tributary), which are primarily fed by smaller drainage systems and surrounding watersheds. North Flint Creek subwatershed is 10.7 square miles.

2. Baker's Lake, Columbus Park Lake, Lake Louise, and Deer/Meadows Lake are located in the Flint Creek (east branch) subwatershed. Baker's Lake and Lake Louise are on-line with the creek in Cook County and Lake County respectively. Flint Creek (east branch) covers 8.5 square miles.

3. LaBuy's Lake, Hawley Lake, Keene Lake, and Hawthorne Lake are all located within Flint Creek (main stem) subwatershed and are on-line with the creek in Cook County. Crabtree Lake, Stephanie Lake, and Heather Lake are also located within Cook County but are hydrologically connected to Flint Creek's main stem via surface or tile drainage. This main stem of Flint Creek covers 17.3 square miles.

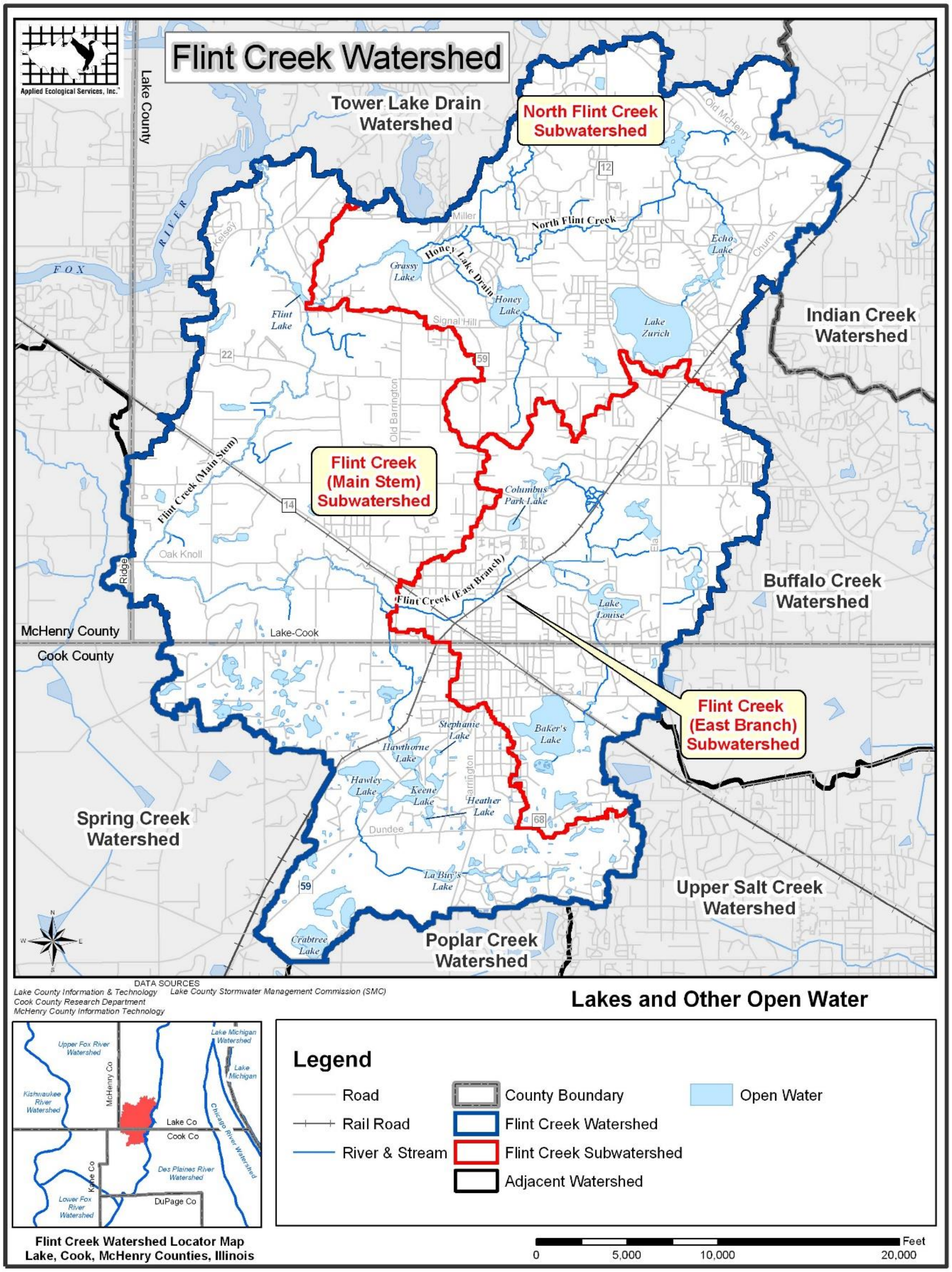


Figure 31: Lakes and Other Open Water

Flint Creek watershed contains 26 SMUs. According to the CWP, SMUs should generally fall between 0.05 and 0.5 square miles but can be larger depending on the location of small subwatershed divides. This size allows for detailed analysis and recommendations for site specific Best Management Practices (BMPs). Table 19 presents each SMU and acreage organized by each of the three subwatersheds. Figure 30 depicts the location of each subwatershed and SMU boundaries delineated within the larger Flint Creek watershed.

Table 16. Subwatershed Management Units and acreage organized by subwatershed.

Subwatershed	SMU #	Total Acres	Total Square Miles
Flint Creek Main Stem	FCM1	1,108	1.7
Flint Creek Main Stem	FCM2	1,203	1.8
Flint Creek Main Stem	FCM3	1,057	1.7
Flint Creek Main Stem	FCM4	1,653	2.6
Flint Creek Main Stem	FCM5	1,232	1.9
Flint Creek Main Stem	FCM6	830	1.3
Flint Creek Main Stem	FCM7	1,176	1.8
Flint Creek Main Stem	FCM8	917	1.4
Flint Creek Main Stem	FCM9	748	1.2
Flint Creek Main Stem	FCM10	1,146	1.8
Flint Creek Main Stem Subtotal		**11,070**	**17.3**
North Flint Creek	FCN1	675	1.1
North Flint Creek	FCN2	1,253	2.0
North Flint Creek	FCN3	1,408	2.2
North Flint Creek	FCN4	1,171	1.8
North Flint Creek	FCN5	710	1.1
North Flint Creek	FCN6	1,079	1.7
North Flint Creek	FCN7	568	0.9
North Flint Creek Subtotal		**6,864**	**10.7**
Flint Creek East Branch	FCE1	369	0.6
Flint Creek East Branch	FCE2	650	1.0
Flint Creek East Branch	FCE3	1,115	1.7
Flint Creek East Branch	FCE4	481	0.8
Flint Creek East Branch	FCE5	902	1.4
Flint Creek East Branch	FCE6	241	0.4
Flint Creek East Branch	FCE7	679	1.1
Flint Creek East Branch	FCE8	719	1.1
Flint Creek East Branch	FCE9	284	0.4
Flint Creek East Branch Subtotal		**5,440**	**8.5**
Watershed Total		**23,374**	**36.5**

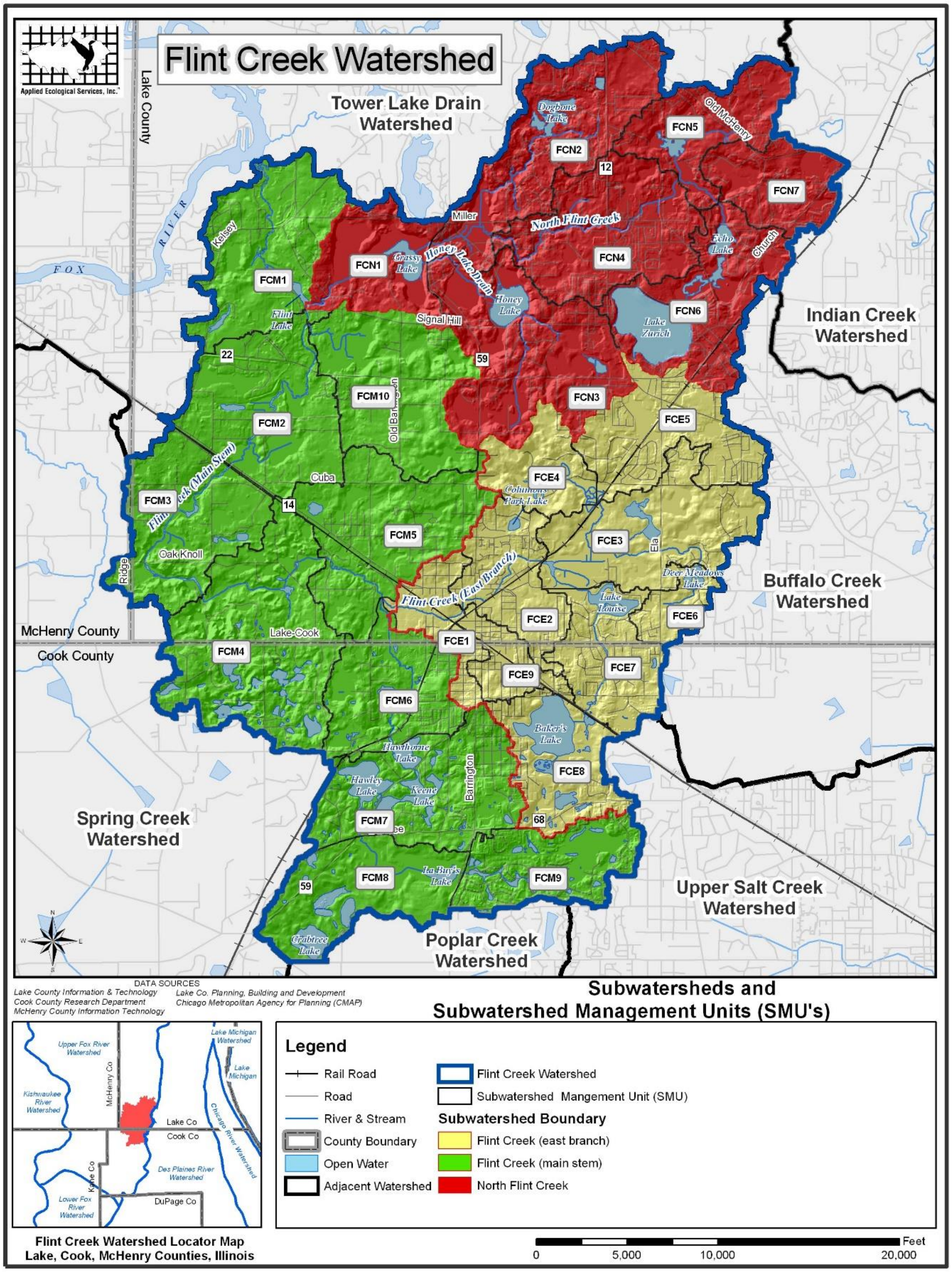


Figure 32: Subwatersheds and Subwatershed Management Units (SMU's)

The headwaters of Flint Creek (main stem) originate in Cook County in a series of detention ponds east of Barrington Road in the far southeast corner of the watershed. From here, a stream channel flows west under Barrington Road and into LaBuy's Lake located within the Crabtree Nature Preserve in the southern portion of the watershed (Figure 30). Water leaving the lake flows to the west before turning north and entering the Hawley, Keene, and Hawthorne Lake chain. Water exits this chain of lakes on the north side of Hawley Lake and flows north where it enters Lake County at Lake-Cook Road and eventually joins Flint Creek (east branch) just northwest of Barrington.

Flint Creek (east branch) originates at Baker's Lake in Cook County where it generally flows north across Lake-Cook Road into Lake Louise (Figure 30). The stream channel that exits Lake Louise flows through the southeast portion of Cuba Marsh where it joins several smaller tributaries that drain the marsh and Deer Lake/Meadows Lake east of Ela Road. At this point Flint Creek (east branch) turns to the west and flows through heavily developed areas in Barrington before joining Flint Creek (main stem).

After Flint Creek (main stem) and Flint Creek (east branch) converge, the main stem continues to the west through large lot residential areas before turning back to the north through additional large lot development and extensive wetland complexes managed by Citizens for Conservation (CFC) (Figure 30). The main stem eventually enters Flint Lake where it joins North Flint Creek and continues as the main stem of Flint Creek for approximately 1.7 miles to the Fox River. Much of this final 1.7 mile reach to the Fox is located within the Grassy Lake Forest Preserve.

The headwaters of North Flint Creek originate within the surrounding watershed to Lake Zurich (Figure 30). Water leaving Lake Zurich to the north flows for a short distance through wetland complexes before entering Echo Lake. From Echo Lake, the stream turns to the west where it flows for several miles through varying residential and open space land uses before entering Grassy Lake. Wynstone tributary enters North Flint Creek just upstream from Grassy Lake. It drains Dogbone Lake (formerly known as Sheree Lake) and its surrounding watershed within the Wynstone Golf Course. Another small tributary called Honey Lake Drain enters Grassy Lake from the east. Honey Lake Drain actually begins just southeast of Honey Lake as two small feeder streams to the lake. Water exiting Grassy Lake to the west again forms the North Flint Creek stream channel that flows west for another mile before entering Flint Lake where it joins Flint Creek (main stem).

In 1991, the Illinois Water Survey determined Flint Creek to be the most degraded of the Fox River's tributaries. The report also stated that Flint Creek possessed above average potential for restoration. At that time, Flint Creek's problems arose from a variety of causes. Residue from road and parking lot salts, fertilizers, pesticides and other chemicals had found their way into the creek. The deep rooted native plants which had originally stabilized the banks, had long been supplanted by shallow rooted, non-native species, such as reed canary grass. At many points, shallow rooted buckthorn, a very aggressive non-native, had shaded out ground vegetation, leaving banks open to further erosion and collapse. Silt had nearly filled Flint Lake. Restoration would be a long, necessarily persistent effort.

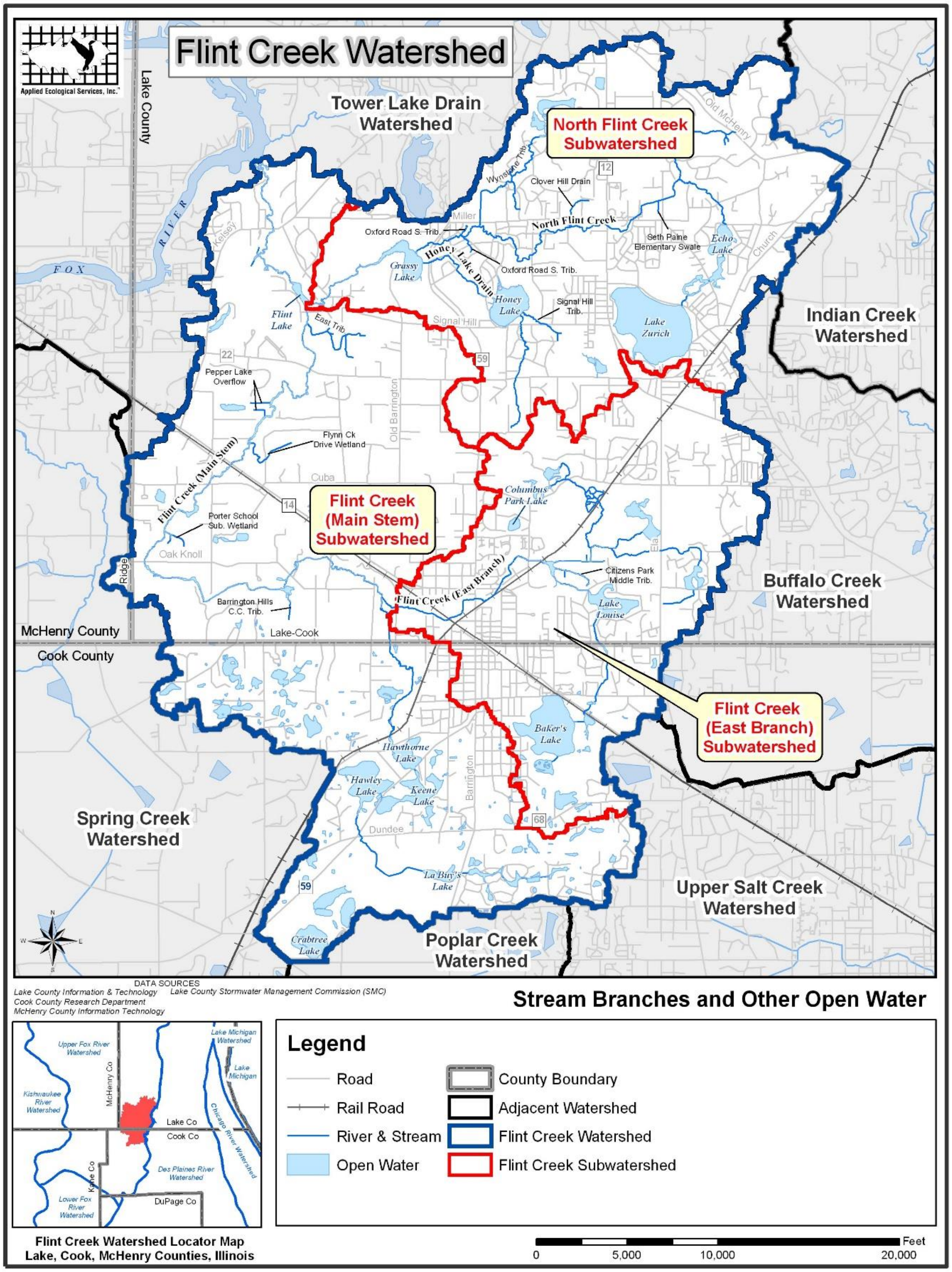


Figure 33: Stream Branches and Other Open Water

While huge strides have been made, there was still much to do. In the summer of 2006, the Lake County Stormwater Management Commission (LCSMC) completed a stream inventory for the Flint Creek watershed. Approximately 24 stream miles were assessed based on dividing major streams into 25 smaller stream reaches (Figure 32 on page 84). Stream reaches are defined as stream segments having fairly homogenous hydraulic, geomorphic, riparian cover, and land use characteristics. Approximately 8.5 miles and 11 reaches comprised of wetlands and lakes connecting stream reaches were not assessed in the stream inventory. Methodology included walking the stream reaches, collecting measurements, taking photos, and noting in-stream, streambank, and riparian corridor characteristics. A Global Positioning System (GPS) was used to locate points of interest to be included in a Geographical Information System (GIS) database. Appendix C contains a detailed summary report of stream reach characteristics in the watershed. Note: The LCSMC Stream Inventory Summary Report uses slightly different nomenclature related to major streams in the watershed as is used throughout this watershed report. First, this report refers to the stream that begins near Crabtree Nature Preserve and flows to the Fox River as Flint Creek (main stem). LCSMC refers to the 1.7 mile stretch between Flint Lake and the Fox River as the main stem. Also, this report refers to North Flint Creek as the entire reach of stream from Flint Lake to Lake Zurich. The LCSMC inventory refers to the reach between Grassy Lake and Flint Lake as the Grassy Lake Drain and the reach between Grassy Lake and Lake Zurich as North Flint Creek.

The major stream characteristics inventoried include:

- Channel conditions (physical size, streambank erosion, sediment accumulation, debris load, riffle-pool development, and hydraulic structures) and discharge points (channel and stormsewer outfall sizes and locations),
- Riparian corridor (land use and vegetated buffer width and composition),
- Aquatic habitat (substrate composition, in-stream fish cover, turbidity, and filamentous algae).

Streambank Erosion


Isolated streambank erosion along Reach FC02 between Kelsey Road and Flint Lake

Streambank erosion and its associated sediment accumulation and transportation downstream can cause significant water quality problems in any watershed. Degree of erosion usually depends on the amount of water **scouring a channel**, the steepness of the banks, and the vegetation that is holding the banks in place. A significant find in LCSMC's stream inventory is that although **some severe erosion can be found in isolated areas, no stream reach exhibits severe erosion along its entire length**. This is a surprising find in light of known flashy stream conditions that occur following significant rain events. According to the stream inventory, 15 of 25 (60%) reaches are experiencing low erosion while 8 reaches (32%) are moderately eroded. Five of these moderately eroded reaches occur along North Flint Creek where **moderate channelization** is also observed. Reach FC21 between Hawley and LaBuy's Lakes appears to be experiencing moderate erosion, likely due in part to highly channelized banks. Two other moderately eroded reaches are found along Flint Creek's main stem (FC04 & FC08). All moderately eroded stream reaches provide excellent opportunities for streambank stabilization projects. The location and severity of streambank erosion in the watershed is summarized in Table 17 and depicted on Figure 34.

Table 17. Summary of streambank erosion in the streams of the Flint Creek Watershed.

Stream	Total Stream Length Assessed (ft)	Total Low or No Erosion (ft/%)		Total Moderate Erosion (ft/%)		Total High Erosion (ft/%)	
Flint Creek (main stem)	63,500	55,300	87%	8,200	13%	0	0%
Flint Creek (east branch)	17,700	17,700	100%	0	0%	0	0%
North Flint Creek & Honey Lake Drain	45,000	13,400	30%	31,600	70%	0	0%
Totals	**126,200**	**86,400**	**68%**	**39,800**	**32%**	**0**	**0%**

Source: LCSMC's Stream Inventory for Flint Creek watershed.

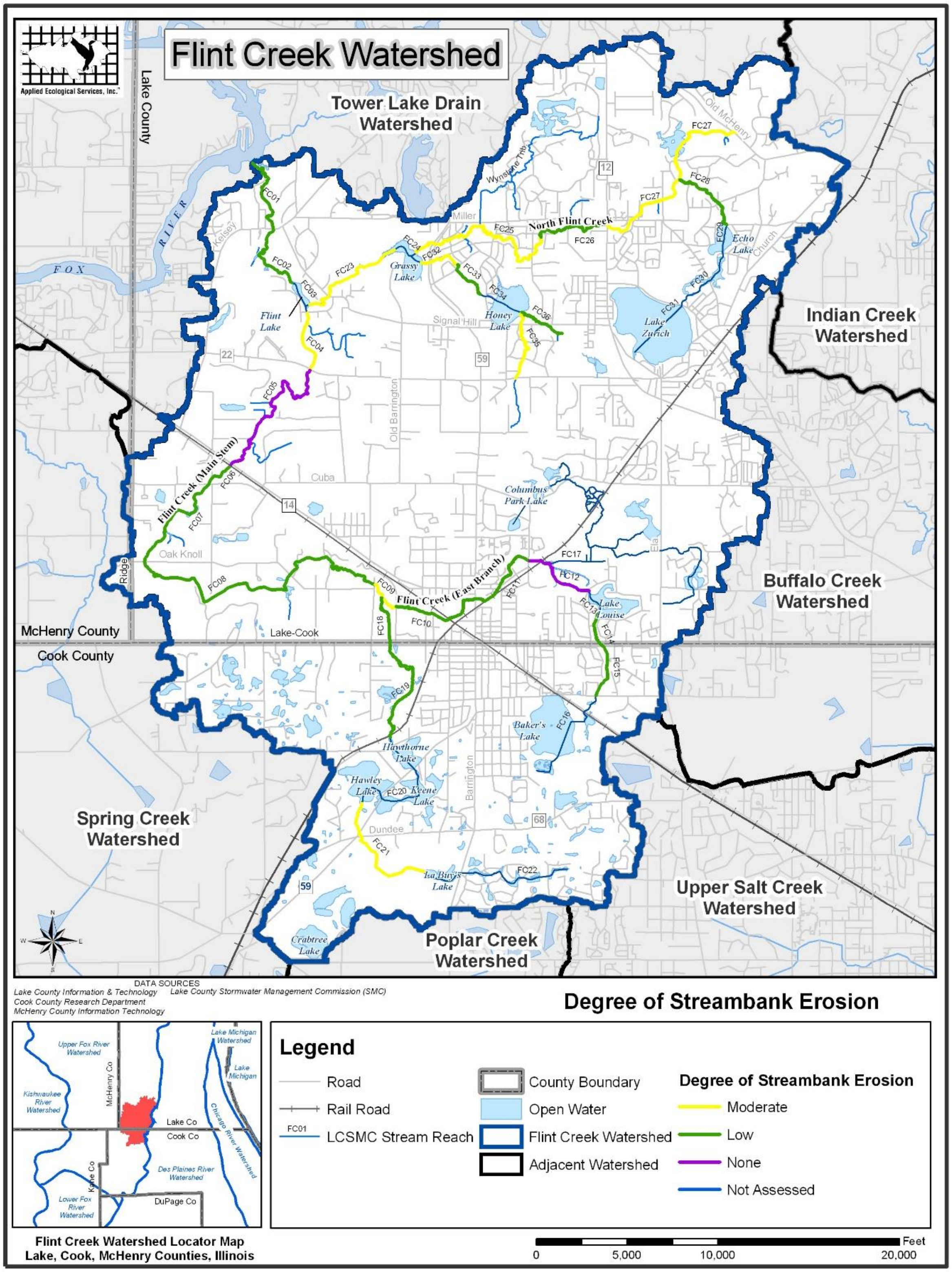


Figure 34: Degree of Streambank Erosion

Sediment Accumulation

Although sediment accumulation and transport is a naturally occurring process in meandering streams, the amount of deposition can be problematic as a result of human activity. In most cases, sediment accumulation in streams is associated with streambank erosion and gradient of the stream. Higher gradient streams tend to transport sediment more readily than lower gradient streams. However, other factors such as debris loads (blockages) and impoundments also cause sedimentation. Sedimentation negatively impacts streams because fine silty particles settle out of the water column and smother the natural gravel or cobble substrates thereby reducing habitat quality for fish and macroinvertebrates. According to LCSMC's stream inventory, all stream reaches in the watershed experience some degree of sediment accumulation. Eighty-four percent (21 of 25 reaches) have moderate or high degrees of accumulation (Figure 35). All of the high sediment accumulation is found on Flint Creek's main stem. FC21, which also is highly channelized and has moderate streambank erosion, exhibits high sediment accumulation. Table 18 below summarizes sediment accumulation in the streams of the watershed.

Table 18. Summary of sediment accumulation in the streams of the Flint Creek Watershed.

Stream	Total Stream Length Assessed (ft)	Total Low or No Sediment (ft/%)		Total Moderate Sediment (ft/%)		Total High Sediment (ft/%)	
Flint Creek (main stem)	63,500	4,600	7%	26,900	42%	32,000	50%
Flint Creek (east branch)	17,700	5,000	28%	12,700	72%	0	0%
North Flint Creek & Honey Lake Drain	45,000	4,100	9%	40,900	91%	0	0%
Totals	**126,200**	**13,700**	**11%**	**80,500**	**64%**	**32,000**	**25%**

Source: LCSMC's Stream Inventory for Flint Creek watershed.

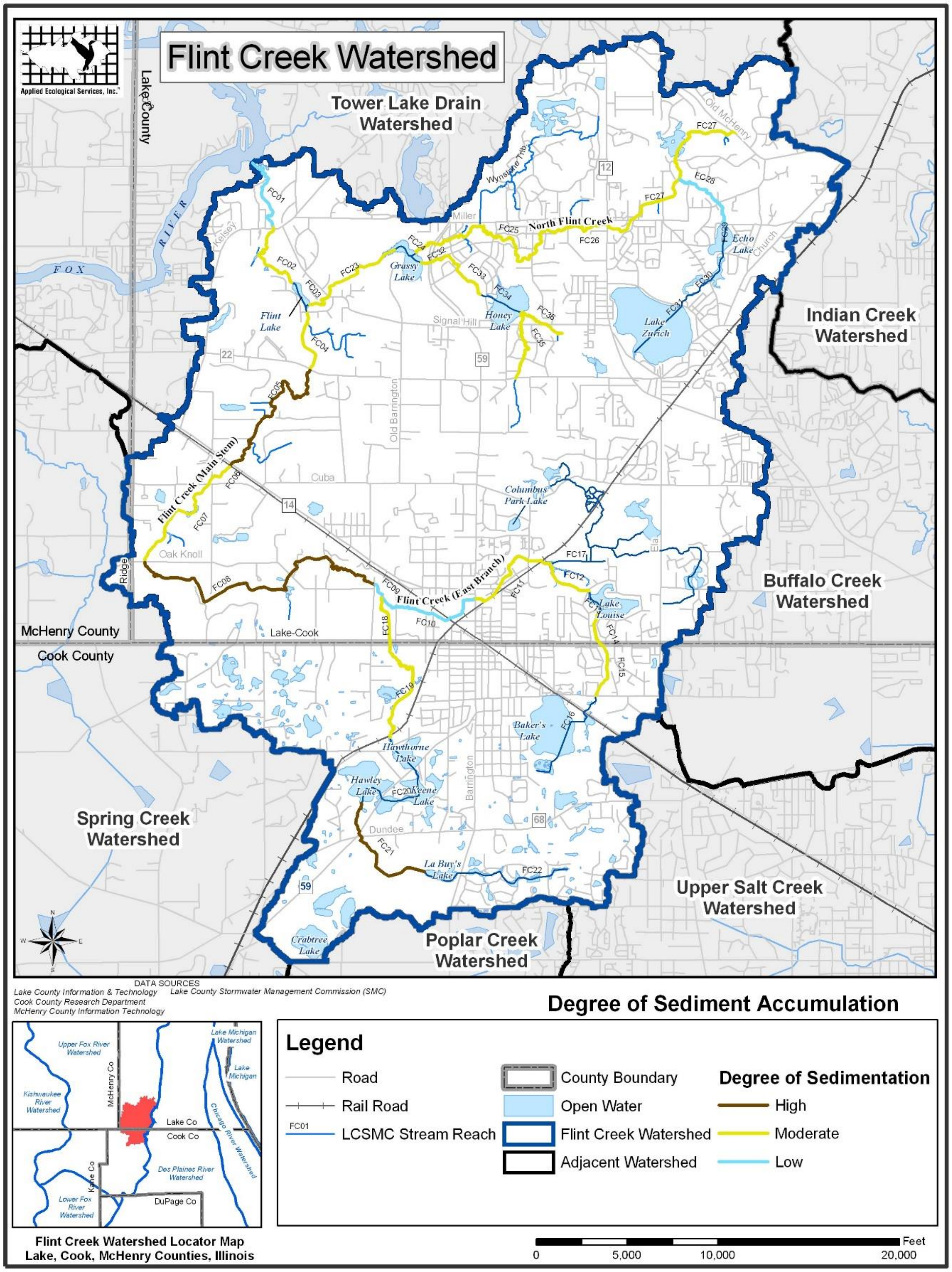


Figure 35: Degree of Sediment Accumulation

Debris Loads

Natural and human-made debris loads refer to debris accumulation and blockages, both in-stream and overbank, that can alter the natural flow regime in streams and contribute to streambank erosion, sediment accumulation, and backwater flooding. Reaches that failed the LCSMC's in-stream or overbank test were usually characterized as having large accumulations of lodged debris across the stream channel and over the banks. Problematic debris loading was identified in 14 of the 25 (56%) inventory reaches and appears to be scattered throughout the stream reaches in the watershed (Figure 35). Debris load removal is a relatively easy stream maintenance issue in which all jurisdictions in the watershed should participate and adopt a general maintenance program. Caution should be taken, however, when removing debris jams because not all are considered problematic. In fact, many provide excellent habitat for aquatic fauna. The American Fisheries Society published "*American Fisheries Society Obstruction Removal Guidelines*" (SRGC 1983) (Appendix D). These guidelines employ debris removal techniques based on the severity and type of obstruction. Additional stream maintenance/ monitoring guidelines are included in Appendix E of this report. Table 19 below summarizes debris loading in the watershed found in 2006. North Barrington has made clearing debris loads a major focus for some of their stream maintenance procedures, and it continues to be a major initiative in 2018.

Debris jam in Reach FC02 between Kelsey Road and Flint Lake

Table 19. Summary of debris loading in the streams of the Flint Creek Watershed.

Stream	Total Stream Length Assessed (ft)	Problematic Debris Loading Present (ft/%)		Problematic Debris Loading Not Present (ft/%)	
Flint Creek (main stem)	63,500	33,700	53%	29,800	47%
Flint Creek (east branch)	17,700	12,300	69%	5,400	31%
North Flint Creek & Honey Lake Drain	45,000	30,200	67%	14,800	33%
Totals	126,200	76,200	60%	50,000	40%

Source: LCSMC's Stream Inventory for Flint Creek watershed.

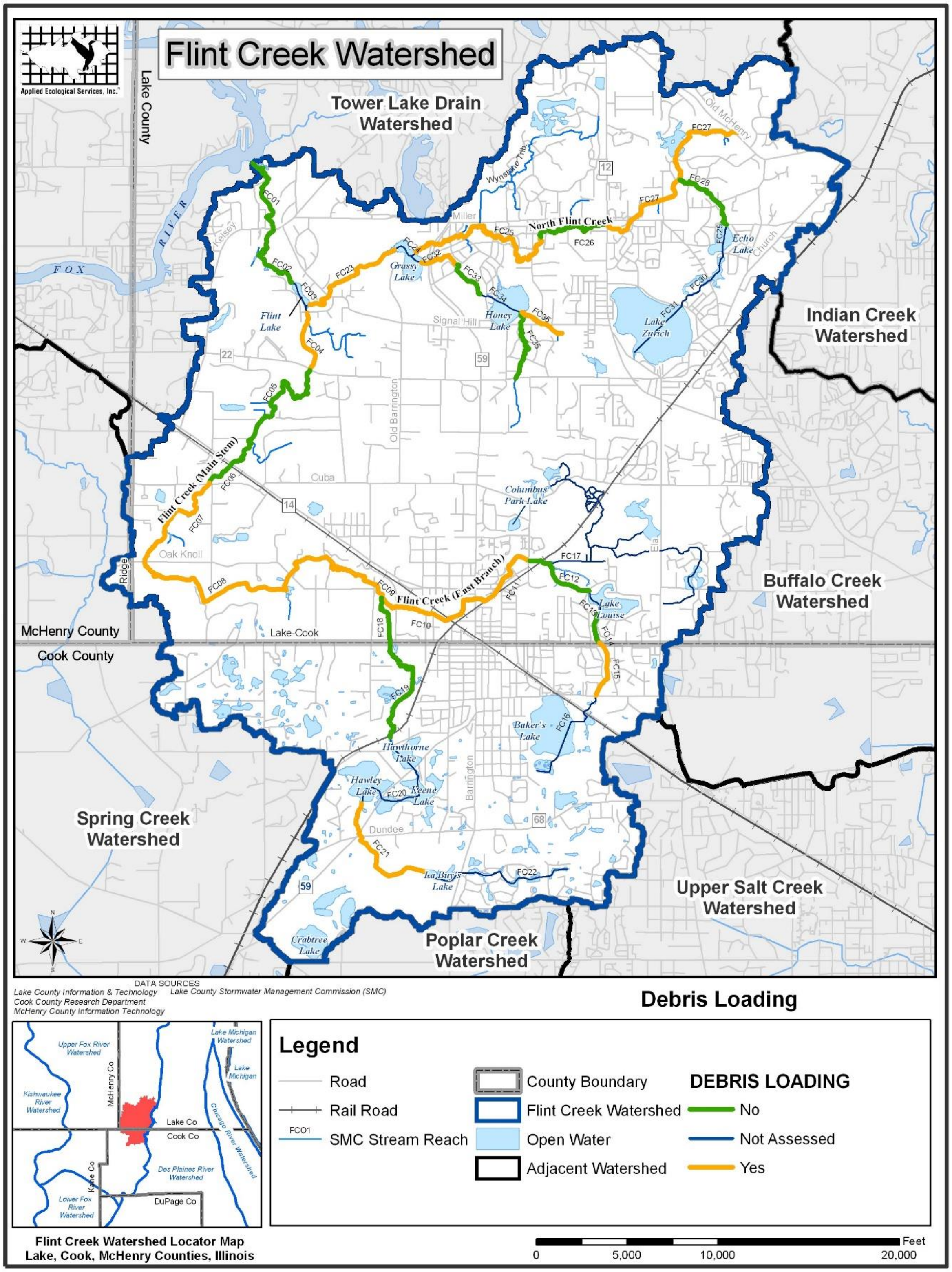


Figure 36: Debris Loading

Hydraulic Structures

Problematic hydraulic structure (bridge) crossing Reach FC35

Hydraulic structures are objects in the stream channel that alter the natural flow by constricting, diverting, redirecting, or damming. Hydraulic structures generally include all bridges, culverts, dams, weirs, and fences that span the channel. These structures may cause flooding, streambank erosion, and impede movement of fish and other aquatic fauna up or downstream. In some cases, poorly constructed hydraulic structures lead to debris jams that further restrict or inhibit flow. Dams can be extremely detrimental to the natural processes of streams. They impound water and act as migration impediments for aquatic fauna. LCSMC's stream inventory noted 136 hydraulic structures in the Flint Creek watershed including 89 bridges, 27 culverts, 12 dams, 2 weirs, 5 fences, and one "other" type (Table 20). Far more than half (65%) of the noted hydraulic structures are bridges. Of these, 43 are wooden foot bridges. LCSMC reports that a number of the wooden foot bridges do not appear to be in use and could be removed. Of the 136 structures documented by LCSMC, 11 are considered problematic hydraulic structures that are shown by stream reach on Figure 36 and addressed in the Action Plan section of this report. LCSMC did not GPS the location of each individual structure. However, plan implementers can contact the LCSMC for locations of these structures. The majority of the problematic hydraulic structures are located along Flint Creek's main stem between Lake-Cook Road and Flint Creek's junction with North Flint Creek.

Table 20. Hydraulic structures categorized by stream branch in the Flint Creek watershed.

Hydraulic Structures	Entire Flint Creek Watershed Totals	Flint Creek (main stem)	Flint Creek (east branch)	North Flint Creek
Bridges	89	31	18	40
Culverts	27	3	7	17
Dams	12	3	4	5
Weirs	2	0	1	1
Fence	5	1	2	2
Other	1	1	0	0
Total Hydraulic Structures	136	38	32	65
Problem Hydraulic Structures	11	4	2	5

Source: LCSMC's Stream Inventory for Flint Creek watershed.

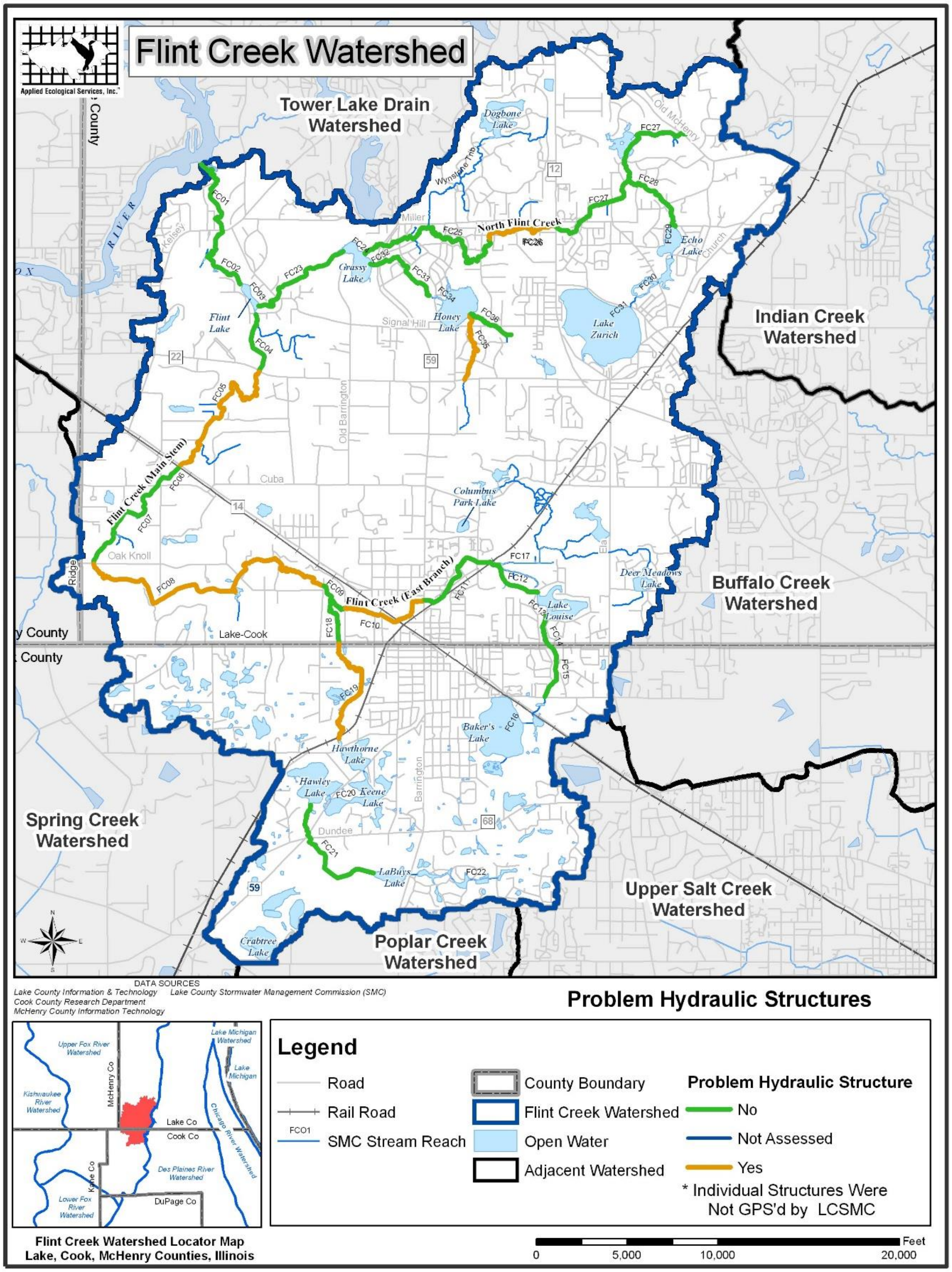


Figure 37: Problem Hydraulic Structures

Riparian Corridor (Buffers)

High quality riparian corridor along Reach FC05 north of Route 14

Riparian corridors buffer waterbodies by filtering pollutants from runoff and by providing beneficial wildlife habitat. Land use within 100 feet of either side of the stream channel was assessed during LCSMC's stream inventory by summarizing the percentage of land falling under six land use categories including residential, commercial/ industrial, recreational, agricultural, open space/vacant, and other. Much of the riparian corridor (approximately 50%) is open space and preserved in public ownership. About 40% is residential and an additional 12% is recreational (mostly golf courses). Vegetation along the streambanks is generally not diverse and dominated by a few species such as buckthorn and reed canary grass. Documentation records for each stream reach were assessed to identify areas needing buffer improvements (Figure 38). All reaches exhibiting no or small buffer widths according to LCSMC's inventory were categorized as high priority for buffer improvements. Reaches with moderate or high buffer widths were categorized as low or medium priority depending on the amount of impacts and the general condition of the vegetation community. Riparian buffer improvements are generally needed most along Flint Creek (east branch) through the Barrington Area and along North Flint Creek and Honey Lake Drain. These areas provide opportunities for improving buffer quality. Recommendations for improving buffer quality are located in the Action Plan section of this report. Table 21 below summarizes the need for riparian corridor improvements in the watershed.

Table 21. Summary of riparian corridor conditions (buffer) in the Flint Creek Watershed.

Stream	Total Stream Length Assessed (ft)	Low or No Need for Improvement (ft/%)		Medium Need for Improvement (ft/%)		High Need for Improvement (ft/%)	
Flint Creek (main stem)	63,500	49,500	78%	10,700	17%	3,300	5%
Flint Creek (east branch)	17,700	5,400	31%	4,300	24%	8,000	45%
North Flint Creek & Honey Lake Drain	45,000	6,000	13%	32,400	72%	6,600	15%
Totals	126,200	60,900	48%	47,400	38%	17,900	14%

Source: LCSMC's Stream Inventory for Flint Creek watershed.

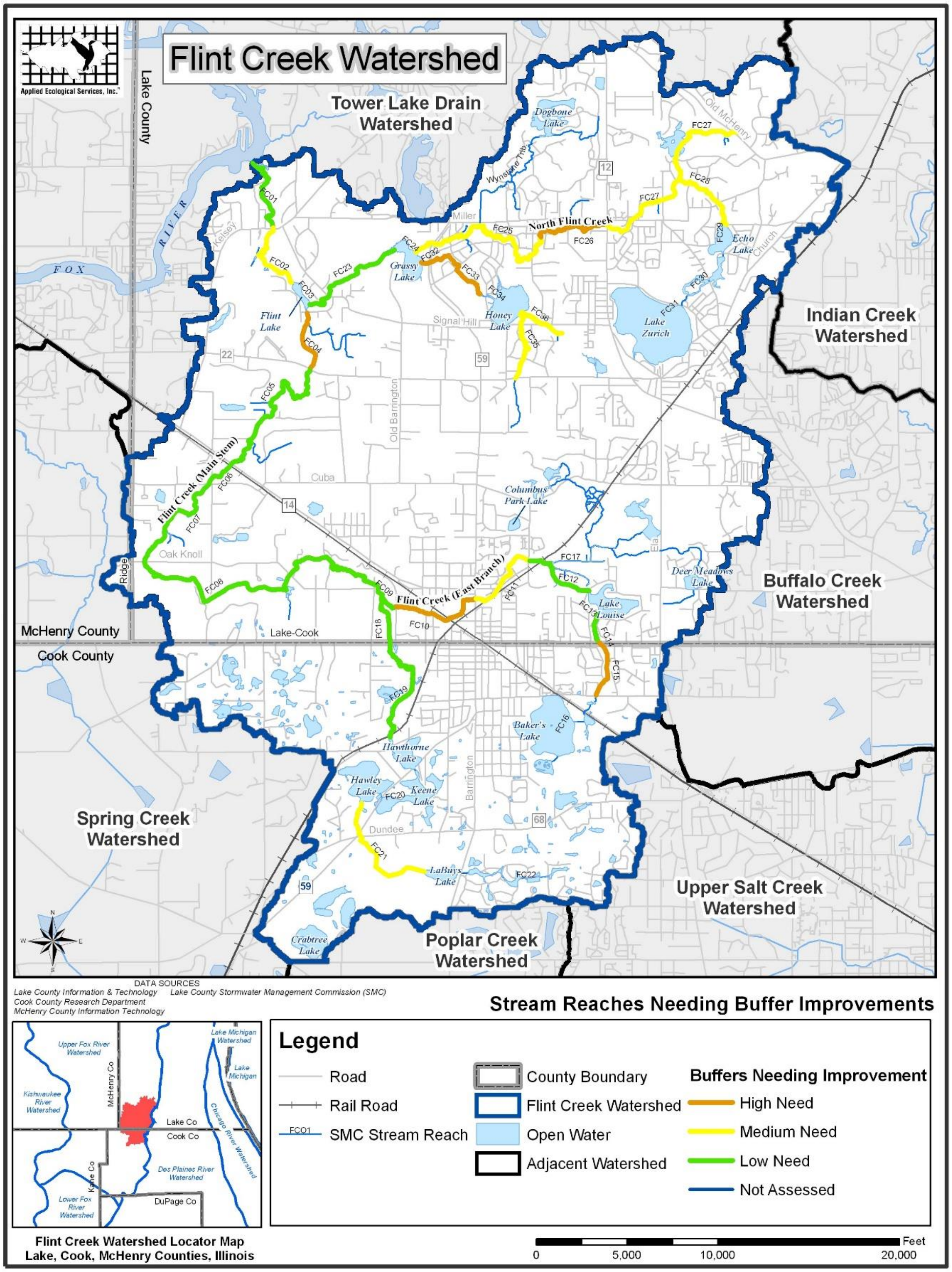


Figure 38: Stream Reaches Needing Buffer Improvements

Detail on Impervious Cover by SMU

In 2007, Impervious cover for each SMU was calculated based on existing land use/land cover classifications. Six SMUs are initially classified as Sensitive, 13 as Impacted, and 7 as Non-Supporting. The majority of the Sensitive SMUs are located in the western half of the watershed in the Villages of North Barrington, Lake Barrington, and Barrington Hills. These areas are primarily dominated by large lot residential and open space areas such as forest preserve and other protected land. Impacted SMUs are the most abundant and scattered throughout the watershed. A closer look at land use/land cover in these SMUs reveals mostly small and medium size residential lots with smaller areas of protected open space. All of the 7 Non-Supporting SMUs are located in highly developed areas associated with Barrington and Lake Zurich. These areas not only have dense small lot residential areas but also many retail, commercial, industrial, institutional/government, and office space.

Table 22. Existing impervious cover information for Subwatershed Management Units (SMUs).

Subwatershed	SMU #	Total Acres	Existing Impervious Percentage	Existing Impervious Classification
Flint Creek Main Stem	FCM1	1,108	14.1	Impacted
Flint Creek Main Stem	FCM2	1,203	23.7	Impacted
Flint Creek Main Stem	FCM3	1,057	7.7	Sensitive
Flint Creek Main Stem	FCM4	1,653	7.3	Sensitive
Flint Creek Main Stem	FCM5	1,232	19.4	Impacted
Flint Creek Main Stem	FCM6	830	19.7	Impacted
Flint Creek Main Stem	FCM7	1,176	17.3	Impacted
Flint Creek Main Stem	FCM8	917	2.3	Sensitive
Flint Creek Main Stem	FCM9	748	17.9	Impacted
Flint Creek Main Stem	FCM10	1,146	8.6	Sensitive
Flint Creek Main Stem Subtotal		**11,070**	**13.8**	**Impacted**
North Flint Creek	FCN1	675	7.3	Sensitive
North Flint Creek	FCN2	1,253	15	Impacted
North Flint Creek	FCN3	1,408	16.6	Impacted
North Flint Creek	FCN4	1,171	27.1	Non-Supporting
North Flint Creek	FCN5	710	19.6	Impacted
North Flint Creek	FCN6	1,079	29.5	Non-Supporting
North Flint Creek	FCN7	568	22.8	Impacted
North Flint Creek Subtotal		**6,864**	**19.7**	**Impacted**
Flint Creek East Branch	FCE1	369	48.4	Non-Supporting
Flint Creek East Branch	FCE2	650	34.8	Non-Supporting
Flint Creek East Branch	FCE3	1,115	11.5	Impacted
Flint Creek East Branch	FCE4	481	7.1	Sensitive
Flint Creek East Branch	FCE5	902	37.3	Non-Supporting
Flint Creek East Branch	FCE6	241	22.9	Impacted
Flint Creek East Branch	FCE7	679	27.3	Non-Supporting
Flint Creek East Branch	FCE8	719	12.0	Impacted
Flint Creek East Branch	FCE9	284	56.1	Non-Supporting
Flint Creek East Branch Subtotal		**5,440**	**28.6**	**Non-Supporting**
Watershed Total		**23,374**	**20.7**	**Impacted**

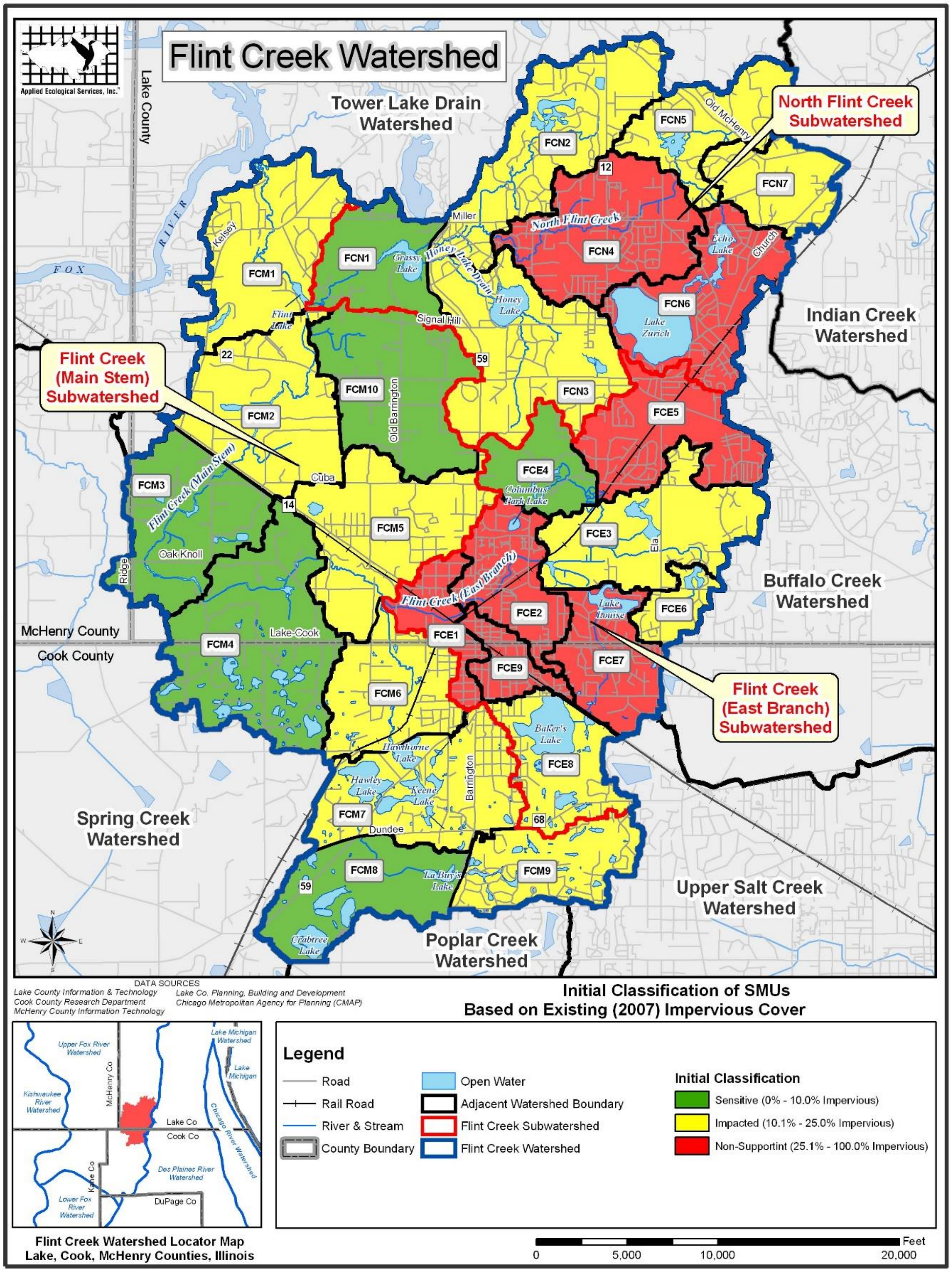


Table 39: Initial Classification on SMUs, Based on Existing Impervious Cover

Projected impervious cover was also evaluated, based on 20-30 year build outs based on comprehensive plans and parcel/zoning information. Similar to the initial classification, a projected classification of Sensitive, Impacted, or Non-Supporting is assigned to each SMU. This view of the future resulted in in 2 Sensitive SMUs, 14 Impacted SMUs, and 10 Non-Supporting SMUs (Table 23; Figure 40). The most significant changes occurred in the western portion of the watershed where four existing Sensitive SMUs are projected to change to Impacted SMUs. These SMUs include FCM3, FCM4, FCM10, and FCE4. This change is projected because the majority of remaining small open space and agricultural land in these watersheds will likely become developed to large lot residential. Also, FCM2, FCE6, and FCN7 are projected to change from impacted to Non-Supporting for many of the same reasons as discussed above. Figure 41 shows the percent change in impervious cover when comparing existing and future projects land use conditions.

Table 23. Projected impervious cover estimates for Subwatershed Management Units (SMUs).

Subwatershed	SMU #	Total Acres	Projected Impervious Percentage	% Change from Existing Impervious	Projected Impervious Classification
Flint Creek Main Stem	FCM1	1,108	22.6	+8.5	Impacted
Flint Creek Main Stem	FCM2	1,203	30.7	+7.0	*Non-Supporting
Flint Creek Main Stem	FCM3	1,057	13.7	+6.0	*Impacted
Flint Creek Main Stem	FCM4	1,653	12.7	+5.4	*Impacted
Flint Creek Main Stem	FCM5	1,232	24.5	+5.1	Impacted
Flint Creek Main Stem	FCM6	830	23.9	+4.3	Impacted
Flint Creek Main Stem	FCM7	1,176	23.1	+5.8	Impacted
Flint Creek Main Stem	FCM8	917	3.3	+1.0	Sensitive
Flint Creek Main Stem	FCM9	748	21.6	+3.7	Impacted
Flint Creek Main Stem	FCM10	1,146	14.4	+5.8	*Impacted
Flint Creek Main Stem Subtotal		**11,070**	**18.1**	**+4.3**	**Impacted**
North Flint Creek	FCN1	675	9.9	+2.6	Sensitive
North Flint Creek	FCN2	1,253	18.6	+3.5	Impacted
North Flint Creek	FCN3	1,408	20.8	+4.2	Impacted
North Flint Creek	FCN4	1,171	29.2	+2.1	Non-Supporting
North Flint Creek	FCN5	710	23.2	+3.6	Impacted
North Flint Creek	FCN6	1,079	29.5	0.0	Non-Supporting
North Flint Creek	FCN7	568	27.6	+4.9	*Non-Supporting
North Flint Creek Subtotal		**6,864**	**22.7**	**+3.0**	**Impacted**
Flint Creek East Branch	FCE1	369	47.9	-0.5	Non-Supporting
Flint Creek East Branch	FCE2	650	38.3	+3.5	Non-Supporting
Flint Creek East Branch	FCE3	1,115	12.5	+0.9	Impacted
Flint Creek East Branch	FCE4	481	12.5	+5.4	*Impacted
Flint Creek East Branch	FCE5	902	37.5	+0.2	Non-Supporting
Flint Creek East Branch	FCE6	241	26.4	+3.5	*Non-Supporting
Flint Creek East Branch	FCE7	679	27.8	+0.5	Non-Supporting
Flint Creek East Branch	FCE8	719	14.1	+2.1	Impacted
Flint Creek East Branch	FCE9	284	54.5	-1.6	Non-Supporting
Flint Creek East Branch Subtotal		**5,440**	**30.2**	**+1.6**	**Non-Supporting**
Watershed Total		**23,374**	**23.7**	**+3.0**	**Impacted**

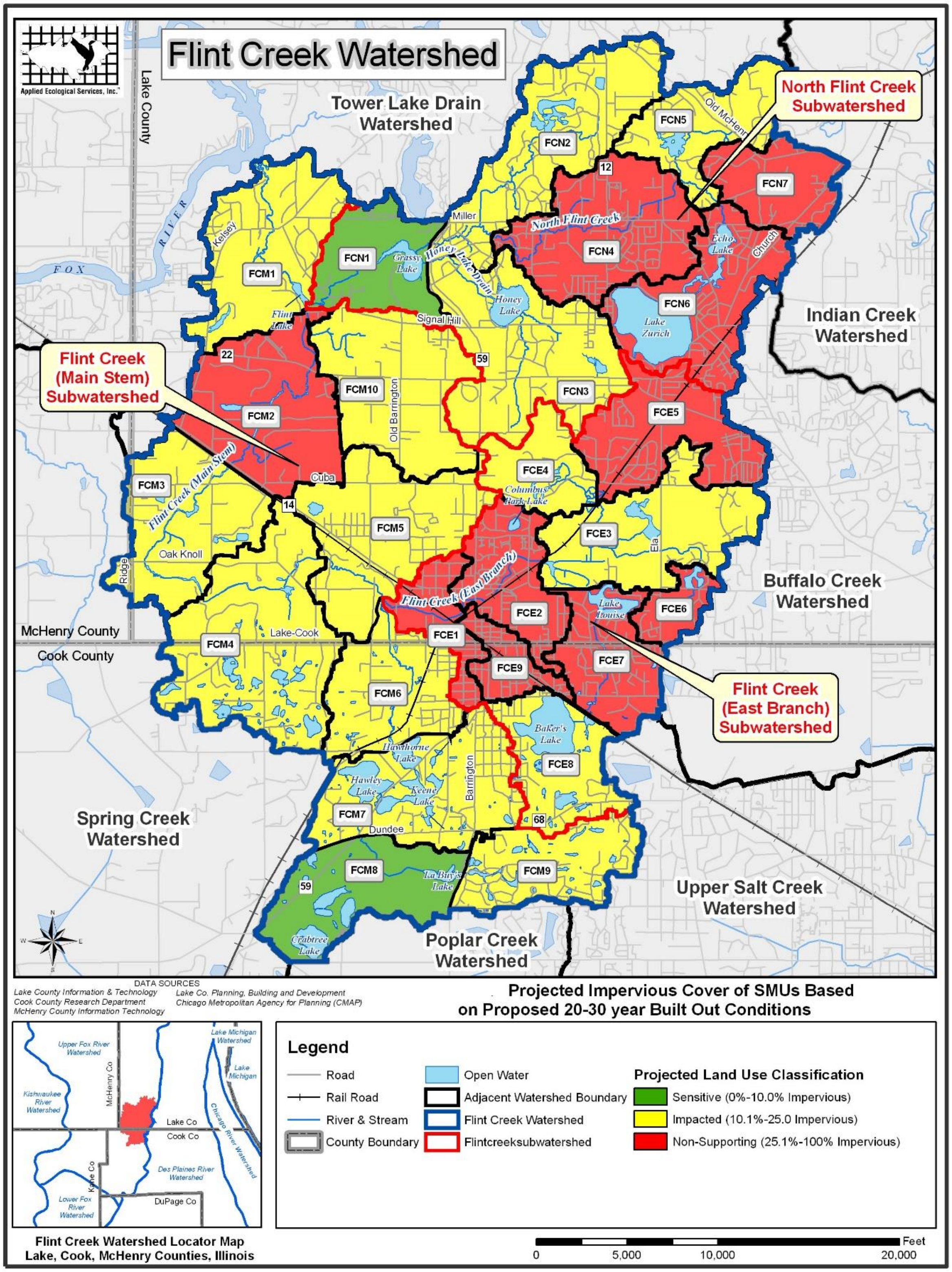


Figure 40: Projected Impervious Cover of SMUs Based on Proposed 20-30 Year Build Out

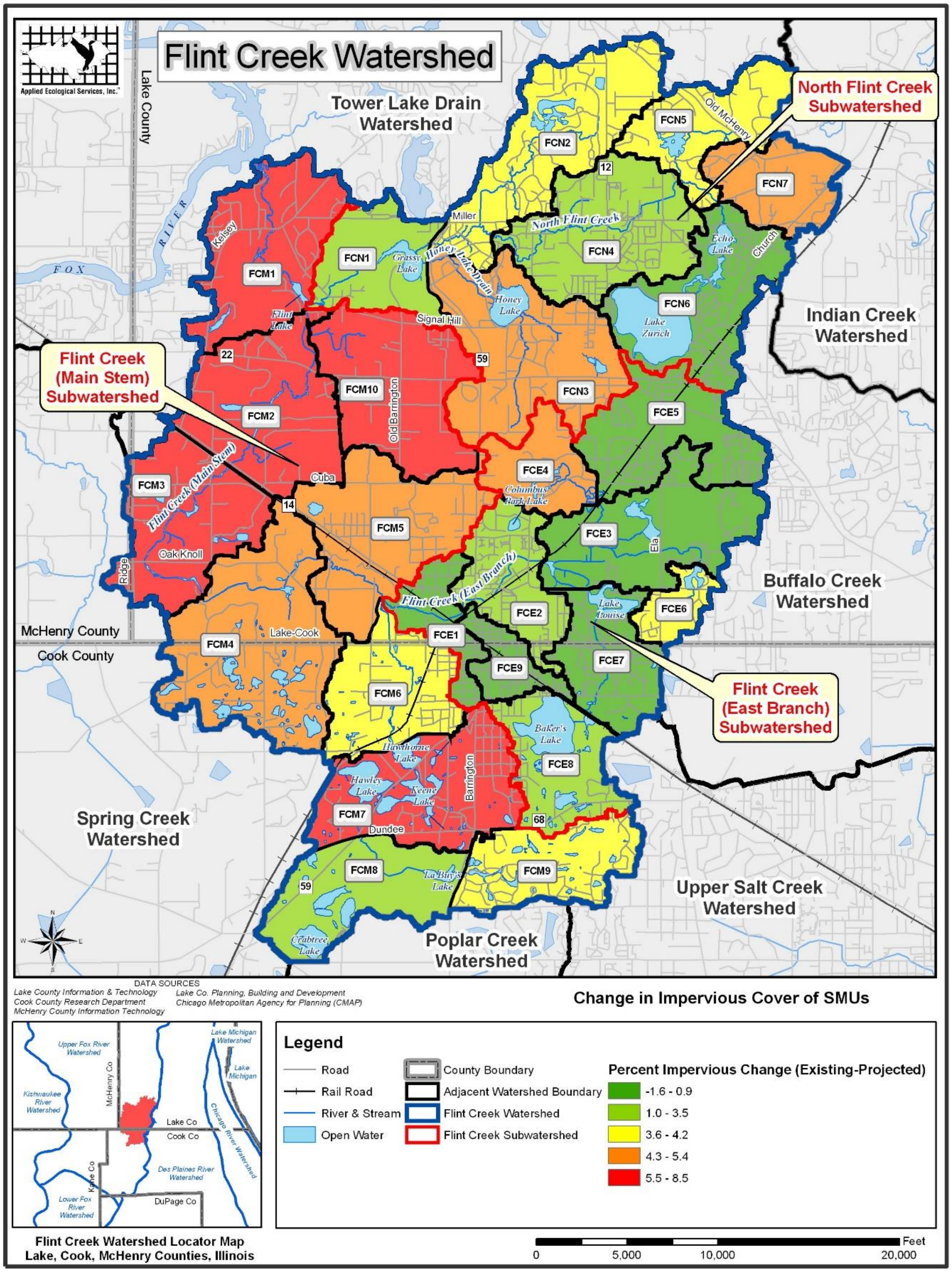


Figure 41: Change in Impervious Cover of SMUs

Aquatic Habitat

Aquatic habitat is the last of the three stream characteristics assessed during LCSMC's stream inventory. Stream substrate, in-stream fish cover, and water quality indicators were assessed to reflect the quality of habitat. Habitats with silt free substrates, good water quality indicators, and in-stream cover are important to macroinvertebrates and fish. The inventory found that the composition of fine sediments (silt, clay, & organic matter) is relatively the same as larger sediments (sand, gravel, and cobble). No substrate type dominates any one reach except for Reach FC01 at the mouth of the Fox River where cobble is the dominant substrate type.

Poor water quality and algal growth along Reach FC10 just west of Route 59

Water quality was assessed by visually inspecting and documenting turbidity, grease/oil in water column, and presence of filamentous algae. Problematic turbidity was noted in only three stream reaches (FC05, FC06, and FC23) during base flow conditions. Carp populations were noted in each of these three reaches and likely were the cause of turbidity. Grease and oil were observed in nearly half of the Flint Creek watershed stream reaches. Residential and commercial/industrial land uses drained directly by pipes to the stream are likely the cause. Filtering of these substances needs to occur prior to water entering the stream system via vegetated swales and naturalized detention areas. Algae is not a significant problem within the streams of the watershed but some areas such as golf courses, residential neighborhoods, and other urban areas were more problematic than others.

Lake County's stream inventory documents the presence or absence of 8 in-stream habitat types within each stream reach that are important to fish and communities. These include undercut banks, pools greater than 28 inches deep, macrophytes, logs, overhanging vegetation, rootwads, boulders, and backwaters. Available habitat types within each reach were used to develop a rating system for mapping good, moderate, and poor-quality habitat stream reaches within the Flint Creek watershed (Figure 39). Stream reaches exhibiting 4 or fewer habitat types are considered poor. Those reaches with between 5 and 6 habitat types are considered moderate, and reaches with 7 or 8 habitat types provide good habitat. Using these scoring criteria, 11 stream reaches in the watershed exhibit poor habitat quality and would benefit from fish habitat restoration. Habitat improvements are particularly needed along North Flint Creek upstream from Grassy Lake, along Honey Lake Drain, Flint Creek (east branch) and Flint Creek's main stem between Barrington Road and Hawley Lake. Recommendations for improving fish habitat are included in the Action Plan section of this report.

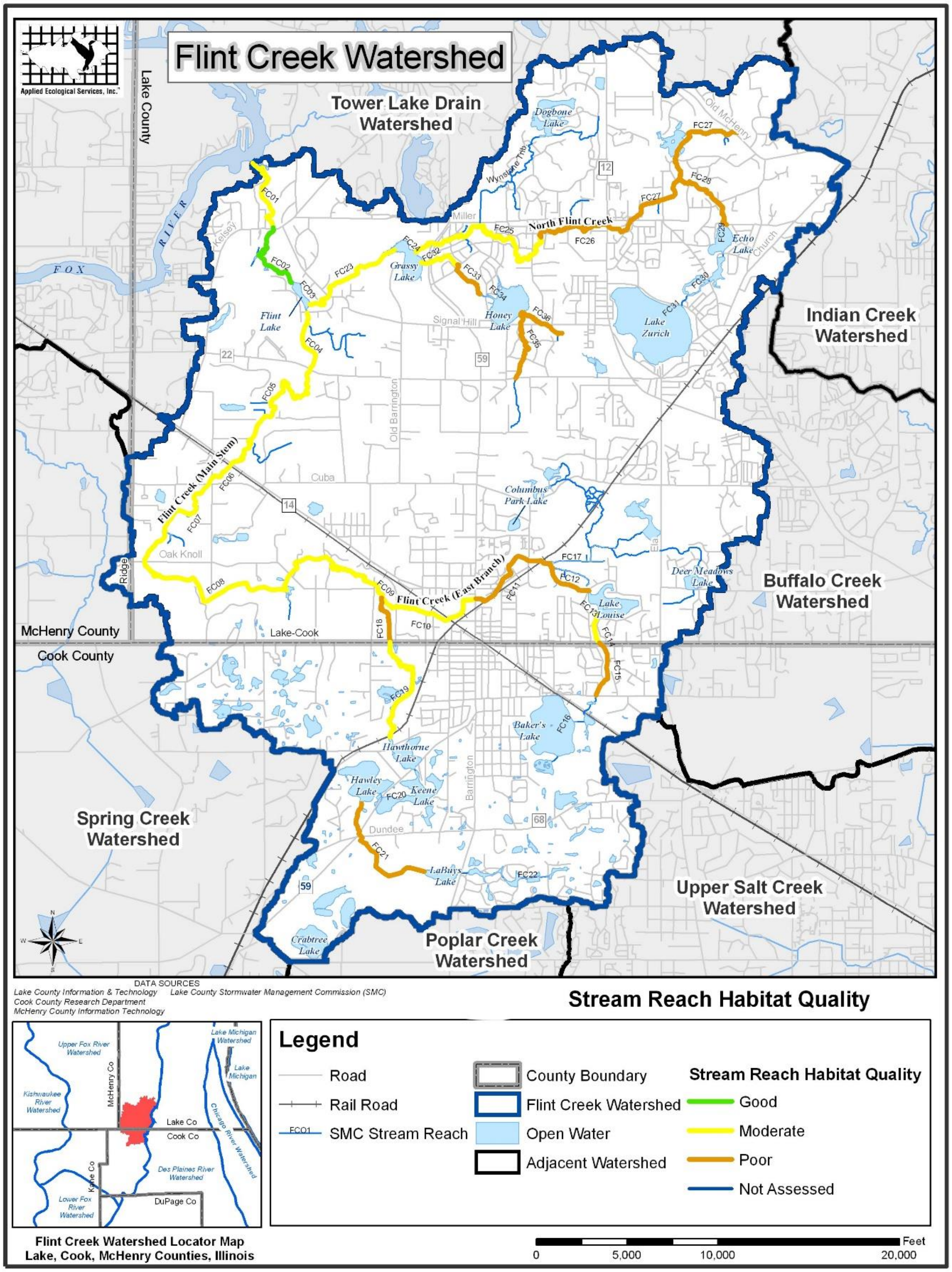


Figure 42: Stream Reach Habitat Quality

As part of the 2016 Baseline Water Quality Report, Stream Profiles featuring the elevation profiles and the water testing/water gage points from the 2016 Baseline Water Quality study (see Appendix H), and are featured here.

Shoreline erosion is common among the lakes in the watershed. Historically, shorelines were dominated with deep-rooted sedges and grasses limiting erosion. Since European settlement and development of shorelines, many land owners have decided to remove native vegetation and replaced it with shallow-rooted non-native vegetation such as turf grass or concrete seawalls. Erosion not only results in loss of shoreline, but also negatively influences the lake's overall water quality by contributing nutrients and sediments into the water. Adding riprap may limit erosion but reduces habitat, shade, and the cleansing functions of native plants. Table 24 documents the extent of lake erosion while the location of lake shoreline erosion is shown on individual aerial maps of each lake discussed below.

Table 24. Linear feet of slight, moderate, and severe erosion documented by LCHD-LMU for the major lakes in the Lake County portion of the watershed.

Lake	Year	Total Shore-line Assessed	No Erosion Shoreline Assessed (ft/%)		Total Slight Erosion (ft/%)		Total Moderate Erosion (ft/%)		Total Severe Erosion (ft/%)	
Lake Zurich	2015	14,877.7	9665.4	65%	3255.1	21.9	1106.6	7.4%	850.6	5.7%
Echo Lake	2015	5,098	2679	50.3	975	18.3	1326	24.9	348.5	6.5
Honey Lake	2015	10,880	7966	83%	1146	12%	439	5%	none	n/a
Grassy Lake	2000	8,643	8,643	100%	none	n/a	none	n/a	none	n/a
Flint Lake	2008	4,055	0	0	1,906	47%	973	24%	1,176	29%
Dogbone Lake	2004	15,906	10,503	66%	3325	20.9%	2,054	13%	244	1%
Columbus Park Lake	2000	2,048	1164.6	56.9	493.8	24.1%	107.2	5%	283.2	14%
Lake Louise	2015	11,260	9565	86%	1304	12%	252	2%	none	n/a
Deer/ Meadows Lake	2004	5,425	4451.3	82%	0	0%	973.7	17.9	none	n/a
*Baker's Lake	2007	n/a			n/a	n/a	n/a	n/a	1,000	n/a

Source: Lake County Health Department-Lake Management Reports
*Visual inspection of Baker's Lake in 2007 by FCWP

As humans remove native plant species from lake shorelines for development purposes, invasive, non-native species often move in and alter the original landscape. Most often, non-native, pioneer species such as buckthorn, purple loosestrife, and/or reed-canary grass are the first to occupy disturbed areas along lake shorelines. According to data obtained through LMU lake surveys, all lakes in the watershed have invasive species growing along the shoreline to some degree but it is not feasible to map these results in this report because of the variation and distribution of data. Non-native species do not perform the same environmental function as native species and are recommended to be removed. Lake and Homeowner associations should implement monitoring and maintenance programs to limit or remove invasive plant communities as needed.

North Flint Creek Subwatershed Lakes and Water Quality

Lake Zurich

Lake Zurich is a 232 acre glacial lake in southwestern Lake County, part of the Flint Lak e drainage of the Fox River watershed. Situated at the top of the Flint Creek Watershed, it has relatively good quality. The lake is managed by the Lake Zurich Property Owners Association (LZPOA), which meets monthly, and has a Lake Management Committee.

The Lake County Health Department-Ecological Services (LCHD-ES) monitored Lake Zurich in 2015. Two water samples were collected once a month from May through September. Samples were from the deepest part of the lake, three feet below the surface, and 3 feet above the bottom. Samples were analyzed for nutrients, solid concentrations and other physical parameters; an aquatic plant survey and a shoreline assessment survey were also done.

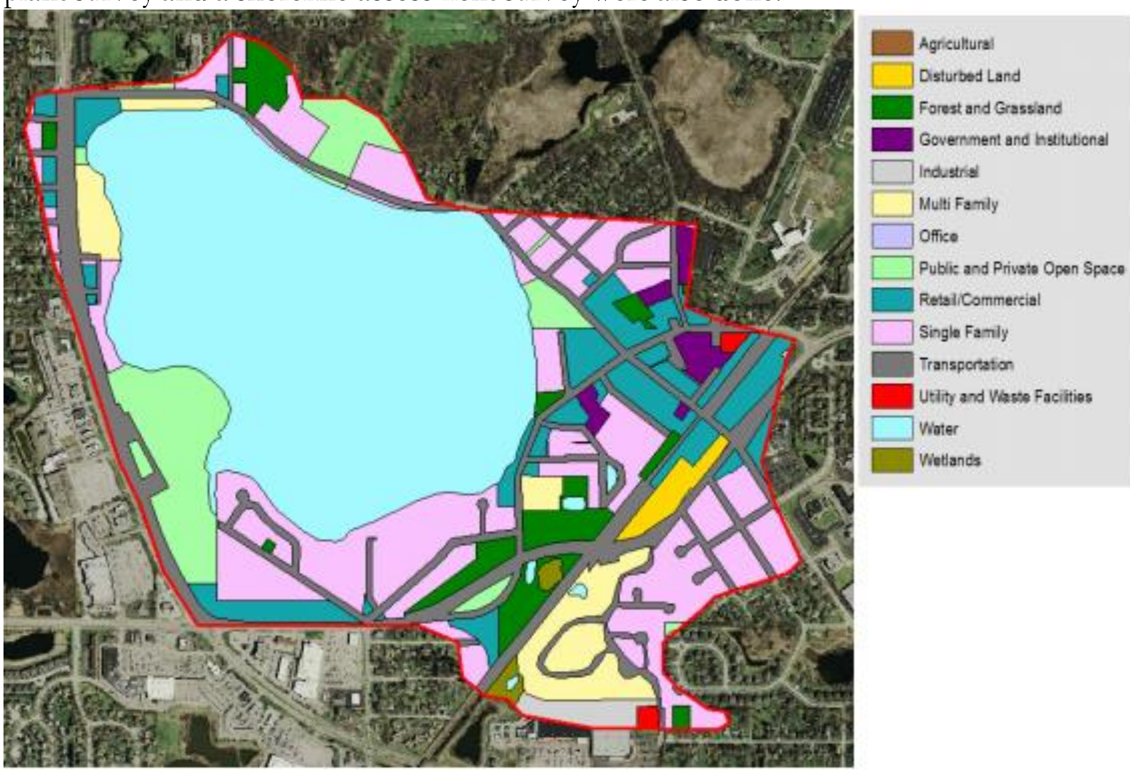


Figure 43: Land Use in the Lake Zurich Watershed (LCHD-ES)

Following are the summary highlights of the water quality sampling, shoreline survey and aquatic macrophyte surveys from the 2015 monitoring:

♦ Average water clarity based on Secchi depth in 2015 was 7.24 ft., which is a 30% decrease since 2008; yet remains well above the Lake County median Secchi depth of 2.96 ft.

♦ Water clarity is influenced by amount of particles in the water column; this is measured by total suspended solids. The average TSS concentrations on Lake Zurich was 3.0 mg/L in 2015, which is below the Lake County median of 8.2 mg/L and only a slight increase from 2.7 mg/L since 2008.

♦ Nutrient availability indicated that Lake Zurich was phosphorus limited with an average TN:TP ratio of 40:1.

♦ In 2015 the average total phosphorus concentration was 0.021 mg/L. This is below the Illinois Environmental Protection Agency (IEPA) water quality standard of 0.050 mg/L.

♦ Total phosphorus concentrations have increased since 2008 by 31% from 0.016 mg/ L to 0.021 mg/L.

♦ Trophic State index (TSIp) for Lake Zurich was 48; meaning Lake Zurich is considered mesotrophic.

♦ Lake Zurich thermally stratified throughout the monitoring season; May—August. ♦ Dissolved oxygen (DO) concentrations dropped below 5 mg/L during all June - September. DO dropped below 5 mg/L at depths greater than 20 ft. (June), 16 ft. (July), 18ft. (August), and 22 ft. (September).

♦ Dissolved oxygen concentrations reached anoxic conditions (<1mg/L) June-August

♦ The July aquatic macrophyte survey showed that 63% of all sampling sites had plant coverage. ♦ A total of 8 plant species and Chara (a macro-algae) were present, which is a decrease since previous monitoring years.

♦ The most dominant aquatic plant species in 2015 were Chara, a macro-algae, at 46.5% and large-leaf pondweed at 31.5% of the sampling sites.

♦ Eurasian watermilfoil and zebra mussels, two aquatic invasive species were present during the 2015 sampling season.

♦ 35% of the Lake Zurich shoreline was experiencing some degree of erosion. ♦ Based on the 2015 shoreline condition survey, 66% of Lake Zurich's lakeshore buffer condition was classified as poor.

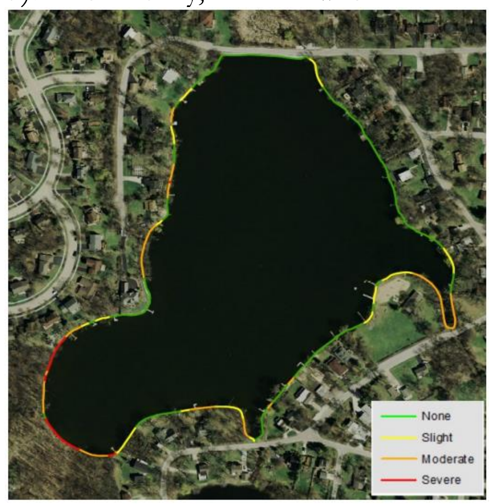
Figure 44: Lake Zurich Shoreline Erosion Condition, 2015

♦ Lake Zurich has three licensed beach including Oakwood Beach Club, Inc., Breezewald Park, and Henry J Paulus Park Beach. There was only one beach closures due to E.coli in 2015 which occurred at Henry J Paulus Park Beach from June 8th sampling, closing the beach on June 9th. Lake Zurich invested in shoreline restoration at Paulus Park Beach in 2016-2017.

In 2015, Lake Zurich was considered mesotrophic with a TSIp value of 48.2 Based on the TSIp, Lake Zurich ranked 18 out of 173 lakes studied by the LCHD-ES from 2000 –2015. This a decrease in ranking from 2008, when it ranked 4th out of 173 lakes in Lake County.

Echo Lake

Echo Lake (25 acres) is a private, man-made lake used for swimming, fishing, and non-motorized boating located just downstream from Lake Zurich (Figure 45). Historically, the lake was a natural wetland that was dammed to create a lake in the 1920s. The Echo Lake Community Corporation owns the majority of the lake. Two small parcels are owned by the Village of Lake Zurich and Lake County respectively. Echo Lake receives water from Lake Zurich and empties into Grassy Lake, eventually flowing into Flint Creek. In 2015, LCHD-ES monitored Echo Lake, following a similar protocol to that used in Lake Zurich.



A shoreline erosion study was assessed for Echo Lake in 2015. Echo lake was divided into reaches, and the shoreline evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure, undercut banks, and other signs of erosion. Based on the 2015 data, 40.7% of Echo Lake's shoreline has some erosion; with 18% being slight erosion, 25% moderate erosion, and 7% severe erosion (FIGURE 43 above). It is recommended to fix areas with slight erosion as it is most economically beneficial. When erosion becomes severe, it is more costly and difficult to fix.

Following are the highlights of the study. While historically, Echo Lake has had below average water quality for Lake County, and while many water quality parameters remain below the Lake County median, water quality parameters have improved since the 2008 study, as summarized below:

♦ Average water clarity was 2.31 ft., which is a 9.5% increase since 2008, yet remains below the Lake County median of 2.96 ft.

♦ Water clarity is influenced by amount of particles in the water column; this is measured by total suspended solids. The average TSS concentrations on Echo Lake was 10.2 mg/L in 2015, which is greater than the Lake County median of 8.2 mg/L. However, TSS concentrations dropped by 24% since 2008.

♦ Nutrient availability indicated that Echo Lake had sufficient concentrations of nitrogen and phosphorus to support algae growth with an average TN:TP ratio of 14:1.

♦ Echo Lake is impaired for phosphorus with a 2015 average total phosphorus concentration of 0.079 mg/L. This exceeds the Illinois Environmental Protection Agency (IEPA) water quality standard of 0.050 mg/L.

♦ Despite having a phosphorus impairment, there was a significant decrease by 37% in total phosphorus levels since the 2008 sampling.

♦ Trophic State index (TSIp) for Echo Lake was 66.2; meaning Echo Lake is considered eutrophic.

♦ Dissolved oxygen (DO) concentrations remained above 5 mg/L in the upper water column only dropping below 5 mg/L at depths greater than 8 feet in June, July and August. When dissolved oxygen drops below 5 mg/L, aquatic life can become stressed.

♦ Dissolved oxygen concentrations never reached anoxic conditions (<1mg/L) in the lake

♦ The aquatic macrophyte survey showed that 85% of all sampling sites had plant coverage.

♦ A total of 3 plant species were present which include: Coontail, Sago Pondweed, and Southern Naiad.

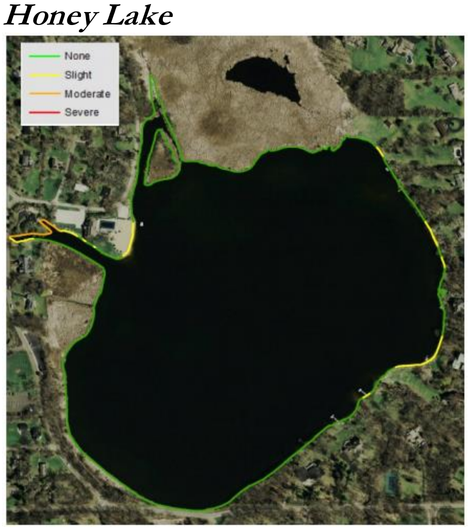
♦ The Floristic Quality Index (FQI) is 10.4, which is below the Lake County Median and ranks Echo Lake at 116/170 of the lakes in Lake County assessed for FQI.

♦ Echo Lake had 50.3% of its shoreline classified as no erosion, 18.3% as slight erosion, 24.9% as moderate erosion, and 6.5% as severe.

♦ Based on the 2015 shoreline condition survey, 61% of Echo's Lake lakeshore buffer condition was classified as poor.

♦ Echo Lake has an unlicensed beach on the south east end of the lake at the park. It is required by law that any beach servicing 5 or more households be licensed with the Illinois Department of Public Health.

Honey Lake



Honey Lake is a 66-acre glacial lake owned primarily by Biltmore Country Club and 11 private land owners (Figure 46). The lake is not on-line with North Flint Creek, but is fed by two small tributaries from the southeast. A spillway was constructed in 1950 to control water levels. Water flowing over the spillway drains west to Grassy Lake. The country club is the primary manager of Honey Lake. Honey Lake is listed as an ADID (advanced identification) wetland by the U.S. Environmental Protection Agency and an Illinois Natural Areas Inventory (INAI) by the state of Illinois. This indicates that the lake and surrounding natural environments have potential to have high quality aquatic resources based on water quality and hydrology values.

In 2015, LCHD-ES monitored Honey Lake, and followed similar protocols to that listed with the other lakes.

The water quality of Honey Lake has declined since the 2006 and 2008 samplings, although many parameters remain below the Lake County median values. Following is a summary of findings:

♦ Average water clarity based on secchi depth in 2015 was 3.11 ft., which is a 56% decrease since 2008; yet remains above the Lake County median secchi depth of 2.96 ft.

♦ Water clarity is influenced by amount of particles in the water column; this is measured by total suspended solids. The average TSS concentrations on Honey Lake was 6.6 mg/L in 2015, which is below the Lake County median of 8.2 mg/L but a 94% increase since 2008 sampling.

♦ Nutrient availability indicated that Honey Lake was phosphorus limited with an average TN:TP ratio of 25:1.

♦ In 2015 the average total phosphorus concentration was 0.059 mg/L. This is above the Illinois Environmental Protection Agency (IEPA) water quality standard of 0.050 mg/L; meaning Honey Lake is impaired for phosphorus.

♦ Total phosphorus concentrations have increased since 2008 by 73%.

♦ Trophic State index (TSIp) for Honey Lake was 59; meaning Honey Lake is considered eutrophic.

♦ Honey Lake thermally stratified throughout the monitoring season; May—September.

♦ Dissolved oxygen (DO) concentrations dropped below 5 mg/L during all sampling months. During June, July, and August DO dropped below 5 mg/L at depths greater than 3 ft., 4ft., and 5 ft., respectively.

♦ Dissolved oxygen concentrations reached anoxic conditions (<1mg/L) during all months during the sample season.

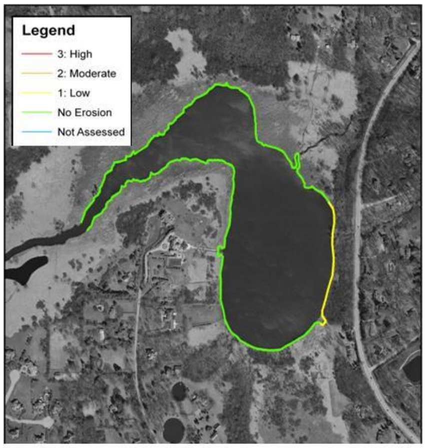
♦ The July aquatic macrophyte survey showed that 43% of all sampling sites had plant coverage. ♦ A total of 9 plant species and Chara (a macro-algae) were present with the most dominant species being Coontail and White Water Lily.

♦ Aquatic invasive plant species were not present during the 2015 sampling season.

♦ 17% of the Honey Lake shoreline was experiencing some degree of erosion.

♦ Based on the 2015 shoreline condition survey, 40% of Honey Lake's lakeshore buffer condition was classified as poor.

♦ Honey Lake has a licensed beach at the Biltmore Country Club. There were zero beach closures due to E.coli in 2015.



2006 Aerial Depiction of Grassy Lake and Degree of Shoreline Erosion

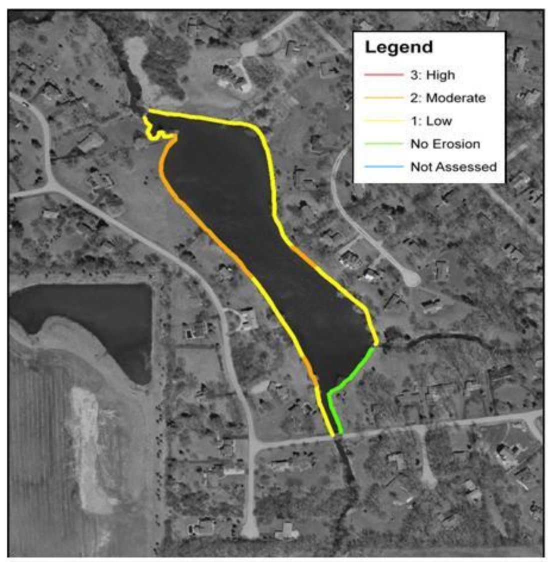
Grassy Lake

Grassy Lake is a 40-acre glacial slough owned by the Lake County Forest Preserve District that receives water from two primary sources: Honey Lake drain and North Flint Creek (Figure 47). The most recent study conducted by LMU in 2000 indicates poor water quality originating from several sources. High levels of phosphorus and suspended solids are of primary concern and are likely the result of bottom disturbance by large carp populations and additional nutrients entering the lake from adjacent land uses (Route 59) and three upstream wastewater treatment plants (Wynstone, North Barrington School, and Mt. St. Joseph). Shoreline erosion is not problematic but numerous stands of invasive purple loosestrife and buckthorn are present. Despite poor water quality, a Sandhill crane (State threatened) and Common tern (State endangered) were observed using the lake in 2000. In addition, few aquatic plants were observed by LMU in 2000. This is attributed to carp disturbance of bottom sediments and ongoing sediment deposition from upstream sources.

The July 2016 Flint Creek/Spring Creek Water Quality Baseline found Grassy Lake to have an average total Phosphorus (mg/L) of 0.161, and to be Hypereutrophic at 77.42. It ranks as 142 of 173 Lake County Lakes.

Flint Lake

Flint Lake is an 11-acre manmade lake in southwestern Lake County. Flint Lake receives water from two main inlets, the Grassy Lake Drain (north inlet) and Flint Creek (south inlet) and empties into Flint Creek which eventually flows into Fox River. Flint Lake residents use the lake for aesthetics. (Figure 48)



2006 Aerial Depiction of Flint Lake and Degree of Shoreline Erosion

Four sewage treatment plants are operating in the Flint Lake Watershed. The largest one is the Barrington Wastewater Treatment Plant that discharges effluent into Flint Creek. The Mount Saint Joseph and North Barrington Elementary plants discharge into Grassy Lake Drain.

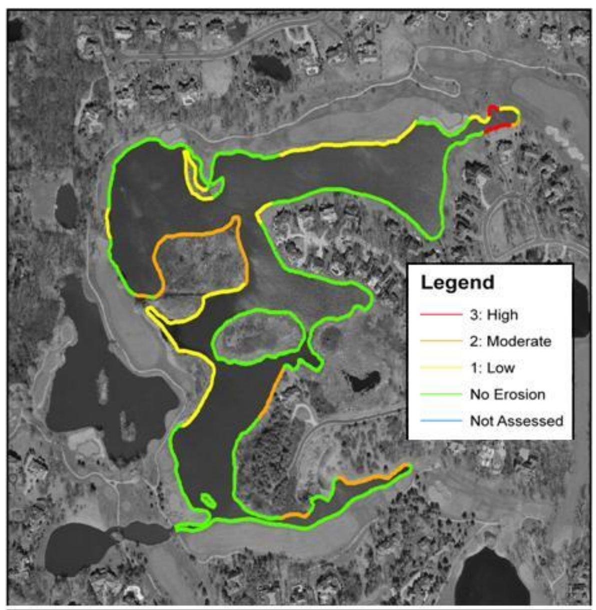
Based on a 2008 LCHD-ES study, Flint Lake is known for having some of poorest water quality of all lakes sampled in Lake County. Water quality in Flint Lake has not deteriorated since the 2003 study. The 2008 average TSS was 57.7 mg/L for the north inlet and 22.9 for the south inlet which is considerably higher than the county median of 8.2 mg/L. Alkalinity also had high values the north inlet 216 mg/L CaCO3 and 243 mg/L CaCO3 at the south inlet both are higher than the county median of 162 mg/L CaCO3. However 2008 values were reduced compared to the 2003 value of 330 mg/L CaCO3 that marked the highest alkalinity concentrations recorded in Lake County.

The Lake County median conductivity reading was 0.8195 milliSiemens/cm (mS/cm). During 2008, the average conductivity reading in Flint Lake for the north inlet was 1.0970 mS/cm and 1.2780 mS/cm for the south inlet. This was decrease from the 2003 average of 1.5818 mS/cm, likely due to rain events in 2008. Conductivity is positively correlated with chloride (Cl) concentrations. The average Cl concentration in Flint Lake was also greater than the Lake County median of 166 mg/L during 2008, with an average of 200 mg/L in the north inlet and 223 in the south inlet. The 2008 average total phosphorus (TP) concentration of 0.188 mg/L for the north inlet and 0.293 mg/L for the south was significantly above the county median of 0.065 mg/L. However the average TP concentration decreased by 48% from the 2003 survey when the average TP concentration was 0.564mg/L.

Aquatic plants were scarce in Flint Lake in 2003 and 2008. Only five species of aquatic plants; Sago Pondweed, Small Duckweed, Curlyleaf Pondweed, Coontail, and Elodea were present and located near the shoreline. Algal blooms and an over abundance of Duckweed occurred in Flint Lake during the season. The shoreline was reassessed in 2008 for significant changes in erosion since 2003. Based on the 2008 assessment, there was an increase in shoreline erosion with 100% of the shoreline having some degree of erosion. Overall, 47% of the shoreline had slight erosion, 24% had moderate erosion, and 29% had severe erosion. Flint Lake is located in a residential setting with the shoreline mainly developed. Although residential areas usually do not offer good wildlife habitat, the mature trees in the lots surrounding the lake offer some songbird habitat.

Dogbone Lake

Dogbone Lake was formerly known as Lake Sheree and is a 28.6 acre private lake located within the Wystone Golf Course community in the Village of North Barrington. The lake serves primarily as an aesthetic amenity for surrounding homes but is also used by local residents for fishing. According to LMU, neither the Wynstone Property Owner's Association nor golf course staff actively manages the lake. (Figure 49)



2006 Aerial Depiction of Dogbone Lake and Degree of Shoreline Erosion

Historically, the lake was a wetland complex that was excavated in 1970 to create the lake. The lake receives water primarily via runoff from its adjacent 700-acre watershed that is primarily golf course. Water exits the lake via the Wynstone tributary and enters North Flint Creek to the south. Wynstone Sewage Treatment Plant is located onsite to serve the surrounding homes and facilities within the golf course community.

This site is currently permitted by the IEPA. The overall water quality and condition of the lake is poor. Most notable reasons include shallow depth (5 feet maximum), low water clarity (0.94 feet), high total suspended solids (39.4 mg/l), high phosphorus (0.199 mg/l), abundant carp populations, stormwater and wastewater effluents. In addition, approximately 68% of the shoreline is developed;

33% of which is lawn or seawalls. These shoreline conditions are likely the cause of approximately 244 linear feet of severe erosion and 2,054 linear feet of moderate erosion. The aquatic plant assessment conducted in 2004 revealed little vegetation that is attributed to low water clarity and carp activity.

The Wynstone HOA has invested in some detention basin work and lake restoration with Dogbone Lake since 2007.

North Branch SubWatershed Elevations

Figure 50: Stream Profile – North Branch Flint Creek

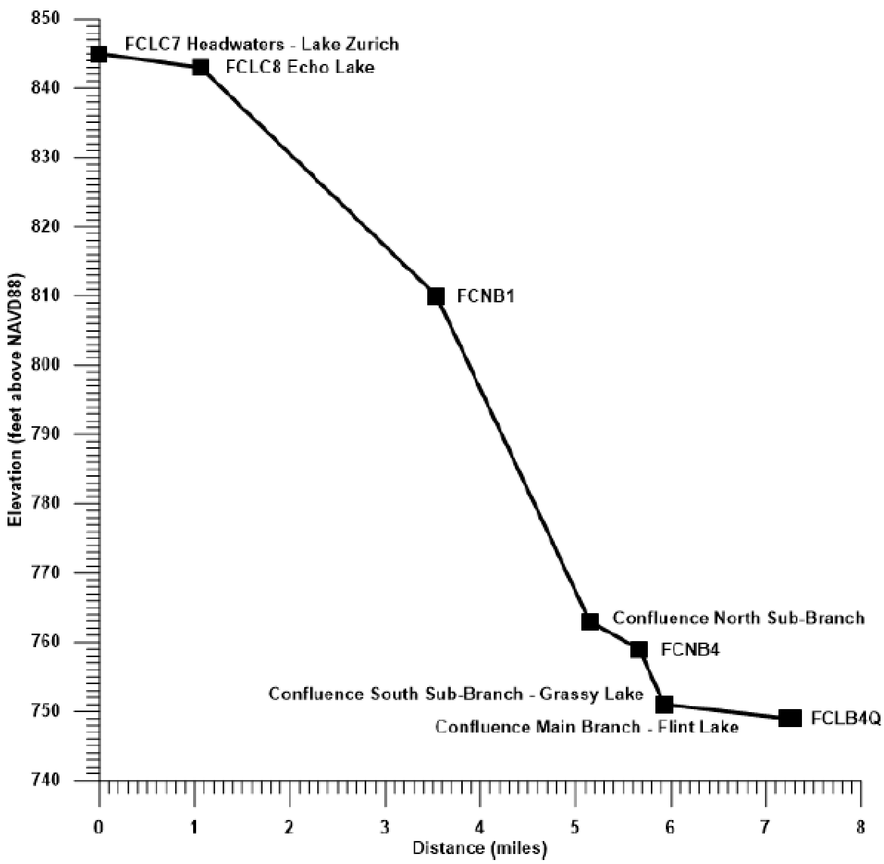


Figure 51: Stream Profile – North Sub-Branch North Branch Flint Creek

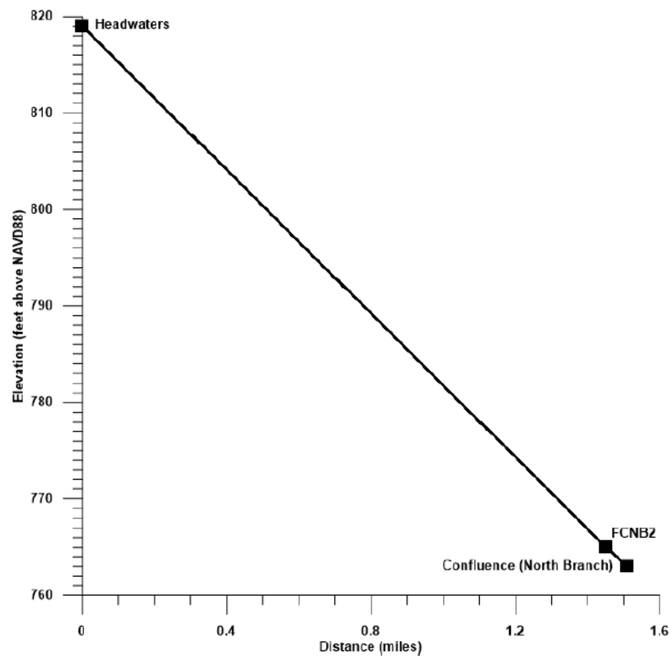
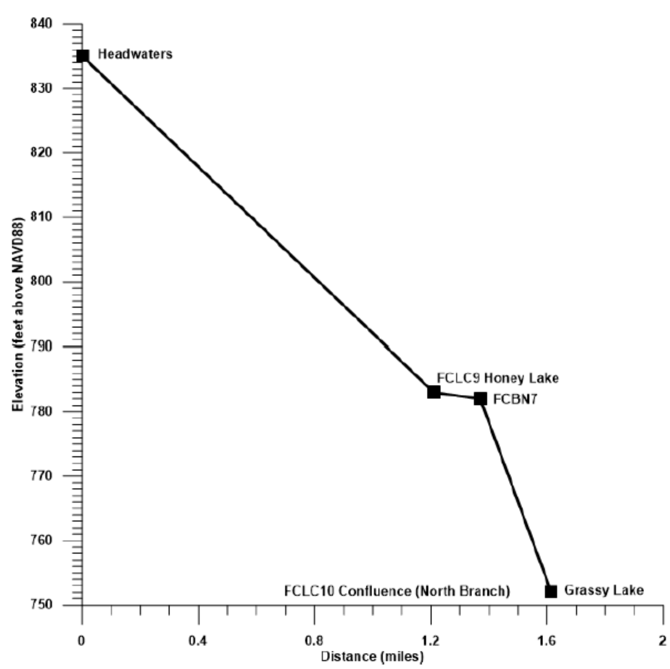
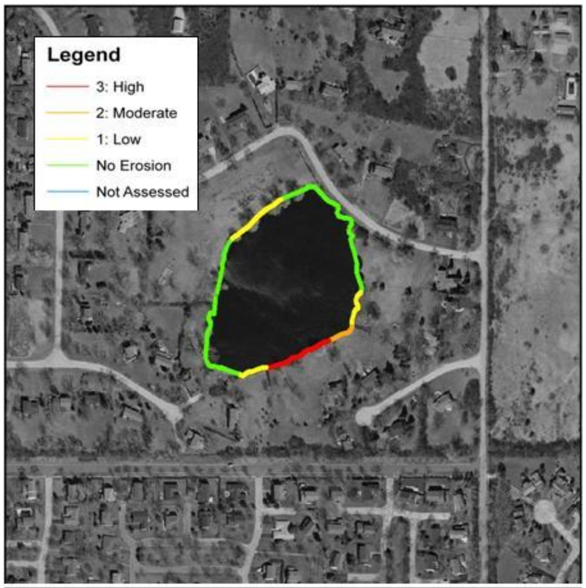


Figure 52: Stream Profile – South Sub-Branch North Branch Flint Creek



East Flint Creek Subwatershed Lakes and Water Quality



2006 Aerial Depiction of Columbus Lake and Degree of Shoreline Erosion

Columbus Park Lake

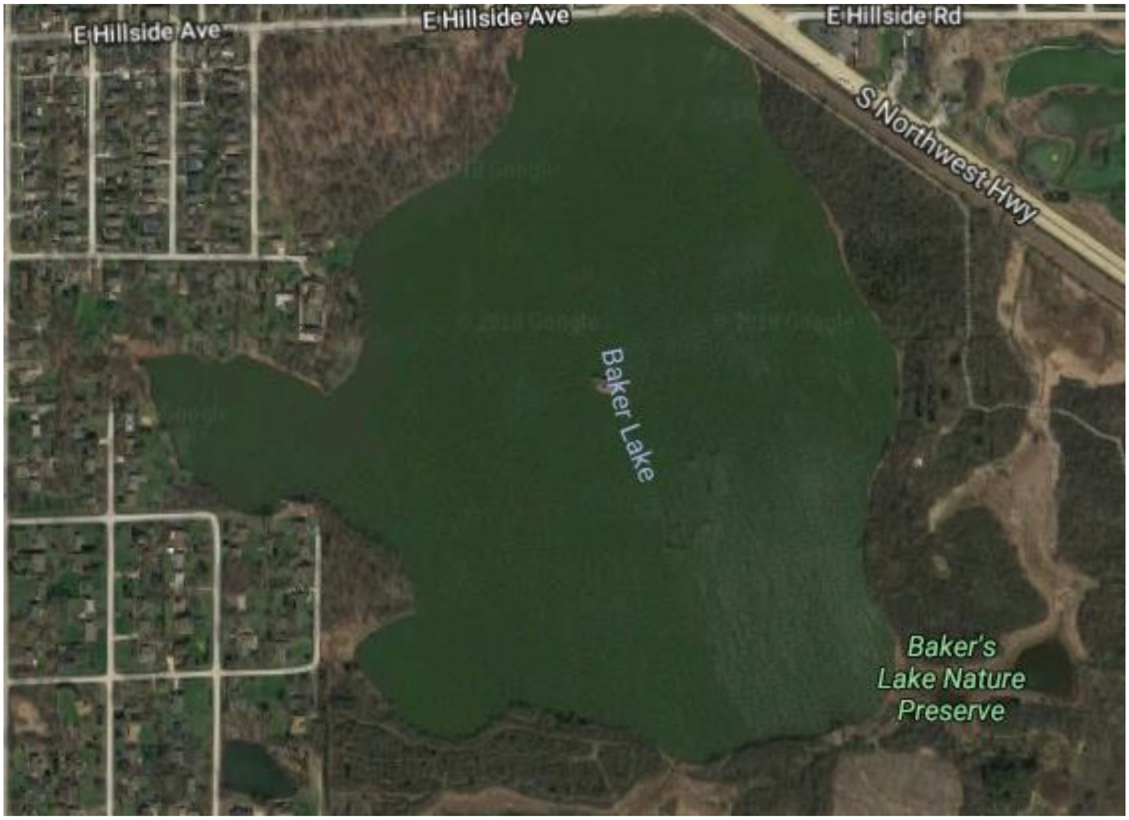
Columbus Park Lake is a small (6.6 acres), shallow, (6 foot deep) Barrington Park District-owned impoundment that serves simply as an aesthetic amenity to the adjacent park. No fishing, swimming, or boating is allowed. This small lake was created in 1962 in a surrounding residential development. Water that enters from the adjacent watershed outlets the lake into a stormwater system that eventually finds its way to Flint Creek (east branch). LMU's 2000 lake report documents poor water quality conditions. Nutrient levels and dissolved solids/conductivity are high. Phosphorus levels were found to be three times higher than the county average and road salts likely contribute to high dissolved solids. Developed areas comprise 88% of the shoreline leading to 110 linear feet of moderate erosion and 274 linear feet of severe erosion. Constant resident Canada goose populations are also known to occur in the adjacent park increasing nutrient loading. Columbus Park Lake is nearly devoid of vegetation apparently due to introduction of Grass Carp. Some work was done as an Eagle Scout project on native vegetation restoration. (Figure 53)

Baker's Lake

Baker's Lake and Lake Louise are the two primary lakes located online with Flint Creek's east branch. Baker's Lake is located in Cook County and Lake Louise in Lake County just north of Lake-Cook Road. Baker's Lake was not assessed by LMU, however some data is available from a 1981 Comprehensive Plan (Cook County Forest Preserve District, 1981) completed for Baker's Lake as well as miscellaneous other information including a visual inspection of the shoreline erosion by FCWP in 2007 and by AES in 2018. Detailed information regarding Lake Louise was available from Lake County's Lakes Management Unit.

Baker's Lake is part of an Illinois Nature Preserve owned by the Forest Preserve District of Cook County (FPDCC) and located just south of Route 14 on Barrington's southeast side (Figure 54 below). The nature preserve itself is over 200 acres while the lake is 112 acres. The majority of the water enters the lake via surface stormwater runoff from the adjacent watershed. Although the lake supports small fish populations, prolonged periods of winter freezing result in numerous fish kills. Wide varieties of birds feed and nest around the preserve including colonies of black-crowned night heron (state threatened), great egret, double-crested cormorant, and great blue heron. Other notable bird observations made near the lake include yellow-headed blackbird (state endangered), common moorhen (state threatened), black tern (state endangered), and pied-billed grebe. CFC also worked with the Village of Barrington to complete one of the most successful savanna restorations in the

Chicago region along the northwest portion of the lake. In addition, FCWP conducted a visual inspection of the shoreline conditions in 2007 and noted approximately 1,000 linear feet of severe erosion along Hillside Avenue which continues, as observed in 2018 by AES. Baker's Lake once supported a large heron rookery, which has now relocated to the Spring Creek Watershed.



Lake Louise

Lake Louise is a 38-acre privately owned (Fox Point Homeowners Association) water body located in the Village of Barrington just north of the Lake/Cook County line (Figure 55, below). The lake was constructed in 1967 during the development of the Fox Point Subdivision. A spillway was installed at the northwest portion of the lake to establish water levels.

Streambank stabilization projects have also been implemented in the Fox Point North subdivision to primarily decrease sediment loads to the lake from Flint Creek. In addition, 75% of the lake's shoreline is rip-rapped, while other areas contain invasive plants including buckthorn, honeysuckle, purple loosestrife, and multiflora rose. Of the 11,260 linear feet of shoreline assessed, only 204 feet is moderately eroded, and no severe erosion is present. Lastly, large numbers of Canada geese use the developed shoreline. Goose feces likely exacerbate nutrient levels within the lake. The Lake was monitored by LCHD-ES in 2015. Historically, Lake Louise has had a variety of lake quality issues dating back to the late 1950's. These problems include or have included excessive aquatic plants, unhealthy fishery, abundance of carp and geese, several algal blooms and nutrient enrichment. Many water quality parameters exceed the Lake County median. A summary follows:

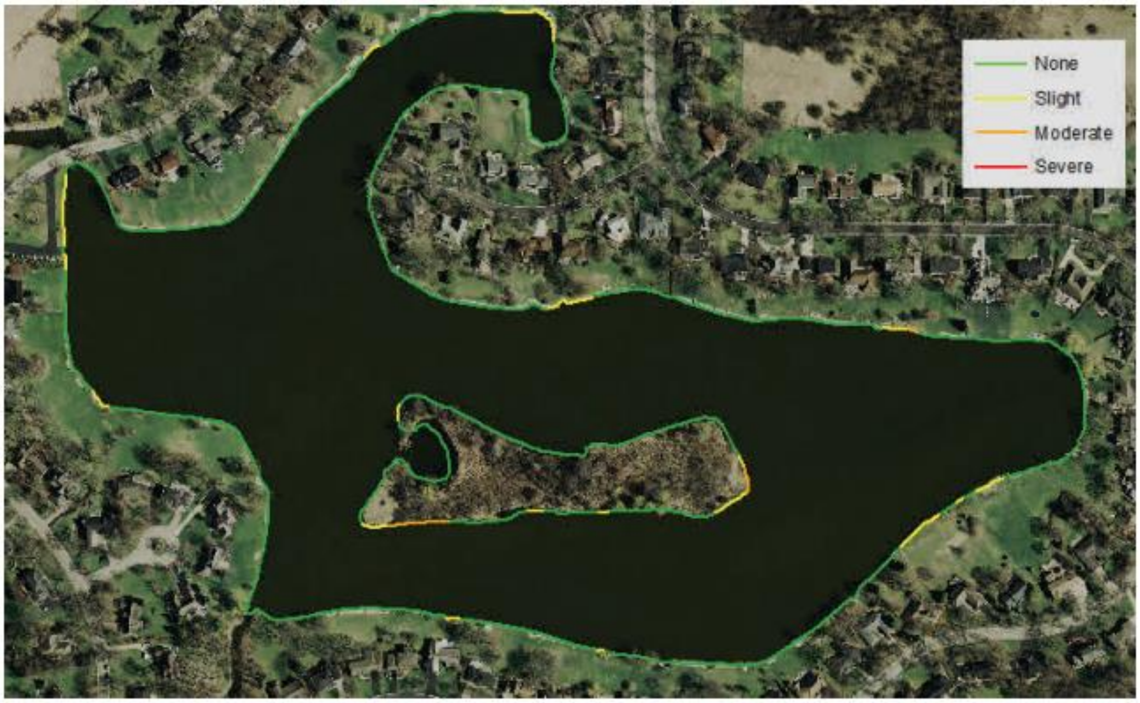


Figure 55: Streambank Erosion in Lake Louise in 2015

Figure 56: Shoreline Buffer Conditions

♦ Average water clarity was 1.04 ft., which is a 38% decrease since 2008, and 65% below the Lake County median Secchi depth of 2.96 ft.

♦ Water clarity is influenced by amount of particles in the water column; this is measured by total suspended solids. The average TSS concentrations on Lake Louise was 36.9 mg/ L in 2015, which is significantly greater than the Lake County median of 8.2 mg/L. TSS concentrations increased by 58% since 2008.

♦ Nutrient availability indicated that the average TN:TP ratio was 14:1 meaning that Lake Louise had adequate amounts of both nitrogen and phosphorus to support algal blooms. Most of the lakes in Lake County tend to be phosphorus limited, meaning addition of phosphorus to the lake ecosystem can affect change in the lake, such as increased algal populations.

♦ The 2015 average total phosphorus concentration was 0.181 mg/L, which exceeds the Illinois Environmental Protection Agency (IEPA) water quality standard of 0.050 mg/L. Lake Louise is impaired for phosphorus

♦ In addition to having a phosphorus impairment, there was an increase by 16% in total phosphorus levels since the 2008 sampling.

♦ Trophic State index (TSIp) for Lake Louise was 79; meaning Lake Louise is considered hypereutrophic.

♦ Dissolved oxygen (DO) concentrations remained above 5 mg/L in the water column from surface to lake bottom, except in July when it dropped below 5 mg/L at depths greater than 6ft. When dissolved oxygen drops below 5 mg/L, aquatic life can become stressed.

♦ Dissolved oxygen concentrations never reached anoxic conditions (<1 mg/L) in the Lake.

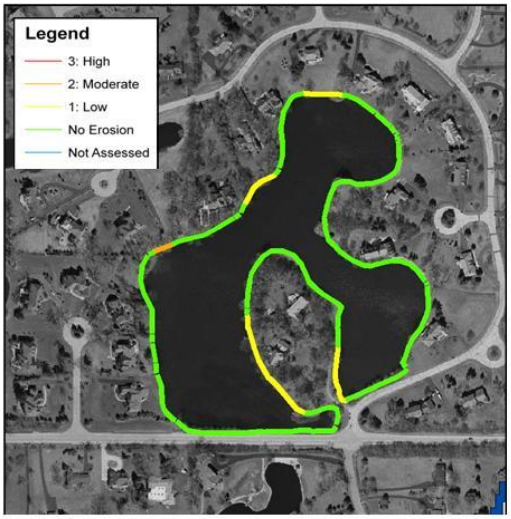
♦ The aquatic macrophyte survey showed that only 6.5% of all sampling sites had plant coverage.

♦ A total of 2 plant species were present which were: Giant Duckweed and Sago Pondweed.

♦ Lake Louise had 14% of its shoreline eroding with 12% classified as slight erosion and 2% as moderate erosion.

♦ Although minimal shoreline erosion was occurring, 76% of Lake Louise's lakeshore buffer condition was classified as poor based on the 2015 shoreline condition survey.

In 2015, Lake Louise was considered eutrophic with a TSIp value of 79 and on the verge of hypereutrophic. Based on the TSIp, Lake Louise ranked 145 out of 173 lakes studied by the LCHD-ES from 2000 –2015.



2006 Aerial Depiction of Deer/ Meadows Lake and Degree of Shoreline Erosion

Deer/Meadows Lake (Figure 57)

The LMU conducted its most recent assessment of Deer/Meadows Lake in 2004. The lake is actually a 13.6-acre detention basin with a maximum depth of about 4 feet that was created in the early 1980's to provide stormwater storage for approximately 20 homes in the surrounding subdivision. The lake is managed by private residents and currently, Environmental Aquatics treats the lake with algaecides as needed. The majority of the 38-acre watershed surrounding the lake is comprised of the residential subdivision. As a result, stormwater runoff to the lake results in poor water quality. The LMU reports phosphorus levels nearly twice the county average that may be caused by internal sources such as resuspended sediment caused by carp activity and decomposing algae. High total suspended solids (TSS) concentrations are also problematic and attributed to suspended sediments and algae. Another problem is high conductivity that results from road salts being washed into the system. Nearly 100% of the shoreline is developed and about 50% of this is comprised of turf grass; rip rap makes up an additional 31%, and buffer another 17%. Approximately 973 linear feet of the shoreline is moderately eroded.

Figure 58: Stream Profile – East Branch Flint Creek

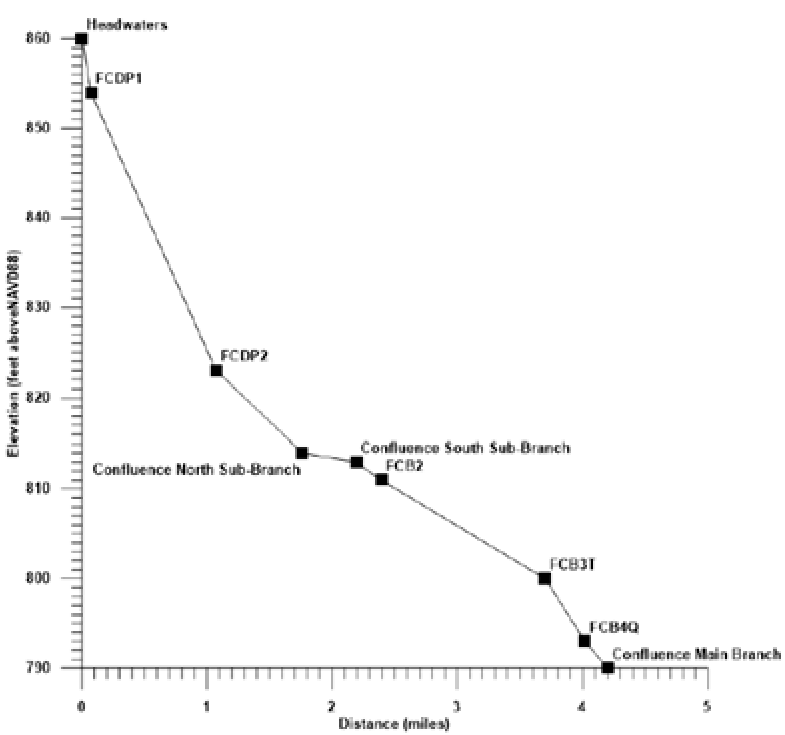


Figure 59: Stream Profile – South Sub-Branch East Branch Flint Creek

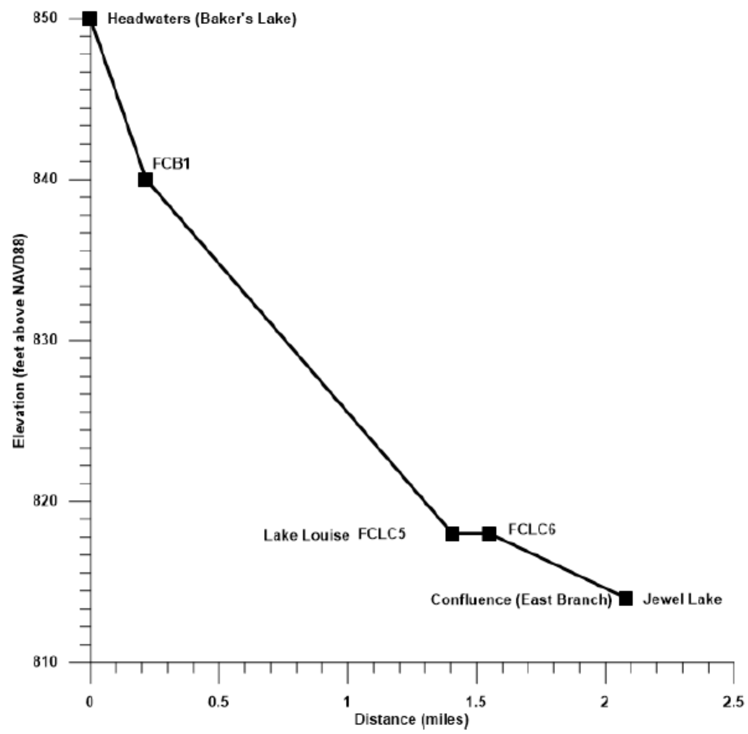
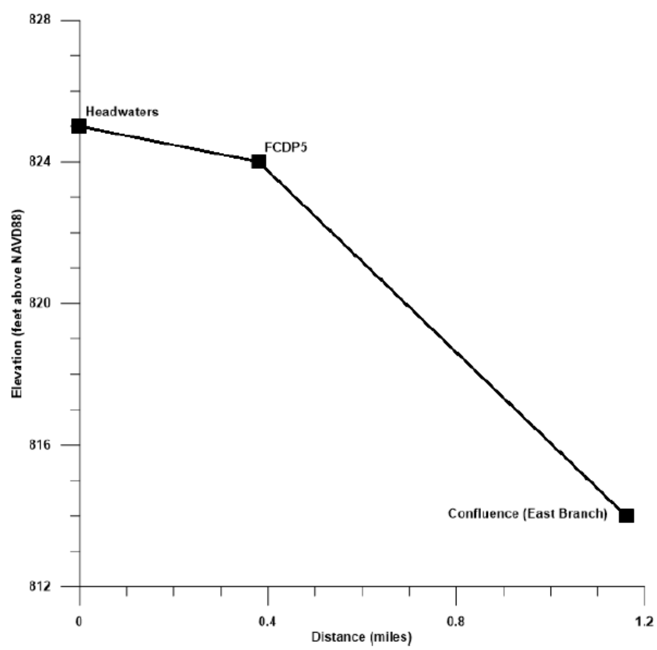


Figure 60: Stream Profile – North Sub-Branch East Branch Flint Creek



Main Stem Flint Creek Subwatershed Lakes and Water Quality

LaBuy's (16 acres), Hawley (67 acres), Keene (51 acres), and Hawthorne (31 acres) Lakes, (Figure 38) are located on-line with Flint Creek's main stem in the Cook County portion of the watershed. Stephanie, Heather, and Crabtree Lakes are also located in the Flint Creek (Main Stem) subwatershed but are hydrologically connected to Flint Creek primarily via smaller surface or tile drainages. None of these lakes were assessed by the LMU. However, some data from the early 1990's is available from IEPA's VLMP for Hawley, Keene, Stephanie, and Heather Lakes. An additional study of physical, chemical, and biological parameters for Heather, Keene, and Stephanie Lakes was conducted by Lake Management Services in 1988. No lake shoreline erosion data is available for any of the lakes located in Cook County except Baker's Lake.

LaBuy's and Crabtree Lakes

LaBuy's Lake (16 acres) and Crabtree Lake (46 acres) are both located in Cook County's Crabtree Nature Center Forest Preserve. These two lakes flow into Flint Creek's main stem within the preserve before flowing north and into a chain of three major lakes. Flint Creek first enters Hawley Lake from the south then exits over a spillway and flows east under Hawthorne Road (Route 59) into Keene Lake. From Keene Lake, Flint Creek flows north into Hawthorne Lake over a dam/spillway before exiting to the north and eventually into Lake County. Stephanie and Heather Lakes are smaller waterbodies that are hydrologically connected to Keene Lake to the south and north respectively.

Hawley Lake

Hawley Lake is a 67-acre private artificial impoundment created in 1938 with a maximum depth of 9 feet. Its water source is primarily from Flint Creek which enters the lake at the south end. According to the VLMP data collected in 1990, the water quality is fair. Phosphorus levels meet general standards and Total Suspended Solids readings are only slightly elevated. The VLMP reports the lake supports an excellent fishery.

Keene Lake

Keene Lake receives water from Hawley Lake under Hawthorne Road (Route 59) to the west. This 51-acre lake has a maximum depth of 11.5 feet and was constructed in 1944 by building a spillway at the north end. VLMP data collected in 1993 reports water clarity at about 3.5 feet. Additional data collected by Lake Management Services in 1988 reports sufficient nutrients to sustain plant and algal growth and varying degrees of water clarity linked to algae blooms, eroded shorelines, and carp. The study also reports an average fishery comprised primarily of largemouth bass and bluegill. Water exiting Keene Lake enters Hawthorne Lake to the north, the third and final lake in the chain. No data is available for Hawthorne Lake.

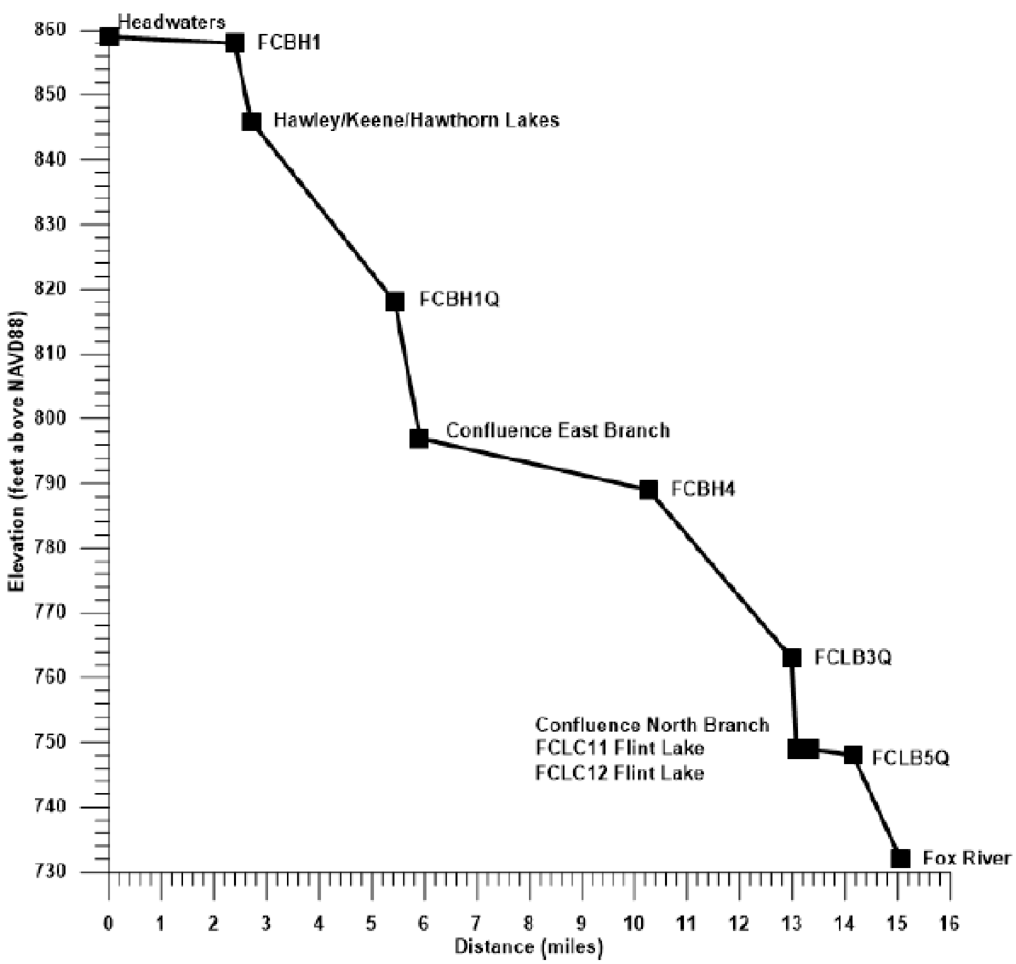
Stephanie Lake

Stephanie Lake is hydrologically connected to Keene Lake to the south but is not on-line with Flint Creek's main stem. The small (4.8 acres) waterbody exhibits a maximum depth of 8 feet. VLMP data collected in 1993 indicates water clarity around 2.5 feet. Data collected by Lake Management Services in 1988 reports poor water clarity due to a summer algae bloom at the time of sampling. Phosphorus levels in 1988 were reported to be 0.26 mg/l, nearly 5 times higher than the general standards. An examination of fish populations noted reduced numbers of largemouth bass, small bluegills, and an abundance of undesirable green sunfish.

Heather Lake

Heather Lake is a small (6.0 acres) impoundment located south of Keene Lake. Like Stephanie Lake, it is not on-line with Flint Creek's main stem but is hydrologically connected to Keene Lake. VLMP data collected in 1993 reports water clarity at about 2.5 feet. Supplemental data provided by Lake Management Services in 1988 indicates varying degrees of water clarity between 2.5 and 6 feet based on algae present in the water column. Phosphorus levels measured in 1988 were relatively high (0.14 mg/l) and were attributed to fertilizers, septic systems, and decomposing organic matter. The lake's fishery is moderate with varying sizes of largemouth bass and good populations of 7-8 inch bluegill.

Figure 61: Stream Profile – Flint Creek



Flint Lake (repeated from page 111, because of its location)

Flint Lake is an 11-acre manmade lake in southwestern Lake County. Flint Lake receives water from two main inlets, the Grassy Lake Drain (north inlet) and Flint Creek (south inlet) and empties into Flint Creek which eventually flows into Fox River. Flint Lake residents use the lake for aesthetics.

Three sewage treatment plants are operating in the Flint Lake Watershed. The largest one is the Barrington Wastewater Treatment Plant that discharges effluent into Flint Creek. The Mount Saint Joseph and North Barrington Elementary plants discharge into Grassy Lake Drain.

Flint Lake is known for having some of poorest water quality of all lakes sampled in Lake County. Water quality in Flint Lake has not deteriorated since the 2003 study. The 2008 average TSS was 57.7 mg/L for the north inlet and 22.9 for the south inlet which is considerably higher than the county median of 8.2 mg/L. Alkalinity also had high values the north inlet 216 mg/L $CaCO_3$ and 243 mg/L $CaCO_3$ at the south inlet both are higher than the county median of 162 mg/L $CaCO_3$. However 2008 values were reduced compared to the 2003 value of 330 mg/L $CaCO_3$ that marked the highest alkalinity concentrations recorded in Lake County.

The Lake County median conductivity reading was 0.8195 milliSiemens/cm (mS/cm). During 2008, the average conductivity reading in Flint Lake for the north inlet was 1.0970 mS/cm and 1.2780 mS/cm for the south inlet. This was decrease from the 2003 average of 1.5818 mS/cm, likely due to rain events in 2008. Conductivity is positively correlated with chloride (Cl) concentrations. The average Cl concentration in Flint Lake was also greater than the Lake County median of 166 mg/L during 2008, with an average of 200 mg/L in the north inlet and 223 in the south inlet. The 2008 average total phosphorus (TP) concentration of 0.188 mg/L for the north inlet and 0.293 mg/L for the south was significantly above the county median of 0.065 mg/L. However the average TP concentration decreased by 48% from the 2003 survey when the average TP concentration was 0.564mg/L.

Aquatic plants were scarce in Flint Lake in 2003 and 2008. Only five species of aquatic plants; Sago Pondweed, Small Duckweed, Curlyleaf Pondweed, Coontail, and Elodea were present and located near the shoreline. Algal blooms and an over abundance of Duckweed occurred in Flint Lake during the season.

The shoreline was reassessed in 2008 for significant changes in erosion since 2003. Based on the 2008 assessment, there was an increase in shoreline erosion with 100% of the shoreline having some degree of erosion. Overall, 47% of the shoreline had slight erosion, 24% had moderate erosion, and 29% had severe erosion.

Flint Lake is located in a residential setting with the shoreline mainly developed. Although residential areas usually do not offer good wildlife habitat, the mature trees in the lots surrounding the lake offer some songbird habitat. **(From the LCHDES 2008 study)**

3.3 Wetlands Inventory

In the 1830's European settlers in the Flint Creek watershed altered significant portions of the watershed's natural hydrology and wetland processes. Where it was feasible, settlers drained wet areas, channelized streams, and cleared forests in order to farm the rich soils. Based on hydric soils mapping provided by the McHenry, Lake, and Cook County Natural Resource Conservation

Services (NRCS), there were approximately 5,738 acres of wetlands in the watershed prior to European settlement. According to existing wetland inventories discussed below, 4,393 acres or 76% of the pre-settlement wetlands remain. This percentage of existing wetlands is much higher than in similar watersheds in Lake County, such as the Indian Creek and Bull Creek/Bull's Brook watersheds where only 45% and 56% remain, respectively.

Functional wetlands do more for water quality improvement and flood damage reduction than any other natural resource within a watershed. In addition, wetlands typically provide habitat for a wide variety of plant and animal species. They also provide groundwater recharge and discharge, filter sediments and nutrients in runoff, and help maintain water levels in streams during drought periods. Wetland information and mapping is available for the entire Flint Creek watershed area from several government agencies. Advanced wetland inventories and identification studies (ADID) are available for both Lake and McHenry Counties. The U.S. Fish & Wildlife Service's (USFWS) National Wetland Inventory (NWI) mapping is the only data available for wetlands in the Cook County portion of the watershed. The combination of wetland data was used to map and describe the existing wetlands in the watershed and to locate potential wetland restoration sites.

Lake and McHenry County Wetland Inventories

In 1998, the Lake County Wetlands Inventory (LCWI) was developed from USDA/Soil Conservation Service wetland inventory maps, National Wetland Inventory (NWI) maps, soil survey of Lake County, and other low altitude aerial photography. The inventory maps natural and artificial wetlands meeting definitions established by the federal agencies that work with the Lake County Geographic Information System. These agencies include the U.S. Environmental Protection Agency (USEPA), the USFWS, the U.S.D.A. Natural Resources Conservation Service (NRCS), and the U.S. Army Corps of Engineers (USACE). Because the LCWI wetland boundaries are based on off-site determination methods and not onsite delineation, the wetland boundaries are only good for general reference, planning, and initial screening purposes. Like Lake County, McHenry County also completed a wetland inventory and ADID study within its jurisdiction in 1998. Only two small non-ADID wetlands are located in the McHenry County portion of the watershed.

High Functionality (ADID) Wetlands

The ADID program is a USEPA and USACE guided program developed to shorten permit-processing time related to filling wetlands and to provide information to local governments. Three primary functions were used by the USEPA and USACE to evaluate wetlands during the ADID process including biological value (i.e. wildlife habitat and plant species diversity), hydrologic functional value (i.e. stormwater storage or bank stabilization), and water quality value (i.e. sediment, and nutrient removal). According to the identification process, 10 wetlands are identified as ADID (Figure 41). All of these wetlands are located within Lake County. Data for each ADID wetland is summarized in Table 23 below.

Some protection of ADID wetlands is provided in Lake County under existing regulatory programs including floodplain development restrictions, the Lake County Watershed Development Ordinance (WDO), and the USACE section 404 Clean Water Act permit program. The USACE will also generally require an individual permit for modifications to all ADID sites. ADID sites are generally considered unmitigatable and unsuitable for filling activities. In rare cases where mitigation is allowed, a 3:1 mitigation ratio is required in Lake County. Additionally, Lake County requires a 100-foot buffer around all ADID wetlands located within developed areas.

Table 25. Lake County ADID wetlands and attributes.

ADID ID #	Name	Acres	ADID Attributes
147	Lyons Prairie & Tower Lake Fen Fox River Complex	41.8	**Biological**: State T&E species, INAI site, high quality plant community **Water Quality/Hydrology**: Stormwater storage, shoreline stabilization, sediment/toxicant retention, nutrient removal
173	Flint Creek	128.5	**Water Quality/Hydrology**: Shoreline stabilization, sediment/toxicant retention, nutrient removal
177	Flint Creek Tributary Wetland	51.2	**Biological**: High quality plant community (sedge meadow) **Water Quality/Hydrology**: Stormwater storage, sediment/toxicant retention, nutrient removal
166	Grassy Lake	252.4	**Biological**: High quality plant Community (sedge meadow) **Water Quality/Hydrology**: Shoreline stabilization, sediment/toxicant retention, nutrient removal
167	Honey Lake Complex	73.9	**Water Quality/Hydrology**: Shoreline stabilization, sediment/toxicant retention, nutrient removal
156	Headwaters of North Flint Creek	29.7	**Biological**: State T&E species **Water Quality/Hydrology**: sediment/toxicant retention, nutrient removal
174	Honey Lake Headwaters	38.3	**Water Quality/Hydrology**: Stormwater storage, sediment/toxicant retention, nutrient removal
175	Honey Lake Headwaters	76.1	**Biological**: State T&E species, sedge meadow **Water Quality/Hydrology**: Stormwater storage, sediment/toxicant retention
179	Deer Park Marsh	14.9	**Biological**: High quality wildlife habitat for State T&E species (hemi marsh) **Water Quality/Hydrology**: Stormwater storage, sediment/toxicant retention
178	Cuba Marsh	31.3	**Biological**: State T&E species, hemi marsh **Water Quality/Hydrology**: Stormwater storage, sediment/toxicant retention, nutrient removal

Source: Lake County Wetland Inventory (LCWI)

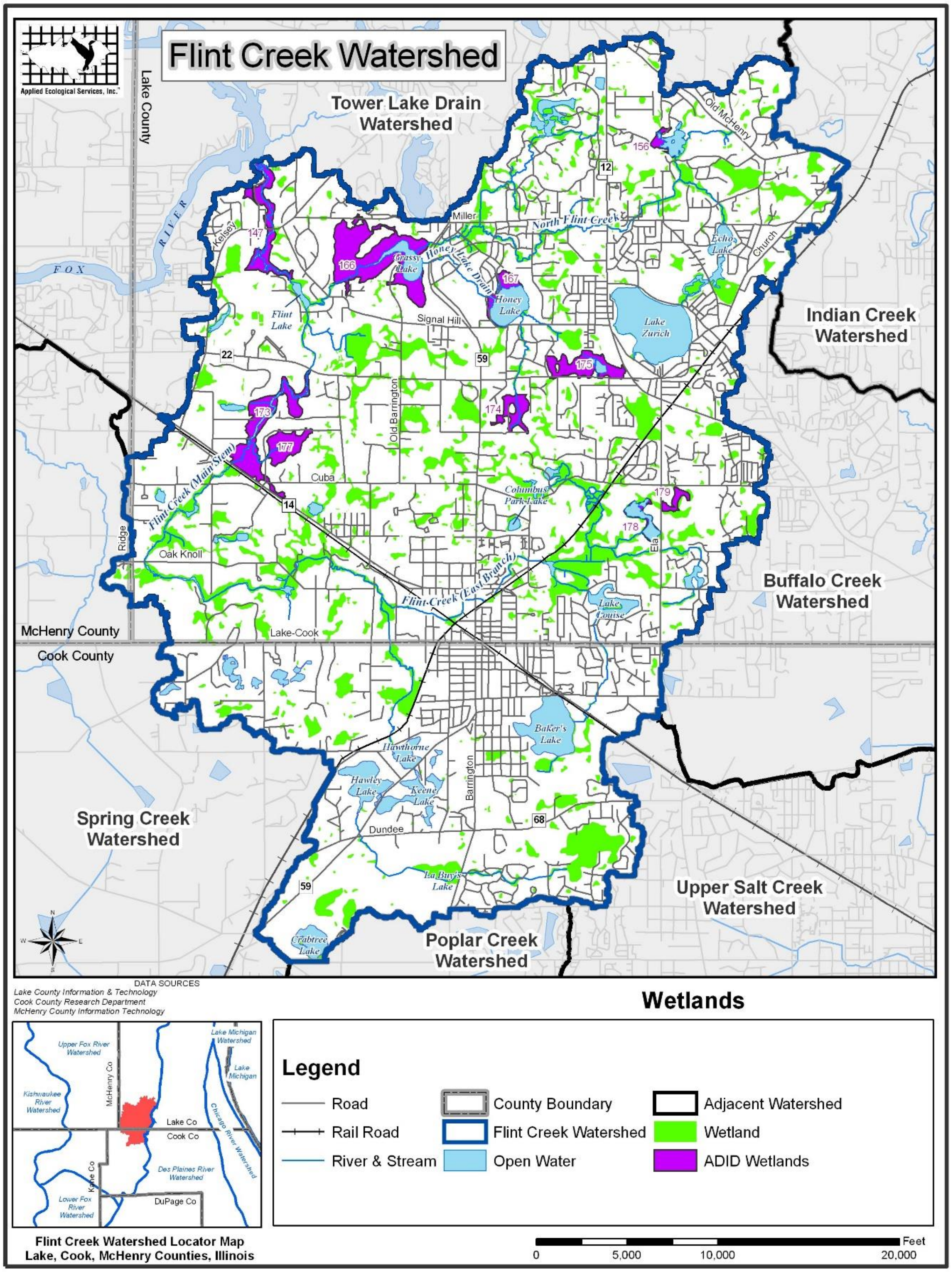


Figure 62: Wetlands

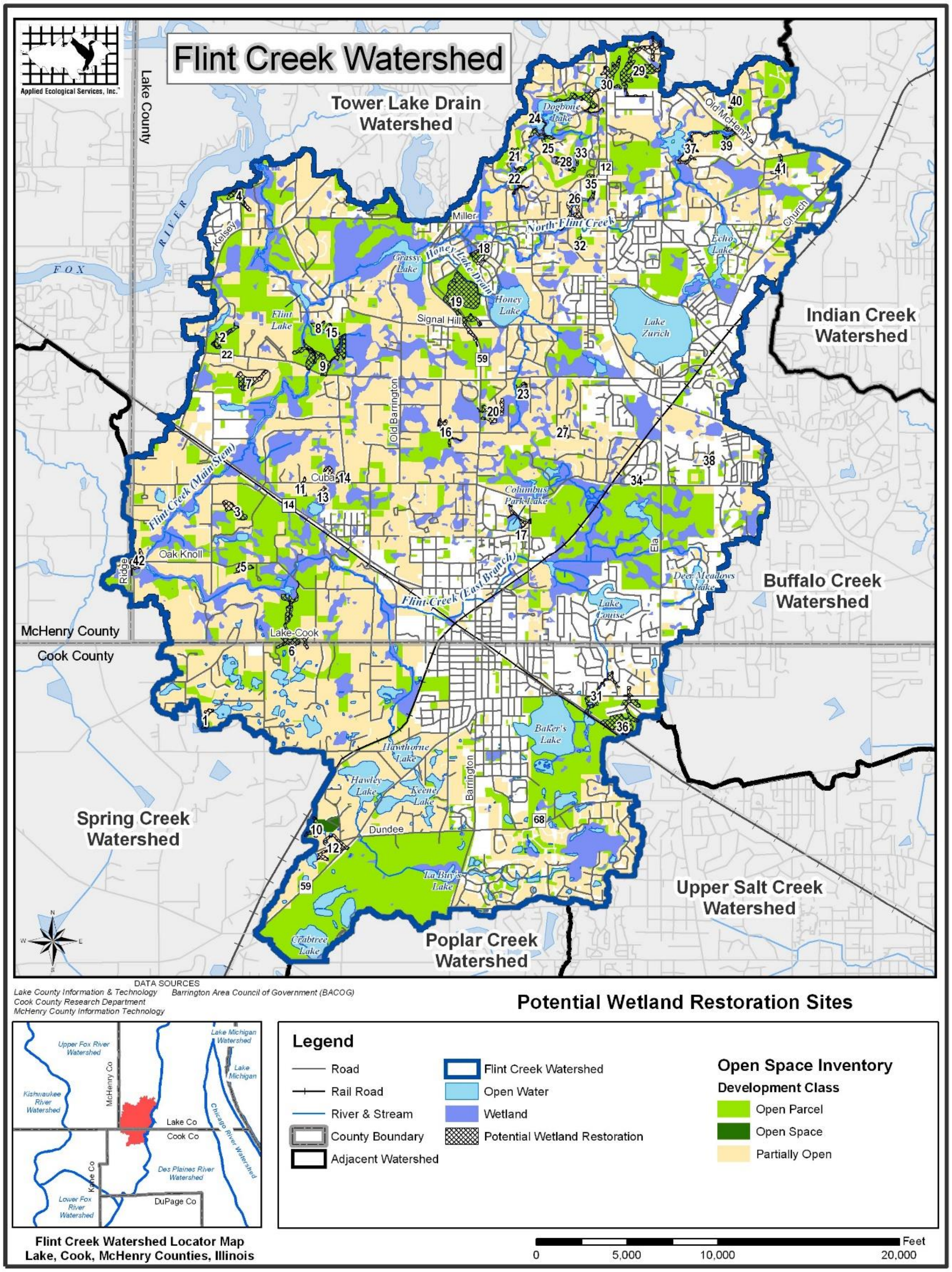


Figure 63: Potential Wetland Restoration Sites

3.4 Groundwater Protection

Groundwater is one the most important factors affecting the ecology of the watersheds. Groundwater is the base flow of streams and contributes water to many of the ponds lakes and wetlands of the watersheds. This water is supplied by the shallow groundwater system. The system consists of the limestone/dolomite bedrock underlying the watersheds plus the overlying unconsolidated materials left behind by the recession of the glaciers. The unconsolidated materials mainly consist of clay, silt, sand, gravel and the combinations thereof that are saturated with water. Groundwater is in storage in the void spaces between the particles of the unconsolidated materials. The coarser materials such as sand and gravel form units/formations called aquifers and are the primary source of water extracted for human consumption in the area.

All of this groundwater flow through, into, and out of the system balance out so that in a natural state, without human intervention, the amount of water in storage remains constant. This constant groundwater storage manifests itself in constant groundwater levels. When human influences are removed, the only change to groundwater levels is a result of climatic conditions. If there were a drought, the water levels go down and conversely, if there were an excess of precipitation, the groundwater levels would rise. Everyone has experienced drought conditions and seen stream water levels drop or disappear altogether. This is a result of groundwater levels dropping below the level of the streambed so that no groundwater discharge occurs to the stream.

Once human influence is added to the equation, it provides a stress that tends to reduce groundwater levels. There is a large volume of groundwater in the area that is *accessible* for consumption, accomplished through public and private well pumping for drinking water, lawn watering, agricultural irrigation, and industrial and other uses. Consumption of more than a few percent of that volume, however, can diminish community supply and reduce groundwater levels and discharge to streams to a point where the ecology of the watershed is substantially affected. The recharge process counters the reduction of groundwater levels by consumption, by allowing precipitation to infiltrate to the shallow aquifer system and increase the groundwater volume. Groundwater levels, especially trends in levels over long periods of time, reflect changes to the groundwater balance and the sustainability of the resource.

Recharge is the process by which precipitation reaches and re-supplies the groundwater aquifers. After precipitation reaches the ground a significant portion runs off and/or evaporates. Of the portion that infiltrates the surface soil, most eventually evaporates from the soil or is taken up and used (transpired) by plants. In areas near streams, rivers, ponds and lakes some of the portion that infiltrated the soil will travel through the near surface soils (upper few feet) and become delayed discharges to these water bodies within a few days of the precipitation event. In terms of annual precipitation, runoff and immediate evaporation accounts for approximately 26 and 5 percent of the precipitation respectively. About 69 percent of the precipitation enters the surface soil were 53 percent of the precipitation evaporates from the soil, is transpired by a plants is discharged by shallow subsurface flow. The remaining 16 percent travels downward through the underlying unconsolidated materials, reaches the groundwater and becomes groundwater recharge. Figure 5 shows the location of the recharge areas in the watersheds while Table 2 lists the acreage of each of the recharge characteristics in the watersheds.

Areas within the watershed that have conditions that favor rapid recharge are the main areas where the shallow system groundwater is replenished. Groundwater can be extracted from anywhere, but is mostly re-supplied through recharge areas. Therefore, recharge areas provide a fast conduit for precipitation to re-supply the groundwater and counter the effects of human consumption. On the other hand, the characteristics that encourage rapid refreshment of the groundwater are the same characteristics that favor the travel of contaminants from the surface to the groundwater and which can degrade the groundwater supply. Activities that use materials that might generate contaminants when released to the ground have the potential to cause these contaminants to migrate rapidly to the groundwater.

Research conducted through the Barrington Area Council of Governments (BACOG) has led to the classification of the watershed recharge areas. The classification is strictly based on analysis of the area's surface soil and underlying unconsolidated material characteristics. Classification is determined by the relative time of travel of water on the surface to reach the uppermost aquifer formation. It does not account for the variability in amount and the sequence of precipitation events nor does it include the effects of transpiration.

Data sources used in the classification and mapping include: Soil Survey for Lake County (USDA, 1970); stratigraphic (sequence of geologic soil types) information obtained from water-well logs (Illinois State Geological Survey [ISGS], 2001); and some techniques used by Berg (2001, ISGS).

The BACOG map (Figure 62) shows the distribution of recharge characteristics in the Flint Creek watershed. The watershed area contains approximately 4,100 acres of "moderate," 900 acres of "important," and 90 acres of "critical" recharge areas. These relatively good recharge areas are located along the western boundary of the watershed beginning with a small area of "moderate' to "important" recharge characteristics in Barrington Hills north of the headwaters of the main stem of Flint Creek. Portions of Lake Barrington and North Barrington also have significant portions of "moderate" to "important" recharge areas as does the western portion of Cuba Township that lies within the watershed boundary This portion of Cuba Township also contains a small area exhibiting "critical" recharge characteristics. The rest of the watershed has recharge characteristics that can be classified as "poor" to "very poor." The distribution of recharge depicted in Figure 62 is based on the best data available, but if recharge is an important consideration at a given site, more detailed site-specific recharge characteristics should be determined.

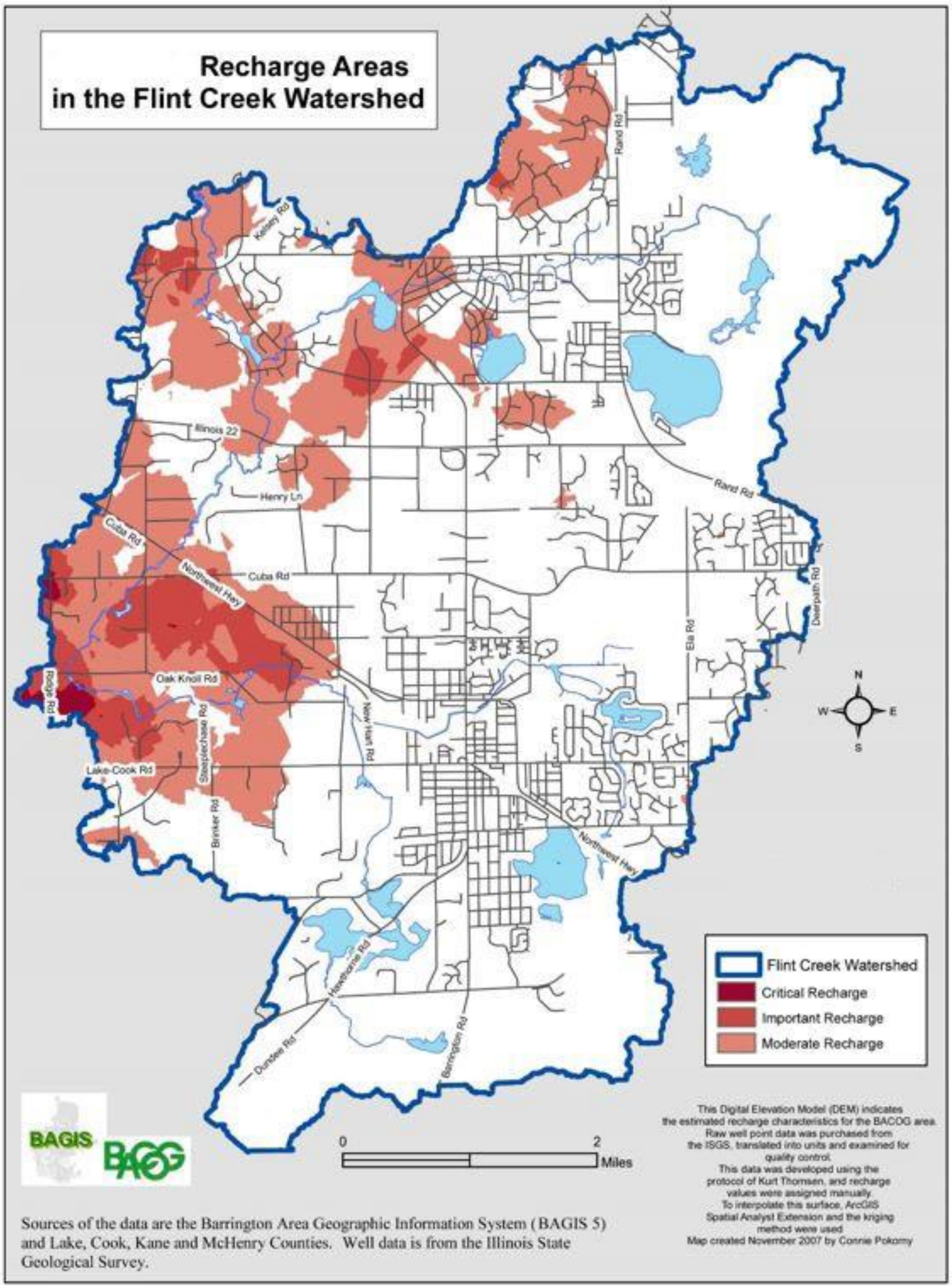


Figure 64: Recharge Areas in the Flint Creek Watershed

Interim Report Shallow Aquifer System Water Levels Monitoring Program, July 2016

(The following information is excerpted from the July, 2016 BACOG report, downloaded 2/26/2017 from http://bacog.org/wp-content/uploads/2017/06/2016-Interim-Summary-Report_FINAL-8-11-16.pdf The full report is included in the Appendix)

"Because the BACOG area is almost entirely reliant on the shallow aquifer system for all its water needs, there is growing concern about the sustainability of this resource. Water consumption due to growth and development has increased around and within the BACOG area and will continue. For the BACOG area, there is no alternate water supply. Lake Michigan water and river water are not available here, and even if another source of water supply were to become available, there is very little piped infrastructure to distribute such a supply. The cost to build distribution systems throughout nearly 90 square miles would be prohibitive.

"Most areas have individual residential private wells or subdivision wells; over 7,800 shallow aquifer system wells provide supply for a population of approximately 35,000. A significant drop in water levels could pose a huge financial impact as private well owners might need to drill deeper or relocate wells. A threat to water levels or water quality would be a threat to public health and safety as well.

"There are thousands of acres of natural areas locally, many of which are dependent on groundwater to feed them. A significant drop in water levels could also mean significant changes to those natural areas if groundwater discharge were no longer adequate to sustain rivers, streams and ponds and natural areas such as fens, woods and wetlands. If the natural areas that define the BACOG area and quality of life were to decline, property values could be negatively affected.

"State studies suggest there will be a downward trend in water levels in the coming decades – by 10 to 20 feet in some BACOG communities -- so monitoring those conditions has become more critical. To address this situation, the Executive Board unanimously approved RESOLUTION #13-04 "Supporting the Establishment and Funding of a Comprehensive Groundwater Monitoring Program under the Barrington Area Council of Governments" on November 19, 2013. Establishing a baseline and then trends in water levels in the shallow aquifer system is necessary information moving forward. Water level data can provide an indication of "what we need to do" in upcoming years to protect the aquifer system that is virtually the sole water supply for the region. Under Resolution #13-04, all BACOG governments share the costs of the program due to the regional nature of this initiative and benefit to all communities…."

While it is too early to establish trends, as "a courtesy to BACOG, two individuals from the ISGS and the USGS have provided comments on the data presented in the Interim Report.

"Comments provided by David R. Larson, Hydrogeologist (retired), Illinois State Geological Survey; former Section Head, Geologic Mapping and Hydrogeology Center: Because the water-level record is so short and with little stage-level data for surface water, discussion of trends would be inappropriate. A discussion of possible indicators might include the overall similarity of the North Barrington and Deep Park hydrographs between the two periods. Another feature is the hydrographs of the first period show less fluctuation of water level than the hydrographs of the second period. A third feature is the different shape of the Lake Barrington hydrographs, but this would need a word of explanation as to why they are different. The hydrographs show minor changes over time, and this may be all that is needed to be said. Adding a weather monitoring station (precipitation, temperature, etc.) within BACOG but some distance from the Barrington NOAA site would be beneficial. The data provided would enhance evaluating the trends in water-level fluctuations, for example. Cooperative programs, such as Mesonet, may help provide the resources to accomplish this, one of which involves schools.

"Comments provided by Amy M. Gahala, Hydrologist, U.S. Geological Survey, DeKalb Office: As previously noted, the required time period necessary to observe and evaluate trends in water levels is generally five years to a decade or more. For the 2019 BACOG report, the data available will include the historical ISGS measurements from 2007-12, which when evaluated together with all data collected through 2019, should provide an adequate time period to establish trends. With the exception of the LZUR05-02 monitoring well, all the other water level data are indicating a stable trend. The Lake Zurich quadrangle well, LZUR-05-02, has shown a 70 foot decrease in water levels from 2007 to 2016. Water levels have dropped consistently on a year-to-year basis, and this is not likely to be caused by natural fluctuations."

Fortunately, this last finding, according to Janet Agnoletti, BACOG Executive Director, was subsequently investigated and found to be a result of irregularities in the data and not a true water level decrease.

BACOG and the FCWP believe that a robust network of gages in monitoring wells and streams will aid in early identification of water supply trends. Such a network has been established. Currently there are 18 monitoring wells in the BACOG area (includes some in the Spring Creek Watershed). Three of these wells have transducers, providing a continuous read of water levels (http://bacog.org/groundwater-resources/program-overview/); the other 15 require manual readings, taken annually. In addition, there is also a network of stream gages, some of which can also measure conductivity. While the stream gages have yet to be calibrated for consistency, the gages and monitoring wells are building a picture of how our surface and groundwater resources are responding to our patterns of use, and climate variations. Adding gages in Spring Creek, adding monitoring wells, and/or equipping more of the monitoring wells would enhance the water level and water quality data needed for evaluating trends.

3.5 Water Quality

While the stream gages and well monitoring are focused on water levels, BACOG also hosts Level 1 private well water testing every fall. These tests are for nitrates and bacteria. Private well water samples found to have bacteria run between 10% and 13% annually. Well owners participating in this testing also may sign up for BACOG's Level 2 water testing, which measure natural water quality in the aquifer. BACOG maintains a GIS database of Level 2 test results, which is being used to characterize the region's natural water quality and which is shared with the State Surveys.

Many water quality studies have been completed by several agencies within the Flint Creek watershed. Water quality monitoring is conducted in both lakes and streams but differs depending on the parameters measured. Lake studies usually monitor for nutrients, suspended solids, water clarity, and dissolved oxygen. These parameters are also monitored in streams along with biological monitoring of macroinvertebrates. The data gathered is in a comprehensive report published in July, 2016, so that recommendations and management strategies could be based on the current and most complete depiction of the present water quality conditions within the Flint Creek watershed. The full report is in the Appendices. This event was the implementation of the approved water quality plan (KOTECI, 2015a) and was conducted following the procedures detailed in the water quality plan and the approved quality assurance project plan (KOTECI, 2015b). While the collected data were used to characterize baseline conditions in both watersheds, only Flint's is reflected here. Data were collected from 25 locations in the Flint Creek watershed. A minimum of three data sets and preferably six data sets are required for any statistical analysis of the data to conduct comparisons and develop trends.

Chemical Monitoring for Water Quality

Chemical monitoring data is a major source of information for the IEPA Section 305 (b) water quality and Section 303 (d) List integrated report. The Clean Water Act defines pollution as the human-made or human-induced alteration of chemical, physical, biological, and radiological integrity of water (Hocutt 1981). Chemical pollution, as documented in Illinois' Section 303 (d) list is a threat to "Designated Uses" of streams and lakes in the Flint Creek watershed.

Limnologists evaluate the ecological health of a waterbody and probability of biological productivity by measuring a variety of water quality parameters. The overall objective of water quality sampling and monitoring is to assess existing conditions in an attempt to restore or maintain the chemical, physical, and biological integrity of the stream or lake. A list of typical chemical and physical monitoring parameters measured is listed below. General use standards are designed to protect the state's water for aquatic life, wildlife, agricultural uses, secondary contact, and most industrial uses. In other words, "General Use" standards are established to protect "Designated Uses".

Table 26. Typical physical and chemical monitoring parameters:

Temperature	Standards/Recommendations:	<32° C
pH	Standards/Recommendations:	6.5 - 9
Dissolved Oxygen (DO) mg/l	Standards/Recommendations:	>5
Total Suspended Solids (TSS)/Turbidity mg/l	Standards/Recommendations:	15
Water Clarity (ft)	Standards/Recommendations:	1.5
Total phosphorus mg/l	Standards/Recommendations:	0.050
Fecal coliform (colonies/100 ml)	Standards/Recommendations:	200
Conductivity	Standards/Recommendations:	N/A
TKN	Standards/Recommendations:	
Metals	Standards/Recommendations:	Varies

Table 27. Sampling Stations and Locations

	Sampling Stations	Latitude	Longitude
Barrington	FCB1	42.1449	-88.1153
	FCB2	42.1653	-88.1260
	FCB3T	42.1582	-88.1453
Barrington Hills	FCBH1	42.1276	-88.1574
	FCBH4	42.1762	-88.1854
Deer Park	FCDP1	42.1723	-88.0877
	FCDP2	42.1667	-88.1019
	FCDP5	42.1781	-88.1085
North Barrington	FCNB1	42.2112	-88.1190
	FCNB2	42.2120	-88.1357
	FCNB4	42.2092	-88.1440
	FCNB7	42.2018	-88.1344
Lake County	FCLC5	42.1599	-88.1131
	FCLC6	42.1611	-88.1152
	FCLC7	42.1955	-88.1000
	FCLC8	42.2100	-88.0903
	FCLC9	42.2004	-88.1301
	FCLC10	42.2053	-88.1472
	FCLC11	42.2007	-88.1672
	FCLC12	42.2037	-88.1703

Table 28. Stream Gage and Sampling Station Locations

Responsible Jurisdiction	Sampling/Stream Gaging Stations	Latitude	Longitude
Barrington Hills	FCBH2Q	42.1544	-88.1520
Barrington	FCB2Q	42.1591	-88.1512
Lake Barrington	FCLB3Q	42.1996	-88.1676
	FCLB4Q	42.2007	-88.1660
	FCLB5Q	42.2114	-88.1735

Table 29. Biological Sampling Station Locations

Responsible Jurisdiction	Biological Sampling Stations	Latitude	Longitude
Barrington Hills	FCBH2QB	42.1544	-88.1520
Barrington	FCB2QB	42.1591	-881510
Lake Barrington	FCLB3QB	42.1996	-88.1671
Lake Barrington	FCLB4QB	42.2007	-88.1660
	FCLB5QB	42.2114	-88.1735
Citizens for Conservation	FCCFC1B	42.1603	-88.1536
	FCCFC2B	42.1975	-88.1673
	FCCFC3B	42.2198	-88.1760
River Watch	FCRW3B	42.2097	-88.1319

Based on the 2016 Baseline Study, following is the Trophic State of some of the Lakes in the Flint Creek Watershed

Table 30. Location of Testing Sites and the Stream Branch and SMU

Stream Branch	Sampling Location	SMU
FCMB	FCBH1	FCM7
FCMB	FCBH2Q	FCM5
FCEB	FCDP2	FCE6
FCEBNSB	FCDPS	FCE3
FCEBSSB	FCB1	FCE3
FCEBSSB	FCLC5	FCE8
FCEBSSB	FCLC6	FCE7
FCEB	FCB2	FCE7
FCEB	FCB3T	FCE2
FCEB	FCB4Q	FCE3
FCMB	FCBH4	FCN1
FCMB	FCLB3Q	FCM3
FCNB	FCLC7	FCN1
FCNB	FCLC8	FCN6
FCNB	FCNB1	FCN6
FCNBNSB	FCNB2	FCN4
FCNB	FCNB4	FCN2
FCNBSSB	FCLC9	FCN1
FCNBSSB	FCLB7	FCN3
FCNBSSB	FCLC10	FCN3
FCNB	FCLB4Q	FCN1
FCMB	FCLC11	FCN1
FCMB	FCLC12	FCN1
FCMB	FCLB5Q	FCN1

The full report is Appendix H Detailed findings are presented later in this report.

Table 31. Specific 2016 303(d) information for assessed waterbodies in the Flint Creek watershed.

Waterbody	Priority	Causes of Impairment	Designated Use
Flint Creek	Medium	Fecal Coliform, Dissolved Oxygen Levels, Total Phosphorus	Aquatic Life and Recreation
Columbus Park Lake	Medium	Total Suspended Solids (TSS), Total Phosphorus (TP)	Aesthetic Quality
Echo Lake	Low	Total Suspended Solids (TSS), Total Phosphorus	Aesthetic Quality
Grassy Lake	Low	Total Suspended Solids (TSS), Total Phosphorus,	Aesthetic Quality
Honey Lake	Low	Fecal Coliform, Total Phosphorus (TP),	Aesthetic Quality
Lake Louise	Low	Total Suspended Solids (TSS), Total Phosphorus	Aesthetic Quality
Lake Zurich	Medium	Mercury	Fish Consumption

Source: IEPA (2016).
*Flint, Baker's, Hawthorne, Keene, Hawley, Heather, Stephanie, Dogbone, and Deer/Meadow Lakes were not assessed for potential inclusion into the 303d list.

Lake County Health Department Water Quality Data

The Lake County Health Department-Lakes Management Unit (LMU) has been collecting water quality data on Lake County lakes since the late 1960's. Detailed reports are written for each lake and include data analyses, a list of problems specific to each lake and recommendations on how to reduce or eliminate those problems (http://www.co.lake.il.us/health/ehs/lmureports.asp). The goal of the LMU is to monitor the quality of the county's surface water in order to:

- Maintain or improve water quality and alleviate nuisance conditions
- Promote healthy and safe lake conditions
- Protect and improve ecological diversity

The LMU collected the most recent water quality data for Lake County Lakes in the Flint Creek watershed from 2000 to 2016 for 9 lakes including Lake Zurich, Echo Lake, Honey Lake, Grassy Lake, Flint Lake, Columbus Park Lake, Deer/Meadows Lake, Dogbone Lake, and Lake Louise. Section 3.9.3 (Lakes Inventory) includes information regarding water quality, aquatic plants, life, and shoreline assessments. The LMU did not collect water quality studies for lakes in the Cook County portion of the watershed. However, the IEPA's Volunteer Lake Monitoring Program (VLMP) conducted basic water quality data sampling for Hawthorn Lake, although nothing since 2004. Keene Lake, Heather Lake, and Stephanie Lake are no longer monitored.

Trophic State Index, Water Clarity, and Total Dissolved Solids

Total phosphorus (TP) concentrations are important to a lake's productivity and health. The state of Illinois set the standard for TP at 0.05 mg/l.

Data from lakes in Lake County show average phosphorus levels at 0.056 mg/l. When TP levels exceed 0.05 mg/l lake wide algal blooms can occur and rooted vegetation can grow uncontrollably.

Increases in algal blooms lead to decreased water clarity, a decrease in light penetration, and increase in total suspended solids. In other words, the biological productivity of the lake increases. Biological productivity is measured by computing a Trophic State Index (TSI). The single index number derived from the TSI is then compared to numerical ranges for the four trophic states discussed below. The most common TSI used to assess Lakes is the phosphorus based TSIp which uses phosphorus levels as the primary indicator of the productivity of a lake. The TSIp categories include: oligotrophic (lacking biological productivity), mesotrophic (moderate biological productivity), eutrophic (high biological productivity), and hypereutrophic (overabundant biological productivity).

Determining the trophic state of a lake is important because it provides a base measure from which lake managers can choose effective strategies to meet the goals of a lake and set reasonable expectations regarding the waterbody's true biological, aesthetic, and recreational potential. For example, oligotrophic and mesotrophic lakes are better managed for swimming than eutrophic lakes because they are generally clearer and contain less biological productivity. Eutrophic lakes are better managed for fishing. Hypereutrophic lakes are typically unhealthy and managed as aesthetic amenities because fish consumption and swimming are generally not safe.

Table 32 below summarizes the most recently documented phosphorus concentrations, TSIp number, and TSIp Category for each assessed lake in the watershed. The water clarity (secchi depth) and Total Suspended Solids (TSS) is also shown in Table 32. Water clarity and TSS is directly related to phosphorus levels. The state of Illinois set the secchi depth standard at 4 feet for swimming and 1.5 feet for general water quality. Several lakes including Grassy, Flint, Dogbone, and Deer/Meadows Lakes do not meet the general water quality secchi depth standard. Lake Zurich and Honey Lake are the only lakes to meet IEPA standards for swimming.

Table 32. Secchi depths, phosphorus concentrations, and TSIp values/categories for assessed lakes in the Flint Creek watershed.

Lake	Year Assessed	Secchi Depth (ft)	Total Suspended Solids (mg/l)	Total Phosphorus (mg/l)	TSIp	TSI Category
Standard	**n/a**	***4 ft/1.5 ft**	***7.5 mg/l**	***0.05 mg/l**	**n/a**	**n/a**
Lake Zurich	2015	7.24	3.0	0.021	48.0	Mesotrophic
Echo Lake	2015	2.3	10.2	0.079	66.2	Eutrophic
Honey Lake	2015	3.11	6.6	0.059	59.0	Eutrophic
Flint Lake	2008	NA	23.3	0.241	93.8	Hypereutrophic
Dogbone Lake	2004	0.9	39.4	0.199	80.5	Hypereutrophic
Columbus Park Lake	2000	2.0	19.0	0.123	73.5	Hypereutrophic
Lake Louise	2015	1.04	36.9	0.181	79.0	Hypereutrophic
Baker's Lake	3/31/2017	n/a	37	0.01	n/a	Eutrophic
	6/15/2017	n/a	276	0.77	n/a	Hypereutrophic
	9/20/2017	n/a	258	0.89	n/a	Hypereutrophic
Hawley Lake	1990	2.5	12.0	0.061	64	Eutrophic
Deer/ Meadows Lake	2004	1.0	23.2	0.116	73	Hypereutrophic

Source: Lake County Health Department Lake Management Reports
* Secchi Depth Standard = 4 ft for swimming, 1.5 ft for water quality
* Total Suspended Solids = 7.5 mg/l standard for general water quality
* Total Phosphorus Standard = 0.05 mg/l standard for general water quality

Results of the TSIp classifications indicate that Echo Lake, Honey Lake, Baker's Lake, and Hawley Lake are all eutrophic (Table 30). A comprehensive study of Baker's Lake conducted by the Cook County Forest Preserve District in 1981 (Forest Preserve District, 1981) classifies the lake as eutrophic. Subsequent testing in 2012 to 2017 by the Village of Barrington would suggest a hypereutropic classification. Eutrophic lakes (TSIp 50-69) have high biological productivity. They possess high nutrient concentrations and are able to support extensive rooted plant populations. These lakes often lack oxygen in the bottom waters during summer stratification limiting the habitat potential of the system. Eutrophic lakes are common in the Midwest especially among human-created lakes and lakes surrounded by heavy development. Lake Zurich was also assessed by LMU in 1991 and 1998. At that time, the lake was classified as mesotrophic (TSIp 40-49); it was classified eutropic as 2007; in 2015, it is again mesotrophic.

Bakers Lake						Lake Zurich Rd						Hart Rd					
Date	Ammonia	Ph	BOD	Total Phos	TSS	Date	Ammonia	Ph	BOD	Total Phos	TSS	Date	Ammonia	Ph	BOD	Total Phos	TSS
Limit	15	6.5-9	< 8	0.05	15-30	Limit	15	6.5-9	< 8	0.05	15-30	Limit	15	6.5-9	< 8	0.05	15-30
2012	0.161	8.5	8	0.11	18	2012	0.01	8.0	1	0.47	5	2012	0.01	7.7	5	0.38	9
2013	0.04	9.8	8	0.18	77	2013	0.11	7.7	3	0.37	0	2013	0.04	8.0	3	4.16	1
2014	0.04	8.9	7	0.05	47	2014	0.12	7.9	5	0.15	2	2014	0.08	7.9	3	1.62	0
2016	0.03	10.2	14	0.67	170		0.17	8.0	7	0.56	12		0.07	8.0	6	1.68	5
3/31/2017	0.509	8.1	9	0.01	37	3/31/2017	0.051	7.7	3	0.02	19	3/31/2017	0.108	7.8	3	0.06	61
6/15/2017	0.022	9.1	11	0.77	276	6/15/2017	0.601	8.8	7	0.49	68	6/16/2017	0.176	7.9	5	0.59	33
9/20/2017	0.27	7.8	12	0.89	258	9/20/2017	0.64	7.7	11	0.64	5	9/20/2017	0.06	8.0	3	1.67	3

Table 33: Recent MS4 testing of Baker's Lake and Main Stem Flint Creek

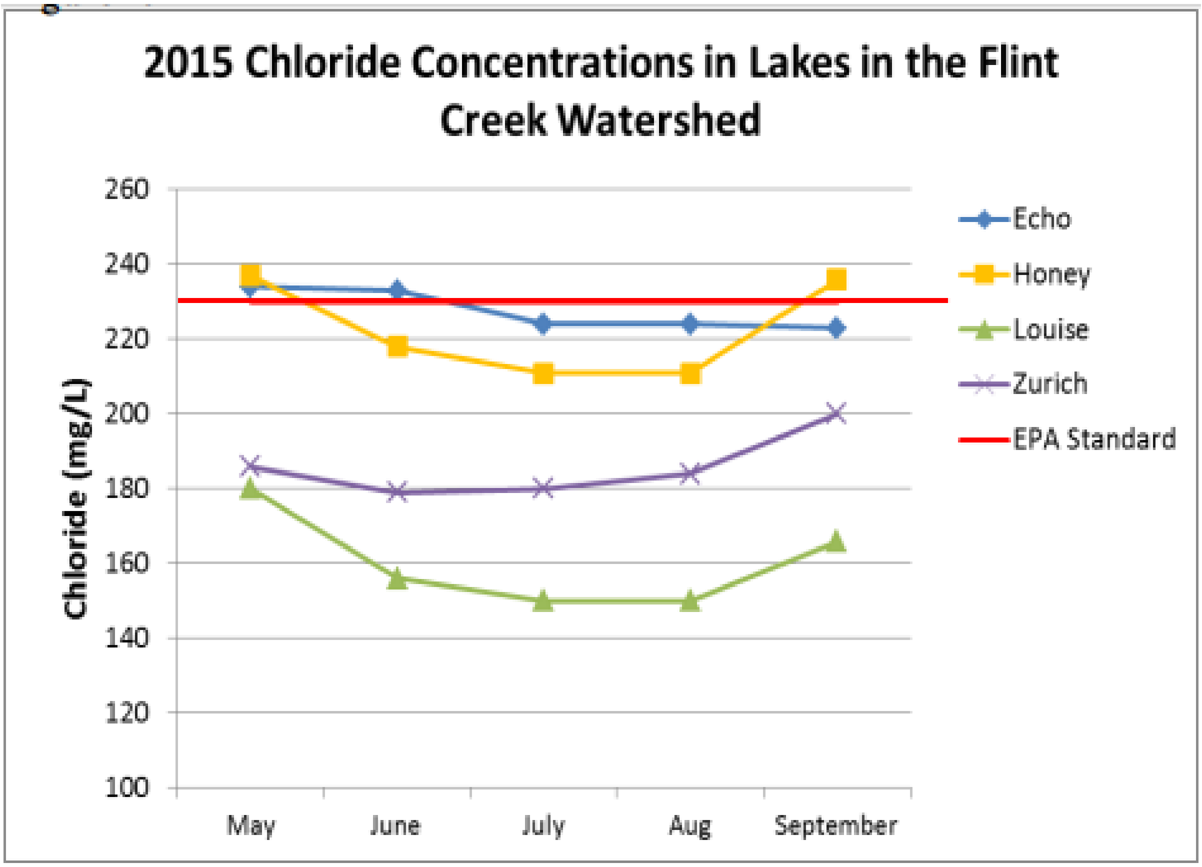
The other assessed lakes in the watershed - Grassy, Flint, Columbus Park, Louise, Dogbone, and Deer/Meadows - are all classified as hypereutrophic (TSIp >70) (Table 30). Hypereutrophic lakes have extremely high nutrient concentrations as well as extensive algal blooms and low water clarity. These problems can result in reduced uses of the waterbody and are often the focus of ongoing management efforts.

Total Suspended Solids (TSS) is a measure of the amount of suspended material in the water column. This can include but is not limited to algae and sediment. High TSS values typically correlate with poor water quality and this is no exception of the assessed lakes in the watershed. Increased turbidity caused by TSS can negatively affect aquatic organisms by decreasing sight for predatory species and decreasing light penetration necessary for aquatic plant growth. Aside from Lake Zurich and Honey Lake, the remaining studied lakes in the watershed far exceed the Lake County standard (7.5 mg/l) for TSS (Table 30).

Total Dissolved Solids (TDS) and correlating conductivity readings in the water column of many urban lakes has increased in recent years. TDS include a variety of dissolved solids such as those being flushed from stormsewers and from stream and lake shoreline erosion. One of the most common dissolved solids is salt applied to roads during winter road maintenance. Chloride ions associated with dissolved salt were found by the U.S. Environmental Protection Agency to be toxic to certain forms of aquatic life at a four-day average concentration of 230 mg/L. Some plant species at the base of the food chain can be impacted at low concentrations. Although high TDS levels can originate from many sources, the LMU identifies road salts as a primary source.

The Lake County median for Chloride concentration is 139 mg/L. Some plant species at the base of the food chain can be impacted at much lower concentrations. Many of the assessed lakes in the watershed show Chloride concentrations above toxic levels and above the county median Although high TDS levels can originate from many sources, the LMU identifies road salts as a primary source.

FIGURE 65: 2015 Chloride Concentrations in Lakes in the Flint Creek Watershed



Biological Monitoring for Water Quality

NGRREC RiverWatch volunteers conducted several macroinvertebrate and fish community surveys in the early 1980's, 1990's, and into 2007 to measure water quality within Flint Creek (Table 34). Biologists and volunteers utilized two biological indices including the Macroinvertebrate Biotic Index (MBI) (IEPA 1987) and the Index of Biotic Integrity (IBI) (Karr 1981; Karr et al.1986; IEPA unpublished) to evaluate the water quality and biological health of streams and to detect and understand change in biological systems that result from the actions of human society on water quality.

Table 34. Index of Macroinvertebrate Biotic Integrity, Flint Creek

Location	Date	Water Quality	Avg. Collected Macroinvertebrates	Avg. Taxa Richness	Avg. EPT Taxa Richness	MBI	Latitude/ years of data
NB Flint Creek Tr R0204301	6/19/14	Poor	118.1764706	8.058823529	1.705882353	6.006922258	42.2097 17 yrs
Flint Creek Petersen Preserve	6/13/2016	Fair	82.0	8.0	2.0	4.52	42.152831 1 year
Flint Creek Savannah R0204201	6/18/2014	Poor	116.7058824	8.705882353	1.705882353	5.720060364	42.1911 17 years
Flint Creek Tr #2; North of Baker's Lake R0213801	6/9/2002	Poor	103	8.71428514	0.4285714286	6.339954018	42.1419 7 years

The MBI is designed to rate water quality using the pollution tolerance of macroinvertebrates and human impacts as an estimate of the degree and extent of organic pollution and disturbance in streams and is a modification of the Hilsenhoff Biotic Index (HBI) (Hilsenhoff 1982) first used in Wisconsin streams. Following data collection, macroinvertebrates are identified and given a predetermined pollution tolerance rating. The MBI is calculated by taking an average of tolerance ratings weighted by the number of individuals in the sample. In 2004, IDNR revised the MBI scoring to better describe and reflect stream conditions in Illinois. Using the 2004 system, MBI scores less than 4.35 represent excellent water quality while scores greater than 6.26 indicate very poor water quality. Flint Creek has much room for improvement, as well as a need for an increase of volunteers with RiverWatch.

The MBI is a valuable monitoring tool because stream biota integrate cumulative effects of sediment/nutrient pollution and respond to habitat degradation (Ohio EPA 1999). Macroinvertebrate and stream fish community surveys are also a major source of information for Section 305 (b) and 303 (d) water quality reports.

Table 35. Water Quality Correlation to Macroinvertebrate Biotic Index Score 2004 Scale.

Macroinvertebrate Biotic Index	Water Quality Category
≤ 4.35	Excellent
≥4.36 to ≤5.0	Good
≥5.1 to ≤5.7	Fair
≥5.71 to ≤6.25	Poor
≥6.26	Very Poor

Note: Score also depends on taxa richness and EPT taxa richness (number of mayfly, stonefly and caddisfly species)

Lake County Health Department sampled area lakes for aquatic plants and invasives. In moderation, native aquatic plants are aesthetically pleasing and environmentally desirable. The diversity and extent of plant populations can be influenced by water clarity and depth. When the light level in the water column falls below 1% of surface light level, plants can no longer grow.

Table 36. Area Lake Macrophytes and Floristic Quality Profiles

Lake	Year Assessed	Macrophytes Sites - % w/ plants	Floristic Quality Index	Invasives	Algae	TSI Category
Lake Co. Median	**n/a**		**13.4**		**n/a**	**n/a**
Lake Zurich	2015	161 sites – 61% Only 8 plant species and Chara (macro-algae)	18.9	Eurasian watermilfoil, Zebra mussels,		Mesotrophic
Echo Lake	2015	23 sites – 85%	10.4	Common carp	treated	Eutrophic
Honey Lake	2015	31sites – 42.5%	20.0		Not in 2015	Eutrophic
Flint Lake	2008	Only 5 species near shore and scarce	11.0	Curlyleaf Pondweed	yes	Hypereutrophic
Dogbone Lake	2004	Only 5 species in just a few locations	15.7* *indicates the quality of the plants found only, and not the density.	Along shore: purple loosestrife, reed canary grass, buckthorn, multiflora rose	slight	Hypereutrophic
Columbus Park Lake	2000	Only 3 species and 1 microalgae found	N/A	Shoreline: purple loosestrife, reed canary grass, buckthorn. Grass carp in the lake	yes	Hypereutrophic
Lake Louise	2015	3 sites – 6.5% Only 2 species	8.3	Carp and gizzard shad	Yes, incl blue-green	Hypereutrophic
Baker's Lake	1981	n/a	n/a	n/a	n/a	Eutrophic
Hawley Lake	1990	n/a	n/a	n/a	n/a	Eutrophic
Deer/ Meadows Lake	2004	Few plants, small localized beds	5.2	Carp, curlyleaf pond-weed; shoreline has 8 invasive species	Yes, incl blue-green	Hypereutrophic

Table 37 presents Hite and Bertrands' (1989) Biological Stream Characterization (BSC) summary while MBI scores for each sampling event are given in Table 34. Class A streams are usually comparable to the best situations without human intervention. Comparatively, Class E streams usually contain very few fish and no sport fishery.

Table 37. Biological Stream Characterization (BSC) Summary

IBI	Class	BSC Category	Biotic Resource Quality Description
51-60	A	Unique Aquatic Resource	Excellent. Comparable to the best situations without human disturbance.
41-50	B	Highly Valued Aquatic Resource	Good. Good fishery for important game fish species; species richness may be somewhat below expectations for stream size or geographic region.
31-40	C	Moderate Aquatic Resource	Fair. Fishery consists predominantly of bullhead, sunfish, and carp. Species diversity and number of intolerant fish reduced. Trophic structure skewed with increased frequency of omnivores, green sunfish, or tolerant species.
21-30	D	Limited Aquatic Resource	Poor. Fishery predominantly for carp; fish community dominated by omnivores and tolerant forms. Species richness may be notably lower than expected for geographic area, stream size or available habitat.
≤20	E	Restricted Aquatic Resource	Very poor. Few fish of any species present; no sport fishery exists.

Source: (Hite and Bertrand 1989)

IBI scores calculated in 1996 and 2002 at Site BIO5 indicate that Flint Creek is a Class D (Limited Aquatic Resources) stream. The Biological Stream Characterization describes a Class D aquatic resource as poor because it is generally dominated by tolerant species, lacks species richness, and may lack suitable habitat for higher quality (intolerant) species. A closer look at the LCHD-ES data supports this assessment. The number of native species and proportion of species that represent particular feeding niches is below average and the number of tolerant species is above expected conditions.

Table 38. Stream Data for Analyte Values that are Above Water Quality Criteria

Location	Ortho-P (mg/L)	Total-P (mg/L)	O2 (mg/L)	BOD (mg/L)	Chloride (mg/L)	TDS (mg/L)	Iron (mg/L)	E. Coli (Col./100mL)	Branch
FCBH1`	0.08	0.16	0.53	3.97	202	0.22	1.5	517.2	Main
FCBH2Q	0.26	0.31	6.64	3.75	136	500	1.3	648.8	Branch
FCDP1	0.06	0.71	0.35	8.83	429	1133	11	435.2	
FCDP2	0.03	0.11	1.92	4.07	224	767	1.4	93.4	
FCDP5	0.01	0.06	5.7	5.37	261	600	0.49	307.6	
FCB1	0.24	0.33	2.40	7.95	658	3.52	1.5	1299.7	East
FCLC5		0.238	7.85	6.3	150	164	1.31		Branch
FCLC6		0.228	11.5	7.4	148	478	1.30		
FCB2	0.34	0.47	1.26	5.29	188	533	1.4	290.9	
FCB3T	2.89	3.03	8.45	2.11	462	1367	0.048	920.8	
FCB4Q	2.85	3	8.56	2.59	457	1367	0.13	980.4	
FCBH4	0.43	0.48	3.55	4.71	339	0.3	1	325.5	Main
FCLB3Q	0.25	0.32	7.68	4.85	257	767	0.62	547.5	Branch
FCLC7		0.021	8.57	3.7	184	472	0.07		
FCLC8		0.074	5.91	3.7	224	606	0.38		
FCNB1	0.11	0.14	6.35	2.19	337	867	0.71	360.9	
FCNB2	0.05	0.1	6.54	2.83	194	667	0.68	36.4	North
FCNB4	0.07	0.09	6.93	2.11	273	733	0.29	155.3	Branch
FCLC9		0.039	5.85	3.7	211	624	0.07		
FCNB7	0.01	0.02	4.46	4.71	228	633	0.037	50.4	
FCLC10		0.149	10.44	4.7	175	576	0.48		
FCLB4Q	0.08		6.31	0.04	0.07	0.11	5.3	21.64	
FCLC11		0.35	6.34	2	218	164	0.43		Main
FCLC12		0.478	5.41	2	223	770	1.91		Branch
FCLB5Q	0.2	0.29	9.40	4.77	245	800	0.49	488.4	
Criteria:	0.01	0.05	> 5.0	< 5.0	250	500	0.3	200	

Table 39. Flint Creek Stream Analyte Loading to the Fox River

Analyte	Loading (Pounds/Day)	Loading Goals (Pounds/Day)	Load Reduction To Meet Goals (%)
Flint Creek:			
Phosphorus	6.3	1.1	82.5
Orthophosphate	4.3	0.22	94.9
Chloride	5,300	5,410	0
Total Dissolved Solids	17,300	10,800	37.6
Iron	10.6	6.5	38.7

From the 2007 Report, following is the SMU analysis of pollutant loading in mg/L.

Table 40. 2007 Subwatershed analysis of pollutant loading, all pollutant loading units in mg/L.

Flint Creek (East Branch) Pollutant Loading Analysis									
SMU ID	Acres	TSS	TDS	BOD	COD	TOT N	TOT KN	DIS P	TOT P
FCE1	369	837.21 H	1688.68 H	36.36 H	330.64 H	9.16 L	6.31 M	0.323 H	1.052 H
FCE2	650	637.01 M	1415.09 M	26.93 H	261.74 H	7.11 L	5.31 M	0.246 H	0.871 H
FCE3	1,115	242.99 L	635.27 L	8.45 H	96.17 H	2.30 L	2.15 L	0.090 H	0.317 H
FCE4	481	176.69 L	490.74 L	6.62 H	74.59 H	1.86 L	1.68 L	0.071 H	0.255 H
FCE5	902	702.19 M	1663.00 H	30.61 H	295.74 H	7.95 L	5.56 M	0.265 H	0.875 H
FCE6	241	457.16 M	1034.86 M	18.27 H	189.65 H	4.98 L	4.10 L	0.168 H	0.667 H
FCE7	679	436.29 M	844.10 M	21.19 H	180.06 H	5.75 L	3.92 L	0.223 H	0.765 H
FCE8	719	477.59 M	1179.28 M	33.63 H	234.56 H	8.15 L	2.95 L	0.284 H	0.558 H
FCE9	284	951.85 H	2065.62 H	44.86 H	400.27 H	11.62 M	7.54 M	0.400 H	1.279 H
Flint Creek (Main Stem) Pollutant Loading Analysis									
FCM1	1,108	318.91 L	752.19 M	11.86 H	126.37 H	3.21 L	2.76 L	0.121 H	0.441 H
FCM2	1,203	462.97 M	885.22 M	16.87 H	154.70 H	4.44 L	3.09 L	0.196 H	0.545 H
FCM3	1,057	194.68 L	427.64 L	7.92 H	75.63 H	2.17 L	1.72 L	0.092 H	0.306 H
FCM4	1,653	158.63 L	358.48 L	7.65 H	67.11 H	2.13 L	1.51 L	0.089 H	0.298 H
FCM5	1,232	414.49 M	1001.89 M	16.40 H	170.27 H	4.34 L	3.43 L	0.150 H	0.531 H
FCM6	830	356.50 L	764.63 M	17.40 H	147.30 H	4.60 L	2.91 L	0.179 H	0.540 H
FCM7	1,176	283.14 L	633.57 L	15.55 H	127.13 H	4.18 L	2.53 L	0.159 H	0.502 H
FCM8	917	76.93 L	325.13 L	2.22 H	31.66 H	0.70 L	0.84 L	0.044 H	0.110 H
FCM9	748	276.33 L	519.86 L	15.34 H	120.64 H	4.28 L	2.69 L	0.168 H	0.560 H
FCM10	1,146	217.53 L	563.76 L	8.02 H	88.83 H	2.23 L	2.00 L	0.087 H	0.322 H
North Flint Creek Pollutant Loading Analysis									
FCN1	674	167.34 L	495.04 L	6.39 H	72.33 H	1.83 L	1.65 L	0.072 H	0.259 H
FCN2	1,253	357.75 L	783.53 M	16.05 H	147.86 H	4.40 L	3.25 L	0.173 H	0.606 H
FCN3	1,408	342.22 L	871.23 M	14.32 H	146.91 H	3.82 L	2.97 L	0.132 H	0.474 H
FCN4	1,171	513.37 M	1194.51 M	21.72 H	214.48 H	5.76 L	4.36 L	0.199 H	0.710 H
FCN5	710	708.95 M	1622.10 H	48.56 H	335.74 H	11.70 M	4.24 L	0.413 H	0.827 H
FCN6	1,079	539.74 M	1094.50 M	21.13 H	205.33 H	5.41 L	4.13 L	0.194 H	0.667 H
FCN7	568	476.45 M	1064.53 M	17.61 H	183.60 H	4.65 L	3.83 L	0.170 H	0.602 H

TSS=Total Suspended Solids; TDS=Total dissolved solids; BOD=Biological oxygen demand; COD=Chemical oxygen demand; Tot N=Total Nitrogen; Dis P=Dissolved Phosphorus; TOT P= Total Phosphorus;
(L)=Low; (M)=Medium; (H)=High compared to IEPA standard. According to the 2016 KOT Baseline Water Quality Report, metals, except for Fe, are inconsequential in Flint Creek waters, and are not reported here.

Water Quality Summary (quoted from the 2016 baseline report)

"The Illinois EPA lists Flint Creek as being impaired. The impairment of Flint Creek is caused by several factors including other flows into the Creek, low dissolved oxygen, high total phosphorous, and high aquatic algae content. The low dissolved oxygen levels are caused by the large amounts of aquatic algae in the creek causing increased eutrophication. The aquatic algae buildup is due in part to the interruption of flow due to the large number of dams in the creek and their resulting impoundments. Also, contributing to the aquatic algae buildup was the urban runoff and stormwater that increases the amount of phosphorus and other nutrients available in the creek. A review of the available water quality data indicated consistently high values of phosphorus, chloride and total suspended solids. Additionally, Flint Creek had consistently reported high values of biological oxygen demand and fecal coliform.

"A water quality monitoring event was conducted in the Flint watershed during the summer of 2015 and was supported by an Illinois EPA 319 grant. This event was the implementation of the approved water quality plan (KOTECI, 2015a) and was conducted following the procedures detailed in the water quality plan and the approved quality assurance project plan (KOTECI, 2015b). The collected data were used to characterize baseline conditions in both watersheds. Data were collected from 25 sampling locations. Very little data analysis could be conducted on this first set of data collected. Little more than presenting the data with descriptive statistics could be accomplished. A minimum of three data sets and preferably six data sets are required for any statistical analysis of the data to conduct comparisons and develop trends.

"Orthophosphate in both watersheds makes up a significant portion of the total phosphorus available. No orthophosphate values were measured in any of the lakes. The headwaters of the East Branch in Deer Park is the only location where the total phosphorus is significantly greater than the orthophosphate. At the Barrington POTW there is a large influx of phosphorus, mainly in the form of orthophosphate, which is carried on down to the confluence of the East Branch with the Main Branch of Flint Creek and is further assimilated/diluted as the water moves through Barrington Hills and into Lake Barrington at Flint Lake.

"In a stream system that is unaffected by urbanization, one would expect total phosphorus, orthophosphate, dissolved oxygen and BOD to be interrelated. In this situation orthophosphate would be expected to be low and the dissolved oxygen levels high with BOD having low values. In urbanized streams such as we have with the Flint Creek, this relationship is not always valid.

"Chloride in streams is primarily due to urban runoff. In the Flint Creek watershed chloride makes up about 32 percent of the TDS values. Local hardness values were estimated to be about 45 percent, therefore, chloride and hardness make up about 77 percent of the TDS in the creeks.

"Although most of the iron concentrations are above the criteria all of the concentrations are below two mg/L with the exception of two apparent outliers having concentrations of 11 and 5.3 mg/L respectively.

"A significant number of the E. coli values are above the 200 colonies/100 mL criteria. The outflow of Baker's Lake has an E. coli value of 1300 colonies/100 mL probably as a result of the heron rookery located in the Lake. A high value of E. coli was also recorded at the Barrington POTW and at the sampling location prior to the confluence with the Main Branch of the Flint Creek. No E. coli values were recorded in the lakes.

"Analyte loadings to the Fox River were estimated for those analytes that did not meet water quality criteria. Review of the loading of these constituents to the Fox River provides insight to the overall health of the creeks. Loadings were estimated using discharge measurements and analyte values from the sampling station closest to the Fox River. The estimated loadings reflect the conditions present during this water quality monitoring effort and are likely to change during the course of the year.

"The analysis shows that total phosphorus and orthophosphate in the Flint Creek watershed are a problem. Total phosphorus and orthophosphate in the watershed need to be reduced by 82.5 and 94.9 percent respectively to meet water quality criteria loads calculated for conditions encountered during this water quality monitoring event.

"Chloride loading to the Fox River is the only analyte in the Flint Creek watershed that meets the estimated water quality criteria loading values. TDS and iron also are over the loadings estimated based on the water quality criteria and their loadings need to be reduced by less than 40 percent to meet the goals.

"The phosphorus loading estimates are an indicator of the degree of urbanization of the Flint Creek watershed. The fate of phosphorus in the watersheds includes uptake and release by vegetation, periphyton and microorganisms; sorption and exchange reactions with soils and sediments; chemical precipitation in the water column; and sedimentation and entrainment. These mechanisms exemplify the combined biological, physical, and chemical nature of phosphorus retention in the stream wetlands and stream itself. The estimated loads to the Fox River represent the amount of phosphorus that can't naturally be assimilated by the streams. Therefore, remedial actions need to be established that will increase the amount of phosphorus that can be assimilated by the watershed or removed from the system.

"The Barrington POTW is the only point source remedial action that removes phosphorus from the system. The POTW discharge averages about 2 million gallons per day (mgd). During the 11 low-flow period that was in effect during the water quality monitoring event, POTW discharge accounted for about three quarters of the Flint Creek flow into the Fox River. Influent total phosphorus levels range from 2 to 3 mg/L and the average total phosphorus discharge concentration was approximately 1.500 to 2.250 mg/L most of which is assimilated by the Flint Creek wetlands and the stream itself. The POTW is in the process of upgrading its treatment in order to meet the US EPA's new discharge criteria of 0.1 mg/L of total phosphorous, and should be online in late 2018. The proposed upgrade is expected to reduce the total phosphorus discharge level to as low as 0.010 mg/L.

"The Flint Creek watershed-based plan Partners each have a comprehensive list of remedial actions that can be undertaken. Each of these remedial actions address the removal of phosphorus, orthophosphate, TDS, and iron by improving the assimilation capacity of the watershed. Chloride is conservative and these actions will have a limited effect on assimilation of chloride. A number of these remedial actions include the maintenance of existing facilities such as detention basins, wetlands and other riparian areas. Private landowners and local environmental organizations are involved in removing invasive species. The Citizens for Conservation and Barrington Area Conservation Trust has conducted and is conducting extensive prairie and savanna restoration. Most of these remedial actions are relatively inexpensive and are very effective in removing runoff pollutants. Clearly, citizen engagement and education is working and must be expanded.

Conclusions:

"Flint Creek is impaired, with significant channelization and eroded streambanks along its reaches. The current pollutants of concern are nutrients, especially phosphorus and orthophosphates, chlorides, total dissolved solids, and iron. Metals contamination were all well below EPA guidelines except for iron, which naturally occurring in the Flint Creek Watershed area.

"Some of the lakes have issues of high E.coli, as well as the aforementioned nutrients, chlorides and total dissolved solids. Details of the lakes with nutrient problems that have poor shorelines, with inadequate buffers, have been documented in the LCHD Lake Unit. Sources of E.coli may be wildlife, pet waste disposal or leaky septic systems. Carp is widespread within the watershed, which means lake bottoms are continually churned, with resulting low clarity. Much of the chloride contamination comes from runoff from streets, parking lots and sidewalks. Dissolved oxygen was low in almost all cases, except Lake Zurich, due to high BOD and COD."

Table 41. Pollutants and Identified and Potential Causes and Sources per EPA's 303(d) Report

Pollutant	**Identified and Potential Causes and Sources Per EPA's 303(d) Reports on Impaired Waters**	**Designated Use Impairment**
E.coli	*Causes*: Animal (esp. avian and canine) and human waste *Sources*: Public parks, streets, lawns, driveways, parking lots, problem septic systems, etc.	Primary and Secondary Contact
Salt	*Causes*: Excess dilution in stormwater runoff *Sources*: Deicing operations on streets, driveways, parking lots, and other impervious surfaces	Aquatic life, water supply
Total Suspended Solids (TSS)	*Causes:* Eroded soils and other loose debris; carp *Sources*: Streets, lawns, driveways, parking lots, soil erosion, elevated and highly varied stream flows, improper construction site management of sediment, agricultural practices (esp. equine) increasing land development without proper stormwater management practices	Aquatic life, water supply, primary contact
Total Dissolved Solids (TDS)	*Causes*: Dilution of substances in stormwater *Sources:* Streets, lawns, driveways, parking lots, construction activities, channel erosion	Aquatic life, water supply, primary contact
Biological Oxygen Demand (BOD)	*Causes:* Organics *Sources*: Poorly treated wastewater, blooms caused by high nutrient load; yard wastes contamination	Aquatic Life
Chemical Oxygen Demand (COD)	*Causes*: Organics	Aquatic Life

	Sources: Poorly treated wastewater, algal blooms caused by high nutrient load; yard wastes contamination	
Total Nitrogen	*Cause*: Excessive dilution in stormwater *Sources*: Applications of fertilizer, failing septic systems, sewage treatment plant discharges, livestock (e.g. horses), geese	Aquatic Life primary contact, water supply
Total Kjeldahl Nitrogen (TKN)	*Causes*: Excess dilution on stormwater *Sources*: Plant and animal decay, yard waste contamination	Aquatic Life primary contact, water supply
Dissolved Phosphorus (DIS P)	*Causes:* Excess dilution in stormwater *Sources:* Streets, residential lawns (lawn fertilizers, grass clippings, leaves), driveways, agricultural and golf course fertilizers, soil erosion, runoff from animal raising/stabling operations, untreated stormwater and wastewater, inadequate or failing septic systems, lake sediments, geese and other wildlife	Aquatic Life primary contact, water supply
Total Phosphorus (TOT P)	Causes: Excess dilution in stormwater Sources: Streets, residential lawns (fertilizers, grass clippings), driveways, agricultural and golf course fertilizers, soil erosion, runoff from animal raising operations, untreated stormwater and wastewater, inadequate or failing septic systems, lake sediments, wildlife, e.g. geese	Aquatic Life primary contact, water supply

4.0 Best Management Practices

For the Flint Creek Watershed-based Plan, BMPs have been separated into watershed-wide and site specific strategies. There are a variety of practices in the plan that address the issues of stormwater and residential modes of use in the watershed. BMPs are suggested based on a number of factors, including need, feasibility, and cost, including labor.

There are a number of golf courses in the area, as well as large lot land holdings, and something like **agricultural filter strips** or **riparian buffers** may be some of the best practices available. Both reduce sediment and nutrients by filtering the water that flows through it. Buffers are generally larger than agricultural filters, and they can reduce the flow of water more significantly. The type of vegetation can dramatically affect the effectiveness of the filter strip and turf grasses are not recommended. When installed, appropriately populated, And functioning correctly, the USEPA has documented that filter strips can reduce total suspended solids (sediment) by 73%, total phosphorus by 45%, and total nitrogen by 40%.

Bioswales may also be an option, depending on the layout of the land. Bioswales, or vegetated swales, are designed to convey water and also can be modified to capture and treat stormwater for watersheds. Bioswales act as filters for stormwater nutrients, and are effective in trapping sediment and other nutrients as they slow the water flow, especially if they are planted with native plants, and the plants are salt-tolerant.. Depending on the "uphill" area for the practice, bioswales can be very effective for reducing total suspended solids. Again, according to the USEPA, vegetated swales reduce total suspended solids by 65%, total phosphorus by 25%, and total nitrogen by 10%.

One longer term mediation strategy – which may be effective to reduce chloride run off - may be working with municipalities to change the cultural attitude toward having turf roadsides, even in suburban neighborhoods, and instead have **swales or vegetated strips with low growing native plants, such as sedges, or other plants that have a high salt tolerance**. Many neighborhoods have drainage ditches that lead to Flint Creek, which are covered with turf grass. If there were sedges or other (native) grassed ditches and roadsides, the impact on the rate of phosphorus and chloride pollution of Flint Creek could be substantial. The task of changing the prevailing culture, ordinances and expectations of what a front lawn should look like is a very long term proposition.

Similarly for owners of lakeside or creekside properties, **riparian buffers, filter strips, raingardens, bioswales** are all viable Best Management Practices options, depending on the property. In many cases, there are Lake Management organizations or Home Owner Associations which would be the required coordinating bodies to encourage homeowner cooperation.

Larger projects required by severe streambank or lakeshore erosion could require cooperation of municipal agencies as well as county or state agency assistance with funding.

Debris removal and programs of regular stream maintenance are an ongoing concern. Depending on the river flow, some blockages can alter the stream channel and cause erosion of the streambank. Major blockages can exacerbate flooding. Ongoing vigilance and maintenance of stream flow is important for the health of streams. At the same time, some tree falls or brush can be beneficial for river life, giving cover, so understanding of the situation is important.

Shoreline and streambank stabilization mitigation can be an important BMP. Various reaches of Flint Creek and shorelines of area lakes have moderate to severe erosion and require stabilization of shorelines and streambanks to reduce the progress of erosion and prevent future occurrences. Stabilization can reduce nutrient loads from runoff as well as sediment loads.

Flint Creek has a number of hydraulic structures throughout its length, which should be regularly reviewed for their utility, condition and effects, in coordination with the Watershed Partnership and landowners, and reflecting a systemic approach to understand upstream and downstream impacts.

There are six probable wetland locations and thirty-five detention basin retrofits located within pollutant loading "hotspot" SMUs that are recommended for water quality retrofits. Three basins are recommended to be changed from dry bottom basins to wet bottom basins. These are shown in Figure 66. Figure 67 shows recommended stream and lake restoration projects within pollutant loading "hotspots" – where land uses have higher pollutant loading rates compared to other SMUs.

Wetlands are essential for water quality improvement and flood reduction in any watershed. They also provide quality habitat for a wide variety of plants and animals. Wetland restoration involves returning the water and vegetation to soils that once supported wetlands. The USEPA estimates that wetland restoration projects can reduce suspended solids by 77.5%, total phosphorus by 44%, and total nitrogen by 20%.

Detention basins, with their capability for temporary storage or semi-permanent storage of stormwater runoff and controlled release after big rain events, are important elements in watershed plans. There are many, many detention basins (as well as in-channel impoundments) in the Flint Creek Watershed. Detention basins planted with turf grass along their sides do not promote good infiltration, water quality improvement of good living areas for wildlife.

Studies completed by several credible actors over the past twenty years show that detention basins that serve multiple functions have many benefits. According to the USEPA, properly designed dry bottom infiltration basins reduce total suspended solids by 75%, total phosphorus by 65%, and total nitrogen by 60%. Wet bottomed basins which are designed to have wetland characteristics reduce total suspended solids by 77.5%, total phosphorus by 44% and total nitrogen by 20%.

Future detention basins and retrofitted basins should consist of naturalized basins serving multiple functions – water storage, water quality improvement, natural aesthetics and wildlife habitat.

Ideally, a minimum 5-foot wide shelf planted to native wet prairie and stabilized with erosion control blanket should be constructed above the normal water level in wet and wetland bottom basins. This area should be designed to inundate after every 0.5 inch rain event or greater. A minimum 10-foot wide shelf planted with native emergent plugs should extend from the normal water level to 2 feet below normal water level in wet and wetland bottom basins. Permanent pools in wet and wetland bottom basins should be at least 4 feet deep. Irregular islands and peninsulas should be constructed in wet and wetland bottom basins to slow the movement of water through the basin. They should be planted to native mesic or wet prairie depending on elevation above normal water level. A 4-6 foot deep artificial pool of water should be built at inlet(s) of wet/wetland bottom basins to capture sediment; a 4-6 foot deep micropool should be constructed at the outlet to prevent clogging.

Establishing native plantings takes at least 3 years of short term management. Measures needed include mowing during the first two growing seasons following seeding to reduce annual and biennial weeds. Spot applications of herbicides will also be required to knock out problematic invasive species, such as reed canary grass, buckthorn, box elder, teasel, and so forth. Inlet and Outlet structures should be checked for erosion and clogging periodically during the year. The following tables are AES recommendations for detention basin vegetation establishment:

Table 42. Establishment Schedule for Naturalized Detention Basins

Year 1 Establishment Recommendations
Mow prairie areas to a height of 6-12 inches in May, July, and September.
Spot herbicide non-native/invasive species throughout site in late May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 2 Establishment Recommendations
Mow prairie areas to a height of 12 inches in June and August.
Spot herbicide non-native/invasive species throughout site in May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Plant additional emergent plugs if needed and reseed any failed areas in fall.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 3 Establishment Recommendations
Spot herbicide non-native/invasive species throughout site in May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Check for clogging and erosion control at inlet and outlet structures during every site visit.

Table 43. Three year cyclical long term Maintenance Schedule

Year 1 of 3 Year Maintenance Cycle
Conduct controlled burn in early spring. Mow to height of 12 inches in November if burning is restricted.
Spot herbicide problematic non-native/invasive species throughout site in mid August. Specifically target thistle, reed canary grass, common reed, & emerging woody saplings such as willow, cottonwood, buckthorn, & box elder.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 2 of 3 Year Maintenance Cycle
Spot herbicide problematic non-native/invasive species throughout site in August. Specifically target thistle, reed canary grass, common reed, & emerging woody saplings such as willow, cottonwood, buckthorn, & box elder.
Mow prairie areas to a height of 6-12 inches in November.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 3 of 3 Year Maintenance Cycle
Spot herbicide problematic non-native/invasive species in August. Specifically target thistle, reed canary grass, common reed, and emerging woody saplings. Cutting & herbiciding stumps of some woody saplings may also be needed.
Check for clogging and erosion control at inlet and outlet structures during every site visit.

Another Best Management Practice for reducing pollutant loading in watersheds is **street sweeping**. Because roads comprise such a sizeable percentage of land in an urbanized watershed, street sweeping can reduce non-point source pollutants in the watersheds, because pollutants such as sediment, trash, road salt, oils, nutrients and metals are gathered and disposed of properly rather than washing into the stormsewers, and from there, Flint Creek. Weekly street sweeping can remove between 9% and 16% of sediment and between 3% and 6% of nitrogen and phosphorus.

The Flint Creek Watershed Partnership had an active **raingarden** program initially, which was very useful in educating citizens about the benefits of native plants, and their ecosystem services. More time will be allocated to that program in the future.

Some newly identified projects will be discussed in the specific site section, as will projects that have yet to be completed from the 2007 plan.

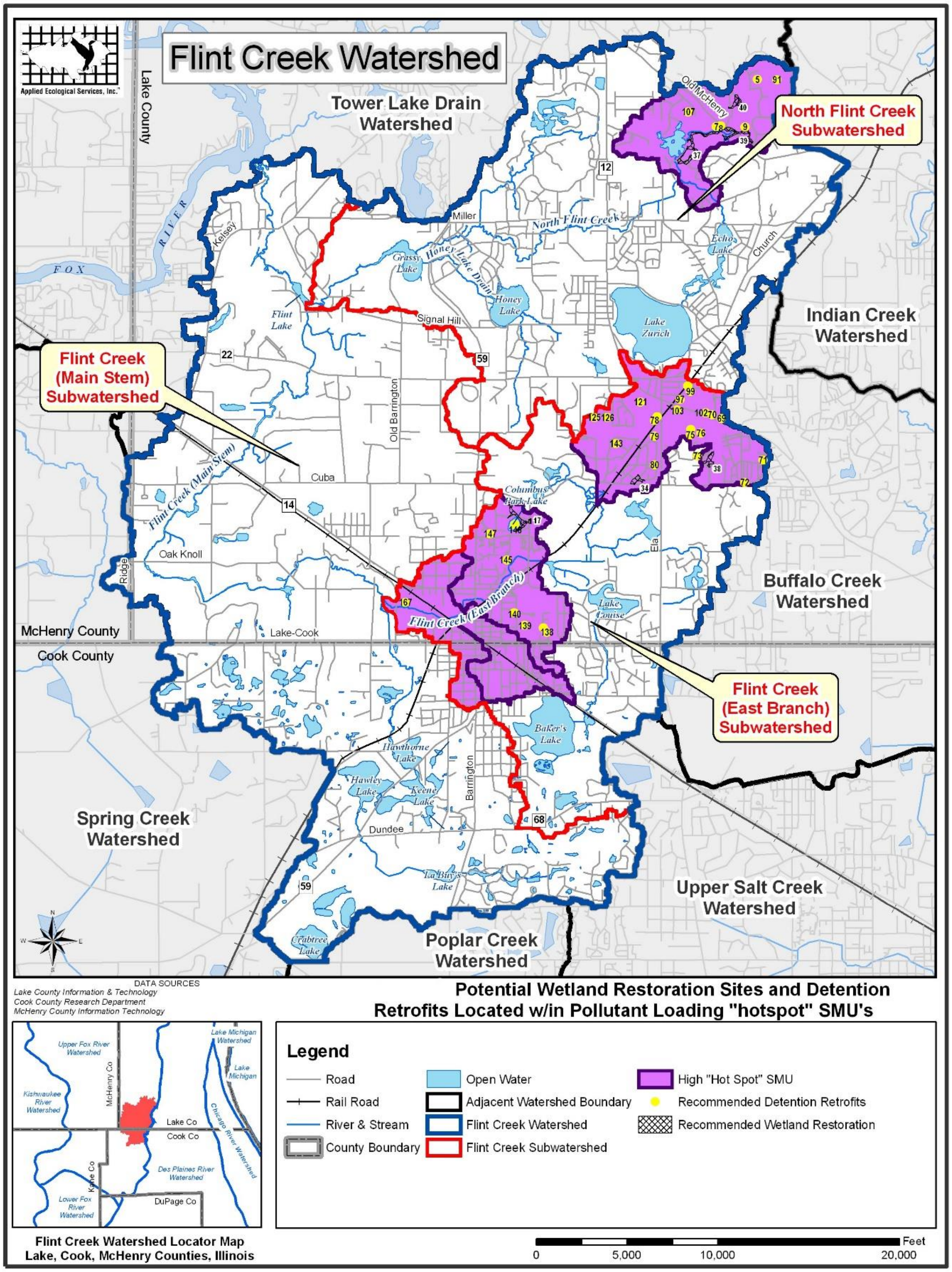


Figure 66: Potential Wetland Restoration Sites and Detention Retrofits

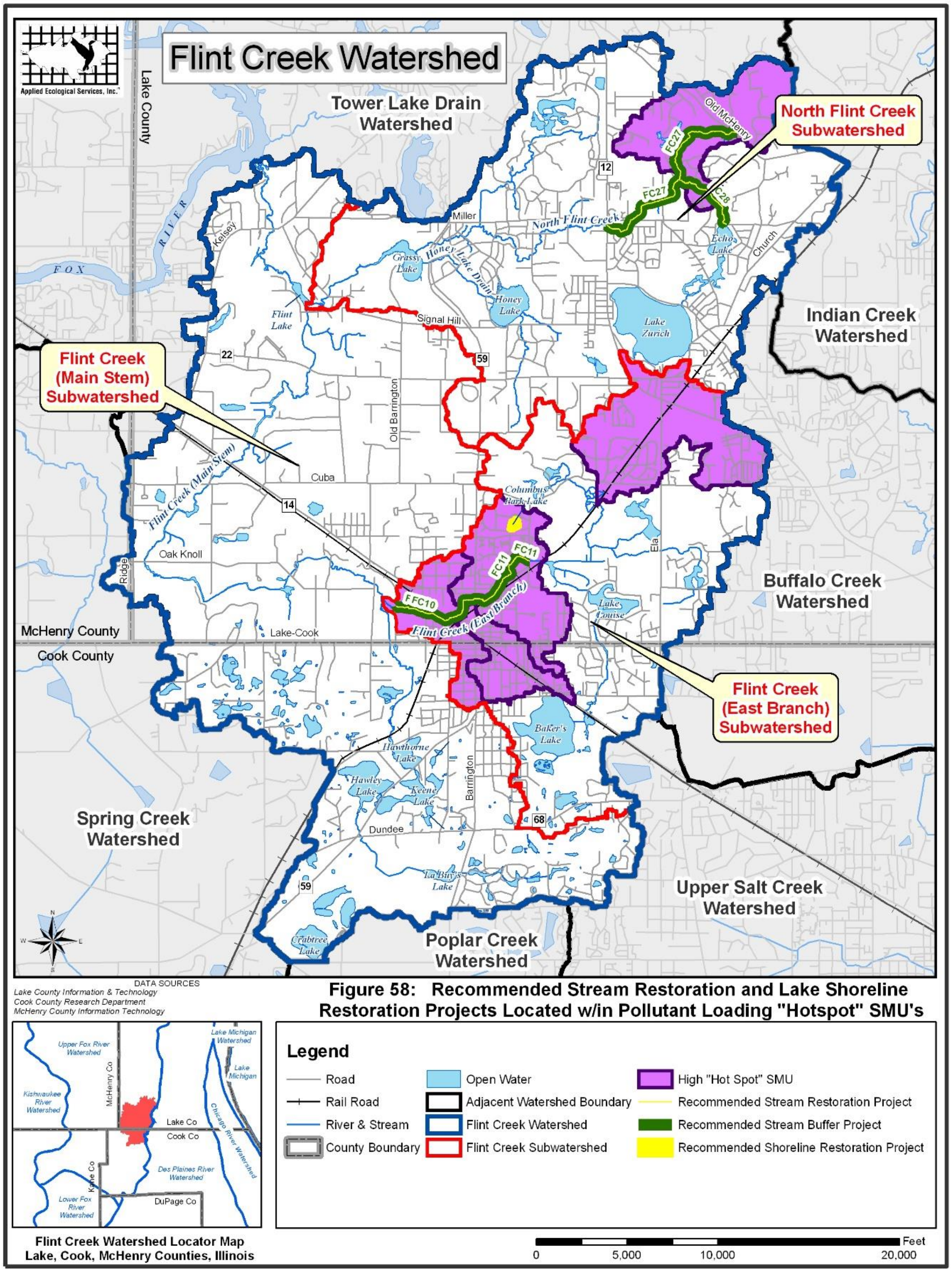


Figure 67: Recommended Stream Restoration and Lake Shoreline Restoration Projects

5.0 PRIORITY AREAS AND PRACTICES

A Prioritized Action Plan has been developed for the Flint Creek Watershed Partnership to provide stakeholders guidance on the action items for watershed improvement practices. This Plan should serve as a guide to assist partners in collaborating and partnering with an extended group of stakeholders to address water quality and flood reduction in the Watershed. The Plan is divided into five subsections:

1. Programmatic Action Plan
2. Site Specific Action Plan Additions
3. Site Specific Action Plans remaining from the 2007 Action Plans
4. Education and Outreach Plans
5. Water Quality Monitoring Plans

The Programmatic Action Plan (Section 5.1) is focused on watershed-wide items that are not site specific. New Site Specific Action Plans (Section 5.2) identifies plan additions of site locations where water quality, flood reduction/prevention projects or hydrologic modifications can be implemented (See also page XX). Similarly, the Site Specific Action Plans (Section 5.3) from the 2007 Action Plans also address the same issues, and have been prioritized. Additionally, where the priority is high, estimated costs and responsible entities for project implementation have been provided. Projects for which priorities are lower may state that gathering updated costs is part of the project.

Section 6.1 includes the Education and Outreach Plan. This section highlights the recommended activities needed to engage and educate an extended network of stakeholders in order to be accomplished. Section 6.3 addresses the Water Quality Monitoring and Groundwater Monitoring Plans. It also recognizes that, since some of our municipalities are below 25,000 in population, testing may include visual observations as part of the regimen. The Water Quality Monitoring Plan also incorporates increasing citizen volunteer scientists – one of the Programmatic Goals – as part of the Monitoring process.

Influenced by projections for changing patterns of precipitation and temperature, the most important recommendations are:

1. Remediate existing flood problems, prevent future flooding by reducing stormwater runoff, protecting and restoring areas for surface water storage and absorption, including floodplains, depressional storage areas, wetlands, and other buffer lands. Remediate in such a way that water quality improvement benefits are also provided. Educate and enlist homeowners and other property owners in understanding how their property management practices, including raingardens and porous pavement strategies, can benefit themselves and their neighbors and enhance natural environmental services. Assess existing hydrologic structures for their contribution to flooding.
2. Restore and maintain stream reaches by restoring natural and native riparian buffers, removing excessive debris, stabilizing streambeds and streambanks in ways that enhance and

protect native habitat. Similarly with lake shores, restore and stabilize shorelines, including creating natural and native buffers in ways that enhance and protect native habitat. Similarly, educate and enlist homeowners and other property owners in understanding how their property management practices, including stream and shoreline buffer strategies or choice of pavement sealants, can benefit themselves and their neighbors and enhance natural environmental services.

3. Use best practice stormwater management and low impact development practices for new and existing developments that promote infiltration and cleansing of stormwater runoff, as well as slowing, cooling or filtering, if necessary, the runoff.

4. Develop outreach and education strategies to improve public understanding and appreciation of watershed resources and issues, to understand the developmental evolution of the land they own, and the impact of their own practices and the power they have to improve the environmental services of their land. Engage the public in such ways that they become interested in citizen science opportunities, such as VLM, eBird or Riverwatch, etc. Develop the Flint Creek\Spring Creek Watersheds website and digital footprint to support citizen engagement and public support for watershed investments.

5. Modify and use planning and development standards, policies, capital improvement plans and budgets to protect and improve water quality, working with BACOG and area governments. Incorporate best practices for resilient communities.

6. Monitor and evaluate watershed plan implementation, the physical watershed conditions, stream and groundwater levels and conductivity, and citizen surveys to assess progress toward watershed goals.

Section 5.1 Programmatic Action Plan

The Programmatic Action Plan recommends watershed-wide action items that generally are not site specific. Action items are based on goals and objectives developed by the Flint Creek Watershed Partnership (FCWP) (see Goals and Objectives) and recommended regulatory changes for jurisdictional bodies. The Site Specific Action Plans identify actual locations where water quality, natural resource issues, and flood reduction/prevention opportunities have been identified in this report. A priority ranking was assigned to both programmatic and site-specific action recommendations. Assigning priority to watershed improvement projects is largely dependent upon need and feasibility, which is determined by size of the project, location, land use, ownership, funding, scope of work, and other factors such as level of interest and support by potential partners. Key stakeholders, technical resources, and some funding sources are listed in Table 44, below.

Key Stakeholders/Resources	Abbreviation
Ancient Oaks	AO
Audubon Society	AS
Barrington Area Council of Governments	BACOG
Barrington Hills Conservation Trust	BACT
Bobolink Foundation	BF
Chicago Metropolitan Agency for Planning	CMAP
Citizens for Conservation	CFC
Cook County	Cook County
Cook County Department of Transportation	CCDOT
Cook County Health Department	CCHD
Farm Bureau	FB
Federal Emergency Management Agency	FEMA
Flint Creek Watershed Partnership	FCWP
Forest Preserve District of Cook County	FPDCC
Friends of the Forest Preserve	FFP
Fox River Ecosystem Partnership	FREP
Golf Courses	Golf
Illinois Department of Natural Resources	IDNR
Illinois Department of Natural Resources – Office of Water Resources	IDNR-OWR
Illinois Department of Transportation	IDOT
Illinois Environmental Protection Agency	IEPA
Illinois Lakes Management Association	ILMA
Lake and Cook County Soil & Water Conservation District	SWCD
Lake County	Lake County
Lake County Department of Transportation	LCDOT
Lake County Department of Planning, Building, and Development	LCPBD
Lake County Forest Preserve District	LCFPD
Lake County Health Department	LCHD
Lake County Stormwater Management Commission	LCSMC
LC Health Department Lakes Management Unit	LMU
McHenry County Stormwater Committee	MCSC
Metropolitan Planning Council	MPC
Metropolitan Water Reclamation District of Greater Chicago	MWRD
Morton Arboretum	MA
Municipalities	Munis
Openlands	OP
Other Foundations	OF
Park Districts	PD
Residents or Owner	Residents/ Owner
Townships	TWP
US Army Corps of Engineers	USACE
US Fish & Wildlife Service	USFWS
USDA Natural Resources Conservation Service	NRCS
Wild Ones (Lake-to-Prairie Chapter)	Wild Ones

Key stakeholder responsibilities are included in the Glossary and discussed in more detail in Plan Implementation.

The Programmatic Action Plan is divided into two sections. The first section includes a table (Table 45) with recommended watershed improvement actions that are applicable throughout the watershed to meet specific goals and objectives developed, refined, and categorized by the FCWP. The six goals that were developed by the Partnership are included below. The second section includes recommended regulatory changes for jurisdictional bodies in the watershed

Programmatic Actions for Plan Goals

Goal A: Protect surface and groundwater resources and enhance overall water quality in the lakes and streams of the watershed

Goal B: Identify and protect important natural areas/open space in the watershed and provide appropriate passive recreational benefits

Goal C: Reduce existing flood damage in the watershed and prevent flooding from worsening downstream

Goal D: Improve aquatic and terrestrial habitat in the watershed

Goal E: Increase communication and coordination among municipal decision-makers and other stakeholders within the watershed

Goal F: Foster appreciation and stewardship of the watershed through education

The Programmatic Action Plan table (Table 45) lists actions to meet each of the above goals and associated objectives and in addition, provides information needed to facilitate implementation of specific actions. This includes the priority, cost (where applicable), designated lead regulatory, governmental, private, or other agency with the greatest potential for implementation, and the designated support agencies that would likely be responsible for issuing appropriate permits or providing technical, regulatory, or funding assistance.

Cost estimates are provided only for those watershed improvement actions that involve remedial action costs such as planting native vegetation. Cost estimates are not provided for preventative measures such as education and regulatory actions. **Cost estimates should not be considered actual costs, but used as a way to compare the relative costs of recommended BMPs**. Furthermore, BMP implementation projects vary dramatically by specific technique employed, size of area, property values, and other factors.

Priority was assigned to each action item and classified as H (high), M (medium), or L (low) and based on several factors including urgency, ownership types, cost, technical and financial needs, and potential shortcomings. High priority recommendations deserve immediate attention and are generally expected to be addressed in the short term (1-5 years) whereas medium and low priority recommendations are not as urgent and should be addressed in the long term (5-10+ years). Medium and low priority recommendations should not be written off as less important projects. In many cases, funding availability, technical assistance, or shortcomings may be responsible for a project being designated as medium or low priority.

Table 45: Programmatic Actions for Goals A-F

- **Goal A:** Protect surface and groundwater resources and enhance overall water quality in the lakes and streams of the watershed.

Objectives:

1) Lakes and streams shall at a minimum attain state water quality standards to fully support designated uses.
2) Reduce sediment and nutrient accumulation in lakes and streams by restoring eroded streambanks and lake shorelines using bioengineering practices.
3) Maintain and expand high quality native riparian buffers and restore native riparian buffers along those stream reaches identified as having poor buffer quality.
4) Retrofit existing stormwater management structures and design new structures within developed areas to specifically reduce nutrient and sediment loading.
5) Publicize the impacts of road salt usage on water quality and aquatic life and develop recommendations for education, alternatives, and use reduction.
6) Identify open space parcels appropriate for implementation of best management practices (BMPs) to reduce pollutants originating from known pollutant loading hotspots.
7) Reduce point source pollutant loading.
8) Educate the public about protecting shallow aquifer water quality, particularly in recharge areas.
9) Implement stormwater BMPs throughout the watershed to improve water quality and reduce runoff.
10) Reduce phosphorus, nutrient & other pollution by educating land-owners and landscape contractors on the effectiveness of native buffers and porous pavements.
11) Continue to educate landowners and developers about the dangers of high Polycyclic Aromatic Hydrocarbon surface sealers, and their impact on water quality, and aquatic life.
12) Work with the LCSMC and local villages and government agencies to educate well and septic owners on best maintenance practices

	Action	rank	Primary objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agencies
1	Work with BACOG and municipalities to develop education strategies and application strategies related to pavement salting and alternatives	H	A 1, 5, 8,10	B, F	n/a	BACOG, FCSCWP	Residents, CFC, Muni, TWPs
2	Identify appropriate water quality enhancement options on "high priority" parcels to maintain or improve water quality and green infrastructure	H	A6	B,D, E, F	n/a	CFC, BACT	BF, AS, FP FCSCWP
3	Amplify BACOG's education initiatives about the importance of groundwater recharge & quality	H	A8, A9, A10	B, C, F	n/a	BACOG	Munis, TWPs, CFC, BACT, FC/SCWP, Schools, Residents
4	Encourage/Educate owners to maintain their septic systems	H	A7	C, D, E, F	$250-350	Munis, TWPs	LCHD, CCHD, LCSMC, MWRD, Owners
	Develop and adopt stream and lake shoreline restoration guidelines			B, D, F	n/a		CFC, LCHD,

5	related to buffer vegetation, stabilization, and other bioengineering techniques.	H	A2, 3			FCSCWP, TWPs, Munis	
6	Encourage collaboration and sharing of MS4 information gathered by Munis & TWPs to supplement formal testing/monitoring schedules	H	A1, 5, 7	D, E	n/a	FCSCWP, TWPs Munis	LCHD, LCFP, CCFP
7	Review and update landscaping recommendations/ stormwater requirements for water quality BMPs to allow use of native vegetation.	M	A1, 2, 5, 7, 8, 9, 10	B, C, D, E, F	n/a	FCSCWP, Munis	CFC, BACT, LCSMC,
8	Implement a watershed-wide stream maintenance program to remove debris and fix problematic discharge and hydraulic structures	M	A2, 3	C,D, E	n/a	Muni, TWP, Owner	LCSMC, MWRD
9	Improve or implement BMPs on remaining agricultural/livestock land	M	A1	D	Var	Owner	FCSCWP, FB, LCSWC, Owners
10	Develop watershed-specific buffer requirements for streams and lakes.	M	A2, 3	B, D	n/a	LCSMC, MWRD, MCSC	FCSCWP, Munis, TWPs
11	Conduct wetland enhancement on existing low quality wetlands and restore/create new wetlands	L	A3	A, B, C D	$5-8K /acre	Owner	FCSCWP; NRCS, SWCD
12	Develop BMPs for handling sump pump discharge.	L	A7		Var	Owner	FCSCWP, NRCS, Owners

- **Goal B:** Identify and protect important natural areas/open space in the watershed and provide appropriate passive recreational benefits.

Objectives:

1) Permanently protect all sites with high quality natural areas or threatened and endangered species.
2) Identify buffer parcels for potential acquisition, protection, and/or restoration adjacent to sites with high quality natural communities and/or threatened and endangered species.
3) Adopt conservation design standards for all new development in designated high priority open space to maximize protection of natural areas and open space in new developments.
4) Identify and protect open space that provides important green infrastructure (conservation) corridor connections and provide passive recreation opportunities

	Action	Rank	Primary Objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agency
1	Identify "High Priority" open space parcels slated for future development and require conservation design to minimize impacts.	H	B1, 3, 4	A, C, D, E, F	n/a	Munis, TWPs, LCFP CCFP, CFC	FCSCWP BACT
2	Locate all unprotected high quality natural areas and/or T&E species	H	B1	D	n/a	CFC, AS, FCSCWP	Munis, TWPs, FPDs, AO
3	Include key greenway parcels identified in Figure 75 in community	H	B4	A, C, D, E	n/a	Munis; Twp,	

	comprehensive plans and green infrastructure plans					LC	FCSCWP, CFC, BACT, AO
4	Buffer existing protected Ecologically Significant Areas and/or T&E species locations by protecting adjacent unprotected "High Priority" open parcels	H	B2	D, E	n/a	CFC, BACT, IDNR	AO, AS, BF, FCSCWP, FPD
5	Conduct Natural Resource Inventories (NRIs) on key sites before development to identify any sensitive/high quality natural areas or species that should be preserved or protected.	H	B1, 4	D	$3K - $6K/ site	Owner, Munis – if required by building permit	NRCS, IDNR, SWCD
6	Use results of the Green Infrastructure Plan to create new trails and trail connections	M	B4	E, F	n/a	Munis; TWP	FCSCWP, CFC, AO
7	Adopt buffer guidelines between developments and high quality terrestrial or aquatic natural communities, wetlands & streams.	M	B1, 2, 3	D, E	n/a	LCSMC; USACE; MWRD	FCSCWP
8	Identify conservation overlay opportunities along existing green space corridors and open parcels for use in new developments or changes in existing zoning in order to identify critical greenways & future protection options	M	B3	A, C, D	n/a	Munis, TWPs	CMAP, CFC, FCSCWP
9	Support a multi-jurisdictional partnership to develop funding packages and grant proposals to implement greenway protection/connection strategies	M	B4	A, D, E	n/a	CFC, FCSCWP	FPD, SWCD, OP, OF, BF, AS,
10	Identify "high priority" private parcels; educate owners about options and incentives for protecting and restoring open space with conservation easements	M	B1, 2, 4	F	n/a	BACT	FCSCWP, CFC
11	Encourage adoption of municipal Codes to complement federal, state and county laws in place, as well as local Codes to protect locally significant resources and improve water quality generally	M	B1, 2	D, E	n/a	LCSMC, MWRD, USACE; MCSC	Munis; TWPs, FCSCWP
12	Engage schools for potential environmental education and recreation	L	B4	F	n/a	BACT, CFC, BACOG	FCSCWP, FPDs

- **Goal C:** Reduce existing flood damage in the watershed and prevent flooding from worsening downstream.

  Objectives:

  1) Inventory undeveloped floodplain that is not currently protected from development and protect it as open space.
  2) Mitigate for existing flood damage at all flood damage sites by identifying open space parcels suitable for wetland restoration or stormwater storage basins.
  3) Reconnect ditched stream reaches to historic floodplain where feasible.
  4) Implement multi-objective stormwater management best management practices (BMPs) within high priority open space and new developments that help reduce runoff and increased stream flows through infiltration of rainwater.

	Action	Rank	Primary Objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agency
1	Protect key "High and Medium Priority" undeveloped floodplain parcels and other priority flood reduction parcels as part of the natural drainage and green infrastructure network.	H	C1	A	n/a	Munis; Twp; Owner	FEMA; LCSMC; MWRD
2	Identify key Flood Problem Areas, classify and identify opportunities to mitigate on adjacent open space as appropriate.	H	C2	A	Var	Munis; Twps; Owners	FEMA; LCSMC; MWRD
3	Identify and construct multi-functional stormwater storage areas and restore/create wetlands	H	C2, 4	A, D	$10K -30K /acre	Owner	LCSMC; USACE
4	Implement a watershed-wide stream maintenance program to remove debris loads/jams	H	C	A, D, E	$200-500 each	Munis; TWPs, Owners	LCSMC, MWRD
5	Require in-watershed mitigation for any wetlands lost within the same watershed or subwatershed.	H	C4	A	Var	LCSMC; MWRD; USACE; Munis	TWPs
6	Modify streets, parking lots, lawns (i.e. rain gardens and natural swales), parks, and other open space within existing and new development for stormwater storage and infiltration.	M	C4	A	Var	Munis, Owners, TWPs	Residents; LCSMC-MWRD
7	Assess each new and old development site for proper implementation of stormwater management practices that best minimize runoff.	M	C4	A	n/a	Munis, HOA, LCPBD, LCSMC, MWRD,	Munis, TWPs
8	Assess storage capacity for older, sediment laden detention basins and consider options for those with storage deficiencies.	M	C	A	Var	Owner	LCSMC; USACE; MWRD
9	Provide educational information on flood proofing to residents along or within the 100-year floodplain.	L	C	none	n/a	FCWP; Owner	Munis, TWPs, FEMA

- **Goal D:** Improve aquatic and terrestrial habitat in the watershed.
  Objectives:

  1) Identify opportunities for habitat improvement on identified open space and improve habitat in degraded stream reaches using natural stream design approaches and improve habitat in degraded terrestrial communities by removing non-native plants and replacing with native plant communities

  2) Develop and implement short and long-term management and monitoring plans for all natural areas

  3) Encourage the development of lake management plans among stakeholders and HOAs

  4) Encourage native plantings in stakeholder landscapes.

	Action	Rank	Primary Objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agency
1	Install or restore pool/riffle complexes, habitat for fish and macroinvertebrates, and bioengineering bank stabilization in identified degraded stream reaches to improve habitat and increase oxygen levels.	H	D1	A, B	$3-5K each	Owners, Munis	LCSMC; IDNR-OWR; USFWS; NRCS; USACE

2	Control existing populations and prevent the spread of non-native/invasive species; replace with native plant communities.	H	D1, 3, 4	B	$1-5K/site	CFC, FCSCWP, BACT	Residents, Owners, FPDs
3	Develop standardized 3 or 5-year and long term (5+ years) maintenance and monitoring plans for created natural areas in newly developed areas.	H	D2, 3, 4	B	$2-4K	LCSMC; MWRD; USACE, AES, CFC	IDNR; NRCS
4	Restore stream and terrestrial habitat in conjunction with construction of roads, bridges, culverts, etc. to minimize negative impacts.	H	D1	A, B	$5-10K /site	LCDOT; CCDOT; IDOT	NRCS; SWCD
5	Expand native seed and plant exchanges and native plant sales.	M	D3, 4	F	n/a	CFC, BACT	Residents, FCSCWP
6	Private owners of "High Priority" parcels for preserving natural resources assess whether native vegetation can be planted on their property	M	D1, 3, 4	A, B	n/a	Owner, HOA	NRCS; IDNR; CFC
7	Outreach to golf courses for buffer areas, or participation in programs such as Audubon Cooperative Sanctuary Program (ACSP)	M	D1	B, D, E, F	n/a	Golf	FCSCWP, Audubon, other
8	Promote native landscaping as an alternative to standard landscaping practices at residential, industrial, commercial, and roadside properties.	M	D4	F	n/a	CFC	FCSCWP
9	Review local ordinances to insure that current codes do not prohibit use of native vegetation in BMP projects and encourage BMPs in other residential and commercial landscaping and pavement design plans.	M	D4	A, B, C, F	n/a	Munis; TWPs; LCPBD	FCSCWP

- **Goal E:** Increase communication and coordination among municipal decision-makers and other stakeholders within the watershed.
  Objectives:

  1) Ensure that municipalities adopt updated Flint Creek Watershed-Based Plan.
  2) Encourage municipalities and stakeholders to participate in Flint Creek Watershed Partnership.
  3) Encourage adoption of municipal comprehensive plans, codes and ordinances supportive of watershed plan goals and objectives.
  4) Develop a planning, funding, and implementation mechanism to provide stream channel maintenance across multiple jurisdictions using environmentally friendly practices.

	Action	Rank	Primary Objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agency
1	Following Watershed-Based Plan final approval, meet with each applicable community leader to adopt the Plan.	H	E1	A-F	n/a	FCSCWP	Munic; TWP; CFC; LCSMC; MWRD; IEPA
2	Continue to recruit additional municipalities and stakeholders to participate in the FCWP using the Final Watershed-Based Plan as a means to get involved.	H	E2, 3, 4	A-F	n/a	FCSCWP	Munis, TWP
3	Recruit Citizen Science Volunteers to the VLM and RiverWatch and similar programs to monitor water quality	H	E2	A-F	n/a	FCSCWP	CFC, BACT, LCSWMC
4	Expand the Flint Creek/Spring Creek Watersheds website to provide news, education resources for all stakeholders	H	E2,3,4	A-F	n/a	FCSCWP	Munic; Twp; LCSMC; MWRD; FPD;

							SWCD; NRCS; CFC; FREP
5	Investigate the feasibility for citizen monitoring of creek and lake conditions via mobile app	M	E2	A-F	n/a	FCSCWP	ILMA, LCSMC, CFC, FREP, OF
6	Explore forming a multi-jurisdictional partnership to develop funding packages and grant proposals to implement recommendations in the Watershed-Based Plan	M	E1, 2	A-F	n/a	Munic; Twp	FCSCWP
7	Provide training and watershed education opportunities for local government planners and engineers related to implementing the Watershed-Based Plan and BMPs for water quality.	M	E1,3	F	n/a	FCSCWP	CFC, FREP, LCSMC; MWRD, CMAP

- **Goal F:** Foster appreciation and stewardship of the watershed through education.
  Objectives:
  1) Provide watershed stakeholders with an education plan that promotes the knowledge, skills, and motivation needed to take action on implementing the watershed plan.
  2) Encourage Volunteer Scientist Programs, such as RiverWatch and the Volunteer Lake Monitoring Program
  3) Educate the public on the benefits and goals of native plants and natural area restoration.
  4) Identify open space parcels adjacent to public facilities such as schools that would be appropriate for outdoor education.
  5) Implement environmental interpretation/education signage throughout greenway (conservation) corridors.

	Action	Rank	Primary Objective	Secondary Goal(s)	Cost	Lead Agency	Supporting Agency
1	Incorporate Water Quality Awareness questions in the Healthy Barrington Survey for 2020	H	F3	A-F	n/a	FCSCWP	BADC, CFC
2	Develop municipal profiles of key committees and HOAs that affect natural resource issues and concerns	H	F1	A-F	n/a	FCSCWP	Munis, TWPs, HOAs, Residents
3	Ensure that students graduating from a school system in the Flint Creek Watershed understands the importance of establishing a sustainable balance between people and nature.	H	F3	A-F	n/a	Schools, CFC, BACT, BACOG	FCSCWP, Residents, OF
4	Offer free workshops that help homeowners identify and choose the appropriate native plants, trees, and shrubs that can be used in landscaping.	M	F3, 4, 5	none	n/a	BACT, CFC, FCSCWP	Residents
5	Communicate documented benefits of local restoration efforts.	M	F1, 3	none	n/a	FCSCWP, CFC, BACT	Munis, TWPs, Media
6	Keep elected officials and staff of local government informed about current watershed improvement projects so they can communicate more effectively to the public.	H	F1, 3	A-F	n/a	FCSCWP, CFC, BACT	Munis, TWPs, Media

7	Support BACOG education efforts on groundwater, and the importance of well testing	H	F1,	A-F	n/a	BACOG	Munis, TWPs, FCSCWP
8	Support BACOG education efforts on salt, high PAH sealer, pharmaceutical, and plastics contaminations of water resources	H	F1, 3	A-F	n/a	BACOG	Munis, TWPs, FCSCWP
9	Encourage Owners/Stewards of Ecologically Significant Areas to install interpretive/education signage on sites.	M	F5	none	Var	FCSCWP, CFC, BACT	Owners

Recommended Regulatory Changes

Lake County Watershed Development Ordinance

Section 3.13 (Jurisdictional Coordination) summarizes the jurisdictional roles and responsibilities in the Flint Creek watershed and the ordinances currently in place related to land development. Development that affects water resources (rivers, streams, lakes, isolated wetlands, and floodplains) in the Lake County Portion of the Flint Creek watershed and the Barrington area within Cook County is regulated by the Lake County Watershed Development Ordinance (WDO) and enforced either by the LCSMC or Certified Communities. Barrington Hills is partially certified in the Lake County portion of the watershed. The WDO applies to projects that create a wetland impact within Waters of the United States (WOUS), Isolated Waters of Lake County (IWLC) or occur in buffer areas adjoining those waters. WOUS are those water bodies and wetland areas that are under USACE jurisdiction as determined by a jurisdictional determination. IWLC are all waters such as lakes, ponds, streams (including intermittent streams), farmed wetlands, and wetlands that are not under USACE jurisdiction.

The WDO was developed as the minimum standard to uniformly and consistently enforce stormwater management throughout Lake County, and as a result, is not watershed specific. Under current WDO regulations, wetlands lost to development must be replaced in Lake County, but not necessarily in the same watershed where the loss occurred. However, wetland replacement or mitigation ratios are higher for wetland mitigation that occurs outside of the watershed where the loss occurred. A rising trend for developers is to buy wetland credits from USACE-approved mitigation banks rather than create wetlands on or off-site of the development project. For watersheds that lack mitigation banks, this results in a net loss of wetlands for the watershed.

Several of the guidelines listed below are mentioned throughout the Best Management Practices (BMP) Toolbox (Appendix B), as well as in BMP toolboxes in several other watershed plans such as Squaw Creek, Sequoit Creek, North Branch Chicago River, Indian Creek, and Bull Creek/Bull's Brook. In addition, these recommended guidelines should be considered when developing the Cook County Stormwater Ordinance. These could also apply to McHenry County Stormwater Management Ordinance but would be less important for Flint Creek because of McHenry County's small contribution to the watershed. It is also important to note than any change to the WDO requires an amendment process.

- *Implement Stormwater Quality Runoff Standards for development sites*
  Certified Communities within the Lake County portion of the Flint Creek watershed could develop and adopt a separate "Stormwater Quality Runoff Ordinance" that sets turbidity or total suspended solid limits for development sites that discharge to WOUS or IWLC. If municipalities set these standards, the developer is required to conduct site runoff sampling during storm

events exceeding 0.5 inches and include the results in required weekly inspection reports. Failure to comply with standards results in violations and fines.

- *Alter wetland and stream buffer requirements.*
  Buffer requirements for non-ADID (low quality) wetlands are currently based on size. LCSMC could consider adopting a formula for calculating buffer widths based additionally on quality. Kane County, for example, considers both wetland size and floristic quality (using a Floristic Quality Index (FQI)) in determining the required buffer width for non-lineal wetlands. High quality (FQI>16), medium quality (FQI>7<16), and low quality (FQI<7) wetlands have their own buffer ratio, or percent of wetland size, that is multiplied by the total wetland acreage to achieve the required buffer width. Kane County requires a buffer equivalent to 50% of the total wetland size for high quality wetlands, 40% for medium quality wetlands, and 30% for low quality wetlands. ADID wetlands in Lake County often have FQI values greater than 16. Buffer widths equivalent to greater than 50% of wetland size should be considered for these higher quality wetlands.

  Lake County also has the opportunity to incorporate additional quality measures in the equation for calculating buffer widths yet to be adopted by other counties. These measures might include one or more of the following: existing adjacent land use, proposed adjacent land use, topography of adjacent land, habitat quality, and extent of habitat for threatened and endangered species. Currently, the WDO requires buffer areas hydrologically disturbed during construction to be revegetated using native plants. Regulations could be implemented that require developers to plant native vegetation in all buffers that are low quality even if they are not disturbed.

  It should be noted that LCSMC's buffer requirements are considered to be the **minimum standard** for the county. Individual communities have the option of adopting wider buffer requirements.

- *Adopt guidelines for stream maintenance.*
  There are currently no county-level programs or maintenance standards for on-going stream maintenance. Such programs are often developed and coordinated by parks, municipal public works departments, highway departments, forest preserves, conservation groups, and drainage districts. These organizations are often forced to cut or substantially reduce long-term maintenance budgets; other times, maintenance is overlooked or deemed unnecessary following a successful restoration install. Stream maintenance is critical to clear obstructions, remove vulnerable trees, and repair failed pipes before they cause blowouts. For restored streams, maintenance for several years following installation is critical to ensure the stream functions as designed. A recommended maintenance program with standards for regular stream maintenance is provided in Appendix E.
- *No net loss of wetlands*
  Efforts should be made at the regulatory level to preserve remaining wetlands for the simple reason that they naturally function in flood control and water quality. A joint agreement between permitting agencies (LCSMC, USACE) and the U.S. Fish and Wildlife Service (USFWS) and the Natural Resources Conservation Service (NRCS) to mitigate for all wetland losses in the same watershed as the impact should be pursued as the optimal action to achieve a no net loss policy for all wetlands within the Flint Creek watershed.
- *All municipalities within the watershed become "Certified Communities"*
  To date, Barrington Hills is a "Partially-Certified Community" under existing Lake County

stormwater ordinances. Inverness is located entirely with Cook County which has also has a stormwater ordinance. Barrington Hills is split between Lake and Cook County.

Local Municipal Codes and Ordinances

Each municipality within the watershed currently has a Village Code. However, most of these existing Codes generally do not adequately address natural resources issues. Updated existing Codes should focus on complementing federal, state, and county laws already in place. Local laws are needed to protect locally significant resources and address local issues. Several Villages in the Chicago region have developed local natural resource ordinances that complement countywide ordinances and would serve as excellent models for municipalities within the Flint Creek watershed. Examples include the Village of Long Grove Zoning Ordinance, the Village of Algonquin Zoning, Soil Erosion and Sediment Control, and Landscaping Codes. Some of the Flint Creek watershed issues not addressed by existing laws include:

- Restrictions on use of high phosphorus fertilizers;
- Guidelines for removing or protecting riparian vegetation;
- Protecting natural resources adjacent to wetlands;
- Natural flood storage;
- Preserving plant and animal biodiversity;
- Native planting requirements, particularly in buffers adjacent to wetlands;
- Conservation easements or deed restrictions.

Requirements for conservation development can also be written into local Village Codes. County and local governments should work together to develop incentives for conservation development. Conservation development is the ideal compromise between economic development and water resource protection. Some ways to incorporate conservation development into developing communities and provide incentives for developers include:

- Establish a joint county/community application process that reduces review time for conservation development;
- Reduce or eliminate fees for conservation development application review;
- Counties and municipalities work together to locate appropriate parcels for future conservation development, and then zone those parcels as conservation development;
- Require all developments to have a certain percentage of preserved open space;
- Develop native landscaping ordinances, particularly in unincorporated areas that may become incorporated;
- Reduce setback requirements between lots and encourage multi-level and clustered residential development;
- Provide credit for combining natural buffers with recreational opportunities;
- Require native plantings in all detention basins;
- Subtract intact natural areas from site area when computing detention requirements.

Conservation development zoning can be applied to re-zoning changes in rural areas. Often the density in the developed portion of a conservation development is as much as double what current zoning would permit which is offset by preserving open space. Conservation development zoning should outline the intent, design guidelines, density bonus and in what areas can be permitted for conservation development zoning changes.

Often, areas that may be re-zoned to a conservation development include areas that are adjacent to areas zoned for conservation, rural residential districts, or less productive agricultural areas. These zones provide large areas to preserve agricultural character and environmentally sensitive areas. Additionally, areas that are defined as rural residential could provide a transition from higher density residential to rural.

Design guidelines for conservation developments can include the process used to determine the environmentally sensitive areas on the site and which areas are developable. Because each site will have different developable areas and sizes, design guidelines can be flexible and should consider different roadway length, width, and lot size. Density bonuses can be written into zoning codes and can include bonuses for the following: use of native vegetation throughout the development, including individual lots, reduction in pavement or impervious surface, percentage of open space, trail or sidewalk connection to other developments or regional trails, additional buffering of natural areas and adjacent spaces and creation of wildlife habitat.

Section 5.2 Site Specific Action Plan Additions Overview

For this watershed plan a "Critical Area" is best described as a location in the watershed where existing or potential future causes and sources of an impairment or existing function are significantly worse than other areas of the watershed. Six Critical Area types were identified during the Flint Creek Watershed-Based Plan update and include:

1. Stream restorations on highly degraded stream reaches;
2. Natural area restorations in highly degraded natural areas;
3. Lake shoreline restoration on highly degraded riparian areas and lake buffers;
4. Detention basin retrofits for poorly designed/functional detention basins;
5. Manure management at an equestrian facility; and
6. Bioswale conversion for eroding swales.

The list of Critical Areas is derived from a comprehensive list of measures found in the Action Plan of this report. Figure 68 and Table 46 identify the location and details of each new project, including the Critical Areas.

Site Specific Action Plan (Best Management Practice [BMP]) recommendations made in this section of the report are backed by findings from the watershed field inventory, overall watershed resource inventory, and input from stakeholders. In general, the recommendations address sites where watershed problems and opportunities can best be addressed to achieve watershed goals and objectives. The Site Specific Action Plan is organized by the jurisdiction in which recommendations are located making it easy for users to identify the location of project sites and corresponding project details. It is important to note that project implementation is voluntary and there is no penalty or reduction in future grant opportunities for not following recommendations.
Descriptions and location maps for each Management Measure category follow. Table 46 includes useful project details such as site ID#, Location, Units (size/length), Owner, Existing Condition, Management Measure Recommendation, Pollutant Load Reduction Efficiency, Priority, Responsible Entity, Sources of Technical Assistance, Cost Estimate, and Implementation Schedule.

Project importance, technical and financial needs, cost, feasibility, and ownership type were taken into consideration when prioritizing and scheduling Management Measures for implementation. High, Medium, or Low Priority was assigned to each recommendation. "Critical Areas" as discussed in Section 5.2 are all High Priority and highlighted in red on project category maps and the Action Plan table. For this watershed plan a "Critical Area" is best described as a location in the watershed where existing or potential future causes and sources of an impairment or existing function are significantly worse than other areas of the watershed. Implementation schedule varies greatly with each project but is generally based on the short term (1-10 years) for High Priority/Critical Area projects and 10-20+ years for medium and low priority projects. Maintenance projects are ongoing.

The Site Specific Management Measures Action Plan is designed to be used in one of two ways.

Method 1: The user should find the respective jurisdictional boundary (listed alphabetically in Table 46) then identify the Management Measure category of interest within that boundary. A Site ID# can be found for each recommendation that corresponds to the Site ID# on Figure 68.

Method 2: The user should go to Figure 68 specified then locate the corresponding Site ID# of the site specific recommendations for that category. Next, the user should go to Table 46 and and locate the jurisdiction where the project is located, then go to the project category and Site ID# for details about the project.

Pollutant load reduction is evaluated for Site Specific Action Plan projects based on efficiency calculations developed for the USEPA's Region 5 Model. This model uses "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" (MDEQ, 1999) to provide estimates nutrient and sediment load reductions from the implementation of *agricultural* Management Measures. Estimate of nutrient and sediment load reduction from implementation of *urban* Management Measures is based on efficiency calculations developed by Illinois EPA. Illinois EPA pollutant load reduction worksheets for each Critical Area Management Measure are located in Appendix J.

If all site specific action plan projects listed in Table 46 were completed, pollutant loading reduction estimates would total 1,347 tons/yr of total suspended solids, 1,781 lbs/yr of total phosphorus, and 5,935 lbs/yr of total nitrogen. Total combined project implementation and maintenance costs on all recommended projects are estimated at $12,450,000.

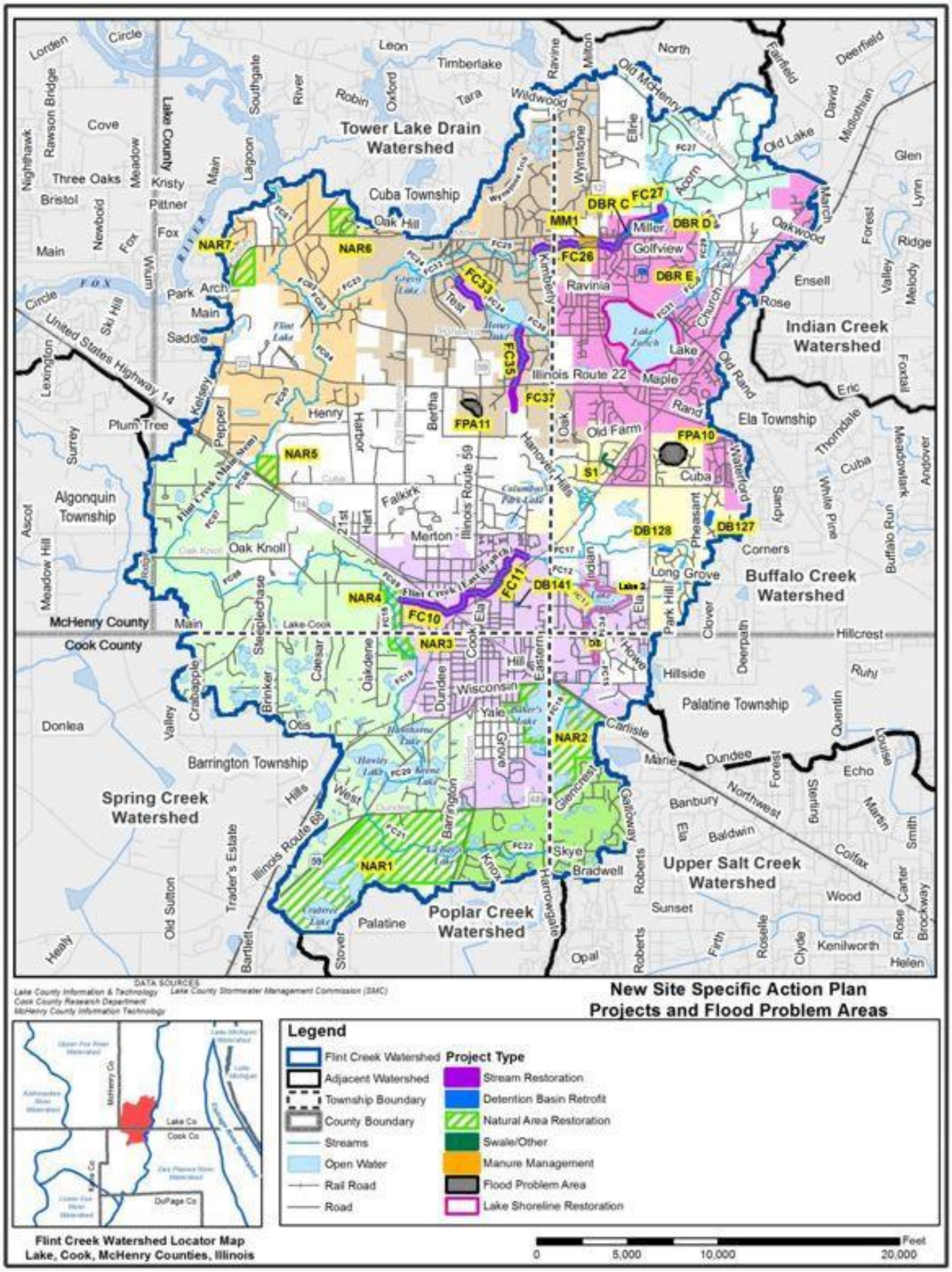


Figure 68: New Site Specific Action Plan Projects and Flood Problem Area

Go to **Section 5.2:** Site Specific Action Plan Additions (New)

Section 5.2 Site Specific Action Plan Additions, Continued

Table 46. Site specific action plan table of new projects within the Flint Creek Watershed.

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Unincor-porated Lake County	Manure Management	MM1	Southwest of Rte 12 and Miller Rd	3.7 acres	Country Charm Farms/ JGarvey	Existing equestrian stables and facilities draining directly to Flint Creek	Design a implement a manure management system on site	N/A	22	196	High/ Critical Area	NRCS	Costs vary by landowner; cannot be estimated.	1-5 years (short-term)
Barrington	Lake Shore native buffers	Lake 2	Fox Point, north of Lake Cook Rd.	11,121 linear ft.	Fox Point Home-owners and HOA	Shoreline is largely turf grass with areas of riprap	Remove ornamental and turf landscaping and replace with buffer of natives and maintain for 3 years to establish	N/A	N/A	N/A	High	Ecological Consultants	Costs may vary, $16,000 to $25,000, including initial maintenance	1-5 years (short-term)
Barrington	Detention Pond Buffers; possibly creek bank buffers	DB, FC13	Fox Point, south of Lake Cook Road	Est. 0.5 acres	Fox Point Home-owners and HOA	Shoreline is largely turf grass; Creek banks have narrow buffers.	Remove ornamental and turf landscaping and replace with buffer of natives and maintain for 3 years to establish	N/A	N/A	N/A	High	Ecological Consultants	Costs will vary	1-5 years (short-term)
Barrington	Feasibility Plan for Removal of Carp and Gizzard Shad & eliminating future access	Lake 2	Fox Point, both the Detention Basin and Lake Louise	See above	Fox Point Home-owners and HOA	Abundant common carp populations in Lake; unknown in Detention Pond	Carp/Gizzard Shad removal; evaluation of spillway barrier modification to preclude recolonization.	N/A	N/A	N/A	High	IDNR and Ecological Consultants	Costs will vary	1-5 years (short-term)
Barrington	Evaluate dredging options and timing for pond & Lake	DB, Lake 2	Fox Point, both the Detention Basin and Lake Louise	See above	Fox Point Home-owners and HOA	Lake is eutrophic, with substantial N & P and poor clarity	Once sources of P & N and sediment are addressed, and carp resolved, evaluate dredging options/ other mitigation	N/A	N/A	N/A	Medium	IDNR, USACE, Ecological Consultants	Costs will vary	5-10 years (long-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Barrington	Detention Basin Retrofit	DBR 140	Rt. 14 and Garlands Ln (Barrington Public Safety)	0.5 acres	Barrington	Wet bottom detention basin with wall on east side, landscaping is mostly ornamental with a small areas of erosion.	Remove ornamental and turf landscaping and replace with buffer of natives and maintain for three years to establish	18	31	244	Medium	Barrington, Ecological Consultant	$15,000 to design & install prairie buffer and naturalize basin including maintenance for 3 years, assumes simple design-build with no permit requirements	5-10 years (long-term)
Barrington	Stream Restoration	FC11	Rte 59 to Lake Zurich Rd	4,300 lf	Private Owners, IDOT	Moderately channelized and eroded stream reach with degraded riparian areas dominated by woody invasives; remeandering needed at CN railroad Elm Road underpass	Remeander section at CN railroad Elm Road underpass, selectively regrade and stabilize banks where necessary remove invasives throughout riparian corridor and replant with natives.	257	219	438	Medium	IEPA, USACE, McHenry County, Ecological Consultant, Engineer	$650,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, increase stream length with meanders, remove invasives throughout stream corridor, naturalize buffer and streambanks with natives, and maintain for three years to establish	5-10 years (long-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Barrington	Stream Restoration	FC10	Flint Creek Dreamway Stream & Riparian Area Restoration Project - Flint Creek between Rt. 59 and Hart Rd	5000 lf	Barrington, Barrington Park District, and School District 220	Severely eroded banks and gullies along portions of the stream as well as heavily degraded and unmanaged riparian corridors.	Selectively pull back and grade sections of eroded bank, stabilize with rock toe where necessary, install in-stream riffle enhancements, and a complete ecological restoration of the riparian corridor including removing non-native and invasive species and reseeding to native mesic prairie and savanna.	134	636	2896	High/ Critical Area	IEPA, USACE, McHenry County, Ecological Consultant, Engineer	$570,000 to design and install full stream and riparian corridor restoration	1-5 years (short-term)
Barrington and Barrington Hills	Stream Restoration	FC18	Flint Creek north of Lake-Cook Rd to confluence with Flint Creek East Branch	2700 lf	District 220	Moderately channelized and moderately eroded stream reach with riparian area of shrub-scrub thicket dominated by buckthorn and weedy trees; outer riparian area is old field dominate by turf grass and teasel.	Design and implement a project to remove invasives from riparian corridor, spot stabilize eroded banks, install artificial pools and riffles, and replant buffer with natives.	162	137	275	High/ Critical Area	IEPA, USACE, McHenry County, Ecological Consultant, Engineer	$600,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, naturalize buffer shoreline with natives, install artificial pools and riffles in channel, and maintain for three years to establish.	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Barrington Hills/Cook County Forest Preserves	Natural Area Restoration	NAR 1	Crabtree Preserve east of Rte 59 and 62	820 acres	CCFPD	Large preserve w/managed prairie and wetland complexes; some remnant but degraded dry-mesic woodland/savanna; Crabtree Lake does not appear to have much erosion, La Bay's Lake has no issues.	The most urgent recommendation is to manage the oak woodland areas by removing heavy buckthorn and thinning and/or removing box elder, silver maple, sugar maple, dead ash, elm, and cherry.	N/A	N/A	N/A	Medium	Ecological Consultant	$7,000,000 to remove invasives and manage oak woodland restoration.	5-10 years (medium to long - term)
Barrington Hills	Natural Area Restoration	NAR 3	Pederson Preserve, south of Lake-Cook Rd and east of Oakdene Rd	27 acres	BACT	Area appears to be under habitat restoration, evidence of buckthorn removal	Continue to maintain to improve condition	N/A	N/A	N/A	Medium	Ecological Consultant	$2,000 per year to control invasives and continue site management.	5-10 years (long-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Barrington Hills	Natural Area Restoration	NAR 4	Ridge/Oak Knoll, between Oak Knoll and Lake-Cook Rd and Old Hart and Hart Rd	54 acres	District 220	Buffer area along FC18 that is highly degraded with buckthorn and second growth woody trees; outside of immediate stream buffer is old field dominated by turf grass and teasel.	Remove all invasive wood species and old field and convert to wet to mesic prairie. Combine work with any work on stream reach FC18.	14	24	264	High/ Critical Area	Ecological Consultant	$250,000 to remove invasives, naturalize buffer with natives, and convert old field to wet to mesic prairie (should be combined with restoration of FC18).	1-5 years (short-term)
Barrington Township	Natural Area Restoration	Baker's Lake/ NAR 2	South and east portions of Baker's Lake riparian area	28 acres	CCFPD/ Barrington, Barrington Park District, Private Owners, Bakers Lake Partners	Most of border around south and east portions of lake are degraded shrub-scrub with buckthorn and second growth weedy trees dominant. Younghusband Prairie appears to be managed.	Remove weedy shrub-scrub border from south and east portions of lake and plant wet to mesic prairie. Remove old fence row weedy trees that exist in Younghusband Prairie.	1	11	14	Medium	Ecological Consultant	$350,000 to remove invasives, naturalize border with natives, convert to wet to mesic prairie, and remove fence row trees from Younghusband Prairie.	5-10 years (long-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Deer Park	Detention Basin Retrofit	DBR 127	Squires Pond at Pheasant Trl & Mallard Ct	3.7 acres	HOA	Wet bottom detention basin with mowed turf side slopes and geese present	Remove turf from slopes and buffer and install native prairie buffer; spot stabilize banks where necessary.	5	22	136	High/ Critical Area	Deer Park, Ecological Consultant	$60,000 to design & install prairie buffer, and naturalize basin including maintenance for 3 years, assumes simple design-build with no permit requirements	1-5 years (short-term)
Deer Park	Detention Basin Retrofit	DBR 128	Meadow Ln north of Glengarry (Meadow Land Pond)	1.4 Acres	HOA	Wet bottom detention basin, mowed turf to edges, slight erosion in spots, geese present	Design and install a project to remove turf, install native buffer, spot stabilize banks where necessary, and install wetland plugs along west edge. Maintain for three years to establish.	1	5	32	High/ Critical Area	Deer Park, Ecological Consultant	$34,500 to design & install prairie buffer & emergent plants, including maintenance for 3 years; assumes simple design-build with no permit requirements	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Deer Park	Other/Swales	S1	Hunters Land and Old Farm Trail	1.3 Acres	multiple residential lots	Open and eroded swales across multiple residential lots; mowed turf grass on all sides, flowing during high water with yard debris in swale.	Design and install a project to remove turf, stabilize and regrade swales and plant swale and narrow buffer with natives. Maintain for three years to establish.	1	2	7	High/ Critical Area	Deer Park, Ecological Consultant	$13,000 to design & install naturalized bioswale conversion including maintenance for 3 years, assumes simple design-build with no permit requirements	1-5 years (short-term)
Lake Barrington	Natural Area Restoration	NAR 5	Flint Creek Savanna South at Rt. 14 & Cuba Road	30 acres	CFC	Site appears to be actively managed by CFC; Recent and extensive buckthorn and weedy tree removal; evidence of native interseeding	Continue to remove invasive woody species and multiflora rose; continue to interseed areas, especially woodland/savanna.	N/A	N/A	N/A	Medium	Ecological Consultant	$3,000 per year to control invasives, continue interseeding and manage woodland.	5-10 years (long-term)
Lake Barrington	Natural Area Restoration	NAR 6	Wedgewood subdivision, north of Miller and Wedgewood Rd.	4 acres	public	Large lot subdivision with roadside turf swales that all drain to central detention basin; pond is bordered primarily by turf.	Design and install project to install a native buffer around detention basin and turn roadside swales into native bioswales.	2	4	13	Low	Ecological Consultant	$50,000 to design and install a native buffer surrounding detention basin and convert swales to native bioswales.	5-10 years (long-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Lake Barrington	Natural Area Restoration	NAR 7	Frier Farm, at Kelsey and Harbor Rd	45 acres	Lake Barrington	Site abuts Grass Lake Forest Preserve, mostly cattail marsh w/invading phragmites, unmaintained dry-mesic oak woodland on east side.	Eradicate phragmites in cattail marsh, manage dry-mesic oak woodland to east at marsh	N/A	N/A	N/A	Medium	Ecological Consultant	$30,000 for the first 3 years, and $4,000 per year after that to eradicate phragmites in marsh and manage woodland.	5-10 years (long-term)
Lake Zurich	Detention Basin Retrofit	DBR C	Detention basin at Manchester Rd and Hampshire Ln	1 acre	Lake Zurich	Wetland bottom detention full of phragmites.	Remove phragmites and replant entire basin bottom and slopes with natives. Maintain for three years to establish.	1	4	14	High/ Critical Area	Lake Zurich, Ecological Consultant	$18,000 to design & install prairie buffer and naturalize basin including maintenance for 3 years, assumes simple design-build with no permit requirements	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Lake Zurich	Detention Basin Retrofit	DBR D	Detention basin at Lorie Ln north of Miller Rd	9.3 acres	Lake Zurich	Wetland and two adjacent wet bottom detention basins with trails throughout. Phragmites and cattails in both basins, wetland full of invasives - teasel, reed canary, phragmites.	Remove invasives in both basins and wetland and reseed with natives and maintaint for three years to establish. Maintain for three years to establish.	4	19	101	High/ Critical Area	Lake Zurich, Ecological Consultant	$145,000 to implement invasive managemenet throughout wetland buffer and basins	1-5 years (short-term)
Lake Zurich	Detention Basin Retrofit	DBR E	Detention basin at Vista and Butterfield	1.4 Acres	Lake Zurich	Wet bottom detention with mowed turf to edges and cattails along all edges	Remove turf and invasives, install native prairie buffer along slopes and plant wetland plugs along toe. Maintain for three years to establish.	4	12	40	High/ Critical Area	Lake Zurich, Ecological Consultant	$34,500 to design & install prairie buffer & emergent plants, including maintenance for 3 years; assumes simple design-build with no permit requirements	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Lake Zurich	Lake Shoreline Restoration	Lake Zurich	Shoreline of Lake Zurich	1957.2 lf	Village of Lake Zurich	850.6 lf of severely eroded and 1106.6 lf of moderately eroded banks need to be stabilized.	Stabilize 850.6 lf of severely eroded shoreline and 1106.6 lf of moderately eroded shoreline using bioengineering techniques such as minor regrading and installation of native plants.	36	31	61	High/ Critical Area	IEPA, USACE, LCSMC, Ecological Consultant, Engineer	$300,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, naturalize buffer shoreline with natives, and maintain for three years to establish.	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Lake Zurich	Stream Restoration	FC26	Rugby Ln. to Rt. 12; partially in Lake Zurich	4,400 lf	private and Village of Lake Zurich	Moderately channelized stream reach exhibiting high levels of erosion, with turf and woody invasives to stream edge along both banks and some hard armoring already in place.	Increase and restore riparian buffer where possible, stabilize streambanks between Seth Paine School to Manr Park, install pools and riffles, and install in-stream habitat (such as rootwads, etc).	376	320	640	High/ Critical Area	IEPA, USACE, LCSMC, Ecological Consultant, Engineer	$650,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, remove invasives throughout stream corridor, naturalize buffer and streambanks with natives, install artificial pools and riffles and in-stream habitat in channel, and maintain for three years to establish.	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
Lake Zurich	Stream Restoration	FC27	Flint Creek from Rt 12 to Brierwood	5,000 lf	private and Village of Lake Zurich	Moderately channelized and moderately eroded stream reach with residential lots and some HOA areas along both banks; narrow riparian buffer dominated by woody invasives.	Design and implement a project to regrade banks and stabilize where necessary, remove invasives from riparian area and replant with natives.	128	109	218	High/ Critical Area	IEPA, USACE, LCSMC, Ecological Consultant, Engineer	$750,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, remove invasives throughout stream corridor, naturalize buffer and streambanks with natives, from channel, and maintain for three years to establish.	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
North Barrington	Stream Restoration	FC33	with partners	2300 lf	private	Highly channelized and moderately eroded stream reach; left bank is golf course with mowed turf to edge, right is residential with woody invasives; some debris in channel (concrete).	Design and install a project to increase/install buffer of natives along both banks, spot stabilize eroded banks, and clear debris.	98	84	167	High/ Critical Area	IEPA, North Barrington, USACE, McHenry County, Ecological Consultant, Engineer	$350,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, remove invasives throughout stream corridor, naturalize buffer and streambanks with natives, remove deris from channel, and maintain for three years to establish.	1-5 years (short-term)

Municipality	Project Type	AES ID#	Location	Units (size/ length)	Owner/ Respon-sible Entity	Existing Condition	Management Measure Recommendation	Pollutant Reduction Efficiency			Priority	Sources of Technical Assistance	Cost Estimate	Implemen-tation Schedule (Years)
								TSS (tons/ yr)	TP (lbs/ yr)	TN (lbs/ yr)				
North Barrington	Stream Restoration	FC35	Honey Lake inlet to Rt. 22	4100 lf	Private Owners	Low to moderately channelized stream reach exhibiting moderate levels of erosion through residential lots with degraded riparian area dominated by woody invasives, moderate levels of debris in channel.	Remove invasives and replant with natives along both banks, spot stabilizatioin of banks, remove debris and install aritificial pools and riffles.	105	89	179	High/ Critical Area	IEPA, North Barrington, USACE, McHenry County, Ecological Consultant, Engineer	$600,000 to design and install a project to selectively stabilize eroded areas using bioengineering techniques, remove invasives throughout stream corridor, naturalize buffer and streambanks with natives, remove deris from channel, install artificial poosl and riffles, and maintain for three years to establish.	1-5 years (short-term)
North Barrington	Stream Restoration	FC37	Honey Lake Drain from Haverton and Grassmere	~1,500 lf	Private, drainage SSA	Natural stream forced into culvert across residential properties.	Conduct feasibility study for daylighting and remeandering section of stream.	N/A	N/ A	N/ A	Medium	IEPA, North Barrington, USACE, McHenry County, Ecological Consultant, Engineer	Not enough information to estimate costs.	5-10 years (long-term)

Section 5.3: Site Specific Action Plan Continuations

The following maps are referenced in the specific plan descriptions.

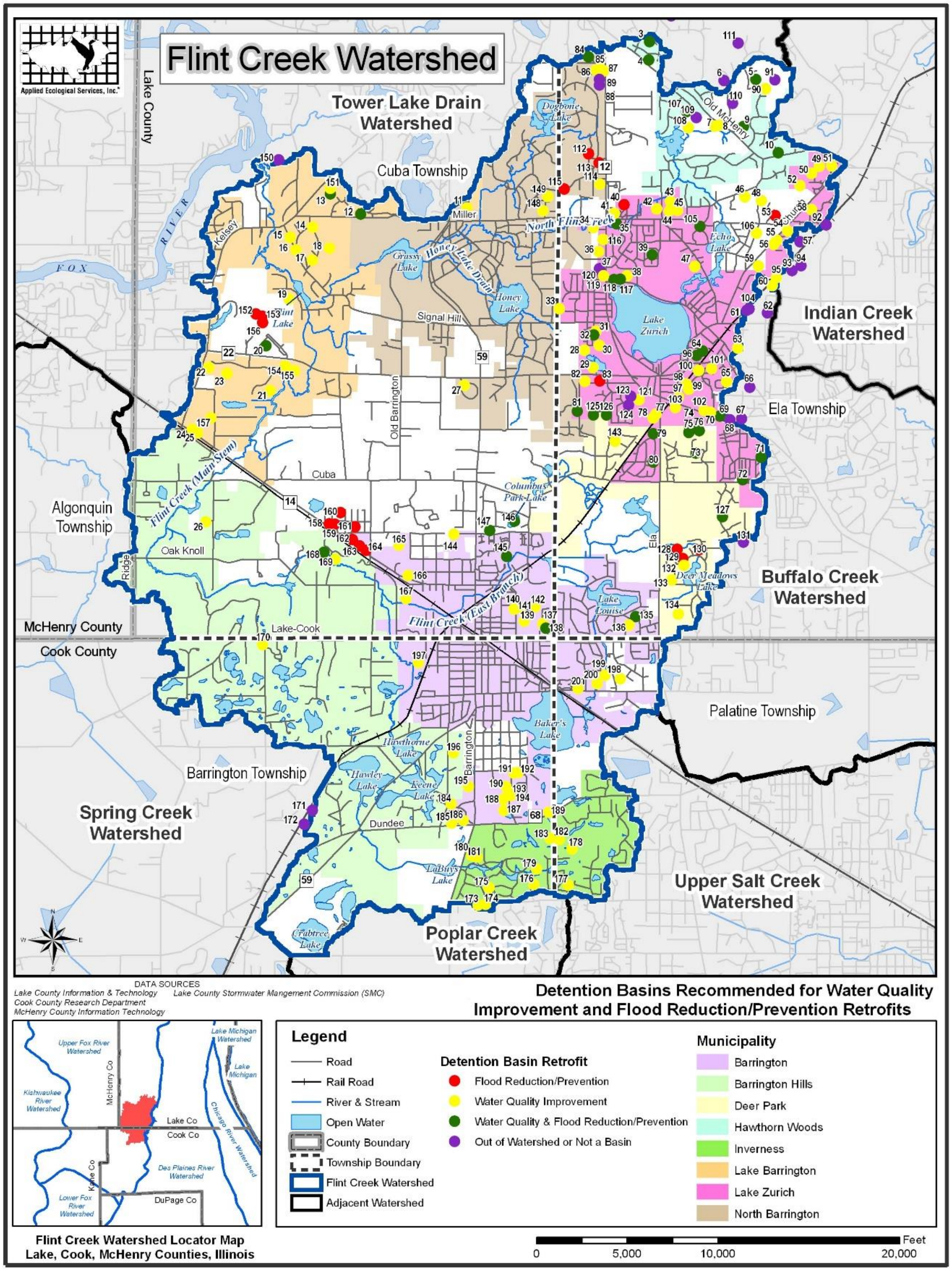


Figure 69: Detention Basins Recommended for Water Quality Improvement & Flood Reduction/Prevention Retrofits

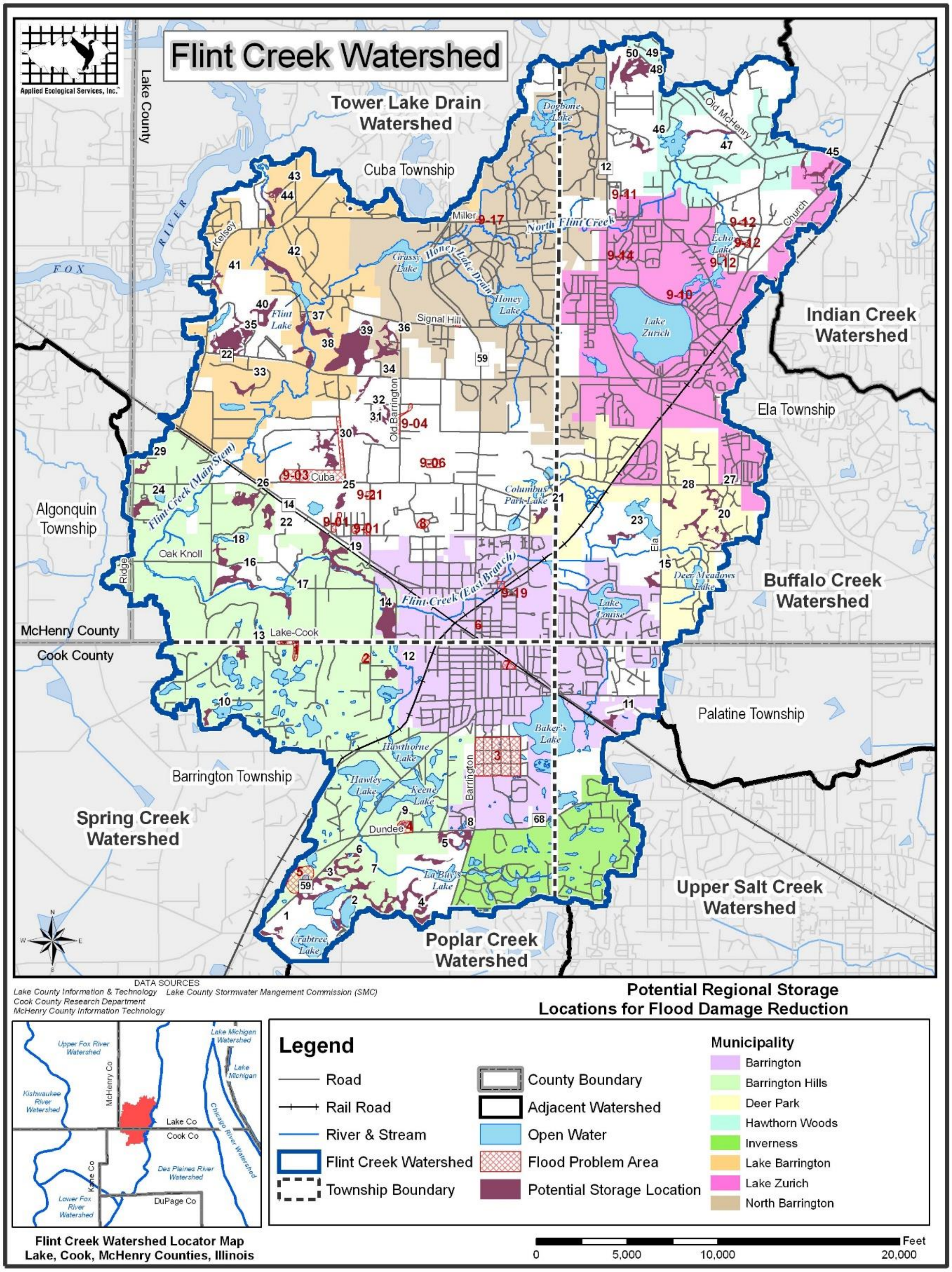


Figure 70: Potential Regional Storage Locations for Flood Damage Reduction

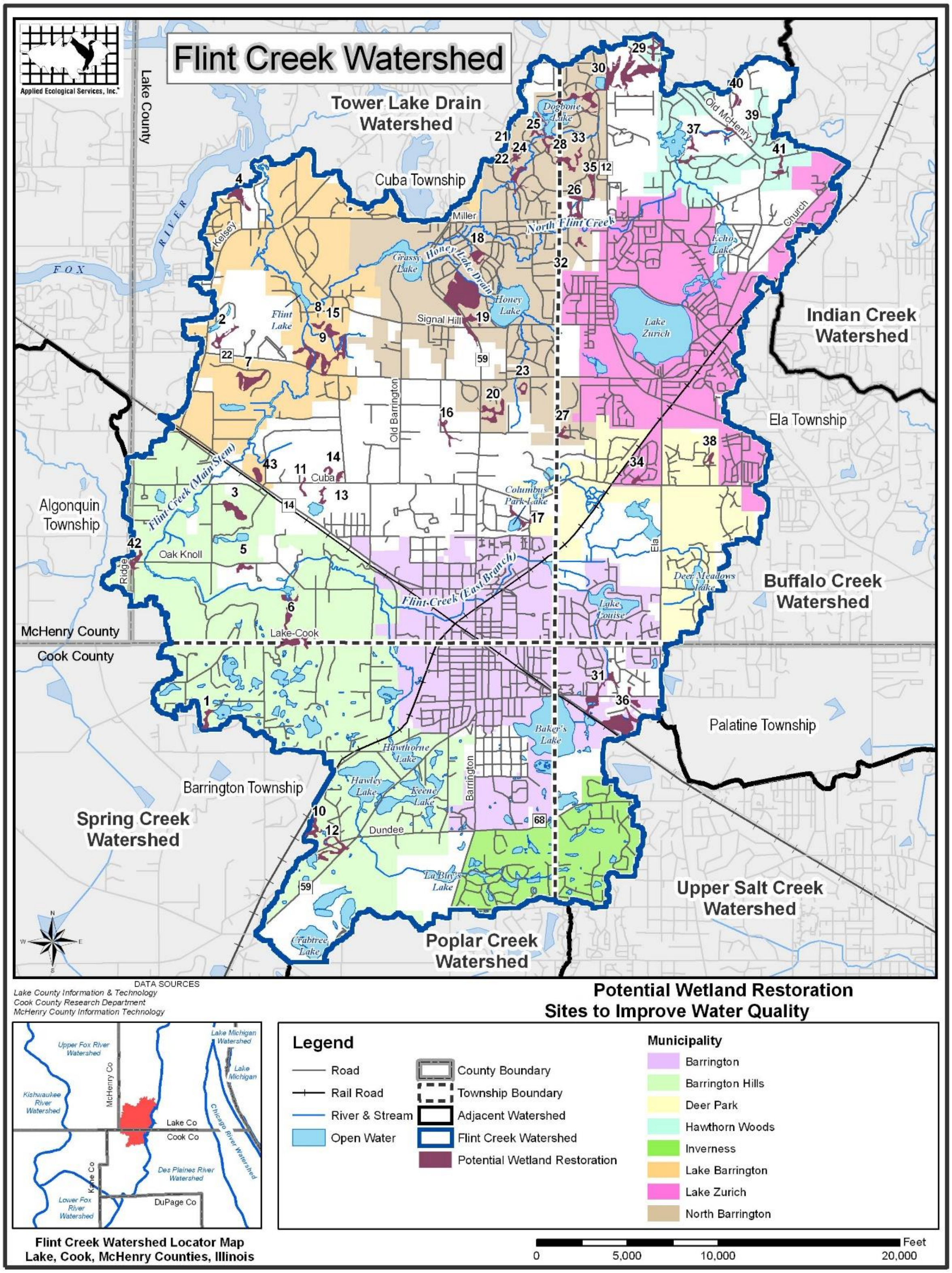


Figure 71: Potential Wetland Restoration

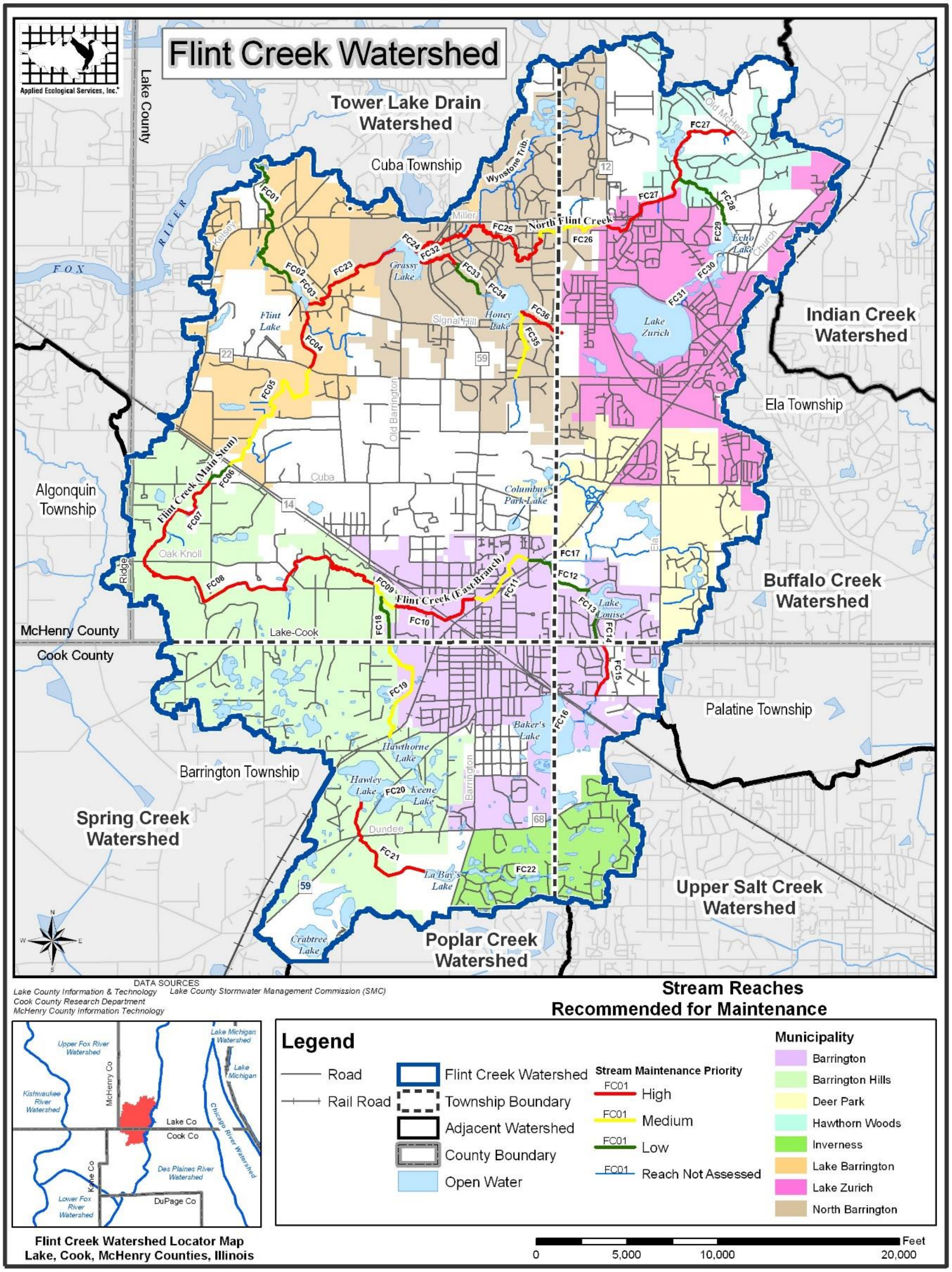


Figure 72: Stream Reaches Recommended for Maintenance

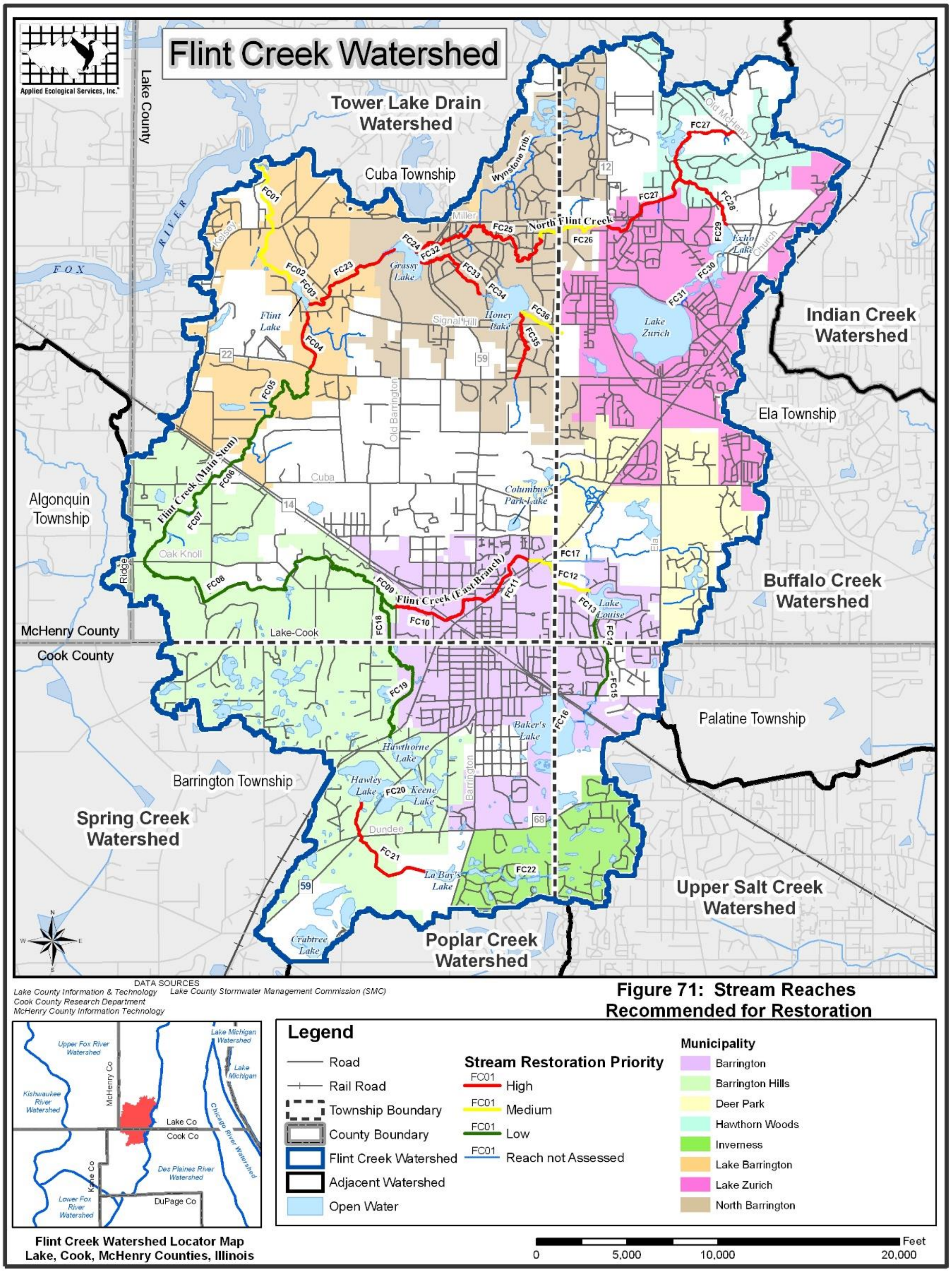


Figure 73: Stream Reaches Recommended for Restoration

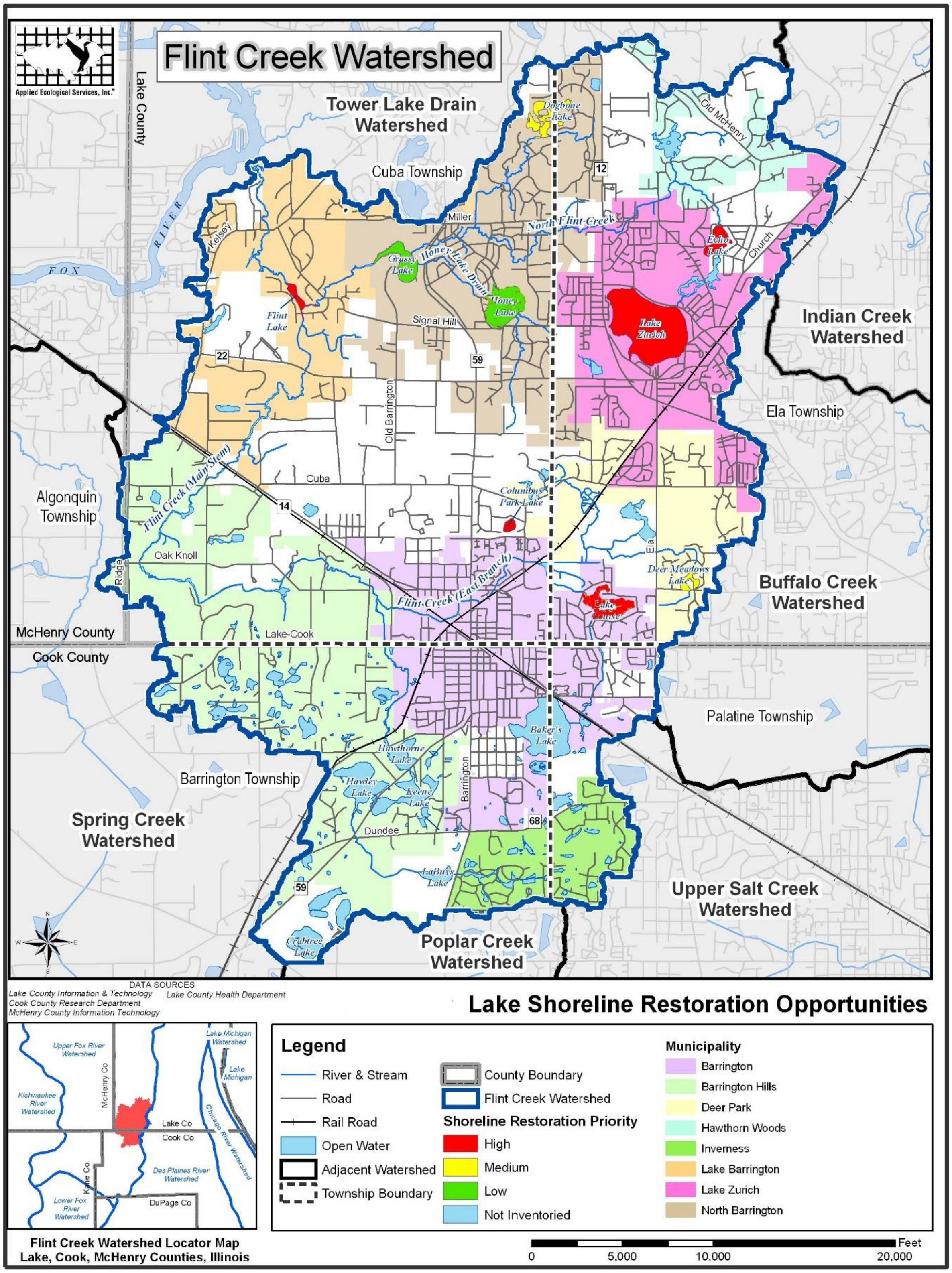


Figure 74: Lake Shoreline Restoration Opportunities

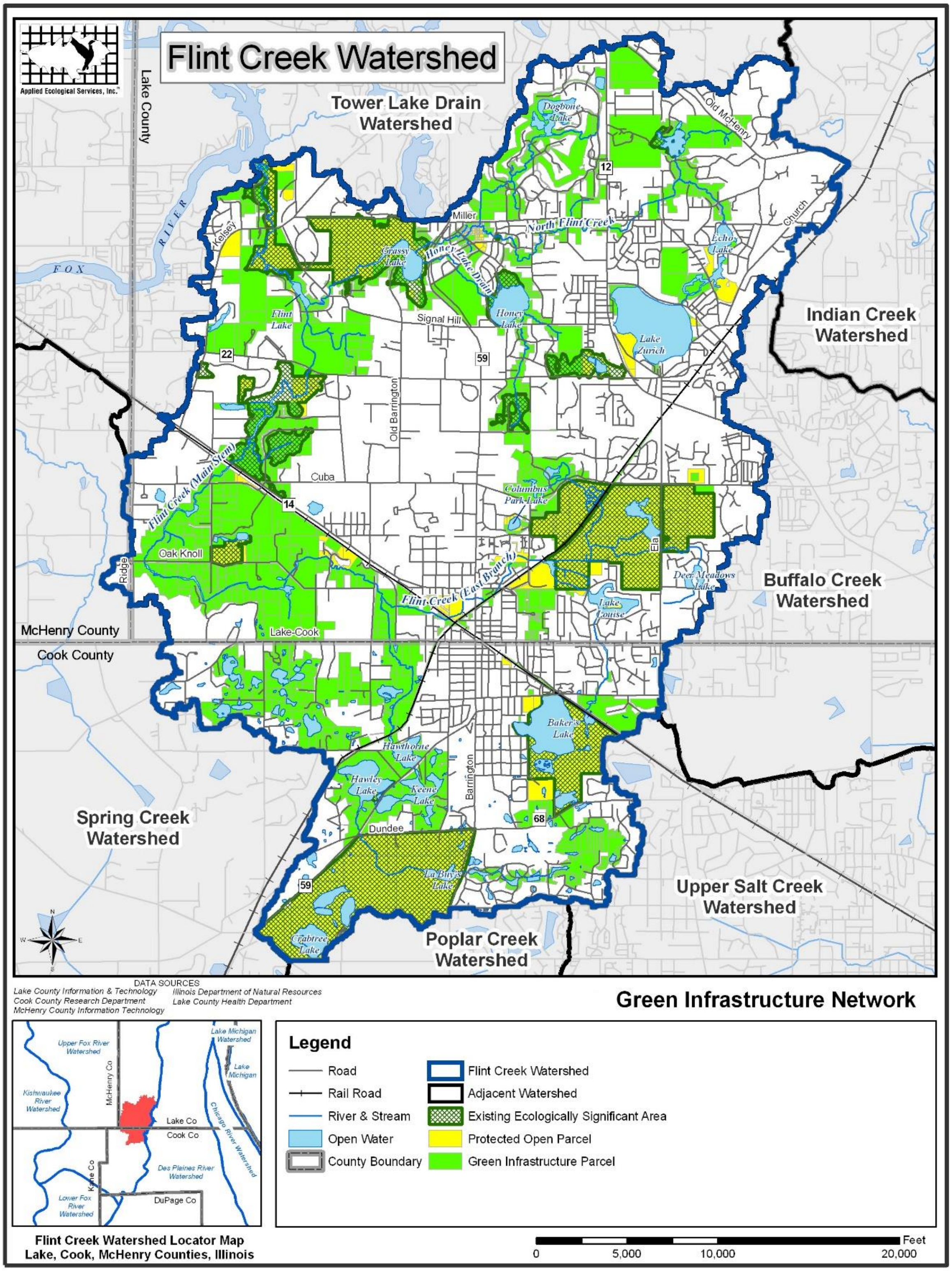


Figure 74: Green Infrastructure Network

Section 5.3 Site Specific Projects (Continuing from 2007 Plan)

Table 47. Site Specific Action Plan Continuing

Barrington

BMP ID#	Location	Acres / Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Med., Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
135	Figure 69: Tall Trees Dr.	n/a	Private	Not Protected	Determine feasibility to convert dry bottom detention to wet bottom planted with native vegetation and constructed with post 1992 restrictor.	M	Private Owner	LCSMC	Varies	LCSMC; LC Watershed Board; HOA	5-10 Years
136	Castle Ct.	n/a	Private	Not Protected	Determine feasibility to convert dry bottom detention to wet bottom planted with native vegetation.	M	Private Owner	LCSMC; Barrington	Varies	EPA 319; IDNR C2000	5-10 Years
197	Lake Cook (Pepsi)	n/a	Private	Not Protected	Determine feasibility to convert dry bottom detention to wet bottom planted with native vegetation.	M	Private Owner	SWCD; MWRD; Barrington	Varies	EPA 319; IDNR C2000	5-10 Years

137	Garlands Ln. (The Garlands)	n/a	Private	Not Protected	Remove invasive and non-native vegetation and shrubs/trees from buffer area. Also located within a pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Barrington	$1-3K/acre	LCSMC; LC Watershed Board; HOA	5-10 Years
138	Whitney Dr. (The Garlands)	n/a	Private	Not Protected	1) Remove existing turf grass buffer and replace with native vegetation; 2) determine feasibility to convert to post 1992 release rates; 3) also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Barrington	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; HOA	5-10 Years
144, 166	Carriage Trl.; Rt. 14/Western (GE Health)	n/a	Private	Not Protected	Determine feasibility to convert existing dry bottom basin to wet bottom planted with native vegetation.	M	Private Owner	Barrington	Varies	EPA 319; IDNR C2000; HOA	5-10 Years
145	Oak Rd. (Chippendale)	n/a	Private	Not Protected	Replace existing turf grass buffer with native vegetation and determine feasibility to convert to post 1992 release rates. Also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Barrington	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board	5-10 Years
162, 163, 164	Rt. 14/20th St. (Foundry of Barrington)	n/a	Private	Not Protected	Determine feasibility to convert to post-1992 release rates.	M	Private Owner	LCSMC	$2-4K (92 release)	LCSMC; LC Watershed Board	5-10 Years
167	Part of Dreamway Plan Barrington High School	n/a	Public	Not Protected	Increase native buffer and conduct maintenance on invasive and non-native species. Also located with pollutant loading hotspot SMU.	M	Barrington High School	Barrington	$3K/acre (Planting)	EPA 319; IDNR C2000; School District	5-10 Years
189	Barrington Middle School	n/a	Public	Not Protected	Increase native buffer and conduct maintenance on invasive and non-native species.	M	Barrington Middle School	Barrington	$3K/acre (Planting)	EPA 319; IDNR C2000; School District	5-10 Years

191, 192, 193, 194	Park Barrington	n/a	Private	Not Protected	Remove existing turf and rip-rap and replace with native vegetation buffer.	M	HOA	Barrington	$3K/acre (Planting)	EPA 319; IDNR C2000; PD	5-10 Years

FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70)

The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.

FPA 9	See Figure 70	n/a	Mostly Private	Mostly Not Protected	Conduct feasibility study to determine if any flood mitigation measures are feasible for depressional flooding along several residential yards/basements in Fox Point Subdivision. One option is to create a naturalized depressional storage area in open space (owned by the Fox Point Homeowners Association) adjacent to the affected lots.	H	Owner (Fox Point HOA)	Barrington; LCSMC; USACE; FEMA	20-30K/acre	LCSMC; LC Watershed Board; Barrington	1-5 Years

LAKE SHORELINE RESTORATION (See Figure 68)

Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.

Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.

Lake Louise	See Figure 68	38 acres	Private	Not Protected	Stabilize 204 linear feet of moderately eroded shoreline using bioengineering techniques such as minor regrading and installation of native plants.	M	HOA; Private Owners	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); Lake Association	5-10 Years

REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70)

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.

14	See Figure 70; Also partially in Barrington Hills	35.9	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space under construction; also recommended in 1994 Flint Creek Management Plan.	H	Private Owner	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
11	See Figure 70	17.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing golf course.	L	Private Owner	MWRD; USACE; NRCS	20-30K/acre	MWRD; USACE	10+ Years

POTENTIAL WETLAND RESTORATION SITES (See Figure 71)

Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.

Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.

31	See Figure 71	12.9	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course.	L	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	10+ Years
36	See Figure 71	32.5	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course.	L	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	10+ Years
STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 72) Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.											
Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.											
FC10	Part of Dreamway Project Hart Rd. to Rt. 59	5,000 ft.	Mostly Public	Partially Protected	1) Install structures that increase flow velocity and transport sediment; 2) Remove debris jams in channel; 3) Repair problematic discharge points (specifically determine feasibility to divert Barrington Park District manhole to adjacent wetlands) and; 4) Repair problematic hydraulic structures.	H	Public and Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Hydraulics and Discharges)	IDNR C2000; EPA 319; LCSMC; Barrington	1-5 Years
FC14	Lake Louise inlet to Lake-Cook Rd.	1,700 ft.	Private	Not Protected	Monitor success of recent stream restoration that occurred in 2005.	H	Private Owners	Barrington	n/a	n/a	1-5 Years
FC15	Lake-Cook Rd. to Hillside Ave.	3,000 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3)	H	Private Owners	IDNR-OWR; USACE;	$1-2K each (Structures); $100-	IDNR C2000; EPA 319; MWRD	1-5 Years

					Repair problematic discharge points			MWRD; NRCS	500 (Debris jams); $1-3K (Discharges)		
FC11	Rt. 59 to Lake Zurich Rd.	4,300 ft.	Private	Partially Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams);	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC19	Lake-Cook Rd. to Hawthorne Lake Dam; also within Barrington Hills	7,100 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Repair problematic hydraulic structures; 3) Repair problematic discharge points.	M	Private Owners	IDNR-OWR; USACE; MWRD; NRCS	$1-2K each (Structures); $1-3K (Hydraulics & Discharges)	IDNR C2000; EPA 319; MWRD	1-5 Years
FC12	Lake Zurich Rd. to Lake Louise Dam; also within Ela Twp.	3,700 ft.	Mostly Public	Mostly Protected	Install structures that increase flow velocity and transport moderate sediment levels.	L	Public and Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC	10+ Years
FC18	Confluence with Flint Creek East to Lake-Cook Rd.; also within Barrington Hills	2,700 ft.	Private	Not Protected	Install structures that increase flow velocity and transport moderate sediment levels.	L	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC	10+ Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC10	Part of DREAMWAY proposal Hart Rd. to Rt. 59	5,000 ft.	Mostly Public	Partially Protected	1) Extend narrow buffer on both banks and plant with native vegetation; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat and 3) located within pollutant loading hotspot SMU. Note: some areas of this reach have been restored by Village of Barrington.	H	Public and Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Barrington	1-5 Years
FC11	Part of CN ByPass Project Rt. 59 to Lake Zurich Rd.	4,300 ft.	Private	Partially Protected	1) Remove non-native vegetation and extend native plant buffer on both banks; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install rootwads and boulders to improve habitat; 4) also located within pollutant loading hotspot SMU.	H	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Barrington	1-5 Years
FC14	Lake Louise inlet to Lake-Cook Rd.	1,700 ft.	Private	Not Protected	Monitor success of recent stream restoration that occurred in 2005.	H	Private Owners	Barrington; HOA	n/a	n/a	1-5 Years
FC12	Lake Zurich Rd. to Lake Louise Dam;	3,700 ft.	Mostly Public	Mostly Protected	1) Remove non-native species from buffer; 2) construct artificial pools and riffles to combat effects of channelization and improve	M	Public and Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC;	$100-300/linear foot	EPA 319; LCSMC; LCFPD	5-10 Years

	also within Ela Twp.				habitat; 3) install rootwads and boulders to improve habitat.			USACE; LCFPD			
FC15	Lake-Cook Rd. to Hillside Ave.	3,000 ft.	Private	Not Protected	1) Monitor success of stream section restored in 1999; 2) maintain restored native buffer; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install rootwads and boulders to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; MWRD; USACE	$100-300/linear foot	EPA 319; MWRD; HOA; Barrington	10+ Years
FC18	Confluence with Flint Creek East to Lake-Cook Rd.; also within Barrington Hills	2,700 ft.	Private	Not Protected	1) Construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and logs to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC	10+ Years
FC19	Lake-Cook Rd. to Hawthorne Lake Dam; also within Barrington Hills	7,100 ft.	Private	Not Protected	1) Remove non-native species from buffer; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and rootwads to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; MWRD; USACE	$100-300/linear foot	EPA 319; MWRD	10+ Years

Barrington Hills

BMP ID #	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)

DETENTION BASIN RETROFITS (See Figure 69)

Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.

Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.

168	Bisque Dr.	n/a	Private	Protected	Monitor success of stabilization project on basin	L	Private Owner	LCSMC; Barrington Hills	$3K/acre (Planting); $2-4K (92 release); $1-3K (repair weir)	EPA 319; IDNR C2000; LC Watershed Board; HOA	10+ Years
170	Countryside School	n/a	Public	Protected	Determine feasibility to convert existing dry bottom detention basin to wet bottom planted with native vegetation. Also located near Flood Problem Area 1.	H		MWRD; Barrington Hills	Varies	EPA 319; IDNR C2000; School District	1-5 Years
26	Buckley Rd.	n/a	Private	Not Protected	Determine feasibility to convert existing dry bottom detention basin to wet bottom planted with native vegetation.	M	Private Owner	Barrington Hills	Varies	EPA 319; IDNR C2000; HOA	5-10 Years

FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 69)

The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.

FP A 1	See Figure 69	n/a	Public Road	Not Protected	Conduct feasibility study to determine if Regional Storage Area # 13, Wetland Restoration # 6 and/or Detention Basin retrofit at # 170 will alleviate local drainage problem along Lake-Cook Rd. No known mitigation has occurred at this site.	H	Barrington Hills; Private Owners	NRCS; Barrington Hills; USACE	Varies	MWRD; USACE	1-5 Years
FP A 2	See Figure 69	n/a	Private	Not Protected	Conduct feasibility study to determine if any flood mitigation measures are feasible for depressional flooding occurring on at northwest corner of Oakdene Rd. and Hart Hills Road. No known mitigation has occurred at this site.	H	Barrington Hills	Barrington Hills; LCSMC	Varies	MWRD	1-5 Years
FP A 4	See Figure 69	n/a	Private	Not Protected	Conduct feasibility study to determine if Regional Storage Area # 9 will alleviate depressional flooding at northwest corner of Route 68 and Lakeview Ln. No known mitigation has occurred at this site.	H	Barrington Hills; Private Owners	NRCS; Barrington Hills; USACE	Varies	MWRD; USACE	1-5 Years
FP A 5	See Figure 69	n/a	Private	Not Protected	Conduct feasibility study to determine if Regional Storage Area #'s 3 and 6 and/or Wetland Restoration #'s 10 and 12 will alleviate depessional flooding between Rt. 59/68 and Old Dundee Rd. No known mitigation has occurred at this site.	H	Barrington Hills; Private Owners	NRCS; Barrington Hills; USACE	Varies	MWRD; USACE	1-5 Years

REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70)

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.

14	See Figure 70; Also partially in Barrington	35.9	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space; also recommended in 1994 Flint Creek Management Plan.	H	Private Owner	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
13	See Figure 70	6.5	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space; also possible flood mitigation for Flood Problem Area 1.	H	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
12	See Figure 70	6.2	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space; also possible flood mitigation for Flood Problem Area 2.	H	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
26	See Figure 70	14.9	Private	Not Protected	Determine feasibility to construct multi-objective storage area in existing agricultural field.	M	Private Owner	USACE; NRCS; SWCD; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
22	See Figure 70	9.9	Private	Not Protected	Determine feasibility to construct multi-objective storage area in existing agricultural field.	M	Private Owner	USACE; NRCS; SWCD; LCSMC	20-30K/acre	LCSMC; USACE	1-5 Years
18	See Figure 70	7.0	Private	Protected	Determine feasibility to construct multi-objective storage area on existing open space.	M	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	5-10 Years

10	See Figure 70	5.2	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space.	M	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	5-10 Years
24	See Figure 70	9.5	Private	Not Protected	Determine feasibility to construct multi-objective storage area in partially open space adjacent to existing large lot residential development.	L	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	10+Years
17	See Figure 70	8.8	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing golf course.	L	Private Owner	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	10+ Years
29	See Figure 70	5.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area in partially open space adjacent to existing large lot residential development.	L	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	10+Years
19	See Figure 70	27.4	Private	Partially Protected	Determine feasibility to construct multi-objective storage area in Flint Creek (main stem) corridor/floodplain.	L	Private Owners	USACE; NRCS; LCSMC	20-30K/acre	LCSMC; USACE	10+ Years
BMP ID #	**Location**	**Acres/ Linear ft.**	**Public or Private**	**Protected or Not Protected**	**Action Recommendation**	**Priority (H, M, or L)**	**Lead Agency/ Owner**	**Sources of Technical Assistance**	**Cost Estimate**	**Funding Mechanism**	**Schedule (Short, Medium, Long Term)**

POTENTIAL WETLAND RESTORATION SITES (See Figure 71)

Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.

Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.

3	See Figure 71	11.4	Private	Not Protected	Determine feasibility for wetland restoration project on existing open and partially residential parcels; also located within high land use vulnerability SMU.	H	Private Owners	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
5	See Figure 71; Also partially in Cuba Twp	4.5	Private	Not Protected	Determine feasibility for wetland restoration project on existing open/partially open parcels and agricultural field; also located within high land use vulnerability SMU.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
10	See Figure 71	6.5	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural field; also potential flood mitigation for Flood Problem Area 5.	H	Private Owner	NRCS; MWRD; SWCD; USACE	20K/acre	EPA 319; IDNR C2000	1-5 Years
12	See Figure 71	12.7	Private	Not Protected	Determine feasibility for wetland restoration project on partially open space north of Dundee Road; also potential flood mitigation for Flood Problem Area 5.	H	Private Owner	NRCS; MWRD; USACE	20K/acre	EPA 319; IDNR C2000; MWRD	1-5 Years
1	See Figure 71	5.3	Private	Not Protected	Determine feasibility for wetland restoration project on existing partially open and agricultural areas; also located within high land use vulnerability SMU.	M	Private Owner	NRCS; MWRD; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; MWRD	5-10 Years
6	See Figure 71; Also partially in Cuba Twp	23.3	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course and south of Lake-Cook Road; area south of Lake-Cook could mitigate at Flood Problem Area 1; also located within high land use vulnerability SMU.	M	Private Owner	NRCS; LCSMC; MWRD; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC; MWRD	5-10 Years

42	See Figure 71	6.9	Private	Not Protected	Determine feasibility for wetland restoration project on existing open/partially open parcels.	M	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	5-10 Years
STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 72) Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.											
Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.											
FC07	Cuba Rd. to Oak Knoll Rd.	6,100 ft	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3) Repair problematic discharge points.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC08	Oak Knoll Rd. to Hart Rd.; Partially in Cuba Township	16,100 ft	Private	Not Protected	May be positively affected by Dreamway (new projects) 1) Install structures that increase flow velocity and transport high sediment levels; 2) Remove debris jams in channel; 3) Repair problematic hydraulic structures.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Hydraulics)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC21	Rt. 59 to LaBuy's Lake Dam; also	6,300 ft.	Private	Mostly Protected	1) Install structures that increase flow velocity and transport high	M	Private Owners	IDNR-OWR; USACE;	$1-2K each (Structure	IDNR C2000; EPA 319;	5-10 Years

	partially in Barrington Twp (Crabtree Nature Preserve)				sediment levels; 2) Remove debris jams in channel.		and FPDCC	MWRD; NRCS; FPDCC	s); $100-500 (Debris jams)	MWRD; FPDCC	
FC09	Old Hart Rd. to Hart Rd.	1,900 ft	Private	Not Protected	May be positively affected by Dreamway (new projects) 1) Install structures that increase flow velocity and transport high sediment levels; 2) Remove debris jams in channel.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC19	Lake-Cook Rd. to Hawthorne Lake Dam; also within Barrington	7,100 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Repair problematic hydraulic structures; 3) Repair problematic discharge points.	M	Private Owners	IDNR-OWR; USACE; MWRD; NRCS	$1-2K each (Structures); $1-3K (Hydraulics & Discharges)	IDNR C2000; EPA 319; MWRD	1-5 Years
FC18	Confluence with Flint Creek East to Lake-Cook Rd.; also within Barrington	2,700 ft.	Private	Not Protected	May be positively affected by Dreamway (new projects) Install structures that increase flow velocity and transport moderate sediment levels.	L	Private Owners	IDNR-OWR; USACE; MWRD; NRCS	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC	10+ Years
STREAM RESTORATION (See Figure 73)											

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC21	Rt. 59 to LaBuy's Lake Dam; partially in Barrington Twp (Crabtree Nature Preserve)	6,300 ft.	Private	Mostly Protected	1) Remove non-native species from buffer; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install boulders and rootwads to improve habitat; 5) potential stream remeandering site.	H	Private Owners and FPDCC	IDNR-OWR; IDNR; NRCS; MWRD; USACE; FPDCC	$100-300/linear foot	EPA 319; MWRD; FPDCC	1-5 Years
FC07	Cuba Rd. to Oak Knoll Rd.	6,100 ft	Private	Not Protected	1) Convert turf grass buffers to native vegetation and remove other non-native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and rootwads to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Residents	10+ Years
FC08	Oak Knoll Rd. to Hart Rd.; partially in Cuba Township	16,100 ft	District 220	Not Protected	Convert turf grass buffers to native vegetation and remove other non-native species.	L	District 220	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$1,000-3,000/acre	EPA 319; LCSMC; Residents	10+ Years
FC09	Old Hart Rd. to Hart Rd.	1,900 ft	District 220	Not Protected	Convert turf grass buffers to native vegetation and remove other non-native species.	L	District 220	IDNR-OWR; IDNR; NRCS;	$1,000-3,000/acre	EPA 319; LCSMC; Residents	10+ Years

								LCSMC; USACE			
FC18	Confluence with Flint Creek East to Lake-Cook Rd.; also within Barrington	2,700 ft.	Private	Not Protected	1) Construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and logs to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC	10+ Years
FC19	Lake-Cook Rd. to Hawthorne Lake Dam; also within Barrington	7,100 ft.	Private	Not Protected	1) Remove non-native species from buffer; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and rootwads to improve habitat.	L	Private Owners	IDNR-OWR; IDNR; NRCS; MWRD; USACE	$100-300/linear foot	EPA 319; MWRD	10+ Years

Barrington Township

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70) The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.											

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.											
FPA 3	See Figure 70	n/a	Private	Not Protected	Working on funding for flood mitigation measures for depressional flooding occurring in subdivision southwest of Baker's Lake. No known mitigation has occurred at this site.	H	Barrington Township	Barrington Township	Varies	MWRD	1-5 Years
LAKE SHORELINE RESTORATION (See Figure 74) Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.											
Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.											
Baker s Lake	See Figure 69	112 acres	Mostly Public	Mostly Protected	Stabilize approximately 1,000 linear feet of severely eroded shoreline along Hillside Avenue using bioengineering techniques such as minor regrading and installation of native plants.	H	FPDCC	USACE: IDNR-OWR; MWRD; NRCS; SWCD	\$100-300/ linear foot	LCSMC; EPA 319; IDNR C2000	1-5 Years
STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 70) Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.											
Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.											

FC21	Rt. 59 to LaBuy's Lake Dam; also partially in Barrington Hills	6,300 ft.	Public (Crabtree Nature Preserve)	Mostly Protected	1) Install structures that increase flow velocity and transport high sediment levels; 2) Remove debris jams in channel.	M	FPDCC	IDNR-OWR; USACE; MWRD; NRCS; FPDCC	$1-2K each (Structures); $100-500 (Debris jams)	IDNR C2000; EPA 319; MWRD; FPDCC	5-10 Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC21	Rt. 59 to LaBuy's Lake Dam; also partially in Barrington Hills	6,300 ft.	Public (Crabtree Nature Preserve)	Mostly Protected	1) Remove non-native species from buffer; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install boulders and rootwads to improve habitat; 5) potential stream remeandering site..	H	FPDCC	IDNR-OWR; IDNR; NRCS; MWRD; USACE; FPDCC	$100-300/linear foot	EPA 319; MWRD; FPDCC	1-5 Years

Cuba Township

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H,	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Mediu

						M, or L)					m, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
146	Lake Zurich Rd. (Columbus Park Lake)	n/a	Public	Protected	1) Replace existing turf grass buffer with native vegetation and treat algae problem; 2) determine feasibility to convert to post 1992 release rates; 3) also located within pollutant loading hotspot SMU.	H	Barrington Park District; Private Owner	LCSMC; BPD, LCPBD	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board; HOA	1-5 Years
20	Good Shepherd Hospital	n/a	Private	Not Protected	1) Remove rip-rap, turf and concrete swales and replace with native vegetation; 2) determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC; CFC	$5K (Remove rip-rip and plant); $2-4 K (92 release)	EPA 319; IDNR C2000; LC Drainage Fund; Lake County Watershed Board	5-10 Years
147	Crestview Dr.	n/a	Private	Not Protected	1) Remove invasive/non-native plants, trees, and shrubs from buffer and replant with natives; 2) determine feasibility to convert to post 1992 release rates; 3) also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; LCPBD	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board; HOA	5-10 Years

152, 153, 156	Good Shepherd Hospital	n/a	Private	Not Protected	Determine feasibility to convert to post 1992 release rates. Note: basins could not be accessed to assess conditions.	M	Private Owner	LCSMC	$2-4 K (92 release)	LC Drainage Fund; Lake County Watershed Board	5-10 Years

FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70)

The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
FPA 9-03	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if Regional Storage Area #'s 30 and 31 and/or Wetland Restoration #'s 11 and 14 will alleviate flooding for local drainage problem along Harbor Rd. and Cuba Rd.. A partial fix occurred to the broken drain tile at this site.	H	Cuba Township; Private Owners	LCSMC; Cuba Township; NRCS; USACE	Varies	LC Watershed Board; LC Drainage Fund; LCSMC; USACE; NRCS	1-5 Years
FPA 9-04	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if Regional Storage Area # 32 will alleviate flooding for local drainage problem near Old Barrington Rd. and N. Edgemond	H	Cuba Township; Private Owners	LCSMC; Cuba Township;	Varies	LC Watershed Board; LC Drainage Fund;	1-5 Years

					Rd. Cuba Township Road District has raised Old Barrington Rd. and recommends running pipe north to pond on Rt. 22.			NRCS; USACE		LCSMC; USACE	
FPA 9-12	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if any flood mitigation measures are feasible for local drainage problem in subdivision east of Echo Lake. Minor drainage improvement work has occurred along N. Lakewood Ln.	H	Cuba Township	LCSMC; Cuba Township	Varies	LC Watershed Board; LC Drainage Fund; LCSMC	1-5 Years
FPA 9-21	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if Regional Storage Area # 25 will alleviate depressional flooding on Hart Rd. Historical aerials show a swale that is filled in west of road blocking flow to nearby pond.	H	Cuba Township; Private Owners	LCSMC; Cuba Township; NRCS; USACE	Varies	LC Watershed Board; LC Drainage Fund; LCSMC; USACE	1-5 Years
FPA 9-22	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if any flood mitigation measures are feasible for local drainage problem along Signal Hill Road.	H	Cuba Township; Private Owners	LCSMC; Cuba Township	Varies	LC Watershed Board; LC Drainage Fund; LCSMC; Owner	1-5 Years
LAKE SHORELINE RESTORATION (See Figure 74) Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.											
Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.											
Columbus	See Figure 74	6.6 acres	Mostly Public	Partially Protected	Stabilize 274 linear feet of moderately eroded shoreline and 110 linear feet of moderately eroded shoreline using bioengineering	H	Barrington Park District;	USACE: IDNR-OWR; LCSMC;	$100-300/	LCSMC; EPA 319; IDNR	1-5 Years

Park Lake					techniques such as minor regrading and installation of native plants. Also located within pollutant loading hotspot SMU.		Private Owner	NRCS; SWCD	linear foot	C2000; Park District	
REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70) Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.											
Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.											
35	See Figure 70	31.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing agricultural land.	H	Private Owner	LCSMC; NRCS; SWCD; USACE	20-30K/acre	LCSMC; USACE	1-5 Years
30	See Figure 70	19.8	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing partially open space; also possible flood mitigation for Flood Problem Area 9-03.	H	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	1-5 Years
32	See Figure 70	9.7	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space and agricultural land; also possible flood mitigation for Flood Problem Area 9-04.	H	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	1-5 Years
25	See Figure 70	5.7	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space; also possible flood mitigation for Flood Problem Area 9-01 and 9-21.	H	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	1-5 Years

39	See Figure 70; also in Lake Barrington and North Barrington	80.1	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing golf course (west half), and existing wetland (east half).	L	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years
40	See Figure 70	27.9	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing partially open space.	L	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years
16	See Figure 70	17.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing partially open space adjacent to residential development.	L	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years
31	See Figure 70	7.3	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing partially open space adjacent to residential development; also possible flood mitigation for Flood Problem Area 9-03.	L	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years
34	See Figure 70	6.1	Private	Partially Protected	Determine feasibility to construct multi-objective storage area on existing partially open space adjacent to residential development and existing wetland.	L	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years

POTENTIAL WETLAND RESTORATION SITES (See Figure 71)

Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.

Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.

2	See Figure 71	7.0	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural land; also located within high land use vulnerability SMU.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
4	See Figure 71	9.8	Private	Not Protected	Determine feasibility for wetland restoration project on existing partially open parcels and agricultural land; also located within high land use vulnerability SMU.	H	Private Owners	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
5	See Figure 71; Also partially in Barringto n Hills	4.5	Private	Not Protected	Determine feasibility for wetland restoration project on existing open/partially open parcels and agricultural land; also located within high land use vulnerability SMU.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319: IDNR C2000; LCSMC	1-5 Years
11	See Figure 71	2.8	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural land; also potential flood mitigation for Flood Problem Areas 9-01and 9-03.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
13	See Figure 71	3.5	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural land; also potential flood mitigation for Flood Problem Area 9-01.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
14	See Figure 71	8.0	Private	Not Protected	Determine feasibility for wetland restoration project on existing partially open residential land; potential flood mitigation for Flood Problem Area 9-03; also located within high land use vulnerability SMU.	H	Private Owners	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years

16	See Figure 71	5.9	Private	Not Protected	Determine feasibility for wetland restoration project on existing partially open residential land and agricultural land; potential flood mitigation for Flood Problem Area 9-06; also located within high land use vulnerability SMU.	H	Private Owners	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	
17	See Figure 71	5.6	Partially Public	Partially Protected	Determine feasibility for wetland restoration adjacent to Columbus Park Lake; also located within pollutant loading hotspot SMU.	H	Barrington PD; Private Owners	NRCS; LCSMC; USACE; Park District	20K/acre	EPA 319; IDNR C2000; LCSMC; Park District	1-5 Years
6	See Figure 71; Also partially in Barrington Hills	23.3	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course and south of Lake-Cook Road; area south of Lake-Cook could mitigate at Flood Problem Area 1; also located in high land use vulnerability SMU.	M	Private Owner	NRCS; LCSMC; MWRD; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC; MWRD	5-10 Years

STREAM CHANNEL MAINTENANCE AND MONITORING
(See Figure 72)

Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.

Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.

FC08	Oak Knoll Rd. to Hart Rd.; partially in	16,100 ft	Private	Not Protected	1) Install structures that increase flow velocity and transport high sediment levels; 2) Remove debris jams in channel; 3) Repair problematic hydraulic structures.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris); $1-3K	IDNR C2000; EPA 319; LCSMC	1-5 Years

	Barrington Hills								(Hydraulics)		
FC05	Rt. 22 to Rt. 14; mostly in Lake Barrington	9,600 ft	Private	Partially Protected	1) Install structures that increase flow velocity and transport high sediment levels; 2) Repair problematic hydraulic structures.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC01	Fox River to Kelsey Rd (Grassy Lake Forest Preserve); also in Lake Barrington	4,600 ft	Partially Public	Mostly Protected	Install structures that increase flow velocity and transport low sediment levels.	L	Private and LCFPD	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	1-2K each	IDNR C2000; EPA 319; LCSMC; LCFPD	10+ Years
FC06	Rt. 14 to Cuba Rd.	1,400 ft	Partially Public	Not Protected	Install structures that increase flow velocity and transport moderate sediment levels.	L	Partially Public Owners	IDNR-OWR; USACE; LCSMC; NRCS	1-2K each	IDNR C2000; EPA 319; LCSMC	10+ Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC01	Fox River to Kelsey Rd.; also in Lake Barrington	4,600 ft	Partially Public	Mostly Protected	Extend buffer on right bank and remove non-natives from all buffers	M	Private and LCFPD	IDNR-OWR; IDNR; NRCS; LCSMC; USACE; LCFPD	$1,000-3,000/ acre	EPA 319; LCSMC; LCFPD	5-10+ Years
FC05	Rt. 22 to Rt. 14; mostly in Lake Barrington	9,600 ft	Private	Partially Protected	Remove non-native species from existing wide buffer and supplement with native species.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$1,000-3,000/ acre	EPA 319; LCSMC	10+ Years
FC06	Rt. 14 to Cuba Rd.	1,400 ft	Partially Public	Not Protected	1) Convert turf grass buffers to native vegetation and remove other non-native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat;	L	Partially Public Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$1,000-3,000/ acre (buffers); $1-3K each (artificial pool/riffle)	EPA 319; LCSMC	10+ Years
FC08	Oak Knoll Rd. to Hart Rd.; partially in Barrington Hills	16,100 ft	Private	Not Protected	Convert turf grass buffers to native vegetation and remove other non-native species.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$1,000-3,000/ acre	EPA 319; LCSMC; Residents	10+ Years

Deer Park

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Priority (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
73, 75, 76	Inglenook Ct. (Hamilton Estates)	n/a	Private	Not Protected	1) Determine feasibility to convert to post 1992 release rates; 2) treat extensive algae problem; 3) extend native plant buffers where appropriate; 4) also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Deer Park	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board; HOA	5-10 Years
74	Rand/Ela Rd.	n/a	Private	Not Protected	1) Remove rip-rap; conduct maintenance of invasive species; 2) extend native plant buffer; 3) determine feasibility to convert to post 1992 release rates; 4) also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Deer Park	$3K/acre (Planting); $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board	5-10 Years
127	Pheasant Trl.	n/a	Public	Not Protected	1) Remove turf, rip-rap, and concrete from shoreline and buffer and replace with native vegetation; 2) repair damaged inlets/outlets and	M	Private Owner	LCSMC; Deer Park	$3K/acre (Planting); $2-	EPA 319; IDNR C2000; LC Watershed Board; HOA	5-10 Years

					determine feasibility to convert to post 1992 release rates.				4K (92 release)		
128, 129, 130	Meadow Ln.	n/a	Private	Not Protected	Determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC; Deer Park	$2-4 K	LC Watershed Board	5-10 Years
143	Old Farm Rd.	n/a	Private	Not Protected	1) Remove existing turf grass buffer and plant with native vegetation to stabilize highly eroded shorelines; 2) also located within pollutant loading hotspot SMU.	M	Private Owner	Deer Park	$3K/acr e	EPA 319; IDNR C2000; HOA	5-10 Years

LAKE SHORELINE RESTORATION (See Figure 74)

Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.

Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.

Deer/ Meadow s Lake	See Figure 74	13.6 acres	Private	Not Protected	Stabilize 59 linear feet of moderately eroded shoreline along the northwest corner of the lake using bioengineering techniques such as minor regrading and installation of native plants.	M	Lake Associati on; Private Owners	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); Lake Association	5-10 Years

REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70)

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.

20	Cuba Marsh (See Figure 70)	17.4	Public	Protected	Determine feasibility to construct multi-objective storage area on existing open space partially within Cuba Marsh Forest Preserve.	H	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	1-5 Years
21	Cuba Marsh (See Figure 70)	5.4	Partially Public	Partially Protected	Determine feasibility to construct multi-objective storage area on existing partially open space adjacent to residential development	M	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	5-10 Years
27	Cuba Marsh (See Figure 70)	7.4	Partially Public	Partially Protected	Determine feasibility to construct multi-objective storage area on existing partially open space adjacent to residential development	L	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	10+ Years
28	Cuba Marsh (See Figure 70)	5.1	Public	Protected	Determine feasibility to construct multi-objective storage area on existing open space/wetland within Cuba Marsh Forest Preserve.	L	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	10+ Years
POTENTIAL WETLAND RESTORATION SITES (See Figure 71) Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.											
Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.											
38	See Figure 71	3.6	Public	Not Protected	Determine feasibility for wetland restoration project on existing open space; also located within pollutant loading hotspot SMU.	H	Public Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
34	See Figure 71	3.0	Public	Not Protected	Determine feasibility for wetland restoration project on existing ball fields; also located within pollutant loading hotspot SMU.	M	Public Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	5-10 Years

Ela Township

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
5	Lochanora Dr.	n/a	Private	Not Protected	1) Remove rip-rap/turf slopes and replace with native vegetation; 2) repair outlet A; 3) determine feasibility to convert to post 1992 release rates; 4) also located within pollutant loading hotspot SMU.	H	Private Owner	LCSMC; Lake County	$5K/acre (Remove rip-rap and plant) $2-4K (92 release)	EPA 319; IDNR C2000; LC Watershed Board; LC Drainage Fund; HOA	1-5 Years
7	Abbey Glen Rd.	n/a	Public	Not Protected	1) Replace turf grass slopes with native vegetation; 2) treat moderate algae problem; 3) also located within pollutant loading hotspot SMU.	H	School	Lake County	$3K/acre (Planting)	EPA 319; IDNR C2000; School District	1-5 Years
8	Abbey Glen Rd.; Old	n/a	Public	Not Protected	Establish native plants on banks. Also located with pollutant loading hotspot SMU.	H	School	Lake County	$3K/acre (Planting)	EPA 319; IDNR C2000; School District	1-5 Years

	McHenry Rd.										
46	Echo Lake Rd. (Alpine Chapel)	n/a	Public	Not Protected	Remove turf buffer and replant with native vegetation.	M	School	Lake County	$3K/acre	EPA 319; IDNR C2000	5-10 Years
53	Gabriel Dr.	n/a	Private	Not Protected	Determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC	$3K/acre (Planting); $2-4 K/acre (92 release)	LC Watershed Board; LC Drainage Fund	5-10 Years
91	Gentry Dr. (White Birch Meadows)	n/a	Private	Not Protected	Replace turf grass buffer with native vegetation. Also located in pollutant loading hotspot SMU.	M	Private Owner	Lake County	$3K/acre (Planting)	EPA 319; IDNR C2000; HOA	5-10 Years
63	Mohawk Trl. (Ela Area Public Library)	n/a	Public	Not protected	Remove turf buffer and replant with native vegetation.	M	Public Library	Ela Twp	$3K/acre	EPA 319; IDNR C2000	5-10 years
107	Sycamore Dr. (Lakewood Estates)	n/a	Private	Not Protected	1) Remove turf grass buffer and replant with native vegetation; 2) determine feasibility to retrofit to post 1992 release rates; 3) also located within pollutant loading hotspot SMU.	M	Private Owner	LCSMC; Lake County	$3K/acre (Planting); $2-4 K/acre (92 release)	EPA 319; IDNR C2000; LC Watershed Board; LC Drainage Fund; HOA	5-10 Years
FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70)											

The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.											
Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.											
FPA 9-11	See Figure 66	n/a	Private	Not Protected	No information is known about the local drainage problem at the northeast corner of Route 12 and Miller Rd. Conduct feasibility study to determine cause of flooding for local drainage problem and if any flood mitigation measures are feasible.	H	Ela Township; Private Owners	LCSMC; Cuba Township	Varies	LC Watershed Board; LC Drainage Fund; LCSMC	1-5 Years
LAKE SHORELINE RESTORATION (See Figure 74) Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.											
Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.											
Echo Lake	See Figure 67	24.5 acres	Public; two southwest parcels owned by Lake Zurich & Lake County	Not Protected	Stabilize 593 linear feet of moderately eroded shoreline (does not include parcels owned by Lake Zurich and Lake County) using bioengineering techniques such as minor regrading and installation of native plants.	M; H Lake Zurich/ Lake County Parcels	Lake Association; Private Owners	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); Lake Association	5-10 Years

REGIONALLY SIGNIFICANT STORAGE LOCATIONS
(See Figure 70)

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.

49	See Figure 70	25.2	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing agricultural land.	H	Private Owner	LCSMC; NRCS; SWCD; USACE	20-30K/acre	LCSMC; USACE	1-5 Years
50	See Figure 70	7.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing agricultural land.	M	Private Owner	LCSMC; NRCS; SWCD; USACE	20-30K/acre	LCSMC; USACE	5-10 Years
23	Cuba Marsh (See Figure 70)	7.2	Public	Protected	Determine feasibility to construct multi-objective storage area on existing open space partially within Cuba Marsh Forest Preserve.	M	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	5-10 Years
15	Cuba Marsh (See Figure 70)	6.7	Public	Protected	Determine feasibility to construct multi-objective storage area on existing open space partially within Cuba Marsh Forest Preserve.	M	LCFPD	LCSMC; NRCS; USACE; LCFPD	20-30K/acre	LCSMC; USACE; LCFPD	5-10 Years
46	See Figure 70	6.3	Private	Not Protected	Determine feasibility to construct multi-objective storage area in agricultural and commercial open space.	M	Private Owner	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	5-10 Years
48	See Figure 70	5.8	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing agricultural land.	M	Private Owner	LCSMC; NRCS;	20-30K/acre	LCSMC; USACE	5-10 Years

								SWCD; USACE			
47	See Figure 70	7.1	Public	Not Protected	Determine feasibility to construct multi-objective storage area along ditch between existing ditch and commercial development	L	Private Owner	LCSMC; NRCS; SWCD; USACE; IDNR-OWR	20-30K/acre	LCSMC; USACE	10+ Years
POTENTIAL WETLAND RESTORATION SITES (See Figure 71) Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.											
Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.											
29	See Figure 71	36.6	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural portion south of Old McHenry Road.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
30	See Figure 71 Partially in N. Barrington	28.1	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural field east of Rt. 12	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR; C2000; LCSMC	1-5 Years
37	See Figure 71	9.3	Public	Not Protected	Determine feasibility for wetland restoration on northern portion containing agricultural land; also located in pollutant loading hotspot SMU	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years

39	See Figure 71	6.2	Public	Not Protected	Determine feasibility for wetland restoration on northern portion containing agricultural land; also located in pollutant loading hotspot SMU	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
40	See Figure 71	3.6	Private	Not Protected	Determine feasibility for wetland restoration on northern portion containing agricultural land; also located in pollutant loading hotspot SMU	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
26	See Figure 71	23.0	Private	Not Protected	Determine feasibility for wetland restoration project on existing open and partially open parcels.	M	Private Owners	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	5-10 Years

STREAM CHANNEL MAINTENANCE AND MONITORING
(See Figure 72)

Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.

Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.

FC27	Rt. 12 to Old McHenry Rd.; also partially in Hawthorn Woods and Lake Zurich	10,900 ft.	Partially Public	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove problematic debris loads; 3) Repair problematic discharge points.	H	Partially Public Owner	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years

FC12	Lake Zurich Rd. to Lake Louise (Cuba Marsh); also within Barrington	3,700 ft.	Mostly Public	Mostly Protected	Install structures that increase flow velocity and transport moderate sediment levels.	L	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC; LCFPD	10+ Years
FC28	Confluence with Flint Cr. North to Echo Lake Dam; also w/in Hawthorn Woods	4,100 ft.	Private	Not Protected	Install structures that increase flow velocity and transport low sediment levels.	L	Private Owner	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC	10+ Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC27	Rt. 12 to Old McHenry Rd.; also	10,900 ft.	Partially Public	Not Protected	1) Increase buffer width using native vegetation and remove other non-native species; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools	H	Partially Public Owner	IDNR-OWR; IDNR; NRCS;	$100-300/linear foot	EPA 319; LCSMC; Residents	1-5 Years

	partially in Hawthorn Woods and Lake Zurich				and riffles to combat effects of channelization and improve habitat; 4) install boulders and rootwads to improve habitat; 5) also located within pollutant loading hotspot SMU.			LCSMC; USACE			
FC28	Confluence with Flint Cr. North to Echo Lake Dam; partially w/in Hawthorn Woods	4,100 ft.	Private	Not Protected	1) Increase buffer width using native vegetation and remove other non-native species; 2)) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install boulders and rootwads to improve habitat; 4) also located within pollutant loading hotspot SMU.	H	Partially Public Owner	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC12	Lake Zurich Rd. to Lake Louise; also within Barrington	3,700 ft.	Mostly Public	Mostly Protected	1) Remove non-native species from buffer; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install rootwads and boulders to improve habitat.	M	Public and Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE; LCFPD	$100-300/linear foot	EPA 319; LCSMC; LCFPD	5-10 Years

Hawthorn Woods

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Priority (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium,

											Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
9	Copperfield Dr.	n/a	Public	Not Protected	1) Remove turf and replant with native vegetation to buffer from street and stabilize moderately eroded banks; 2) determine feasibility to retrofit to post 1992 release rates; 3) also located within pollutant loading hotspot SMU.	H	Private Owner	LCSMC; Lake County	$3K/acre (Planting); $2-4 K/acre (92 release)	EPA 319; IDNR C2000; LC Watershed Board; LC Drainage Fund; HOA	1-5 Years
3, 4	Thornfield	n/a	Private	Not Protected	1) Plant additional native plants along banks; 2) unclog outlets; 3) treat algae; 4) determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC, Hawthorn Woods	$2-4 K (92 release); 3K/acre (Planting)	EPA 319; IDNR C2000; LC Watershed Board; HOA	5-10 Years
10	Chancellor Ct. (Copperfield)	n/a	Private	Not Protected	1) Remove existing rip-rap and turf and replant to native vegetation; 2) determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC, Hawthorn Woods	$2-4 K (92 release); 5K/acre (Planting)	EPA 319; IDNR C2000; LC Watershed Board; HOA	5-10 Years
POTENTIAL WETLAND RESTORATION SITES (See Figure 71)											

Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.

Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.

41	See Figure 69	4.7	Private	Not Protected	Determine feasibility for wetland restoration project on existing agricultural land.	H	Private Owner	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR; C2000; LCSMC	1-5 Years

STREAM CHANNEL MAINTENANCE AND MONITORING
(See Figure 72)

Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.

Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.

FC27	Rt. 12 to Old McHenry Rd.; also partially in Ela Twp. and Lake Zurich	10,900 ft.	Partially Public	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove problematic debris loads; 3) Repair problematic discharge points.	H	Partially Public Owner	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years

FC28	Confluence with Flint Creek North to Echo Lake Dam; also partially within Ela Twp.	4,100 ft.	Private	Not Protected	Install structures that increase flow velocity and transport sediment.	L	Private Owner	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures)	IDNR C2000; EPA 319; LCSMC	10+ Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC27	Rt. 12 to Old McHenry Rd.; also partially in Ela Twp. and Lake Zurich	10,900 ft.	Partially Public	Not Protected	1) Increase buffer width using native vegetation and remove other non-native species; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install boulders and rootwads to improve habitat; 5) also located within pollutant loading hotspot SMU.	H	Partially Public Owner	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC28	Confluence with Flint Creek	4,100 ft.	Private	Not Protected	Where feasible, 1) Increase buffer width using native vegetation and remove other non-native species; 2)) construct artificial pools and riffles to combat	H	Private Owners	IDNR-OWR; IDNR; NRCS;	$100-300/linear foot	EPA 319; LCSMC; Residents	1-5 Years

	North to Echo Lake Dam; also partially within Ela Twp.				effects of channelization and improve habitat; 3) install boulders and rootwads to improve habitat; 4) also located within pollutant loading hotspot SMU.			LCSMC; USACE			

Inverness

BMP ID#	Location	Acres / Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Priority (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
179	MaCalpin Dr. (Braymore Hills)	n/a	Private	Not Protected	Stabilize highly eroded shoreline with native vegetation.	H	Private Owner	MWRD; NRCS; CFC	$3K/acre	EPA 319; IDNR C2000; HOA	1-5 Years

180, 181	Barrington Rd./Braymore Dr.	n/a	Private	Not Protected	Remove existing turf from side slopes of large basins and replant with native vegetation.	M	Private Owner	MWRD; NRCS; CFC	$3K/acre	EPA 319; IDNR C2000; HOA	5-10 Years

Lake Barrington

BMP ID#	Location	Acres / Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Priority (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
12	Miller Rd.	n/a	Private	Not Protected	Determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC	$2-4K	LC Watershed Board	5-10 Years
13	Wedgewood Ln.	n/a	Private	Not Protected	1) Replace turf grass banks with native vegetation; 2) stabilize erosion at inlet A; 3) determine feasibility to convert to post 1992 release rates.	M	Private Owner	LCSMC; Lake Barrington	$3K/acre (Planting); $1K (Stabilization); $2-4K (92	EPA 319; IDNR C2000; HOA; LC Watershed Board	5-10 Years

									release rates)		
151, 157	Fieldstone Ct.; Pepper Rd	n/a	Private	Not Protected	Determine feasibility to convert existing dry bottom detention basin to wet bottom planted with native vegetation.	M	Private Owner	LCSMC; Lake Barrington	Varies	EPA 319; IDNR C2000; HOA	5-10 Years

LAKE SHORELINE RESTORATION (See Figure 74)

Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.

Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.

Flint Lake	See Figure 74	11 acres	Private	Not Protected	Stabilize 1,128 linear feet of moderately eroded shoreline (primarily along western shoreline) using bioengineering techniques such as minor regrading and installation of native plants; also increase buffer width. No severe erosion was noted. Also, determine feasibility to remove dam to restore original stream channel and riparian wetlands.	H	Lake Association; Private Owners	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); Lake Association	1-5 Years

REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70)

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.

33	In Lake Barrington See Figure 70	6.0	Private	Partially Protected	Determine feasibility to construct multi-objective storage area on existing open space, detention basin and new construction area north of industrial area.	M	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	5-10 Years
43	See Figure 70	7.3	Partially Public	Partially Protected	Determine feasibility to construct multi-objective storage area on existing open space.	M	Private and Public Owners	LCSMC; NRCS	20-30K/acre	LCSMC; USACE	5-10 Years
41	See Figure 70	5.2	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing open space.	M	Private Owner	LCSMC; NRCS	20-30K/acre	LCSMC; USACE	5-10 Years
39	See Figure 70; also in Cuba Twp and North Barrington	80.1	Private	Not Protected	Determine feasibility to construct multi-objective storage area on wetland.	H	Private Owners	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	1-5 Years
37	See Figure 70	8.6	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing golf course.	L	Private Owner	LCSMC; NRCS; USACE	20-30K/acre	LCSMC; USACE	10+ Years
44	See Figure 70	7.6	Partially Public	Partially Protected	Determine feasibility to construct multi-objective storage area online with Flint Creek (main stem)/ floodplain.	L	Private and Public Owners	LCSMC; NRCS; IDNR-OWR	20-30K/acre	LCSMC; USACE	10+ Years
38	See Figure 70	5.0	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing golf course.	L	Private Owner	LCSMC; NRCS	20-30K/acre	LCSMC; USACE	10+ Years
POTENTIAL WETLAND RESTORATION SITES (See Figure 71)											

Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.											
Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.											
7	See Figure 71	14.5	Private	Partially Protected	Determine feasibility for wetland restoration project on open area partially surrounded by residential development; site also noted in 1994 Flint Creek Watershed Management Plan; also located within high land use vulnerability SMU.	M	Private Owners	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	5-10 Years
8, 9, 15	See Figure 71	2.8; 29.0; 6.1	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course; also located in high land use vulnerability SMU.	L	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	10+ Years
STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 72) Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.											
Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.											
FC04	Flint Lake inlet to Rt. 22	2,200 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3) Repair problematic discharge points.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years

FC23	Flint Lake inlet to Grassy Lake outlet; also within North Barrington	6,000 ft.	Partially Public (Grassy Lake Forest Preserve)	Partially Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3) Repair problematic discharge points.	H	Private and Public Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC; LCFPD	1-5 Years
FC05	Rt. 22 to Rt. 14 (Flint Creek Savanna); partially in Cuba Township	9,600 ft.	Private	Partially Protected	1) Install structures that increase flow velocity and transport high sediment levels; 2) Repair problematic hydraulic structures.	M	Private and Public Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC; CFC	1-5 Years
BMP ID#	**Location**	**Acres / Linear ft.**	**Public or Private**	**Protected or Not Protected**	**Action Recommendation**	**Priority (H, M, or L)**	**Lead Agency/ Owner**	**Sources of Technical Assistance**	**Cost Estimate**	**Funding Mechanism**	**Schedule (Short, Medium, Long Term)**
FC01	Fox River to Kelsey Rd (Grassy Lake Forest Preserve); also Cuba Township	4,600 ft.	Partially Public (Grassy Lake Forest Preserve)	Mostly Protected	Install structures that increase flow velocity and transport low sediment levels.	L	Private and LCFPD	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$1-2K each	IDNR C2000; EPA 319; LCSMC; LCFPD	10+ Years

FC02	Kelsey Rd. to Flint Lake Dam	4,400 ft.	Partially Public (Grassy Lake Forest Preserve)	Mostly Protected	Install structures that increase flow velocity and transport moderate sediment levels.	M	LCFPD	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$1-2K each	IDNR C2000; EPA 319; LCSMC; LCFPD	5-10 Years
STREAM RESTORATION (See Figure 73) Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.											
Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.											
FC04	Flint Lake inlet to Rt. 22	2,200 ft.	Private	Not Protected	1) Extend buffers on both banks along golf course and plant with native vegetation; 2) restore moderately eroded streambanks using multiple BMPs.	H	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300 linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC23	Flint Lake inlet to Grassy Lake outlet; also within North Barrington	6,000 ft.	Partially Public (Grassy Lake Forest Preserve)	Partially Protected	1) Remove non-native species from buffer; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat.	H	Public and Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; LCFPD	1-5 Years

FC01	Fox River to Kelsey Rd.; also Cuba Township	4,600 ft.	Partially Public (Grassy Lake Forest Preserve)	Mostly Protected	Extend buffer on right bank and remove non-natives from all buffers	M	Private and LCFPD	IDNR-OWR; IDNR; NRCS; LCSMC; USACE; LCFPD	$1,000-3,000/ acre	EPA 319; LCSMC; LCFPD	5-10+ Years
FC02	Kelsey Rd. to Flint Lake Dam	4,400 ft.	Partially Public (Grassy Lake Forest Preserve)	Mostly Protected	Extend buffer on right bank and remove non-natives from all buffers	M	Private and LCFPD	IDNR-OWR; IDNR; NRCS; LCSMC; USACE; LCFPD	$1,000-3,000/ acre	EPA 319; LCSMC; LCFPD	5-10+ Years
FC05	Rt. 22 to Rt. 14; partially in Cuba Township	9,600 ft.	Private	Partially Protected	Remove non-native species from existing wide buffer and supplement with native species.	L	Private Owners	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$1,000-3,000/ acre	EPA 319; LCSMC	10+ Years

Lake Zurich

BMP ID#	Location	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69)											

Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.

Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.

69	Deerpath Plaza	n/a	Private	Not Protected	1) Extend native plant buffer; 2) conduct maintenance on overgrown invasive shrubs and other species; 3) determine feasibility to convert to wet bottom detention basin; 4) also located within pollutant loading hotspot SMU.	H	Private Owner	Lake Zurich	$3K/acre	EPA 319; IDNR C2000	1-5 Years
70	Deerpath Plaza	n/a	Private	Not Protected	1) Create native plant buffer upslope from retaining wall; 2) plant emergent native plants. Also located within pollutant loading hotspot SMU.	H	Private Owner	Lake Zurich	$3K/acre	EPA 319; IDNR C2000	1-5 Years
63	Mohawk Trl. (Ela Area Public Library)	n/a	Public	Not Protected	Remove turf buffer and replant with native vegetation.	M	Public Library	Lake Zurich	$3K/acre	EPA 319; IDNR C2000	5-10 Years
97, 102, 103	Rand/Ela Rds	n/a	Private	Not Protected	1) Remove turf grass buffers and replace with native vegetation; 2) control invasive and non-native species; 3) also located within pollutant loading hotspot SMU.	M	Private Owners	Lake Zurich	$3K/acre (Planting & maintenance)	EPA 319; IDNR C2000	5-10 Years
98, 99	Rosehall Dr. (Mews Townhouses)	n/a	Private	Not Protected	Maintain newly constructed basin primarily by controlling invasive and non-native species. Also located within pollutant loading hotspot SMU.	M	Private Owners	Lake Zurich	$1-3K/acre	EPA 319; IDNR C2000	5-10 Years

FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70)

The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.

Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.

FPA 9-10	See Figure 70	n/a	Private	Not Protected	Conduct feasibility study to determine if any flood mitigation measures are feasible for depressional flooding. In current flood plain.	H	Lake Zurich; Private Owners	LCSMC; Lake Zurich; LCSMC	Varies	LC Watershed Board; LCSMC	1-5 Years
FPA 9-14	See Figure 70	n/a	Private	Not Protected	Village of Lake Zurich conducst on-going grate maintenance to alleviate local drainage problem.	H	Lake Zurich	LCSMC; Lake Zurich	Varies	LC Watershed Board; LCSMC	1-5 Years

STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 72)

Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.

Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.

FC26	Rugby Ln. to Rt. 12; also partially in North Barringt on	4,400 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Repair problematic hydraulic structures; 3) Repair problematic discharge points.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structure s); $1-3K (Hydrauli cs & Discharg es)	IDNR C2000; EPA 319; LCSMC	1-5 Years

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC27	Rt. 12 to Old McHenry Rd.; also partially in Hawthorn Woods and Ela Twp.	10,900 ft.	Partially Public	Not Protected	1) Increase buffer width using native vegetation and remove other non-native species; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install boulders and rootwads to improve habitat; 5) also located within pollutant loading hotspot SMU.	H	Partially Public Owner	IDNR-OWR; IDNR; NRCS; LCSMC; USACE	$100-300/linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC26	Rugby Ln. to Rt. 12; also partially in North Barrington	4,400 ft.	Private	Not Protected	1) Increase native plant buffer width along residential areas and remove other non-native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install rootwads, boulders, and logs to improve habitat.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	5-10 Years

North Barrington

BMP ID#	Loca-tion	Acres/ Linear ft.	Public or Private	Protected or Not Protected	Action Recommendation	Rank (H, M, or L)	Lead Agency/ Owner	Sources of Technical Assistance	Cost Estimate	Funding Mechanism	Schedule (Short, Medium, Long Term)
DETENTION BASIN RETROFITS (See Figure 69) Detention basin retrofit recommendations included in this plan primarily address improving water quality and reducing flooding but also improve natural resources (wildlife habitat) as a secondary function.											
Technical and Financial Assistance Needs: Technical assistance needed to implement detention basin retrofits is generally low to medium while financial assistance is generally moderate. Installing post 1992 construction outlet restrictors on appropriate Lake County basins requires less technical assistance than installing a native plant buffer. Private landowners will require the greatest assistance.											
11	Grand view Dr.	n/a	Public	Not Protected	Replace turf slopes with native vegetation to stabilize highly eroded slopes. Construct outlet to replace make-shift pipe and sandbags.	H	Private Owners	LCSMC; North Barrington	$3K/acre (Planting) ; $2K (Outlet)	EPA 319; IDNR C2000; LC Watershed Board; HOA	1-5 Years
87	Rand/ Timber (State Bank)	n/a	Private	Not Protected	Determine feasibility to convert dry bottom basin to wet bottom.	M	Private Owners	North Barrington	Varies	EPA 319; IDNR C2000	5-10 Years
FLOOD MITIGATION AT FLOOD PROBLEM AREA SITES (See Figure 70) The primary objective of implementing flood mitigation projects is to reduce existing flood damage. Secondary benefits include water quality and natural resource improvement depending on the nature of the project.											
Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations and wetland restorations is generally high because of land protection, design, permitting, and construction costs. Smaller mitigation projects such as detention retrofits and drainage improvements require less technical and financial assistance.											

36	Rt. 59	n/a	Public	Not Protected	Determine feasibility to construct multi-objective storage area on existing wetland surrounded by residential development	H	Private Owners	LCSMC; North Barrington	$30-40K/acre	EPA 319; IDNR C2000; LC Watershed Board; HOA	1-5 Years
LAKE SHORELINE RESTORATION (See Figure 74) Lake shoreline restoration projects are implemented to primarily buffer the waterbody and have equal benefits for improving water quality and improving natural resources by introducing native plants that are beneficial to wildlife.											
Technical and Financial Assistance Needs: Lake shoreline restoration is not as complex as restoring stream reaches but still requires a moderate amount of technical and financial assistance to complete the project. The cost for implementing this type of project depends on the amount of invasive species to be removed and extent of grading work involved in stabilizing the shoreline.											
Honey	See Figure 67	66 acres	Private	Not Protected	No severe or moderate erosion is present. The entire lake shoreline (10,880 linear feet) exhibits slightly or no erosion. No immediate actions are recommended at this time. Future recommendations include minor stabilization efforts and introduction of native plant buffers.	L	Biltmore Country Club and 11 Private Owners	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); Lake Association; Country Club	10+ Years
Grassy Lake	See Figure 67	40 acres	Public	Protected	No severe or moderate erosion is present. The entire lake shoreline (8,643 linear feet) exhibits slight or no erosion. No immediate actions are recommended at this time. Future recommendations include thinning of dense cattail stands that surround the lake and introduction of native emergent vegetation. WORK ONGOINT	L	Lake County Forest Preserve District	USACE: IDNR-OWR; LCSMC; NRCS; SWCD	$100-300/ linear foot	LCSMC; EPA (C-2000 & 319); LCFPD	10+ Years
REGIONALLY SIGNIFICANT STORAGE LOCATIONS (See Figure 70)											

Implementation of potential Regionally Significant Storage Locations primarily prevents and reduces flooding downstream but also improves water quality and natural resources if planted with native vegetation.											
Technical and Financial Assistance Needs: Technical and financial assistance needed to implement storage locations is generally high because of land protection, design, permitting, and construction costs.											
36	See Figure 70	18.5	Private	Not Protected	Determine feasibility to construct multi-objective storage area on existing wetland surrounded by residential development	L	Private Owners	LCSMC; NRCS	20-30K/acre	LCSMC; USACE	10+ Years
POTENTIAL WETLAND RESTORATION SITES (See Figure 71) Wetland restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources.											
Technical and Financial Assistance Needs: Wetland restoration projects are typically complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration.											
20	See Figure 71	11.9	Private	Not Protected	Determine feasibility for wetland restoration project on existing open space.	H	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
27	See Figure 71	3.3	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf open space and agricultural land; also located in high land use vulnerability SMU.	H	Private Owners	NRCS; LCSMC; SWCD; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	1-5 Years
32	See Figure 71	2.7	Private	Not Protected	Determine feasibility for wetland restoration project on existing private opens space adjacent to commercial area.	M	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	5-10 Years
18, 19, 21, 22, 24, 25,	See Figure 71 30 Partiall	7.2, 63.4, 3.9, 7.6, 5.7, 4.2,	Private	Not Protected	Determine feasibility for wetland restoration project on existing golf course.	L	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	10+ Years

28, 30, 33, 35	y in Ela Twp	6.6, 28.1, 3.0, 5.0									
23	See Figure 70	3.4	Private	Not Protected	Determine feasibility for wetland restoration project on existing partially open residential lots.	L	Private Owner	NRCS; LCSMC; USACE	20K/acre	EPA 319; IDNR C2000; LCSMC	10+ Years
STREAM CHANNEL MAINTENANCE AND MONITORING (See Figure 72) Most stream maintenance is conducted to keep the stream channel clear of problematic debris that may cause flooding issues. Water quality also benefits when problem hydraulic structures and discharge points are repaired.											
Technical and Financial Assistance Needs: Technical and financial assistance associated with stream maintenance is generally low for minor tasks such as removing debris jams and repairing problematic hydraulic and discharge points.											
FC23	Flint Lake inlet to Grassy Lake outlet; also within Lake Barrington	6,000 ft.	Partially Public (Grassy Lake Forest Preserve)	Partially Public	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3) Repair problematic discharge points.	H	Public and Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$1-2K each (Structures); $100-500 (Debris jams); $1-3K (Discharges)	IDNR C2000; EPA 319; LCSMC; LCFPD	1-5 Years
FC25	Grassy Lake inlet to Rugby Ln.	10,600 ft.	Private	Partially Public	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel; 3) Repair problematic discharge points.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams); $1-3K	IDNR C2000; EPA 319; LCSMC	1-5 Years

									(Discharges)		
FC32	Grassy Lake inlet to Golfview Dr.	2,200 ft.	Private	Partially Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Remove debris jams in channel;	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC36	Honey Lake inlet to headwaters	2,700 ft.	Private	Not Protected	Install structures that increase flow velocity and transport moderate sediment levels; Regularly Removing debris jams in channel. NOW WORKING	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $100-500 (Debris jams)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC26	Rugby Ln. to Rt. 12; partially in Lake Zurich	4,400 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Repair problematic hydraulic structures; 3) Repair problematic discharge points.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $1-3K (Hydraulics & Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC35	Honey Lake inlet to Rt. 22	4,100 ft.	Private	Not Protected	1) Install structures that increase flow velocity and transport moderate sediment levels; 2) Repair problematic hydraulic structures; 3) Repair problematic discharge points.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS	$1-2K each (Structures); $1-3K (Hydraulics & Discharges)	IDNR C2000; EPA 319; LCSMC	1-5 Years
FC33	Golfview Dr. to Honey	2,200 ft.	Private	Not Protected	Install structures that increase flow velocity and transport low sediment levels.	L	Private Owners	IDNR-OWR; USACE;	$1-2K each	IDNR C2000; EPA 319; LCSMC	10+ Years

	Lake Dam							LCSMC; NRCS	(Structures)		

STREAM RESTORATION (See Figure 73)

Stream restoration projects are implemented primarily to improve water quality but also have excellent secondary benefits for reducing flooding and improving natural resources. They improve water quality by stabilizing eroded banks, reduce flooding by reconnecting channelized streams to the historic floodplain, and improve natural resources by improving aquatic habitat.

Technical and Financial Assistance Needs: Stream restorations are often complex and require high technical and financial assistance needs to protect land, design, construct, monitor, and maintain the restoration. The project becomes more complex when construction occurs on reaches that flow through several governing bodies or multiple private residences.

FC23	Flint Lake inlet to Grassy Lake outlet; also within Lake Barrington	6,000 ft.	Partially Public (Grassy Lake Forest Preserve)	Partially Public	1) Remove non-native species from buffer; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat.	H	Public and Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; LCFPD	1-5 Years
FC25	Grassy Lake inlet to Rugby Ln.	10,600 ft.	Private	Partially Public	1) Increase native plant buffer width primarily in turf grass areas; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat.	H	Mostly Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC32	Grassy Lake inlet to Golfview Dr.	2,200 ft.	Private	Partially Protected	1) Increase native plant buffer widths and remove additional non-native species; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	1-5 Years

FC33	Golfview Dr. to Honey Lake Dam	2,200 ft.	Private	Not Protected	Extend native plant buffer widths on both banks within golf course; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install logs, rootwads and boulders to improve habitat. IN PROCESS	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC35	Honey Lake inlet to Rt. 22	4,100 ft.	Private	Not Protected	1) Increase native plant buffer widths and remove additional non-native species; 2) restore moderately eroded streambanks using multiple BMPs; 3) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install rootwads and boulders to improve habitat.	H	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	1-5 Years
FC26	Rugby Ln. to Rt. 12; partially in Lake Zurich	4,400 ft.	Private	Not Protected	1) Increase native plant buffer width along residential areas and remove other non-native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 4) install rootwads, boulders, and logs to improve habitat.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	5-10 Years
FC36	Honey Lake inlet to headwaters	2,700 ft.	Private	Not Protected	1) Increase native plant buffer widths and remove additional non-native species; 2) construct artificial pools and riffles to combat effects of channelization and improve habitat; 3) install rootwads and boulders to improve habitat.	M	Private Owners	IDNR-OWR; USACE; LCSMC; NRCS; LCFPD	$100-300 linear foot	EPA 319; LCSMC; Residents	5-10 Years

Section 6: Information and Education Components

Policy Recommendations

Various recommendations are made throughout this report related to how local governments can improve the condition of Flint Creek watershed through policy. Policy recommendations focus on improving watershed conditions by preserving green infrastructure, protecting groundwater, minimizing road salts, minimizing lawn fertilizer, sustainable management of stormwater, and allowances for native landscaping. To be successful, the Flint Creek Watershed-Based Plan would need to be adopted and/or supported by local communities. The process of creating and implementing policy changes can be complex and time consuming. And, although there are numerous potential policy recommendations for the watershed, the following policy recommendations are considered the most important and highest priority for implementation. **Behavior change: The expected change is municipal and citizen support for greener zoning and ordinances to encourage greater use of pervious surfaces and water filtering natural borders, bioswales, detention areas and stormwater options for developers and residents**.

6.1 Information and Education Goals:

1. Publicize the effectiveness of best management practices of filter strips and buffer zones along creekside and lakeside properties, partnering with BACT and CFC, and others, and making it as straightforward as possible for owners to participate. Working with landscapers to reduce the use of herbicides and phosphorus in their fertilizers would also play a part.
2. Partnering with BACOG and local municipalities, publicize the impacts of road salt usage on water quality and aquatic life and develop recommendations for education, alternatives and use reduction.
3. Partnering with, BACT, CFC, Ancient Oaks and others, identify open space parcels and recruit owners willing to implement BMPs to reduce nutrient and sediment loading, increase buffer areas with natural plantings, eradicate buckthorn, and protect T&E flora and fauna.
4. Partnering with BACOG and government agencies, continue to educate landowners, landlords and developers about the dangers of high PAH sealers on water quality and aquatic life.
5. Partnering with BACOG, Lake County, CFC, the EPA and governmental agencies, encourage the use of green infrastructure best practices, as well as continue to monitor green infrastructure innovations that protect surface and groundwater resources and enhance overall water quality.
6. Partnering with governmental agencies, BACOG, LCHD and LCSMC, continue to educate well and septic owners on best maintenance practices
7. Partnering with government agencies, continue to educate citizens about noteworthy efforts of their local governments to mitigate flooding, and share information on how they can partner
8. Encourage adoption of municipal comprehensive plans, codes and ordinances supportive of watershed goals and objectives, Green Infrastructure Network (GIN) approaches, and work with the County on ways to encourage and streamline governments' participation.
9. Partner with local organizations, such as BACT and CFC and others, on engaging citizens of all ages in becoming citizen scientists, monitoring flora, fauna, lakes or streams.
10. Partner with local organizations to educate citizens on the value of the ecological services afforded by healthy ecosystems.
11. Partner with local organizations to create periodic surveys measuring citizen awareness of healthy watershed issues.
12. Partnering with Partnership members, citizens and experts in the field, continue to improve area capabilities and utility of stream gages, well monitoring and lake and stream testing practices to best

inform officials and citizens on area water resource levels and water quality. Secure funding for additional analyses and capabilities investments.

Target Audiences

The target audiences for goals 1, 2, 3, 4, 6, 7, 8, and 9, 10, 12 are citizens, HOAs, civic groups and church congregations.
The target audiences for goal 2 includes citizens, parking lot owners, developers, HOAs, governmental agencies, and anyone else responsible for winter public safety.
The target audiences for goal 5, 7, and 12 includes local governmental agencies, as well as Lake County governmental agencies.
The target audience for goal 11 is local agencies, Healthier Barrington, a triennial survey, and any similar organization in Lake Zurich and Hawthorn Woods.
All of the goals assume good partnership with local municipalities and other governmental agencies.

Programs, tools, materials, actions, campaigns and delivery mechanisms

Many of the education goals require dissemination of information, and the first element in the strategy is to identify all of the effective local media groups, and to understand the roles they could play. This includes municipal newsletters, and those of other partnering entities, web-based groups, everything from neighborhood and HOA networks to more commercial operations, such as Living60010 and 365Barrington. It includes our own Flint Creek website, as well as those of other organizations, and other social media, such as Instagram, FaceBook and Pinterest. Tools include the possibility of targeted mailings, limited "ads" or targeted messaging, brochures, other informational pieces, presentations, Slideshare and YouTube presence, and so forth. Many of these strategies are light on costs, albeit heavy on time, both for creating appropriate content, and distributing it intelligently. Recruiting volunteers to assist, especially those who are social media savvy, will be important. High school community service resources will be approached for assistance.

Near term and ongoing campaigns will include "Choose Latex or Asphalt Emulsion Sealants" run in partnership with BACOG, which will occur in the Spring and Summer. Work is currently active on a Fall and Winter campaign for reduction of salt usage. There is a significant opportunity to educate citizens on when to expect salt to be used, and when it is just a waste. BACT is beginning a Buckthorn Buster campaign, already begun by Ancient Oaks.

Future campaigns will focus on Native Buffers, Raingardens, Swales and Butterfly Gardens (which help T&E species), and will be directed at Creekside landowners and lake shore landowners and management groups. Ideally, there will be some grant funding available for installation, and clear obligations for maintenance of the native plantings, especially for the first three years.

Meanwhile, the Partnership expects to work with both County agencies, BACOG, and local government agencies to think through and research watershed friendly codes and ordinances, especially green infrastructure, to encourage smart tools, such as protection overlays, setbacks, conservation easements, and so forth, in municipal comprehensive plans and zoning to protect environmentally sensitive areas, and support their adoption via programs to educated citizenry as to their value. There may be opportunities to evolve incentives for developers who propose sustainable or innovative approaches to preserve green infrastructure and use naturalized stormwater treatment approaches. Some of these programs would initially be targeted to civic groups, such as Rotary or Lions, etc., to engage them in the conversation.

Behavior change: The objective is to change community norms to encourage good stewardship of our water resources, via rain gardens, bioswales, conservation easements, meaningful collaboration for watershed projects.

Section 6.2: Priorites/Schedules, Lead and Supporting Organizations, Outcomes and Costs:

Table 48. Priorities/Schedules and **Lead** (in **BOLD**) and Supporting Organizations, Outcomes, **Indicators** and Costs

Goal Number	Priority Rank	Schedule of Key Steps	Partners	Outcomes/ Success **Indicators**	Costs
1	H	Yr. 1-2: Presentations to Partners of approved plan Adoption by 8 government agencies Yr. 3-5: Ongoing Presentation, Adoption by 2 more	**FCSWP,** Municipalities	Partners adopt and/or support (via a resolution) the FCWP Plan **All major village partners adopt**.	n/a
2	H	Yr. 1 Find out who has ordinances & follow-up procedures against phosphorus; compile lists of HOAs and lake mgmt. assoc., and Creekside owners; prepare information. Include education and outreach efforts on eradicating buckthorn. Yr. 2-3: outreach to targets; search for helpful funding; pilots Yr. 4-6: Expand efforts; monitor maintenance Yr. 7-10: ongoing outreach	**FCSCWP,** HOAs, civic clubs, municipalities	Reduced phosphorus and nutrient levels in waterways. Effective buffers can reduce P, N and TSS by 45%, 40% and 73% respectively **Numbers of water side buffers increase**	$100-300 per linear foot of shoreline
3	H	Yr. 1: Compile information on salt and alternatives. Work with BACOG & NWWA. Help publicize Yr. 2-3: Survey attitudes; publicize Yr. 4-6: Repeat, continue research Yr. 7-10: Repeat, continue research	**BACOG, NW Water Planning Alliance (NWPA),** Municipalities FCSCWP	Reduced chloride use and lower conductivity readings over time **Downward trend**	$5-10K for brochures, shared among partners
4	H	Yr. 1: Partnering with BGI (Barrington Greenway Initiative) to identify parcels and owners; work with municipalities for incentives; help recruit volunteers, and highlight buckthorn eradication Yr. 2-3: Develop plans for sites and continue recruiting owners Yr. 4-6: Monitor, maintain and continue recruiting Yr. 7-10: Monitor, maintain and continue recruiting	**CFC, AS, BF,** OF, BACT, AO, FPDs, FOFP, IDNR, municipalities FCSCWP	Over 10 years, 25% growth in greenways **More greenways, conservation easements, and more waterways buffers with no buckthorn**	$100-$300 per linear foot of shoreline affected, assuming sizeable buffers
5	H	Yr. 1: Compile information on high PAH sealers and alternatives. Help compile info on owners of large pavement areas. Work with BACOG on outreach. Help publicize. Yr. 2-3: Work w/ municipalities to ban. Repeat., survey attitudes; publicize	**BACOG,** Municipalities, FCSCWP, CFC, BACT, IDNR, LCSMC	Reduced use of high PAH sealers **Greater awareness of low PAH alternatives. More sealers**	Cost of publications and research; Perhaps a speaker.

		Yr. 4-6: Repeat, Survey, publicize Yr. 7-10: Repeat, Survey, publicize		**not using high PAH sealers**	$5-10K over 10 years
6	H	Yr 1: Compile information on BMP green infrastructure; host open Partnership meeting on sustainable infrastructure with a focus on watersheds. Publicize concepts. Year 2-3: Continue to work with Partnership, and encourage member Partners to include BMP green infrastructure elements in ordinances and codes. Year 4-6: Continue to update BMP green infrastructure information; develop list of additional resources, including funding. Continue to work with municipalities on ordinances and codes Year 7-10: Continue the process	**FCSCWP,** BACOG, Municipalities, CFC, BACT, IDNR, LCSMC, EPA, CMAP	Integration of BMP Green Infrastructure in Municipal Codes and Ordinances including retrofits. **More villages with ordinances aligned with green infrastructure best practices**	n/a
7	M	Yr. 1: Develop information on website, using LCHD, ISGS and LCSMC info Yr. 2-3: Publicize & support programming with BACOG and municipalities Yr. 4-6: Refresh & repeat Yr. 7-10: Refresh & repeat	**FCSCWP,** BACOG, and municipalities	See more participation in well Level 1 testing, Lower E.coli in lakes, depending on geese population. **Growth in Level 1 testing**	n/a
8	M	Yr. 1: Website & media articles about municipal/gov. investments & impacts Yr. 2-3: Continued, plus presentations Yr. 4-6: Continued, plus presentations Yr. 7-10: Continued, plus presentations	**FCSCWP,** Municipalities	Less flooding, more swales, raingardens & public support for governments **More articles**	n/a
9	H	Yr. 1: Assessment of current municipal ordinances Yr. 2-3: Work with gov. agencies at state, and county levels on recommended codes & ordinances Yr. 4-6: Presentations to municipalities and civic orgs Yr. 7-10: Continuation	**BACOG, FCSCWP,** CMAP, FREP, LC, LCSWC	More municipal adoptions of green BMP watershed friendly codes & ordinances **Two munis scoring 60+**	n/a
10	H	Yr. 1: Gathering information on volunteer scientist programs, esp. for lakes and waterways Yr. 2-3: Partner with orgs to recruit, and publicize with area garden clubs, civic orgs, etc. Yr. 4-6: Partner with orgs to recruit, and publicize with area garden clubs, civic orgs, etc. Organize and find funding a recognition celebration Yr. 7-10: Partner with orgs to recruit, and publicize with area garden clubs, civic orgs, etc. Organize and find funding for a recognition celebration	**BACT**, CFC, CMAP, ILMA, FCSCWP	More lake, creek, bird, butterfly, flora volunteer monitors **Growth in VLM volunteers; Garden clubs assisting with buffer designs, projects**.	$5 - $10K over 10 years

11	H	Yr. 1: Gather information and write articles for area media; find some funding to encourage native plantings Yr. 2-3: Continue gathering; post on website, area media and present programming. Recognize key greenspace achievements (BGI) Yr. 4-6: Continue gathering; post on website, area media and programming Yr. 7-10: Continue gathering; post on website, area media and present programming. Survey for impact	**BACT, CFC**, FPDs, FOFP, FCSCWP	Growth in amount of protected greenspace and protected areas around sensitive areas; more conservation easements. **More (15+) conservation easements.**	Variable, depending on incentives for seeding and maintenance funding needed
12	H	Yr. 1: Research key questions; find community partner surveys. Yr. 2-3: Survey, assess, adjust other strategies as appropriate Yr. 4-6: Survey, assess, adjust other strategies as appropriate Yr. 7-10: Survey, assess, adjust other strategies as appropriate	**FCSCWP,** BADC,	Growth in civic understanding of the importance of protecting water and ecological services and increased willingness to play a part. **Growth in number who identify drinking water source**	Variable, depending on whether can piggyback on existing surveys or need to create own.
13	H	By yr. 5: Coordinate MS4 testing and citizen scientist work and sync testing points to drive action and priorities in the Watershed Improve the current watershed testing regimen with information from calibrated/ coordinated stream gages and expanded well level/water quality monitoring. By yr. 10: Secure funding for more analyses, possible equipment upgrades for better intelligence on water flows, groundwater levels and overall water quality.	**FCSCWP,** BACOG, BACT, government agencies, LCHD, EPA	Growth in civic understanding; improved coordination among agencies, improved comparability of stream reach data; assessments **Funding for water flow research and more water testing**	$60 K - $75K depending on services, costs of eqpt. improvements

6.3 Monitoring Success

It is important to establish interim management milestones to determine whether nonpoint pollution management and programmatic measures are being implemented. Milestones and their relationship to watershed goals and objectives established by stakeholders early on are represented in Table 49

FCWP stakeholders will assess progress annually, and reflect on efforts such that it will become clear as to whether changes to an approach, or even the plan itself, are needed. Progress from each partner will be documented. **We expect to see a greater awareness and more discussion of a common responsibility to care for our watersheds and other natural areas, more homeowners investing in their Creekside and lakeshore buffers, and more support for code and ordinance changes supporting green infrastructure, including conservation easements.**

Plan recommendations require local commitments, resources and collaboration for success. Funding is also critical, and both LCSMC grants, IDNR grants and the EPA's Clean Water Act Section 319 program are especially critical, as are identifying, developing and applying for other funding resources.

Table 49: Interim milestones for assessing progress in meeting the goals of the Watershed Plan

Goal	Indicator	Two-year milestone	Five-year milestone	Ten-year milestone
Improve water quality	Lin. ft. streambank stabilization	–	10,000	22,000 total
	Lin. ft. shoreline stabilized	–	2,000	4,000 total
	Lin. ft. shoreline/ creekside buffers	–	2,000	4,000 total
Protect surface & groundwater resources	Convert dry detention basin to wet w/native vegetation	1	1	3 total
	Develop chloride mitigation strategies	Investigate cul-de-sac low/no salt options	Recruit volunteer cul-de-sac pilot participation	Rollout
	Expand anti high PAH efforts	1 additional ordinance ban	County ordinance	State Ordinance
	Encourage BMP green infrastructure projects & supporting code/ordinances	Assessment of current area codes & ordinances	3 municipalities with codes & ordinances to support green infrastructures	80% municipalities supporting green infrastructure codes & ordinances
Protect natural areas/open space	Increase number of acres with conservation status	20 acres	100 acres	200 acres
	Increase number of acres buffering key natural areas	20 acres	150 acres	250 acres
Improve aquatic & terrestrial habitat	Recruit privately owned native buffers installations	2	6	10 total
	Wetland restoration	1	2	4 total
	Conduct study of utility of hydrologic structures	Request proposals	Secure partial funding	Implementation of identified priorities
Strengthen local partnerships	Develop local funding partnerships for buffers & other projects	3 grant proposals	7 grant proposals	15 proposals
	Recruit more HOAs with water resources	2	3	7 total
Reduce existing flooding	Feasibility studies of multi-objective storage open space	2	3	7 total
	Create plans for alleviating depressional flooding	2	2	7 total
Raise public awareness	Digital Media Development	Complete website & digital media plan	Execute & Evaluate	Ongoing & evaluation
	Publish articles on water resources	5 published	15 published	30 total published

	Create raingardens & monarch gardens	5 new	10 new	15 total
Engage students & residents in citizen science programs	Grow number of VLM volunteers	Add 2	Add 5	10 Total
	Expand number of RiverWatch volunteers	Add 2	Add 3	7 Total

6.4 Criteria for Determining Progress

The success of the Plan will be determined by how many of the Plan's recommendations are implemented. High priority BMPs are expected to be implemented within the first five years, assuming timely approval and adoption by member municipalities. Medium BMPs are expected to be implemented within 10 years. Logically, progress made with implementing BMP recommendations should eventually positively impact water quality, so that the Watershed's waters would, over time, no longer be classified as impaired.

Table 50. Criteria for Determining Progress: Analyte Loading to the Fox River

Criteria	*5 year benchmark*	*10 year benchmark*
Phosphorus	15% reduction	30% total reduction
Total Dissolved Solids	7% reduction	15% total reduction
No. of lake mgmt. plans	2	5 total

Another criterion for determining progress will be delisting of a water body due to use attainment as reported in the IEPA's integrated water quality reports (Section 303(d) in the 2027 Integrated Report.)

Frankly, given that so much of our stream banks and shorelines are privately owned, the limitations of funding, and the nature of our non-point sources of pollution, and the prevalence of carp throughout the watershed, we do not anticipate meeting Watershed quality standards during the duration of this Watershed Plan. We expect to make progress. It could take another 30 years to meet the water quality standards. Given the poor water quality assessments assigned to Flint Creek in 1991 (the most polluted tributary of the Fox), we have made progress and expect to continue to do so.

6.5 Monitoring Components for Evaluating Effectiveness

The Flint Creek Watershed Partnership consists of both lakes and three branches of the Flint Creek. We have in place an approved monitoring plan for both the Flint Creek and the Spring Creek watersheds. We are well served by the LCHD Lakes Management Unit, and their every periodic lake monitoring program.

Ongoing monitoring of water quality to evaluate the effectiveness of the watershed plan will largely depend on the following programs:

1) Continuation of the lake monitoring program by the LCHD Lakes Management Unit, with an emphasis on collecting samples for analysis of total phosphorus, dissolved oxygen, and E.coli.
2) RiverWatch and Volunteer Lake Monitoring Program. We will strive to expand VLMP and RiverWatch participation and analyze data at minimum on a three-year cycle, with a focus on clarity and P concentrations and macroinvertebrates.

3) Required MS4 testing done by our municipal partners, again tracking Phosphorus, BOD, TSS, and pH.
4) Stream gages in Flint (and Spring) Creeks monitoring water levels and conductivity (e.g. chloride)
5) June testing as outlined in the Water Quality Monitoring study for Flint (and Spring) Creeks by KOT Consulting

Evaluation of the effectiveness of the Watershed Plan will require analysis of changes, if any, in total phosphorus concentrations over time, a continued monitoring of chloride infiltration (currently we are below levels of concern for chloride, and we intend to stay that way), and Total Dissolved Solids. We will work with our partners to track BMPs implemented in the Watershed by municipalities, especially green infrastructure projects, as well as progress made by our not-for-profit partners. Continued collaboration and analysis will help us understand any changes that occur or trends that emerge.

The overall goals for the Flint Creek Watershed Partnership are to engage our citizens to partner in improving the quality of the surface waters of our watershed so they are unimpaired, support a diversity of flora and fauna, and protect our groundwater resources, by implementing an appropriate mix of best practices, as well as advocate for their continued protection. Municipalities and other government agencies are vital partners, with their ability to communicate with their citizens, conduct research, as well as employ appropriate incentives and encouragements via codes, and regulations. Not-for-profits are also vital partners, as many have long been working toward environmental stewardship, and we will build on the foundations they have built, as well as on the foundation that Clean Air and Clean Water regulations and their coordinating agencies have created over the years. We recognize that this is a long term goal, and we hope to make good progress toward it with this plan. Changing mindsets takes time.

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