3.0 WATERSHED CHARACTERISTICS, PROBLEMS, AND OPPORTUNITIES

3.1 Geology & Climate

Geology

The terrain of the Midwestern United States was created over thousands of years as glaciers advanced and retreated during the Pleistocene Era or "Ice Age". Some of these glaciers were a mile or more thick. The Illinoian glacier extended to southern Illinois between 300,000 and 125,000 years ago. It is largely responsible for the flat, farm-rich areas in the central portion of the state that were historically prairie. Only the northeastern part of Illinois was covered by the most recent glacial event known as the Wisconsin Episode that began approximately 70,000 years ago and ended around 14,000 years ago (Figure 3). During this period the earth's temperature warmed and the ice slowly retreated leaving behind moraines and glacial ridges where it stood for long periods of time (Hansel 2005). A tundra-like environment covered by spruce forest was the first ecological community to colonize after 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.

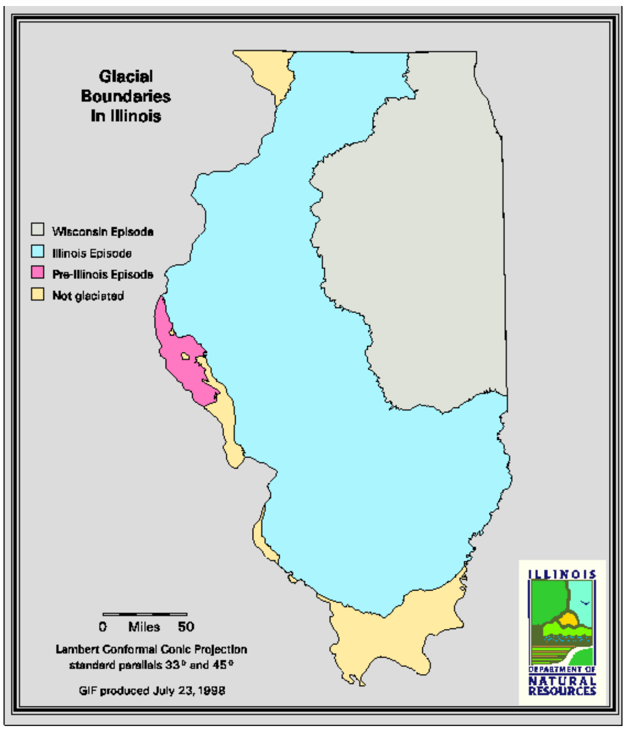


Figure 3. Glacial Episodes in Illinois.

The nearby Fox River was formed at the end of the Wisconsin glaciation as a stream at the edge of the Valparaiso Moraine system and an older moraine to the west. Spring Creek watershed is part of this Valparaiso Moraine system, which created the picturesque rolling hills and valleys found there today (Hansel 2005). The composition of the soil in the Spring Creek watershed is also a remnant of the ancient ice movement. Above the bedrock lies a layer of deposits left behind from the glaciers, consisting of clay, silt, sand, and limestone cobble.

Climate

The northern Illinois climate can be described as temperate with cold winters and warm summers where great variation in temperature, precipitation, and wind can occur on a daily basis. Lake Michigan does influence the study area to some degree but not as much as areas immediately adjacent, south, and east of the lake where it reduces the heat of summer and buffers (warms) the cold of winter. Surges of polar air move southward or tropical air move northward causing daily and seasonal temperature fluctuations. The action between these two air masses fosters the development of low-pressure centers that generally move eastward and frequently pass over Illinois, resulting in abundant rainfall. Prevailing winds are generally from the west, but are more persistent and blow from a northerly direction during winter.

The National Climatic Data Center (NCDC) provides an excellent summary of climate statistics including normals and extremes for sites in Illinois that were selected based on length of record and completeness of data. The NCDC has compiled average temperature and precipitation data from the past 30 years and daily extremes since 1923. Data collected in nearby Barrington, Illinois best represents the climate and weather patterns experienced in the Spring Creek watershed.
The winter months are cold, averaging 22° F, winter lows average 14° F. The coldest temperature on record is -16° F recorded on January 11, 1979. Summers are warm, averaging 70° F, summer highs average 80° F. The highest recorded temperature, 103° F occurred in July 2000.

Fairly typical for the Midwest, the current climate of the Spring Creek watershed consists of an average rainfall of 36 inches and average snowfall of 33 inches. According to data collected in Barrington, the most precipitation received in one month is 13.20 inches. This occurred in August 2007, breaking the previous record of 9.63 inches which occurred in September of 1986. The least amount of precipitation received in one month (0.0 inches) occurred in February of 1990. The one-day maximum precipitation (4.17 inches) occurred on September 23, 1986.

3.2 Pre-European Settlement Ecological Communities & Changes

Pre-European settlement prairie-savanna landscape

An ecological community is made up of all living things in a particular ecosystem and is usually named by its dominant vegetation type. The original public land surveyors that worked for the office of U.S. Surveyor General in the early and mid 1800's mapped and described natural and man-made features and vegetation while creating the "rectangular survey system" for mapping and sale of western public lands of the United States (Daly & Lutes et. al., 2011) We know by interpreting survey notes and hand drawn Federal Township Plats of Illinois (1804-1891) that a complex interaction existed between several ecological communities including prairies, savannas, and wetlands prior to European settlement in the 1830's. The surveyors described the northern portion of the Spring Creek watershed as "Timber" dominated by oaks while the southern portion of the watershed was described mostly as "Prairie" with smaller islands of timber (Figure 5).

This mixture of "Prairie" and "Timber" as an ecological community was widely described in the mid 1800's as the surveyors and early settlers moved west out of the heavily forested eastern portion of the United States and encountered a much more open environment that ecologists now refer to as "Savanna". In the Midwest the term savanna is generally used to describe an ecosystem that was

Pre-European settlement savanna community

historically part of a larger complex bordered by prairies of the west and deciduous forests of the east. Oak dominated savannas were the communities in the middle of this prairie-forest continuum and were maintained by frequent natural fires, fires ignited by Native Americans, and grazing by bison and elk. These processes renewed the prairie, savanna, and wetland communities. Fires ultimately removed dead plant material, exposing the soils to early spring sun, and returning nutrients to the soil. Scattered among the savanna were meandering stream corridors and low wet depressions consisting of fen wetlands, wet prairie, sedge meadow, and marsh.

During pre-European settlement times most of the water that fell as precipitation was absorbed in upland prairie and savanna communities and within the extensive wetlands that existed along stream corridors. Infiltration and absorption of water was so great that many of the defined stream channels seen today were likely sedge and grass-dominated swales exhibiting excellent water quality.

European settlement resulted in drastic changes to the fragile ecological communities. Fires rarely occurred and large tracts of savanna were cleared, prairies were tilled for farmland or developed, wetlands were drained, and many streams were channelized. Today, remnants of once healthy ecological communities exist in the Spring Creek watershed but most are degraded. Most areas that were once healthy oak savanna in the northern portion of the watershed have shifted to either degraded oak woodland communities invaded by honeysuckle, buckthorn, and low quality native species (Figure 4) or retain an oak canopy component but have been cleared in the understory and planted to manicured turf grass in residential areas. In both cases oak regeneration is nearly non-existent.

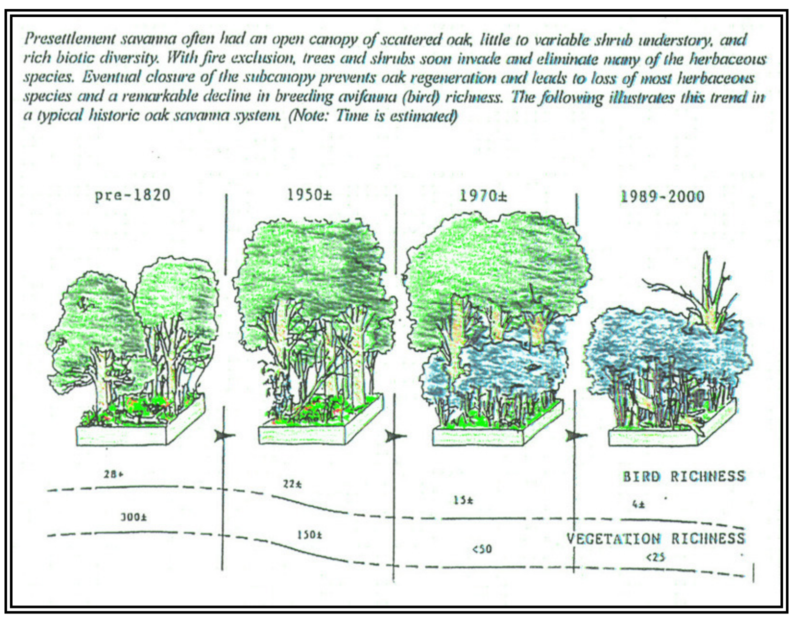


Figure 4. Change in savanna over time.

The earliest aerial photographs of this area were taken in 1939 (Figure 6) and depict the Spring Creek watershed when early farming was the primary land use but before residential and commercial development seen today. The 1939 aerial provides a snapshot of conditions that more closely resemble the pre-European settlement prairie and savanna landscape. As seen in the photo much of the "Timber" described in the northern half of the watershed during the original land survey was logged to create farmland. However, small remnants remained along ridge lines adjacent to the Spring Creek and several of its tributaries. Upon close examination, the open character of the remaining savanna is still recognizable in 1939. The southern half of the watershed where prairie once existed appears to be comprised almost entirely of farmland.

Degraded overgrown savanna/second growth woodland

Figure 7 shows a 2010 aerial image of the Spring Creek Watershed. The most obvious changes can be seen along the perimeter of the entire watershed where residential, commercial, and retail development is common. The central and south-central portions of the watershed are now Cook County Forest Preserves and surrounding areas that were mostly farmed prior to the 1950's are now mostly large lot residential within Barrington Hills, where equestrian and other agrarian uses are practices including organic farming, native landscaping and animal husbandry. Also of interest are the now overgrown savanna areas and expanding degraded second growth woodlands throughout the watershed. The Village of Barrington Hills has compiled a historical aerial inventory of Spring Creek Valley Forest Preserve and other areas within the Village from 1939 to 2005 that clearly show the change from savanna to degraded/second growth woodland. It also shows the change from farming to residential and other land uses throughout the watershed. The images can be views at the following: http://www.youtube.com/user/vbh1957#p/a/u/2/KQuiAXVkiR8.

With degraded ecological conditions comes the opportunity to implement ecological restoration to improve the condition of the Spring Creek Watershed. Present day knowledge of how pre-European settlement ecological communities formed and evolved provides a general template for developing present day natural area restoration and management plans. One of the primary goals of this watershed plan is to identify, protect, restore, and manage natural areas. With this in mind, it is important to note that the processes that shaped the historic landscape, such as intense fire and bison grazing have largely been removed or greatly altered and the condition of most ecological communities has been degraded in some way by human activities. In most cases, pristine conditions that once existed can no longer be completely restored. Thus, we are left to manage remaining remnants and to restore and manage degraded ecosystems back to a sustainable state.

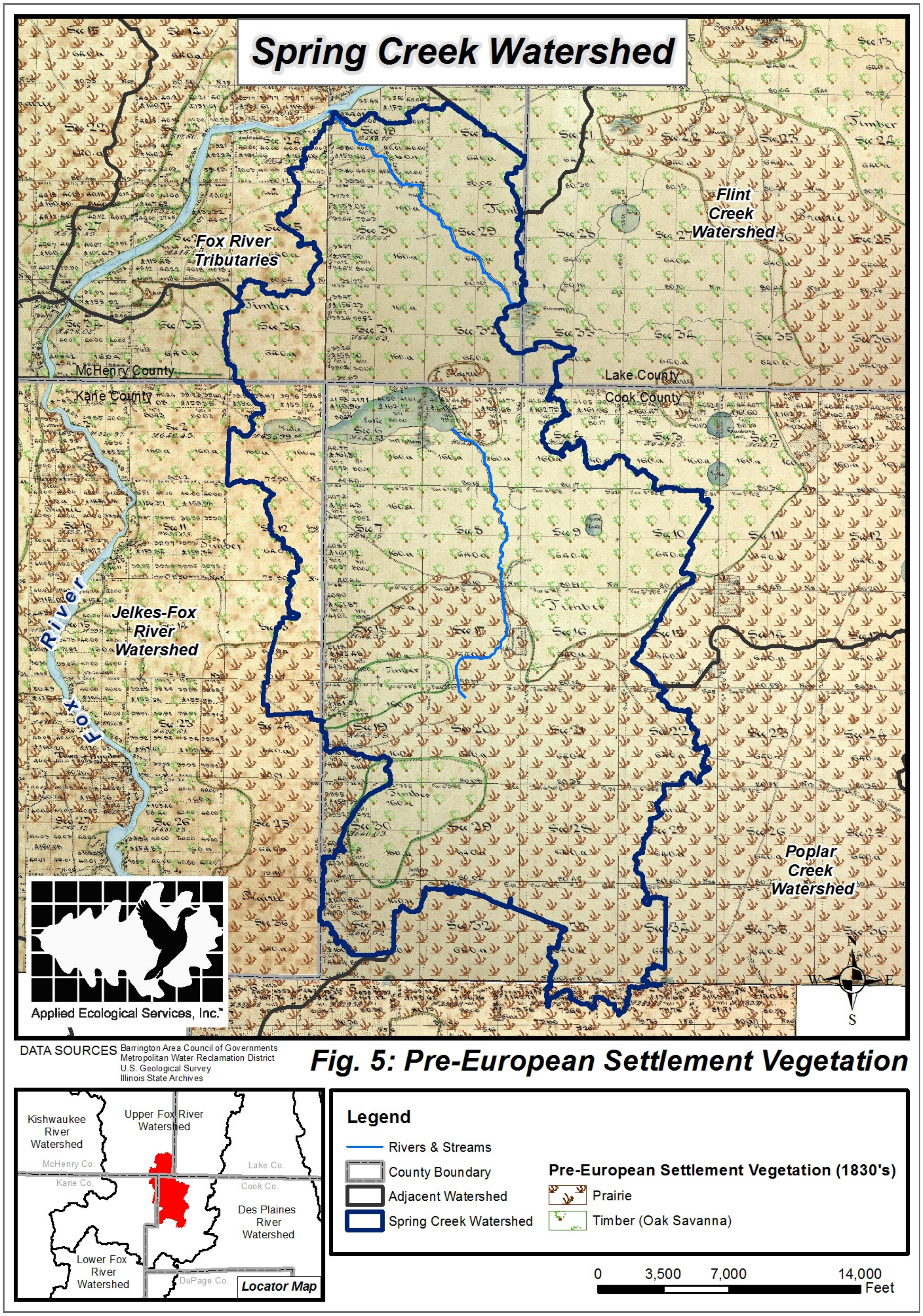


Fig. 5: Pre-European Settlement Vegetation

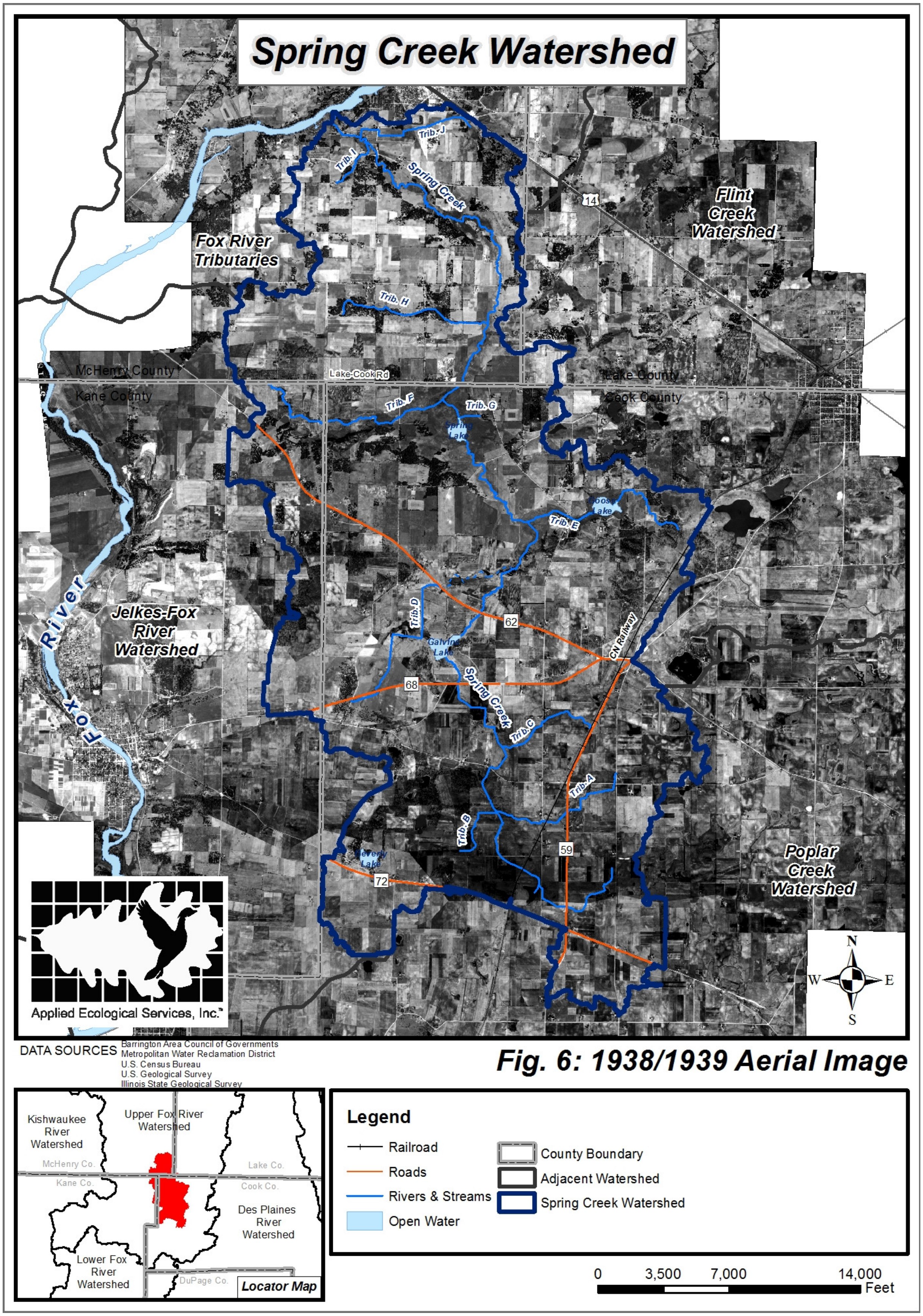


Fig. 6: 1938/1939 Aerial Image

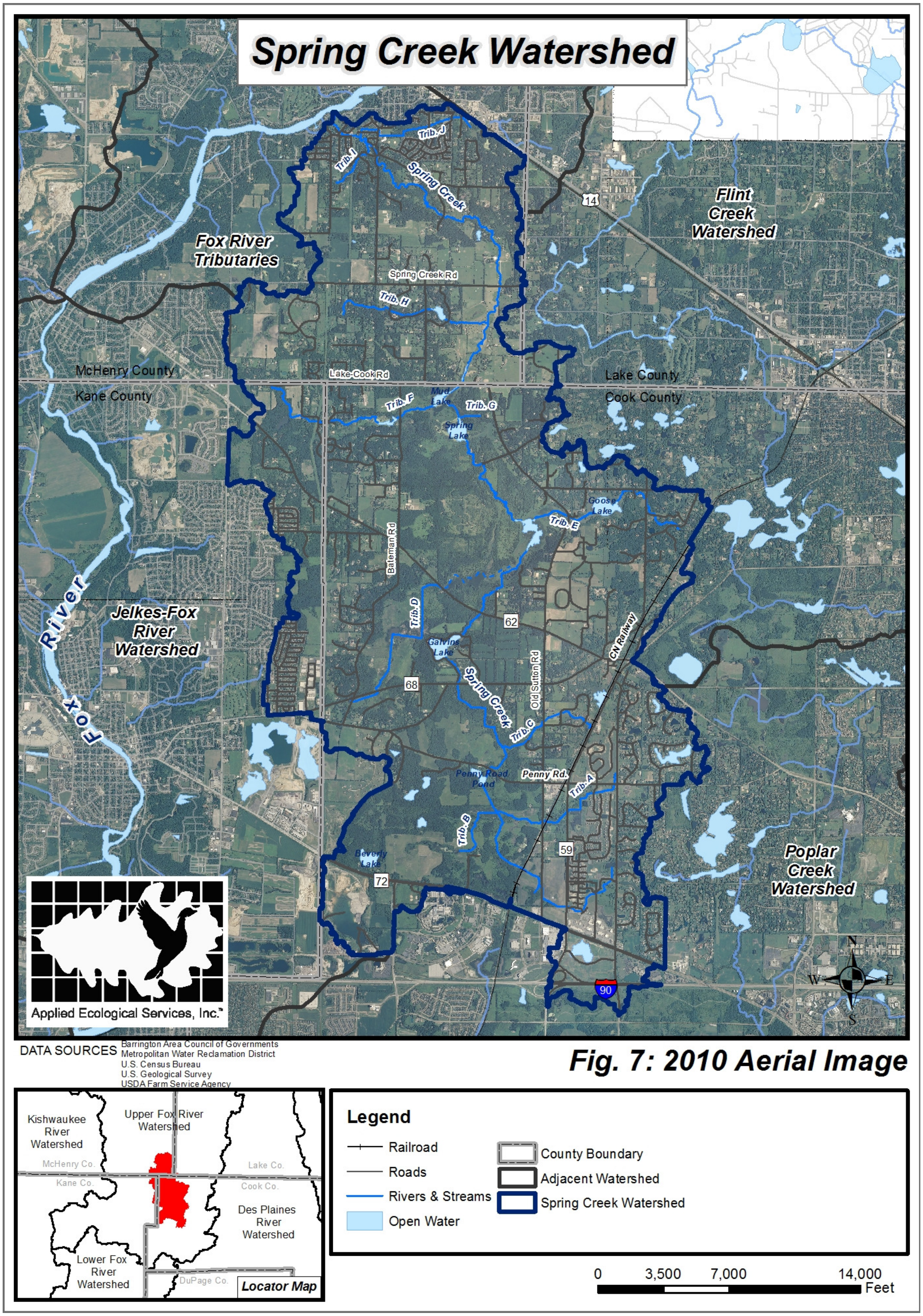


Fig. 7: 2010 Aerial Image

3.3 Topography, Watershed Boundary, & Subwatershed Management Units

Topography & Watershed Boundary

The Wisconsin glacier that retreated 14,000 years ago formed the topography and generally defined the Spring Creek watershed boundary. Topography refers to elevations of a landscape that describe the configuration of its surface and ultimately defines watershed boundaries. And, the specifics of watershed planning can not begin until a watershed boundary is clearly defined.

The Spring Creek watershed boundary was spliced together using a variety of the most up-to-date and accurate data and methods available. First, Metropolitan Water Reclamation District of Greater Chicago's (MWRD) data for the Cook County portion of the Spring Creek watershed boundary that was created as a result of the "Detailed Watershed Plan for Poplar Creek Watershed" (MWRD 2010) was used. The Kane County portion of the watershed was obtained from Gewalt Hamilton & Associates, Inc. who used various USGS control points as refinements. The remainder of the watershed boundary in McHenry and Lake Counties was derived from available 2-foot topography data. Finally, the Village of Carpentersville provided stormsewer information that slightly altered the watershed boundary within a development on the west side of the watershed. The refined watershed boundary was then input into a GIS model (Arc Hydro) that generated a Digital Elevation Model (DEM) of the watershed (Figure 8).

The Spring Creek watershed drains from south to north and eventually to the Fox River within the municipality of Fox River Grove. The highest point in the watershed (948 feet above sea level) is not in the southern tip of the watershed as one might expect but rather along the top of a ridge on the west side of the watershed. As expected, the lowest point (731 feet above sea level) is where Spring Creek enters the Fox River. The difference in the highest and lowest points reflects a 217 foot change in elevation. As seen on the DEM (Figure 8) the southern third of the watershed is relatively flat while the northern two-thirds contains a variety of ridge lines along the clearly defined Spring Creek valley.

Spring Creek Valley near Old Sutton/Donlea Roads

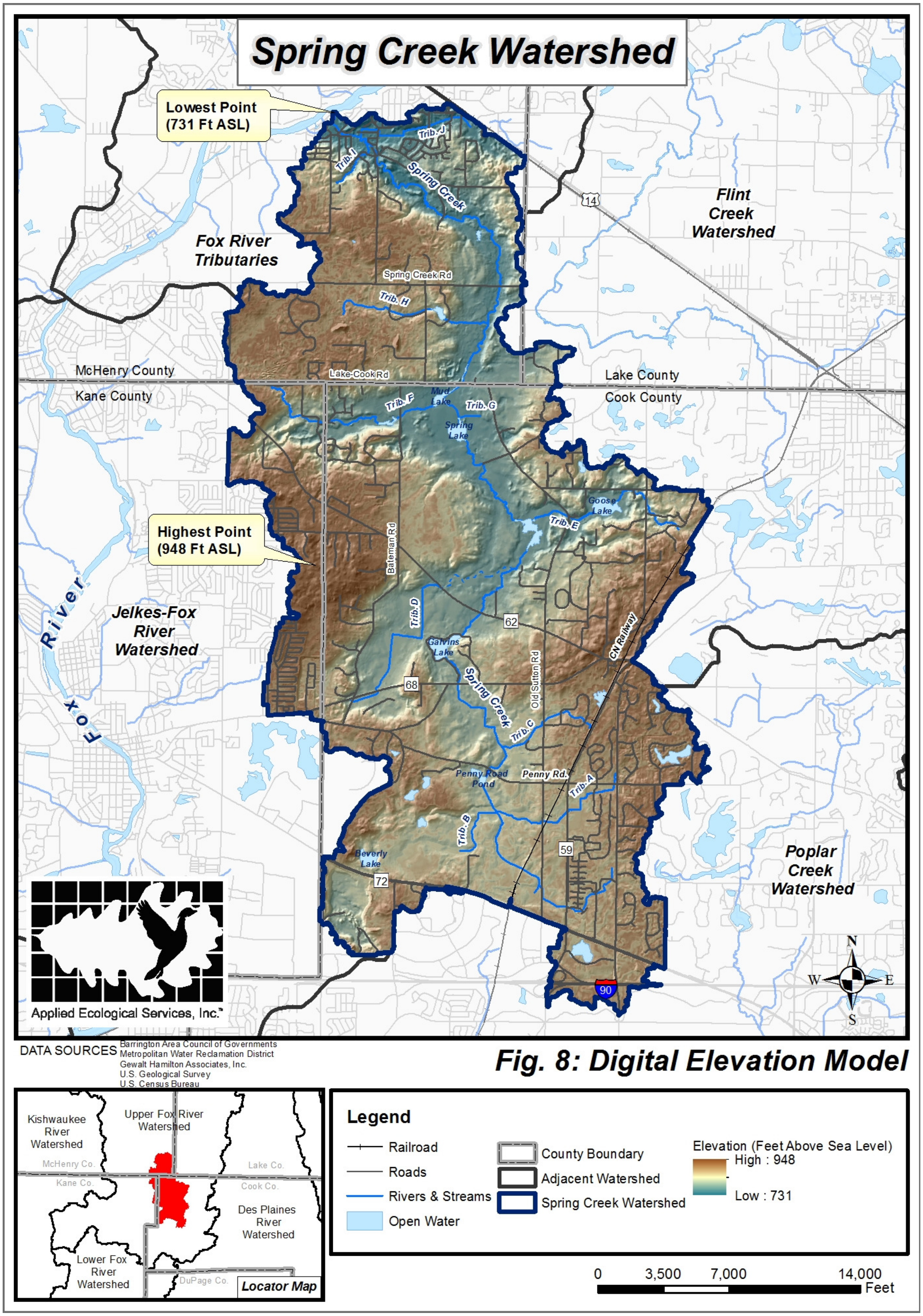


Fig. 8: Digital Elevation Model

Subwatershed Management Units (SMUs)

The Center for Watershed Protection (CWP) is a leading watershed planning agency and has defined appropriate watershed and subwatershed sizes to meet watershed management goals. In 1998, the CWP released the "Rapid Watershed Planning Handbook" (CWP 1998) as a guide to be used by watershed planners when addressing issues within urbanizing watersheds. The CWP defines a watershed as an area of land that drains anywhere from 10 to 100 square miles. The Spring Creek watershed drains 26.9 square miles. Broad assessments of conditions such as soils, wetlands, and water quality are often evaluated at the watershed level and provide some information about the overall condition. However, a more detailed look at smaller drainage areas must be completed to find specific problem areas or "Critical Areas".

To address issues at a smaller scale, a watershed can be divided into smaller subwatersheds called Subwatershed Management Units (SMUs). The Spring Creek watershed contains 17 SMUs as delineated using the Digital Elevation Model (DEM). This size allows for detailed analysis and better recommendations for site specific Best Management Practices (BMPs). Table 2 presents each SMU and acreage within the watershed. Figure 9 depicts the location of each SMU boundary delineated within the larger Spring Creek watershed.

Table 2. Subwatershed Management Units and acreage.

SMU #	Total Acres	Total Square Miles
SMU 1	1,357	2.1
SMU 2	1,189	1.8
SMU 3	1,113.8	1.7
SMU 4	305.9	0.5
SMU 5	746.3	1.2
SMU 6	1,436.8	2.2
SMU 7	2,093.2	3.3
SMU 8	951.9	1.5
SMU 9	941.3	1.5
SMU 10	1,301.1	2.0
SMU 11	2,203.2	3.4
SMU 12	608.7	0.9
SMU 13	874.9	1.4
SMU 14	1,184.2	1.8
SMU 15	260.7	0.4
SMU 16	416.4	0.6
SMU 17	254	0.4
Totals	**17,239**	**26.9**

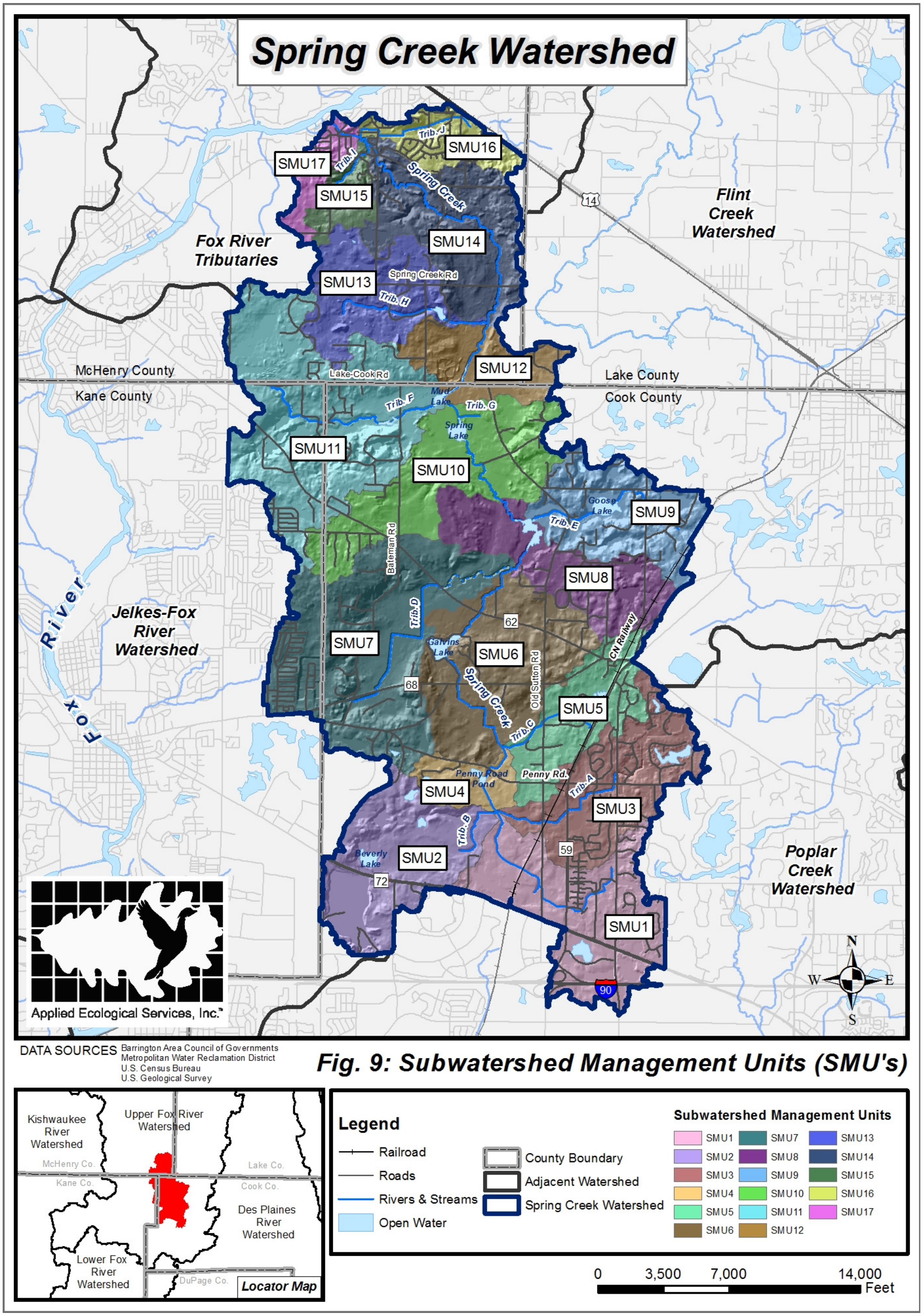


Fig. 9: Subwatershed Management Units (SMU's)

3.4 Hydric Soils, Soil Erodibility, & Hydrologic Soil Groups

Deposits left by the Wisconsin glaciation 14,000 years ago are the raw materials of present soil types. These raw materials 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 with wetland, savanna, forest, and prairie vegetation. The most up to date Natural Resources Conservation Services' (NRCS) soils information for McHenry, Lake, Kane, and Cook Counties was used to map the soil types including the extent of hydric soils, soil susceptibility to erosion, and infiltration capacity of soils in the Spring Creek watershed.

Soil properties are a key component to consider when designing and implementing Best Management Practices (BMPs). 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. This is the case with many of the wetlands that once existed within Spring Creek Valley Forest Preserve. By breaking these tiles, wetland hydrology can generally be restored and a wetland created. A wetland inventory and discussion of wetland restoration sites is included in Section 3.12.

Soils also exhibit differences in erodibility depending on their composition and slope. Erodibility of soils is especially important on construction sites where improper installation or maintenance of erosion control devices can lead to sediment creating turbid water within the stream.

Soils also exhibit different infiltration capabilities and have been classified to fit what are known as "Hydrologic Soil Groups". Knowing how a soil will hold water ultimately affects the type and location of infiltration BMPs such as wetland restorations and detention basins. More importantly however is the link between hydrologic soil groups and groundwater recharge areas. Groundwater Recharge is discussed in detail in Section 3.13.

Hydric Soils

Hydric soils are important because they indicate the presence of existing wetlands or drained wetlands where restoration may be possible. Wetland restoration opportunities in the watershed are discussed in detail in Section 3.12. Historically, wetland soils formed over poorly drained clay material associated with wet prairies, marshes, and other wetlands and accumulated organic matter from decomposing surface vegetation. Table 3 and Figure 10 list acreages and map the location of hydric and non-hydric soils in the watershed respectively. Hydric soils comprise 4,007 acres or 23% of the watershed. 12,648 acres or 73% of the watershed is comprised of upland soils. The remaining 584 acres (4%) of the watershed is not classified (water & urban land (Beverly gravel quarry)).

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

Soil	Total Area (acres)	Percentage of Watershed
Hydric Soil	4,007	23%
Non-Hydric Soil	12,648	73%
Not Classified (Water & Urban Land)	584	4%
Totals	**17,239**	**100%**

Soil Erodibility

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 change the course and floodplain of the stream and 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. It is important to map highly erodible soils because they represent areas that have the highest potential to degrade water quality during farm tillage and development. Based on the mapping, 5,010 acres (29%) of the watershed exhibits highly erodible soils (Figure 11). Fortunately, most of these soils are located along ridges in the northern two-thirds of the watershed in areas that are currently within forest preserve land or large lot residential where little large scale earth moving is expected. It is also important to note that several of the currently farmed areas and equestrian sites contain highly erodible soils that are susceptible to erosion in early spring and late fall. Therefore, soil erosion and sediment control practices should be emphasized on remaining agricultural lands and equestrian areas. One option for farmers is to convert highly erodible areas to vegetative cover under the USDA NRCS's Conservation Reserve Program (CRP). Under this program farmers receive an annual rental payment for the term of the multi-year contract.

It is also important to address highly erodible soils in relation to trails within preserves, overgrazed woodlands, and areas covered by invasive buckthorn and/or honeysuckle.

Noteworthy- NPDES and County Ordinances

National Pollution Discharge Elimination System (NPDES) Phase II Stormwater Regulations were implemented by the Illinois EPA 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 require that a Designated Erosion Control Inspector 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 control practices.

All of the counties comprising the watershed (Lake, McHenry, Kane, & Cook) have taken additional steps to control erosion on construction sites. All counties have adopted stormwater management ordinances that address erosion and sedimentation as part of the overall stormwater management plan for a site.

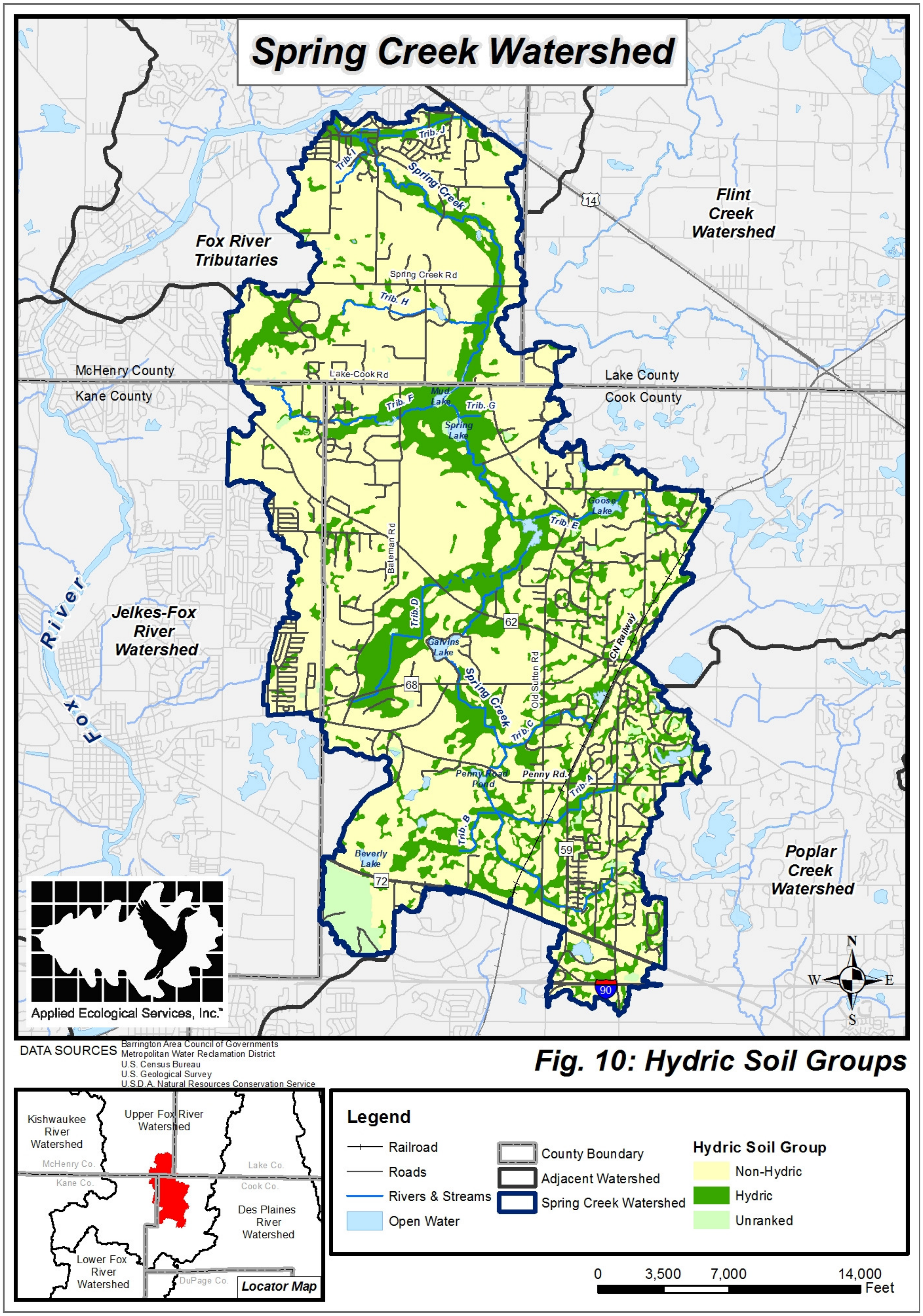


Fig. 10: Hydric Soil Groups

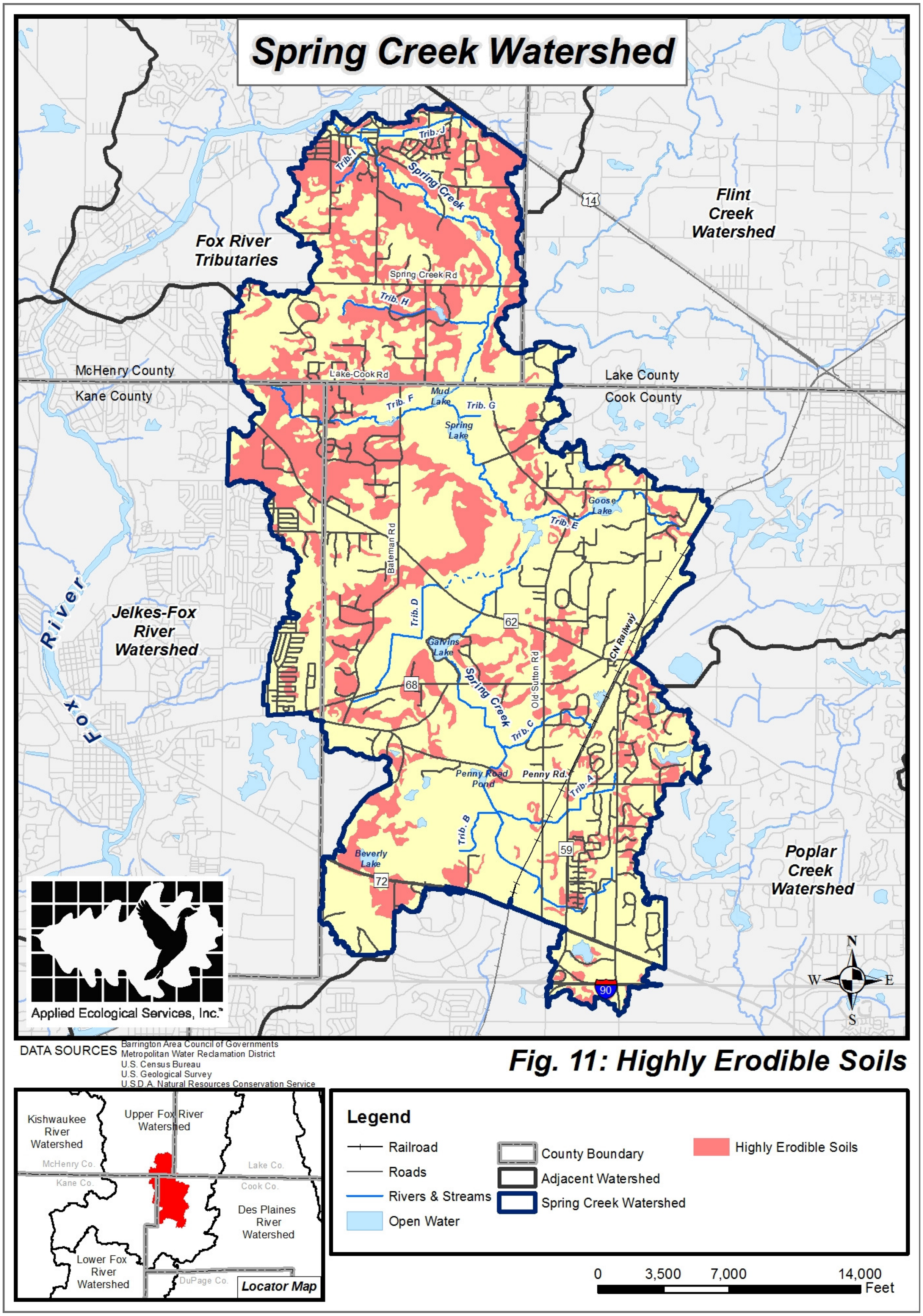


Fig. 11: Highly Erodible Soils

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. The characteristics of these groups are included in Table 4. Note: 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.

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 Excessively 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

Management Measures 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 12 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 (Groups C, C/D and D) account for about 37% of the watershed. These are found almost exclusively on the southeast half of the watershed. Excessively and moderately drained (Group A, A/D, B, and B/D) areas make up an additional 59% of the watershed. The majority of these soils are found in the northwest half of the watershed. Urban areas (gravel quarry) and open water comprise the remaining 4% of the watershed.

Table 5. Hydrologic Soil Groups including acreage and percent of watershed.

Hydrologic Soil Group	Total Acreage	Percent of Watershed
A	1.8	0.01%
A/D	780	4.5%
B	8,006	46.4%
B/D	1,461	8.5%
C	4,819	28%
C/D	1,549	9.0%
D	38	0.01%
Open Water & Urban Land	584	4%
Totals	**17,239**	**100%**

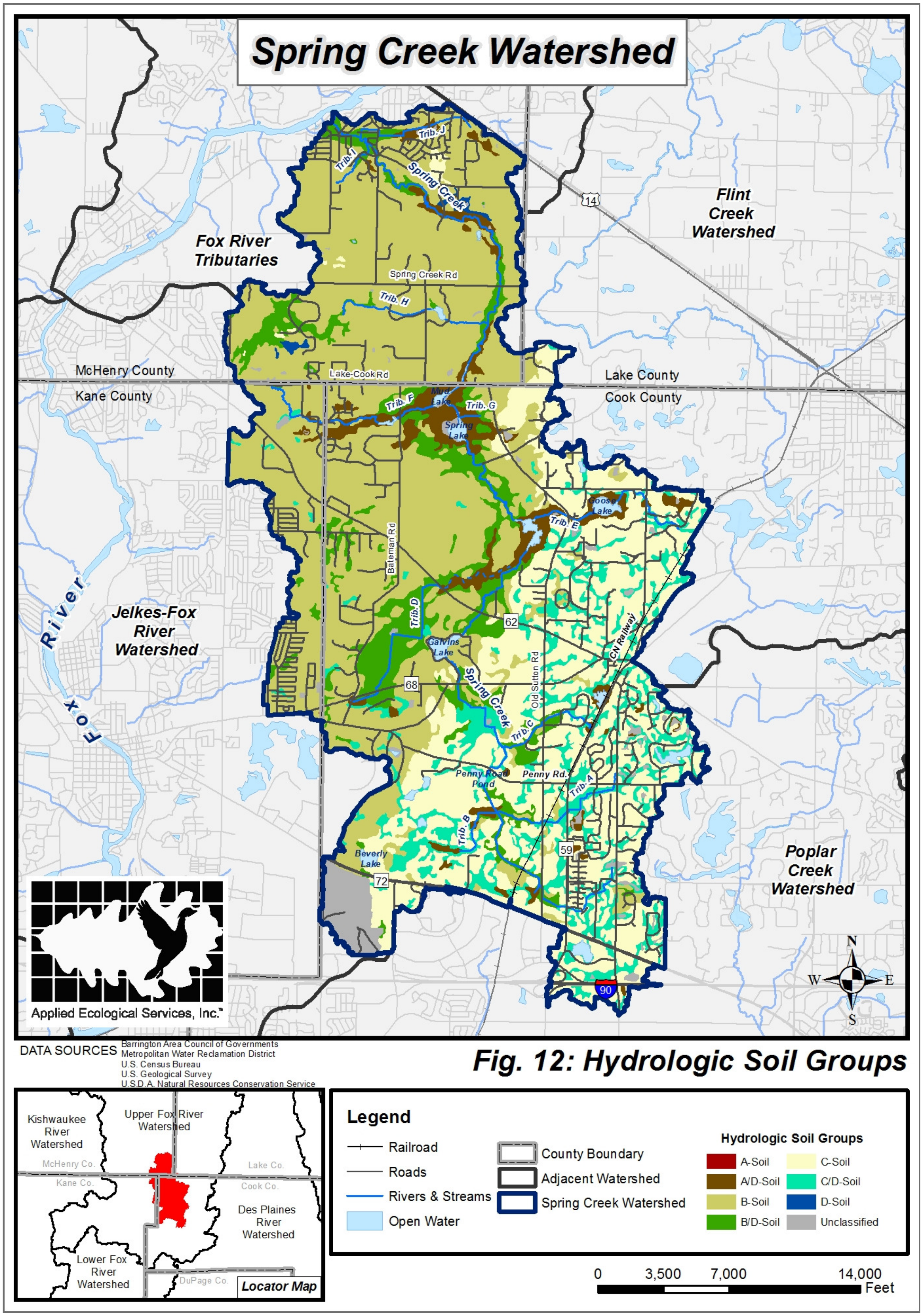


Fig. 12: Hydrologic Soil Groups

3.5 Watershed Jurisdictions, Roles & Responsibilities

The Spring Creek watershed contains portions of 4 counties, 5 townships, 7 municipalities, and 2 unincorporated areas (Table 6, Figure 13). The majority of the watershed is located in Cook County (11,776 acres/68%) and McHenry County (4,106 acres/24%). Kane County (1,255 acres/7%) and Lake County (102 acres/1%) occupy the remaining area. 90% of the watershed falls within a municipality. The municipality of Barrington Hills occupies most of the watershed (12,588 acres/73%) followed by South Barrington (1,568 acres/9%). Municipalities of Algonquin, Carpentersville, East Dundee, Fox River Grove, and Hoffman Estates combine to occupy 1,405 acres/9% of the watershed. The remaining 10% falls within unincorporated areas in Barrington Township (1,036 acres/6%) and Algonquin Township (641 acres/4%). Cook and Kane County Forest Preserve Districts also have significant holdings that overlap with Barrington Hills.

Table 6. County, township, municipal, and unincorporated jurisdictions.

Jurisdiction	Acres	% of Watershed
County	**17,239**	**100%**
Cook	11,776	68%
Kane	1,255	7%
Lake	102	1%
McHenry	4,106	24%
Township	**17,239**	**100%**
Algonquin Township	4,104	24%
Barrington Township	11,654	67%
Cuba Township	100	1%
Dundee Township	1,267	7%
Hanover Township	114	1%
Municipalities	**15,561**	**90%**
Algonquin	12	0%
Barrington Hills	12,588	73%
Carpentersville	265	2%
East Dundee	107	1%
Fox River Grove	305	2%
Hoffman Estates	716	4%
South Barrington	1,568	9%
Unincorporated Areas	**1,677**	**10%**
Unincorporated Algonquin Twp.	641	4%
Unincorporated Barrington Twp.	1,036	6%
Forest Preserve Districts	4,233	**25%**
Cook County	4,000	23%
Kane County	233	1%

Source: Illinois State Geological Survey

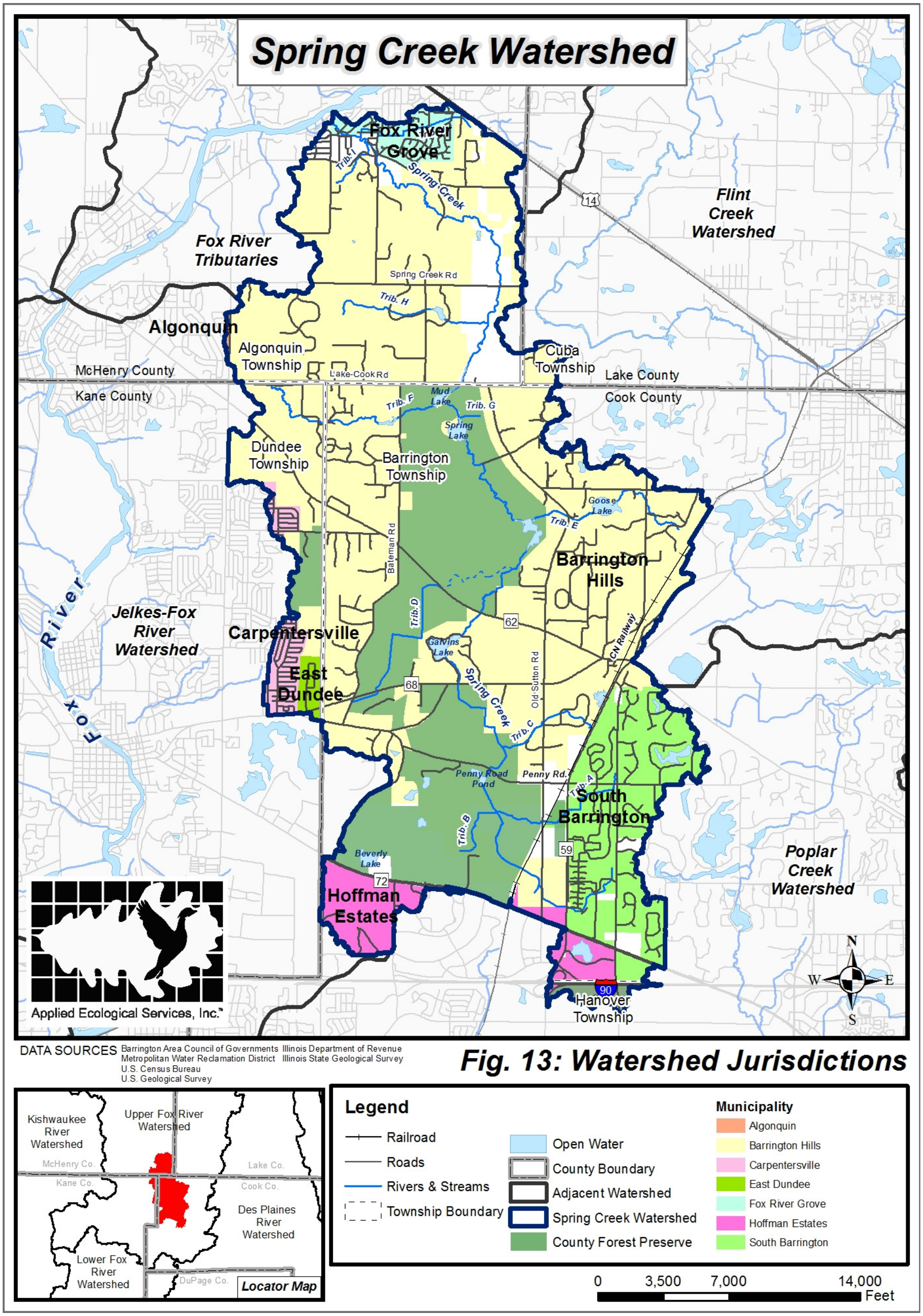


Fig. 13: Watershed Jurisdictions

Jurisdictional Roles and Responsibilities

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 local 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 codes that address other natural resource issues. Watershed protection in McHenry, Lake, Kane, and Cook Counties is primarily the responsibility of county and city level government.

Land development affecting water resources (rivers, streams, lakes, isolated 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 wetlands.

Land development in each county is regulated by stormwater ordinances including the McHenry County Stormwater Management Ordinance (amended March 15, 2011), Lake County Watershed Development Ordinance (amended October 10, 2006), Kane County Stormwater Ordinance (amended January 1, 2005), and Cook County Stormwater Management Ordinance (effective February 15, 2007). Most of these ordinances are enforced by either county agencies or by "Certified Communities". Barrington Hills is currently in the process of becoming a certified community to administer the Lake County Watershed Development Ordinance. The Village of Algonquin, East Dundee, and Carpentersville are certified in Kane County to administer the Kane County Stormwater Ordinance. Hoffman Estates and South Barrington will be required to follow the Cook County Stormwater Management Ordinance but are not considered certified communities. Fox River Grove is the only community that does not apply a county ordinance.

Water resources on unincorporated land within McHenry, Lake, Kane, and Cook Counties are ultimately regulated by the McHenry County Department of Planning and Development, Lake County Planning, Building and Development Office, Water Resources Division of the Kane County Development & Resource Management Department, or Cook County Department of Building and Zoning respectively. Unincorporated areas include 641 acres in Algonquin Township and 1,036 acres in Barrington Township. Development affecting water resources in these townships must be reviewed by the respective agencies listed above. It is important to note that McHenry County passed the "Conservation Design Standards and Procedures" in February 2008. This could affect future development of unincorporated areas in Algonquin Township.

Other governments and private entities with watershed jurisdictional or technical advisory roles include the USFWS, IDNR, and INPC, Kane and Cook County Forest Preserve Districts (FPDs), County Board Districts, and the McHenry, Lake, Kane, and Cook Soil and Water Conservation Districts (SWCDs). The USFWS, IDNR, INPC, and FPDs 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 resource 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.

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. Municipal codes present opportunities for outlining and requiring recommendations in this plan such as conservation and/or low density development, Special Service Area (SSA) or watershed protection fees, and use of native trees and plants in landscapes.

Planning, Policy and Regulation

Planning, policy, and regulation are the foundation of watershed protection, because the process sets the minimum standards for development that occurs or is proposed to occur in the vicinity of water resources. It is hoped that recommendations from this watershed plan would be referenced in future comprehensive plans and implemented in ordinances. In many cases, Village Codes also lay the foundation for the types of trees that can be removed from sites as well as what types of plant communities and species that can be replanted. Stormwater Ordinances are the primary preventative measure that McHenry, Lake, Kane, and Cook Counties currently use to standardize for the respective county the requirements that proposed developments must meet. Regulation or implemented Village Code and Stormwater Ordinances fall in the hands of local municipalities or County agencies. It is up to these enforcing bodies to communicate effectively and discuss often the problems with how ordinance language is interpreted and amendments that may help clarify certain regulations.

Planning/zoning guidance provides another level of watershed and natural resource protection. Most planning and zoning guidance is in the form of local floodplain or zoning ordinances that regulate onsite land use practices to ensure adequate floodplain, wetland, stream, lake, pond, soil, and other natural resource protection. Zoning ordinances and overlay districts in particular define what type of development is allowed and where it can be located relative to natural resources. Other examples of planning/zoning forms of resource protection include riparian and wetland buffers, impervious area reduction, open space/greenway dedication, conservation easements and conservation and/or low density development.

To improve the impact of planning/zoning guidance on water resource protection, there needs to be improved coordination and communication between county and local government. Watershed development regulations should be made very clear to local enforcement officers; local planners and zoning boards should consider revisions to local ordinances that address watershed, subwatershed, and/or site-specific natural resource issues. For example, communities with less impervious development now should revise their zoning ordinances sooner rather than later in order to adequately prevent the types of development that contribute to flooding, degrade wildlife habitat, and reduce water quality. Several recommended regulatory changes are included in Programmatic Measures Action Plan (Section 5.0)

3.6 Watershed Demographics

The Chicago Metropolitan Agency for Planning (CMAP) provides a 2040 regional framework plan for the greater Chicagoland area to plan more effectively with growth forecasts. CMAP's 2010 to 2040 forecasts of population, households, and employment was used to project how these attributes will impact the Spring Creek watershed. CMAP develops these forecasts by first generating region wide estimates for population, households, and employment then meets with local governments to determine future land development patterns within each jurisdiction.

Table 7 includes CMAP's population, households, and employment forecast changes between 2010 and 2040 for the Spring Creek watershed area. The data is generated by Township, Range, and quarter Section and is depicted on Figures 14-16. Note: AES used GIS to overlay the Spring Creek watershed boundary onto CMAP's quarter Section data. If any part of a quarter Section fell inside the watershed boundary, the statistics for the entire quarter Section were included in the analysis.

The combined population of the watershed is expected to increase from 27,786 in 2010 to 37,254 by 2040, a 34% increase. The highest population increase is expected in the southwest corner of the watershed within Hoffman Estates and also in the far west portion of the watershed along outlying Carpentersville/East Dundee and southwest of Route 62 in Barrington Hills. Some growth is also forecasted in Fox River Grove in the far northern portion of the watershed.

The southwest corner of the watershed in Hoffman Estates currently contains a quarry owned and operated by Beverly Materials LLC that will be remediated into residential and retail development according to Hoffman Estates future land use plans (Village of Hoffman Estates 2007). The western area of the watershed, southwest of Route 62 in Barrington Hills, is currently open space but is expected to become residential according comprehensive plans for Barrington Hills (Barrington Hills 2008). Population growth in Fox River Grove is expected to include additional residential homes in future years. Very little change in population is expected throughout much of Barrington Hills and South Barrington. Only areas that are currently agricultural within Barrington Hills may become residential in the future. In addition, projected household change generally follows change in population. The combined number of households in the watershed is expected to increase from 8,404 in 2010 to 11,421 by 2040, a 40% increase.

Employment change is expected to increase from 5,693 jobs in 2010 to14,616 by 2040, a 157% increase. Nearly all employment change is predicted in the southern portion of the watershed along Route 72. Sutton Crossing is a retail/commercial development currently being constructed between Route 72 and Interstate 90. The area showing increased employment growth north of Route 72 is currently agricultural but located in a prime retail/commercial area. The remaining employment growth is expected when Beverly Quarry is converted to a mixed residential/retail development.

Table 7. CMAP 2010 data and 2040 forecast data.

Data Category	2010	2040	Change (2010-2040)
Population	27,786	37,254	9,467
Household	8,404	11,421	3,017
Employment	5,693	14,616	8,923

Source: Chicago Metropolitan Agency for Planning 2040 Forecasts

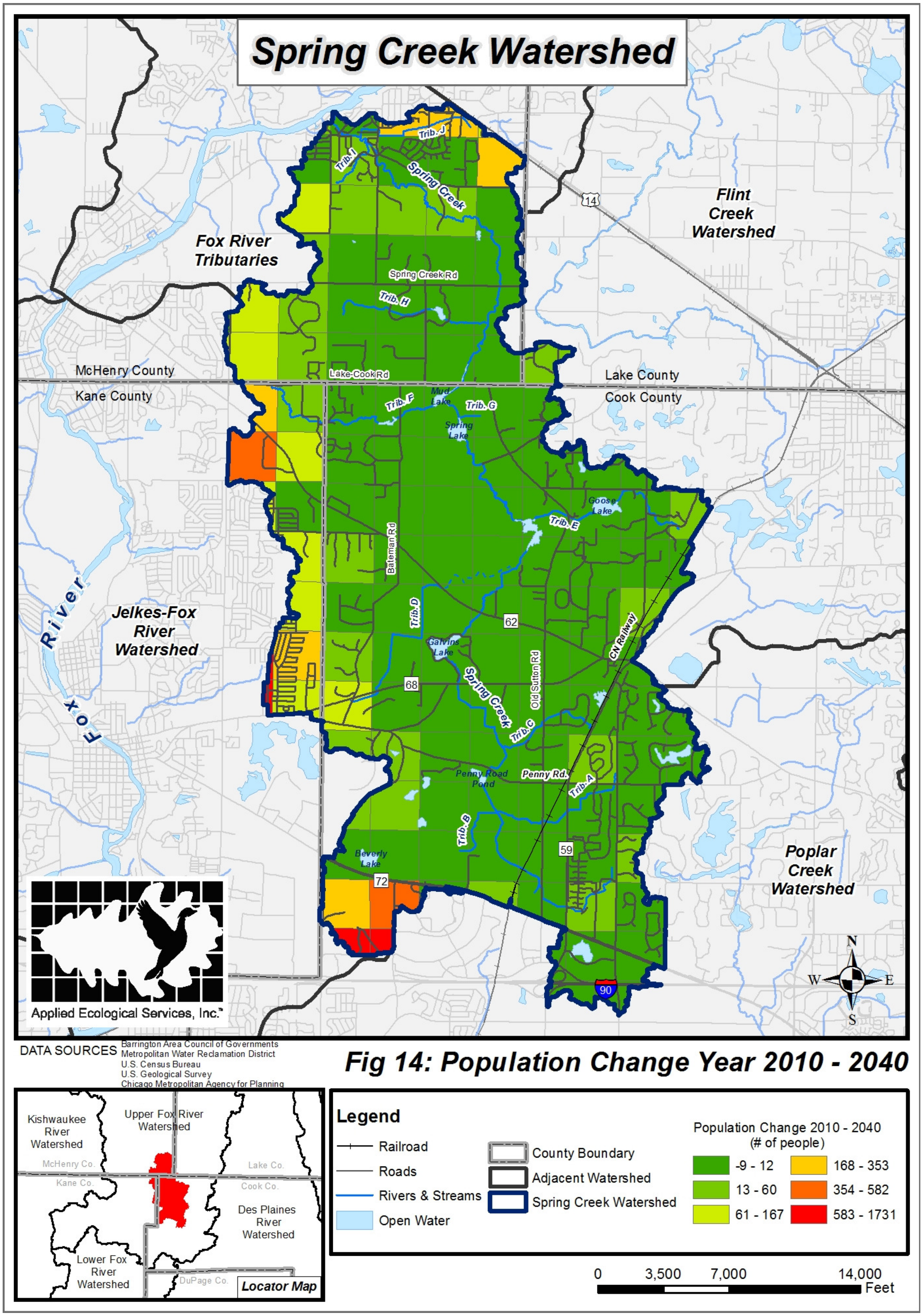
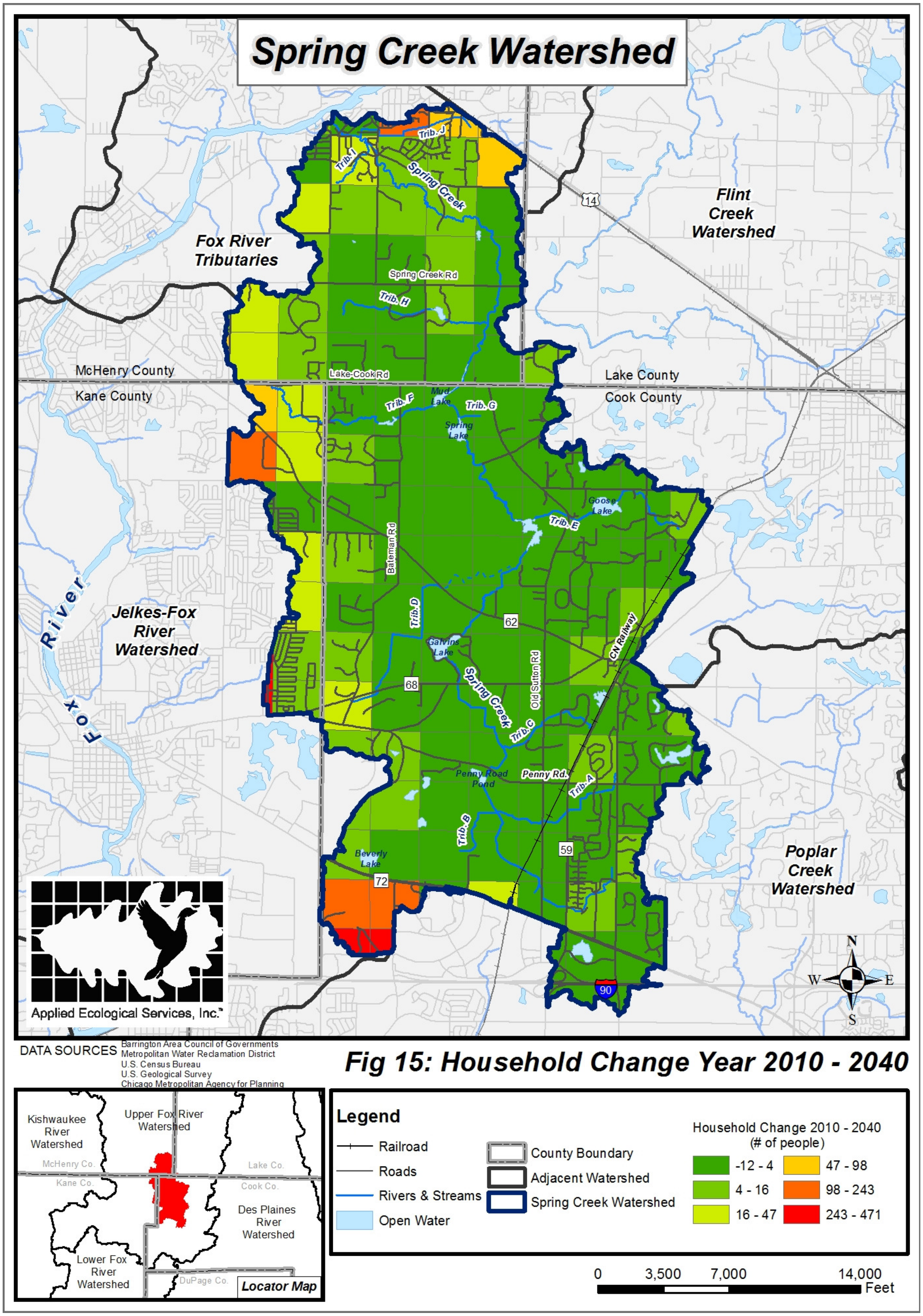


Fig 14: Population Change Year 2010 - 2040


Spring Creek Watershed
Fox River Tributaries
Flint Creek Watershed
Jelkes-Fox River Watershed
Poplar Creek Watershed
Fox River
McHenry County
Kane County
Lake County
Cook County
Spring Creek Rd
Lake-Cook Rd
Bateman Rd
Old Sutton Rd
Penny Rd.
Penny Road Pond
CN Railway
Spring Creek
Trib. A
Trib. B
Trib. C
Trib. D
Trib. E
Trib. F
Trib. G
Trib. H
Trib. I
Trib. J
Mud Lake
Spring Lake
Goose Lake
Galvins Lake
Beverly Lake
14
62
68
59
72
90
N
S
E
W
Applied Ecological Services, Inc.
DATA SOURCES
Barrington Area Council of Governments
Metropolitan Water Reclamation District
U.S. Census Bureau
U.S. Geological Survey
Chicago Metropolitan Agency for Planning
Fig 15: Household Change Year 2010 - 2040
Kishwaukee River Watershed
Upper Fox River Watershed
McHenry Co.
Lake Co.
Kane Co.
Cook Co.
Des Plaines River Watershed
Lower Fox River Watershed
DuPage Co.
Locator Map
Legend
Railroad
Roads
Rivers & Streams
Open Water
County Boundary
Adjacent Watershed
Spring Creek Watershed
Household Change 2010 - 2040
(# of people)
-12 - 4
4 - 16
16 - 47
47 - 98
98 - 243
243 - 471
0
3,500
7,000
14,000
Feet

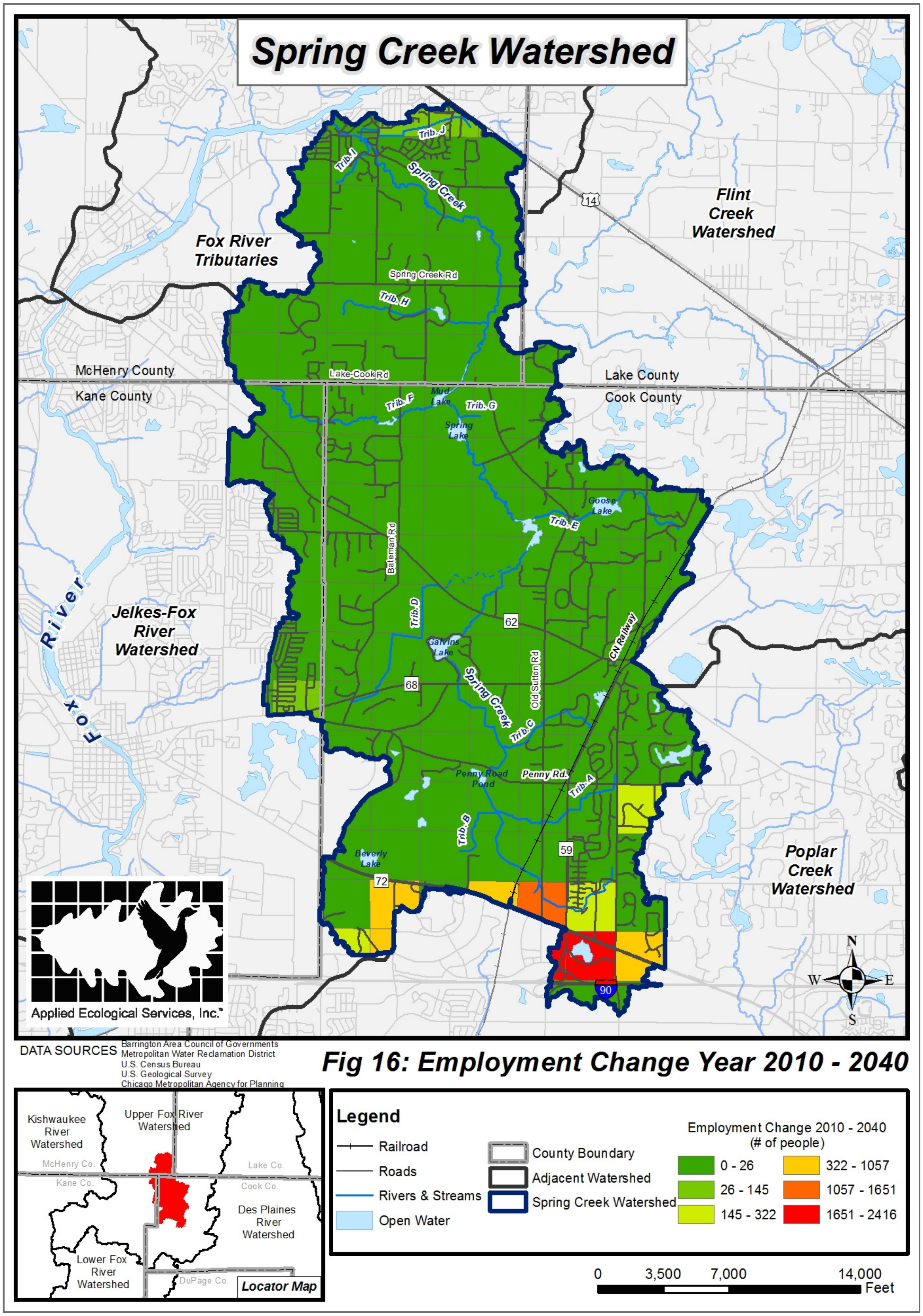


Fig 16: Employment Change Year 2010 - 2040

3.7 Existing & Future Land Use/Land Cover

Existing (2011) Land Use/Land Cover

Spring Creek watershed land use/land cover data was derived through several processes. First, 2005 Chicago Metropolitan Agency for Planning (CMAP 2005) land use/land cover data was obtained and mapped in GIS. Next, 2010 USDA aerial photography of the watershed was overlaid on CMAP data so that discrepancies could be corrected. In addition, watershed stakeholders were allowed to recommend changes at the July 21, 2011 stakeholder meeting. Finally, uncertainties in land uses and cover types were field verified and corrected if needed to produce the 2011 land use/land cover data and map for the Spring Creek watershed (Table 8; Figure 17).

CMAP Land Use/Land Cover Definitions:

Agricultural: Land use that includes out-buildings and barns, row & field crops and fallow field farms and pasture, includes dairy and other livestock agricultural processing. Also includes nurseries, greenhouses, orchards, tree farms, and sod farms.

Cemetery: Land use that includes associated chapels and mausoleums.

Construction-Residential: Scraped earth/construction activity indicating construction of residential property.

Construction-Retail/Office: Scraped earth/construction activity indicating construction of retail/office property.

Equestrian Facilities: Land use that includes boarding, training and breeding facilities, with associated pastures and buildings.

Forest and Grassland: Land cover that includes all private and some public property that has not been developed for any human purpose and undeveloped and unused land areas. Also includes bands of vacant forested land or grassland along streams (riparian corridors).

Government and Institutional: Land use that includes medical facilities, educational facilities, religious facilities, and others.

Industrial: Land use that includes industrial, warehousing and wholesale trade, such as mineral extraction, manufacturing and processing, warehousing and distribution centers for wholesale, associated parking areas, truck docks, etc.

Multifamily Residential: Land use that includes multifamily residences. These include duplex and townhouse units, apartment complexes, retirement complexes, mobile home parks, trailer courts, condominiums, cooperatives, and associated parking.

Single Family Residential: Land use that includes single family homes and farmhouses and immediate residential area around them.

Office Space: Land use that includes office campuses and research parks defined as non-manufacturing and characterized by large associated manicured landscape.

Public & Private Open Space: Land cover that includes parks, arboretums, botanical gardens, golf courses, and others such as bike trails through open space, etc.

Retail/Commercial: Land use that includes shopping malls and their associated parking, single structure office/hotels, urban mix (retail trade like lumber yards, department stores, grocery stores, gas stations, restaurants, etc.) and hotels/motels.

Transportation: Land use that includes railroads, rail rapid transit and associated stations, rail yards, linear transportation such as streets and highways, and airport transportation.

Utility/Waste Facility: Land use that includes telephone, radio and television towers, dishes, gas, sewage pipeline, ComEd rows, waste water facilities, etc.

Water: Land cover that includes rivers, streams and canals, lakes, reservoirs, and lagoons.

Wetland: Land cover that includes all wetlands on public and private land. In some situations, wetlands are mapped under a different land cover category. This sometimes occurs on open space areas and vacant forest and grassland classifications.

Table 8. 2011 land use/land cover classifications and acreage.

Land Use	Area (acres)	% of Watershed
Agricultural	1,578.7	9.2%
Cemetery	9.0	0.05%
Construction-Residential	141.2	0.8%
Construction-Retail/Office	92.8	0.5%
Equestrian Facilities	961.3	5.6%
Forest and Grassland	5,353.9	31.1%
Government and Institutional	71.8	0.4%
Industrial	293.9	1.6%
Multifamily Residential	23.2	0.1%
Single Family Residential	6,723.0	39.0%
Office Space	3.3	0.02%
Public & Private Open Space	106.5	0.6%
Retail/Commercial	144.9	0.8%
Transportation	911	5.3%
Utility/Waste Facilities	147.6	0.9%
Water	331.6	1.9%
Wetlands	364.8	2.1%
Total	**17,239**	**100%**

Single family residential (which includes small areas of Carpentersville, and Fox River Grove, as well as 73% of the watershed of Barrington Hills with 5-acre minimum lot sizes) comprises the most acreage in the watershed (6,723 acres; 39%) followed by forest & grassland (5,353.9 acres; 31.1%) then agricultural (1,578.7 acres; 9.2%). Most of the residential area is located within 5+ acre parcels within the Village of Barrington Hills. The majority of forest and grassland is included in Kane and Cook County Forest Preserves. Agriculture is scattered throughout the watershed with large parcels remaining in the northwest, central, and southeast.

Other common land uses/cover types include equestrian (961.3 acres; 5.6%), transportation (911 acres; 5.3%), wetlands (364.8 acres; 3.1%), water (331.6 acres; 1.9%), and industrial (293.9 acres; 1.6%). Note: the wetland land cover class only includes areas not included in other land use/cover classes and therefore does not accurately compare to the McHenry and Kane County Wetland Inventory and National Wetland Inventory acreage described in Section 3.12.

Total open and partially open space comprised of agricultural lands, equestrian, utility corridors, water resources, forest/grassland, and public/private open space is approximately 8,844.4 acres or 51% of the watershed. Total developed land including residential, commercial, industrial, government/ institutional, office space, cemetery, and transportation accounts for approximately 8,394.6 acres or 49% of the watershed. It is important to note that the Forest Preserve District of Cook County has identified corporate areas including the Sears Center, Prairie Stone, and IDOT holding along Route 72 as “Critical” pollutant contributors to the headwater areas of Tributary B within Spring Creek Valley Forest Preserve.

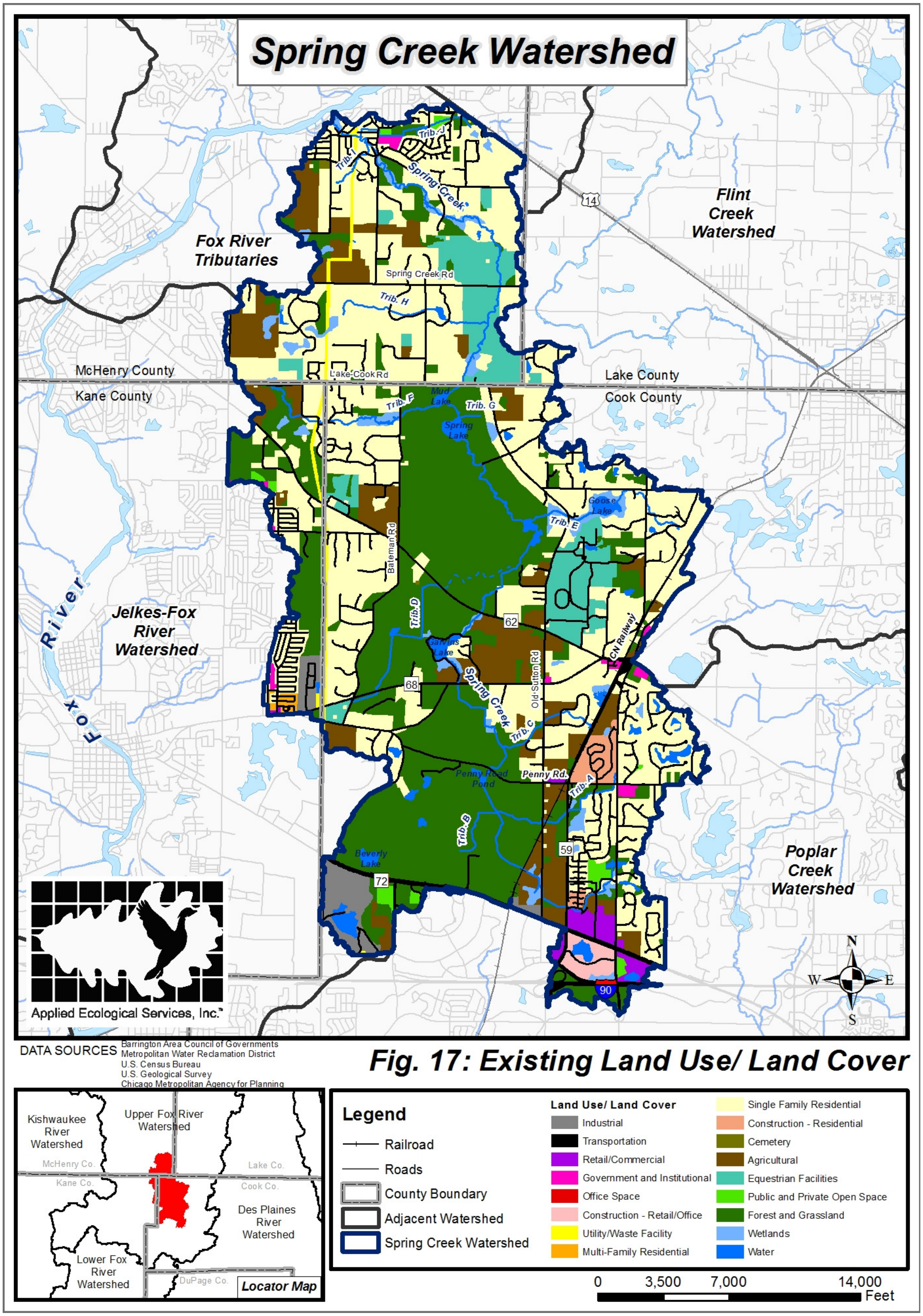


Fig. 17: Existing Land Use/ Land Cover

Future Land Use/Land Cover Predictions

Information on predicted future land use/land cover for the watershed was obtained from municipal comprehensive plans where available (Village of Barrington Hills 2008; Village of Carpentersville 2007; Village of Fox River Grove 2007; Village of Hoffman Estates 2007; and Village of Algonquin 2008. No future land use mapping was available from the Village of South Barrington and East Dundee. Available data was analyzed and GIS used to map predicted land use/land cover changes. The results are summarized in Table 9 and depicted on Figure 18.

Table 9 compares existing land use/land cover to predicted future land use/land cover. The greatest loss of a current land use/land cover classes occurs on agricultural land (-1,289.4 acres; -7.5%), forest & grassland (-960.3 acres; -5.4%), residential and retail-office sites currently under construction (-234 acres; -1.3%), industrial (-190.6 acres; -1.1%), and public & private open space (-9.4 acres; 0.2%).

Conversely, single family residential development is predicted to increase the most (+1,408.7 acres; 8.2%) and occur within areas that are currently agriculture, public & private open space, and forest & grassland. Other significant increases in land use/land cover are predicted to occur with retail-residential mixed use (+342.6 acres; +0.2%), office-retail-residential mixed use (+182.4 acres; +1.1%), office-retail mixed use (+91.8 acres; +0.5%), and retail-commercial (+85 acres; +0.5%).

Predicted land use/land cover changes occur primarily in the southern portion of the watershed within the Villages of Hoffman Estates and Barrington Hills and unincorporated Barrington Township. Much of this area along the Route 72 corridor was recently developed to retail and commercial. Additional retail-commercial-office development is currently under construction at "Sutton Crossing" located between Route 72 and Interstate 90. It is also important to note that Beverly Gravel Quarry, located south of Route 72 in the far southwest tip of the watershed, is slated to become mixed residential-retail in the future. This accounts for the 190.6 acre decrease in industrial use compared to current conditions.

Finally, the proposed Longmeadow Parkway road expansion would enter the Spring Creek watershed on its west side and connect up with Route 62. This expansion will likely impact many wetlands along its route across the Fox River and wetland mitigation will be required by the Corps of Engineers and/or Counties involved. Section 3.12 of this plan identifies potential wetland restoration/mitigation sites in the watershed. A nearly 40 acre potential wetland mitigation site (site # 1)is located just north of Lake-Cook Road in the northwest portion of the watershed and is located within the same subwatershed where Longmeadow Parkway is proposed to enter Spring Creek watershed.

Table 9. 2011 and predicted future land use/land cover, including percent change for each land use/land cover class.

Land Use/Land Cover	Current Area (acres)	Current % of Watershed	Predicted Area (acres)	Predicted % of Watershed	Change (acres)	Change (%)
Agricultural	1,578.7	9.2	289.3	1.7	-1,289.4	-7.5
Cemetery	9.0	0.05	9.0	0.05	0	0
Construction-Residential	141.2	0.8	0.0	0	-141.2	-0.8
Construction-Retail/Office	92.8	0.5	0.0	0	-92.8	-.05
Equestrian Facilities	961.3	5.6	961.3	5.6	0	0
Forest and Grassland	5,353.9	31.1	4,393.6	25.5	-960.3	-5.4
Government and Institutional	71.8	0.4	71.8	0.4	0	0
Industrial	293.9	1.6	83.3	0.5	-190.6	-1.1
Multifamily Residential	23.2	0.1	23.2	0.1	0	0
Single Family Residential*	6,723.0	39.0	8,131.7	47.2	+1,408.7	+8.2
Office Space	3.3	0.02	3.3	0.02	0	0
Office-Retail Mixed Use	0	0	91.8	0.5	+91.8	+0.5
Office-Retail-Residential Mixed Use	0	0	182.4	1.1	+182.4	+1.1
Public & Private Open Space	106.5	0.6	77.2	0.4	-29.4	-0.2
Retail/Commercial	144.9	0.8	229.1	1.3	+85	+0.5
Retail-Residential Mixed Use	0	0	342.6	2.0	+342.6	+2.0
Transportation	911	5.3	911	5.3	0	0
Utility/Waste Facilities	147.6	0.9	147.6	0.9	0	0
Water	331.6	1.9	331.6	1.9	0	0
Wetlands	364.8	2.1	364.8	2.1	0	0

*Single-family residential includes small pocket of high density in Carpentersville and Fox River Grove and the majority of single family homes on 5-acre lot minimums in Barrington Hills (73%). Future changes in development patterns would severely impact water quality as homes in this region depend upon well and septic for water supply and disposal.

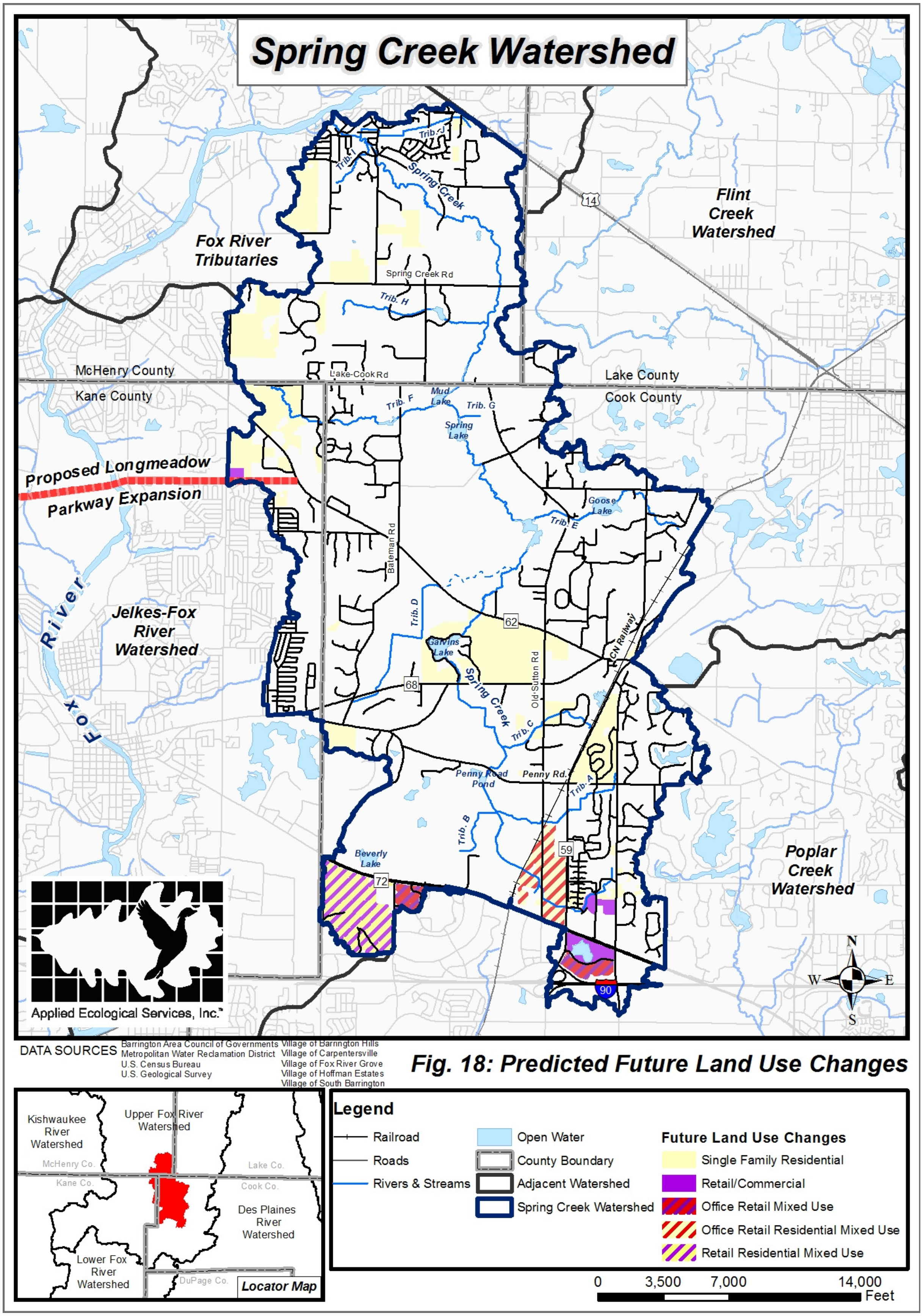


Fig. 18: Predicted Future Land Use Changes

3.8 Transportation Network

Roads

Major roads that are present in the Spring Creek watershed include State Roads 59, 62, 68, 72 and US Interstate 90 (Figure 19). Illinois Route 59 is located in the southeast portion of the watershed and runs north-south between US Interstate 90 and Illinois Route 62/68. On the eastern portion of the watershed Illinois Route 68 and 62 is the same road but splits going west. Illinois Route 68 runs east-west in the watershed, where to the east it runs between the Villages of Barrington and South Barrington and to the west it ends in East Dundee where it meets Route 72. Illinois Route 62 runs northwest from where 62 and 68 are connected heading to the Village of Algonquin. In the southern portion of the watershed, Illinois Route 72 runs east-west between the towns of East Dundee and Hoffman Estates. In the southeast corner of the watershed, US Interstate 90 runs east-west through a fairly short stretch of the watershed. US Interstate 90 provides heavy traffic throughout Chicago and its surrounding suburbs. Illinois Route 59 is the only junction along US Interstate 90 that is in the Spring Creek watershed.

Also of interest are the unique scenic roads that traverse Barrington Hills and provide an important environmental character. Barrington Hills Comprehensive Plan (Village of Barrington Hills 2008) stresses the importance of preserving the character of these roadways by considering their importance in any planning and execution of roadway and subdivision improvements and maintenance.

Scenic Braeburn Road

Railroads

The Canadian National Railway (CN) was purchased from Elgin, Joliet & Eastern Railway Company (EJ&E) in 2009 by Canadian National Railway Company. The railway runs across the southeast portion of the Spring Creek watershed (Figure 19) and skirts the perimeter of the Chicago area, running from Waukegan, Illinois to Gary, Indiana. Along the way it crosses or connects with every other railroad going into Chicago. This rail line came into existence in December 1888 and has been used primarily to transport steel products to the Chicago land area. Since its purchase in 2009, the CN has reported increased freight traffic throughout the US, allowing some railway traffic to bypass the congested rail system of the City of Chicago.

The Village of Barrington Hill's Comprehensive Plan (Village of Barrington Hills 2008) outlines real concerns about CN. These include more traffic back-ups, slow moving and potentially derailing trains, noise pollution, and higher risk from pollutants from stormwater runoff and potential contamination from derailments/spills that could enter the groundwater and/or stream systems in adjacent Spring Creek Valley Forest Preserve.

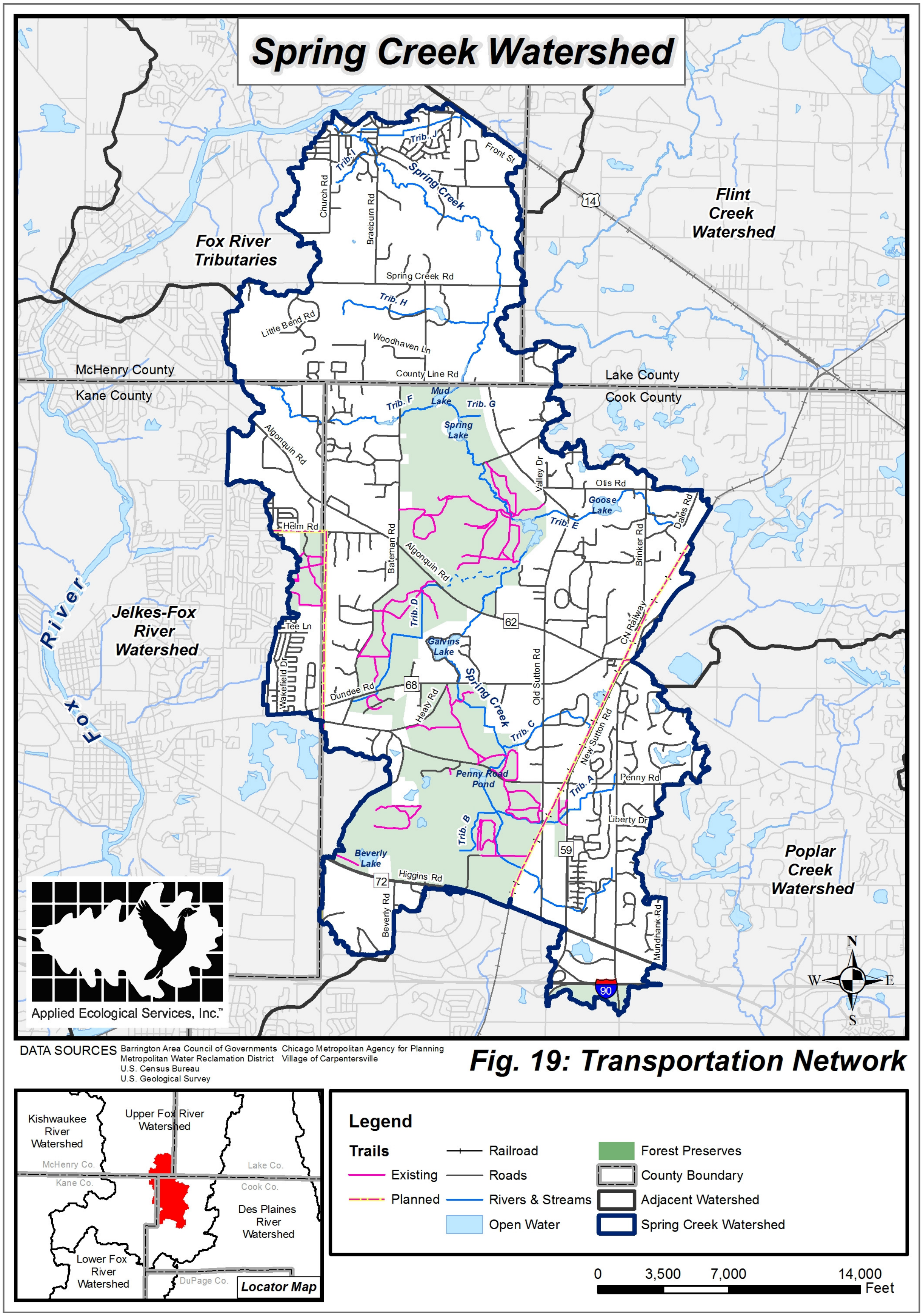


Fig. 19: Transportation Network

CMAP Trails

The Chicago Metropolitan Agency for Planning (CMAP) adopted the Regional Greenways and Trails Implementation Program in 1992 followed by updates in 1997 and 2009. The program's plan identifies existing major open space and trails, recommendations for revised and new greenway and trail linkages, stream corridors as greenway linkages, location of existing Illinois Natural Area Inventory Sites (INAI) and other natural areas, and identifies commuter rail lines that can provide access to trails and greenways. CMAP's proposed trails within the watershed are shown on Figure 19. A primary regional trail, one that makes critical links and interconnections, called EJ&E Corridor is proposed to be built along the CN railroad throughout the entire watershed. Another primary regional trail that is on the edge of the watershed, along Illinois Route 14/Union Pacific-Metra Northwest Line, is proposed to be extended south of Illinois Route 22 still following Illinois Route 14. The name of this trail is the Route 14 Corridor Bike Path. A regional trail named County Line Corridor is a proposed regional trail that will run along the north end of Helm Woods and turn south eventually reconnecting with the EJ&J Corridor trail outside of the Spring Creek watershed. These trails are all what CMAP refers to as Land-Based Greenways, as opposed to Water-Based Greenways or On Street Routes.

Forest Preserve and Other Trails

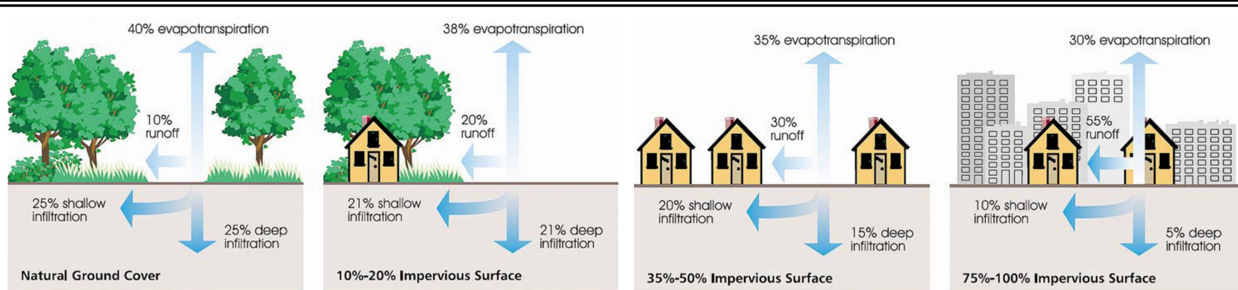
Cook County Forest Preserve and Kane County Forest Preserve Districts both have existing preserves within the Spring Creek watershed. These areas are described in more detail in Section 3.11. Cook County owns the Spring Creek Valley Forest Preserve, Spring Creek Nature Preserve, and the Poplar Creek Forest Preserve. The Spring Creek Valley Forest Preserve occupies the most land of any preserve within the watershed and is the only preserve in Cook County that has trails within the watershed. Kane County Forest Preserve District manages Helm Woods in the western portion of the watershed. This preserve also has an established trail system. These existing trails can be seen on Figure 19.

Horse crossing sign near intersection of Spring Creek Road & Spring Creek Lane.

While not depicted on the transportation map, there is an extensive trail system spanning some 210 miles throughout Barrington Hills and the Spring Creek watershed that is used for equestrian riding. Since 1937 these trails have been maintained by the Riding Club of Barrington Hills. The Riding Club had its beginnings in the 1920's when the area was mostly farmed and cattle grazed. The private equestrian trail system is a unique feature which helps to attract and retain equestrians who require low density land use practices for their purposes. As such, the private trail system is an asset which ultimately aids the watershed in ensuring low stressors to the local ecosystems. Some of these trails are public, many of them connecting with forest preserve foot trails, and others are private. A map of the known equestrian trail network that exists within the Village of Barrington Hills can be obtained from the Village's Comprehensive Plan and/or Riding Club of Barrington Hills.

3.9 Impervious Cover Impacts

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/depressional storage, and habitat related to streams. Based on studies and other background data, Scheuler (1994) and the Center for Watershed Protection (CWP) developed an Impervious Cover Model used to classify streams within subwatersheds into three quality categories: Sensitive, Impacted, and Non-Supporting (Table 10). 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. In addition, runoff over impervious surfaces 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.



Source: The Federal Interagency Stream Restoration Working Group, 1998 (Rev. 2001).

Figure 20. Relationship between impervious surfaces, evapotransporation, & Infiltration.

Table 10. Impervious categories and descriptions based on the CWP's Impervious Cover Model.

Category	% Impervious Cover	Subwatershed Description
Sensitive	10% or less	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%	Generally possesses moderate impervious cover (11-25%), and somewhat degraded stream channels, altered habitat, decreasing water quality, and fair-quality biological communities.
Non-Supporting	Greater than 25%	Generally has high impervious cover (>25%), and highly degraded stream channels, degraded habitat, poor water quality, and poor-quality biological communities.

Source: (Zielinski 2002)

The following paragraphs describe the implications of increasing impervious cover:

Water Quality Impacts
Impervious surfaces accumulate pollutants and affects water quality in lakes, rivers, streams, and wetlands by increasing nonpoint source pollutant loading and water temperatures. During a storm event, pollutants such as nutrients (nitrogen and phosphorus), metals, oil/grease, and bacteria are delivered to water bodies. 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 and can generally occur during hot summer months.

Hydrology and Flows Impacts
Hydrology and flows are altered by the amount of impervious cover in a watershed because higher impervious cover translates to greater runoff volumes. If unmitigated, high runoff volumes can 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: 1) disconnected and 2) directly connected. Disconnected impervious areas are represented primarily by rooftops, so long as the rooftop runoff does not get funneled to impervious driveways or a stormsewer system. Significant portions of runoff from disconnected surfaces usually infiltrate into soils more readily than directly connected impervious areas such as parking lots that typically end up as stormwater runoff directed to a stormsewer system that discharges directly to a waterbody.

Flooding and Depressional Storage Impacts
Flooding is an obvious consequence of increased flows resulting from increased impervious cover. As stated above, 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.

Habitat Impacts
Increased impervious cover negatively impacts stream habitat and its 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 leading to 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. Booth and Reinelt (1993) found that a threshold in habitat quality exists at approximately 10% to 15% imperviousness.

Impervious Cover Estimate & Future Vulnerability

In 1998, the Center for Watershed Protection (CWP) published the Rapid Watershed Planning Handbook. This document introduced rapid assessment methodologies for watershed planning. The CWP released the Watershed Vulnerability Analysis as a refinement of the techniques used in the Rapid Watershed Planning Handbook (Zielinski 2002). The vulnerability analysis focuses on existing and predicted impervious cover as the driving forces impacting potential stream quality within a watershed. It incorporates the Impervious Cover Model described above to classify Subwatershed Management Units (SMUs).

AES used a modified *Vulnerability Analysis* to compare each SMU's vulnerability to projected land use changes across the Spring Creek watershed. Three steps were used to generate a vulnerability ranking of the SMUs. The results are used to make recommendations in the Action Plan related to curbing the negative effects of predicted land use changes on the watershed. The three steps are listed below and described in detail in the following pages:

1. Initial classification of SMUs based on existing (2011) land use/land cover and impervious cover;
2. Future classification of SMUs based on predicted land use/land cover and impervious cover,
3. Vulnerability Ranking of SMUs based on changes in impervious cover.

Step 1: Initial Classification

The first step in the vulnerability analysis involves an initial classification of each SMU based on existing (2011) measured impervious cover. Calculating existing (2011) and predicted impervious cover in the Spring Creek watershed begins with an analysis of land use/land cover. Existing (2011) impervious cover is calculated by assigning an impervious cover percentage for each land use/land cover category based upon the U.S. Department of Agriculture's (USDA) Technical Release 55 (TR55). TR55 provides estimates of impervious cover based on land use categories. GIS analysis is used to estimate the percent impervious cover for each Subwatershed Management Unit (SMU) in the watershed using existing and predicted land use/land cover data. Each SMU then receives an initial classification (Sensitive, Impacted, or Non-Supporting) based on percent of existing impervious cover (Table 11; Figure 21).

Six SMUs are classified as Sensitive, 9 as Impacted, and 2 as Non-Supporting. The majority of the Sensitive SMUs are located in the central portion of the watershed in areas comprised of forest preserve and large lot residential within Barrington Hills. Impacted SMUs are generally located in areas with mixed medium & large lot residential, equestrian, and agricultural land uses. The two Non-Supporting SMUs (SMUs 1 & 16) are located in the far southeast corner and northern border of the watershed in heavily developed areas comprised mostly of retail, commercial, and/or small single family residential lots.

Table 11. Existing & predicted impervious cover for Subwatershed Management Units (SMUs).

SMU #	Step 1: Existing Impervious %	Step 2: Predicted Impervious %	Percent Change	*Impervious Classification	Step 3: Vulnerability
SMU1	27%	34%	8%	Non-Supporting	Medium
SMU2	16%	23%	7%	Impacted	High
SMU3	19%	22%	3%	Impacted	Medium
SMU4	0%	0%	0%	Sensitive	Low
SMU5	22%	23%	1%	Impacted	Medium
SMU6	5%	7%	2%	Sensitive	Low
SMU7	11%	12%	0%	Impacted	Low
SMU8	8%	8%	0%	Sensitive	Low
SMU9	9%	9%	0%	Sensitive	Low
SMU10	4%	4%	0%	Sensitive	Low
SMU11	8%	9%	2%	Sensitive	Medium
SMU12	12%	12%	0%	Impacted	Low
SMU13	13%	13%	1%	Impacted	Low
SMU14	14%	15%	0%	Impacted	Low
SMU15	23%	25%	2%	Impacted	Medium
SMU16	31%	31%	0%	Non-Supporting	Low
SMU17	23%	25%	2%	Impacted	Medium

*No change in impervious classification occurred between existing and predicted conditions for all SMUs

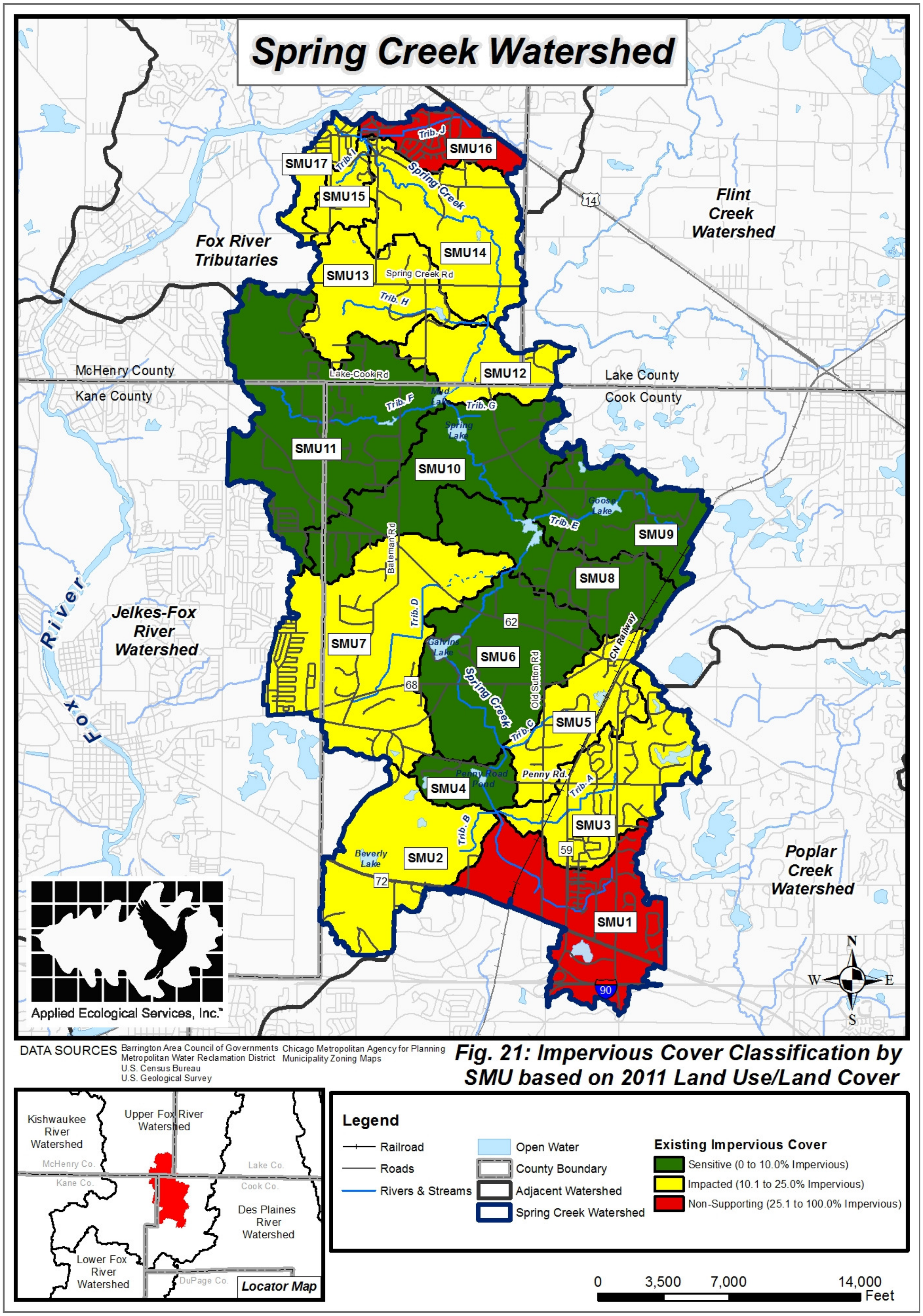


Fig. 21: Impervious Cover Classification by SMU based on 2011 Land Use/Land Cover

Step 2: Future Classification

Predicted impervious cover was evaluated during the second step of the vulnerability analysis. For this study, projected imperviousness was based on future land use/zoning maps found in municipal comprehensive plans. Like the initial classification, a predicted classification of Sensitive, Impacted, or Non-Supporting was assigned to each SMU. This step is important because it identifies Sensitive and some Impacted SMUs that are most vulnerable to future development pressure. None of the 17 SMUs changed impervious classification compared to existing (2011) conditions despite several predicted land use changes in the southern, central, and northwest portions of the watershed. Figure 21depicts percent change in impervious cover for each SMU from existing to predicted land use conditions. SMUs 1 & 2, located in the southern portion of the watershed, are expected to see additional retail, commercial, and residential land use changes and therefore are predicted to change the most. SMUs 3, 5, 6, 11, 13, 15, and 17 are also expected to see some future residential development primarily in areas that are currently agricultural.

Step 3: Vulnerability Ranking

The vulnerability of each SMU to predicted future land use changes was determined by considering the following questions:

1. Will the SMU classification change? (e.g. shift from sensitive to impacted);
2. Does the SMU classification come close to changing (within 2%)? (e.g. future impervious cover is predicted at 9.0%);
3. What is the absolute change in impervious cover from existing to projected conditions? (e.g. a SMU that increases by 10% is more vulnerable than a SMU that increase only 1%)

A vulnerability of low, medium, or high was assigned to each SMU based on the following:

Low = no change in classification, <2% change in impervious cover;
Medium = classification close to changing (within 2%) and/or 3-5% change in impervious cover;
High = classification change or close to changing (within 2%) and >5% change in impervious cover.

The vulnerability analysis resulted in 1 High, 6 Medium, and 10 Low ranked SMUs (Table 11; Figure 23.) SMU 2 was the only SMU ranked as highly vulnerable to future problems associated with impervious cover because it was close to changing from Impacted to Non-Supporting and showed an increase of over 5% impervious cover based on predicted land use changes. SMUs 1, 3, 5, 11, 15, and 17 were all moderately vulnerability because they are predicted to come close to changing classification but have less than 5% predicted increase in impervious cover. The remainder of the SMUs are not considered vulnerable to predicted land use changes based on the established criteria.

In addition, the Forest Preserve District of Cook County (FPDCC) considers SMU 11 a critical area to protect against the potential impacts of future development as this SMU drains via Tributary F into Mud Lake, part of the Spring Lake Nature Preserve within Spring Creek Valley Forest Preserve. Two large areas that are currently agricultural but slated for future development within SMU 11 are considered "Priority Protection Areas" (see Section 4.0). Conservation development and/or low impact design standards are recommended for these parcels when/if developed. The FPDCC also recommends more protection, easement agreements, and other Management Measures for SMUs 6, 7, and 9.

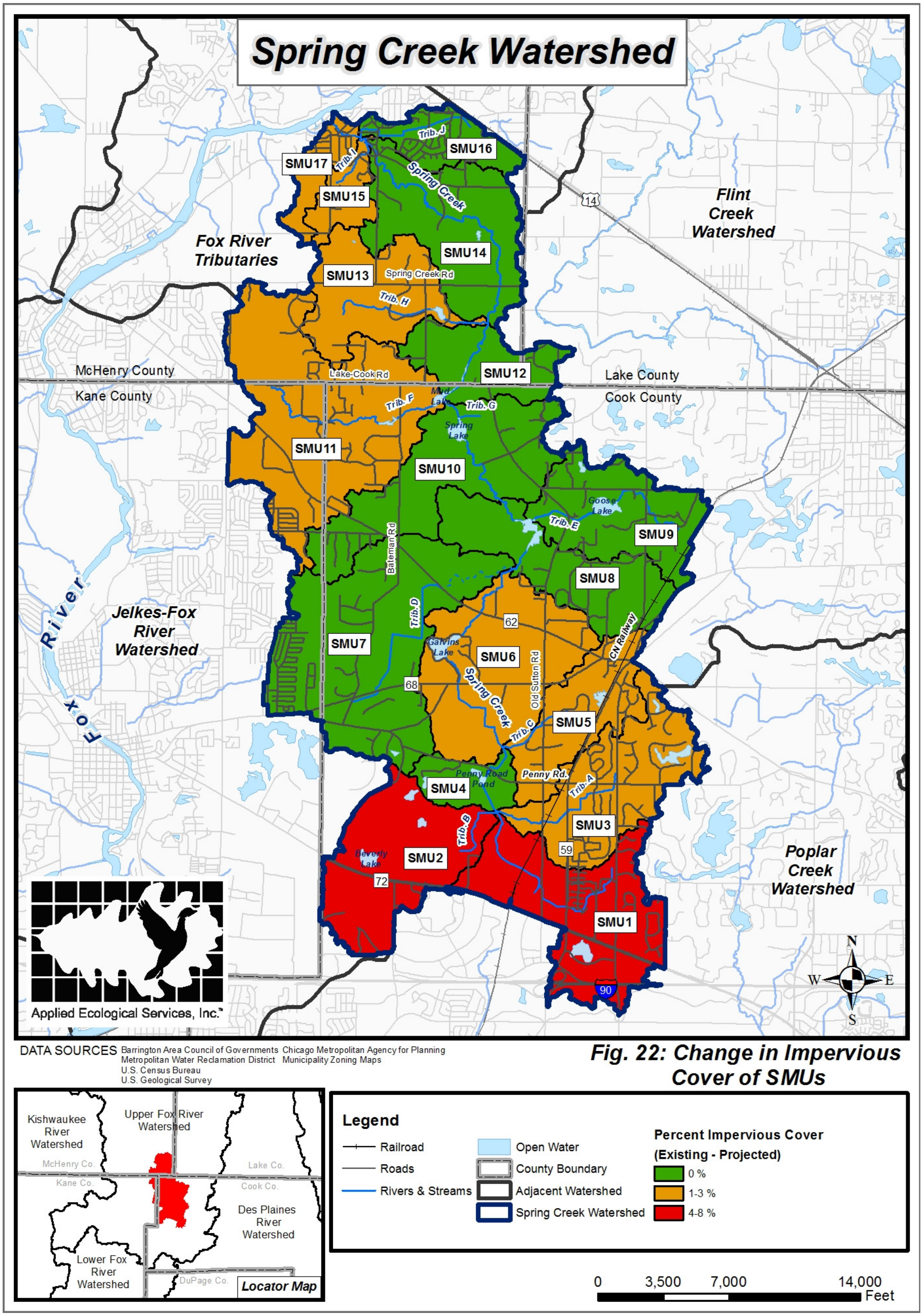


Fig. 22: Change in Impervious Cover of SMUs

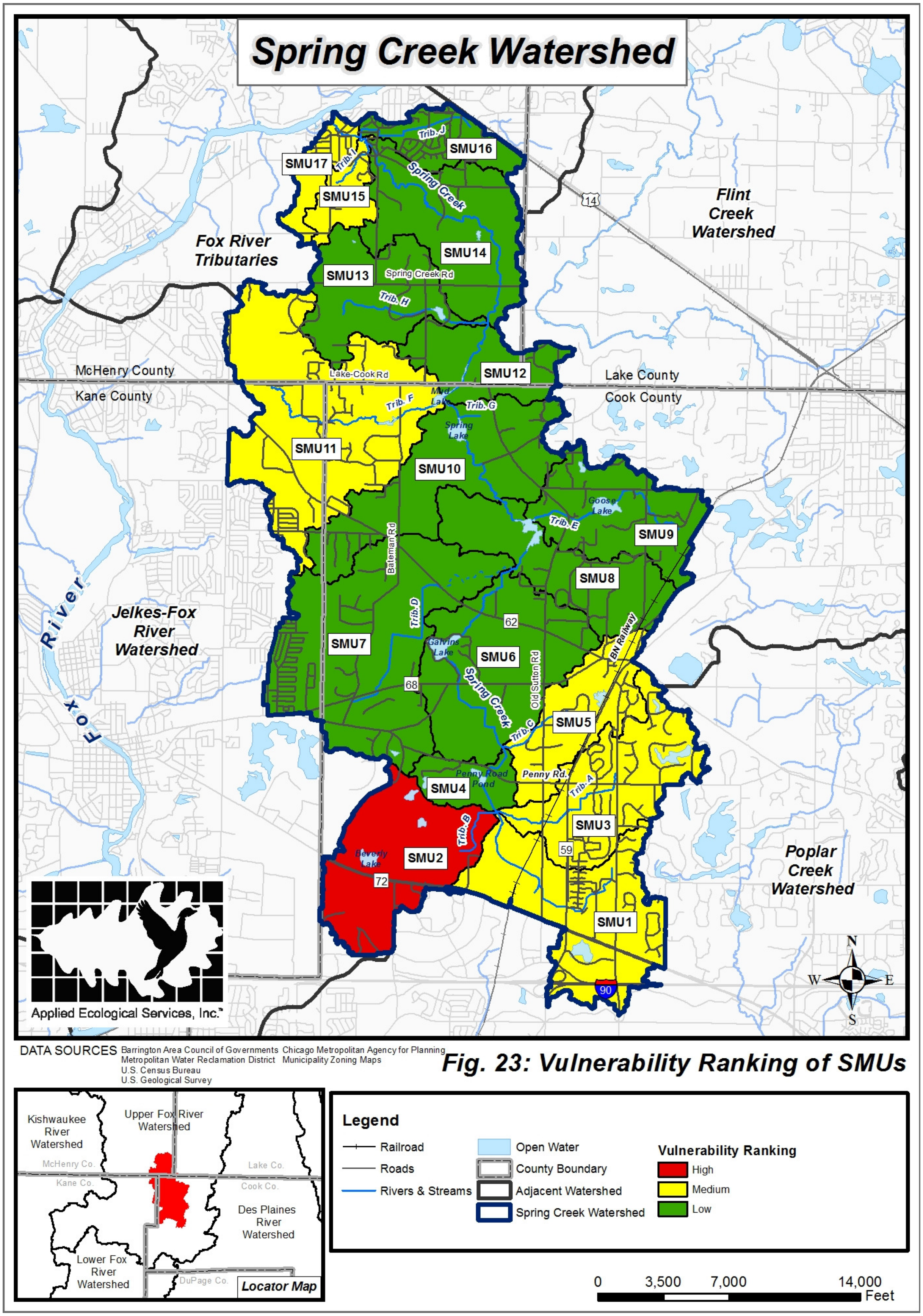


Fig. 23: Vulnerability Ranking of SMUs

3.10 Open Space Inventory, Prioritization, & Green Infrastructure Network Plan

A primary objective of the watershed planning process is to examine open space in the Spring Creek watershed and determine how this open space best fits into a "Green Infrastructure Network" which 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 areas such as wetlands, woodlands, prairie, natural features such as streams, as well as working lands such as farms can be considered components of a Green Infrastructure Network. Green infrastructure can also include portions of developed areas like naturalized detention basins and buffers.

A three step process was used to create a Green Infrastructure Network plan for the Spring Creek watershed. Step one involved inventorying parcel based open space. Second, open space was prioritized based on a set of criteria important to green infrastructure. Finally, prioritized open space, smaller linking parcels, ecologically significant areas, and stakeholder recommendations were combined to form the network.

For this study, "open space" is generally defined as any parcel that is not developed such as a forest preserve district owned parcel. Other parcels are classified as "partially open". These parcels are generally private but are large enough and with minimal development to offer potential open space opportunities. Parcels that are mostly built out are considered "developed". Agricultural land is also classified as partially open.

Open space is either protected or unprotected. Protected open space differs from unprotected in that it is permanently preserved by outright ownership by a body chartered to permanently preserve land, or by a permanent deed restriction such as a conservation easement.

Open and Partially Open Parcels

There are 4,665 parcels of land in the Spring Creek watershed. Of these, 203 "open space" parcels (26% of watershed) and 1,081 "partially open" parcels (50% of watershed) were identified totaling 76% of the watershed area is open space (Table 12, Figure 24). Developed parcels account for another 20% of the watershed area. Open space parcels average nearly 22 acres in size while partially open parcels are nearly 8.1 acres. A closer look at Figure 24 indicates that most of the open space is located in protected natural areas such as Spring Creek Valley Forest Preserve, Helm Woods Forest Preserve, Foxmoor Park, and Poplar Creek Forest Preserve. Other open space is located along a Commonwealth Edison utility easement and private land.

Table 12. Summary of open and partially open parcels.

Parcel Type	Parcels (n)	Area (acres)	Average Size (acres)	% of Watershed
Closed (Developed)	3,381	3,472	1.0	20%
Open Space	203	4,470	22.0	26%
Partially Open Space	1,081	8,753	8.1	50%
Totals	**4,665**	**16,558**	**3.5**	**96%**

***** 4% of watershed (681 acres) is unclassified parcels - mostly roads

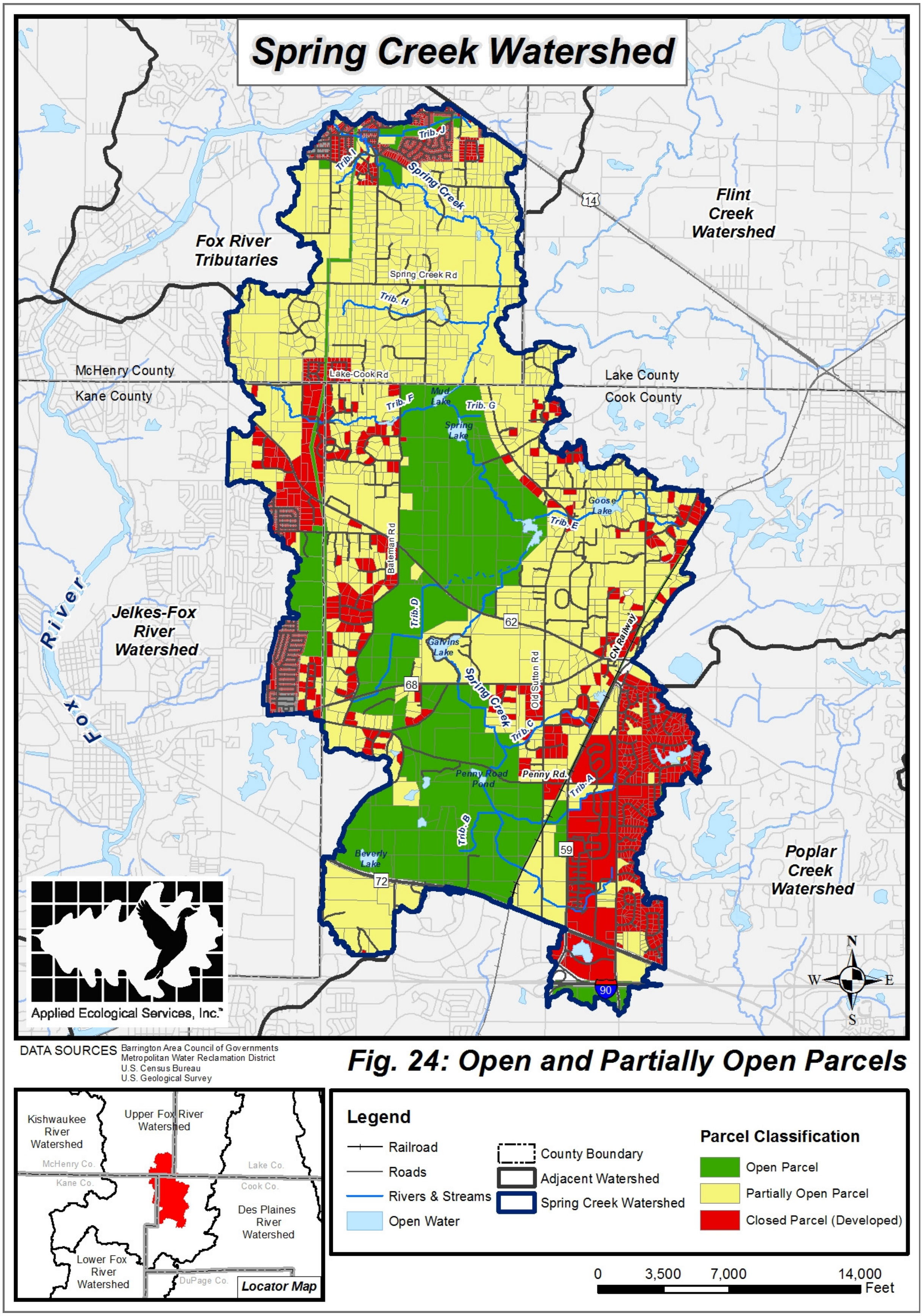


Fig. 24: Open and Partially Open Parcels

Public/Private Ownership of Open and Partially Open Parcels

The public or private ownership of each open and partially open parcel was determined from available parcel data. Publicly owned parcels include those owned by federal, state, county, or municipal government, the forest preserve districts of Kane and Cook Counties, park districts, school districts, and townships. Private ownership types include homeowners/business associations, land trusts, commercial, residential, private clubs, religious, universities, and utilities.

The amount of publicly owned land in the watershed is important because it reduces land acquisition fees for implementation of management measures such as conservation, riparian corridor protection, and stormwater retrofitting. Recommended Management Measures in the Action Plan that are located on public parcels are generally higher priority than similar projects located on private land.

Table 13 includes a summary of public versus private ownership for open and partially open parcels, and Figure 25 depicts the location of these parcels. 158 parcels combine to equal 4,229 acres of publicly owned open space (25% of the watershed). Partially open public land such as parks with ball fields consists of 21 parcels totaling 94 acres (<1% of the watershed). As expected, most of the public open space is located in protected natural areas such as Spring Creek Valley Forest Preserve, Helm Woods Forest Preserve, Foxmoor Park, and Poplar Creek Forest Preserve. (These charts are for informational purposes only and accuracy is not guaranteed.)

Table 13. Public versus private ownership of open and partially open parcels.

Parcel Type	Parcels (n)	Area (acres)	Average size (acres)	% of Watershed
Open				
Private	45	241	5.4	1%
Public	158	4,229	26.8	25%
Partially Open				
Private	1,060	8,659	8.2	50%
Public	21	94	4.4	<1%
Totals	**1,284**	**13,223**	**10.3**	**76%**

* 4% of watershed (681 acres) is unclassified parcels - mostly roads

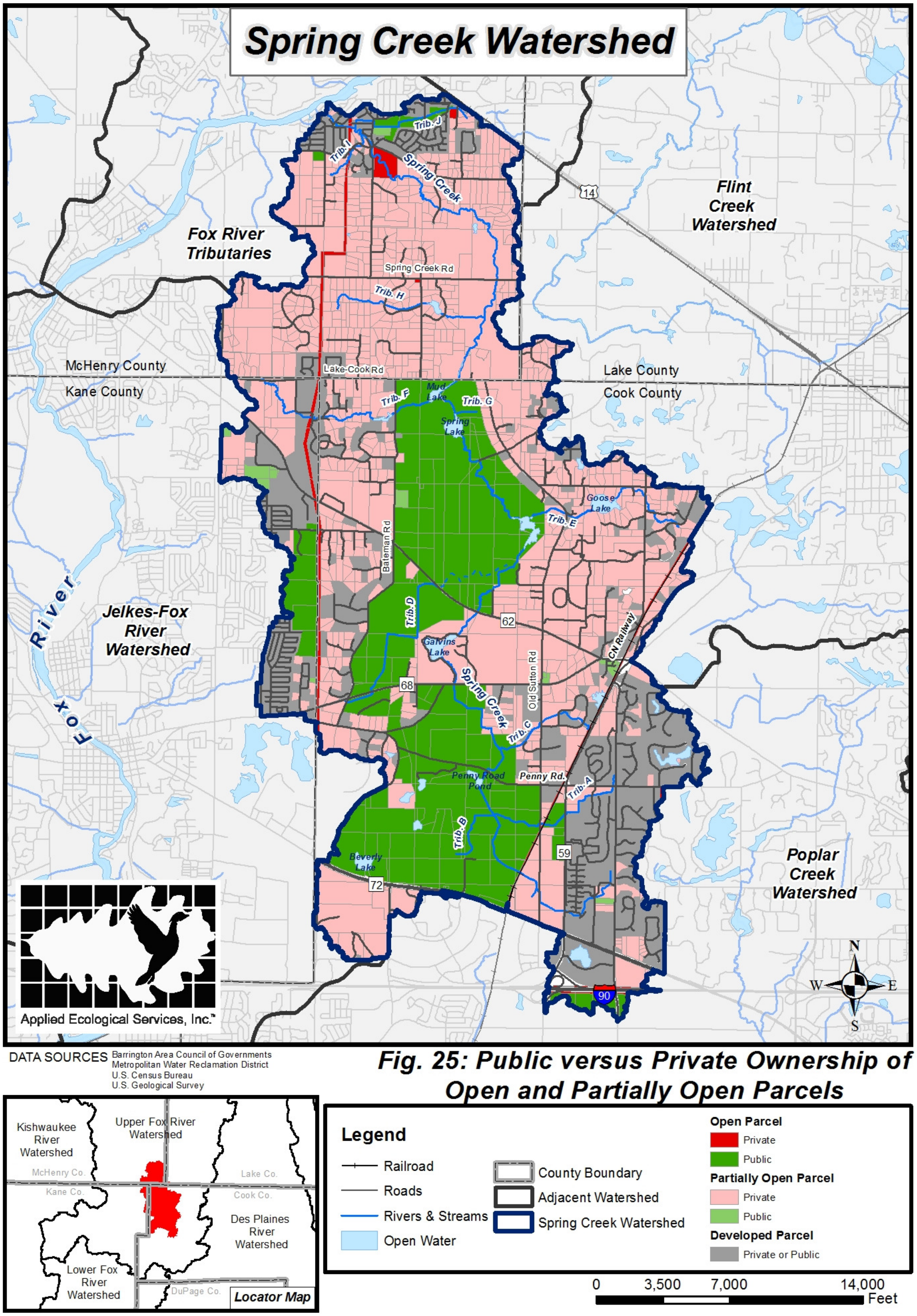


Fig. 25: Public versus Private Ownership of Open and Partially Open Parcels

Protected Status of Open and Partially Open Parcels

Preservation of open space in the Spring Creek watershed is critical to maintaining and expanding green infrastructure and is an important component of sustaining water quality, hydrological processes, ecological function, and the general quality of life for both animals and people. Without preservation, open space can be converted to other land uses in the future. Of the 13,223 acres of open and partially open space in the watershed, 4,230 acres (25%) are open and protected, and 498 acres (3%) are partially open and protected (Table 14, Figure 26). The majority of protected open and partially open parcels include forest preserve districts, township and village open space, and equestrian areas. Incorporation of unincorporated land areas for equestrian and agricultural use would provide greater protection of the watershed.

Because the loss of existing open and partially open space to other land uses poses a significant threat to watershed resources, opportunities to acquire and preserve additional open space will be extremely important in the next 10-20 years. Figure 26 identifies several large partially open space parcels that are currently not protected. Many of these areas abut existing protected open space such as those around Spring Creek Valley Forest Preserve and Helm Woods Forest Preserve. While most of these surrounding areas are single family residential that are unlikely to be acquired and redeveloped, there are agricultural lands that could be acquired in the future. By protecting or preserving these parcels, existing protected open space and greenways can be expanded.

Table 14. Protected versus unprotected status of open and partially open parcels.

Parcel Type	Parcels (n)	Area (acres)	% of Watershed
Open			
Unprotected	44	240	<1%
Protected	159	4,230	25%
Partially Open			
Unprotected	1,041	8,255	48%
Protected	40	498	3%
Totals	**1,284**	**13,223**	**76%**

* 4% of watershed (681 acres) is unclassified parcels - mostly roads

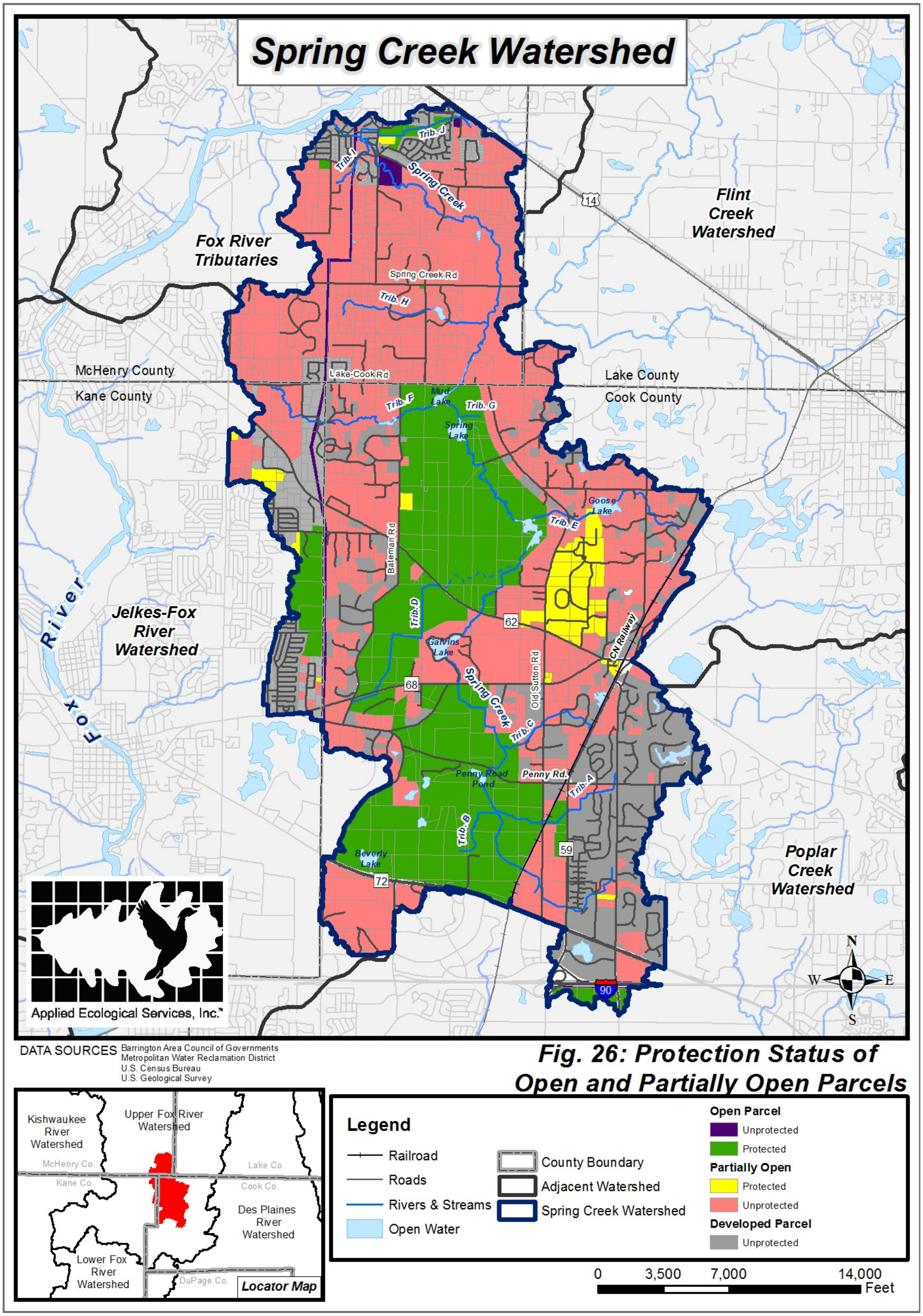


Fig. 26: Protection Status of Open and Partially Open Parcels

Open Space Parcel Prioritization

Prioritizing open and partially open parcels is the second step in forming a Green Infrastructure Network plan for the Spring Creek watershed. This step includes applying 11 prioritization criteria important to green infrastructure via a GIS analysis (Table 15). If an open or partially open parcel met a criterion it received one point; if the parcel did not meet that criterion, it did not receive a point. This process was repeated for each open and partially parcel and for all criteria. The total points received for each parcel were summed to determine parcel importance within the Green Infrastructure Network. Parcels with the highest number of points are more important to green infrastructure than parcels that met fewer criteria.

The combined possible total of points any one parcel can accumulate is 11 (11 of 11 total criteria met). The highest total value received by a parcel in the weighting process was 9 (having met 9 of the 11 criteria). After completion of the prioritization, parcels were categorized as "High Priority", "Medium Priority", or "Low Priority" based on point totals. Parcels meeting 6-9 of the criteria are designated High Priority for inclusion into the Green Infrastructure Network while parcels meeting 4-5 criteria are designated Medium Priority. Parcels with a combined value of 1-3 are categorized as Low Priority. Parcels with a score of 0 are not considered a priority.

Table 15. Criteria used to prioritize parcels for a Green Infrastructure Network.

Green Infrastructure Criteria
1. Open or partially open parcels that intersect 100-year floodplain and inundation areas
2. Open or partially open parcels within 0.5-miles of any headwater stream
3. Open or partially open parcels that intersect a wetland
4. Open or partially open parcels that intersect a high quality (ADID) wetland
5. Open or partially open parcels that intersect a potential wetland restoration site
6. Open or partially open parcels that are within 100 feet of a watercourse or lake
7. Open or partially open parcels equal to or greater than 5 acres
8. Open or partially open parcels in a "Highly Vulnerable" Land Use/Land Cover SMU
9. Open or partially open parcels adjacent to or including Forest Preserves/Nature Preserves and other privately or publicly protected open space
10. Open or partially open parcels that intersect "Critical", "Important", or "Moderate" groundwater recharge areas
11. Open or partially open parcels that intersect existing or planned trails

Figure 27 depicts the results of the parcel prioritization. An obvious correlation can be seen between High Priority and Medium Priority open or partially open parcels and their relation to Spring Creek and its tributaries. Nearly all the open space adjacent to or including Spring Creek is High Priority while most of the open space surrounding the tributaries is at least Medium Priority. Low Priority parcels generally fall outside the vicinity of Spring Creek and its tributaries.

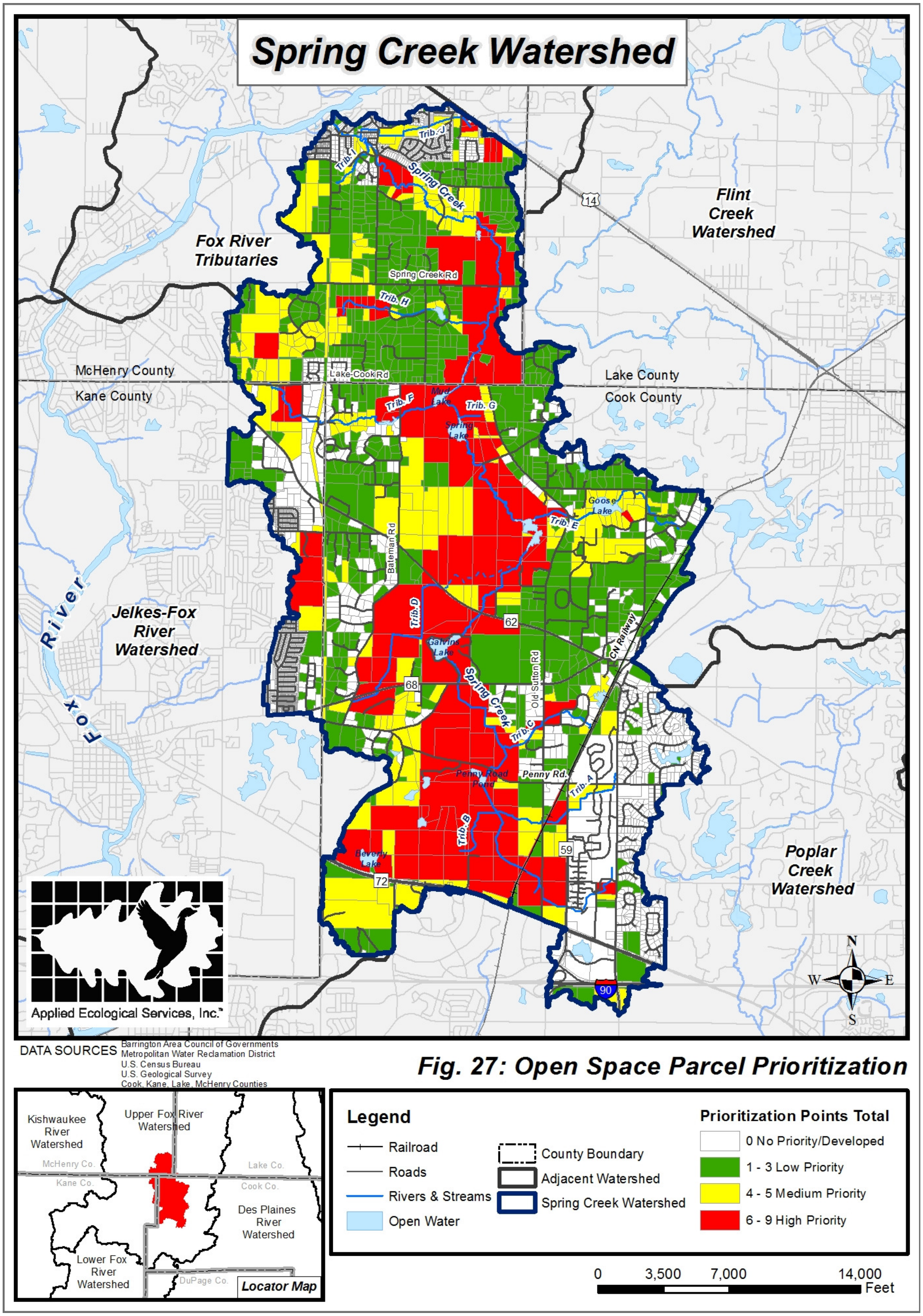


Fig. 27: Open Space Parcel Prioritization

Green Infrastructure Network Plan

So far, two of the three steps required to create a Green Infrastructure Network plan have been completed. The final step involves the actual creation of the network using prioritized open space, linking smaller parcels, ecologically significant areas, information gathered during the watershed characteristics inventory, and stakeholder recommendations. County and regional wide green infrastructure plans generally feature stream corridors, wetlands, floodplain, buffers, and other natural components. The green infrastructure network created for this watershed study captures all the natural components but at the parcel level. This is important because creation of green infrastructure involves protection of land through acquisition, regulation, or incentives and is almost always done at the parcel level.

Perhaps the most important aspect of green infrastructure planning is that it helps communities identify and prioritize conservation opportunities and plan development in ways that optimize the use of land to meet the needs of people and nature (Benedict 2006). It does this by providing a framework for future growth that pre-identifies areas not suitable for development or green infrastructure where development is suitable but should follow conservation or low impact design.

Green infrastructure plan implementation involves three steps:

1) Identification of a Green Infrastructure Network
2) Protection of unprotected green infrastructure parcels through acquisition, regulation, conservation easements and/or incentives
3) Long term ecological management of green infrastructure

Step one or identification of a Green Infrastructure Network for Spring Creek watershed has been completed as part of this watershed study (Figure 28). The network is a system of *Hubs*, *Links*, and *Sites* comprised of ecologically significant areas, private and public protected parcels, large unprotected parcels, and smaller unprotected residential parcels. Hubs generally consist of the largest, highest quality, least fragmented ecologically significant areas such as ADID wetlands. All of Spring Creek Valley Forest Preserve, and small piece of Poplar Creek Forest Preserve in Cook County and Helm Woods Forest Preserve in Kane County are considered hubs. Links are generally formed by private/unprotected parcels along many of the tributaries to Spring Creek. These links are extremely important because they provide biological conduits between hubs. Links also provide potential opportunities for trail connections between hubs. Sites are generally smaller than hubs and in many cases are not connected to the larger green infrastructure network but still provide important ecological and social values.

Protection of unprotected parcels is the second green infrastructure planning step and occurs via three tools; 1) acquisition, 2) regulation, and/or 3) incentives. The simplest form of acquisition is through outright purchase or donations but can also occur through conservation easements and land trusts. Protection of land through state and federal regulation covers natural features such as wetlands or threatened and endangered species/important habitat. Local regulation protection occurs by enforcing stormwater, zoning, comprehensive plans, and subdivision ordinances. Keeping with the current low-density land use patterns, and the inclusion of equestrian trails, separate from other trail use types, where appropriate would help protect the watershed. Regulatory action can also come in the form of Special Service Area assessments and Development Impact Fees. Land protection through incentives usually occurs on smaller private lands. Some incentives include landowner recognition/rewards, tax incentives, or benefits for farms through the Conservation

Reserve Program. A more detailed list of the tools and methods for protecting green infrastructure are included in Table 16.

Table 16. Tools for protection of green infrastructure.

Tool	Method of Implementation
Land Acquisition	Outright purchase Conservation easements Donations Land trusts
Regulation	Buffer or landscape ordinance Comprehensive plans Development Impact Fee Mitigation and mitigation banking Special Service Area assessment Stormwater regulations Subdivision ordinances Zoning Wetland permitting T&E species and habitats
Incentives	Management agreements Landowner recognition and rewards Tax incentives Technical assistance from local agencies Conservation Reserve Program

Source: Benedict 2006.

A green infrastructure network can only be realized by planning efforts of local municipalities, forest preserve districts, developers, private land owners, and other stakeholders. Each governing community and major stakeholder groups in the watershed should follow the recommended process below to initiate and implement the green infrastructure plan for Spring Creek watershed.

1) Identify and designate a lead person to serve as an open space plan "coordinator" and meet with other stakeholderse to plan for future green infrastructure.
2) Include all green infrastructure parcels in community comprehensive plans and development review maps.
3) Create zoning overlay and update development ordinances to require conservation and/or low impact development design on all green infrastructure parcels.
4) Require Development Impact Fees and/or Special Service Area taxes for all new development to help fund future management of green infrastructure.
5) Identify unprotected green infrastructure buffer parcels adjacent to existing forest and nature preserves and other sites with high quality natural areas then protect and implement long term management.
6) Work with private land owners along stream and tributary corridors to protect and manage their land. An excellent source for riparian area management information is the "Riparian Area Management: A Citizen's Guide" produced by the Lake County Stormwater Management Commission and included in Appendix C of this report.
7) Use the Green Infrastructure Network to identify and create new trails and trail connections.

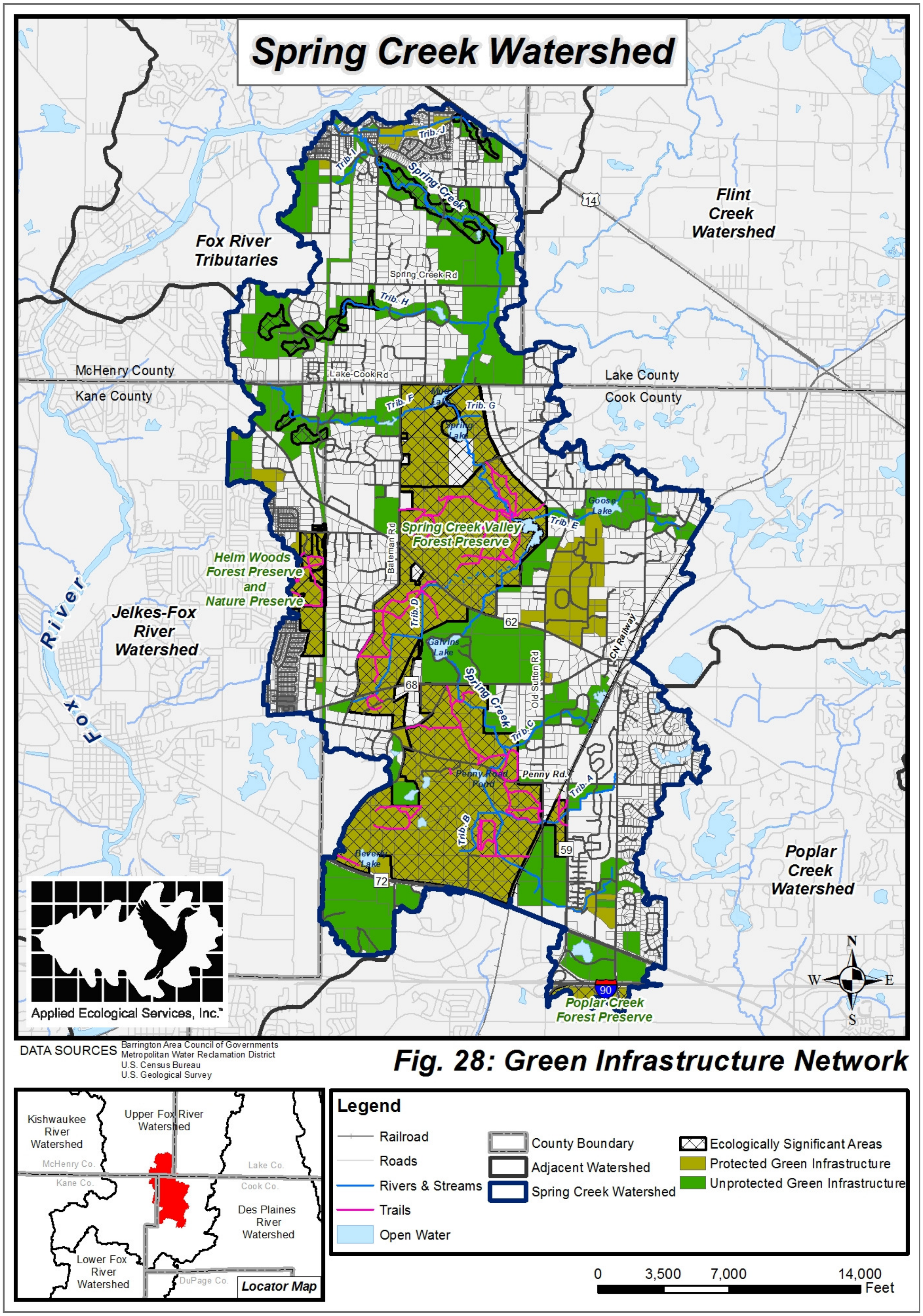


Fig. 28: Green Infrastructure Network

3.11 Ecologically Significant Areas

High quality wetlands (ADID wetlands), forest preserves, nature preserves, and Illinois Natural Area Inventory (INAI) sites are all considered "Ecologically Significant Areas" within the Spring Creek watershed. These areas often provide high quality habitat for and harbor uncommon or even threatened & endangered (T & E) species. 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 12 ADID wetlands (McHenry and Kane County only), 3 forest preserves, 2 nature preserves, and 3 INAI sites (Figure 29).

ADID Wetlands

The Advanced Identification (ADID) wetland inventory was completed for Lake, McHenry, and Kane Counties. These inventories were conducted in order to identify the functional and ecological values of individual wetlands as well as identify wetlands where special protection should be enforced. Local communities can use the ADID inventory to help them better understand the values and functions of wetlands under their jurisdiction. The 12 ADID wetlands located in the watershed are mapped on Figure 29. Three of these ADID wetlands are located in Helm Woods Forest Preserve/Nature Preserve which makes up a unique northern flatwoods habitat in the watershed that is protected. Wetlands are present in Cook County but an ADID wetland inventory has not been completed for this county. A separate wetlands map and more detailed description of their ecological significance are found in Section 3.12.3.

Forest Preserves, Nature Preserves, & INAI Sites

Three forest preserves, two which include an Illinois Nature Preserve, are located in Spring Creek watershed (Figure 29). Forest Preserves include Spring Creek Valley Forest Preserve, and Poplar Creek Forest Preserve located in the Cook County portion of the watershed. Helm Woods Forest Preserve is located in Kane County. Spring Lake Nature Preserve is found within the northern portion of Spring Creek Valley Forest Preserve while Helm Woods Nature Preserve is located within Helm Woods Forest Preserve and extends south onto open space owned by Dundee Township. Illinois Nature Preserves offer the highest level of protection for T&E species and natural communities. Forest preserves are county owned and also offer some protection to T&E species and natural communities.

The Illinois Natural Areas Inventory (INAI) was originally conducted from 1975-1978 by the Illinois Nature Preserves Commission (INPC) in order to provide information on high quality natural areas, habitats of endangered species, and other significant natural features. The inventory is currently being updated by a team consisting of the Illinois Department of Natural Resources (IDNR), INPC, INHS (Illinois Natural History Survey) and Applied Ecological Services, Inc. (AES). There are 3 INAI sites in the Spring Creek watershed (Figure 29). The first is found within Spring Lake Nature Preserve located in the northern portion of Spring Creek Valley Forest Preserve and contains high quality prairie and sedge meadow. The second INAI site is also located in Spring Creek Valley Forest Preserve just north of Route 68 and is noted for a high quality dry gravel prairie. The third INAI site is found within Helm Woods Nature Preserve and is on the inventory for its high quality dry-mesic upland forest and northern flatwoods communities.

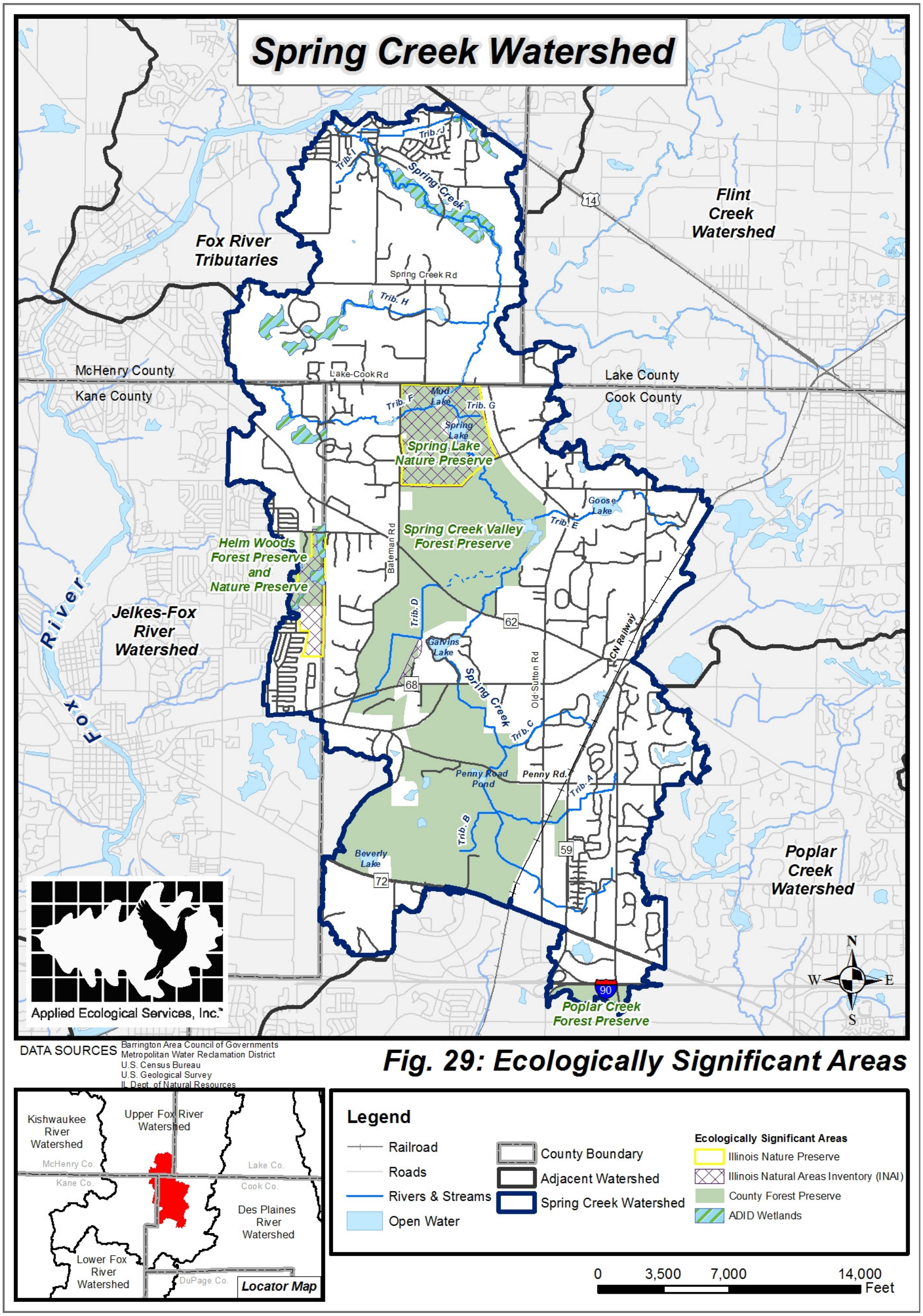


Fig. 29: Ecologically Significant Areas

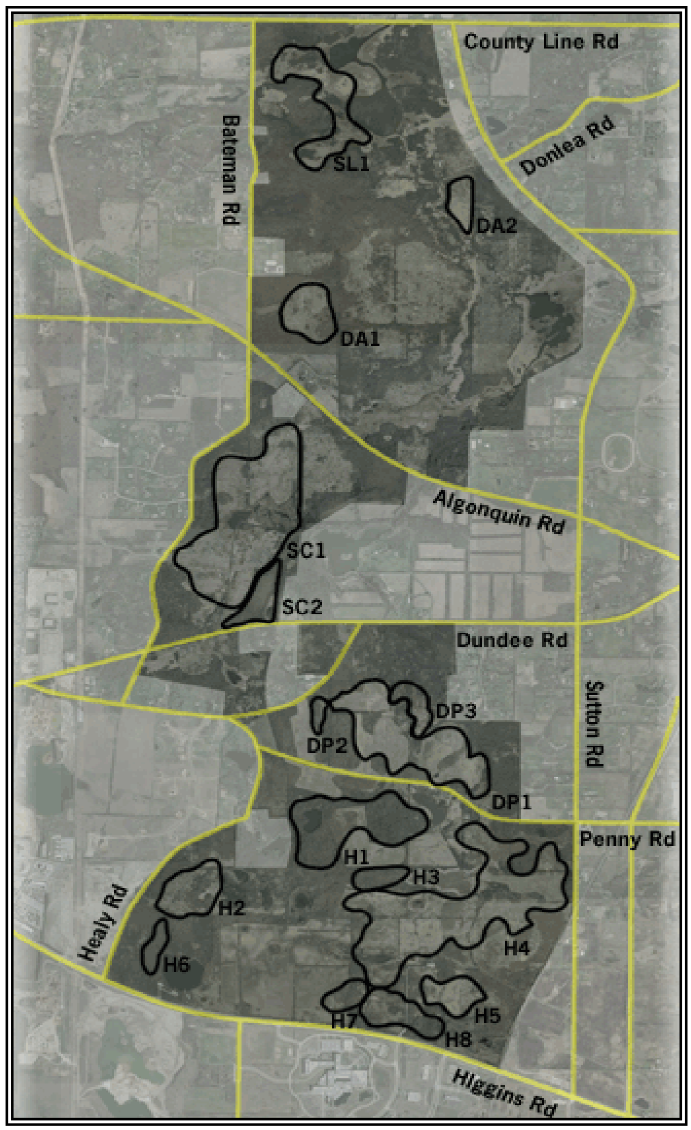
Spring Creek Valley Forest Preserve

Current Management

The Spring Creek Valley Forest Preserve consists of 3,910 acres owned and managed by the Forest Preserve District of Cook County (FPDCC). Several groups are partnered with the FPDCC in management and restoration efforts, including the U.S. Army Corps of Engineers-Chicago District, Audubon Chicago Region, Barrington Countryside Park District, Citizens for Conservation, Riding Club of Barrington Hills, Sierra Club – Northwest Cook Group, Spring Creek Volunteers, and the U. S. Fish and Wildlife Service (Chicago Wilderness 2011). First dedicated as a forest preserve in 1956, land acquisition continued through 1999 in parcel sizes ranging from 1 to 454 acres and including over 55 land owners (Chicago Wilderness 2011). In the summer of 2010, the National Audubon Society proclaimed the Preserve as an Important Bird Area for Black-billed Cuckoos, Henslow's Sparrows, bobolinks, meadowlarks, grasshopper sparrows, dickcissels, willow flycatchers, and blue-winged warblers.

To date, the management of the Spring Creek Valley Forest Preserve is divided into five regions: 1) Spring Lake Nature Preserve, 2) Donlea to Algonquin Road (Route 62), 3) Spring Creek Valley, 4) Dundee (Route 68) to Penny Road, and 5) Headwaters. Brush and burn management has resulted in hydrological benefits such as rehydration of soils and return of native grasses and sedges. This highlights the importance of having a comprehensive watershed-based plan approach to help nature with its own healing.

Within Spring Creek Valley Forest Preserve lies Region 1 comprised of the 560 acre Spring Lake Nature Preserve between County Line Road (Lake-Cook Road) and Donlea Road. This area contains a mixture of woodland, prairie, marsh, fen, and old field communities with two glacial lakes; Spring Lake and Mud Lake. "Most of the area surrounding the lakes is a peat-filled depression that supports a variety of aquatic vegetation and wetland wildlife. Small fens, sedge meadows, and mesic prairie communities occur throughout and contribute much to the species richness of the preserve. Open-grown bur oaks occur along the slopes of the moraines that lie on three sides of the preserve." The preserve was dedicated in January of 1965 as the 11th Illinois Nature Preserve (IDNR 2011). Within the Spring Lake Nature Preserve is an



Source: Chicago Wilderness Habitat Project

Figure 30. Spring Creek Valley Forest Preserve Management Regions

INAI site called Spring Lake Prairie (SL1 on Figure 30). This site is approximately 30 acres of prairie and sedge meadow that has been managed by brush control and controlled burns since the early 1980s.

Region 2 within the Spring Creek Valley Forest Preserve is located between Donlea Road and Algonquin Road (Route 62). This region consists of 950 acres of former cropland and drained wetland hayfields and grazing lands (Chicago Wilderness 2011). Within this region lies the 50 acre Steeplechase Meadow (DA1 on Figure 30) where "shrubs and tree saplings have invaded a field of Eurasian pasture grasses. Restoration as a prairie shrubland began in 2006. The goal is to restore native shrubs and herbaceous plants in a matrix that will be managed by controlled burns." Bluebird Field (DA2 on Figure 30), also within Region 2, is a roughly 20 acre field that is "home to bluebirds, kingbirds, towhees and other birds of open shrubland. Neighbors and other volunteers have cleared away invasive weeds and buckthorn so that the scenic beauty and open shrubland habitat can be preserved. Native seed has been donated by Citizens for Conservation to help diversify and stabilize the grassland matrix (Chicago Wilderness 2011)." The Riding Center, and cooperative efforts of the Countryside Park District have assisted in the maintenance and preservation of the equestrian lifestyle that continues to protect and enhance the area.

View of Spring Creek Valley Forest Preserve

Spring Creek Valley, between Algonquin Road (Route 62) and Dundee Road (Route 68) makes up Region 3. Formerly a mix of bur oak savanna, prairie and wetland, this area contains a small (4 acre) high quality prairie known as Spring Creek Prairie (SC2 on Figure 30) that is also an INAI site. The rest of these 480 acres are now mostly Eurasian meadow, brushland and partially drained wetland. Management has consisted of brush and weed control and controlled burns by the Forest Preserve District.

During the winter of 2006, a grant from the Bobolink Foundation, allowed the Forest Preserve District to realize a long-planned removal of about 15 acres of invasive brush and a tree plantation to reconnect Spring Creek Prairie to the larger adjacent grassland. The Spring Creek Valley region also comprises about 70 acres called Spring Creek Valley Prairie (SC1 on Figure 30) known for its breeding grassland birds. However, this area grew in with invasive brush to the extent that by 2002 no grassland birds continued to breed. In response, Forest Preserve District staff mowed much of the brush during the winter of 2003. Subsequent monitoring found sandhill cranes, bobolinks, and grasshopper sparrows breeding the following summer. Additional brush and weed control was conducted every year since, funded by U.S. Fish and Wildlife, Exelon, and the Bobolink Foundation.

About 20 acres were also seeded in fall 2007 with rare seed donated by Citizens for Conservation. Currently there is a wide variety of grassland bird species breeding on this site including sedge wren, Henslow's sparrow, meadowlark, and others.

Region 4 includes 540 acres from Dundee (Route 68) to Penny Road. While this area was once mostly prairie and wetlands, the "area is currently a mix of hayfields (leased to farmers), recovering native prairie, brushland, tree plantation, and partially drained wetlands including a small high-quality fen. Some of the brushland contains important populations of shrubland birds. The hayfields are currently home to Henslow's sparrow, grasshopper sparrows, meadowlarks, bobolinks, and other birds of open grassland." Within this region lies the 110 acre restored Galloping Prairie (DP1 on Figure 30). Another 5 acre area known as Stony Ridge (DP2 on Figure 30) was seeded with local prairie seed by Citizens for Conservation and Spring Creek Volunteers. A wetland complex within this area includes "sedge meadow and streamside marsh (DP3 on Figure 30), was recognized for the high quality fen harboring the Baltimore checkerspot butterfly and rare plant species such as Kalm's lobelia and bog goldenrod. Possible breeding wetland species in the less-brushy wetland include sandhill crane, least bittern, and blue-winged teal (Chicago Wilderness 2011)."

Region 5 comprises the southern-most portion of the Spring Creek Valley Forest Preserve. This is considered the Headwaters, stretching from Penny Road to Higgins Road (Route 72). "Formerly a mix of oak woodland, oak savanna, prairie, sedge meadow and marsh, this 1,330-acre area includes the headwaters of Tributary B of Spring Creek. Vegetation now includes 50 acres of hay meadow and 160 acres of row crop fields leased to farmers and prairie restoration, as well as other communities in various stages of restoration." Within this region is 80 acres of mixed oak woodland known as Hidden Pond Woods (H1 on Figure 30), consisting of "bur, white, scarlet, swamp white and red oak along with shagbark and bitternut hickory, walnut and other natural species." Removal of invasives has been done here including "buckthorn and black locust, along with a reduction of numbers of ash, basswood, maple and others. The goal is the restoration of sustainable oak woodland. The Healy Road Savanna (H2 of Figure 30) consists of "about 50 acres of bur oak savanna and a slope with remnant bur, white and red oak woodland. Volunteers began in 2004 to restore this area (Chicago Wilderness 2011)."

Also within Region 5 is the Headwaters Prairie (H4 on Figure 30), a 500 acre area of which 140 acres have been undergoing restoration efforts. "Miscellaneous brush and dozens of tall cottonwoods were cut by contractors through a grant from the U.S. Fish and Wildlife Service to restore prairie and wetland habitat during the winter of 2007. Controlled burns in 2005 through 2007 have benefited about 60 acres. The work includes mowing small brush and removing invasive tree lines that have fragmented this grassland in many areas. Spring Creek Volunteers each year cut brush (and broadcast seed donated by Citizens for Conservation)." Headwaters Prairie South (H5 on Figure 30) is similar, but separated by dense brush to the northwest. "This area has remnant native grassland species including prairie dock." Beverly Lake Woods (H6 on Figure 30) includes 30 acres of once high-quality woods, mostly on steep slopes and featuring old bur and white oaks. Headwaters Grove (H7 on Figure 30) consists of 15 acres of old bur oaks "on a north facing gentle slope. The initial goal is to open up this grove sufficiently for oak reproduction and a healthy understory." Finally, the Headwaters Shrubland (H8 on Figure 30) consists of 50 acres of open shrubland. "The area now is mostly dense brush with just a few areas still open enough for breeding shrubland birds including the blue-winged warbler and willow flycatcher. Brush was removed from parts of this area in 2007 to re-establish some of the grassland component. Natural shrubs here include hazelnut, wild plum, sumac, dogwood, oak grubs and others (Chicago Wilderness 2011)."

Future Management

There are extensive plans for future ecological restoration and management within Spring Creek Valley Forest Preserve. Under the authority provided by Section 206 of the Water Resources Development Act of 1996, the U.S. Army Corps of Engineers plans to design and implement various large scale projects to restore aquatic ecosystems for fish and wildlife. The Corps is spending much of 2011 and 2012 identifying, prioritizing, and determining feasibility for projects within the preserve where drain tiles currently drain wetlands, riparian areas needing restoration, stream reaches needing morphological repair, and existing trails improvements. Initial findings suggest that drain tile removal and ditch filling to restore pre-European settlement wetlands as well as removal of invasive species in many riparian areas followed by reestablishment by natives will comprise the majority of the projects implemented over a proposed 5 year period beginning in late 2012.

The Corps specifically studied approximately 1,600 acres within the preserve thought to be tile drained and found 120,000 linear feet of 4-inch to 16-inch drain tile. One major wetland restoration site has already been identified and proposed within Region 2 management area SC1. Here, the Corps proposes to disable a large network of existing drain tiles and fill Tributary B which historically did not exist until it was excavated for farming. This project would potentially restore 300+ acres of wetland that has been tile drained since the 1930's.

<u>Helm Woods Forest Preserve</u>

The Forest Preserve District of Kane County (FPDKC) first acquired the 233 acre Helm Woods Forest Preserve in 1980. The preserve is situated in the far west central portion of the Spring Creek watershed within Kane County (Figure 29). Historically, the site was owned by the Helm family who settled Dundee Township in the late 1800s. The family farmed portions of the site while wooded areas were used for cattle grazing. Today, the preserve contains a variety of ecological communities including old field grassland concentrated on the west-central side of the preserve and mixture of dry-mesic woodland and northern flatwoods on the east and south portions of the preserve.

Flatwoods at Helm Woods Forest Preserve

More than half of Helm Woods is dedicated Illinois Nature Preserve containing an INAI site. The nature preserve includes 75 acres of high quality northern flatwoods and dry-mesic woodland communities with 80 acres of additional buffer. The heavy clay soils and slow drainage on the southern portion of the site supports the flatwoods ecosystem comprised of water tolerant trees such as swamp white oak and ash. Uncommon plants and shrubs like swamp sedge, hop sedge, bur sedge, crowfoot fox sedge, forked aster, eastern prairie fringed orchid, large-seed sedge, buttonbush, and pagoda dogwood are also found here. In addition, wood ducks and amphibians are known to breed in the unique conditions provided by flatwoods.

Dry-Mesic Woodland at Helm Woods

Average to high quality dry-mesic woodland generally surrounds the northern flatwoods and extends to the northeast portion of the site. This community is dominated by bur, white, black, and red oak in the canopy while the understory supports rare or uncommon species such as long leaved shinleaf, shooting star, wild geranium, and red trillium, Iowa crap, hazelnut, black current, and wild gooseberry.

The FPDKC is actively managing Helm Woods Forest Preserve via landscape-scale woodland burns, enlisted the help of staff and volunteers, and employing contractors to eliminate areas dominated by heavy buckthorn, box elder, and wild black cherry. Over the course of the past eight years, the FPDKC has also reintroduced 40 species of habitat-appropriate grasses and wildflowers.

Poplar Creek Forest Preserve

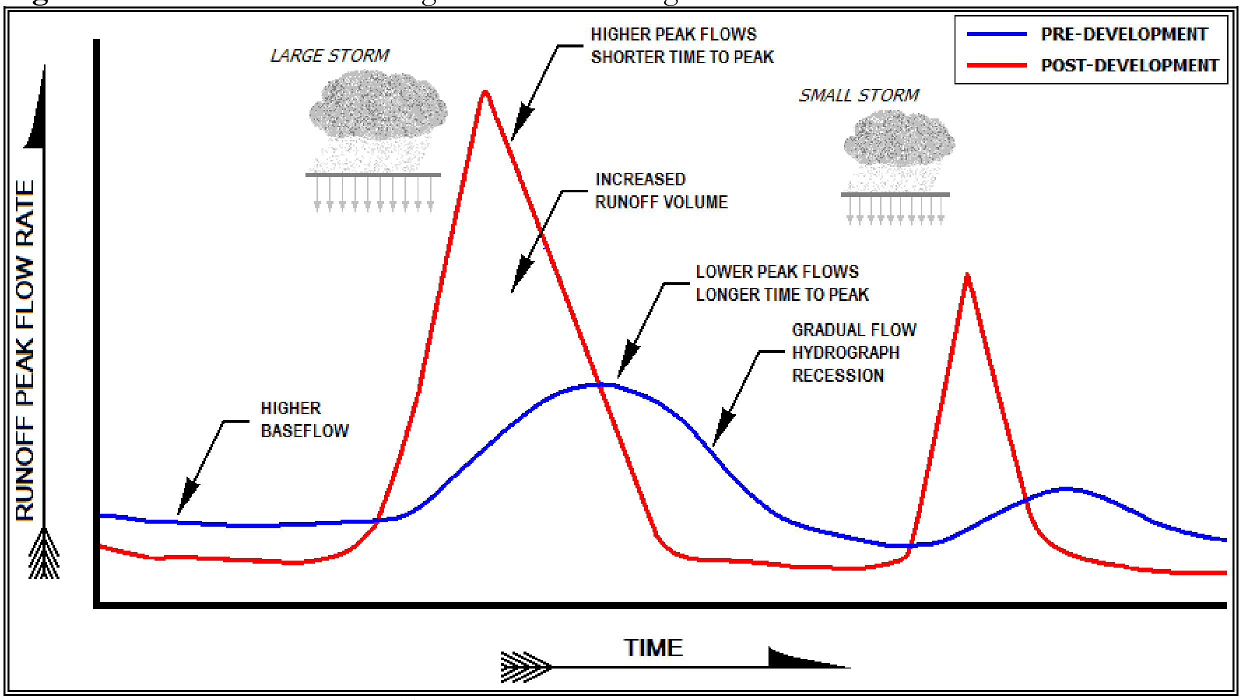
The Poplar Creek Forest Preserve is owned and managed by the Cook County Forest Preserve District. It is a large (4,200 acre) complex generally bound by Interstate 90 to the north, Route 58 to the east, W. Schaumburg Road and Bode Road to the south and the EJ&E Railroad to the west. However, only a small fraction of this preserve is located in the far southeast tip of the Spring Creek watershed (Figure 29) and is isolated from other open space in the watershed due to I90 and dense retail, commercial, and residential development to the north. The area within the watershed exhibits relatively flat topography and consists of varies ecological communities such as restored prairie, old field, marsh, and shrubland.

3.12 Watershed Drainage System

The pre-European settlement landscape in Spring Creek watershed "naturally managed" stormwater very differently than humans manage stormwater today. A relatively small percentage of the precipitation in a similar healthy watershed 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. 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, most small streams were identified as vegetated swales, wetlands, wet prairies, and swamps in the original land survey records of the U.S. General Land Office.

Land use, stream data, and wetland data collected in the Spring Creek watershed indicate that changes in hydrology have occurred since European settlement and continue to change as land is developed. Europeans drastically changed the land after 1830 by clearing trees, tilling soils, installing drain tiles, and excavating ditches. Residential and commercial development since the 1950's also altered the overland flow of surface water following rain events. The historic slow overland flows that promoted infiltration is changing to concentrated flows where water is rushed to receiving detention basins and streams. The result is increased runoff rates and volumes that increases streambank erosion, degrades stream habitat, and transports sediment and other pollutant loads. Figure 31 depicts the effects of streamflow and volume for hypothetical pre and post development conditions whereby runoff volume spikes drastically following rain events under developed conditions compared to pre-development. The low-density development patterns in this watershed have mitigated the patterns of development that surround the central portion of the watershed. As such, significant infiltration still occurs and provides significant water quality protection.

Figure 31. The effect of reduced groundwater recharge on streamflow.



Source: *'Controlling Urban Runoff'*, Schueler, T., 1987.

3.12.1 Spring Creek & Tributaries

During the spring of 2011, the "Project Team" completed an inventory of Spring Creek and its tributaries. Approximately 27.3 stream and tributary miles were assessed based on divisions into stream reaches (Figure 32). Stream reaches are segments having similar hydraulic, geomorphic, riparian cover, and adjacent land use characteristics. Methodology included walking the reaches, collecting data, taking photos, and noting in-stream, streambank, and riparian corridor conditions. Detailed notes were recorded related to potential Management Measure and their corresponding priority for eventual inclusion into the Action Plan section of this report. Results of the inventory and detailed summaries of each stream, including an overall stream reach summary table, can be found in Appendix B. Note: Additional information about stream reaches located within Spring Creek Valley Forest Preserve was obtained via communication with the Army Corps of Engineers-Chicago District who is currently assessing the feasibility to implement large scale water quality improvement projects within the preserve. Information was also provided from the FPDCC.

Spring Creek was divided into 15 distinct reaches flowing for approximately 13.4 linear miles on its journey north from the headwaters to the Fox River (Figure 32). The stream is mostly natural with wide buffers but is heavily overgrown with invasive shrubs, trees, and herbaceous vegetation along the riparian corridor. Mowing along the water's edge in the stream corridor is common in residential areas. Several reaches are at least moderately channelized but erosion is minimal in most areas.

Spring Creek originates within the relatively new "Woods of South Barrington" residential community in the southeast portion of the watershed and flows west then north through residential and agricultural land for 1.5 miles before entering Spring Creek Valley Forest Preserve where it flows north for over 7 miles and through 4 lakes/ponds including Penny Road Pond, Galvins Lake, Spring Lake, and Mud Lake. The next 2 mile reach of Spring Creek flows north of County Line Rd. through a large equestrian area before turning to the northwest through large lot residential areas for another 2 miles then small lot residential for another mile before entering the Fox River.

Naturally meandering section of Spring Creek

Ten tributary streams (Tributaries A-J) flow into Spring Creek and total 13.9 linear miles (Figure 32). Many of the tributaries exhibit at least moderate channelization while several tributary reaches are highly channelized. Unlike the main channel of Spring Creek, several tributaries have moderate erosion and all tributaries have poor quality riparian areas dominated by invasive species. Buckthorn is the dominant invasive species found throughout the tributary reaches in wooded areas, while reed canary grass dominates wetter areas. Maintained turf grass is also common in residential areas. Most riparian areas need maintenance via removal of problematic debris, removal of invasive species, and increased natural buffer in select areas. Three secondary drainage areas are also mapped that are not considered true stream channels and are not included in the stream inventory. They are located near the Riding Center west of Bateman Road, extending south from Tributary B, and north of Horizon Farms. The FPDCC identifies these three areas as contributing significant pollutants to SCVFP and Spring Lake Nature Preserve.

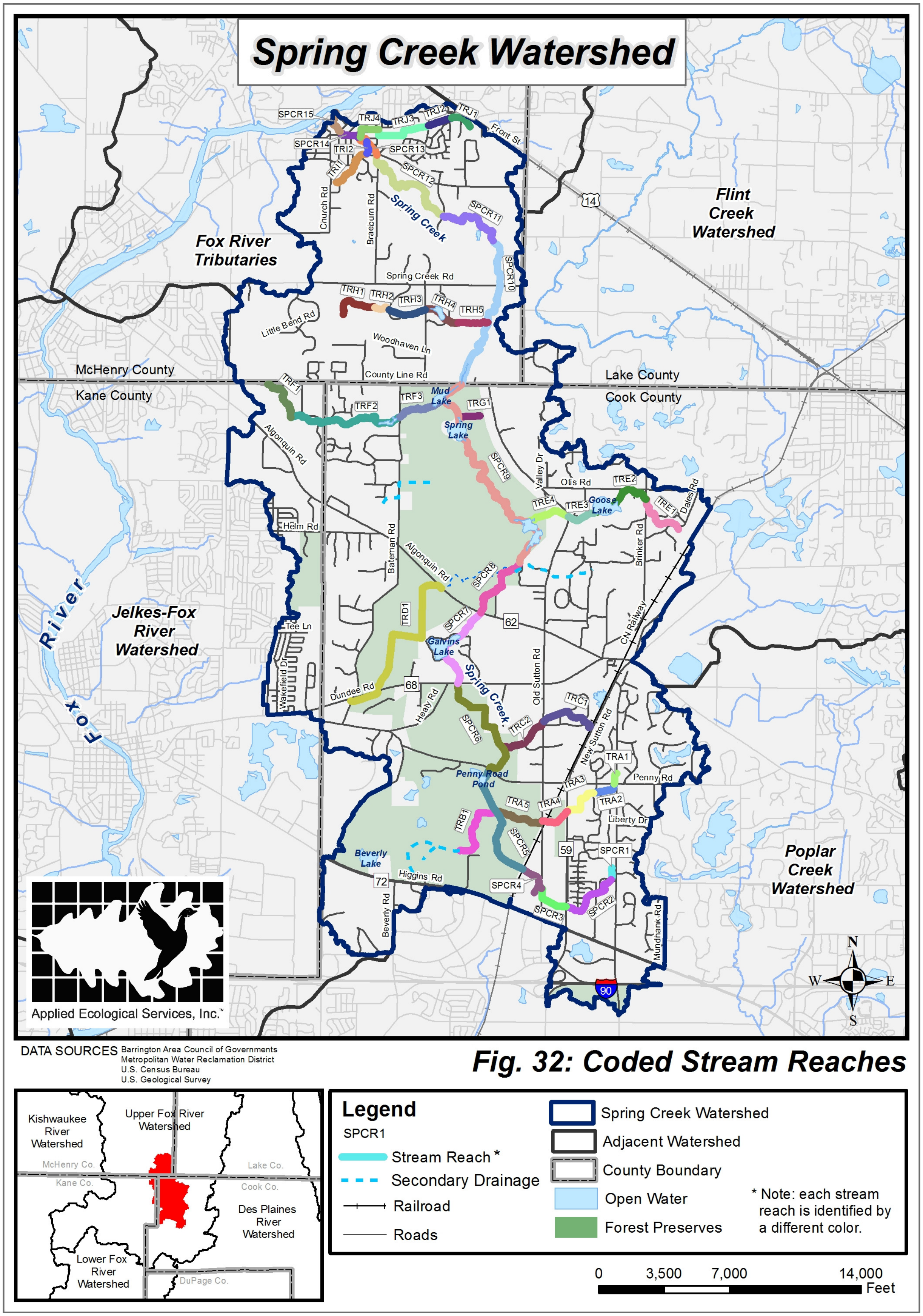


Fig. 32: Coded Stream Reaches

Degree of Channelization

Riffle-pool sequences are generally associated with naturally meandering streams and benefit the system by providing various habitats while aerating the water during low flow conditions. Channelized or ditched streams are often void of or have low quality riffles and pools. Spoils pile berms are also common along channelized streams and inhibit natural flooding into the adjacent floodplain.

Channelization along Spring Creek; Reach 10 (SPCR10)

The stream inventory reveals that over 40% of stream and tributary length is naturally meandering. However, more than 37% of the total stream & tributary length has been moderately channelized while 19% is highly channelized. Much of Spring Creek is moderately channelized in the southern half of the watershed and a large reach north of County Line Road. The most highly channelized reaches are located on Tributaries A, G, D, H, and J.

Channelized areas present many opportunities for projects such as artificial riffle and pool restoration, regrading or breaking of adjacent spoil piles for reconnection to floodplain, and in the case of Tributary D, filling a channel that was not present historically to rehydrate surrounding drained wetlands. Table 17 and Figure 33 summarize and depict the location and severity of channelized stream reaches in the watershed. The Action Plan addresses opportunities for improving many of these channelized reaches. Improvements will assist in improving water quality.

Table 17. Summary of stream and tributary channelization.

Stream or Tributary Name	Stream Length Assessed (ft)	None or Low Channelization (ft/%)		Moderate Channelization (ft/%)		High Channelization (ft/%)	
Spring Creek	71,003	33,417	47%	33,515	47%	4,070	6%
Tributary A	8,689	629	7%	4,419	51%	3,641	42%
Tributary B	3,903	0	0%	3,903	100%	0	0%
Tributary C	6,139	6,139	100%	0	0%	0	0%
Tributary D	10,313	0	0%	0	0%	10,313	100%
Tributary E	10,863	3,029	28%	7,835	72%	0	0%
Tributary F	12,823	12,823	100%	0	0%	0	0%
Tributary G	1,167	0	0%	0	0%	1,167	100%
Tributary H	9,069	4,157	46%	2,420	27%	2,491	27%
Tributary I	3,357	3,357	100%	0	0%	0	0%
Tributary J	7,155	0	0%	1,234	17%	5,921	83%
Totals	**144,481**	**63,511**	**44%**	**53,326**	**37%**	**27,603**	**19%**

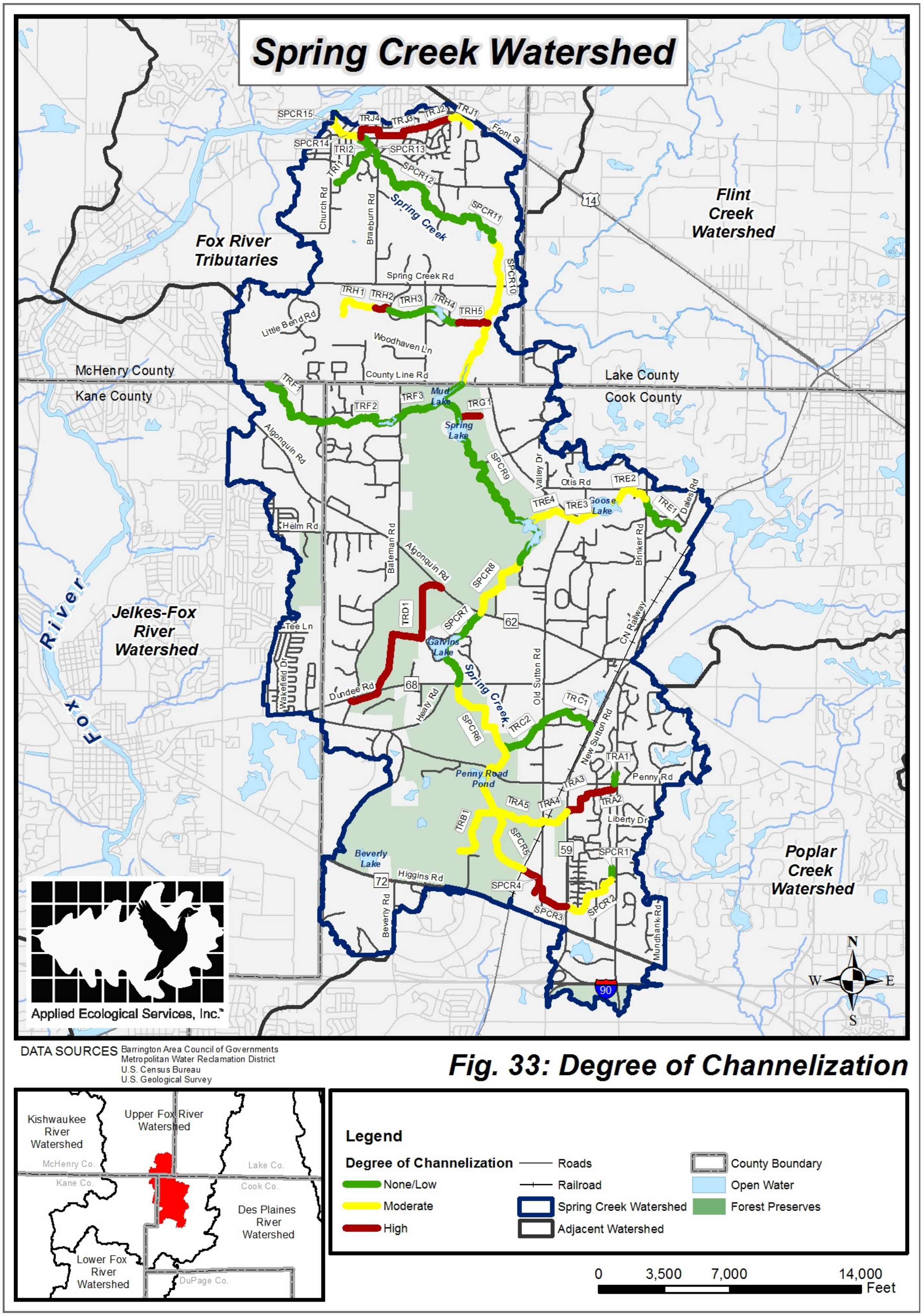


Fig. 33: Degree of Channelization

Streambank Erosion

Problematic streambank erosion generally results following an instability in water rate or volume, human alteration such as ditching, or change in streambank vegetation. Resulting sediment accumulation and transportation downstream can cause significant water quality problems. Streambank erosion is minimal in the watershed despite the number and degree of channelized streams reaches, significant changes in riparian vegetation, and increased water volume from development in the headwaters.

Highly eroded banks along Tributary H; Reach 2 (TRH2)

22% of the total stream and tributary length is moderately eroded while only 1% is highly eroded. Most of the moderate erosion is found at the headwaters of Spring Creek, Reach 9 within Spring Creek Valley Forest Preserve, and near the confluence with the Fox River. Other moderate erosion occurs along isolated reaches in Tributaries A, C, E, and H. Only one stream reach (TRH2) along Tributary H is severely eroding and in somewhat urgent need of stabilization. This reach is considered a “Critical Area”.

All moderately and highly eroded stream reaches provide excellent opportunities for streambank stabilization projects. The location and severity of streambank erosion in the watershed is summarized in Table 18 and depicted on Figure 34. The Action Plan addresses and prioritizes opportunities for reducing streambank erosion.

Table 18. Summary of stream and tributary bank erosion.

Stream or Tributary Name	Stream Length Assessed (ft)	None or Low Erosion (ft/%)		Moderate Erosion (ft/%)		High Erosion (ft/%)	
Spring Creek	71,003	51,297	72%	19,706	30%	0	0%
Tributary A	8,689	8,060	93%	629	7%	0	0%
Tributary B	3,903	3,903	100%	0	0%	0	0%
Tributary C	6,139	2,976	48%	3,162	52%	0	0%
Tributary D	10,313	10,313	100%	0	0%	0	0%
Tributary E	10,863	7,253	67%	3,610	33%	0	0%
Tributary F	12,823	12,823	100%	0	0%	0	0%
Tributary G	1,167	1,167	100%	0	0%	0	0%
Tributary H	9,069	3,743	41%	4,462	49%	863	10%
Tributary I	3,357	3,357	100%	0	0%	0	0%
Tributary J	7,155	7,155	100%	0	0%	0	0%
Totals	**144,481**	**112,047**	**78%**	**51,569**	**22%**	**863**	**1%**

Riparian Corridor Condition

Riparian corridors buffer streams and tributaries by filtering pollutants from runoff and during flood events. They also provide beneficial wildlife habitat and extend or connect green infrastructure. Land use within approximately 100 feet of either side of each stream or tributary reach was assessed during the stream inventory by summarizing the percentage of land falling under general categories and by noting the type of vegetation growing in these areas.

Typical riparian corridor (Reach SPCR11) dominated by reed canary grass and invasive shrubs

Only 3% of the riparian corridor in the Spring Creek watershed is in good condition. These areas are found at the headwaters of Spring Creek and Tributary A where recent residential development included restoration of prairie and wetland habitat. The remaining 97% of the riparian corridor is in poor condition primarily because it is dominated by invasive and/or non-native species including reed canary grass and common buckthorn in areas that were historically marsh, wet prairie, or sedge meadow. Not only do these areas function differently after becoming dominated by invasives, they also support fewer insect, bird, and other wildlife species. The LCFPD and Corps of Engineers are well aware of the invasive species problems along Spring Creek within Spring Creek Valley Forest Preserve and plans are underway to implement large scale restoration projects.

The condition of riparian buffers along Spring Creek and Tributaries is summarized in Table 19 and depicted on Figure 34. The Action Plan section of this report lists and prioritizes opportunities for improving riparian areas.

Table 19. Summary of stream and tributary riparian area condition.

Stream or Tributary Name	Stream Length Assessed (ft)	Good Condition (ft/%)		Poor Condition (ft/%)	
Spring Creek	71,003	4,243	6%	66,760	94%
Tributary A	8,689	629	7%	8,086	93%
Tributary B	3,903	0	0%	3,903	100%
Tributary C	6,139	0	0%	6,139	100%
Tributary D	10,313	0	0%	10,313	100%
Tributary E	10,863	0	0%	10,863	100%
Tributary F	12,823	0	0%	12,823	100%
Tributary G	1,167	0	0%	1,167	100%
Tributary H	9,069	0	0%	9,096	100%
Tributary I	3,357	0	0%	3,357	100%
Tributary J	7,155	0	0%	7,155	100%
Totals	**144,481**	**4,872**	**3%**	**139,662**	**97%**

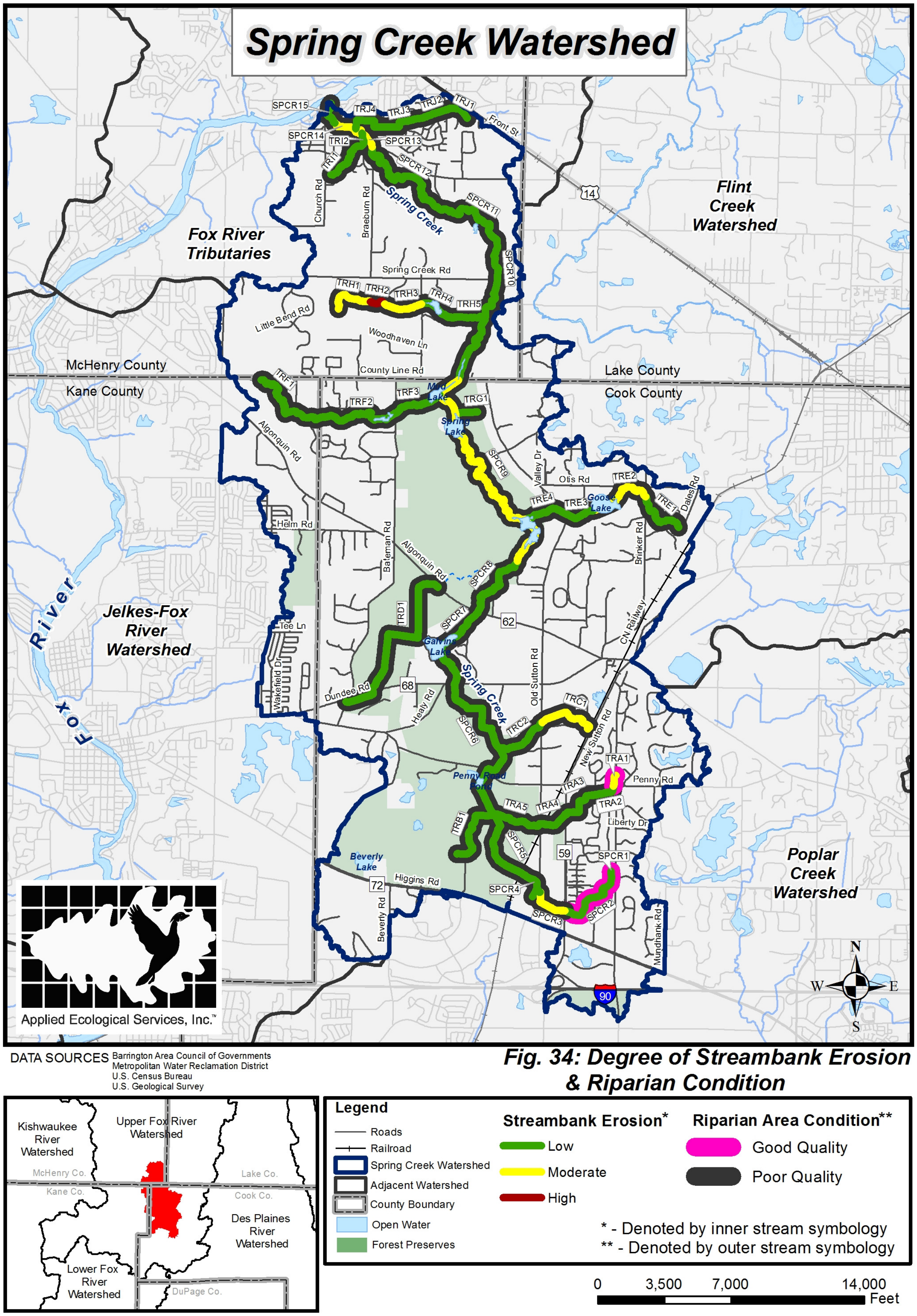


Fig. 34: Degree of Streambank Erosion & Riparian Condition

3.12.2 Lakes, Ponds, & Detention Basins

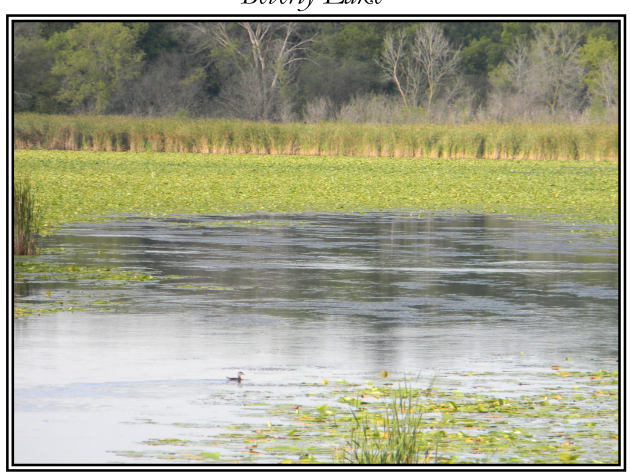
The "Project Team" completed a basic assessment of 7 lakes, 48 ponds, and 82 detention basins in spring 2011 (Figure 35). A lake differs from a pond based on size; a lake is at least 5 acres. Wet bottom detention basins differ from lakes and ponds because they are generally constructed with the purpose of detaining water during rain events to prevent flooding elsewhere. Detention basins are usually found around development and are required by local ordinances. Assessment methodology included a visit to each site and collection of data related to existing site conditions. Detailed notes were also recorded related to potential Management Measures and their corresponding priority for eventual inclusion into the Action Plan section of this report. Results of the inventory and detailed summaries of each lake, pond, or detention basin can be found in Appendix B.

Lakes
Of the 7 main lakes within the Spring Creek watershed, only one has remained unmanipulated over time. Goose Lake is a glacial remnant containing a natural cranberry bog in its southwest corner. Beverly Lake and Penny Road Pond were both dug as gravel pits during the First World War. Mud Lake and Spring Lake are the remains of a larger glacial lake apparent on the earliest survey plats and are now part of Spring Lake Nature Preserve. The lake currently located at Beverly Quarry is being filled under permits with clean fill but a new gravel pit is being excavated to the west that will eventually become a 90 acre pond for use by Max McGraw Wildlife Area in about 20 years. Galvin's Lake was constructed about 75 years ago by placing a dam online with Spring Creek.

Goose Lake

Beverly Lake

Penny Road Pond



Mud Lake

Ponds

The vast majority of the ponds observed are small, human-made, and generally constructed in areas that were once wetlands or low lying areas. Most are also located on private property with generally only one of few owners. Many of the horse farms have ponds with mowed lawn down to the shoreline and little to no buffer zones. Also, ponds that are in highly visible areas near homes or estate entrances tend to have manicured shorelines. Typically ponds in parks or residential areas have mowed lawn in sections of the shoreline and also wooded buffer zones. The wooded buffer zones often have native oak trees but are mixed with invasive shrubs and other non-native or invasive trees. Nearly all of the ponds in the watershed require larger and better quality buffers or maintenance of existing buffers in order to improve water quality. Project recommendations are included in the Action Plan section of this report.

Typical pond in Spring Creek watershed

Detention Basins

The natural drainage system in the Spring Creek watershed is changing from farmland driven tiles, channels, and ditches to one that is now dominated by residential and commercial/retail, and transportation land uses. Most early development was constructed without detention basins. In these areas stormwater is directed to streams and lakes as quickly as possible. More recently land planners, ecologist, and engineers have realized the benefits of storing stormwater runoff in detention basins that are designed to capture stromwater runoff from a surrounding development and release the water slowly over a given amount of time. Detention basins can also provide excellent wildlife habitat and improve water quality if designed with the proper slopes and water depths then planted with native vegetation.

Detention basins are most often constructed in low areas relative to a development and contain stormsewer networks that drain into and out of them. Restrictors placed on the outlet structure controls the rate at which water is released. These basins can be constructed to be wet bottom, wetland bottom, or dry bottom. An inventory of the Spring Creek watershed conducted in spring 2011 found 67 wet bottom, 5 wetland bottom, and 10 dry bottom basins (Figure 35). The overall condition of detention basins covers the range of shoreline features from heavy amounts of rip rap to highly manicured mowed turf to fully naturalized vegetation.

Wet and wetland bottom basins typically hold water that is controlled by the elevation of the outlet pipe. These basins are usually greater than 3 feet deep and do not have emergent vegetation throughout whereas wetland bottom detentions are shallow enough to be dominated by emergent plants.

Many older wet bottom basins are lined with turf grass and in many cases have rip rap near the toe of the slope. These basins were designed with aesthetics in mind and not necessarily the potential water quality and habitat benefits. Because of this, most adjacent residents and HOAs will likely disapprove of installing water quality retrofits such as native buffers unless they can be designed to look formal. Most basins of this type are associated with older development in the southeast portion of the watershed east of Bartlett Road. Potential retrofit opportunities for older basins are included in the Action Plan section of this report.


Typical older wet bottom detention found in the east portion of the watershed

The majority of the newly constructed wet bottom detention basins can be found on the southeast portions of the watershed between Bartlett Road and New Sutton Road in the "Woods of South Barrington" residential community. Most of these have naturalized shorelines and are currently being managed so there are relatively few problems. However, most of these basins are small, scattered throughout the development, and could have been designed and constructed to look even more natural and be more effective at treating for water quality and providing wildlife habitat. A good example of this is the naturalized detention area behind the Arboretum shopping center. It will be extremely important for HOA's in this area to implement appropriate long term management by a qualified ecological contractor to maintain the existing condition.


Typical naturalized wet bottom detention basin in new residential developments

The majority of the dry bottom basins in the watershed are associated with large lot residential development in the northern and eastern portions of the watershed. All are manicured turf grass which does little to improve water quality or promote infiltration to replenish groundwater. This is because dry bottom basins planted to turf grass hold water for short periods following rain events but quickly drain and dry without the help of deep rooted vegetation. Fortunately, most dry bottom basins are relatively easy to "naturalize" with native plantings. Naturalized dry bottom basins also provide excellent wildlife habitat and can increase green infrastructure networks.


Dry bottom basin at Barbara Rose Elementary

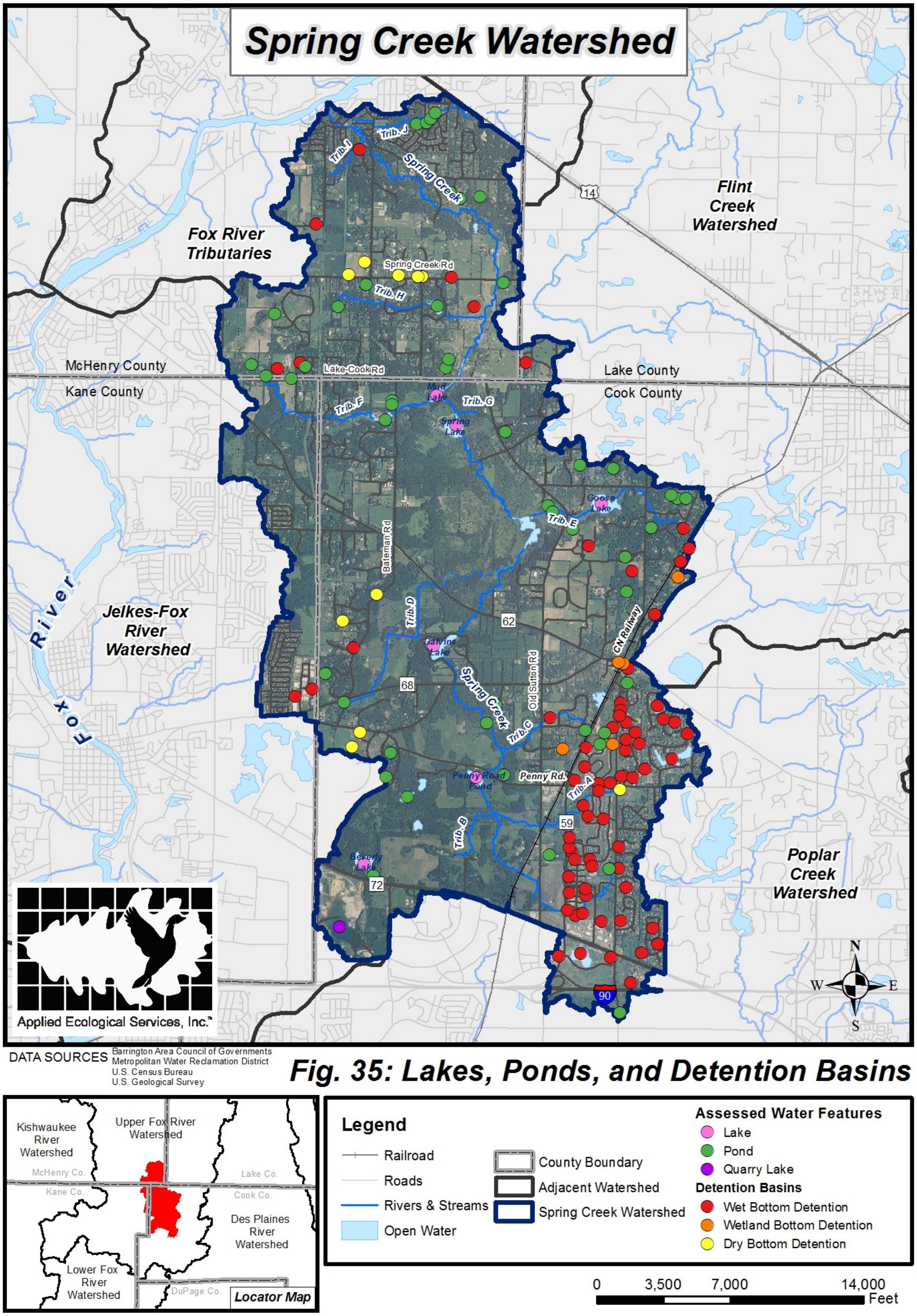


Fig. 35: Lakes, Ponds, and Detention Basins

Naturalized Detention Basin Design & Maintenance Recommendations

Future detention basin designs within the watershed should be naturalized basins that serve multiple functions including appropriate water storage, water quality improvement, natural aesthetics, and wildlife habitat. Native vegetation planted in a properly designed basin also provides excellent water quality benefits through nutrient uptake, filtering, and by gravitational settling. Up to 75% of Total Suspended Solids, 45% of Total Phosphorus, 30% of Total Nitrogen, 50% of heavy metals, and 70% of Fecal Coliform can be removed if designed properly (City of Wichita/Sedgwick County, 2011). Recommendations below and Figure 36 include schematics and seed/plant lists for the recommended design of naturalized detention basins. Note: all requirements of local and county ordinances is also required.

Properly designed/planted wet bottom naturalized detention at Arboretum Shopping Center

Location & Siting Recommendations

- Naturalized detention basins should be restricted to natural depressions, adjacent to existing USACE regulated wetlands, and adjacent to other existing natural green infrastructure in an attempt to aesthetically fit and blend into the landscape. Use of existing isolated wetlands for detention should be evaluated on a case by case basis.
- Basins should not be constructed in any average to high quality ecological community.
- Outlets from detentions should not enter sensitive ecological areas.

General Design Recommendations

- Large naturalized detentions designed for stormwater storage, water quality treatment, wildlife usage, and passive recreation across multiple development parcels should be constructed rather than designing and constructing multiple smaller detentions for each individual development.
- Side slopes should be no steeper than 4H:1V, at least 25 feet wide, planted to native mesic prairie, and stabilized with erosion control blanket. Native oaks (*Quercus sp.*) should be the only woody species planted because of maintenance implications.
- A 5-foot minimum wide shelf planted to native wet prairie and stabilized with erosion control blanket should be constructed above the normal water level. This area should be designed to inundate after every 0.5 inch rain event or greater.
- A 10-foot minimum wide shelf planted with native emergent plugs should extend from the normal water level to 2 feet below normal water level.
- Permanent pools that do not contain emergent vegetation should be at least 4 feet deep.
- Irregular islands and peninsulas should be constructed 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' deep forebay should be constructed at the inlet to capture sediment; a 4-6' deep micropool should be constructed at the outlet to prevent clogging.

Short Term (3 Years) Establishment Recommendations

The developer in new developments should be responsible for implementing short term management of detention basins and other natural areas to meet performance standards. Generally speaking, three years of management is needed to establish native plant communities. Measures needed include mowing during the first two growing seasons following seeding to reduce annual and biennial weeds. Spot herbiciding is also required to eliminate problematic non-native/invasive species such as thistle, reed canary grass, common reed, cattail, purple loosestrife, and emerging cottonwood, willow, buckthorn, and box elder saplings. Table 20 includes a three year schedule appropriate to establish native plantings around naturalized detention basins.

Table 20. Three year maintenance schedule for naturalized detention basins.

Year 1 Maintenance
Mow mesic prairie buffer and wet prairie shelf to a height of 6-12 inches when dry in late June, August, & September.
Spot herbicide problematic non-native/invasive species throughout site in early June and again in August/September. Specifically target thistle, reed canary grass, common reed, purple loosestrife, cattail, and emerging woody samplings such as willow, cottonwood, buckthorn, and box elder.
Year 2 Maintenance
Mow mesic prairie buffer and wet prairie shelf when dry to a height of 12 inches in late June and early August.
Spot herbicide problematic non-native/invasive species throughout site in early June and again in mid August. Specifically target thistle, reed canary grass, common reed, cattail, purple loosestrife, and emerging woody samplings such as willow, cottonwood, buckthorn, and box elder.
Plant additional emergent plugs if needed and reseed failed areas in fall.
Year 3 Maintenance
Spot herbicide problematic non-native/invasive species throughout site in early June and again in mid August. Specifically target thistle, reed canary grass, common reed, and emerging woody samplings such as willow, cottonwood, buckthorn, and box elder.

Long Term (3 Years +) Maintenance Recommendations

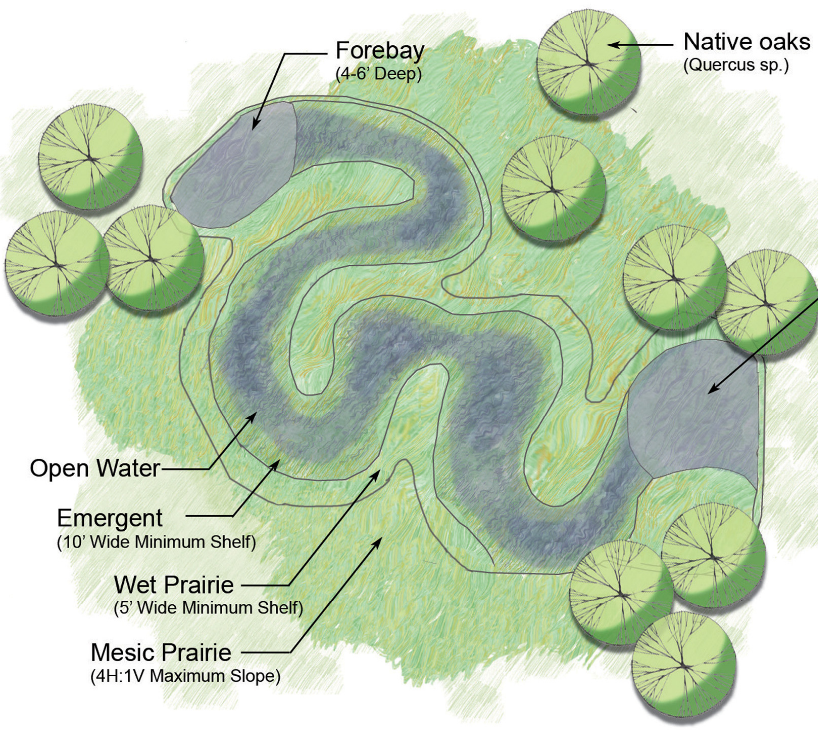
Currently, long term management of most detention basins and other areas associated with development is the responsibility of the homeowner's association (HOA) or business association. Often, these groups lack the knowledge and funding to implement long term management of natural areas resulting in decline of these areas over time. Future developers should be encouraged to donate naturalized detentions and other natural areas to a public agency or conservation organization for long term management who receive funding for management via a Special Service Area (SSA) tax or other means such as a watershed protection fee. Table 21 includes a cyclical long term schedule appropriate to maintain native vegetation around detention basins and other natural areas.

Table 21. Three year cyclical long term maintenance schedule for naturalized detention basins.

Year 1 of 3 Year Maintenance Cycle
Conduct controlled burn in early spring. Mow to height of 12 inches in November if burning is not allowed.
Spot herbicide problematic non-native/invasive species throughout site in mid August. Specifically target thistle, reed canary grass, common reed, cattail, and emerging woody samplings such as willow, cottonwood, buckthorn, and box elder.
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, cattail, and emerging woody samplings such as willow, cottonwood, buckthorn, and box elder.
Mow mesic prairie buffer and wet prairie shelf when dry in November.
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 samplings. Cutting & herbiciding stumps of some woody samplings may also be needed.

Figure 36. Naturalized Detention Basin Design Recommendations.

Naturalized Detention Basin Design Recommendations



MESIC PRAIRIE

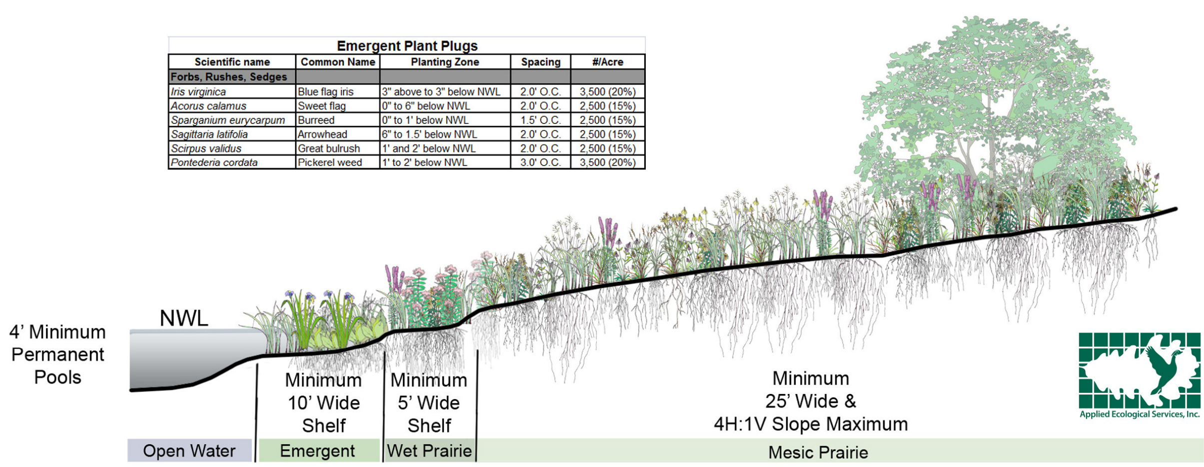
Scientific name	Common Name	Oz./Acre	lbs./Acre
Grasses:			
Andropogon gerardii	Big bluestem	12.8	
Andropogon scoparius	Little bluestem	85.1	
Bouteloua curtipendula	Side oats gramma	20.3	
Elymus canadensis	Canada wild rye	24.6	
Sorgastrum nutans	Indian grass	12.3	
Total Grasses		**155.1**	**9.7**
Forbs:			
Aster laevis	Smooth blue aster	1.5	
Asclepias tuberosa	Butterfly milkweed	7.3	
Coreopsis lanceolata	Sand coreopsis	2.2	
Echinacea pallida	Pale purple coneflower	16.8	
Eryngium yuccifolium	Rattlesnake master	9.3	
Liatris pycnostachya	Prairie blazing star	7.9	
Monarda fistulosa	Wild bergamot	0.4	
Penstemon digitalis	Foxglove Beard tongue	0.2	
Petalostemum purpureum	Purple prairie clover	3.5	
Ratibida pinnata	Yellow coneflower	1.4	
Rudbeckia hirta	Black eyed Susan	0.9	
Silphium integrifolium	Rosinweed	4.4	
Solidago rigida	Stiff goldenrod	1.5	
Zizia aurea	Golden Alexanders	3.2	
Total Forbs		**60.3**	**3.8**
Total Grasses and Forbs		**215.4**	**13.5**
Temporary Cover Crop:			
Avena sativa	Common oats	**320.0**	**20.0**

WET PRAIRIE

Scientific name	Common Name	Oz./Acre	lbs./Acre
Grasses, Sedges, Rushes:			
Carex scoparia	Pointed broom sedge	1.6	
Carex vulpinoidea	Brown fox sedge	1.0	
Carex comosa	Bristly sedge	0.9	
Juncus dudleyi	Dudley's rush	0.1	
Juncus torreyi	Torrey's rush	0.1	
Leersia oryzoides	Rice cut grass	2.8	
Panicum virgatum	Switch grass	27.7	
Scirpus atrovirens	Dark green rush	0.7	
Total Grasses		**34.8**	**2.2**
Forbs:			
Asclepias incarnata	Swamp milkweed	17.3	
Bidens cernua	Swamp bur marigold	3.6	
Eryngium yuccifolium	Rattlesnake master	10.5	
Helenium autumnale	Sneezeweed	0.7	
Liatris spicata	Marsh blazing star	14.3	
Lobelia cardinalis	Cardinal flower	0.3	
Lobelia siphilitica	Great blue lobelia	0.3	
Physostegia virginiana	False dragonhead	3.1	
Pycnanthemum virginianum	Common mountain mint	0.2	
Rudbeckia subtomentosa	Sweet black-eyed Susan	2.8	
Solidago riddellii	Riddell's goldenrod	1.4	
Zizia aurea	Golden Alexanders	7.1	
Total Forbs		**61.6**	**3.8**
Total Grasses and Forbs		**96.4**	**6.0**
Temporary Cover Crop:			
Elymus virginicus	Virginia wild rye	**80.0**	**5.0**

Emergent Plant Plugs

Scientific name	Common Name	Planting Zone	Spacing	#/Acre
Forbs, Rushes, Sedges				
Iris virginica	Blue flag iris	3" above to 3" below NWL	2.0' O.C.	3,500 (20%)
Acorus calamus	Sweet flag	0" to 6" below NWL	2.0' O.C.	2,500 (15%)
Sparganium eurycarpum	Burreed	0" to 1' below NWL	1.5' O.C.	2,500 (15%)
Sagittaria latifolia	Arrowhead	6" to 1.5' below NWL	2.0' O.C.	2,500 (15%)
Scirpus validus	Great bulrush	1' and 2' below NWL	2.0' O.C.	2,500 (15%)
Pontederia cordata	Pickerel weed	1' to 2' below NWL	3.0' O.C.	3,500 (20%)



3.12.3 Wetlands & Potential Wetland Restoration Sites

Most of the wetlands in the Spring Creek watershed were intact until the late 1830's when European settlers began to alter significant portions of the watershed's natural hydrology and wetland processes. Where it was feasible, wet areas were drained, streams channelized, and savanna and prairie cleared in order to farm the rich soils. There were approximately 4,007 acres of wetlands in the watershed prior to European settlement based on hydric soils data provided by the McHenry, Lake, Kane, and Cook County Natural Resource Conservation Services (NRCS). According to existing wetland inventories, 1,791 acres or 45% of the pre-European settlement wetlands remain.

An inventory of many of the wetlands in the Spring Creek watershed was conducted by the "Project Team" in spring 2011 (Appendix B). In general, the wetlands in the watershed are neglected, tucked behind walls of invasive brush or cattails, poorly buffered, and need invasive and/or non-native species removal and control. Most contain heavy infestations of reed canary grass and cattails. Often there is some native vegetation but in most cases it is low quality and outcompeted by invasives. In areas where development is or has occurred wetlands are surrounded by silt fence; much is in need of repair and other fencings needs to be removed because development is no longer occurring in the vicinity. Many of the wetlands contain dead trees, standing and fallen, likely due to altered hydrologic conditions. Some of the wetlands were excavated into ponds many years ago and are now either overgrown or surrounded by manicured turf.

Wetland area within Spring Lake Nature Preserve

Functional wetlands do more for water quality improvement and flood reduction than any other natural resource. 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 Spring Creek watershed area from several government agencies. Advanced wetland inventories and identification studies (ADID) are available for Lake, Kane, 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. Note: no wetlands are present in the Lake County portion of the watershed.

McHenry and Kane County ADID Wetland Inventories

The McHenry County ADID wetland inventory (NIPC 1998) was developed in 1998. The methodology used builds on methods used in Lake County as well as other documented methods. The Kane County ADID wetland inventory (NIPC 2004) was completed in 2004 and builds on methods used in both Lake and McHenry Counties. The ADID studies are designed to do two things: 1) identify the values of individual wetlands and 2) identify wetlands of such high value that they merit special consideration for protection.

Protection of ADID wetlands is provided in McHenry and Kane Counties under existing Watershed Development Ordinances and the U.S. Army Corps of Engineers (USACE) via section 404 of the Clean Water Act. The USACE will usually require an Individual Permit (IP) for modifications to ADID wetlands. ADID wetlands are generally considered unmitigatable. In rare cases where mitigation is allowed, as much as a 5:1 mitigation ratio is required. Additionally, ADID wetlands located within developed areas require a 100-foot buffer to aid in protection.

Methods for conducting the ADID wetland inventories include evaluation of USDA/Soil Conservation Service wetland inventory maps, National Wetland Inventory (NWI) maps, soil surveys, and low altitude aerial imagery. Site inspections also verify the quality of wetlands. Agencies involved include the Northeast Illinois Planning Commission (NIPC now CMAP), Kane County Department of Environmental Management, U.S. Environmental Protection Agency (USEPA), U.S. Fish & Wildlife Service (USFWS), U.S.D.A. Natural Resources Conservation Service (NRCS), and the U.S. Army Corps of Engineers (USACE). Following evaluation, wetlands were categorized based on function; 1) High Habitat Value, 2) High Functional Value, and 3) Other Wetlands.

Sixty two (62) wetlands were identified in the McHenry County portion of the Spring Creek watershed, 22 wetlands in the Kane County portion of the watershed, and 128 wetlands in Cook County for a total of 212 individual wetlands (Figure 37). Of these, 5 ADID wetlands are found in McHenry County and 7 in Kane County. Data for each ADID wetland is summarized in Table 22.

Table 22. McHenry & Kane Counties ADID wetlands and attributes.

ADID ID #	Acres	ADID Attributes
McHenry County		
L333	14.8	**High Quality Habitat**: floodplain forest & marsh
L184	21.3	**High Quality Functional Value:** sediment retention, nutrient removal, stormwater storage
L207	141.4	**High Quality Habitat**: fen/sedge meadow
L299	42.7	**High Quality Functional Value:** sediment retention, nutrient removal, stormwater storage
L315	27.9	**High Quality Functional Value:** sediment retention, nutrient removal, stormwater storage
Kane County		
631	10.1	**High Quality Functional Value:** sediment retention
641	27.1	**High Quality Habitat**: fen & sedge meadow
673	3.4	**High Quality Habitat**: northern flatwoods, T&E species
676, 688, 690	11.3, 1.3, 11.1	**High Quality Habitat**: northern flatwoods within Helm Woods Nature Preserve
699	4.2	**High Quality Habitat**: mesic forest within Helm Woods Nature Preserve

Source: McHenry and Kane County ADID Wetland Inventories

National Wetland Inventory (NWI)

The USFWS is responsible for developing National Wetland Inventory (NWI) maps. By 2001, the USFWS inventoried and produced wetland maps for more than 90 percent of the lower 48 states including all of Illinois. The maps are prepared from the analysis of high altitude imagery, vegetation, visible hydrology, and geography. Onsite wetland inspections and delineations are not part of the inventory. Also, specific wetland habitats classifications are not included in the inventory because of the limitations of aerial reconnaissance. In general, the NWI maps are not as detailed or refined as the McHenry and Kane County wetland inventories. NWI wetland data for Cook County was used in this report because Cook County does not currently have its own wetland inventory.

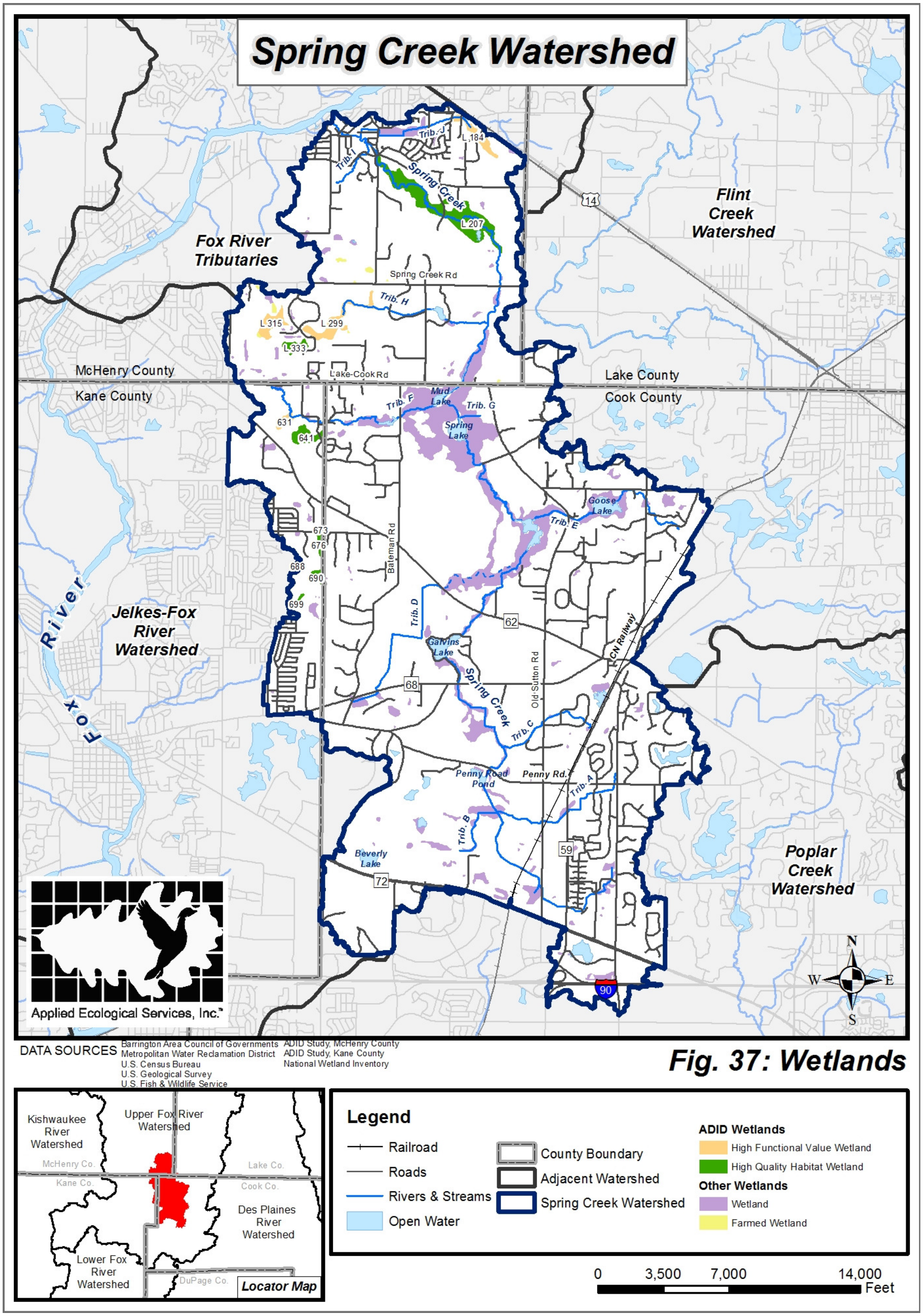


Fig. 37: Wetlands

Potential Wetland Restoration Sites
Wetland restoration projects have many positive impacts within a watershed. They are beneficial in restoring basic environmental functions that historic wetlands once served such as reducing flood volumes and rates, increasing biodiversity, and improving water quality conditions. Wetland restoration projects can also be completed as part of a Wetland Mitigation Bank where developers are able to buy wetland credits for wetland impacts occurring elsewhere in the watershed. Isolated wetland preservation is addressed by current McHenry, Lake, and Kane County Watershed Development Ordinances. The U.S. Army Corps of Engineers (USACE) regulates navigable waterways and connected wetlands. These ordinances and regulations allow only minimal impacts to wetlands. However, unavoidable larger impacts require mitigation to create or restore new wetlands. This is where Wetland Mitigation Banks become beneficial.

Potential wetland restoration sites were identified using a Geographic Information Systems (GIS) exercise and specific criteria determined to be essential for restoration of a functional and beneficial wetland. The criteria used to identify these potential sites is as follows:

- Site with at least 5 acres of drained hydric soils located on an open or partially open parcel.

The initial analysis resulted in 59 sites meeting the above criteria. After careful review of each site using 2010 aerial photography, open space inventory results, and existing (2011) land use, 29 of the original 59 sites or portions of these sites were determined to be potentially feasible or have some limited feasibility (Table 23; Figure 38). The majority of the larger potentially feasible sites are located on either private agricultural land, within public forest preserves, or on land currently under equestrian use. Smaller potentially feasible sites and sites with limited feasibility are generally associated with large lot residential areas, small agricultural fields, and forest preserves. Overall, the analysis resulted in 21 "Potentially Feasible" sites, and 8 "Limited Feasibility" sites. Note: A feasibility study beyond the scope of this project will need to be completed prior to the planning and implementation of any potential wetland restoration site.

Potential wetland restoration site #'s 1, 2, 14, 15, and 28 are worth discussing in more detail because of location, size, potential to remediate watershed problems, or potential as Wetland Mitigation Banks. Site #'s 7, 8, 9, 13, 15, 16, and 29 are also important because they are located within SCVFP and are currently being investigated by the USACE.

- Potential site #1 is a 37.9 acre area located at the headwaters of Tributary H to Spring Creek on existing agricultural land. The site is also located in a Subwatershed Management Unit (SMU) that is expected to see residential growth in the future on adjacent agricultural areas and the Longmeadow Parkway Road extension. This potential site could serve as wetland mitigation bank for wetland impacts resulting in the road extension.

Potential wetland restoration site #1 located in northwest portion of watershed.

- Potential site #2 is another large site (124 acres) located almost entirely within an existing equestrian area that was heavily farmed and likely tile drained in the late 1930s. It also borders a large stretch of Spring Creek's main stem that was partially channelized in the past. Restoration of this large complex and reconnection of Spring Creek to the floodplain would greatly benefit the watershed.

- Potential site #14 is located in the southeast corner of the watershed and surrounds a section of the headwaters of Spring Creek. Restoration of this 52.5 acre wetland could prove extremely beneficial in capturing increased stormwater runoff/volume and pollutants from recent dense commercial, retail, and new residential development upstream. This potential site is also located in a Subwatershed Management Unit (SMU) that is highly impacted by impervious cover and that is expected to see an additional 8% increase in impervious cover once built out.

Potential wetland restoration site # 14

- Potential site #15 is located within Spring Creek Valley Forest Preserve along Tributary B to Spring Creek. This 44.8 acre area was previous farmed and contains various drain tiles. Tributary B was created to help drain the area. The FPDCC has identified corporate areas including the Sears Center, Prairie Stone, and IDOT holding along Route 72 as "Critical" pollutant contributors to the headwater areas of Tributary B. Restoration of this wetland would improve wildlife habitat and water quality function at the headwaters of Tributary B. Note: The U.S. Army Corps of Engineers-Chicago District is currently working with FPDCC to design and implement this wetland restoration project.

- Potential site #28 is located within Spring Creek Valley Forest Preserve south of Route 62 and forms the headwaters of Tributary D to Spring Creek. This large (334.6 acre) potential wetland restoration site was heavily farmed and tile drained by the late 1930s. It borders a large portion of Tributary D which is highly channelized. Restoration of this wetland complex would provide beneficial habitat and improve water quality function. (Note: USACE-Chicago District is working with Cook County Forest Preserve District to prioritize water quality improvement projects within the preserve. Drain tiles in this area are already plugged to test responding hydrology prior to restoring. If selected, full wetland restoration would begin in late 2012.)

- Potential site #'s 7, 8, 9, 13, 15, 16, & 29 are located throughout Spring Creek Valley Forest Preserve and total 116 acres of potential wetland restoration in areas that were historically farmed. Restoration of these wetland complexes would primarily beneficial wildlife but also improve water quality and increase flood storage. Note: USACE-Chicago District is working with Cook County Forest Preserve District to prioritize water quality improvement projects within the preserve. Drain tiles in these areas are already plugged to test responding hydrology prior to restoring. If selected, full wetland restoration would begin in late 2012.

Table 23. Potential Wetland Restoration Sites.

ID #	Area (Acres)	Feasibility	Existing Condition
1	37.9	Potentially Feasible	Located primarily on private agricultural land; south and east portions are on residential land and not feasible. Potential as mitigation bank site.
2	124.0	Potentially Feasible	Located almost entirely on private equestrian (pasture) land use. Note: Spring Creek is highly channelized within this area.
3	7	Limited Feasibility	Located on private residential lots with connecting excavated ponds.
4	6.9	Potentially Feasible	West portion located primarily on private agricultural Land; east portion on private residential land.
5	8.1	Potentially Feasible	West end located in SCVFP; east end abuts existing wetland on private agricultural field.
6	5	Potentially Feasible	Located partially within wooded area on west end and public park on east end.
7	9.7	Potentially Feasible	Located within SCVFP in previous agricultural area.
8	10	Potentially Feasible	Isolated area located within SCVFP; site visit is required to confirm is wetland is already present.
9	15	Potentially Feasible	Located within SCVFP; site is located in previously farmed area.
10	7.2	Potentially Feasible	Isolated area located on existing agricultural land.
11	5.7	Limited Feasibility	Primarily located on private tree farm/agricultural.
12	14.9	Limited Feasibility	Located in open private pasture/agricultural residential area.
13	7.2	Potentially Feasible	Located within SCVFP in previous tree farm/agricultural area.
14	52.5	Potentially Feasible	Located primarily on agricultural land. North portion located in SCVFP. Potential to store/treat stormwater from development upstream.
15	44.8	Potentially Feasible	Located within SCVFP on previously farmed area at headwaters of Tributary B.
16	11.4	Potentially Feasible	Located within SCVFP on previously farmed area.
17	6.3	Limited Feasibility	Located primarily on private tree farm; south portion in new development.
18	13.7	Limited Feasibility	Located on private residential lots with connecting excavated ponds.
19	14.9	Potentially Feasible	Located on agricultural land but split by Old Sutton Road.
20	6.4	Limited Feasibility	Located in equestrian land use area with adjacent structures.
21	38.1	Potentially Feasible	Located primarily on equestrian land use; however is bisected by several roads/drives and track.
22	46.9	Potentially Feasible	Located on agricultural land adjacent to SCVFP.
23	6.2	Limited Feasibility	Located within open space on private residential property.
24	6.5	Potentially Feasible	Located primarily on private agricultural land.
25	40.4	Potentially Feasible	Located primarily on equestrian land use.
26	5.4	Potentially Feasible	Located on equestrian land; partially wooded; site visit required to confirm if existing wetlands currently exists.
27	5.7	Potentially Feasible	Located primarily on private agricultural land.
28	334.6	Potentially Feasible	Large area within SCVFP that was heavily farmed and tile drained in the past. Note: Tributary D is excavated channel within this area.
29	25.1	Potentially Feasible	Area is located adjacent to Spring Creek within SCVFP; north portion on previous agricultural land; west portion is shrubland.

Note: A feasibility study will need to be completed prior to the planning and restoration of any potential wetland restoration site.

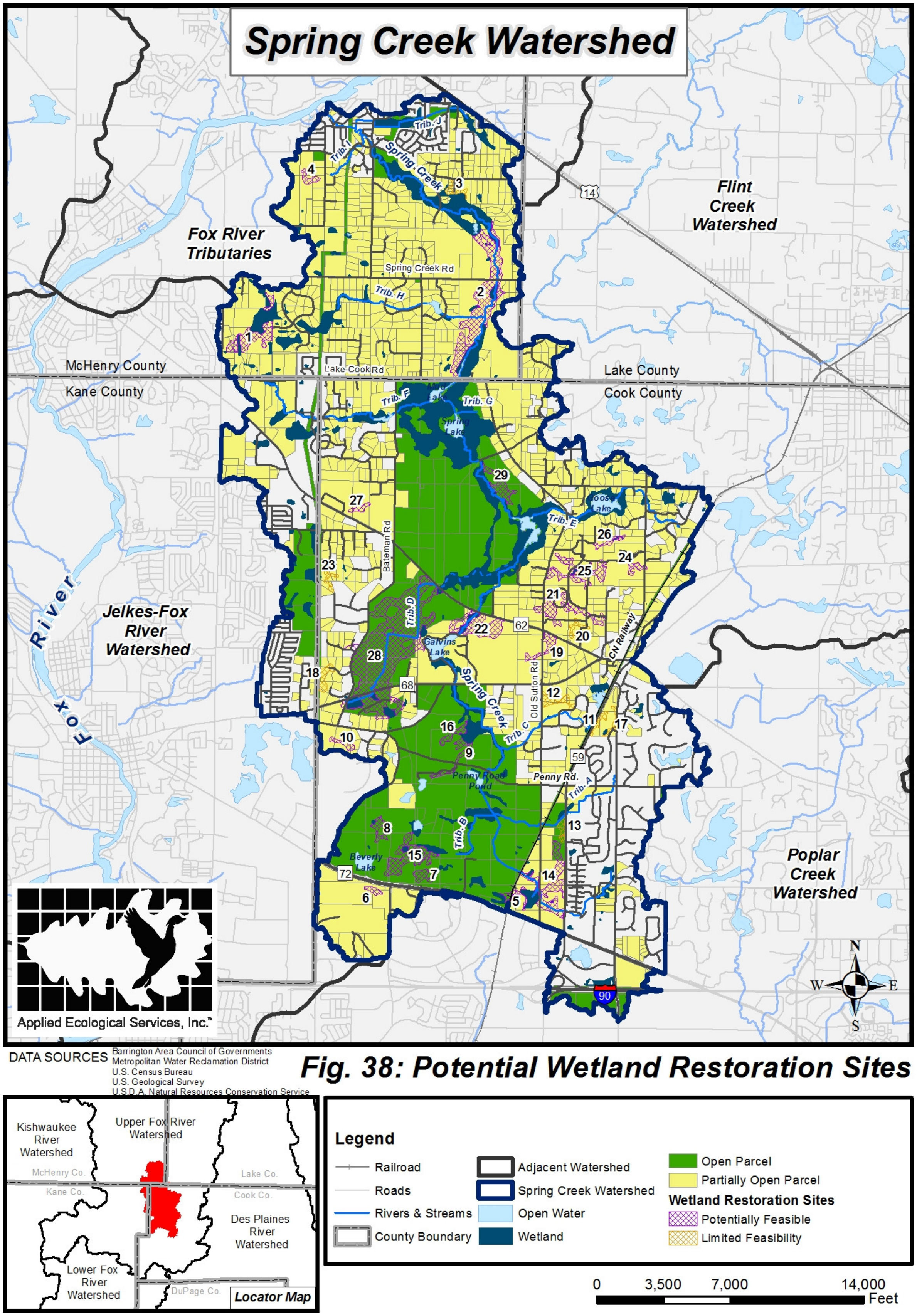


Fig. 38: Potential Wetland Restoration Sites

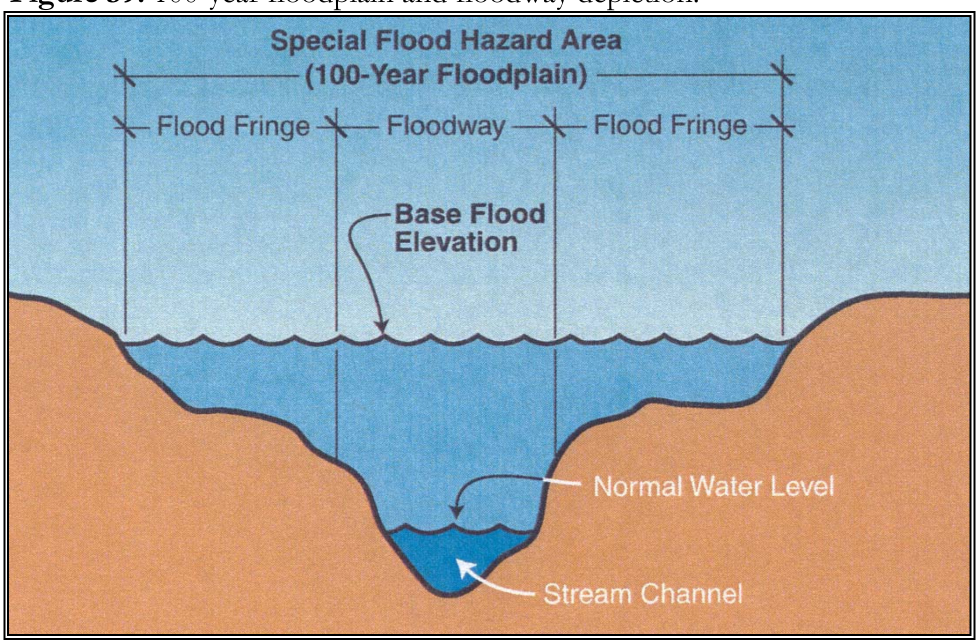
3.12.4 Floodplain & Flood Problem Areas

FEMA 100-Year Floodplain & MWRD 100-Year Inundation Model

Functional floodplains along stream and river corridors perform a variety of green infrastructure benefits such as flood storage, water quality improvement, passive recreation, and wildlife habitat. The most important function however is the capacity of the floodplain to hold water during significant rain events to minimize flooding downstream. The 100-year floodplain is defined by the Federal Emergency Management Agency (FEMA) as the area that would be inundated during a flood event that has a one percent chance of occurring in any given year (100 –year flood). 100-year floods can and do occur more frequently, however 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 39 below depicts the 100-year floodplain and floodway in relation to a hypothetical stream channel.

Figure 39. 100-year floodplain and floodway depiction.



In December, 2010 Metropolitan Water Reclamation District of Greater Chicago (MWRD) completed a watershed plan for Poplar Creek located just south of the Spring Creek watershed (MWRD 2010). This report includes some general data about the Spring Creek watershed including an updated 100-year inundation area for the portion of Spring Creek watershed south of Lake-Cook Road. Figure 40 includes a map of the FEMA 100-year floodplain (mapped north of Lake-Cook Road) and MWRD's updated 100-year inundation area mapped south of Lake-Cook Road.

Potential & Documented Flood Problem Areas

A Flood Problem Area (FPA) is defined as a location where flooding causes property damage. Information about the location and condition of potential and documented FPAs was gathered from several sources. Metropolitan Water Reclamation District of Greater Chicago produced a report in 2010 that includes information about several documented FPAs and potential FPAs (based on 100-year flood modeling) south of Lake-Cook Road. Other information was gathered by conducting personal interviews with representatives from Villages and watershed residents. Other potential FPA's were found simply by viewing recent aerial imagery in relation to the mapped floodplain, particularly north of Lake-Cook Road where less information is available.

Four potential and three documented FPAs were identified in the Spring Creek watershed. Information about each is included in Table 24 and mapped on Figure 40. MWRD flood modeling found three potential FPAs; two pavement flooding areas and one structure. An additional potential FPA can be found within Spring Creek's floodplain between Algonquin Road and the Fox River where several residential homes are located. Documented FPAs are found at three locations including road and basement flooding at Tributary E's crossing with Old Sutton Road, flooding over Chapel Road, and Flooding on Bartlett Road. Mitigation measures for FPAs include flood proofing or acquisition of structures, culver replacement, and creation of additional stormwater storage upstream. It is important to note that resolving flood problems is not the focus of this report although many of the water quality improvement recommendations in the Action Plan have excellent secondary flood reduction benefits.

Table 24. Potential and documented Flood Problem Areas.

Flood Problem Area # (MWRD #)	Cause of Flooding	Location/Description	Potential Mitigation Measures
Potential FPAs (based on MWRD modeling & aerial interpretation)			
1 (MPA-8)*	Pavement Flooding	Penny Road crossing of Spring Creek. Road floods and one structure is damaged.	No feasible options recommended
2 (MPA-9)*	Overbank Flooding	Structure floods between Penny Road and Route 72.	Candidate for flood-proofing or possible acquisition
3 (MPA-10)*	Pavement Flooding	Route 62 crossing of Spring Creek. Road floods.	Replace culvert with larger structure and raise road elevation
4	Overbank Flooding	Potential flooding of several homes between Algonquin Road and Fox River	Stormwater storage in upper reaches of watershed
Documented FPAs			
5 (SCFP-1)*	Pavement Flooding	Tributary E and Old Sutton Road. Overflow results in flooding of local roads and basements west of Old Sutton Road and bank erosion on FPDCC property.	None developed; pavement flooding less than 6 inches deep.
6 (SCSB-1)*	Local Drainage Pavement Flooding	Higgins Road & Bartlett Road. Detention basin at Allstate property floods onto Bartlett Road.	None developed; local drainage system problem.
7	Pavement Flooding	Flooding on Chapel Road.	Improve and protect surrounding wetlands to improve hydrologic function and install/replace culverts

* Information obtained from MWRD 2010 report "Detailed Watershed Plan for the Poplar Creek Watershed Study Area: Volume 1".

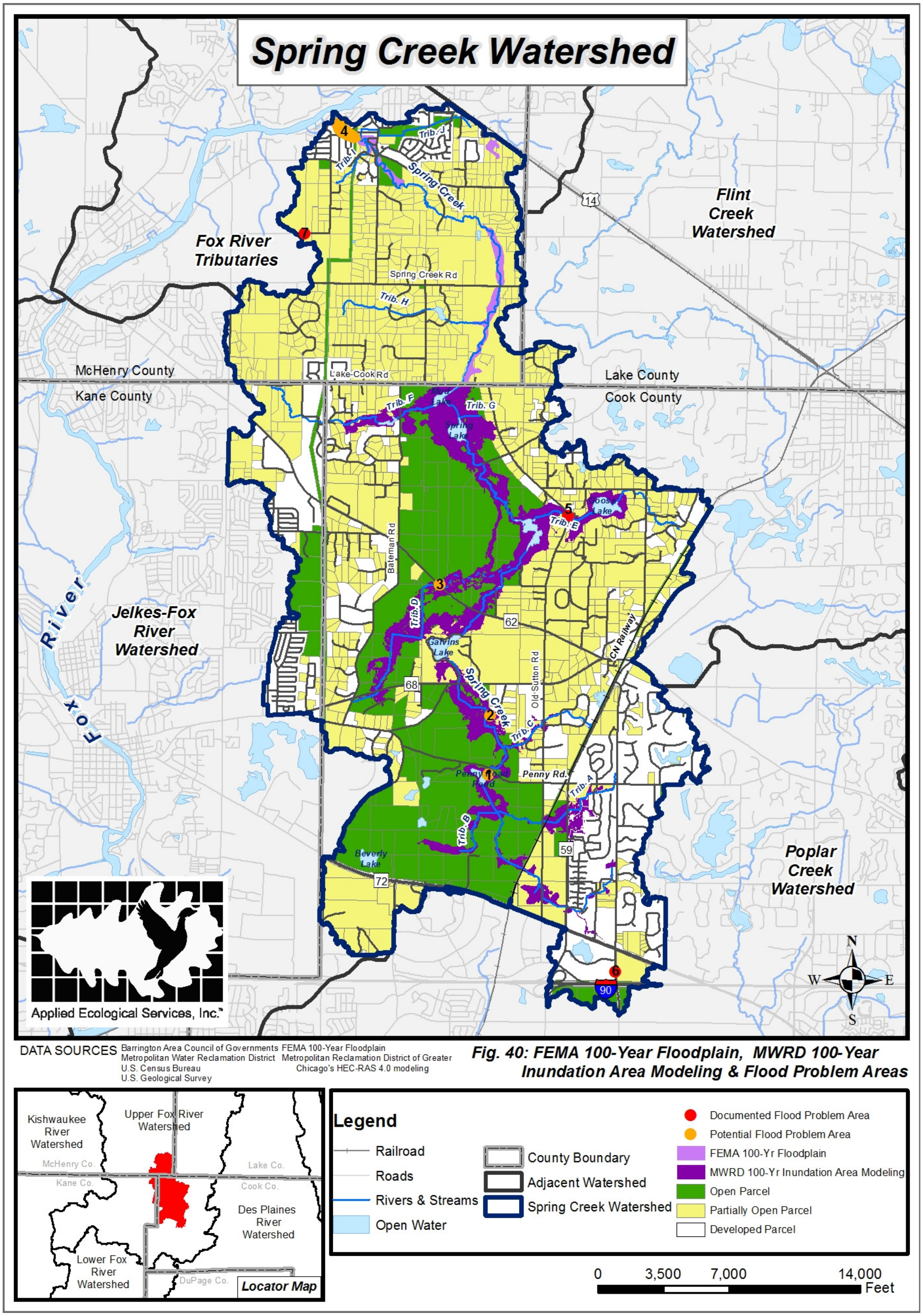


Fig. 40: FEMA 100-Year Floodplain, MWRD 100-Year Inundation Area Modeling & Flood Problem Areas

3.13 Groundwater Recharge[1]

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

Groundwater is transient and its flow does not recognize watershed or political boundaries. In a natural state, a groundwater balance or equilibrium was reached long before human impact on the system. Groundwater flowed through the system from west to east and there was vertical flow upward and downward between the bedrock and the overlying unconsolidated materials. In addition, groundwater discharged to the surface and water was added to the system by the infiltration of rainwater, snow melt, and surface water. In the area of the Spring Creek watershed, the groundwater generally moves in an easterly direction, but significant variation in flow direction occurs near the ground surface where the flow is influenced by surface topography and discharge to surface waterways.

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 available 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. After precipitation reaches the ground a significant portion runs off and immediately evaporates. Of the larger portion that infiltrates the surface soil, most of it 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 where 53 percent of the precipitation evaporates from the soil, is transpired by the plants and is discharged by shallow sub-surface flow. The remaining 16 percent travels downward through the underlying

[1] Groundwater recharge information was obtained from Barrington Area Council of Governments' Water Resources Initiative, Janet Agnoletti, BACOG Executive Director; written report provided by Kurt Thomsen Ph.D. PG, Principal, KOT Environmental Consulting, Inc.

unconsolidated materials, reaches the groundwater and becomes groundwater recharge. This recharging of the groundwater is a long-term process. Once the recharge contributes to the groundwater, it is available for extraction, discharge to surface waters, or remains in storage. The percentages presented above vary from place to place and over time, but are representative of typical values for the distribution of precipitation.

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 can only be effectively re-supplied through moderate to highly sensitive recharge areas. Therefore, these 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's recharge areas. The classification is strictly based on the area's surface soil and underlying unconsolidated material characteristics. Classification is predicated on the relative time of travel of recharging water to reach the uppermost unconsolidated material formation consisting of aquifer material after the water infiltrates the surface soil horizon. 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), Soil Survey for Du Page and Part of Cook County (USDA, 1979), Soil Survey for Kane County (USDA, 1979), and Soil Survey for McHenry County (USDA, 2002); 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).

Figures 41 and 42 show the distribution of recharge characteristics in the Spring Creek Watershed. The area of the watershed is approximately 17,100 acres of which 1,900 acres are "moderate," 2,200 acres are "sensitive," and 8,800 acres are "highly sensitive" recharge areas. A very high percentage of the watershed area has excellent recharge capability with 75.5 percent of the watershed having moderate to highly sensitive recharge characteristics. Most of the 24.5 percent of the poor to very poor recharge area lies south of Otis Road and east of Old Sutton Road with a small area located just north of the intersection of the McHenry and Kane County lines.

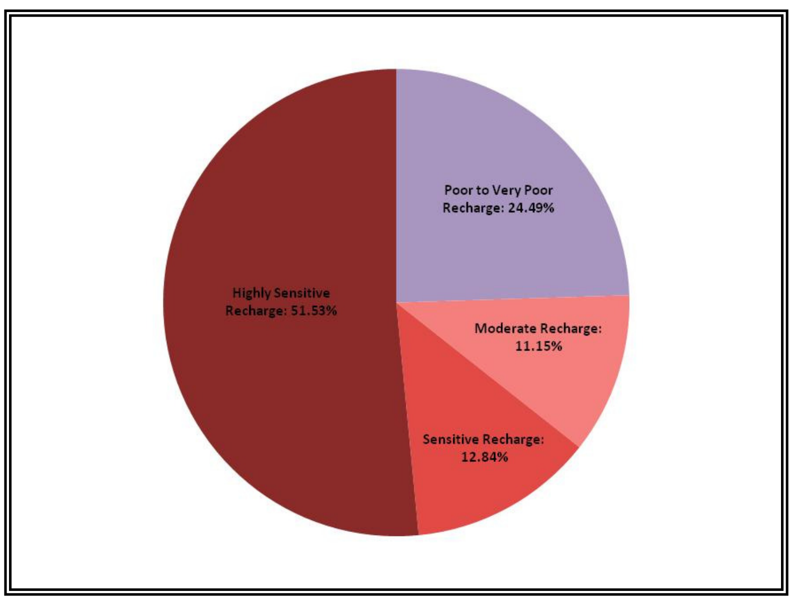


Figure 41. Distribution of recharge areas in the watershed.

The headwaters of Spring Creek originate in the southeast corner of the watershed in an area of poor to very poor recharge. The creek flows northwest entering an area of moderate recharge at the confluence with Tributary A. The headwaters of both Tributary A and Tributary C are located within poor to very poor recharge areas. Once these tributaries join Spring Creek, the Creek flows through moderate to highly sensitive recharge areas to the Fox River. All the other tributaries to Spring Creek originate and flow through areas having moderate to highly sensitive recharge. Streams flowing through recharge areas are more likely to have adequate flow through periods of drought and contribute to groundwater recharge during periods of high flow. The distribution of recharge depicted in Figures 41 and 42 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.

Recommendations for Action

Areas within the watershed that have conditions that favor rapid recharge are important for two reasons. First, they provide a fast conduit for precipitation to re-supply the groundwater. These areas should remain open, as much as possible, to facilitate the exchange of water between the surface and the groundwater. Second, 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 degrade the groundwater supply. These areas should be protected from activities that might generate contaminants that have the potential to migrate to the groundwater.

Local planning and zoning regulations need to be evaluated for their ability to protect against future potential development. Current land use and low-density development patterns have protected these important recharge areas thus far. Future development in an identified recharge area, should require the directing of intercepted water into the ground through use of a recharge basins or galleries.
In areas having insufficient information available to assess recharge conditions, a borehole-drilling program could be instituted to collect that data. Once the data collection is completed, a monitoring well could be installed and used in a water-level measurement program.

It is critically important both to local communities and to the ecology of the watershed to monitor and understand groundwater levels. Maintenance of constant levels and increases in water levels are indicators of a healthy aquifer system. Decreases in water levels are a function of over consumption and lack of precipitation. A large decrease in the water level could affect availability of water supply for the public. It also could negatively impact the watershed ecology by not supplying sufficient water to maintain the wetlands, streams and fens, for example.

Although the data is very limited, analysis of water level trends from existing data is needed. More importantly, a program to generate new water level measurements and data such as the long-term well water level program offered by BACOG should be promoted and expanded within the watershed. Because much of the watershed is dependent on private and other non-municipal wells, a monitoring program will measure these types of wells across the watershed. The information collected will establish baseline water level conditions that could be used as a reference for comparison of future groundwater level data. This will allow for trend analysis over time. Additional private wells should be sought and brought into the BACOG program.

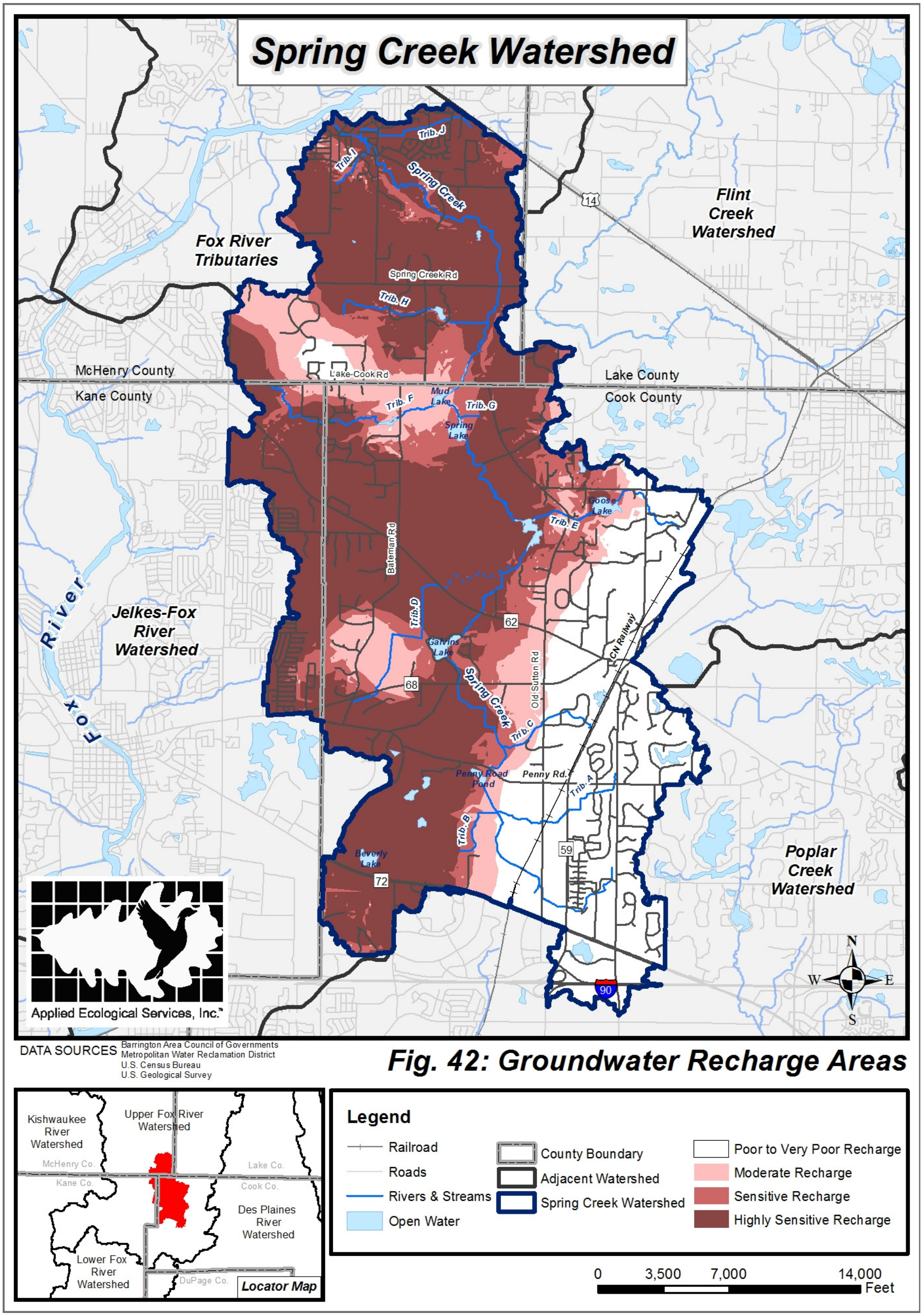


Fig. 42: Groundwater Recharge Areas

A similar evaluation of water quality in public and private wells is recommended. An analysis from existing records is needed but data is limited. A program is in place at BACOG to sample water chemistry and quality features in wells across the watershed, and this program should be encouraged and expanded throughout the watershed. The data will be used to create a baseline, and future sampling would be compared to the baseline to allow for trend analysis. Analysis might identify contaminants or undesirable chemistry features that are caused by surface management practices, such as excessive driveway or road salting or over use by businesses and/or homeowners, and lawn fertilization activities. Such analysis could lead to development of additional local government policies and public education programs to improve water conditions.

A well water monitoring program focused on natural areas within and near the watershed that are designated or intended for protection is also recommended as contained in the BACOG comprehensive program. These areas might include significant wetlands, the Wagner Fen, and Barrington Bog. Monitoring would cluster measurements in relation to the natural areas, and would include measurements of water levels and water quality. Combined with data on water levels and quality in surface waters, the groundwater measurements would help to establish the relationship between groundwater and surface waters. Information also could be used to evaluate the relationship of changes in water levels and water quality to changes in flora and fauna. This component of the BACOG program has not yet been implemented but would be ideal for initiation in the Spring Creek watershed

If a wellhead protection assessment has been prepared it should be revised to reflect the current recharge conditions. If an assessment has not been prepared, it should be prepared using the current recharge information and by paying particular attention to identifying potential sources of contamination.

Overall, public education programs are needed to increase awareness of the importance of groundwater to watershed management and to encourage conservation and protection measures.

3.14 Water Quality Assessment

Data that is available within Spring Creek watershed indicates that water quality is generally fair with only moderate impairments. The Fox River Grove Wastewater Treatment Plant (WWTP) is the only NPDES outfall currently permitted by the Illinois EPA in the watershed but it discharges directly to the Fox River so is not a pollutant source to Spring Creek. Municipalities discharging to Spring Creek are regulated by the Illinois EPA's NPDES Phase II Stormwater Permit Program. Table 25 lists all known water quality data for the watershed while Figure 43 displays the location of water quality sample sites. In general, the most recent available data is summarized in this section so that recommendations and management strategies are based on the most current depiction of the water quality and biological conditions within the watershed. It should be noted that many of the water quality monitoring activities and collected data may not have followed an Illinois EPA approved Quality Assurance Action Plan.

Section 305 (b) of the Federal Clean Water Act requires Illinois and all other states to submit to the USEPA a biannual report of the quality of the state's surface and groundwater resources called the *Integrated Water Quality Report*. These reports must also describe how Illinois assessed water quality and whether assessed waters meet or do not meet water quality standards specific to each "Designated Use" of a waterbody as defined by the Illinois Pollution Control Board (IPCB). When a waterbody is determined to be impaired, Illinois EPA must list potential reasons for impairment in the 303 (d) impaired waters list. There are seven "Designated Uses" in Illinois; Illinois EPA has assigned five of these uses to Spring Creek including:

- Aquatic Life
- Fish Consumption
- Primary Contact
- Secondary Contact
- Aesthetic Quality

The Illinois EPA does not list Spring Creek as being impaired for any of its Designed Uses because it was not assessed in any of the most recent *Integrated Water Quality Reports* (IEPA Draft 2010, 2008, 2006). Despite the lack of Illinois EPA data, attainment of the "Aquatic Life" Designated Use is most applicable to Spring Creek and is the basis by which the quality of Spring Creek is determined in the following subsections. Fish, aquatic macroinvertebrate, and mussel data is examined in the biological monitoring subsection. This data indicates that although not fully supporting for Aquatic Life, Spring Creek is only moderately impaired and is a fair to good aquatic resource. Nutrients (nitrogen and phosphorus) and suspended solids/sedimentation are specifically examined under the water chemistry monitoring subsection as these were identified by stakeholders as the primary potential causes of water quality impairment in the watershed. Water chemistry sampling results indicate that Spring Creek is generally in good condition although phosphorus, chloride, and total suspended solids levels exceeding recommended standards have been documented.

Table 25. List of known chemical (H2O) and biological (BIO) water quality sample sites.

Map Code	Location(s)	Sampling Entity(s)	Year(s)	Purpose	Water Quality Parameters
H201	Spring Creek - @ Lincoln St. - Site# 31, McHenry County	Cary Grove H.S. (T. Bruley & CG Environmental Science) - Friends of the Fox River	4/10/2001, 9/11/2002 10/14/2004,10/26/2005 4/4/2006, 10/6/2006/ 5/2/2007, 10/3/2008 5/2011	Stream assessment study	Temp, pH, N, Phosphate, Turb. DO, Fecal coliform, BOD, substrate, water dimensions, Macroinvertebrates
H202 H203	H202: Spring Creek @ Route 59 H203: Spring Creek @ Braeburn & Algonquin Roads	Village of Barrington Hills via Gewalt Hamilton Associates, Inc.	2009-2011	NPDES Phase II requirements	Ammonia, Chloride, Flouride, BOD, Phenolics, Total Phosphorus, Total Suspended Solids, Total Kjeldahl Nitrogen, Potassium, Dissolved Oxygen, Total Dissolved Solids, Temperature, Conductivity, pH
BIO1	Spring Creek, McHenry County	Illinois Department of Natural Resources	1941	Fish Survey	Not known. Data could not be obtained.
BIO2	Spring Creek, McHenry County	Illinois Natural History Survey, Illinois Department of Natural Resources	1960	Fish Survey	Not known. Data could not be obtained.
BIO3	Spring Creek, Cook County	Illinois Natural History Survey, Illinois Department of Natural Resources	1970	Fish Survey	Not known. Data could not be obtained.
BIO4	Spring Creek - Barrington Hills, Cook County	T.G. Marsh – Illinois Department of Natural Resources	8/12/1988	Mussel Survey	None; survey only
BIO5	Spring Creek - 2 mi E Carpentersville, Spring Creek Valley Forest Preserve, Cook County	C. Anchor – Illinois Department of Natural Resources	8/28/1993	Mussel Survey	None; survey only
BIO6	Spring Creek - 2 mi S Fox River Grove near Spring Creek Rd., McHenry County	R.W. Schanzle – Illinois Department of Natural Resources	7/8/1994	Mussel Survey	None; survey only
BIO7	Goose Lake, Cook County	Illinois Natural History Survey, Illinois Department of Natural Resources	1994	Fish Survey	None; survey only
BIO8A BIO8B	Spring Creek - S of Donlea Rd., & N of Donlea Rd., Spring Creek Valley Forest Preserve, Cook County	C. Anchor & D. Antlitz – Illinois Department of Natural Resources	8/4/1995	Mussel Survey	None; survey only
BIO9	West of Rock Ridge Rd. Bridge; Rock River Farm south, Barrington Hills	McHenry County Conservation District	9/12/1996	Fish Survey	Water quality using fish communities: Index of Biotic Integrity (IBI)
BIO10	Spring Creek – Fox River Grove, Lincoln St., McHenry County	R.W. Schanzle, R. Rung, F. Jakubisek, et al. – Illinois Department of Natural Resources	9/18/1997	Mussel Survey	None; survey only
BIO11	Spring Creek - 4 mi W Algonquin, N of Spring Creek Rd., McHenry County	P. Golden – Illinois Department of Natural Resources	7/23/1997	Mussel Survey	None; survey only
BIO12A BIO12B BIO12C	Spring Creek, Spring Creek Valley Forest Preserve between Donlea Rd. and Route 62	W. Schennum, B Woodsen	1/8/99	Fish Survey	Water quality using fish communities: Index of Biotic Integrity (IBI)
BIO13	Spring Creek at Penny Road Crossing (Riverwatch # R0204101)	Riverwatch	6/2/2001, 5/25/2002, 6/7/2003, 7/5/2006, 7/13/2008, 7/5/2009, 7/17/2010	Macroinvertebrate Survey	Water quality using Macroinvertebrate Biotic Index (MBI)
BIO14	Spring Lake, Cook County	Southern Illinois University, Illinois Department of Natural Resources	2002	Fish Survey	None; survey only
BIO15	Goose Lake, Cook County	Southern Illinois University, Illinois Department of Natural Resources	2002	Fish Survey	None; survey only
KEY:		NH3 = ammonia nitrogen	TDS = total dissolved solids		
DO = dissolved oxygen		NO3 = nitrate nitrogen	Turb = turbidity		
Tot. P = total phosphorus		TKN = kjeldahl nitrogen	TSS = total suspended solids		
IBI = Index of Biotic Integrity		Cond.= conductivity	pH=acid/base scale		
MBI = Macroinvertebrate Biotic Index		BOD = Biological Oxygen Demand			

Note: Many of the water quality monitoring activities and collected data may not have followed an Illinois EPA approved Quality Assurance Action Plan.

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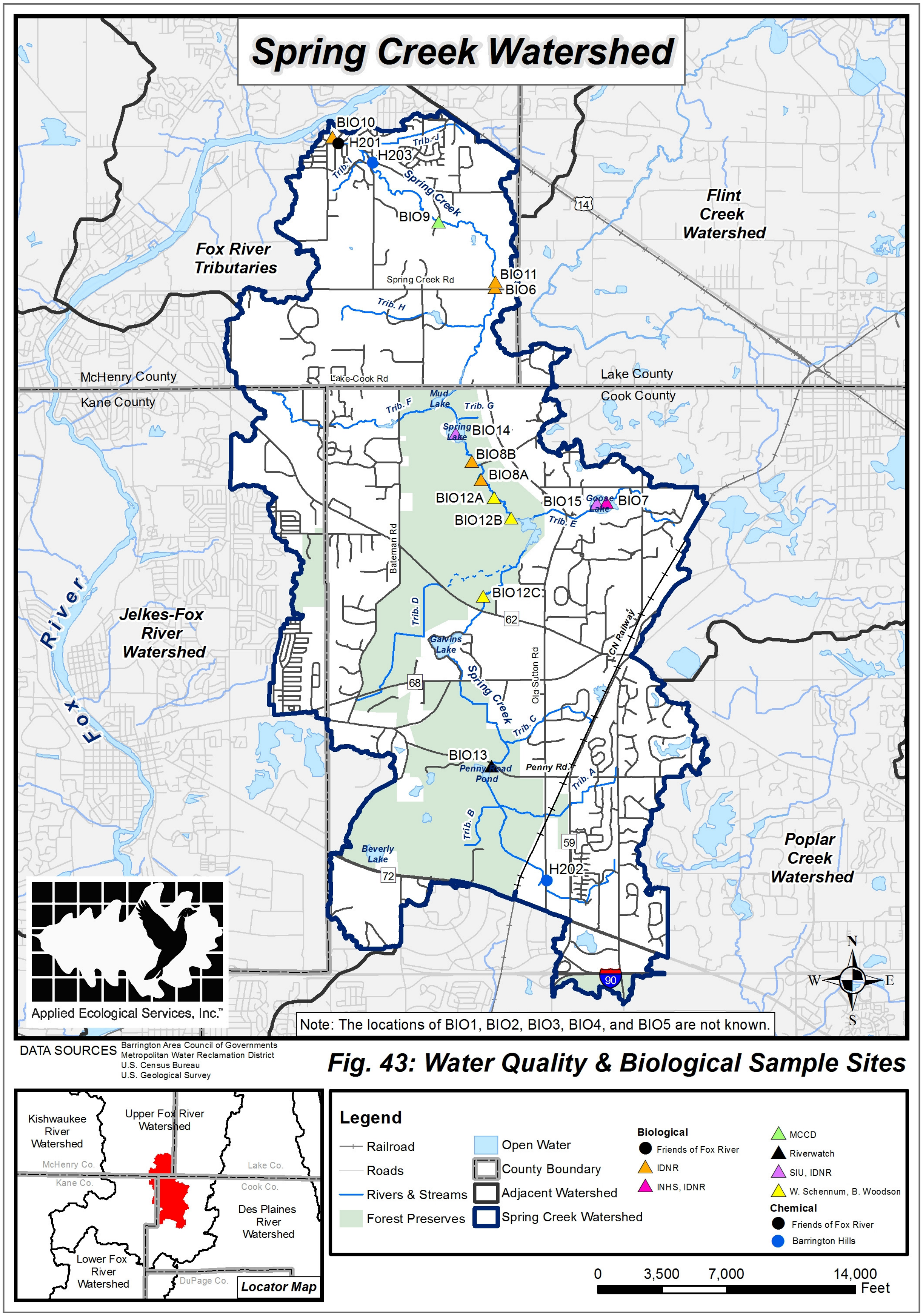


Fig. 43: Water Quality & Biological Sample Sites

Biological Monitoring

Biological data provides the primary basis for determining the level of Aquatic Life support and is a major source of information for Illinois EPA's *Integrated Water Quality Reports*. Illinois Department of Natural Resources (IDNR), Illinois Natural History Survey (INHS), McHenry County Conservation District (MCCD), and private consultant biologists, and RiverWatch and Friends of the Fox River (FOFR) volunteers conducted several macroinvertebrate, fish community, and mussel surveys beginning in the 1940's and as recently as 2011 (Table 25; Figure 43). Biologists and volunteers utilized several indices based on macroinvertebrate and fish communities including the Macroinvertebrate Biotic Index (MBI), Macroinvertebrate Index, and fish Index of Biotic Integrity (fIBI) to evaluate the water quality and biological health of Spring Creek and to detect and understand change in biological systems that result from the actions of human society.

The Illinois EPA currently uses MBI and fIBI data to determine the Aquatic Life support status of streams as shown in Table 26. The Macroinvertebrate Index (Oram 2011) is not an approved method used by the Illinois EPA and therefore is not discussed in detail below. Also, no biological index currently exists to evaluate mussels but conclusions about the quality of water can be made depending on the species present or absent.

Table 26. Illinois EPA indicators of Aquatic Life impairment using MBI and fIBI scores.

Biological Indicator	Score		
MBI	> 8.9	5.9 < MBI < 8.9	≤ 5.9
fIBI	≤ 20	20 < IBI< 41	≥ 41
Impairment Status - Use Support - Resource Quality			
Impairment Status	Severe Impairment	Moderate Impairment	No Impairment
Designated Use Support	Not Supporting	Not Supporting	Fully Supporting
Resource Quality	Poor	Fair	Good

Source: Integrated Water Quality Report (2010).

Macroinvertebrate Community Monitoring

RiverWatch and FOFR volunteers sampled the macroinvertebrate community several times at locations BIO13 and H2O1 respectively (Table 25; Figure 43). RiverWatch calculated MBI scores for each year while FOFR calculated Macroinvertebrate Index scores (Table 27.) The MBI and Macroinvertebrate Index are 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. The Illinois EPA has determined that a MBI score less than 5.9 indicates a stream is not fully supporting aquatic life. Overall, RiverWatch macroinvertebrate data indicates that there is no impairment, the resource quality is good, and the Illinois EPA Aquatic Life Designated Use is fully supported.

Table 27. MBI and Macroinvertebrate Index scores at RiverWatch and FOFR survey sites.

Site	Year	Stream Branch	Location	MBI (Resource Quality)	Macroinvertebrate Index (Quality)
BIO13	2001	Spring Creek	SCVFP	5.59 (Good)	-
BIO13	2002	Spring Creek	SCVFP	5.78 (Good)	-
BIO13	2003	Spring Creek	SCVFP	5.69 (Good)	-
BIO13	2006	Spring Creek	SCVFP	6.27 (Fair)	-
BIO13	2008	Spring Creek	SCVFP	5.76 (Good)	-
BIO13	2009	Spring Creek	SCVFP	5.76 (Good)	-
BIO13	2010	Spring Creek	SCVFP	5.6 (Good)	-
H2O1	2001	Spring Creek	Lincoln St.	-	36 (Excellent)
H2O1	2002	Spring Creek	Lincoln St.	-	40 (Excellent)
H2O1	2004	Spring Creek	Lincoln St.	-	37 (Excellent)
H2O1	2005	Spring Creek	Lincoln St.	-	37 (Excellent)
H2O1	2006A	Spring Creek	Lincoln St.	-	35 (Excellent)
H2O1	2006B	Spring Creek	Lincoln St.	-	34 (Excellent)
H2O1	2007	Spring Creek	Lincoln St.	-	41 (Excellent)
H2O1	2008	Spring Creek	Lincoln St.	-	34 (Excellent)
H2O1	2011	Spring Creek	Lincoln St.	-	40 (Excellent)

Fish Community Monitoring

The fIBI assess biological health and water quality through several attributes of fish communities found in streams. These attributes fall into such categories as species richness and composition, trophic composition, and fish abundance and condition. After data from sampling sites has been collected, values for the metrics are compared with their corresponding expected values for a high quality reference stream and a rating is assigned to each metric based on whether it deviates strongly from, somewhat from, or closely approximates the reference values. The sum of these ratings gives a total fIBI score for the site. The Illinois EPA uses fIBI scores to determine aquatic life impairments and has determined that a score less than 41 indicate a stream is not fully supporting aquatic life.

MCCD and private consultants sampled Spring Creek's fish community and calculated fIBI scores one time at BIO9 in 1996 and at BIO12A, BIO12B, and BIO12C in 1999 (Table 25; Figure 43). Site BIO9 is located near the Rock River Road bridge over Spring Creek; BIO12A-C are located between Donlea Road and Route 62 within Spring Creek Valley Forest Preserve. fIBI scores for these sites are outlined in Table 28.

Fantail Darter found at site BIO9

The fIBI scores indicate that there is moderate impairment, the resource is fair, and the Illinois EPA Aquatic Life Designated Use is not fully supporting. A closer look at the fish data reveals that five darter species were found at BIO9. Darters are small fish that generally require sandy to gravely substrates and good water quality for survival. Conversely, only one darter species was found upstream at BIO12A-C. The report generated for the survey conducted at BIO12A, BIO12B & BIO12C (Schennum & Woodson, 1999) notes that many of the riffles in the upper reaches of Spring Creek were dry in early August and much of the stream was dry by mid September. This is a sign of reduced groundwater recharge to the stream that causes fish populations to find permanent pools or move downstream then recolonize when water levels rise. The report also notes that typical "headwater species" were not found but rather "pioneer species" that can tolerate hydrologically unstable streams. Note: fish data collected in 1941, 1960, 1970, 1994, and 2002 could not be obtained. However, this data was collected in a fashion that does not allow for calculation of fIBI scores.

Table 28. fIBI scores and class at fish survey sites.

Site	Year	Stream Branch	Location	IBI	Quality
BIO9	1996	Spring Creek	Rock River Road Bridge	38	Fair
BIO12A	1999	Spring Creek	South of Donlea Rd. Bridge	34	Fair
BIO12B	1999	Spring Creek	Between Donlea Rd. & Route 62	36	Fair
BIO12C	1999	Spring Creek	North of Route 62	36	Fair

Mussel Community Monitoring

The IDNR conducted several mussel surveys within Spring Creek beginning in 1988 with the most recent survey occurring in 1997(Table 25; Figure 43). Data from BIO4, BIO5, BIO6, BIO8A, and BIO8B could not be obtained and therefore are not summarized in this report. Results from BIO10 and BIO11 mussel surveys conducted in 1997 were available. BIO10 is located on Spring Creek near the mouth of the Fox River while BIO11 is located just north of the Spring Creek Road bridge. Weathered shells of four species were found at BIO10: three ridge, plain pocketbook, creek heelsplitter, and ellipse. Live specimens of white heelsplitter and giant floater were also present. Weathered shells of spike and plain pocketbook were found at BIO11. Live specimens of five species were also found including slippershell, round pigtoe, giant floater, creeper, and ellipse.

Endangered Slippershell mussel found in Spring Creek

The presence of mussels in any stream is a sign of at least fair water quality and good habitat conditions. Threeridge, plain pocketbook, white heelsplitter, giant floater, and creeper are all common in Illinois streams and rivers (INHS 2011). However, round pigtoe is considered uncommon; spike, creek heelsplitter, and ellipse are considered special concern; creek heelsplitter is threatened and slippershell is endangered in Illinois (INHS 2011).

Water Chemistry Monitoring

The Illinois EPA primarily uses water chemistry data to supplement biological data when determining if streams are meeting the Aquatic Life support Designated Use. The Illinois EPA did not assess Spring Creek in their *Integrated Water Quality Report s* for 2006, 2008, or 2010 and therefore did not include any pollutants as potential causes of impairment. Consequently, the watershed stakeholder committee reasoned that based on known conditions and field inspections that nutrients (nitrogen and phosphorus) and sedimentation are the likely pollutants that are currently causing any degree of impairment to aquatic life in Spring Creek.

To date, the IPCB has not developed *numeric* water quality standards for nutrients in streams. And, Illinois rejected the USEPA ecoregion based national criteria for nitrogen and phosphorus due to lack of scientific backing. Illinois EPA does provide *statistical* guidelines for various pollutants including nitrogen, phosphorus, and sedimentation.

Two sampling locations provide the best water quality data for the watershed. Friends of the Fox River volunteer water quality monitoring program collected water quality data for Spring Creek at site H201 in 2001, 2002, 2004, 2005, 2006 (two sample dates), 2007, 2008, and 2011. The location of this site is just downstream from the Fox River Grove Waste Water Treatment Plant at Lincoln Street (Table 25; Figure 43). Sampling at this site provides a snapshot of water quality for nearly the entire watershed. The most recent data (2006 – 2011) is summarized in Table 29 below. An average over the nine sample periods does provide information to make several conclusions about water quality. First, BOD is slightly elevated but because oxygen levels are high, BOD does not appear to be a problem. Second, is a general trend in slightly elevated phosphorus levels. The average level is 0.79 mg/l which exceeds the recommended standard of 0.61 mg/l for streams. Finally, nitrate and turbidity do not appear to be problems as initially suspected by the watershed stakeholder committee.

The Village of Barrington Hills has been collecting water quality samples from 2009-2011 as part of their NPDES Phase II requirements at locations H2O2 and H2O3 (Table 25; Figure 43). Site H2O3 (known as Spring Creek North) is located at Spring Creek where it leaves Barrington Hills at Braeburn and Algonquin Roads. This sampling location also provides a snapshot of water quality for the majority of the watershed and the samples were processed using a certified lab. The sampling is conducted by the Village Engineer: Gewalt Hamilton Associates, Inc. (GHA 2011). The results for many of the sampled parameters are included in Table 29. An average of the data over the 3-year monitoring period indicates that water quality is good as it nears the point where it leaves the watershed. The most significant finding is that total phosphorus averages 0.03 mg/l as opposed to 0.79 mg/l documented by Friends of Fox River. This is far below the 0.61 mg/l recommended standard for streams and even meets the 0.05 mg/l recommendation for lakes.

Table 29. Summary of water chemistry data collected within Spring Creek at sites H2O1, H2O2, & H2O3.

Parameter	Stream Aquatic Life Statistical Guideline*	Sampling Entity	2006A	2006B	2007	2008	2009	2010	2011	Ave.
DO (mg/l)	>5.0 mg/l	FOFR	16.1	15.0	-	14.0	-	-	5.9	**13.9**
		GHA	-	-	-	-	7.5	9.1	11.5	**9.4**
pH	>6.5 or <9.0	FOFR	8.3	8.5	8.0	7.8	-	-	6.8	**7.9**
		GHA	-	-	-	-	8.4	7.1	7.7	**7.7**
BOD (mg/l)	<5.0 mg/l	FOFR	1.9	7.0	4.1	6.0	-	-	3.3	**7.0**
		GHA	-	-	-	-	0.5	1.2	<2	**1.2**
Temp (Celsius)	<32.2 C	FOFR	14.9	13.6	16.1	17.5	-	-	16.2	**12.6**
		GHA	-	-	-	-	21	13	4	**12.7**
Phosphorus (mg/l)	<0.61 mg/l	FORF	0.89	0.33	0.55	0.00	-	-	0.40	**0.79**
		GHA	-	-	-	-	0.04	0.02	0.04	**0.03**
Nitrate (mg/l)	<7.8 mg/l	FOFR	3.4	0.5	0.0	2.0	-	-	10.0	**2.5**
Ammonia (N)	<15.0 mg/l	GHA	-	-	-	-	0.4	0.1	0.1	**0.2**
Turbidity (JTU)	<20 JTU	FOFR	17.8	0.0	23.5	1.0	-	-	23.1	**13.8**
TSS	<19 mg/l	GHA	-	-	-	-	11	4	9	**8**
Chloride	<500 mg/l	GHA	-	-	-	-	99	78	70	**82**

*Statistical Guidelines obtained from Illinois EPA Integrated Water Quality Reports & conversations with Illinois EPA staff and other sources.

Illinois EPA Permit Programs

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 separate stormsewer systems (MS4's) and construction sites.

NPDES Permit Sites

One Waste Water Treatment Plant (WWTP) permit has been issued for plant in Fox River Grove located near Spring Creek's confluence with the Fox River. However, this plant discharges directly to the Fox River and therefore is not a pollutant source to Spring Creek.

NPDES Phase II Stormwater Permit Program

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. These three categories are discussed in more detail below. 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) including; 1) Develop a stormwater management program comprised of BMPs and measurable goals for at least 6 control measures such as public education and pollution prevention; 2) Submit a completed Notice of Intent (NOI) to share Phase II requirement with other municipalities; and 3) Submit an annual report to Illinois EPA reporting on the status of the implemented programs.

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 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.

3.15 Pollutant Loading Analysis

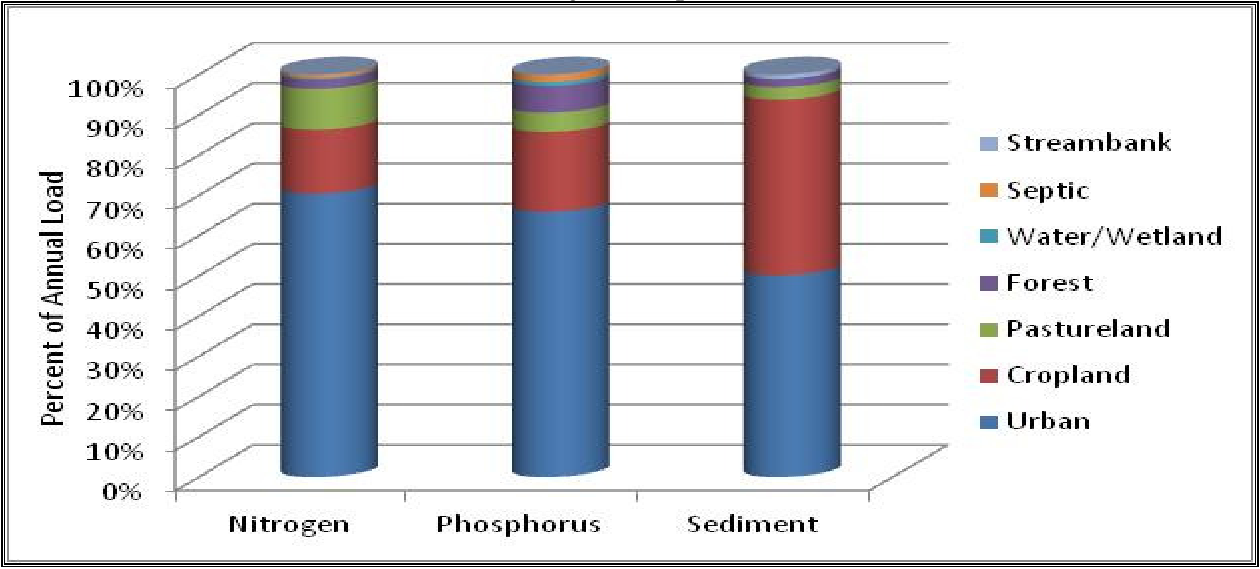
A modeling tool called STEPL (Spreadsheet Tool to Estimate Pollutant Loads) was used to estimate the existing nonpoint source load of nutrients (nitrogen & phosphorus) and sediment from Spring Creek watershed as a whole and by individual Subwatershed Management Unit (SMU). The model uses land use/cover category types, precipitation, management measures, and known water quality data input information. The model outputs average annual pollutant load for each of the land use/cover types. The results of this analysis were used to; 1) estimate the total watershed load for nitrogen, phosphorus, and sediment and 2) identify and map pollutant load "Critical Area" SMU's

The results of the STEPL model run at the watershed scale indicate that urban land uses contribute the highest load of nitrogen (70%), phosphorus (66%), and sediment (50%) (Table 30; Figure 44). This result is not surprising since approximately 6,750 acres or 39% of the watershed is in residential land use. Also notable is the contribution of nitrogen (16%), phosphorus (20%), and sediment (44%) from cropland. Cropland is also one of the dominant land uses in the watershed at about 1,580 acres or 9%. Pastureland also contributes significantly to nitrogen at 10% of the total load. Forest, water/wetland, septic, and streambanks do not contribute significantly to watershed pollutant loading. Note: Detailed STEPL Model results can be found in Appendix D.

Table 30: Estimated existing (2011) annual pollutant load by source at the watershed scale.

Source	N Load (lb/yr)	P Load (lb/yr)	Sediment Load (t/yr)
Urban	35,444	5,854	786
Cropland	7,977	1,757	685
Pastureland	5,109	430	48
Forest	1,200	588	33
Water/Wetland	191	95	0.02
Septic	382	150	0
Streambank	23	9	16
Total	**50,327**	**8,883**	**1,567**

Figure 44. Estimated contributions to existing (2011) pollutant load by source.



The results of the STEPL model were also analyzed at the SMU scale. This allows for a more refined breakdown of pollutants sources and leads to the identification of pollutant load "Critical Areas". "Critical Area" SMUs were selected based on the following criteria:

- Nitrogen contribution from SMU is greater than 3,000 lb/yr
- Phosphorus contribution from SMU is greater than 500 lb/yr
- Sediment contribution from SMU is greater than 100 tons/yr

Table 31 and Figure 45 summarize and depict the results using the criteria above. A detailed table summarizing the pollutant load for all 17 SMUs making up Spring Creek watershed can be found in Appendix D. Nine of the 17 SMUs comprising Spring Creek watershed are considered pollutant load "Critical Areas". SMUs 1, 3, and 5 are all located in the southeast portion of the watershed where commercial, transportation (roads), and small lot residential land uses dominate. SMU 1 also has significant cropland. These land uses are the primary contributors of pollutants. SMU 6 is dominated by large lot residential and pastureland which contribute pollutants. Pollutants from SMU 7 originate mostly from industrial, institutional, transportation, and small lot residential in the west half of the subwatershed. SMUs 9 and 14 contribute pollutants from large lot residential and pastureland. SMU 11 contributes pollutants from transportation, large lot residential, and cropland. Sediment from cropland is the primary pollutant coming from SMU 13.

Table 31: Pollutant load "Critical Area" SMUs based on contribution criteria.

Critical Area SMU	N Load (lb/yr)	P Load (lb/yr)	Sediment Load (t/yr)
SMU 1	6,624	1,094	206
SMU 3	4,737	804	119
SMU 5	3,480	632	119
SMU 6	4,274	821	185
SMU 7	4,374	817	-
SMU 9	3,001	501	-
SMU 11	5,352	110	197
SMU 13	-	-	103
SMU 14	3,604	532	-

The information obtained from the pollutant loading analysis is also used in Section 4.0 of this plan to map "Critical Areas", help with identification of Management Measures appropriate to reduce pollutants in "Critical Areas", and identify pollutant load reduction targets using USEPA's Region 5 Model (MDEQ 1999). The Region 5 Model provides estimates of nutrient and sediment load reductions from implementation of recommended agricultural and urban Management Measures to evaluate the ability of recommended projects to reduce pollutants to targets levels.

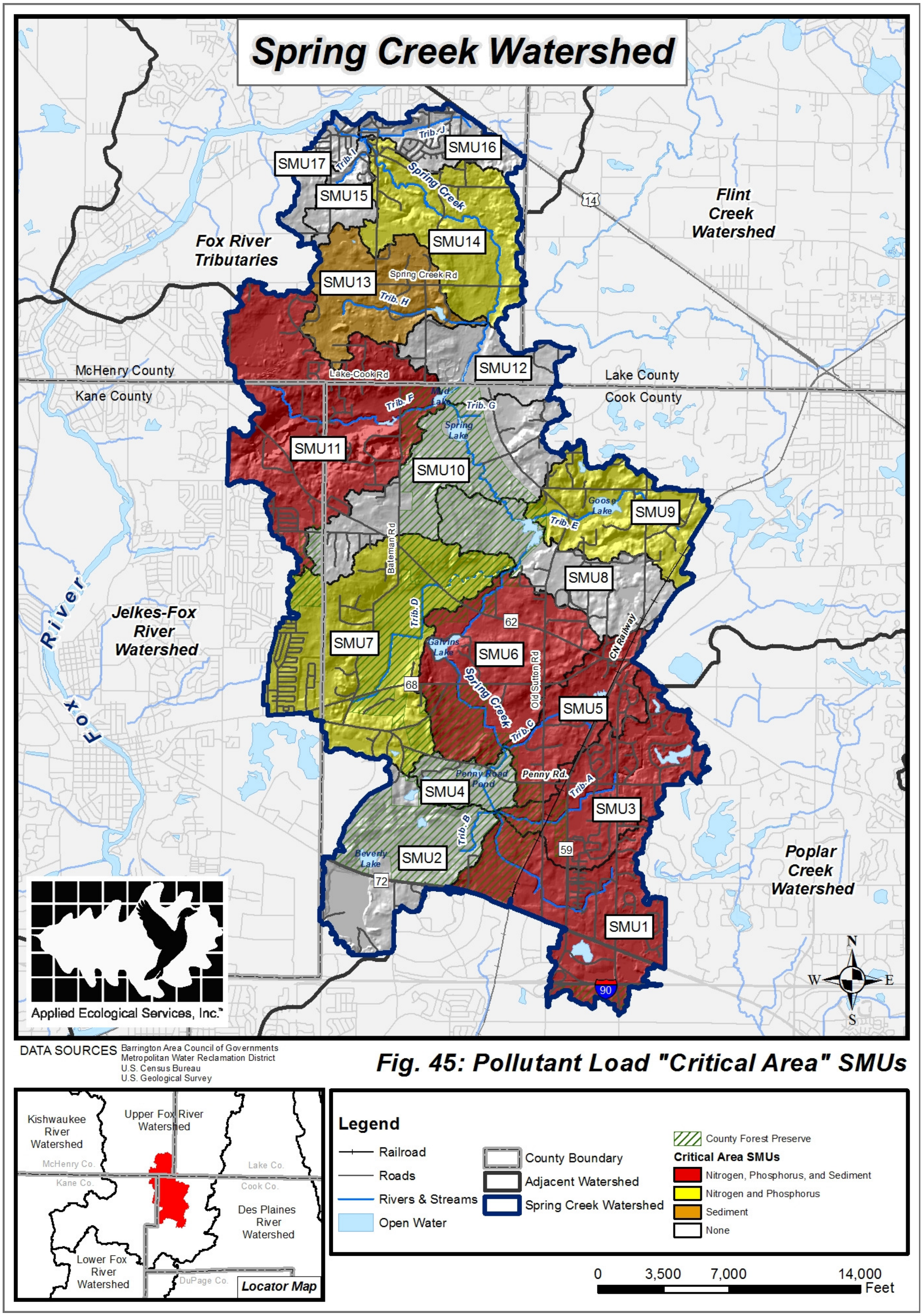


Fig. 45: Pollutant Load "Critical Area" SMUs