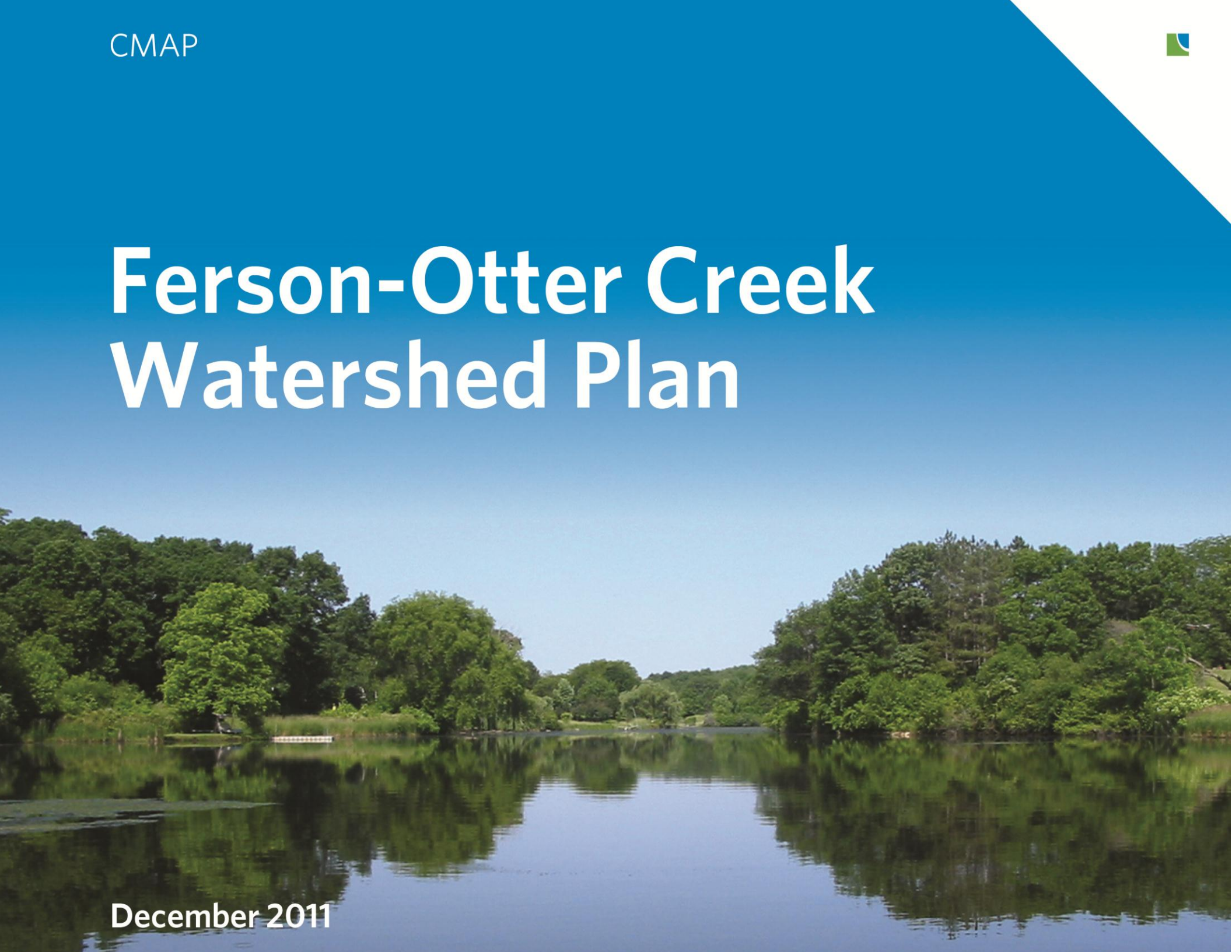
CMAP

Ferson-Otter Creek Watershed Plan



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This plan was prepared for the Ferson–Otter Creek Watershed Coalition that formed as the plan neared completion. The many contributors to this planning process include Trotter and Associates, Village of South Elgin, Campton Township, Village of Campton Hills, Village of Lily Lake, City of Elgin, City of St. Charles, Kane County Planning, Kane- DuPage Soil and Water Conservation District-Natural Resources Conservation Service, Kane County Health Department, Pizzo and Associates, St. Charles Park District, Lake Campton Property Owners Association, Wildrose Subdivision, The Windings of Ferson Creek HOA, Deer Run Creek HOA, Deer Run East Property Owners Association, Black Creek Hydrology, and the Sierra Club.

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1. INTRODUCTION

1.1 WATERSHED PLANNING

Watershed planning is a public process involving local residents, governmental agencies, and other concerned interests. Those participating in the planning process as well as the interests they represent are known as stakeholders since they all have a vested interest, or stake, in the overall health of the place they live or work. Addressing nonpoint-source pollution to protect good water quality or improve poor water quality is the primary purpose for developing a watershed-based plan. Other objectives can be pursued too as they are often related to the health of water resources. The planning process and resultant plan are informed by both local knowledge and science-based information.

The watershed, defined by topography and influential in the movement of surface water, has become the organizing principle for planning and for understanding the interrelationships between the many ways that people view and interact with water resources. When combined with an adaptive management approach to plan implementation, the plan and its stakeholders offer a potentially effective framework for producing and evaluating project and policy recommendations to correct water resource problems.[1] It is through this lens that the Ferson-Otter Creek Watershed Plan was created.

The purpose of the plan that follows is to provide a roadmap for improving local water quality and thus, the quality of life for those that live, work, and play within the Ferson-Otter Creek Watershed. It should be noted that this plan's recommendations are advisory in nature.

[1] Adaptive management is a natural resource management approach that formulates and implements policies as experiments. If a new policy is found to be successful, hypotheses are confirmed; if policies fail to achieve their objectives, adaptive management learns from the experience and makes informed adjustments accordingly. See, for example, Kai N. Lee. *Compass and Gyroscope: Integrating Science and Politics for the Environment*. Washington, D.C.: Island Press, 2003. Dr. Lee thinks of science and democracy as compass and gyroscope — "navigational aids in the quest for sustainability." Page 6.

1.2 HISTORY OF THE WATERSHED

Ferson Creek was named after two brothers, Dean and Reed Ferson, who traveled to the area in 1833 from Vermont to invest in real estate. The brothers laid claim to land that at the time was known as Charleston, present day St. Charles. Dean settled in what is now known as the LeRoy Oakes Forest Preserve before moving to the northwest side of the city near where his brother Reed built a log cabin in the WildRose area.

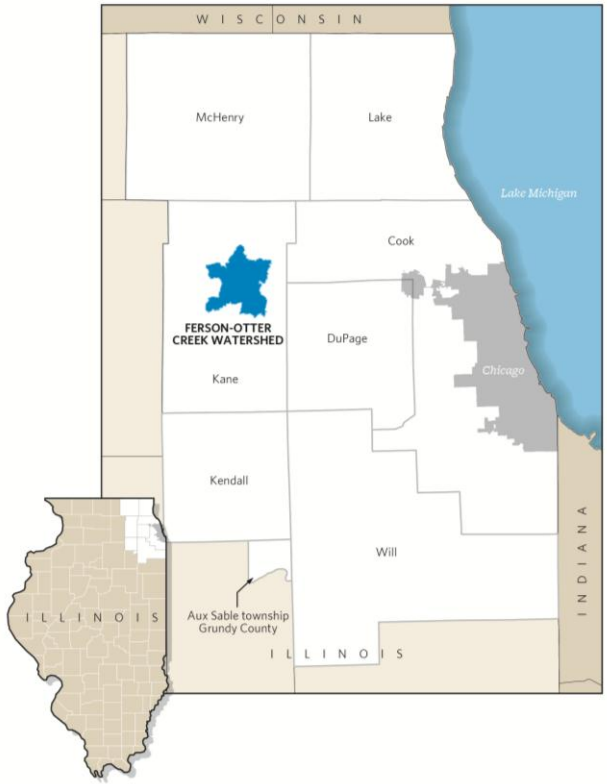
Stemming from Ferson Creek is Lake Campton, a man-made lake formed from damming Ferson Creek. The idea to create this lake was that of Bill Fisher, an insurance man who developed a number of properties in the Wasco area in the 1950s, which are now part of the Village of Campton Hills. A dam was built on Ferson Creek, just west and south of the intersection of Burlington and Corron Roads to make a private lake and recreation area for boating, fishing and skating. Originally known as Fisher's Lake, this 40 acre body of water has come to be known as Lake Campton.

Otter Creek winds throughout land once dedicated to the Henry Sherman and Cyrus Larkin farms. The Creek was surrounded with prairie to the west and woodland to the east. The Cyrus Larkin farm was located where the Elgin Larkin High School now stands today. Henry Sherman was a businessman in addition to being a farmer and Sherman Hospital in Elgin carries his name. He was also part owner of the Elgin Watch factory, which employed women during World War II when the factory converted from making watches to making war materials.

1.3 OVERVIEW

The Ferson-Otter Creek Watershed is located within the Lower Fox River Basin (Hydrologic Unit Code [HUC] 07120007) and consists of Ferson Creek (HUC 071200070104) and Otter Creek (HUC 071200070103) subwatersheds. For our planning purposes, the two subwatersheds will be studied together as Otter Creek is a tributary to Ferson Creek. The Ferson-Otter Creek Watershed is located on the urban fringe of the Chicago metropolitan area in Kane County, the 5th most populated county in Illinois with a 27.5% population growth from 2000-2010 (Figure 1). The watershed covers portions of the Cities of Elgin and St. Charles as well as the Villages of Campton Hills, South Elgin, and Lily Lake (Figure 2). The total population in Ferson-Otter Creek Watershed is approximately 50,704.[2] The watershed has experienced a 49% increase in population growth since 2000 and has a drainage area of approximately 54 square miles. Additionally, the watershed has a total of 55.1 miles of streams within the watershed.[3] Ferson Creek is 14.6 miles long while Otter Creek is 6.5 miles long.[4] Table 1 breaks down the number of square miles contained within each municipality as well as unincorporated areas.[5] As of 2005, twenty-nine percent of the land area within the watershed was developed.[6]

Figure 1. **Regional location map of Ferson-Otter Creek Watershed**



[2] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2011. http://www2.census.gov/census_2010/04-Summary_File_1 (accessed November 3, 2011).

[3] NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study, Kane County, Illinois Final Report*. Chicago, IL: USACE Chicago District, August 2004. http://www.lrc.usace.army.mil/co-r/pdf/KaneADIDReport.pdf (accessed November 7, 2011).

[4] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).

[5] CMAP. "Municipality Boundaries." Chicago, IL: CMAP, 2009.

[6] "Kane County, Illinois Flood Information," Kane County, Illinois, last modified January 12, 2005, accessed November 7, 2011, http://www.co.kane.il.us/kcstorm/flood/index.htm.

Figure 2. **Municipalities & Townships in Ferson-Otter Creek Watershed**

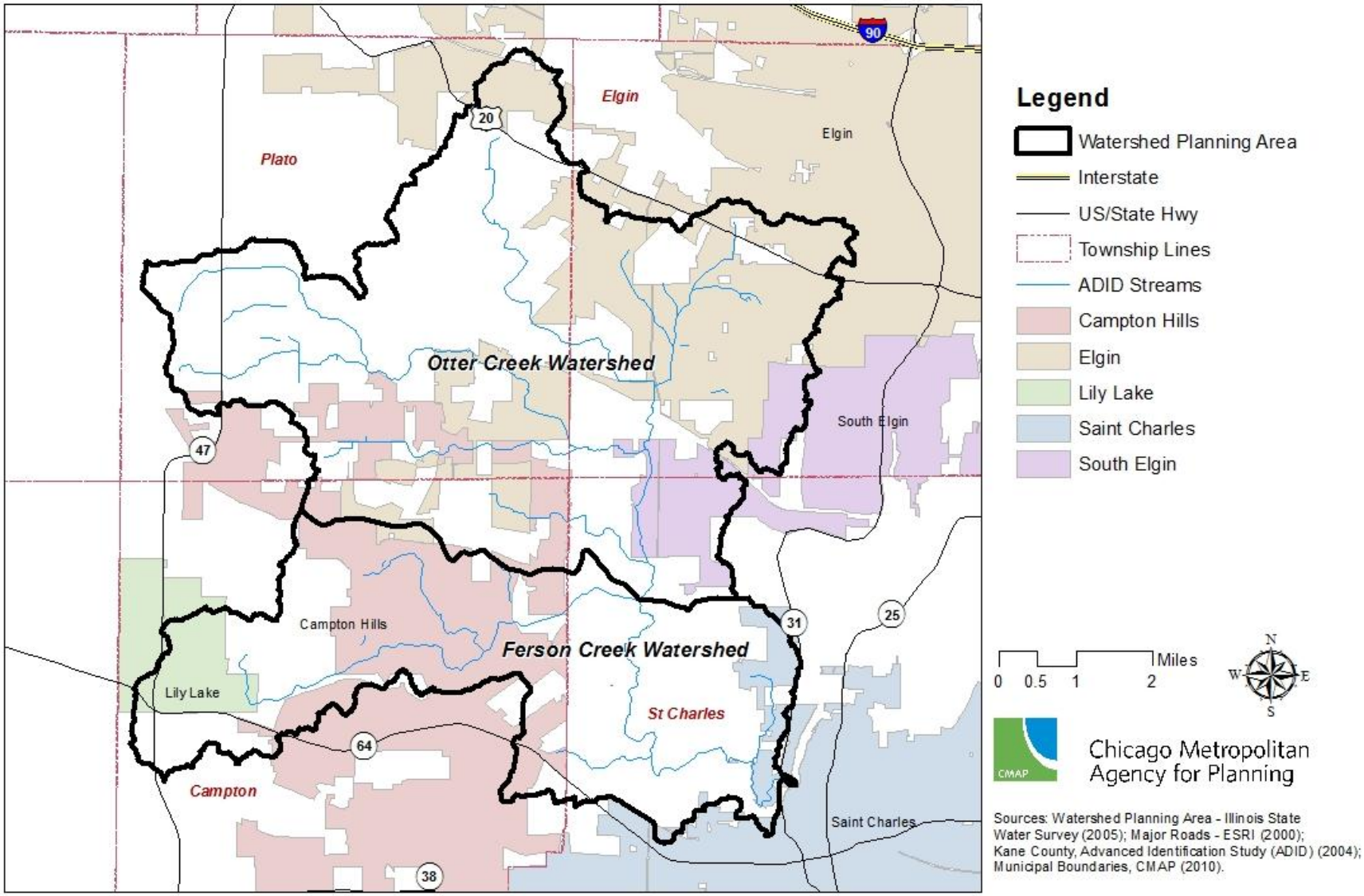


Table 1. Number of square miles for each municipality within Ferson-Otter Creek Watershed

MUNICIPALITY	AREA, IN SQUARE MILES
Campton Hills	8.4
Elgin	10.3
Lily Lake	1.4
South Elgin	2.5
St. Charles	1.0
Unincorporated Kane County	30.4
Total	**54.0**

Presently, fecal coliform is the only cause of impairment that has been identified in the watershed.[7] The primary focus of the plan, therefore, will be on recommendations to eliminate this cause to the extent possible. Currently, a lack of comprehensive monitoring data (i.e., spatial resolution) prevents identification of source locations of this contaminant throughout the watershed. Policy recommendations made in the plan regarding fecal coliform will cover a variety of potential sources (septic system failure, wildlife, pet waste, etc.). Similarly the project recommendations will include various projects that will improve overall water quality in addition to having some fecal coliform reduction benefits. The need for more comprehensive monitoring is addressed in Chapter 7.

Additionally the plan will address water quality concerns facing the Fox River given that the Ferson-Otter Creek is a major tributary. To provide context, a brief discussion of the Fox River Basin will be provided in Chapter 2.

In 2010, the Chicago Metropolitan Agency for Planning (CMAP) entered into an agreement with the Illinois Environmental Protection Agency (IEPA)[8] to complete three watershed-based plans within the Fox River Basin, including the Ferson-Otter Creek Watershed. As the delegated authority for the region's areawide water quality management plan, CMAP works with local partners to outline management strategies for eliminating point- and nonpoint-source pollution, protecting groundwater, and managing wastewater throughout the seven-county region.[9] CMAP, as did the Northeastern Illinois Planning Commission before it, uses a collaborative watershed approach to planning that seeks to protect and/or remediate water quality.[10] Funding for these projects was provided by IEPA through Section 604(b) of the Clean Water Act and must meet certain requirements which are discussed below.

[7] Ferson Creek and Otter Creek were not assessed for all designated uses and potential causes of impairment such as nutrients and other pollutants. Water quality data presented for Ferson Creek were collected at station DTF-01 at its mouth. This station is at Illinois Route 31 in St. Charles in Ferson Creek Park. The soil type at this station is called "Otter silt loam," which is occasionally flooded and has a slope of 0 to 2 percent. For the soil at this station, the hydrological soil group is B and the hydric classification is "all hydric."

[8] "Bureau of Water," IEPA, accessed November 8, 2011, http://www.epa.state.il.us/water/.

[9] NIPC. *Areawide Water Quality Management Plan for Northeastern Illinois*. Chicago, IL: CMAP, 1979.

[10] A watershed planning approach often addresses other related natural resource (e.g. open space, habitat, etc. or built-environment (flooding, stormwater, etc.) management issues in a complementary fashion. In so doing, a watershed plan can be multiobjective.

1.4 PLAN GUIDANCE

The United States Environmental Protection Agency (USEPA) provides guidelines for watershed-based plans produced with Clean Water Act (CWA), Section 319 grant funding aimed at controlling nonpoint-source pollution. Under these guidelines, a watershed-based plan must include at a minimum the following nine components:

1. An identification of the causes and sources that need to be controlled to achieve pollutant load reductions estimated in this plan;
2. An estimate of the load reductions expected for the management measures described under (#3) below;
3. A description of the non-point source management measures that will need to be implemented to achieve the load reductions estimated under (#2) above;
4. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan;
5. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented;
6. A schedule for implementing the non-point source management measures identified in this plan;
7. A description of interim, measurable milestones for determining whether non-point source management measures or other control actions are being implemented;
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards; and
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (#8) above.

Three additional regional criteria listed below are being explored for their utility as well:

1. Set target pollutant-load reductions for impaired waters taking into account both point- and nonpoint-source pollution sources;
2. Consider groundwater protection from both water quality and water quantity perspectives;
3. Compare municipal codes and ordinances against the Center for Watershed Protection's Code and Ordinance Worksheet.[11]

Criterion one is addressed in the Water Quality chapter. The second criterion, groundwater protection, was discussed during stakeholder meetings and covered a variety of topics including groundwater quality, population growth, water supply / demand, and conservation and efficiency. Groundwater protection is especially important in the Ferson-Otter Creek Watershed because all of the communities' public water supplies are dependent on groundwater or river water (Table 2). Lastly the Center for Watershed Protection's Code and Ordinance worksheet provides a starting point to evaluate municipal codes and ordinances to guide relevant plan recommendations discussed in more detail in Chapter 5.

[11] Center for Watershed Protection. *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program*. Tool 4: Code and Ordinance Worksheet. Ellicott City, MD: Center for Watershed Protection, 2008. http://www.cwp.org/documents/cat_view/76-stormwater-management-publications/90-managing-stormwater-in-your-community-a-guide-for-building-an-effective-post-construction-program.html (accessed November 8, 2011).

Table 2. Water source by municipality within the Ferson-Otter Creek Watershed

MUNICIPALITY	WATER SOURCE
Campton Hills	**groundwater**
Elgin	**Fox river**[1]
Lily Lake	**groundwater**
South Elgin	**groundwater**
St. Charles	**groundwater**

1 Elgin relies primarily on the Fox River for their water supply; however, a small portion of their supply is provided by groundwater.

1.5 STAKEHOLDER CONCERNS AND GOALS

One of the first tasks for the watershed's diverse set of stakeholders was the discussion and establishment of goals for the Ferson-Otter Creek Watershed Plan. Before developing the goals, stakeholders were asked to communicate their concerns and vision for the watershed. Stakeholder concerns included:

- Fecal coliform, nutrients and sediment and other pollutants.
- Current and future development in the watershed and its effect on stream health.
- Lack of education for land owners along creeks, need to encourage stream corridor best management practices.
- The ecological condition of the lands adjacent to the creek as well as the natural areas throughout the watershed, protecting quality of open space and the need for a healthy stream corridor.
- Stormwater
    - Too much runoff and not enough infiltration and recharge.
    - Non-point source pollution
    - Volume of stormwater channeled into creek leading to stream bank erosion and sedimentation.
- Need for improved recreation and education opportunities on public land in coordination with Kane County.
- Log jams and beaver dams along the creek.
- Tree removal and clearing debris.

Goals were then drafted directly from the concerns expressed by the stakeholders. The final goals were adopted November 23, 2010 and capture the desired outcomes and vision for the watershed. Recommendations throughout the plan will address each of the following goals:

1) Reduce fecal coliform contributions to Ferson and Otter Creek.
2) Reduce nutrients, sediments, and other pollutant contributions to Ferson and Otter Creek.
3) Raise stakeholder (residents, public officials, etc.) awareness about the importance and best management practices of proper watershed stewardship.
4) Promote land use and best management practices that minimize increases in the volume of stormwater runoff and reduce the risk of flood damage.
5) Protect the quality and quantity of our water supplies.
6) Improve the physical condition of our waterways.
7) Develop an effective and lasting Watershed Coalition to foster continuing stewardship efforts in the watershed.

1.6 THE PLANNING PROCESS

The Ferson-Otter Creek Watershed planning process was designed to be stakeholder-driven with assistance from CMAP and other partner agencies. As the project lead, CMAP facilitated monthly meetings (between September 2010 and December 2011) and provided technical assistance for the watershed-based plan. The kick-off meeting was held on September 21, 2010 at the Campton Township Community Center in St. Charles, Illinois. In addition to monthly meetings, one evening Open House meeting was held to better accommodate a wider variety of stakeholders. Several "stream walks" were organized in which stakeholders experienced both healthy landscapes within the watershed as well as areas in need of improvement. Together these meetings directed the development of the watershed-based plan based on stakeholder input, best professional judgment, and the requirements enumerated above.

The Conservation Foundation (TCF)[12] and the Fox River Ecosystem Partnership (FREP)[13] are both partners in the planning process and have received grants from CMAP. In coordination with CMAP and FREP, TCF served as the watershed coordinator, convened local stakeholders, and executed an education and outreach campaign during the planning process.

FREP supported the outreach and education effort by upgrading their website (subwatersheds webpage), highlighting watershed planning activity in their monthly e-newsletter – "Downstream" and hosting a Noon Network in the Ferson-Otter Creek Watershed on October 19, 2011.[14]

[12] "The Conservation Foundation," Conservation Foundation, accessed November 8, 2011, http://www.theconservationfoundation.org/. The Conservation Foundation (TCF) was established in 1972 as a not-for-profit land and watershed protection organization. TCF has been involved in planning coordination and technical assistance for a number of watershed plans including Upper DuPage River, Aux Sable Creek, Lower DuPage River, Salt Creek and Tyler Creek.

[13] "Fox River Ecosystem Partnership," FREP, accessed November 8, 2011, http://foxriverecosystem.org/. The Fox River Ecosystem Partnership (FREP) is a not-for-profit created in 1996, comprised of local governments, private businesses, not-for-profits and landowners in the Fox River Basin. FREP's vision for the *Fox River Basin "is to balance all the uses and demands on our natural resources while preserving and enhancing a healthy environment."*

[14] Ibid. 13.

2. RESOURCE INVENTORY AND ASSESSMENT

The Resource Inventory and Assessment chapter is a summary of publicly available data that have been gathered for the Ferson-Otter Creek Watershed. The compendium of data and information that follows does not claim to be exhaustive, but rather a good-faith effort at organizing as much as could be collected in a timely manner during the construction of this plan. Data were taken from a variety of sources with the purpose of characterizing the watershed and providing stakeholders with information about existing conditions to assist in the formulation of recommendations for the watershed plan.

2.1 FOX RIVER OVERVIEW

This watershed-based plan aims to address the fecal coliform impairment in Ferson Creek; however, the plan can also address some of the Fox River concerns given that the Ferson-Otter Creek is a major tributary. These concerns include nutrients (phosphorus and nitrogen) and sediment or total suspended solids. Sources of these pollutants include both agricultural and urban runoff. To provide context, a brief discussion of the Fox River Basin follows.

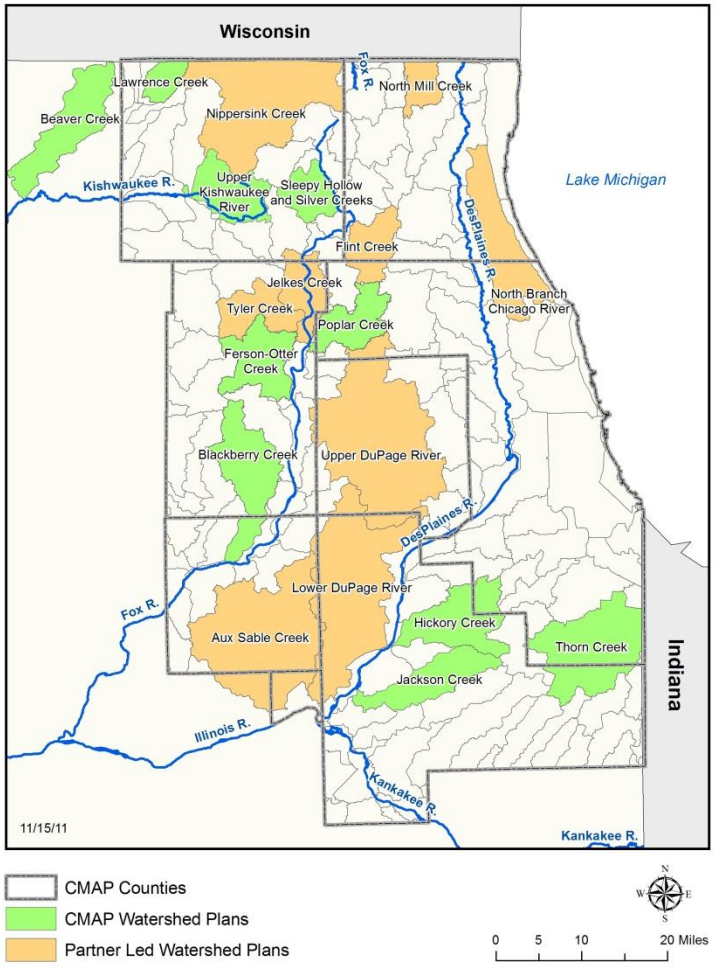
The Fox River is the third largest tributary of the Illinois River stretching 185 miles (115 miles in Illinois) from its headwaters near Waukesha, Wisconsin, to its confluence with the Illinois River in Ottawa. The Fox River Basin covers approximately 2,658 square miles of which 1,720 (65%) are in Illinois. The river basin includes portions of eleven Illinois counties including six (Cook, DuPage, Kane, Lake, McHenry, and Will) that are the most populated in the state and six that are among the top ten fastest growing counties in Illinois (#1: Kendall, #2: Will, #3: Grundy, #5: Kane, #7: McHenry, #8: DeKalb)[15]. An attraction for the population growth in the Fox River Basin is the abundance of recreational opportunities and high quality natural resources associated with the river and its tributaries. However, those same high quality resources are being lost or significantly impaired by historic land use change and a type of development that is often inconsistent with sustainable land and water resources stewardship.

The Illinois portion of the Fox River Basin contains about 2,300 river and tributary stream miles and 406 lakes, many of the lakes glacially formed (IDNR, 1998). Perhaps the most noticeable of these lakes are in the Fox Chain-of-Lakes in northwestern Lake County, comprised of fifteen interconnected lakes with more than 7,500 surface acres of water. Four segments of the Fox River and fourteen glacial lakes are considered to be "biologically significant" with more than 150 state-threatened and endangered species found within the basin (IDNR, 1997).

The map below shows Ferson-Otter Creek's placement within the larger Fox River Basin. The Basin is divided into the Upper and Lower sections with the Lower Fox reaching south into LaSalle County and the Upper Fox River Basin reaching north into Wisconsin. In addition to the Ferson-Otter Creek Watershed Plan, CMAP is simultaneously leading two other watershed planning processes for a total three plans: Sleepy Hollow / Silver Creek in the Upper Fox River Basin and Blackberry Creek along with Ferson-Otter Creek in the Lower Fox River Basin. Figure 3 illustrates where watershed plans exist or are under development within the Fox River Basin, reflecting the need for improving or protecting water quality.

[15] Bureau of the Census, Population Division. "Population Estimates for the 100 Fastest Growing U.S. Counties in 2003: April 1, 2000 to July 1, 2004." *Population Estimates Program*, Table CO-EST2003-09 (April 14, 2005). http://www.census.gov/popest/counties/CO-EST2004-09.html (accessed November 3, 2011).

Figure 3. **IEPA compliant watershed plans in northeastern Illinois**



Agricultural and urban development throughout the river basin have had negative impacts on the hydrology, aquatic habitat, and water quality of the Fox River and its tributaries. The invasion of nonnative vegetation has compounded the problem. In many areas the absence of deep rooted native riparian vegetation results in little or no filtering of pollutants and sediment in surface or subsurface runoff from the watershed to the streams.

The water quality of surface and groundwater resources is assessed throughout the state and is reported in IEPA's biannual *Illinois Integrated Water Quality Report (Report) and Section 303(d) List (List)*[16]. In the 2010 draft *Report*, designated uses listed for the 17 IEPA-identified segments of the Fox River are Aquatic Life, Primary Contact, secondary contact, fish consumption, and/or public water supply. All 17 segments were assessed for Aquatic Life use, with 14 considered nonsupport (impaired) and three segments (one in the Upper Fox, two in the Lower Fox Basin) yielding full support (not impaired). Causes of impairment include sedimentation/siltation, total suspended solids, total phosphorus, pH, certain organics, and unknown causes. Impairment sources include urban runoff/storm sewers, combined sewer overflows, municipal point source discharges, flow regulation/modification, dams/impoundments, agriculture and crop-related sources, habitat modification, bank modification/destabilization, upstream impoundments, recreational pollution, and contaminated sediments.

All 17 segments also were assessed for fish consumption use, and all were considered nonsupport (impaired) due to polychlorinated biphenyls (PCBs) and in some cases also mercury from unknown sources. Of the ten segments assessed for Primary Contact, three were considered full support (not impaired) and the other seven nonsupport (impaired). Causes of Primary Contact impairment were total fecal coliform bacteria from unknown sources. Two segments are used for public water supply, and one was considered full support (not impaired) and the other nonsupport (due to

[16] IEPA. Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).

chloride) for that designated use. Per IEPA's *List* (IEPA, 2010a; Appendices A-2 and A-3), the entire Fox River within Illinois and all 10 lakes within the Fox Chain O'Lakes are 303(d)-listed waters. Additionally, 66 of the other 72 lakes that were assessed within the Fox River Basin are 303(d)-listed (for the aesthetic quality and/or fish consumption designated use), including Silver Lake for fish consumption use due to mercury.

2.2 PHYSICAL AND CULTURAL CHARACTERISTICS

This section characterizes the physical and cultural aspects of the watershed. The physical conditions of Ferson-Otter Creek directly affect water quality and quantity and provide guidance for recommendations so that they may work *with* not against the natural features of the landscape. The cultural watershed characteristics provide information on the effects of cultural decisions such as land use change that also affect water quality and quantity in the watershed.

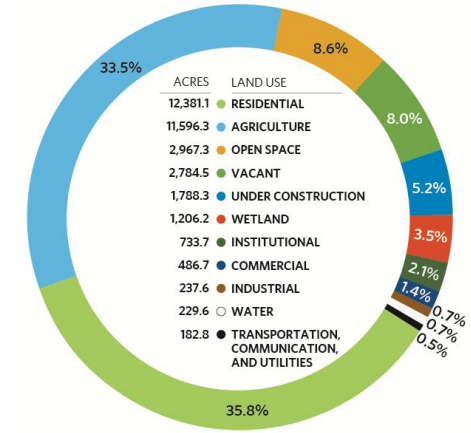
2.2.1 Land Use and Pre-settlement Land Cover

Land use refers to the human use of land. Land use decisions have a significant impact on water quality. For example, an intensely developed area features impervious surfaces,[17] reduced natural vegetation, and causes considerable change to local hydrology. Surface runoff from such an area, picks up contaminants and along with the altered hydrologic regime, impacts Aquatic Life in streams and lakes. Such a scenario can also contribute to local or regional flooding. Additionally, impervious surfaces reduce or prevent the natural infiltration of rainwater and snowmelt into the ground and thus, reduce natural groundwater recharge. Land use, therefore, is an important consideration in watershed planning.

A variety of land uses are present in the Ferson-Otter Creek Watershed. Figure 4 shows the land use breakdown by percentage within the watershed with residential use being the most prominent –covering 35.79% of the total watershed, followed by agricultural use with 33.52%.[18] The remaining land uses are all below 10% each. Figure 5 shows land use within the watershed spatially.

For a qualitative sense of historic land use change, Figure 6 shows the pre-settlement land cover as it existed in the early 1800's and is provided by the Illinois Natural History Survey.[19] The watershed was mostly prairie and forest.

Figure 4. **Land use breakdown within Ferson-Otter Creek Watershed**



[17] "Water Science for Schools," USGS, last modified February 8, 2011, accessed November 3, 2011, http://ga.water.usgs.gov/edu/impervious.html. Naturally vegetated areas that have been replaced by roads, buildings, housing developments, and parking lots are described as impervious surfaces.

[18] NIPC. Land Use Inventory. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).

[19] "Land Cover of Illinois in the Early 1800's," Illinois Natural History Survey, accessed October 31, 2011, http://www.inhs.uiuc.edu/resources/gisresources.html.

Figure 5. **Land use in Ferson-Otter Creek Watershed**

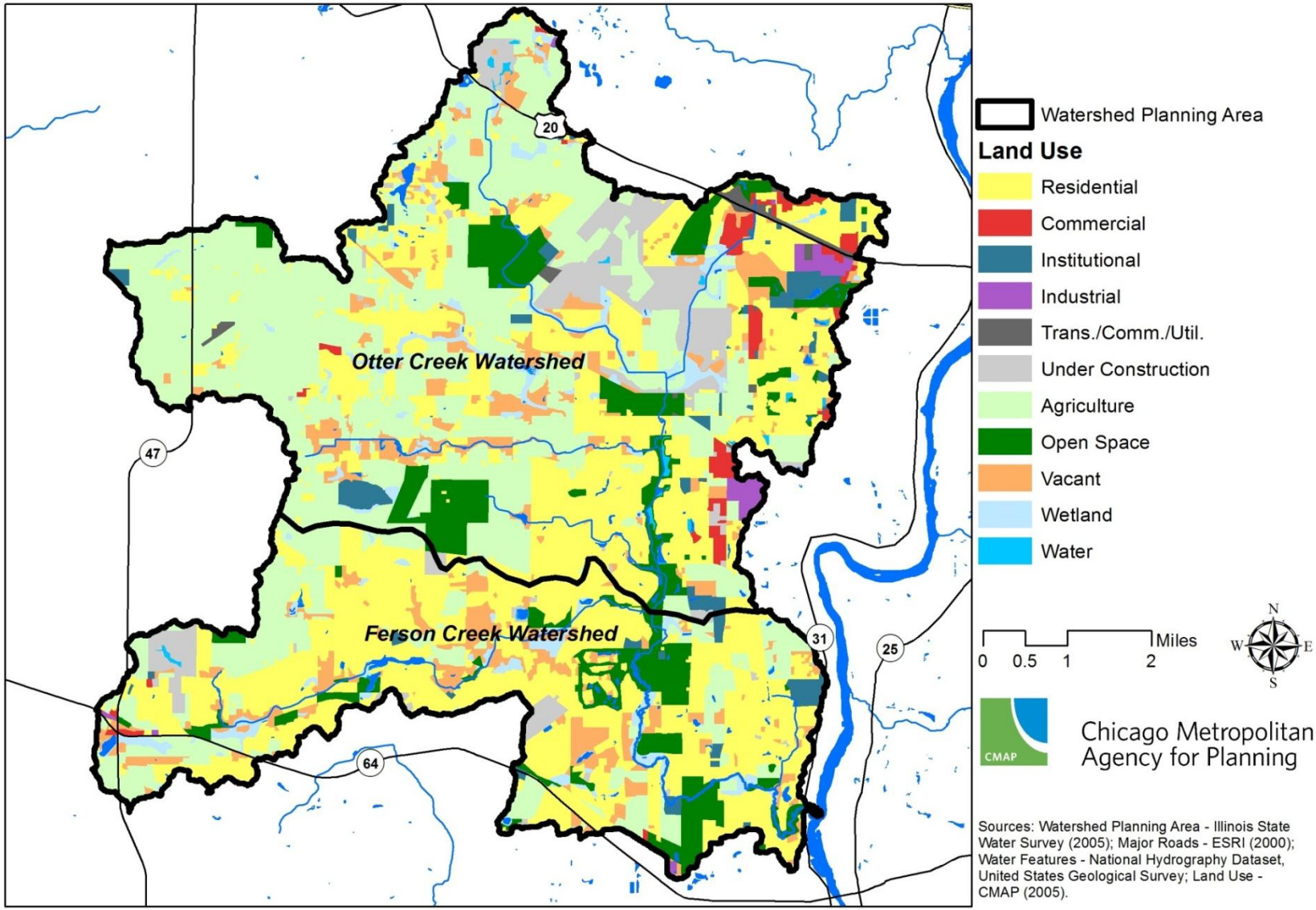
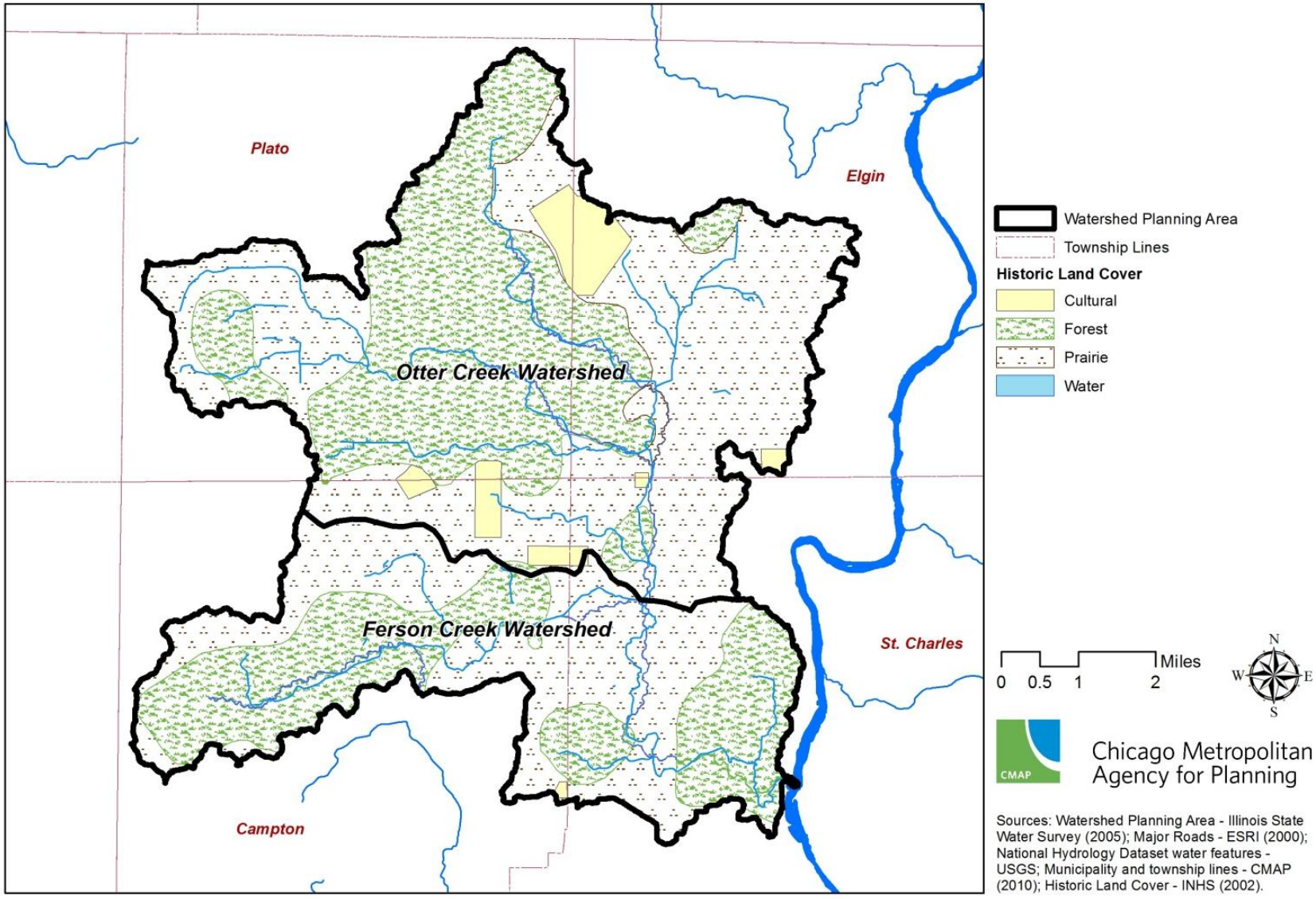


Figure 6. **Pre-settlement land cover for Ferson-Otter Creek Watershed**



Impervious Surface

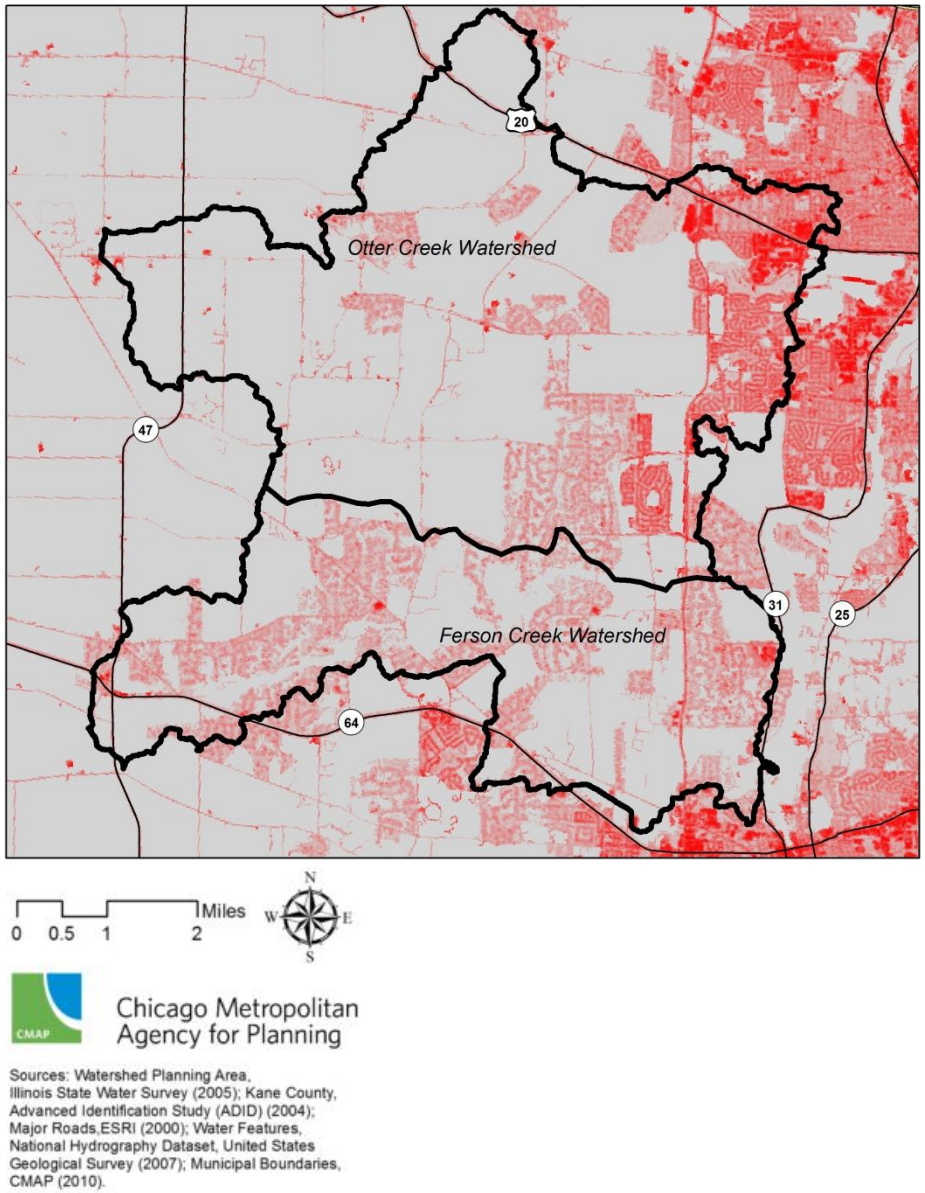
Impervious surface cover includes roofs, sidewalks, driveways, roads, parking lots, and other surfaces that restrict water infiltration on site and increase the quantity and decrease the quality of stormwater runoff. As of 2001, impervious surface covered less than 10% of the entire watershed planning area (Figure 7). At the watershed scale, this is encouraging since research indicates that impervious surface cover greater than 10% results in degraded water quality.[20] However, impervious surface in an amount beyond this threshold exists within every municipality, with the most impervious areas found in Elgin and South Elgin and moderate amounts of impervious areas located in unincorporated areas. Given the age of the data from which the analysis was done, it is highly likely that impervious surface cover has increased.

In general imperviousness increases with development, however, these increases of imperviousness can be minimized by using best management practices including low impact development principles. This topic will be covered in more detail in the Green Infrastructure section of Chapter 5.

Protected Open Space

In this plan, protected open space includes publically and privately owned land. Combined, the watershed has approximately 3, 771 acres of protected open space, accounting for 11% of the watershed's land area (Figure 8).[21] Open space is a valuable resource for protecting water quality, among other benefits such as recreation and habitat. More information on open space is available in the Green Infrastructure section of Chapter 5.

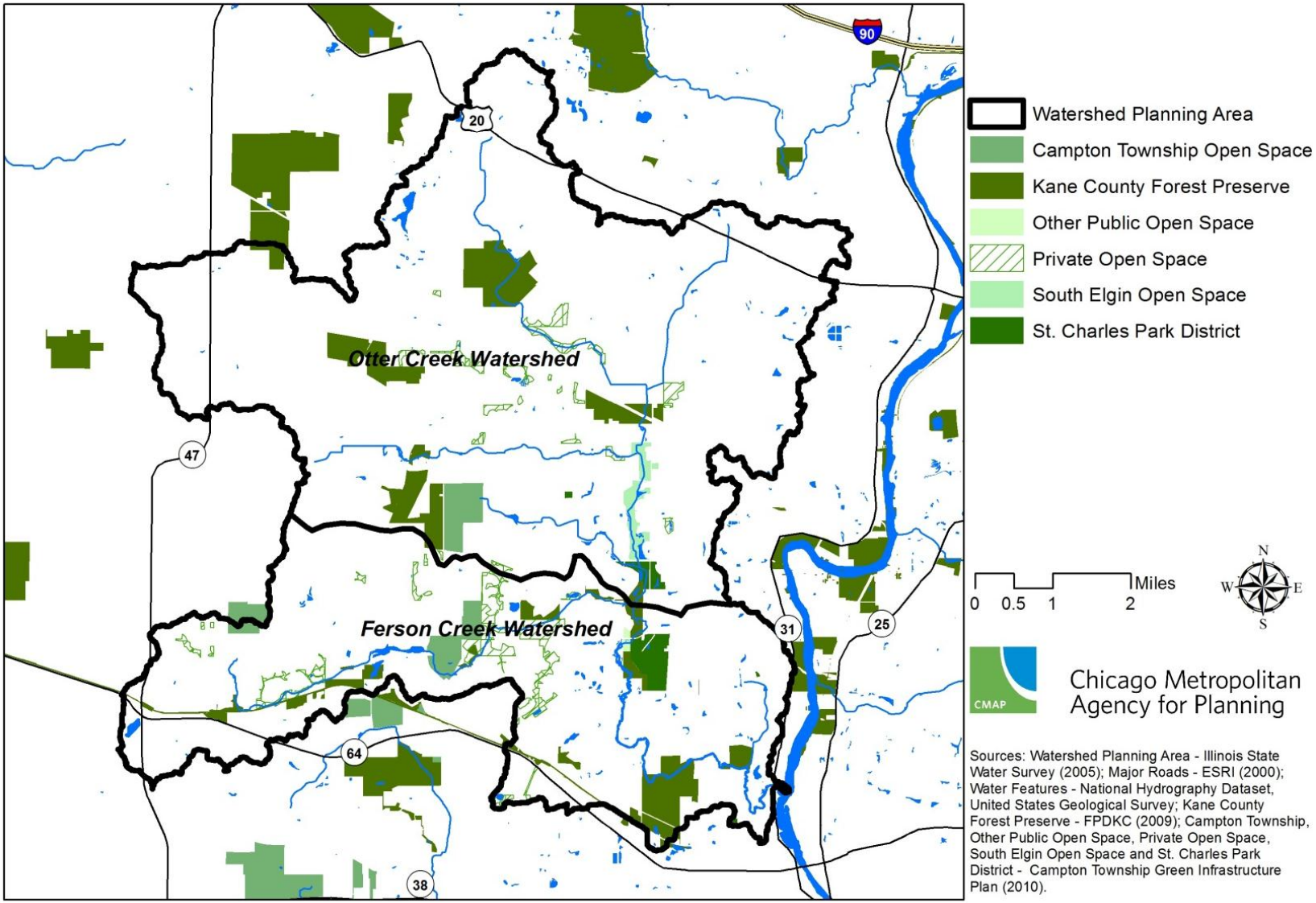
Figure 7. **Impervious surface in Ferson-Otter Creek Watershed**



[20] The Center for Watershed Protection. *Impacts of Impervious Cover on Aquatic Systems*. Mansfield, CT: University of Connecticut, 2003. http://clear.uconn.edu/projects/TMDL/library/papers/Schueler_2003.pdf (accessed November 8, 2011).

[21] See Figure 8.

Figure 8. **Protected open space in Ferson-Otter Creek Watershed**



Forest Management Plans

The Illinois Department of Natural Resources (IDNR), Office of Resource Conservation, Division of Forestry, works with private landowners to reforest agricultural land and help with managing private woodlots. The Illinois Forestry Development Act (IFDA; 525 ILCS 15), funded in part by the U.S. Department of Agriculture (USDA) Forest Service, provides for this program. The IFDA created the Illinois Forestry Development Council, the Forestry Development Cost Share Program, and the Forestry Development Fund. Timber harvests in the State of Illinois are subject to a 4% harvest fee which helps to fund the cost-share component of the program.[22]

Ten acres of woods is the minimum land-area requirement, eleven acres if a home is present on the property. The program requires a landowner to develop an IFDA-approved management plan. With passage of the IFDA, the Illinois Property Tax Code was amended in order to provide a tax incentive to timber growers. In counties with less than 3,000,000 residents (i.e., all Illinois counties other than Cook), any land being managed in the IFDA is considered as "other farmland". Thus, the land is valued at one-sixth of its equalized assessed value based on cropland.

In northeastern Illinois, the program emphasizes exotic species removal and oak regeneration. Within the Ferson-Otter Creek Watershed, there are currently no properties enrolled in the IFDA program.

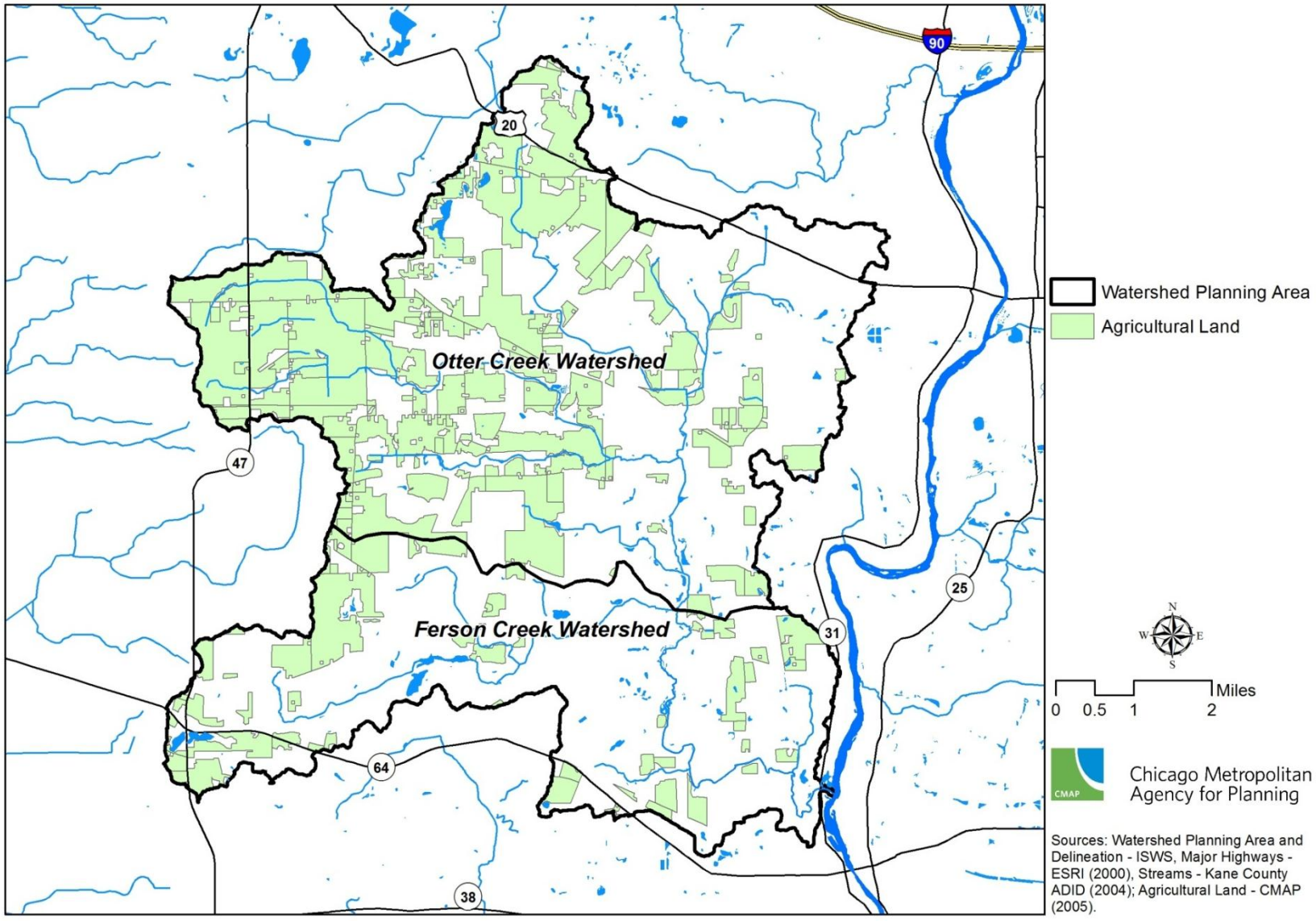
[22] IDNR. *Information Sheet: Illinois Forestry Development Act*. Springfield, IL: IDNR, June 2006. http://dnr.state.il.us/conservation/forestry/IFDA/ (accessed November 2, 2011).

Agriculture

The distribution of agricultural land throughout Ferson-Otter Creek Watershed is characterized from the 2005 CMAP Land Use Inventory. See Figure 9 for the distribution of agricultural land throughout these watersheds, a total of 11,596 acres.[23] Beyond the county-level, more detailed watershed-level statistics do not exist for agricultural land use and practices in Ferson-Otter Creek Watershed.[24] County-level statistics are available through the USDA 2007 Census of Agriculture. Kane County is 57% agricultural by land area and of this, 60% is planted in corn and 24% in soy.[25] Although row crop agriculture is the predominant agricultural land use in Kane County, the county also has a small amount of animal agriculture. Kane County accounts for 0.48% of livestock in Illinois, with 124,978 head.[26] Figure 9 shows the distribution of land used for livestock and equestrian purposes for Ferson-Otter Creek Watershed, a total of 694 acres.[27]

[23] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[24] Thomas Ryterske, NRCS Illinois District Conservationist, email message to author(s), June 27, 2011.
[25] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 1, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).
[26] Ibid.
[27] Ibid. 23.

Figure 9. **Agricultural land in Ferson-Otter Creek Watershed**



The Census also collects information on selected agricultural practices. Some of these practices are relevant to the discussion of agricultural impacts to water quality. For Kane County, a significant number of farmers employ some form of conservation practice: 33% of farms used some form of conservation method for crop production; 9% of farms practiced rotational or management-intensive grazing; and no farms grazed livestock on an animal unit month (AUM) basis.[28] Conservation practices include any of the several projects or management practices such as conservation tillage or nutrient management planning, described in the National Resource Conservation Service (NRCS) Illinois Field Office Technical Guides (FOTG) that are detailed more thoroughly below.[29] Rotational or management-intensive grazing both involve systematically moving livestock herds throughout available grazing lands according to a plan that is designed to most efficiently encourage forage growth and livestock health. For Kane County specifically, farmers most often use the following conservation practices: residue management (strip-, no- or mulch-tillage); nutrient management planning (monitoring soil nutrient levels and applying fertilizers only in needed amounts); and integrated pest management (using pest-resistant crop varieties, rotating crops and targeting areas for pesticide that exceed defined damage thresholds).[30]

In addition, 0.4% of agricultural land in Kane County is enrolled in the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), Farmable Wetlands, or Conservation Reserve Enhancement Program (CREP) based on the Census.[31] Statewide, 3.3% of agricultural land is enrolled in one of these programs.[32] These are voluntary programs for agricultural landowners that provide assistance and incentives to farmers for conserving natural resources on private lands. CRP offers payments to farmers to establish environmentally beneficial plant cover on eligible croplands. The Wetlands Reserve and Farmable Wetlands programs both focus on wetlands, and in the first case, help farmers to protect or restore wetlands on their property, and in the second, enable farmers to prevent degradation of wetlands on land enrolled in CRP. Finally, CREP combines CRP resources with tribal, state and federal authorities for a community-based approach to conservation issues on private lands locally.

Agricultural irrigation can also have direct consequences for water resources given its consumptive nature. Irrigation in Illinois is used to a more limited extent than in other regions. In Kane County, 1.5% of farmland is irrigated.[33] For comparison, 6.1% of agricultural land is irrigated nationally, while in Illinois, 1.8% of farmland is irrigated.[34] However, a water demand study commissioned by CMAP found that total water withdrawals for agricultural irrigation in northeastern Illinois are not insignificant.[35] Total water

[28] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 44, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011). An *AUM* is the amount of forage necessary to sustain an animal for a month, varying by the type of animal. An AUM accounting system can be used to calculate the required grazing area for a herd, which informs appropriate stocking densities and timing of rotations when farmers are developing grazing patterns.

[29] USDA NRCS. *Field Office Technical Guides*. Kane County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

[30] Thomas Ryterske, NRCS Illinois District Conservationist, email message to author(s), June 27, 2011.

[31] Ibid. 28, Table 8.

[32] Ibid.

[33] Ibid. 28, Table 10.

[34] USDA NASS. "Irrigation: 2007 and 2002." *2007 Census of Agriculture*, United States Summary and State Data, Volume 1, Geographic Area Series, Part 51, Chapter 2, Table 10, Report No. AC-07-A-51. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_US_State_Level/index.asp (accessed September 13, 2011).

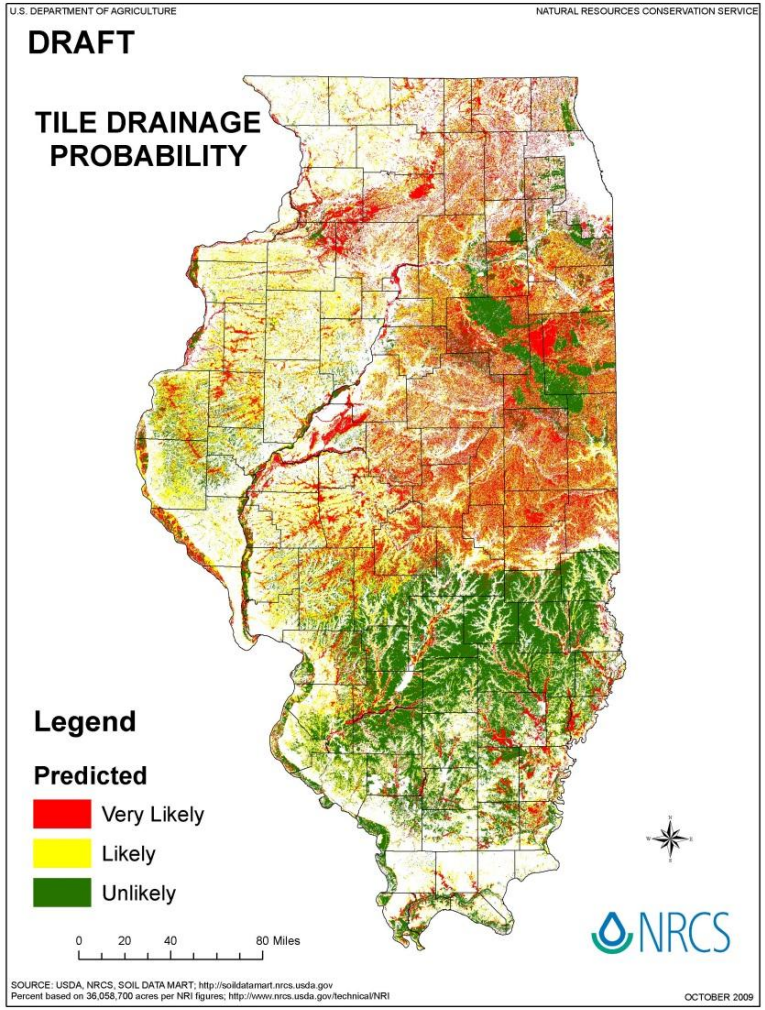
[35] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008.

withdrawal for Kane County in 2005 was 61.5 million gallons per day (MGD).[36] For the same county and year, total water withdrawal for cropland irrigation was 2.47 MGD, while estimated water use for livestock was 0.29 MGD.[37] Cropland irrigation and livestock water use therefore accounted for 4% and 0.04% of total water withdrawals in 2005 in Kane County respectively.

Agriculture in turn is affected by prevalent biophysical conditions in Ferson-Otter Creek Watershed. Soil conditions in particular provide an indication of the hydrological character of land in the watershed, especially with regard to the likely extent of tile drainage on agricultural lands. The location and extent of hydric soils and hydrologic soil groups within this watershed, as well as the definitions of these terms, are discussed further in the Resource Inventory. Such soil characteristics inform the overall drainage ability of agricultural lands. The extent of tile drainage is not well-documented at either national or local levels.[38] Drainage classes determined by NRCS are used to estimate the extent of tile drainage in Ferson-Otter Creek Watershed. At a statewide level, however, NRCS has performed a similar analysis based on the interpretation of soil groups in the Illinois Drainage Guide. Figure 10 features the results of this analysis by NRCS, depicting the probability of tile drainage for agricultural lands throughout the state of Illinois.[39]

Based on this figure, most agricultural lands in Kane County are either "Likely" or "Very Likely" to have tile drainage.

Figure 10. **Tile drainage probability in Illinois**



http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

[36] Ibid.

[37] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

[38] World Resources Institute. *Assessing U.S. Farm Drainage: Can GIS Lead to Better Estimates of Subsurface Drainage Extent?* By Z. Sugg. Washington, D.C.: World Resources Institute 2007. http://pdf.wri.org/assessing_farm_drainage.pdf (accessed September 21, 2011).

[39] "Illinois Suite of Maps: Potential Tile Drainage Extent," USDA NRCS last modified April 11, 2011, accessed September 21, 2011, http://www.il.nrcs.usda.gov/technical/soils/Suite_Maps.html.

The likely extent of tile drainage in Ferson-Otter Creek Watershed is estimated here based on soil drainage classes. NRCS recognizes seven natural drainage classes describing the frequency and duration of wet periods for various soils. The drainage class for soil features is obtained from the SSURGO dataset (Soil Survey Geographic Database).[40] These classes are Excessively Drained, Somewhat Excessively Drained, Well Drained, Moderately Well Drained, Somewhat Poorly Drained, Poorly Drained and Very Poorly Drained.[41] The last three drainage classes indicate soils which limit or exclude crop growth unless artificially drained. Soils with the Somewhat Poorly Drained, Poorly Drained or Very Poorly Drained drainage class occur on 45% of the agricultural land in Ferson-Otter Creek Watershed. These areas can be taken as an approximation of the likely extent of artificial drainage on currently farmed agricultural lands, given that crop growth on these lands would be impossible or severely impacted without artificial drainage. The extent of soils with these drainage classes is depicted in Figure 11.

Some of these poorly drained areas were likely once wetland areas which are now farmed. There are nine sites identified as "Wetlands Being Farmed" in the CMAP 2005 Land Use Inventory on agricultural lands within Ferson-Otter Creek Watershed (Figure 12).[42] Officially, a Farmed Wetland is a wetland that has been modified to produce agricultural goods that also meets certain hydrologic conditions.[43] The CMAP classification, however, might not meet these criteria. "Wetlands Being Farmed" were identified for the CMAP 2005 Land Use Inventory from any features in the National Wetlands Inventory that are greater than 2.5 acres, on agricultural lands, and verified to be an existing wetland through aerial photography.[44] Farmed wetlands meeting the federal definition are often still wet enough to act as valuable wetland habitats that are subject to Swampbuster, the Wetland Conservation provision in the Farm Bill, and Clean Water Act Section 404, which regulates the management of wetland areas. Consequently, these nine sites with the CMAP "Wetlands Being Farmed" classification might be potential best management practices (BMPs) implementation sites for wetland restoration opportunities given sufficient interest and ability on the part of these private landowners. Additionally, they might require further investigation to determine whether they meet the federal Farmed Wetlands classification.

Finally, the SSURGO dataset from NRCS also includes information about the distribution of highly erodible lands (HEL). Highly erodible lands are those most vulnerable to significant amounts of erosion, and are identified according to a specific set of criteria defined in the Code of Federal Regulations. For Ferson-Otter Creek Watershed, 7% of the total land area is highly erodible, while 18% of all agricultural land is highly erodible. Soil surveys identify HEL soil units based on the erodibility index of the soil.[45] The erodibility index is calculated by dividing the potential average annual rate of erosion for each soil by the maximum annual rate of soil erosion that could occur without causing a decline in long-term productivity (also called the T level).[46] Erosion in turn is calculated according to

[40] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. Kane County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011).
[41] Soil Conservation Service, Soil Survey Staff. *Soil Survey Manual*. USDA Handbook 18. Washington, D.C.: USDA NRCS, 1993. http://soils.usda.gov/technical/manual/ (accessed September 14, 2011).
[42] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[43] "Highly Erodible Land and Wetland Conservation." *Code of Federal Regulations*. Title 7, Part 12 (1996). http://edocket.access.gpo.gov/cfr_2011/janqtr/pdf/7cfr12.2.pdf (accessed September 14, 2011).
[44] David Clark, Senior Analyst for CMAP, email message to author(s), September 14, 2011.
[45] "Identification of highly erodible lands criteria." *Code of Federal Regulations*. Title 7, Part 12 (2011). http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=pEGmgU/11/2/0&WAISaction=retrieve (accessed October 3, 2011).
[46] Ibid.

the Universal Soil Loss Equation (USLE), which includes factors like rainfall and runoff (R); the degree to which the soil resists erosion (K); and a formula measuring slope length and steepness (LS).[47]

Like wetlands, HEL lands are the focus of specific NRCS conservation efforts. The Highly Erodible Land Conservation Compliance Provisions in the Food Security Act of 1985 requires that under certain circumstances, farmers producing agricultural goods on lands deemed highly erodible lands must use a USDA-approved conservation system.[48] In addition, this Act established a stricter provision called Sodbuster (similar to the Swampbuster provision discussed above) requiring that under certain circumstances, farmers cultivating HEL lands must adopt a conservation system that reduces erosion to the T level.[49] Violations of either provision can result in the loss of some or all USDA program benefits to the farmer. Any HEL lands currently being farmed in the Ferson-Otter Creek Watershed (Figure 13) might be subject to these provisions, if these lands satisfy the criteria used to determine applicability of these provisions to specific properties.

[47] "Identification of highly erodible lands criteria." *Code of Federal Regulations*. Title 7, Part 12 (2011). http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=pEGmgU/11/2/0&WAISaction=retrieve (accessed October 3, 2011).
[48] "Highly Erodible Land Conservation Compliance Provisions," USDA NRCS, accessed October 3, 2011, http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?ss=16&navtype=SUBNAVIGATION&cid=nrcs143_008440&navid=100170150000000&pnavid=100000000000000&position=Welcome.Html&ttype=detail&pname=Highly%20Erodible%20Land%20Conservation%20Compliance%20Provisions%20|%20NRCS.
[49] Ibid.

Figure 11. **Drainage classes in Ferson-Otter Creek Watershed**

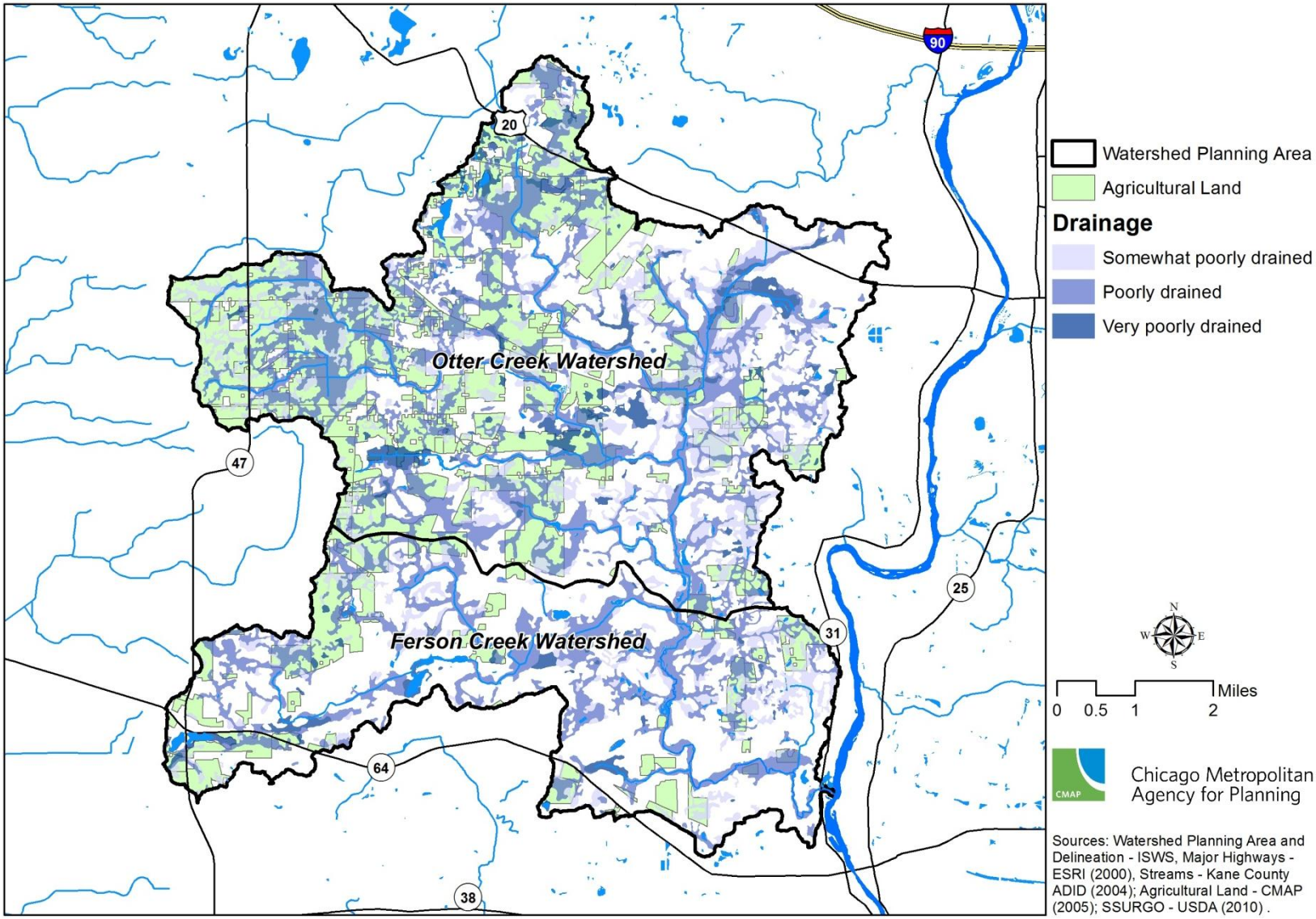


Figure 12. **Farmed wetlands in Ferson-Otter Creek Watershed**

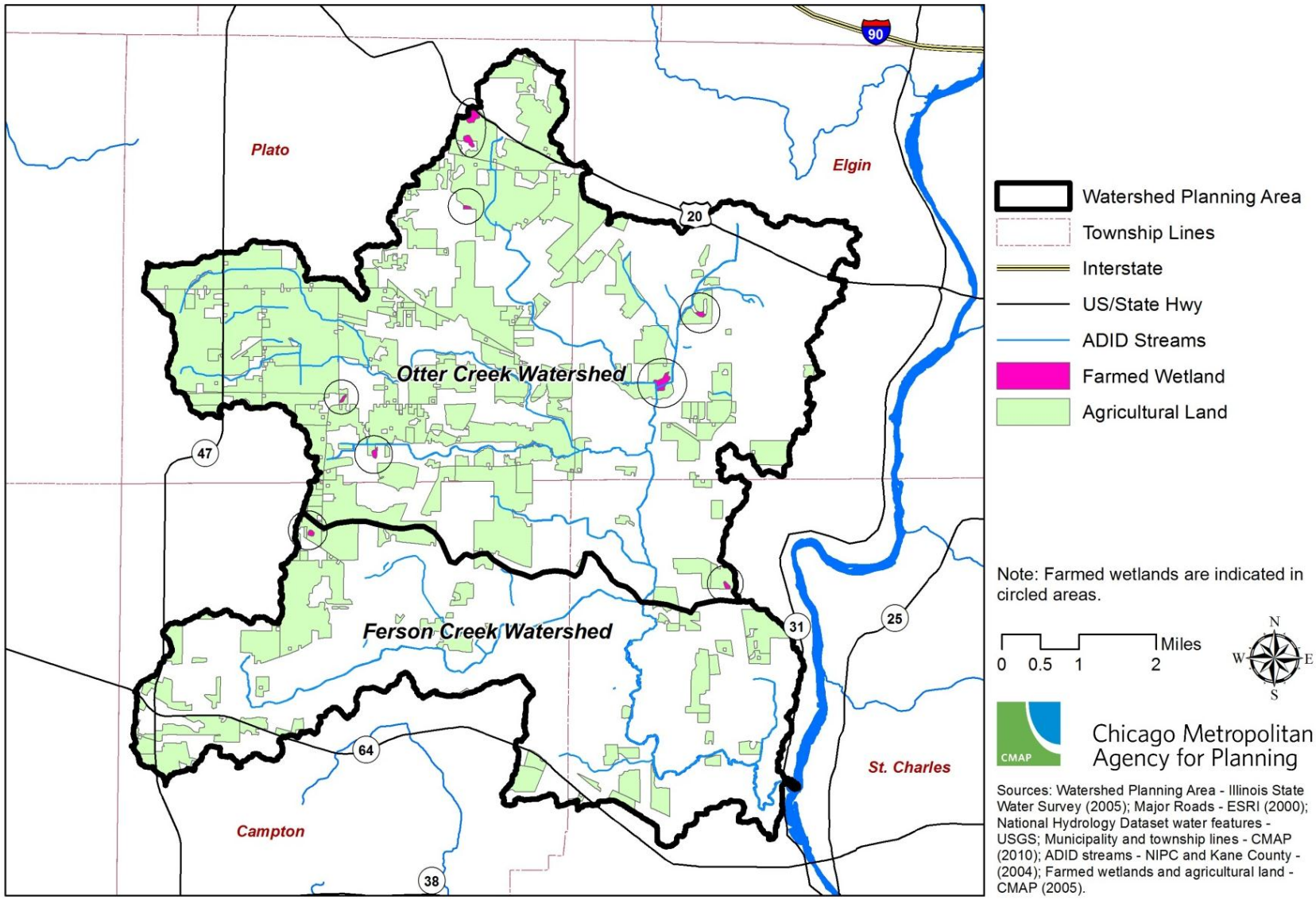
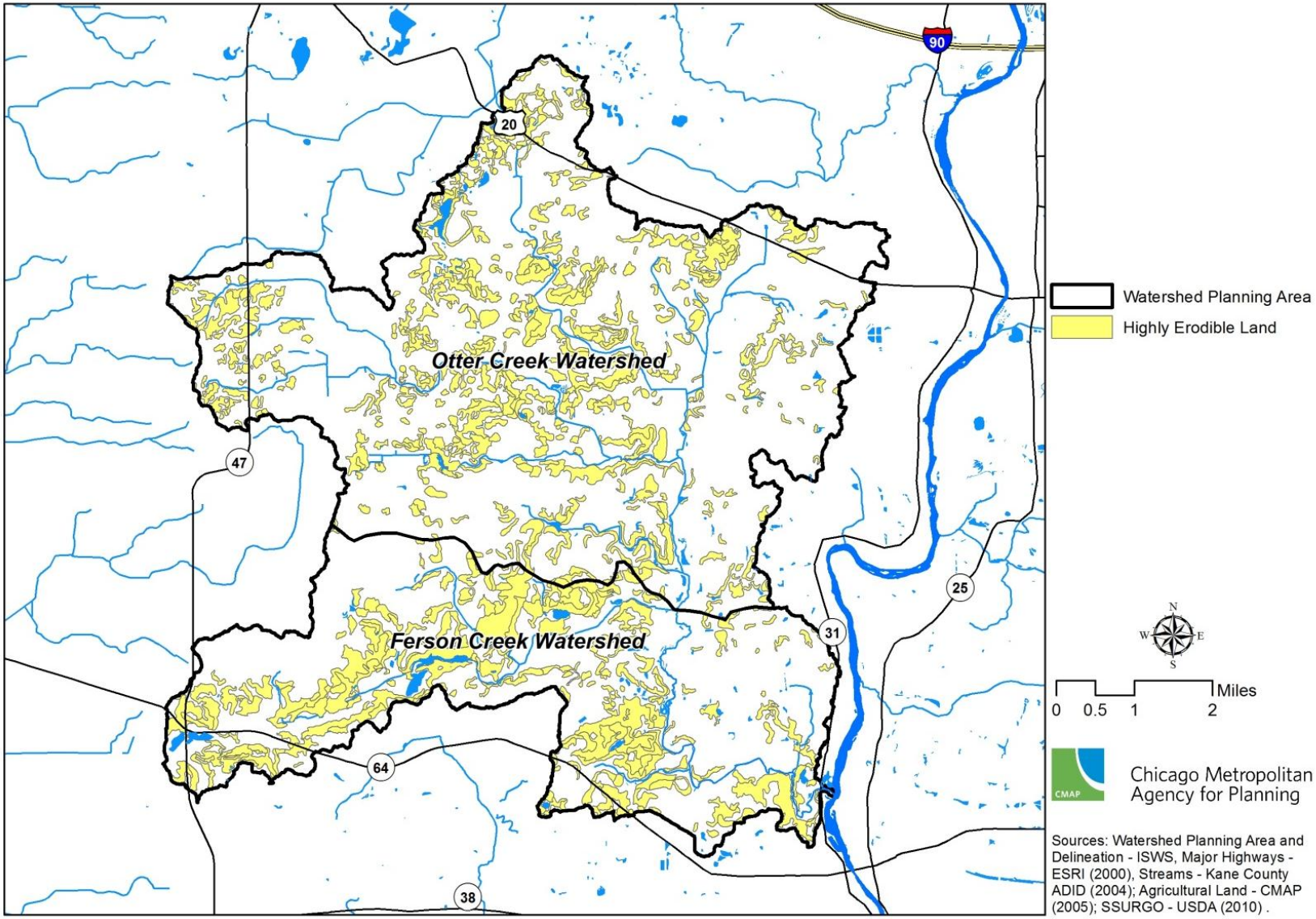


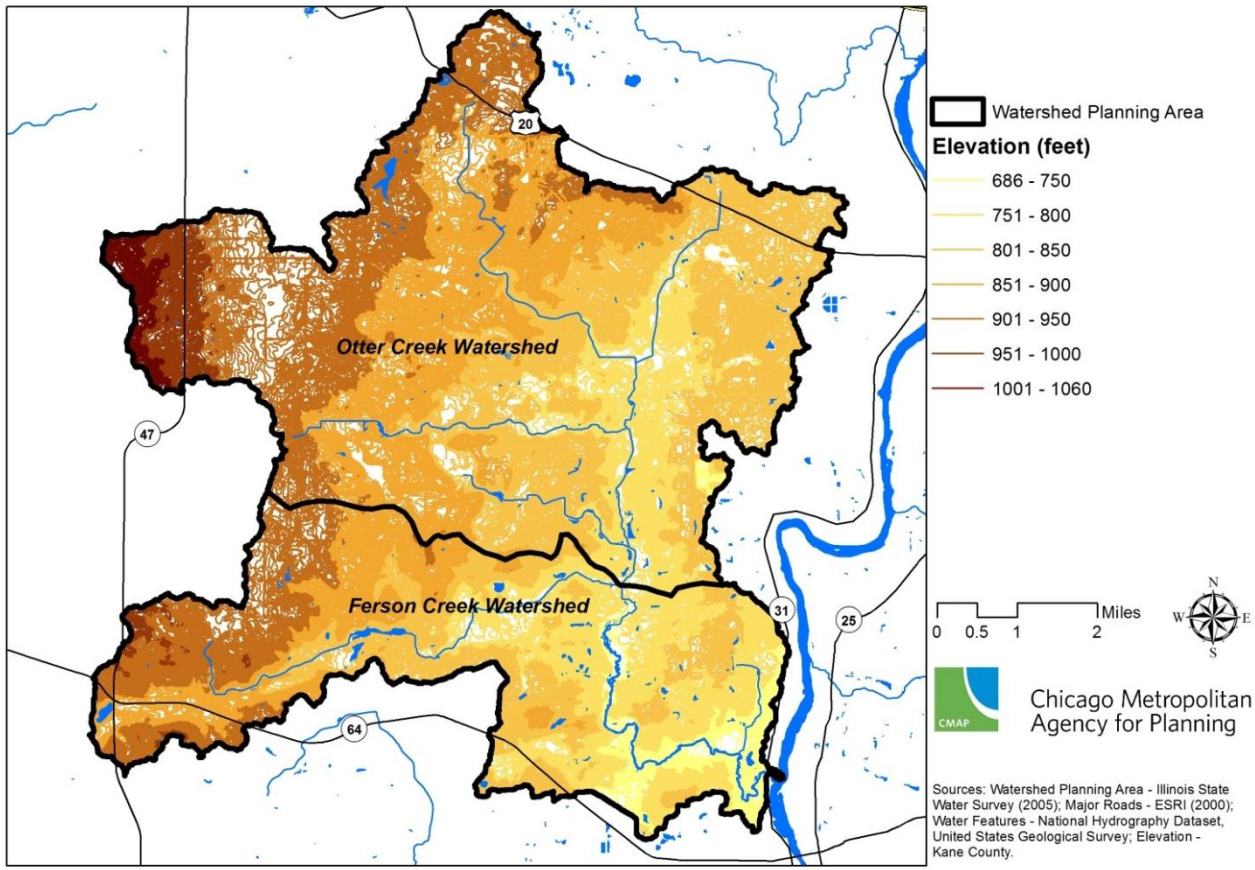
Figure 13. **Highly erodible land in Ferson-Otter Creek Watershed**



2.2.2 Topography

Elevation is highest in the western portion of the watershed and gradually lowers to the east as the land approaches the Fox River. Elevations range from 686 to 1060 feet above mean sea level (AMSL) for a total relief of 374 feet (Figure 14).[50] The majority of the watershed lies under 1000 feet AMSL. Agriculture is the dominant land use in the highest areas of the watershed (900 feet and above).

Figure 14. **Elevation in Ferson-Otter Creek Watershed**



[50] CMAP. "Two Foot Topographic Contours." Geneva, IL: Kane County, Illinois, 2006.

2.2.3 Soils

Hydric Soils

The soils data is sourced from the Soil Survey Geographic (SSURGO) Database produced by the USDA, Natural Resources Conservation Services (NRCS).[51] While NRCS provides a wealth of information about the watershed's soils, this plan will focus on two datasets: Hydric Soils and Hydrologic Soil Groups. Figure 15 shows the range of hydric soils in the watershed from "All hydric" to "unknown." Hydric soils are those that are developed under sufficiently wet conditions such as flooding, ponding, or saturation for a long enough time period to support the growth and regeneration of hydrophytic vegetation, plants that grow partly or wholly in water. Thus, hydric soils are one indicator of the historic presence of wetlands, and among other matters, are useful in guiding wetland restoration efforts.

Partially hydric soils meet some but not all of the criteria and have the potential for hydric inclusion. Hydric soils make up 28.9% of the watershed and are spatially dispersed throughout the land area. Partially hydric soils make up 7.1% of the watershed, 1% of the soils are classified unknown, and 63.2% of the watershed contains nonhydric soils.

Hydrologic Soil Groups

Another way to classify soils is through Hydrologic Soil Groups (HSG) as shown in Figure 16. Soil classification systems, including hydrologic groups, are used by planners, builders, and engineers among others to determine site suitability for projects. The four HSG are defined as Groups A-D, however some soils in our watershed have characteristics of multiple groups depending on site conditions. The following soils are present in the Ferson-Otter Creek Watershed:

- Group A: Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil.
- Group B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.
- Group B/D: The first letter applies to the drained condition and the second to the undrained condition.
- Group C: Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.
- Group D: Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted.

Over 71% of the watershed planning area contains Group B soils. Both B/D and C soil groups cover about 12% each. Group B and B/D soils are dispersed throughout the watershed. Group C soils, however, are mainly concentrated along the eastern boundary of the watershed in parts of Elgin, South Elgin, St. Charles, and unincorporated Kane County. The location of the Group C soils coincides with the more developed portions of the watershed. Soil Groups A and D cover minimal areas in the watershed.

[51] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. Kane County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011).

Figure 15. **Hydric soils in Ferson-Otter Creek Watershed**

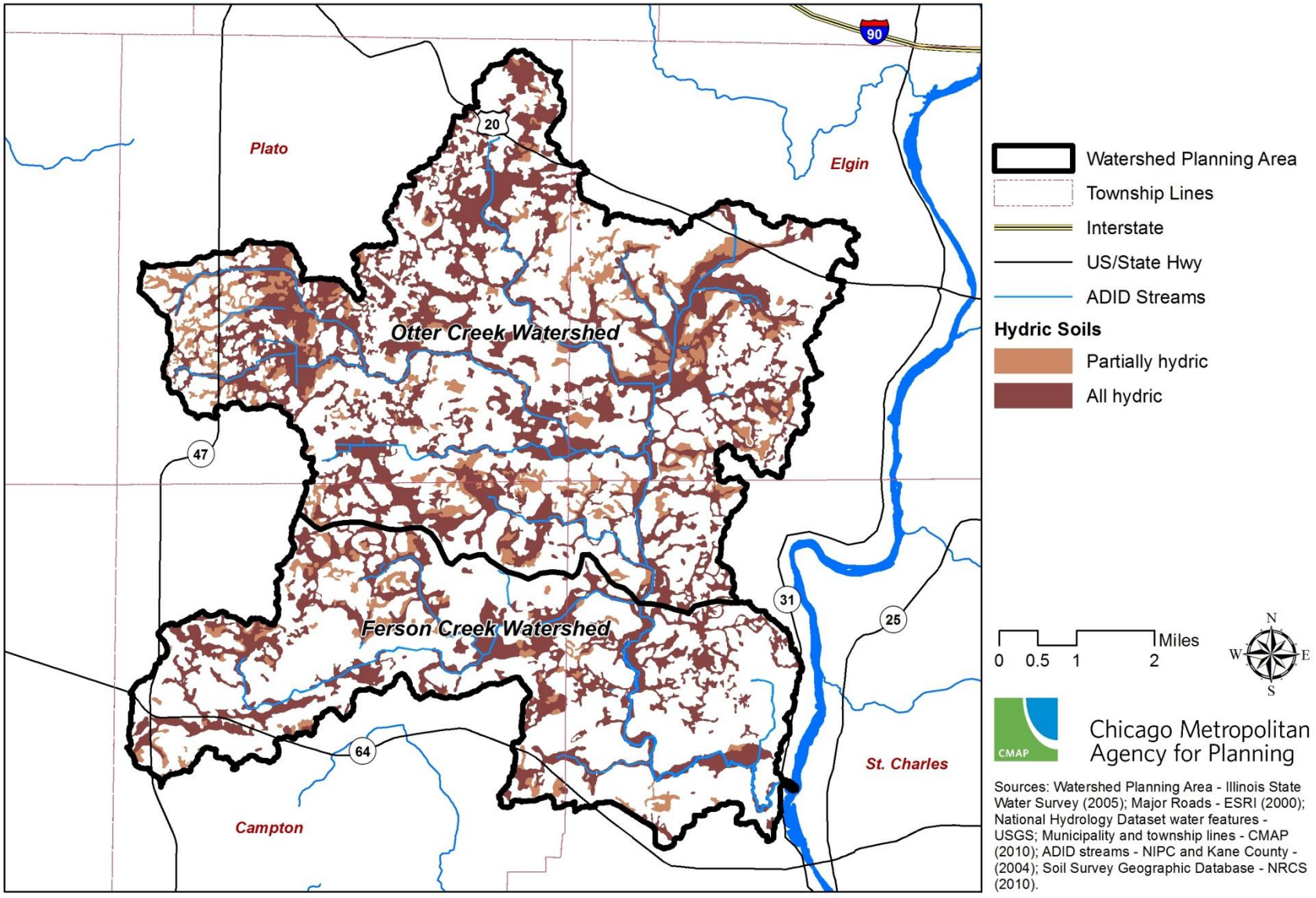
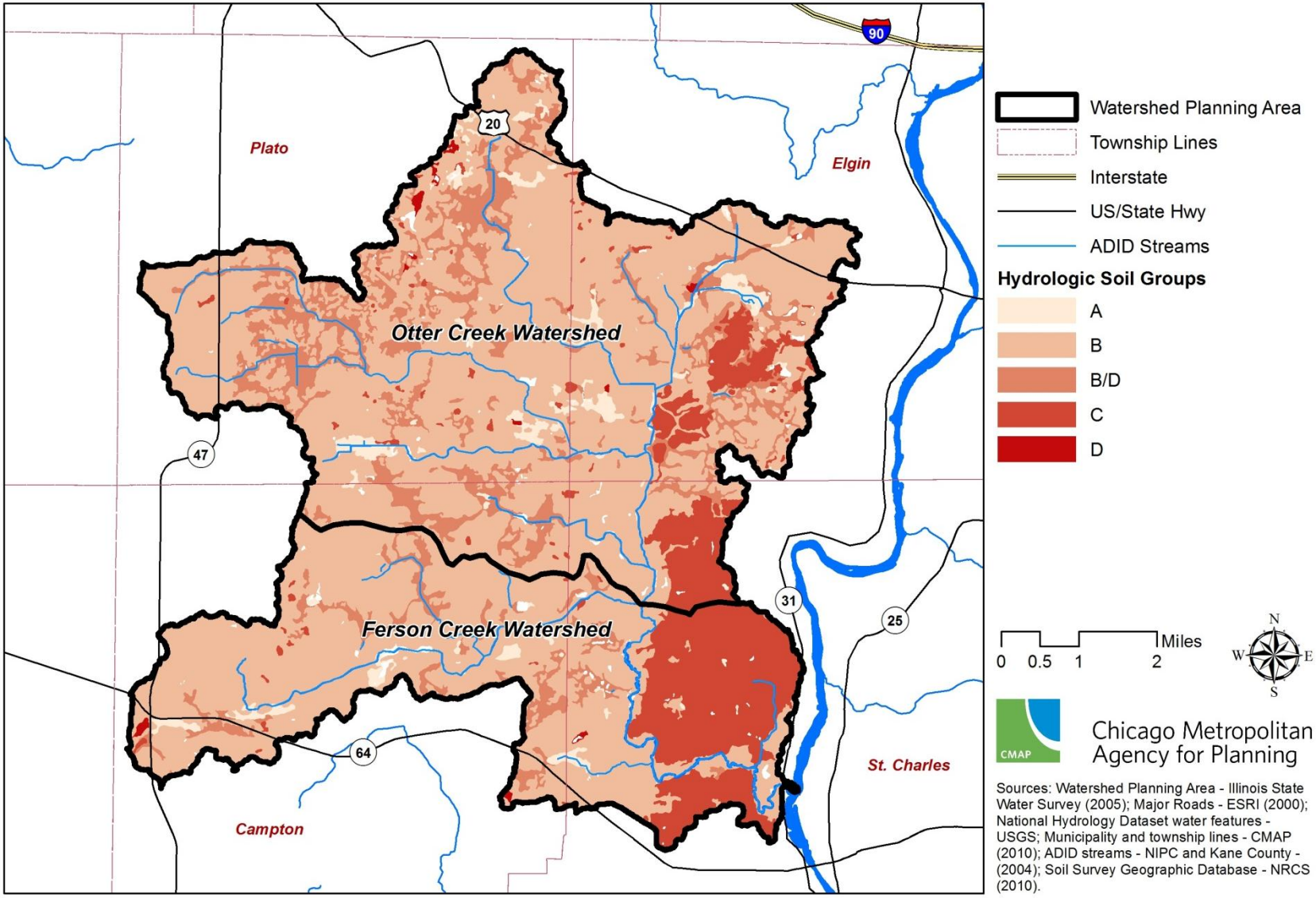


Figure 16. **Hydrologic soil groups in Ferson-Otter Creek Watershed**



2.2.4 Floodplains and Floodways

Floodplain and floodway data are sourced from Federal Emergency Management Agency (FEMA). A floodplain is defined as "any land area susceptible to being inundated by flood waters from any source."[52] However areas that are not directly adjacent to a body of water are often flooded in heavy storms. For example, the 100-year floodplain or base flood encompasses an area of land that has a 1-in-100 chance of being flooded or exceeded within any given year.[53] Whereas the 500-year floodplain has a 1-in-500 chance of being flooded or exceeded within any given year. If a natural floodplain is developed for any other use, such use becomes susceptible to flooding. This results in property and crop damage and degraded water quality. Therefore, floodplains and their relationship to land use should be considered in a watershed plan as well as any other type of land use planning.

Both floodplains and floodways are depicted in Figure 17. Floodways are defined by the National Flood Insurance Program as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." [54] Floodways are a subset of the 100-year floodplain and carry the deeper, faster moving water during a flood event. [55] It should be noted that Kane County's Stormwater Ordinance addresses floodplain requirements that are applicable to all of the county's municipalities.[56]

2.2.5 Wastewater

Wastewater Treatment Plants[57]

Under the National Pollutant Discharge Elimination Systems (NPDES), all facilities that discharge pollutants from any point source into surface waters of the United States are required to obtain a permit. This permit may assign pollutant limits, monitoring and reporting requirements and other provisions to protect surface water quality. In the watershed, only one NPDES permit was issued and is held by the privately owned Ferson Creek Utilities Sewage Treatment Plant (STP) to treat domestic wastewater for the majority of the Windings Subdivision in St. Charles (Figure 18).[58] The STP discharges into a Ferson Creek tributary that ultimately discharges into Lake Campton.[59] The current permit was issued in May of 2007 and is set to expire June 30, 2012 at which time it will need to be renewed. The design average flow (DAF) is 0.095 million gallons per day (MGD) with a design maximum flow (DMF) being 0.238 MGD. This is a relatively small-volume facility. Water quality treatment methods include manually cleaned bar screen, two-stage activated sludge, sedimentation, sand filters, chlorination and dechlorination. The 2007 permit contains water quality standards for the effluent and includes load limits for Carbonaceous BOD_5, Suspended Solids, Dissolved Oxygen, pH, Fecal Coliform, Chlorine Residual, Ammonia Nitrogen, and Phosphorus. The permit for fecal coliform is in line with the statewide standard discussed in the Chapter 3.

[52] FEMA. Appendix D: Glossary. Washington, D.C. http://www.fema.gov/pdf/floodplain/nfip_sg_appendix_d.pdf (accessed November 8, 2011).
[53] "Flood Zones," FEMA, last modified August 11, 2010, accessed November 8, 2011, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/flood_zones.shtm.
[54] "Floodway," FEMA, last modified August 11, 2010, accessed November 7, 2011, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/floodway.shtm.
[55] Illinois Association for Floodplain and Stormwater Management. *Regulatory Floodways*. St. Charles, IL: Illinois Association for Floodplain and Stormwater Management, March 2006. http://www.illinoisfloods.org/documents/home_study_course/11%20Regulatory%20Floodways.pdf (accessed November 8, 2011).
[56] *Stormwater Management*. *Kane County*, *Illinois*, *County Code*, Chapter 9. http://www.sterlingcodifiers.com/IL/Kane%20County/index.htm (accessed December 19, 2011).
[57] This includes Sewage Treatment Plants (STPs).
[58] "Permit Compliance Systems (PCS)," U.S. EPA, accessed December 19, 2011, http://www.epa.gov/enviro/facts/pcs/search.html. Information found through Envirofacts for NPDES ID number IL0045411.
[59] Ibid. Main discharge number 001.

Figure 17. **Floodplains and floodways in Ferson-Otter Creek Watershed**

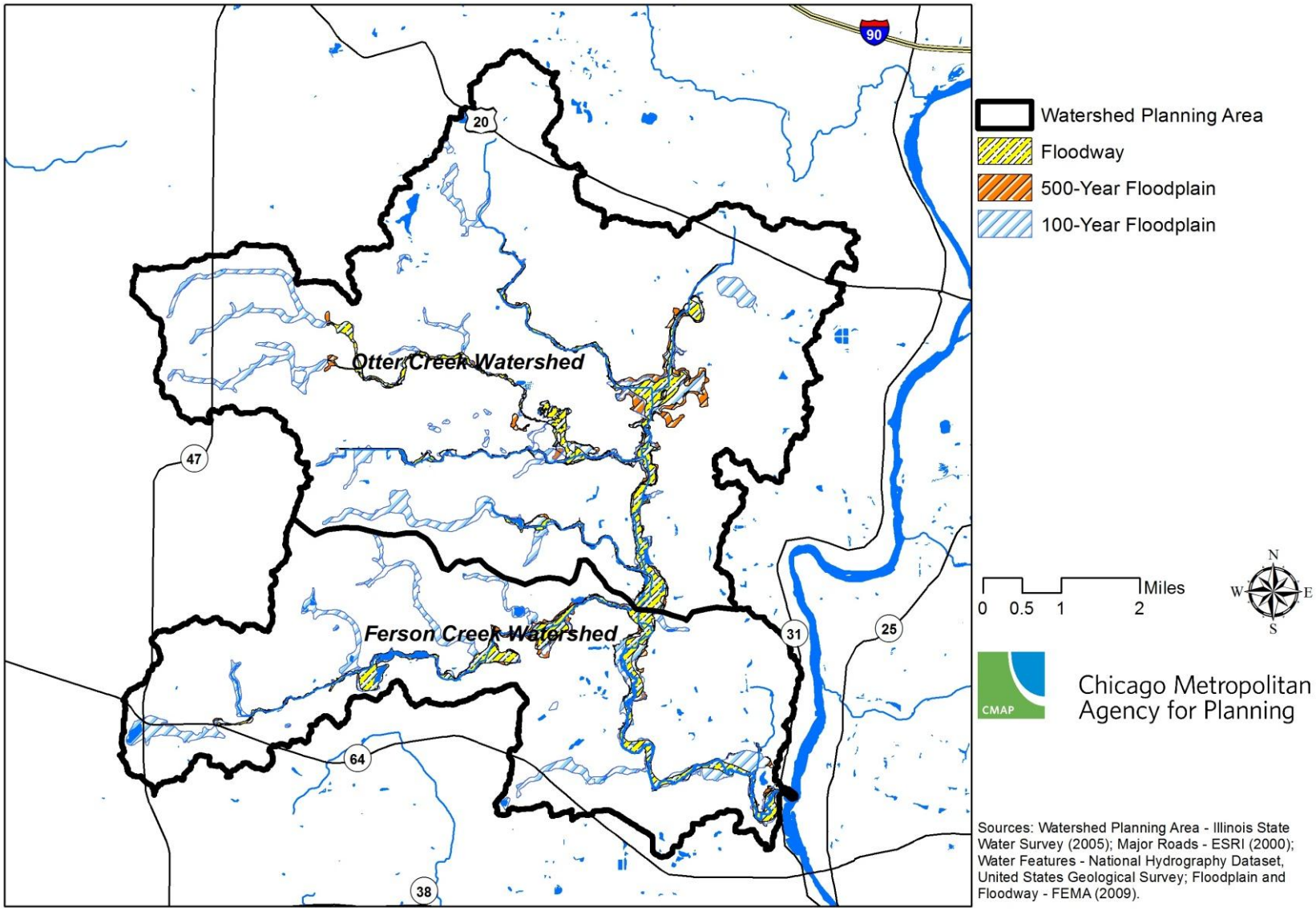
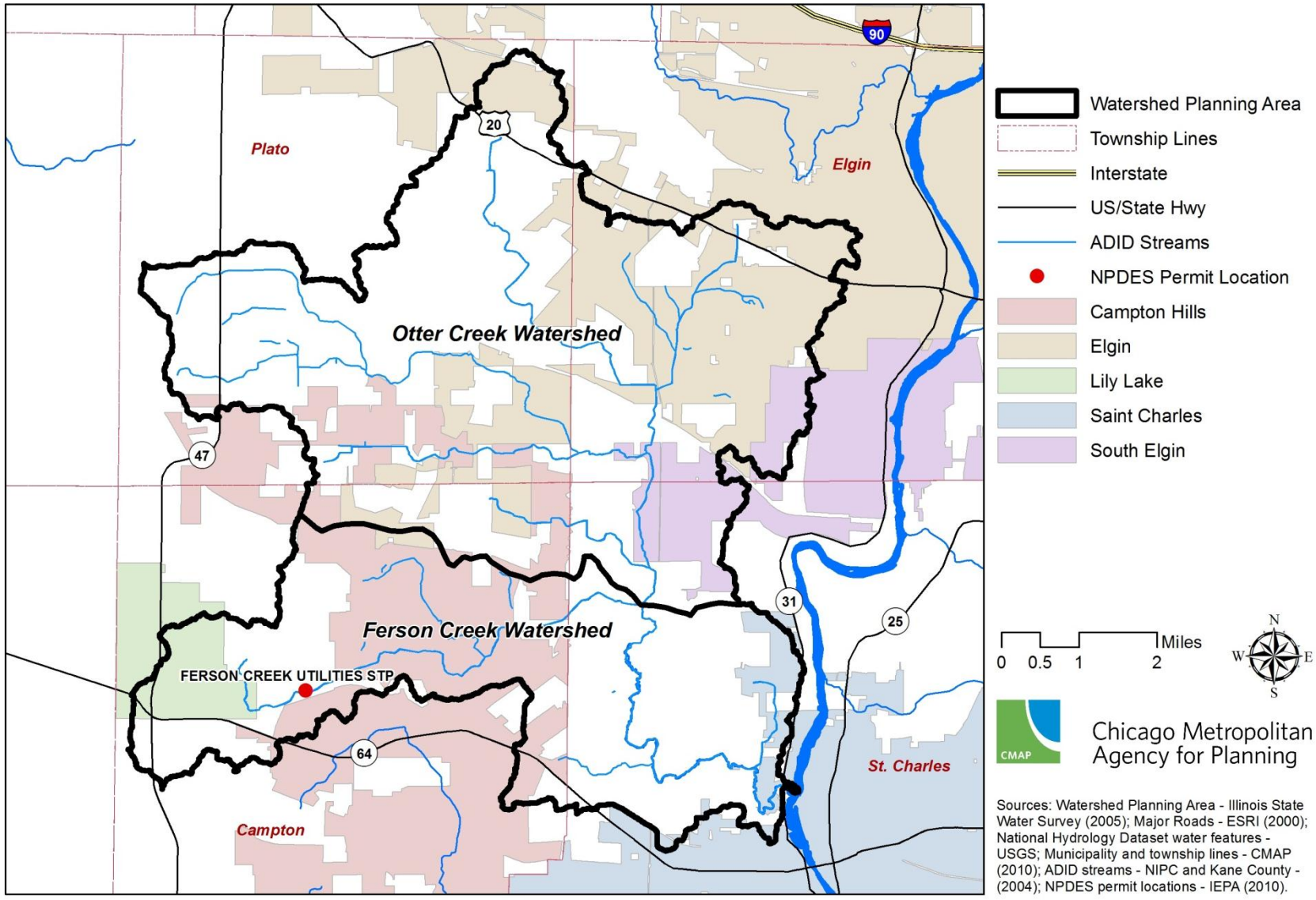


Figure 18. **NPDES permit locations**

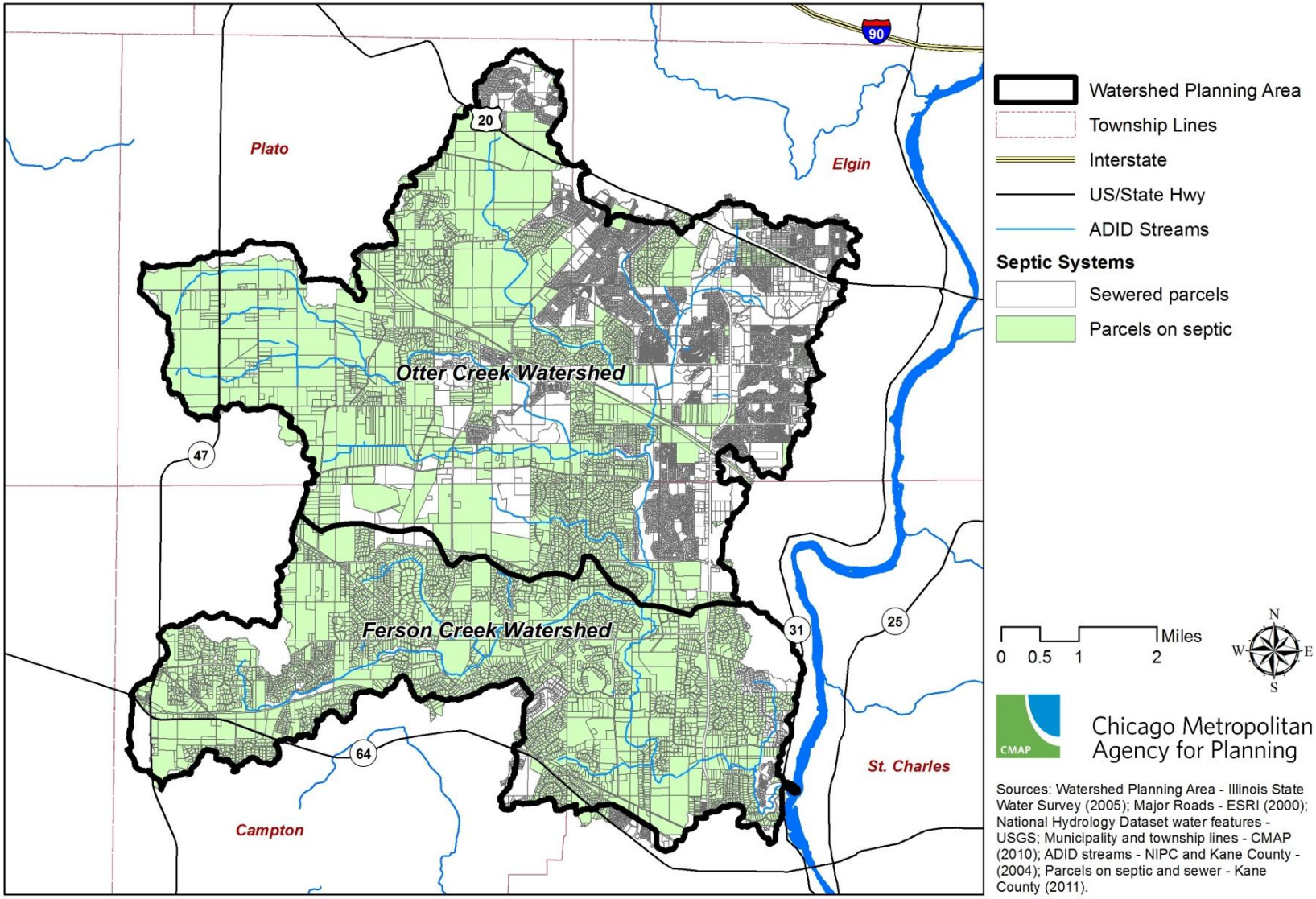


Septic Systems

Kane County provided the data to identify parcels within the watershed that use septic systems (Figure 19). The data were created through the following steps: 1) The Kane County Health Department identified all subdivisions that are on septic within the watershed. 2) All parcels that fell within a sanitary district were deemed to NOT be on septic. 3) All parcels that fall within municipal boundaries that provide sewer service were deemed NOT to be on septic. 4) All remaining parcels were deemed to be on septic. As Figure 19 shows, the large majority - around 70% of the watershed – is likely on septic systems.[60] As stated above, Ferson Creek is impaired by fecal coliform and one potential source that can cause fecal coliform contamination is failing or improperly maintained septic systems.[61] For this reason, septic-related policies at the county level were examined and summarized as follows. Regular maintenance of septic systems is not required for homeowners with traditional septic systems. However those homeowners with aerobic treatment plants are required to have perpetual maintenance contracts on their units necessitating inspections twice a year. Failure rate of septic systems is not known, however the county does track renovation permits which could allude to a certain number of failures. Finally the county does not track or estimate house plumbing tie-ins to agriculture drain tile systems. If such situations are identified, correction is required. Kane County does offer an annual free or low-cost septic system class for residents to learn proper septic system care and provides an online guide.[62]

[60] Sean Glowacz, Land Use Planner for Kane County, email message to CMAP, April 29, 2011.
[61] It should be noted that currently there is no data identifying septic system failure as a source of contamination in Ferson-Otter Creek. Without more specific data, the planning process looked at a wide variety of potential causes include septic system failure. Kane County is aware of very few failed septic systems.
[62] "Kane County Environmental Health Services," Kane County Health Department, accessed December 19, 2011, http://www.kanehealth.com/water_waste.htm. Attendance is generally 25-40 people each year.

Figure 19. **Potential parcels on septic systems in the Ferson-Otter Creek Watershed**



MS4 Permits

In addition to wastewater treatment plants, urban stormwater runoff is also regulated through NPDES.[63] The NPDES Stormwater Program was implemented in two phases. Phase I of this program was implemented in 1990 and applies to medium and large municipal storm sewer systems, as well as certain counties with populations of 100,000 or more; Phase II was implemented in 2003 and expands the scope of storm sewer systems which are subject to NPDES.[64] Unlike Phase I, Phase II applies to small municipal separate storm sewers (MS4's), including smaller construction or industrial sites that are owned and operated in urbanized areas.[65] Industrial sites or construction activities that disturb one or more acres of land must obtain an NPDES permit before construction activities begin.[66]

Under the terms of Phase II permits, industrial, construction, and MS4 Phase II permittees are required to implement certain practices that control pollution in stormwater runoff. To prevent the contamination of stormwater runoff, industrial and construction permittees must develop a stormwater pollution prevention plan (SWPPP), while MS4 permittees must develop a similar stormwater management program (SWMP). Stormwater runoff carrying pollutants from impervious surfaces can degrade water quality when discharged untreated into local rivers and streams, as is often the case. Programs like Phase II that encourage planning and implementation on a watershed basis are therefore vital for protecting water quality from stormwater runoff from both large and small separate stormwater sewer systems, as well as industrial and construction sites.

The following information focuses on the Phase II permit status of municipalities in the watershed planning area. As part of an integrated approach to stormwater pollution prevention, MS4 pollution prevention plans must address the following six minimum control measures: Public education and outreach, Public participation and involvement, Illicit discharge detention and elimination, Construction site runoff control, Post-construction runoff control, and Proper maintenance of pollution prevention controls.[67] The locations of NPDES Phase II permittees that comply with these control measures within Ferson-Otter Creek are shown in Table 3.

Table 3. Municipal MS4 permit status within Ferson-Otter Creek Watershed

MUNICIPALITY	MS4 PERMITTEE	NUMBER
Campton Hills	No	
Elgin	Yes	ILR400333
Lily Lake	No	
South Elgin	Yes	ILR400450
St. Charles	Yes	ILR400454
TOWNSHIP		
Plato Township Hwy. Dept.	Yes	ILR400484
Campton Township Hwy. Dist.	Yes	ILR400483
St. Charles Township	Yes	ILR400131
COUNTY		
Kane County	Yes	ILR400259

[63] "NPDES Permit Program Basics," U.S. EPA, last modified January 4, 2011, accessed October 12, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=45.
[64] "NPDES Stormwater Program," U.S. EPA, last modified January 4, 2011, accessed October 13, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=6.
[65] Ibid.
[66] U.S. EPA. "Stormwater Phase II Final Rule: An Overview." EPA Report No. 833-F-00-001. Washington, D.C.: U.S. EPA, 2005. http://www.epa.gov/npdes/pubs/fact2-0.pdf (accessed October 12, 2011).
[67] Ibid.

2.2.6 Groundwater Protection

Recharge Areas

This plan considers groundwater protection in addition to surface water quality. Aquifer recharge areas are critical to groundwater protection from both quality (i.e., vulnerable to contamination) and quantity (i.e., infiltration capacity) standpoints. As identified by USGS, the main recharge area is located in and nearby Lily Lake and extends north beyond the watershed. The data are sourced from the 2006 United States Geological Survey (USGS), Campton Township Groundwater Study.[68]

Aquifer Sensitivity to Contamination

Certain areas in the watershed are more vulnerable to aquifer contamination from land use activity than others. Kane County commissioned a study to classify sensitivity ranges from Unit A-D with "A" having the highest potential for contamination and "D" having the lowest.[69] Each classification is qualified by distance to land surface and the degree of aquifer thickness. This plan focuses on Unit A, defined as "areas where the upper surface of the aquifer is within 20 feet of the land surface and with sand and gravel or high-permeability bedrock aquifers greater than 20 feet thick."[70] Table 4 further explains Unit A's 4 subcategories A1-A4.

Table 4. Aquifer sensitivity to contamination

SUBCATEGORY	AQUIFER THICKNESS	LAND (WITHIN) SURFACE DEPTH
A1	**X[1] > 50 feet**	**X[2] < 5 feet**
A2	**X > 50 feet**	**5 < X < 20 feet**
A3	**20 < X < 50 feet**	**X < 5 feet**
A4	**20 < X < 50 feet**	**5 < X < 20 feet**

1 X=the number of feet thick the aquifer is.

2 X=number of feet the aquifer is within the land surface.

Within the county, Unit A areas are common in southern and northwestern sections and along the Fox River (Figure 20). Within the planning area, sensitive-aquifer areas are more common in Otter Creek than in Ferson Creek. These areas have the highest potential for contamination due to the presence of sand and gravel deposits that allow for contaminants to move rapidly through to wells or nearby streams.

Leaking Underground Storage Tank (LUST) Sites

IEPA has identified 30 Leaking Underground Storage Tanks, or LUST sites within the watershed (Figure 20).[71] These sites could be contaminated by gasoline or diesel fuel from leaks, spills, or overfills from when the tanks were in use. In any case, the concern is that LUST sites pose a threat of contamination to soil, groundwater, streams, rivers, and lakes in watersheds, such as this one, that are

[68] USGS. *Hydrogeology, Water Use, and Simulated Ground-Water Flow and Availability in Campton Township, Kane County, Illinois*, by Robert T. Kay, Leslie D. Arihood, Terri L. Arnold, and Kathleen K. Fowler. Scientific Investigations Report 2006–5076. Reston, VA: USGS, 2006. http://pubs.usgs.gov/sir/2006/5076/pdf/sir20065076.pdf (accessed November 7, 2011).

[69] ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. ISGS Open File Series, 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011).

[70] Ibid. It should be noted that aquifer sensitivity classification rates sequence from Map Unit A to Map Unit E in order of decreasing sensitivity to aquifers becoming contaminated. For this plan, only Map Unit A category (High Potential for Aquifer Contamination) is shown in the resource inventory. However subsequent categories such as Map Unit B (Moderately High Potential for Aquifer Contamination) should be considered for planning purposes when appropriate.

[71] "Leaking Underground Storage Tank Program," IEPA, accessed November 2, 2011, http://www.epa.state.il.us/land/lust/index.html. LUST is often interchanged with Underground Storage Tanks (UST).

predominantly dependent on groundwater as a potable water supply source.

Groundwater Geology

In Kane County, materials from the Quaternary geological period (2.6 million years ago to the present) overlie older Paleozoic bedrock, primarily Silurian limestone and dolomite or Ordovician shale.[72] The Cambrian-Ordovician bedrock forms a deep aquifer system, typically 800 to 1,500 feet deep, throughout the entire region that is heavily developed for groundwater pumping.[73] Quaternary materials are also a source of groundwater, forming shallow aquifers from which wells pump water. Quaternary materials include sand, gravel, peat and floodplain alluvium. The sand and gravel in Quaternary materials act as aquifers when they are saturated with water because their porosity and hydraulic conductivity are high, allowing water to flow freely.[74]

Shallow Aquifers

Many of the Quaternary aquifer systems previously described are major, meaning in this region that they yield pumped water at a rate of at least 70 gallons per minute.[75] These major aquifers, mapped for Kane County by the Illinois State Geological survey, are pictured in Figure 21.[76] The St. Charles, Kaneville and some unnamed formations are the predominant major aquifers in the watershed planning area.

Well Setback Zones

Community well systems (CWS) are subject to the Illinois Groundwater Protection Act (IGPA; P.A. 85-0863). Passed in 1987, IGPA emphasizes the comprehensive management of groundwater resources by requiring the implementation of practices and policies that protect groundwater through prevention-oriented approaches.[77] Among these approaches, IGPA guides federal, state and local government in setting groundwater protection policies; assessing the quality and quantity of groundwater resources being utilized; and establishing groundwater quality standards.

One concrete action required by IGPA is that municipalities establish setback zones for CWS wells. Well setback zones help to prevent contamination of groundwater resources with pollution by restricting certain land uses within the setback zone. Industrial, commercial, municipal, agricultural or residential land uses could be restricted by a setback zone given their potential contribution of pollutants and contamination of groundwater. Under IGPA, a 200 or 400 foot minimum setback zone is mandated for CWS wells, depending on the sensitivity of a particular well to possible contamination.[78] The 400 foot setback zone is specified for wells deemed "vulnerable" to contamination based on the depth or character of the aquifer supplying the well. IGPA empowers municipalities to adopt more stringent ordinances to protect groundwater resources. For well setback zones, municipalities can

[72] Edward Mehnert. "Groundwater Flow Modeling as a Tool to Understand Watershed Geology: Blackberry Creek Watershed, Kane and Kendall Counties, Illinois." *Circular 576*, Champaign, IL: ISGS, 2010. http://www.isgs.uiuc.edu/maps-data-pub/publications/monthly/jun-10-pubs.shtml (accessed November 3, 2011).
[73] "Center for Groundwater Science: Northeastern Illinois," ISWS, accessed October 26, 2011, http://www.isws.illinois.edu/gws/neillinois.asp.
[74] ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. *ISGS Open File Series,* 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011).
[75] Ibid.
[76] Ibid. 74.
[77] *Illinois Groundwater Protection Act*. *Ill. Comp. Stat*. 415 (1987), § 55. http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1595&ChapAct=415%A0ILCS%A055/&ChapterID=36&ChapterName=ENVIRONMENTAL%20SAFETY&ActName=Illinois%20Groundwater%20Protection%20Act (accessed October 12, 2011).
[78] Ibid.

voluntarily adopt ordinances requiring a maximum setback zone of 1,000 feet around certain eligible wells.[79]

Well setback zones have been depicted for CWS wells in Ferson-Otter Creek Watershed (Figure 22). A 400 foot setback is shown for all shallow wells, which are more susceptible to contamination, while a 200 foot setback is shown for the less vulnerable deep wells. Maximum well setback zones are also illustrated in Figure 22. Well location data were obtained from IEPA for CWS wells on both shallow and deep aquifers.[80] For this dataset, Table 5 summarizes the number of wells within the watershed planning area utilized by each municipality.

Table 5. Municipal groundwater well designation

MUNICIPALITY	SHALLOW AQUIFER WELLS	DEEP AQUIFER WELLS
Campton Hills	2	1
Elgin	1	3
Lily Lake	-	-
St. Charles	-	5
South Elgin	-	-

[79] "Maximum Setback Zones," IEPA, accessed October 12, 2011, http://www.epa.state.il.us/water/groundwater/maximum-setback-zones/.
[80] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.

Figure 20. **Recharge areas, aquifer sensitivity to contamination, and LUST sites**

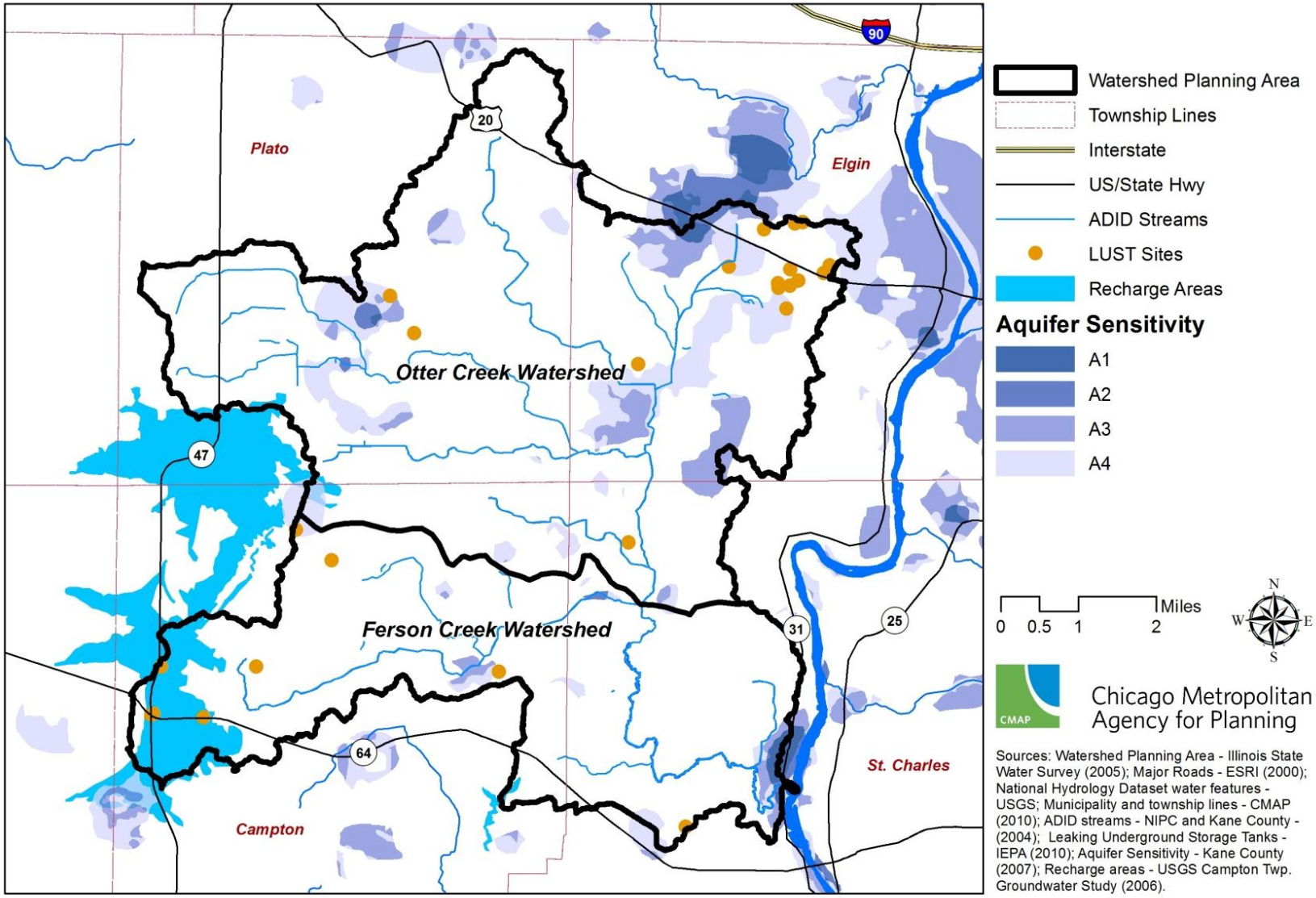


Figure 21. **Major aquifers in Ferson-Otter Creek Watershed**

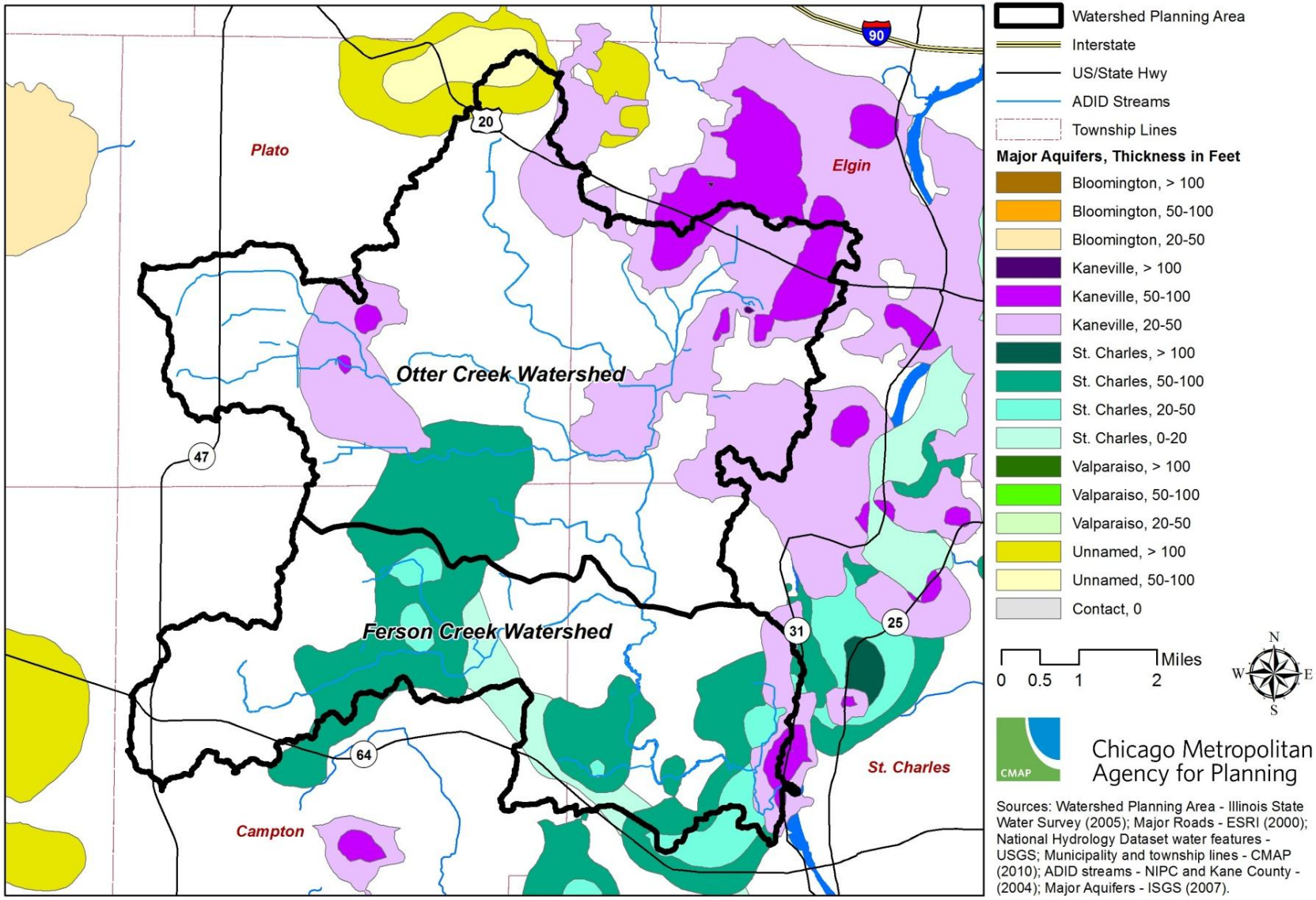
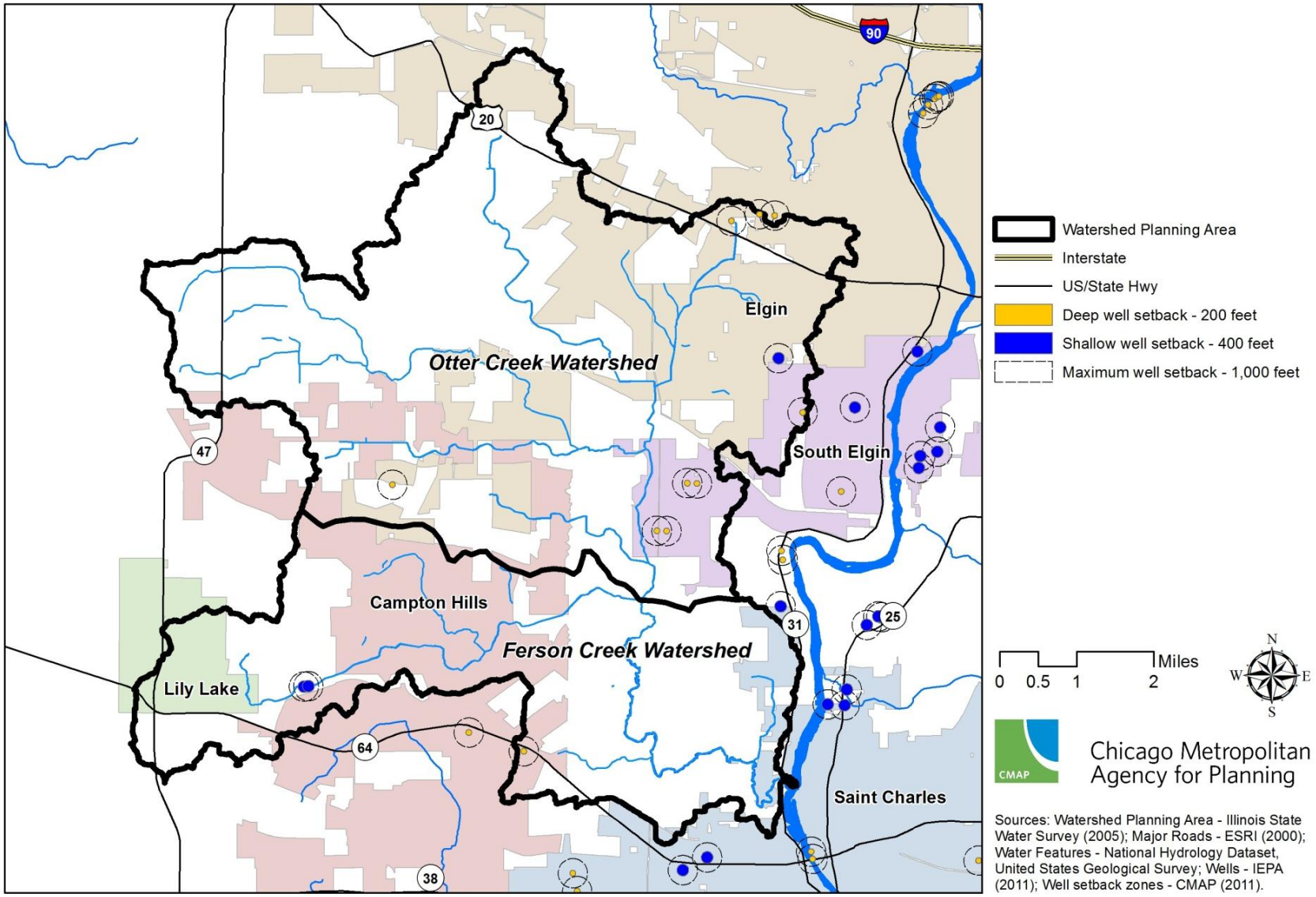


Figure 22. **Well set back locations**



2.2.7 Wetlands and Streams

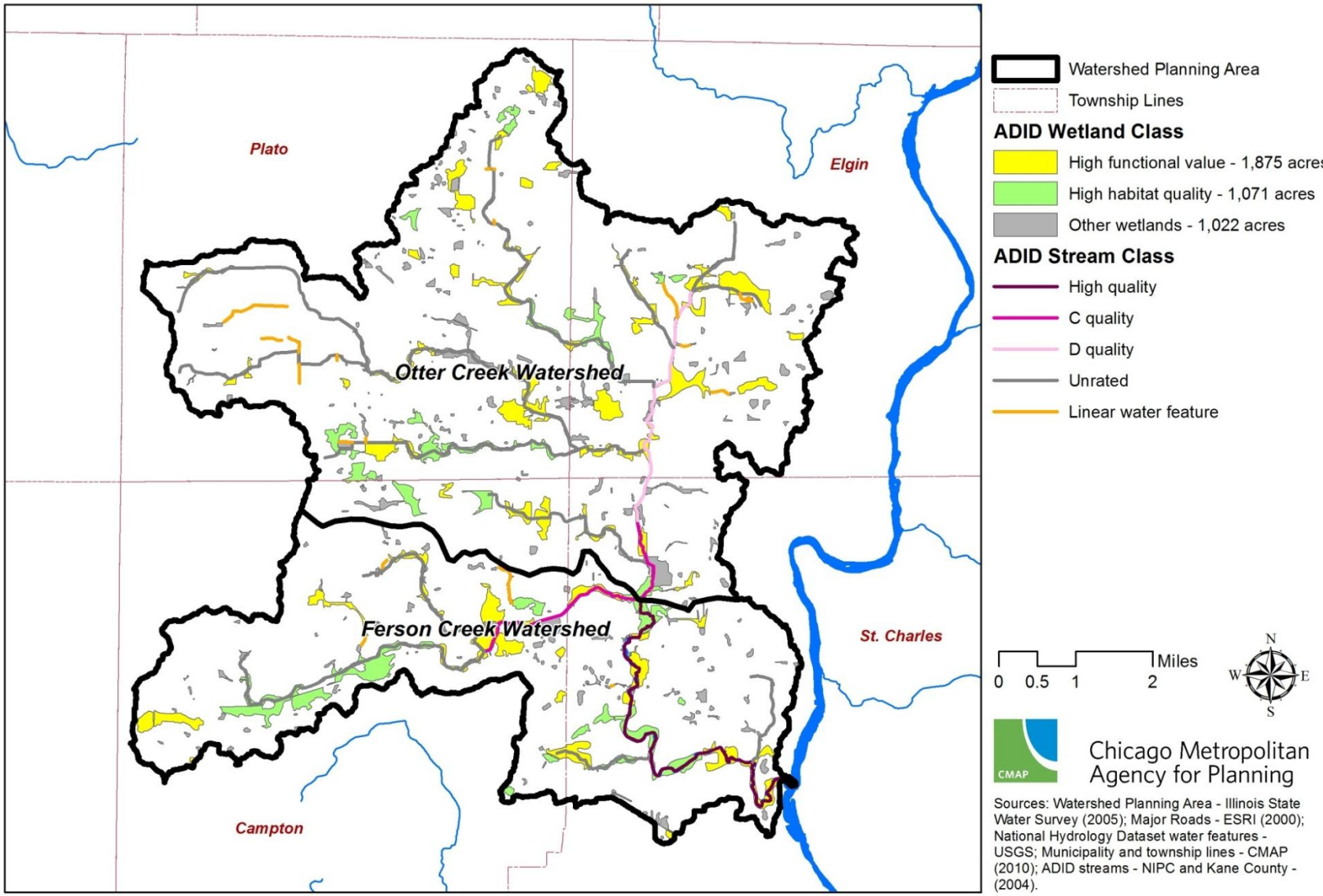
The wetland and streams data are taken from Kane County's Advanced Identification (ADID) Study produced in August of 2004.[81] The ADID study was a cooperative effort between federal, state, and local agencies including the Chicago Metropolitan Agency for Planning, U.S. Fish and Wildlife Service, Chicago Illinois Field Office, USEPA, Region 5, and Kane County Department of Environmental Management. This study inventoried, evaluated, and mapped high quality wetland and stream resources in the county with the primary purpose of identifying wetlands and streams unsuitable for dredging and filling because they are of particular high quality. Incorporating this data into planning, zoning, permitting, land acquisition, and related decision making is one intended application of this data. As of 2004, Kane County has 27,368 acres of wetlands covering 8.2% of the total land area. This is a small portion of the wetlands that existed pre-settlement. Most of the wetland acreage has been degraded. In the Ferson-Otter Creek Watershed, there are approximately 3,967 acres of mapped wetlands accounting for 11% of the watershed land area.

Figure 23 illustrates two ADID components, wetlands and streams, of which there are three types. The first type is "High Habitat Value Wetlands and High Quality Streams" which have been identified as having high quality wildlife habitat, high floristic quality, or high quality aquatic habitat. This group is considered "unmitigatable" due to the complex biological systems and functions they provide and it is stated that they cannot be "successfully recreated within a reasonable time frame using existing mitigation methods."[82] The second is "High Functional Value wetlands" which provide water quality and stormwater storage benefits to the county. The third type is simply called "Other Wetlands and Streams." This last type includes all other wetlands and streams not included in the first two types either because they were not thoroughly evaluated or they were evaluated but did not meet the criteria for high habitat value or high functional value. This last type also includes all headwater streams.

It should be noted that there are some natural meander scars and historical floodplain terraces of Ferson Creek in the Leroy Oakes Forest Preserve. These areas depict streams in the watershed prior to European settlement and can create a vision on how to naturalize other stream reaches.

[81] NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study*, *Kane County*, *Illinois Final Report*. Chicago, IL: USACE Chicago District, August 2004. http://www.lrc.usace.army.mil/co-r/pdf/KaneADIDReport.pdf (accessed November 7, 2011). It should be noted that methodology used to develop this data resulted in an overestimation of the number of acres of wetland in Kane County. Contact Kane County for more information about the data set.
[82] Ibid.

Figure 23. **Wetlands and streams**



2.2.8 Lake Campton

Brief History and Background

Lake Campton is an impoundment lake, created in 1953 by the construction of a 15 foot high earthen dam across Ferson Creek.[83] Two 24-inch valve pipes and one 10-inch pipe[84] were built into the dam to allow the lake level to be drawn down.

The lake is owned and managed by the Lake Campton Property Owners Association (LCPOA), which formed in the mid-1960s.[85] The lake is used recreationally for fishing, nonpower and electric-powered boating, ice skating, and aesthetic enjoyment. Lake access is available to LCPOA members and their guests. Lake management activities have included fish population surveys, fishery rehabilitations, fish stocking, water quality monitoring, and annual nuisance/ invasive aquatic plant control. In years past during dry summer months, the valves in the dam were reportedly opened to provide some water movement and flushing of the lake. This practice has not been conducted for at least 20 years and it is unknown whether the valves are still operable.[86]

Hydrological Description

Lake Campton lies within the Ferson-Otter Creek Watershed of the Fox River Basin, which itself is part of the Illinois River Watershed and subsequently the Upper Mississippi Watershed. The area that drains to Lake Campton is approximately 3,900 acres (6.12 sq. miles).[87]

"Normal" lake elevation is equal to the elevation of the crest of the outlet spillway: 810.3 feet above mean sea level. At this water level, Lake Campton has a surface area of about 27 acres,[88] maximum depth of approximately 9 feet, an estimated average depth of 3 feet,[89] and a calculated volume of about 82 acre-feet (surface area x average depth). Average water residence time was calculated to be roughly 0.03 years using the watershed area, lake volume, and an average annual runoff value of 10 inches/year.[90] Data is summarized in Table 6.

Lake Campton receives its water via surface water flowing in from Ferson Creek at the lake's northwest corner, rain and snowmelt flowing off the land surrounding the lake, and precipitation directly onto the lake surface. The wetlands to the south/southwest of the lake, now owned in part by a local school district and the Forest Preserve District of Kane County, are connected to Lake Campton via a pipe that directs overflow to the lake during wet periods.[91] Outflow from the lake passes over the dam's concrete spillway located at the east end of the lake. Ferson Creek continues approximately 3½ miles downstream to its confluence with Otter Creek and then another 5½ miles down to the Fox River. Water is also lost from Lake Campton via evaporation from the lake's water surface. It is unknown to what degree groundwater infiltration or exfiltration may contribute to the lake's water cycle.

[83] IDOC Division of Fisheries. *Lake Survey for Campton Lake*. Spring Grove, IL: IDOC Division of Fisheries, 1967.
[84] Ibid.
[85] J. Holley, Lake Campton Property Owners Association, personal communication.
[86] Ibid.
[87] "Illinois StreamStats," USGS, accessed December 12, 2011. http://water.usgs.gov/osw/streamstats/illinois.html.
[88] Measurements performed by H. Hudson using 2010 USGS aerial orthophotography.
[89] Based on Volunteer Lake Monitoring Program data collected 2001–2011.
[90] Thomas Price, Principal Civil Engineer/Hydrologist, Conservation Design Forum, personal communication.
[91] Ibid. 85.

Table 6. Lake Campton morphometric data

Surface Area	**27 acres**
Maximum Depth	**9 feet**
Average Depth	**3 feet**
Volume	**82 acres-feet**
Shoreline Length	**1.7 miles**
Maximum Fetch	**2,000 feet E-W**
Lake Elevation (top of weir)	**810.3 feet**
Watershed Area	**3,900 acres**
Average Water Residence Time	**0.03 years**

Aquatic Plant Community

Based on a 1967 Illinois Department of Conservation fisheries survey report along with VLMP observations recorded over the past decade, it appears Lake Campton has experienced extensive nuisance aquatic plant growth (aquatic "weeds") since the lake's creation. Annual aquatic herbicide treatments, accompanied by a weed harvester for a period of years between the mid-1990s and early 2000s, have produced successions of rooted plants, filamentous algae, and phytoplankton. In fact, the 1967 fisheries survey report noted that "Rooted aquatics cover at times up to 75% of the lake area with sago and leafy pondweeds predominating, except in bay area receiving creek where coontail and buttercup and predominated. Filamentous algae is a secondary problem." Similar conditions exist to the present day with the same native aquatic plant species, exacerbated by the addition of an invasive, nonnative aquatic plant, curlyleaf pondweed, which is most abundant in the spring. Small floating plants, duckweed and watermeal, also have become abundant, at times covering more than 50-75% of the lake surface during the summer months.

Fish Community

Lake Campton was first stocked with sport fish, largemouth bass, in 1954—the year after the lake's creation. In 1963, the lake was rehabilitated and restocked with bluegill along with fingerling and breeder largemouth bass. A 1970 fish survey indicated that these populations remained in good condition, as several size groups indicated annual recruitment.[92] A fisheries survey conducted by a private firm in the 1990s indicated that the fish population was in generally good condition at that time.[93]

More recently, a partial fishkill occurred in late July 2001, apparently associated with extremely low oxygen concentrations (CMAP staff measured dissolved oxygen concentrations on August 13, 2001, at the request of the LCPOA). Several factors converging may have contributed to this situation: the lake was nearly covered with duckweed (limiting sunlight penetration and thus photosynthetic oxygen production by phytoplankton and rooted aquatic plants below, and limiting atmospheric oxygen exchange), water temperatures were very warm (the warmer the water, the less oxygen it can hold), and an aquatic herbicide application had recently occurred (decaying plant materials consume oxygen).

Since that time, no formal fish population survey has been conducted to assess the types, numbers, and year classes of fish present. The LCPOA has stocked some 6-8 inch largemouth bass, and discussions with LCPOA members who frequently fish the lake indicate that bluegill are plentiful and that largemouth bass numbers seem fine.[94]

[92] IDOC Division of Fisheries. *Lake Survey for Campton Lake*. Spring Grove, IL: IDOC Division of Fisheries, 1967.
[93] Wight Consulting Engineers, Inc. *Lake Campton Property Owners Association Engineering Study for Lake Campton Lake Enhancement*. Barrington, IL: Wight Consulting Engineers, Inc., 1994.
[94] J. Holley, Lake Campton Property Owners Association, personal communication.

2.2.9 Dams

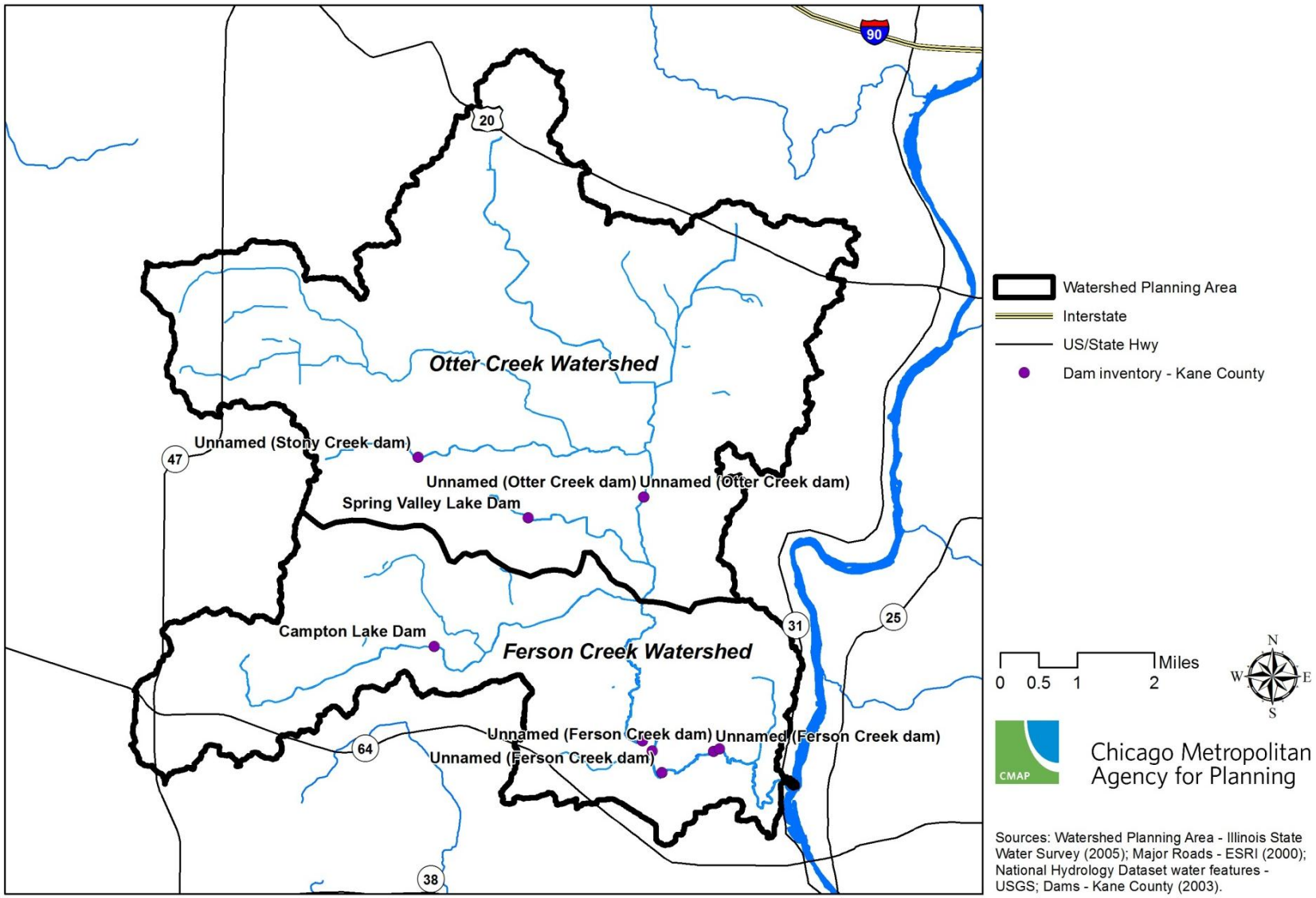
Congress authorized the U.S. Army Corps of Engineers (USACE) to create a nation-wide inventory of dams in 1972. Today, the National Inventory of Dams (the Inventory) is a database maintained by USACE that contains information on dams throughout the nation meeting certain criteria. Dams included in the Inventory are those that meet one or more of the following classifications: they are high hazard (i.e., loss of life is likely in the event of dam failure); significant hazard (i.e., loss of life or damage to property or the environment is possible in the event of dam failure); greater than or equal to 25 feet in height and 15 acre-feet in storage; or greater than or equal to 50 acre-feet in storage and 6 feet in height.[95] All dams meeting these criteria are eligible for inclusion in the Inventory, yet in reality, data collection is subject to financial limitations, particularly for those dams unregulated by state or federal agencies.[96]

Due to security concerns regarding dam hazard information, the Inventory is not available for download by the general public, but can be acquired by government agencies like CMAP. Although Inventory records for dams in the watershed planning area were obtained, USACE has acknowledged reports of error in the geographic coordinates for dams in the state of Illinois.[97] Dam locations were therefore impossible to map for this watershed planning area. The Illinois Department of Natural Resources, Office of Water Resources, which maintains information on dams in the state, is aware of this problem, but with limited funding available for data collection, is not currently able to correct the error.[98] While mapping was not possible, the dimensions and number of dams in the Inventory for Illinois are correct. For this database, there is one dam listed on Ferson Creek in Kane County. Campton Lake Dam is 13 feet in height and 98 acre-feet in storage.[99] There are no dams listed on Otter Creek.

In addition, Kane County staff provided a spatial data layer of county dams. However, this layer was last maintained in 2003 and may contain dams that have since been removed.[100] Figure 24 illustrates 10 dams in the watershed, including Campton Lake Dam, also listed in the National Inventory of Dams.

[95] "CorpsMaps National Inventory of Dams," USACE, last modified January 15, 2009, accessed October 12, 2011, http://geo.usace.army.mil/pgis/f?p=397:1:8757593860658286::NO.
[96] Ibid. 95.
[97] Rebecca Ragon, USACE staff, email message to author(s), August 4, 2011.
[98] Paul Mauer, IDNR Senior Dam Safety Engineer, email message to author(s), August 24, 2011.
[99] USACE. "National Inventory of Dams." Full dataset obtained through non-disclosure agreement between USACE and CMAP, July 22, 2011.
[100] Jason Vertracht, Kane County GIS Analyst, email message to author(s), July 20, 2011.

Figure 24. **Dam locations in Ferson-Otter Creek Watershed**

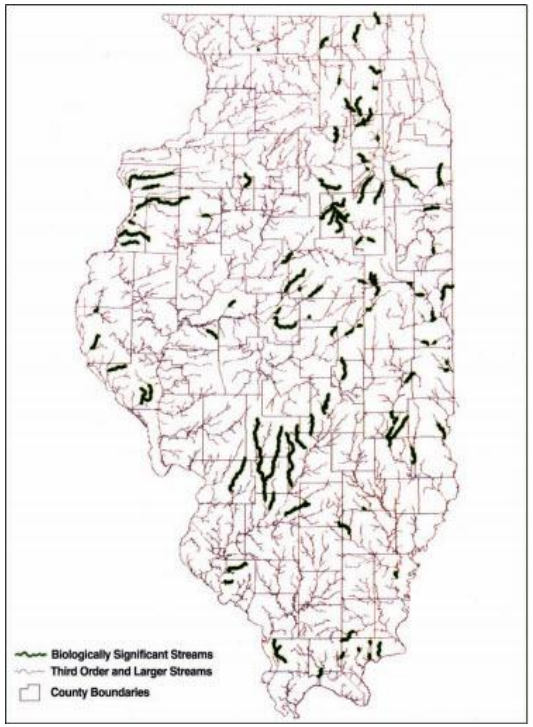


2.2.10 Aquatic Biology

This section focuses on IDNR's Biological Stream Ratings for Diversity, Integrity and Significance. The purpose of these ratings is to assess fish and macroinvertebrate communities, water quality, and habitat throughout the major basins of Illinois and among other objectives identify stream segments that exhibit a high potential for resource management or restoration activities and bring awareness to segments that have uncommon aquatic biotic resources.

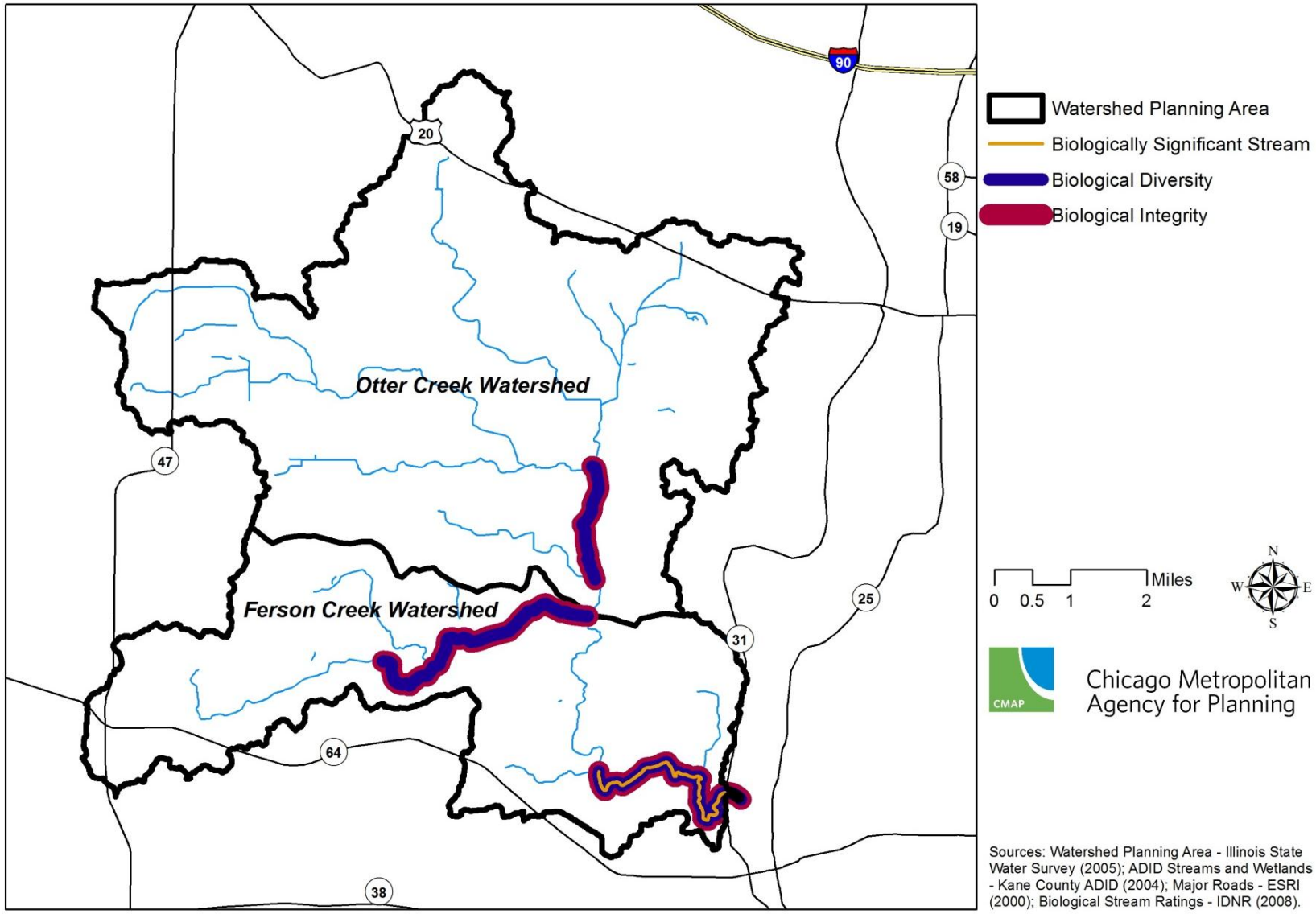
Ratings for Diversity and Integrity are derived from a variety of sources that are then quantified and categorized on a scale from A to E with A being the desired condition. Biologically Significant Streams (BSS) classification is derived from a high rating or score based on data from at least two taxonomic groups. IDNR considers data used to classify both Biotic Diversity and Integrity in the process of identifying BSS. Figure 25 displays all of Illinois' BSS. It should be noted that diversity and integrity are scored separately because it is possible to have a highly intact community (achieve integrity) that is not biological diverse. Data considered for these current ratings were collected from 1997-2006 by IDNR, IEPA, or Illinois Natural History Survey (INHS) monitoring programs.[101] In this watershed, there are three main segments that are identified using these three rating systems- two in Ferson Creek and one in Otter Creek shown in Figure 26. A lengthy stretch of Ferson Creek leading to its mouth at the Fox River is the only stream segment in the planning area that merits a BSS designation. This Ferson Creek BSS is just one of twenty steam segments in the 11-county region that is third order or larger and of this class of highest quality aquatic resource.

Figure 25. Biologically significant streams in Illinois



[101] IDNR. *Integrating Multiple Taxa in a Biological Stream Rating System*. Springfield, IL: IDNR, 2008. http://www.dnr.state.il.us/orc/biostrmratings/images/BiologicalStreamRatingReportSept2008.pdf (accessed November 9, 2011).

Figure 26. **Biological stream ratings within Ferson-Otter Creek Watershed**



2.2.11 Fish Surveys

Fish are integral members of the watershed community. Fish surveys can serve as a tool to understand current watershed conditions but also can be an indicator of watershed health when data is collected over time. The Ferson-Otter Creek Watershed has had several surveys completed in the recent past. Below are short summaries of selected surveys.

Ferson/Otter Creek Biological Survey, IDNR, Division of Fisheries, September 1998[102]

Illinois Department of Natural Resources (IDNR) collected these data in 1998 with the purpose of establishing a baseline for evaluating management practices and to provide information for restoration efforts in the Ferson-Otter Creek Watershed. Samples were taken at four locations on the major branches of Ferson and Otter Creek to evaluate fish, macroinverbrates, and habitat quality. The Index of Biotic Integrity (IBI), the Macroinvertebrate Biotic Index (MBI), and the Stream Habitat Assessment Procedure (SHAP) were all used as evaluation tools at each sampling location. A combined total of 716 fish collected represent 31 species from the four locations. While the specific scores of each station vary for a variety of reasons, at the time of the survey water quality did not appear to be a limiting factor (based on MBI scores). However habitat quality and connectivity to the Fox River were more of a concern due to land use and channel manipulation. Specific sampling locations and location scores can be found from the original source.

2002 Fox River Basin Survey Report, IDNR, Division of Fisheries, Region 2, Streams Program, Published September 2004 by Stephen M. Pescitelli and Robert C. Rung.[103]

Both IDNR and IEPA surveyed the Fox River Basin as part of a larger statewide monitoring program to measure the health of Illinois streams. Data were collected from the fish community, macroinvertebrates, habitats, and water and sediment sampling. The conclusions of the report include species composition, distribution, and determination of stream quality based on fish community structure. Overall in the Fox River Basin, 10,317 fish representing 63 species were collected in 2002 from the 18 stations. The 2002 individual, species, and species composition were similar to the comparative 1996 study. All species were native except for the common carp.

For this 2002 report, the only sampling station within the watershed was within the Leroy Oaks Forest Preserve (Ferson Creek) in St. Charles.[104] For Ferson Creek specifically, the total fish count was 282 representing 17 species. The top fish counts were Hornyhead Chub (48 fish), Largescale Stoneroller (43 fish), and the Central Stoneroller (38 fish). The Index of Biotic Integrity (IBI) score dropped 4 points from 48 to 44 from 1996 to 2002 but remained in the good resource quality category as indicated in the Draft 2010 Illinois Integrated Water Quality Report and Section 303(d) List. However the Biological Stream Characterization remained the same, "B."

[102] IDNR. *Ferson/Otter Creek Biological Survey*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, September 1998. http://www.ifishillinois.org/science/streams/1998%20Ferson%20-%20Otter%20Creek%20Survey%20Report.pdf (accessed November 9, 2011).

[103] IDNR. *2002 Fox River Basin Survey Report*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, September 2004. http://www.ifishillinois.org/science/streams/2002%20Fox%20Survey.pdf (accessed November 9, 2011).

[104] The Ferson Creek sampling location (DTF-02) is the same for the 1996, 2002, and 2007 Fox River Basin Surveys.

Fish Assemblages and Stream Condition in the Fox River Basin: Spatial and Temporal Trends, 1996-2007, IDNR, Division of Fisheries, Region 2, Streams Program, Published April 2009 by Stephen M. Pescitelli and Robert C. Rung.[105]

This 2007 report builds on the data gathered for the previous Fox River Basin Survey Reports described above. Sixteen stations were added to the 2007 survey when compared to both the 2002 and 1996 surveys, including a station in Otter Creek near Silver Glen Road for a total of 34 stations in the Fox River Basin. Perhaps the additional stations can account for the nearly doubled fish count for the Fox River Basin with a total of 20,285 fish, representing 17 families and 79 species (76 of which are native). For Ferson Creek, the total fish count was 288 representing 18 species. The top fish counts were Hornyhead Chub (71 fish), Central Stoneroller (64 fish), and Bluntnose minnow (57 fish). For Otter Creek, the total fish count was 261 representing 17 species. The top fish counts were Green Sunfish (74 fish), Sand Shiner (47 fish), and Bluntnose minnow (29 fish). The Ferson Creek IBI increased from 44 in 2002 to 48 and Otter Creek reported an IBI of 29.

Overall the IBI scores for the Ferson Creek testing station have been stable throughout the sampling period. More data will need to be collected to track similar trends for Otter Creek. The Table 7 summarizes the Fox River Basin Surveys from 1996-2007. It should be noted that more data is provided in each of these respective full documents.

[105] IDNR, Division of Fisheries. *Fish Assemblages and Stream Condition in the Fox River Basin: Spatial and Temporal Trends, 1996- 2007*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, 2009. http://www.ifishillinois.org/science/streams/2007%20Fox%20Survey%20Final%20Report.pdf (accessed November 8, 2011).

Table 7. Fish assemblages and stream condition testing stations in Ferson-Otter Creek Watershed

STATION ID AND YEAR	TOTAL FISH COUNT	NUMBER OF SPECIES	IBI SCORE
DTF-02 Ferson Creek-1996	–	–	48
DTF-02 Ferson Creek-2002	282	17	44
DTF-02 Ferson Creek-2007	288	18	48
DTFA-02 Otter Creek-1996	–	–	–
DTFA-02 Otter Creek-2002	–	–	–
DTFA-02 Otter Creek-2007	261	17	29

"-" Indicates no data available.

2.2.12 Stream Assessment

A stream assessment and final report was initiated by the St. Charles Park District and completed in November 2000. The assessment covered four miles of stream channel in various levels of detail and included 24 cross section surveys. The report concluded that Ferson and Otter Creeks "are in a gradual process of channel geometry adjustment in response to changes in flow patterns and volumes." Land use pressures and subsequent alterations to the surface area of the watershed are thought to contribute to these changes. The Ferson-Otter Creek Watershed is experiencing both lateral-changes in channel alignment through bank erosion and vertical migration-changes in the elevation of the longitudinal profile of a given reach or stream. Furthermore the report states that restoration projects should always consider the option of re-connecting the stream system to the adjacent floodplain as a priority. The full report contains additional information including project background,

watershed conditions, data collection methods, cross section installations, photographs and recommendations among others.[106]

2.2.13 Data Availability Status

CMAP and partners worked together to inform the plan with available data that are relevant to watershed planning. Some requests for information could not be fulfilled due to lack of data. Table 8 summaries the unfulfilled requests.

Table 8. Data availability status for resource inventory in Ferson-Otter Creek Watershed Plan

DATA REQUEST	CURRENT STATUS
Depressional storage locations and opportunities	**Data not available**
Description of man-made drainage networks (field tiles, storm sewers)	**Data not available**
Supplemental Stream assessment(s)	**Data not available**
Septic system inspection data	**Data not available**
Total length of drainage ditches, length of ditch erosion, length of ditch bed erosion, length of sediment accumulation, length of debris jabs, length of needed buffers	**Data not available**

[106] Prepared for the St. Charles Park District, St. Charles, Illinois. *Ferson/Otter Creek Stream Assessment Report*, by Steven W. Belz, and H. Lee Silvey. St. Charles, IL: St. Charles Park District, November 2000. Contact the St. Charles Park District for more information.

3. WATER QUALITY AND MODELING RESULTS

3.1 INTEGRATED WATER QUALITY REPORT

The *Illinois Integrated Water Quality Report and Section 303(d) List* (the Report, the List, respectively) comprises a primary source of information on the status of stream, lake, and groundwater health and identifying potential causes and sources of impairment for which watershed planning initiatives can work to address. This document is prepared every two years by the Illinois Environmental Protection Agency (IEPA), with the most recent Report issued in 2010. The basic purpose of the Report is to provide information to the federal government (USEPA) and the citizens of Illinois on the condition of the state's surface and groundwaters. This fulfills requirements of Sections 305(b), 303(d), and 314 of the federal Clean Water Act and the Water Quality Planning and Management regulation at 40 CFR Part 130 for the State of Illinois.[107] The Report seeks to assess the extent to which waterbodies support a set of recognized "designated uses." The designated uses assessed by IEPA for streams and lakes include Aquatic Life, fish consumption, Primary Contact (swimming), secondary contact (boating, fishing), public and food processing water supply, and aesthetic quality. The degree of support of a designated use in a particular stream segment or lake is determined by analyzing various types of information including biological, physiochemical, physical habitat, and toxicity data. For groundwater, the degree of use support is based primarily on chemical monitoring of community water supply wells. The data are compared against specific water quality standards set by the Illinois Pollution Control Board (IPCB) to protect each designated use. IEPA is responsible for developing scientifically based water quality standards and proposing them to the IPCB for adoption into states rules and regulations. While most of Illinois' water quality standards are numeric, some standards (such as temperature) utilize narrative language.

Through their assessment, IEPA determines whether a waterbody falls into one of two use-support levels for each designated use: "Fully Supporting" or "Not Supporting." Fully Supporting means that the designated use is attained; IEPA also refers to this status as "Good" resource quality for that particular designated use. Not Supporting means the designated use is not attained. If a designated use is not attained, the quality of the resource is further determined to be "Fair" or "Poor" depending on the degree to which the use is not attained. Designated uses that are determined to be Not Supporting are called "impaired" uses (Table 9). Any waters found to be not fully supporting of any one of its designated uses are also called impaired and placed on the "303(d) List" of impaired waters. For each impaired use in each assessed waterbody, IEPA attempts to identify potential causes and sources of the impairment.

Table 9. IEPA designated use support levels description

LEVEL OF USE SUPPORT	GENERAL RESOURCE QUALITY	RELATIONSHIP TO WATER QUALITY STANDARD	IMPAIRED?
Fully Supporting	Good	Meets standard	No
Not Supporting	Fair	Does not meet standard	Yes
Not Supporting	Poor	Does not meet standard	Yes

Improving the condition of impaired waters and ultimately removing such waters from the 303(d) List is a main objective of watershed planning efforts like that for the Ferson-Otter Creek Watershed. The following sections summarize the available information from the 2010 Report relevant to these efforts.

[107] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011). Note: Ferson Creek and Otter Creek are displayed separately in this report.

3.2 ASSESSMENTS AND DESIGNATED USES

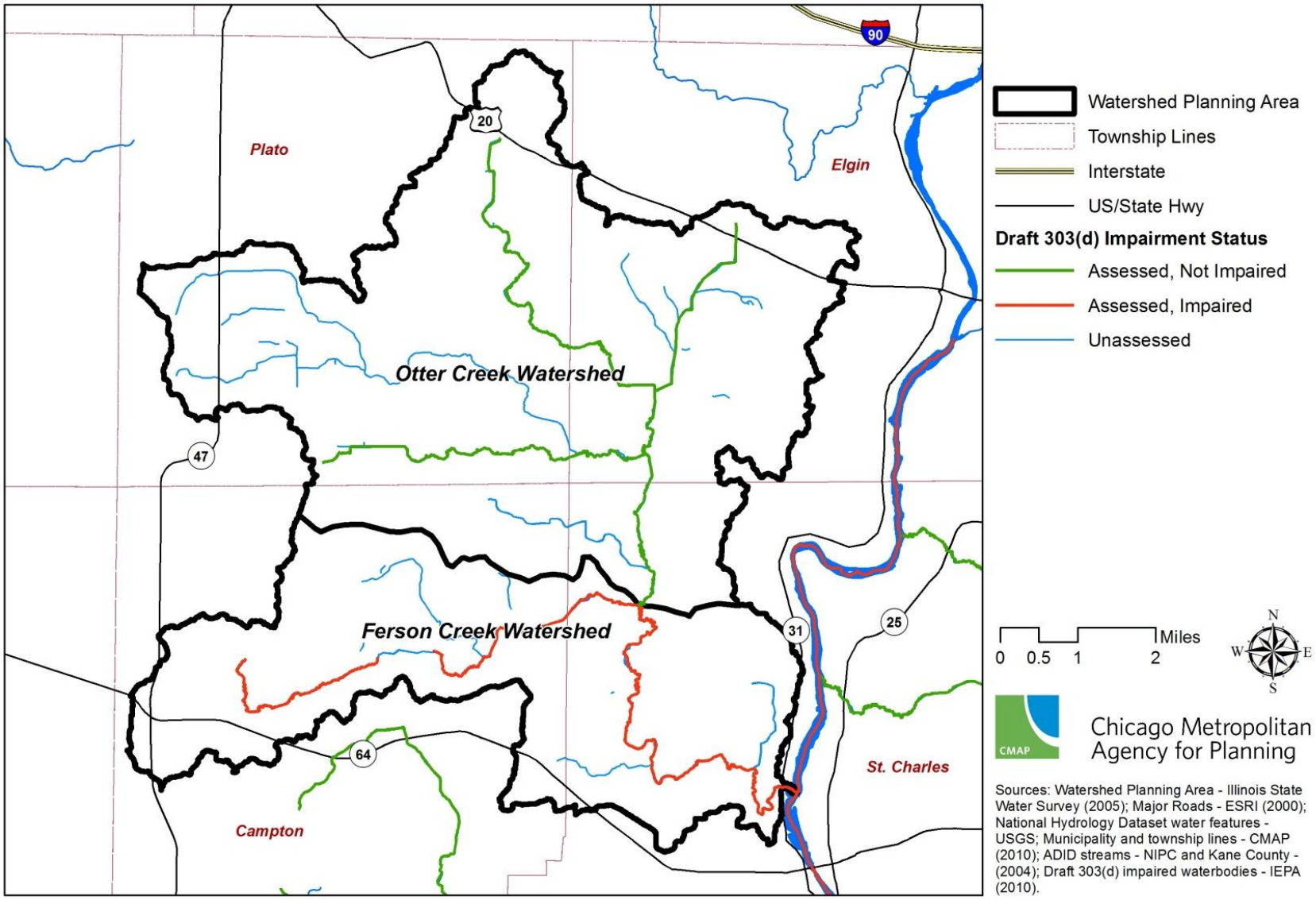
Both Ferson Creek and Otter Creek subwatersheds were assessed in the Report and determined to be Fully Supporting for the Aquatic Life designated use. However, Ferson Creek was also assessed for the Primary Contact designated use, for which it was determined to be Not Supporting. Ferson Creek was not assessed for Secondary Contact, Fish Consumption, or Aesthetic Quality. Otter Creek was not assessed for Primary Contact, Secondary Contact, Fish Consumption or Aesthetic Quality. Therefore, there may be other designated use impairments in the watershed given that assessments have not been performed for all designated uses. See Figure 27 for the water bodies which were assessed and their associated impairment status. Tables 10 summarize the designated uses, assessment status, and impairment status of Ferson and Otter Creek.

Since Ferson Creek and Otter Creek were assessed for Aquatic Life, and also Primary Contact in the case of Ferson Creek, the sections below examine these two designated uses in more detail, including how IEPA defines the designated use, the standard for each and the assessment data with which the impairment determination was made.

Table 10. IEPA designated use status for Ferson-Otter Creek Watershed

DESIGNATED USE: FERSON CREEK	APPLIES TO FERSON CREEK?	ASSESSED IN 2010 IEPA 303(d) LIST?	IMPAIRED?
Aquatic Life	Y	Y	N
Fish Consumption	Y	N	–
Public & Food Processing Water Supplies	N	–	–
Primary Contact	**Y**	**Y**	**Y**
Secondary Contact	Y	N	–
Indigenous Aquatic Life	N	-	–
Aesthetic Quality	Y	N	–
DESIGNATED USE: OTTER CREEK	**APPLIES TO OTTER CREEK?**	**ASSESSED IN 2010 IEPA 303(d) LIST?**	**IMPAIRED?**
Aquatic Life	Y	Y	N
Fish Consumption	Y	N	–
Public & Food Processing Water Supplies	N	–	–
Primary Contact	Y	N	–
Secondary Contact	Y	N	–
Indigenous Aquatic Life	N	–	–
Aesthetic Quality	Y	N	–

Figure 27. **Assessment and Impairment Status for the Ferson-Otter Creek Watershed**



3.2.1 Aquatic Life

IEPA relies on biological, water chemical and stream habitat data to determine the extent to which a stream supports Aquatic Life. These data are used to create two indices used in making this assessment. These indices include (1) the fish Index of Biotic Integrity (fIBI), and (2) the Macroinvertebrate Index of Biotic Integrity (mIBI). Table 11 comprehensively states the standards and interpretation information for these indices.

Table 11. IEPA Aquatic Life standards

BIOLOGICAL INDICATOR[1]			
Fish Index of Biotic Integrity(fIBI)	fIBI ≤ 20	20 < IBI < 41	fIBI ≥ 41
Macroinvertebrate Index of Biotic Integrity (mIBI)	mIBI ≤ 20.9	20.9 < mIBI < 41.8	mIBI ≥ 41.8
Impairment Status	Severe Impairment	Moderate Impairment	No Impairment
Designated Use Support	Not Supporting	Not Supporting	Fully Supporting
Resource Quality	Poor	Fair	Good

The scores for both Ferson Creek and Otter Creek indicate each to be Fully Supporting for the Aquatic Life designated use. Table 12 shows the scores for each watershed from the Report. While Otter Creek shows an fIBI score of 29 indicating a moderate impairment, the combination of these scores still leads to an overall status of Fully Supporting.

Table 12. Aquatic Life Ferson-Otter Creek Watershed data

	FERSON CREEK	OTTER CREEK
Segment ID	IL_DTF-02	IL_DTFA-02
Biological Indicator		
Fish Index of Biotic Integrity (fIBI)	**48**	**29**
Macroinvertebrate Index of Biotic Integrity (mIBI)	**59.1**	**56.5**
Impairment Status	**No Impairment**	**No Impairment**
Designated Use Support	**Fully Supporting**	**Fully Supporting**
Resource Quality	**Good**	**Good**

3.2.2 Primary Contact

Primary Contact as defined by Illinois Water Quality Standards as "any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing." IEPA primarily uses fecal coliform bacteria data to determine whether or not a stream is supporting this designated use. Fecal coliform is a type of bacteria that is generally found in human and animal feces.[108] The IEPA standard for Fecal Coliform states that "the geometric mean of all fecal coliform bacteria observations (a minimum of five samples over the most recent five year period) collected May through October may not exceed 200 colony forming units per 100 mL OR 10% of all fecal

[108] "Monitoring and Assessment: Fecal Bacteria," U.S. EPA, last modified June 29, 2011, accessed August 15, 2011, http://water.epa.gov/type/rsl/monitoring/vms511.cfm.

coliform bacteria observed may not exceed 400 colony forming units per 100 mL." Table 13 articulates the standards for the Primary Contact designated use. Fecal coliform data on which the Report's assessment of Ferson Creek and Otter Creek is based was collected by the Illinois State Water Survey (ISWS) at the mouth of Ferson Creek on behalf of the Fox River Study Group over the last 5 years.[109]

Table 13. IEPA Primary Contact support standards

DEGREE OF USE SUPPORT	STANDARDS
Fully Supporting (Good)	No exceedances of the fecal coliform bacteria standard in the last five years and the geometric mean of all fecal coliform bacteria observations <200/100 ml, and <10% of all observations exceed 400/100 ml.
Not Supporting (Fair)	One exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) OR The geometric mean of all fecal coliform bacteria observations in the last five years <200/100 ml, and >10% of all observations in the last five years exceed 400/100 ml OR the geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and <25% of all observations in the last five years exceed 400/100 ml.
Not Supporting (Poor)	More than one exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) OR the geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and >25% of all observations in the last five years exceed 400/100 ml.

Given these results in Table 14, the Report finds that Ferson Creek is Not Supporting (Poor) for the Primary Contact designated use. A 44% reduction in fecal coliform is needed to meet the geometric mean standard of 200 per 100 ml, while a 71% reduction is required to meet the standard for the percentage of samples over 400 (#/100mL). As stated above, Otter Creek was not assessed for Primary Contact. Ferson-Otter Creek stakeholders have therefore chosen the water-quality standard as the threshold for setting the target pollutant-load reduction.

Table 14. ISWS fecal coliform data in reference to state water quality standard

WATER QUALITY STANDARD	FLOW WEIGHTED MEAN CONCENTRATION IN FERSON CREEK	IEPA IMPAIRMENT STANDARD	REDUCTION NEEDED
Geometric Mean	355 (#/100mL)	200 (#/100mL)	44%
% of Samples > 400 (#/100 mL)	35%	10%	71%

3.2.3 Sources of Fecal Coliform Impairment

While this assessment demonstrates that fecal coliform is a cause of Primary Contact use impairment (and the only known cause of impairment in Ferson Creek), the specific location(s) contributing the most to fecal coliform contamination are unknown. IEPA has identified potential sources of fecal coliform impairment to be urban runoff and storm sewers, and runoff from forests, grasslands and parks. It is important to note that runoff from forests, grasslands and parks contains a naturally-occurring, background level of fecal coliform because wildlife are a component of both natural and man-made landscapes. This plan does not recommend wildlife eradication, although some fecal coliform contamination from wildlife can certainly be prevented. For example, naturalizing detention basins discourages the presence of Canada Geese. Rather the emphasis in this plan is on human-managed fecal coliform sources. For forests, grasslands and parks, this likely means waste which pet owners fail to pick up.

[109] Howard Essig, IEPA, email message to author(s), January 31, 2011. Preliminary monitoring data for the Fox River, collected by Illinois State Water Survey on behalf of Fox River Study Group, 2011.

Runoff is the nonpoint source mechanism by which fecal coliform contamination arrives in nearby water bodies. Urban runoff carries fecal coliform and other pollutants, and can be a source of contamination when it empties into storm sewers before it is either discharged untreated into streams or carried to a wastewater treatment facility to be treated and released. The volume of urban runoff is determined by the amount of impervious surface area (e.g., parking lots, rooftops or streets). As impervious surface area increases, runoff from urban areas generally increases, while water quality generally decreases. Water flowing over impervious urban surfaces picks up fecal coliform from pet waste, in addition to a variety of pollutants including oil and toxic chemicals from cars; sediment; road salts; and pesticide and nutrient runoff from lawns and gardens. Similarly, runoff from forests, grasslands and parks can be source of contamination because it carries fecal coliform from pets, livestock or wildlife. Leaking septic systems in both urban and rural areas can also contaminate water with fecal coliform from runoff over locations of failing septic systems. All three of these sources, however—impervious surface cover, forests, grasslands and parks, and areas with failing septic systems—are spatially dispersed throughout the watershed. Given the limited spatial resolution of data collected, IEPA data cannot determine the specific location(s) from which fecal coliform may be entering the stream system.

This plan will include recommendations that address runoff generally and aim to increase stormwater infiltration to limit these sources of current and future fecal coliform contamination. Additionally, this plan will include recommendations to address proper septic system and leach field maintenance to limit potential fecal coliform contamination from leaking septic systems.

3.2.4 Water Quality Considerations Beyond Fecal Coliform

In addition to the fecal coliform data used for stream assessment in the Report, ISWS has also collected data in Ferson Creek over the last five years for Total Nitrogen (TN), Total Phosphorus (TP) and Total Suspended Solids (TSS).[110] Data were not collected for the Otter Creek tributary. While total phosphorus, sedimentation/siltation, and total suspended solids are identified causes of impairment in the mainstem Fox River below the mouth of Ferson Creek, neither nutrients nor sediment are implicated as causes of any use impairment within Ferson Creek.[111] Furthermore, the State of Illinois has yet to set water quality standards associated with nutrients in streams and rivers, except for phosphorus at points where streams enter a lake or reservoir greater than twenty surface acres.[112] This particular water quality standard does not apply to Ferson Creek or Otter Creek. However, for water quality parameters for which there are no numeric water quality standards, Illinois does offer statistically-derived guidelines that are used to identify potential use impairment. These guidelines are summarized in Table 15 along with the observed mean concentrations found in Ferson Creek. Given that neither the nutrient concentration nor suspended solids concentration exceeds these guidelines in the watershed, the Ferson-Otter Creek Watershed stakeholders did not set a threshold for acceptable nutrient or sediment concentrations. Establishing target load reductions for nutrients or sediment was, therefore, not necessary at this time. It should be noted that although the Report

[110] Howard Essig, IEPA, email message to author(s), January 31, 2011. Preliminary monitoring data for the Fox River, collected by Illinois State Water Survey on behalf of Fox River Study Group, 2011.
[111] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).
[112] *Phosphorus*. *Ill. Adm. Code 35*, Subtitle C, Chapter 1, Part 302 Subpart B, Section 205. http://water.epa.gov/scitech/swguidance/standards/wqslibrary/upload/2006_09_05_standards_wqslibrary_il_il_5_c302.pdf (accessed September 7, 2011).

does not show definitive data pointing to an impairment, nutrients and sediment is still a present stakeholder concern in the watershed, which is affirmed by the plan's short-term project selections in Chapter 4.

Table 15. Pollutant concentration in Ferson Creek

POLLUTANT	FLOW WEIGHTED MEAN CONCENTRATION	STATISTICAL GUIDELINE FOR AQUATIC QUALITY IN ILLINOIS STREAMS
Total Nitrogen	2.64 (mg/L)	7.8 (mg/L)
Total Phosphorus	0.19 (mg/L)	0.61 (mg/L)
Total Suspended Solids	38.68 (mg/L)	116 (mg/L)

3.3 LAKE CAMPTON WATER QUALITY DATA

Lake Campton Property Owners Association (LCPOA) residents began participating in IEPA's Volunteer Lake Monitoring Program (VLMP) in 2001, recording water transparency measurements using a Secchi disk. The volunteer monitors also collected water samples in 2002 and 2004. These samples were analyzed at an IEPA laboratory. A summary of the VLMP data follows.

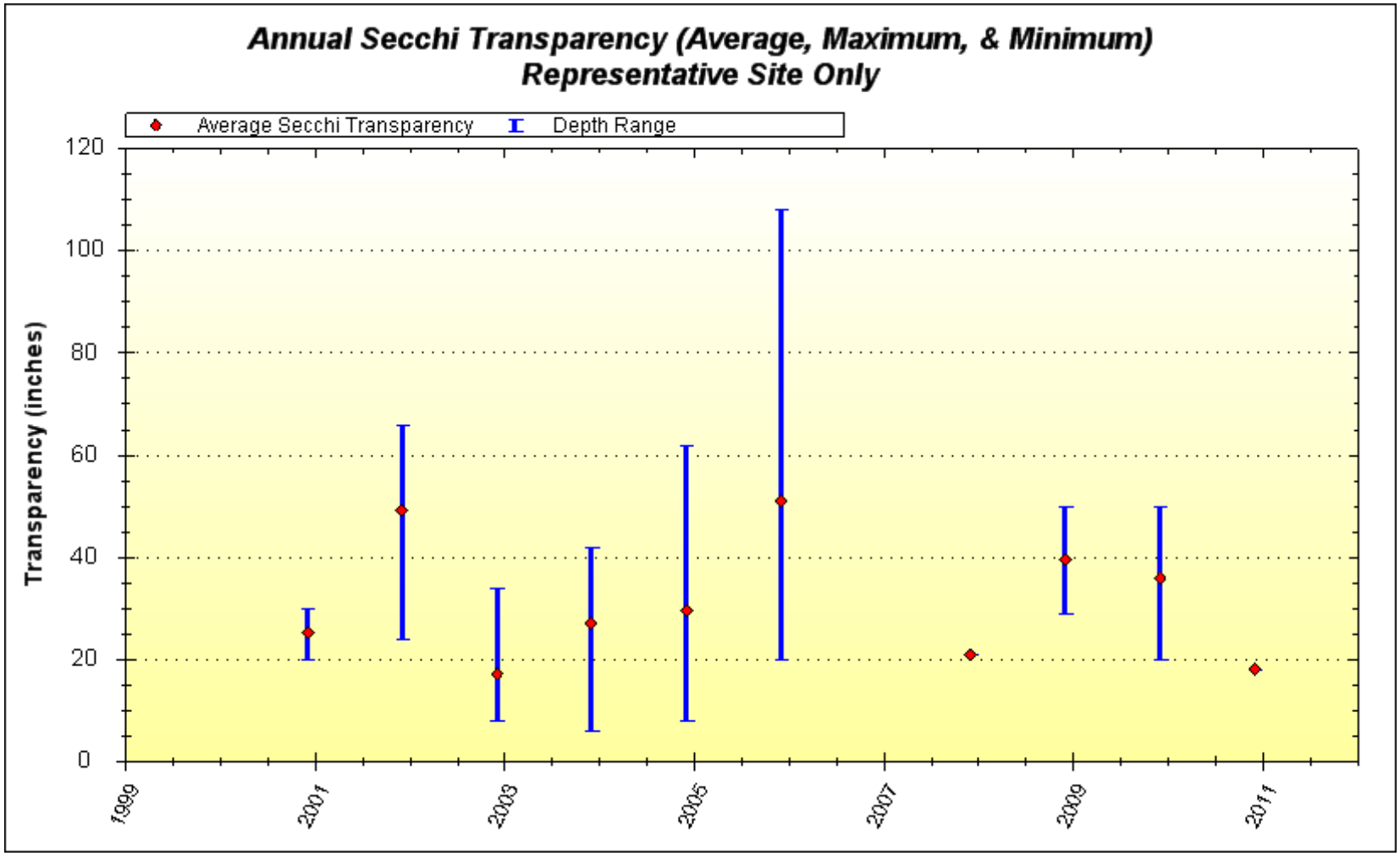
Secchi transparency readings were recorded at three locations in Lake Campton at least four times during the May through October VLMP monitoring season in 2001-2006 and 2010. Table 16 exhibit the average, minimum, and maximum Secchi transparency at Site 1, the lake's representative site, for these years. Water samples also were collected at Site 1 during 2002 and 2004 on a monthly basis, May through October. Figure 28 gives more details on annual Secchi transparency.

Secchi transparency at Site 1 has tended to average between about 2 - 2 ½ feet, although in 2002 and 2006 transparency averaged slightly more than 4 feet, elevated by the increased water clarity during the fall of those years. In fact in 2006, the Secchi disk occasionally could even be seen on the lake bottom at Site 1 in 8½ - 9 feet of water. The lowest transparency readings of around 1 foot and less were recorded after storm events and are associated with high levels of suspended solids carried into the lake from upstream eroding areas and streambanks. The resuspension of soft lake bottom sediments by wind and waves also contributes to the lake's generally low water clarity. Microscopic, planktonic algae further contribute to low Secchi transparency readings, notably in the hotter summer months as supported by the high chlorophyll *a* concentrations.

Table 16. Lake Campton VLMP Secchi transparency (inches), 2001-2006 & 2010

YEAR	MAY I	MAY II	JUN. I	JUN. II	JUL I	JUL II	AUG. I	AUG. II	SEP. I	SEP. II	OCT. I	OCT. II	MIN.	MAX.	AVG.
2001	-	-	-	-	-	-	23	30	20	-	28	-	20	30	25
2002	45	38	34	-	42	-	-	24	66	62	66	66	24	66	49
2003	8	34	24	18	14	14	16	16	12	12	14	24	8	34	17
2004	40	6	30	32	18	24	24	36	18	28	-	42	6	42	27
2005	42	38	62	24	26	8	16	12	24	26	38	40	8	62	30
2006	32	26	28	52	26	42	20	40	96	96	46	108	20	108	51
2010	-	33	-	-	27	20	-	-	50	50	-	-	20	50	36

Figure 28. **Lake Campton VLMP monitoring sites**



As summarized in Table 17, Lake Campton is also very nutrient-rich, with plenty of phosphorus and nitrogen available to support nuisance growth of planktonic and filamentous algae. Total phosphorus (TP) concentrations at Lake Campton were high, ranging from 0.086 to 0.704 mg/L, with an average of 0.26 mg/L, over the two sampling years. This is considerably above the 0.05 mg/L General Use Water Quality Standard as well as the 0.03 mg/L level known to contribute to nuisance growth of algae and some aquatic plants.

Inorganic forms of nitrogen (nitrate+nitrite and ammonia nitrogen) may also stimulate algae growth, notably at concentrations in excess of 0.03 mg/L. At Lake Campton, nitrate+nitrite nitrogen ranged from below detection (0.01K) to 3.4 mg/L over the two sampled years, averaging 0.728 mg/L.

Lake Campton is not alone among the many lakes in the state that exceed these phosphorus and nitrogen thresholds. Further, the overall water quality and aquatic plant conditions in Lake Campton are not surprising due to the large watershed above the lake which has and will continue to provide an ongoing source of siltation and nutrients.

Sedimentation

Water depth measurements were conducted throughout Lake Campton by the Illinois Department of Conservation (now Department of Natural Resources) fisheries biologist in 1967 (Figure 29) and by Wight Consulting Engineers in 1993 (Figure 30). Using the three VLMP monitoring sites as reference points and the depths measured at each of these points by the VLMP monitors between 1967 and 2010, it appears that in the vicinity of Site 1, water depths have decreased about 1½ - 2 feet, at Site 2 about 2½ - 3 feet, and at Site 3 about 1-2 feet. The overall surface area of the lake also appears to have declined from 30.6 acres in 1967 to about 27 acres today (Table 18). Sediment accumulation over time is evidenced in the northwestern finger of the lake where an approximately 1-acre marshy area has formed.

Table 17. Lake Campton site 1 summary statistics, 2002 & 2004 water quality data

PARAMETER	UNITS	MEAN	MEDIAN	MINIMUM	MAXIMUM	SD	N
Total Phosphorus	mg/L	0.260	0.191	0.086	0.704	0.190	8
Nitrate+Nitrite Nitrogen	mg/L	0.728	0.085	0.01K	3.400	1.171	10
Total Suspended Solids	mg/L	13.000	9.000	4.000	48.000	12.000	10
Volatile Suspended Solids	mg/L	8.000	7.000	2.000	13.000	3.000	10
Chlorophyll a (uncorrected)	ug/L	28.940	11.400	4.510	66.400	25.300	5
Chlorophyll a (corrected)	ug/L	27.510	12.500	4.650	63.000	23.470	5
Chlorophyll b	ug/L	4.834	1.350	1.000	18.900	7.040	5
Chlorophyll c	ug/L	2.918	1.360	1.000	8.600	2.900	5
Phaeophytin a	ug/L	2.284	1.310	1.000	6.160	1.970	5

Table 18. Lake Campton water depths and surface area, 1967-2010

YEAR	WATER DEPTHS (FEET) SITE 1	SITE 2	SITE 3	SURFACE AREA (ACRES)
1967	10.0 - 11.0	7.0	3.0 - 4.0	30.6
1993	9.0 - 10.0	5.0 - 5.5	3.0 - 4.0	—
2010	8.5 - 9.0	4.0 - 4.5	2.0 - 3.0	27.0

Figure 29. **Lake Campton water depth soundings, 1967**

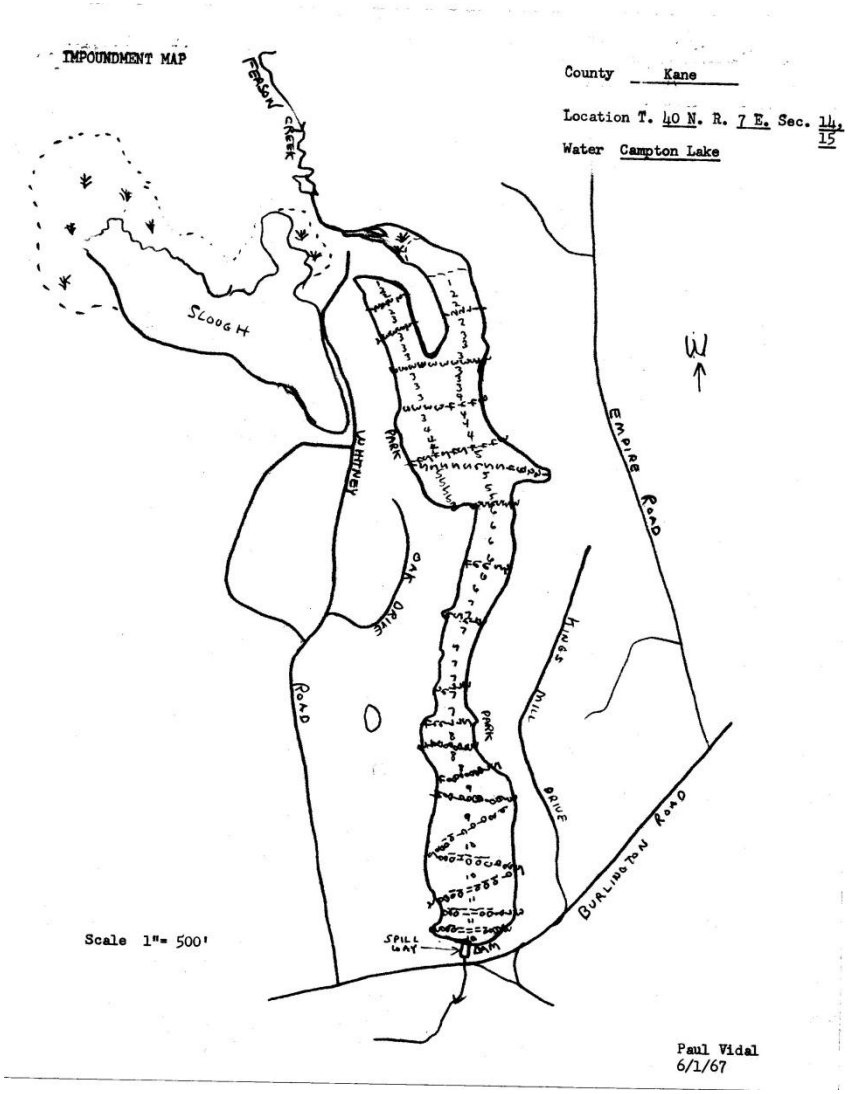
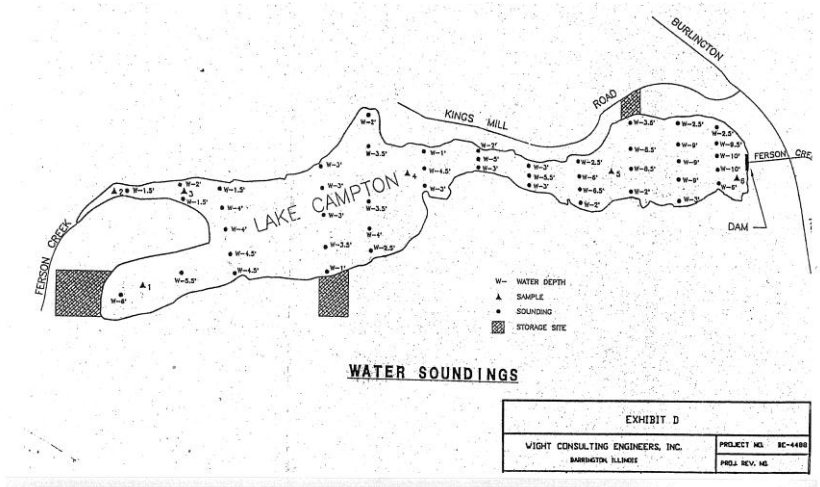
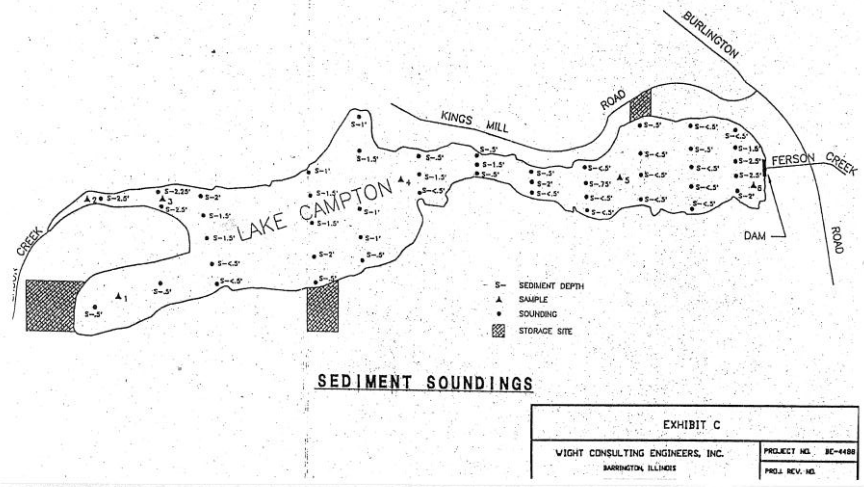


Figure 30. **Lake Campton water and sediment depth sounding, 1993**





3.4 GROUNDWATER QUALITY DATA

Groundwater quality data were obtained from IEPA for community water supply (CWS) wells on both sand & gravel and shallow-bedrock aquifers in the Ferson-Otter Creek Watershed.[113] These data reflect raw water samples, collected prior to treatment/distribution by the water supply operator. (Routine operator sampling is most frequently performed only for treated drinking water.) Since the 1980s, IEPA has sampled all CWS wells at least once for baseline raw water quality data, while a subset of 350 wells are sampled every two years as part of the Ambient Monitoring Network.[114]

Table 19 presents the mean concentration, standard deviation, minimum observed value, maximum observed value and number of observations for each inorganic contaminant among all CWS wells in this watershed. This table also lists the Maximum Contaminant Levels (MCL) or Secondary Maximum Contaminant Levels (SMCL) as applies to each contaminant presented here.[115] MCL standards are enforced drinking water regulations, while SMCL standards are recommended levels for preserving aesthetic characteristics of drinking water like appearance, smell, and taste.

Chlorides in particular have become a groundwater quality concern given a persistent trend of rising chloride concentrations in shallow wells throughout the region.[116] However, chlorides do not pose a threat to human health, although they can impart an undesirable salty taste to drinking water at high levels. Consequently, chloride currently has an SMCL of 250 mg/L (equivalent to parts per million, or ppm).[117] Road salt, septic-system effluent, and water-softener brine waste are major sources of chlorides in urban areas. A recent study found chloride concentrations to be increasing in shallow public wells in the western and southern counties surrounding Chicago. Among shallow public wells in this area, 43% were found to be increasing at a rate greater than 1 mg/L of chloride per year and an additional 15% were found to be increasing at a rate greater than 4 mg/L of chloride per year.[118] Figure 30 from the same study shows mean chloride concentrations for public wells in northeastern Illinois by county for the period 1900 to 2005.[119] The majority of these measurements do not exceed the current SMCL of 250 mg/L, but are much higher than 10 mg/L, the median chloride concentration for Chicago-area wells in 1960.[120,121]

As stated previously, the MCL and SMCL values presented with raw well water sample data in Table 19 are drinking water standards (i.e., finished water for distribution). However, a complex set of water quality standards also apply specifically to in-situ groundwater in Illinois.[122] Groundwater quality data are compared only with drinking water standards in this document (rather than with the more complex groundwater standards) because they are more straightforward, allowing for the abbreviated comparison included here.

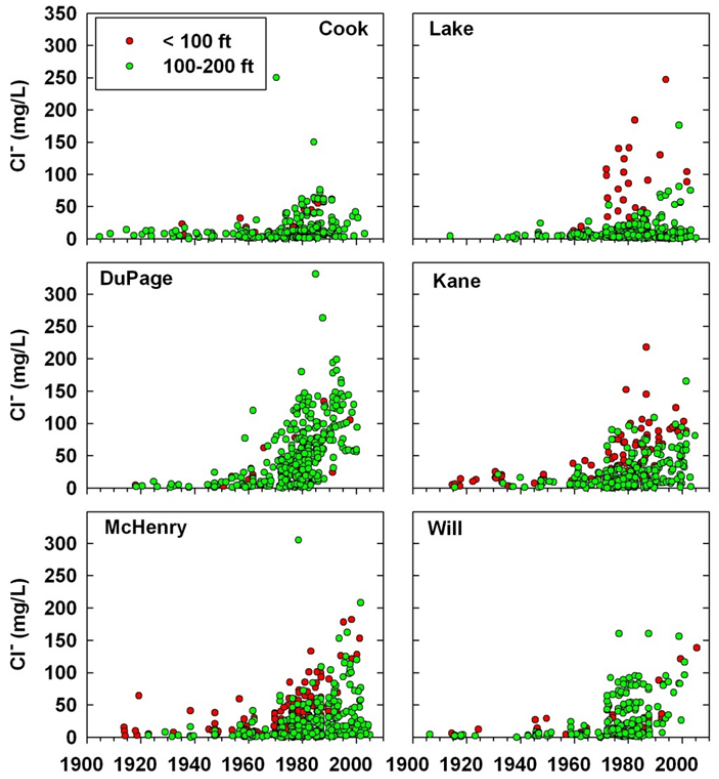
IEPA also collects data on organic contaminants. IEPA detected no synthetic organic contaminants (SOCs) or volatile organic contaminants (VOCs) in any of the wells in this watershed planning

[113] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.
[114] Ibid.
[115] *Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).
[116] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.
[117] Ibid. 115.
[118] Ibid. 116.
[119] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.
[120] Ibid. 115.
[121] Ibid. 116.
[122] *Groundwater Quality*. *Ill. Adm. Code* 35, Part 620. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33425/ (accessed November 14, 2011).

area.[123] In particular, there were no detections of a special class of VOCs called carcinogenic VOCs (CVOCs). Data presented here for all VOCs are for raw water samples, as for inorganic contaminants above. Unlike for inorganic contaminants, however, finished drinking water samples are likely to have similar VOC levels as raw water samples because conventional water treatment does nothing to remove them. A new law passed in Illinois in 2010, P.A. 96-1366/ SB 3070 or the MCL Prevention Law, oversees concentrations of CVOC's in finished drinking water.[124]

The six CVOC's affected by this law are benzene, carbon tetrachloride, 1,2-dichlorethane, tetrachloroethylene, trichloroethylene and vinyl chloride. The MCL Prevention Law is designed to prevent concentrations of these CVOCs in public water supplies from reaching regulated MCLs. The law requires that if facilities detect one of the CVOCs regulated by this law at a concentration of 50% or more of that CVOC's MCL in finished drinking water, then under certain circumstances, that facility must submit a response plan to prevent exceedence of the MCL, and to lower the concentration of the CVOC below its detectable limit.[125] Compliance with this law is not explored with regard to the sample data in Table 19 for two reasons. First, raw rather than finished water sample data are presented, and the VOC standards do not apply to these raw water samples. Second, even for finished water samples, there is complexity involved in IEPA's interpretation of standards in making a compliance determination.

Figure 31. **Chloride concentrations for public wells in northeastern Illinois at a county level, 1900 to 2000.** [126]



[123] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.
[124] *EPA—Carcinogenic Compounds*. *Ill. Comp. Stat.* 810 (2010), § 5/1-101. http://ilga.gov/legislation/BillStatus.asp?DocTypeID=SB&DocNum=3070&GAID=10&SessionID=76&LegID=50631 (accessed September 15, 2011).
[125] Ibid.

[126] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.

Table 19. Groundwater quality statistics for inorganic contaminants for Ferson-Otter Creek Watershed

CONTAMINANT	STANDARD TYPE	STANDARD LEVEL	MEAN	STANDARD DEVIATION	MINIMUM OBSERVATION	MAXIMUM OBSERVATION	NUMBER OF OBSERVATIONS	UNIT
Antimony	MCL	6	0.00	0.00	0.00	0.00	1	ppb
Arsenic	MCL	10	0.00	0.00	0.00	0.00	5	ppb
Barium	MCL	2,000	123.20	50.86	78.00	203.00	5	ppb
Beryllium	MCL	4	0.00	0.00	0.00	0.00	5	ppb
Cadmium	MCL	5	0.00	0.00	0.00	0.00	5	ppb
Chloride	SMCL	250	17.66	21.06	6.80	55.30	5	ppm
Chromium	MCL	100	0.00	0.00	0.00	0.00	5	ppb
Cyanide	MCL	200	0.00	0.00	0.00	0.00	5	ppb
Fluoride	MCL	4,000	390.00	90.00	310.00	530.00	5	ppb
Iron	SMCL	300	1,278.00	360.00	930.00	1,800.00	5	ppb
Manganese	SMCL	50	23.00	15.33	0.00	38.00	5	ppb
Mercury	MCL	2	0.004	0.009	0.00	0.02	5	ppb
Nickel	No MCL or SMCL	–	0.00	0.00	0.00	0.00	1	ppb
Nitrate	MCL	10	0.00	0.00	0.00	0.00	4	ppm
Selenium	MCL	50	0.00	0.00	0.00	0.00	5	ppb
Sodium	No MCL or SMCL	–	12.90	7.16	7.00	23.50	5	ppm
Sulfate	SMCL	250	58.72	38.25	18.60	99.00	5	ppm
Thallium	MCL	2	0.00	0.00	0.00	0.00	1	ppb
Zinc	SMCL	5,000	1.20	2.68	0.00	6.00	5	ppb

3.5 FECAL COLIFORM CRITICAL AREAS ANALYSIS

The preceding discussion has provided an overall characterization of water quality issues in Ferson-Otter Creek Watershed. The following discussion now focuses on critical areas and modeling results at a subwatershed level in the Ferson-Otter Creek Watershed to inform localized plan implementation activities. Critical areas are defined as those subwaters within the watershed for which a source of contamination for a given impairment is present at a concentration relatively higher than that found in the watershed in general.[127] Prioritizing recommended projects and policies for implementation is generally performed according to the financial ability and political will of the implementer, as well as the impact that a given recommendation will have on the ground, likely in that order. By helping to identify areas within a watershed which are thought to generate a disproportionately high pollutant load (critical areas) stakeholders have another tool for prioritizing recommended projects and policies based on the relative need for mitigation throughout the watershed.

While pollutant load reductions demonstrate the mitigation capacity of a particular project or policy, critical areas on the other hand demonstrate those locations within the watershed which are likely most in need of attention. A project or policy could potentially have a large pollutant load reduction, signaling a large impairment mitigation capacity, but might be implemented in an area within the watershed which is relatively unimpaired compared with other subwatersheds. If, however, stakeholders must choose among a larger set of possible project or policy options due to realistic financial or planning constraints, such a scenario might not result in the efficient use of time, money and energy in implementing plan recommendations on the ground. This fecal coliform critical areas analysis is therefore presented as an additional decision-making tool which stakeholders may use to further prioritize projects and policies aimed at mitigating fecal coliform contamination, following those most likely to be successfully implemented in the short term (i.e., within 5 years).

The Fecal Coliform Critical Areas Analysis was performed for Ferson-Otter Creek Watershed given the stakeholder need/choice to establish target load reductions for this impairment. Four potential sources of fecal coliform were considered in this analysis: the amount of urban stormwater runoff, the amount of pet waste, the number of failing septic systems and the presence of manure from livestock agriculture. Unfortunately, specific fecal coliform contamination data related to these sources do not exist at a subwatershed or even watershed level. Therefore, this analysis instead quantifies metrics for proxies that indicate relative levels of likely sources of fecal coliform contamination.

These proxies, quantified at the subwatershed level, include the percent impervious area (a proxy for urban runoff); population density (a proxy for number of pets and therefore amount of pet waste); the number of septic systems (a proxy for number of failing septic systems); and the percent agricultural area (a proxy for fecal coliform from livestock manure). Because this analysis focuses on proxies rather than on observed fecal coliform data, the high, medium and low subwatershed groups for each proxy indicating likely fecal coliform contribution should be taken as a relative rather than an absolute measure. Municipalities in watersheds identified as priorities for fecal coliform through this analysis will be targeted for broader-based policy or ordinance amendments and for public education efforts related to stormwater management and pet waste best practices. In addition, private agricultural landowners who raise

[127] CMAP and IEPA. *Guidance for Developing Watershed Action Plans in Illinois*. Chicago, IL: CMAP, 2007. http://www.epa.state.il.us/water/watershed/publications/watershed-guidance.pdf (accessed August 15, 2011).

livestock can be encouraged to develop comprehensive manure management plans.

Current imperviousness in each subwatershed was determined from the National Land Cover Dataset, which includes an imperviousness component.[128] Cell values in this layer represent the fraction of imperviousness for that cell. This layer was converted to actual impervious area per grid cell by multiplying the fraction of imperviousness of the cell by the area of the cell. The impervious area grid cells were then summed within each subwatershed. Finally, the impervious area in each subwatershed was divided by that subwatershed's total area to calculate percent impervious area. Figure 33 displays the results of this analysis. The Chesapeake Stormwater Network[129] has developed an Impervious Cover Model which correlates impervious cover in a watershed with stream quality in that watershed. As the percent impervious area in a watershed increases, stream quality tends to decrease. Specific thresholds for percent impervious area in each subwatershed area displayed according to this model. The associated recommendations are summarized in Figure 33.

Within Ferson-Otter Creek, three subwatersheds have been identified as nonsupporting watersheds and 8 subwatersheds have been identified has impacted subwatersheds given the relationship established between percentage of impervious cover and water quality (Figure 33). Table 20 identifies the subwatersheds that are nonsupporting or impacted and the municipality that is primarily present within each subwatershed. This analysis leads stakeholders to approach municipalities, Kane County, and other appropriate groups with policy and education and outreach recommendations that focus on these critical areas. These recommendations are reflected in the both the policy and education and outreach section in Chapter 5.

Figure 32. **Impervious cover model guidelines, percent impervious cover**

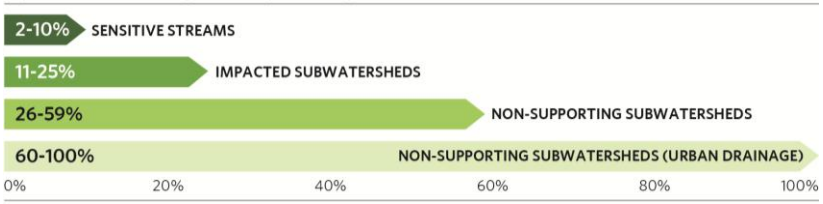
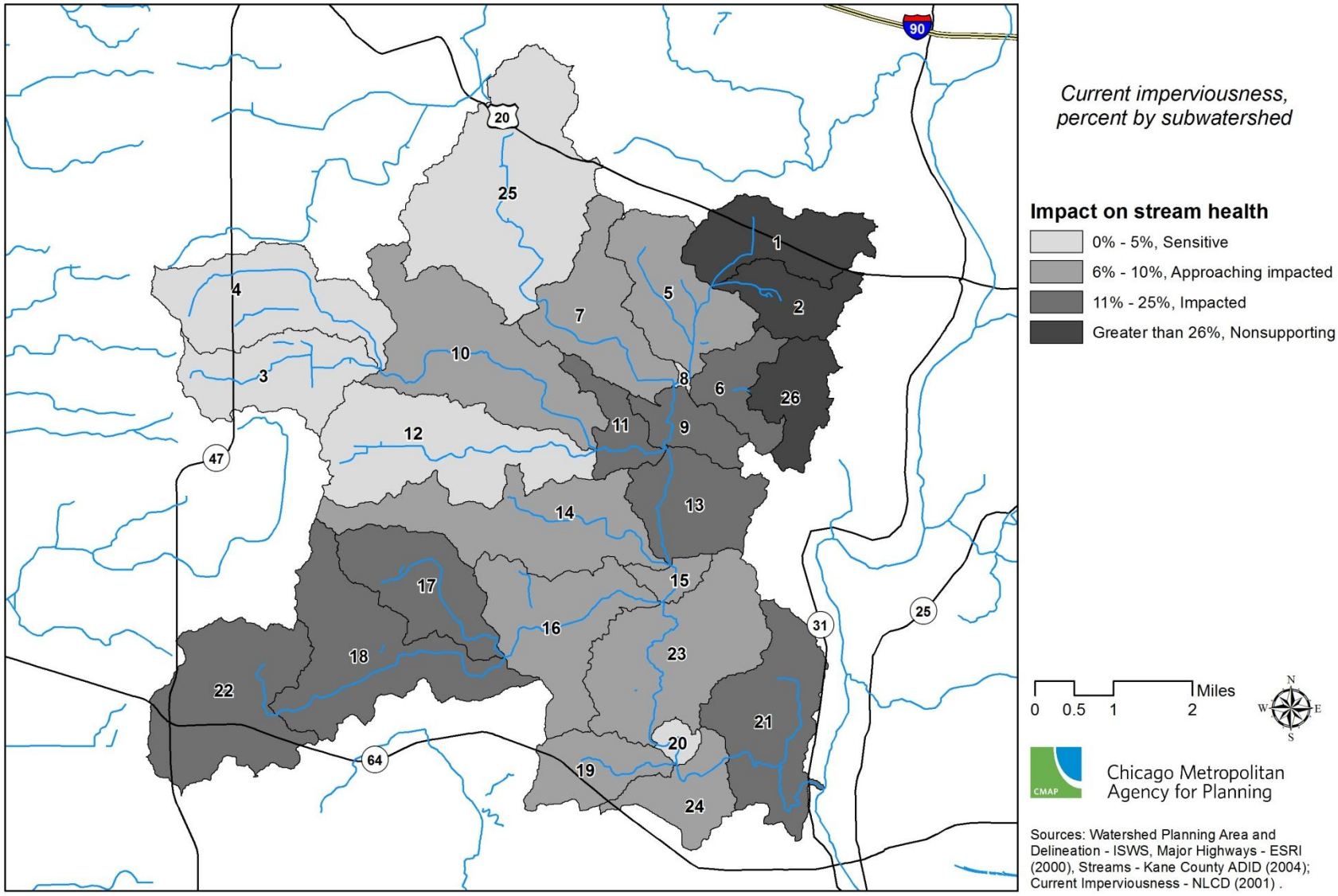


Table 20. Results of impervious cover model for Ferson-Otter Creek Watershed

SUBWATERSHED NUMBER	DESCRIPTION	MUNICIPALITY
1	Nonsupporting Subwatershed	City of Elgin
2	Nonsupporting Subwatershed	City of Elgin
6	Impacted Subwatershed	City of Elgin
9	Impacted Subwatershed	Unincorporated Kane County
11	Impacted Subwatershed	UnincorporatedKane County
13	Impacted Subwatershed	Village of South Elgin
17	Impacted Subwatershed	Village of Campton Hills
18	Impacted Subwatershed	Village of Campton Hills/ Unincorporated Kane County
21	Impacted Subwatershed	City of St. Charles/ Unincorporated Kane County
22	Impacted Subwatershed	Village of Lily Lake/ Unincorporated Kane County
26	Nonsupporting Subwatershed	City of Elgin

[128] USGS Multi-Resolution Land Characteristics Consortium (MRLC). *National Land Cover Dataset*. Sioux Falls, SD: USGS MRLC, 2001. http://www.mrlc.gov/index.php (accessed August 15, 2011).
[129] Chesapeake Stormwater Network. *The Reformulated Impervious Cover Model: Implications for Stream Classification, Subwatershed Management and Permitting, Version 1.0.* Technical Bulletin No. 3. CSN, 2008. http://www.chesapeakestormwater.net/all-things-stormwater/tag/technical-bulletin (accessed September 15, 2011).

Figure 33. **Current imperviousness percent by subwatershed in Ferson-Otter Creek Watershed**



Future projected imperviousness was also estimated at a subwatershed level using future land use specified in municipal and county comprehensive planning maps. Comparing current and projected future imperviousness indicated areas within the watershed that might be most vulnerable to water quality impacts from increasing impervious surface area and urban runoff. Municipal and county comprehensive planning maps were georeferenced in ArcGIS (Geographic Information System) to enable digitizing. Comprehensive plans used in this analysis include those from Campton Hills, Elgin, South Elgin, St. Charles and Kane County.[130] All developed land uses—those excluding open space, agriculture, agricultural residential and water bodies—were digitized and assigned to one of seven simplified land use categories for this analysis. These land use categories were then associated with a fraction of impervious surface area.[131] See Table 21 for land use categories and impervious runoff coefficients used in this analysis. Given ambiguity among comprehensive plans regarding precise definitions of low and medium density residential housing, the average of the coefficients for low and medium density residential land uses was calculated and applied to both of these land use types.

The digitized future land use features were then clipped to the watershed boundary and intersected with the watershed's subwatersheds. Once intersected, the fraction of impervious land cover could be multiplied by the area for each of the digitized future land use features within each subwatershed to give the actual impervious land cover for that future land use feature. The areas of impervious land cover for each of these features was then summed within each subwatershed and divided by that subwatershed's total area to give the percent. Figure 34 displays the results of the projected imperviousness analysis.

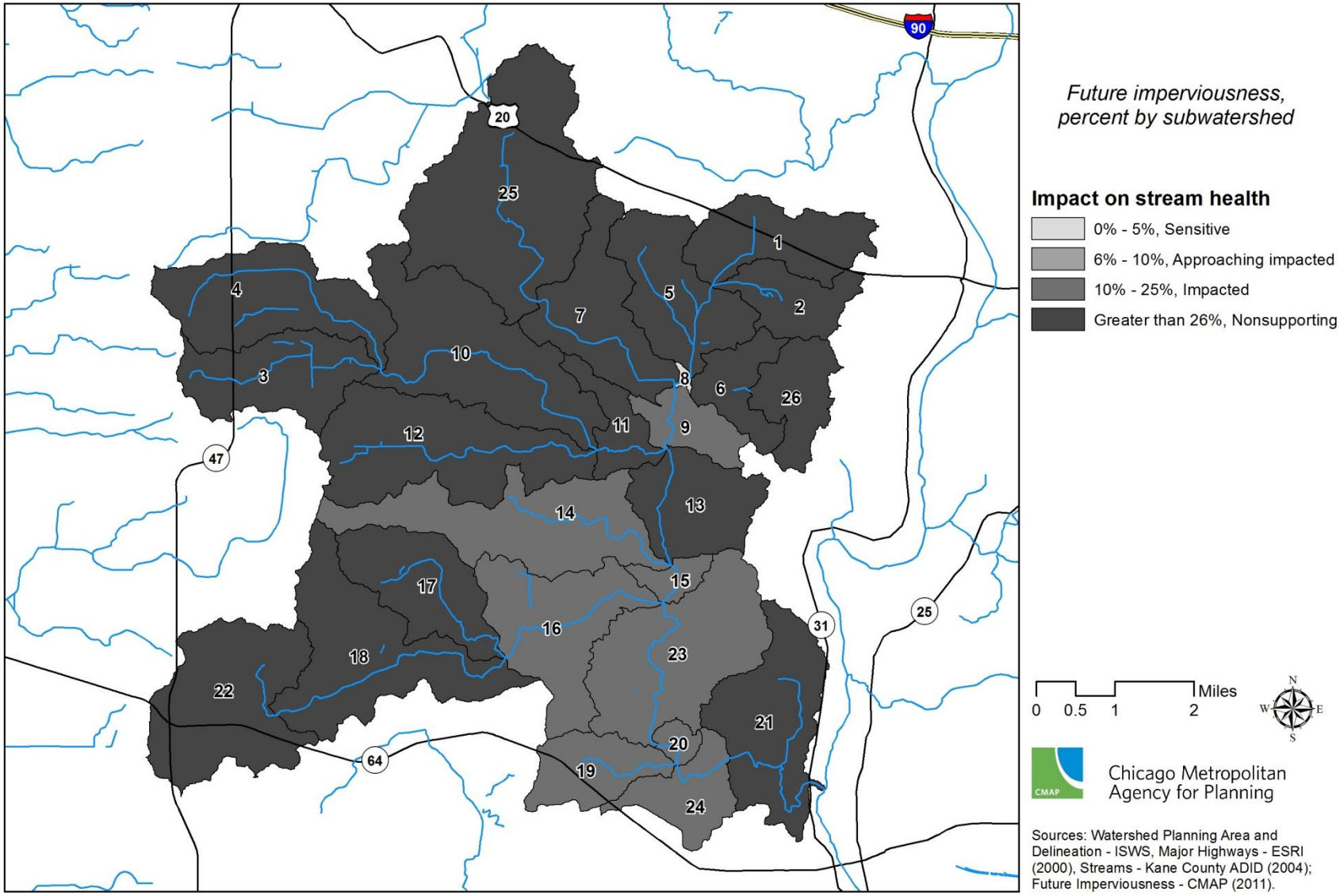
Table 21. Land use categories and associated fraction of impervious cover used in plan analysis

LAND USE	FRACTION IMPERVIOUS LAND COVER
Low density residential	0.285
Medium density residential	0.285
High density residential	0.514
Commercial	0.562
Office/industrial park	0.659
Institutional	0.280
Industrial	0.759

[130] It should be noted that the anticipated maximum buildout areas for each comprehensive plan were not adjusted for the varying planning horizons. Additionally many of the comprehensive plan land areas overlapped boundaries with other neighboring comprehensive plans.

[131] Wayne County, MI, Rouge Program Office. *Determination of Impervious Area and Directly Connected Impervious Area*, by Ed Kluitenberg. Wayne County, MI: Rouge Program Office, 1994. www.rougeriver.com/pdfs/modeling/RPO-MOD-SR35.pdf (accessed August 9, 2011).

Figure 34. **Future imperviousness, percent by subwatershed in Ferson-Otter Creek Watershed**



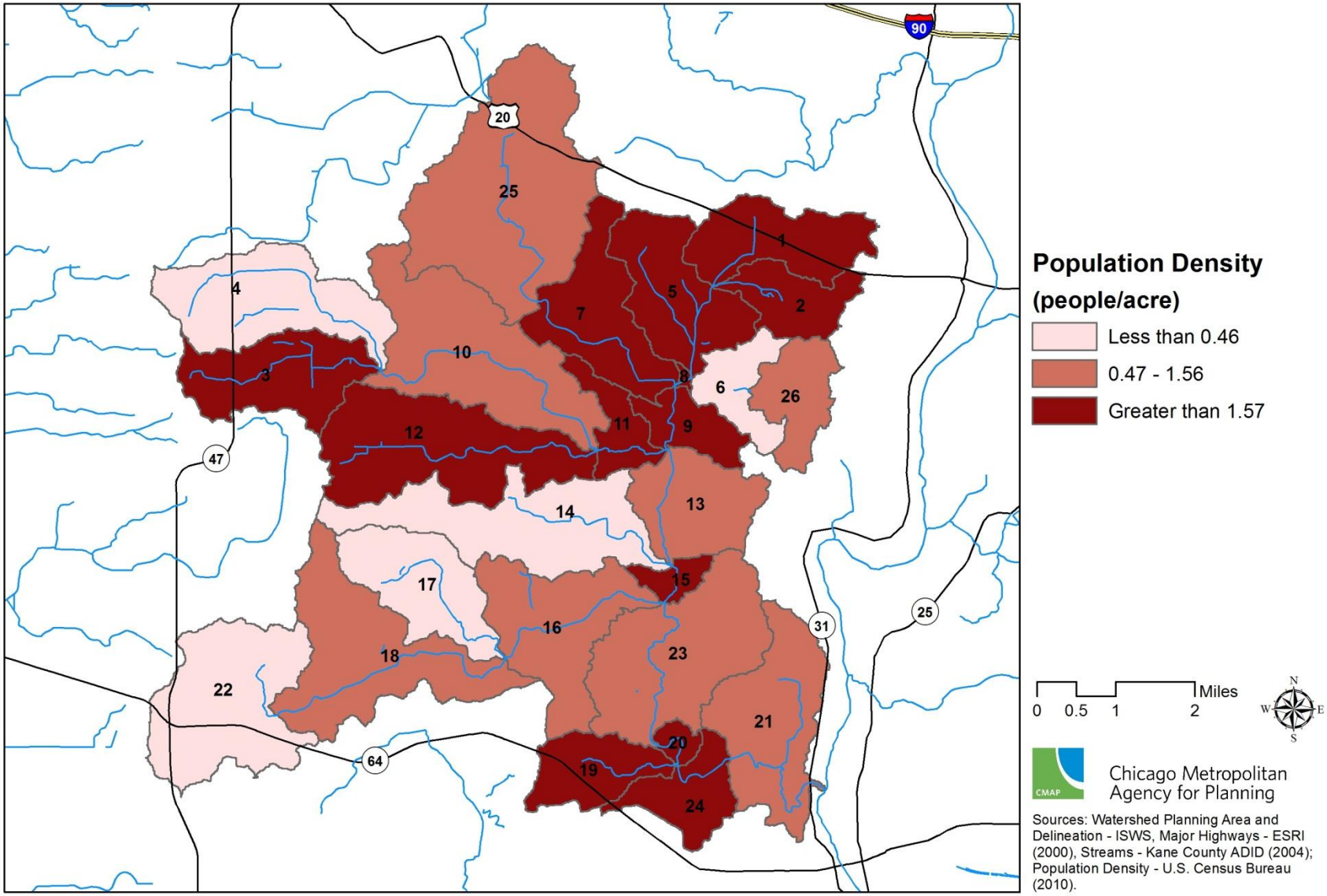
From this figure, it is clear that imperviousness is projected to increase by some amount in all subwatersheds. As previously stated, the analysis of current imperviousness leads stakeholders to approach municipalities, Kane County, and other appropriate groups with policy and education and outreach recommendations that focus on impacts to water quality from imperviousness, as well as stormwater management. Adoption of these recommendations would not only improve management of these impacts in the present, but would also better position Kane County and these municipalities for managing impacts to water quality from imperviousness that will emerge as urbanization increases in the watershed planning area.

As noted, pet waste was also considered as a potential source of fecal coliform. While there is a national pet ownership dataset for the United States, there are no subwatershed, watershed, county or state level datasets on pet populations.[132] Population data for 2010 from the U.S. Census Bureau were used to calculate human population density in each subwatershed, based on the assumption that pet population density scales proportionally with human population density.[133] The importance of urbanization to stream health has been investigated previously, and broadly supports the assumption for this analysis that urban areas contribute a significant amount of fecal coliform to water bodies receiving urban runoff. In addition to impacts from the amount of impervious area, higher population densities are correlated to the potentially lower quality of stream aquatic health, of which fecal coliform concentrations are one determinant. For example, one study found lower values for the Index of Biotic Integrity (IBI) in urban areas when compared with rural areas, indicating that urban areas tend to be associated more often with lower stream aquatic health, an impact caused in part by fecal coliform contamination.[134,135]

Figure 35 displays the results of this analysis. Dreher defines population density thresholds for rural (fewer than 0.46 people/acre), urbanizing (0.46 to 1.56 people/acre) and urban (more than 1.56 people/acre) watersheds.[136] Adopting Dreher's thresholds, there are 12 urban subwatersheds within Ferson-Otter Creek Watershed with the highest population densities. These subwatersheds likely have relatively higher pet populations given our assumption that pet population scales with human population. Beyond this assumption, these population density thresholds do not allow us any definitive conclusions about fecal coliform contamination directly, but rather suggest that the urban watersheds contribute more pollution to runoff from all sources, possibly including fecal coliform. Subwatersheds showing the highest population densities encompass primarily the City of Elgin and unincorporated areas, and to a lesser extent, parts of the Village of Campton Hills.

[132] "U.S. Pet Ownership & Demographics Sourcebook," AVMA, accessed September 15, 2011, http://www.avma.org/reference/marketstats/sourcebook.asp.
[133] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, Kane and Kendall Counties, Illinois. Washington, D.C.: Bureau of the Census, 2011. http://www2.census.gov/census_2010/04-Summary_File_1 (accessed November 3, 2011).
[134] Dreher, Dennis W. "Watershed Urbanization Impacts on Stream Quality in Northeastern Illinois." In *Assessing the Cumulative Impacts of Watershed Development on Aquatic Ecosystems and Water Quality*. Chicago, IL: Northeastern Illinois Planning Commission, 1996.
[135] Fitzpatrick, F.A., M.A. Harris , T.L. Arnold , and K.D. Richards. "Urbanization Influences on Aquatic Communities in Northeastern Illinois Streams." *Journal of the American Water Resources Association (JAWRA)*, Vol. 40, No. 2 (2000): 461-475.
[136] Ibid. 134.

Figure 35. **Population density critical areas.**



A septic system analysis was also completed on the subwatershed level. Kane County staff provided an estimate of the number of parcels serviced by septic systems.[137] This estimate was calculated from a Kane County Health Department inventory of subdivisions that are on septic within the watershed. In addition, all land parcels that fell within a sanitary district were assumed to be sewered rather than on septic. Likewise, all land parcels that fall within municipal boundaries that provide sewer service were assumed to be sewered rather than on septic. All remaining parcels were assumed to be on septic. These statistics were then summarized at a subwatershed level to identify areas with high septic system density. While only failing septic systems are a possible source of fecal coliform contamination, we assume a uniform system failure rate throughout the watershed. Therefore, areas with a higher density of septic systems overall are also likely to have a higher density of failing septic systems as well. As Figure 36 shows, the majority of the watershed is determined by this analysis to use septic systems rather than municipal sewers. The subwatersheds that are identified as high priority encompass primarily unincorporated areas, the Village of Campton Hills and the Village of Lily Lake. See Chapter 5 for associated policy recommendations.

Finally, agricultural runoff from livestock and horse manure was considered as a possible source of fecal coliform. Agricultural areas used for livestock and equestrian purposes were identified from the 2005 CMAP Land Use Inventory.[138] (See Resource Inventory for the location of all agricultural land use in Ferson-Otter Creek Watershed.) These areas were summed within each subwatershed and then divided by the total subwatershed area to calculate the percent of livestock and equestrian agricultural area. Figure 37 shows the percent agricultural land use for livestock and equestrian purposes. Two subwatersheds were identified to have more than 5% livestock and equestrian agricultural land use. These subwatersheds encompass primarily unincorporated areas and the Village of Campton Hills. See Chapter 5 for associated policy recommendations.

[137] Sean Glowacz, Land Use Planner for Kane County, email message to CMAP, April 29, 2011.
[138] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).

Figure 36. **Septic System Critical Areas**

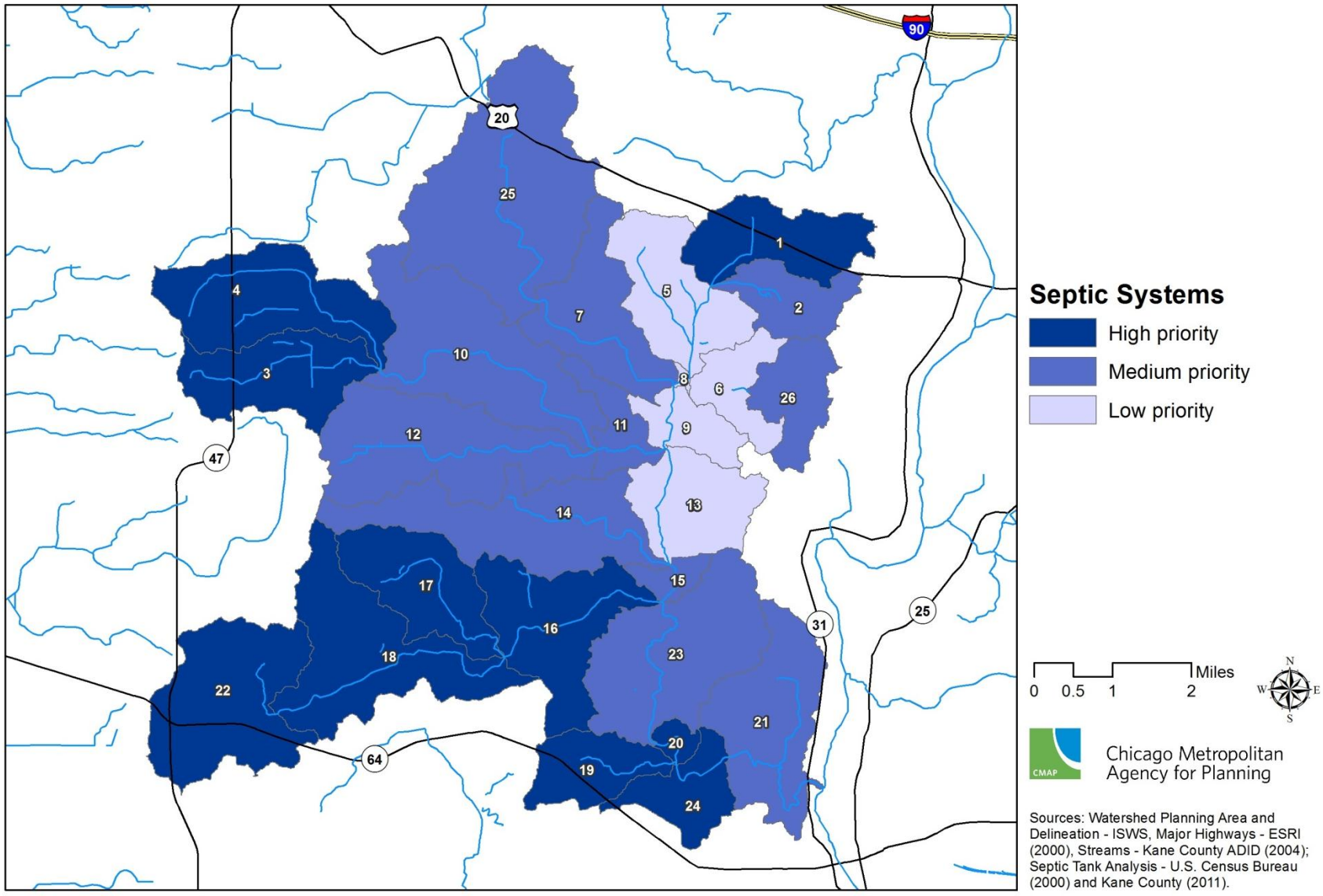
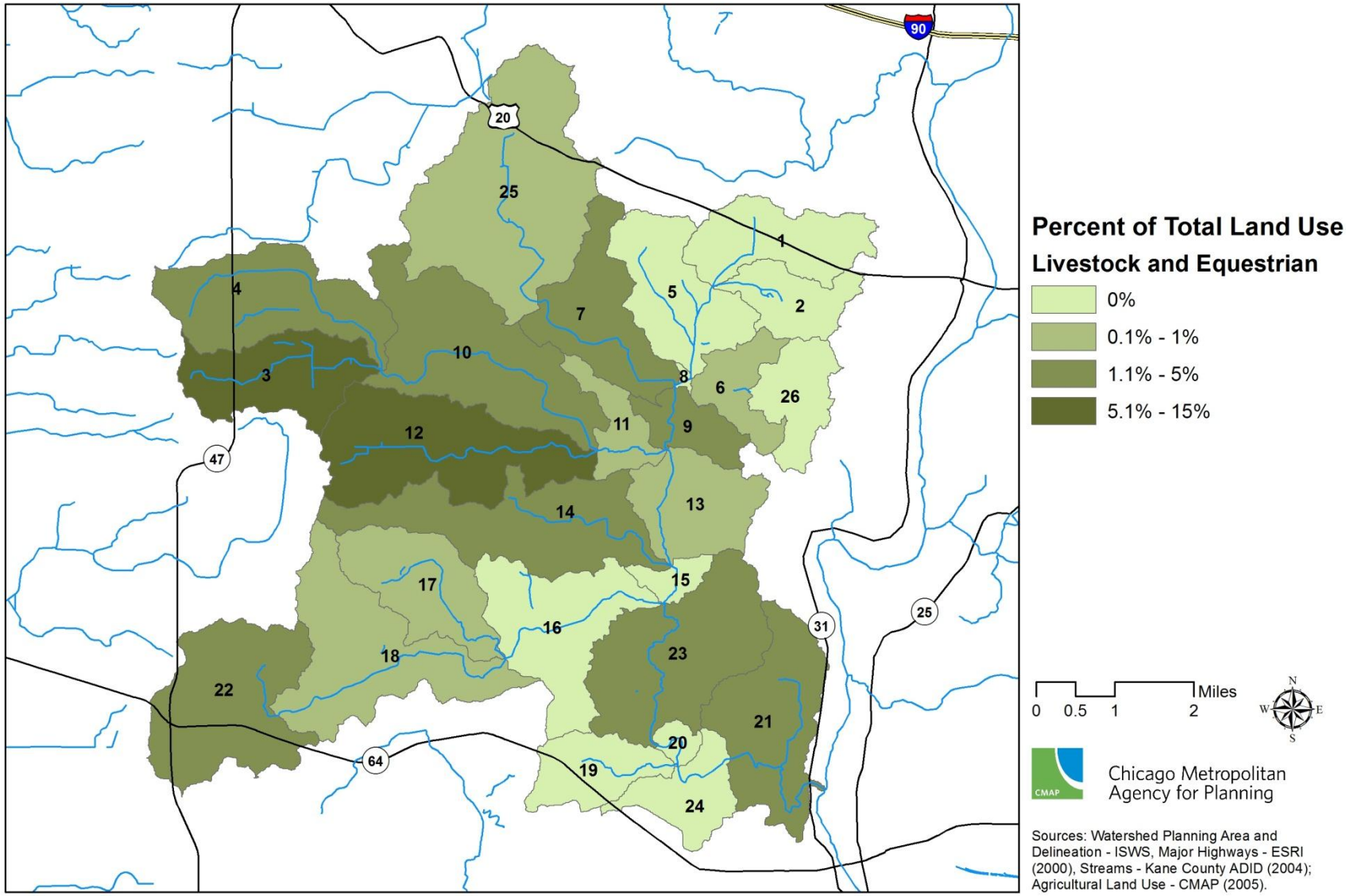


Figure 37. **Percent of Total Land use-livestock and equestrian critical areas**



Modeling Results

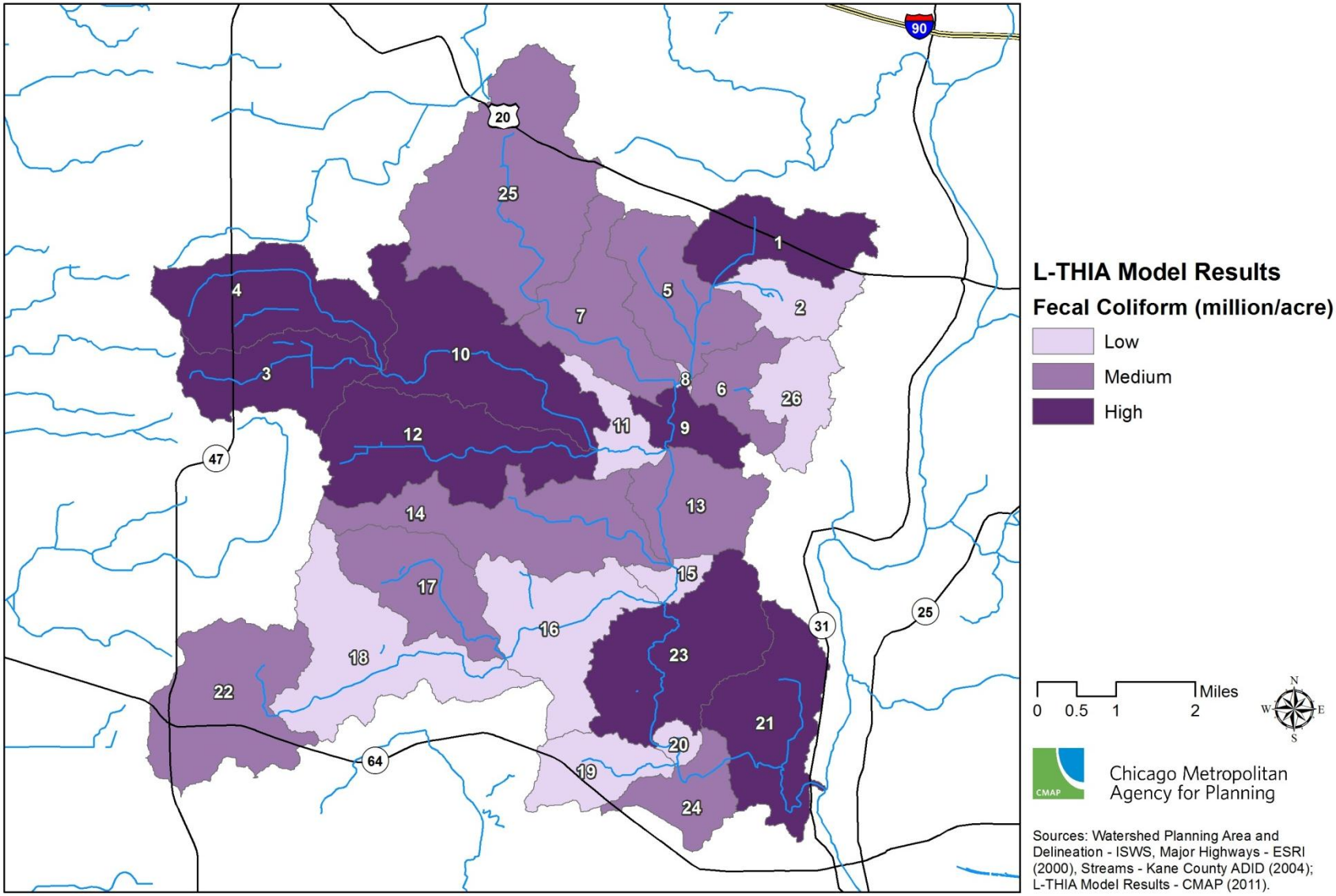
A Long-Term Hydrologic Impact Analysis (L-THIA) model was run at a subwatershed level for Ferson-Otter Creek Watershed. L-THIA predicts runoff volume, runoff depth, and nonpoint-source pollutant loadings based on the land use and the hydrologic soil group on which this land use is occurring. L-THIA uses observed, long-term climate data at a county level to model precipitation events. Nonpoint-source pollutants modeled by L-THIA include Total Nitrogen (TN), Total Phosphorus (TP), Total Suspended Solids (TSS) and Fecal Coliform. L-THIA estimates runoff volume and nonpoint-source pollutant loadings based on Event Mean Concentrations (EMC) specific to unique combinations of land uses and pollutant types.[139] EMC values are determined by taking water quality measurements at various points in time during a runoff event, and averaging these measurements by the flow rates corresponding to the sample concentrations. The default EMC values used in the L-THIA model are based on a study by the Texas Natural Resource Conservation Commission.[140] L-THIA uses EMC values to calculate total annual pollutant loadings by multiplying the total annual runoff depth for a land use by the area of that land use, as well as by the appropriate EMC value and converting units when necessary.[141]

Model results are useful because they can help to identify potential sources of impairments. L-THIA results for fecal coliform concentrations among the subwatersheds in Ferson-Otter Creek might provide insight when compared with the results of the fecal coliform critical areas analysis, for example, if an area modeled to have high fecal coliform is also identified as a fecal coliform critical area based on the proxies investigated. Although nutrient and sediment concentrations in Ferson Creek were found to be below the respective Illinois guideline concentrations for streams, the L-THIA results similarly help to present a comprehensive view of water quality issues throughout the Ferson-Otter Creek Watershed. Nutrient and sediment concentrations were collected at a point in Ferson Creek that captures runoff from the entire (combined) watershed(s). Otter Creek was not similarly sampled as an isolated tributary to Ferson Creek. While water quality conditions are potentially similar in Otter Creek, model results offer one way to investigate this premise.

To assess relative contributions of pollutants among the 26 subwatersheds in Ferson-Otter Creek, average annual loadings from L-THIA are converted to unit-area loads, meaning that the total load for each pollutant is divided by the subwatershed area to calculate pounds of pollutant per acre. Unit area loads provide a more meaningful point of comparison than average annual loads because they account for varying area size among subwatersheds. Larger subwatersheds are expected to contribute more pollutants overall as a function of their greater area, but if the unit area load for a subwatershed is still larger than others after dividing by its area, then that subwatershed's pollutant contribution is assumed to be disproportionately large. Figure 38 shows unit area loads for fecal coliform by subwatershed within Ferson-Otter Creek.

[139] "How L-THIA Estimate[s] NPS Pollutant Loadings using Event Mean Concentration," Purdue University, accessed November 7, 2011, https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/documnt/how_lthia_estimate_nps_using_emc.htm.
[140] Texas Natural Resource Conservation Commission. *Characterization of Nonpoint Sources and Loadings to the Corpus Christi Bay National Estuary Program Study Area*, by Charles Baird and Marshall Jennings. Report No. CCBNEP-05. Corpus Christi, TX: Texas Natural Resource Conservation Commission, 1996. http://www.cbbep.org/publications/virtuallibrary/ccbnep05.pdf (accessed August 15, 2011).
[141] Ibid.

Figure 38. **L-Thia Model Results**



This figure can be compared qualitatively with the critical areas identified through the previous analysis to assess which sources of fecal coliform contamination might be most likely in this watershed-based on the geographic overlap of likely sources (critical areas) with likely high unit area loads (L-THIA results). While some fecal coliform likely does originate from all sources discussed in this plan, the subwatersheds in this map with the highest unit area loads reflect the critical areas for the pet waste, agricultural waste and septic system leakage proxies to a greater extent than for the urban runoff proxy, suggesting that pet waste, agricultural waste and failing septic systems might contribute more to fecal coliform contamination in this watershed than urban runoff.

The results for fecal coliform are conservative, since the L-THIA model likely underestimates fecal coliform loading. Fecal coliform loading is calculated using an EMC, as are loadings of the other non-point source compounds; that is, a constant in units of bacteria per volume is multiplied by the total volume of water passing over a particular land use. As such, the loadings modeled by L-THIA constitute only nonpoint sources of contamination, including those for fecal coliform. The L-THIA model employed here uses minimum EMC values for fecal coliform that are derived from the existing literature. Therefore, model outputs will be low compared to other forms of estimation that use maximums or averages.[142] For purposes of this plan, the nonpoint source component of fecal coliform contamination is more relevant, since wastewater treatment plant point sources must disinfect effluent during the period when sample counts determine a stream's use attainment or impairment status.

Nitrogen, phosphorus or sediment pollutants are displayed spatially in the aggregate. Bundling these pollutants is intuitive because they likely share a common source. For example, agricultural land uses, and nonnative turf-grass lawns in urban areas, can lead to disproportionately large loadings of all three of these pollutants. If a subwatershed has a high nitrogen unit area load, it likely also has high phosphorus and sediment unit area loads. Therefore only one map is displayed rather than three. The method for aggregating these metrics is detailed below and is similar to the general process employed in identifying critical areas above. This method has been applied to bundle factors contributing to water quality in other watershed planning documents as well.[143,144]

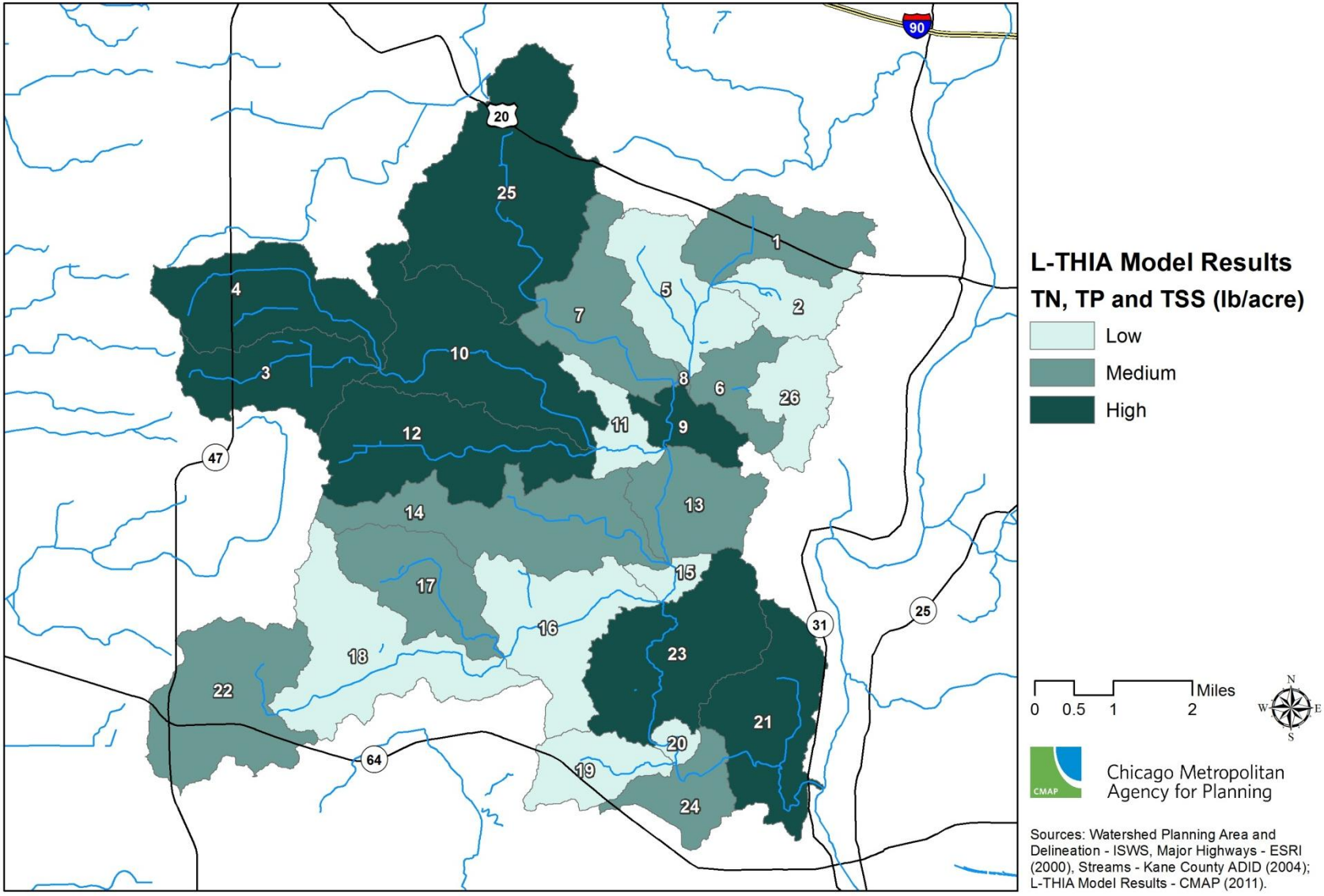
To view TN, TP and TSS in the aggregate, each subwatershed receives three scores, one for each pollutant's unit-area load. Scores are based on ranking the subwatersheds from the lowest unit area pollutant load to the highest. A score of one for each pollutant corresponds to the subwatershed with the lowest unit-area load, while a score of 25 corresponds to the subwatershed with the highest unit area load. The aggregated total rank for each subwatershed is calculated by summing the three ranks for each individual pollutant. Subwatersheds with the highest total rankings are then recognized to have disproportionately high unit area loads across several pollutants. Here, as in the critical areas analysis, the scores delineating the subwatersheds into high, medium and low unit area load groups should be taken as a relative rather than an absolute measure. Figure 39 shows the overall scores for nutrients and sediment among subwatersheds based on unit-area loads within Ferson-Otter Creek.

[142] Larry Theller, GIS specialist, Purdue University Department of Agricultural and Biological Engineering, email to author(s), September 21, 2011.

[143] Mill Creek Subwatershed Stakeholder Advisory Group. *Mill Creek Subwatershed Management Plan*, by Elizabeth Riggs. Ann Arbor, MI: Huron River Watershed Council, 2006. http://www.michigan.gov/documents/deq/ess-nps-wmp-mill-creek_209206_7.pdf (accessed August 18, 2011).

[144] White River Resource Conservation & Design, Inc. *Defining Critical Areas: Hogan Creek Watershed Project, Upper Anderson River Watershed Project and Tanners Creek Watershed Project*, by Kris Vance. PowerPoint presentation. Salem, IN: White River Resource Conservation & Design, Inc., 2011. https://engineering.purdue.edu/watersheds/webinars/IWLA2011/CriticalAreas/DefiningCriticalAreasVance.pdf (accessed August 18, 2011).

Figure 39. **L-Thia model results for TN, TP, and TSS, pounds per acre.**



The L-THIA model results for TN, TP and TSS when viewed in the aggregate show subwatersheds 3, 4, 9, 10, 12, 21, 23 and 25 to generate the highest unit-area loads. These subwatersheds overlap in large part with the subwatersheds that have the highest percentages of agricultural land by area (see the top two percentages classes Figure 37), with the exception of subwatersheds 21 and 23. Agricultural activities in this watershed are therefore implicated for generating a disproportionately large contribution of the nutrient and sediment loads in Ferson-Otter Creeks as predicted by L-THIA. However, more investigation into the sources of nutrient and sediment runoff is warranted, particularly into the dynamics of subwatersheds 21 and 23. These two subwatersheds possess some degree of agricultural land use, but agriculture is by no means dominant. If these subwatersheds do demonstrate high unit area loads as suggested by L-THIA, there might be factors in addition to agriculture contributing to these disproportionately high loads. Ideally, monitoring data should be collected with greater spatial resolution throughout the watershed. Such data can be used in conjunction with model results to inform identification of pollutant sources at a subwatershed level to guide nutrient and sediment runoff mitigation efforts. In the meantime, L-THIA model results are instructive in terms of where emphasis should be placed to reduce sediment and nutrient runoff.

4. NONPOINT-SOURCE PROJECT RECOMMENDATIONS

4.1 PROCESS OF SOLICITING PROJECTS

Stakeholders were encouraged to submit project recommendations for inclusion in the plan. Electronic and paper submissions were welcome. A few stakeholders utilized Google Earth software and ArcGIS to submit exact locations along with detailed project descriptions. A project submission sheet was also sent to all stakeholders on the watershed outreach list several times throughout the planning process. Utilizing the local knowledge of all the stakeholders, the planning process produced an abundance of project ideas. A total of 87 projects were submitted covering a wide variety of best management practices. As requested by IEPA, all submitted projects were organized into 5 categories: Urban, Hydrologic, Agriculture, Livestock, and Other.

4.2 SHORT TERM PROJECTS

After project solicitation, the stakeholders began discussion on selection criteria for short term projects, a subset of all submitted projects expected to be implemented within 5 years. Stakeholders settled on the following project selection criteria:

- Ability to address the Primary Contact use impairment in Ferson Creek,[145]
- Ability to address Aquatic Life and fish consumption impairments in downstream segment of the Fox River,
- Ability to support Ferson-Otter Creek Watershed Goals, and
- Lead implementer, local, and municipal support.

Given the uncertainty regarding sources of fecal coliform, there was much discussion on how these short-term projects might affect fecal coliform reductions. Outside of the pollutant load reductions calculated for each short-term project, additional recommendations that address the fecal coliform are discussed in Chapters 5 and 6. Water quality benefits can also be achieved by addressing related impairments in the Fox River. The downstream segment of the Fox River was assessed and determined to be in nonsupport for Aquatic Life and fish consumption. The causes of impairment are dissolved oxygen, mercury, polychlorinated biphenyls, alterations in stream-side or littoral vegetative covers and other flow regime alterations. The sources of impairment were identified as streambank modifications/destabilization, impacts from hydrostructure flow regulation/modification, atmospheric deposition-toxics and unknown sources.

As previously noted, the Ferson-Otter Creek Watershed is within the Lower Fox River Basin. The watershed-based plan will need to specifically address the fecal coliform impairment. In addition, the plan can potentially positively impact some of the Fox River water quality concerns given that the Ferson-Otter Creek is a major tributary. The concerns include nutrients (phosphorus and nitrogen) and sediment or total suspended solids. Sources of these pollutants include both agricultural and urban runoff. Many of these sources of impairment are addressed in the plan's short-term projects.

Obtaining lead implementer, local, and municipal support for a project helps ensure successful implementation. Support can include grant match funds and partnerships. Local support can include non-profits, homeowners associations, individual private homeowners, etc. This criterion was added because stakeholders realized without support, project implementation is unlikely.

[145] The limited data and knowledge about exact locations and sources of impairment was understood and taken into consideration.

A total of 21 short-term projects were selected for the Ferson-Otter Creek Watershed Plan. Table 22 provides a summary of those 21 projects organized by IEPA categories. More detailed short-term project descriptions are provided in the remainder of this chapter.

Table 22. Ferson-Otter Creek Watershed short-term projects, organized by IEPA project categories

IEPA CATEGORY	NUMBER OF PROJECTS	GENERAL DESCRIPTION
Hydrologic	15	Stream channel and stream corridor restoration projects to stabilize banks from erosion.
Other	2	Various improved management practices to reduce nutrient runoff and accumulation and improve habitat foraquatic life.
Urban	4	Retrofits to existing stormwater management infrastructure to address pollutant loading and increased runoff volume in developed areas.
Total	**21**	

Additionally Figure 40 displays the location of each short-term project within the watershed. The projects are mainly located in the eastern half of the watershed.

After the short-term projects were selected, CMAP contracted with Hey and Associates to calculate pollutant load reduction and cost estimates for each project. Sediment, total suspended solids, phosphorus, fecal coliform, and nitrogen reductions were considered in the estimates. Table 23 summarizes expected pollutant load reductions organized by IEPA project categories.

Lastly, costs for each short-term project were calculated and are also displayed in Table 23. Cost estimates include construction, contingency, and design and permitting. **However it should be noted that some lead implementers will need to further develop project proposals. This will likely affect and potentially increase the estimated project costs due to a number of reasons including unforeseen variables such as site conditions, implementation timelines, etc.** Funding for these short-term projects will likely come from state and federal grants and local sources.

Figure 40. **Short-term project recommendation locations**

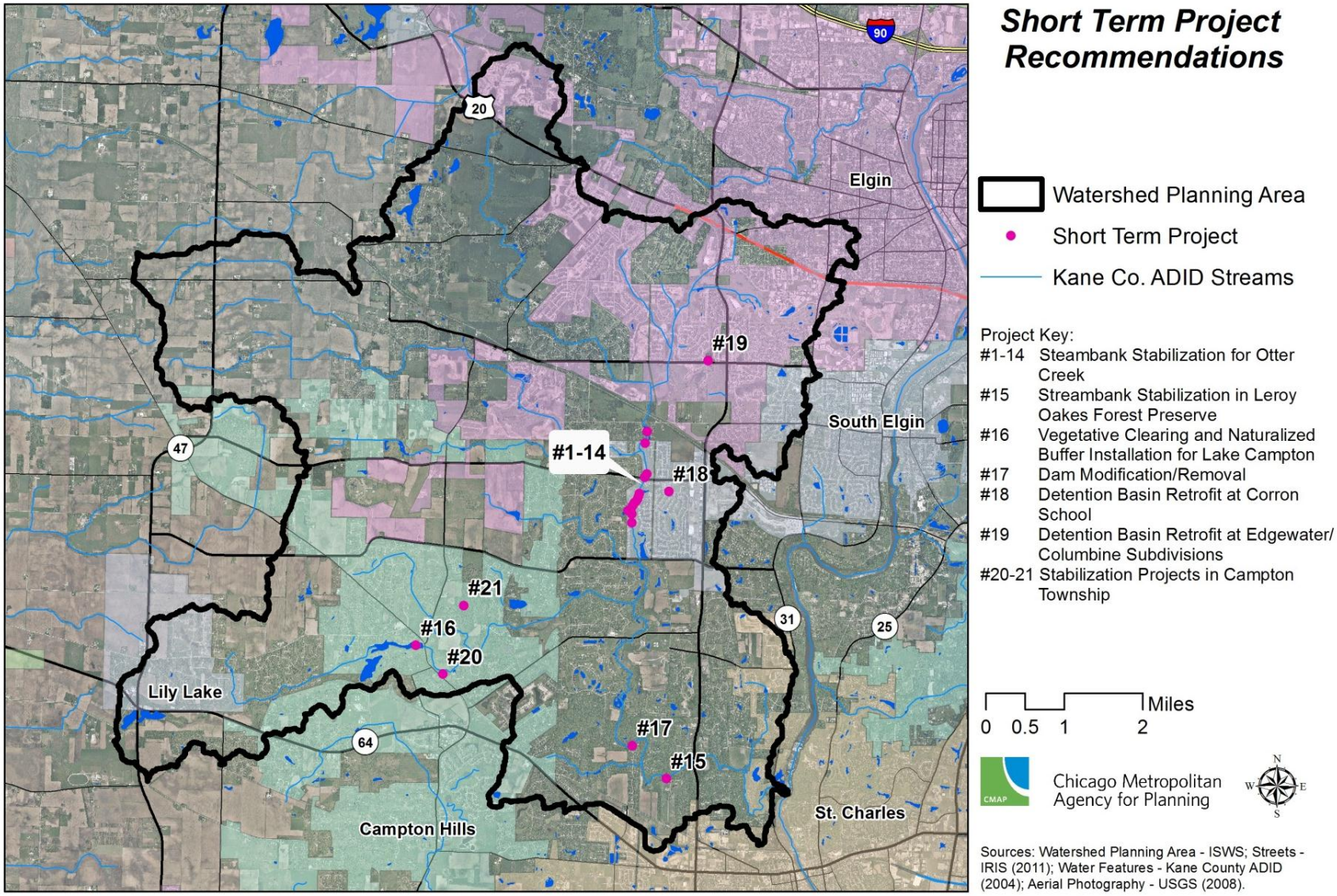


Table 23. Summary of short-term projects

PROJECT #	IEPA CATEGORY	BEST MANAGEMENT PRACTICE	LEAD IMPLIMENTER	UNIT	AMOUNT	COST	SEDIMENT (TONS/YR)	TSS (LBS/YR)	PHOSPHORUS (LBS/YR)	FECAL COLIFORM (COUNTS)	NITROGEN (LBS/YR)
1	Hydrologic	Regrade and Gabion, Station 7870-7990	South Elgin	feet	120	$69,120	3.82	—	6.12	—	15.29
2	Hydrologic	Stream bank armoring, Station 1860-2000	South Elgin	feet	140	$45,360	3.72	—	5.95	—	14.86
3	Hydrologic	Regrade w/Stone Toe and Gabion, Station 4920-5170	South Elgin	feet	250	$144,000	7.96	—	12.74	—	31.85
4	Hydrologic	Regrade with Stone Toe, Station 5280-5350	South Elgin	feet	70	$17,640	1.11	—	1.78	—	4.46
5	Hydrologic	Vegetative Maintenance, Station 7140-7290	South Elgin	feet	150	$27,000	4.78	—	7.64	—	19.11
6	Hydrologic	Gabion, Station 7380-7470	South Elgin	feet	90	$38,880	2.87	—	4.59	—	11.47
7	Hydrologic	Regrade and Gabion, Station 8150-8570	South Elgin	feet	420	$136,080	13.37	—	21.41	—	53.51
8	Hydrologic	Gabion, Station 8670-8980	South Elgin	feet	310	$133,920	8.23	—	13.17	—	32.91
9	Hydrologic	Regrade with Stone Toe, Station 6350-6490	South Elgin	feet	140	$35,280	2.23	—	3.57	—	8.92
10	Hydrologic	Regrade with Stone Toe, Gabion, and Vegetative Maintenance, Station 6620-6740	South Elgin	feet	120	$90,720	2.55	—	4.08	—	10.19
11	Hydrologic	Regrade with Stone Toe and Gabion, Station 6820-6870	South Elgin	feet	50	$28,800	1.59	—	2.55	—	6.37
12	Hydrologic	Gabion, Station 6960-7120	South Elgin	feet	160	$69,120	6.79	—	10.87	—	27.18
13	Hydrologic	Regrade with Stone Toe, Station 1190-1290	South Elgin	feet	100	$25,200	1.59	—	2.55	—	6.37
14	Hydrologic	Gabion, Station 7570-7720	South Elgin	feet	150	$64,800	4.78	—	7.64	—	19.11
15	Hydrologic	Streambank Stabilization Project; Leroy Oakes FP; Severe Erosion (> 15 FT). Major bank stabilization to address sediment/TSS release into the stream. Channel stabilization also to be included.	Kane County Forest Preserve District	feet	450	$339,109	42.99	—	68.80	—	172.00
16	Other	Clearing of woody tree and brush species for installation of lake shoreline buffer around Lake Campton, 20 foot buffer approximates to +/- 3.5 acres.	Lake Campton Property Owners Assocation	feet	7,700	$60,663	—	421	3.29	250,000,000,000	5.33
17	Other	Working with private landowner to remove or modify existing dam north end of Knoll Creek West Subdivision, St. Charles Township, unincorporated Kane County.	Kane County	feet	n/a	$244,058	---------- No reductions in sediment or nutrient loading ----------				
18	Urban	Retrofit existing dry-bottom detention basin with native vegetation for increased filtering/pollutant removal, Corron School.	South Elgin	acre	3.11	$16,286	—	—	—	—	—
19	Urban	Edgewater/Columbine Subdivision naturalized basin with combined drainage.	Elgin	acre	4.7	$76,542	—	1,473.71	5.79	1,220,000,000,000	1,123.01
20	Urban	Stabilize eroded storm drainage channel which drains directly into Ferson Creek (banks > 5 ft); Drains Burlington Rd runoff onto Campton Township Gray Willows open space property.	Campton Township	feet	200	$50,000	5.34	—	8.86	—	2.21
21	Urban	Stabilize eroded swale on Campton Township Gray Willows Property. Erosion > 4 feet in places; drains runoff from Fair Oaks Drive.	Campton Township	feet	450	$79,000	8.49	—	13.59	—	33.97
	TOTALS					$1,791,578	122.00	1,895	205.00	1,470,000,000,000	1,598.00

4.2.1 Hydrologic Projects

#1-14 Steambank Stabilization for Otter Creek

This streambank stabilization project consists of 15 separate project sites within South Elgin.[146] As the lead implementer, South Elgin finds it appropriate to list each project site separately. Collectively these sites improve the stability of 3,360 feet of Otter Creek streambank. The project sites vary in both slope and severity of erosion. Of particular concern is the village's trailway infrastructure (bike path) that is threatened by stream erosion seen in Figure 41. The main water quality benefit associated with the implementation of these projects is the reduction of nonpoint-source pollutants including sediment generated from erosion and in-stream sediment movement.

Figure 41. **Station 1860-2000**

[146] One of these projects lists a private landowner as the lead implementer; however the land is located within South Elgin. South Elgin will work with the local landowner to establish a partnership for implementation.

#15 Streambank Stabilization in Leroy Oakes Forest Preserve

This project site is located in the Leroy Oakes Forest Preserve. The site has severe erosion (> 15 feet) issues as seen below in Figure 42. Major bank stabilization best management practices are needed to address and reduce sediment and total suspended solids release into the stream. This reduction is the main water quality benefit associated with the project. Channel stabilization is also needed. The site also contains a substantial public safety concern due to drop offs in certain locations that reach about 24 feet in height. Kane County Forest Preserve District has been identified as the lead implementer for this project.

Figure 42. **Streambank in Leroy Oakes Forest Preserve**

4.2.2 Other Projects

#16 Vegetative Clearing and Naturalized Buffer Installation for Lake Campton

This project would entail the removal of existing woody tree and brush species from the shoreline of Lake Campton, followed by the establishment of a naturalized buffer. Both the clearing and the buffer installation (20 feet) are needed for 7,700 linear feet of shoreline shown in Figure 43. Lake Campton is privately owned and the Lake Campton Property Owners Association (LCPOA) has been identified as the lead implementer. The main water quality benefit of this project is the improvement in the quality and the reduction in quantity of stormwater that enters Lake Campton. Concentrations of phosphorus and nitrogen are the main concern to LCPOA. As part of the project, the LCPOA would also like to include an educational component in which the Association or another appropriate partner would provide educational materials to homeowners on the importance of naturalized buffers, proper working septic systems and proper use of lawn fertilizers with phosphorus.

Figure 43. **Lake Campton**

#17 Dam Modification/Removal

As lead implementer, Kane County will work with the private landowner to remove or modify the existing dam at the north end of the Knoll Creek West Subdivision located in St. Charles Township (unincorporated Kane County). The main water quality benefits associated with this project's implementation include: decreased water temperature, increased dissolved oxygen, and minimized sedimentation behind the dam (if the dam were removed). Additional benefits would be increased fish and other invertebrates' passage as well as increased connection of the Ferson-Otter Creek Watershed with the Fox River.

4.2.3 Urban Projects

#18 Detention Basin Retrofit at Corron School

This project entails the retrofit of a dry-bottom detention basin to native vegetation. South Elgin is the lead implementer for this project. Partnerships with the school district should be established and utilized. The main water quality benefit for this project is increased filtration of stormwater and pollutant removal.

#19 Detention Basin Retrofit at Edgewater/Columbine Subdivisions

Within the City of Elgin, separate detention/retention facilities of two subdivisions abut land within a third subdivision over which any collected but non-absorbed water then conveys (Figure 44). The City is responsible for the maintenance of one of the detention/retention facilities (North Columbine), and two different homeowners associations are responsible for the other detention/retention facility (Woodbridge) and the water conveyance area (Edgewater). Currently, the city is providing technical assistance to the Woodbridge Homeowner's Association (HOA) as that HOA seeks funding to naturalize their facility and generally implement other best management practices versus the original design. Their specific area consists of approximately 2.6 acres. Long term and depending upon funding, the city would like to naturalize the facility for which it is responsible, and the intent of such an effort would be that the plantings of all three areas make them appear as one larger area. The area for which the city is responsible consists of approximately 2.1 acres. The immediate area within the Edgewater subdivision (over which water conveys) is approximately 1.8 acres, but it is already naturalized. Long term plans could include a bike trail through the areas and educational opportunities, such as trail markers that explain the benefits of the larger, more-unified ecosystem, with before and after photographs. Elgin has been identified as the lead implementer for this project and will work in partnership with the appropriate homeowners associations on implementation.

The main water quality benefits of this project would result from the replacement of the basin's turf grass with native plants. Native plantings are a more sustainable alternative because they are drought resistant, promote infiltration and biodiversity, and require little maintenance. Native plantings help slow down flows which allow some of the pollutants in the water to settle out and be absorbed by the plants and microorganisms in the soil of the basin floor. With dense root systems making up two thirds of their biomass, native plantings enrich the soil with their organic matter. They also have high water-holding capacities and draw water deep into the earth, replenishing the shallow aquifer, because of the great depths their roots reach. Native plants support biodiversity by providing food and habitats for native birds and insects.

Figure 44. **Edgewater/Columbine Subdivisions**

#20-21 Stabilization Projects in Campton Township

Two separate but related stabilization locations have been identified as short-term projects. The first project entails the stabilization of an eroded storm drainage channel that not only drains directly into Ferson Creek but also drains Burlington Road runoff onto Campton Township Gray Willows Farm open space property (Figure 45). The second project entails the stabilization of an eroded swale that drains runoff from Fair Oaks Drive onto Campton Township Gray Willows Farm property located at 5N949 Corron Road, St. Charles, Illinois (Figure 46). Campton Township has been identified as the lead implementer for both of these projects. The main water quality benefit is the reduction in the amount of stormwater runoff and associated pollutants on the Gray Willows Farm property.

Figure 45. **Burlington Road Gully**

Figure 46. **Fair Oaks Drive Gully**

4.3 LONG-TERM AND ADDITIONAL PROJECTS

After the short-term projects were identified from all of the submissions, the remaining projects were classified as long-term, expecting implementation in 5-10 years from plan completion. These projects are located in Appendix A. Please note that the long- and short-term projects outlined in the plan do not represent all the opportunities for water quality improvement projects in the Ferson-Otter Creek Watershed. As more data and resources become available, additional projects that are not currently listed in the watershed plan may be considered by the Ferson-Otter Creek Watershed Coalition. It will be important that these additional projects directly correspond and reflect the plan's goals as stated in Chapter 1 of this plan.

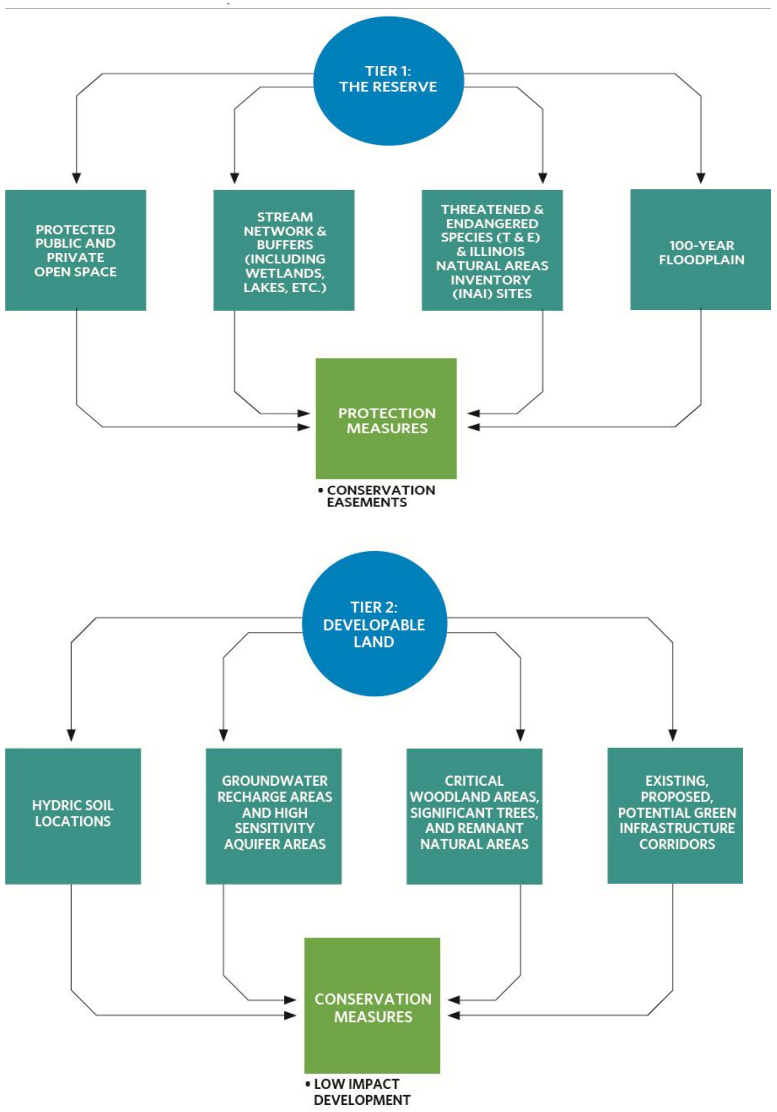
5. WATER RESOURCE POLICY RECOMMENDATIONS

In addition to on-the-ground project recommendations, water quality improvements in the watershed can also be made through policy recommendations. This chapter outlines various policy considerations including a green infrastructure framework, groundwater protection policies, agricultural best management practices, updates to codes and ordinances, fecal coliform related policies, and more.

5.1 GREEN INFRASTRUCTURE

Green infrastructure can be described as an interconnected system of open space and natural areas that provides habitat for wildlife, flood protection, recreational opportunities, and water quality protection including groundwater recharge.[147] Green infrastructure functions much like gray infrastructure except instead of connecting roadways and streets, green infrastructure connects open space and natural areas. Open space and natural areas include publicly owned land such as park district property and forest preserves, privately owned land maintained by homeowners associations (HOAs), floodplains, and other areas. The components of green infrastructure can be organized in many ways. For this plan the components are organized into two tiers to create the Green Infrastructure Framework shown in Figure 47. The purpose of these tiers is not to prioritize open space and natural areas, but rather to group certain characteristics, functions, and areas together so that similar policy recommendations can be applied. Figure 48 displays Tier 1 and Tier 2 land areas within the Ferson-Otter Creek Watershed.

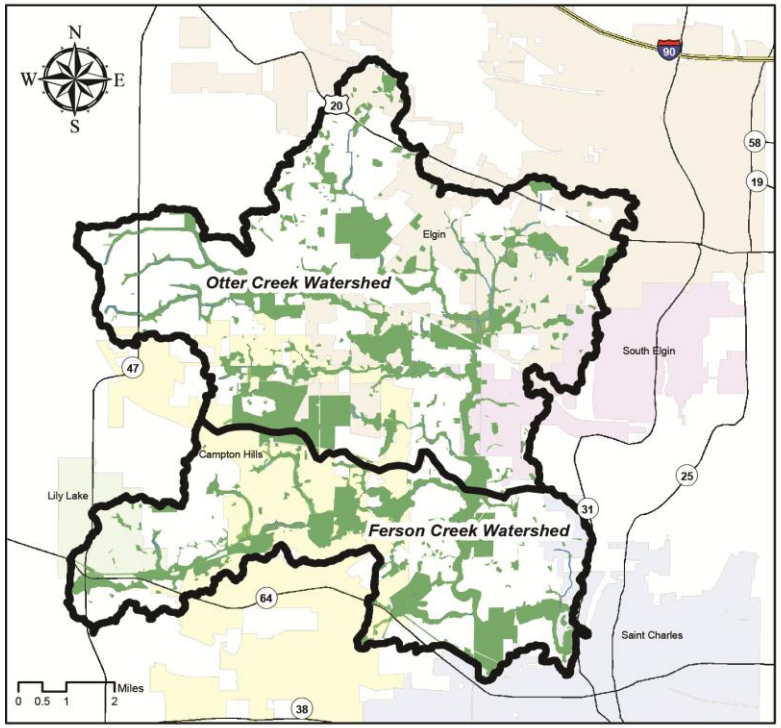
Figure 47. **Green infrastructure Framework**



[147] "Managing Wet Weather with Green Infrastructure," U.S. EPA, last modified January 4, 2011, accessed November 9, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=298.

Figure 48. **Tier 1 and Tier 2 land areas**

Tier 1: The Reserve



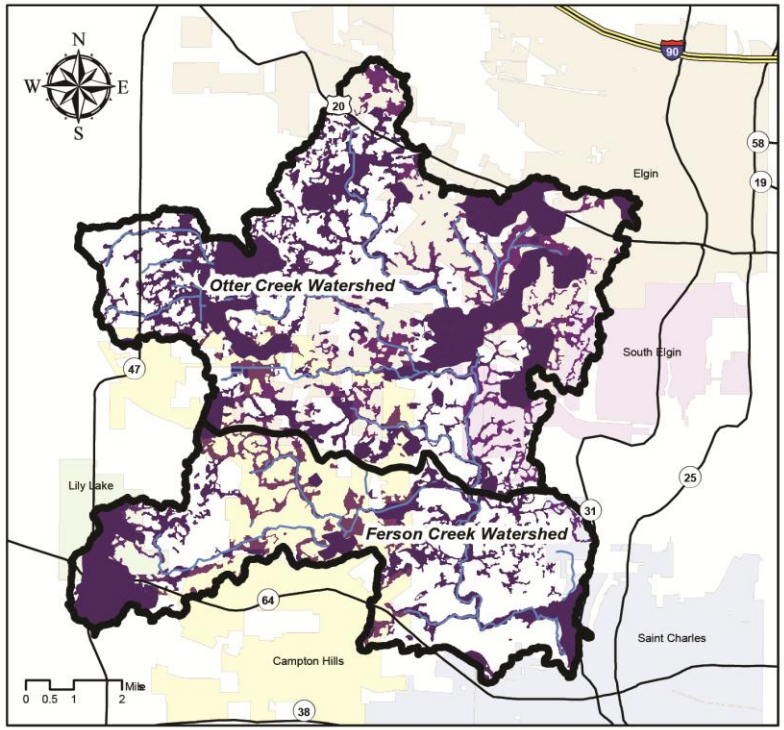
Legend

- Watershed Planning Area
- Tier 1
- Campton Hills
- Elgin
- Lily Lake
- Saint Charles
- South Elgin
- ADID Streams
- Interstate
- US/State Hwy

Chicago Metropolitan Agency for Planning

Kane County Forest Preserve - FPDKC (2009); Campton Township, Other Public Open Space, Private Open Space, South Elgin Open Space and St. Charles Park District - Campton Township Green Infrastructure Plan (2010), Elgin Open Space (2011), Watershed Planning Area, Illinois State Water Survey (2005), Kane County, I Advanced Identification Study (ADID) (2004), Major Roads, ESRI (2000), Municipal Boundaries, CMAP (2010).

Tier 2: Developable Land



Legend

- Watershed Planning Area
- Tier 2
- Campton Hills
- Elgin
- Lily Lake
- Saint Charles
- South Elgin
- ADID Streams
- Interstate
- US/State Hwy

Chicago Metropolitan Agency for Planning

Watershed Planning Area, Illinois State Water Survey (2005), Kane County Advanced Identification Study (ADID)(2004); Major Roads, ESRI (2000); Municipal Boundaries, CMAP (2010); USGS Campton Township GroundwaterStudy (2006); Kane County, Aquifer Sensitivity (2007); Soil Survey GeographicDatabase-National Resource Conservation Service (2010).

5.2.1 Tier 1: The Reserve

Tier 1 or the Reserve includes protected public and private open space, stream network and buffers, threatened and endangered species sites, Illinois Natural Areas Inventory Sites (INAI) and the 100-year floodplain (Figure 48).[148] Land identified in the Reserve either is currently protected or should be protected now and in the future.

Recommendation: All Tier 1 landowners should apply or maintain protective measures including conservation easements (purchased or donated).

Protected means either no land use change or limited land use change/activity depending on the particular component. Conservation of these areas will help to protect water quality and wetlands and protect against flooding. Other benefits include wildlife habitat protection including habitat connectedness and connectivity.

Protected Public and Private Open Space

This component includes current and future park district and forest preserve land, privately owned land maintained by homeowners associations (HOAs), and other open space/natural areas. The Tier 1 maps shows protected land from Campton Township, Kane County, St. Charles Park District, South Elgin, Elgin, and multiple homeowners associations. Open space provides flood storage, protects wetlands, provides habitat and connectivity for wildlife, and minimizes runoff that in turn reduces nonpoint source pollution.

[148] The floodplain includes all floodways.

Stream Network and Buffers

The stream network component includes the streams themselves, high habitat value and high functional value wetlands[149] and lakes. This plan recommends 100 foot buffers around the stream network with the first 60 feet closest to the network utilizing native plantings and the remaining 40 reserved for lower impact use, such as passive recreation (e.g., biking, jogging, etc.) and uninhabitable structures such as toolsheds.[150] This recommendation is beyond what Kane County requires, a buffer between 15-50 feet depending on the circumstances.[151] Protecting the stream network through buffers, especially with native planting, prevents pollutants from reaching the stream network in the first place. Additionally, buffers slow down the movement of water flowing into the stream network to help decrease erosion and sediment transport. Furthermore it is recommended that remaining wetlands within the watershed be restored where appropriate.

[149] As defined in NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study, Kane County, Illinois Final Report*. Chicago, IL: USACE Chicago District, August 2004. http://www.lrc.usace.army.mil/co-r/pdf/KaneADIDReport.pdf (accessed November 7, 2011).

[150] Buffer recommendations support previous planning efforts (i.e. Village of Campton Hills Comprehensive Plan and Code Assessment) as well as CMAP's Model Stream and Wetland Protection Ordinance, October 1999 (http://www.cmap.illinois.gov/water-quality/about-fpa-requests). Furthermore, it should be noted that ideal buffer width can vary depending on the specific site conditions, desired buffer function, and the landowner's objectives. In the case where the site is also part of the 100-year floodplain, buffer width should reflect the larger of the two widths. For more information on buffer widths see: USDA NRCS. *Where the Land and Water Meet, A Guide for Protection and Restoration of Riparian areas*. Tolland, CT: USDA, September, 2003.

[151] *Protection of Special Management Areas*. *Kane County*, *Illinois*, *County Code*, Chapter 9, Article IV (2001). http://www.sterlingcodifiers.com/IL/Kane%20County/index.htm (accessed November 9, 2011).

Threatened and Endangered Species (T & E sites)

There are 53 species in Kane County that are either classified as state threatened or endangered.[152] "Threatened" is defined as an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range. "Endangered" is defined as an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range.[153] Within the watershed, there are several areas identified by IDNR that possibly contain threatened or endangered species.[154] Within these areas, 11 species have been identified and are summarized in Table 24. These areas are not mapped in the plan.

Table 24. Status of threatened and endangered species

COMMON NAME	SCIENTIFIC NAME	NAME CATEGORY	STATE PROTECTION STATUS
White Lady's Slipper	*Cypripedium candidum*	Vascular Plant	**Threatened**
Spike	*Elliptio dilatata*	Vascular Animal	**Threatened**
Least Bittern	*Ixobrychus exilis*	Vascular Animal	**Threatened**
Kittentails	*Besseya bullii*	Vascular Plant	**Threatened**
American Burreed	*Sparganium americanum*	Vascular Plant	**Endangered**
Spotted Pondweed	*Potamogeton pulcher*	Vascular Plant	**Endangered**
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Vascular Animal	**Endangered**
Common Moorhen	*Gallinula chloropus*	Vascular Animal	**Endangered**
Royal Catchfly	*Silene regia*	Vascular Plant	**Endangered**
Blanding's Turtle	*Emydoidea blandingii*	Vascular Animal	**Endangered**
Prairie Moonwort	*Botrychium campestre*	Vascular Plant	**Endangered**
Speckled Alder	*Alnus incana ssp. Rugosa*	Vascular Plant	**Endangered**

[152] IDNR. *Illinois Natural Heritage Database: Illinois Threatened and Endangered Species*. Springfield, IL: IDNR, September 12, 2011. http://www.dnr.state.il.us/conservation/naturalheritage/pdfs/et_by_county.pdf (accessed November 8, 2011).
[153] "Endangered Species Glossary," U.S. Fish & Wildlife Service, last modified October 12, 2011, accessed November 8, 2011, http://www.fws.gov/midwest/endangered/glossary/index.html.
[154] Exact location information is not available for this watershed planning document.

Illinois Natural Areas Inventory (INAI) Sites

The first Illinois Natural Areas Inventory was conducted from 1975-1978 by the University of Illinois. Since then IDNR has maintained and updated the inventory. The INAI includes sites that contain high quality natural areas, habitats of endangered species, and other significant natural features. INAI information is used to "guide and support land acquisition and protection programs by all levels of government as well as by private landowners and conservation organizations."[155] There are 5 INAI sites within the Ferson-Otter Creek Watershed area: Burr Woods Marsh, Lily Lake Marsh, Horlock Hill (previously Murray Prairie), Meissner Prairie (previously Russell Prairie), and Ferson Creek's Sedge Meadow. Together these sites cover 191 acres of the watershed.

100-year Floodplain

The 100-year floodplain was discussed earlier in the resource inventory chapter and is included as a Tier 1 Green Infrastructure Framework component because of the beneficial functions floodplains provide to a watershed.[156] An undeveloped floodplain helps contain flooding, aids in the absorption and filtration of water, and helps to minimize erosion and siltation in the waterway. Native plants can also increase the functionality of the floodplain.[157]

[155] "Illinois Natural Areas Inventory," Illinois Natural History Survey, accessed November 8, 2011, http://www.inhs.illinois.edu/research/inai/.
[156] *Stormwater Management. Kane County, Illinois, County Code*, Chapter 9. http://www.sterlingcodifiers.com/IL/Kane%20County/index.htm (accessed December 19, 2011). It should be noted that Kane County's Stormwater Ordinance addresses floodplain requirements that are applicable to all of the county's municipalities.
[157] NIPC and Chicago Wilderness. *Conservation Design Resource Manual*, by Lori Heringa, Sarah Nerenburg, and Kathleen Odell. Chicago, IL: NIPC and Chicago Wilderness, 2003.

5.2.2 Tier 2: Developable Land

Tier 2 includes developable land that falls in one or more of the following components: hydric soil locations, groundwater recharge areas, high sensitivity aquifer areas, critical woodland areas, significant trees, remnant natural areas, and existing, proposed, and potential greenways and trails (green infrastructure corridors; Figure 48). Currently, land in Tier 2 is not formally protected but contains characteristics that are valuable to maintaining and protecting water quality.

Recommendation: All Tier 2 landowners should incorporate low impact development (LID) best management practices when and if the land is developed.

LID is a land development approach to managing stormwater that includes such practices as permeable pavement, native landscaping, and rain water harvesting to reduce runoff and pollutant loadings by managing stormwater as close to the source as possible. As stated earlier in the plan, urban runoff/storm sewers is an identified source of the fecal coliform impairment facing Ferson Creek. Recommending LID practices on developable land in Tier 2 is a proactive measure that reduces the future impact of built areas while maintaining the natural movement of water throughout the watershed.

Perhaps the most distinct difference between LID practices and traditional stormwater systems (sewers, pipes, gutters, etc.) is the view of stormwater as a resource rather than a waste product. LID practices can be used throughout the watershed from high density urban settings to low density areas and across a variety of land uses. Even though this section focuses on developable land, LID can also be used to retrofit existing sites as well as complete redevelopment sites.[158]

It should be noted that there are other similar development/stormwater approaches with similar goals of LID that could also be applied to land within Tier 2 such as Conservation Design and Light Imprint design. Conservation Design is a density neutral design strategy that incorporates similar stormwater treatments as LID while focusing on physical site design in which development is "clustered" to allow for a larger contiguous common open space.[159] Light Imprint is a design approach that focuses on creating compact, walkable, and mixed-use neighborhoods while incorporating stormwater management and natural drainage.[160]

Hydric Soil Locations

As stated in the resource inventory, hydric soils cover nearly 30% of the watershed. Hydric soils were developed under sufficiently wet conditions and this condition should be considered when planning for development and land use change. These soils provide habitat for hydrophytic vegetation and other plant and animal species. For this reason, hydric soils are included in Tier 2.

[158] "Low Impact Development," U.S. EPA, last modified March 18, 2011, accessed November 9, 2011, http://www.epa.gov/owow/NPS/lid/. For more information, see also "Stormwater Management," Center for Watershed Protection, accessed November 9, 2011, http://www.cwp.org/your-watershed-101/stormwater-management.html.

[159] CMAP. *Conservation Design Strategy Report*. Chicago, IL: CMAP, August 2008. http://www.cmap.illinois.gov/strategy-papers/conservation-design (accessed November 8, 2011).

[160] "Light Imprint New Urbanism," Congress for New Urbanism, accessed November 9, 2011, http://www.cnu.org/node/1209.

Groundwater Recharge Areas and High Sensitivity Aquifer Areas

Recharge areas for this component include the USGS recharge areas discussed in the Resource Inventory as well as fen recharge areas.[161] Recharge areas are important for water quality as well as water supply as they are one of the primary points where water enters the ground to replenish the aquifers.[162] As the majority of the watershed's communities rely on groundwater, Tier 2 also includes the High Sensitivity Aquifer Areas (A1-A4) to expand the recommended coverage of conservation measures in the Ferson-Otter Creek Watershed.[163]

Critical Woodland Areas, Significant Trees, and Remnant Natural Areas

The purpose of this component is to minimize the effects of development on high value natural areas. Critical woodland areas, significant trees, and remnant natural areas are considered high value natural areas in the Ferson-Otter Creek Watershed. These areas are defined in Table 25.

Table 25. Definitions

COMPONENT	DEFINITION
Critical woodland areas	Contiguous wooded areas larger than 4 acres on undeveloped parcels which contained woodlands in the same location in 1939 (verified through inspection of 1939 aerial photos in GIS.)[1]
Significant trees	Trees with 12" diameter trunks at 4' above grade except those determined to be hazardous or nuisance species and where it is agreed that the density of trees is greater than desirable for proper forest management.[2]
Remnant natural areas	Areas with a high degree of native biodiversity, i.e. native floristic quality index of 25 or greater and a native Mean C value of 3.2 or greater.[3]

Sources:
1 Trotter and Associates, Inc. Green Infrastructure in the Village of Campton Hills. Campton Hills, IL: Village of Campton Hills, August 2010. http://www.villageofcamptonhills.org/Joint%20ERMC/VCH_GreenINF_RptFINAL_all_maps.pdf (accessed November 9, 2011). Data waby Kane County GIS Technologies Department.
2 Conservation Design Forum. Comprehensive Plan and Code Assessment. Campton Hills, IL: Village of Campton Hills, April 2010.
3 Ibid.

Existing, proposed, and potential green infrastructure corridors

This component includes trails, greenways, corridors, and other areas of land that connect open space parcels. Not all of these areas were mapped for the plan, but they are included in Tier 2 because they are valuable open space that should have LID practices applied if and when these areas are developed.

5.2 ADDITIONAL BEST MANAGEMENT PRACTICES

Existing developments could benefit from retrofit opportunities. Several naturalized detention basin retrofit projects are recommended in Chapter 4. Proper maintenance of detention basins is important to ensure their functionality.

[161] Christopher B. Burke Engineering West, Ltd. *Kane County Fen Identification and Recharge Area Mapping Project Final Report*. Batavia, IL: Kane County Department of Environmental Management, September 2004. http://www.co.kane.il.us/kcstorm/fen/final_report.pdf (accessed October 15, 2011).

[162] It should be noted that other groundwater recharge datasets exist that can be also be used for planning purposes within Kane County, specifically the following study should be considered: ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. *ISGS Open File Series,* 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011).

[163] As defined in ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. *ISGS Open File Series,* 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011). It should be noted that aquifer sensitivity is classified from Map Unit A to Map Unit E in order of decreasing sensitivity to aquifers becoming contaminated. For this plan, the stakeholders agreed to include only Map Unit A category (High Potential for Aquifer Contamination) in Tier 2. However subsequent categories such as Map Unit B (Moderately High Potential for Aquifer Contamination) should be considered for planning purposes when appropriate.

The Center for Watershed Protection offers a variety of resources that articulate stormwater retrofit opportunities.[164] In addition, USEPA offers information on stormwater management best practices.[165]

Recommendation: Communities within the watershed should consult the established water quality best management practice resources such as from the Center for Watershed Protection and the USEPA before any retrofit activity.

5.3 GROUNDWATER PROTECTION

Regional water supply planning, which got underway in 2006, culminated with the publication of *Water 2050: Northeastern Illinois Water Supply/Demand Plan* in March 2010.[166] Water 2050 is informed by the most detailed water demand study ever conducted for the region.[167] Additionally, the work of the Illinois State Water Survey (ISWS) quantified the impacts of regional water demand scenarios on the deep-bedrock aquifer underlying the eleven-county planning area, shallow aquifer system beneath the Fox River Basin, and the Fox River itself.

With regional population projected to grow 38% by 2050, demand scenarios indicate growth in water use ranging from 36 – 64% under business-as-usual scenarios.[168] Given the new and enhanced understanding of regional water supply sources and their relatively finite or constrained nature, such growth in water demand is not thought to be sustainable. For example, at current withdrawal rates, the deep-bedrock aquifer is being mined. And overpumping of the shallow aquifer is beginning to capture streamflow where it has been studied in the Fox River Basin; a phenomenon that is projected to get worse as population and demand increases through time. In order to avoid supply / demand imbalances and offer some protection to other users of water (e.g., aquatic ecosystems), implementing *Water 2050* has the potential to keep water demand relatively flat – 7% growth – as compared to projected population growth.[169]

On the groundwater quality side of the resource management challenge, IEPA has concluded that the state's groundwater quality is being degraded.[170] In concert with that conclusion and as discussed in the water quality chapter, chloride concentrations are trending upwards in shallow wells throughout the six-county region. Thus, there are ample reasons for groundwater-dependent communities and private-well owners to work collaboratively and recommend that measures be implemented to improve protection (i.e., quality) and conservation (i.e., quantity) of local groundwater resources.

At the county level, the Kane County 2040 Land Resource Management Plan identified providing a sustainable water supply as one of the three major challenges facing the county through the year

[164] Most recently summarized in Center for Watershed Protection. "Urban Stormwater Retrofit Practices." *Urban Subwatershed Restoration Manual*, Manual 3. Ellicott City, MD: Center for Watershed Protection, August 2007. http://www.cwp.org/categoryblog/92-urban-subwatershed-restoration-manual-series.html (accessed November 7, 2011).

[165] "Stormwater Management Best Practices," U.S. EPA, last modified August 16, 2011, accessed November 9, 2011, http://www.epa.gov/oaintrnt/stormwater/best_practices.htm.

[166] CMAP. *Northeastern Illinois Regional Water Supply/Demand Plan*. Chicago, IL: CMAP, March 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 8, 2011).

[167] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008.

[168] Ibid.

[169] Ibid. 166, p. 90. For example, although population increased in the City of Seattle, WA from 1990 to 2004, water demand during the same period still decreased.

[170] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume II: Groundwater*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

2040. The population of Kane County is projected to increase more than 55 percent from the year 2010 population of 515,000 to over 800,000 by the year 2040. Lake Michigan water will not be available to Kane County due to legal and economic constraints. That leaves the shallow aquifer, deep aquifer and the Fox River as the future water sources for the county. Previous scientific studies offered only a qualitative understanding of the geology and hydrogeology of the county and scattered observations that were inadequate for water supply planning. Shallow aquifer withdrawals were close to exceeding sustainable yields in the eastern portions of the county and deep aquifer yields have long exceeded the sustainable supply in the region. The limitations of inland surface water supplies were also in question.

Therefore, Kane County entered into a contract in 2002 with the Illinois State Water Survey and Illinois State Geological Survey (ISGS) to conduct scientific investigations and prepare computer models and reports on the future availability of drinking water for Kane County. Preliminary results were completed by 2007, and the final reports and models were delivered in 2009.[171]

A series of surface water, geology and groundwater investigations were conducted, including streamflow analysis and modeling, mapping of groundwater levels, mapping and modeling of near-surface geology, analysis and trends in deep groundwater quality, assessment of shallow groundwater quantity, and computer modeling of groundwater flow.

The results are intended to allow the 30 municipalities and other water providers within the County to collectively plan and manage their future drinking water supplies based on a level of science unsurpassed by any other county in the State of Illinois. To that end, the County joined the five-county Northwest Water Planning Alliance (NWPA) in September 2010 to continue the process of cooperative planning for future water supplies, not only with the municipalities and water providers within the county, but also with neighboring counties and municipalities.

5.3.1 Groundwater Protection Ordinance

At the local level, the city of St. Charles has a groundwater protection ordinance that establishes regulations for land uses within Groundwater Protection Areas (GWPAs). These GWPAs are defined as portions of an aquifer within the minimum or maximum setback zones for existing and permitted water supply or within the 5- year capture zone of a well or well field.[172]

Recommendation: Communities within the watershed that have not already done so should consider adopting Groundwater Protection ordinances.

In addition to groundwater protection ordinances, Wellhead Protection Programs, sensible salting, demand-initiated water softeners, and street sweeping are other recommended plan strategies for groundwater protection.

5.3.2 Wellhead Protection Programs

Under the Safe Drinking Water Act Amendments of 1986, Wellhead Protection Program(WHPP)s are voluntary on the local level, but are a valuable supplement to existing state groundwater protection programs. A WHPP, once implemented, reduces the susceptibility of wells to contaminants.

[171] "Water Resources Investigations for Kane County, Illinois," ISWS, accessed November 8, 2011, http://www.isws.illinois.edu/gws/kaneco/kaneco.asp.

[172] *Groundwater Protection*. *City of St. Charles*, *Illinois*, *City Code*, Title 13 Chapter 18. http://stcharlesil.gov/codebook/Title-13/T13-CH18.pdf (accessed November 9, 2011).

Recommendation: Appropriate authorities within the watershed should establish voluntary local protection programs such as wellhead protection plans.

A sample process of developing a wellhead protection plan follows:

1) Organize a Local Committee
2) Map the Protection (sensitive) Areas Confined or Unconfined Aquifer
3) Conduct Contaminant Source Inventory
4) Develop Management and Protection Strategies
5) Plan for the Future – Contingency Plans, New Wells Adopt Maximum Setback Zones
   a) Additional Protection - 1,000 Ft. Radial Area
   b) Additional Siting Prohibitions - Certain Activities
   c) Extended "Compliance Point" for Remediation Sites to Meet Groundwater Quality Standards

5.3.3 Sensible Salting

Road salt can cause groundwater contamination from chlorides. Reducing the use of road salt and utilizing alternatives can help mitigate some of the negative effects on water quality. The idea of sensible salting includes the following recommendations developed for the DuPage River Salt Creek Workgroup[173] and are presented here for any entity responsible for winter highway maintenance within the watershed:

1) Provide proper training of road salt applicator staff and public education to build community awareness.
2) Conduct regular equipment maintenance and calibration.
3) Ensure proper salt storage, handling, and transport.
4) Explore greater reliance on anti-icing and deicing (e.g., prewetted road salt) practices.
5) Pursue judicious use of alternative deicing chemicals, including organic deicers such as those based on corn or beet derivatives.
6) Monitor salt use to determine program effectiveness.

A highway department can reduce both salt use and costs for winter roadway maintenance by following these measures.[174] Those with private wells can participate in groundwater protection from chloride contamination accordingly:

1) Adopt alternative water softening technologies such as electrodialysis or membrane filtration, and
2) Reconfigure plumbing to bypass the water softener for certain indoor water uses.[175]

Lastly county health departments can take the lead in making recommendations or creating new guidelines.

Recommendation: Appropriate entities should follow sensible salting measures within the watershed.

Luckily, there are already some communities within the Ferson-Otter Creek Watershed that are actively practicing these techniques. For example, South Elgin and Kane County implement pre-storm anti-icing practices. Elgin applies an in-house made Geomelt product that is 80% salt brine, 15% beet juice, and 5% calcium chloride. Elgin, Lily Lake, and Kane County use vehicles with computer or sensor

[173] CDM. *Chloride Usage Education and Reduction Program Study Final Report*. Naperville, IL: DuPage River Salt Creek Workgroup, August 16, 2007. http://www.drscw.org/chlorides/ChlorideRecomendations.Final_Report.pdf (accessed November 9, 2011).

[174] Baxter and Woodman, Inc. "Chlorides and Agricultural Chemicals: Problem Assessments and Corrective Actions." *Illinois Groundwater Resources Management Plan*, Report 5. Woodstock, IL: McHenry County, Illinois, Department of Planning and Development, November 2006.

[175] Ibid.

controlled spreaders for pre-wetted solids. Kane County also has several vehicles that are equipped with computer or sensor controlled spreaders for liquids and pretreats salt with a carbohydrate.

The Village of Campton Hills and Campton Township primarily use a mix of Magic Melt, a green alternative de-icer, and salt. Calcium chloride is only used in extreme cold weather. Additionally an in-house system provides salt brine for pre-storm treatment and spreader regulators on every truck are set before each storm to ensure the appropriate amount of salt is dispersed. Together all of these practices have reduced the amount of salt used by Campton Hills and Campton Township by two-thirds.

5.3.4 Water Softeners

Communities that are dependent on groundwater often need a water softener, a device that reduces the hardness of water by replacing and/or exchanging certain elements in the water. A water softener either regenerates by a timer or a meter. The timer is set to a certain number of days and will regenerate no matter the water usage. A meter will monitor the water use and regenerate overnight when a certain amount of water has been consumed (known as demand-initiated). Maintaining that water use habits are the about same among households, it can be assumed that a timer-based water softener uses more water than a demand initiated water softener.

Recommendation: Residents within the watershed should install demand-initiated water softener in their households. For households that are currently using a timer-based water softener, when replacement is necessary, residents should replace with a demand-initiated water softener.

5.3.5 Street Cleaning

Street cleaning can help to improve water quality by reducing pollutants (sediment, trash, road salt, and trace metals) in stormwater runoff. Typically when it rains, water washes into sewers or into other stormwater management structures such as detention basin where the water is then treated to varying degrees. By removing pollutants and debris from the roadways on a regular basis before they are carried away by stormwater, water quality can be improved. The frequency of sweeping depends on weather conditions, traffic patterns, resources, and a host of other conditions. The optimal frequency should be determined for each government body. However there are suggested guidelines ranging from 9 times a year to biweekly based on the type of street.[176] Furthermore innovative sweeping practices and schedules may reduce the need for other structural stormwater controls while remaining cost effective.[177] There are several communities in the Ferson-Otter Creek Watershed that currently use best management practices in this area. South Elgin and Elgin use mechanical or vacuum sweepers while Kane County uses both.

Recommendation: Local governments should review and revise current street sweeping practices and schedules to follow current best management practices.

[176] Minnesota Department of Transportation. *Resource for Implementing a Street Sweeping Best Practice*. Report no. 2008 RIC06. St. Paul, MN: Minnesota Department of Transportation, 2008. http://www.lrrb.org/PDF/2008RIC06.pdf (accessed November 8, 2011).

[177] "Parking Lot and Street Cleaning," U.S. EPA, last modified May 24, 2006, accessed November 8, 2011, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=99.

5.4 WATER EFFICIENCY/CONSERVATION

One approach to reducing wastewater volume is to practice water efficiency and conservation. By reducing the amount of water being used on the supply side (for toilets, showers, faucets, etc.), the amount of water being discharged is also reduced. This reduction in water volume reduces the amount of wastewater and its associated pollutants. Water efficiency and conservation strategies can be especially helpful for communities that have combined wastewater and stormwater sewers.

Efficiency and conservation are similar concepts in that they both can reduce the amount of wastewater produced. Efficiency achieves reduced wastewater flows by replacing less efficient fixtures and/or appliances with more water efficient models as when a low-flow 1.6 gallon per flush toilet is replaced with a high efficiency 1.28 gallon per flush toilet. The same service, toilet flushing, is provided but with less water. Conservation includes efficiency measures but also includes behavioral changes in which residents consciously use less water such as only watering the lawn 2 days a week instead of 3 days a week during the summer. It should be noted that both water efficiency and conservation strategies need to be coupled with an outreach and education campaign. To complement outreach and education, there are policies and ordinances that municipalities can adopt to facilitate and promote water efficiency and conservation in their communities.

5.4.1 WaterSense Promotional Partner

One of the first steps toward becoming a more water efficient municipality is to become a WaterSense Promotional Partner. WaterSense is a voluntary, nationally recognized program sponsored by USEPA that promotes water conservation and efficiency.[178]

[178] "Water Sense," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/index.html.

Similar to the ENERGYSTAR program, there are two main branches of the WaterSense Program. First, is product labeling in which products such as toilets, faucets and showerheads are rated for compliance with WaterSense standards. If compliant, the fixture is then labeled as a WaterSense product. This typically means that the product uses approximately 20% less water than its conventional product. Table 26 contains all the current WaterSense products.

Table 26. WaterSense products, Fall 2011

CURRENT PRODUCTS	FUTURE PRODUCTS
Toilets	Water softeners
Bathroom sink faucets and accessories	Pre-rinse spray valves
Showerheads	
Urinals	
Landscape irrigation controllers	

The second branch offers a variety of voluntary partnerships. The promotional partnership is most appropriate for utilities, municipalities, and local units of government.[179] As the name infers, a promotional partner promotes the use of WaterSense products and water conservation and efficiency in general. The degree to which a utility or municipality "promotes" WaterSense is entirely up to partner and their available resources. The only requirement is that a partner provides an annual report (1 page form) of activities. Typical promotion activities include displaying a WaterSense logo on a municipal website, requiring WaterSense products for any rebate program, participation in Fix-a-Leak Week (March 11-19), or using public information materials provided to partners to

[179] "Water Sense Promotional Partners," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/partners/promotional.html.

communicate water conservation messages to residents.

The WaterSense Program is free and easy to sign up and participate in. The benefits include providing a starting point to launch a public information campaign by providing access to promotional materials such as bill inserts, magnet designs, press releases, public service announcements, etc. The program gives municipalities and utilities national attention on the WaterSense website and provides a WaterSense logo for outreach materials. WaterSense partners are part of a network with other communities/utilities where they can learn what others are doing in this region and the rest of the country. Additionally the partnership can provide a unified message for the watershed's residents about the importance of water conservation and efficiency if all represented municipalities were to join.

Recommendation: All communities within the watershed should become WaterSense Promotional Partners.

5.4.2 CMAP Model Water Use Conservation Ordinance

Beyond becoming a WaterSense Partner, municipalities can formally promote water efficiency and conservation practices through the adoption of all or a portion of CMAP's Model Water Use Conservation Ordinance. The 2010 ordinance is an update of the 1980 Model Water Use Conservation Ordinance completed by the Northeastern Illinois Planning Commission (NIPC) and provides draft language that may be directly incorporated into local ordinances and codes. The ordinance addresses conservation measures by sectors, including Residential and Commercial/Industrial/Institutional (CII) as well as location: indoors and outdoors. With additional sections covering key topics such as Variances, Water Waste, Pricing, Violations, and Information and Outreach. More information about ordinance items, examples, and additional resources are provided in the "Commentary," "In Practice," and "Learn More" sections, respectively. Where possible, local examples are highlighted and calculations of water savings that demonstrate benefits are also included. Of particular importance to this watershed plan is the adoption of the following ordinance components:

- Plumbing Fixtures and Fixture Fittings
- Dishwashers and Clothes Washers
- Water Recycling Systems
- Lawn watering
- Waterwaste

The model ordinance is a direct result of a larger regional effort *Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan*, as previously mentioned in the Groundwater Protection section of the plan. Water 2050 includes additional information about water conservation and efficiency measures.

Recommendation: All communities within the watershed and Kane County adopt portions or all of CMAP's Model Water Use Conservation Ordinance.

Often a water conservation and efficiency plan is developed to help guide the adoption of related ordinances.[180] Currently none of the communities within the watershed have a water conservation and efficiency plan. However most of the communities do have a lawn watering ordinance, one of the topics covered in the model water conservation ordinance. In addition, Elgin's ordinances address waterwaste.[181]

[180] "Water Conservation Plan Guidelines," U.S. EPA, last modified November 2, 2011, accessed November 9, 2011, http://www.epa.gov/WaterSense/pubs/guide.html.
[181] *Waste of Water Prohibited*. *City of Elgin, Illinois, City Code*. Title 14, Chapter 4.04.140, http://www.sterlingcodifiers.com/codebook/index.php?book_id=524 (accessed November 9, 2011).

5.5 AGRICULTURE

5.5.1 BMPs Suitable for Agricultural Areas

In addition to wetland restoration opportunities on currently farmed wetlands, there are many other best management practices (BMPs) available and appropriate for implementation in agricultural areas. The Natural Resource Conservation Service (NRCS) Field Office Technical Guides (FOTG) comprehensively document conservation practices applicable to the State of Illinois as well as standards and specifications for these practices.[182] Standards describe the conservation practice and where it applies, while the specifications describe the detailed, site-specific requirements for implementing or installing a practice. Many of the conservation practices and BMPs that are discussed in this plan are thoroughly outlined in the NRCS Illinois FOTG. The following text is a set of guidelines that briefly describes the types of practices most commonly employed for conservation-orientated efforts in an agricultural context.

Many agricultural BMPs focus on livestock management. Better management of manure in agricultural areas can help to reduce nutrient, sediment and fecal coliform runoff contributing to water resource degradation. Developing a farm-wide manure management plan might involve such practices as excluding livestock from water bodies with fencing or stream crossings, along with the construction of alternative water sources to prevent contamination from manure entering water bodies. Similarly, diverting clean water away from areas covered with manure on farms can help to reduce contamination of runoff. To address sediment runoff caused by livestock, heavy use area protection helps to prevent erosion by creating foundations to support animals and soil where animals gather for watering and feeding.

Recommendation: Livestock managers should implement livestock exclusion fencing to separate livestock from direct contact with streams. Developing an alternative water source could facilitate this exclusion. Heavy use area protections should also established to reduce erosion from livestock.

Likewise, nutrient management is extremely important for preventing the loss of nutrients to storm runoff during and after precipitation events. Developing a nutrient management plan coupled with soil testing can help to prevent excess nutrient application while better matching the timing and form of nutrient application to the plant's need. A nutrient management plan allows farmers to adopt integrated strategies for monitoring and controlling the form, placement, timing and amount of fertilizer applications and other soil amendments which help to reduce nutrient runoff. Similarly, integrated pest management (IPM) seeks to apply a systems approach to agricultural management to reduce dependence on synthetic inputs, possibly improving water quality through less pesticide runoff. For example, IPM relies on the close observation of the lifecycle of pests and their interaction with the ecosystem to detect crop damage. When detected, further crop damage is prevented through the use of mechanical trapping, natural predators, growth regulators, chemical mating disruptors, and possibly the judicious use of chemical pesticides.

Recommendation: Agricultural landowners should adopt integrated nutrient and/or pest management plans that help to reduce nutrient and pesticide runoff to streams in the watershed planning area.

Finally, altering cropping practices can help significantly to reduce nutrient and sediment runoff. Prescribed or rotational grazing can be used to control the location, intensity, frequency, duration, and

[182] USDA NRCS. *Field Office Technical Guides*. Kane County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

season of grazing, which can help to improve water quality and filtration and prevent erosion. Cover cropping, that is, maintaining a crop cover or crop residue in agricultural fields, increases nutrient retention in soil and prevents erosion. Green manure is cover cropping designed to add nutrients to soil and reduce required fertilizer application. In this case, the cover crop is grown for a specified amount of time and then plowed under. The related practice of conservation tillage (with variations including no-till and strip-till methods) leaves soil totally or partially untilled and covered with some amount of crop residue which prevents erosion and increases soil moisture. However, a higher reliance on herbicide with conservation tillage to control weeds may lead to more chemical runoff, so this practice might be best limited to those lands with the greatest risk of erosion.

Recommendation: Cropland management practices such as rotational grazing, cover cropping and/or conservation tillage should be implemented to control erosion and reduce required nutrient applications.

Additionally, many BMPs not specific to agriculture are still complementary to agricultural land use and appropriate for implementation by private landowners. The NRCS FOTG contain practice standards and specifications for many of these BMPs as well.[183] Upland erosion control relies on practices that slow and filter water prior to drainage into a water body, for example, grass waterways; terracing; buffer and filter strip creation; and installation or retrofitting of water and sediment control basins. Streambank or lake shore protection can prevent erosion using rip rap; longitudinal peaked stone toe protection; critical area seeding and bank re-shaping; tree revetments; root wad installation; stream barbs; bendway weirs; rock riffles; and grade stabilization structures to prevent streambank failure. Wetland protection, restoration or construction can improve water quality since wetlands act to filter water and can remove some particulate and dissolved contaminants such as sediment and nutrients. Finally, conservation easements are voluntary, legally enforceable land preservation agreements between landowners and a government agency. Conservation easements maintain open space and its associated environmental benefits by excluding development on protected lands. These easements along with naturalized streambanks and buffer strip plantings add to wildlife corridors and stream water quality as well.

Recommendation: Agricultural landowners should implement general best management practices like upland erosion controls, streambank or lake shore protection (e.g., filter strips), and/or wetland protection/restoration to protect water quality, in addition to agriculture-specific BMPs discussed above.

5.6 ORDINANCE REVIEW AND EXISTING POLICIES

5.6.1 Ordinance Review

Local ordinances and codes regulate and guide land use and subdivision standards for development. Among other influences, ordinances and codes dictate how stormwater runoff is stored and conveyed in, around, and through a community. For example how a community designates impervious surfaces such as sidewalks, streets, and parking has a substantial effect on the community's runoff both in terms of water quality and quantity. Research has shown a positive correlation between percentage impervious cover in a watershed and concentrations of nutrients, sediment, and trace

[183] USDA NRCS. *Field Office Technical Guides*. Kane County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

metals in surface waters.[184] Thus as impervious cover increases, surface water quality is negatively impacted.

Kane County is one of the fastest growing counties in Illinois and continued urban growth is expected in the Ferson-Otter Creek Watershed. Therefore, it is important to understand how current development regulations and ordinances help shape communities and their impact on water quality. For example, Kane County's Stormwater Ordinance (effective January 1, 2002) was developed pursuant to state legislation granting powers to certain counties to regulate the discharge of stormwater.[185] This power was granted in recognition of the fact that stormwater management problems are generally regional in nature and impacts to stormwater management systems often go across typical government boundaries.

The purpose of this ordinance is to unify the stormwater management framework throughout the county and to establish a set of minimum standards that will apply to all new development throughout the county. The ordinance defines a "developer" who must obtain a permit for development. This ordinance applies to individuals, corporations and units of local government who propose new development after the effective date of the ordinance. Development activities which affect the discharge of stormwater are regulated under this ordinance. These include addressing such requirements as detention/retention, sediment and erosion control plans, floodplains and wetlands not regulated by the Corps of Engineers (COE).

In addition to the Kane County's Stormwater Ordinance, gaining a better comprehension of local policies is critical for outlining recommendations for code and ordinance updates for inclusion in this watershed plan. To facilitate this understanding, an assessment of local policies was conducted to compare existing regulations against the Code and Ordinance Worksheet (COW) created by the Center for Watershed Protection (CWP).[186] This worksheet provides an evaluation of development rules by assigning points on how well current rules agree with model development principles. The three categories on which points are assigned are: Residential Streets and Parking Lots, Lot Development, and Conservation of Natural Areas. The 'model' score for the worksheet is 100 and points are awarded when a development rule agrees with site specific planning benchmarks that directly or indirectly relate to stormwater management. The purpose of CWP's checklist is to provide a general assessment of a community's current ordinances and codes.

Municipal and county representatives within the watershed were asked to complete the worksheet for their respective units of government. The results of the completed COWs are in Appendix B. A majority of the governmental units within the Ferson-Otter Creek Watershed completed a COW.[187] It is important to note that while CWP sets a high standard for development regulation, the intent behind this review is to seek opportunities to reduce effective impervious cover to protect stream health and reduce future flooding. Governmental representatives are encouraged to explore locally appropriate rules that are more protective of water resources, particularly in future development.

[184] The Center for Watershed Protection. *Impacts of Impervious Cover on Aquatic Systems*. Mansfield, CT: University of Connecticut, 2003. http://clear.uconn.edu/projects/TMDL/library/papers/Schueler_2003.pdf (accessed November 8, 2011).
[185] *Stormwater Management. Kane County, Illinois, County Code*, Chapter 9. http://www.sterlingcodifiers.com/IL/Kane%20County/index.htm (accessed December 19, 2011).

[186] "Better Site Design Publications," Center for Watershed Protection, accessed December 20, 2011, http://www.cwp.org/documents/cat_view/77-better-site-design-publications.html.
[187] Please note: no data was available for Lily Lake.

The total scores are summarized in Figure 49 for each community and range from 44-78 out of a 100. The Center for Watershed Protection specific recommendations for each community based on their score and are displayed in Figure 50. It should be noted that the analysis is coded (A-E) to display the results anonymously.

After reviewing the results of the assessment, a community can choose to hold a facilitated "roundtable" with officials from municipal engineering, planning, and other departments to discuss what opportunities there are for ordinance updates and revisions. Those recommended changes may then move forward for action by elected officials. It should be noted that the CWP's guidelines are not ideal for every community, however, each community has opportunities for establishing ordinances and codes that further protect water quality and manage water quantity as it pertains to stormwater.

Figure 49. **Total Code and Ordinance Worksheet (COW) scores**

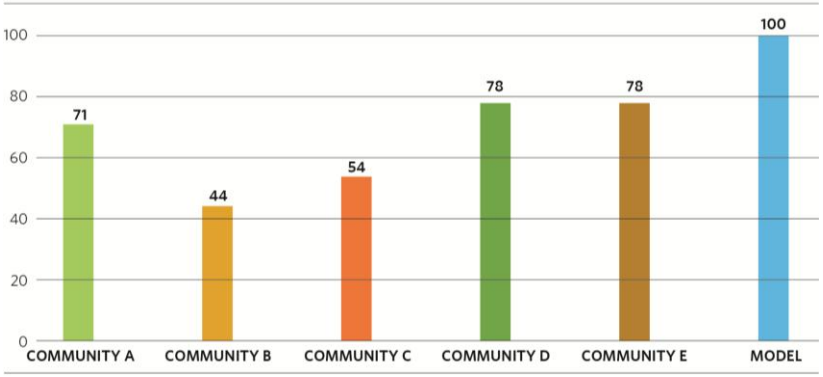


Figure 50. **Center for Watershed Protection's COW recommendations**

Center for Watershed Protection's Code and Ordinance Worksheet recommendations

90-100	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work
80 -89	Your local development rules are pretty good, but could use some tweaking in some areas.
70 -79	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 -69	Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
Less than 60	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

The following text breaks out the analysis in the three sections designated on the COW: Residential Streets and Parking Lots, Lot Development, and Conservation of Natural Areas to provide more detailed data and recommendations.

Residential Streets and Parking Lots

From an analysis of the responses, the category that contrasted the most from the model principles was Residential Streets and Parking Lots (Figure 51). Within this category, scores ranged from 14 to 27 out of 40 possible points, averaging 20 which is 20 points less than the model score. The scoring for this category focused on principles related to reduced road lengths and widths, reduced surface parking, increased use of landscaping and pervious surfaces for stormwater retention, among others. Impediments to the use of model principles within current regulations include requirements for access to emergency vehicles and the location of water/sewer lines under parkways rather than paved roadways, both of which necessitate wider streets.

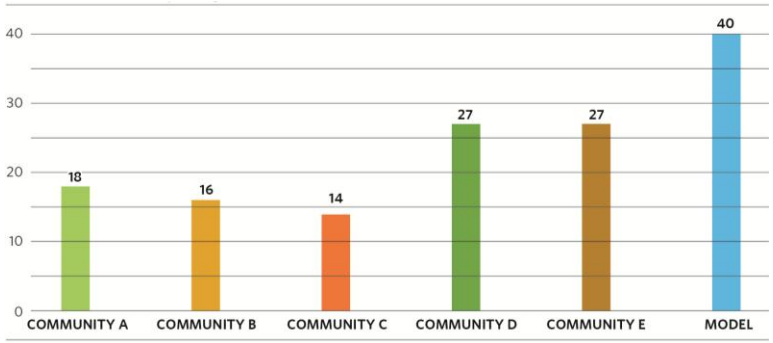
Recommendation: Local governments should adopt ordinances that incentivize:

- **shared parking;**
- **decreased dimensions in residential driveways/parking areas;**
- **use of biorention for on-site stormwater treatment;**
- **development design that minimizes road width and length;**
- **flexible arrangements to meet parking standards.**

Increasing flexibility in development design for example removing prescribed street dimensions in ordinances may allow for narrower streets and reduced impervious surfaces. Where possible, parking requirements should match level of demand,[188] allow flexible arrangements to meet parking standards, and provide flexibility to reduce parking in exchange for specific actions that reduce parking demands on site[189] through improved accessibility to transit or other alternative transportation options such as car-share.[190]

Access for emergency vehicles within narrow street designs has been successfully addressed in various parts of the country and standards for such street designs are available from sources such as the American Association of State Highway and Transportation Officials (AASHTO)191 and the Institute of Transportation Engineers (ITE).192

Figure 51. **Residential streets and parking lots results**



[188] For more information on Parking Management see "Parking Management Strategy Report Summary," CMAP, accessed December 20, 2011, http://www.cmap.illinois.gov/strategy-papers/parking.

[189] "Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale," U.S. EPA, last modified November 17, 2011, accessed December 20, 2011, http://www.epa.gov/smartgrowth/water_scorecard.htm.

[190] For more information on car-sharing, see "Car Sharing Strategy Report," CMAP, accessed December 20, 2011, http://www.cmap.illinois.gov/strategy-papers/car-sharing.

[191] AASHTO. *The Policy on Geometric Design of Streets and Highway*. Washington, D.C.: AASHTO, 2011.

[192] Lerner-Lam, Eva, Stephen P. Celniker, Gary W. Halbert, Chester Chellman and Sherry Ryan. "Traffic Engineering for Neo-Traditional Neighborhood Design." *ITE* (January 1992): 17–25.

Lot Development

The lot development category focuses on principles related to development density, lot size/shape, driveways/sidewalks, and open space management. Within this category, scores ranged from 12 to 30 out of 36 possible points, 25 being the average score, Figure 52. In general most of the existing zoning ordinances allow for flexibility in lot development and open space design whereas subdivision regulations had more specifics on setbacks, driveways, and sidewalks that may not allow the incorporation of the model principles.

As in the residential streets and parking lots category, ordinance updates that include allowances for stormwater management BMPs and reduction in impervious cover may decrease the speed and increase the filtration of runoff prior to entering waterways. Additionally, reduced setbacks, smaller lots, and cluster development designs that maximize open space are additional measures that governmental entities can encourage within existing regulations (e.g., via density bonuses, to decrease overall impervious cover).

Recommendation: Local governments should adopt ordinances that include:

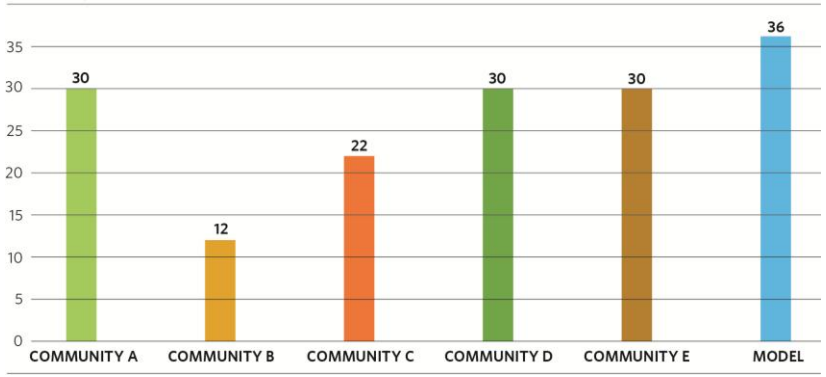
- **allowances for stormwater management BMPs and reductions in impervious cover;**
- **reduced setbacks, smaller lots, and cluster developments.**

From a regional perspective, local governments are encouraged to adopt policies and incentives to direct development to areas that have existing infrastructure such as water and sewer. This approach may reduce the overall development footprint in a watershed by maximizing use of existing sites. Additionally, compact, mixed use, and transit-oriented developments should be encouraged where possible to avoid loss of agricultural lands, increase conservation opportunities, and reduce degradation of streams and wetlands due to encroaching development and stormwater runoff.[193]

Recommendation: Local governments should adopt policies and incentives that:

- **utilize existing infrastructure such as water and sewer;**
- **encourage compact, mixed use, and transit-orientated developments.**

Figure 52. **Lot development results**



Conservation of Natural Lands

The conservation of natural areas category highlights stream buffer maintenance, tree conservation, incentives for land conservation, treatment of stormwater prior to discharge from outfalls, and limitations on development within the 100-year floodplain. Scores ranged from 16 to 23 out of 24 possible points, with an average of 20 points (Figure 53). Again, it appears as if the majority of the respondents' local codes regarding the protection of existing natural

[193] "GO TO 2040 Comprehensive Regional Plan," CMAP, accessed December 20, 2011, http://www.cmap.illinois.gov/2040/main.

areas and the incorporation of open space into new development are in line with the model principles. Potential areas of improvement may include adjustments in ordinances relating to stream buffers, stormwater outfalls, and tree conservation.

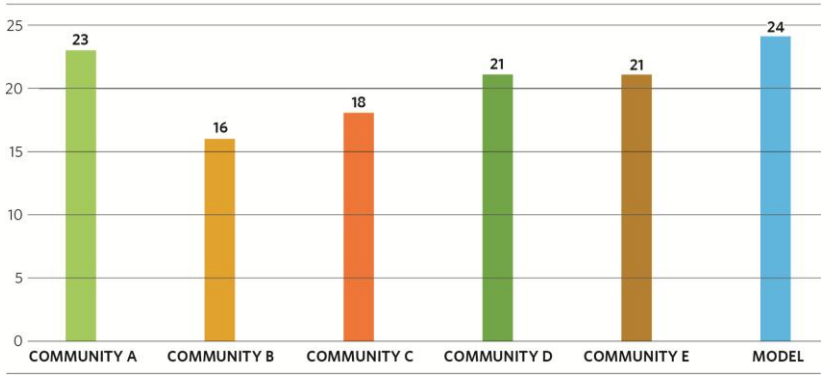
Other improvements could focus on long term protection, management, and restoration of natural areas and future habitats from future development. Local governmental units may wish to consider mandatory no-development buffer codes for critical areas such as wetlands, floodplains, lakes, streams, and rivers. Such areas may serve dual functions of providing recreational areas while reducing stormwater runoff.

Recommendation: Local governments should consider a mandatory no-development buffer codes for critical areas such as wetlands, floodplains, lakes, streams, and rivers.

To enhance the urban tree canopy, local governments are encouraged to adopt programs for tree protection and maintenance on public properties and right-of-ways, in addition to preserving trees on private property and requiring replacement when trees are removed or damaged during development. Local governments are also encouraged to increase the overall tree canopy through implementing tree planting initiatives.

Recommendation: Local governments should adopt programs for tree protection and maintenance on public properties and right-of-ways, require tree replacement for trees lost during development, and implement tree planting initiatives.

Figure 53. **Conservation of natural areas results**



5.6.2 Existing Best Management Practices

In addition to ordinances and codes, many communities in the watershed have already put some BMPs into place (Table 27).

Table 27. Community existing best management practices

COMMUNITY	RAIN GARDENS	BIO-SWALES	NATIVE PLANTINGS	PERMEABLE PAVERS	LOW-IMPACT DESIGN
Campton Hills	–	–	–	–	–
Elgin	–	Yes	Yes	Yes	–
Kane County	Yes	Yes	Yes	Yes	–
Lily Lake	–	Yes	Yes	–	–
South Elgin	Yes	Yes	Yes	Yes	–
St. Charles	Yes	Yes	Yes	–	–

Recommendation: Municipalities continue and/or begin to incorporate rain gardens, bioswales, native plantings, permeable pavers and low impact design.

5.7 FECAL COLIFORM CRITICAL AREAS ANALYSIS

The following recommendations were developed from the fecal coliform critical areas analysis in Chapter 3. Three methodologies were used to help target fecal coliform related policy recommendations. The first methodology was based on the density of pet populations. The analysis found that certain areas of the watershed were likely contributing a higher proportion of pet waste to the watershed.

Recommendation: The Village of Campton Hills and Kane County should adopt a pet waste pickup ordinance.

It should be noted that the city of Elgin was also identified in this analysis but already has a current pet waste ordinance.[194] Promoting a new policy such as this will then require an outreach and education campaign to raise awareness of benefits of pet waste pickup.

The second methodology involved estimating density of parcels that use septic systems. The analysis found that certain areas of the watershed were likely contributing a higher proportion of potential septic system failures, assuming a uniform failure rate.

Recommendation: The Village of Campton Hills, the Village of Lily Lake, and Kane County should require or at least encourage cyclical septic system maintenance.

As stated in the recommendation, cyclical septic system maintenance is at the very least encouraged. One example of such a program is found in Isle of Wight County, VA where legislation was enacted requiring regular septic tank maintenance.[195] Their septic tank pump-out initiative is a state-mandated program that requires regular septic tank pump-outs at least once every three to five years under Article 6 of the Chesapeake Bay Preservation Area Ordinance (CBPA). CBPA more broadly is legislation in the Chesapeake Bay Watershed that regulates development occurring in the watershed, promoting natural vegetative land cover to protect Chesapeake Bay water quality.

The third methodology involved estimating those areas with higher percentages of agricultural areas used for livestock and equestrian purposes. The analysis concluded that areas with more than 5% livestock and equestrian agricultural use were high priority areas.

Recommendation: Livestock and equestrian landowners in the Village of Campton Hills and Kane County should be contacted and encouraged by local authorities or agencies (e.g., county Soil and Water Conservation Districts) to adopt manure management plans and livestock exclusion (from direct access to streams) practices.

5.8. GOLF COURSES

There are 435 acres of golf courses within the Ferson-Otter Creek Watershed (Figure 55). Typically golf course landscapes consist primarily of turf grass and do not include stream buffers to help protect water quality. Furthermore, golf course management strategies such as the application of pesticides and herbicides can have an additional negative effect on water quality. The Audubon Cooperative Sanctuary Program is an award winning education and certification program that empowers golf courses to protect the

[194] *Removal Of Debris And Residue*. *City of Elgin, City Code*. Title 9, Chapter 32.IV, Section 250.C.2. http://www.sterlingcodifiers.com/codebook/index.php?book_id=524 (accessed November 30, 2011).

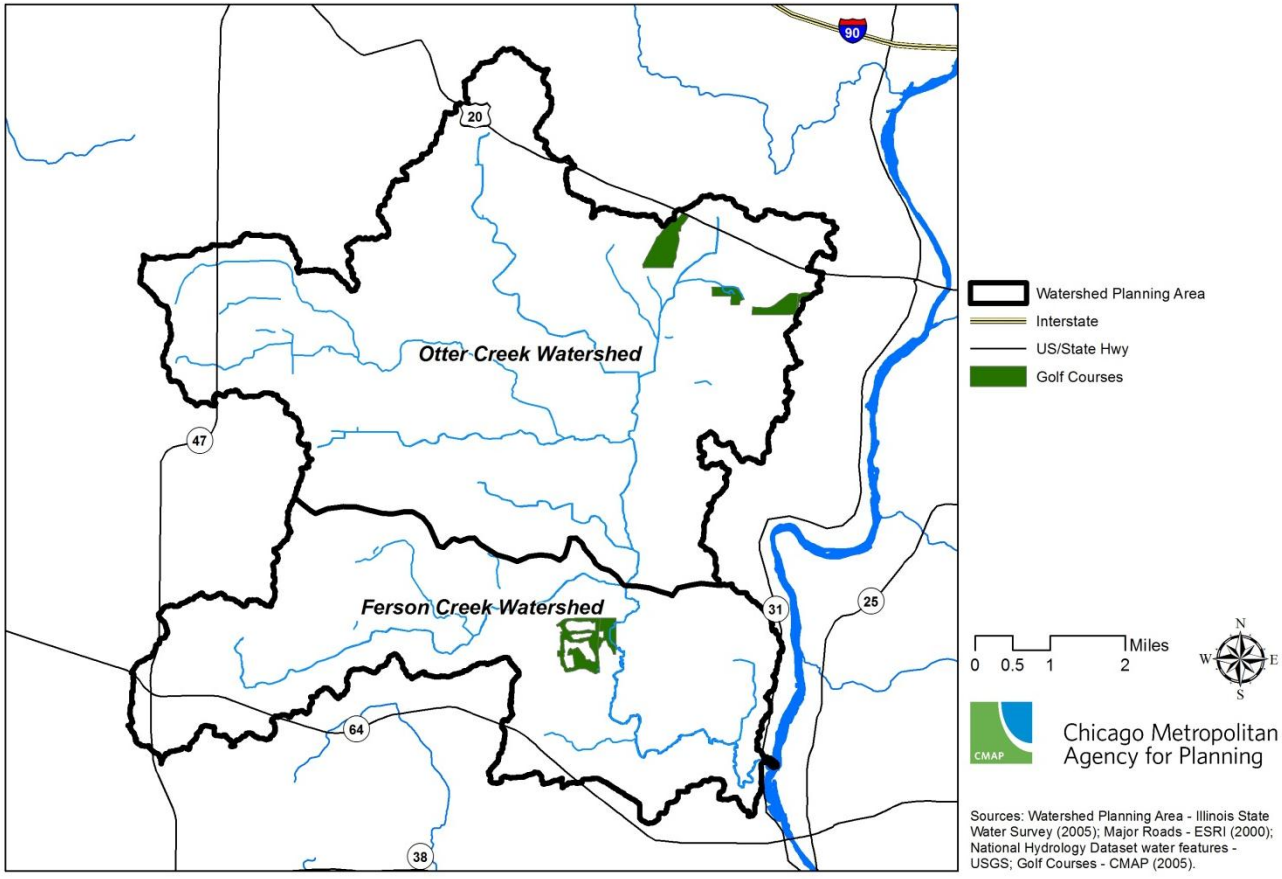
[195] *Septic Pump-Out Program*. *Isle of Wight County, Virginia, County Code*. Appendix B-1, Article 6. http://library.municode.com/HTML/14449/level2/APXB-1CHBAPRAROR_ART6SEPUTPR.html#TOPTITLE (accessed December 20, 2011).

natural features and heritage of the courses while improving water quality. [196]

Recommendation: The Ferson-Otter Creek Watershed Coalition as well as other interested parties will work with the local golf course management teams to move them towards becoming certified under the Audubon Cooperative Sanctuary Program.

It should be noted that a list of all policy recommendations is in Appendix E.

Figure 54. **Golf course locations in Ferson-Otter Creek Watershed**



[196] "Audubon Cooperative Sanctuary Program for Golf Courses," Audubon International, accessed November 9, 2011, http://acspgolf.audubonintemational.org/.

6. PUBLIC EDUCATION AND OUTREACH

We all have an impact on water quality. From the cars that we drive to the fertilizer we put on our lawns, pollutants from these activities and many others wash off the land and flow across the landscape, often through storm sewer systems, to our rivers and streams. These individual actions have relatively small impacts on water quality, but when looked at cumulatively they have a huge impact. This is nonpoint source pollution, so named because it does not originate from one pipe, but from many sources scattered across the landscape. Nonpoint source pollution is the nation's largest remaining water quality problem.

Education and outreach is essential to improving water quality within a watershed. If people don't understand what effects their actions have on water quality, improvements might be made through regulation and incentives, but only for a period of time. People want to do the right thing; they often just don't know what it is or how to do it. A watershed plan needs to include ways to make stakeholders aware of the issues, informing them on what needs to be done, and motivating them to take action. If stakeholders are involved in creating and implementing the plan, research shows that the watershed will have a higher level of long-term support and success.

Education of local residents must start with the basics; many studies have found that although the general public has heard the term "watershed," few are able to define it or explain how they have an impact on it. Not only will the education and outreach campaign need to define terms, but it will need to raise a general awareness of the problems in the watershed and the potential solutions. Then the campaign will need to find a way to motivate residents to act, contributing to improving water quality through their own actions, their government, and their family. The impact of not taking action must also be demonstrated.

This section of the watershed plan will lay the groundwork for creating a successful education and outreach campaign. First, it will summarize some existing literature on how to create a successful education and outreach campaign. Then it reviews some education and outreach activities that occurred during the watershed planning effort. Lastly, this section closes with a look ahead at education and outreach activities that were determined by the stakeholders to be necessary for improving water quality in the Ferson-Otter Creek Watershed.

6.1 EDUCATION AND OUTREACH CAMPAIGNS

There are many resources available to assist in developing an effective watershed education and outreach campaign. Agencies like USEPA and IEPA have many resources available including U.S. EPA's *Getting in Step: a Guide for Conducting Watershed Outreach Campaigns* (2003) and CMAP and IEPA's *Guidance for Watershed Action Plans in Illinois* (2007). Not-for-profit organizations like the Center for Watershed Protection and The Conservation Foundation are also great sources of information, often having brochures, fliers and other information applicable to watershed problems already on hand. The following information summarizes key findings from these resources.

6.1.1 Cause-Based Marketing

Research has shown that cause-based or social marketing is the most effective way to get people to change their behavior. Cause-based marketing is the practice of looking at people as consumers, but

instead of selling products or services, as a watershed group, we are selling ideas, attitudes and behaviors. The goal of cause-based marketing is not to make a profit, but to improve society and the environment. Part of this campaign should include persuading the public that there is a problem that only they can solve.

Identifying the Audience

Before any of the following education and outreach strategies are employed, the target audience must be identified. Different strategies will be used for different audiences. For example, if the goal is to reduce fecal coliform in the watershed, then targeting residents that have pets might be an effective strategy. The target audience should be broken down into the smallest segment possible to achieve the best results, then creating a message that resonates with the target audience and inspires them to act.

Understanding the Audience

Knowing some information about the target audience is essential. Campaign audiences have varied values and beliefs, and they will not necessarily be the same as those implementing the watershed plan. The following is a list of a few questions that are important to know about the target audience, before education and outreach activities begin:

1. What does the audience know already?
2. What are their existing beliefs and perceptions?
3. How does the audience receive messages and information?
4. What will make the audience change their behavior?
5. Other important factors include: education, age, culture, and religion.

The understanding of the audience can be completed at the same time or subsequent to identifying the audience. Surveys, focus groups, and even simple observations can lead to a greater understanding of the audience and a successful campaign. In order to create a successful education and outreach campaign, a manager must also consider how to most effectively convey that message to the target audience.

Barriers

Another component to establishing a successful education and outreach campaign is anticipating problems and road blocks. Barriers are just that: problems that might prevent residents from changing their behavior. Often barriers include time and/or resources. A barrier can also be that a person is simply not aware of the effect of their actions.

A common barrier is the social acceptability of the desired action. For example, rain gardens or other native vegetation is often perceived as looking weedy or unkempt. A resident might want to improve infiltration and have a low maintenance garden, but is resistant to installing a rain garden because he does not want to offend neighbors. The message needs to be conveyed to that resident and neighbors that natives can be planted in beds, can be low to the ground, and not look weedy. In this regard, barriers can be minimized or removed.

Social Norms

Related to the example just cited are social norms. Social norms are the behavioral expectations and cues within a group of people. It is a social norm that we maintain our lawns with grass species that are mowed to a certain height frequently. Through education and outreach, new examples need to be created showing the different, desired action. Then one by one, new social norms need to be established. People are more likely to change their behavior if they see someone else benefitting from the new behavior.

Creating and Formatting the Message

Messages must be clear and contain specific calls to action. They are designed to raise awareness, educate or motivate to action. Campaigns should inform and suggest acceptable behaviors.

Messages need to capture the audience's attention. What is needed to get the audience's attention will vary by different segments of the audience. Insights to this information may have been gleaned when identifying the audience, through information such as demographics or may be indicated by the message itself. Ask people to do something in response and let them know what effect this behavior will have. Be clear and concise. Consider what behavior you are trying to change and what behavior should replace it.

How the message is distributed to the audience can make or break an outreach campaign. The packaging of a message can help foster relationships and a sense of community, build understanding, and motivate people to action or it can be expensive and time consuming while producing little results. The target audience should dictate which format should be used to convey the message. Formats can change over the course of the campaign.

A campaign could start out raising general awareness with public service announcements (PSAs) and once the audience understands the problem, brochures could be distributed to further inform residents about what they can to do to contribute to the solution. According to the USEPA's *Getting in Step* guide, if the budget is small, the frequency in which your audience hears or sees the message is important. The following describes formats and messages that were used during this planning effort.

6.2 WATERSHED PLANNING PROCESS ACTIVITIES

A variety of education and outreach activities took place during the creation of this plan. They have laid the groundwork for a successful education and outreach campaign.

6.2.1 Website

Materials for the watershed planning effort are currently located at the Fox River Ecosystem Partnership website: www.foxriverecosystem.org/ferson_otter.htm. Agendas, maps, upcoming events, and the watershed plan are posted there.

6.2.2 Literature

Two brochures were developed as part of the watershed planning effort. The first brochure provides information about the watershed planning effort itself. The second brochure contains more detailed information about nonpoint source pollution and BMPs. In addition, a poster was developed for the Ferson-Otter Creek Watershed to show what can be done to reduce potential sources of fecal coliform, thereby improving water quality.

6.2.3 FREP Noon Networks

Stakeholders helped identify and coordinate a program for the (October 19, 2011) FREP Noon Network. The Ferson Creek dam removal at LeRoy Oakes Forest Preserve in St. Charles was the focus of the Noon Network in which 12 people attended. [197]

6.2.4 Stream Walks and Open House

Stakeholders and landowners visited various points of interest and concern along both Ferson and Otter Creeks. A second stream walk

[197] "Program Presentations," FREP, accessed November 9, 2011, http://foxriverecosystem.org/presentations.htm.

was held at the St. Charles Park District's Otter Creek Bend Park. Members and stakeholders toured the park and heard from Steve Belz, from Black Creek Hydrology, regarding two 319 implementation projects for bank stabilization.

6.2.5 Municipal Outreach

The Conservation Foundation created visual presentations to help keep our municipal partners informed of the watershed planning process, and to let them know we would be visiting again to ask for plan adoption. We made scheduled appearances with municipal staff, board and/or committee members at Lily Lake, South Elgin, Elgin, Campton Hills, St. Charles, Campton Township and Kane County.

6.2.6 Presence in the Community

Throughout the late summer and early fall we participated in a number of community events in each of the communities identified in the Ferson-Otter Creek Watershed. We participated and/or distributed information to stakeholders at: National Night Out, Campton Hills; Riverfest Express, South Elgin; Hawthorne Pond Walk, Elgin; Prairie Fest, Campton Township; and Scarecrow Fest, St. Charles.

6.2.7 Open House

The watershed planning process was presented to stakeholders at a public forum on March 29, 2011 from 4:30 – 6:30 PM, where people could ask questions of CMAP, TCF, and other parties involved in writing the plan.

6.3 ACTIVITIES GOING FORWARD

Throughout the watershed planning process, the stakeholders discussed education and outreach a number of times. The following recommendations and list of activities for targeted audiences were determined to be desirable. Stakeholders expressed an interest in partnering with state and regional resources with similar goals and missions. A list of state, regional, and local resources is found in Appendix C.

6.3.1 Organization

Momentum from the planning process will continue through the organization of a "coalition" to help encourage plan implementation and continue efforts towards reaching the plan's goals. The interim name for this entity is the Ferson-Otter Creek Watershed Coalition and is in direct response to watershed Goal #7 in Chapter 1.

Ideally the Coalition would meet quarterly. More frequent meetings could be warranted depending on current activities such as applying for grant funding or urgent watershed issues. The Coalition could be supported by dues collected from interested parties. The planning process reviewed and considered similar successful models from the DuPage River Salt Creek Workgroup and the Lower DuPage River Watershed Planning processes.
The Coalition will mostly likely consist of current interested parties that were active during this planning process in addition to other potential partners. A desired outreach list to continue building the Coalition is provided in Appendix D. This list is not exhaustive and was the original outreach list utilized by The Conservation Foundation at the beginning of this planning process.

In terms of staffing, the Coalition would be best served by hiring a watershed coordinator to organize and lead this effort. The watershed coordinator would provide a focused, local approach to watershed planning, taking into consideration regional activities and opportunities. The ideal candidate will be familiar with available resources, grant writing, and fostering collaborative partnerships/efforts. The coordinator would establish a presence

with each of the watershed municipal governments as well as with other partners to promote the goals and priorities in the watershed plan. Please note that grant to grant support for the watershed coordinator position is not the preferred funding option due to lack of financial stability.

Recommendations: The Ferson-Otter Creek Watershed Coalition should:

- **Hire a part-time watershed coordinator to promote and coordinate the implementation of the watershed plan's recommendations;**
- **Partner with existing organizations to provide a 319 grant writing workshop to assist lead implementers with 319 applications;**
- **Work with partnering organizations to raise awareness about all potential sources of fecal coliform bacteria and water quality;**
- **Heavily target landowners/Homeowners Associations, especially those identified in the critical areas analysis for fecal coliform, about proper septic maintenance and warning signs of a failing system;**
- **Distribute USEPA's Healthy Lawn Care Practices and Reduce Runoff: Slow it Down, Spread it Out, Soak it in! DVD to Homeowners Associations for use at meetings as an educational tool;**
- **Continuously work with municipalities to promote the use of CMAP's Model Water Use Conservation Ordinance in their respective municipalities;**
- **Hold two educational seminars per year on stormwater issues for all NPDES[198] Phase II permit holders in the watershed.**

[198] "National Pollutant Discharge Elimination System (NPDES)," U.S. EPA, last modified March 12, 2009, accessed December 20, 2011, http://cfpub.epa.gov/npdes/.

6.3.2 Public Awareness Campaign

It may be desirable to put a number of the activities listed below together into a campaign that would pool resources from, and benefit, the entire watershed. The Coalition would conduct pre-campaign research to identify and better understand the targeted audience, develop a slogan, determine the method(s) and message(s), develop a fixed timeframe, and include pre- and post-testing to gauge effectiveness.

Website

Websites are an excellent way of quickly connecting to a large audience. A mix of scientific and general information about the watershed can be located all in one place. The material can be changed and updated frequently and people can provide feedback and information quickly. A website is a relatively inexpensive education and outreach tool.

Recommendation: The Ferson-Otter Creek Watershed Coalition should investigate ways to maintain the existing website on the Fox River Ecosystem Partnership website.

Brochures

Printed material is a popular format for conducting education and outreach activities. It can be created easily and inexpensively. People can refer to printed materials again and again. The current brochures created for this planning process should continue to be distributed as long as they are useful. New brochures could be developed or adapted to cover additional topics including BMPs for homeowners, information on proper salt and fertilizer use, and information on fecal coliform.

Interpretive Signs

Interpretive signs communicate specific messages to viewers. These messages can be written to change behavior, educate, or evoke an emotion in the reader. They are mounted so they are visible to all viewers and can be constructed of many different materials. Interpretive signs can be used to educate viewers on a number of water quality issues: the purpose of detention ponds, no mow zones, establishing native plants, being a good neighbor to wetlands, etc.

Public Service Announcements

A public service announcement (PSA) can be an inexpensive way to reach a variety of people. PSAs can be broadcast on radio, television or even on websites. In addition to the USEPA's PSA on lawn care, local college students and broadcasting classes can be used to assist in the creation of a PSA. PSAs are often aired for no charge on local cable access channels or radio stations, although time slots may not be ideal.

6.3.3 Program Activities for Targeted Audiences

In order to prioritize our outreach and education activities, stakeholders identified the following targeted audiences to increase awareness of watershed issues, inform them of potential solutions, and motivate them to act.

Children/Students

Curricula and Training

The Chicago Wilderness Corporate Council's Teaching Academy is a program that provides technical assistance to teachers to help prepare localized curricula relevant to natural resources in the area. The Project WET Curriculum and Activity Guide contains 91 multidisciplinary water-related activities for students in grades K to 12. The guide features cross-reference and planning charts, a glossary and background material on activity development and field testing. Main program contacts include: Kane-DuPage Soil & Water Conservation District;[199] 630-584-7961, Ext. 3; The Chicago Wilderness Corporate Council, Teaching Academy,[200] 312-580-2137; Project WET,[201] 866-337-5486; The Conservation Foundation, Judy Fitchett, 630-428-4500 Ext. 11.

Recommendations: The Ferson-Otter Creek Watershed Coalition should support:

- **strategies to implement water science curriculums into classrooms and training opportunities for teachers that will increase their capacity to incorporate concepts of water science in their environmental education classrooms;**
- **growth of students' awareness of water-related employment opportunities and educational criteria.**

Watershed Quilt Project[202]

The Watershed Quilt Project is a grassroots project inspired by the Nature Quilt Project in Macomb, Illinois.[203] Our local version of the project builds on recommendations of the recent Aux Sable Creek Watershed Plan that recommends introducing the concepts of watersheds and stormwater in the classroom as well as working on programs with children such as precipitation monitoring, runoff tracing, stream monitoring and analysis, and habitat assessments.

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[199] "Kane-DuPage Soil and Water Conservation District," Kane-DuPage SWCD, accessed December 20, 2011, http://www.kanedupageswcd.org/.
[200] "Chicago Wilderness," Chicago Wilderness, accessed December 20, 2011, http://www.chicagowilderness.org/.
[201] "Worldwide Water Education," Project Wet, accessed December 20, 2011, http://www.projectwet.org/.
[202] "Watershed Quilt Project," Aux Sable Creek Watershed, accessed December 20, 2011, www.auxsablecreekwatershed.org/watershedquiltproject.html.

The Project's mission is raising awareness of the assets, opportunities and challenges in our local natural areas to gain a better understanding of the interconnectedness between people and the natural world around them through children's education. This project accomplishes this through promoting outdoor environmental education, environmental literacy, the arts, cultural discovery and activism demonstrating the ability of children to make a positive difference in addressing global environmental challenges. Main program contacts include: Aux Sable Creek Coalition, Watershed Quilt Project, Joan Soltwisch, 815-690-3658.

Recommendation: The Watershed Quilt Program should be implemented in the Ferson-Otter Creek Watershed in the next five years.

Agriculture in the Classroom

USDA Agriculture in the Classroom (AITC) supports state programs by providing a network that seeks to improve agricultural literacy — awareness, knowledge, and appreciation — among PreK-12 teachers and their students. The program is carried out in each state, according to state needs and interests, by individuals representing farm organizations, agribusiness, education and government. In Illinois, the AITC program is coordinated by the Illinois Farm Bureau and County Ag Literacy Coordinators administer the program locally.

Recommendation: The AITC program should be implemented or expanded in the Ferson-Otter Creek Watershed in the next 5 years.

World Water Monitoring Day™

World Water Monitoring Day™ is an international education and outreach program that builds public awareness and involvement in protecting water resources around the world by engaging citizens to conduct basic monitoring of their local water bodies.[204] The program is coordinated by the Water Environment Federation and the International Water Association. Sponsors include the USGS, USEPA, PerkinElmer, Sinclair Knight Merz, ITT Corporation, and Smithfield Foods. Groups can purchase test kits on the World Water Monitoring Day website. Basic test kits include one set of hardware and enough reagents to conduct up to 50 rounds of testing for pH, dissolved oxygen, temperature, and turbidity. The Classroom kit includes five sets of hardware and enough reagents to conduct up to 50 rounds of testing for pH, dissolved oxygen, temperature and turbidity. Main program contacts include: Water Environment Federation,[205] 703-535-5264.

Recommendation: Ferson-Otter Creek Watershed Coalition should participate in World Water Monitoring Day in the next three-five years.

Envirothon Competition

The Envirothon is an exciting, fun way for high school students to learn about the environment. It combines in-class curriculum with hands-on field experiences, while demonstrating the role people have in important environmental issues, such as forestry and wildlife management, water quality, and soil erosion. At the completion of the year-long learning process, the Envirothon conducts a series of competitions where students are tested on five subjects: soil, aquatics, wildlife, forestry and a specific environmental issue, which changes from year to year. The Illinois Envirothon competition is co-sponsored by the Association of Illinois Soil & Water Conservation Districts (AISWCD), local Soil & Water Conservation Districts (SWCD) and cooperating conservation

[204] "World Water Monitoring Day," WEF and IWA, accessed December 20, 2011, http://www.worldwatermonitoringday.org/.
[205] Ibid.

partners. Main program contacts include: Kane-DuPage Soil & Water Conservation District,[206] 630-584-7961, Ext. 3.

Recommendation: The Ferson-Otter Creek Watershed Coalition should encourage participation in the program by each high school in the watershed in the next three-five years.

The Mighty Acorns®

The Mighty Acorns® program incorporates classroom curriculum, hands-on restoration activities and exploration as it seeks to provide our children with multiple, meaningful, sustained interactions with the land. Students use the land as an outdoor laboratory for learning science and, at the same time, the ecosystems benefit from their restoration work. Mighty Acorns® is a stewardship-based curriculum for 4th-6th graders. Classes adopt a natural area in their community and visit it throughout the school year in order to participate in stewardship activities. Each field trip is preceded by a classroom lesson on related ecological concepts. Summer nature camps for Mighty Acorns® have also been developed through partnerships between The Conservation Foundation and local park districts. Main program contacts include: The Conservation Foundation,[207] 630-428-4500.

Recommendation: School districts and park districts within the Ferson-Otter Creek Watershed should implement the Mighty Acorns program within the next five years.

Landowners/Homeowners Associations

Conservation @ Home

Conservation @ Home is a program created by The Conservation Foundation which is geared towards homeowners. The program encourages and recognizes property owners who protect and/or create yards that are environmentally friendly and conserve water. This includes planting native vegetation, creating butterfly and rain gardens, and removing invasive species. Conservation @ Home is appropriate for outreach to municipalities, park districts, homeowners and homeowner associations through seminars, workshops, one-on-one conversations and the distribution of printed materials. Main program contacts include: The Conservation Foundation,[208] 630-428-4500.

Presentations

Stakeholders believe the watershed would benefit from providing a variety of topics to present to Homeowners Associations throughout the watershed. The topics might include a series of presentations covering the following topics: soil testing/ fertilizer, benefits of native plants, establishing no mow zones, detention ponds, rain barrels/gardens, etc. A variety of agricultural and natural resource topics are available through the KDSWCD Community Assistance program and The Conservation Foundation. Main program contacts include: The Conservation Foundation,[209] 630-428-4500; .Kane-DuPage Soil & Water Conservation District (KDSWCD),[210] 630-584-7961, Ext. 3.

Partners for Conservation

Partners for Conservation provides technical and financial assistance (cost-share) to landowners to address erosion issues. The Kane-DuPage Soil and Water Conservation District administers this program with funding provided by the State of Illinois through the Illinois Department of Agriculture. Practices on agricultural land

[206] "Kane-DuPage Soil and Water Conservation District," Kane-DuPage County SWCD, accessed December 20, 2011, http://www.kendallswcd.org/.
[207] "The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/.
[208] Ibid.
[209] Ibid. 207.
[210] Ibid 206.

include: Grassed waterways, grade stabilization structures, water & sediment control basins, filter strips, nutrient management, etc. Practices not specific to agricultural land include: Streambank stabilization and restoration, well sealing, rain gardens, and special projects (non-traditional practices such as urban stormwater basin retro-fitting). Main program contacts include: Kane-DuPage Soil & Water Conservation District,[211] 630-584-7961, Ext. 3.

Events/Conferences

The Coalition could promote its message about improving water quality in the Ferson-Otter Creek Watershed by attending and distributing information at existing events/ conferences or by creating their own event (watershed tour, an environmental fair, or a listening session). The Coalition would benefit from the opportunities to talk to residents and gauge their understanding of water quality concerns as well as hear their concerns about the watershed. In an effort to pool resources, share ideas, and provide technical assistance, the Coalition might also pursue coordinating a session at a larger, regional conference. Professionals are encouraged to attend workshops and conferences hosted by government agencies or non-profit water-quality groups. Main program contacts include: The Conservation Foundation,[212] 630-428-4500.

River Sweep

A river sweep is a coordinated, periodic clean-up of area waterways. The purpose is to create a connection between people and the river by having volunteers remove trash and debris from the river. A community-coordinated river sweep can involve a number of stakeholders, from students to corporations. The river sweep can also help develop a stewardship program to restore natural areas by removing invasive species. A central coordination entity should be established. Funding for supplies is available through the IEPA SCALE grant program. Main program contacts include: The Conservation Foundation,[213] 630-428-4500 and Friends of the Fox, 815-356-6605.

Storm drain stenciling

Storm drain stenciling involves volunteers painting a stenciled message on or near a storm drain as well as distributing literature explaining what they are doing. Stenciling is a way of explaining nonpoint source pollution to the general public and connecting volunteers and residents to the environment. The program has two target audiences: the crew of volunteers who stencil and those who read the message, "Dump no Waste – Drains to River." Various groups can participate in stenciling, youth groups, homeowners associations, and businesses. Main program contacts include: The Conservation Foundation,[214] 630-428-4500; .Kane-DuPage Soil & Water Conservation District,[215] 630-584-7961, Ext. 3.

Decision Makers/Municipal Officials

Policy, Codes, and Ordinance Review

By utilizing the USEPA's "Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale," and "Managing Wet Weather with Green Infrastructure," municipalities increase awareness and receive guidance about the process of removing barriers, revising and creating codes, ordinances, and incentives to better protect water quality. This process can be formally facilitated by agencies like the Chicago Metropolitan Agency for Planning (CMAP), or structured as a peer-

[211] "The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/.
[212] Ibid.
[213] Ibid. 211.
[214] Ibid. 211.
[215] "Kane-DuPage Soil and Water Conservation District," Kane-DuPage SWCD, accessed December 20, 2011, http://www.kanedupageswcd.org/.

to-peer roundtable. Topics may include: restoring wetlands; maintaining natural drainage areas for water quality and water supply benefits and reduced flooding; deicing practices and products; etc. Main program contacts include: The Chicago Metropolitan Agency for Planning,[216] (CMAP) 312-454-0400.

Regional Planning

Developing a regional floodplain management plan has many potential benefits of the plan including: improvement of public safety; reduction of flood damage costs to communities; increase in resources for local flood safety programs; opportunities for reduced flood insurance rates for communities participating in FEMA's Community Rating System; improvement of riparian vegetation, wildlife habitat and water quality; preservation of historical land uses; retention of natural beauty of the area. Main program contacts include: Federal Emergency Management Agency, National Flood Insurance Program,[217] 800-611-6122.

WaterSense Program

For local governments, partnering with WaterSense provides access to tools and resources to promote and educate residents the need for water efficiency. Using water more efficiently makes sense for consumers, communities, and the environment. Water efficiency measures, as part of broader conservation efforts, can help reduce water and wastewater infrastructure costs and ensure resources for future generations.

In some areas the growing population is putting stress on water supplies and distribution systems, threatening human health and the environment. The average household uses 100+ gallons of water each day. Water supply has become a national priority. The WaterSense website states that at least 36 states are anticipating local, regional, or statewide water shortages by 2013. Using water more efficiently, will help preserve supplies for future generations and protect the environment. WaterSense makes it easier to identify water-efficient products and practices. Main program contacts include: Environmental Protection Agency, Water Sense Program,[218] 866-987-7367.

Technical Workshops

Municipal and county planners, engineering and public works staff members could participate in technical workshops. Topics would be chosen that address water quality issues, particularly fecal coliform, presented by the Kane-DuPage Soil and Water Conservation District as well as The Conservation Foundation. Main program contacts include: The Conservation Foundation,[219] 630-428-4500; .Kane-DuPage Soil & Water Conservation District,[220] 630-584-7961, Ext. 3.

Natural Resource Information (NRI) Reports

The Kane-DuPage Soil and Water Conservation District provides natural resource information to officials of the local governing body and other decision makers. The Natural Resource Information (NRI) report intends to present the most current natural resource information available in an understandable format for sites that are being considered for development. It contains a description of the present conditions and resources available and their potential impact

[216] "Chicago Metropolitan Agency for Planning," CMAP, accessed December 20, 2011, http://www.cmap.illinois.gov/.
[217] "Community Rating System," FEMA, accessed December 20, 2011, http://www.fema.gov/business/nfip/crs.shtm.
[218] "Water Sense," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/index.html.
[219] "The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/.
[220] "Kane-DuPage Soil and Water Conservation District," Kane-DuPage SWCD, accessed December 20, 2011, http://www.kanedupageswcd.org/.

on each other. Main program contacts include: Kane-DuPage Soil & Water Conservation District,[221] 630-584-7961, Ext. 3.

Soil Erosion & Sediment Control

Soil Erosion & Sediment Control expertise provided by the Kane-DuPage Soil and Water Conservation District to agencies (IEPA, United States Army Corps of Engineers) and local governments (County and Municipal Government) as part of a cooperative agreement. Main program contacts include: Kane-DuPage Soil & Water Conservation District,[222] 630-584-7961, Ext. 3.

Natural Resources Conservation Service (NRCS) Conservation Programs

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty. The Coalition could help encourage landowners to utilize NRCS programs, especially those that help reduce the potential for fecal coliform bacteria loadings in local steams. Main program contacts include: US Department of Agriculture, Natural Resources Conservation Service[223] and Kane-DuPage Soil & Water Conservation District, 630-584-7961, Ext. 3.

A list of all education and outreach recommendations are in Appendix E.

[221] "Kane-DuPage Soil and Water Conservation District," Kane-DuPage SWCD, accessed December 20, 2011, http://www.kanedupageswcd.org/.
[222] Ibid.
[223] "Natural Resources Conservation Service," USDA NRCS, accessed December 20, 2011, http://www.nrcs.usda.gov/.

7. PLAN IMPLEMENTATION AND MONITORING

7.1 SCHEDULE AND MILESTONES

Although there is considerable merit in producing a watershed plan, improving water quality in the watershed will be a result of implementing the plan's project, policy, and education and outreach recommendations in a meaningful way. Improving water quality will happen over time and with considerable effort by the stakeholders, partner agencies, local governments, and residents alike.

7.1.1 Project Recommendations

All short-term lead implementers estimate a 2016 project completion date. It should be noted that implementation of any of these projects is based on a variety of factors including, but not limited to, securing appropriate funding and participation from willing landowners and local governments.

The milestone for project recommendations is development of at least 10 grant applications to implement projects within the 5-year/short-term planning timeframe.

7.1.2 Policy Recommendations

In addition to project recommendations, the watershed plan also describes numerous policy recommendations. As this plan was written on the premise of a 5-year planning cycle, identified parties are encouraged to consider and implement the plan's policy recommendations by 2016. To help facilitate these efforts, CMAP or other consultants can provide assistance to communities for those recommendations that are related to comprehensive plans and ordinances, such as incorporating CMAP's Model Water Use Conservation Ordinance. Furthermore the Ferson-Otter Creek Watershed Coalition should continue to work with the watershed's communities to support this effort.

The milestone for policy recommendations is the adaptation of at least 3 of the recommended measures by each municipality within the 5-year planning timeframe.

7.1.3 Education and Outreach Recommendations

The outreach and education recommendations will be an on-going effort with partnering agencies, homeowners associations, and other relevant groups that are active within the watershed. The pace of implementation of the outreach and education recommendations would be greatly increased by the hiring of a part-time watershed coordinator.

7.2 FUNDING OPTIONS

Plan implementation is largely based on the availability of funding for projects and other plan recommendations. Table 28 describes possible funding sources that may be used to move forward with plan implementation.

Table 28. Funding sources

PROGRAM	FUNDING AGENCY	TYPE	FUNDING AMOUNT	ELIGIBILITY	ACTIVITIES FUNDED	WEBSITE
WATER QUALITY						
Capitalization Grants for Clean Water State Revolving Funds	U.S. EPA/Office of Wastewater Management	Loan revolving fund	No limit on wastewater funds; Drinking water up to 25% of available funds	Local government, Individuals, Citizen groups, Not-for-profit groups	Wastewater treatment; Nonpoint source pollution control; Watershed management; Restoration & protection of groundwater, wetlands/riparian zones, and habitat.	http://www.epa.gov/owm/cwfinance/index.htm
Non-point Source Management Program (319 grants)	Illinois EPA	Matching Grant (60% funded)	No set limit on awards	Local government, Businesses, Individuals, Citizen & environment groups	Controlling or eliminating non-point pollution sources; Stream bank restoration; Pesticide and fertilizer control.	http://www.epa.state.il.us/water/financial-assistance/non-point.html
Illinois Green Infrastructure Grant Program for Stormwater Management	Illinois EPA	Matching Grant Minimum Local MatchCSO: 15%; Retention and Infiltration: 25%; Green Infrastructure Small Projects: 25%	Up to: CSO: $3M or 85% of project costs; Retention and Infiltration: $750,000 or 75% of project costs; Green Infrastructure Small Projects: $75,000 or 75% of project costs	Any entity that has legal status to accept funds from the state of Illinois, including state and local governmental units, nonprofit organizations, citizen and environmental groups, individuals and businesses	Green infrastructure best management practices (BMPs) for stormwater management to protect or improve water quality.	http://www.epa.state.il.us/water/financial-assistance/igig.html
Sustainable Agriculture Grant Program	Illinois Department of Agriculture	Matching Grant (60% funded)	—	Organizations, governmental units, educational institutions, non-profit groups, individuals	Practices are aimed at maintaining producers' profitability while conserving soil, protecting water resources and controlling pests through means that are not harmful to natural systems, farmers or consumers.	http://www.agr.state.il.us/Environment/conserv/index.html
Streambank Stabilization and Restoration Program	Illinois Department of Agriculture	Matching grant (amount funded not specified)	—	Landowners, Citizen groups, Not-for-profit groups	Naturalized streambank stabilization in rural and urban communities, work with SWCD	http://www.agr.state.il.us/Environment/conserv/index.html
Conservation Innovation Grants	Natural Resources Conservation Service	Matching grant (50% funded)	Up to $75,000 under State Component	Landowners, Organizations	Projects targeting innovative on-the-ground conservation, including pilot projects and field demonstrations.	http://www.il.nrcs.usda.gov/programs/cig/
HABITAT						
Partners for Fish and Wildlife Habitat Restoration Program	Department of Interior, U.S. Fish and Wildlife Service	Cost-share (50% funded)	up to $25,000	Private landowners	Voluntary restoration or improvements of native habitats for fish and wildlife; Restoration of former wetlands, native prairie stream and riparian areas and other habitats.	http://www.fws.gov/policy/640fw1.html
Bring back the Natives Grant Program	National Fish and Wildlife Foundation	Matching Grant (33% funded)	Varies with project ($50,000-$75,000)	Not-for-profit groups, Universities, Local governments	Restoration of damaged or degraded riverine habitats and native aquatic species through watershed restoration and improved land management.	http://www.nfwf.org/AM/Template.cfm?Section=charter_programs_list&CONTENTID=18473&TEMPLATE=/CM/ContentDisplay.cfm
Wildlife Habitat Incentives Program	U.S. Department of Agriculture	Grant, Matching Grant (at least 75% funded)	—	Private landowners, Not-for-profit groups	Establishment and improvement of fish and wildlife habitat on private land.	http://www.nrcs.usda.gov/programs/whip/
Native Plant Conservation Initiative	National Fish and Wildlife Foundation	Matching Grant (50% funded)	$10,000-$50,000	Community and watershed groups, Nonprofit groups Educ. institutions, Conservation districts, Local governments	"On-the-Ground" projects that involve local communities and citizen volunteers in the restoration of native plant communities.	http://www.nfwf.org/programs/npci.htm
WETLANDS						
Wetlands Reserve Program	USDA NRCS	Direct contracts with landowners; Easement (100%); Cost Share and 30 year easements (75%)	No set limit on awards	Individual Citizen groups, Not-for-profit groups	Wetlands restoration or protection through easement and restoration agreement	http://www.nrcs.usda.gov/programs/wrp/states/il.html
Wetlands Program Development Grants	U.S. EPA	Matching Grant (75% funded)	No set limit on awards	Not-for-profit groups; Local government	Developing a comprehensive monitoring and assessment program; Improving the effectiveness of compensatory mitigation; Refining the protection of vulnerable wetlands and aquatic resources	http://www.epa.gov/owow/wetlands/grantguidelines
Northeastern Illinois Wetlands Conservation Account	U.S. Fish and Wildlife Service/ The Conservation Fund	Grant/Matching Grant (50% match strongly suggested)	Average of ~$38,000	A partnership of: Governmental agencies; Not-for-profit conservation groups; Private landowners	Restoration of former wetlands; Enhancement and preservation of existing wetlands; Creation of new wetlands Wetlands education and stewardship	http://www.conservationfund.org/node/133
Small Grants Program	North American Wetlands Conservation Council	Matching Grant	Up to $75,000	A partnership of: Governmental agencies, Not-for-profit conservation groups; Private landowners	Long-term acquisition, restoration, enhancement of natural wetlands	http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm
Wetland Restoration Fund	Openlands	Grant	$5,000-$100,000	Local government; Not-for-profit groups; Citizen groups; Other organizations	Wetlands and other aquatic ecosystem restorations within the six-county Chicago region on land under conservation easement or owned by a government agency	
Five Star Restoration Program	National Fish and Wildlife Foundation	Matching Grant (50% funded)	One-year projects: $10,000-$25,000; Two-year projects: $10,000 -$40,000	Any public or private entity that can receive grants	Seeks to develop community capacity to sustain local natural resources for future generations by providing modest financial assistance to diverse local partnerships for wetland and riparian habitat restoration	http://www.nfwf.org/AM/Template.cfm?Section=Charter_Programs_List&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=60&ContentID=17901
PRIVATE						
Tellabs	Tellabs Foundation	Grant	At least $10,000	Not-for-profit groups	Environmental protection and improvement programs; Organizations which protect the environment	http://www.ivp.tellabs.com/about/foundation.shtml
GVF Core Program	Grand Victoria Foundation	Grant/Matching Grant	Varies with scope of project, size of organization, other funding	Not-for-profit groups	Preservation and restoration of natural lands and waterways	www.grandvictoriafdn.org

7.3 MONITORING FOR SUCCESS

7.3.1 In-stream Sampling

As stated throughout the plan, fecal coliform is the watershed's only identified impairment (specifically in Ferson Creek). Although the Illinois 303 (d) list has identified urban runoff and storm sewers, and runoff from forests, grasslands and parks as potential sources of the impairment, there is still uncertainty as to where geographically in the watershed and from what origin (sewage treatment plants, septic system, pet waste, wildlife, drain tiles, etc.) the contamination derives. Absent this information, this watershed plan covers a variety of potential sources through recommendations aimed at reducing the concentration of fecal coliform in the watershed (public outreach and education, policy, projects).

For this reason, more detailed and frequent monitoring should be implemented throughout the Ferson Creek Watershed by 2016. The Ferson-Otter Creek Watershed Coalition should partner with Fox River Study Group (FRSG) and Illinois State Water Survey (ISWS) to develop a more robust water quality monitoring scheme with a goal of achieving an improved understanding of the sources of fecal coliform within the watershed. Developing a better baseline to understand fecal coliform issues will allow for evaluation of the effectiveness of implementation efforts over time. To that end, water samples that indicate a positive change or trend towards lower fecal coliform concentrations and ultimately, compliance with the water quality standard, will provide the best criteria to measure success.

After monitoring data are collected and analyzed with conclusive results as to where and from what origin the fecal coliform contamination is coming from, the Ferson-Otter Creek Watershed Coalition can reevaluate the plan's recommendations and make appropriate adjustments to priorities at that point. Additionally there are several efforts to collect more water quality data already happening throughout the Fox River Basin. The Ferson-Otter Creek Watershed Coalition should work closely with these organizations and partner on monitoring projects as funding and resources are available.

7.3.2 Effluent Monitoring

As stated, only one NPDES permit is issued within the watershed and that is to Ferson Creek Utilities Sewage Treatment Plant (STP) to treat domestic wastewater for the majority of the Windings Subdivision in St Charles.[224] The permit does outline water quality standards for fecal coliform. It is inconclusive to date if the STP has had any fecal coliform violations. It is recommended that the Ferson-Otter Creek Watershed Coalition partner with the management at the STP to prevent any potential future violations.

7.4 NEXT STEPS

With the initial planning cycle closing at the end of 2011 with approval of the new watershed plan, attention will turn to implementation in 2012. Full plan and executive summary documents will be printed and distributed during the first quarter of 2012. Access to these documents will also be available via both CMAP and FREP websites. CMAP will approach local governments and request a resolution of support for the watershed plan. CMAP and TCF will maintain contact with the new Ferson-Otter Creek Watershed Coalition and support their implementation efforts where possible.

A list of all figures and tables is found in Appendix F and Appendix G respectfully.

[224] NPDES ID number IL0045411.

Appendix A
List of Long-term Project Recommendations for Ferson-Otter Creek Watershed Plan

Project Number	IEPA Category	Best Management Practices (BMPs)	Lead Implementer(s)
22	**AGRICULTURE**	Meissner-Corron Forest Preserve– block selected drain tiles, fill or divert overgrown farm ditches, remove tree along ditches, plant deep-rooted native species, stabilize area to ensure Nature Preserve protection.	Kane County Forest Preserve District
23	**AGRICULTURE**	Primrose Farm-stream bank stabilization, stream bottom evaluation.	St. Charles Park District
24	**HYDROLOGIC**	Install water level control structure & drain tile improvements to allow water level management of wetland to control cattails in high quality wetland. Cost estimate: $50,000.	Deer Run East HOA
25	**HYDROLOGIC**	Culvert under Empire Road, west of Boxwood Lane. Utilize green infrastructure to stabilize channel.	Kane County
26	**HYDROLOGIC**	Otter Creek Forest Preserve – support purchase of adjacent lands, remeander stream out of ditch banks, recreate wetlands across 50+ acres.	Kane County Forest Preserve District
27	**HYDROLOGIC**	Fitchie Creek Forest Preserve- remove trees along creek banks, stabilize creek banks, install small-scale engineered BMPS in creek, control reed canary grass, and plant deep-rooted native species.	Kane County Forest Preserve District
28	**HYDROLOGIC**	Hazelcrest Subdivision-severe erosion issue.	Kane County Forest Preserve District/ Lily Lake
29	**HYDROLOGIC**	Lenkaitis Farm-streambank stabilization.	Landowner
30	**HYDROLOGIC**	Work with developer/landowner to permanently protect 30+ acres of high quality wetland on 54 acre property (north of 64, west of West Mary Drive). Only 20 acres of property is buildable (not wetland or floodplain).	Landowner
31	**HYDROLOGIC**	Streambank Stabilization Project; landowner at 36W394 Wild Rose Lane; Moderate erosion (< 4 foot banks). Total feet: 375. Cost estimate: $25,000.	Landowner

32	**HYDROLOGIC**	Drainage improvements to reduce residential flooding (east of Denker Road, south of Deerhaven Trail). Cost estimate: $25,000.	Landowner
33	**HYDROLOGIC**	Work with developer/landowner to permanently protect sedge meadow wetland, which is the headwaters to Fitchie Creek.	Landowner
34	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near end Harvest Lane, St. Charles).	Windings HOA
35	**HYDROLOGIC**	Work with developer/landowner to restore former wetland complex that is headwaters of Ferson Creek. Wetland is also located in major aquifer recharge area (west of Anderson Road, south of 64).	Landowner/ Village of Lily Lake
36	**HYDROLOGIC**	Stream maintenance for survey stations: 430-1150, 850-1100, 10050-10270, and 10630-10850. This is 4 separate projects. Project details for each project (station, length, erosion, action, cost, and priority) in Attachment A. Total feet: 1410. Accumulative cost estimate: $84,600-$105,751.	South Elgin
37	**HYDROLOGIC**	Ferson Creek Park-naturalized buffer.	St. Charles Park District
38	**HYDROLOGIC**	Otter Creek Bend Wetland-soil deposition mitigation.	St. Charles Park District
39	**HYDROLOGIC**	Floodplain forest / stream corridor restoration to remove invasive/nuisance species on Wild Rose Springs HOA property; Wild Rose Springs owns more than 60 acres of natural area along Ferson Creek and more than 1 mile of stream. Cost estimate: $100,000.	WildRose Springs HOA
40	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near Eagle Court, St. Charles).	Windings HOA
41	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near Ravine Drive in between Forest Glen Lane and Jens Jensen Lane, St. Charles).	Windings HOA
42	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near Ravine Drive, northwest of Kingswood Drive St. Charles).	Windings HOA
43	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near west of Ravine Drive, south of Empire Road, St. Charles).	Windings HOA
44	**HYDROLOGIC**	Ravine stabilization at the Windings Subdivision (near southeast intersection of Bridle Court and Paddock Lane, St. Charles).	Windings HOA

45	**HYDROLOGIC**	Ravine Stabilization at the Windings Subdivision (near Bridle Court, south of Steeplechase Road, St. Charles)	Windings HOA
46	**HYDROLOGIC**	Ravine Stabilization at the Windings Subdivision (near end of Paddock Lane, St. Charles).	Windings HOA
47	**LIVESTOCK**	Lenkaitis Farm-vegetative filter strip, updating manure pit.	Landowner
48	**LIVESTOCK**	Encourage farmer to install animal exclusion zone from swale, which drains 32 acres through cow pasture; Cows observed defecating in small swale apparently fed by upstream drain tile that discharges to tributary to Ferson Creek(south of Willowbrook Drive, east of Corron Road). Cost estimate: $5,000.	Landowner
49	**LIVESTOCK**	Investigate what type of farming operation and the extent, if any, of agriculture feed lot runoff from animal operation; headwaters to Bowes Creek (south of Plato Road, east of Pease Road).	USDA/Farm Bureau/Landowner
50	**OTHER**	Monitor water quality of Ferson Creek at Corron Road.	Campton Hills
51	**OTHER**	Restore oak woodland/savanna on Campton Township Gray Willows property. Total acreage: 21. Cost estimate: $25,000.	Campton Township
52	**OTHER**	Restore 9+ acres of farmed wetland on Campton Township Gray Willows Property. Total acreage: 9. Cost estimate: $25,000.	Campton Township
53	**OTHER**	Install water level control structure on existing tile to facilitate wetland restoration on Campton Township Gray Willows Farm property. Cost estimate: $8,000.	Campton Township
54	**OTHER**	Monitor water quality in the Otter Creek Tributary to Ferson Creek.	Homeward Glen, Campton Hills
55	**OTHER**	Remove dense stands of Phragmites from along Randall Rd - US 20 interchange swales; source of invasive seeds from farthest north end of Otter Creek. Total acreage: 0.75. Cost estimate: $7,500.	Illinois Department of Transportation (IDOT)
56	**OTHER**	Develop and implement stream corridor management program to remove debris jams, nuisance & invasive species (east of Prairie Springs Drive); Adjacent landowners have expressed willingness to help. Cost estimate: $20,000.	Kane County Forest Preserve District

57	**OTHER**	Remove invasive species (Phragmites) spreading across constructed wetland basin; develop and implement vegetative management plan to maintain wetland quality (east of Prairie Springs Drive). Adjacent landowners have expressed willingness to help Kane County Forest Preserve District. Cost estimate: $15,000.	Kane County Forest Preserve District
58	**OTHER**	Kane County wetlands adjacent to Lake Campton-investigate drainage ditch constructed under Whitney road from the wetlands to the west end of Lake Campton.	Lake Campton POA, Kane County Forest Preserve District, St. Charles School District 303
59	**OTHER**	Ferson Creek upstream from Lake Campton-Creek walk to assess potential stabilization and other improvements.	Lake Campton POA, St. Charles School District 303
60	**OTHER**	Eroded Banks, further investigation needed (southwest corner of Silver Glen Road and Burr Road)	Landowner
61	**OTHER**	Work with landowner to preserve as much of 25 acre oak woodland as possible (north of Lenz Road, east of Crawford Road).	Landowner
62	**OTHER**	Work with landowners and Girl Scout Organization to permanently protect stream corridor & oak woodlands. Site includes HHQ ADID wetland with T&E species (south of Woodgate Road, east of Burr Road).	Landowner
63	**OTHER**	Work with landowner to maintain and permanently protect oak woodland and undeveloped fen recharge area (south of Burr Road Lane, west of Burr Road).	Landowner
64	**OTHER**	Protect Fen #1272 from development and insure water quality BMPs are integrated into all development proposed within its recharge area.	Landowner
65	**OTHER**	Restore Lily Lake and pre-settlement wetlands (north and south of Route 64), total acreage 18.	Lily Lake/Developer
66	**OTHER**	Streambank erosion monitoring for survey stations: 0-12270. This is 48 separate projects. Project details for each project (station, length, erosion, action, cost, and priority) in Attachment A. Total feet: 6,805.	South Elgin
67	**OTHER**	Vegetative Maintenance for survey stations: 2990-3080, 3160-3330, 4120-4870, 5380-5580, 5760-5880, 6170-6320, 7500-7610, 9240-9420, and 10870-11370. This is 10 separate projects. Project details for each project (station, length, erosion, action, cost, and priority) in Attachment A. Total feet: 2,260. Accumulative cost estimate: $169,750-$283,750.	South Elgin

68	**URBAN**	Retrofit existing turf bottom detention basin with native plants - minimum 25,000 square feet. Cost estimate: $10,000	Burlington School District 301 -Prairie View Grade School
69	**URBAN**	Streambank and stream channel stabilization of Tucker Run along north side of Gray Willows Open Space Property; about 600 ft and 8 riffle grade control structures. Cost estimate: $96,000.	Campton Township
70	**URBAN**	Streambank and stream channel stabilization of Ferson Creek through the Gray Willows Open Space Property; about 2500 ft and 20 riffle grade control structures. Cost estimate: $250,000.	Campton Township
71	**URBAN**	Retrofit existing dry-bottom detention basins with native vegetation for increased filtering/pollutant removal. 11 projects in total along parts of Spinnaker Street, Umbdenstock Road, Mission Hills Street, Foxmoor Road, Country Water Road, Amber Street, Bowes Road, Hopps Road, Deerpath Road.	Elgin
72	**URBAN**	Detention basin retrofit to ease flooding concerns and water quality benefits (east of Tuscan View Drive, south of College Green Drive).	Landowner
73	**URBAN**	Work with landowner to establish water quality BMP basin between Stony Creek and landscape business / farm animal stalls to filter runoff (west of Crawford Road, north of McDonald Road).	Landowner / USDA-NRCS
74	**URBAN**	Install infiltration-based BMPs (pavers, bioretention basins, etc.) retrofits into strip mall development; significantly undersized detention storage and no water quality treatment before discharge to Otter Creek (west of Randall Road, north of South Street). Cost estimate: $500,000.	Landowner/Shopping Center Corporation
75	**URBAN**	Install infiltration-based BMPs (pavers, bioretention basins, etc.) retrofits into strip mall development; significantly undersized detention storage and no water quality treatment before discharge to Otter Creek (north of South Street, west of Edgewood Street). Cost estimate: $450,000.	Landowner/Shopping Center Corporation
76	**URBAN**	Detention Basin Retrofit; replant turf grass bottom basin with native plants for added pollutant removal; Otter Creek Shopping Mall east side of Randall Rd. Total acreage: 1.1. Cost estimate: $15,000.	Landowner/Shopping Center Corporation

77	**URBAN**	Retrofit existing turf bottom detention basin with native plants-mesic prairie garden (north of Bolcum Road, east of Burr Road). Total feet: 6,000. Cost estimate: $85,000.	School District 303
78	**URBAN**	Install rain garden to infiltrate/filter Ferson Creek Elementary roof runoff before uncontrolled release to Ferson Creek. Project could also serve as outdoor education classroom for students. Cost estimate: $85,000.	School District 303, Ferson Creek Elementary
79	**URBAN**	Work with strip mall owner to install retrofit water quality BMPs to reduce total runoff and/or parking lot pollutants prior to discharge into downstream storm sewer, Target, Randall Road. 2 locations.	South Elgin/Elgin
80	**URBAN**	Work with strip mall owner to install retrofit water quality BMPs to reduce total runoff and/or parking lot pollutants prior to discharge into downstream storm sewer, Best Buy/Home Depot, Randall Road	South Elgin
81	**URBAN**	Work with strip mall owner to install retrofit water quality BMPs to reduce total runoff and/or parking lot pollutants prior to discharge into downstream storm sewer, Caputos, Randall Road.	South Elgin
82	**URBAN**	Work with strip mall owner to install retrofit water quality BMPs to reduce total runoff and/or parking lot pollutants prior to discharge into downstream storm sewer, Kohls, Randall Road.	South Elgin
83	**URBAN**	Work with strip mall owner to install retrofit water quality BMPs to reduce total runoff and/or parking lot pollutants prior to discharge into downstream storm sewer, TRU/Ross, Randall Road.	South Elgin
84	**URBAN**	Re-grade w/Stone Toe &/or Gabion at survey stations: 5450-5570, 5980-6100, 9440-9500, and 10300-10630. This is 5 separate projects. Project details for each project (station, length, erosion, action, cost, and priority) in Attachment A. Total feet: 610. Accumulative cost estimate: $91,500-$197,250.	South Elgin

Appendix B

Comparative municipal ordinance review results from Center for Watershed Protection's Codes and Ordinance Worksheet (COW).

	COMMUNITY A	SCORE	COMMUNITY B	SCORE	COMMUNITY C	SCORE	COMMUNITY D & E	SCORE	CENTER FOR WATERSHED PROTECTION COW[1]	MAX SCORE
Street width (local access)	24′	0	26′	0	N/A	0	>22	4	**18-22′**	4
Queuing	No	0	No	0	N/A	0	No	0	**Yes**	3
Street length	Yes	1	No	0	N/A	0	Yes	1	**Minimize**	1
ROW width for minor roads	66′	0	66′	0	N/A	0	66′	0	**<45′**	3
Allow utilities under paved part of ROW?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Culs-de-sac radii	60′	0	45.5′	0	N/A	0	60′	0	**<35′ or <45′**	3
Require landscaped island?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Allow alternative turn-arounds?	Yes	1	No	0	N/A	0	Yes	1	**Yes**	1
Curb and gutter required?	No	2	Yes	0	N/A	0	No	2	**No**	2
Established swale criteria?	Yes	2	Yes	2	N/A	0	Yes	2	**Yes**	2
Parking ratio, professional office	4.0	0	3.0	0	N/A	0	2.5	1	**<3**	1
Parking ratio, shopping center	5.0	0	4.0	1	N/A	1	3.3	1	**<4.5**	1
Parking ratio, single family detached	4.0	0	2.0	1	N/A	1	2.0	1	**<2**	1
Max rather than min?	No	0	No	0	N/A	0	No	0	**Yes**	2
Promote shared parking?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Provide model shared parking agreements?	No	0	No	0	N/A	0	Yes	1	**Yes**	1
Reduce parking ratios w/ shared parking?	No	0	Yes	1	N/A	1	Yes	1	**Yes**	1
Parking ratio reduced near transit?	No	0	No	0	N/A	0	Yes	1	**Yes**	1
Parking stall width	9′	1	9′	1	N/A	1	9′	1	**<9**	1
Stall length	18.0	1	18.0	1	N/A	0	18′	1	**<18**	1
Smaller dimensions for compact cars?	No	0	No	0	N/A	0	No	0	**Yes**	1
Pervious area for spillover parking?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Incentives for structured parking?	Yes	1	No	0	N/A	1	No	0	**Yes**	1
Minimum landscaping for parking lots?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Bioretention islands allowed?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Cluster development allowed?	Yes	3	No	0	N/A	3	Yes	3	**Yes**	3
Land conservation or impervious cover a major goal of open space design ordinance?	Yes	1	—	0	N/A	0	Yes	1	**Yes**	1
Additional submittal or review requirements for CD?	No	1	—	0	N/A	1	No	1	**No**	1
By-right form of development?	No	0	—	0	N/A	0	Yes	1	**Yes**	1
Flexible site design criteria?	Yes	2	—	0	N/A	2	Yes	2	**Yes**	2
Irregular lot shapes allowed?	Yes	1	No	0	N/A	1	Yes	1	**—**	1
Front setback for 0.5 acre residential lot	25.0	0	40.0	0	N/A	0	35′	0	**<20′**	1
Rear setback for 0.5 acre residential lot	30.0	0	50.0	0	N/A	0	35′	0	**<25′**	1
Min. side setback for 0.5 acre residential lot	7.5	1	10′-15′	0	N/A	0	10′	0	**<8′**	1
Frontage for 0.5 acre residential lot	75.0	2	100′-125′	0	N/A	0	125′	0	**<80′**	2
Min. sidewalk width	4.0	2	4.0	2	N/A	2	4.0	2	**<4′**	2

Required on both sides of street?	No	2	Yes	0	N/A	0	No	2	**No**	2
Sloped to drain to yard, not street?	No	0	No	0	N/A	0	No	0	**Yes**	1
Substitute alternate pedestrian networks?	Yes	1	No	0	N/A	1	Yes	1	**Yes**	1
Minimum driveway width?	18.0	2	—	?	N/A	2	18′	2	**<9′**	2
Can pervious materials be used?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Use two-track design?	No	0	Yes	1	N/A	1	Yes	1	**Yes**	1
Shared driveways permitted in residential developments?	Yes	1	Yes	1	N/A	0	Yes	1	**Yes**	1
Require association to manage common open space?	Yes	2	No	0	N/A	2	Yes	2	**Yes**	2
Require consolidation of open space?	Yes	1	No	0	N/A	0	Yes	1	**Yes**	1
Keep percentage of open space in natural condition?	No	0	No	0	N/A	0	Yes	1	**Yes**	1
Uses defined for open space?	Yes	1	Yes	1	N/A	0	Yes	1	**Yes**	1
Allow management of open space by third party?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Discharge roof runoff to yard?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Allow temporary ponding on yard or roof?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Stream buffer ordinance?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Minimum buffer width?	—	—	—	—	N/A	0	15′	—	**<75′**	1
Include wetlands, steep slope, and floodplain?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Require native vegetation in buffer?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Ordinance outline allowable uses in buffer?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Buffer ordinance specifies education and enforcement?	Yes	1	Yes	1	N/A	0	Yes	1	**Yes**	1
Preserve natural vegetation on residential lots?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Clear trees from septic field?	No	1	—	—	N/A	0	No	1	**No**	1
Require tree conservation?	Yes	2	No	0	N/A	2	Yes	2	**Yes**	2
Limits of disturbance on construction plans adequate to prevent clearing?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Incentives for conserving non-regulated land?	Yes	2	No	0	N/A	2	No	—	**Yes**	2
Flexibility to meet regulatory requirements?	Yes	2	No	0	N/A	2	Yes	2	**Yes**	2
Require water quality treatment for stormwater?	Yes	2	Yes	2	N/A	0	Yes	2	**Yes**	2
Effective design criteria for BMPs?	Yes	1	Yes	1	N/A	1	Yes	1	**Yes**	1
Discharge stormwater directly into wetland without pretreatment?	No	1	No	1	N/A	0	No	1	**No**	1
Restrict or prohibit development in 100 yr. floodplain?	Yes	2	Yes	2	N/A	2	Yes	2	**Yes**	2
Total		**71**		**44**		**54**		**78**		**100**

1 Center for Watershed Protection, Code and Ordinance Worksheet

Appendix C

Ferson-Otter Creek Watershed Plan Regional Resources

Chicago Wilderness
The Chicago Metropolitan Agency for Planning
The Conservation Foundation
The Delta Institute
Friends of the Fox
Fox River Ecosystem Partnership
Fox River Study Group
Illinois Department of Natural Resources
Illinois Environmental Protection Agency
Illinois State Water Survey
The Morton Arboretum
National Council for Public Partnerships
National Resource Conservation Service
Openlands
Peggy Notebaert Nature Museum
Pizzo & Associates
United States Department of Agriculture
United States Environmental Protection Agency
United States Fish and Wildlife Service
United States Geological Survey
University of Illinois Extension

Local Resources

Equestrian Groups
Faith-based Organizations
Homeowners Associations
Kane County Drainage District
Kane County Farm Bureau
Kane County Forest Preserve District
Kane County Health Department
Kane County Soil & Water Conservation District
Libraries
Park Districts
Parks and Recreation Departments
Property Owners Associations
Sanitary Districts/Wastewater Treatment Plants
Schools
Scouting Organizations
Municipalities
Township Offices

Appendix D

Outreach List for Potential Ferson-Otter Creek Watershed Coalition Members

Campton Township, Highway Commissioner
Campton Township, Parks and Open Space Coordinator
Campton Township, Supervisor
City of Elgin, City Engineer
City of Elgin, City Manager
City of Elgin, Director of Community Development
City of Elgin, General Services Group Director for Public Works
City of Elgin, Mayor
City of Elgin, Parks and Recreation Coordinator
City of Elgin, Parks and Recreation Director
City of Elgin, Senior Engineer
City of St. Charles, City Administrator
City of St. Charles, Mayor
City of St. Charles, President
City of St. Charles, Project Coordinator - Mapping
City of St. Charles, Public Works Director
City of St. Charles, Public Works Engineering Manager
Deer Run East Property Owners Association
Elgin Community College, Managing Director of Facilities
Elgin Township, Supervisor
Forest Preserve District Kane County, Director of Natural Resources
Forest Preserve District Kane County, Executive Director
Fox River Study Group
Geosyntec Consultants
Illinois Department of Natural Resources (IDNR)
IDNR, Ecosystem Administrator
IDNR, Stream Specialist
Illinois State Water Survey
Judson University
Kane County, Board Member
Kane County Environmental Management, Facilities, Subdivisions, and Environmental Resources
Kane County Environmental Management, Subdivision/Project Manager
Kane County Environmental Management, Watershed Engineer
Kane County Farm Bureau, Director
Kane County Forest Preserve District, Director of Planning and Development
Kane County Forest Preserve District, Nature Programs Manager
Kane County, Board Chairman
Kane County, Development
Kane County, Development and Community Services Director
Kane County, Water Resources Director
Kane-DuPage Soil and Water Conservation District, Resource Conservationist
Lake Campton Property Owners Association
Lake Campton Residents
Natural Resources Conservation Service-Kane County
Pizzo and Associates
Private Landowners
St. Charles Park District, Superintendent of Parks and Planning
St. Charles Park District, Director of Parks and Recreation
St. Charles Park District, Manager of Natural Areas
St. Charles Park District, Manager of Nature Programs and Interpretive Services
St. Charles Township, Supervisor
Stony Creek Landowner
The Conservation Foundation Advisory Council Members
The Conservation Foundation Ambassadors
The Conservation Foundation Members
The Windings Subdivision
Thornwood Homeowners Association, President
Trotter and Associates

Village of Campton Hills, Environmental Resource Management Committee
Village of Campton Hills, Plan Commission Chairperson
Village of Campton Hills, Public Works Committee Chairperson
Village of Campton Hills, Village President
Village of Lily Lake, Village Clerk
Village of Lily Lake/ Engineering Resources Association
Village of South Elgin, Community Development Director
Village of South Elgin, Parks and Recreation Director
Village of South Elgin, Planner
Village of South Elgin, President
Village of South Elgin, Public Works Director
Village of South Elgin, Village Administrator
Wild Rose Subdivision
Wills Burke Kelsey Association
Witness Tree Native Landscapes, Inc.

Appendix E

List of Policy and Education and Outreach Recommendations

Recommendation: All Tier 1 landowners should apply or maintain protective measures including conservation easements (purchased or donated). 92

Recommendation: All Tier 2 landowners should incorporate low impact development (LID) best management practices when and if the land is developed. 94

Recommendation: Communities within the watershed should consult the established water quality best management practice resources such as from the Center for Watershed Protection and the USEPA before any retrofit activity. 96

Recommendation: Communities within the watershed that have not already done so should consider adopting Groundwater Protection ordinances. 97

Recommendation: Appropriate authorities within the watershed should establish voluntary local protection programs such as wellhead protection plans. 98

Recommendation: Appropriate entities should follow sensible salting measures within the watershed. 98

Recommendation: Residents within the watershed should install demand-initiated water softener in their households. For households that are currently using a timer-based water softener, when replacement is necessary, residents should replace with a demand-initiated water softener. 99

Recommendation: Local governments should review and revise current street sweeping practices and schedules to follow current best management practices. 99

Recommendation: All communities within the watershed should become WaterSense Promotional Partners. 101

Recommendation: All communities within the watershed and Kane County adopt portions or all of CMAP's Model Water Use Conservation Ordinance. 101

Recommendation: Livestock managers should implement livestock exclusion fencing to separate livestock from direct contact with streams. Developing an alternative water source could facilitate this exclusion. Heavy use area protections should also established to reduce erosion from livestock. 102

Recommendation: Agricultural landowners should adopt integrated nutrient and/or pest management plans that help to reduce nutrient and pesticide runoff to streams in the watershed planning area. .. 102

Recommendation: Cropland management practices such as rotational grazing, cover cropping and/or conservation tillage should be implemented to control erosion and reduce required nutrient applications. 103

Recommendation: Agricultural landowners should implement general best management practices like upland erosion controls, streambank or lake shore protection (e.g., filter strips), and/or wetland protection/restoration to protect water quality, in addition to agriculture-specific BMPs discussed above. 103

Recommendation: Local governments should adopt ordinances that incentivize: 106

- shared parking; 106
- decreased dimensions in residential driveways/parking areas;
- use of biorention for on-site stormwater treatment;
- development design that minimizes road width and length;
- flexible arrangements to meet parking standards.

Recommendation: Local governments should adopt ordinances that include: 107

- allowances for stormwater management BMPs and reductions in impervious cover;
- reduced setbacks, smaller lots, and cluster developments;

Recommendation: Local governments should adopt policies and incentives that: 107

- utilize existing infrastructure such as water and sewer;

- encourage compact, mixed use, and transit-orientated developments.

Recommendation: Local governments should consider a mandatory no-development buffer codes for critical areas such as wetlands, floodplains, lakes, streams, and rivers. 108

Recommendation: Local governments should adopt programs for tree protection and maintenance on public properties and right-of-ways, require tree replacement for trees lost during development, and implement tree planting initiatives. 108

Recommendation: Municipalities continue and/or begin to incorporate rain gardens, bioswales, native plantings, permeable pavers and low impact design. 108

Recommendation: The Village of Campton Hills and Kane County should adopt a pet waste pickup ordinance. 109

Recommendation: The Village of Campton Hills, the Village of Lily Lake, and Kane County should require or at least encourage cyclical septic system maintenance. 109

Recommendation: Livestock and equestrian landowners in the Village of Campton Hills and Kane County should be contacted and encouraged by local authorities or agencies (e.g., county Soil and Water Conservation Districts) to adopt manure management plans and livestock exclusion (from direct access to streams) practices. 109

Recommendation: The Ferson-Otter Creek Watershed Coalition as well as other interested parties will work with the local golf course management teams to move them towards becoming certified under the Audubon Cooperative Sanctuary Program. 110

Recommendations: The Ferson-Otter Creek Watershed Coalition should support: 116

- strategies to implement water science curriculums into classrooms and training opportunities for teachers that will increase their capacity to incorporate concepts of water science in their environmental education classrooms;
- growth of students' awareness of water-related employment opportunities and educational criteria.

Recommendation: The Watershed Quilt Program should be implemented in the Ferson-Otter Creek Watershed in the next five years. 117

Recommendation: The AITC program should be implemented or expanded in the Ferson-Otter Creek Watershed in the next 5 years. 117

Recommendation: Ferson-Otter Creek Watershed Coalition should participate in World Water Monitoring Day in the next three-five years. 117

Recommendation: The Ferson-Otter Creek Watershed Coalition should encourage participation in the program by each high school in the watershed in the next three-five years. 118

Recommendation: School districts and park districts within the Ferson-Otter Creek Watershed should implement the Mighty Acorns program within the next five years. 118

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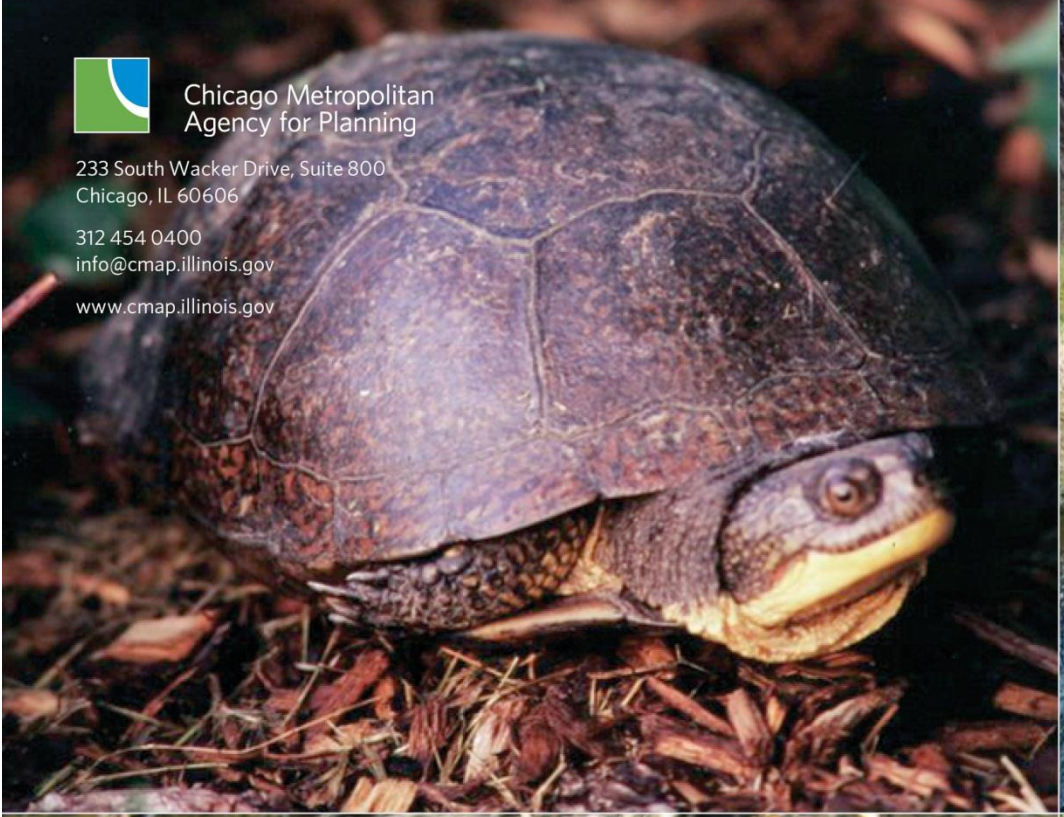
About CMAP

The Chicago Metropolitan Agency for Planning (CMAP) is the region's official comprehensive planning organization. Its GO TO 2040 planning campaign is helping the region's seven counties and 284 communities to implement strategies that address transportation, housing, economic development, open space, the environment, and other quality of life issues. See **www.cmap.illinois.gov** for more information.

Additional back cover photography: Blanding's Turtle - Jack Shouba, Campton Township, Deer Run East HOA; Mussel survey in Otter Creek - Rob Linke, FREP/FRSG/Deer Run Creek HOA



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