Chapter 4
ASSESSMENT OF STORMWATER CONDITIONS AND PROBLEMS

4.1 Introduction

In order to develop the countywide stormwater management program, knowledge of current conditions is needed. This chapter reviews the features and characteristics of Cook County as they relate to stormwater management including its watersheds (defined as all land drained by, or contributing water to, the same stream, lake or stormwater facility) and land uses. The findings in this chapter are from existing data and information for Cook County, Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR) watershed planning studies, and Illinois Environmental Protection Agency (IEPA) water quality data.

4.2 County Overview

Cook County includes 138 municipalities spanning 946 square miles. According to the Chicago Metropolitan Agency for Planning (CMAP) 2030 ***Forecasts of Population, Households and Employment*** report, Cook County is expecting a population growth of 10% over the next 24 years from its current population of 5.3 million. Projections show the number of households increasing by 13% and employment increasing by 17%. The Cook County municipalities showing the largest percentage of population, household and employment growth border three collar counties—Lake, DuPage and Will. With these growth patterns, an increase in construction and development is expected. Uniform countywide standards developed as part of a countywide stormwater management program can address stormwater and watershed issues that can be expected with the County's continued growth.

4.3 Watershed Descriptions and Floodplains

This section describes the major watersheds in Cook County for the purpose of understanding existing and potential stormwater problems. The enacting legislation, Public Act 93-1049 (Act), in which authority was granted to the District for the responsibilities of stormwater management for Cook County, identifies the following six primary watersheds for the Chicago Metropolitan Area:

1. North Branch Chicago River
2. Lower Des Plaines Tributaries
3. Calumet-Sag Channel
4. Little Calumet River
5. Poplar Creek

6. Upper Salt Creek

A Watershed Planning Council was formed after the passage of the Act for each of the above watersheds. In addition, the Act requires a stormwater management planning council be created for the combined sewer areas of Cook County. The combined sewer area is the conglomeration of all combined sewer areas within Cook County, rather than a geographical feature of the county as are the six watersheds listed above. The combined sewer area encompasses a significant portion of the City of Chicago and overlaps areas of four of the six primary watersheds listed above. There are no combined sewer areas in the Poplar Creek and Upper Salt Creek watersheds.

The following sections provide a brief description for each of the six primary watersheds. The figures cited below for average annual flood damages for each primary watershed were obtained from the October, 1998 publication of "Our Community and Flooding."

4.3.1 North Branch Chicago River

The North Branch Chicago River watershed area is approximately 180 square miles. The river originates in Lake County and flows south through northeastern Cook County. The North Branch Chicago River watershed area in Cook County is approximately 160 square miles, which includes over 50 miles of rivers and creeks. Average annual flood damages for the entire watershed were estimated to be $2,995,000. Eight flood control projects have been completed within the watershed by IDNR-OWR, United States Army Corps of Engineers (USACE), Natural Resources Conservation Service (NRCS), the District, and the Lake County Stormwater Management Commission. The approximate boundaries of the North Branch Chicago River watershed are shown in Figure 4-1.

4.3.2 Lower Des Plaines Tributaries

The Des Plaines River originates in Wisconsin and flows south through Cook County. The entire Des Plaines River watershed is 681 square miles. The Des Plaines River has been divided into two planning areas, the Upper Des Plaines watershed (from the Wisconsin headwater to Libertyville in Lake County) and the Lower Des Plaines Tributaries watershed (from Libertyville to Riverside). The Lower Des Plaines Tributaries watershed is nearly fully urbanized throughout Cook County. The Lower Des Plaines Tributaries watershed area in Cook County (excluding Upper Salt Creek watershed area) is approximately 330 square miles, with 250 miles of rivers and creeks. Average annual residential and business flood damages have been estimated to be $21,400,000 for the upper and lower portions of the watershed. Forty flood control projects have been completed within the watershed by IDNR-OWR, USACE, NRCS, the District, DuPage County Stormwater Management Committee, Lake County Stormwater Management Commission and the City of Chicago. The approximate boundaries of the Lower Des Plaines Tributaries watershed are shown in Figure 4-2.

4.3.3 Calumet-Sag Channel

The Calumet-Sag Channel originates in Cook County and accepts the flows from the Little Calumet River. The channel is located in southern Cook County and has historically served barge traffic through heavy industrial zones. The Calumet-Sag Channel watershed area is approximately 126 square miles (excluding the Little Calumet watershed area), with over 25 miles of rivers and creeks. Estimated average annual damages were approximately

$2,646,000 for residences and businesses. There have been 11 major flood control projects within the Calumet-Sag Channel watershed that have been completed by IDNR-OWR and the District. Exhibit 4-3 shows the approximate boundaries of the Calumet-Sag Channel watershed.

4.3.4 Little Calumet River

The Little Calumet River watershed originates in northwest Indiana. The Little Calumet River flows west into the Calumet-Sag Channel in Cook County. The Little Calumet River watershed area in southern Cook County is approximately 200 square miles, with over 100 miles of rivers and creeks. Average annual flood damages for residential and business properties have been estimated at $5,835,000. There have been 15 major flood control projects completed within the Little Calumet River watershed that have been completed by NRCS, USACE, IDNR-OWR, the District and the Cook County Highway Department (CCHD). The approximate boundaries of the Little Calumet River watershed are depicted in Exhibit 4-4.

4.3.5 Poplar Creek

The Poplar Creek watershed area in northwestern Cook County is approximately 40 square miles, with 26 miles of rivers and creeks. Poplar Creek flows generally west through Cook County until it reaches Kane County and its confluence with the Fox River. Between residential and business damages, estimated average annual flood damages were $125,000. There have been four major flood control projects within the Poplar Creek watershed that have been completed by IDNR-OWR and the District. Exhibit 4-5 shows the approximate boundaries of the Poplar Creek watershed.

4.3.6 Upper Salt Creek

Salt Creek originates in Cook County and flows south towards DuPage County. This portion of the Salt Creek watershed is considered Upper Salt Creek. The Upper Salt Creek watershed area in northwestern Cook County is approximately 52 square miles, with 17 miles of rivers and creeks. Estimated average annual residential and business flood damages were $46,000. There have been nine major flood control projects within the Upper Salt Creek watershed that have been completed by NRCS, IDNR-OWR and the District. The approximate boundaries of the Upper Salt Creek watershed are shown in Exhibit 4-6.

4.4 Soil Erosion and Sediment Control

Soil erosion and sediment control have become a concern in Cook County among regulatory agencies and municipalities alike. Sediment can cause stormwater infrastructure failure as well as jeopardize water quality within streams. Examples of causes of soil erosion are described below.

4.4.1 Construction Activities

Uncontrolled soil erosion from construction activities can generate large quantities of sediment. Measurements of sediment yields in streams have indicated that watersheds under development contribute 5 to 200 times as much sediment as stable urbanized watersheds (IEPA, 1987). The conveyance of eroded sediment offsite can cause severe problems downstream. These problems may include:

- Loss of Floodwater Conveyance and Storage – Excess sediment from construction sites can deposit and fill in roadways, storm sewers, ditches, detention basins, wetlands, streams and river channels, eliminating storage and conveyance capabilities, and damaging vegetation. This accumulated sediment can cause or exacerbate drainage and flood problems. Removal of deposited sediment can be expensive.

- Water Quality Impairment – Sediment from construction sites reduces water clarity that can limit the presence of game fish and reduce sunlight penetration, thereby limiting photosynthesis of aquatic plants. Sediment wash-off from roadways transfers nutrients and pollutants to downstream lakes and rivers, degrading habitats by burying natural substrates which causes damage to spawning areas of aquatic organisms. This increases water supply treatment costs where the water body is a source of drinking water.

- Safety and Nuisance Problems – Sediment on roadways, conveyed either by wash-off from construction sites or tracked by construction traffic, can be a hazard. Dust generated at uncontrolled construction sites is a nuisance, depositing on neighboring properties, clogging air filters, and aggravating respiratory difficulties.

4.4.2 Streambank Erosion

Erosion and deposition of sediment within a stream are natural processes. In a stable stream, erosion and deposition are generally in equilibrium, and stream characteristics remain relatively constant over time. The processes of erosion and deposition can be greatly accelerated as watersheds urbanize, causing stream characteristics to change rapidly while adjusting to the changing hydrologic conditions. Vegetation surrounding the stream and within the stream's watershed plays a critical role in erosion. Streambank erosion tends to originate at the toe when there is shallow-rooted or no vegetation to reduce the velocity of flow and protect the bank. Vegetation binds the soil together, and is needed to support a steep bank slope. For the vegetation to be effective in protecting streambanks, roots must extend deeply into the soil. Shallow root systems associated with lawns do not extend more than a few inches deep, binding only the top layer of soil and doing little to prevent bank failure.

Excessive woody vegetation, such as buckthorn thickets, suppresses the growth of desirable herbaceous groundcover that stabilizes the soil.

Armoring streams with hard materials, such as rip-rap, gabion baskets or concrete lining can solve local erosion problems, but the materials are generally not natural looking. These techniques may cause increased downstream erosion due to increased channel flow velocity. Armoring alone tends to transmit flow energy downstream rather than absorb the energy as vegetation will. An alternative to armoring streams can be to employ bioengineering methods. The method selected will be dependent on many factors, including flow velocity. For example, bioengineering methods may not be appropriate for streams with a high velocity of flow.

Excessive streambank erosion creates water quality and infrastructure concerns. In urban areas, severe streambank erosion can result in loss of adjacent property, threaten the structural stability of adjacent structures, and reduce habitat value.

New developments and redevelopments should be encouraged to restore, to the extent possible, eroded stream sections within the project area to their original condition to decrease streambank erosion.

4.5 Effects of Urban Development and Redevelopment

Urban development has characterized much of Cook County's history. Much of this development occurred many years ago, and redevelopment of urban areas is now common. Urban development and its associated stormwater runoff directly and indirectly affect water bodies and other valuable natural features both during and after construction. Some of these impacts occur from modifying or filling in streams, lakes and wetlands. Other impacts occur downstream of developments, resulting from changes in the quality and quantity of stormwater runoff. Some common impacts of urban development and redevelopment are listed below:

4.5.1 Development Activity in Streams, Lakes and Wetlands

Although less common due to current local regulations, some developments directly impact water bodies and wetlands. Development activity may include conversion of wetlands to detention basins, dredging of wetlands to create open water, removal of native vegetation, and elimination of adjacent buffers. Some streams are channelized, rerouted, or conveyed through extended culverts. These activities destroy critical aquatic habitats and impair other valuable environmental functions. These impacts are summarized below:

- Destruction of Aquatic and Terrestrial Habitat – Draining, straightening, filling and dredging of natural water bodies and wetlands adversely affect habitat for fish and wildlife. While natural streams help to preserve water quality, replenish water tables, and help maintain wetland hydrology, channelized streams tend to have the opposite effects.

- Loss of Habitat Diversity – In addition to short-term effects caused by construction, a reduction in habitat diversity is often long term as spawning and breeding areas are eliminated. Construction activities might address streambank erosion with stabilization technologies, but not the habitat needs of aquatic life and wildlife.

- Water Quality Impairment – As discussed in Section 4.4, construction activities within water bodies and wetlands can affect water quality. The long-term effects of construction activities relate primarily to the elimination of vegetation and other natural materials. The typical consequences of these alterations include reduced shading and an increase in water temperature, reduced capacity for pollutant filtering, and an increased propensity for soil instability and erosion.

- Alterations of Natural Storage and Conveyance – State and federal regulations place constraints on the degree of alteration in floodplains and wetlands, but even permitted activities can have adverse impacts by altering the function of a stream or wetland. Typical consequences include reduction in stream roughness and length caused by channel modifications and loss of stormwater storage caused by draining or filling of small wetlands and depressions.

With the increasing trend in Cook County to tear down aging buildings and redevelop the site, there are opportunities for restoring floodplains and wetlands. Rather than maintaining negative conditions that development has caused in a floodplain or wetland, redevelopment can create an opportunity for additional setback buffers or native restoration. The importance of redeveloping with an emphasis on stormwater management is further discussed in Section 7.11.

4.5.2 Changes to Runoff Rates and Volumes

Developments alter runoff patterns by converting pervious land to impervious land, as well as by changing the lay of the land and drainage patterns. When this results in a shift of groundwater-dominated hydrology to surface water-dominated hydrology, a dramatic increase in the rate and volume of stormwater runoff and a reduction in groundwater recharge also result. Along with changing land cover and layout, construction activities compact soils, smooth natural grades, diminish native vegetation, and add storm sewers and lined channels that convey greater volumes of runoff downstream at much faster rates. Changing runoff rates and volumes can create these typical impacts:

- Increase in Flooding – Without stormwater detention, flow rates have been shown to increase by 100 to 200 percent or more as a watershed is urbanized. Although detention basins can essentially eliminate increases in flow rates, cumulative increases in runoff volumes over the entire watershed decrease detention effectiveness.

- Stream Channel Erosion – Without the detention basins, increased rates of runoff create higher channel velocities, leading to destabilization of streambanks. The impacts are compounded as more development occurs in a watershed.

- Hydrologic Destabilization of Streams – Development generally results in higher and more frequent storm flows, and in dry seasons, lower flows of longer duration. The more frequent the high flows and accompanying high velocities, the more natural substrates and bottom dwelling organisms are flushed away. Reduced low flows tend to concentrate stream pollutants and reduce the stream depths on which aquatic life relies. Extended low flows can result in higher summertime water temperatures that further stress aquatic life. Previously perennial streams may dry up, killing resident organisms.

By implementing alternative development methods, the increase in runoff rates and volumes for a development may be minimized. This is further discussed in Section 7.9.

4.5.3 Degraded Quality of Runoff

Construction activities degrade the water quality of the runoff itself, causing increases in pollutants such as sediment, heavy metals, petroleum-based hydrocarbons, nutrients, pesticides, chlorides, bacteria, and oxygen-demanding organic matter.

Much of the pollutant load in runoff originates from impervious surfaces, particularly roadways and parking lots, and is related to automobile traffic. Higher density developments such as commercial, industrial and highway projects tend to contribute higher pollutant loads than lower-density residential developments. Another important factor that changes the level of pollutants in runoff from developments is the loss of natural filtering functions of the site.

Some common water quality impacts of stormwater runoff:

- Sediment Contamination – The bottom substrates of water bodies can become coated with a layer of contaminated sediment. The pollutants in the sediment may be toxic to some sensitive organisms due to elevated concentrations of pesticides, heavy metals and petroleum based organic compounds. These pollutants tend to attach to the smallest particles, the ones most readily entrained and transported by runoff and the most difficult to remove from it. Urban runoff sediments may have a high organic content that exerts a high oxygen demand as it decomposes in receiving water bodies.

- Nutrient Enrichment – Pollutant loads of phosphorus and nitrogen in urban runoff are substantially higher than in runoff from undeveloped lands. High levels of these nutrients in lakes and slow moving rivers can stimulate excessive growth of algae and other undesirable aquatic plants. This growth can impair aesthetics, water quality, and recreational uses of the water body.

- Toxicity to Aquatic Life – Pollutant concentrations in urban runoff often exceed water quality standards. Although data are not conclusive in showing that these pollutants occur in concentrations acutely toxic to aquatic life, evidence indicates adverse impacts from chronic exposure and accumulation of pollutants in the tissue of sensitive organisms. High water temperatures and low dissolved oxygen levels may increase the toxicity problem. Dissolved oxygen may be reduced to low levels by the decomposition of organic matter that is washed into the water by storm events, especially in summer.

- Bacterial Contamination – After storm events, the water quality standard for fecal coliform bacteria is frequently violated in urban water bodies. The violation of this standard generally reflects the presence of significant animal or human waste in the water, and is commonly used as a criterion for closing swimming beaches.

- Salt Contamination – Salts used for deicing roads can result in extremely high salinity levels in storm sewers, roadside ditches and downstream water bodies. While salinity levels are typically not high enough to be acutely toxic to fish and other aquatic organisms, they may adversely affect sensitive plant communities, particularly wetland species.

- Impaired Aesthetic Conditions – Urban runoff carries refuse and other discarded matter that may impair the visual appeal and clarity of receiving water bodies. Apart from sediment, trash and debris, this includes suspended solids, oil and grease that reduce the recreation potential of urban water bodies.

- Elevated Water Temperatures – Watershed urbanization causes increases in summertime temperatures of receiving streams. This effect is due to a number of factors, including the removal of natural shading and the reduction of baseflows. Runoff from impervious surfaces that have been heated by the sun raises the temperature. When streams are destabilized, the elevated water temperatures stress aquatic life and exacerbate water quality problems.

4.6 Flooding

Flooding is the primary motivator for preparing watershed plans and initiating countywide stormwater programs and projects.

Historical flooding prompted legislation for other northeastern Illinois counties and Public Act 93-1049. One such flood was the July 1996 flood that resulted from extremely heavy rainfall over northern Will County and the southern portions of Kane, DuPage, and Cook counties. The heaviest rainfall was centered over Aurora where 16.9 inches of rainfall was reported in less than 24 hours. This is the second highest rainfall ever recorded anywhere in the United States, excluding areas affected by hurricanes. Many of the creeks and rivers in northeastern Illinois reached record high stages. Over 400 residences were reported to have experienced first floor flooding.

Floods are a natural occurrence; flood damage is not. Floods create flood damages only when they cause destruction by inundating developed areas. Floods damage buildings and infrastructure, threaten health and safety, destroy agricultural crops, and disrupt business and traffic. Flooding is not limited to mapped floodplains. Flooding in Cook County can be caused from different sources and can happen any time of the year. Some examples of flooding include:

- Overbank flooding – The most common and most damaging floods occur along Cook County's rivers and streams. This is commonly called overbank flooding. This type of flooding occurs when flow in the stream exceeds the stream's capacity and flood waters spill into the floodplain. In highly urbanized areas of the county, flash flooding can occur where impervious surfaces, gutters and storm sewers speed runoff to the streams. Overbank flooding can cause property damage to structures built in the floodplain or near floodplains.

- Localized Drainage-Related Flooding – Many flooding problems occur from localized drainage problems. These problems are usually caused by heavy local rains and are often not related to overbank flooding or floodplain locations. In isolated depressional areas where water ponds with no gravity outlet, the area will remain flooded until the saturated ground drains and accepts additional water or the water evaporates. This problem is often exacerbated by high water tables where only a small amount of runoff can infiltrate into the ground.

  Other localized drainage problems stem from areas where flood routes are not well defined or have become blocked. Many subdivisions are designed with a reliance on side-yard or rear-yard swales that become filled or blocked by fences, gardens, pools and other incidental structures and landscaping. These obstacles lower the effectiveness of overland flow routes. Due to the relatively flat topography of Cook County and the level of urbanization, localized flooding is common.

- Combined Sewer Overflow – Combined sewer systems accept stormwater runoff in addition to normal sanitary flow. The combined flow can surcharge and backup into basements and roadways, and can overflow into water bodies, creating health and pollution risks.

  To prevent flooding within combined sewer areas, the District developed the Tunnel and Reservoir Plan (TARP). TARP consists of two phases, the tunnels (Phase I), which are a water pollution control project, and the reservoirs (Phase II), associated primarily with urban flood control. There are approximately 109 miles of tunnels ranging in size between 9 feet and 33 feet in diameter constructed 150 to 350 feet below grade. The tunnels intercept combined sewage from existing overflow points and convey the water to pumping stations. The pumps direct the flow to treatment plants where the water is treated before being discharged into adjacent waterways. There are three flood control reservoirs associated with TARP, O'Hare CUP Reservoir, Thornton Composite Reservoir, and McCook Reservoir. These three reservoirs will have a combined storage volume of approximately 47,850 ac-ft of flood storage upon completion.

Flooding must be distinguished from flood damages. Flooding is a natural, regularly occurring phenomenon. The aim of the countywide stormwater management program is to allow floods to occur while flood damage to property is minimized.

4.7 Water Quality and Water Body Use Impairment

Significant data is available from IDNR-OWR and IEPA on stream and water quality in Cook County. The information on stream and lake quality in the findings was generally taken from the April 2006 Illinois Integrated Water Quality Report and Section 303(d) List prepared by IEPA.

IEPA developed the list in Section 303(d) to:

- Identify waters that will not attain applicable water quality standards with technology-based controls alone.
- Identify waters for which controls on thermal discharges are not stringent enough to achieve water quality standards for the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife.
- Establish a priority ranking for such waters, taking into account the severity of pollution and the uses to be made of such waters.
- Target waters for development of Total Maximum Daily Loads (TMDLs) that should be initiated before the next biennial reporting period.

The list is updated every two years, with stretches of water added or subtracted based on an IEPA prioritization. The assessment of streams is based on a combination of data—chemical (water, sediment and fish tissue), physical (habitat and flow discharge), and biological (macroinvertebrate, macrophyte, algal and fish). Once a water body has been identified on the list with a high priority, a TMDL must be developed for each pollutant. Although every watershed named in Public Act 93-1049 is identified on the 303(d) list, only Upper Salt Creek has a TMDL.

The TMDL sets the pollutant reduction goal necessary to improve impaired waters. IEPA develops computer models with the sampling data to determine the amount of specific pollutants each source contributes, calculates the amount that each pollutant must be reduced, and specifies how the reduced pollutant load would be allocated among the different sources. An implementation plan can be developed for the watershed describing the actions necessary to achieve the goals, specifying limits for point source discharges and recommending Best Management Practices (BMPs) for non-point sources.

Common pollutants found in Cook County watersheds and their potential sources are summarized in Table 4.1. The IEPA 2006 report lists at least one stretch of the main branch river for all six Cook County watersheds. The 303(d) list is further summarized in Appendix B. It is expected during the development of the Detailed Watershed Plans (DWPs), a summary of this information will be provided.

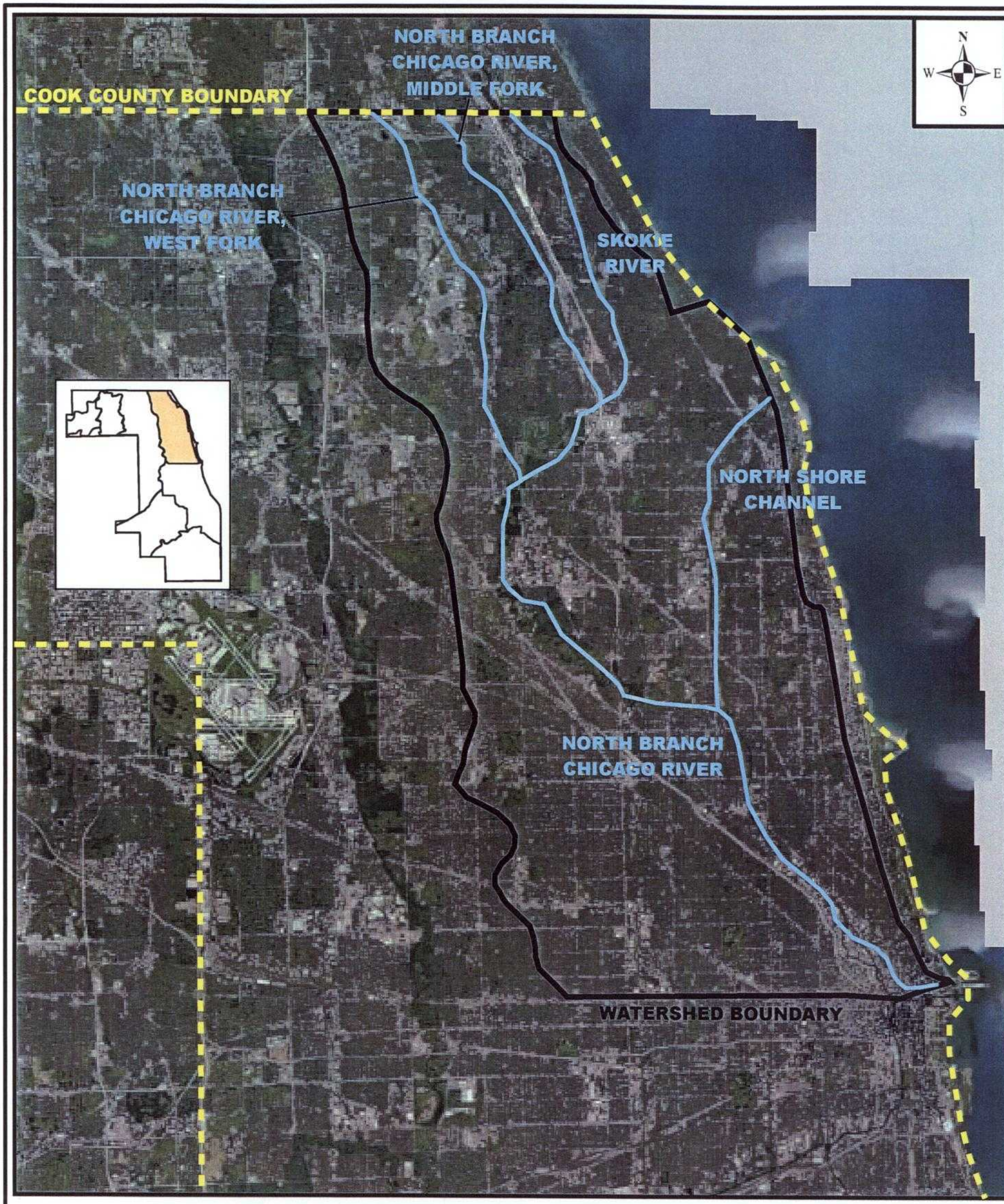
Table 4.1 Common Pollutants from Section 303(d) Listings for Cook County Watersheds

Pollutant	Potential Source
Total Dissolved Solids	highway/road/bridge runoff (non-construction related), urban runoff/storm sewers, combined sewer overflows, municipal point source discharges, sanitary sewer overflows
Total Suspended Solids	combined sewer overflows, sanitary sewer overflows, site clearance (land development or redevelopment), urban runoff/storm sewers
Sedimentation/Siltation	combined sewer overflows, sanitary sewer overflows, site clearance (land development or redevelopment), urban runoff/storm sewers
Dissolved Oxygen	channelization, combined sewer overflows, upstream impoundments, impacts from hydrostructure flow regulation, sanitary sewer overflows
Nitrogen (Total)	combined sewer overflows, municipal point source discharges, sanitary sewer overflows
Phosphorus (Total)	combined sewer overflows, sanitary sewer overflows, municipal point source discharges, urban runoff/storm sewers
Chlorine	combined sewer overflows, highway/road/bridge runoff (non-construction related), municipal point source discharges, urban runoff/storm sewers
Iron	combined sewer overflows, industrial point source discharges, municipal point source discharges, urban runoff/storm sewer
Silver	combined sewer overflows, municipal point source discharges, urban runoff/storm sewers, contaminated sediments
DDT	contaminated sediments
Heptachlor	contaminated sediments
Hexachlorobenzene	contaminated sediments
Aldrin	contaminated sediments

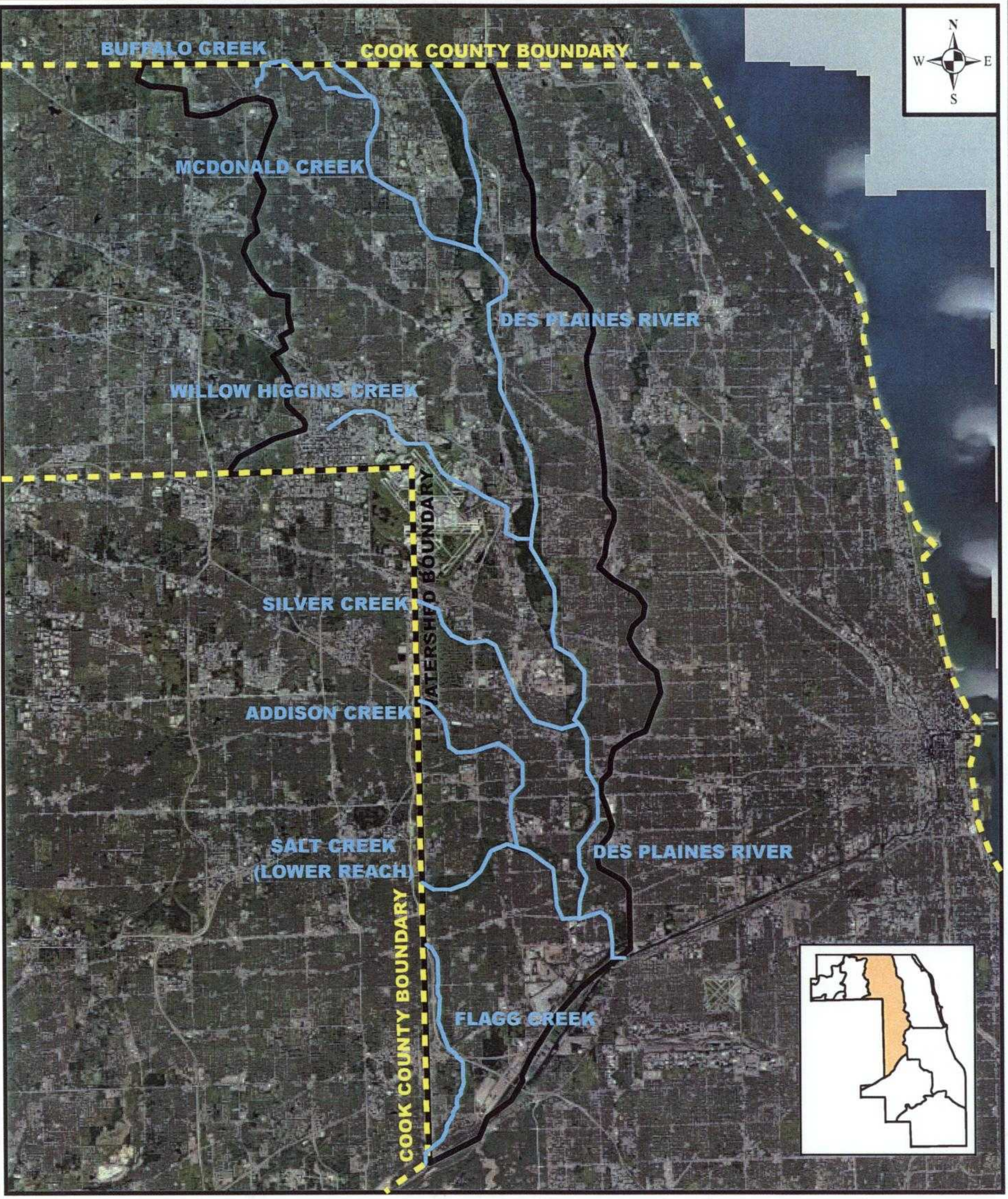
There is a strong relationship between stream quality and the level of urbanization in Cook County. The data suggests that stream quality has declined as urbanization has increased, and progressive new development standards should be encouraged that address the quantity and quality of runoff from urban development. Water quality standards will better protect the habitat of streams and wetlands to preserve high quality streams and protect their beneficial uses in the face of future urbanization and redevelopment.

4.8 Summary

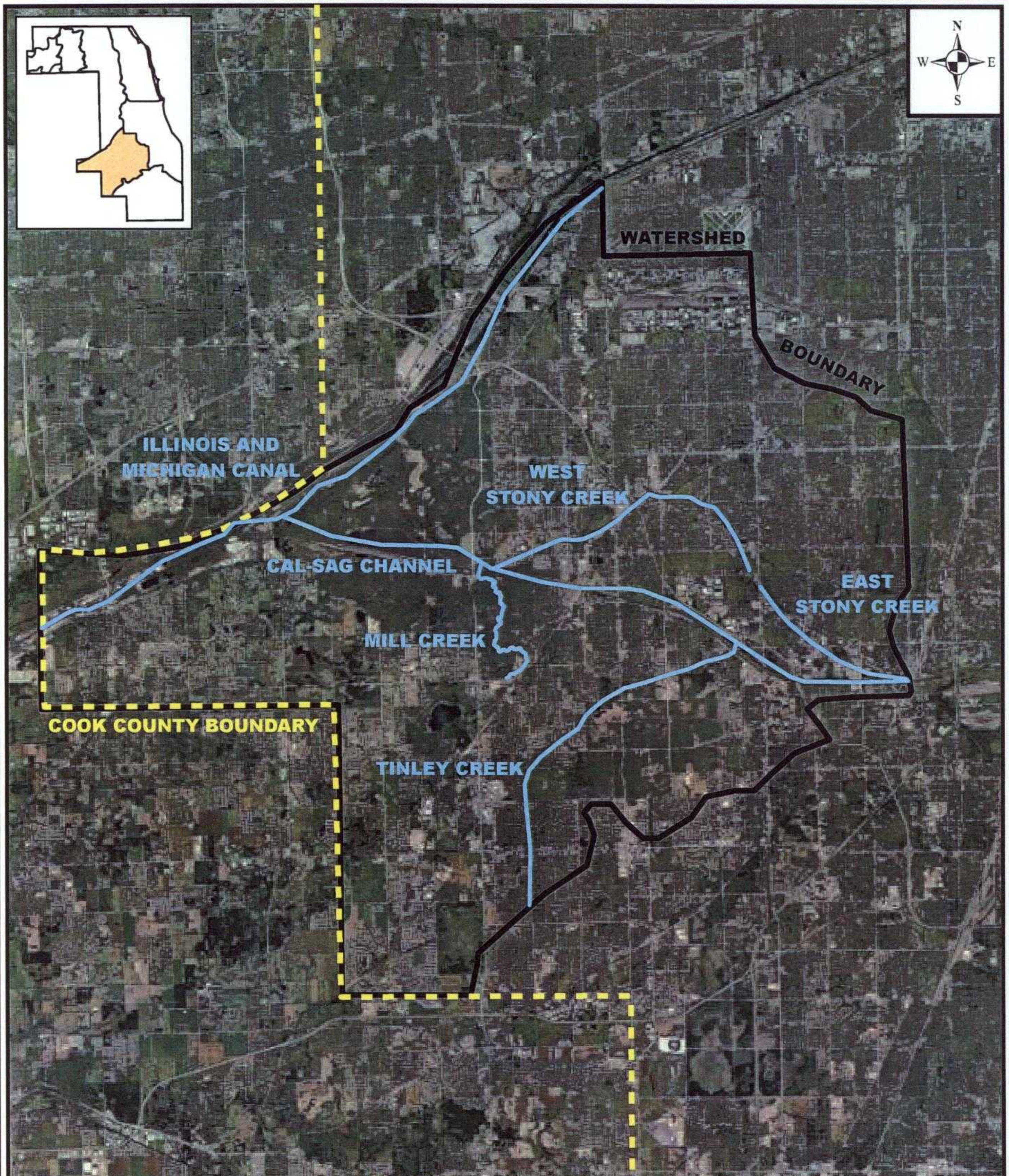
Significant flooding problems are generally limited to urbanized areas of Cook County though soil erosion, sedimentation and water quality problems are countywide. Without adequate stormwater controls, these problems are likely to continue as the county population grows, rural lands diminish, and developed areas continue to redevelop.



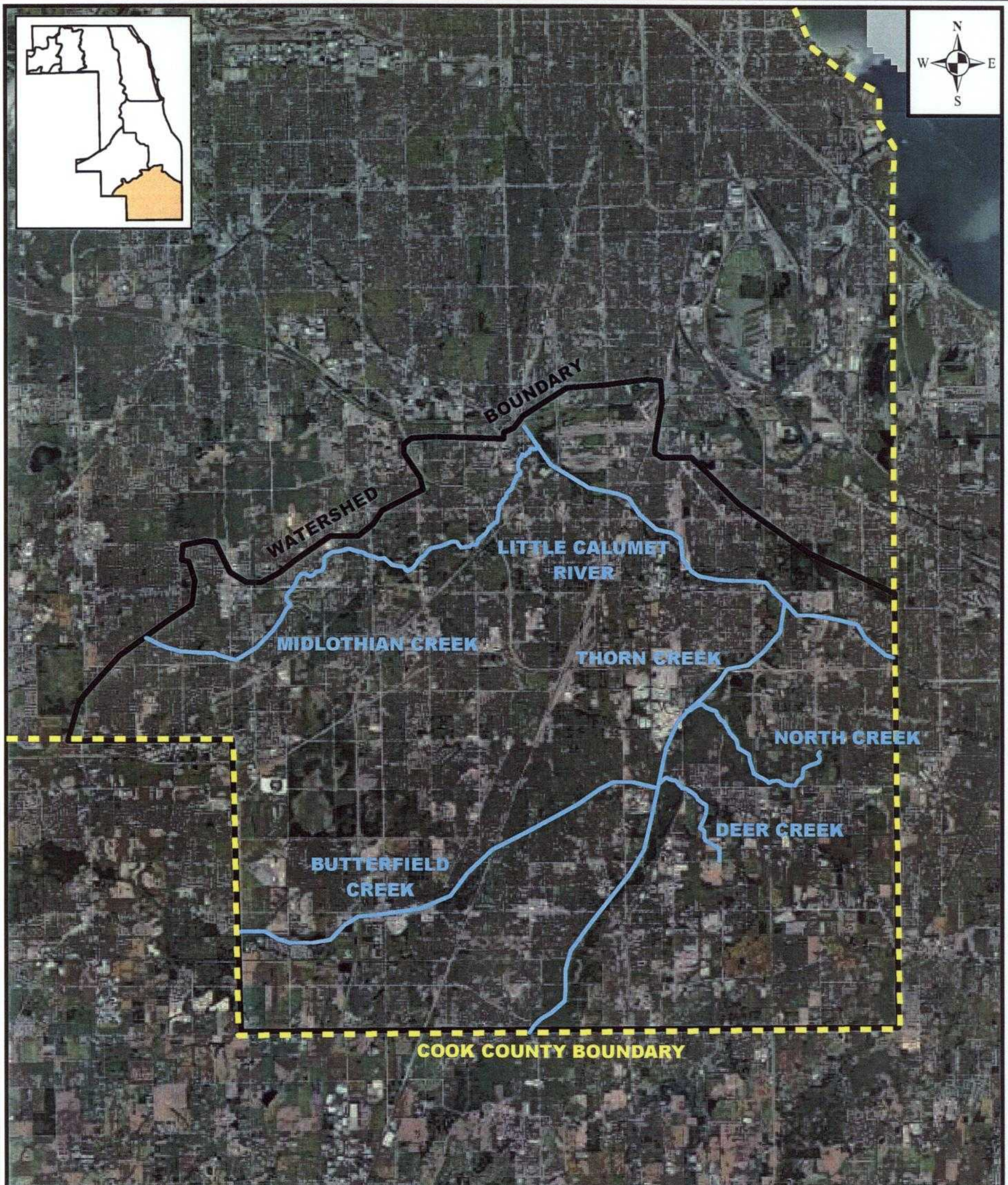
COOK COUNTY STORMWATER MANAGEMENT PLAN	NORTH BRANCH CHICAGO RIVER WATERSHED	EXHIBIT 4-1



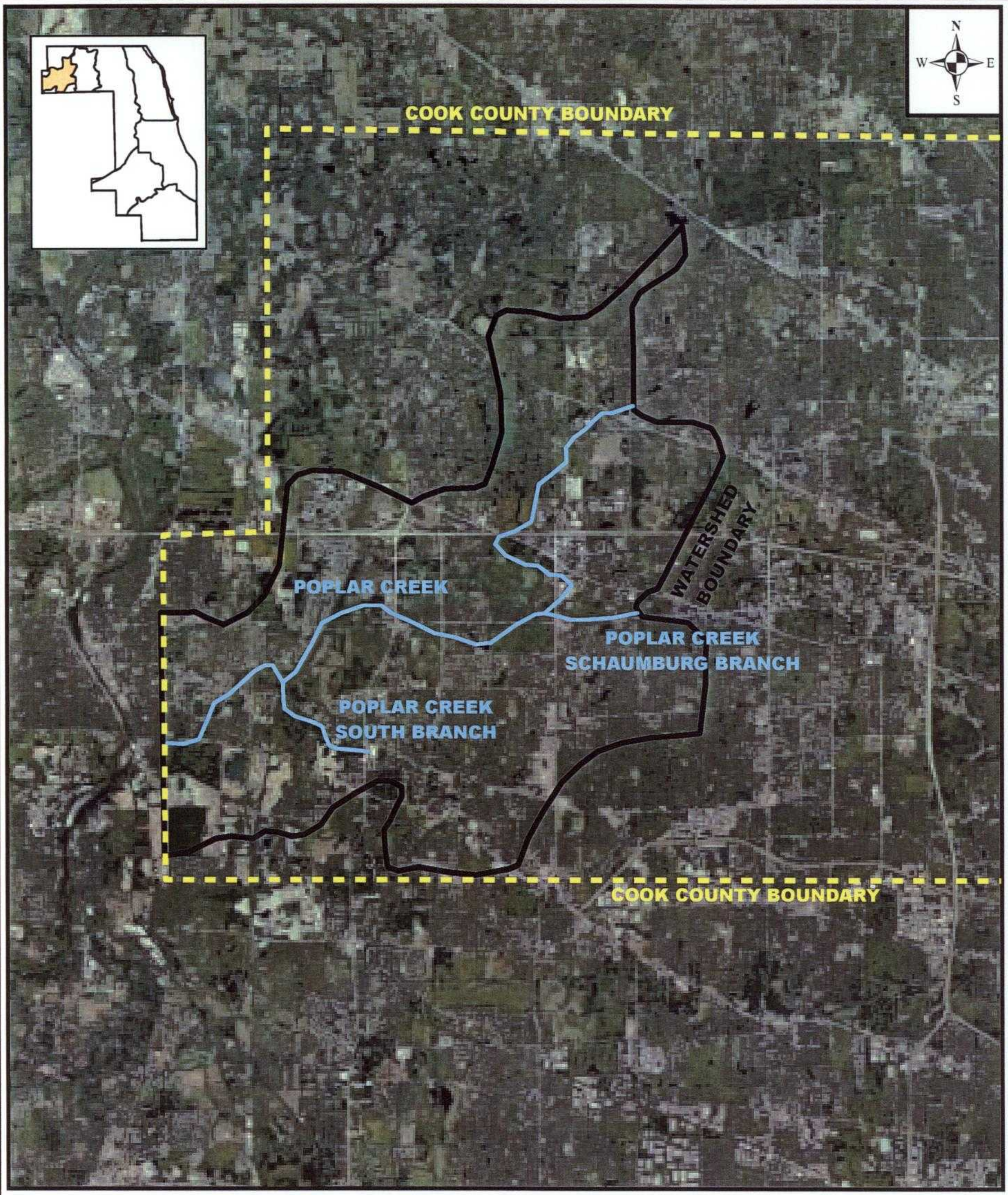
COOK COUNTY STORMWATER MANAGEMENT PLAN	LOWER DES PLAINES RIVER WATERSHED	EXHIBIT 4-2



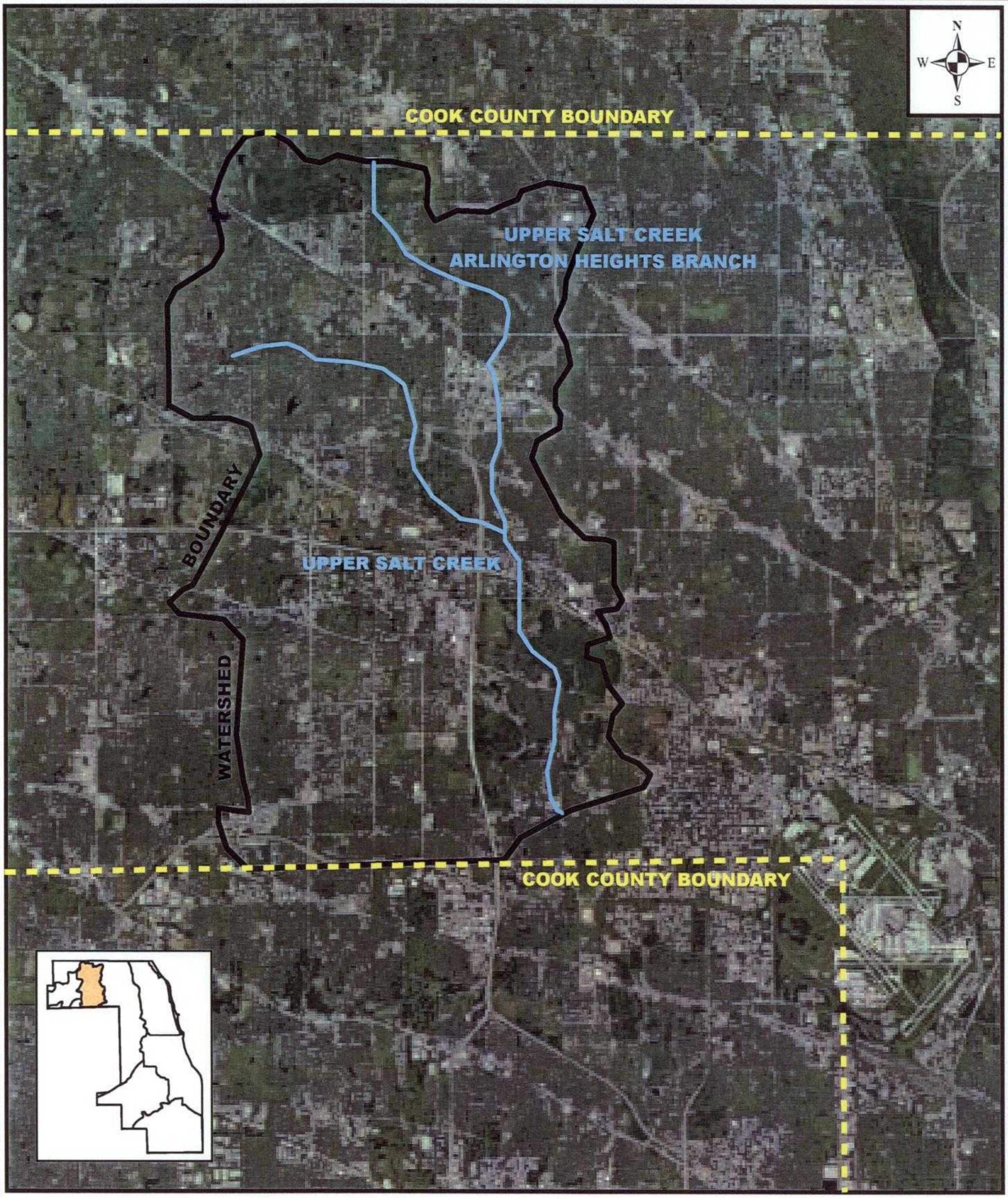
COOK COUNTY STORMWATER MANAGEMENT PLAN	CAL-SAG CHANNEL WATERSHED	EXHIBIT 4-3



COOK COUNTY STORMWATER MANAGEMENT PLAN	LITTLE CALUMET RIVER WATERSHED	EXHIBIT 4-4



COOK COUNTY STORMWATER MANAGEMENT PLAN	POPLAR CREEK WATERSHED	EXHIBIT 4-5



COOK COUNTY STORMWATER MANAGEMENT PLAN	UPPER SALT CREEK WATERSHED	EXHIBIT 4-6