# Watershed Resource Inventory and Assessment

## 3.1 Introduction

An understanding of the unique features and natural processes associated with the East Branch South Branch Kishwaukee River watershed (including Virgil Ditch and Union Ditch), as well as the current and potential future condition, is critical to developing an effective watershed-based plan. This watershed inventory and assessment organizes, summarizes, and presents available watershed data in a manner that clearly communicates the issues and processes that are occurring in the watershed so that stakeholders living the East Branch South Branch Kishwaukee River watershed can make informed decisions about the watershed's future.

As part of the preparation of the Watershed Resource Inventory and Assessment, the DeKalb County Watershed Steering Committee collected and reviewed available watershed data, conducted an investigation of stream reaches in the field, and gathered input from watershed stakeholders. Examples of information investigated includes water quality, streambank erosion, soils, wetlands, flood damage areas, the detention and drainage system, population, and current and future land use.

Geographic Information System (GIS) software was used to compile, analyze, and display this detailed information in graphical and map format so that stakeholders can easily understand the condition and location of watershed resources. The amounts of different pollutants that are expected from various land uses to enter the East Branch South Branch Kishwaukee River was also investigated.

This chapter presents the results of the inventory and analysis in a series of maps, tables, graphs, and narrative format. A summary of the watershed assessment is included at the end of the chapter.

## 3.2 Watershed Setting

The East Branch South Branch Kishwaukee River watershed is located in east-central DeKalb County and southwestern Kane County (Figure 3-1). The East Branch South Branch Kishwaukee River is a major tributary to the South Branch Kishwaukee River in DeKalb County, with the confluence about one mile west of Shabbona. The watershed drains approximately 123 square miles of land into the South Branch Kishwaukee River. The South Branch Kishwaukee River continues to flow west to its confluence with the Kishwaukee River. From this confluence, the Kishwaukee River flows westward through Rockford before joining the Rock River. The Rock River flows to the southwest before joining the Mississippi River in the Quad Cities area (Moline, Illinois; Rock Island, Illinois, Davenport, Iowa; and Bettendorf, Iowa).

## 3.3 Water Resources

The East Branch South Branch Kishwaukee River watershed can be divided into 3 primary subwatersheds: Virgil Ditch, Union Ditch, and the East Branch South Branch Kishwaukee

River (Figure 3-2). The Virgil Ditch subwatershed finds its headwaters in northwestern Kane County and flows south into Union Ditch. The Union Ditch system generally flows west from Kane County into DeKalb County and flows into the East Branch South Branch Kishwaukee River. As noted above, the East Branch South Branch Kishwaukee River is a major tributary to the South Branch Kishwaukee River.

Collectively, there are 72.7 stream miles in the East Branch South Branch Kishwaukee River watershed: 21.3 miles attributed to East Branch South Branch Kishwaukee River, 13.7 miles of Virgil Ditch and 37.7 miles of Union Ditch. Available data indicates that 2,475 acres of wetlands are located within the East Branch South Branch Kishwaukee River watershed. There is one major surface impoundment in the watershed: Sycamore Lake. Sycamore Lake is 7.5 acres in size and is located within the East Branch South Branch Kishwaukee River subwatershed.

The streams and ditches within the East Branch South Branch Kishwaukee River Watershed have undergone significant changes since the time of European settlement in the late 1800s. Two hundred years ago, much of the watershed would have been comprised of wetlands and very few defined stream channels. The United States Township plat book survey for Virgil Township dated June 1877 indicates that Virgil Ditch #2 and Virgil Ditch #3 did not extend as stream channel north of the Town of Virgil. Additionally, Virgil Ditch #1 is not shown. Presumably, the watershed upstream of Town of Virgil was a wetland slough, falling gradually as it flowed westerly and southwesterly. The presence of the wetlands made agriculture difficult due to the presence of standing water. According to information provided by Kane County, the first recorded right-of-way for the construction of a portion of the Virgil Ditch system was issued to the Drainage Commissions of the Virgil Ditch Drainage District #1 of the Town of Virgil on October 31, 1883. Subsequent right-of-way permits were issued and a large percentage of the watershed's wetlands were filled and the ditches were installed to drain water away from agricultural fields. By the time the 1937 United States Geological Survey (USGS) Topographic Map was prepared, Virgil Ditches #1, #2, and #3 and Union Ditch #4 are shown in their current configuration.

Similarly in the DeKalb County portion of the watershed, significant alterations were made to the watershed in the late 1800s to early 1900s. On the Map of Cortland Township dated 1871, Union Ditch #1, Union Ditch #3, and the East Branch South Branch Kishwaukee River are shown in an alignment similar to what is present today. A wetland complex is identified in the current location of Union Ditch #2. By 1892, excavation of Union Ditch #2 had begun near the current location of downtown Maple Park. A large wetland complex was still present north of Maple Park separating Union Ditch #2 and Union Ditch #3. By 1908, the wetland complex had been drained and Union Ditch #2 flowed directly into Union Ditch #3. Also by 1908, Union Ditch #1, Union Ditch #2, Union Ditch #3, and the East Branch South Branch Kishwaukee River were shown in their current configuration.

## 3.4 Geology/Topography

During the Pleistocene Era or "Ice Age" advancing and receding glaciers covered much of North America. The Illinoian glacier extended to southern Illinois between 300,000 and 125,000 years ago. It is the Illinoian glacier that is responsible for the flat, farm-rich areas in the southern half of the state. The northeastern portion of Illinois including the study watershed area was also covered by the most recent glacial event known as the Wisconsinan. The Wisconsinan began approximately 70,000 years ago and ended around 14,000 years ago. It was during this time that the temperatures began to rise and the ice retreated to form a landscape similar to the Alaskan tundra. As the temperatures began to rise, the tundra was replaced by cool moist deciduous forests, and eventually oak-hickory forests and prairies. The final retreat of the Lake Michigan lobe of the Wisconsin glacier is responsible for the formation of the Great Lakes and the landscape of the watershed. This landscape contains moraines, flood plains, bogs, outwash plains, lake plains, beaches, stream terraces, kames, ridges, and kettle holes (wetlands, ponds, and lakes).

The soils found in the watershed have been derived from Wisconsin Age glacial tills, glacial outwash, loess, and alluvium. The surface soil layer and subsoils found in the watershed are typically a silty clay loam. Underlying material is generally clay loam with strata of sand and gravel. The bedrock beneath is Ordovician Age assigned to the Maquoketa and Galena Groups.

Topography refers to the elevations of landscape that describes the configuration of its surface. Topography is an essential tool in the watershed planning process because topography defines the boundaries of the East Branch South Branch Kishwaukee River watershed. For this watershed-based plan, the Online Watershed Delineation (HYMAPS-OWL) tool, created by Department of Agriculture and Biological Engineering at Purdue University was use to create the initial subwatershed boundaries. The subwatershed (also referred to as subbasin) boundaries generated by HYMAPS-OWL were then cross referenced with boundaries obtained by inputting 2-foot topography into the GIS-based model, Arc Hydro. This combined data generated a Digital Elevation Model (DEM) that was used to delineate and refine the watershed and subwatershed boundaries for East Branch South Branch Kishwaukee River including the Union Ditch and Virgil Ditch watersheds. Inconsistencies in the two model's delineations were adjusted to reflect real-world conditions and more accurately depict the hydrologic boundaries. Most of these inconsistencies occurred in areas divided by roadways that were not accounted for the in the model. Figure 3-3 depicts the DEM and boundary of East Branch of the South Branch Kishwaukee River watershed.

The East Branch South Branch Kishwaukee River watershed generally drains from east to west to the South Branch Kishwaukee River.

## 3.5 Climate and Precipitation

### 3.5.1 Climate

Illinois is situated midway between the Continental Divide and the Atlantic Ocean and is often times underneath the polar jet-stream. The polar jet-stream is a focal point for movement between cold polar air masses from the north moving southward and warmer, tropical air from the south moving northward. The convergence of polar and tropical air causes Illinois to have a humid continental climate with hot humid summers and cool to cold winters with short frequent fluctuations in wind direction, cloudiness, humidity, and temperature.

Data collected in Sycamore, Illinois best represents the overall climate and weather patterns experienced in the watershed. The average annual temperature for the watershed is 54°F. The winter months (December – February) are cold with an average temperature of 31°F with the lowest temperature on record of -27°F recorded in 1985. There is an average of 100 annual days below freezing. The summer months are hot and humid with an average temperature of 81.3°F. The highest temperature on record for Sycamore, Illinois is 103°F recorded in 1988. The prevailing winds are west-northwest from November through May and south-southwest from June through October.

### 3.5.2 Precipitation

Average yearly precipitation for Illinois varies from just over 48 inches at the southern tip of the state to just under 32 inches in the northern portion of the state. May and June are the wettest months of the year. Flooding is the most damaging weather hazard within the state. Increased warming within urban heat islands leads to an increase in rainfall downwind of cities. Lake Michigan leads to an increase in winter precipitation along its south shore due to lake effect snow forming over the relatively warm lakes. Normal annual snowfall exceeds 38 inches in Chicago, and the southern portion of the state normally receives less than 14 inches. Storms exceeding the normal winter value are possible within one day. In summer, the relatively cooler lake leads to a more stable atmosphere near the lake shore, reducing rainfall potential. Illinois averages around 50 days of thunderstorm activity a year which put it somewhat above average for number of thunderstorm days for the United States. Illinois is also vulnerable to tornadoes with an average of 35 occurring annually.

The average annual rainfall for the watershed is 35.3 inches. Average snowfall for the area is 31 inches. The wettest month of the year is June with an average rainfall of 4.49 inches.

## 3.6 Soils

Deposits left during by the Lake Michigan lobe of the Wisconsin glacier are the raw materials of the soils currently found in the East Branch South Branch Kishwaukee River watershed. A combination of biological, physical, and chemical variables such as climate, drainage patterns, vegetation, and topography have all interacted together to form the soils found today.

Soil properties are key components to consider when designing and implementing water quality and flood reduction Best Management Practices (BMPs). Some soils are saturated for extended periods of time throughout the year and become what are referred to as hydric soils. Hydric soils generally hold water or infiltrate water very slowly. These properties are the reason why tiles are found utilized in areas with hydric soils and through the breaking of these tiles, wetland hydrology may be able to be restored.

Soils also exhibit different infiltration capabilities. Knowing the infiltration capabilities of the watershed's soils will allow for the proper placement of infiltration BMPs, as well as the location of wetland creation/restoration projects and detention basins.

Soils also exhibit differences in erodibility depending on their composition and slope. Erodibility of soils is especially important on construction sites where improper installation and maintenance of soil erosion and sediment control practices can lead to the release of sediment into creeks and lakes.

The 2004 DeKalb County and 2003 Kane County Natural Resource Conservation Services' (NRCS) Soil Survey were used to conduct a soil analysis for the watershed. The data was used to map the soil series, extent of hydric soils, soil susceptibility to erosion, and the infiltration capacity.

### 3.6.1 Soil Series

Soils are identified by a name associated with each series or class of soils with similar characteristics. A soil series is commonly derived from a town or landmark in or near the areas where the soil series was first identified, although sometimes naming conventions vary by county. Soil series are differentiated based on the amounts and size of particles making up the soil, water-holding capacity, the slopes where they are located, permeability characteristics, and organic content.

Tables 3-1 through 3-3 and Figures 3-4 through 3-6 list the dominant soil series located within the watershed by major subwatersheds: East Branch South Branch Kishwaukee River, Union Ditch and Virgil Ditch.

**Table 3-1** Soil Series in the East Branch South Branch Kishwaukee River Subwatershed

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 512B | Danabrook silt loam | - | MODERATE | B | 3158.49 | 13.04% |
| 356A | Elpaso silty clay loam | Yes | MODERATE | B/D | 3031.58 | 12.51% |
| 152A | Drummer silty clay loam | Yes | MODERATE | B/D | 2911.39 | 12.02% |
| 348B | Wingate silt loam | - | MODERATE | B | 1880.87 | 7.76% |
| 154A | Flanagan silt loam | - | MODERATE | B | 1511.69 | 6.24% |
| 3076A | Otter silt loam | Yes | MODERATE | B/D | 1396.60 | 5.77% |
| 171B | Catlin silt loam | - | MODERATE | B | 1075.67 | 4.44% |
| 193B | Mayville silt loam | - | HIGH | B | 770.22 | 3.18% |
| 62A | Herbert silt loam | - | MODERATE | B | 675.57 | 2.79% |
| 198A | Elburn silt loam | - | MODERATE | B/D | 656.41 | 2.71% |
| 662B | Barony silt loam | - | MODERATE | B | 607.36 | 2.51% |
| 667A | Kaneville silt loam | - | MODERATE | B | 554.52 | 2.29% |
| 221B2 | Parr silt loam | - | MODERATE | B | 527.17 | 2.18% |

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 656B | Octagon silt loam | - | MODERATE | B | 495.59 | 2.05% |
| 667B | Kaneville silt loam | - | MODERATE | B | 417.62 | 1.72% |
| 104A | Virgil silt loam | - | MODERATE | B | 397.39 | 1.64% |
| 668B | Somonauk silt loam | - | HIGH | B | 386.92 | 1.60% |
| 219A | Millbrook silt loam | - | MODERATE | B | 348.29 | 1.44% |
| 221C2 | Parr silt loam | - | MODERATE | B | 331.04 | 1.37% |
| 668A | Somonauk silt loam | - | HIGH | B | 292.07 | 1.21% |
| 662A | Barony silt loam | - | MODERATE | B | 274.97 | 1.14% |
| 67A | Harpster silty clay loam | Yes | MODERATE | B/D | 266.71 | 1.10% |
| 60C2 | La Rose loam | - | MODERATE | B | 215.83 | 0.89% |
| 512C2 | Danabrook silt loam | - | MODERATE | B | 206.35 | 0.85% |
| 865 | Pits, gravel | - | - | - | 175.36 | 0.72% |
| 656C2 | Octagon silt loam | - | MODERATE | B | 159.00 | 0.66% |
| 59A | Lisbon silt loam | - | MODERATE | B | 156.02 | 0.64% |
| 348A | Wingate silt loam | - | MODERATE | B | 145.80 | 0.60% |
| 171A | Catlin silt loam | - | MODERATE | B | 123.08 | 0.51% |

There are 56 soil series found in the East Branch of the South Branch Kishwaukee River subwatershed. Of these 56, 29 are considered dominant soil types (greater than 0.5% of the watershed). The remaining 27 soils have been classified as "non-dominant soils". The "non-dominant" soils cover 4.44% of the East Branch of the South Branch Kishwaukee River subwatershed.

Danabrook silt loam is the predominant soil type in the watershed, covering 3158.49 acres or approximately 13.09% of the watershed. Elpaso silty clay loams are the next most dominant soil series covering approximately 12.51% or 3031.58 acres of the watershed. The majority of the soils located in the watershed are well drained, non-hydric soils. Native plant communities in the watershed were likely comprised of prairie grasses, forest, woodlands, and savannas.

**Table 3-2** Soil Series in the Union Ditch Subwatershed

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 152A | Drummer silty clay loam | Yes | MODERATE | B/D | 8558.63 | 23.00% |
| 356A | Elpaso silty clay loam | Yes | MODERATE | B/D | 2577.00 | 6.93% |
| 512B | Danabrook silt loam | - | MODERATE | B | 2403.38 | 6.46% |
| 193B | Mayville silt loam | - | HIGH | B | 1314.04 | 3.53% |
| 154A | Flanagan silt loam | - | MODERATE | B | 1239.37 | 3.33% |
| 3076A | Otter silt loam | Yes | MODERATE | B/D | 1236.85 | 3.32% |
| 667B | Kaneville silt loam | - | MODERATE | B | 1236.34 | 3.32% |
| 662B | Barony silt loam | - | MODERATE | B | 1235.57 | 3.32% |
| 104A | Virgil silt loam | - | MODERATE | B | 1073.11 | 2.88% |
| 668B | Somonauk silt loam | - | HIGH | B | 1053.87 | 2.83% |
| 656B | Octagon silt loam | - | MODERATE | B | 973.89 | 2.62% |
| 149A | Brenton silt loam | - | MODERATE | B | 805.09 | 2.16% |
| 198A | Elburn silt loam | - | MODERATE | B/D | 793.76 | 2.13% |
| 667A | Kaneville silt loam | - | MODERATE | B | 764.52 | 2.05% |
| 656C2 | Octagon silt loam | - | MODERATE | B | 743.66 | 2.00% |
| 219A | Millbrook silt loam | - | MODERATE | B | 703.44 | 1.89% |
| 103A | Houghton muck | Yes | - | A/D | 669.86 | 1.80% |
| 348B | Wingate silt loam | - | MODERATE | B | 660.17 | 1.77% |
| 62A | Herbert silt loam | - | MODERATE | B | 639.59 | 1.72% |
| 171B | Catlin silt loam | - | MODERATE | B | 509.10 | 1.37% |
| 662A | Barony silt loam | - | MODERATE | B | 491.29 | 1.32% |
| 512C2 | Danabrook silt loam | - | MODERATE | B | 440.71 | 1.18% |
| 663A | Clare silt loam | - | MODERATE | B | 437.91 | 1.18% |
| 527B | Kidami silt loam | - | MODERATE | B | 434.19 | 1.17% |
| 59A | Lisbon silt loam | - | MODERATE | B | 358.29 | 0.96% |

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 668A | Somonauk silt loam | - | HIGH | B | 340.43 | 0.91% |
| 330A | Peotone silty clay loam | Yes | MODERATE | C/D | 322.68 | 0.87% |
| 527C2 | Kidami loam | - | MODERATE | B | 312.72 | 0.84% |
| 67A | Harpster silty clay loam | Yes | MODERATE | B/D | 306.15 | 0.82% |
| 171A | Catlin silt loam | - | MODERATE | B | 303.15 | 0.81% |
| 663B | Clare silt loam | - | MODERATE | B | 297.83 | 0.80% |
| 134C2 | Camden silt loam | - | HIGH | B | 281.99 | 0.76% |
| 221B2 | Parr silt loam | - | MODERATE | B | 250.54 | 0.67% |
| 680B | Campton silt loam | - | HIGH | B | 242.12 | 0.65% |
| 221C2 | Parr silt loam | - | MODERATE | B | 210.08 | 0.56% |
| 512A | Danabrook silt loam | - | MODERATE | B | 203.51 | 0.55% |

There are 90 soil series found in the Union Ditch subwatershed. Of these 90, 36 are considered dominant soil types (greater than 0.5% of the watershed). The remaining 54 soils have been classified as "non-dominant soils". The "non-dominant" soils cover 7.49% of the Union Ditch subwatershed.

Drummer silty clay is the predominant soil type in the watershed, covering 8558.63 acres or approximately 23% of the watershed. Elpaso silty clay loams are the next most dominant soil series covering approximately 6.95% or 2577 acres of the watershed. The majority of the soils located in the watershed are well drained, non-hydric soils. Native plant communities in the watershed were likely comprised of prairie and forested areas.

**Table 3-3** Soil Series in the Virgil Ditch Subwatershed

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 152A | Drummer silty clay loam | Yes | MODERATE | B/D | 5809.16 | 33.47% |
| 193B | Mayville silt loam | - | HIGH | B | 1346.62 | 7.76% |
| 668B | Somonauk silt loam | - | HIGH | B | 625.89 | 3.61% |
| 656B | Octagon silt loam | - | MODERATE | B | 591.85 | 3.41% |
| 149A | Brenton silt loam | - | MODERATE | B | 510.91 | 2.94% |

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 662B | Barony silt loam | - | MODERATE | B | 510.59 | 2.94% |
| 219A | Millbrook silt loam | - | MODERATE | B | 442.87 | 2.55% |
| 356A | Elpaso silty clay loam | Yes | MODERATE | B/D | 442.28 | 2.55% |
| 62A | Herbert silt loam | - | MODERATE | B | 379.14 | 2.18% |
| 656C2 | Octagon silt loam | - | MODERATE | B | 345.63 | 1.99% |
| 104A | Virgil silt loam | - | MODERATE | B | 337.41 | 1.94% |
| 59A | Lisbon silt loam | - | MODERATE | B | 314.48 | 1.81% |
| 527B | Kidami silt loam | - | MODERATE | B | 301.21 | 1.74% |
| 527C2 | Kidami loam | - | MODERATE | B | 281.82 | 1.62% |
| 134C2 | Camden silt loam | - | HIGH | B | 247.39 | 1.43% |
| 668A | Somonauk silt loam | - | HIGH | B | 245.58 | 1.41% |
| 193C2 | Mayville silt loam | - | HIGH | B | 229.72 | 1.32% |
| 527D2 | Kidami loam | - | MODERATE | B | 227.97 | 1.31% |
| 523A | Dunham silty clay loam | Yes | MODERATE | B/D | 204.42 | 1.18% |
| 696B | Zurich silt loam | - | HIGH | C | 203.52 | 1.17% |
| 67A | Harpster silty clay loam | Yes | MODERATE | B/D | 201.34 | 1.16% |
| 154A | Flanagan silt loam | - | MODERATE | B | 173.32 | 1.00% |
| 662A | Barony silt loam | - | MODERATE | B | 166.13 | 0.96% |
| 348B | Wingate silt loam | - | MODERATE | B | 155.59 | 0.90% |
| 512B | Danabrook silt loam | - | MODERATE | B | 155.18 | 0.89% |
| 526A | Grundelein silt loam | - | MODERATE | B | 150.66 | 0.87% |
| 369A | Waupecan silt loam | - | MODERATE | B | 140.71 | 0.81% |
| 791A | Rush silt loam | - | HIGH | B | 138.95 | 0.80% |
| 330A | Peotone silty clay loam | Yes | MODERATE | C/D | 137.50 | 0.79% |
| 198A | Elburn silt loam | - | MODERATE | B/D | 128.93 | 0.74% |
| 343A | Kane silt loam | - | MODERATE | B | 122.78 | 0.71% |
| 329A | Will loam | Yes | MODERATE | B/D | 121.20 | 0.70% |

| Soil Code | Soil Name | Hydric | Erosivity | Soil Group | Acreage | % of Subwatershed |
|---|---|---|---|---|---|---|
| 680A | Campton silt loam | - | HIGH | B | 120.54 | 0.69% |
| 667B | Kaneville silt loam | - | MODERATE | B | 106.90 | 0.62% |
| 792A | Bowes silt loam | - | MODERATE | B | 104.33 | 0.60% |
| 663A | Clare silt loam | - | MODERATE | B | 98.94 | 0.57% |
| 103A | Houghton muck | Yes | - | A/D | 94.73 | 0.55% |
| 680B | Campton silt loam | - | HIGH | B | 88.39 | 0.51% |
| 697A | Wauconda silt loam | - | MODERATE | B/D | 87.99 | 0.51% |

There are 85 soil series found in the Virgil Ditch subwatershed. Of these 85, 39 are considered dominant soil types (greater than 0.5% of the watershed). The remaining 46 soils have been classified as "non-dominant soils". The "non-dominant" soils cover 7.29% of the Virgil Ditch subwatershed.

Danabrook silt loam is the predominant soil type in the watershed, covering 5809.16 acres or approximately 33.47% of the watershed. Elpaso silty clay loams are the next most dominant soil series covering approximately 7.76% or 1346.62 acres of the watershed. The majority of the soils located in the watershed are well drained, non-hydric soils. Native plant communities in the watershed were likely comprised of prairies and forested areas.

### 3.6.2 Hydric Soils

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that are formed under conditions of saturation, flooding, or ponding and retain moisture long enough during the growing season to develop anaerobic (oxygen-deprived) conditions in the soil layers closest to the surface. Hydric soils are important because they indicate the presence of existing or historical wetlands and digressional areas. Thus areas of hydric soils may be suitable for wetland restoration. Often, drain tiles are found in areas of hydric soils but because the tiles are draining water away from the area, wetlands that were once present are no longer present. By breaking these tiles and restoring the natural flow of water to these areas, wetland hydrology can potentially be restored and with a properly designed excavation, planting and management plan, a high quality wetland can be established. Table 3-4 identifies the percent coverage of hydric soils in each subwatershed and Figure 3-7 displays the coverage of hydric soils.

**Table 3-4** Percent Coverage of hydric and non-hydric soils in the East Branch South Branch Kishwaukee River Watershed

| Soil | Total area (acres) | Percentage of Subwatershed |
|---|---|---|
| **East Branch South Branch Kishwaukee River Subwatershed** | | |
| Non-Hydric Soils | 16,617.65 | 68.6% |
| Hydric Soils | 7606.28 | 31.40% |
| Total | 24,223.93 | 100% |
| **Union Ditch Subwatershed** | | |
| Non-Hydric Soils | 23,539.96 | 63.26% |
| Hydric Soils | 13,671.16 | 36.74% |
| Total | 37,211.12 | 100% |
| **Virgil Ditch Subwatershed** | | |
| Non-Hydric Soils | 10,348.11 | 59.61% |
| Hydric Soils | 7,010.64 | 40.39% |
| Total | 17,358.75 | 100% |

### 3.6.3 Soil Erodibility

Soil erosion and sedimentation are significant causes of degraded water quality in Illinois. Soil erosion is the process in which soil is detached and moved by flowing water, wave action or wind. Through erosion, sediment is transported from its original location and deposited in a new location such as a stream, river, lake, or other ground surface. This deposition process is commonly referred to as sedimentation. The movement of eroded soils into streams, rivers, and lakes affects water quality chemically, biologically, and physically. Damage from sediment can be expensive both environmentally and economically. Over time, sediment deposits can blanket rock, cobble, and sandy substrate needed by fish and macroinvertebrates for habitat, food, and reproduction; reduce useful storage volumes in ponds, reservoirs, and lakes; and increase the need for costly water filtration systems for municipal drinking water supplies. Often times, the impacts of erosion and sedimentation are additive and the effects and costs of the sedimentation can be severe, both for those immediately affected and for those who must mitigate subsequent problems.

A map identifying the highly erodible soils in the watershed was created (Figure 3-8) by selecting soils that have been classified as highly erodible by the Natural Resource Conservation Service (NRCS). It is important to map the highly erodible soils because they represent those areas that have the highest potential to degrade water quality. As identified in Table 1-5, 10.06% (7,928.25 acres) of the watershed is comprised of highly erodible soils. This includes 5.98% (1,449.21 acres) of the soils within the East Branch South Branch Subwatershed, 8.69% (3,232.46 acres) of the soils within the Union Ditch Subwatershed, and 18.70% (3,246.58) of the soils in the Virgil Ditch Subwatershed. It should also be noted that all remaining dominant soils in each of the three subwatersheds are considered moderately erodible soils.

**Table 3-5** Highly erodible soils in the East Branch of the South Branch Kishwaukee River Watershed

| Soil Name | Soil Code | Acres | Percent of Subwatershed |
|---|---|---|---|
| **East Branch South Branch Kishwaukee River Subwatershed** | | | |
| 193B | Mayville silt loam | 770.22 | 3.18% |
| 668A | Somonauk silt loam | 292.07 | 1.21% |
| 668B | Somonauk silt loam | 386.92 | 1.60% |
| | Total | 1,449.21 | 5.98% |
| **Union Ditch Subwatershed** | | | |
| 134C2 | Camden silt loam | 281.99 | 0.76% |
| 193B | Mayville silt loam | 1314.04 | 3.53% |
| 668A | Somonauk silt loam | 340.43 | 0.91% |
| 668B | Somonauk silt loam | 1053.87 | 2.83% |
| 680B | Campton silt loam | 242.12 | 0.65% |
| | Total | 3,232.46 | 8.69% |
| **Virgil Ditch Subwatershed** | | | |
| 134C2 | Camden silt loam | 247.39 | 1.43% |
| 193B | Mayville silt loam | 1346.62 | 7.76% |
| 193C2 | Mayville silt loam | 229.72 | 1.32% |
| 668A | Somonauk silt loam | 245.58 | 1.41% |
| 668B | Somonauk silt loam | 625.89 | 3.61% |
| 680A | Campton silt loam | 120.54 | 0.69% |
| 680B | Campton silt loam | 88.39 | 0.51% |
| 696B | Zurich silt loam | 203.52 | 1.17% |
| | Total | 3,246.58 | 18.70% |

### 3.6.4 Soil Infiltration Capabilities (Hydrologic Soil Groups)

The permeability and surface runoff potential of the soils in the United States have been classified by the NRCS into Hydrologic Soil Groups (HSGs). HSGs are based on a soil's infiltration and transmission (or permeability) rates and are used by engineers to estimate runoff curve numbers. Runoff curve numbers are an estimate of runoff potential of different soil types with different land covers. The curve numbers allow engineers to estimate the approximate amount of direct runoff from a rainfall event in a particular area and design new development in that area in a way which stormwater runoff is controlled. HSGs are classified into four primary categories: A, B, C, and D, and three dual classes, A/D, B/D, and C/D.

- Group A is comprised of the most permeable soil types and have the lowest runoff potential. These soils consist of mainly deep, well drained to excessively drained sands or gravelly sands. Group A soils have a high rate of water transmission.
- Group B soils have a moderate infiltration rate and are moderately deep, moderately well drained or well drained with fine texture to moderately course texture (silt and sand). Group B soils have a moderate rate of water transmission.
- Group C soils have slow infiltration rates because of a fine texture soil layer comprised of silt and clay that impedes the downward migration of water. Group C soils have a slow rate of water transmission.
- Group D soils have the slowest infiltration rates and a high runoff potential. These soils are typically clay and exhibit very very slow rates of water transmission.

- Dual hydrologic groups (A/D, B/D, and C/D) are classified differently. The first letter represents the HSGs for the artificially drained soils in the area. The second letter represents the HSGs for the undrained, natural conditions. Only soils that are rate D in the natural conditions are assigned to dual classes.

The location of Group A and Group B soils within a watershed is imperative to a watershed planning process. Many of the BMPs included in watershed plans are infiltration BMPs including rain gardens, bioswales, and infiltration basins. Table 3-6 summarizes the HSGs and their corresponding attributes. Figure 3-9 depicts the location of each HSG within the watershed while Table 3-7 summarizes the acreage and percent of each subwatershed for each HSG. In summary, 93.28% of the soils in the East Branch of the South Branch Kishwaukee River watershed as Group B with 4.37% classified as Group B/D. The remaining 2.35% of soils are comprised of Group A, C, C/D, and unclassified soils. There are no Group A or D soils in the East Branch of the South Branch Kishwaukee River watershed.

**Table 3-6** Hydrologic Soil Groups and their corresponding attributes in the East Branch South Branch Kishwaukee River Creek watershed

| HSG | Soil Texture | Drainage Description | Runoff Potential | Infiltration Rate | Transmission Rate |
|---|---|---|---|---|---|
| A | Sand, loamy sand, or sandy loam | Well to excessively well drained | Low | High | High |
| A/D | Sand or silt loam to clay | Well drained to poorly drained | High to Low | High to Very Low | High to Very Low |
| B | Silt loam or loam | Moderately well to well drained | Moderate | Moderate | Moderate |
| B/D | Silt loam, silty clay loam, clay | Moderately well to poorly drained | Moderate to Low | Moderate to Low | Moderate to Very Low |
| C | Sandy clay loam | Somewhat poorly drained | High | Low | Low |
| C/D | Sandy clay loam, silty clay loam, clay | Somewhat poorly drained to poorly drained | High | Low to Very Low | Low to Very Low |
| D | Clay loam, silty clay loam, sandy clay loam, silty clay, clay | Poorly drained | High | Very Low | Very Low |

**Table 3-7** Hydrologic Soil Groups including acreage and percent of subwatershed

| HSG | Total Acreage | Percent of Watershed |
|---|---|---|
| **East Branch South Branch Kishwaukee River Subwatershed** | | |
| A | 0 | 0.00% |
| A/D | 24.37 | 0.10% |
| B | 15516.97 | 64.06% |
| B/D | 8262.69 | 34.11% |
| C | 54.07 | 0.22% |
| C/D | 90.81 | 0.37% |
| D | 0 | 0.00% |
| Unclassified | 275.02 | 1.14% |

| HSG | Total Acreage | Percent of Watershed |
|---|---|---|
| **Union Ditch Subwatershed** | | |
| A | 0 | 0.00% |
| A/D | 669.86 | 1.80% |
| B | 22081.91 | 59.34% |
| B/D | 13716.70 | 36.86% |
| C | 351.97 | 0.95% |
| C/D | 322.68 | 0.87% |
| D | 0 | 0.00% |
| Unclassified | 67.99 | 0.18% |
| **Virgil Ditch Subwatershed** | | |
| A | 2.06 | 0.01% |
| A/D | 112.50 | 0.65% |
| B | 9688.50 | 55.81% |
| B/D | 7159.08 | 41.24% |
| C | 244.60 | 1.41% |
| C/D | 137.50 | 0.79% |
| D | 0 | 0.00% |
| Unclassified | 14.51 | 0.08% |

As noted above, East Branch of the South Branch Kishwaukee River watershed is comprised mainly of Type B and B/D soils. Type B soils are soils with moderately low runoff potential when thoroughly wet. Water is typically transmitted through these soils without impediment. Type B soils typically have less than 20 percent clay, and between 50 and 90 percent loamy sand or sandy loam textures. These soils have moderately fine to moderately course textures. Type B/D soils are soils with a water table within 24 inches of the surface. When adequately drained, Type B/D soils exhibit properties of Type B soils. In undrained conditions, Type B/D soils exhibit the properties of Type D soil. Type D soils have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Type D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. The predominance of these Type B and B/D soils (when drained) in the East Branch of the South Branch Kishwaukee River watershed should facilitate infiltration in pervious areas.

## 3.7 Watershed Jurisdictions

Two counties, eight municipalities and eleven townships comprise the East Branch South Branch Kishwaukee River watershed (Table 3-8, Figure 3-10). Additional entities with jurisdiction in the watershed include:

1. DeKalb County Soil and Water Conservation District
2. Kane/DuPage County Soil and Water Conservation District
3. DeKalb County Board Districts (District 1, 3, 4, 8, 9, 10, and 11)
4. Kane County Board Districts (District 15, 25, and 26)
5. Illinois State Representative District (Districts 50, 65, 70, and 90)
6. Illinois State Senatorial District (Districts 25, 33, 35, and 45)
7. US Congressional District (Districts 14 and 15)

**Table 3-8** County, municipal, and township jurisdictions in the East Branch of the South Branch Kishwaukee River Watershed

| Jurisdiction | Square Miles in E Branch S Branch Kishwaukee River subwatershed | Square Miles in Union Ditch subwatershed | Square Miles in Virgil Ditch Subwatershed | Total Square Miles in Watershed | Percent of Watershed |
|---|---|---|---|---|---|
| **Counties** | | | | | |
| DeKalb | 37.83 | 21.98 | 0.59 | 60.40 | 49.1% |
| Kane | 0.02 | 36.16 | 26.54 | 62.72 | 50.9% |
| **Municipalities** | | | | | |
| Burlington | 0.00 | 0.00 | 1.73 | 1.73 | 1.41% |
| Campton Hills | 0.00 | 1.39 | 0.07 | 1.46 | 1.19% |
| Cortland | 1.95 | 1.58 | 0.00 | 3.53 | 2.87% |
| Elburn | 0.00 | 0.04 | 0.00 | 0.04 | 0.03% |
| Lily Lake | 0.00 | 1.30 | 0.00 | 1.30 | 1.06% |
| Maple Park | 0.00 | 2.25 | 0.00 | 2.25 | 1.83% |
| Sycamore | 8.56 | 0.00 | 0.00 | 8.56 | 6.95% |
| Virgil | 0.00 | 1.69 | 0.44 | 2.13 | 1.73% |
| **Townships** | | | | | |
| Afton | 0.00 | 1.17 | 0.00 | 1.17 | 0.95% |
| Burlington | 0.02 | 0.32 | 16.89 | 17.23 | 13.99% |
| Campton | 0.00 | 7.30 | 0.00 | 7.30 | 5.93% |
| Cortland | 17.41 | 16.12 | 0.07 | 33.59 | 27.29% |
| DeKalb | 0.00 | 1.10 | 0.00 | 1.10 | 0.90% |
| Kaneville | 0.00 | 0.32 | 0.00 | 0.32 | 0.26% |
| Mayfield | 0.78 | 0.00 | 0.00 | 0.78 | 0.63% |
| Pierce | 0.00 | 3.57 | 0.00 | 3.57 | 2.90% |
| Plato | 0.00 | 1.90 | 1.60 | 3.51 | 2.85% |
| Sycamore | 19.64 | 0.01 | 0.52 | 20.17 | 16.39% |
| Virgil | 0.00 | 26.32 | 8.05 | 34.36 | 27.91% |
| **Soil and Water Conservation Districts** | | | | | |
| DeKalb | 37.83 | 21.98 | 0.59 | 60.40 | 49.1% |
| Kane/DuPage | 0.02 | 36.16 | 26.54 | 62.72 | 50.9% |
| **Drainage Districts** | | | | | |
| Burlington #1 | not available | not available | not available | not available | not available |
| Burlington #2 | not available | not available | not available | not available | not available |
| Afton DeKalb | 0.00 | 0.32 | 0.00 | 0.32 | 0.26% |
| Coon Creek Drainage | 0.03 | 0.00 | 0.11 | 0.14 | 0.11% |
| Cortland Pierce Drainage #16 | 1.85 | 10.26 | 0.00 | 12.11 | 9.84% |
| Union Drainage | 0.00 | 14.86 | 0.36 | 15.22 | 12.36% |
| Virgil Courtland Drainage #15 | 2.57 | 6.41 | 0.00 | 8.98 | 7.29% |
| Virgil #1 | not available | not available | not available | not available | not available |
| Virgil #2 | not available | not available | not available | not available | not available |
| Virgil #3 | not available | not available | not available | not available | not available |

| Jurisdiction | Square Miles in E Branch S Branch Kishwaukee River subwatershed | Square Miles in Union Ditch subwatershed | Square Miles in Virgil Ditch Subwatershed | Total Square Miles in Watershed | Percent of Watershed |
|---|---|---|---|---|---|
| **DeKalb County Board Districts** | | | | | |
| 01 | 1.46 | 0.00 | 0.00 | 1.46 | 1.19% |
| 03 | 28.35 | 4.77 | 0.58 | 33.70 | 27.37% |
| 04 | 5.00 | 0.00 | 0.00 | 5.00 | 4.06% |
| 08 | 1.93 | 0.00 | 0.00 | 1.93 | 1.57% |
| 09 | 0.00 | 0.05 | 0.00 | 0.05 | 0.04% |
| 10 | 0.63 | 3.58 | 0.00 | 4.21 | 3.42% |
| 11 | 0.45 | 13.56 | 0.00 | 14.01 | 11.38% |
| **Kane County Board Districts** | | | | | |
| 15 | 0.00 | 4.53 | 0.00 | 4.53 | 3.68% |
| 25 | 0.02 | 24.86 | 26.54 | 51.42 | 41.77% |
| 26 | 0.00 | 6.77 | 0.00 | 6.77 | 5.50% |
| **Illinois General Assembly Districts** | | | | | |
| 50 | 0.00 | 2.81 | 0.00 | 2.81 | 2.29% |
| 65 | 0.00 | 0.00 | 0.14 | 0.14 | 0.12% |
| 70 | 37.85 | 53.58 | 26.98 | 118.41 | 96.18% |
| 90 | 0.00 | 1.75 | 0.00 | 1.75 | 1.42% |
| **Illinois Senate Districts** | | | | | |
| 25 | 0.00 | 2.81 | 0.00 | 2.81 | 2.29% |
| 33 | 0.00 | 0.00 | 0.14 | 0.14 | 0.12% |
| 35 | 37.85 | 53.58 | 26.98 | 118.41 | 96.18% |
| 45 | 0.00 | 1.75 | 0.00 | 1.75 | 1.42% |
| **US House of Representative Districts** | | | | | |
| 1714 | 32.41 | 55.88 | 27.12 | 115.41 | 93.75% |
| 1716 | 5.71 | 2.26 | 0.00 | 7.97 | 6.25% |

*One Watershed: Multiple Decision Makers*

As watershed boundaries do not typically follow political boundaries, one of the greatest challenges faced during watershed planning and implementing a watershed plan is that watersheds typically include multiple jurisdictions that have varying interests, resources, and responsibilities. Actions by one jurisdiction in the watershed impact others in watershed both negatively and positively. By actively working together, jurisdictions within the watershed can ensure that that goals, objectives, and projects outlined in the watershed plan are considered in each of the jurisdiction's decision making process on policies, projects, and programs.

As part of the watershed planning process, the DeKalb County Watershed Steering Committee was formed. The DeKalb County Watershed Steering Committee has been successful in bringing together representatives from the counties, municipalities, townships, Drainage Districts, and SWCDs. Additionally, the DeKalb County Watershed Steering Committee includes watershed residents. Ensuring that the DeKalb County Watershed Steering Committee or a similar watershed council continues to be active after the watershed planning process is complete is a necessity to provide a venue for communication, coordination, and collaboration between the multiple watershed jurisdictions and ensure the implementation of the watershed plan.

Key stakeholders in the watershed are listed in Table 3-9. A brief description of each stakeholder's role in watershed-plan implementation is also included.

**Table 3-9** Key Watershed Stakeholders

| Watershed Stakeholders | Abbreviation |
|---|---|
| Corporate and Business Landowners | CBL |
| Counties | C |
| DeKalb County Community Foundation | DCCF |
| DeKalb County Forest Preserve | DCFP |
| DeKalb County Stormwater Management Committee | DCSMPC |
| DeKalb County Watershed Steering Committee | DCWSC |
| Developers and Builders | DB |
| Drainage Districts | DD |
| Educational Institutions | EI |
| Federal Emergency Management Agency | FEMA |
| Forest Preserve District of Kane County | FPDKC |
| Golf Courses | GC |
| Illinois Department of Natural Resources | IDNR |
| Illinois Department of Transportation | IDOT |
| Illinois Emergency Management Agency | IEMA |
| Illinois Environmental Protection Agency | Illinois EPA |
| Kishwaukee Ecosystem Partnership | KREP |
| Municipalities | MUN |
| Park Districts | PD |
| Residents/Owners | RO |
| Soil Water Conservation Districts | SWCD |
| US Army Corps of Engineers | USACE |
| US Department of Agriculture | USDA |
| US Environmental Protection Agency | US EPA |
| US Fish and Wildlife Service | US FWS |

**Corporate and Business Landowners (CBL)**

The active participation of CBLs in the planning process can lead to positive impacts on the quality of the East Branch South Branch Kishwaukee Creek Watershed. Businesses and commercial properties can become involved by retrofitting existing detention basins and swales, managing their grounds, roof runoff, and parking lots to reduce stormwater runoff volume and pollutant loadings, and sponsoring watershed events. Coordination with the CBL community can also lead to new development designed to minimize runoff and pollutant loadings.

**Counties (C) including DeKalb and Kane**

The Counties are responsible for land use planning, development, natural resource protection, and drainage system management in the unincorporated areas of the East Branch South Branch Kishwaukee Creek Watershed. Working with the Counties and their public works, development, water resources, health, and transportation departments, can help ensure responsible, sustainable land use planning, road and sewer maintenance, and public health policies for the watershed.

**DeKalb County Community Foundation (DCCF)**

The DeKalb County Community Foundation is committed to providing tools and resources to enhance land use planning within the County through a watershed-based approach and provided the local cash match for the watershed-based planning grant. DCCF holds a position on the DeKalb County Watershed Steering Committee. The DCCF Land Use Committee composed of DCCF board members and community stakeholders, prioritizes and funds eligible projects to implement and enhance the County's watershed-based plan and supports watershed planning opportunities for the balance of the County.

**DeKalb County Forest Preserve (DCFP)**

The DeKalb County Forest Preserve District carries out a broad range of ecological restoration and maintenance activities intended to address our core mission: acquire lands to "preserve, protect and restore the flora, fauna and natural beauties, as near as may be, in their natural state and condition, for the education and recreation of our citizens". The DeKalb County Forest Preserve District manages 16 preserves with woodlands, prairies, wetlands and waterways and within the East Branch South Branch Kishwaukee River watershed the Forest Preserve maintains the Great Western Trail.

**DeKalb County Stormwater Management Committee (DCSWMPC)**

The DeKalb County Stormwater Management Planning Committee is responsible for the creation for the County-wide Stormwater Management Plan and Ordinance. The Committee provides direction for the Plan's implementation and coordinates the County-wide Stormwater Management Ordinance with the municipalities within the boundaries of the County. The Committee monitors and evaluates the implementation of the County-wide Stormwater Management Plan and Ordinance, and recommends updates and amendments when deemed necessary or appropriate.

**DeKalb County Watershed Steering Committee** (DCWSC)

The DeKalb County Watershed Steering Committee (DCWSC) is a consortium of municipalities in the watershed, resource agency professionals, environmental advocates, and local residents that established itself to guide the development of strategies to protect and restore the East Branch South Branch Kishwaukee River and its tributaries. It is likely that DCWSC will be the primary lead for the implementation of the watershed-based plan.

**Developers & Builders (DB)**

As discussed previously in the watershed-based plan, the design and construction of properties can significantly impact a watershed. Developers should be encouraged or required to utilize development techniques that protect water quality and stream health. Builders should properly install and maintain BMPs during the construction phase in order to reduce the potential for sediment-bearing water to be discharged to creek and natural areas.

**Drainage Districts (DD)**

Drainage districts are local bodies formed for the purpose of draining, ditching, and improving land for agricultural and sanitary purposes.

**Educational Institutions (EI)**
There are numerous educational institutions such has Sycamore High School and Northern Illinois University located within and near the watershed that can have an integral role in implementing the watershed plan. These educational institutions have expertise in water quality monitoring and environmental education that can be used to support watershed protection and improvement initiatives.

**Federal Emergency Management Agency (FEMA)**
FEMA is the principal federal agency involved in flood mitigation and flood disaster response. FEMA is responsible for the National Flood Insurance Program, helps municipalities develop and enforce floodplain ordinances, develops floodplain maps, and administers funding for flood mitigation plans and projects.

**Forest Preserve District of Kane County (FPDKC)**
The Forest Preserve District of Kane County owns and manages a number of acres of open space within the East Branch South Branch Kishwaukee River Watershed. Issues related to the protection and management of these and potential future FPD holdings will rely in part on the FPDKC.

**Golf Courses (GC)**
Golf courses can help reduce pollutant loadings, especially nutrients, as well as runoff volume by incorporating BMPs into their golf course management programs.

**Illinois Department of Natural Resources (IDNR)**
Several offices within IDNR provide services that will be key to the implementation of the East Branch South Branch Kishwaukee Creek Watershed Plan for issues related to water resource management, habitat protection and management, wildlife management, invasive species control, and wetland management.

- The Office of Water Resources (OWR) is responsible for the regulation of floodplain development as well as for the implementation and funding of structural flood control and mitigation.
- The Office of Realty and Environmental Planning (OREP) is responsible for natural resource and outdoor recreation planning. It also administers the Conservation 2000 Ecosystems Program, which provides technical and financial assistance through a grant program for natural resource protection.
- The Office of Resource Conservation (ORC) reviews Clean Water Act Section 404 wetland permits for impacts on fish and wildlife resources; it manages threatened and endangered species issues; it also protects fisheries and other aquatic resources through regulation, ecological management and public education.

**Illinois Department of Transportation (IDOT)**
IDOT Region 3 is responsible for the planning, construction, and maintenance of portions of the transportation network that covers the East Branch South Branch Kishwaukee River Watershed. Incorporation of BMPs into IDOT projects can help lead to improvements in the environmental quality of the watershed.

**Illinois Emergency Management Agency (IEMA)**
IEMA is responsible for flood and disaster planning, emergency response, and hazard mitigation. IEMA works with local governments on flood mitigation plans and provides operational support during floods. IEMA also administers FEMA-funded programs in the state, including flood mitigation grant programs.

**Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water**
The Illinois EPA is responsible for the protection of the state's water resources and ensuring that Illinois' rivers, streams and lakes will support all uses for which they are designated including protection of aquatic life, recreation and drinking water supplies. The Illinois EPA also provides technical assistance and administers several state and federal grant programs, including Section 319 funding, which helps local governments, not-for-profits, and other stakeholders to complete projects that are aimed at reducing nonpoint source pollution.

**Kane County Division of Transportation (KCDOT)**
KDOT is responsible for the planning, construction, and maintenance of county highways located in the transportation network that covers the East Branch South Branch Kishwaukee River Watershed. Incorporation of BMPs into KDOT projects can help lead to improvements in the environmental quality of the watershed.

**Kishwaukee River Ecosystem Partnership (KREP)**
The Kishwaukee River Ecosystem Partnership is a group of open space agencies, conservation organizations and local governments in the Kishwaukee River watershed organized under the auspices of the Illinois Department of Natural Resources to protect and restore the high water quality and habitat values of the river and its tributary streams.

**Municipalities (all departments) (MUN)**
Municipalities (i.e., local elected officials and local agency staff) have the principal responsibility for land use and development planning, establishing legislative and administrative policies, adopting ordinances and resolutions, setting zoning standards, establishing the annual budget, appropriating funds, and setting tax rates. Municipalities are a critical stakeholder in watershed protection efforts because they are responsible for the enforcement of local land use and development ordinances.

**Parks Districts (PD)**
Park Districts maintain numerous recreational facilities and parks in the watershed. Partnerships with local park districts can help ensure the preservation of open space while also facilitating recreational and other community opportunities that can help increase support for watershed protection efforts.

**Residents and Owners (RO)**
The activities of residential landowners, often unknowingly, can have a significant impact of the quality of a watershed. Practices such as excessive lawn fertilization application, disposal of trash and yard waste in waterways or encroachment riparian buffers can be significant sources of nonpoint pollution. Recommendations of the watershed-based plan should include education and outreach programs aimed at informing residents about potential consequences of their actions and presenting alternative actions. Additionally, political

pressure from local residents on municipal, township, state and federalcounty officials can lead to increased efforts focused on water quality protection and flood remediation.

**Townships (TOWN)**
While unincorporated townships generally play a secondary role in watershed protection, they often have responsibility for road upkeep and occasionally sponsor drainage system improvement projects. The use of BMPs by townships, especially for road maintenance, can help improve water quality and stream habitat within the watershed.

**Soil and Water Conservation Districts (SWCD) including DeKalb and Kane/DuPage**
Soil & Water Conservation Districts are locally operated units of government functioning under Illinois law. The SWCD's mission is to promote the protection, restoration, and wise use of the soil, water, and related resources within the district. They provide technical and educational resources in the areas of soils and land use, water quality, soil erosion in both urban and agricultural land uses, conservation program needs, wildlife habitat, and native ecosystem restoration and management.

**U.S. Army Corps of Engineers (USACE)**
USACE plays a major role in wetland protection and regulation through Section 404 of the Clean Water Act, which requires USACE to administer permit applications for alterations to wetlands that are considered Waters of the United States.

**U.S. Department of Agriculture (USDA)**
USDA's Farm Services Agency (FSA) has several programs that support watershed protection and restoration efforts. Under the Conservation Reserve Program (CRP), farmers receive annual rental payments, cost sharing, and technical assistance to plant vegetation for land they put into reserve for 10 to 15 years. The Conservation Reserve Enhancement Program (CREP) targets state and federal funds to achieve shared environmental goals of national and state significance. The program uses financial incentives to encourage farmers and ranchers to voluntarily protect soil, water, and wildlife resources. The Grassland Reserve Program (GRP) uses 30-year easements and rental agreements to improve management of, restore, or conserve up to 2 million acres of private grasslands. The USDA Natural Resource Conservation Service (NRCS) Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. The USDA NRCS Environmental Quality Improvement Program (EQIP) provides financial and technical assistance to agricultural producers in order to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation or improved or created wildlife habitat.

**U.S. Environmental Protection Agency (USEPA)**
The USEPA oversees the environmental protection efforts of the Illinois EPA and is the ultimate source for Section 319 and other environmental improvement programs. Section 404 of the Clean Water Act, which regulates the dredging and filling of wetlands, is jointly administered by USEPA and the US Army Corps of Engineers.

**U.S. Fish and Wildlife Service (USFWS)**
The USFWS provides technical assistance to local watershed protection groups. It also administers several grant and cost-share programs that fund wetland and aquatic habitat restoration. The USFWS also administers the federal Endangered Species Act and supports a program called Endangered Species Program Partners, which features formal or informal partnerships for protecting endangered and threatened species and helping them to recover. These partnerships include federal partners as well as states, tribes, local governments, nonprofit organizations, and individual landowners.

## 3.8 Watershed Demographics

The Chicago Metropolitan Agency for Planning (CMAP), formerly known as the Northeastern Illinois Planning Commission (NIPC) and Chicago Area Transportation Study (CATS), provides a 2040 regional framework plan for the greater Chicagoland Area including Kane County. The *Go To 2040* regional framework plan focuses on centers, corridors, and green areas to establish a framework for the region's communities to plan more effectively to deal with growth forecasts. CMAP's 2010 to 2040 forecasts of population, households, and employment for Kane County and Kane County municipalities was used to project how these attributes will affect the Kane County portion of the East Branch South Branch River watershed (Table 3-10).

Information on 2010 population, households, and employment for DeKalb County and DeKalb County municipalities was obtained from the US Census Bureau (Table 1-10). Future forecast on population for DeKalb County for 2030 was obtained from the Illinois Department of Commerce and Economic Opportunity. Additional demographics were not readily available for DeKalb County. A request for forecasts on population, households, and employment was submitted to the Northern Illinois University (NIU) Center for Governmental Studies but was not yet available at the time of this report.

**Table 3-10** 2010 and 2040 Forecast Data for the Kane and DeKalb Counties

| County | Population | | Households | | Employment | |
|---|---|---|---|---|---|---|
| | 2010 | 2030/2040 | 2010 | 2040 | 2010 | 2040 |
| DeKalb | 105,610 | 124,200 | 38,484 | not available | 58,734 | not available |
| Kane | 532,852 | 802,231 | 179,702 | 274,085 | 224,546 | 368,494 |

Information from CMAP's *Go To 2040* forecast was also used to summarize population, households, and employment for Kane County municipalities with borders in the East Branch South Branch Kishwaukee River watershed. Additionally, information from the US Census was used to summarize 2010 population, households, and employment for the DeKalb County municipalities within the watershed. Additionally 2020 population forecasts were obtained from the Illinois Department of Commerce and Economic Opportunity for the DeKalb County municipalities. It is important to note that many of these watersheds have boundaries that extend beyond the watershed; therefore, the information in Table 3-11 is for the entire municipality, not just those areas contained within the watershed. Municipal data indicates significant population and household growth projected for Burlington, Campton Hills, Elburn, and Virgil. Employment is also expected to significantly increase in

Burlington and Elburn. This growth will likely have a significant effect on land use and watershed conditions in the northeastern and eastern portion of the watershed.

**Table 3-11** 2010 and 2040 Forecast Data for Each Municipality in the Watershed

| County | Population | | Households | | Employment | |
|---|---|---|---|---|---|---|
| | 2010 | 2020/2040 | 2010 | 2040 | 2010 | 2040 |
| Burlington | 2,051 | 5,049 | 729 | 1,796 | 260 | 1,200 |
| Campton Hills | 13,763 | 18,006 | 4,242 | 5,657 | 1,208 | 1,209 |
| Cortland | 4,270 | 17,220 | 1,423 | not available | not available | not available |
| Elburn | 5,729 | 12,260 | 2,014 | 4,471 | 1,801 | 3,106 |
| Lily Lake | 1,055 | 1,265 | 351 | 401 | 214 | 257 |
| Maple Park | 979 | 1,492 | 343 | 515 | 42 | 248 |
| Sycamore | 20,006 | not available | 6,993 | not available | not available | not available |
| Virgil | 975 | 2,362 | 353 | 825 | 145 | 198 |

Table 3-12 includes 2010 population, households, and employment forecast for the East Branch South Branch Kishwaukee watershed only. This data was generated by Township, Range, and quarter Sections. If any part of a quarter section was located within the watershed boundary, the statistics for the entire quarter section were included in the calculations. Therefore, the numbers in Table 3-12 are overstated.

**Table 3-12** 2010 Data for the East Branch South Branch Kishwaukee River Watershed

| Data Category | 2010 |
|---|---|
| Population | 30,648 |
| Households | 12,163 |
| Employment | 41,466 |

Information on median age and median income of the watershed's counties and municipalities was obtained from Cubit Planning via Illinois-demographics.com and is displayed in Table 3-13. The median age and median income data was compiled using information obtained from the 2010 Census Data and American Communities Survey Data.

**Table 3-13** Median Age and Income by Jurisdiction

| Jurisdiction | Median Age (2010) | Median Income (2010) |
|---|---|---|
| ***Counties*** | | |
| Kane | 34.5 | $67,767 |
| DeKalb | 29.3 | $54,002 |
| ***Municipalities*** | | |
| Burlington | 40.3 | $59,010 |
| Campton Hills | 42.4 | $135,385 |
| Cortland | 29.5 | $65,868 |
| Elburn | 35.1 | $91,950 |
| Lily Lake | 40.3 | $95,000 |
| Maple Park | 35.9 | $62,059 |
| Sycamore | 34.8 | $66,359 |
| Virgil | 36.5 | $71, 875 |

## 1.9 Land Use

Land use and cover refer to the type of use assigned to a parcel, such as residential or commercial, and the type of surface coverage found on a parcel, such as forest and grassland, respectively. This information is necessary for understanding the impact of current and future land use on watershed resources and the restoration potential.

### 1.9.1 Historical Land Use

1972 Land Use data for the East Branch South Branch Kishwaukee River watershed was obtained from the United States Geological Survey (USGS) GIRAS Land Use and Land Cover database. USGS GIRAS Land Use and Land Cover for the East Branch South Branch Kishwaukee River watershed is summarized in Table 3-14 and depicted in Figure 3-11.

**Table 3-14** Geological Survey (USGS) GIRAS Land Use and Land Cover for the East Branch South Branch Kishwaukee River Watershed

| USGS GIRAS Land Use and Land Cover Type | Acres | Percent of Watershed |
|---|---|---|
| Commercial and Services | 621.62 | 0.79% |
| Combined Animal Feeding Operations | 166.82 | 0.21% |
| Cropland and Pasture | 74765.51 | 94.89% |
| Deciduous Forest Lands | 411.23 | 0.52% |
| Evergreen Forest Land | 101.42 | 0.13% |
| Industrial | 177.22 | 0.22% |
| Mixed Urban or Built-Up Land | 95.86 | 0.12% |
| Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticulture | 77.24 | 0.10% |
| Other Agricultural Lands | 44.60 | 0.06% |
| Other Urban or Built-Up Land | 225.86 | 0.29% |
| Reservoirs | 89.10 | 0.11% |
| Residential | 1449.53 | 1.84% |
| Strip Mines | 160.94 | 0.20% |
| Transportation, Communication and Utilities | 180.95 | 0.23% |
| Transitional Areas | 225.90 | 0.29% |

Definitions of each land use/cover types listed in Figure 3-11 and Table 3-14 are as follows:

*Commercial and Services:* Land cover that contains commercial areas used predominately for the sale of products and services. Includes such land uses as urban business districts, shopping centers, commercial strip developments, junkyards, resorts, etc. Institutional land uses such as educational, religious, health, correctional and military facilities are also included in this land use.

*Combined Animal Feeding Operations:* Land cover than contains areas used predominately for specialized livestock production including beef cattle feedlots, dairy operations with confined feeding, large poultry farms, and hog feedlots.

*Cropland and Pasture:* Land cover consisting of agricultural land used for harvest and pasture.

*Deciduous Forest Lands:* Land cover consisting of all forested areas having a predominance of trees that lose their leaves at the beginning of the forest system or at the beginning of a dry season.

*Evergreen Forest Lands:* Land cover consisting of all forested areas dominated by trees where 75 percent or more of the tree species `maintain their leaves all year. Canopy is never without green foliage.

*Industrial:* Land cover that contains commercial areas used predominately for the manufacturing, production, and warehousing of goods.

*Mixed Urban or Built-Up Land*: Land cover that contains commercial areas where one third of the land area is comprised of a non-commercial use such as residential or institutional. These areas are typically downtown business districts.

*Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticulture:* Land cover consisting of all areas utilized as orchards and groves that produce fruit and nut crops and nurseries and horticulture areas such as seed-and-sod areas, greenhouses, and floriculture.

*Other Agricultural Land:* Land cover of other agricultural land uses not included in confined feeding operations, crop and pasture lands, and orchards, vineyards, nurseries, and horticulture. These typically include farmsteads, holding areas for livestock, breeding and training facilities on horse farms, and similar uses.

*Other Urban or Built-Up Land*: Land cover consisting of golf driving ranges, zoos, urban parks, cemeteries, waste sumps, water-control structures and spillways, golf courses, and ski areas.

*Reservoirs:* Land cover that contains artificial impoundments of water used for irrigation, flood control, municipal water supplies, hydroelectricity, recreation, and similar uses.

*Residential:* Land cover than contains residential areas ranging from high density to low density.

*Strip Mines:* Land cover consisting of extractive mining activities with a significant surface expression.

*Transportation, Communications and Utilities:* Land cover that includes roads, railways, airports, seaports, and major lake ports.

*Transitional Areas:* Land cover in areas that are in transition from one land use activity to another.

### 3.9.2 Existing Land Use

2005 Land Use data for Kane County was obtained from the Chicago Metropolitan Agency for Planning (CMAP). DeKalb County provided Land Use data for the DeKalb County portion of the watershed. However, the land use provided by DeKalb County did not cover the entire watershed area. For areas where land use data was not available, aerial photography, zoning information and field inspections was used to generate existing land use. Existing Land Use and Land Cover for the East Branch South Branch Kishwaukee River watershed is summarized in Table 3-15 and depicted in Figure 3-12.

**Table 3-15** Existing Land Use for the East Branch South Branch Kishwaukee River Watershed

| Land Use | Acres | Percent of Watershed |
| --- | --- | --- |
| Agricultural | 66455.72 | 84.34% |
| Forest and Grassland | 1862.23 | 2.36% |
| Government, Civic and Institutional | 500.86 | 0.64% |
| Industrial | 708.69 | 0.90% |
| Mixed Use | 52.29 | 0.07% |
| Multifamily Residential | 318.28 | 0.40% |
| Office Space | 83.22 | 0.11% |
| Open Space/Conservation/Parks | 1542.40 | 1.96% |
| Retail/Commercial | 186.97 | 0.24% |
| Single-family Residential | 3001.08 | 3.81% |
| Transportation | 4046.68 | 5.14% |
| Utility/Waste Facility | 35.37 | 0.04% |

Definitions of each land use/cover types listed in Figure 3-12 and Table 3-15 are as follows:

*Agriculture:* Land cover consisting of agricultural land used for harvest and pasture.

*Forest and Grasslands:* Land cover consisting of primarily natural areas for passive recreational use. Includes such land uses as forest preserves and conservation easements.

*Government, Civic and Institutional:* Land cover consisting of large institutional structures such as schools and governmental administration buildings.

*Industrial:* Land cover consisting of manufacturing and processing, warehousing and distribution centers, wholesale facilities, and industrial parks.

*Mixed Use:* Land cover where various types residential and commercial land uses are grouped or clustered together as a planned development.

*Multifamily Residential:* Land cover that contains multi-family and duplex residential properties of varying density.

*Office Space:* Land cover where the primary usage of structures is for office space and limited or no retail sales occur.

*Open Space/Conservation/Parks*: Land cover consisting of parks, golf courses, nature preserves, playgrounds and athletic fields when associated with another open space activity. Also included in this category are wetlands, open water and riparian corridors.

*Retail/Commercial:* Land cover that contains commercial areas used predominately for the sale of products and services. Includes such land uses as urban business districts, shopping centers, commercial strip developments, etc.

*Single Family Residential:* Land cover that contains single family residential properties of varying densities.

*Transportation:* Land cover that includes roads, railways, airports, seaports, and major lake ports.

*Utility/Waste Facility*: Land use consists of facilities whose primary function is for the support of large scale infrastructure or processing of public wastes. This includes items such as natural gas or electric distribution sub-stations, telecommunications structures, wastewater treatment facilities and water distribution facilities.

### 3.9.3 Future Land Use/Land Cover Projections

Information on future built out lands for the Kane County portion of the watershed was obtained from Kane County. DeKalb County provided future land use data for the DeKalb County portion of the watershed. Additionally, future land use plans were obtained from Burlington, Campton Hills, Cortland, DeKalb, Maple Park, Sycamore, and Virgil and was used to develop the future land use information for areas not covered by Kane and DeKalb Counties. The data was analyzed and GIS used to map the land use/land cover based on an approximate 2030-2040 projection. Future Land Use and Land Cover for the East Branch South Branch Kishwaukee River watershed is summarized in Table 3-16 and depicted in Figure 3-13.

Table 3-16 also compares the existing land use/land cover to future land use/land cover projections. The most obvious change occurs with agriculture (loss of 22,471.1 acres). This decrease is the result of development including single family residential (additional 3,789.56 acres) mixed use (additional 3,467.99 acres), multifamily residential (additional 3,468.26 acres), and retail/commercial (additional 1,482.65 acres). Much of the development change is predicted to occur in the western and eastern portion of the watershed near the Campton Hills, Cortland, Elburn, Maple Park and Sycamore.

**Table 3-16** Projected Land Use for the East Branch South Branch Kishwaukee River Watershed

| Land Use | Current Area (acres) | Current % of Watershed | Projected Area (acres) | Projected % of Watershed | Change (acres) | Change (%) |
|---|---|---|---|---|---|---|
| Agricultural | 66455.72 | 84.34% | 43984.67 | 55.82% | -22471.05 | -28.52% |
| Conservation Neighborhood | 0.00 | 0.00% | 2968.18 | 3.77% | 2968.18 | 3.77% |
| Forest and Grassland | 1862.23 | 2.36% | 498.83 | 0.63% | -1363.4 | -1.73% |
| Government, Civic and Institutional | 500.86 | 0.64% | 565.98 | 0.72% | 65.12 | 0.08% |
| Industrial | 708.69 | 0.90% | 3520.28 | 4.47% | 2811.59 | 3.57% |
| Mixed Residential | 0 | 0.00% | 3786.54 | 4.81% | 3786.54 | 4.81% |
| Mixed Use | 52.29 | 0.07% | 657.48 | 0.83% | 605.19 | 0.76% |
| Multifamily Residential | 318.28 | 0.40% | 314.4 | 0.40% | -3.88 | 0.00% |
| Office Space | 83.22 | 0.11% | 1669.62 | 2.12% | 1586.4 | 2.01% |
| Open Space/Conservation/Parks | 1542.4 | 1.96% | 6799.63 | 8.63% | 5257.23 | 6.67% |
| Retail/Commercial | 186.97 | 0.24% | 1466.02 | 1.86% | 1279.05 | 1.62% |

| Land Use | Current Area (acres) | Current % of Watershed | Projected Area (acres) | Projected % of Watershed | Change (acres) | Change (%) |
|---|---|---|---|---|---|---|
| Single-family Residential | 3001.08 | 3.81% | 8750.6 | 11.11% | 5749.52 | 7.30% |
| Transportation | 4046.68 | 5.14% | 3811.26 | 4.84% | -235.42 | -0.30% |
| Utility/Waste Facility | 35.37 | 0.04% | 0.31 | 0.00% | -35.06 | -0.04% |

Definitions of each land use/cover types listed in Figure 3-13 and Table 3-16 are as follows:

*Agriculture:* Land cover consisting of agricultural land used for harvest and pasture.

*Conservation Development*: Land cover consisting that adopts the principle for allowing limited sustainable development while protecting the area's natural environmental features by preserving open space, farmland or natural habitats for wildlife and maintaining the character of rural communities

*Forest and Grasslands:* Land cover consisting of primarily natural areas for passive recreational use. Includes such land uses as forest preserves and conservation easements.

*Government, Civic and Institutional:* Land cover consisting of large institutional structures such as schools and governmental administration buildings.

*Industrial:* Land cover consisting of manufacturing and processing, warehousing and distribution centers, wholesale facilities, and industrial parks.

*Mixed Residential:* Land cover consisting of various types of residential land uses are grouped or clustered together.

*Mixed Use:* Land cover where various types of the residential and commercial land uses are grouped or clustered together as a planned development.

*Multifamily Residential:* Land cover that contains multi-family and duplex residential properties of varying density.

*Office Space:* Land cover where the primary usage of structures is for office space and limited or no retail sales occur.

*Open Space/Conservation/Parks*: Land cover consisting of parks, golf courses, nature preserves, playgrounds and athletic fields when associated with another open space activity. Also included in this category are wetlands, open water and riparian corridors.

*Retail/Commercial:* Land cover that contains commercial areas used predominately for the sale of products and services. Includes such land uses as urban business districts, shopping centers, commercial strip developments, etc.

*Single Family Residential:* Land cover that contains single family residential properties of varying densities.

*Transportation:* Land cover that includes roads, railways, airports, seaports, and major lake ports.

*Utility/Waste Facility*: Land use consists of facilities whose primary function is for the support of large scale infrastructure or processing of public wastes. This includes items such as natural gas or electric distribution sub-stations, telecommunications structures, wastewater treatment facilities and water distribution facilities.

### 3.9.4 Land Use Impacts on the Watershed

The conversion of agricultural lands to residential and retail/commercial land uses increases the amount of impervious cover for a given area and reduces the amount of open space available for infiltrating and storing storm water runoff. Imperviousness is generally defined as the sum of roads, parking lots, sidewalks, rooftops, and other surfaces within an urban landscape that prevent infiltration of storm water runoff. Imperviousness can be used to measure the impacts of urban land uses on aquatic systems. For example, an increase in imperviousness has negative implications on the natural functions of streams including water quality; hydrology and flows; flooding and depressional storage; and instream and riparian habitat.

*Water Quality*

Increases in impervious area negatively affects water quality in streams and lakes by increasing pollutant loads and water temperature. During dry conditions, impervious areas accumulate pollutants including nutrients, sediment, oils, bacteria, and metals from the atmosphere, vehicles, roof surfaces, lawns, and other sources. During storm events, these pollutants are washed from the impervious surface and delivered to streams and lakes. Additionally, runoff from impervious surfaces is typically 12 degrees (Fahrenheit) higher in temperature than runoff from vegetated areas. Water temperatures over 68°F may preclude most fish from using the streams for habitat.

*Hydrology and Flows*

Hydromodification is a term that is used to describe human induced activities that change the dynamics of surface or subsurface flow. The process of urbanization affects streams by altering watershed hydrology and sediment-transport patterns. Development increases the amount of impervious surfaces (parking lots, rooftops, highly compacted ground, etc) on formerly undeveloped landscapes. This reduces the capacity of the remaining pervious surfaces to capture, filter rainfall, and allow the rainfall to infiltrate into the ground. As a result, a larger percentage of rainfall becomes runoff during any given storm. Subsequently, runoff reaches stream channels much more quickly, and peak discharge rates are higher than before development for the same size rainfall event.

*Flooding and Depressional Storage*

Flooding is also a consequence of increased stream flows that can result from increased impervious cover. As discussed above, increased flows lead to hydromodification. The short-term impact result of hydromodification is localized, overbank flooding. Over the long term, hydromodification will cause the stream channel to expand as a means of handling the higher flows. As the stream channel expands, the banks will erode and the bottom will become deeper. This deepening of the stream channel is called incision. Channel incision leads to a disconnect between the stream and its floodplain. Once separated, high flows that were once stored in the floodplain and wetlands and slowly released back into the stream are forced to remain in the channel. These "trapped" flows have high velocities leading to additional streambank erosion and incision of the stream channel. It becomes a vicious pattern where with each rainfall event; the creek continues to erode adding additional sediments to the watershed and further preventing the creek to access the floodplain.

*Habitat*

Increased impervious cover negatively impacts stream habitat and its associated biological communities (fish, macroinvertebrates, amphibians, etc). As discussed above, as hydromodification occurs streambanks and stream bottoms will begin to erode. The process of stream bank erosion and channel incision causes a significant amount of sediment to be generated within the stream and carried through the watershed and into the stream's receiving water. The sediment suspended in the water causes turbid conditions that can be detrimental to aquatic organisms. Additionally, as this sediment falls out of the water column, the deposited sediment can also negatively affect aquatic organisms by filling interstitial spaces in substrates that are necessary for macroinvertebrate and fish propagation and life. Physical habitat degradation can also occur when hydromodification causes loss of riffle-pool structures and loss of riparian cover.

### 3.9.5 Impervious Area Analysis

As discussed above in Section 3.9.4, impervious area can be used to qualitatively measure the impacts of urban land uses on aquatic systems. Studies on impervious areas have indicated that stream health begins to degrade when the watershed reaches approximately 10% impervious cover. The Impervious Area Analysis utilized is based on the belief that as the percentage of watershed imperviousness increases with increasing urbanization, the quality of physical, chemical, and biological conditions of streams within the watershed decreases.

The Impervious Area Analysis was used to help understand how stream quality relates to the subwatershed area that drains to a particular stream reach. This analysis uses the subbasins described in Section 3.13.2 and illustrated in Figures 3-23 to 3-25. Impervious cover was calculated by assigning an impervious cover percentage for each land use/land cover based upon data collected for the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) in Northeastern Illinois (Table 3-17). GIS was used to estimate the area of existing and projected land use/land cover by subbasin.

The Center for Watershed Protection has developed an Impervious Cover Model used to classify streams in the subwatersheds into stream quality categories based on percent impervious cover: Sensitive, Impacted and Non-Supporting. In general, sensitive subwatersheds have less than 10% impervious cover and typically have stable channels, good stream habitat, good water quality and diverse biological communities. Streams in the non-supporting category have impervious cover greater than 25% and typically have highly degraded channels, degraded habitat, impacted water quality, and impacted biological communities. Subwatersheds with impervious cover between 11% and 25% are considered impacted and could begin seeing degradation to stream channels, habitat, water quality, and biological communities.

**Table 3-17** Summary of MWRDGC Impervious Cover Percentages

| Land Use | Percent Impervious |
|---|---|
| Agricultural | 5% |
| Conservation Neighborhood | 15% |
| Forest and Grassland | 5% |
| Government, Civic and Institutional | 72% |
| Industrial | 72% |
| Mixed Residential | 65% |
| Mixed Use | 85% |
| Multifamily Residential | 65% |
| Office Space | 85% |
| Open Space/Conservation/Parks | 5% |
| Retail/Commercial | 85% |
| Single-family Residential | 30% |
| Transportation | 95% |
| Utility/Waste Facility | 5% |

According to the impervious cover model, the East Branch South Branch Kishwaukee River Watershed has a current impervious cover of 11.9%. This would indicate that the stream channels in the watershed are considered "impacted" by surrounding land. An analysis of impervious cover within each of the three subwatesheds (East Branch South Branch, Union Ditch and Virgil Ditch) provides a better understanding of how the current and future land uses affects and will affect the watershed (Tables 3-18 to 3-20).

**Table 3-18** Impervious Area Analysis Results in the East Branch South Branch Kishwaukee River Subwatershed

| SMU | Total Acres | Existing Percent of Impervious | Future Percent of Impervious |
|---|---|---|---|
| EBKR-1 | 12.24 | 5.00% | 5.00% |
| EBKR-2 | 2389.18 | **37.13%** | **54.95%** |
| EBKR-3 | 1013.59 | **33.01%** | **33.05%** |
| EBKR-4 | 2317.66 | **28.44%** | **46.18%** |
| EBKR-5 | 3683.00 | 8.15% | 14.96% |
| EBKR-6 | 1128.93 | 21.86% | 19.09% |
| EBKR-7 | 5.48 | 10.12% | 10.12% |
| EBKR-8 | 1419.61 | 18.19% | **24.40%** |
| EBKR-9 | 1450.96 | 17.77% | **25.55%** |
| EBKR-10 | 2857.50 | 7.50% | 14.16% |
| EBKR-11 | 1890.84 | 14.58% | **27.03%** |
| EBKR-12 | 1827.37 | 8.14% | 13.39% |
| EBKR-13 | 2751.66 | **29.24%** | **58.45%** |
| EBKR-14 | 1475.90 | 8.40% | **37.93%** |
| **Average Percent of Impervious for the E Branch S Branch Kishwaukee Subwatershed** | | 17.67% | **27.45%** |

**Table 3-19** Impervious Area Analysis Results in the Union Ditch Subwatershed

| SMU | Total Acres | Existing Percent of Impervious | Future Percent of Impervious |
|---|---|---|---|
| UD-1 | 28.76 | 12.79% | 16.77% |
| UD-2 | 2147.38 | 14.47% | **44.06%** |
| UD-3 | 1006.23 | 11.39% | **57.91%** |
| UD-4 | 2821.78 | 8.58% | **39.43%** |
| UD-5 | 1807.45 | 9.36% | **29.89%** |
| UD-6 | 2028.09 | 16.31% | **32.40%** |
| UD-7 | 265.97 | 8.12% | 8.00% |
| UD-8 | 3187.32 | 6.83% | 8.57% |
| UD-9 | 266.38 | 5.87% | 8.56% |
| UD-10 | 594.00 | 7.14% | 8.39% |
| UD-11 | 3097.35 | 8.34% | 8.44% |
| UD-12 | 2952.74 | 7.90% | 7.77% |
| UD-13 | 3272.11 | 7.93% | 14.59% |
| UD-14 | 3277.85 | 8.12% | 14.08% |
| UD-15 | 4088.48 | 9.25% | 19.98% |
| UD-16 | 2150.67 | 20.67% | **74.90%** |
| UD-17 | 1631.51 | 9.78% | **38.62%** |
| UD-18 | 2587.06 | 8.82% | 8.49% |
| **Average Percent of Impervious for the Union Ditch Subwatershed** | | 10.10% | **24.49%** |

**Table 3-20** Impervious Area Analysis Results in the Virgil Ditch Subwatershed

| SMU | Total Acres | Existing Percent of Impervious | Future Percent of Impervious |
|---|---|---|---|
| VD-1 | 1329.40 | 7.91% | 13.77% |
| VD-2 | 1534.24 | 7.71% | 13.05% |
| VD-3 | 163.91 | 8.98% | 8.98% |
| VD-4 | 1831.67 | 7.39% | 9.03% |
| VD-5 | 2455.17 | 10.40% | 9.79% |
| VD-6 | 1112.19 | 9.29% | 9.88% |
| VD-7 | 1319.43 | 8.01% | 9.44% |
| VD-8 | 1542.02 | 7.46% | 7.90% |
| VD-9 | 2423.26 | 6.66% | 8.92% |
| VD-10 | 2259.68 | 7.38% | 7.41% |
| VD-11 | 1387.79 | 6.69% | 6.80% |
| **Average Percent of Impervious for the Virgil Ditch Subwatershed** | | 8% | 9.54% |

Using current land use, the East Branch South Branch of the Kishwaukee River subwatershed is approximately 17.8% impervious and would be considered “Impacted” based on Sheuler’s model (Table 3-18). This data seems to correlate with visual and anecdotal evidenced observed in the watershed including problems such as channelization, sedimentation, erosion, debris jams, lack of riparian buffers and degraded stream habitat. Highly impervious areas surrounding Sycamore and Cortland are the primary reasons for the elevated impervious areas through this subwatershed.

Using current land use, the Union Ditch subwatershed (10.1% impervious) and Virgil Ditch subwatershed (8% impervious) are considered "sensitive" using the model. The scores at the high end of the "sensitive" rating confirm what is known about the subwatershed in that the stream channels are somewhat degraded, instream habitat has been altered and water quality and biological communities are slightly impacted.

A more telling picture is told by looking at the model's prediction of future imperviousness in the watershed. If growth occurs as predicted by the Land Use plans adopted by the counties and municipalities, both the East Branch South Branch of the Kishwaukee River subwatershed and the Union Ditch subwatershed will be considered "Not Supporting" by the model. As this growth occurs, if changes are not made to current development patterns, it is likely that significant degradation to the watershed including channelization, sedimentation, erosion, debris loading, and degraded stream habitat will occur. The degradation related to the proposed development can be reduced through the implementation of sustainable development that includes the use of best management practices (BMPs) and green infrastructure. More information on BMPs and green infrastructure can be found in Chapter 4 and Chapter 5. As Kane County does not predict much growth for the Virgil Ditch subwatershed, it would be expected to remain "sensitive".

Impervious cover was also modeled for the present and future conditions of each Subwatershed Management Units (SMU) within each of the subwatersheds. SMUs are smaller subwatersheds located within each of the three subwatersheds. The information obtained from analyzing the SMUs will be used in the identification of critical areas for watershed plan implementation. See Section 3.18 for more information on Critical Areas.

### 3.10 Cultural Resources

Cultural resources are sites, structures, buildings, landscapes, districts, and objects that are significant in history, prehistory, archeology, architecture, engineering, and/or culture. Knowing the cultural resources of a watershed provides information on changes that occurred in the landscape and help define information related to historical vegetative communities, climate change, wildlife populations, and historic uses of the land. All of which could be useful during the watershed planning process. Additionally, as cultural resources provide learning opportunities for the public, the preservation and protection of the cultural resources located in the watershed from development and damage is an important objective of watershed planning.

In 1966, the National Historic Preservation Act was passed to manage and protect cultural resources by requiring Federal and State agencies to establish historic preservation programs to identify, evaluate, and protect important sites under their jurisdiction. The National Park Service administers the National Register of Historic Places as part of the requirements of the National Historic Preservation Act. Properties in the Register include districts, sites, buildings, structures, and objects that are significant in American history, archeology, architecture, engineering, and culture. The National Register sites have been nominated by governments, organizations, and individuals according to a defined, uniform set of standards. According to the National Register of Historical Places, there are six Historic Places/Districts listed for the East Branch South Branch Kishwaukee River watershed (Table 3-21 and Figure 3-14).

**Table 3-21** National Register of Historic Places in the East Branch South Branch Kishwaukee River watershed

| Site Name | Address | Certification Date |
|---|---|---|
| Brower, Adolphus W., House | 705 DeKalb Avenue<br>Sycamore, DeKalb, Illinois | 02/14/1979 |
| Chicago and Northwestern Depot | Sacramento and DeKalb Streets<br>Sycamore, DeKalb, Illinois | 12/08/1978 |
| Elmwood Cemetery Gates | S. Cross and Charles Streets<br>Sycamore, DeKalb, Illinois | 11/28/1978 |
| Marsh, William W., House | 740 W. State Street<br>Sycamore, DeKalb, Illinois | 12/22/1978 |
| North Grove School | 26475 Brickville Road<br>Sycamore, DeKalb, Illinois | 02/15/2012 |
| Sycamore Historic District | Irregular pattern along Main and Somonauk Streets<br>Sycamore, DeKalb, Illinois | 05/02/1978 |

In Illinois, the Illinois Historical Preservation Agency (IHPA) preserves and protects public and private historical properties and library collections. The IHPA Historic Architecture and Archeological Resource Geographic Information System (HAAGIS) (http://gis.hpa.state.il.us/hargis/) was utilized to locate and identify Illinois Historic Sites and Monuments in the East Branch South Branch Kishwaukee River database. There are no sites within the East Branch South Branch Kishwaukee River watershed identified on the HAAGIS site as Illinois Historic Sites and Monuments.

In Kane County, the Kane County Board of Commissioners has included four properties in the East Branch South Branch Kishwaukee River watershed in the Kane County Register of Historical Preservation Figure 1-14): Beith House, Kaut House, Read House, and South Burlington Community House. By placing these assets on the Register for Historic Places, the Kane County Historic Preservation Commission is given the authority to "review significant exterior alterations, additions, new construction or demolitions proposed for designated landmarks or within historic districts." As a result, historical assets are able to be carefully managed in the face of growing construction efforts in Kane County.

## 3.11 Transportation

The impact of streets and highways on the watershed, particularly water quality, is significant. Table 3-22 lists a number of water quality pollutants and their sources, all of which are associated with the transportation system. Rain water flowing over the surface of our streets can carry these pollutants into our wetlands and streams, where they can accumulate and impair the quality of these resources for aquatic life.

**Table 3-22** Transportation Related Pollutants

| Pollutant | Primary Sources |
|---|---|
| Particulates | Pavement wear, atmosphere, vehicles |
| Nutrients including nitrogen and phosphorus | Atmosphere, fertilizer application |
| Lead | Tire wear, exhaust |
| Zinc | Tire wear, motor oil and grease |
| Iron | Rust, steel highway structures, engine parts |
| Copper | Metal plating, break lining wear, engine parts, bearing and bushing wear, fungicides and pesticides |
| Cadmium | Tire wear, insecticides |
| Chromium | Metal plating, engine parts, break lining wear |
| Nickel | Diesel fuel, gasoline, oils, metal plating, break lining wear, asphalt paving |
| Manganese | Engine parts |
| Cyanide | Anticake compound used in deicing salts |
| Sodium, Calcium, Chloride | Deicing salts |
| Sulphate | Fuel, deicing salts |
| Petroleum | Spills and leaks of motor oils, antifreeze and hydraulic fluids, asphalt surface leachate |

### 3.11.1 Existing Transportation Network

Several major arterial roads and one interstate transverse the East Branch South Branch Kishwaukee River watershed including Illinois State Route 47, Illinois State Route 23, Illinois State Route 64, Illinois State Route 38, and Interstate 88. Illinois State Route 47 is located in the eastern portion of the watershed and runs north to south. Lily Lake and Campton Hills are situated along Illinois State Route 47. Illinois State Route 23 is a north-south road running through the City of Sycamore in the western portion of the watershed. Illinois State Route 64 is the main east-west highway bisecting the watershed as it runs on a northwesterly angle through Lily Lake, Virgil, and Sycamore. Illinois State Route 38 is located in the southern portion of the watershed and runs east-west through Cortland, Maple Park, and Elburn. Interstate 88 runs east to west in the southwest corner of the watershed south of Cortland and Maple Park. Figure 3-15 depicts the transportation network found in the watershed.

### 3.11.2 Proposed Transportation Projects

There are no significant road construction or road widening projects proposed in the East Branch South Branch Kishwaukee watershed. As such, no changes to the existing transportation network are presumed to occur in the watershed.

## 3.12 Natural Resources

This section of the plan describes the natural areas within the East Branch South Branch Kishwaukee River watershed, including natural areas, parks, recreational trails, plant and animal species concerns, wetlands, and groundwater.

### 3.12.1 Illinois Natural Area Inventory Sites

Illinois Natural Areas Inventory (INAI) sites are a designation established in the 1970's by the Illinois Nature Preserves Commission (INPC) to identify "high quality" areas of the natural features found in Illinois. Included in the INAI inventory is a system to classify natural communities based on a grading scale related to the quality of the natural area. Portions of one INAI site is located in the watershed: Elburn Forest Preserve (Figure 3-16).

<u>Elburn Forest Preserve</u>

Approximately 5.2 acres of the 57.1 acre Elburn Forest Preserve is located in the Union Ditch subwatershed. The Elburn Forest Preserve is owned by the Forest Preserve District of Kane County. The Elburn Forest Preserves is a morainal, gravel hill at the county watershed divide, which separates the Fox and Kishwaukee River Basins. It is a high quality savanna woodland dominated by White, Black and Bur Oak and Shagbark Hickory. Kane County's largest Shagbark is located within this preserve. The Preserve is also home to many classic, spring ephemeral plants, including trillium, buttercups and violets. Additionally, the Preserve is home to Kane County's squirrel preserve, where you can find both Fox and Gray squirrels living compatibly with each other, as well as Flying Squirrels.

### 3.12.2 Forest Preserves and Parks

*3.12.2.1 Municipal Parks*

The Town of Cortland and Sycamore Park District manage numerous recreational parks located entirely or partially within the watershed. These facilities and a description of their amenities are included in Table 3-23 and depicted on Figure 3-17.

**Table 3-23** Natural Areas and Recreational Parks in the East Branch South Branch Kishwaukee River watershed

| Park Name | Address | Acreage in Watershed | Golf Course | Natural Areas | Playground | Tennis Count | Ball Diamond | Basketball Court | Soccer Field |
|---|---|---|---|---|---|---|---|---|---|
| **Town of Cortland** | | | | | | | | | |
| Cortland Community Park | 70 S Llanos Street, Cortland, Illinois | 19.40 | | | | | ✓ | | |
| Hetchler Park | Ellen Avenue, Cortland, Illinois | 4.98 | | | | | ✓ | ✓ | |
| McPhillips Park | 1-103 W Prairiefield Ave, Cortland, Illinois | 8.77 | | | ✓ | | ✓ | ✓ | ✓ |
| Suppland Park | Meadow Drive, Cortland, Illinois | 6.78 | | ✓ | | | | | |
| Welsh Park | North Avenue, Cortland, Illinois | 0.42 | | | ✓ | | | | |
| **Sycamore Park District** | | | | | | | | | |
| Boynton Park | 303 Northgate Dr. Sycamore, Illinois | 2.40 | | ✓ | | | | | |

| Park Name | Address | Acreage in Watershed | Golf Course | Natural Areas | Playground | Tennis Count | Ball Diamond | Basketball Court | Soccer Field |
|---|---|---|---|---|---|---|---|---|---|
| Charley Laing Memorial Park | 325 S. Main St. Sycamore, Illinois | 0.56 | | | ✓ | | | | |
| Chief Black Partridge Nature Preserve | 2112 Frantum Rd. Sycamore, Illinois | 15.23 | | ✓ | | | | | |
| Elmer and Stanley Larson Park | 1501 John St. Sycamore, Illinois I | 0.27 | | | ✓ | | | | |
| Emil Cassier Park | 500 Olin H. Smith Dr. Sycamore, Illinois | 70.71 | | ✓ | | | | | |
| Founders Park | 500 Heron Creek Dr. Sycamore, Illinois | 2.76 | | | ✓ | | | | |
| Future Park | | 29.52 | | | | | | | |
| Kiwanis East Park | 555 Borden Ave. Sycamore, Illinois | 1.91 | | ✓ | | | | | |
| Kiwanis Prairie Park | 800 Borden Ave. Sycamore, Illinois | 7.47 | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Leon D. Larson Memorial Park | 1212 Larsen St. Sycamore, Illinois | 23.11 | | ✓ | | | | | |
| Old Mill Park | 50 Mt. Hunger Rd. Sycamore, Illinois | 20.29 | | ✓ | | | | | |
| Parkside Preserve | 1212 Freedom Circle Sycamore, Illinois | 134.69 | | ✓ | | | | | |
| Reston Ponds | 444 Becker Pl. Sycamore, Illinois | 3.15 | | ✓ | | | | | |
| Sycamore Community Park | 940 E. State St. Sycamore, Illinois | 224.10 | ✓ | | ✓ | | | | |
| Sycamore Lake Rotary Park | 400 North Cross St. Sycamore, Illinois | 12.83 | | | ✓ | | | | |
| Wetzel Park | 212 Rowantree Dr. Sycamore, Illinois | 1.92 | | | ✓ | ✓ | ✓ | ✓ | |

No municipal parks are located within the Kane County portion of the watershed.

*3.12.2.2 Forest Preserve District of Kane County*

In addition to the Elburn Forest Preserve discussed in Section 1.12.1, there are three additional properties managed by the Forest Preserve District of Kane County (FPDKC) located in the watershed: Cardinal Creek Forest Preserve, Great Western Trail, and Virgil Forest Preserve (Figure 3-17).

Cardinal Creek Forest Preserve
The 165.7 acre Cardinal Creek Forest Preserve is located in the Virgil Ditch watershed.

Great Western Trail
Approximately 14 miles of the Great Western Trail are owned and managed by the FPDKC. Of these 14 miles, 6.62 miles are located in the Kane County portion of the East Branch South Branch Kishwaukee watershed (2.98 miles within the Virgil Ditch subwatershed and 3.64 within the Union Ditch subwatershed). See Section 3.12.3 for more information on the Great Western Trail.

Virgil Forest Preserve
The 1,139 acre Virgil Forest Preserve is located in the Union Ditch (568.7 acres) and Virgil Ditch (555.7 acres) subwatershed. Virgil Ditch #2 and Virgil Ditch #3 transect this property.

*3.12.2.3 DeKalb County Forest Preserve District*
The DeKalb County Forest Preserve manages the DeKalb County portion of the Great Western Trail. See Section 3.12.3 for more information on the Great Western Trail.

### 3.12.3 Pedestrian Trails
There are two pedestrian/recreational trails located within or partially within the East Branch South Branch Kishwaukee River watershed: Great Western Trail and DeKalb/Sycamore Bike Path (Figure 3-18).

Great Western Trail
The Great Western Trail extends approximately 17 miles from its trailhead in St Charles, Kane County, Illinois to Sycamore, DeKalb County, Illinois. The trail connects to the Fox River Trail in Kane County and to a larger regional trail system. Approximately 9.6 miles of trail are located within the East Branch South Branch Kishwaukee River watershed.

The Great Western trail follows the abandoned Chicago Great Western Railway corridor and is surfaced with limestone screenings. Bicycling, hiking, and snowmobiling when there is 4" of snow are permitted on the trail. Horseback riding is also allowed on the mowed shoulder along the trail. Shelters and rest areas are located along the trail.

The Great Western Trail crosses small streams and wetlands where duck, coot and the Great Blue Heron nest and raise their young. Shrubs, including Dogwood, Blackberry and Hazelnut mingle with the few remaining patches of native prairie. It is a place of quiet beauty, a linear wildlife refuge, and truly one of the finer experiences available in DeKalb and Kane County.

DeKalb/Sycamore Bike Path
The DeKalb/Sycamore Bike Path starts at Pleasant Street in DeKalb, Illinois and extends north and east into the City of Sycamore, Illinois. The paved trail is six miles in length with

wooded and prairie features. The Trail follows along the east side of Peace Road for several miles before winding its way into the Sycamore Community Park. Trail users include bicyclists, hikers, runners, and cross country skiers.

Figure 3-18 shows the location of each of the pedestrian trails located in the East Branch South Branch Kishwaukee River watershed.

### 3.12.4 Threatened and Endangered Species

The Illinois Endangered Species Protection Board was created by the passage of the Endangered Species Protection Act in 1972 and determines which plant and animal species are threatened or endangered (T&E) in the state. The Illinois Endangered Species Protection Board also advises the Illinois Department of Natural Resources (IDNR) on means of conserving those species. State listed T&E species are designated "endangered" if a species is in danger of extinction as a "breeding" species and is considered "threatened" if the species is likely to become an endangered species within the foreseeable future. Figure 3-19 shows the general location of all T&E species within the watershed based on the Illinois Endangered Species Protection Board 2006 Endangered and Threatened Species List. Table 3-24 lists each of the T&E species and provides its status.

**Table 3-24** Threatened and Endangered Species

| Common Name | Scientific Name | Status |
|---|---|---|
| Dog Violet | *Viola conspersa* | Threatened |
| Iowa Darter | *Etheostoma exile* | Threatened |
| Slippershell | *Alasmidonta viridis* | Threatened |
| Wooly Milkweed | *Asclepias lanuginosa* | Endangered |

### 3.12.5 Wetlands

Wetlands, once prevalent within Illinois, have continued to decline in area and quality. Wetlands are of interest to watershed studies of this sort due to the benefits they provide. Wetlands do more for water quality improvement and flood damage reduction than any other natural resource within a watershed. Wetlands provide a multitude of ecological, economic and social benefits. They provide habitat for fish, wildlife and a variety of plants. Wetlands are also important landscape features because they hold and slowly release flood water and snow melt, recharge groundwater, recycle nutrients, and provide recreation and wildlife viewing opportunities for residents.

<u>NWI Wetland Inventories</u>

The National Wetlands Inventory (NWI) is available for DeKalb County. The NWI was established by the US Fish and Wildlife Service (FWS) to conduct a nationwide inventory of U.S. wetlands to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. The NWI maps are prepared from the analysis of high altitude imagery, vegetation, visible hydrology, and geography. Field inspections and wetland delineations were not utilized in the preparation of the NWI maps. Additionally, certain wetland habitats are not included on their maps due to limitations of aerial reconnaissance to properly identify these habitats as wetlands. According to the NWI maps, there are approximately 1,214.45 acres of wetland in DeKalb County (1.54% of the watershed). Of the 1,214.75 acres, 859.34 acres are located within the East Branch South

Branch Kishwaukee subwatershed, 350.59 in the Union Ditch subwatershed, and 4.53 in the Virgil Ditch subwatershed (Figure 3-20).

Advanced Identification (ADID)Wetlands

In 2004, Kane County implemented the Advanced Identification (ADID) process of wetlands in an attempt to identify highly functional wetlands that should be protected because of their high quality plant communities and/or functional values. The ADID program is an US Environmental Protection Agency (USEPA) and US Army Corps of Engineers (USACE) guided program developed to shorten permit-processing time related to filling wetlands and to provide information to local governments. Three primary functions were used by the USEPA and USACE to evaluate wetlands during the ADID process including biological value (i.e. wildlife habitat and plant species diversity), hydrologic functional value (i.e. stormwater storage or bank stabilization), and water quality value (i.e. sediment and nutrient removal). The survey identified 1,260.52 acres of wetlands in Kane County (1.60% of the watershed. Of the 1,260.52 acres, 768.17 acre are located in the in the Union Ditch subwatershed and 492.36 in the Virgil Ditch subwatershed (Figure 3-21). Per the identification process, twenty one wetlands totaling 501.94 acres are high functional value (HFV) and one 7.52 acre wetland as a high habitat quality (HHQ) wetland in the ADID study. Data for each HFV and HHQ wetland is summarized in Table 3-25 and shown on Figure 3-21.

**Table 3-25** Kane County HFV and HHQ wetlands

| ADID ID# | Acres | ADID Attributes |
|---|---|---|
| 3467 | 18.02 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1548 | 26.87 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 989 | 16.30 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 996 | 10.18 | **Water Quality/Hydrology** Stormwater storage, sediment/toxicant retention**:** |
| 997 | 11.77 | **Water Quality/Hydrology** Stormwater storage, sediment/toxicant retention**:** |
| 1015 | 12.17 | **Water Quality/Hydrology** Stormwater storage, sediment/toxicant retention**:** |
| 1016 | 13.33 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1040 | 17.11 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1166 | 16.98 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1511 | 15.61 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1518 | 16.73 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1555 | 14.59 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1568 | 43.96 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1575 | 31.14 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1581 | 16.99 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1684 | 12.55 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 3236 | 33.59 | **Water Quality/Hydrology:** Streambank/shoreline stabilization, sediment/toxicant retention |
| 3241 | 10.22 | **Water Quality/Hydrology:** Streambank/shoreline stabilization, sediment/toxicant retention |
| 3243 | 106.75 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 3244 | 36.66 | **Water Quality/Hydrology:** Nutrient removal, sediment/toxicant retention |
| 3245 | 20.44 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1024 | 7.52 | **Biological:** Sedge meadow<br>**Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |

In addition to the twenty two HFV and HHQ wetlands, one farmed wetland and twenty two wetlands (169.99 acres) were noted for their significant water quality and stormwater functions. These wetlands met basic criteria of "significant functional" value but did not qualify for the high functional value rating. Due to their significant water quality and stormwater functions these wetlands should be preserved and/or restored when feasible. Table 3-26 and Figure 3-21 includes the Kane County significant functional wetlands.

**Table 3-26** Kane County significant functional wetlands

| ADID ID# | Acres | ADID Attributes |
|---|---|---|
| 1574 | 8.61 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 978 | 5.82 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 979 | 6.42 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 980 | 6.45 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 982 | 5.60 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1002 | 5.13 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1018 | 5.29 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1023 | 3.17 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1028 | 9.62 | **Water Quality/Hydrology:** Streambank/shoreline stabilization |
| 1029 | 5.75 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1032 | 5.13 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1038 | 8.27 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1039 | 5.27 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1220 | 5.43 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 1558 | 7.52 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 1616 | 8.02 | **Water Quality/Hydrology:** Streambank/shoreline stabilization, sediment/toxicant retention |
| 3242 | 6.02 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 3247 | 16.29 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 3248 | 11.52 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 3254 | 3.61 | **Water Quality/Hydrology:** Streambank/shoreline stabilization |
| 3345 | 8.47 | **Water Quality/Hydrology:** Stormwater storage, sediment/toxicant retention |
| 3356 | 5.89 | **Water Quality/Hydrology:** Sediment/toxicant retention |
| 3370 | 7.70 | **Water Quality/Hydrology:** Streambank/shoreline stabilization, sediment/toxicant retention |

ADID wetland information is not available for DeKalb County.

In order to protect wetlands, projects and other activity should be designed to avoid and minimize any disturbance to the wetland, stream, or other aquatic area. However, if there is an unavoidable impact or disturbance to a wetland or stream, a Clean Water Act Section 404 permit must be obtained from the US Army Corps of Engineers (USACE). The USACE has jurisdiction over waters of the United States (WOUS) including connected wetlands and navigable streams and rivers. For wetlands and WOUS in the East Branch South Branch Kishwaukee River watershed, the USACE Rock Island District is the responsible entity for permitting any activities that impact jurisdictional wetlands and WOUS. The Rock Island permit program includes a series of regional permits (RP) for various activities such as bank stabilization, flood damage control and road crossings. Activities outside the RP categories are required to obtain an individual permit (IP). The USACE permits must be applied for and issued before any wetland or WOUS disturbance or impacts occur.

### 3.12.6 Potential Wetland Restoration Sites

Wetland restoration and creation could be beneficial to the East Branch South Branch Kishwaukee River watershed. By restoring the environmental functions of impacted wetlands or creating new wetlands in suitable areas, wetland restoration and wetland creation could potentially reduce flood volumes and rates, increase plant and animal diversity, and improve water quality conditions.

Potential restoration sites were identified using a Geographic Information System (GIS) exercise. As part of this exercise, an initial criterion of 10 acres parcels with hydric soils was utilized. This identified 789 potential wetland restoration sites (17,707.61 acres) within the watershed. Additional criterions and a rating scale were then used to better identify potential wetland sites. These criterions include:

- Hydric Soil Order: Histosol (organic hydric soils) were given preference to Mollisol (mineral hydric soils) as Histosol soils are known to respond better to restoration than Mollisol soils. Histosol soils tend to be easier to rehydrate as they are typically wet and provide better soils for wetland plant establishment. Histosol soils were assigned a 1 on the rating scale and Mollisol soils were assigned a 0.
- Riparian: Preference was given to sites that were located immediately adjacent to a stream or ditch. Sites located immediately adjacent to a stream or ditch were assigned a 1 on the rating scale.
- Riparian (within 1,000 feet): Preference was given to sites that were located within 1,000 feet of a stream or ditch. Sites located within 1,000 feet of a stream or ditch were assigned a 1 on the rating scale.
- Floodplain: Preference was given to sites that were located within the 100-year floodplain. Sites located within the 100-year floodplain were assigned a 1 on the rating scale.
- Adjacent to ADID or NWI wetlands: Preference was given to sites located immediately adjacent to ADID or NWI wetlands. Sites located immediately adjacent to a ADID or NOW wetland were assigned a 1 on the rating scale.

The maximum rank value that any potential wetland location site can receive is five (5). Of the 789 sites (17,707.61 acres) originally identified, 9 sites (177.6 acres) had a value of 5. These sites are included in Table 3-27 and shown on Figure 3-22. One hundred and fifty one (151) potential restoration sites had a ranking of 4. For all of the sites ranked 4, they are of the Mollisol soil type and thus did not earn a point for soil order. Table 3-27 and Figure 3-22 also list 64 additional sites (2,889.6 acres) that have acreage of at least 25 acres and Ranking of 4. A size of 25 acres was chosen for inclusion in the table as the larger sites would be a priority for restoration as they would have the highest functional value. Table 3-27 also identifies if the wetland is located on public lands.

**Table 3-27** Potential Restoration Sites in the East Branch South Branch Kishwaukee River Watershed

| ID | Acres | Soil Order Score | Riparian Score | Riparian (within 1,000 feet) Score | Floodplain Score | Adjacent to ADID or NWI Wetland Score | Ranking | Public Ownership |
|---|---|---|---|---|---|---|---|---|
| **Potential Restoration Sites with a Ranking of 5** | | | | | | | | |
| 1 | 14.7 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 2 | 16.2 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 3 | 28.1 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 4 | 23.9 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 5 | 19.2 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 6 | 31.1 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 7 | 11.8 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 8 | 18.4 | 1 | 1 | 1 | 1 | 1 | 5 | |
| 9 | 14.3 | 1 | 1 | 1 | 1 | 1 | 5 | |
| **Potential Restoration Sites with a Ranking of 4** | | | | | | | | |
| 10 | 102.01 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 11 | 93.69 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 12 | 92.32 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 13 | 82.81 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 14 | 74.85 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 15 | 71.84 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 16 | 67.79 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 17 | 66.46 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 18 | 65.89 | 0 | 1 | 1 | 1 | 1 | 4 | Yes |
| 19 | 65.73 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 20 | 65.09 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 21 | 63.90 | 0 | 1 | 1 | 1 | 1 | 4 | Yes |
| 22 | 62.99 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 23 | 60.55 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 24 | 58.45 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 25 | 56.08 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 26 | 55.98 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 27 | 51.87 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 28 | 47.22 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 29 | 46.50 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 30 | 45.13 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 31 | 45.08 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 32 | 44.51 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 33 | 44.39 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 34 | 43.74 | 0 | 1 | 1 | 1 | 1 | 4 | Yes |
| 35 | 43.55 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 36 | 43.43 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 37 | 42.84 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 38 | 42.42 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 39 | 42.00 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 40 | 39.84 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 41 | 39.39 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 42 | 39.28 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 43 | 39.22 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 44 | 36.83 | 0 | 1 | 1 | 1 | 1 | 4 | |

| ID | Acres | Soil Order Score | Riparian Score | Riparian (within 1,000 feet) Score | Floodplain Score | Adjacent to ADID or NWI Wetland Score | Ranking | Public Ownership |
|---|---|---|---|---|---|---|---|---|
| 45 | 36.75 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 46 | 36.66 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 47 | 36.30 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 48 | 35.31 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 49 | 34.62 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 50 | 34.26 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 51 | 34.26 | 0 | 1 | 1 | 1 | 1 | 4 | Yes |
| 52 | 34.02 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 53 | 33.60 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 54 | 33.33 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 55 | 33.16 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 56 | 33.08 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 57 | 32.68 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 58 | 32.62 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 59 | 32.28 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 60 | 31.98 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 61 | 31.93 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 62 | 29.21 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 63 | 29.10 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 64 | 28.51 | 0 | 1 | 1 | 1 | 1 | 4 | Yes |
| 65 | 28.32 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 66 | 27.74 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 67 | 27.56 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 68 | 27.56 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 69 | 27.43 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 70 | 26.94 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 71 | 25.67 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 72 | 25.66 | 0 | 1 | 1 | 1 | 1 | 4 | |
| 73 | 25.39 | 0 | 1 | 1 | 1 | 1 | 4 | |

### 3.12.7 Groundwater in the East Branch South Branch Kishwaukee River Watershed

Underlying the ground surface of the watershed is a thick layer (several hundred feet) of unconsolidated material including sand, gravel, clay and silt. These materials were laid down tens of thousands of years ago when glaciers covered this part of the country. Underneath these unconsolidated materials is several thousand feet of sedimentary rock consisting of alternating dolomite, sandstone, and shale formations. These formations were deposited in shallow seas and near coastlines during the Cambrian and Tertiary Periods (543-290 million years ago). Between 290 million years ago and today, the exposed bedrock surface was erodes by rivers and streams into a complex Valley Systems known as the Troy bedrock valley located in western DeKalb County. The advancing and retreating glaciers of the last ice age deposited the sand, gravel, clay and silt that eventually filled the Troy Valley and formed the landscape observed today.

The sand and gravel glacial aquifers in the Troy Valley recharge the sandstone bedrock aquifers where the Troy Valley aquifers are in direct contact with the bedrock surface. Immediately under the Troy Valley is the shallowest bedrock aquifer in the area, referred to as the Galena/Platteville Dolomite aquifer. The bottom aquifer unit of the Troy Valley lies directly above the bedrock surface. As such, the Troy Valley is one of the primary sources for recharging the deep sandstone aquifers on which much of DeKalb County and many of the suburbs west of Chicago depend upon for clean drinking water upon for clean drinking water

Aquifers in the glacial drift (sand and gravel) of the Quaternary age (less than 75,000 year old) and the carbonate deposits (dolomite and limestone) of the Platteville and Galena Group of Ordovician age (about 450 million years old) are the major sources of groundwater in the watershed. These glacial drift and Galena-Platteville aquifers are considered to be extremely susceptible to contamination as the aquifer is near the land surface, typically at a depth of less than 50 feet, and the soils compose and overlie the aquifers have relatively high hydraulic conductivity of at least 1 foot per day.

Residents in the East Branch South Branch Kishwaukee River Watershed utilize groundwater for a variety of purposes including drinking water, irrigation, and industrial process water. All of the municipalities in the wateshed use groundwater as their source of drinking water. While under natural undisturbed conditions, groundwater in the East Branch South Branch Kishwaukee River Watershed is of high quality and meets the drinking and groundwater standards set for different contaminants by the Illinois Pollution Control Board. Due to the nature of the aquifers in the region, impacts associated with urbanization have the potential to negatively impact drinking and groundwater. Potential sources for contamination associated with urbanization include septic system effluent, oil, gasoline, animal wastes, industrial effluent, paint, solvents, road salt, and lawn and household chemicals.

In order to protect groundwater in Illinois in 1987, the General Assembly passed the Illinois Groundwater Protection Act (IGPA). The IGPA emphasizes the comprehensive management of groundwater resources by requiring the implementation of practices and policies to protect groundwater. These include setting groundwater protection policies such as setback zones; assessing the quality and quantity of groundwater resources being utilized; and establishing groundwater standards.

### 3.12.8 Agricultural Best Management Practices

Various programs sponsored by the Natural Resource Conservation Service (NRCS) and Farm Service Agency Wetlands Reserve Program (WRP), Grasslands Reserve Program (GRP), Wildlife Habitat Incentives Program (WHIP), Environmental Quality Incentives Program (EQIP), Conservation Reserve Enhancement Program (CREP), and Conservation Reserve Program (CRP) promote and fund the construction of agricultural BMPs on farmland.

According to information obtained from the DeKalb County Soil and Water Conservation District (DC SWCD), there are 36 acres of riparian buffers, 36 acres of vegetative filter strips, 46 acres of grass waterways, and 123.21 acres of wetland enhancement in the DeKalb County portion of the watershed preserved by the above-listed programs.

Per the requirements of Section 1619, b, 4, B of the Farm Bill, the Natural Resource Conservation Service (NRCS) in Champaign, Illinois is only able to provide the number of contracts and the obligation amount by County for following programs: WRP, GRP, WHIP, and EQIP. According to the NRCS, there are no active or completed WHIP contracts in both DeKalb and Kane Counties. Additionally, no GRP easements have been issued in either County. The following tables provide information on the number of contracts and obligations amounts for WRP and EQIP.

**Table 3-28** WRP Easements in DeKalb and Kane Counties

| County | Easement Values | Restoration Value |
|---|---|---|
| DeKalb | $235,000.00 | $0.00 |
| Kane | $0.00 | $0.00 |

**Table 3-29** Active and Completed EQIP Contracts in DeKalb County

| Fiscal Year | Number of Contracts | Obligation Amount |
|---|---|---|
| 2008 | 16 | $121,623.00 |
| 2009 | 6 | $245,091.74 |
| 2010 | 3 | $38,548.19 |
| 2011 | 3 | $384,576.10 |
| 2012 | 9 | $161,486.19 |
| 2013 | 17 | $260,307.38 |

**Table 3-30** Active and Completed EQIP Contracts in Kane County

| Fiscal Year | Number of Contracts | Obligation Amount |
|---|---|---|
| 2008 | 6 | $38,000.00 |
| 2009 | 1 | $24,588.70 |
| 2010 | 1 | $6,926.04 |
| 2011 | 1 | $9,686.20 |
| 2012 | 2 | $48,486.75 |
| 2013 | 4 | $103,166.00 |

## 3.13 Natural Drainage System

This section describes the conditions and characteristics of the natural drainage system of the East Branch South Branch Kishwaukee River watershed.

### 3.13.1 Stream Flow/Discharge

There are no active USGS gauging stations on East Branch South Branch Kishwaukee River or within the East Branch South Branch Kishwaukee River watershed. Historically, the US Geological Survey (USGS) had a gage on Virgil Ditch No. 3/Union Ditch No. 3 at the Illinois Route 64 bridge, west of Virgil; however, no data has been collected at this location since 1981.

In June 1988, the US Army Corps of Engineers (ACOE) released the Reconnaissance Report for Section 205 Flood Control, East Branch of the South Branch Kishwaukee River, DeKalb County, Illinois. Table 3-31 includes the discharge summary for the mouth of the Branch South Branch Kishwaukee River as included in the report.

**Table 3-31** 1988 Discharge Summary

| Location | Slope | Flow-Frequency Values in ft³/s | | | | |
|---|---|---|---|---|---|---|
| | | 2-Year | 10-Year | 50-Year | 100-Year | 500-Year |
| At mouth | 5 foot/mile | 2,050 | 4,280 | 6,120 | 6,870 | 8,490 |

### 3.13.2 Watershed Hydrology and Hydraulics

Hydrology and hydraulics are commonly used terms to describe the effects of precipitation, runoff, and evaporation on the flow of water in streams and rivers and on adjacent land surfaces. The basis for hydrology and hydraulics studies typically starts with an understanding of how topography delineates the land into watershed and subwatersheds. As discussed in the Topography section of this report, the Online Watershed Delineation (HYMAPS-OWL) tool, created by Department of Agriculture and Biological Engineering at Purdue University was used to create the initial subwatershed boundaries. The subwatershed boundaries generated by HYMAPS-OWL were then cross referenced with boundaries obtained by inputting 2-foot topography into the GIS-based model, Arc Hydro. This combined data generated a Digital Elevation Model (DEM) that was used to delineate and refine the watershed and subwatershed boundaries for East Branch South Branch Kishwaukee River. Inconsistency in the two models' delineations was altered to reflect real-world conditions and more accurately depict the hydrologic boundaries. Most of these inconsistencies occurred in areas divided by roadways that were not accounted for the in model.

The East Branch South Branch Kishwaukee River watershed drains 123.12 square miles. Broad assessment of conditions such as soils, wetlands, and water quality are often evaluated at watershed levels and provide great information of the overall condition of the watershed. However, a more detailed look at smaller drainage areas will often be helpful in finding specific problem areas. As previously discussed the East Branch South Branch Kishwaukee River watershed includes three major subwatersheds: East Branch South Branch Kishwaukee River, Union Ditch and Virgil Ditch. For the purposes of this report, each of the major subwatersheds have been broken down into subwatershed management units (SMU) (Tables 3-32 to 3-34. Figure 3-23 to 3-25 depicts the location of each of the SMUs by subwatershed.

**Table 3-32** SMUs in the East Branch South Branch Kishwaukee River Subwatershed

| SMU | Total Acres | Percent of Subwatershed |
|---|---|---|
| EBKR-1 | 12.24 | 0.05% |
| EBKR-2 | 2389.18 | 9.86% |
| EBKR-3 | 1013.59 | 4.18% |
| EBKR-4 | 2317.66 | 9.57% |
| EBKR-5 | 3683.00 | 15.20% |
| EBKR-6 | 1128.93 | 4.66% |
| EBKR-7 | 5.48 | 0.02% |
| EBKR-8 | 1419.61 | 5.86% |
| EBKR-9 | 1450.96 | 5.99% |
| EBKR-10 | 2857.50 | 11.80% |

| SMU | Total Acres | Percent of Subwatershed |
|---|---|---|
| EBKR-11 | 1890.84 | 7.81% |
| EBKR-12 | 1827.37 | 7.54% |
| EBKR-13 | 2751.66 | 11.36% |
| EBKR-14 | 1475.90 | 6.09% |

**Table 3-33** SMUs in the Union Ditch Subwatershed

| SMU | Total Acres | Percent of Subwatershed |
|---|---|---|
| UD-1 | 28.76 | 0.08% |
| UD-2 | 2147.38 | 5.77% |
| UD-3 | 1006.23 | 2.70% |
| UD-4 | 2821.78 | 7.58% |
| UD-5 | 1807.45 | 4.86% |
| UD-6 | 2028.09 | 5.45% |
| UD-7 | 265.97 | 0.71% |
| UD-8 | 3187.32 | 8.57% |
| UD-9 | 266.38 | 0.72% |
| UD-10 | 594.00 | 1.60% |
| UD-11 | 3097.35 | 8.32% |
| UD-12 | 2952.74 | 7.94% |
| UD-13 | 3272.11 | 8.79% |
| UD-14 | 3277.85 | 8.81% |
| UD-15 | 4088.48 | 10.99% |
| UD-16 | 2150.67 | 5.78% |
| UD-17 | 1631.51 | 4.38% |
| UD-18 | 2587.06 | 6.95% |

**Table 3-34** SMUs in the Virgil Ditch Subwatershed

| SMU | Total Acres | Percent of Subwatershed |
|---|---|---|
| VD-1 | 1329.40 | 7.66% |
| VD-2 | 1534.24 | 8.84% |
| VD-3 | 163.91 | 0.94% |
| VD-4 | 1831.67 | 10.55% |
| VD-5 | 2455.17 | 14.14% |
| VD-6 | 1112.19 | 6.41% |
| VD-7 | 1319.43 | 7.60% |
| VD-8 | 1542.02 | 8.88% |
| VD-9 | 2423.26 | 13.96% |
| VD-10 | 2259.68 | 13.02% |
| VD-11 | 1387.79 | 7.99% |

### 3.13.3 Flow Paths

Three primary subwatersheds drain the East Branch South Branch Kishwaukee River watershed: East Branch South Branch Kishwaukee River, Union Ditch, and Virgil Ditch. The flow paths of each subwatershed are detailed below.

Virgil Ditch Subwatershed

The Virgil Ditch subwatershed is located in northeast portion of the watershed and is 20.12 square miles in size. There are 13.68 miles of stream in the subwatershed with the Virgil Ditch Number #3 being the primary tributary. The headwaters of Virgil Ditch Number 3 are located in the southwest portion of Burlington, approximately 1,500 feet east of the intersection of Chapman Road and Godfrey Road. From Burlington, Virgil Ditch Number 3 flows in a southerly direction. South of Ramm Road, Virgil Ditch Number 3 flows through the Virgil Forest Preserve. After leaving the Virgil Forest Preserve, Virgil Ditch Number 3 flows south/southwesterly under Peplow Road, the Great Western Trail, and Illinois State Route 64. South of Illinois State Route 64, Virgil Ditch Number 3 flows along the eastern edge of Midwest Ground Covers as it continues to flow in a southerly direction to its confluence with Union Ditch Number 3, approximately 2,100 feet south of Winter Road. There are four small unnamed tributaries to Virgil Ditch Number 3 located within the subwatershed.

For planning purposes, streams in the subwatershed were divided into unique stream reaches. The reaches for the Virgil subwatershed are depicted in Figure 3-26.

Union Ditch Subwatershed

The Union Ditch subwatershed is located in south and southeast/eastern portion of the watershed and is 58.14 square miles in size. The Union Ditch subwatershed is predominately located within Kane County. There are 37.7 miles of stream in the subwatershed. There are five primary tributaries in the Union Ditch subwatershed: Virgil Ditch Number 2, Virgil Ditch Number 1, Union Ditch Number 1, Union Ditch Number 2, and Union Ditch Number 3.

The headwaters of Virgil Ditch Number 2 are located in Campton Hills, approximately 1,350 feet south of the intersection of Connor Road and Illinois State Route 47. From Campton Hills, Virgil Ditch Number 2 flows in an easterly direction through agricultural fields before turning to the south just east of Kendall Road. From this point, Virgil Ditch Number 2 flows in a southerly direction to Burlington Road. At Burlington Road, the creek turns and begins flowing in a southwesterly direction towards Illinois State Route 47. After flowing under Illinois State Route 47, the ditch flows towards Illinois State Route 64 south of the Aeroview Airport in an east/southeasterly direction. South of Illinois State Route 64, Virgil Ditch Number 2 flows towards the south to its confluence with Union Ditch Number 3 just east of Meredith Road. There are two small unnamed tributaries to Virgil Ditch Number 2 located within the subwatershed.

Virgil Ditch Number 1 is located in the southeast corner of the Union Ditch subwatershed. Virgil Ditch Number 1's headwaters are located just northwest of Elburn northwest of the intersection of Illinois State Route 38 and Illinois State Route 47. From this point, the stream flows westward through agricultural fields. Approximately 2,500 feet west of Meredith Road, Virgil Ditch Number 1 turns to the north and flows in a northwesterly direction to its confluence with Union Ditch Number 3 just north of Beith Road and west of Thatcher Road.

Union Ditch Number 1 is located in the western portion of the Union Ditch subwatershed. The headwaters of Union Ditch are situated south of Cortland and Interstate 88 near the intersection of Somonauk Road and Gurler Road. The creek continues to flow in a northeasterly direction through agricultural fields and passing under Interstate 88 and Illinois State Route 38. Just north of Illinois State Route 38, Union Ditch Number 1 takes a slight bend to the north and then continues to flow to the north/northeast to its confluence with

Union Ditch Number 2 approximately 750 feet south of the intersection of Pleasant Street and Hartman Road.

The headwaters of Union Ditch Number 2 are located west of Howard Road and north of the railroad tracks. From its headwaters, the creek flows westward under the railroad tracks and through an agricultural area towards Maple Park. East of Maple Park, Union Ditch Number 2 bends towards the south for a short distance before turning to the west and heading into Maple Park. Through Maple Park, the stream flows on a northwest trajectory. Immediately north of the railroad tracks and Maple Park Road, Union Ditch Number 2 turns and flows northward for approximately 6,000 feet before bending to the west. From this point, Union Ditch Number 2 flows westward for approximately 4,700 feet to the confluence with Union Ditch Number 3. From the confluence of Union Ditch Number 2 and Union Ditch Number 3, the creek is known as the East Branch of the South Branch Kishwaukee River.

Union Ditch Number 3 is considered the main stem and is the receiving stream for the Virgil Ditch system, Union Ditch Number 1 and Union Ditch Number 2. The headwaters of Union Ditch Number 3 are located in the east central portion of the Union Ditch subwatershed, southwest of Lily Lake. The creek then flows eastward through agricultural fields. From east to west, the following tributaries flow into Union Ditch Number 3: Virgil Ditch Number 2, Virgil Ditch Number 3, Virgil Ditch Number 1, and Union Ditch Number 2. From the confluence of Union Ditch Number 2 and Union Ditch Number 3, the creek is known as the East Branch of the South Branch Kishwaukee River.

For planning purposes, streams in the subwatershed were divided into unique stream reaches. The reaches for the Union Ditch subwatershed are depicted in Figure 3-27.

<u>East Branch South Branch Subwatershed</u>

The East Branch South Branch Kishwaukee River subwatershed is located in the northwest portion of the watershed and is 37.85 square miles in size. The East Branch South Branch Kishwaukee River connects the Union and Virgil Ditches to the South Branch Kishwaukee River. From the confluence of Union Ditch Number 2 and Union Ditch Number 3, the East Branch South Branch Kishwaukee River flows northward running along the eastern side of the quarry. After passing the quarry, the river continues to run northward through an agricultural area towards Bethany Road. Just north of Bethany Road, the river takes a 90-degree bend and begins flowing westward to Airport Road. Approximately 2,500 feet west of Airport Road, the East Branch South Branch Kishwaukee River takes another 90-degree turn towards the north flowing towards Sycamore. The river flows through Sycamore Community Park, the Sycamore Gold Club, and the Sycamore Family Sports Center. Just north of Illinois State Route 64, the East Branch South Branch Kishwaukee River bends slightly to the west and the river flows in a west/northwest direction through the northern portion of Sycamore. The Sycamore Wastewater Treatment Plant discharges to the river approximately 1,500 feet west of Brickwell Road. After flowing through Sycamore, the East Branch South Branch Kishwaukee River continues to flow to the northwest through an agricultural area and south of the Anderson Airport to its confluence with the South Branch of the Kishwaukee River.

There are three main tributaries to the East Branch South Branch Kishwaukee River: Blue Heron Creek located north of Sycamore and two unnamed tributaries in the central portion of the subwatershed.

There is one impoundment located in the East Branch South Branch Kishwaukee River subwatershed: Lake Sycamore. Lake Sycamore is 7.5 acres and is owned and managed by the Sycamore Park District.

For planning purposes, streams in the subwatershed were divided into unique stream reaches. The reaches for the East Branch South Branch Kishwaukee River subwatershed are depicted in Figure 3-28.

### 3.13.4 Channel Conditions

A number of factors can be used to describe the condition of the East Branch South Branch Kishwaukee River watershed. The degree of hydromodification and channelization can be used to assess the health and condition of a river or stream.

<u>Hydromodification</u>

Hydromodification is a term that is used to describe human induced activities that change the dynamics of surface or subsurface flow. Historically, the most prevalent form of hydromodification was the draining of wetlands, construction of the ditches, and channelization of natural stream channels to increase agricultural production. Early settlers of the Midwest quickly realized that the soils found under wetlands and wet prairies were ideal for crop production once the water was removed. In order to "dry" the wetlands and the wet prairies, systems of sub-surface drainage tiles were installed in order to re-route the groundwater away from the wetlands and wet prairies and discharged into surface waters. Given that the drain tiles were drained by gravity flow, the receiving surface water needed to be a lower elevation than the tile. As such, naturalized stream channels were often excavated to a deeper depth and straightened to facilitate quicker drainage of the fields. Once the water was removed, these areas could be put into successful agricultural production. This creation of agricultural land was at the cost of the loss of wetlands, wet prairies, and riparian habitat. Hydromodification attributed to the installation of drain tiles is prevalent throughout the East Branch South Branch Kishwaukee River.

The likely extent of tile drainage in the East Branch South Branch Kishwaukee River is estimated here based on soil drainage class. NRCS recognizes seven natural drainage classes describing the frequency and duration of wet periods for various soils: Excessively Drained, Somewhat Excessively Drained, Well Drained, Somewhat Poorly Drained, Poorly Drained and Very Poorly Drained. The last three drainage classes indicate soils which limit or exclude crop growth unless artificially drained. Soils in the Somewhat Poorly Drained, Poorly Drained and Very Poorly Drained occur on approximately 40% of the land in the East Branch South Branch Kishwaukee River watershed. These areas can be taken as an approximation of the likely extent of artificial drainage on agricultural lands given that crop growth on these lands would be severely impacted or impossible without artificial drainage.

The short-term impact result of this type of hydromodification is localized flooding. Water that was once stored on land during wet periods now increasing filters into the underground tiles and flow quickly into ditches and streams causing the channel to experiences what is called "flashy" hydrology. "Flashy" hydrology means that the water level in the stream rises very quickly during a storm and falls quickly afterward. Since less water is infiltrating into the ground and constantly seeping out and creating a steady base flow within the stream, low flows are considerably lower. Likewise, because less water is absorbed by the ground and more water is flowing into the streams, high flows are considerably higher. High flows can result in damage to property of watershed residents, erosion, flooding, and pollution. Decreased or low flows degrade aquatic habitat because low flows have low levels of dissolved oxygen necessary for aquatic animals and because, in extreme cases, the stream can dry up completely for periods of time.

Over the long term, hydromodification will cause the ditch and stream channels to expand as a means of handling the higher flows. As the stream channel expands, the banks will erode and the bottom will become deeper. This deepening of the stream channel is called incision. The process of stream bank erosion and channel incision causes a significant amount of sediment to be generated within the stream and carried through the watershed and into the stream's receiving water. Channel incision also leads to a disconnect between the stream and its floodplain. Once separated, high flows that were once stored in the floodplain and slowly released back into the stream are forced to remain in the channel. These "trapped" flows have high velocities leading to additional streambank erosion and incision of the stream channel. It becomes a vicious pattern where with each rainfall event; the creek continues to erode adding additional sediments to the watershed and further preventing the creek to access the floodplain.

Channelization

Channelization is the practice of dredging and straightening stream channels to increase flow rates and carrying capacities. Traditionally, channelization was done to move as much water as possible away from an area in a short period of time and prevent flooding. The streams in the East Branch South Branch Kishwaukee River watershed were almost entirely channelized by the early 20$^{th}$ Century. According to the Report on the Natural Resources and Habitat in the Kishwaukee River Watershed published by the Kishwaukee River Ecosystem Partnership (KREP) in April 2004, the East Branch South Branch Kishwaukee River was once a meandering 4$^{th}$ order river that has almost entirely (98%) channelized and converted to an agricultural conveyance system. Many of the natural stream features have been destroyed through the elimination of the meandering bends and the over-widening of the channel bottom. Blue Heron Creek, a tributary north of downtown Sycamore, is the only steam in the subwatershed that has not been channelized and has natural stream features such as riffle-pools. However, it should be noted that development pressures in the Blue Heron Creek watershed is threatening water quality and habitat degradation and channel instability in the Blue Heron Creek catchment. According to the same report, the Union Ditch subwatershed is the number one most channelized subwatershed out of the 42 subwatersheds located in the Kishwaukee River basin and the Virgil Ditch subwatershed is one of the 10 most channelized subwatersheds in the 42 subwatersheds. Almost 100% of all streams in the Union Ditch watershed have been channelized and the stream channels are moderately to severely entrenched.

There are problems resulting from channelization of streams and ditches. Channelization is detrimental for the health of streams and rivers through the elimination of suitable instream habitat for fish and wildlife by limiting the number of natural instream features such as pool-riffle sequences in the channel. Channelization can also lead to the creation of excessive flows in the stream leading to hydromodification both within and downstream of the channelized areas. Additionally, in many locations, a berm comprised of historic side-cast dredge spoils cuts off the stream channels from the floodplain.

### 3.13.5 Hydraulic Structures

Hydraulic structures are categorized as bridges, culverts, levees, weirs, dams, fencing and any other human made structures located in or over the stream channel. The location and condition of hydraulic structures is a valuable piece of information as hydraulic structures may act as possible constrictions in conveying river flow, increase the potential for backwater flooding problems, and impede the movement of fish and other aquatic species up and down the stream. A hydraulic structure inventory was not conducted as part of the watershed-planning process.

Dams can serve as potential barriers to the movement and dispersal of aquatic organisms such as fish and may limit available habitat for breeding and feeding. There are no dams in the watershed.

### 3.13.6 Instream and Riparian Habitat Assessment

*3.13.6.1 Illinois Natural History Survey and Illinois Department of Natural Resource Data*

Fish Surveys

According to the Report on the Natural Resources and Habitat in the Kishwaukee River Watershed, fish were collected in the East Branch South Branch Kishwaukee River subwatershed in 1965, 1967, 1997, and 2001. Thirty two (32) species were documented in the watershed. Table 3-35 listed the documented fish species and if the species is pollutant intolerant.

**Table 3-35** Documented Fish Species in the East Branch South Branch Kishwaukee River Subwatershed (IDNR)

| Genus/species | Common Name | Date Last Collected | Pollution Intolerant |
|---|---|---|---|
| Etheostoma zonale | Banded darter | | Yes |
| Notropis dorsalis | Bigmouth shiner | 2001 | |
| Ameriurus melas | Black bullhead | 1965 | |
| Percina maculata | Blackside darter | 2001 | |
| Lepomis macrochirus | Bluegill | | |
| | Bluegill – green sunfish hybrid | | |
| Pimephales notatus | Bluntnose minnow | 2001 | |
| Campostoma anomalum | Central stoneroller | 2001 | |
| Lexilus cornutus | Common shiner | 2001 | |
| Semotilus atromaculatus | Creek chub | 2001 | |
| Pimephales promelas | Fathead minnow | 1997 | |
| Moxostoma erythrurum | Golden redhorse | 2001 | |
| Lepomis cyanellus | Green sunfish | 2001 | |
| Nocomis biguttatus | Hornyhead chub | 2001 | |
| Ethepstoma exile | Iowa darter | 1967 | Yes |
| Ethepstoma nigrum | Johnny darter | 2001 | |
| Campostoma oligolepis | Largescale stoneroller | 1997 | Yes |
| Hypentelium nigricans | Northern hog sucker | 2001 | Yes |

| Genus/species | Common Name | Date Last Collected | Pollution Intolerant |
|---|---|---|---|
| Esox lucius | Northern pike | 2001 | |
| Carpiodes cyprinus | Quilback | 2001 | |
| Lythrurus umbratilis | Redfin shiner | 1997 | |
| Ambloplolites rupestris | Rock bass | 2001 | Yes |
| Notropis rubellus | Rosyface shiner | 2001 | Yes |
| Notropis ludibundus | Sand shiner | 2001 | |
| Moxostoma macrolepidotum | Shorthead redhorse | 2001 | Yes |
| Moxostoma anisurum | Silver redhorse | 2001 | Yes |
| Micropterus dolomieu | Smallmouth bass | 2001 | Yes |
| Phoxinus erythrogaster | Southern redbelly dace | 2001 | Yes |
| Cyprinelle spiloptera | Spotfin shiner | 2001 | Yes |
| Noturus flavus | Stonecat | 2001 | Yes |
| Catostomus commersoni | White sucker | 2001 | |
| Ameiurus natalis | Yellow bullhead | 2001 | |

No fish survey information was available for the Union Ditch and Virgil Ditch subwatersheds.

Mussel Surveys

According to the Report on the Natural Resources and Habitat in the Kishwaukee River Watershed, mussels were collected in the East Branch South Branch Kishwaukee River subwatershed in 1999. Four (4) species were documented in the watershed. Table 3-36 listed the documented fish species and if the species is pollutant intolerant.

**Table 3-36** Documented Mussel Species in the East Branch South Branch Kishwaukee River Subwatershed (IDNR)

| Genus/species | Common Name | Date Last Collected |
|---|---|---|
| Pyganodon grandis | Giant floater | 1999 |
| Lasmigona compressa | Creek heelsplitter | 1999 |
| Lasmigona comlanata | White heelsplitter | 1999 |
| Anodontoides ferussacianus | Cylindrical papershell | 1999 |

No mussel survey information was available for the Union Ditch and Virgil Ditch subwatersheds

Biological Stream Characterization Report

In November 1996, the Illinois EPA released a Biological Stream Characterization Report for the Virgil Ditch system. As part of the Biological Stream Characterization Report, Index of Biological Integrity (IBI) scores were calculated for Virgil Ditch Number 1, Virgil Ditch Number 2, and Virgil Ditch Number 3. The IBI index is designed to measure the aquatic vertebrate community and the surrounding conditions by using fish species as indicators. In the index there are 12 fish community variables that can be broken down into three main categories: species richness and composition, trophic composition, and fish abundance and condition. By assessing the variables within these parameters, scientists compare a sampled site with a relatively undisturbed site with similar geographical and climatic conditions. With this rationale, the only variable would be stressors resulting from human development and disturbance. The IBI scores are then used to give a stream rating to the assessed stream.

Table 3-37 listed the IBI and stream rating for the Virgil Ditch system.

**Table 3-37** IBI and Stream Rating for the Virgil Ditch System (IDNR)

| Stream | Survey Date | IBI Score | Stream Rating |
|---|---|---|---|
| Virgil Ditch Number 1 | 1988 | 40 | C |
| Virgil Ditch Number 2 | 1988 | 38 | C |
| Virgil Ditch Number 3 | 1988 | 42 | B |

Data indicated that at the time of the survey (15 years ago), the streams of the Virgil Ditch system were generally considered of moderate to high quality based on the biological diversity of fish pollutions recorded in the streams.

A request for additional data on instream and riparian habitat conditions was submitted to the Illinois Natural History Surevy and the Illinois Department of Natural Resources. This information was pending at the time of the report.

*3.13.6.2 Data collected by DeKalb County*

Birds

Based on data provided by DeKalb County, 207 species of birds have been seen within the vicinity of the DeKalb County portion of the East Branch South Branch Kishwaukee River watershed with in the last 10 years. A list of the observed species in included in Appendix B.

*3.13.6.3 Data collected as part of the Watershed Planning Process*

Northern Illinois University in coordination with the East Branch South Branch Kishwaukee River (including Union Ditch and Virgil Ditch) Watershed Steering Committee (Watershed Steering Committee) conducted a stream inventory of the watershed as part of the development of this watershed-based plan. Habitat, biological, and/or water quality data was collected at 8 sites in the watershed. The sites and their location are listed in Table 3-38 and shown in Figure 3-29. Field data sheets for the sampling can be found in Appendix B.

**Table 3-38** Data Collection Sites in East Branch South Branch Kishwaukee River Watershed

| Site Name | Location | Date Sampled |
|---|---|---|
| East Branch of the South Branch Kishwaukee River | Near Motel Road | 08/06/2013 |
| Blue Heron Creek | Near Motel Road | 08/09/2013 |
| Union Ditch #1 | Near Hartmann Road | 08/14/2013 |
| Union Ditch #2 | Near Maple Park Road and railroad tracks | 08/14/2013 |
| Union Ditch #3 | Near Airport Road | 08/17/2013 |
| Virgil Ditch #1 | Near Thatcher Road | 09/07/2013 |
| Virgil Ditch #2 | Near Welter Road | 09/28/2013 |
| Virgil Ditch #3 | Near Winters Road | 09/07/2013 |

Qualitative Habitat Evaluation Index (QHEI)

NIU used a modified qualitative habitat evaluation index (QHEI) to evaluate the stream condition in the watershed. The QHEI gives scientists a qualitative assessment of physical characteristics of a sampled stream similar to IBI biological data. QHEI represents a measure of instream geography. This comprehensive assessment is critical for evaluating disturbance and land use practices. There are six variables which comprise the QHEI (see Table 3-39). The QHEI scores for the sampled sites are included in Table 3-40.

**Table 3-39** QHEI Components

| Metric | Metric Component | Best Possible Score |
|---|---|---|
| Substrate | • Type<br>• Quality | 20 |
| Instream Cover | • Type<br>• Amount | 20 |
| Channel Morphology | • Sinuosity<br>• Development<br>• Channelization<br>• Stability | 20 |
| Riparian Zone | • Width<br>• Quality<br>• Bank Erosion | 10 |
| Pool Quality | • Max Depth<br>• Current<br>• Morphology | 12 |
| Riffle Quality | • Depth<br>• Substrate Stability<br>• Substrate embeddedness | 8 |
| Map Gradient | | 10 |
| | Total | 100 |

**Table 3-40** QHEI Scores for the Sampled Sites

| Site | Substrate | Instream Cover | Channel Morphology | Riparian Zone | Pool Quality | Riffle Quality | Map Gradient | TOTAL |
|---|---|---|---|---|---|---|---|---|
| East Branch South Branch Kishwaukee River | 6 | 7 | 14 | 10 | 1 | 4 | 2 | 44 |
| Blue Heron Creek | 0 | 10 | 12 | 7 | -1 | 0 | 2 | 30 |
| Union Ditch #1 | 15 | 8 | 12 | 6 | 1 | 4 | 2 | 48 |
| Union Ditch #2 | -2 | 9 | 14 | 9 | -1 | 4 | 2 | 35 |
| Union Ditch #3 | -2 | 7 | 8 | 8 | 1 | 2 | 2 | 26 |
| Virgil Ditch #1 | 8 | 13 | 8 | 7 | -1 | 0 | 2 | 37 |

| Site | Substrate | Instream Cover | Channel Morphology | Riparian Zone | Pool Quality | Riffle Quality | Map Gradient | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Virgil Ditch #2 | 18 | 12 | 13 | 4 | 2 | 3 | 2 | 54 |
| Virgil Ditch #3 | 20 | 10 | 14 | 7 | -1 | 5 | 2 | 57 |

For communicating general habitat quality narrative categories have been assigned to QHEI scores. The narrative category by QHEI score is shown in Table 3-41. The narrative category for the samples sites is included in Table 3-42.

**Table 3-41** Narrative Ranges Assigned to QHEI Scores

| Narrative Rating | QHEI Score | |
|---|---|---|
| | **Headwater Streams (<20 square mile tributary area)** | **Larger Streams** |
| Excellent | >70 | >70 |
| Good | 55-69 | 60-69 |
| Fair | 43-54 | 45-59 |
| Poor | 30-42 | 30-44 |
| Very Poor | <30 | <30 |

**Table 3-42** Narrative Ranges for the Sampled Sites

| Location | Score | Narrative Category |
|---|---|---|
| East Branch South Branch Kishwaukee River | 44 | Fair |
| Blue Heron Creek | 30 | Poor |
| Union Ditch #1 | 48 | Fair |
| Union Ditch #2 | 35 | Poor |
| Union Ditch #3 | 26 | Very Poor |
| Virgil Ditch #1 | 37 | Poor |
| Virgil Ditch #2 | 54 | Good/Fair |
| Virgil Ditch #3 | 57 | Good |

More information on QHEI and how it is calculated can be found in *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)*, published by State of Ohio Environmental Protection Agency, Division of Surface Water in June 2006.

Macroinvertebrates

In each 200 foot stream segment, NIU collected aquatic macroinvertebrates. Aquatic macroinvertebrates, other than unioinid clams, were sampled qualitatively primarily using a triangular net (1 mm mesh). The aquatic vegetation in, and the overhanging vegetation along the sides of, the channel were swept repeatedly and systematically with the net. In the middle sections of the channel, the net was positioned vertically to the bottom of the substrate while the area just upstream of the net (~ 0.5 m2) was disturbed by kicking the substrate. All specimens collected with the net were sorted in a white enamel pan, identified, and then returned to the water. When present, larger rocks and submerged woody debris were removed and examined for macroinvertebrates. Macroinvertebrate data collected by NIU is summarized in Table 3-43.

**Table 3-43** Macroinvertebrate Data Collected by NIU

| Site | Observed | Species | Narrative Category |
|---|---|---|---|
| East Branch South Branch Kishwaukee River | Yes | Mayflies, Caddisflies, Damselflies, Snails, Amphipods, Leeches, Worms, Crayfish, Fingernail Clams, Simuliidae, Haliplidae, Frogs | Good |
| Blue Heron Creek | Yes | Mayflies, Dragonflies, Snails, Worms, Beetles | Poor |
| Union Ditch #1 | Yes | Caddisflies, Damselflies, Snails, Amphipods, Isopods, Leeches, Worms, Hemiptera belostomatidae, pipuladae, back swimmer, water boatman, midge, chironomus | Good |
| Union Ditch #2 | Yes | Mayflies, Dragonflies, Damselflies, Snails, Isopods, Beetles, Plankton, Corixid | Poor |
| Union Ditch #3 | Yes | Mayflies, Caddisflies, Dragonflies, Damselflies, Snails, Amphipods, Worms, Beetles, Crayfish, Caddi-pupal Case, Pollywods in Myriophyllus, Zooplankton, Mosquito larva, Corixids | Fair |
| Virgil Ditch #1 | Yes | Mayflies, Dragonflies, Damselflies, Snails, Amphipods, Worms, Beetles | Fair |
| Virgil Ditch #2 | Yes | Dragonflies, Damselflies, Snails, Amphipods, Leeches, Beetles, Crayfish, | Fair |
| Virgil Ditch #3 | Yes | Mayflies, Caddisflies, Dragonflies, Damselflies, Snails, Worms, Beetles, Crayfish | Good |

Fish/Amphibians

Fish and amphibians were not sampled and collected as part of this assessment. Field staff anecdotally noted the presence of any small fish or amphibians observed during the collection of macroinvetrbrates. Fish and amphibian species noted by NIU are included in Table 3-44.

**Table 3-44** Fish and Amphibians Noted by NIU

| Site | Observed | Species | Narrative Category |
|---|---|---|---|
| East Branch South Branch Kishwaukee River | Yes | Minnow, Frogs | Present |
| Blue Heron Creek | Yes | | Present |
| Union Ditch #1 | None | | None |
| Union Ditch #2 | Yes | Fish larva | Present |
| Union Ditch #3 | Yes | | Present |
| Virgil Ditch #1 | Yes | | Present |
| Virgil Ditch #2 | Yes | | Present |
| Virgil Ditch #3 | Yes | | Present |

Unionid clams/ Mussel Beds

A team of NIU investigators also sampled unionid clams in each of the 200 ft. sampling reaches. The NIU investigators systematically probed the substrate across the breadth of the channel as they moved in unison upstream. The number of live clams collected in each 10 ft. section was recorded. All live clams collected were immediately placed back in the stream sediments. Sampling for clams preceded the collection of other macroinvertebrates. Unuionid clams/mussel bed data collected by NIU is summarized in Table 3-45.

**Table 3-45** Unuionid Clams/Mussel Bed Data Collected by NIU

| Site | Observed | Field Notes | Narrative Category |
|---|---|---|---|
| East Branch South Branch Kishwaukee River | Yes | 19 beds observed | Good |
| Blue Heron Creek | None | Found 10 dead shells | None |
| Union Ditch #1 | None | | None |
| Union Ditch #2 | No survey conducted | | |
| Union Ditch #3 | Yes | 31 beds observed | Good |
| Virgil Ditch #1 | No survey conducted | | |
| Virgil Ditch #2 | None | | None |
| Virgil Ditch #3 | Yes | 12 beds observed | Poor |

Water Quality

NIU conducted a water quality sampling at the 8 sampling sites in the East Branch South Branch Kishwaukee River watershed. See Section 3.14.2 for additional information on the water quality sampling conducted by NIU.

## 3.14 Water Quality

Water quality is impacted by pollutants from a number of point and non-point sources. Point sources are discharges from a single source such as a pipe conveying wastewater from a wastewater treatment facility into the stream. Nonpoint sources contribute pollutants to the water system from across the landscape including runoff from yards, rooftops, roads, parking lots, and other urban and nonurban surfaces. During storms, pollutants on the landscape are washed from the ground and impervious surfaces into storm sewers and roadside drainage ditches, and ultimately into the East Branch South Branch Kishwaukee River stream system. Physical changes in the watershed, such as hydromodification, channelization and the loss of riparian vegetation and wetlands, also impact water quality and aquatic habitat.

The causes and sources of water quality problems in the East Branch South Branch Kishwaukee River watershed are urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to agricultural to urban. These changes have included modification of the stream channel, floodplain, and wetlands. Other changes are the result of the increased watershed impervious cover that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. In addition to increasing surface runoff, impervious surfaces reduce the amount of rainwater that infiltrates into the ground to recharge groundwater sources.

### 3.14.1 State of Illinois Reporting

Surface water quality monitoring is used by limnologists and scientists to evaluate the ecological health of a waterbody. The overall objective for water quality sampling is to assess the existing conditions of a stream, river or lake in an attempt to restore or maintain the chemical, physical, and biological integrity of the monitored surface water. In Illinois, the Illinois EPA utilizes water quality monitoring data as its major source of information for the Illinois EPA Section 305(b) and Section 303(d) List integrated report. Section 303(b) of the Federal Clean Water Act required each state to submit to the USEPA a biannual report of the quality of the state's surface and groundwater resources. The 305(b) report includes a detailed description of the how Illinois assesses water quality and whether the assessed waters meet or do not meet "Designated Uses". When a waterbody is determined to be impaired, Illinois must list the potential reasons for the impairment in the Section 303(d) impaired waters list.

Section 303(d) of the Clean Water Act requires Illinois to submit to the USEPA a list of waterbodies with impaired uses, the pollutant causing the impairment, and a priority ranking for the development of Total Maximum Daily Loads (TMDLs). The establishment of the TMDL sets the pollution reduction goal to improve the impaired waters. Historically, the 305(b) list and the 303(d) list were submitted to the USEPA as separate documents, however, since 2006, the reports have been integrated into a single report.

The surface water assessments included in the 2012 Illinois Integrated Water Quality Report and Section 303(d) List are based on data obtained through chemical, physical, and biological sampling. These assessments help protect "Designated Uses" by setting water quality standards that will protect the designated uses. In Illinois, the "designated uses" for surface waters include: aquatic life, indigenous aquatic life, fish consumption, primary contact, secondary contact, water supply and aesthetic quality. For each "designated use", it is determined if a waterbody is either "fully supporting" or "not supporting" the use based on the available data and any waters that are determined to be not supporting a designated use are considered impaired. Additionally, the USEPA required that the assessed waters be placed into categories based on their attainment (Table 3-44). Category 5 waters comprise the Illinois 303 (d) list. The 303(d) listed waters are prioritized by the Illinois EPA and TMDLs are prepared for waters in the order of priority (highest to lowest).

**Table 3-46** Categorization of 303(d) Listed Waters

| Category | Sub-Category | Description |
|---|---|---|
| 1 | | All designated uses are assessed as fully supporting and no use is threatened (Note- Illinois does not assess any waters as threatened). |
| 2 | | Available data and/or information indicate that some but not all designated uses are supported |
| 3 | | Insufficient data and/or information to make a use support determine for any use |
| 4 | | Waterbodies contain at least one impaired use but TMDL is not required. Category 4 is subdivided as listed below based on the reason a TMDL is not required. |
| | a | TMDL has been approved or established by the USEPA. |
| | b | Technology based effluent limitations required by the Clean Water Act, more stringent effluent limits required by the state, local, or federal authority, or other pollution control requirements required by state, local or federal authority are stringent enough to implement applicable water quality standards within a reasonable period of time |
| | c | Failure to meet the applicable water quality standards is not caused but a pollutant but other types of pollution (such as aquatic life impairment due to habitat degradation) |
| 5 | | Available data and/or information indicate that at least one designated use is impaired and a TMDL is required. |

According to the 2012 Integrated Water Quality Report and Section 303(d) list, 7.17 miles of the East Branch South Branch Kishwaukee River (Segment IL_PQCL-02) was assessed for aquatic life by the IEPA. As of the 2012 303(d) list, this segment of the East Branch South Branch Kishwaukee River was fully supporting its aquatic life use. No other uses (fish consumption, primary contact, secondary contact or aesthetic quality) of the East Branch South Branch Kishwaukee River were assessed by the IEPA. Additionally, no use assessment was conducted for any waters within the East Branch South Branch Kishwaukee River, Virgil Ditch, and Union Ditch subwatershed.

According to the 2012 Integrated Water Quality Report and Section 303(d) list, Lake Sycamore is listed on the 303(d) List as not supporting fish consumption use due to elevated levels of polychlorinated bi-phenyls (PCBs) from an unknown source. No other uses (fish consumption, primary contact, secondary contact or aesthetic quality) of Lake Sycamore were assessed by the IEPA.

A request for the data utilized by the IEPA to make the use assessment determinations for the East Branch South Branch Kishwaukee River and Lake Sycamore was submitted. However, at the time of this report, this information was pending.

### 3.14.2 Available Chemical and Physical Water Quality Monitoring

Typically, chemical and physical water quality monitoring includes the collection of water quality samples that are analyzed for the following parameters:

- Temperature
- pH
- Dissolved oxygen (DO)

- Conductivity
- Total suspended solids (TSS)
- Total dissolved solids (TDS)
- Metals including cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc
- Nitrogen including nitrite, nitrate, and total nitrogen
- Phosphorus including dissolved phosphorus and total phosphorus
- Bacteria
- Chlorides

There is no known water quality data available for East Branch South Branch Kishwaukee River watershed collected by any local, state, or Federal agency. But it appears that the IEPA may have collected data within the watershed as both the East Branch South Branch Kishwaukee River and Lake Sycamore have been assessed as part of the development of the 2012 Integrated Water Quality Report and Section 303(d) list. A request for the data collected by the IEPA for the East Branch South Branch Kishwaukee River and Lake Sycamore was submitted. However, at the time of this report, this information was pending. A request for additional data has also been submitted to the DeKalb County Health Department for information on water quality sampling in Lake Sycamore. This information is also pending.

Northern Illinois University in coordination with the East Branch South Branch Kishwaukee River (including Union Ditch and Virgil Ditch) Watershed Steering Committee (Watershed Steering Committee) conducted a stream inventory of the watershed as part of the development of this watershed-based plan. As part of the stream inventory, water quality data was collected at 8 sites within the watershed. At each sampling location, water samples were collected for water quality analysis at the half way point of each sampling location. Samples were collected before any other activities occurred in the waterway upgradient from the location. Turbidity using a turbidimeter was used directly from the river. Sampling consisted of rinsing a bucket three times with water from the river and then filling it to 2 gallon point. Water was then tested on the river banks. A multiprobe meter (HACH HQ probe) was used to determine temperature, pH, and conductivity immediately after sampling. HACH tests kits were run for nitrate, nitrite, phosphate, sulfate, sulfide, and ammonia next. See Table 3-38 and Figure 3-25 for information regarding the location of the sampling sites. Table 3-47 details the results of the water quality sampling.

**Table 3-47** NIU Water Quality Sampling Results for the East Branch South Branch Kishwaukee River Watershed

| Site | Temp | Conductivity | pH | Nitrate | Nitrite | Ammonia | Ortho Phosphate | Sulfide | Sulfate | Turbidity | Color | Water Clarity | Aesthetic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Detection Limit** | 0-60 | 0.01 µS/cm to 200.0 mS/cm | 1-14 | 8 | 0.05 | 0.03 | 0.03 | <0.1 | 1 | 1 | N/A | N/A | N/A |
| **Units** | °C | µS/cm | N/A | mg/L | | | | | | NTU | N/A | Inch | N/A |
| East Branch South Branch Kishwaukee River | NR | 598 | 7.5 | 110 | NR | 1.75 | 1.62 | <0.1 | 82 | 21 | Brown | <6 | N/A |
| Blue Heron Creek | 19.6 | 686 | 7.07 | 41 | 0.22 | 2.37 | 0.54 | 0.2 | <1 | 19 | Clear | 6-12 | Trash/ litter |
| Union Ditch #1 | 14.1 | 785 | 8.6 | 49 | 0.16 | 2.9 | 1.07 | 0.1 | 26 | 13 | Clear | <6 | N/A |
| Union Ditch #2 | 16.4 | 850 | 7.65 | 18 | 0.11 | >5.8 | 1.34 | 0.1 | <1 | 135 | Clear | <6 | Oil sheen, nuisance odor |
| Union Ditch #3 | 20 | 715 | 7.94 | <8 | <0.05 | <0.03 | 0.6 | <0.1 | 82 | 4 | NR | NR | |
| Virgil Ditch #1 | 24 | NR | 8.04 | NR | <0.05 | 0.21 | 1.89 | 0.1 | 71 | 12 | Clear | NR | Minimal trash / litter |
| Virgil Ditch #2 | 15.3 | 718 | 5.81 | 117 | 0.05 | 1.51 | 0.85 | 0.1 | 73 | 6 | Clear | 6-12 | Nuisance odor |
| Virgil Ditch #3 | 19.8 | NR | 7.64 | <8 | 0.98 | 1.59 | 0.56 | 0.4 | 92 | 13 | Clear | 6 | Trash / Litter |

NR= Not Reported
N/A = Not Applicable

*Temperature*
Water temperatures fluctuated with daily air temperatures as well as with seasonal changes, i.e., water temperatures are higher in summer and cooler in spring and fall. Maximum water temperatures over 20°C may preclude most fish from using these streams for habitat.

*Conductivity*
Specific conductivity indirectly measures the concentration of chemical ions or dissolved salts in the water, and may be an indicator of salt as a pollutant. The more chemical ions or dissolved salts a body of water contains, the higher the conductivity will be. Conductivity levels of 200-1,000 μS/cm are indicative of normal background levels. Conductivity outside of this range may not be suitable for certain species of fish or bugs. High conductivity (1000 to 10,000 μS/cm) is an indicator of saline conditions. High chloride concentrations following salt applications for snow melting in winter can lead to high conductivity readings, as can the leaching of effluent from a sanitary sewer line into a stream. Low water levels tend to increase concentrations of ions in the water column, while rain events tended to temporarily flush ions out of the stream system.

*pH*
Normal pH (a measure of hydrogen ions in the water) values in streams should range from 6.5 to 8.5, good conditions for aquatic life.

*Nitrogen*
Nitrogen can be found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH3), nitrates (NO3), and nitrites (NO2). Nitrogen is an essential plant nutrient, but in excess amounts it can cause significant water quality problems. Together with phosphorus, nitrogen in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth (for example algae blooms) and changes in the types of plants and animals that live in stream and lakes. The increase in aquatic plant growth, in turn, affects dissolved oxygen (DO), temperature, and other indicators. Excess ammonia (NH3), nitrates (NO3), and nitrites (NO2) can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at high concentrations under certain conditions. Nitrate levels above 10 mg/L are above drinking water guidelines. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L).

Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors.

*Phosphate*
Similar to nitrogen, phosphorus is an essential nutrient for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply (limiting nutrient) in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

Pure, "elemental" phosphorus (P) is rarely found in nature. Typically, phosphorus exists as part of a phosphate molecule ($PO_4$). Phosphorus in aquatic systems occurs as organic phosphate and inorganic phosphate. Organic phosphate consists of a phosphate molecule associated with a carbon-based molecule, as in plant or animal tissue. Phosphate that is not associated with organic material is inorganic. Inorganic phosphorus is the form required by plants. Animals can use either organic or inorganic phosphate. Both organic and inorganic phosphorus can either be dissolved in the water or suspended (attached to particles in the water column).

There are many sources of phosphorus, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure storage areas, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations.

*Sulfide*

Water containing hydrogen sulfide, commonly called sulfur water, has a distinctive "rotten egg" or swampy odor. Hydrogen sulfide is a gas formed by the decay of organic matter such as plant material. It is typically found in groundwater containing low levels of dissolved oxygen and a pH less than 6.0. If the pH range of the water is higher (7.0-12.0), the water may contain other forms of sulfur (sulfide or bisulfide). Sulfur problems occur less frequently in surface waters because flowing water is aerated naturally so that the hydrogen sulfide reacts with oxygen and escapes as a gas or settles as a solid.

Hydrogen sulfide is not regulated by drinking water standards as it is considered a nuisance chemical and does not pose a health risk at concentrations typically present in household water. Concentrations high enough to be a health risk also make the water unpalatable. Conversely, concentrations as low as 0.5 milligrams per liter (mg/L) can add objectionable taste and a rotten egg odor to drinking water.

*Sulfate*

Similarly to nitrogen and phosphorus, sulfate is an essential nutrient for tissue growth in plants and animals. However, at higher concentrations sulfate can contribute to detrimental conditions in aquatic habitat. At higher concentrations, sulfate can encourage the release of metals from streambed sediments, thereby increasing stream alkalinity, which can adversely affect aquatic organisms that have low tolerance level for high pH.

Sources of sulfate in surface water can be derived from natural processes and anthropogenic (originating from human activity) activities. Natural sources of sulfate include weathering of rocks, dry deposition from the atmosphere, and precipitation. Anthropogenic sources of sulfate include: combustion of fossil fuels; industrial byproducts such as cement, steel mill slag; and crushed limestone (commonly used in parking lots and road construction). The combustion of fossil fuels accounts for the majority of sulfur in the atmosphere, which can return to the surface as sulfate through precipitation or dry deposition.

*Turbidity*

Turbidity, a measurement of the 'cloudiness' of water, is caused by suspended particles, or TSS (total suspended solids). Suspended materials include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than cold. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of DO. Suspended materials can clog fish gills, reducing resistance to disease in fish, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates.

Sources of turbidity include: soil erosion; waste discharge; urban runoff; eroding stream banks; large numbers of bottom feeders (such as carp), which stir up bottom sediments; and excessive algal growth. Turbidity tends to increase after rain events when runoff carries particles into the stream, when high flows erode streambanks and/or the streambed, and when the increased volume of water in the channel stirs the sediment in the bottom of the channel.

*Dissolved Oxygen*

Algae and aquatic plants in the creek elevate dissolved oxygen (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below the Illinois Environmental Protection Agency standard of 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic conditions) can be detrimental to aquatic life.

### 3.14.3 Illinois EPA Permit Programs

The Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water regulates wastewater discharges through the implementation of the National Pollution Discharge Elimination System (NPDES) program. This program was imitated under the Clean Water Act to reduce pollution to surface waters and required permits be issued for the discharge of: 1) treated municipal effluent; 2) treated industrial effluent; and 3) stormwater from separate storm sewer systems (MS4s) and construction sites.

NPDES Point Source Discharges for Municipal and Industrial Effluent

Point sources of pollution are discharges from a single source such as a pipe conveying wastewater from an industrial process or a wastewater treatment facility into the stream. There are no municipal wastewater treatment plants discharging to the East Branch South Branch Kishwaukee River watershed. There are 9 NPDES point source industrial permits issued in the watershed: Central High School, DeKalb County Packing Company, Evergreen Mobile Home Park, Maple Park Sewage Treatment Plant, Larson Quarry, Suter Company, Sycamore Sewage Treatment Plant and Vulcan Materials Company. The locations of the NPDES Discharges are shown in Figure 3-30.

Table 3-48 provides additional information on these NPDES point source dischargers.

**Table 3-48** NPDES Point Source Dischargers

| Name | Description | NPDES Permit Number | Permit Status | Receiving Water |
|---|---|---|---|---|
| Central High School<br>Burlington, Illinois | Sewage treatment plant | IL0049832 | Active | Kishwaukee River |
| DeKalb County Packing Company<br>Cortland, Illinois | Meat packing plant | IL0049832 | Active | Unnamed tributary to the Kishwaukee River |
| Evergreen Village Mobile Home Park<br>Sycamore, Illinois | Sewage treatment plant | IL0036811 | Active | E Branch S Branch Kishwaukee River |
| Maple Park Sewage Treatment Plant<br>Maple Park, Illinois | Sewage treatment plant | IL0070131 | Active | Union Ditch #2 |
| Larson Quarry (operated by Vulcan Materials)<br>Sycamore, Illinois | Crushed and broken limestone | IL0003786 | Active | E Branch S Branch Kishwaukee River |
| Maple Park Sewage Treatment Plan<br>Maple Park, Illinois | Sewage treatment plant | ILG580261 | Active | Union Ditch #2 |
| Suter Company<br>Sycamore, Illinois | Poultry Processing | IL0060828 | Active | Martins Ditch (tributary to E Branch S Branch Kishwaukee River) |
| Sycamore North Sewage Treatment Plant<br>Sycamore, Illinois | Sewage treatment plant | IL0031291 | Active | E Branch S Branch Kishwaukee River |
| Vulcan Materials Company<br>Sycamore, Illinois | Crushed and broken limestone | IL0068110 | Active | E Branch S Branch Kishwaukee River |

NPDES Stormwater Regulations

Stormwater runoff is a major source of pollution to the East Branch South Branch Kishwaukee River watershed. Stormwater runoff includes rainwater and snow melt that flows off the land into storm sewers or directly into lakes, rivers, or streams. Stormwater runoff can carry a wide range of pollutants including sediment, nutrients, metals, chlorides, and petroleum. Additionally, as the runoff flows over land, it can lead to increased erosion of exposed soils, especially on construction sites.

In order to reduce the impacts of stormwater on our rivers, streams and lakes, Illinois has been implementing stormwater regulations since 1990 through the NPDES program. The regulations have been implemented in two phases: Phase I and Phase II. Phase I began in 1990 and required large and medium-size cities with populations over 100,000 to obtain an NPDES permit coverage for their municipal separate storm sewer system (MS4). Phase I also required NPDES permits for ten industrial uses and for construction sites disturbing 5 acres or more of land.

The NPDES Phase II program began in 2003 and was an update to the 1990 Phase I program. The Phase II program expanded the program by including additional MS4 categories, providing a "no exposure" exemption to certain industrial facilities if activities are protected by a storm-resistant shelter to prevent the exposure of runoff and material from leaving the facility, and decreasing the threshold for a construction site permit to 1 acre or more of land disturbing activity.

MS4 Permits

The following governmental entities with the East Branch South Branch Kishwaukee River watershed are designated as MS4 communities: Campton Township, Town of Cortland, Cortland Township, DeKalb County, DeKalb Township, Village of Elburn, Kane County, Village of Lily Lake, Mayfield Township, Plato Township, City of Sycamore, and Sycamore Township. The Phase II communities all operate under a General Permit for Discharges from Small MS4s (Illinois EPA Permit Number ILR40).

The MS4 communities are required to complete a series of Best Management Practices (BMPs) including 1) Develop a stormwater management program consisting of BMPs and measurable goals for at least 6 control measures: 1) public education and outreach on stormwater impacts; 2) public involvement; 3) illicit discharge detection and elimination; 4) construction site stormwater runoff control; 5) post-construction stormwater runoff control in new developments; and 6) pollution prevention/good housekeeping for municipal operations. In addition to the six control measures, the MS4s must also submit a Notice of Intent (NOI) and an annual report of activities related to the permit to the Illinois EPA.

Construction Permits

As discussed above, NPDES Phase II Stormwater Regulations were implemented by the Illinois EPA in 2003 to address potential erosion from construction including commercial, residential, road building, and demolition sites in the state that disturb more than one acre of land. Land disturbance is defined as exposing soil during clearing, grading, or excavation. The regulations specifically require the operator (person with operational control of the day to day construction activities) of the property to ensure compliance with the permit conditions outlined in the Illinois Construction Site General Permit (ILR10). These requirements include submitting a Notice of Intent (NOI) to begin construction, create a Stormwater Pollution Prevent Plan (SWPPP) to control erosion during construction, and submit a Notice of Termination (NOT) when the site is permanently stabilized. The regulations also require that the construction site be inspected every 7 days and after every 0.5-inch or greater rainfall event or equivalent snowfall by a qualified inspector. During the weekly inspection, existing soil erosion and sediment control (SESC) practices are inspected for needed repairs. Additionally, the inspections are used to identify additional potential sources of erosion and sedimentation and make recommendations for additional SESC control practices. If construction activities result in an off-site discharge of sediment bearing waters, the operator is required to submit a Incident of Non-compliance (ION) to the Illinois EPA and provide a plan to prevent further releases of sediment.

The counties and municipalities also have soil erosion and sediment control ordinances that are aimed at reducing the potential for sediment from construction activities for negatively impacting the East Branch South Branch Kishwaukee River watershed.

### 3.14.4 Nonpoint Source Pollution

When rain flows across the landscape, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams. This kind of pollution is called nonpoint source pollution, because it comes from the entire watershed rather than a single point, plant, or facility. These pollutants accumulate as the water flows downstream and eventually begin to degrade the quality of East Branch South Branch Kishwaukee River for aquatic life, as well as for human uses such as fishing, wading, and bird watching. In this way, every small bit of pollution adds up to a very large problem.

In addition to chemicals and other substances picked up from the landscape, non point source pollution includes other measures such as temperature, acidity, and the amount of oxygen in the water. Aquatic organisms including fish and benthic macroinvertebrates that are critical links in the food chain, need oxygen that is dissolved in the water to breathe. Low flows and nonpoint source pollution can cause the dissolved oxygen levels in the water to fall below healthy levels. When this happens, some plants and animals will die, in some cases causing fish kills, and others will leave that location to try to find cleaner water.

Water temperature can also cause problems. Many fish and other aquatic animals require cool or cold flowing water to survive. As rainwater flows across urban surfaces and through the sewer system, these surfaces warm the water causing the overall temperature of the receiving stream to be too warm for many aquatic plants and animals. This water can also be either more acidic (low pH) or more alkaline (high pH) than is healthy for these organisms to survive.

*Sanitary Sewer System*

The Sycamore Sewage Treatment Plant and Maple Park Sewage Treatment Plant discharges treated wastewater in the East Branch South Branch Kishwaukee River watershed. These discharges are point sources of pollution covered by the NPDES point source permitting process discussed in Section 3.11. However, non-point source pollution also can be traced to issues (cross connections with the storm sewer system, leakage into or out of the sanitary sewer system, overflows of the sanitary sewer system due to stormwater infiltration or combined sewers) within the sanitary or sewer system. The following are known about the Sycamore and Maple Park systems:

- No known cross connections exist between the sanitary system and the storm sewer system within the East Branch South Branch Kishwaukee River watershed that could result in sanitary discharge into the storm sewers.
- There are no combined sewers within these watersheds
- There are no overflow structures discharging into the waters of the watershed.

Additional sanitary sewer systems provide services to the Village of Campton Hills and Cortland. However, the discharges for these sanitary sewer systems are located outside the watershed.

*Septic Systems*

Several areas in the East Branch South Branch Kishwaukee River watershed are serviced by septic systems. Areas not serviced by sanitary sewer are assumed to be on septic systems.

Septic systems have the potential to discharge nutrients (phosphorus and nitrogen) and bacteria and virus in to the surface and groundwater of the East Branch South Branch Kishwaukee River watershed. When properly designed and maintained, the quantity of pollution discharge from the septic systems is limited. However, failing septic systems have the potential to be a significant cause of surface water and groundwater quality degradation. Additionally, it has been noted that straight-pipe septic systems can be found across the watershed. "Straight-piping" occurs when there is no in-ground treatment (septic system) of the sewage and instead the raw sewage is pumped directly to a stream. In the East Branch South Branch Kishwaukee River watershed, drain tiles are often used to deliver the untreated, raw sewage from homes to the creeks. Straight pipes have been illegal since the passage of the Clean Water Act in 1972, however, they can still be found in the old farmsteads in the watershed. Both failed septic systems and drain pipes can cause significant water quality degradation by introducing high levels of bacteria and nutrients into surface waters.

**Nonpoint Point Source Pollutant Load Analysis**

As a means of quantifying non-point source pollution loading in the watershed, a Pollutant Loading (PLOAD) application model for the East Branch South Branch Kishwaukee River watershed was developed. PLOAD is an extension of the comprehensive modeling tools in the Environmental Protection Agency's (EPA) Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) model. PLOAD is a GIS-based model that estimates nonpoint-source and point-source loadings on an annual average basis for small urban watersheds.

Hey has selected PLOAD as the nutrient loading modeling application that is the most appropriate for the East Branch South Branch Kishwaukee River watershed for the following reasons:

**Transferability**

PLOAD was designed to be utilized in a wide range of applications and uses including NPDES stormwater permitting, watershed management, watershed planning, and lake/reservoir protection projects. PLOAD is applicable for both small urban and rural watersheds of any size. The model inputs include GIS coverages of land use, subbasin boundaries, and BMP locations along with look-up tables for pollutant event mean concentrations (EMCs), imperviousness and BMP removal efficiencies.

Additionally, as PLOAD is an extension of the BASINS model, the model can be downloaded for free from the Illinois EPA on the BASINS homepage. As such it is not cost prohibitive for even the smallest watershed planning organizations.

**Applicability**

PLOAD has the ability to estimate the importance of pollution contributions from multiple land uses and many individual sources in a watershed. Thus, it can be used to target important areas of pollution generation and identify areas best suited for controls within a watershed. Once these "hot spots" are identified, PLOAD can then be utilized to evaluate the effectiveness that various types and locations of BMPs within the "hot spots" on pollutant loading.

PLOAD also has the ability to assess seasonal or inter-annual variability of nonpoint-source pollution and to assess long-term water quality trends. It can also be used to address land use patterns and landscape configurations in the watershed. This allows for the user to evaluate changes in pollutant loading that may occur as the result of future, predicted land use conditions.

**Ease of Use**

PLOAD has a user-friendly interface. Starting a new project within the BASINS platform involves an easy to follow step-by-step process. Once a project is started in BASINS, the gathering of background data necessary to run the PLOAD model can begin. After the initial background data is loaded into the model (land use, elevation and hydrology information, watershed boundaries, etc.) the PLOAD model plug-in can be utilized. The PLOAD model plug-in incorporates another step-by-step process where land use, precipitation, event mean concentration, BMPs, point sources, and bank erosion can either be referenced to BASINS or inserted manually where applicable for the particular project or area being analyzed. Manual insertion of the data is clearly detailed within the software instructions.

After modeling is complete, PLOAD gives its user the ability to generate out-puts as user-defined formats. This enables the user to tailor the output data they need. If so desired, the user can view the data from BASINS and PLOAD in ArcGIS if that software is installed on the computer being utilized.

**Customizable**

PLOAD's organization and structure facilitates modification and customization. By using look-up tables for EMCs, imperviousness terrain factor, and BMP removal efficiencies, PLOAD gives the user the opportunity to integrate site and region specific data on loading and removal rates into the model. This allows for a more refined calculation of loading and reduction rates.

Pollutants evaluated using PLOAD included

- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)

- Total Phosphorus (TP)
- Total Nitrogen (TN)
- Nitrate-Nitrite (NO3-NO2)
- Total Kjeldahl Nitrogen (TKN)
- Lead
- Copper
- Cadmium
- Chromium
- Nickel
- Zinc

The model estimated pollutant loading of each pollutant from each subwastershed management unit (SMU). The modeled values were compared to the Illinois Environmental Protection Agency (Illinois EPA) Water Quality Standards for General Use, Secondary Contact, and Aquatic Life. The Illinois EPA Water Quality Standards used for this assessment are included in Table 3-49.

**Table 3-49** Illinois EPA Water Quality Standards

| Pollutant | Illinois EPA Standards |
|---|---|
| TSS | 750 ppm |
| TDS | 1,500 mg/L |
| BOD | 5.0 mg/L |
| COD | 30 mg/L |
| Total Phosphorus* | 0.05 mg/L |
| Total Nitrogen (TN) | 15 mg/L |
| Nitrate – Nitrite (NO3-NO2) | Not applicable |
| Total Kjeldahl Nitrogen (TKN) | 10 mg/L |
| Lead (Pb) | 0.1 mg/L |
| Copper (Cu) | 1.0 mg/L |
| Cadmium (Cd) | 0.15 mg/L |
| Chromium (Cr) | 0.3 mg/L |
| Nickel (Ni) | 1.0 mg/L |
| Zinc (Zn) | 1.0 mg/L |

* Applicable only to lakes/reservoirs and streams at its confluence with a lake/reservoir

Four pollutants in particular (TSS, TP, COD, and BOD) are considered as pollution indicators for this watershed. TSS and TP are typical indicators of urban pollutant loadings. TSS can lead to excessive sedimentation in stream reaches and ultimately cover and impair instream habitat. TP can lead to excessive productivity levels of aquatic plants in slow moving reaches and in wetlands. This can then lead to low DO levels as the plant material decays Low DO levels make the stream uninhabitable for some species of aquatic life. Since COD and BOD represent oxygen demanding substances they were included in the list of indicator pollutants for this watershed.

The pollutant loading results were used to identify and prioritize SMUs by their respective degree of pollutant loading. Table 3-50 details the pollution loading estimates from each subwatershed on a concentration basis (mg/L). Table 3-51 includes pollutant load calculations in pounds per year for each subbasin. Table 3-52 lists pollutant load in pounds per year for each land use.

The loading calculations were used to establish a ranking system for each of the modeled pollutants in order to identify priority watersheds. The rankings included "High" for those pollutants that exceeded the Illinois EPA standard, "Medium" for those pollutants that were under the Illinois EPA standard but at least half their value, and "Low" for those pollutants that were less than half of the Illinois EPA standard. Table 3-53 lists the Illinois EPA standards by pollutant and those subwatersheds exhibiting High, Medium, and Low levels for each pollutant.

**Table 3-50** Estimated Pollutant Loading by Subwatershed in the East Branch of the South Branch Kishwaukee River watershed (mg/L)

| SMU | Area (square mile) | TSS | TDS | BOD | COD | TP | $PO_4$ | TN | $NO_3$ | $NO_2/NO_3$ | TKN | ORGN | $NH_4$ | Pb | Cu | Cd | Cr | Ni | Zinc | Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **East Branch of the South Branch Kishwaukee River Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| EBKR-1 | 0.02 | 1216.41 | 84.49 | 5.00 | 37.93 | 0.20 | 0.10 | 1.00 | 0.10 | 0.50 | 0.70 | 0.20 | 0.10 | 0.00710 | 0.00303 | 0.00152 | 0.00203 | 0.00203 | 0.03035 | 0.00303 |
| EBKR-2 | 3.73 | 232.92 | 53.49 | 14.27 | 48.31 | 0.48 | 0.19 | 1.93 | 0.19 | 0.96 | 1.44 | 0.39 | 0.19 | 0.01886 | 0.00943 | 0.00471 | 0.00750 | 0.00750 | 0.09427 | 0.00943 |
| EBKR-3 | 1.58 | 261.29 | 53.98 | 14.12 | 48.16 | 0.47 | 0.19 | 1.91 | 0.19 | 0.96 | 1.43 | 0.38 | 0.19 | 0.01867 | 0.00932 | 0.00466 | 0.00741 | 0.00741 | 0.09323 | 0.00932 |
| EBKR-4 | 3.62 | 295.76 | 55.96 | 13.79 | 47.05 | 0.46 | 0.19 | 1.88 | 0.19 | 0.94 | 1.40 | 0.38 | 0.19 | 0.01809 | 0.00904 | 0.00452 | 0.00716 | 0.00716 | 0.09040 | 0.00904 |
| EBKR-5 | 5.75 | 883.32 | 83.44 | 8.16 | 33.53 | 0.29 | 0.13 | 1.32 | 0.13 | 0.66 | 0.95 | 0.26 | 0.13 | 0.00921 | 0.00458 | 0.00229 | 0.00326 | 0.00326 | 0.04578 | 0.00458 |
| EBKR-6 | 1.76 | 335.52 | 58.83 | 13.15 | 45.72 | 0.44 | 0.18 | 1.82 | 0.18 | 0.91 | 1.35 | 0.36 | 0.18 | 0.01712 | 0.00855 | 0.00427 | 0.00673 | 0.00673 | 0.08548 | 0.00855 |
| EBKR-7 | 0.01 | 755.63 | 78.24 | 9.34 | 35.91 | 0.33 | 0.14 | 1.43 | 0.14 | 0.72 | 1.05 | 0.29 | 0.14 | 0.01095 | 0.00547 | 0.00274 | 0.00404 | 0.00404 | 0.05477 | 0.00548 |
| EBKR-8 | 2.22 | 433.26 | 60.53 | 12.72 | 45.03 | 0.43 | 0.18 | 1.77 | 0.18 | 0.89 | 1.32 | 0.35 | 0.18 | 0.01653 | 0.00823 | 0.00412 | 0.00646 | 0.00646 | 0.08233 | 0.00823 |
| EBKR-9 | 2.27 | 450.34 | 62.31 | 12.42 | 44.04 | 0.42 | 0.17 | 1.74 | 0.17 | 0.87 | 1.29 | 0.35 | 0.17 | 0.01599 | 0.00798 | 0.00399 | 0.00623 | 0.00623 | 0.07978 | 0.00798 |
| EBKR-10 | 4.46 | 927.50 | 85.84 | 7.81 | 32.11 | 0.28 | 0.13 | 1.28 | 0.13 | 0.64 | 0.93 | 0.26 | 0.13 | 0.00852 | 0.00426 | 0.00213 | 0.00298 | 0.00298 | 0.04257 | 0.00426 |
| EBKR-11 | 2.95 | 537.48 | 66.76 | 11.55 | 41.79 | 0.40 | 0.17 | 1.65 | 0.17 | 0.83 | 1.22 | 0.33 | 0.17 | 0.01457 | 0.00727 | 0.00364 | 0.00562 | 0.00562 | 0.07269 | 0.00727 |
| EBKR-12 | 2.86 | 899.85 | 84.28 | 8.08 | 32.96 | 0.29 | 0.13 | 1.31 | 0.13 | 0.65 | 0.95 | 0.26 | 0.13 | 0.00899 | 0.00449 | 0.00224 | 0.00318 | 0.00318 | 0.04488 | 0.00449 |
| EBKR-13 | 4.30 | 321.59 | 57.60 | 13.48 | 46.20 | 0.45 | 0.18 | 1.85 | 0.18 | 0.92 | 1.38 | 0.37 | 0.18 | 0.01757 | 0.00878 | 0.00439 | 0.00694 | 0.00694 | 0.08783 | 0.00878 |
| EBKR-14 | 2.31 | 857.06 | 82.98 | 8.40 | 33.51 | 0.30 | 0.13 | 1.34 | 0.13 | 0.67 | 0.97 | 0.27 | 0.13 | 0.00945 | 0.00472 | 0.00236 | 0.00338 | 0.00338 | 0.04724 | 0.00472 |
| **Union Ditch Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| UD-1 | 0.04 | 635.67 | 72.70 | 10.46 | 38.65 | 0.36 | 0.15 | 1.55 | 0.15 | 0.77 | 1.14 | 0.31 | 0.15 | 0.01274 | 0.00637 | 0.00318 | 0.00482 | 0.00482 | 0.06352 | 0.00635 |
| UD-2 | 3.36 | 551.11 | 67.88 | 11.42 | 41.06 | 0.39 | 0.16 | 1.64 | 0.16 | 0.82 | 1.21 | 0.33 | 0.16 | 0.01428 | 0.00714 | 0.00357 | 0.00550 | 0.00550 | 0.07140 | 0.00714 |
| UD-3 | 1.57 | 692.52 | 75.38 | 9.92 | 37.31 | 0.35 | 0.15 | 1.49 | 0.15 | 0.75 | 1.09 | 0.30 | 0.15 | 0.01188 | 0.00594 | 0.00297 | 0.00445 | 0.00445 | 0.05935 | 0.00593 |
| UD-4 | 4.41 | 852.28 | 82.58 | 8.45 | 33.77 | 0.30 | 0.13 | 1.35 | 0.13 | 0.67 | 0.98 | 0.27 | 0.13 | 0.00955 | 0.00477 | 0.00239 | 0.00343 | 0.00343 | 0.04772 | 0.00477 |
| UD-5 | 2.82 | 791.39 | 79.69 | 9.04 | 35.19 | 0.32 | 0.14 | 1.40 | 0.14 | 0.70 | 1.02 | 0.28 | 0.14 | 0.01049 | 0.00524 | 0.00262 | 0.00384 | 0.00384 | 0.05240 | 0.00524 |
| UD-6 | 3.17 | 491.76 | 65.30 | 11.93 | 42.37 | 0.41 | 0.17 | 1.69 | 0.17 | 0.85 | 1.25 | 0.34 | 0.17 | 0.01510 | 0.00755 | 0.00377 | 0.00585 | 0.00585 | 0.07546 | 0.00755 |
| UD-7 | 0.42 | 885.98 | 83.40 | 8.13 | 33.61 | 0.29 | 0.13 | 1.31 | 0.13 | 0.66 | 0.95 | 0.26 | 0.13 | 0.00920 | 0.00457 | 0.00228 | 0.00326 | 0.00326 | 0.04569 | 0.00457 |
| UD-8 | 4.98 | 1000.86 | 89.09 | 7.08 | 30.62 | 0.26 | 0.12 | 1.21 | 0.12 | 0.60 | 0.87 | 0.24 | 0.12 | 0.00743 | 0.00370 | 0.00185 | 0.00249 | 0.00249 | 0.03699 | 0.00370 |
| UD-9 | 0.42 | 1107.27 | 93.26 | 6.10 | 28.79 | 0.23 | 0.11 | 1.11 | 0.11 | 0.56 | 0.79 | 0.22 | 0.11 | 0.00601 | 0.00296 | 0.00148 | 0.00185 | 0.00185 | 0.02962 | 0.00296 |
| UD-10 | 0.93 | 956.59 | 86.88 | 7.48 | 31.80 | 0.27 | 0.12 | 1.25 | 0.12 | 0.62 | 0.90 | 0.25 | 0.12 | 0.00811 | 0.00403 | 0.00202 | 0.00278 | 0.00278 | 0.04032 | 0.00403 |
| UD-11 | 4.84 | 801.65 | 80.09 | 8.93 | 35.04 | 0.32 | 0.14 | 1.39 | 0.14 | 0.70 | 1.01 | 0.28 | 0.14 | 0.01034 | 0.00516 | 0.00258 | 0.00377 | 0.00377 | 0.05161 | 0.00516 |
| UD-12 | 4.61 | 903.39 | 84.72 | 7.98 | 32.76 | 0.29 | 0.13 | 1.30 | 0.13 | 0.65 | 0.94 | 0.26 | 0.13 | 0.00884 | 0.00441 | 0.00221 | 0.00311 | 0.00311 | 0.04407 | 0.00441 |
| UD-13 | 5.11 | 876.24 | 83.31 | 8.28 | 33.44 | 0.30 | 0.13 | 1.33 | 0.13 | 0.66 | 0.96 | 0.27 | 0.13 | 0.00930 | 0.00464 | 0.00232 | 0.00331 | 0.00331 | 0.04644 | 0.00464 |
| UD-14 | 5.12 | 854.91 | 82.33 | 8.49 | 33.90 | 0.30 | 0.13 | 1.35 | 0.13 | 0.67 | 0.98 | 0.27 | 0.13 | 0.00963 | 0.00481 | 0.00240 | 0.00346 | 0.00346 | 0.04810 | 0.00481 |
| UD-15 | 6.39 | 761.32 | 76.83 | 9.46 | 36.87 | 0.33 | 0.14 | 1.45 | 0.14 | 0.72 | 1.06 | 0.29 | 0.14 | 0.01131 | 0.00563 | 0.00281 | 0.00418 | 0.00418 | 0.05625 | 0.00562 |
| UD-16 | 3.36 | 413.27 | 62.49 | 12.50 | 43.76 | 0.42 | 0.17 | 1.75 | 0.17 | 0.87 | 1.30 | 0.35 | 0.17 | 0.01600 | 0.00800 | 0.00400 | 0.00625 | 0.00625 | 0.07998 | 0.00800 |
| UD-17 | 2.55 | 773.80 | 79.11 | 9.18 | 35.45 | 0.33 | 0.14 | 1.42 | 0.14 | 0.71 | 1.03 | 0.28 | 0.14 | 0.01069 | 0.00534 | 0.00267 | 0.00392 | 0.00392 | 0.05343 | 0.00534 |
| UD-18 | 4.04 | 803.30 | 80.02 | 8.88 | 35.18 | 0.32 | 0.14 | 1.39 | 0.14 | 0.69 | 1.01 | 0.28 | 0.14 | 0.01033 | 0.00514 | 0.00257 | 0.00376 | 0.00376 | 0.05144 | 0.00514 |
| **Virgil Ditch Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| VD-1 | 2.08 | 885.56 | 83.27 | 8.15 | 33.69 | 0.29 | 0.13 | 1.31 | 0.13 | 0.66 | 0.95 | 0.26 | 0.13 | 0.00923 | 0.00458 | 0.00229 | 0.00327 | 0.00327 | 0.04583 | 0.00458 |
| VD-2 | 2.40 | 912.43 | 85.10 | 7.91 | 32.57 | 0.29 | 0.13 | 1.29 | 0.13 | 0.65 | 0.93 | 0.26 | 0.13 | 0.00872 | 0.00435 | 0.00218 | 0.00306 | 0.00306 | 0.04349 | 0.00435 |
| VD-3 | 0.26 | 825.27 | 81.50 | 8.70 | 34.25 | 0.31 | 0.14 | 1.37 | 0.14 | 0.68 | 1.00 | 0.27 | 0.14 | 0.00992 | 0.00496 | 0.00248 | 0.00359 | 0.00359 | 0.04960 | 0.00496 |
| VD-4 | 2.86 | 940.38 | 84.94 | 7.66 | 33.12 | 0.28 | 0.13 | 1.27 | 0.13 | 0.63 | 0.91 | 0.25 | 0.13 | 0.00861 | 0.00424 | 0.00212 | 0.00298 | 0.00298 | 0.04244 | 0.00424 |
| VD-5 | 3.84 | 638.76 | 71.96 | 10.51 | 39.18 | 0.37 | 0.16 | 1.55 | 0.16 | 0.78 | 1.14 | 0.31 | 0.16 | 0.01291 | 0.00644 | 0.00322 | 0.00489 | 0.00489 | 0.06440 | 0.00644 |
| VD-6 | 1.74 | 745.61 | 77.66 | 9.40 | 36.28 | 0.33 | 0.14 | 1.44 | 0.14 | 0.72 | 1.05 | 0.29 | 0.14 | 0.01111 | 0.00554 | 0.00277 | 0.00410 | 0.00410 | 0.05544 | 0.00554 |
| VD-7 | 2.06 | 843.22 | 81.87 | 8.55 | 34.19 | 0.31 | 0.14 | 1.35 | 0.14 | 0.68 | 0.98 | 0.27 | 0.14 | 0.00976 | 0.00487 | 0.00243 | 0.00351 | 0.00351 | 0.04868 | 0.00487 |
| VD-8 | 2.41 | 935.52 | 86.35 | 7.68 | 31.91 | 0.28 | 0.13 | 1.27 | 0.13 | 0.63 | 0.91 | 0.25 | 0.13 | 0.00834 | 0.00416 | 0.00208 | 0.00289 | 0.00289 | 0.04162 | 0.00416 |
| VD-9 | 2.17 | 1017.47 | 89.50 | 6.93 | 30.54 | 0.26 | 0.12 | 1.19 | 0.12 | 0.60 | 0.85 | 0.24 | 0.12 | 0.00726 | 0.00360 | 0.00180 | 0.00241 | 0.00241 | 0.03599 | 0.00360 |
| VD-10 | 3.79 | 948.29 | 86.44 | 7.57 | 32.02 | 0.28 | 0.13 | 1.26 | 0.13 | 0.63 | 0.91 | 0.25 | 0.13 | 0.00825 | 0.00410 | 0.00205 | 0.00285 | 0.00285 | 0.04101 | 0.00410 |
| VD-11 | 3.53 | 1009.24 | 89.45 | 7.03 | 30.40 | 0.26 | 0.12 | 1.20 | 0.12 | 0.60 | 0.86 | 0.24 | 0.12 | 0.00733 | 0.00365 | 0.00183 | 0.00245 | 0.00245 | 0.03652 | 0.00365 |

**Table 3-51** Estimated Pollutant Loading by Subwatershed in the East Branch of the South Branch Kishwaukee River watershed (mg/L)

| SMU | Area (square mile) | TSS | TDS | BOD | COD | TP | $PO_4$ | TN | $NO_3$ | $NO_2/NO_3$ | TKN | ORGN | $NH_4$ | Pb | Cu | Cd | Cr | Ni | Zinc | Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **East Branch of the South Branch Kishwaukee River Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| EBKR-1 | 0.02 | 437.9 | 384.13 | 22.73 | 172.43 | 0.91 | 0.45 | 4.55 | 0.45 | 2.27 | 3.18 | 0.91 | 0.45 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.14 | 0.01 |
| EBKR-2 | 3.73 | 527.48 | 298483.94 | 79635.31 | 269567.23 | 2668.07 | 1075.37 | 10753.66 | 1075.37 | 5376.83 | 8044.90 | 2150.73 | 1075.37 | 105.27 | 52.61 | 26.30 | 41.85 | 41.85 | 526.06 | 52.61 |
| EBKR-3 | 1.58 | 512.01 | 110530.38 | 28905.85 | 98607.66 | 969.56 | 391.44 | 3914.41 | 391.44 | 1957.21 | 2926.76 | 782.88 | 391.44 | 38.24 | 19.09 | 9.54 | 15.17 | 15.17 | 190.89 | 19.09 |
| EBKR-4 | 3.62 | 501.06 | 226537.45 | 55843.63 | 190472.29 | 1877.73 | 760.86 | 7608.62 | 760.86 | 3804.31 | 5682.04 | 1521.72 | 760.86 | 73.22 | 36.60 | 18.30 | 28.99 | 28.99 | 365.98 | 36.60 |
| EBKR-5 | 5.75 | 448.61 | 160952.59 | 15741.65 | 64685.16 | 568.70 | 253.87 | 2538.66 | 253.87 | 1269.33 | 1838.03 | 507.73 | 253.87 | 17.76 | 8.83 | 4.42 | 6.29 | 6.29 | 88.33 | 8.83 |
| EBKR-6 | 1.76 | 492.61 | 100554.86 | 22476.30 | 78152.35 | 759.75 | 310.22 | 3102.24 | 310.22 | 1551.12 | 2310.87 | 620.45 | 310.22 | 29.27 | 14.61 | 7.31 | 11.51 | 11.51 | 146.10 | 14.61 |
| EBKR-7 | 0.01 | 453.31 | 265.06 | 31.63 | 121.65 | 1.12 | 0.49 | 4.86 | 0.49 | 2.43 | 3.55 | 0.97 | 0.49 | 0.04 | 0.02 | 0.01 | 0.01 | 0.01 | 0.19 | 0.02 |
| EBKR-8 | 2.22 | 472.32 | 96603.12 | 20298.35 | 71876.13 | 688.75 | 282.79 | 2827.88 | 282.79 | 1413.94 | 2102.69 | 565.58 | 282.79 | 26.38 | 13.14 | 6.57 | 10.31 | 10.31 | 131.41 | 13.14 |
| EBKR-9 | 2.27 | 471.46 | 97561.12 | 19452.77 | 68949.21 | 661.87 | 272.82 | 2728.15 | 272.82 | 1364.08 | 2025.95 | 545.63 | 272.82 | 25.04 | 12.49 | 6.25 | 9.76 | 9.76 | 124.90 | 12.49 |
| EBKR-10 | 4.46 | 447.68 | 122062.48 | 11112.29 | 45658.38 | 404.47 | 182.22 | 1822.22 | 182.22 | 911.11 | 1315.58 | 364.44 | 182.22 | 12.12 | 6.05 | 3.03 | 4.23 | 4.23 | 60.54 | 6.05 |
| EBKR-11 | 2.95 | 463.91 | 112387.66 | 19435.74 | 70340.85 | 667.24 | 278.52 | 2785.25 | 278.52 | 1392.62 | 2059.86 | 557.05 | 278.52 | 24.53 | 12.24 | 6.12 | 9.45 | 9.45 | 122.39 | 12.24 |
| EBKR-12 | 2.86 | 448.21 | 79074.80 | 7582.13 | 30922.24 | 274.37 | 122.73 | 1227.31 | 122.73 | 613.65 | 888.03 | 245.46 | 122.73 | 8.44 | 4.21 | 2.10 | 2.98 | 2.98 | 42.09 | 4.21 |
| EBKR-13 | 4.30 | 494.93 | 251532.10 | 58856.58 | 201753.24 | 1984.04 | 806.90 | 8069.05 | 806.90 | 4034.52 | 6018.56 | 1613.81 | 806.90 | 76.71 | 38.35 | 19.18 | 30.28 | 30.28 | 383.54 | 38.35 |
| EBKR-14 | 2.31 | 449.78 | 66267.11 | 6711.90 | 26762.42 | 241.29 | 107.05 | 1070.50 | 107.05 | 535.25 | 776.54 | 214.10 | 107.05 | 7.54 | 3.77 | 1.89 | 2.70 | 2.70 | 37.72 | 3.77 |
| **Union Ditch Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| UD-1 | 0.04 | 458.78 | 1561.75 | 224.71 | 830.31 | 7.82 | 3.32 | 33.21 | 3.32 | 16.61 | 24.42 | 6.64 | 3.32 | 0.27 | 0.14 | 0.07 | 0.10 | 0.10 | 1.37 | 0.14 |
| UD-2 | 3.36 | 463.30 | 126352.34 | 21266.83 | 76440.22 | 731.08 | 305.74 | 3057.45 | 305.74 | 1528.72 | 2259.81 | 611.49 | 305.74 | 26.58 | 13.29 | 6.65 | 10.23 | 10.23 | 132.91 | 13.29 |
| UD-3 | 1.57 | 455.96 | 51541.02 | 6784.77 | 25508.41 | 237.73 | 102.03 | 1020.34 | 102.03 | 510.17 | 747.90 | 204.07 | 102.03 | 8.12 | 4.06 | 2.03 | 3.04 | 3.04 | 40.60 | 4.06 |
| UD-4 | 4.41 | 449.89 | 126866.07 | 12982.77 | 51878.40 | 466.30 | 206.64 | 2066.44 | 206.64 | 1033.22 | 1499.52 | 413.29 | 206.64 | 14.68 | 7.33 | 3.67 | 5.26 | 5.26 | 73.31 | 7.33 |
| UD-5 | 2.82 | 451.72 | 84748.18 | 9613.68 | 37421.03 | 341.58 | 149.31 | 1493.09 | 149.31 | 746.54 | 1088.13 | 298.62 | 149.31 | 11.15 | 5.57 | 2.79 | 4.08 | 4.08 | 55.72 | 5.57 |
| UD-6 | 3.17 | 468.45 | 130067.34 | 23760.39 | 84388.83 | 812.40 | 337.19 | 3371.95 | 337.19 | 1685.97 | 2498.38 | 674.39 | 337.19 | 30.07 | 15.03 | 7.52 | 11.66 | 11.66 | 150.32 | 15.03 |
| UD-7 | 0.42 | 448.45 | 11576.06 | 1128.88 | 4665.05 | 40.81 | 18.23 | 182.29 | 18.23 | 91.14 | 131.95 | 36.46 | 18.23 | 1.28 | 0.63 | 0.32 | 0.45 | 0.45 | 6.34 | 0.63 |
| UD-8 | 4.98 | 445.93 | 130421.25 | 10367.81 | 44819.68 | 384.23 | 176.87 | 1768.71 | 176.87 | 884.36 | 1268.58 | 353.74 | 176.87 | 10.88 | 5.41 | 2.71 | 3.65 | 3.65 | 54.15 | 5.41 |
| UD-9 | 0.42 | 443.60 | 10259.04 | 671.08 | 3166.80 | 25.63 | 12.21 | 122.11 | 12.21 | 61.06 | 86.69 | 24.42 | 12.21 | 0.66 | 0.33 | 0.16 | 0.20 | 0.20 | 3.26 | 0.33 |
| UD-10 | 0.93 | 446.81 | 24843.39 | 2138.91 | 9092.66 | 78.46 | 35.69 | 356.86 | 35.69 | 178.43 | 256.90 | 71.37 | 35.69 | 2.32 | 1.15 | 0.58 | 0.80 | 0.80 | 11.53 | 1.15 |
| UD-11 | 4.84 | 451.33 | 143940.24 | 16051.56 | 62964.17 | 571.40 | 250.37 | 2503.73 | 250.37 | 1251.86 | 1823.27 | 500.75 | 250.37 | 18.58 | 9.28 | 4.64 | 6.77 | 6.77 | 92.77 | 9.28 |
| UD-12 | 4.61 | 448.29 | 128008.06 | 12060.05 | 49500.82 | 437.35 | 196.15 | 1961.47 | 196.15 | 980.73 | 1418.08 | 392.29 | 196.15 | 13.36 | 6.66 | 3.33 | 4.70 | 4.70 | 66.63 | 6.66 |
| UD-13 | 5.11 | 448.93 | 143871.29 | 14295.52 | 57753.87 | 515.21 | 229.30 | 2293.01 | 229.30 | 1146.50 | 1661.71 | 458.60 | 229.30 | 16.07 | 8.02 | 4.01 | 5.72 | 5.72 | 80.17 | 8.02 |
| UD-14 | 5.12 | 449.52 | 146191.10 | 15084.68 | 60204.09 | 541.33 | 239.63 | 2396.34 | 239.63 | 1198.17 | 1739.50 | 479.27 | 239.63 | 17.10 | 8.54 | 4.27 | 6.14 | 6.14 | 85.40 | 8.54 |
| UD-15 | 6.39 | 451.84 | 192081.42 | 23645.80 | 92184.46 | 834.37 | 361.46 | 3614.56 | 361.46 | 1807.28 | 2641.65 | 722.91 | 361.46 | 28.27 | 14.06 | 7.03 | 10.45 | 10.45 | 140.62 | 14.06 |
| UD-16 | 3.36 | 478.71 | 160611.46 | 32112.61 | 112468.37 | 1091.88 | 449.63 | 4496.26 | 449.63 | 2248.13 | 3340.01 | 899.25 | 449.63 | 41.12 | 20.56 | 10.28 | 16.06 | 16.06 | 205.55 | 20.56 |
| UD-17 | 2.55 | 452.55 | 77822.41 | 9029.35 | 34870.29 | 320.07 | 139.48 | 1394.81 | 139.48 | 697.41 | 1017.47 | 278.96 | 139.48 | 10.51 | 5.26 | 2.63 | 3.86 | 3.86 | 52.56 | 5.26 |
| UD-18 | 4.04 | 451.17 | 119857.40 | 13304.58 | 52696.34 | 474.03 | 207.94 | 2079.39 | 207.94 | 1039.70 | 1513.73 | 415.88 | 207.94 | 15.47 | 7.70 | 3.85 | 5.63 | 5.63 | 77.05 | 7.70 |
| **Virgil Ditch Subwatershed** | | | | | | | | | | | | | | | | | | | | |
| VD-1 | 2.08 | 448.40 | 57774.90 | 5651.84 | 23376.44 | 204.24 | 91.21 | 912.08 | 91.21 | 456.04 | 660.28 | 182.42 | 91.21 | 6.41 | 3.18 | 1.59 | 2.27 | 2.27 | 31.80 | 3.18 |
| VD-2 | 2.40 | 448.02 | 66082.39 | 6140.23 | 25293.82 | 223.03 | 100.23 | 1002.29 | 100.23 | 501.15 | 724.18 | 200.46 | 100.23 | 6.77 | 3.38 | 1.69 | 2.38 | 2.38 | 33.78 | 3.38 |
| VD-3 | 0.26 | 450.75 | 7519.19 | 802.51 | 3160.06 | 28.69 | 12.64 | 126.38 | 12.64 | 63.19 | 91.88 | 25.28 | 12.64 | 0.92 | 0.46 | 0.23 | 0.33 | 0.33 | 4.58 | 0.46 |
| VD-4 | 2.86 | 446.61 | 76148.90 | 6864.97 | 29693.32 | 250.77 | 113.48 | 1134.75 | 113.48 | 567.38 | 818.15 | 226.95 | 113.48 | 7.72 | 3.80 | 1.90 | 2.67 | 2.67 | 38.05 | 3.80 |
| VD-5 | 3.84 | 457.81 | 130491.07 | 19056.81 | 71055.12 | 662.37 | 281.24 | 2812.36 | 281.24 | 1406.18 | 2068.55 | 562.47 | 281.24 | 23.42 | 11.68 | 5.84 | 8.87 | 8.87 | 116.78 | 11.68 |
| VD-6 | 1.74 | 453.46 | 54141.18 | 6554.57 | 25297.23 | 231.50 | 100.41 | 1004.05 | 100.41 | 502.03 | 733.52 | 200.81 | 100.41 | 7.75 | 3.86 | 1.93 | 2.86 | 2.86 | 38.65 | 3.86 |
| VD-7 | 2.06 | 449.90 | 59379.06 | 6200.77 | 24799.61 | 222.29 | 98.27 | 982.72 | 98.27 | 491.36 | 713.65 | 196.54 | 98.27 | 7.08 | 3.53 | 1.76 | 2.55 | 2.55 | 35.29 | 3.53 |
| VD-8 | 2.41 | 447.54 | 65652.97 | 5840.91 | 24260.85 | 213.24 | 96.43 | 964.26 | 96.43 | 482.13 | 695.38 | 192.85 | 96.43 | 6.34 | 3.16 | 1.58 | 2.20 | 2.20 | 31.64 | 3.16 |
| VD-9 | 2.17 | 445.41 | 97836.14 | 7571.93 | 33379.76 | 281.81 | 130.37 | 1303.75 | 130.37 | 651.87 | 933.69 | 260.75 | 130.37 | 7.93 | 3.93 | 1.97 | 2.63 | 2.63 | 39.34 | 3.93 |
| VD-10 | 3.79 | 447.03 | 94908.99 | 8307.79 | 35160.72 | 304.13 | 137.98 | 1379.77 | 137.98 | 689.89 | 994.02 | 275.95 | 137.98 | 9.06 | 4.50 | 2.25 | 3.12 | 3.12 | 45.04 | 4.50 |
| VD-11 | 3.53 | 445.78 | 56504.14 | 4443.30 | 19205.80 | 164.88 | 76.02 | 760.18 | 76.02 | 380.09 | 544.97 | 152.04 | 76.02 | 4.63 | 2.31 | 1.15 | 1.55 | 1.55 | 23.07 | 2.31 |

**Table 3-52** Estimated Annual Pollutant Load by Land Use in the East Branch of the South Branch Kishwaukee River watershed (lbs/year)

| Source | TDS | BOD | COD | TP | PO4 | TN | NO3 | NO2/NO3 | TKN | Pb | Cu | Cd | Cr | Ni | Zn | Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural | 3169664 | 400988 | 50148 | 15478 | 7697 | 62584 | 3969 | 31426 | 45031 | 407 | 214 | 114 | 132 | 132 | 1972 | 197 |
| Forest and Grassland | 62174 | 11237 | 141914 | 434 | 216 | 1754 | 11 | 881 | 1262 | 28 | 214 | 114 | 132 | 132 | 111 | 11 |
| Government, Civic and Institutional | 11944 | 9066 | 10471 | 292 | 116 | 943 | 299 | 474 | 727 | 15 | 214 | 114 | 132 | 132 | 74 | 7 |
| Industrial | 16901 | 12829 | 63735 | 413 | 164 | 1335 | 423 | 670 | 1029 | 22 | 214 | 114 | 132 | 132 | 105 | 11 |
| Mixed Use | 1247 | 947 | 16665 | 30 | 12 | 98 | 31 | 49 | 76 | 2 | 214 | 114 | 132 | 132 | 8 | 1 |
| Multifamily Residential | 7590 | 5761 | 308862 | 185 | 74 | 599 | 190 | 301 | 462 | 10 | 214 | 114 | 132 | 132 | 47 | 5 |
| Office Space | 1985 | 1506 | 37440 | 48 | 19 | 157 | 50 | 79 | 121 | 3 | 214 | 114 | 132 | 132 | 12 | 1 |
| Open Space/Conservation/Parks | 51496 | 9307 | 600960 | 359 | 179 | 1453 | 9 | 729 | 1045 | 24 | 214 | 114 | 132 | 132 | 92 | 9 |
| Retail/Commercial | 4459 | 3384 | 810339 | 109 | 43 | 352 | 112 | 177 | 271 | 6 | 214 | 114 | 132 | 132 | 28 | 3 |
| Single-family Residential | 71570 | 54325 | 7083 | 1747 | 695 | 5652 | 1792 | 2838 | 4358 | 92 | 214 | 114 | 132 | 132 | 445 | 45 |
| Transportation | 96505 | 73252 | 0.00 | 2356 | 937 | 7622 | 2417 | 3827 | 5876 | 124 | 214 | 114 | 132 | 132 | 600 | 60 |
| Utility/Waste Facility | 844 | 640 | 0.00 | 21 | 8 | 67 | 21 | 33 | 51 | 1 | 214 | 114 | 132 | 132 | 5 | 1 |

**Table 3-53** Levels of pollutant compared to Illinois EPA standards in the East Branch South Branch Kishwaukee River watershed

| Pollutant | Illinois EPA Standard (mg/L) | High | Medium | Low |
|---|---|---|---|---|
| TSS | 750ppm | **EBKR – 1, 5, 7, 10, 12 & 14**<br><br>**UD – 4, 5, 7, 8. 9, 10, 11, 12, 13, 14, 15, 17 & 18**<br><br>**VD – 1, 2, 3, 4, 7, 8, 9, 10 & 11** | EBKR – 8, 9 & 11<br><br>UD – 1, 2, 3 & 16<br><br>VD – 5 & 6 | EBKR – 2, 3, 4, 6 & 13<br><br>UD – None<br><br>VD – None |
| TDS | 1,500 mg/L | None | None | All |
| BOD | 5.0 mg/L | **All** | None | None |
| COD | 30 mg/L | **All but UD-9** | UD-9 | |
| Total Phosphorus | 0.05 mg/L | **All** | None | None |
| Total Nitrogen (TN) | 15 mg/L | None | None | All |
| Total Kjeldahl Nitrogen (TKN) | 10 mg/L | None | None | All |
| Lead (Pb) | 0.1 mg/L | None | None | All |
| Copper (Cu) | 1.0 mg/L | None | None | All |
| Cadmium (Cd) | 0.15 mg/L | None | None | All |
| Chromium (Cr) | 0.3 mg/L | None | None | All |
| Nickel (Ni) | 1.0 mg/L | None | None | All |
| Zinc (Zn) | 1.0 mg/L | None | None | All |

### 3.14.5 Summary of Water Quality Assessment

The conclusions drawn and management strategies recommended in this report are the best possible, given the extremely limited water quality data in this watershed. The primary issues with respect to water quality, including those that relate to instream and riparian habitat, are discussed below.

*Total Suspended Solids*

Nutrient modeling identified Total Suspended Solids (TSS) as a major source of impairment in the Watershed. Additionally, the habitat assessment and stakeholder input has also identified TSS as a major issue in the watershed. The primary impact of high suspended solids concentrations in streams occurs when these solids settle in depositional areas of the stream system and cover the more desirable gravel substrates. Excessive levels of particulate material also create difficult conditions for gill breathing fish and some of their food sources, including macroinvertebrate organisms.

The sources of TSS appear to be streambank and riparian erosion (due to hydrologic instability) with contributions from agricultural and urban runoff. Suspended solids can be transported to the streams and lakes, even from remote areas of the watershed, via storm sewers and roadside ditches.

Increases in impervious cover combined with introduction of stormwater drainage systems in the urban areas and the channelization of streams and the loss of wetlands in the rural areas have led to significant changes in watershed hydrology (flow alterations and hydromodification). This has in turn led to increased streambank and streambed erosion and degradation of instream habitat in many reaches.

As the remaining undeveloped land of the watershed develops, as projected, construction site runoff will be a potential growing source of sediment if soil erosion and sediment control practices are not properly designed, installed, and maintained.

*Habitat*
There are very limited high quality habitat features such as instream habitat and relatively natural floodplains in the East Branch of the South Branch Kishwaukee River Watershed. As such, biological communities are of poor quality with limited diversity. The lack of instream features, the flashy hydrology of the streams due to urban development and instream alterations within the watershed, periods of very low flow, and low dissolved oxygen conditions in the summer months all contribute to the impacts to the biological community of the creek. Additional biological sampling should be conducted in a variety of locations to establish a baseline from which improvement or degradation can be assessed.

Additionally, there has been significant encroachment by urban uses into the stream corridor and loss of riparian habitat. These encroachments can be locations of yard waste dumping as well as sheet drainage of fertilizers and pesticides into the stream. These encroachments can also disrupt wildlife corridors.

*Nutrients*
Stormwater runoff is the likely contributor of high nutrient loads, particularly phosphorous, to the stream systems. Stream or streambank dumping of yard waste, grass clippings, and leaves collected in the fall can also contribute significant nutrient loading to the stream. Pet wastes may also contribute to the nutrient loading to the stream.

## 3.15 Floodplain and Flood Hazard Areas

This section of the plan includes information on the FEMA floodplain as well as areas of known flooding within the East Branch South Branch Kishwaukee River watershed.

### 3.15.1 Floodplain

Floodplains along stream and river corridors provide a variety of benefits including aesthetic value, flood storage, water quality, and plant and wildlife habitat. However, the most important function is the capacity of the floodplain to hold water during significant rainfall events to minimize flooding. Flood hazard areas are identified on the Flood Insurance Rate Map (FIRMs) and are categorized as a Special Flood Hazard Areas (SFHA). SFHAs are defined as the area that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year. This 1-percent annual chance flood is commonly referred to as the base flood or 100-year flood. It should be noted that the 100-year flood can and do occur more frequently than every 100 years. SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.

There are approximately 10,580.60 acres of 100-year floodplain with in East Branch South Branch Kishwaukee River watershed (Table 3-54 and Figure 3-31). The East Branch South Branch Kishwaukee watershed 100-year floodplain is classified as Zone A and Zone AE. Zone AE areas are subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. Mandatory flood insurance purchase requirements and floodplain management standards apply for all structures located in Zone AE.

Zone A Areas are subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown for Zone A areas. Mandatory flood insurance purchase requirements and floodplain management standards apply for all structures located in Zone A.

**Table 3-54** Floodplain in the East Branch South Branch Kishwaukee watershed

| SFHA | Acres in E Branch S Branch Kishwaukee River subwatershed | Acres in Union Ditch subwatershed | Acres in Virgil Ditch Subwatershed | Total Square Miles in Watershed | Percent of Watershed |
|---|---|---|---|---|---|
| AE | 2753.56 | 5410.79 | 0.0 | 2062.69 | 2.61% |
| A | 694.83 | 5406.84 | 2416.24 | 8517.91 | 10.81% |

In addition to the 100-year floodplain, there are 8659.76 acres of Zone X (shaded) floodplain in the East Branch South Branch Kishwaukee River watershed (Table 3-52 and Figure 3-31. Zone X (shaded) is described by FEMA as areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Zone X (shaded) is also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.

### 3.15.2 Flooding and Drainage Problems

Over the past years the East Branch South Branch Kishwaukee River watershed has recorded some of its worst flooding to date. Five inches of rain fell on September 4, 2006 leading to damage to hundreds of homes (including the Evergreen Mobile Home Park). Less than a year later on August 7, 2007, the watershed was again hit by rain when 5 to 7-inches of rain fell. Many streets, including major thoroughfares were flooded. Following the 2007 storm, the Governor of Illinois declared Rockford and Winnebago County a state disaster area. Debris removal, law enforcement, damage assessment, and other duties were offered by the governor.

In addition to these flooding events caused by significant rainfalls, the East Branch South Branch Kishwaukee River watershed experiences flood and drainage problems following much smaller rainfall events. Several different types of flooding that occurs in the watershed include:

- Overbank flooding from a waterway
- Local drainage problems (shallow flooding on roads, yards and sometimes buildings) often due to development in a drainage way, inadequately maintained drainage ditches, undersized storm sewers, and storm sewers.
- Depressional flooding in areas where water ponds in a natural depression in the landscape and there is no natural outlet for runoff. May be caused by failed sewer or adjacent or surrounding development causing increased runoff into the depressional area.
- Sanitary sewer backups may occur, flooding basements, when stormwater infiltrates into the sanitary sewer pipes, leaky manholes, or inappropriate connections to the sanitary lines.

### 3.15.3 Constructed Drainage System

The natural drainage system began to experience changes when vacant lands were converted to agricultural uses. During the conversion of land to agricultural uses, hydromodification and channelization began to occur (See Section 3.13.4 for more information on hydromodification and channelization). Now more changes occur as the land transitions from agricultural uses to residential, industrial, commercial, and transportation land uses. Early development was constructed without detention basins with stormwater directed into streams via ditches and storm sewer systems with the goal of removing runoff from the developed areas as quickly as possible. Without detaining stormwater from developed areas, flashy hydrology can become prevalent in the streams. Flashy hydrology results when the water level in streams rises quickly during storm events and then falls quickly once the storm passes. Flashy hydrology can lead to stream channel degradation such as downcutting and channel widening as well as flooding. More recently city planners and engineers have realized the benefit of storing stormwater runoff in detention basins that are designed to capture the runoff from a developed area and release the water slowly over a given amount of time.

Detention basins or detention ponds are stormwater management facilities that are constructed on or adjacent to rivers, streams, or lakes that are designed to store rainfall in order to protect against flooding and protect downstream channels from hydromodification. Detention facilities that are constructed on a river or stream are commonly referred to as "on-line" basins. On-line basins are not recommended and are commonly prohibited under a variety of stormwater regulations. Detention basins that are not on-line are typically constructed in low areas relative to development and either discharge directly to a surface water or discharge to surface water through a stormwater sewer network. Detention basins are typically designed to be dry bottom or wet bottom.

Dry bottom basins typically hold water for short periods of time following rain events. They are commonly lined with manicured turf grass. While dry detention basins may slow water from reaching creeks and rivers, their short residence time do not promote groundwater infiltration or provide significant water quality benefits. Structures such as gazebos and storage sheds should not be located in dry bottom basins.

Wet bottom basins are designed to permanently retain some volume of water at all times. The amount of water is determined by the elevation of the outlet pipe of the basin. The sideslopes of wet bottom basins can be planted with both turf grass or native grasses. Often wet bottom basins planted with turf grass will experience bank erosion resulting in the placement of riprap near the toe of slope as a measure to slow the erosion.

Wet detention basins planted with native vegetation are commonly referred to as naturalized detention basins. Naturalized detention basins are designed to be wet bottom with side slopes and an emergent zone that is planted with native plants, flowers, and shrubs. In addition to providing stormwater management, naturalized detention basins promote groundwater infiltration and maximize the water quality benefits and wildlife habitat.

A detailed detention and/or retention basin inventory was not conducted as part of this watershed-based planning process. As both DeKalb and Kane Counties have had stormwater ordinances in place since the mid-1990s, it is assumed that all development constructed since that time has meet the respective stormwater management requirements that include provisions for detention and/or retention. According to information obtained as part of the watershed planning process, there are no paved stormwater storage areas, automobile parking stormwater storage areas, underground stormwater storage areas, and/or regional compensatory storage facilities in the East Branch South Branch Kishwaukee River Watershed.

### 3.15.4 Problem Areas Identified By Watershed Stakeholders

During the initial phase of the development of the watershed-based plan, the DeKalb County Watershed Steering Committee (DCWSC) held two (2) public workshops to solicit stakeholder input on the East Branch of the South Branch of the Kishwaukee River watershed. During these meetings, stakeholders were asked to denote problem areas within the watershed. Problems were reported using worksheets designed by the DCWSC committee and their locations were denoted on maps. The problem areas identified at the public meeting were refined by the DCSWC and compiled into five (5) main problem types: water quality concern; streambank erosion or channel condition; overbank flooding; storm water management or drainage issues; and restrictive bridge or culvert. The problem areas identified during the development of the watershed-based plan are discussed in Table 3-55 and their locations depicted in Figure 3-32.

**Table 3-55** Summary of Problems in the East Branch South Branch Kishwaukee River Watershed Stakeholders

| Label | Location | Submitted Concern | Problem Type | | | | | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| | | | Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | |
| **East Branch South Branch Kishwaukee River Watershed** | | | | | | | | |
| EBKR-1 | B&O Junkyard. Brickville Rd. at the river. | Tires and other debris noted in creek. Oil residue observed in water. | ✓ | | | | | Specific property issue. Develop recommendations for this site. |
| EBKR-2 | Evergreen Village Mobile Home Park, 955 East State Street, Sycamore. | Household and automotive waste disposed into river. Potential released of nutrients and fecal coliform from the wastewater treatment plant discharges into the river. | ✓ | | | | | Specific property issue. Develop recommendations for this site. |
| EBKR-3 | Peace Road and E Br S Br Kishwaukee River | Increased flooding observed after road construction. Bridge could be undersized. Erosion observed. | | ✓ | | | | Undersized bridge structure. Determine if recent engineering data regarding the bridge is available. Develop estimates of bridge capacity and identify adverse impacts of bridge. |
| EBKR-4 | Martin's Ditch (City of Sycamore) | Significant flooding of basements, streets, and yards observed following storms | | | | ✓ | | Small urban waterway serves older neighborhoods developed without detention. Stormwater management improvements could reduce flooding and improve water quality. Identify potential remedial stormwater management and green infrastructure projects in this subwatershed. |

| Label | Location | Submitted Concern | Problem Type: Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| EBKR-5 | Route 64 just east of Old State Road and west of the Hardwood Connection | Roadway flooding observed following storm events. Trees and other debris restricting flow in river. | | | | ✓ | | (Location may be just outside watershed.) |
| EBKR-6 | Blue Heron Creek | Trees and other debris restricting flow in creek. | | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| EBKR-7 | ¼ mile south of Peace Road and Route 64 | Overland flow has increased and occurs after a ½ inch rain event. | | | | ✓ | | Drainage pathway leads from high school property. |
| EBKR-8 | Motel Road (north of Route 64) | Major flooding observed after 3 inch rain event. | | | ✓ | | ✓ | Bridge crossing potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. |
| EBKR-9 | Quarry | Water quality impacts from quarry discharge | ✓ | | | | | Specific property issue. Develop recommendations for this site. |
| EBKR-10 | Barber Green and E Branch S Branch Kishwaukee River (north of quarry) | Flow is restricted by bridge. | | | | | ✓ | Bridge crossings potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. |
| EBKR-11 | E Branch S Branch Kishwaukee River just north of Bethany Road and Fenstemaker Road | River bends 90-degrees. Trees and other debris restricting flow in creek. Bank erosion observed. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. Consider river restoration to reduce channelization and locations with poor hydraulic performance. |

| Label | Location | Submitted Concern | Problem Type: Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| EBKR-12 | E Branch S Branch Kishwaukee River along Airport Road just north of Bethany Road | Erosion observed. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations including streambank stabilization projects. |
| EBKR-13 | Loves Road/Juniper Street/DeKalb Taylor Municipal Airport area (from Barber Green Road south to the railroad tracks) | Stormwater from west side of Loves Road floods homes on the east side of Loves Road. It appears that the water should flow into the detention pond located within the park but flow is restricted due to grading. | | | | ✓ | | Local drainage concern. Once investigated, could involve the improvement of detention basin operation. |
| EBKR-14 | Near Plank Road | Trees and other debris restricting flow in creek. | | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| EBKR-15 | 12764 William Road | Trees and other debris restricting flow in creek. Restrictive culvert also noted. | | ✓ | | | ✓ | Develop channel maintenance and riparian buffer management recommendations. |
| EBKR-16 | 12733 William Road | Restrictive culvert noted. | | | | | ✓ | |
| EBKR-17 | 0.2 miles north of Pleasant Road along Airport Road | Restrictive culvert noted. | | | | | ✓ | |
| EBKR-18 | 0.5 miles north of Pleasant Road along Airport Road | Restrictive culvert noted. | | | | | ✓ | |

| Label | Location | Submitted Concern | Problem Type | | | | | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| | | | Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | |
| **Union Ditch** | | | | | | | | |
| UD-1 | Union Ditch #3 and County Line Road | Flow is restricted by bridge. Flooding observed after 4-inch rainfall event. | | | | ✓ | | Bridge crossings potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. |
| UD-2 | Union Ditch #3 – Maple Park Branch | Trees and other debris restricting flow in creek. Creek is also silted in. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| UD-3 | Union Ditch south of Sycamore to the Union Drainage District | Trees and other debris restricting flow in creek. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| UD-4 | East of Meredith Road between Welters Road and Beith Road | Significant flooding following rain events. Tile needs to be protected. Bank erosion observed. | ✓ | ✓ | ✓ | ✓ | ✓ | Bridge crossings potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. Develop channel maintenance and riparian buffer management recommendations. |
| UD-5 | Landfill | Potential for water quality concerns. Trash and debris blows from trucks into watershed. | ✓ | | | | | Specific property issue. Develop recommendations for this site. |
| UD-6 | Corner of Ottawa St. and Chestnut-Cortland Road | Significant flooding following rain events. Water seems to originate at the elevator in Cortland. | | | | ✓ | | Local drainage issue. |

| Label | Location | Submitted Concern | Problem Type | | | | | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| | | | Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | |
| UD-7 | Chase Road and Union Ditch | Trees and other debris restricting flow in creek. Potential for water quality concerns. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| UD-8 | Airport Road and North Street | Continuous no-till (corn and soybean rotation). | ✓ | | | | | Agricultural management recommendations would be needed to address this concern. |
| UD-9 | Maple Park Wastewater Treatment Plan | Significant algae observed on settling ponds. | ✓ | | | | | Review processes employed at the lagoons (aeration, etc.) and water quality records for the facility. Some algae is nearly unavoidable. |
| UD-10 | West limits of Virgil #1 Drainage District (north of Beth Road and Thatcher Road) | Trees and other debris restricting flow in creek. Extensive channelization observed. | ✓ | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |
| UD-11 | Elburn Village limits to Virgil #1 Drainage District (taxable limits) (northwest of Route 38 and Route 47). | Stormwater discharge from Jewel Shopping Center under Route 38 contributes to the overland and tiled flow into the district waterway. | ✓ | | | ✓ | | Local drainage issue. Review existing stormwater management facilities. Look for stormwater management facility retrofits or enhancements. |
| UD-12 | Headwaters of Virgil #1 Drainage District (east and south, property east of Route 47) | Virgil #1 Drainage District receives extensive runoff from adjacent lands. | ✓ | | | ✓ | | Adjacent lands appear to all be agricultural. No apparent modifications to tributary areas. |
| UD-13 | Union Ditch #2 at County Line Road and DeKalb Road | Flooding observed. | | | | | | Local drainage issue. |

| Label | Location | Submitted Concern | Problem Type | | | | | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| | | | Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | |
| UD-14 | Virgil Ditch #3 at Peplow Road | Erosion observed. | | ✓ | | | | Review upstream flows, develop streambank stabilization recommendations. |
| UD-15 | Village of Lily Lake (headwaters of Virgil Ditch #2. | Water quality concerns (fecal coliform) associated with septic systems. | ✓ | | | | | Develop septic system maintenance recommendations. |
| UD-16 | Burlington Road over Virgil Ditch #2 | Restrictive culvert or bridge noted. | | | | | ✓ | Bridge crossings potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. |
| **Virgil Ditch** | | | | | | | | |
| VD-1 | Ramm Road south to Union Ditch | Creek has silted in | ✓ | ✓ | | | | Develop channel maintenance recommendations. |
| VD-2 | ½ mile East of Peplow Road and Ramm Road | Flooding observed. | | | ✓ | | | Bridge crossings potentially undersized. Investigate existing information and develop comparison of peak flows to structure capacity. Unless pavement floods, no developed property appears at risk here. |
| VD-3 | Virgil Ditch south of Route 64 | Significant bank erosion noted in channel. | | ✓ | | | | Review upstream flows, develop streambank stabilization recommendations. |
| VD-4 | Field tiles located north of Route 64 | Tiles are functioning but steel end needs to be leveled. | | ✓ | | | | Maintenance issue related to tiles. |

| Label | Location | Submitted Concern | Problem Type | | | | | Suspected Causes of Impairment and Potential Solutions |
|---|---|---|---|---|---|---|---|---|
| | | | Water Quality Concern | Streambank Erosion or Channel Condition | Overbank Flooding | Stormwater Management or Drainage Issues | Restrictive Culvert or Bridge | |
| VD-5 | 5N851 McGough Road | Water originating offsite flows onto property through culverts causing water to pond on the property. | | | | ✓ | | Local drainage issue. Property is near a drainage divide. |
| VD-6 | Near Burlington School District Property (west of Peace Road and north of Ellithorpe Road) | Trees and other debris restricting flow in creek. | | ✓ | | | | Develop channel maintenance and riparian buffer management recommendations. |

### 3.16 Critical Areas

The intent of identifying Critical Areas is to focus watershed improvement efforts on areas where impairments are concentrated or relatively worse than in other areas of the watershed. Restoration, prevention, and remediation efforts in these Critical Areas are expected to achieve a greater impact than in less critical parts of the watersheds. These results and recommendations for watershed improvement, have been incorporated into the Watershed Action Plan.

#### 3.16.1 Critical SMUs

Critical SMUs are those that have particularly strong impact on watershed resources and water quality due to the type and extent of current and planned development. These subbasins will require action to reduce the impact of existing impervious surfaces. Critical Subbasins are listed in Table 3-56 and shown on Figure 3-33 and include the following:

**Table 3-56** Critical SMUs

| SMU | Acres | Rationale |
|---|---|---|
| EBKR-2 | 2389.18 | • Future land use changes<br>• Blue Heron Creek headwater area |
| EBKR-6 | 1128.93 | • Hydromodification<br>• Streambank erosion |
| UD-9 | 266.38 | • Future land use changes |
| UD-15 | 4088.48 | • Future land use changes |
| VD-2 | 1534.24 | • Headwater area<br>• Future land use changes |
| VD-7 | 1319.43 | • Future land use changes |

### 3.17 Summary and Conclusions

The East Branch of the South Branch Kishwaukee River (including Union Ditch and Virgil Ditch) watershed resource inventory and assessment provides important insight into the issues and problems in the watershed and the opportunities available for preserving and improving watershed resources. The vast majority of the impacts and impairments to watershed resources identified are the direct result of years of modification of the stream and surrounding lands as land use in the watershed changed from undeveloped to agriculture. The impacts of this changing landscape on watershed resources are summarized here and actions for addressing these impacts are included in the Action Plan in Chapter 5.

It is important to identify potential causes and sources of impairment in the watershed so that preventive and restorative measures can be planned and implemented. The issues, causes and sources identified below and in Table 3-57 are based on the best professional judgment based on the watershed inventory assessment and input from the watershed stakeholders. Thus, they should be considered as potential rather than confirmed until additional sampling and surveying can be done. Table 3-57 includes those impairments, causes, and sources that are most relevant to the Watershed-Based Plan nine element requirements of the US EPA. Nonetheless, although the table does not include all of the issues and problems identified below, they all have been addressed within the Action Plan included in Chapter 5.

*Water Quality*

The most important water quality issues that need to be addressed include the following:

- Elevated levels of total suspended solids generated from streambank and riparian erosion and storm water runoff;
- low dissolved oxygen concentrations due to low flow and the lack of adequate stream habitat features to help oxygenate the water; and
- elevated levels of bacteria and nutrients from failing septic systems and straight pipes.

*Watershed Hydrology*

The most important issues related to watershed hydrology that need to be addressed include the following.

- flashy hydrology (higher high flows and lower low flows), which impact a number of other watershed resources; and
- unmaintained, undersized and/or damaged culverts and roadside conveyance systems restricting flow in the stream channels; and

*Stream Channels*

The most important issues related to stream channels that need to be addressed include the following:

- streambank erosion resulting from poor riparian management, flashy hydrology, unstable streambanks, and stormwater discharges; and
- debris buildup and obstruction within the stream channel that is the result of streambank erosion and dislodged trees and vegetation.

*Riparian Corridors*

The most important riparian corridor issues that need to be addressed include the following:

- lack of riparian vegetation;
- inadequate riparian vegetation management that leads to destabilizes streambanks and provides no water quality or riparian habitat benefits; and
- dumping of yard waste along the stream banks and in stream channels, which smothers ground level vegetation and adds organic matter and nutrients to the water.

*Natural Areas and Wetlands*

The most important issues related to watershed wetlands include the following:

- lack of management and restoration plans and action to preserve and restore native habitat;
- invasive species infestations that degrade natural habitat;
- lost wetland acreage; and
- impairment of natural hydrologic patterns that support healthy wetlands resulting from stormwater discharge.

*Flooding*

The most important flooding issues that need to be addressed include the following:

- risk of flood damage to structures located along the waterways;

- hydrologic modification causing high flows; and
- creation of detention and retention areas including wetlands and depressional storage.

*Land Use*
The most important land use issues that need to be addressed include the following:
- conversion of vacant, agricultural, or open land to urban uses, which increases impervious surface area and impacts water quality and runoff volume; and
- redevelopment of existing developed land to other land uses with greater impervious surface area and/or higher pollutant loading rates.

**Table 3-57** Watershed Impairments, Causes and Sources

| Impairment | Causes | Sources |
|---|---|---|
| Water Quality | Total suspended solids/sedimentation and siltation | In channel erosion caused by streambank modification and destabilization |
| | | Urban runoff/storm sewers |
| | | Agricultural activities |
| | | Construction sites |
| | | Streets, highway and bridge runoff |
| Water Quality | Nutrients – phosphorus and nitrogen | Urban runoff/storm sewers |
| | | Soil erosion |
| | | Agricultural activities/golf courses |
| | | Improper disposal of wastes (yard waste, pet waste, etc) |
| | | Leaking septic systems and straight pipes |
| Water Quality | Low dissolved oxygen (elevated biological oxygen demand & chemical oxygen demand) | Flow alteration (low flow) |
| | | Habitat modifications |
| | | Urban runoff/storm sewers |
| | | Improper disposal of wastes (yard waste, pet waste, etc) |
| Water Quality | Bacteria | Leaking septic systems and straight pipes |
| Habitat degradation | Hydromodification and flow alterations | Urban runoff/storm sewers |
| | | Loss of riparian buffer |
| | | Loss of floodplain, wetlands, and depressional storage |
| | | Modification to stream flow regime |
| | | Development |
| | | Habitat modifications |
| Habitat degradation | Lack of instream habitat | Unstable streambanks |
| | | Channelization |
| | | Habitat modifications |
| Habitat degradation | Loss of riparian buffer | Development |
| | | Inappropriate land management |
| | | Unstable streambanks |
| | | Habitat modifications |
| Increased stream flows | Increased rate and volume or runoff | Development |
| | | Loss of floodplain, wetlands, and depressional storage |
| | | Poorly functioning/undersized detention |
| Increased stream flows | Loss of floodplain, wetlands, and depressional storage | Draining of floodplain, wetlands, and depressional storage |
| | | Development |

| Impairment | Causes | Sources |
|---|---|---|
| Flood damage | Past encroachment on floodplain | Past floodplain development |
| Flood damage | Undersize/improperly maintained infrastructure (storm sewers, culverts, detention, etc) | Development |
| | | Lack of infrastructure maintenance |