Illinois
Environmental
Protection Agency

Bureau of Water
P.O. Box 19276
Springfield, IL
62794-9276
www.epa.illinois.gov

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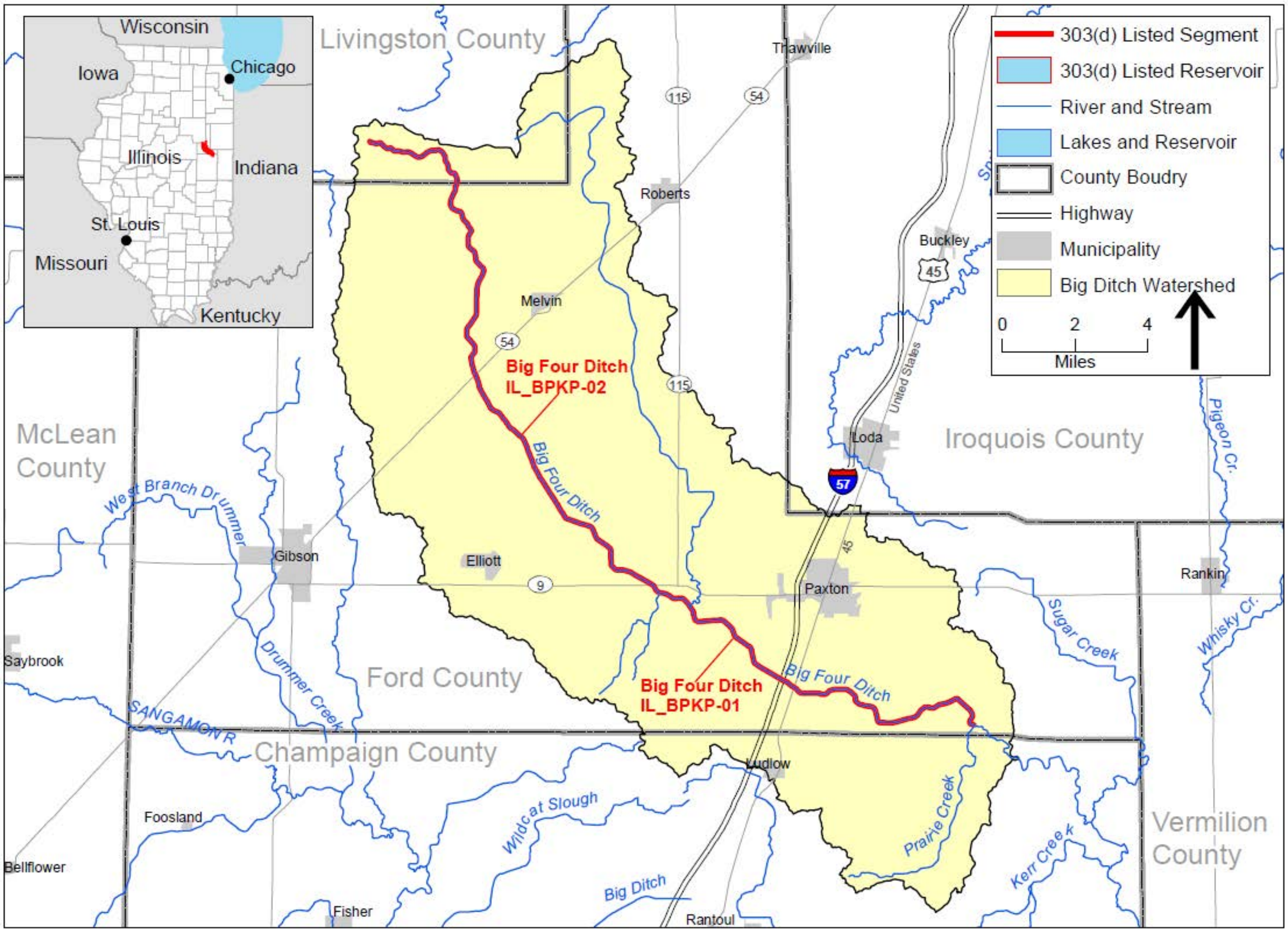
Big Four Ditch Watershed
Watershed Protection Plan



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Abbreviations

BMP	best management practice
CBOD	carbonaceous biochemical oxygen demand
cfs	cubic feet per second
CPS	Conservation Practice Standard
CWA	Clean Water Act
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
GIGO	Green Infrastructure Grant Opportunities
GIS	geographic information system
HUC	hydrologic unit code
IDA	Illinois Department of Agriculture
ID	identifier
Illinois EPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
ISWS	Illinois State Water Survey
LA	load allocation
lb/day	pounds per day
LC	loading capacity
MGD	million gallons per day
mg/L	milligrams per liter
MOS	margin of safety
NASS	National Agricultural Statistics Service
NED	National Elevation Dataset
NPDES	National Pollutant Discharge Elimination System

NRCS	Natural Resources Conservation Service
RC	reserve capacity
SSURGO	Soil Survey Geographic
STORET	storage and retrieval
SWCD	Soils and Water Conservation District
TMDL	total maximum daily load
TP	total phosphorus
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WASCOB	water and sediment control basin
WBP	watershed-based plan
WLA	waste load allocation
WPP	watershed protection plan
°F	degrees Fahrenheit
≥	greater than or equal to
µg/L	micrograms per liter

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Executive Summary

A total maximum daily load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs are a requirement of Section 303(d) of the Clean Water Act (CWA). To meet this requirement, the Illinois Environmental Protection Agency (Illinois EPA) must identify water bodies not meeting water quality standards and then establish TMDLs for restoration of water quality. Illinois EPA develops a list, known as the 303(d) list, of water bodies not meeting water quality standards every 2 years, which is included in the Integrated Water Quality Report. Water bodies on the 303(d) list are then targeted for TMDL development. In accordance with U.S. Environmental Protection Agency (EPA) guidance, the report assigns all waters of the state to one of five categories; 303(d)-listed water bodies make up category five in the Integrated Report.

Water bodies listed as impaired in the 2018 Illinois Integrated Water Quality Report and 303(d) List[1] were originally targeted for TMDL development in 2019. A Stage 1 TMDL report was initiated for the Big Four Ditch watershed (HUC 0512010901) based on the 2018 303(d) list. Stage 1 of TMDL development reviews and documents the physical characteristics of a watershed as well as available historical data in comparison to applicable water quality standards. **Table ES-1** contains information on the 2018 impaired water bodies that were investigated for this report:

Table ES-1 Impaired Water Bodies in the Big Four Ditch Watershed

Segment Identifier (ID)	Segment Name	Potential Cause of Impairment	Designated Use	Potential Source of Impairment (as identified by the 2018 303(d) list)
IL_BPKP-01	Big Four Ditch	Dissolved Oxygen (DO)	Aquatic Life	Channelization, Source Unknown[1]
IL_BPKP-02	Big Four Ditch	DO	Aquatic Life	Channelization, Source Unknown[1]

Note:

1 Potential natural sources of low DO may include excessive algae, sediment oxygen demand, and/or lack of reaeration.

No recent violations of the DO standard were noted during the Stage 1 data review. Since the completion of Stage 1, the 2020/2022 Illinois Integrated Water Quality Report and 303(d) List was approved on June 30, 2022.[2] Segment IL_BPKP-02 has been removed from the latest 303(d) list and Segment IL_BPKP-01 remains listed as impaired for the aquatic life use, however, DO has been removed as a potential cause of the impairment. Appendix A-1 of the 2020/2022 Illinois Integrated Report[3] includes specific assessment information for streams. **Table ES-2** presents

1 Illinois EPA. 2018. *Illinois Integrated Water Quality Report and Section 303(d) List, 2018*. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2018-cycle-integrated-report-final-20210201.pdf

2 Illinois EPA. 2022. *Illinois Integrated Water Quality Report and Section 303(d) List, 2020/2022*. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2020-2022-ir-final-6-01-22.pdf https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdfhttps://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdf

3 Illinois EPA. 2022. *Illinois Integrated Water Quality Report and Section 303(d) List, 2020/2022. Appendix A-1.* https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/a1-streams-final-5-26-22.pdf

detailed information for Segments IL_BPKP-01 and IL_BPKP-02 from the 2020/2022 Illinois Integrated Report.

Table ES-2 2020/2022 Assessment Information for Big Four Ditch

Segment ID	Segment Name	Category	Assessed Use	Potential Causes of Impairment
IL_BPKP-01	Big Four Ditch	5	Aquatic Life	Unknown Causes, Loss of Cover, Stream Alteration
IL_BPKP-02	Big Four Ditch	4c	Aquatic Life	Habitat Alteration

This report did not progress beyond Stage 1of TMDL development because of the delisting of DO as a cause of impairment. No numeric water quality standards have been adopted by Illinois for the causes of impairment identified in **Table ES-2**. A watershed protection plan (WPP) has been included to describe how designated uses can be supported through nutrient control, erosion prevention, improvement of stream coverage, and mitigation of previous and existing habitat and stream alterations. The WPP includes applicable best management practices (BMPs) to maintain water quality and address other watershed issues.

Section 1

Goals and Objectives for the Big Four Ditch Watershed

1.1 Total Maximum Daily Load Overview

A total maximum daily load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs are a requirement of Section 303(d) of the Clean Water Act (CWA). To meet this requirement, the Illinois Environmental Protection Agency (Illinois EPA) must identify water bodies not meeting water quality standards and then establish TMDLs for restoration of water quality. Every 2 years, Illinois EPA develops a list, known as the 303(d) list, of water bodies not meeting water quality standards. The list is included in the Integrated Water Quality Report. Water bodies on the 303(d) list are then targeted for TMDL development. Water bodies listed as impaired in this report are from the 2018 Illinois Integrated Water Quality Report and Section 303(d) List (Appendix A of the report) that was approved by the U.S. Environmental Protection Agency (EPA) on March 19, 2021.[4] In accordance with EPA's guidance, the report assigns all waters of the state to one of five categories; 303(d)-listed water bodies make up category five in the integrated report.

In general, a TMDL is a quantitative assessment of water quality impairments, contributing sources, and pollutant reductions needed to attain water quality standards. The TMDL specifies the amount of pollutant or other stressor that needs to be reduced to meet water quality standards, allocates pollutant control or management responsibilities among sources in a watershed, and provides a scientific and policy basis for taking actions needed to restore a water body.

Water quality standards are laws or regulations that states authorize to enhance water quality and protect public health and welfare. Water quality standards provide the foundation for accomplishing two of the principal goals of the CWA. These goals are:

- Restore and maintain the chemical, physical, and biological integrity of the nation's waters
- Where attainable, achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water

Water quality standards consist of three elements:

- Designated beneficial use or uses of a water body or segment of a water body
- Water quality criteria necessary to protect the use or uses of that particular water body

[4] Illinois EPA. 2018. *Illinois Integrated Water Quality Report and Section 303(d) List, 2018*. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2018-cycle-integrated-report-final-20210201.pdf

- Antidegradation policy

Examples of designated uses are primary contact (swimming), protection of aquatic life, and public and food processing water supply. Water quality criteria describe the quality of water that will support a designated use. Water quality criteria can be expressed as numeric limits or as a narrative statement. Antidegradation policies are adopted so that water quality improvements are conserved, maintained, and protected.

1.2 Total Maximum Daily Load Goals and Objectives

The Illinois EPA has a three-stage approach to TMDL development. The stages are:

Stage 1 – Watershed Characterization, Data Analysis, Methodology Selection

Stage 2 – Data Collection (optional)

Stage 3 – Model Calibration, TMDL Scenarios, Implementation Plan

Water bodies listed as impaired in the 2018 Illinois Integrated Water Quality Report and 303(d) List[5] were originally targeted for Stage 1 TMDL development in 2019. Illinois EPA uses the U.S. Geological Survey (USGS) 10-digit hydrologic unit code (HUC) to group subbasins into TMDL watersheds. The following water body segments in the Big Four Ditch watershed are addressed in this report:

- Big Four Ditch (IL_BPKP-01)
- Big Four Ditch (IL_BPKP-02)

These water body segments are shown on **Figure 1-1**. **Table 1-1** lists the water body segment, potential cause of impairment, use description, and potential source of impairment.

Table 1-1 Impaired Water Bodies in the Big Four Ditch Watershed

Segment Identifier (ID)	Segment Name	Potential Cause of Impairment	Designated Use	Potential Source of Impairment (as identified by the 2018 303(d) list)
IL_BPKP-01	Big Four Ditch	DO	Aquatic Life	Channelization, Source Unknown[1]
IL_BPKP-02	Big Four Ditch	DO	Aquatic Life	Channelization, Source Unknown[1]

Note:
[1] Potential natural sources of low DO may include excessive algae, sediment oxygen demand, and/or lack of reaeration.

[5] Illinois EPA. 2018.

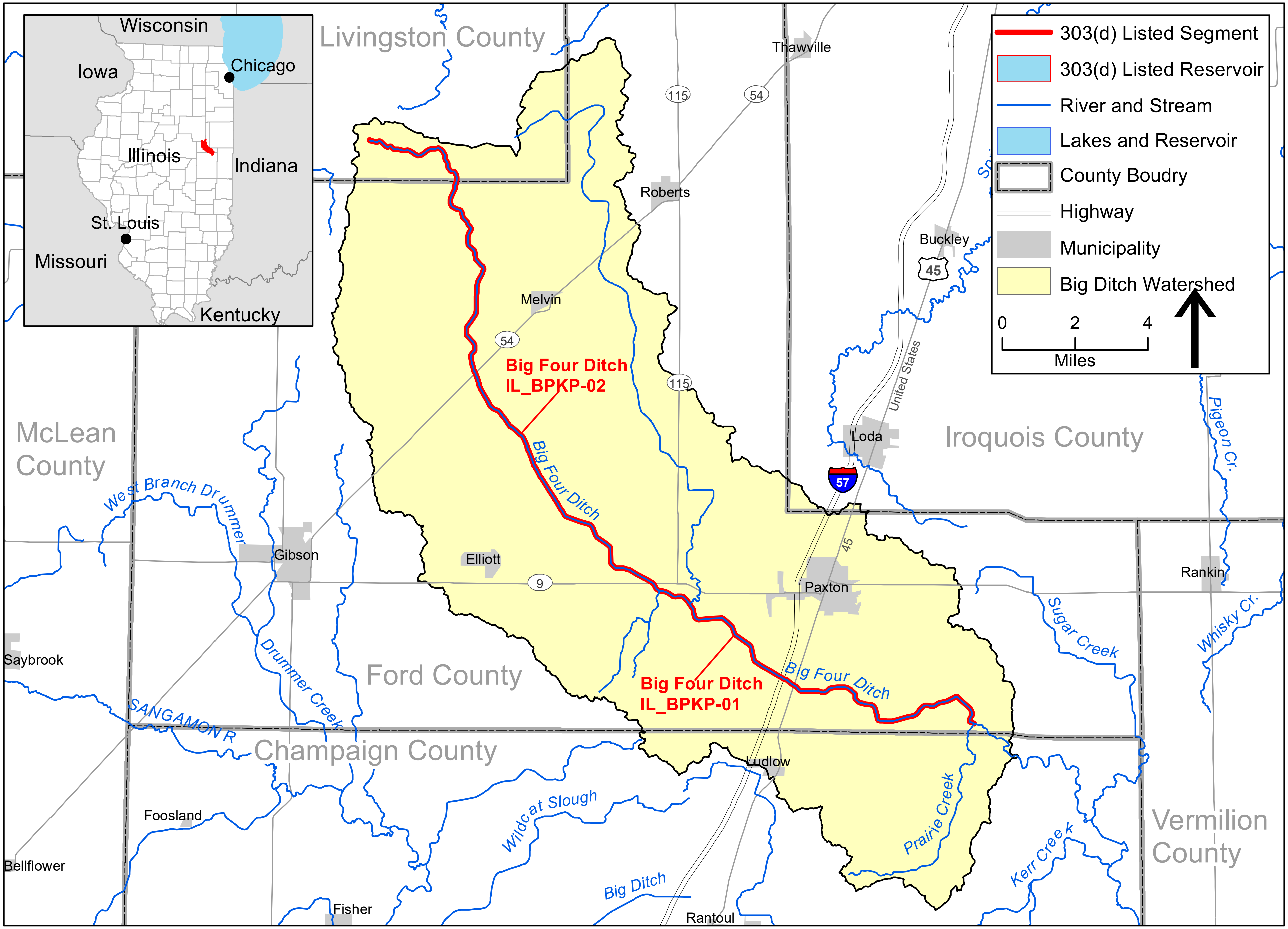

Figure 1-1: Big Four Ditch Watershed
HUC 0512010901

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TMDLs for impaired segments with numeric water quality standards typically specify the following elements:

- Loading capacity (LC) or the maximum amount of pollutant loading a water body can receive without violating water quality standards
- Waste load allocation (WLA) or the portion of the TMDL allocated to existing or future point sources
- Load allocation (LA) or the portion of the TMDL allocated to existing or future nonpoint sources and natural background
- Margin of safety (MOS) or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality
- Reserve capacity (RC) or a portion of the load explicitly set aside to account for growth in the watershed

These elements are combined into the following equation:

$$\mathbf{TMDL = LC = \Sigma WLA + \Sigma LA + MOS + RC}$$

TMDL development considers the seasonal variability of pollutant loads so that water quality standards are met during all seasons of the year. Also, reasonable assurance that the TMDL will be achieved is described in a watershed-based plan (WBP). Data compiled during Stage 1 showed that historical DO concentrations in the impaired segments of Big Four Ditch have not recently violated the water quality standard (see discussion in Section 5) and TMDLs were not developed (refer to Section 6). Since the completion of Stage 1, the 2020/2022 Illinois Integrated Water Quality Report and 303(d) List was approved on June 30, 2022.[6] Segment IL_BPKP-02 has been removed from the latest 303(d) list and Segment IL_BPKP-01 remains listed as impaired for the aquatic life use, however, DO has been removed as a potential cause of the impairment.

Appendix A-1 of the 2020/2022 Illinois Integrated Report[7] includes specific assessment information for streams. **Table 1-2** presents detailed information for Segments IL_BPKP-01 and IL_BPKP-02. Category 5 waters are those where available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed, while Category 4c waters are those where one or more designated uses are impaired or threatened but establishment of a TMDL is not required because the impairment or threat is not caused by a pollutant.

[6] Illinois EPA. 2022. *Illinois Integrated Water Quality Report and Section 303(d) List, 2020/2022*. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2020-2022-ir-final-6-01-22.pdf https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdfhttps://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdf

[7] Illinois EPA. 2022. *Illinois Integrated Water Quality Report and Section 303(d) List, 2020/2022. Appendix A-1.* https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/a1-streams-final-5-26-22.pdf

Table 1-2 2020/2022 Assessment Information for Big Four Ditch

Segment ID	Segment Name	Category	Assessed Use	Potential Causes of Impairment
IL_BPKP-01	Big Four Ditch	5	Aquatic Life	Unknown Causes, Loss of Cover, Stream Alteration
IL_BPKP-02	Big Four Ditch	4c	Aquatic Life	Habitat Alteration

No numeric water quality standards have been adopted by Illinois for the causes of impairment identified in **Table 1-2**. Although the segments have been delisted for impairment caused by low DO, the State notes that IL_BPKP-01 is impaired by stream alteration, loss of cover, and other unknown causes, and that IL_BPKP-02 is threatened by habitat alteration. A watershed protection plan (WPP) for the Big Four Ditch watershed is included at the end of this report (Section 7) to describe how designated uses can be supported through nutrient control, erosion prevention, improvement of stream coverage, and mitigation of previous and existing habitat and stream alterations. The WPP includes applicable best management practices (BMPs) to maintain water quality and address other watershed issues.

1.3 Report Overview

The remaining sections of this report contain:

- **Section 2 Big Four Ditch Watershed Description** describes the watershed's location, topography, geology, land use, soils, population, and hydrology.
- **Section 3 Big Four Ditch Watershed Public Participation** discusses public participation activities that occurred throughout the TMDL/WPP development.
- **Section 4 Big Four Ditch Watershed Water Quality Standards** defines the water quality standards for the impaired water bodies.
- **Section 5 Big Four Ditch Watershed Data and Potential Pollution Sources** presents the available water quality data, discusses the characteristics of the impaired stream segments in the watershed, and describes the point and nonpoint sources with the potential to contribute to the watershed load.
- **Section 6 Approach to Developing Total Maximum Daily Loads and Identifying Data Needs** makes recommendations for Stages 2 and 3 of TMDL development based on the information presented in the previous sections.
- **Section 7 Watershed Protection Plan for the Big Four Ditch Watershed** includes recommendations for continued implementation actions, point and nonpoint source monitoring, management measures, and BMPs that can be used to protect and maintain water quality in the watershed.

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Section 2

Big Four Ditch Watershed Description

2.1 Location

The Big Four Ditch watershed (HUC 0512010901 shown on **Figure 1-1**) is in east-central Illinois, flows in a south-easterly direction, and drains approximately 128,000 acres (200 square miles), 106,000 of which are in Ford County (82.8 percent of the watershed), 15,670 of which are in Champaign County (12.2 percent of the watershed), 5,950 of which are in Livingston County (4.7 percent of the watershed), and approximately 350 of which are in Iroquois County (0.3 percent of the watershed).

2.2 Topography

Topography is an important factor in watershed management because stream types, precipitation, and soil types can vary significantly with elevation. Elevation data are available from USGS[8] for each 1:24,000 topographic quadrangle in the United States. Elevation data for the Big Four Ditch watershed were obtained by overlaying the elevation grid onto the geographic information system (GIS)-delineated watershed. **Figure 2-1** shows the elevations found within the watershed.

Elevation in the Big Four Ditch watershed ranges from approximately 865 feet above sea level in the northwestern portion of the watershed to approximately 705 feet at the confluence of the Big Four Ditch with the Middle Fork Vermilion River dam at the southeastern extent of the watershed.

2.3 Land Use

Land use data for the Big Four Ditch watershed were extracted from the U.S. Department of Agriculture's (USDA's) National Agriculture Statistics Service (NASS) 2018 Cropland Data Layer (CDL).[9] The CDL is a raster-based, georeferenced, crop-specific land cover data layer created to provide acreage estimates to the Agricultural Statistics Board for the state's major commodities and to produce digital, crop-specific, categorized georeferenced output products. This information is made available to all agencies and to the public free of charge and represents the most accurate and up-to-date land cover datasets available at a national scale. The most recent available CDL dataset was produced in 2018 and includes 27 separate land use classes applicable to the watershed. The available resolution of the land cover dataset is 30 square meters.

8 USGS. 3D Elevation Program webpage. https://www.usgs.gov/3d-elevation-program

9 NASS CDL. https://www.nass.usda.gov/Research_and_Science/Cropland/Release/index.php

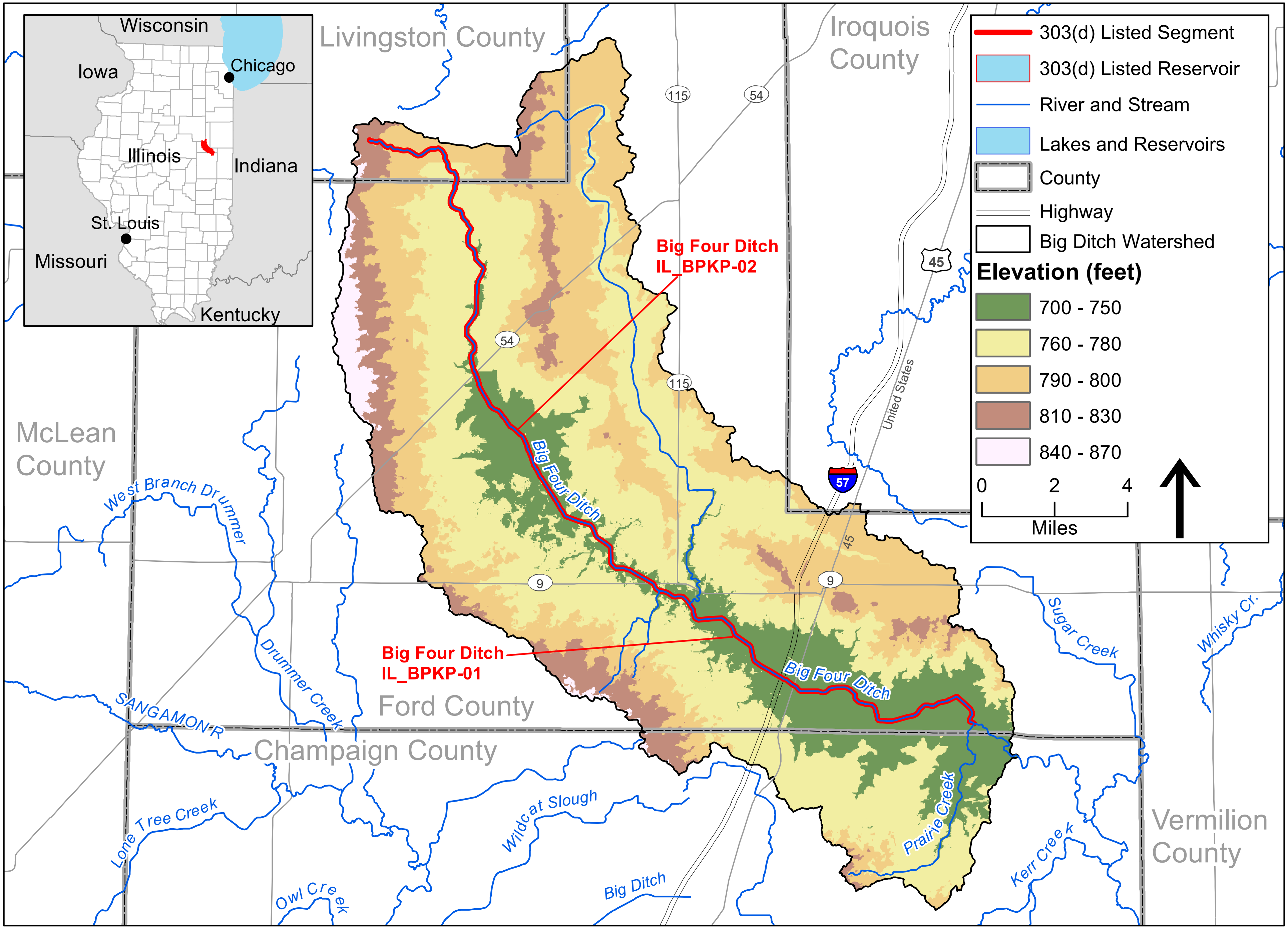

Figure 2-1: Big Four Ditch Watershed Elevation

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Land use characteristics of the Big Four Ditch watershed were determined by overlaying the Illinois Statewide 2018 CDL onto the GIS-delineated watershed. **Table 2-1** contains the main categories of land uses in the Big Four Ditch watershed, based on the 2018 CDL land cover categories. The table also includes the area of each land cover category and percentage of the watershed area. **Figure 2-2** illustrates the land uses of the watershed. **Appendix A** contains a table of all land uses in the watershed.

Table 2-1 Land Cover in the Big Four Ditch Watershed

Land Cover Category	Area (Acres)	Percentage
Corn	56,681	44%
Soybeans	56,523	44%
Developed/Low Intensity	4,427	3.5%
Developed/Open Space	3,430	2.7%
Grass/Pasture	2,964	2.3%
Deciduous Forest	1,530	1.2%
Winter Wheat	961	0.8%
Developed/Medium Intensity	471	0.4%
Other Hay/Non-Alfalfa	343	0.3%
All Others	748	0.6%
Total	**128,088**	**100%**

The land cover data reveal that most of the watershed area is used for crop production (89 percent). Approximately 6.5 percent of the watershed area is developed or urbanized, and 2.3 percent is pasture. Just over 1 percent of the watershed area is forested, while wetlands, marshes, and open water make up the remaining 0.2 percent.

2.3.1 Subbasin Land Use

The subbasin area draining to each of the two impaired segments were further delineated through GIS (**Figure 2-2**). Land cover data were then intersected with the subbasin boundaries to determine the land uses contributing runoff to each impaired water body, as shown in **Table 2-2** and **Table 2-3**. The IL_BPKP-01 subbasin area and land use classification areas include the entire drainage area, including the upstream subbasin area that drains to the other impaired segment in the Big Four Ditch watershed (IL_BPKP-02).

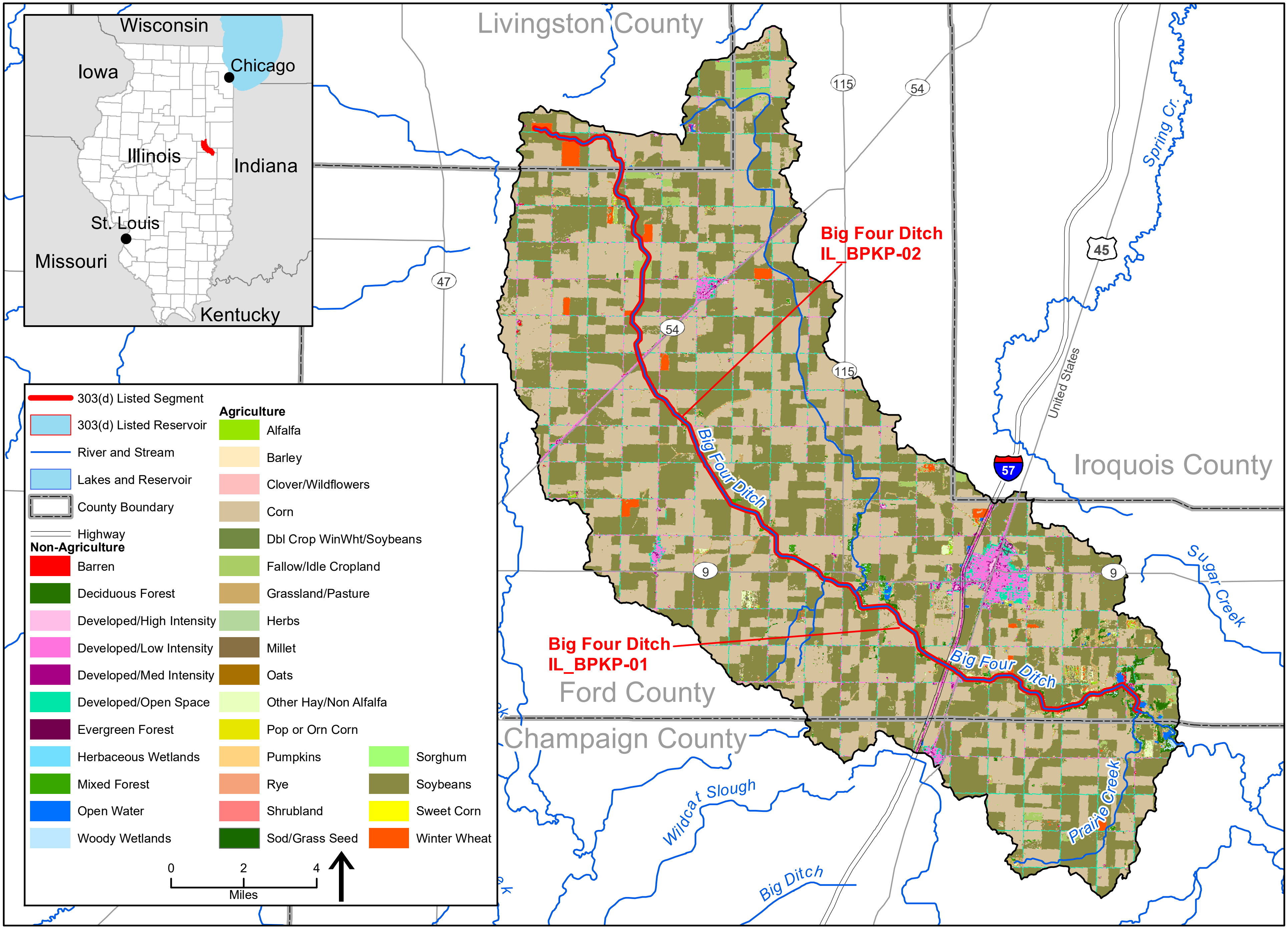

Figure 2-2: Big Four Ditch Watershed Land Use

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Table 2-2 Land Cover in the Big Four Ditch Segment IL_BPKP-01 Subbasin

Land Cover Category	Area (acres)	Percentage
Corn	53,327	44.4%
Soybeans	52,962	44.1%
Developed/Low Intensity	4,337	3.6%
Developed/Open Space	3,280	2.7%
Grass/Pasture	2,644	2.2%
Deciduous Forest	1,235	1.0%
Winter Wheat	945	0.8%
Developed/Med Intensity	465	0.4%
Other Hay/Non Alfalfa	326	0.3%
All Others	585	0.5%
Total	**120,106**	**100%**

Table 2-3 Land Cover in the Big Four Ditch Segment IL_BPKP-02 Subbasin

Land Cover Category	Area (acres)	Percentage
Corn	27,365	48%
Soybeans	25,115	44%
Developed/Low Intensity	1,628	2.9%
Developed/Open Space	1,319	2.3%
Grass/Pasture	804	1.4%
Winter Wheat	303	0.5%
Deciduous Forest	199	0.3%
Other Hay/Non Alfalfa	154	0.3%
All Others	205	0.4%
Total	**57,092**	**100%**

2.4 Soils

Soils data are available through the Natural Resources Conservation Service's (NRCS's) Soil Survey Geographic Database (SSURGO).[10] For SSURGO data, field mapping methods using national standards are used to construct the soil maps. Mapping scales generally range from 1:12,000 to 1:63,360, making SSURGO the most detailed level of soil mapping done by NRCS.

Attributes of the spatial coverage can be linked to the SSURGO database, which provides information on various chemical and physical soil characteristics for each map unit and soil series. Of particular interest for TMDL development are the hydrologic soil groups and the K-factor of the Universal Soil Loss Equation. The section discusses the soil characteristics of the Big Four Ditch watershed.

2.4.1 Soil Characteristics

Appendix B contains a table of the SSURGO soil series for the Big Four Ditch watershed. A total of 75 soil types exist in the watershed. The three most common types—Ashkum silty clay loam (0 to 2 percent slopes), Bryce silty clay (0 to 2 percent slopes), and Elliot silt loam (0 to 2 percent

[10] NRCS SSURGO. https://www.nrcs.usda.gov/resources/data-and-reports/soil-survey-geographic-database-ssurgo

slopes)— cover almost half of the overall watershed collectively (22.5, 14.3, and 11.8 percent, respectively). All other soil types each represent less than 9 percent of the total watershed area. The table in **Appendix B** also contains the area, dominant hydrologic soil group, and K-factor range. The two characteristics are described in more detail below.

Figure 2-3 shows the hydrologic soils groups found within the Big Four Ditch watershed. Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms:

- Group A: Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil.
- Group B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.
- Group C: Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.
- Group D: Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted.

While hydrologic soil groups B, C, D, A/D, B/D, and C/D are all found within the Big Four Ditch watershed, group C/D is by far the most common type and represents 81 percent of the overall watershed. Group C/D is a dual soil group wherein the first letter applies to the drained condition and the second to the undrained condition. Group C is defined as having "moderately high runoff potential when thoroughly wet." These soils are poorly drained. Group D soils are defined as having "high runoff potential when thoroughly wet." These soils have very low drainage. Group C/D, along with the other dual hydrologic soil groups in this area (A/D, B/D) are soils that can be adequately drained. For the purpose of hydrologic soil group, adequately drained means that the seasonal high-water table is kept at 24 inches below the surface.[11]

A commonly used soil attribute is the K-factor, which is a measure of soil erodibility and quantifies the relative susceptibility of soil to sheet and rill erosion. Values of K range from 0.02 to 0.69, from least erodible to most erodible, respectively, and are influenced by elements including texture, organic matter content, structure and saturated hydraulic conductivity.[12] The distribution of K-factor values in the Big Four Ditch watershed range from 0.26 to 0.44, as shown in **Figure 2-4**.

[11] NRCS. 2007. *Hydrology National Engineering Handbook*. Part 630, Hydrologic Soil Groups. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

[12] Institute of Water Research. Michigan State University. 2002. RUSLE Online Soil Erosion Assessment Tool. http://www.iwr.msu.edu/rusle/kfactor.htm

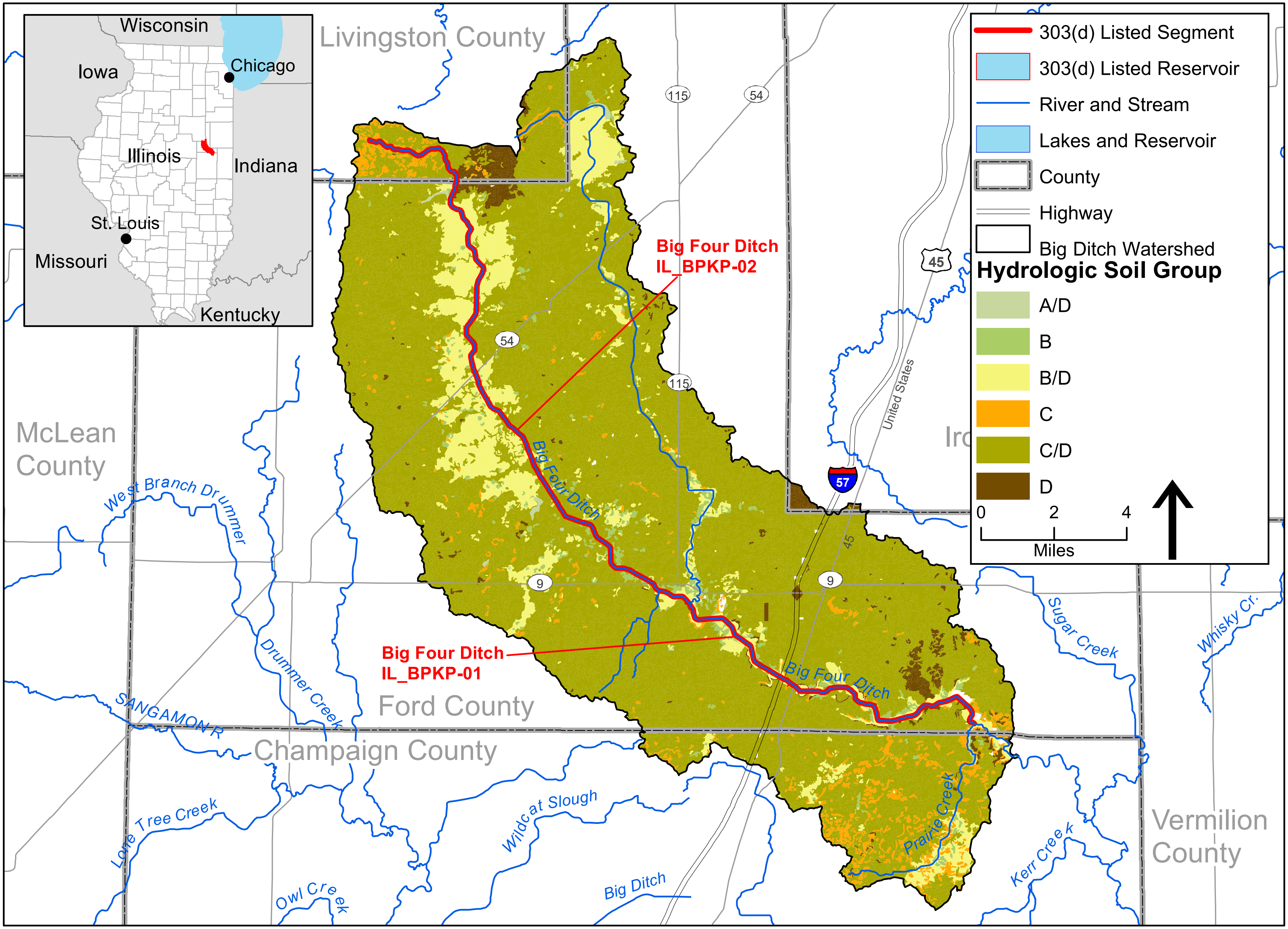

Figure 2-3: Big Four Ditch Watershed Hydrologic Soil Groups

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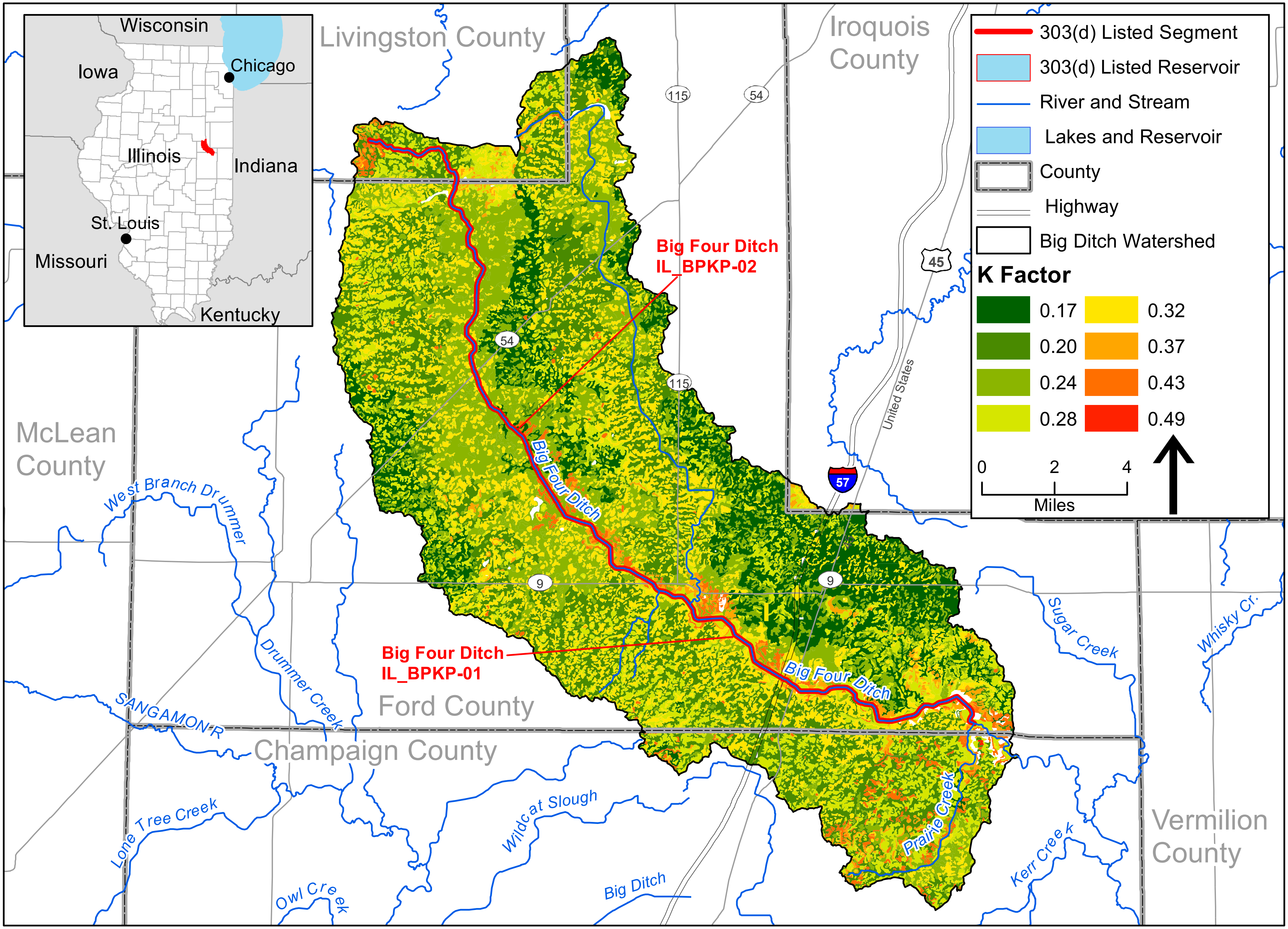

Figure 2-4: Big Four Ditch Watershed Soil K-Factor Range

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2.5 Population

The Census TIGER/Line data[13] from the U.S. Census Bureau were retrieved. Geographic shapefiles of census block groups[14] were downloaded for the entire state of Illinois. All census block groups that have geographic center points (centroids) within the watershed were selected and tallied in order to provide an estimate of populations in all census blocks both completely and partially contained by the watershed boundary. Given that the optimal size of a census block group is 1,500 people, and six block group centroids are within the watershed, it is estimated that approximately 9,000 people reside in the Big Four Ditch watershed. The major municipality in the watershed, which is shown in **Figure 1-1**, is the City of Paxton, with a population of approximately 4,470 according to the 2020 census.[15]

2.6 Climate and Streamflow

2.6.1 Climate

East-central Illinois has a temperate climate with hot summers and cold, moderately snowy winters. Monthly precipitation data from Paxton, Illinois (station USC00116663) in Ford County were extracted from the National Centers for Environmental Information (formerly known as the National Climatic Data Center) database[16] for 1987 through 2015. The data station in Paxton is near the center of the Big Four Ditch watershed and is expected to be representative of precipitation throughout the watershed.

Table 2-4 contains the average monthly precipitation along with average high and low temperatures for the period of record. The average annual precipitation is approximately 37.4 inches. May and June are historically the wettest months, while January and February are the driest. July is historically the warmest month, with an average maximum temperature of 84 degrees Fahrenheit (°F). January is typically the coldest month, with an average minimum temperature of 16°F.

[13] U.S. Census Bureau. TIGER/Line Shapefiles. https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html

[14] U.S. Census Bureau. 2010 Census – Block Maps. https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-block-maps.html

[15] U.S. Census Bureau. QuickFacts. https://www.census.gov/quickfacts/fact/table/US/PST045221?

[16] National Centers for Environmental Information. Station USC00116663 precipitation data. https://www.ncdc.noaa.gov/cdo-web/datatools/findstation

Table 2-4 Average Monthly Climate Data for Paxton, Illinois

Month	Average Total Precipitation (inches)	Average Daily Maximum Temperature (°F)	Average Daily Minimum Temperature (°F)
January	1.9	32.3	16.0
February	1.8	36.1	18.9
March	2.6	48.2	28.8
April	3.7	61.7	39.0
May	4.3	73.0	50.9
June	4.1	81.4	60.1
July	3.9	83.9	63.2
August	3.5	82.8	60.4
September	3.0	78.2	52.6
October	3.3	64.7	41.1
November	2.9	49.7	31.1
December	2.4	36.4	20.9
Total	**37**[1]	**61**	**40**

Note:
[1] Average annual total.

2.6.2 Streamflow

Analysis of the Big Four Ditch watershed requires an understanding of flow throughout the drainage area. There are four historical USGS gages within the watershed, however, none of them are active or have recent data.[17] There is one USGS gage in an adjacent watershed with similar characteristics to those of the Big Four Ditch watershed that has available discharge data and may be used to estimate streamflow for the impaired segments of the Big Four Ditch. USGS gage 05570910 (Sangamon River at Fisher, IL) is approximately 9 miles southwest of the Big Four Ditch watershed and has a drainage area of 240 square miles (**Figure 2-5**). The average monthly flow at USGS gage 05570910 ranges from 22.0 cubic feet per second (cfs) in August to 1,095 cfs in January, as shown in **Figure 2-6**. **Table 2-5** summarizes the station information.

[17] USGS. National Water Information System. Daily Streamflow Data for Illinois. https://waterdata.usgs.gov/IL/nwis/current/?type=dailydischarge&group_key=basin_cd

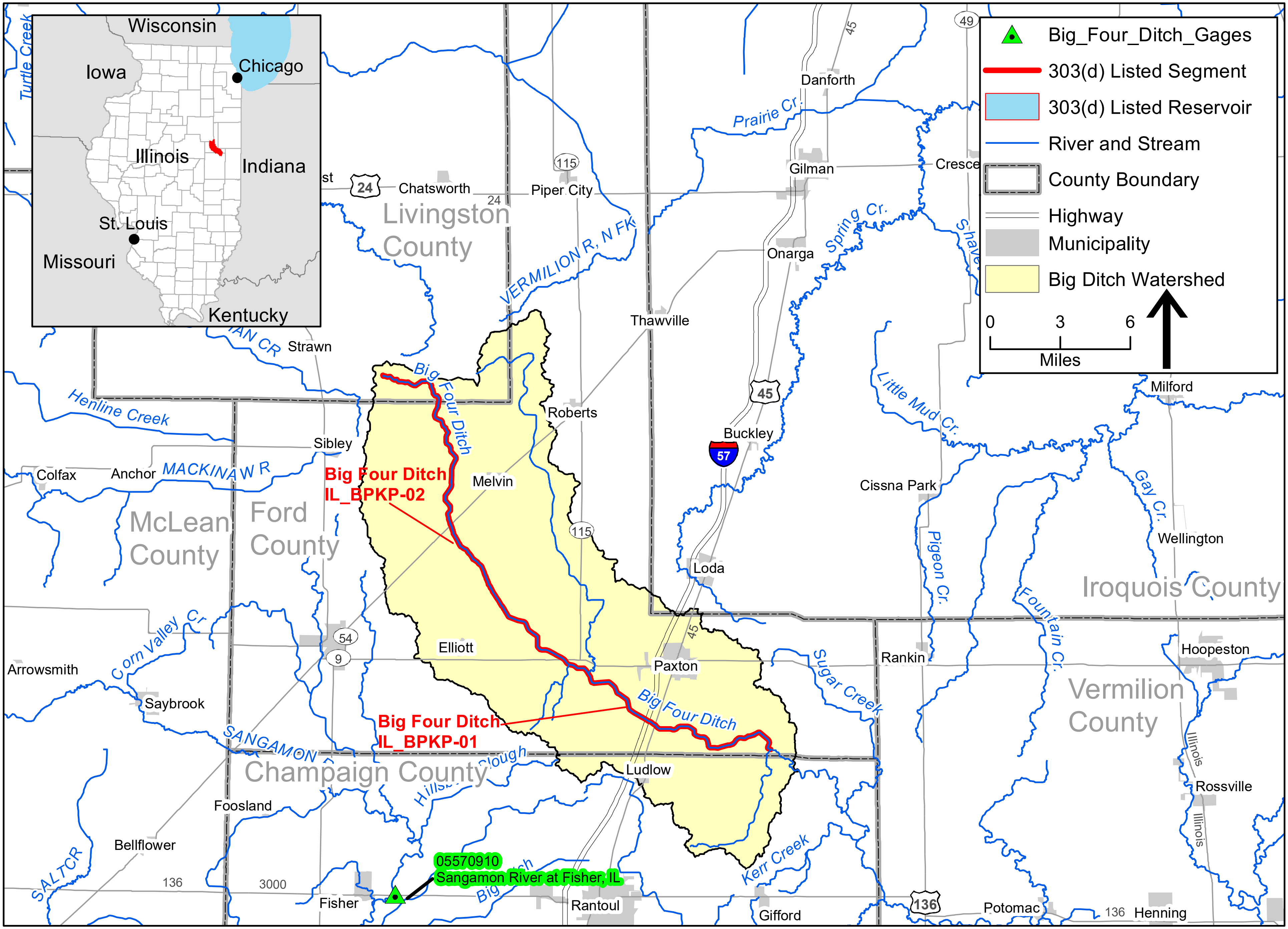

Figure 2-5: Big Four Ditch Watershed Active USGS Gages

CDM Smith

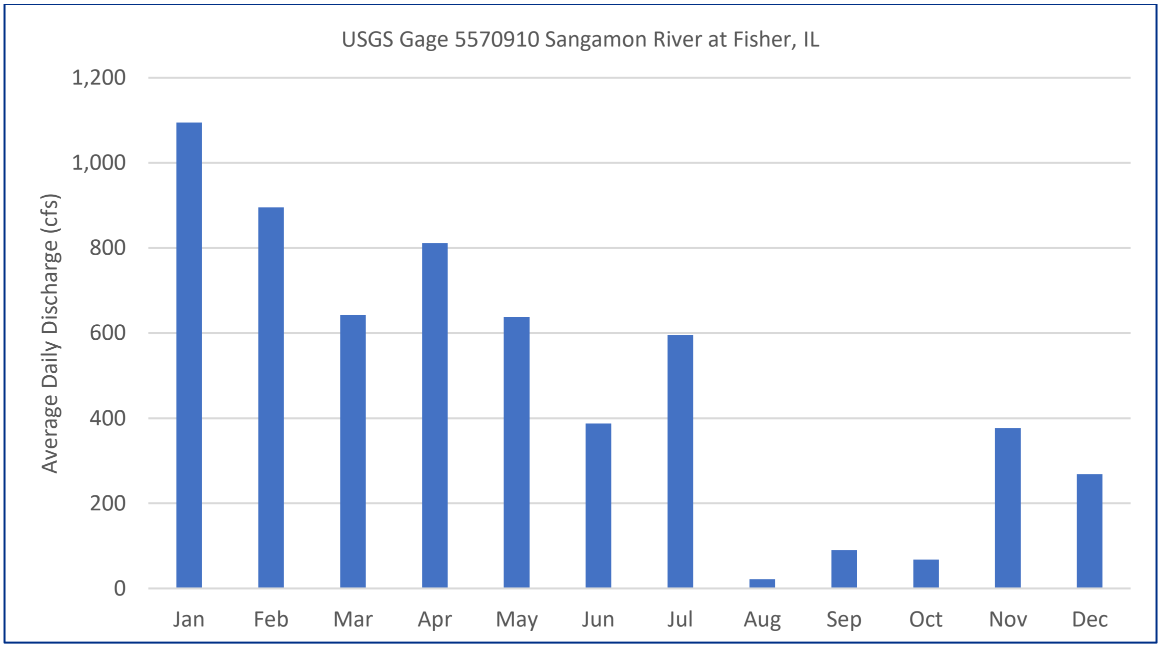

Figure 2-6 Monthly Average Streamflow for USGS Gage 5570910 Sangamon River at Fisher, IL

Table 2-5 Historical Streamflow Gages in and around the Big Four Ditch Watershed

Gage Number	Name	Available Data	Period of Record
03336075	Big Four Ditch near Perdueville, IL	Discharge	1966
03336100	Big Four Ditch Tributary near Paxton, IL	Gage Height, Discharge	1956–1977
03336150	Big Four Ditch above Paxton, IL	Gage Height, Discharge	1966
03336200	Big Four Ditch below Paxton, IL	Discharge	1966
05570910	Sangamon River at Fisher, IL	Gage Height, Discharge	1978–2019

Discharge data from USGS gage 05570910 (Sangamon River at Fisher, IL), which is in an adjacent and similarly sized watershed to that of the Big Four Ditch, has been used to estimate flow values for the impaired water bodies in the Big Four Ditch watershed using the drainage area ratio method represented by the following equation:

$$Q_{gaged}\left(\frac{Area_{ungaged}}{Area_{gaged}}\right) = Q_{ungaged}$$

Where,

Q_{gaged} = Streamflow of the gaged basin

$Q_{ungaged}$ = Streamflow of the ungaged basin

$Area_{gaged}$ = Area of the gaged basin

$Area_{ungaged}$ = Area of the ungaged basin

The assumption behind the equation is that the flow per unit area is equivalent in watersheds with similar characteristics. Therefore, the flow per unit area in the gaged watershed multiplied by the area of the ungaged watershed estimates the flow for the ungaged watershed.

Data downloaded through USGS for the surrogate gage for the period of record were adjusted to account for point source influence in the watershed upstream of the gaging station. Average daily flows from all National Pollutant Discharge Elimination System (NPDES) permitted facilities upstream of the surrogate USGS gages were subtracted from the gaged flow prior to the flow per unit area calculations. The resulting estimates account for flows associated with precipitation and overland runoff only. Average daily flows from permitted NPDES discharges upstream of the impaired segments in the Big Four Ditch watershed were then added back into the equation to more accurately reflect estimated daily streamflow conditions in a given segment.

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Section 3

Big Four Ditch Watershed Public Participation

Public knowledge, acceptance, and follow-through are necessary to implement a plan to meet recommended TMDLs, WBPs, and/or WPPs. It is important to involve the public as early in the process as possible to achieve maximum cooperation and counter concerns as to the purpose of the process and the regulatory authority to implement any recommendations.

Illinois EPA and CDM Smith held a virtual public meeting on June 30, 2021, to present Stage 1 of TMDL development. An additional virtual public meeting was held on January 17, 2024 to present the final results of the TMDL process and report. **Appendix D** contains a Responsiveness Summary to present comments received throughout the public participation process and how the comments have been addressed, where applicable.

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Section 4

Big Four Ditch Watershed Water Quality Standards

4.1 Illinois Water Quality Standards

Water quality standards are developed and enforced by the state to protect the designated uses of the state's waterways. In Illinois, the Illinois Pollution Control Board (IPCB) is responsible for setting the water quality standards. Illinois is required to update water quality standards every 3 years in accordance with the CWA. The standards requiring modifications are identified and prioritized by Illinois EPA in conjunction with EPA. New standards are then developed or revised during the 3-year period.

Illinois EPA is also responsible for developing scientifically based water quality criteria and proposing them to the IPCB for adoption into state rules and regulations. The Illinois water quality standards are established in the Illinois Administrative Rules Title 35, Environmental Protection; Subtitle C, Water Pollution; Chapter I, Pollution Control Board; Part 302, Water Quality Standards.[18]

4.2 Designated Uses

The waters of Illinois are classified into four primary categories of narrative and numeric water quality standards for surface waters, which include General Use Standards, Public and Food Processing Water Supplies Standards, Secondary Contact and Indigenous Aquatic Life Standards, and Lake Michigan Basin Water Quality Standards.[19] Segments IL_BPKP-01 and IL_BPKP-02 of the Big Four Ditch were listed in the 2018 Illinois Integrated Report for impairment of the aquatic life use by low DO under the General Use standard.

4.2.1 General Use

The General Use classification is defined by IPCB as standards that "are intended to protect aquatic life, wildlife, agricultural, primary contact, secondary contact, and most industrial uses." They are also intended to "ensure the aesthetic quality of the state's aquatic environment and to protect human health from disease or other harmful effects that could occur from ingesting aquatic organisms taken from surface waters of the state."[20]

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[18] Illinois Pollution Control Board. Title 35 Procedural and Environmental Rules. Subtitle C. Chapter 1. Part 302. https://pcb.illinois.gov/SLR/IPCBandIEPAEnvironmentalRegulationsTitle35

[19] Illinois Numeric Water Quality Standards for Surface Waters. https://pcb.illinois.gov/documents/dsweb/Get/Document-33354/

[20] Illinois Pollution Control Board. Title 35 Procedural and Environmental Rules. Subtitle C. Chapter 1. Part 303. Subpart A. https://pcb.illinois.gov/SLR/IPCBandIEPAEnvironmentalRegulationsTitle35

4.3 Water Quality Criteria

According to the 2020/2022 Illinois Integrated Report,[21] aquatic life use assessments in streams are typically based on the interpretation of biological information, physiochemical water data, and physical habitat. The primary biological measures used are the Fish Index of Biotic Integrity, the macroinvertebrate Index of Biotic Integrity, and the Macroinvertebrate Biotic Index. Physical habitat information used in assessments includes quantitative and qualitative measures of stream bottom composition and qualitative descriptors of channel and riparian conditions. Physiochemical water data used include measures of conventional parameters (e.g., DO, pH, and temperature), priority pollutants, nonpriority pollutants, and other pollutants.

Table 4-1 presents the numeric water quality standards of the potential cause of 2018 impairment for segments IL_BPKP-01 and IL_BPKP-02 in the Big Four Ditch watershed.

Table 4-1 Summary of Numeric Water Quality Standards for Potential Causes of Stream Impairments in the Big Four Ditch Watershed

Parameter	Units	General Use Water Quality Standard	Regulatory Reference
DO	mg/L	*March through July* ≥5.0 minimum and ≥6.0 7-day daily mean averaged over 7 days *August through February* ≥3.5 minimum, ≥4.0 7-day minimum averaged over 7 days and ≥5.5 30-day daily mean	302.206(b)

Source: https://pcb.illinois.gov/documents/dsweb/Get/Document-33354/.
mg/L – milligrams per liter; ≥ – greater than or equal to

Since the completion of Stage 1, the 2020/2022 Illinois Integrated Water Quality Report and 303(d) List was approved on June 30, 2022.[22] Segment IL_BPKP-02 has been removed from the latest 303(d) list and Segment IL_BPKP-01 remains listed as impaired for the aquatic life use. The current potential cause of impairment is now listed as Cause Unknown. Aquatic life impairments may also be caused by loss of stream coverage, and habitat and stream alterations. No numeric water quality standards have been adopted by Illinois for these causes of impairment.

[21] 2020/2022 Illinois, *Integrated Report*, 17. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2020-2022-ir-final-6-01-22.pdf

[22] Illinois EPA. 2022.https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdfhttps://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdf

Section 5

Big Four Ditch Watershed Data and Potential Pollution Sources

To further characterize the Big Four Ditch watershed, a wide range of data were collected and reviewed. Water quality data for streams and information on potential point and nonpoint sources within the watershed were compiled from a variety of data sources. This information is discussed further in this section.

5.1 Water Quality Data

Illinois EPA monitoring programs that contribute data to the assessment of streams include the Ambient Water Quality Monitoring Network, the Pesticide Monitoring Subnetwork, Facility-Related Stream Surveys, Intensive Basin Surveys, and the Fish Contaminant Monitoring Program.[23] Much of the data used for this report came from the Ambient Water Quality and Lake Monitoring Programs and Intensive Basin Surveys. The Ambient Water Quality Network and Ambient Lake Monitoring Programs include 146 fixed stream stations statewide that are sampled every 6 weeks. Additional data are collected during Intensive Basin Surveys, which are typically conducted on a 5-year cycle and focus on basins where intensive data are currently lacking or where historical data need updating. Additional information on Illinois EPA's monitoring programs can be found in the Illinois Water Monitoring Strategy report.[24]

Data from historical water quality stations on or upgradient of impaired streams within the Big Four Ditch watershed were located and reviewed for this report. These water quality data were primarily provided by the Illinois EPA, however, some additional water quality data provided by USGS and other sources were identified from the EPA's Storage and Retrieval (STORET) database. **Figure 5-1** shows all the water quality data stations on the impaired segments, although not all stations include data relevant to the impairments. **Figure 5-2** and **Figure 5-3** show the subbasins draining to each impaired segment. The figures include land use/land cover data that were presented in Section 2.3.1 and show the locations of active dischargers, further discussed in Section 5.3.

The impaired water body segments in the Big Four Ditch watershed were presented in Section 1. Refer to **Table 1-1** for impairment information specific to each segment. Data are summarized by listed impairment and discussed in relation to the relevant Illinois numeric water quality standard.

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[23] Illinois EPA. River and stream webpage. https://epa.illinois.gov/topics/water-quality/monitoring/river-and-stream.html

[24] Illinois EPA. 2014. *Illinois Water Monitoring Strategy 2015–2020*. https://www2.illinois.gov/epa/Documents/epa.state.il.us/water/water-quality/monitoring-strategy/monitoring-strategy-2015-2020.pdf

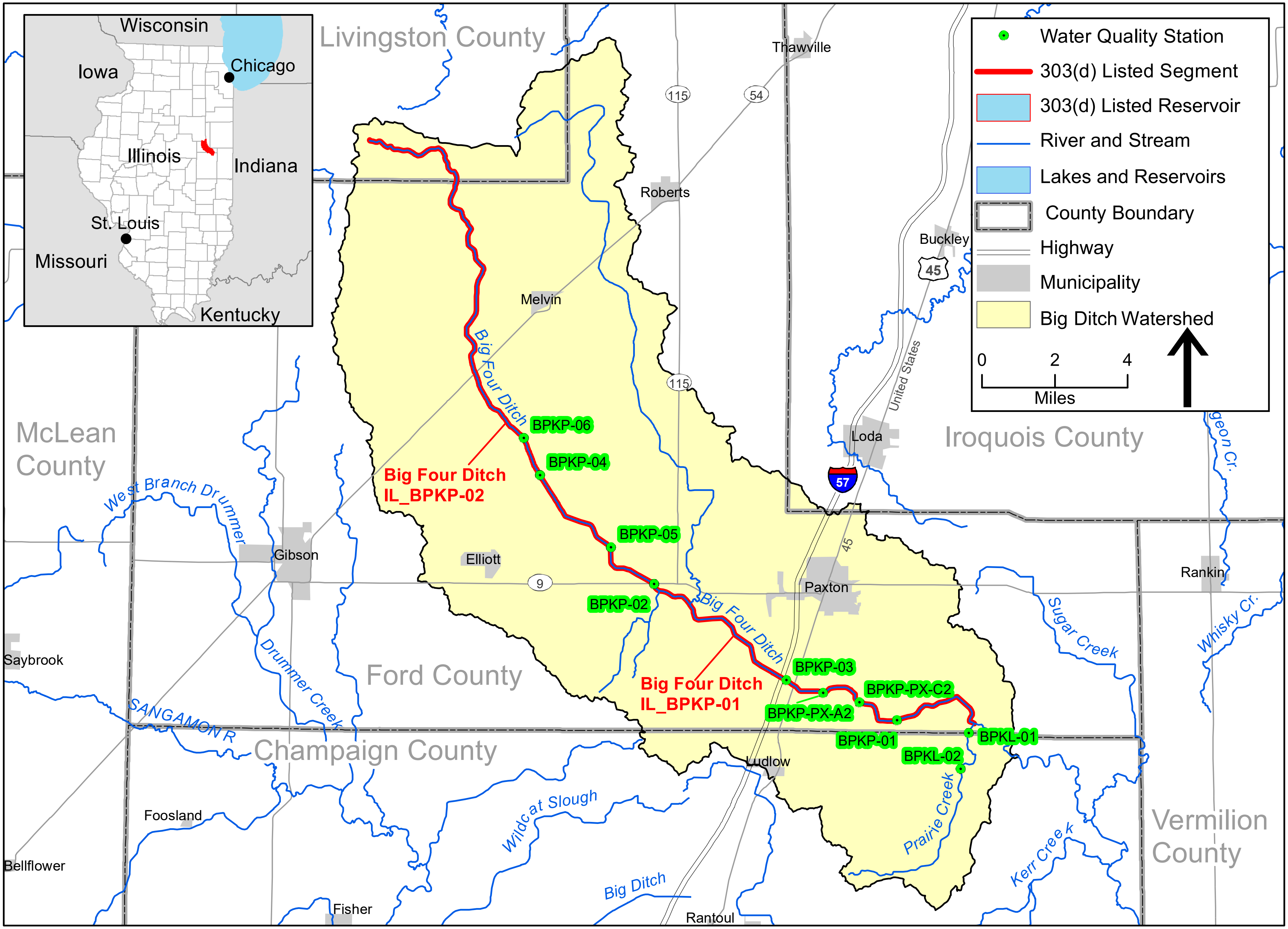

Figure 5-1: Big Four Ditch Watershed Water Quality Stations

CDM Smith

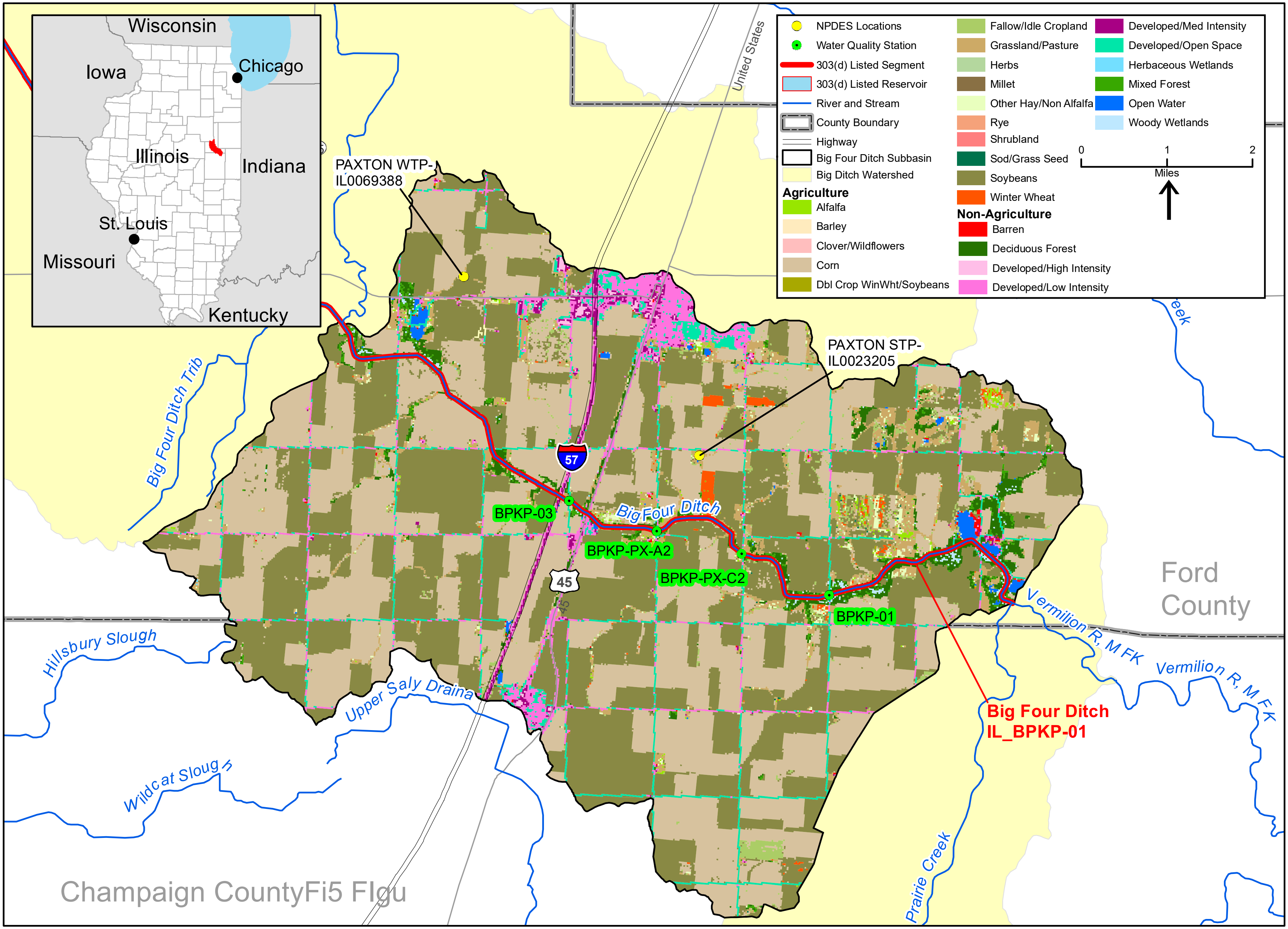

Figure 5-2: Big Four Ditch Watershed
Big Four Ditch Segment IL_BPKP-01 Subbasin

CDM Smith

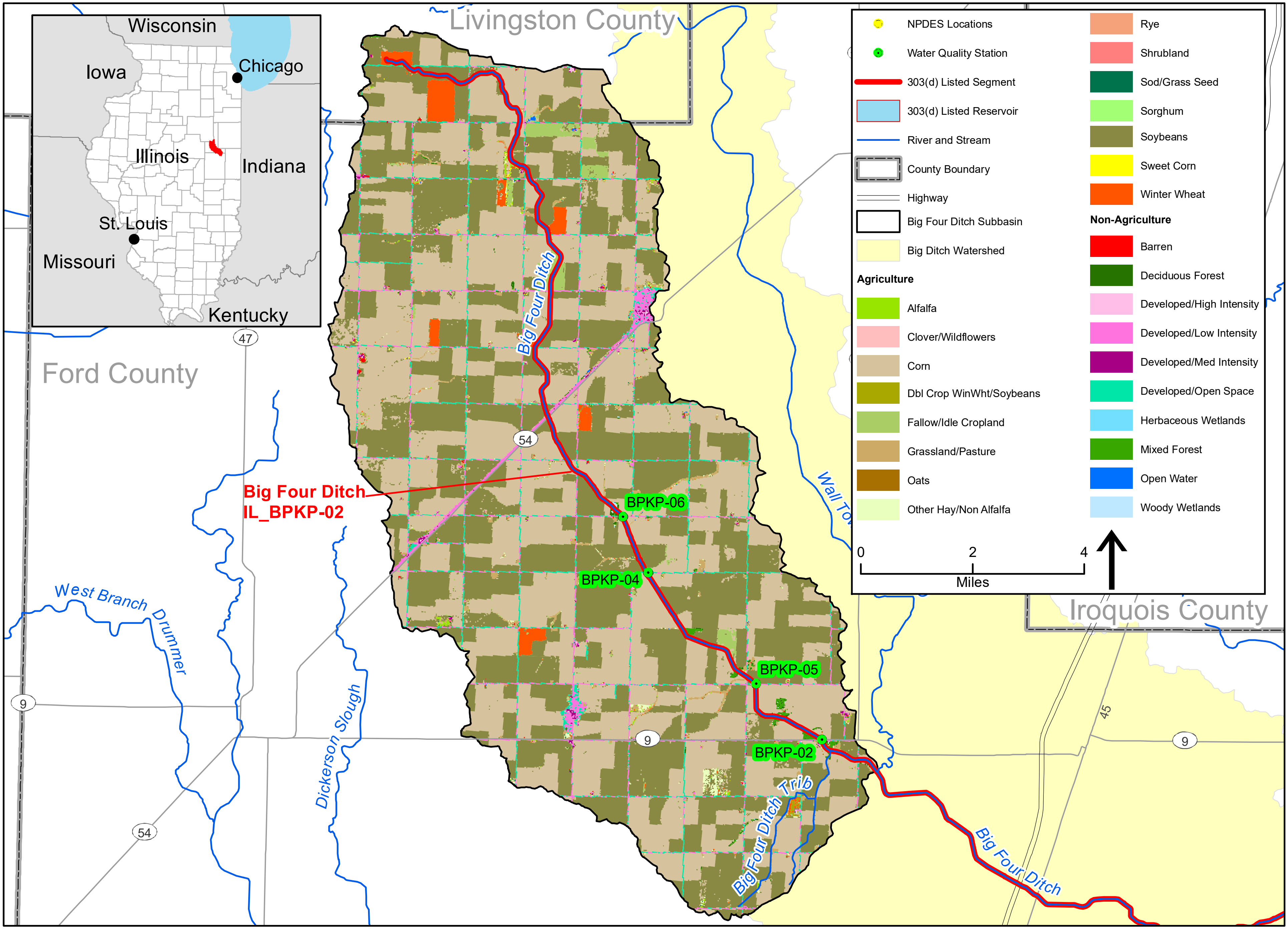

Figure 5-3: Big Four Ditch Watershed
Big Four Ditch Segment IL_BPKP-02 Subbasin

CDM Smith

Data summaries provided in this section include all available date ranges of collected data. The information presented in this section is a combination of EPA STORET and Water Quality Portal databases and Illinois EPA data. The following sections will discuss data for the impaired stream segments in the Big Four Ditch watershed.

5.1.1 Stream Water Quality Data

Two impaired stream segments within the Big Four Ditch watershed are addressed in this report (shown on **Figure 5-2** and **Figure 5-3**). There are three active water quality stations with applicable data on impaired segment IL_BPKP-01 and two on impaired segment IL_BPKP-02 of the Big Four Ditch, which is directly upstream of segment IL_BPKP-01. The historical water quality data for these impaired segments are provided in **Appendix C**.

5.1.1.1 Dissolved Oxygen

Big Four Ditch segments IL_BPKP-01 and IL_BPKP-02 are listed for impairment of the aquatic life use by low DO concentrations. **Table 5-1** summarizes available historical DO data on these segments. The general use water quality standard for DO provides seasonal instantaneous minimum and maximum weekly (7-day) average concentrations for DO in streams. Because of inconsistent and limited datasets, the instantaneous minimum standards of 5.0 mg/L for March through July and 3.5 mg/L for August through February were first used to review data for exceedances of the standard. Given there were no exceedances of these standards, the data were also evaluated using the minimum weekly (7-day) average standard of 6.0 mg/L averaged over 7 days for March through July, and 4.0 mg/L averaged over 7 days for August through February. The dataset showed no violations of either of these standards.

Table 5-1 Existing Dissolved Oxygen Data for Big Four Ditch Segments IL_BPKP-01 and IL_BPKP-02

Impaired Segment	Illinois WQ Standard (mg/L)	Period of Record and Number of Data Points	Mean	Maximum	Minimum	Number of Exceedances	Sample Location
IL_BPKP-01	5.0,[1] 3.5[2] 6.0,[3] 4.0[4]	1997; 2 2016; 2	8.66	9.60	8.29	0	BPKP-01, BPKP-PX-A2, BPKP-PX-C2
IL_BPKP-02	5.0,[1] 3.5[2] 6.0,[3] 4.0[4]	2001; 3 2011; 3 2016; 3	8.48	10.90	5.27	0	BPKP-02, BPKP-05

Notes:
[1] Instantaneous minimum March–July.
[2] Instantaneous minimum August–February.
[3] Weekly (7-day) average minimum March–July.
[4] Weekly (7-day) average minimum August–February.

The summary of data presented in **Table 5-1** reflects single samples from each segment compared to the standards during the appropriate months. Only four samples were available for the impaired segment IL_BPKP-01. Nine samples were available for the impaired segment IL_BPKP-02. No sample violated the Illinois water quality standard. **Figure 5-4** and **Figure 5-5** show the DO measurements collected over time at each impaired segment.

The DO measurements in the 2018 303(d)-listed segments of Big Four Ditch segments IL_BPKP-01 and IL_BPKP-02 were collected between May and October. The four samples from segment IL_BPKP-01 were collected in September and October and are subject to the seasonal instantaneous minimum of 3.5 mg/L. The three samples from segment IL_BPKP-02 are subject to the seasonal instantaneous minimum of 5.0 mg/L. The remaining samples are subject to the seasonal instantaneous minimum of 3.5 mg/L.

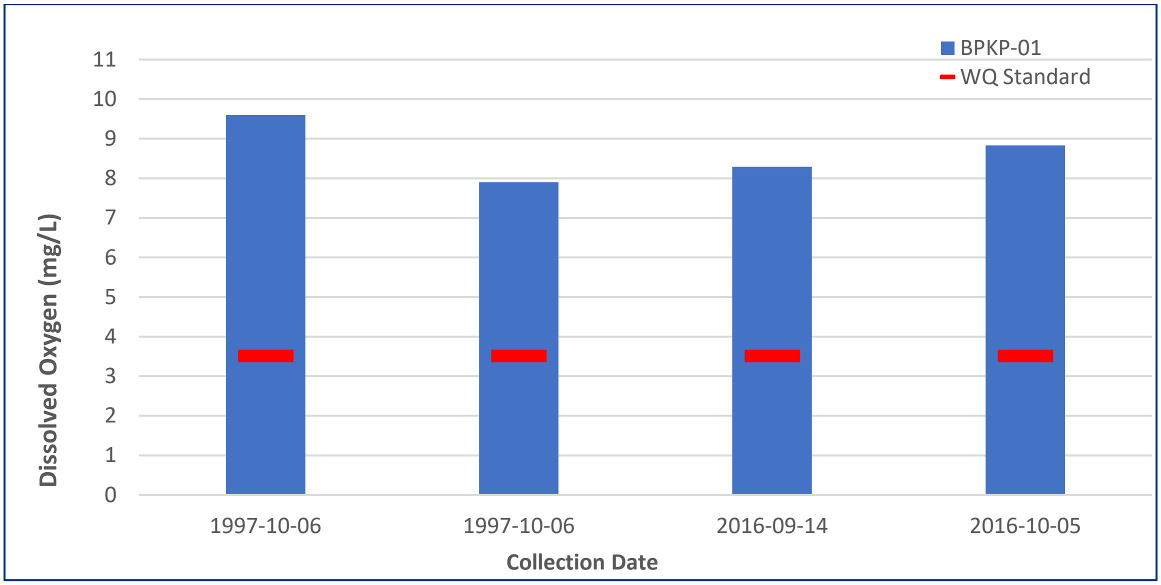

Figure 5-4 Historical Dissolved Oxygen Data for Big Four Ditch Segment IL_BPKP-01

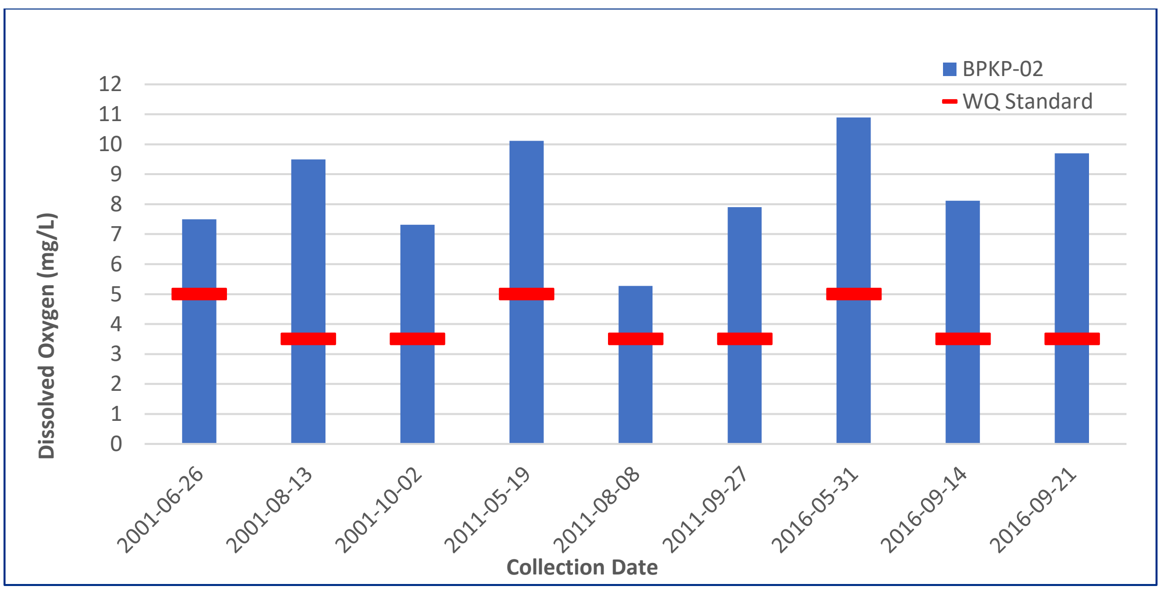

Figure 5-5 Historical Dissolved Oxygen Data for Big Four Ditch Segment IL_BPKP-02

5.2 Point Sources

In general, facilities discharging treated domestic wastewater have the potential to affect DO concentrations (through the discharge of nutrients and other oxygen-demanding materials) in their receiving waters. There are two active point sources within the Big Four Ditch watershed that discharge to or upstream of impaired segment BPK-01. The City of Paxton water treatment plant is unlikely to discharge effluent that impacts DO levels in its receiving water, while treated effluent from the sanitary treatment plant (STP) may contribute oxygen-demanding materials to the impaired segment (**Figure 5-6**). **Table 5-2** contains permit information for the wastewater treatment plant.

Table 5-2 Permitted Facilities Discharging within the Big Four Ditch Watershed

Facility ID	Facility Name	Design Average/Maximum Flow (MGD)	Receiving Water
IL0023205	City of Paxton STP	0.51/1.42	Unnamed Tributary to Big Four Ditch (IL_BPK-01)

MGD – million gallons per day

5.3 Nonpoint Sources

The 2018 303(d) list stated “source unknown” for potential sources of impairment within the watershed. This section discusses site-specific cropping practices, animal operations, and area septic systems, as they are historically nonpoint sources of sediment and oxygen-demanding materials within streams. Data were collected through online sources, communication with the local NRCS, Soil and Water Conservation Districts (SWCDs), and county health departments. Available data are included in this section.

The 2020/2022 303(d) list also noted that loss of coverage, and stream and habitat alterations were causes of impairment to the aquatic life uses in Big Four Ditch. Although these causes of impairment are not sources of loading, they can contribute to low DO in streams through loss of the traditional run-riffle sequence that introduces oxygen to waters through turbulence. Stagnant waters that lack riparian cover also experience higher temperatures and foster algae growth, which contributes to the depletion of DO in the water body.

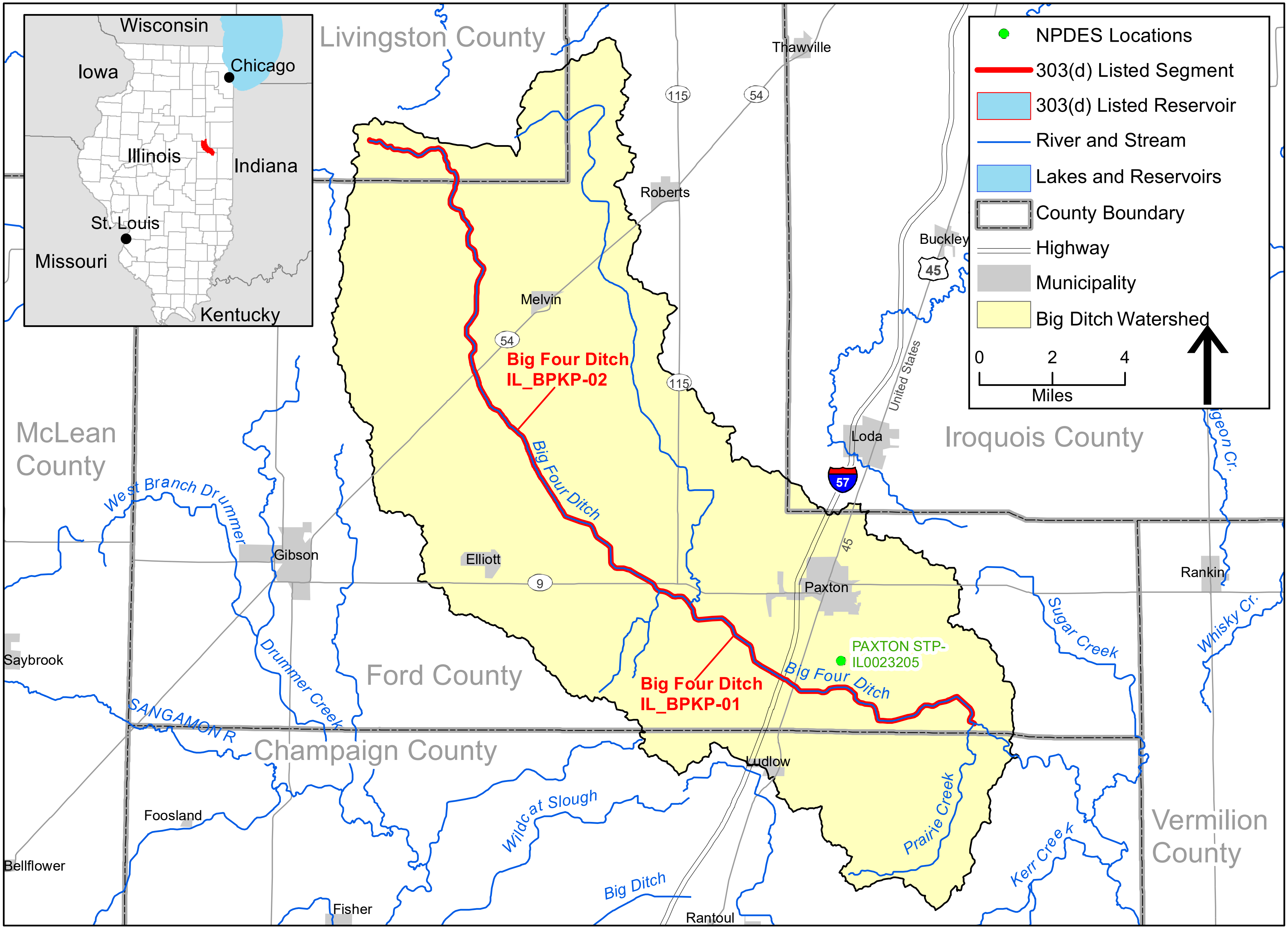

Figure 5-6: Big Four Ditch Watershed NPDES Discharge Locations

CDM Smith

5.3.1 Crop Information

Approximately 90 percent of the land within the Big Four Ditch watershed is dedicated to agriculture. Of the agricultural lands, corn and soybean farming each account for approximately 44 percent of the watershed. Tillage practices can be categorized as conventional till, reduced till, mulch till, and no till. The percentage of each tillage practice for corn, soybeans, and small grains by county are generated by the Illinois Department of Agriculture (IDA) from county transect surveys.[25] Data specific to the Big Four Ditch watershed were not available; however, Ford, Iroquois, Livingston, and Champaign Counties practice data were available and are presented as they were reported in the transect surveys, in **Table 5-3** through **Table 5-6**.

Table 5-3 Tillage Practices in Ford County

Tillage System	Corn		Soybean		Small Grain	
	2015	2018	2015	2018	2015	2018
Conventional	66.9%	95.4%	4.3%	28.9%	0.0%	0.0%
Reduced Till	16.9%	3.1%	18.0%	33.7%	66.7%	0.0%
Mulch Till	6.8%	0.9%	42.0%	10.7%	33.3%	0.0%
No Till	9.4%	0.6%	35.7%	26.7%	0.0%	0.0%

Table 5-4 Tillage Practices in Champaign County

Tillage System	Corn		Soybean		Small Grain	
	2015	2018	2015	2018	2015	2018
Conventional	75.0%	93.5%	8.0%	20.4%	100.0%	0.0%
Reduced Till	13.0%	5.6%	25.0%	41.6%	0.0%	0.0%
Mulch Till	10.0%	0.6%	41.0%	14.3%	0.0%	0.0%
No Till	2.0%	0.3%	25.0%	23.7%	0.0%	25.0%

Note:

1 Values presented are as reported in the Transect Survey data and may not total 100%.

Table 5-5 Tillage Practices in Livingston County

Tillage System	Corn		Soybean		Small Grain	
	2015	2018	2015	2018	2015	2018
Conventional	64.3%	65.2%	5.4%	8.3%	0.0%	0.0%
Reduced Till	16.6%	8.9%	10.3%	13.1%	66.7%	0.0%
Mulch Till	12.3%	13.3%	40.2%	62.4%	0.0%	0.0%
No Till	6.8%	12.6%	44.1%	16.2%	33.3%	0.0%

Table 5-6 Tillage Practices in Iroquois County

Tillage System	Corn		Soybean		Small Grain	
	2015	2018	2015	2018	2015	2018
Conventional	31.6%	59.4%	50.0%	4.8%	0.0%	0.0%
Reduced Till	32.0%	24.9%	6.4%	12.9%	0.0%	25.0%
Mulch Till	30.2%	9.6%	4.3%	51.9%	0.0%	0.0%
No Till	6.2%	6.1%	39.3%	30.4%	100.0%	75.0%

25 IDA. 2018. Illinois Soil Conservation Transect Surveys. https://agr.illinois.gov/resources/landwater/illinois-soil-conservation-transect-survey-reports.html

According to the County Transect Survey Summary Report,[26] fields planted conventionally leave less than 15 percent of the soil surfaced covered with crop residue after planting, while mulch till leaves at least 30 percent of the residue from the previous crop remaining on the soil surface after being tilled and planted. Reduced till falls between conventional and mulch (greater than 15 percent but less than 30 percent) and no till practices leave the soil virtually undisturbed from harvest through planting. Residue is important because it shields the ground from the eroding effects of rain and helps retain moisture for crops.

Information on field tiling practices was also sought as field drains can influence the timing and amount of water delivered to area streams and reservoirs and deliver dissolved nutrients from fields to receiving waters. Local SWCD officials reported that, given the predominant soils in the watershed (very poorly, poorly, or somewhat poorly drained or moderately well drained soils on slopes of less than 2 percent), approximately 88 percent of the area would be in need of tile drainage.[27]

5.3.2 Animal Operations

Information on animal operations within each county in Illinois is available from NASS. Knowing the number of animal units in a watershed is useful in TMDL development as grazing animals have the potential to increase erosion and contribute nutrients through manure. Data specific to the Big Four Ditch watershed were not available; however, the Ford, Livingston, Champaign, and Iroquois County animal populations were reviewed and are presented in **Table 5-7** through **Table 5-10**.[28,29]

Table 5-7 Ford County Animal Populations

Livestock Type	2012	2017	Percent Change
Cattle and Calves	3,032	2,967	-2.1%
Beef	(D)	(D)	--
Dairy	(D)	(D)	--
Hogs and Pigs	128,522	54,271	-57.8%
Poultry	975	1,863	91.1%
Sheep and Lambs	685	736	7.4%
Horses and Ponies	273	181	-33.7%

(D) – Withheld to avoid disclosing data for individual farms.

[26] IDA. 2018. Illinois Soil Conservation Transect Survey Reports. https://agr.illinois.gov/content/dam/soi/en/web/agr/resources/landwater/documents/2018-transect-survey-summary-report.pdf

[27] Earles, S. 2019, November 15. Ford County SWCD Resource Conservationist. Email correspondence.

[28] NASS. 2019. 2017 Census of Agriculture, Illinois State and County Data. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/

[29] NASS. 2014. 2012 Census of Agriculture, Illinois State and County Data. https://agcensus.library.cornell.edu/census_parts/2012-illinois/

Table 5-8 Champaign County Animal Populations

Livestock Type	2012	2017	Percent Change
Cattle and Calves	12,135	7,300	-39.8%
Beef	(D)	(D)	--
Dairy	(D)	(D)	--
Hogs and Pigs	9,852	10,117	2.7%
Poultry	74	49	-33.8%
Sheep and Lambs	440	460	4.5%
Horses and Ponies	763[1]	410	-46.3%

(D) – Withheld to avoid disclosing data for individual farms.

Table 5-9 Livingston County Animal Populations

Livestock Type	2012	2017	Percent Change
Cattle and Calves	10,510	10,893	3.6%
Beef	2,490	2,946	18.3%
Dairy	1,344	1,604	19.3%
Hogs and Pigs	236,426	133,911	-43.4%
Poultry	53	54	1.9%
Sheep and Lambs	359	787	119.2%
Horses and Ponies	357[1]	201	-43.7%

Table 5-10 Iroquois County Animal Populations

Livestock Type	2012	2017	Percent Change
Cattle and Calves	23,621	16,057	-32.0%
Beef	5,536	3,332	-39.8%
Dairy	200	204	2.0%
Hogs and Pigs	57,778	52,640	-8.9%
Poultry	44	47	6.8%
Sheep and Lambs	508	760	49.6%
Horses and Ponies	370[1]	305	-17.6%

Communications with local SWCD and NRCS officials have indicated there is not a prevalence of animal populations given that most of the watershed is lacking in bottomland floodplain.[30]

5.3.3 Septic Systems

Many households in rural areas of Illinois that are not connected to municipal sewers make use of on-site sewage disposal systems or septic systems. There are many types of septic systems. The most common is composed of a septic tank draining to a septic field, where nutrient removal occurs. However, the degree of nutrient removal in these systems is limited by the soils and by system upkeep and maintenance.

[30] Earles, S. 2019, November 15. Ford County SWCD Resource Conservationist. Email correspondence.

Across the United States, septic systems have been found to be a significant source of phosphorous pollution, and failing or leaking septic systems contribute to fecal coliform pollution; both can contribute to low DO. Animal waste, urban runoff, and permitted point sources can also contribute. County health departments were contacted for information on the extent of sewered and nonsewered municipalities. Responses from each of the counties were sparse, but in general, there are several unsewered communities throughout the watershed where homes are dependent on private septic systems. It is likely that any homes outside of the sewered areas of Paxton are on septic systems.

Section 6

Approach to Developing Total Maximum Daily Loads and Identifying Data Needs

Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. The available dataset for DO concentrations in Big Four Ditch segment IL_BPKP-01 includes two measurements from 2016 and two measurements from 1997. There are nine measurements for DO in segment IL_BPKP-02. No DO concentrations below the applicable water quality standards were observed in the datasets for either segment. Further development of TMDLs for oxygen-demanding materials is not recommended based on the available historical data.

As discussed in Section 1, the 2020/2022 Illinois Integrated Report was approved in June 2022.[31] Segment IL_BPKP-02 has been removed from the 303(d) list and moved to Category 4c, while Segment IL_BPKP-01 remains listed as impaired for the aquatic life use. The potential causes of impairment are now listed as “Cause Unknown.” Additional assessment information provided in Appendix A-1 of the 2020/2022 Illinois Integrated Report indicate the aquatic life impairments may be caused by loss of stream coverage, and stream alterations. No numeric water quality standards have been adopted by Illinois for these causes of impairment. Although no TMDL can be developed for these causes, a WPP is included in Section 7 to provide mitigation measures to improve and support the aquatic life use in the impaired segments.

[31] Illinois EPA. 2022.https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdfhttps://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/2020-2022_IR_DRAFT-FINAL_2-14-22.pdf

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Section 7

Watershed Protection Plan for the Big Four Ditch Watershed

7.1 Protection Plan

As presented in Section 5, the available DO dataset for Big Four Ditch segments IL_BPKP-01 and IL_BPKP-02 showed that these segments are no longer impaired by low DO concentrations. Big Four Ditch has since been removed from the 2020/2022 303(d) List for a DO impairment and therefore a TMDL was not developed. A watershed protection plan was developed and is presented in this section to help guide the implementation of effective BMPs that maintain water quality, protect the watershed from future instream DO depletions, and that may improve the aquatic life use in Big Four Ditch.

High-phosphorus concentrations in receiving streams often result in excessive algae growth, typically periphyton in smaller streams and phytoplankton in larger rivers. Excessive algae growth is known to cause water column DO depletions as the algae respires. An effective way to maintain adequate DO concentrations and mitigate against future DO depletions is to reduce nonpoint source nutrient loads. Given the Big Four Ditch watershed area is dominated by agricultural land uses, nutrient and erosion control BMPs will likely have a positive effect on receiving water quality and aquatic life uses.

The 2020/2022 Illinois Integrated Water Quality Report also identified in-stream conditions that may be contributing to aquatic life use impairment in the Big Four Ditch. These conditions can include excessive sedimentation caused by erosion, high nutrients associated with sediment loads, stagnant or slowly flowing water, lack of natural stream structure (runs, riffles, and pools), channelization, and lack of adequate habitat. Erosion control and restoration of channelized segments can have positive benefits for stream function, habitat, and water quality.

7.2 Adaptive Management

Watershed planning is an iterative and adaptive process that requires continuous monitoring and evaluation of success criteria to help improve results as lessons are learned throughout implementation. This adaptive management approach is recommended for the implementation of management practices designed to minimize point and nonpoint source pollutants within the Big Four Ditch watershed. Adaptive management conforms to EPA guidelines as it is a systematic process for continually improving management policies and practices through learning from the outcomes of operational programs. Some defining characteristics of an adaptive management approach include:

- Acknowledgment of uncertainty about what policy or practice is “best” for the particular management issue

- Thoughtful selection of the policies or practices to be applied (the assessment and design stages of the cycle)
- Careful implementation of a plan of action designed to reveal the critical knowledge that is currently lacking
- Monitoring of key response indicators
- Analysis of the management outcomes in consideration of the original objectives and incorporation of the results into future decisions

Implementation actions, management measures, and additional monitoring are discussed in the remainder of this section to assist in the development of an adaptive management program. The point and nonpoint source BMPs presented herein are voluntary measures for dischargers and/or landowners to implement within or upstream of the Big Four Ditch IL_BPKP-01 and IL_BPKP-02 segments.

7.3 Best Management Practice Recommendations

Implementation actions, point source controls, management measures, and/or BMPs are used to control the generation or distribution of pollutants within a watershed. BMPs are either structural such as wetlands, sediment basins, fencing, or filter strips; or managerial such as conservation tillage practices, nutrient management plans, or crop rotation. Both structural and managerial BMPs require effective management to be successful in reducing pollutant loading to water resources.[32]

It is typically most effective to install a combination of nonpoint source controls and BMPs or a BMP system. A BMP system is a combination of two or more individual BMPs that are used to control pollutants from a single critical source. If the watershed has more than one identified pollutant but the transport mechanism is the same, then a BMP system that establishes controls for the transport mechanism can be employed.[33] The following subsections describe BMPs that the State and watershed stakeholders will pursue for the reduction of watershed erosion, total phosphorus (TP) loads, and instream rehabilitation that can help to maintain water quality, minimize DO depletions, and enhance aquatic life use within the Big Four Ditch watershed.

7.3.1 Recommendations for Total Phosphorus and Erosion Reduction

Phosphorus is a nutrient critical to healthy ecosystems at low concentrations; however, over enrichment of phosphorus can result in aquatic ecosystem degradation when nitrogen is also available in sufficient quantities. Nutrient enrichment can result in rapid algal growth as available nutrients and carbon dioxide are consumed. This response can alter pH, decrease DO (which is critical to other aquatic biota), alter the diurnal DO pattern, and even create anoxic conditions. In addition, nutrient enrichment can reduce water clarity and light penetration and is aesthetically displeasing.

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[32] Osmond, D.L., D.L.K. Hoag, A.E. Luloff, D.W. Meals, and K. Neas. 2015. "Farmers' Use of Nutrient Management: Lessons from Watershed Case Studies." *Journal of Environmental Quality*, February. DOI: http://dx.doi.org/10.2134/jeq2014.02.0091

[33] Osmond et al. 2015.

Inputs of phosphorus originate from both point and nonpoint sources. Most of the phosphorus discharged by point sources is soluble and originates from anthropogenic sources. For example, effluents from municipal sewage treatment plants are often a contributor of phosphorous loads to area waterways. Contributions from failed on-site wastewater treatment (septic) systems can also be a significant source (nonpoint), especially if they are concentrated in a small area. Phosphorus from nonpoint sources is generally insoluble or particulate. Most of this phosphorus is bound tightly to soil particles and enters streams from erosion, although some may come from sources such as tile drainage in the dissolved form. The impact from phosphorus discharged by nonpoint sources is typically intermittent and is most often associated with stormwater runoff. Sedimentation can impact the physical attributes of the stream and act as a transport mechanism for phosphorus.

Phosphorus loads in the Big Four Ditch watershed originate primarily from external sources. As presented in previous sections, possible external sources of TP include agricultural activity throughout the watershed. To manage TP loading within the Big Four Ditch watershed, management measures must primarily address loading through sediment and surface runoff controls.

7.3.1.1 Point Sources of Phosphorus

There is one active municipal point source discharger within the Big Four Ditch watershed that discharges into an unnamed tributary to Big Four Ditch IL_BPK-01. **Table 7-1** contains permit and flow information for the City of Paxton STP which discharges upstream of segment IL_BPKP-01. Effluent from the facility is regulated through the NPDES program and the Illinois EPA permits section reviews permits every five year to ensure that facility operations and permit limits are protective of downstream uses.

Table 7-1 Current CBOD Discharge Limits for NPDES Permitted Point Sources in the Big Four Ditch River Watershed

Facility	NPDES Permit Number	Design Average/Daily Maximum Flow (MGD)	CBOD Monthly Average Limit		CBOD Daily Maximum Limit	
			mg/L	lbs/day	mg/L	lbs/day
City of Paxton STP	IL0023205	0.51/1.42	10	43(118)	20	85(237)

lbs/day – pounds per day

7.3.1.2 Nonpoint Sources of Sediment and Phosphorus

There are many potential nonpoint sources of sediment and attached phosphorus within the Big Four Ditch watershed. This section presents information on watershed cropping practices and other BMPs that help manage nutrient loads and maintain DO levels in area waterways.

BMPs that will positively impact water quality and the aquatic life use within the watershed include:

- Nutrient management
- Conservation tillage practices
- Filter strips and riparian buffers

- Farming/soil retention practices
- Wetlands
- Water and sediment control basins (WASCOBs)

Nutrient Management: Crop management of nitrogen and phosphorus originating in the agricultural portions of the watershed can be accomplished through nutrient management plans (NMPs) that focus on increasing the efficiency with which applied nutrients are used by crops, thereby reducing the amount of nutrients available to be transported to both surface water and groundwater.

The overall goal of nutrient reduction from agriculture is to increase the efficiency of nutrient use by balancing nutrient inputs in feed and fertilizer with outputs in crops and animal produce, and to manage the concentration of nutrients in the soil. The four "Rs" of nutrient management are applying the right fertilizer source at the right rate at the right time and in the right place. It is not unusual for crops in fields or portions of fields to show nutrient deficiencies during periods of the growing season, even where an adequate NMP is followed. The fact that nutrients are applied does not necessarily mean they are available. Plants obtain most of their nutrients and water from the soil through their root system. Any factor that restricts root growth and activity has the potential to restrict nutrient availability and result in increased nutrient runoff.

Reducing nutrient loss in agricultural runoff may be brought about by source and transport control measures such as filter strips or grassed waterways. NMPs account for all inputs and outputs of nutrients to determine reductions. NMPs typically include the following measures:

- Review of aerial photography and soil maps.
- Regular soil testing to determine areas where adequate or excessive fertilization has taken place, monitor where nutrient buildup in soils occurs, and aid in determining fertilization maintenance requirements. Appropriate soils sampling and analysis techniques are described in the Illinois Agronomy Handbook. (http://extension.cropsciences.illinois.edu/handbook/).
- Review of current and/or planned crop rotation practices.
- Establishment of yield goals and associated nutrient application rates which can help minimize the potential for excessive buildup of phosphorus and reallocate phosphorus sources to fields or areas where the greatest agronomic benefits can be produced.
- Development of nutrient budgets with planned application rates, application methods, and timing and form of nutrient application.
- Identification of sensitive areas and restrictions on application when land is snow covered, frozen, or saturated.

Regional differences in phosphorus-supplying power are shown in Figure 8-4 of the Illinois Agronomy Handbook.[34] The differences were broadly defined primarily based on variability in parent material, degree of weathering, native vegetation, and natural drainages. For example, soils developed under forest cover appear to have more available subsoil phosphorus than those developed under grass. Soil test values are used to determine when the buildup and maintenance of soil phosphorus is needed to supplement soils with low phosphorus-supplying power. Specific application amounts should be determined by periodic soil testing. Subsoil levels of phosphorus in the southern Illinois region may be rather high by soil test in some soils, but this is partially offset by conditions that restrict rooting.

However, excessively high-phosphorus soil test levels should not be maintained. While soil test procedures were designed to predict where phosphorus was needed and not to predict environmental problems, the likelihood of phosphorus loss increases with high-phosphorus test levels. Environmental decisions regarding phosphorus applications should include such factors as distance from a significant lake or stream, infiltration rate, slope, and residue cover. One possible problem with using soil test values to predict environmental problems is in sample depth. Normally, samples are collected to a 7-inch depth for predicting nutritional needs. For environmental purposes, it would often be better to collect the samples from a 1- or 2-inch depth, which is the depth that will influence phosphorus runoff. Another potential problem is variability in soil test levels within fields in relation to the dominant runoff and sediment-producing zones. Several fertilizer placement recommendations are described in the Illinois Agronomy Handbook. However, given the propensity of phosphorus to bind tightly to soil particles and subsequently enter streams through erosion, the deep fertilizer placement technique may be most appropriate in phosphorus-impaired areas. Under the deep placement technique, the fertilizer is placed 4 to 8 inches deep into the soil rather than being spread near the surface.

Conservation Tillage Practices: Conservation tillage practices help to reduce the erosion of soils from agricultural land. **Table 7-2** shows the areas (acres) in the watershed that are under cultivation along with the percent of the corresponding watershed area that is cultivated. Crop residuals or living vegetation cover on the soil surface protects against soil detachment from water and wind erosion.

Table 7-2 Cultivated Areas for the Big Four Ditch Watershed Subbasins

Impaired Stream Segment	Segment ID	Land Cover Area (acres)	Cultivated Area (acres)	Percent Cultivated
Big Four Ditch	IL_BPKP-01	120,106	107,560	90%
Big Four Ditch	IL_BPKP-02	57,092	52,937	93%

Conservation tillage practices are no till and reduced till. No till is the practice of limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year-round.[35] Reduced till is managing the amount, orientation, and distribution of

[34] Fernandez, F.G., and R.G. Hoeft. Under revision. “Managing Soil pH and Crop Nutrients.” Chapter 8 in *Illinois Agronomy Handbook*. Illinois Extension and Outreach Department of Crop Sciences. http://extension.cropsciences.illinois.edu/handbook/pdfs/chapter08.pdf

[35] NRCS. 2016a. Conservation Practice Standard. Residue and Tillage Management, No Till. Code 329. https://www.nrcs.usda.gov/resources/guides-and-instructions/residue-and-tillage-management-no-till-ac-329-conservation

crop and other plant residue on the soil surface year-round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.[36]

The no till practice consists only of an in-row soil tillage operation during the planting activities and a seed row/furrow closing device. No full-width tillage is performed from the time of harvest or termination of one cash crop to the time of harvest/termination of the next cash crop in the rotation regardless of the depth of the tillage operation. Limited tillage is allowed to close or level ruts from harvesting equipment, however no more than 25 percent of the field may be tilled for this purpose.

As discussed, the reduced till practice consists of managing plant residue on the soil surface while limiting soil-disturbing activities. The practice includes tillage methods commonly referred to as mulch tillage or conservation tillage where the entire soil surface is disturbed by tillage operations such as chisel plowing, field cultivating, tandem disking, or vertical tillage. It also includes tillage/planting systems with few tillage operations (e.g., ridge till) but which do not meet the criteria for the no till practice as described herein and in Illinois NRCS Conservation Practice Standard (CPS) 329.[37]

In both the no till and reduced till practices, removal of residue from the row area prior to or as part of the planting operation is acceptable. In the no till practice, however, the disturbed portion of the row width should not exceed one-third of the crop row width. In either practice, none of the residue should be burned. To reduce erosion to the targeted level, the current approved water and/or wind erosion prediction technology should be used to determine the amount of randomly distributed surface residue needed, the period of the year the residue needs to be present in the field, and the amount of surface soil disturbance allowed. All residues shall be uniformly distributed over the entire field. Residue should not be shredded after harvest because shredding makes it susceptible to movement by wind or water, and areas where the shredded residue accumulates may interfere with planting of the next crop.

If the no till BMP is selected for use by a landowner, a separate plan shall be prepared for each area that will use this practice. Additional guidance and minimum plan elements are discussed in Illinois NRCS CPS 329.[38] If the reduced till BMP is selected for use by a landowner, a separate plan shall be prepared for each area that will use this practice. Additional guidance and minimum plan elements are discussed in Illinois NRCS CPS 345.[39]

Conservation tillage practices can remove up to 45 percent of the phosphorus from runoff. The 2018 Illinois Department of Agriculture's Soil Transect Survey estimated that conventional till accounts for 76 percent of tillage practices in the state, while soybeans and small grain tillage were estimated at 16 and 0 percent, respectively.

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[36] NRCS. 2016b. Conservation Practice Standard. Residue and Tillage Management, Reduced Till. Code 345. https://www.nrcs.usda.gov/resources/guides-and-instructions/residue-and-tillage-management-reduced-till-ac-345-conservation

[37] NRCS. 2016a.

[38] NRCS. 2016b.

[39] NRCS. 2016b.

Filter Strips: Filter strips are strips or areas of permanent herbaceous vegetation situated between cropland, grazing land, or disturbed land and environmentally sensitive areas such as waterways. The filter strips are permanently designated plantings to treat runoff and are not part of an adjacent cropland's rotation.

The filter strip vegetation may consist of a single species or a mixture of grasses, legumes, and/or other forbs that are appropriately adapted to the soil and climate, as well as to the farm chemicals used in the adjacent land. Approved seed listings are provided in the Illinois NRCS CPS 393.[40] Applicable maintenance shall be performed, as needed, to ensure the strips continue to function properly, including removing state-listed noxious weeds, repairing gullies, removing excess sediment, and reseeding. Overland flow entering the filter strip should be primarily sheet flow; areas of concentrated flow should be dispersed as part of the maintenance activities so as not to circumvent the filter strip. Harvesting of the filter strip vegetation, where appropriate, will help to encourage dense growth, maintain an upright growth habit, and remove contaminants and unwanted nutrients contained in the plant tissue. Prescribed burning may be used to manage and maintain the filter strip when an approved burn plan has been developed.

The installation of filter strips adjacent to the impaired stream segments and any contributing tributaries can result in a considerable reduction of overland contributions of sediments, suspended solids, and nutrients to an impaired water body. Filter strips implemented along impaired streams and their tributaries slow and filter runoff and provide bank stabilization, thereby decreasing erosion and re-sedimentation. However, they should not be installed on unstable channel banks already eroding because of undercutting of the bank toe. When used in support of a riparian forest buffer, filter strips can also restore or maintain sheet flow.

Illinois NRCS CPS 393 describes filter strip requirements based on land slope; the requirements are designed to achieve a minimum flow of 15 to 30 minutes at a half-inch depth. **Table 7-3** provides a summary of the guidance for filter strip width, or flow length, as a function of slope.[41]

Table 7-3 Filter Strip Flow Lengths Based on Land Slope

Percent Slope	Filter Strip Flow Length (feet)	
	Minimum	Maximum
0.5 %	36	72
1.0 %	54	108
2.0 %	72	144
3.0 %	90	180
4.0 %	108	216
5.0 % or greater	117	234

In conjunction with the available land use, topography, and soil information discussed in Section 2, mapping software was used to buffer impaired segments and their major tributaries to an appropriate width to determine the total area found in the subbasin. Because of the wide range of

[40] NRCS. 2017a. Conservation Practice Standard. Filter Strip. Code 393. https://efotg.sc.egov.usda.gov/api/CPSFile/5609/393_IL_CPS_Filter_Strip_2017

[41] NRCS. 2017a.

soil types and slopes found throughout the watershed, the appropriate buffer widths estimated in GIS were based on the maximum buffer area of 234 feet adjacent to the impaired segment's major tributaries.

Not all land use types within the buffer areas are candidates for conversion to filter strips. Existing forests and undisturbed grasslands already function as filter strips and conversion of developed residential or commercial lands is often not feasible. In general, agricultural lands are the land use type most conducive to conversion to buffer strips and will likely provide the greatest benefit to water quality once converted. Therefore, GIS software was used to extract the approximate acreage of agricultural lands surrounding potential tributaries and buffer areas of the impaired stream segments within the Big Four Ditch watershed. The calculated overall buffer areas and acreage of agricultural land within the buffer distances for the impaired segments and their tributaries are provided in **Table 7-4**. These data represent an approximation of the maximum acreage of land potentially available for conversion to filter strips. A more detailed assessment of a given property is necessary to determine the exact size and extent of convertible lands likely to provide the greatest benefit to surface water quality following conversion to filter strips.

Table 7-4 Average Slopes, Filter Strip Flow Length, Total Buffer Area, and Area of Agricultural Land within Buffers Potentially Suitable for Conversion to Filter Strips within the Big Four Ditch Watershed

Impaired Stream Segment	Segment ID	Average Stream Slope	Filter Strip Flow Length (feet)	Total Buffer Area (acres)	Agricultural Land in Buffer (acres)
Big Four Ditch	IL_BPKP-01	3.46%	180	592	166
Big Four Ditch	IL_BPKP-02	1.89%	144	1,062	875

Landowners are encouraged to evaluate their land adjacent to a waterway to determine the practicality of installing or extending filter strips to achieve effective flow lengths as described in the NRCS guidance provided in **Table 7-3**. **Figure 7-1** shows a general overview of the buffered areas and agricultural lands suitable for conversion to filter strips within the watershed.

If this BMP is selected for use by a landowner, a separate plan should be prepared for each area that will use this practice. Additional guidance and minimum plan elements are discussed in Illinois NRCS CPS 393, including site preparation; seed, seeding rates, and mixtures; lime and fertilizer; seedbed preparation and seeding; and operation and maintenance.

Riparian Buffers: Similar to filter strips, riparian vegetation buffers enhance infiltration of runoff and subsequent trapping of nonpoint source pollutants such as phosphorus. The vegetation also serves to reinforce streambank soils, which helps minimize erosion. The primary difference between filter strips and riparian buffers are the types of vegetation plantings used within the buffer area. Riparian buffers leverage woody vegetation such as trees and shrubs. Riparian buffers can also provide shade to exposed streams where aquatic communities may benefit from cooling cover.

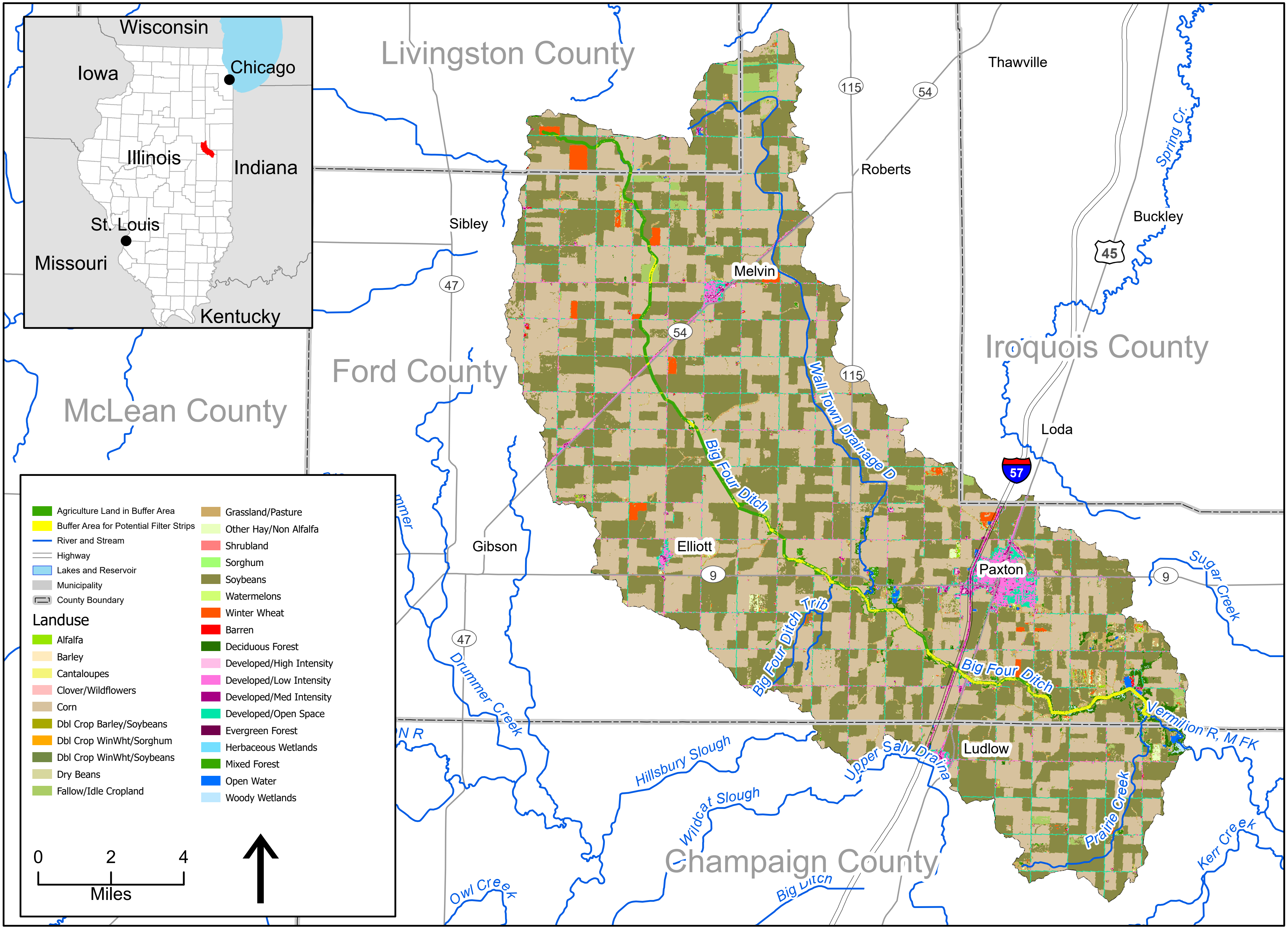

Figure 7-1: Big Four Ditch
Buffer Areas and Agricultural Lands Potentially Suitable for Conversion to Filter Strips

The total buffer area for the Big Four Ditch stream segment within the Big Four Ditch watershed is shown in **Table 7-4**. There are 2,409 acres within 234 feet of impaired stream segments. Approximately 2,124 of these acres are currently classified as agricultural. Landowners should assess parcels adjacent to the stream channels and maintain or improve existing riparian areas, or potentially convert cultivated lands.

Soil Retention: Over 30,000 acres of the Big Four Ditch segments IL_BPKP-01 and IL_BPKP-02 subbasins are under cultivation, accounting for about 74 percent of the watershed area. Farming practices in the watershed should be assessed to determine methods being used and where they can be improved upon, and what additional practices might be appropriate to maintain or reduce nutrient loads through soil retention.

Any farming/soil retention methods with the capability to reduce sediment and suspended solids entering impaired waterways also have the potential to reduce nutrient loads. In addition to conservation tillage and buffer strips (riparian or filter strips), as described previously in this section, other examples of soil retention methods may include:

- Field borders: A minimum 30-foot strip of permanent vegetation, such as stiff-stemmed, upright grasses, grass/legumes, forbs, and/or shrubs, established at the edge or around the perimeter of a cropland or grazing fields to reduce erosion from wind and water and protect soils and water quality.
- Contour farming: Aligning ridges, furrows, and roughness formed by tillage, planting, and other operations to alter the velocity and/or direction of water flow to or around hillslopes in areas where crops are grown on sloping lands.[42]
- Conservation crop rotation: A planned sequence of at least two different crops grown on the same ground over a period (i.e., the rotation cycle), applied to all cropland where at least one annually planted crop is included in the rotation. To recover excess nutrients from the soil profile and reduce water quality degradation, crops with quick germination and root system formation, a rooting depth sufficient to reach the nutrients not removed by the previous crop, and nutrient requirements that readily use the excess nutrients should be used.
- Stripcropping: A practice of growing planned rotations of erosion-resistant and erosion-susceptible crops or fallow in a systematic arrangement of approximately equal strips (two or more) across a field. Stripcropping can reduce sheet, rill, and wind erosion, and the transport of sediment and other water- and wind-borne contaminants. Stripcropping can be applicable on steeper slopes but is less effective on slopes exceeding 12 percent.[43]

[42] NRCS. 2021a. Conservation Practice Standard. Contour Farming. Code 330. https://efotg.sc.egov.usda.gov/api/CPSFile/32990/330_IL_CPS_(Con)tour_Farming_2021

[43] NRCS. 2017b. Conservation Practice Standard. Stripcropping. Code 585. https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/?cid=nrcs143_026849

- Cover cropping: A cover crop consists of grasses, legumes, and forbs planted for seasonal vegetative cover that may either be established between successive production crops or companion- or relay-planted into production crops. The cover crop should be established as soon as practical prior to or after harvest of the production crop and terminated as late as practical to maximize plant biomass production and nutrient uptake while allowing time to prepare the field for the next production crop.[44]

- Terracing: A soil conservation practice that may consist of an earthen embankment, channel, or combination of ridges and channels constructed across high-gradient slopes that can prevent runoff of precipitation from causing serious erosion. Terraces reduce both the volume and velocity of water moving across the soil surface, which reduces peak discharge rates by temporarily storing runoff and allowing associated sediment and other contaminants to settle out behind the terrace ridge rather than directly entering receiving waters.[45]

- Critical area planting: The establishment of permanent vegetation on sites that have or are expected to have high erosion rates and/or on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation using normal practices.[46]

- Sediment basins: A basin formed by an embankment or excavation, or combination of these, with a constructed engineered outlet that captures and detains sediment-laden runoff or other debris for a sufficient period. Sediment basins act as the last line of defense for capturing sediment when erosion has already occurred, and must have sediment storage capacity, detention storage, and temporary flood storage capacities. For maximum sediment retention, the basin should be designed so that the detention storage remains full of water between storm events. If site conditions, safety concerns, or local laws preclude a permanent pool of water, all or a portion of the detention and sediment storage may be designed to be dewatered between storm events.

Wetlands: The use of wetlands as a structural control is applicable to nutrient management and reduction. Wetlands constructed at select locations where more focused runoff from fields occurs (e.g., downstream of a tile drainage system) will treat loads from agricultural runoff, such as phosphorus. Wetlands are effective BMPs for phosphorus and sediment control because they:

- Prevent floods by temporarily storing water, allowing the water to evaporate or percolate into the ground

- Improve water quality through natural pollution control such as plant nutrient uptake

- Filter sediment

- Slow overland flow of water, thereby reducing soil erosion

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[44] NRCS. 2016c. Conservation Practice Standard. Cover Crop. Code 340. https://efotg.sc.egov.usda.gov/api/CPSFile/14651/340_OK_CPS_Cover_Crop_2016

[45] NRCS. 2021b. Conservation Practice Standard. Terrace. Code 600. https://efotg.sc.egov.usda.gov/api/CPSFile/31209/600_IL_CPS_Terrace_2021

[46] NRCS. 2022. Conservation Practice Standard. Critical Area Planting. Code 342. https://efotg.sc.egov.usda.gov/api/CPSFile/35815/342_IL_CPS_Critical_Area_Planting_2022

A properly designed and functioning wetland can provide very efficient treatment of pollutants such as phosphorus. Design of wetland systems is critical to the sustainable functionality of the system and should consider soils in the proposed location, hydraulic retention time, and space requirements. In general, soils classified as hydric are most suitable for wetland construction. There is approximately 24,593 acres of soils classified as at least 90 percent hydric within the Big Four Ditch watershed, which makes up about 40 percent of the entire watershed area. Areas near waterways that are not currently classified as wetlands but have hydric soils present are typically strong candidates for potential wetland construction. Existing wetland areas may also be candidates for reconstruction or enhancement to improve their nutrient uptake capacity.

Constructed wetlands, which comprise the second or third stage of a nonpoint source treatment system, can be very effective at improving water quality. Studies have shown that artificial wetlands designed and constructed specifically to remove pollutants from surface water runoff have removal rates of greater than 90 percent for suspended solids, up to 90 percent for TP, 20 to 80 percent of orthophosphate, and 10 to 75 percent for nitrogen species.[47,48,49,50] Although the removal rate for phosphorus is low in long-term studies, the rate can be improved if sheet flow is maintained to the wetland and vegetation and substrate are monitored to ensure the wetland is operating optimally. Sediment or vegetation removal may be necessary if the wetland removal efficiency is lessened over time.[51] Guidelines for wetland design suggest a wetland-to-watershed ratio of 0.6 percent for nutrient and sediment removal from agricultural runoff.

WASCOBs: WASCOBs are earth embankments or combination ridge and channel systems constructed across the slopes of minor watercourses to reduce watercourse and gully erosion. These basins act as water detention basins and trap sediment (and the pollutants bound to the sediment) prior to the sediment reaching a receiving water. The WASCOB reduces gully erosion by controlling flow within the drainage area, and the basins may be installed singly or in series as part of a system. The practice applies to sites where the topography is generally irregular, runoff and sediment damage land and improvements, and watercourse or gully erosion is a problem. Adequate and stable outlets from the basin are required to convey runoff water to a point where it will not cause damage. Additionally, sheet and rill erosion should be controlled by other conservation practices (i.e., the WASCOB would be part of another conservation system that adequately addresses resource concerns both above and below the basin). However, if land ownership or physical conditions preclude treatment of the upper portion of a slope, a WASCOB may be used to separate the upper area from, and permit treatment of, the lower slope.

WASCOBS should, at a minimum, be designed to be large enough to control runoff from at least a 10-year, 24-hour storm using a combination of flood storage and discharge through the outlet. Additionally, the WASCOB must be designed to have the capacity to store at least the anticipated 10-year sediment accumulation. Otherwise, periodic sediment removal is needed to maintain the

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[47] Johnson, R., R. Evans, and K. Bass. 1996. *Constructed Wetlands Demonstration Project for NPS Pollution Control*. North Carolina Department of Natural Resources: Division of Water Quality.

[48] Moore, J.A., and D. Smith. 2006. *Understanding Natural Wetlands*. Oregon State University Extension Service. EC1407. https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1407.pdf

[49] EPA. 2003a. *National Management Measures to Control Nonpoint Source Pollution from Agriculture*. Office of Water. EPA 841-B-03-004.

[50] Kovosic, D.A., M.B. David, L.E. Gentry, K.M. Starks, and R.A. Cooke. 2000. "Effectiveness of Constructed Wetlands in Reducing N and P Export from Agricultural Tile Drainage." *Journal of Environmental Quality*. 29:1262–1274.

[51] EPA. 2003a.

required capacity. Locations are determined based on slopes, erosion areas, crop management, and soil survey data.

When using a WASCOB, a separate plan shall be prepared for each treatment unit that will use this practice. Local NRCS personnel can often provide information and advice for design and installation. Illinois NRCS CPS 638[52] also provides additional information on the design and maintenance requirements for WASCOBs, and information on cropping activity recommendations and requirements around the basin. Maintenance includes reseeding or planting the basins to maintain vegetation, where specified, and periodically checking them, especially after large storms, to determine the need for embankment repairs or mechanical removal of excess sediment. Inlets and outlets should be cleaned regularly. Damaged components should be replaced promptly.

7.3.2 Stream Rehabilitation Practices

The 2020/2022 Illinois Integrated Water Quality Report identified loss of cover, stream alteration, and habitat alteration as potential causes of impairment to the aquatic life use in the Big Four Ditch. Various BMPs are available to address altered stream settings and enhance aquatic habitat:[53]

- Log-type structures (weirs, sills, deflectors, logs): Placing logs or log-type structures into a stream can establish pools and provide cover for fish while also trapping gravel and/or creating spawning habitat.
- Log jams (multiple log-type structures, engineered log jams): Log jams can be placed in a waterway to form debris dams and trap gravel. Log jams encourage pool development which provide holding and rearing areas for fish, trap sediment, prevent channel migration, and can help restore floodplain and side channels for a more natural stream environment.
- Cover structures: Cover structures may include lunker structures, rock or log shelters that are embedded into streambanks. The structures provide cover for fish while also preventing streambank erosion.
- Gabions: A gabion is a cage, cylinder or wire-mesh box filled with rocks, gravel, concrete, or rip rap that can be used instream to trap sediment and gravel to encourage pool development to enhance stream structure and habitat.
- Brush bundles/rootwads: Placing woody materials into established pools or other areas of slow-moving water provides cover for juvenile and adult fish, refuge from high flows, and substrate for macroinvertebrates.

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[52] NRCS. 2018. Conservation Practice Standard. Water and Sediment Control Basin. Code 638. https://efotg.sc.egov.usda.gov/api/CPSFile/5838/638_IL_CPS_Water_and_Sediment_(Con)trol_Basin_2018

[53] Roni, P., K. Hanson, T. Beechie, G. Pess, M. Pollock, and D. Bartley. 2005. *Habitat rehabilitation for inland fisheries Global review of effectiveness and guidance for rehabilitation of freshwater ecosystems.* Food and Agricultural Organization of the United Nations. Technical Paper 484.

- Gravel/boulder additions: Adding gravel and boulders or cobble to streams at strategic locations can encourage the creation of riffles. Riffles provide breaks in stream segments where stream alterations have impacted aeration or have destabilized stream beds. Riffles provide shallow water spawning habitat for fish.

- Engineering controls: Engineering controls may involve channel reconstruction and realignment to establishes meanders and natural flow complexity and connect the stream channel with the floodplain. This helps to restore natural meandering patterns while increasing habitat within pool-riffle sequences. Constructed riffles are engineered using alluvial materials to increase hydraulic complexity, provide aquatic habitats, increase re-aeration, and stabilize beds in altered streams. Constructed pool systems, such as step or riffle-pools, may be implemented to slow flow velocities, provide aquatic habitat, reduce sedimentation, and lower water temperatures in altered or straightened stream segments.

7.4 Watershed-Specific Priority Areas and Projects

Through the public meeting process, the City of Paxton noted that it is currently considering several stormwater retention options as part of a comprehensive drainage plan. The city requested additional information on wetlands and WASCOBs which was provided by Illinois EPA.

7.5 Information and Education

Public outreach and education campaigns that support watershed protection must take on a holistic approach that considers more than just water quality problems within a watershed. Stakeholder engagement and cooperation improves when outreach strategies also address broader stakeholder concerns such as water supply availability and aesthetics. Watershed plans that incorporate this holistic approach are more successful in changing social behaviors and implementing multi-benefit BMPs that help with maintaining healthy water quality conditions while also protecting other important resources such as drinking water sources, agricultural resources, forests and rangeland, and parks and open space. Existing training and education programs should be leveraged to help bolster communication between agricultural producers and other landowners and industries and encourage them to learn and support successful implementation of the protection plan.

7.6 Monitoring

Successful watershed protection plan implementation relies on continued monitoring of in-stream conditions to document any improvements or changes in water quality over time. This is accomplished by conducting monitoring programs designed to:

- Track implementation of BMPs in the watershed
- Estimate effectiveness of BMPs
- Continue monitoring point source discharges in the watershed
- Monitor storm-based high flow events
- Conduct low-flow monitoring of TP and DO throughout the watershed

- Complete a habitat and stream survey in the watershed to establish existing conditions and document where instream improvements will be implemented with greatest effect
- Establish a baseline from which decisions can be made regarding the need for additional incentives for implementation of BMPs
- Measure the extent of voluntary implementation efforts
- Determine the extent to which management measures are properly maintained and operated

Estimating the effectiveness of the BMPs implemented in the watershed will be completed by monitoring before and after the BMP is incorporated into the watershed. Additional monitoring will be conducted on specific structural systems such as a sediment control basin. Inflow and outflow measurements will be conducted to determine site-specific removal efficiency.

Illinois EPA conducts Intensive Basin Surveys every 5 years. Additionally, select ambient sites are monitored nine times a year. Continuation of this state monitoring program will assess stream water quality as improvements in the watershed are completed. This data will also be used to assess whether water quality standards are being attained.

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Appendix A

Land Use Categories

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Appendix A

Land Use Categories

Table A-1: Big Four Ditch TMDL Watershed Land Use

Land Cover Category	Acres	Percent
Corn	56,681	44%
Soybeans	56,523	44%
Developed/Low Intensity	4,427	3.5%
Developed/Open Space	3,430	2.7%
Grass/Pasture	2,964	2.3%
Deciduous Forest	1,530	1.2%
Winter Wheat	961	0.8%
Developed/Med Intensity	471	0.4%
Other Hay/Non Alfalfa	343	0.3%
Open Water	218	0.2%
Alfalfa	125	0.1%
Developed/High Intensity	112	<0.1%
Woody Wetlands	102	<0.1%
Barren	46	<0.1%
Sod/Grass Seed	33	<0.1%
Double Crop Corn/Soybeans	28	<0.1%
Shrubland	20	<0.1%
Herbaceous Wetlands	12	<0.1%
Rye	4.4	<0.1%
Double Crop Winter Wheat/Soybeans	2.8	<0.1%
Fallow/Idle Cropland	2.1	<0.1%
Oats	2.0	<0.1%
Spring Wheat	1.3	<0.1%
Switchgrass	1.1	<0.1%
Mixed Forest	0.4	<0.1%
Christmas Trees	0.2	<0.1%
Potatoes	0.1	<0.1%

Table A-2: Segment IL_BPKP-01 Subbasin Land Use

Land Cover Category	Acres	Percentage
Corn	53,327	44%
Soybeans	52,962	44%
Developed/Low Intensity	4,337	3.6%
Developed/Open Space	3,280	2.7%
Grass/Pasture	2,644	2.2%
Deciduous Forest	1,235	1.0%
Winter Wheat	945	0.8%
Developed/Medium Intensity	465	0.4%
Other Hay/Non-Alfalfa	326	0.3%
Open Water	173	0.1%
Alfalfa	116	0.1%
Developed/High Intensity	111	<0.1%
Barren	44	<0.1%
Woody Wetlands	40	<0.1%
Sod/Grass Seed	30	<0.1%
Double Crop Corn/Soybeans	28	<0.1%
Shrubland	19	<0.1%
Herbaceous Wetlands	12	<0.1%
Rye	4.4	<0.1%
Double Crop Winter Wheat/Soybeans	2.8	<0.1%
Fallow/Idle Cropland	2.1	<0.1%
Oats	1.6	<0.1%
Spring Wheat	1.0	<0.1%
Switchgrass	0.7	<0.1%
Christmas Trees	0.2	<0.1%
Mixed Forest	0.2	<0.1%

Appendix B

Soil Characteristics

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Appendix B

Soil Characteristics

Map unit Symbol	Map unit Name	Hydrologic Group - Dominant Condition	K-Factor	Acres	Percent
232A	Ashkum silty clay loam, 0 to 2 percent slopes	C/D	0.35	28,877.8	22.5%
235A	Bryce silty clay, 0 to 2 percent slopes	C/D	0.27	18,311.7	14.3%
146A	Elliott silt loam, 0 to 2 percent slopes	C/D	0.39	15,155.3	11.8%
69A	Milford silty clay loam, 0 to 2 percent slopes	C/D	0.31	11,270.3	8.8%
146B2	Elliott silty clay loam, 2 to 4 percent slopes, eroded	C/D	0.43	10,928.0	8.5%
152A	Drummer silty clay loam, 0 to 2 percent slopes	B/D	0.33	7,947.9	6.2%
91A	Swygert silty clay loam, 0 to 2 percent slopes	C/D	0.3	6,046.0	4.7%
149A	Brenton silt loam, 0 to 2 percent slopes	B/D	0.35	3,698.6	2.9%
91B2	Swygert silty clay loam, 2 to 4 percent slopes, eroded	C/D	0.33	3,224.3	2.5%
189A	Martinton silt loam, 0 to 2 percent slopes	C/D	0.32	2,515.0	2.0%
375B	Rutland silty clay loam, 2 to 5 percent slopes	C/D	0.3	2,464.5	1.9%
3107A	Sawmill silty clay loam, 0 to 2 percent slopes, frequently flooded	B/D	0.39	1,832.4	1.4%
330A	Peotone silty clay loam, 0 to 2 percent slopes	C/D	0.31	1,510.9	1.2%
223B2	Varna silt loam, 2 to 4 percent slopes, eroded	D	0.42	1,274.0	1.0%
148B	Proctor silt loam, 2 to 5 percent slopes	B	0.32	1,059.0	0.8%
230A	Rowe silty clay loam, 0 to 2 percent slopes	D	0.29	1,040.9	0.8%
192A	Del Rey silt loam, 0 to 2 percent slopes	C/D	0.43	938.4	0.7%
375A	Rutland silty clay loam, 0 to 2 percent slopes	C/D	0.34	899.2	0.7%
134A	Camden silt loam, 0 to 2 percent slopes	B	0.4	662.7	0.5%
223C2	Varna silt loam, 4 to 6 percent slopes, eroded	C	0.36	619.6	0.5%
23A	Blount silt loam, Lake Michigan Lobe, 0 to 2 percent slopes	C/D	0.4	586.0	0.5%
147A	Clarence silty clay loam, 0 to 2 percent slopes	D	0.31	541.3	0.4%
147B2	Clarence silty clay loam, 2 to 4 percent slopes, eroded	D	0.3	518.9	0.4%
241C3	Chatsworth silty clay, 4 to 6 percent slopes, severely eroded	D	0.36	485.1	0.4%
687B	Penfield loam, 2 to 5 percent slopes	B	0.32	422.2	0.3%
223D3	Varna silty clay loam, 6 to 12 percent slopes, severely eroded	C	0.41	386.9	0.3%
238A	Rantoul silty clay, 0 to 2 percent slopes	D	0.28	335.7	0.3%
614A	Chenoa silty clay loam, 0 to 2 percent slopes	C/D	0.4	321.5	0.3%
541B	Graymont silt loam, 2 to 5 percent slopes	C	0.4	285.9	0.2%
23B2	Blount silt loam, Lake Michigan Lobe, 2 to 4 percent slopes, eroded	D	0.39	274.3	0.2%

Map unit Symbol	Map unit Name	Hydrologic Group - Dominant Condition	K-Factor	Acres	Percent
530B	Ozaukee silt loam, 2 to 4 percent slopes	C	0.4	269.4	0.2%
223B2	Varna silt loam, 2 to 4 percent slopes, eroded	C	0.39	268.0	0.2%
56B	Dana silt loam, 2 to 5 percent slopes	C	0.36	265.4	0.2%
294B	Symerton silt loam, 2 to 5 percent slopes	C	0.39	259.8	0.2%
1103A	Houghton muck, undrained, 0 to 2 percent slopes	A/D	<Null>	243.6	0.2%
3405A	Zook silty clay, 0 to 2 percent slopes, frequently flooded	C/D	0.34	237.3	0.2%
481A	Raub silt loam, non-densic substratum, 0 to 2 percent slopes	B/D	0.34	227.1	0.2%
614B	Chenoa silty clay loam, 2 to 5 percent slopes	C/D	0.4	165.9	0.1%
W	Water	<Null>	<Null>	159.0	0.1%
663B	Clare silt loam, 2 to 5 percent slopes	C	0.34	147.9	0.1%
622B	Wyanet silt loam, 2 to 5 percent slopes	C	0.4	143.6	0.1%
293A	Andres silt loam, 0 to 2 percent slopes	C/D	0.37	121.2	0.1%
102A	La Hogue loam, 0 to 2 percent slopes	B/D	0.26	118.8	0.1%
805B	Orthents, clayey, undulating	D	0.32	97.1	0.1%
67A	Harpster silty clay loam, 0 to 2 percent slopes	B/D	0.37	86.6	0.1%
530D2	Ozaukee silt loam, 6 to 12 percent slopes, eroded	C	0.4	74.6	0.1%
865	Pits, gravel	<Null>	<Null>	73.7	0.1%
241D3	Chatsworth silty clay, 6 to 12 percent slopes, severely eroded	D	0.35	59.3	0.0%
802B	Orthents, loamy, undulating	C	0.33	59.2	0.0%
53000	Ozaukee silt loam, 12 to 20 percent slopes, eroded	C	0.4	58.7	0.0%
295A	Mokena silt loam, 0 to 2 percent slopes	C/D	0.28	52.2	0.0%
448B2	Mona silt loam, 2 to 5 percent slopes, eroded	C	0.28	47.4	0.0%
570C2	Martinsville loam, 5 to 10 percent slopes, eroded	B	0.32	44.5	0.0%
622C2	Wyanet silt loam, 5 to 10 percent slopes, eroded	C	0.39	39.2	0.0%
59A	Lisbon silt loam, 0 to 2 percent slopes	C/D	0.39	36.1	0.0%
294B2	Symerton loam, 2 to 5 percent slopes, eroded	C	0.36	34.4	0.0%
448B	Mona silt loam, 2 to 5 percent slopes	C	0.34	32.7	0.0%
146C2	Elliott silty clay loam, 4 to 6 percent slopes, eroded	C/D	0.44	28.2	0.0%
530C2	Ozaukee silt loam, 4 to 6 percent slopes, eroded	C	0.38	19.9	0.0%
23B	Blount silt loam, Lake Michigan Lobe, 2 to 4 percent slopes	C/D	0.39	18.4	0.0%
147C2	Clarence silty clay loam, 4 to 6 percent slopes, eroded	D	0.31	17.6	0.0%
145B	Saybrook silt loam, 2 to 5 percent slopes	C	0.36	16.6	0.0%
91C2	Swygert silty clay loam, 4 to 6 percent slopes, eroded	D	0.34	15.8	0.0%
687C2	Penfield loam, 5 to 10 percent slopes, eroded	B	0.3	15.1	0.0%
802B	Orthents, loamy, undulating	C	0.38	13.7	0.0%
623A	Kishwaukee silt loam, 0 to 2 percent slopes	B	0.31	12.6	0.0%

Map unit Symbol	Map unit Name	Hydrologic Group - Dominant Condition	K-Factor	Acres	Percent
125A	Selma loam, 0 to 2 percent slopes	B/D	0.26	11.2	0.0%
60C2	La Rose loam, 5 to 10 percent slopes, eroded	C	0.44	10.3	0.0%
570B	Martinsville silt loam, 2 to 5 percent slopes	B	0.35	10.0	0.0%
153A	Pella clay loam, Glacial Lake Watseka, 0 to 2 percent slopes	B/D	0.39	9.1	0.0%
490A	Odell silt loam, 0 to 2 percent slopes	C/D	0.42	8.8	0.0%
	Pella silty clay loam, 0 to 2 percent slopes	B/D	0.33	8.5	0.0%
637A+	Muskego silty clay loam, 0 to 2 percent slopes, overwash	B/D	0.28	8.2	0.0%
387B	Ockley silt loam, 2 to 5 percent slopes	B	0.29	5.6	0.0%
3473A	Rossburg silt loam, 0 to 2 percent slopes, frequently flooded	B	0.37	4.2	0.0%

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Appendix C

Water Quality Data

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Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	26-Jun-01	CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN ug/l		1.4		
BPKP-05	26-Jun-01	CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN,Fixed	Fixed	3.6		
BPKP-05	26-Jun-01	CHLOROPHYLL-B		0.97		
BPKP-05	26-Jun-01	CHLOROPHYLL-C		0.98		
BPKP-05	26-Jun-01	PHEOPHYTIN-A		3.66		
BPKP-05	26-Jun-01	DEPTH ft		1		
BPKP-05	26-Jun-01	CHLOROPHYLL (A+B+C),Filterable	Filterable	510		
BPKP-05	26-Jun-01	SOLIDS, FIXED		410		
BPKP-05	26-Jun-01	ALKALINITY, CARBONATE AS CACO3,Total mg/l	Total	235		
BPKP-05	26-Jun-01	FLUORIDES		0.23		
BPKP-05	26-Jun-01	NITROGEN, NITRITE (NO2) + NITRATE (NO3) mg/l		14		
BPKP-05	26-Jun-01	NITROGEN, AMMONIA (NH3),Total mg/l	Total	0.01		K
BPKP-05	26-Jun-01	PHOSPHORUS AS P,Dissolved mg/l	Dissolved	0.02		
BPKP-05	26-Jun-01	PHOSPHORUS AS P,Total mg/l	Total	0.03		
BPKP-05	26-Jun-01	CARBON, TOTAL ORGANIC mg/l		2.5		
BPKP-05	26-Jun-01	SOLIDS, FIXED,Total mg/l	Total	18		
BPKP-05	26-Jun-01	SOLIDS, FIXED,Volatile mg/l	Volatile	1		
BPKP-05	26-Jun-01	ARSENIC,Total	Total	0.87		
BPKP-05	26-Jun-01	LEAD,Total ug/l	Total	5		K
BPKP-05	26-Jun-01	CALCIUM,Dissolved mg/l	Dissolved	79		
BPKP-05	26-Jun-01	MAGNESIUM,Dissolved mg/l	Dissolved	34		
BPKP-05	26-Jun-01	SODIUM,Dissolved mg/l	Dissolved	6		
BPKP-05	26-Jun-01	POTASSIUM,Dissolved mg/l	Dissolved	1.4		K
BPKP-05	26-Jun-01	ALUMINUM,Dissolved ug/l	Dissolved	100		K
BPKP-05	26-Jun-01	BARIUM,Dissolved ug/l	Dissolved	47		
BPKP-05	26-Jun-01	BORON,Dissolved ug/l	Dissolved	34		
BPKP-05	26-Jun-01	BERYLLIUM,Dissolved ug/l	Dissolved	1		K
BPKP-05	26-Jun-01	CADMIUM,Dissolved ug/l	Dissolved	3		K
BPKP-05	26-Jun-01	CHROMIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	26-Jun-01	COPPER,Dissolved ug/l	Dissolved	10		K
BPKP-05	26-Jun-01	COBALT,Dissolved ug/l	Dissolved	10		K
BPKP-05	26-Jun-01	IRON,Dissolved ug/l	Dissolved	50		K
BPKP-05	26-Jun-01	MANGANESE,Dissolved ug/l	Dissolved	15		K
BPKP-05	26-Jun-01	NICKEL,Dissolved ug/l	Dissolved	25		K
BPKP-05	26-Jun-01	SILVER,Dissolved ug/l	Dissolved	3		K
BPKP-05	26-Jun-01	STRONTIUM,Dissolved ug/l	Dissolved	120		
BPKP-05	26-Jun-01	VANADIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	26-Jun-01	ZINC,Dissolved ug/l	Dissolved	100		K
BPKP-05	26-Jun-01	CALCIUM,Total mg/l	Total	85		
BPKP-05	26-Jun-01	MAGNESIUM,Total mg/l	Total	36		
BPKP-05	26-Jun-01	SODIUM,Total mg/l	Total	6.5		
BPKP-05	26-Jun-01	POTASSIUM,Total mg/l	Total	1.4		K
BPKP-05	26-Jun-01	ALUMINUM,Total ug/l	Total	210		
BPKP-05	26-Jun-01	BARIUM,Total ug/l	Total	52		
BPKP-05	26-Jun-01	BORON,Total ug/l	Total	40		
BPKP-05	26-Jun-01	BERYLLIUM,Total ug/l	Total	1		K

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	26-Jun-01	CADMIUM,Total ug/l	Total	3		K
BPKP-05	26-Jun-01	CHROMIUM,Total ug/l	Total	5		K
BPKP-05	26-Jun-01	COPPER,Total ug/l	Total	10		K
BPKP-05	26-Jun-01	COBALT,Total ug/l	Total	10		K
BPKP-05	26-Jun-01	IRON,Total ug/l	Total	380		
BPKP-05	26-Jun-01	MANGANESE,Total ug/l	Total	19		
BPKP-05	26-Jun-01	NICKEL,Total ug/l	Total	25		K
BPKP-05	26-Jun-01	SILVER,Total ug/l	Total	3		K
BPKP-05	26-Jun-01	STRONTIUM,Total ug/l	Total	130		
BPKP-05	26-Jun-01	VANADIUM,Total ug/l	Total	5		K
BPKP-05	26-Jun-01	ZINC,Total ug/l	Total	100		K
BPKP-05	26-Jun-01	HARDNESS, CA,MG mg/l		361		C
BPKP-05	26-Jun-01	TEMPERATURE, AIR deg C		27		
BPKP-05	26-Jun-01	TEMPERATURE, WATER deg C		19.8		
BPKP-05	26-Jun-01	DISSOLVED OXYGEN (DO) mg/l		7.5		
BPKP-05	26-Jun-01	CONDUCTANCE, SPECIFIC umho/cm		681		
BPKP-05	26-Jun-01	PH		7.4		
BPKP-05	26-Jun-01	TURBIDITY FTU		25.6		
BPKP-05	13-Aug-01	SOLIDS, FIXED		379		
BPKP-05	13-Aug-01	ALKALINITY, CARBONATE AS CACO3,Total mg/l	Total	235		
BPKP-05	13-Aug-01	FLUORIDES		0.25		
BPKP-05	13-Aug-01	CHLORIDE,Total mg/l	Total	36.5		
BPKP-05	13-Aug-01	SULFATE		55.1		
BPKP-05	13-Aug-01	NITROGEN, NITRITE (NO2) + NITRATE (NO3) mg/l		0.04		
BPKP-05	13-Aug-01	NITROGEN, AMMONIA (NH3),Total mg/l	Total	0.01		K
BPKP-05	13-Aug-01	PHOSPHORUS AS P,Dissolved mg/l	Dissolved	0.02		
BPKP-05	13-Aug-01	PHOSPHORUS AS P,Total mg/l	Total	0.08		
BPKP-05	13-Aug-01	CARBON, TOTAL ORGANIC mg/l		6.9		
BPKP-05	13-Aug-01	SOLIDS, FIXED,Total mg/l	Total	24		
BPKP-05	13-Aug-01	SOLIDS, FIXED,Volatile mg/l	Volatile	7		
BPKP-05	13-Aug-01	ARSENIC,Total	Total	3.8		
BPKP-05	13-Aug-01	LEAD,Dissolved ug/l	Dissolved	5		K
BPKP-05	13-Aug-01	LEAD,Total ug/l	Total	5		K
BPKP-05	13-Aug-01	CALCIUM,Dissolved mg/l	Dissolved	60		
BPKP-05	13-Aug-01	MAGNESIUM,Dissolved mg/l	Dissolved	42		
BPKP-05	13-Aug-01	SODIUM,Dissolved mg/l	Dissolved	15		
BPKP-05	13-Aug-01	POTASSIUM,Dissolved mg/l	Dissolved	1.9		
BPKP-05	13-Aug-01	ALUMINUM,Dissolved ug/l	Dissolved	100		K
BPKP-05	13-Aug-01	BARIUM,Dissolved ug/l	Dissolved	52		
BPKP-05	13-Aug-01	BORON,Dissolved ug/l	Dissolved	79		
BPKP-05	13-Aug-01	BERYLLIUM,Dissolved ug/l	Dissolved	1		K
BPKP-05	13-Aug-01	CADMIUM,Dissolved ug/l	Dissolved	3		K
BPKP-05	13-Aug-01	CHROMIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	13-Aug-01	COPPER,Dissolved ug/l	Dissolved	10		K
BPKP-05	13-Aug-01	COBALT,Dissolved ug/l	Dissolved	10		K
BPKP-05	13-Aug-01	IRON,Dissolved ug/l	Dissolved	50		K
BPKP-05	13-Aug-01	MANGANESE,Dissolved ug/l	Dissolved	45		
BPKP-05	13-Aug-01	NICKEL,Dissolved ug/l	Dissolved	25		K

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	13-Aug-01	SILVER,Dissolved ug/l	Dissolved	3		K
BPKP-05	13-Aug-01	STRONTIUM,Dissolved ug/l	Dissolved	160		
BPKP-05	13-Aug-01	VANADIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	13-Aug-01	ZINC,Dissolved ug/l	Dissolved	100		K
BPKP-05	13-Aug-01	CALCIUM,Total mg/l	Total	63		
BPKP-05	13-Aug-01	MAGNESIUM,Total mg/l	Total	44		
BPKP-05	13-Aug-01	SODIUM,Total mg/l	Total	15		
BPKP-05	13-Aug-01	POTASSIUM,Total mg/l	Total	2		
BPKP-05	13-Aug-01	ALUMINUM,Total ug/l	Total	280		
BPKP-05	13-Aug-01	BARIUM,Total ug/l	Total	57		
BPKP-05	13-Aug-01	BORON,Total ug/l	Total	85		
BPKP-05	13-Aug-01	BERYLLIUM,Total ug/l	Total	1		K
BPKP-05	13-Aug-01	CADMIUM,Total ug/l	Total	3		K
BPKP-05	13-Aug-01	CHROMIUM,Total ug/l	Total	5		K
BPKP-05	13-Aug-01	COPPER,Total ug/l	Total	10		K
BPKP-05	13-Aug-01	COBALT,Total ug/l	Total	10		K
BPKP-05	13-Aug-01	IRON,Total ug/l	Total	430		
BPKP-05	13-Aug-01	MANGANESE,Total ug/l	Total	110		
BPKP-05	13-Aug-01	NICKEL,Total ug/l	Total	25		K
BPKP-05	13-Aug-01	SILVER,Total ug/l	Total	3		K
BPKP-05	13-Aug-01	STRONTIUM,Total ug/l	Total	160		
BPKP-05	13-Aug-01	VANADIUM,Total ug/l	Total	5		K
BPKP-05	13-Aug-01	ZINC,Total ug/l	Total	100		K
BPKP-05	13-Aug-01	HARDNESS, CA,MG mg/l		340		C
BPKP-05	13-Aug-01	TEMPERATURE, AIR deg C		27		
BPKP-05	13-Aug-01	TEMPERATURE, WATER deg C		30.5		
BPKP-05	13-Aug-01	DISSOLVED OXYGEN (DO) mg/l		9.5		
BPKP-05	13-Aug-01	CONDUCTANCE, SPECIFIC umho/cm		631		
BPKP-05	13-Aug-01	PH		8.4		
BPKP-05	13-Aug-01	TURBIDITY NTU		24		
BPKP-05	13-Aug-01	CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN ug/l		15		
BPKP-05	13-Aug-01	CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN,Fixed	Fixed	16.4		
BPKP-05	13-Aug-01	CHLOROPHYLL-B		1.93		
BPKP-05	13-Aug-01	CHLOROPHYLL-C		1.05		
BPKP-05	13-Aug-01	PHEOPHYTIN-A		1.56		
BPKP-05	13-Aug-01	DEPTH ft		1		
BPKP-05	13-Aug-01	CHLOROPHYLL (A+B+C),Filterable	Filterable	430		
BPKP-05	02-Oct-01	CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN ug/l		3.3		
BPKP-05	02-Oct-01	CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN,Fixed	Fixed	2.98		
BPKP-05	02-Oct-01	CHLOROPHYLL-B		1		K
BPKP-05	02-Oct-01	CHLOROPHYLL-C		1		K
BPKP-05	02-Oct-01	PHEOPHYTIN-A		1		K
BPKP-05	02-Oct-01	DEPTH ft		1		
BPKP-05	02-Oct-01	CHLOROPHYLL (A+B+C),Filterable	Filterable	540		
BPKP-05	02-Oct-01	SOLIDS, FIXED		411		
BPKP-05	02-Oct-01	ALKALINITY, CARBONATE AS CACO3,Total mg/l	Total	195		

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	02-Oct-01	FLUORIDES		0.2		
BPKP-05	02-Oct-01	CHLORIDE,Total mg/l	Total	46.3		
BPKP-05	02-Oct-01	SULFATE		61.5		
BPKP-05	02-Oct-01	NITROGEN, NITRITE (NO2) + NITRATE (NO3) mg/l		0.06		
BPKP-05	02-Oct-01	NITROGEN, AMMONIA (NH3),Total mg/l	Total	0.01		K
BPKP-05	02-Oct-01	PHOSPHORUS AS P,Dissolved mg/l	Dissolved	0.01		
BPKP-05	02-Oct-01	PHOSPHORUS AS P,Total mg/l	Total	0.03		
BPKP-05	02-Oct-01	CARBON, TOTAL ORGANIC mg/l		7.1		
BPKP-05	02-Oct-01	SOLIDS, FIXED,Total mg/l	Total	11		
BPKP-05	02-Oct-01	SOLIDS, FIXED,Volatile mg/l	Volatile	4		
BPKP-05	02-Oct-01	ARSENIC,Total	Total	2		K
BPKP-05	02-Oct-01	LEAD,Dissolved ug/l	Dissolved	5		K
BPKP-05	02-Oct-01	LEAD,Total ug/l	Total	5		K
BPKP-05	02-Oct-01	CALCIUM,Dissolved mg/l	Dissolved	61		
BPKP-05	02-Oct-01	MAGNESIUM,Dissolved mg/l	Dissolved	42		
BPKP-05	02-Oct-01	SODIUM,Dissolved mg/l	Dissolved	25		
BPKP-05	02-Oct-01	POTASSIUM,Dissolved mg/l	Dissolved	3.4		
BPKP-05	02-Oct-01	ALUMINUM,Dissolved ug/l	Dissolved	100		K
BPKP-05	02-Oct-01	BARIUM,Dissolved ug/l	Dissolved	50		
BPKP-05	02-Oct-01	BORON,Dissolved ug/l	Dissolved	79		
BPKP-05	02-Oct-01	BERYLLIUM,Dissolved ug/l	Dissolved	1		K
BPKP-05	02-Oct-01	CADMIUM,Dissolved ug/l	Dissolved	3		K
BPKP-05	02-Oct-01	CHROMIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	02-Oct-01	COPPER,Dissolved ug/l	Dissolved	10		K
BPKP-05	02-Oct-01	COBALT,Dissolved ug/l	Dissolved	10		K
BPKP-05	02-Oct-01	IRON,Dissolved ug/l	Dissolved	50		K
BPKP-05	02-Oct-01	MANGANESE,Dissolved ug/l	Dissolved	35		
BPKP-05	02-Oct-01	NICKEL,Dissolved ug/l	Dissolved	25		K
BPKP-05	02-Oct-01	SILVER,Dissolved ug/l	Dissolved	3		K
BPKP-05	02-Oct-01	STRONTIUM,Dissolved ug/l	Dissolved	170		
BPKP-05	02-Oct-01	VANADIUM,Dissolved ug/l	Dissolved	5		K
BPKP-05	02-Oct-01	ZINC,Dissolved ug/l	Dissolved	100		K
BPKP-05	02-Oct-01	CALCIUM,Total mg/l	Total	59		
BPKP-05	02-Oct-01	MAGNESIUM,Total mg/l	Total	40		
BPKP-05	02-Oct-01	SODIUM,Total mg/l	Total	24		
BPKP-05	02-Oct-01	POTASSIUM,Total mg/l	Total	2.8		
BPKP-05	02-Oct-01	ALUMINUM,Total ug/l	Total	230		
BPKP-05	02-Oct-01	BARIUM,Total ug/l	Total	52		
BPKP-05	02-Oct-01	BORON,Total ug/l	Total	80		
BPKP-05	02-Oct-01	BERYLLIUM,Total ug/l	Total	1		K
BPKP-05	02-Oct-01	CADMIUM,Total ug/l	Total	3		K
BPKP-05	02-Oct-01	CHROMIUM,Total ug/l	Total	5		K
BPKP-05	02-Oct-01	COPPER,Total ug/l	Total	10		K
BPKP-05	02-Oct-01	COBALT,Total ug/l	Total	10		K
BPKP-05	02-Oct-01	IRON,Total ug/l	Total	270		
BPKP-05	02-Oct-01	MANGANESE,Total ug/l	Total	53		
BPKP-05	02-Oct-01	NICKEL,Total ug/l	Total	25		K
BPKP-05	02-Oct-01	SILVER,Total ug/l	Total	3		K
BPKP-05	02-Oct-01	STRONTIUM,Total ug/l	Total	160		

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	02-Oct-01	VANADIUM,Total ug/l	Total	5		K
BPKP-05	02-Oct-01	ZINC,Total ug/l	Total	100		K
BPKP-05	02-Oct-01	HARDNESS, CA,MG mg/l		313		C
BPKP-05	02-Oct-01	TEMPERATURE, AIR deg C		24		
BPKP-05	02-Oct-01	TEMPERATURE, WATER deg C		15.6		
BPKP-05	02-Oct-01	DISSOLVED OXYGEN (DO) mg/l		7.32		
BPKP-05	02-Oct-01	CONDUCTANCE, SPECIFIC umho/cm		681		
BPKP-05	02-Oct-01	PH		7.77		
BPKP-05	02-Oct-01	TURBIDITY NTU		12		
BPKP-05	19-May-11	Dissolved oxygen (DO)		10.12	mg/l	
BPKP-05	19-May-11	Dissolved oxygen saturation		94.1	%	
BPKP-05	19-May-11	pH		7.2	none	
BPKP-05	19-May-11	Specific conductance		542	umho/cm	
BPKP-05	19-May-11	Temperature, air		20	deg C	
BPKP-05	19-May-11	Temperature, water		11.42	deg C	
BPKP-05	19-May-11	Turbidity		32.5	NTU	
BPKP-05	19-May-11	Alkalinity, total		180	mg/l	
BPKP-05	19-May-11	Aluminum	Dissolved	9.19	ug/l	J
BPKP-05	19-May-11	Aluminum	Total	789	ug/l	
BPKP-05	19-May-11	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	19-May-11	Arsenic	Dissolved	4.57	ug/l	V
BPKP-05	19-May-11	Arsenic	Total	3.53	ug/l	V
BPKP-05	19-May-11	Barium	Dissolved	30.3	ug/l	
BPKP-05	19-May-11	Barium	Total	41.7	ug/l	
BPKP-05	19-May-11	Beryllium	Dissolved	0.2	ug/l	J
BPKP-05	19-May-11	Beryllium	Total		ug/l	ND
BPKP-05	19-May-11	Boron	Dissolved	17.4	ug/l	
BPKP-05	19-May-11	Boron	Total	23.6	ug/l	
BPKP-05	19-May-11	Cadmium	Dissolved		ug/l	ND
BPKP-05	19-May-11	Cadmium	Total		ug/l	ND
BPKP-05	19-May-11	Calcium	Dissolved	48900	ug/l	
BPKP-05	19-May-11	Calcium	Total	60200	ug/l	
BPKP-05	19-May-11	Chloride	Total	17.9	mg/l	
BPKP-05	19-May-11	Chromium	Dissolved	0.54	ug/l	J
BPKP-05	19-May-11	Chromium	Total	1.15	ug/l	J
BPKP-05	19-May-11	Cobalt	Dissolved	1	ug/l	J
BPKP-05	19-May-11	Cobalt	Total	0.65	ug/l	J
BPKP-05	19-May-11	Copper	Dissolved	3.21	ug/l	J
BPKP-05	19-May-11	Copper	Total	5.01	ug/l	
BPKP-05	19-May-11	Cyanide	Total		mg/l	ND
BPKP-05	19-May-11	Fluoride	Total	0.18	mg/l	
BPKP-05	19-May-11	Hardness, Ca, Mg		255000	ug/l	C
BPKP-05	19-May-11	Inorganic nitrogen (nitrate and nitrite)	Total	14	mg/l	
BPKP-05	19-May-11	Iron	Dissolved	53.5	ug/l	
BPKP-05	19-May-11	Iron	Total	909	ug/l	
BPKP-05	19-May-11	Kjeldahl nitrogen	Total	0.428	mg/l	J
BPKP-05	19-May-11	Lead	Dissolved	2.97	ug/l	J
BPKP-05	19-May-11	Lead	Total	1.44	ug/l	J
BPKP-05	19-May-11	Magnesium	Dissolved	20600	ug/l	
BPKP-05	19-May-11	Magnesium	Total	25300	ug/l	

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	19-May-11	Manganese	Dissolved	6.91	ug/l	
BPKP-05	19-May-11	Manganese	Total	19.3	ug/l	
BPKP-05	19-May-11	Nickel	Dissolved		ug/l	ND
BPKP-05	19-May-11	Nickel	Total	1.5	ug/l	J
BPKP-05	19-May-11	Organic carbon	Total	2.25	mg/l	
BPKP-05	19-May-11	Phenols	Total		ug/l	ND
BPKP-05	19-May-11	Phosphorus	Dissolved	0.032	mg/l	
BPKP-05	19-May-11	Phosphorus	Total	0.052	mg/l	
BPKP-05	19-May-11	Potassium	Dissolved	617	ug/l	J
BPKP-05	19-May-11	Potassium	Total	986	ug/l	
BPKP-05	19-May-11	Silver	Dissolved		ug/l	ND
BPKP-05	19-May-11	Silver	Total		ug/l	ND
BPKP-05	19-May-11	Sodium	Dissolved	3670	ug/l	V
BPKP-05	19-May-11	Sodium	Total	4370	ug/l	V
BPKP-05	19-May-11	Strontium	Dissolved	75.8	ug/l	
BPKP-05	19-May-11	Strontium	Total	93.3	ug/l	
BPKP-05	19-May-11	Sulfate	Total	10.4	mg/l	
BPKP-05	19-May-11	Temperature, sample		3	deg C	
BPKP-05	19-May-11	Total suspended solids		32	mg/l	
BPKP-05	19-May-11	Vanadium	Dissolved	0.72	ug/l	J
BPKP-05	19-May-11	Vanadium	Total	2.05	ug/l	J
BPKP-05	19-May-11	Volatile suspended solids		8	mg/l	
BPKP-05	19-May-11	Zinc	Dissolved	1.5	ug/l	J
BPKP-05	19-May-11	Zinc	Total	2.64	ug/l	J
BPKP-05	19-May-11	Chlorophyll a, corrected for pheophytin	Total	1.46	ug/l	
BPKP-05	19-May-11	Chlorophyll a, uncorrected for pheophytin	Total	1.63	ug/l	
BPKP-05	19-May-11	Chlorophyll b	Total		ug/l	ND
BPKP-05	19-May-11	Chlorophyll c	Total		ug/l	ND
BPKP-05	19-May-11	Pheophytin a	Total	0.07	ug/l	J
BPKP-05	01-Jun-11	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	01-Jun-11	Inorganic nitrogen (nitrate and nitrite)	Total	15.2	mg/l	
BPKP-05	01-Jun-11	Kjeldahl nitrogen	Total	0.234	mg/l	J,J7
BPKP-05	01-Jun-11	Phosphorus	Total	0.047	mg/l	
BPKP-05	01-Jun-11	Temperature, sample		4	deg C	
BPKP-05	01-Jun-11	Total suspended solids		48	mg/l	
BPKP-05	01-Jun-11	Volatile suspended solids		9	mg/l	
BPKP-05	03-Aug-11	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	03-Aug-11	Inorganic nitrogen (nitrate and nitrite)	Total	0.152	mg/l	
BPKP-05	03-Aug-11	Kjeldahl nitrogen	Total	0.764	mg/l	
BPKP-05	03-Aug-11	Phosphorus	Total	0.073	mg/l	
BPKP-05	03-Aug-11	Temperature, sample		2	deg C	
BPKP-05	03-Aug-11	Total suspended solids		31	mg/l	
BPKP-05	03-Aug-11	Volatile suspended solids		9	mg/l	
BPKP-05	08-Aug-11	Dissolved oxygen (DO)		5.27	mg/l	
BPKP-05	08-Aug-11	Dissolved oxygen saturation		64	%	
BPKP-05	08-Aug-11	pH		7.36	none	
BPKP-05	08-Aug-11	Specific conductance		600	umho/cm	
BPKP-05	08-Aug-11	Temperature, air		26	deg C	
BPKP-05	08-Aug-11	Temperature, water		25.22	deg C	
BPKP-05	08-Aug-11	Turbidity		25	NTU	

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	08-Aug-11	Alkalinity, total		220	mg/l	
BPKP-05	08-Aug-11	Aluminum	Dissolved	7.84	ug/l	J
BPKP-05	08-Aug-11	Aluminum	Total	638	ug/l	
BPKP-05	08-Aug-11	Ammonia-nitrogen	Total	0.17	mg/l	
BPKP-05	08-Aug-11	Arsenic	Dissolved	3.06	ug/l	
BPKP-05	08-Aug-11	Arsenic	Total	4.18	ug/l	
BPKP-05	08-Aug-11	Barium	Dissolved	48.2	ug/l	
BPKP-05	08-Aug-11	Barium	Total	54.3	ug/l	
BPKP-05	08-Aug-11	Beryllium	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Beryllium	Total		ug/l	ND
BPKP-05	08-Aug-11	Boron	Dissolved	84.1	ug/l	
BPKP-05	08-Aug-11	Boron	Total	91	ug/l	
BPKP-05	08-Aug-11	Cadmium	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Cadmium	Total		ug/l	ND
BPKP-05	08-Aug-11	Calcium	Dissolved	51100	ug/l	
BPKP-05	08-Aug-11	Calcium	Total	49700	ug/l	
BPKP-05	08-Aug-11	Chloride	Total	36.3	mg/l	
BPKP-05	08-Aug-11	Chromium	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Chromium	Total	2.83	ug/l	J
BPKP-05	08-Aug-11	Cobalt	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Cobalt	Total		ug/l	ND
BPKP-05	08-Aug-11	Copper	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Copper	Total		ug/l	ND
BPKP-05	08-Aug-11	Cyanide	Total		mg/l	ND
BPKP-05	08-Aug-11	Fluoride	Total	0.23	mg/l	
BPKP-05	08-Aug-11	Hardness, Ca, Mg		289000	ug/l	C
BPKP-05	08-Aug-11	Inorganic nitrogen (nitrate and nitrite)	Total	0.097	mg/l	J
BPKP-05	08-Aug-11	Iron	Dissolved	13.2	ug/l	J
BPKP-05	08-Aug-11	Iron	Total	634	ug/l	
BPKP-05	08-Aug-11	Kjeldahl nitrogen	Total	0.59	mg/l	
BPKP-05	08-Aug-11	Lead	Dissolved	10.8	ug/l	V
BPKP-05	08-Aug-11	Lead	Total		ug/l	ND,V
BPKP-05	08-Aug-11	Magnesium	Dissolved	41400	ug/l	
BPKP-05	08-Aug-11	Magnesium	Total	40100	ug/l	
BPKP-05	08-Aug-11	Manganese	Dissolved	94.5	ug/l	
BPKP-05	08-Aug-11	Manganese	Total	124	ug/l	
BPKP-05	08-Aug-11	Nickel	Dissolved	1.97	ug/l	J
BPKP-05	08-Aug-11	Nickel	Total	2.33	ug/l	J
BPKP-05	08-Aug-11	Organic carbon	Total	5.74	mg/l	
BPKP-05	08-Aug-11	Phenols	Total		ug/l	ND
BPKP-05	08-Aug-11	Phosphorus	Dissolved	0.032	mg/l	
BPKP-05	08-Aug-11	Phosphorus	Total	0.071	mg/l	
BPKP-05	08-Aug-11	Potassium	Dissolved	1930	ug/l	J7
BPKP-05	08-Aug-11	Potassium	Total	2100	ug/l	J7
BPKP-05	08-Aug-11	Silver	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Silver	Total	1.99	ug/l	J
BPKP-05	08-Aug-11	Sodium	Dissolved	16400	ug/l	
BPKP-05	08-Aug-11	Sodium	Total	16000	ug/l	
BPKP-05	08-Aug-11	Strontium	Dissolved	166	ug/l	
BPKP-05	08-Aug-11	Strontium	Total	160	ug/l	

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	08-Aug-11	Sulfate	Total	49.3	mg/l	J3
BPKP-05	08-Aug-11	Temperature, sample		3	deg C	
BPKP-05	08-Aug-11	Total suspended solids		21	mg/l	
BPKP-05	08-Aug-11	Vanadium	Dissolved		ug/l	ND
BPKP-05	08-Aug-11	Vanadium	Total		ug/l	ND
BPKP-05	08-Aug-11	Volatile suspended solids		8	mg/l	
BPKP-05	08-Aug-11	Zinc	Dissolved		ug/l	ND,V
BPKP-05	08-Aug-11	Zinc	Total		ug/l	ND,V
BPKP-05	08-Aug-11	Chlorophyll a, corrected for pheophytin	Total	11.3	ug/l	
BPKP-05	08-Aug-11	Chlorophyll a, uncorrected for pheophytin	Total	12.3	ug/l	
BPKP-05	08-Aug-11	Chlorophyll b	Total	1.8	ug/l	
BPKP-05	08-Aug-11	Chlorophyll c	Total	0.39	ug/l	J
BPKP-05	08-Aug-11	Pheophytin a	Total	1.13	ug/l	
BPKP-05	27-Sep-11	Dissolved oxygen (DO)		7.9	mg/l	
BPKP-05	27-Sep-11	Dissolved oxygen saturation		79	%	
BPKP-05	27-Sep-11	pH		7.4	none	
BPKP-05	27-Sep-11	Specific conductance		613	umho/cm	
BPKP-05	27-Sep-11	Temperature, air		13	deg C	
BPKP-05	27-Sep-11	Temperature, water		14.4	deg C	
BPKP-05	27-Sep-11	Turbidity		25.5	NTU	
BPKP-05	27-Sep-11	Alkalinity, total		175	mg/l	
BPKP-05	27-Sep-11	Aluminum	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Aluminum	Total	527	ug/l	
BPKP-05	27-Sep-11	Ammonia-nitrogen	Total	0.31	mg/l	
BPKP-05	27-Sep-11	Arsenic	Dissolved	1.81	ug/l	J
BPKP-05	27-Sep-11	Arsenic	Total	2.14	ug/l	
BPKP-05	27-Sep-11	Barium	Dissolved	44.5	ug/l	
BPKP-05	27-Sep-11	Barium	Total	48	ug/l	
BPKP-05	27-Sep-11	Beryllium	Dissolved	0.63	ug/l	J,V
BPKP-05	27-Sep-11	Beryllium	Total	0.84	ug/l	J,V
BPKP-05	27-Sep-11	Boron	Dissolved	83.1	ug/l	V
BPKP-05	27-Sep-11	Boron	Total	84	ug/l	V
BPKP-05	27-Sep-11	Cadmium	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Cadmium	Total		ug/l	ND
BPKP-05	27-Sep-11	Calcium	Dissolved	40900	ug/l	
BPKP-05	27-Sep-11	Calcium	Total	41500	ug/l	
BPKP-05	27-Sep-11	Chloride	Total	52.1	mg/l	
BPKP-05	27-Sep-11	Chromium	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Chromium	Total		ug/l	ND
BPKP-05	27-Sep-11	Cobalt	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Cobalt	Total	0.45	ug/l	J
BPKP-05	27-Sep-11	Copper	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Copper	Total	1.09	ug/l	J
BPKP-05	27-Sep-11	Cyanide	Total		mg/l	ND
BPKP-05	27-Sep-11	Fluoride	Total	0.16	mg/l	
BPKP-05	27-Sep-11	Hardness, Ca, Mg		242000	ug/l	C
BPKP-05	27-Sep-11	Inorganic nitrogen (nitrate and nitrite)	Total	0.023	mg/l	J
BPKP-05	27-Sep-11	Iron	Dissolved	32.8	ug/l	J
BPKP-05	27-Sep-11	Iron	Total	678	ug/l	
BPKP-05	27-Sep-11	Kjeldahl nitrogen	Total	0.39	mg/l	J

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	27-Sep-11	Lead	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Lead	Total		ug/l	ND
BPKP-05	27-Sep-11	Magnesium	Dissolved	33000	ug/l	
BPKP-05	27-Sep-11	Magnesium	Total	33600	ug/l	
BPKP-05	27-Sep-11	Manganese	Dissolved	18	ug/l	
BPKP-05	27-Sep-11	Manganese	Total	33.3	ug/l	
BPKP-05	27-Sep-11	Nickel	Dissolved	1.89	ug/l	J
BPKP-05	27-Sep-11	Nickel	Total	1.9	ug/l	J
BPKP-05	27-Sep-11	Organic carbon	Total	4.2	mg/l	
BPKP-05	27-Sep-11	Phenols	Total		ug/l	ND
BPKP-05	27-Sep-11	Phosphorus	Dissolved	0.024	mg/l	
BPKP-05	27-Sep-11	Phosphorus	Total	0.036	mg/l	
BPKP-05	27-Sep-11	Potassium	Dissolved	2570	ug/l	
BPKP-05	27-Sep-11	Potassium	Total	2820	ug/l	
BPKP-05	27-Sep-11	Silver	Dissolved		ug/l	ND
BPKP-05	27-Sep-11	Silver	Total		ug/l	ND
BPKP-05	27-Sep-11	Sodium	Dissolved	27000	ug/l	
BPKP-05	27-Sep-11	Sodium	Total	27200	ug/l	
BPKP-05	27-Sep-11	Strontium	Dissolved	126	ug/l	
BPKP-05	27-Sep-11	Strontium	Total	132	ug/l	
BPKP-05	27-Sep-11	Sulfate	Total	52.6	mg/l	J3
BPKP-05	27-Sep-11	Temperature, sample		2	deg C	
BPKP-05	27-Sep-11	Total suspended solids		17	mg/l	
BPKP-05	27-Sep-11	Vanadium	Dissolved		ug/l	ND,V
BPKP-05	27-Sep-11	Vanadium	Total	2.43	ug/l	J,V
BPKP-05	27-Sep-11	Volatile suspended solids		5	mg/l	
BPKP-05	27-Sep-11	Zinc	Dissolved	2.11	ug/l	J
BPKP-05	27-Sep-11	Zinc	Total	3.52	ug/l	J
BPKP-05	27-Sep-11	Chlorophyll a, corrected for pheophytin	Total	1.13	ug/l	
BPKP-05	27-Sep-11	Chlorophyll a, uncorrected for pheophytin	Total	1.12	ug/l	
BPKP-05	27-Sep-11	Chlorophyll b	Total	0.02	ug/l	J
BPKP-05	27-Sep-11	Chlorophyll c	Total		ug/l	ND
BPKP-05	27-Sep-11	Pheophytin a	Total		ug/l	ND
BPKP-05	5/31/2016	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	5/31/2016	Manganese	Total	15.4	ug/l	
BPKP-05	5/31/2016	Organic carbon	Total	1.65	mg/l	
BPKP-05	5/31/2016	Sodium	Total	5660	ug/l	
BPKP-05	5/31/2016	Sulfate	Total	21.2	mg/l	
BPKP-05	5/31/2016	Fluoride	Total	0.16	mg/l	
BPKP-05	5/31/2016	Chloride	Total	24.4	mg/l	
BPKP-05	5/31/2016	Phenols	Total	4.83	ug/l	J
BPKP-05	5/31/2016	Phosphorus	Total	0.029	mg/l	
BPKP-05	5/31/2016	Inorganic nitrogen (nitrate and nitrite)	Total	12.7	mg/l	
BPKP-05	5/31/2016	Boron	Total	37.9	ug/l	
BPKP-05	5/31/2016	Volatile suspended solids		4	mg/l	
BPKP-05	5/31/2016	Total suspended solids		24	mg/l	
BPKP-05	5/31/2016	Aluminum	Total	244	ug/l	
BPKP-05	5/31/2016	Cadmium	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Vanadium	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Kjeldahl nitrogen	Total	0.17	mg/l	J

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	5/31/2016	Iron	Total	384	ug/l	
BPKP-05	5/31/2016	Chlorophyll a, uncorrected for pheophytin	Total	1.86	ug/l	
BPKP-05	5/31/2016	Chlorophyll b	Total		ug/l	ND
BPKP-05	5/31/2016	Chlorophyll c	Total		ug/l	ND
BPKP-05	5/31/2016	Pheophytin a	Total		ug/l	ND
BPKP-05	5/31/2016	Lead	Total		ug/l	ND
BPKP-05	5/31/2016	Alkalinity, total		266	mg/l	J3
BPKP-05	5/31/2016	Barium	Total	51.4	ug/l	
BPKP-05	5/31/2016	Magnesium	Total	37300	ug/l	
BPKP-05	5/31/2016	Beryllium	Total	0.38	ug/l	J
BPKP-05	5/31/2016	Hardness, Ca, Mg		370000	ug/l	C
BPKP-05	5/31/2016	Copper	Total		ug/l	ND
BPKP-05	5/31/2016	Cobalt	Total	1.37	ug/l	J
BPKP-05	5/31/2016	Chromium	Total		ug/l	ND
BPKP-05	5/31/2016	Calcium	Total	86500	ug/l	
BPKP-05	5/31/2016	Cadmium	Total		ug/l	ND
BPKP-05	5/31/2016	Potassium	Dissolved	580	ug/l	J
BPKP-05	5/31/2016	Nickel	Total		ug/l	ND
BPKP-05	5/31/2016	Specific conductance		670	umho/cm	
BPKP-05	5/31/2016	Sodium	Dissolved	5280	ug/l	
BPKP-05	5/31/2016	Arsenic	Total		ug/l	ND
BPKP-05	5/31/2016	Zinc	Total	17.7	ug/l	
BPKP-05	5/31/2016	Vanadium	Total		ug/l	ND
BPKP-05	5/31/2016	Strontium	Total	144	ug/l	
BPKP-05	5/31/2016	Zinc	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Phosphorus	Dissolved	0.016	mg/l	
BPKP-05	5/31/2016	Temperature, sample		4	deg C	
BPKP-05	5/31/2016	Arsenic	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Dissolved oxygen (DO)		10.9	mg/l	
BPKP-05	5/31/2016	pH		7.6	None	
BPKP-05	5/31/2016	Temperature, water		19.7	deg C	
BPKP-05	5/31/2016	Turbidity		19.6	NTU	
BPKP-05	5/31/2016	Temperature, air		34	deg C	
BPKP-05	5/31/2016	Dissolved oxygen saturation		120	%	
BPKP-05	5/31/2016	Chlorophyll a, corrected for pheophytin	Total	1.92	ug/l	
BPKP-05	5/31/2016	Chromium	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Potassium	Total	757	ug/l	J
BPKP-05	5/31/2016	Silver	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Nickel	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Manganese	Dissolved	5.03	ug/l	
BPKP-05	5/31/2016	Magnesium	Dissolved	34800	ug/l	
BPKP-05	5/31/2016	Lead	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Iron	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Selenium	Total		ug/l	ND
BPKP-05	5/31/2016	Cobalt	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Strontium	Dissolved	131	ug/l	
BPKP-05	5/31/2016	Calcium	Dissolved	81500	ug/l	
BPKP-05	5/31/2016	Silver	Total		ug/l	ND
BPKP-05	5/31/2016	Boron	Dissolved	36.9	ug/l	
BPKP-05	5/31/2016	Beryllium	Dissolved		ug/l	ND

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	5/31/2016	Barium	Dissolved	47.8	ug/l	
BPKP-05	5/31/2016	Aluminum	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Selenium	Dissolved		ug/l	ND
BPKP-05	5/31/2016	Copper	Dissolved		ug/l	ND
BPKP-05	6/2/2016	Total suspended solids		49	mg/l	
BPKP-05	6/2/2016	Inorganic nitrogen (nitrate and nitrite)	Total	14.1	mg/l	
BPKP-05	6/2/2016	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	6/2/2016	Kjeldahl nitrogen	Total	0.55	mg/l	
BPKP-05	6/2/2016	Temperature, sample		0	deg C	
BPKP-05	6/2/2016	Phosphorus	Total	0.078	mg/l	
BPKP-05	6/2/2016	Volatile suspended solids		8	mg/l	
BPKP-05	8/10/2016	Ammonia-nitrogen	Total	0.13	mg/l	
BPKP-05	8/10/2016	Kjeldahl nitrogen	Total	0.75	mg/l	
BPKP-05	8/10/2016	Phosphorus	Total	0.055	mg/l	
BPKP-05	8/10/2016	Total suspended solids		34	mg/l	
BPKP-05	8/10/2016	Inorganic nitrogen (nitrate and nitrite)	Total	0.244	mg/l	
BPKP-05	8/10/2016	Volatile suspended solids		5	mg/l	
BPKP-05	8/10/2016	Temperature, sample		1	deg C	
BPKP-02	9/14/2016	Temperature, water		20.2	deg C	
BPKS-01	9/14/2016	Temperature, air		23	deg C	
BPKS-01	9/14/2016	pH		8.4	None	
BPKQ-01	9/14/2016	Dissolved oxygen saturation		101.4	%	
BPKP-01	9/14/2016	Dissolved oxygen (DO)		8.29	mg/l	
BPKP-02	9/14/2016	Temperature, air		22	deg C	
BPKQ-01	9/14/2016	Dissolved oxygen (DO)		9.14	mg/l	
BPKQ-01	9/14/2016	pH		8.2	None	
BPKQ-01	9/14/2016	Temperature, water		20	deg C	
BPKS-01	9/14/2016	Specific conductance		693	umho/cm	
BPKP-01	9/14/2016	Temperature, water		21.4	deg C	
BPKQ-01	9/14/2016	Specific conductance		641.6	umho/cm	
BPKS-01	9/14/2016	Dissolved oxygen saturation		89.8	%	
BPKP-02	9/14/2016	pH		8.9	None	
BPKQ-01	9/14/2016	Temperature, air		23	deg C	
BPKP-02	9/14/2016	Dissolved oxygen saturation		90.2	%	
BPKS-01	9/14/2016	Dissolved oxygen (DO)		7.97	mg/l	
BPKS-01	9/14/2016	Temperature, water		20.9	deg C	
BPKP-01	9/14/2016	Temperature, air		24	deg C	
BPKP-01	9/14/2016	Specific conductance		695.3	umho/cm	
BPKP-01	9/14/2016	pH		8	None	
BPKP-01	9/14/2016	Dissolved oxygen saturation		94.4	%	
BPKP-02	9/14/2016	Specific conductance		713.6	umho/cm	
BPKP-02	9/14/2016	Dissolved oxygen (DO)		8.12	mg/l	
BPKP-05	9/21/2016	Sulfate	Total	21.8	mg/l	
BPKP-05	9/21/2016	Organic carbon	Total	1.95	mg/l	
BPKP-05	9/21/2016	Aluminum	Total	165	ug/l	
BPKP-05	9/21/2016	Vanadium	Total	3.86	ug/l	J
BPKP-05	9/21/2016	Strontium	Total	137	ug/l	
BPKP-05	9/21/2016	Cadmium	Total		ug/l	ND
BPKP-05	9/21/2016	Beryllium	Total		ug/l	ND
BPKP-05	9/21/2016	Fluoride	Total	0.15	mg/l	

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	9/21/2016	Chloride	Total	18.1	mg/l	
BPKP-05	9/21/2016	Total suspended solids		15	mg/l	
BPKP-05	9/21/2016	Volatile suspended solids			mg/l	ND
BPKP-05	9/21/2016	Phenols	Total	2.14	ug/l	J
BPKP-05	9/21/2016	Calcium	Total	87800	ug/l	
BPKP-05	9/21/2016	Phosphorus	Total	0.031	mg/l	
BPKP-05	9/21/2016	Potassium	Total	1070	ug/l	J
BPKP-05	9/21/2016	Boron	Total	54.7	ug/l	V
BPKP-05	9/21/2016	Ammonia-nitrogen	Total		mg/l	ND
BPKP-05	9/21/2016	Kjeldahl nitrogen	Total		mg/l	ND
BPKP-05	9/21/2016	Copper	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Inorganic nitrogen (nitrate and nitrite)	Total	6.6	mg/l	
BPKP-05	9/21/2016	Chlorophyll a, corrected for pheophytin	Total	0.74	ug/l	
BPKP-05	9/21/2016	Chlorophyll a, uncorrected for pheophytin	Total	1.02	ug/l	
BPKP-05	9/21/2016	Chlorophyll b	Total		ug/l	ND
BPKP-05	9/21/2016	Chlorophyll c	Total		ug/l	ND
BPKP-05	9/21/2016	Magnesium	Total	37300	ug/l	
BPKP-05	9/21/2016	Barium	Total	59.1	ug/l	
BPKP-05	9/21/2016	Chromium	Total		ug/l	ND
BPKP-05	9/21/2016	Manganese	Total	17.3	ug/l	
BPKP-05	9/21/2016	Temperature, sample		2	deg C	
BPKP-05	9/21/2016	Lead	Total		ug/l	ND
BPKP-05	9/21/2016	Iron	Total	264	ug/l	
BPKP-05	9/21/2016	Hardness, Ca, Mg		373000	ug/l	C
BPKP-05	9/21/2016	Copper	Total		ug/l	ND
BPKP-05	9/21/2016	Cobalt	Total	1.33	ug/l	J
BPKP-05	9/21/2016	Pheophytin a	Total		ug/l	ND
BPKP-05	9/21/2016	Silver	Total	1.66	ug/l	J
BPKP-05	9/21/2016	Beryllium	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Barium	Dissolved	60.6	ug/l	
BPKP-05	9/21/2016	Aluminum	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Phosphorus	Dissolved	0.021	mg/l	
BPKP-05	9/21/2016	Selenium	Total		ug/l	ND
BPKP-05	9/21/2016	Arsenic	Total		ug/l	ND
BPKP-05	9/21/2016	Boron	Dissolved	56.4	ug/l	
BPKP-05	9/21/2016	Lead	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Temperature, water		22	deg C	
BPKP-05	9/21/2016	Specific conductance		723	umho/cm	
BPKP-05	9/21/2016	Dissolved oxygen (DO)		9.7	mg/l	
BPKP-05	9/21/2016	Dissolved oxygen saturation		111.5	%	
BPKP-05	9/21/2016	pH		7.9	None	
BPKP-05	9/21/2016	Temperature, air		33	deg C	
BPKP-05	9/21/2016	Turbidity		17.4	NTU	
BPKP-05	9/21/2016	Selenium	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Zinc	Total		ug/l	ND
BPKP-05	9/21/2016	Strontium	Dissolved	140	ug/l	
BPKP-05	9/21/2016	Cadmium	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Zinc	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Vanadium	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Sodium	Dissolved	6150	ug/l	

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	9/21/2016	Alkalinity, total		335	mg/l	
BPKP-05	9/21/2016	Silver	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Potassium	Dissolved	1010	ug/l	J
BPKP-05	9/21/2016	Nickel	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Magnesium	Dissolved	39500	ug/l	
BPKP-05	9/21/2016	Sodium	Total	5700	ug/l	
BPKP-05	9/21/2016	Iron	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Nickel	Total		ug/l	ND
BPKP-05	9/21/2016	Cobalt	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Chromium	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Manganese	Dissolved	8.93	ug/l	
BPKP-05	9/21/2016	Arsenic	Dissolved		ug/l	ND
BPKP-05	9/21/2016	Calcium	Dissolved	91000	ug/l	
BPKP-05	10/5/2016	Boron	Total	56.1	ug/l	
BPKP-05	10/5/2016	Beryllium	Total	0.18	ug/l	J
BPKP-05	10/5/2016	Cadmium	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Hardness, Ca, Mg		372000	ug/l	C
BPKP-05	10/5/2016	Phosphorus	Dissolved	0.012	mg/l	
BPKP-05	10/5/2016	Cobalt	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Chromium	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Calcium	Dissolved	83800	ug/l	
BPKP-05	10/5/2016	Boron	Dissolved	60.4	ug/l	
BPKP-05	10/5/2016	Beryllium	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Potassium	Total	1020	ug/l	J
BPKP-05	10/5/2016	Aluminum	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Selenium	Total		ug/l	ND
BPKP-05	10/5/2016	Vanadium	Total		ug/l	ND
BPKP-05	10/5/2016	Cadmium	Total	0.68	ug/l	J
BPKP-05	10/5/2016	Chlorophyll a, corrected for pheophytin	Total	1.76	ug/l	
BPKP-05	10/5/2016	Zinc	Total		ug/l	ND
BPKP-05	10/5/2016	Manganese	Total	19.1	ug/l	
BPKP-05	10/5/2016	Temperature, sample		2	deg C	
BPKP-05	10/5/2016	Arsenic	Total		ug/l	ND
BPKP-05	10/5/2016	Chlorophyll a, uncorrected for pheophytin	Total	3.28	ug/l	
BPKP-05	10/5/2016	Strontium	Total	142	ug/l	
BPKP-05	10/5/2016	Chlorophyll c	Total		ug/l	ND
BPKP-05	10/5/2016	Pheophytin a	Total	2.35	ug/l	
BPKP-05	10/5/2016	Chlorophyll b	Total		ug/l	ND
BPKP-05	10/5/2016	Nickel	Total		ug/l	ND
BPKP-05	10/5/2016	Calcium	Total	85200	ug/l	
BPKP-05	10/5/2016	Magnesium	Total	38600	ug/l	
BPKP-05	10/5/2016	Lead	Total		ug/l	ND
BPKP-05	10/5/2016	Iron	Total	149	ug/l	
BPKP-05	10/5/2016	Aluminum	Total	95	ug/l	
BPKP-05	10/5/2016	Copper	Total		ug/l	ND
BPKP-05	10/5/2016	Sodium	Total	7440	ug/l	
BPKP-05	10/5/2016	Chromium	Total		ug/l	ND
BPKP-05	10/5/2016	Cobalt	Total	0.52	ug/l	J
BPKP-05	10/5/2016	Turbidity		7	NTU	
BPKP-05	10/5/2016	Zinc	Dissolved		ug/l	ND

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-05	10/5/2016	Strontium	Dissolved	141	ug/l	
BPKP-05	10/5/2016	Silver	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Potassium	Dissolved	996	ug/l	J
BPKP-05	10/5/2016	Nickel	Dissolved	0.83	ug/l	J
BPKP-05	10/5/2016	Manganese	Dissolved	15.1	ug/l	
BPKP-05	10/5/2016	Magnesium	Dissolved	39800	ug/l	
BPKP-05	10/5/2016	Arsenic	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Iron	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Specific conductance		698	umho/cm	
BPKP-05	10/5/2016	Dissolved oxygen (DO)		8.6	mg/l	
BPKP-05	10/5/2016	Dissolved oxygen saturation		91.3	%	
BPKP-05	10/5/2016	pH		7.9	None	
BPKP-05	10/5/2016	Sulfate	Total	25.7	mg/l	
BPKP-05	10/5/2016	Temperature, air		24	deg C	
BPKP-05	10/5/2016	Silver	Total		ug/l	ND
BPKP-05	10/5/2016	Temperature, water		17.5	deg C	
BPKP-05	10/5/2016	Vanadium	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Organic carbon	Total	2.06	mg/l	
BPKP-05	10/5/2016	Barium	Dissolved	57.1	ug/l	
BPKP-05	10/5/2016	Total suspended solids		4	mg/l	
BPKP-05	10/5/2016	Selenium	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Chloride	Total	21.9	mg/l	
BPKP-05	10/5/2016	Barium	Total	58.5	ug/l	
BPKP-05	10/5/2016	Ammonia-nitrogen	Total	0.03	mg/l	J
BPKP-05	10/5/2016	Alkalinity, total		331	mg/l	
BPKP-05	10/5/2016	Copper	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Kjeldahl nitrogen	Total	0.27	mg/l	J
BPKP-05	10/5/2016	Phosphorus	Total	0.019	mg/l	
BPKP-05	10/5/2016	Volatile suspended solids			mg/l	ND
BPKP-05	10/5/2016	Lead	Dissolved		ug/l	ND
BPKP-05	10/5/2016	Phenols	Total	4.12	ug/l	J
BPKP-05	10/5/2016	Inorganic nitrogen (nitrate and nitrite)	Total	4.94	mg/l	
BPKP-05	10/5/2016	Fluoride	Total	0.15	mg/l	
BPKP-05	10/5/2016	Sodium	Dissolved	7410	ug/l	
BPKQ-01	10/13/2016	Total suspended solids		21	mg/l	
BPKS-01	10/13/2016	Inorganic nitrogen (nitrate and nitrite)	Total	5.56	mg/l	
BPKP-02	10/13/2016	Ammonia-nitrogen	Total		mg/l	ND
BPKQ-01	10/13/2016	Temperature, sample		2	deg C	
BPKS-01	10/13/2016	Temperature, sample		2	deg C	
BPKP-01	10/13/2016	Total suspended solids		18	mg/l	
BPKQ-01	10/13/2016	Volatile suspended solids			mg/l	ND
BPKQ-01	10/13/2016	Kjeldahl nitrogen	Total	0.27	mg/l	J
BPKP-02	10/13/2016	Inorganic nitrogen (nitrate and nitrite)	Total	6	mg/l	
BPKP-02	10/13/2016	Volatile suspended solids		4	mg/l	
BPKP-02	10/13/2016	Total suspended solids		24	mg/l	
BPKP-02	10/13/2016	Kjeldahl nitrogen	Total	0.46	mg/l	J
BPKP-01	10/13/2016	Inorganic nitrogen (nitrate and nitrite)	Total	5.41	mg/l	
BPKQ-01	10/13/2016	Inorganic nitrogen (nitrate and nitrite)	Total	4.39	mg/l	
BPKS-01	10/13/2016	Total suspended solids		1750	mg/l	
BPKQ-01	10/13/2016	Ammonia-nitrogen	Total		mg/l	ND

Station Code	Collection Date	Analyte	Sample Fraction	Result	Result Units	Qualifier
BPKP-01	10/13/2016	Volatile suspended solids		4	mg/l	
BPKS-01	10/13/2016	Kjeldahl nitrogen	Total	0.38	mg/l	J
BPKS-01	10/13/2016	Volatile suspended solids			mg/l	ND
BPKP-01	10/13/2016	Ammonia-nitrogen	Total		mg/l	ND
BPKS-01	10/13/2016	Phosphorus	Total	0.063	mg/l	
BPKQ-01	10/13/2016	Phosphorus	Total	0.041	mg/l	
BPKP-01	10/13/2016	Temperature, sample		2	deg C	
BPKP-02	10/13/2016	Temperature, sample		2	deg C	
BPKP-01	10/13/2016	Phosphorus	Total	0.066	mg/l	
BPKP-01	10/13/2016	Kjeldahl nitrogen	Total	0.31	mg/l	J
BPKP-02	10/13/2016	Phosphorus	Total	0.096	mg/l	
BPKS-01	10/13/2016	Ammonia-nitrogen	Total		mg/l	ND

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Appendix D

Public Comments and Responsiveness Summary

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Appendix - D

Responsiveness Summary

Total Maximum Daily Load (TMDL) and Watershed Protection Plan (WPP) for:

1. Rock River/Pierce Lake Watershed
2. Kyte River Watershed
3. Saline Branch Watershed
4. Little Wabash River/Green Creek Watershed
5. Big Four Ditch Watershed
6. Kickapoo Creek Watershed
7. Salt Creek Watershed
8. Big Creek Watershed

The responsiveness summary responds to questions and comments received during the Stage 3 public comment period from January 17, 2024, through February 16, 2024.

What is a TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. TMDL reports contain a plan detailing the actions necessary to reduce pollutant loads to the impaired water bodies and ensure compliance with applicable water quality standards.

A Watershed Protection Plan (WPP) report has been developed for the watersheds where a TMDL could not be developed as the waterbody segment is no longer impaired or recommended for delisting or recategorized to Category 4C (impairment due to non-pollutant).

The Clean Water Act and U.S. Environmental Protection Agency (U.S. EPA) regulations require that states develop TMDLs for waters on the Section 303(d) List. The Illinois Environmental Protection Agency (Illinois EPA) implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and regulations thereunder.

Background

The 2018 Cycle TMDLs/ WPPs are as follows:

- **Rock River/Pierce Lake Watershed** (HUC: 0709000501)
    - Location:
        - Northern Illinois (Winnebago and Boon Counties).
    - Headwaters (North and South Kinnikinnick Creek):
        - Northwestern Boone county, over Illinois Route 76.
    - Headwaters (North Fork and South Fork Kent Creek):
        - Near Winnebago, IL.
    - Headwaters (Spring Creek North and Keith Creek):
        - The eastern edge of the city of Rockford, roughly near Interstate 90.
    - Course:
        - All segments untimely flow into the Rock River; North and South Kinnikinnick first, followed downriver by Spring Creek, and then the remainder at the far southern end of the watershed.
    - Downstream End:
        - The Rock River, in the middle of Rockford, IL.

- **Kyte River Watershed** (HUC: 0512011206)
    - Location:
        - Northern Illinois (Ogle and Lee Counties, with a small part in Dekalb County).
    - Headwaters (Kyte River):
        - The Rock River, just south of the Oregon, IL.
    - Headwaters (Beach Creek):
        - Where the Kyte river splits into Beach creek and Steward creek, near the border of Ogle and Lee counties.
    - Course:
        - The Kyte river forms as a branch of the Rock River just south of the city of Oregon and flows in a southeasterly direction.
        - Beach Creek forms after the Kyte river splits near the border between Ogle and Lee County and flows in a southwesterly direction.
    - Downstream end (Kyte river):
        - West of Rochelle at the border of Ogle and Leek County, where the river branches off into Beach creek and Steward creek.
    - Downstream end (Beach creek):
        - West of the village of Ashton.

- **Saline Branch Watershed** (HUC: 0512010902)
    - Location:
        - Northeast central Illinois (Champaign County).
    - Headwaters (Saline Branch):

    - North of Thomasboro and southwest of Rantoul, west of U.S. Route 45.
  - Headwaters (Boneyard Creek):
    - Champaign, IL, along U.S. Route 150.
  - Course:
    - The Saline Branch flows south from Thomasboro roughly along U.S. Route 45 and into the city of Urbana, where it meets with Boneyard Creek and then flows eastward.
  - Downstream end:
    - Confluence of Saline Branch and Boneyard creek in Urbana, IL.

- **Little Wabash River/Green Creek Watershed** (HUC: 0512011401)
  - Location:
    - Southeast central Illinois (Shelby, Effingham, Coles, and Cumberland Counties).
  - Headwaters:
    - Southwestern corner of Coles County, southwest of Mattoon.
  - Course:
    - The Little Wabash River flows southward from near Mattoon, though Paradise Lake, across Coles, Shelby and Effingham Counties, though the far western edge of Effingham, IL.
  - Downstream end:
    - West of Effingham, IL.

- **Big Four Ditch Watershed** (HUC: 0512010901)
  - Location:
    - Northeast Central Illinois (Ford, Livingston, Champaign, and Iroquois Counties)
  - Headwaters:
    - Southeast corner of Livingston County.
  - Course:
    - Flows in a south-easterly direction through Ford County toward the northeast border of Champaign County.
  - Downstream End:
    - Confluence of Prairie Creek and Middle Fork Vermilion River near the northeast border of Champaign County.

- **Kickapoo Creek Watershed** (HUC: 0512011206)
  - Location:
    - Southeast Central Illinois (Coles County)
  - Headwaters:
    - Confluence of Cassell Creek, .23 miles north of Illinois – 16.
  - Course:
    - Flows in an easterly direction in Coles County, between the municipalities of Mattoon and Charleston.

- Downstream end:
    - Confluence of Kickapoo Creek.

- **Salt Creek Watershed** (HUC: 0512011402)
  - Location:
    - Southeast central Illinois (Effingham and Cumberland Counties)
  - Headwaters:
    - Second Salt Creek near Lillyville, IL in the southwest corner of Cumberland County.
  - Course:
    - Primarily flows within Effingham County, with a portion in Cumberland County, and feeds into the Little Wabash River in south central Effingham County.
  - Downstream end:
    - Confluence of Little Water River.

- **Big Creek Watershed** (HUC: 0512011211)
  - Location:
    - Southeast Central Illinois (Crawford and Jasper Counties)
  - Headwaters:
    - Dogwood Creek north of Dogwood, IL in northwest Crawford County.
  - Course:
    - Flows primarily within Crawford County with a small portion in Jasper County, and feeds into Big Creek south of Oblong, IL in Crawford County.
  - Downstream End:
    - Confluence of Brush Creek.

The TMDLs and WPPs were developed for the following waterbody segments:

- **Rock River/Pierce Lake Watershed TMDL**
  - A Fecal Coliform TMDL was developed for the following segments:
    - IL_PR-99
    - IL_PR-01
    - IL_PSB-01
    - IL_PSA-01
    - IL_PU-03
    - IL_PT-01
    - IL_PZZG-03
  - A Total Phosphorus TMDL was developed for the following segments:
    - IL_RPC

- **Kyte River Watershed TMDL**
  - A Total Phosphorus and DO TMDL were developed for the following segments:

        - IL_PLB-C1
    - A Fecal Coliform TMDL was developed for the following segments:
        - IL_PL-03

- **Saline Branch Watershed TMDL**
    - A Dissolved Copper TMDL was developed for the following segment:
        - IL_BPJCA

- **Little Wabash River/Green Creek TMDL**
    - Dissolved Oxygen TMDLs were developed for the following segments:
        - IL_C-24
        - IL_RCG

- **Big Four Ditch Watershed WPP**
    - Included a WPP to address Dissolved Oxygen in the following segments:
        - IL_BPKP-01
        - IL_BPKP-02

- **Kickapoo Creek Watershed WPP**
    - Included a WPP to address Dissolved Oxygen in the following segment:
        - IL_BENA-01

- **Salt Creek Watershed WPP**
    - Included a WPP to address Manganese in the following segment:
        - IL_CPD-01
    - Included a WPP to address Total Phosphorus in the following segments:
        - IL_CPD-01
        - IL_CPD-03
        - IL_CPD-04
        - IL_CPC-TU-C1
        - IL_CP-04
        - IL_CP-EF-C2
        - IL_CP-EF-C4
        - IL_CP-TU-C3

- **Big Creek Watershed WPP**
    - Included a WPP to address Manganese, DO and Total Phosphorus in the following segment:
        - IL_BEDB-01

Initial TMDL development for the targeted watersheds began in 2019. During the development process, the 2020/2022 Illinois Integrated Water Quality Report and 303(d) List was approved by EPA on June 30, 2022. TMDLs were completed based on the updated 2020/2022 303(d) List. Illinois EPA develops TMDLs for parameters that have numeric water quality standards. TMDLs for parameters that do not have water quality standards have been deferred until criteria are adopted. Load reduction goals and watershed protection plans have also been included in the reports where appropriate. Illinois EPA contracted with CDM Smith to complete the Stage 1 and Stage 3 TMDL reports.

Public Meetings

The Stage 1 public meeting was held virtually on June 30, 2021, and comments and questions received from the first public meeting have been addressed and incorporated into the Stage 3 TMDL/WPP reports.

The Stage-3 public meeting was conducted virtually using WebEx on January 17, 2024. The meeting started at 10:00 am and concluded at 12:00 pm, central time. Approximately 30 people attended the meeting, with the public notice period remaining open for 30 days until midnight of February 16, 2024. The draft Stage-3 TMDL report was available for review and comment on the Illinois EPA's webpage: https://epa.illinois.gov/public-notices/general-notices.html

In addition, a direct mailing was sent to NPDES permittees and stakeholders in the watersheds prior to the Stage 3 meeting. The notice gave the date, time, and purpose of the Stage-3 TMDL meeting.

The notice also provided references on how to obtain additional information about these TMDLs/WPPs, Illinois EPA's Total Maximum Daily Load Program, and other related information.

Questions and Comments Received During Public Notice

1. After reading through the WPP, the City of Paxton would be interested in learning more about potential wetland and/or WASCOB construction. The City of Paxton is currently considering several stormwater retention options as part of a comprehensive drainage plan.

   Response – Information on wetlands and WASCOBs is presented in the WPP (Section 7 of the Big Four Ditch Watershed report) in Section 7.3.1.2. Additional detail on WASCOBs and constructed wetlands can be found in the NRCS Conservation Practice Standards:

   WASCOBS:
   https://efotg.sc.egov.usda.gov/api/CPSFile/5838/638_IL_CPS_Water_and_Sediment_(Con)trol_Basin_2018

   Constructed Wetlands:
   https://www.nrcs.usda.gov/sites/default/files/2022-09/656_NHCP_CPS_Constructed_Wetland_2020_0.pdf

Stakeholders interested in pursuing water quality improvement projects are encouraged to contact their local NRCS/SWCD offices and the Illinois EPA Nonpoint Source Management Program.

Ford County SWCD: https://fordcountyswcd.tripod.com/

Illinois EPA Nonpoint Source Management: https://epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources.html

Contact: Jeff Edstrom, IEPA/BOW-Watershed Management Section, Nonpoint Source Unit, email: Jeffrey.Edstrom@Illinois.gov, phone: (217)782-3362

2. The 2002 watershed report for North Fork Kent Creek and a 2008 draft modeling report for Kinnikinnick Creek and North Fork Kent Creek have been completed.

Response – Thank you for the information. Both reports have been listed with summary information in Section 5.5.

3. Upon reviewing the Stage 1 Draft report for the Rock River and Pierce Lake watershed, Winnebago County has identified the need for updated local water quality sample collection to reflect and monitor changes since the last recorded collection in 2013. The County will continue to engage with the IEPA throughout TMDL report stages (2 and 3), and collaborate with the agency to locally monitor, address and mitigate potential sources of impairment to preserve water quality, public health and mitigate subsequent issues through long term planning and environmental regulation. The continued collaboration and communication with the IEPA will inform future local planning efforts related to the criteria stated above.

Response – Thank you for the comment. Text has been incorporated into Section 9 (watershed protection plan) to reflect Winnebago County's engagement. Additional comments and information were provided by Winnebago County following the Stage 3 public meeting. Please refer to responses to comment #5 below.

4. I was glancing through the presentation on TMDLs that are underway and noticed a Keith Creek is listed for arsenic. Anything easy you can send me on the cause of that impairment. To my knowledge, that is the only arsenic impairment listed for a creek in Illinois. (my knowledge may be limited)

Response – Additional investigation into the 2018 stream listing of Keith Creek for arsenic found that the listing was initially based on 2008 sediment data. Instream water quality data presented in Section 5 did not show impairment of the aquatic life use and TMDL development for water column arsenic did not continue beyond the Stage 1 report (Sections 1-6). Text has been included throughout the report to clarify the delisting.

5. After reviewing the Draft TMDL Phase 3 report bein completed for the Rock River/Pierce Lake watershed, I thought I would provide a few comments:

- There was a watershed study for an unnamed creek that was identified as Buckbee Creek, which was completed in 2013. This is a smaller drainageway/watershed just south of the Keith Creek watershed (that may be included in the overall Spring Creek watershed). That was identified more of flooding issue, as the stream itself is more intermittent in flow and much of it is channelized. There were a few priority areas identified in that study to address water quality.

Response – This information has been added to Section 5.5.

- The Region 1 Planning Council recently received an IEPA 319 grant for 2 site projects (bioswales) in the Buckbee Creek and the South Fork Kent Creek watersheds. Part of the grant includes a "watershed Education and Outreach" component, to look at BMP's in the Agricultural, Suburban and Urban areas to address soil loss, stormwater runoff and nutrient management. The District is working with them on some of education and outreach.

Response – This information has been added to Section 9.4.2.2 and 9.6.

- The Region 1 Planning Council also has a "Climate Resiliency Forum" that is developing a "Climate Action Plan" to be completed by next winter. This also looks at vulnerabilities regarding increased stormwater runoff, and potential impacts across all sectors. The District is on that committee as well.

Response – This information has been added to Section 9.6.

- The Region 1 Planning Council and Winnebago County Health Department also did a "Small Community Water Assessment and Report." While this mainly looks at groundwater, with the highly sensitive aquifers in the Region, it is addressing surface water management concerns. We sat on that committee as well.

Response – This information has been added to Section 9.6.

- Like you mention in Section 9.4.2. the District and NRCS have various state and federal programs. While those programs are popular and very much in use in the rural areas on the western side of this watershed, it is limited in much of the eastern side of the watershed, due to ownership, development pressures, etc. which typically limit investment in agricultural BMP's. Also, cost is typically a factor, especially with streambank stabilization, as the actual costs often far exceed what a landowner can bare, even with cost share assistance (a streambank stabilization grant was funded for a project upstream of Pierce Lake several years ago, but was cancelled due to excessive cost/burden to the landowner.

Response – This information has been added to Section 9.4.2. and 9.4.3.

- The District also is hosting an Erosion & Sediment Control workshop (for construction sites) and a Producer workshop (crop ground) in March; and have tree, fish, seed and rain barrel sales this spring.

Response – This information has been added to Section 9.5.

- I realize many of these comments above don't necessarily address fecal coliform directly, but they do provide overall watershed improvements.

Response – Thank you for all the local information provided for this report. The information has been incorporated throughout the watershed-based plan (Section 9).

6. Looking over the data for the copper issue and it seems like the data is mostly from 2006 (with one being from 2001) and there aren't a lot of data points overall.   One of the points also seems like it could be an outlier, which the paragraph below the chart does point toward but it didn't help us understand why that was included or not re-sampled since it was significantly different.

Is there concern over the data being 18+ years old?

Or is there concern over one of the data points sampled at the same location as the others is quite different from the others? The time window is only a few months for all samples taken in 2006 so it seems like the October one is too different to not be either ruled out or have triggered a re-sample.   October also showed a major spike in TP concentrations in the Boneyard. Is there any connection between the two measurements?

Or are there any concerns that only one section was sampled for copper as opposed to a wider selection of locations through the Boneyard Creek area?

Response – Copper was first listed as impacting Aquatic Life in the segment back in 2010 based on the available data from 2006. The listing was given a low priority ranking for TMDL development but has remained listed as a pollutant indicator. The HUC-10 watershed containing Boneyard Creek was slated for TMDL development in 2018 and the TMDL was calculated using available data as there has not been additional data collected since the time of the original listing to confirm or refute that copper continues to impact the aquatic life use. There is not enough data/information available at this time to conclusively determine if the high copper, high phosphorus, and low hardness values were outliers, sampling error, or a legitimate spike from an urban watershed source. The text throughout the report has been expanded to emphasize the limited amount of data and to strongly recommend monitoring as a starting place for TMDL implementation.

7. In the presentation you had suggested cities could send in some updates they have done in the recent past (i.e. since the 2006 sampling that was done for copper and phosphorous). Attached is a word doc that has a short timeline of what we've done since 2006, what we have in the works/hope to get done soon, and our ongoing activities. Let me know if you have any questions or need more information.

<u>City of Champaign Boneyard Creek Improvements Timeline since 2006</u>

2010: Scott Park Drainage Improvements implemented

2010: Second Street Detention Basin constructed

2012: Dredging of Healey Street Basin

2012-2020: Boneyard Creek Reporting to ACOE as part of permitting process for Boneyard Creek Projects

2018 – 2020: Bristol Park Basin constructed

2018 – 2020: Boneyard Creek Improvements (Bradley Avenue to Hickory Street, part of Phase D)

2020-2023: Boneyard Creek Improvements (Hickory Street to Neil Street, part of Phase D)

2023-2024: Boneyard Creek Improvement at Skelton Park (part of future Phase B/C, added onto a Champaign Park District improvement project in the same area to cause less overall disruption)

<u>City of Champaign Future Boneyard Creek Projects</u>

Boneyard Creek Improvements Phase B/C (Hill Street to Bradley Avenue): This project will include underground storage for storm water, a new wet detention basin and a new dry bottom detention basin (also doubles as a park area when dry) just north of Washington Street to alleviate localized flooding, provide for suspended particle settlement (basin), and trash removal (trash separator installed with the underground detention). In addition to the above, there will be an increase of open channel with native plantings of the Boneyard created with the moving of the Boneyard from piping underneath businesses on the northern end of the project to City property east of those businesses. Further, this phase of the project will also include wetland creation and repairs to the existing wetlands throughout the project length (all locations suggested by the EPA draft report on wetland construction as a mitigation option).

Boneyard Creek Improvements Phase A (University Avenue to Hill Street): This is the smallest section of the overall Boneyard Creek Improvement plan and will connect the Second Street Basin to the work already performed in advance for Phase B/C at Skelton Park (between Hill Street and Washington Street). This section will also move part of the Boneyard Creek out from pipes under a business and create open channel with native plantings. The overall stretch of the Boneyard Creek through this project phase will have the entire channel upgraded with improved bank stabilization and native plantings.

*Dredging of the Second Street Basin***:** The Second Street Basin has proven to be quite effective at retaining particulate matter from the storm water run off and keeping it from being released downstream. This project is still in the early planning stages and care is being taken to make sure any plans are made to limit the impact on water quality downstream and limit the impact on native plant and animal life in the basin area.

MS4 Group Planning: This activity is still in the preliminary phase of organizing either the entire MS4 group or a task force with a representative from each organization to come up with further ongoing plans to have more water test samples taken, more locations of sampling, and further implementation of BMPs (existing or new).

City of Champaign Continuous Boneyard Creek Management Projects

Boneyard Creek Community Day: Started in 2006 and typically run in April, this is a community event that is run by City staff and utilizes volunteers to pick up trash along Boneyard Creek. The usual locations for trash pick-up on this day run through the Second Street Basin, through Scott Park, and down south along the Boneyard Creek area in Campustown. More information can be found here: https://champaignil.gov/2023/05/05/2023-boneyard-creek-community-day/

America Recycles Day: An additional clean up day was added to the regular BCCD to align with the EPA's America Recycles Day in the Fall. The usual locations for this are focused more on the norther sections of the Boneyard Creek and go from University Avenue to as far north as volunteers wish to walk. More information can be found here: https://champaignil.gov/public-works/recycling/america-recycles-day/

National Flood Insurance Program: Participant since May 2016 and the region's only Class 5 city

MS4 Requirements: All minimum measures required to maintain the MS4 permitting requirements

Ongoing Maintenance projects: There are several ongoing maintenance projects for the Boneyard Creek areas that utilize city staff and third-party contractors to perform the work time, weather and budget permitting. Tasks include, but are not limited to, the following:

- Grass mowing
- Native plant management and maintenance
- Removal of invasive plant species
- Canada goose management in compliance with IDNR
- Trash removal from stream and surrounding native plantings
- Pump and equipment maintenance at/in the basins and water features
- Community outreach

- Channel repairs from human, animal, or natural damages

Response – Summary information of previous work has been included in Sections 5.4 and the timeline of improvements and future plans have been included throughout Section 9.

8. The City of Urbana would like to submit the following comments on the Draft Stage 3 TMDL Report and Watershed Protection Plan for the Saline Branch Watershed (HUC 0512010902):

- High levels of Cu may not actually be an issue for Boneyard Creek. The data used to determine that a TMDL was needed was from 2001-2006 (and included only 4 data points, where only 1 data point exceeded the water quality standard), so as the watershed-based plan points out, due to improvements in recent years in brake pads other materials that were large contributors of Cu in the past, this issue may no longer exist.
- A spike TP occurred in the October 2006 sampling, which is rationalized by it being the end of the agricultural growing season and during low stream flows. However, a spike also occurred in the Cu sampling during October 2006 and no further data was collected to see if these points were outliers tied to one specific event.

Response – Refer to the responses to similar comment addressed in comment/response #6.

The data used for the draft TMDL Report and Watershed Protection Plan for Saline Branch is over 17 years old. Numerous BMPs have been put in place along with other activities performed which would improve water quality within the watershed in the City of Urbana since the data was collected, including, but not limited to:

2007 – Urbana adopted a new Erosion & Sediment Control Ordinance to control water pollution from construction sites that disturb over 2,000 sq. ft.

2012 – Urbana adopted a Stormwater Utility Ordinance to provide dedicated funds for stormwater management & comply with the NPDES Phase II Stormwater Permit requirements.

2012-2014 – Urbana constructed the Boneyard Creek Crossing project along Boneyard Creek from Griggs to Broadway Avenue which included a new public park and gathering space, channel naturalization and widening, gabion toe protection, stone landscaping, earth retaining walls, structural walls, storm sewers, and new landscaping.

2023 – Urbana repaired erosive bank conditions along Boneyard Creek with installation of riprap to stabilize the banks and J-Hooks in -stream to slow erosive flows.

2023 – Urbana passed an ordinance updating the Stormwater Utility with a revised fee structure and increased rate to more equitably bill property owners and more sustainably fund the stormwater management program.

Response – Summary information has been included in Sections 5.4 and the timeline of improvements has been included throughout Section 9.

9. I am attaching a watershed plan for the Salt Creek Watershed (HUC 0512011402) that was developed in 2020-2021 by Regina Cassidy as her capstone project for the Master of Urban and Regional Planning from University of Illinois. I hope this can be useful to you as you continue developing the TMDL for the Salt Creek.

Response – Thank you for the information. Ms Cassidy's watershed plan has been referenced and cited in Sections 5 and 9 of the Salt Creek Watershed Protection Plan report. Implementation information relevant to this study has also been referenced/included as Appendix F.

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