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Environmental
Protection Agency

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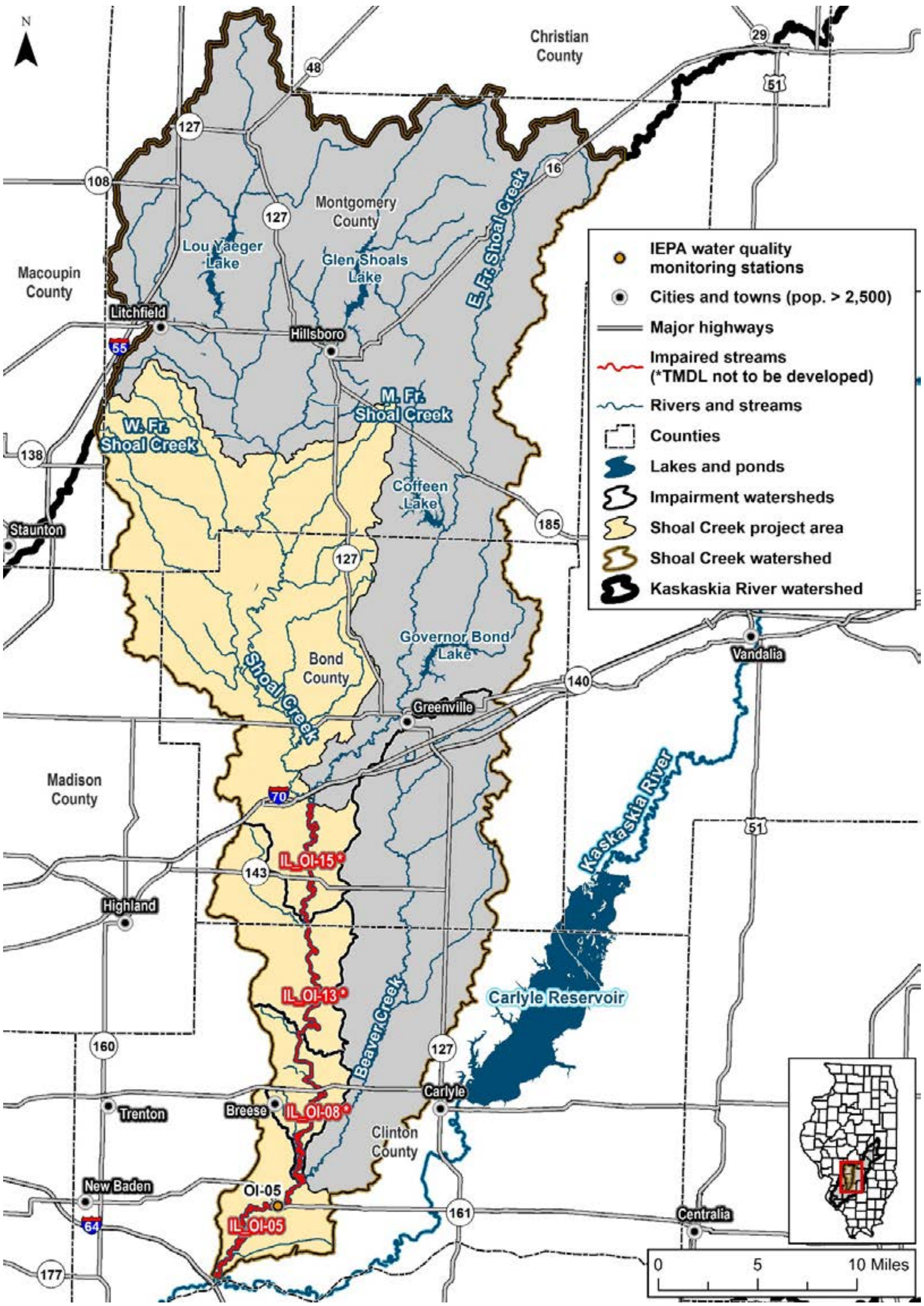
Shoal Creek Watershed (II) Watershed Protection Plan



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Shoal Creek Watershed (II) Protection Plan

(Waterbody Segments IL_OI-05, IL_OI-13, & IL_OI-15) - Dissolved Oxygen

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Contents

Figures ii

Tables ii

Acronyms and Abbreviations ii

Units of Measurement iii

Executive Summary iv

1. Introduction 1
1.1 TMDL Development Process 3
1.2 Water Quality Standards 3
1.2.1 Designated Uses 3
1.2.2 Endpoints 4

2. Watershed Characterization 5
2.1 Jurisdictions and Population 5
2.2 Climate 5
2.3 Land Use and Land Cover 5
2.4 Topography 5
2.5 Soils 5
2.6 Hydrology 5
2.7 Watershed Studies and Information 6

3. Watershed Source Assessment 6
3.1 Pollutants of Concern 6
3.2 Point Sources 7
3.3 Nonpoint Sources 7
3.3.1 Agricultural Runoff 8
3.3.2 Onsite Wastewater Treatment Systems 8
3.3.3 Animal Feeding Operations (AFOs) 8

4. Water Quality 10
4.1 Shoal Creek (IL_OI-05) 10
4.2 Shoal Creek (IL_OI-13) 14
4.3 Shoal Creek (IL_OI-15) 16

5. Watershed Protection Plan 18
5.1 Recommended Protection Activities 18
5.1.1 Protection Activities 18
5.1.2 Protection Activities to Maintain and Improve In-Stream Conditions 21
5.1.3 Education and Outreach Activities 22
5.2 Priority Areas for Implementation 22
5.3 Monitoring Recommendations 23
5.4 Adaptive Management 24

6. Public Participation 24

7. References 25

Appendix A - Stage 1 Report
Appendix B - Stage 2 Laboratory Results
Appendix C – Watershed Protection Plan Comments and Responses

Figures

Figure 1. Shoal Creek Watershed (II) project area. 2
Figure 2. Dissolved oxygen water quality time series, Shoal Creek OI-05. 11
Figure 3. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-05 segment. 12
Figure 4. Total phosphorus verse dissolved oxygen, Shoal Creek OI-05. 13
Figure 5. Dissolved oxygen water quality time series, Shoal Creek OI-13. 15
Figure 6. Dissolved oxygen water quality time series, Shoal Creek OI-15. 16
Figure 7. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-15 segment. 17
Figure 8. Adaptive management iterative process (U.S. EPA 2008) 24

Tables

Table 1. Shoal Creek watershed impairments and pollutants (2016 Illinois 303(d) List) 1
Table 2. Summary of water quality standards for the Shoal Creek watershed 4
Table 3. NPDES permitted facilities in the Shoal Creek watershed. 7
Table 4. Data summary, Shoal Creek OI-05 11
Table 5. Dissolved oxygen data (Shoal Creek at monitoring site OI-05) 13
Table 6. Dissolved oxygen data (Shoal Creek at monitoring site OI-13) 15
Table 7. Minimum and maximum filter strip length for land slope (NRCS 2017b) 21
Table 8. Recommended BMPs by priority area 23

Acronyms and Abbreviations

AFO	animal feeding operation
BMP	best management practice
CWA	Clean Water Act
CAFO	concentrated animal feeding operation
CBMP	Council on Best Management Practices
DO	dissolved oxygen
HUC	Hydrologic Unit Code
IDOA	Illinois Department of Agriculture
IEPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
Ill. Adm. Code	Illinois Administrative Code
MS4	municipal separate storm sewer systems
NLRS	Nutrient Loss Reduction Strategy
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
STP	sewage treatment plant
TMDL	total maximum daily load
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWTP	wastewater treatment plan

Units of Measurement

MGD	million gallons per day
mg/L	milligram per liter

Executive Summary

The Clean Water Act and U.S. Environmental Protection Agency (U.S. EPA) regulations require that Total Maximum Daily Loads (TMDLs) be developed for waters that do not support their designated uses. In simple terms, a TMDL is a plan to attain and maintain water quality standards in waters that are not currently meeting them.

The Shoal Creek watershed (II) addressed in this report includes 310 square miles of the larger Shoal Creek watershed (HUC 07140203) located in south central Illinois. Four segments in the Shoal Creek watershed were placed on the 2016 State of Illinois §303(d) list. Shoal Creek (IL_OI-05, IL_OI-13, and IL_OI-15) were listed due to low levels of dissolved oxygen (DO). Shoal Creek segments (IL_OI-05 and IL_OI-15) were removed from the 2020/2022 303(d) list. Shoal Creek segment (IL_OI-13) is recommended for delisting. Shoal Creek (IL_OI-08) is listed due to elevated levels of iron. The impairment was removed from the 2018 303(d) list but restored in the 2020/2022 303(d) list. Potential causes of decreased DO levels in the watershed include point and nonpoint sources and can often be linked to eutrophication (high levels of algae) and nutrient loading.

The State of Illinois typically uses a three-stage approach to develop TMDLs for a watershed:

Stage 1 – Watershed characterization, historical dataset evaluation, data analysis, methodology selection, data gap identification
Stage 2 – Data collection to fill in data gaps, if necessary
Stage 3 – Model calibration, TMDL scenarios, and implementation plan

The data summaries provided in this report indicate that Shoal Creek is no longer impaired for DO and therefore TMDLs were not developed for this watershed. A protection plan was developed instead to guide implementation of recommended practices to maintain acceptable levels of DO in Shoal Creek in the future. This final report represents a compilation of Stage 1 and Stage 2 and a protection plan. Stage 3 was not required as the data summaries in the previous stages indicate that is no longer impaired for DO
.

1. Introduction

The Clean Water Act (CWA) and U.S. Environmental Protection Agency (U.S. EPA) regulations require that Total Maximum Daily Loads (TMDLs) be developed for waters that do not support their designated uses. In simple terms, a TMDL is a plan to attain and maintain water quality standards in waters that are not currently meeting them.

The Shoal Creek watershed (II) addressed in this report is located in south central Illinois and includes a 310-square mile portion of the larger Shoal Creek watershed (HUC 07140203). Several Shoal Creek segments were placed on the State of Illinois §303(d) list in 2016 (Table 1) (Figure 1). Within the project area, three Shoal Creek segments (IL_OI-05, IL_OI-13, and IL_OI-15) were listed as being impaired for aquatic life due to low levels of dissolved oxygen (DO). The data summaries provided in this report indicate that these Shoal creek segments are no longer impaired for DO. Shoal Creek segments (IL_OI-05 and IL_OI-15) were removed from the 2020/2022 303(d) list. Shoal Creek segment (IL_OI-13) is recommended for delisting. Shoal Creek segment IL_OI-08 was listed as impaired for public and food processing water supplies due to elevated levels of iron in the 2016 303(d) list; this iron listing was removed from the 2018 draft 303(d) list and then added to the 2020/2022 303(d) list. Because this watershed protection plan addresses dissolved oxygen, the iron impairment is not addressed further in this report.

Table 1. Shoal Creek watershed impairments and pollutants (2016 Illinois 303(d) List)

Name	Segment ID	Segment Length (Miles)	Watershed Area (Sq. Miles)	Designated Uses	Cause of Impairment
Shoal Creek	IL_OI-05	13.37	917	Aquatic Life	Dissolved Oxygen [b]
Shoal Creek	IL_OI-08	14.29	745	Public and Food Processing Water Supply	Iron [a]
Shoal Creek	IL_OI-13	11.49	726	Aquatic Life	Dissolved Oxygen [c]
Shoal Creek	IL_OI-15	11.12	685	Aquatic Life	Dissolved Oxygen [b]

a. The iron impairment is not addressed in the watershed protection plan for dissolved oxygen. As such, the impairment not addressed further in this report.
b. No TMDLs were developed; recommended watershed protection activities provided in Section 5. The dissolved oxygen impairments were delisted in the 2020/2022 303(d) list.
c. No TMDL was developed; recommended watershed protection activities are provided in Section 5. This impairment was recommended for delisting dissolved oxygen.

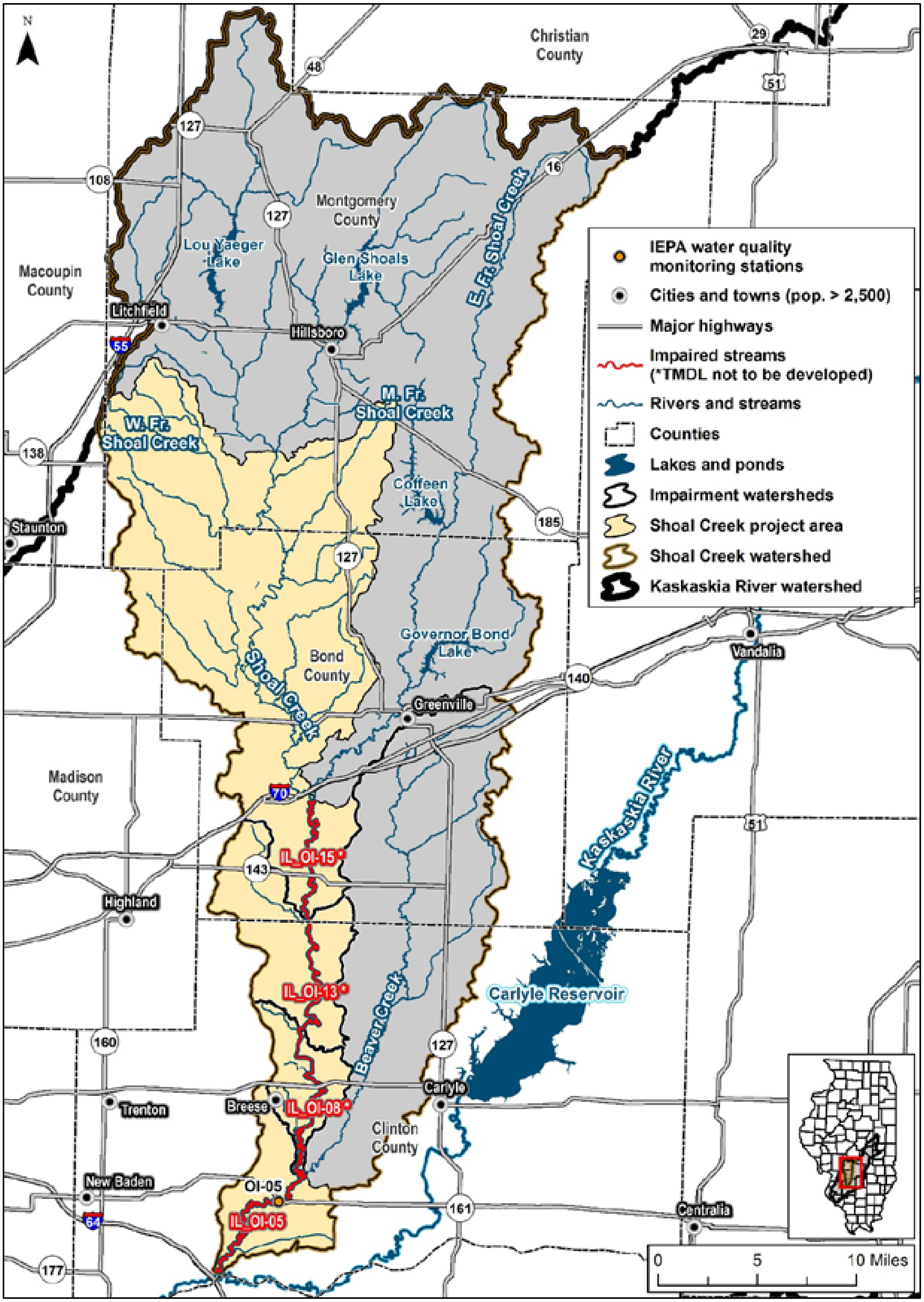

Figure 1**. Shoal Creek Watershed (II) project area.**

1.1 TMDL Development Process

The TMDL process typically establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream conditions. This allowable loading represents the maximum quantity of the pollutant that the waterbody can receive without exceeding water quality standards. The TMDL also takes into account a margin of safety, which reflects scientific uncertainty, as well as the effects of seasonal variation. By following the TMDL process, States can establish water quality-based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (U.S. EPA 1991).

IEPA typically uses a three-stage approach to develop TMDLs for a watershed:

Stage 1 – Watershed characterization, data analysis, methodology selection, data gap identification
Stage 2 – Data collection to fill in data gaps, if necessary
Stage 3 – Model development, TMDL scenario, and implementation plan

The purpose of Stage 1 is to characterize the watershed background; verify impairments in the listed waterbody by comparing observed data with water quality standards or appropriate targets; evaluate spatial and temporal water quality variation; provide a preliminary assessment of sources contributing to impairments; and describe potential TMDL development approaches. The Stage 1 report recommended additional data collection. The Stage 1 Report is provided in Appendix A. Data collected as part of Stage 2 are provided in Appendix B.

This protection plan includes relevant components of the original Stage 1 report and provides documentation needed to delist Shoal Creek segments for DO. A protection plan was developed which should guide implementation of recommended practices in order to maintain acceptable levels of DO in Shoal Creek in the future.

1.2 Water Quality Standards

This section presents information on the water quality standards, which are designed to protect beneficial uses. The authority to designate beneficial uses and adopt water quality standards is granted through Title 35 of the Illinois Administrative Code (Ill. Adm. Code). Designated uses to be protected in surface waters of the state are defined under Section 303, and water quality standards are designated under Section 302.

1.2.1 Designated Uses

IEPA uses rules and regulations adopted by the Illinois Pollution Control Board (IPCB) to assess the designated use support for Illinois waterbodies. The following are the use support designations provided by the IPCB that apply to waterbodies in the Shoal Creek watershed:

General Use Standards – These standards protect for aquatic life, wildlife, agricultural uses, primary contact (where physical configuration of the waterbody permits it, any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing), secondary contact (any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating, and any limited contact incident to shoreline activity), and most industrial uses. These standards are also designed to ensure the aesthetic quality of the state's aquatic environment.

Shoal Creek segment IL_OI-05 is designated for DO enhanced protection according to 35 Ill. Adm. Code 302.206. Waters with enhanced protection have a more stringent DO standard than other waters of the State. These waters were chosen based on the potential biota (fish early life stages present) and the DO needed for these biota to thrive.

1.2.2 Endpoints

Water quality standards are published in 35 Ill. Adm. Code 302. This section presents the DO standards applicable to impairments within the Shoal Creek study area. Water quality standards are typically the endpoints to be used for TMDL development; in the Shoal Creek watershed, water quality standards (Table 2) are the endpoints to recommend delisting and to support development of the watershed protection plan.

Table 2. Summary of water quality standards for the Shoal Creek watershed

Parameter	Units	General Use Water Quality Standard for Waters with Enhanced Protection
Dissolved Oxygen [a]	mg/L	March-July > 5.0 min & > 6.25 7-day mean Aug-Feb > 4.0 min, > 4.5 7-day mean, & > 6.0 30-day mean

a. Applies to the dissolved oxygen concentration in the main body of all streams, in the water above the thermocline of thermally stratified lakes and reservoirs, and in the entire water column of unstratified lakes and reservoirs.

Aquatic life use assessments in streams are typically based on the interpretation of biological information, physicochemical water data and physical-habitat information from the Intensive Basin Survey, Ambient Water Quality Monitoring Network or Facility-Related Stream Survey programs. The primary biological measures used are the fish Index of Biotic Integrity (Karr et al. 1986; Smogor 2000, 2005), the macroinvertebrate Index of Biotic Integrity (Tetra Tech 2004) and the Macroinvertebrate Biotic Index (IEPA 1994). Physical habitat information used in assessments includes quantitative or qualitative measures of stream bottom composition and qualitative descriptors of channel and riparian conditions. Physicochemical water data used include measures of conventional parameters (e.g., DO, pH and temperature), priority pollutants, non-priority pollutants, and other pollutants (U.S. EPA 2002a and https://www.epa.gov/wqc). In a minority of streams for which biological information is unavailable, aquatic life use assessments are based primarily on physicochemical water data.

When a stream segment is determined to be Not Supporting aquatic life use, generally, one exceedance of an applicable Illinois water quality standards (related to the protection of aquatic life) results in identifying the parameter as a potential cause of impairment. Additional guidelines used to determine potential causes of impairment include site-specific standards (35 Ill. Adm. Code 303, Subpart C), or adjusted standards (published in the IPCB's Environmental Register at https://pcb.illinois.gov/Resources/EnvironmentalRegister.

2. Watershed Characterization

The Shoal Creek watershed is located in southwestern Illinois and has a drainage area of 310 square miles. The watershed includes portions of Bond, Montgomery, Clinton, Madison, and Macoupin counties. The headwaters begin in northern Montgomery County and Christian County, IL and flow south towards its confluence with the Kaskaskia River. Shoal Creek joins the Upper Kaskaskia River downstream of Carlyle Lake and the Kaskaskia River eventually joins the Mississippi River south of St. Louis, Missouri. (Figure **1**).

A TMDL was previously developed for a portion of the Shoal Creek watershed (IEPA 2008). The previous *Shoal Creek Watershed TMDL Report* provides the basis for the watershed characterization and source assessment for the current Shoal Creek watershed project area.

2.1 Jurisdictions and Population

Relevant information on jurisdictions and population can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008). The project area is located within Bond, Montgomery, Clinton, Madison, and Macoupin counties.

2.2 Climate

In general, the climate of southern Illinois is temperate with hot summers and cold, snowy winters. Relevant information on climate can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008).

2.3 Land Use and Land Cover

Relevant information on land use and land cover can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008). Cultivated crops make up the majority of the land cover in the project area.

2.4 Topography

Relevant information on topography can be found within the recently completed *Shoal Creek Watershed TMDL Report* (IEPA 2008).

2.5 Soils

Relevant information on soils can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008). Soils are primarily Group C that are defined as “soils having a slow infiltration rate when thoroughly wet” with slow infiltration rates. They typically consist of “soils having a layer that impedes the downward movement of water or soils of moderately fine texture or find texture” (IEPA 2008).

2.6 Hydrology

Relevant information on hydrologic conditions can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008). An active U.S. Geological Survey (USGS) flow gage site is located on the Shoal Creek IL_OI-08 segment (USGS gage 05594000).

Channelized streams and tile drainage throughout the agricultural areas of the Shoal Creek watershed result in altered hydrological regimes. Subsurface drain tiles are typically installed in agricultural areas to drain wet soils and pooled water from precipitation on relatively flat crop fields. Rainwater from precipitation on tile-drained fields will flow through tiles and into ditches much more rapidly than rainwater from precipitation events on crop fields without tile drainage. The subsurface flow moves rapidly through the tiles and discharges to ditches along fields and roads.

Ditches and streams are channelized (i.e., straightened and often widened and deepened) to rapidly move water downstream. Water flowing through ditches and channelized streams moves much more rapidly (and with greater stream power) that water flowing in natural stream channels. The more powerful flow can result in increased erosion and flooding. Additionally, more powerful flows can transport larger particles (e.g., sediment, gravel).

Corn and soybean are planted on flat land throughout the Shoal Creek watershed. Frankenberger et al. (2022a,b) estimates that 88% of agricultural land is likely or potentially drained (based on the 2011 National Land Cover Database and 2008 Soil Survey Geographic Database). Much of the streamflow in the Shoal Creek watershed is in an altered hydrologic regime, where precipitation results in faster and larger flows than natural flow regimes.

2.7 Watershed Studies and Information

Relevant information for this section can be found within the *Shoal Creek Watershed TMDL Report* (IEPA 2008). County soil and water conservation districts and health departments were contacted for additional information; no new information was provided. One study about agricultural BMPs was recently published:

- **Assessing the impacts of agricultural conservation practices on freshwater biodiversity under changing climate** (Acero Triana et al. 2021)

  A Soil and Waters Assessment Tool model and fish regression models were developed to evaluate the impact of future climate conditions and agricultural land management practices on fish species richness across the Kaskaskia River watershed. The study focused on four agricultural BMPs: crop rotation, cover crops, reduced tillage, and modified fertilizer application. The results indicated that fish species richness was more sensitive to changes in climate than changes in land management. Additionally, the authors found no significant differences between fish species richness from the scenarios with agricultural BMPs and current land management.

3. Watershed Source Assessment

Source assessments are an important component of water quality management plans and TMDL development. This section provides a summary of potential sources that contribute to low DO conditions in Shoal Creek.

3.1 Pollutants of Concern

Pollutants of concern evaluated within this source assessment include parameters influencing DO such as biochemical oxygen demand, phosphorus, and ammonia. These pollutants can originate from an array of sources including point and nonpoint sources. Eutrophication (high levels of algae) is also often linked directly to low DO conditions and therefore nutrients are also a pollutant of concern. Point sources typically discharge at a specific location from pipes, outfalls, and conveyance channels. Nonpoint sources are diffuse sources that have multiple routes of entry into surface waters, particularly overland runoff. This section provides a summary of potential point and nonpoint sources that contribute to Shoal Creek.

3.2 Point Sources

Point source pollution is defined by the Federal CWA §502(14) as:

> *"any discernible, confined and discrete conveyance, including any ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation [CAFO], or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture storm water discharges and return flow from irrigated agriculture."*

Under the CWA, all point sources are regulated under the National Pollutant Discharge Elimination System (NPDES) program. A municipality, industry, or operation must apply for an NPDES permit if an activity at that facility discharges wastewater to surface water. Point sources can include facilities such as municipal wastewater treatment plants (WWTPs), industrial facilities, concentrated animal feeding operations (CAFOs), or regulated storm water including municipal separate storm sewer systems (MS4s).

Five NPDES permitted facilities are located in the watersheds draining to impaired segments IL_OI-05 and IL_OI-15; none are located in the IL_OI-13 watershed. Two permitted facilities are located in the Shoal Creek IL_OI-05 watershed - the Germantown Sewage Treatment Plant (STP; ILG580186) and one CAFO (ILA010007). Germantown STP is a domestic lagoon that discharges to an unnamed Shoal Creek tributary. Three individual NPDES permitted facilities are located in the Shoal Creek IL_OI-15 watershed - Pocahontas STP (ILG580010), Pierron East STP (ILG580237), and Louisville STP (ILG580081). Pocahontas STP and Pierron East STP discharge to tributaries of Shoal Creek and Louisville STP (ILG580081) discharges to the main stem of Shoal Creek. Design average flows and design maximum flows for these STPs are presented in Table 3.

No MS4s are located in the watersheds draining to the three impaired segments (IL_OI-05, IL_OI-13, and IL_OI-15).

Table 3. NPDES permitted facilities in the Shoal Creek watershed.

IL Permit ID	Facility Name	Type of Discharge	Receiving Water	Average Design Flow (MGD)	Maximum Design Flow (MGD)
ILG580186	Germantown STP	STP	Unnamed tributary of Shoal Creek	0.135	0.330
ILG580010	Pocahontas STP	STP	Unnamed tributary of Shoal Creek	0.125	0.5
ILG580237	Pierron East STP	STP	Unnamed tributary of Shoal Creek	0.0206	0.0854
ILG580081	Louisville STP	STP	Shoal Creek	0.15	0.375

MGD – Million gallons per day
STP – Sewage treatment plant

3.3 Nonpoint Sources

The term nonpoint source pollution is defined as any source of pollution that does not meet the legal definition of point sources. Nonpoint source pollution typically results from overland stormwater runoff that is diffuse in origin, as well as background conditions. It should be noted that stormwater collected and conveyed through a regulated MS4 is considered a controllable point source.

Nonpoint pollutant sources commonly associated with low DO conditions include agricultural runoff, onsite wastewater treatment systems, and animal agriculture activities. As part of the water resource assessment process, IEPA has identified several sources as contributing to the impairments: loss of riparian habitat, crop production (cropland or dry land), and agriculture, all of which are nonpoint sources.

3.3.1 Agricultural Runoff

During wet-weather events (snowmelt and rainfall), pollutants are incorporated into runoff and can be delivered to downstream waterbodies. The resultant pollutant loads are linked to the land uses and practices in the watershed. Agricultural areas can have significant effects on water quality if proper best management practices are not in place, specifically contributing to high biochemical oxygen demand and nutrients that can affect the DO conditions in streams.

The majority of land within the Shoal Creek watershed is in cultivated crops and such land is assumed to be tiled. In the Shoal Creek watershed (HUC 07140203), 88% of agricultural land is identified as likely or potentially drained (Frankenberger et al. 2022; based on the 2011 National Land Cover Database and 2008 Soil Survey Geographic Database). Drain tiles also transport agricultural runoff directly to ditches and streams, whereas runoff flowing over the land surface may infiltrate to the subsurface and may flow through riparian areas.

3.3.2 Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure include seasonally high water tables, compact glacial till, bedrock, and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters (Horsley and Witten 1996). Septic systems contain all the wastewater discharged from homes and business and can be significant sources of pollutants.

IEPA estimates that between 20–60 percent of onsite wastewater treatment systems are failing in the state of Illinois (IEPA 2004). During the development of this TMDL county health departments were contacted for county specific information on septic systems and unsewered communities. Septic systems throughout the watershed are typically inspected during installation and on a complaint-basis. There are approximately 20,000 septic systems in Madison County. In 2017, 223 systems were inspected in Madison County and 96.5 percent of systems that were previous found under violation were brought into compliance.

3.3.3 Animal Feeding Operations (AFOs)

Animal feeding operations that are not classified as CAFOs are known as animal feeding operations (AFOs) in Illinois. Non-CAFO AFOs are considered nonpoint sources by U.S. EPA. AFOs in Illinois do not have state permits. However, they are subject to state livestock waste regulations and may be inspected by the IEPA, either in response to complaints or as part of the Agency’s field inspection responsibilities to determine compliance by facilities subject to water pollution and livestock waste regulations. The animals raised in AFOs produce manure that is stored in pits, lagoons, tanks and other storage structures. The manure is then applied to area fields as fertilizer. When stored and applied properly, this beneficial re-use of manure provides a natural source for crop nutrition. It also lessens the need for fuel and other natural resources that are used in the production of fertilizer. AFOs, however, can pose environmental concerns, including the following:

- Manure can leak or spill from storage pits, lagoons, tanks, etc.
- Improper application of manure can contaminate surface or ground water.

- Manure over application can adversely impact soil productivity.

Livestock are potential sources of nutrients to streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Bond and Clinton Soil and Water Conservation Districts received a 319 grant from IEPA in 2016 to continue work in the two counties assisting livestock producers in making improvements to their animal waste systems to reduce nutrient and sediment loading to waterbodies.

4. Water Quality

Background information on water quality monitoring can be found in the recently completed *Shoal Creek Total Maximum Daily Load* (IEPA 2008). In the Shoal Creek watershed, water quality data were found for numerous stations that are part of the Illinois EPA Ambient Water Quality Monitoring Network. Parameters sampled in the streams include field measurements (e.g., DO) as well as those that require lab analyses (e.g., nutrients). For the Stage 1 analysis, the most recent 10 years of data collection, 2007–2016, were used to evaluate impairment status. Data that are greater than 10 years old are not included in impairment status evaluation; however, data from 2002 were available for segment IL_OI-05. Each data point was reviewed to ensure the use of quality data in the analysis below. Data were obtained directly from Illinois EPA.

The following sections (1) summarize initial data used for impairment verification in Stage 1, (2) identify the Stage 2 monitoring recommendations following the initial Stage 1 analysis, and (3) analyze any data collected in response to those recommendations. Data were collected by IEPA and the Illinois State Water Survey in 2019 in Shoal Creek IL_OI-05 and IL_OI-13. See Appendix B for all Stage 2 data.

4.1 Shoal Creek (IL_OI-05)

Shoal Creek (IL_O1-05) was listed as impaired for aquatic life due to low levels of DO on the 2016 303(d) list and delisted for the 2020/2022 303(d) list. One IEPA sampling site is present on segment IL_OI-05 of Shoal Creek (Table 4 and Figure 2). Ten samples were collected at the site from 2007–2012. Four violations of the general use water quality standard – enhanced protection were observed in June and August 2007 and July of 2012. Continuous DO data were collected in 2007 and 2017; multiple violations of the standard were observed in July and August 2007 (Figure 3). During the Stage 1 process, these violations verified impairment.

Further review of available data was conducted to determine the cause of impairment:

- **Point Sources:** The point source discharging into Shoal Creek is downstream from the monitoring station (OI-05) and is therefore not contributing to the impairment.

- **Eutrophication:** Available phosphorus data were evaluated to determine if eutrophication was contributing to low DO conditions; however, no eutrophication relationship exists between high levels of phosphorus and low levels of DO (Figure 4).

Although the impairment had been verified, a strong link to a pollutant was not present during Stage 1 analysis and there are no point sources contributing to the impairment that has been assessed based on data at OI-05. The following additional data needs were identified:

> Collect DO, chlorophyll-*a*, and TP grab samples at station OI-05; two samples per day (one per day in the early morning) on three separate sampling days, during the warm summer months (July–August) and during low flows.

In response to this recommendation, additional DO data were collected in September and October 2019. Continuously recording data sondes were used to collect DO measurements in the morning and afternoon on each day of sampling. The data were averaged for each morning and each afternoon (Table 5).

All measurements were greater than the 4.0 mg/L enhanced instantaneous minimum standard for August through February (refer to the Section 1.2 for a discussion of standards).

IEPA provided new guidelines in 2020 to assess streams using continuous DO data and recommended that a shorter window of time be considered. Specifically, for assessment in 2020, IEPA considers data collected between 2015 and 2017. As 2019 DO data did not exceed standards, the segment was recommended for delisting, and no further TMDL work has been conducted.

Table 4. Data summary, Shoal Creek OI-05

Sample Site	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	Number of exceedances of general use water quality standard – enhanced protection (>5 mg/L (Mar-Jul) and >4 mg/L (Aug-Feb))
OI-05	10	3.1	5.4	8.8	4

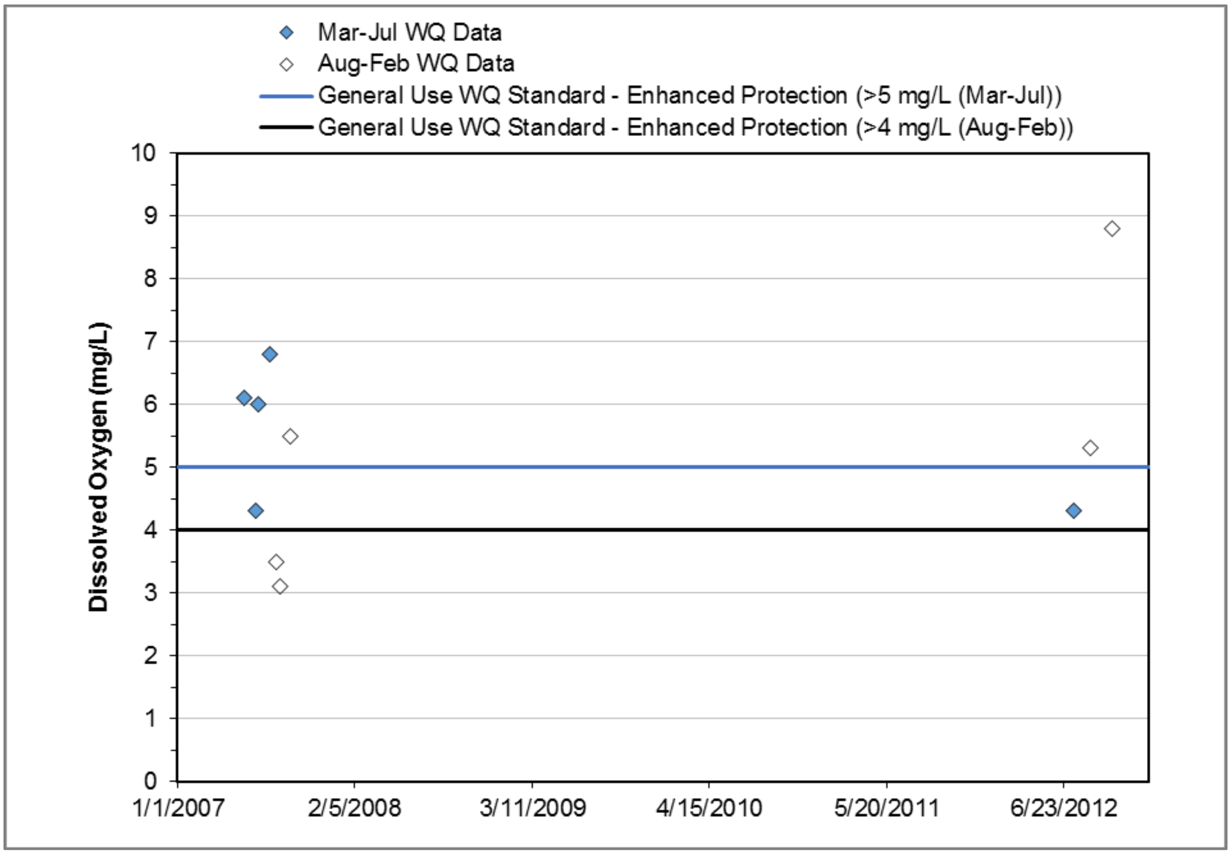

Figure 2. Dissolved oxygen water quality time series, Shoal Creek OI-05.

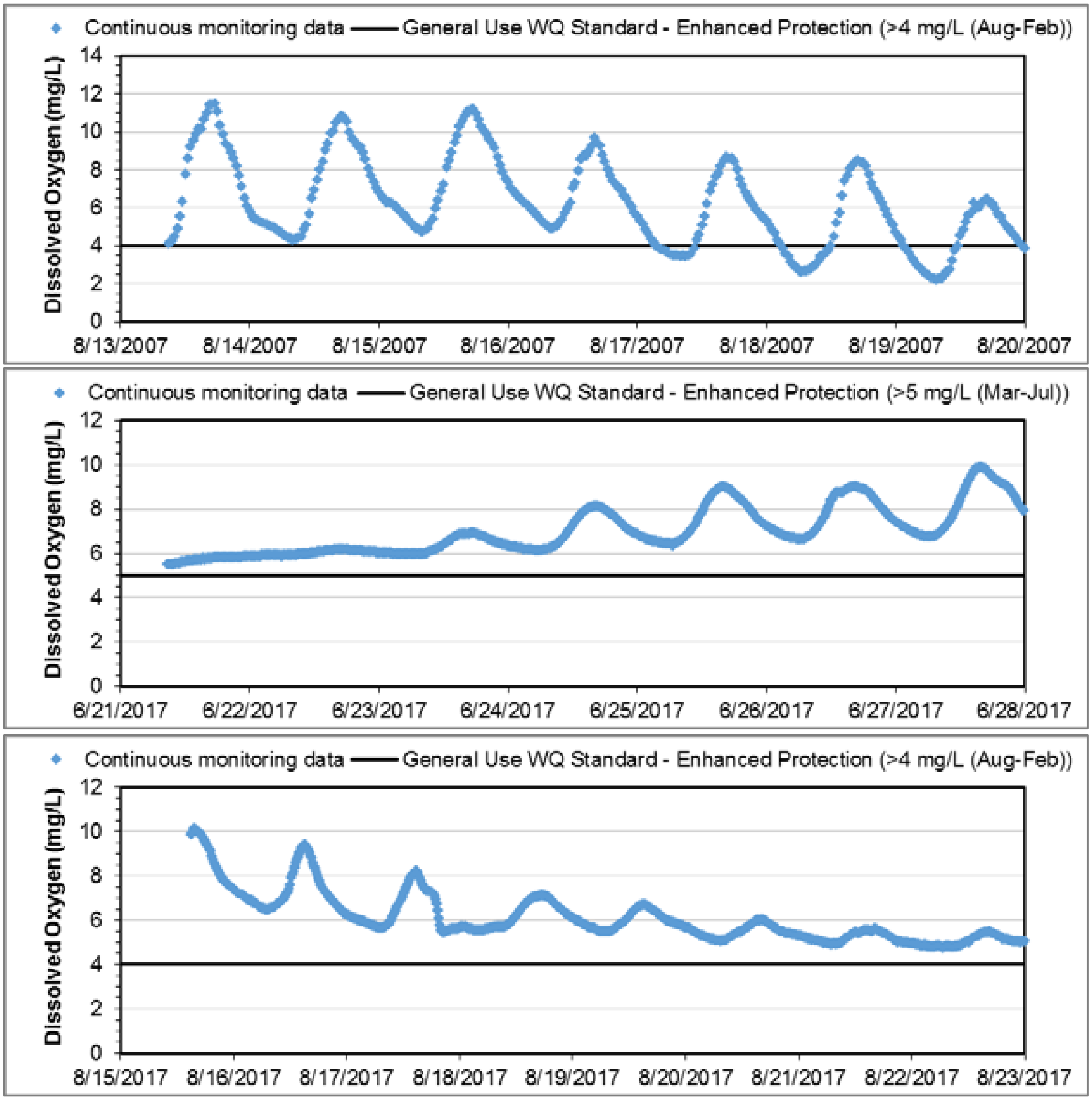

Figure 3. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-05 segment.

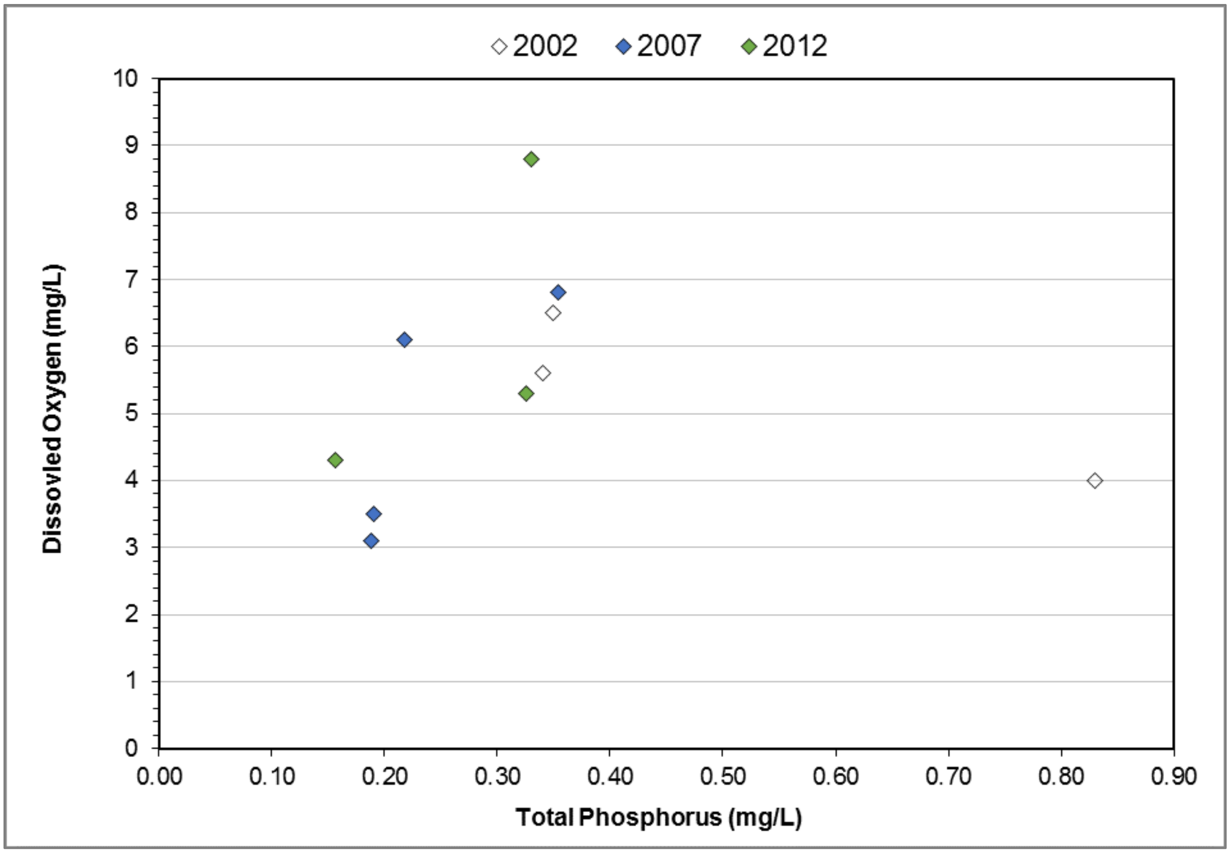

Figure 4. Total phosphorus verse dissolved oxygen, Shoal Creek OI-05.

Table 5. Dissolved oxygen data (Shoal Creek at monitoring site OI-05)

Date	Time of Day	Dissolved oxygen (mg/L)
9/23/2019	AM	6.54
	PM	7.39
9/30/2019	AM	6.77
	PM	7.37
10/7/2019	AM	7.38
	PM	7.62

4.2 Shoal Creek (IL_OI-13)

Shoal Creek segment IL_OI-13 is listed as impaired for aquatic life due to DO. One IEPA sampling site (OI-13) was identified on the segment. As part of the Stage 1 analysis, data collection between 2007–2016 did not indicate impairment in the segment (Figure 5); however, due to the small sample size, the following additional data were recommended to verify impairment:

- Additional continuous DO data should be collected at OI-13 for 7 days during low flow conditions.
- Alternatively, collect DO, chlorophyll-*a*, and TP grab samples at station OI-13; two samples per day (one per day in the early morning) on three separate sampling days, during the warm summer months (July–August) and during low flows. This grab sampling will also satisfy the monitoring needs to determine the relationship with eutrophication and evaluate 4C classification.

In response to these recommendations, additional DO data were collected during September and October 2019 to confirm the status of this reach. Continuously recording data sondes were used to collect DO measurements in the morning and afternoon on each day of sampling in 2019. The data were averaged for each morning and each afternoon (Table 6).

All the measurements were greater than the 3.5 mg/L instantaneous minimum standard for August through February (refer to Section 1.2 for a discussion of standards). There are no data that indicate DO impairment. Based upon IEPA’s new guidelines to focus on 2015 through 2019 DO data, since 2019 data do not indicate impairment, this segment is recommended for delisting.

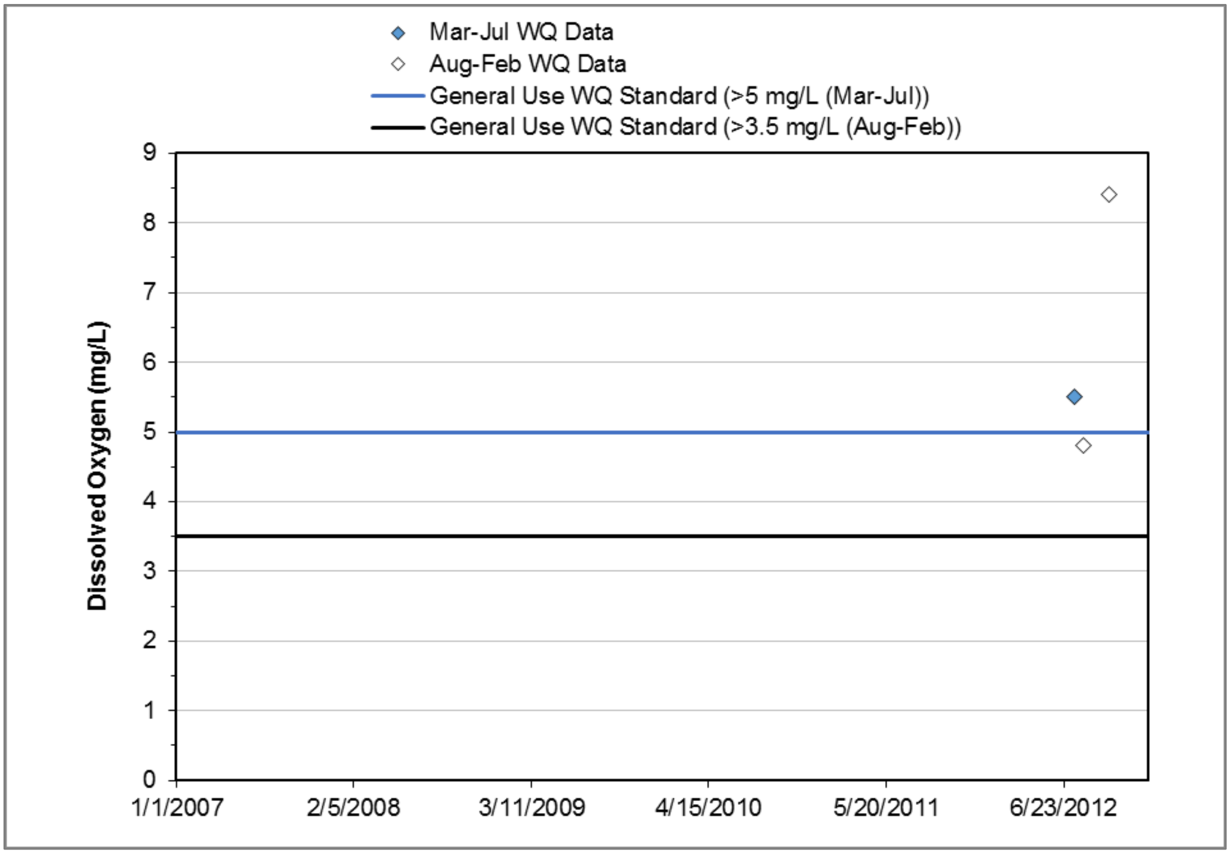

Figure 5. Dissolved oxygen water quality time series, Shoal Creek OI-13.

Table 6. Dissolved oxygen data (Shoal Creek at monitoring site OI-13)

Date	Time of Day	Dissolved oxygen (mg/L)
9/23/2019	AM	8.17
	PM	10.08
9/30/2019	AM	6.81
	PM	7.34
10/7/2019	AM	7.80
	PM	8.27

4.3 Shoal Creek (IL_OI-15)

Shoal Creek segment (IL_OI-15) was listed as impaired for aquatic life due to DO. One IEPA sampling site was identified on the segment, OI-15. Data collection between 2007–2012 (Figure 6) and continuous data from June and August 2017 (Figure 7) do not indicate impairment. No additional DO data were collected during 2019 to confirm the status of this reach.

Three grab samples each collected in 2007 and 2012 ranged from 5.2 to 9.5 mg/L. Thus no sample collected in August through February was less than 3.5 mg/L and no sample collected in March through September was less than 5.0 mg/L.

Continuous data were collected in June and August 2017. The June 2017 continuous DO data ranged from 5.5 to 11.2 mg/L and were always greater than 5.0 mg/L. The August 2017 continuous DO data ranged from 4.3 to 8.0 mg/L and were always greater than 3.5 mg/L.

IEPA provided new guidelines in 2020 to assess streams using continuous DO data and recommended that a shorter window of time be considered. Specifically, for assessment in 2020, IEPA considers data collected between 2015 and 2017. Since the 2017 DO data did not exceed standards, the segment was recommended for delisting DO.

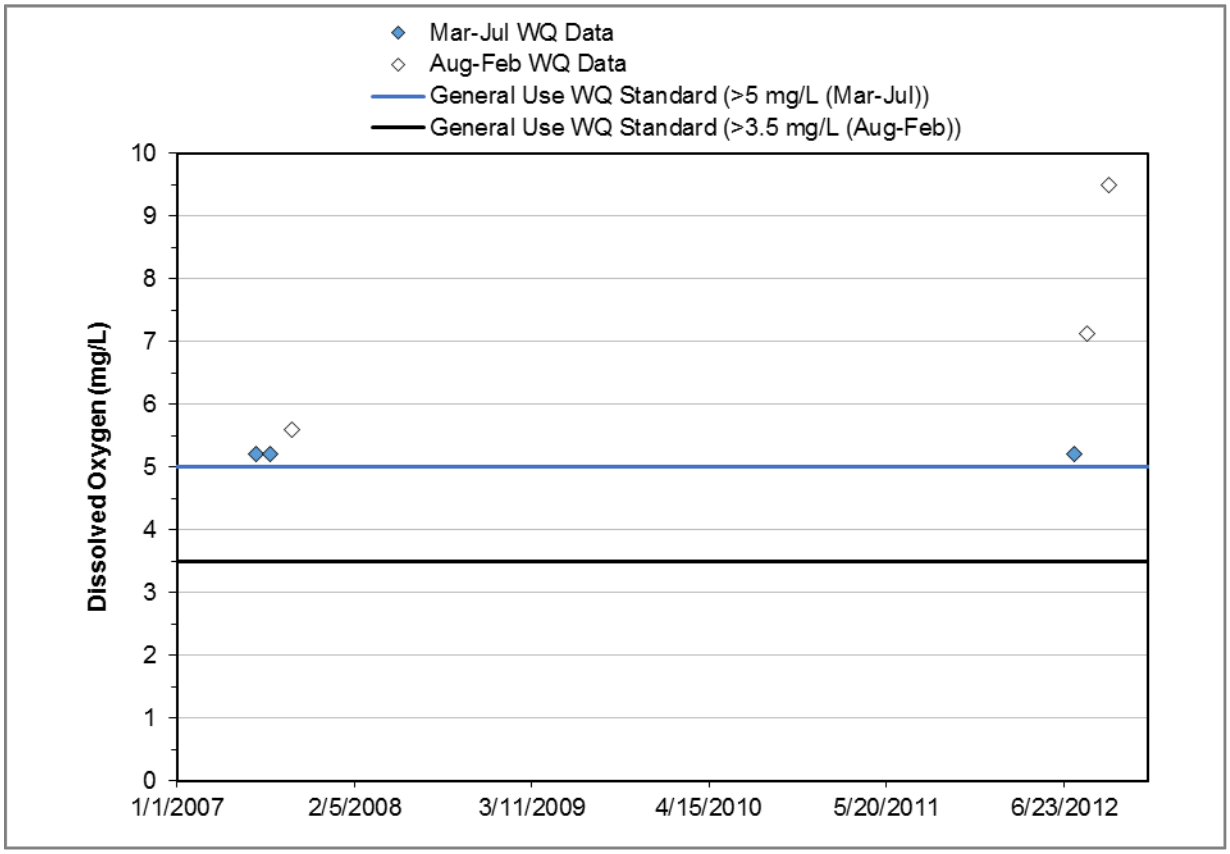

Figure 6. Dissolved oxygen water quality time series, Shoal Creek OI-15.

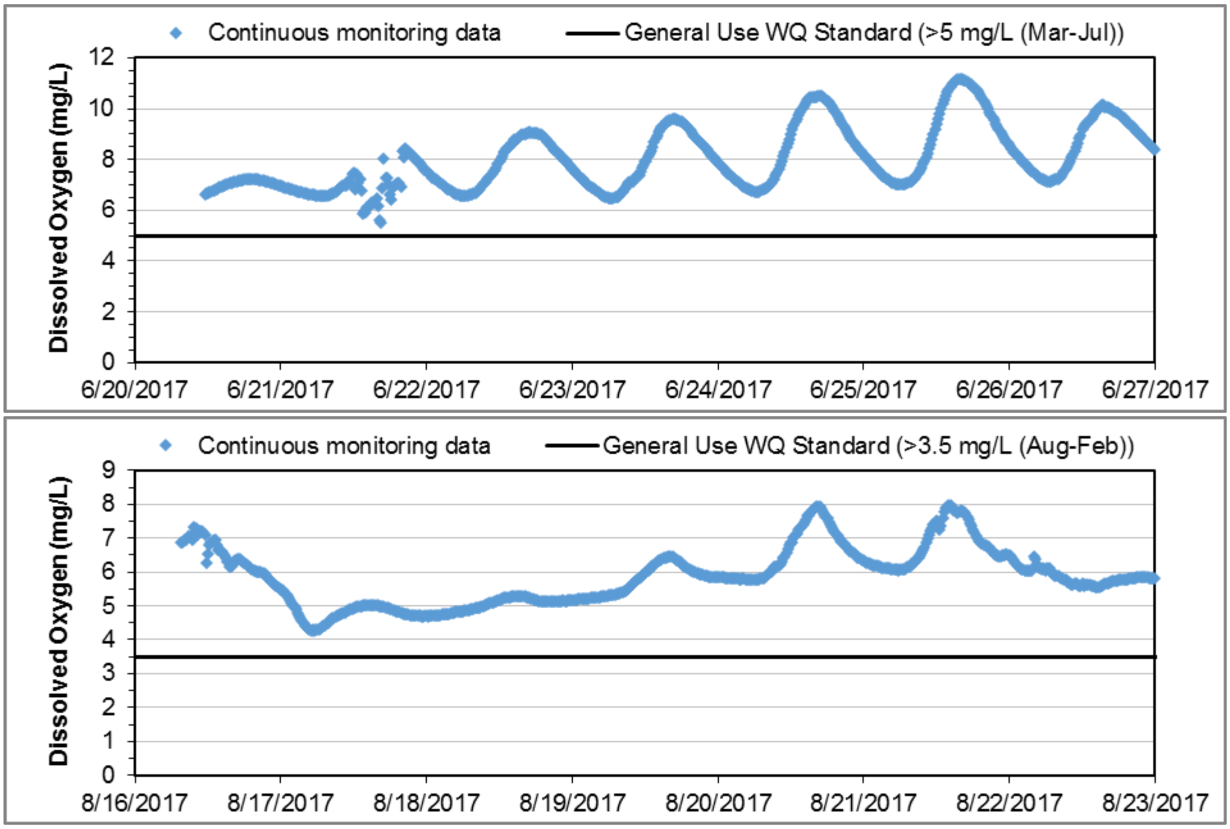

Figure 7. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-15 segment.

5. Watershed Protection Plan

The data summaries provided in Section 4 indicate that Shoal Creek segments (IL_OI-05, IL_OI-13, and IL_OI-15) are no longer impaired for low DO. As such, a watershed protection plan has been developed in lieu of a TMDL implementation plan to maintain and improve in-stream DO levels and prevent increases in pollutants that may impact DO levels (such as phosphorus). In addition to a suite of protection activities, this plan provides monitoring recommendations and an adaptive management process to ensure that implemented practices remain effective. The activities recommended in this protection plan not only help to protect waters from impairment but can also result in a cleaner, healthier watershed for the people who depend on the resources for their livelihood now and in the future.

5.1 Recommended Protection Activities

To maintain acceptable levels of DO in the Shoal Creek watershed, a number of best management practices (BMPs) can be implemented. Maintaining and protecting current conditions can be accomplished by prioritizing BMPs that reduce nutrient loss from the watershed and maintain and improve in-stream conditions that are supportive of healthy DO levels. Education and outreach activities complement BMPs by creating stewardship opportunities and ensuring stakeholder engagement in future watershed activities.

5.1.1 Protection Activities

During wet-weather events (snowmelt and rainfall), nutrients are incorporated into runoff and can be delivered to downstream waterbodies. Several cropland BMPs are recommended to reduce nutrient loss from cropland. The following practices are a subset of those provided in the Illinois Nutrient Loss Reduction Strategy (NLRS) and by the Illinois Council on Best Management Practices (CBMP). Additional information is available in the NLRS (IDOA and IEPA 2015) and on the Illinois CBMP website (http://illinoiscbmp.com/). Many of these practices have the added benefit of improving soil health.

Conservation Tillage

The Illinois NLRS identifies reduced or conservation tillage as a primary BMP to control phosphorus loading to waters. The Illinois Agronomy Handbook defines conservation tillage as any tillage practice that results in at least 30% coverage of the soil surface by crop residuals after planting (University of Illinois Extension 2009). Several practices are commonly used to maintain the suggested 30% cover:

- **No-till** systems disturb only a small row of soil during planting, and typically use a drill or knife to plant seeds below the soil surface.
- **Strip till** operations leave the areas between rows undisturbed but remove residual cover above the seed to allow for proper moisture and temperature conditions for seed germination.
- **Ridge till** systems leave the soil undisturbed between harvest and planting: cultivation during the growing season is used to form ridges around growing plants. During or prior to the next planting, the top 0.5 to 2 inches of soil, residuals, and weed seeds are removed, leaving a relatively moist seed bed.
- **Mulch till** systems are any practice that results in at least 30% residual surface cover, excluding no-till and ridge till systems.

Corn residues are more durable and capable of sustaining the required 30% cover required for conservation tillage. Soybeans generate less residue, the residue degrades more quickly, and supplemental measures or special care may be necessary to meet the 30% cover requirement. Based on 2018 satellite imagery, 35% of the cropland acres in the Shoal Creek major watershed had residue greater than 30% (Applied Geosolutions LLC et al. 2019).

Cover Crops

Winter cover crops are also identified in the NRLS as an important management practice (IDOA and IEPA 2015). According to the Natural Resources Conservation Service (NRCS), cover crops "have the potential to provide multiple benefits in a cropping system. They can prevent soil and wind erosion, improve soil's physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles along with various other benefits. The species of cover crop selected along with its management determine the benefits and returns" (NRCS 2020). There are many different types of crops being used for cover crops, including various grasses and legumes. Based on 2018 satellite imagery, 4% of the cropland acres in the Shoal Creek major watershed had winter cover crops (Applied Geosolutions LLC et al. 2019).

Fertilizer Management

Proper application of fertilizer (both commercial and manure) to cropland can greatly reduce nutrient levels in agricultural runoff. In general, fertilizer management aims to optimize application rates and improve storage and disposal of fertilizer to reduce pollution in runoff.

The Illinois Agronomy Handbook lists guidelines for fertilizer application rates based on the inherent properties of the soil (typical regional soil phosphorus concentrations, root penetration, pH, etc.), the starting soil test phosphorus concentration for the field, and the crop type and expected yield (University of Illinois Extension 2009). Limiting commercial application of fertilizers to only fields with soil test phosphorus levels below the recommended maintenance and applying nitrogen according to the University of Illinois "Maximum Return to Nitrogen" recommendations can reduce nutrient loading from excess fertilization. Application of fertilizer should address application rates, methods, and timing as described in the NRLS and according to the 4Rs – **R**ight Source, **R**ight Rate, at the **R**ight Time, and in the **R**ight Place. Application to frozen ground or snow cover should be strongly discouraged. Researchers studying loads from agricultural fields in east-central Illinois found that fertilizer application to frozen ground or snow followed by a rain event could transport 40% of the total annual phosphorus load (Gentry et al. 2007).

Fertilizer transport, storage, and disposal practices should also be monitored to reduce potential pollution in runoff. Commercial fertilizers should be stored at least 100 feet from nearby surface waters and should not be stored underground or in pits. Application equipment should be cleaned, inspected, and calibrated regularly, and excess fertilizer from wash water should be recovered for reuse. Disposal of commercialized fertilizers should follow manufacturer guidelines. Improvements to storage and disposal practices may require improvements to existing equipment or storage infrastructure to reduce potential leakages.

Livestock BMPs

Proper management of runoff and waste is important to improving water quality and reducing nutrient loading to the watershed. Animal operations are typically either pasture-based or confined, or sometimes a combination of the two. The operation type dictates the practices needed to manage manure and soil erosion from the facility. A pasture or open lot system with a relatively low density of animals (1 to 2 head of cattle per acre [U.S. EPA 2003]) may not produce manure in quantities that require management for the protection of water quality. If excess manure is produced, then the manure will typically be stored, which can then be land applied. Application of manure should be at agronomic rates, taking into account commercial fertilizer application, when the ground is not frozen and precipitation forecasts are low. Rainfall runoff should be diverted around storage facilities with berms or grassed waterways.

Confined facilities (typically dairy cattle, swine, and poultry operations) often collect manure in storage pits. Wash water used to clean the floors and remove manure buildup combines with the solid manure to form a liquid or slurry in the pit. Final disposal of waste usually involves land application on the farm or transportation to another site.

Livestock operation BMPs generally seek to contain manure and manure wastewater; contain and treat runoff contaminated with manure or manure wastewater; divert clean water; and prevent runoff following manure land application. The following livestock and feedlot BMPs are recommended:

- **Composting manure structures and manure management**. Composting manure structures contain manure and other organic materials as they are broken down through aerobic microbial processes. Once decomposed, the organic materials are suitable for storage, on farm use, and application to land as a soil amendment. Composting facilities typically consist of a concrete floor separated by stalls, cover such as a roof or loose tarp is recommended to maintain an environment conducive to aerobic digestion (NRCS 2017a). Other manure management practices include:
    - Grading, earthen berms, and such to collect, direct, and contain manure
    - Installation of concrete pads
- **Runoff management** (runoff from production areas)
    - Grading, earthen berms, and such to collect and direct manure-laden runoff
    - Filter strips
    - Storage ponds
- **Clean water diversion**
    - Roof runoff management
    - Grading, earthen berms, and such to collect and direct uncontaminated runoff
- **Manure land application**
    - Nutrient management strategy (e.g., the 4Rs: **R**ight Source, **R**ight Rate, **R**ight Time, **R**ight Place), see Fertilizer Management
    - Filter strips and grassed waterways

In addition, BMPs for alternative water systems and exclusion fencing can be used to reduce nutrients from livestock with access to streams. These BMPs limit or eliminate livestock access to a stream or waterbody. Fencing can be used with controlled stream crossings to allow livestock to cross a stream while minimizing disturbance to the stream channel and streambanks. Providing alternative water supplies for livestock allows animals to access drinking water away from the stream, thereby minimizing the impacts to the stream and riparian corridor. U.S. EPA (2003) studied the impacts of providing alternative watering sites without structural exclusions and found that cattle spend 90% less time in the stream when alternative drinking water is furnished and estimates that total phosphorus reductions from 15-49% can be expected.

Additional information on the context of these practices within the Shoal Creek watershed is available in the 2008 *Shoal Creek Watershed TMDL Report* (IEPA 2008).

Riparian Buffers and Filter Strips

Riparian buffers provide many benefits and can effectively address water quality degradation. Riparian buffers that include perennial vegetation and trees can filter runoff from adjacent cropland, provide shade and habitat for wildlife, and reinforce streambanks to minimize erosion. The root structure of the vegetation in a buffer enhances infiltration of runoff and subsequent trapping of pollutants. However, buffers are only effective in this manner when the runoff enters the buffer as a slow moving, shallow “sheet”; concentrated flow in a ditch or gully, will quickly pass through the buffer offering minimal opportunity for retention and uptake of pollutants. Similarly, tile lines can often allow water to bypass a buffer, thus reducing its effectiveness. The NRCS suggests a 35-foot wide buffer.

Filter strips are a strip of permanent vegetation located between disturbed land (cropland or pastureland) and environmentally sensitive areas that can effectively address water quality degradation from nutrient loading while also enhancing habitat (NRCS 2017b). Filter strips provide many of the same benefits as vegetated buffers but are also subject to the same design considerations. Determining adequate filter strip widths depends on the slope of the land. Table 7 summarizes the minimum and maximum flow lengths for filter strips according to Illinois NRCS standards.

Table 7. Minimum and maximum filter strip length for land slope (NRCS 2017b)

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

Onsite Wastewater Treatment System Practices

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, if systems are maintained improperly, sited improperly, or are connected to subsurface or tile drainage systems, they can have adverse effects on surface waters.

IEPA estimates that between 20–60% of onsite wastewater treatment systems are failing in the state of Illinois (IEPA 2004). Septic systems throughout the watershed are typically inspected during installation and on a complaint basis. There are approximately 20,000 septic systems in Madison County. In 2017, 223 systems were inspected in Madison County and 96.5% of systems that were previous found under violation were brought into compliance.

BMPs to reduce nutrient loads from septic systems include maintenance, inspection programs, and public education. The most effective BMP for managing loads from septic systems is regular maintenance. U.S. EPA recommends that septic tanks be pumped every 3 to 5 years depending on the tank size and number of residents in the household (U.S. EPA 2002b). Annual inspections, in addition to regular maintenance, ensure that systems are functioning properly. Additional point of sale inspections, or inspections when a property is sold and purchased, can improve the baseline understanding of septic conditions and decrease occurrences of leaks potentially contributing to nutrient loading in the watershed.

Several areas within the watershed are served by sewers. Within rural areas of Illinois, such as the Shoal Creek watershed, it is assumed that non-sewered communities rely on septic systems.

5.1.2 Protection Activities to Maintain and Improve In-Stream Conditions

In-stream conditions that may be contributing to low DO conditions may include stagnant water, lack of riffles, channelization, lack of shade, and lack of adequate flow. Restoration of altered (channelized or ponded) stream segments can greatly enhance the stream function, habitat, and water quality. Altered stream segments can be addressed by many different BMPs:

- **Engineering controls** include armoring with materials that straighten the banks, deflection of the water course with rock or log structures, and removal of debris to restore flows. Example practices include stone toes, stream barbs and removal of any problematic log jams that contribute to erosion.
- **Vegetative stabilization** and **restoration of riparian areas** can reduce peak flows from runoff areas and channel velocities directing runoff. Using vegetative controls also enhance infiltration, which reduces high flows that cause erosion.

- **Natural channel restoration** that establishes meanders and natural flow complexity and connects the stream channel with the floodplain.
- **Riffles** provide breaks in stream segments where stream alterations have impacted aeration or have destabilized stream beds. Constructed riffles are engineered using alluvial materials or to increase hydraulic complexity, provide aquatic habitats, and stabilize beds in altered streams.
- **Pooling,** or stream portions with deeper and slower flows, occur organically along many natural stream segments. 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.

5.1.3 Education and Outreach Activities

Raising stakeholders' awareness about issues in the watershed and developing strategies to change stakeholders' behavior is essential to promoting voluntary participation. Successful implementation in the Shoal Creek watershed will rely heavily on effective public education and outreach activities that will encourage participation and produce changes in behavior. This section presents recommendations related to developing and implementing coordinated watershed-wide education and outreach.

The first step to a successful information and education strategy is to identify target audiences and determine how to best reach these audiences. Potential audiences in the Shoal Creek watershed may include homeowners, row crop and livestock producers, and public works departments and staff. Consideration should be given to the complexity of the water resource concerns of each of these groups. Whenever possible, stakeholder attitudes and preferences should be considered in the implementation of protection activities and should influence message development, selection of outreach platforms, and other aspects of information and education.

Engagement and outreach strategies should also be flexible to accommodate future changes in stakeholder awareness and behaviors. A pre- and post-implementation survey can be used to measure these changes, and the results of these surveys should be shared between local partners. These surveys can be used to measure changes in the level of stakeholder knowledge and involvement and will help watershed outreach campaign organizers to further develop tailored outreach messages. Other measures of change can include the number of producers who are signing up for cost-share programs or participating in field days or demonstration projects. Results from these outreach activities should be used to inform potential changes and adaptations to this protection plan.

5.2 Priority Areas for Implementation

Prioritization of implementation activities should occur based on stakeholder input, willing landowners, and availability of funding. In addition, prioritization can focus on areas with the greatest potential for pollutants to negatively impact water quality:

- **Cropland:** Agricultural land uses comprise 65% of land cover in the Shoal Creek watershed. Cropland typically contributes to pollutant loading during wet-weather events that result in erosion and runoff. The contribution of nutrient loading from cropland runoff is also exacerbated by the presence of tile drainage lines in the watershed, which is estimated in previous planning efforts (IEPA 2008).
- **Pasture and animal feeding operations:** Areas of the watershed with grazed pastures and other non-permitted AFOs are potential sources of nutrients to streams, particularly when livestock can access streams and where feeding structures are located adjacent to riparian areas.

- **Failing septic systems:** Private septic systems in the watershed may negatively impact water quality issues in the watershed if septic systems are not properly maintained and inspected.
- **Altered (channelized or ponded) stream segments:** Land use changes, ditching, and other hydrologic modifications may detrimentally affect habitat and biological health in riparian areas and result in lower DO levels. Altered segments should be targeted during implementation.

Management practices recommended for each of these priority areas are provided in Table 8.

Table 8. Recommended BMPs by priority area

	Priority area for implementation			
Recommended best management practice (BMP)	Cropland	Pasture and animal feeding operations	Failing septic systems	Altered (channelized or ponded) stream segments
Conservation tillage	x			
Cover crops	x			
Fertilizer management	x	x		
Livestock BMPs		x		x
Riparian buffers and filter strips	x	x		x
Onsite wastewater treatment system practices			x	
Practices to maintain and improve in-stream conditions				x
Education and outreach	x	x	x	x

5.3 Monitoring Recommendations

The ultimate measure of success will be maintained or improved water quality over time. Monitoring will help determine whether the recommended practices have maintained water quality levels or if further action is needed.

DO should continue to be evaluated through ambient monitoring by IEPA. The state conducts routine water quality monitoring by evaluating watersheds on a rotating basis, collecting measurements of physical, chemical, and biological parameters. In addition to the ambient monitoring program conducted by IEPA, monitoring in the watershed is also conducted by the USGS (see Section 2.6).

Increased frequency of monitoring, and expansion of monitoring sites to characterize additional Shoal Creek tributaries, will further allow evaluation of any future water quality concerns. Synoptic stream sampling can be used to better understand sources of pollutants and identify hot spots or additional critical areas. When possible, a variety of flow regimes should be sampled for a range of parameters to improve understanding of water quality concerns and ensure the effectiveness of protection efforts.

There are limited local data on the effectiveness of many BMPs; therefore, monitoring the results of programs and representative practices are critical. BMP monitoring can include quantitative monitoring of physical components (e.g., water quality and flow) qualitative (i.e., visual) monitoring of physical components (e.g., vegetation), and monitoring of behaviors. A monitoring program can be put in place as BMPs are implemented to 1) measure success and 2) identify changes that could be made to increase effectiveness.

5.4 Adaptive Management

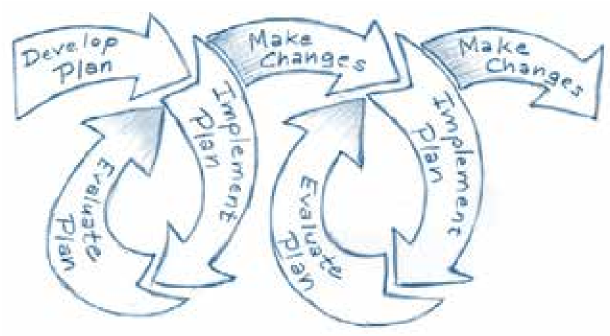

Figure 8. Adaptive management iterative process (U.S. EPA 2008)

Adaptive management is a commonly used strategy to address natural resource management that involves a temporal sequence of decisions (or implementation actions), in which the best action at each decision point depends on the state of the managed system. As a structured iterative implementation process, adaptive management offers the flexibility for responsible parties to monitor implementation actions, determine the success of such actions and ultimately, base management decisions upon the measured results of completed implementation actions and the current state of the system. This process, depicted in Figure 8, enhances the understanding and estimation of predicted outcomes and ensures refinement of necessary activities to better guarantee desirable results. In this way, understanding of the resource can be enhanced over time, and management can be improved.

While the Stage 1 and 2 documents indicate that Shoal Creek segments (IL_OI-05, IL_OI-13, and IL_OI-15) are recommended for delisting, the protection activities and adaptive management principles outlined in this protection plan should be coordinated to maintain water quality conditions and prevent impairment in the future.

6. Public Participation

A public meeting was held on December 12, 2018, at the Carlyle Lake Visitor Center in Carlyle, IL to present the Stage 1 report and findings. A public notice was placed on the IEPA website. There were many stakeholders present including representatives from the Army Corps of Engineers, the Kaskaskia Watershed Association, Original Kaskaskia Area Wilderness, Inc., and others.

The public comment period closed on January 12, 2019. No written comments were provided on the draft Stage 1 report.

A second virtual public meeting was held on January 11, 2023, to present this protection plan. A public notice was placed on the IEPA website. The public comment period closed on February 10, 2023. The summary of comments and response to comments is provided in Appendix D.

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Appendix A – Stage 1 Report

Shoal Creek Watershed (II)
Total Maximum Daily Load

Final Stage 1 Report

1021 North Grand Avenue East
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Report Prepared by:

TETRA TECH

February 2019

Contents

Figures iii

Tables iii

Acronyms and Abbreviations iv

1. Introduction 1
1.1 Water Quality Impairments 1
1.2 TMDL Endpoints 3
1.2.1 Designated Uses 3
1.2.2 Water Quality Standards and TMDL Endpoints 3

2. Watershed Characterization 4
2.1 Jurisdictions and Population 4
2.2 Climate 4
2.3 Land Use and Land Cover 4
2.4 Topography 4
2.5 Soils 4
2.6 Hydrology 5
2.7 Watershed Studies and Information 5

3. Watershed Source Assessment 5
3.1 Pollutants of Concern 5
3.2 Point Sources 5
3.3 Nonpoint Sources 6
3.3.1 Agricultural Runoff 6
3.3.2 Onsite Wastewater Treatment Systems 6
3.3.3 Animal Feeding Operations (AFOs) 7

4. Water Quality 7
4.1 Shoal Creek (OI-05) 7
4.2 Shoal Creek (OI-13) 11
4.3 Shoal Creek (OI-15) 12

5. TMDL Methods and Data Needs 13
5.1 TMDL Methods 13
5.2 Additional Data Needs 15

6. Public Participation 16

7. References 17

Figures

Figure 1. Shoal Creek watershed, TMDL project area. 2
Figure 2. Dissolved oxygen water quality time series, Shoal Creek OI-05. 8
Figure 3. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-05 segment. 9
Figure 4. Total phosphorus verse dissolved oxygen, Shoal Creek OI-05. 10
Figure 5. Dissolved oxygen water quality time series, Shoal Creek OI-13. 11
Figure 6. Dissolved oxygen water quality time series, Shoal Creek OI-15. 12
Figure 7. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-15 segment. 13

Tables

Table 1. Shoal Creek watershed impairments and pollutants (2016 Illinois 303(d) Draft List) 1
Table 2. Summary of water quality standards for the Shoal Creek watershed 3
Table 3. Data summary, Shoal Creek OI-05 8
Table 4. Proposed model summary 14
Table 5. Relationship between duration curve zones and contributing sources 15
Table 6. Additional data needs 16

Acronyms and Abbreviations

AFO	animal feeding operation
AWQMN	Ambient Water Quality Monitoring Network
CAFO	confined animal feeding operation
CWA	Clean Water Act
Illinois EPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
MGD	millions of gallons per day
MS4	municipal separate storm sewer system
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
STP	sewage treatment plant
TMDL	total maximum daily load
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WQS	water quality standards

1. Introduction

The Clean Water Act and U.S. Environmental Protection Agency (U.S. EPA) regulations require that Total Maximum Daily Loads (TMDLs) be developed for waters that do not support their designated uses. In simple terms, a TMDL is a plan to attain and maintain water quality standards in waters that are not currently meeting standards. This TMDL study addresses the Shoal Creek watershed in south-central Illinois. The project area, referred to as the Shoal Creek II watershed, is approximately 310 square miles and includes multiple impairments (Figure 1). A TMDL study was previously completed for the Shoal Creek watershed. Relevant information from the study is included herein where applicable (IEPA 2008).

The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and instream conditions. This allowable loading represents the maximum quantity of the pollutant that the waterbody can receive without exceeding water quality standards. The TMDL also includes a margin of safety, which reflects uncertainty as well as the effects of seasonal variation. By following the TMDL process, States can establish water quality-based controls to reduce pollution from both point and nonpoint sources, and restore and maintain the quality of their water resources (U.S. EPA 1991). The Illinois EPA will be working with stakeholders to implement the necessary controls to improve water quality in the impaired waterbodies and meet water quality standards. It should be noted that the controls for nonpoint sources (e.g., agriculture) will be strictly voluntary.

1.1 Water Quality Impairments

Numerous segments are included on the draft 303(d) list of impaired waters; however, only four segments are addressed as part of this project. Segment OI-05 within the Shoal Creek watershed has been placed on the State of Illinois §303(d) list (Table 1 and Figure 1) and requires development of a TMDL. The segment was previously recommended for delisting based on data collected during two periods of continuous monitoring in 2006 as part of the previous completed Shoal Creek TMDL (IEPA 2008). Since the 2006 monitoring, however, water quality standard violations have been observed in this segment.

Table 1. Shoal Creek watershed impairments and pollutants (2016 Illinois 303(d) Draft List)

Name	Segment ID	Segment Length (Miles)	Watershed Area (Sq. Miles)	Designated Uses	Cause of Impairment
Shoal Creek	OI-05	13.37	917	Aquatic Life	**Dissolved Oxygen**
Shoal Creek	OI-08	14.29	745	Public and Food Processing Water Supply	Iron [a]
Shoal Creek	OI-13	11.49	726	Aquatic Life	Dissolved Oxygen [b]
Shoal Creek	OI-15	11.12	685	Aquatic Life	Dissolved Oxygen [c]

BOLD – TMDLs are addressed in this Stage 1 report.
a. Impairment was removed from the 2018 draft 303(d) list and is not addressed further in this report.
b. Additional data are needed to verify impairment.
c. While recent data show no impairment, the assessment is still undergoing quality control review.

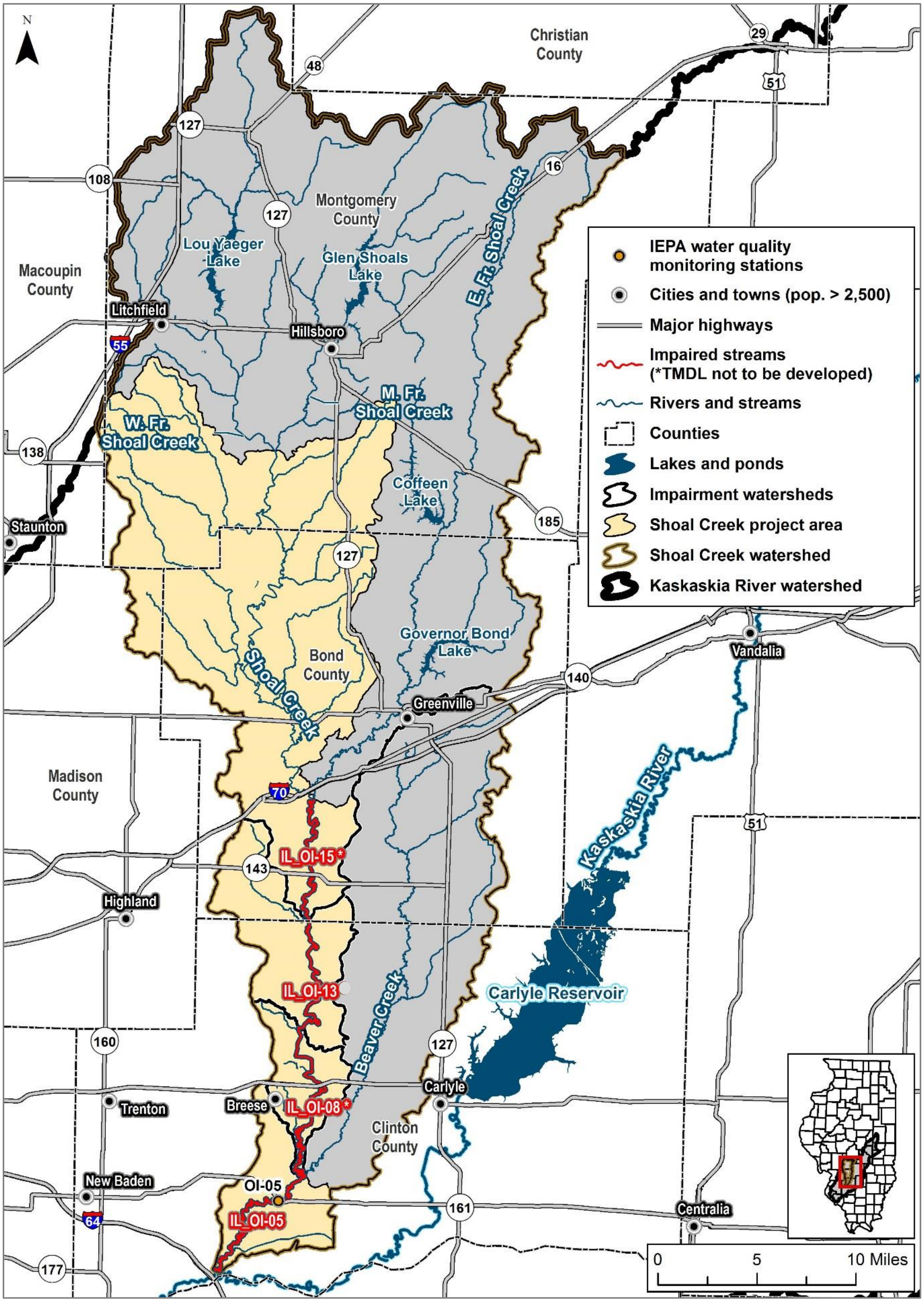

Figure 1. Shoal Creek watershed, TMDL project area.

1.2 TMDL Endpoints

This section presents information on the water quality standards (WQS) that are used for TMDL endpoints. WQS are designed to protect beneficial uses. The authority to designate beneficial uses and adopt WQS is granted through Title 35 of the Illinois Administrative Code. Designated uses to be protected in surface waters of the state are defined under Section 303, and WQS are designated under Section 302 (Water Quality Standards). Designated uses and WQS are discussed below.

1.2.1 Designated Uses

Illinois EPA uses rules and regulations adopted by the Illinois Pollution Control Board (IPCB) to assess the designated use support for Illinois waterbodies. The following are the use support designations provided by the IPCB that apply to waterbodies in the Shoal Creek watershed:

General Use Standards – These standards protect for aquatic life, wildlife, agricultural uses, primary contact (where physical configuration of the waterbody permits it, any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing), secondary contact (any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating, and any limited contact incident to shoreline activity), and most industrial uses. These standards are also designed to ensure the aesthetic quality of the state's aquatic environment.

Shoal Creek segment OI-05 is designated for dissolved oxygen enhanced protection according to 35 Ill Adm. Code 302.206. Waters with enhanced protection have a more stringent dissolved oxygen standard than other waters of the State. These waters were chosen based on the potential biota (fish early life stages present) and the dissolved oxygen needed for these biota to thrive.

1.2.2 Water Quality Standards and TMDL Endpoints

Environmental regulations for the State of Illinois are contained within the Illinois Administrative Code, Title 35. Specifically, Title 35, Part 302 contains water quality standards promulgated by the IPCB. This section presents the standards applicable to impairments within the study area. Water quality standards are the endpoints to be used for TMDL development in the Shoal Creek watershed (Table 2).

Table 2. Summary of water quality standards for the Shoal Creek watershed

Parameter	Units	General Use Water Quality Standard for Waters with Enhanced Protection
Dissolved Oxygen [a]	mg/L	March-July > 5.0 min & > 6.25 7-day mean Aug-Feb > 4.0 min, > 4.5 7-day mean, & > 6.0 30-day mean

a. Applies to the dissolved oxygen concentration in the main body of all streams, in the water above the thermocline of thermally stratified lakes and reservoirs, and in the entire water column of unstratified lakes and reservoirs.

Aquatic life use assessments in streams are typically based on the interpretation of biological information, physicochemical water data and physical-habitat information from the Intensive Basin Survey, Ambient Water Quality Monitoring Network or Facility-Related Stream Survey programs. The primary biological measures used are the fish Index of Biotic Integrity (fIBI; Karr et al. 1986; Smogor 2000, 2005), the macroinvertebrate Index of Biotic Integrity (mIBI; Tetra Tech 2004) and the Macroinvertebrate Biotic Index (MBI; Illinois EPA 1994). Physical habitat information used in assessments includes quantitative or qualitative measures of stream bottom composition and qualitative descriptors of channel and riparian conditions. Physicochemical water data used include measures of conventional parameters (e.g., dissolved oxygen, pH and temperature), priority pollutants, non-priority pollutants, and other pollutants (U.S. EPA 2002 and https://www.epa.gov/wqc). In a minority of streams for which biological information is unavailable, aquatic life use assessments are based primarily on physicochemical water data.

When a stream segment is determined to be Not Supporting aquatic life use, generally, one exceedance of an applicable Illinois WQS (related to the protection of aquatic life) results in identifying the parameter as a potential cause of impairment. Additional guidelines used to determine potential causes of impairment include site-specific standards (35 Ill. Adm. Code 303, Subpart C), or adjusted standards (published in the ICPB's Environmental Register at http://www.ipcb.state.il.us/ecll/environmentalregister.asp).

2. Watershed Characterization

The Shoal Creek watershed is located in southwestern Illinois (Figure 1). The headwaters begin in northern Montgomery County and Christian County, IL and flow south towards its confluence with the Kaskaskia River. Shoal Creek joins the Upper Kaskaskia River downstream of Carlyle Lake and the Kaskaskia River eventually joins the Mississippi River south of St. Louis, Missouri. A TMDL has recently been developed for a portion of the Shoal Creek watershed (IEPA 2008) therefore the previous Shoal Creek Watershed TMDL provides the basis for the watershed characterization and source assessment for the Shoal Creek project area below.

2.1 Jurisdictions and Population

Relevant information on jurisdictions and population can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). The project area is located within Bond, Montgomery, Clinton, Madison, and Macoupin counties.

2.2 Climate

In general, the climate of southern Illinois is temperate with hot summers and cold, snowy winters. Relevant information on climate can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008).

2.3 Land Use and Land Cover

Relevant information on land use and land cover can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). Cultivated crops make up the majority of the land cover in the project area.

2.4 Topography

Relevant information on topography can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008).

2.5 Soils

Relevant information on soils can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). Soils are primarily category C soils that are defined as "soils having a slow infiltration rate when thoroughly wet" with slow infiltration rates. They typically consist of "soils having a layer that impedes the downward movement of water or soils of moderately fine texture or find texture" (IEPA 2008).

2.6 Hydrology

Relevant information on hydrologic conditions can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). An active U.S. Geological Survey (USGS) flow gage site is located on the Shoal Creek OI-08 segment (USGS gage 05594000).

2.7 Watershed Studies and Information

Relevant information for this section can be found within the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). County soil and water conservation districts and health departments were contacted for additional information; no new information was provided.

3. Watershed Source Assessment

Source assessments are an important component of water quality management plans and TMDL development. This section provides a summary of potential sources that contribute to low dissolved oxygen conditions in Shoal Creek.

3.1 Pollutants of Concern

Pollutants of concern evaluated within this source assessment include parameters influencing dissolved oxygen such as biochemical oxygen demand, phosphorus, and ammonia. These pollutants can originate from an array of sources including point and nonpoint sources. Eutrophication (high levels of algae) is also often linked directly to low dissolved oxygen conditions and therefore nutrients are also a pollutant of concern. Point sources typically discharge at a specific location from pipes, outfalls, and conveyance channels. Nonpoint sources are diffuse sources that have multiple routes of entry into surface waters, particularly overland runoff. This section provides a summary of potential point and nonpoint sources that contribute to Shoal Creek.

3.2 Point Sources

Point source pollution is defined by the Federal Clean Water Act (CWA) §502(14) as:

> *"any discernible, confined and discrete conveyance, including any ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation [CAFO], or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture storm water discharges and return flow from irrigated agriculture."*

Under the CWA, all point sources are regulated under the NPDES program. A municipality, industry, or operation must apply for an NPDES permit if an activity at that facility discharges wastewater to surface water. Point sources can include facilities such as municipal wastewater treatment plants (WWTPs), industrial facilities, CAFOs, or regulated storm water including municipal separate storm sewer systems (MS4s).

There are two individual NPDES permitted facilities in the Shoal Creek (OI-05) watershed—the Germantown Sewage Treatment Plant (STP) (NPDES permit ILG580186) and one CAFO (NPDES permit ILA010007). There are no permitted MS4s. Germantown STP is a domestic lagoon that discharges to a Shoal Creek tributary with average design flow of 0.135 million gallons per day (MGD) and maximum design flow of 0.330 MGD.

There are three individual NPDES permitted facilities in the Shoal Creek (OI-15) watershed—Pocahontas STP (ILG580010), Pierron East STP (ILG580237), and Louisville STP (ILG580081).

There are no permitted facilities or MS4s in the Shoal Creek (OI-13) watershed.

3.3 Nonpoint Sources

The term nonpoint source pollution is defined as any source of pollution that does not meet the legal definition of point sources. Nonpoint source pollution typically results from overland stormwater runoff that is diffuse in origin, as well as background conditions. Nonpoint pollutant sources potentially contributing to low dissolved oxygen impairments include agricultural runoff, onsite wastewater treatment systems, and animal agriculture activities. As part of the water resource assessment process, Illinois EPA has identified several sources as contributing to the impairments: loss of riparian habitat, crop production (crop land or dry land), and agriculture, all of which are nonpoint sources.

3.3.1 Agricultural Runoff

During wet-weather events (snowmelt and rainfall), pollutants are incorporated into runoff and can be delivered to downstream waterbodies. The resultant pollutant loads are linked to the land uses and practices in the watershed. Agricultural areas can have significant effects on water quality if proper best management practices are not in place, specifically contributing to high biochemical oxygen demand and nutrients that can affect the dissolved oxygen conditions in streams. Drain tiles also transport agricultural runoff directly to ditches and streams, whereas runoff flowing over the land surface may infiltrate to the subsurface and may flow through riparian areas. The majority of land within the Shoal Creek watershed is in cultivated crops.

3.3.2 Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure include seasonally high water tables, compact glacial till, bedrock, and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters (Horsley and Witten 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pollutants.

Illinois EPA estimates that between 20–60% of onsite wastewater treatment systems are failing in the state of Illinois (IEPA 2004). During the development of this TMDL county health departments were contacted for county specific information on septic systems and unsewered communities. Septic systems throughout the watershed are typically inspected during installation and on a complaint basis. There are approximately 20,000 septic systems in Madison County. In 2017, 223 systems were inspected in Madison County and 96.5 percent of systems that were previous found under violation were brought into compliance.

3.3.3 Animal Feeding Operations (AFOs)

Animal feeding operations that are not classified as CAFOs are known as animal feeding operations (AFOs) in Illinois. Non-CAFO AFOs are considered nonpoint sources by U.S. EPA. AFOs in Illinois do not have state permits. However, they are subject to state livestock waste regulations and may be inspected by the Illinois EPA, either in response to complaints or as part of the Agency's field inspection responsibilities to determine compliance by facilities subject to water pollution and livestock waste regulations. The animals raised in AFOs produce manure that is stored in pits, lagoons, tanks and other storage devices. The manure is then applied to area fields as fertilizer. When stored and applied properly, this beneficial re-use of manure provides a natural source for crop nutrition. It also lessens the need for fuel and other natural resources that are used in the production of fertilizer. AFOs, however, can pose environmental concerns, including the following:

- Manure can leak or spill from storage pits, lagoons, tanks, etc.
- Improper application of manure can contaminate surface or ground water.
- Manure over application can adversely impact soil productivity.

Livestock are potential sources of nutrients to streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Bond and Clinton SWCDs received a 319 grant from IEPA in 2016 to continue work in the two counties assisting livestock producers in making improvements to their animal waste systems to reduce nutrient and sediment loading to waterbodies.

4. Water Quality

An important step in the TMDL development process is the review of water quality conditions, particularly data and information used to list segments. Examination of water quality monitoring data is a key part of defining the problem that the TMDL is intended to address.

Background information on water quality monitoring can be found in the recently completed Shoal Creek Total Maximum Daily Load (IEPA 2008). In the Shoal Creek watershed, water quality data were found for numerous stations that are part of the Illinois EPA Ambient Water Quality Monitoring Network (AWQMN). Parameters sampled in the streams include field measurements (e.g., dissolved oxygen) as well as those that require lab analyses (e.g., nutrients).

The most recent 10 years of data collection, 2007–2016, were used to evaluate impairment status. Data that are greater than 10 years old are not included in impairment status evaluation; however, data from 2002 were available for segment OI-05. Each data point was reviewed to ensure the use of quality data in the analysis below. Data were obtained directly from Illinois EPA.

4.1 Shoal Creek (OI-05)

Shoal Creek (O1-05) is impaired for aquatic life due to low levels of dissolved oxygen. One Illinois EPA sampling site is present on segment OI-05 of Shoal Creek (Table 3 and Figure 2). Ten samples were collected at the site from 2007–2012. Four violations of the general use water quality standard – enhanced protection were observed in June and August 2007 and July of 2012. Continuous dissolved oxygen data were collected in 2007 and 2017; multiple violations of the standard were observed in July and August 2007 (Figure 3). These violations verify impairment.

Table 3. Data summary, Shoal Creek OI-05

Sample Site	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	Number of exceedances of general use water quality standard – enhanced protection (>5 mg/L (Mar-Jul) and >4 mg/L (Aug-Feb))
OI-05	10	3.1	5.4	8.8	4

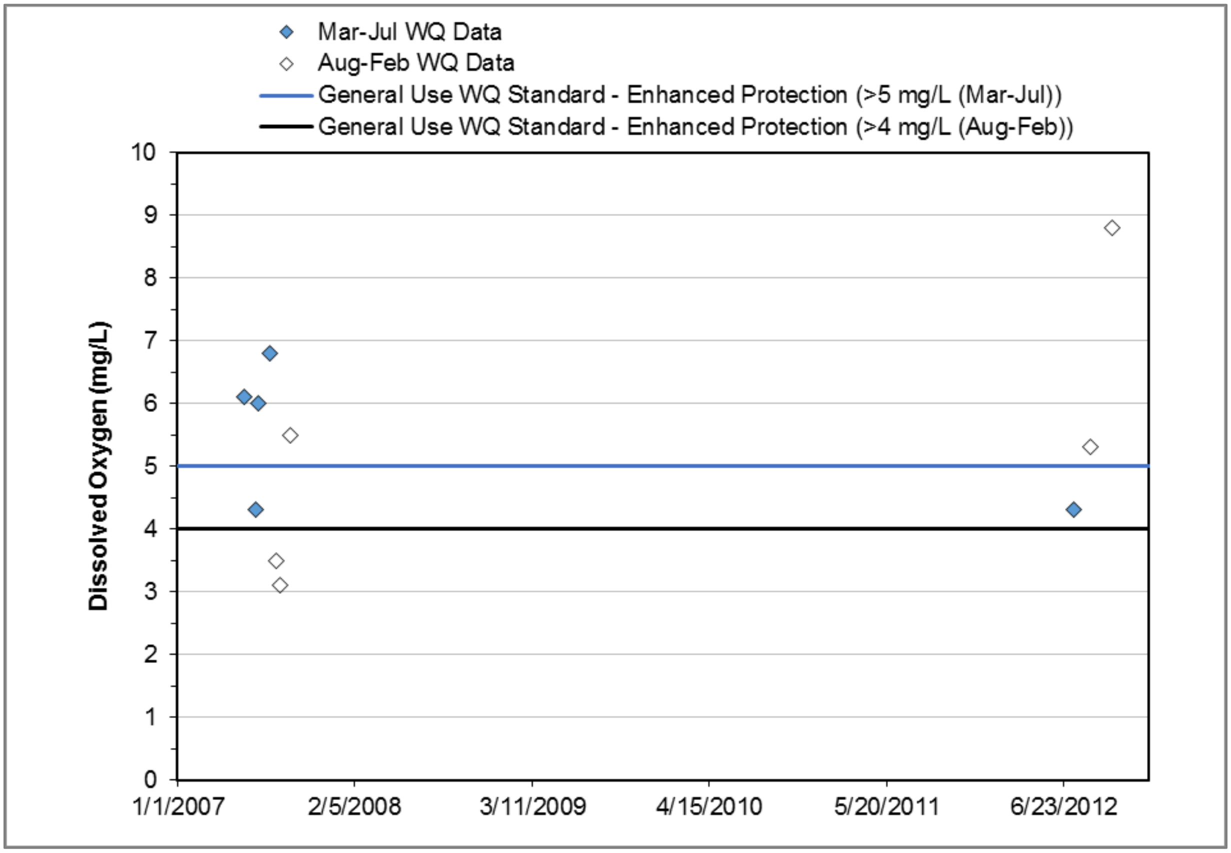

Figure 2. Dissolved oxygen water quality time series, Shoal Creek OI-05.

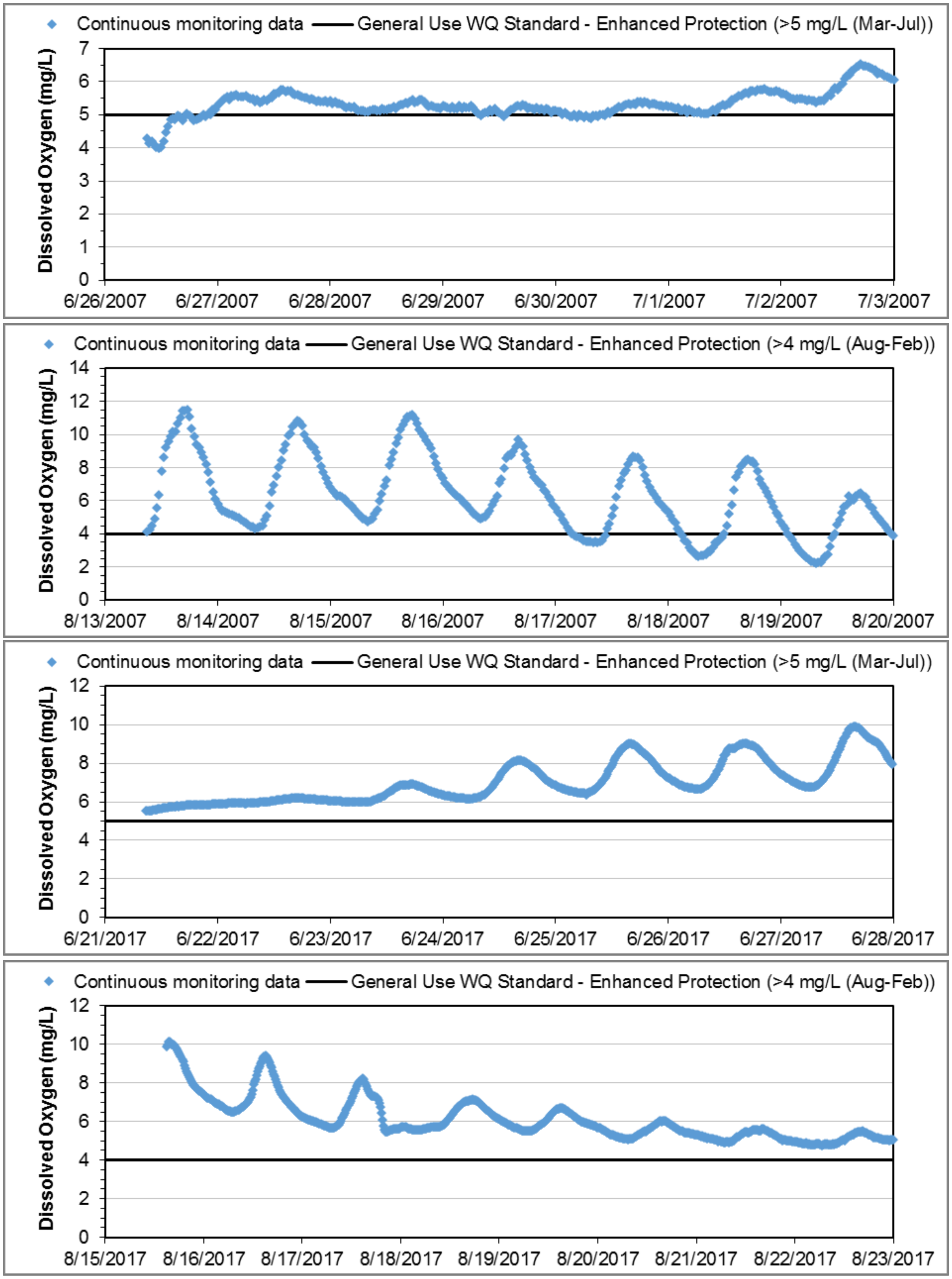

Figure 3. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-05 segment.

Further review of available data was conducted to determine the cause of impairment:

- **Point Sources:** The point source discharging into Shoal Creek is downstream from the monitoring station (OI-05) and is therefore not contributing to the impairment.

- **Eutrophication:** Available phosphorus data were evaluated to determine if eutrophication was contributing to low dissolved oxygen conditions; however, no eutrophication relationship exists between high levels of phosphorus and low levels of dissolved oxygen (Figure 4).

Although the impairment has been verified, a strong link to a pollutant is not present and there are no point sources contributing to the impairment that has been assessed based on data at OI-05.

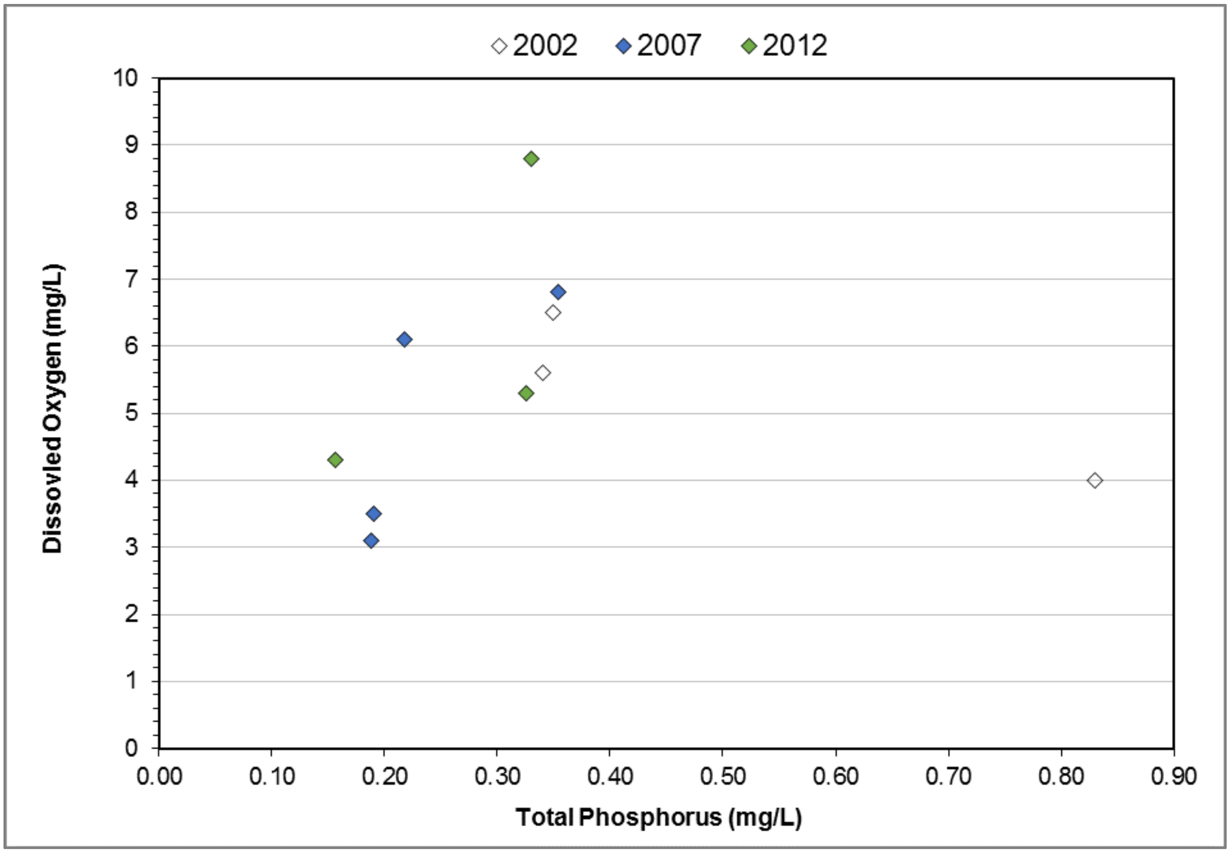

Figure 4. Total phosphorus verse dissolved oxygen, Shoal Creek OI-05.

4.2 Shoal Creek (OI-13)

Shoal Creek segment OI-13 is listed as impaired for aquatic life due to dissolved oxygen. One IEPA sampling site (OI-13) was identified on the segment. Data collection between 2007–2016 does not indicate impairment in the segment (Figure 5); however, due to the small sample size, additional data are needed to verify impairment.

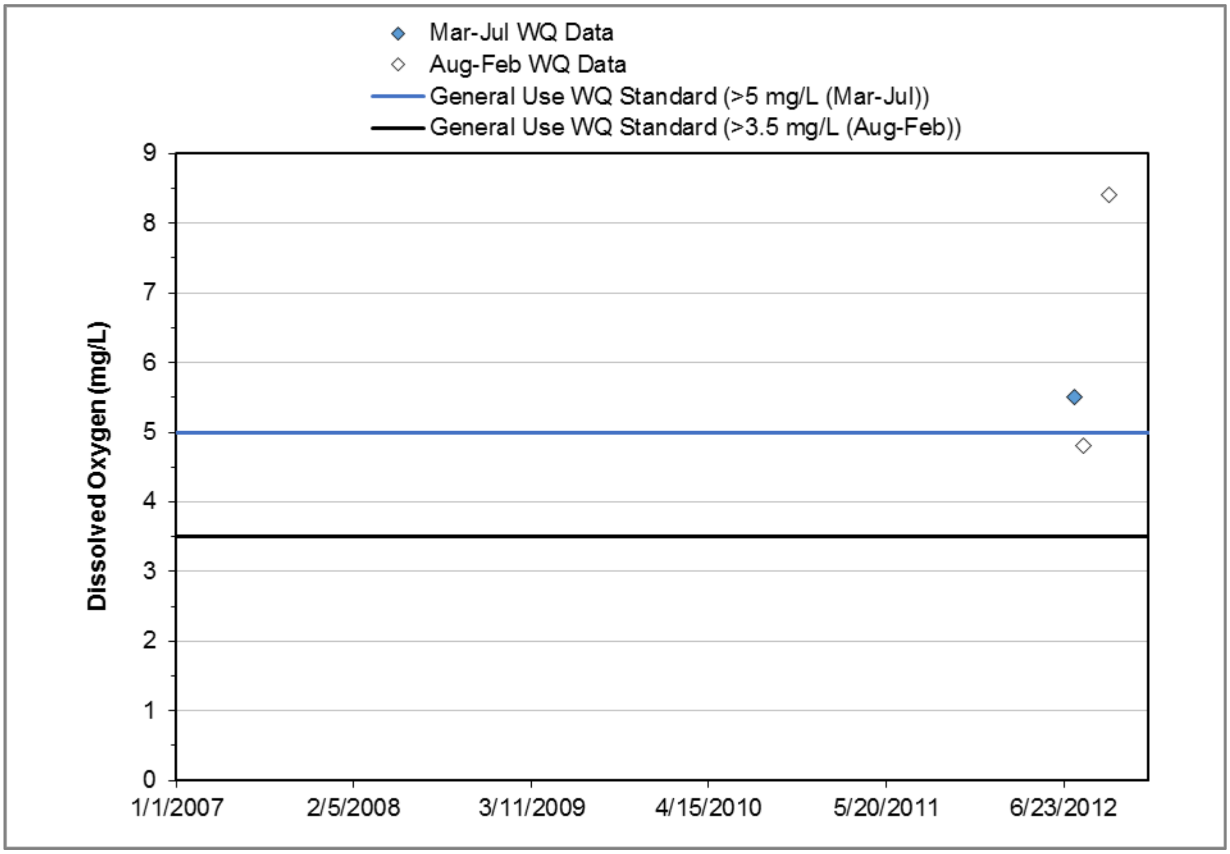

Figure 5. Dissolved oxygen water quality time series, Shoal Creek OI-13.

4.3 Shoal Creek (OI-15)

Shoal Creek segment OI-15 is listed as impaired for aquatic life due to dissolved oxygen. One IEPA sampling site was identified on the segment, OI-15. Data collection between 2007–2012 (Figure 6) and continuous data from June and August 2017 (Figure 7) do not indicate impairment. While the data do not show impairment, the assessment is still undergoing quality control review.

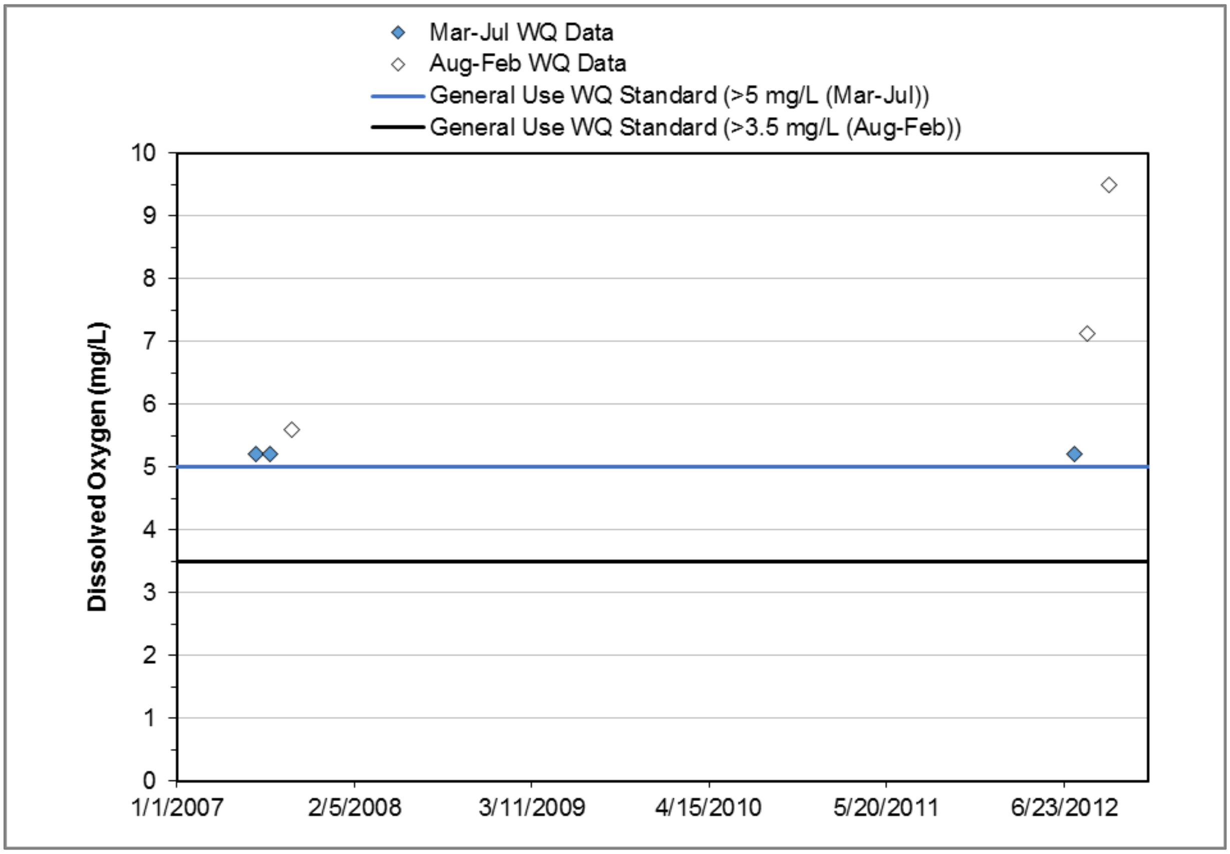

Figure 6. Dissolved oxygen water quality time series, Shoal Creek OI-15.

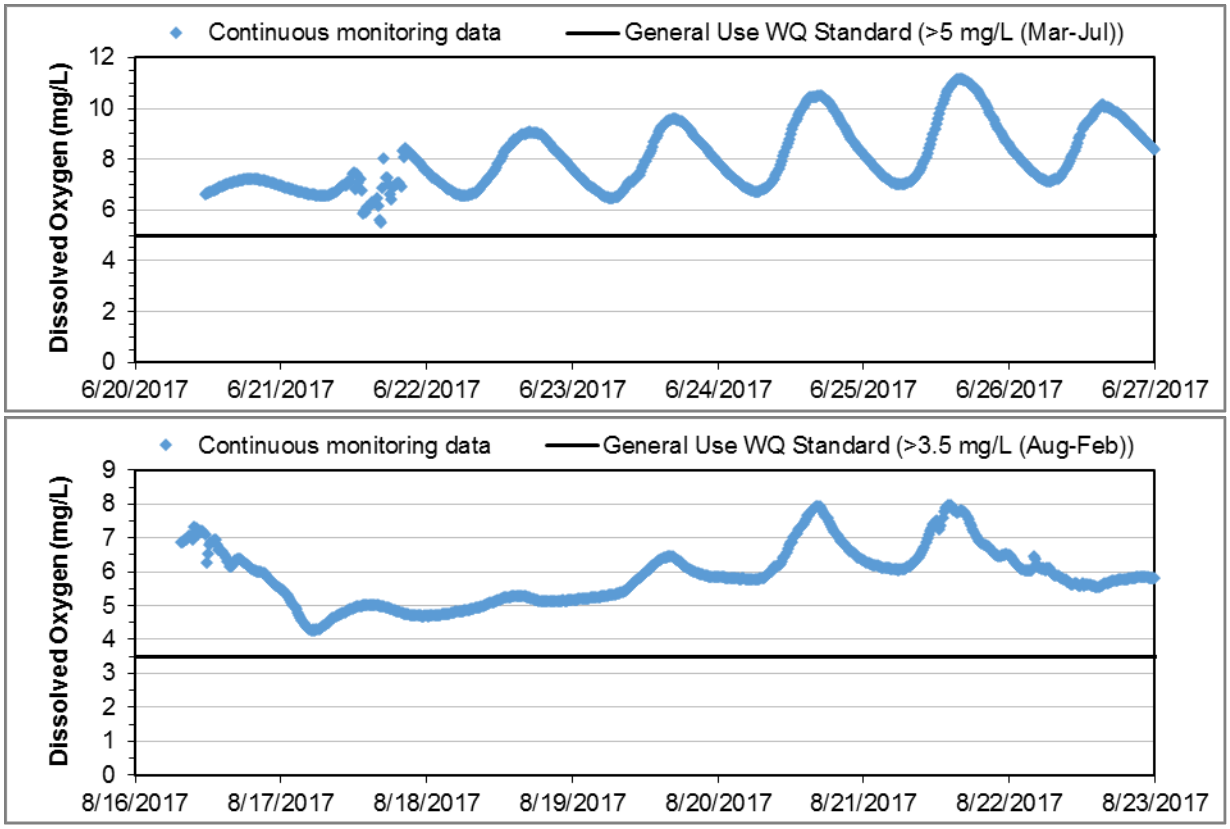

Figure 7. Continuous water quality time series for dissolved oxygen, Shoal Creek OI-15 segment.

5. TMDL Methods and Data Needs

The first stage of this project assesses available data followed by evaluation of their credibility. The types of data available, their quantity and quality, and their spatial and temporal coverage relative to impaired segments or watersheds drive the approaches used for TMDL model selection and analysis. Credible data are those that meet specified levels of data quality, with acceptance criteria defined by measurement quality objectives, specifically their precision, accuracy, bias, representativeness, completeness, and reliability. The following sections describe the methods that will be used to derive TMDLs and the additional data needed to develop credible TMDLs.

5.1 TMDL Methods

TMDLs are proposed for segments with verified impairments and known pollutants (Table 4). If point sources are not present and if there is a correlation with eutrophication (i.e., phosphorus concentration or high levels of algae and/or plant growth), a duration curve approach is suggested to develop a phosphorus TMDL. The phosphorus target will be derived from the relationship between phosphorus and dissolved oxygen in the impaired stream. TMDLs are not proposed for dissolved oxygen impairments that are not affected by point sources and do not show a correlation with eutrophication. In these cases, it is assumed that the cause of impairment is non-pollutant based (e.g., the effect of lack of re-aeration in low-gradient streams or the effect of hydromodification).

Table 4. Proposed model summary

Name	Segment ID	Designated Uses	TMDL Parameter(s)	Proposed Model	Proposed Pollutant
Shoal Creek	OI-05	Aquatic life	Dissolved Oxygen	4C classification	Non-pollutant
Shoal Creek	OI-13	Aquatic life	Dissolved Oxygen	Load duration curve or 4C classification, pending impairment verification	Phosphorus or non-pollutant, pending impairment verification

The primary benefit of duration curves in TMDL development is to provide insight regarding patterns associated with hydrology and water quality concerns. The duration curve approach is particularly applicable because water quality is often a function of stream flow. For instance, sediment concentrations typically increase with rising flows as a result of factors such as channel scour from higher velocities. Other parameters, such as chloride, may be more concentrated at low flows and more diluted by increased water volumes at higher flows. The use of duration curves in water quality assessment creates a framework that enables data to be characterized by flow conditions. The method provides a visual display of the relationship between stream flow and water quality.

Allowable pollutant loads have been determined through the use of load duration curves. Discussions of load duration curves are presented in *An Approach for Using Load Duration Curves in the Development of TMDLs* (U.S. EPA 2007). This approach involves calculating the allowable loadings over the range of flow conditions expected to occur in the impaired stream by taking the following steps:

1. A flow duration curve for the stream is developed by generating a flow frequency table and plotting the data points to form a curve. The data reflect a range of natural occurrences from extremely high flows to extremely low flows.

2. The flow curve is translated into a load duration (or TMDL) curve by multiplying each flow value (in cubic feet per second) by the water quality standard/target for a contaminant (mg/L), then multiplying by conversion factors to yield results in the proper unit (i.e., pounds per day). The resulting points are plotted to create a load duration curve.

3. Each water quality sample is converted to a load by multiplying the water quality sample concentration by the average daily flow on the day the sample was collected. Then, the individual loads are plotted as points on the TMDL graph and can be compared to the water quality standard/target, or load duration curve.

4. Points plotting above the curve represent deviations from the water quality standard/target and the daily allowable load. Those plotting below the curve represent compliance with standards and the daily allowable load. Further, it can be determined which locations contribute loads above or below the water quality standard/target.

5. The area beneath the TMDL curve is interpreted as the loading capacity of the stream. The difference between this area and the area representing the current loading conditions is the load that must be reduced to meet water quality standards/targets.

6. The final step is to determine where reductions need to occur. Those exceedances at the right side of the graph occur during low flow conditions, and may be derived from sources such as illicit sewer connections. Exceedances on the left side of the graph occur during higher flow events, and may be derived from sources such as runoff. Using the load duration curve approach allows Illinois EPA to

determine which implementation practices are most effective for reducing loads on the basis of flow regime.

Water quality duration curves are created using the same steps as those used for load duration curves except that concentrations, rather than loads, are plotted on the vertical axis. Flows are categorized into the following five hydrologic zones (U.S. EPA 2007):

- High flow zone: stream flows that plot in the 0 to 10-percentile range, related to flood flows
- Moist zone: flows in the 10 to 40-percentile range, related to wet weather conditions
- Mid-range zone: flows in the 40 to 60-percentile range, median stream flow conditions
- Dry zone: flows in the 60 to 90-percentile range, related to dry weather flows
- Low flow zone: flows in the 90 to 100-percentile range, related to drought conditions

The duration curve approach helps to identify the issues surrounding the impairment and to roughly differentiate among sources. Table 5 summarizes the general relationship among the five hydrologic zones and potentially contributing source areas (the table is not specific to an individual pollutant). For example, the table indicates that impacts from point sources are usually most pronounced during dry and low flow zones because there is less water in the stream to dilute their loads. In contrast, impacts from stormwater are most pronounced during moist and high flow zones due to increased overland flow from stormwater source areas during rainfall events.

Table 5. Relationship between duration curve zones and contributing sources

Contributing source area	Duration Curve Zone				
	High	Moist	Mid-range	Dry	Low
Point source				M	H
Livestock direct access to streams				M	H
On-site wastewater systems	M	M-H	H	H	H
Stormwater: Impervious		H	H	H	
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	

Note: Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low).

The load reduction approach also considers critical conditions and seasonal variation in the TMDL development as required by the Clean Water Act and U.S. EPA's implementing regulations. Because the approach establishes loads on the basis of a representative flow regime, it inherently considers seasonal variations and critical conditions attributed to flow conditions. An underlying premise of the duration curve approach is correlation of water quality impairments to flow conditions. The duration curve alone does not consider specific fate and transport mechanisms, which may vary depending on watershed or pollutant characteristics.

5.2 Additional Data Needs

Data satisfy two key objectives for Illinois EPA, enabling the agency to make informed decisions about the resource. These objectives include developing information necessary to:

- Determine if the impaired areas are meeting applicable water quality standards for their respective designated use(s)

- Support modeling and assessment activities required to allocate pollutant loadings for all impaired areas where water quality standards are not being met

Additional data may be needed to verify impairment, understand probable sources, calculate reductions, develop calibrated water quality models, and develop effective implementation plans. Table 6 summarizes the additional data needed for each impaired segment.

Table 6. Additional data needs

Name	Segment ID	Designated Uses	TMDL Parameters	Additional Data Needs
Shoal Creek	OI-05	Aquatic Life	Dissolved Oxygen	To determine relationship with eutrophication
Shoal Creek	OI-13	Aquatic Life	Dissolved Oxygen	To verify impairment and determine relationship with eutrophication
All	All	All	All	Implementation plan development

Specific data needs include:

Additional data collection on Shoal Creek (OI-05)—If additional data are necessary for 4C classification, collect DO, chlorophyll-*a*, and TP grab samples at station OI-05; two samples per day (one per day in the early morning) on three separate sampling days, during the warm summer months and during low flows.

Additional data collection on Shoal Creek (OI-13)—To verify impairment, preferably collect continuous dissolved oxygen data at OI-13 for 7 days during low flow conditions. Alternatively, collect DO, chlorophyll-*a*, and TP grab samples at station OI-13; two samples per day (one per day in the early morning) on three separate sampling days, during the warm summer months and during low flows. This grab sampling will also satisfy the monitoring needs to determine the relationship with eutrophication and evaluate 4C classification.

Additional field-based monitoring–Further in-field assessment can help to better determine the sources of impairments and develop an effective TMDL implementation plan. Additional monitoring for impaired waterbodies includes:

- Wind shield surveys
- Streambank survey and stream assessment for Shoal Creek (OI-05 and OI-13) and associated pollutants (phosphorus or non-pollutant, pending TMDL approach)
- Farmer/landowner surveys
- Word of mouth and in-person conversations with local stakeholders and landowners

6. Public Participation

A public meeting was held on December 12, 2018 at the Carlyle Lake Visitor Center in Carlyle, IL to present the Stage 1 report and findings. A public notice was placed on the Illinois EPA website. There were many stakeholders present including representatives from the Army Corps of Engineers, the Kaskaskia Watershed Association, Original Kaskaskia Area Wilderness, Inc., and others. The public comment period closed on January 12, 2019. No written comments were provided on the draft Stage 1 report.

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Appendix B – Stage 2 Laboratory Results

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	MFS	Lab Sample ID:	**19I0970-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 15:45
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/21/19 10:00
Units:	mg/L	Analyzed:	10/22/19 10:15

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.246**	Q	0.0050	0.0042

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Reported:
10/29/19 14:59

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

Q	Maximum holding time exceeded.
ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:59

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS/VIT	Lab Sample ID:	**19I0992-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 15:10
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	100	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	09/30/19 12:01
Units:	ug/L	Analyzed:	10/03/19 10:31

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**32.0**		0.50	
Chlorophyll-A (unco)	**37.5**		0.50	
Chlorophyll-B	**1.25**		0.50	
Chlorophyll-C	**4.05**		0.50	
Pheophytin-A	**7.21**		0.50	

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Reported:

10/15/19 11:21

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/15/19 11:21

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS/VIT	Lab Sample ID:	**19I0994-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 11:40
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	09/30/19 12:01
Units:	ug/L	Analyzed:	10/03/19 10:31

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**18.7**		0.50	
Chlorophyll-A (unco)	**22.2**		0.50	
Chlorophyll-B	**0.97**		0.50	
Chlorophyll-C	**1.99**		0.50	
Pheophytin-A	**4.67**		0.50	

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Reported:
10/15/19 11:21

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702   217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND   Analyte NOT DETECTED at or above the method detection limit

*   Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/15/19 11:21

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702   217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19I0995-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 15:45
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	09/30/19 12:01
Units:	ug/L	Analyzed:	10/03/19 10:31

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**129**		0.50	
Chlorophyll-A (unco)	**140**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**20.2**		0.50	
Pheophytin-A	**9.75**		0.50	

Reported:
10/15/19 11:20

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/15/19 11:20

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702   217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19I0997-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 12:20
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	100	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	09/30/19 12:01
Units:	ug/L	Analyzed:	10/03/19 10:31

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**254**		0.50	
Chlorophyll-A (unco)	**286**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**38.1**		0.50	
Pheophytin-A	**37.9**		0.50	

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Reported:
10/15/19 11:20

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/15/19 11:20

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	MFS	Lab Sample ID:	**19J0089-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 12:02
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/22/19 09:00
Units:	mg/L	Analyzed:	10/22/19 17:18

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.196**		0.0050	0.0042

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Reported:
10/29/19 14:57

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:57

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL
Client Sample ID:	TOTAL	Collected By:	MFS	Lab Sample ID:	**19J0090-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 15:10
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/22/19 09:00
Units:	mg/L	Analyzed:	10/22/19 17:19

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.187**		0.0050	0.0042

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	VIT	Lab Sample ID:	**19J0091-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 12:48
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/22/19 09:00
Units:	mg/L	Analyzed:	10/22/19 17:19

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.116**		0.0050	0.0042

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	VIT	Lab Sample ID:	**19J0092-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 16:00
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/24/19 11:00
Units:	mg/L	Analyzed:	10/24/19 15:04

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.107**		0.0050	0.0042

Reported:
11/07/19 15:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Scott Clark
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	2.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
11/07/19 15:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19J0104-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 12:02
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	150	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method: 10200 H

Units: ug/L

Prepared: 10/07/19 14:15

Analyzed: 10/10/19 10:23

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**19.6**		0.50	
Chlorophyll-A (unco)	**30.8**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	ND		0.50	
Pheophytin-A	**16.6**		0.50	

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19J0105-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 15:10
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	150	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	10/07/19 14:15
Units:	ug/L	Analyzed:	10/10/19 10:23

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**23.1**		0.50	
Chlorophyll-A (unco)	**27.4**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**0.73**		0.50	
Pheophytin-A	**5.52**		0.50	

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Reported:

10/16/19 14:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	VIT	Lab Sample ID:	**19J0106-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 12:48
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method: 10200 H

Units: ug/L

Prepared: 10/07/19 14:15

Analyzed: 10/10/19 10:23

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**16.0**		0.50	
Chlorophyll-A (unco)	**19.4**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**0.72**		0.50	
Pheophytin-A	**4.54**		0.50	

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	VIT	Lab Sample ID:	**19J0107-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/30/19 16:00
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H		Prepared:	10/07/19 14:15
Units:	ug/L		Analyzed:	10/10/19 10:23

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**14.7**		0.50	
Chlorophyll-A (unco)	**16.0**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**0.75**		0.50	
Pheophytin-A	**1.20**		0.50	

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/02/19 11:00 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190930INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/16/19 14:35

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	MFS	Lab Sample ID:	**19J0358-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	10/08/19 11:53
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/29/19 08:00
Units:	mg/L	Analyzed:	10/29/19 16:10

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.136**		0.0050	0.0042

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Reported:
11/07/19 15:34

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

* Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
11/07/19 15:34

Illinois Environmental Protection Agency Laboratory

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LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	MFS/VIT	Lab Sample ID:	**19J0359-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	10/08/19 14:40
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/29/19 08:00
Units:	mg/L	Analyzed:	10/29/19 16:10

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.134**		0.0050	0.0042

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Reported:
11/07/19 15:34

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
11/07/19 15:34

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS/CDT	Lab Sample ID:	**19J0360-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	10/07/19 14:40
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method:	10200 H	Prepared:	10/16/19 08:09
Units:	ug/L	Analyzed:	10/17/19 10:18

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**9.34**		0.50	
Chlorophyll-A (unco)	**12.5**		0.50	
Chlorophyll-B	**0.86**		0.50	
Chlorophyll-C	ND		0.50	
Pheophytin-A	**4.67**		0.50	

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19J0361-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	10/07/19 11:53
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method: 10200 H — Prepared: 10/16/19 08:09

Units: ug/L — Analyzed: 10/17/19 10:18

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**5.34**		0.50	
Chlorophyll-A (unco)	**7.98**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	ND		0.50	
Pheophytin-A	**4.00**		0.50	

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory

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LABORATORY RESULTS

Station Code:	OI-05			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:56

Illinois Environmental Protection Agency Laboratory

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LABORATORY RESULTS

Station Code: OI-13
Received : 10/08/19 16:20 by Amber Royster

Waterbody Name: SHOAL CREEK
County: CLINTON
Temperature C:

Funding Code: WP06
Monitoring Unit: TMDL

Trip ID: 20191007INHS
Visit Number: 001
Monitoring Program: TMDL

Client Sample ID: CHLOROPHYLL
Collected By: VIT
Lab Sample ID: **19J0364-01**

Sample Medium: Water
PWS Intake:
Date/Time Collected: 10/08/19 13:38

Sample Fraction: Total
Chlorophyll volume filtered (ml): 200
Sample Depth:

Chlorophyll by Standard Method 10200 H

Method: 10200 H
Prepared: 10/16/19 08:09

Units: ug/L
Analyzed: 10/17/19 10:18

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**4.00**		0.50	
Chlorophyll-A (unco)	**5.09**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	**0.56**		0.50	
Pheophytin-A	**1.60**		0.50	

Reported:
10/29/19 14:55

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:55

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702   217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	CHLOROPHYLL	Collected By:	MFS	Lab Sample ID:	**19J0365-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	10/08/19 9:20
Sample Fraction:	Total	Chlorophyll volume filtered (ml):	200	Sample Depth:	

Chlorophyll by Standard Method 10200 H

Method: 10200 H   Prepared: 10/16/19 08:09

Units: ug/L   Analyzed: 10/17/19 10:18

Analyte	Result	Qualifier	Reporting Limit	MDL
Chlorophyll-A (corr)	**2.67**		0.50	
Chlorophyll-A (unco)	**3.48**		0.50	
Chlorophyll-B	ND		0.50	
Chlorophyll-C	ND		0.50	
Pheophytin-A	**1.07**		0.50	

Reported:
10/29/19 14:55

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	10/08/19 16:20 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20191007INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND Analyte NOT DETECTED at or above the method detection limit

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Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:55

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL
Client Sample ID:	TOTAL	Collected By:	MFS/VIT	Lab Sample ID:	**19I0967-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/24/19 11:40
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/21/19 10:00
Units:	mg/L	Analyzed:	10/22/19 11:06

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.192**		0.0050	0.0042

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Reported:
10/29/19 15:00

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 15:00

Illinois Environmental Protection Agency Laboratory
825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL
Client Sample ID:	TOTAL	Collected By:	MFS/VIT	Lab Sample ID:	**19I0968-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 15:10
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/21/19 10:00
Units:	mg/L	Analyzed:	10/22/19 10:14

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.214**	Q	0.0050	0.0042

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Reported:
10/29/19 14:59

LABORATORY RESULTS

Station Code:	OI-05			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

Q	Maximum holding time exceeded.
ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:59

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Client Sample ID:	TOTAL	Collected By:	MFS	Lab Sample ID:	**19I0969-01**
Sample Medium:	Water	PWS Intake:		Date/Time Collected:	09/23/19 12:20
Sample Fraction:	Total	Chlorophyll volume filtered (ml):		Sample Depth:	

Phosphorus, All Forms, Colorimetric, Automated, by EPA Method 365.1

Method:	EPA 365.1	Prepared:	10/21/19 10:00
Units:	mg/L	Analyzed:	10/22/19 10:14

Analyte	Result	Qualifier	Reporting Limit	MDL
Phosphorus as P	**0.236**	Q	0.0050	0.0042

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Reported:

10/29/19 14:59

Illinois Environmental Protection Agency Laboratory

825 N. Rutledge Springfield, Illinois 62702 217.782.9780

LABORATORY RESULTS

Station Code:	OI-13			Received :	09/25/19 08:45 by Amber Royster
Waterbody Name:	SHOAL CREEK	County:	CLINTON	Temperature C:	3.00
Funding Code:	WP06			Monitoring Unit:	TMDL
Trip ID:	20190923INHS	Visit Number:	001	Monitoring Program:	TMDL

Notes and Definitions

Q	Maximum holding time exceeded.
ND	Analyte NOT DETECTED at or above the method detection limit
*	Non-NELAP accredited

Report Authorized by:

Tom Weiss
Laboratory Manager

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Reported:
10/29/19 14:59

Appendix C – Watershed Protection Plan Comments and Responses

Responsiveness Summary

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

1. Upper Kaskaskia River/Lake Fork Watershed;
2. Middle Kaskaskia River/Carlyle Lake Watershed;
3. Lower Kaskaskia River–II* Watershed;
4. East Fork Kaskaskia River/Farina Lake Watershed;
5. Crooked Creek/Lost Creek Watershed, and;
6. Shoal Creek–II* Watershed.

*II – An earlier TMDL Report has been developed for the watershed

The responsiveness summary responds to questions and comments received during the Stage 3 public meeting comment period from January 11, 2023, through February 10, 2023.

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. The **Kaskaskia River Watershed's** TMDL reports contain plans 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 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 six watersheds targeted for TMDL / WPP development are as follows:

- **Upper Kaskaskia River/Lake Fork Watershed**
  - *Location*
    - Central Illinois
  - *Headwaters (Kaskaskia)*
    - Along Interstate 74, between Champaign and Mahomet, IL.
  - *Headwaters (Lake Fork)*
    - Southwest of Bondville, IL, in Champaign County.
  - *Course*
    - Lake Fork joins the Upper Kaskaskia River upstream of Shelbyville Lake and continues to the southwest from the Shelbyville Dam. The Kaskaskia River eventually joins the Mississippi River south of St. Louis, Missouri.
  - *Downstream End*
    - Confluence of the Kaskaskia River with Becks Creek.

- **Middle Kaskaskia River/Carlyle Lake Watershed**
  - *Location*
    - Central Illinois
  - *Headwaters*
    - Northeastern Fayette County, approximately 20 miles northeast of Vandalia, IL, the county seat.
  - *Course*
    - The Kaskaskia River then flows along the eastern edge of Vandalia on its way to and through Carlyle Lake at the downstream end of the watershed. The TMDL watershed covers 946 square miles. Major tributaries of the river include Big Creek, Ramsey Creek, Hickory Creek, and Hurricane Creek.
  - *Downstream End*
    - Carlyle Dam, south end of Carlyle Lake, near Carlyle, IL.

- **Lower Kaskaskia River–II Watershed**
  - *Location*
    - Southwestern Illinois
  - *Headwaters*
    - Confluence of the Kaskaskia River and Shoal Creek, approximately 13-14 miles east of Mascoutah, IL, 5 miles northwest of Okawville, IL.
  - *Course*
    - Southwest via New Athens, IL to where the Kaskaskia River joins the Mississippi River.
  - *Downstream End*
    - At the Mississippi River south of St. Louis, near Sainte Genevieve, MO.

- **East Fork Kaskaskia River/Farina Lake Watershed**
  - *Location*
    - Central Illinois
  - *Headwaters (East Fork)*
    - Northeast of Farina, IL (southeastern Fayette County).
  - *Headwaters (North Fork)*
    - South of St. Peter, IL (southeastern Fayette County).
  - *Course*
    - Both forks, alongside their tributaries, continue in a general west-southwest direction until their confluence with the Kaskaskia River at Carlyle Lake.
  - *Downstream End*
    - Carlyle Lake on opposite side of reservoir from Keyesport, IL.

- **Crooked Creek/Lost Creek Watershed**
  - *Location*
    - Southern Illinois
  - *Headwaters*
    - Just north and northwest of the city of Salem, IL.
  - *Course*
    - Crooked Creek and Lost Creek flow westward toward their confluence south of unincorporated Posey, continuing west as Crooked Creek, joining the Kaskaskia River downstream of Carlyle Lake near Bartelso, IL
  - *Downstream End*
    - Confluence of the Kaskaskia River and Shoal Creek.

- **Shoal Creek–II Watershed**
  - *Location*
    - *Southwestern Illinois*
  - *Headwaters*
    - *Begin in northern Montgomery County (and tiny portions of southern Christian County), north and northeast of the cities of Litchfield and Hillsboro, IL.*
  - *Course*
    - *With a drainage area of 310 square miles,* the watershed includes portions of Bond, Montgomery, Clinton, Madison, and Macoupin counties, and the water flows generally southward towards southwestern Clinton County and the confluence with the Kaskaskia River.
  - *Downstream End*
    - *Confluence of Shoal Creek into the Kaskaskia River, near Interstate 64, downstream of Carlyle Lake.*

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

- **Upper Kaskaskia River/Lake Fork Watershed**
  - *Chloride TMDLs for the following Lake Fork waterbody segments:*
    - IL_OW-01
    - IL_OW-02

- **Middle Kaskaskia River/Carlyle Lake Watershed**
  - *Fecal Coliform TMDLs for the following Kaskaskia River waterbody segments:*
    - IL_O-08
    - IL_O-38
  - *A phosphorus (Total) TMDL for Carlyle Lake waterbody segment:*
    - IL_ROA

- **East Fork Kaskaskia River/Farina Lake Watershed**
  - *Atrazine and Terbufos TMDLs for North Fork Kaskaskia River waterbody segment:*
    - IL_OKA-01

- **Lower Kaskaskia River–II Watershed**
  - *A WPP to address Iron for the following Kaskaskia River waterbody segments:*
    - IL_O-20
    - IL_O-30

- **Crooked Creek/Lost Creek Watershed**
  - *Included a WPP to address Dissolved Oxygen, pH, and Simazine for the following waterbody segments:*
    - IL_O-25 (Kaskaskia River)
    - IL_OJ-11 (Crooked Creek)
    - IL_OJBA (Prairie Creek)
    - IL_OJF (Raccoon Creek)
    - IL_ROR (Salem Lake)

- **Shoal Creek–II Watershed**
  - *Included a WPP to address Dissolved Oxygen for the following Shoal Creek waterbody segments:*
    - IL_OI-05
    - IL_OI-13
    - IL_OI-15

These TMDLs/WPPs address impairment listings placed in the 2016 Illinois Integrated Water Quality Report, and Section 303(d) List.

Public Meetings

The Stage-1 public meeting was held on December 12, 2018, at the Carlyle Lake Visitor Center in Carlyle, IL, and comments received during the subsequent Stage 1 public notice period were addressed and incorporated in the Stage-3 TMDL report.

The Stage-3 public meeting was conducted virtually using WebEx on Wednesday, January 11, 2023. The meeting started at 10:00 am and concluded at 12:00 pm. Approximately 30 people attended the meeting, with the public notice period remaining open for 30 days until midnight of February 10, 2023. The draft Stage-3 TMDL report was available for review and comment on the Illinois EPA's webpage: **Public Notices (illinois.gov) – https://epa.illinois.gov/public-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 Period

1. I have looked over the papers and it appears that segments IL_O-97 and IL_O-03 were delisted:

A. Based on a few days of data that did not show a DO violation. Is that correct?
B. Attached please see USGS data taken at New Athens 2017 until data stopped being collected. It is clear both that there have been a number DO violations and supersaturation.
C. Does Illinois EPA and Geosyntec [sic- Tetra Tech] totally ignore the USGS data or am I missing something here?

Response:

A. Illinois EPA recommends that the waterbody segment IL_O-97 be delisted from the 303(d)list in the next cycle of the Integrated Report (IR) for low dissolved oxygen (DO) as available data do not show impairment. Data collected by Illinois EPA from 2007 through 2012 meets the Illinois DO water quality standards. This segment was evaluated in the Stage 1 Report and was recommended for delisting. A waterbody segment (reach) is considered impaired due to dissolved oxygen if greater than 10 percent of the samples violate the standard. In this case, less than 10 percent of the samples violated the standard and therefore it is recommended that the segment be delisted for aquatic life.

USGS gage DO data indicate that waterbody segment IL_O-03 is impaired due to low DO and the cause of impairment is not a pollutant, based on the Stage 1, and 2 study for this watershed. Therefore, it is not appropriate to develop a TMDL to address the impairment, instead, the low DO impairment for segment IL_O-03 is recommended for recategorization to Category 4C (impairment due to non-pollutant that will not be addressed by a TMDL).

The above delisting and recategorization recommendations are proposed to be implemented in the next cycle of the Illinois IR and Section 303(d) list (Draft 2024 IR).

B-C. As discussed in Section 2.3 of the Lower Kaskaskia River-II Watershed WPP, data collected for waterbody segment IL_O-03 by Illinois EPA and the U.S. Geological Survey (USGS) in 2007 through 2016 do not meet Illinois's water quality standards for DO (i.e., this segment is impaired).

A USGS gage is on the Kaskaskia River at New Athens (05595000) on impaired segment IL_O-03, and the 2015 through 2016 DO data were summarized in the Stage 1 report (Appendix A). A new figure (Figure 6) was inserted in Section 2.3.2 that summarizes the 2015 to 2021 DO data at this gage; these data also indicate impairment. The DO concentration data collected by USGS at gage 05595000 in 2007 through 2016 show supersaturation and large diel swings, which may be indicative of nutrient eutrophication. However, continuous DO data collected by Illinois EPA in 2012 (7-days in July and 7-days in August) and 2019 (7-days in September) at site IL_O-03 (collocated with gage 05595000) do not show supersaturation or large diel swings.

In addition to the above, Illinois EPA collected total phosphorus (TP) and chlorophyll-*a* data at site IL_O-03 in 2002 (n=3) and 2007 (n=3) and collected only TP data in 2012 (n=2). Paired Total Phosphorus (TP)/DO and chlorophyll-*a*/DO data were regressed to determine if DO was related to TP or chlorophyll-*a*, which can be indicators of eutrophication. No relationships exist at site IL_O-03. As such, these data are not indicative of eutrophication as the cause of low DO concentration.

Widening of the Kaskaskia River, due to bank erosion, may also contribute to low DO. As the channel widens, the surface area of the water exposed to sunlight increases, which can increase the temperature of the water. As water temperature increases, DO concentration decreases. The CWA and U.S. EPA regulation do not support TMDL development to address channel widening and water temperature increases. However, the CWA encourages implementation of BMPs to limit or prevent bank erosion that causes channel-widening. Illinois EPA also encourages channel restoration activities to restore a more natural channel.

The QUAL2K modeling discussed in the Stage 1 report (Appendix A) indicated that increasing reaeration and decreasing sediment oxygen demand (SOD) are necessary to increase DO concentrations instream. Organic matter in the riverbed has likely built-up over the course of decades and its decomposition is consuming water column DO at a rate that is out of balance with reaeration occurring with the atmosphere at the air/water interface. The CWA and U.S. EPA regulations do not support TMDL development to address riverbed organic matter.

2. At one time the river segment IL_O-20 to IL_O-03 (from Venedy Station to New Athens) was designated 303(d) due to excessive levels of: (1) Manganese and (2) Mercury, plus high (3) turbidity. These results were also supported by a 6-year monitoring project through the Kaskaskia Watershed Association (testing 2x/year at approximately 0-91 and IL_O-03, i.e., Boat ramp access at Fayetteville & New Athens).

Then the Illinois EPA deferred creating a TMDL plan for these analytes at this location.

A. Can you tell me when this river segment will get a final TMDL & recommendations?

B. Can we still apply for a 303 (d) grant in 2023?

Response:

A. The Kaskaskia River waterbody segment IL_O-03 is still listed on the 303(d) list as impaired for sedimentation/siltation and mercury, and waterbody segment IL_O-20 is still listed for mercury. Illinois EPA developed TMDLs in 2012 to address the manganese impairments.

Manganese TMDLs were developed for four waterbody segments of the Kaskaskia River Watershed, including waterbody segments IL_O-03 and IL_O-20. Refer to approved TMDL reports in the *Lower Kaskaskia River Watershed Total Maximum Daily Load Report* (Illinois IEPA 2012).

Illinois EPA has not developed a TMDL for sedimentation/siltation for segment IL_O-03, as Illinois does not have a numeric criterion (i.e., water quality standard) for sedimentation siltation.

Illinois EPA has not developed mercury TMDLs for Kaskaskia River Watersheds. In order to develop a mercury TMDL, significant amount of monitoring data will be needed, and Illinois EPA has reached out to USEPA for support to develop a Statewide Mercury TMDL in the near future.

B. The CWA and Illinois EPA do not have a 303(d) grant program. However, Illinois EPA does administer the Section 319 Nonpoint Source Pollution (NPS) Control financial assistance Program, to support watershed planning and implementation efforts. The program can support local entities with technical and financial assistance to develop programs to implement NPS pollution control best management practices and outreach activities. Section 319 NPS applications are normally due August 1st of each year. For more information, visit the Agency's website at: https://epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources/grants.html

3. We are documenting SEVERE leaf-damage throughout the timber in this watershed due to herbicide drift of 2,4-Dichlorophenoxyacetic acid (2,4-D) and dicamba.

The Best Management practice of NO-TILL currently includes heavy use of 2,4-D and dicamba herbicides for "spring burndown" on NO-TILL fields. This heavy use of herbicide throughout the agriculture land occurs within the same week that trees (and many other plants) are leafing out and growing at their highest rate. Since 2,4-D and dicamba are growth stimulator hormones they exert a very detrimental effect on plants at spring leaf-out.

My request to you is that you should NOT recommend NO-TILL as a solution to erosion and high rates of sedimentation in the river segments, UNLESS Only Mechanical Methods will be used to Remove Unwanted Vegetation on Agricultural lands.

Response:

The following text was added to the conservation tillage subsection in Section 6.2.1 of the Lower Kaskaskia River-II Water Protection Plan:

Pesticide application at agricultural operations must comply with Illinois Department of Agriculture (IDOA) certification and licensing requirements. Several pesticides, including dicamba, have special application requirements. Pesticide applicators can obtain training materials from IDOA or the University of Illinois Extension Pesticide Safety Education Program.

4. Coal mining operations and mine waste adversely affects communities and waterways in the Shoal Creek and Kaskaskia River watersheds.

A. The commenter was disappointed "that coal mining was not listed as some of the point sources of contamination."
B. The delisting is premature because coal mining operations continue, and some such operations have expanded.
C. The commenter further states that coal mine operations contribute to erosion and increased sediment results in low DO.
D. The commenter also opposed Illinois EPA's approval of several NPDES permits for coal mining operations.

Response:

A. Illinois EPA develops TMDLs and WPPs to address specific pollutants and specific impairments in Illinois's 303(d) list. The environmental issues identified are beyond the scope of Illinois EPA's TMDL Program and therefore are not included in this study.

B. Illinois EPA recommends delisting of the waterbody segment based on the most recent data that indicated the Shoal Creek is meeting the Illinois's DO water quality standards.

C. The Shoal Creek WPP provides documentation of dissolved oxygen (DO) levels to support delisting and identifies and prioritizes best management practices (BMPs) to address anthropogenic activities that can contribute to low DO. Potential causes of decreased DO levels in the watershed include point sources (wastewater treatment plants and coal mine operations), and nonpoint sources, can often be linked to eutrophication (high levels of algae) and nutrient loading.

D. The Illinois EPA /BOW/Permit Section has issued NPDES permits for coal mine operations because the applicants provided information in the permit application forms to show the discharge from the treatment facilities will be in compliance with the Federal and Illinois Pollution Control Board Regulations (Title 35 Ill. Adm. Subpart A: NPDES Permits, Section 309).

5. The commenter discusses a chloride limit in an NPDES permit, chloride toxicity, and additional pollutants. The commenter stated that "Illinois EPA did not consider the interaction of chloride and other pollutants on increasing toxic cyano-bacteria and toxic methyl mercury in the surrounding waterways that endanger residents."

Response:

Per Illinois EPA's TMDL Program under the Clean Water Act (CWA), the Shoal Creek WPP focused on DO and potential causes of low DO, including nutrient eutrophication and organic enrichment. Chloride, methylmercury, and other pollutants are beyond the scope of the Shoal Creek WPP study.

6. A pipeline rupture, proposed legal action regarding mining operations, discharge of firefighting foam, a state lawsuit, a 2004 news report about drinking water contamination from mining operations, coal dust and leachate, fines paid by energy companies, a temperature limit in an NPDES permit, and more. The commenter attempted to link each issue with low DO in the Kaskaskia River watershed.

Response:

Illinois EPA develops TMDLs to address specific pollutants and specific impairments placed in Illinois's 303(d) list. The environmental issues identified are beyond the scope of this TMDL study.

7. The Shoal Creek WPP does not discuss the U.S. Army Corp of Engineers (USACE) operation of the Carlyle Lake and reservoir water releases. Rapid release of water from the dam at Carlyle Lake results in downstream bank erosion that contributes to degraded water quality. What is Illinois EPA's solution to this issue?

Response:

Operation of the Carlyle Lake Dam and water levels in Carlyle Lake is beyond the scope of this TMDL study.

The Clean Water Act and U.S. EPA regulations do not grant Illinois EPA authority to supersede the U. S Army Corp of Engineers with management of Carlyle Lake, including dam and reservoir operations. However, Illinois EPA has invited the USACE to participate in the development of TMDLs and WPPs.

The USACE manages Carlyle Lake according to the 2016 master plan that USACE developed. USACE periodically updates its master plans for the projects throughout the Kaskaskia River basin and USACE seeks public input for each master plan update.

For more information, refer to the Corp's master plan: https://www.mvs.usace.army.mil/Missions/Recreation/Carlyle-Lake/Carlyle-Lake-Master-Plan-Update/.

Illinois EPA encourages stakeholders, including the Kaskaskia River Watershed Association and local governments, to work with USACE to investigate and resolve this issue. Illinois EPA may also support development of a watershed-based plan through the

Section 319 NPS Pollution Control program to help address bank erosion and resulting degraded water quality.

8. Bank erosion in the Kaskaskia River, between Lake Shelbyville and Carlyle Lake, is the predominant source of phosphorus loading to Carlyle Lake. Additional details in the Middle Kaskaskia River/Carlyle Lake Watershed TMDL reports should be included regarding this issue.

Response:

Illinois EPA has developed a total phosphorus TMDL for Carlyle Lake in the watershed, and the implementation plan outlines best management practices to address the impairments, including bank erosion in the in the Kaskaskia River basin.

9. The Water Resources Development Act of 2007 and its funding authorization should be discussed in Section 8.4 of the Middle Kaskaskia River Watershed TMDL report. Section 5073 of this Act is about the Kaskaskia River watershed and includes a $20M authorization for implementation activities. The State of Illinois should provide the required matching funds to restart the study effort.

Response:

The following paragraph was appended to Section 8.4.2:

The Water Resources Development Act of 2007 (Public Law 110-114) reauthorized USACE to conduct flood control, navigation, and environmental studies and projects. Section 5073 authorized a study of the Kaskaskia River watershed (including the Middle Kaskaskia watershed), including the identification of critical projects.

The Water Resources Development Act of 2007 is published online: https://www.congress.gov/110/plaws/publ114/PLAW-110publ114.pdf.

The Water Resources Development Act of 2007 authorized but did not appropriate $20M of funding. For the $20M to become available, Congress would need to pass an appropriations bill and the President would need to sign that bill.

10. The U.S. Army Corp of Engineers (2003): *Bank Erosion and Historical River Morphology Study of the Kaskaskia, Shelbyville to Carlyle Lake* should be included in the TMDL report.

Response:

A summary of this study was added in Section 3.7 of the Middle Kaskaskia River and Carlyle Lake Watershed TMDL report. The summary was revised to read as follows:

- **Bank Erosion and Historical River Morphology Study of the Kaskaskia, Shelbyville to Carlyle Lake** (USACE 2003)

  This study analyzes the river evolution of the Middle Kaskaskia River and identifies mainstem bank erosion as a significant source of sediment to Carlyle Lake. Over two centuries, the Kaskaskia River meandering and sinuosity of the river have decreased while the river's width has increased, which contributes to increased sediment loading to Carlyle Lake. Sediment and flow delivery to the Kaskaskia River have increased due to land use change and increased precipitation.

11. Riparian buffers are effective in small streams but bank full flows in the mainstem Kaskaskia River can overpower and wash away riparian buffers. KWA wishes for this to be emphasized in the TMDL report.

Response:

The following was appended to Section 8.3.4 of the Middle Kaskaskia River and Carlyle Lake Watershed TMDL report:

Vegetated riparian buffers can be used to stabilize and restore streambanks. However, for larger rivers, like the Kaskaskia River, bank full and bank-overtopping flows can overwhelm riparian vegetation, and such flows can significantly erode riverbanks. During BMP planning phases, stakeholders will need to consider the feasibility of vegetated riparian buffers as the sole recommended BMP for specific streams and rivers.

12. The chloride impairments in Lake Fork (IL_OW-01 and IL_OW-02), within the Upper Kaskaskia and Lake Fork Watershed TMDL report, are based upon one exceedance of six samples collected in 2007-2012. Illinois EPA should collect additional samples to verify the impairment and include in the TMDL calculations.

Response:

The chloride monitoring data and impairment history has been documented in the TMDL Report as follow:

- In 2007-2012, one sample (August 1, 2012; 876 milligrams per liter [mg/L]) exceeded the chloride water quality standard (500 mg/L). A second sample (September 24, 2012; 487 mg/L) was close to but met the chloride standard. Finally, a new sample was collected on September 19, 2017, with a chloride result of 612 mg/L). Based on the above information, it was necessary to develop a chloride loading capacity analysis and to develop a TMDL at this time. The TMDL Implementation Plan has recommended that Chloride Monitoring be required as part of the TMDL Implementation Plan.

13. The commenter states that the 2012 season was a dry one, and Lake Fork ran dry and Illinois EPA should wait until data collected in 2022 are available before finishing the Upper Kaskaskia and Lake Fork Watershed TMDL report.

Response:
Illinois EPA developed the Chloride TMDLs for Lake Fork using the most recent available data. Chloride is a conservative pollutant and the critical conditions for chloride in Lake Fork are summer low-flow conditions. Samples collected in 2012 were during low-flow conditions, albeit some samples were collected in extreme low flow conditions.

Illinois EPA first listed Lake Fork (IL_OW-01 and IL_OW-02) for chloride in Illinois's 2016 303(d) list, based in part, upon data collected in 2012. After data collected in 2017 confirmed impairment, the TMDL development process began in 2018. Data collected in 2022 will need to be vetted through Illinois EPA's data quality process and may not be available for use in TMDLs until the Draft 2024 Illinois Integrated Water Quality Report. Therefore, Illinois EPA will finish up this TMDL report based on the currently available data.

14. "Chlorine: in segment, IL_OW- 02 was not actually sampled but yet interpreted to say there is an issue."

Response:
Lake Fork (IL_OW-02) is listed for chloride impairment (not chlorine); chloride is an ion in an aqueous solution. Chloride is derived from such sources as soil and road.

Illinois EPA's assessment methodology allows for water quality samples to be used to assess attainment on segments up to 10 miles upstream or downstream from the sampling location. Lake Fork segment IL_OW-02 is less than 10 miles upstream of sampling site IL_OW-01 on segment IL_OW-01.
As discussed in Section 5 of the Upper Kaskaskia and Lake Fork Watershed TMDL report, the data collected at monitoring station OW-01 on segment IL_OW-01 were used by Illinois EPA to assess and determine impairment in segment IL_OW-02. The proximity of station IL_OW-01 to segment IL_OW-02 enables assessment of these adjoining segments with equal weight. Aquatic life use assessments can be made within approximately 10 miles upstream and downstream from the sample site for wadable streams and 25 miles for unwadable streams (IEPA 2016).

15. Bank erosion is a major source of impairment to the Kaskaskia River and discusses multiple funding programs to address erosion. The targeted watersheds of certain programs could be more strategically selected. The Water Resources Development Act of 2007 (which was discussed in Comment #9). New in-kind projects will need to be identified for Illinois's cost share if the Water Resources Development Act study is to resume. In the "Kaskaskia River Basin the biggest impairment and hypoxia zone contributor is Government created, not from farmer/agriculture".

Response:
Illinois EPA has developed a total phosphorus TMDL for Carlyle Lake in the watershed, and the implementation plan outlines best management practices to address the impairments, including bank erosion in the Kaskaskia River basin.

Local, state, and/or federal funding programs to implement the recommended BMPs, will have to deploy their available resources according to their policy goals independent of the TMDL Program.

16. More recent research of agricultural BMPs should be included in the Kaskaskia River watershed studies.

Response:

The following information has been added to the *Watershed Studies and Information* to each TMDL report and WPP:

- **Assessing the impacts of agricultural conservation practices on freshwater biodiversity under changing climate (Acero Triana et al. 2021)**

  A Soil and Waters Assessment Tool model and fish regression models were developed to evaluate the impact of future climate conditions and agricultural land management practices on fish species richness across the Kaskaskia River watershed. The study focused on four agricultural BMPs: crop rotation, cover crops, reduced tillage, and modified fertilizer application. The results indicated that fish species richness was more sensitive to changes in climate than changes in land management. Additionally, the authors found no significant differences between fish species richness from the scenarios with agricultural BMPs and current land management.

  The full reference was also appended to the references section in each TMDL report and WPP:

  Acero Triana, J.S., M.L. Chu, and J.A. Stein. 2021. Assessing the impacts of agricultural conservation practices on freshwater biodiversity under changing climate. *Ecological Modelling* 453 (2021) 109604.

17. It is not entirely clear what has been done in the Lower Kaskaskia River Watershed (II) Protection Plan (the "Plan"), but supporting data are inadequate for many of the

conclusions drawn in the Plan. Much of the available data have been misinterpreted or ignored.

Response:

Refer to Response #1 for discussion of the delisting and recategorization recommendations. TMDLs were in development for dissolved iron in segments IL_O-03 and IL_O-20 when new data indicated that the segments met water quality standards. Once those segments were delisted from Illinois's 2020/2022 303(d) list, the Stage 3 report was converted into a WPP. The Lower Kaskaskia River-II Watershed WPP provides documentation of DO levels to support delisting and recategorization and identifies and prioritizes BMPs to address anthropogenic activities that can contribute to dissolved iron impairments.

18. The DO at the USGS gage at New Athens "frequently measured clear violations of the DO standards as well as supersaturation in the mid-May through August period when high algal growth is expected."

Response:

Refer to Response #1.

19. Waterbody Segment IL_O-97 was recommended for delisting based upon continuous data from 7-days in September 2012 and such data are insufficient for delisting.

Response:

Refer to Response #1.

20. The organizations note that some data collected in segment IL_O-03 were collected "outside the period of most algal activity." The organizations contend that the data show supersaturation that is indicative of algal/plant photosynthesis and a large diel swing, that can be characteristic of nutrient pollution.

Response:

The DO concentration data collected by USGS at gage 05595000 in 2007 through 2016 show supersaturation and large diel swings, which may be indicative of nutrient eutrophication. However, continuous DO data collected by IEPA in 2012 (7-days in July and 7-days in August) and 2019 (7-days in September) at site IL_O-03 (collocated with gage 05595000) do not show supersaturation or large diel swings.

21. The QUAL2K modeling conclusion that reducing phosphorus inputs by one-half only indicates that phosphorus levels are more than twice of what is needed to limit algal growth. The organizations refer to research by Todd Royer that investigated the relationship between TP and chlorophyll at relatively low TP levels. The organizations then refer to Wisconsin's 0.1 mg/L TP standard that is equivalent to the proposed threshold for the Illinois Nutrient Science Advisory Committee. They contend that the lack of correlation is because so much TP is present that another factor is the limiting condition. The organizations believe that "phosphorus pollution is a major cause of the common DO violations and impairment."

Response:

Illinois EPA develops TMDLs for anthropogenic pollutants with numeric criteria (i.e., water quality standards). Currently, Illinois has no stream or river numeric criterion for Total Phosphorus (TP), therefore Illinois EPA does not develop TP TMDLs for streams or rivers. Although there is existing research and reporting on what TP concentrations may be considered beneficial targets to improve aquatic life conditions, these studies do not equate to numeric criterion for TP concentrations in streams.

The cause of low DO concentrations has not been clearly established. Nutrient eutrophication (as represented by TP) may contribute to impairment, but other factors may also be contributing to impairment. As discussed in Response #1, activities (e.g., reaeration, reducing SOD) beyond reducing TP may be needed to increase DO levels in the Kaskaskia River basin.

22. The organizations recommend "a proper analysis" of pollutants from the Prairie State Generation plant. They discuss how decreased flow, increased pollutant concentrations, and increased temperature would all affect in-stream DO levels. The organizations also advise that other sources of carbonaceous biochemical oxygen demand and ammonia should be considered.

Response:

The Prairie State Generation Plant effluent flow has been accounted in the QUAL2K model. QUAL2K is a one-dimensional, steady-state water quality model for streams and rivers and Illinois EPA used this model to address DO impairments during critical low-flow conditions in the Kaskaskia River. Illinois EPA used the QUAL2K model that includes treated effluent flow inputs coming from the Prairie State Generation Plant.

23. The WPP should be clearer on the forms of phosphorus being discussed.

Response:

The WPP is limited to total phosphorus (TP) loading, with Appendix C discussing orthophosphate (PO4) data. Section 2.3.2 refers only to total phosphorus. The QUAL2K model simulates TP speciation as “organic phosphorus” and “inorganic phosphorus”, for which orthophosphate is assumed to be “inorganic phosphorus”. The 72% of TP was assumed to be inorganic for treated municipal effluent dischargers; this fraction was applied in the QUAL2K model presented in Appendix C. Instream TP speciation at the model extent headwaters were assumed to be equally organic and inorganic.

24. The September 2019 data should not be used for model development because the samples were collected when water quality is expected to be better and not during a period of increased algal production. They also contend that the QUAL2K simulation should not have been for September 24, 2019, the midpoint of sonde-deployment.

Response:

Illinois EPA developed the QUAL2K model using the most recent, available data, which was the September 2019 data. No impairment was observed during the entire sonde deployment from September 9-13,2019, so simulation at any time during that deployment date (midpoint or otherwise) would have similar QUAL2K modeling results.

25. The organizations ask why diffuse inflows were set to the average of the inputs for Mud Creek and Silver Creek.

Response:

In QUAL2K, diffuse inflows represent an aggregate of all surface and groundwater inflows into the modeled segment that occur between known tributaries and point sources. No runoff or groundwater data were available for this reach. Therefore, the average of the two monitored streams was assumed to be representative of the small contributions of aggregated runoff and groundwater inputs.

26. The headwaters boundary condition for the Kaskaskia River for pH (hourly inputs; averaged to 7.95 standard units) is not representative of the Kaskaskia River as measured at New Athens by the USGS gage.

Response:

The USGS gage data cannot be used to develop the headwaters boundary condition because then all inputs between the headwaters boundary condition and gage would have to be zeroed out to be able to calibrate to the gage.

The headwaters boundary condition for the Kaskaskia River was determined from observed data from site IL_O-91, which is located near the upstream terminus of segment IL_O-03. Site IL-O-91 is at an appropriate location to use as the upstream boundary condition for segment IL_O-03. USGS gage 05595000 is located along the downstream half of segment IL_O-03, and this is not an appropriate location to use as the upstream boundary condition. Furthermore, USGS gage quarter-hourly pH data ranged from 5.8 to 10.4 standard units on September 24, 2019, with a daily average of 7.2 standard units.

27. The organizations question whether single site's minimum, average, and maximum are sufficient to calibrate the model and they question whether the lines plotted in the QUAL2K chart are representative of actual conditions in the Kaskaskia River.

Response:

Illinois EPA acknowledges that it would be preferable to have additional data against which to calibrate the model, and more data needs to be collected in the future as part of the TMDL Implementation Plan. QUAL2K is a one-dimensional, steady-state water quality model for streams and rivers. Instream data were available for only one site, therefore only that single site is plotted on the figure spatially. In other watersheds with data available for more than one site, multiple sites have been plotted on associated figures.

Modeling is simply a representation of actual conditions, limited by data availability and modeling assumptions. The lines in the figure, which is the standard figure included in QUAL2K output visualization, are representative of the 7-day, 10-year low flow conditions that were simulated for September 24, 2019. They are intended to portray low flow critical conditions in the river, not the full range of actual conditions. Under these low-flow conditions, some sources ran dry; as such, those sources would not have affected DO levels in the Kaskaskia River. Models are used to simplify and simulate real world conditions based on well researched governing equations for physical, chemical, and biological activities. Inputs for every part of the model cannot be reasonably measured; best professional judgement, and literature-based assumptions are used to help fill in those gaps. Additional spatial and temporal data observations from the watershed could help constrain and refine the model simulation.

28. It is suggested that instream DO concentration is not controlled by nutrient concentrations, but by other DO-reducing forces instream. It appears that Tetra Tech is requiring a clear, direct relationship to find that a pollutant caused an impairment, but we do not believe that that is how aquatic ecosystems work.

Response:

TMDL development and a linkage analysis require an anthropogenic pollutant for TMDL development, and the pollutant must have a defensible, direct relationship with the cause(s) of impairment.

29. The organizations ask what "further testing" means in Appendix C with regards to the QUAL2K modeling and investigating the means to improve DO levels.

Response:

"Further testing" consisted of systematically altering various model inputs and parameter rates in the QUAL2K model and evaluating the results to assess sensitivity to various inputs and assumptions. For example, dedicated specific field monitoring of both sediment oxygen demand (SOD) and reaeration rates would aid in understanding the systematic balance (or imbalance) between these two significant drivers of instream DO concentrations. SOD is the consumption of DO as organic material decays as part of the sediment instream. High SOD can result from the die-off of algae related to nutrient eutrophication; however, high SOD can also result from untreated or partially treated sanitary waste due to the presence of effluent-derived organics.

30. Iron loadings from point sources "have not been monitored adequately and that reductions from those sources should be considered."

Response:

As outlined in the Illinois's 2020/2022 303(d) list, the Lower Kaskaskia River waterbody segments (IL_O-03 and IL_O-20) are no longer impaired for dissolved iron. Therefore, iron reductions from point sources will not be recommended.

As discussed in Sections 5.1.1 and 5.1.4, wastewater treatment plants and sewage treatment plants covered by individual or General NPDES permits do not have iron limits because Illinois EPA does not expect such facilities to discharge appreciable levels of iron. The four facilities discussed in Section 5.1.2 are authorized to discharge total iron in their effluent and must comply with their individual NPDES permits. Additionally, the eight public water supplies discussed in Section 5.1.4 are authorized to discharge total iron in their backwash and must comply with their General NDPES Permit ILG640.