Middle Illinois River Total Maximum Daily Load and Load Reduction Strategies

FINAL TMDL

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Prepared for

U.S. Environmental Protection Agency -- Region 5
Illinois Environmental Protection Agency

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Acronyms and Abbreviations

AFOs	animal feeding operations
AWQMN	Ambient Water Quality Monitoring Network
CAFO	confined animal feeding operation
CFR	Code of Federal Regulation
CPP	Conservation Practice Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
CSO	combined sewer overflows
DAF	average design flow
DAP	diammonium phosphate
DMF	maximum design flow
EQIP	Environmental Quality Incentive Program
G-Org/day	Giga (1,000,000,000) organisms per day
HUC	hydrologic unit code
HSG	hydrologic soil group
HSPF	Hydrologic Simulation Program - Fortran

IBI	Index of Biotic Integrity
ICCI	Illinois Conservation and Climate Initiative
IDNR	Illinois Department of Natural Resources
ICCI	Illinois Conservation and Climate Initiative
Illinois EPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
IRBR	Illinois River Basin Restoration
ISWS	Illinois State Water Survey
LA	load allocation
LRS	load reduction strategy
MBI	macroinvertebrate biological integrity
MEP	maximum extent practical
MGD	million gallon per day
MHP	mobile home park
MOS	margin of safety
MRBI	Mississippi River Basin Initiative
MS4	municipal separate storm sewer system
N/A	not applicable
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NSMP	Nonpoint Source Management Program
SARE	Sustainable Agriculture Grant Program
STP	sewage treatment plant
SSO	sanitary sewer overflow
SSC	suspended sediment concentration
TCRPC	Tri-County Regional Planning Commission
TDS	total dissolved solids
TMDL	total maximum daily load
TP	total phosphorus
TSS	total suspended solids
U.S. EPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VW	volume weighted
WLA	wasteload allocation
WQS	water quality standards
WY	water year
WWTP	wastewater treatment plant

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- United States Geological Survey (USGS)
- City of Peoria
- Illinois State Water Survey (ISWS)
- United States Army Corps of Engineers (USACE)
- Several individuals from engineering firms in the Peoria area

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- Illinois American Water Company provided Illinois EPA TMDL monitoring staff timely access to the sampling site on the mainstem of the Illinois River, segment D-30.
- NPDES facilities that provided data in addition to what is collected under the Illinois EPA discharge monitoring report (DMR) dataset.

Executive Summary

The Clean Water Act and U.S. Environmental Protection Agency (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. In addition to TMDL development, load reduction strategies (LRS) are included to address additional pollutants in the watershed that do not have water quality standards, namely nutrients and sediment.

This TMDL and LRS study addresses the approximately 2,100 square mile portion of the Middle Illinois River watershed near Peoria located in central Illinois, generally referred to as the Illinois River Bluffs region. Major tributaries along this stretch of the river include Big Bureau Creek, Senachwine Creek, Sandy Creek, Crow Creek West, Crow Creek East, Clear Creek, Partridge Creek, Tenmile Creek, Farm Creek, and Kickapoo Creek.

Several waters within the Middle Illinois River project area have been placed on the State of Illinois §303(d) list, and require the development of a TMDL including portions of the main stem of the Illinois River in the Peoria area, Kickapoo Creek (the 19 mile segment from its confluence at West Peoria continuing upstream); Big Bureau Creek (the five mile segment from Princeton continuing downstream); West Bureau Creek (from its confluence with Bureau Creek continuing 23 miles upstream); Farm Creek (the 19 mile segment from its confluence at East Peoria continuing upstream); Depue Lake (in the Lake Depue State Fish & Wildlife Area near the village of Depue); and Senachwine Lake (north of Henry). This project addresses the following pollutants or response indicators: bacteria, phosphorus, total suspended solids, sedimentation / siltation, dissolved oxygen, chloride, aquatic algae, pH, alteration in streamside vegetative cover, manganese, and total dissolved solids as identified on the State of Illinois §303(d) list. In addition, phosphorus, nitrogen, and suspended sediment are addressed as part of LRSs. Water quality targets are defined for each LRS pollutant, derived through literature.

The sources of pollutants in the Middle Illinois River watershed, also referred to as the Illinois River (Peoria Area) watershed, include NPDES permitted facilities including wastewater treatment facilities, regulated stormwater, combined and separate sanitary sewer overflows. In addition, nonpoint source pollution results from several key sources including stormwater runoff (both agricultural and developed); watershed, in-stream, gully and bluff erosion; onsite wastewater treatment systems, animal feeding operations, and livestock populations. An evaluation using flow and water quality duration curves is presented that provides insight into the sources and flow regimes that are affecting water quality.

A TMDL identifies the total allowable load that a waterbody can assimilate (the loading capacity) and still meet water quality standards. The loading capacity for each river and Senachwine Lake was determined using a load duration curve framework. An in-lake response model was used to determine the phosphorus loading capacity for Lake Depue. TMDLs and LRSs are presented in Sections 5 – 13. The required pollutant reductions vary between zero and 100 percent, depending on the waterbody and pollutant.

A TMDL is equal to the loading capacity for a waterbody, and that loading capacity is distributed among load allocations to nonpoint and background sources and wasteload allocations to point sources. Allocations are based on the water quality standard for all pollutants with the exception of phosphorus. A 1 mg/L technology-based phosphorus limit was used for wastewater treatment facilities discharging to phosphorus impaired lakes. An explicit and implicit margin of safety was used, dependent on the pollutant of concern.

An implementation plan is presented in Section 15 which includes potential implementation activities for both urban and agricultural sources of pollutants. A more detailed implementation plan will be developed in the future to further define activities, partners, and milestones.

1. Watershed Characterization

The Middle Illinois River, also referred to as the Illinois River (Peoria area), watershed is located in central Illinois (Figure 1-1). The general vicinity has often been referred to as the Illinois River Bluffs region. The project area begins near Spring Valley, where the Illinois River makes its *Big Bend* toward the south (Figure 1-2). The project area continues downstream past Peoria, ending near Pekin just above the confluence with the Mackinaw River; this reach is bound between the Starved Rock Lock and Dam to the north and the Peoria Lock and Dam further downstream. The project area covers nearly 2,100 square miles, and includes land within Bureau, Putnam, LaSalle, Marshall, Woodford, Peoria and Tazewell Counties. Major tributaries along this stretch of the river include Big Bureau Creek, Senachwine Creek, Sandy Creek, Crow Creek West, Crow Creek East, Clear Creek, Partridge Creek, Tenmile Creek, Farm Creek, and Kickapoo Creek.

Figure 1-1. Illinois River at Spring Bay.

1.1 Water Quality Impairments

Several waters within the Illinois River project area have been placed on the State of Illinois §303(d) list (Table 1-1 and Figure 1-2), and require development of TMDLs. This TMDL project is intended to address documented water quality problems on middle segments of the Illinois River in the Peoria area. Other §303(d) waters included on the 2008 list are: Kickapoo Creek (the 19 mile segment from its confluence at West Peoria continuing upstream); Big Bureau Creek (the five mile segment from Princeton continuing downstream); West Bureau Creek (from its confluence with Bureau Creek continuing 23 miles upstream); Farm Creek (the 19 mile segment from its confluence at East Peoria continuing upstream); Depue Lake (in the Lake Depue State Fish and Wildlife Area near the village of Depue); and Senachwine Lake (north of Henry).

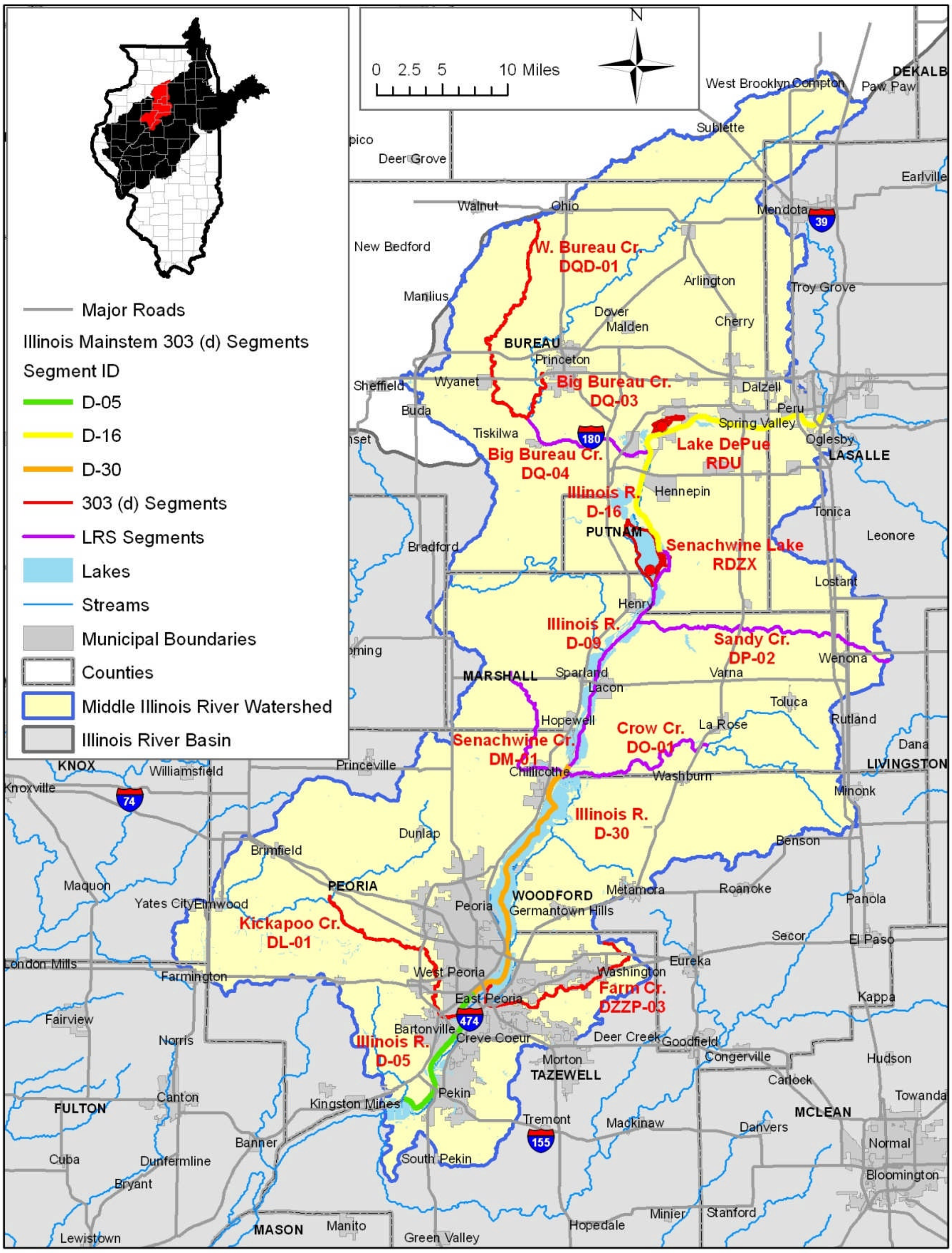

Figure 1-2. Middle Illinois River watershed.

Table 1-1. Middle Illinois River watershed impaired waters.

Impaired Waters			Designated Uses	Impairments
Name	Segment ID	Miles / Acres		
Illinois River	D-05	12	Primary contact recreation	Fecal coliform
	D-16	25		
	D-30	22		
	D-30	22	Public water supply	Manganese, total dissolved solids
Kickapoo Creek	DL-01	21	Primary contact recreation	Fecal coliform
Big Bureau Creek	DQ-03	5		
West Bureau Creek	DQD-01	24		
Farm Creek	DZZP-03	20	Aquatic life use	Alteration in streamside vegetative cover, chloride, pH, phosphorus, total suspended solids
Depue Lake [a]	RDU	524	Aesthetic quality and aquatic life	Aquatic algae, dissolved oxygen, phosphorus, sedimentation / siltation, total suspended solids
Senachwine Lake [a]	RDZX	3324		

a. Included within the Illinois River main stem watershed cluster.

Lake Depue is 524 acres and is a former oxbow lake, the shoreline is approximately 11 miles long and the lake is on average 2.3 feet in depth. It is a backwater lake of the Illinois River that fluctuates in depth with the Illinois River levels. It is connected to the Illinois River at the western end by a narrow shallow channel and separated from the river by a low lying peninsula. Senachwine Lake is a 3,324 acre lake that forms part of the Illinois River valley. It is located in Putnam and Marshall Counties. To the north, Senachwine Lake is connected to Goose Lake by a shallow channel and both are backwaters of the Illinois River.

The middle segments of the main stem Illinois River in the Peoria area appear on the Illinois §303(d) list for not supporting primary contact recreation due to elevated levels of fecal coliform bacteria. Several tributaries including Big Bureau Creek, West Bureau Creek, and Kickapoo Creek are listed for the same reason. One segment of the Illinois River (D-30) appears on the §303(d) list for not supporting public water supply due to elevated levels of manganese and total dissolved solids. Depue and Senachwine Lakes are on the §303(d) list for not supporting aesthetic quality and aquatic life uses due to aquatic algae, low dissolved oxygen levels, sedimentation / siltation, as well as elevated levels of phosphorus and total suspended solids (TSS). Farm Creek is listed as not supporting aquatic life use due to alteration in streamside vegetative cover as well as elevated levels of chloride, pH, phosphorus, and TSS.

In addition to the impairments listed in Table 1-1, several segments are not meeting sediment and nutrient targets, as described in Section 3.2. Table 1-2 and Figure 1-2 identify these segments. Load reduction strategies (LRS) are developed for each of these stream segments.

Table 1-2. Segments not meeting sediment and nutrient targets

Stream Segment	Total Suspended Solids	Total Phosphorus	Nitrate Nitrogen
D-05	X	X	X
D-09		X	X
D-16		X	X
D-30	X	X	X
DL-01	X	X	X
DM-01			X
DO-01			X
DP-02			X
DQ-03	X	X	X
DQ-04		X	X
DQD-01	X	X	X
DZZP-03	X	X	X
RDU	X	TMDL	X
RDZX	X	TMDL	X

1.2 Project Setting

The geology of the Illinois River Valley was first deposited over 500 million years ago when the region was covered by a shallow sea. Glacial processes, subsequent glacial melt and flooding generated from the Illinoian Glaciation, and the more recent Wisconsin Glaciation created the river bed in its general location. Due to the glacial origin, the floodplains of the Illinois River Valley are much larger than would be expected for a river equivalent in size (Theiling 1998a). The floodplains offer unique habitat and productive soils that sustain the current agricultural economy of the area. The Illinois River system remains one of a world-class river floodplain. It continues to be a surprisingly diverse and biologically productive ecosystem despite historic degradation and continuing sedimentation.

1.3 Problem Identification

Across the Illinois River basin, land use and hydrologic changes have reduced the quantity, quality, and functions of floodplain, riparian, and aquatic habitats. Studies have specifically identified the following areas to be principle factors limiting the system’s ecological integrity: excessive sedimentation; loss of productive backwaters, side channels and islands; loss of floodplain, riparian, and aquatic habitats and function; loss of aquatic connectivity on the Illinois River and its tributaries; altered hydrologic regime; water quality and sediment quality; and, invasive species (Table 1-3).

Table 1-3. Studies and literature relevant to the Middle Illinois River TMDL

Information Source	
Year	**Title**
Tri-County Regional Planning Commission	
2009	*Honoring our Water: A Regional Stormwater Plan for Peoria, Tazewell, and Woodford Counties of Illinois (May 2009)*
2009	*Geographic Information System (GIS) data coverages*
2009	*Low Impact Development (LID) Model Ordinance Information*
2004	*Ackerman Creek Watershed Restoration Plan (January 2004)*
2004	*Tenmile Creek Watershed Restoration Plan (January 2004)*
2004	*Partridge Creek Watershed Restoration Plan (January 2004)*
2003	*Farm Creek Watershed Hydrology (May 2003)*
2003	*Aquatic insect survey from Partridge Creek, Ten Mile Creek and Ackerman Creek, Illinois*
2003	*Partridge Creek - Tenmile Creek – Ackerman Creek Fishery Resources Description*
2003	*Tenmile and Partridge Creeks Erosion and Sedimentation Investigation (July 2003)*
2003	*Ackerman Creek Erosion and Sedimentation Investigation (July 2003)*
2002	*Mossville Bluffs Watershed Restoration Master Plan (October 2002)*
2001	*Farm Creek Watershed Restoration Plan (January 2004)*
City of Peoria	
	[Peoria Combined Sewer Overflow (CSO) Study data and Long Term Control Plan]
	[Wastewater treatment plant monitoring data]
Illinois State Water Survey	
1976	*Sediment Conditions in Backwater Lakes along the Illinois River*
1979	*Sediment Transport in the Illinois River*
1984	*Sediment Yield of Streams in Northern and Central Illinois*
1986	*Sediment Loads of Illinois Streams and Rivers*
1986	*Peoria Lake Sediment Investigations*
1999	*The Illinois River Decision Support System (ILRDSS)*
2001	*Sediment and Nutrient Monitoring at Selected Watersheds within the Illinois River Watershed for Evaluating the Effectiveness of the Illinois River Conservations Reserve Enhancement Program (CREP)*
2005	*Illinois River Basin Assessment Framework*
2007	*Hydrologic Model Development for the Illinois River Basin Using BASINS 3.0*
2004	*The Sediment Budget of the Illinois River*
2001	*Historical Sedimentation at the Mouths of Five Deltas on Peoria Lake*
2011	*Illinois State Climatology Data*
Illinois Department of Natural Resources	
2006	*Big Bureau Creek Watershed Inventory and Evaluation*
2010	*Illinois River Bluffs*
U.S. Geological Survey	
	[Synoptic survey data]
	[Historic hydrology and water quality data]

Information Source	
Year	**Title**
2006	*Present and Reference Concentrations and Yields of Suspended Sediment in Streams in the Great Lakes Region and Adjacent Areas.*
1999	*Review of Phosphorus Control Measures in the United States and Their Effects on Water Quality.*
2007	*Upper Midwest Environmental Sciences Center. Illinois River.*
1998	*Water Quality Assessment of the Lower Illinois River Basin: Environmental Setting.*
Illinois Scientific Survey	
1984	*Conceptual Models of Erosion and Sedimentation in Illinois. Vol. 1.*
1984	*Conceptual Models or Erosion and Sedimentation in Illinois. Vol. II.*
Erosion and Sediment Yield: Global and Regional Perspectives. Proceedings of the Exeter Symposium	
1996	*Patterns of Erosion and Sedimentation in the Illinois River Basin*
Natural Resources Conservation Service (NRCS)	
2007	*Soil Survey Geographic (SSURGO) Database.*
Scientific Journal	
1985; Havera, S et al.	*The Illinois River: A lesson to be learned.*
1984; Sparks, R.	*The Role of Contaminants in the Decline of the Illinois River: Implications for the Mississippi.*
2006; Sparks, R. et al.	*Disturbance and Recovery of Large Floodplain Rivers.*
1984; Walker, R.	*Historical Changes in Illinois Agriculture.*
Book	
1998; Theiling, C.	*Ecological Status and Trends in the Upper Mississippi River System*
U.S. Department of Agriculture.	
2001	*National Cooperative Soil Survey. Soil Survey of Marshall County, IL.*
2007	*The Census of Agriculture*
2007-2009	*National Agriculture Statistics Service (NASS).*
1992	*National Cooperative Soil Survey. Soil Survey of Peoria County, IL.*
U.S. Army Corp of Engineers (USACE)	
2007	*Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment*
2008	*Senachwine Creek Critical Restoration Project, Project Implementation Report with Integrated Environmental Assessment.*
U.S. Census Bureau.	
2010	*Peoria County Illinois.*
U.S. Environmental Protection Agency (EPA)	
2000	*Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Lakes and Reservoirs in Nutrient, Ecoregion VI.*
2004	*Report to Congress, Impacts and Control of CSOs and SSOs.*
2007	*An Approach for Using Load Duration Curves in the Development of TMDLs.*
2011	*Depue/New Jersey Zinc/Mobil Chemical Corp.*
National Water-Quality Assessment Program	
1994	*The Lower Illinois River Basin*
Illinois Rivers Decision Support System	
2005	*Illinois River Basin Assessment.*

For example, channelization is estimated to impair approximately 1,400 miles within the basin, and backwater lakes have lost 73 percent of their capacity due to sedimentation (USACE 2007). In all tributary watersheds, some degree of channelization has occurred. The highest degree of channelization occurs in Farm Creek, which includes agricultural channelization as well as flood control. A type of channelization that is particular to this region and others with similar topography is that of transportation channelization. In this region, many roadways and railroad grades occupy the same parallel corridors as streams. The results are nearly always a straightened stream channel that cannot migrate into the hardened structure and is forced into more sensitive (in terms of sediment deliver) bluff area. The erosion results in almost instant sediment transport to the stream and potential transport to the Illinois River. Ever expanding deltas at the mouths of tributaries are a sign of constant sediment loading from these tributaries to the Illinois River; as an example, the Partridge Creek delta expanded by 900 acre-feet in 30 years (Demissie et al. 1986).

In addition to channelization, urban development has increased the volume and concentration of stormwater delivered to tributaries and the main stem. The Mossville Bluffs region, just north of Peoria, represents an extreme example of consequences resulting from stormwater runoff as during the last few decades, increased residential development has occurred at the top of the Bluffs. The increase in imperviousness associated with this development, paired with efficient stormwater conveyance systems, has resulted in the discharge of runoff from discrete points along the steep slopes. These concentrated stormwater flows dislodge soil and create gullies or ravines (TCRPC 2009). In only 20 to 25 years, huge channels of 20 to 30 feet wide, and ten to 15 feet deep have eroded and in extreme cases, unstable homes and collapsed walls have been caused by gullies or ravines (TCRPC 2009).

As economic development and populations grew around the Chicago area, significant anthropogenic disturbances included increased navigation and spread of agriculture. These cultural changes continue to have lasting effects on the region; the most significant human influences have been related to commercial navigation, municipal and industrial waste discharge, and agricultural practices in the watershed (Demissie et al. 1999). Directly or indirectly, such disturbances have affected the environment and ecosystems along the length of the river. First, navigation from Lake Michigan to the Mississippi River became crucial as populations and economic development around Chicago grew (Theiling 1998). The establishment of navigation resulted in extensive channel alterations and hydromodifications associated with an intricate levee system designed to maintain and control sufficient flow for navigation and agriculture. Seven locks and dams (Figure 1-3) still exist along the Illinois River, creating a system of navigational pools (USGS 2007).

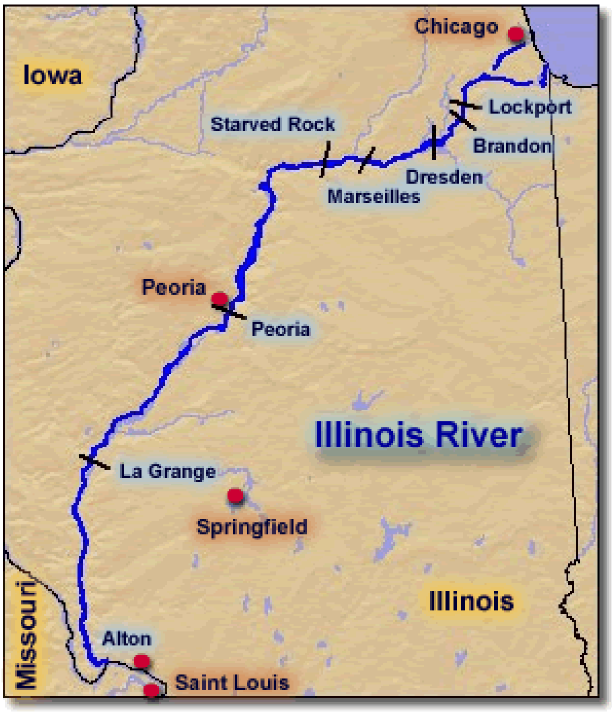

Figure 1-3.The lock and dam system of the Illinois River (USGS 2007).

Another significant historical disturbance came with the advent of mechanized equipment, which dramatically increased agricultural production of the watershed. Between 1945 and 1976, the acreage of row crop production increased 60 percent (Sparks 1984). As agricultural production increased, marginal lands were put into production through wetland filling, field draining (or field tiling), bank planting and further stream channelization (Theiling 1998). Additional factors that have contributed to increased erosion are improvements in tractors and plowing techniques that pulverize the soil more efficiently and the increased use of inorganic fertilizers to farm marginal areas continuously using crop rotation (Demissie 1996; Walker 1984). With the loss of floodplains water quality rapidly degraded and aquatic and terrestrial organisms that depended on the river system had massive reductions in population size (PCWRP). The destruction of more than 90 percent of the original wetland acreage can be blamed for high erosion rates from stream banks and bluffs (Havera and Bellrose 1985). From 1958 to 1961, formerly productive backwaters and lakes along specific reaches of the Illinois River changed from clear, vegetated areas to turbid, barren basins (Sparks 2006).

Problems within the basin are not limited to sedimentation. As additional issues such as flooding, degradation of aquatic habitats, and water-based recreation also need to be addressed (Demissie et al. 1999). Water quality within the Illinois River has been subjected to many impacts associated with development, including waste discharges from urban areas, water-level control for navigation, and sediment and chemical inflow from agricultural and urban watersheds (Demissie et al. 2004). Both point and nonpoint sources of pollution have been identified as potentially impacting the water quality within the watershed.

1.4 Jurisdictions and Population

Counties with land located in the project area include Bureau, Putnam, LaSalle, Marshall, Woodford, Peoria and Tazewell. U.S. Census data for each county is given in Table 1-4. Major government units with jurisdiction adjacent to the Illinois River within the project area include the Cities of Hennepin, Henry, Lacon, Sparland, Chillicothe, Spring Bay, Mossville, Peoria Heights, Peoria, and Pekin. The approximate total population for the watershed is over 523,000. Population density within the project area is indicated on Figure 1-4.

Table 1-4. County populations within the Illinois River project area.

County	1990	2000	2009[a]
Peoria County	182,827	183,433	185,816
Bureau County	35,688	35,503	34,699
Putnam County	5,730	6,086	6,009
La Salle County	106,913	111,509	112,498
Marshall County	12,846	13,180	12,702
Tazewell County	123,692	128,485	132,466
Woodford County	32,653	35,469	38,862
TOTAL	***500,349***	***513,665***	***523,052***

Source: U.S. Census Bureau.
a. U.S. Census Bureau estimate.

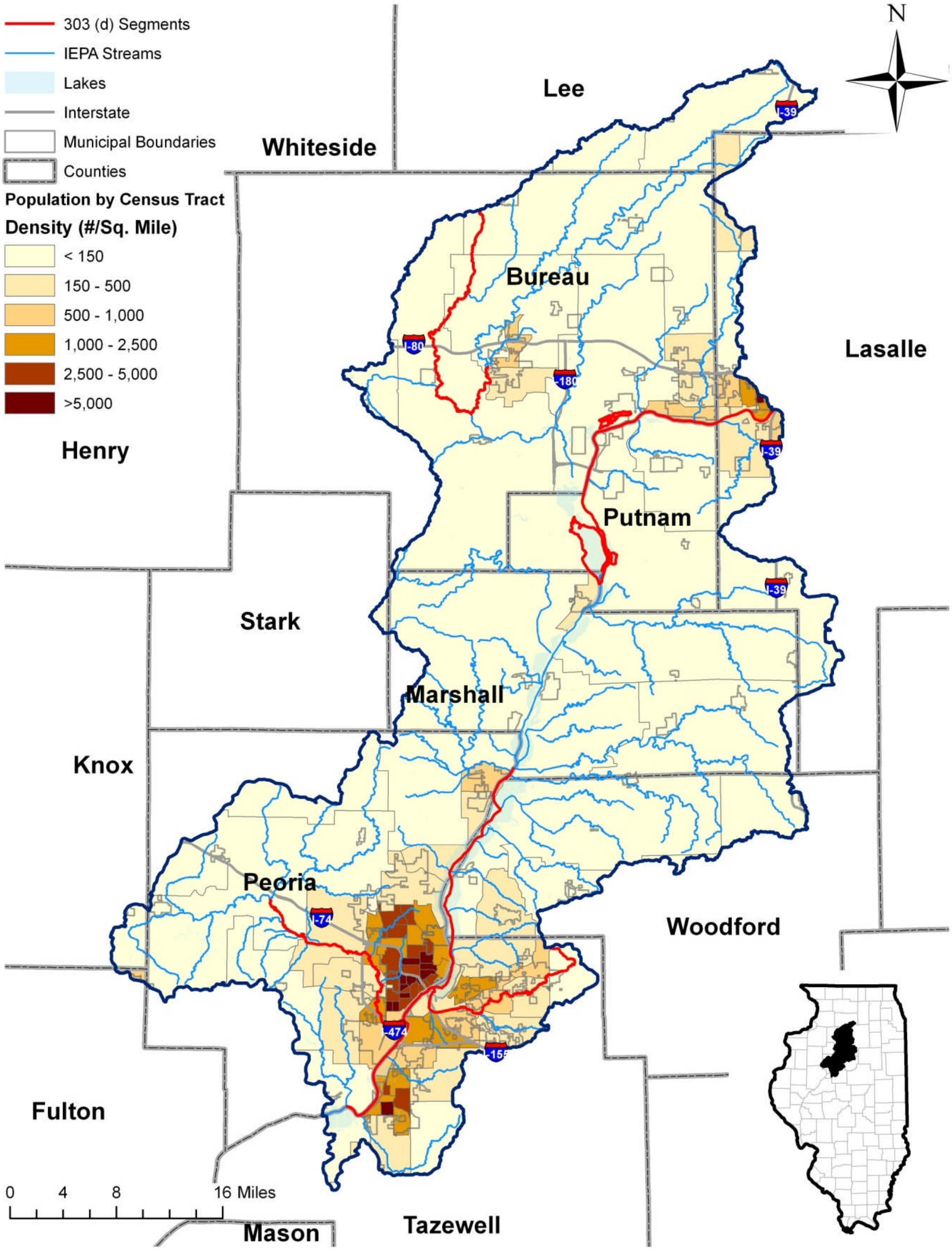

Figure 1-4. Middle Illinois River watershed population density.

1.5 Climate

Climate data are available from the Illinois State Water Survey Climatologist; Station 116711 is located in Peoria and was used for analysis within this report. Monthly data from 1901-2009 were available at the time of report development. In general, the climate of the region is continental with hot, humid summers and cold winters (Warner and Schmidt 1994). Table 1-5 contains historical temperature data collected at the Peoria climate station. From 1980 to 2009 the average winter temperature in Peoria was 27.7 °F and the average summer temperature was 73.7 °F (Table 1-5). The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 148 days.

Table 1-5. Climate summary for Peoria (1901 – 2009).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High °F	32	36	49	62	73	82	86	84	77	65	49	36
Average Low °F	16	20	30	41	51	61	65	63	55	44	32	21
Average Mean °F	24	28	39	51	62	71	76	74	66	54	41	28
Average Precipitation (in)	1.8	1.6	2.8	3.7	4.0	3.9	3.7	3.2	3.6	2.6	2.4	2.0
Average snow fall (in)	7.15	5.41	3.73	0.80	0	0	0	0	0	0.05	1.92	6.23

From 1980 to 2009, the annual average precipitation in Peoria (station 116711) was approximately 36 inches, including approximately 21 inches of snowfall. Peoria represents the middle range of precipitation within the Illinois River drainage. Patterns vary across the watershed from 35 to 40 inches annually. In general, larger volumes of precipitation tend to occur between the months of April and September. Figure 1-5 presents annual precipitation and temperature patterns for the Peoria area.

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of stormwater on the Illinois River. Figure 1-6 presents one way to show rainfall intensity. Evaluating Peoria data collected between 1948 and 2009, 57 percent of the precipitation events were very low intensity (i.e., less that 0.2 inches). Eight percent of the measurable precipitation events were greater than one inch.

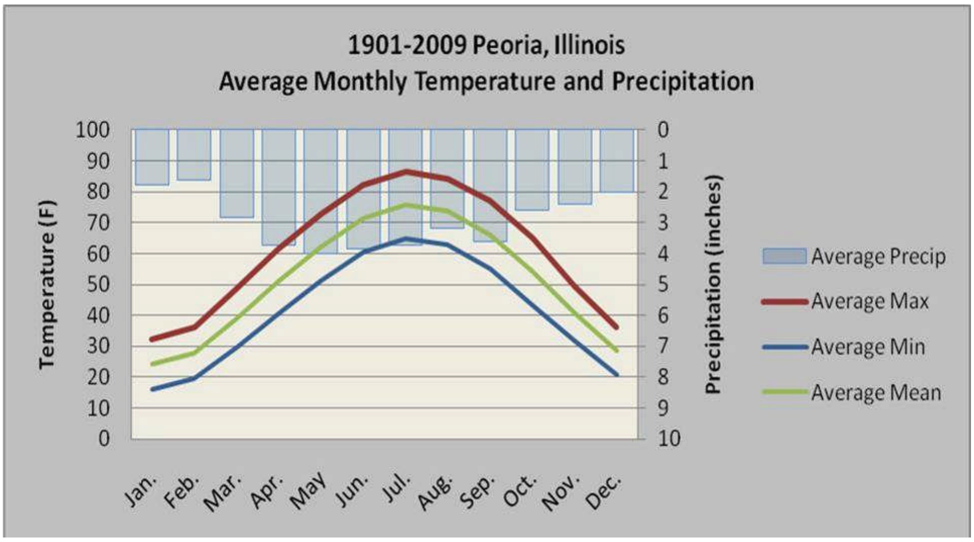

Figure 1-5. Average precipitation and monthly temperatures for Peoria.

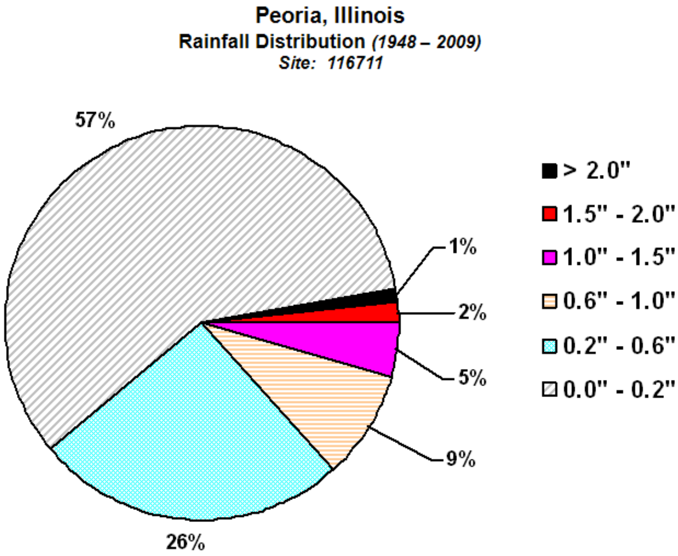

Figure 1-6. Precipitation intensity -- Peoria airport gage.

1.6 Land Use / Land Cover

Land use in the watershed is heavily influenced by agriculture in the upper and lower reaches in combination with the urban setting surrounding Peoria in the lower portion. Specific land use across the watershed includes agriculture (nearly 70 percent), forest (approximately 15 percent), and urban (approximately 11 percent). Figure 1-7 shows land use within the Middle Illinois River watershed. Table 1-6 presents area percent cover by land use type.

In general, the upper reach of the project area watershed is dominated by agriculture. Corn and soybeans are the primary crops in the lower Illinois River basin (Warner and Schmidt 1994). Secondary farm products include winter wheat, oats, hay, vegetables, cattle, hogs, dairy products, poultry, sheep and wool (USDA 1992). To increase agricultural productivity throughout the project area, a common practice includes field drainage or tiling to quickly transport excess moisture from the fields to adjacent surface waters. Currently, residential development within the upper reaches of the project area is predominately low density. The most densely populated areas of the watershed surround Peoria.

Table 1-6.Watershed land use summary.

Land Use / Land Cover Category	Acreage	Percentage
Cultivated Crops	844,311	62.8%
Deciduous Forest	203,767	15.2%
Pasture/Hay	61,423	4.6%
Developed, Open	62,298	4.6%
Developed, Low-Intensity	61,352	4.6%
Open Water	44,340	3.3%
Woody Wetlands	25,432	1.9%
Developed, Medium-Intensity	20,936	1.6%
Developed, High Intensity	6,441	0.5%
Grassland/Herbaceous	7,229	0.5%
Emergent Herbaceous Wetlands	3,811	0.3%
Barren Land	1,215	0.1%
Evergreen Forest	38	0.0%
Mixed forest	1	0.0%
Shrub/Scrub	1	0.0%
TOTAL	**1,342,595**	**100.0%**

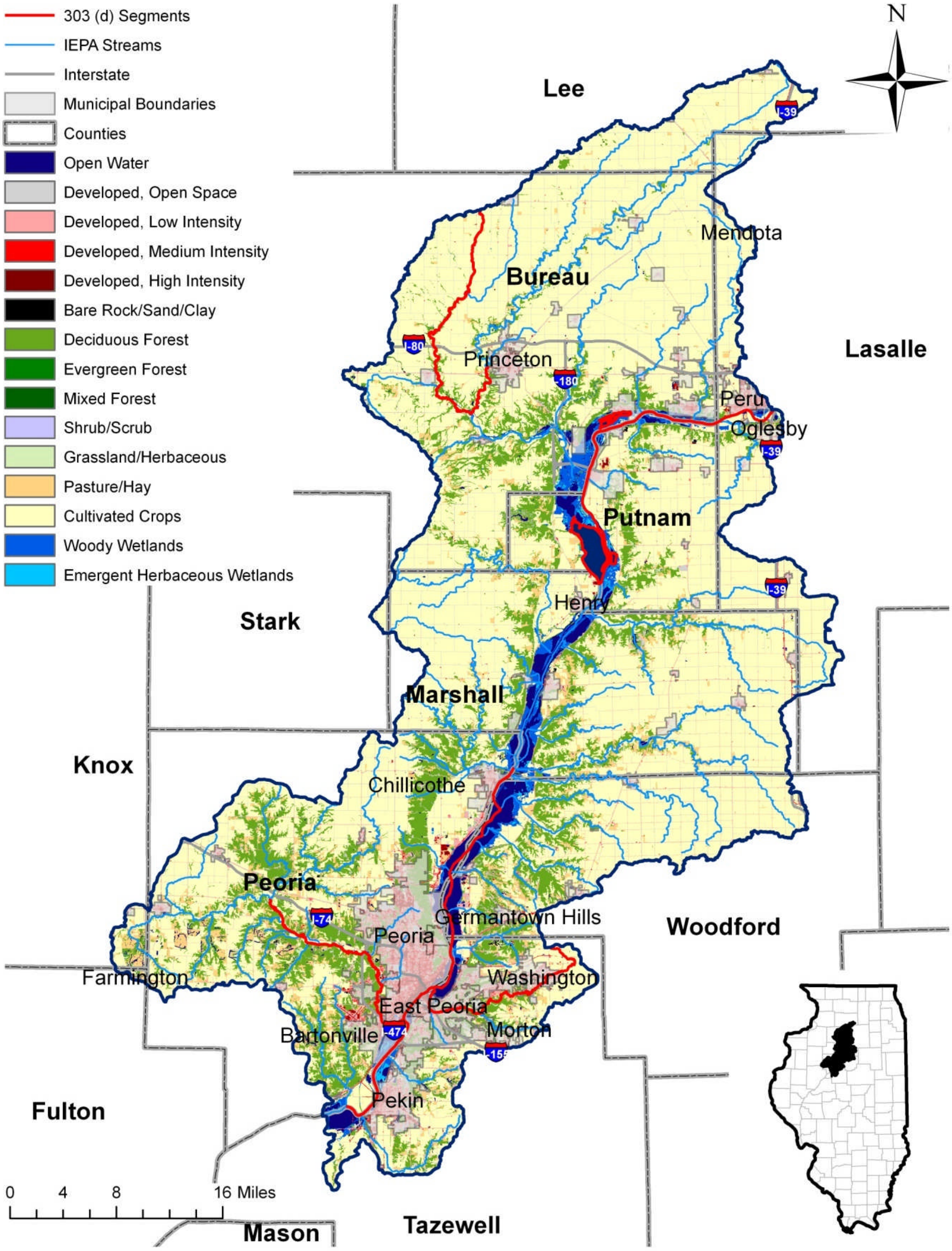

Figure 1-7. Middle Illinois River watershed land use.

1.7 Geology and Soils

Over 500 million years ago, the Illinois River region was covered by an expansive shallow sea that shaped the geology of the area. The Illinoian and Wisconsin Glaciations dramatically influenced the topography and hydrology of the Illinois River. As common to areas covered by glaciers, the basin evolved as the glaciers advanced and retreated. During advances, glaciers modified the previous landscape and with retreat, deposited glacial drift and glacial outwash (USDA 1992).

In the region, deposited glacial materials include sands, gravels, silts, and clays. The material varies in terms of mixtures and thickness within the region. Ice movement and its melt water influenced the patterns and distribution of various landforms, such as moraines and stream valleys; the Illinois River bed itself was scoured by a series of great floods that resulted from failed ice-dams during the last ice age (approximately 12,000 years ago) (Theiling 1998). The melt water that created rivers also deposited glacial materials throughout the region. These glacial deposits and associated land forms exerted a major effect that influence present day hydrology, soil types and land cover. Current topography and river valleys carved by such processes are shown Figure 1-8.

Soil is the dominant natural resource in Peoria County (USDA 1992) and across the agricultural region. The National Cooperative Soil Survey publishes soil surveys for each county within the U.S. These soil surveys contain predictions of soil behavior for selected land uses. The surveys also highlight limitations and hazards inherent in the soil, general improvements needed to overcome the limitations, and the impact of selected land uses on the environment. The soil surveys are designed for many different uses, including land use planning, the identification of special practices needed to ensure proper performance, and Hydrologic Soil Groups (NRCS 2007).

Hydrologic Soil Groups (HSGs) refers to the grouping of soils according to their runoff potential. Soil properties that influence the HSGs include depth to seasonal high water table, infiltration rate and permeability after prolonged wetting, and depth to slow permeable layer (USDA 2002). There are four groups of HSGs: Group A, B, C, and Group D. Table 1-7 describes those HSGs found in the Illinois River watershed and provides a summary description of each group.

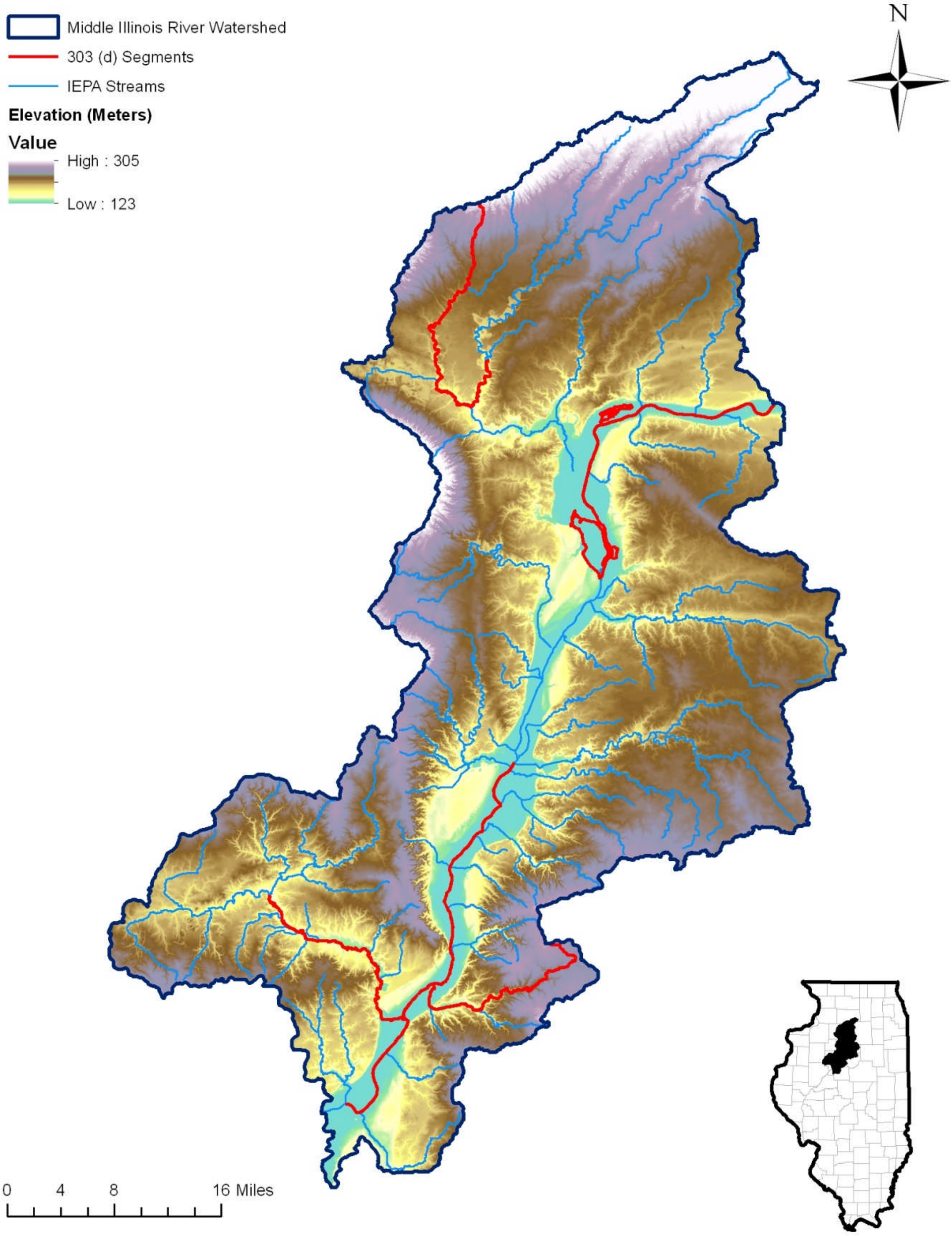

Figure 1-8. Illinois River basin topography.

Table 1-7. Hydrologic Soil Group descriptions.

HSG	Group Description
A	Sand, loamy sand or sandy loam types of soils. Low runoff potential and high infiltration rates even when thoroughly wetted. Consist chiefly of deep, well to excessively drained sands or gravels with a high rate of water transmission.
B	Silt loam or loam. Moderate infiltration rates when thoroughly wetted. Consist chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
C	Soils are sandy clay loam. Low infiltration rates when thoroughly wetted. Consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
D	Soils are clay loam, silty clay loam, sandy clay, silty clay or clay. Group D has the highest runoff potential. Low infiltration rates when thoroughly wetted. Consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.
B/D	Dual Hydrologic Soil Groups. Certain wet soils are placed in group D based solely on the presence of a water table within 24 inches of the surface even though the saturated hydraulic conductivity may be favorable for water transmission. If these soils can be adequately drained, then they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition.

Figure 1-9 shows the location of different HSGs in the watershed. Soils in this area are typically Group B, composed of loamy soils with a moderate infiltration rate and to a lesser degree, Group A, C and B/D (USDA 2002). Table 1-8 summarizes the composition of HSGs per watershed. The protection of areas with high infiltration capacity (e.g., Group A soils) is important for maintaining hydrology and temperature regimes within the watershed. Additionally, Table 1-9 shows the percent of highly erodible soils. Although much of the soil within the watershed has not been assessed, that which has been assessed shows that 13 to over 30 percent of the soils within the watersheds are highly erodible.

Table 1-8. Percent composition of HSGs per watershed.

Watershed	A	A/D	B	B/D	C	C/D	D	No Data
	%							
Big Bureau Creek	1.12	0.12	79.62	16.72	1.44	0.27	0.10	0.61
Farm Creek	0.00	0.00	86.04	11.64	0.16	0.00	0.00	2.15
Illinois River Main Stem	2.90	0.09	68.12	14.57	5.05	0.06	0.61	8.59
Kickapoo Creek	0.85	0.00	78.33	4.87	13.72	0.00	0.65	1.58
Sandy Creek	0.68	0.00	50.77	18.11	25.84	4.29	0.00	0.31
Senachwine Creek	0.75	0.00	88.00	5.00	4.36	0.00	0.32	1.56
Snag Creek and Crow Creek	0.60	0.16	63.09	22.55	9.93	1.69	0.62	1.36

Source: NRCS 2007

Table 1-9. Percent of highly erodible versus not highly erodible soils per watershed.

Watershed	Highly Erodible	Not Highly Erodible	Not Assessed
	%		
Big Bureau Creek	15.23	0.00	84.77
Farm Creek	27.11	0.00	72.89
Illinois River Main Stem	22.04	0.94	77.02
Kickapoo Creek	33.74	0.00	66.26
Sandy Creek	13.21	0.00	86.79
Senachwine Creek	31.52	0.00	68.48
Snag Creek and Crow Creek	13.30	2.24	84.46

Source: NRCS 2007

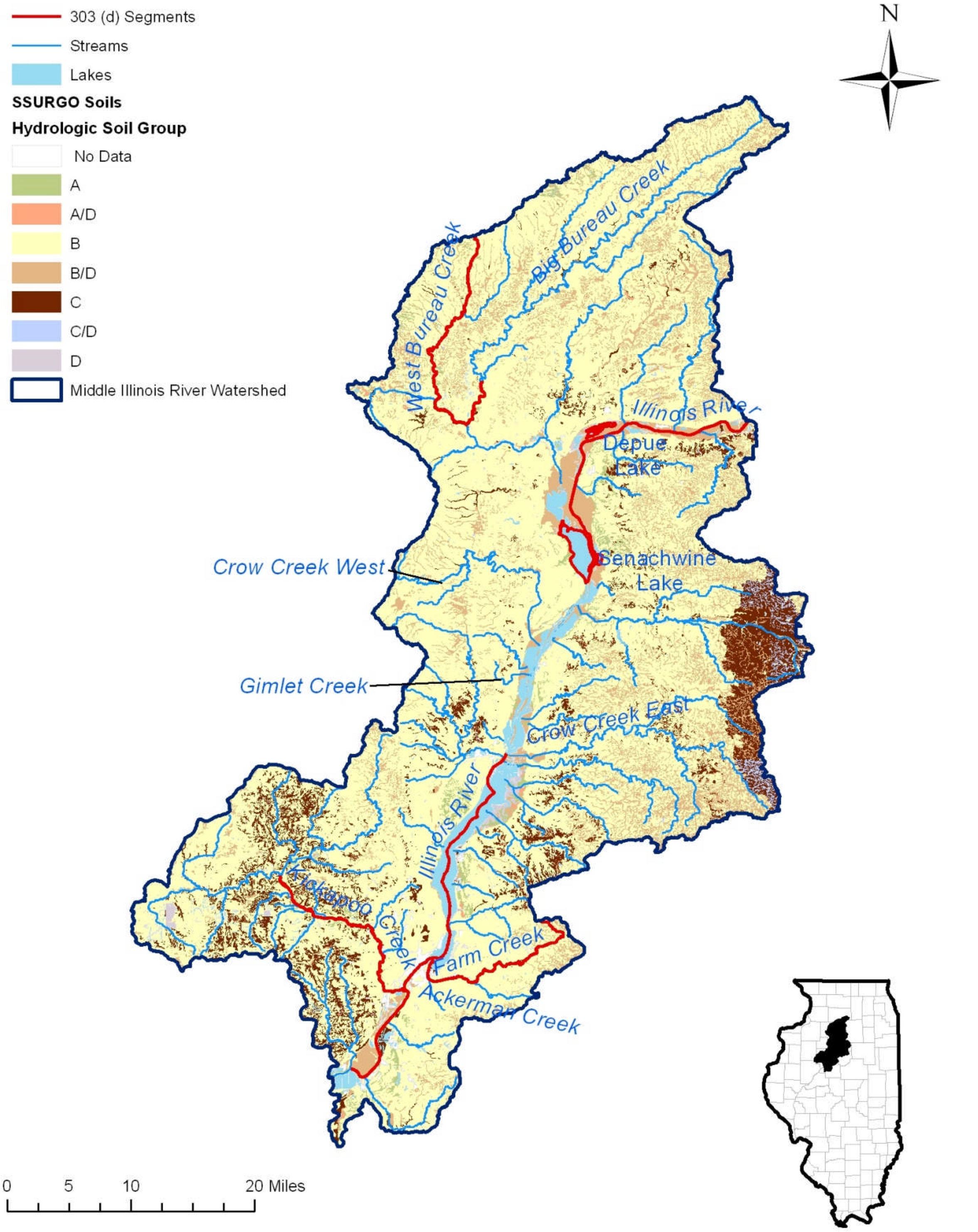

Figure 1-9. Illinois River basin hydrologic soil groups.

1.8 Hydrology

Hydrology plays an important role in evaluating water quality. The hydrology of the Middle Illinois River watershed is driven by local climate conditions and alterations to the landscape. In addition, ditching and channelizing has been used throughout this region to drain areas where soils are too wet for settlement and agriculture. This creates situations that often result in flashy flows on tributary creeks, where streams respond to and recover from precipitation events relatively quickly. Flooding periodically occurs in areas of the watershed, flowing over roads and encroaching on streamside properties.

Some of the tributaries that flow to the Illinois River have been channelized or relocated to facilitate agricultural or commercial development. A common practice for improving drainage is to install subsurface tile drains and ditches to lower the water table beneath agricultural fields. Subsurface drains (e.g., corrugated plastic tile or pipe) installed beneath the ground surface serve as conduits to collect and / or convey drainage water, either to a stream channel or to a surface field drainage ditch. While these drainage alterations increase the amount of land available for cultivation, they also influence the hydrology, the aquatic habitat, and water quality of area streams.

Drains intercept precipitation and snowmelt as they infiltrate the subsurface soil layer. This intercepted water would normally reach the water table where it would be stored as groundwater. Instead, the subsurface flow is quickly conveyed through the network of drains and ditches to nearby waterbodies. This process can increase the volume of water that reaches local streams during rainfall and snowmelt events, which leads to a rapid rise in stream levels during runoff events. Often this rapid response is similar to that observed in areas where natural vegetation has been replaced by impervious surfaces. Extensive tiling can also alter the quality of drainage water exiting the fields to receiving waters. For example, shorter delivery times to a stream often reduce the benefits associated with longer filtration through soil layers. In addition to water volume excesses due to stormwater and flooding, natural dry weather periods (e.g., the lack of sufficient water) can make water quantity a factor that affects water quality.

The U.S. Geological Survey (USGS) has monitored flow at several locations in the watershed (Table 1-10 and Figure 1-10). Figure 1-11 and Figure 1-12 illustrate the hydrologic variability in stream flow for the Illinois River, as well as for two tributary streams: Big Bureau Creek and Farm Creek. These graphs also show daily precipitation measured at the Peoria site.

Table 1-10. USGS stream gages within project area.

Gage ID	Area *(mi.^{2})*	Location	Latitude	Longitude	Period of Record
05556500	196	Big Bureau Creek at Princeton	41° 21' 57"	89° 29' 54"	1936 - 2010
05557000	86.7	West Bureau Creek at Wyanet	41° 21' 54"	89° 34' 08"	1936 - 1966
05557500	99.0	East Bureau Creek near Bureau	41° 20' 05"	89° 22' 55"	1936 - 1966
05558300	13,544	Illinois River at Henry	41° 06' 26"	89° 21' 22"	1981 - 2010
05558500	56.2	Crow Creek (West) near Henry	41° 09' 00"	89° 25' 00"	1949 - 1971
05559000	5.66	Gimlet Creek at Sparland	41° 01' 37"	89° 26' 21"	1945 - 1971
05559500	115	Crow Creek near Washburn	40° 57' 15"	89° 18' 30"	1944 - 1971
05560500	27.4	Farm Creek at Farmdale	40° 40' 03"	89° 30' 15"	1948 - 2008
05561000	11.2	Ackerman Creek at Farmdale	40° 39' 43"	89° 30' 13"	1953 - 1980
05561500	5.54	Fondulac Creek near East Peoria	40° 40' 38"	89° 31' 52"	1948 - 2009
05562000	61.2	Farm Creek at East Peoria	40° 40' 04"	89° 34' 40"	1943 - 1980
05563000	119	Kickapoo Creek near Kickapoo	40° 48' 02"	89° 48' 01"	1944 - 1962
05563500	297	Kickapoo Creek at Peoria	40° 40' 52"	89° 39' 19"	1942 - 1971
05568500	15,818	Illinois River at Kingston Mines	40° 33' 11"	89° 46' 38"	1939 - 2010

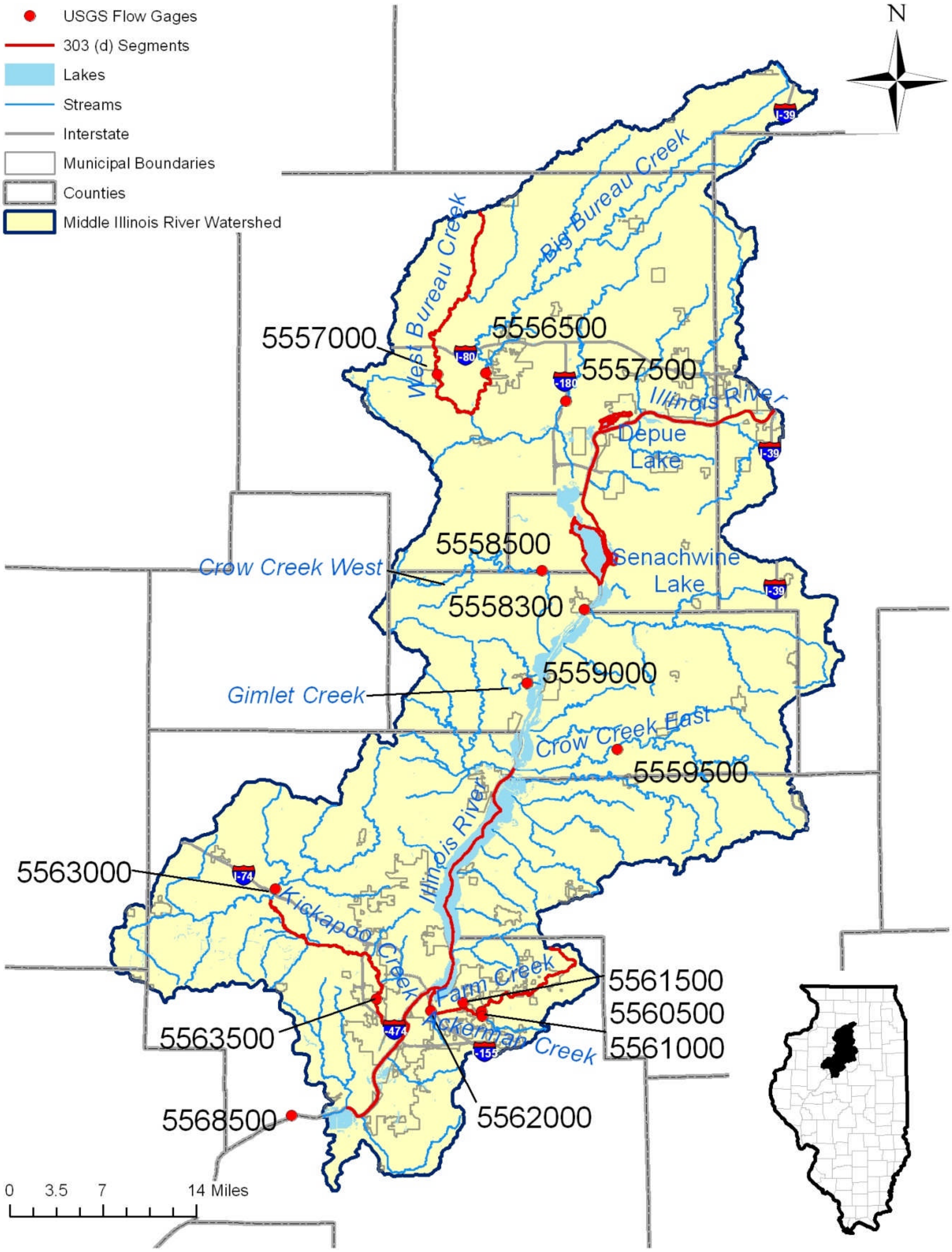

Figure 1-10. USGS stream gages within project area.

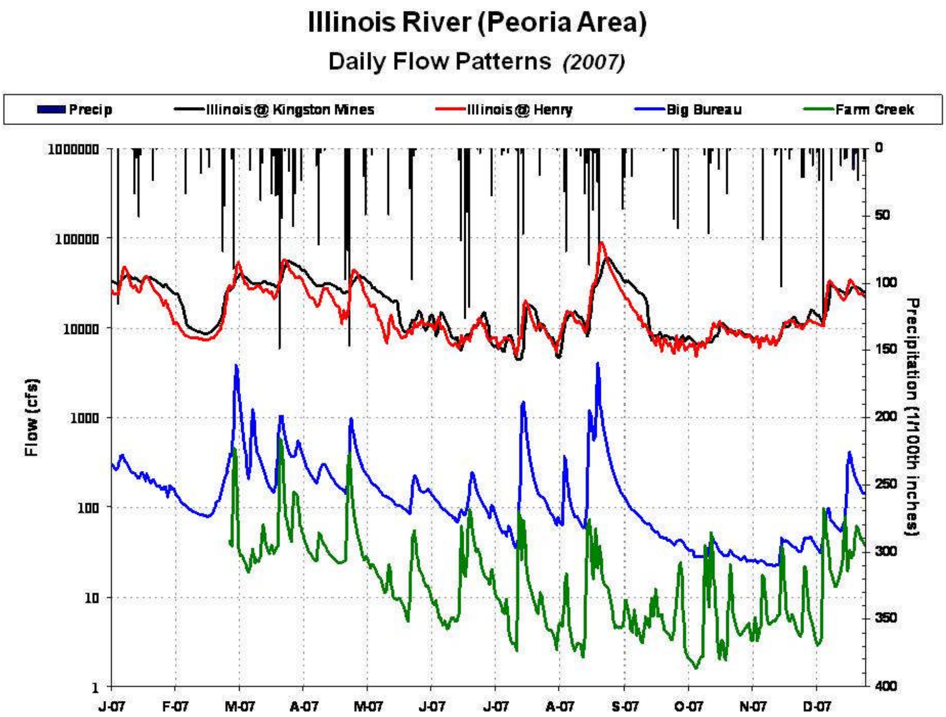

Figure 1-11. Daily average flow at several USGS gages in the Peoria area -- 2007.

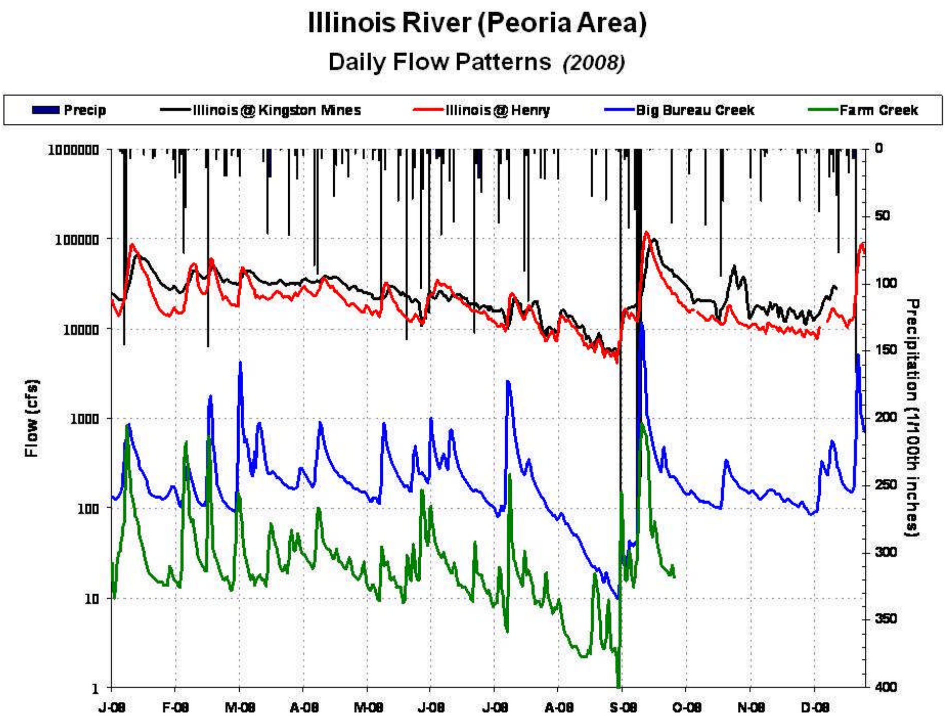

Figure 1-12. Daily average flow at several USGS gages in the Peoria area -- 2008.

1.8.1 Seasonal Flow Variation

Seasonal variation in flow is a key part of the overall TMDL assessment because water quality parameters are often related to stream flow rates. This is a particularly important component of subsequent analyses linking sources to observed water quality, where the timing of source loads is connected to seasonal water quality patterns.

Figure 1-13 shows the seasonal variation of flow for the Illinois River at Henry site using the entire period of record (1981 – 2010). In addition to showing general patterns, the box and whisker format used in Figure 1-13 highlights the variability of flows from month to month. For example, the highest flows typically occur between March and May. Flows during these months also tend to vary, reflecting the significant effect that air temperatures exert on hydrology. Periods of heavy snow followed by warmer temperatures can result in major runoff events. Conversely, lower winter flows may coincide with extended periods of below freezing temperatures.

Related to seasonal variation, year-to-year variability is another consideration that affects watershed hydrology. This in turn influences water quality, in particular sediment transport. Peak flow history is one way to view the effect of interannual variation, as shown in Figure 1-15 using the Illinois River at Henry gage. Figure 1-16 shows the peak flow history for the Big Bureau Creek gage which demonstrates the difference between main stem and tributary peak flows. The information in both figures is expressed as unit area flows.

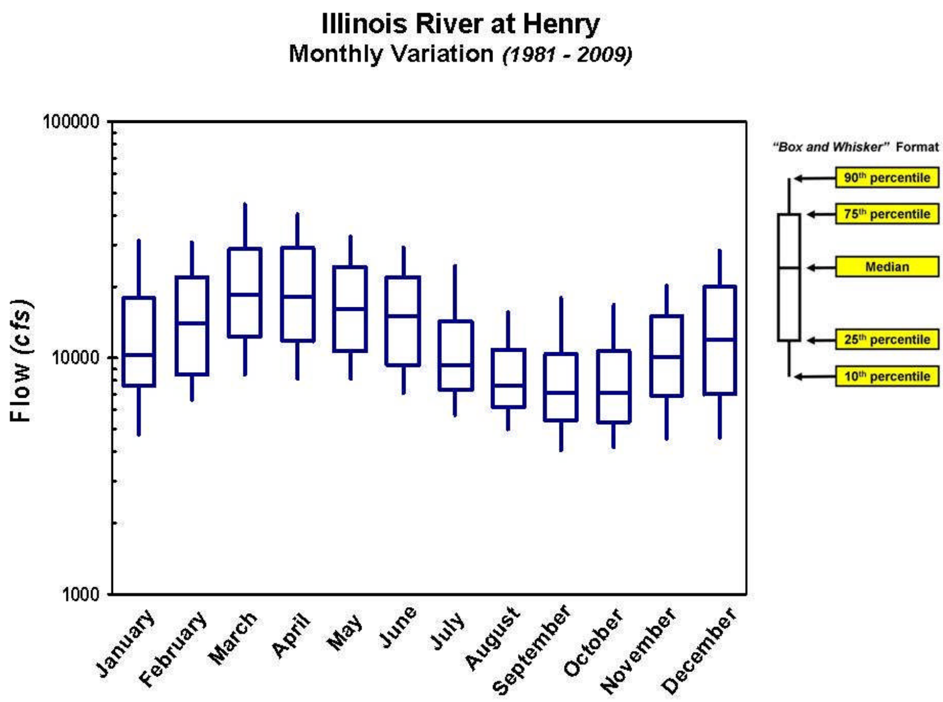

Figure 1-13. Seasonal variation of Illinois River flows.

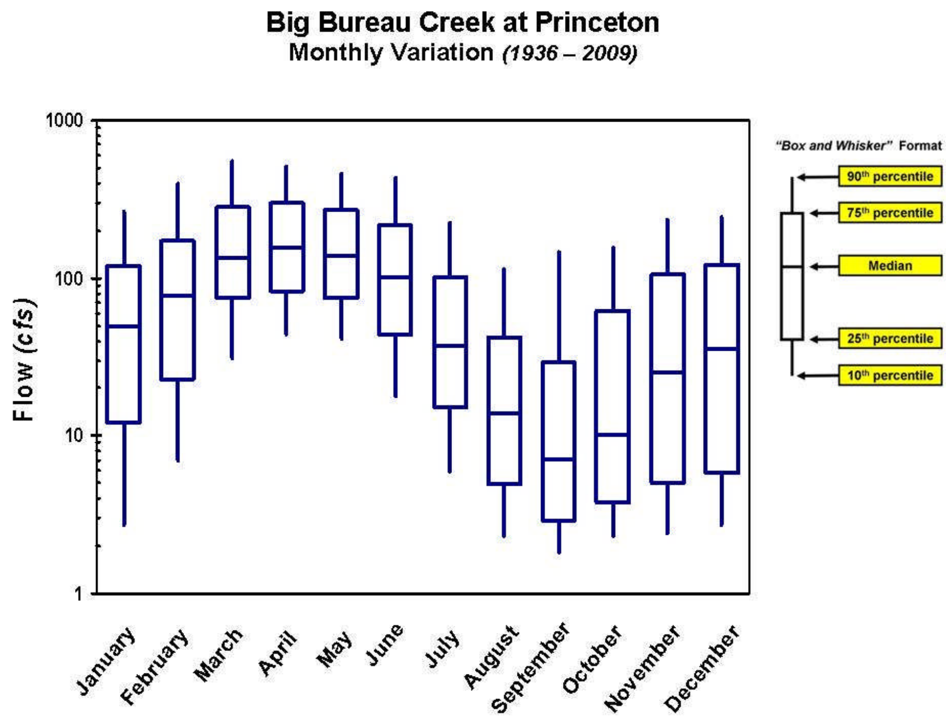

Figure 1-14. Seasonal variation of Big Bureau Creek flows.

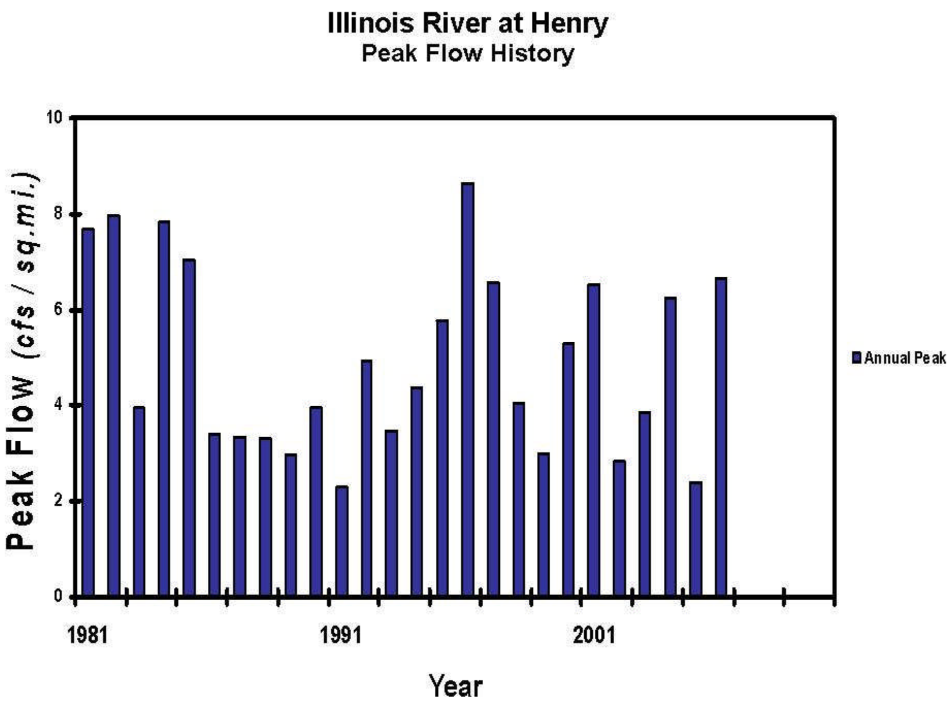

Figure 1-15. Peak flow history for Illinois River at Henry gage.

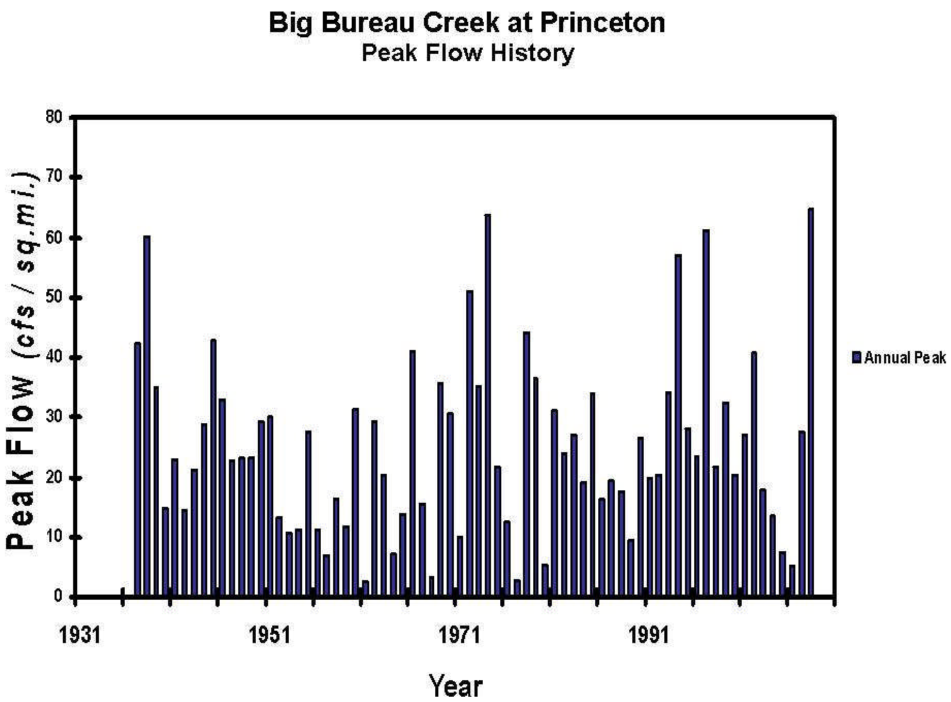

Figure 1-16. Peak flow history for Big Bureau Creek gage.

1.8.2 Flow Duration Curves

The daily average, peak history, and monthly flow data show the inherent variability associated with hydrology. Flow duration curves provide a way to address that variability and flow related water quality patterns. Duration curves describe the percentage of time during which specified flows are equaled or exceeded. Flow duration analysis looks at the cumulative frequency of historic flow data over a specified period, based on measurements taken at uniform intervals (e.g., daily average or 15-minute instantaneous). Duration analysis results in a curve that relates flow values to the percent of time those values have been met or exceeded. Low flows are exceeded a majority of the time, whereas floods are exceeded infrequently. In the case of this TMDL, a load duration curve approach is used in which the curve represents the target value for a given pollutant in order to determine flow conditions, or intervals, under which exceedances occur. This approach is further described in Section 4.2.

Duration curves provide the benefit of considering the full range of flow conditions (U.S. EPA 2007). Development of a flow duration curve is typically based on daily average stream discharge data. A typical curve runs from high flows to low flows along the x-axis, as illustrated in Figure 1-17. Note the flow duration interval of sixty associated with a stream discharge of 9,400 cfs (i.e., sixty percent of all observed stream discharge values equal or exceed 9,400 cfs).

Flow duration curve intervals can be grouped into several broad categories or zones. These zones provide additional insight about conditions and patterns associated with water quality impairments where hydrology may play a major role. One common way to look at the duration curve is by dividing it into five zones, as illustrated in Figure 1-17: one representing high flows (0-10 percent), another for moist conditions (10-40 percent), one covering mid-range flows (40-60 percent), another for dry conditions (60-90 percent), and one representing low flows (90-100 percent).

This particular approach places the midpoints of the moist, mid-range, and dry zones at the 25th, 50th, and 75th percentiles respectively (i.e., the quartiles). The high zone is centered at the 5th percentile, while the low zone is centered at the 95th percentile. Other schemes can be used, depending on local hydrology, the water quality issues being addressed by assessment efforts, data availability, and the way in which water quality criteria are expressed.

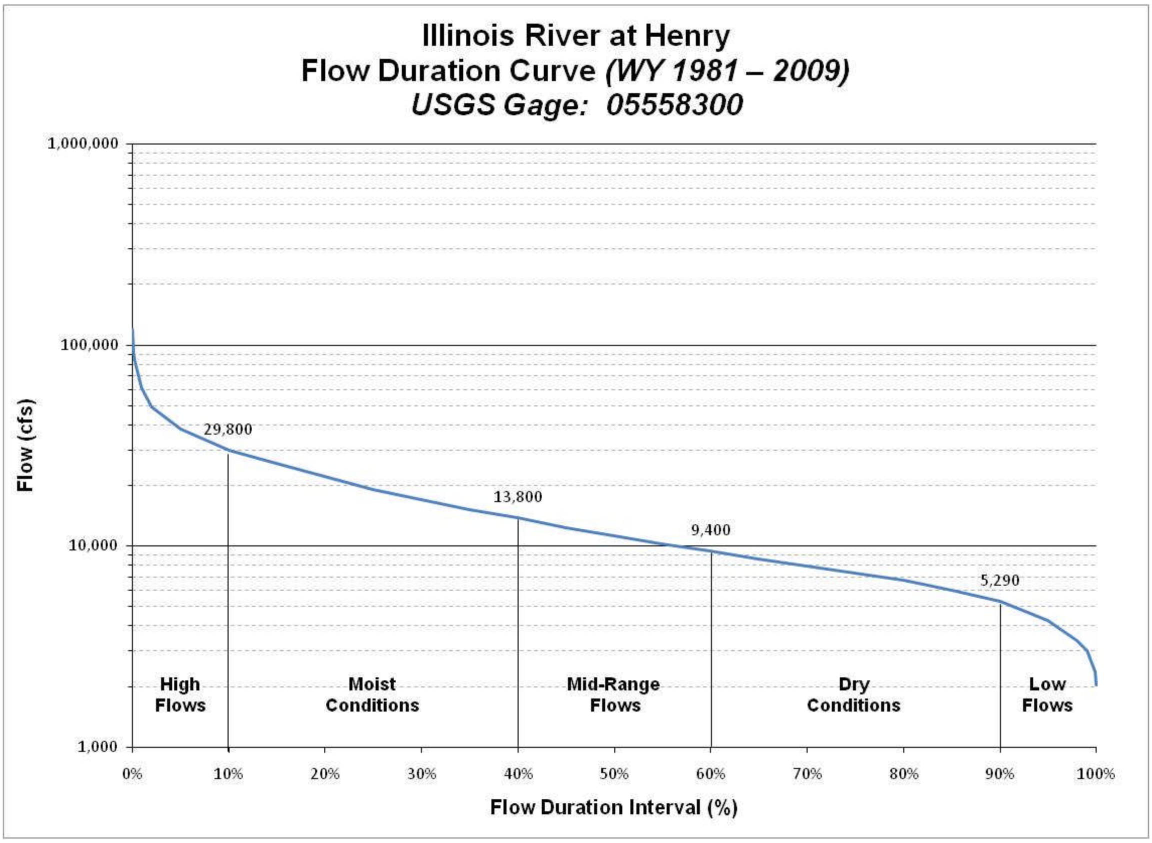

Figure 1-17. Flow duration curve for Illinois River at Henry gage.

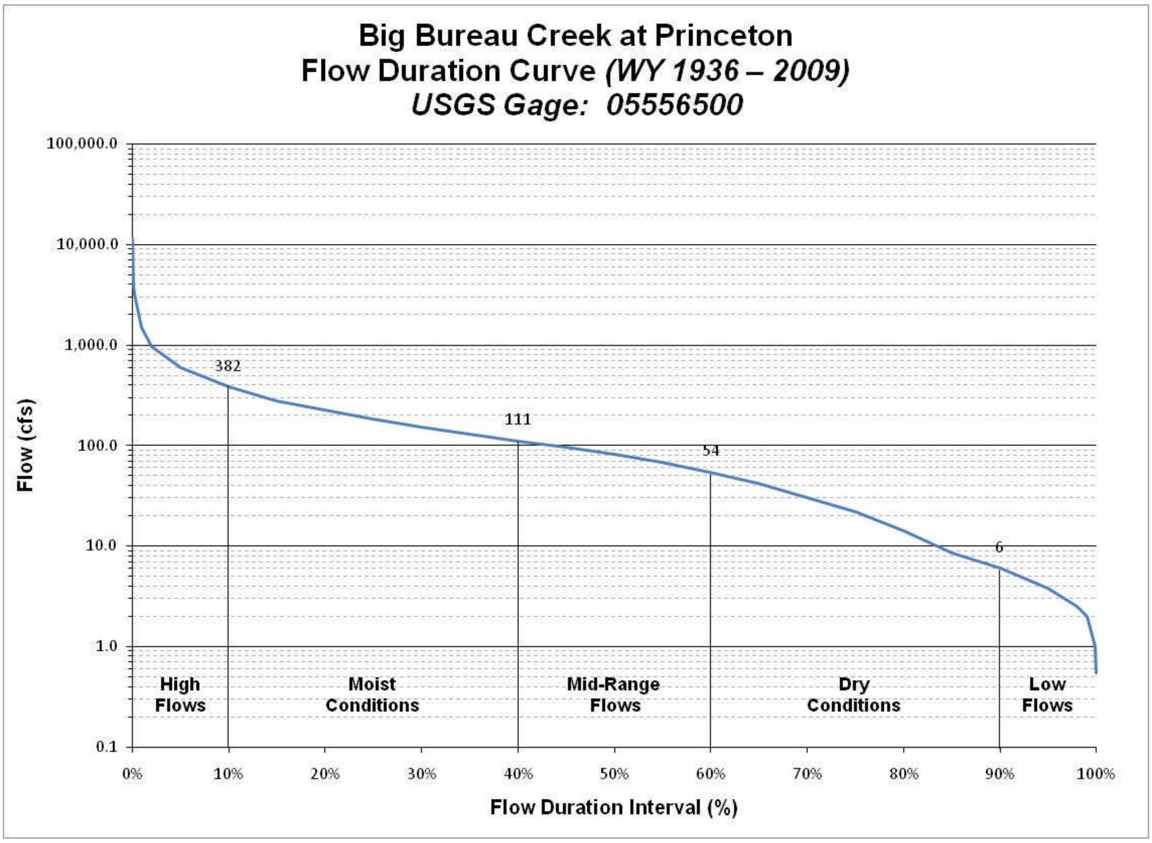

Figure 1-18. Flow duration curve for Big Bureau Creek at Princeton gage.

1.9 Monitoring and Special Studies

1.9.1 Ambient Water Quality Monitoring

Routine water quality monitoring is a key part of the Illinois EPA assessment program. The goals of Illinois EPA surface water monitoring programs are to identify causes of pollution (toxics, nutrients, sedimentation) and sources (point or nonpoint) of surface water impairments, determine the overall effectiveness of pollution control programs and identify long term resource quality trends. Illinois EPA has operated a widespread, active long-term monitoring network in Illinois since 1977, known as the Ambient Water Quality Monitoring Network (AWQMN). The AWQMN is utilized by the Illinois EPA to provide baseline water quality information, to characterize and define trends in the physical, chemical and biological conditions of the state's waters, identify new or existing water quality problems and to act as a triggering mechanism for special studies or other appropriate actions.

Additional uses of the data collected by the Illinois EPA through the AWQMN program include the review of existing water quality standards and establishment of water quality based effluent limits for NPDES permits. The AWQMN is integrated with other Illinois EPA chemical and biological stream monitoring programs which are more regionally based (specific watersheds or point source receiving stream) and cover a shorter span of time (e.g. one year) to evaluate compliance with water quality standards and determine designated use support. Information from this program is compiled by Illinois EPA into a biennial report required by the Federal Clean Water Act.

Within the Middle Illinois River watershed, there are eight active stations that are part of AWQMN (Table 1-11 and Figure 1-19). Parameters sampled include field measurements (e.g., conductivity, water temperature, dissolved oxygen, turbidity) as well as those that require lab analyses (e.g., bacteria, nutrients, total suspended solids). Additional sites were sampled during Stage 2 of this TMDL process for tributary data. Water samples were analyzed for fecal coliform, total phosphorus, nitrate nitrogen, and total suspended solids.

A large amount of information exists that can be used to closely examine longitudinal, seasonal, and year-to-year patterns. Examples are shown in Figure 1-20 through Figure 1-24. Improved pattern analysis can help focus additional watershed characterization activities, prioritize source assessment needs, and strengthen the TMDL linkage analysis. Longitudinal, seasonal, and year-to-year profiles for all parameters can be developed that support efforts to assess important patterns, identify critical conditions, and evaluate potential cause and effect relationships.

Table 1-11. Middle Illinois River watershed AWQMN sites.

AWQMN and TMDL Sites	USGS Gage	Water Body	Location	County	Lat	Long
D-05	05563800	Illinois River	Route 9 at Pekin	Peoria	40.5730	89.6547
D-09	05558995		Route 17 at Lacon	Marshall	41.0250	89.4172
D-16	05556200		Route 26 at Hennepin	Putnam	41.2575	89.3469
D-30	05559900		Peoria PWS Intake	Peoria	40.7250	89.5494
DL-01	05563525	Kickapoo Creek	US 24 north of Bartonville	Peoria	40.6550	89.6477
DQ-03	05556500	Big Bureau Creek	Route 6 near west edge of Princeton	Bureau	41.3652	89.4986
DQD-01	05557000	West Bureau Creek	US 6/34 at east edge of Wyanet	Bureau	41.3650	89.5688
DZZP-03	05562010	Farm Creek	Camp Street north of East Peoria, Gage #05562000 Main St.	Tazewell	40.6711	89.5800
DM-01[a]	na	Senachwine Creek	1 Mi NNW Chillicothe	Peoria	40.9403	-89.5008
DO-01[a]	na	Crow Creek E	Route 26 7 Mi W Washburn	Marshall	40.9321	-89.4282
DP-01[a]	na	Sandy Creek	Route 89 Br 1 Mi S Magnolia	Marshall	41.0917	-89.2039
DP-02[a]	na	Sandy Creek	2.5 Mi ESE Henry	Marshall	41.0894	-89.3129
DQ-04[a]	na	Big Bureau Creek	Route29 Br 1Mi SW Bureau	Bureau	41.2787	-89.3833
RDU-1	na	Lake Depue	SITE 1 TIP OF SW PENN. MID LAKE	Bureau	41.3110	-89.3196
RDU-2			SITE 2 1.75 MI NE SITE 1 MIDL	Bureau	41.3185	-89.3116
RDU-3			SITE 3 2MI ENE S2 MIDLAKE	Bureau	41.3205	-89.2995
RDZX-1	na	Senachwine Lake	SITE 1 N END OF LK	Putnam	41.1517	-89.3377
RDZX-2			SITE 2 75 YDS S OF ISLAND	Putnam	41.1743	-89.3398
RDZX-3			ST3 600 YDS S OF RAMP NEAR HOUSES	Putnam	41.1906	-89.3545

na – no USGS gage at/near sampling site
a. Sites sampled during Stage 2 TMDL development

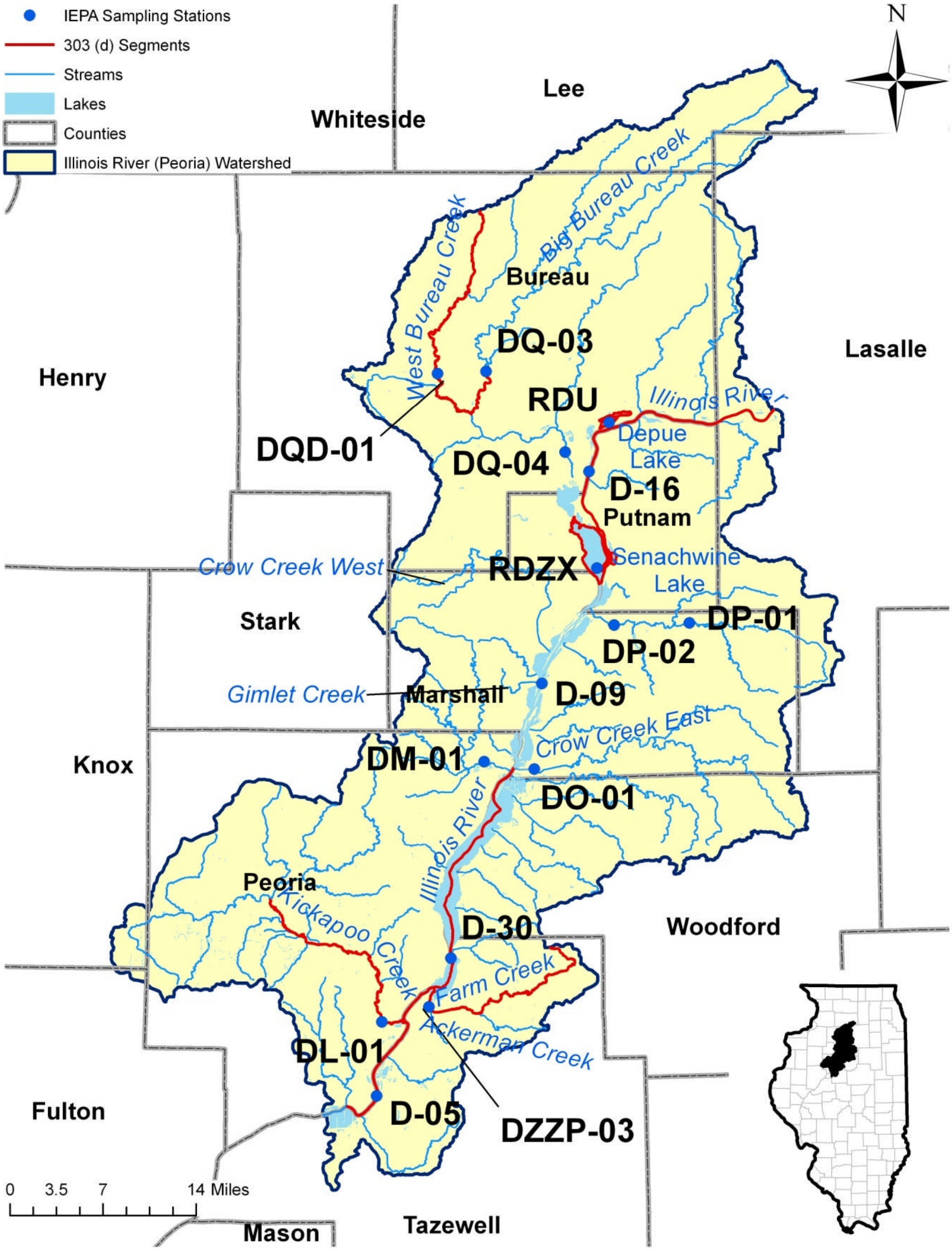

Figure 1-19. Location of Middle Illinois River watershed AWQMN sites.

Bacteria

Fecal coliform is used as a water quality indicator for the possible risk associated with the presence of bacteria. When elevated, harmful bacteria and viruses may be present. Potential sources of bacteria include agricultural runoff, illicit sewage connections, domestic pet waste, water fowl, and animal waste in storm sewer lines (e.g., rats and raccoons).

Box and whisker plots provide one way to analyze the variability in bacteria data. The *Box* is divided at the median, and expands to the 75th and 25th percentile; the *Whiskers* extend from the 75th and 25th percentile to the 90th and 10th percentile respectively. Figure 1-20 presents a box and whisker plot representing available bacteria data per drainage area of the tributaries and the main stem of the Illinois River. In general, concentrations within the tributaries were highly variable and elevated in relation to concentrations found within the main stem of the Illinois River. This may represent seasonal runoff from agricultural areas. Within the Illinois River, concentrations of fecal coliform are lowest at the Peoria Intake. Downstream of Peoria, concentrations of fecal bacteria tend to be elevated relative to other points along the Illinois River. Sources from Peoria, being an urbanized area, include stormwater runoff, combined sewer overflows, and point source discharges.

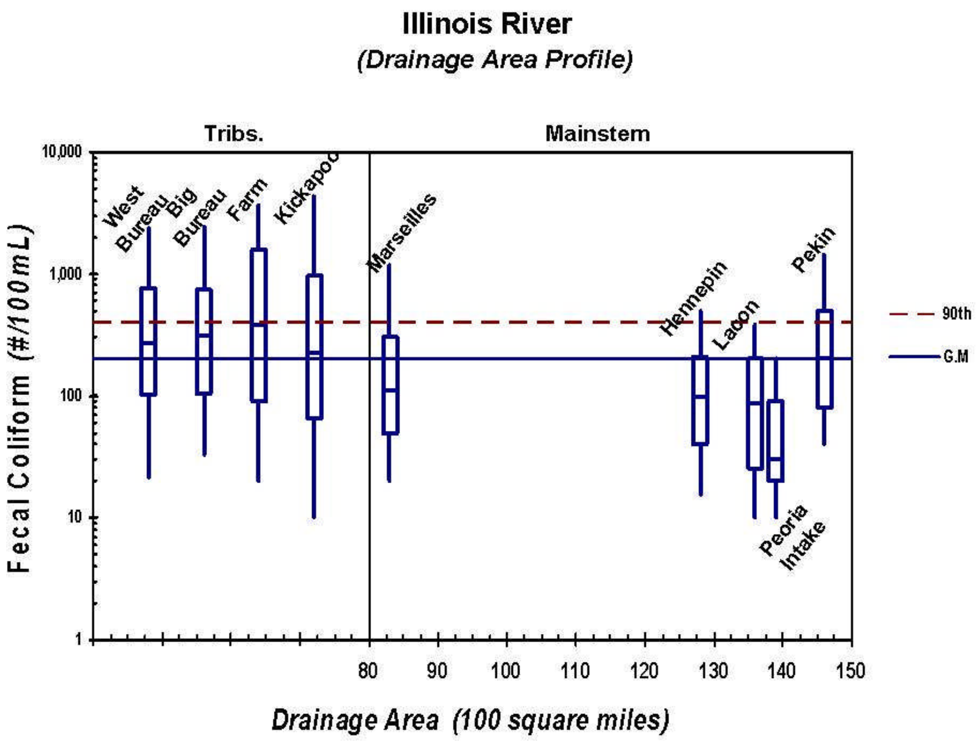

Figure 1-20. Longitudinal profile of fecal coliform.

Total Suspended Solids

Loading of total suspended solids (TSS) can increase the system's turbidity and lead to accelerated sedimentation. Primary sources of TSS are typically associated with runoff events and include: construction sites, poorly stabilized slopes, different types of erosion, or bare farm fields. Due to the association with runoff, TSS can be paired with other constituents for enhanced source evaluation. For example, elevated nitrate levels that follow a similar trend as elevated TSS may indicate a similar source such as a farm field.

Figure 1-21 presents a box and whisker plot presenting available TSS data per drainage area of tributaries and the main stem of the Illinois River. In general, tributaries exhibited high variability while the Illinois River had considerably less. Along the Illinois River, median concentrations of TSS corresponded to increased drainage area, with increasing concentrations further downstream. Variability within the tributaries may indicate seasonal differences associated with runoff events.

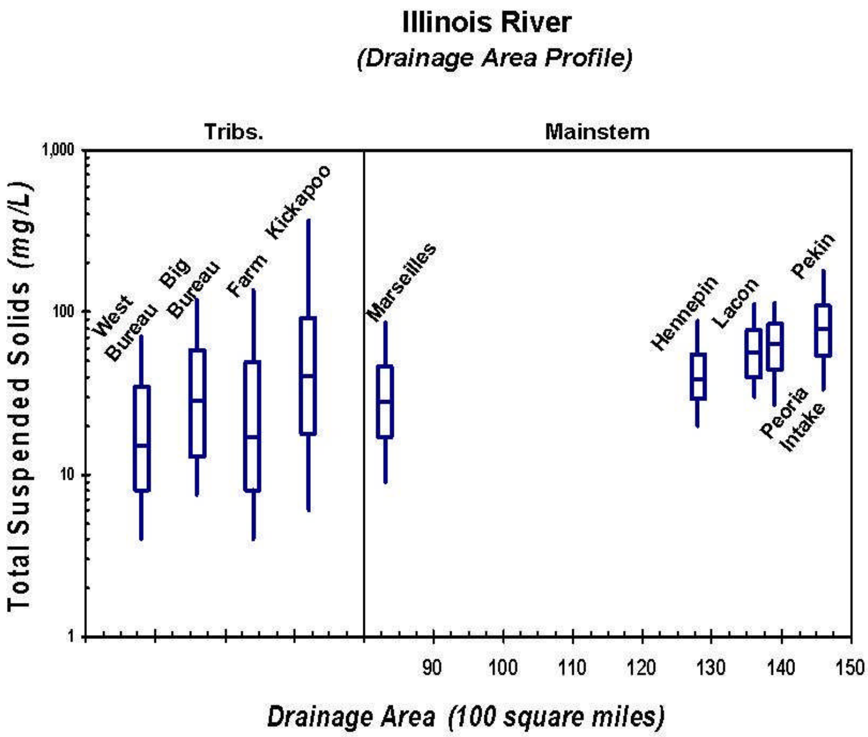

Figure 1-21. Longitudinal profile of total suspended solids.

Nutrients

Elevated levels of phosphorus and nitrogen can lead to undesirable algal blooms, low oxygen levels, and ultimately, decreased aquatic life. Phosphorus can originate from both point and nonpoint sources. Typical sources include: wastewater treatment facilities, lawn fertilizers, pet waste, grass clippings, leaves, sediments, and phosphorus accumulated on impervious surfaces; all of which can be transported to receiving waters either directly or during rain and snowmelt events.

Figure 1-22 presents a box and whisker plot presenting available phosphorus data per drainage area of tributaries and the main stem of the Illinois River. In general, a wide range of concentrations were found within the tributaries; less variability but consistently higher median concentrations were found within the main stem of the Illinois River.

Figure 1-23 presents a box and whisker plot presenting available nitrate data per drainage area of tributaries and the main stem of the Illinois River. In general, nitrate concentrations within the tributaries had considerable variability, and in some cases, the highest median concentrations. The main stem of the Illinois River has relatively decreased variability and a consistent range in concentrations with increasing drainage area.

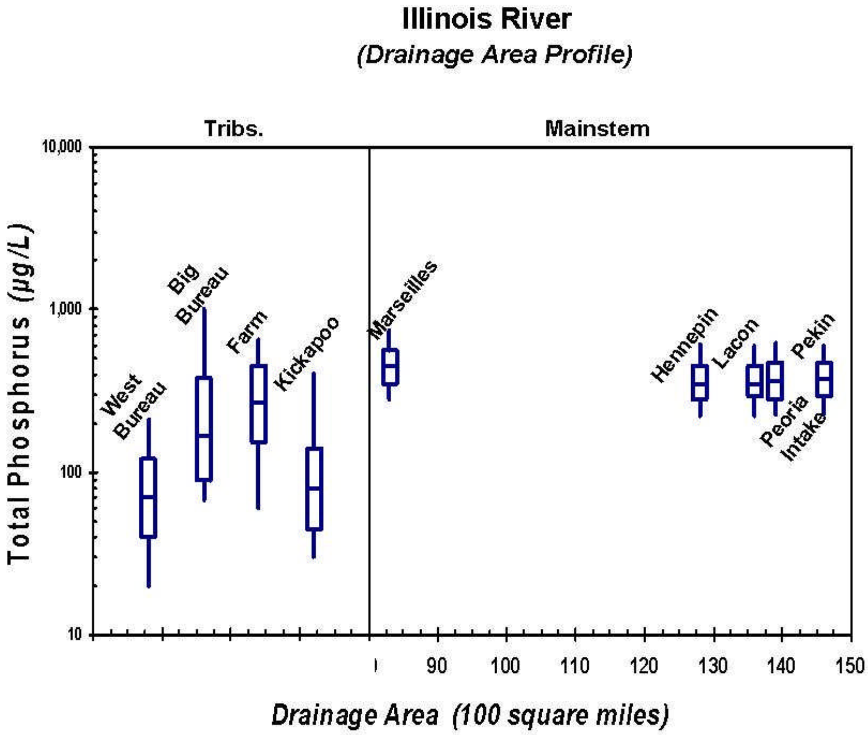

Figure 1-22. Longitudinal profile of total phosphorus.

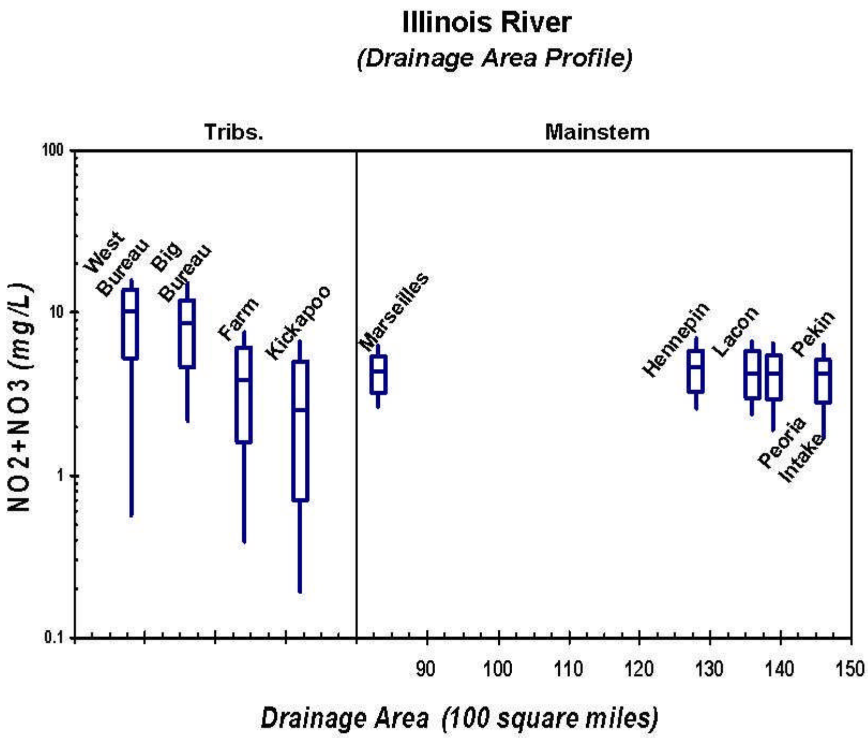

Figure 1-23. Longitudinal profile of nitrate plus nitrite as nitrogen.

Other Parameters

Conductivity can be a good indicator of water quality, in particular the concentration of ions within the water column. Figure 1-24 presents conductivity data within the tributaries and main stem of the Illinois River. In general, a wide range of concentrations were found in both the tributaries and main stem of the Illinois River, with the highest median concentrations found in Farm Creek and Kickapoo Creek, which could be due to the urban land uses within these two watersheds.

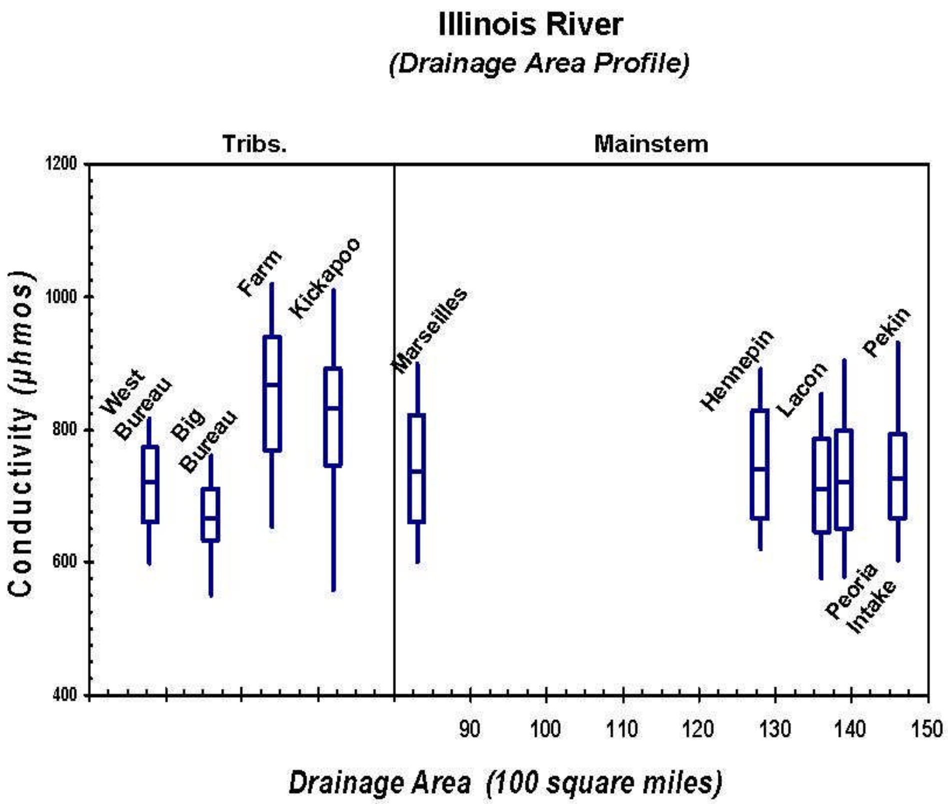

Figure 1-24. Longitudinal profile of conductivity.

1.9.2 Special Studies

Illinois State Water Survey Sediment Studies

Due to concern surrounding sedimentation and siltation across the Illinois River valley, numerous studies have been conducted to identify sources of sediment and evaluate the transport and total sediment yield or load generated within the watershed. The Illinois State Water Survey (ISWS) has been instrumental in the effort to better characterize sediment loading within the Illinois River valley.

It has been identified that many of the environmental problems in the Illinois River Basin are due to urban and agricultural development, fragmentation of the landscape, alteration of upland drainage networks and floodplain alterations. These and other landscape alterations have resulted in advanced rates of landscape erosion; destabilization of the Illinois River main stem and tributary streams; sedimentation of the river main stem, backwaters, and side-channels; sedimentation of significant tributary floodplain pools and lakes; and, unnatural flow regimes (White et al. 2005).

In parts of Illinois, nearly 70 percent of the topsoil has been lost due to wind and water erosion (Bhowmik 1984). Such erosion and subsequent sedimentation have long been recognized as the primary causes for most of the environmental and ecological problems across the Illinois River Valley (Demissie et al. 2004). One of the most serious problems identified is the sedimentation in the river channel and backwater lakes (Demissie et al. 1999). For example, it has been found that excessive sedimentation has led to the loss of over 68 percent of the original volume of Lake Peoria (Demissie and Bhowmik 1986) as the deltas within the Lake continue to grow (Bhowmik et al. 2001). Although conditions in bottomland lakes along the Illinois River were significantly altered when the State of Illinois increased diversion of water from Lake Michigan (Lee et al. 1979; Demissie 1996), studies have now identified the main sources of sediment to the Illinois River valley as watershed erosion, streambank erosion, and bluff erosion (Demissie et al. 2004). A sediment budget calculation based on suspended sediment data shows that tributary streams deliver a significant amount of the sediment to the Illinois River valley, of which a portion is discharged into the Mississippi River or trapped in the Illinois River (Demissie 1996).

The evaluation of sediment loading can be potentially useful in evaluating and predicting the relative effects of seasonal differences in tillage practices, cropping patterns, and pesticide applications on stream sediment and water quality (Adams et al. 1984; Bhowmik et al. 1986). For example, data show that spring (February through May) and summer months (June through September) both carry a much higher percentage of the total annual load than fall and winter (October through January) seasons (Adams et al. 1984; Bhowmik et al. 1986). This trend is likely related to land use practices such as tilling fields and exposing soil to spring rains.

It should be noted that most soil conservation-oriented agencies concentrate erosion control practices in the uplands of agricultural and urban areas yet current evidence now suggests that streambeds, streambanks, and near-channel areas such as hill slopes are significant sources of sediment where conservation practices need to be targeted (White et al. 2005).

USGS Synoptic Bacteria Survey

The USGS monitored the main stem Illinois River and tributaries for fecal coliform and *E. coli* bacteria from October 2007 to September 2008. Monthly samples were collected on the main stem at Hennepin and downstream of Peoria. Random samples were taken throughout the watershed. Table 1-12 summarizes the number of samples and geometric mean of all samples at each location. For a comparison of fecal coliform and *E. coli*, Figure 1-25 contains data at pertinent locations for the day of October 10, 2007. This is the only day in which samples were obtained for all locations. Tributaries are on the left and the main stem locations are on the right side of the figure. Sandy Creek, Farm Creek, and Kickapoo Creek had the highest tributary concentrations. The Illinois River at Peoria had the highest main stem bacteria concentration.

Table 1-12. USGS bacteria study sampling summary.

USGS Site	USGS Site Description	Number of Samples	Data Geomean (cfu/100 mL)
05556500	Big Bureau Creek at Princeton	11	410
05558000	Big Bureau Creek at Bureau	1	200
05558295	SANDY CREEK AT HENRY	1	400
05558500	CROW CREEK (WEST) NEAR HENRY	1	6
05558990	THENIUS CREEK AT SPARLAND	1	216
05559590	CROW CREEK NEAR CHILLICOTHE	1	146
05559700	SENACHWINE CREEK AT CHILLICOTHE	9	168
05559770	RICHLAND CREEK BL DRY CREEK NR CHILLICOTHE	1	987
05559800	PARTRIDGE CREEK NEAR METAMORA	4	573
05559820	PARTRIDGE CREEK TRIBUTARY NEAR METAMORA	3	608
05559830	PARTRIDGE CREEK NEAR SPRING BAY	1	34
05559840	BLALOCK CREEK NEAR SPRING BAY	1	640
05559890	TENMILE CREEK AT TRAILPARK GARDENS	1	6
05560500	FARM CREEK AT FARMDALE	10	357
05561800	FARM CREEK AT RT 150 AT EAST PEORIA	1	800
05562000	FARM CREEK AT EAST PEORIA	1	83
05562010	FARM CR AT CAMP ST BRIDGE AT EAST PEORIA	1	140
05563525	KICKAPOO CREEK AT BARTONVILLE	2	336
05556200	ILLINOIS RIVER AT HENNEPIN	35	59
05558300	ILLINOIS RIVER AT HENRY	3	59
05558995	ILLINOIS RIVER AT LACON	3	37
05559600	ILLINOIS RIVER AT CHILLICOTHE	4	47
05559850	ILLINOIS RIVER AT SOUTH ROME	2	41
05559900	ILLINOIS RIVER AT WATER COMPANY AT PEORIA	3	9
05560000	ILLINOIS RIVER AT PEORIA	6	72
05562100	ILLINOIS RIVER AT FRANKLIN ST BRIDGE AT PEORIA	4	79
05562200	ILLINOIS RIVER BELOW PEORIA LAKE AT PEORIA	34	72
05563590	ILLINOIS R AB PEORIA LOCK AND DAM NR CREVE COEUR	1	520

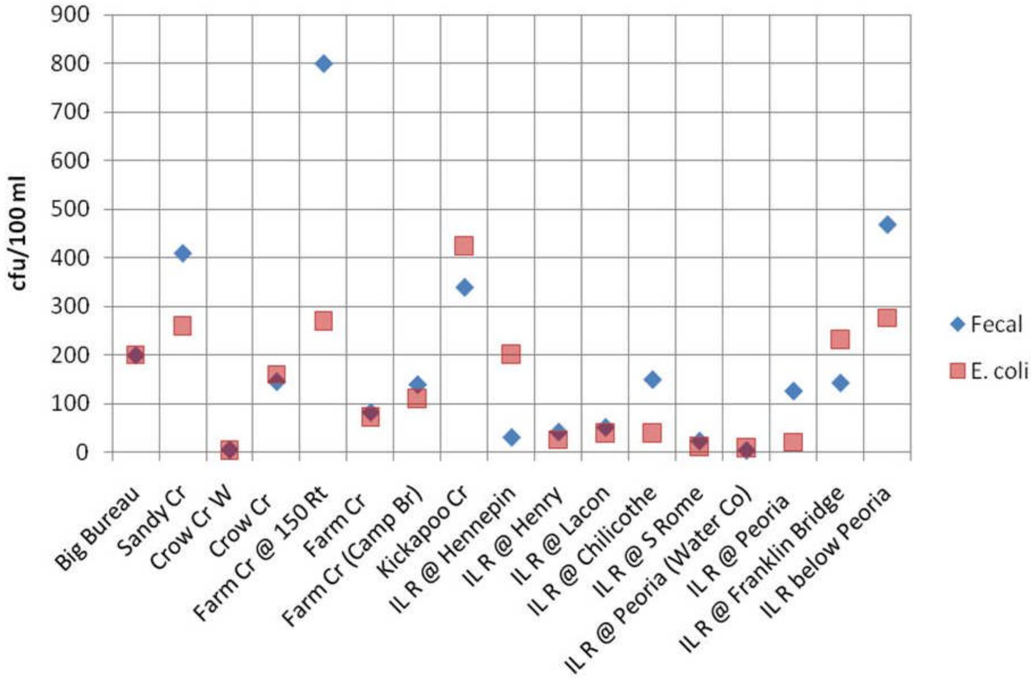

Figure 1-25. USGS bacteria data on 10/10/2007.

2. Watershed Source Assessment

Source assessments are an important component of water quality management plans and TMDL development. Source assessment methods vary widely with respect to their applicability, ease of use, and acceptability. This section provides a summary of potential watershed-wide sources that contribute listed pollutants to the Middle Illinois River watershed. Watershed specific source assessments are provided in Sections 5 through 13.

Approximately 68 percent of the watershed area is devoted to agricultural activities. Wetlands and upland forest occupy approximately 17 percent of the watershed area. Other land use categories, including urban, represent the remaining 11 percent. There are numerous point source discharges (e.g., municipal or industrial wastewater treatment plants, urban stormwater, livestock facilities) in this watershed. Potential nonpoint sources include agriculture, pasture management, and crop-related sources, land disposal of human / animal waste, on-site wastewater systems, bank or shoreline modification / destabilization, habitat modification, urban runoff / stormwater and waterfowl.

Historic development revolving around the growth and urbanization of the greater Peoria area has created a wide array of potential sources that could deliver contaminants to the Illinois River. For example, one dominant source of pollutants to the Illinois River is associated with stormwater. The high percentage of impervious surface in the urbanized portion of the watershed has resulted in a network of drainage systems. Stormwater is quickly conveyed to the Illinois River through numerous stormwater outfalls. The increased stormwater volumes also enter the combined sewer system, causing occasional discharge of untreated domestic wastewater to the Illinois River through CSOs. In addition, pollutants associated with runoff from agricultural areas have the potential to be carried to the Illinois River and its tributaries during rain and snowmelt events.

2.1 Overview of Watershed Sources

Pollutants of concern evaluated within this source assessment include fecal coliform, phosphorus, nitrogen, sediment, chloride, manganese, and total dissolved solids. These pollutants can originate from an array of sources including point and nonpoint sources. 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 listed pollutants to the impaired waterbodies.

2.1.1 Point Sources

Point source pollution is defined by the Federal Clean Water Act (CWA) §502(14) as: *any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture stormwater discharges and return flow from irrigated agriculture*.

Point sources can include facilities such as municipal wastewater treatment plants, industrial facilities, confined animal feeding operations (CAFOs), or regulated stormwater including municipal separate storm sewer systems (MS4s). Under the CWA all point sources are regulated under the Nation Pollutant Discharge Elimination System (NPDES) program. MS4 and NPDES permit holders within the project area are discussed below.

NPDES Facilities

A municipality, industry, or operation must apply for an NPDES permit if an activity at that facility discharges wastewater to surface water. Examples of NPDES facilities within the study area include municipal and industrial wastewater treatment plants. Bacteria, nutrients, and total dissolved solids can be found in these discharges.

Twenty two WWTPs have disinfection exemptions in the watershed which allow a facility to discharge wastewater without disinfection. Facilities with year-round disinfection exemptions may be required to provide Illinois EPA with updated information to demonstrate compliance with these requirements and facilities directly discharging into a fecal-impaired segment may have their year-round disinfection exemption revoked through future NPDES permitting actions.

There are 112 NPDES permitted facilities within the project area. The list and locations of all current NPDES permitted facilities within the watershed are provided within each watershed cluster section (Sections 5 through 13). Exemption status is included in the facility summaries. Average design flows for Illinois NPDES facilities are also listed.

Municipal Separate Storm Sewer Systems

Regulated stormwater runoff may be a significant source of pollutants to the Illinois River. Stormwater runoff can contain sediment, nutrients, bacteria, chloride, total dissolved solids, and sediment derived manganese.

Under the NPDES program, municipalities serving populations over 100,000 people are considered Phase I MS4 communities. Within the project area, there are no Phase I communities. Municipalities serving populations under 100,000 people are considered Phase II communities. Within Illinois, Phase II communities are allowed to operate under the statewide General Stormwater Permit (ILR40) which first requires dischargers to file a Notice of Intent (NOI), acknowledging that discharges shall not cause or contribute to a violation of water quality standards.

To assure pollution is controlled to the maximum extent practical, regulated entities operating under the State General Permit (ILR40) are required to implement six control measures including public education, public involvement, illicit discharge and detection programs, control of construction site runoff, post construction stormwater management in new development and redevelopment, and pollution prevention/good housekeeping for municipal operations. Regulated entities operating under the State General Permit within the project area are identified in Table 2-1.

Table 2-1. MS4 permits in the Middle Illinois River watershed.

Permit ID	Regulated Entity	Location (watershed cluster)	MS4 Area (Square Miles)
IRL400287	Village of Bartonville	Kickapoo Creek and Illinois River Main Stem	5.62
IRL400073	Kickapoo Township	Kickapoo Creek	26.96
IRL400078	Limestone Township	Kickapoo Creek and Illinois River Main Stem	9.11
IRL400085	Medina Township	Kickapoo Creek and Illinois River Main Stem	26.98
IRL400424	City of Peoria	Kickapoo Creek and Illinois River Main Stem	45.62
IRL400392	Village of Morton	Farm Creek	3.54
IRL400683	Cincinnati Township	Illinois River Main Stem	0.01
IRL400331	City of East Peoria	Farm Creek and Illinois River Main Stem	20.53
IRL400403	City of North Pekin	Illinois River Main Stem	1.12
IRL400423	City of Pekin	Illinois River Main Stem	8.60
IRL400665	Washington Township	Farm Creek and Illinois River Main Stem	37.53
ILR400165	City of Bellevue	Kickapoo Creek	1.64
ILR400322	City of Creve Coeur	Farm Creek and Illinois River Main Stem	4.40
ILR400381	City of Marquette Heights	Illinois River Main Stem	1.61
ILR400425	City of Peoria Heights	Kickapoo Creek and Illinois River Main Stem	6.71
ILR400506	City of West Peoria	Kickapoo Creek	1.26
ILR400599	Peoria City Township	Kickapoo Creek and Illinois River Main Stem	2.13
ILR400493	Illinois Department of Transportation Roads	Farm Creek, Kickapoo Creek, and Illinois River Main Stem	2.68
IRL400271	Tazewell County Roads	Farm Creek and Illinois River Main Stem	0.10
IRL400267	Peoria County Roads	Kickapoo Creek and Illinois River Main Stem	0.72
Total MS4 Area			**207**

Sewer Overflows

Combined sewer systems are designed to collect and carry stormwater runoff as well as domestic and industrial wastewater in the same pipe. Under dry weather conditions, this system efficiently conveys flow to the wastewater treatment facility. However, under heavy rains, the system can be stressed beyond its capacity. When this occurs, combined sewer systems are designed to overflow and discharge excess wastewater including bacteria, nutrients, and sediment, to nearby surface waters. For this reason, combined sewer overflows (CSOs) are a major water quality concern. To regulate such sources of pollution, combined sewer systems are regulated under the NPDES program. Outfalls for both combined sewer overflows and sanitary sewer overflows (SSOs) are identified in Table 2-2 and reported maximum flows from each outfall are reported in the appendix in Table A-11. Table 2-3 summarizes the number of CSOs and SSOs per year as reported by the facilities. The status of long term control plans (LTCPs) are summarized in Table 2-4.

Table 2-2. Combined sewer systems and sanitary sewer overflows within the project area.

Facility Name	NPDES Permit ID	Number of Regulated Outfalls	CSO or SSO	Maximum CSO flow (MGD) [a]	Downstream Receiving Water
Bureau Junction STP	IL0033120	1	CSO	13.6	Big Bureau Creek
East Peoria STP #1	IL0028576	4	SSO	0	Farm Creek
Granville STP	IL0022331	3	CSO	13.6	Illinois River Main Stem
Kewanee STP	IL0029343	1	SSO	0	Kickapoo Creek
Lasalle WWTP	IL0029424	2[b]	CSO	27.1	Illinois River Main Stem
		1	SSO	0	
Metamora North STP	IL0021539	1	SSO	0	Illinois River Main Stem
Oglesby STP	IL0024996	7	CSO	0	Sandy Creek
Pekin STP #1	IL0034495	4	CSO	278.3	Illinois River Main Stem
Peoria CSOs	IL0037800	16	CSO	42.5[c]	Illinois River Main Stem
Peoria SD STP	IL0021288	1	SSO	0	Illinois River Main Stem
Peru STP #1	IL0030660	22	CSO	986.6	Illinois River Main Stem
Spring Valley STP	IL0031216	8	CSO	118.1	Illinois River Main Stem
Washington STP #2	IL0042412	4	SSO	0	Farm Creek
Wenona STP	IL0021792	1	CSO	NIA	Sandy Creek

a. Flow data provided by facility as of September 19, 2011. Additional flow data may be available in the future.
b. An additional outfall is located outside of the Illinois River Main Stem watershed
c. Based on a maximum annual overflow of 170 MG as reported in Peoria's CSO modeling estimates and the assumption of 4 overflows per year.
NIA= No Information Available

Table 2-3. Summary of available reported data for CSO Outfalls within the project area.

Facility	NPDES ID	CSO outfall	Number of CSO Events per Year			
			2007	2008	2009	2010
Bureau	IL0033120	002	1	--	--	--
Granville	IL0022331	002	--	3	4	8
Granville	IL0022331	004	--	1	1	1
LaSalle STP	IL0029424	003	5	1	--	--
LaSalle STP	IL0029424	006A	20	3	--	--
Oglesby	IL0024996	0020	--	--	--	
Oglesby	IL0024996	0030	--	--	--	--
Oglesby	IL0024996	0050	--	--	--	--
Oglesby	IL0024996	0090	--	--	--	--
Oglesby	IL0024996	A010	17	9	--	--
Oglesby	IL0024996	B010	17	9	--	
Oglesby	IL0024996	C010	40	15	--	--
Oglesby	IL0024996	D010	15	--	--	--
Oglesby	IL0024996	E010	--	9	--	--
Pekin	IL0034495	003	5	32	15	20
Pekin	IL0034495	004	7	31	32	52
Peoria	IL0037800	A07	18	21	31	59
Peoria	IL0037800	B06	25	28	36	73
Peoria	IL0037800	A06	25	28	36	73
Peoria	IL0037800	1	3	2	--	6
Peoria	IL0037800	3	15	21	36	73

Facility	NPDES ID	CSO outfall	Number of CSO Events per Year			
			2007	2008	2009	2010
Peoria	IL0037800	9	--	3	--	18
Peoria	IL0037800	16	26	35	12	57
Peoria	IL0037800	17	34	46	33	98
Peoria	IL0037800	18	14	29	35	158
Peoria	IL0037800	19	22	45	40	152
Peoria	IL0037800	20	3	8	8	6
Peru	IL0030660	Plant Bypass	--	12	10	--
Peru STP #1	IL0030660	0030	--	16	37	28
Peru STP #1	IL0030660	0040	--	21	37	23
Peru STP #1	IL0030660	0050	--	21	34	18
Peru STP #1	IL0030660	0060	--	19	24	17
Peru STP #1	IL0030660	0070	--	22	30	34
Peru STP #1	IL0030660	0080	--	0	2	1
Peru STP #1	IL0030660	0090	--	15	22	13
Peru STP #1	IL0030660	0100	--	20	31	24
Peru STP #1	IL0030660	0110	--	22	37	29
Peru STP #1	IL0030660	0120	--	5	20	19
Peru STP #1	IL0030660	0130	--	21	24	18
Peru STP #1	IL0030660	0140	--	21	30	34
Peru STP #1	IL0030660	0150	--	3	0	3
Peru STP #1	IL0030660	0160	--	5	4	3
Peru STP #1	IL0030660	0170	--	3	0	0
Peru STP #1	IL0030660	0180	--	--	--	--
Peru STP #1	IL0030660	0190	--	--	2	11
Peru STP #1	IL0030660	0200	--	3	0	3
Peru STP #1	IL0030660	0210	--	15	24	10
Peru STP #1	IL0030660	0220	--	3	0	0
Peru STP #1	IL0030660	0230	--	4	0	0
Peru STP #1	IL0030660	0240	--	15	18	11
Spring Valley	IL0031216	002	--	22	39	9
Spring Valley	IL0031216	003	--	24	31	12
Spring Valley	IL0031216	004	--	--	--	1
Spring Valley	IL0031216	005	--	2	10	--
Spring Valley	IL0031216	006	--	30	49	19
Spring Valley	IL0031216	008	--	31	60	21
Spring Valley	IL0031216	010	--	20	40	6
Spring Valley	IL0031216	011	--	9	11	6
Wenona	IL0021792	003	--	3	3	--
Wenona	IL0021792	A01	4	--	--	--

Information on total number of annual overflows was not available for every facility and was not consistently reported during every year for facilities included above. This table is a summary of the data made available to Illinois EPA at the time of this report.
“--“ No information available

Table 2-4. Long term control plan status

NPID	Facility	Long Term Control Plan (LTCP) Status
IL0033120	BUREAU JUNCTION STP	By instituting CSO controls, permittee has achieved 4 overflows/year as required under Presumption Approach, and, as allowed in Special Condition 11.10b in its permit, is exempted from developing a LTCP unless required to develop and implement by Special Condition 11.10c.
IL0022331	GRANVILLE STP	By instituting CSO controls, permittee has achieved 4 overflows/year as required under Presumption Approach, and, as allowed in Special Condition 12.10b in its permit, is exempted from developing a LTCP unless required to develop and implement by Special Condition 12.10c.
IL0029424	LASALLE WWTP	LTCP submitted 3/29/2010. Include LTCP in next permit reissue cycle. 5/19/11 - LTCP under review.
IL0024996	OGLESBY STP	They did not meet their deadline of 2010.
IL0034495	PEKIN STP #1	LTCP submitted in 6/2009. Accepting revised schedule to LTCP improvements.
IL0037800	PEORIA CSOS	LTCP submitted 12/1/2008. Revised LTCP submitted 3/2010.
IL0030660	PERU STP #1	LTCP submitted 11/16/2007. Not approved.
IL0031216	SPRING VALLEY STP	12/4/08 Plan of Study submitted and forwarded for review and comment.
IL0021792	WENONA STP	By instituting CSO controls, permittee has achieved 4 overflows/year as required under Presumption Approach, and, as allowed in Special Condition 11.10B in its permit, is exempted from developing a LTCP unless required to develop and implement by Special Condition 11.10C.

CAFOs

The removal and disposal of manure, litter, or processed wastewater that is generated as the result of concentrated animal feeding operations (CAFOs) is considered a point source that is regulated through the NPDES Program. In Illinois, the CAFO program is administered by the Illinois EPA through general permit number ILA01 (refer to the following Web site for more details: http://www.epa.state.il.us/water/cafo/). The federal regulations for all CAFOs can be found in 40 CFR Parts 9, 122, and 412 and U.S. EPA requires that CAFOs receive a WLA as part of the TMDL development process. The WLA is typically set at zero for all pollutants to be consistent with the requirement that CAFOs not discharge to waters of the state. There is one CAFO in the Middle Illinois River watershed: The Bradford Pig Palace (Permit IL0064319).

2.1.2 Nonpoint Sources

The term nonpoint source pollution is defined as any source of pollution that does not met 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. With agricultural practices such as crop cultivation (63 percent) and pasture/hay (5 percent) covering an estimated 68 percent of the project area, nonpoint source pollution may contribute a significant amount of the total pollutant load. In addition to runoff and erosion, significant nonpoint sources also include septic system and animal agriculture.

Stormwater Runoff

During wet weather events (snow melt 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 within the watershed. Agricultural and developed areas can have significant impacts on water quality if proper best management practices are not in place. The main pollutants of concern associated with agricultural runoff are sediment, nutrients, pesticides, and bacteria. Stormwater from developed areas can be contaminated with oil, grease, chlorides, pesticides, herbicides, nutrients, viruses, bacteria, metals, and sediment. In the Illinois River basin, manganese is naturally occurring in the soils as a result of past glacial activities.

In addition to pollutants, alterations to the hydrology of a watershed as a result of land uses changes can also detrimentally affect habitat and biological health. Imperviousness associated with developed land uses and tiling of agricultural fields can result in increased peak flows and runoff volumes and decreased base flow as a result of reduced ground water discharge.

Sheet and Rill Erosion

Sheet erosion is the detachment of soil particles by raindrop impact and their removal by water flowing overland as a sheet instead of in channels or rills. Rill erosion refers to the development of small, ephemeral concentrated flow paths, which function as both sediment source and sediment delivery systems for erosion on hillsides. Sheet and rill erosion occurs more frequently in areas that lack or have sparse vegetation, such as cropland during certain parts of the year and construction sites.

Bank and Channel Erosion

Bank and channel erosion refers to the wearing away of the banks of a stream or river. High rates of bank and channel erosion can often be associated with water flow and sediment dynamics being out of balance. This may result from land use activities that either alter flow regimes, adversely affect the floodplain and streamside riparian areas, or a combination of both. Hydrology is a major driver for both sheet/rill and stream channel erosion. The USACE has estimated that channel erosion from unstable streams accounts for 30 to 40 percent of the sediment delivered from eastern Illinois River Basin watersheds, and up to 80 percent of the sediment delivered from watersheds in the western part of the basin (USACE 2007).

Stream geomorphology pertains to the shape of stream channels and their associated floodplains. The capacity of a stream system to assimilate pollutants such as sediment, nutrients, and organic matter depends on features related to its geomorphology. This is especially the case for floodplains which, if connected to the channel, can store large quantities of sediment. A conceptual model of channel evolution was used to characterize varying stages of channel modification through time, as illustrated in Figure 2-1 (Simon and Hupp 1986). Stage I, undisturbed conditions, is followed by the construction phase *(Stage II)* where vegetation is removed and / or the channel is modified significantly (through altered hydrology, for example). Degradation *(Stage III)* follows and is characterized by channel incision. Channel degradation leads to an increase in bank heights and angles, until critical conditions of the bank material are exceeded. Eventually, stream banks fail by mass wasting processes *(Stage IV)*. Sediments eroded from upstream degrading reaches and tributary streams are deposited along low gradient downstream segments. This process reflects channel aggradation and begins in Stage V. Aggradation continues until stability is achieved through a reduction in bank heights and bank angles. Stage VI (restabilization) is characterized by the relative migration of bank stability upslope, point-bar development, and incipient meandering. Stages I and VI represent two true *reference* or attainment conditions.

The USACE has noted that landscape changes in the Illinois River watershed have led tributaries to drain more rapidly than they did historically. Increased bed and bank migration have resulted from higher energy flows and erosive forces on these stream systems. This development in the basin has resulted in streams that are more structurally simple and homogeneous than in the past (USACE 2007).

Bank and channel erosion is made worse when streams are straightened or channelized because channelization shortens overall stream lengths and results in increased velocities, bed and bank erosion, and sedimentation. Channelization potentially impairs 1,400 perennial stream miles within the Illinois River Basin. However unassessed streams tend to be smaller and USACE (2007) identified that the smaller streams tend to be channelized to a disproportionately higher extent. USACE (2007) estimated that 27 percent of streams in the state were channelized at the time of publication; this would correspond to nearly 3,000 stream miles in the Illinois River basin. Modified stream channels often have little habitat structure and variability necessary for diverse and abundant aquatic species. Channelization also disconnects streams from floodplain and riparian areas that are often developed into agricultural or built environments (USACE 2007).

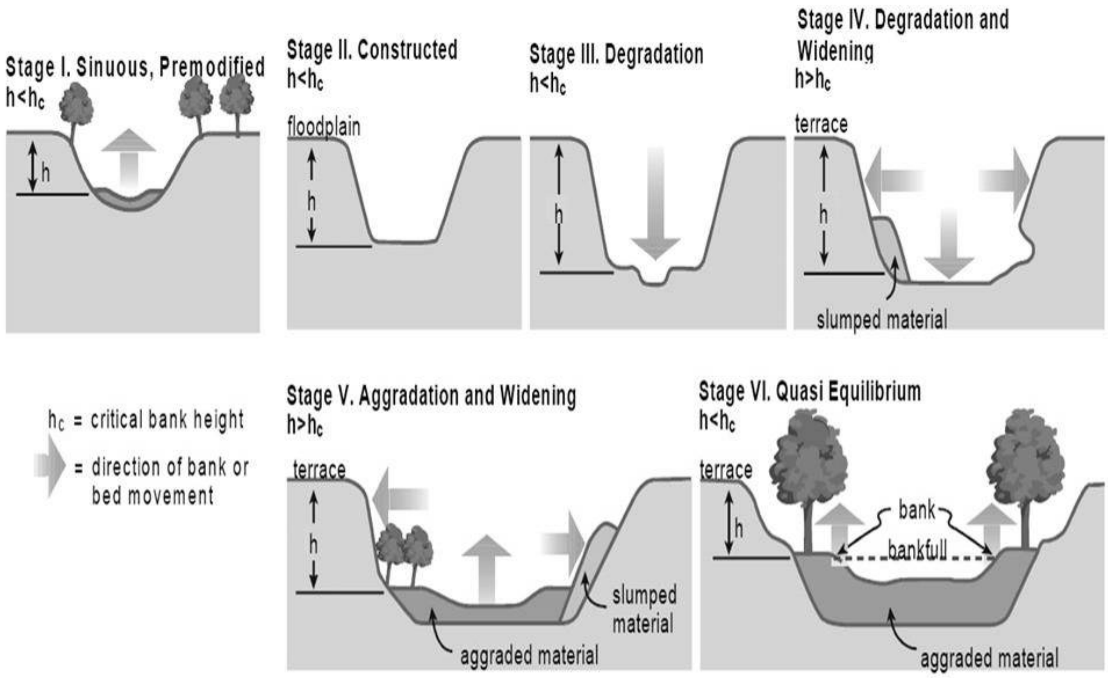

Figure 2-1. Channel evolution model (from Simon and Hupp 1986).

Bank erosion is a natural process. Acceleration of this process, however, leads to a disproportionate sediment supply, channel instability, and aquatic habitat loss (Rosgen 2006). Bank erosion processes are driven by two major components: streambank characteristics (e.g., erodibility) and hydraulic forces. Many land use activities affect both these components, which can lead to increased bank erosion. Riparian vegetation and floodplain protection provide internal bank strength. Bank strength can protect banks from fluvial entrainment and subsequent collapse. For instance, when riparian vegetation is changed from woody species to annual grasses, the internal strength is weakened, thus accelerating bank erosion processes.

Confronted by more frequent and severe floods that increase hydraulic forces, stream channels must respond. They typically increase their cross-sectional area to accommodate the higher flows. As described previously, this is done either through widening of the stream banks, down cutting of the stream bed, or frequently both. This phase of channel instability, in turn, triggers a cycle of stream bank erosion and habitat degradation.

Discharge flow rate is a major factor that affects sediment transport in stream systems. Higher discharge volumes lead to increased flow velocities, thus raising shear stress and stream power exerted on the channel bed and banks. This effect, combined with channel stability, determines the amount of sediment that is mobilized, which in turn influences habitat and aquatic biota. In many areas of the Illinois River Basin, current storm flows are higher than occurred under pre-development conditions due to land use changes and increased efficiency brought about by channelization in urban and rural areas. Channelization increases peak flows as it allows flood waves to pass more quickly through the basin, increasing the volume and the erosive force of the water (USACE 2007). Because bank erosion is often a symptom of larger, more complex problems, long-term solutions often involve much more than bank stabilization.

Gully and Bluff Erosion

Gullies are relatively steep-sided watercourses, which experience ephemeral flows during heavy or extended rainfall. Gully erosion occurs when water flows in narrow channels during or immediately after heavy rains or melting snow. The erosion is both downward, deepening the channel, and headward, extending the channel into the hillside. Gully erosion is caused when runoff concentrates and flows at a velocity sufficient to detach and transport soil particles. Widening of gully sides subsequently occurs by slumping and mass movement. Runoff may also enter a gully from the sides, causing secondary gullies or branching. Gully development associated with concentrated flow is evident in numerous streams around the country. Like sheet and rill erosion, sediment from gullied areas is delivered to stream systems during high flow conditions. Sediment delivered to the stream may contain elevated concentrations of nutrients.

Gully formation may be triggered by land use changes, such as vegetation removal or by construction of new commercial / residential areas. Gully erosion is an important factor when considering upland sources, particularly where the delivery path is connected to small tributary streams or ditches. Riparian conditions adjacent to larger streams and in floodplains are also important. The development of rills and gullies can create direct paths, which *short circuit* the sediment and nutrient interception function of riparian zones.

Significant sediment is also delivered to the river from the bluffs of the Illinois River; bluffs can reach heights of 500 feet and form steep banks along the floodplain. Evidence of degradation is found in the erosion of the bluffs' slopes and down-cutting of ravines which are now observed at rates that are not natural (TCRPC 2002). Bluff erosion has been reported to be worsened by fire suppression activities (abatement leading to loss of grass lands and over developed canopy), as well as over grazing (TCRPC 2002). Stormwater management practices have also increased bluff erosion by creating large ravines at stormsewer outlets (TCRPC 2002). In some cases, huge channels of 20 to 30 feet wide have been created. The primary cause has been the flow of stormwater from concrete storm sewers as well as drastic vegetative changes in the forest (TCRPC 2002; TCRPC 2009).

The importance of hydrology in addressing gully and bluff erosion in the Illinois River watershed is further supported based on relationships between flow, velocity, shear stress, and stream power. Increased sediment transport occurs from elevated velocities associated with higher stream flow. Impaired streams, such as Farm Creek, will mobilize more sediment even if flows are held constant, due to decreased resistance associated with the greater silt fraction in the channel substrate.

The combined effect of these factors highlights the need to consider not only direct sediment loads to the stream, but also the importance of hydrology, channel substrate, and bank conditions. These relationships also point out the role that the floodplain and riparian zones play in providing bank and channel stability. Finally, land use and floodplain management changes that alter hydrology in the watershed can further exacerbate sediment problems through the resultant effect on stream habitat.

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 are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters (Horsely and Witten 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients.

Animal Feeding Operations (AFOs)

Animal feeding operations that are not classified as CAFOs are known as animal feeding operations (AFOs) in Illinois. Non-CAFO animal feeding operations 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. In Illinois, an AFO is defined as a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

> (1) Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
> (2) Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

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 overapplication can adversely impact soil productivity.

Bacteria and nutrients are typically found in AFO discharges.

Livestock Population

Livestock are potential sources of bacteria and nutrients to streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. However, county wide data available from the National Agricultural Statistic Service were downloaded and area weighted to estimate animal population in the watershed (Table 2-5). An estimated 92,767 animal units are in the watershed and the animal unit density is 45 animal units per square mile. No strong correlation between animal unit density and fecal coliform counts by watershed was found.

Table 2-5. Estimated (area weighted) livestock.

Watershed	Cattle	Poultry	Horses	Sheep	Hogs
Kickapoo Creek	7,744	578	505	478	11,350
Big Bureau Creek (DQ-04)	7,688	6,588	486	663	47,165
Big Bureau Creek (DQ-03)	2,933	2,025	185	252	17,529
West Bureau Creek	1,396	1,346	88	121	8,740
Sandy Creek	2,006	95	176	166	2,551
Senachwine Creek	1,652	96	136	112	2,369
Snag Creek	2,476	44	231	381	20,999
Farm Creek	842	46	95	75	6,830

Source: USDA 2007-2009

3. TMDL Endpoints and LRS Targets

This section presents information on the water quality impairments within the Middle Illinois River watershed and the associated water quality standards and targets.

3.1 Applicable Standards

Water quality standards (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 water quality criteria are discussed below.

3.1.1 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 water bodies in the Middle Illinois River watershed:

General Use Standards – These standards protect for aquatic life, wildlife, agricultural, 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.

Public and food processing water supply standards – These standards are cumulative with the general use standards and apply to waters of the state at any point at which water is withdrawn for treatment and distribution as a potable supply to the public or for food processing.

3.1.2 Water Quality Criteria

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 Illinois Pollution Control Board. This section presents the standards applicable to impairments within the study area. Water quality criteria to be used for TMDL development in the Middle Illinois River watershed are listed in Table 3-1. Table 3-2 summarizes the TMDL endpoints used for this project.

Table 3-1. Summary of water quality standards for the Middle Illinois River watershed.

Parameter	Units	General Use Water Quality Standard	Public and Food Processing Water Supplies
Alteration in Stream-side Vegetate Covers	N/A	No numeric standard	No numeric standard
Aquatic Algae	N/A	No numeric standard	No numeric standard
Chloride	mg/L	500	250
Dissolved Oxygen	mg/L	*Instantaneous minimum:* 5.0 *(March – July)* 3.5 *(August – February)*	No numeric standard
		Daily minimum averaged over 7 days: 4.0 *(August – February)*	
		Daily mean averaged over 7 days: 6.0 *(March - July)* 5.5 *(August – February)*	
Fecal Coliform [a]	#/100 ml	400 in <10% of samples [b]	Geometric mean [c] < 2,000
		Geometric mean < 200 [c]	
Manganese	µg/L	1,000	150
Ph	SU	6.5 minimum, 9.0 maximum	No numeric standard
Phosphorus, Total	µg/L	50 [d]	No numeric standard
Sedimentation / Siltation	N/A	No numeric standard	No numeric standard
Total Dissolved Solids (TDS)	mg/L	No numeric standard	500
Total Suspended Solids	N/A	No numeric standard	No numeric standard

a. Fecal coliform standards are for the recreation season only (May through October)
b. Standard shall not be exceeded by more than 10% of the samples collected during a 30 day period
c. Geometric mean based on minimum of 5 samples taken over not more than a 30 day period
d. Standard only applies in lakes/reservoirs that are greater than 20 acres in surface area and in any stream at the point where it enters such a lake / reservoir. There is no numeric standard for streams.

Table 3-2. TMDL endpoints.

Parameter	TMDL Endpoint
Chloride (mg/L)	250
Fecal Coliform (#cfu/100 mL)	400
Manganese (µg/L)	150
Phosphorus, Total (µg//L)	50

3.2 Load Reduction Strategy Targets

As described below, load reduction strategy (LRS) targets are defined for TSS and nutrients which are lacking numeric criteria (Table 3-3).

Table 3-3. Load reduction strategies targets

LRS Parameter	Target Criteria
Nitrogen, Nitrate (mg/L)	1.798
Phosphorus, Total (mg/L)	0.072
Total Suspended Solids (mg/L)	59.3 (Zone 4) 50.4 (Zone 5)

3.2.1 Nitrogen and Phosphorus

Nutrient targets are based on reference conditions for Ecoregion 54 from the U.S. EPA document entitled *Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VI*. U.S. EPA's ecoregion criteria are intended to address cultural eutrophication. These values were derived to represent conditions of surface waters that are minimally impacted by human activities and protective of aquatic life and recreational uses (U.S. EPA 2000).

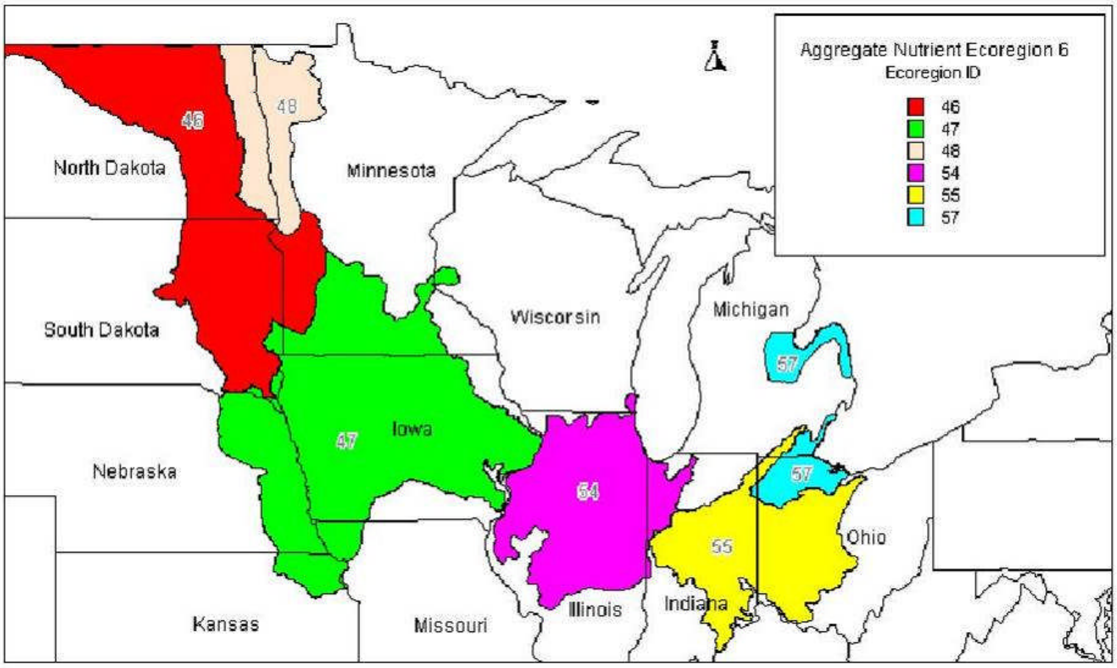

Figure 3-1. Nutrient ecoregions.

3.2.2 Total Suspended Solids, Sedimentation, and Siltation

Total suspended solids targets are based on reference conditions from the USGS document entitled *Present and Reference Concentrations and Yields of Suspended Sediment in Streams in the Great Lakes Region and Adjacent Areas*. The USGS and U.S. EPA completed a cooperative study in which suspended solids data was collected and reference conditions were derived for zones in the Great Lakes Region. Reference median TSS concentrations, reference median annual volume weighted (VW) TSS concentration, and reference TSS yields were determined based on data collected throughout the Great Lakes region. Reference median TSS concentrations are most applicable to waters with biological concerns, VW TSS concentrations are most applicable to waters that require mitigation of anthropogenic effects on water quality, and TSS yields are most applicable to issues related to sedimentation in harbors and lakes (Robertson et al. 2006).

VW TSS concentrations were chosen for LRS targets in the Illinois River and its tributaries. VW TSS concentrations are much higher than median concentrations because median concentrations primarily reflect concentrations during low flow conditions. They are derived by calculating the total annual load divided total annual flow. VW TSS concentrations are more heavily influenced by high flow TSS concentrations, which is when most of the TSS is transported (Robertson et al. 2006). Figure 3-2 summarizes the VW TSS concentration zones applicable to the watershed.

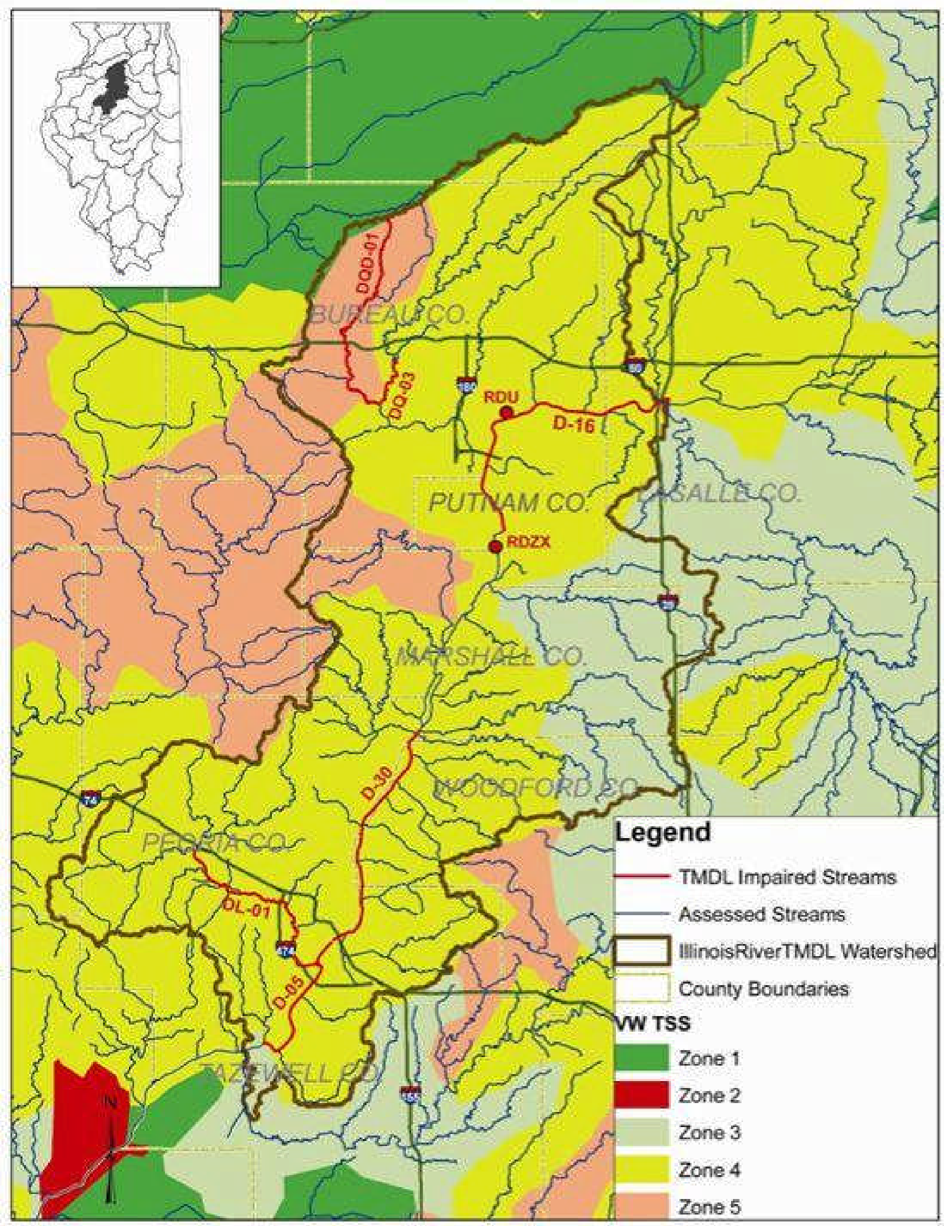

Figure 3-2. TSS concentration zones.

4. Technical Approach for TMDL and LRS

The technical approach section identifies the impaired waterbody-pollutant combinations and describes the general water quality issues within the basin. The approach to estimating flow and deriving TMDLs and LRSs are also presented.

4.1 Waterbody-Pollutant Impairments

TMDLs will be developed for impairments with numeric water quality standards and LRSs will be developed to help prioritize implementation of nonpoint sources for impairments without numeric water quality standards. The TMDL waterbody-pollutant combinations are summarized in Table 4-1 and are shown in Figure 4-1. The LRS waterbody-pollutant combinations are summarized in Table 4-2.

The Illinois EPA 305(b) Water Quality Report lists all the impairments in a waterbody. The 303(d) list of waters contains those 305(b) impairments. Illinois EPA develops TMDLs for impaired waters caused by pollutants with numeric standards. LRSs are developed for impairments with nonnumeric standards and will help prioritize implementation of nonpoint sources to reduce these pollutants in the watershed. TMDLs will contain point and nonpoint source allocations while LRSs will only contain allocations for nonpoint sources. Until numeric standards are developed for parameters such as phosphorus, nitrogen and TSS, implementation activities will focus on nonpoint source controls for reductions.

Based on the effect of nutrients on response indicators including aquatic algae, low dissolved oxygen and pH, LRSs will address these nonpollutant impairments in Depue and Senachwine Lakes. In addition, best management practices that lead to reductions phosphorus and total suspended solids will lead to reductions in algae and help balance the pH. Relationships between these parameters are further evaluated in the linkage analyses.

Table 4-1. Summary of TMDLs

Impaired Water		TMDL Pollutant
Name	Segment ID	
Illinois River	D-05	Fecal coliform
	D-16	Fecal coliform
	D-30	Fecal coliform, manganese, total dissolved solids
Kickapoo Creek	DL-01	Fecal coliform
Big Bureau Creek	DQ-03	Fecal coliform
West Bureau Creek	DQD-01	Fecal coliform
Farm Creek	DZZP-03[a]	Chloride
Depue Lake	RDU[b]	Phosphorus, dissolved oxygen
Senachwine Lake	RDZX[b]	Phosphorus, dissolved oxygen

a. Farm Creek is also listed on the 303(d) list for pH; no TMDL will be completed for this pollutant, but impairment will be addressed through LRSs and implementation.
b. Depue and Senachwine Lakes are also listed on the 303(d) list for TSS, algae, and sedimentation; no TMDL will be completed for these pollutants, but impairments will be addressed through LRSs and implementation.

Table 4-2. Summary of LRSs

Impaired Water		LRS Pollutants
Name	Segment ID	
Illinois River	D-05	TSS, total phosphorus, nitrate plus nitrite nitrogen
	D-09	
	D-16	
	D-30	
Kickapoo Creek	DL-01	
Senachwine Creek	DM-01	
Snag and Crow Creek	DO-01	
Sandy Creek	DP-02	
Big Bureau Creek	DQ-04	
	DQ-03	
West Bureau Creek	DQD-01	
Farm Creek [a]	DZZP-03	
Depue Lake [b]	RDU	TSS, nitrate plus nitrite nitrogen
Senachwine Lake [b]	RDZX	

a. Farm Creek is listed on the 303(d) list for TSS and total phosphorus.
b. Depue and Senachwine Lakes are listed on the 303(d) list for TSS, total phosphorus, algae, and sedimentation.

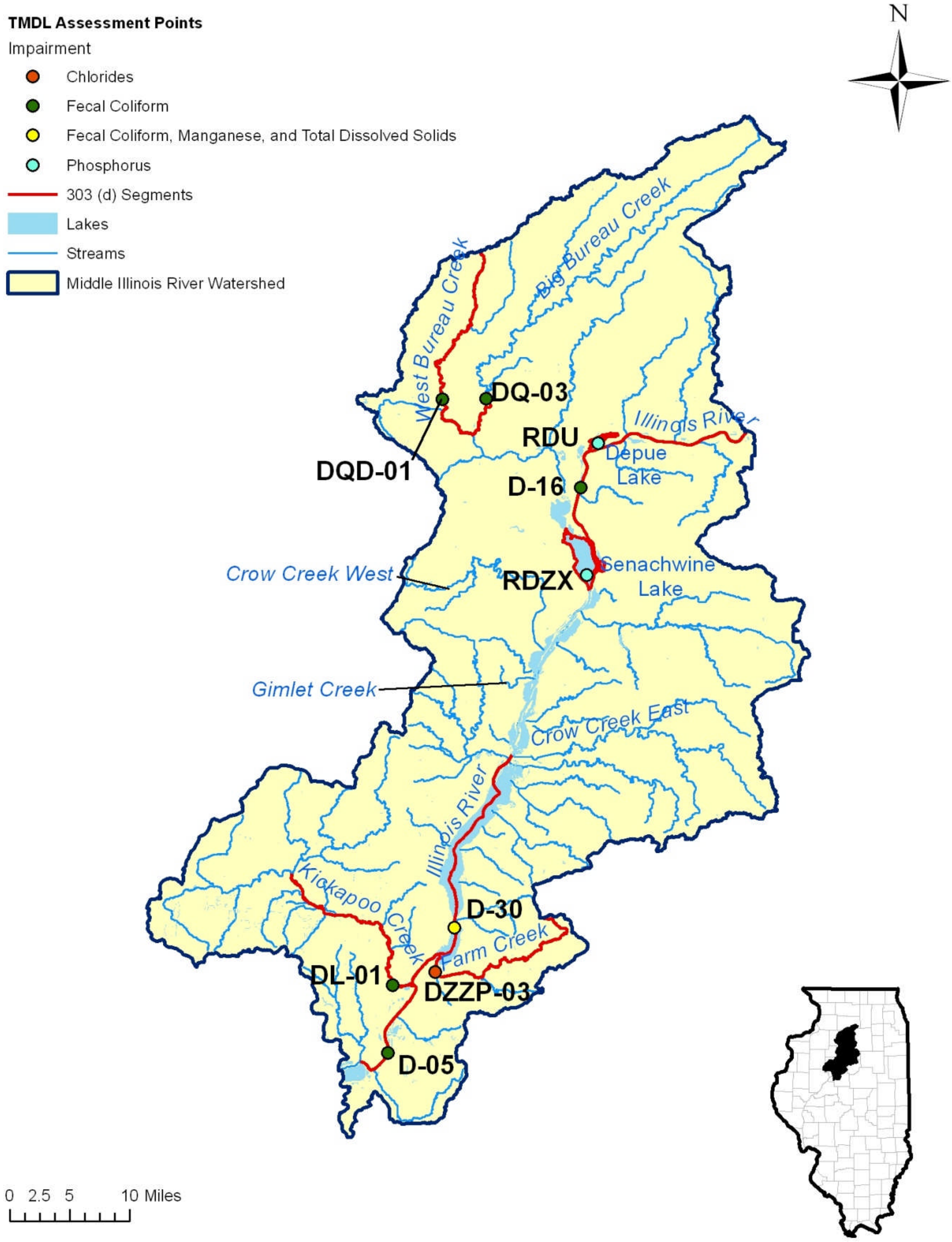

Figure 4-1. TMDL locations.

4.2 Watershed Clusters

The Middle Illinois River watershed has been partitioned into watershed clusters. Watershed cluster boundaries were delineated in a way that aligns with USGS ten-digit hydrological unit code (HUC) codes. The 10-digit HUC codes reflect hydrologic watersheds and subwatersheds in the area. Seven watershed clusters were identified, these include: Illinois River Main Stem, Big Bureau Creek, Sandy Creek, Crow Creek/Snag Creek, Senachwine Creek, Farm Creek, and Kickapoo Creek. Specific details of each are identified in Table 4-3 while watershed cluster boundaries are shown in Figure 4-2.

Table 4-3. Watershed clusters.

Watershed Cluster	10-digit HUC ID	10-Digit HUC Name	Area	
			(acres)	*(sq. mi.)*[a]
Illinois River Main Stem	07130001 08	Allforks Creek - Illinois River	113,642	177.6
	07130001 09	Senachwine Lake - Illinois R.	92,024	143.8
	07130001 11	Scholes Branch - Crow Creek	51,638	80.7
	07130001 13	Sawyer Slough - Illinois River	62,543	97.7
	07130001 17	Partridge Creek - Illinois River	94,396	147.5
	07130003 03	Lamarsh Creek-Illinois River	83,782	130.9
		Total Subwatershed Area	*498,025*	*778.2*
Big Bureau Creek	07130001 04	West Bureau Creek	56,187	87.8
	07130001 05	Pike Creek-Big Bureau Creek	129,676	202.6
	07130001 06	East Bureau Creek	71,483	111.7
	07130001 07	Big Bureau Creek	63,942	99.9
		Total Subwatershed Area	*321,288*	*502.0*
Sandy Creek	07130001 10	Sandy Creek	94,454	147.6
Crow Creek / Snag Creek	07130001 12	Crow Creek	82,508	128.9
	07130001 15	Snag Creek	52,990	82.8
		Total Subwatershed	*229,952*	*359*
Senachwine Creek	07130001 14	Senachwine Creek	58,136	90.8
Farm Creek	07130001 16	Farm Creek	39,423	61.6
Kickapoo Creek	07130003 01	Headwaters Kickapoo Creek	76,296	119.2
	07130003 02	Outlet Kickapoo Creek	119,939	187.4
		Total Subwatershed Area	*196,235*	*306.6*
TOTAL			**1,343,059**	**2,098.5**

a. Note that drainage areas at the TMDL and LRS sampling stations do not always line up with the drainage area of the entire Watershed Cluster as stations are not always located at the outlet of the cluster.

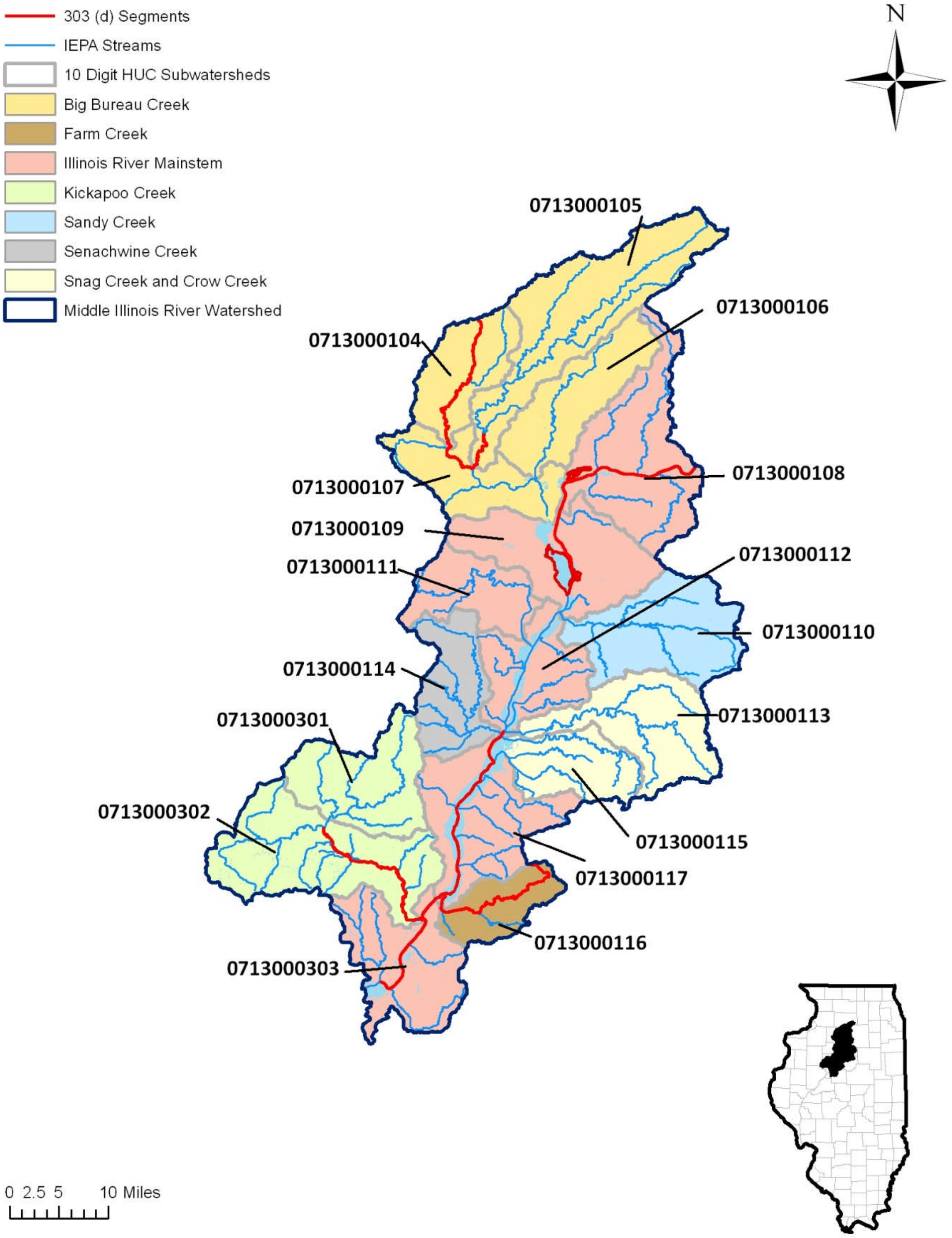

Figure 4-2. Watershed clusters.

4.3 Hydrology and Water Quality Relationships

A waterbody's loading capacity represents the maximum rate of loading of a pollutant that can be assimilated without violating water quality standards (40 CFR 130.2(f)). Establishing the relationship between in-stream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading and the evaluation of potential changes to water quality resulting from implementation of various management options. The following section describes the methodology being used in this analysis; results are then presented by watershed cluster in Section 5 - 13.

A duration curve approach is being used to evaluate the relationships between hydrology and water quality and calculate the TMDLs and LRSs. 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 or count/100 mL), then multiplying by conversion factors to yield results in the proper unit (i.e., kilograms per day or count/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. If loads are considerable during wet-weather events (including snowmelt), implementation efforts can target those BMPs that will most effectively reduce stormwater runoff.

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.

The stream flows displayed on water quality or load duration curves may be grouped into various flow regimes to aid with interpretation of the load duration curves. The flow regimes are typically divided into 10 groups, which can be further 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 50 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 between sources. Table 4-4 summarizes the general relationship between the five hydrologic zones and potentially contributing source areas (the table is not specific to any 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 channel bank erosion is most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur.

Table 4-4. 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
Riparian areas		H	H	M	
Stormwater: Impervious		H	H	H	
Combined sewer overflow	H	H	H		
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	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.

4.4 Approach to Estimate Flow

Estimating stream flow at ungaged reaches and during ungaged time periods was determined using drainage area weighting techniques and regressional relationships (see Section 4.4.1 for details). Several other sources of flow data and methods were investigated including the existing HSPF model of the Illinois River basin (Demissie et al. 2007), using flow data derived as part of the ISWS Sediment Budget of Illinois Study (2004), and using the Illinois Streamflow Assessment Model. A hydrologic model of the entire Illinois River Basin has been created using HSPF (Demissie et al. 2007). A regression analysis of the modeled flow versus monitored flows for the major Illinois River tributary subwatersheds (Spoon, Kankakee, Iroquois, Fox, Des Plaines, Vermillion, Mackinaw, Sangamon, La Moine, and Macoupin) showed R^2 values ranging from 0.36 to 0.89. The model was not calibrated for the smaller tributaries like Big Bureau Creek, Kickapoo Creek, and Farm Creek. In addition, runoff parameters were not calibrated for the main stem watershed which includes this TMDL's study area. Model parameters from the calibrated Spoon River watershed were applied to the main stem and other uncalibrated tributary watersheds.

The USACE Sediment Budget of the Illinois River determined annual sediment loads for many of the tributaries in the Illinois River watershed. A review of their document showed that in order to calculate annual sediment loads they used annual water discharge from each tributary from 1981 to 2000. It is unclear how these annual discharges were calculated and no daily estimated flows are provided in the document.

USGS gage flows for the watershed vary in their period of record; from the 1920s to present, 13 gages were sampled in the watershed. Six of these gages have current data:

- Illinois River at Marseilles (5543500)
- Illinois River at Kingston Mines (5568500)
- Illinois River at Henry (5558300)
- Big Bureau Creek at Princeton (5556500)
- Farm Creek at Farmdale (5560500)
- Fondulac Creek near East Peoria (5561500).

Many of the other gages sampled have overlapping period of records. Where possible, flow data and duration curves for overlapping time periods were compared from one gage to another to determine if any relationships existed from which to estimate flow for currently ungaged streams.

Unit area flow duration curves of the available tributary flow data within the watershed (excluding 5560500 and 5561500) are presented in Figure 4-3. The figure illustrates that flow in the tributaries generally follows the same pattern, with the smaller streams like Ackerman Creek and Gimlet Creek *drying up* at low flows and the larger streams like Big Bureau Creek, Kickapoo Creek, and Farm Creek having similar flow duration curves. Higher low flows in certain streams, like Farm Creek, likely reflect the impact of point sources.

Unit area flow duration curves for three gages located on the Illinois River are presented in Figure 4-4. Similar to Farm Creek, higher low flows at Marseilles may indicate the impact of upstream point sources. The pools located along the Illinois River also likely have a large influence on the flow duration patterns at each location. Table 4-5 summarizes the available flow datasets, including the number of missing flow days. The majority of missing flow days is attributed to not monitoring flows during the winter months.

Only three tributary gages in the watershed have current flow data: Big Bureau Creek at Princeton, Il (5556500), Farm Creek at Farmdale, Il (5560500), and Fondulac Creek near East Peoria, Il (5561500). Neither Farm Creek nor Fondulac Creek recorded flows during recent winter months.

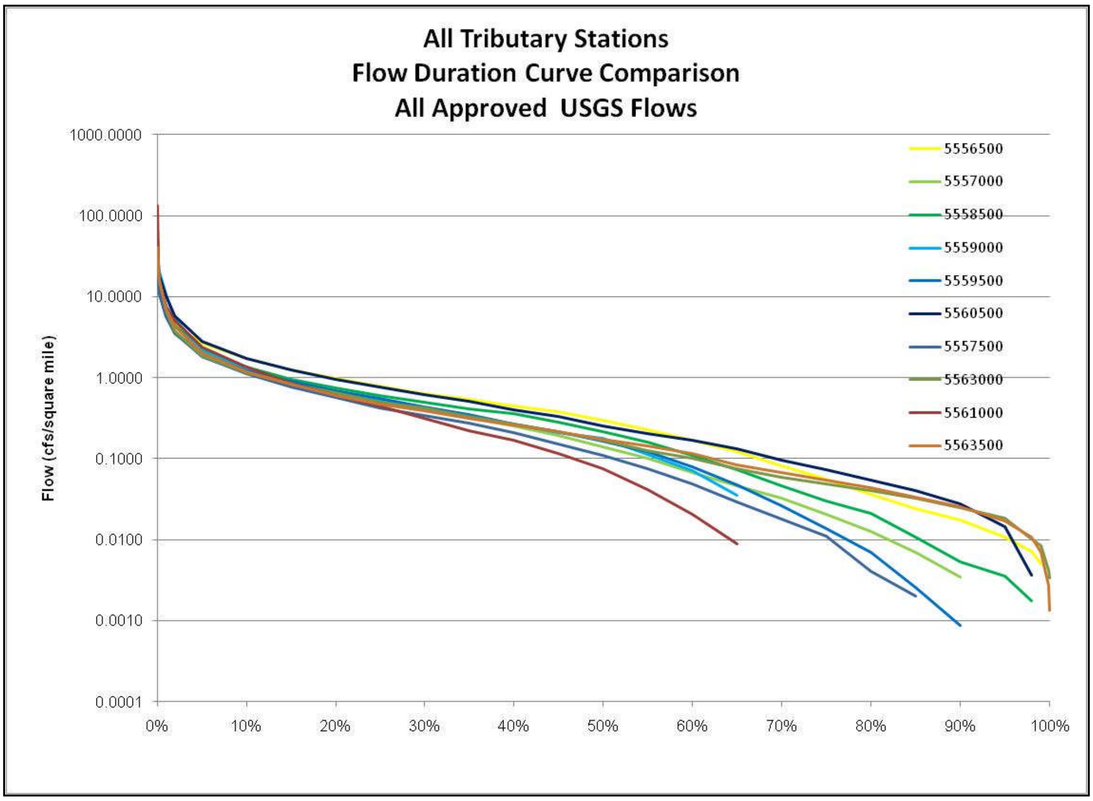

Figure 4-3. Unit area flow duration curves for Illinois River tributaries.

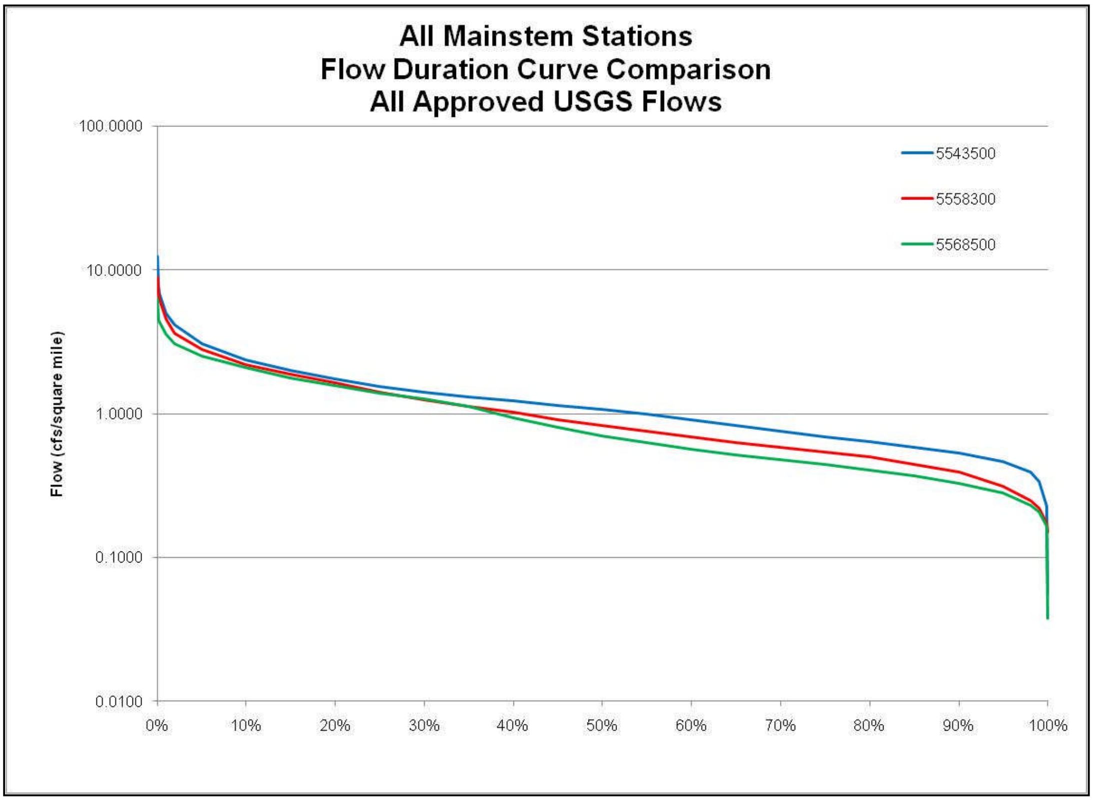

Figure 4-4. Unit area flow duration curves for USGS gage locations along the Illinois River.

Table 4-5. Available USGS Flow Data

USGS Gage Name	Site Number	Drainage Area (sq mi)	Start Date	End Date	Count	Missing Flow Count
Illinois River at Marseilles, IL	5543500	8,259	10/1/1919	12/22/2010	33,321	0
Illinois River at Henry, IL	5558300	13,544	10/1/1981	12/22/2010	10,637	37
Illinois River at Kingston Mines, IL	5568500	15,818	10/1/1939	9/13/2010	25,916	0
Big Bureau Creek at Princeton, IL	5556500	196	3/1/1936	12/22/2010	27,308	16
West Bureau Creek at Wyanet, IL	5557000	86.7	3/1/1936	9/30/1966	11,171	0
East Bureau Creek Near Bureau, IL	5557500	99	4/1/1936	9/30/1966	11,140	0
Crow Creek (West) Near Henry, IL	5558500	56.2	5/13/1949	10/1/1971	8,177	0
Gimlet Creek at Sparland, IL	5559000	5.66	10/1/1945	9/30/1971	8,765	730
Crow Creek Near Washburn, IL	5559500	115	10/1/1944	10/1/1971	9,862	0
Farm Creek at Farmdale, IL	5560500	27.4	10/1/1948	8/29/2010	19,311	3,301
Ackerman Creek at Farmdale, IL	5561000	11.2	12/1/1953	9/30/1980	9,801	0
Fondulac Creek Near East Peoria, IL	5561500	5.54	1/14/1948	9/30/2009	19,186	3,354
Farm Creek at East Peoria, IL	5562000	61.2	5/1/1943	10/22/1980	13,659	30
Kickapoo Creek Near Kickapoo, IL	5563000	119	10/1/1944	9/30/1962	6,574	0
Kickapoo Creek at Peoria, IL	5563500	297	3/24/1942	9/30/1971	10,783	0
Indian Creek near Wyoming, IL[a]	5568800	62.7	10/1/1959	1/17/2011	18,737	0

a. Indian Creek is tributary to the Spoon River and was used to derive flow estimations

4.4.1 Drainage Area Weighting Technique

Drainage area weighting is a widely used technique to estimate streamflow in cases where limited streamflow monitoring data are available. This method is most valid in situations where watersheds are of similar size, land use, soil types, and experience similar precipitation patterns. Drainage area weighting is used to estimate flows for all ungaged streams in the watershed, with the exception of Kickapoo and Crow Creeks. Streamflow is estimated by drainage area weighting using the following equation:

$$Q_{ungaged} = \frac{A_{ungaged}}{A_{gaged}} \times Q_{gaged}$$

where:

$Q_{ungaged}$: Flow at the ungaged location
Q_{gaged}: Flow at surrogate USGS gage station
$A_{ungaged}$: Drainage area of the ungaged location
A_{gaged}: Drainage area at surrogate USGS gage station

Many of the watershed clusters do not have current flow data. An evaluation of available flow data was used to determine if relationships existed to justify the use of regression analysis or drainage area weighting technique. In all cases where overlapping historical flow data existed, it was found that using drainage area weighting resulted in a more accurate flow duration curve than the use of regression analysis.

A review of five gages in similar watersheds with both historical and current data outside of the Middle Illinois River watershed, but within the surrounding Rock River (07090005), Vermillion River (07130002 and 05120109), and Sangamon River (07130008) watersheds was performed; however, acceptable relationships to gages with historical flow data within the Middle Illinois River watershed were not found. It was determined that the Big Bureau Creek gage near Princeton and the Farm Creek gage at Farmdale provided the best relationship for applying drainage area weighting techniques to the other tributaries in the Middle Illinois River watershed. Table 4-6 summarizes which gages were used to derive an estimated flow duration curve for each ungaged location where a TMDL or LRS will be performed. The locations of the gages are shown in Figure 4-5.

Table 4-6. Drainage area weighting locations

TMDL or LRS Watershed	Drainage Area (mi^2)[c]	Gage used for Drainage Area Weighting
D-05 (Illinois River Cluster)	14,585	5568500
D-16 (Illinois River Cluster)	12,756	5558300
D-30 (Illinois River Cluster)	13,900	5568500
DQD-01 (West Bureau Creek)	86	5556500[a]
DQ-04 (Big Bureau Creek Cluster)	497	5556500[a]
DZZP-03 (Farm Creek Cluster)	61	5560500[a]
DP-02 (Sandy Creek Cluster)	142	5568800
DM-01 (Senachwine Cluster)	90	5568800
DO-01 (Snag and Crow Cluster)	129[b]	5568800

a. The Farm Creek gage (5560500) does not record winter flows. Winter flows at Farm Creek were therefore assigned based on drainage area weighting of winter flows from the Indian Creek gage near Wyoming.
b. Three streams are in this cluster with their own drainage area: Crow, Richland, and Snag. The total area is 359 square miles. There are no sampling stations on Richland or Snag creeks and the LRS was completed for Crow Creek at station DO-01.
c. Note that drainage areas at the TMDL and LRS sampling stations do not always line up with the drainage area of the entire Watershed Cluster as stations are not always located at the outlet of the cluster.

4.4.2 Regression Analysis

Regression analysis is a viable technique used in many cases where limited streamflow monitoring data are available. Like drainage area weighting, this method is most valid in situations where watersheds are of similar size, land use, soil types, and experience similar precipitation patterns. Discharge is estimated by computing a regressional relationship of area weighted flows for time periods where two gages both have data. This relationship is then used to estimate flows for ungaged time periods. Flows were estimated in the Kickapoo Creek and Crow Creek watersheds using this method.

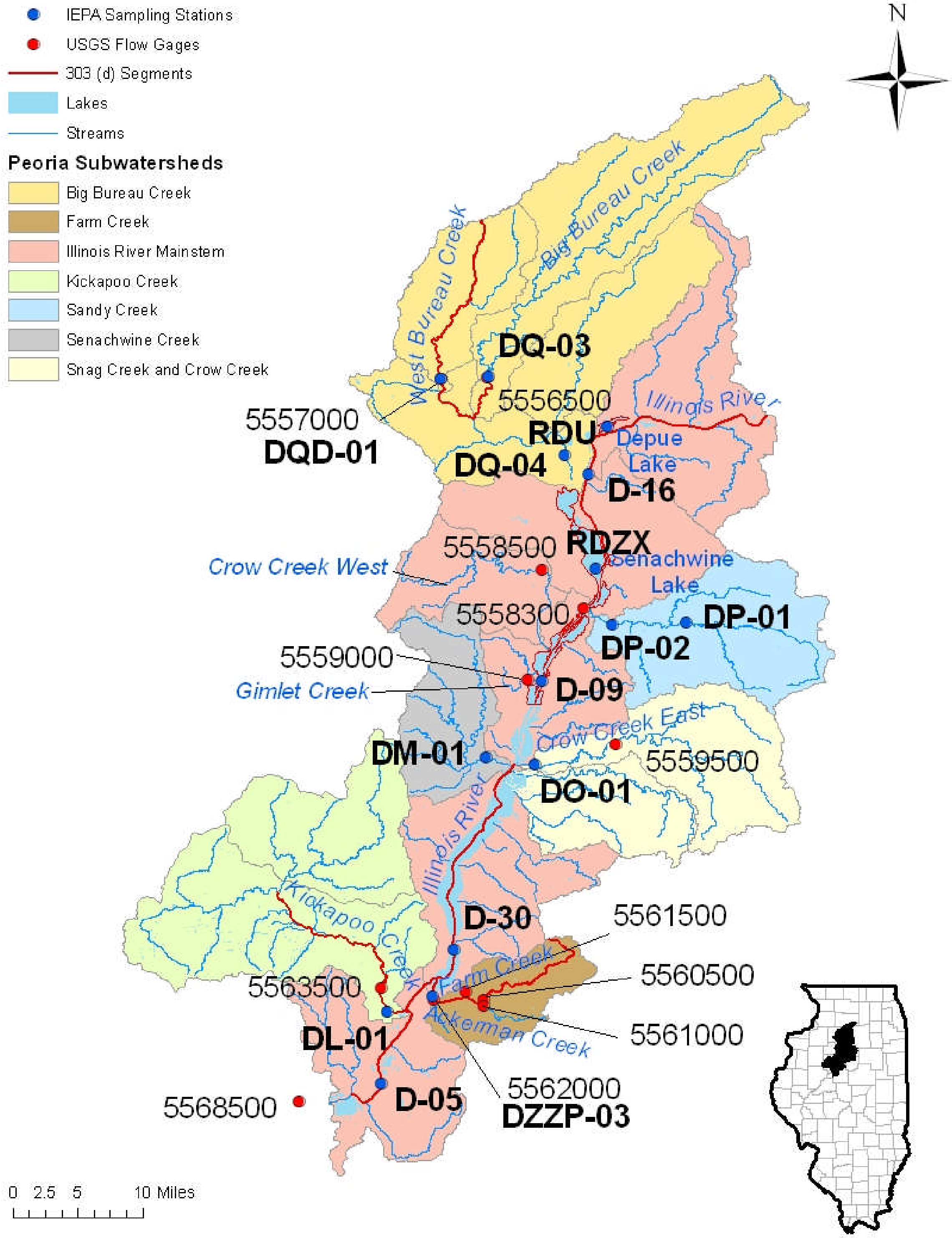

Figure 4-5. Project area overview including watershed clusters, monitoring stations, and USGS gages.

4.5 TMDL Derivation

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual wasteload allocations (WLAs) for regulated sources and load allocations (LAs) for unregulated sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this is defined by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

Sections 5 - 13 present the allowable loads and associated allocations for each of the impaired waterbodies in the watershed. The results are presented by assessment location in each of the applicable watershed clusters. The bacteria TMDLs are based on the median allowable load in each of the flow regimes and reductions are based on the 90th percentile of observed load in each flow regime. All other TMDLs are based on the maximum allowable load in each of the flow regimes and reductions are based on the maximum observed load in each flow regime.

4.5.1 Load Allocations

Load allocations represent the portion of the allowable load that is reserved for nonpoint sources and natural background conditions. The load allocations are based on subtracting the allocations for WLAs and the MOS from allowable loads. The load allocations are summarized in Sections 5 - 13 for each of the waterbody TMDL pollutant combinations along with the baseline loads and WLAs. The load allocations are presented on a daily basis and were developed to meet TMDL targets.

The load allocations set for the Illinois River main stem, Lake Depue, and Senachwine Lake include all loading upstream of the study area boundary, including point sources. Determining allocations for point sources upstream of the Middle Illinois River watershed was not feasible.

4.5.2 Wasteload Allocations

Numerous known NPDES facilities are within the watershed with the potential to discharge pollutants identified within the TMDL. As required by the Clean Water Act, individual WLAs were developed for these permittees as part of the TMDL development process (Appendix A). Each facility's maximum design flow was used to calculate the WLA for the high flow and moist flow zones and the average design flow was used for all other flow zones. Illinois assumes that facilities will have to discharge at their maximum flow during both high and moist flows based on the following:

> *For municipal NPDES permits in Illinois, page 2 of the NPDES permit lists 2 design flows: a design average flow (DAF) and a design maximum flow (DMF). These are defined in 35 Ill. Adm. Code 370.211(a) and (b) (see http://www.ipcb.state.il.us/documents/dsweb/Get/Document-12042/). Since rain (and to a certain extent, high ground water) causes influent flows to wastewater treatment facilities to increase and precipitation also leads to higher river levels, a correlation between precipitation and treatment flows exists. The load limits in these permits gives a tiered load limit, one based on DAF for flows of DAF and below, and another load limit in the permit for flows above DAF through DMF.*

Fecal coliform WLAs are based on the already established permit limits. The fecal coliform WLA is based on the 400 cfu/100 mL standard. All of the treatment facilities are required to comply with both the geometric mean fecal coliform water quality standard of 200 cfu/100 mL and the instantaneous water quality standard of 400 cfu/100 mL at the closest point downstream where recreational use occurs in the receiving water or where the water flows into a fecal-impaired segment. Permit limits can be based on the instantaneous and/or the geometric mean standard. Most permits were written based on the instantaneous standard and many smaller facilities do not sample frequently enough to use the geometric standard. WLAs for facilities with disinfection exemptions were therefore based on the design flows for each facility multiplied by 400 cfu/100 mL. The resulting WLAs apply at the end of their respective disinfection exemptions. Facilities with year-round disinfection exemptions may be required to provide Illinois EPA with updated information to demonstrate compliance with these requirements and facilities directly discharging into a fecal-impaired segment may have their year-round disinfection exemption revoked through future NPDES permitting actions

Phosphorus WLAs for Lake Depue and Senachwine Lake are set using a technology based limit of 1 mg/L total phosphorus in wastewater.

76 regulated CSOs and SSOs are in the watershed associated for 14 facilities (Table 2-2). Each permitted CSO community/entity was contacted for further information regarding long term control plans and CSO flow volumes. The WLAs for all CSOs were calculated to be equal to the maximum flow associated with a CSO event, as reported by the regulated entity, multiplied by 400 cfu/100 mL for fecal coliform, and occurring four times per year. When no flow information was provided, a WLA equal to zero was assigned. WLAs apply when the permitted facility is in compliance with their approved long term control plans (LTCPs) which will require no more than 4 overflows per year. During the development of LTCPs for the CSO communities, Illinois may decide to modify the WLA if deemed appropriate.

Fifteen NPDES facilities in the watershed have permitted excess flows (Table 4-7). The excess flows at these sites have primary treatment and disinfection with a fecal coliform limit. Discharges during wet weather events need to be in compliance with all applicable permit requirements. Due to the increased assimilative capacity of the receiving waters during extreme wet weather, daily load allocations are not appropriate. Concentration limits must be met for all flows at all times, including during extreme wet weather events.

Table 4-7. Permitted excess flows

Permit ID	NPDES Facility Name	Outfall	Months Discharged	Average MG Month	Average cfu/100 mL	Exceedances [a]
IL0021237	CREVE COEUR WWTP	A01	7 of 72	0.3	1,315	3
IL0028576	EAST PEORIA STP #1	002	21 of 72	9.8	298	1
IL0028576	EAST PEORIA STP #1	005	1 of 72	2.94	16,000	1
IL0028576	EAST PEORIA STP #1	007	3 of 72	3.6	61,000	1
IL0028576	EAST PEORIA STP #1	A02	2 of 72	1.3	10	0
IL0046213	EAST PEORIA STP #3	A01 (was 002)	1 of 72	1.13	11,000	1
IL0029343	Kewanee STP	004	0 of 72	0	0	0
IL0029343	Kewanee STP	005	6 of 72	15.2	264	0
IL0029424	LASALLE WWTP	004	8 of 36	4	181	2
IL0029424	LASALLE WWTP	A01	31 of 36	5.7	354	6
IL0030007	MORTON STP #3	A02	1 of 60	No Data	16	0
IL0034495	PEKIN STP #1	002	65 of 72	5.4	19	0

Permit ID	NPDES Facility Name	Outfall	Months Discharged	Average MG Month	Average cfu/100 mL	Exceedances [a]
IL0037800	PEORIA CSOS	006	44 of 48	3.8		
IL0037800	PEORIA CSOS	007	40 of 48	5.4		
IL0021288	PEORIA SD STP	005	7 of 48	0.1	2,215	3
IL0021288	PEORIA SD STP	006	4 of 48	0.5	2,605	1
IL0021288	PEORIA SD STP	A01	17 of 48	144.7	232	1
IL0021288	PEORIA SD STP	004	0 of 48	0	0	0
IL0030660	PERU STP #1	002	68 of 72	1.5	Too numerous to count	68
IL0030660	PERU STP #1	A01	72 of 72	9.9	267[b]	19
IL0020575	PRINCETON, CITY OF STP	A01	27 of 72	3.3	364	11
IL0047384	SUNDALE HILLS STP	003	11 of 72	0.9	2,788	9
IL0047406	WASHINGTON ESTATES INC STP	A01	15 of 72	3.1	3,918	4
IL0042412	WASHINGTON STP #2	A01	28 of 72	22.3	1,142	5
IL0021792	WENONA STP	A01	7 of 72	1.8	3,237	2

Source: NPDES Data provided by IEPA on 7/25/2011
a. Exceedances during May through October only
b. Average does not include TNTC (T) values

21 regulated MS4s are in the watershed (Table 2-1). Individual WLAs were established for each MS4 based on the area of the regulated community. The jurisdictional areas of townships and municipalities were used as surrogates for the regulated area of each MS4. These areas were then used to calculate WLAs based on the proportion of the upstream drainage area located within the MS4 boundaries by multiplying that proportional area by the loading capacity of the assessment location. For regulated road authorities including Peoria and Tazewell County and the Illinois Department of Transportation, the MS4 area was determined using the length of applicable roads and estimated right-of-way width.

One CAFO is located in the watershed. The Bradford Pig Palace (Permit IL0064319) is designated as a CAFO and receives a WLA of 0. Illinois EPA does not have information on additional CAFOs at this time. In the event Illinois EPA obtains information on CAFOs in the future, the TMDL strategy may be amended to better account for contributing sources.

4.5.3 Margin of Safety

The CWA requires that a TMDL include a margin of safety (MOS) to account for uncertainties in the relationship between pollutants loads and receiving water quality. U.S. EPA guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS). A 10 percent explicit MOS has been applied as part of this TMDL for fecal coliform, chloride, manganese, total phosphorus, and total dissolved solids. A moderate MOS was specified because the use of the load duration curves is expected to provide accurate information on the loading capacity of the stream, but this estimate of the loading capacity may be subject to potential error associated with the method used to estimate flows within the watershed. An implicit MOS is also associated with estimating the level of load reduction necessary based on the maximum observed loads for each flow condition for chloride, manganese, and total dissolved solids. The MOS for fecal coliform is also implicit because the load duration analysis does not address die-off of pathogens.

4.5.4 Critical Conditions and Seasonality

The CWA requires that TMDLs take into account critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. Through the load duration curve approach it has been determined that load reductions are needed for specific flow conditions; however, the critical conditions (the periods when the greatest reductions are required) vary by location and are inherently addressed by specifying different levels of reduction according to flow.

When calculated, the allocation of point source loads (i.e., the WLA) will also take into account critical conditions by assuming that the facilities will always discharge at their maximum design flows. In reality, many facilities discharge below their design flows.

The Clean Water Act also requires that TMDLs be established with consideration of seasonal variations. Seasonal variations are addressed in this TMDL by assessing conditions only during the season when the water quality standard applies (May through October) for fecal coliform. The load duration approach also accounts for seasonality by evaluating allowable loads on a daily basis over the entire range of observed flows and by presenting daily allowable loads that vary by flow. For example, the critical conditions for each of the TMDLs are summarized in Table 4-8 which presents the pollutant reductions for each constituent by flow conditions.

Table 4-8. Summary of critical conditions.

Flow Condition Percentile	**Constituent**	**Season** [a]	**High 0-10**	**Moist 10-40**	**Mid-Range 40-60**	**Dry 60-90**	**Low 90-100**
Illinois River at Hennepin (D-16)	Fecal Coliform	Recreation	**63.64%**	35.95%	0%	0%	0%
Illinois River at Peoria Intake (D-30)	Fecal Coliform	Recreation	0%	0%	0%	0%	0%
	Manganese	Annual	0%	0%	0%	**26.24%**	15.94%
	Total Dissolved Solids	Annual	0%	0%	0%	0%	0%
Illinois River at Pekin (D-05)	Fecal Coliform	Recreation	68.81%	76.68%	70.66%	73.12%	**79.03%**
West Bureau (DQD-01)	Fecal Coliform	Recreation	**98.86%**	76.40%	68.11%	50.51%	15.15%
Big Bureau Creek (DQ-03)	Fecal Coliform	Recreation	**99.14%**	79.06%	91.71%	64.83%	78.72%
Farm Creek	Chloride	Annual	0%	0%	0%	**74.72%**	0%
Kickapoo Creek	Fecal Coliform	Recreation	**98.84%**	83.49%	48.42%	96.44%	0%
Lake Depue	Total Phosphorus	Annual	**91.2%** (critical conditions are further discussed in Section 12.1.1)				
Senachwine Lake	Total Phosphorus	Annual	84.88%	83.25%	85.80%	85.84%	**92.34%**

a. Recreation Season is designated as May through October
BOLD indicates critical condition

4.6 Load Reduction Strategies

Load reduction strategies (LRSs) have been developed for total phosphorus, nitrate nitrogen, and total suspended solids for the segments and lakes identified in Table 4-2. LRSs include the loading capacity of the receiving water and the reduction requirements to meet that loading capacity. A LRS does not include WLAs and is focused on nonpoint sources of pollution.

Several of the TSS LRSs are based on sampling sites with only data from 2009 and 2010. These data do not appear to be representative of typical TSS concentrations in the watershed during other years. The annual average volume weighted TSS is meant to represent a large dataset that includes all observed flows and concentrations. It should be noted that for many of the sites, data may not be representative of a typical annual load as many of the samples were collected during high flows and less data were collected during lower flow regimes.

Sections 5 - 13 present the LRSs for the Middle Illinois River watershed. The results are presented by assessment location in each of the applicable watershed clusters. The LRSs results correspond to assessment location. LRSs are based on the median allowable load in each of the flow regimes and reductions are based on the median observed load in each flow regime.

5. Illinois River Main Stem

The Illinois River main stem watershed cluster includes the drainages immediately adjacent to the Illinois River from the *Big Bend* area to just south of Peoria. In total, the drainage area is 782 square miles and consists of twenty-one 12-digit HUCs (Figure 5-2). Table 5-1 details area per 12-digit HUC associated with the Illinois River main stem unit. Counties with jurisdiction within the Illinois River main stem watershed cluster include: Bureau, LaSalle, Marshall, Woodford, Peoria, Putnam and Tazewell.

Along the Illinois River, seven locks and dams still exist, creating a system of navigational pools (USGS 2007a). The Illinois River main stem watershed cluster is contained between two lock and dam systems (Starved Rock and La Grange); a third lock and dam system (Peoria) is located within the watershed cluster near Peoria. The Peoria Lock and Dam create a chain of lakes, or large navigational pools, including: Senachwine Lake, Goose Lake, Upper Peoria Lake, and Peoria Lake. As depicted in Figure 5-1, which shows a view of the Illinois River above the lake system, the river dramatically widens as it flows into the lakes. As the river widens, the flows tends to slow which allows sediment to accumulate on the river's bottom and sand bars throughout the stretch. As an example, the average depth of Peoria Lake has decreased from eight feet to two feet from 1903 to current time, causing the need for constant dredging to maintain water habitat needed for many fish species (TRRPC 2004).

Figure 5-1. View of Illinois River in the lakes area.

The Illinois River is impaired by elevated concentrations of fecal coliform, manganese, and total dissolved solids (TDS). A watershed source assessment and linkage analysis are presented in this section. To address these impairments, a TMDL is presented for each constituent. Additionally, LRSs are developed for TSS, phosphorus, and nitrate plus nitrite nitrogen.

Lake Depue and Senachwine Lake are both located within this watershed cluster; however water quality analysis, TMDLs, and LRSs for each lake are presented in Section 12 and Section 13, respectively.

Table 5-1. Illinois River main stem 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 08	01	Cedar Creek	17,947	28.0
	02	Spring Creek	31,755	49.6
	03	Negro Creek	19,419	30.3
	04	Depue Lake - Illinois River	44,522	69.6
07130001 09	01	Coffee Creek - Illinois River	22,459	35.1
	02	Clear Creek	23,055	36.0
	03	Lake Thunderbird - Senachwine Lake	24,899	38.9
	04	Senachwine Lake - Illinois River	24,040	37.6
07130001 11	01	Scholes Branch - Crow Creek	28,637	44.7
	02	Town of Whitefield - Crow Creek	23,001	35.9
07130001 13	01	Thenius Creek - Illinois River	30,468	47.6
	02	Strawn Creek - Illinois River	32,075	50.1
07130001 17	01	Partridge Creek	17,380	27.2
	02	Blalock Creek-Illinois River	14,726	23.0
	03	Blue Creek-Illinois River	23,575	36.8
	04	Funks Run-Illinois River	17,803	27.8
	05	Tenmile Creek-Illinois River	20,912	32.7
07130003 03	01	Lick Creek	12,336	19.3
	02	Lost Creek	16,208	25.3
	03	Lamarsh Creek	26,403	41.3
	04	Pekin Lake - Illinois River	28,834	45.1
Total			**500,454**	**782**

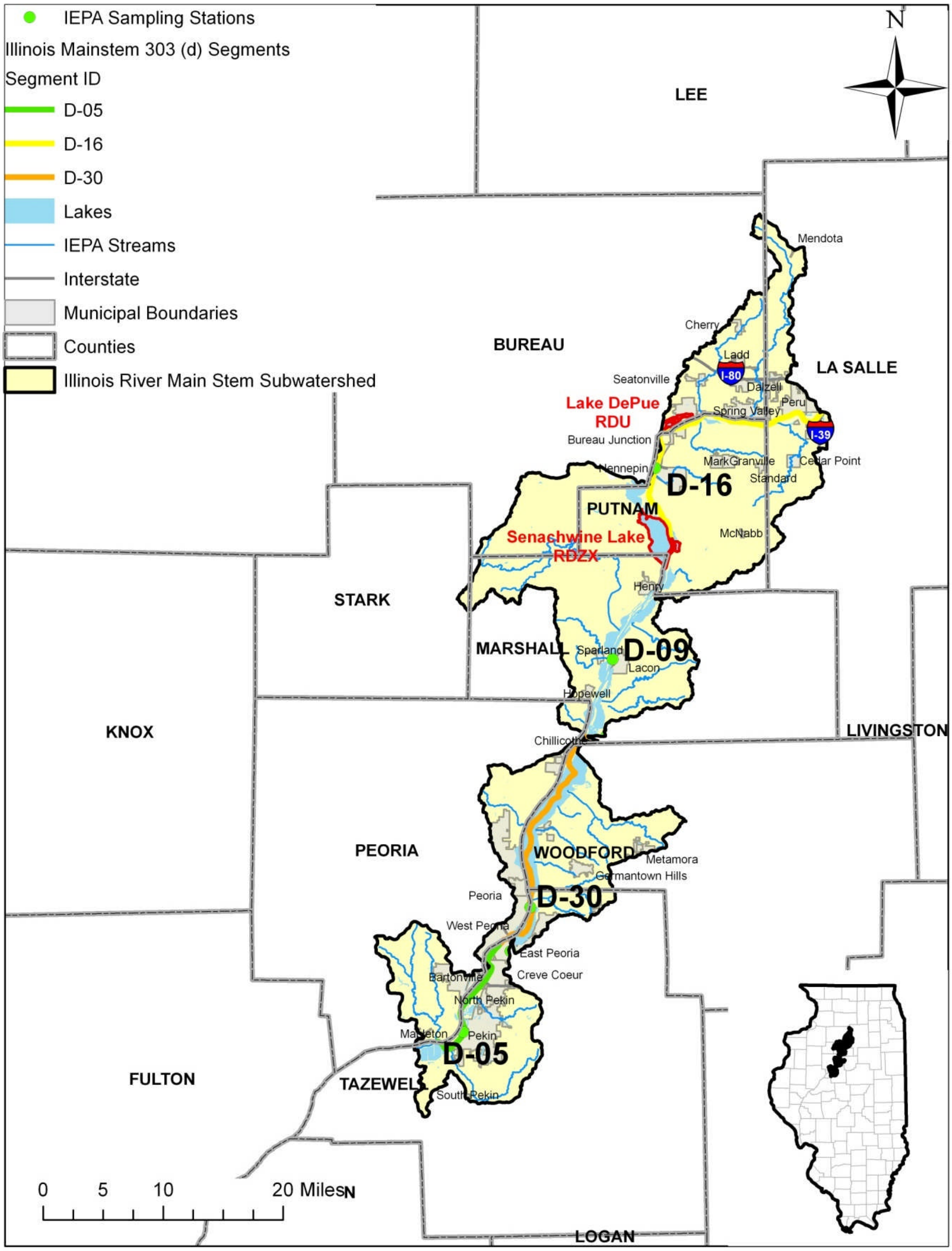

Figure 5-2. Illinois River main stem segments and stations

5.1 Source Assessment

The Illinois River main stem watershed cluster is largely agricultural and contains relatively little developed land within its drainage area (Figure 5-3). Predominating land use includes cultivated crops (55 percent), deciduous forests (17 percent), open water (8 percent), and development including low, medium, and high (6 percent).

The main sources of sediment to the Illinois River are watershed erosion, streambank erosion, and bluff erosion (Demissie et al. 2004). Excessive sedimentation not only reduces the lake volume and depth but also impacts water quality, aquatic habitat, navigation, recreation, real estate values, and tourism. Thus, sedimentation poses a very serious problem since it negatively impacts all of the beneficial uses of the lake (Demissie and Bhowmik 1986).

The Illinois River main stem watershed has significant animal agriculture activities in the watershed cluster. Table 5-2 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics. These livestock populations are in addition to livestock populations in the tributary watersheds, presented in the following sections.

Table 5-2. Livestock populations in Illinois River main stem watershed cluster.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Bureau	1,906	1,837	121	165	11,930
La Salle	1,062	61	60	118	856
Marshall	2,022	71	204	147	3,272
Peoria	2,768	215	186	176	3,526
Putnam	1,315	181	195		
Stark	23	4	2		96
Tazewell	1,309	71	147	116	10,617
Woodford	784		67	185	12,120
Total Number of Animals	11,190	2,442	982	908	42,416
Equivalent Animal Units	11,190	49	1,964	91	16,966

Source: USDA 2007-2009

Stormwater runoff may be a significant source of pollutants to the Illinois River. Three regulated MS4s are in this watershed including the City of Peoria, County of Peoria, and Tazewell County.

A total of 80 NPDES facilities are permitted within the Illinois River main stem watershed cluster, this includes five wastewater treatment plants, twenty seven sewage treatment plants and two CSOs. Locations of NPDES facilities within the watershed cluster are identified in Figure 5-3 and listed in Table 5-3. Five regulated CSOs with 57 outfalls discharge to the main stem of the Illinois River.

The City of Peoria, as part of their Long Term Control Plan requirements, has submitted a monitoring plan to characterize the CSO and stormwater discharges. They have proposed 23 sites for monitoring at times of CSO and non CSO events. As part of the regular operations, the City monitors specific locations throughout Peoria. Monitoring data were not available for analysis as part of the TMDL; however data should be available for future evaluations.

Tributary loads, including point sources within tributary watersheds, are also sources of pollutants.

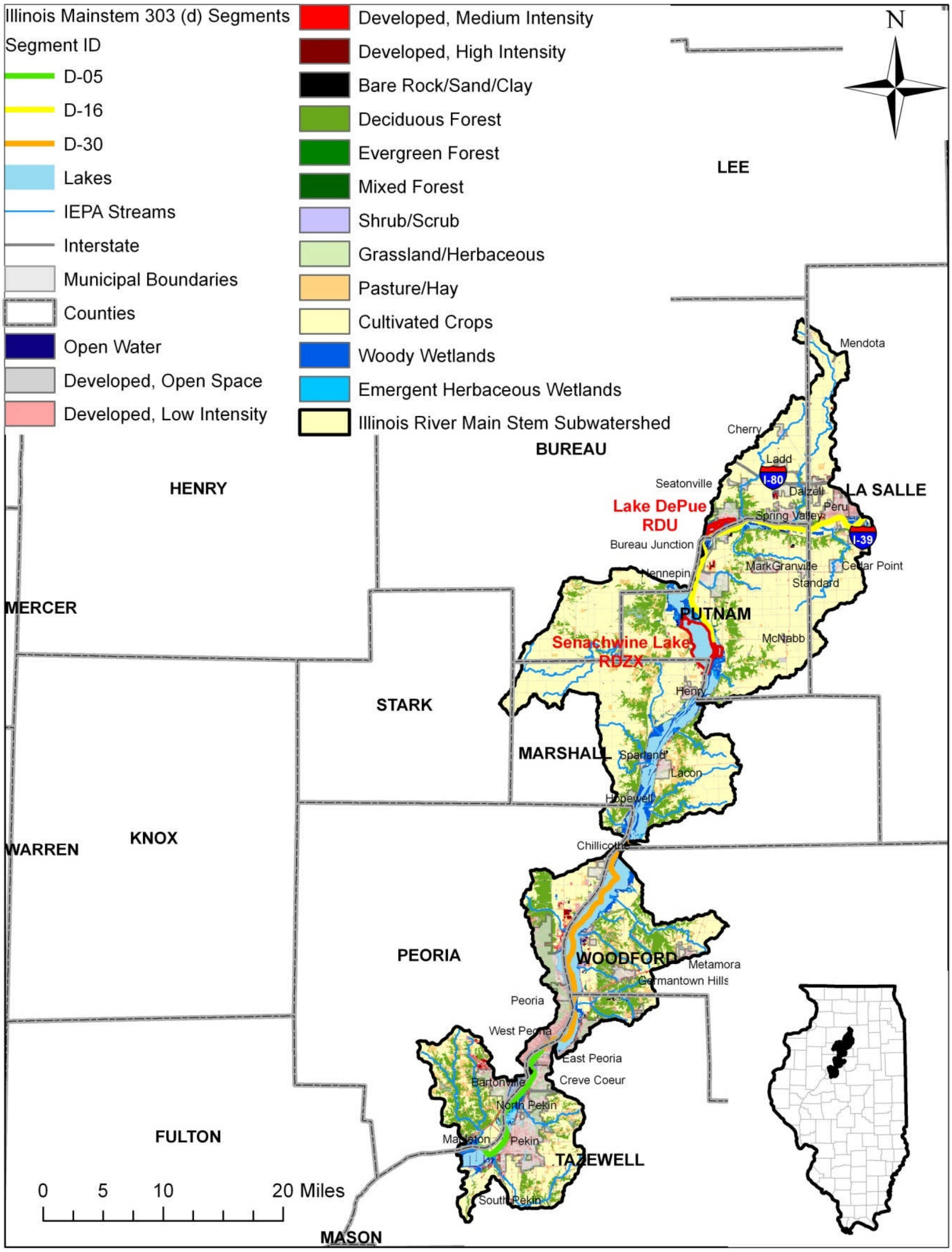

Figure 5-3. Illinois River main stem watershed cluster land use.

Table 5-3. NPDES facilities within the Illinois River main stem watershed cluster.

Downstream Segment ID	10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
D-16	0713000108	ILG580008	Cedar Point STP	0.05	Exempt
		IL0021491	Ladd STP	0.365	Exempt and required to monitor
		IL0031216	Spring Valley STP	1.1	limit 400
		ILG580130	Dalzell STP	0.11	Exempt
		IL0051705	Cherry WTP	--	--
		ILG640144	Seatonville WTP	0.005	--
		IL0001554	Dynegy Midwest Gen -- Hennepin	218	--
		IL0001724	AMERICAN NICKELOID CO-PERU	0.0436	--
		IL0001783	CF INDUSTRIES - PERU	0.003	--
		IL0002631	ISG HENNEPIN INC.	7.246	--
		IL0022331	GRANVILLE STP	0.289	limit 400
		IL0023523	DEPUE STP	0.48	limit 400
		IL0025313	HENNEPIN PWD STP	0.3	limit 400
		IL0029424	LASALLE WWTP	3.33	001, 004, A01- limit 400
		IL0030660	PERU STP #1	3	001, 002, A01- limit 400
		IL0052183	NEW JERSEY ZINC COMPANY, INC.	--	--
		IL0075507	PERU STP #2	1	limit 400
		IL0076848	MARK WTP	0.005	--
D-09	0713000109	IL0026573	PUTNAM COUNTY JUNIOR HS	0.01	Exempt and required to monitor
		IL0001392	NOVEON INC-HENRY	0.947	limit 400
		IL0002518	UNITED SUPPLIERS-HENRY	0.011	--
		IL0070548	HENRY STP	0.3	limit 400
D-09	0713000111	IL0064319	BRADFORD PIG PALACE	0	0- CAFO, no discharge
		IL0070424	J&D RENTALS AND SALES	--	--
D-09	0713000112	ILG580226	SPARLAND STP	0.105	Exempt
		IL0029378	LACON WWTP	0.32	limit 400
		IL0068047	HOPEWELL WTP	--	--
D-30	0713000117	IL0021539	METAMORA NORTH STP	0.36	001, 002- limit 400
		IL0053864	LAKE WILDWIND MHP-METAMORA	0.05	Exempt
		IL0060461	OAK RIDGE SD STP	0.0144	3 outfalls exempt
		IL0077224	METAMORA PWS	0.031	--
		IL0023159	CHILLICOTHE SD STP	0.8	limit 400
		IL0001414	CATERPILLAR INC-MOSSVILLE	2.48	limit 400
		IL0042234	PINEWOOD MHP	0.03	Exempt and required to monitor
		IL0059391	CEDAR BLUFF UTILITIES, INC STP	0.07	Exempt
		IL0065072	MEDINA UTILITIES INC-EAST STP	0.165	Exempt

Downstream Segment ID	10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
		IL0028916	GERMANTOWN HILLS STP #1	0.2	Exempt
		IL0059030	MOUNT ALVERNO NOVITIATE-E PEOR	0.0088	Exempt
		IL0071358	TRICO, INC., MILL POINT MHP	0.015	limit 400
		ILG840039	SENECA PETROLEUM-POWLEY SAND	--	--
		IL0001961	IL AMERICAN WATER-PEORIA MN	--	--
		IL0002011	IL AMERICAN WATER-PEORIA SAN	0.142	--
		IL0024163	CATERPILLAR INC.- PEORIA	0.006	Exempt
		IL0025615	PMP FERMENTATION PRODUCTS, INC	3.26	--
		IL0026972	GRANDVIEW MOBILE HOME PARK	0.025	Exempt
		IL0037800	PEORIA CSOS	na	--
		IL0046213	EAST PEORIA STP #3	1.2	001, 002- limit 400
		IL0077321	CATERPILLAR TRAILS PWD WTP	0.065	--
		ILG580262	GERMANTOWN HILLS WWTP #2	0.2	Exempt
D-05	07130003 03	ILG551081	PEKIN COUNTRY CLUB	0.01	Exempt
		IL0072451	ILLINOIS&MIDLAND RAILROAD	na	--
		ILG580252	SOUTH PEKIN STP	0.15	Exempt
		IL0044636	HOLLIS CONSLDTD GRD SCH STP	0.005	Exempt
		IL0055816	LIMESTONE WALTERS SCHOOL STP	0.004	Exempt
		IL0074560	COYOTE CREEK HOMEOWNERS ASSN	0.03	Exempt
		IL0001830	CATERPILLAR INC.-MAPLETON	0.061	limit 400
		IL0001953	AVENTINE RENEWABLE ENERGY	34.09	--
		IL0002232	MIDWEST GENERATION-POWERTON	0.036	Exempt
		IL0002291	CATERPILLAR INC.-EAST PEORIA	1.424	--
		IL0002526	KEYSTONE STEEL AND WIRE	8.392	--
		IL0002909	MGP INGREDIENTS OF ILLINOIS	5.45	--
		IL0021237	CREVE COEUR WWTP	1.55	001, A01- limit 400
		IL0021288	PEORIA SD STP	37	001, 003, 004, 005, 006, A01- limit 400
		IL0023728	DEGUSSA/GOLDSCHMIDT CHEMICAL	0.323	--
		IL0027910	CARMI WWTP	1.4	limit 400
		IL0028576	EAST PEORIA STP #1	4.22	001, 002, 005, 007, A02- limit 400
		IL0034495	PEKIN STP #1	4.5	001, 002- limit 400
		IL0037729	PEKIN PAPERBOARD	Na	--
		IL0037800	PEORIA CSOS	Na	--
		IL0061930	ARCHER DANIELS MIDLAND-PEORIA	63.21	--

Downstream Segment ID	10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
		IL0063827	EXCEL FOUNDRY & MACHINE, INC.	0.0026	--
		IL0067563	AMOCO OIL-PEORIA TERMINAL	3.32	--
		IL0070122	AIR LIQUIDE INDUSTRIAL US LP	0.009	Exempt
		IL0073270	CONAGRA INTERNATIONAL-N PEKIN	0.0296	--

Source: NPDES Data provided by IEPA on 7/25/2011
na – No reported design flows
"—" No information provided

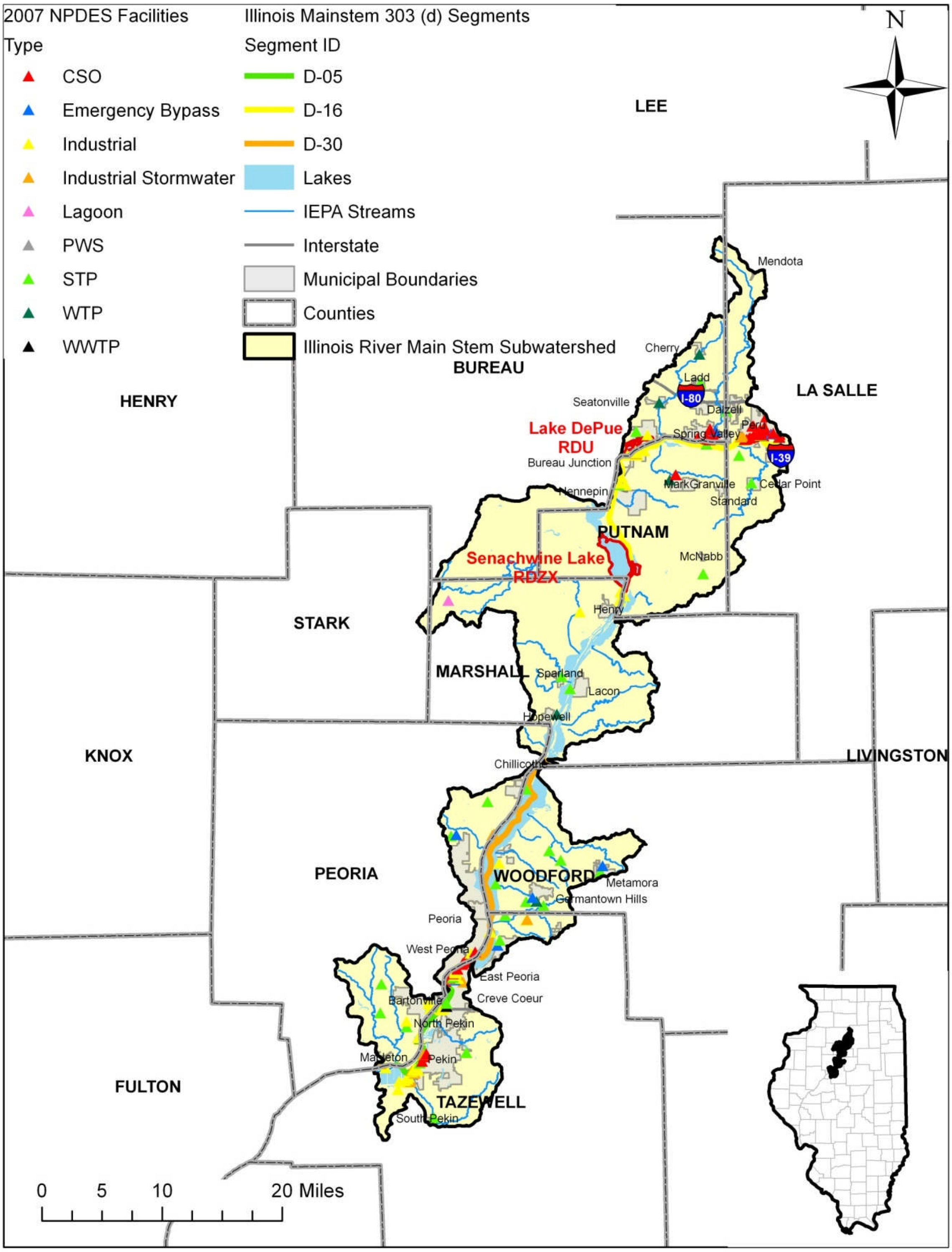

Figure 5-4. Illinois River main stem watershed cluster segments and stations.

Within the Illinois River main stem watershed cluster, two watershed plans have been developed for smaller, 12-digit subwatersheds including Partridge Creek and Tenmile Creek, discussed below.

5.1.1 Partridge Creek

Partridge Creek originates north of the Village of Metamora and flows northwest for approximately 12 miles to Upper Peoria Lake. Including all tributaries that drain to Partridge Creek, the system is composed of 73.5 miles and drains approximately 18,000 acres of land (TCRPC 2004b). The Partridge Creek watershed is dominated by row crops with urbanization concentrated around Village of Metamora (2009 estimated census population 3,437). Partridge Creek has been classified for *overall* and *aquatic life* use. Potential sources of impacts include agriculture, hydromodification, municipal point sources, resource extraction and urban runoff/storm sewers (TCRPC 2004b).

5.1.2 Tenmile Creek

The Tenmile Creek watershed covers approximately 11,027 acres and flows ten miles northwest from Washington Township to Peoria Lake (TCRPC 2004c). Predominating land use includes deciduous forests and cultivated crops; urban development surrounds Germantown Hills. The 2004 Tenmile Watershed Restoration Plan identified the lack of stormwater management as the primary cause of water quality degradation in the watershed (TCRPC 2004c). Additionally, specific concerns associated with stormwater were identified by the Watershed Restoration Plan. These concerns include: increased volumes of stormwater flows generated from human alterations; soil erosion and soil washed from the watershed to Peoria Lake; and, a lack of stable stream channels contributing to downstream sedimentation, loss of aquatic life and property damage (TCRPC 2004c). Tenmile Creek has been classified for *overall* and *aquatic life* use; however, concerns include agriculture, hydromodification, municipal point sources, resource extraction and urban runoff/storm sewers (TCRPC 2004c).

5.2 Watershed Linkage Analysis

Due to the concern surrounding sedimentation, the Illinois River watershed has been a focus of several detailed studies, including those by the Illinois State Water Survey (ISWS) that evaluated sources of environmental degradation and sediment throughout the watershed. As discussed in more detail below, the high rate of sedimentation is related to the geology of the Peoria Lake region, which is surrounded by highly erodible loess bluffs and moraine deposits. In addition, alteration of the tributary watersheds has resulted in degradation of riparian habitat along stream corridors. Typically, this is a result of agricultural practices. The results are increased sheet and rill erosion in formerly riparian areas that had trapped sediments before entering tributary waters.

Along the main stem, problems are not limited to sedimentation as additional issues such as flooding, degradation of aquatic habitats, and water-based recreation also need to be addressed (Demissie et al. 1999). Water quality within the Illinois River has been subjected to many impacts associated with development, including waste discharges from urban areas, water-level control for navigation, and sediment and chemical inflow from agricultural and urban watersheds (Demissie et al. 2004). Both point and nonpoint sources of pollution have been identified as potentially impacting the water quality within the watershed.

Three locations along the main stem have been sampled by the Illinois EPA and are discussed in detail within this section. These sites include: the Illinois River at Hennepin (D-16); Illinois River at Peoria Intake (D-30); and Illinois River at Pekin (D-05). In addition, Illinois EPA data collected at unimpaired sites at Marseilles (D-23) and Lacon (D-09) are included in longitudinal profiles and discussion.

5.2.1 Total Suspended Solids

Erosion and sedimentation have long been recognized as principal causes for many of the environmental and ecological problems in the Illinois River watershed (Demissie et al. 2004). Many of these problems were identified by the USACE (2007) and include:

- Loss of ecological integrity due to sedimentation of backwaters and side channels, degradation of tributary streams, and loss of floodplain and riparian habitat functions.
- On average, the backwater lakes along the Illinois River have lost 73 percent of their capacity. Some lakes have filled with sediment at an average rate as high as 0.74 inches per year.
- Lakes along the main stem of the river are also rapidly filling, with Peoria Lake losing nearly 80 percent of its capacity (TCRPC 2002).
- Primary sources of sediment to Lake Peoria are (1) Upper Illinois River watershed; (2) watershed tributaries which drain directly to the lake; and (3) shoreline erosion.
- Water clarity is the primary factor limiting submersed aquatic plants. During periods of high turbidity, aquatic plant growth is limited, since suspended sediments interfere with light penetrations into the water.

The USACE (2007) explains that many of these problems are associated with the historical development of the watershed, including the following:

- Between 1902 and 1923, drainage districts greatly modified the landscape, removing approximately one-third of the terrestrial and aquatic life habitat from the floodplain for agricultural purposes. By 1929, 38 organized drainage and levee districts and three private levees enclosed roughly 200,000 acres of the Illinois River Valley. Levees erected in the 20th century isolated and facilitated the drainage of almost all of the lakes and wetlands along the lower river. The levees affected the hydrology and sediment transport processes of the river as they increased flood stages by reducing the space available for water flow, storage, and sediment deposition.
- Beginning in the 1950s, many farmers dramatically changed their farming operations, from diversified livestock and grain farms to specialized farms with primarily corn and soybean production. This resulted in a 67 percent increase in acres under row crops between 1945 and 1986.
- In many areas, storm flows are now higher than occurred under pre-development conditions due to land use changes and increased efficiency brought about by channelization in urban and rural areas. Channelization increases peak flows as it allows flood waves to pass more quickly through the basin, increasing the volume and the erosive force of the water. Increased bed and bank migration have resulted from higher energy flows and erosive forces of these stream systems, resulting in streams that are more structurally simple and homogeneous than in the past.
- Some degree of channelization has occurred in almost every Illinois River tributary. The highest degree of channelization occurs in Farm Creek, which includes agricultural channelization as well as flood control. Transportation channelization is also common in the study area, with many roadways and railroad grades located in parallel corridors as streams. The results are nearly always a straightened stream channel that cannot migrate into the hardened structure and is forced into more sensitive areas.
- Recent studies show that the Illinois River Bluffs have been subject to intense development pressures and since 1969 over 10,000 acres of forest land have been lost along the river. Furthermore, 80 percent of new housing projects in Peoria County built between 1993 and 2000 were within 500 feet of forested bluff area (TCRPC undated).

In addition to the direct impacts of excessive sediment loading (e.g., impact on biota, recreation, and water supplies), other pollutants such as fecal coliform and phosphorus can be transported into the Illinois River by sediment.

Figure 5-5 presents the longitudinal TSS profile of the Illinois River main stem project area. As shown, median TSS concentrations gradually increase from sites furthest upstream to the downstream most location at Pekin. It can be noted that sediments tend to be less concentrated in the Illinois River itself, but because of its much greater water volume, the total sediment load is very high (IDNR 2010). Additionally, worsening sediment conditions moving downstream are likely due to the cumulative effect of watershed and tributary loading.

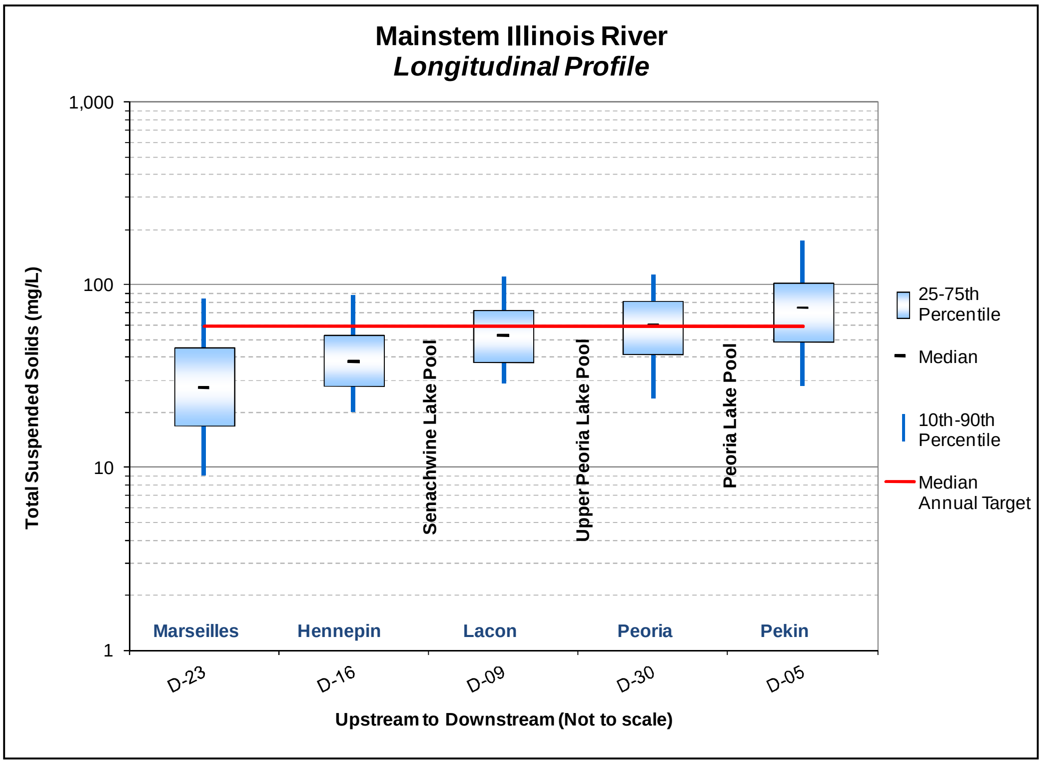

Figure 5-5. Illinois River main stem longitudinal TSS profile.

As shown in Figure 5-6, median TSS concentrations in the tributaries are generally below target levels; however, of particular concern, concentrations within Big Bureau Creek, Farm Creek and Kickapoo Creek do exceed target concentrations. It should be noted that both Farm Creek and Kickapoo Creek are located immediately upstream of the Illinois River monitoring location at Pekin. It is likely that loads from these two tributaries contribute to the high TSS concentrations observed at Pekin.

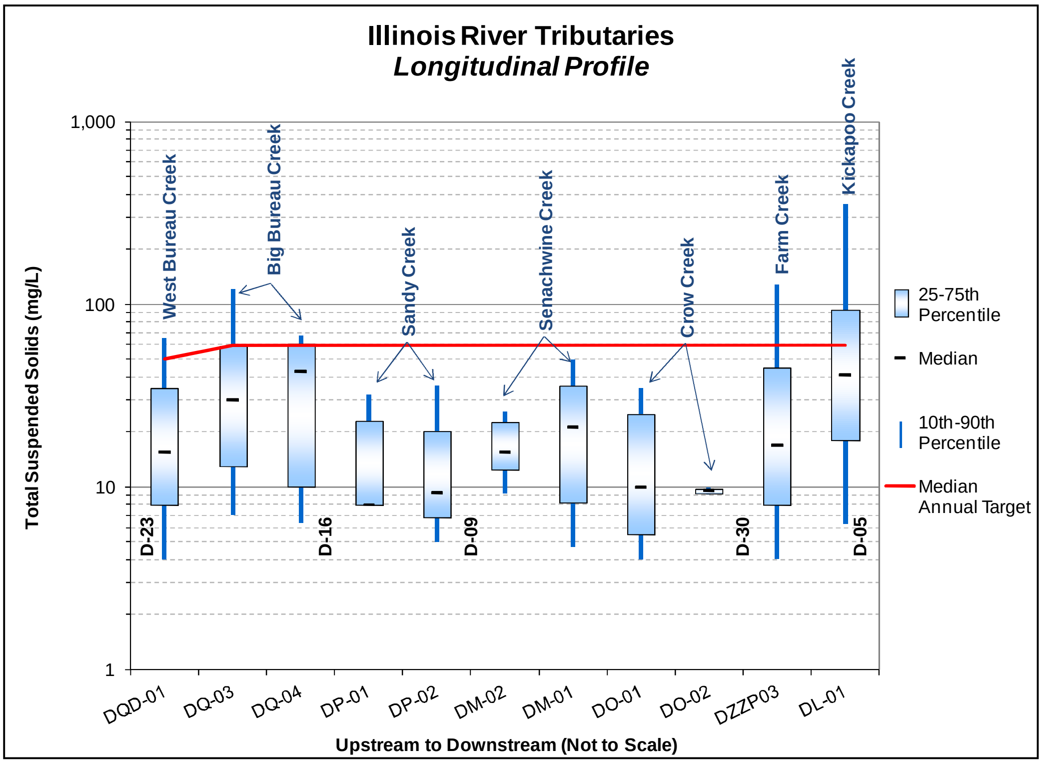

Figure 5-6. Illinois River tributary longitudinal TSS profile.

The ISWS created a sediment budget for the Illinois River (Demissie et al. 2004) that relied on USGS suspended sediment data, average annual flows, and estimates of channel erosion. The study included the development of sediment rating curves to ensure annual sediment yields were not underestimated. Sediment data from 44 stations in the Illinois River watershed were used to develop regional calculations to estimate sediment yield for periods of time when data were not available. ISWS researchers further determined that bed load contributions of five to 25 percent were appropriate for the streams in this watershed (Simons and Senturk 1977; Nakato 1981). Bed load estimates and sediment concentrations were summed to determine an average annual sediment yield.

An analysis of TSS data provided by Illinois EPA combined with the flow estimates described in Section 4.4 is presented in Table 5-4 for tributary streams with long-term flow data. The magnitude of loads between the two different approaches is similar, as are the contributing load proportions. This finding supports the use of the existing ISWS sediment budget to represent current sediment loads in the watershed, as well as the relative importance for implementation priority.

Table 5-4. Sediment load comparison

Stream	Station	Average Annual TSS Load (tons/year)	ISWS Average Annual Sediment Yield Load (tons/year)
Kickapoo Creek	DL-01	497,031	424,000
Big Bureau Creek	DQ-03	129,374	252,000[a]
West Bureau Creek	DQD-01	44,570	
Farm Creek	DZZP-03	35,721	44,100

a. Represents the entire Big Bureau Creek watershed, which is larger than the area drained by stations DQ-03 and DQD-01.

Illinois River at Hennepin (Site D-16)

Since monitoring began in 1977, TSS in the Illinois River at Hennepin has sporadically exceeded the target (Figure 5-7), with median TSS concentrations exceeding the target only in 1995. No long-term trend is apparent, although median TSS concentrations have generally increased over the past six years. Seasonally, TSS is greatest in the spring and summer. The high loads in the spring may be related to the plowing and planting of agricultural fields occurs during these months, increasing the opportunity for sheet and rill erosion.

Further analysis pairing the TSS concentrations with flow conditions (Figure 5-8) reveals elevated TSS concentrations during high flows and slightly lower concentrations during mid-range and lower flow conditions. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Many high flow events occur during the spring, which is consistent with the seasonal pattern.

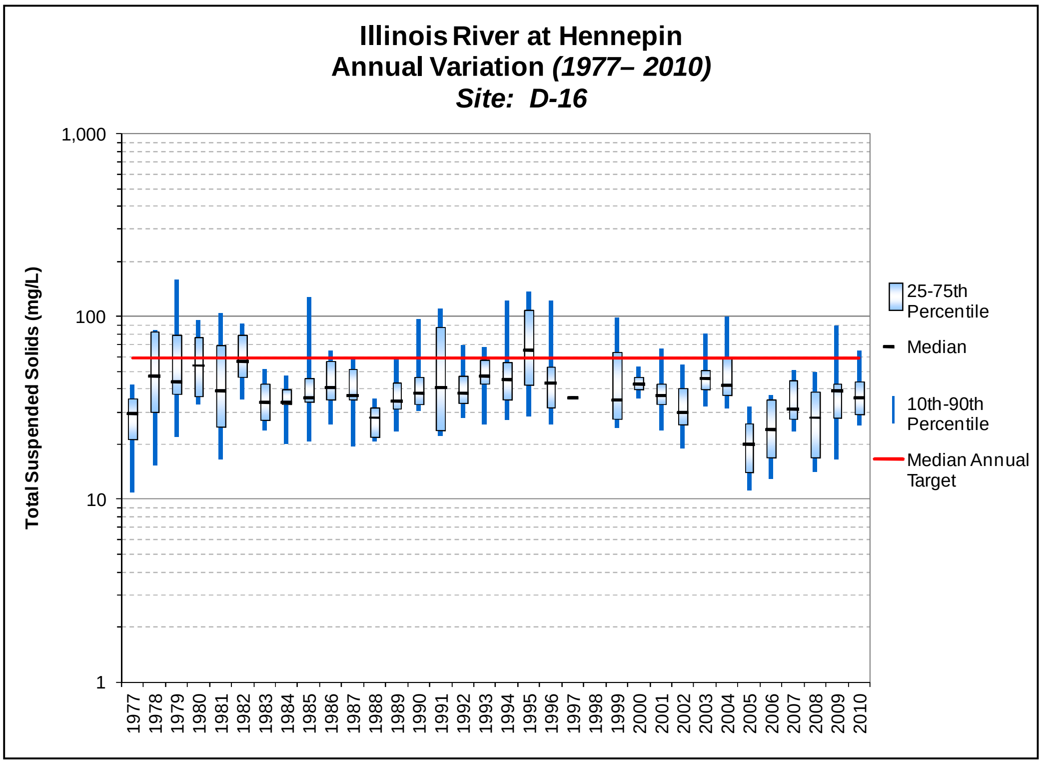

Figure 5-7. Annual TSS concentrations, Illinois River at Hennepin, 1977 - 2010.

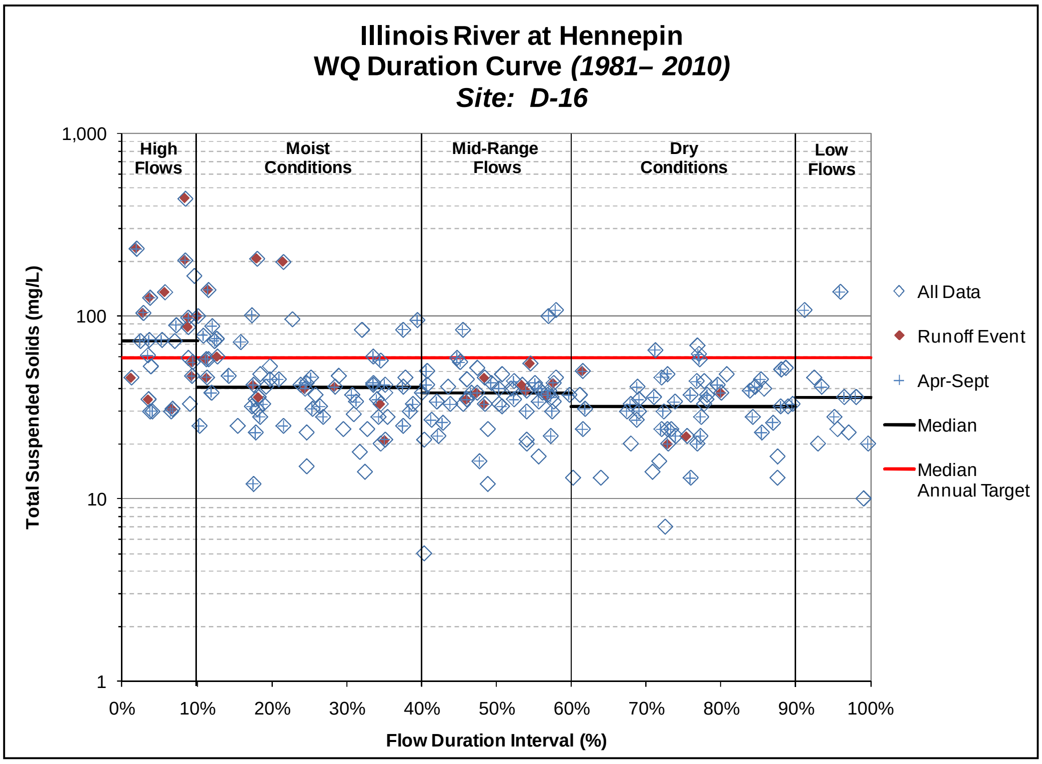

Figure 5-8. TSS water quality duration curve, Illinois River at Hennepin, 1981 – 2010.

Illinois River at Peoria Intake (Site D-30)

Since water quality monitoring at the Peoria intake began in 1977, annual median TSS concentrations have sporadically exceeded the criteria (Figure 5-9), with no apparent long-term trends. Analysis of seasonal TSS data indicates increased concentrations occurring during the spring and summer.

Further analysis pairing the TSS concentrations with flow conditions occurring from 1979 to 2010 (Figure 5-10), reveals elevated TSS concentrations exceeded target concentrations during all flow regimes. Elevated concentrations during high flow periods are likely due to bank, channel, and gully erosion, whereas increased concentrations during moist and mid-range conditions may be due to sheet and rill erosion.

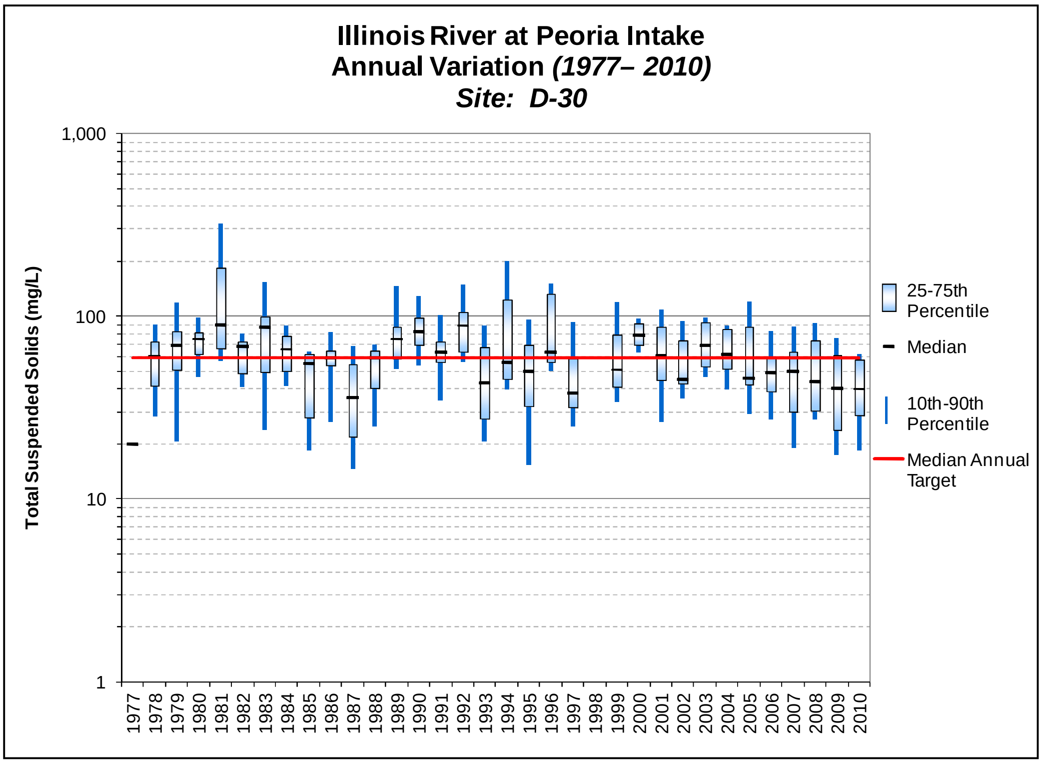

Figure 5-9. Annual TSS concentrations, Illinois River at Peoria Intake, 1977 - 2010.

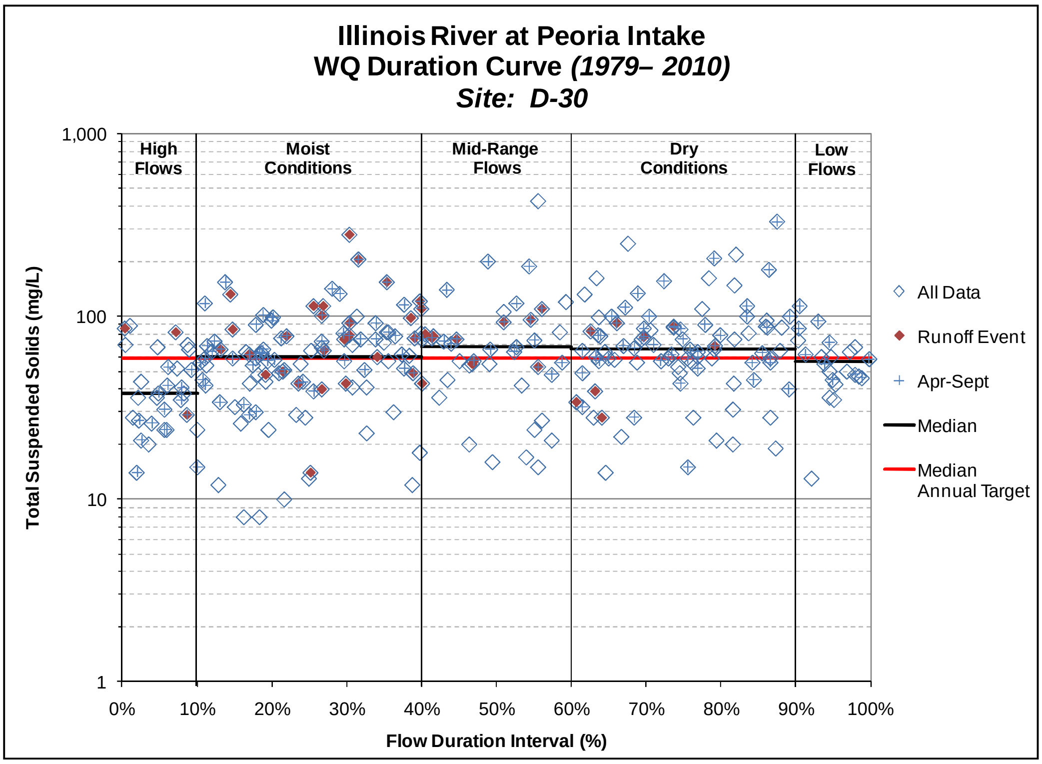

Figure 5-10. TSS water quality duration curve, Illinois River at Peoria Intake, 1979 – 2010.

Illinois River at Pekin (Site D-05)

Since water quality monitoring began in 1977, annual concentrations of TSS in Illinois River at Pekin have sporadically exceeded the TSS target prior to 2004 (Figure 5-11). In the last seven years, the annual median TSS concentrations have typically been below the TSS target.

Analysis of seasonal trends shows elevated TSS concentrations exceeding the target concentration throughout the year. TSS concentrations are slightly higher during the cultivating and harvesting months of April through September compared to the remaining months of the year. Plowing and planting of agricultural fields during the spring months increases the opportunity for watershed erosion and may contribute to the TSS concentrations in the Illinois River at Pekin.

Further analysis pairing the TSS concentrations (Figure 5-12) with flow conditions recorded between 1979 and 2010 shows elevated TSS concentrations occurred in all flow regimes. In particular, unlike the other sites on the Illinois River, elevated TSS concentrations occurred during mid-range flows compared to the high flows. Figure 5-12 illustrates that a significant number of runoff events occurring during these periods. The high TSS concentrations at Pekin during mid-range and moist flows may therefore be due to precipitation events that occur locally but are not large enough to increase the flow in the main stem of the river.

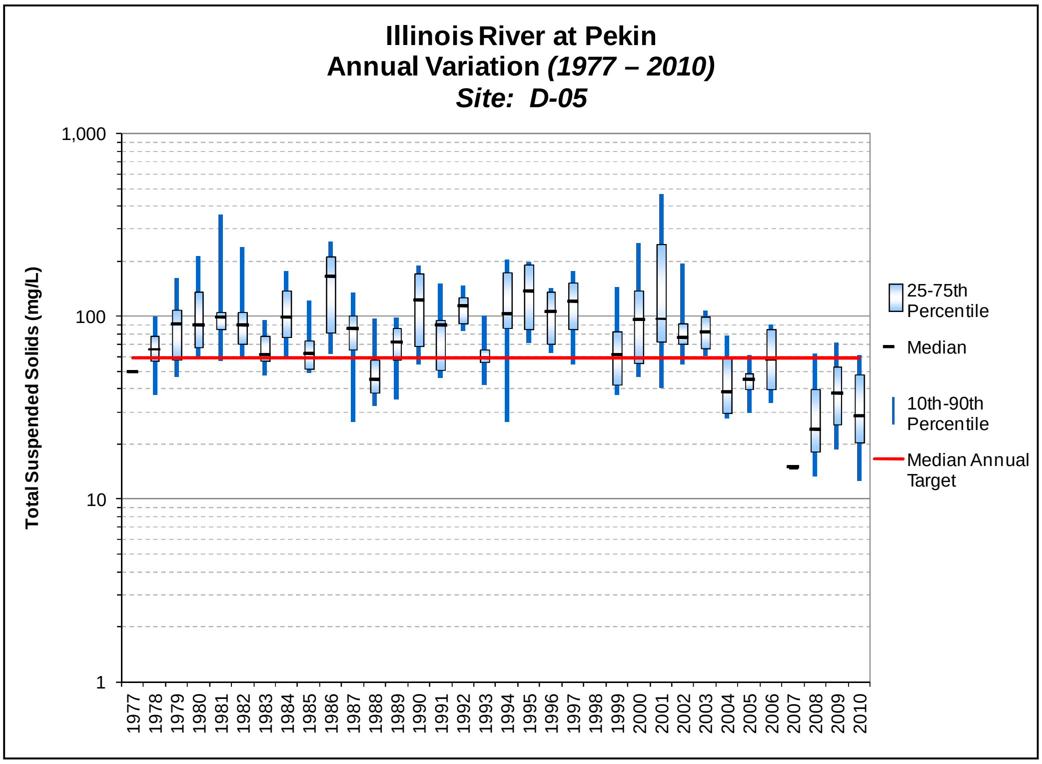

Figure 5-11. Annual TSS concentrations, Illinois River at Pekin, 1977 - 2010.

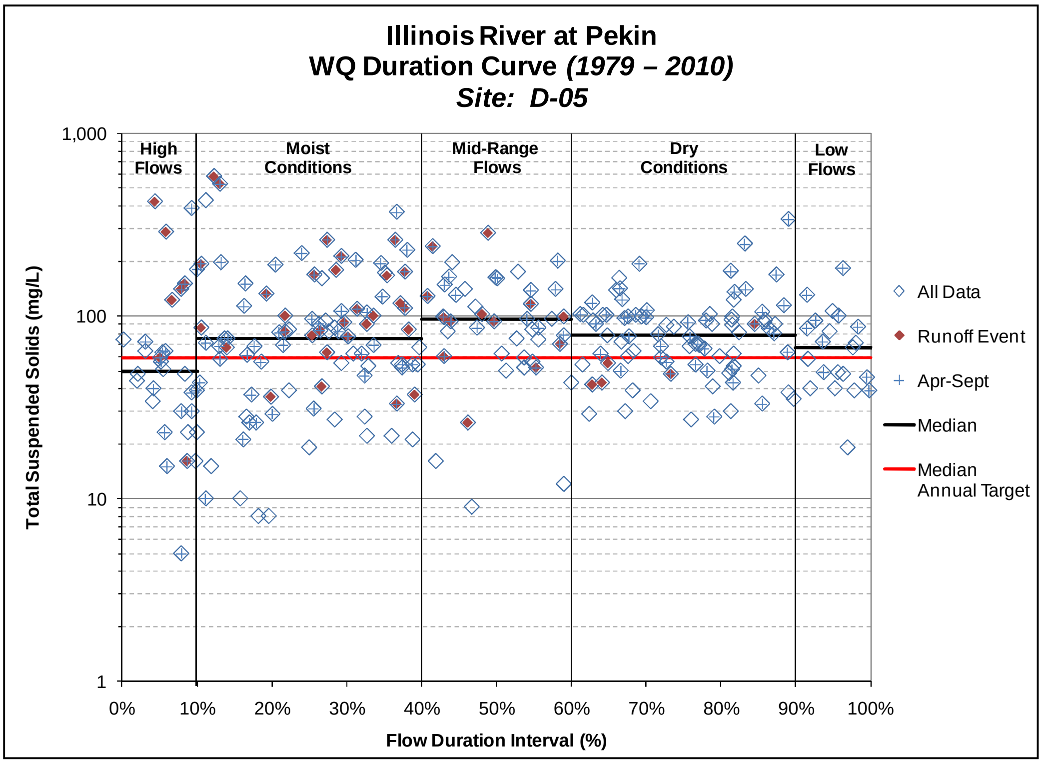

Figure 5-12. TSS water quality duration curve, Illinois River at Pekin, 1979 – 2010.

5.2.2 Fecal Coliform

As shown in Figure 5-13, counts of fecal coliform within the Illinois River main stem are elevated, especially at Marseilles (upstream of the project area) and at Pekin, the furthest downstream location. Fecal coliform steadily decreases from Marseilles to Peoria, where the lowest median fecal coliform counts occur. This may be due to the settling of the bacteria as the river widens and velocities decrease; it also indicates the lack of major sources of bacteria through this stretch. Downstream of Peoria, median counts in the Illinois River are near the geometric mean standard, and over 25 percent of the samples exceed 400 counts/100 mL. Due to the increased urbanization in and around Peoria and Pekin, it is likely that urban runoff, CSOs, and SSOs contribute to elevated fecal coliform counts that occur at Pekin.

As shown in Figure 5-14, tributary fecal coliform counts often exceed the instream geometric mean standards. Of greatest concern, the median count in Senachwine Creek exceeds 400 counts/100 mL while nearly 50 percent of the samples in Farm Creek exceed 400 counts/100 mL. It is likely that fecal coliform loads from both Farm Creek and Kickapoo Creek contribute significantly to elevated concentrations at Pekin.

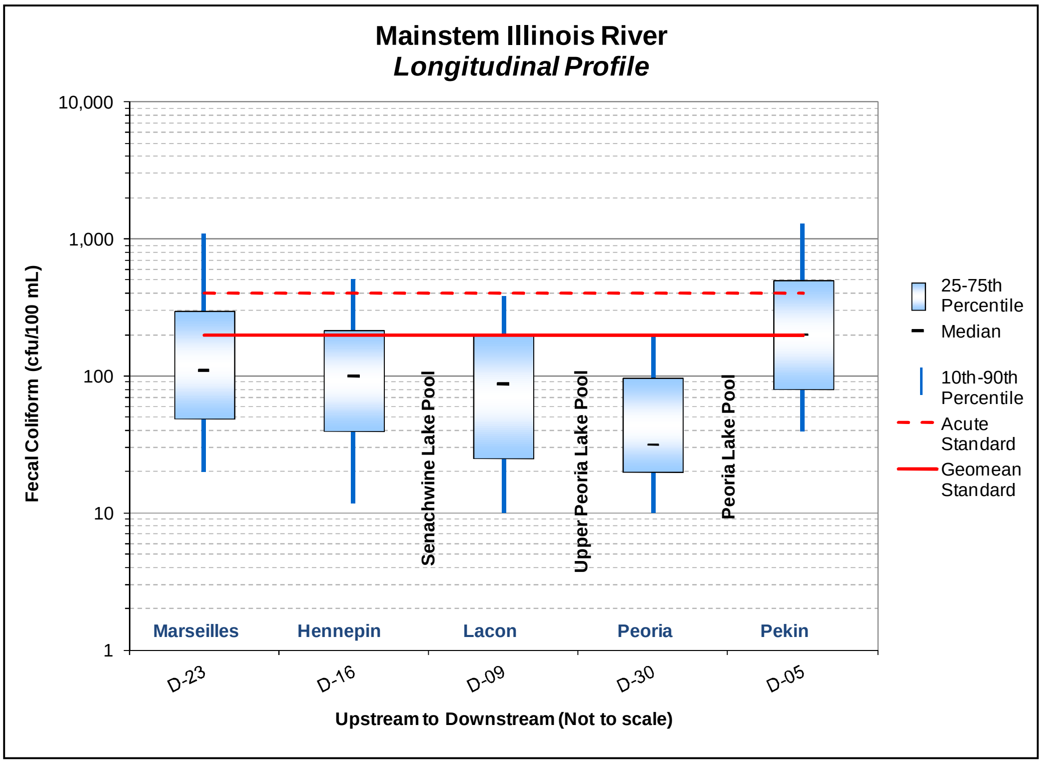

Figure 5-13. Illinois River main stem longitudinal fecal coliform profile (1974-2010).

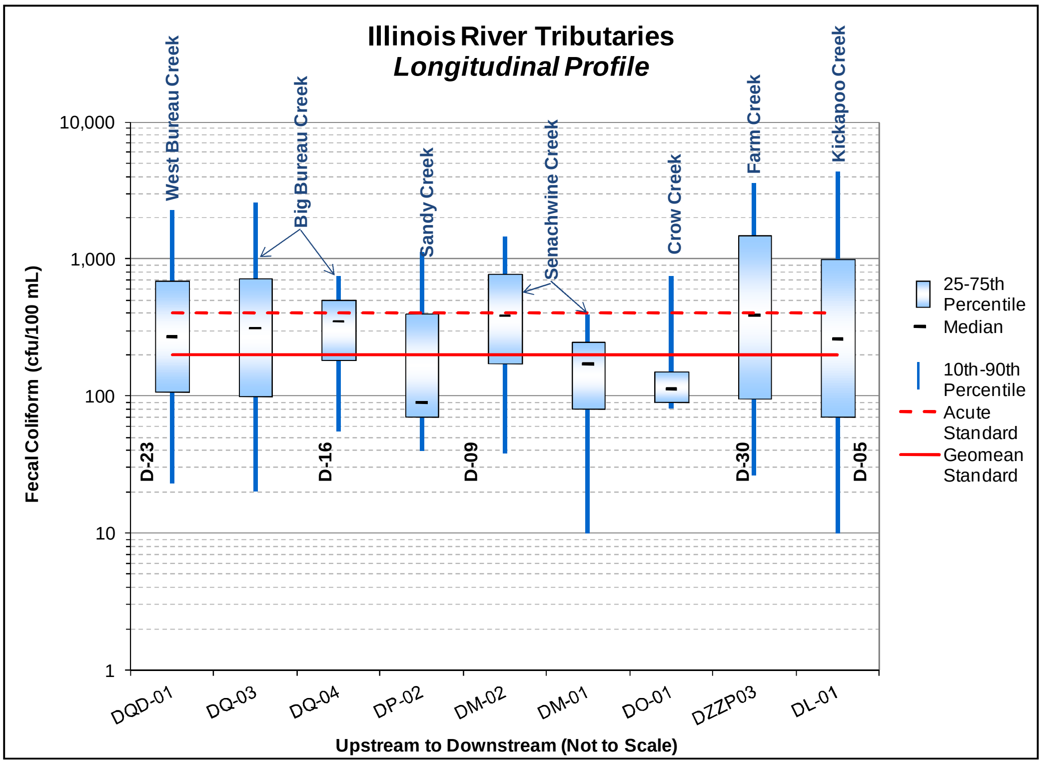

Figure 5-14. Illinois River tributary longitudinal fecal coliform profile (1974-2010).

Additional presentations of the fecal coliform data for the sites at Hennepin, Peoria Intake, and Pekin are shown in Figure 5-15 to Figure 5-26. The following observations are apparent from these figures:

- Fecal coliform is only consistently above the standards at Hennepin during high flow periods (Figure 5-17).
- Fecal coliform at the Peoria intake is highest in the fall (October to December) and during high flow conditions (Figure 5-22, Figure 5-23).
- Numerous CSOs are tributary to the main stem of the Illinois. These point sources contribute high levels of bacteria to the River during rainfall events.
- Fecal coliform at the Pekin intake is highest in the fall (October to December) and during low flows (Figure 5-25, Figure 5-26). Similar to TSS, the fecal coliform counts at Pekin during low flows may be due to precipitation events that occur locally but are not large enough to increase the flow in the main stem of the river. However, they could also indicate dry weather sources in the area, such as leaking sewers and SSOs. Fecal coliform at Pekin may also be affected by local point sources.

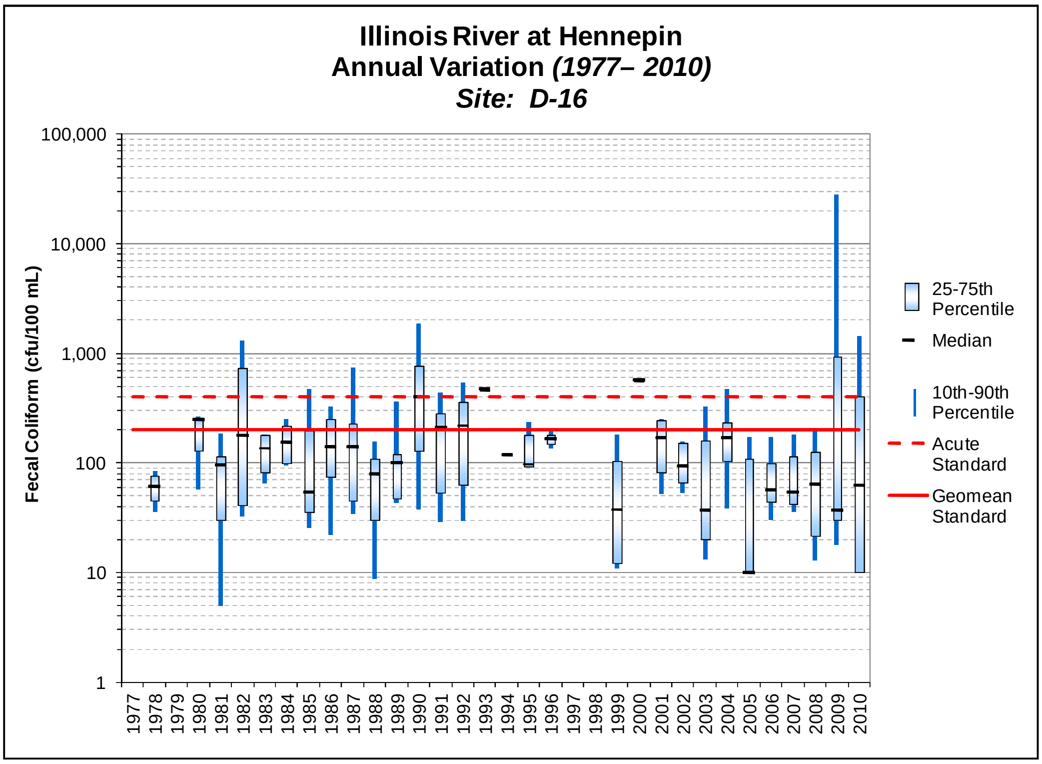

Figure 5-15. Annual fecal coliform concentrations, Illinois River at Hennepin, 1977 - 2010.

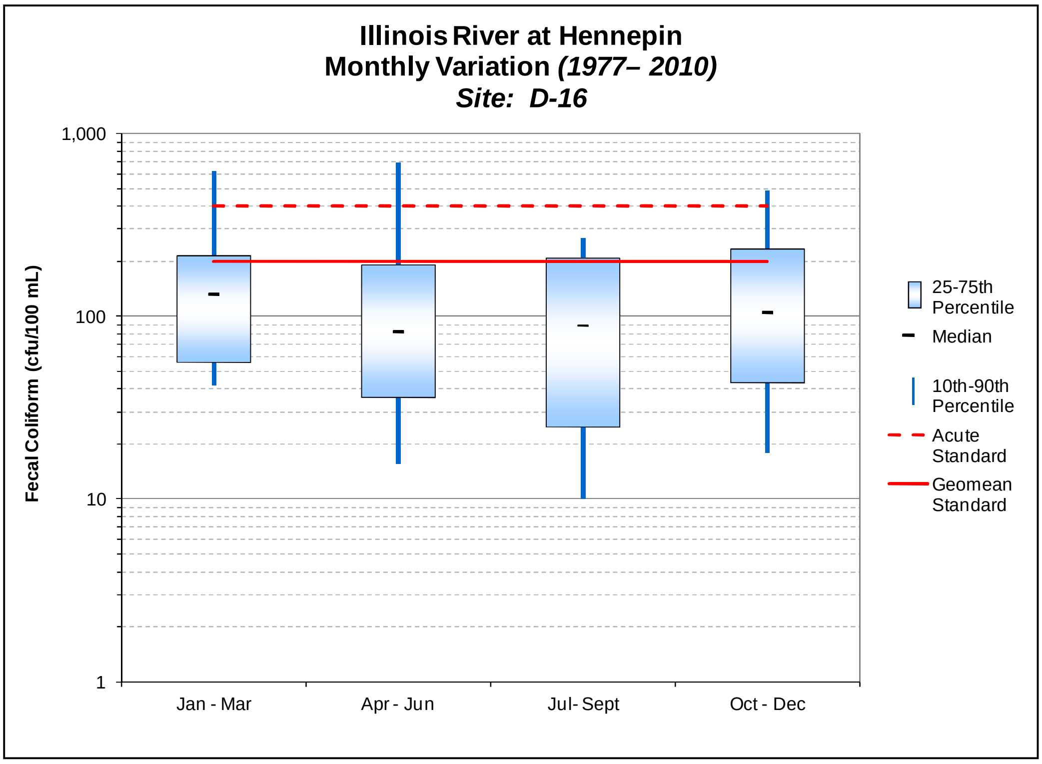

Figure 5-16. Seasonal fecal coliform data, Illinois River at Hennepin, 1977 - 2010.

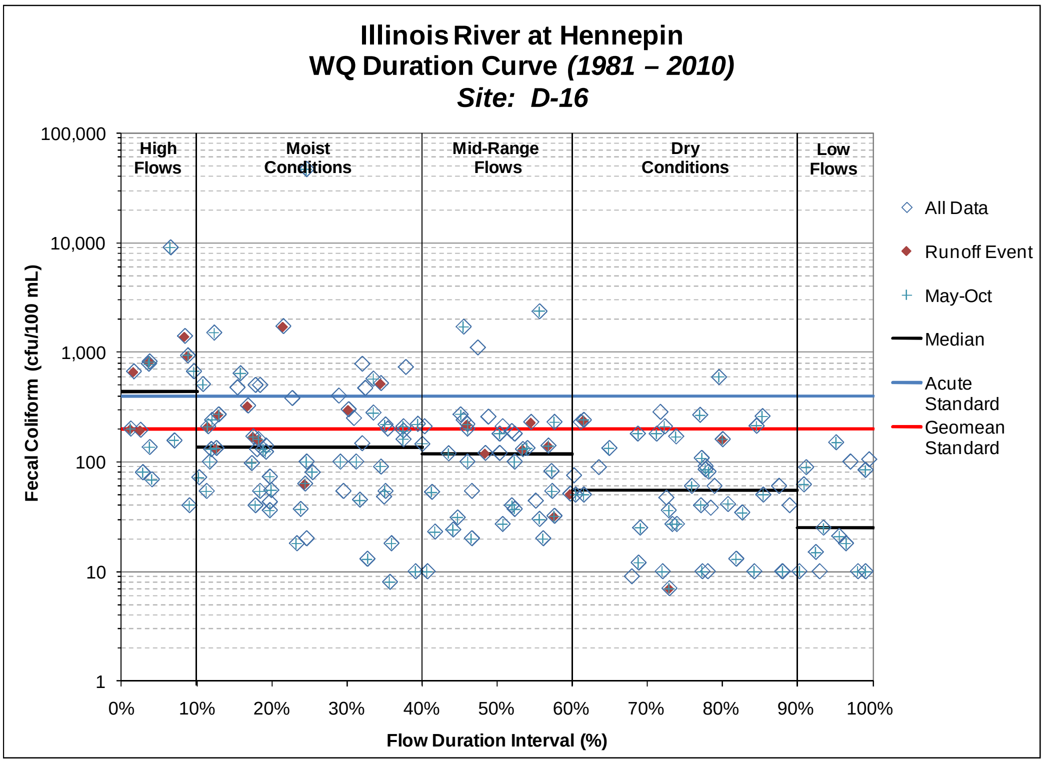

Figure 5-17. Fecal coliform water quality duration curve, Illinois River at Hennepin, 1981 – 2010.

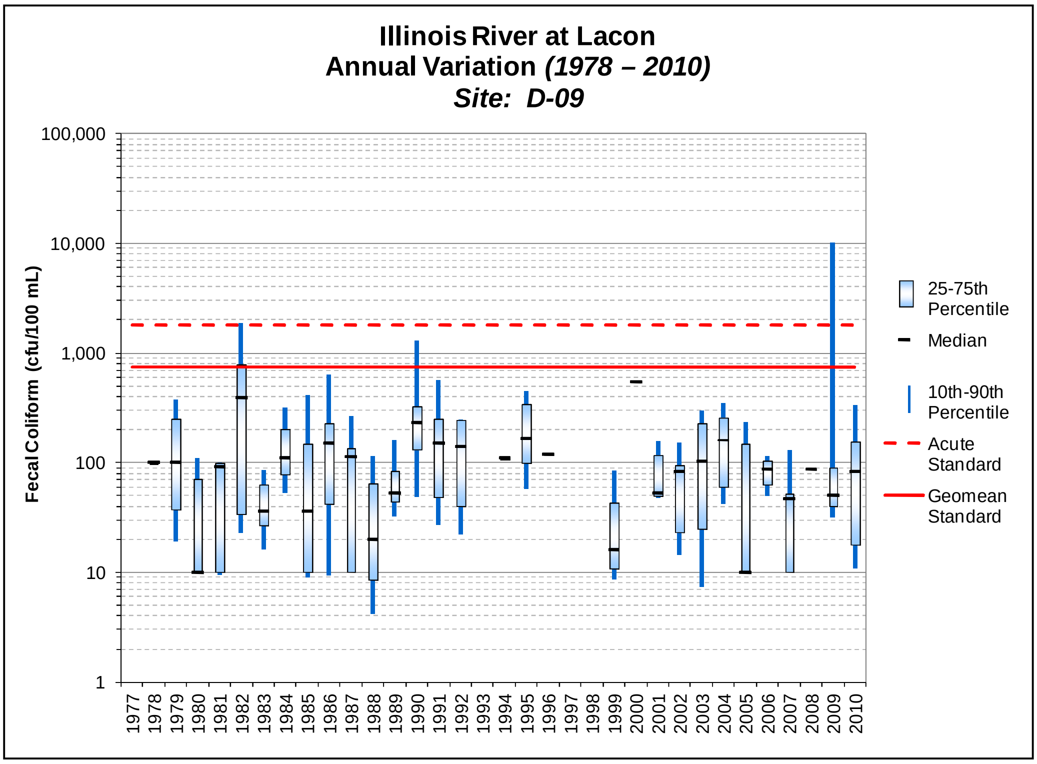

Figure 5-18. Annual fecal coliform concentrations, Illinois River at Lacon, 1977 - 2010.

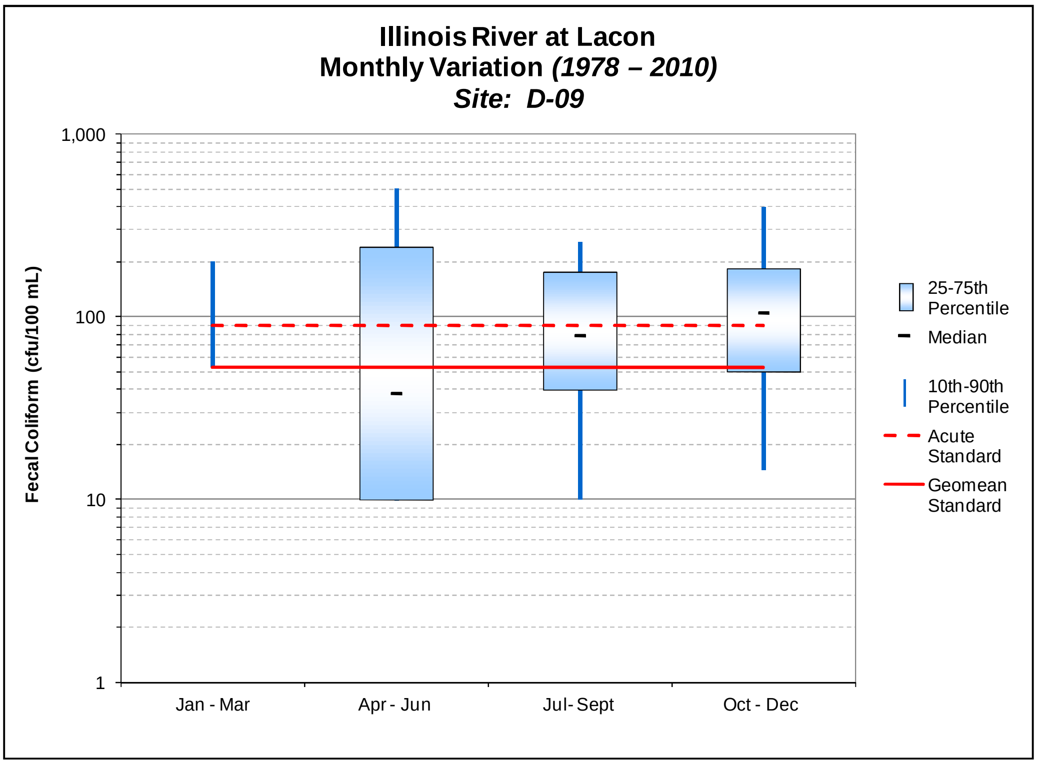

Figure 5-19. Seasonal fecal coliform data, Illinois River at Lacon, 1977 - 2010.

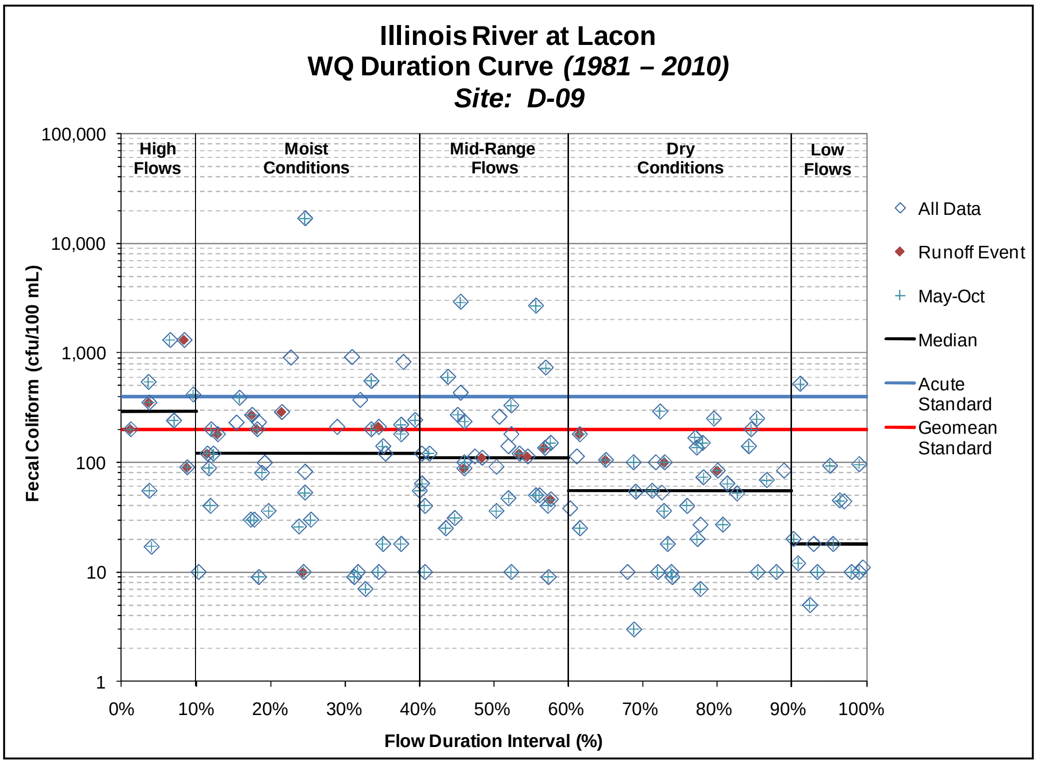

Figure 5-20. Fecal coliform water quality duration curve, Illinois River at Lacon, 1978 – 2010.

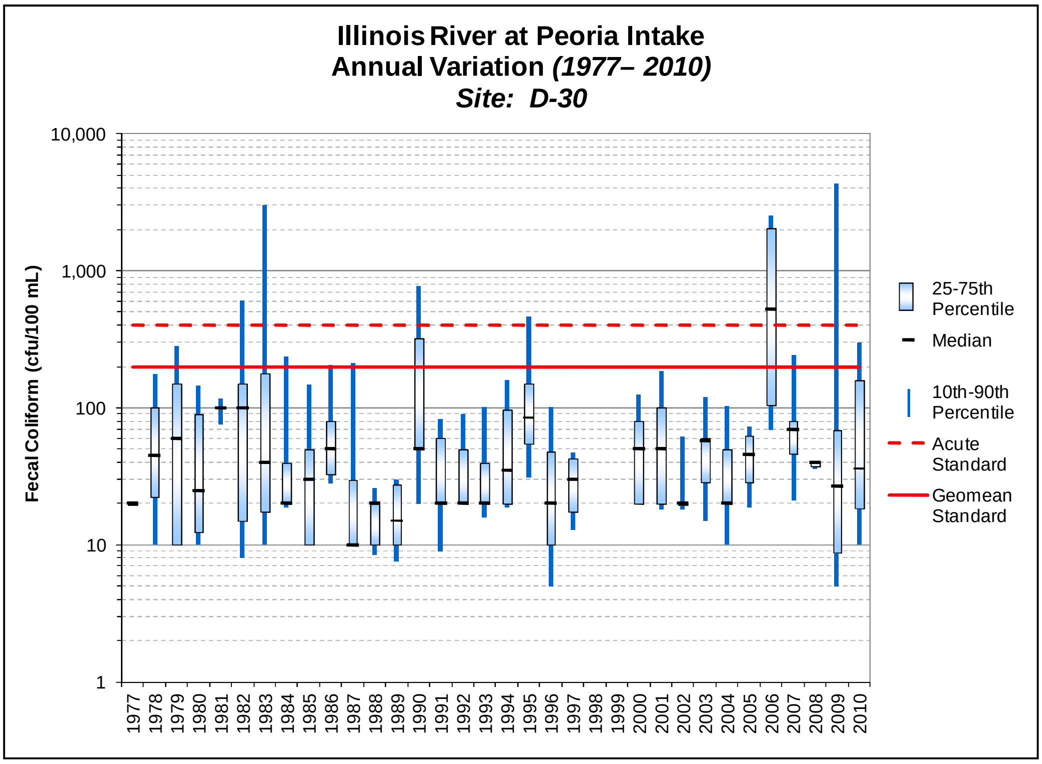

Figure 5-21. Annual fecal coliform concentrations, Illinois River at Peoria Intake, 1977 - 2010.

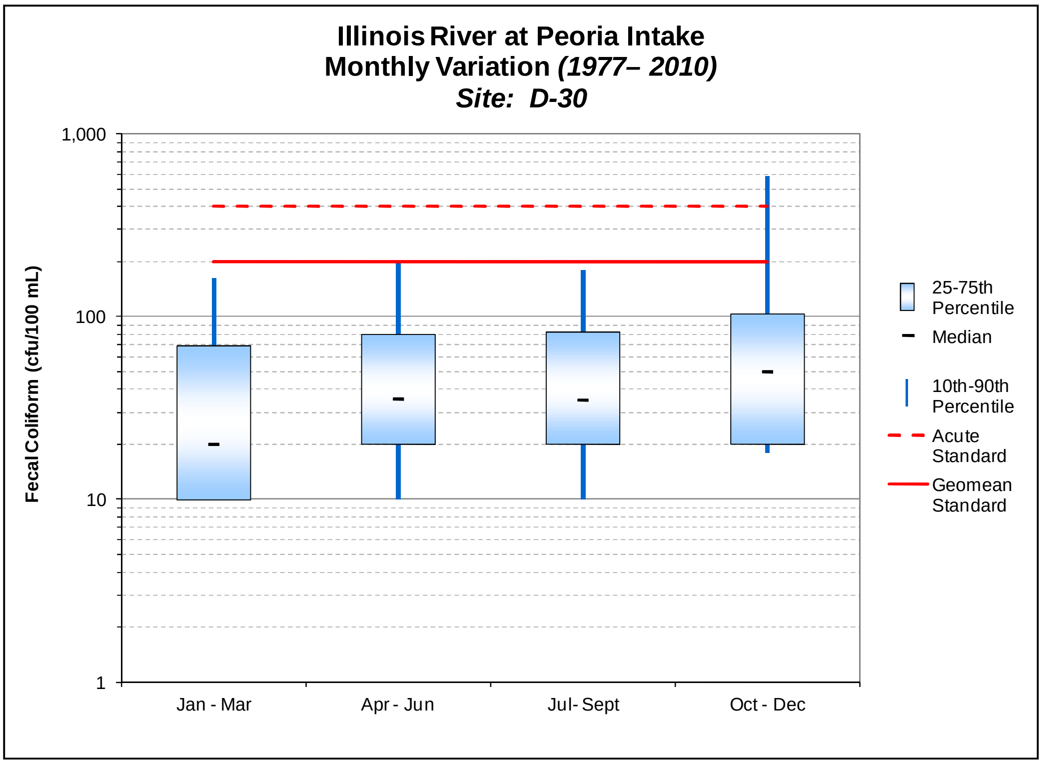

Figure 5-22. Seasonal fecal coliform data, Illinois River at Peoria Intake, 1977 – 2010.

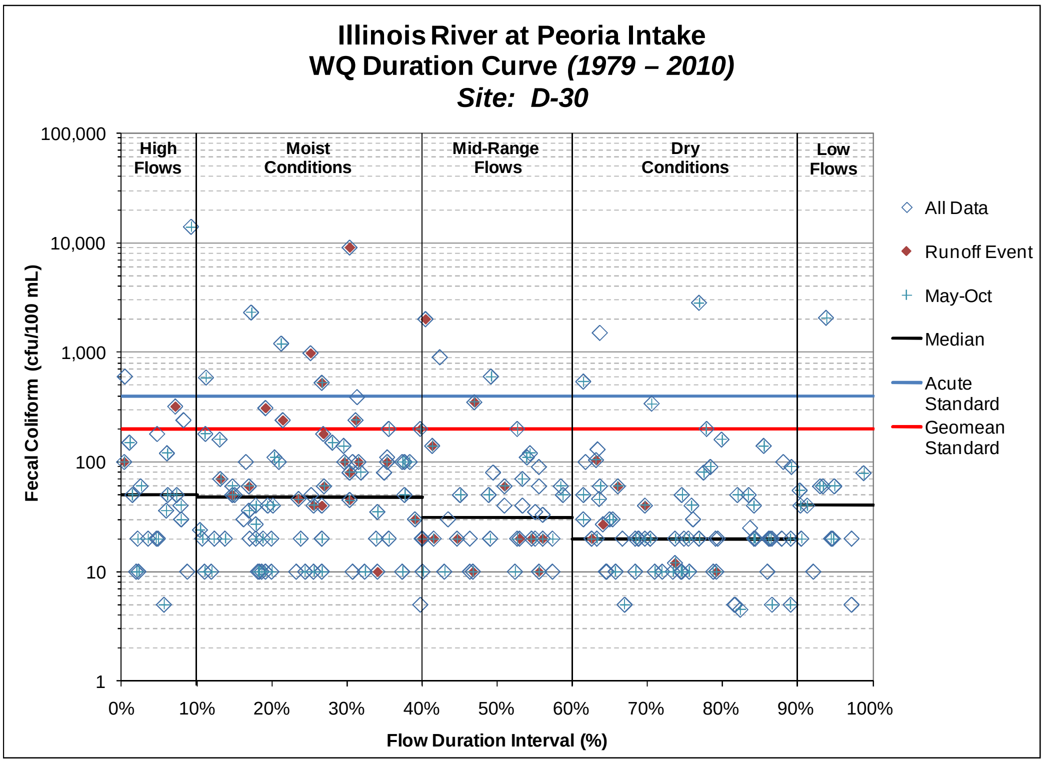

Figure 5-23. Fecal coliform water quality duration curve, Illinois River at Peoria Intake, 1979 – 2010.

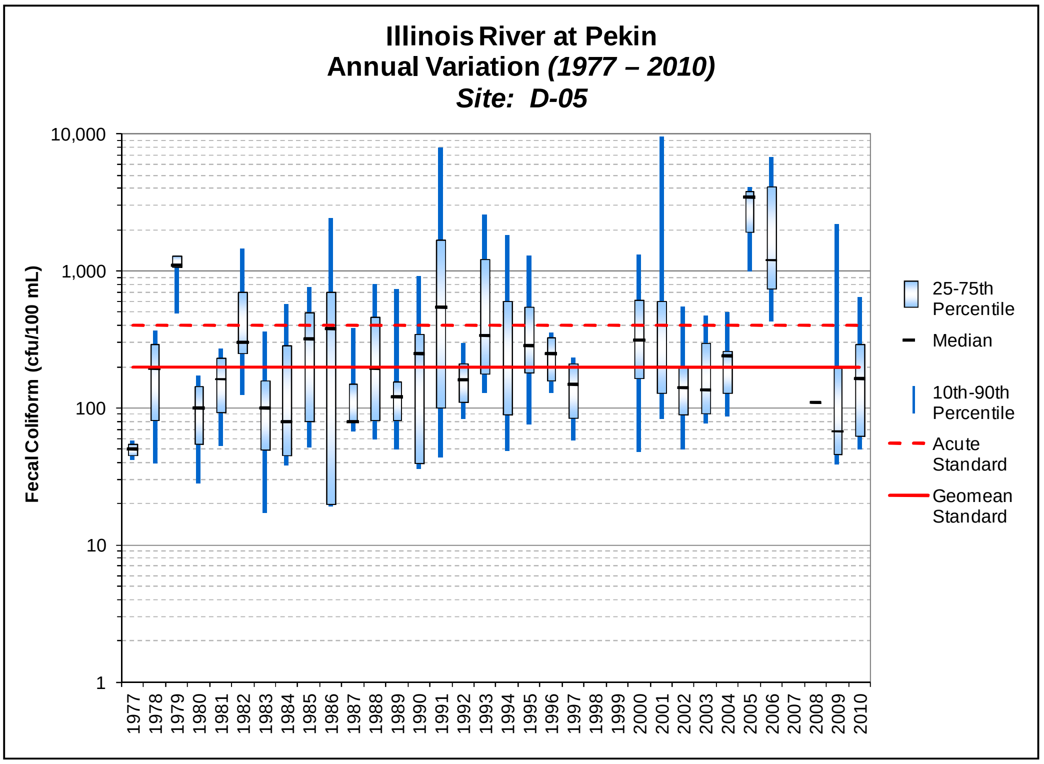

Figure 5-24. Annual fecal coliform concentrations, Illinois River at Pekin, 1977 - 2010.

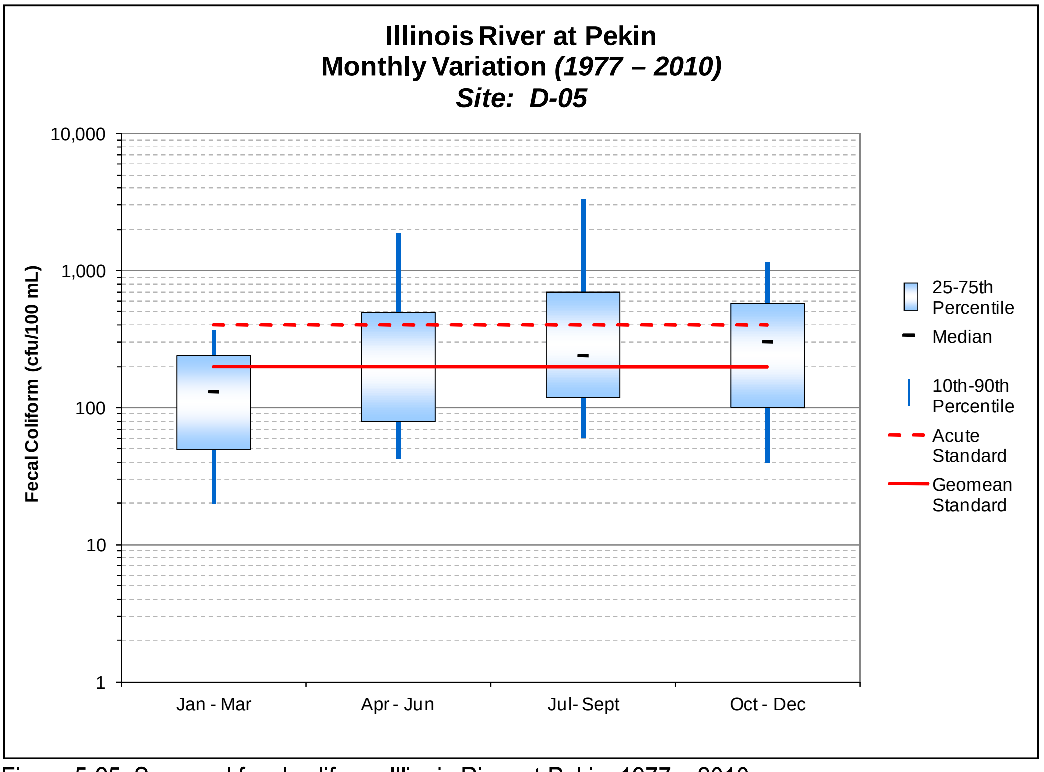

Figure 5-25. Seasonal fecal coliform, Illinois River at Pekin, 1977 – 2010.

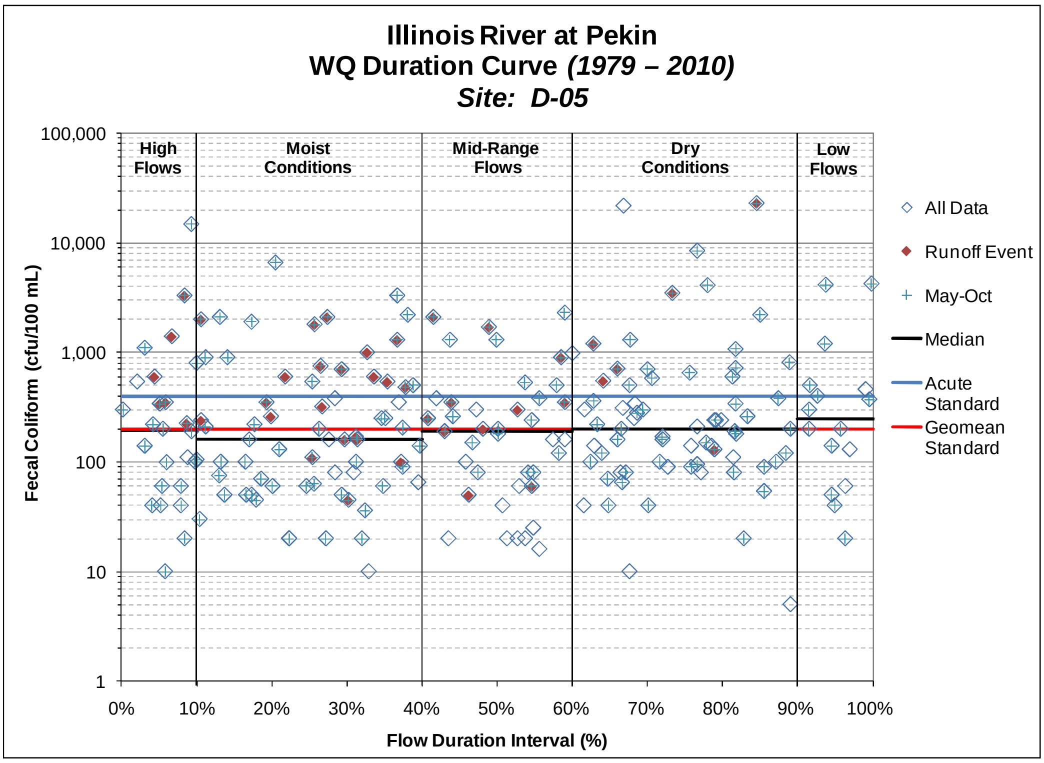

Figure 5-26. Fecal coliform water quality duration curve, Illinois River at Pekin, 1979 – 2010.

5.2.3 Phosphorus

As shown in Figure 5-27, concentrations of phosphorus are significantly higher than the target along the length of the Illinois River from Marseilles to Pekin. The fact they are so high at Marseilles indicates significant sources upstream of the project area. However, sources within the project area are large enough to keep the concentrations high. As discussed in each of the tributary sections (Sections 6 to 11), both point and nonpoint sources have been identified as a concern within several of the tributaries, and of particular concern is runoff that occurs during high flow conditions and high loads from point sources during low flow conditions. Tributary concentrations are shown in Figure 5-28. Of particular concern, median phosphorus concentrations in Big Bureau Creek, Farm Creek and Kickapoo Creek exceed the instream target concentrations with sporadic concentrations in these three tributaries reaching four to nearly eight times the target concentrations. Big Bureau Creek concentrations are likely to contribute significantly to elevated concentrations at Hennepin, while Farm Creek and Kickapoo contribute significantly to elevated concentrations Pekin.

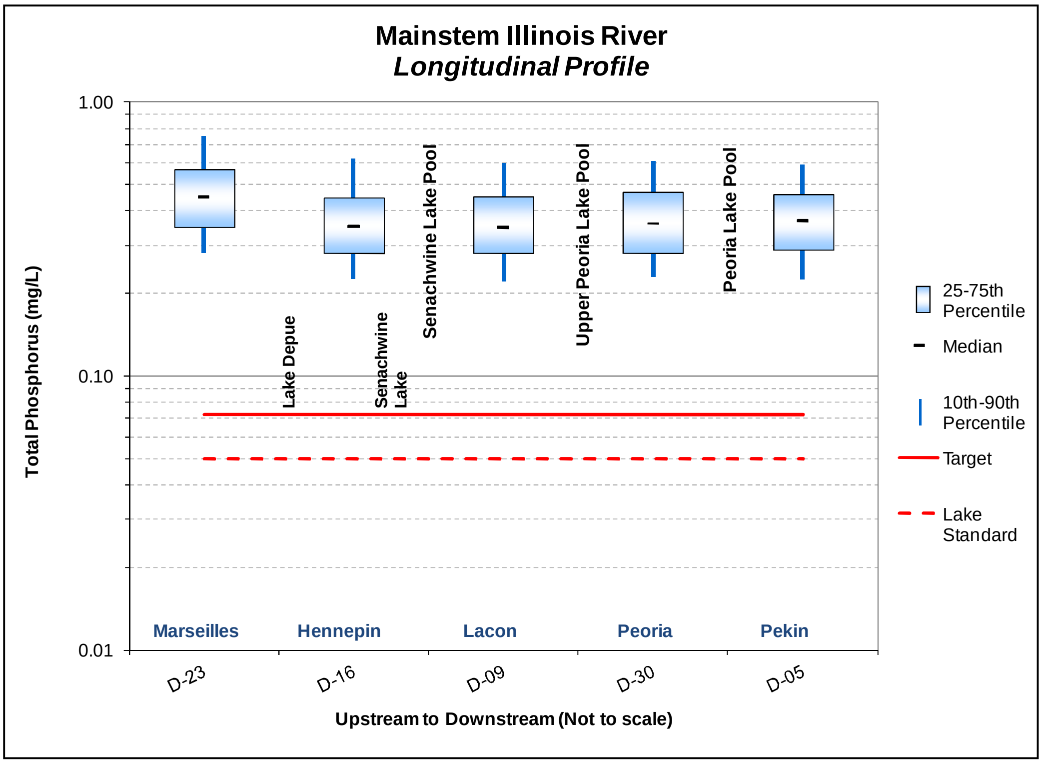

Figure 5-27. Illinois River main stem longitudinal phosphorus profile.

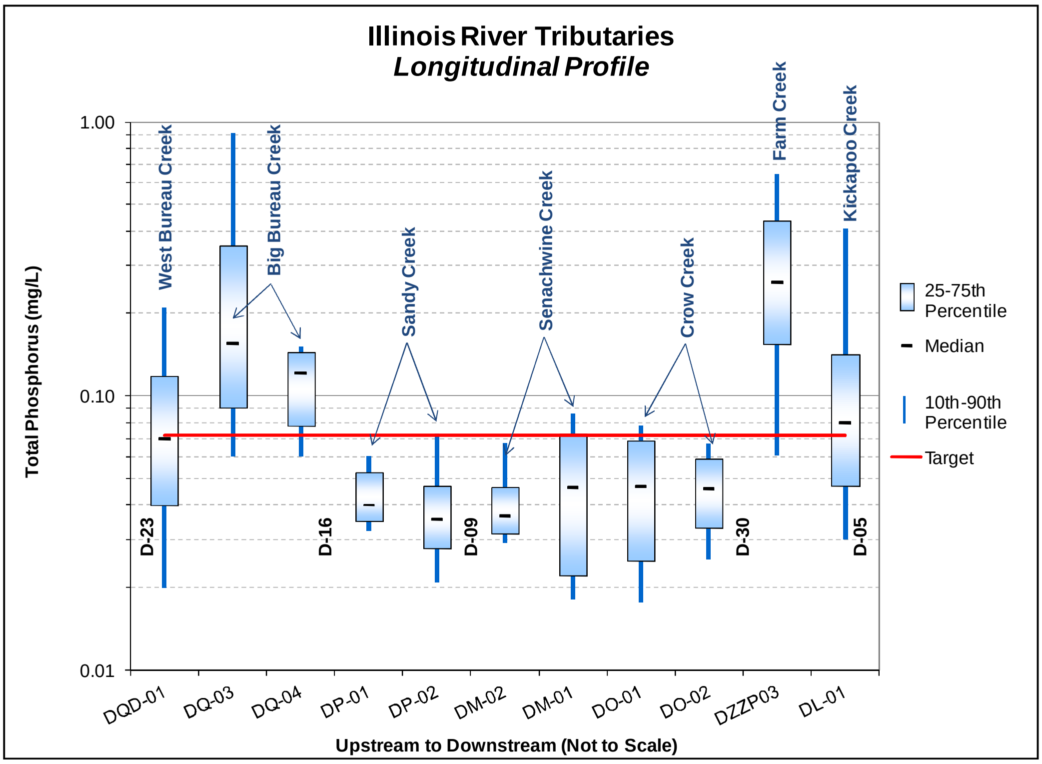

Figure 5-28. Illinois River tributary longitudinal phosphorus profile.

Illinois River at Hennepin (Site D-16)

Since monitoring began in 1984, median annual concentrations of phosphorus in Illinois River at Hennepin have consistently exceeded the target phosphorus concentration (Figure 5-29). Analysis of seasonal trends shows the potential for both point and nonpoint sources of phosphorus. Phosphorus concentrations have consistently exceeded criteria throughout the year with limited variability from season to season. The likelihood of point and nonpoint sources of pollution is confirmed by water quality duration curves (Figure 5-30) which illustrate phosphorus exceedances in all types of flow conditions, but particularly elevated concentrations are seen during low flow conditions. Point source pollution is often indicated by elevated pollutant concentrations during low flow conditions and dry seasons as instream dilution is minimal.

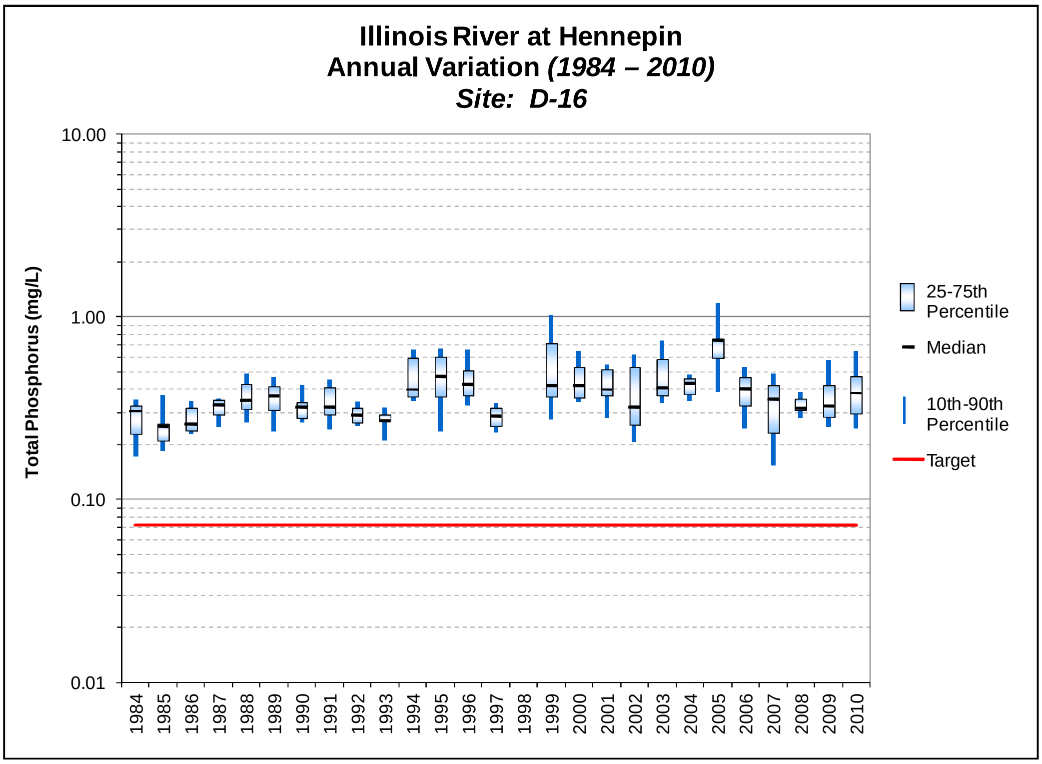

Figure 5-29. Annual phosphorus concentrations, Illinois River at Hennepin, 1984 - 2010.

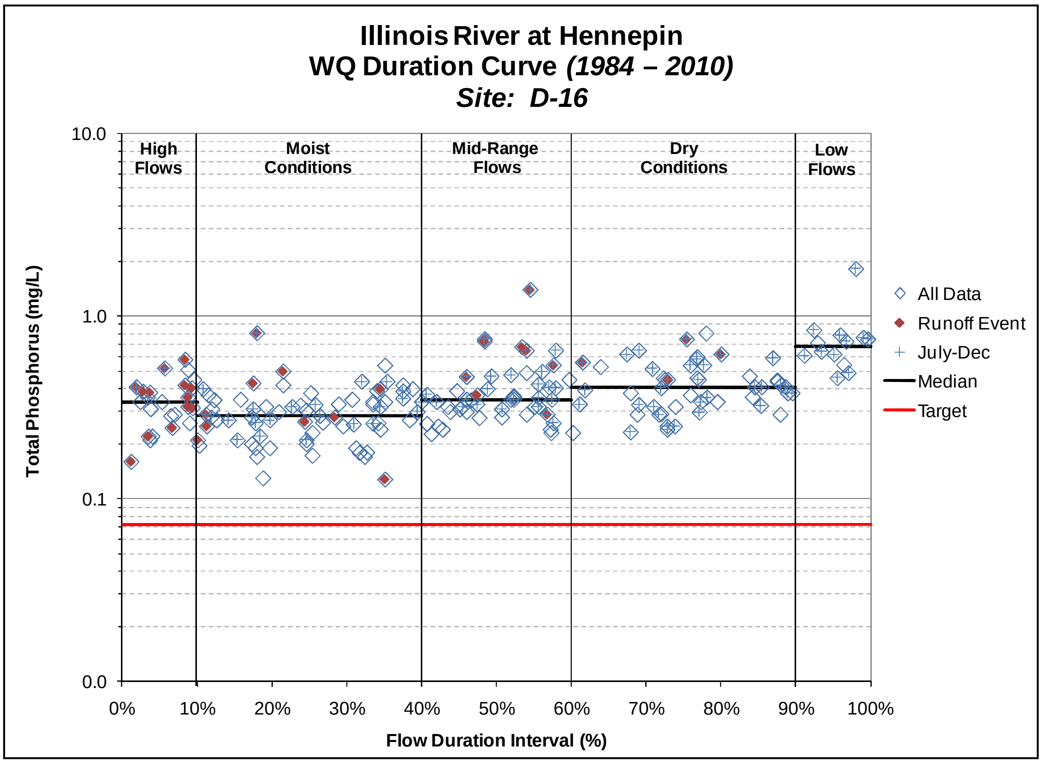

Figure 5-30. Phosphorus water quality duration curve, Illinois River at Hennepin, 1981 – 2010.

Illinois River at Peoria Intake (Site D-30)

Since monitoring began in 1969, median annual concentrations of phosphorus in Illinois River at Peoria Intake have consistently exceeded the target phosphorus concentration (Figure 5-31). Analysis of seasonal trends shows potential for point and nonpoint sources of pollution. Phosphorus concentrations have consistently exceeded criteria throughout the year with limited concentration variability from season to season. Likelihood of point and nonpoint sources of pollution is confirmed by the water quality duration curve (Figure 5-32) which shows phosphorus exceedances in all types of flow conditions.

This location is likely affected by both upstream and local point sources, as well as both watershed and tributary phosphorus loads. Additional point sources may also contribute to elevated instream concentrations.

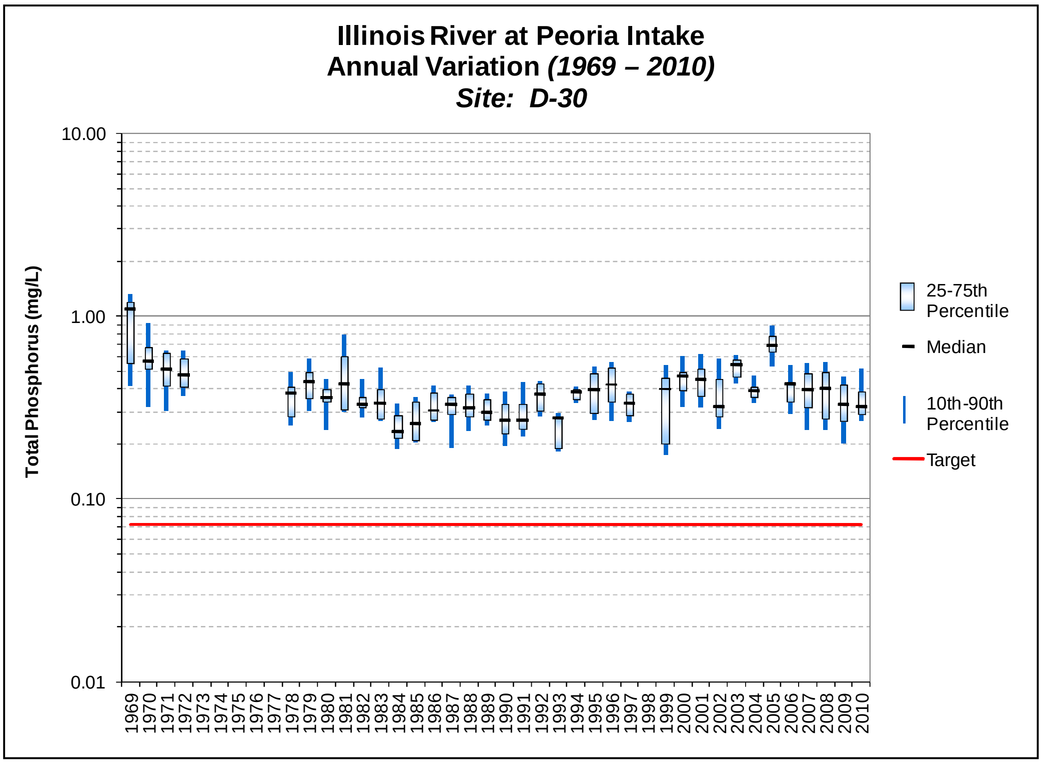

Figure 5-31. Annual phosphorus concentrations, Illinois River at Peoria Intake, 1969 - 2010.

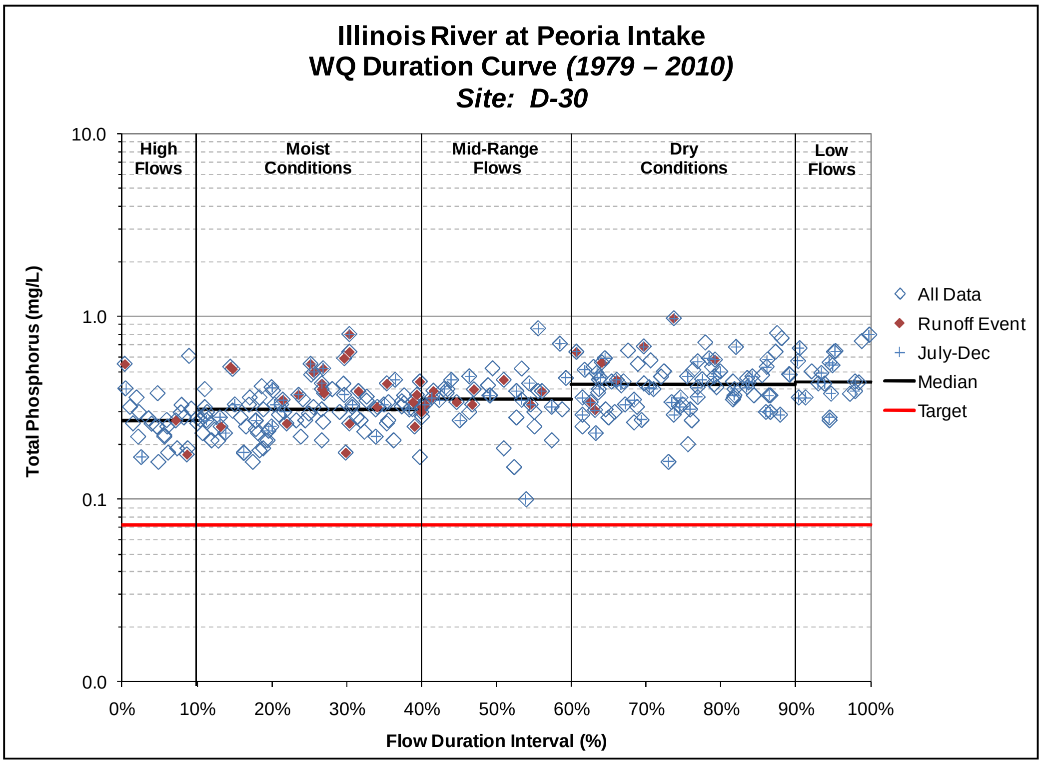

Figure 5-32. Phosphorus water quality duration curve, Illinois River at Peoria Intake, 1979 – 2010.

Illinois River at Pekin (Site D-05)

Since monitoring began in 1980, median annual concentrations of phosphorus in Illinois River at Pekin have consistently exceeded the target phosphorus concentration (Figure 5-33). The seasonal patterns and water quality duration curves are similar to the other sites, with concentrations always in excess of the target and especially high during the summer and low flows (Figure 5-34).

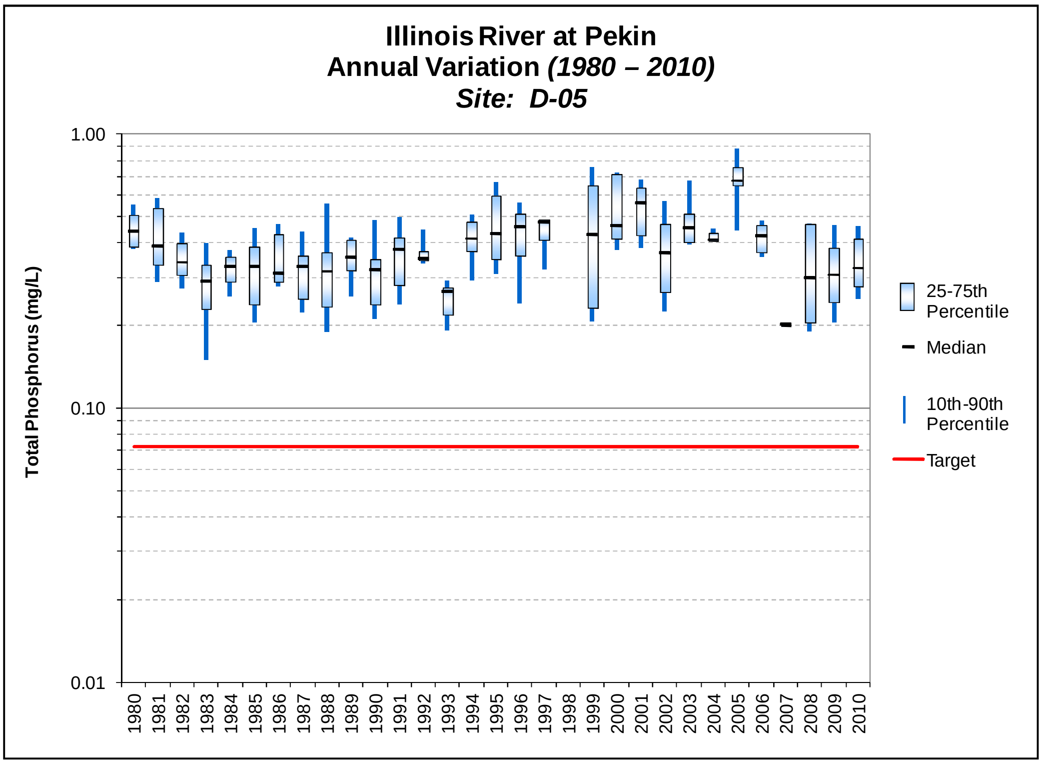

Figure 5-33. Annual phosphorus concentrations, Illinois River at Pekin, 1980 - 2010.

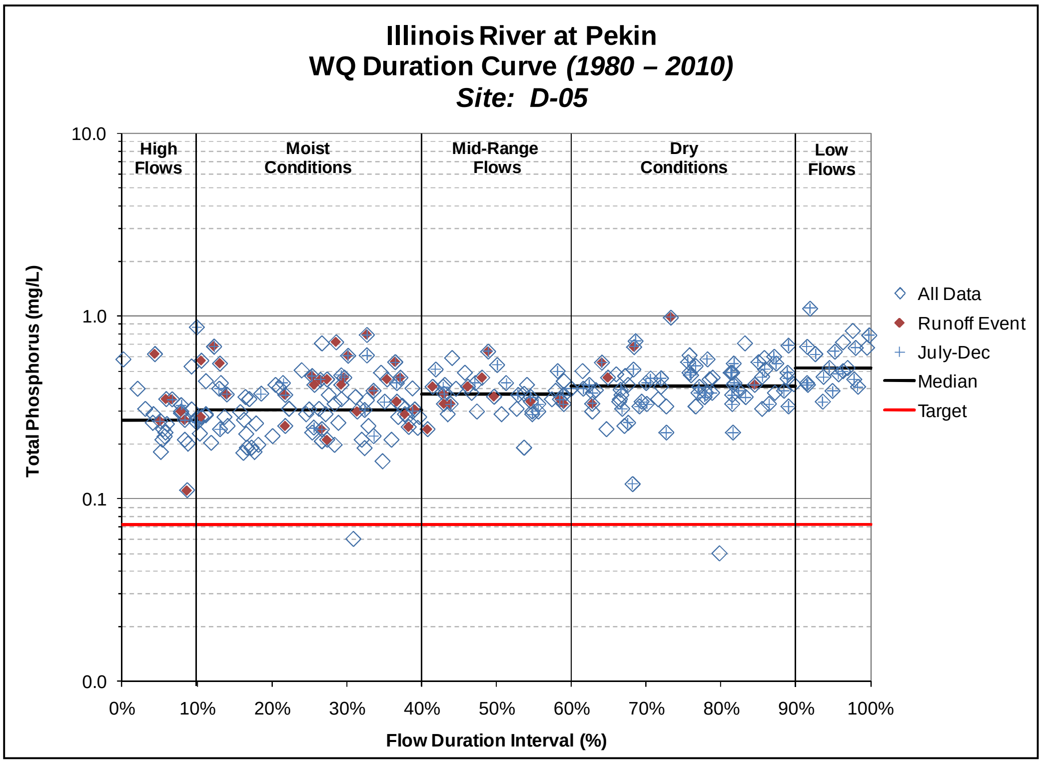

Figure 5-34. Phosphorus water quality duration curve, Illinois River at Pekin, 1980 – 2010.

5.2.4 Nitrogen

Similar to phosphorus, nitrogen is elevated along the length of the Illinois River main stem (Figure 5-35), with median concentrations well above the target concentration. The concentrations are high upstream of the project area but do not decrease significantly moving downstream, suggesting significant sources within the project area. Tributary nitrogen concentrations are presented in Figure 5-36; each tributary has median concentrations in exceedance of the instream target. Interestingly, the furthest upstream location in Sandy Creek as well as the furthest downstream location in Crow Creek does not exceed target concentrations. Despite this, nitrogen loads from the tributaries are significant and it is likely that the Illinois River is unable to recover due to the continuous loading.

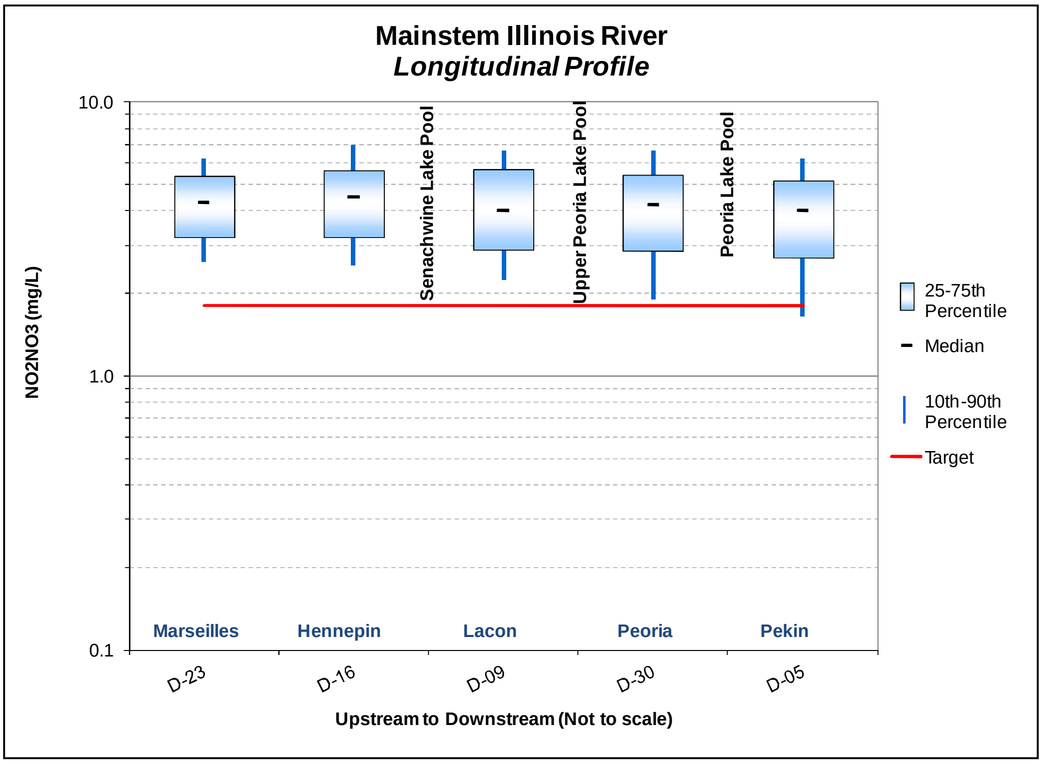

Figure 5-35. Illinois River main stem longitudinal nitrogen profile.

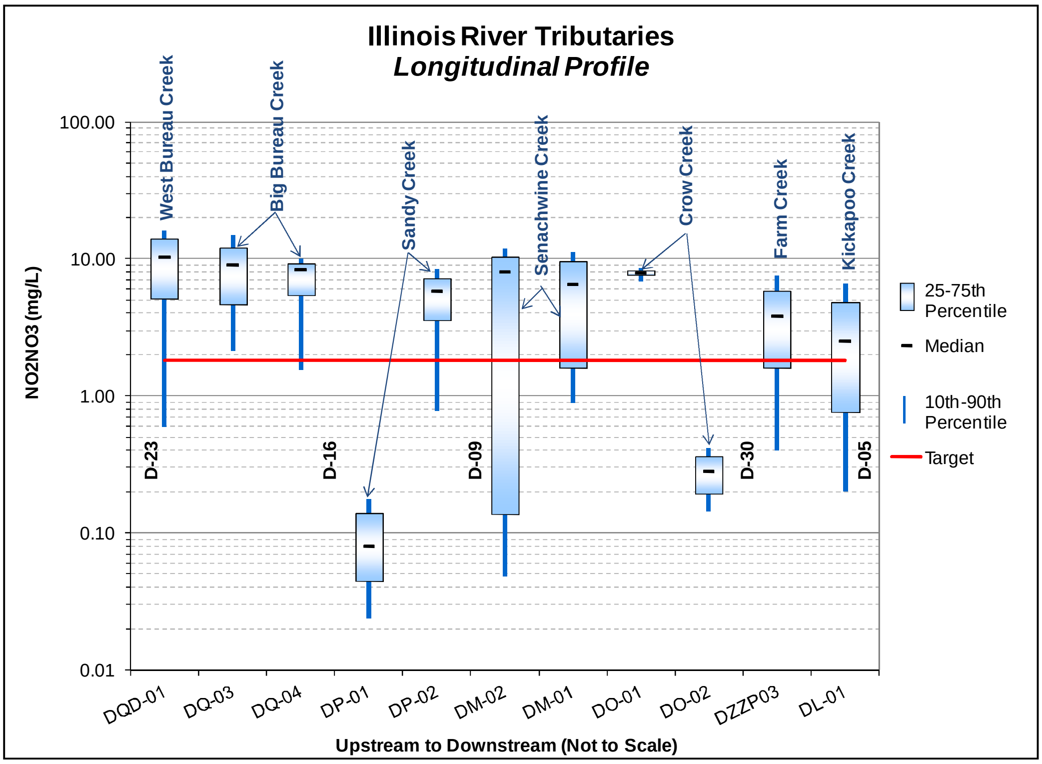

Figure 5-36. Illinois River tributary longitudinal nitrogen profile.

Additional presentations of the nitrogen data for the sites at Hennepin, Peoria Intake, and Pekin are shown in Figure 5-37 to Figure 5-42. The following observations are apparent from these figures:

- Median annual concentrations of nitrogen in at all three sites have consistently exceeded the criteria.
- Analysis of seasonal trends shows that nitrogen concentrations are typically highest during the winter and spring (January to June). This coincides with periods when agricultural fields are fertilized with either manure or chemical fertilizers. During this time, winter snow melt or spring rains also wash nitrogen from the fields and into tributaries and the Illinois River.
- Analysis of water quality duration curves, such as shown in Figure 5-38, indicates that nitrogen concentrations are typically highest during moist and high flow conditions. This is consistent with a large nonpoint source which is washed into waterways during precipitation events. Note, however, that targets are also always exceeded during low flow periods which suggest the presence of significant point sources, as well.

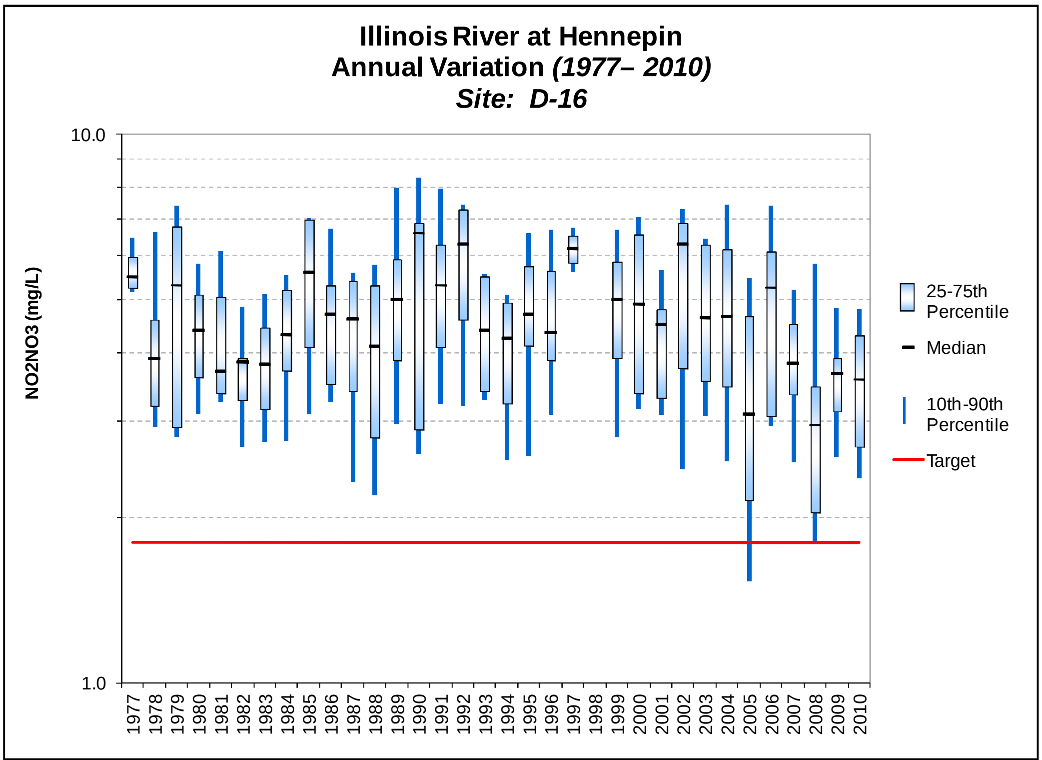

Figure 5-37. Annual nitrogen concentrations, Illinois River at Hennepin, 1977 - 2010.

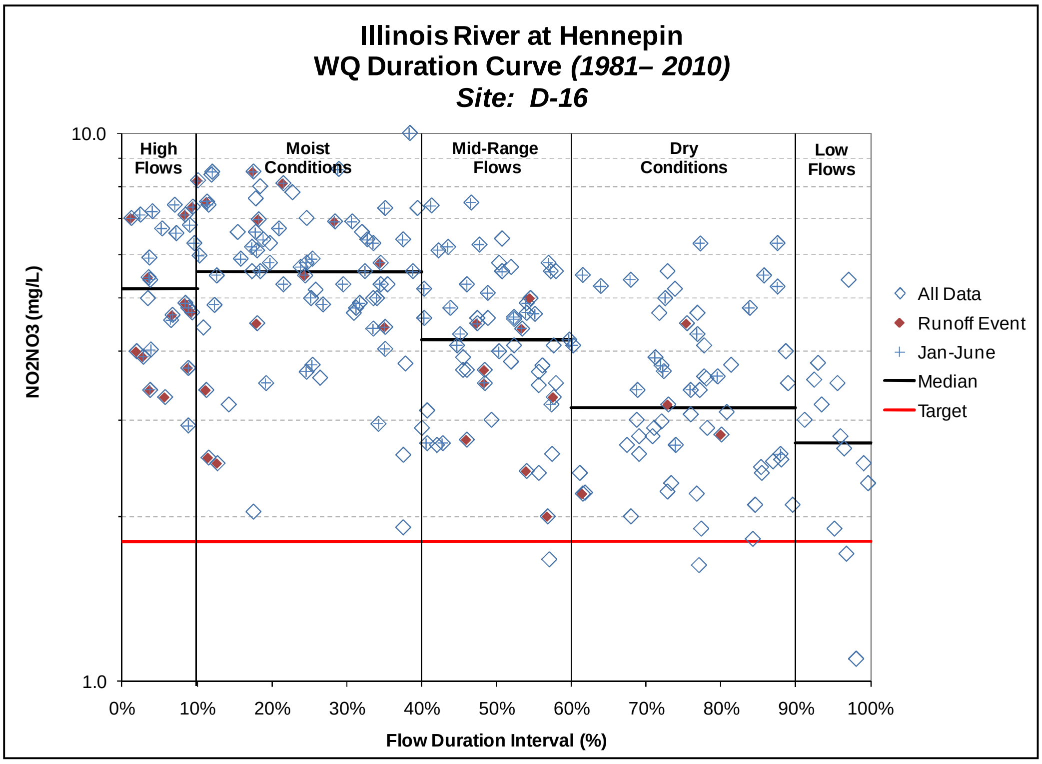

Figure 5-38. Nitrogen water quality duration curve, Illinois River at Hennepin, 1981 – 2010.

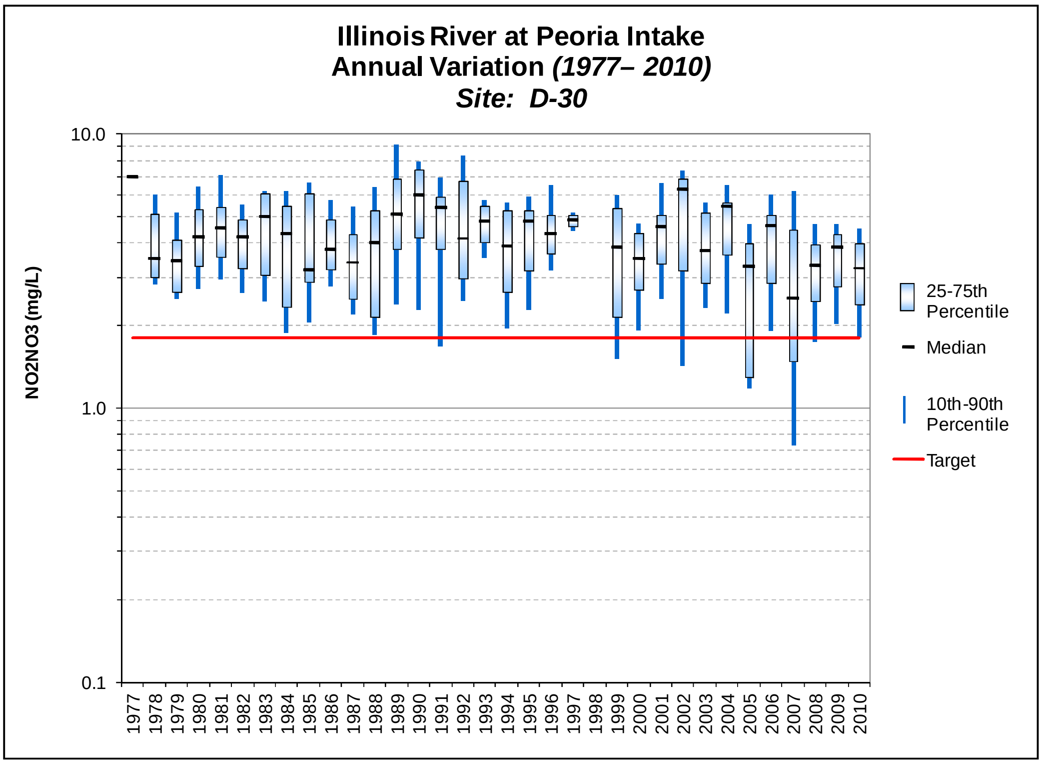

Figure 5-39. Annual nitrogen concentrations, Illinois River at Peoria Intake, 1977 - 2010.

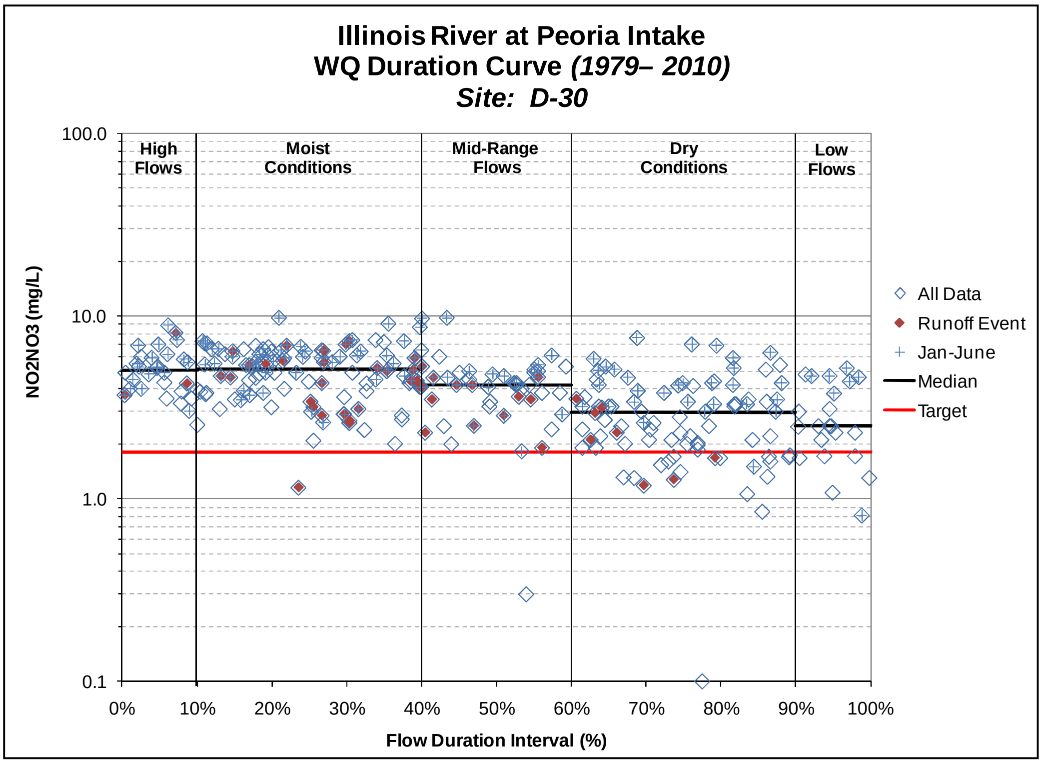

Figure 5-40. Nitrogen water quality duration curve, Illinois River at Peoria Intake, 1979 – 2010.

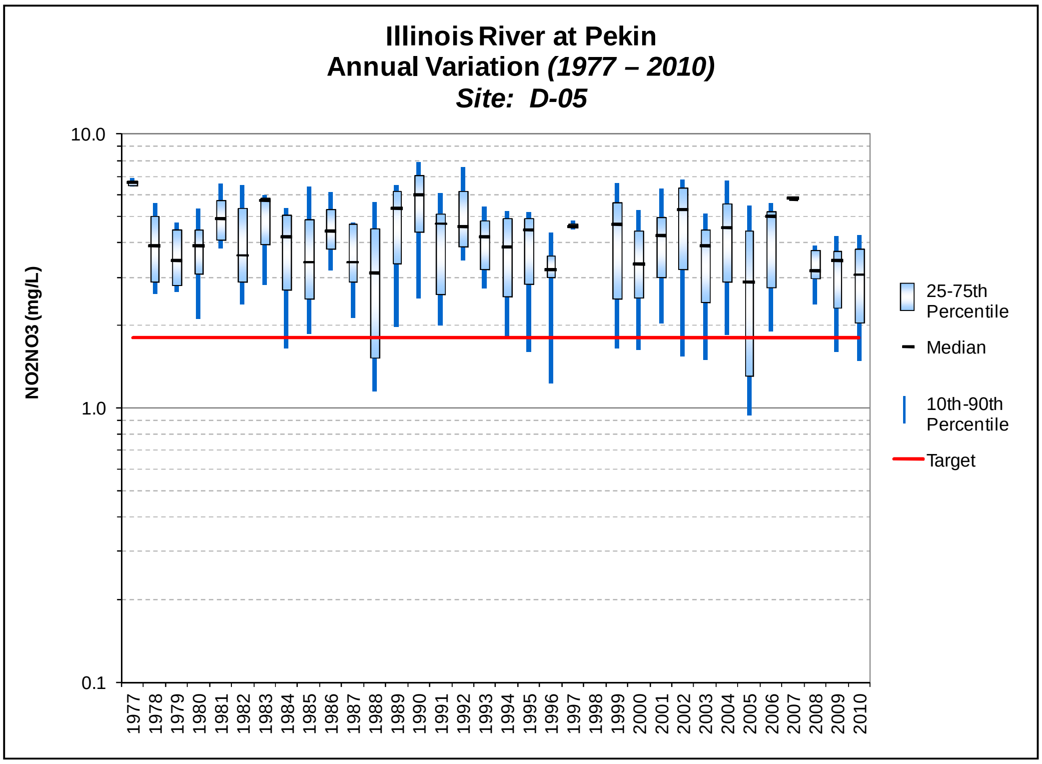

Figure 5-41. Annual nitrogen concentrations, Illinois River at Pekin, 1977 - 2010.

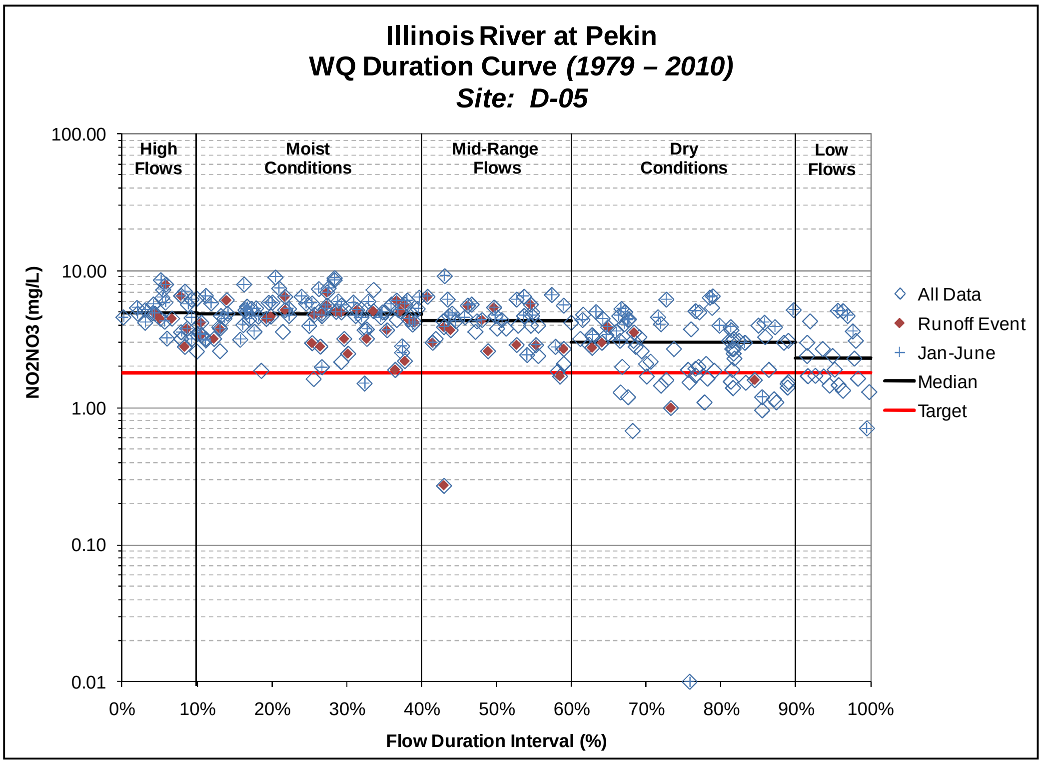

Figure 5-42. Nitrogen water quality duration curve, Illinois River at Pekin, 1979 – 2010.

5.2.5 Manganese (Site D-30)

Since monitoring began in 1999, median annual concentrations of manganese in Illinois River at Hennepin have not exceeded the target manganese concentration (Figure 5-43). However, a few samples have exceeded the target and resulted in the need for a TMDL. Analysis of seasonal trends shows slightly elevated manganese concentrations from April through September, similar to typically seasonal TSS trends, and the water quality duration curve (Figure 5-44) indicates these occur during low flow periods. Manganese exceedances during low flow conditions indicate that groundwater and natural soil conditions are likely sources. Manganese is naturally occurring in the watershed's glacial soils which are transported to waterbodies during runoff events.

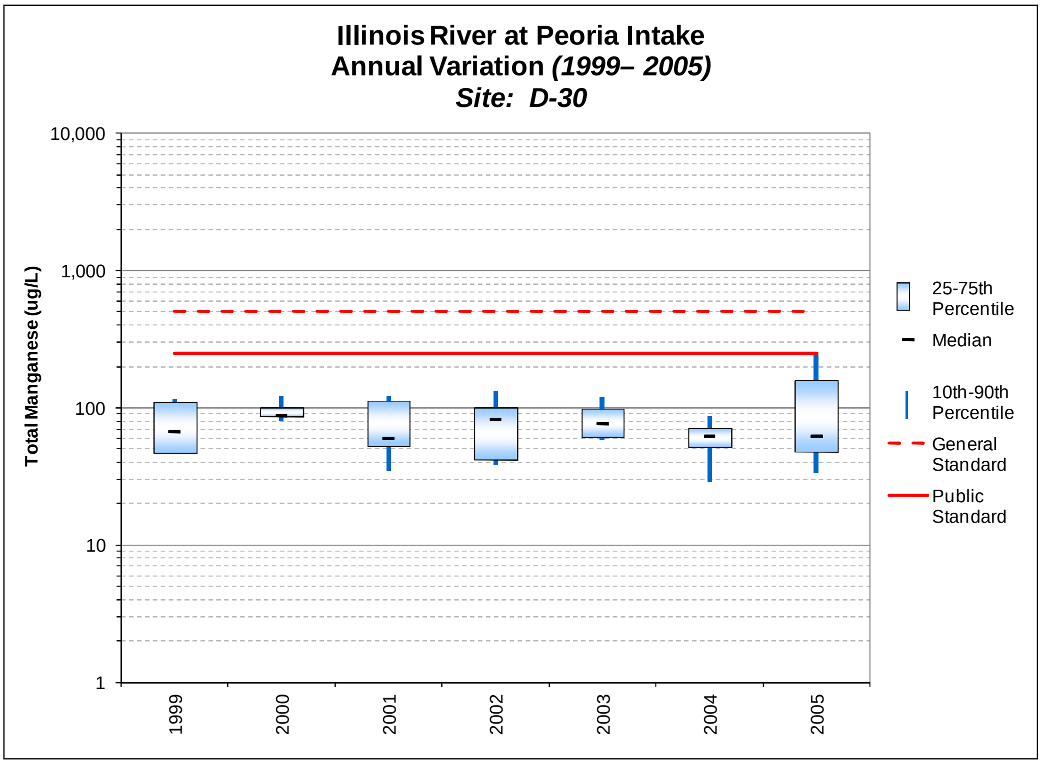

Figure 5-43. Annual manganese concentrations, Illinois River at Peoria Intake, 1999 - 2005.

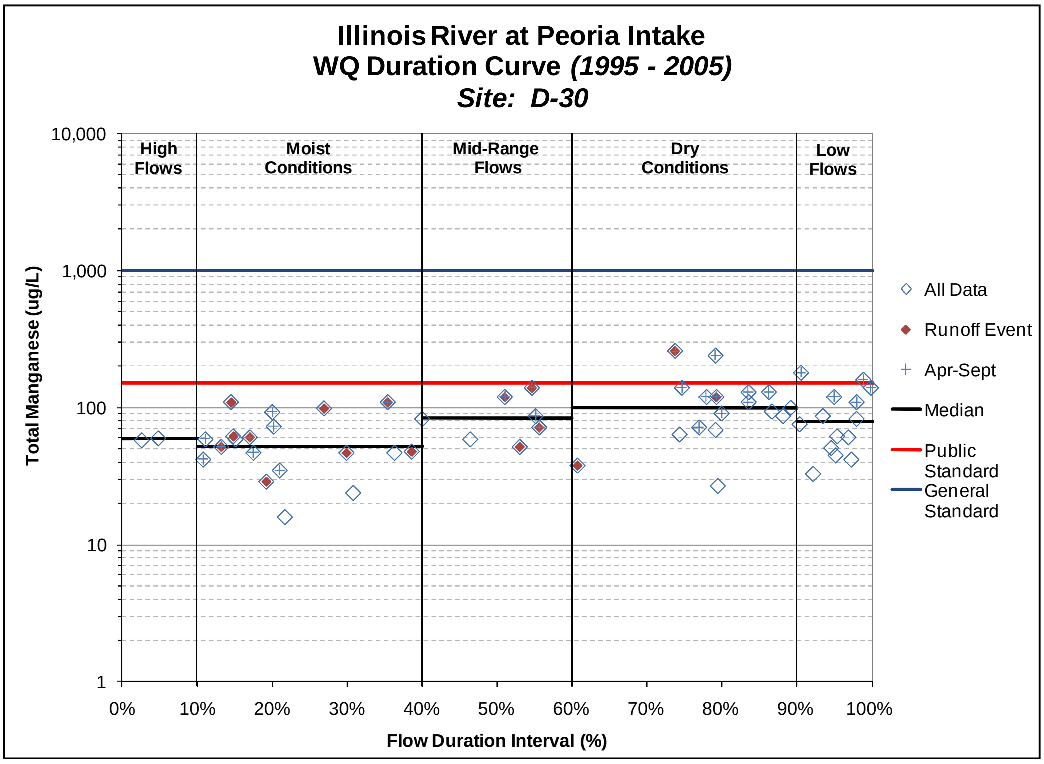

Figure 5-44. Manganese water quality duration curve, Illinois River at Peoria Intake, 1999 – 2005.

5.2.6 Total Dissolved Solids (Site D-30)

Since monitoring began in 2006, median annual concentrations of total dissolved solids at the Illinois River at Hennepin site have not exceeded the target total dissolved solids concentration (Figure 5-45). However, a few samples have exceeded the target and resulted in the need for a TMDL. Analysis of seasonal trends shows that total dissolved solids levels do not vary much throughout the year. Total dissolved solids exceedances during mid-range and dry flow conditions indicate that stormwater and wastewater are likely sources.

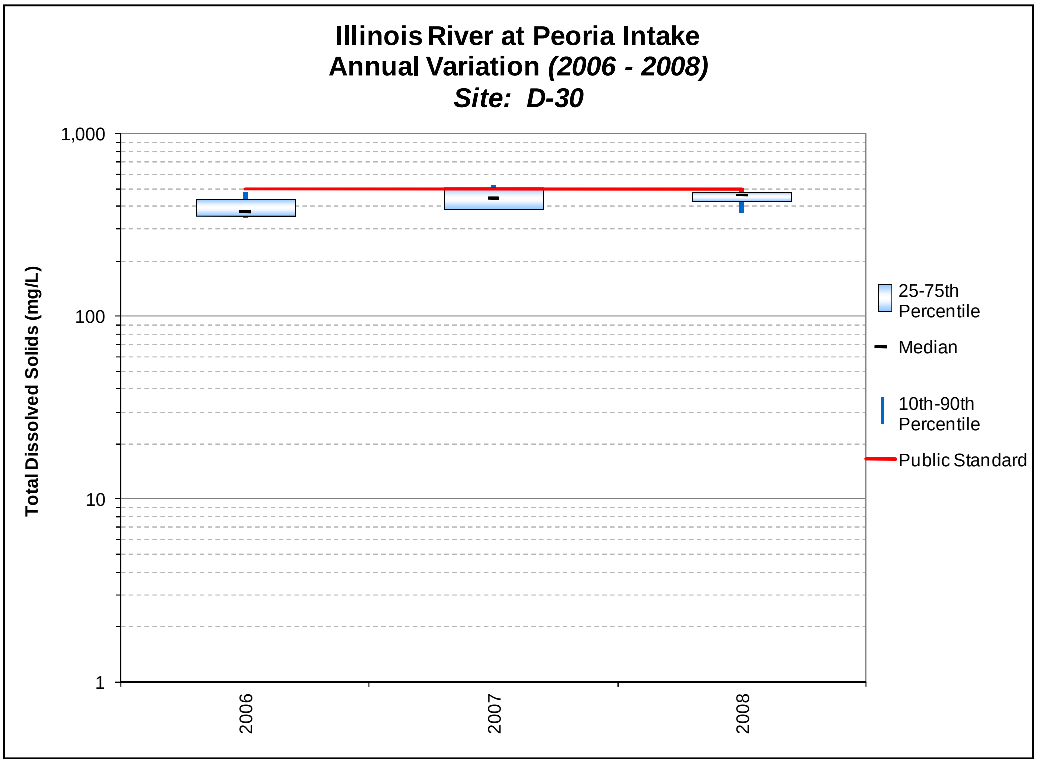

Figure 5-45. Annual total dissolved solids concentrations, Illinois River at Peoria Intake, 2006 - 2008.

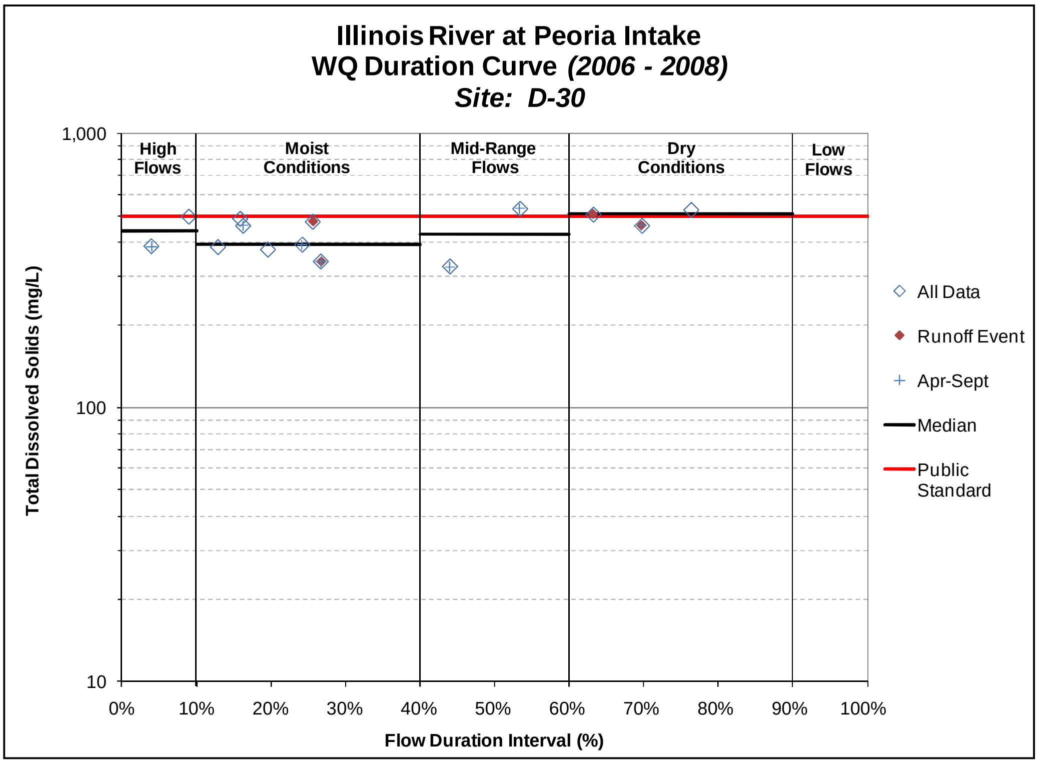

Figure 5-46. Total dissolved solids water quality duration curve, Illinois River at Peoria Intake, 2006 - 2008.

5.3 Illinois River at Hennepin TMDL and LRS (Site D-16)

Table 5-5 summarizes the Illinois River at Hennepin watershed and pollutant sources. The Illinois River at Hennepin watershed includes one bacteria impaired segment. Figure 5-47 presents the fecal coliform load duration curve and Table 5-6 presents the TMDL for the Illinois River at Hennepin assessment site. LRSs are presented in Sections 5.3.2 and 5.3.3 for TSS and nutrients, respectively.

Table 5-5. Illinois River at Hennepin summary table.

Upstream Characteristics [a]	
Drainage Area	12,756 square miles
Peoria D-16 Watershed Area	178 square miles
Sampling Station	D-16
Listed Segments	D-16
Land Use	cultivated crops (67 percent); deciduous forests (nine percent); developed land including low, medium, and high intensity (eight percent); developed open space (five percent); wetlands (three percent); pasture/hay (two percent); grasslands/herbaceous (one percent); other (five percent). [b]
Soil Type	64% B, 26% B/D, 4% C, 3% No Data, 1% A, <1% C/D, <1% D, <1% A/D
Erodible Soils	14% Highly Erodible, 0% Not Highly Erodible, 86% Not Assessed
Animal Unit Density	5,900 [b]
Key Sources	agricultural and urban runoff; NPDES facilities; CSOs/SSOs; watershed, streambank and gully erosion, bluff erosion; hydromodification; tributary loads; animal agriculture; livestock[b]
NPDES Facilities	Princeton, City of STP (IL0020575)
	Ladd STP (IL0021491)
	Granville STP (IL0022331)
	Depue STP (IL0023523)
	Malden STP (IL0024791)
	Tiskilwa STP (IL0025160)
	Hennepin Pwd STP (IL0025313)
	Lasalle WWTP (IL0029424)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Bureau Junction STP (IL0033120)
	Lake Arispie Water Co STP (IL0042625)
	Prairie View Nursing Home STP (IL0067024)
	Peru STP #2 (IL0075507)
	Maple Acres MHP (ILG551015)
	Cedar Point STP (ILG580008)
	Lamoille, Village Of STP (ILG580127)
	Dalzell STP (ILG580130)
	Ohio, Village Of STP (ILG580190)
	Wyanet STP (ILG580245)
NPDES Facility Disinfection Exemption [c]	12 of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [d]	Six facilities have exceedances averaging 409 to 1,269 cfu/100mL
MS4 Communities	None
CSO/SSO Communities	Granville STP (IL0022331)
	LaSalle WWTP (IL0029424)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
CSO/SSO Overflows	There have been 1,450 reported CSOs between 2007 and 2010. The LaSalle WWTP SSO has discharged 21 out of 36 months between 2008 and 2010.

a. Does not include information for area upstream of the Middle Illinois River watershed.
b. Does not include tributary watershed clusters
c. See Table 5-3 for exemption and permit specifics.
d. See Appendix A for DMR Exceedance Summary Table (2005-2010)

5.3.1 Bacteria TMDL

Figure 5-47 presents the load duration curve and TMDL for fecal coliform at the Illinois River at Hennepin assessment site. Table 5-6 summarizes the TMDL and required reductions. Reductions in bacteria are only needed during high and moist flow conditions. The data suggest that there is a lack of significant point sources between Marseilles and Peoria; therefore control of runoff from urban and agricultural land uses in combination with reductions in bacteria loading from tributary watersheds is needed to achieve the reductions necessary. Six of the 24 facilities have in the past exceeded their permit limits or the instantaneous 400 cfu/100 mL standard.

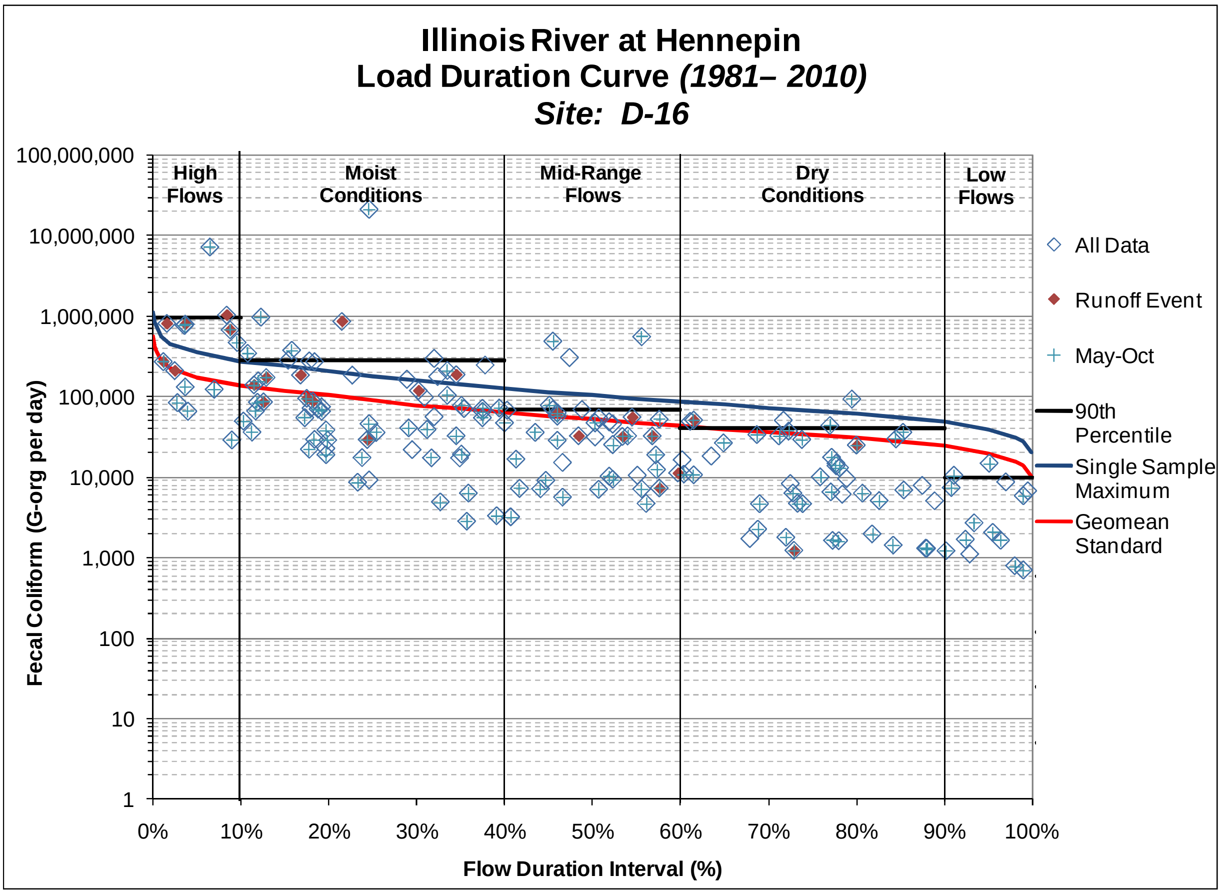

Figure 5-47. Fecal coliform load duration curve, Illinois River at Hennepin (D-16).

Table 5-6. Fecal coliform TMDL, Illinois River at Hennepin (D-16).

Station D 16 TMDL[c]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Fecal Coliform (G-org/day)	Current Load	962,391	280,586	68,673	40,824	9,884
	LA[a]	297,221	161,328	93,529	60,352	35,138
	WLA: NPDES Facilities	409	409	195	195	195
	WLA: CSOs [d]	17,342	0	0	0	0
	Total WLA[b]	17,751	409	195	195	195
	MOS (10%)	34,997	17,971	10,414	6,728	3,926
	TMDL=LA+WLA+MOS	349,969	179,708	104,138	67,275	39,259
	TMDL Reduction %[e]	63.64%	35.95%	0%	0%	0%

a. Note that the Load Allocation includes all upstream area
b. Note that the WLA is based on point sources in the Middle Illinois River watershed
c. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime
d. Note that CSOs are only allowed to discharge at this level 4 times per year.
e. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

5.3.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 5-7 for the Illinois River at Hennepin using the volume weighted target for TSS presented in Section 3. No sediment reductions are needed to meet the sediment target.

Table 5-7. TSS LRS, Illinois River at Hennepin.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Illinois River at Hennepin	D-16	58	59.3	0%

5.3.3 Nutrient LRS

Figure 5-48 and Figure 5-49 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Illinois River at Hennepin assessment site. Table 5-8 and Table 5-9 summarize the LRS and required reductions. Reduction of nutrients loadings from the tributary watersheds, specifically Big Bureau, should be a primary implementation focus, in addition to controlling point sources, CSOs/SSOs, and urban and agricultural runoff. In addition, upstream loadings coming from outside of the watershed should be further evaluated to determine their potential impact.

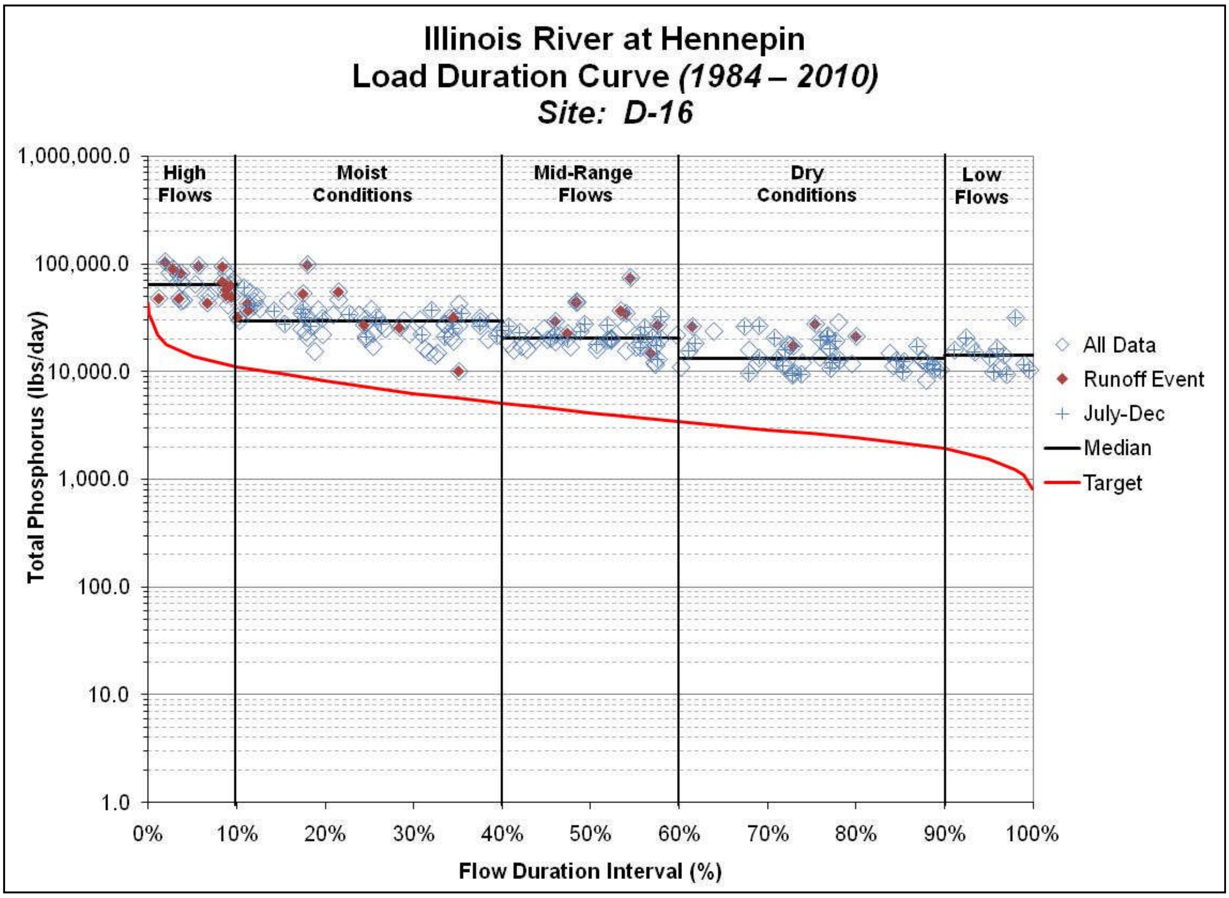

Figure 5-48. Total phosphorus load duration curve, Illinois River at Hennepin (D-16).

Table 5-8. Total phosphorus LRS, Illinois River at Hennepin (D-16).

Station D 16 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	63,809	29,571	20,214	13,096	14,127
	LRS Target	13,890	7,132	4,133	2,670	1,558
	LRS Reduction %	78.23%	75.88%	79.55%	79.61%	88.97%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

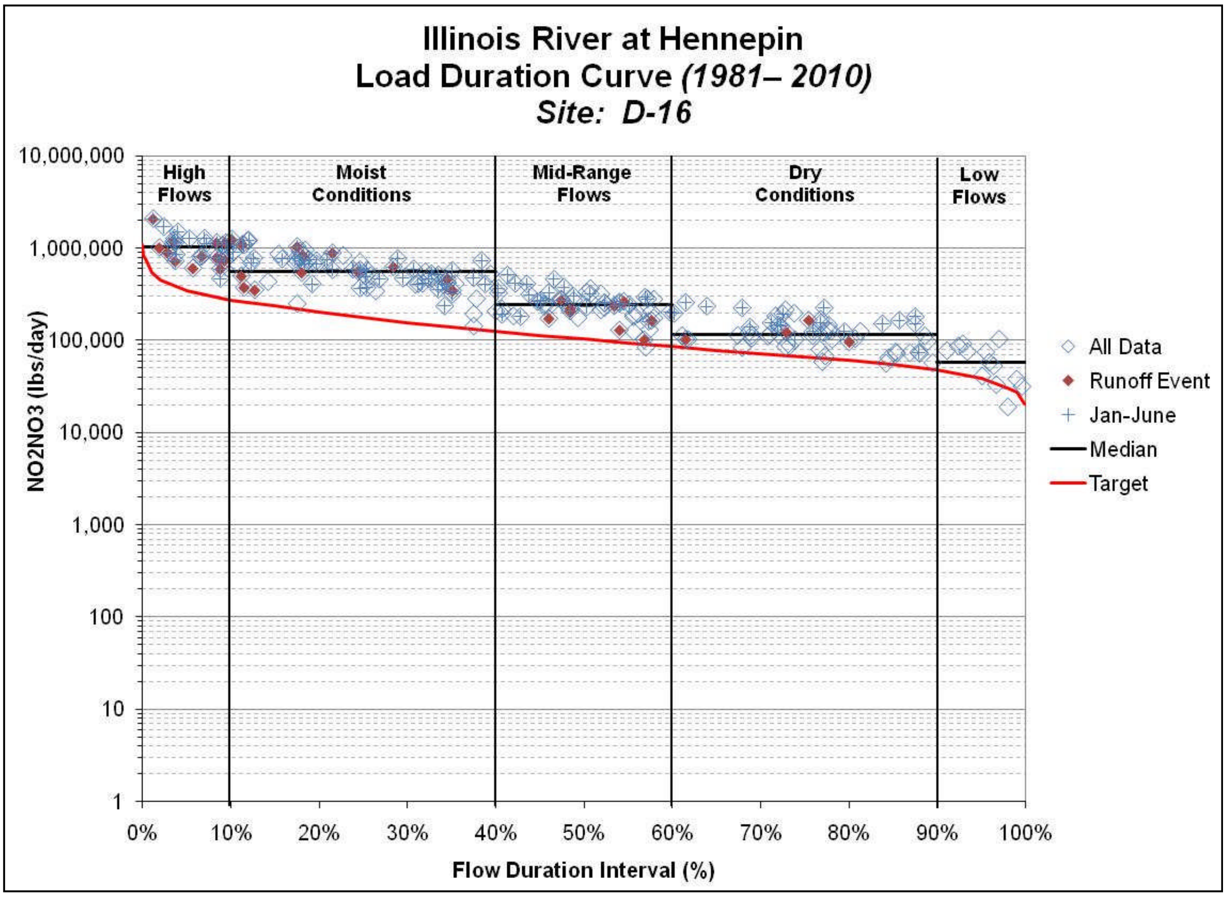

Figure 5-49. Nitrogen load duration curve, Illinois River at Hennepin (D-16).

Table 5-9. Nitrogen LRS, Illinois River at Hennepin (D-16).

Station D 16 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	1,045,151	556,002	244,874	115,959	57,749
	LRS Target	346,855	178,109	103,212	66,677	38,910
	LRS Reduction %	66.81%	67.97%	57.85%	42.50%	32.62%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

5.4 Illinois River at Peoria Intake TMDL and LRS (Site D-30)

Table 5-10 summarizes the Illinois River at Peoria Intake (Site D-30) watershed and pollutant sources. The Illinois River at Peoria Intake (Site D-30) watershed includes one bacteria, one TDS, and one manganese impaired segment. Figure 5-50, Figure 5-51, and Figure 5-52 present the load duration curves and Table 5-11, Table 5-12, and Table 5-13 present the TMDLs for the Illinois River at Peoria Intake (Site D-30) at the D-30 assessment site. LRSs are presented in Sections 5.4.4 and 5.4.5 for TSS and nutrients, respectively.

Table 5-10. Illinois River at Peoria Intake (Site D-30) summary table.

Upstream Characteristics [a]	
Drainage Area	13,900 square miles
Peoria D-30 Watershed Area	1,574 square miles
Sampling Station	D-30
Listed Segments	D-30
Land Use	cultivated crops (70 percent); deciduous forests (13 percent); developed land including low, medium, and high intensity (four percent); developed open space (four percent); pasture/hay (four percent); wetlands (two percent); other (three percent).
Soil Type	71% B, 17% B/D, 6% C, 4% No Data, 2% A, <1% C/D, <1% D, <1% A/D
Erodible Soils	18% Highly Erodible, <1% Not Highly Erodible, 81% Not Assessed
Animal Unit Density	9,100 [b]
Key Sources	agricultural and urban runoff; NPDES facilities; CSOs/SSOs; MS4s; watershed, streambank and gully erosion, bluff erosion; hydromodification; tributary loads; animal agriculture; livestock [b]
NPDES Facilities	Noveon Inc-Henry (IL0001392)
	Caterpillar Inc-Mossville (IL0001414)
	Princeton, City Of STP (IL0020575)
	Ladd STP (IL0021491)
	Metamora North STP (IL0021539)
	Toluca STP (IL0021695)
	Wenona STP (IL0021792)
	Granville STP (IL0022331)
	Chillicothe Sd STP (IL0023159)
	Depue STP (IL0023523)
	Caterpillar Inc.- Peoria (IL0024163)
	Malden STP (IL0024791)
	Oglesby STP (IL0024996)
	Tiskilwa STP (IL0025160)
	Hennepin Pwd STP (IL0025313)
	Putnam County Junior Hs (IL0026573)
	Grandview Mobile Home Park (IL0026972)
	Germantown Hills STP #1 (IL0028916)
	Kewanee STP (IL0029343)
	Lacon WWTP (IL0029378)
	Lasalle WWTP (IL0029424)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Bureau Junction STP (IL0033120)

Upstream Characteristics [a]	
	Washburn STP (IL0039411)
	Pinewood MHP (IL0042234)
	Lake Arispie Water Co STP (IL0042625)
	Camp Manitoumi-Low Point (IL0053066)
	Lake Wildwind MHP-Metamora (IL0053864)
	Hpa - Jubilee College Historic (IL0054674)
	Mount Alverno Novitiate-E Peor (IL0059030)
	Cedar Bluff Utilities, Inc STP (IL0059391)
	Oak Ridge Sd STP (IL0060461)
	Medina Utilities Inc-East STP (IL0065072)
	Prairie View Nursing Home STP (IL0067024)
	Henry STP (IL0070548)
	Trico, Inc., Mill Point MHP (IL0071358)
	Peru STP #2 (IL0075507)
	Maple Acres MHP (ILG551015)
	Cedar Point STP (ILG580008)
	Brimfield Sd STP (ILG580050)
	Dunlap STP (ILG580099)
	Lamoille, Village Of STP (ILG580127)
	Dalzell STP (ILG580130)
	Ohio, Village Of STP (ILG580190)
	Sparland STP (ILG580226)
	Wyanet STP (ILG580245)
	Germantown Hills WWTP #2 (ILG580262)
	Elmwood STP (ILG582012)
NPDES Facility Disinfection Exemption [c]	32 of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [d]	Thirteen facilities above have exceedances averaging between 409 to 15,495 cfu/100mL
MS4 Communities	City of East Peoria (IRL400331): 0.38 square miles
	Medina Township (IRL400085): 22.29 square miles
	City of Peoria (IRL400424): 10.05 square miles
	Peoria Heights (ILR400425): 5.97 square miles
	Washington Township (IRL400665): 8.4 square miles
CSO/SSO Communities	East Peoria STP#1
	Bureau Junction STP (IL0033120)
	Granville STP (IL0022331)
	LaSalle WWTP (IL0029424)
	Oglesby STP (IL0024996)
	Peoria SD STP (IL0021288)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Washington STP #2 (IL0042412)
	Wenona STP (IL0021792)
CSO/SSO Overflows	There have been 1,591 reported overflows from the multiple outfalls at CSOs listed above from 2007-2010. The East Peoria SSO has overflowed 3 times in the past 5 years. The LaSalle WWTP SSO discharged 21 out of 36 months from 2008-2010.

a. Does not include information for area upstream of the Middle Illinois River watershed.
b. Does not include tributary watershed clusters
c. See Table 5-3 for exemption and permit specifics.
d. See Appendix A for DMR Exceedance Summary Table (2005-2010)

5.4.1 Bacteria TMDL

Figure 5-50 presents the load duration curve and TMDL for fecal coliform at the Illinois River at Peoria Intake assessment site. Table 5-11 summarizes the TMDL and required reductions. Reductions in bacteria loading are not needed at this location.

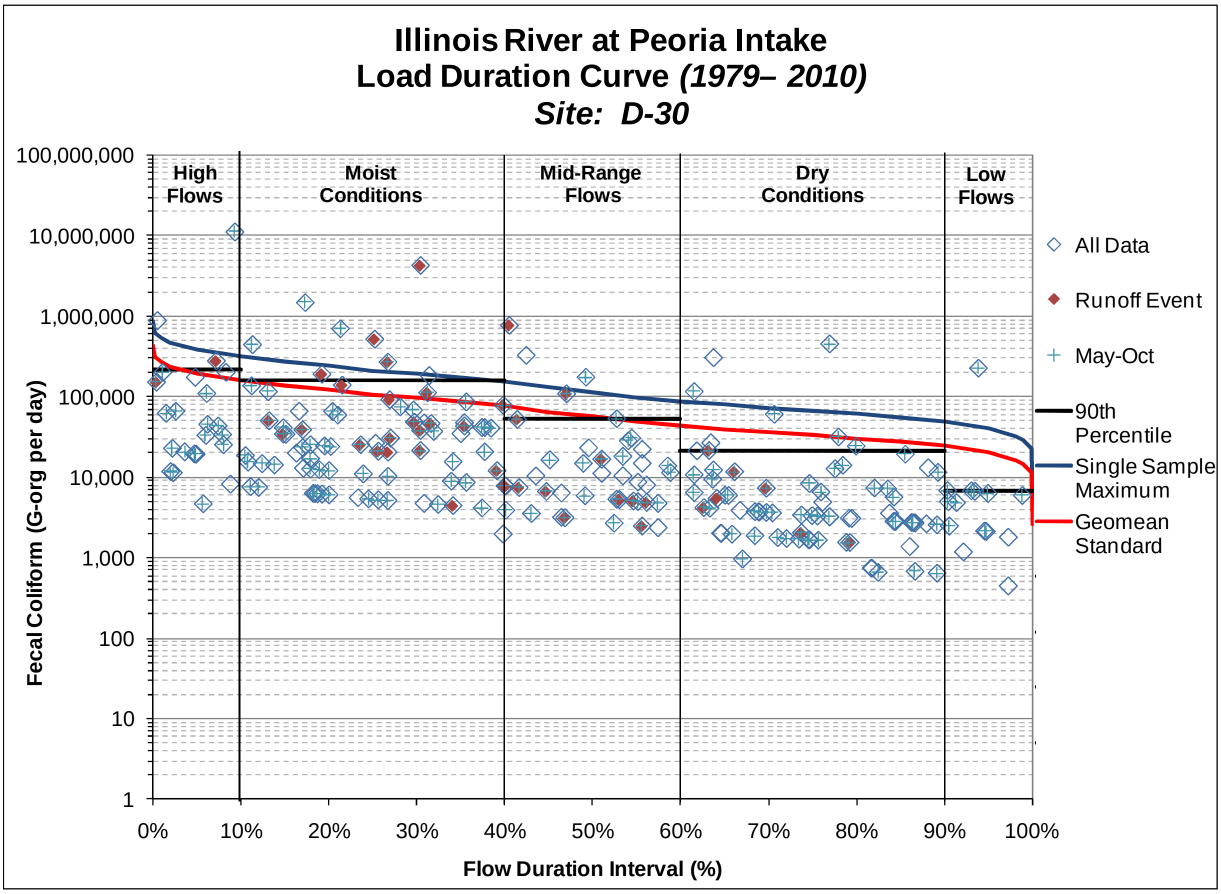

Figure 5-50. Fecal coliform load duration curve, Illinois River at Peoria Intake (D-30).

Table 5-11. Fecal coliform TMDL, Illinois River at Peoria Intake (D-30).

Station D 30 TMDL[c]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Fecal Coliform (G-org/day)	Current Load	216,822	156,993	53,217	21,437	6,835
	LA[a]	320,091	188,997	100,685	58,883	36,609
	WLA: NPDES Facilities	733	733	350	350	350
	WLA: CSOs[d]	21,762	0	0	0	0
	WLA: MS4 Communities	1,014	642	343	200	125
	Total WLA[b]	23,509	1,375	693	550	475
	MOS (10%)	38,178	21,153	11,264	6,604	4,120
	TMDL=LA+WLA+MOS	381,778	211,525	112,642	66,037	41,204
	TMDL Reduction %[e]	0%	0%	0%	0%	0%

a. Note that the Load Allocation includes all upstream area
b. Note that the WLA is based on point sources in the Middle Illinois River Watershed
c. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime
d. Note that CSOs are only allowed to discharge at this level 4 times per year.
e. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

5.4.2 Manganese TMDL

Figure 5-51 presents the load duration curve and TMDL for manganese at the Illinois River at Peoria Intake assessment site. Table 5-12 summarizes the TMDL and required reductions. Pollutant reductions are needed under dry and low flow conditions. Reductions in TSS within the Illinois River should help to reduce manganese loading, as manganese is typically bound to sediment particles. It is also possible that local groundwater has concentrations of manganese that are contributing to the impairment under lower flow conditions. Additional monitoring could be warranted to further evaluate the impairment.

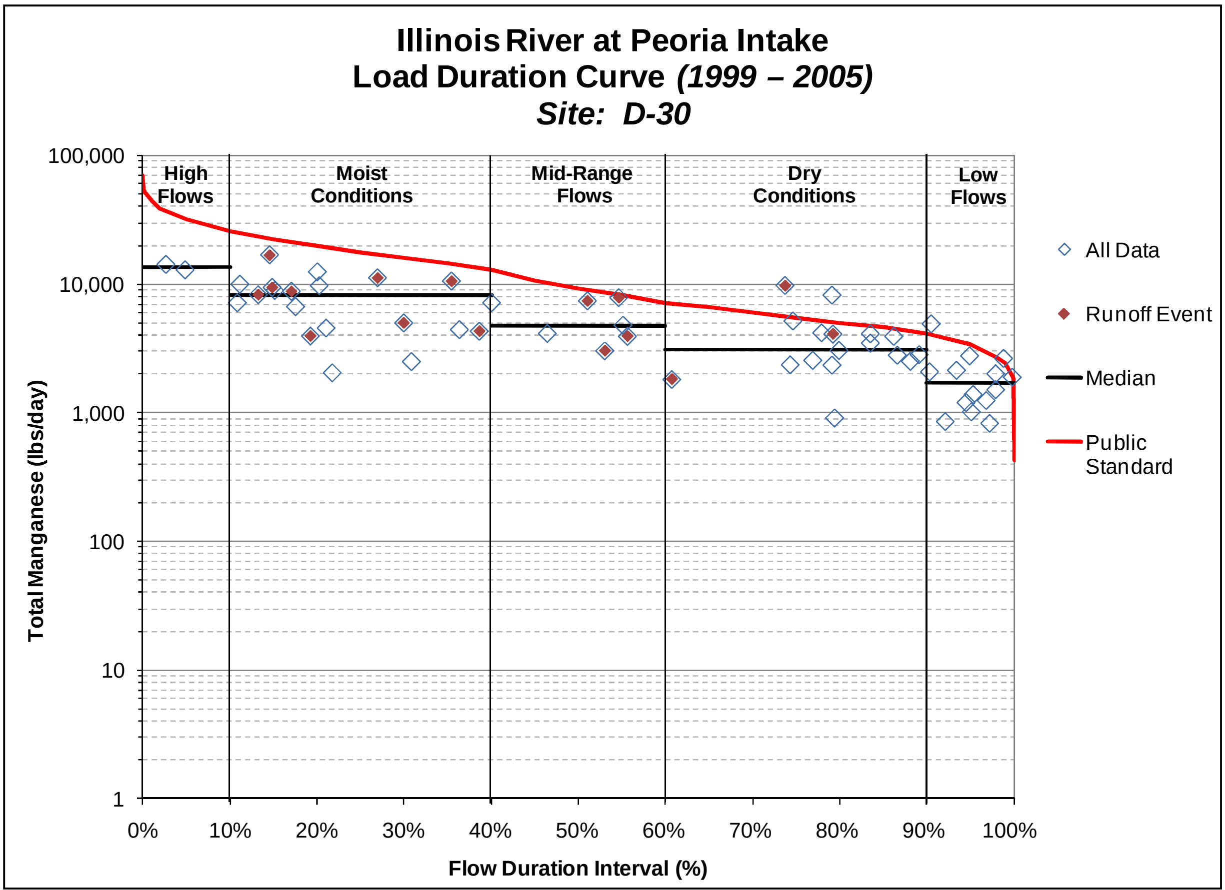

Figure 5-51. Manganese load duration curve, Illinois River at Peoria Intake (D-30).

Table 5-12. Manganese TMDL, Illinois River at Peoria Intake (D-30).

Station D 30 TMDL[c]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Manganese (lbs/day)	Current Load	14,158	16,788	7,830	9,735	4,906
	LA[a]	63,068	23,012	11,206	6,151	3,400
	WLA: NPDES Facilities	343	343	311	311	311
	Total WLA[b]	343	343	311	311	311
	MOS (10%)	7,046	2,595	1,280	718	412
	TMDL=LA+WLA+MOS	70,456	25,950	12,797	7,181	4,124
	TMDL Reduction %	0%	0%	0%	26.24%	15.94%

a. Note that the Load Allocation includes all upstream area
b. Note that the WLA is based on point sources in the Middle Illinois River watershed
c. Note that the TMDL is based on the maximum allowable load in each flow regime and reduction is based on maximum observed load in each flow regime

5.4.3 Total Dissolved Solids TMDL

Figure 5-52 presents the load duration curve and TMDL for total dissolved solids at the Illinois River at Peoria Intake assessment site. Table 5-13 summarizes the TMDL and required reductions. Total dissolved solids reductions are not required.

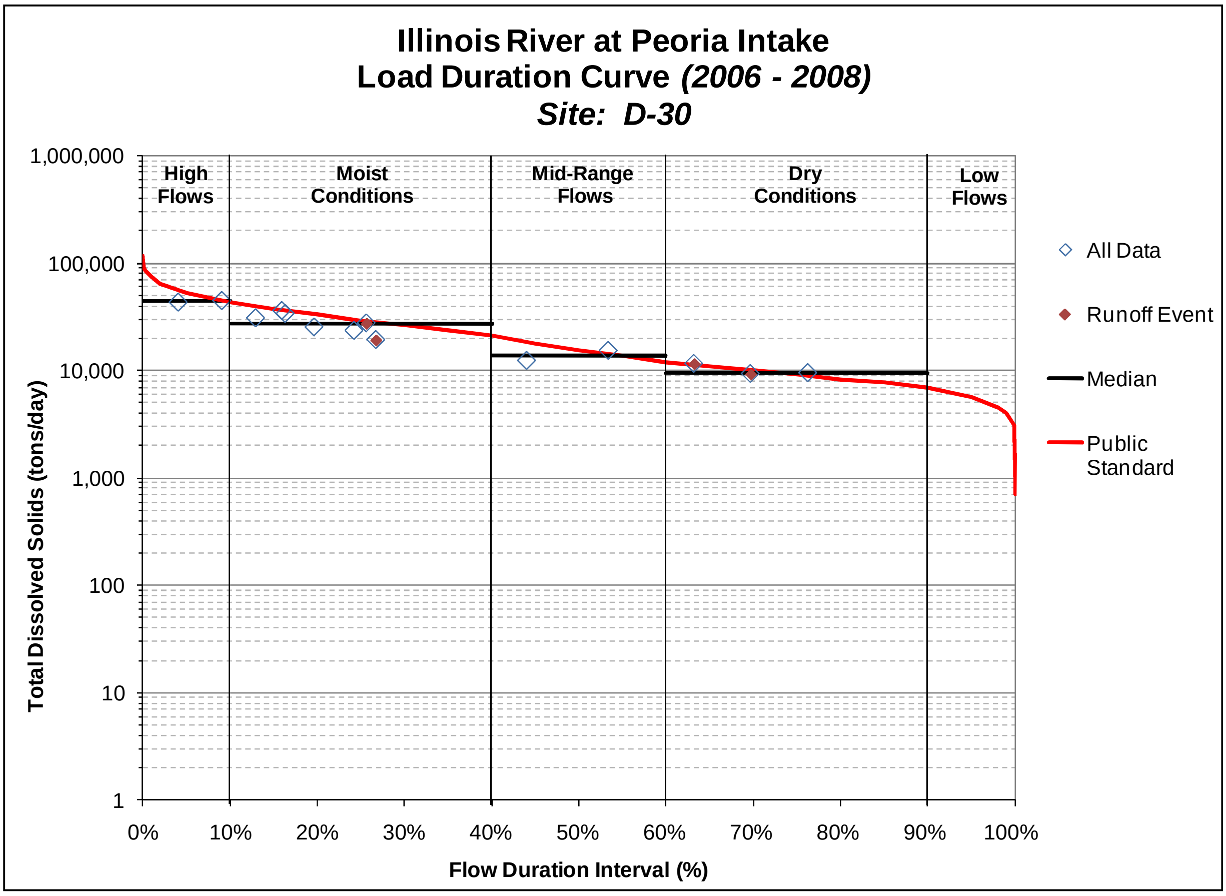

Figure 5-52. Total dissolved solids load duration curve, Illinois River at Peoria Intake (D-30).

Table 5-13. Total dissolved solids TMDL, Illinois River at Peoria Intake (D-30).

Station D 30 TMDL[c]		High Flows	Moist Conditions	Mid-Range Flows[d]	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Dissolved Solids (tons/day)	Current Load	44,640	36,083	15,227	11,536	N/A
	LA[a]	105,113	38,354	18,677	10,252	5,667
	WLA: NPDES Facilities	571	571	519	519	519
	Total WLA[b]	571	571	519	519	519
	MOS (10%)	11,743	4,325	2,133	1,197	687
	TMDL=LA+WLA+MOS	117,427	43,250	21,329	11,968	6,873
	TMDL Reduction %[d]	0%	0%	0%	0%	N/A

a. Note that the Load Allocation includes all upstream area
b. Note that the WLA is based on point sources in the Middle Illinois River watershed
c. Note that the TMDL is based on the maximum allowable load in each flow regime and reduction is based on maximum observed load in each flow regime
d. Note that there is only one observed exceedance of the TMDL. That exceedance occurs at the 53% during mid-range flows. The percent reduction of load required to meet the standard on that day is 5.84%

5.4.4 Total Suspended Solids LRS

TSS load reductions are presented in Table 5-14 for the Illinois River at Peoria using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. A small reduction in TSS is needed in order to achieve the TSS standards. Focus should be placed on controlling bluff, bank, channel, and gully erosion.

Table 5-14. TSS LRS, Illinois River at Peoria.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Illinois River at Peoria	D-30	63	59.3	6%

5.4.5 Nutrient LRS

Figure 5-53 and Figure 5-54 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Illinois River at Peoria Intake assessment site. Table 5-15 and Table 5-16 summarize the LRS and required reductions. Reduction of nutrients loadings from the tributary watersheds should be a primary implementation focus, in addition to controlling point sources, CSOs/SSOs, and urban and agricultural runoff.

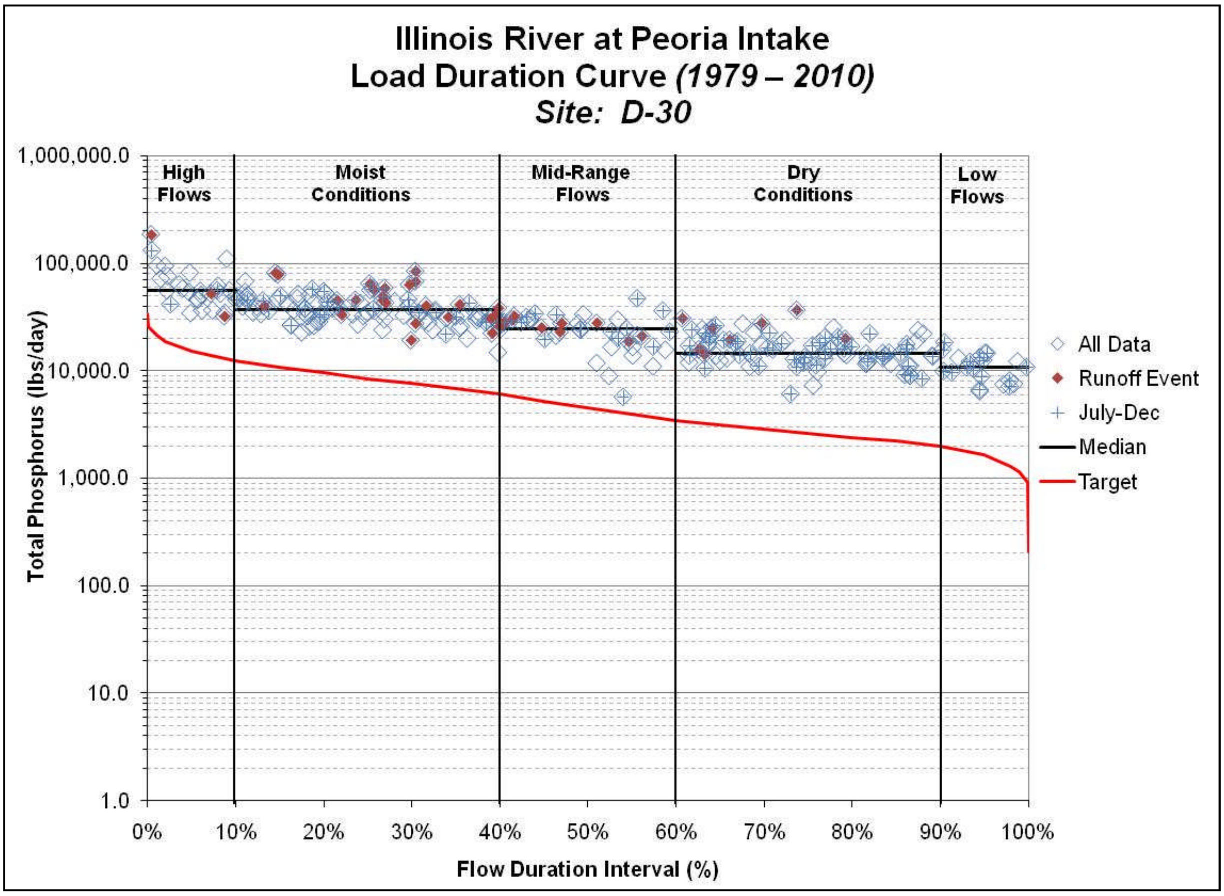

Figure 5-53. Total phosphorus load duration curve, Illinois River at Peoria Intake (D-30).

Table 5-15. Total phosphorus LRS, Illinois River at Peoria Intake (D-30).

Station D 30 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	55,370	36,734	24,266	14,628	10,720
	LRS Target	15,152	8,395	4,471	2,621	1,635
	LRS Reduction %	72.63%	77.15%	81.58%	82.08%	84.75%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

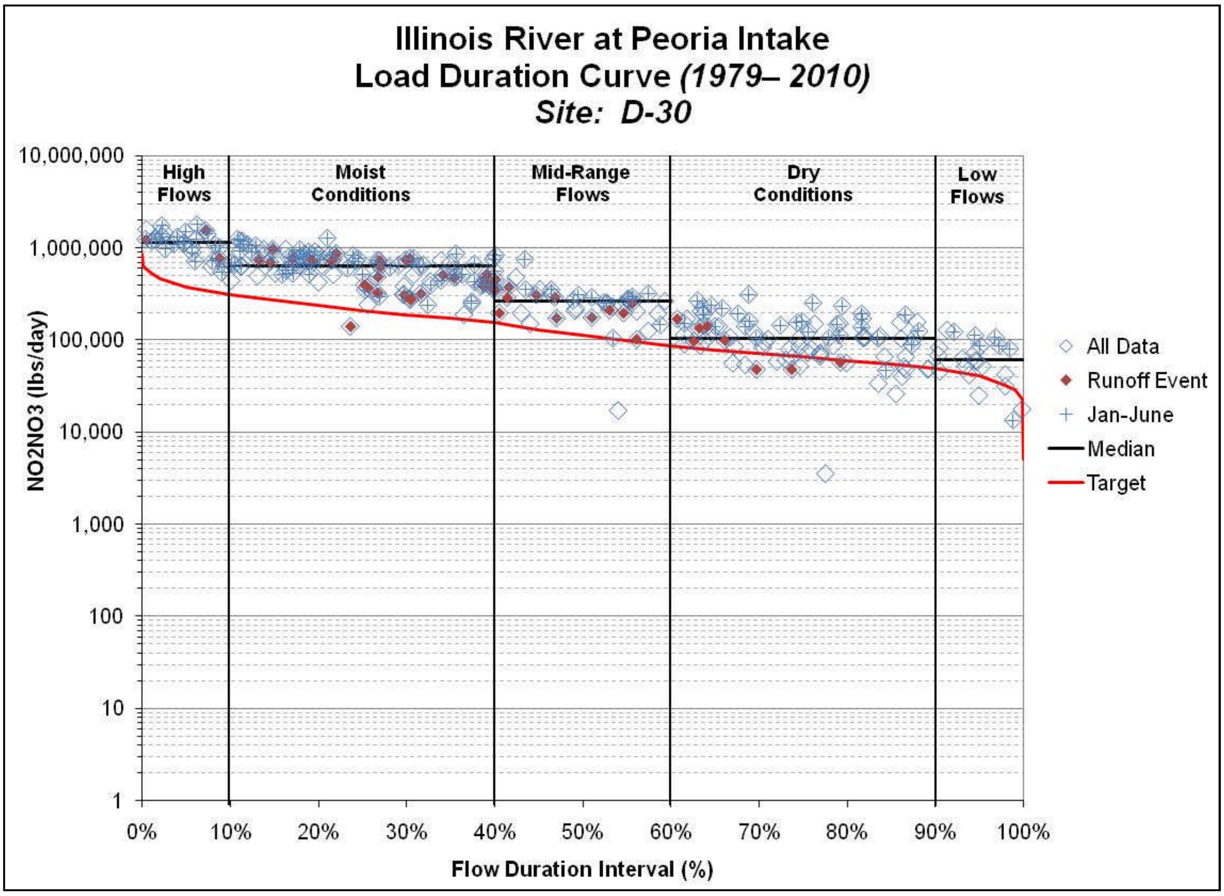

Figure 5-54. Nitrogen load duration curve, Illinois River at Peoria Intake (D-30).

Table 5-16. Nitrogen LRS, Illinois River at Peoria Intake (D-30).

Station D 30 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	1,157,994	645,579	263,768	104,502	60,787
	LRS Target	378,381	209,643	111,639	65,450	40,838
	LRS Reduction %	67.32%	67.53%	57.68%	37.37%	32.82%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

5.5 Illinois River at Pekin TMDL and LRS (Site D-05)

Table 5-17 summarizes the Illinois River at Pekin watershed and pollutant sources. The Illinois River at Pekin watershed includes one bacteria impaired segment. Figure 5-55 presents the fecal coliform load duration curve and Table 5-18 presents the TMDL for the Illinois River at Pekin at the D-05 assessment site. LRSs are presented in Sections 5.5.2 and 5.5.3 for TSS and nutrients, respectively.

Table 5-17. Illinois River at Pekin summary table.

Upstream Characteristics [a]	
Drainage Area	14,585 square miles
Peoria D-05 Watershed Area	1,994 square miles
Sampling Station	D-05
Listed Segments	D-05
Land Use	cultivated crops (66 percent); deciduous forests (15 percent); developed land including low, medium, and high intensity (seven percent); developed open space (five percent); pasture/hay (five percent); wetlands (two percent).
Hydrologic Soil Group	72% B, 15% B/D, 7% C, 4% No Data, 1% A, <1% C/D, <1% D, <1% A/D
Erodible Soils	21% Highly Erodible, <1% Not Highly Erodible, 78% Not Assessed
Animal Unit Density	4,600 [b]
Key Sources	agricultural and urban runoff; NPDES facilities; CSOs/SSOs; MS4s; watershed, streambank and gully erosion, bluff erosion; hydromodification; tributary loads; animal agriculture; livestock[b]
NPDES Facilities	Noveon Inc-Henry (IL0001392)
	Caterpillar Inc-Mossville (IL0001414)
	Caterpillar Inc.-East Peoria (IL0002291)
	Princeton, City Of STP (IL0020575)
	Creve Coeur WWTP (IL0021237)
	Peoria Sd STP (IL0021288)
	Ladd STP (IL0021491)
	Metamora North STP (IL0021539)
	Toluca STP (IL0021695)
	Wenona STP (IL0021792)
	Oaklane Acres Homeowners Assoc (IL0022152)
	Granville STP (IL0022331)
	Chillicothe Sd STP (IL0023159)
	Depue STP (IL0023523)
	Caterpillar Inc.- Peoria (IL0024163)
	Malden STP (IL0024791)
	City Of Washington STP #1 (IL0024881)
	Oglesby STP (IL0024996)
	Tiskilwa STP (IL0025160)
	Hennepin Pwd STP (IL0025313)
	Putnam County Junior Hs (IL0026573)
	Grandview Mobile Home Park (IL0026972)
	Carmi WWTP (IL0027910)
	East Peoria STP #1 (IL0028576)
	Germantown Hills STP #1 (IL0028916)
	Kewanee STP (IL0029343)
	Lacon WWTP (IL0029378)
	Lasalle WWTP (IL0029424)

Upstream Characteristics [a]	
	Morton STP #3 (IL0030007)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Bureau Junction STP (IL0033120)
	Pekin STP #1 (IL0034495)
	Peoria CSOs (IL0037800)
	Washburn STP (IL0039411)
	Pinewood MHP (IL0042234)
	Washington STP #2 (IL0042412)
	Lake Arispie Water Co STP (IL0042625)
	East Peoria STP #3 (IL0046213)
	Sundale Hills STP (IL0047384)
	Washington Estates Inc STP (IL0047406)
	Camp Manitoumi-Low Point (IL0053066)
	Norwood School District #63 STP (IL0053813)
	Lake Wildwind MHP-Metamora (IL0053864)
	Hpa - Jubilee College Historic (IL0054674)
	Mount Alverno Novitiate-E Peor (IL0059030)
	Cedar Bluff Utilities, Inc STP (IL0059391)
	Oak Ridge Sd STP (IL0060461)
	Medina Utilities Inc-East STP (IL0065072)
	Prairie View Nursing Home STP (IL0067024)
	Henry STP (IL0070548)
	Trico, Inc., Mill Point MHP (IL0071358)
	Peru STP #2 (IL0075507)
	Maple Acres MHP (ILG551015)
	Sundale Sewer Corp-Highland (ILG551039)
	Pekin Country Club (ILG551081)
	Cedar Point STP (ILG580008)
	Brimfield Sd STP (ILG580050)
	Dunlap STP (ILG580099)
	Lamoille, Village Of STP (ILG580127)
	Dalzell STP (ILG580130)
	Ohio, Village Of STP (ILG580190)
	Sparland STP (ILG580226)
	Wyanet STP (ILG580245)
	Germantown Hills WWTP #2 (ILG580262)
	Elmwood STP (ILG582012)
	Hanna City Sd STP (ILG582022)
NPDES Facility Disinfection Exemption [c]	38 of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [d]	Twenty-two facilities have exceedances averaging 409 to 36,250 cfu/100mL

Upstream Characteristics [a]	
MS4 Communities	Village of Bartonville (IRL400287): 5.62 square miles
	Kickapoo Township (IRL400073): 26.96 square miles
	Limestone Township (IRL400078): 9.11 square miles
	Medina Township (IRL400085): 26.98 square miles
	City of Peoria (IRL400424): 45.62 square miles
	Village of Morton (IRL400392): 3.54 square miles
	Cincinnati Township (IRL400683): 0.01 square miles
	City of East Peoria (IRL400331): 20.53 square miles
	City of North Pekin (IRL400403): 1.12 square miles
	City of Pekin (IRL400423): 8.6 square miles
	Village of South Pekin (IRL400515): 0 square miles
	Washington Township (IRL400665): 37.53 square miles
	Bellevue (ILR400165): 1.64 square miles
	Creve Coeur (ILR400322): 4.4 square miles
	Marquette Heights (ILR400381): 1.61 square miles
	Peoria Heights (ILR400425): 6.71 square miles
	West Peoria (ILR400506): 1.26 square miles
	Peoria City Township (ILR400599): 2.13 square miles
	ILDOT Roads (ILR400493): 2.68 square miles
	Tazewell County (IRL400271): 0.1 square miles
	Peoria County Roads (IRL400267): 0.72 square miles
CSO/SSO Communities	Bureau Junction STP (IL0033120)
	East Peoria STP #1 (IL0028576)
	Granville STP (IL0022331)
	Kewanee STP (IL0029343)
	Lasalle WWTP (IL0029424)
	Oglesby STP (IL0024996)
	Pekin STP #1 (IL0034495)
	Peoria CSOs (IL0037800)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Wenona STP (IL0021792)
CSO/SSO Overflows	There have been 3,275 reported overflows from the multiple outfalls at CSOs listed above between 2007 and 2010.The East Peoria SSO has discharged 3 times in the past 5 years. The Kenawee STP SSO has discharged once in the past five years. The LaSalle WWTP SSO has discharged 21 out of 36 months from 2008-2010.

a. Does not include information for area upstream of the Illinois Peoria Watershed.
b. Does not include tributary watershed clusters
c. See Table 5-3 for exemption and permit specifics.
d. See Appendix A for DMR Exceedance Summary Table (2005-2010)

5.5.1 Bacteria TMDL

Figure 5-55 presents the load duration curve and TMDL for fecal coliform at the Illinois River at Pekin assessment site. Table 5-18 summarizes the TMDL and required reductions. Fairly consistent reductions in bacteria loadings are needed across all flow conditions. The data suggest significant sources of bacteria originating between Peoria and Pekin. Tributary load reductions from Kickapoo Creek and Farm Creek are needed. Local point sources and dry weather sources such as leaking sewers and SSOs should be further investigated during implementation. Control of CSOs in the Peoria area and Farm Creek watersheds is also needed.

Urban stormwater is also a significant source of bacteria to this site, including regulated stormwater from MS4s. Urban stormwater management is needed to reduce bacteria levels from these sources, including education programs.

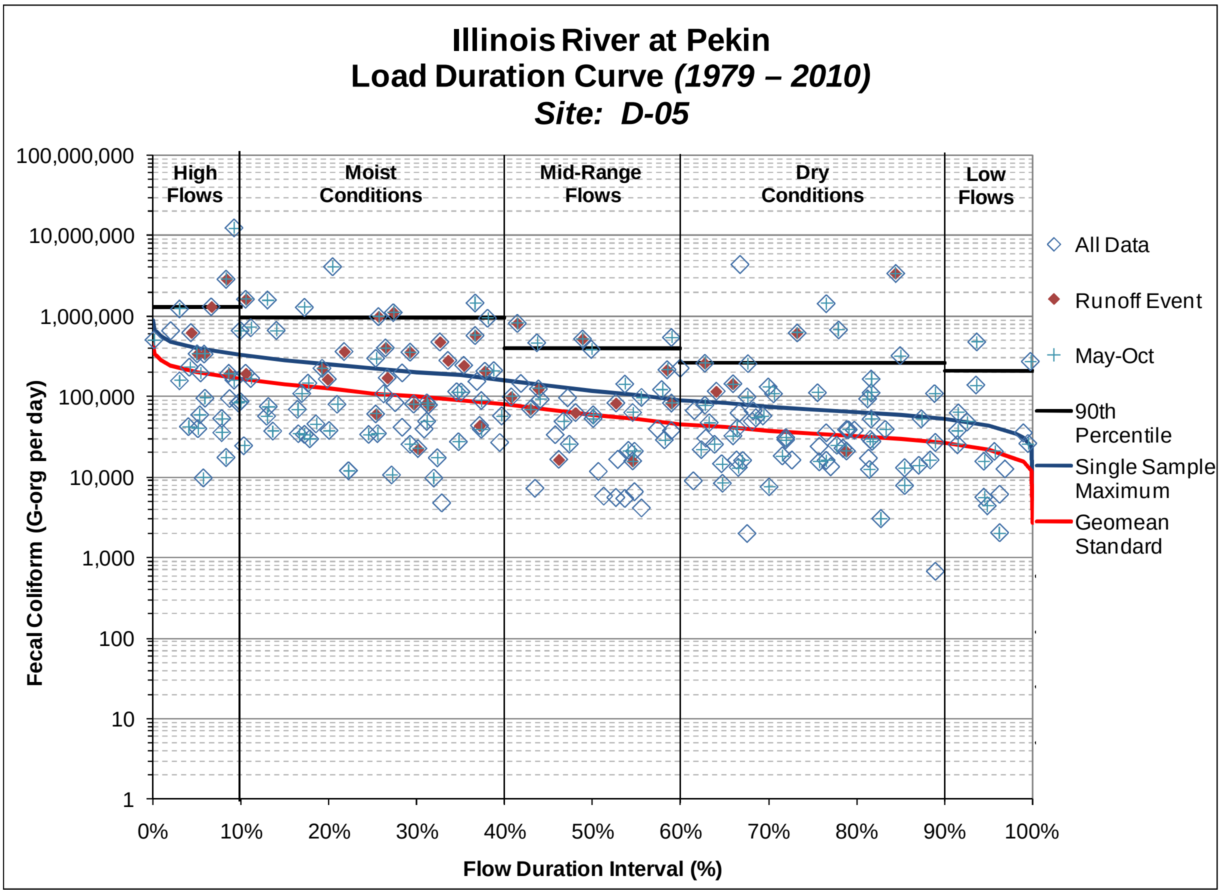

Figure 5-55. Fecal coliform load duration curve, Illinois River at Pekin (D-05).

Table 5-18. Fecal coliform TMDL, Illinois River at Pekin (D-05).

Station D 05 TMDL[c]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	TMDL Component	0-10%	10-40%	40-60%	60-90%	90-100%
Fecal Coliform (G-org/day)	Current Load	1,284,330	951,586	402,892	257,804	206,136
	LA[a]	331,480	194,751	103,696	60,309	37,190
	WLA: NPDES Facilities	2,201	2,201	1,186	1,186	1,186
	WLA: CSOs[d]	22,405	0	0	0	0
	WLA: MS4s	4,447	2,802	1,492	868	535
	Total WLA[b]	29,053	5,003	2,678	2,054	1,721
	MOS (10%)	40,059	22,195	11,819	6,929	4,324
	TMDL=LA+WLA+MOS	400,592	221,949	118,193	69,292	43,235
	TMDL Reduction %[e]	68.81%	76.68%	70.66%	73.12%	79.03%

a. Note that the Load Allocation includes all upstream area
b. Note that the WLA is based on point sources in the Middle Illinois River watershed
c. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime
d. Note that CSOs are only allowed to discharge at this level 4 times per year.
e. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

5.5.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 5-19 for the Illinois River at Pekin using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. Reduction of TSS loadings from the tributary watersheds, particularly Kickapoo Creek and Farm Creek, should be a primary implementation focus, in addition to controlling local channel, bluff, and gully erosion.

Table 5-19. TSS LRS, Illinois River at Pekin.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Illinois River at Pekin	D-05	97	59.3	39%

5.5.3 Nutrient LRS

Figure 5-56 and Figure 5-57 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Illinois River at Pekin assessment site. Table 5-20 and Table 5-21 summarize the LRS and required reductions. Reduction of nutrients loadings from the tributary watersheds, particularly Kickapoo Creek and Farm Creek, should be a primary implementation focus, in addition to controlling point sources, CSOs/SSOs, and urban and agricultural runoff.

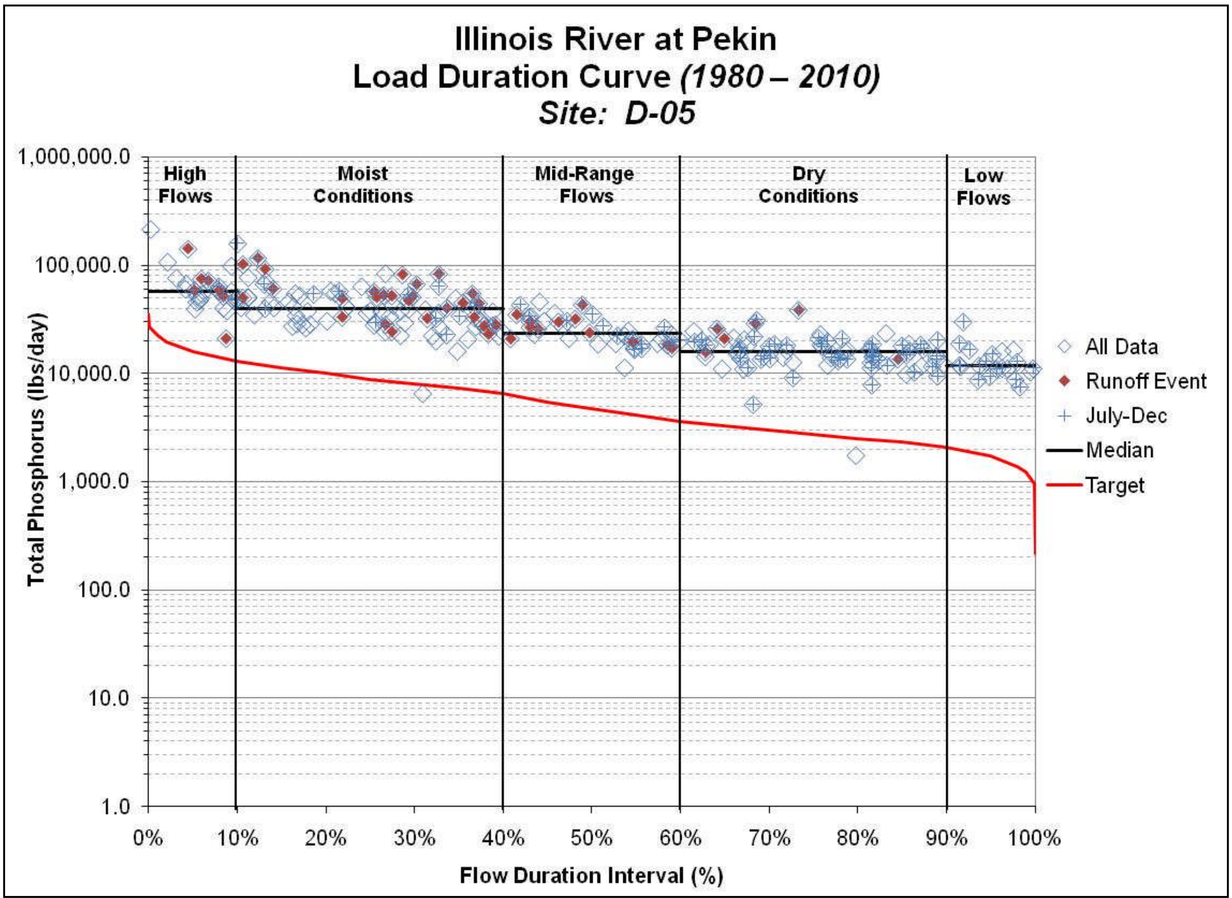

Figure 5-56. Total phosphorus load duration curve, Illinois River at Pekin (D-05).

Table 5-20. Total phosphorus LRS, Illinois River at Pekin (D-05).

Station D 05 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	57,442	39,986	23,510	15,986	11,727
	LRS Target	15,899	8,809	4,691	2,750	1,716
	LRS Reduction %	72.32%	77.97%	80.05%	82.80%	85.37%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

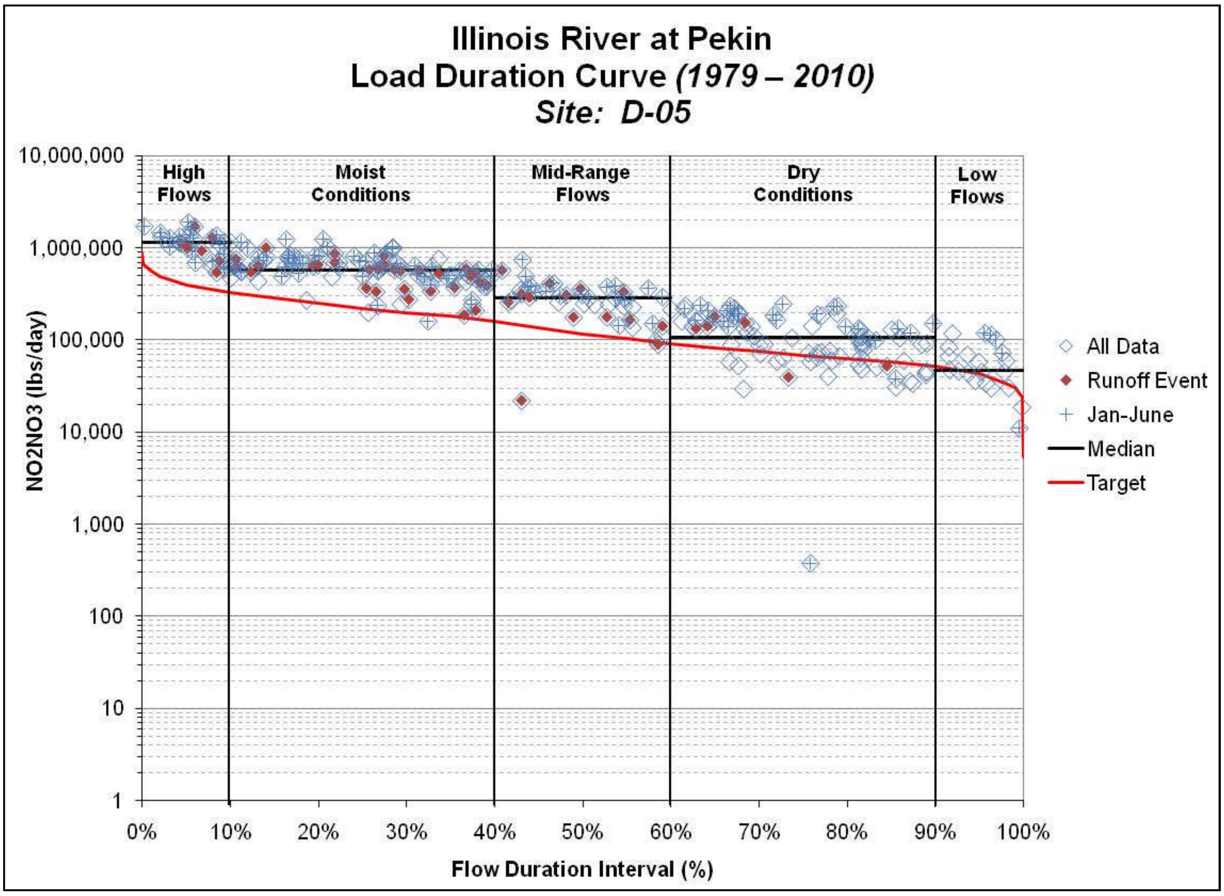

Figure 5-57. Nitrogen load duration curve, Illinois River at Pekin (D-05).

Table 5-21. Nitrogen LRS, Illinois River at Pekin (D-05).

Station D 05 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	1,134,229	579,990	286,464	106,380	47,284
	LRS Target	397,027	219,975	117,141	68,675	42,850
	LRS Reduction %	65.00%	62.07%	59.11%	35.44%	9.38%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

5.6 Illinois River at Lacon LRS (Site D-09)

Table 5-22 summarizes the Illinois River at Lacon watershed and pollutant sources. The Illinois River at Lacon watershed does not include any bacteria impaired segments. LRSs for the Illinois River at Lacon at the D-09 are presented in Sections 5.6.1 and 5.6.2 for TSS and nutrients, respectively.

Table 5-22. Illinois River at Lacon summary table.

Upstream Characteristics [a]	
Drainage Area	13,202 square miles
Peoria D-09 Watershed Area	1,089 square miles
Sampling Station	D-09
Listed Segments	D-09
Land Use	cultivated crops (74 percent); deciduous forests (10 percent); developed land including low, medium, and high intensity (three percent); developed open space (four percent); pasture/hay (three percent); wetlands (two percent); other (four percent).
Soil Type	72% B, 18% B/D, 5% C, 3% No Data, 1% A, <1% C/D, <1% D, <1% A/D
Erodible Soils	16% Highly Erodible, 84% Not Assessed
Animal Unit Density	8,400[b]
Key Sources	agricultural and urban runoff; NPDES facilities; CSOs/SSOs; watershed, streambank and gully erosion, bluff erosion; hydromodification; tributary loads; animal agriculture; livestock [b]
NPDES Facilities	Noveon Inc-Henry (IL0001392)
	Dynegy Midwest Gen-Hennepin (IL0001554)
	American Nickeloid Co-Peru (IL0001724)
	Cf Industries - Peru (IL0001783)
	United Suppliers-Henry (IL0002518)
	Isg Hennepin Inc. (IL0002631)
	Princeton STP (IL0020575)
	Ladd STP (IL0021491)
	Wenona STP (IL0021792)
	Granville STP (IL0022331)
	Depue STP (IL0023523)
	Malden STP (IL0024791)
	Oglesby STP (IL0024996)
	Tiskilwa STP (IL0025160)
	Hennepin Pwd STP (IL0025313)
	Putnam County Junior Hs (IL0026573)
	Lasalle WWTP (IL0029424)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Bureau Junction STP (IL0033120)
	Lake Arispie Water Co STP (IL0042625)
	Beecher STP (IL0049522)
	Cherry WTP (IL0051705)
	New Jersey Zinc Company, Inc. (IL0052183)
	Dover WTP (IL0063363)
	Bradford Pig Palace (IL0064319)
	Central Limestone Co-Morris (IL0065056)
	Princeton WTP (IL0065757)
	Prairie View Nursing Home STP (IL0067024)
	J&D Rentals And Sales (IL0070424)
	Henry STP (IL0070548)
	Sublette WTP (IL0073652)
	Peru STP #2 (IL0075507)
	Mark WTP (IL0076848)
	Maple Acres MHP (ILG551015)

Upstream Characteristics [a]	
	Cedar Point STP (ILG580008)
	Lamoille STP (ILG580127)
	Dalzell STP (ILG580130)
	Ohio STP (ILG580190)
	Sparland STP (ILG580226)
	Wyanet STP (ILG580245)
	Seatonville WTP (ILG640144)
	Magnolia WTP (ILG640187)
NPDES Facility Disinfection Exemption [c]	15 of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [d]	Eight facilities above have exceedances averaging 409 to 3,375 cfu/100mL
MS4 Communities	None
CSO/SSO Communities	Bureau Junction STP (IL0033120)
	Granville STP (IL0022331)
	Lasalle WWTP (IL0029424)
	Oglesby STP (IL0024996)
	Peru STP #1 (IL0030660)
	Spring Valley STP (IL0031216)
	Wenona STP (IL0021792)
CSO Overflows	There have been 3,296 reported overflows from the multiple outfalls at CSOs listed above between 2007 and 2010. The LaSalle WWTP SSO has discharged 21 out of 36 months from 2008-2010.

a. Does not include information for area upstream of the Illinois Peoria Watershed.
b. Does not include tributary watershed clusters
c. See Table 5-3 for exemption and permit specifics.
d. See Appendix A for DMR Exceedance Summary Table (2005-2010)

5.6.1 Total Suspended Solids LRS

TSS load reductions are presented in Table 5-23 for the Illinois River at Lacon using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. Reductions in sediment are not needed in order to meet the sediment target.

Table 5-23. TSS LRS, Illinois River at Lacon.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Illinois River at Lacon	D-09	59	59.3	0%

5.6.2 Nutrient LRS

Figure 5-58 and Figure 5-59 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Illinois River at Lacon assessment site. Table 5-24 and Table 5-25 summarize the LRS and required reductions. Reduction of nutrients loadings from the tributary watersheds, specifically Big Bureau, should be a primary implementation focus, in addition to controlling point sources, CSOs/SSOs, and urban and agricultural runoff.

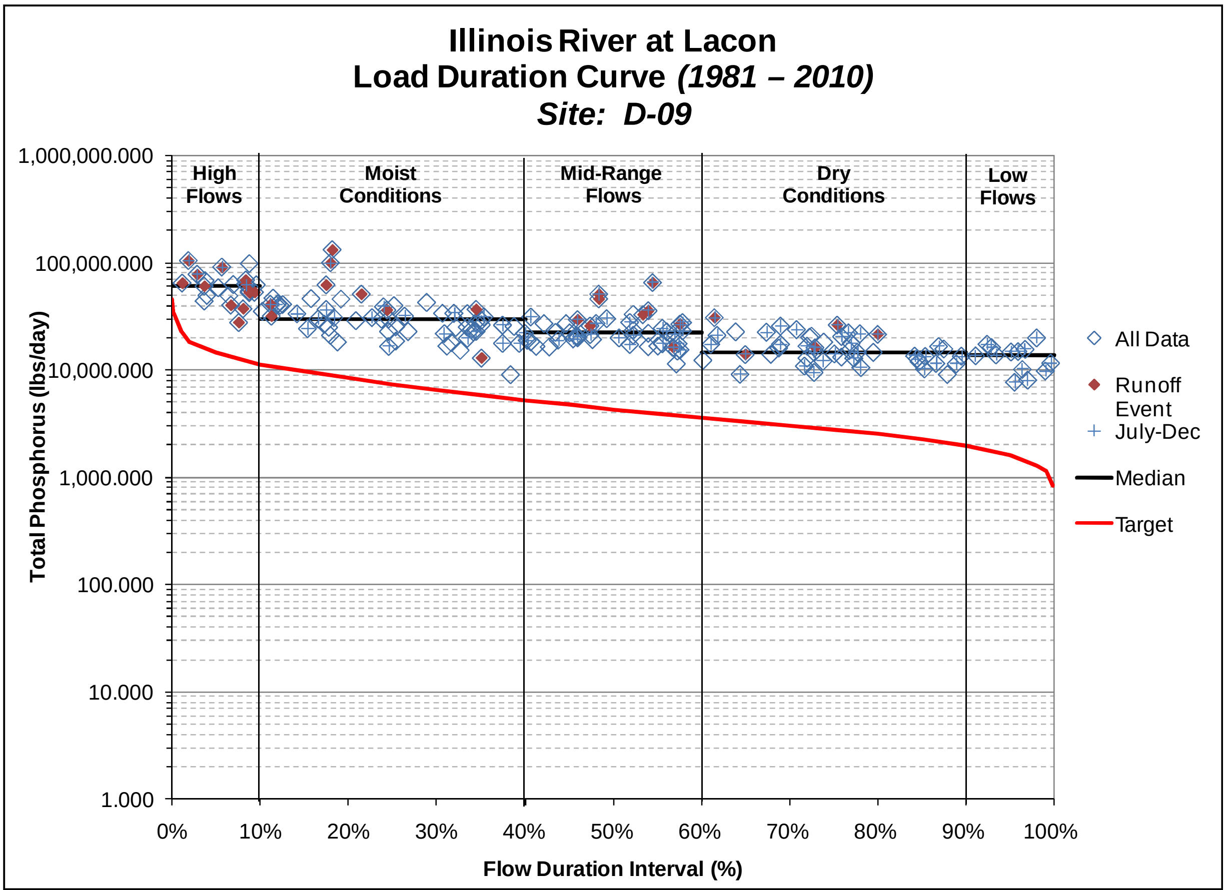

Figure 5-58. Total phosphorus load duration curve, Illinois River at Lacon (D-09).

Table 5-24. Total phosphorus LRS, Illinois River at Lacon (D-09).

Station D 09 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	61,293	29,564	22,082	14,721	13,905
	LRS Target	14,375	7,382	4,278	2,763	1,613
	LRS Reduction %	76.55%	75.03%	80.63%	81.23%	88.40%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

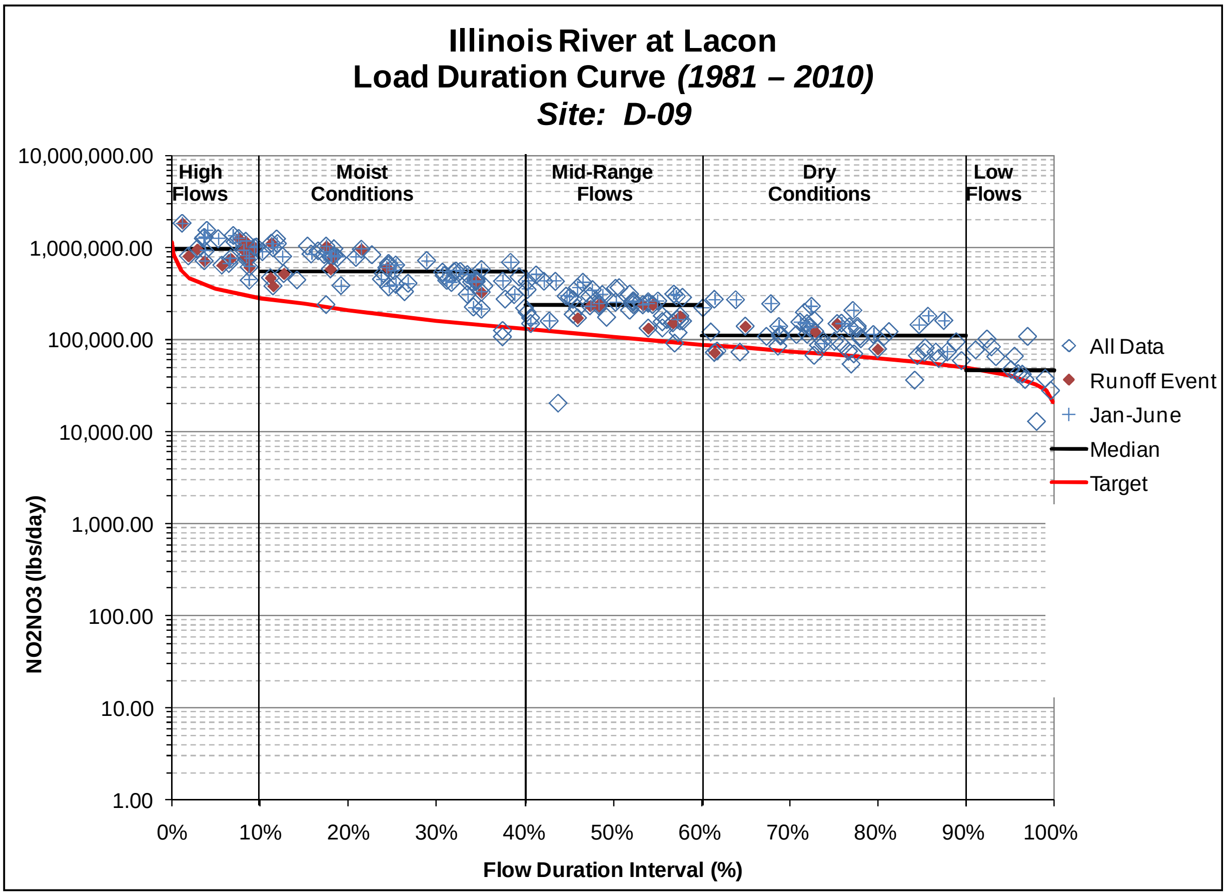

Figure 5-59. Nitrogen load duration curve, Illinois River at Lacon (D-09).

Table 5-25. Nitrogen LRS, Illinois River at Lacon (D-09).

Station D 09 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	960,507	545,211	240,692	111,686	47,258
	LRS Target	358,982	184,336	106,820	69,008	40,270
	LRS Reduction %	62.63%	66.19%	55.62%	38.21%	14.79%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

6. Big Bureau Creek

The Big Bureau Creek watershed cluster covers approximately 520 square miles in the northwest region of the project area (Figure 6-1). The drainage area can be further delineated into thirteen 12-digit HUCs; Table 6-1 details area per 12-digit HUC associated with the Big Bureau Creek watershed cluster. Counties with jurisdiction within the Big Bureau Creek watershed cluster include: Bureau, LaSalle and Lee. The Big Bureau Creek watershed drains into Goose Lake which then drains into Senachwine Lake and the Illinois River. The watershed has been a focus of detailed studies including the 2006 Inventory and Evaluation Report (I&E Report) by the Illinois Department of Natural Resources (IDNR 2006).

Big Bureau Creek and its tributary West Bureau Creek have elevated concentrations of bacteria, TSS and nutrients. A watershed source assessment and linkage analysis are presented in this section. A TMDL will be developed for fecal coliform bacteria and LRSs will be developed for TSS, phosphorus, and nitrate plus nitrate nitrogen.

Table 6-1. Big Bureau Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 04	01	Lime Creek	17,180	26.8
	02	West Bureau Creek	39,007	60.9
07130001 05	01	Pike Creek	20,649	32.3
	02	Town of Sublette - Big Bureau Creek	41,006	64.1
	03	Masters Fork	35,335	55.2
	04	Town of Greenoak - Big Bureau Creek	10,195	15.9
	05	Epperson Run - Big Bureau Creek	22,491	35.1
07130001 06	01	Town of Arlington - Brush Creek	24,522	38.3
	02	Town of Malden - East Big Bureau Creek	25,799	40.3
	03	Brush Creek - East Big Bureau Creek	21,162	33.1
07130001 07	01	Pond Creek - Big Bureau Creek	25,382	39.7
	02	Rocky Run - Big Bureau Creek	17,487	27.3
	03	Old Channel - Big Bureau Creek	21,074	32.9
Total			**321,074**	**502**

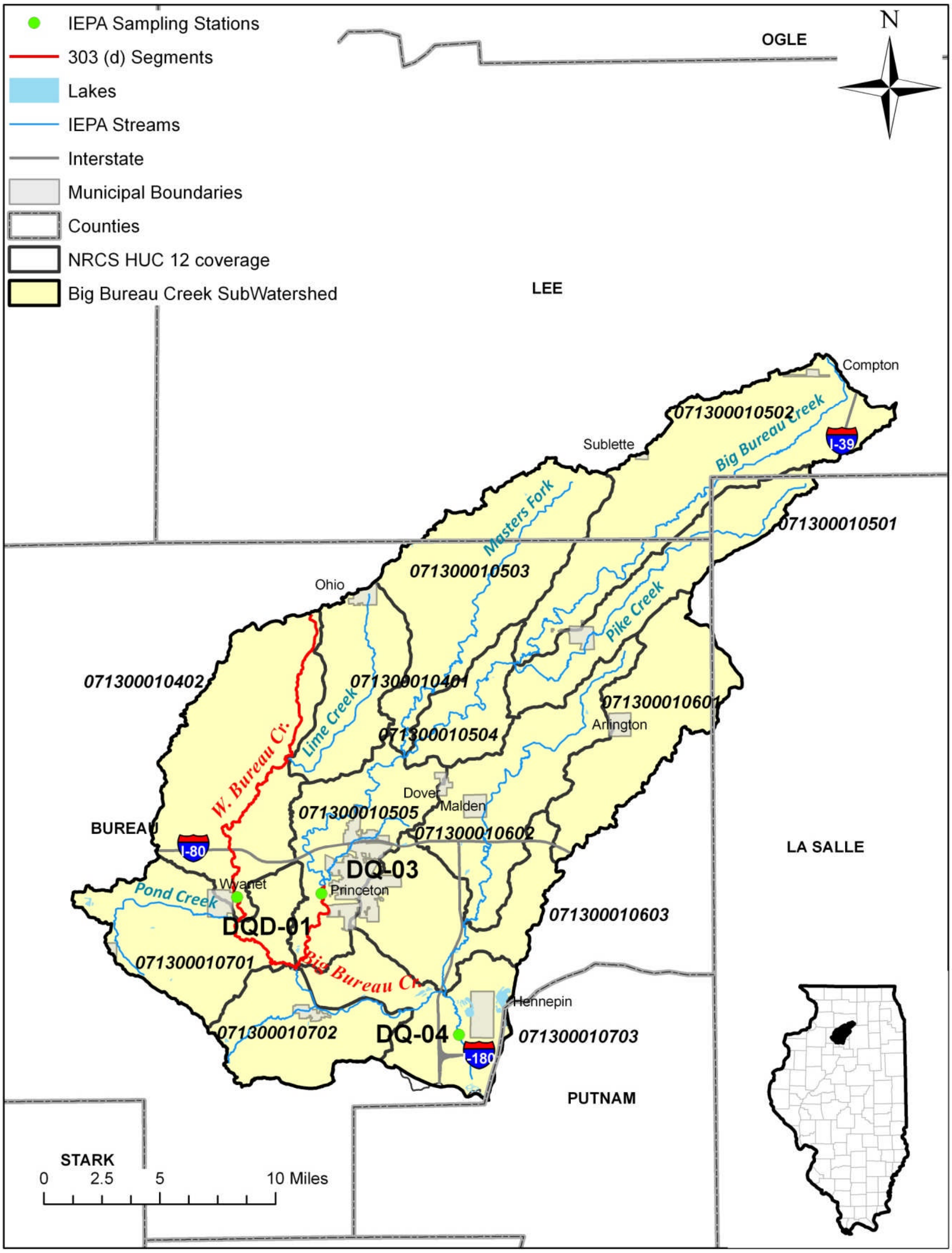

Figure 6-1. Big Bureau Creek watershed cluster segments and stations.

6.1 Source Assessment

Point and nonpoint sources have impacted the water quality within Big Bureau Creek and poor water quality has been shown to degrade aquatic life within the creek. For example, the 2004 macroinvertebrate biological integrity (MBI) study determined a very poor rating in the furthest upstream site, fair to good ratings in the middle reach and an exceptional rating at the furthest site downstream. Similar to the MBI scores, fish quality IBI also showed improving quality in the downstream reaches (IDNR 2006). Overall, the I&E Report indicates a strong spatial trend as the stream quality also improves downstream.

Figure 6-2 presents the land uses within the Big Bureau Creek watershed cluster. Land uses are predominately agricultural and contain relatively little developed land within its drainage area. Predominating land use includes cultivated crops (80 percent) and deciduous forests (9 percent). The largest area of development occurs around Princeton. Due to the dominance of crop land, this watershed provides a typical example of water quality that can occur in heavily agriculture areas. Specifically, some of the most significant channel erosion in the state occurs in this watershed and research has shown annually, nearly 1.2 million tons of soil becomes detached and 15 percent of that load leaves the watershed and washes downstream (TCRPC 2009). Of concern, the I&E Report identified 44 eroding stream banks that exceeded 10 feet, seven of these exceeded 19 feet in height. Additionally, 109 gullies were identified by the I&E Report along the main stem of the creek (IDNR 2006). Such sediment load washing from the Big Bureau Creek watershed cluster has led to infill and sedimentation of Goose Lake and adds to the sediment load to the Illinois River. To mitigate such consequences, the Wetlands Initiative was awarded an EPA grant in 2008 to analyze the market feasibility of grade control land and wetland restoration.

Additional concerns were identified in the Lee County reaches of Big Bureau Creek by the I&E Report. Concerns include significantly degraded and poor to very poor habitat quality. Much of this area has been channelized and riparian zones are either inadequate or non-existent; and at the time of the I&E Report, cattle were able to access significant portions of the creek, further degrading stream banks, riparian zones and accelerating runoff. Additionally, the I&E Report identified active tile lines, raw sewage outlets, active stream dumping and a lack of canopy cover. Despite such conditions, as the stream flows into Bureau County, the overall habitat conditions improved dramatically (IDNR 2006).

A total of 14 NPDES facilities are permitted within the Big Bureau Creek watershed cluster, this includes ten sewage treatment plants. Locations of NPDES within the watershed cluster are identified in Figure 6-2 and listed in Table 6-3. Additionally, CSOs are permitted in Bureau Junction (IL0033120). Furthermore the I&E Report identified 16 cattle operations along the main stem of the creek; impacting approximately 26,188 feet of the stream (IDNR 2006).

The Big Bureau Creek watershed has a significant amount of animal agriculture activities in the watershed. Table 6-2 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 6-2. Livestock populations in Big Bureau Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Bureau	6,655	6,415	421	575	41,653
La Salle	167	10	9	19	134
Lee	866	163	56	70	5,378
Total Number of Animals	**7,688**	**6,588**	**486**	**663**	**47,165**
Equivalent Animal Units	**7,688**	**132**	**972**	**66**	**18,866**

Source: USDA 2007-2009

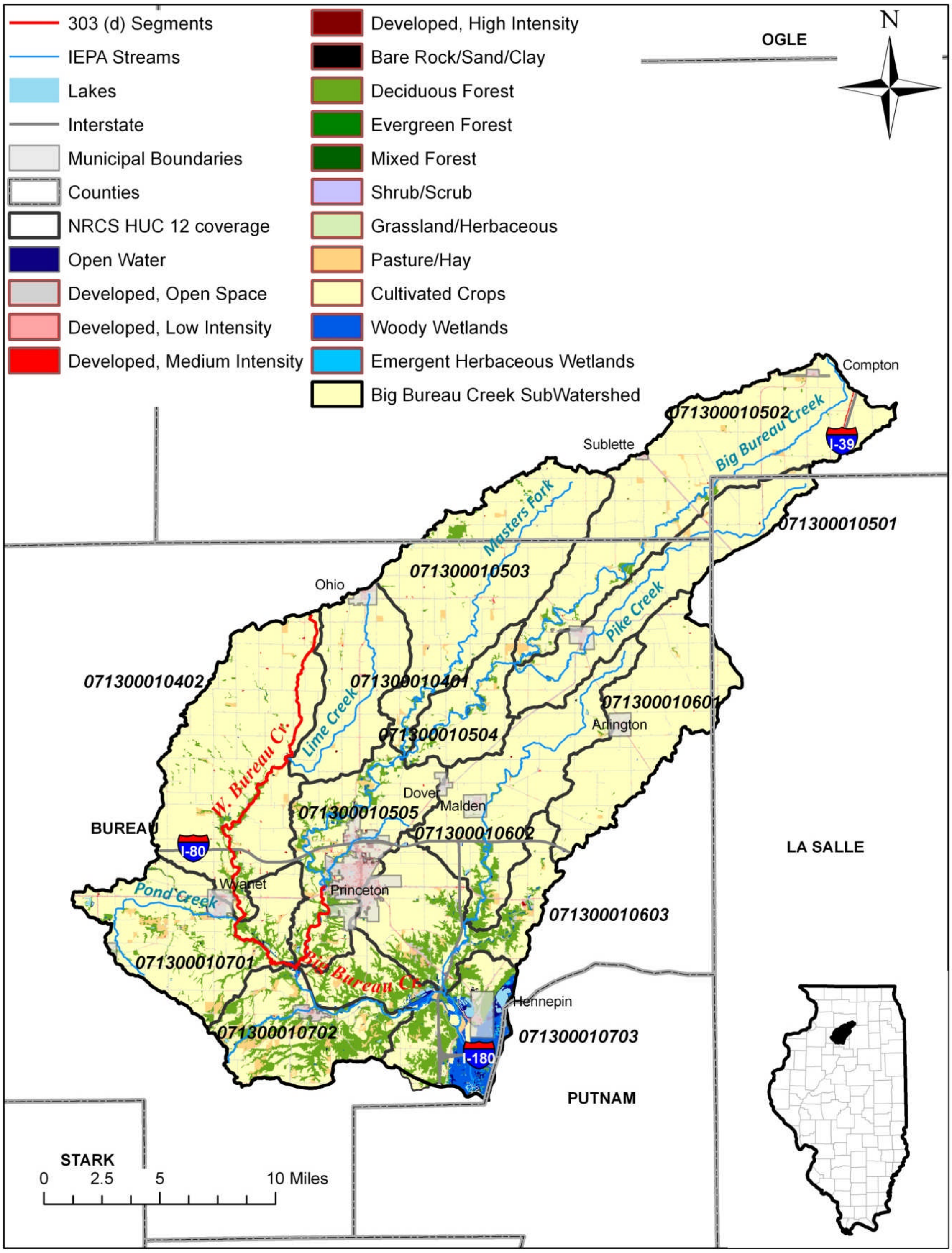

Figure 6-2. Big Bureau Creek watershed cluster land use.

Table 6-3. NPDES facilities within the Big Bureau Creek watershed cluster.

10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
07130001 04	IL0065056	CENTRAL LIMESTONE CO-MORRIS	--	--
	ILG580190	OHIO, VILLAGE OF STP	0.0766	Exempt
07130001 05	ILG580127	LAMOILLE, VILLAGE OF STP	0.063	Exempt
	IL0073652	SUBLETTE WTP	--	--
	IL0020575	PRINCETON, CITY OF STP	2.15	001, A01- limit 400
	IL0065757	PRINCETON WTP	--	--
	ILG551015	MAPLE ACRES MHP	0.0259	Exempt
07130001 06	IL0024791	MALDEN STP	0.05	Exempt
	IL0063363	DOVER WTP	--	--
07130001 07	IL0067024	PRAIRIE VIEW NURSING HOME STP	0.02	Exempt
	ILG580245	WYANET STP	0.25	Exempt
	IL0025160	TISKILWA STP	0.12	Exempt
	IL0033120	BUREAU JUNCTION STP	0.071	Exempt
	IL0042625	LAKE ARISPIE WATER CO STP	0.05	Exempt

"—" Not applicable

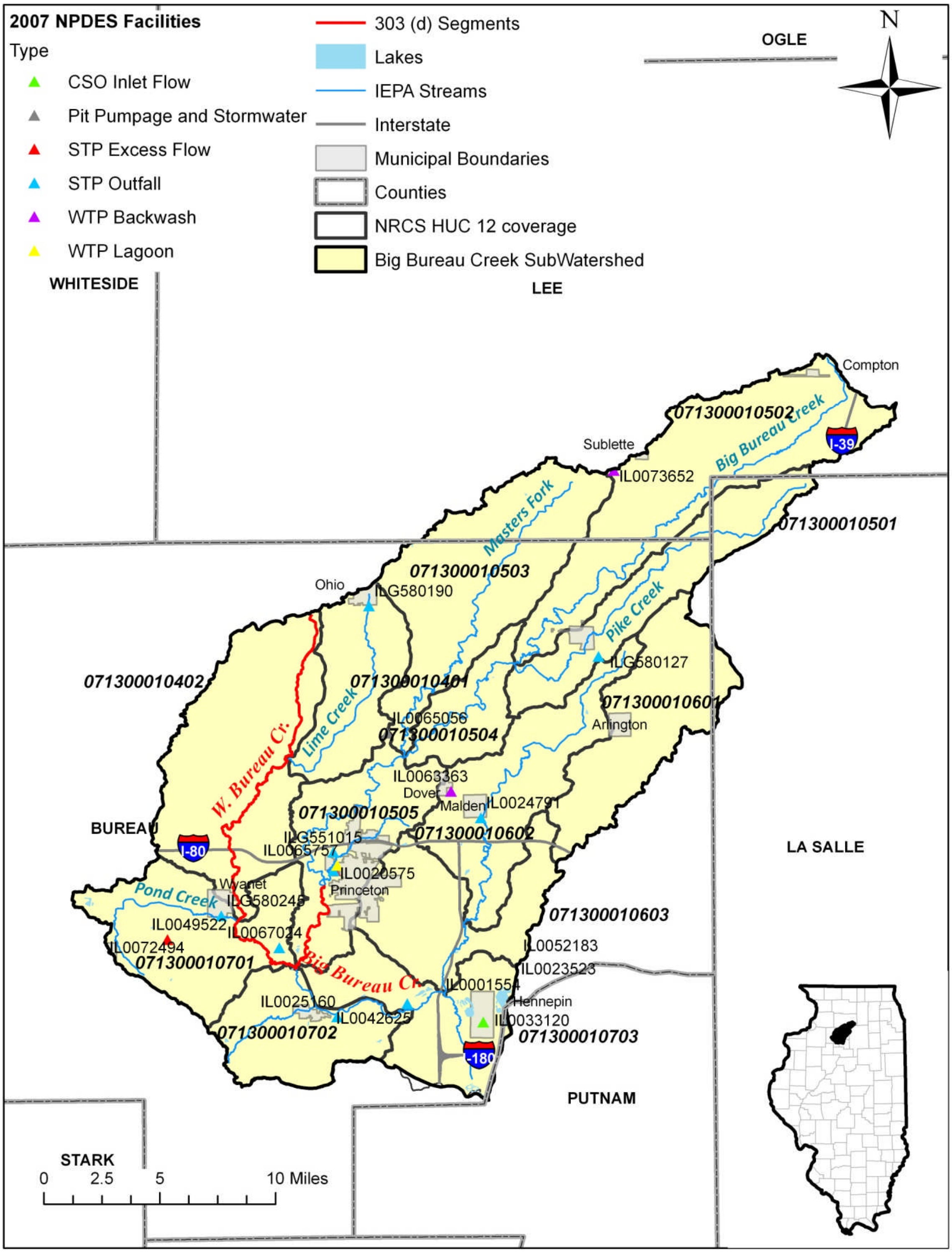

Figure 6-3. Big Bureau Creek watershed cluster NPDES facilities.

6.2 Watershed Linkage Analysis

6.2.1 Bacteria

Data collected within the Big Bureau watershed between 1979 and 2010 indicate fecal coliform exceedances throughout the watershed. Within the Big Bureau Creek watershed, the I&E Report found that concentrations of fecal bacteria decreased with downstream distance, suggesting that the primary sources of bacteria are located in the headwaters. Potential sources of bacteria observed during the I&E Report included raw sewage outlets and cattle access points (IDNR 2006). Sixteen cattle operations were identified by the I&E Report along the main stem of Big Bureau Creek, and as noted, some of these operations allowed direct access to the creek. Additionally, wastewater treatment facilities can be ongoing sources of bacteria, namely fecal coliform. Of particular concern, the Princeton treatment plant has been in violation of permit limitations for fecal coliform.

Bacteria have been sampled in three locations within the Big Bureau Creek watershed. These are: Big Bureau Creek at Princeton (DQ-03), West Bureau Creek at Wyanet (Site DQD-01), and Big Bureau Creek at Outlet (DQ-04). Figure 6-4 summarizes the annual trends in fecal coliform concentrations in Big Bureau Creek at Princeton. As is typical of fecal coliform, concentrations fluctuate considerably but there do not appear to be any significant long-term trends. West Bureau Creek shows similar trends, although fecal coliform concentrations are generally lower.

As shown in Figure 6-5 and Figure 6-6, seasonal trends are evident at sampling locations near Princeton and Wyanet, with highest counts at both sites occurring between July and September. This suggests a constant source of bacteria, like a wastewater treatment plant or cattle in the creek, which is unrelated to flow and has the largest impact during low flow periods. Sampling is limited at the outlet of Big Bureau Creek (Figure 6-7), making it impracticable to analyze seasonal trends at this location.

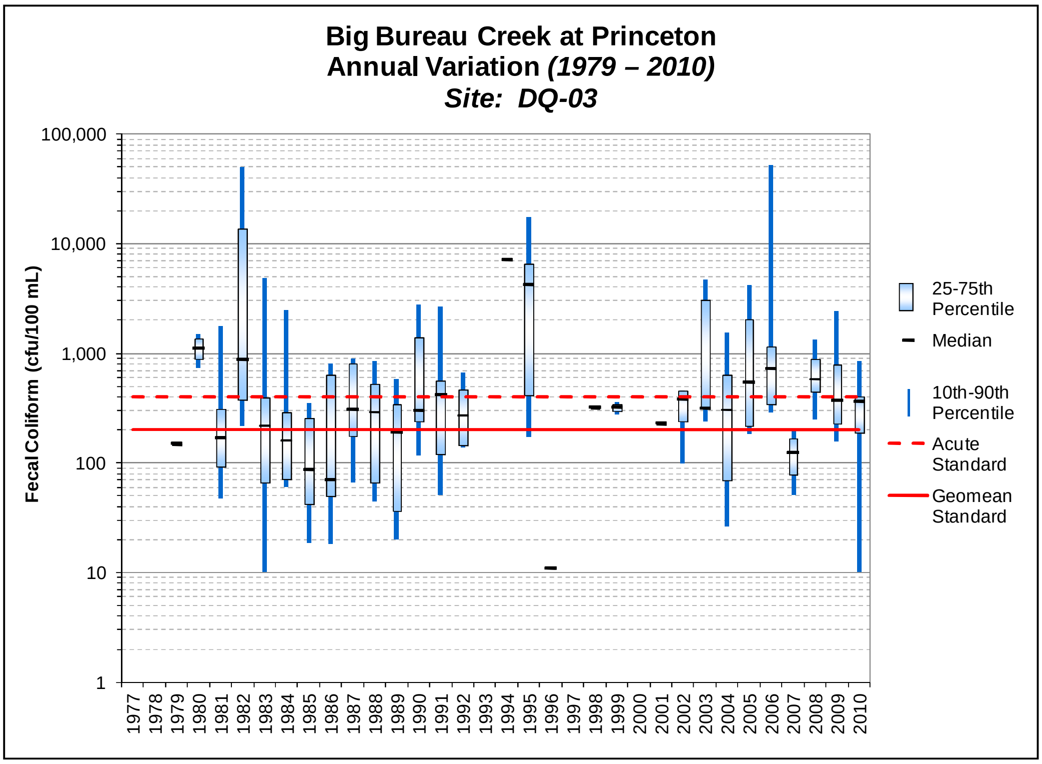

Figure 6-4. Annual fecal coliform concentrations, Big Bureau at Princeton, 1979 - 2010.

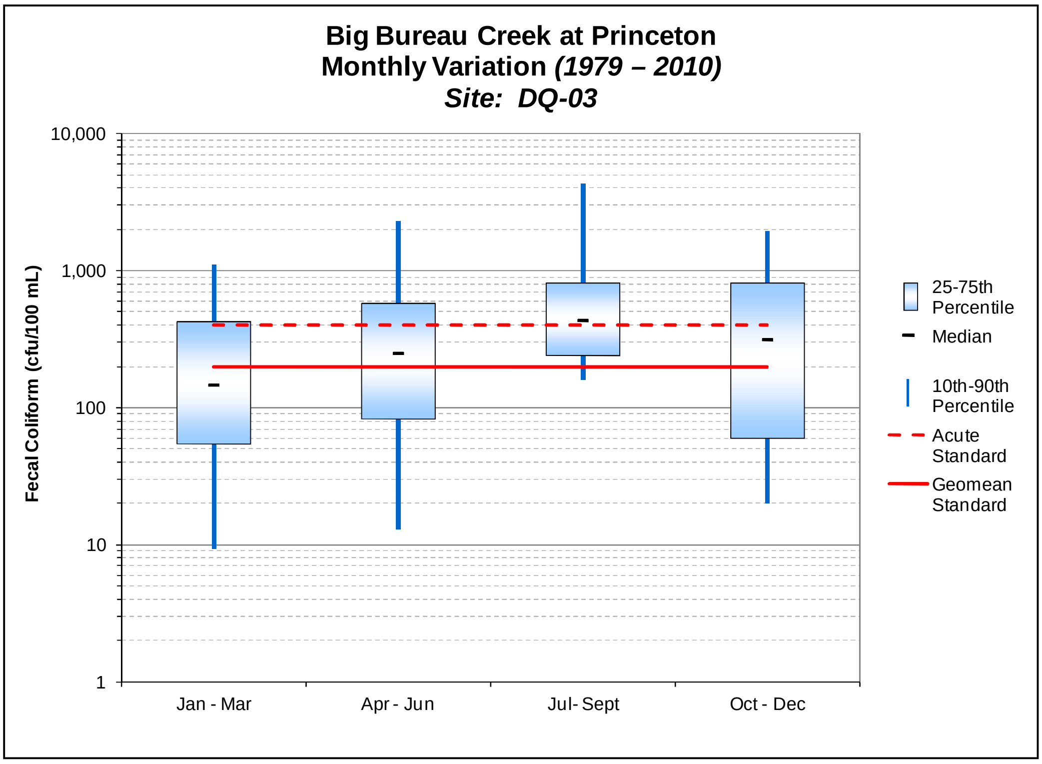

Figure 6-5. Seasonal fecal coliform concentrations, Big Bureau Creek at Princeton , 1979-2010.

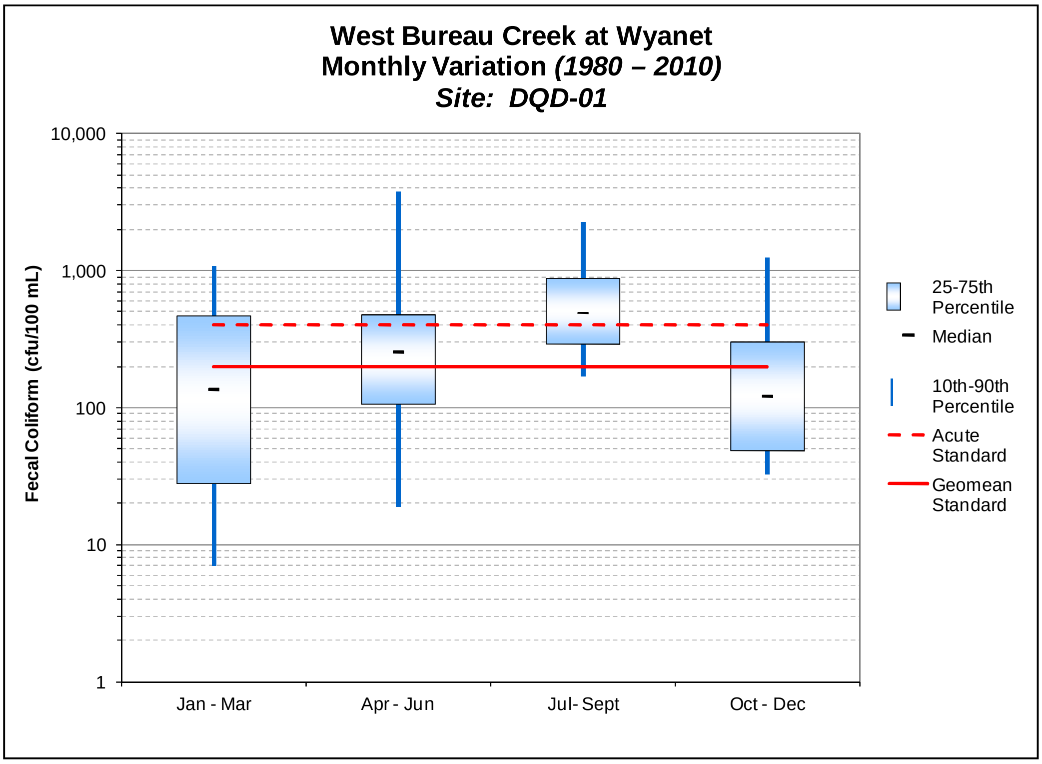

Figure 6-6. Seasonal fecal coliform concentrations, West Bureau Creek at Wyanet, 1980-2010.

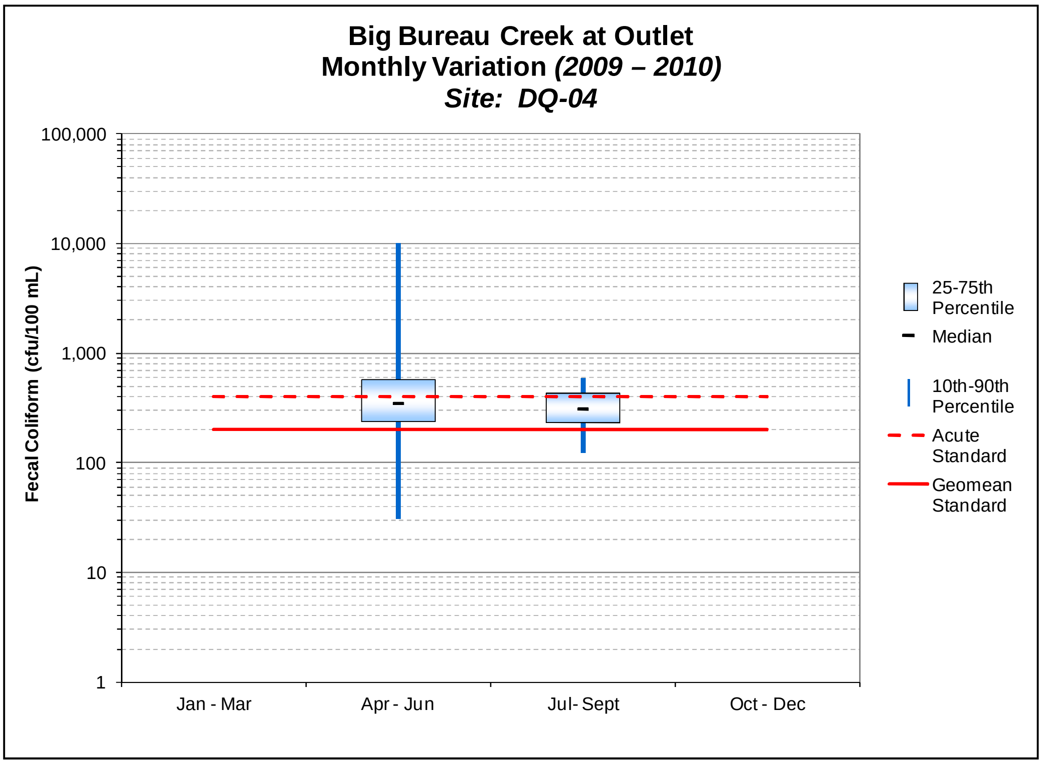

Figure 6-7. Seasonal fecal coliform concentrations, Big Bureau Creek at Outlet, 2009-2010.

Water quality duration curves were developed for each of the monitoring stations. Evaluation of the available fecal coliform data within Big Bureau Creek and West Bureau Creek indicates nonpoint and potentially point sources of fecal coliform pollution. The Big Bureau Creek at Princeton and West Bureau Creek water quality duration curves (Figure 6-8 and Figure 6-9) indicate that all flow regimes are contributing to exceedances, although high flow events are the largest contributor. As shown in Figure 6-8 and Figure 6-9, both runoff events and non-runoff events show exceedances of the standards; however, runoff events typically correspond to exceedances during the high flow and moist conditions. Sources of bacteria during high flow events are typically derived from urban and rural runoff, the wash-off of wastes from failing septic systems, and in-stream bacteria re-suspension. The City of Princeton wastewater treatment facility has had numerous permit limits exceedances for fecal coliform bacteria during the last three years, and is a likely source of bacteria during low flow and dry conditions. In addition, cattle in and adjacent to the creek may also be a source of fecal coliform bacteria. Based on data contained within the Source Assessment, approximately 3,000 cattle are found within the Big Bureau Creek drainage area versus 1,400 cattle within the West Bureau drainage area. No strong correlation between the estimated number of cattle within each watershed and the monitored fecal coliform data was found (see Section 2.1.2). There are no identified permit exceedances within the West Bureau watershed. Bureau Junction has a permitted CSO (IL0033120), which may be a minor source of bacteria during runoff events within this watershed. The facility has had one reported overflow in the past few years which lasted 30 minutes.

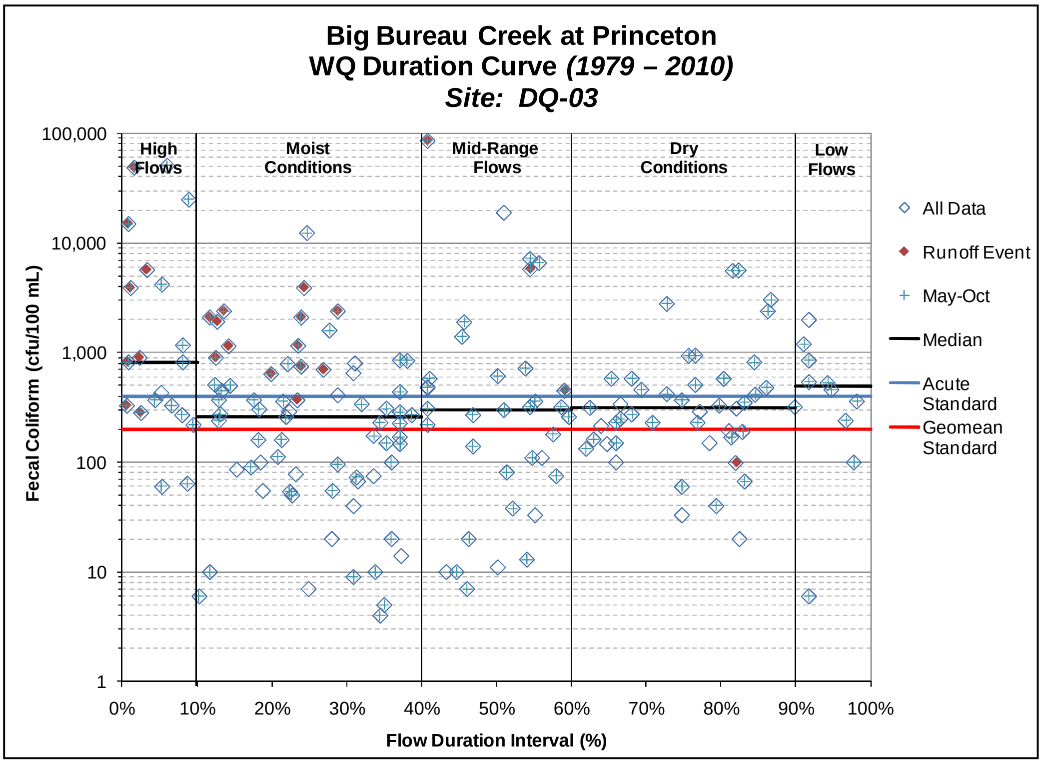

Figure 6-8. Fecal coliform water quality duration curve, Big Bureau Creek at Princeton, 1979 – 2010.

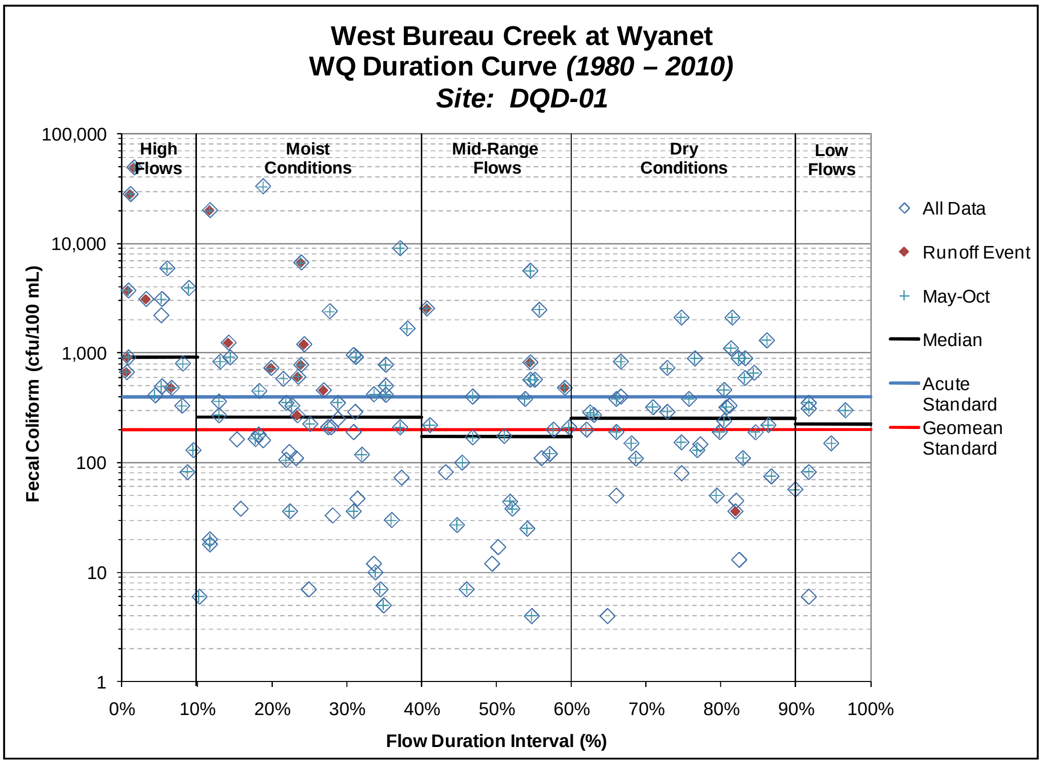

Figure 6-9. Fecal coliform water quality duration curve, West Bureau Creek at Wyanet, 1980 – 2010.

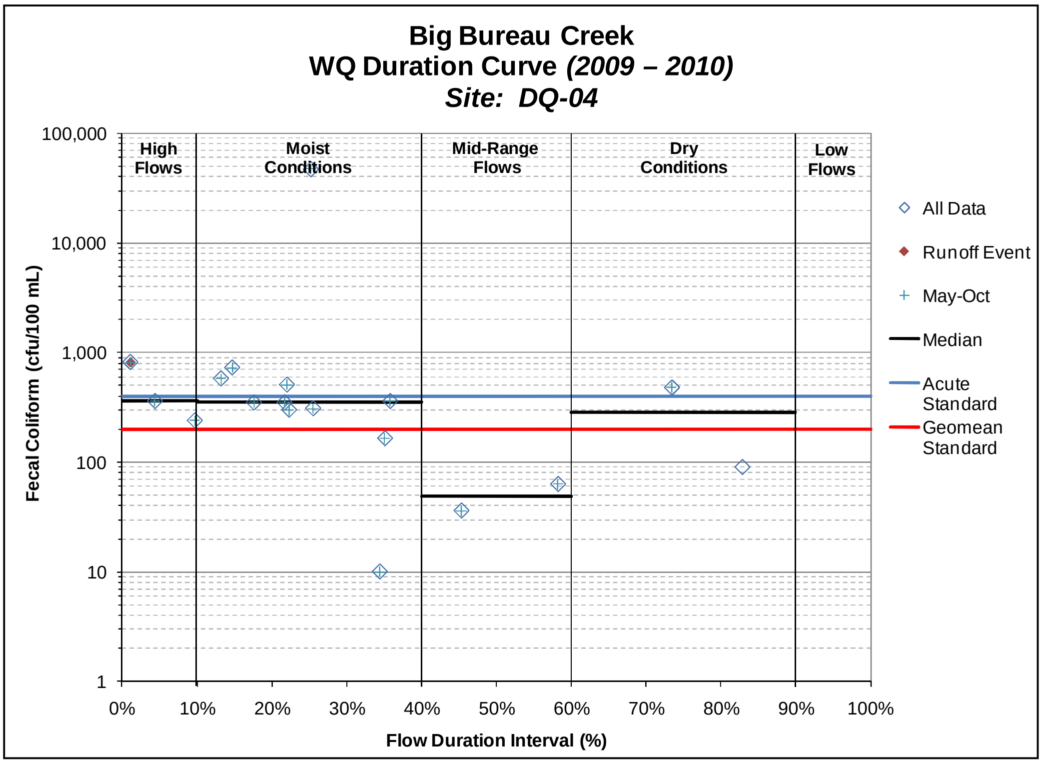

Figure 6-10. Fecal coliform water quality duration curve, Big Bureau Creek at Outlet, 2009 – 2010.

6.2.2 Total Suspended Solids

Total suspended solids (TSS) generally include both organic and inorganic materials that are suspended in the water column. TSS is often considered an indication of water clarity and is typically directly related to runoff events (i.e., higher TSS concentrations are associated with more runoff). In general, areas of accumulated fine-grained sediment or sand and gravel substrate buried by feet of 'muck' in Big Bureau Creek tended to be located immediately downstream of a livestock operation or large bank and gully erosion locations (IDNR 2006).

It is estimated by the I&E Report that nearly 1.2 million tons of soil becomes detached each year in the Big Bureau Creek watershed (IDNR 2006). Although stream bank erosion was found to account for 24 percent and gully erosion accounted for eight percent of the sediment that leaves the watershed, sheet and rill erosion accounts for the majority of watershed erosion within watershed (IDNR 2006). Contributions from bank erosion are proportionally higher in this watershed relative to other watersheds in the region. This may be due to the fact that 44 eroding stream banks were identified that exceeded 10 feet, and seven of these exceeded 19 feet in height (IDNR 2006). In total, it is estimated that 8,528 feet of stream length of Big Bureau Creek is significantly affected by bank or bluff erosion. Furthermore, 109 gullies were identified by the I&E Report along the main stem of the creek (IDNR 2006). Finally, numerous knick points (a sharp change in streambed slope) were identified, with the majority between Princeton and Tiskilwa; knick points were commonly found adjacent to large bluffs (IDNR 2006).

TSS has been sampled in three locations within the Big Bureau Creek watershed including: Big Bureau Creek at Princeton (DQ-03), West Bureau Creek at Wyanet (Site DQD-01) and, Big Bureau Creek at Outlet (DQ-04). Analysis of the data at DQ-04 is not included due to a limited data, LRSs are provided for this site in Section 6.5. Figure 6-11 summarizes the annual variation of TSS concentrations over time.

TSS concentrations vary year to year, but often fall at or below the target concentration. There does not appear to be any significant long-term trends, although TSS concentrations sampled during the past 10 years are somewhat lower than in the previous 10 years. Only slight seasonal trends are evident at sampling locations near Princeton and Wyanet, with slightly higher concentrations at both sites typically occurring between July and September. Sampling is more limited at the outlet of Big Bureau Creek and no definitive pattern could be determined.

The TSS water quality duration curve (Figure 6-12) developed for Big Bureau Creek shows a direct relationship between TSS and flow; as flow increases, so does TSS. Moreover, TSS concentrations during runoff events are typically elevated and correlated with moist conditions and high flows. This relationship indicates high flow, runoff events as the primary cause of elevated TSS loading, specifically bank and in-stream sources. As discussed above, varying forms of erosion have been identified as a source of sediment to the Big Bureau Creek watershed, especially bluff and bank erosion. In addition to high flow exceedances, the water quality duration curve developed for West Bureau Creek (Figure 6-13) shows increasing concentrations in both high flow and low flow conditions.

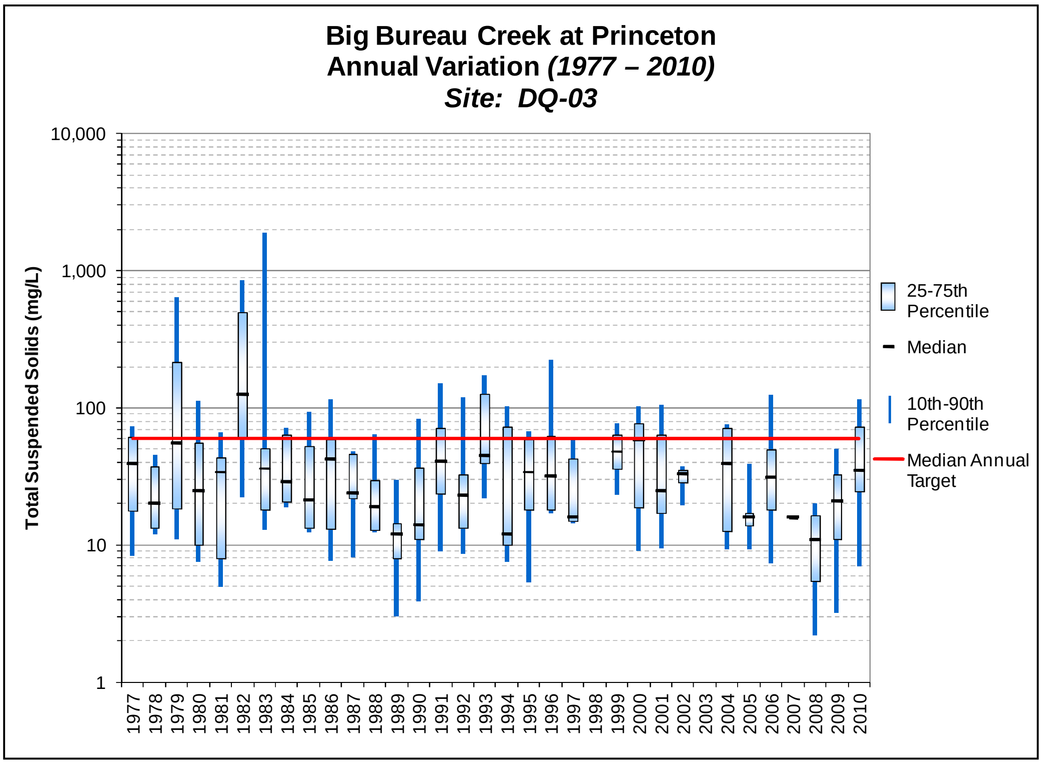

Figure 6-11. Annual TSS concentrations, Big Bureau at Princeton, 1977 - 2010.

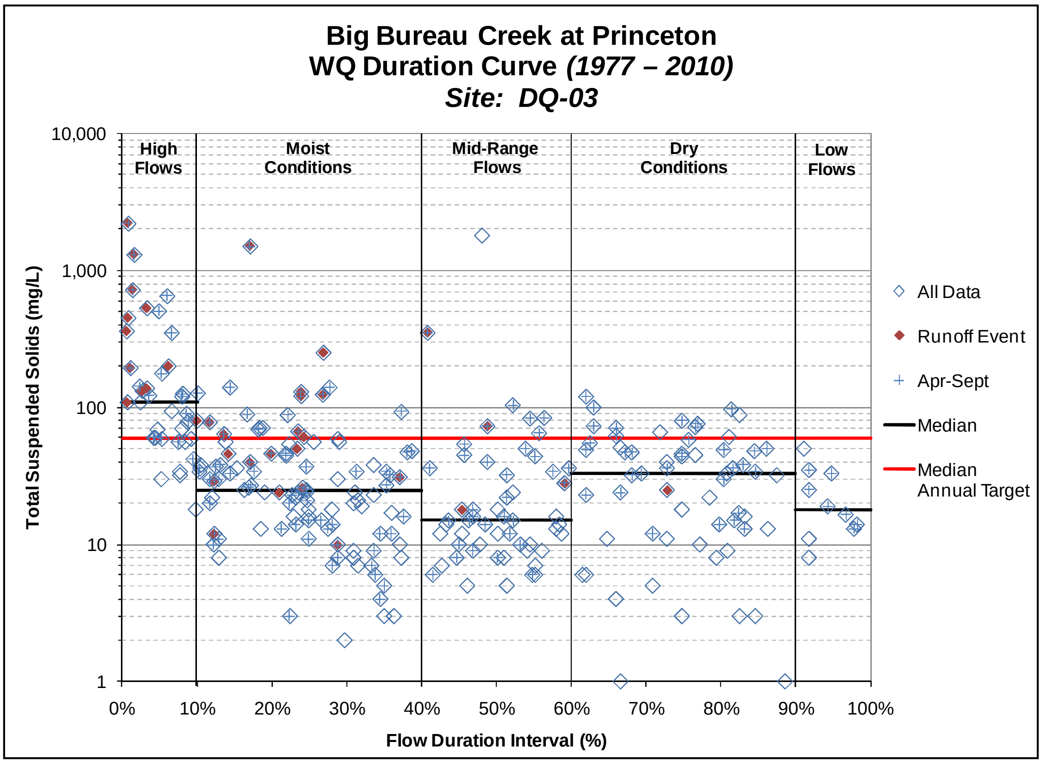

Figure 6-12. TSS water quality duration curve, Big Bureau Creek at Princeton, 1977 – 2010.

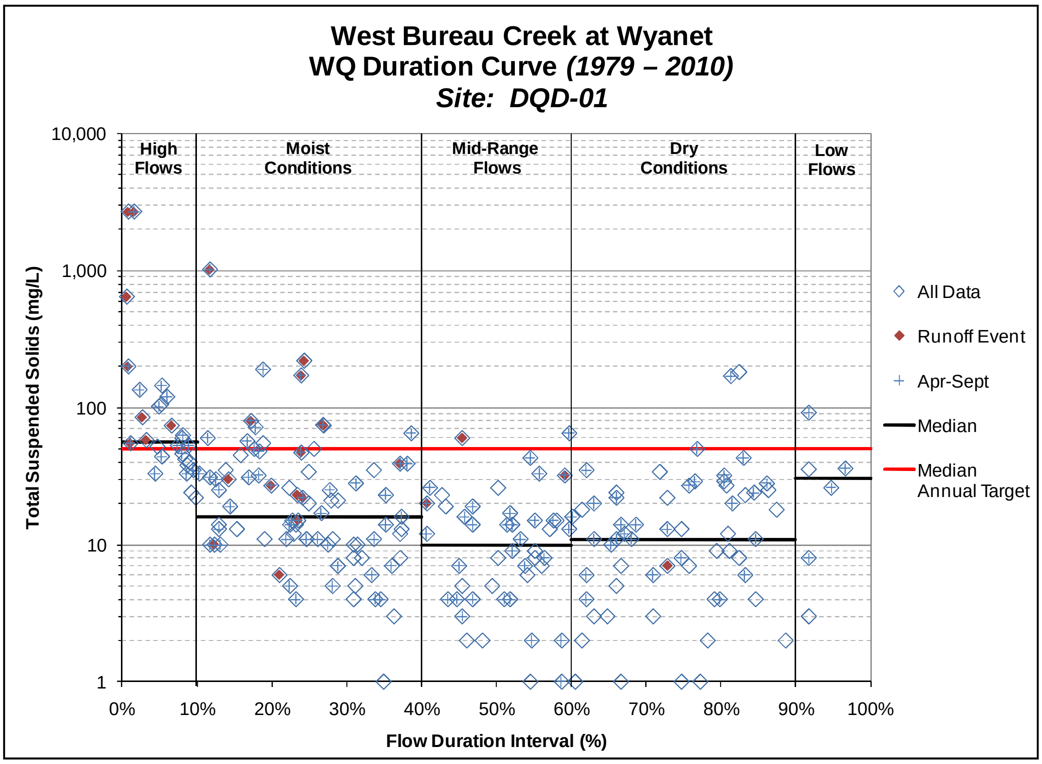

Figure 6-13. TSS water quality duration curve, West Bureau Creek at Wyanet, 1979 – 2010.

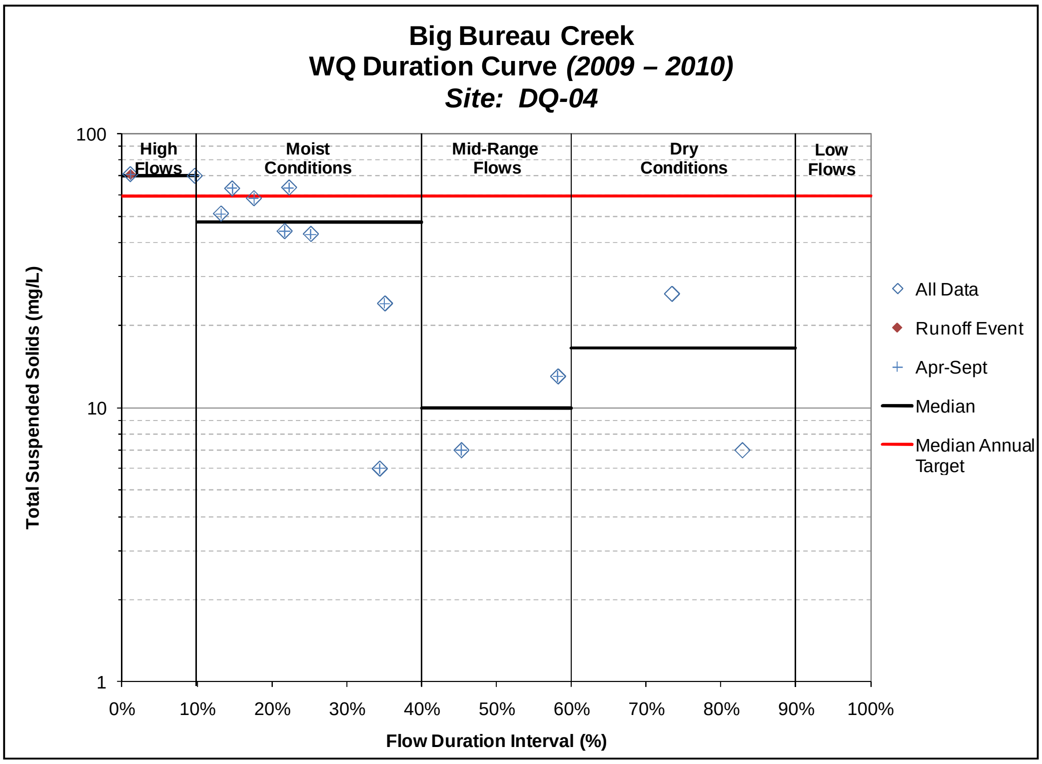

Figure 6-14. TSS water quality duration curve, Big Bureau Creek at Outlet, 2004 – 2010.

6.2.3 Nutrients

Elevated concentrations of nutrients are commonly detected in the watershed. Similar to other water quality concerns, nitrogen was found to be more elevated in upstream reaches of Big Bureau Creek. This again indicates that significant sources are located near the headwaters and are potentially a function of land practices (IDNR 2006); specific nutrient generating land practices include application of fertilizer and spreading of manure on fields.

Wastewater treatment facilities can be ongoing sources of nutrients. Two sewage treatment plants have had violations in effluent limitations (ammonia as nitrogen) within the last three years including the Village of Princeton and Prairie View Nursing Home STP. The plants do not have limits for phosphorus and are therefore likely discharging TP at concentrations between 4 and 7 mg/L (USGS 1999). Additionally, 16 cattle operations were identified along the main stem of Big Bureau Creek by the I&E Report (IDNR 2006).

Nutrients have been sampled in three locations within the Big Bureau Creek watershed including: Big Bureau Creek at Princeton (DQ-03), West Bureau Creek at Wyanet (Site DQD-01) and, Big Bureau Creek at Outlet (DQ-04). Analysis of the data at DQ-04 is not included due to a limited data, LRSs are provided for this site in Section 6.5. Figure 6-15 and Figure 6-16 summarize annual phosphorus concentrations. Mean annual phosphorus concentrations are higher in Big Bureau Creek than West Bureau Creek, exceeding the in-stream target in all but two years. Figure 6-17 and Figure 6-18 summarize the annual nitrogen data for Big Bureau Creek and West Bureau Creek, respectively. Annual mean concentrations of nitrate exceed the instream water quality target for Big Bureau Creek and West Bureau Creek in all but one year on West Bureau Creek.

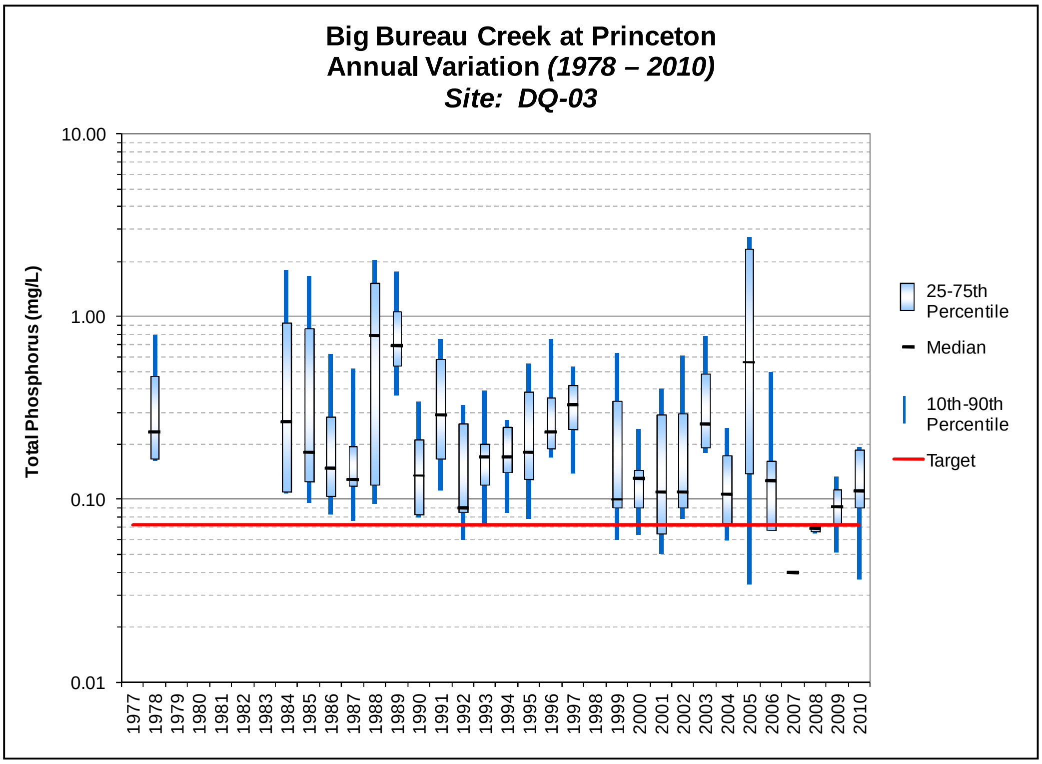

Figure 6-15. Annual phosphorus concentrations, Big Bureau at Princeton, 1978 - 2010.

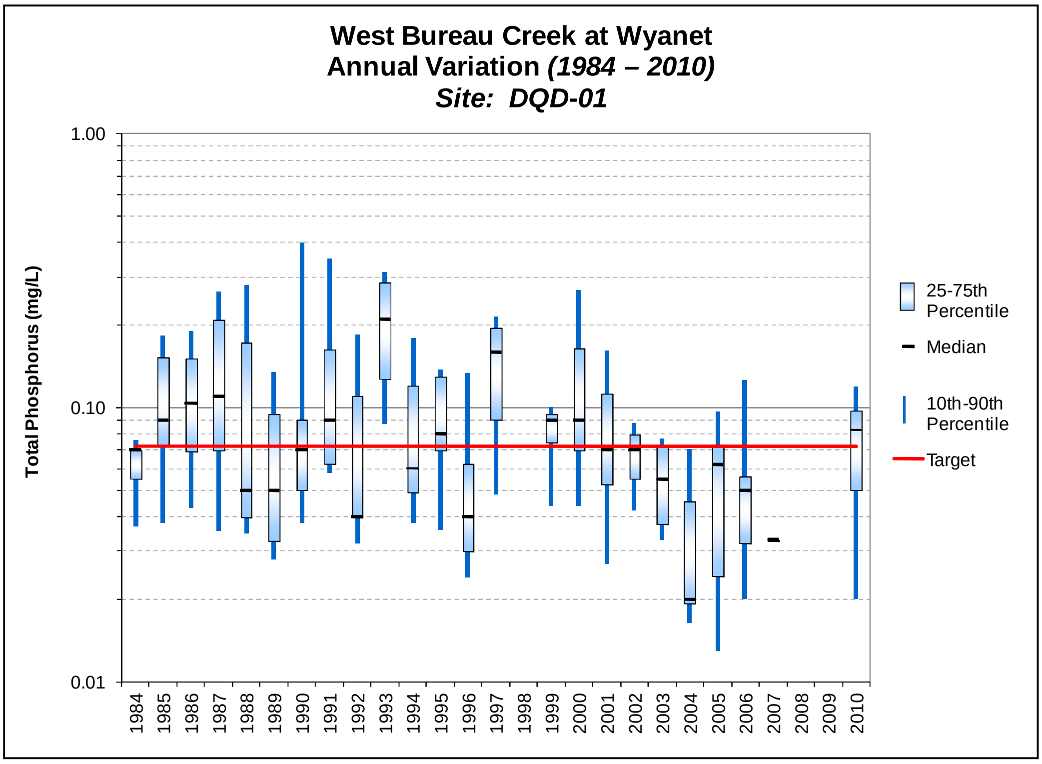

Figure 6-16. Annual phosphorus concentrations, West Bureau at Wyanet, 1984 - 2010.

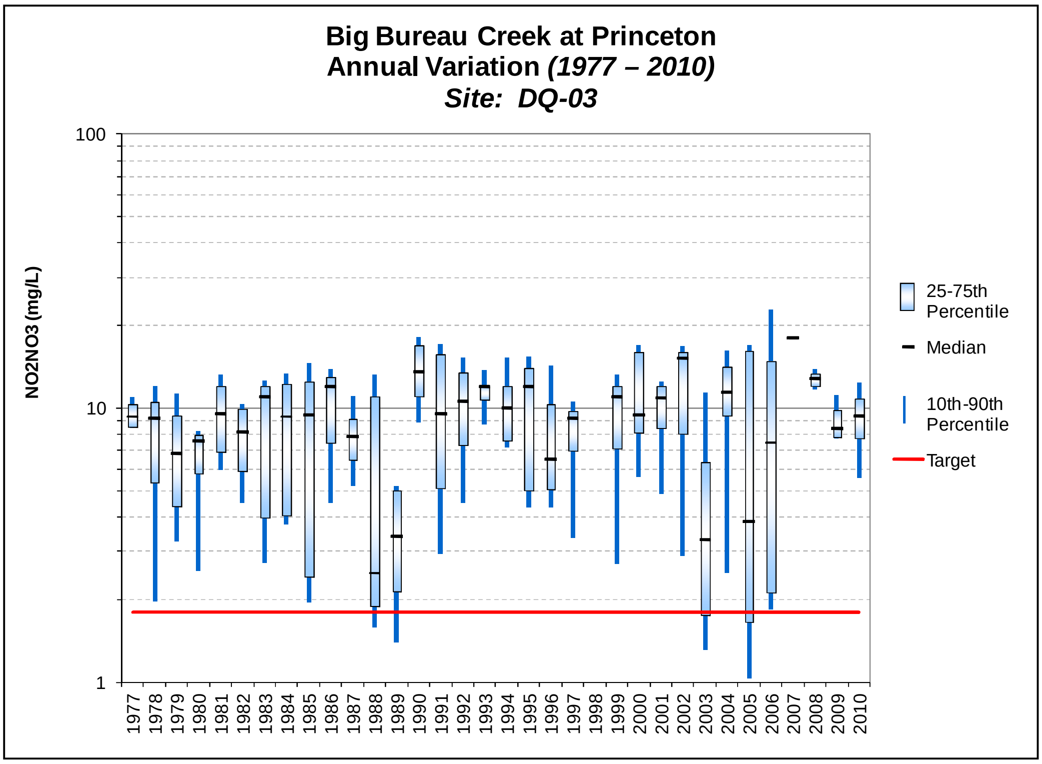

Figure 6-17. Annual nitrogen concentrations, Big Bureau at Princeton, 1977 - 2010.

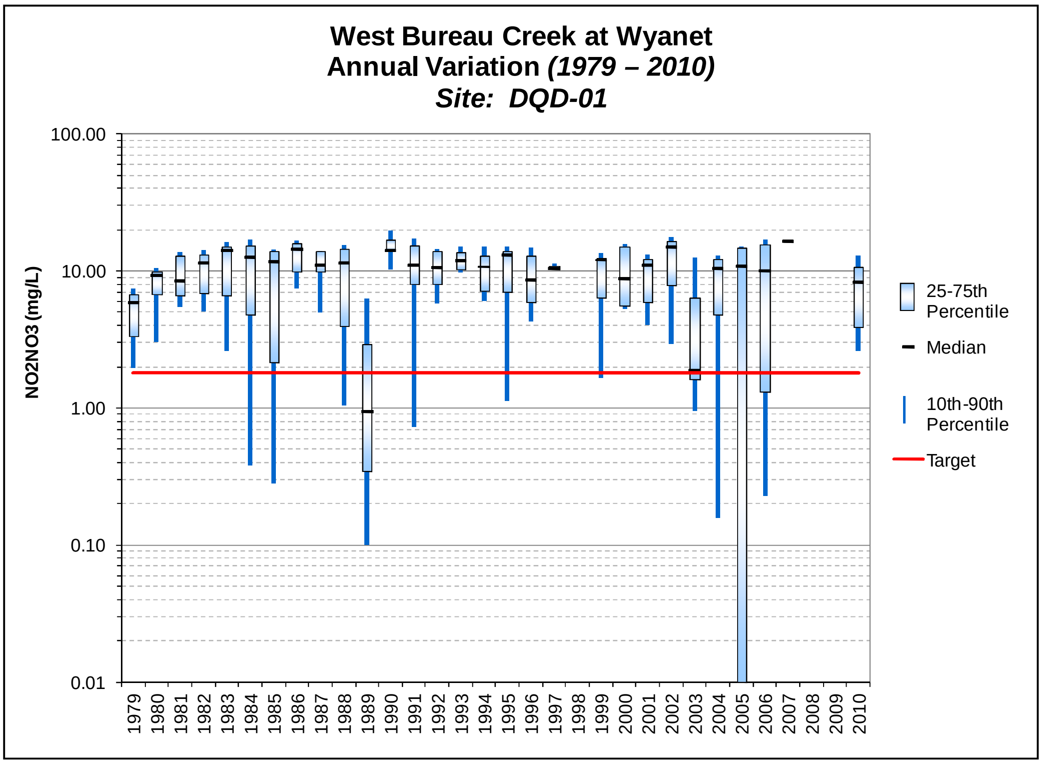

Figure 6-18. Annual nitrogen concentrations, West Bureau at Wyanet, 1979 - 2010.

Nutrient concentrations are typically elevated throughout the year, with the highest phosphorus seen later in the year (July-September) and the highest nitrogen concentrations typically seen in spring (April-June). It is evident that there is little variation in nitrogen concentrations within early season concentrations relative to the substantial range of concentrations shown from July through December. Elevated median concentrations occurring during spring and early summer likely correspond to spring rains and snowmelt paired with land use activities such as fertilizer application on lawns and farm fields. Such trends also indicate nonpoint source pollution as a significant source of nitrate.

Phosphorus concentrations in Big Bureau Creek are elevated July through December. In general, this period corresponds to decreasing precipitation and runoff events. Due to the lack of relationship with rainfall, these analyses indicate point sources as the most significant source of phosphorus in Big Bureau Creek. The source assessment identifies numerous wastewater or sewage treatment plants within the Big Bureau Creek watershed cluster. The high concentration of WWTPs further indicates a probability of point source pollution being the leading cause of elevated phosphorus concentrations. Seasonal phosphorus data for West Bureau Creek shows the opposite trends with higher concentrations occurring during the spring months, which indicates spring snowmelt and rainfall as a significant source of nutrients.

Further analysis of nutrient concentrations and flow conditions in Big Bureau Creek at Princeton indicates a probable mixture of point and nonpoint sources of nutrients. Data analyzed on Big Bureau Creek shows increasing phosphorus concentrations with decreasing flows (Figure 6-19). These figures show only a slight relationship between phosphorus concentrations and runoff events; the majority of runoff events correspond with near average concentrations of phosphorus. These results indicate a constant source of phosphorus, which is likely related to the two sewage treatment plants upstream of the sampling point.

Additional potential low flow sources include cattle operations and wastewater or sewage effluents identified in the I&E Report (IDNR 2006). Data analyzed on West Bureau Creek shows higher phosphorus concentration during high flow conditions, thus indicating runoff and nonpoint sources as the primary source of phosphorus in that watershed (Figure 6-20).

In contrast to phosphorus data, as shown in Figure 6-21 though Figure 6-22, nitrogen concentrations are most often elevated during high flow, moist conditions and mid-range flows. Concentrations also increase during the winter and spring. It may therefore be that fertilizers applied during the spring are washing into the stream during snowmelt and rainfall events.

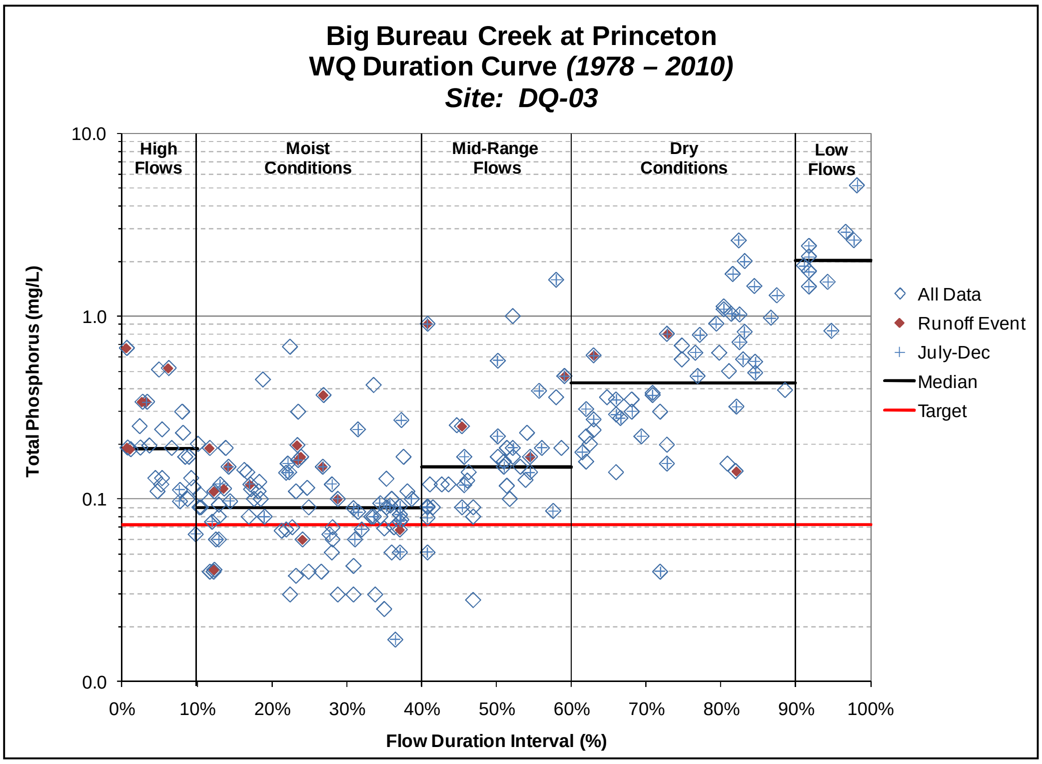

Figure 6-19. Phosphorus water quality duration curve, Big Bureau Creek at Princeton, 1978 – 2010.

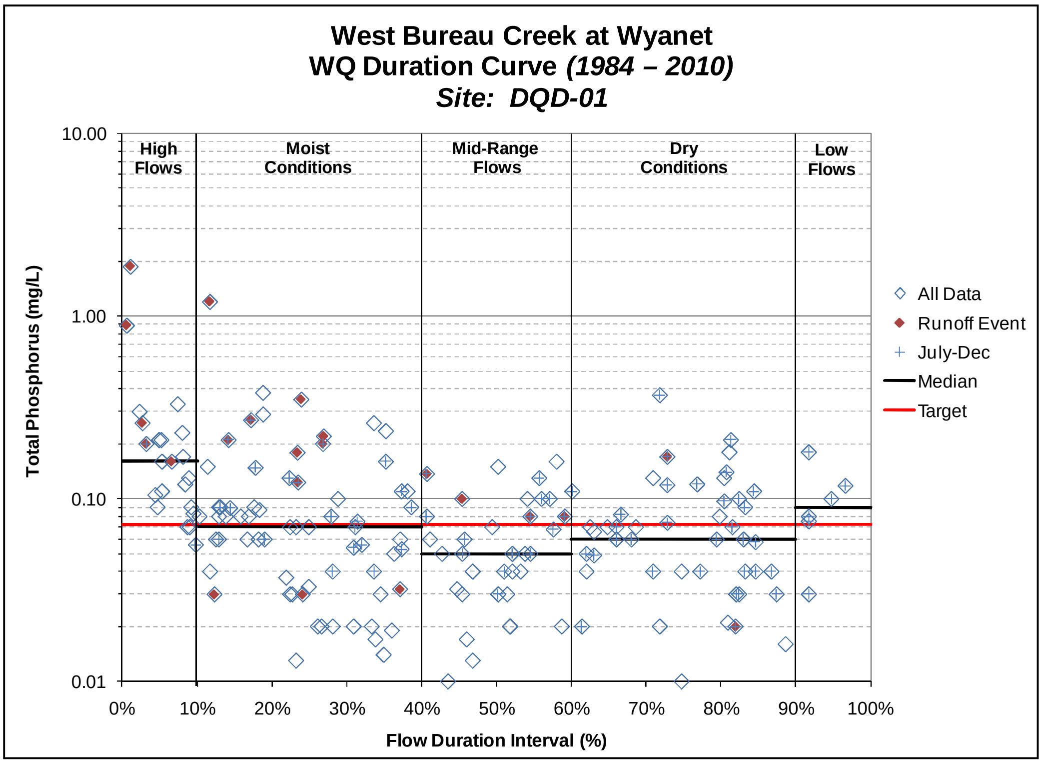

Figure 6-20. Phosphorus water quality duration curve, West Bureau Creek, 1984 – 2010.

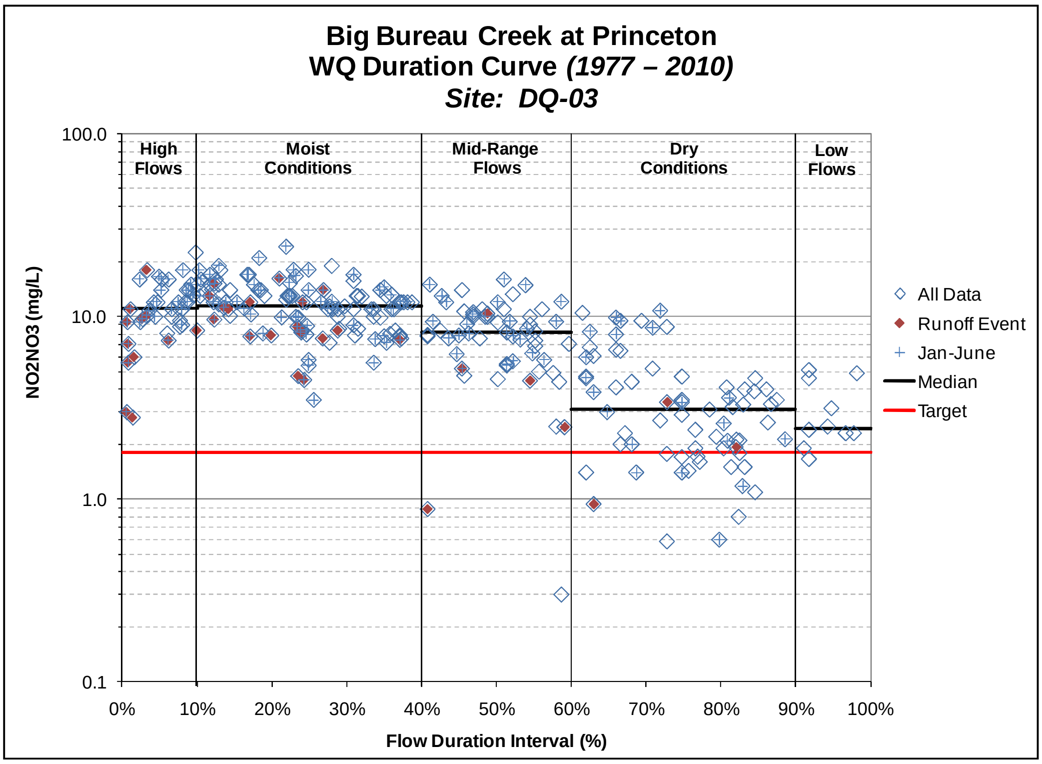

Figure 6-21. Nitrogen water quality duration curve, Big Bureau Creek at Princeton, 1977 – 2010.

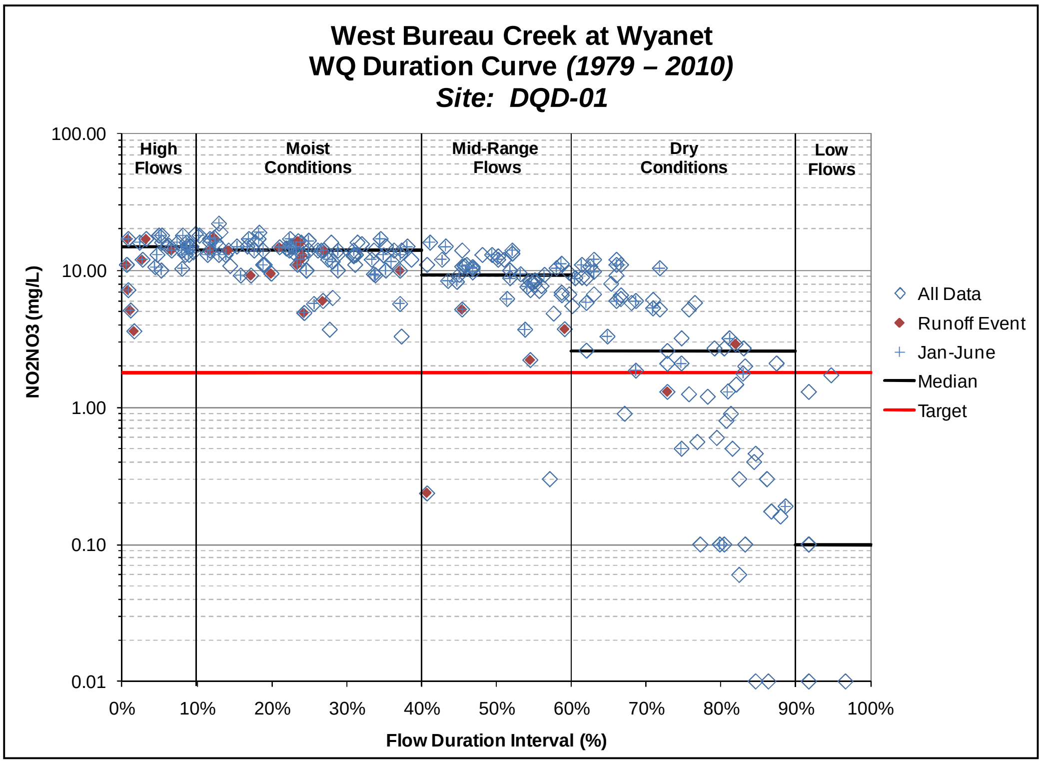

Figure 6-22. Nitrogen water quality duration curve, West Bureau Creek at Wyanet, 1979 – 2010.

6.3 West Bureau Creek TMDL and LRS (site DQD-01)

Table 6-4 summarizes the West Bureau Creek watershed and pollutant sources. The West Bureau Creek watershed includes one bacteria impaired segment. Figure 6-23 presents the fecal coliform load duration curve and Table 6-5 presents the TMDL for the West Bureau Creek at the Wyanet assessment site. LRSs are presented in Sections 6.3.2 and 6.3.3 for TSS and nutrients, respectively.

Table 6-4. West Bureau Creek summary table.

Upstream Characteristics	
Drainage Area	86 square miles
Sampling Station	DQD-01
Listed Segments	DQD-01
Land Use	cultivated crops (90 percent); developed open space (four percent); deciduous forests (three percent); developed land including low, medium, and high intensity (one percent); pasture/hay (one percent); other (one percent).
Soil Type	77% B, 19% B/D, 1% C, 3% A, <1% C/D, <1% A/D, 0% D
Erodible Soils	14% Highly Erodible, 86% Not Assessed
Animal Unit Density	5,100; 59 per square mile
Key Sources	streambank, bluff, and gully erosion; urban and agricultural stormwater runoff; livestock access to waterways; animal agriculture; untreated sewage; NPDES facilities
NPDES Facilities	Ohio, Village Of STP (ILG580190)
NPDES Facility Disinfection Exemption [a]	This facility has a disinfection exemption
Fecal Coliform Exceedance Summary [b]	This facility has not exceeded the 400 cfu/100 mL standard according to DMR data from 2005-2010
MS4 Communities	None
CSO/SSO Communities	None

a. See Table 6-3 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

6.3.1 Bacteria TMDL

Figure 6-23 presents the load duration curve and TMDL for fecal coliform at the West Bureau Creek at Wyanet assessment site. Table 6-5 summarizes the TMDL and required reductions. Bacteria load reductions are needed across all flow conditions, with higher reductions needed under higher flow conditions. Watershed runoff and livestock are believed to be the primary non-natural sources of bacteria in the watershed. As such, recommended actions include urban stormwater management and agricultural best management practices such as manure management to limit runoff and prevent bacteria being conveyed to the Creek. Livestock exclusion fencing should be used to limit cattle activities in and near the Creek. Failing septic systems and other potential sources of untreated sewage should be further investigated and evaluated to determine proper implementation activities.

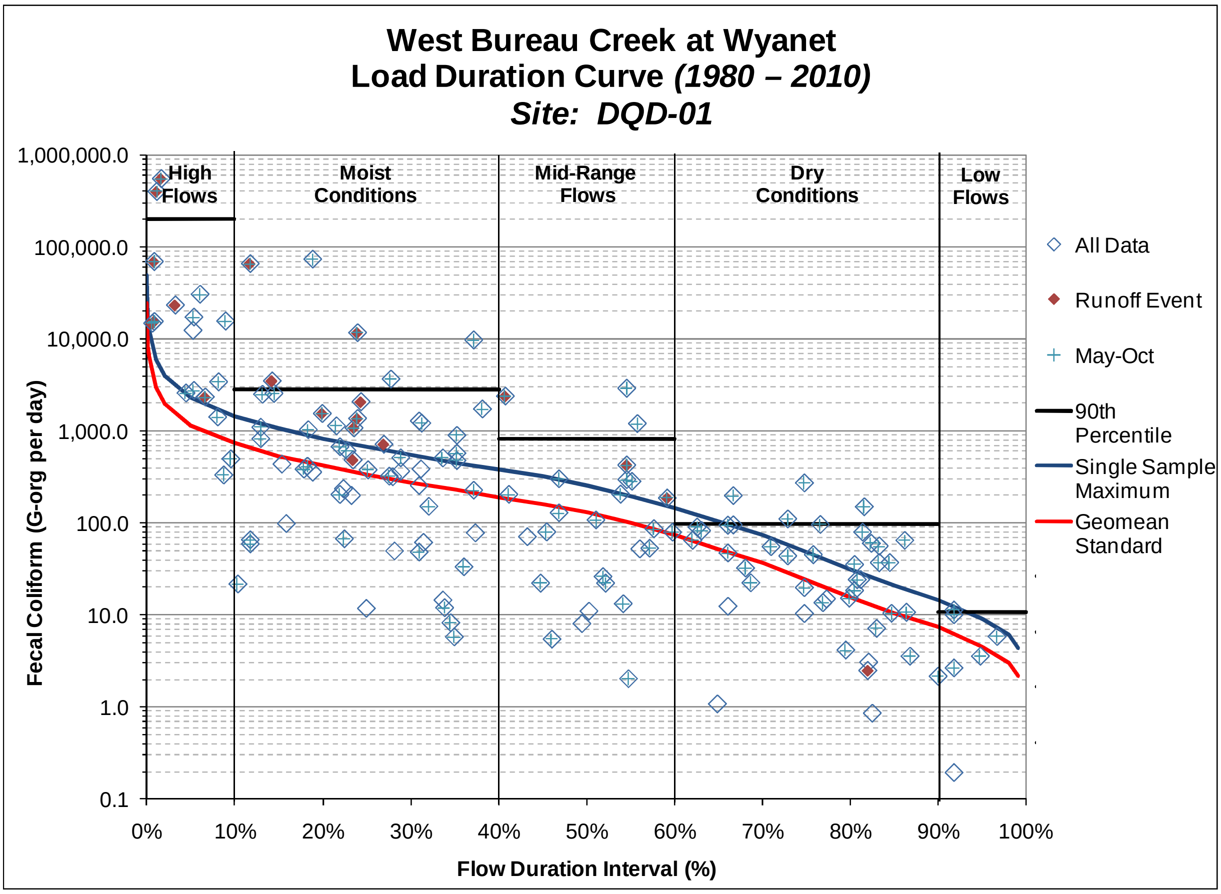

Figure 6-23. Fecal coliform load duration curve, West Bureau Creek at Wyanet (DQD-01).

Table 6-5. Fecal coliform TMDL, West Bureau Creek at Wyanet (DQD-01).

Station DQD 01 TMDL[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Fecal Coliform (G-org/day)	Current Load	201,537	2,843	814	96	11
	LA[a]	2,067	601	233	42	7
	WLA: NPDES Facilities	3	3	1	1	1
	Total WLA	3	3	1	1	1
	MOS (10%)	230	67	26	5	1
	TMDL=LA+WLA+MOS	2,298	671	260	48	9
	TMDL Reduction %[b]	98.86%	76.40%	68.11%	50.51%	15.15%

a. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime
b. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

6.3.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 6-6 for West Bureau Creek at DQD-01 using the volume weighted target for TSS presented in Section 3. Stream, bluff, and gully restoration activities are needed to address the TSS reductions. Cattle exclusion fencing should also be promoted to limit cattle activities that can lead to back failure.

Table 6-6. TSS LRS, West Bureau Creek (DQD-01).

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
West Bureau Creek	DQD-01	281	50.4	82%

6.3.3 Nutrient LRS

Figure 6-24 and Figure 6-25 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the West Bureau Creek at Wyanet assessment site. Table 6-7 and Table 6-8 summarize the LRS and required reductions. Nutrient load reductions are highest under higher flow conditions, indicating that runoff and nonpoint sources should be the focus of implementation activities. Fertilizer and manure management in the agricultural land uses and urban stormwater best management practices can be used to achieve nutrient reductions. Untreated sewage sources should also be investigated and eliminated.

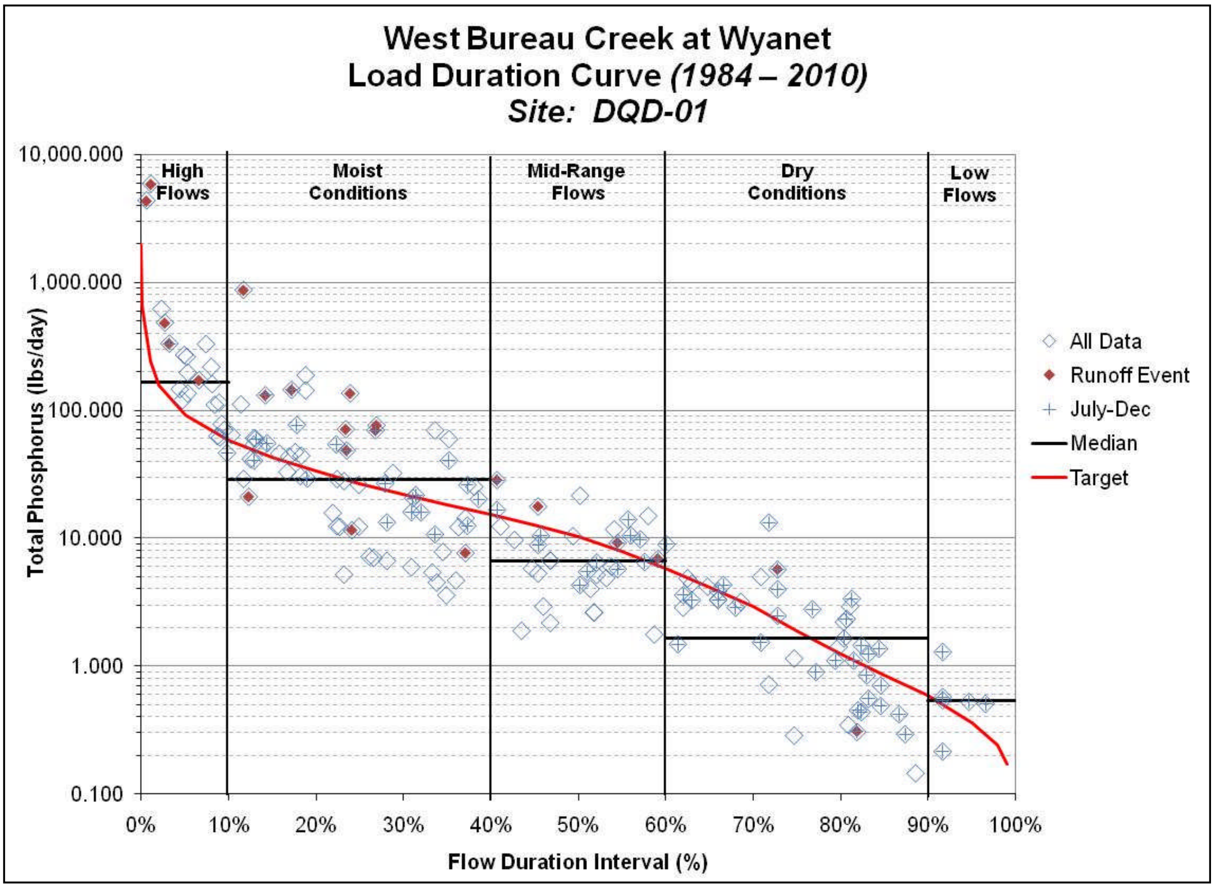

Figure 6-24. Total phosphorus load duration curve, West Bureau Creek at Wyanet (DQD-01).

Table 6-7. Total phosphorus LRS, West Bureau Creek at Wyanet (DQD-01).

Station DQD 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	LRS Component	0-10%	10-40%	40-60%	60-90%	90-100%
Total Phosphorus (lbs/day)	Current Load	166	29	7	2	1
	LRS Target	91	27	10	2	0.4
	LRS Reduction %	44.98%	8.03%	0%	0%	32.23%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

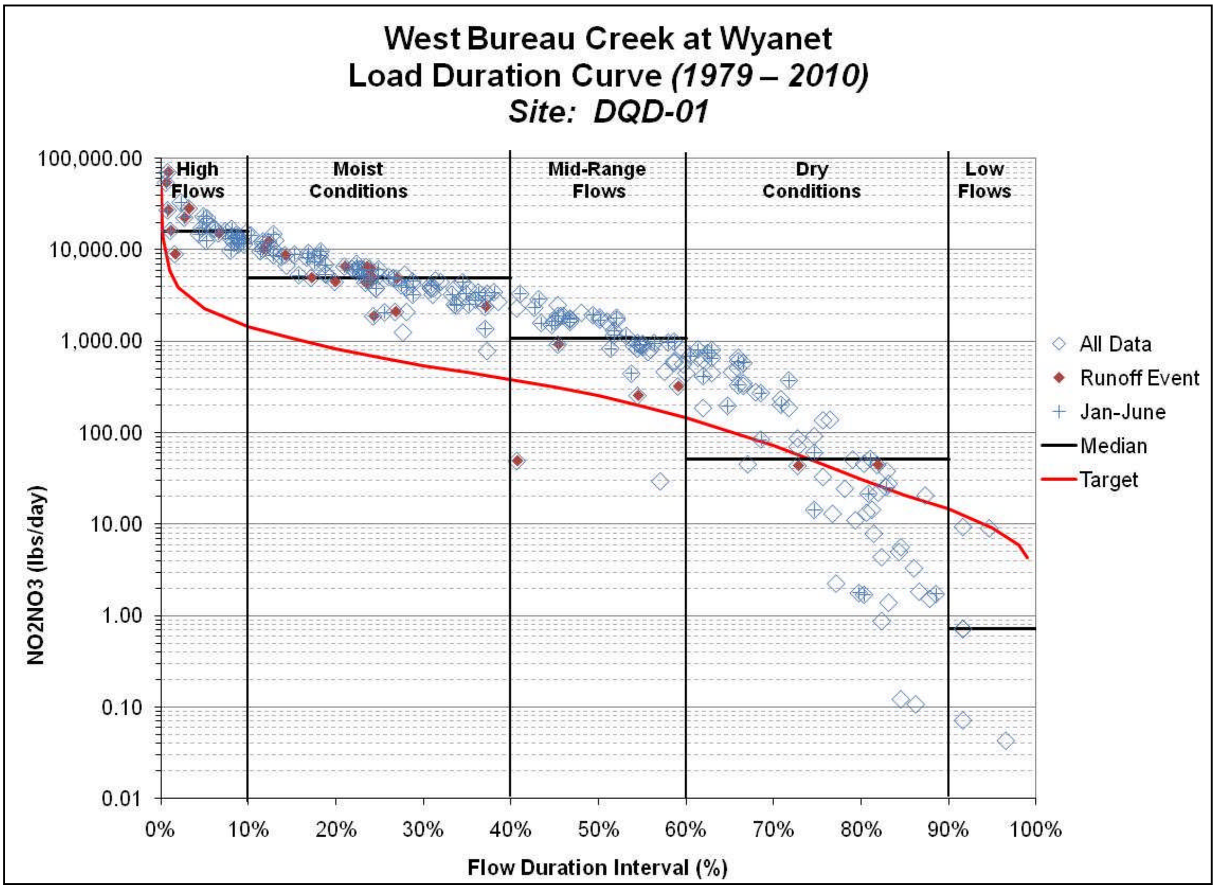

Figure 6-25. Nitrogen load duration curve, West Bureau Creek at Wyanet (DQD-01).

Table 6-8. Nitrogen LRS, West Bureau Creek at Wyanet (DQD-01).

Station DQD 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	LRS Component	0-10%	10-40%	40-60%	60-90%	90-100%
NO2NO3 (lbs/day)	Current Load	15,919	4,917	1,066	52	1
	LRS Target	2,278	665	257	47	9
	LRS Reduction %	85.69%	86.48%	75.86%	9.11%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

6.4 Big Bureau Creek TMDL and LRS (Site DQ-03)

Table 6-9 summarizes the Big Bureau Creek at Princeton watershed and pollutant sources. The Big Bureau Creek at Princeton watershed includes one bacteria impaired segment. Figure 6-26 presents the fecal coliform load duration curve and Table 6-10 presents the TMDL for the Big Bureau Creek at the Princeton assessment site. LRSs are presented in Sections 6.4.2 and 6.4.3 for TSS and nutrients, respectively.

Table 6-9. Big Bureau Creek at Princeton summary table.

Upstream Characteristics	
Drainage Area	196 square miles
Sampling Station	DQ-03
Listed Segments	DQ-03
Land Use	cultivated crops (85 percent); deciduous forests (five percent); developed land including low, medium, and high intensity (three percent); developed open space (five percent); pasture/hay (two percent).
Soil Type	80% B, 18% B/D, 1% C, 1% A, <1% No Data, <1% C/D, <1% D, <1% A/D
Erodible Soils	10% Highly Erodible, 90% Not Assessed
Animal Density Unit	10,000; 51 per square mile
Key Sources	streambank, bluff, and gully erosion; urban and agricultural stormwater runoff; livestock access to waterways; animal agriculture; untreated sewage; NPDES facilities
NPDES Facilities	City of Princeton STP (IL0020575)
	Maple Acres MHP (ILG551015)
	Village of Lamoille STP (ILG580127)
NPDES Facility Disinfection Exemption [a]	Two of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [b]	The City of Princeton STP had 7 fecal exceedances between 2005 and 2010 averaging 1,269 cfu/100 mL
MS4 Communities	None
CSO/SSO Communities	None

a. See Table 6-3 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

6.4.1 Bacteria TMDL

Figure 6-26 presents the load duration curve and TMDL for fecal coliform at the Big Bureau Creek at Princeton assessment site. Table 6-10 summarizes the TMDL and required reductions. Pollutant load reductions are needed across all flow conditions, indicating both point and nonpoint sources will need to be reduced. Watershed runoff, point sources and livestock are believed to be the primary non-natural sources of bacteria in the watershed. Recommended actions include urban stormwater management and agricultural best management practices such as manure management. Livestock exclusion fencing should be used to limit cattle activities in and near the Creek. Failing septic systems and other potential sources of untreated sewage should be further investigated and evaluated to determine proper implementation activities. Point source violations should be addressed through NDPES permitting programs.

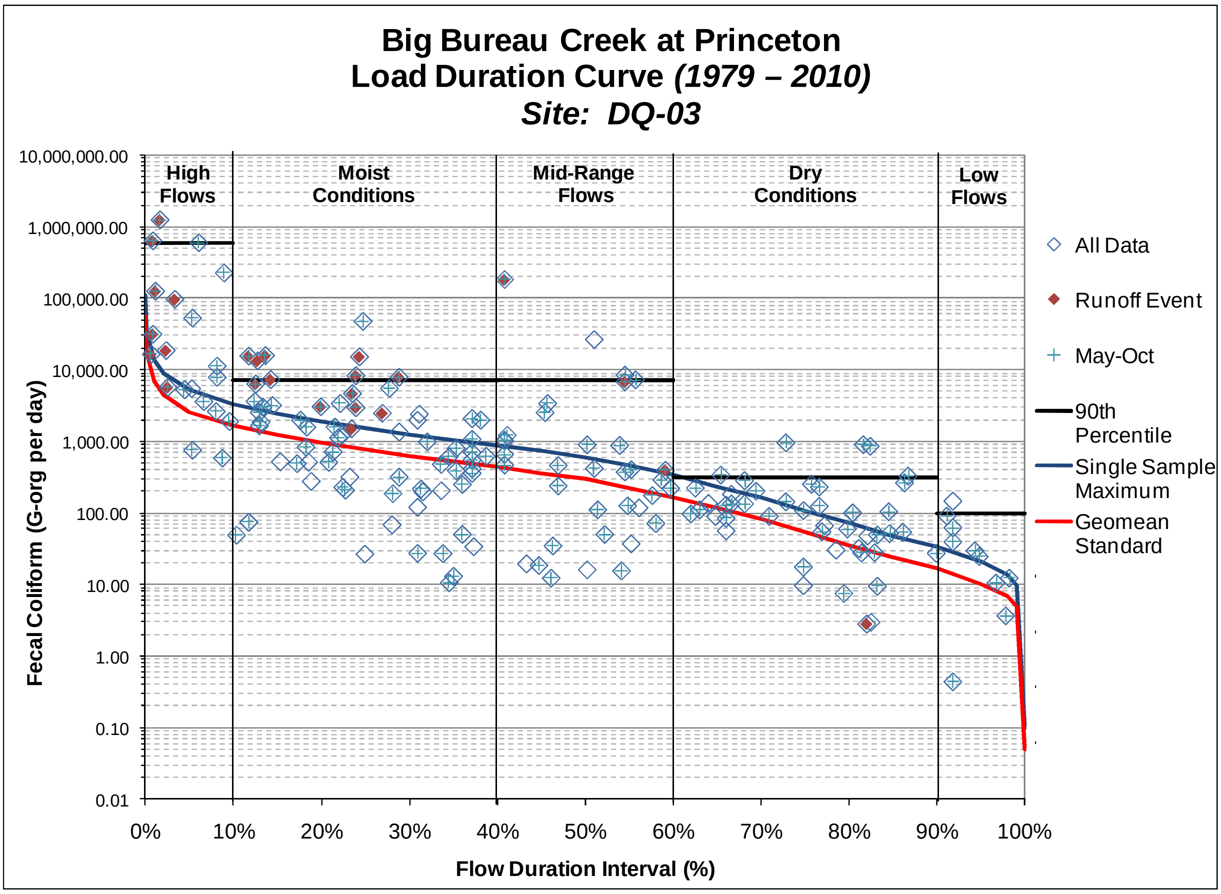

Figure 6-26. Fecal coliform load duration curve, Big Bureau Creek at Princeton (DQ-03).

Table 6-10. Fecal coliform TMDL, Big Bureau Creek at Princeton (DQ-03).

Station DQ 03 TMDL[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Fecal Coliform (G-org/day)	Current Load	601,320	7,245	7,083	306	97
	LA	4,576	1,265	494	63	1
	WLA: NPDES Facilities	101	101	34	34	18
	Total WLA	101	101	34	34	18
	MOS (10%)	520	152	59	11	2
	TMDL=LA+WLA+MOS	5,196	1,517	587	108	21
	TMDL Reduction %[b]	99.14%	79.06%	91.71%	64.83%	78.72%

a. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime
b. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

6.4.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 6-11 for Big Bureau Creek at DQ-03 using the volume weighted target for TSS presented in Section 3. Stream, bluff, and gully restoration activities are needed to address the TSS reductions. Cattle exclusion fencing should also be promoted to limit cattle activities that can lead to back failure.

Table 6-11. TSS LRS, Big Bureau Creek (DQ-03).

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Big Bureau Creek	DQ-03	231	59.3	74%

6.4.3 Nutrient LRS

Figure 6-27 and Figure 6-28 present the load duration curve total phosphorus and nitrate nitrogen, respectively, at the Big Bureau Creek at Princeton assessment site. Table 6-12 and Table 6-13 summarize the LRS and required reductions. Nutrient load reductions are needed across all flow conditions with the highest TP reductions needed under low flow conditions and the highest nitrogen load reductions needed under high flow conditions. The Princeton STP and other point sources are identified as significant sources of phosphorus to the creek, and as such should be considered for phosphorus limits. Monitoring of the effluent from these point sources will provide further information on the extent of phosphorus loadings. Nonpoint sources of both nitrogen and phosphorus include watershed runoff and animal agriculture activities. Both agricultural and urban stormwater best management practices should be utilized to limit nutrient loadings. Exclusion fencing and manure management should also be used to mitigate for the effects of livestock on nutrient loads. Untreated sewage sources should also be investigated and eliminated.

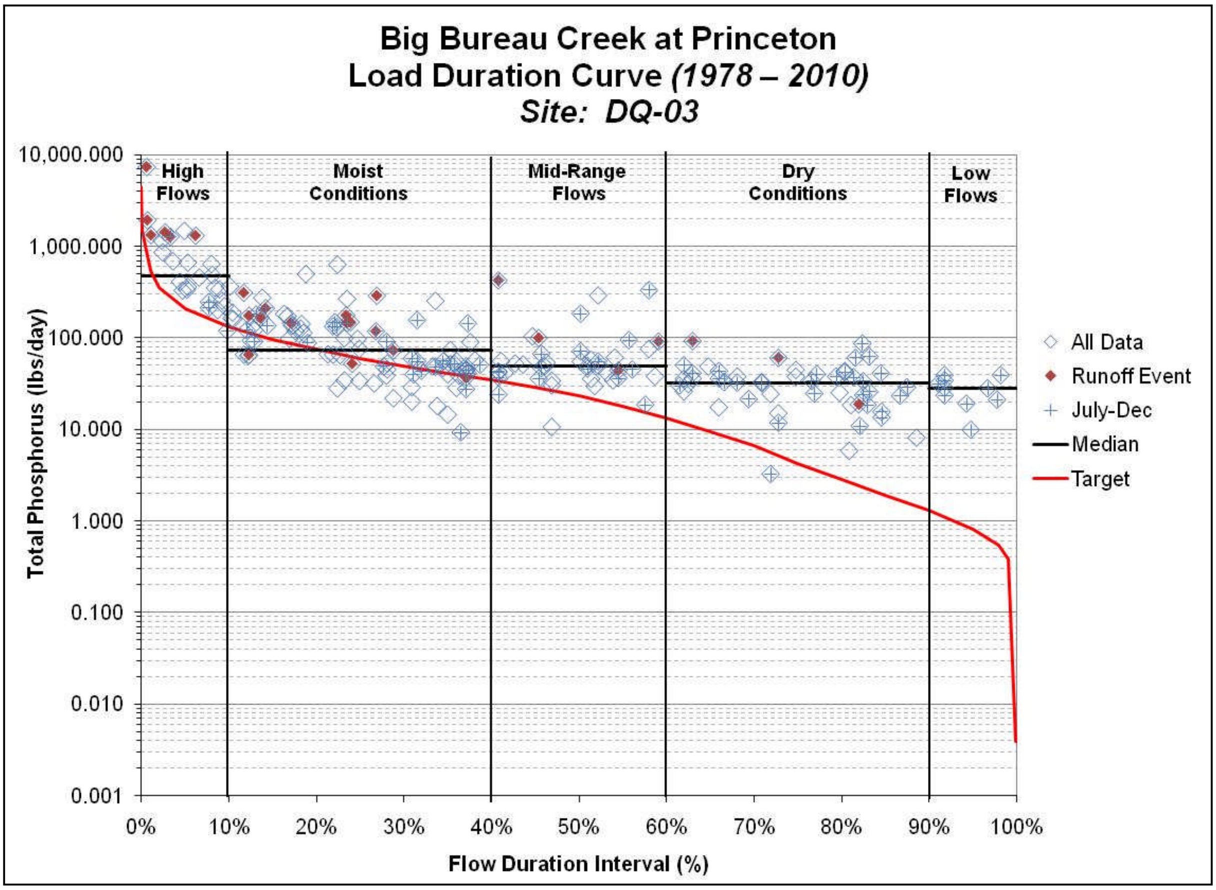

Figure 6-27. Total phosphorus load duration curve, Big Bureau Creek at Princeton (DQ-03).

Table 6-12. Total phosphorus LRS, Big Bureau Creek at Princeton (DQ-03).

Station DQ 03 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	473	74	49	33	28
	LRS Target	206	60	23	4	1
	LRS Reduction %	56.44%	18.39%	52.51%	86.89%	97.12%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

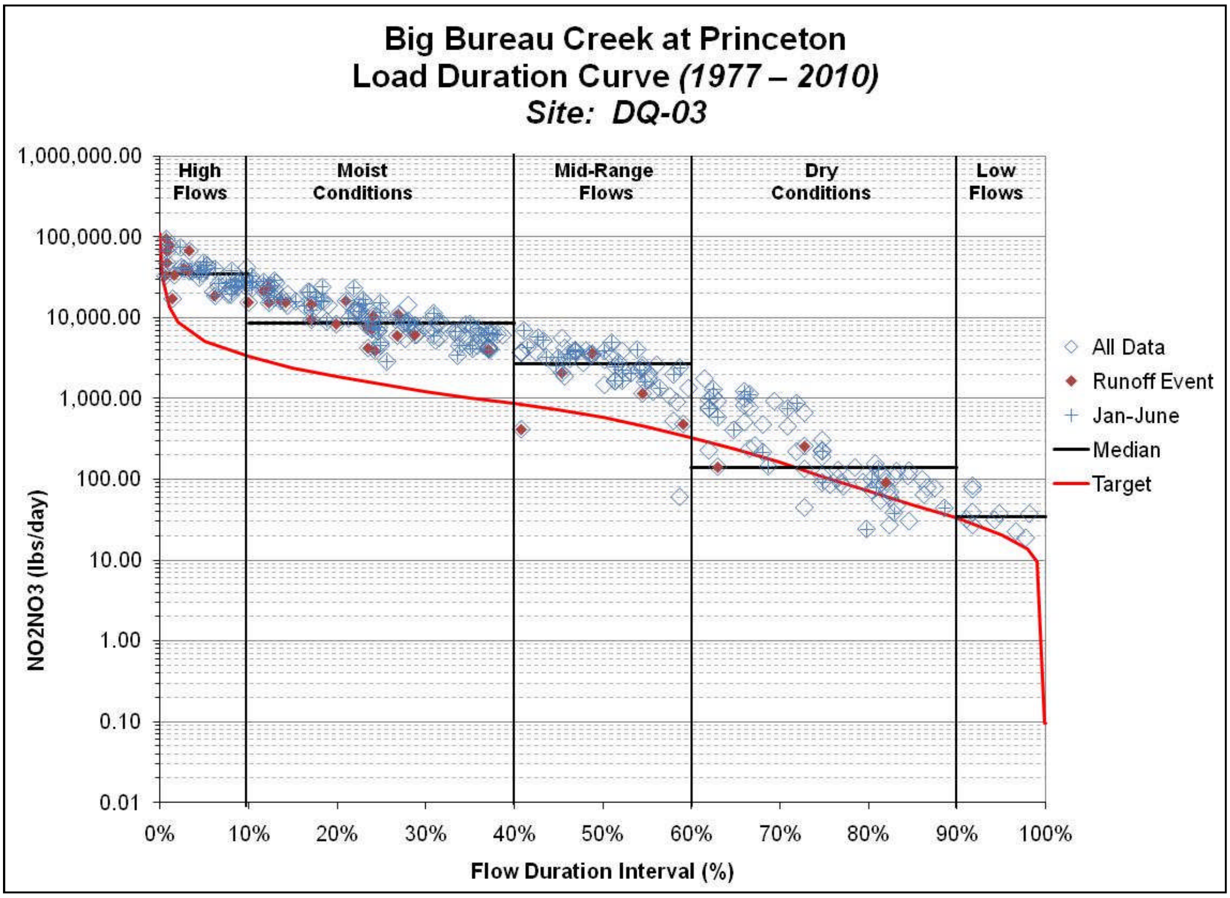

Figure 6-28. Nitrogen load duration curve, Big Bureau Creek at Princeton (DQ-03).

Table 6-13. Nitrogen LRS, Big Bureau Creek at Princeton (DQ-03).

Station DQ 03 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	34,855	8,670	2,679	139	34
	LRS Target	5,150	1,503	582	107	20
	LRS Reduction %	85.23%	82.66%	78.28%	23.13%	40.77%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

6.5 Big Bureau Creek LRS (Site DQ-04)

Table 6-14 summarizes the Big Bureau Creek watershed and pollutant sources. The Big Bureau Creek watershed includes one bacteria impaired segment. LRSs are presented for the Big Bureau Creek at the outlet assessment site in Sections 6.5.1 and 6.5.2 for TSS and nutrients, respectively.

Table 6-14. Big Bureau Creek (DQ-04) summary table.

Upstream Characteristics	
Drainage Area	502 square miles
Sampling Station	DQ-04
Listed Segments	DQ-03 and DQD-01 are upstream of Site DQ-04
Land Use	cultivated crops (80 percent); deciduous forests (nine percent); developed land including low, medium, and high intensity (two percent); developed open space (four percent); pasture/hay (two percent); wetlands (two percent); other (one percent).
Soil Type	80% B, 17% B/D, 1% C, 1% A, <1% No Data, <1% C/D, <1% D, <1% A/D
Erodible Soils	15% Highly Erodible, 85% Not Assessed
Animal Unit Density	28,000; 56 per square mile
Key Sources	streambank, bluff, and gully erosion; urban and agricultural stormwater runoff; livestock access to waterways; animal agriculture; untreated sewage; NPDES facilities; CSOs
NPDES Facilities	Princeton STP (IL0020575)
	Malden STP (IL0024791)
	Tiskilwa STP (IL0025160)
	Bureau Junction STP (IL0033120)
	Lake Arispie Water Co STP (IL0042625)
	Beecher STP (IL0049522)
	Dover WTP (IL0063363)
	Central Limestone Co-Morris (IL0065056)
	Princeton WTP (IL0065757)
	Prairie View Nursing Home STP (IL0067024)
	Sublette WTP (IL0073652)
	Maple Acres MHP (ILG551015)
	Lamoille STP (ILG580127)
	Ohio STP (ILG580190)
	Wyanet STP (ILG580245)
NPDES Facility Disinfection Exemption [a]	Nine of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [b]	The City of Princeton STP had 7 fecal exceedances from 2005 to 2010 averaging 1,269 cfu/100 mL
MS4 Communities	None
CSO/SSO Communities	Bureau Junction STP (IL0033120)
CSO Overflows	No information is available for SSO overflows from Bureau Junction STP

a. See Table 6-3 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

6.5.1 Total Suspended Solids LRS

TSS load reductions are presented in Table 6-15 for Big Bureau Creek at DQ-04 using the volume weighted target for TSS presented in Section 3. Reductions in sediment are not needed in order to meet the sediment target. Additional monitoring is needed to fully understand the sediment budget.

Table 6-15. TSS LRS, Big Bureau Creek (DQ-04).

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Big Bureau Creek	DQ-04	50	59.3	0%

6.5.2 Nutrient LRS

Figure 6-29 and Figure 6-30 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Big Bureau Creek assessment site. Table 6-16 and Table 6-17 summarize the LRS and required reductions. Nutrient load reductions are found predominantly under higher flow conditions, although there are limited data. Additional monitoring is needed at this site to fully understand the nutrient budget. Tributary nutrient loads should be addressed in the headwater areas including West Bureau Creek and downstream of Princeton. CSOs should be monitored and evaluated to determine their overall effect on Big Bureau Creek.

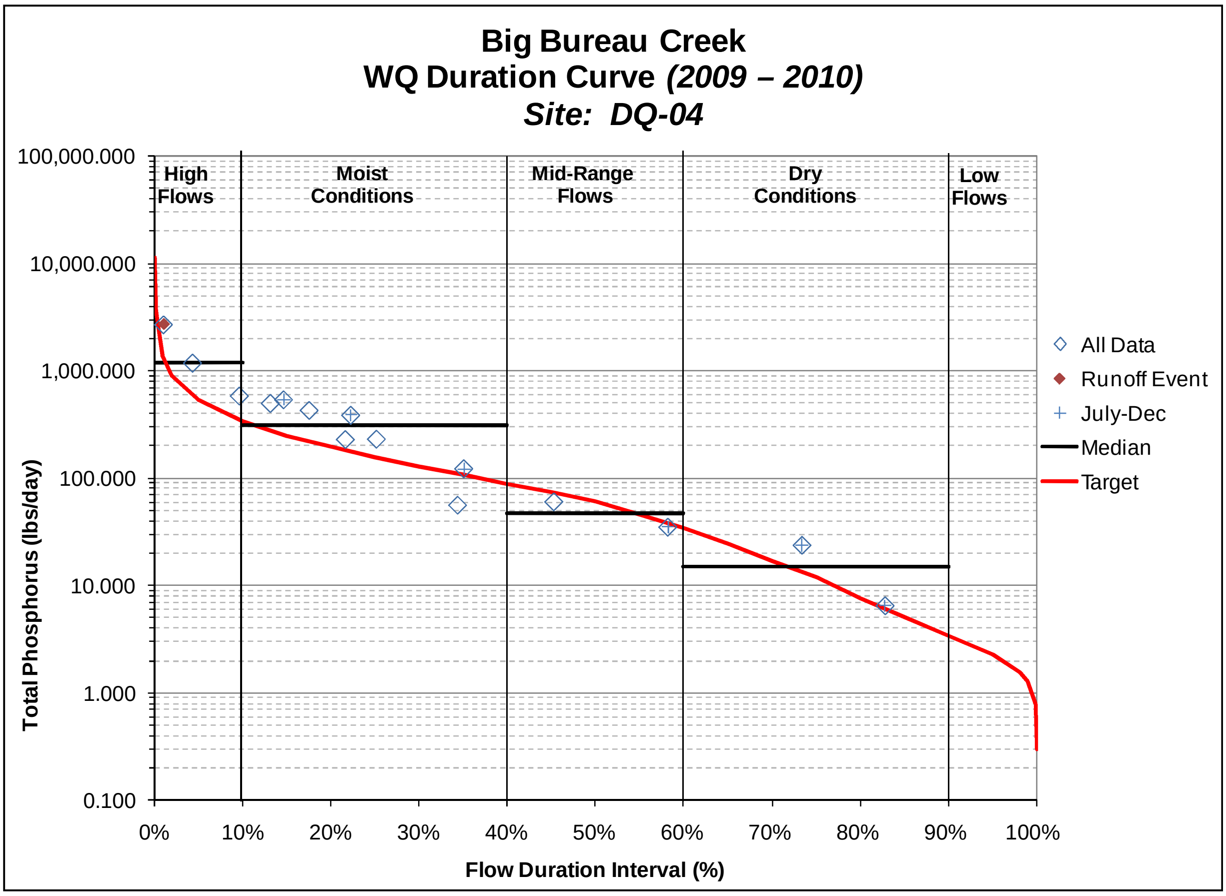

Figure 6-29. Total phosphorus load duration curve, Big Bureau Creek at the mouth (DQ-04).

Table 6-16. Total phosphorus LRS, Big Bureau Creek at the mouth (DQ-04).

Station DQ 04 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	1,188	309	48	15	N/A
	LRS Target	529	155	61	12	2
	LRS Reduction %	55.43%	50.05%	0%	21.80%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

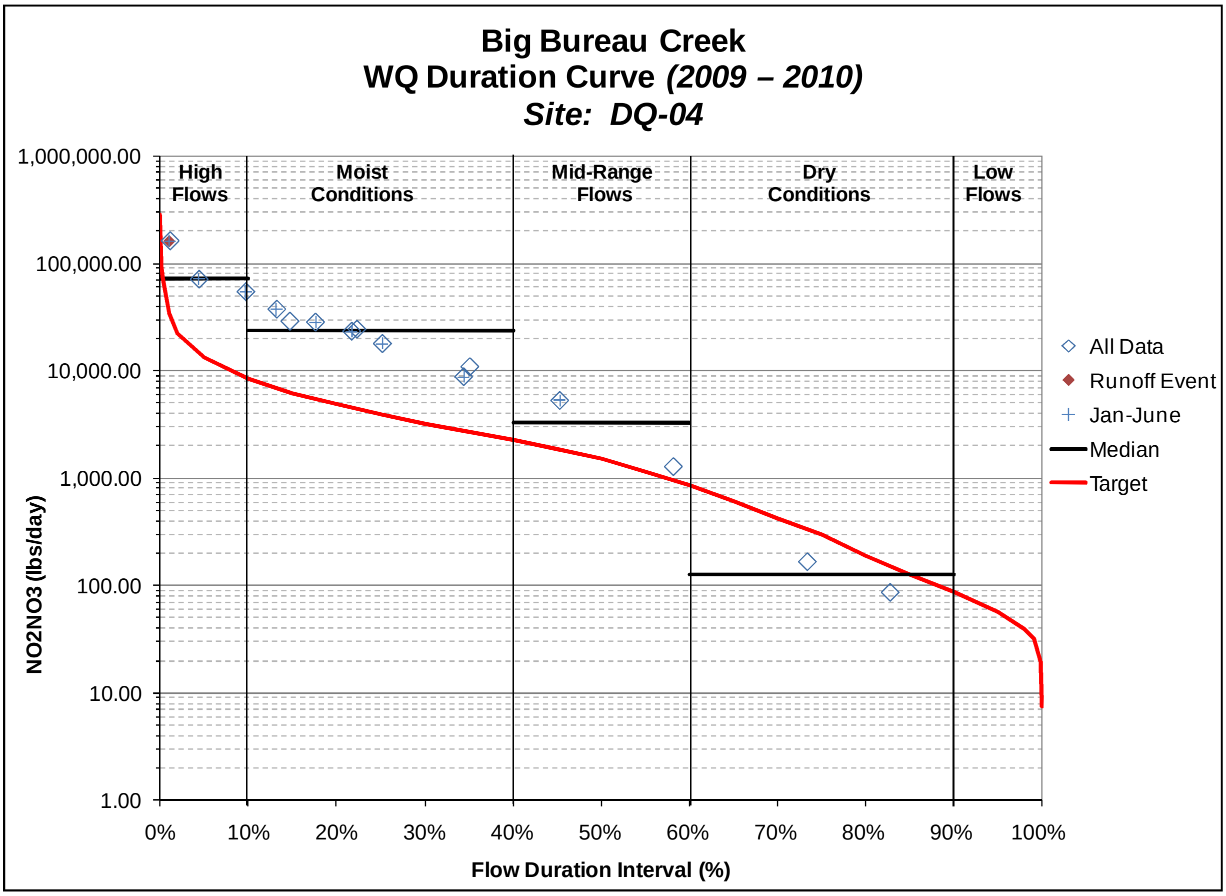

Figure 6-30. Nitrogen load duration curve, Big Bureau Creek at the mouth (DQ-04).

Table 6-17. Nitrogen LRS, Big Bureau Creek at the mouth (DQ-04).

Station DQ 04 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	71,126	23,824	3,280	127	N/A
	LRS Target	13,223	3,861	1,525	295	57
	LRS Reduction %	81.41%	83.79%	0%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

7. Farm Creek

Located east of Peoria, the Farm Creek watershed cluster has a total drainage area of 62 square miles and can be further delineated into two 12-digit HUCs (Figure 7-2). Table 7-1 details area per 12-digit HUC associated with the Farm Creek watershed cluster. The entire watershed cluster is located within Tazewell County.

Farm Creek is impaired due to elevated concentrations of TSS, phosphorus, and chloride. A watershed source assessment and linkage analysis are presented in this section. To address the impairments, a TMDL has been developed for chloride, while a LRS is developed for TSS, phosphorus, and nitrate plus nitrite nitrogen. Bacteria analyses are included in the linkage analysis as downstream waters are impaired for bacteria.

Figure 7-1. View of Farm Creek.

Table 7-1. Farm Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 16	01	Ackerman Creek-Farm Creek	24,971	39.0
	02	Coal Creek-Farm Creek	14,452	22.6
Total			**39,423**	**62**

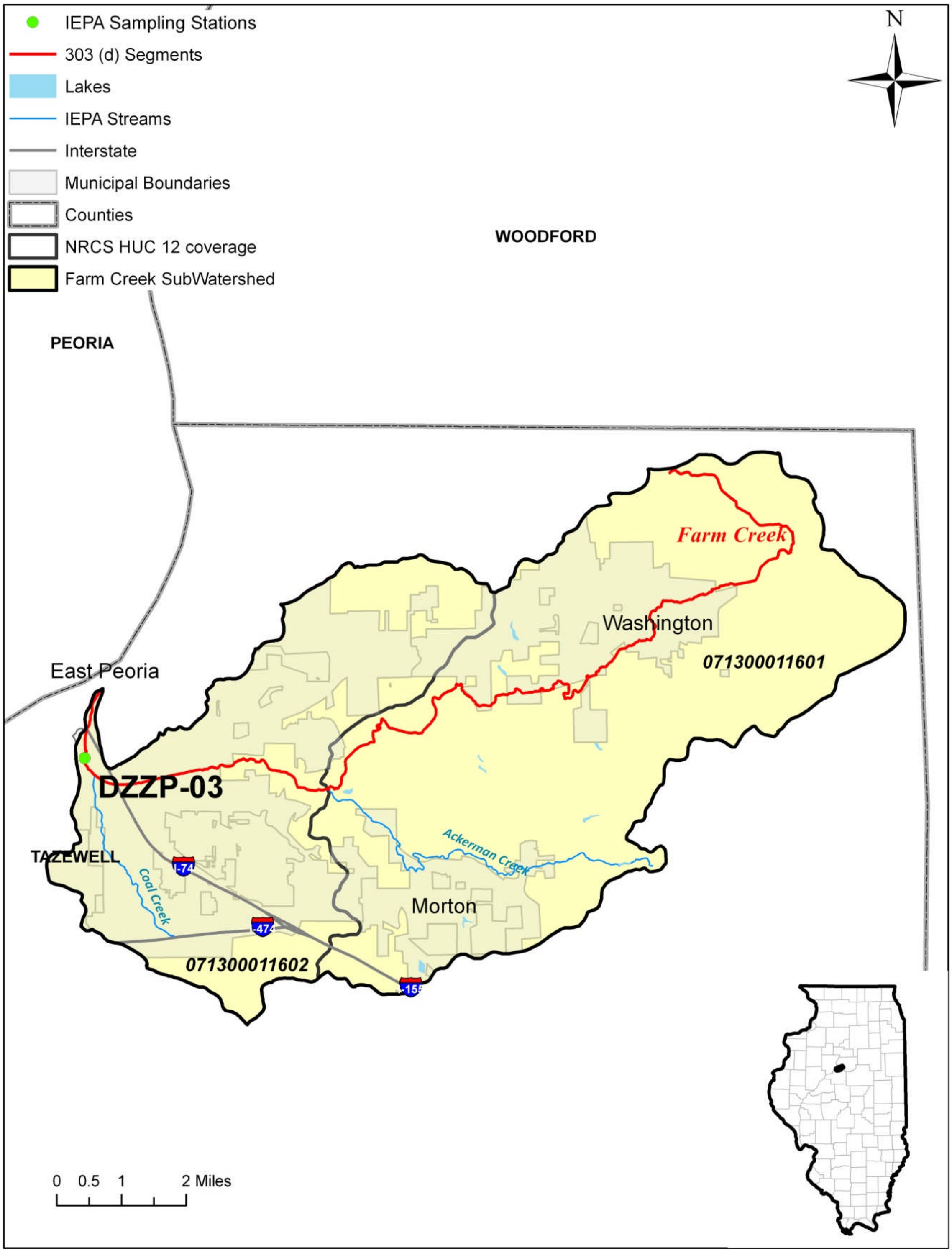

Figure 7-2. Farm Creek watershed cluster segments and stations.

7.1 Source Assessment

The Farm Creek watershed cluster has a mix of land use (Figure 7-3); predominating land use includes cultivated crops (38 percent), deciduous forests (21 percent), developed land including low, medium and high intensity (22 percent), and pasture/hay (five percent). The largest area of development surrounds East Peoria and includes Washington and Morton. It should be noted that from 1987-1997, the amount of cropland acres decreased by six percent while the amount of irrigated acreage increased by 44 percent (TCRPC 2001).

Stormwater runoff may be a significant source of pollutants to the Farm Creek watershed cluster. Regulated MS4s within the watershed cluster include: Tazewell County, City of East Peoria, and Village of Morton. In addition to stormwater point sources, a total of nine NPDES facilities are permitted within the Farm Creek watershed cluster, this includes eight sewage treatment plants. Locations of NPDES facilities within the watershed cluster are identified in Figure 7-3 and listed in Table 7-2. In addition, there are four permitted SSOs within the watershed.

Table 7-2. NPDES facilities within the Farm Creek watershed cluster.

10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
07130001 16	IL0022152	OAKLANE ACRES HOMEOWNERS ASSOC	0.015	limit 400
	IL0024881	CITY OF WASHINGTON STP #1	0.6	Exempt
	IL0030007	MORTON STP #3	0.95	001, 002, A02- limit 400
	IL0042412	WASHINGTON STP #2	1.5	001, A01- limit 400
	IL0047384	SUNDALE HILLS STP	0.275	001, 003- limit 400
	IL0047406	WASHINGTON ESTATES INC STP	0.2	001- exempt and required to monitor/ A01- limit 400
	IL0074632	V-MIX CONCRETE INC	0.045	N/A
	IL0028576	EAST PEORIA STP #1	4.22	001, 002, 005, 007, A02- limit 400
	ILG551039	SUNDALE SEWER CORP-HIGHLAND	0.053	Exempt

Farm Creek watershed has a limited amount of animal agriculture activities in the watershed. Table 7-3 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 7-3. Livestock populations in Farm Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Tazewell	842	46	95	75	6,830
Total Number of Animals	**842**	**46**	**95**	**75**	**6,830**
Equivalent Animal Units	**842**	**1**	**189**	**7**	**2,732**

Source: USDA 2007-2009

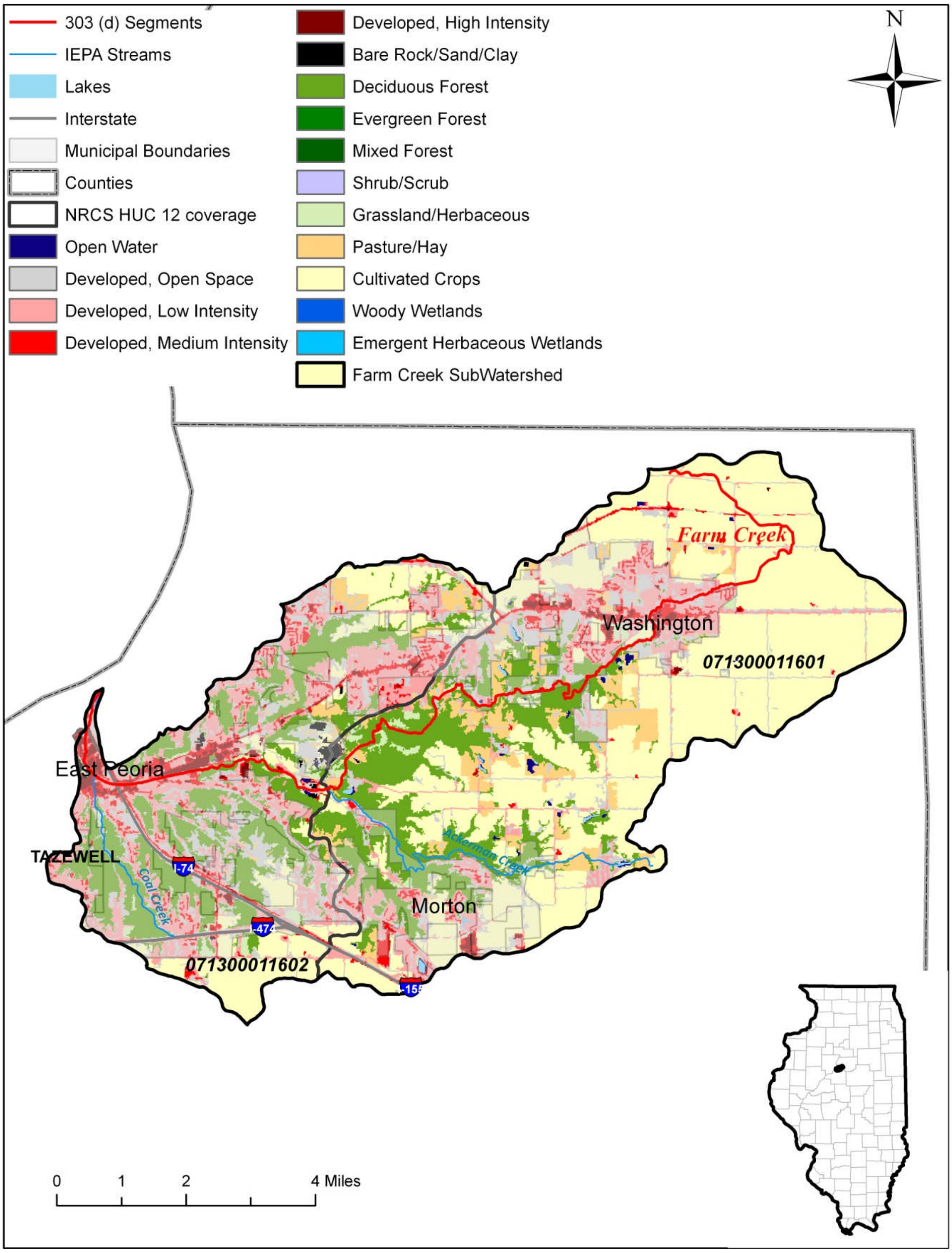

Figure 7-3. Farm Creek watershed cluster land use.

Figure 7-4. Farm Creek watershed cluster NPDES facilities.

The 2001 Farm Creek Watershed Management Plan presented macroinvertebrate sampling completed within the watershed. At the time of sampling, the majority of organisms collected (95 percent) were from the order Diptera (TCRPC 2001). Diptera is a generally tolerant fly larva and their presence indicates poor water quality. Although overall diversity was low, it can be noted that certain stream segments contained intolerant to moderately tolerant species. Additionally, a higher degree of diversity was associated with the presence of less tolerant species (TCRPC 2001).

In regards to erosion and sedimentation, it has been indicated that the streams in Farm Creek watershed do not appear to be approaching any type of re-establishment of equilibrium, and, without interdiction, it is thought that the streams will continue to degrade and enlarge for many years to come. Results from an erosion study completed by the USDA and NRCS were also presented within the 2001 Farm Creek Watershed Management Plan. In total, the study found that an estimated 203,650 tons of sediment are eroded within the watershed annually; of this, it was found that 33,600 tons were washed from the Farm Creek watershed to the Illinois River (TCRPC 2001). In addition to these reports, a watershed restoration plan has been developed for Ackerman Creek, a smaller 12-digit subwatershed. This watershed plan is discussed below.

7.1.1 Ackerman Creek

The Ackerman Creek watershed which is tributary to Farm Creek covers approximately 7,408 acres southeast of Peoria (TCRPC 2004a). Predominating land use includes deciduous forests and cultivated crops, deciduous forests, and development including low, medium and high intensity. The 2004 Ackerman Creek Watershed Restoration Plan identified development, specifically, development along the ridges and bluffs, as a primary cause of erosion, gullying, sedimentation and reduced water quality (TCRPC 2004a). Erosion concerns were also identified in farm fields, construction sites and bluffs. In total, it is estimated that the Ackerman Creek watershed contributes 16,000 tons of sediment to Farm Creek (TCRPC 2004a). Ultimately this sediment load may wash to the Illinois and Mississippi Rivers. Ackerman Creek has been classified for overall, swimming, and aquatic life use; however, concerns to designated uses across Illinois include agriculture, hydromodification, municipal point sources, resource extraction and urban runoff/storm sewers (Illinois EPA 2002 as in TCRPC 2004a).

7.2 Watershed Linkage Analysis

7.2.1 Bacteria

Counts of fecal coliform are elevated and highly variable within Farm Creek (Figure 7-5). Analysis of the seasonal trends within the Farm Creek watershed cluster (Figure 7-6) reveals the potential for both nonpoint and point source pollution. Concentrations of fecal coliform peak during spring and summer months and decrease during fall and winter (October-March). Such trends indicate runoff from nonpoint sources or MS4 systems, including spring snowmelt and rainfall events, as a potentially significant source of pollution.

Evaluation of data collected on Farm Creek with flow shows fecal coliform is most elevated and most variable during high flow conditions (Figure 7-7). Although counts are somewhat lower during low flow conditions, they continue to exceed the geometric mean standard. The elevated counts during high flows are most likely from rural runoff from cropland as well as urban sources from East Peoria. In addition, an estimated 840 cattle within the drainage area and four permitted SSOs within this watershed contribute bacteria loads during SSO events. In the past five years only three SSO overflows have occurred. The low flow exceedances are likely due to a variety of sources including wastewater treatment facilities, and nonpoint urban sources. Of concern during low flow conditions, five sewage treatment plants have had reported bacteria violations within the last three years.

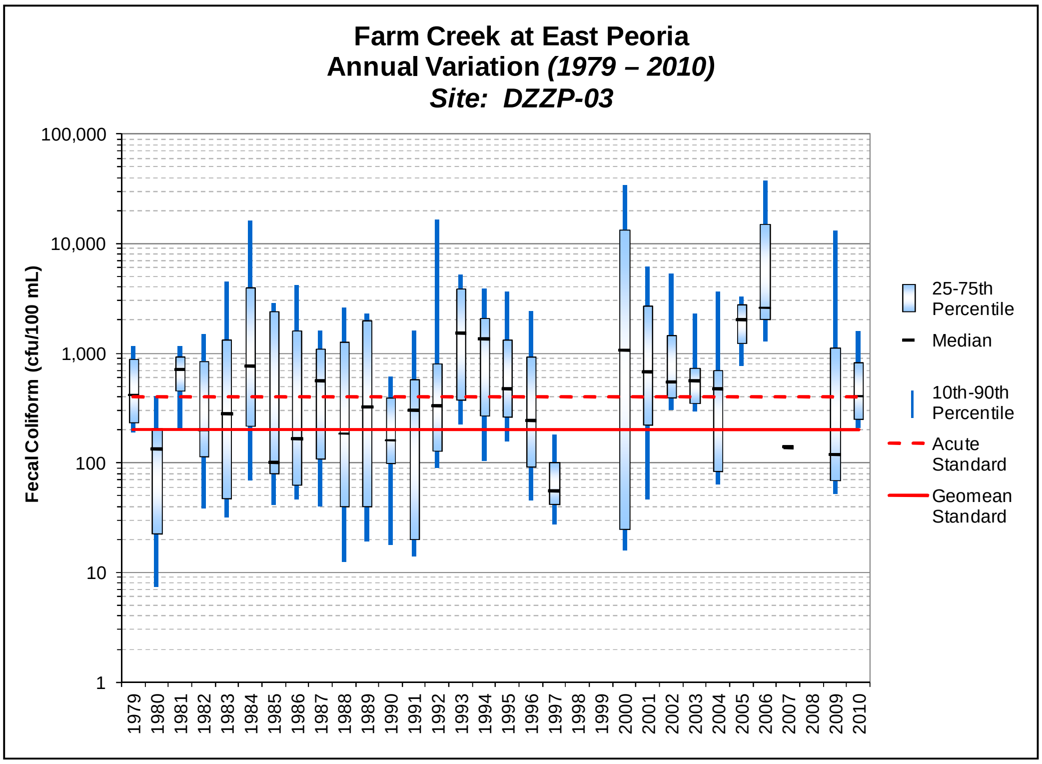

Figure 7-5. Annual fecal coliform concentrations, Farm Creek at East Peoria, 1979 - 2010.

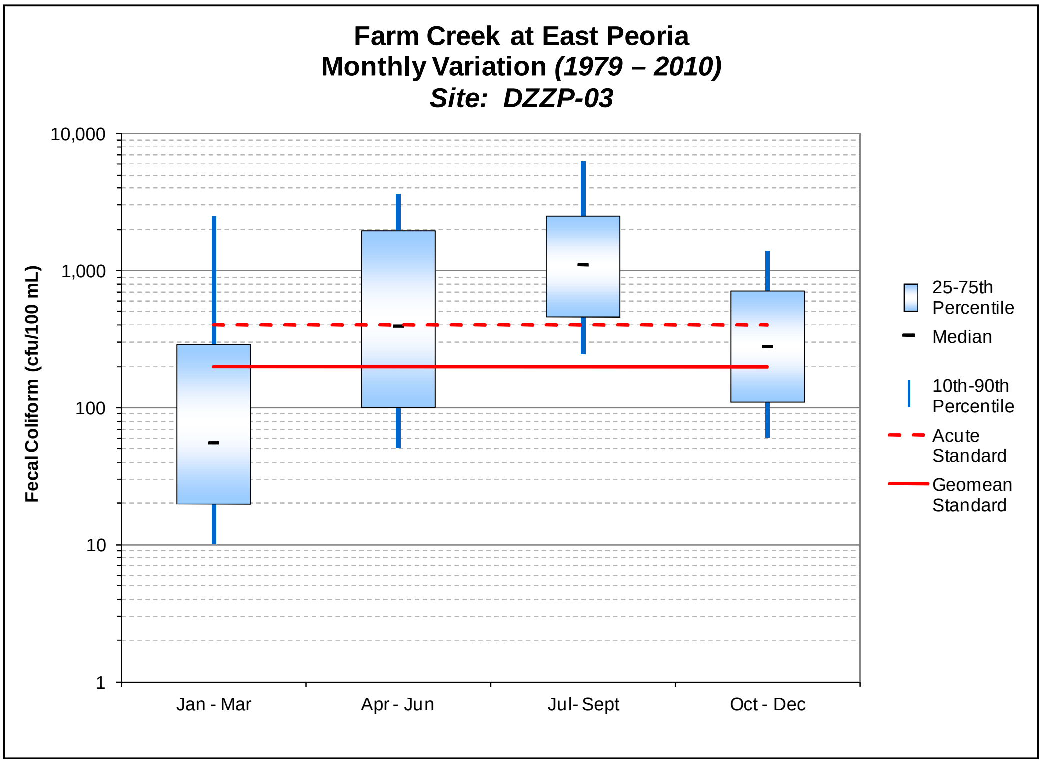

Figure 7-6. Seasonal fecal coliform data, Farm Creek at East Peoria, 1979-2010.

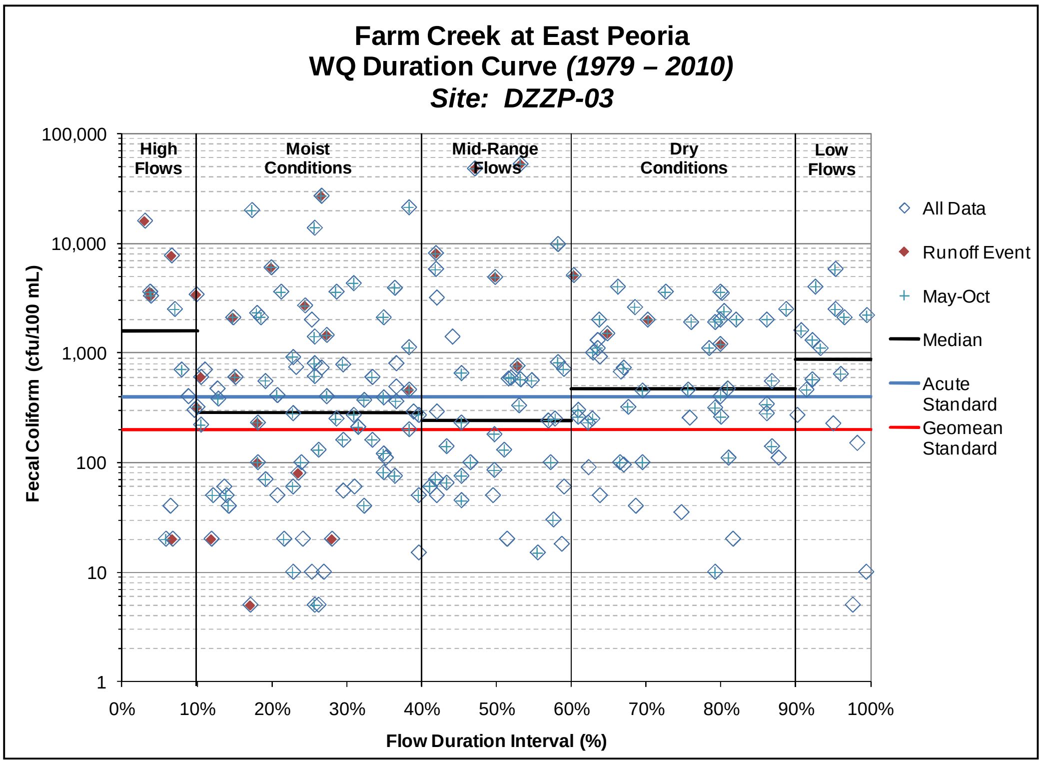

Figure 7-7. Fecal coliform water quality duration curve, Farm Creek at East Peoria, 1979 – 2010.

7.2.2 Total Suspended Solids

Erosion and sedimentation are of concern throughout the Illinois River drainage, including Farm Creek. Results from an erosion study completed by the USDA and NRCS were presented within the 2001 Farm Creek Watershed Management Plan. In total, the study found that 55 percent of the sediment that eroded within the watershed originated from gully erosion, 34 percent from sheet and rill erosion, nine percent from streambank erosion and two percent from ephemeral (channel) erosion (TCRPC 2001). In addition to the effects of erosion and sedimentation, the Farm Creek watershed has also undergone extensive sand and gravel mining. During the 1980s, Freesen Incorporated mined approximately 30,000 cubic yards of sediment from the Farm Creek Channel (Bhowmik et al. 2001). It is likely that mining efforts dramatically altered hydrology within the channel.

Mean annual concentrations of TSS in Farm Creek are below the TSS target for all but one year (Figure 7-8) and there do not appear to be any long-term trends. Analysis of TSS data collected on Farm Creek shows extreme variability and sporadically elevated concentrations in exceedance of the target throughout the year (Figure 7-8). Further analysis pairing the TSS concentrations with flow conditions (Figure 7-9) reveals significantly elevated TSS concentrations during high flows and dramatically lower concentrations during lower flow conditions. Elevated concentrations during high flows, confirmed by the water quality duration curve (Figure 7-9), indicates that streambank and gully erosion are the major sources of sediment. Watershed erosion is also contributing to the sediment loads as indicated by target exceedances during moist to dry flow conditions.

The relatively high proportion of developed lands in the Farm Creek watershed (22 percent) is likely contributing to the streambank and gully erosion problems. High rates of channel erosion can often be associated with water flow and sediment dynamics being out of balance. This may result from land use activities that either alter flow regimes, adversely affect the floodplain and streamside riparian areas, or a combination of both. Hydrology is a major driver for both upland and stream channel erosion. The results from the 2001 Farm Creek Watershed Management Plan provides information confirming that hydrology based erosion is a major concern in Farm Creek, specifically related to stream bank and gully erosion.

The importance of hydrology in addressing sediment concerns in the Farm Creek watershed is further supported based on relationships between flow, velocity, shear stress, and stream power. Increased sediment transport occurs from elevated velocities associated with higher stream flow. Impaired streams, such as Farm Creek, will mobilize more sediment even if flows are held constant, due to decreased resistance associated with the greater silt fraction in the channel substrate.

The combined effect of these factors highlights the need to consider not only direct sediment loads to the stream, but also the importance of hydrology, channel substrate, and bank conditions. These relationships also point out the role that the floodplain and riparian zones play in providing bank and channel stability. Finally, land use and / or floodplain management changes that alter hydrology in the watershed can further exacerbate sediment problems through the resultant effect on stream habitat.

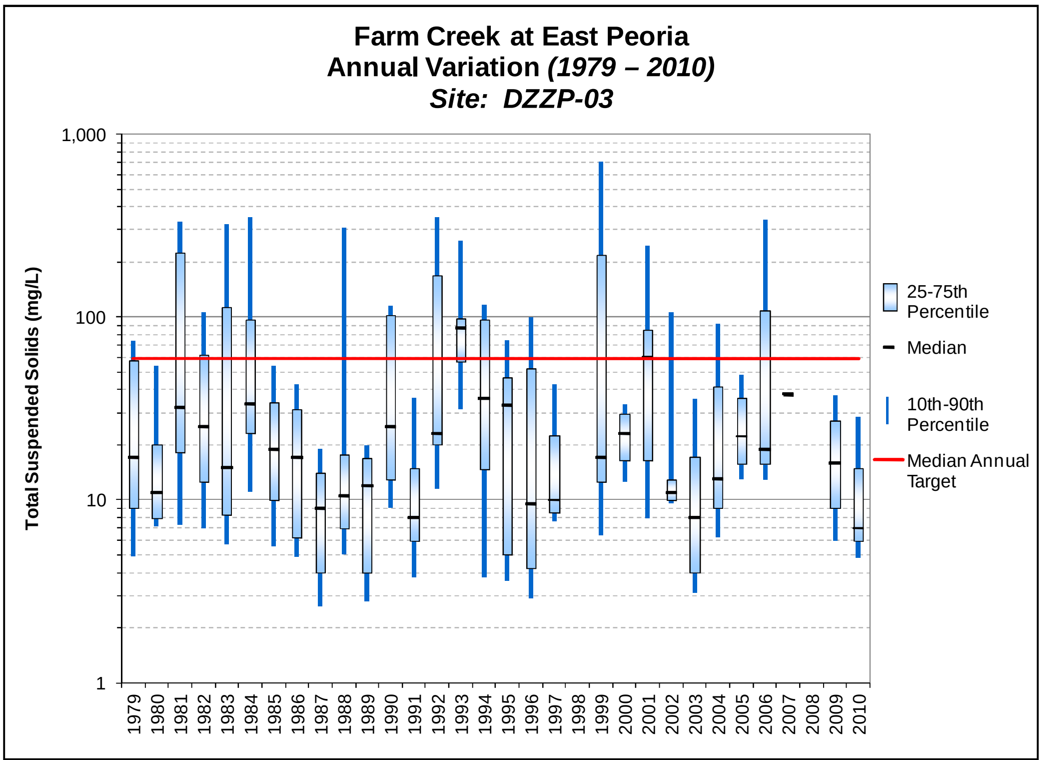

Figure 7-8. Annual TSS concentrations, Farm Creek at East Peoria, 1979 - 2010.

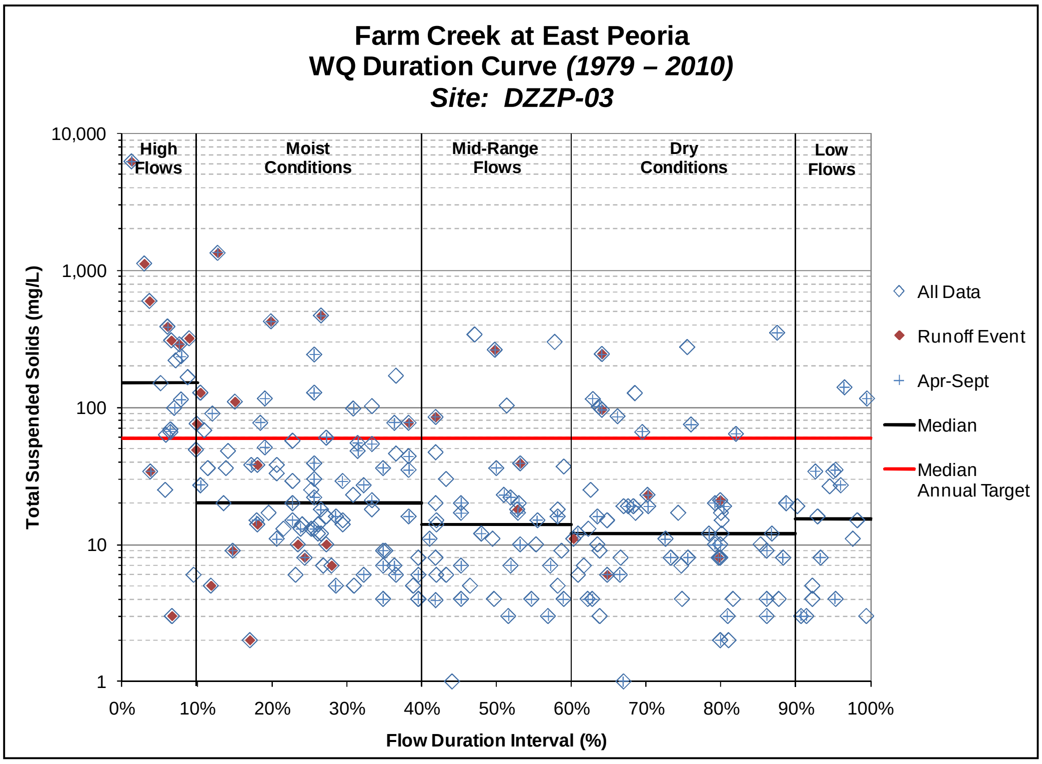

Figure 7-9. TSS water quality duration curve, Farm Creek at East Peoria, 1979 – 2010.

7.2.3 Nutrients

Nutrient concentrations within Farm Creek, including phosphorus and nitrogen, have been consistently elevated since monitoring began in 1979 and 1984 respectively (Figure 7-10 and Figure 7-12). Nitrate concentrations are highly variable and the annual mean exceeds the in-stream target in all but two years; mean annual phosphorus always exceeds the in-stream target. This watershed contains a mix of agricultural, forested and urbanized land. Nutrients are commonly washed from fields after the application of fertilizers and can be found at high concentrations in urban stormwater. In addition to agricultural and urban runoff, five permitted facilities have exceeded effluent limitations for nutrient related parameters within the last three years. There are also four permitted SSOs within this watershed.

Analysis of the seasonal trends within the Farm Creek watershed cluster reveals the potential for both nonpoint and point source pollution. Concentrations of phosphorus and nitrogen are elevated throughout the year, with lower concentrations seen during summer months (Figure 7-11). High concentrations of phosphorus and nitrogen in the winter and during high flow periods is likely associated with the runoff of applied fertilizers, as well as other sources of nutrients.

The elevated phosphorus concentrations that occur during low flow conditions indicate a likelihood of point source pollution. This implication is warranted as eight of the nine NPDES permitted facilities are sewage treatment facilities. The sewage treatment facilities do not have permit limits for nitrate nitrogen or total phosphorus.

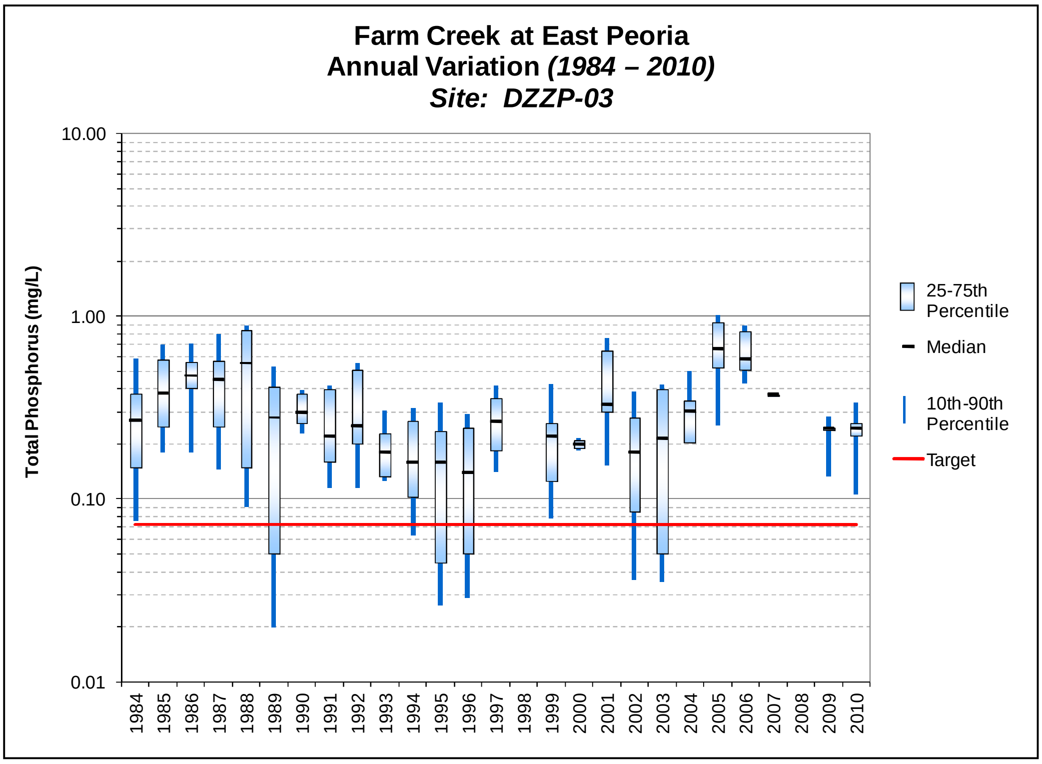

Figure 7-10. Annual phosphorus concentrations, Farm Creek at East Peoria, 1984 - 2010.

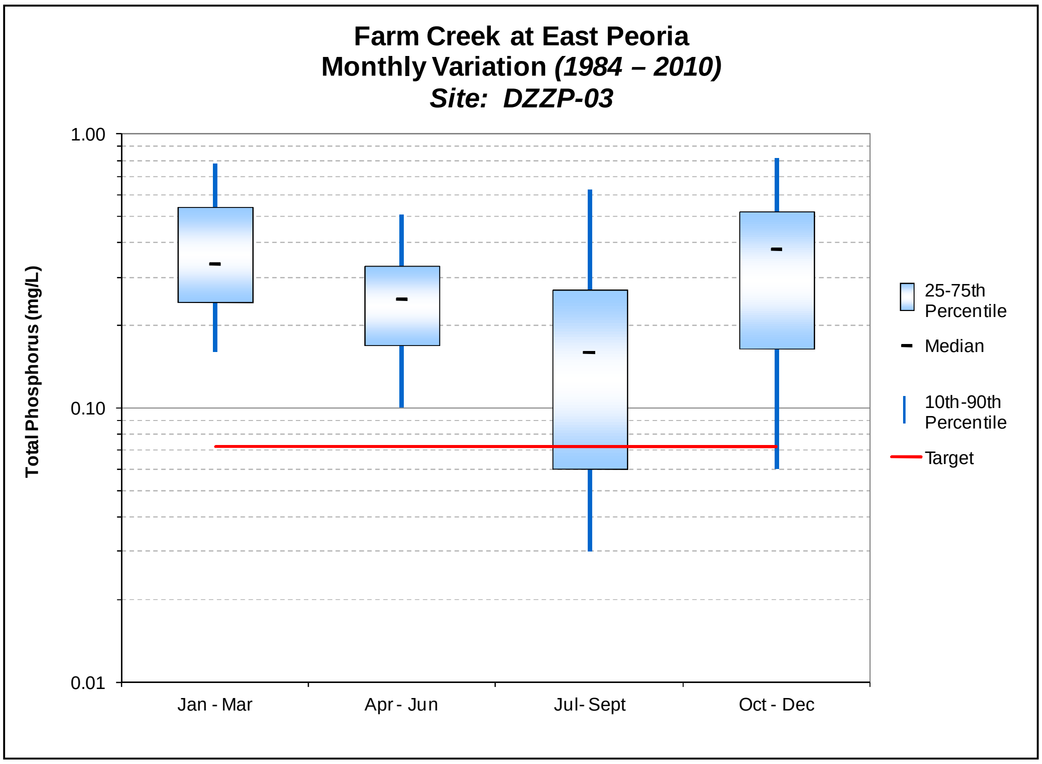

Figure 7-11. Seasonal phosphorus data, Farm Creek at East Peoria, 1984-2010.

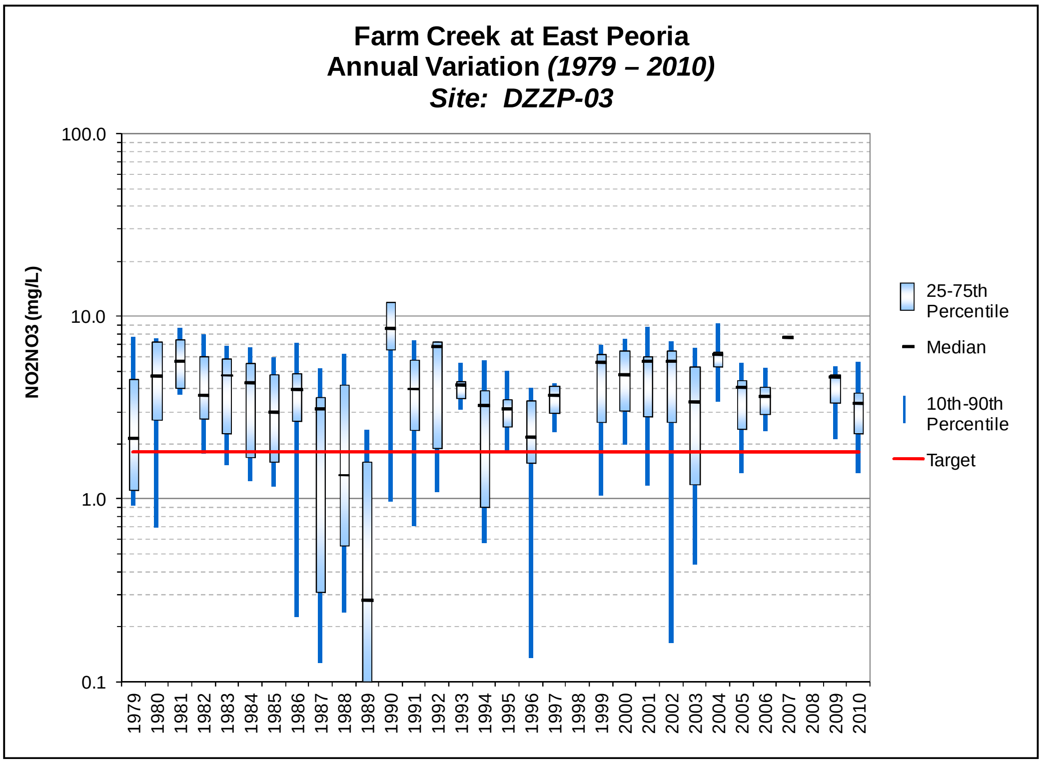

Figure 7-12. Annual nitrogen concentrations, Farm Creek at East Peoria, 1979 - 2010.

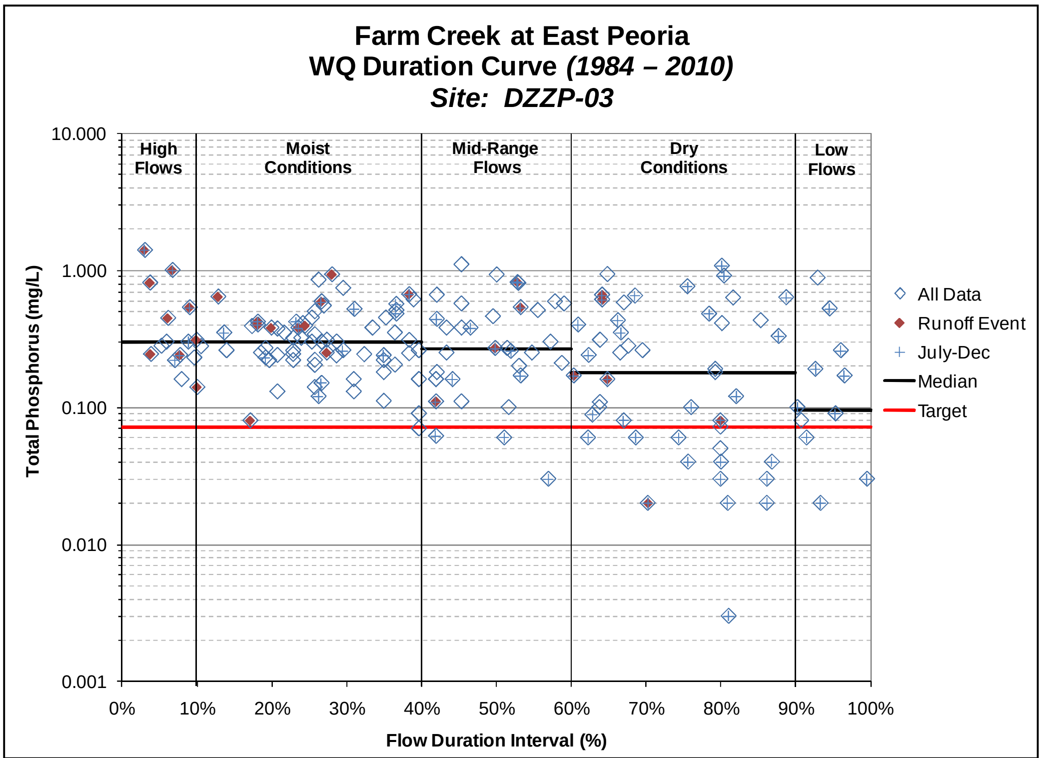

Figure 7-13. Phosphorus water quality duration curve, Farm Creek at East Peoria, 1984 - 2010.

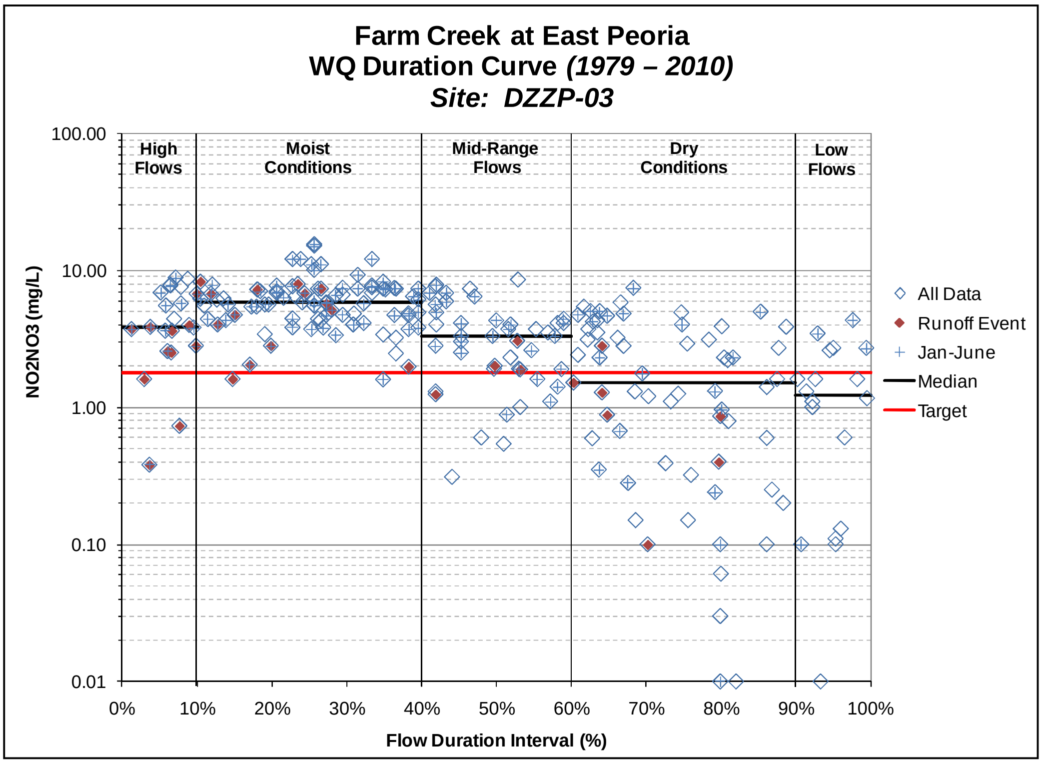

Figure 7-14. Nitrogen water quality duration curve, Farm Creek at East Peoria, 1979 - 2010.

7.2.4 Chloride

With high levels of development and impervious surfaces in the Farm Creek watershed, it is likely that roadways and other impervious surfaces are a significant source of chloride. The application and handling of chloride-based de-icing agents during the winter can negatively impact the water quality of local waterbodies which receive the snow melt or runoff from nearby impervious surfaces. In addition to nonpoint sources such as de-icing agents; septic systems, fertilizers, and landfill leachate can also contain elevated levels of chloride.

Figure 7-15 summarizes the annual chloride concentrations between 1999 and 2005. Variability increased in 2003 and 2005, however, median concentration have stayed fairly even. Analysis of seasonal trends shows slightly elevated concentrations of chloride in the fall and winter (Figure 7-16). This corresponds to periods of snowfall and potential application of de-icing salts on roadways. De-icing road salts (typically magnesium or sodium chloride) readily dissolve and wash into nearby waterbodies.

Additionally, a strong trend is revealed by the analysis of chloride data with flow. Figure 7-17 shows elevated concentrations of chloride during low flow periods. Elevated concentrations during low flow conditions generally indicates a constant point source of pollution as this period generally corresponds to dry weather conditions when runoff from nonpoint sources in minimal. Lower concentrations occurring during high flow event is likely a result of increased dilution by flow and in contrast, exceedances of chloride during low flow (as shown in Figure 7-17) indicates a diminished stream flow dilution.

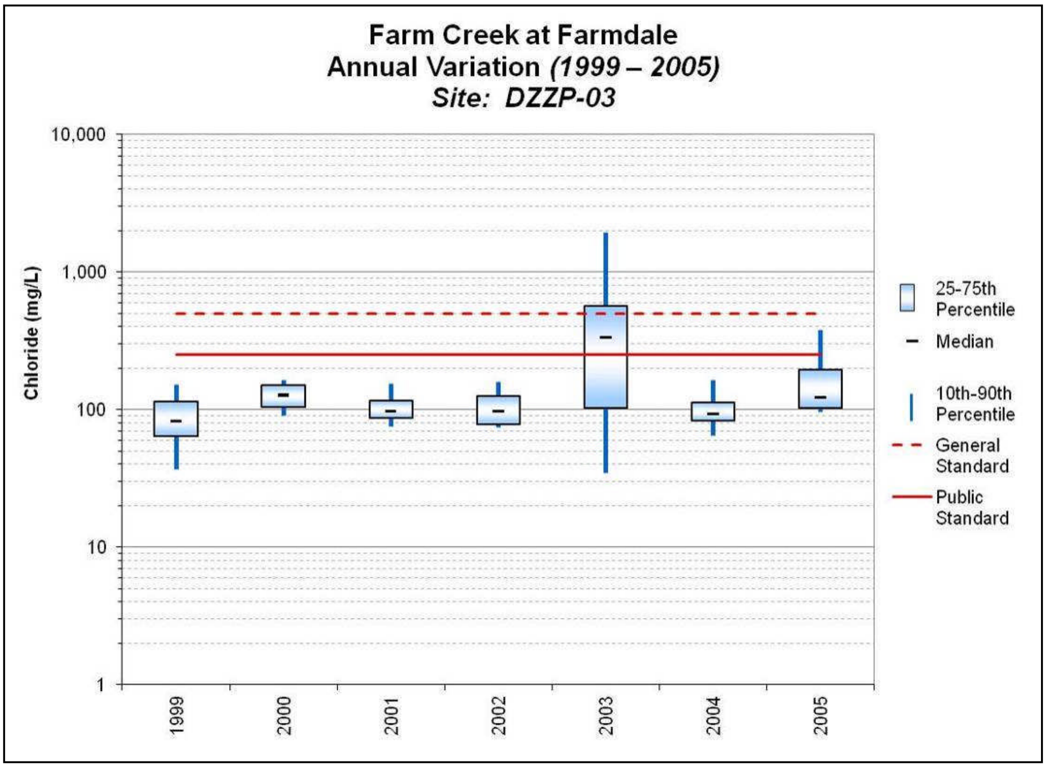

Figure 7-15. Annual chloride concentrations, Farm Creek at East Peoria, 1999- 2005.

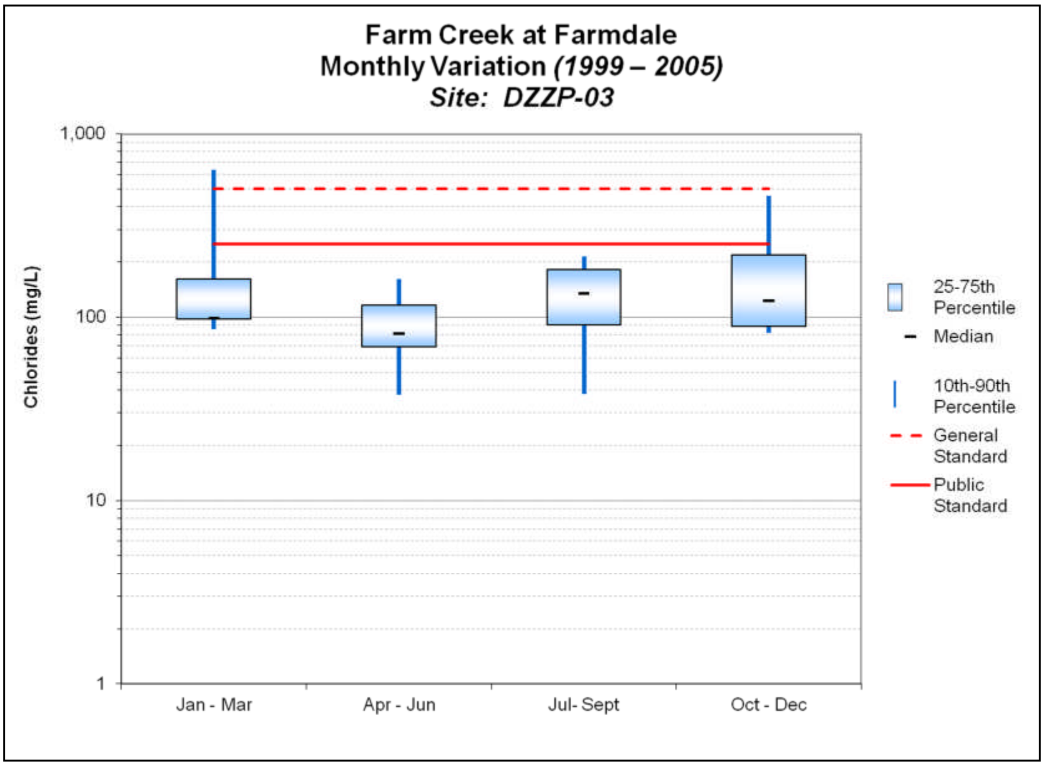

Figure 7-16. Seasonal chloride data, Farm Creek at East Peoria, 1999 – 2005.

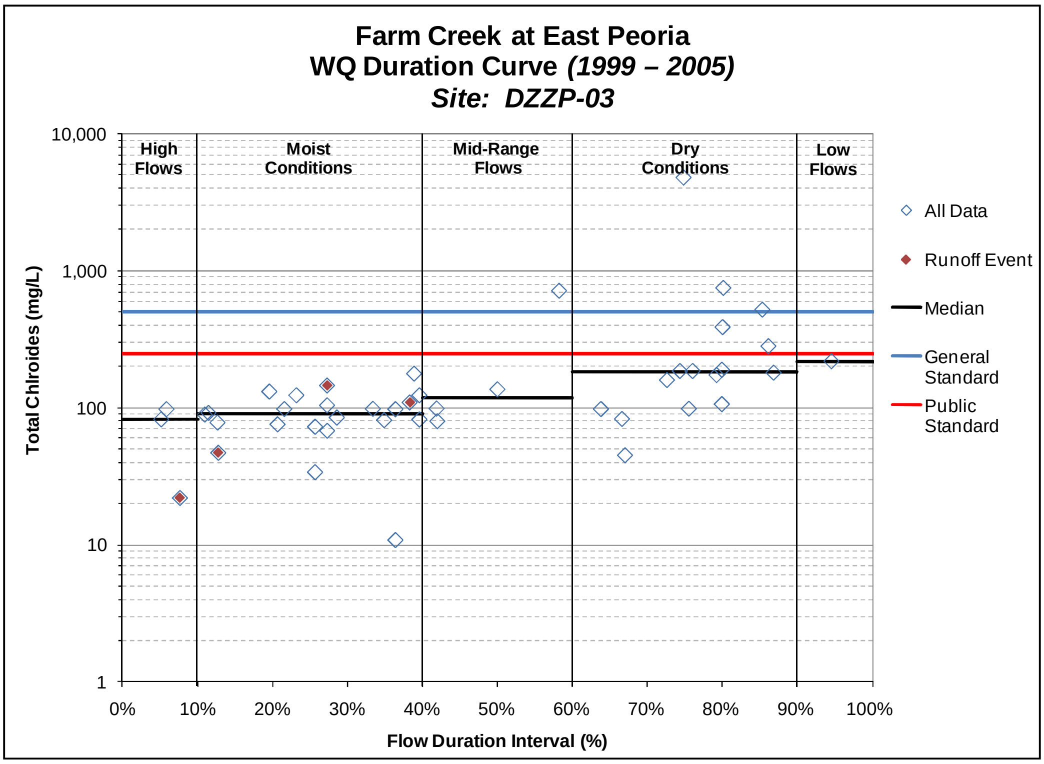

Figure 7-17. Chloride water quality duration curve, Farm Creek at East Peoria, 1999 - 2005.

7.3 Farm Creek TMDL and LRS

Table 7-4 summarizes the Farm Creek watershed and pollutant sources. The Farm Creek watershed includes one chloride impaired segment. Figure 7-18 presents the chloride load duration curve and Table 7-5 presents the TMDL for the Farm Creek at the East Peoria assessment site. LRSs are presented in Sections 7.3.2 and 7.3.3 for TSS and nutrients, respectively.

Table 7-4. Farm Creek summary table.

Upstream Characteristics	
Drainage Area	62 square miles
Sampling Station	DZZP-03
Listed Segments	DZZP-03
Land Use	cultivated crops (38 percent); developed land including low, medium, and high intensity (22 percent); deciduous forests (21 percent); developed open space (12 percent); pasture/hay (five percent); grassland/herbaceous (one percent); other (one percent).
Soil Type	86% B, 12% B/D, 2% No Data, <1% C
Erodible Soils	27% Highly Erodible, 73% Not Assessed
Animal Unit Density	3,800; 61 per square mile
Key Sources	watershed, streambank, and gully erosion; urban and agricultural stormwater runoff; NPDES facilities; MS4s; SSOs; hydromodification; deicing agents
NPDES Facilities	Oaklane Acres Homeowners Assoc (IL0022152)
	V-Mix Concrete Inc (IL0074632)
	Sundale Sewer Corp-Highland (ILG551039)
	Washington Estates Inc STP (IL0047406)
	Sundale Hills STP (IL0047384)
	City Of Washington STP #1 (IL0024881)
	Morton STP #3 (IL0030007)
	Washington STP #2 (IL0042412)
	East Peoria STP #1 (IL0028576)
NPDES Facility Disinfection Exemption [a]	Three of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [b]	Six facilities above have exceedances averaging 827 to 36,250 cfu/100mL
MS4 Communities	Village of Morton (IRL400392): 3.56 square miles
	City of East Peoria (IRL400331): 13.37 square miles
	Washington Township (IRL400665): 29.44 square miles
	Creve Coeur (ILR400322): 0.58 square miles
	Tazewell County Roads (IRL400271): 0.48 square miles
	ILDOT Roads (ILR400493): 0.06 square miles
CSO/SSO Communities	East Peoria STP #1 (IL0028576)
	Washington STP #2 (IL0042412)
SSO Overflows	There have been 3 reported overflows from East Peoria in the past five years

a. See Table 7-2 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

7.3.1 Chloride TMDL

The Farm Creek watershed includes one chloride impaired segment. Figure 7-18 presents the chloride load duration curve and Table 7-5 presents the TMDL and allocations. Chloride load reductions are only needed during dry conditions. Judicial use of deicing agents in the watershed is needed to help control the chloride load. Additional source assessment work is needed to further evaluate potential chloride sources including point sources and shallow groundwater.

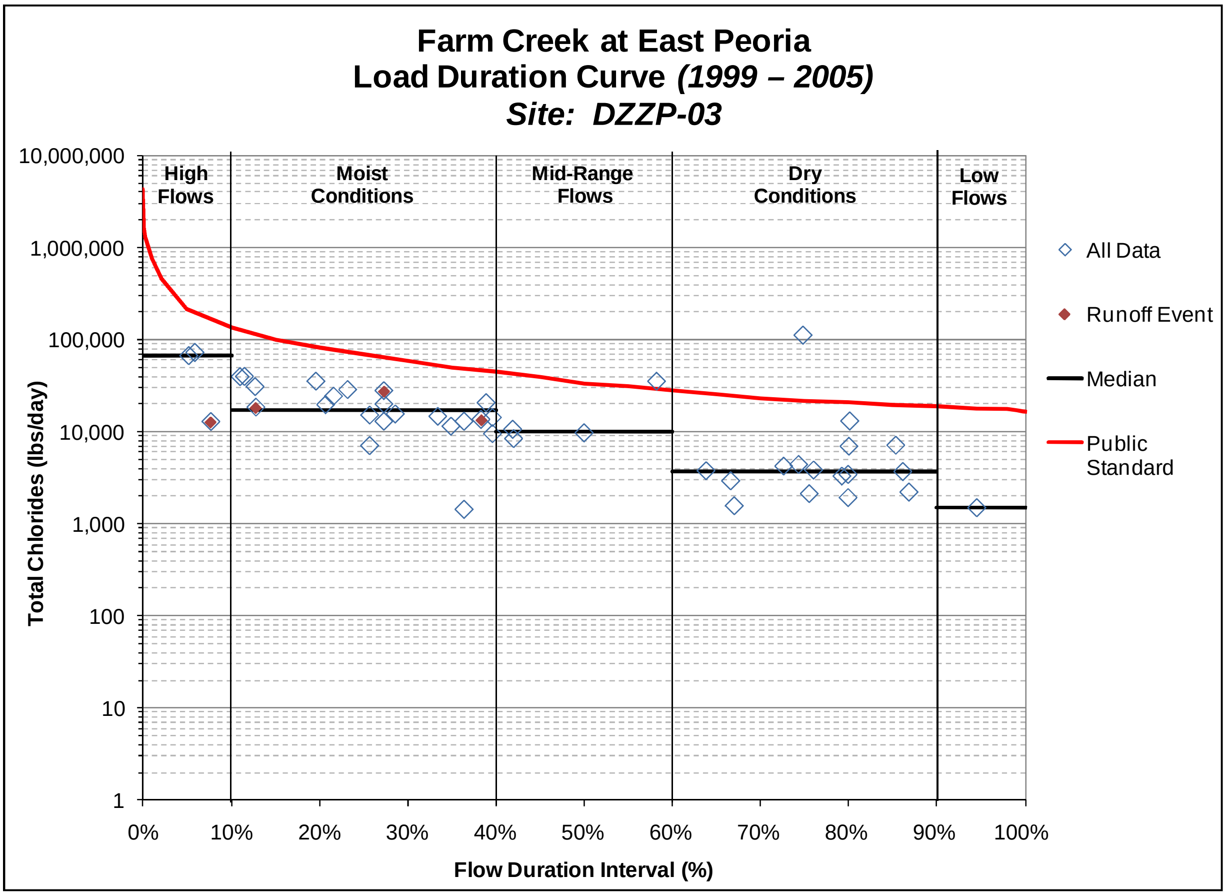

Figure 7-18. Chloride load duration curve, Farm Creek at East Peoria (DZZP-03).

Table 7-5. Chloride TMDL, Farm Creek at East Peoria (DZZP-03).

Station DZZP 03 TMDL [a, b]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Chlorides (lbs/day)	Current Load	71,629	39,372	34,985	110,366	1,487
	LA	867,193	19,749	5,286	1,951	150
	WLA: NPDES Facilities	32,547	32,547	16,301	16,301	16,301
	WLA: SSOs	0 [c]	0	0	0	0
	WLA: MS4s	3,046,645	69,384	18,570	6,856	526
	Total WLA	3,079,192	101,931	34,870	23,156	16,827
	MOS (10%)	438,487	13,520	4,462	2,790	1,886
	TMDL=LA+WLA+MOS	4,384,872	135,200	44,618	27,897	18,863
	TMDL Reduction %	0%	0%	0%	74.72%	0%

a. Note that the TMDL is based on the maximum allowable load in each flow regime and reduction is based on maximum observed load in each flow regime
b. Note that Farm Creek flows were adjusted to account for NPDES design flows during all flow regimes
c. Note that both facilities in Farm Creek are SSOs and are not allowed to discharge.

7.3.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 7-6 for Farm Creek using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. Streambank stabilization and gully restoration is needed to mitigate for excessive sediment loads in Farm Creek. Development and stormwater standards may need to be updated to protect the bluffs and ridges along Farm Creek from potentially harmful development activities that can result in gully formation along the bluffs. Further analysis of hydrologic conditions within Farm Creek is also needed to fully understand existing hydromodifications and implications on biotic habitat.

Table 7-6. TSS LRS, Farm Creek.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Farm Creek	DZZP-03	511	59.3	88%

7.3.3 Nutrient LRS

Nutrient LRSs have been developed for the Farm Creek watershed. Figure 7-19 and Figure 7-20 present the load duration curve and LRSs for total phosphorus and nitrate nitrogen, respectively, at the Farm Creek at East Peoria assessment site. Table 7-7 and Table 7-8 summarize the LRS and required reductions. Nutrient load reductions are needed for the majority of flow conditions. Agricultural and urban best management practices are needed to provide water quality treatment such as fertilizer and manure management and low impact development practices in urban areas. Control of SSOs is also needed.

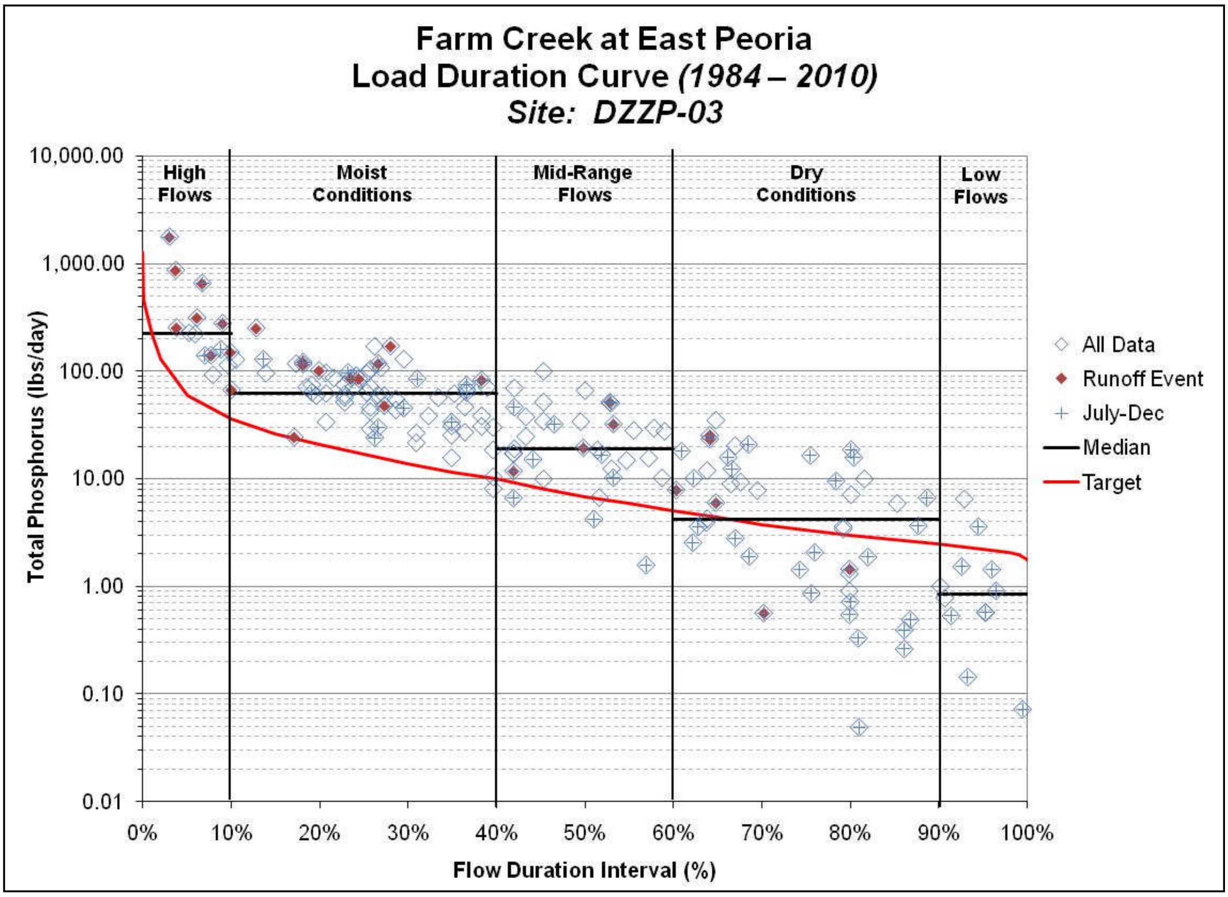

Figure 7-19. Total phosphorus load duration curve, Farm Creek at East Peoria (DZZP-03).

Table 7-7. Total phosphorus LRS, Farm Creek at East Peoria (DZZP-03).

Station DZZP 03 LRS[a, b]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	223	62	19	4	1
	LRS Target	60	17	7	3	2
	LRS Reduction %	73.10%	72.92%	64.52%	21.49%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime

b. Note that Farm Creek flows were adjusted to account for NPDES design flows during all flow regimes

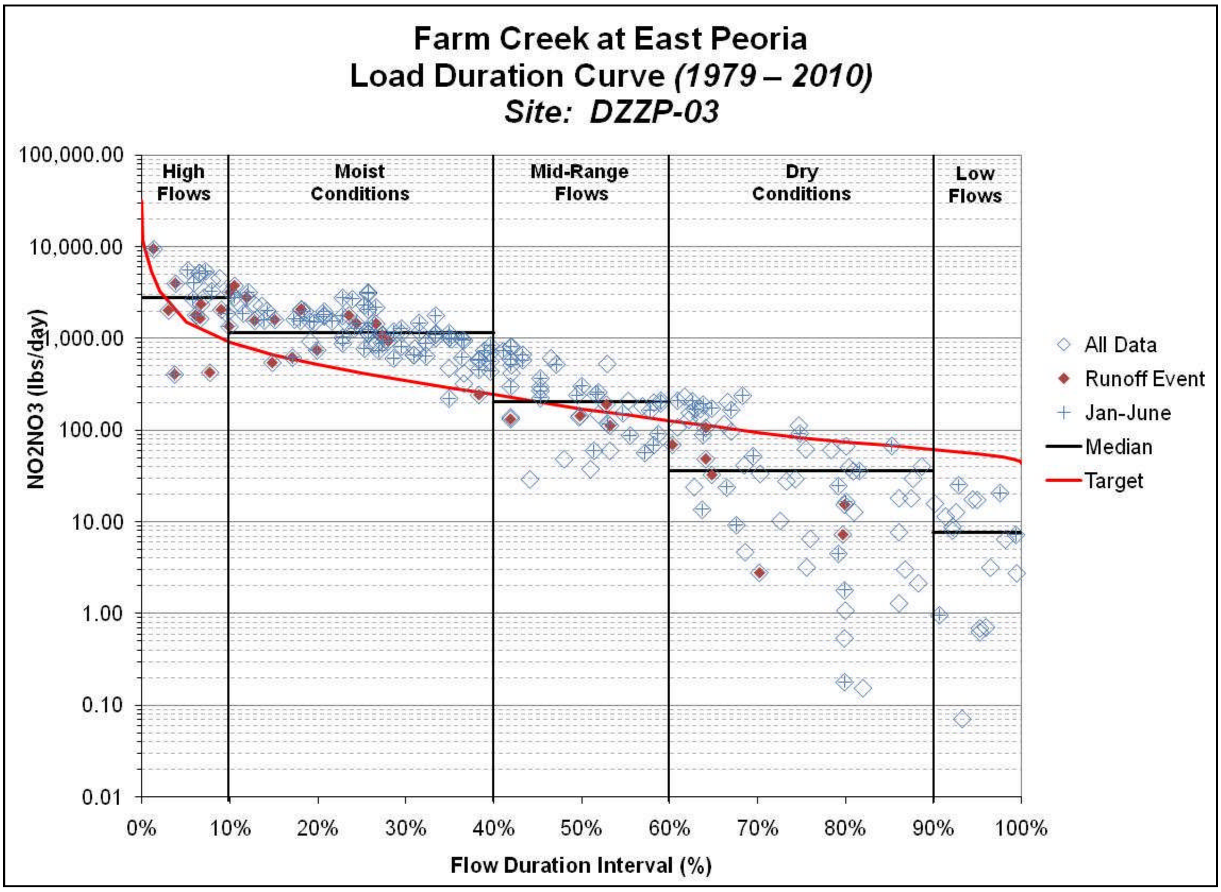

Figure 7-20. Nitrogen load duration curve, Farm Creek at East Peoria (DZZP-03).

Table 7-8. Nitrogen LRS, Farm Creek at East Peoria (DZZP-03).

Station DZZP 03 LRS[a, b]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	2,793	1,150	205	36	8
	LRS Target	1,500	422	169	83	55
	LRS Reduction %	46.29%	63.33%	17.48%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime
b. Note that Farm Creek flows were adjusted to account for NPDES design flows during all flow regimes

8. Kickapoo Creek

The Kickapoo Creek watershed cluster (Figure 8-2) has a total drainage area of 307 square miles and consists of nine 12-digit HUCs. Table 8-1 details the area per 12-digit HUC associated with the Kickapoo Creek watershed cluster. Counties with jurisdiction within this watershed cluster include Peoria, Knox, and Fulton. Kickapoo Creek is impaired due to elevated concentrations of bacteria. A watershed source assessment and linkage analysis are presented in this section. To address the bacteria impairment, a TMDL for fecal coliform bacteria is presented in Section 8.3. A LRS is also presented for TSS, phosphorus and nitrate plus nitrite nitrogen.

Figure 8-1. View of Kickapoo Creek.

Table 8-1. Kickapoo Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130003 01	01	Kickapoo Creek	32,035	50.1
	02	Jubilee Creek	22,378	35.0
	03	Hickory Run	21,884	34.2
07130003 02	01	Walnut Creek	16,418	25.7
	02	West Fork Kickapoo Creek	20,137	31.5
	03	Clark Branch	19,814	31.0
	04	Nixon Run - Kickapoo Creek	25,273	39.5
	05	Big Hollow Creek - Kickapoo Creek	20,786	32.5
	06	Dry Run - Kickapoo Creek	17,511	27.4
Total			**196,236**	**307**

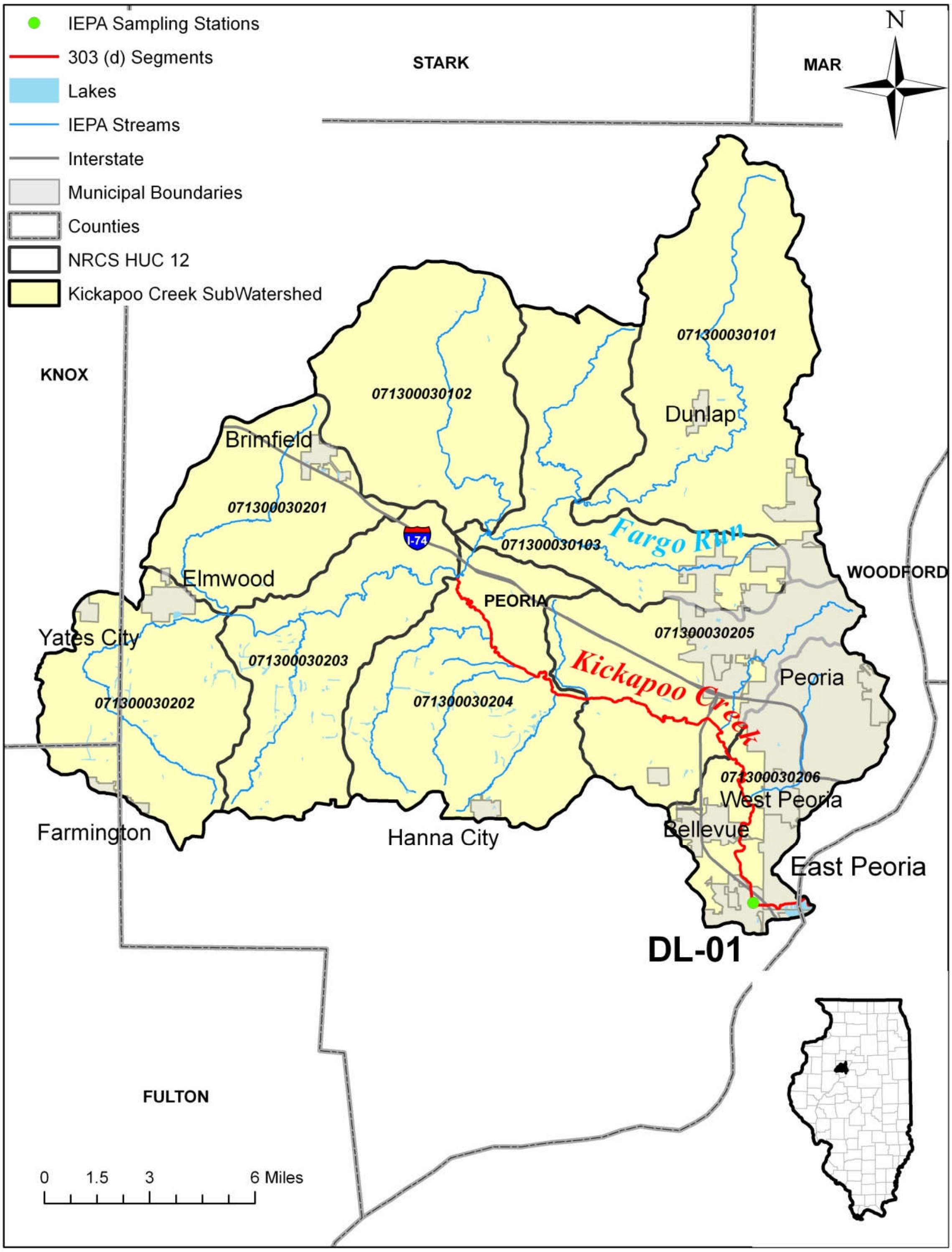

Figure 8-2. Kickapoo Creek watershed cluster sampling stations and listed segment.

8.1 Source Assessment

The Kickapoo Creek watershed cluster has a mix of land use (Figure 8-3); predominating land use includes: cultivated crops (48 percent); deciduous forests (24 percent); developed land including low, medium, and high intensity (12 percent); pasture/hay (eight percent); developed open space (five percent); and other (two percent). Development within the Kickapoo Creek watershed cluster surrounds Peoria. MS4s operating under the State General Stormwater Permit within the watershed cluster include: the City and County of Peoria, Peoria City Township, the Village of Bartonville, Kickapoo Township, Limestone Township, Medina Township, Bellevue, Peoria Heights, West Peoria, and ILDOT.

A total of 11 NPDES facilities are permitted within the Kickapoo Creek watershed cluster, this includes seven sewage treatment plants. NPDES facilities are listed in Table 8-2 and delineated in Figure 8-4. The Kickapoo Creek watershed has a significant amount of animal agriculture activities in the watershed. Table 8-3 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 8-2. NPDES facilities within the Kickapoo Creek watershed cluster.

10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
07130003 01	ILG580099	Dunlap STP	0.095	Exempt
	IL0054674	HPA - Jubilee College Historic	0.002	Exempt
	IL0066486	IL DNR - Jubilee College State Park	0.14	001, 002- limit 400
07130003 02	ILG580050	Brimfield SD STP	0.14	Exempt
	ILG582012	Elmwood STP	0.37	Exempt
	IL0029343	Kewanee STP	2.00	001- exempt and required to monitor/ 004, 005- limit 400
	ILG582022	Hanna City SD STP	0.274	Exempt
	IL0053813	Norwood School District #63 STP	0.0025	Exempt
	IL0002526	Keystone Steel & Wire	8.392	--

"—" Not applicable

Table 8-3. Livestock populations in Kickapoo Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Peoria	7,331	568	492	467	9,339
Fulton	47	3	2	2	107
Knox	366	7	11	9	1,904
Total Number of Animals	**7,744**	**578**	**505**	**478**	**11,350**
Equivalent Animal Units	**7,744**	**12**	**1,010**	**48**	**4,540**

Source: USDA 2007-2009

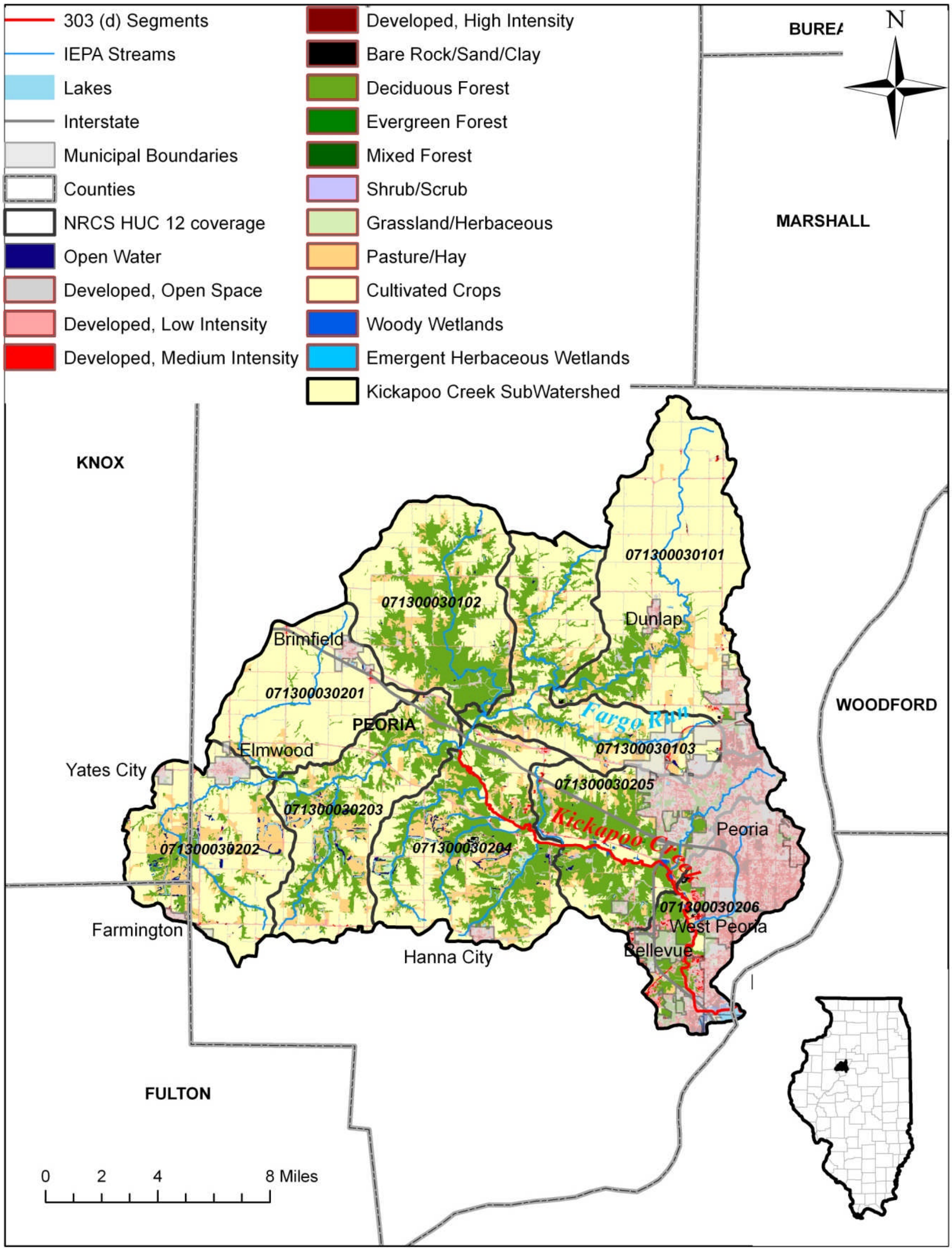

Figure 8-3. Kickapoo Creek watershed cluster land use.

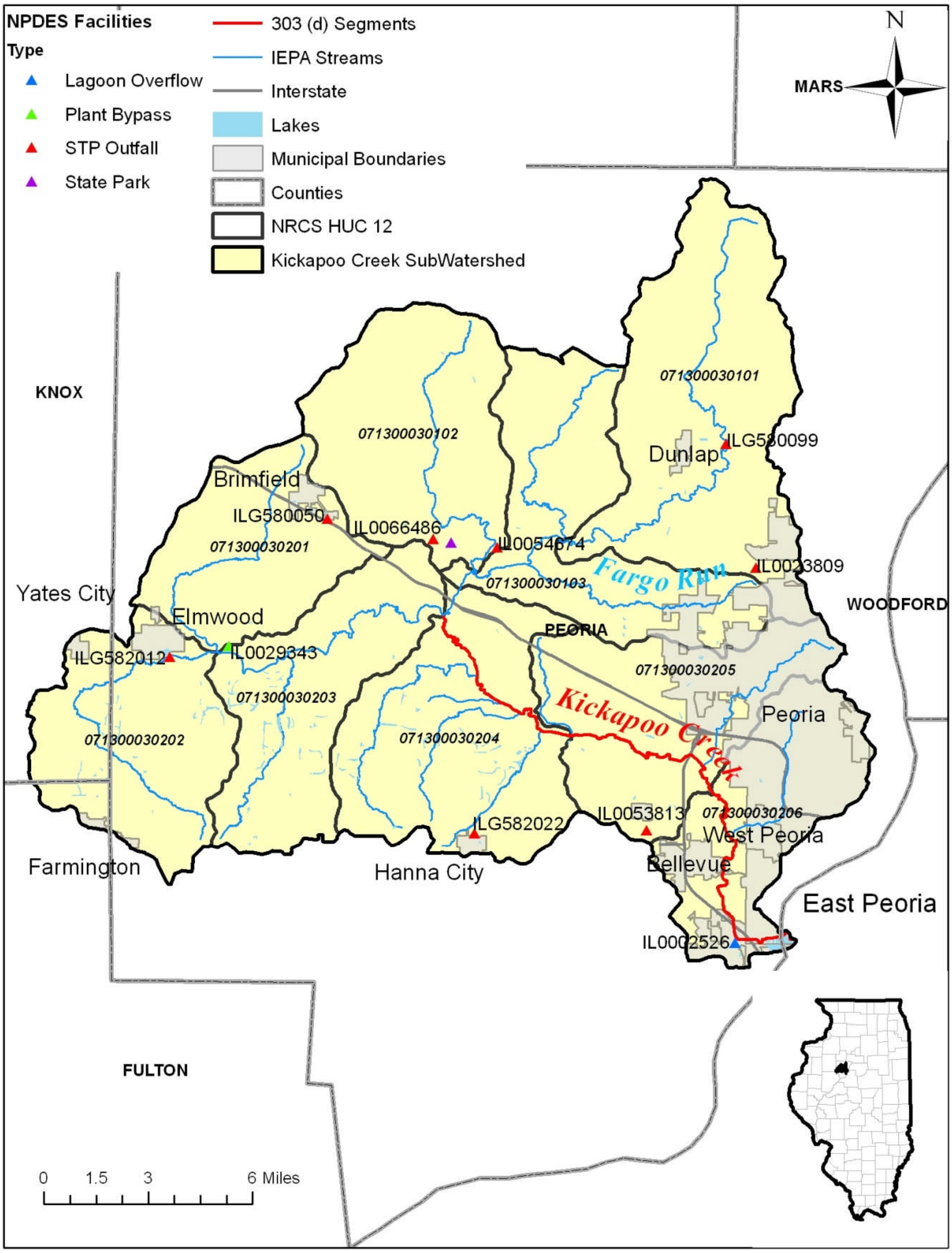

Figure 8-4. Kickapoo Creek watershed cluster NPDES facilities.

8.2 *Watershed Linkage Analysis*

8.2.1 Bacteria

Fecal coliform in Kickapoo Creek has been elevated since monitoring began in 1979. Bacteria sources within the watershed include agricultural activities and permitted dischargers. Cattle make up the majority of the livestock within the Kickapoo Creek with an estimated 7,750 animal units; in addition Jubilee College State Park has documented fecal coliform bacteria violations within the last three years. .

Figure 8-5 summarizes the annual fecal coliform data. Median counts have increased during the past ten years. Annual analysis of bacteria data shows strong seasonal trends, with highest counts of fecal coliform typically observed during the summer Fecal coliform peaks during the wet season, and decreases slightly during dry months (October-March) indicating runoff as the dominant source (Figure 8-6). Further analysis of the flow trends within the Kickapoo Creek watershed cluster reveals pollution predominately associated with higher flows, and likely runoff events (Figure 8-7).

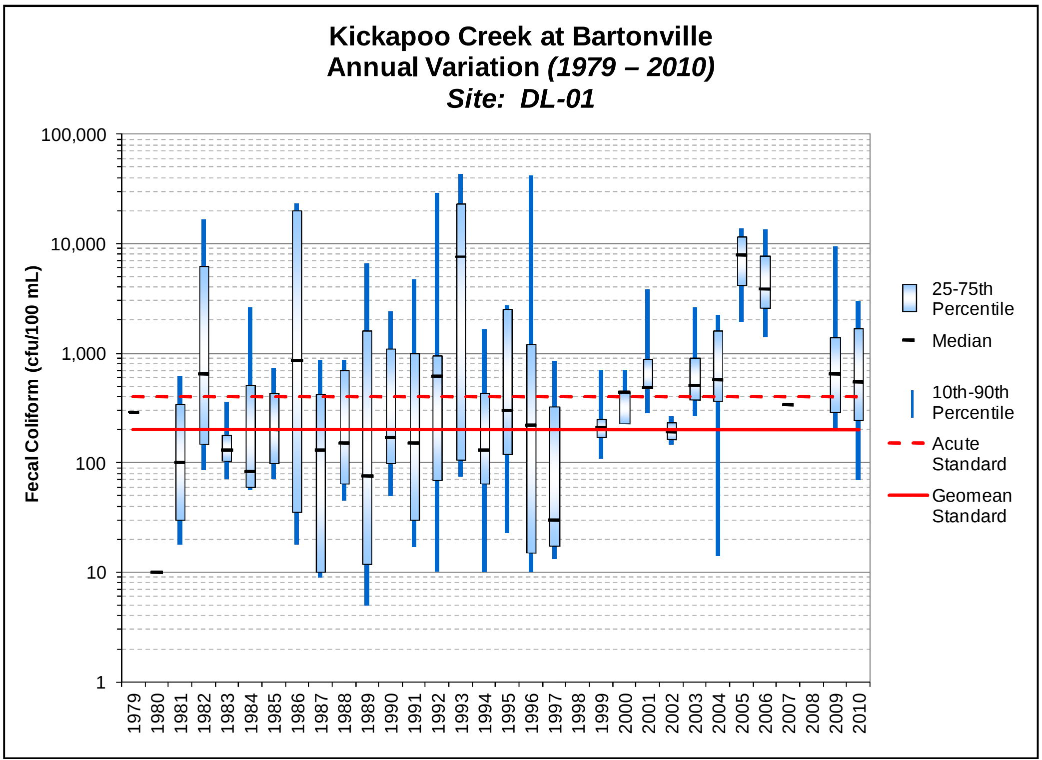

Figure 8-5. Annual fecal coliform concentrations, Kickapoo Creek, 1979 - 2010.

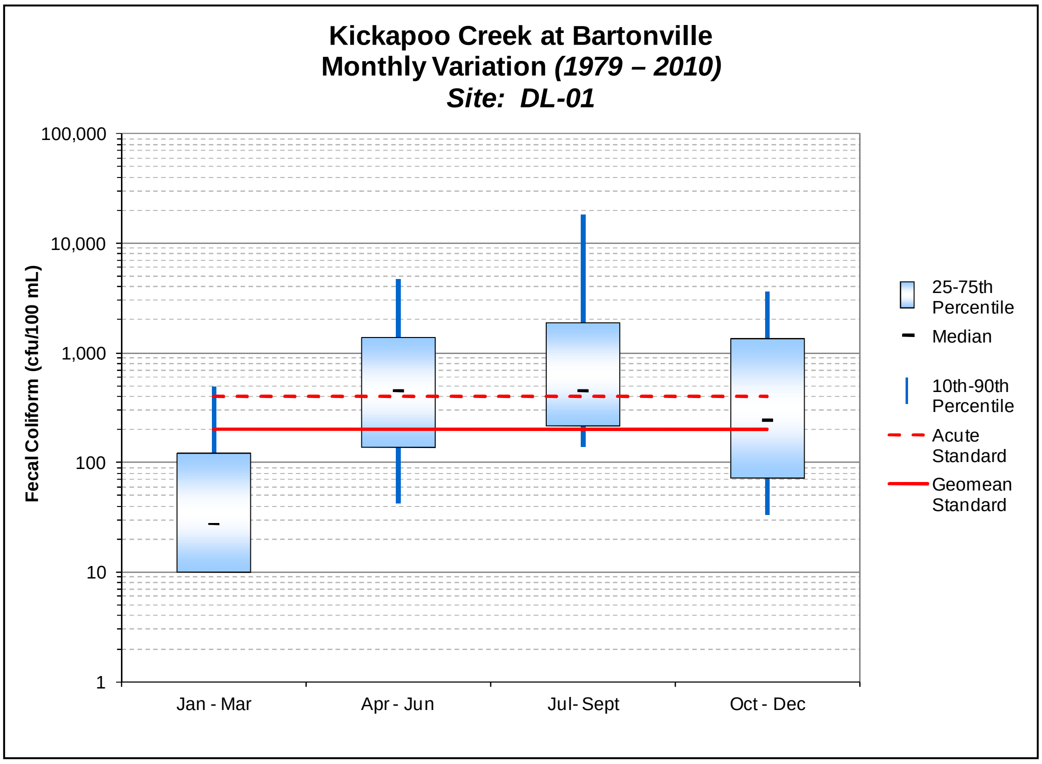

Figure 8-6. Seasonal fecal coliform, Kickapoo Creek at Bartonville, 1979-2010.

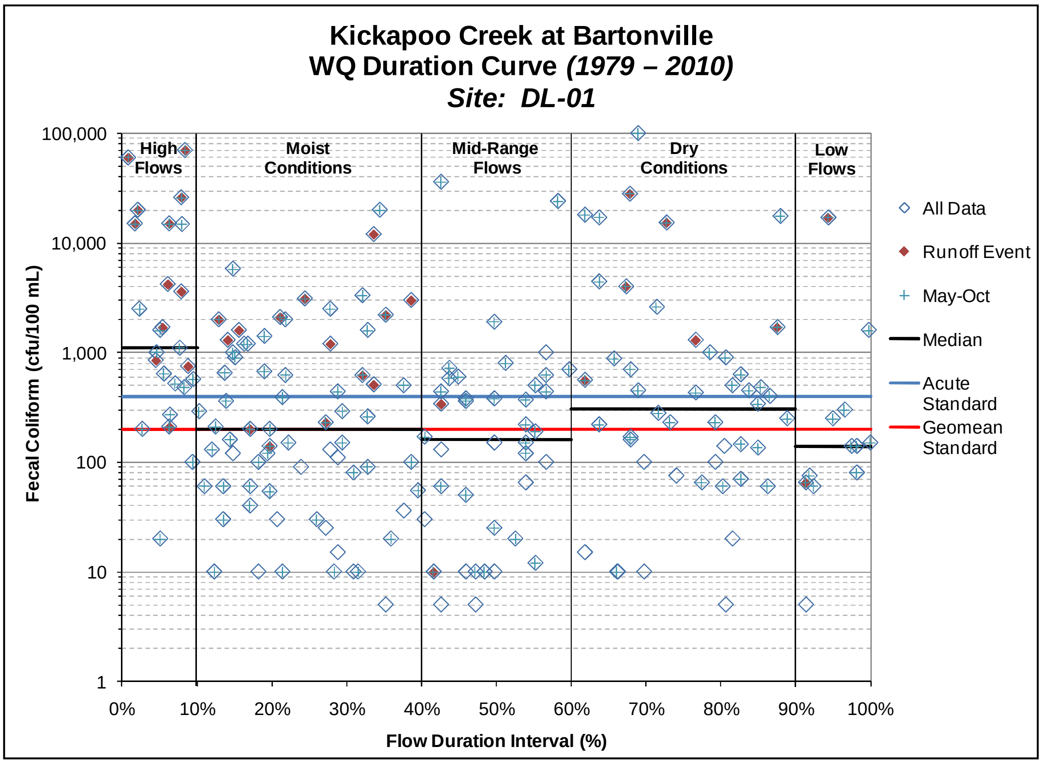

Figure 8-7. Fecal coliform water quality duration curve, Kickapoo Creek, 1979 – 2010.

8.2.2 Total Suspended Solids

Since monitoring began in 1979, TSS has sporadically exceeded the criteria (Figure 8-8). Elevated TSS is of particular concern due to the occurrence of sedimentation within the Illinois River. Analysis of TSS data shows strong seasonal trends. The highest concentrations of TSS occur during the wet spring months. Plowing and planting of agricultural fields occurs during the spring months, increasing the opportunity for watershed erosion during spring snowmelt and rainfall events. Additionally, analysis of flows indicates that TSS is dramatically elevated during high flow conditions relative to the other flow regimes (Figure 8-9). Elevated TSS during high flows indicates watershed, gully, and stream bank erosion as significant sources.

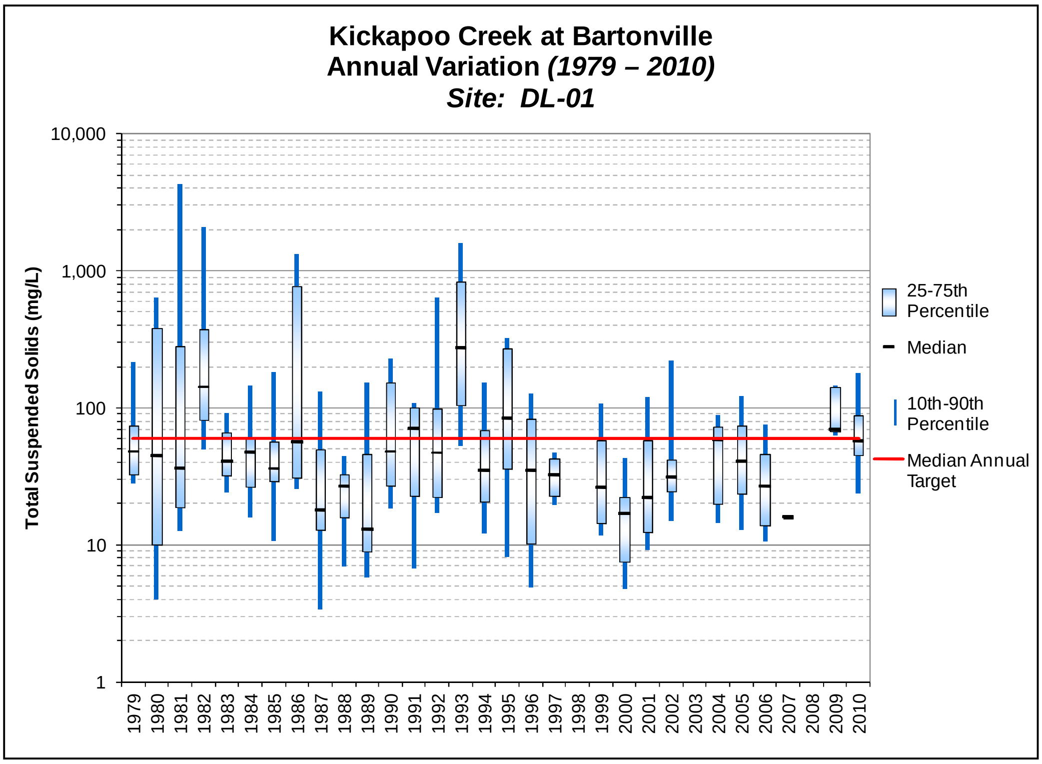

Figure 8-8. Annual TSS concentrations, Kickapoo Creek, 1979 - 2010.

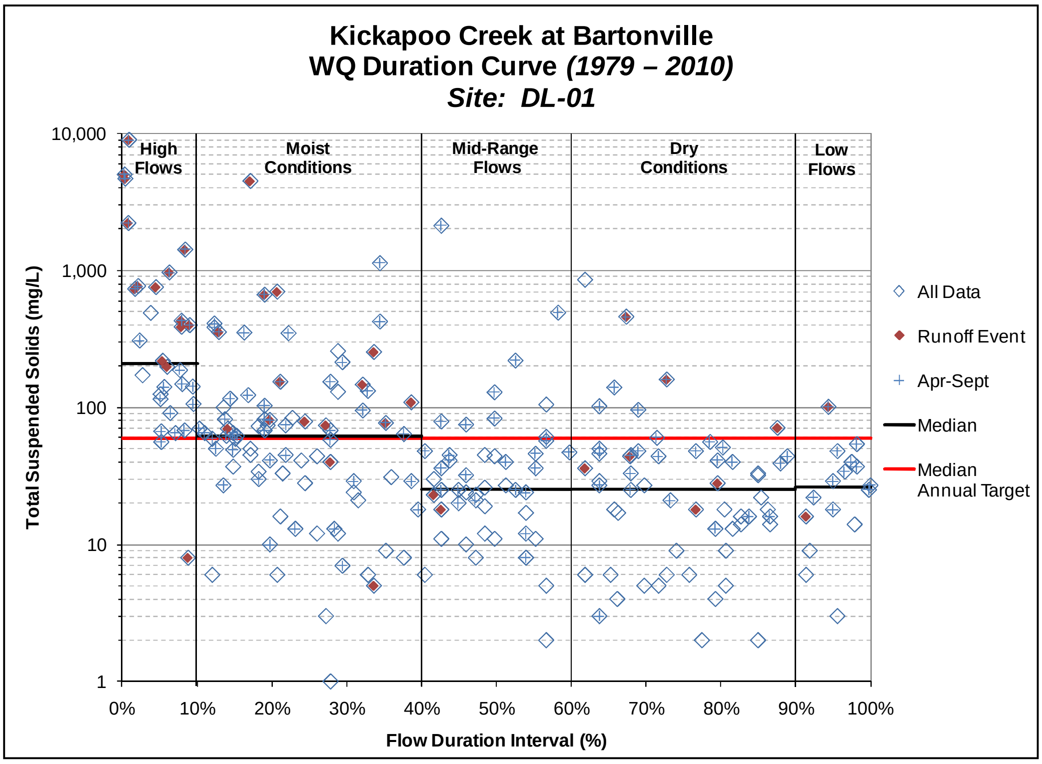

Figure 8-9. TSS water quality duration curve, Kickapoo Creek, 1979 - 2010.

8.2.3 Nutrients

Nutrients, including phosphorus and nitrogen have been consistently elevated in Kickapoo Creek since monitoring began in 1979 and 1984 respectively (Figure 8-10 and Figure 8-11). Phosphorus shows only slight seasonal trends with somewhat elevated concentrations occurring from April through September. In contract, analysis of nitrogen (nitrite plus nitrate) data shows strong seasonal trends with dramatically elevated concentrations from January through June.

Analysis of nutrient concentrations related to flow conditions shows an overwhelming trend of elevated concentrations during high flows and moist conditions.

Concentrations of phosphorus are slightly elevated during dry flow conditions (Figure 8-12). Slightly elevated phosphorus concentrations occurring during low flow conditions indicates point source pollution, although in this case wastewater is only a small portion of the phosphorus loading issue relative to runoff as indicated by dramatically elevated concentrations during high flow conditions. Indicating some concern, three NPDES permitted facilities have documented violations in effluent limitations for BOD, which is often related to nutrients.

Concentrations of nitrate also tend to be elevated during early spring. This corresponds to a time period of fertilizer application when crop fields are typically bare and have limited protection against spring snowmelt and rainfall events. Additionally Figure 8-12 through Figure 8-13 show that a majority of nutrient exceedances during high flow correspond to runoff events. Increased variability in nitrate concentrations occurs during dry conditions; presumably, this is related to the longer periods of dry weather (and lower concentrations) with intermittent runoff events washing elevated concentrations into the Creek.

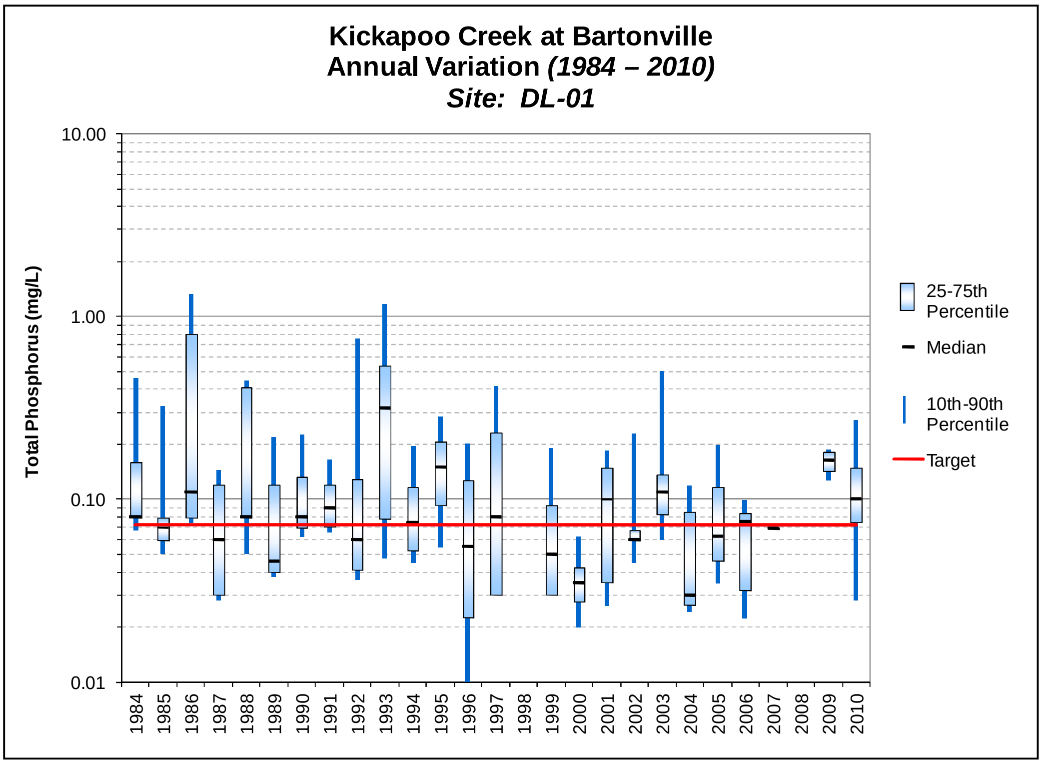

Figure 8-10. Annual phosphorus concentrations, Kickapoo Creek, 1984 - 2010.

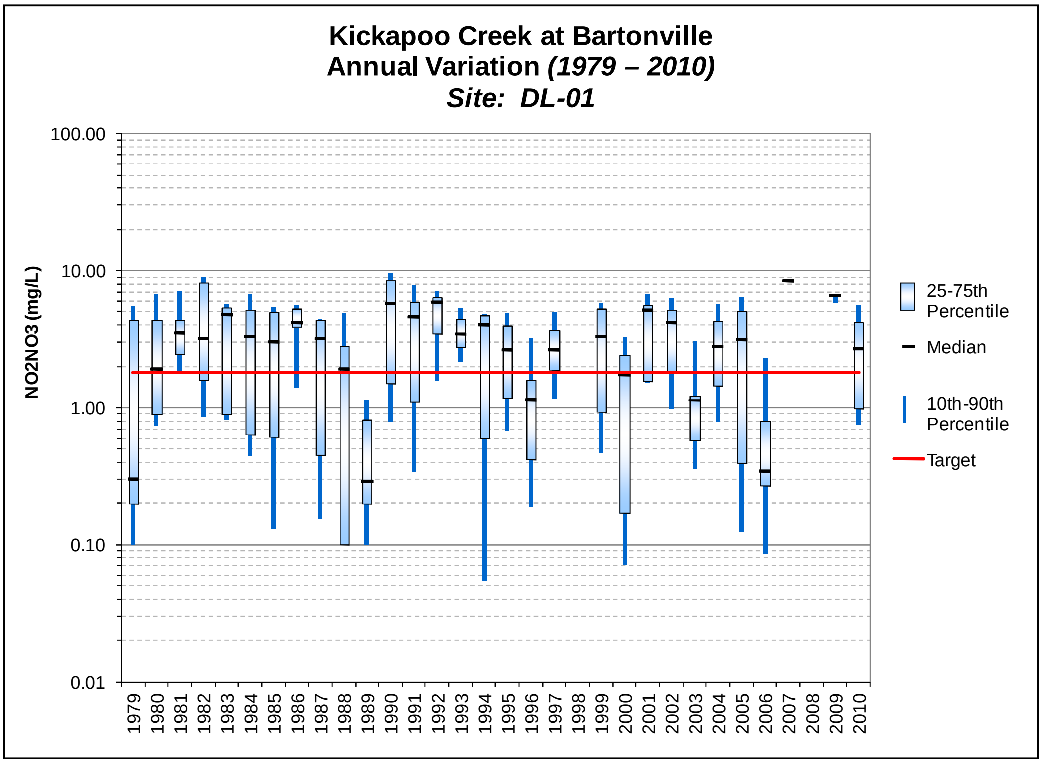

Figure 8-11. Annual nitrogen concentrations, Kickapoo Creek, 1979 - 2010.

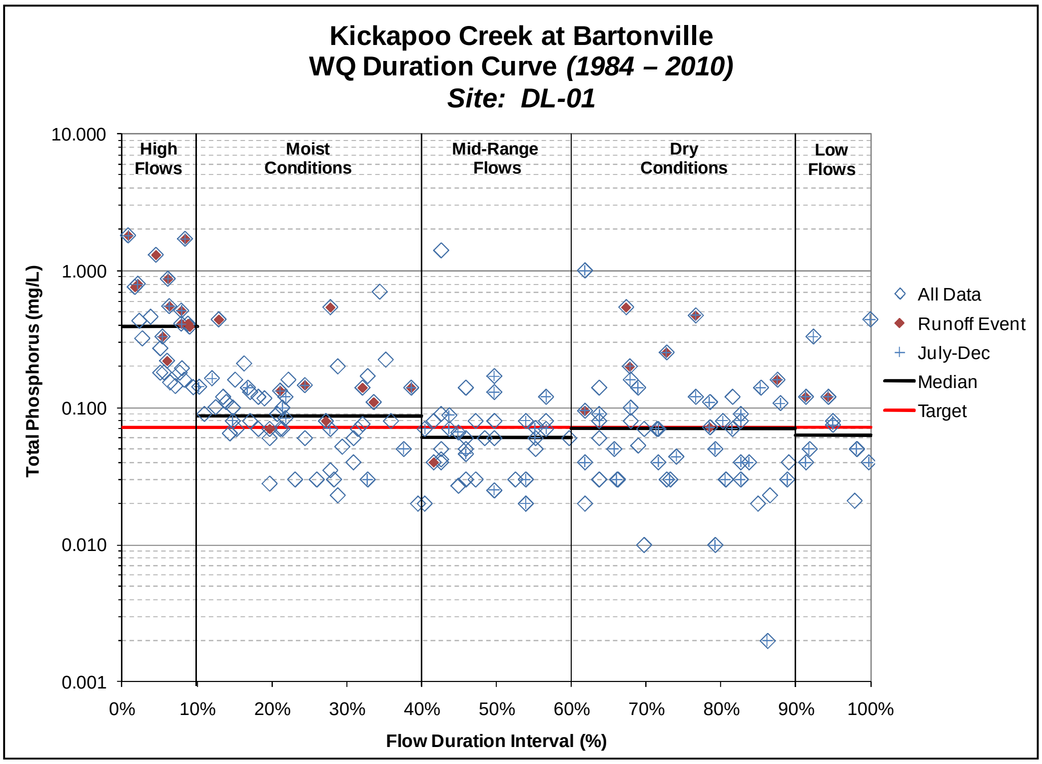

Figure 8-12. Phosphorus water quality duration curve, Kickapoo Creek, 1984 – 2010.

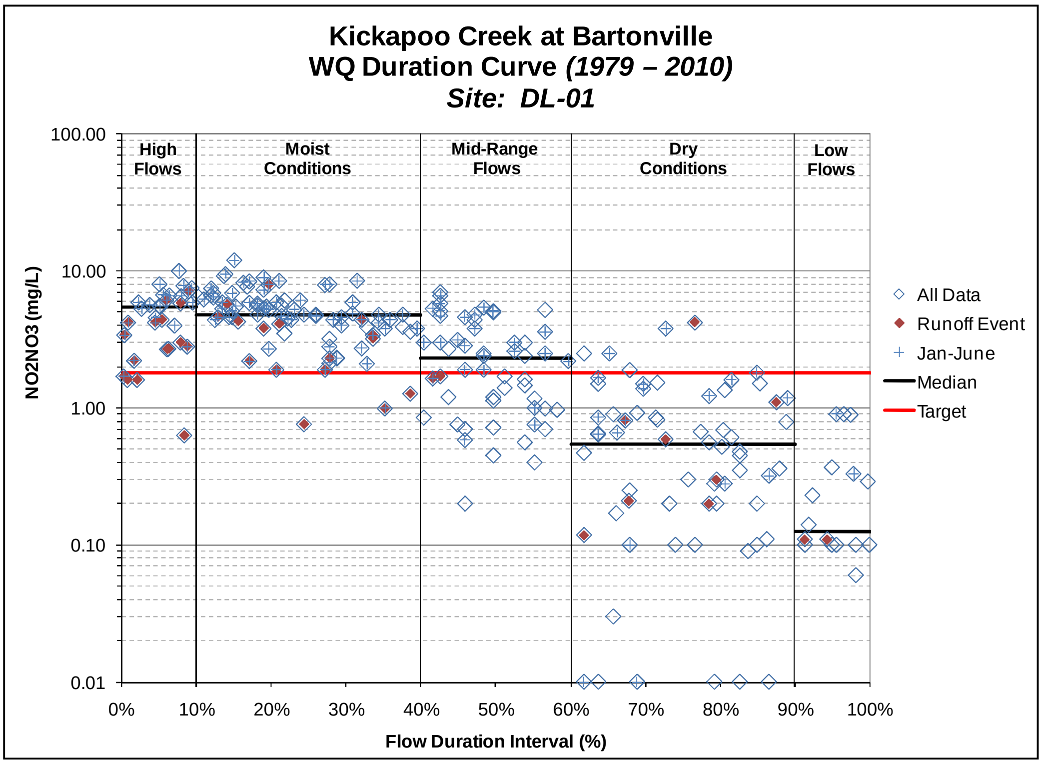

Figure 8-13. Nitrogen water quality duration curve, Kickapoo Creek, 1979 – 2010.

8.3 Kickapoo Creek TMDL and LRS

Table 8-4 summarizes the Kickapoo Creek watershed and pollutant sources. The Kickapoo Creek watershed includes one bacteria impaired segment. Figure 8-14 presents the fecal coliform load duration curve and Table 8-5 presents the TMDL for the Kickapoo Creek at the Bartonville assessment site. LRSs are presented in Sections 8.3.2 and 8.3.3 for TSS and nutrients, respectively.

Table 8-4. Kickapoo Creek summary table.

Upstream Characteristics	
Drainage Area	307 square miles
Sampling Station	DL-01
Listed Segments	DL-01
Land Use	cultivated crops (48 percent); deciduous forests (24 percent); developed land including low, medium, and high intensity (12 percent); pasture/hay (eight percent); developed open space (five percent); other (two percent).
Hydrologic Soil Group	78% B, 14% C, 5% B/D, <1% A, <1% D, 1% No Data
Erodible Soils	34% highly erodible, 66% not assessed
Animal Units	13,000; 42 per square mile
Key Sources	watershed, streambank, and gully erosion; urban and agricultural stormwater runoff; animal agriculture; MS4s; NPDES facilities
NPDES Facilities	Kewanee STP (IL0029343)
	Norwood School District #63 STP (IL0053813)
	HPA - Jubilee College Historic (IL0054674)
	Brimfield SD STP (ILG580050)
	Dunlap STP (ILG580099)
	Elmwood STP (ILG582012)
	Hanna City SD STP (ILG582022)
	IL DNR - Jubilee College State Park (IL0066486)
	Keystone Steel & Wire (IL0002526)
NPDES Facility Disinfection Exemption [a]	Eight of the facilities above have disinfection exemptions
Fecal Coliform Exceedance Summary [b]	Three facilities above have exceedances averaging 2,703 to 15,495 cfu/100mL
MS4 Communities	Village of Bartonville (IRL400287): 1.98 square miles
	Kickapoo Township (IRL400073): 26.86 square miles
	Limestone Township (IRL400078): 9.07 square miles
	Medina Township (IRL400085): 5.05 square miles
	City of Peoria (IRL400424): 28.24 square miles
	Bellevue (ILR400165): 1.64 square miles
	Peoria Heights (ILR400425): 0.84 square miles
	West Peoria (ILR400506): 1.26 square miles
	Peoria City Township (ILR400599): 1.68 square miles
	ILDOT Roads (ILR400493): 1.06 square miles
	Peoria County Roads (IRL400267): 0.56 square miles
CSO/SSO Communities	Kewanee STP
SSO Overflows	The Kewanee STP SSO has overflowed once in the past 5 years.

[a] See Table 8-2 for exemption and permit specifics.
[b] See Appendix A for DMR Exceedance Summary Table (2005-2010)

8.3.1 Bacteria TMDL

A fecal coliform bacteria TMDL has been developed for Kickapoo Creek. Figure 8-14 presents the fecal coliform load duration curve at the Bartonville assessment site and Table 8-5 summarizes the TMDL and required reductions. Pollutant reductions are needed for all flow conditions, except under low flows. Watershed runoff and livestock are believed to be the primary non-natural sources of bacteria in the Kickapoo Creek watershed. As such, recommended actions include urban stormwater management and agricultural best management practices such as manure management to limit runoff and prevent bacteria being conveyed to the Creek. Point sources with bacteria limit violations should also be addressed through the NPDES permitting program.

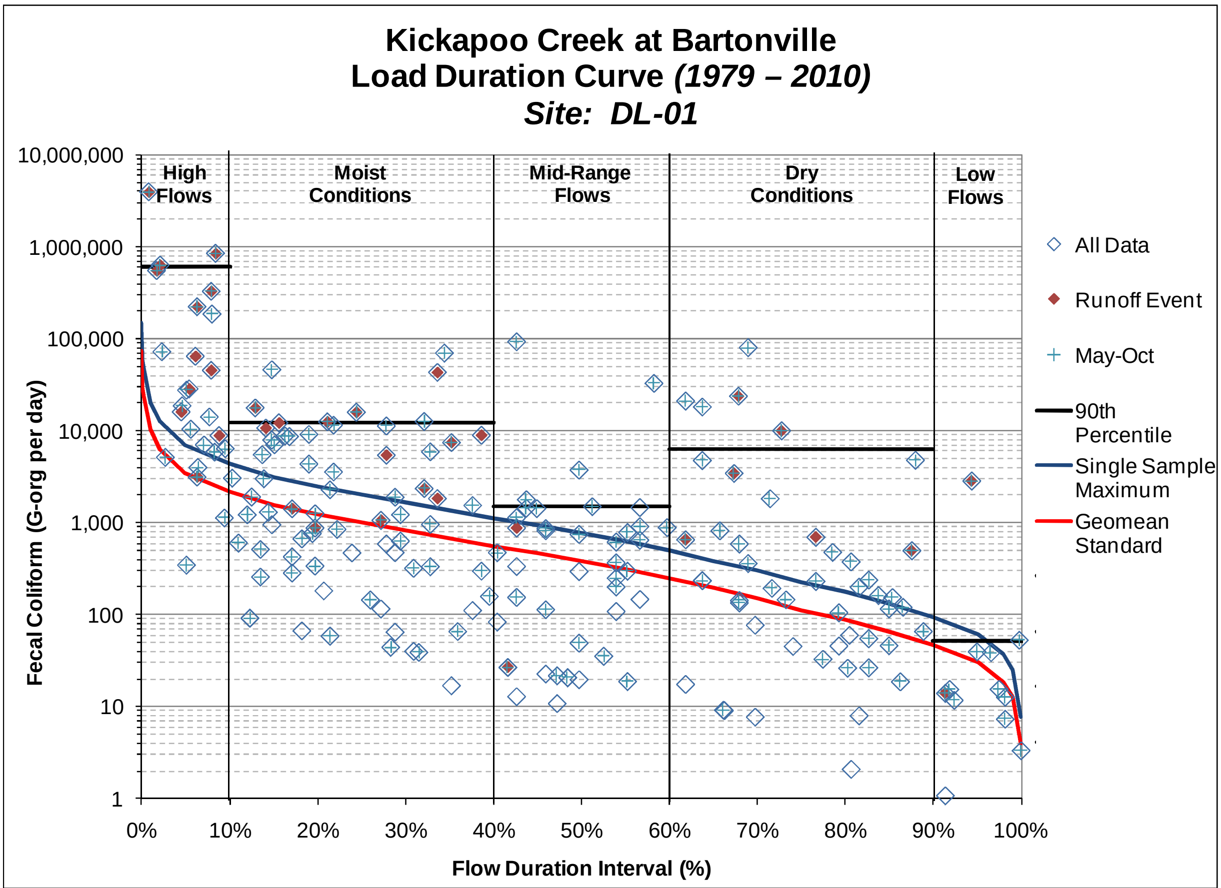

Figure 8-14. Fecal coliform load duration curve, Kickapoo Creek at Bartonville (DL-01).

Table 8-5. Fecal coliform TMDL, Kickapoo Creek at Bartonville (DL-01).

Station DL 01 TMDL[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Fecal Coliform (G-org/day)	Current Load	602,867	12,248	1,499	6,367	52
	LA	4,555	1,255	480	118	9
	WLA: NPDES Facilities	116	116	44	44	44
	WLA: MS4s	1,628	449	172	42	3
	Total WLA	1,744	565	216	86	47
	MOS (10%)	700	202	77	23	6
	TMDL=LA+WLA+MOS	6,999	2,022	773	227	62
	TMDL Reduction %[b]	98.84%	83.49%	48.42%	96.44%	0%

a. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on the observed 90th percentile load in each flow regime.
b. Note that daily load reductions are based on the instantaneous water quality standard; the seasonal geometric standard also needs to be met.

8.3.2 Total Suspended Solids LRS

TSS load reductions are presented in Table 8-6 for Kickapoo Creek using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. Kickapoo Creek has the highest volume weighted TSS reduction of all the Illinois River tributaries. To achieve this reduction, a focused effort is needed in this watershed to reduce watershed erosion from both urban and agricultural sources including conservation tillage, grassed waterways, and buffers. Stream restoration activities should be conducted once hydrologic conditions are improved through the use of urban and agricultural stormwater best management practices. Gullies should be inventoried and restored.

Table 8-6. TSS LRS, Kickapoo Creek.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Kickapoo Creek	DL-01	1,430	59.3	96%

8.3.3 Nutrient LRS

Nutrient LRSs have been developed for the Kickapoo Creek watershed. Figure 8-15 and Figure 8-16 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Kickapoo Creek assessment site. Table 8-7 and Table 8-8 summarize the LRS and required reductions. Nutrient load reductions are not needed during the lower flow conditions, as such controlling watershed runoff is a high priority activity in this watershed from both urban and agricultural land uses.

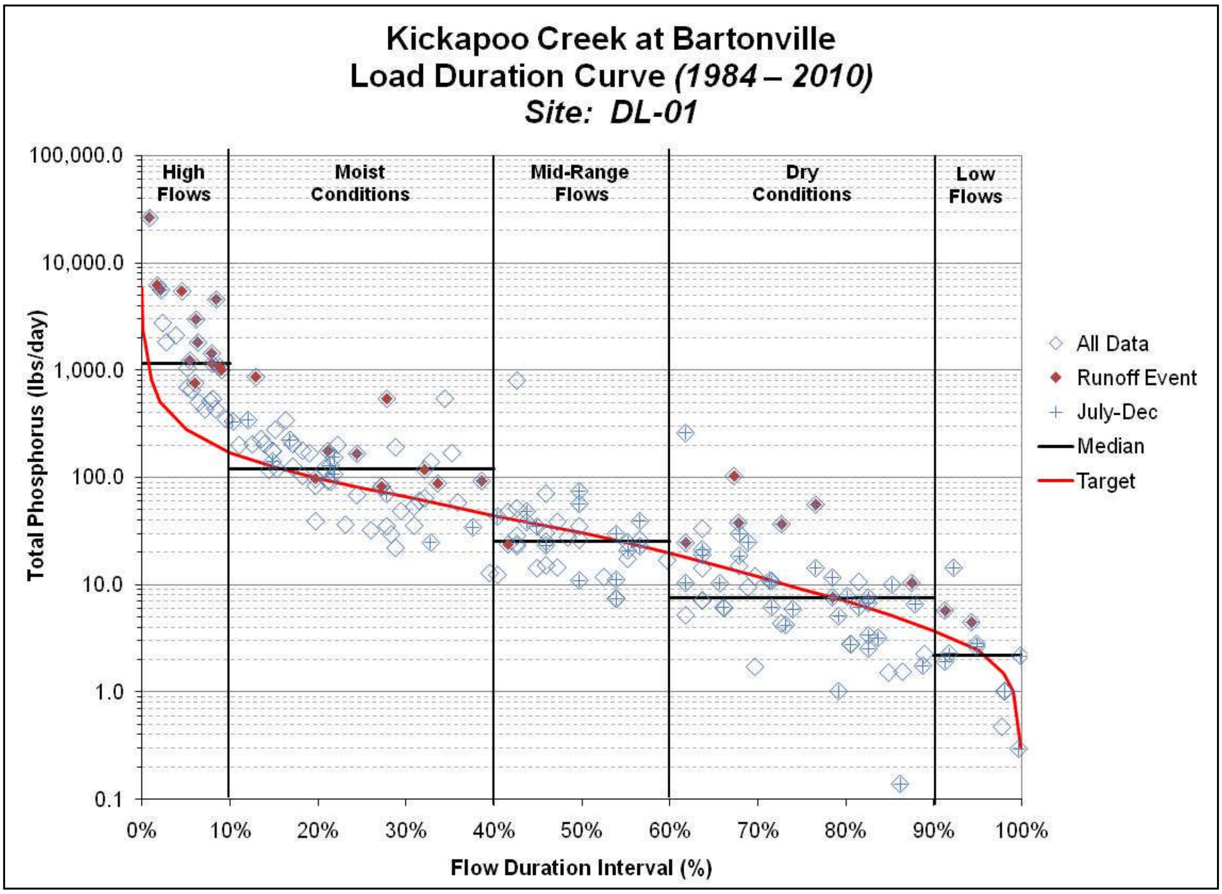

Figure 8-15. Total phosphorus load duration curve, Kickapoo Creek at Bartonville (DL-01).

Table 8-7. Total phosphorus LRS, Kickapoo Creek at Bartonville (DL-01).

Station DL 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	1,148	119	26	8	2
	LRS Target	278	80	31	9	2
	LRS Reduction %	75.81%	32.45%	0%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

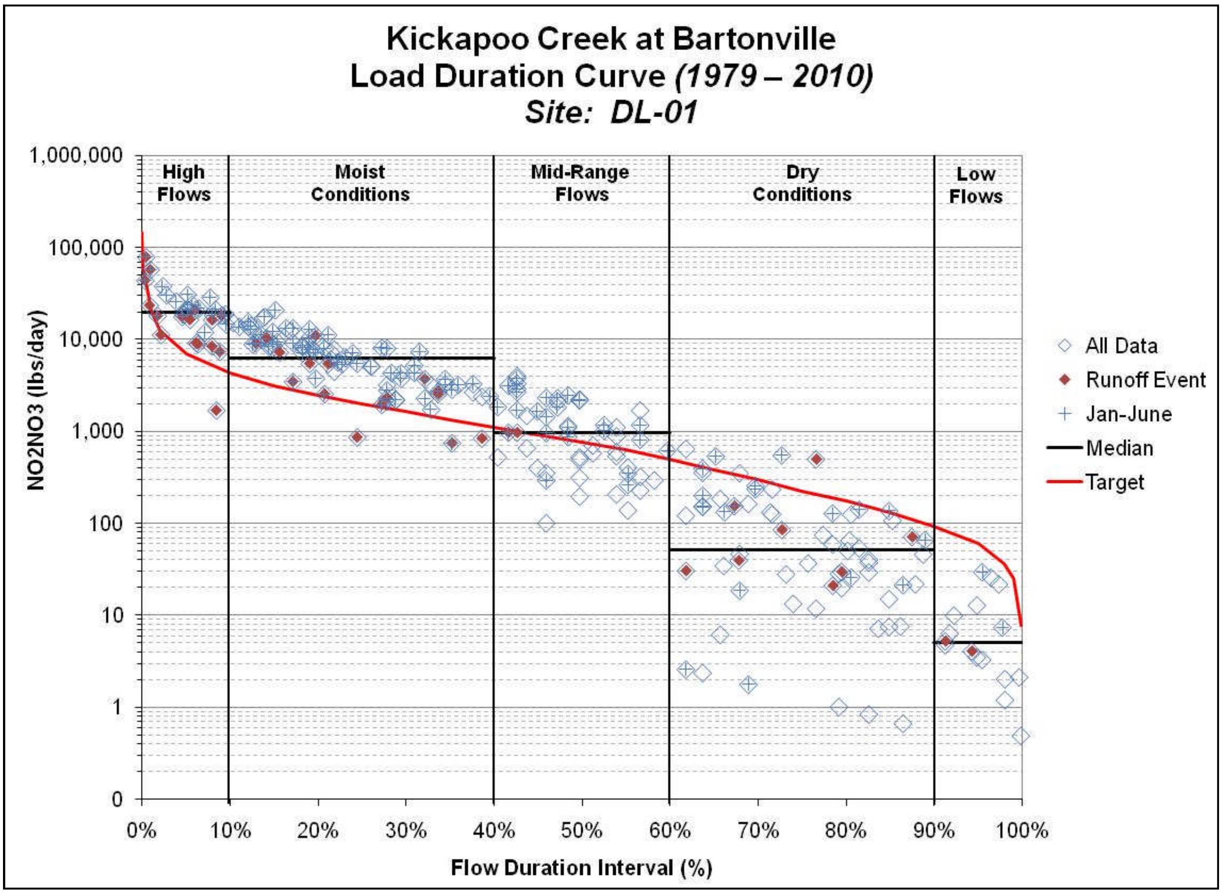

Figure 8-16. Nitrogen load duration curve, Kickapoo Creek at Bartonville (DL-01).

Table 8-8. Nitrogen LRS, Kickapoo Creek at Bartonville (DL-01).

Station DL 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	19,838	6,270	963	52	5
	LRS Target	6,937	2,004	766	225	61
	LRS Reduction %	65.03%	68.04%	20.44%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

9. Senachwine Creek

The Senachwine Creek watershed cluster has a total drainage area of 90 square miles and can be further delineated into three 12-digit HUCs (Figure 9-1). Table 9-1 details area per 12-digit HUC associated with the Senachwine Creek watershed cluster. Counties with jurisdiction within the Senachwine Creek watershed cluster include: Marshall, Woodford and Peoria. Senachwine Creek is unimpaired. A watershed source assessment and linkage analysis are presented in this section. A LRS is presented for TSS, phosphorus and nitrate plus nitrite nitrogen.

Senachwine Creek originates near Camp George, Illinois where it flows for approximately 29 miles and outlets into the Illinois River at Chillicothe, Illinois. Water quality data collected between 1999 and 2010 indicate potentially elevated concentrations of TSS, phosphorus, and nitrate plus nitrite nitrogen. A LRS has been developed to address all the aforementioned constituents.

Table 9-1. Senachwine Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 14	01	Saratoga Church - Senachwine Creek	16,875	26.4
	02	Little Senachwine Creek - Senachwine Creek	20,141	31.5
	03	Gilfillan Creek - Senachwine Creek	21,120	33.0
Total			**58,136**	**90**

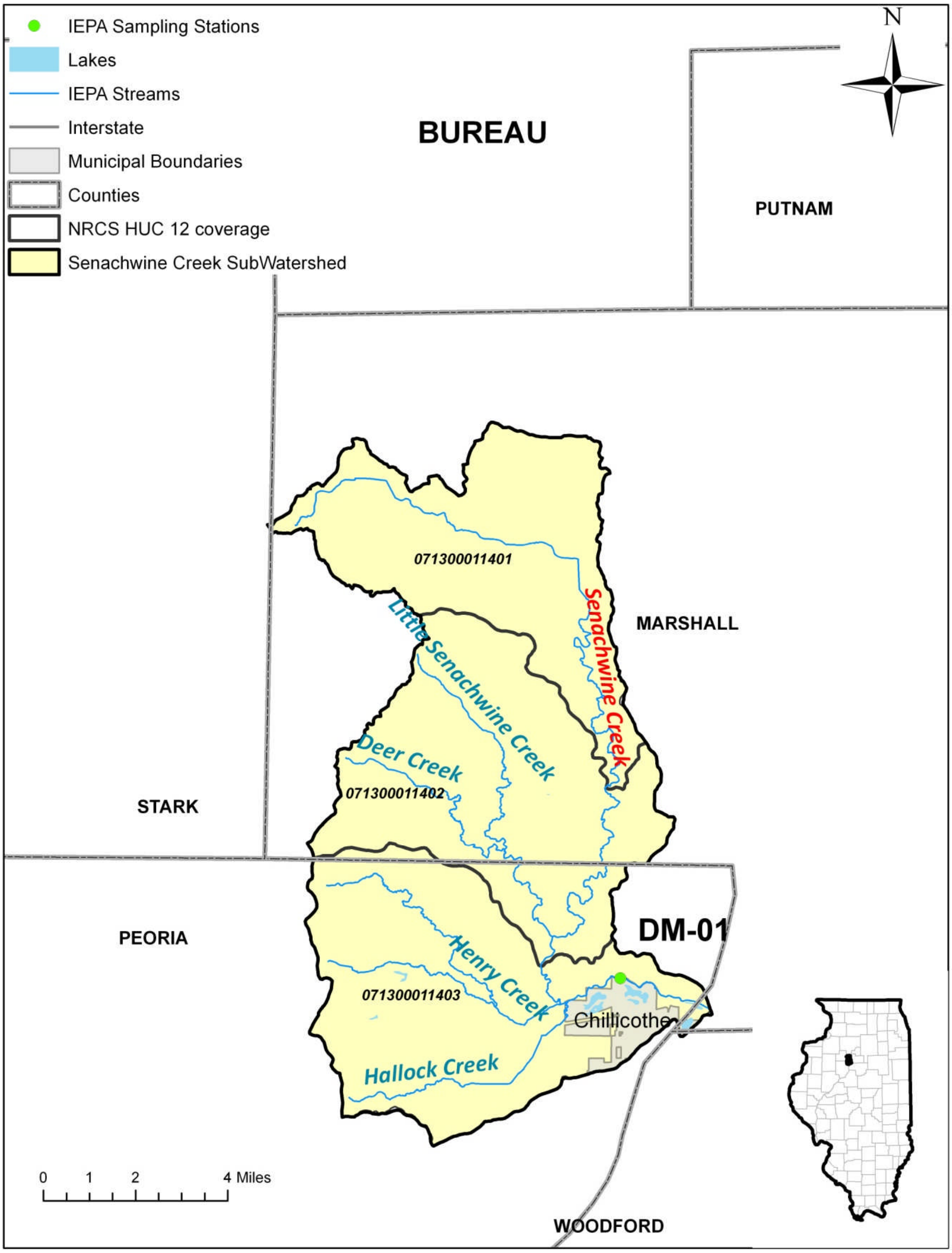

Figure 9-1. Senachwine Creek watershed cluster segments and stations.

9.1 Source Assessment

This particular watershed cluster is largely agricultural and contains relatively little developed land within its drainage area (Figure 9-2). Predominating land use includes cultivated crops (70 percent) and deciduous forests (19 percent). With an estimated 2009 population of 6,004, the largest area of development within the Senachwine Creek watershed cluster is centered around Chillicothe. There are no regulated point sources within this watershed.

The Senachwine Creek watershed has a significant amount of animal agriculture activities in the watershed. Table 9-2 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 9-2. Livestock populations in Senachwine Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Marshall	757	27	76	55	1,225
Peoria	894	69	60	57	1,138
Stark	1	0	0	0	5
Total Number of Animals	**1,652**	**96**	**136**	**112**	**2,369**
Equivalent Animal Units	**1,652**	**2**	**273**	**11**	**947**

Source: USDA 2007-2009

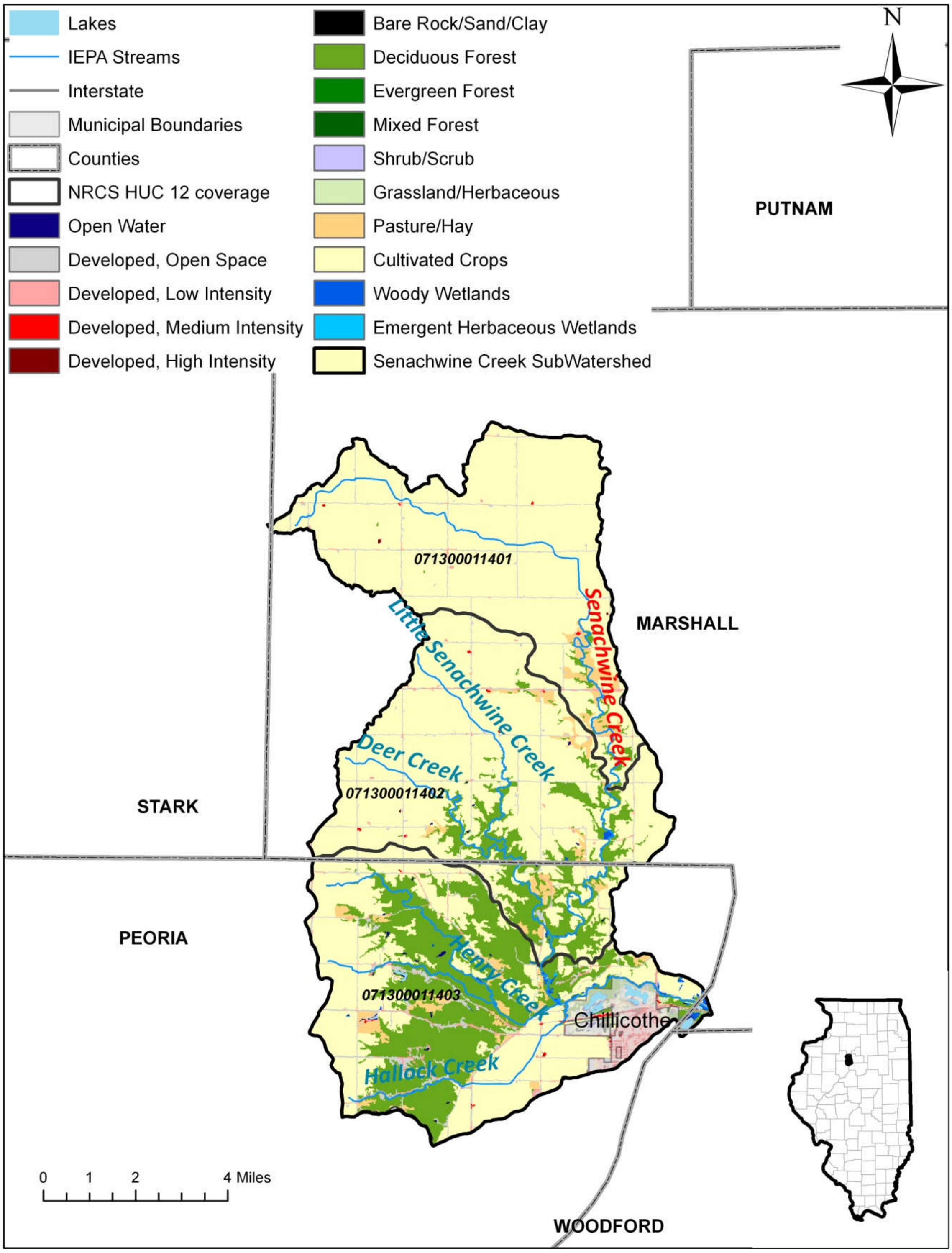

Figure 9-2. Senachwine Creek watershed cluster land use.

9.2 Watershed Linkage Analysis

9.2.1 Total Suspended Solids

Limited TSS data are available in Senachwine Creek compared to several of the other Illinois River tributaries. Since monitoring began in 1999, median annual concentrations of TSS in Senachwine Creek are below the median annual TSS target (Figure 9-3). Analysis of TSS data collected on Senachwine Creek shows limited variability and no concentrations in exceedance of the target throughout the year. However, 2009 and 2010 sampling from other tributaries in the study area reveal that they are lower than the median from all previous years sampled. This suggests that the limited data for Senachwine Creek may not fully represent the sediment issues within the watershed. Further analysis pairing the TSS concentrations with flow conditions (Figure 9-4) reveals elevated TSS concentrations during high flows and slightly lower concentrations during lower flow conditions. Elevated TSS concentrations during high flows tend to correspond to periods of heavy rain and may indicate stream bank and gully erosion as significant sources of sediment.

The USACE (2008) reported that excessive agricultural development in the Senachwine Creek watershed has caused increased stream bank and bed erosion and stream fragmentation and excessive sediment delivery from Senachwine Creek to the Illinois River is systematically degrading floodplain and backwater habitats in the vicinity of the confluence with the Illinois River.

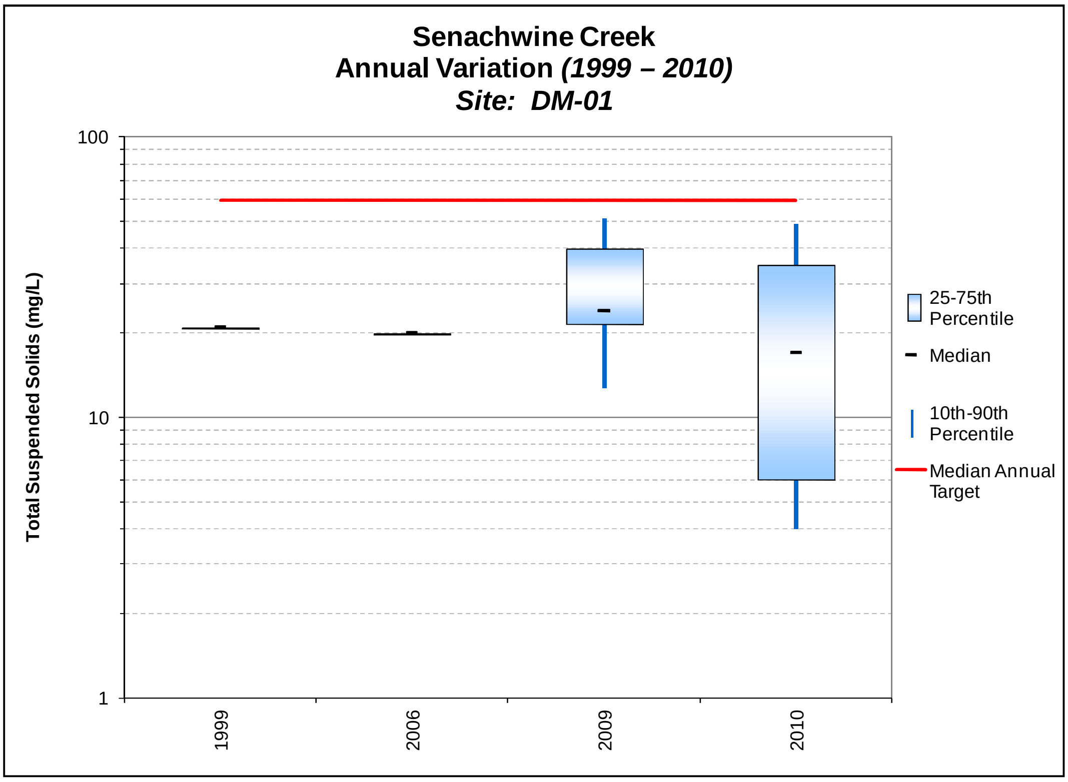

Figure 9-3. Annual TSS concentrations, Senachwine Creek, 1999 - 2010.

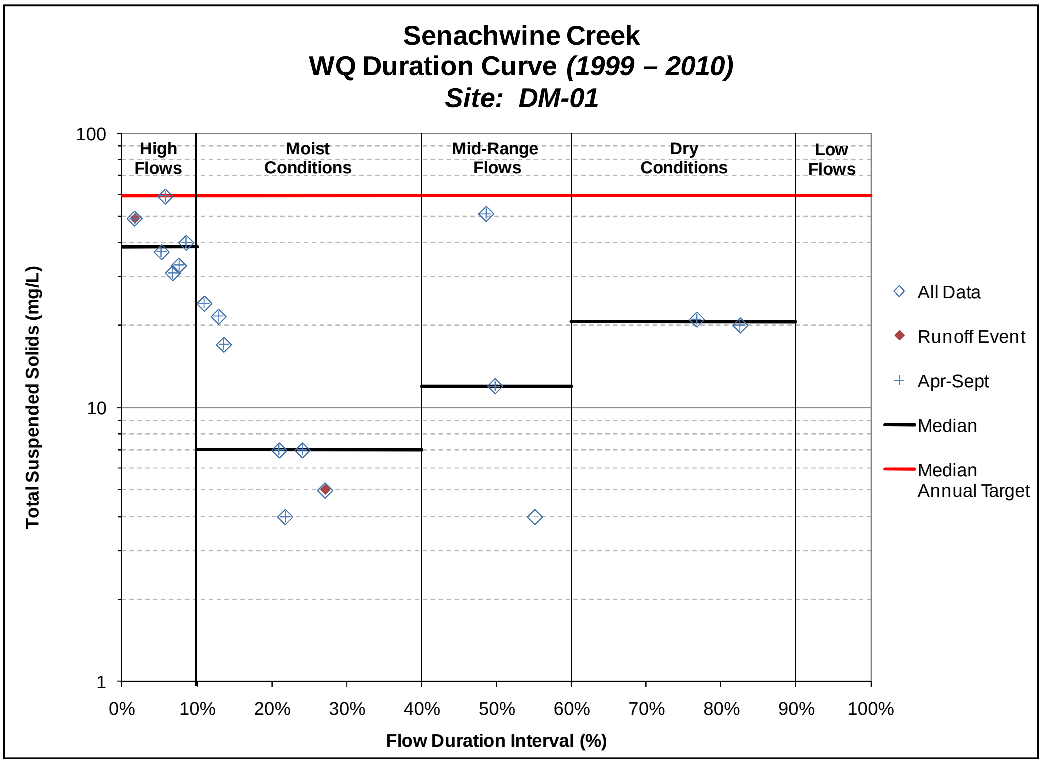

Figure 9-4. TSS water quality duration curve, Senachwine Creek, 1999 - 2010.

9.2.2 Nutrients

As with TSS, there are only four years with nutrient data for Senachwine Creek. The median annual phosphorus concentration for 2009 exceeds the target whereas it is below the target for 2010 (Figure 9-5). Median annual concentrations of nitrogen exceed the nitrogen target in both 2009 and 2010 (Figure 9-6). Long-term trends could not be distinguished from the limited available data; continued monitoring would be necessary to determine such trends.

Analysis of seasonal trends shows slightly higher phosphorus concentrations between the months of April and June compared to the later summer months of July through September. Nitrogen concentrations are elevated during the entire growing season, with higher concentrations during high flow periods likely associated with runoff from applied fertilizers, as well as other nonpoint sources of nutrients.

Elevated concentrations during high flow periods are also confirmed in water quality duration curves (Figure 9-7 and Figure 9-8). The monitoring data identify phosphorus concentrations exceeding the target concentrations during high flow and moist conditions. Nitrogen concentrations have exceeded target concentrations during high flow, moist, and mid-range flow conditions. Further analysis pairing the nitrogen concentrations with flow conditions reveals elevated nitrogen concentrations during high flows and significantly lower concentrations during lower flow conditions. Elevated nutrient concentrations during high flow periods are likely associated with the runoff of fertilizers, as well as other nonpoint sources of nutrients such as animal waste from field pastures.

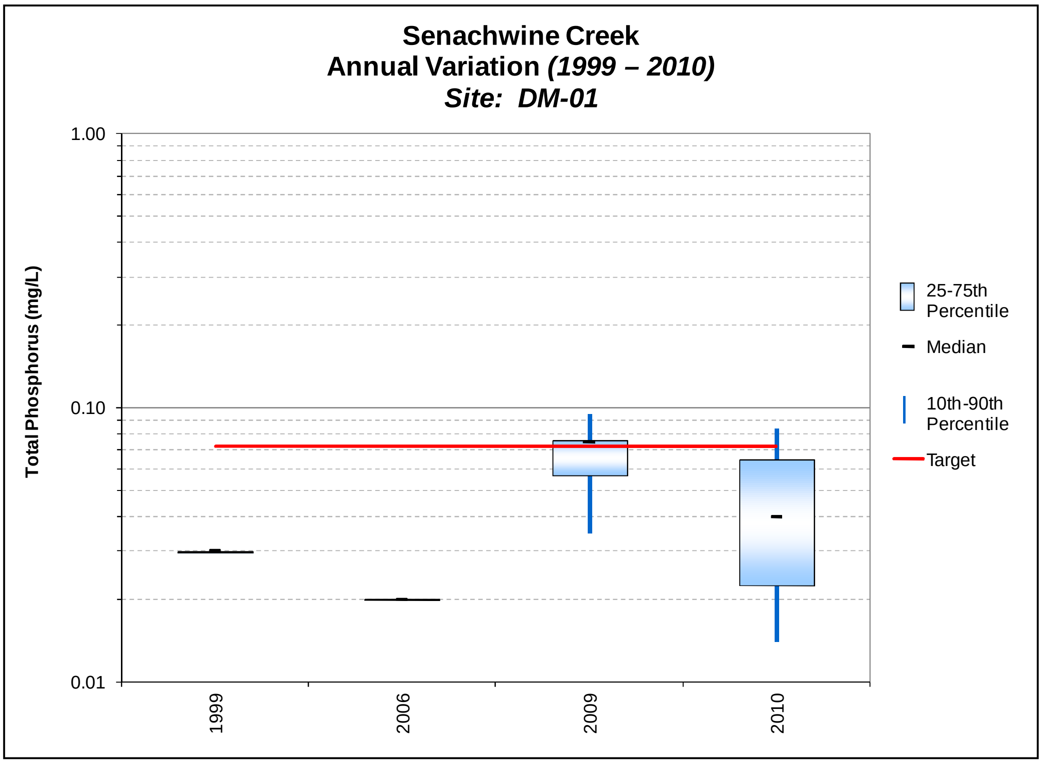

Figure 9-5. Annual phosphorus concentrations, Senachwine Creek, 1999 – 2010.

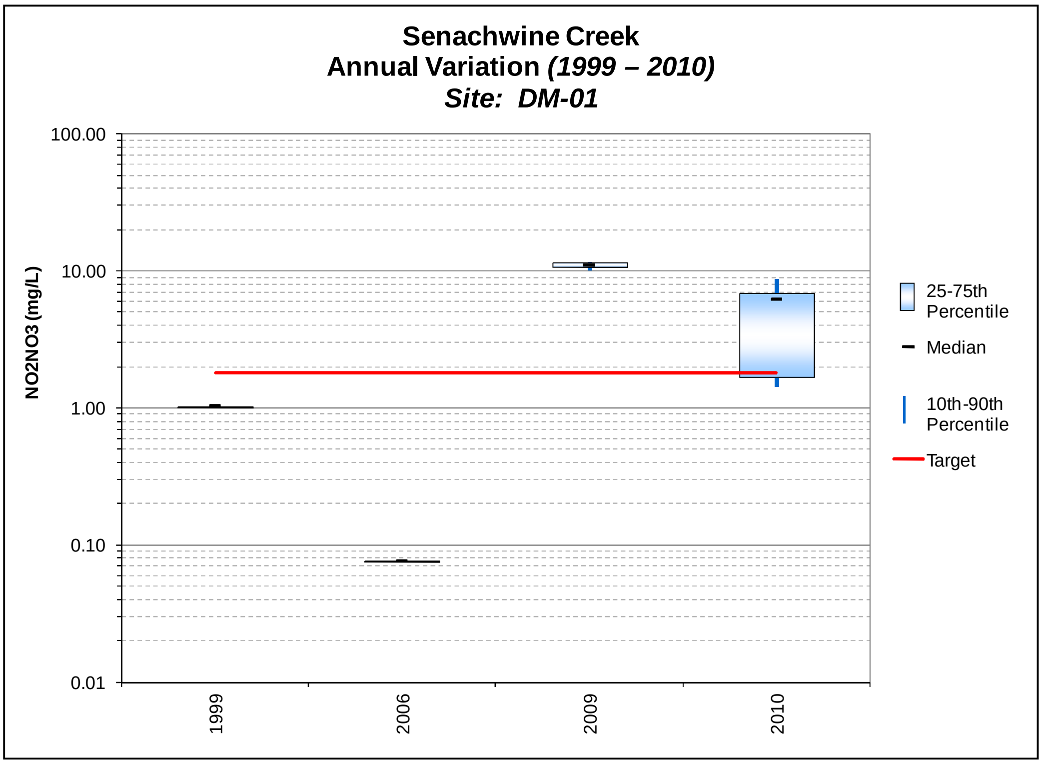

Figure 9-6. Annual nitrogen concentrations, Senachwine Creek, 1999 – 2010.

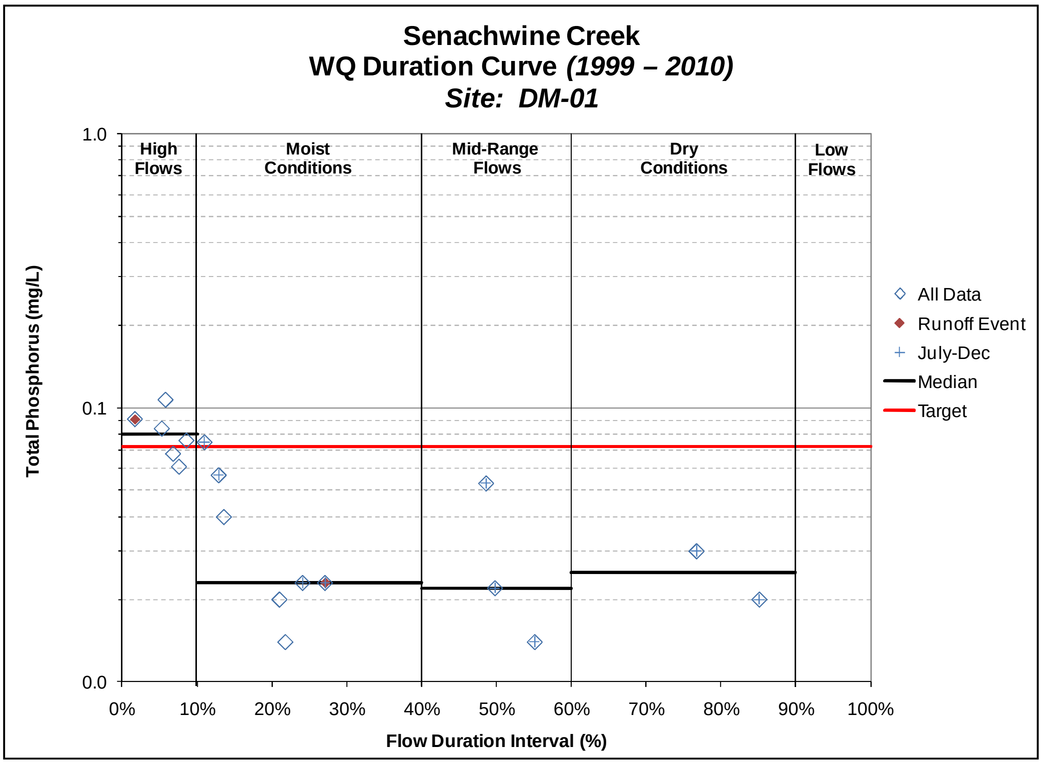

Figure 9-7. Phosphorus water quality duration curve, Senachwine Creek, 1999 – 2010.

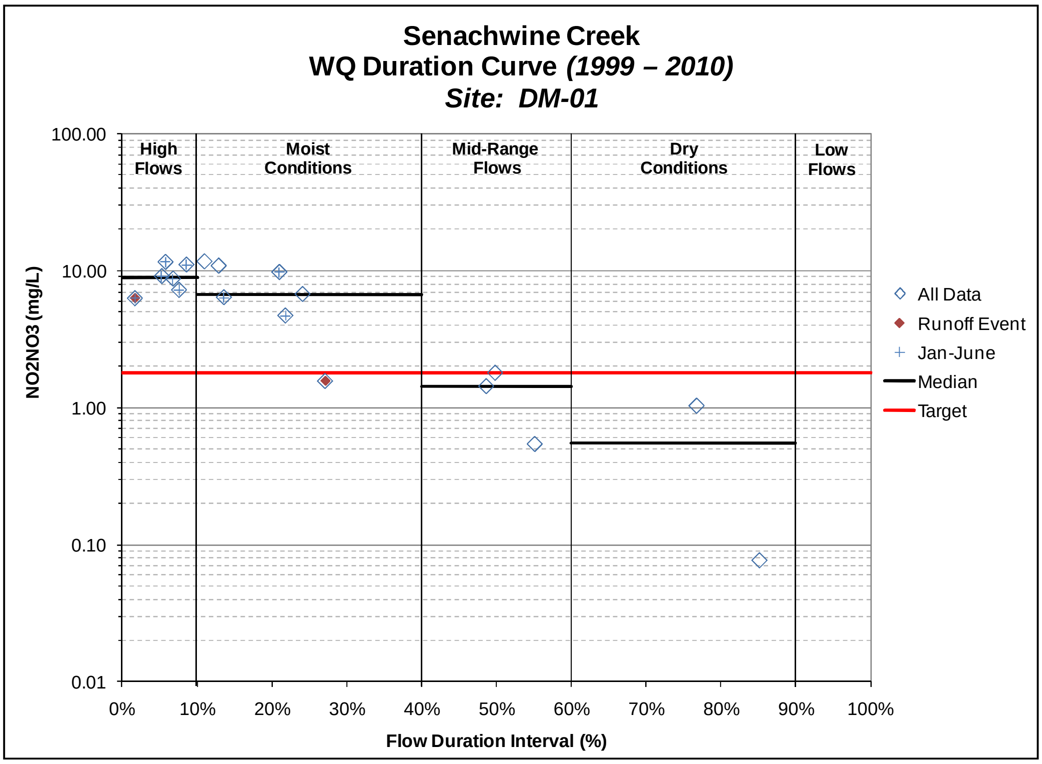

Figure 9-8. Nitrogen water quality duration curve, Senachwine Creek, 1999 - 2010.

9.3 Senachwine Creek LRS

Table 9-3 summarizes the Senachwine Creek watershed and pollutant sources. LRSs are presented in Sections 9.3.1 and 9.3.2 for TSS and nutrients, respectively.

Table 9-3. Senachwine Creek summary table.

Upstream Characteristics	
Drainage Area	90 square miles
Sampling Station	DM-01
Listed Segments	None
Land Use	cultivated crops (70 percent); deciduous forests (19 percent); developed open space (four percent); pasture/hay (three percent); developed land including low, medium, and high intensity (two percent); other (two percent).
Soil Type	88% B, 5% B/D, 4% C, 2% No Data, 1% A, <1% D
Erodible Soils	32% Highly Erodible, 68% Not Assessed
Animal Units	2,900; 32 per square mile
Key Sources	agricultural activities; watershed runoff; livestock; streambank and gully erosion
NPDES Facilities	None
MS4 Communities	None
CSO/SSO Communities	None

9.3.1 Total Suspended Solids LRS

TSS load reductions are presented in Table 9-4 for Senachwine Creek using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. No sediment reductions are needed to meet the sediment target. Additional monitoring is needed to fully understand Senachwine Creek's sediment budget.

Table 9-4. TSS LRS, Senachwine Creek.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Senachwine Creek	DM-01	33	59.3	0%

9.3.2 Nutrient LRS

Nutrient LRSs have been developed for the Senachwine Creek watershed. Figure 9-9 and Figure 9-10 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Senachwine Creek assessment site. Table 9-5 and Table 9-6 summarize the LRS and required reductions. Total phosphorus reductions are not needed. Nitrogen reductions are needed during high and moist flow conditions. Fertilizer management is needed for agricultural lands and watershed runoff controls should be implemented.

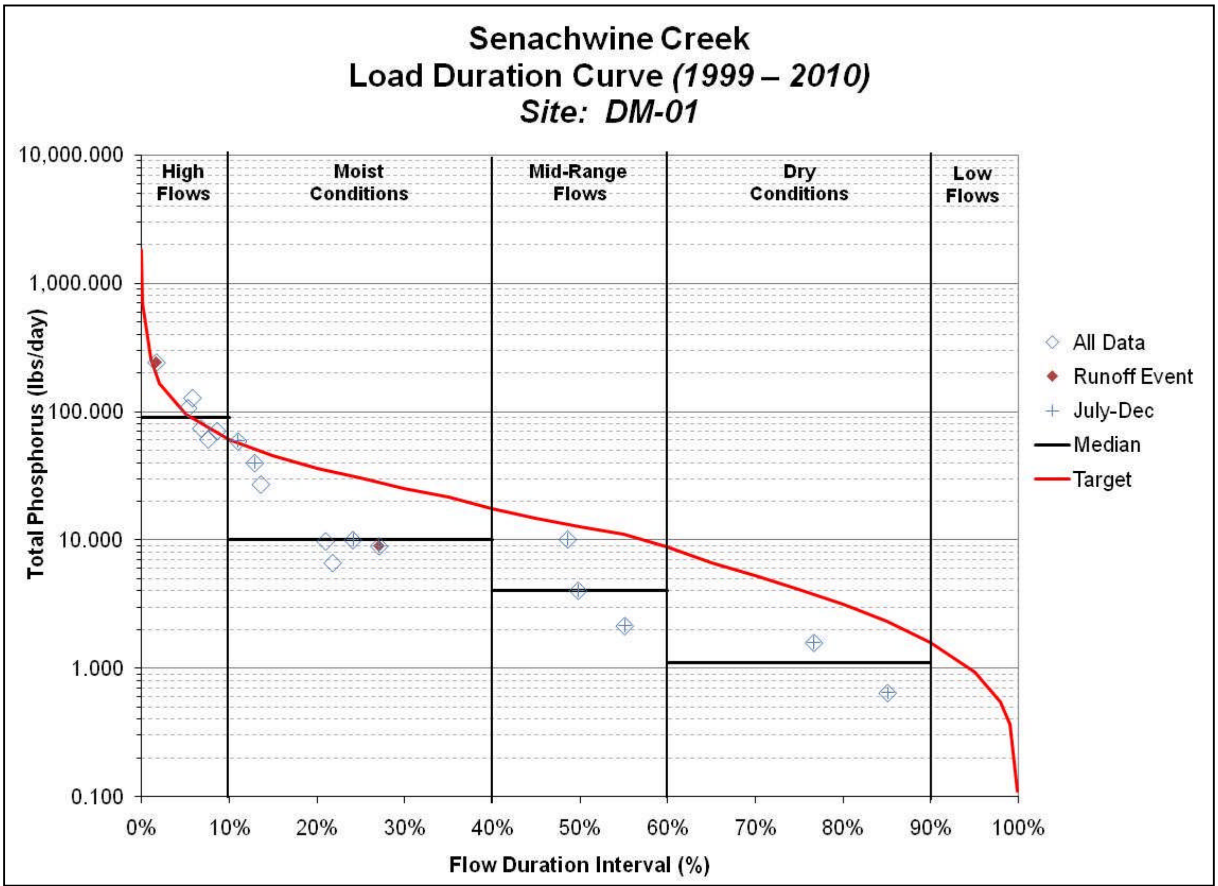

Figure 9-9. Total phosphorus load duration curve, Senachwine Creek (DM-01).

Table 9-5. Total phosphorus LRS, Senachwine Creek (DM-01).

Station DM 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	91	10	4	1	N/A
	LRS Target	95	30	13	4	1
	LRS Reduction %	0%	0%	0%	0%	N/A

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

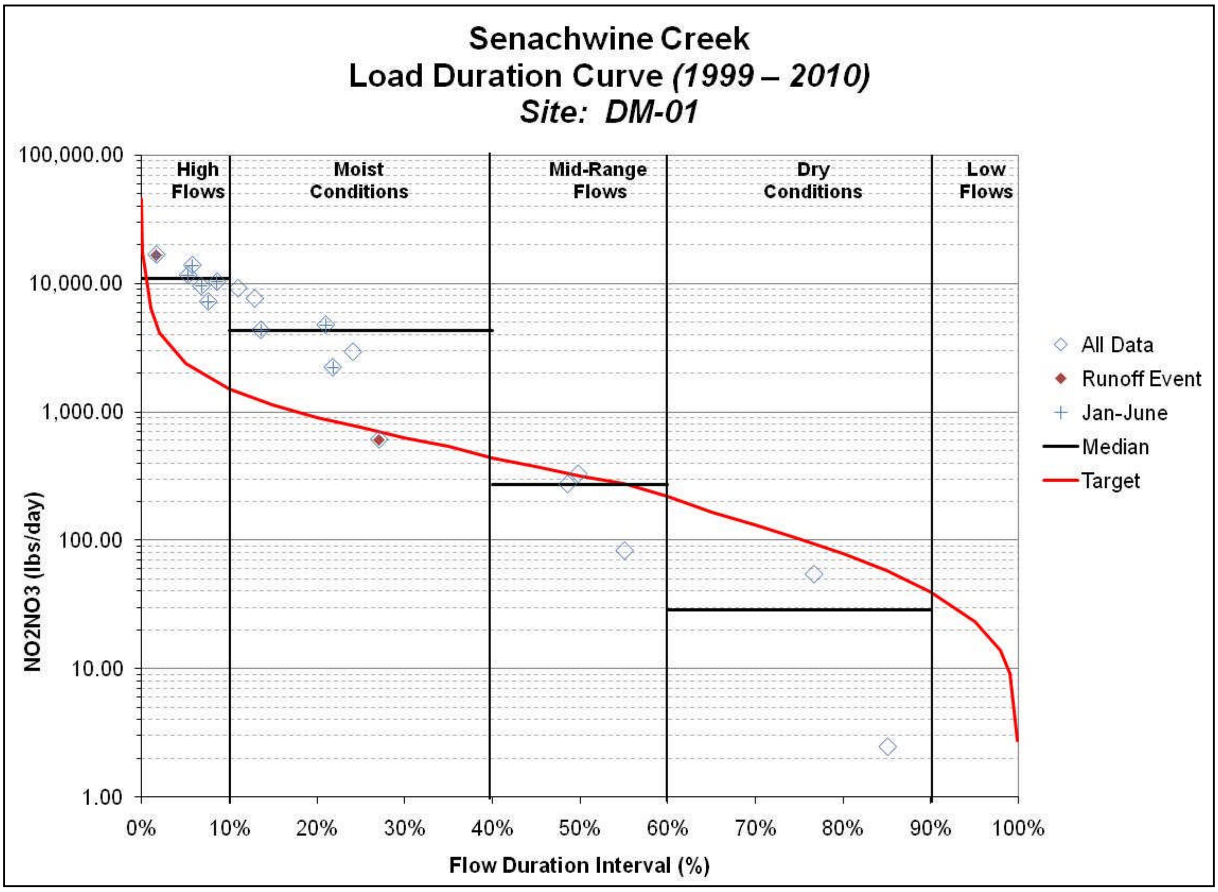

Figure 9-10. Nitrogen load duration curve, Senachwine Creek (DM-01).

Table 9-6. Nitrogen LRS, Senachwine Creek (DM-01).

Station DM 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	10,929	4,334	274	28	N/A
	LRS Target	2,368	757	317	103	23
	LRS Reduction %	78.34%	82.53%	0%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

10. Crow Creek and Snag Creek LRS

Located in east of Peoria County, the Crow Creek and Snag Creek watershed cluster has a total drainage area of 212 square miles and can be further delineated into seven 12-digit HUCs (Figure 10-1). Table 10-1 details area per 12-digit HUC associated with this watershed cluster. Counties with jurisdiction within the Crow Creek and Snag Creek watershed cluster include: Marshall and Woodford. The Crow Creek and Snag Creek watershed has potentially elevated concentrations of TSS, phosphorus, and nitrate plus nitrite nitrogen, for all of which a LRS has been developed. A watershed source assessment and linkage analysis are presented in this section.

Table 10-1. Crow Creek and Snag Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 12	01	South Branch Crow Creek	22,865	35.7
	02	Hallenback Creek - South Branch Crow Creek	20,019	31.3
	03	North Branch Crow Creek	19,600	30.6
	04	Bell Plain-Crow Creek	20,025	31.3
07130001 15	01	Snag Creek	18,806	29.4
	02	Coon Creek-Richland Creek	20,142	31.5
	03	Richland Creek	14,043	21.9
Total			**135,500**	**212**

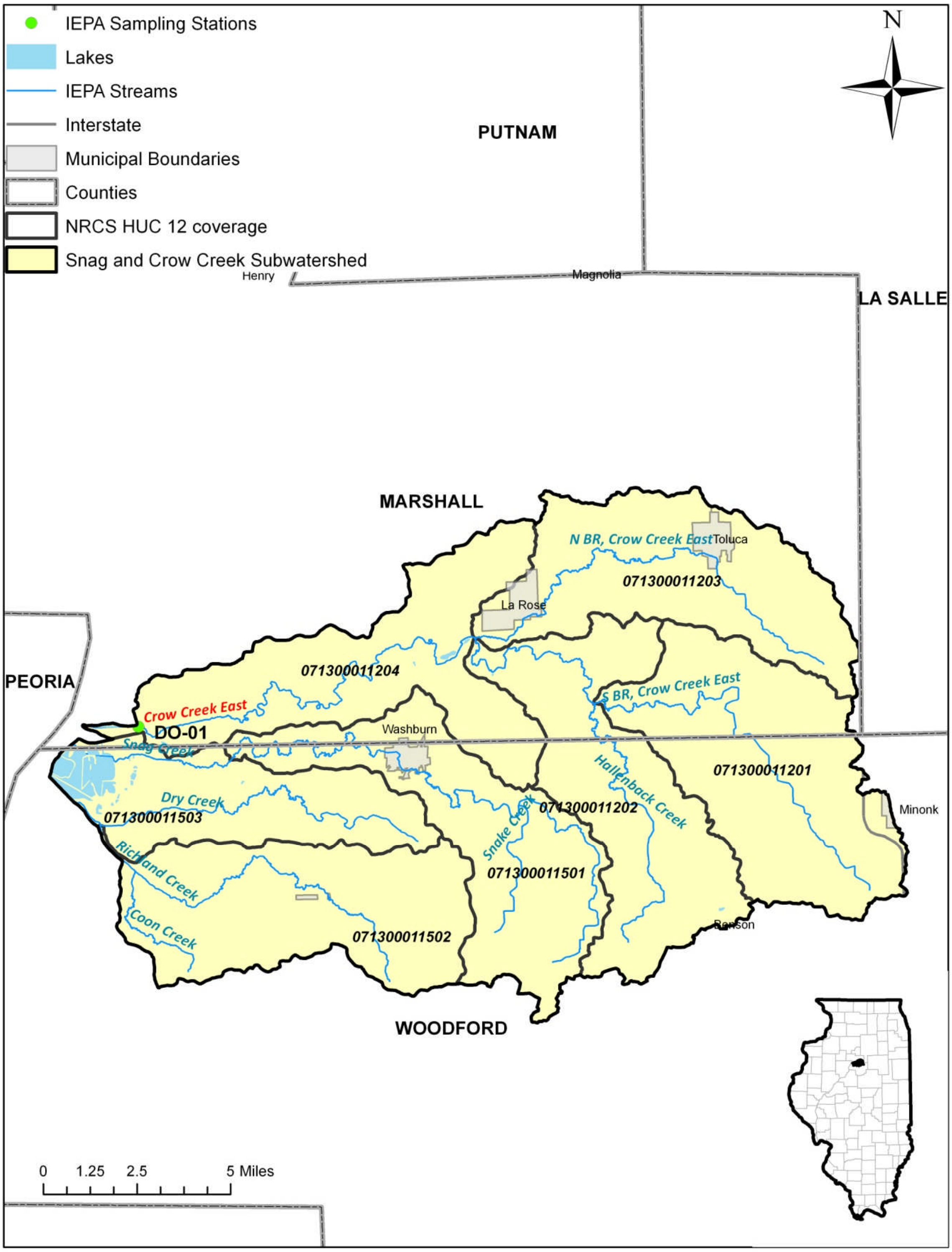

Figure 10-1. Crow Creek and Snag Creek watershed cluster segments and stations.

10.1 Source Assessment

The Crow Creek and Snag Creek watershed cluster is largely agricultural and contains very little developed land within its drainage area (Figure 10-2). Predominating land use includes cultivated crops (77 percent), deciduous forests (10 percent) and pasture/hay (five percent). With an estimated 2009 population of 1,249 and 1,111, the largest areas of development within the Crow Creek and Snag Creek watershed cluster are centered near Toluca and Washburn, respectively.

A total of four NPDES facilities are permitted in the Crow Creek/Snag Creek watershed cluster, this includes three sewage treatment plants. Locations of NPDES within the watershed cluster are identified in Figure 10-2 and listed in Table 10-2.

Table 10-2. NPDES facilities within the Crow Creek and Snag Creek watershed cluster.

10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
07130001 12	IL0021695	TOLUCA STP	0.3	002- limit 400
	IL0035807	LAROSE WTP	--	--
07130001 15	IL0039411	WASHBURN STP	0.138	Exempt and required to monitor
	IL0053066	CAMP MANITOUMI-LOW POINT	0.015	limit 400

"—" Not applicable

The Crow Creek and Snag Creek watershed has a significant amount of animal agriculture activities in the watershed. Table 10-3 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 10-3. Livestock populations in Crow Creek and Snag Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
Marshall	1,248	44	126	91	2,020
Woodford	1,228	0	105	290	18,979
Total Number of Animals	**2,476**	**44**	**231**	**381**	**20,999**
Equivalent Animal Units	**2,476**	**1**	**462**	**38**	**8,399**

Source: USDA 2007-2009

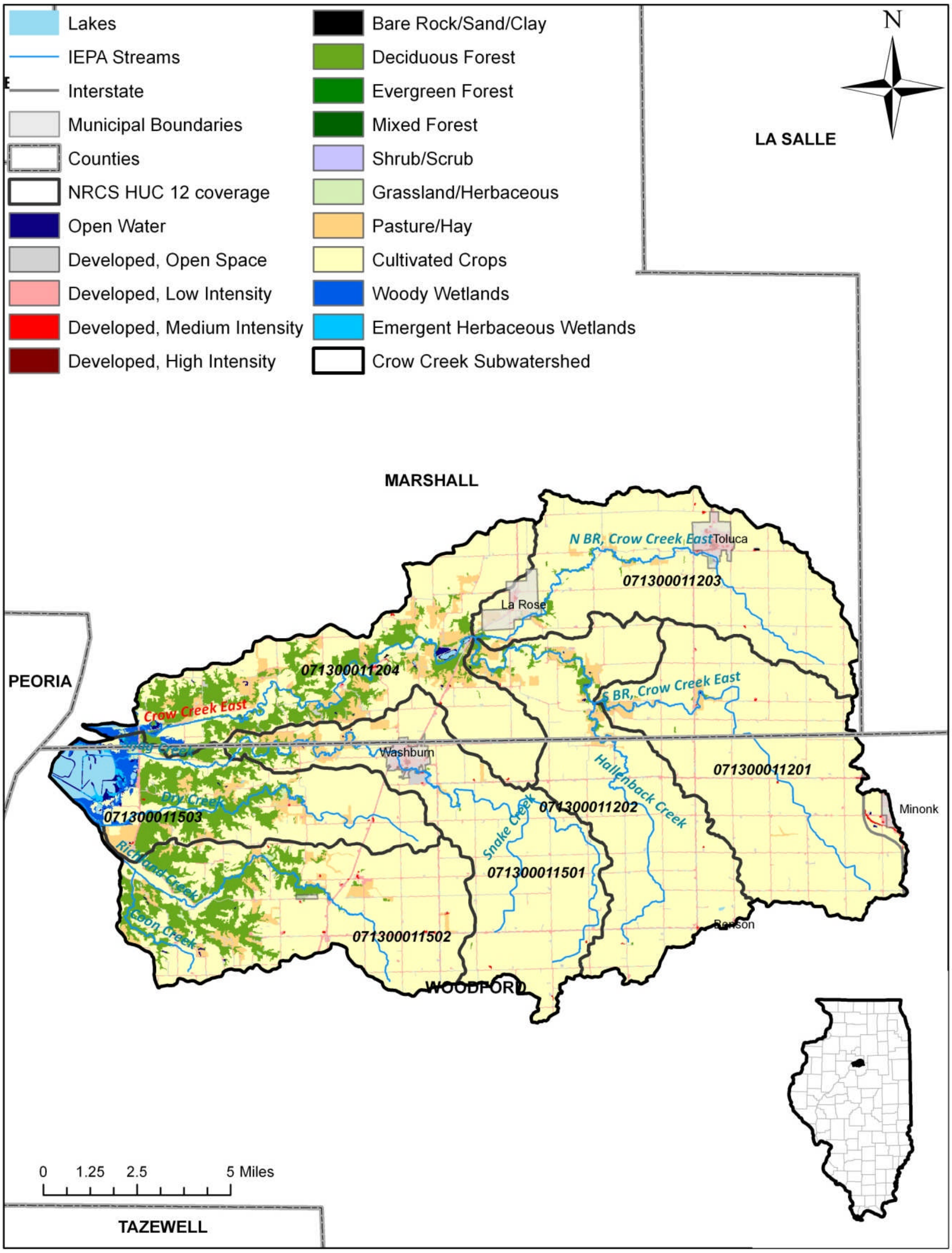

Figure 10-2. Crow Creek and Snag Creek watershed cluster land use.

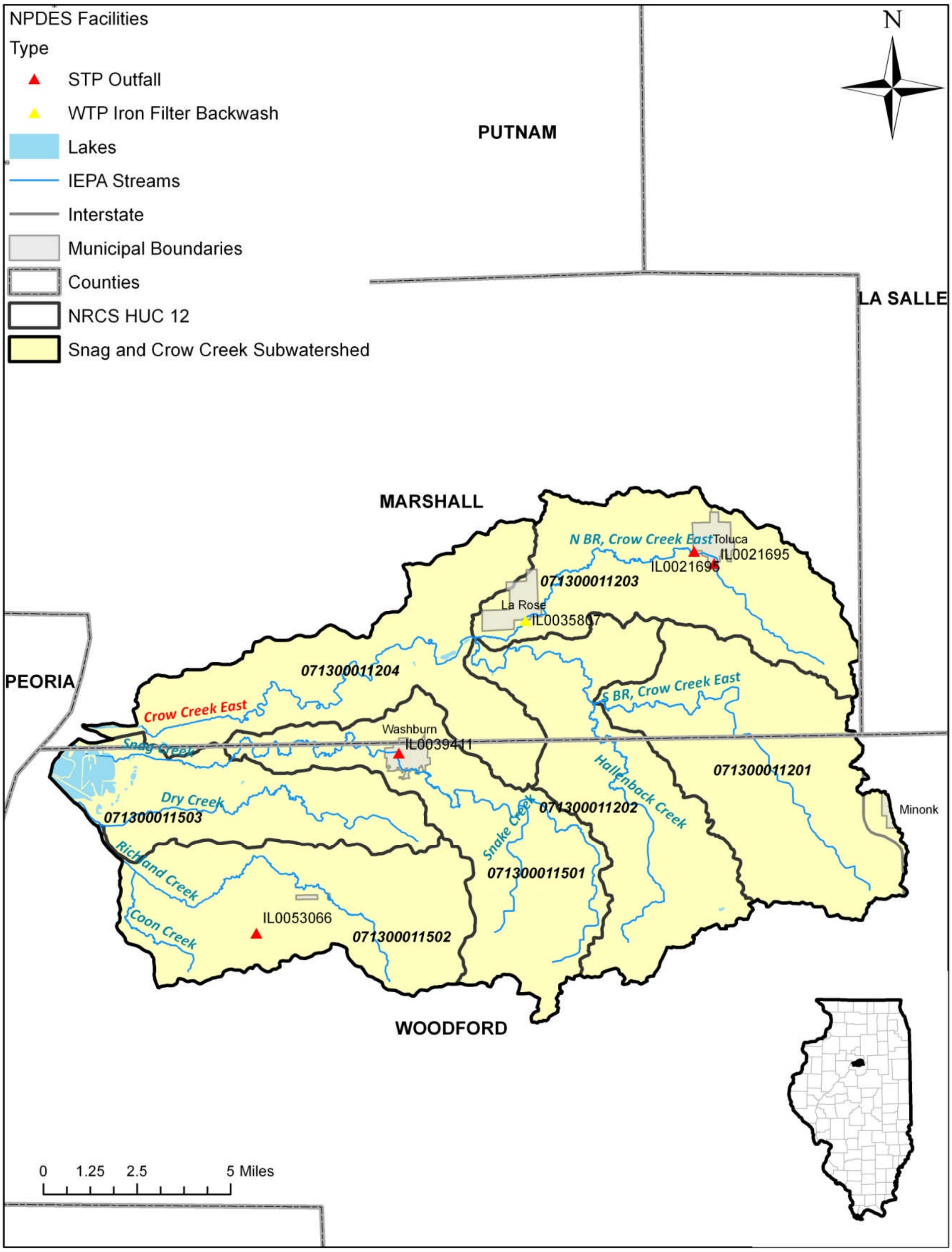

Figure 10-3. Crow Creek and Snag Creek watershed cluster NPDES facilities.

10.2 Watershed Linkage Analysis

10.2.1 Total Suspended Solids

Crow Creek was monitored in 2009 and 2010. Median annual concentrations of TSS were well below the TSS target (Figure 10-4). Given the short monitoring period, no long-term trends can be distinguished. Analysis of TSS data collected on Crow Creek shows limited variability and no concentrations in exceedance of the median annual TSS target throughout the year (Figure 10-4). However, as noted previously, 2009 and 2010 may not have been fully representative years for sampling. Further analysis pairing the TSS concentrations with flow conditions (Figure 10-5) reveals elevated TSS concentrations during high flows and slightly lower concentrations during lower flow conditions. Elevated TSS concentrations during high flows tend to correspond to periods of heavy ,rain and may indicate stream bank and gully erosion as significant sources of sediment.

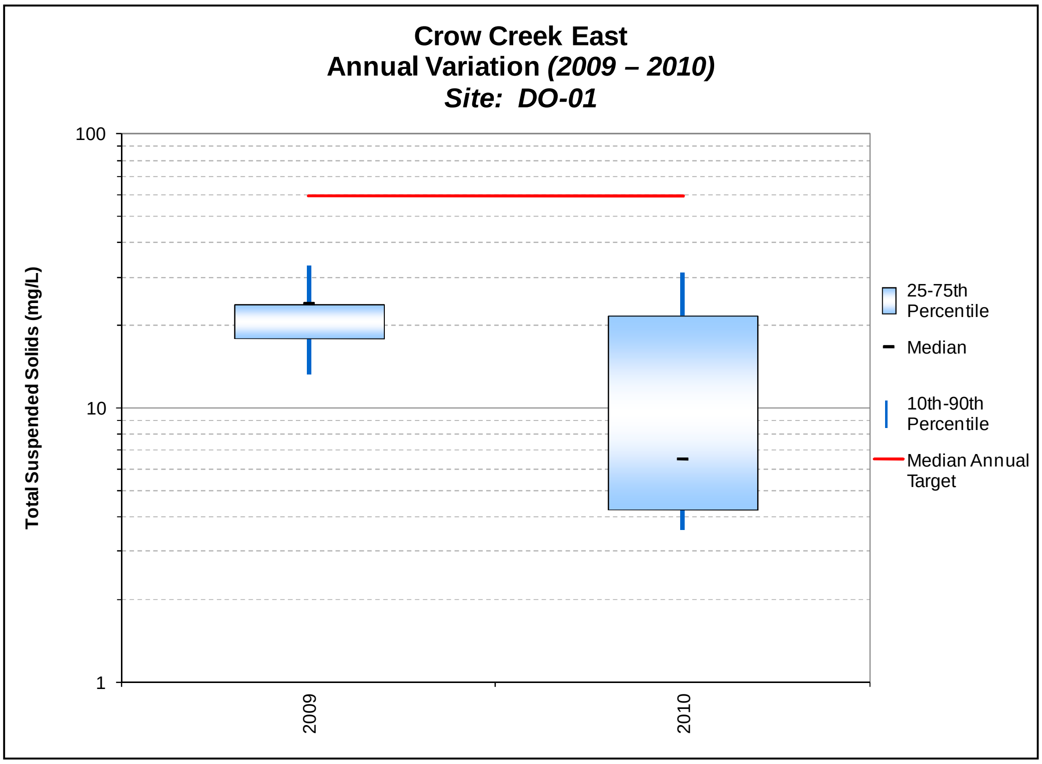

Figure 10-4. Annual TSS concentrations, Crow Creek, 2009 – 2010.

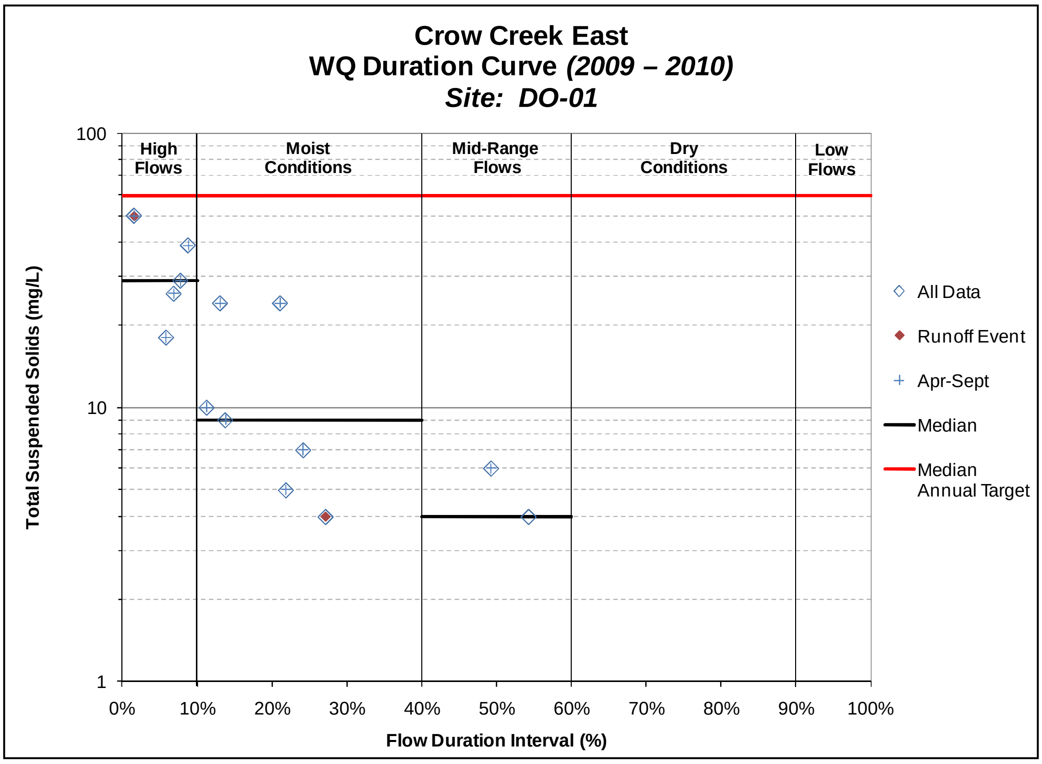

Figure 10-5. TSS water quality duration curve, Crow Creek, 2009 - 2010.

10.2.2 Nutrients

The median annual concentrations of phosphorus within Crow Creek did not exceed the target phosphorus concentration in 2009 or 2010 (Figure 10-6). Given the short monitoring period, no long-term trends can be distinguished. The median annual concentrations of nitrogen within Crow Creek significantly exceeded the nitrogen target in both monitoring years (Figure 10-7).

Analysis of available seasonal phosphorus data illustrates slightly higher phosphorus concentrations between the months of April and June compared to the summer months. Analysis of seasonal nitrogen trends illustrates elevated nitrogen concentrations during the growing season between April and September. High concentrations during early spring may correspond to runoff events including snowmelt and spring rains that wash-off fertilizer that has been applied to fields. The increased variability in phosphorus concentration may also be attributed to intermittent runoff events washing nutrients into Crow Creek.

Elevated phosphorus concentrations during high flow periods are also confirmed in water quality duration curves (Figure 10-8). Elevated concentrations during high flow periods are likely associated with runoff from applied fertilizers, as well as other sources of nutrients such as animal waste in pastures. The nitrogen water quality duration curve (Figure 10-9) reveals elevated nitrogen concentrations during all monitored flow conditions. Elevated concentrations during high flow periods likely correspond to runoff events. Elevated nitrogen concentrations during mid-range flows, as well as the consistency of elevated concentrations, indicate point source pollution as another cause of elevated concentrations. Point sources, such as wastewater treatment facilities, can be ongoing sources of nutrients and their contributions, relative to instream flow, can be more significant during low flow periods.

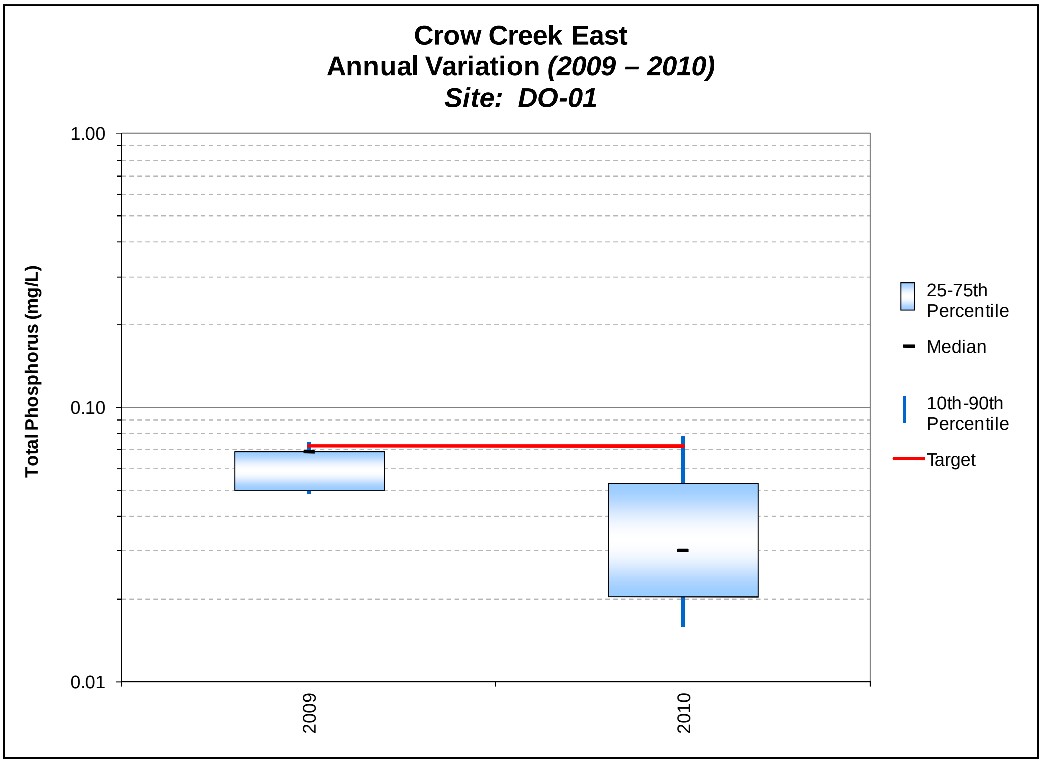

Figure 10-6. Annual phosphorus concentrations, Crow Creek, 2009 – 2010.

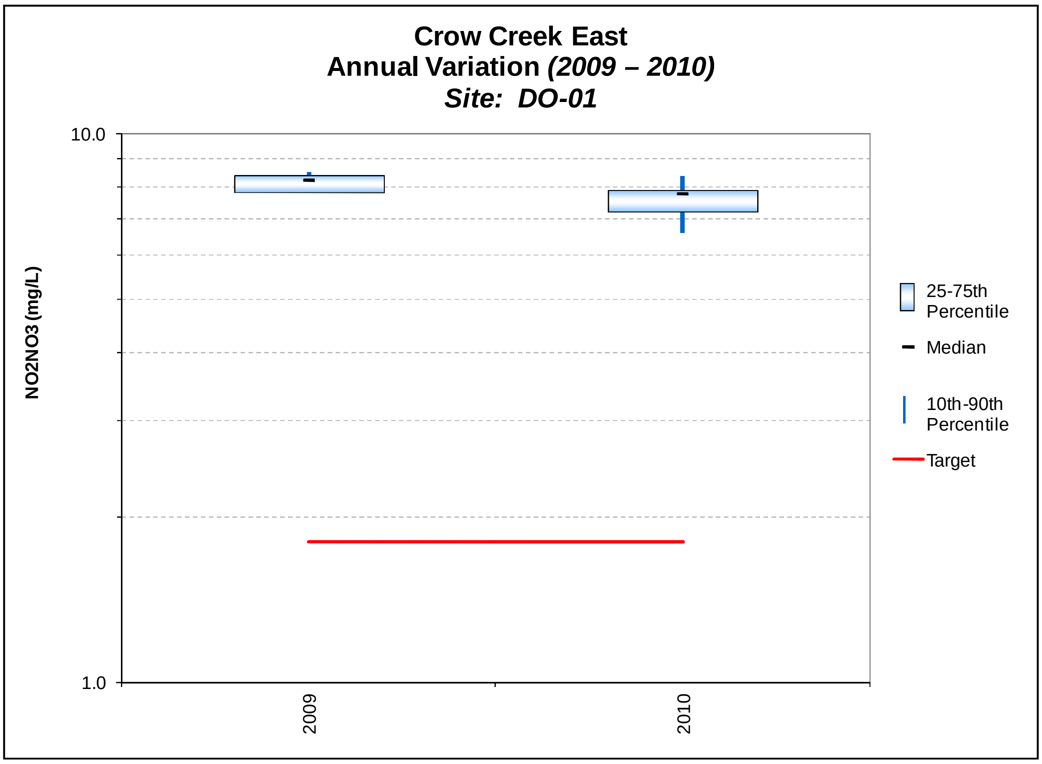

Figure 10-7. Annual nitrogen concentrations, Crow Creek, 2009 – 2010.

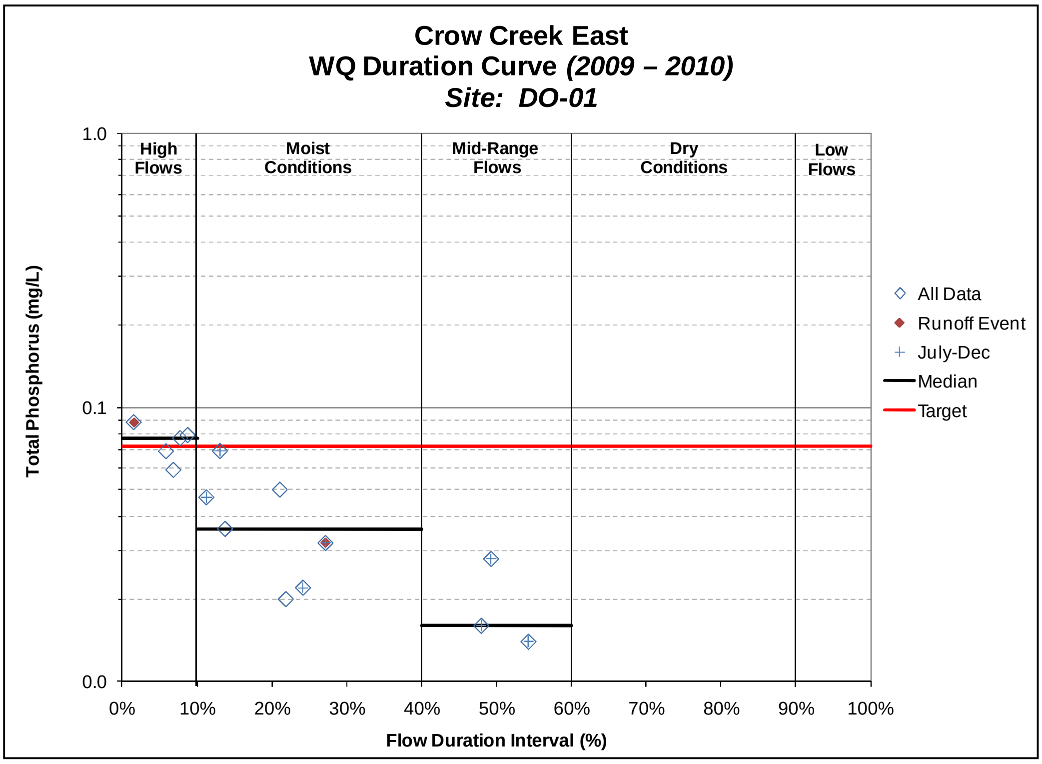

Figure 10-8. Phosphorus water quality duration curve, Crow Creek, 2009 - 2010.

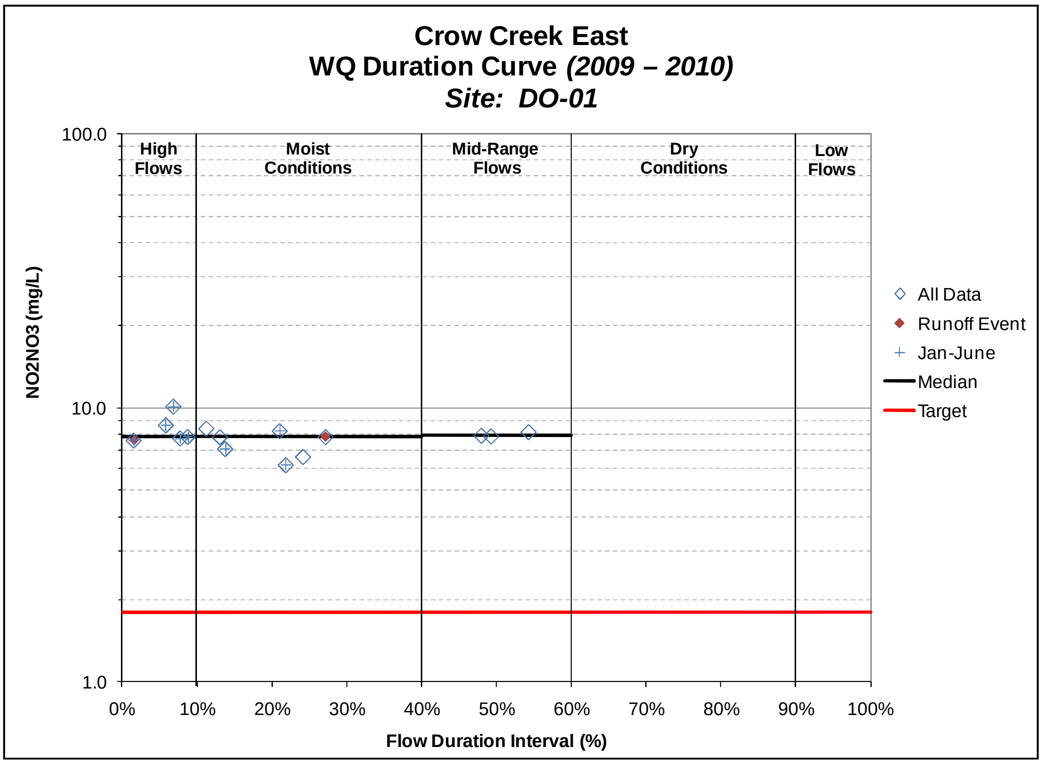

Figure 10-9. Nitrogen water quality duration curve, Crow Creek, 2009 - 2010.

10.3 Crow Creek and Snag Creek LRS

Table 10-4 summarizes the Crow Creek and Snag Creek watershed and pollutant sources. LRSs for the Crow Creek and Snag Creek watershed are presented in Sections 10.3.1and 10.3.2 for TSS and nutrients, respectively.

Table 10-4. Crow Creek and Snag Creek summary table.

Upstream Characteristics	
Drainage Area	212 square miles
Sampling Station	DO-01
Listed Segments	None
Land Use	cultivated crops (77 percent); deciduous forests (10 percent); developed open space (two percent); pasture/hay (five percent); developed land including low, medium, and high intensity (four percent); wetland (one percent); other (one percent).
Soil Type	70% B, 16% B/D, 4% C, 8% No Data, 2% A, <1% D, <1% A/D, <1% C/D
Erodible Soils	21% Highly Erodible, 3% Not Highly Erodible, 76% Not Assessed
Animal Units	11,000; 52 per square mile
Key Sources	agricultural runoff; streambank and gully erosion; NPDES facilities
NPDES Facilities	Toluca STP (IL0021695)
	Larose WTP (IL0035807)
	Washburn STP (IL0039411)
	Camp Manitoumi-Low Point (IL0053066)
NPDES Facility Disinfection Exemption [a]	One of the facilities above has a disinfection exemption
Fecal Coliform Exceedance Summary [b]	Two facilities above have exceedances averaging 1,454 to 6,780 cfu/100mL
MS4 Communities	None
CSO/SSO Communities	None

a. See Table 10-2 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

10.3.1 Total Suspended Solids LRS

TSS load reductions are presented in Table 10-5 for Crow Creek and Snag Creek using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. No sediment reductions are needed to meet the sediment target. Additional monitoring is needed to fully understand the sediment budget.

Table 10-5. TSS LRS, Crow Creek and Snag Creek

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Crow Creek and Snag Creek	DO-01	27	59.3	0%

10.3.2 Nutrient LRS

Nutrient LRSs have been developed for the Crow Creek watershed. It is assumed that similar reductions will be needed for the Snag Creek watershed. Figure 10-10 and Figure 10-11 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Crow Creek East assessment site. Table 10-6 and Table 10-7 summarize the LRS and required reductions. No reductions are required for total phosphorus. Nitrogen reductions are needed during high, moist, and mid-range flow conditions. Fertilizer management is needed for agricultural lands and watershed runoff controls should be implemented.

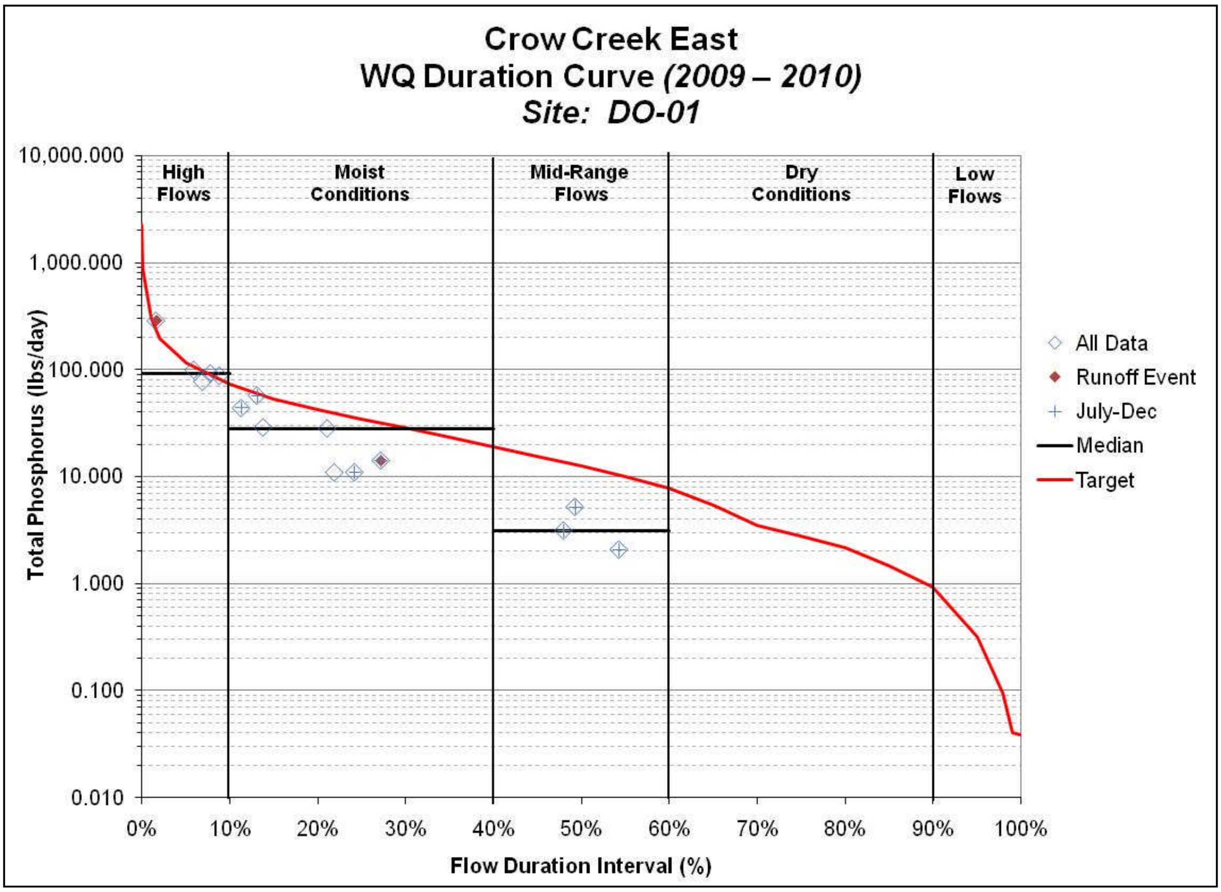

Figure 10-10. Total phosphorus load duration curve, Crow Creek East (DO-01).

Table 10-6. Total phosphorus LRS, Crow Creek East (DO-01).

Station DO 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	92	28	3	N/A	N/A
	LRS Target	116	34	13	3	0.3
	LRS Reduction %	0%	0%	0%	N/A	N/A

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

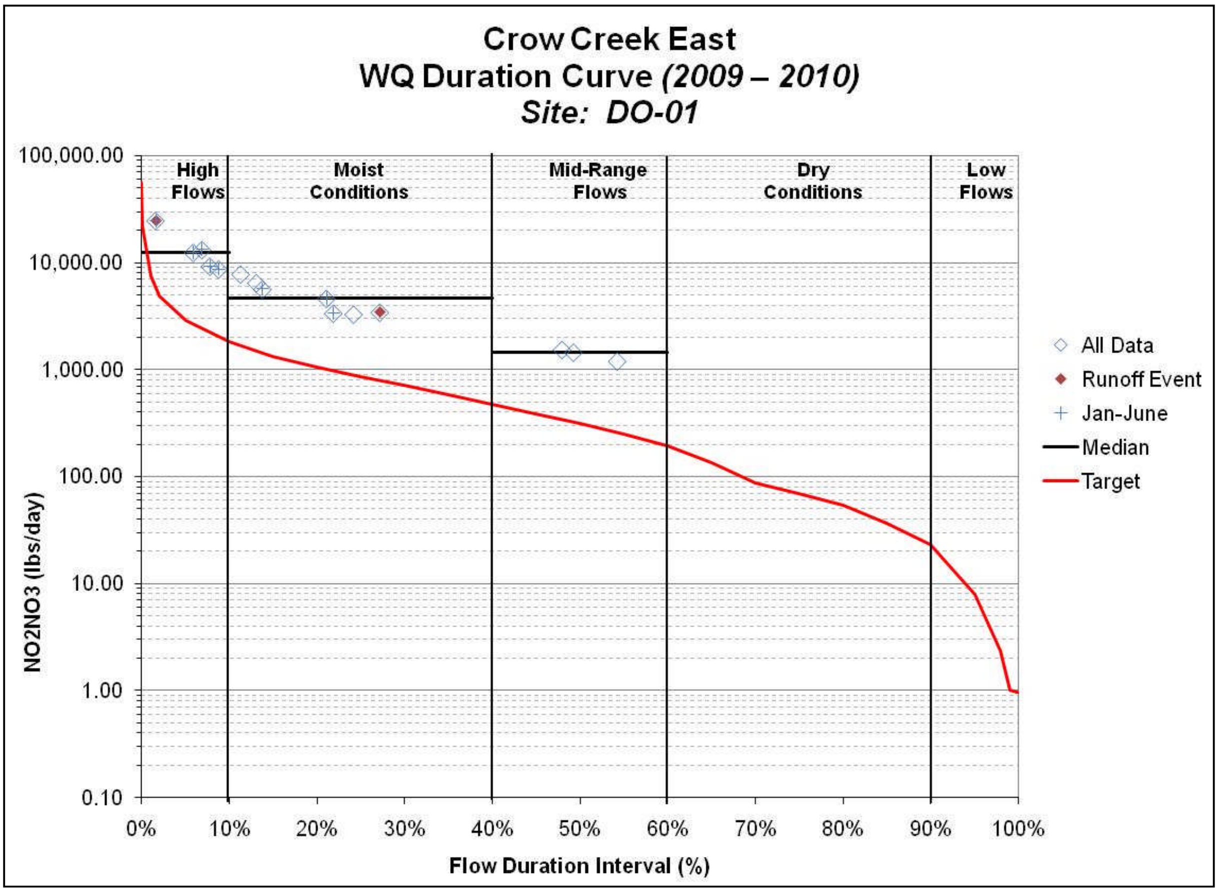

Figure 10-11. Nitrogen load duration curve, Crow Creek East (DO-01).

Table 10-7. Nitrogen LRS, Crow Creek East (DO-01).

Station DO 01 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	12,459	4,633	1,455	N/A	N/A
	LRS Target	2,899	859	315	70	8
	LRS Reduction %	76.73%	81.45%	78.32%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

11. Sandy Creek LRS

Located in the northeast region of the project area, the Sandy Creek watershed cluster has a total drainage area of 144 square miles and can be further delineated into four 12-digit HUCs (Figure 11-1). Table 11-1 details area per 12-digit HUC associated with the Sandy Creek watershed cluster. Counties with jurisdiction within the Sandy Creek watershed cluster include: LaSalle, Marshall, and Putnam. A watershed source assessment and linkage analysis are presented in this section. LRSs are developed for TSS, phosphorus, and nitrate plus nitrite nitrogen.

Table 11-1. Sandy Creek 12-digit HUC subwatersheds.

10-digit HUC	12-digit HUC	12-Digit Watershed Name	Area	
			(acres)	*(sq. mi.)*
07130001 10	01	Headwaters Sandy Creek	24,222	37.8
	02	Little Sandy Creek	21,248	33.2
	03	Judd Creek - Sandy Creek	22,010	34.4
	04	Shaw Creek - Sandy Creek	24,543	38.3
Total			**92,023**	**144**

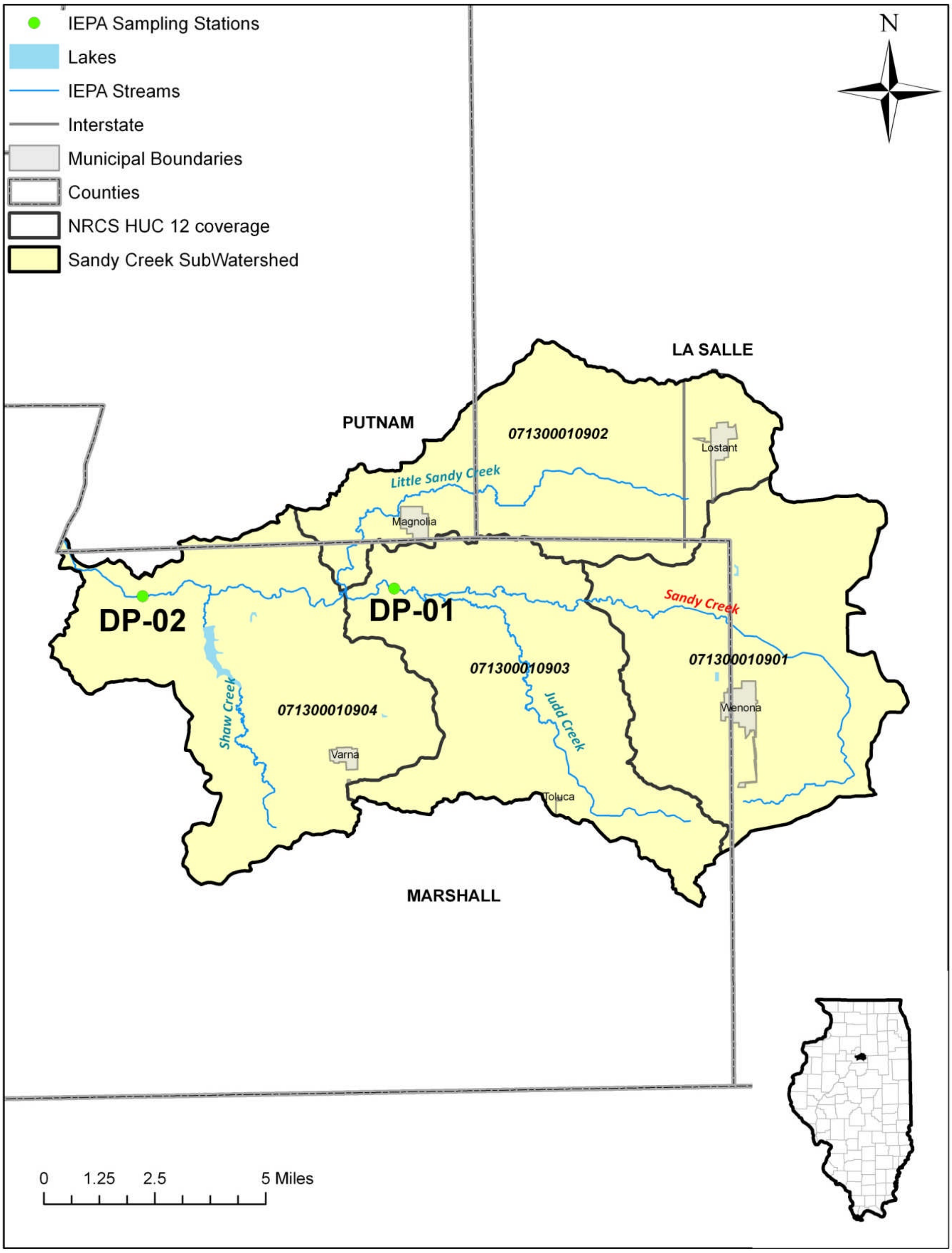

Figure 11-1. Sandy Creek watershed cluster segments and stations.

11.1 Source Assessment

The Sandy Creek watershed cluster is largely agricultural and contains very little developed land within its drainage area (Figure 11-2). Predominating land use includes cultivated crops (81 percent of total subwatershed area) and deciduous forests (8 percent of total subwatershed area). The largest area of development within the Sandy Creek watershed cluster is centered near Wenona.

Stormwater runoff associated with developed areas including Wenona, Lostant, Magnolia, and Varna can contribute sediment and nutrient loads to Sandy Creek. A total of three NPDES facilities are permitted within the Sandy Creek watershed cluster. Locations of NPDES facilities within the watershed cluster are identified in Figure 11-2 and listed in Table 11-2. Two communities with permitted CSOs are in this watershed.

Table 11-2. NPDES facilities within the Sandy Creek watershed cluster.

10-digit HUC ID	Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Exemption/Permit Limit Status
07130001 09	IL0021792	WENONA STP	0.19	001- exempt/ A01- limit 400
	IL0024996	OGLESBY STP	0.879	limit 400
	ILG640187	MAGNOLIA WTP	0.006	--

"—" Not applicable

Sandy Creek watershed has a significant amount of animal agriculture activities in the watershed. Table 11-3 presents the total number of animals and equivalent animal units within the watershed, area weighted using County statistics.

Table 11-3. Livestock populations in Sandy Creek watershed.

Counties	Cattle	Poultry	Horses	Sheep	Hogs
La Salle	687	40	39	76	553
Marshall	1,234	44	125	90	1,998
Putnam	85	12	13	0	0
Total Number of Animals	**2,006**	**95**	**176**	**166**	**2,551**
Equivalent Animal Units	**2,006**	**2**	**352**	**17**	**1,020**

Source: USDA 2007-2009

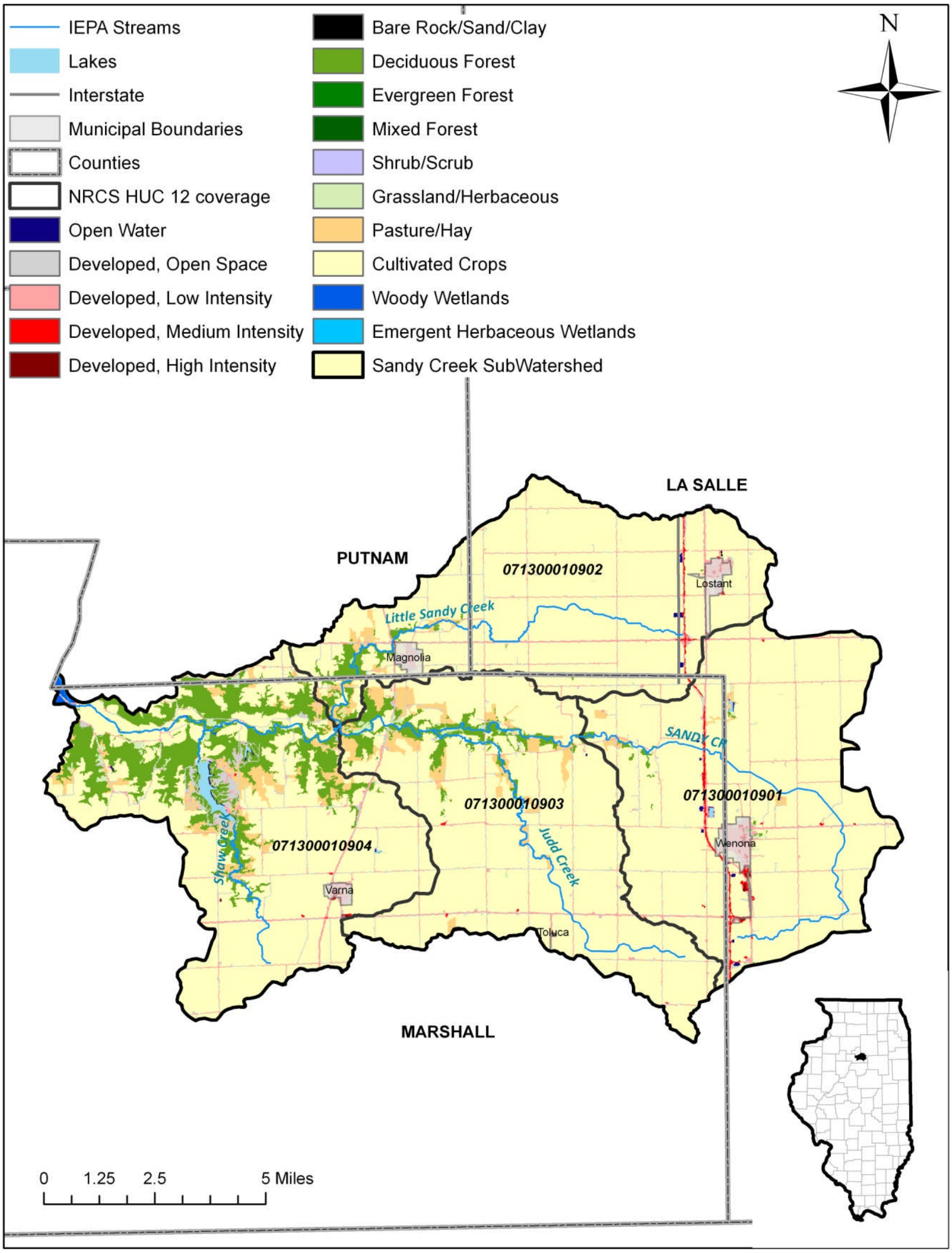

Figure 11-2. Sandy Creek watershed cluster land use.

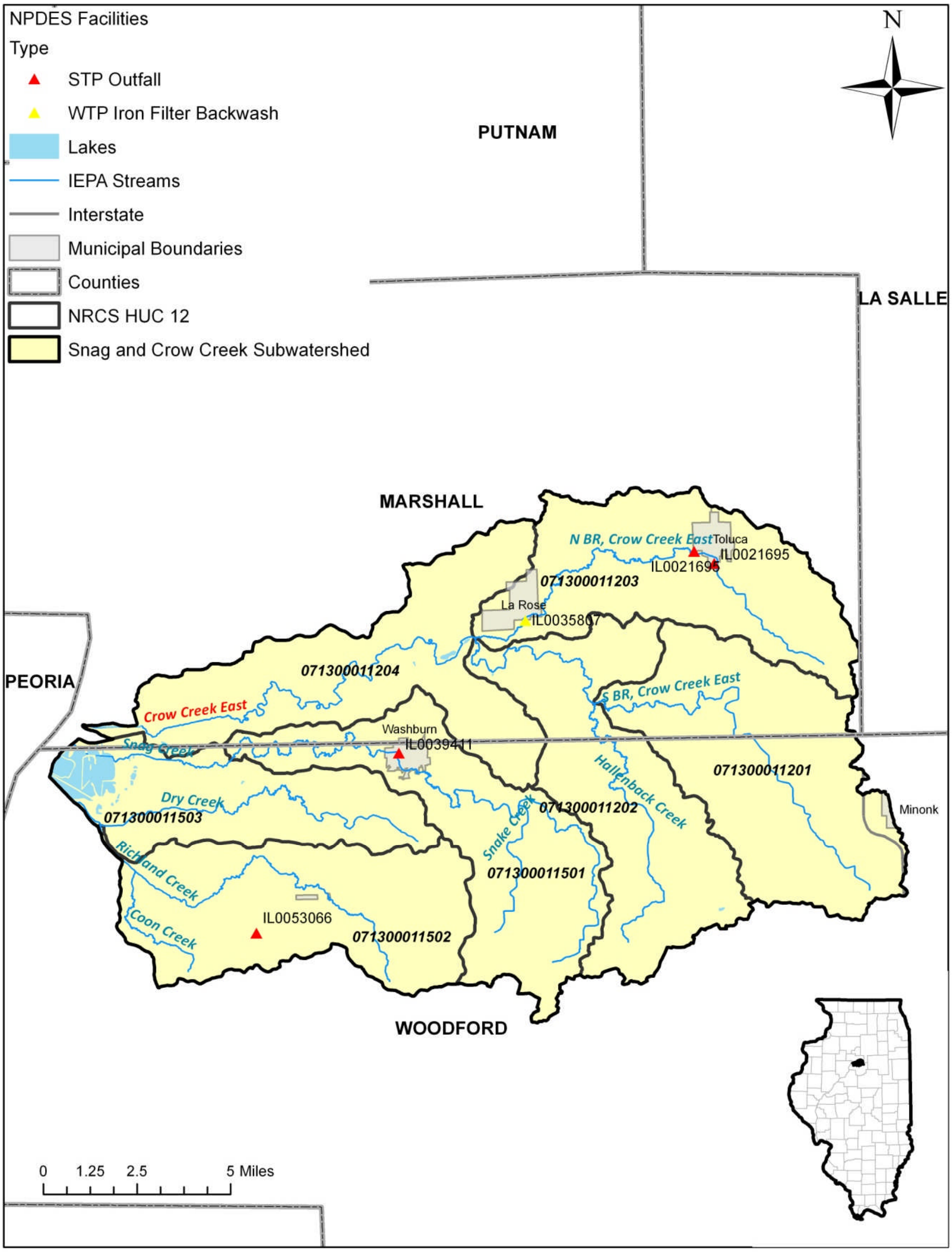

Figure 11-3. Sandy Creek watershed cluster NPDES facilities.

11.2 Watershed Linkage Analysis

11.2.1 Total Suspended Solids

Data were collected in 2009 and 2010 in Sandy Creek. Median annual concentrations of TSS were below the TSS target (Figure 11-4). However, as noted previously 2009 and 2010 may not have been fully representative years for sampling. Given the short monitoring period, no long-term trends can be distinguished. Analysis of available TSS data shows little to no variability and no concentrations in exceedance of the target during spring and summer months. Further analysis pairing the TSS concentrations with flow conditions (Figure 11-5) reveals elevated TSS concentrations during high flows and slightly lower concentrations during lower flow conditions. Elevated TSS concentrations during high flows tend to correspond to periods of heavy rain and may indicate stream bank and gully erosion as significant sources of sediment.

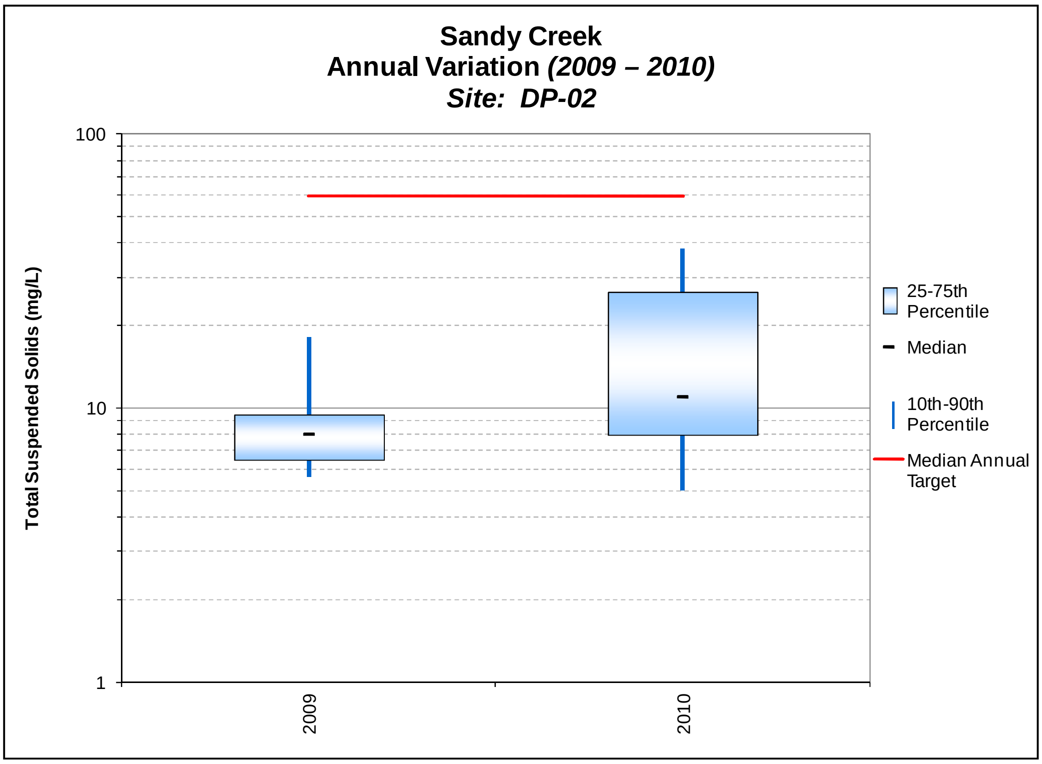

Figure 11-4. Annual TSS concentrations, Sandy Creek, 2009 – 2010.

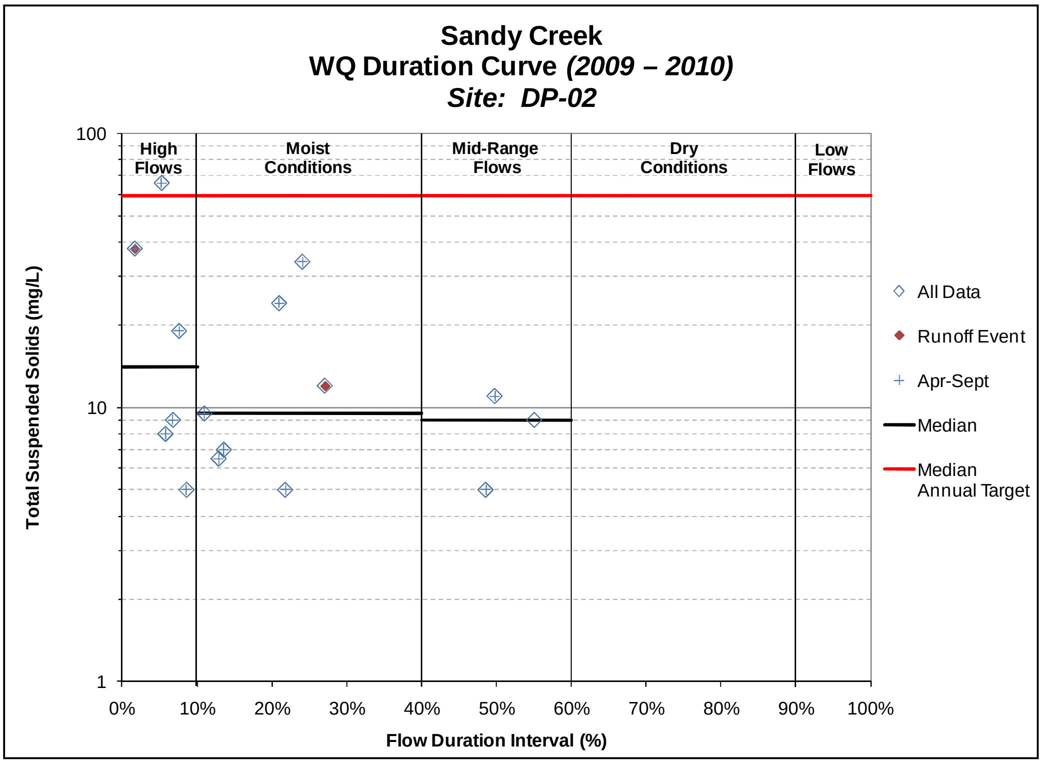

Figure 11-5. TSS water quality duration curve, Sandy Creek, 2009 - 2010.

11.2.2 Nutrients

Median annual phosphorus concentrations within Sandy Creek have not exceeded the target phosphorus concentration (Figure 11-6) based on data collected in 2009 and 2010. Given the short monitoring period, no long-term trends can be distinguished. The median annual concentrations of nitrogen have significantly exceeded the nitrogen target (Figure 11-7). The elevated annual nitrogen concentrations are likely linked to nutrient sources on agricultural lands.

Analysis of available seasonal data illustrates slightly higher phosphorus concentrations in the spring compared to summer months. Nitrogen concentrations are elevated throughout the growing season. Elevated concentrations during high flow periods are also confirmed in the water quality duration curve (Figure 11-8 and Figure 11-9). Elevated concentrations during high flow periods are likely associated with runoff from applied fertilizers, as well as other sources of nutrients such as animal waste from pastures and fields.

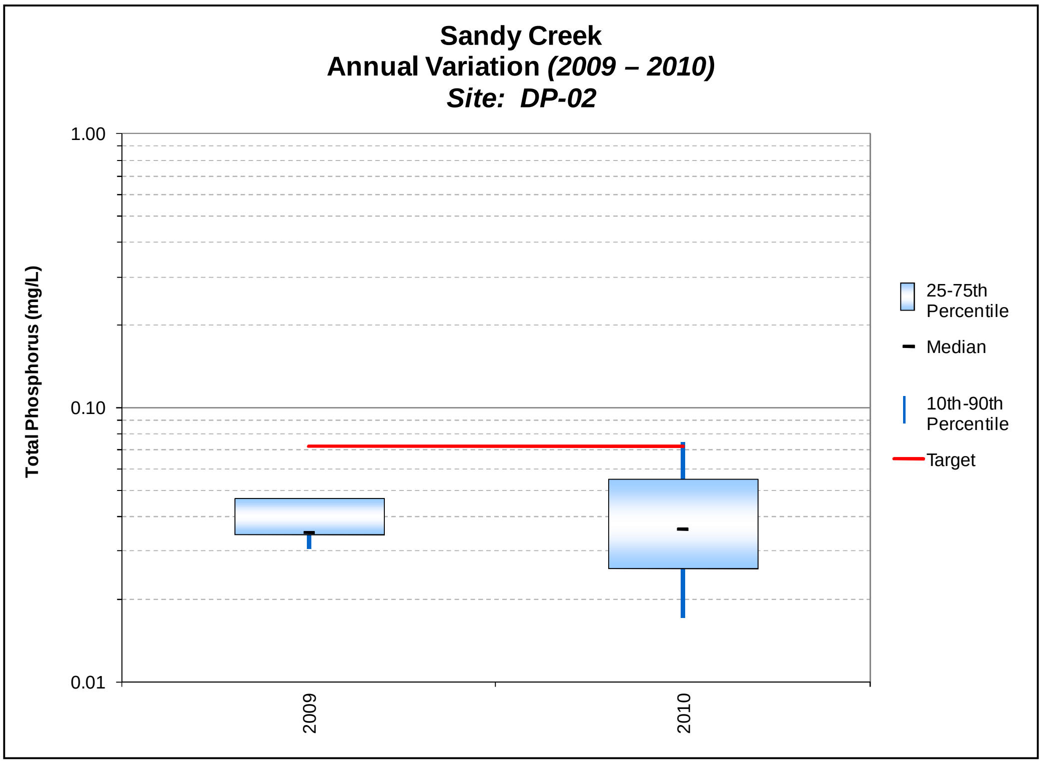

Figure 11-6. Annual phosphorus concentrations, Sandy Creek, 2009 – 2010.

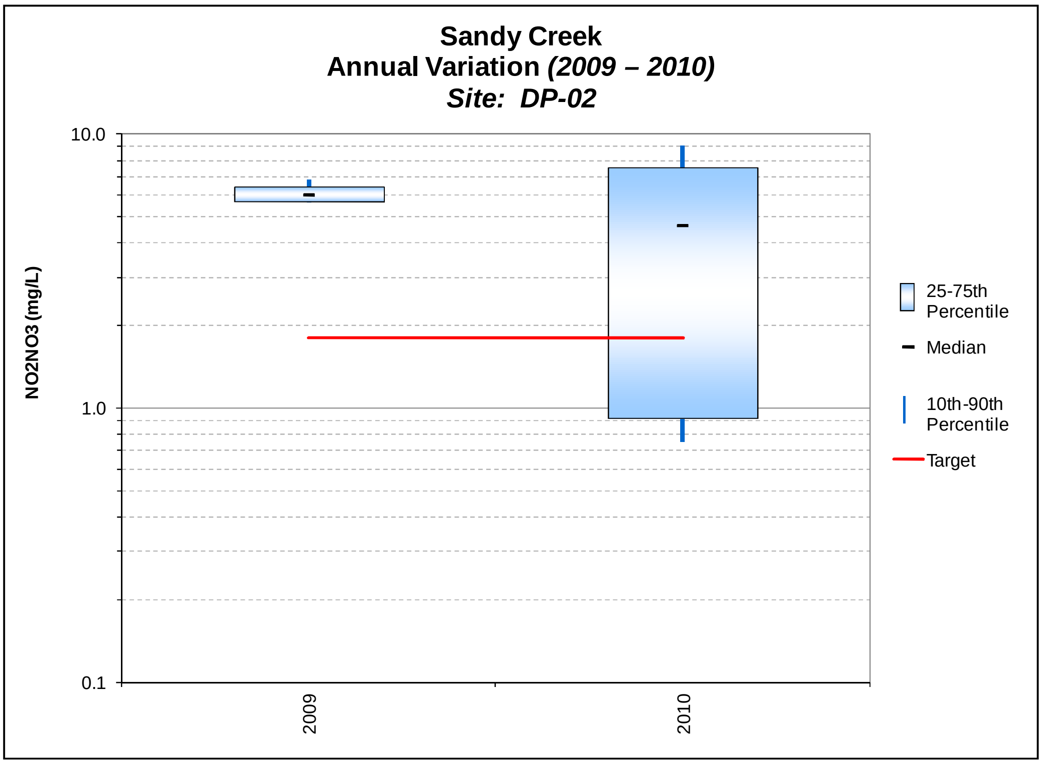

Figure 11-7. Annual nitrogen concentrations, Sandy Creek, 2009 – 2010.

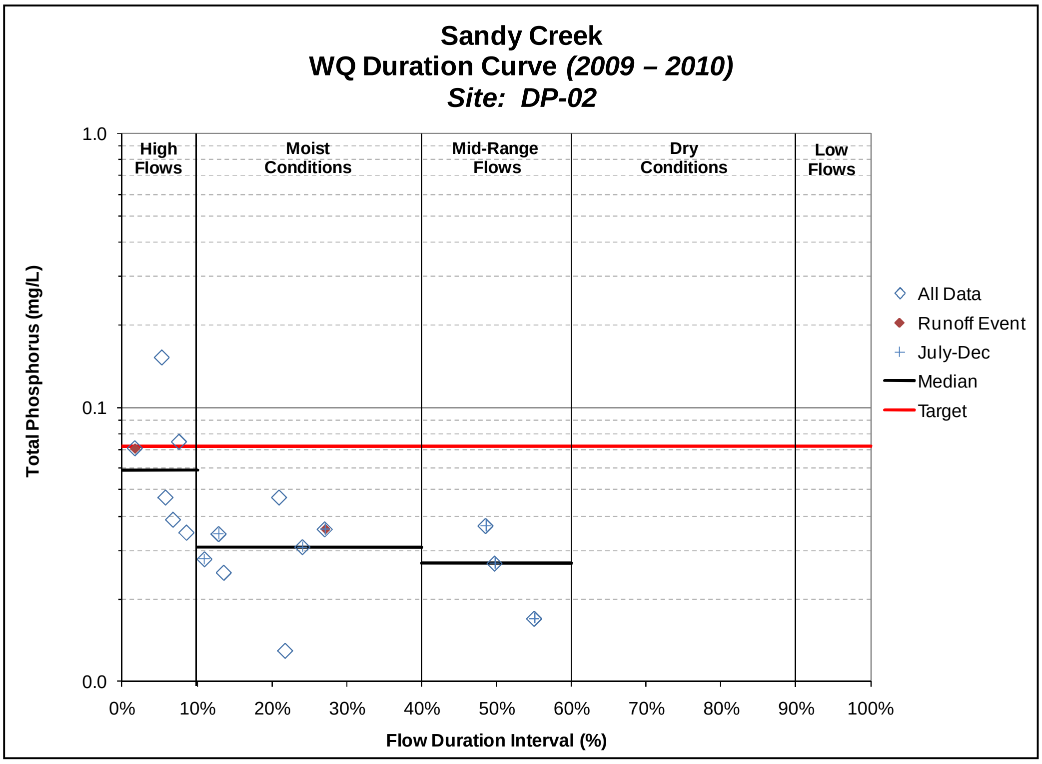

Figure 11-8. Phosphorus water quality duration curve, Sandy Creek, 2009 - 2010.

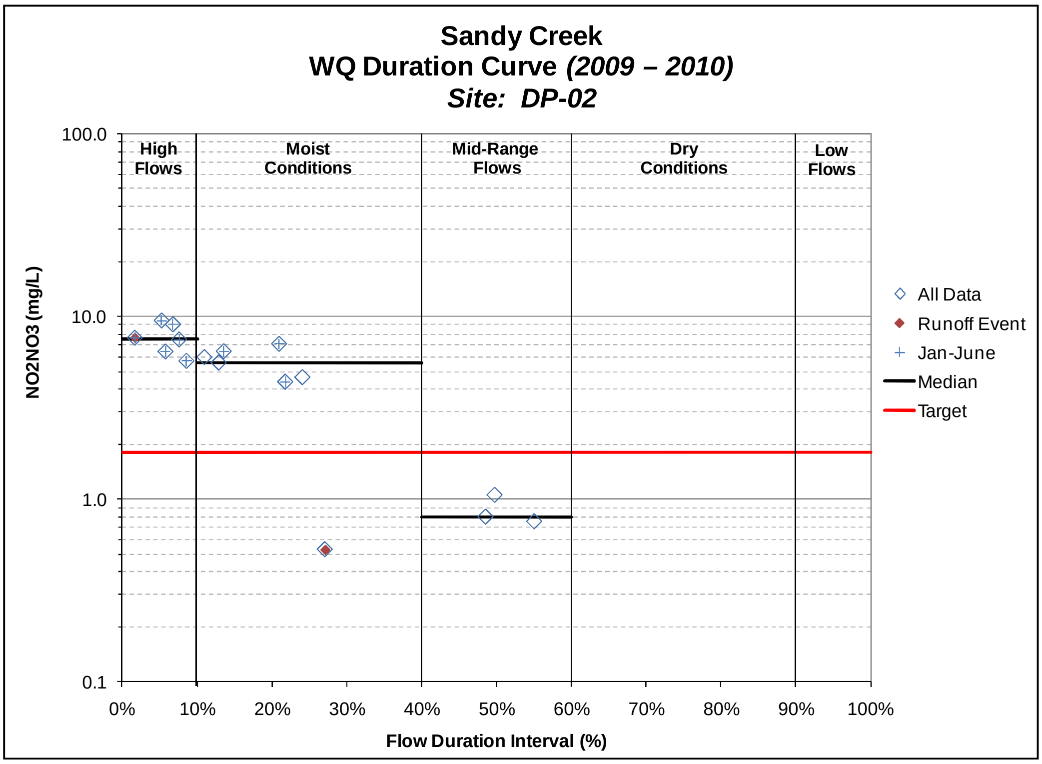

Figure 11-9. Nitrogen water quality duration curve, Sandy Creek, 2009 - 2010.

11.3 Sandy Creek LRS

Table 11-4 summarizes the Sandy Creek watershed and pollutant sources. LRSs are presented in Sections and 11.3.1 and 11.3.2 for TSS and nutrients, respectively.

Table 11-4. Sandy Creek summary table

Upstream Characteristics	
Drainage Area	144 square miles
Sampling Station	DP-02
Listed Segments	None
Land Use	cultivated crops (81 percent); deciduous forests (eight percent); developed land including low, medium, and high intensity (four percent); developed open space (three percent); pasture/hay (three percent); other (one percent).
Soil Type	66% B, 18% B/D, 8% No Data, 3% C, 4% A, <1% A/D, <1% C/D
Erodible Soils	19% Highly Erodible, 81% Not Assessed
Animal Units	3,400; 24 per square mile
Key Sources	streambank and gully erosion, agricultural runoff, NPDES facilities, and CSOs
NPDES Facilities	Wenona STP (IL0021792)
	Oglesby STP (IL0024996)
	Magnolia WTP (ILG640187)
NPDES Facility Disinfection Exemption [a]	Wenona STP has a disinfection exemption
Fecal Coliform Exceedance Summary [b]	Wenona STP has exceed the standard on 4 occasions between 2005 and-2010 averaging 3,375 cfu/100 mL when exceeding
MS4 Communities	None
CSO/SSO Communities	Oglesby STP (IL0024996)
	Wenona STP (IL0021792)
CSO Overflows	There have been 141 reported overflows from the multiple outfalls at CSOs listed above from 2007-2010

a. See Table 11-2 for exemption and permit specifics.
b. See Appendix A for DMR Exceedance Summary Table (2005-2010)

11.3.1 Total Suspended Solids LRS

TSS load reductions are presented in Table 11-5 for Sandy Creek using the volume weighted target for TSS presented in Section 3, Water Quality Indicators and Targets. Sediment reductions are not required to meet the sediment target. Additional monitoring is needed to fully understand the sediment budget.

Table 11-5. TSS LRS, Sandy Creek.

Stream	Station	Volume Weighted TSS Results (mg/L)	LRS Target (mg/L)	Reduction Needed to Achieve LRS Target
Sandy Creek	DP-02	22	59.3	0%

11.3.2 Nutrient LRS

Nutrient LRSs have been developed for the Sandy Creek watershed. Figure 11-10 and Figure 11-11 present the load duration curve for total phosphorus and nitrate nitrogen, respectively, at the Sandy Creek assessment site. Table 11-6 and Table 11-7 summarize the LRS and required reductions. There are no required reductions for total phosphorus. Nitrogen reductions are needed during high and moist flow conditions. Fertilizer management is needed for agricultural lands and watershed runoff controls should be implemented. The impact of CSOs may be significant and should be further evaluated as part of long term control plans.

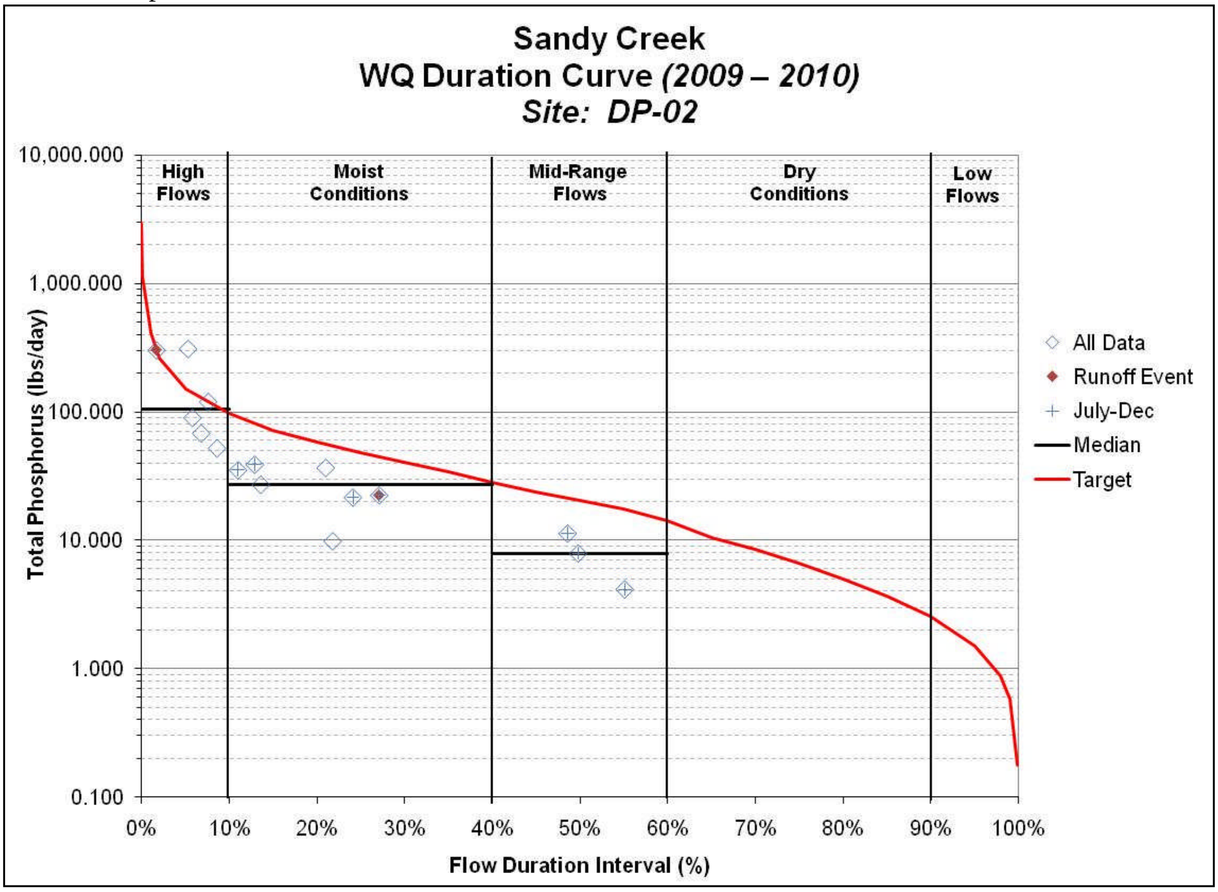

Figure 11-10. Total phosphorus load duration curve, Sandy Creek (DP-02).

Table 11-6. Total phosphorus LRS, Sandy Creek (DP-02).

Station DP 02 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load	105	27	8	N/A	N/A
	LRS Target	151	48	20	7	1
	LRS Reduction %	0%	0%	0%	N/A	N/A

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

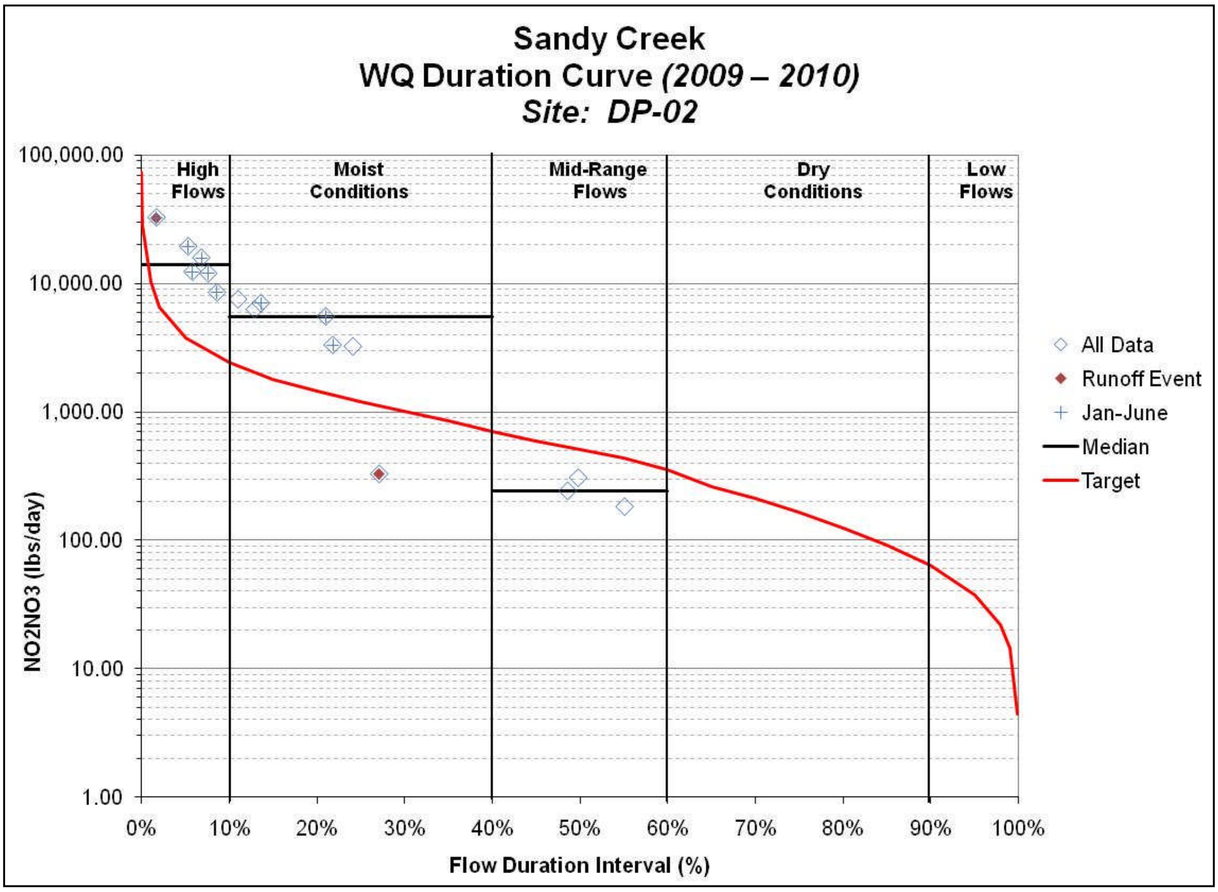

Figure 11-11. Nitrogen load duration curve, Sandy Creek (DP-02).

Table 11-7. Nitrogen LRS, Sandy Creek (DP-02).

Station DP 02 LRS[a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**LRS Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
NO2NO3 (lbs/day)	Current Load	14,061	5,527	244	N/A	N/A
	LRS Target	3,778	1,208	505	165	37
	LRS Reduction %	73.13%	78.14%	0%	0%	0%

a. Note that the LRS is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime.

12. Lake Depue

Lake Depue is 524 acres and is a former oxbow lake (Figure 12-1). The Village of Depue is on its northern shore and, according to the 2000 Census, has a population of 1,842. The shoreline is approximately 11 miles long and the lake averages 2.3 feet in depth. It is a backwater lake of the Illinois River and depth fluctuates with the Illinois River levels. It is connected to the Illinois River at the western end by a narrow shallow channel and separated from the river by a low lying peninsula.

Lake Depue has been identified by the Illinois EPA as impaired by aquatic algae, dissolved oxygen, phosphorus, siltation/sedimentation, and total suspended solids. The Illinois TP standard for lakes and waters draining into lakes is 0.05 mg/L. This report presents a TP TMDL for Depue Lake. Lake Depue is also listed for other impairments; however this TMDL only addresses the aesthetic quality and aquatic life impairments. A LRS is presented for TSS in Section 12.2.2.

The Depue/New Jersey Zinc/Mobil Chemical site, a primary zinc smelting facility currently listed as a federal clean-up site, is located in close proximity to the lake. In addition to zinc smelting, the site also produced phosphate fertilizers. This facility is no longer in production, and site clean-up activities have begun under an Interim Consent Decree. A surface water treatment plant is now in operation to treat surface water discharged from the property to Lake Depue (U.S. EPA 2011).

12.1 Water Quality Analysis

Nutrient sources to Lake Depue include runoff from developed and undeveloped land uses, loading associated with Illinois River floodwaters, point sources, and internal loading. Internal loading is likely due to phosphorus release from bottom sediments through chemical reactions and physical disturbances. The Village of Depue is served by a WWTP which discharges into Lake Depue. The facility does not have nutrient limits.

Additionally, the 303(d) assessment found Lake Depue to be impacted by contaminated sediments, municipal point source discharge, other recreational pollution sources, crop production (crop land or dry land), urban runoff/storm sewers, and runoff from forests, grasslands and parklands. Of significant concern to Lake Depue is the Depue/New Jersey Zinc/Mobil Chemical site, currently listed as a federal clean-up site. According to EPA Region 5, industrial activities began at this site in 1903 and included zinc smelting and production of sulfuric acid. In 1967, and with the growing demand for phosphate fertilizers, a diammonium phosphate (DAP) fertilizer plant was constructed by Depue/New Jersey Zinc. Manufacturing continued until operations ceased in 1987, and plants were later demolished in 1991. Several sources of contamination have been identified, these include a residue pile, a waste pile, lithopone waste material ridges, a cinder fill area, contaminates soils, lagoons/cooling ponds, and the gypsum stack. To remediate such concerns, in 1995, an Interim Consent Decree required remedial investigations, including a rigorous dust monitoring and dust control program as well as the construction of a water treatment plant to treat surface water discharged from the property to Lake Depue (U.S. EPA 2011).

Three locations have been sampled within the lake between 1995 and 2007 (Figure 12-1). Table 12-1 summarizes the water quality data. Total phosphorus concentrations exceeded the in-lake standard at all of the three monitoring locations. Figure 12-2 and Figure 12-3 summarize the average annual phosphorus and chlorophyll-a data, respectively.

Table 12-1. Surface Water Quality Means, Lake Depue, 1995 – 2007.

	Surface Water Quality Mean (April - October)		
Parameter	**RDU-1**	**RDU-2**	**RDU-3**
TP (mg/L)	0.50	0.46	0.74
Chl-a (µg/L)	145.89	159.48	284.26
Secchi depth (inch)	8.93	9.29	6.94
TSS (mg/L)	95.74	68.58	158.80

Total phosphorus concentrations in Lake Depue generally increase throughout the growing season, with the highest concentrations occurring in August (Figure 12-4). Chlorophyll-*a* shows a similar seasonal trend (Figure 12-5). This time period corresponds to low flow, warm temperature months. Under low flow conditions, point sources and internal loading will have a strong effect on in-lake phosphorus concentrations.

There is a positive relationship between TP and chlorophyll-*a*, indicating that algae, as measured by chlorophyll-a concentration, is dependent on TP concentrations (Figure 12-6). Therefore, reducing TP will result in lower chlorophyll-*a* concentrations and algae. In addition, a positive relationship exists between TP and TSS (Figure 12-7), which also indicates that efforts to reduce TP may also reduce TSS. However, reductions in dissolved phosphorus sources derived from wastewater and manure will not reduce TSS concentrations. During 2007, dissolved phosphorus accounted for 40-80 percent of the total phosphorus concentration in the lake.

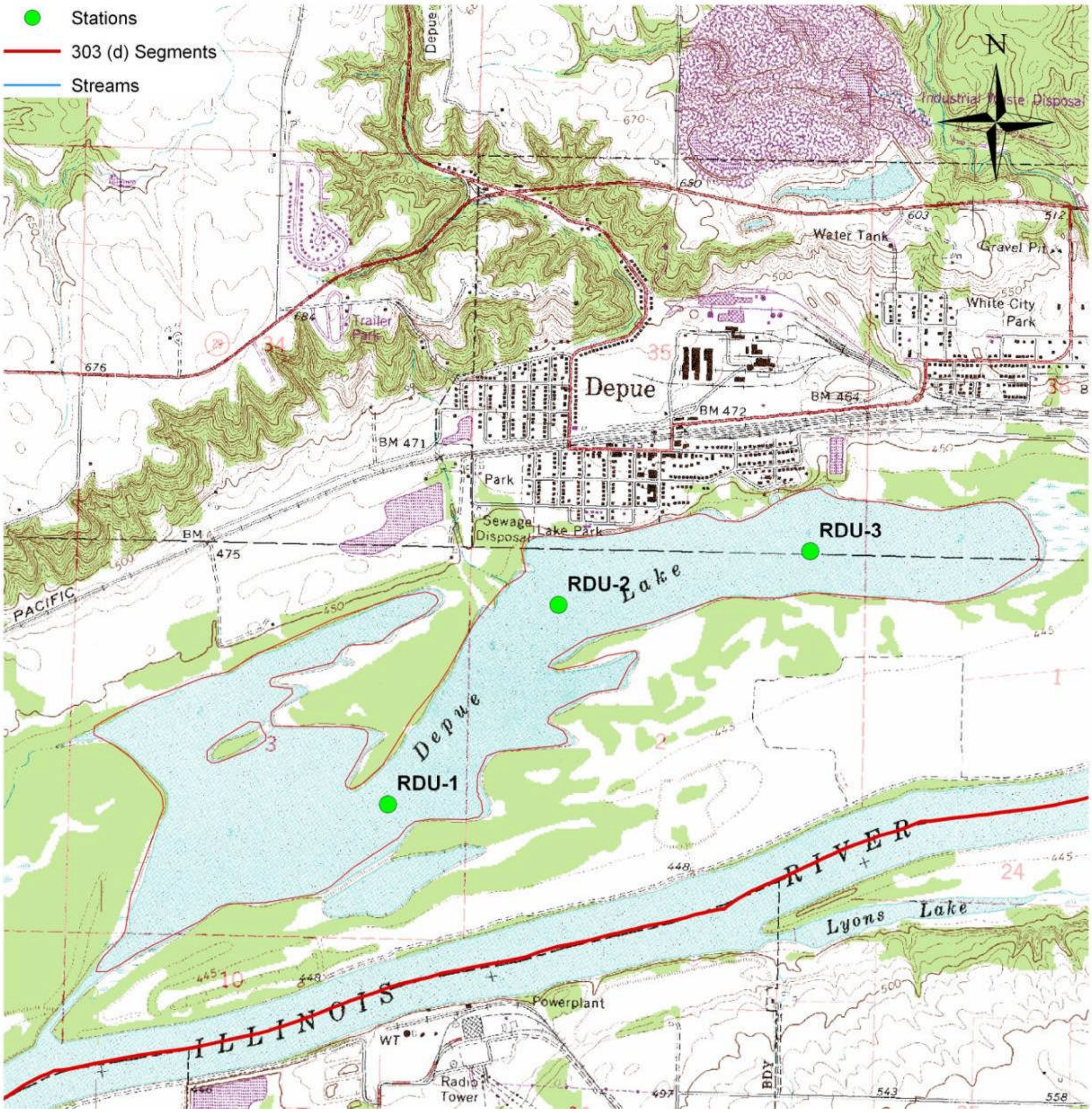

Figure 12-1. Lake Depue sampling stations.

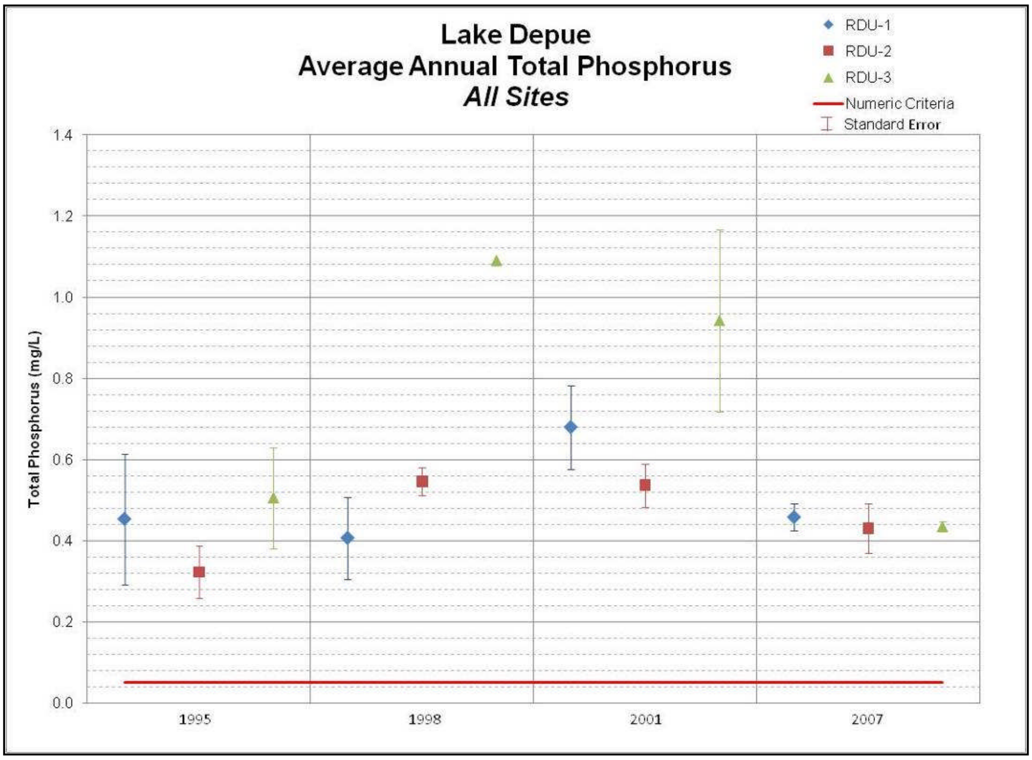

Figure 12-2. Lake Depue average annual total phosphorus concentrations.

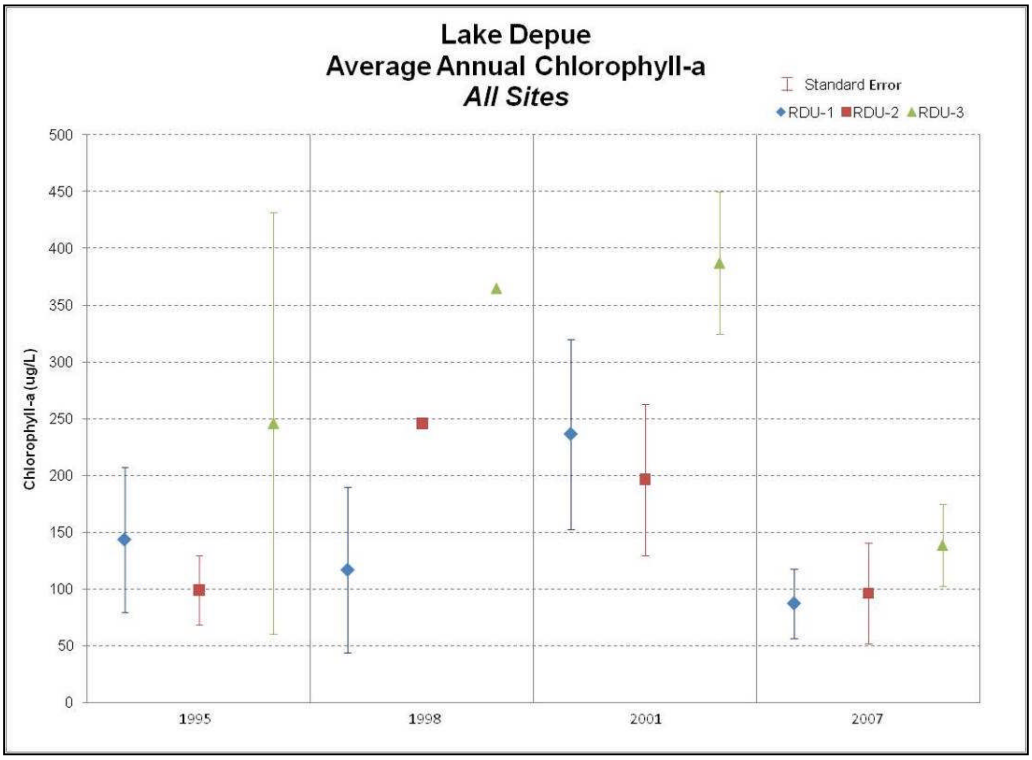

Figure 12-3. Lake Depue average annual chlorophyll-a concentrations.

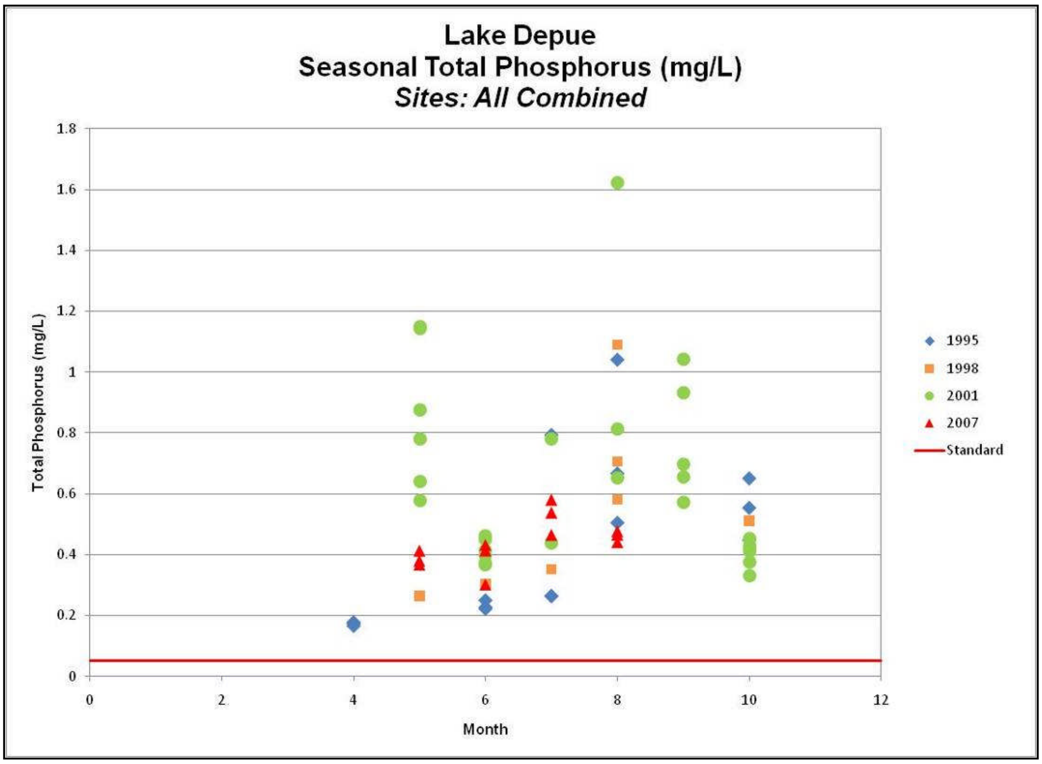

Figure 12-4. Lake Depue seasonal TP concentrations.

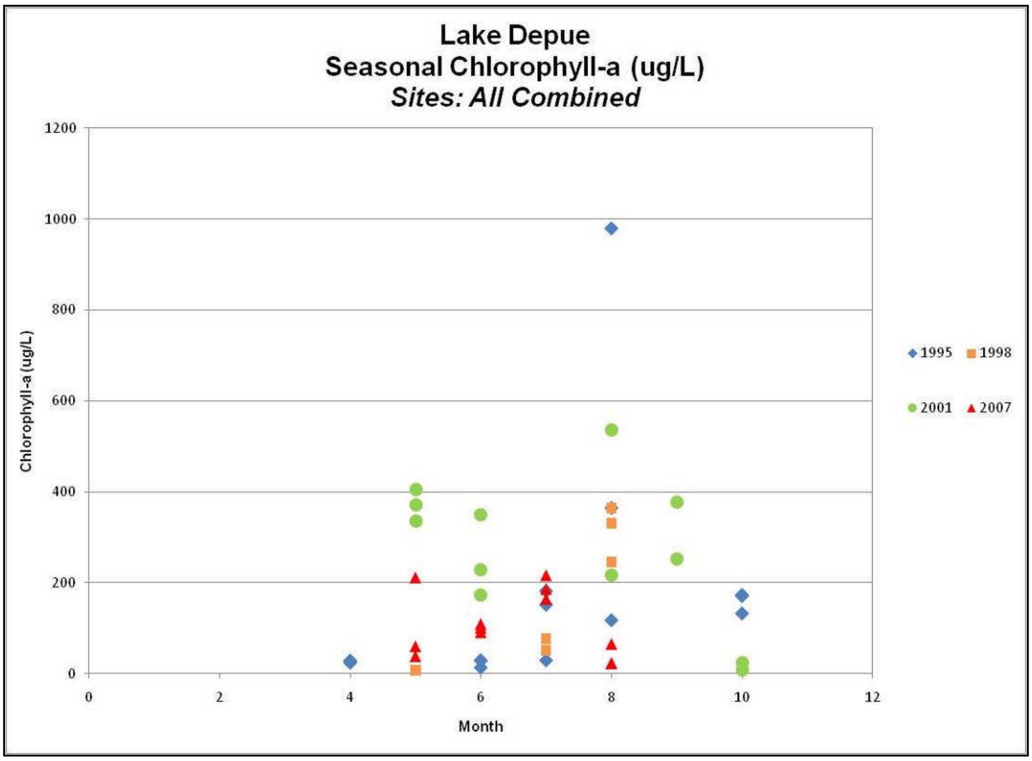

Figure 12-5. Lake Depue seasonal chlorophyll-a data.

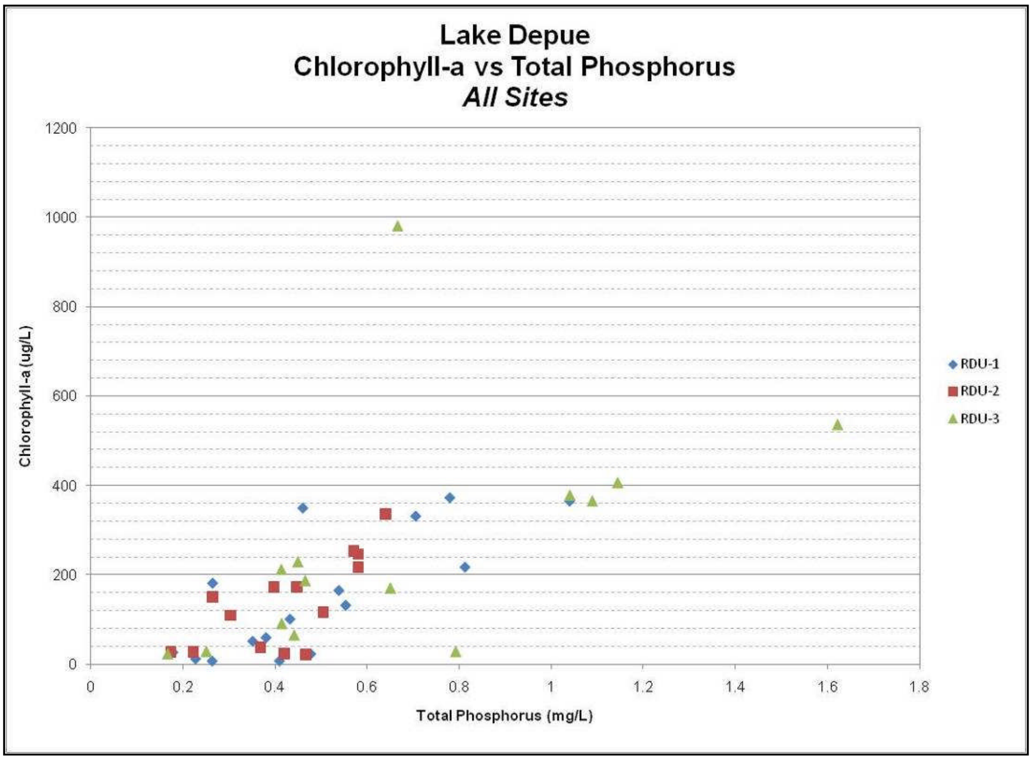

Figure 12-6. Lake Depue relationship between phosphorus and chlorophyll-a concentrations.

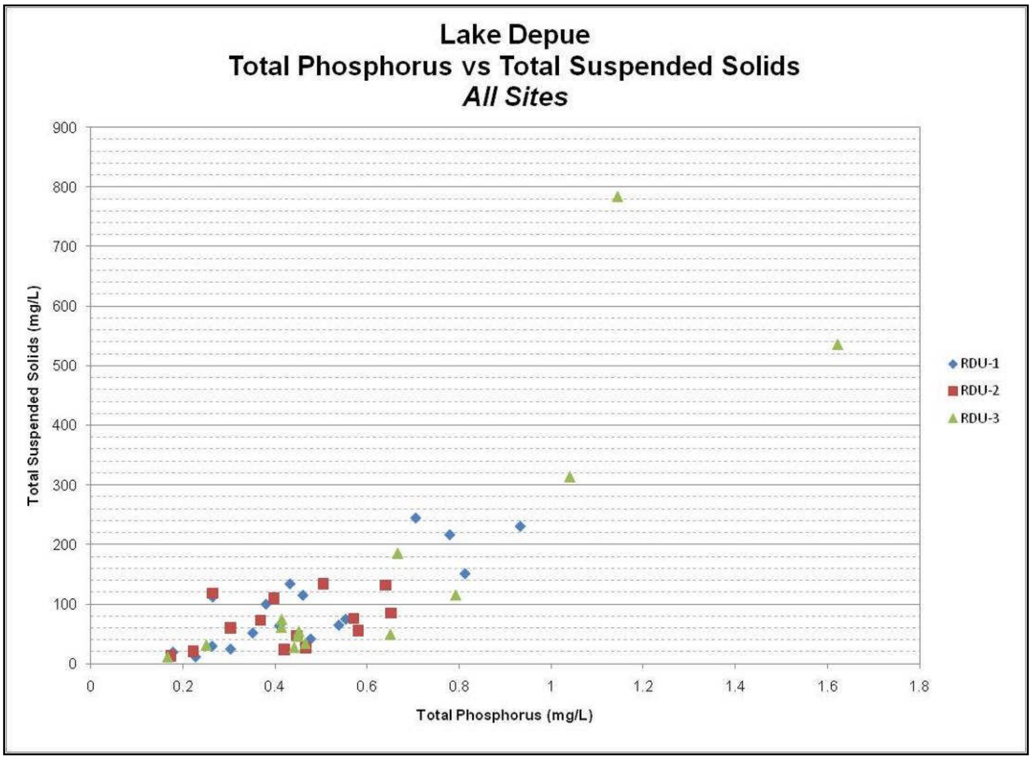

Figure 12-7. Correlation between TSS and TP in Lake Depue, all data.

Dissolved oxygen and temperature depth profiles were taken at three locations in Lake Depue. Figure 12-8 is a representative dissolved oxygen depth profile measured during 1995. The dissolved oxygen depth profile from 1995 indicates that the deeper portion of the lake stratifies during the early growing season and is relatively mixed during in spring and fall. Based on dissolved oxygen data, the lake is weakly stratified. Stratification tends to occur during June or August, and does not typically persist. It is likely that during stratification, phosphorus is released from the low oxygen sediments into the water column, creating an additional internal phosphorus load.

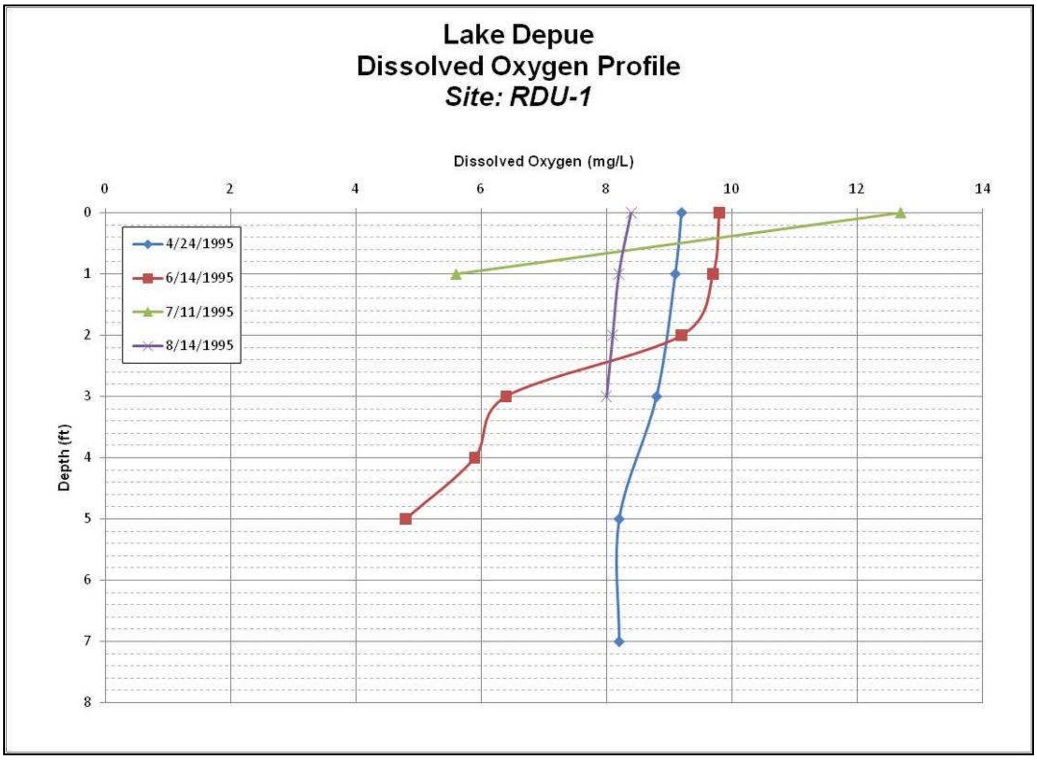

Figure 12-8. Lake Depue dissolved oxygen depth profile, 1995.

12.1.1 Critical Conditions and Internal Loading

The critical conditions for Depue Lake occur when there is limited interaction with the Illinois River, typically occurring during the dry, summer months. During this time, the impact of wastewater discharging to the lake and internal loading of phosphorus both can contribute to high concentrations of phosphorus in the lake and associated algae concentrations.

The Depue STP discharges into Lake Depue at an average rate of 0.45 MGD (based on six years of monitoring). Although phosphorus is not monitored in the effluent, an average concentration of 4 mg/L can be used to estimate current phosphorus loadings from wastewater treatment facilities. The current phosphorus load to the lake by the Depue STP is estimated at 5,500 lbs/year, or 15 lbs/day. During this time, the Depue STP accounts for an estimated 70 percent of the total phosphorus load to the lake.

Internal loading of phosphorus can become a significant factor affecting the water quality of a lake during critical conditions. Internal phosphorus loading in lakes can be exasperated by the following factors:

- Anoxic conditions at the soil water interface which releases phosphorus into the water column;
- Mixing of the sediments by wind action, boating, or benthic fisheries; and
- Presence of certain aquatic plants such as curlyleaf pondweed which dies during mid-summer releasing large amounts of phosphorus into the water column.

The amount of phosphorus bound to the sediment can be used as an indicator of the potential for internal phosphorus loading from the sediments. Phosphorus sediment data were collected in Depue Lake in 2001 and 2007 and are summarized in Table 12-2. The highest concentration of sediment phosphorus occurs at RDU-3, which coincides with the highest water column phosphorus concentrations. In-lake sediment phosphorus concentrations reflect the high water column phosphorus concentration. Illinois EPA sampled sediment phosphorus concentrations in nine other lakes and results ranged from 597 to 1,390 mg/kg although water column phosphorus concentrations were lower than Lake Depue. In the future as in-lake management strategies and restoration plans are developed, a comprehensive evaluation of internal loading should be conducted.

Table 12-2. Sediment phosphorus data, Lake Depue.

Sample Date	TP Sediment Concentration (mg/kg)		
	RDU-1	RDU-2	RDU-3
8/7/2001	1,260	--	2,390
9/4/2001	1,550	--	--
6/13/2007	1,230	1,170	2,050

12.2 Lake Depue TMDL and LRS

12.2.1 Total Phosphorus TMDL

Lake Depue is impaired for total phosphorus and dissolved oxygen. The empirical Vollenweider Lake Model (Vollenweider 1975) was utilized to determine the annual phosphorus loading to the lake under existing conditions and the allowable phosphorus load in order to meet in-lake standards. This model describes the in-lake nutrient concentration of a lake as a function of the nutrient loading, mean depth, and hydraulic residence time based on evaluation of many temperate lakes.

The Vollenweider Lake Model is expressed as:

$$P = \frac{Lp}{qs}\frac{1}{1+\sqrt{z/qs}}$$

where:

P = in-lake total phosphorus concentration
Lp = annual total phosphorus load / lake surface area
qs = surface overflow rate = z/T
z = mean lake depth
T = hydraulic residence time

The equation was solved for annual total phosphorus load using the variables described in Table 12-3. Inflow or outflow data are not available for Lake Depue. A review of historical flow records (Lee and Stall 1976) indicates that on average, between 1940 and 1974, the Peoria Pool of the Illinois River higher than at or equal to the average Lake Depue elevation for all but 36.5 days per year, or 90 percent of the time. It is assumed that when the Illinois River is at or above the average lake elevation that the lake is fully mixed with inflow from the Illinois River.

Using the watershed to lake volume ratio, a hydraulic residence time of 0.05 days was determined. The watershed includes the direct drainage area to the lake as well as the watershed area of the Illinois River. The flow connection between the Illinois River and Lake Depue is unknown, although the Illinois River is connected to the lake though a side channel inlet and when the Illinois River is high, the lake is fully inundated with River water.

Table 12-4 presents the total phosphorus TMDL and allocations.

Table 12-3. In-lake model inputs.

Variable	Value
In-lake total phosphorus concentration (ug/L)	0.57 (existing conditions) 0.05 (in-lake standard)
Lake surface area (acres)	524
Mean depth (ft)	2.3
Hydraulic residence time (day)	0.05

Table 12-4. Phosphorus TMDL, Lake Depue.

Pollutant	TMDL Component	Total Phosphorus (lbs/day)
Total Phosphorus (lbs/day)	Current Load	34,885.2
	LA	2,766.3
	WLA: NPDES Facilities	4.0
	Total WLA	4.0
	MOS (10%)	307.8
	TMDL Target	3,078.1
	TMDL Reduction (%)	91.2%

A significant reduction in TP loads is needed to comply with the TMDL. The majority of this load reduction will need to be from nonpoint sources, specifically reductions in TP within the Illinois River main stem. The Depue STP does not currently have a TP limit; the TMDL proposes a technology based limit of 1 mg/L. This will require the Depue STP to reduce TP loads from approximately 15 lbs/day to 4 lbs/day during mid-range to low flow conditions. Monitoring of the effluent from the Depue STP could indicate that less or more reductions are needed to comply with the WLA. Additional data collected on Lake Depue could also aid in future management plans including bathymetry, hydrologic interaction with the Illinois River (timing, flow, volume, elevations), sediment oxygen demand, lake stage, flow budget, and monitoring of the tributaries and of the Depue STP.

Dissolved Oxygen TMDL: Nutrient Enrichment and Oxygen

Lake Depue is also listed as being impaired due to dissolved oxygen, which is considered to be a side-effect of the phosphorus impairment. Excessive phosphorus loadings are believed to be exerting negative effects on the aquatic ecosystem by increasing algal and aquatic plant life production (Sharpley et al. 1994). As algae and aquatic plants die off, they consume oxygen resulting in depressed oxygen levels in the lake. Illinois EPA believes that attaining the in-lake total phosphorus target of 0.05 mg/L will result in shifting plant production back to natural levels, which in turn will result in dissolved oxygen meeting the water quality standard.

Phosphorus is critical for plant growth and is often the limiting nutrient. The form that can be readily used by plants and therefore can stimulate nuisance algae blooms is orthophosphate. The amount of phosphorus tied up in the nucleic acids of food and waste is actually quite low. This organic material is eventually converted to orthophosphate by bacteria.

Phosphorus levels in water are related to oxygen levels in that nutrient enrichment promotes the growth of nuisance algae that subsequently dies and serves as food for bacteria. Oxygen is used by bacteria that consume dead organic matter. Plant photosynthesis produces oxygen, but at night, respiration reverses the process and consumes oxygen. Under these conditions, oxygen can be depleted unless it is replenished from the air. Conversely, oxygen concentrations can become supersaturated during the day, due to abnormally high amounts of photosynthesis. The significant swing in diurnal dissolved oxygen levels causes stress to both fish and invertebrate communities.

Inputs of phosphorus originate from both point and nonpoint sources. Most of the phosphorus discharged by point sources is soluble. Another characteristic of point sources is they have a continuous impact and are human in origin, for instance, effluents from municipal sewage treatment plants and permitted industrial discharges. The contribution from failed on-site wastewater treatment systems can also be significant, especially if they are concentrated in a small area. The phosphorus concentration in raw waste water is generally 8-10 mg/l and after secondary treatment is generally 4-6 mg/l.

The non-point sources of phosphates include: natural decomposition of rocks and minerals, stormwater runoff, agricultural runoff, erosion and sedimentation, atmospheric deposition, and direct input by animals/wildlife.[1] Phosphorus load from rural stormwater varies depending on land use and management practices and includes contributions from livestock feedlots and pastures and row crop agriculture. Crop fertilizer includes granular inorganic types and organic types such as manure or sewage sludge. Pasture land is especially a concern if the livestock have access to the stream. Large feedlots with manure storage lagoons create the potential for overflows and accidental spills.

A characteristic of phosphorus discharged by nonpoint sources is that the impact is intermittent and is most often associated with stormwater runoff. Sedimentation can impact the physical attributes of the stream and act as a transport mechanism for phosphorus. Phosphorus from nonpoint sources is generally insoluble or particulate, and most of this phosphorus is bound tightly to soil particles and enters streams from erosion, although some comes from tile drainage.

Erosion is worse on streams without any riparian buffer zone and streams that are channelized because they no longer have a functioning flood plain and cannot expel sediment during flooding. Additionally,

[1] Mr. Brian Oram, PG, Phosphate in Water , Water Research Center, www.water-reseearch.net/phosphate.htm

phosphorus transport to the stream decreases with decreased sedimentation. Oxygen levels must also be considered, because phosphorus is released from sediment at higher rates under anoxic conditions; therefore as mentioned earlier, lack of tree and shade not only increase water temperature and photosynthesis but also decrease oxygen levels and create anoxic conditions.

Various BMPs such as riparian buffers, and agricultural tile management not only reduce soil erosion, but can also reduce the sediment and associated phosphorus load within runoff with entrapment. BMPs to reduce total phosphorus can also affect sediment. BMPs that serve to restrain overland flow and allow infiltration will reduce total phosphorus loads and allow sediment time to settle out many of the BMPs proposed will reduce both total phosphorus and sediment.

Considering the linkages between phosphorus and oxygen outlined above, it is expected that the measures taken to reduce the loads of phosphorus from identified point sources and nonpoint source to meet the WLAs and LAs in this TMDL, will improve the fluctuations and oxygen levels and increase the biotic integrity scores for fish and macroinvertebrate communities in the impaired water bodies.

12.2.2 Total Suspended Solids LRS

The methods previously described for determining TSS LRSs are not applicable to the backwater lakes since the volume weighted TSS targets are derived to provide targets for streams under a variety of flow conditions. The Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment (USACE 2007) is used to derive LRS reductions for the backwater lakes.

TSS load reductions are presented in Table 12-5 for Depue Lake using the objective presented in the Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment (USACE 2007) for sediment reduction to the Illinois River that states “reduce total sediment delivery to the Illinois River by at least 20 percent by 2055 (reduction to an average of 9.7 million tons per year above Valley City, based on ISWS estimate of delivery for WY 1981 to 2000)”. This objective is identified by the USACE to mitigate for sediment loads from the basin that have resulted in increasing turbidity and filling backwater areas, side channels and islands.

Table 12-5. Lake Depue TSS LRS.

Lake	Station	TSS Load Reduction Needed to Achieve LRS Target
Lake Depue	RDU-1	20%

13. Senachwine Lake

Senachwine Lake is a 3,324 acre lake that forms part of the Illinois River valley. Monitoring data indicates that the maximum depth of this lake is eight feet deep. To the north, it is connected to Goose Lake by a shallow channel and both are backwaters of the Illinois River. Senachwine Lake receives drainage from a very large watershed including the Big Bureau Creek watershed, in addition to inflow from the Illinois River through side channels under lower flow conditions and backwater during higher flow conditions.

Senachwine Lake has been identified by the Illinois EPA as impaired by aquatic algae, dissolved oxygen, phosphorus, siltation/sedimentation, and total suspended solids. The Illinois TP standard for lakes and waters draining into lakes is 0.05 mg/L. A TP TMDL and TSS LRS will be developed for Senachwine Lake.

13.1 Water Quality Analysis

Three locations were sampled within the Senachwine Lake during 2001 (Figure 13-1). Table 13-1 summarizes the water quality data. Total phosphorus concentrations exceeded the in-lake standard at all of the three monitoring locations. The 303(d) assessment found contaminated sediments, crop production (crop land or dry land) and urban runoff/storm sewers as potential sources of impairment to Senachwine Lake.

Table 13-1. Surface Water Quality Means, Senachwine Lake, 2001.

	Surface Water Quality Mean (May - October)		
Parameter	**RDZX-1**	**RDZX-2**	**RDZX-3**
TP (mg/L)	0.67	0.59	0.44
Chl-a (µg/L)	174.33	155.58	118.85
Secchi depth (inch)	5.20	5.25	5.0
TSS (mg/L)	237.80	197.75	121.0

Total phosphorus concentrations in Senachwine Lake generally decline throughout the growing season, with the highest concentrations occurring in the spring (Figure 13-2). This pattern is reflective of spring phosphorus concentrations in the Illinois River and Big Bureau Creek which have high TP loads in the spring. It is therefore apparent that Senachwine Lake's water quality is very dependent on the Illinois River. Spring flows and their associated phosphorus loads are having a significant effect on the water quality of the lake. Nonpoint sources of phosphorus in the drainage area and spring phosphorus loads from the Illinois River will need to be reduced to improve the quality of this lake. Figure 13-3 and Figure 13-4 summarize the annual transparency and chlorophyll-*a* data, respectively.

There is a positive relationship between TP and chlorophyll-*a*, indicating that algae, as measured by chlorophyll-*a* concentration, is dependent on TP concentrations (Figure 13-5). Therefore, reducing TP will result in lower chlorophyll-*a* concentrations and algae. In addition, a positive relationship exists between TP and TSS (Figure 13-6), which indicates that efforts to reduce TP may also reduce TSS; the opposite also holds true. On average, dissolved phosphorus accounts for 46 percent of the total phosphorus in the lake, therefore source reductions of both dissolved and particulate phosphorus are needed.

TSS concentrations in the lake are high, with the highest average annual concentrations occurring in the southern portion of the lake near the confluence with the Illinois River. Sampling point RDZX-3, located in the northern portion of the lake, has the lowest TSS concentrations, likely a result of Goose Lake upstream that allows sediment from Big Bureau Creek to settle.

Dissolved oxygen concentrations measured in 2001 were less than 6.0 mg/L during the month of July at two of the three monitoring locations. This third site averaged 8.1 mg/L dissolved oxygen. The low dissolved oxygen is the result of decaying algae, a process that consumes the oxygen in the lake. During low flow conditions in July, TP increases in the lake as a result of point source dischargers, particularly in the Big Bureau Creek watershed, and internal loading. An increase in chlorophyll-*a* is also measured at this time. It is possible that the sediments may become anoxic during the summer, resulting in release of phosphorus from the sediment into the water column, thus increasing the internal load of the lake. Phosphorus reductions will decrease the chlorophyll-*a* concentration in the lake, which will in turn increase the dissolved oxygen in the lake.

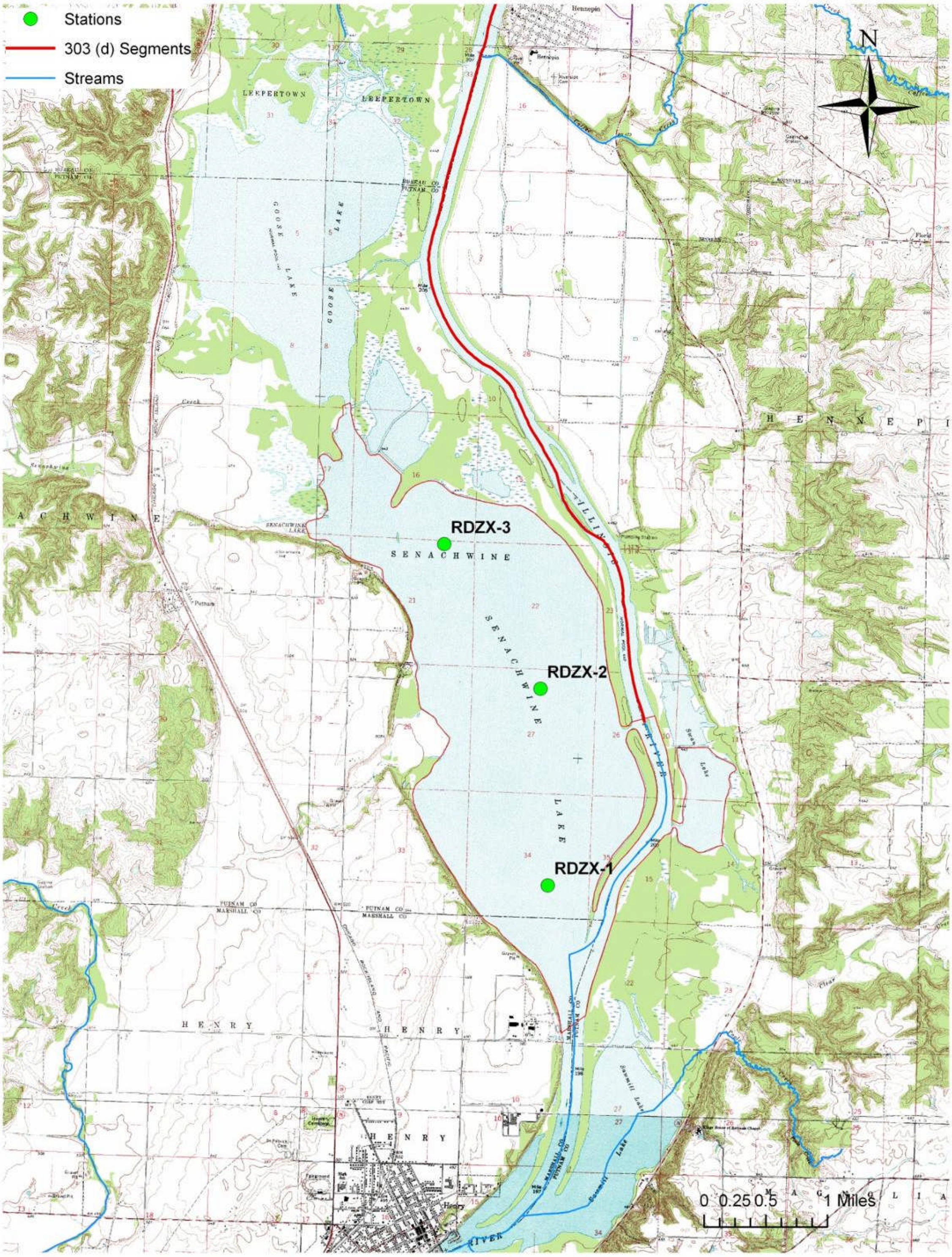

Figure 13-1. Senachwine Lake sampling stations.

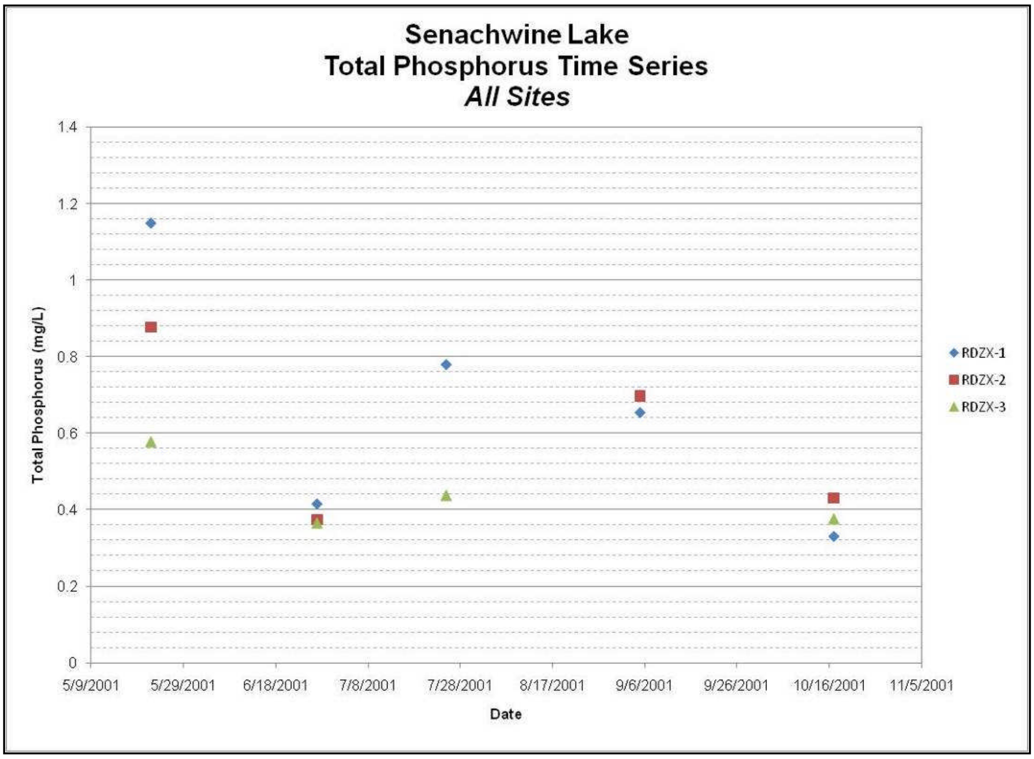

Figure 13-2. Senachwine Lake phosphorus data.

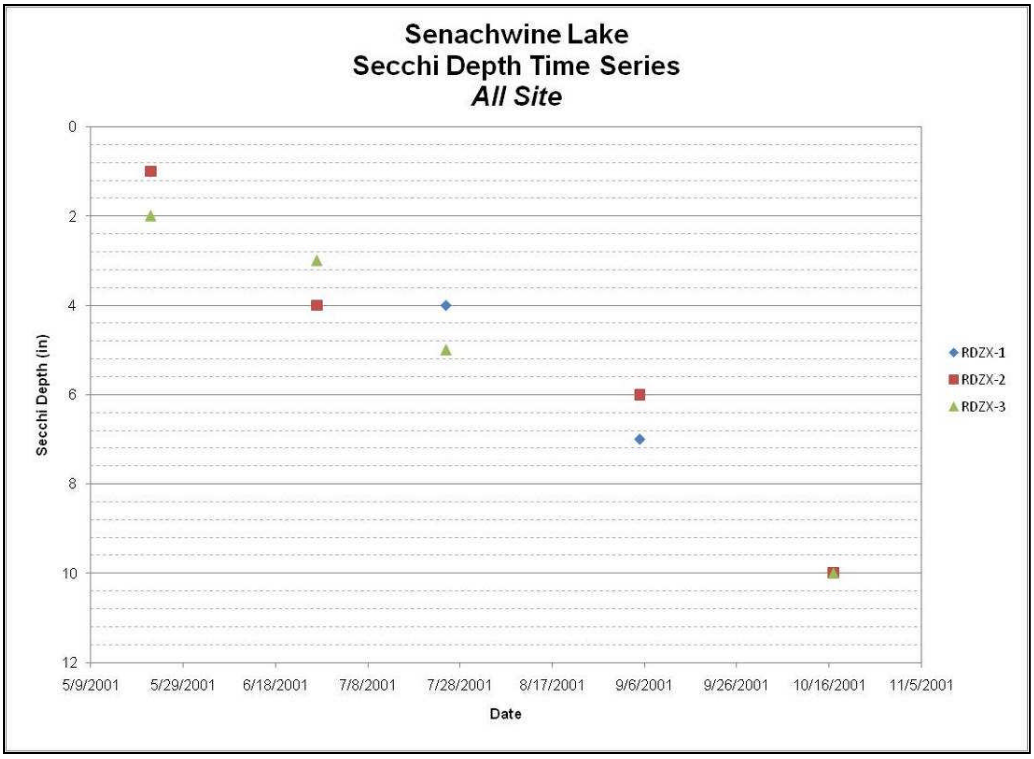

Figure 13-3. Senachwine Lake Secchi depth data.

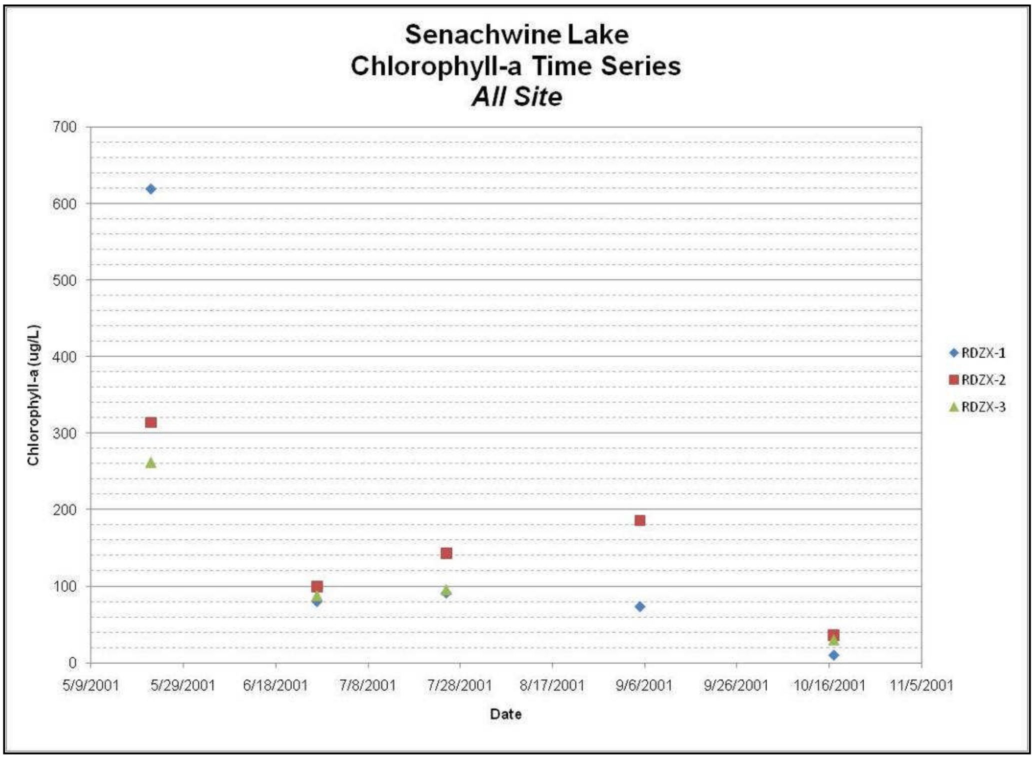

Figure 13-4. Senachwine Lake chlorophyll-a data.

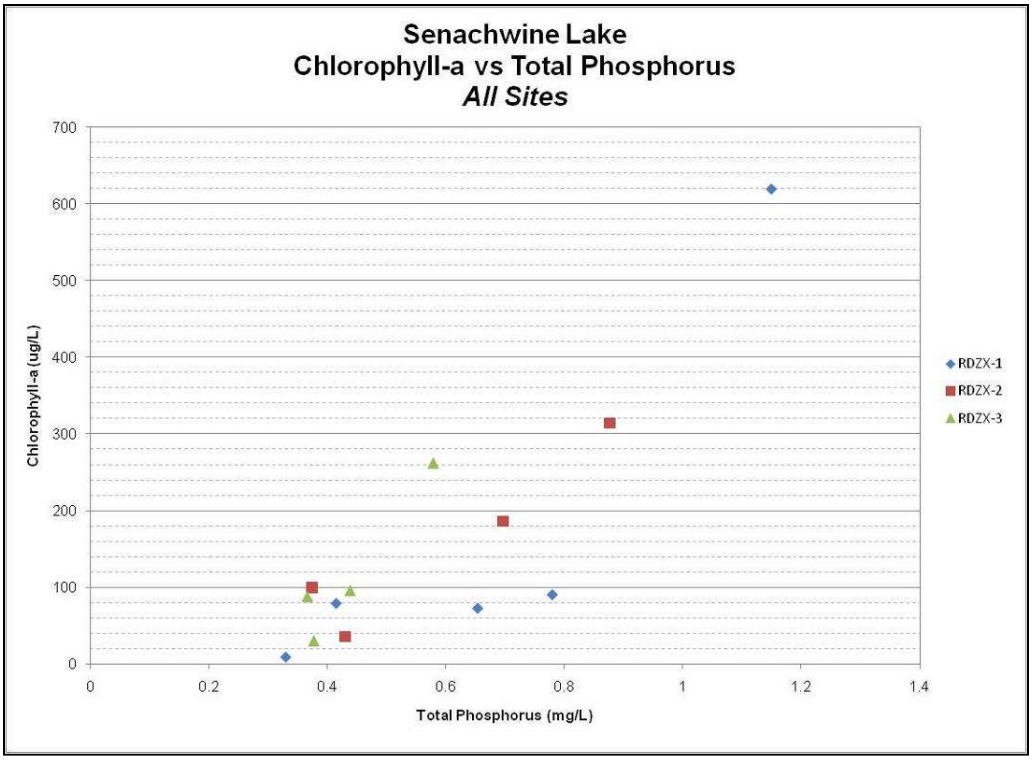

Figure 13-5. Senachwine Lake relationship between chlorophyll-a and total phosphorus.

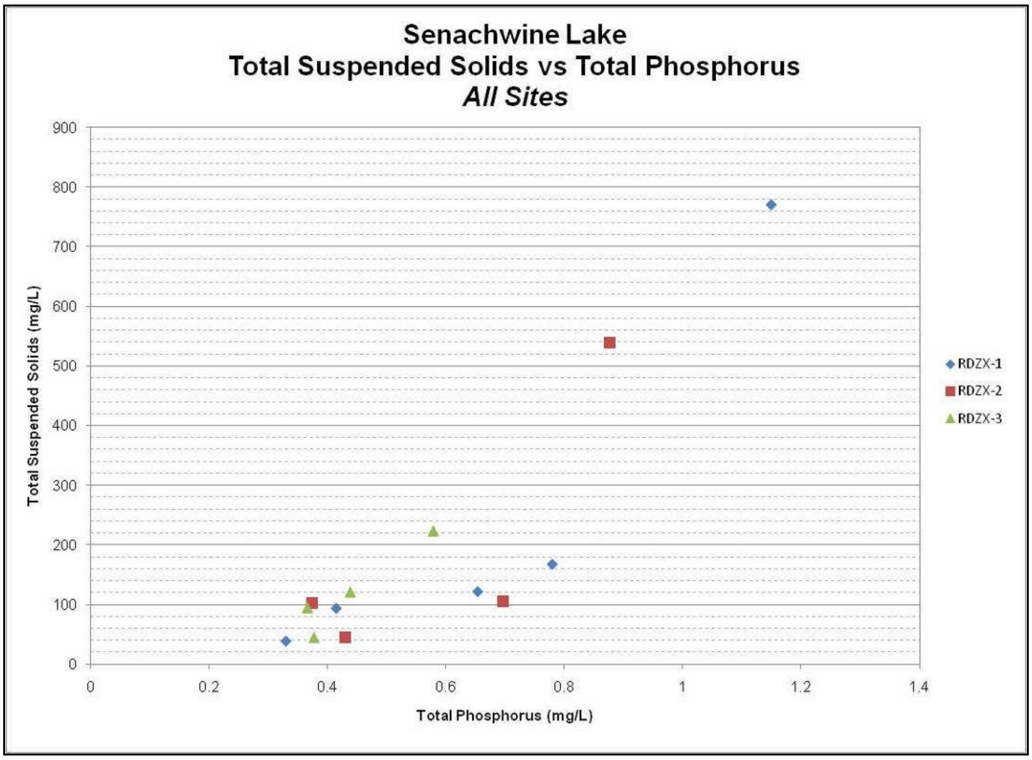

Figure 13-6. Relationship between TP and TSS, Senachwine Lake.

13.2 Senachwine Lake TMDL and LRS

13.2.1 Total Phosphorus TMDL

Senachwine Lake is impaired for total phosphorus and dissolved oxygen. Figure 13-7 presents the load duration curve for inflows to Senachwine Lake derived from Illinois River flows. Table 13-2 presents the total phosphorus TMDL and allocations. The presented reductions are based on Illinois River gage D-16, upstream of Senachwine Lake.

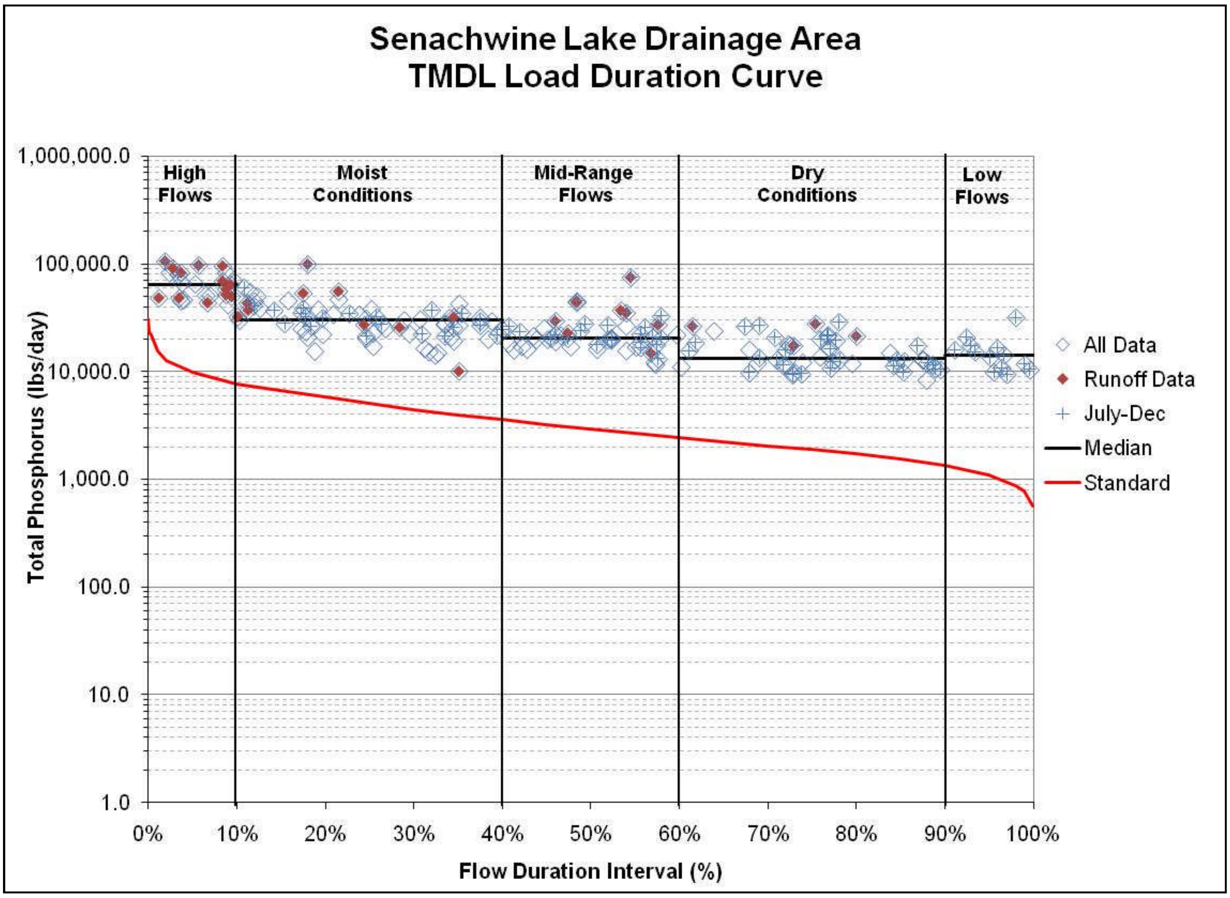

Figure 13-7. Phosphorus load duration curve, Senachwine Lake.

Table 13-2. Phosphorus TMDL, Senachwine Lake.

Station RDZX TMDL [a]		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	**TMDL Component**	**0-10%**	**10-40%**	**40-60%**	**60-90%**	**90-100%**
Total Phosphorus (lbs/day)	Current Load [b]	63,809	29,571	20,214	13,096	14,127
	LA	8,051	4,306	2,440	1,526	831
	WLA: NPDES Facilities	152	152	143	143	143
	WLA: CSOs	478	0	0	0	0
	Total WLA	630	152	143	143	143
	MOS (10%)	965	495	287	185	108
	TMDL Target	9,646	4,953	2,870	1,854	1,082
	TMDL Reduction %[b]	84.88%	83.25%	85.80%	85.84%	92.34%

a. Note that the TMDL is based on the median allowable load in each flow regime and reduction is based on median observed load in each flow regime
b. Note that the current load and percent reductions are based on total phosphorus concentration data from the nearest Illinois River gage upstream of Senachwine Lake, D-16.

Dissolved Oxygen TMDL: Nutrient Enrichment and Oxygen

Senachwine Lake is also listed as being impaired due to dissolved oxygen, which is considered to be a side-effect of the phosphorus impairment. Excessive phosphorus loadings are believed to be exerting negative effects on the aquatic ecosystem by increasing algal and aquatic plant life production (Sharpley et al. 1994). As algae and aquatic plants die off, they consume oxygen resulting in depressed oxygen levels in the lake. Illinois EPA believes that attaining the in-lake total phosphorus target of 0.05 mg/L will result in shifting plant production back to natural levels, which in turn will result in dissolved oxygen meeting the water quality standard.

Phosphorus is critical for plant growth and is often the limiting nutrient. The form that can be readily used by plants and therefore can stimulate nuisance algae blooms is orthophosphate. The amount of phosphorus tied up in the nucleic acids of food and waste is actually quite low. This organic material is eventually converted to orthophosphate by bacteria.

Phosphorus levels in water are related to oxygen levels in that nutrient enrichment promotes the growth of nuisance algae that subsequently dies and serves as food for bacteria. Oxygen is used by bacteria that consume dead organic matter. Plant photosynthesis produces oxygen, but at night, respiration reverses the process and consumes oxygen. Under these conditions, oxygen can be depleted unless it is replenished from the air. Conversely, oxygen concentrations can become supersaturated during the day, due to abnormally high amounts of photosynthesis. The significant swing in diurnal dissolved oxygen levels causes stress to both fish and invertebrate communities.

Inputs of phosphorus originate from both point and nonpoint sources. Most of the phosphorus discharged by point sources is soluble. Another characteristic of point sources is they have a continuous impact and are human in origin, for instance, effluents from municipal sewage treatment plants and permitted industrial discharges. The contribution from failed on-site wastewater treatment systems can also be significant, especially if they are concentrated in a small area. The phosphorus concentration in raw waste water is generally 8-10 mg/l and after secondary treatment is generally 4-6 mg/l.

The non-point sources of phosphates include: natural decomposition of rocks and minerals, stormwater runoff, agricultural runoff, erosion and sedimentation, atmospheric deposition, and direct input by animals/wildlife.[2] Phosphorus load from rural stormwater varies depending on land use and management practices and includes contributions from livestock feedlots and pastures and row crop agriculture. Crop fertilizer includes granular inorganic types and organic types such as manure or sewage sludge. Pasture land is especially a concern if the livestock have access to the stream. Large feedlots with manure storage lagoons create the potential for overflows and accidental spills.

A characteristic of phosphorus discharged by nonpoint sources is that the impact is intermittent and is most often associated with stormwater runoff. Sedimentation can impact the physical attributes of the stream and act as a transport mechanism for phosphorus. Phosphorus from nonpoint sources is generally insoluble or particulate, and most of this phosphorus is bound tightly to soil particles and enters streams from erosion, although some comes from tile drainage.

Erosion is worse on streams without any riparian buffer zone and streams that are channelized because they no longer have a functioning flood plain and cannot expel sediment during flooding. Additionally,

[2] Mr. Brian Oram, PG, Phosphate in Water , Water Research Center, www.water-reseearch.net/phosphate.htm

phosphorus transport to the stream decreases with decreased sedimentation. Oxygen levels must also be considered, because phosphorus is released from sediment at higher rates under anoxic conditions; therefore as mentioned earlier, lack of tree and shade not only increase water temperature and photosynthesis but also decrease oxygen levels and create anoxic conditions.

Various BMPs such as riparian buffers, and agricultural tile management not only reduce soil erosion, but can also reduce the sediment and associated phosphorus load within runoff with entrapment. BMPs to reduce total phosphorus can also affect sediment. BMPs that serve to restrain overland flow and allow infiltration will reduce total phosphorus loads and allow sediment time to settle out many of the BMPs proposed will reduce both total phosphorus and sediment.

Considering the linkages between phosphorus and oxygen outlined above, it is expected that the measures taken to reduce the loads of phosphorus from identified point sources and nonpoint source to meet the WLAs and LAs in this TMDL, will improve the fluctuations and oxygen levels and increase the biotic integrity scores for fish and macroinvertebrate communities in the impaired water bodies.

13.2.2 Total Suspended Solids LRS

The methods previously described for determining TSS LRSs are not applicable to the backwater lakes since the volume weighted TSS targets are derived to provide targets for streams under a variety of flow conditions. The Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment (USACE 2007) is used to derive LRS reductions for the backwater lakes.

TSS load reductions are presented in Table 13-3 for Senachwine Lake using the objective presented in the Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment (USACE 2007) for sediment reduction to the Illinois River that states “reduce total sediment delivery to the Illinois River by at least 20 percent by 2055 (reduction to an average of 9.7 million tons per year above Valley City, based on ISWS estimate of delivery for WY 1981 to 2000)”. This objective is identified by the USACE to mitigate for sediment loads from the basin that have resulted in increasing turbidity and filling backwater areas, side channels and islands.

Table 13-3. Senachwine Lake TSS LRS.

Lake	Station	TSS Load Reduction Needed to Achieve LRS Target
Senachwine Lake	RDZX-1	20%

14. Public Participation

Illinois EPA TMDL staff held workgroup meetings at the Tri-County Regional Planning Commission (TCRPC) office in Peoria, IL, throughout the TMDL process. Members of the workgroup included the TCRPC, the USGS, City of Peoria, ISWS, USACE and NRCS. The workgroup provided data including GIS shapefiles and numerous relevant watershed related documents. Any information gathered during these work group meetings were shared with stakeholder organizations. TCRPC provided recommendations to create LRSs for pollutants in watersheds with high pollutant loads despite not having numeric water quality standards that Illinois EPA requires for TMDL allocations. LRS development can be useful for determining load capacities and reductions needed. This information can be used in project development for watershed plans and implementation projects and may increase prioritization for funding.

TCRPC staff created a social resource inventory and an education strategy to guide the process of TMDL education throughout the region. These documents identified stakeholder groups including elected officials, watershed practitioners, and environmental organizations. TCRPC also provided the North Central Illinois Council of Governments with the information necessary to report the project start-up to their board. In addition, TCPRC distributed the TMDL fact sheet provided by Illinois EPA to the above organizations. TCRPC posted press releases in local media sources, sent notices out by email to stakeholders, and reported on the upcoming meeting to the Illinois River Valley Council of Governments, North Central Illinois Council of Governments, Peoria Lakes Basin Alliance, and Natural Resources and Your Development Taskforce. The meetings attracted media coverage from WMBD-TV in Peoria, WCBU-FM in Peoria, the LaSalle News Tribune, and the Bureau County Republican based in Princeton. A solid attendance was seen at both the Peoria and Princeton public meetings on September 2, 2010; 26 individuals attended the Peoria meeting at the Peoria Public Library (Lakeview Branch) and 23 individuals attended the Princeton meeting at the Princeton City Hall. Stakeholders provided input on the watershed characterization report. A summary of public comments from the Illinois EPA meetings held in Peoria and Princeton was submitted to Illinois EPA from TCRPC staff.

TCRPC provided implementation information for the Stage 3 Final TMDL report. They included future implementation activities as well as details on current watershed implementation projects. Illinois EPA and U.S. EPA staff met with a representative of the USACE for project descriptions of all the current and upcoming projects in the watershed. Illinois EPA and U.S. EPA staff presented information on the Middle Illinois River TMDL on October 5, 2011 at the *13th Biennial Governor's Conference on the Management of the Illinois River System*. The session was titled *Illinois River TMDL: Focusing on Implementation in a Local, State, and Federal Partnership*. An exhibit was also on display for information and outreach opportunities with stakeholders.

The Final TMDL public meeting occured on November 17, 2011. Public notices were sent out and the public comment period closed on December 16, 2011. Comments received on the draft TMDL were compiled by IEPA and are presented in Appendix B. The goal is to create a plan that the regional stakeholders will feel confident in implementing. The interest in improving Illinois River water quality among elected officials and stakeholders helped spur the Illinois River TMDL study, and TCRPC will continue to keep the region engaged in this important effort. TCRPC staff is currently coordinating a meeting with local governments to communicate the need for some sanitary sewer operations to reapply for disinfection exemptions. This level of regional communication will be necessary if individual jurisdictions, business, and/or facilities are going to be involved in plan implementation.

15. Implementation and Reasonable Assurance

The focus of the implementation plan for the Middle Illinois River TMDL is to meet the fishable / swimmable goals of the CWA. The implementation plan is intended to address all TMDLs and LRSs in the Middle Illinois River watershed, specifically related to the following pollutants: fecal coliform bacteria, total dissolved solids, manganese, chloride, total suspended solids, and nutrients.

15.1 Existing Implementation Activities

Numerous implementation efforts have been initiated in the watershed by the USACE, TCRPC, the City of Peoria, NRCS, and others (e.g., §519 projects, wetlands initiatives). These efforts include the following, amongst others:

- Central Illinois Committee on NPDES Phase 2 Stormwater Regulations (CICN)
- Village of Morton Stormwater Utility
- TCRPC, Watershed Plans and Implementation Activities
  - Low Impact Development Research
- DNR
- IEPA 319 Watershed Planning and Implementation Activities (http://rmms-space4.ad.uiuc.edu/RMMS-ArcGIS/(S(ju3tx25500qjs545udxjitf1))/Home.aspx)
  - Implementing Best Management Practices in the Mossville Bluffs Watershed 2009
  - Big Bureau Creek Watershed-based Plan, 2008.
- Environmental Ordinance Adoption
- Mossville Bluffs Best Management Practices Program
- NRCS Mississippi River Basin Cooperative Conservation Partnership (MRBI-CCPI) Big Bureau Creek Targeted Subwatershed Project
- Agricultural Activities
- Peoria Lakes Basin Alliance
- ACOE - Illinois River Basin Restoration Comprehensive Plan with Integrated Assessment
- ACOE Section 519 Senachwine Creek Critical Restoration Project
- Peoria Clean Water Committee (Combined Sewer Overflow Investigation)
- Watermarks
- The Natural Resources and Your Development Task Force
- Base Flood Elevation Revision
- Springdale Cemetery / Turkey Creek Project

15.1.1 Illinois Basin Restoration Comprehensive Plan with Integrated Environmental Assessment (USACE 2007) - Projects in the TMDL Watershed

This report represents a final response to the Comprehensive Plan portion of the Illinois River Basin Restoration authority required by Section 519(b) of the Water Resources Development Act (WRDA) 2000 and to the Illinois River Ecosystem Restoration Feasibility Study conducted under Section 216 of the 1970 Flood Control Act as a review of the completed 9-Foot Channel Navigation Project. Section 519 also provides ongoing authority to evaluate and implement Critical Restoration Projects. This report assesses the total basin restoration needs and makes recommendations regarding continuing implementation under the existing authority and conducting some further evaluations of ways to improve implementation. The USACE and Illinois Department of Natural Resources (sponsor) worked in close coordination with numerous other state and Federal agencies in developing the plan.

This Comprehensive Plan provides the vision, goals, objectives, desired future, and identifies the preferred alternative plan to restore the ecological integrity of the Illinois River Basin System. This plan documents the need for and potential scope of the four components called for in Sec 519 (b)(3): a restoration program; a long-term resource monitoring program; a computerized inventory and analysis system; and a program to encourage sediment removal technology, sediment characterization, sediment transport, and beneficial uses of sediment. An implementation framework and criteria are also presented to guide the identification, selection, study and implementation of restoration projects, monitoring and adaptive management activities, and further system investigations.

The following projects are taking place in the Middle Illinois River watershed:

- Tenmile Creek- bluff lined watershed contributing significant loads of sediment to the Illinois River. IDNR finalized a watershed restoration plan in 2004. The USACE is working with ISWS to identify critical areas for restoration. Invasive species have led to erosion and habitat loss in the bluff regions. An overload of sediment from this region contributes to the decline in ecological habitat of the Illinois River. It also discharges immediately upstream of the Peoria Riverfront Restoration Project.
- Senachwine Creek- sediment reductions needed in watershed. Back in 1994, the Peoria County SWCD with the 319 Program installed BMPs throughout the watershed for sediment reductions. In 2010, local partners secured USDA grant funding for the Senachwine Creek Watershed through the Mississippi River Basin Healthy Watershed Initiative. This program aims to install farming BMP's through the Environmental Quality Incentives Program. There is a need for more sediment reduction measures and in-stream and riparian habitat restoration. The USACE is modeling and delineating project areas.
- Crow Creek West- another bluff lined watershed contributing significant loads of sediment to the Illinois River. Crow Creek West Watershed Committee, Marshall/Putnam SWCD, Bureau SWCD and NRCS finalized a watershed resource plan for Crow Creek West. The USACE is looking into doing a project here that fits in with the resource plan.
- Turkey Creek – In 2008, Tri-County Regional Planning Commission partnered with Illinois EPA through Section 319 of the Clean Water Act to complete stream channel stabilization and hillside restoration in Turkey Creek of Historic Springdale Cemetery. The goal of stream channel stabilization was to reduce erosion and improve water quality by protecting the stream from the energy of water flowing downstream. A number of Best Management Practices (BMPs) were installed to achieve this goal including gabion baskets, rock riffles, and log revetment. The objective of hillside restoration was to increase the growth of vegetation that grows on the forest floor. Vegetation slows down stormwater runoff during rainstorms, which therefore reduces the amount of stormwater that flows into lakes, rivers and streams. Opening up the dense forest canopy by removing undesirable tree species allows sunlight to reach the ground so that vegetation can grow. For both facets of the project, there were two additional goals. They were to incorporate a variety of stream stabilization techniques (BMPs) to enable the project to be used as an educational site, and to provide practices that were compatible with the aesthetic requirements of the public in a historical cemetery.
- Peoria Riverfront- dredge and construct a 21 acres island. Apparently work has begun on this project and the outer island has been built.
- Pekin Lake North and South Units- restoration of backwaters to mimic natural flows. This is a water management project to restore backwaters and their critical habitats for aquatic life. The South project will focus on forest and wetland restoration in this floodplain region. This has been partially done and is currently on hold due to lack of funding.
- Middle Peoria Pool Backwater Restoration- restoration of backwaters in the Peoria pool. Monitoring has been done and the implementation plan is currently being developed.

- Tri-County Stormwater Video – In 2004 Tri-County Regional Planning Commission partnered with a number of local Phase II NPDES communities and Bradley University to create an educational video focused on stormwater issues. This video was played on public access channels and is available for viewing on Tri-County Regional Planning Commission's website.

15.1.2 River Bluff Restoration

The following information was derived from the Tri-County Regional Planning Committee's Mossville Bluff Watershed Management Plan and ISWS/TCRPC Draft Ten Mile Creek TMDL/LRS Implementation Plan.

The Illinois River bluff areas are being rapidly dissected by steep gradient streams draining the uplands through the Illinois River bluff area and into the floodplain and the Illinois River. The highest rates of erosion occur within these steep slopes along the Illinois River. The tributaries make up for approximately four percent of the total drainage area, but deliver 40 percent of more of the sediment deposited in the Peoria Lakes.

River bluffs are comprised of soils that are sensitive to erosion. Historical slope stability was the result of native plants of the prairies and savannas. The fibrous root systems provided infiltration of most rainfall events. Post-settlement fire suppression and overgrazing have changed the structure of the bluffs. Excessive tree-canopy density has shaded out crucial native grasses and sedges. The woodlands have lost their groundcover and the newer trees and plants do not hold soil or let water infiltrate as needed in this area.

Houses and associated infrastructure have not been designed, sited and built to sustain the long-term integrity for the bluffs or the houses. Contemporary stormwater practices have disrupted the natural model. Stormwater practices shed rainwater from lawns, roofs, streets, driveways and parking lots and direct this water down ravines. This has resulted in severe degradation of the bluff and ravine system. In only 20 to 25 years time, huge channels 20 to 30 feet wide and 10 to 15 feet deep have been eroded and much due to the discharges from concrete storm sewers. Soil erosion will continue to threaten and undermine homes and infrastructure.

Water management practices must emulate the Natural Rainwater Management Model. Prairie and savanna restorations are a vegetation management practice that provides a stable landscape and infiltration of stormwater, thereby reducing runoff and soil erosion. Controlled burning is used to maintain this landscape very inexpensively.

Restoration work has been done at Robinson Park, Detweiller Park, The Farm Creek Watershed and the Mossville Bluffs watershed. Other BMPs include buffers and easements, open spaces and greenways, minimizing impervious surfaces, encouraging mixed-use development, cluster development, reducing runoff from lawns/roofs, streets and infiltration of ravine runoff. For more information on these practices and codes/ordinances, please refer to the Mossville Bluffs Watershed Management Plan.

Ten Mile Creek watershed is located in Tazewell and Woodford Counties on the eastern bluffs of the Illinois River. It drains over 11,000 acres of flat fertile upland, steeply sloping forested Illinois bluffs and Illinois River floodplain. Ten Mile Creek has a proposed implementation project to reduce sedimentation from its steep mainstem channel. High stream power and intense channel downcutting occurs in this watershed and reducing the sediment transport would result in considerable reductions in sediment rates in the Illinois River. The Comprehensive Plan to Restore the Illinois River System (USACE 2007) identifies Ten Mile Creek as one of sixteen critical restoration areas. The Ten Mile Creek Watershed Plan (TCRPC) and the Ten Mile Creek Stream and Watershed Assessment (USACE and IDNR) identified potential restoration locations. ISWS and TCRPC have proposed the Ten Mile Creek TMDL/LRS Implementation Project. For grade control and habitat enhancement, construction of riffle and pool structures is proposed in four target reaches (approximately 11 miles total). Funding for this project has not been secured.

15.1.3 New Locally Led Surface Water Quality Monitoring Program

The 2009 Regional Stormwater Plan for Peoria, Tazewell, and Woodford Counties identified a great need for localized data collection on water quality of surface waters of the region. Practitioners are concerned that despite best efforts to implement best management practices in the watershed, a lack of data could lead to misguided efforts with a less than efficient approach to improving water quality. In response to this need, Tri-County Regional Planning Commission has partnered with Bradley University, Illinois Central College, the Heart of Illinois Sierra Club, and the National Great Rivers Research and Education Center (River Watch program) to form the IL River Action League program that aims to engage citizens of various capabilities in water quality monitoring. This program is currently in its infancy and is in need of funding; however, local partners thus far have developed protocol and assembled monitoring kits to launch a test run of citizen-based data collection with both Girl Scout organizations and middle school teachers. This program will continue to evolve as partners find resources for implementation. Partners anticipate that this program will serve as a mechanism to provide long term data collection where data is publically available via internet mapping platforms.

15.1.4 Mississippi River Basin Initiative (MRBI) Program Project in Big Bureau and Senachwine Watersheds

The federal grant program, called the MRBI, is designated to improve the health of the Mississippi River Basin by helping producers voluntarily implement conservation practices that prevent, control and trap nutrient and sediment runoff from agricultural land from entering surface and ground water; and restore and protect wetlands. Big Bureau Creek and Senachwine Creek watershed are within a USDA priority subwatershed within the Middle Illinois River TMDL.

The Big Bureau Creek and Senachwine Creek Targeted Subwatershed Initiative was selected through a competitive process under the MRBI Cooperative Conservation Partnership Initiation. Nineteen projects were selected nationwide. CCPI funding is administered by NRCS directly to eligible agricultural producers through the Conservation Stewardship Program, Environmental Quality Incentives Program and Wildlife Habitat Incentives Program. This is an extraordinary financial and technical assistance commitment by the NRCS to the priority areas above and beyond the regular conservation working lands programs.

Earth Team volunteers and private partners are working hand in hand with NRCS stage in USDA Service Centers and field offices in nearly every county. These partnership efforts which will be carried out through local watershed partners will strengthen access to much needed resources and directly benefiting landowners and communities at the local level.

Information for the Big Bureau Creek project is from Pam Horwitz who is the executive director of the American Corn Growers Association, the principle project sponsor for the Big Bureau Creek Targeted Watershed Initiative and an Earth Team volunteer. Melissa Eaton of the Tri-County Regional Planning Commission provided information on the Senachwine Creek project.

Friends of the Big Bureau Creek watershed group was formed to partner with the U.S. Department of Agriculture Natural Resources Conservation as a Coalition for Clean Water. The group includes the American Corn Growers Association, Prairie River RC&D, the Wetlands Initiative, Environmental Defense Fund, Prairie Rivers Network and Pheasants Forever. Senachwine Creek partners include the Tri-County Regional Planning Commission, Environmental Defense Fund, Iowa Soybean Association, and the Peoria County Soil and Water Conservation District.

In support of these projects, the Illinois EPA has agreed to partner with the watershed groups for the monitoring component. Big Bureau Creek and Senachwine Creek are tributaries to and within the Illinois River watershed, which has been designated as a high priority watershed by NRCS for the MRBI. As part of this TMDL, Illinois EPA is monitoring for nitrate nitrogen, total phosphorus, total suspended solids and fecal coliform bacteria.

Monitoring stations in the Bureau Creek watershed include two stations on the Big Bureau Creek and one on West Bureau Creek. Additional monitoring stations have been added for the Big Bureau River MRBI Project: East Bureau Creek, Big Bureau Creek, Pike Creek and Lime Creek. In addition to this, continuous monitoring equipment was placed at stations Big Bureau Creek, Pike Creek and East Bureau Creek starting in August 2011. One monitoring station was added upstream in the Senachwine River watershed for a total of two stations.

Three monitoring sites in the Big Bureau Creek watershed and one in Senachwine were sampled six times in June and July of 2009. Biweekly (2x/month) sampling started in April 2010 and monthly data has been taken since October. The addition of five sampling stations in this project area during and after implementation actions will provide necessary data to verify improvements. Continuous and monthly data is planned until at least July 2012 for the stations in the MRBI watershed. Illinois EPA provides staff for all monthly sampling and is providing the three continuous monthly samplers. All monitoring follows Illinois EPA's Quality Assurance Project Plan as approved by U.S. EPA and the Monitoring Strategy that is currently being developed in anticipation of this program.

15.2 Implementation Activities

Point and nonpoint sources in both urban and agricultural regions have been identified as sources of pollutants in the watershed. In addition, in-stream sources including erosion of stream banks and bluffs is a significant source of sediment in the watershed.

Table 15-1 summarizes the TMDL and LRS pollutant reduction requirements and potential sources. The range of pollutant reductions represents the pollutant reductions acorss all flow conditions as presented in the TMDLs and LRSs.

The following sections describe the different activities that could be used to implement the TMDLs and LRSs.

Table 15-1. TMDL and LRS summary of pollutants and potential sources.

Watershed Cluster	Pollutants of Concern	Pollutant Reduction Requirement (%)	Potential Sources
Illinois River	Fecal Coliform	0 - 79	agricultural and urban runoff; NPDES facilities; MS4s; CSOs/SSOs; watershed, streambank and gully erosion, bluff erosion; hydromodification; tributary loads; animal agriculture; livestock
	Manganese	0 - 26	
	Total dissolved solids	0	
	Total suspended solids	0 - 39	
	Nitrogen	9 -68	
	Phosphorus	72 -89	
Big Bureau Creek	Fecal Coliform	15 - 99	streambank, bluff, and gully erosion; urban and agricultural stormwater runoff; livestock access to waterways; animal agriculture; untreated sewage; NPDES facilities; CSOs
	Total suspended solids	0 - 82	
	Nitrogen	9 - 86	
	Phosphorus	8 - 97	
Farm Creek	Chloride	75	watershed, streambank, and gully erosion; urban and agricultural stormwater runoff; NPDES facilities; MS4s; SSOs; hydromodification; deicing agents
	Total suspended solids	88	
	Nitrogen	17 - 63	
	Phosphorus	21 - 73	
Kickapoo Creek	Fecal Coliform	97 - 100	watershed, streambank, and gully erosion; urban and agricultural stormwater runoff; animal agriculture; MS4s; NPDES facilities
	Total suspended solids	96	
	Nitrogen	20 - 65	
	Phosphorus	32 - 76	
Senachwine Creek	Total suspended solids	0	agricultural activities; watershed runoff; livestock; streambank and gully erosion
	Nitrogen	78 - 83	
	Phosphorus	0	
Crow Creek and Snag Creek	Total suspended solids	0	agricultural runoff; streambank and gully erosion; NPDES facilities
	Nitrogen	77 - 81	
	Phosphorus	0	
Sandy Creek	Total suspended solids	0	streambank and gully erosion; agricultural runoff; NPDES facilities; CSOs
	Nitrogen	73 - 78	
	Phosphorus	0	
Lake Depue	Phosphorus	91	Illinois River inflows; NPDES facilities; watershed runoff
	Total suspended solids	20	
Senachwine Lake	Phosphorus	83 -92	Illinois River inflows; NPDES facilities; watershed runoff
	Total suspended solids	20	

15.2.1 Future Anticipated Activities in the Watershed

The following activities have been identified as future anticipated activities within the watershed. These activities apply to a variety of pollutant sources.

- Conduct the next phase of the geomorphic studies completed on Senachwine, Partridge, and Tenmile Creeks. This includes site specific engineering and construction of stream channel stabilization/naturalization practices that address the new predictions of meteorological trends as well as potential landuse changes and resultant geomorphologic responses by addressing systemic causes of unnatural rates of fluvial processes and resultant stream instability.

- Initiate stream and watershed geomorphic analysis using Illinois River Basin Geomorphic Assessment (IRBGA) protocols on priority stream systems including Partridge and Farm Creek and Kickapoo Creek.
- Implement a long-term monitoring program where data is accessible and useful to regional and local watershed and stormwater practitioners. A likely source for reliable, long-term data is the River Action League, a volunteer, citizen-based water quality monitoring program created and supported by Tri-County Regional Planning Commission and Bradley University.
- Conduct reconnaissance level studies to determine appropriate monetary allocation of runoff management versus stream channel stabilization projects in priority watersheds. Description: Watershed stabilization can be accomplished by modifying streams to resist increased erosive velocities or decreasing the velocity and volume of runoff from the landscape. It is anticipated that the optimum economic solution would involve a combination of stream rehabilitation and runoff management. What is unknown is to what degree actions should be pursued in the watershed versus stream rehabilitation to have optimum impact on watershed stability. This study would quantify the relationship between runoff conditions and rates of stream erosion to develop a strategy to prioritize watersheds and sites for implementing controls.
- Replicate workshops conducted through the TCRPC and IEPA program entitled *Implementing BMPs in the Mossville Bluffs Watershed*. These workshops educate landowners on urban stormwater best management practices and ravine stabilization technologies.
- Improve current development ordinances, stormwater regulations, and environmental protection ordinances to prevent poor environmental practices. Example of ordinances to consider include: City of Peoria's Stream Buffer Ordinance, City of East Peoria's Steep Slope Ordinance, and model low impact development and stormwater ordinances created by Tri-County Regional Planning Commission.
- Educate planners, engineers, and developers on Low Impact Development and Best Management Practices approved by the U.S. EPA as well as the impacts of non-point source pollutants on local water bodies.
- Construct a demonstration stream stabilization and regional stormwater best management practice site in unique areas of topography including bluffs and smaller gullies. Monitor and measure the effectiveness of these projects.
- Target wetland restoration of hydric soils and edge-of-tile nutrient management in locations where soil and water level conditions are conducive to this habitat.

15.2.2 Implementation Activities for Agricultural Sources

Agricultural activities have been identified as a primary source of bacteria, sediment, and nutrients in the watershed. These activities include row crop agriculture and animal agriculture. The following is a partial list of activities that can be used to mitigate the effects agricultural activities:

- Riparian Area Management - Management of riparian areas protects stream banks and river banks with a buffer zone of vegetation, either grasses, legumes, or trees.
- Manure Collection and Storage - Collecting, storing, and handling manure in such a way that nutrients or bacteria do not run off into surface waters or leach down into ground water.
- Conservation Tillage – Use of tillage practices and residue management to control erosion and surface transport of pollutants from fields used for crop production.
- Contour Row Crops - Farming with row patterns and field operations aligned at or nearly perpendicular to the slope of the land.

- Manure Nutrient Testing - If manure application is desired, sampling and chemical analysis of manure should be performed to determine nutrient content for establishing the proper manure application rate in order to avoid overapplication and run-off.
- Drift Fences - Drift fences (short fences or barriers) can be installed to direct livestock movement. A drift fence parallel to a stream keeps animals out and prevents direct input of bacteria to the stream and prevents livestock from destabilizing stream banks.

15.2.3 Implementation Activities for Urban Sources

Urban sources of pollutants are primarily related to stormwater runoff. Sediment, nutrients, bacteria, chloride, and total dissolved solids are commonly associated with stormwater runoff from urban areas. In addition, higher runoff flow volumes and peak discharges are found in developed areas, which can degrade habitat and lower the assimilative capacity of the water body. Urban development and deforestation near streams and bluffs also contribute to impairments in the urban area. The following is a partial list of activates that can be used to mitigate the effects urban pollutant sources:

- Green Infrastructure Retrofitting and Development (Pollution Prevention) - The use of green infrastructure, especially those practices which reduce the volume of runoff from urban areas, can address pollutant loads from existing developed areas and prevent additional stormwater runoff volumes from contributing to many of the sources below.
- Local Stormwater Regulations and Land Use Planning – Local land use planning requirements and stormwater regulations can be strengthened to more fully address the activities that are causing impairments including:
    - Bluff and channel setbacks and buffers
    - Stormwater volume control for new developments
    - Protection of bluff regions from stormwater discharges
- NPDES Permitting and Compliance - Although several NPDES facilities have been found to be in violation of their permit limits for bacteria, the majority of facilities discharge effluent that meets water quality standards. WLAs set for TP in this TMDL will be implemented through NPDES permitting.
    - Combined Sewer Overflows – Control of CSOs through long term control plans and elimination of untreated wastewater discharges
    - Municipal Separate Stormwater Systems (MS4s) – Control of stormwater collected in separated municipal systems. Requirements include 6 minimum measures:
        - Public education and outreach on stormwater impacts
        - Public involvement and participation
        - Illicit discharge detection and elimination
        - Construction site stormwater runoff control
        - Post construction stormwater management in new development and redevelopment
        - Pollution prevention/good housekeeping for municipal operations

    Projects or activities carried out to comply with the 6 minimum control measures are not eligible for Section 319 funding. However, there may be some activities that promote opportunities to implement the watershed approach that are 319-eligible that could indirectly benefit the six minimum measures as well as nonpoint source projects. See IEPA webpage for further detail, or contact IEPA 319 staff for further information.

- Channel, Gully, and Bluff Restoration - Identification, stabilization, and restoration of degraded stream banks, gullies, and bluffs through use of engineering controls, vegetative stabilization, restoration of riparian areas, and watershed management.
- Pet Clean-up/Education - Education programs for pet owners can improve water quality of runoff from urban areas.
- Septic Management/Public Education - Programs for management of septic systems can provide a systematic approach to reducing septic system pollution. Education on proper maintenance of septic systems as well as the need to remove illicit discharges could alleviate some anthropogenic sources of bacteria and nutrients.

Illinois EPA NPDES Disinfection Exemptions

Forty-eight facilities in the Middle Illinois River watershed have chlorination exemptions (Table 15-2). A facility may have to reapply for the disinfection exemption for two reasons:

- Facilities are required to reapply at the next permit renewal if they are on the Agencies statewide list of facilities that are within three miles of a stream impaired for primary contact due to fecal coliform bacteria. (There are some facilities on the 3 Mile List that have already renewed their disinfection exemption.)

- Facilities must reapply at the time of their next permit renewal if required due to the TMDL process.

Table 15-2. NPDES facilities with chlorination exemptions

Permit ID	NPDES Facility Name	Fecal limit/ exempt status	Reapplication due to TMDL	Reapply due to 3 Mile List
IL0070122	Air Liquide Industrial US LP	Exempt	no	
ILG580050	Brimfield SD STP	Exempt	no	
IL0033120	Bureau Junction STP	Exempt	--	Yes
IL0024163	Caterpillar Inc.- Peoria	Exempt	yes	
IL0059391	Cedar Bluff Utilities, Inc STP	Exempt	yes	
ILG580008	Cedar Point STP	Exempt	no	
IL0024881	City of Washington STP #1	Exempt	--	Yes
IL0024619	Country Club Manor Condos	Exempt and required to monitor	no	
IL0074560	Coyote Creek Homeowners Assn	Exempt	no	
ILG580130	Dalzell STP	Exempt	--	Yes
ILG580099	Dunlap STP	Exempt	no	
ILG582012	Elmwood STP	Exempt	no	
IL0028916	Germantown Hills STP #1	Exempt	yes	
ILG580262	Germantown Hills WWTP #2	Exempt	--	Yes
IL0026972	Grandview Mobile Home Park	Exempt	yes	
ILG582022	Hanna City SD STP	Exempt	yes	
IL0044636	Hollis Consolidated Grade School STP	Exempt	no	

Permit ID	NPDES Facility Name	Fecal limit/ exempt status	Reapplication due to TMDL	Reapply due to 3 Mile List
IL0054674	HPA - Jubilee College Historic	Exempt	--	Yes
IL0024309	Illinois DOT I-80 Bureau County Rest Area	Exempt	yes	
IL0021491	Ladd STP	Exempt and required to monitor	no	
IL0042625	Lake Arispie Water Co STP	Exempt	yes	
IL0053864	Lake Wildwind MHP-Metamora	Exempt	yes	
ILG580127	Lamoille, Village of STP	Exempt	no	
IL0055816	Limestone Walters School STP	Exempt	no	
IL0075221	Lostant WWTP	Exempt and required to monitor	no	
IL0024791	Malden STP	Exempt	no	
ILG551015	Maple Acres MHP	Exempt	--	Yes
IL0078000	McNabb WWTP	Exempt and required to monitor	no	
IL0065072	Medina Utilities Inc-East STP	Exempt	yes	
IL0023221	Mendota STP	Exempt	--	Yes
IL0002232	Midwest Generation- Powerton	Exempt	yes	
IL0059030	Mount Alverno Novitiate- E Peoria	Exempt	yes	
IL0053813	Norwood School District #63 STP	Exempt	--	Yes
IL0060461	Oak Ridge SD STP	Exempt	yes	
ILG580190	Ohio, Village of STP	Exempt	--	Yes
ILG551081	Pekin Country Club	Exempt	yes	
IL0042234	Pinewood MHP[a]	Exempt and required to monitor	yes	
IL0067024	Prairie View Nursing Home STP	Exempt	--	Yes
IL0026573	Putman County Junior HS	Exempt and required to monitor	no	
ILG580252	South Pekin STP	Exempt	yes	
ILG580226	Sparland STP	Exempt	no	
ILG551039	Sundale Sewer Corp-Highland	Exempt	yes	
IL0025160	Tiskilwa STP	Exempt	--	Yes
IL0039411	Washburn STP	Exempt and required to monitor	no	
IL0047406	Washington Estates Inc STP	Exempt and required to monitor	no	
IL0021792	Wenona STP	Exempt	no	
ILG580245	Wyanet STP	Exempt	yes	

a. This facility is required to monitor for fecal coliform, but no DMR data for fecal coliform were located and the facility will be required to reapply for the exemption.

The following language is taken from Title 35 Ill. Adm. Code Part 378- Effluent Disinfection Exemptions (http://www.ilga.gov/commission/jcar/admincode/035/03500378sections.html) and describes the conditions under which an exception may be granted.

Assessment of Waters for Protected Status (Section 378.204)
The permitee shall conduct surveys necessary to determine whether affected waters currently support or have the potential to support primary contact activities. The permitee shall determine and document the following:

a. Whether the water body segments have potential for primary contact use. For example, such segments must have water depths that would ordinarily permit swimming during the months of May through October;
b. Whether the water body segments are free of obstacles to primary contact activities, such as unsuitable access to the streambank or existence of logs, log jams or other debris which render the water body hazardous or unattractive to swimmers;
c. Whether the adjacent land use to water body segments would discourage primary contact activities; or
d. Whether the water bodies are being used for primary contact activities. The permitee shall make inquiries of local residents, land owners, or local law enforcement officials. The permitee shall also make a list of all downstream access areas and water-based activities of the water body segments in question.

The permitee shall conduct surveys necessary to determine whether any affected waters which flow through or adjacent to parks or residential areas have the potential to attract the public and create a risk of incidental or accidental contact. Such water bodies are protected by the seasonal fecal coliform standard of 35 Ill. Adm. Code 302.209(a) unless the permitee can demonstrate that access is limited by such impediments as fences or steep banks.

The Agency shall review the information provided by the permitee and determine whether it is accurate and complete in accordance with requirements of this Section Subpart C contains the Fecal Coliform Die-off Model section with equations and application information. Application information includes a sketch of the stream and waters it flows into, an average fecal coliform concentration upstream and an average concentration of fecal coliform from effluent prior to disinfection (average of three months is preferable, but a minimum of four samples in 30 days is acceptable).

15.3 Monitoring

Multiple best management practices will likely be needed to address the water quality impairments found in the Middle Illinois River watershed. Water quality monitoring should be implemented to monitor BMP success, and to determine if additional best management practices are needed to achieve water quality standards. In addition, additional monitoring is needed in the following watershed clusters to more fully understand the sediment and nutrient contributions from these tributaries: Senachwine Creek, Crow Creek and Snag Creek, and Sandy Creek. Monitoring of nutrients in wastewater effluent is also needed to better understand their contribution to phosphorus and nitrogen loading in the watershed and inform permitting authorities.

Further monitoring of impaired lakes is needed to fully understand their nutrient cycling. Data collection could include bathymetry, hydrologic interaction with the Illinois River (timing, flow, volume, and elevations), sediment oxygen demand, lake stage, flow budget, and monitoring of the tributaries.

15.4 Reasonable Assurance

U.S. EPA requires reasonable assurance that TMDLs will be achieved and water quality standards will be met. The primary strategy for attaining water quality standards in the Middle Illinois River watershed is to implement agricultural and urban stormwater best management practices and in-stream restoration. However, landowner participation may be limited due to resistance to change and upfront costs. Educational efforts and cost sharing programs will likely increase participation to levels needed to protect water quality. The following sections discuss the programs that are available to assist landowners and local entities in implementing best management practices.

A more complete description of implementation and reasonable assurance for the Middle Illinois River watershed will describe how the programs below, and others, might contribute to water quality improvements to support the goals of the TMDL and other discrete watershed plans and efforts being undertaken in the Middle Illinois River watershed.

15.4.1 Environmental Quality Incentives Program (EQIP)

Several cost share programs are available to landowners who voluntarily implement resource conservation practices. The most comprehensive is the NRCS Environmental Quality Incentives Program (EQIP) which offers cost sharing and incentives to farmers who utilize approved conservation practices to reduce pollutant loading from agricultural lands.

- The program will pay $10 for one year for each acre of farmland that is managed under a nutrient management plan (up to 400 acres per farm).
- Use of vegetated filter strips will earn the farmer $100/ac/yr for three years (up to 50 acres per farmer).
- The program will also pay 60 percent of the cost to construct grassed waterways, riparian buffers, and windbreaks.
- Use of residue management will earn the farmer $15/ac for three years (up to 400 acres per farm).
- Installation of drainage control structures on tile outlets will earn the farmer $5/ac/yr for three years for the effected drainage area as well as 60 percent of the cost of each structure.
- The program will pay 75 percent of the construction cost for a composting facility.
- Sixty percent of the fencing, controlled access points, spring and well development, pipeline, and watering facility costs are covered by the program.
- Waste storage facilities and covers for those facilities have a 50 percent cost share for construction.
- Prescribed grazing practices will earn the farmer $10/ac/yr for three years (up to 200 acres per farmer).

In order to participate in the EQIP cost share program, all best management practices must be constructed according to the specifications listed for each conservation practice. A demonstration of how this program could be targeted to specific areas in the TMDL is the Big Bureau Creek Targeted Subwatershed Project which will focus on various practices such as Nutrient Management plans, livestock practices and rotational grazing systems, Tile drainage water management systems, wetland restoration, filter strips, dry dams and reduced tillage.

15.4.2 Conservation Reserve Program (CRP)

The Farm Service Agency of the USDA supports the Conservation Reserve Program (CRP) which rents land that is converted from crop production to grass or forestland for the purposes of reducing erosion and protecting sensitive waters. This program is available to farmers who establish vegetated filter strips or grassed waterways. The program typically provides 50 percent of the upfront cost to establish vegetative cover for up to 15 years.

15.4.3 Conservation 2000

In 1995 the Illinois General Assembly passed the Conservation 2000 bill providing $100 million in funding over a 6-year period for the promotion of conservation efforts. In 1999, legislation was passed to extend the program through 2009. Conservation 2000 currently funds several programs applicable through the Illinois Department of Agriculture.

Conservation Practices Program (CPP)

The Conservation Practices Cost Share Program provides monetary incentives for conservation practices implemented on land eroding at one and one-half times or more the tolerable soil loss rate. Payments of up to 60 percent of initial costs are paid through the local conservation districts. The program will cost share cover crops, filter strips, grassed waterways, no-till systems, and pasture planting, amongst other best management practices. Other sediment control options such as contour farming and installation of stormwater ponds are also covered. Practices funded through this program must be maintained for at least 10 years.

Streambank Stabilization Restoration Program

Conservation 2000 also funds a streambank stabilization and restoration program aimed at restoring highly eroding streambanks. Research efforts are also funded to assess the effectiveness of vegetative and bioengineering techniques.

Sustainable Agriculture Grant Program (SARE)

The Sustainable Agricultural Grant Program funds research, education, and outreach efforts for sustainable agricultural practices. Private landowners, organizations, educational, and governmental institutions are all eligible for participation in this program.

15.4.4 Nonpoint Source Management Program (NSMP)

Illinois EPA receives federal funds through Section 319(h) of the Clean Water Act to help implement Illinois' Nonpoint Source (NPS) Pollution Management Program. The purpose of the Program is to work cooperatively with local units of government and other organizations toward the mutual goal of protecting the quality of water in Illinois by controlling NPS pollution. The program emphasizes funding for implementing cost-effective corrective and preventative best management practices on a watershed scale; funding is also available for best management practices on a non-watershed scale and the development of information/education NPS pollution control programs.

The maximum federal funding available is 60 percent, with the remaining 40 percent coming from local match. The program period is two years unless otherwise approved. This is a reimbursement program.

Section 319(h) funds are awarded for the purpose of implementing approved NPS management projects. The funding will be directed toward activities that result in the implementation of appropriate BMPs for the control of NPS pollution or to enhance the public's awareness of NPS pollution.

15.4.5 Agricultural Loan Program

The Agricultural Loan Program offered through the Illinois State Treasury office provides low-interest loans to assist farmers who implement soil and water conservation practices. These loans will provide assistance for the construction, equipment, and maintenance costs that are not covered by cost share programs.

15.4.6 Illinois Conservation and Climate Initiative (ICCI)

The Illinois Conservation and Climate Initiative (ICCI) is a joint project of the State of Illinois and the Delta Pollution Prevention and Energy Efficiency (P2/E2) Center that allows farmers and landowners to earn carbon credits when they use conservation practices. These credits are then sold to companies or agencies that are committed to reducing their greenhouse gas emissions. Conservation tillage earns 0.5 metric tons (1.1 US ton) of carbon per acre per year (mt/ac/yr), grass plantings (applicable to filter strips and grassed waterways) earn 0.75 mt/ac/yr, and trees planted at a density of at least 250 stems per acre earn somewhere between 3.5 to 5.4 mt/ac/yr, depending on the species planted and age of the stand. Current exchange rates are available online at http://chicagoclimatex.com. Administrative fees of $0.14/mt plus 8 percent are subtracted from the sale price. Program enrollment occurs through the P2/E2 Center which can be found online at http://p2e2center.org/. The requirements of the program are verified by a third party before credits can be earned.

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Appendix A

Note – When Average Design Flow and Maximum Design Flow are equal, a Maximum Design Flow was not reported.

Table A-1. NPDES fecal coliform WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (G-Org/day)	
				Mid-Range to Low Flow Conditions (40-100%)	High and Moist Flow Conditions (0-40%)
IL0001392	NOVEON INC-HENRY	0.947	--	14.338	14.338
IL0001414	CATERPILLAR INC-MOSSVILLE	2.480	--	37.549	37.549
IL0002291	CATERPILLAR INC.-EAST PEORIA	1.424	--	21.560	21.560
IL0020575	PRINCETON, CITY OF STP	2.150	6.330	32.553	95.841
IL0021237	CREVE COEUR WWTP	1.550	4.850	23.468	73.433
IL0021288	PEORIA SD STP	37.000	60.000	560.210	908.448
IL0021491	Ladd STP	0.365	2.850	5.526	43.151
IL0021539	METAMORA NORTH STP	0.360	1.440	5.451	21.803
IL0021695	TOLUCA STP	0.300	--	4.542	4.542
IL0021792	WENONA STP	0.190	0.480	2.877	7.268
IL0022152	OAKLANE ACRES HOMEOWNERS ASSOC	0.015	0.060	0.227	0.908
IL0022331	GRANVILLE STP	0.289	0.504	4.376	7.631
IL0023159	CHILLICOTHE SD STP	0.800	2.000	12.113	30.282
IL0023523	DEPUE STP	0.480	0.960	7.268	14.535
IL0024163	CATERPILLAR INC.-PEORIA	0.006	--	0.091	0.091
IL0024791	MALDEN STP	0.050	0.125	0.757	1.893
IL0024881	CITY OF WASHINGTON STP #1	0.600	0.600	9.084	9.084
IL0024996	OGLESBY STP	0.879	1.224	13.309	18.532
IL0025160	TISKILWA STP	0.120	0.600	1.817	9.084
IL0025313	HENNEPIN PWD STP	0.300	0.750	4.542	11.356
IL0026573	PUTNAM COUNTY JUNIOR HS	0.010	0.025	0.151	0.379
IL0026972	GRANDVIEW MOBILE HOME PARK	0.025	0.062	0.379	0.939
IL0027910	CARMI WWTP	1.400	3.200	21.197	48.451
IL0028576	EAST PEORIA STP #1	4.220	8.440	63.894	127.788
IL0028916	GERMANTOWN HILLS STP #1	0.200	0.500	3.028	7.570
IL0029343	Kewanee STP	2.000	5.000	30.282	75.704
IL0029378	LACON WWTP	0.320	1.150	4.845	17.412
IL0029424	LASALLE WWTP	3.330	5.000	50.419	75.704
IL0030007	MORTON STP #3	0.950	2.380	14.384	36.035
IL0030660	PERU STP #1	3.000	4.530	45.422	68.588
IL0031216	Spring Valley STP	1.100	2.500	16.655	37.852
IL0033120	BUREAU JUNCTION STP	0.071	0.178	1.075	2.695
IL0034495	PEKIN STP #1	4.500	8.700	68.134	131.725
IL0039411	WASHBURN STP	0.138	1.130	2.089	17.109
IL0042234	PINEWOOD MHP	0.030	0.050	0.454	0.757
IL0042412	WASHINGTON STP #2	1.500	3.000	22.711	45.422

Table A-1. NPDES fecal coliform WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (G-Org/day)	
				Mid-Range to Low Flow Conditions (40-100%)	High and Moist Flow Conditions (0-40%)
IL0042625	LAKE ARISPIE WATER CO STP	0.050	0.125	0.757	1.893
IL0046213	EAST PEORIA STP #3	1.200	2.400	18.169	36.338
IL0047384	SUNDALE HILLS STP	0.275	0.688	4.164	10.417
IL0047406	WASHINGTON ESTATES INC STP	0.200	0.300	3.028	4.542
IL0053066	CAMP MANITOUMI-LOW POINT	0.015	0.072	0.227	1.090
IL0053813	Norwood School District #63 STP	0.003	0.063	0.038	0.946
IL0053864	LAKE WILDWIND MHP-METAMORA	0.050	0.125	0.757	1.893
IL0054674	HPA - Jubilee College Historic	0.002	0.005	0.030	0.076
IL0059030	MOUNT ALVERNO NOVITIATE-E PEOR	0.009	0.022	0.133	0.333
IL0059391	CEDAR BLUFF UTILITIES, INC STP	0.070	0.175	1.060	2.650
IL0060461	OAK RIDGE SD STP	0.014	0.356	0.218	5.390
IL0064319	BRADFORD PIG PALACE	0.000	--	0	0
IL0065072	MEDINA UTILITIES INC-EAST STP	0.165	0.330	2.498	4.996
IL0067024	PRAIRIE VIEW NURSING HOME STP	0.020	0.050	0.303	0.757
IL0070548	HENRY STP	0.300	0.750	4.542	11.356
IL0071358	TRICO, INC., MILL POINT MHP	0.015	0.060	0.227	0.908
IL0075507	PERU STP #2	1.000	--	15.141	15.141
ILG551015	MAPLE ACRES MHP	0.026	0.065	0.392	0.981
ILG551039	SUNDALE SEWER CORP-HIGHLAND	0.053	0.132	0.802	1.999
ILG551081	PEKIN COUNTRY CLUB	0.010	0.025	0.151	0.379
ILG580008	Cedar Point STP	0.050	0.125	0.757	1.893
ILG580050	Brimfield SD STP	0.140	0.520	2.120	7.873
ILG580099	Dunlap STP	0.095	0.240	1.438	3.634
ILG580127	LAMOILLE, VILLAGE OF STP	0.063	0.243	0.954	3.679
ILG580130	Dalzell STP	0.110	0.275	1.665	4.164
ILG580190	OHIO, VILLAGE OF STP	0.077	0.191	1.160	2.892
ILG580226	SPARLAND STP	0.105	0.260	1.590	3.937
ILG580245	WYANET STP	0.250	0.625	3.785	9.463
ILG580262	GERMANTOWN HILLS WWTP #2	0.200	0.500	3.028	7.570
ILG582012	Elmwood STP	0.370	1.180	5.602	17.866
ILG582022	Hanna City SD STP	0.274	0.685	4.149	10.371

Table A-2. MS4 fecal coliform WLAs.

Operator Name	Permit ID	Watershed Area (sq mile)	WLA (G-Org/day) High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Village of Bartonville	IRL400287	5.72	120.79	76.11	40.53	23.57	14.53
Kickapoo Township	IRL400073	27.43	579.57	365.19	194.45	113.09	69.74
Limestone Township	IRL400078	9.26	195.73	123.33	65.67	38.19	23.55
Medina Township	IRL400085	27.45	580.07	365.50	194.62	113.19	69.80
City of Peoria	IRL400424	46.41	980.71	617.95	329.03	191.36	118.01
Village of Morton	IRL400392	3.60	76.01	47.89	25.50	14.83	9.15
Cincinnati Township	IRL400683	0.01	0.21	0.13	0.07	0.04	0.03
City of East Peoria	IRL400331	20.89	441.39	278.12	148.09	86.13	53.11
City of North Pekin	IRL400403	1.14	24.09	15.18	8.08	4.70	2.90
City of Pekin	IRL400423	8.74	184.78	116.43	61.99	36.05	22.23
Washington Township	IRL400665	38.18	806.74	508.33	270.67	157.42	97.07
Bellevue	ILR400165	1.67	35.28	22.23	11.84	6.88	4.25
Creve Coeur	ILR400322	4.48	94.67	59.65	31.76	18.47	11.39
Marquette Heights	ILR400381	1.64	34.69	21.86	11.64	6.77	4.17
Peoria Heights	ILR400425	6.83	144.31	90.93	48.42	28.16	17.36
West Peoria	ILR400506	1.29	27.16	17.11	9.11	5.30	3.27
Peoria City Township	ILR400599	2.17	45.80	28.86	15.37	8.94	5.51
ILDOT Roads	ILR400493	2.68	57.61	36.30	19.33	11.24	6.93
Tazewell County	IRL400271	0.10	2.20	1.39	0.74	0.43	0.27
Peoria County Roads	IRL400267	0.72	15.44	9.73	5.18	3.01	1.86

Table A-3. NPDES manganese WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (lbs/day) Mid-Range to Low Flow Conditions (40-100%)	High and Moist Flow Conditions (0-40%)
IL0001392	NOVEON INC-HENRY	0.947	--	1.19	1.19
IL0001414	CATERPILLAR INC-MOSSVILLE	2.48	--	3.10	3.10
IL0001554	Dynegy Midwest Gen -- Hennepin	218	--	272.89	272.89
IL0001724	AMERICAN NICKELOID CO-PERU	0.0436	--	0.05	0.05
IL0001783	CF INDUSTRIES - PERU	0.003	--	0.00	0.00
IL0002518	UNITED SUPPLIERS-HENRY	0.011	--	0.01	0.01
IL0002631	ISG HENNEPIN INC.	7.246	--	9.07	9.07
IL0020575	PRINCETON, CITY OF STP	2.15	6.33	2.69	7.92
IL0021491	Ladd STP	0.365	2.85	0.46	3.57
IL0021539	METAMORA NORTH STP	0.36	1.44	0.45	1.80
IL0021695	TOLUCA STP	0.3	--	0.38	0.38
IL0021792	WENONA STP	0.19	0.48	0.24	0.60
IL0022331	GRANVILLE STP	0.289	0.504	0.36	0.63
IL0023159	CHILLICOTHE SD STP	0.8	2	1.00	2.50
IL0023523	DEPUE STP	0.48	0.96	0.60	1.20

Table A-3. NPDES manganese WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (lbs/day) Mid-Range to Low Flow Conditions (40-100%)	WLA (lbs/day) High and Moist Flow Conditions (0-40%)
IL0024163	CATERPILLAR INC.-PEORIA	0.006	--	0.01	0.01
IL0024791	MALDEN STP	0.05	0.125	0.06	0.16
IL0024996	OGLESBY STP	0.879	1.224	1.10	1.53
IL0025160	TISKILWA STP	0.12	0.6	0.15	0.75
IL0025313	HENNEPIN PWD STP	0.3	0.75	0.38	0.94
IL0026573	PUTNAM COUNTY JUNIOR HS	0.01	0.025	0.01	0.03
IL0026972	GRANDVIEW MOBILE HOME PARK	0.025	0.062	0.03	0.08
IL0028916	GERMANTOWN HILLS STP #1	0.2	0.5	0.25	0.63
IL0029343	Kewanee STP	2	5	2.50	6.26
IL0029378	LACON WWTP	0.32	1.15	0.40	1.44
IL0029424	LASALLE WWTP	3.33	5	4.17	6.26
IL0030660	PERU STP #1	3	4.53	3.76	5.67
IL0031216	Spring Valley STP	1.1	2.5	1.38	3.13
IL0033120	BUREAU JUNCTION STP	0.071	0.178	0.09	0.22
IL0035807	LAROSE WTP	N/A	N/A	N/A	N/A
IL0039411	WASHBURN STP	0.138	1.13	0.17	1.41
IL0042234	PINEWOOD MHP	0.03	0.05	0.04	0.06
IL0042625	LAKE ARISPIE WATER CO STP	0.05	0.125	0.06	0.16
IL0051705	Cherry WTP	N/A	N/A	N/A	N/A
IL0052183	NEW JERSEY ZINC COMPANY, INC.	N/A	N/A	N/A	N/A
IL0053066	CAMP MANITOUMI-LOW POINT	0.015	0.072	0.02	0.09
IL0053864	LAKE WILDWIND MHP-METAMORA	0.05	0.125	0.06	0.16
IL0054674	HPA - Jubilee College Historic	0.002	0.005	0.00	0.01
IL0059030	MOUNT ALVERNO NOVITIATE-E PEOR	0.0088	0.022	0.01	0.03
IL0059391	CEDAR BLUFF UTILITIES, INC STP	0.07	0.175	0.09	0.22
IL0060461	OAK RIDGE SD STP	0.0144	0.356	0.02	0.45
IL0063363	DOVER WTP	N/A	N/A	N/A	N/A
IL0064319	BRADFORD PIG PALACE	0	--	0.00	0.00
IL0065056	CENTRAL LIMESTONE CO-MORRIS	N/A	N/A	N/A	N/A
IL0065072	MEDINA UTILITIES INC-EAST STP	0.165	0.33	0.21	0.41
IL0065757	PRINCETON WTP	N/A	N/A	N/A	N/A
IL0066486	IL DNR - Jubilee College State Park	0.14	0.048	0.18	0.06
IL0067024	PRAIRIE VIEW NURSING HOME STP	0.02	0.05	0.03	0.06
IL0068047	HOPEWELL WTP	N/A	N/A	N/A	N/A

Table A-3. NPDES manganese WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (lbs/day) Mid-Range to Low Flow Conditions (40-100%)	WLA (lbs/day) High and Moist Flow Conditions (0-40%)
IL0070424	J&D RENTALS AND SALES	N/A	N/A	N/A	N/A
IL0070548	HENRY STP	0.3	0.75	0.38	0.94
IL0071358	TRICO, INC., MILL POINT MHP	0.015	0.06	0.02	0.08
IL0073652	SUBLETTE WTP	N/A	N/A	N/A	N/A
IL0075507	PERU STP #2	1	--	1.25	1.25
IL0076848	MARK WTP	0.005	--	0.01	0.01
IL0077224	METAMORA PWS	0.031	--	0.04	0.04
IL0077321	CATERPILLAR TRAILS PWD WTP	0.065	--	0.08	0.08
ILG551015	MAPLE ACRES MHP	0.0259	0.0648	0.03	0.08
ILG580008	Cedar Point STP	0.05	0.125	0.06	0.16
ILG580050	Brimfield SD STP	0.14	0.52	0.18	0.65
ILG580099	Dunlap STP	0.095	0.24	0.12	0.30
ILG580127	LAMOILLE, VILLAGE OF STP	0.063	0.243	0.08	0.30
ILG580130	Dalzell STP	0.11	0.275	0.14	0.34
ILG580190	OHIO, VILLAGE OF STP	0.0766	0.191	0.10	0.24
ILG580226	SPARLAND STP	0.105	0.26	0.13	0.33
ILG580245	WYANET STP	0.25	0.625	0.31	0.78
ILG580262	GERMANTOWN HILLS WWTP #2	0.2	0.5	0.25	0.63
ILG582012	Elmwood STP	0.37	1.18	0.46	1.48
ILG640144	Seatonville WTP	0.005	--	0.01	0.01
ILG640187	MAGNOLIA WTP	0.006	--	0.01	0.01
ILG840039	SENECA PETROLEUM-POWLEY SAND	N/A	N/A	N/A	N/A

"—" No information provided

Table A-4. NPDES TDS WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (tons/day) Mid-Range to Low Flow Conditions (40-100%)	WLA (tons/day) High and Moist Flow Conditions (0-40%)
IL0001392	NOVEON INC-HENRY	0.947	--	1.98	1.98
IL0001414	CATERPILLAR INC-MOSSVILLE	2.48	--	5.17	5.17
IL0001554	Dynegy Midwest Gen -- Hennepin	218	--	454.82	454.82
IL0001724	AMERICAN NICKELOID CO-PERU	0.0436	--	0.09	0.09
IL0001783	CF INDUSTRIES - PERU	0.003	--	0.01	0.01
IL0002518	UNITED SUPPLIERS-HENRY	0.011	--	0.02	0.02
IL0002631	ISG HENNEPIN INC.	7.246	--	15.12	15.12

Table A-4. NPDES TDS WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (tons/day) Mid-Range to Low Flow Conditions (40-100%)	WLA (tons/day) High and Moist Flow Conditions (0-40%)
IL0020575	PRINCETON, CITY OF STP	2.15	6.33	4.49	13.21
IL0021491	Ladd STP	0.365	2.85	0.76	5.95
IL0021539	METAMORA NORTH STP	0.36	1.44	0.75	3.00
IL0021695	TOLUCA STP	0.3	--	0.63	0.63
IL0021792	WENONA STP	0.19	0.48	0.40	1.00
IL0022331	GRANVILLE STP	0.289	0.504	0.60	1.05
IL0023159	CHILLICOTHE SD STP	0.8	2	1.67	4.17
IL0023523	DEPUE STP	0.48	0.96	1.00	2.00
IL0024163	CATERPILLAR INC.-PEORIA	0.006	--	0.01	0.01
IL0024791	MALDEN STP	0.05	0.125	0.10	0.26
IL0024996	OGLESBY STP	0.879	1.224	1.83	2.55
IL0025160	TISKILWA STP	0.12	0.6	0.25	1.25
IL0025313	HENNEPIN PWD STP	0.3	0.75	0.63	1.56
IL0026573	PUTNAM COUNTY JUNIOR HS	0.01	0.025	0.02	0.05
IL0026972	GRANDVIEW MOBILE HOME PARK	0.025	0.062	0.05	0.13
IL0028916	GERMANTOWN HILLS STP #1	0.2	0.5	0.42	1.04
IL0029343	Kewanee STP	2	5	4.17	10.43
IL0029378	LACON WWTP	0.32	1.15	0.67	2.40
IL0029424	LASALLE WWTP	3.33	5	6.95	10.43
IL0030660	PERU STP #1	3	4.53	6.26	9.45
IL0031216	Spring Valley STP	1.1	2.5	2.29	5.22
IL0033120	BUREAU JUNCTION STP	0.071	0.178	0.15	0.37
IL0035807	LAROSE WTP	N/A	N/A	N/A	N/A
IL0039411	WASHBURN STP	0.138	1.13	0.29	2.36
IL0042234	PINEWOOD MHP	0.03	0.05	0.06	0.10
IL0042625	LAKE ARISPIE WATER CO STP	0.05	0.125	0.10	0.26
IL0051705	Cherry WTP	N/A	N/A	N/A	N/A
IL0052183	NEW JERSEY ZINC COMPANY, INC.	N/A	N/A	N/A	N/A
IL0053066	CAMP MANITOUMI-LOW POINT	0.015	0.072	0.03	0.15
IL0053864	LAKE WILDWIND MHP-METAMORA	0.05	0.125	0.10	0.26
IL0054674	HPA - Jubilee College Historic	0.002	0.005	0.00	0.01
IL0059030	MOUNT ALVERNO NOVITIATE-E PEOR	0.0088	0.022	0.02	0.05
IL0059391	CEDAR BLUFF UTILITIES, INC STP	0.07	0.175	0.15	0.37
IL0060461	OAK RIDGE SD STP	0.0144	0.356	0.03	0.74
IL0063363	DOVER WTP	N/A	N/A	N/A	N/A
IL0064319	BRADFORD PIG PALACE	0	--	0.00	0.00

Table A-4. NPDES TDS WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (tons/day) Mid-Range to Low Flow Conditions (40-100%)	WLA (tons/day) High and Moist Flow Conditions (0-40%)
IL0065056	CENTRAL LIMESTONE CO-MORRIS	N/A	N/A	N/A	N/A
IL0065072	MEDINA UTILITIES INC-EAST STP	0.165	0.33	0.34	0.69
IL0065757	PRINCETON WTP	N/A	N/A	N/A	N/A
IL0066486	IL DNR - Jubilee College State Park	0.14	0.048	0.29	0.10
IL0067024	PRAIRIE VIEW NURSING HOME STP	0.02	0.05	0.04	0.10
IL0068047	HOPEWELL WTP	N/A	N/A	N/A	N/A
IL0070424	J&D RENTALS AND SALES	N/A	N/A	N/A	N/A
IL0070548	HENRY STP	0.3	0.75	0.63	1.56
IL0071358	TRICO, INC., MILL POINT MHP	0.015	0.06	0.03	0.13
IL0073652	SUBLETTE WTP	N/A	N/A	N/A	N/A
IL0075507	PERU STP #2	1	--	2.09	2.09
IL0076848	MARK WTP	0.005	--	0.01	0.01
IL0077224	METAMORA PWS	0.031	--	0.06	0.06
IL0077321	CATERPILLAR TRAILS PWD WTP	0.065	--	0.14	0.14
ILG551015	MAPLE ACRES MHP	0.0259	0.0648	0.05	0.14
ILG580008	Cedar Point STP	0.05	0.125	0.10	0.26
ILG580050	Brimfield SD STP	0.14	0.52	0.29	1.08
ILG580099	Dunlap STP	0.095	0.24	0.20	0.50
ILG580127	LAMOILLE, VILLAGE OF STP	0.063	0.243	0.13	0.51
ILG580130	Dalzell STP	0.11	0.275	0.23	0.57
ILG580190	OHIO, VILLAGE OF STP	0.0766	0.191	0.16	0.40
ILG580226	SPARLAND STP	0.105	0.26	0.22	0.54
ILG580245	WYANET STP	0.25	0.625	0.52	1.30
ILG580262	GERMANTOWN HILLS WWTP #2	0.2	0.5	0.42	1.04
ILG582012	Elmwood STP	0.37	1.18	0.77	2.46
ILG640144	Seatonville WTP	0.005	--	0.01	0.01
ILG640187	MAGNOLIA WTP	0.006	--	0.01	0.01
ILG840039	SENECA PETROLEUM-POWLEY SAND	N/A	N/A	N/A	N/A

"—" No information provided

Table A-5. NPDES chloride WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (tons/day) Mid-Range to Low Flow Conditions (40-100%)	High and Moist Flow Conditions (0-40%)
IL0022152	OAKLANE ACRES HOMEOWNERS ASSOC	0.015	0.06	31.30	125.18
IL0024881	CITY OF WASHINGTON STP #1	0.6	0.6	1251.81	1251.81
IL0028576	EAST PEORIA STP #1	4.22	8.44	8804.37	17608.75
IL0030007	MORTON STP #3	0.95	2.38	1982.03	4965.50
IL0042412	WASHINGTON STP #2	1.5	3	3129.52	6259.03
IL0047384	SUNDALE HILLS STP	0.275	0.688	573.74	1435.41
IL0047406	WASHINGTON ESTATES INC STP	0.2	0.3	417.27	625.90
IL0074632	V-MIX CONCRETE INC	0.045	--	93.89	93.89
ILG551039	SUNDALE SEWER CORP-HIGHLAND	0.053	0.132	110.58	275.40

"—" No information provided

Table A-6. MS4 chloride WLAs.

Operator Name	Permit ID	Watershed Area (sq mile)	WLA (lbs/day) High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Village of Morton	IRL400392	3.60	228114.10	5194.49	1389.85	512.76	38.84
City of East Peoria	IRL400331	13.52	857538.17	19527.40	5224.81	1927.59	146.02
Washington Township	IRL400665	29.78	1888654.15	43007.43	11507.20	4245.34	321.60
Creve Coeur	ILR400322	0.59	37335.78	850.19	227.48	83.92	6.36
Tazewell County Roads	IRL400271	0.48	30944.20	704.64	188.54	69.56	5.27
ILDOT Roads	ILR400493	0.06	4051.33	92.25	24.68	9.11	0.69

Table A-7. NPDES Total phosphorus WLAs.

Permit ID	NPDES Facility Name	Average Design Flow (MGD)	Maximum Design Flow (MGD)	WLA (lbs/day)	
				Mid-Range to Low Flow Conditions (40-100%)	High and Moist Flow Conditions (0-40%)
IL0001554	Dynegy Midwest Gen -- Hennepin	218	--	90.96	90.96
IL0001724	AMERICAN NICKELOID CO-PERU	0.0436	--	0.02	0.02
IL0001783	CF INDUSTRIES - PERU	0.003	--	0.00	0.00
IL0002631	ISG HENNEPIN INC.	7.246	--	3.02	3.02
IL0020575	PRINCETON, CITY OF STP	2.15	6.33	17.94	52.83
IL0021491	Ladd STP	0.365	2.85	3.05	23.78
IL0022331	GRANVILLE STP	0.289	0.504	2.41	4.21
IL0023523	DEPUE STP	0.48	0.96	4.01	8.01
IL0024791	MALDEN STP	0.05	0.125	0.42	1.04
IL0025160	TISKILWA STP	0.12	0.6	1.00	5.01
IL0025313	HENNEPIN PWD STP	0.3	0.75	2.50	6.26
IL0029424	LASALLE WWTP	3.33	5	27.79	41.73
IL0030660	PERU STP #1	3	4.53	25.04	37.80
IL0031216	Spring Valley STP	1.1	2.5	9.18	20.86
IL0033120	BUREAU JUNCTION STP	0.071	0.178	0.59	1.49
IL0042625	LAKE ARISPIE WATER CO STP	0.05	0.125	0.42	1.04
IL0051705	Cherry WTP	N/A	N/A	N/A	N/A
IL0052183	NEW JERSEY ZINC COMPANY, INC.	N/A	N/A	N/A	N/A
IL0063363	DOVER WTP	N/A	N/A	N/A	N/A
IL0065056	CENTRAL LIMESTONE CO-MORRIS	N/A	N/A	N/A	N/A
IL0065757	PRINCETON WTP	N/A	N/A	N/A	N/A
IL0067024	PRAIRIE VIEW NURSING HOME STP	0.02	0.05	0.17	0.42
IL0073652	SUBLETTE WTP	N/A	N/A	N/A	N/A
IL0075507	PERU STP #2	1	--	8.35	8.35
IL0076848	MARK WTP	0.005	--	0.04	0.04
ILG551015	MAPLE ACRES MHP	0.0259	0.0648	0.22	0.54
ILG580008	Cedar Point STP	0.05	0.125	0.42	1.04
ILG580127	LAMOILLE, VILLAGE OF STP	0.063	0.243	0.53	2.03
ILG580130	Dalzell STP	0.11	0.275	0.92	2.29
ILG580190	OHIO, VILLAGE OF STP	0.0766	0.191	0.64	1.59
ILG580245	WYANET STP	0.25	0.625	2.09	5.22
ILG640144	Seatonville WTP	0.005	--	0.04	0.04

"—" No information provided

Table A-8. CSO/SSO pathogen WLAs.

Facility Name	NPDES Permit ID	Number of Regulated Outfalls	CSO or SSO	Maximum permitted CSO flow (MGD)	Downstream Receiving Water	4 Times per Year WLA (G-org/day)[a]
Bureau Junction STP	IL0033120	1	CSO	13.6	Big Bureau Creek	206
East Peoria STP #1	IL0028576	4	SSO	0	Farm Creek	0
Granville STP	IL0022331	3	CSO	13.6	Illinois River Main Stem	206
Kewanee STP	IL0029343	1	SSO	0	Kickapoo Creek	0
Lasalle WWTP	IL0029424	2[b]	CSO	27.1	Illinois River Main Stem	410
		1	SSO	0		0
Metamora North STP	IL0021539	1	SSO	0	Illinois River Main Stem	0
Oglesby STP	IL0024996	7	CSO	NIA	Sandy Creek	0
Pekin STP #1	IL0034495	4	CSO	278.3	Illinois River Main Stem	4,214
Peoria CSOs	IL0037800	16	CSO	42.5	Illinois River Main Stem	643
Peoria SD STP	IL0021288	1	SSO	0	Illinois River Main Stem	0
Peru STP #1	IL0030660	22	CSO	986.6	Illinois River Main Stem	14,938
Spring Valley STP	IL0031216	8	CSO	118.1	Illinois River Main Stem	1,788
Washington STP #2	IL0042412	4	SSO	0	Farm Creek	0
Wenona STP	IL0021792	1	CSO	NIA	Sandy Creek	0

a. The CSO will be allowed to discharge the above daily G-org/day only four times during one year.

Table A-9. CSO/SSO TP WLAs.

Facility Name	NPDES Permit ID	Number of Regulated Outfalls	CSO or SSO	Maximum permitted CSO flow (MGD)	Downstream Receiving Water	4 Times per Year WLA (lbs/day) [a]
Granville STP	IL0022331	3	CSO	13.6	Senachwine Lake	113
Lasalle WWTP	IL0029424	2[b]	CSO	27.1	Senachwine Lake	226
		1	SSO	0		0
Peru STP #1	IL0030660	22	CSO	986.6	Senachwine Lake	8234
Spring Valley STP	IL0031216	8	CSO	118.1	Senachwine Lake	986

a. The CSO will be allowed to discharge the above daily lbs/day only four times during one year.

Table A-10. NPDES Fecal Coliform Exceedance Summary (DMR Data 2005-2010).

NPDES ID	NPDES Facility Name	Design Flow	# of Exceedances	Average Exceedance Value (cfu/100 Ml)	Standard	Exceeded Standard or Permit Limit
IL0020575	PRINCETON, CITY OF STP	2.15	7	1,269	400	standard
IL0021237	CREVE COEUR WWTP	1.55	6	1,237	400	permit limit
IL0021288	PEORIA SD STP	37.00	14	4,171	400	permit limit
IL0021539	METAMORA NORTH STP	0.36	10	5,140	400	permit limit
IL0021695	TOLUCA STP	0.30	5	6,780	400	permit limit
IL0021792	WENONA STP	0.19	4	3,375	400	permit limit
IL0022152	OAKLANE ACRES HOMEOWNERS ASSOC	0.02	37	6,994	400	permit limit
IL0023523	DEPUE STP	0.48	1	409	400	permit limit
IL0028576	EAST PEORIA STP #1	4.22	16	36,250	400	permit limit
IL0029343	Kewanee STP		14	15,495	400	permit limit
IL0029424	LASALLE WWTP	3.33	5	884	400	permit limit
IL0030007	MORTON STP #3	0.95	6	827	400	permit limit
IL0030660	PERU STP #1	3.00	7	691	400	permit limit
IL0031216	Spring Valley STP	1.10	6	727	400	permit limit
IL0037729	PEKIN PAPERBOARD		8	7,330	400	standard
IL0042234	PINEWOOD MHP	0.03	5	5,100	400	standard
IL0042412	WASHINGTON STP #2	1.50	10	3,950	400	permit limit
IL0046213	EAST PEORIA STP #3	1.20	2	7,000	400	permit limit
IL0047384	SUNDALE HILLS STP	0.28	17	5,722	400	permit limit
IL0047406	WASHINGTON ESTATES INC STP	0.20	24	5,150	400	permit limit
IL0053066	CAMP MANITOUMI-LOW POINT	0.02	7	1,454	400	permit limit
IL0066486	IL DNR – Jubilee College State Park	0.14	3	2,703	400	permit limit
IL0070548	HENRY STP	0.30	9	2,433	400	permit limit
IL0075507	PERU STP #2	1.00	7	987	400	permit limit

Table A-11. Reported CSO/SSO maximum flows

NPDES ID	Facility Name	Type	Outfall	Description	Reported Maximum Flow (MGD)
IL0033120	BUREAU JUNCTION STP	CSO	0020	CSO- STP overflow	13.6
IL0028576	EAST PEORIA STP #1	SSO	0030	SSO-MH30 (SPRINGFIELD ROAD)	0.0
IL0028576	EAST PEORIA STP #1	SSO	0040	SSO-WOODLAWN LIFT STATION	0.0
IL0028576	EAST PEORIA STP #1	SSO	0080	SSO-KERFOOT ST STORAGE TANK	0.0
IL0028576	EAST PEORIA STP #1	SSO	0110	SSO-EAST OAKWOOD AVE	0.0
IL0022331	GRANVILLE STP	CSO	0020	CSO-STP OVERFLOW	10.0
IL0022331	GRANVILLE STP	CSO	0040	CSO-GRANVILLE INTERCEPTOR	2.4
IL0022331	GRANVILLE STP	CSO	0050	CSO-HOPKINS AVENUE	1.2
IL0029343	Kewanee STP	SSO	003	--	0.0
IL0029424	LASALLE WWTP	CSO	0030	CSO-CREVE COEUR STREET	17
IL0029424	LASALLE WWTP	CSO	0061	CSO-UNION STREET (006A)	10
IL0029424	LASALLE WWTP	SSO	002	--	0.0
IL0021539	Metamora North STP	SSO	A01	--	0.0
IL0024996	OGLESBY STP	CSO	0020	CSO-400 FT EAST JORDAN & ALICE	Not Reported
IL0024996	OGLESBY STP	CSO	0030	CSO-600 FT NE CLARK & SCHOOL	Not Reported
IL0024996	OGLESBY STP	CSO	0050	CSO-400 FT JONES&I.C. RAILROAD	Not Reported
IL0024996	OGLESBY STP	CSO	A010	CSO-400 FT NW FLORENCE&SPRING	Not Reported
IL0024996	OGLESBY STP	CSO	B010	CSO-400 FT NE FLORENCE&SPRING	Not Reported
IL0024996	OGLESBY STP	C	C010	CSO-TREATMENT PLANT BYPASS	Not Reported
IL0024996	OGLESBY STP	C	D010	CSO-SECONDARY TREATMENT BYPASS	Not Reported
IL0034495	PEKIN STP #1	CSO	0030	CSO-STATE STREET LIFT STATION	73.2
IL0034495	PEKIN STP #1	CSO	0040	CSO-CAROLINE STREET OVERFLOW	44.0
IL0034495	PEKIN STP #1	CSO	0050	CSO-COURT STREET OVERFLOW	66.4
IL0034495	PEKIN STP #1	CSO	0060	CSO-FAYETTE STREET OVERFLOW	94.7
IL0037800	PEORIA CSOS	CSO	0010	CSO GREEN STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0030	CSO SPRING STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0080	CSO HAMILTON STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0090	CSO FULTON STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0100	CSO LIBERTY STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0110	CSO HARRISON STREET	Not Reported

Table A-11. Reported CSO/SSO maximum flows					
NPDES ID	**Facility Name**	**Type**	**Outfall**	**Description**	**Reported Maximum Flow (MGD)**
IL0037800	PEORIA CSOS	CSO	0130	CSO WALNUT STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0140	CSO STATE STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0160	CSO CEDAR STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0170	CSO SOUTH STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0180	CSO SANGER STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0190	CSO DARST STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	0200	CSO MAIN STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	A060	CSO OLD EATON STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	A070	CSO FAYETTE STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	B060	CSO NEW EATON STREET	Not Reported
IL0037800	PEORIA CSOS	CSO	All	All combined sewer overflows	42.5
IL0021288	Peoria SD STP	SSO	002	002- Emergency High Level Bypass	0.0
IL0030660	PERU STP #1	CSO	0030	CSO FRUIT ST (IR-1)	37.6
IL0030660	PERU STP #1	CSO	0040	CSO CHURCH ST(IR-2)	33.5
IL0030660	PERU STP #1	CSO	0050	CSO GREEN ST (IR-3)	42.2
IL0030660	PERU STP #1	CSO	0060	CSO PIKE ST (IR-5)	53.2
IL0030660	PERU STP #1	CSO	0070	CSO S. PEORIA ST (IR-6A)	43.0
IL0030660	PERU STP #1	CSO	0080	CSO PUTNAM ST (IR-7A)	75.0
IL0030660	PERU STP #1	CSO	0090	CSO GRANT ST (IR-8A)	63.7
IL0030660	PERU STP #1	CSO	0100	CSO STATE ROUTE 251 (IR-9A)	67.2
IL0030660	PERU STP #1	CSO	0110	CSO BUFFALO ST (IMC-1)	55.8
IL0030660	PERU STP #1	CSO	0120	CSO CALHOUN ST (IR-4)	14.2
IL0030660	PERU STP #1	CSO	0130	CSO STATE ROUTE 251 (IR-9)	190.9
IL0030660	PERU STP #1	CSO	0140	CSO FARM ST (IR-10)	45.3
IL0030660	PERU STP #1	CSO	0150	CSO 6TH ST (WR-4A)	72.4
IL0030660	PERU STP #1	CSO	0160	CSO EAST 9TH ST (ER-2A)	1.2
IL0030660	PERU STP #1	CSO	0170	CSO 9TH ST (ER-C5)	1.2
IL0030660	PERU STP #1	CSO	0180	CSO EAST 9TH ST (ER-2A)	2.6
IL0030660	PERU STP #1	CSO	0190	CSO BRUNNER ST (WR-6)	42.3
IL0030660	PERU STP #1	CSO	0200	CSO 6TH ST (WR-4)	35.1
IL0030660	PERU STP #1	CSO	0210	CSO 6TH ST (ER-4)	37.3
IL0030660	PERU STP #1	CSO	0220	CSO 12TH ST (WR-3)	23.3
IL0030660	PERU STP #1	CSO	0230	CSO NO PEORIA ST (WR-1)	47.1
IL0030660	PERU STP #1	CSO	0240	CSO WESTCLOX AVENUE (ER-1A)	2.5
IL0031216	SPRING VALLEY STP	CSO	0020	CSO-OAKDALE AVENUE	21.9
IL0031216	SPRING VALLEY STP	CSO	0030	CSO-TERRY STREET	21.9
IL0031216	SPRING VALLEY STP	CSO	0040	CSO-PLANT INLET STRUCTURE	9.1
IL0031216	SPRING VALLEY STP	CSO	0050	CSO-ILLINOIS STREET	5.8
IL0031216	SPRING VALLEY STP	CSO	0060	CSO-CAROLINE STREET	21.9

Table A-11. Reported CSO/SSO maximum flows

NPDES ID	Facility Name	Type	Outfall	Description	Reported Maximum Flow (MGD)
IL0031216	SPRING VALLEY STP	CSO	0080	CSO-CLEVELAND STREET	21.9
IL0031216	SPRING VALLEY STP	CSO	0100	CSO-THIRD STREET	13.0
IL0031216	SPRING VALLEY STP	CSO	0110	CSO-POWER STREET	2.6
IL0042412	WASHINGTON STP #2	SSO	002	--	0.0
IL0042412	WASHINGTON STP #2	SSO	003	--	0.0
IL0042412	WASHINGTON STP #2	SSO	004	--	0.0
IL0042412	WASHINGTON STP #2	SSO	005	--	0.0
IL0021792	WENONA STP	CSO	0030	CSO-Emergency Lift Station Outfall	Not Reported

Appendix B Stage Three Responsiveness Summary

This responsiveness summary responds to substantive questions and comments on the *Middle Illinois Watershed Total Maximum Daily Load* received during the public comment period from August 16, 2011 through February 16, 2012. The summary includes questions and comments from the August 16, 2011 public meeting as discussed below.

What are a TMDL and LRS?

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. Each contributing source of the pollutant will be assigned an amount of pollutant which it cannot exceed if the TMDL is to be met. This amount is called an "allocation." A TMDL is developed for each water that is impaired by pollutants that have numeric water quality standards. Some pollutants do not have numeric standards. Target criteria will be used to develop Load Reduction Strategies (LRSs) for these pollutants to address the impacts of nonpoint source loads.

This TMDL/LRS is for the Middle Illinois River watershed. The report details the watershed characteristics, impairments, sources, load and wasteload allocations, and reductions for each impaired segment in the watershed. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the Federal Clean Water Act and regulations thereunder.

Background

The project area begins on the Illinois River near Hennepin, where the river moves towards the south and continues past Peoria, ending in Pekin. The watershed covers nearly 2,100 square miles and includes land within the Bureau, Putnam, LaSalle, Marshall, Woodford, Peoria and Tazewell Counties. Major tributaries along this stretch of the Illinois River include Big Bureau Creek, Senachwine Creek, Crow Creek East, Sandy Creek, Farm Creek and Kickapoo Creek. The mainstem segments of the Illinois River that are impaired for primary contact designated use due to fecal coliform bacteria are D-05, D-09, D-16, and D-30. Kickapoo Creek (DL-01) and Big Bureau Creek (DQ-01 and DQD-01) are also impaired due to fecal coliform. There are two backwater lakes that are impaired for aquatic life use and aesthetic quality use due to phosphorus, siltation/sedimentation and total suspended solids.

The Clean Water Act and USEPA regulations require that states develop TMDLs for waters that do not meet water quality standards and have been placed on the Section 303(d) List. IEPA has developed TMDL allocations for parameters with numeric water quality standards such as fecal coliform in streams and phosphorus in lakes. Load Reduction Strategies (LRSs) have been developed for other parameters, such as total suspended solids, that do not have a numeric standard.

Public Meetings

On September 2, 2010 public meetings were held at the Peoria Public Library at 2 p.m. and Princeton City Hall at 6 p.m. The purpose of the meetings was to provide the public with an opportunity to comment on the August 2, 2010 Illinois River Watershed Characterization & Source Assessment Report (Stage 1), and to provide additional data to further inform the TMDL process. Public meetings were also held **August 16, 2011** at 1:30 p.m. in Peoria and 6 p.m. in Princeton to provide the public with the opportunity to comment on the Draft Illinois River Total Maximum Daily Load Report (Stage 3).

The Illinois EPA provided public notices for all meetings by placing a display ad in the local newspaper in the watershed; The Journal Star. The public notice gave the date, time, location, and purpose of the meetings. It also provided references to obtain additional information about this specific site, the TMDL Program, and other related issues. Individuals and organizations were also sent the public notice by first class mail. Tri-County Regional Planning Committee sent out notices and information to everyone on their mailing list. The draft TMDL Report was available for review on the Agency's web page at http://www.epa.state.il.us/water/tmdl . Approximately 25 people attended the first meeting and 15 attended the second meeting for the Stage 1 meeting. 40 people attended the first meeting and 20 attended the second meeting for the Stage 3 meeting.

Comments

Bacteria

Comment: Is Farm Creek not impaired for fecal coliform? Does Farm Creek have an exemption from primary contact use? Our group questions the "exempted" status listed on page 172 for Farm Creek, as the Farmdale Dam U.S. Army Corps of Engineers recreation area at the edge of East Peoria has several public use trails that directly cross the creek. Mountain bicyclists, hikers, people walking dogs, regularly are in contact with Farm Creek when using this popular recreation area. We hope measures can be taken to address the pollution impacts and problems from the Farm Creek drainage. (Heart of Illinois Sierra Club)

Response: Farm Creek has elevated fecal coliform bacteria but the segment is not assessed for primary contact recreation designated use. Morton STP #3 included Farm Creek (downstream of their facility) and the Illinois River in its die-off equations for the chlorination exemption application. The other facilities on Farm Creek also had exemptions for their facilities at their outfalls to 100 feet downstream- Sundale Hills, Washington Estates, Washington STP#1, Washington STP #2 and Sundale Sewer. Through the assessment process, the entire stream segment was not assessed for primary contact designated use because of these exemptions. Illinois EPA is evaluating exemptions statewide and through this process, some facilities had year-round exemptions revoked and were granted seasonal exemptions: Sundale Hills, Morton STP #3, Washington #2, and Washington STP #3. Seasonal exemptions apply May through October.

Washington Estates had a monitoring requirement put in their permit, and Washington STP #1 was regranted the exemption based on new data and other information provided for the reapplication process. Farm Creek was removed as an ambient stream that receives regular monitoring in 2007. It now is on the Intensive Basin Survey lists and monitoring takes place approximately every five years and does not include fecal coliform sampling or primary contact analysis.

Comment: Was wildlife considered as a potential source of fecal coliform during the development of the TMDL?

Response: It is a potential source for all locations where there is wildlife. There are practices that can be put in place to minimize the effect of wildlife on water. For example, there are shoreline areas that can be naturalized with vegetation that deter animals such as waterfowl from occupying those areas.

Comment: Is it possible to conduct a seasonal assessment of the bacteria contribution made by waterfowl?

Response: Detailed bacterial source tracking is not within the scope of the TMDL. The sources identified in any particular water sample using microbial source tracking are highly dependent on when and where *individual samples are collected, and is not a replacement for the TMDL study process. Research is ongoing to improve the accuracy and utility of microbial source tracking techniques.*

Comment: There is a graph on Page 49 that plots the correlation between livestock and fecal coliform. The correlation is very weak and does not provide enough confidence that the correlation should even be used in the draft report. (Illinois Farm Bureau) The correlation between the number of cattle in the area and the fecal coliform on Page 146 is 0.0555 which is not sufficiently strong to raise that correlation. This should be deleted. (Illinois Farm Bureau, Bureau County FB)

Response: This graphic has been removed. Text on page 49 has been modified to state: No strong correlation between animal unit density and fecal coliform counts by watershed was found. Text on page 146 has been modified to state: No strong correlation between the estimated number of cattle within each watershed and the monitored fecal coliform data was found (see Section 2.1.2). Text on page 195 citing the correlation was removed.

Comment: Is the 60 milligram bacteria value a water quality target or a water quality standard?

Response: The water quality standard for fecal coliform is a geometric mean of 200 cfu/100ml in at least 5 samples taken in a 30 day period. The instantaneous standard of 400 cfu/100ml, cannot be exceeded in more than 10% of samples.

Comment: GPSD has six permitted outfalls. Outfall 004 is to Kickapoo Creek approximately 100 yards upstream of its confluence with the Illinois River. As indicated in the Stage 3 draft report, there have been no discharges from this outfall in the past four years. Additionally, Outfall 004 is located approximately 1.5 miles downstream of the IEPA sample location. With no discharges to Kickapoo Creek, GPSD requests that any reference to GPSD as a pollutant source to Kickapoo Creek be deleted. (Greater Peoria Sanitary District)

Response: Information regarding Outfall 004 has been updated throughout the document to indicate that Outlet 004 is below the Kickapoo Creek sampling station and therefore not a pollutant source to Kickapoo Creek.

Comment: Table 8-2 lists all GPSD outfalls as NPDES discharges to Kickapoo Creek. On Outfall 004 discharges to Kickapoo Creek, GPSD requests all other outfalls be deleted from this table. Also, in this table, Wilder Waite Elementary School (IL0023809) is no longer an NPDES discharger. GPSD connected this facility to a public sewer in 2005. (Greater Peoria Sanitary District)

Response: Information regarding Outfall 004 has been updated throughout the document to indicate that Outlet 004 is below the Kickapoo Creek sampling station and therefore not a pollutant source to Kickapoo Creek. IL0023809 has been removed from Table 8-2.

Comment: Section 8.2.1 on Page 195 discusses elevated fecal coliform levels in Kickapoo Creek. The last sentence in the first paragraph states: "*… in addition there are two NPDES permitted facilities with documented fecal coliform bacteria violations within the last two years: Jubilee College State Park and Peoria SD sewage treatment plant.*" GPSD does not discharge to Kickapoo Creek. Pleas delete any reference to GPSD permit violations or discharges contributing to elevated fecal coliform levels in Kickapoo Creek. (Greater Peoria Sanitary District)

Response: Information regarding Outfall 004 has been updated throughout the document to indicate that Outlet 004 is below the Kickapoo Creek sampling station and therefore not a pollutant source to Kickapoo Creek.

Comment: Are there multiple sampling points along Kickapoo Creek? If there is just one sampling point along Kickapoo Creek, is there any data that indicate whether bacteria comes from urban sources or rural sources? GPSD conducted monthly water quality monitoring at 8 locations along the length of Kickapoo Creek, including fecal coliform, solids and nutrient data. The data collected indicate elevated levels of fecal coliform bacteria well upstream of the GPSD service area. If interested, we would be willing to share this information with IEPA. (Greater Peoria Sanitary District)

Response: Illinois EPA has one ambient station on Kickapoo Creek that monitors for bacteria. Data collected by GPSD were not available to Illinois EPA when we solicited data in the Stage 1 process of the TMDL and was therefore not used in the report.

Comment: There are also some pollutant contributions from failing septic systems. (Lee County Farm Bureau, Bureau County Farm Bureau)

Response: County health departments regulate septic systems and may have any information on failing ones. There are systems that are not reported as failing or are discharging illegally to waters, so it is very difficult to account for these. For fecal coliform TMDLs, we include an estimate of the failing septic systems in the watershed based on US statistics and census information. There will be implementation actions in the final report. These actions will include educating the public on how they can maintain properly working systems.

Comment: Peoria bacteria sources in the second paragraph on Page 31 should include Farm Creek and Kickapoo Creek which also enter the main stem in the urbanized area of Peoria. (City of Peoria)

Response: On page 130, the tributaries are specifically mentioned in the report.

Comment: Will local agencies, such as county health departments, be able to work with IEPA during implementation planning to address existing problems/concerns?

Response: Yes. Illinois EPA welcomes participation by all interested local stakeholders.

Comment: A sewage lift plant in Sparland is apparently out of compliance. Will IEPA enforce the NPDES regulations that pertain to this? (meeting)

Response: A violation notice was issued to the Village of Sparland on May 18, 2004 (W-2004-00277). From an investigation conducted by the Illinois EPA on April 15, 2004, it was determined the Village allowed raw sewage to discharge from their sanitary sewer system and it is deposited on land in a manner that causes or threatened to cause water pollution in waters of the State. A written response or a Compliance Commitment Agreement (CCA) was mandated. In response, the Village of Sparland replaced a defective pump with a new pump. They are currently working to get a loan/ grant to help the Village update their system. Illinois EPA rejected the CCA and it was considered for referral to the Office of the Attorney General, the State's Attorney and USEPA for enforcement action. The Village does not have the funding for system improvements and was supposed to be in the process of raising sewer rates. Because there was never a raise in the sewage fee, the Agency decided to go forward with enforcement action in June of 2012.

Peoria's CSOs and LTCP

Comment: Is the maximum flow rate CSO for City of Peoria in Table 2-2 from the CSO monitoring study? Because the CSO discharges from Peoria are high rate for a short period of time, a value in MGD may not be very useful. Is this meant to be MGY? The values seem awfully high where they are listed, for instance Peru STP. A value of MGY (or MG/event) may prove to be more useful. (City of Peoria)

Response: The City did not provide the requested CSO information and therefore Peoria CSOs were not given flow rates in the draft TMDL. The values have been updated to represent flow provided by the City of Peoria during the public comment process. A Total Maximum Daily Load (TMDL) requires a daily load and the values are intended to be MGD. Values were calculated using maximum reported discharges and these were applied to daily events.

Comment: The event occurrence for Peoria for 2010 in Table 2-3 appears to be abnormally high. It is 2 - 3 times greater than previous years reporting and the CSO Long Term Control Plan (LTCP) modeled results for Sanger, South, Cedar, Fayette, Eaton, and Spring Street outfalls. This illustrates the difference in using CSO flows from any given year compared to modeled long term flow estimates. (City of Peoria)

Response: This data was taken from the DMR that is provided by the City of Peoria.

Comment: Eaton and Fayette seem to show no fecal coliform concentration in Table 4-7. These are listed as excess flow facilities. Are they being double counted as CSOs and excess flow facilities? What was the source of data to create this table? What were the years applicable to the data? (City of Peoria)

Response: Outfalls 006 and 007 do not have an average fecal coliform count because they do not have limits for fecal coliform in their permit and therefore do not provide data.

Comment: There does not appear to be a waste load allocation for Peoria CSOs in Table A-1. The City's comments regarding coordination between the LTCP and the TMDL are provided in the section below. (City of Peoria) Would it be more accurate to present the maximum permitted flow in Table A-8 as MG/event rather than MGD because some events last a few hours and others last several days? This table seems to assume that a CSO would only occur in one 24-hour period. (City of Peoria)

Response: The City did not provide the data needed for inclusion in the draft TMDL. Data recently provided by the City have been used to calculate a CSO wasteload allocation in the final TMDL. The TMDL must give daily loads in the allocations.

Comment: The draft report does not contain location specific estimates for Peoria's Combined Sewer Overflows (CSOs). We have summarized the CSO characteristics for Peoria and attached those data to these comments. The City of Peoria is currently in the process of developing a CSO LTCP and is working with Illinois EPA and U.S. EPA to choose the appropriate level of control to be achieved by the LTCP. Because that process has not been completed, the volume and character of any remaining CSO flows is not known. The City has proposed a level of control, but that has not yet been accepted by the agencies. In addition, it should be noted that the level of control specified in the final LTCP will not be achieved until the specified activities have been fully implemented. Such implementation could take 15-20 years or longer, during which time the City CSO discharges likely will occur with greater frequency and at different pollutant concentrations than will ultimately be achieved at the end of the LTCP implementation period. The draft report should account for the gradual improvements that will occur during the LTCP implementation period and any CSO permit issued to the City of Peoria should authorize discharges in accordance with an approved LTCP.

During the 2007 monitoring effort the City consistently observed upstream concentrations of bacteria well in excess of in-stream standards. The range of fecal coliform concentrations was 10 cfu/100ml to >60,000 cfu/100ml. This suggests significant impairment upstream of Peoria. When these concentrations are applied to the flows in the Illinois River at the time of sampling, the calculated bacterial loads ranged from 2.7E+14 to 2.7E+15. These results are detailed in the draft LTCP (Appendix 1). The citizen's committee formed for the LTCP expressed concern that Peoria would be required to expend significant sums of money to abate CSO while the upstream loads would continue and the impairment of the Illinois River go unchanged. The City strongly desires that the TMDL study will result in recommendations that will create sufficient upstream improvements so that CSO abatement improvements are noticeable.

It appears that CSOs in Peoria (along with all other CSO locations) are assumed to be abated to 4 overflows. During the recent public meeting on the draft report, inquiry was made as to what event or condition the 4 overflows apply. The City was told the 4 overflows are related to "worst case" conditions. It is unclear what this means. The City understands that federal CSO policy establishes 4 untreated overflows per typical year as a long term average and, as such, is the minimum level of control under the presumptive basis of compliance. In this sense 4 untreated overflows is the maximum frequency allowed under federal policy, a type of "worst case". Is this the intent of "worst case" alluded to in the meeting? If so, use of the long term model would be the appropriate basis for estimating CSO flows and loads because the long term model reflects a long term profile of CSO characteristics. The model reflects what federal LTCP methodology defines as the typical year; the typical year is the basis from which CSO control options are evaluated.

IEPA should be aware that the federal presumptive level of control of 4 untreated CSOs per typical year may not be the level of control selected and ultimately included in the approved LTCP adopted for the City's CSOs. The TMDL should include sufficient flexibility to allow the City to discharge from its CSO outfalls in accordance with the approved LTCP, whatever level of control is chosen. It should also be noted that the level of control likely will reflect the number of overflows that will occur during a typical year. For Peoria, the typical year approved by the agencies was 1949. Selection of a typical year level of control, however, will not establish a maximum frequency of annual CSO discharges that can occur—the frequency of CSO discharges will necessarily vary in accordance with the intensity and volume of rainfall in a given year and may frequently exceed the typical year frequency established in the approved LTCP. As a result, the TMDL should not assume that 4 overflows per year (or any other frequency chosen in the City's LTCP) represent the CSO volume that the City will be allowed to discharge. The TMDL should recognize that the typical year frequency will be exceeded and any NPDES permit implementing the TMDL should not be construed to establish a maximum CSO discharge frequency at the typical year level.

Alternatively, the TMDL report may suggest that the "worst case" reference reflects Illinois River flows as the TMDL method seems to be based upon in-stream flows at the 90+ percentile high flow conditions. In-stream flow conditions are determined by several factors unrelated to local Peoria conditions and are largely irrelevant in the federal guidelines that define how any LTCP assessment should be performed. Therefore, it is important that the TMDL and the LTCP are developed in ways which allow for the two studies to be co-related in order for TMDL requirements to be relevant for CSO control assessments.

Because IEPA has stated that the TMDL is based upon worst case conditions, the City has also provided a load allocation assessment based upon the wettest year in the period of record for the Peoria area. This year, 1990, shows the highest precipitation and resulting run-off. Therefore, the loadings for this year, when combined with controls ultimately negotiated with IEPA and USEPA, will define worst case loadings that are appropriate to use in the TMDL. Again, please keep in mind that the reductions in

CSO volume and frequency will only occur over time and that the level of control specified in the LTCP likely will not be achieved until full implementation after 15-20 years or more.

Response: The TMDL accounts for all point sources in the watershed. Any reductions will be identified in the final report. CSOs have NPDES permits and are required to develop and implement a Long-Term Control Plan (LTCP) that includes attainment of water quality standards. The TMDL will not alter the National Pollutant Discharge Elimination System requirement, and that process will continue. The TMDL will include information on these LTCPs for cities in this watershed, and there will be an exchange of information to ensure consistency and synergy between NPDES and TMDL actions and recommendations.

Comment: GPSD's design flows are 37 MGD DAF and 60 MGD DMF through full treatment. The GPSD NPDES Permit (IL0021288) also allows an additional 94MGD during excess flow events for a total flow of 154 MGD (Outfall A01). GPSD requests this higher flow value (154 MGD) be considered in any TMDL development. (Greater Peoria Sanitary District)

Response: Section 4.5.2 explains that both the average and maximum design flows are used to determine the WLAs. Loadings associated with excess flows are allowed as long as they are in compliance with all permit requirements. Excess flows are required to meet both the geometric mean of 200 cfu/100ml in at least 5 samples taken in a 30 day period and the instantaneous standard of 400 cfu/100ml which cannot be exceeded in more than 10% of samples.

Comment: GPSD requests that the second sentence in the last paragraph on Page 101, "*Local point sources of phosphorus may include the Peoria SD STP, though the facility does not currently report total phosphorus effluent concentrations in it DMR reports.*" be deleted. The Peoria SD STP is located approximately 6 miles downstream of the Peoria Intake sample location. The Peoria SD STP cannot be a source of phosphorus at this location. Additionally GPSD has been reporting total phosphorus concentrations in its DMR since September 2010. (Greater Peoria Sanitary District)

Response: We will make corrections in the final document.

Conservation Tillage/Landuse

Comment: Compare the old soil conservation numbers done by earlier Transect Surveys by the local Soil and Water Conservation District and the 2011 Soil Transect Survey. Each county has more than 500 data points that are entered into the Transect Survey for the county to determine how agriculture is doing with those positive practices. The same data points are reviewed about every three years by driving a specific route through the county to check to see if specific fields have conservation tillage practices. (Lee County Farm Bureau, Illinois Farm Bureau) More than 90 % of the fields in Illinois have a soil loss that is less than "T", the tolerable soil loss. (Lee County Farm Bureau, Illinois Farm Bureau, Bureau County Farm Bureau)

*Response: According to the 2006 USDA Transect Surveys, around 85 percent of the acres in Illinois were at or below T or tolerable soil loss levels (*http://www.agr.state.il.us/Environment/LandWater/Transect%20Survey2000.html*). That still leaves 3 million acres that exceed the tolerable soil loss levels. The state's goal is to bring as much land as possible below the tolerance level because that means soil is being replenished as rapidly as it is being lost. The tolerable level varies according to the soil type, but it generally falls between 3 and 5 tons of eroded soil per acre annually. Specifically for the counties in the TMDL watershed, 94-99 percent of all the acres were at or below T levels. Although T levels are better in this area of the state, there are still improvements that could be made.*

Comment: The statement “The trend is likely related to land use practices such as tilling fields and exposing soil to spring rains.” is incorrect and should be deleted from Page 36. (Illinois Farm Bureau, Bureau County FB)

Response: Because agricultural landuse in the Middle Illinois River watershed is approximately 70 percent, relating erosion from agricultural use would seem applicable. According to USDA documents, it can be reasonable to expect tilling fields and exposing bare soil to spring rain is a source of erosion absent any more precise information on conservation practices and prevention practices in the watershed. We look forward to working with the farming community to fine tune our implementation planning to focus on areas in need of additional help with these issues.

Comment: The discussion of tile drainage on Page 20 is incorrect. The draft report needs to reflect a better understanding of drainage and how it works. (Illinois Farm Bureau, Bureau County FB) What is meant by tile management in the first sentence of the first paragraph on Page 251? (Illinois Farm Bureau, Bureau County FB)

Response: The report discusses tile drains and that seems to be relevant since it is a tile drained watershed. Tile management is referring to drainage water management. It is the practice of using a water control structure in a main or lateral drain to vary the depth of the draining outlet.

Comment: Agriculture supports voluntary, incentive-based programs that have a strong educational component. Agriculture has and will continue to work with Soil and Water Conservation Districts and others at the local level to educate farmers about BMPs. The challenge is that the programs of the United States Department of Agriculture, Soil and Water Conservation Districts, the Illinois Department of Agriculture, and the Illinois Department of Natural Resources have had neither sufficient funding for these positive programs nor enough staff needed to implement them. (Illinois Farm Bureau, Lee County Farm Bureau, Bureau County Farm Bureau)

Response: Thank you for your comment and we concur that fully staffing these programs would benefit the Illinois River.

Comment: This second paragraph on Page 45 is incorrect and the entire paragraph should be deleted. It ignores the increase in conservation tillage that farmers have made. Soil loss for the watershed is less than the tolerable soil loss according to the IDOA and SWCD Transect Survey. The draft report needs to reflect a better understanding of modern agricultural practices. An example of a lack of understanding of modern agriculture is the phrase that "tractors pulverize the soil”. (Illinois Farm Bureau, Bureau County FB)

Response: This paragraph, taken from Walker, 1984, has been eliminated. The previous paragraph has been modified as follows: Sheet and rill erosion occurs more frequently in areas that lack or have sparse vegetation, <u>such as cropland during certain parts of the year and construction sites</u>.

Comment: There are many incorrect statements in the last paragraph on Page 198. Due to conservation tillage, fields are not bare in the spring since they have crop residue on the surface. (Illinois Farm Bureau, Bureau County FB)

Response: Conventional tilling ranges from 2-48% for the counties in this watershed. Counties such as Marshall (2%), Bureau (4%), Peoria (6%) and Putnam (7%) have much more conservation tillage compared to Tazewell (21%) and Woodford (48%). There are still improvements that could be made in the watershed.

Comment: The paragraph on Page 86 regarding the total suspended solids in the system raises a lot of questions. The draft report states that high spring loads may be due to planting in the spring; however, agriculture continues to increase the use of conservation tillage practices. Did the IEPA consider that spring rains may be the main factor that should be correlated to total suspended solids? (Illinois Farm Bureau, Bureau County FB) In the second paragraph on Page 89, the draft report should take into consideration the spring rainfall. Agriculture has increased the use of conservation tillage thereby decreasing sheet and rill erosion. This should be acknowledged. Stating that agriculture "may contribute to total suspended solids" is an unfair statement not backed by data. (Illinois Farm Bureau, Bureau County FB)

Response: Rainfall is not considered a source of the elevated levels of total suspended solids. Rainfall does not contain the suspended solids until after it becomes surface runoff and carries eroded particles of soil in it. While much of the land has conservation tillage, surface runoff still exists in these areas as well, just at a lower level than conventional tillage. In order to make improvements in agricultural areas in the watershed, more information would make this attainable. GIS map coverages that have land enrolled in conservation services/programs or land practicing conservation tillage would be useful. This could help identify areas where future potential exists. Illinois EPA does not have any coverages with this information.

Comment: What is the source of the data for Table 1-8, "Percent composition of Hydrologic Soil Groups per watershed" and Table 1-9, "Percent of highly erodible versus not highly erodible soils per watershed"? (Illinois Farm Bureau, Bureau County FB)

Response: The source has been added as a note to Table 1-8 and 1-9. The source of the data is:
Natural Resources Conservation Service (NRCS). 2007. Soil Survey Geographic (SSURGO) Database. http://soils.usda.gov/survey/geography/ssurgo/.

Comment: Soil erosion for agriculture is down by 40 % since 1982 and yet total phosphorus is up. Why is the total phosphorus number higher? (Lee County Farm, Bureau County Farm Bureau)

Response: Documentation that cites a 40 percent decrease in soil erosion for agriculture has not been provided, and therefore no comment can be made on this statement.

Comment: The Illinois State Water Survey has stated in several reports that 40 % to 60 % of the sediment load in streams comes from streambanks. The draft report refers to the ISWS and yet throughout, statements about streambank erosion are forgotten and not even mentioned as an issue. This paints an incorrect picture of the watershed. Streambanks could be a source of phosphorus, but it is extremely expensive to fix. (Lee County Farm Bureau, Illinois Farm Bureau, Bureau County Farm Bureau)

Response: A discussion on streambank stabilization techniques will be in the TMDL implementation plan for the watershed. There are a lot of channelized tile drained streams in this watershed that can increase velocities and peak flows and contribute to streambank erosion. Many natural streams meander, have floodplains and have vegetated areas surrounding it. Most streams in agricultural areas do not have these characteristics. We believe these areas can still be improved, but it will take a cooperative effort of all parties to identify and persuade stakeholders to take actions where limit resources can be put to best use to improve the watershed.

Nutrients/Fertilizer Application

Comment: What will IEPA do to address phosphorus as it pertains to NPDES regulations? Is there a numeric water quality standard for phosphorus in streams?

Response: Right now there is no numeric water quality standard for phosphorus. This is in development along with our narrative standard. Most facilities were not required to monitor for phosphorus in their effluent. Currently Illinois EPA requires all major facilities have monitoring in their NPDES permit renewals. If a facility is upgrading, they will automatically receive a phosphorus permit limit of 1 mg/L.

Comment: The third sentence on Page 98 stating that "sources within the area are large enough to keep the phosphorus concentrations high" is an incorrect implication. It should be deleted. (Illinois Farm Bureau, Bureau County FB)

Response: This was explaining that there are high levels upstream of the watershed, but tributary loads are also high in the watershed. They both are contributing.

Comment: Most of the phosphorus in the Illinois River is from Chicago and not from nonpoint sources. The statements and implication made on Page 249 that the phosphorus in the system is coming mainly from nonpoint sources should be deleted. Dr. David of the U of I has stated that about 70 % of the phosphorus load in the Illinois River is from point sources, not nonpoint sources. (Illinois Farm Bureau, Bureau County FB) There is not sufficient recognition of the existing pollutants that are coming into the Middle Illinois River Watershed from upstream. There should be some kind of accounting for water that flows into the Middle Illinois from upstream. (Illinois Farm Bureau, Lee County Farm Bureau, Bureau County Farm Bureau)

Response: There are eight 8-digit HUC watersheds upstream of the Middle Illinois watershed. According to the SPARROW model created by USGS, those watershed contribute phosphorus yield varying from 43 kg/km2 (Kankakee) to 341 kg/km2(DesPlaines). The Lower Illinois-Senachwine Lake HUC contributes 52 kg/km2. Point sources contribute 38% of the upstream load compared to 16% in the Lower Illinois. Fertilizers contribute 37% upstream and 58% in the Lower Illinois.

Comment: The last paragraph on Page 223 has many incorrect statements and should be deleted. Most of the phosphorus concentrations are not going to be due to runoff from applied fertilizers and pastures. The first paragraph on Page 151 is incorrect and should be deleted. The draft report incorrectly states that elevated concentrations of nutrients are a function of application of fertilizer and spreading manure on fields. This should be deleted. Delete references on Page 179 to "nutrients being commonly washed from fields". This is incorrect and nutrients are rarely washed from fields after application. (Illinois Farm Bureau, Bureau County FB)

Response: Both point and nonpoint sources are mentioned in the report. Relating the elevated nutrients in the watershed to fertilizer and manure used in the farm fields is not unrealistic since there is farmland in the area. Approximately 70 percent of land in the watershed is used for agricultural purposes. Most farmers use fertilizers on their crops so it is a potential source. Claiming that fertilizers are not occurring in surface runoff of farm fields is not realistic.

Comment: The draft report mentions many times that farmers fertilize in the spring when in actuality, farms use split application of fertilizer—applying some in the fall, some in the spring, and some later when the crop is up. (Lee County Farm Bureau, Illinois Farm Bureau, Bureau County FB)

Response: Thank you for the comment.

Comment: The University of Illinois has stated that Illinois farmers are applying less phosphorus than they remove with the crops and therefore phosphorus levels in the soils of Illinois are at deficit levels. The University of Illinois has also stated that there is more nitrogen being removed in the crops than is applied to the fields in many areas of the state. Farmers have increased their nitrogen use efficiency. (Illinois Farm Bureau, Lee County Farm Bureau, Bureau County FB)

Response: We agree and appreciate that fertilizer use has begun to be used more effectively than past practices.

Comment: The statements made in the draft report that farmers are misusing fertilizers should be deleted. Farmers are making a more efficient use of fertilizers, and have reduced the amount of fertilizer they are using per acre. (Illinois Farm Bureau, Lee County Farm Bureau, Bureau County FB)

Response: The report does not state that fertilizers are being misused, but that fertilizer management is needed to control nutrient loading. We agree that farmers are more efficiently using fertilizers for crop production.

Designated Uses/Assessment

Comment: In the study it mentions that the purpose of the Illinois River is for recreational use and drinking water. Transportation and agriculture (economic activity) is not considered as an Illinois River use. These extremely important uses should be included. (Bureau County Farm Bureau) The TMDL is looking at the designated use of recreation. Why isn't there a Designated Use of Agriculture or Industry? As a follow up question, how are agriculture and industrial uses of the waterway taken into consideration for the TMDL development? Knowing both ag and industry view the river(s) as a resource.

Response: "Designated uses" are recognized uses of Waters of the State established by state and federal water quality programs under the Federal Clean Water Act. The use of water that is withdrawn for Agricultural and industrial uses are considered in the water supply use where applicable. Water that is returned to the river through a conveyance after use is considered a discharge, subject to NPDES permits. Water returned through surface runoff (such as might be the case with irrigation) is considered nonpoint source runoff.

Comment: There is not sufficient data to correlate aquatic life impacts to agriculture on Page 52. It should be deleted. (Illinois Farm Bureau, Bureau County FB)

Response: Page 52 contains information on the nutrient criteria that USEPA established. The intent of developing ecoregional nutrient criteria is to represent conditions of surface waters that are minimally impacted by human activities and thus protect against the adverse effects of nutrient overenrichment from cultural eutrophication.

Comment: Describing the relationship in the second paragraph on Page 31, from the three Illinois River locations on Figure 1-20 as a "trend" may be an overstatement of the reliability of only three locations over a reach of the river that extends more than 60 miles. (City of Peoria)

Response: In this watershed the Agency has three ambient stations on the Illinois River. We collect data approximately nine times per year. The Agency believes these samples represent water in these segments of the river. The sentence has been rephrased to state that fecal coliform concentrations are lowest at the Peoria Intake.

Comment: Why do all streams have the same numeric water quality standards/targets? Shouldn't streams have individual standards/targets based on their unique individual characteristics?

Response: Targets for phosphorus and TSS do differ per area. There are two phosphorus targets and three TSS targets that apply in this watershed. Nitrate-nitrogen targets have an ecoregional approach and the entire Middle Illinois River watershed is in one ecoregion. Fecal coliform is a statewide water quality standard approved by the Illinois Pollution Control Board.

Data

Comment: The meaning of Table 4-8 is unclear. How was this information derived? (City of Peoria)

Response: Table 4-8 is using the information from the load duration curve analysis and explaining how the analysis takes into account seasonality and critical conditions.

Comment: What was the source of data to create Table 5-3? What were the years applicable to the data? (City of Peoria)

Response: The most recent NPDES permit information was used. A source has been added to this table.

Comment: What was the source of data to create Figures 5-13 and 5-14? What were the years applicable to the data? (City of Peoria)

Response: IEPA sampling data from 1974 to 2010 were used to create longitudinal summaries of fecal coliform data in Figures 5-13 and 5-14.The captions have been updated to reflect the applicable years of data.

Comment: How were livestock numbers derived for use in the modeling efforts? Assuming it was a database or citation what year of data was used? Were National Agriculture Statistics used for the TMDL modeling efforts?

Response: National Agricultural Statistic Service- http://www.nass.usda.gov/. We used area weighted county statistics. A source has been added to each table which includes livestock data.

Comment: During the development of the TMDL was land use changes looked at? For instance the increased number of homes in the watershed or number of people in the watershed? Were demographics considered? If so in any of these instances, what databases where used to collect this information?

Response: US Census data was used for county population statistics from 1990, 2000 and 2009 (estimated) to see if there are changes taking place or expected. Those are listed in the report.

Other Comments

Comment: The E.D. Edwards Power Plant is listed in Table 5-3 as having an average design flow of 0.007 MGD. A project was completed on November 28, 2007, that effectively terminated the sewage treatment discharge to the Illinois River. Appropriate permits were secured from and prior notification was provided to the IEPA. All sanitary wastewater generated at the E.D. Edwards Power Plant is directed to a forcemain that is contributory to and treated by the GPSD.

Table 5-17 should be revised to eliminate the E.D. Edward Power Plant as a source of fecal coliform impairments to segment D-05 of the Middle Illinois River watershed. Other non-sanitary wastewater flows from the E.D. Edwards Power Plant (NPDES Permit IL0001970 operating permit) are Outfalls 001, 002, 003, and 004. Outfall 001 consists of discharges from the facility ash pond system that predominately consist of untreated Illinois River water used for ash sluicing. Outfall 002 is primarily comprised of untreated Illinois River water used for once-through heat exchanger cooling. Outfall 003 is the Illinois River water used for backwashing of the raw water intake screens. Outfall 004 is a stormwater only discharge from various plant years that is contributory to the Illinois River via an unnamed tributary managed by the Pekin and LaMarsh Drainage & Levee District. With the exception of Outfall 004, all of these discharges will have some incidental fecal coliforms as a result on the untreated Illinois River source water used.

Table A-1 in Appendix A lists E. D. Edwards Power Plant and it is our opinion that this facility should be deleted from the table. Other non-sanitary wastewater flows from the E.D. Edwards Power Plant (NPDES Permit IL0001970 operating permit) are Outfalls 001, 002, 003, and 004. Outfall 001 consists of discharges from the facility ash pond system that predominately consist of untreated Illinois River water used for ash sluicing. Outfall 002 is primarily comprised of untreated Illinois River water used for once-through heat exchanger cooling. Outfall 003 is the Illinois River water used for backwashing of the raw water intake screens. Outfall 004 is a stormwater only discharge from various plant years that is contributory to the Illinois River via an unnamed tributary managed by the Pekin and LaMarsh Drainage & Levee District. With the exception of Outfall 004, all of these discharges will have some incidental fecal coliforms as a result of the untreated Illinois River source water used. (Ameren)

Response: We will change the final report accordingly.

Comment: The load reductions on Page 258 are extreme and cannot be achieved no matter what is done to change the watershed. (Illinois Farm Bureau, Bureau County FB)

Response: For this waterbody to meet the water quality standard for phosphorus, those reductions are needed. This lake is a backwater of the Illinois River and receives river water.

Comments: Will preparation of this TMDL study enable local governments to access any additional government funding?

Response: Having a completed TMDL prioritizes a waterbody/ watershed to receive funds from several programs including CWA Section 319 and Farm Bill funds.

Comment: What impacts will the TMDL study have on existing permits?

Response: Major dischargers will have to monitor for phosphorus and nitrogen. Some sewage treatment facilities with chlorination exemptions will have to reapply for the chlorination exemption. These changes will occur beginning with the next permit cycle.

Comment: The Illinois River is a tremendous natural resource for our area that continues to be severely impacted from upstream pollution, too much silt run-off, and irresponsible civic practices like the City of Peoria Sewage overflow from their combined sewers. A voluntary effort to control erosion and sediment runoff from urban and rural areas does not really appear to be adequate. Stronger controls are needed for construction site erosion control, farm land erosion control, steep slope, and stream bank erosion. We look to your agency to set higher standards to protect our river for now and for future generations. (Heart of Illinois Sierra Club)

Response: Both nonpoint and point sources have an effect of the watershed. Implementation will address both. There is no regulatory authority over nonpoint sources. The implementation plan will have suggested actions to reduce impairment from all sources.

Comment: Heart of Illinois Group Sierra Club thanks IEPA for the inclusion of comments regarding Lake Depue, beginning on page 241. We remain very concerned about the Superfund Site at Depue, which continues to allow heavy metals and other pollutants into the Illinois River. While I realize from IEPA answers to my questions during the first round of TMDL public meetings, that heavy metals pollution concerns are not part of this process, we sincerely hope that IEPA will continue with pertinent action recommendations for TMDL and LRS related issues as identified from Lake Depue. Measures to reduce specific pollutant levels could help reduce total suspended solids, as pointed out in your report. We encourage IEPA to proceed with requirements that address these issues and that will reduce the pollution load down river. (Heart of Illinois Sierra Club)

Response: Thank you for your comment.

Comment: In mid-February, 2012, Illinois American Water will begin chloramine treatment for the Peoria city public water supply necessitated because of river water treatment concerns. This treatment method has raised local public concern, particularly because of the great extent of very old homes with lead pipes in impoverished areas of Peoria. While this is not part of the TMDL and LRS process, we appreciate IEPA looking into additional end-of-pipe water testing in the oldest parts of the city. Peoria already has one of the highest child lead poisoning levels in the entire state. We do not want to have problems with chloramine water treatment such as occurred in Washington, D.C. some years ago, which resulted in dangerous lead levels at end of tap. Peoria citizens certainly hope there will be no problems from the chloramine water treatment, but if our river water quality was improved, perhaps this change would not have had to occur and the additional worries for lead pipe homes could have been avoided. (Heart of Illinois Sierra Club)

Response: After the switch to chloramines, Illinois American Water – Peoria's monitoring schedule for lead/copper was increased to 100 distribution sites every six months. This increased monitoring starts with the July – December 2012 sample period. The water system will be required to monitor every six months for two years, before the Agency will consider allowing a reduced monitor schedule for lead/copper. Also, past sample locations were reviewed and a recommendation was made to add sample sites to provide coverage to certain areas of the distribution system. We are currently working with Illinois American Water Company staff to update the sample site plan before the next round of samples are collected.

Comment: What was the determining factor or factors for selecting the uppermost segment of the Illinois River as opposed to the northernmost point of the Illinois River near Chicago?

Response: We have developed and are currently developing TMDLs in that uppermost area near Chicago- six to be exact. This TMDL began with two segments impaired for fecal- D-05 and D-30. In the middle of the process, segment D-16 became impaired so that will be included.

Comment: Silica Sand Company leaches silica into the Little Vermilion. Is this having an effect downstream?

Response: Silica Sand Company currently has permit limits for total suspended solids. They are meeting their limits. This study did not look into silica.

Typo

Comment: The following items are missing from the list of abbreviations: G-Org/day, MGD and N/A. (City of Peoria).

Response: These items have been added to the acronyms and abbreviations section

Comment: The precipitation range for Figure 1-6 should be 1.0 – 1.5”, not 1 – 2”. There is a separate range for 1.5 – 2.0”. (City of Peoria)

Response: This figure has been updated.

Comment: Bookmark report.

Response: Bookmarks have been updated.