Kankakee Basin Regional Water Study

The Kankakee River flowing through Kankakee River State Park

Prepared By:

Stantec

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Stantec

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Prepared for:
Indiana Finance Authority

Prepared by:
Stantec Consulting Services Inc.
5778 West 74th Street
Indianapolis, Indiana 46278

Executive Summary

Study Purpose: The Kankakee Basin Regional Water Study (Study) estimated historical and 50-year future water demand and water supply availability. The Kankakee Basin Study Area in northwestern Indiana encompasses all or portions of the 14 counties within the Kankakee River Watershed, including Benton, Elkhart, Fulton, Jasper, Kosciusko, La Porte, Lake, Marshall, Newton, Porter, Pulaski, St. Joseph, Starke, and White, and covers approximately 3,125 square miles (**Figure ES-1**).

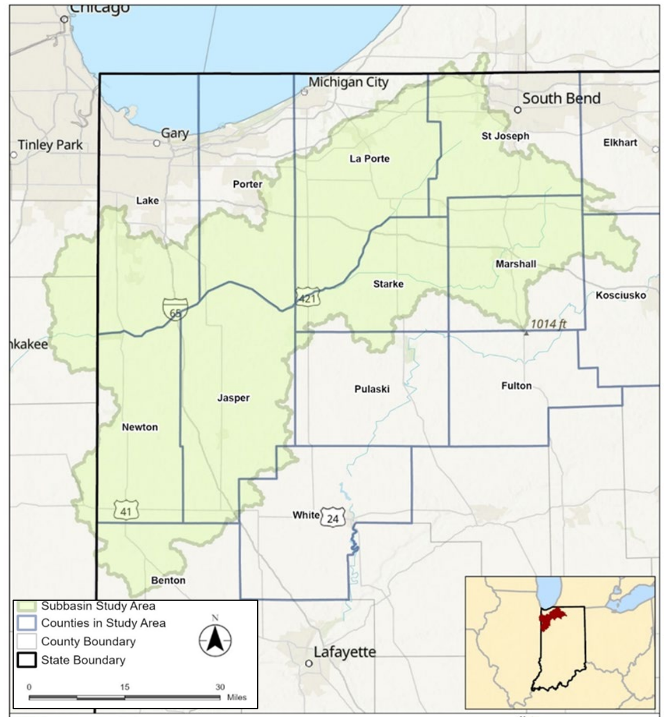

Figure ES-1. Kankakee Basin Regional Water Study Area

Study Approach: The water availability estimates presented in this Study are based on **data-driven analyses following a methodology similar to that used in previous regional water studies in Indiana**. Water availability was calculated as baseflow in a stream or river not allocated to a defined use or purpose, also referred to as 'excess' water in the system. Calculations were conducted, and results are presented, for eight hydrologic subbasins of the Kankakee River Watershed. **Stakeholders throughout the Study Area provided important input to the Study** on topics such as future demand assumptions and estimates of water withdrawals and return flows.

Regional Setting: The Kankakee Basin in Indiana (including the Yellow River, Kankakee River, and Iroquois River) contains a diverse landscape characterized by low relief topography and an intricate network of rivers, ditches, and wetlands that shape local hydrology. **The region is largely agricultural, with relatively low population density. The populated areas are largely concentrated along the Interstate 65 corridor.** Most residents live in rural areas interspersed with small urban centers and unincorporated communities. The combination of flat topography, sandy soils, and intensive land use continues to influence water availability, water quality, and water management across the basin. Note that **riverine flooding and erosion/ sedimentation are active concerns in the Basin, but these topics are outside the water availability focus of the Indiana regional water studies.**

Water Demand: Historical water withdrawals within the Study Area were primarily characterized using monthly water use data by sector for 1985 to 2023 from the Indiana Department of Natural Resources Significant Water Withdrawal Facility database. Historical withdrawals are relatively evenly split between surface water and groundwater in the Kankakee Basin – the primary use of surface water is energy production, and the primary uses of groundwater are irrigation and public supply.

In 2023, average annual withdrawals from the Kankakee Basin were 165 million gallons per day (MGD). By comparison, Kankakee Basin water withdrawals were 21% of the adjacent North Central

Indiana regional water study area (which drains approximately 8,320 square miles) 2022 average withdrawals, estimated to be 789 MGD (Stantec 2025). **A major difference between water use in the Kankakee Basin and other regions of the State is that agricultural/ irrigation water withdrawals comprise the largest share of total average annual withdrawals** (**Figure ES-2**).

By 2075, total Kankakee Basin water withdrawals are projected to increase to 244 MGD, a 48% increase over historical. Irrigation, industrial, energy production, and public supply are all projected to increase into the future, with the industrial sector (inclusive of currently planned data centers) having the largest relative increase compared to historical (41%). Irrigation water withdrawals exhibit either a constant or increasing trend through the forecasted future period, reaching an expected annual average of 105 MGD in 2075 (a 31% increase over historical).

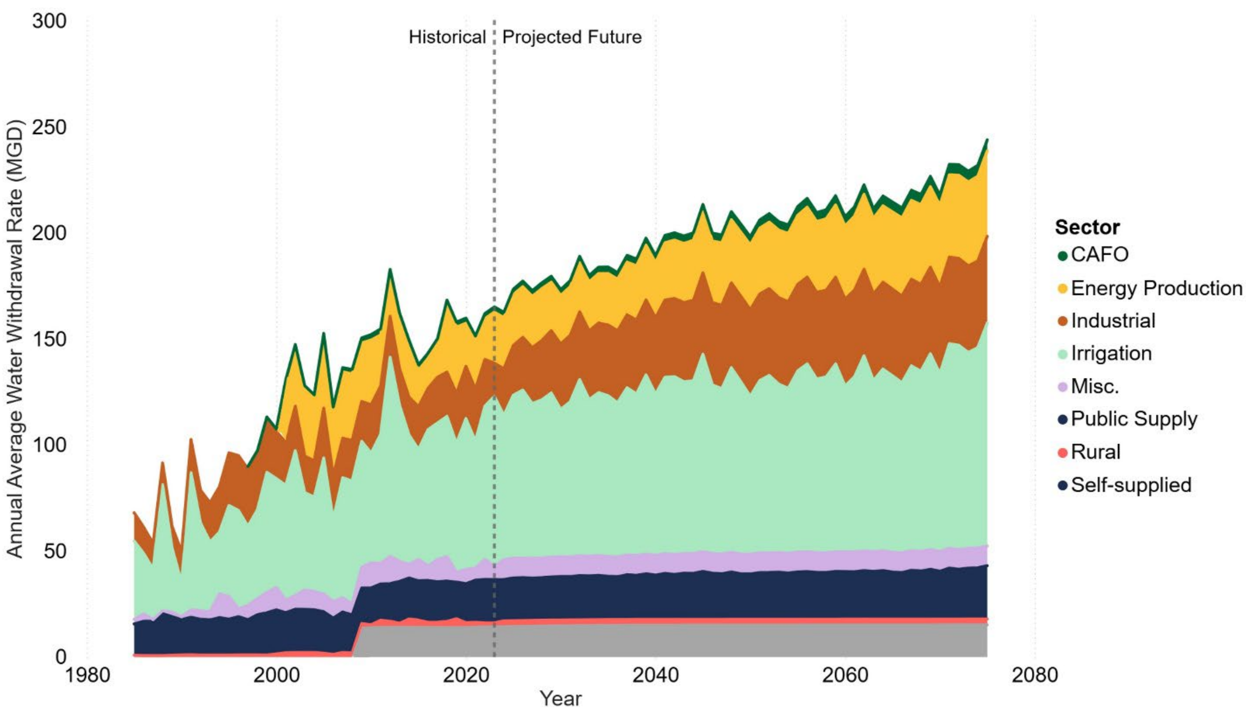

Figure ES-2. Historical (1985 – 2023) and Projected Future (2024 – 2075) Annual Water Demand in Kankakee Basin, by Sector (MGD)

Historical Water Availability: The Kankakee Basin has historically had adequate water available for the needs in the basin. However, the available water is not equally distributed throughout the region or throughout the year, with larger availability in the mainstem Kankakee River subbasins and greater seasonal fluctuations in smaller tributary subbasins. Spring consistently exhibits the highest water availability due to precipitation and snowmelt-driven runoff, followed by Winter. Summer and Fall are more limited, reflecting higher evapotranspiration and irrigation-related water use. In the mainstem Kankakee River subbasins, Fall water availability often exceeds Summer levels, likely due to reduced irrigation withdrawals later in the year. Subbasins with larger drainage areas, particularly those along the mainstem, show the highest cumulative water availability (i.e., water availability inclusive of flows generated from regional upstream contributions). Seasonal and year-to-year differences in cumulative excess water availability (combined locally-derived and upstream-contributed) closely mirror changes in baseflow (i.e., the portion of streamflow supplied by groundwater that sustains rivers and streams during periods with little to no rainfall), confirming that **hydrologic and geologic factors such as aquifer recharge potential, groundwater storage, and seasonal precipitation govern regional water supply more strongly than human influences in this basin.**

Projected Future Water Availability: **The magnitude of projected future water availability in the Study Area will likely differ from recent history because of the influence of projected future water demands and the effects of climate change. Across all seasons, median future projections of available water are expected to meet or exceed water demands in all subbasins.** Seasonal patterns are expected to be similar to historical trends – highest available water in Spring, followed by Winter and Summer, and lowest in Fall. Elevated Spring water availability is primarily attributed to increased natural baseflow projected under future climate conditions. In contrast, Fall water availability is projected to decline, driven by reduced baseflow during drier late-season conditions.

All subbasins are projected to experience reductions in Fall excess and cumulative excess water availability (both local and regional) ranging from -15% to -32% (**Figure ES-3**) compared to historical conditions. These reductions are attributed primarily to declines in projected Fall baseflow and higher seasonal water demands. The largest decreases in Fall excess water availability generated within each subbasin and cumulative excess water availability contributed from regional upstream subbasins are observed in Subbasins 02 and 03 which include portions of La Porte, Marshall, St. Joseph, and Starke Counties.

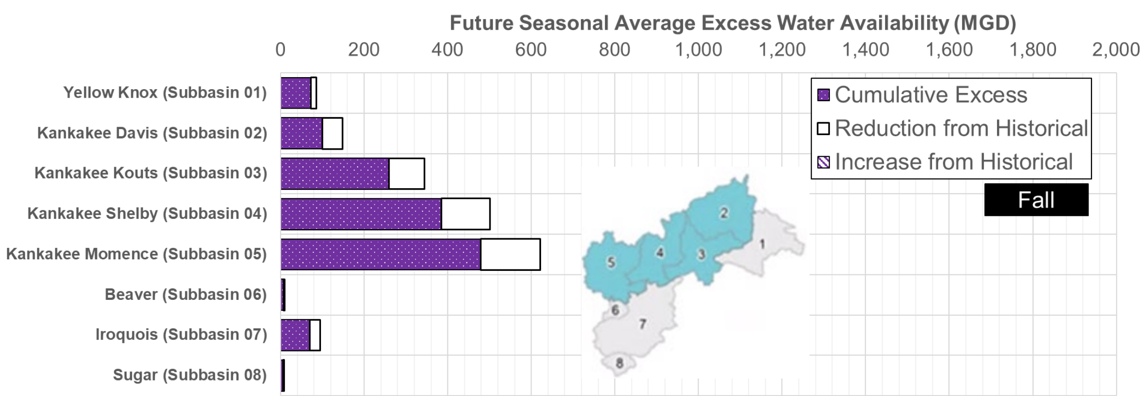

Figure ES-3. Change from Historical (2007 – 2023) to Future (2060s) Fall Season Cumulative Excess Water Availability by Subbasin

Similar to historical conditions, cumulative (local+regional) excess water availability remains positive in most future years, with future supplies typically exceeding projected demands (including instream flow requirements). Wet season (Winter and Spring) baseflow is projected to increase under future climate conditions, leading to higher water availability during these periods.

Figure ES-4 compares historical and projected future cumulative (local+regional) excess water availability at representative “typical” (median), “dry year,” and “drought” conditions, in this case for the Fall season. The results show a consistent projected decline in median Fall water availability across all subbasins. The Kankakee Davis (Subbasin 02; including portions of La Porte, Marshall, St. Joseph Counties), Kankakee Kouts (Subbasin 03; including portions of La Porte and Starke Counties), Iroquois (Subbasin 07; including portions of Jasper, Newton, and White Counties), and Sugar (Subbasin 08; including portions of Benton County) subbasins are projected to exhibit the largest water availability reductions relative to historical conditions. **Under drought conditions, these subbasins are projected to experience negative cumulative excess water availability, suggesting potential water supply shortages and increased ecological stress in future Fall seasons.**

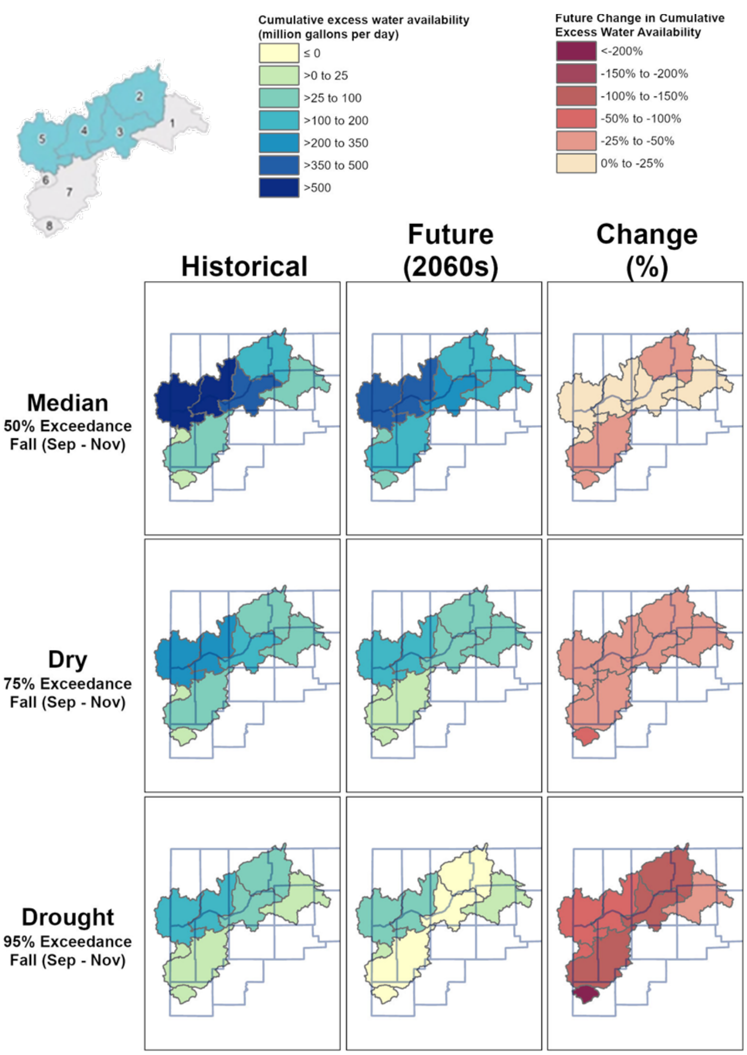

Figure ES-4. Changes between Historical and Projected Fall Cumulative Excess Availability for Median (50%), Dry (75%), and Drought (95%) Conditions

Cumulative excess water availability (regional) in the Fall is projected to decline substantially across all subbasins, by approximately 15% to 127% relative to historical conditions, due to decreased baseflow and higher consumptive demands. Even with projected increases in consumptive use of up to 25–30%, most subbasins are expected to retain adequate water availability during typical conditions. Under extreme dry conditions, particularly in the Fall, multiple subbasins can transition from surplus to deficit, reflecting the compounding effects of lower precipitation, reduced baseflow, and elevated demand. Seasonal contrasts intensify under future conditions, with wetter Spring and Winter periods followed by drier Fall periods.

Water Resource Risks, Opportunities, and Recommendations: Like many other regions of Indiana, **the Kankakee Basin is projected to grow – slightly in population, and more significantly**

in economic productivity and in water demand. Fortunately, **the Basin has generally abundant water resources, and this is projected to remain the case under most conditions in the future. The region can likely support increases in water demand while maintaining overall supply reliability.** However, **future projections of water availability under some conditions – notably in the Fall season in dry and drought years for certain subbasins – indicate potential for water stress, meaning potential unsatisfied demands and/or heightened ecological stress in the future.**

Risks: Specific risks and uncertainties are identified in three broad categories – **Demand Growth Uncertainty, Water Availability Risks and Drivers, and Local Versus Regional/Upstream Contributed Water Availability.**

Opportunities and Recommendations: **Six potential approaches are recommended that can individually and/or collectively contribute toward an increase in future available water supply to maintain or strengthen the people, environment, productivity, and economy of the Kankakee Basin in Indiana. These include strategies to enhance the supply of surface water and/or groundwater, decrease the demand for water, and better understand and manage water as a limited resource.** Included are strategies for water users, water providers, and local/regional and state entities. Also note that many of these recommendations are applicable to basins across the State**;** some were included in the adjacent North Central Indiana Regional Water Study (Stantec 2025), and others were recently mandated by Governor Braun's Executive Order 25-63 (2025).

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Abbreviations

°F	degrees Fahrenheit
303(d)	Section 303(d) of the Clean Water Act
7Q10	lowest 7-day average flow that occurs every 10 years (on average)
BFI	Baseflow Index
BG	billion gallons
bgs	below ground surface
CAFO	Concentrated Animal Feeding Operation
CESM1-CAM5	Community Earth System Model Community Atmosphere Model 5.0, a future climate model
CEWA	cumulative excess water availability
CFO	Confined Feeding Operation
cfs	cubic feet per second
CSO	Combined Sewer Overflow
CWA	cumulative water availability
CWS	Community Water System
ECHO	U.S. EPA Environmental Compliance History Online
EIA	U.S. Department of Energy, Energy Information Administration
EO	Executive Order
EP	energy production (water-use sector)
EPA	U.S. Environmental Protection Agency
EWA	excess water availability
FSMP	Fixed Station Monitoring Program
ft2/day	square feet per day
GCM	Global Climate Model
GPM	gallons per minute
GWMN	Groundwater Monitoring Network

HAB	harmful algal bloom
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IDNR-DFW	Indiana Department of Natural Resources-Division of Fish and Wildlife
IFA	Indiana Finance Authority
IN	industrial (water-use sector)
INCCIA	Indiana Climate Change Impacts Assessment
IR	irrigation (water-use sector)
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG	million gallons
mg/L	milligrams per liter
MGD	million gallons per day
MI	miscellaneous (water-use sector)
NID	National Inventory of Dams
NPDES	National Pollutant Discharge Elimination System
PFAS	per- and polyfluoroalkyl substances
PS (PWS)	Public supply (Public Water Supply; water-use sector)
Q80	minimum daily flow that is present 80% of the time (i.e., stream flow has only been that level or below 20% of the time)
Q90	minimum daily flow that is present 90% of the time (i.e., stream flow has only been that level or below 10% of the time)
RCP	Representative Concentration Pathway, refers to greenhouse gas concentrations in future climate model scenarios
RF	return flow
RU	rural use (water-use sector)
SMCL	Secondary Maximum Contamination Level
SS	self-supplied (water-use sector)

Study Area	Kankakee Basin
Study	Kankakee Basin Regional Water Study
SWWF	significant water withdrawal facility (high-capacity water pumping)
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VIC	Variable Infiltration Capacity
WQMS	Water Quality Monitoring Strategy
WW	water withdrawals
WWTP	Wastewater Treatment Plant

Glossary

7Q10	The lowest 7-day average flow that occurs (on average) once every 10 years. In this Study, the 7Q10 low flow was used as a minimum instream flow.
Anticline	An arch of stratified rock in which the layers bend downward in opposite directions from the crest.
Alluvial (aquifer)	Unconsolidated geologic sediment of any grain size deposited by a river, stream, or creek. In Indiana, “alluvium” is often used to distinguish modern finer-grained riverine sediment from coarser-grained glacially derived outwash sediment.
Anthropogenic	Man-made or influenced by humans. Anthropogenic refers to interventions by humans, such as water withdrawals from aquifers and streams, wastewater returns, land use, land-cover modifications, and sources of contamination.
Aquifer	Subsurface water-bearing layer of geologic sediment or rock that facilitates the flow of groundwater.
Baseflow	The portion of streamflow that is supplied by groundwater and sustains flow in rivers and streams during dry periods, when direct runoff from rainfall or snowmelt is minimal. Baseflow reflects the natural contribution of groundwater to surface water systems.
Baseline scenario	The foundational reference that outlines the most likely situation and outcome to occur.
Basin (watershed)	The contributing land area that drains water, such as rainfall or snowmelt, to a basin outlet. Also called a drainage basin or catchment. *Note that the term “Basin” is also used throughout this report to refer specifically to the “Kankakee River Basin.”*
Bedrock	Any lithified geologic material that remains intact and in place where it was deposited.
Capture	Pumping an extraction well “captures” water in a zone around the well. Extraction wells can be used to remove contaminated groundwater for treatment and further disposal
Change factor	A number reflecting the future proportional change in monthly stream flow simulated by a hydrologic model that incorporates future temperature, precipitation, and/or other meteorological input data.
Conjunctive use	Coordinated use of surface water and groundwater.
Consumptive use	The percent of water withdrawals that are not returned to waterways. For example, irrigation water is estimated to have an 80 percent consumptive-use rate, meaning the plant transpires or absorbs 80 percent of the applied irrigation water, and 20 percent of the irrigation water either runs off or percolates into the groundwater.

Critical habitat	Specific geographic areas essential to the conservation of a listed threatened or endangered species.
Dewatering	The removal of surface water or groundwater by pumping to facilitate excavations for construction or mining.
Discharge	Streamflow volume, usually measured in cubic feet per second.
Evapotranspiration	The removal of water from the earth’s surface and vegetation through the processes of evaporation and transpiration.
Excess water availability	The portion of water availability in a stream (at the subbasin outlet) that could be used to support additional surface water or groundwater withdrawals without impacting instream flows or existing surface water and net groundwater withdrawals.
Fall	The season defined by the months of September, October, and November.
First order subbasin	A subbasin that does not receive flow any upstream subbasin(s). These are typically located on tributaries to larger rivers.
Glacial till (till)	An often thick, poorly sorted, clay-rich, unconsolidated geologic deposit that is created by the movement of a glacier.
Groundwater	Water that occurs beneath the land surface and fills the pore spaces of the alluvium, soil, or rock formation in which it is situated. It excludes soil moisture, which refers to water held by capillary action in the upper unsaturated zones of soil or rock.
Groundwater recharge	The amount of water that is added to a groundwater aquifer through the process of infiltration.
Headwaters	The most up-gradient, or first-order, tributary watersheds contributing water and sediment downstream to the stream network.
Hydrograph	A graph showing streamflow (y-axis) over time (x-axis), reflecting streamflow from the area upstream of the measurement point.
HYSEP	A software tool for separating and analyzing streamflow hydrographs into baseflow (groundwater) and precipitation (runoff) components.
Instream flow	Instream flows are minimum stream flows required to support the ecological health of the stream, recreational use, and water quality.
Mainstem	The central or primary flow of a river system, with inflow from tributaries and streams.
Moraines	Ridges or mounds of glacial origin that consist of intermixed clay, silt, sand, gravel, cobbles, and boulders.

Natural baseflow	The groundwater contribution of streamflow that is discharged from aquifers to streams. Streams can have gaining (groundwater contribution to the stream) or losing (water loss from the stream bed to recharge groundwater) reaches. Natural baseflow is an estimate of the groundwater discharge contribution to a stream reach without considering anthropogenic (man-made) interventions such as water withdrawals or wastewater-return flows.
Natural streamflow	The streamflow that would be measured if anthropogenic (man-made) effects of surface-water and groundwater withdrawals and wastewater return flows were removed.
Observation well	A subsurface borehole (groundwater well) that, instead of pumping, is used to observe and monitor the water table elevation.
Outstanding Resource Waters	A component of the federal Clean Water Act that allows states to identify pristine waterways that constitute an outstanding state resource due to their exceptional water quality, statewide ecological importance, and/or unique recreational value.
Outwash	Geologic sediment deposited by meltwater from a receding glacier; in Indiana, modern rivers and streams often follow meltwater channels.
Public Water System	Water utilities that distribute water from either surface water or groundwater sources. A PWS can be a community system that serves a large population, or a system such as a school that has their own water well(s). Also represented as “PS” in this report, referring to the Public Supply water-use sector.
Reservoir reallocation	The process of changing how, and for what purpose, water is stored and released in a reservoir.
Return flow	Discharge to surface waters from facilities permitted by the NPDES program, such as wastewater treatment plants. Also refers to estimated non-consumptive flows that return to the hydrologic system through diffuse infiltration and subsurface migration.
Runoff	Precipitation that is unable to infiltrate into a groundwater aquifer and instead flows along the earth’s surface.
Streamflow	Streamflow discharge, usually measured in cubic feet per second.
Streamgage	Equipment to measure streamflow at a given location where a flowing body of water is confined to a known geometry (such as a channel) to facilitate the measurement of flow volume and other flow statistics.
Spring	The season defined by the months of March, April, and May.
Subbasin	A smaller drainage area within a larger river basin or watershed, such as the drainage area for a tributary to a larger river system.
Summer	The season defined by the months of June, July, and August.
Surface water	Water flowing and stored in streams, lakes, and reservoirs. In Indiana, surface water bodies are fresh (non-saline) water.

Unconfined aquifers	An aquifer that does not flow beneath an impermeable geologic layer and is free to flow in accordance with gravity. Sometimes called “water table aquifer” in shallow wells.
Unconsolidated	Geologic material (such as sediment, alluvium, soil, and till) that has not gone through the process of lithification.
Water availability	The amount of water, specifically, remaining baseflow, that remains available at a subbasin outlet after accounting for withdrawals, return flows, and instream flow requirements (ecological needs).
Water budget	An accounting method of estimating the net sum movement of water into and out of a hydrologic system through precipitation, evapotranspiration, recharge, diversions, return flows, and runoff.
Water demand	The amount of water required for different purposes and in different water use sectors, such as for residential, industrial, and public water supplies. Historical water demand is often quantified by water withdrawal (water use) volumes.
Watershed (basin)	The contributing land area that drains water, such as rainfall or snowmelt, to a basin outlet. Also called a drainage basin or catchment.
Winter	The season defined by the months of December, January, and February.

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In addition to the three above, the following individuals served on the Kankakee Basin Regional Water Study Advisory Committee and provided valuable information and guidance throughout the project.

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- David Lampe, United States Geological Survey
- Aubrey Bunch, United States Geological Survey
- Christian Walker, Indiana Department of Environmental Management
- Alexander Powers, Indiana Department of Environmental Management
- Katie Nelson, Indiana Farm Bureau

Local insights on current conditions and growth trends facilitated development of a more accurate projection of future water demand. In addition, targeted discussion with academic, agency, and consulting partners offered valuable context on basin conditions, management practices, and long-term hydrologic considerations. Stakeholder participants contributing to this study include:

- Bill Schalliol, St. Joseph County Division of Economic Development
- Bob Barr, Indiana University Indianapolis
- Caitlin Smith, (formerly) Indiana Farm Bureau
- Craig Zandstra, Lake County Parks and Recreation

- Jared Huss, Town of New Carlisle
- Matt Reardon, La Porte County Community & Economic Development
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1.0 Introduction

1.1 Authorization and Purpose

Pursuant to Indiana Code (IC) 5-1.2-11.5 (https://iga.in.gov/laws/2024/ic/titles/5#5-1.2-11.5) and the State of Indiana's Water Infrastructure Task Force Final Report (dated November 9, 2018), the Indiana Finance Authority (IFA) began in 2017 to systematically undertake a series of regional studies to identify water infrastructure needs and solutions, and to identify efficiencies that may be gained through regional partnerships and improved sharing of resources.

On April 21, 2025, Executive Order (EO) 25-63 was signed by Governor Mike Braun “Ensuring Future Economic Prosperity and Opportunity for Hoosiers by the Development of a Statewide Water Inventory and Management Plan.” The water inventory outlined within the EO focuses on the availability of surface and groundwater resources and forecasting of future demand. The EO also defined the future development of a statewide water planning framework and recommendations for enhancement and optimization of Indiana’s water resource monitoring networks. Findings from the 10 regional water studies will be synthesized to inform the statewide water inventory.

The purpose of this Kankakee Basin Regional Water Study (Study) is to examine and provide an assessment of the historical and projected future 50-year water demand and water supply availability for the watersheds primarily located in and contributing to the basin (3,125 square miles). This includes all or portions of Benton, Elkhart, Fulton, Jasper, Kosciusko, La Porte, Lake, Marshall, Newton, Porter, Pulaski, St Joseph, Starke, and White Counties, as shown in Figure 1-1. A portion of the Kankakee Basin Study Area (Study Area) is located in Illinois, and a tiny portion is also located in Michigan. For an accurate estimate of future water availability within the watershed, all water budget components, including both supply and demand of water in the Illinois portion of the basin, were included in the Study. However, the Risks, Opportunities, and Recommendations (Chapter 9) are focused on Indiana alone.

With the completion of the Kankakee Regional Water Study, the IFA has now completed 6 out of the 10 study areas (Figure 1-2). The Lake Michigan, Northeast Indiana, Southwest Indiana, Ohio River and Southeast Indiana regional studies are currently in progress.

Note that riverine flooding and erosion/sedimentation are active concerns in the Basin, but these topics are outside the water availability focus of the Indiana regional water studies.

Also note that this Study is a new independent analysis of demand for and availability of groundwater and surface water in the region; study objectives are described further in Section 1.2. Several prior basin-wide and watershed-scale studies have been completed that provide useful background on water quality, watershed management, and regional hydrology within the basin, including:

- “Water Resource Availability in the Kankakee River Basin, Indiana,” prepared by the Indiana Department of Natural Resources, Division of Water, Water Resource Assessment 90-3 (IDNR 1990).

- "Water Supply Planning: Kankakee Watershed Assessment of Water Resources for Water Supply," Illinois State Water Survey, Illinois Department of Natural Resources (Kelly et al. 2019).
- "The Indiana Water Resource (Vol. 1): Availability, Uses, and Needs," prepared by the Governor's Water Resource Study Commission, Department of Natural Resources (IDNR 1980).
- "Kankakee River Basin, Indiana: Report on the Water and Related Land Resources," prepared by the State of Indiana; Department of Natural Resources – State Planning Services Agency, State Board of Health, U.S. Department of Agriculture – Soil Conservation Service, Forest Service, and Economic Research Service; U.S. Department of the Interior – Geological Survey (IDNR 1976). This foundational assessment characterized hydrologic and land-use conditions across the basin and evaluated opportunities for coordinated land and water management.
- "Total Maximum Daily Load (TMDL) Report for the Kankakee/Iroquois Watershed" (Tetra Tech 2009). This TMDL report identified key pollutants of concern and established load allocations to improve water quality and protect designated uses within the Kankakee and Iroquois watersheds.
- The Lower Kankakee River Watershed Initiative's "Lower Kankakee River Watershed Management Plan" (Peel 2022). This plan documented current watershed conditions, water-quality issues, and priority management actions to reduce nutrient and sediment loading and enhance aquatic and riparian habitat within the lower Kankakee River watershed.

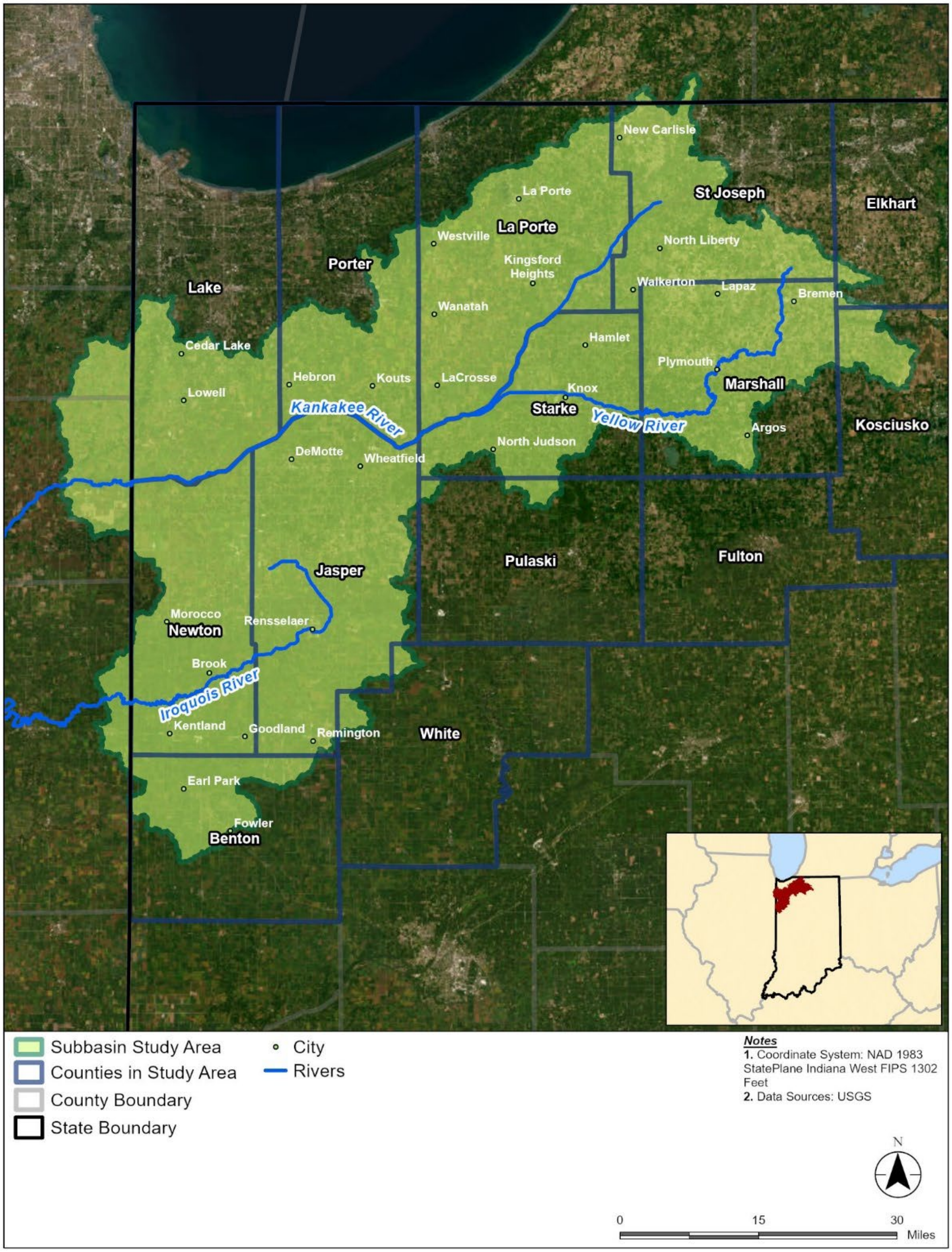
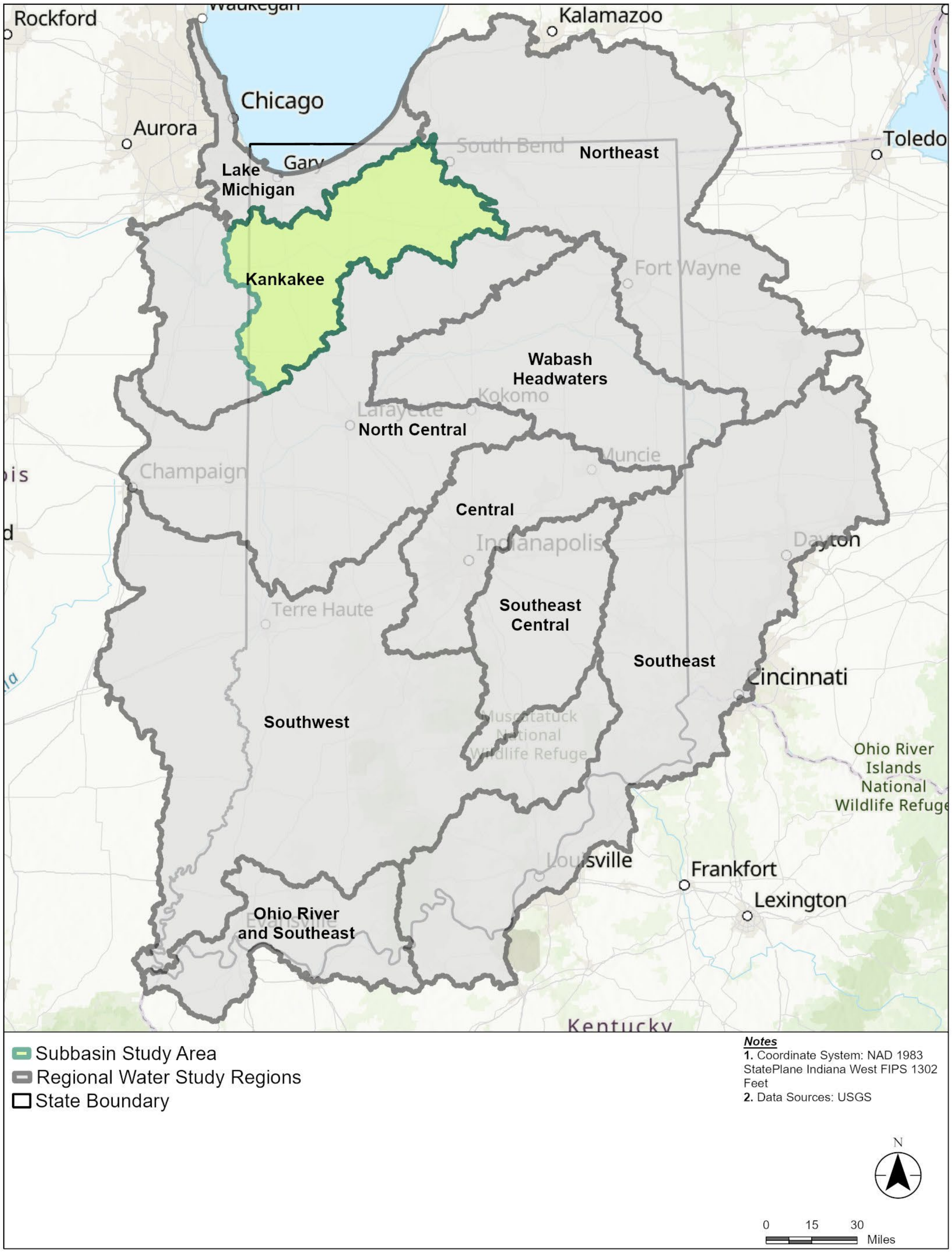


Figure 1-1. Study Areas and Study County Boundaries



Source: IFA 2025

Figure 1-2. Indiana Regional Water Study Regions

1.2 Study Objectives

The primary goal of the Study is to improve the understanding of groundwater and surface water demand and water availability throughout the Study Area, both historically and 50 years into the future. Objectives of the Study include:

- **Build Upon Current Knowledge:** Assemble and process water resources data within the Kankakee region, identify data gaps, and recommend upgrades to the monitoring networks to address data gaps.
- **Collaborate Across Many Partners:** Consult with utilities, industry, and county representatives to better understand current and future water demands and growth plans, and to establish productive partnerships among water resources agencies and other regional water interests to incorporate the best available science and data into the analysis.
- **Evaluate Historical Water Demand:** Quantify recent historical water demands by sector and source and evaluate major growth drivers for historical water resources development.
- **Evaluate Available Water Supply Information:** Assess streamflow records, reservoir operations, and instream flows, and investigate surface water and groundwater interactions.
- **Quantify Historical Water Availability:** Build a representation of regional water resources based on water budgets and geology consistent with other regional water studies to quantify historical water supply availability and investigate potential regional water supply limitations and/or surpluses.
- **Project Future Water Availability:** Forecast future water demands and streamflow over the next 50 years, incorporating water conservation, population, economic growth, and historical droughts, then use the same water resources system representation to quantify future water availability and investigate potential regional water supply limitations and/or surpluses.
- **Develop Recommendations:** Analyze historical and future trends in water availability, identify risks and opportunities for future water resources development, consider ideas to address future needs, identify key topics for further analysis surrounding water supply and demand issues, and communicate findings to local and state officials.

The Kankakee Basin Regional Water Study provides a data-driven foundation for collaborative decision making on shared water needs, challenges, and opportunities.

The water availability estimates presented in this Study rely on data-driven, formulaic analyses following a methodology similar to that used in previous regional water studies in Indiana, with some refinement. The data used in this Study are primarily from publicly available, authoritative sources, including:

- Federal (e.g., U.S. Geological Survey (USGS), U.S. Census Bureau, U.S. Environmental Protection Agency)

- State (e.g., Indiana Department of Natural Resources (IDNR), Indiana Department of Environmental Management (IDEM))
- University (e.g., Purdue University, Indiana University)
- Regional (e.g., Economic Development authorities)
- Local (e.g., water utilities, industry)

As referenced in EO 25-63, the intent of the Indiana regional water studies program is to provide technical analyses intended to underpin or support follow-on regional water planning. Accordingly, this Study seeks to identify regions of excess historical and projected future water availability and regions where a water supply deficit may exist, but does not seek to specifically identify or evaluate solutions to address such excesses and/or deficits. It is important to note that this is not intended to be a full water planning study (i.e., which would include identification and analysis of actionable water management strategies). However, some suggested recommendations, opportunities, and possible next steps are offered.

2.0 Regional Setting

The Kankakee Watershed spans a diverse landscape characterized by low relief topography and an intricate network of rivers, ditches, and wetlands that shape local hydrology. The watershed encompasses portions of both Indiana and Illinois and is made up of unconsolidated sand and gravel, with layers of lakebed sediments and glacial soils mixed in. These soils, remnants of glacial retreat, create a mix of well-drained uplands and poorly drained lowlands that historically supported one of the largest wetland systems in the Midwest, the Grand Kankakee Marsh. The channelization and dredging of the Kankakee River in the early twentieth century transformed this marsh into the largely agricultural landscape seen today, with modified drainage patterns and elevated sediment and nutrient transportation. The hydrology of the basin is strongly influenced by these human-made alterations.

The river now flows through a broad, flat valley that promotes both flooding and rapid surface runoff during storm events. Numerous tributaries, including the Yellow and Iroquois Rivers, contribute to the mainstem Kankakee River, while a network of manmade ditches, levees, and irrigation systems regulates surface water for agriculture and flood control purposes. High water tables and sandy soils enhance infiltration but also facilitate nutrient leaching to groundwater, while legacy drainage modifications continue to affect streamflow dynamics and water quality. Streamgages maintained by the USGS, such as those near Shelby and Momence, reflect these dynamic flow regimes and have long been used to monitor hydrologic responses across the basin.

Land use across the watershed is dominated by agriculture, with approximately three-quarters of the land area devoted to corn and soybean production. The remaining landscape includes scattered forested areas, remnant wetland, and developed (residential and commercial) areas which concentrated along the Interstate 65 corridor and in towns such as Rensselaer, DeMotte, and Wheatfield. Population density remains low across the basin overall, with most residents living in rural areas interspersed with small urban centers and unincorporated communities such as Roselawn and Lake Village.

The combination of flat topography, sandy soils, and intensive land use continues to influence water availability, quality, and management across the basin. These factors, together with growing development pressures near transportation corridors and the continuing importance of agriculture, define the present-day hydrologic and socioeconomic setting of the Kankakee Watershed. The following sections provide additional background on the physical and human elements that shape regional water resource conditions within the Study Area.

2.1 Climate

2.1.1 OVERVIEW

Indiana's climate is classified as humid continental and is characterized by distinct seasonal variation that strongly influences hydrologic processes across the state. Winters are typically cold and snowy, followed by wet Springs with frequent rainfall and thunderstorms. Summers are generally warm and humid, while

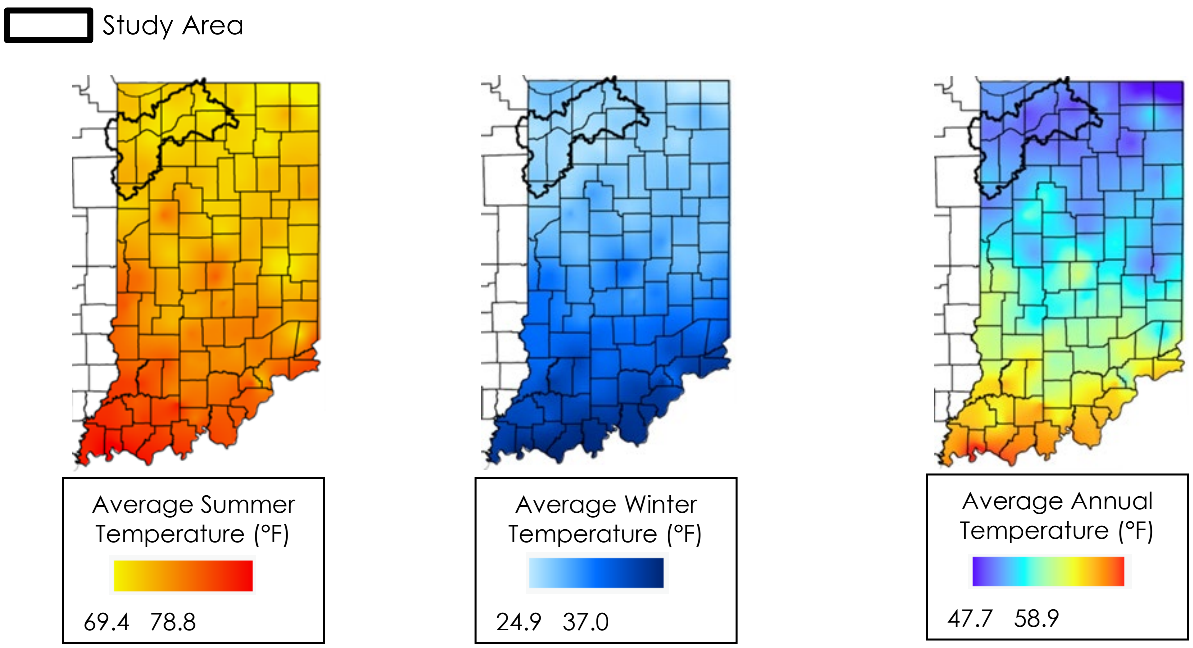
Fall conditions are cooler and drier, marking a period of reduced evapotranspiration and declining streamflow.

The state's inland position exposes it to contrasting air masses throughout the year. Warm, moisture-laden air from the Gulf of Mexico often interacts with cooler, drier air masses descending from central and western Canada along the jet stream (Scheeringa 2011). The convergence of these air masses promotes the formation of low-pressure systems that move eastward across the region and produce widespread precipitation, particularly during Winter and Spring. By midsummer, storm tracks typically shift northward, resulting in warmer and drier conditions across much of Indiana.

Annual precipitation across the state averages approximately 31 to 52 inches, with the greatest amounts generally occurring during Spring and early Summer (Waggoner 2022). Snowfall is an important component of total precipitation in northern Indiana, where annual accumulation can exceed 40 inches. Precipitation is unevenly distributed by season, and surface runoff, baseflow, and groundwater recharge are highest during late Winter and Spring and lowest in late Summer and early Fall.

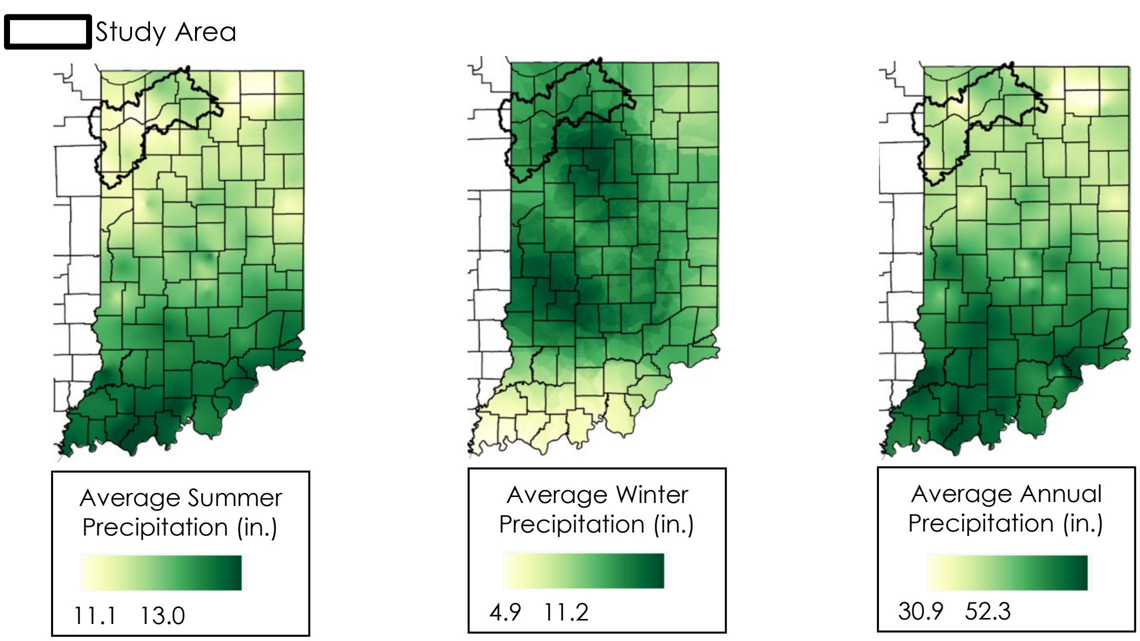
Temperature and precipitation patterns display a clear north–south gradient (Figure 2-1 and Figure 2-2), with warmer temperatures and higher annual precipitation totals in southern Indiana. **The Study Area, located in the northwestern portion of the state, typically experiences cooler average temperatures, greater Winter precipitation, and lower Summer precipitation than southern Indiana regions. The area is also periodically influenced by lake-effect snowfall from Lake Michigan, which enhances Winter precipitation and contributes to early-season soil moisture recharge.**

Long-term climate records indicate that precipitation intensity and variability have increased across much of Indiana in recent decades, particularly during Spring and early Summer (Cherkauer et al. 2021). These observed trends underscore the importance of accounting for potential shifts in seasonal precipitation patterns and hydrologic response when evaluating future water availability within the Study Area.



Note: Data are from 1981 through 2020 and collected from NOAA, NCDC, and NCEI (Waggoner 2022). Statewide averages were created from 124 observation stations across Indiana.

Figure 2-1. Statewide Temperature Averages 1981 – 2020



Note: Data are from 1981 through 2020 and collected from NOAA, NCDC, and NCEI (Waggoner 2022). Statewide averages were created from 124 observation stations across Indiana.

Figure 2-2. Statewide Precipitation Averages 1981 – 2020

Analysis of climate data from the past 30 years (1991 – 2020) from the Knox, Indiana (NWS 2025) reveals strong seasonal variation in air temperature, precipitation, and snowfall in the Study Area (Figure

2-3). Average daily minimum air temperatures approach 15 degrees Fahrenheit (°F) in January, while average daily maximums exceed 80°F in July. Snowfall typically occurs between November and April, peaking in January and February, whereas rainfall is distributed throughout the year and generally reaches its highest monthly totals from April through July.

As illustrated in Figure 2-3, precipitation transitions from snow-dominated inputs in Winter to rain-dominated inputs in late Spring, coinciding with warming temperatures and an increase in convective storm activity. This seasonal transition often drives high-flow events and elevated groundwater recharge. For example, the Yellow River near Knox experienced record flooding in February 2018 when rapid snowmelt combined with 4 to 6 inches of rainfall over several days (NWS 2018). Such events demonstrate the basin's sensitivity to freeze-thaw cycles and early-Spring precipitation, which strongly influence surface runoff timing and streamflow variability.

The Kankakee Basin receives approximately 31 to 52 inches of precipitation annually, with year-to-year variability largely controlled by the intensity of Spring and Summer storm systems. The region's low-relief glacial topography and permeable outwash soils contribute to temporary flooding and slow drainage during wet seasons. These climatic and hydrologic characteristics are key to understanding both historical and projected water availability patterns in the basin.

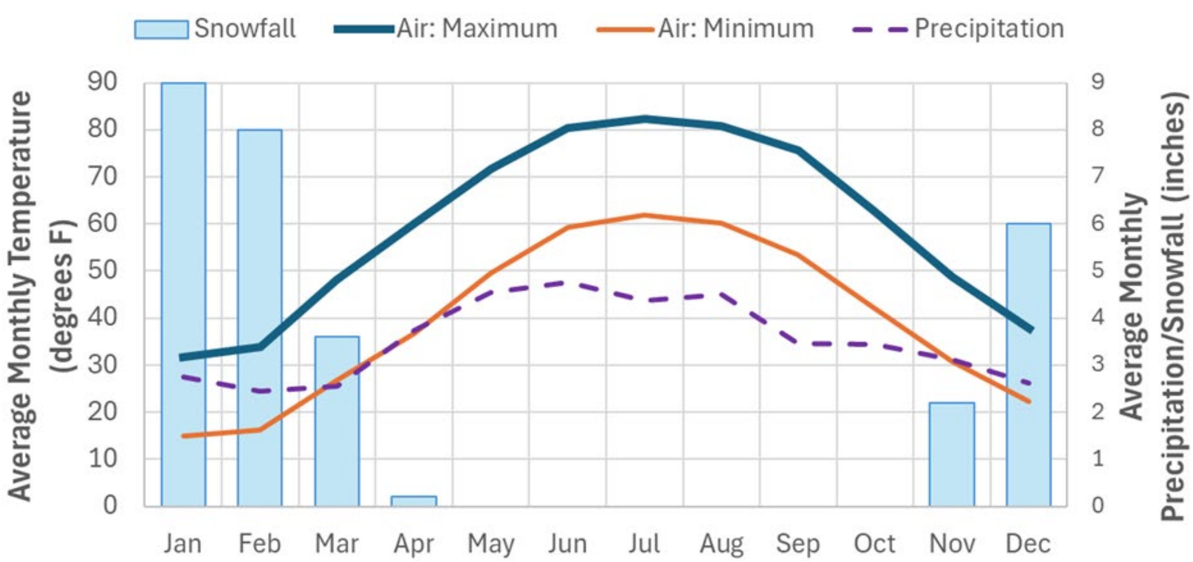


Figure 2-3. Average Monthly Climate Variables Near Knox, Indiana from 1991 – 2020

2.1.2 TRENDS

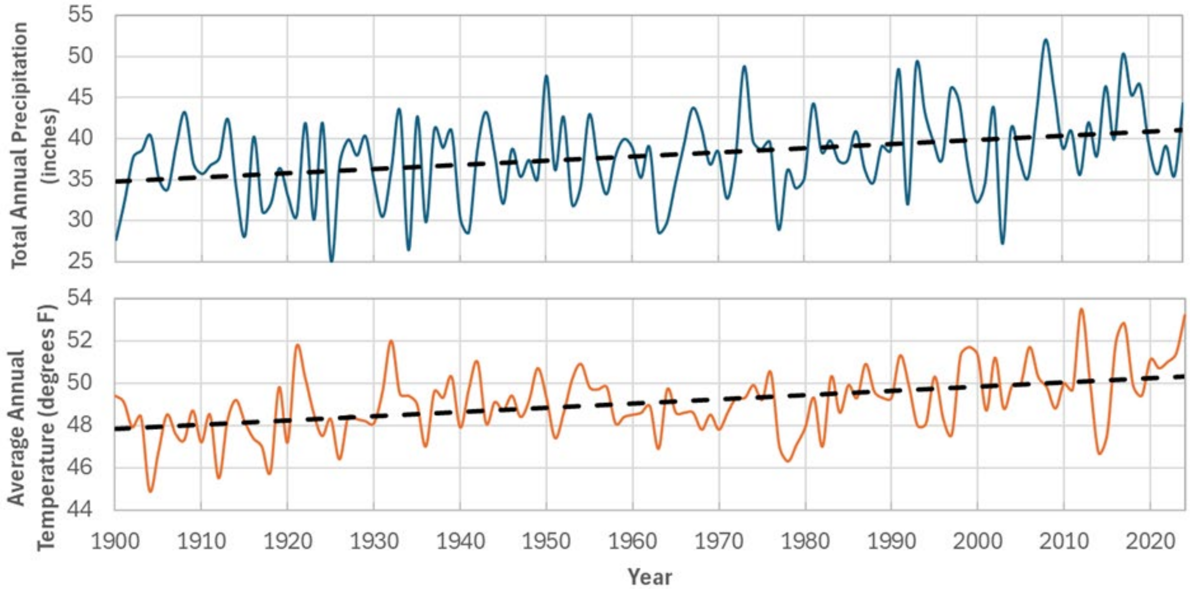
Long-term climate records for Indiana (dating back to 1895) and recent analyses (Widhalm et al. 2018a, Widhalm et al. 2018b, Cherkauer et al. 2021) show statistically significant trends in precipitation, air temperature, and the frequency of extreme hydrologic events. Observations for Starke County and the surrounding Kankakee River Basin exhibit trends consistent with statewide patterns (Figure 2-4).

- **Precipitation: Average annual precipitation across Indiana has increased by approximately 5.6 inches since 1895, though trends vary by season and region.** The largest increases have occurred in the southern part of the state, but northern Indiana, including the Kankakee Basin, has also experienced measurable gains, particularly during Spring. **Local records for Starke County show that annual precipitation has increased by about 6 inches since 1900 (Figure 2-4) (NCEI 2025), with more frequent heavy rainfall events contributing to this long-term rise.** The increase in precipitation aligns with a shift toward wetter conditions in late Winter and Spring, when snowmelt and rainfall often coincide, enhancing runoff potential and raising flood risk.

- **Temperature: Average air temperatures in Indiana have increased by approximately 1.2°F statewide since 1895, equivalent to a rate of 0.1°F per decade, with the largest amount of warming occurring in Spring which is equivalent to a rate of 0.2°F per decade.** Warming has accelerated for all four seasons since 1960, with Winter showing the most pronounced increase at roughly 0.7°F per decade (Widhalm et al. 2018a, Widhalm et al., 2018b). **Data from Starke County indicates a comparable upward trend, with mean annual temperatures increasing by roughly 2.5°F since 1900 (Figure 2-4).** Warmer Winters and earlier Spring thaws may extend the duration of rainfall liquid precipitation events while shortening the seasonal period of snow accumulation.

- **Climate variability and extremes: Recent studies have documented increasing variability in both wet and dry extremes across Indiana.** The frequency of extreme precipitation days (defined as days exceeding the 95th percentile of historical rainfall) has risen by approximately 0.2 days per decade between 1900 and 2016, translating to roughly two additional extreme rainfall days per year compared to early 20th-century averages (Widhalm et al. 2018a, Widhalm et al. 2018b). These wetter extremes are increasing at a faster rate than dry extremes, resulting in greater hydrologic volatility (Ford et al. 2021). However, the occurrence of “flash droughts,” which are short-duration droughts triggered by high evapotranspiration demand and rapid soil moisture loss, is also increasing (Otkin et al. 2018). The 2012 drought across Indiana exemplified this pattern, where limited precipitation combined with high atmospheric demand to create rapid-onset moisture deficits that affected both agricultural and natural systems.

Collectively, these long-term observations indicate that while the Kankakee Basin is trending toward higher annual precipitation and warmer average temperatures, it is also becoming more hydrologically dynamic, experiencing both heavier rainfall events and shorter, more intense dry spells. These shifts have direct implications for future surface water availability, flood management, and groundwater recharge potential within the basin.



Note: Data is from NCEI (2025) Climate at a Glance for Starke County, Indiana. Black dashed lines represent the trend over the entire historical period.

Takeaway: The past century shows a clear trend toward warmer, wetter conditions in the Study Area.

Figure 2-4. Historical Precipitation, Temperature, and Trends for Starke County, Indiana (1900 – 2020)

2.2 Hydrology

Indiana's hydrology reflects a complex interaction among geology, climate, and topography, which together shape regional water resource conditions, groundwater–surface water interactions, and flood potential.

2.2.1 OVERVIEW

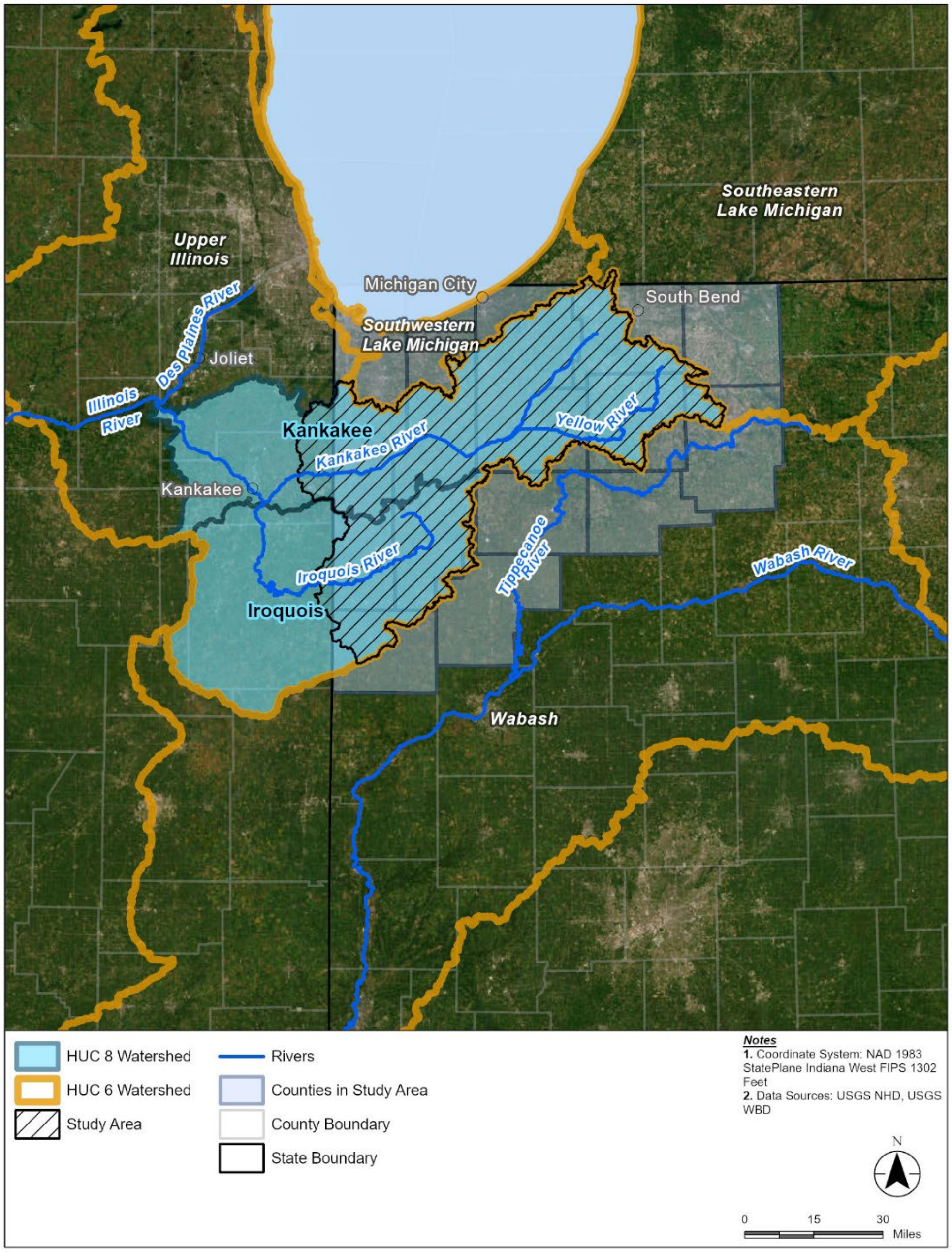
The Kankakee River, the primary surface water feature in the Study Area, originates near South Bend in northern Indiana and flows approximately 133 miles (214 kilometers) westward into Illinois, where it joins the Des Plaines River to form the Illinois River. Historically, the Kankakee River drained the Grand Kankakee Marsh, once among the largest inland wetlands in North America, and provided an important portage between the Great Lakes and Mississippi River systems. Large-scale channelization and wetland drainage projects in the late 19th and early 20th centuries significantly altered its natural course and floodplain connectivity. Today, the river traverses a predominantly agricultural landscape south of Lake Michigan and continues to serve as an essential source of water supply for agricultural, industrial, municipal, and domestic uses (Martin et al. 2016).

A watershed, or basin, encompasses all land that drains to a common outlet via interconnected streams and rivers. Watersheds exist at many scales and are hierarchical, with smaller watersheds (subbasins) comprising larger ones. The Kankakee–Iroquois River Watershed spans portions of Indiana and Illinois and drains a total area of approximately 5,153 square miles). Of this area, about 3,000 square miles lie within northwest Indiana, 2,170 square miles in northeast Illinois, and roughly 7 square miles in southwestern Lower Michigan. Major tributaries include the Yellow River, Little Kankakee River, Iroquois River, Beaver Creek, and Sugar Creek. The Iroquois River, originating in the southern portion of the watershed in Indiana, serves as a major tributary to the Kankakee River, joining it near Kankakee, Illinois.

The Study Area covers approximately 3,125 square miles within the broader Kankakee–Iroquois Watershed (Figure 2-5). The upper portion of the Study Area includes the Yellow River Watershed, which drains 435 square miles before joining the Kankakee River in Starke County, along with approximately 2,294 square miles of the Kankakee River drainage area. The Iroquois River Watershed is within the lower portion of the Study Area, which drains 686 square miles into the Iroquois River. Two additional smaller subbasins, Beaver Creek and Sugar Creek, are also located in the lower portion of the Study Area, draining approximately 60 and 85 square miles, respectively.

Streamflow in the Study Area (USGS 2025) exhibits pronounced seasonal and interannual variability, reflecting both climatic forcing and watershed storage characteristics. Table 2-1 summarizes total seasonal and annual flow volumes (in billion gallons [BG]) for the 2007–2023 period at USGS gage 05520500 (Kankakee River at Momence, Illinois). Flows are partitioned into Winter/Spring (December – May) and Summer/Fall (June – November) seasons to highlight hydrologic differences between wet and dry periods. During the 17-year period, Winter/Spring flow volumes ranged from 6,046 BG (2021) to 17,562 BG (2009), while Summer/Fall flow volumes ranged from 3,053 BG (2012) to 11,613 BG (2015). Total annual flow varied substantially, from 12,368 BG (2023, the driest year) to 26,982 BG (2008, the wettest year). These values underscore the system's hydrologic responsiveness to precipitation variability and the influence of snowmelt, storm intensity, and evapotranspiration patterns across seasons.

The ranking column in Table 2-1 provides context for hydrologic extremes within the record, identifying wet and dry years that correspond to known meteorological events. For instance, the 2008 water year, ranked 1, corresponds with above-average precipitation and widespread regional flooding, whereas 2023, ranked 17, represents a drought year characterized by below-normal precipitation and reduced baseflow. Such variability is typical of low-gradient glacial plains systems like the Kankakee, where limited topographic relief and extensive tile-drained farmland amplify both flood and low-flow responses (Adelsperger and Ficklin 2024, Adelsperger et al. 2023).



Key:
FIPS = Federal Information Processing Standard
HUC = Hydrologic Unit Code
NAD = North American Datum
NHD = National Hydrography Dataset
USGS = U.S. Geological Survey
WBD = Water Boundary Dataset

Takeaway: The Study Area sits within the Kankakee-Iroquois Watershed, a key water resource for Indiana and eastern Illinois.

Figure 2-5. Kankakee-Iroquois Watershed and Smaller Watersheds Within the Study Area

Table 2-1. Total Seasonal and Annual Flow Volumes and Ranking for USGS 05520500 Kankakee River at Momence, IL (2007 – 2023)

Takeaway: Streamflow fluctuates widely year to year from 2007 to 2023; 2008 was the wettest and 2023 was the driest.

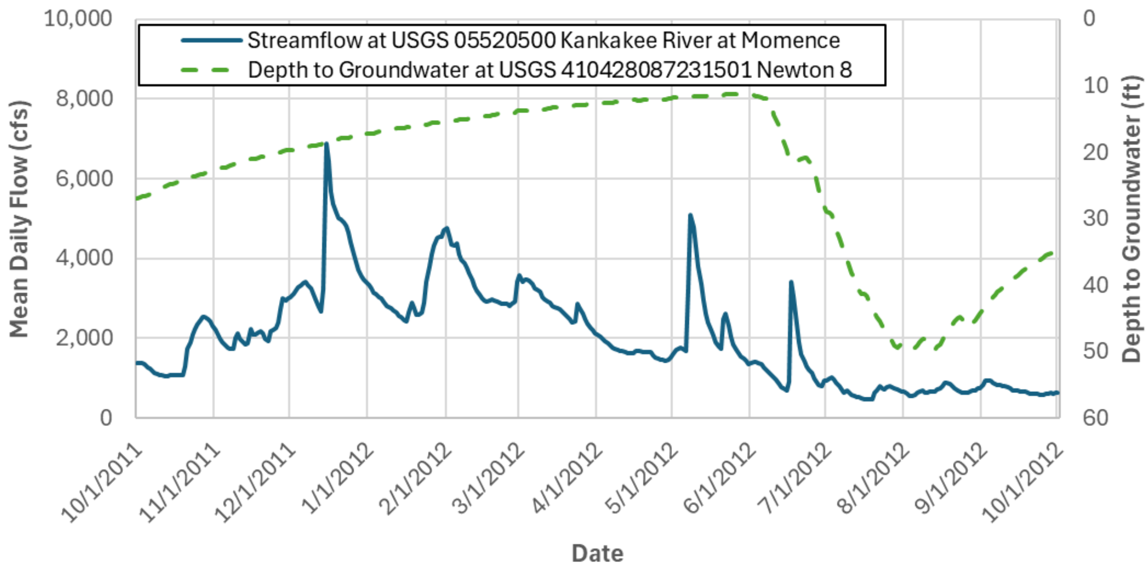
Year	Total Winter/Spring Flow Volume (BG)	Total Summer/Fall Flow Volume (BG)	Total Flow Volume (BG)	Study Period Rank
2007	14,269	6,392	20,661	6
2008	17,061	9,921	26,982	1
2009	17,562	6,692	24,254	3
2010	10,097	5,803	15,900	12
2011	11,096	8,031	19,128	9
2012	10,516	3,053	13,568	16
2013	9,178	5,876	15,054	13
2014	11,056	10,117	21,173	5
2015	9,007	11,613	20,621	7
2016	12,074	9,559	21,633	4
2017	13,178	7,280	20,458	8
2018	12,802	5,473	18,275	11
2019	14,846	9,600	24,447	2
2020	14,046	4,297	18,343	10
2021	6,046	8,372	14,418	14
2022	10,206	3,380	13,586	15
2023	8,6264	3,742	12,368	17

Key:
BG = billion gallons
USGS = U.S. Geological Survey

Seasonal variation in streamflow across the Study Area is largely governed by precipitation patterns, evapotranspiration rates, and groundwater–surface water interactions that are strongly influenced by the region's glacial geology. **In Winter and early Spring, saturated soils, limited evapotranspiration, and frequent storm events promote overland flow and groundwater recharge. During Summer and Fall, precipitation declines, soils dry, and streamflow is sustained primarily by groundwater discharge from aquifers.**

Figure 2-6 illustrates these dynamics using USGS streamflow data from gage 05520500 (Kankakee River at Momence, IL) and groundwater elevation data from well 410428087231501 (Newton 8) for the representative dry year of 2012. The solid blue line represents daily streamflow in cubic feet per second (cfs), while the dashed green line shows groundwater elevation in feet below ground surface (bgs). From October 2011 through June 2012, a sequence of Winter storms and Spring snowmelt produced multiple streamflow peaks, with discharge reaching nearly 5,000 cfs in May and June. Groundwater levels responded in parallel, reflecting rapid recharge in hydraulically connected aquifers; depth to groundwater decreased from roughly 25 feet bgs in October 2011 to about 10 feet bgs by early June 2012.

As the dry season progressed, streamflow began to decline sharply after June 2012. By July through September 2012, streamflow dropped below 1,000 cfs, and groundwater levels receded substantially, from 10 feet to nearly 50 feet bgs. This decline corresponds with the peak irrigation demand period, when increased groundwater withdrawals further lowered local aquifer levels. By late Summer, minimal precipitation, high evapotranspiration, and active pumping together produced the lowest flow conditions of the year. During this period, the river was primarily sustained by baseflow contributions from shallow aquifers, emphasizing the interdependence of groundwater and surface water systems in maintaining late-season flow in the Kankakee Basin.



Note: USGS 410428087231501 is a groundwater well located a few miles south of the Kankakee River on US Highway 41 and was completed in "Silurian-Devonian aquifers" based on the National Aquifer Code and "Silurian System" based on the local aquifer code. This groundwater monitoring well is located in Newton County, IN and near Momence, IL, and is taken to be generally representative of groundwater elevations in the floodplain-connected aquifer near Momence, IL.

Key:
cfs = cubic feet per second
ft = feet
USGS = U.S. Geological Survey

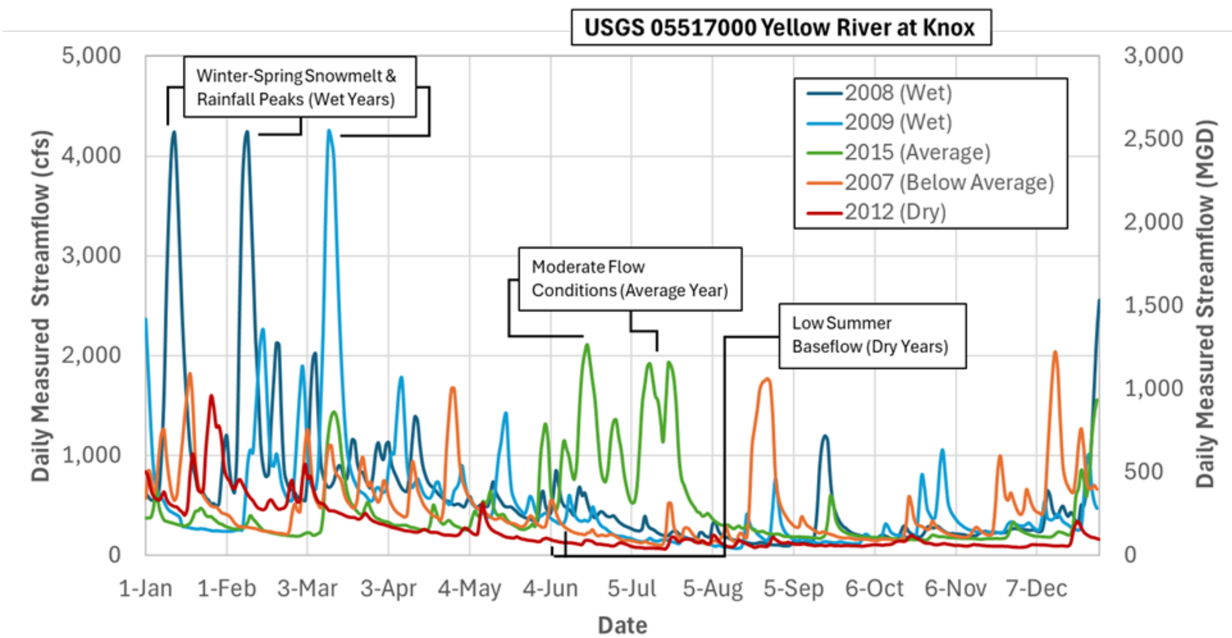
Takeaway: Streamflow and groundwater rise together in Winter-Spring 2011 – 2012, then drop sharply during the 2012 dry season.

Figure 2-6. Streamflow and Groundwater Elevation in the Study Area for October 2011 Through September 2012

To illustrate variability in daily and seasonal flow within the upper portion of the Study Area, daily streamflow records from USGS 05517000 (Yellow River at Knox, IN) were analyzed for five representative years: 2007, 2008, 2009, 2012, and 2015. These years capture a range of hydrologic conditions, including wet (2008, 2009), average (2015), below average (2007), and dry/drought (2012) periods.

As shown in Figure 2-7, wet years such as 2008 and 2009 exhibit pronounced Winter and early Spring peaks, with flows frequently exceeding 3,000 to 4,000 cfs. These high-flow periods reflect the combined influence of snowmelt and rainfall events typical of the region’s late Winter to early Spring season. In contrast, the dry year (2012) and below-average year (2007) display substantially reduced streamflow magnitudes and flatter hydrographs, with minimal peak events through the Summer and Fall months, corresponding to lower precipitation totals and higher evapotranspiration. The average year (2015) shows moderate flow conditions, with occasional peaks that Fall between the extremes of wet and dry years.

This range of hydrographs demonstrates the strong dependence of streamflow on seasonal precipitation and antecedent soil moisture. Maximum and minimum daily streamflow values for these years range from 4,250 cfs (2,747 million gallons per day (MGD)) in 2015 to 1,600 cfs (1,034 MGD) in 2012, and from 160 cfs (104 MGD) in 2014 to 68 cfs (44 MGD) in 2012, respectively, illustrating the significant impact of hydrologic extremes on basin response.

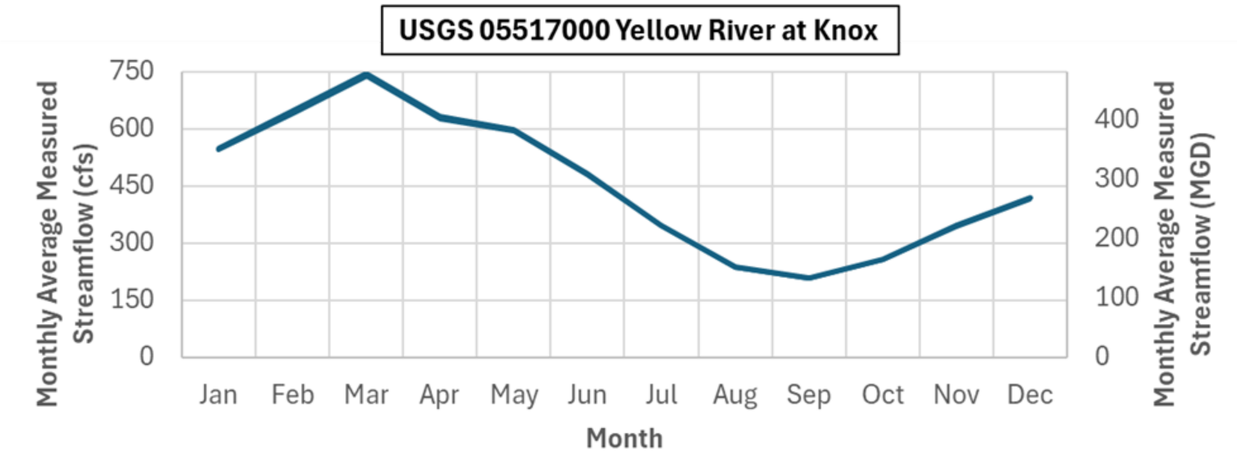


Note: USGS 05517000 is located at the outlet of the blue shaded subbasin in the inset map.
Key:
MGD = million galllons per day
cfs = cubic feet per second
USGS = U.S. Geological Survey

Takeaway: Wet years show big Winter peaks, while dry years flatten out with minimal Summer flow.

Figure 2-7. Daily Streamflow Hydrographs at USGS 05517000, Yellow River at Knox, IN, for Five Years (2007, 2008, 2009, 2012, and 2015), Highlighting the Variability in Flow Across Wet, Average, Below Average, and Dry Hydrological Conditions

The long-term average monthly streamflow (2007 – 2023), shown in Figure 2-8, follows a distinct seasonal pattern characteristic of northern Indiana rivers. Flows are highest in late Winter and early Spring, peaking in March at 739 cfs (478 MGD), as rainfall and snowmelt combine to produce elevated discharge. Streamflow gradually declines through Summer and early Fall, reaching a minimum of 209 cfs (135 MGD) in September, before recovering in late Fall as precipitation increases and evapotranspiration declines. Annual average streamflow for this period varies from 265 cfs (171 MGD) in 2012 (dry year) to 621 cfs (402 MGD) in 2008 (wet year), reinforcing the relationship between climatic variability and stream response in the Yellow River Watershed.



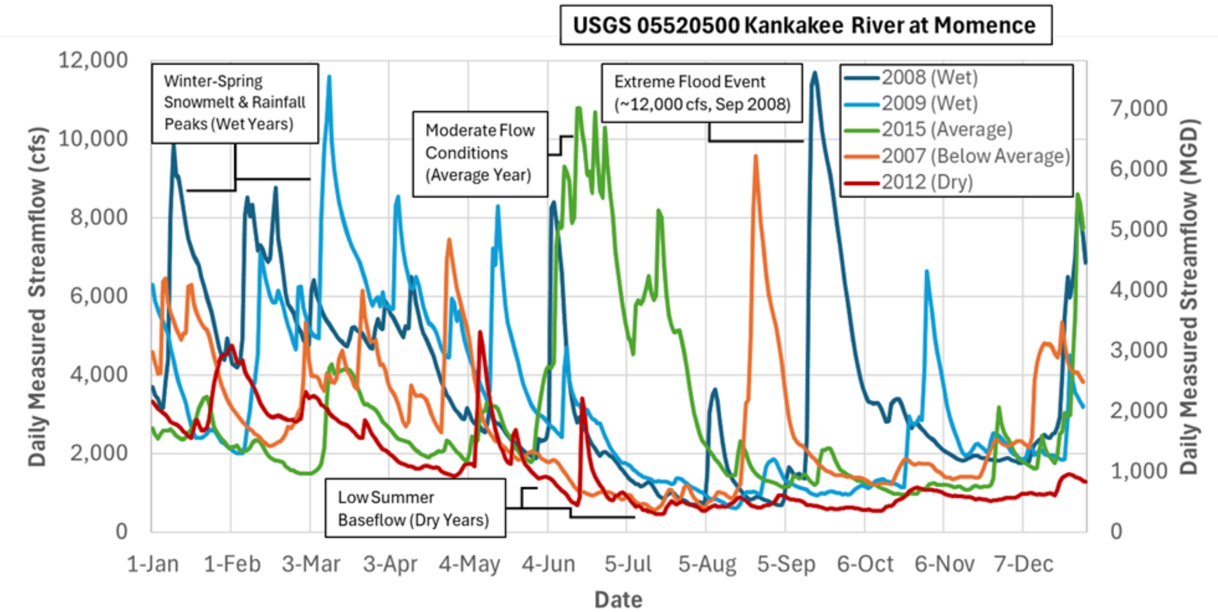
Key:
cfs = cubic feet per second
MGD = million galllons per day
USGS = U.S. Geological Survey

Takeaway: The Yellow River peaks in March and hits its low in September, following a clear seasonal flow cycle.

Figure 2-8. The Hydrograph of Monthly Average Measured Streamflow at U.S. Geological Survey 05517000 Yellow River at Knox, IN (2007 – 2023)

Streamflow along the Kankakee River shows a clear downstream increase in discharge through the Study Area, reflecting cumulative inflow from tributaries and the river's extensive drainage network. Near the upstream end at Davis, IN, average daily flow is approximately 622 cfs (402 MGD), while at the downstream end near Momence, IL, the average daily flow more than doubles to 2,611 cfs (1,688 MGD).

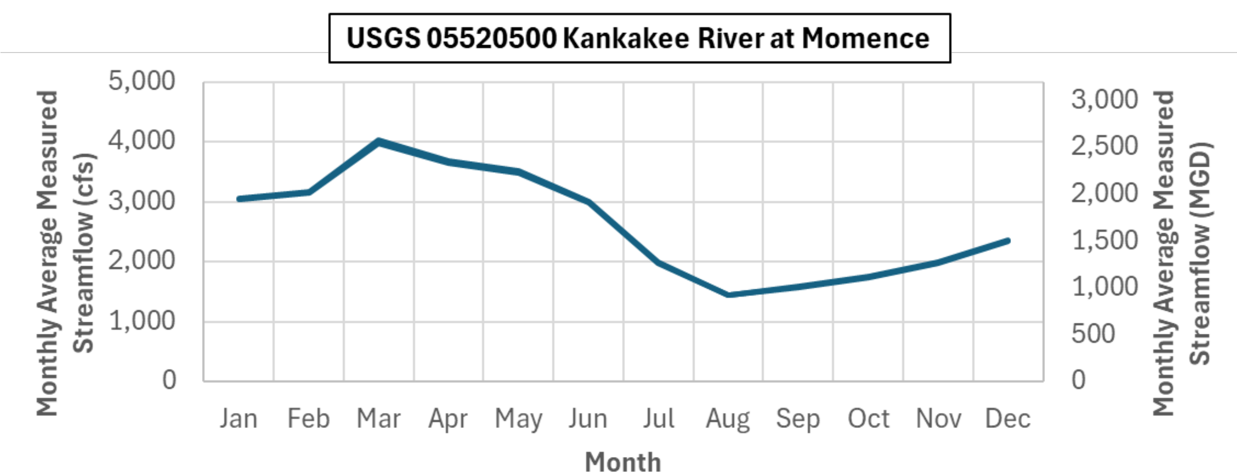
Figure 2-9 presents daily streamflow for five representative years (2007, 2008, 2009, 2012, and 2015) at USGS 05520500 (Kankakee River at Momence, IL). Similar to the Yellow River, wet years (2008 and 2009) display distinct Winter and early Spring peaks, often exceeding 8,000-10,000 cfs, driven by heavy rainfall and snowmelt across the watershed. The year 2008 in particular includes an exceptional September peak (~12,000 cfs) associated with widespread regional flooding. These high-flow events underscore the responsiveness of the Kankakee River to both seasonal precipitation and large-scale storm systems. In contrast, dry and below average years (2012 and 2007) are characterized by low, stable flows with minimal variability, reflecting limited precipitation and reduced groundwater contribution during the growing season. The average year (2015) exhibits intermediate flows with occasional peaks that, while less frequent than in wet years, remain more variable than in the Yellow River due to the Kankakee's larger drainage area and cumulative inflows. Maximum daily streamflow during the study years ranged from 11,700 cfs (7,562 MGD) in 2008 to 5,099 cfs (3,296 MGD) in 2012, while minimum flows ranged from 950 cfs (614 MGD) in 2014 to 456 cfs (295 MGD) in 2012. These values highlight the basin's sensitivity to annual precipitation and underscore the role of upstream catchments in moderating downstream hydrologic conditions. The long-term monthly average hydrograph (Figure 2-10) shows a seasonal cycle consistent with the Yellow River: flows peak in March (3,987 cfs; 2,577 MGD) and reach their lowest values in August (1,440 cfs; 931 MGD). This seasonal signal reflects typical Midwestern hydrology, where high Spring runoff transitions to low Summer baseflow sustained primarily by groundwater discharge.



Note: USGS 05520500 is located at the outlet of the blue shaded subbasin in the inset map.
Key:
cfs = cubic feet per second MGD = million galllons per day USGS = U.S. Geological Survey

Takeaway: Wet years bring big Winter peaks (and a major September 2008 flood) on the Kankakee River, while dry years stay low and steady.

Figure 2-9. Daily Streamflow Hydrographs at U.S. Geological Survey 05520500 Kankakee River at Momence, IL, for Five Years (2007, 2008, 2009, 2012, and 2015), Highlighting the Variability in Flow Across Wet, Average, Below Average, And Dry Hydrological Conditions



Key:
cfs = cubic feet per second; MGD = million galllons per day; USGS = U.S. Geological Survey

Takeaway: The Kankakee River peaks in March due to snowmelt and bottoms out in August, following a clear seasonal flow cycle.

Figure 2-10. The Hydrograph of Monthly Average Measured Streamflow at U.S. Geological Survey 05520500 Kankakee River at Momence, IL (2007 – 2023)

2.2.2 TRENDS

Long-term streamflow trends across Indiana have been the subject of numerous studies aimed at identifying whether river flow volumes are increasing, decreasing, or remaining relatively stable over time (e.g., Ficklin et al. 2018, Cherkauer et al. 2021). Most studies indicate that streamflow has been increasing on an annual basis, consistent with statewide increases in precipitation. For example, previous Indiana regional water studies (Letsinger and Gustin 2024, Stantec 2025) found upward trends in annual river flows and groundwater levels over the past three decades, with the greatest increases occurring during the Winter and Spring. Similarly, a statewide water balance assessment (Letsinger et al. 2021) showed that average annual groundwater recharge has increased across all seasons from 2000 – 2019 compared to 1980 – 1999, with recharge occurring earlier in the year (shifting from Spring to Winter) and the largest gains observed in near-stream or outwash aquifers. These patterns reflect the influence of more frequent and intense precipitation events and shorter recharge durations typical of Indiana's changing climate.

To evaluate whether similar seasonal trends are evident in the Kankakee Basin Study Area, a Mann-Kendall trend analysis was performed using daily flow data from six USGS stream gages and groundwater elevation data from two USGS monitoring wells (see Figure B-1 for a map of streamflow gage locations). The analysis covered the 1990 – 2023 period, representing a 30-year baseline consistent with climate analysis standards and capturing recent changes in precipitation, withdrawals, and hydrologic conditions. Seasonal totals were calculated for Winter (December – February), Spring (March – May), Summer (June – August), and Fall (September – November). For each gage or well, the Mann-Kendall test was used to determine both the direction of change (positive = increasing, negative = decreasing) and the statistical significance of the observed trend.

Results are summarized in Table 2-2. Overall, the findings indicate modest but consistent seasonal trends:

- **Spring and Summer flows show a general increasing signal, suggesting rising discharge volumes over time.**
- **Winter and Fall flows exhibit a decreasing signal, though magnitudes are small and not statistically significant.**
- Groundwater elevations at both monitoring wells (Newton 8 and Jasper 7) indicate a gradual rise in water levels, or decreasing depth to groundwater, across most seasons, also without statistical significance. **However, the two selected monitoring wells are both located in deeper bedrock aquifers (approximately 130 to 150 feet), which may respond differently to climate variability, pumping, and short-term drought stress than the shallow sand-and-gravel aquifers that dominate much of the Kankakee Basin.**

Although none of the trends reach the 90% confidence level, their direction aligns with statewide findings of increasing Spring and Summer runoff and decreasing Fall and Winter baseflow. These patterns are consistent with a regional hydrologic shift toward greater precipitation intensity and seasonality, where wetter Springs and drier late Summers are becoming more common. Such changes have implications for recharge timing, irrigation water availability, and long-term aquifer sustainability across the Kankakee Basin.

Recent hydrologic assessments also indicate that groundwater conditions in northern Indiana vary widely by aquifer type and location. Several nearby wells in or near the basin, such as LaPorte 9 (shallow sand and gravel) and Jasper 13 (deeper bedrock), show stable or declining long-term groundwater levels (USGS 2025b, 2025c). Additionally, the 2025 water year has produced some of the lowest groundwater levels observed statewide, associated with prolonged drought and multi-season precipitation deficits (NOAA 2025a; Purdue University 2025).

Table 2-2. Mann Kendall Analysis on U.S. Geological Survey Gages from 1990 – 2023

Takeaway: Observed Spring and Summer flows show slight increases, while some groundwater levels are steady.[3]

U.S. Geological Survey Gage (Subbasin)	Mann Kendall Slope and Significance[1] for Seasonal Flow Volumes or Depth to Groundwater[2]			
	Winter	Spring	Summer	Fall
05517000 Yellow River at Knox, IN (01)	-	-	-	-
05515500 Kankakee River at Davis, IN (02)	+	+	+	+
05517530 Kankakee River at Kouts, IN (03)	-	+	-	-
05518000 Kankakee River at Shelby, IN (04)	-	+	+	-
05520500 Kankakee River at Momence, IL (05)	-	+	-	-
05525000 Iroquois River at Iroquois, IL (07)	+	+	+	-
410428087231501 Newton 8 (groundwater elevation) (05)[3]	+	+	+	+
410809087580801 Jasper 7 (groundwater elevation) (07)[3]	-	+	+	-

Notes:
[1] One "+" sign equals increasing and one "-" sign equals decreasing but not statistically significant at a 90% significance level.
[2] For groundwater, one "-" sign indicates lower groundwater elevations or increasing depth to groundwater, while one "+" sign indicates increasing groundwater elevations or decreasing depth to groundwater.
[3] Groundwater trends shown here reflect only two USGS monitoring wells within the Study Area and should not be interpreted as representing basin-wide conditions. Several nearby wells show declining or mixed trends during the 2024–2025 drought period (NOAA 2025; Purdue University 2025; USGS 2025b). Additionally, the two wells included in this analysis (Newton 8 and Jasper 7) are both located in deeper bedrock aquifers (approximately 130-150 ft), which may respond differently to climate variability and short-term drought stress than the shallower sand-and-gravel aquifers that dominate much of the Kankakee Basin.
Key:
IL = Illinois
IN = Indiana

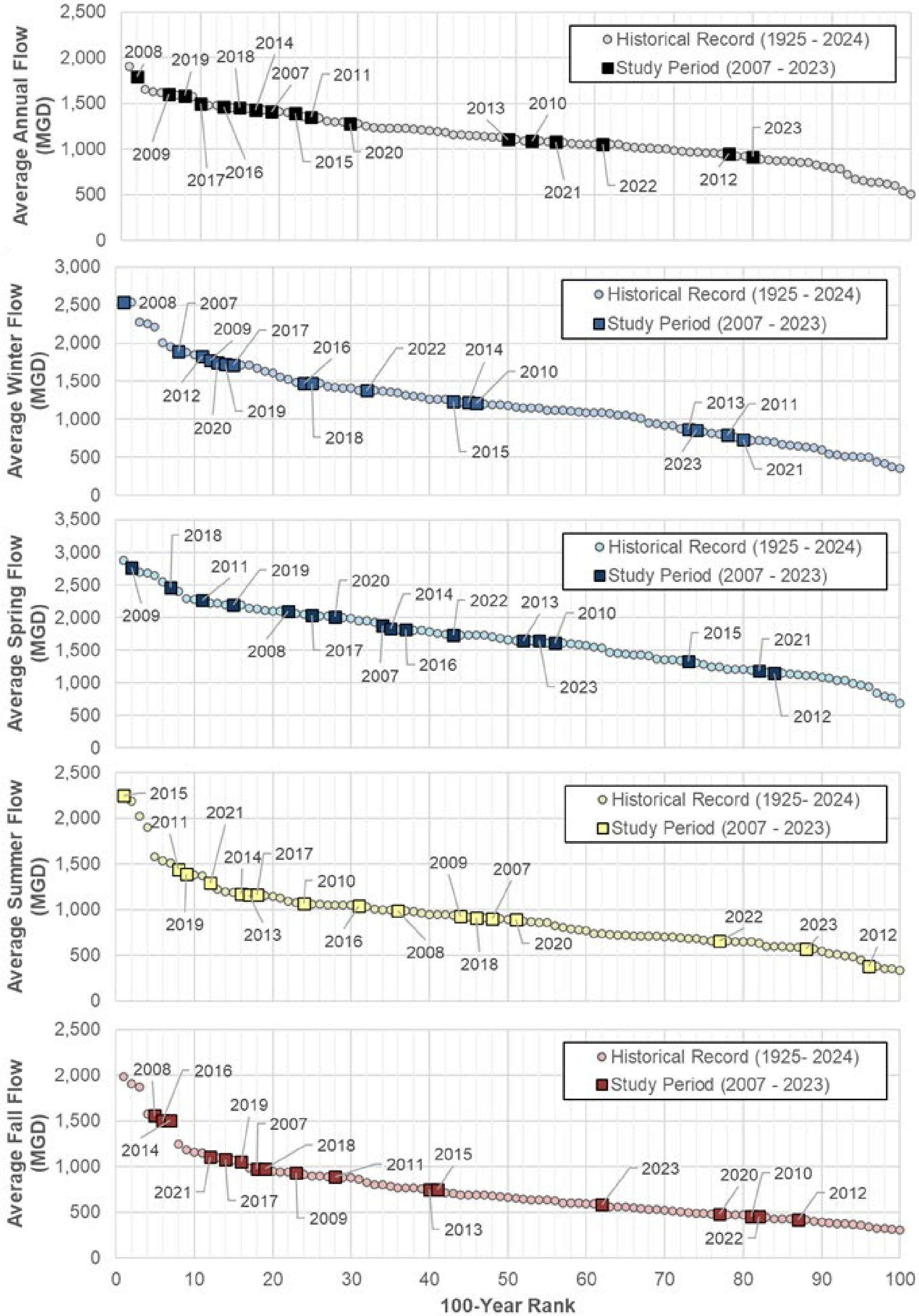
The results of the streamflow and groundwater elevation trend analysis generally align with findings from recent statewide and regional studies (Letsinger et al. 2021, Letsinger and Gustin 2024, Stantec 2025). Consistent with those studies, the Kankakee Basin analysis indicates increasing streamflow volumes in Spring and rising groundwater elevations in some aquifer systems, reflecting wetter conditions during the early part of the year. However, unlike the broader statewide results, this study also shows higher Summer streamflow volumes and lower Winter volumes, suggesting localized hydrologic responses that differ from statewide averages. As noted by Letsinger et al. (2021), shifts in seasonal precipitation patterns, particularly increased Winter rainfall and more intense Spring storm events, are altering groundwater recharge timing and distribution. Recharge is increasingly occurring during Winter and early Spring and is concentrated in near-stream and outwash aquifers, where rapid runoff from intense rainfall promotes infiltration in low-lying areas but limits recharge on upland slopes. These findings suggest that the outwash aquifers along the Kankakee River and its tributary subbasins will likely continue to experience active replenishment under future conditions, supported by projected increases in Spring and Summer precipitation, streamflow, and recharge potential.

To evaluate how recent hydrologic conditions compare with the long-term record, an additional trend and ranking analysis was performed using streamflow data from USGS 05518000 (Kankakee River at Shelby, IN). Annual flow volumes for the 2007–2023 study period were compared with the full 100-year record (1925–2024), along with corresponding seasonal averages for Winter (December – February), Spring (March – May), Summer (June – August), and Fall (September – November). The results, shown in Figure 2-11, illustrate how recent hydrologic behavior aligns within the longer-term historical context.

Across the century-long record, the recent study period contains a greater concentration of high-flow years. Eleven of the wettest 25 years on record occurred since 2007, indicating that the past two decades have been generally wetter than average. Conversely, five years, including the drought years 2012 and 2023, rank in the lower half of the historical record, underscoring the persistence of inter-annual variability even within an overall wetter trend.

Seasonally, Winter, Spring, and Summer flows tend to rank in the upper 50% of the historical distribution, reflecting more frequent high-flow conditions in recent decades. This pattern supports documented increases in precipitation intensity and extreme rainfall events across Indiana. In contrast, Fall flow volumes display a wider distribution, with several recent years, such as 2015, 2018, and 2021, ranking below the historical median, suggesting that late-season flow variability remains high.

The year-to-year variation further demonstrates the dynamic nature of the basin's hydrology. For instance, 2011, one of the wettest years on record, was immediately followed by 2012, one of the driest. Similarly, 2021 experienced unusually low Winter flows, within the lowest 25% of recorded historical hydrology, but relatively high Summer flows, ranking among the top quartile for that season. Such "inverted" years highlight the influence of shifting precipitation timing and seasonal redistribution of runoff.



Key:
MGD = Million gallons per day

Takeaway: The study period (2007 – 2023) captures the full range of water year types, from dry to wet, but is weighted toward wetter years.

Figure 2-11. Ranking of Annual (top), Winter (second), Spring (third), Summer (fourth), and Fall (bottom) Kankakee River Flow Volume at U.S. Geological Survey 05518000 Near Shelby, IN (1925 – 2024)

Overall, the 2007 – 2023 period is weighted toward wetter conditions compared to the long-term record. While the period includes both wet and dry years, drought events appear less frequent and shorter in duration than in earlier decades. Using this recent 17-year window as a baseline for historical and future water availability analyses is appropriate, given its representation of current climatic and hydrologic patterns. However, the analysis also carries an inherent limitation: the recent data may underestimate the frequency and severity of low flows and drought. Future studies incorporating extended climate simulations or drought-frequency modeling could better assess future frequency and severity of long-term shifts in low-flow and drought behavior (Adelsperger and Ficklin 2024).

2.3 Geology and Hydrogeology

The geology in the Kankakee River Basin features unconsolidated glacial deposits that overlie sedimentary bedrock. The unconsolidated and bedrock aquifers within the watershed serve as important water supply sources for municipal, domestic, irrigation, and industrial use. An aquifer is a portion of a geologic unit that is sufficiently saturated to provide usable quantities of groundwater to wells and Springs. The hydrogeologic conditions of the different unconsolidated and bedrock aquifers are presented in detail in “Water Resources Availability in the Kankakee River Basin, Indiana” (IDNR 1990).

2.3.1 GEOLOGY

The unconsolidated deposits of the Kankakee River Basin originated from the Wisconsin and Pre-Wisconsin glacial events and eolian, fluvial, and alluvial deposition and primarily consist of till, intertills, outwash, and other morainal deposits. Sand and gravel outwash deposits span from the Illinois border to the central and northeastern portion of the watershed, while till and intertill deposits are present in the eastern and southern sections of the Kankakee River Basin. Deposits of fine to medium-grained sands are present in the central and southeastern Kankakee River Basin with flanking deposits of till and outwash to the north and south.

As shown in Figure 2-12, glacial deposits include the Valparaiso Moraine, Iroquois Moraine, Iroquois Lowland, Nappanee Till Plain, and Valparaiso Outwash Fan. The outwash deposits in the Upper Kankakee River Basin in St. Joseph County are thicker and more complex with gravel lenses, compared to the simpler glacial deposits in the west. Eolian sands occupy the southeast portion of the Kankakee River Basin in Starke and Marshall counties. Intertill gravel and sand lenses are present in the deeper sections of the eolian sands. The thicknesses of the unconsolidated deposits are generally greatest where morainal topographic highs overlie bedrock valleys, and smallest where rivers overlie bedrock highs.

The bedrock topography of the Kankakee River Basin is a result of bedrock structure and stream and glacial erosion. The bedrock structure in northern Indiana is largely influenced by the Kankakee Arch, a broad, upward bow of the bedrock surface trending from the northwest corner of Indiana to the southeast. The bedrock surface dips from the crest of the arch with a general gradient of 35 feet per mile. The oldest rocks at the bedrock surface occur along the Kankakee Arch, where erosion has shaved off the surface, and younger rocks are present along the slopes of the arch towards neighboring basins (IDNR 1990). South-central Newton County features a structural disturbance called the Kentland impact structure. The structure covers about 5 square miles, has been uplifted over 2,000 feet vertically, and includes complexly folded, faulted, and truncated bedrock. The Kentland impact structure does not serve as a feasible bedrock water source and has been omitted from Section 2.4.2 Hydrogeology.

The sedimentary rocks in the Kankakee River Basin consist of consolidated and cemented shale, siltstone, sandstone, limestone, and coal. The Silurian dolomite and limestone rocks are the oldest in the Kankakee River Basin and are part of the Wabash Formation. Overlying these rocks, Devonian dolomite, limestone, and evaporite deposits belonging to the Muscatatuck Group make up much of the basin's bedrock surface. The Upper Devonian Antrim Shale, consisting of brown to black non-calcareous shale, lies above the Muscatatuck Group on the northeastern slope of the Kankakee Arch. Also overlying the Muscatatuck Group is the Upper Devonian to Lower Mississippian New Albany Shale on the southwestern slope of the Kankakee Arch. The New Albany Shale consists of green to gray shale, brown to black carbonaceous shale, and small amounts of limestone and dolomite. The New Albany Shale often correlates with the Antrim Shale of the Michigan Basin (Shaffer et al. 1983). The Devonian and Mississippian Ellsworth Shale is made up of gray-green shale with limestone and dolomite lenses in the upper part of the unit and alternating gray-green and black-brown shales in the lower part. The Ellsworth shale occupies a large area of the bedrock surface in the northeastern part of the Kankakee River Basin. The Mississippian Borden Group occupies the bedrock surface in the southwest portion of the Kankakee River Basin and consists of gray siltstone and shale with interbedded limestone lenses.

2.3.2 HYDROGEOLOGY

The hydrogeologic setting within the Kankakee River Basin consists of glacial, eolian, fluvial, and alluvial deposited unconsolidated aquifers. The unconsolidated aquifers can be distributed into four defined lithologic descriptions (IDNR 2011): surficial sand and gravel (alluvial deposits, outwash till, and moraines), buried sand and gravel (outwash, complex till, and moraines), discontinuous buried sand and gravel (till and outwash plains), and sand and gravel aquifers in the Kankakee River and tributary valleys (alluvial and outwash).

Similarly, the IDNR grouped similar bedrock units into five bedrock aquifer systems. These aquifer units were derived from maps produced by Gray et al. (1987) and are referred to as: Coldwater, Ellsworth, and Antrim Shales (shales and minor amounts of limestone), Silurian and Devonian Carbonates (Wabash Formation and Muscatatuck Group), New Albany Shale (shale), and the Borden Group (argillaceous siltstone and shale, some fine-grained sandstone, interbedded limestone lenses). The IDNR considers the Raccoon Creek Group as its own aquifer unit; however, the Raccoon Creek Group is not a significant topic in this report, as it is only found at the Kentland impact structure.

2.3.2.1 Unconsolidated Aquifers

Unconsolidated aquifers, as shown in Figure 2-12, provide approximately 83% of all groundwater used in the Kankakee River Basin. The unconsolidated aquifers in the basin consist of glacial deposits such as intertill sand and gravel, outwash, and morainal complexes and eolian deposits. Unconsolidated aquifer systems have gradational boundaries and individual aquifers may extend across the boundaries of aquifer systems (IDNR 1990). The significant water withdrawal facilities (SWWF) are shown in Figure 2-13 along with approximate maximum yields for the respective aquifer units.

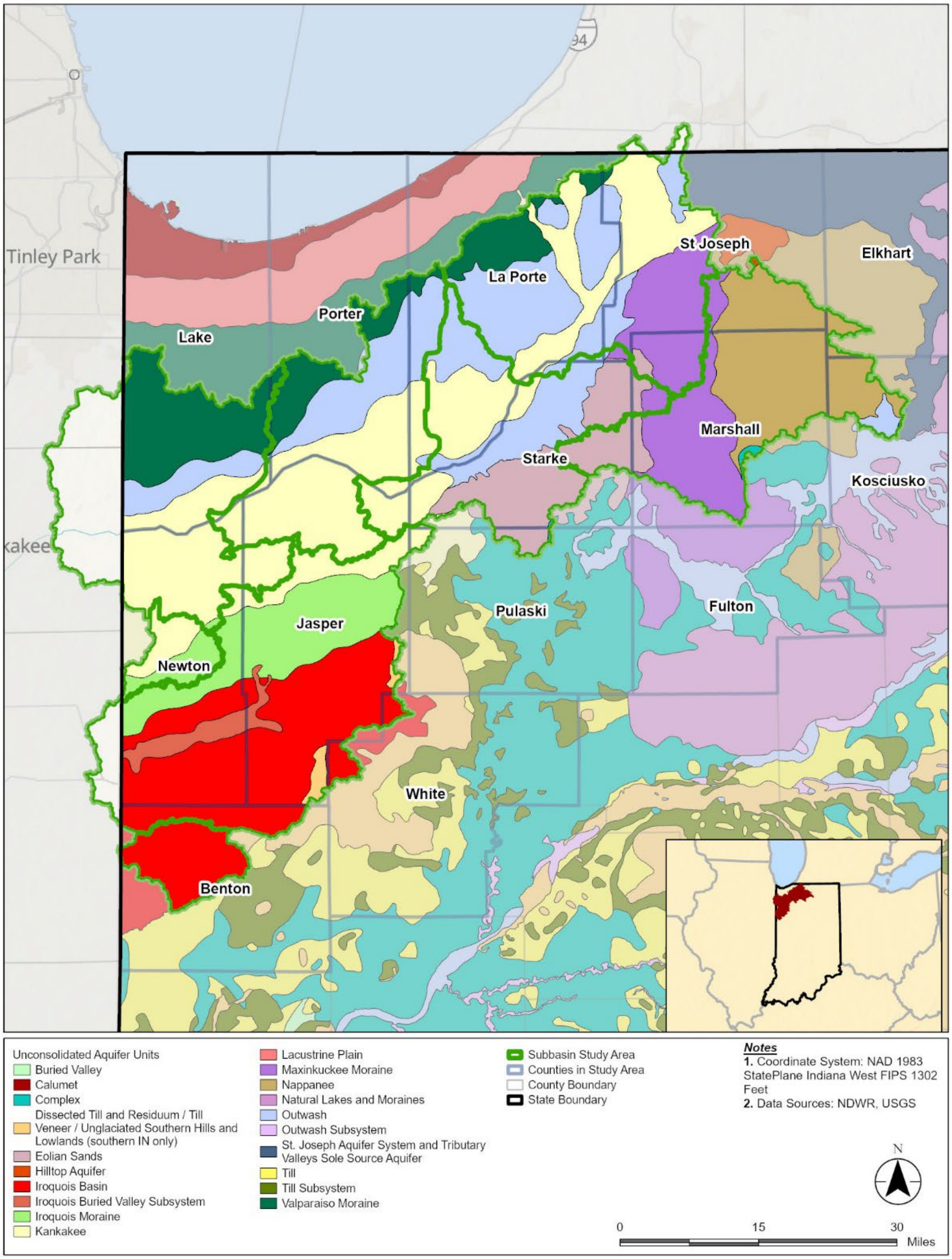
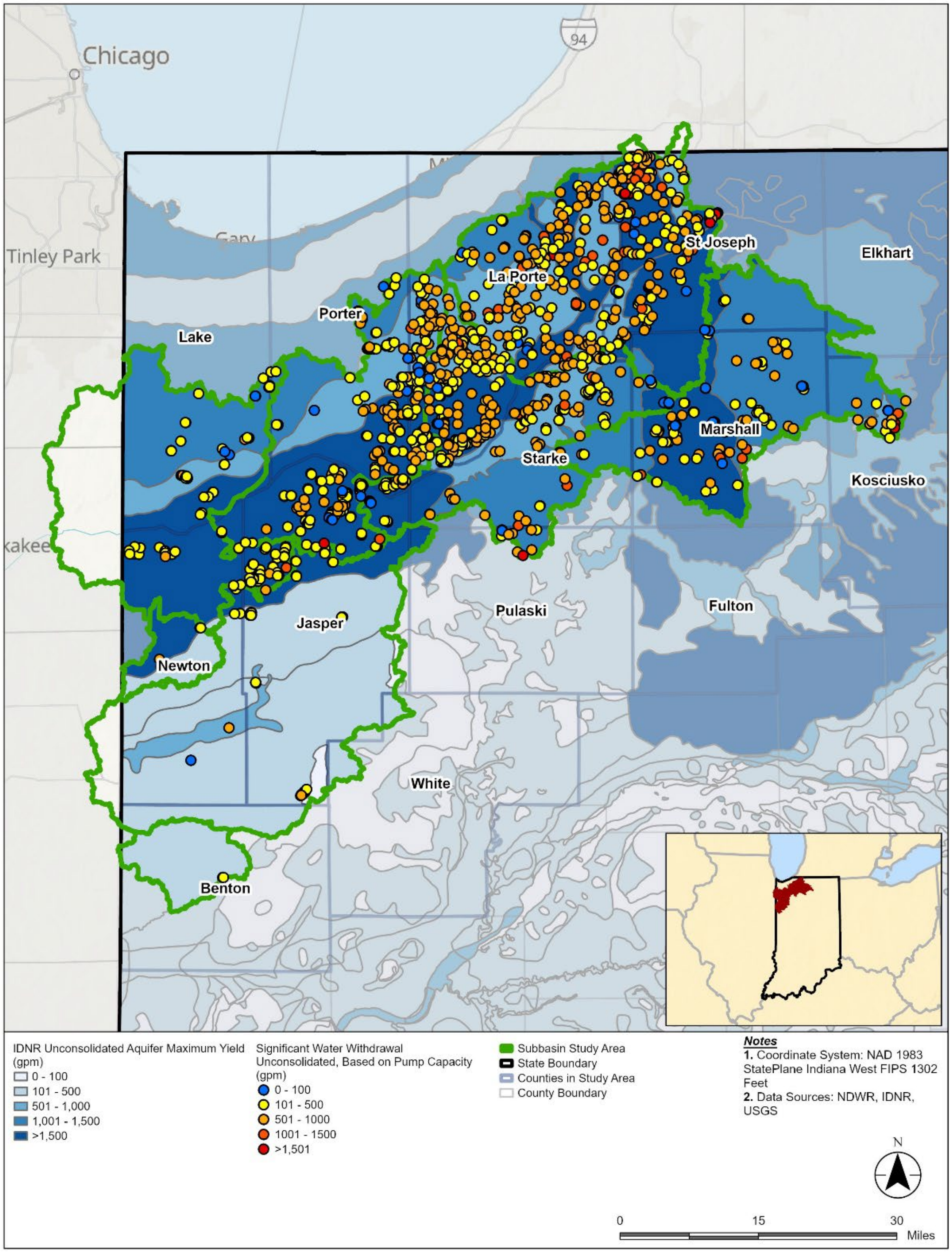


Figure 2-12. Unconsolidated Aquifers in the Kankakee River Basin



Notes: Also illustrated are the locations and yields (Gallons per Minute) of Active Significant Water Withdrawal Facilities and wells completed in the Unconsolidated Aquifers.

Figure 2-13. Maximum Yields (Gallons per Minute) Associated with the Various Unconsolidated Aquifers Within the Kankakee River Basin

Water Resources Availability in the Kankakee River Basin, Indiana (IDNR 1990) presents findings on estimated recharge within the Study Area. Recharge rates are dynamic and fluctuate in response to the magnitude and duration of precipitation events, drought, impervious surfaces, soil moisture, and surface water runoff among other variables. Nevertheless, these recharge estimates provide a relative sense of how much different aquifers may be replenished annually, Recharge ranges from 50,000 to 500,000 gpd/square mile. The highest recharge values are found in the unconfined outwash systems, St. Joseph and Tributary Valley and Kankakee, Hilltop, and Valparaiso Outwash Apron Aquifer Systems. The distribution of high-capacity unconsolidated wells corresponds with these aquifer systems and recharge rates. According to IDNR, the Kankakee and Valparaiso Outwash Apron Aquifer Systems make up 70% of the total recharge to the basin.

Generally, the unconsolidated aquifers are permeable and can provide ample amounts of groundwater, but there are places where the unconsolidated deposits are less permeable and less likely to provide sufficient groundwater. A series of aquifer tests in northwestern Indiana determined transmissivities ranged from approximately 300 to 27,000 square feet per day (ft^2/day) (Arihood and Basch 1994). A later study reviewed 101 aquifer tests that were completed in these aquifers across Indiana and western Ohio and determined transmissivities of the glacial aquifers ranged from 300 to 69,700 ft^2/day and storage coefficients ranged from 0.00002 to 0.38 (Eberts and George 2000). The same study found that vertical hydraulic conductivities from the wells completed in glacial deposits range from 0.0001 to 0.77 feet per day.

The majority of the active high-capacity wells in Figure 2-13 are found in unconfined sand and gravel deposits in the Kankakee River and tributary basins, outwash deposits along the Kankakee River valley, surficial intertill sands and gravels, complex morainal deposits, and buried bedrock valleys. Most productive unconsolidated facilities are located in the Kankakee, Outwash, Valparaiso Moraine, and Eolian Sands aquifer systems in the northern portion of the Kankakee River Basin (Figure 2-12 and Figure 2-13).

The unconsolidated aquifers overlying the Coldwater, Ellsworth, and Antrim Shales include the Valparaiso Moraine, Outwash, Kankakee, Eolian Sands, Maxinkuckee Moraine, Nappanee, and Iroquois Moraine. Active well production rates in these unconsolidated aquifers range from 7 to 2,500 gallons per minute (GPM) with 93% of wells producing over 100 GPM (IDNR 2025). The recharge rates of these aquifers contribute to their productivity. The two highest yielding unconsolidated aquifers include the Kankakee and Outwash aquifers, whose estimated recharge rates are 500,000 and 300,000 gpd/square mile, respectively (IDNR 1990). The maximum yield of these aquifers is expected to range from 500 GPM to over 1,500 GPM (Figure 2-13). The western portions of these aquifer systems are generally less utilized than the northern and eastern portions. This suggests that the western portions may be more variable in geology and hydrogeologic characteristics. Significant water withdrawal facilities in this area generally report pump capacities from 101 to 500 GPM, but some wells have pump capacities from 500 to over 1,501 GPM.

Within the southern Jasper and Newton Counties, only 32 active unconsolidated wells are present in the Iroquois Moraine, Iroquois Basin, Iroquois Buried Valley Subsystem, and Dissected Till Aquifers. The capacities of these 32 active wells range from 50 to 800 GPM (IDNR 2025). The Iroquois Basin, Iroquois

Buried Valley Subbasin, Iroquois Moraine, and Dissected Till aquifers overlie the Silurian and Devonian Wabash Formation and Muscatatuck Group.

Along the northern and southeastern margins of the basin, the Valparaiso Moraine, Eolian Sands, and Nappanee aquifer systems are estimated to produce yields up to 1,500 GPM. These aquifer systems are much less utilized compared to the Kankakee and Outwash systems. Additionally, the estimated recharge rates for these aquifers range from 125,000 to 200,000 gpd/square mile. In general, the groundwater development potential throughout the unconsolidated aquifers is high in the northern portion of the Kankakee River Basin, with favor leaning towards less utilized zones in the far western and eastern portions of the basin.

2.3.2.2 Bedrock Aquifers

Sedimentary rock types and characteristics strongly influence the bedrock aquifers, water availability, and the amount of groundwater each aquifer will yield. Fracturing caused by weathering and unloading of the bedrock units is present in the upper zone of the Silurian and Devonian carbonate aquifer system. At depths of 250 to 300 feet below land surface, bedrock fractures are generally thought to not transmit water. The bedrock aquifers in the area are more permeable toward the bedrock surface due to weathering and dissolution that have increased aquifer permeability (IDNR 1990). Because of this, upper bedrock layers are more suitable as water sources and more productive aquifers. The rock types of the upper bedrock aquifers range from unproductive shales to highly productive limestones and dolomites (IDNR 1990). Some bedrock aquifers have hydrogeologic characteristics that are suitable for the completion of high yield wells, but the overlying strata limits or prevents recharge to the bedrock. At the same time, the bedrock aquifers in some other areas are not used where the high yield characteristics of the overlying unconsolidated aquifers are preferred.

Recharge rates to the bedrock aquifers in the Study Area are strongly influenced by the overlying unconsolidated aquifer deposits. Where clay or till predominantly compose the unconsolidated units, recharge to underlying bedrock aquifers is limited. Silurian and Devonian carbonate aquifers that are overlain by outwash sand and gravel are expected to have higher recharge rates than areas covered by till.

The Coldwater, Ellsworth, and Antrim Shales, which cover approximately 60% of the upper Kankakee River Basin, supply groundwater to only 20 active bedrock wells due to the presence of shales and overlying productive unconsolidated aquifers (Figure 2-14). The limestone and shales of the Coldwater, Ellsworth, and Antrim Shales underlie 50 to 300 feet of unconsolidated deposits. In the western portion of the watershed, bedrock aquifers are favored over unconsolidated aquifers due to a relatively thin mantle of unconsolidated deposits atop carbonate bedrock aquifers. In the western portion of these units, the unconsolidated thickness ranges from approximately 50 to 100 feet thick, making access to the bedrock aquifers easier and favors development of groundwater from the more productive bedrock aquifers.

The SWWFs are shown in Figure 2-14 in relation to the bedrock aquifer units. Of the bedrock aquifers in the Kankakee River Basin, groundwater is mainly supplied from the Silurian and Devonian Carbonate aquifers. These aquifers include the Wabash Formation and Muscatatuck Group which yield between 40 to 2,000 GPM to 133 active wells, 97% of wells producing 100 GPM or more (IDNR 2025). Significant withdrawal wells have been reported to penetrate to depths of 550 feet while domestic wells commonly penetrate 15 to 150 feet of carbonate bedrock (IDNR 2025). The general thickness of the Silurian and Devonian Carbonate aquifer system is estimated to reach 1,000 feet. Silurian and Devonian aquifer transmissivities range from 70 to 28,000 ft^2/day and storage coefficients ranging from 0.00005 to 0.01 (Casey 1994).

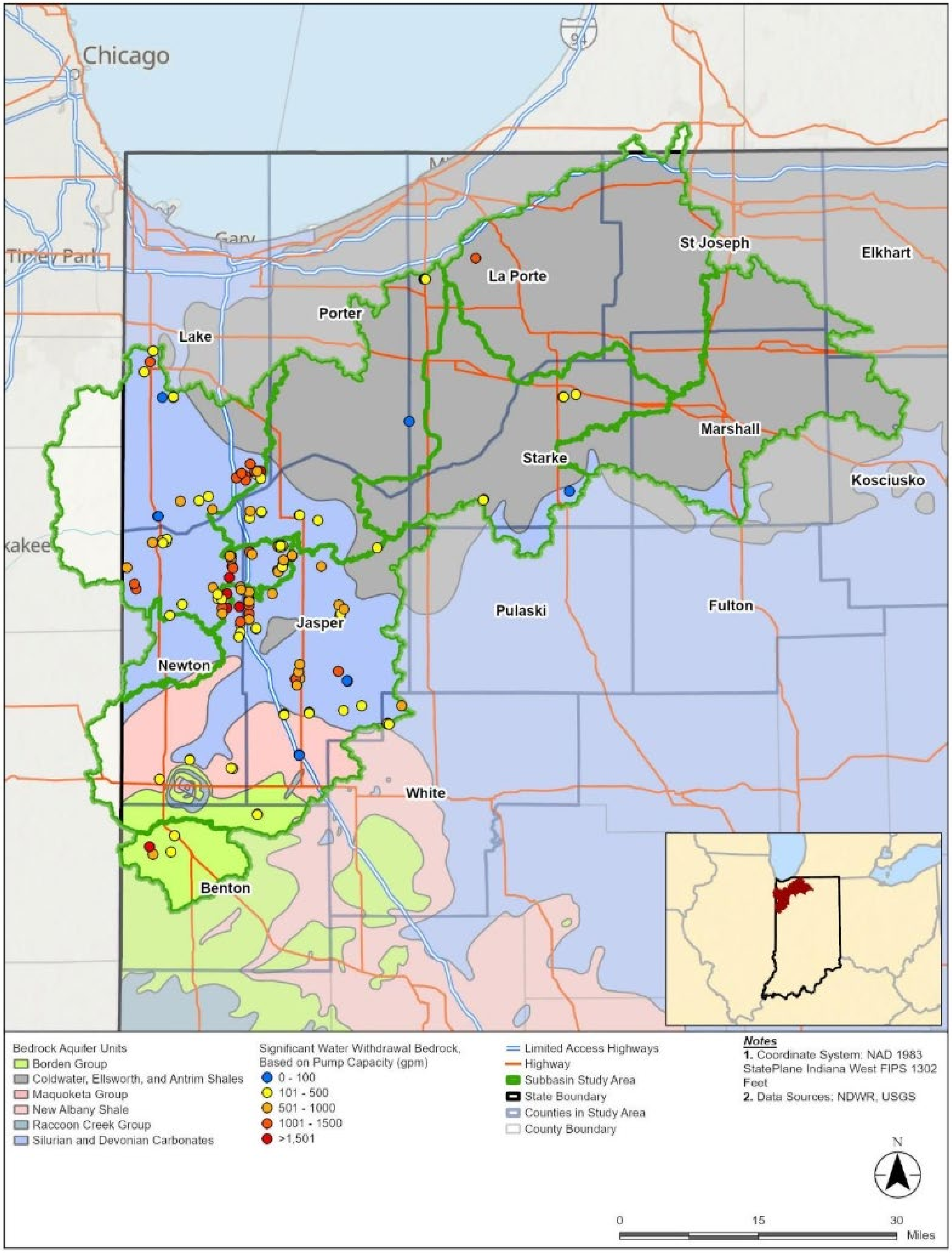
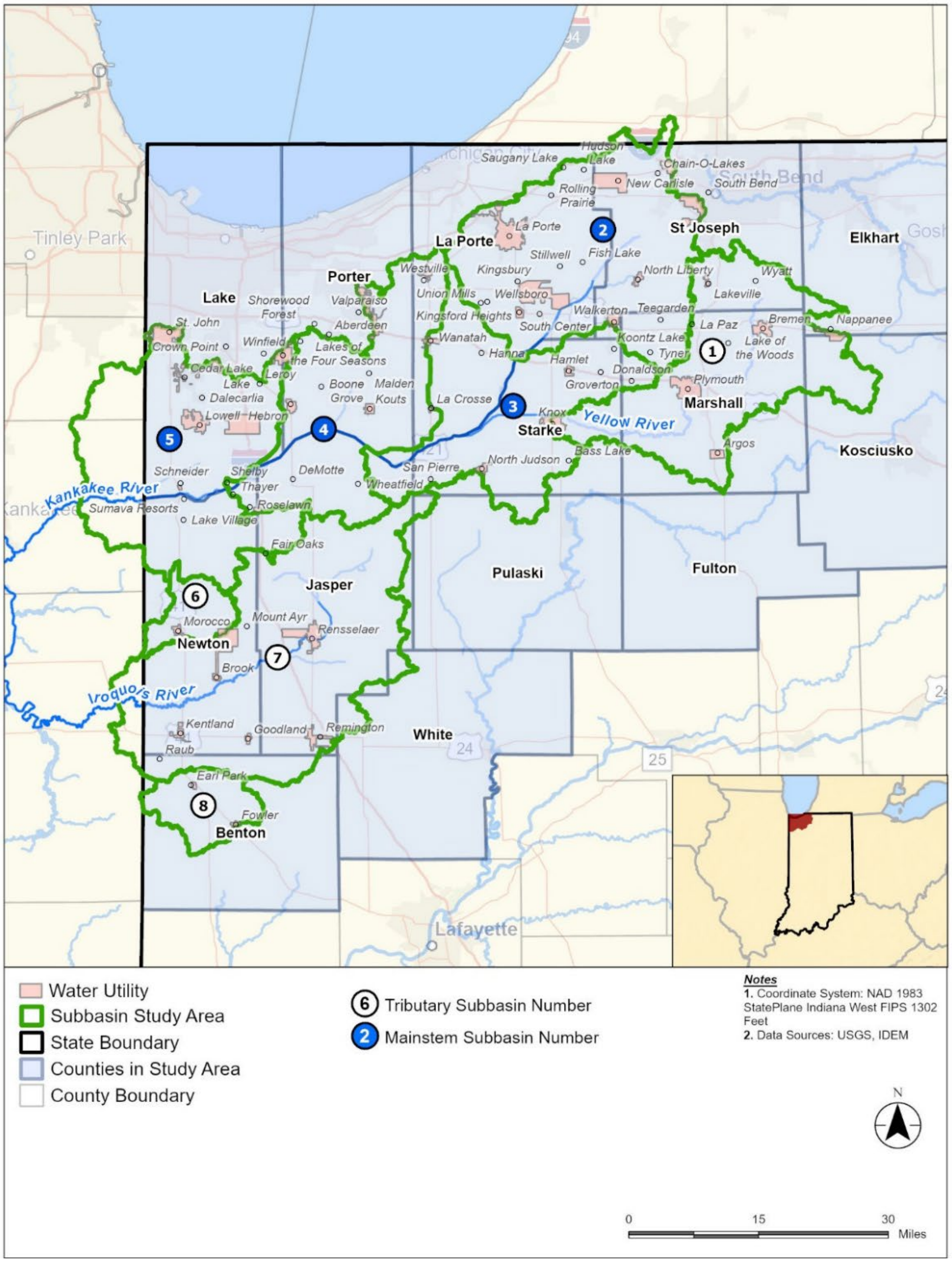


Figure 2-14. Bedrock Aquifers in the Kankakee River Basin Shown Along with the Yields (Gallons per Minute) of Active Significant Water Withdrawal Facilities and Wells

The domestic wells in the Silurian and Devonian bedrock aquifers have pump capacities ranging from 4 to 90 GPM. The Devonian-Mississippian bedrock aquifers within the study area, including New Albany Shale and Borden Group aquifers, contain 22 significant water withdrawal facilities with pump capacities ranging from 35 to 2,750 GPM where 90% of the wells have capacities over 100 GPM. The two highest-producing wells are in the southwest portion of the Borden Group and reported as penetrating limestone. Ordovician and Pennsylvanian aquifers are present in the watershed, but they cover a very small area and do not have any bedrock wells completed in them. The variability in well capacity makes these aquifers less ideal for groundwater production.

2.4 Population Centers

The surface water and groundwater of Kankakee Basin are divided into eight subbasins based on hydrology detailed in Section 3.1. The regions historical and future water demand and availability are estimated for each subbasin and then aggregated for the entire Kankakee Basin. The subbasins geographic boundaries are shown in Figure 2-15. The counties, cities, and towns within each subbasin are identified in Table 2-3. **This Study's discussion of water demand, supply, and availability primarily follows the subbasin boundaries, and the communities within each subbasin are presented here in Table 2-3 to support local connection to the Kankakee Basin.**



Note: The utility services area boundaries are clipped to show only within the boundary of the basin.

Subbasin Key

1	Yellow Knox	4	Kankakee Shelby	7	Iroquois
2	Kankakee Davis	5	Kankakee Momence	8	Sugar
3	Kankakee Kouts	6	Beaver		

Figure 2-15. Map of Cities, Towns, and Public Water Supply Services Areas Within Kankakee Basin

Table 2-3. Study Area Subbasins, County, Cities, and Town Crosswalk

Subbasin	County	City / Town
Yellow Knox (Subbasin 01)	Elkhart / Kosciusko	Nappanee
	Marshall	Argos
		Bremen
		Plymouth
	St. Joseph	Lakeville
	Starke	Knox
Kankakee Davis (Subbasin 02)	La Porte	Hudson Lake
		Kingsford Heights
		La Porte
	Marshall	Walkerton
	St. Joseph	New Carlisle
		North Liberty
		South Bend
Kankakee Kouts (Subbasin 03)	La Porte	La Crosse
		Wanatah
	Starke	Bass Lake
		Hamlet
		Knox
		Koontz Lake
		North Judson
Kankakee Shelby (Subbasin 04)	Jasper	DeMotte
	La Porte	La Crosse
		Wanatah
		Westville
	Newton	Roselawn
	Porter	Aberdeen
		Hebron
		Kouts
		Shorewood Forest
		Valparaiso
Kankakee Momence (Subbasin 05)	Lake	Cedar Lake
		Crown Point
		Lake Dalecarlia
		Lowell
		St. John
	Porter	Winfield
	Newton	Roselawn
Beaver (Subbasin 06)	Newton	Morocco
Iroquois (Subbasin 07)	Jasper	Remington
		Rensselaer
	Newton	Goodland
		Kentland
	White	Remington
Sugar (Subbasin 08)	Benton	Earl Park
		Fowler

The Study Area is one of the most productive agricultural regions in the state and is predominantly populated by rural communities. The region includes one midsize city, several small cities, a few large towns, and about two dozen small towns and villages. The population of the Study Area is estimated to be 315,800 in Indiana, based on available information for 2023.

Figure 2-15 identifies the cities, towns and public water utilities in the Kankakee Basin. Most cities in the basin report a population of less than 10,000 people. Most of the large public water supply service areas sit outside of the basin. Within the Kankakee Basin there are only a handful of medium sized public water utilities. The majority of the land area in the basin is sparsely populated and residents living outside of the utility boundaries typically source water from a private well. The largest city in the region is South Bend, though only a small portion of the city is within and receives water from the Kankakee Basin. South Bend has a population of 102,866. The Lake and Porter County portion of the northern rim of the basin is the most developed area with several small cities clustered together straddling the border of the basin: Cedar Lake, Crown Point, St. John, Winfield Township, and Valparaiso. A few other small cities are more fully in the Study Area including La Porte and Lowell (Table 2-4).

The entire Kankakee Basin land area is 3,128 square miles, which is almost 9% of the state's land area. The total land area of every city with a utility within the Study Area is 210 square miles which is 7% of the Kankakee Basin land area. The population of every city with a utility within the Study Area is 327,292 which is less than 5% of the state's population. Table 2-5 lists all major public utilities within the Study Area and identifies the primary populations served by each utility.

Table 2-4. Cities, 2023 Population, and Population Density of the Study Area

City/Town Name	County	2023 Population	Square Miles	People per Square Mile
Indiana (statewide)		*6,811,752*	*35,826*	*190*
South Bend	St. Joseph	102,866	41.9	2,455
Valparaiso	Porter	34,377	16.8	2,049
Crown Point	Lake	34,042	19.0	1,791
La Porte	La Porte	22,125	12.3	1,799
St. John	Lake	21,639	12.7	1,699
Cedar Lake	Lake	14,686	9.2	1,596
Lowell	Lake	10,911	7.0	1,554
Plymouth	Marshall	10,506	7.6	1,388
Winfield	Porter	7,501	12.4	605
Nappanee	Kosciusko	7,040	4.9	1,428
Rensselaer	Jasper	5,369	6.7	798
Westville	La Porte	5,291	3.3	1,627
Bremen	Marshall	4,660	2.8	1,644
DeMotte	Jasper	4,219	3.6	1,177
Knox	Starke	3,843	4.0	971
Hebron	Porter	3,712	2.0	1,856
Roselawn	Newton	3,231	6.6	487
Shorewood Forest	Porter	3,030	1.9	1,596

City/Town Name	County	2023 Population	Square Miles	People per Square Mile
Fowler	Benton	2,286	1.4	1,619
Kouts	Porter	2,261	1.2	1,864
New Carlisle	St Joseph	2,110	2.0	1,040
North Judson	Starke	2,094	1.1	1,890
Walkerton	Marshall	2,052	1.9	1,079
North Liberty	St Joseph	1,838	1.0	1,788
Argos	Marshall	1,822	1.3	1,417
Aberdeen	Porter	1,761	1.3	1,401
Kentland	Newton	1,759	1.4	1,303
Remington	White	1,581	3.8	415
Lake Dalecarlia	Lake	1,421	1.1	1,260
Kingsford Heights	La Porte	1,313	0.9	1,479
Wanatah	La Porte	1,248	1.4	892
Hudson Lake	La Porte	1,245	1.9	647
Koontz Lake	Starke	1,217	3.5	345
Morocco	Newton	1,169	1.1	1,097
Bass Lake	Starke	1,067	8.7	122

Source: U.S. Census Bureau 2023 ACS 5-Year Population Estimates, U.S. Census Bureau 2023 U.S. Gazetteer Files

Table 2-5. Major Public Water Utilities in the Study Area

Utility Name	Principal City Served	County	Principal City Population	Primary Water Source
Valparaiso Department of Water Works	Valparaiso	Porter	34,377	Groundwater
La Porte Water Works	La Porte	La Porte	22,125	Groundwater
Aqua Indiana Incorporated	St. John	Lake	21,639	Groundwater
Lowell Water Department	Lowell	Lake	10,911	Groundwater
Plymouth Water Department	Plymouth	Marshall	10,506	Groundwater
Nappanee Water Utility	Nappanee	Kosciusko	7,040	Groundwater
Rensselaer Water Department	Rensselaer	Jasper	5,369	Groundwater
Westville Water Department	Westville	La Porte	5,291	Groundwater
Bremen Water Department	Bremen	Marshall	4,660	Groundwater
Knox Water Works	Knox	Starke	3,843	Groundwater
Apple Valley Utilities, Inc.	Hebron	Lake	3,712	Groundwater
Indiana-American Water Co Inc	Roselawn	Newton	3,231	Groundwater
Fowler, Town of	Fowler	Benton	2,286	Groundwater
Kouts Water Works	Kouts	Porter	2,261	Groundwater
North Judson Water Company	North Judson	Starke	2,094	Groundwater

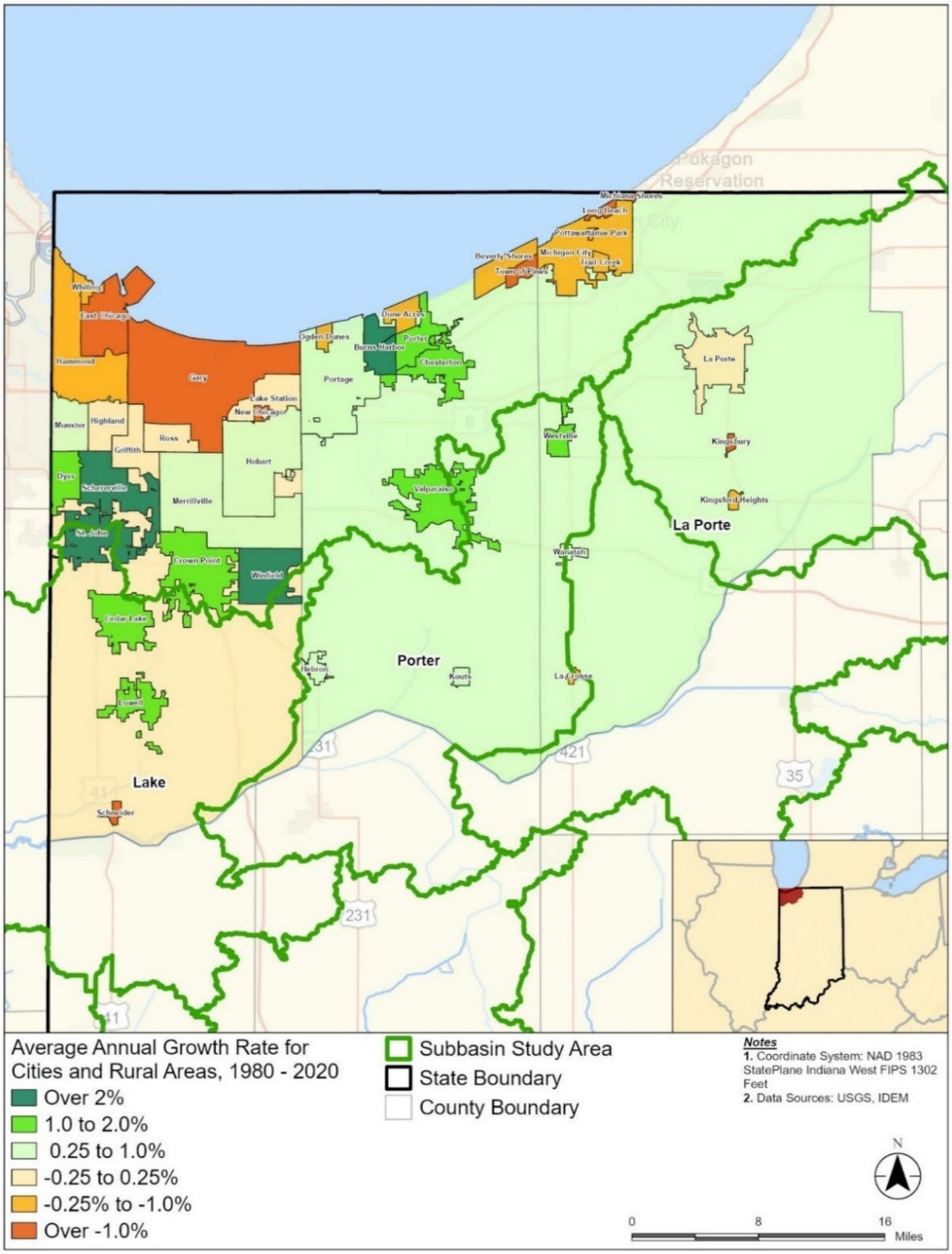
Utility Name	Principal City Served	County	Principal City Population	Primary Water Source
Walkerton Water Department	Walkerton	Marshall	2,052	Groundwater
North Liberty Water Works	North Liberty	St Joseph	1838	Groundwater
Argos Water Works	Argos	Marshall	1,822	Groundwater
Kentland Water Works	Kentland	Newton	1,759	Groundwater
Remington Water Works	Remington	Jasper	1581	Groundwater
Kingsford Heights Water	Kingsford Heights	La Porte	1,313	Groundwater
Wanatah Water Utility	Wanatah	La Porte	1,248	Groundwater
Morocco Water Department	Morocco	Newton	1,169	Groundwater
Goodland Water Works	Goodland	Newton	923	Groundwater
Hamlet Water Works	Hamlet	Starke	910	Groundwater
Lakeville, Town of	Lakeville	St Joseph	669	Groundwater
Lacrosse Water Department	La Crosse	La Porte	640	Groundwater
Earl Park Municipal Water Utility	Earl Park	Benton	334	Groundwater

Source: US Census Bureau 2023 5-Year Population Estimates; IDNR 2025

Note: This is not a comprehensive list of all public utilities in the Kankakee Basin. These facilities were identified as having the largest annual water withdrawal rates in the region (IDNR 2025) as well as highlighting the major public water suppliers to the larger population centers in the Study Area.

Historically, the Kankakee Basin’s economy largely centered around agriculture, though the economic development trajectory and industrial activity is changing in some regions with significant shifts recently and planned in the near future. Northwest Indiana is generally characterized by its proximity to Chicago and neighboring urban centers and major industrial areas bordering Lake Michigan, but the Kankakee Basin differs with more rural communities.

The recent historical trends in population growth for several of the cities and towns within Kankakee Basin display different characteristics than the full counties where they are located. Available county level projections underestimated the population growth expected by local experts within the region who were consulted as part of this study. For example, the Northwestern Indiana Regional Planning Commission (2023) identified a southward migration since 1980 that is expected to continue into the future (Figure 2-16).



Source: Northwestern Indiana Regional Planning Commission (2023)

Takeaway: Three counties within Kankakee Basin display unique population trends compared to the rest of the counties within the Basin. Lake, Porter, and La Porte all showed dramatic within-county population shift, from the northern part of the counties (outside the Kankakee Basin) into the southern part of the counties (inside the Kankakee Basin). The other counties in the Basin display similar population growth trends county-wide.

Figure 2-16. Average Annual Growth Rate for Cities and Rural Areas, 1980 – 2020

Water demand, supply, and availability within the entire Kankakee Basin is analyzed in this study. However, basin boundaries do not coincide with county boundaries. The Kankakee Basin Regional Water Study includes most of or part of 17 counties, though the basin only overlaps with a very small portion of five of the counties and three of the counties are within Illinois. Table 2-6 below designates the nine Primary Study Area Counties, the five supplemental counties with a small overlap into the basin, and the Illinois counties. The estimated water demand included all Study Area Counties, supplemental counties and Illinois counties. The following review of socioeconomic characteristics is based on data from Indiana Study Area counties.

Table 2-6. County Designations for Counties Included in the Water Demand Analysis

Primary Study Area Counties	Supplemental	Illinois counties
Benton	Elkhart	Iroquois
Jasper	Fulton	Kankakee
Lake	Kosciusko	Will
La Porte	Pulaski	
Marshall	White	
Newton		
Porter		
St Joseph		
Starke		

The largest industries by employment rates are health care and social services, manufacturing, and retail trade (STATS Indiana 2024). Information technology is the fastest growing industry in the region. For example, the Town of New Carlisle in St. Joseph County has invested in the development of the Indiana Enterprise Center with a large data center and a battery plant currently under development (St. Joseph County Redevelopment Commission 2023) In the southern region of the Kankakee basin, Newton, Jasper, and Benton Counties, common industries are aggregates, agriculture, and ethanol production.

Table 2-7 compares selected socioeconomic characteristics in the Indiana Study Area counties to the State of Indiana, over three years in the past decade. The Study Area counties' metrics are slightly below statewide metrics for labor force participation, median household income, and median home value and mostly match the statewide metrics for unemployment rate and poverty rate. Labor force participation rate, which represents the percentage of the working-age population that is employed or actively seeking employment, is 64% for the state of Indiana in 2023 while the Study Area's labor force participation rate is slightly lower at 61% in 2023.

Median household income in the Study Area counties, $68,596, is 2% below the statewide median household income of $70,051. Median home values in 2023 in the Study Area are also 10% lower than the median home value in Indiana. The statewide median home value has increased by 62% over nine years while statewide median income has only increased by 42% over that period. Meanwhile, in the study area, median home value has increased by 47%, and median household income has increased by 46%, at almost the same rate over the same nine-year period, indicating that home values in the Study Area are not increasing as dramatically as statewide and remain more affordable.

Table 2-7. Selected Socioeconomic Characteristics in Study Area Counties, Indiana

Year	Labor Force Participation Rate		Unemployment Rate		Median Household Income		Poverty Rate		Median Home Value	
	Study Area	Indiana	Study Area	Indiana	Study Area	Indiana	Study Area	Indiana	Study Area	Indiana
2023	61%	64%	3%	3%	$68,596	$70,051	12%	12%	$180,700	$201,600
2019	60%	64%	3%	3%	$53,658	$56,303	13%	13%	$132,600	$141,700
2015	62%	64%	5%	5%	$47,046	$49,255	14%	15%	$123,100	$124,200

Source: US Census Bureau. ACS Selected Economic Characteristics. 2023, 2019, 2015
Note: The socioeconomic characteristics represent the entire counties of Benton, Jasper, Lake, La Porte, Marshall, Newton, Porter, St Joseph, Starke. These counties make up a majority of the Study Area.

2.5 Water Withdrawals

Data for the historical water withdrawals within the Kankakee Basin was primarily obtained from the SWWF database (IDNR 2025). Estimates of historical water use for sectors not reported in SWWF, and historical water demand in Illinois, other methods and sources were used.

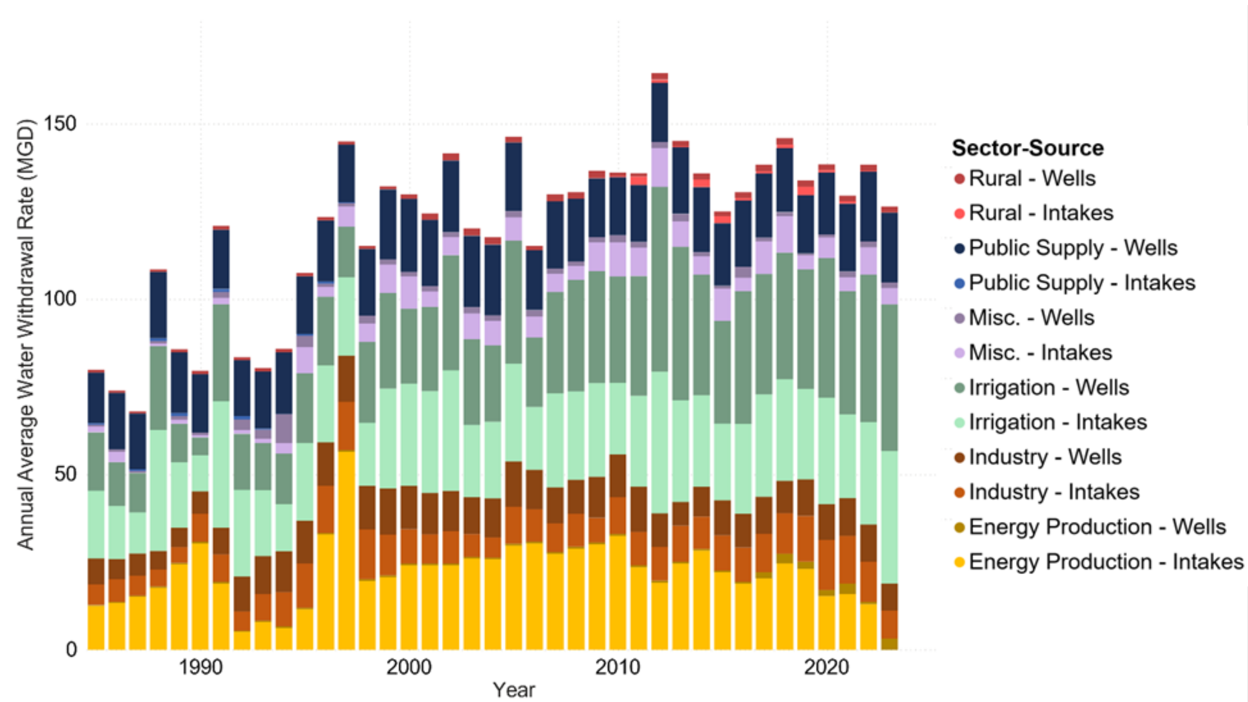
The SWWF data reports water withdrawals by water use sector, by month and by facility. The SWWF data dictionary defines a facility as “the water withdrawal facilities of a person, in the aggregate from all sources and by all methods, has the capacity of withdrawing more than 100,000 gallons of groundwater, surface water, or ground and surface water combined in one (1) day” (IDNR 2025). The SWWF database included a monthly withdrawal time series for all Indiana SWWF facilities in the Kankakee Basin from 1985 – 2023, with each withdrawal characterized by source (surface water intake or groundwater well) and one of six water use sectors:

- Public supply (PS) (public water supply and drinking water/sanitary facilities)
- Irrigation (IR) (agricultural irrigation, golf course irrigation)
- Industrial (IN) (process water, cooling water, mineral extraction except coal, quarry dewatering, waste assimilation)
- Energy production (EP) (power generation, cooling water, coal mining, geothermal, oil recovery)
- Rural (RU) (livestock, aquaculture)
- Miscellaneous (MI) (representing a variety of uses including fire departments, correctional facility, waste management departments, and habitat management in natural areas)

The SWWF data for water withdrawals by sector and source from 1985 – 2023, is shown in Figure 2-17, and illustrates the following:

- Irrigation water withdrawals from surface water intakes and groundwater wells represent the largest portion of total withdrawals and have trended upward since 1985.

- Energy production water withdrawals from surface water intakes represent the second largest portion of withdrawals.
- Public water supply represents a large portion of the total withdrawals and is primarily sourced from groundwater. Rates are relatively consistent throughout the period.
- Industrial water withdrawals represent another large portion of total withdrawals and are sourced somewhat evenly from surface water and groundwater. Industrial water withdrawals have fluctuated significantly since 1985 largely due to the cyclic nature of the mining gravel pits lifecycle, the largest industrial water user.



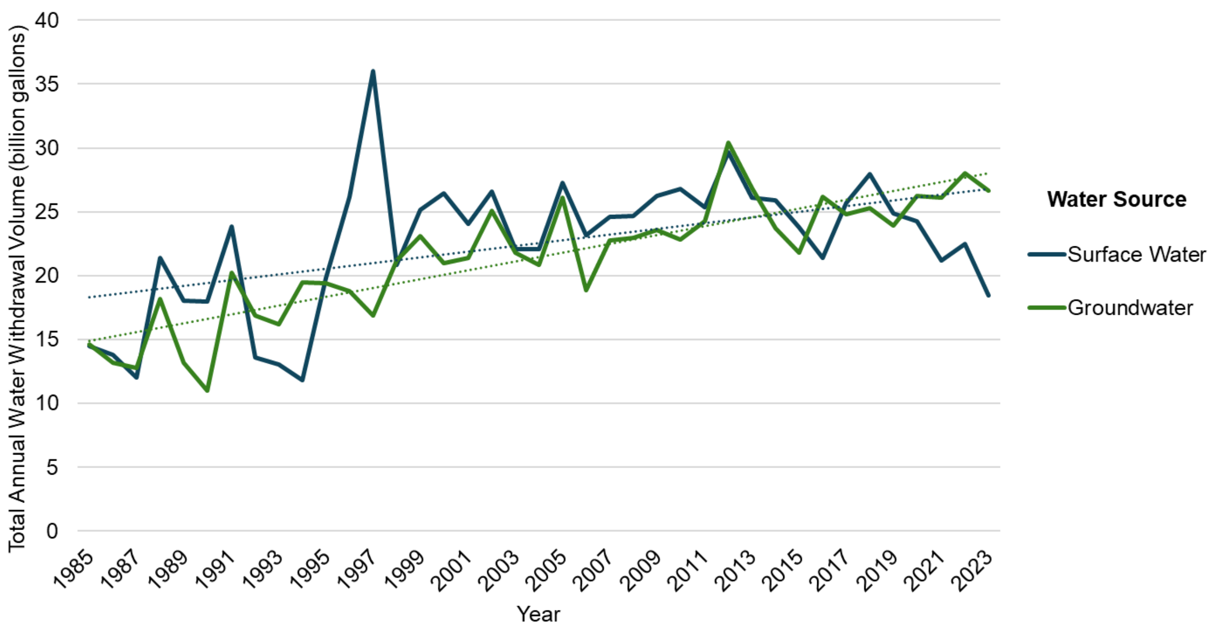
Source: Indiana Significant Water Withdrawal Facility database (IDNR 2025)
Note: SWWF database only includes sectors reporting to IDNR: energy production, industry, irrigation, miscellaneous, public supply, and rural.
Key:
Intake = surface water intake; MGD = million gallons per day
SWWF = Significant Water Withdrawal Facility; Wells = groundwater wells

Takeaway: Irrigation water use has grown the most, energy use stays second, public supply remains steady and groundwater-based, and industry fluctuates with mining cycles.

Figure 2-17. Kankakee Basin Significant Water Withdrawals Database Summary: Annual Average by Use Type and Water Source, 1985 – 2023

Long-term water withdrawal records indicate notable fluctuations between surface water and groundwater use across the Study Area. Historically, total withdrawals from both sources have been relatively comparable, with surface water generally exceeding groundwater until recent years (Figure 2-18). **From 1985 – 2023, both water sources show an overall increasing trend in annual withdrawals.** Groundwater withdrawals increased from approximately 15 BG (41 MGD) in 1985 to 27 BG (74 MGD) in 2023, representing a higher rate of growth than surface water withdrawals, which rose from 15 BG (41

MGD) to 22 BG (60 MGD) over the same period. This long-term increase reflects both expanded agricultural irrigation and municipal water demand across the region. In addition to these long-term, some of these year-to-year changes likely reflect hydrologic conditions, with higher water use observed during dry years such as 2012 when precipitation is limited and irrigation demand increases, and lower withdrawals during wetter years such as 2008 when precipitation reduces reliance on both groundwater and surface water. **When examining the shorter recent period that used for the historical analysis in this study (2007–2023), the patterns diverge. Groundwater withdrawals exhibit an upward trend, increasing from about 24 BG (65 MGD) in 2007 to 27 BG (74 MGD) in 2023. In contrast, surface water withdrawals show a gradual decline, decreasing from roughly 27 BG (74 MGD) to 22 BG (60 MGD) during the same period.** These trends suggest a growing dependence on groundwater resources in recent years, possibly reflecting localized changes in water management practices, reliability of surface water supplies, or infrastructure preferences for groundwater systems.



Source: Indiana Significant Water Withdrawal Facility database (IDNR 2025)
Note: The solid lines indicate the reported volumes, and the dashed lines are trend lines.

Takeaway: Groundwater and surface water use both rise since 1985, but groundwater grows faster, and yearly swings track wet and dry years.

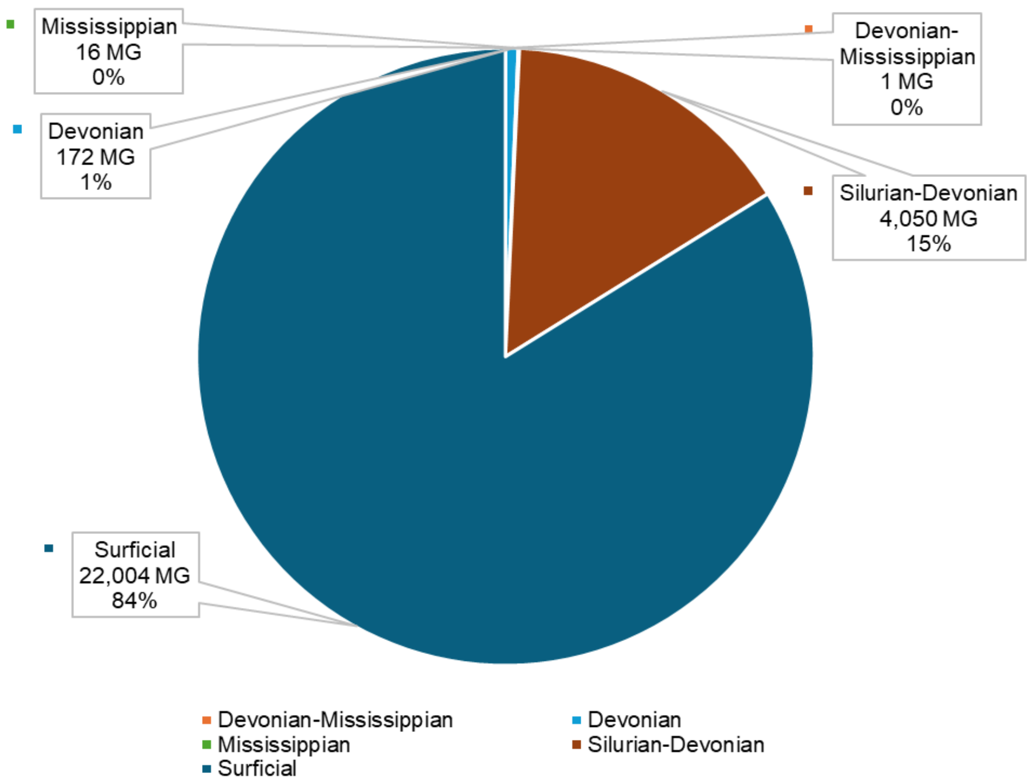
Figure 2-18. Trend in Annual Surface Water and Groundwater Withdrawal Volumes by Source from 1985 – 2023 in the Study Area

As reported to IDNR (2025), total water withdrawals in the Study Area for 2023 were approximately 45 BG (123 MGD). Of this total, about 41% (18.5 BG/51 MGD) originated from surface water intakes, while the remaining 59% (26.2 BG/72 MGD) was provided from groundwater wells.

To better understand the spatial and hydrogeologic distribution of groundwater use, aquifer units defined by IDNR were mapped to SWWF locations based on well depth and reported source. Withdrawals were then categorized by aquifer unit to distinguish contributions from unconsolidated and bedrock systems

(Figure 2-19). Results show that the majority of groundwater withdrawals, approximately 22,000 million gallons (MG) (22 BG) (84%), were drawn from surficial (unconsolidated) aquifers, while the remaining 4,200 MG (4.2 BG) (16%) were sourced from bedrock aquifers, primarily within the Silurian-Devonian system.

Although unconsolidated aquifers provide most groundwater in the Study Area, several counties rely more heavily on bedrock sources. Among counties accounting for more than 2% of total groundwater withdrawals in 2023, Newton (70%), Lake (61%), and Jasper (48%) depend primarily on the Silurian-Devonian aquifer to meet water demands. This reliance reflects both the regional hydrogeologic setting and the distribution of high-capacity wells developed in bedrock formations.



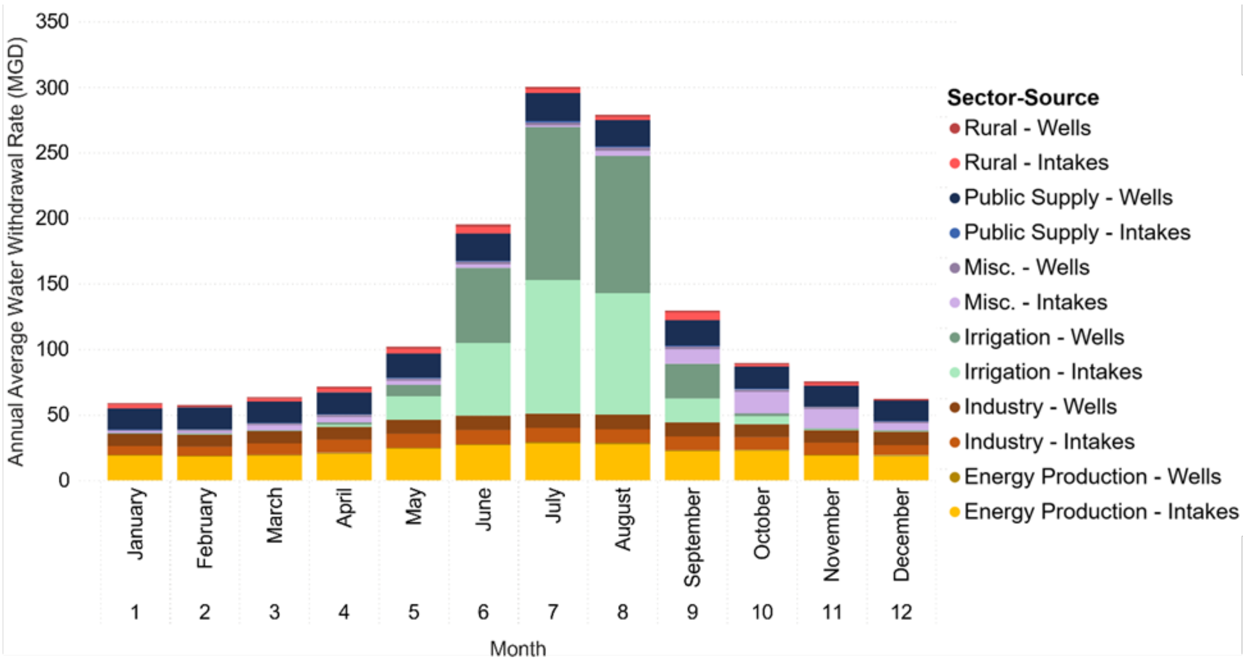
Source: Indiana Significant Water Withdrawal Facility database (IDNR 2025)
Note: Devonian, Devonian-Mississippian, Mississippian, Silurian-Devonian are bedrock aquifers and Surficial is unconsolidated aquifer.
Key:
MG = million gallons

Takeaway: Surficial aquifers provide 84% of 2023 withdrawals; Silurian-Devonian bedrock adds 15%, and all others make up less than 2%.

Figure 2-19. Kankakee Basin Study Area Total Annual Groundwater Withdrawals (million gallons and percent of total) in 2023 by Aquifer Types

Monthly average water withdrawals across the Study Area exhibit clear seasonal variability, largely driven by temperature and water demand patterns (Figure 2-20). **Among all water use sectors, irrigation withdrawals show the strongest seasonality, with peak withdrawals occurring during the Summer months of June through August. These peaks coincide with periods of high air temperatures,**

elevated evapotranspiration rates, and maximum water demand for agricultural production, particularly for corn and soybean crops. In contrast, public supply withdrawals show only a modest seasonal increase during Summer, reflecting additional domestic and commercial outdoor uses such as landscape irrigation and cooling. Industrial withdrawals remain relatively consistent year-round, indicating steady process water demands that are largely unaffected by temperature or precipitation fluctuations.

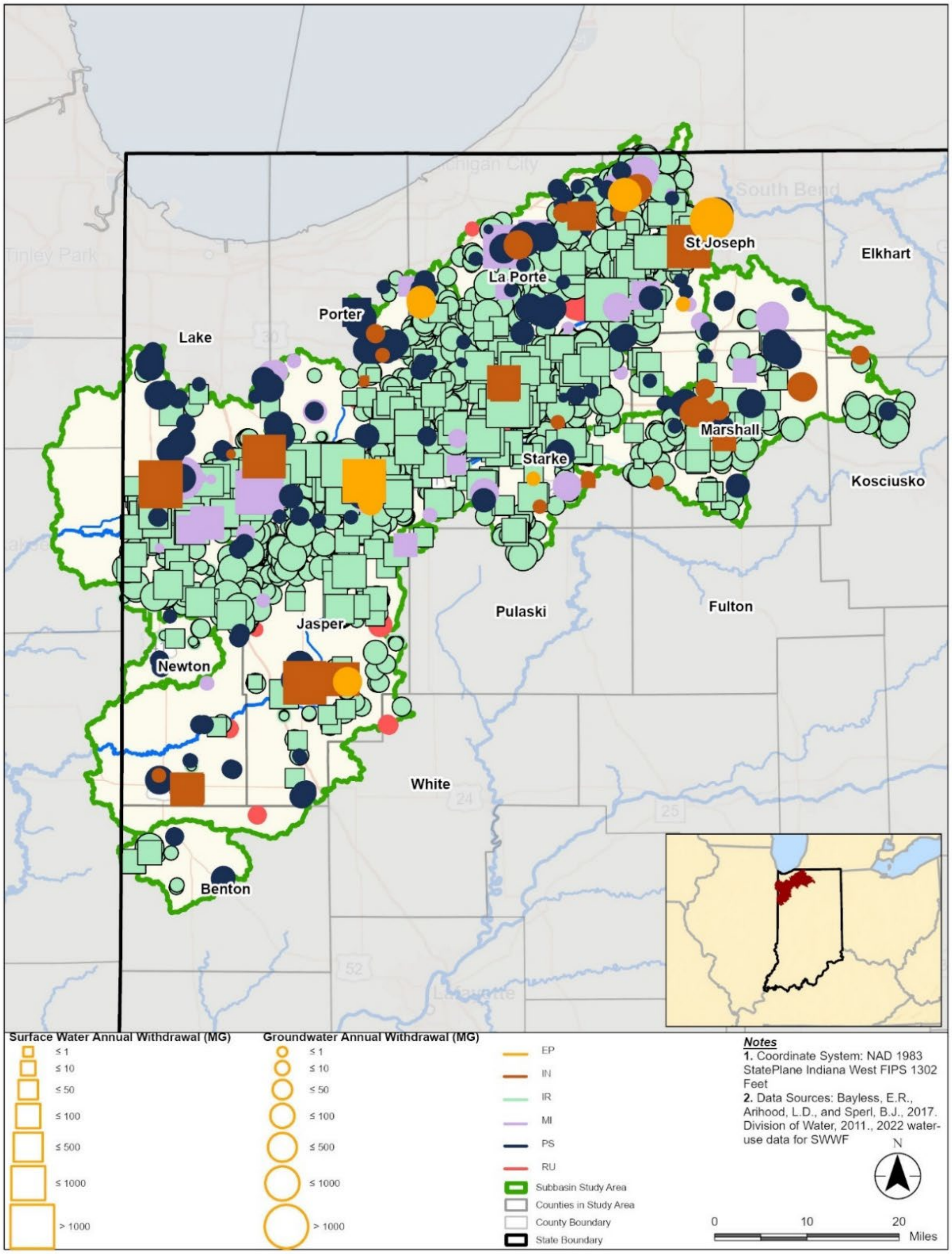


Source: Indiana Significant Water Withdrawal Facility database (IDNR 2025)
Key:
Intake = surface water intake; MGD = million gallons per day; Wells = groundwater wells

Takeaway: Irrigation drives big Summer peaks, while public supply rises slightly and industry stays relatively steady year-round.

Figure 2-20. Monthly Average Water Withdrawals in the Study Area from 1985 – 2023 by Water Use Sector and Source

The spatial distribution of water withdrawals shows several trends that reflect the hydrologic, geologic, and population characteristics of the Study Area (Figure 2-21). A majority of wells are concentrated in the north central portion of the basin. Jasper county has the largest consumption use in 2023, with a majority from energy production and irrigation (Figure 2-21). Other large irrigation withdrawals are prominent in the northern counties of La Porte, St. Joseph, and Lake. Large public supply withdrawals are also predominantly from groundwater and clustered around major population centers.



Note: Based on data for 2023.

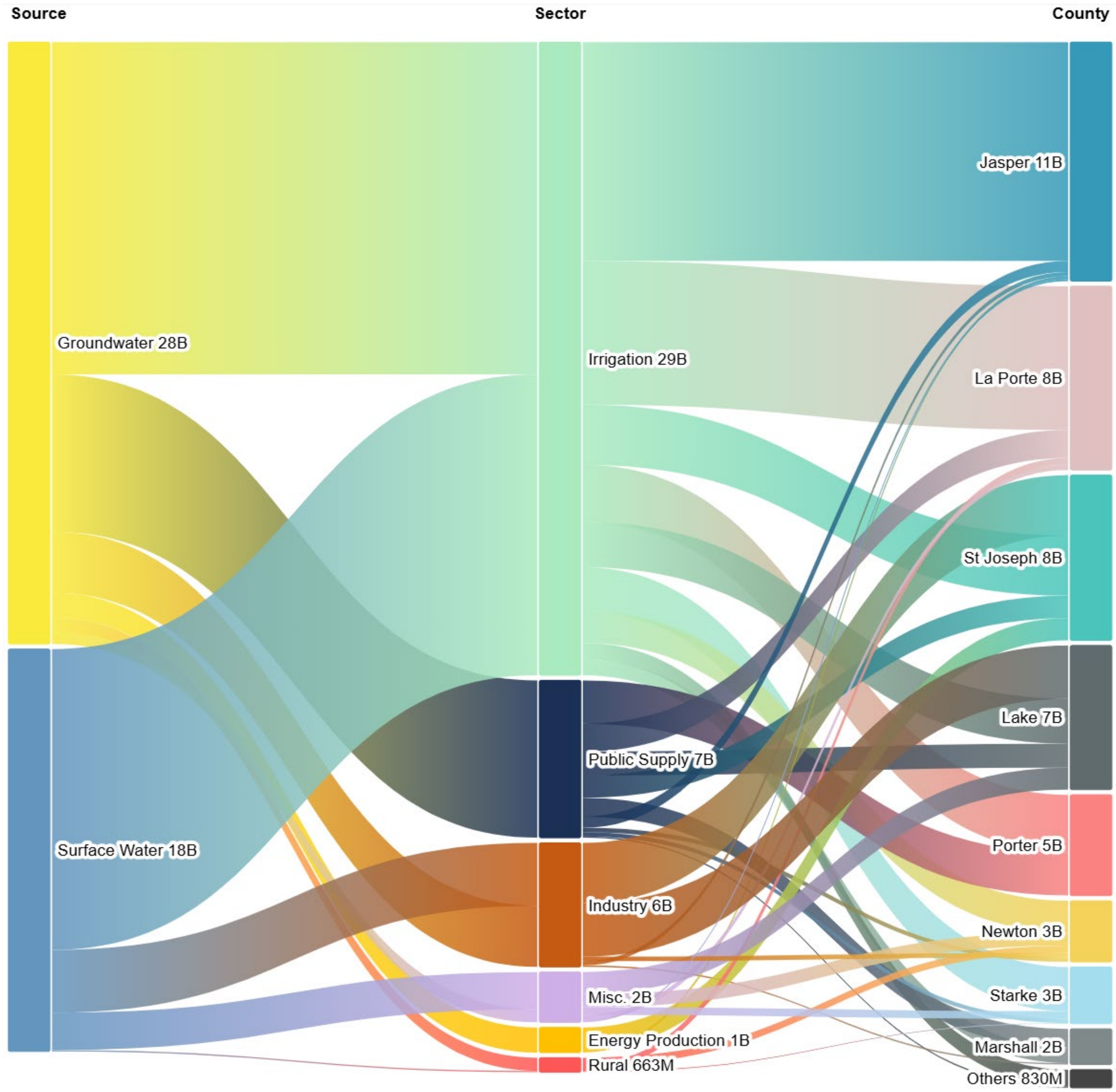
Key:
FIPS = Federal Information Processing Standard
MG = million gallons
NAD = North American Datum
USGS = U.S. Geological Survey

Sector Key:

EP =	Energy production	PS =	Public supply
IN =	Industrial	RU =	Rural
IR =	Irrigation	SS =	Self-supplied

Figure 2-21. Significant Water Withdrawal Facilities Within Kankakee Basin Study Area

A review of 2023 total water withdrawals by source, sector, and county provides additional insight into regional water relationships (Figure 2-22). Water withdrawals are sourced from both surface water and groundwater, relatively evenly distributed between the two. The majority of surface water withdrawals belong to the energy production sector and irrigation, while a smaller portion of surface water withdrawals support industrial use and miscellaneous. Public water supply withdrawals occur in all counties, with the greatest withdrawals supporting larger population centers in Porter (City of Valparaiso) and La Porte (City of La Porte) Counties. St. Joseph County also supports the largest industrial withdrawals. Withdrawals for agricultural irrigation occur mainly in Jasper, La Porte, St. Joseph, and Lake Counties, which accounted for 76% of total irrigation withdrawals in 2023. Rural and miscellaneous withdrawals are relatively small in the Study Area. The majority of withdrawals were concentrated in Jasper, La Porte, St. Joseph, and Lake Counties, while the combined withdrawals from Porter, Newton, Marshall, Starke, Kosciusko, Pulaski, Benton, Elkhart, and White Counties represented only 20% of total annual withdrawals in 2023 across the Study Area.



Source: Indiana Significant Water Withdrawal Facility database (IDNR 2025)
Note: Other counties include Pulaski, Kosciusko, Benton, and White, which collectively represent 1.3% of withdrawals in 2023.
Key:
B = billions of gallons; M = millions of gallons

Figure 2-22. Kankakee Basin Total Annual Water Withdrawals in 2023 by Source, Sector, and County, Significant Water Withdrawal Facilities Only (billions of gallons)

Two withdrawal sectors are not included in the SWWF database because their individual withdrawal rates fall below the minimum criteria for registration. However, when considered collectively, these sectors represent a meaningful portion of total regional water use. These sectors are self-supplied residential (domestic) users and Concentrated Animal Feeding Operations (CAFOs). In addition, Illinois withdrawal data were estimated using data from the nearest Indiana counties within the same subbasins, ensuring consistency across the Study Area. Additional details regarding data sources and estimation methods for these categories are provided in Appendix C.

As summarized in Table 2-8, the total estimated withdrawal volume from these additional sectors in 2023 was approximately 6.65 billion gallons (18 MGD), representing about 11% of the total 2023 withdrawals reported in the SWWF database. The majority of this volume comes from self-supplied withdrawals (5.18 BG/15 MGD), which is consistent with the region's predominantly rural land use and widespread reliance on private groundwater wells for domestic supply.

Table 2-8. Other Sector Estimated Withdrawals in the Study Area for 2023

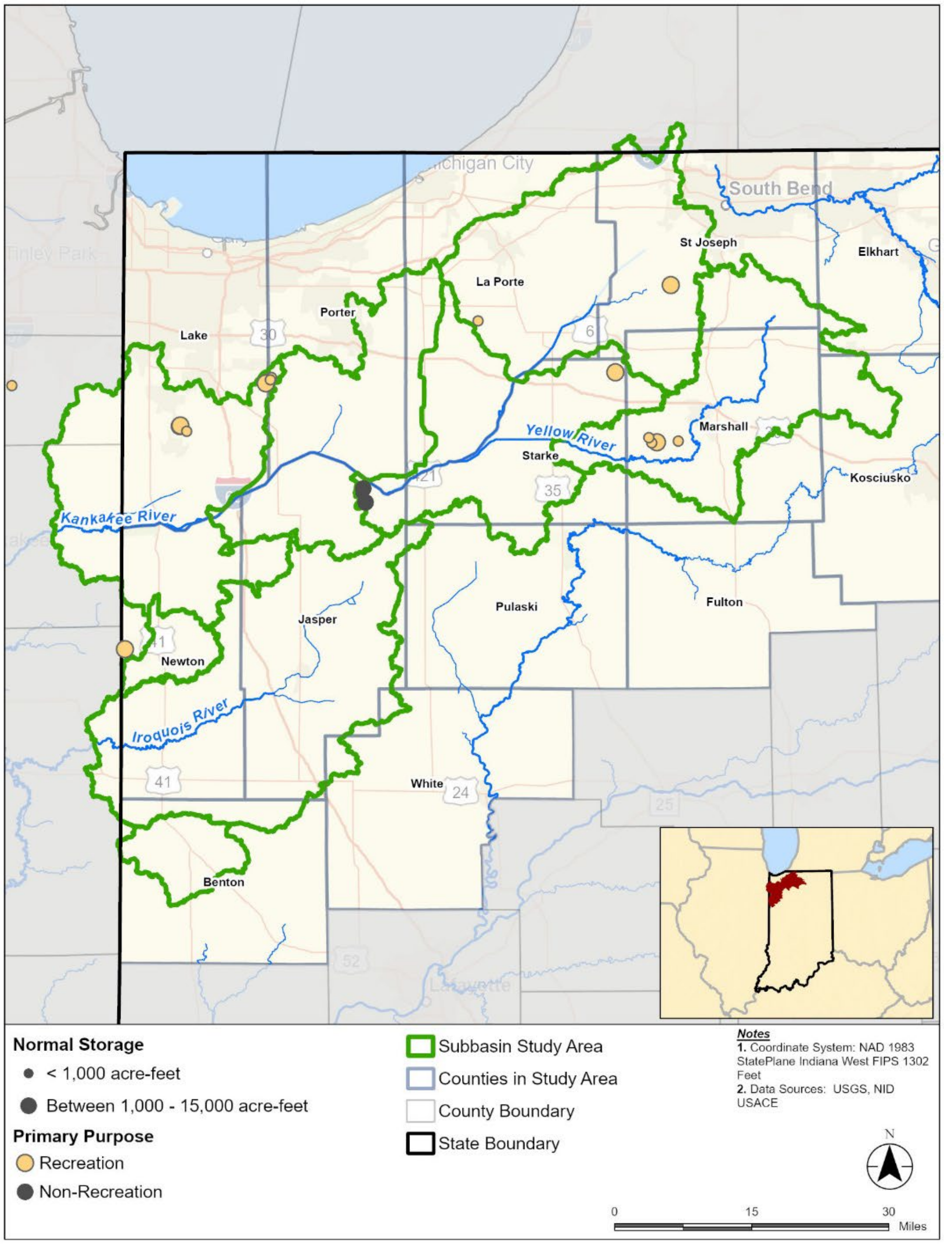
Sector	**2023 Estimated Withdrawal Volume (billion gallons)**
CAFO (Indiana and Illinois)	0.89
Industrial (Illinois)	0.018
Irrigation (Illinois)	0.327
Public Supply (Illinois)	0.220
Rural (Illinois)	0.015
Self-supplied (Indiana and Illinois)	5.18
Total	**6.65**

Key:
CAFO = Concentrated Animal Feeding Operation

2.6 Dams

Dam information and data for the Kankakee Basin Study Area were obtained from the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID) database. A total of 31 dams were identified within the Kankakee River Watershed, of which 16 dams are located within the Study Area, as shown in Figure 2-23. In the NID, normal storage volume is defined as the total volume of water stored below the normal retention level, including dead and inactive storage, but excluding any flood control or surcharge storage. Dams were classified into three categories based on normal storage volume: less than 1,000 acre-feet (eight dams in Study Area), 1,000 to 15,000 acre-feet (eight dams in Study Area), and greater than 15,000 acre-feet (0 dams in Study Area). The number of dams categorized by their primary purpose and normal storage capacity are presented in Table 2-9.

Half of the dams in the study area have normal storage volume <1,000 acre-feet. Dams of this size were assumed to have negligible impact on this Study, and hence, were not considered for further analyses. Most of the dams with normal storage volume between 1,000 and 15,000 acre-feet serve recreation as their primary purpose. Recreation dams generally do not have standard reservoir operation rules, and inflow is typically assumed equal to outflow. The drainage area for these dams is relatively small compared to subbasin area, and they are located on tributaries off the main stem of large rivers. **Consequently, all identified dams in the Study Area are assumed to have a negligible impact on water availability and were not included in the analysis. Additional information on dams is provided in Section 5.3.**



Key:
FIPS = Federal Information Processing Standard
NAD = North American Datum
NID = National Inventory of Dams
USACE = U.S. Army Corps of Engineers
USGS = United States Geological Survey

Takeaway: Within the Study Area, all 16 dams sit on tributaries, giving them limited influence on basin-wide flows.

Figure 2-23. Regional Overview of Dam Locations and Relative Normal Storage

Table 2-9. Primary Purpose and Storage Capacity of Dams in the Study Area

Dam Primary Purpose	Number of Dams per Normal Storage Category (acre-feet)			
	<1,000	**1,000-15,000**	**>15,000**	**Total**
Recreation	7	6	0	13
Other	1	2	0	3
Total	**8**	**8**	**0**	**16**

3.0 Regional Water Study Approach

The methodology used to quantify water availability within the Study Area involves developing water budgets for delineated subbasins, each representing a distinct drainage area. The water budget framework quantifies inflows and outflows within each subbasin, thereby characterizing how water is allocated for different uses and hydrologic components. In this context, water availability refers to the portion of flow not allocated to a specific use or purpose and is also referred to as excess water in the system. The analysis applies a regional, data-driven framework adapted from prior Indiana regional water resource studies (INTERA 2021a, Letsinger and Gustin 2024, Stantec 2025) to calculate individual water budget components and assess both historical and projected water availability across Study Area subbasins.

3.1 Historical Water Availability Analysis Framework

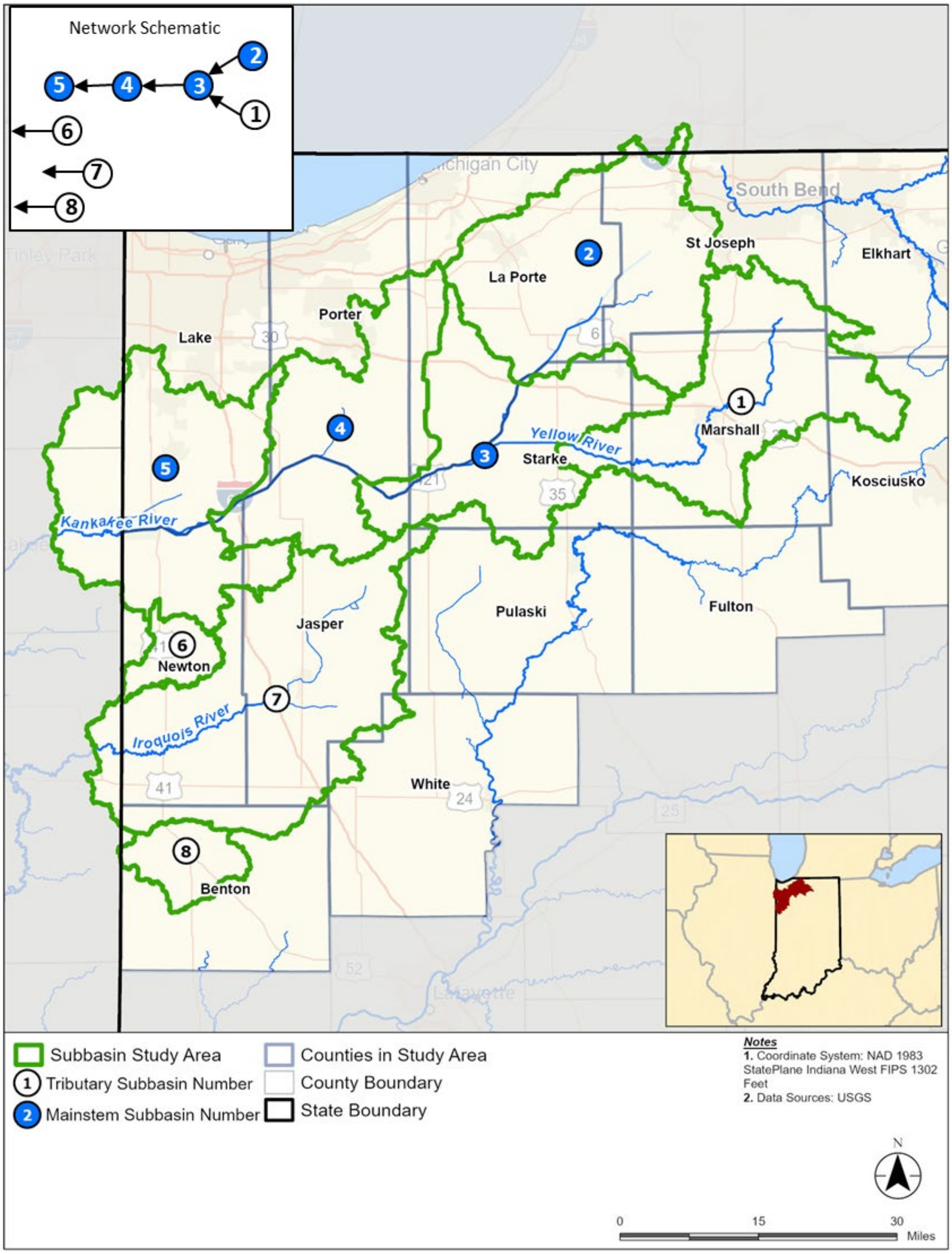
The Kankakee Basin Study Area was divided into subbasins based on the locations of USGS streamgaging stations with continuous daily flow records from 2007 through 2023 (Figure 3-1 and Table 3-1). Additional details on how streamgages were selected and how subbasins were delineated are provided in Appendix B. Water availability in this Study is evaluated using hydrologic, rather than political, boundaries, meaning subbasins were used instead of counties or other administrative areas. Each subbasin represents the land area that drains to a single downstream outlet, making it a practical unit for examining how water withdrawals affect streamflow across the river system. Setting the downstream limit of each subbasin at a USGS gaging station ensures that results are based on actual measured data. With this approach, some datasets used in the estimation of water demand originally organized by county, state, or census boundaries were re-scaled to match the subbasin boundaries, as described further in Chapter 4.

Although “subbasin” and “watershed/basin” are often used interchangeably, they represent different scales. The subbasins defined in this Study are smaller hydrologic areas that receive inflow from one or more upstream subbasins, while a watershed/basin includes the full area draining to a common outlet and may contain multiple subbasins. Figure 3-1 shows the flow direction between subbasins using arrows, and Table 3-1 lists the upstream subbasins that contribute to each downstream outlet.

Water availability is defined and evaluated using two separate but related metrics (INTERA 2021a):

- ***Water Availability***: the portion of natural baseflow remaining in a stream (at the subbasin outlet) after instream flow requirements in the subbasin are accounted for. Natural baseflow is an estimate of the natural groundwater discharge to the stream that would occur in the watershed in the absence of groundwater withdrawals and return flows. Instream flows are minimum stream flows required to support the ecological health of the stream, recreational use, and water quality. Water availability may be supplemented by flows released from reservoir storage.
- ***Excess Water Availability (EWA):*** the portion of water availability that could be used to support additional surface water or groundwater withdrawals without impacting instream flows or existing

water uses. Excess Water Availability is calculated as the water available in the subbasin under natural baseflow conditions reduced by the effects of existing water use (i.e., existing withdrawals minus returns).



Key: FIPS = Federal Information Processing Standard; NAD = North American Datum
USGS = United States Geological Survey

Figure 3-1. Regional Water Availability Subbasin, County Boundaries, and Upstream-Downstream Flow Connections

Table 3-1. Description of Subbasins in Study Area.

Takeaway: Eight subbasins were delineated; six gaged by USGS and two based on synthetic flows.

Subbasin ID	Subbasin Name	Subbasin Area (sq. mi.)	Watershed Area (sq. mi.)	Upstream Subbasin(s) in Watershed	USGS Streamgage at Outlet	Station Name
1	Yellow Knox	435	435		05517000	Yellow River at Knox, IN
2	Kankakee Davis	405	405		05515500	Kankakee River at Davis, IN
3	Kankakee Kouts	536	1,376	1,2	05517530	Kankakee River near Kouts, IN
4	Kankakee Shelby	403	1,779	1,2,3	05518000	Kankakee River at Shelby, IN
5	Kankakee Momence	515	2,294	1,2,3,4	05520500	Kankakee River at Momence, IL
6	Beaver	60	60		Synthetic[1]	-
7	Iroquois	686	686		05525000	Iroquois River at Iroquois, IL
8	Sugar	85	85		Synthetic[1]	-

Note:
[1] A synthetic hydrograph was developed for Subbasins 6 and 8 since they are along the Indiana state boundary at a location with no USGS gage. Additional details are provided in Appendix B.1.

Key:
IL = Illinois
IN = Indiana
sq. mi. = square mile
USGS = U.S. Geological Survey

Water Availability and ***Excess Water Availability*** are calculated at both the subbasin (i.e., local) and watershed (i.e., regional) scale. When calculated at the watershed scale (regional), these metrics are defined as ***Cumulative Water Availability*** and ***Cumulative Excess Water Availability***, and they account for the cumulative effects of all water budget components from all upstream subbasins that contribute to streamflow at the individual subbasin outlet. These metrics most closely represent the water available at a subbasin outlet, which could include flow contributions from the upper watershed.

At the subbasin scale, ***Water Availability*** and ***Excess Water Availability*** are calculated using the net natural baseflow, water withdrawals, return flows, instream flow, and net reservoir storage generated within an individual subbasin. These metrics are useful for relating withdrawals to streamflow and baseflow generated within each subbasin, independent of contributions from the upper watershed.

The general process for calculating cumulative water budget components, cumulative excess water availability, and excess water availability is briefly described below. The order of calculation describes cumulative water budget components first, which are then used to estimate excess water availability.

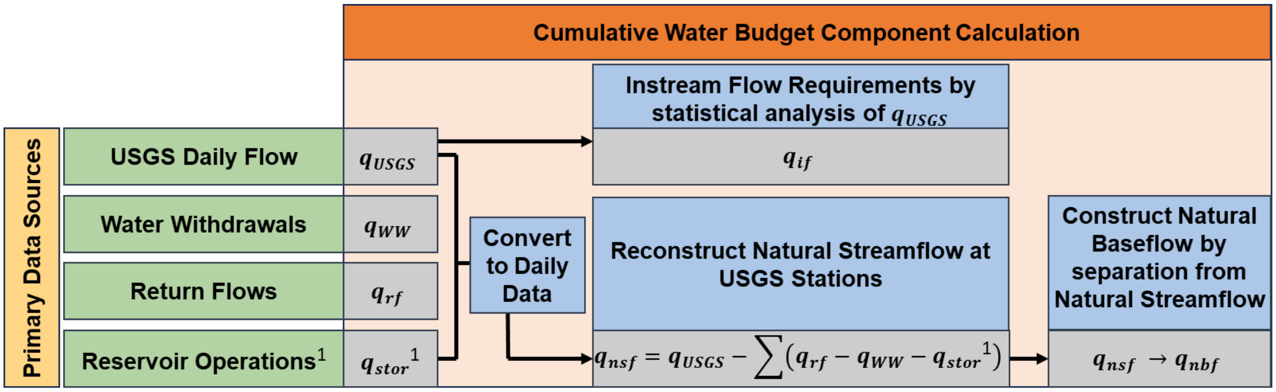
3.1.1 CUMULATIVE WATER BUDGET COMPONENT CALCULATION (WATERSHED)

Calculation of water availability requires quantification of five primary water budget components:

- **Natural Baseflow**
- **Instream Flow**
- **Reservoir Operations**[1]
- **Water Withdrawals**
- **Return Flows**

All components of the historical water budget were collected or derived from publicly available data. The general process used to calculate water budget components is illustrated in Figure 3-2 and summarized in the following section. Additional details on data sources, pre-processing steps, and analytical methods are provided in Appendix B. The analysis period was limited to 2007 – 2023 to align with the availability of return flow data, which have been publicly accessible through the U.S. Environmental Protection Agency's Enforcement and Compliance History Online (ECHO) database beginning in 2007.

[1] Reservoir operations are not considered in this study. Additional details are provided in Section 5.3.



Note:
[1] Reservoir operations are not considered in this study. Additional details are provided in Section 5.3.

Figure 3-2. General Process for Calculating Cumulative Water Budget Components

Cumulative water budget components were calculated following this sequence:

- **Measured Streamflow (q_{USGS}):** Collect historical USGS daily stream flow for all gages at subbasin outlets. No data synthesis was required, as the gage records were complete with no missing dates.

- **Instream Flow (q_{if}) [2]:** Calculate instream flow requirements at each USGS gage consistent with previous regional water studies (e.g., INTERA 2021a, Letsinger and Gustin 2024, Stantec 2025). From December through May (Winter and Spring seasons), instream flow is defined using a Q90 metric, a value that indicates the minimum daily streamflow level that is exceeded 90% of the time. From June through November (Summer and Fall seasons, when low flows typically occur), instream flow is defined using a 7Q10 metric, or the lowest 7-day average flow that occurs (on average) once every 10 years. A full description of the calculation is provided in Section 5.2.

- **Reservoir Operations (q_{stor}):** For the Kankakee Study Area, reservoir operations were not included in the analysis, as none of the dams or reservoirs within the basin significantly influence the streamflow regime. Additional information is provided in Sections 2.6 and 5.3 and Appendix B.5.

- **Water Withdrawals (q_{ww}):** Collect water withdrawal data available within the Study Area and estimate daily water withdrawals from all surface water intakes and groundwater wells. Water withdrawals were quantified for the following six water use sectors using data reported in the SWWF database (IDNR 2025): public supply, energy production, industrial and commercial, irrigation, miscellaneous, and rural. Water withdrawals from CAFOs and self-supplied residential

[2] The Indiana Natural Resources Commission is authorized to determine and establish minimum instream flows based on Indiana Code 14-25-7-14. The statute does not explicitly define minimum instream flows for river systems, but suggests that when values are established, they should be based on the varying low flow characteristics of streams and the importance of instream and withdrawal uses. Instream uses means any use of water that uses surface water in place, including commercial and recreational navigation, hydroelectric power generation, waste assimilation, fish and wildlife habitat, general recreation, and maintenance of environmental and aesthetic values.

sectors were estimated from available data as described in Chapter 4. Additional information is provided in Appendix B.2 and Appendix C.

- **Return Flows (q_{rf}):** Estimate daily return flows for all water withdrawal sectors. The ECHO database was used to quantify monthly return flows from regulated National Pollutant Discharge Elimination System (NPDES) discharge points, which were converted to daily return flow data. These returns were assumed to represent major return flows from SWWFs in the public supply, energy production, industrial and commercial, miscellaneous, and rural sectors. Return flows for CAFOs, irrigation, and self-supplied residential uses were estimated using a return flow factor multiplied by daily withdrawals. Additional information is provided in Appendix B.3 and Appendix B.4.

- **Natural Streamflow (q_{nsf}):** Convert daily measured historical streamflow to daily natural streamflow by subtracting all daily upstream return flows and adding all daily upstream withdrawals. This step simulates the removal of anthropogenic influences on measured streamflow by adding back all water withdrawn upstream and subtracting all water discharged upstream. Note that reservoir operations were not considered in this study and were excluded from the natural streamflow calculations.

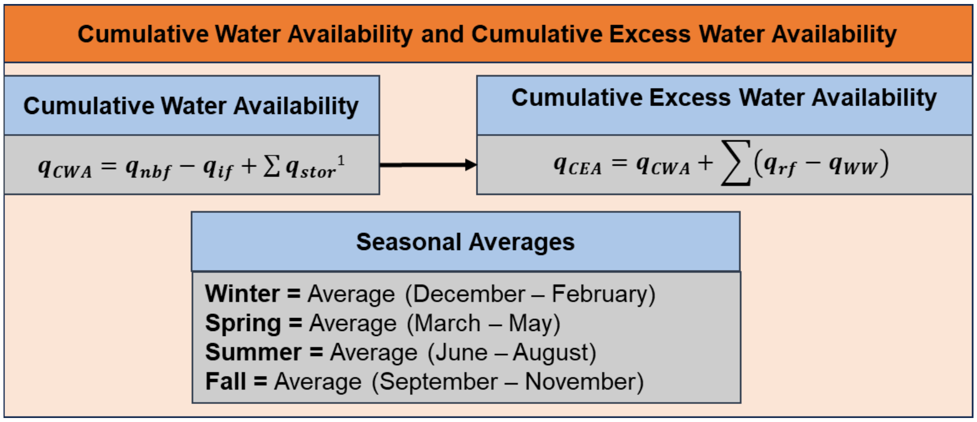
- **Natural Baseflow (q_{nbf}):** Apply a baseflow separation algorithm to the reconstructed natural streamflow time series to estimate a natural stream baseflow time series at the watershed outlet. Additional details on the baseflow separation methodology are provided in Section 5.6.

3.1.2 CUMULATIVE EXCESS WATER AVAILABILITY (WATERSHED)

Cumulative excess water availability (regional) was calculated using the following sequence, as shown in Figure 3-3.

- ***Cumulative Water Availability (CWA)*** **(q_{CWA}):** Subtract daily instream flow from daily natural baseflow. Note that reservoir operations were not considered in this study and were excluded from the cumulative water availability calculations. Summarize results by averaging daily results across four seasons: Winter (December – February), Spring (March – May), Summer (June – August), and Fall (September – November).

- ***Cumulative Excess Water Availability (CEWA)*** **(q_{CEA}):** Add daily net returns (returns minus withdrawals) from all locations within the watershed. Calculate seasonal averages.



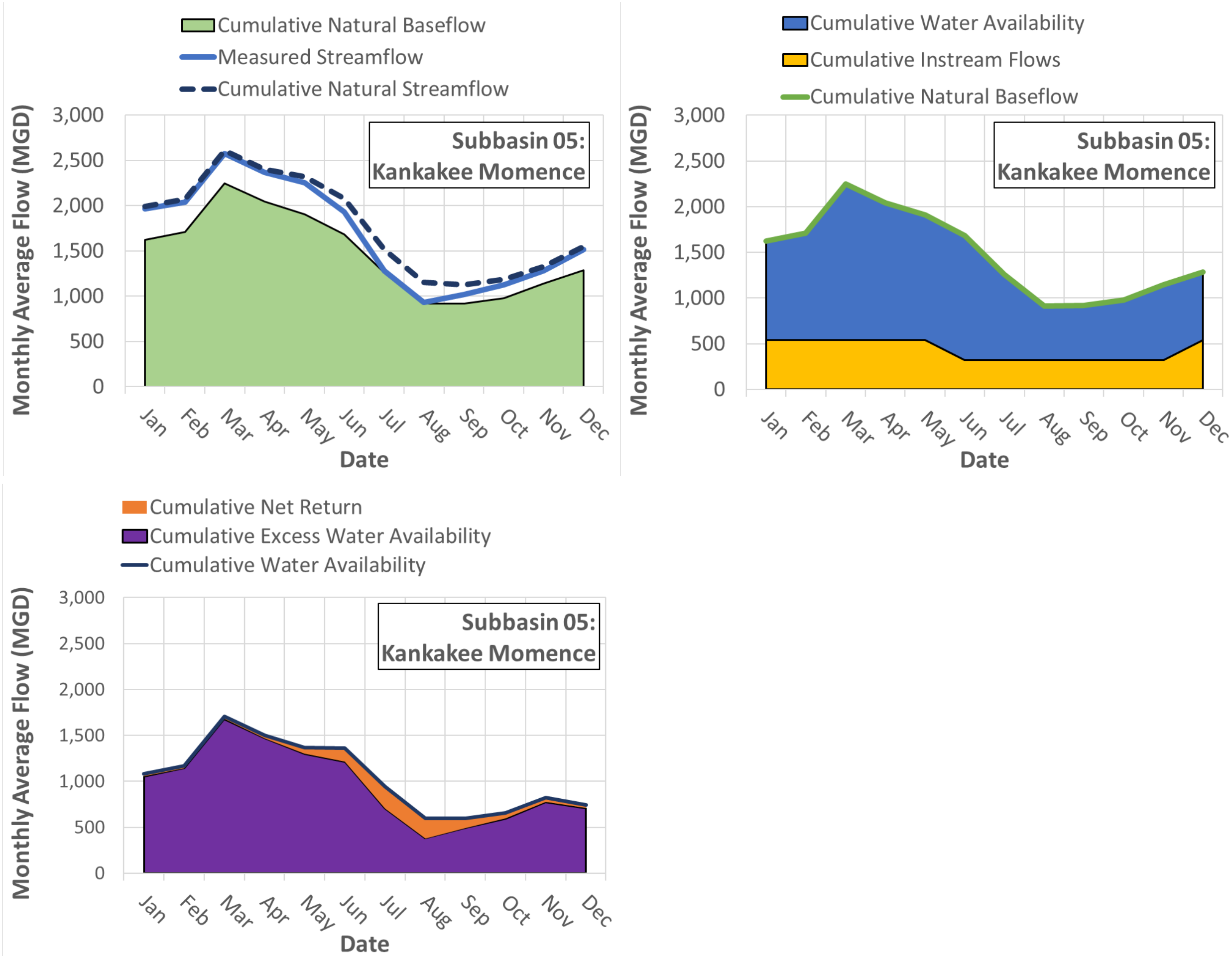
Note:
[1] Reservoir operations are not considered in this study. Additional details are provided in Section 5.3.

Figure 3-3. General Process for Calculating Cumulative Water Availability and Cumulative Excess Water Availability (regional water availability)

Figure 3-4 illustrates an example of how available water from upstream and regional contributions (CWA) was calculated for Subbasin 05 (Kankakee Momence), which includes portions of Lake, Porter, and Newton Counties and communities such as Crown Point, Lake Dalecarlia, and Lowell. The results are shown as monthly averages in an annual hydrograph. On the top left plot, measured streamflow is adjusted by adding upstream withdrawals and subtracting upstream return flows to estimate cumulative natural streamflow. The resulting dashed line representing natural streamflow remains consistently higher than the measured streamflow, illustrating the removal of upstream human influences where withdrawals exceed return flows. The baseflow separation method is then applied to derive cumulative natural baseflow, representing only groundwater contributions by excluding stormflow effects.

On the top right plot, the green line shows cumulative natural baseflow, while the blue shaded area represents cumulative water availability (CWA) generated from regional upstream contributions, the portion of baseflow that exceeds cumulative instream flow requirements. Cumulative water availability generated regionally (CWA) is lower than total natural baseflow and shows greater seasonal variation, with the largest differences occurring in Winter and Spring when instream flow needs are higher. The lowest cumulative water availability generated regionally (CWA) typically occurs from August through November due to reduced baseflow during late Summer and early Fall.

The bottom plot retains the cumulative water availability (regional) curve (blue) and illustrates how cumulative net return flows further reduce it to produce cumulative excess water availability generated from regional flows (CEWA). In this example, net return flows are relatively small compared to total baseflow and primarily occur in late Summer.



Key:
MGD = million gallons per day

Takeaway: Example showing how measured streamflow is adjusted for withdrawals and return flows to create cumulative natural streamflow and natural baseflow, how instream flow needs are subtracted from natural baseflow to get cumulative water availability (CWA), and how net return flows are applied to estimate cumulative excess water generated from regional upstream contributions (CEWA).

Figure 3-4. Cumulative Excess Water Availability Example Plots

3.1.3 EXCESS WATER AVAILABILITY (SUBBASIN)

Excess water availability was calculated using the following sequence as shown in Figure 3-5:

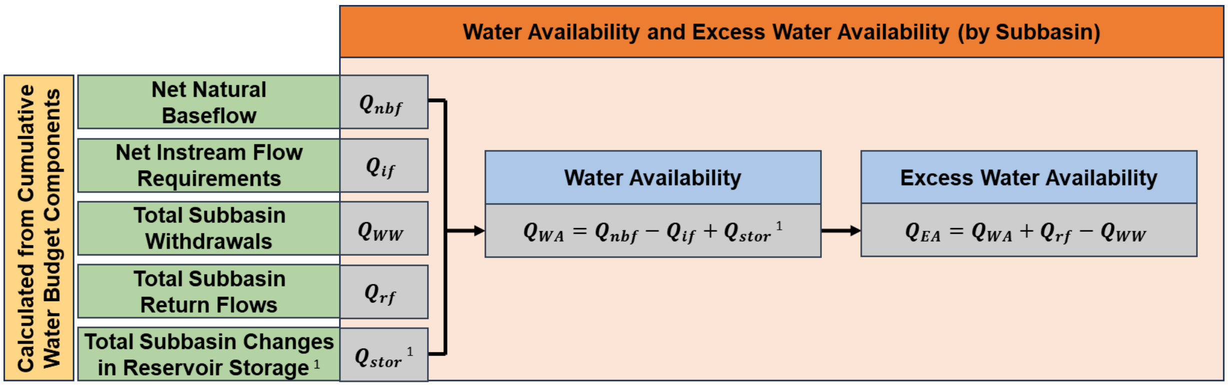
- Calculate net water budget components within a subbasin (***Q_{nbf}*, *Q_{if}*, *Q_{ww}*, *Q_{rf}*, *Q_{stor}***[3]) by subtracting the cumulative water budget component from all upstream connected subbasins. For example, to calculate net water budget components for Subbasin 05, cumulative water budget components from Subbasin 01, 02, 03, and 04 would be subtracted from the Subbasin 05 cumulative water budget components (refer to the stream network in Figure 3-1). This step

[3] Reservoir operations are not considered in this study. Additional details are provided in Section 5.3.

provides an estimate of the local water budget component generated strictly within the subbasin (excluding all upstream contributions).

- ***Water Availability (Q_{WA}):*** Subtract daily net instream flow from daily net natural baseflow. Calculate seasonal averages.

- ***Excess Water Availability (EWA) (Q_{EA}):*** Add daily net returns (net returns minus net withdrawals) within the subbasin. Calculate seasonal averages.



Note:
[1] Reservoir operations are not considered in this study. Additional details are provided in Section 5.3.

Figure 3-5. General Process for Calculating Water Availability and Excess Water Availability

3.2 Future Water Availability Analysis Framework

The same subbasin delineation and analytical framework used to quantify historical water availability were applied to estimate future water availability for the period 2024 – 2075. Future cumulative water budget components were calculated based on projected natural baseflow, water withdrawals, and return flows. The general process is summarized below, with corresponding steps illustrated in Figure 3-6. Additional details on climate change assumptions and the overall study approach are provided in Section 3.3.

1. **Developing the future flow sequence**: Each year from the historical record of daily natural streamflow (2007 – 2023) was used to represent a year within the future period (2024 – 2075). The sequencing of future years follows the approach used in the Indiana Climate Change Impacts Assessment (INCCIA) (Cherkauer et al. 2021) and the North Central Indiana Regional Water Study (Stantec 2025), which provided the basis for the climate change assumptions adopted in this Study. The detailed methodology and criteria for year selection and sequencing are provided in Section 5.5.2.

2. **Applying climate change factors**: For each daily natural streamflow series representing 2024 – 2075, monthly climate-change adjustment factors were applied to account for projected changes in temperature, precipitation, and other meteorological inputs. These factors vary by time and location, and typically range between 0.5 and 1.5, reflecting simulated future changes in

streamflow derived from hydrologic modeling in the INCCIA study. Further details are available in Appendix G.

3. **Estimating future natural baseflow:** A baseflow separation algorithm was applied to each future natural streamflow time series to estimate future natural baseflow at the subbasin outlet.

4. **Projecting future withdrawals:** Future monthly water withdrawals for each water-demand sector and subbasin were estimated as described in Chapter 4. Projections for certain sectors were developed using simulated future air temperature and precipitation data from the INCCIA study, averaged at the county scale.

5. **Estimating return flows:** Return flows for each demand sector and subbasin were estimated using regression relationships developed between historical withdrawals and return flows. Separate regression equations were created for the public supply, industrial and commercial, and energy production sectors. For the future period, projected withdrawals were used as inputs to these equations to estimate future return flows. Additional details are provided in Appendix G. Return flows for CAFOs, irrigation, and self-supplied residential uses were estimated using the same return flow factors applied in the historical analysis, multiplied by the corresponding monthly average withdrawals.

6. **Instream flow requirements**: Instream flow requirements for each future year were assumed to be the same as those defined for the representative historical year.

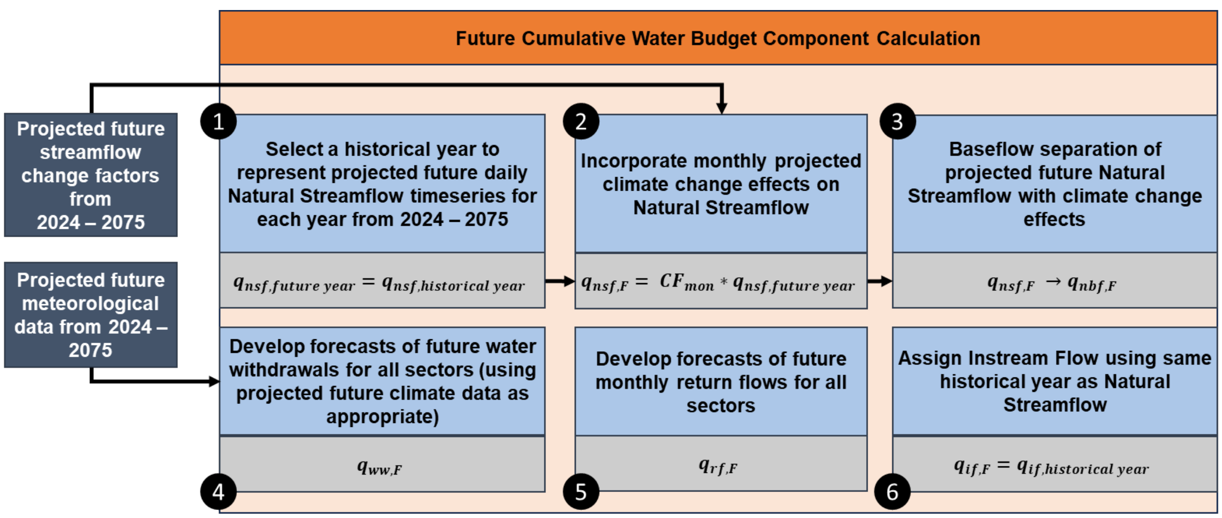


Figure 3-6. General Process for Calculating Future Cumulative Water Budget Components

The same general framework for the historical period for calculating local and regional water availability was applied to the future period (see Figure 3-3).

3.3 Defining a Future Baseline Scenario

A singular future baseline scenario was developed based on estimated trends in population, economic development, and climate over the next 50 years. **Under the Baseline scenario, future demand is based upon foreseeable (e.g., publicly announced) plans and historical trends.** In this way the Baseline scenario estimates the minimum needs for existing and known future growth and minimizes the concern over including water demand based on speculative growth predictions.

The Baseline scenario of water demand relied on historical data analysis, projected estimations based on future explanatory data (e.g., population and climate), and known foreseeable future industrial and agricultural (i.e., irrigation) development plans. Trends of historical data analyzed include water withdrawal volumes, population and socioeconomic statistics, economic development, and climate variables. Future explanatory data estimates, from both peer-reviewed publications and unique forecasts developed for this study, include population and climate factors. Qualitative information includes reviews of published reports, studies, and press releases relevant to local water demands as well as interviews with local community members. Refer to Chapter 4 and Appendix C for additional discussion about the Baseline scenario.

3.3.1 PARTICIPANTS/STAKEHOLDER INPUT

Interviews with representatives from various local agencies helped inform demand assumptions. Representatives included the water utilities for the City of Valparaiso and the Town of New Carlisle, the county economic development departments for La Porte County and St. Joseph County, and the Lake County Parks and Recreation Department. State and regional representatives included the IDNR Division of Water and the Indiana Farm Bureau.

The following themes emerged from the agency representative conversations:

- Concerns about water availability range from no concerns to active planning efforts to secure water sources outside of the Kankakee Basin.
- Water concerns within a county can differ greatly depending on existing infrastructure, basin bedrock constraints, and growth areas.
- Industrial growth for high water demand industries is anticipated in ethanol production, data centers, battery production, and continued growth or sustained activity in mining.
- Limited local supply has been halted or deterred development in some areas until an external water source can be secured.
- Trends point toward an increase in agricultural irrigation water demand, though investment in irrigation equipment may have already peaked.
- Farmers within the Kankakee Basin have strong partnerships with each other to manage flooding using surface water ditch intakes during the off-season.

- Periodic drought has caused wells to run dry, as experienced in 1988 and 2012.
- The Kingsbury, LaSalle, and Kankakee Fish and Wildlife Areas managed by Indiana Department of Natural Resources-Division of Fish and Wildlife (IDNR-DFW), contribute to regional wetland and habitat management within the Kankakee Basin. These areas rely on managed surface water diversions and storage to sustain wetland hydrology and ecological functions; however, because inflows and outflows are generally balanced, they have minimal influence on basin-scale streamflow conditions.
- Discussions with regional academic and engineering partners highlighted that the Kankakee Basin has undergone substantial geomorphic and hydrologic modification from its original wetland system to an intensively managed agricultural landscape. The basin's high drainage density, extensive ditch network, and localized groundwater pumping have increased conveyance efficiency but reduced natural floodplain storage and sediment transport capacity. Current basin management efforts focus on restoring more functional flow conditions and improving sediment and flood management while maintaining agricultural viability under a changing climate.

3.3.2 DEMAND ASSUMPTIONS

Assumptions used to forecast future water demand are summarized in Table 3-2. Chapter 4 and Appendix C describe how these assumptions were incorporated into the sector-specific forecasts in greater detail.

Table 3-2. Demand Assumptions in the Future Baseline Scenario

Sector[4]	Assumption
Energy Production	Future energy generating capacity by technology is based on statewide projections in Purdue University's "Indiana Electricity Projections: The 2023 Forecast." Purdue's report included projections through 2041. Beyond 2042, the average growth rate by technology from 2023 – 2041 was assumed to be the same for 2042 – 2075. The data and methodology are consistent with the North Central Indiana Regional Water Study (Stantec 2025).
Industrial Use	General industrial growth is based on time trends and interviews with economic development departments and other publicly announced undertakings that might be documented by a news article detailing a major development.
Irrigation	Time trends since 1985 indicate significant increases in irrigation withdrawals. Based on these time trends and interviews with industry experts, irrigation withdrawals are forecasted to continue increasing. A portion of irrigation withdrawals reported during the off-season were excluded from the demand analysis as they were assumed to be for drainage and not irrigation. Farmers in the Kankakee Basin use surface water pumps to move water off fields for drainage during the off-season months, November – April. The average growing season assumes consistency between years without variation of timing based on interannual differences such as abnormally wet or dry years or early or late rains.
Public Supply	Population forecast for the region is based on historical trends (US Census Bureau 2023) and forecasts published by STATS Indiana (2024).

[4] Additional sectors are included in the forecast but not discussed here because the data used in the estimation is from supplemental sources (self-supplied and CAFOs are not included in the IDNR SWWF database) and the volume of estimated water withdrawals is relatively low (miscellaneous and rural).

3.3.2.1 Historical Data Limitations

The SWWF historical database allowed for analysis to forecast future demand (IDNR 2025). However, possible limitations of the data require acknowledgment here. All data are self-reported.

For the public supply sector, water withdrawal data for utilities are often reported under the single water use type, public supply. In addition to supplying residents with water, utilities also supply water to industry, schools, municipal agencies, and other unspecified uses beyond residential homes. Identification of the different use types of utility-supplied water can vary by utility.

The assumption that some water reported under irrigation is for drainage relies on the water withdrawal records of water use purpose. Each withdrawal record contains both a use type (sector) and a use purpose which has additional details. Surface water withdrawals coded as irrigation use type are sometimes labeled with the purpose “drainage.” The same withdrawal site has a single purpose throughout a single year, though it is assumed that the purpose may change throughout the year. This limitation required an assumption that the seasonal withdrawals labeled with the purpose of drainage during the off season, November – April, would not be counted as consumptive use.

In addition, this study reclassified two ethanol production facilities which were originally categorized under energy production into the industrial sector, as they do not generate electricity but produce ethanol fuel for external markets.

3.3.3 CLIMATE CHANGE ASSUMPTIONS

The potential effects of future climate change on air temperature, precipitation, and streamflow were evaluated using data developed for the INCCIA by Cherkauer et al. (2021). The INCCIA represents a collaborative effort among scientists and decision makers across Indiana to understand how climate change influences local and statewide resources. To assess these changes, the study used statistically downscaled climate projections, specifically temperature and precipitation data, from six Global Climate Models (GCM) selected for their ability to represent climate processes in the Midwestern United States (Byun and Hamlet 2018, Byun et al. 2019). Each GCM was analyzed under two emissions scenarios: a medium-emissions pathway (Representation Concentration Pathways (RCP) 4.5) and a high-emissions pathway (RCP 8.5).

The downscaled climate projections were used to drive simulations of surface hydrology using the Variable Infiltration Capacity (VIC) large-scale hydrology model, which was calibrated to Indiana conditions. The model produced long-term simulations of precipitation, temperature, and streamflow, spanning from 2011 through 2100.

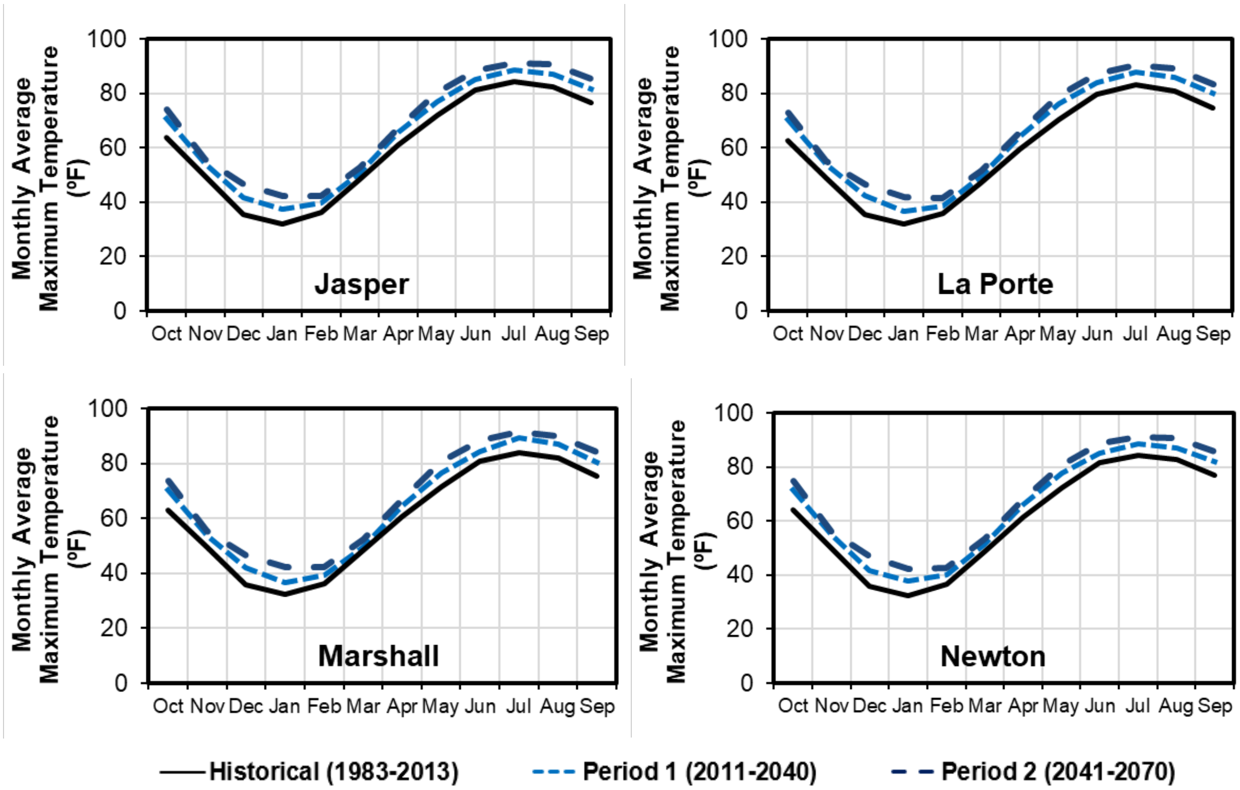
Data from the INCCIA were provided to the project team for this analysis (Cherkauer et al., 2025). The dataset included simulated daily precipitation, air temperature, and streamflow at gridded locations and selected USGS gage sites across Indiana for four 30-year periods: **Historical (1984–2013), Period 1 (2011–2040), Period 2 (2041–2070), and Period 3 (2071–2100).** For consistency with the future planning horizon of this Study (2024–2075), only data from Periods 1 and 2 were analyzed.

Future climate conditions for the Kankakee Basin were assessed following the framework established in the North Central Indiana Regional Water Study (Stantec 2025), which compared multiple GCMs and emissions scenarios for projected changes in temperature, precipitation, and streamflow. That analysis concluded that variability among GCMs was greater than the variability between emissions scenarios through the mid-21st century. **The Community Earth System Model (CESM1-CAM5) was identified as best representing the central tendency of projected hydroclimatic changes across Indiana. To remain consistent with statewide planning studies and to adopt a conservative approach, the RCP 8.5 emissions scenario was selected as the future baseline climate condition for this Study.**

Figure 3-7 through Figure 3-9 summarize projected changes in air temperature, precipitation, and streamflow simulated under the CESM1-CAM5 RCP 8.5 scenario at selected county and subbasin locations:

- **Figure 3-7 shows simulated monthly maximum air temperature for Jasper, La Porte, Marshall, and Newton Counties. Projected temperatures increase across all months, with the greatest increases occurring during Fall, Winter, and Summer. Warming is more pronounced during Period 2 (2041–2070) than Period 1 (2011–2040), and these patterns are consistent across all locations.**
- **Figure 3-8 presents simulated monthly precipitation for the same counties. Precipitation is generally projected to increase, with the largest relative increases in late Winter, Spring, and early Summer. Period 1 shows slightly drier conditions from late Summer through early Winter, while Period 2 indicates overall wetter conditions, especially across northern counties such as La Porte. Seasonal distribution of precipitation also shifts, with earlier peaks in mid-Spring and a secondary peak in mid- to late Summer.**
- **Figure 3-9 illustrates simulated streamflow for representative subbasins across the Kankakee River Basin, which include portions of Marshall, St. Joseph, Starke, La Porte, Jasper, Newton, Porter, Lake, and White Counties. In general, Winter and Spring months are projected to experience higher streamflow compared to historical conditions, while late Summer and Fall show reductions of approximately 10%.**

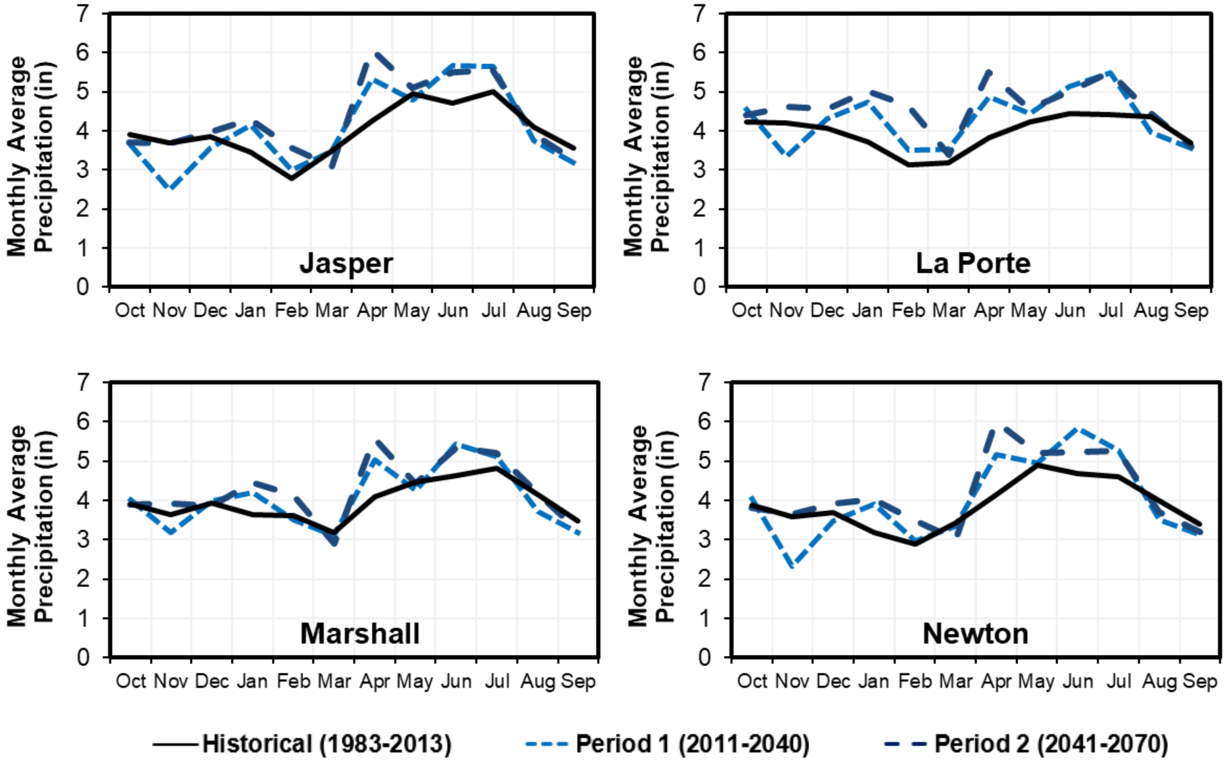
The meteorological and hydrologic data from Cherkauer et al. (2021) were also used to support the development of future water demand and natural streamflow estimates. For water demand projections, a time series of future monthly meteorological data (2024 – 2075) was developed for each county and subbasin using the grid point nearest to the county centroid. These data served as inputs for estimating sector-specific water demands, as described in Appendix C. To estimate future natural streamflow, each year between 2024 and 2075 was represented by a historical streamflow year from 2007 – 2023, selected following the sequencing framework described in Section 5.3. To account for climate change impacts, monthly streamflow values were adjusted using climate change factors derived from the VIC model simulations, which scale the historical natural streamflow to reflect the magnitude of projected increases or decreases under future climate conditions.



Note:
County-subbasin relationships and combined boundary information are provided in Table 2-3 and Figure 3-1.

Takeaway: Maximum temperatures rise across all months, with bigger increases in Fall, Winter, and Summer and consistently higher warming in Period 2 (2041 – 2070).

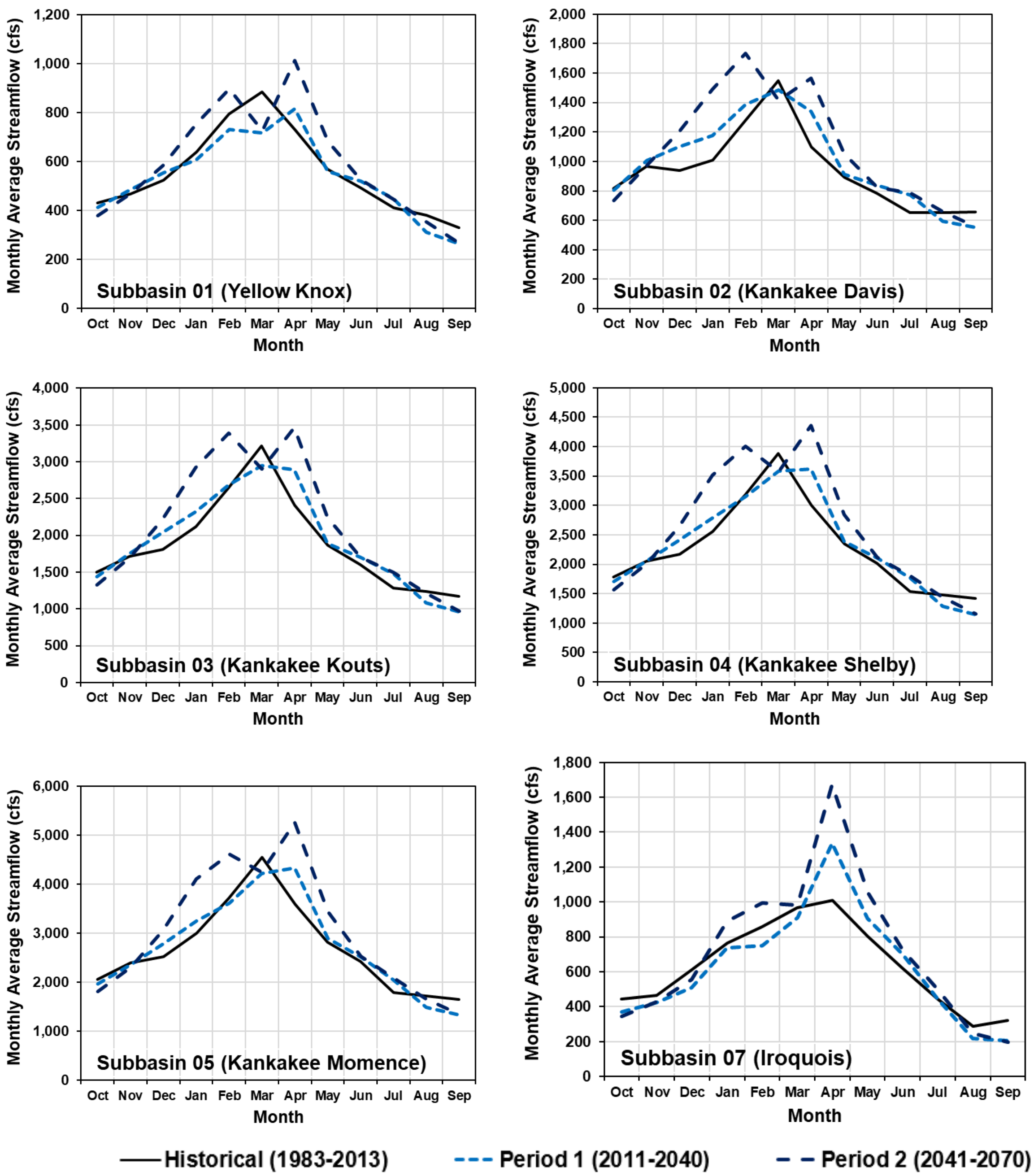
Figure 3-7. Simulated Maximum Average Monthly Temperature for Historical and Future Periods by County



Note:
County-subbasin relationships and combined boundary information are provided in Table 2-3 and Figure 3-1.

Takeaway: Future projections show wetter late-Winter to early-Summer conditions, with Period 2 (2041 – 2070) bringing the biggest increases, especially in northern counties.

Figure 3-8. Simulated Total Average Monthly Precipitation for Historical and Future Periods by County



Key:
cfs = cubic feet per second
Note:
County-subbasin relationships and combined boundary information are provided in Table 2-3 and Figure 3-1.

Takeaway: Future projections boost Winter/Spring streamflow while cutting late Summer and Fall flow by roughly 10% across all subbasins.

Figure 3-9. Simulated Monthly Average Streamflow for Historical and Future Periods by Subbasin Location

3.4 Simplifying Assumptions for Water Availability Estimates

The general approach used to quantify water availability in this Study follows the framework established in prior regional assessments (e.g., INTERA 2021a, Stantec 2025). As with most regional-scale analyses, several simplifying assumptions were adopted to allow for a practical yet scientifically defensible evaluation of complex hydrologic processes. These assumptions are described below, along with their rationale and implications for interpretation of results.

- **Streamflow Depletion from Groundwater Withdrawals:** Groundwater withdrawals are assumed to cause instantaneous streamflow depletion of equal magnitude, with no change in aquifer storage explicitly considered. This simplification assumes that any volume of groundwater extracted immediately reduces streamflow, representing a steady-state interaction between groundwater and surface water. This assumption is considered reasonable for the Kankakee Basin, where most groundwater withdrawals occur from hydraulically connected outwash and alluvial aquifers adjacent to major rivers. In reality, streamflow depletion caused by pumping would lag over time as induced infiltration occurs between connected aquifers and surface water bodies. However, since this Study summarizes results on a seasonal (three-month) basis, and approximately 84% of groundwater withdrawals originate from unconfined aquifers (Section 2.6), the temporal lag is not expected to significantly affect the overall results.

- **Groundwater Storage Not Considered as a Source of Water Availability:** Changes in aquifer storage are not included as a component of excess water availability generated locally (EWA). Although groundwater storage fluctuates in response to recharge and pumping, the majority of wells in the Study Area draw from shallow, alluvial aquifers hydraulically connected to surface water systems, while only about 16% extract from deeper, confined aquifers (Section 2.6). Because the recharge processes and sustainable yields of these deeper aquifers are complex and not easily quantified, they are excluded from this assessment. As such, any additional water potentially available from deep aquifers should be evaluated separately through a detailed groundwater study that considers recharge, withdrawals, and long-term storage dynamics. The quantities estimated in this Study represent water availability from surface water and shallow connected aquifers only.

- **Exclusion of Variable Stormflow as a Water Supply Source:** Stormflow runoff is not included as a source of water availability. Instead, natural baseflow is used as a proxy for the continuous groundwater supply available for future development. This approach provides a conservative estimate of the minimum, sustained water volume in the system. While some future demands may be seasonal and could potentially utilize stormflow during wet periods, such scenarios would require a more detailed hydrologic analysis to account for the timing and variability of storm events. These dynamic, short-term sources are beyond the scope of the present Study.

- **Reservoir Operations Not Included in Natural Streamflow or Water Availability Calculations:** Reservoir operations were not considered in the estimation of natural streamflow or water availability. A review of existing dams and impoundments in the Kankakee Basin (Section 5.3) indicated that most facilities are small, off-stream, or have limited drainage areas relative to their surrounding subbasins. These structures generally function as recreational lakes, sediment basins, or minor impoundments, and operate under near-steady conditions where inflow is approximately equal to outflow. Given the absence of public operational data and their limited hydrologic influence, reservoir storage, evaporation, and groundwater exchange processes were not modeled. The resulting natural streamflow values therefore represent conditions unaffected by reservoir management or controlled releases.

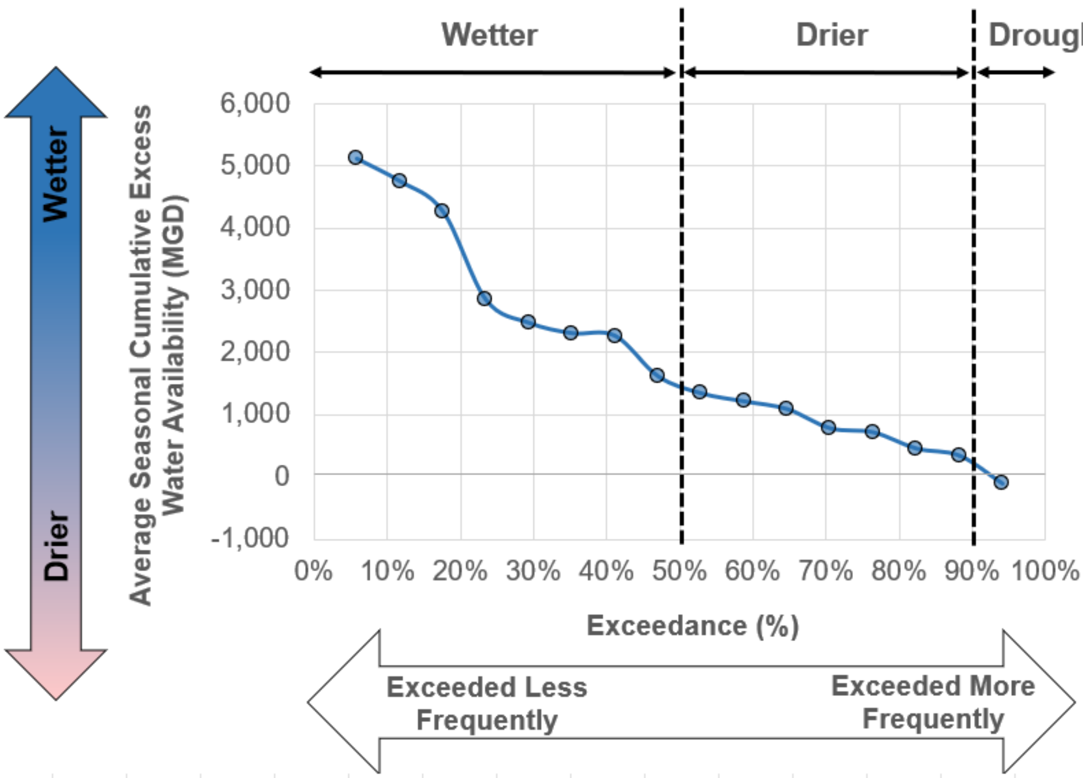
- **Interaction Between Unconsolidated and Bedrock Aquifers:** Within the Kankakee River Basin, bedrock aquifers are recharged by overlying unconsolidated aquifers, especially where sand and gravel units intersect bedrock and the confining layer is thin or absent (0-125 feet thick), such as in parts of northern and southern Jasper County. Hydrograph data show annual replenishment after Summer irrigation seasons. Oxygen-18 isotope analyses (Hasenmueller et al. 2001) indicate mixing of younger recharge water with older bedrock water, confirming active exchange between the two systems. Historical pumping data (Arihood and Basch 1994) show seasonal drawdowns of 5–80 feet in carbonate bedrock aquifers due to irrigation pumping, while overlying aquifers remain largely unaffected due to a continuous clay confining layer (hydraulic conductivity: 1.8×10^{-4} to 1.8×10^{-6} ft/day). Groundwater not extracted from bedrock aquifers ultimately discharges to the Kankakee and Iroquois Rivers (Basch and Funkhouser 1985, Eberts 1999). Given this hydraulic connection, withdrawals from bedrock wells are an important component of the regional groundwater balance. Arihood and Basch (1994) estimated that about 59 cfs of groundwater that would otherwise discharge to streams is intercepted by irrigation pumping. These findings from available literature, regional hydrogeologic understanding, and long-term water-level data, support evaluating surface water and groundwater as interconnected resources in assessing regional water availability.

3.5 Presentation of Results

Study results are presented in several formats to illustrate variability in water budget components, both spatially across subbasins and temporally across multiple years and within individual seasons.

3.5.1 EXCEEDANCE CURVE

An exceedance curve provides a visual representation of how often a particular value, such as cumulative excess water availability generated regionally (CEWA), is equaled or exceeded over a specified time period. In hydrologic analyses, these curves are frequently used to describe the frequency or recurrence of water related conditions, such as streamflow magnitude or cumulative water availability above a threshold. An example of an exceedance curve is shown in Figure 3-10. The x-axis represents the exceedance probability (in percent), and the y-axis represents the value of interest (in this case, average seasonal cumulative excess water availability). Each point on the curve corresponds to a pair of values, an exceedance probability and its associated flow or availability amount. For instance, a value of 5,000 MGD at the 10% exceedance level indicates that cumulative excess water availability generated regionally (CEWA) of 5,000 MGD or greater occurs only 10% of the time, representing relatively wet conditions or high-flow events. Conversely, a value of -100 MGD at the 95% exceedance level means that such low water availability is exceeded 95% of the time, reflecting more frequent and drier conditions, including drought periods. As shown in Figure 3-10, exceedance ranges are interpreted as follows: values at lower exceedance probabilities (0–50%) represent wetter-than-normal conditions; mid-range exceedance probabilities (approximately 50–90%) correspond to increasingly drier conditions; and exceedance probabilities above 90% indicate drought conditions.

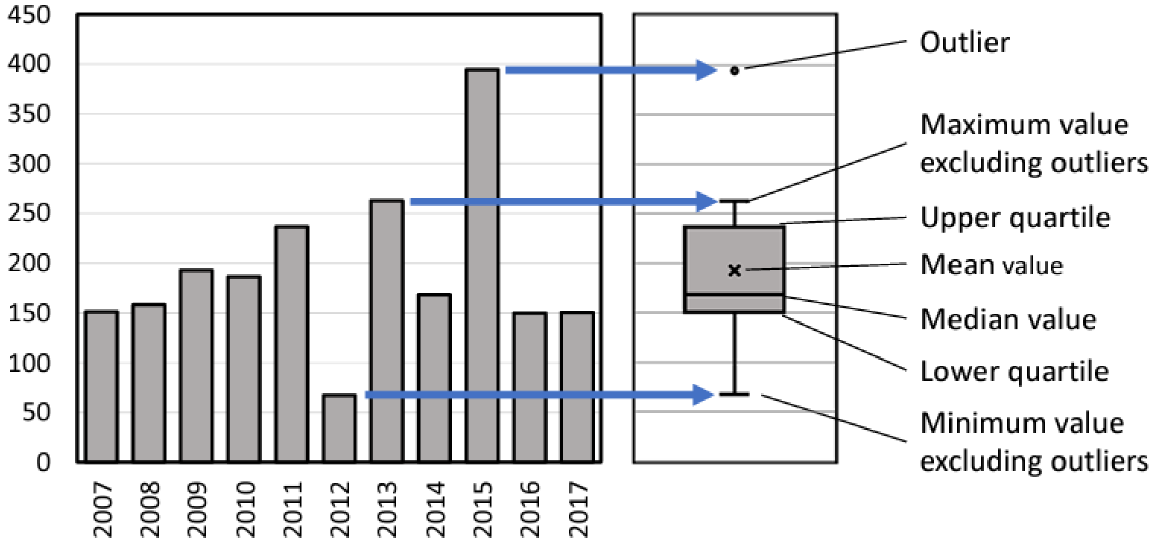


Source: North Central Indiana regional water study (Stantec 2025)
Note: The x-axis of the exceedance curve represents the exceedance probability as a percentage, while the y-axis shows the value of interest. Every marker on the plot aligns with an exceedance value on the x-axis and a value on the y-axis. Wetter conditions correspond to exceedance probabilities of 0–50%, drier conditions to approximately 50–90%, and drought conditions to exceedance levels greater than 90%.

Figure 3-10. Example Exceedance Curve

3.5.2 BOX AND WHISKER PLOT

A box and whisker plot (or box plot) is a graphical tool used to summarize the distribution of a dataset by displaying its central tendency, spread, and variability. An annotated example is provided in Figure 3-11. The box represents the interquartile range, bounded by the lower (25th percentile) and upper (75th percentile) quartiles, with the horizontal line inside the box showing the median value and the “X” symbol denoting the mean. The upper whisker extends from the top of the box to the maximum value excluding outliers, while the lower whisker extends from the bottom of the box to the minimum value excluding outliers. Data points that Fall beyond 1.5 times the interquartile range above or below the quartiles are identified as outliers and plotted individually. Box and whisker plots provide a concise visualization of the data distribution and are particularly useful for comparing multiple datasets, such as water budget components, across different time periods or subbasins. They highlight the range, central values, and variability within a dataset, allowing for straightforward identification of outliers or trends over time.



Source: North Central Indiana regional water study (INTERA 2021b)
Note: The annual time series on the left is represented as a single box and whisker plot on the right, illustrating outliers, minimum and maximum values, and quartile values.

Figure 3-11. Example Box and Whisker Plot

4.0 Water Demand Estimates

The Kankakee Basin Regional Water Study focuses on understanding water demand 50 years into the future in the eight subbasins of the Study Area (Figure 4-1). While water utilities are a focus of the study, the analysis includes water use in all water-use sectors to ensure an integrated understanding of water demand and availability in the region. This chapter reviews key results regionally, by subbasin and by sector, and summarizes the primary methodology used.

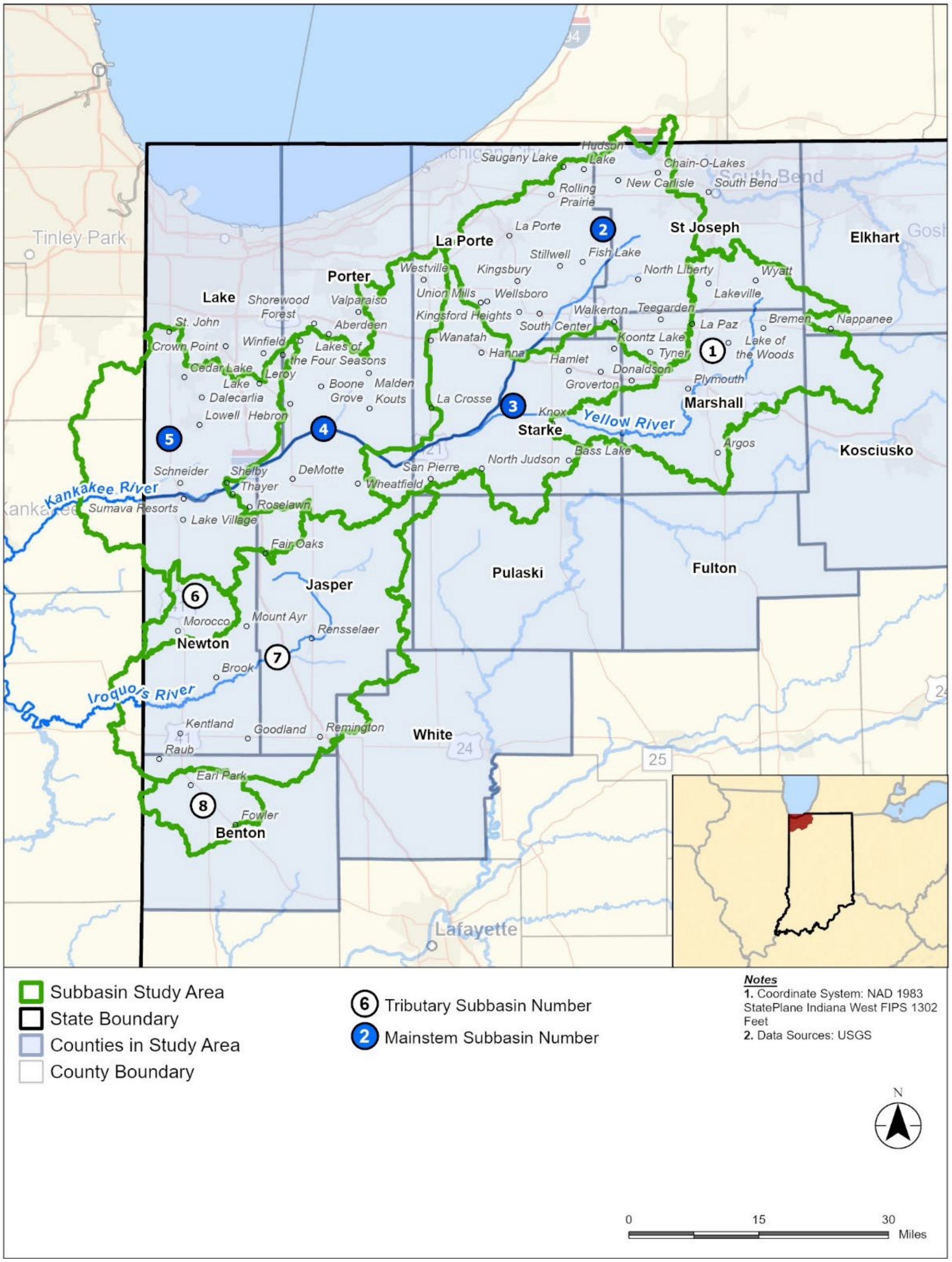


Figure 4-1. Kankakee Basin Study Area, Subbasin Boundaries, County Boundaries, Major Cities and Towns

4.1 Regional Comparisons

Water withdrawals vary regionally due to differences in geographic scope, population, industries, and economic drivers. In 2023, average annual withdrawals in the Kankakee Basin were 165 MGD, which is the second lowest average withdrawal rate annually in Indiana of the published studies discussed in this section (Table 4-1). By comparison, 2023 Kankakee Basin water withdrawals were 21% of the North Central Indiana Basin 2022 average annual withdrawals, estimated to be 789 MGD (Stantec 2025). Kankakee Basin withdrawals in 2023 were approximately 42% of that reported in the Central Indiana Water Study (INTERA 2020) at 384 MGD in 2018. Additionally, water withdrawals in the Southeast Central study area (Letsinger and Gustin 2024) were reported to be 74 MGD in 2020, 45% less than Kankakee Basin in 2023 (Table 4-1).

Table 4-1. Comparison of Current and Projected Water Demand Across Four Indiana Regional Water Study Areas, by Water Use Sector (MGD)

Water Use Sector (MGD) and Percent of Total	Current [a]				Projected Future (2070)			
	Kankakee Basin	North Central Indiana [b]	Central Indiana [a, c]	Southeast-Central [d]	Kankakee Basin	North Central Indiana [b]	Central Indiana [a, c]	Southeast-Central [d]
Public Supply	20	71	199	44	23	78	250	68
% Total	*12%*	*9%*	*52%*	*59%*	*10%*	*30%*	*50%*	*70%*
Agricultural (irrigation) [e]	83	43	12	15	89	70	19	17
% Total	*50%*	*5%*	*3%*	*21%*	*41%*	*27%*	*4%*	*18%*
Industrial	16	36	83	8	41	65	95	7
% Total	*9%*	*5%*	*22%*	*11%*	*19%*	*25%*	*19%*	*7%*
Energy Production	24	627	58	0	38	35	87	0
% Total	*15%*	*79%*	*15%*	*0%*	*18%*	*13%*	*18%*	*0%*
Domestic [f]	22	12	32	7	27	12	45	5
% Total	*14%*	*2%*	*8%*	*9%*	*12%*	*5%*	*9%*	*5%*
Total	**165**	**789**	**384**	**74**	**218**	**260**	**496**	**97**

Sources: [b]Stantec 2025, [c] INTERA 2020, [d] Letsinger and Gustin 2024

Notes:

[a] The Central Indiana Study did not report 2022 water demand as the report was completed in 2020, therefore 2018 was the most current water demand available. 2070 was used as the projected future year as it was the latest year common between all reports.

[e] For comparison purposes, water demand of the North Central Indiana water use sectors CAFO and CFO and irrigation were added together and reported in the agricultural sector.

[f] The water use sectors self-supplied, rural and miscellaneous were added together and reported in the domestic water use sector.

Blue highlighted cells indicate the dominant water use sector for each study area and time period.

Key:

MGD = million gallons per day

A difference between water use in the Kankakee Basin and all other basins is that agricultural/ irrigation water withdrawals comprise the largest share of total average annual withdrawals. In nearly all other basins studied to date, public supply withdrawals comprise the largest share of total average annual withdrawals.[5]

By 2070, the Kankakee Basin estimated demand for irrigation (agricultural) water withdrawals is projected to remain the water use type with the greatest share of total estimated water withdrawals, at 41% of total. Industrial and energy production make up similar shares at 19% and 18% of the total. This is in comparison to North Central, Central, and the Southeast Central study areas, where public supply is projected to be the greatest share of withdrawals. The North Central study area is similarly distributed between public supply (30% of total), irrigation (27% of total), and industrial (25% of total) water use sectors.

4.2 Subbasin Overview

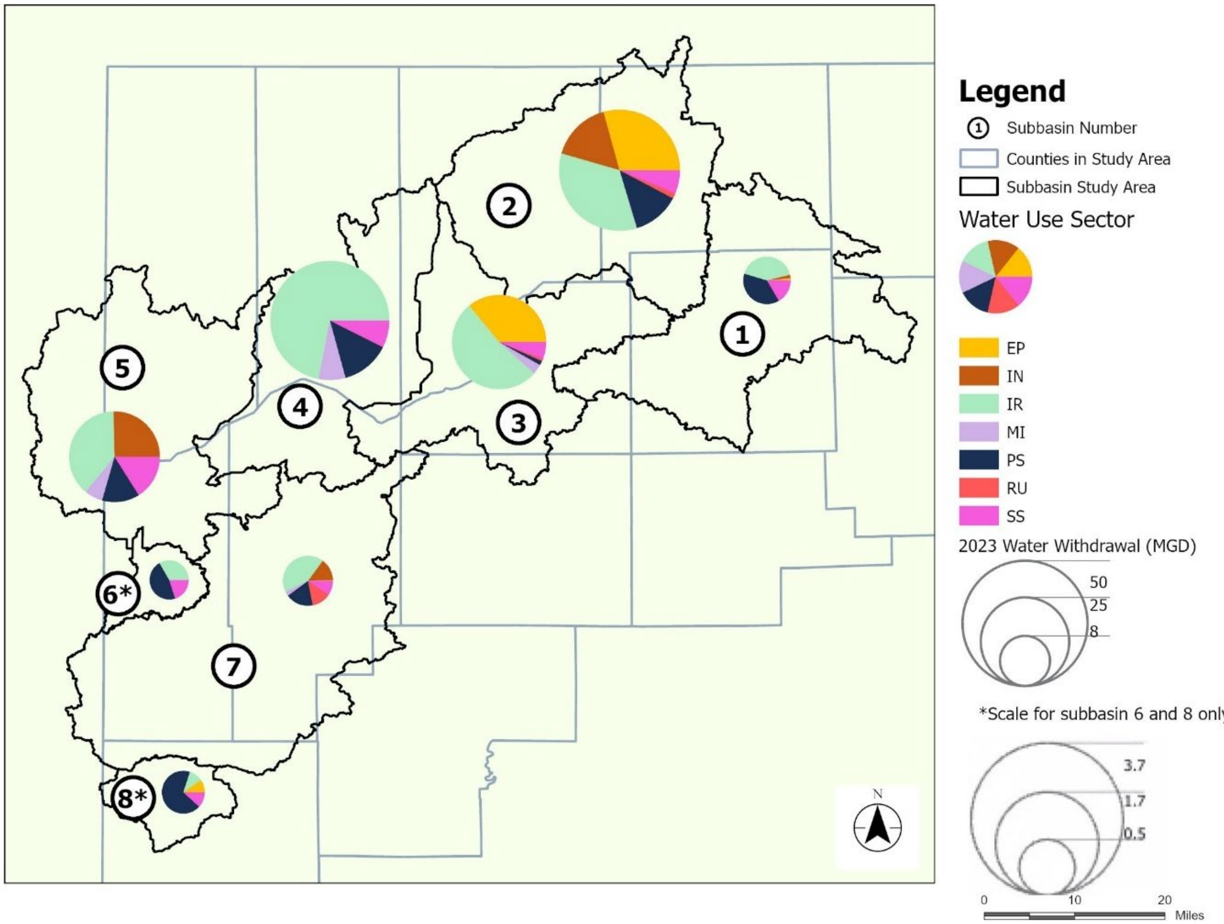
A review of historical 2023 water withdrawals in the Kankakee Basin highlights differences by sector type and subbasin (Figure 4-2). Among the eight subbasins, four pairs show similar annual average water use:

- Kankakee Davis (Subbasin 02) and Kankakee Shelby (Subbasin 04) used 47 MGD and 45 MGD, respectively, or 28% of the total annual average withdrawal rate.
    - Kankakee Davis (Subbasin 02) covers portions of La Porte, St. Joseph, and Marshall Counties and includes the cities Hudson Lake, Kingsford Heights, La Porte, New Carlisle, North Liberty, portions of South Bend, and Walkerton.
    - Kankakee Shelby (Subbasin 04) covers portions of Jasper, La Porte, Newton, and Porter Counties and includes the cities Aberdeen, DeMotte, La Crosse, Hebron, Kouts, Roselawn, Shorewood Forest, portions of Valparaiso, Wanatah, and Westville.
- Kankakee Kouts (Subbasin 03) and Kankakee Momence (Subbasin 05) used 29 MGD and 27 MGD, or 17% and 16% of the total annual average withdrawal rate, respectively.
    - Kankakee Kouts (Subbasin 03) covers portions of La Porte and Starke Counties and includes the cities of Bass Lake, Hamlet, Knox, Koontz Lake, La Crosse, North Judson, and Wanatah.
    - Kankakee Momence (Subbasin 05) covers portions of Lake, Porter, and Newton counties and includes the cities of Lake Dalecarlia, Lowell and portions of Cedar Lake, Crown Point, Roselawn, St. John, and Winfield.
- Yellow Knox (Subbasin 01) and Iroquois (Subbasin 07) used 9 and 7 MGD, respectively, or 5% of the total annual average withdrawal rate.

[5] In the North Central region average annual water withdrawals in energy comprised the largest share of total annual water withdrawals, however, as coal energy plants are retired, energy water withdrawals were estimated to decline, making public supply the dominant water use type.

    - Yellow Knox (Subbasin 01) covers portions of Elkart, Kosciusko, Marshall, St. Joseph, and Starke and includes the cities of Argos, Bremen, Knox, Lakeville, Nappanee, and Plymouth.
    - Iroquois (Subbasin 07) covers portions of Jasper, Newton, and White Counties and includes the cities of Goodland, Kentland, Remington, and Rensselaer.
- Beaver (Subbasin 06) and Sugar (Subbasin 08) each used less than 0.5 MGD, or 0.2% of the total annual average withdrawal rate.
    - Beaver (Subbasin 06) covers portions of Newton County and includes the city of Morcco.
    - Sugar (Subbasin 08) covers portions of Benton County and includes the cities of Earl Park and portions of Fowler.

Irrigation water withdrawals accounted for the majority of withdrawals in almost every subbasin, except Beaver (Subbasin 06) and Sugar (Subbasin 08), where public supply withdrawals comprise the largest share of total subbasin withdrawals. Water withdrawals in the energy production sector are second to irrigation in both Kankakee Davis (Subbasin 02) and Kankakee Kouts (Subbasin 03).



Note: County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.

Subbasin Key

ID	Name	ID	Name
1	Yellow Knox	5	Kankakee Momence
2	Kankakee Davis	6	Beaver
3	Kankakee Kouts	7	Iroquois
4	Kankakee Shelby	8	Sugar

Sector Key

ID	Sector	ID	Sector
EP	Energy production	RU	Rural
IN	Industrial	SS	Self-supplied
IR	Irrigation		
PS	Public supply		

Figure 4-2. Water Withdrawals by Subbasin and Water Use Sector, 2023

By 2075, the total Kankakee Basin water withdrawals are projected to increase to 244 MGD, up 48% from 165 MGD in 2023 (Figure 4-3). There are projected to be shifts in the share of total withdrawals among the four highest water use subbasins, while the trend for the four lowest water use subbasins are expected to remain consistent with 2023 values.

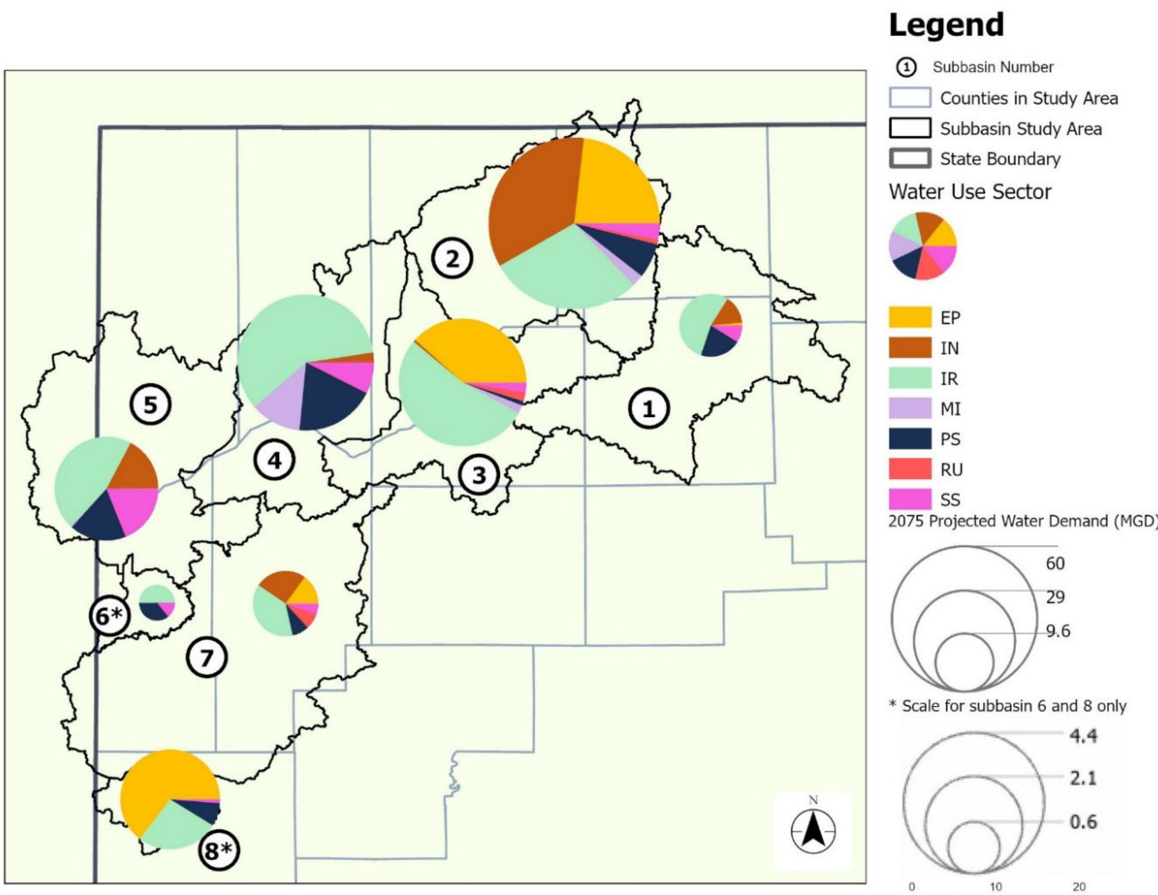
Withdrawals in Kankakee Davis (Subbasin 02) are projected to increase by 37 MGD to 84 MGD or 34% of the of the total annual projected withdrawals, outpacing Kankakee Shelby (Subbasin 04) which is projected to increase by 7 MGD to 53 MGD or 22% of the total annual average withdrawal rate.

Annual water withdrawals in Kankakee Kouts (Subbasin 03) are projected to increase by 18 MGD to reach 47 MGD by 2075 or 16% of the total annual average projected subbasin withdrawals. Water withdrawals in Kankakee Momence (Subbasin 05) are projected to increase by 4 MGD to reach 31 MGD or 13% of the total annual average basin withdrawals.

Water withdrawals in both Yellow Knox (Subbasin 01) and Iroquois (Subbasin 07) are each projected to increase to 15 MGD and 12 MGD, or 6% and 5% of the total annual average basin withdrawal, respectively.

Water withdrawals in Beaver (Subbasin 06) and Sugar (Subbasin 08) are projected to be less than 2 MGD, or 0.8% of the total annual average withdrawal rate each.

The projected increase in water withdrawals in Kankakee Davis (Subbasin 02) is driven by the projected increased demand of the industrial water use sector, which is projected to grow from 16 MGD, or 9% of total water demand in the basin in 2023, to 41 MGD, or 17% of the total water demand in 2075.



Note: County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.

Subbasin Key

ID	Name	ID	Name
1	Yellow Knox	5	Kankakee Momence
2	Kankakee Davis	6	Beaver
3	Kankakee Kouts	7	Iroquois
4	Kankakee Shelby	8	Sugar

Sector Key

ID	Sector	ID	Sector
EP	Energy production	RU	Rural
IN	Industrial	SS	Self-supplied
IR	Irrigation		
PS	Public supply		

Figure 4-3. Projected Water Demand by Subbasin and Water Use Sector, 2075

4.3 Baseline Water Demand Projection Approach

This section of the study describes the Baseline future water demand projections. Future development plans, and subsequent water demand, can contain a degree of speculation. To increase the accuracy of the Baseline future water demand projection, the analysis incorporated information about publicly announced industrial and public water supply development plans with estimated dates for opening and/or expanding facilities. The demand projections for some categories also incorporated historical trends, estimated future demographics (e.g., population and income), or estimated future climate conditions. Utilizing the Baseline approach to future water demand projections also provides decision makers with the ability to include other regional development plans in future planning efforts.

4.3.1 BACKGROUND

Water demand projections provide the basis for making operational, tactical, and strategic decisions for water utilities and water resource planning agencies (Gardiner and Herrington 1990, Billings and Jones 2008). Projections for operational and tactical decisions are aimed at short-term demand estimation, like peak day and peak hour demand. These decisions affect how resource managers operate treatment plants and wells to meet short-term demand. Projections for strategic decisions are aimed at predicting water demand many years into the future to develop new water sources and/or expand existing treatment capacity (Donkor et al. 2012). The methods used to project demand are selected based on the type of decision to be informed and the future projection horizon. Note that throughout this document the terms water demand, water withdrawals, and water use are used interchangeably.

The planning horizon, the projection periodicity (e.g., annual, monthly, seasonal, daily), and the water use sector inform which projection method is appropriate for water demand projections. Variables that are considered influential in determining long-term future water demand projections can include socio-economic variables as well as various types of weather-related variables. However, not all water use types will be influenced by the same variables.

The academic literature suggests that the principal explanatory variables in water demand estimation include the following (Wang et al. 2009, Wu and Zhou 2010):

- Historical demand
- Time, annual and monthly trends
- Population
- Measures of wealth, such as gross domestic product or median household income
- Weather variables such as temperature, precipitation, and evapotranspiration

4.3.2 METHODOLOGY OVERVIEW

The long-term water demand projection for this Study estimates monthly demand over a 50-year period, from 2024 – 2075, for eight subbasins that encompass the Study Area (see Figure 4-1). In addition to the temporal and geographic scale, the Study estimates demand for the following eight water use sectors (in order of the magnitude of the future projection of water demand):

- **Irrigation** (IR), representing water used in the production of crops
- **Energy Production** (EP), representing water used in the production of electricity, power generation, and cooling water
- **Public Supply** (PS), representing water served to cities and towns from a public or private water utility and schools, or other public entities, that have their own water wells to meet their individual institutional demand
- **Industrial** (IN), representing dedicated, industry-owned wells and surface water intakes, used for industrial production. Note that this water demand does not account for industries historically served by public water suppliers
- **Self-supplied** (SS), representing individual residential well owners supplied by on-site wells for domestic use
- **Miscellaneous** (MI), representing a variety of uses including fire departments, a correctional facility, waste management departments, and habitat management in natural areas
- **Confined Feeding Operations** (CFO) and (CAFO), with CAFOs representing larger scale livestock facilities than CFOs (IDEM 2025b)
- **Rural** (RU), representing a variety of rural users, but not rural residential users. Water withdrawals from residentials users are below the statutory reporting requirement threshold of 100,000 gallons per day Examples include several agricultural limited liability corporations. Note it appears that some large CAFO water withdrawals may be reported in this category in the SWWF database.

The eight water use sectors, the data used for the historical water demand, and the factors that affect water demand (historical and projected future) are listed in Table 4-2. **Although historical use played an important role in determining future water demand, history alone does not accurately project future use, particularly for water use sectors that are impacted by economic development decisions, climate change, and industries undergoing changes in operational practices.**

For example, annual historical irrigation demand increased by approximately 2% per year on average from 1985 – 2023. Understanding whether this observed time trend of increasing average annual irrigation withdrawals would continue in the future requires more than an understanding of the past. Therefore, experts in the field were consulted to inform future projections. For agricultural irrigation, this information was obtained by interviewing experts from the Indiana Farm Bureau and Indiana Department of Natural Resources. The consensus from the experts was that average annual irrigation will continue to trend upwards as growers are able to invest in irrigation equipment in response to continued and future drought years and to maintain or improve crop yield. Additionally, actual future annual demands may spike in periods of elevated drought, the timing of which is not possible to predict. Therefore, the region could experience spikes in future annual demand of irrigation water, rather than the steady rate of increase predicted in this analysis.

Economic development directors and utility managers also provided insights into development plans for the industrial water use sector. Additionally, multiple methods by source type informed water use estimates for Illinois (Appendix C). Therefore, the determinants of future water withdrawal by water use sector, listed in Table 4-2, include information gleaned from area experts.

The demand analysis required reconciliation of data at multiple geographic scales. The geographic units for the water demand projections, by necessity, are at a subbasin scale to align with the hydrologically based water availability methodology being used here (see Figure 4-1 and Table 4-4). When possible, the study analyzed the trend variables at the subbasin level. However, some of the data that determines water demand is collected and reported by political boundaries (e.g., population). Political boundaries of cities, counties, states and even water service territories do not always align with hydrologic subbasin boundaries. Additionally, most of the activity that drives future water demand is managed at the county or city level (e.g., local economic development agencies, industries, water utilities).

Significantly, the trend variable of population required a creative solution to support subbasin-specific analysis. To address the within-county differences in population growth and water use, this study developed a population forecast at the subregion level. A subregion was created for each county and subbasin combination. Development of subbasin and subregion specific datasets for trend variables allowed analysis for most sectors at the subbasin (subregion) level. Appendix C details the methods used for subregion population forecasting. Subregion forecasts were then aggregated into subbasins and counties. For irrigation, an alternative method was used whereby future water demand was projected at the county level only for irrigation and then disaggregated into subbasins (Table 4-2).

For detailed descriptions of the methods used to estimate future water demand for each water use sector and predictive variables, see Appendix C.

Table 4-2. Water Demand Projection Method and Demand Drivers, By Water Use Sector

Water Use Sector	Historical Use	Projection Method	Modeled Demand	Demand Drivers		
				Explanatory Variables	Seasonality	Geographic Approach
Irrigation	SWWF	Regression	Historical annual water withdrawals	Annual trend and climate forecast (evapotranspiration, precipitation, temperature).	Monthly	County
Energy production	Modeled embedded water demand by energy type		Historical annual energy demand	Long-term future energy demand obtained from Purdue University's "Indiana Electricity Projections: The 2023 Forecast." (Purdue 2023). Applied water requirements for portfolio of power generation technologies. Seasonal demand patterns from historical energy generation data.	Annual	Subbasin
Public supply	SWWF[1]	Regression	Historical annual water withdrawals	Annual trend, population, and climate forecast (evapotranspiration, temperature precipitation).	Monthly	Subregion
Industrial	SWWF	Historical averages combined with planned development	Historical annual water withdrawals	Analysis of historical annual water withdrawals and interviews with county economic development directors and utility managers[2]	Annual	Subregion
Self-supplied residential	Modeled embedded water demand using per capita water demand and rural household address database		Imputed water demand based on population of rural households	Population and seasonal demand patterns from PS data.	Annual	Subregion
Misc.	SWWF	Historical averages	Historical annual water withdrawals	Fixed at historical averages.	Annual	Subregion
CAFOs & CFOs[4]	Modeled embedded water demand using animal water requirement by animal type, count, and density of CAFOs		Historical animal count	Annual trend and seasonal animal watering demand patterns.	Annual	Subbasin
Rural use	SWWF	Historical averages	Historical annual water withdrawals	Fixed at historical averages.	Annual	Subregion

Notes:
[1] Indiana SWWF database used for all counties located within Indiana. Historical and future water withdrawals for Illinois were estimated from the nearest Indiana county within each subbasin.
[2] For information obtained during various interviews, see Section 3.3.1, Participants, Stakeholder Input.
[3] The methodology is consistent with the North Central Indiana Water Study (Stantec 2025).
[4] The terms CFO and CAFO relate to the size of the Combined Feeding Operation. All farms with at least 300 cattle, 600 swine or sheep, 30,000 poultry, or 500 horses in confinement are CFOs. A CAFO designation is strictly a size designation in Indiana, where CAFOs confine a larger number of animals than CFOs (IDEM 2022b).

Key:
CAFO = Concentrated Animal Feeding Operation
CFO = Confined Feeding Operation
SWWF = Significant Water Withdrawal Facility

The counties that were mostly located within the Study Area are referred to in this analysis as Primary Study Area Counties. There were a few other counties that were partially located within the subbasins and reported withdrawals within Study Area subbasins, however at far lower volumes than withdrawals in the Primary Study Area Counties (Table 4-3). These counties, with minimum withdrawals within the subbasins, are referred to as supplemental counties in this analysis. See Appendix C for a detailed description of the development of the county-level future water use projections.

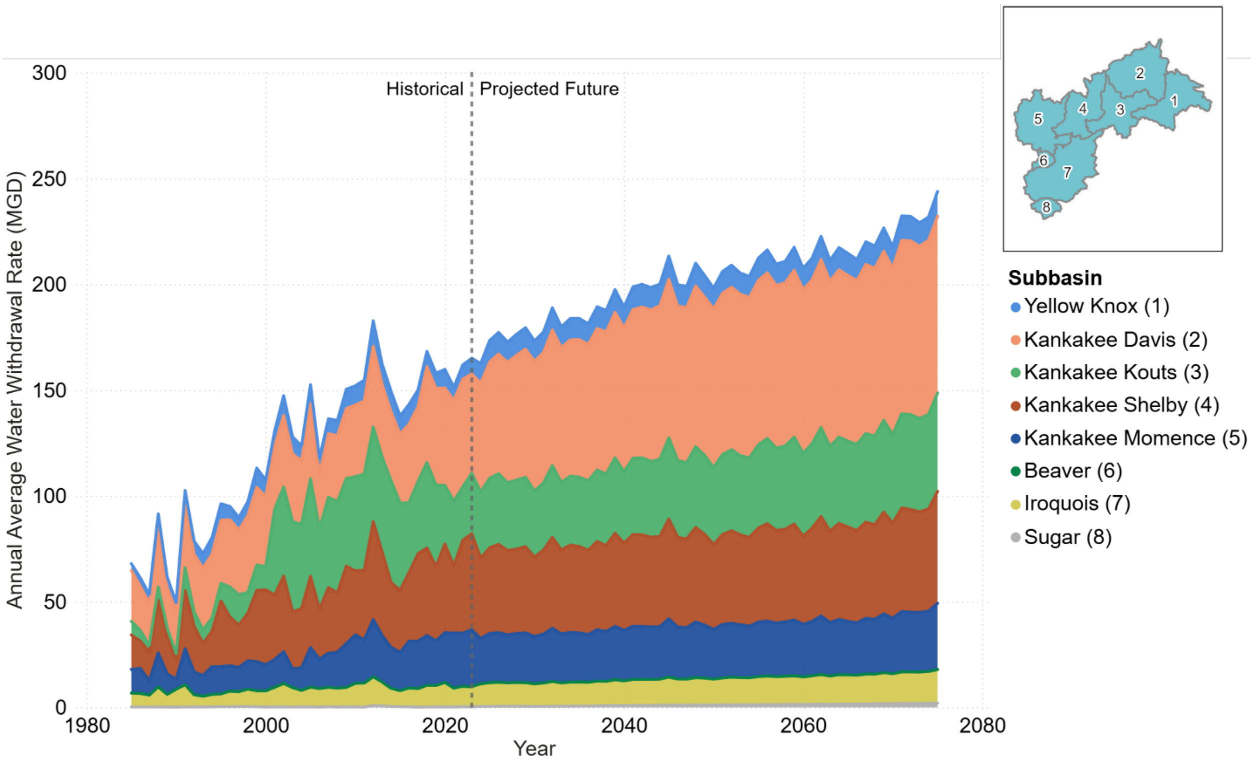
Table 4-3. Study Area Subbasins, Waterways and Counties

Sub-basin ID	Subbasin Name	Waterway	County (all or part)	
			Study Area	Supplemental
1	Yellow Knox	Yellow River	Marshall, St. Joseph, Starke	Elkhart, Fulton, Kosciusko
2	Kankakee Davis	Kankakee River (Davis)	La Porte, Marshall, St. Joseph	
3	Kankakee Kouts	Kankakee River (Kouts)	La Porte, Marshall, Porter, Starke	Pulaski
4	Kankakee Shelby	Kankakee River (Shelby)	Jasper, La Porte, Lake, Porter, Newton	
5	Kankakee Momence	Kankakee River (Momence)	Jasper, La Porte, Lake, Newton	Illinois (Will, Kankakee)
6	Beaver	Beaver Creek	Newton	
7	Iroquois	Iroquois River (Iroquois)	Jasper, Newton, Benton	Pulaski, White, Illinois (Iroquois)
8	Sugar	Sugar Creek	Benton	

4.4 Water Demand by Subbasin

What follows is a discussion of the water demand projections for the entire Kankakee Basin Study Area, summarized over all subbasins. For a detailed description of historical and the projected future water demands summarized for each individual subbasin, see Appendix D.

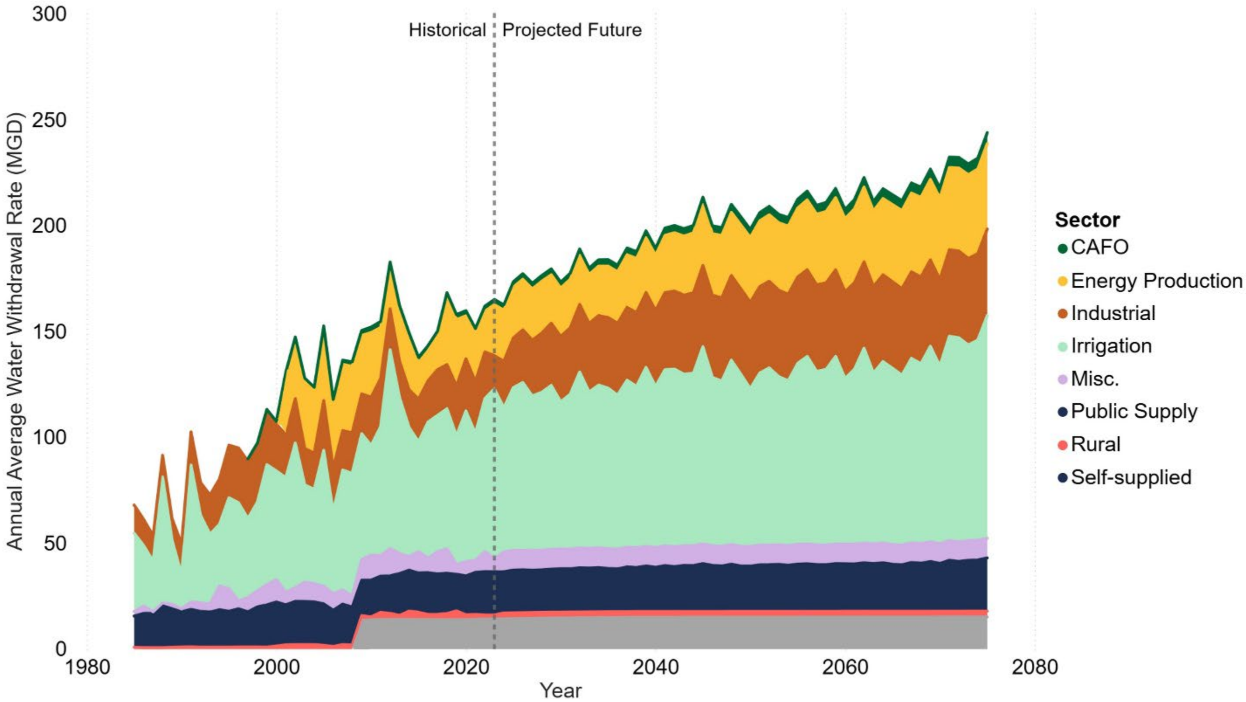
Historical and projected future water demand is presented by subbasin (Figure 4-4) and by sector (Figure 4-5). Subbasins Kankakee Davis (2), Kankakee Kouts (3), and Kankakee Shelby (4), which covers large portions of Jasper, La Porte, Porter, Starke, and St. Joseph Counties, represented the largest portions of water demand in the basin, and that trend is projected to continue into the future. Refer to Table 2-3 for a detailed list of counties and cities by subbasin.



Note: County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.

Figure 4-4. Historical (1985 – 2023) and Projected Future (2024 to 2075) Annual Water Demand in Kankakee Basin, by Subbasin (million gallons per day)

Irrigation water withdrawals represent the largest share of historical water demand within the Kankakee Basin, followed by energy production. Looking to the future, irrigation water withdrawals are projected to remain the largest share of water demand, but industrial water demand will likely outpace energy production water demand. Water demand from energy production decreases as coal power, generally a high-water withdrawal energy source, is phased out through 2028 in Jasper County, Kankakee Kouts (Subbasin 3). Industrial water demand increases as economic growth plans foster development of a new data center and a battery plant in St. Joseph County, Kankakee Davis (Subbasin 2). Water demand in all other sectors is projected to increase, however at a slower rate than irrigation or industrial water demand. For detailed methods used to develop data in this chapter and results by sector, see Appendix C.



Takeaway: Irrigation water withdrawals represent the largest share of historical water demand within the Kankakee Basin, followed by energy production. Looking to the future, irrigation water withdrawals are projected to remain the largest share of water demand, but industrial water demand will likely outpace energy production water demand.

Figure 4-5. Historical (1985 – 2023) and Future Projected (2024 – 2075) Annual Water Demand by Water Use Sector in Kankakee Basin, All Subbasins (million gallons per day)

Figures 4-6 and 4-7show how water use changes in both place of use and sector of use over time. Figure 4-6 shows historical water use in 2023 where:

- Total Study Area water use is 165 MGD (Indiana and Illinois)
- **The top four water use sectors ranked by withdrawal rates:**
  - **Irrigation – 80 MGD or 49% of total**
  - **Energy production – 24 MGD or 15% of total**
  - **Public supply – 20 MGD or 12% of total**
  - **Industrial – 16 MGD or 9% of total**
- Top four subbasins ranked by withdrawal rate:
  - Kankakee Davis, Subbasin 02 – 47 MGD or 28% of total
  - Kankakee Shelby, Subbasin 04 – 45 MGD or 28% of total

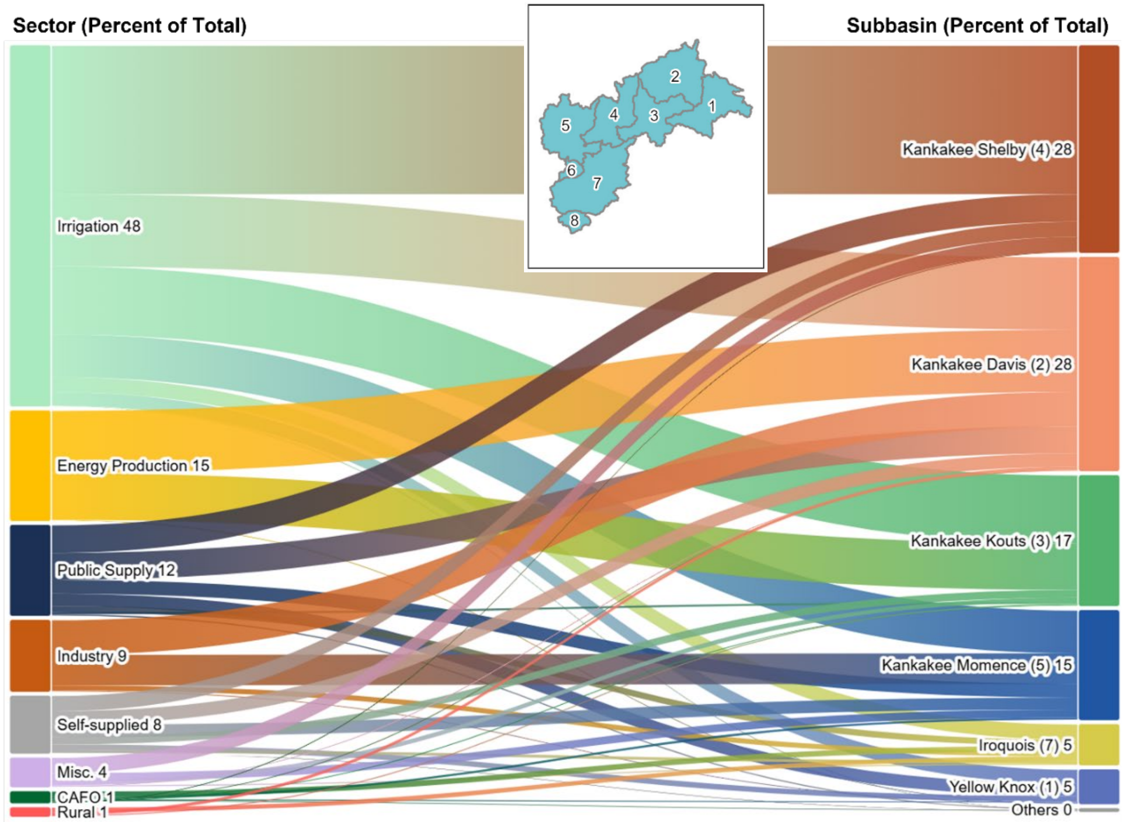
  - Kankakee Kouts, Subbasin 03 – 29 MGD or 17% of total
  - Kankakee Momence, Subbasin 05 – 27 MGD or 16% of total

Figure 4-7 shows how water use is projected to change by 2075:

- Total Study Area water use is projected to be 244 MGD, up from 165 MGD
- **The top four water use sectors ranked by withdrawal rates:**
  - **Irrigation – 105 MGD or 43% of total**
  - **Industrial – 41 MGD or 17% of total**
  - **Energy production – 40 MGD or 17% of total**
  - **Public supply – 25 MGD or 10% of total**
- Top four subbasins ranked by withdrawal rate:
  - Kankakee Davis, Subbasin 02 – 84 MGD or 34% of total
  - Kankakee Shelby, Subbasin 04 – 53 MGD or 22% of total
  - Kankakee Kouts, Subbasin 03 – 47 MGD or 19% of total
  - Kankakee Momence, Subbasin 05 – 31 MGD or 13% of total

In summary, Figures 4-6 and 4-7 show the following changes in water use sector over the 50-year planning horizon:

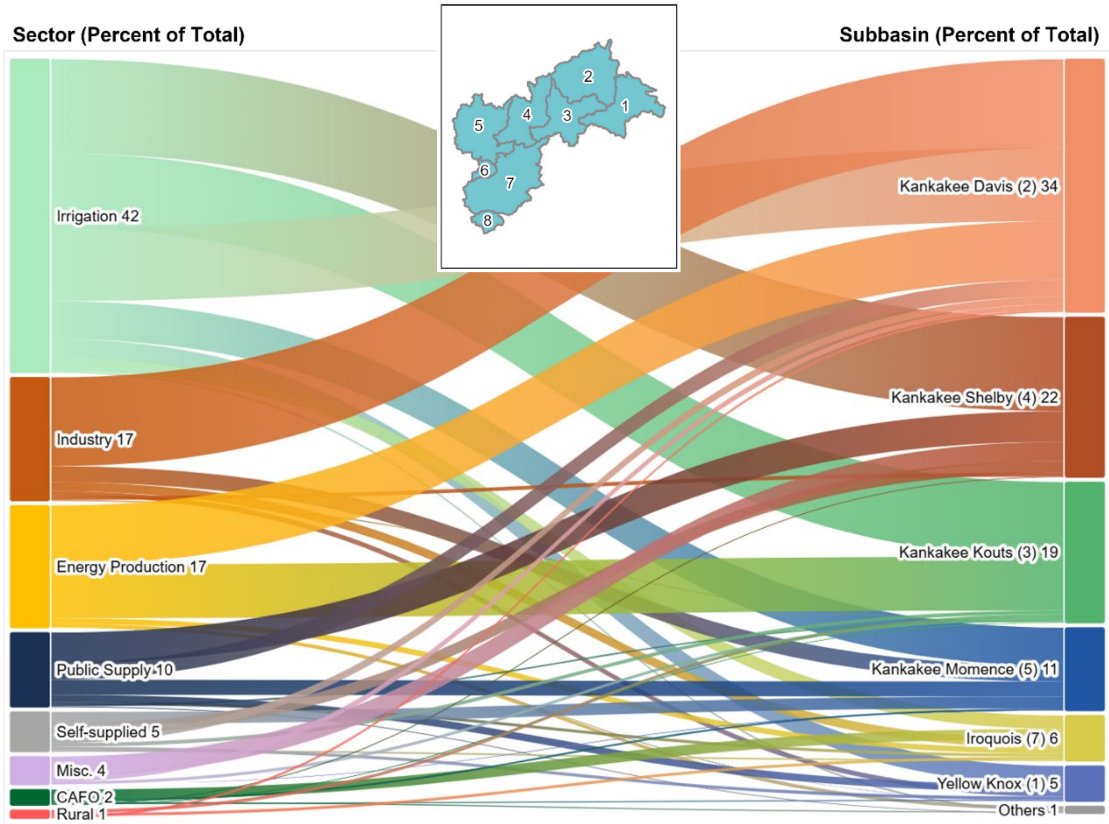
- Irrigation was the largest water use sector in 2023 in Kankakee Shelby (Subbasin 04) making up 72% of the water use in that subbasin.
- **Irrigation, industrial, energy production, and public supply are all projected to increase over the study period, with the industrial sector having the largest increases**. The increase in industrial water use corresponds to the increase in Kankakee Davis (Subbasin 02). The following second and third subbasins are using nearly the same percentage of water in the Study Area, between 22% (Kankakee Shelby, Subbasin 04) and 19% (Kankakee Kouts, Subbasin 03).



Note: County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.

Takeaway: Irrigation is historically the largest water use sector at 48% of the total and Kankakee Shelby (Subbasin 04) and Kankakee Davis (Subbasin 02) each use 28% of total basin withdrawals.

Figure 4-6. Water Withdrawals by Use Sector and Subbasin, as 2023 Percent of Total



Note: County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.

Takeaway: Irrigation is projected to be the largest water use sector at 42% of the total and Kankakee Davis (Subbasin 02) is projected to use 34% of total basin withdrawals.

Figure 4-7. Water Withdrawals by Use Sector and Subbasin, as 2075 Percent of Total

Tabular data summarizing the information presented in Figures 4-4 through 4-7 is presented in Table 4-4, providing the average annual withdrawals and future projected water demand for 10-year periods from 1985 – 2075. Note that the initial period (1985 – 1993) is averaged over nine years and the final period (2064 – 2075) is averaged over 12 years. Additionally, Table 4-4 shows the average annual change in water withdrawals for each period.

Table 4-4. Ten Year Average Annual Water Demand by Subbasin, Historical (1985 – 2023) and Projected Future (2024 – 2075), Average Annual Rate (MGD), and Average Annual Change (%)

Subbasin	Historical Use (MGD)				Project Future Use (MGD)				
	1985 – 1993[a]	1994 – 2003	2004 – 2013	2014 – 2023	2024 – 2033	2034 – 2043	2044 – 2053	2054 – 2063	2064 – 2075[b]
Yellow Knox (1)	5.1	7.6	8.8	7.9	9.9	10.3	10.3	10.4	10.8
Average Annual Percent Change	*NA*	*4.1%*	*1.4%*	*-1.0%*	*2.3%*	*0.4%*	*0.0%*	*0.1%*	*0.5%*
Kankakee Davis (2)	24.4	32.4	32.6	42.0	59.0	67.8	74.9	77.7	80.4
Average Annual Percent Change	*NA*	*2.9%*	*0.1%*	*2.6%*	*3.5%*	*1.4%*	*1.0%*	*0.4%*	*0.4%*
Kankakee Kouts (3)	5.7	20.1	43.1	34.8	32.4	34.4	37.3	39.8	43.0
Average Annual Percent Change	*NA*	*13.4%*	*7.9%*	*-2.1%*	*-0.7%*	*0.6%*	*0.8%*	*0.7%*	*0.9%*
Kankakee Shelby (4)	17.6	27.5	33.0	37.3	40.1	41.8	43.1	44.1	46.9
Average Annual Percent Change	*NA*	*4.6%*	*1.8%*	*1.2%*	*0.7%*	*0.4%*	*0.3%*	*0.2%*	*0.7%*
Kankakee Momence (5)	10.9	12.6	18.9	22.8	23.1	24.1	25.2	25.7	27.2
Average Annual Percent Change	*NA*	*1.5%*	*4.2%*	*1.9%*	*0.1%*	*0.4%*	*0.4%*	*0.2%*	*0.7%*
Beaver (6)	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Average Annual Percent Change	*NA*	*-0.3%*	*5.6%*	*1.3%*	*1.5%*	*0.8%*	*0.8%*	*0.0%*	*1.0%*
Iroquois (7)	7.0	7.8	9.9	9.1	10.9	11.6	12.4	13.1	14.2
Average Annual Percent Change	*NA*	*1.1%*	*2.4%*	*-0.8%*	*1.7%*	*0.6%*	*0.7%*	*0.5%*	*1.0%*
Sugar (8)	0.3	0.3	0.4	0.3	0.6	0.8	1.1	1.4	1.8
Average Annual Percent Change	*NA*	*3.1%*	*0.9%*	*-1.4%*	*5.3%*	*3.6%*	*3.7%*	*2.3%*	*2.7%*
Total	71.1	108.6	146.9	154.6	176.2	191.1	204.6	212.5	224.7
Average Annual Percent Change	*NA*	*4.3%*	*3.1%*	*0.5%*	*1.3%*	*0.8%*	*0.7%*	*0.4%*	*0.7%*

Notes:
[a] 1985 – 1993 is averaged over 9 years.
[b] 2064 – 2075 is averaged over 12 years.
The ten year periods were selected for consistency with previously published regional reports.
County-subbasin relationships and combined boundary information are provided in Figure 2-15 and Table 2-3.
Key:
MGD = million gallons per day

Subbasin level trends are discussed below. Refer to Table 2-3 for a detailed list of counties and cities by subbasin to understand trends within areas of interest.

Yellow Knox (Subbasin 01) experienced modest growth historically, and projections include minimal growth continuing around 10 MGD (2024 – 2075) throughout the future period. The period between 2014 – 2023 shows a decline in water use in several subbasins including Yellow Knox (Subbasin 01) Kankakee Kouts (Subbasin 03), Iroquois (Subbasin 07), and Sugar (Subbasin 08). This is the only period with an average decline over a decade for multiple subbasins and does not coincide with any obvious cause, the decline is not concentrated around 2020, the COVID pandemic, and the years of decline are inconsistent between the basins. This suggests that the declines are due to local sector-specific changes rather than impacts on the entire region. This study explores sector trends later in this chapter.

Projections for Kankakee Kouts (Subbasin 03), Kankakee Shelby (Subbasin 04), and Kankakee Momence (Subbasin 05) reflect similar levels of growth through the forecasted period from 2024 – 2075, at less than 1% on average per decade. This reflects the consistent level of growth expected for irrigation, which is the largest water use sector historically for all three subbasins. The trend of Kankakee Kouts (Subbasin 03) differs from the other two subbasins during the period of 2024 – 2033 where demand is projected to decrease slightly due to changes in energy production. A coal plant in the subbasin is scheduled to close within that period, with a portion of that electricity being generated by renewables (which use negligible amounts of water), and a portion being generated from natural gas (which uses less water than coal).

Kankakee Davis (Subbasin 02) experienced dramatic growth historically, increasing 17 MGD from 24 MGD in the first period (1985 – 1993) to 42 MGD in the current decade (2014 – 2023). The dramatic trend is projected into the first two forecasted decades (2024 – 2043) due to planned industrial growth. This trend is largely driven by the Town of New Carlisle in St. Joseph County, which has invested in the development of the Indiana Enterprise Center with a large data center and a battery plant currently under development (St. Joseph County Redevelopment Commission 2023).

See Appendix C for a detailed description of the methods used to estimate each of the water use sectors by county. See Appendix D for a detailed description of individual subbasin projections, including tabular data detailing historical and future water availability within subbasins in the Study Area by year and month in five-year increments. Lastly, see Appendix I for historical and projected future water demand summaries by county.

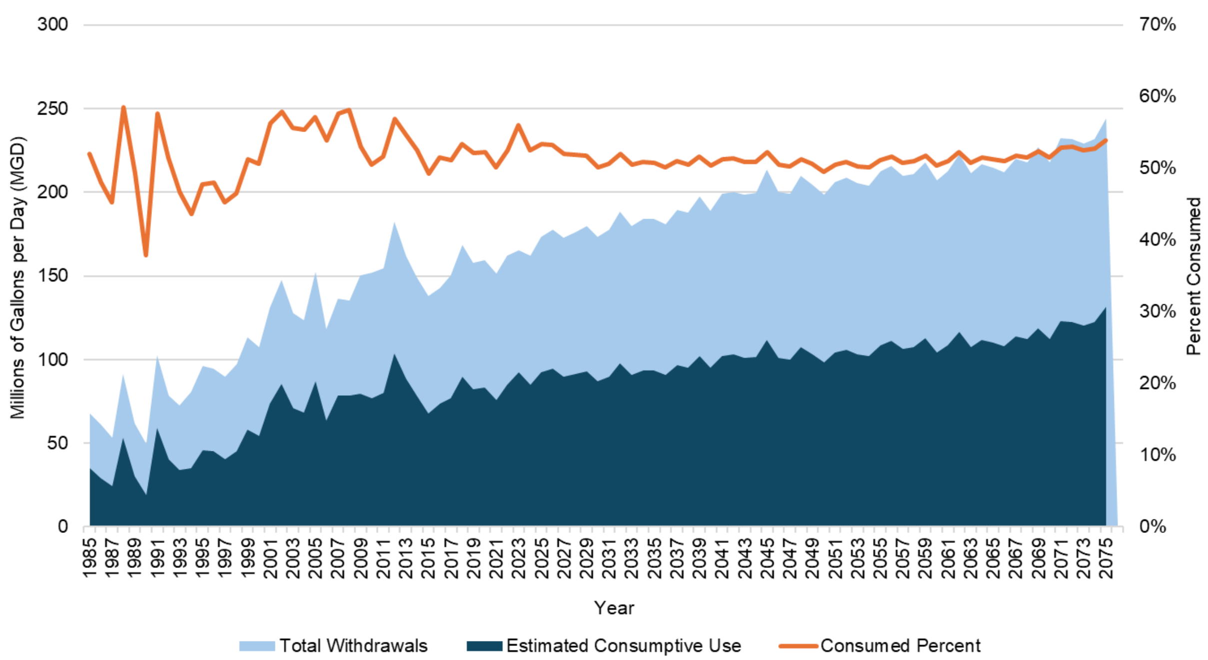
4.5 Consumptive Use Estimates and Historical Sources

The volume of water withdrawn from the Kankakee Basin is not completely consumed. A portion of water from most sectors is returned to the basin. For example, much of the water withdrawals for energy production is used for cooling equipment; once used, the water is treated and returned to the local environment.

Historically the percentage of water consumed remained steady between 50%-60% of withdrawals with a few dips (Figure 4-8). Agricultural uses (irrigation and CAFOs) have the highest estimated consumptive-use rate at 80%, driving up the total volume of water consumed in the basin. In drought years, this higher consumption-use rate is especially prominent. There was a drought in 2012 and the consumptive-use rate spiked that year as the agricultural irrigation withdrawals increased over non-drought years to preserve crop yields.

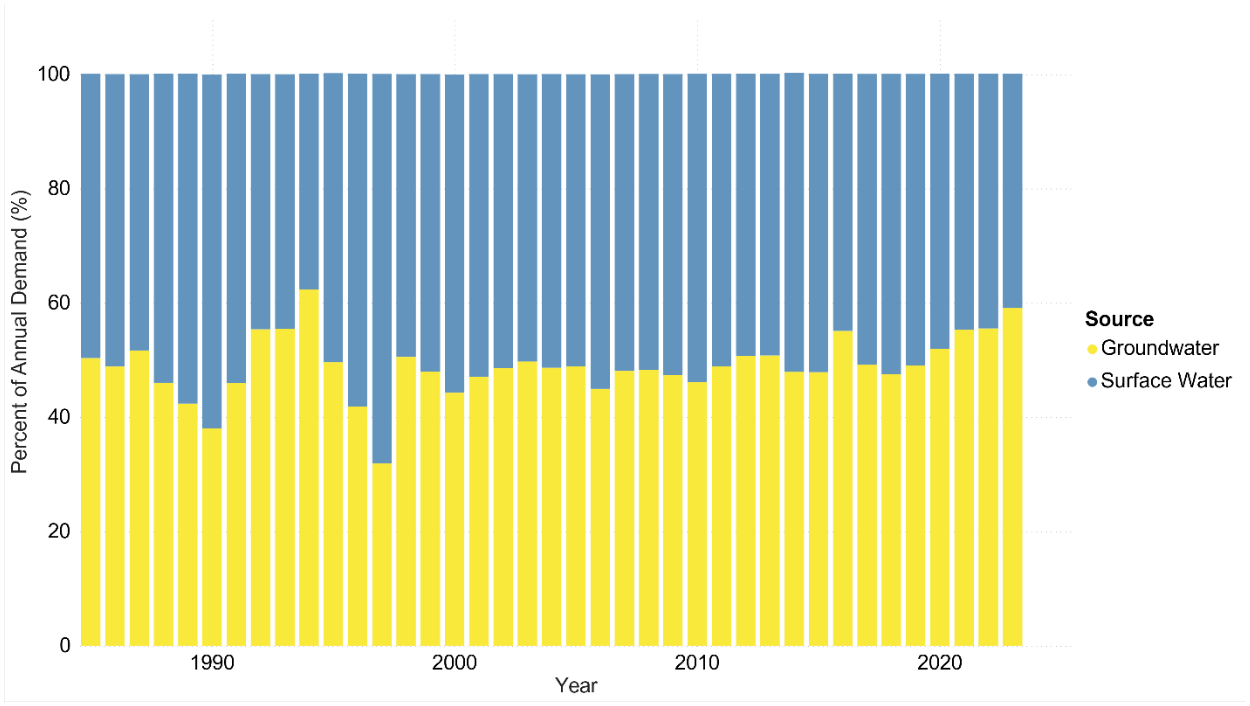
This study projects increases in irrigation throughout the entire study period. Industrial water use (inclusive of data centers) is projected to increase through 2050, and this sector has a low consumptive-use rate of 10% (most of the water is returned to the basin). The basin-wide consumed-water percentage, therefore, is projected to decrease from the current rate in 2023 through 2050. Increases in industrial demand will balance out increases in irrigation water demand during this period. Industrial water demand is not projected to increase after 2050, and so the consumed percentage will increase again, corresponding to the continued increases in irrigation demand.

Historical and future projections of water withdrawals have been presented by subbasin and water use sector, and their consumptive use has been addressed, but the projected future demand presented in this study does not estimate or project the specific water source of supply to meet that demand (See Chapter 7, Future Water Availability). However, the historical source of water withdrawals, either surface water or groundwater, is known. Surface water is characterized as water diverted from a river or stream, whereas groundwater is water supply pumped from aquifers. The primary uses of surface water in Kankakee Basin are irrigation and energy production (Figure 4-9), though historical withdrawals are relatively evenly split between surface and groundwater.



Takeaway: Projections forecast that consumption rates (water not returned to the system) will remain steady at around 50-60% of withdrawals; so as withdrawals increase, consumption increases accordingly.

Figure 4-8. Historical Annual (1985 – 2023) and Projected Future (2024 – 2075) Water Withdrawals and Consumptive Use in Kankakee Basin, Millions of Gallons per Day



Source: Significant Water Withdrawal Facility data 1985 – 2023 (INDR 2025)
Note: SWWF database only includes sectors reporting to IDNR: energy production, industrial, irrigation, miscellaneous, public supply, and rural use.

Figure 4-9. Kankakee Basin Significant Water Withdrawals Database Summary by Source, All Subbasins, Percent of Total

4.6 Average Monthly and Seasonal Demand

Long-term water demand projections, such as those in this Kankakee Basin Regional Water Study, are used as strategic planning tools and frequently focus on average usage, either monthly or annual. Over a 50-year planning horizon, consideration should also be given to potential changes in not only average volumes of water demand but also the usage pattern over a year, particularly if changes in climate shift the peak usage periods (e.g., from mid-Summer months to early Fall months). These monthly averages and monthly usage patterns provide useful information for long-term planning.

Summer seasonal usage includes months with peak demand and informs operational and tactical decisions for water utilities or facility-level infrastructure or operational and management decisions. For example, an industrial facility may invest in on-site water storage to manage facility-level peaks in water demand. Or resource managers may consider whether standard operating procedures such as the cycling or filling of water tower storage, flushing hydrants, and schedule to fill backup utility reservoir storage are adequate for future conditions. Therefore, reporting on changes in the magnitude of average seasonal demand may also provide insights into the strategic planning process.

What follows is a summary of the monthly average usage pattern, and the seasonal averages for water demand over a 5-year period of time for all subbasins. Details are also provided for five sectors in order of the magnitude of 2023 water withdrawals, from greatest to least. The sections that follow describe monthly and seasonal trends for each of the five largest water use sectors: Irrigation; Energy production; Public supply; Industrial; Self-supplied.

4.6.1 KANKAKEE BASIN MONTHLY ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SECTORS

Water withdrawals within the Kankakee Basin exhibit distinct seasonal trends, which are projected to persist throughout the study period. The highest projected withdrawals occur in the Summer months (June – August) and the lowest projected withdrawals occur in the Winter and early Spring months (December – March) (Table 4-5). This seasonal trend is largely driven by irrigation water demand during the growing season. The historical maximum basin-wide average monthly water withdrawal was 375 MGD in July during the period 2011 – 2015, which coincided with an extreme regional drought (National Weather Service).

Table 4-5. Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, All Subbasins, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	21	24	23	49	74	113	234	135	48	36	29	24
1986 – 1990	26	28	26	33	52	112	180	149	55	40	30	27
1991 – 1995	32	34	36	47	83	169	219	198	71	56	45	38
1996 – 2000	41	42	51	53	78	147	260	238	102	75	62	51
2001 – 2005	68	69	73	79	101	202	327	317	145	93	84	73
2006 – 2010	76	77	78	81	108	211	337	284	134	101	94	74
2011 – 2015	74	76	77	87	126	246	375	360	162	116	100	81
2016 – 2020	79	80	81	85	122	220	366	365	171	112	100	84
2021 – 2025 [a]	81	83	79	84	128	249	368	376	194	114	100	92
2026 – 2030	95	98	92	91	153	253	384	390	200	130	114	104
2031 – 2035	98	105	94	106	173	265	402	378	205	137	117	106
2036 – 2040	106	107	99	102	175	270	412	400	214	138	124	113
2041 – 2045	112	114	105	117	190	310	429	421	237	140	124	118
2046 – 2050	116	119	108	108	194	295	425	424	221	154	128	125
2051 – 2055	118	124	114	108	193	294	424	435	245	162	133	129
2056 – 2060	124	124	119	112	198	305	430	442	252	166	138	130
2061 – 2065	124	129	117	126	211	314	441	422	258	169	139	131
2066 – 2070	129	129	119	120	211	312	454	441	260	167	142	134
2071 – 2075	131	133	121	142	234	366	481	469	275	168	141	137

Notes: Darker colored shading indicates the highest withdrawal volumes, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.
[a] the period 2021 – 2025 is a combination of historical water use (2021 – 2023) and projected water use (2024 and 2025).

To calculate an average seasonal day demand for the Kankakee Basin over each five-year period, the total volume of water withdrawal (historical and projected) in each sector was divided by the number of days in the Summer season (June, July, and August) (Table 4-6). The growth rate for seasonal demand between 1985 – 2075 is 1.1%. The highest average seasonal day withdrawal was in irrigation, as expected, as seasonal increases in temperature and the pattern of the growing season in the region require increased water applications to maximize production yields. Public supply shows a small seasonal trend for higher water use in the Summer. Seasonal demand is discussed further only for irrigation and public supply, as all other sectors do not show distinct seasonal trends in water withdrawals.

Table 4-6. Average Seasonal Summer Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, All Subbasins, June – August, Millions of Gallons per Day

Period	Sector								
	CAFO	Energy Production	Industrial	Irrigation	Misc.	Public Supply	Rural	Self-Supplied	Total
1985			19.8	122.7	1.4	16.5	0.9		**161.2**
1986 – 1990			14.5	110.2	1.8	20.2	0.8		**147.5**
1991 – 1995			22.2	144.4	8.3	19.8	0.9		**195.6**
1996 – 2000	1.3		28.8	158.8	4.0	21.9	1.1		**215.9**
2001 – 2005	2.0	35.3	22.0	191.8	5.7	23.9	2.2		**282.8**
2006 – 2010	2.9	35.4	20.9	183.1	6.0	21.0	2.2	6.6	**278.1**
2011 – 2015	3.8	25.2	20.9	229.8	4.6	21.4	5.3	16.9	**327.9**
2016 – 2020	3.2	25.9	24.2	217.4	4.2	21.4	4.7	16.8	**317.9**
2021 – 2025	3.3	25.7	22.2	232.4	3.3	24.5	3.1	17.2	**331.7**
2026 – 2030	3.7	26.0	27.9	235.1	4.8	25.1	2.7	17.7	**343.0**
2031 – 2035	4.0	25.6	32.4	235.8	4.8	25.9	2.7	17.9	**349.1**
2036 – 2040	4.3	27.8	34.9	243.1	4.8	26.1	2.7	18.1	**361.8**
2041 – 2045	4.7	30.6	37.4	261.1	4.8	28.1	2.7	18.2	**387.4**
2046 – 2050	5.0	32.7	39.9	251.4	4.8	27.6	2.7	18.2	**382.3**
2051 – 2055	5.4	34.9	40.9	250.4	4.8	28.1	2.7	18.2	**385.4**
2056 – 2060	5.7	37.0	40.9	255.6	4.8	28.3	2.7	18.3	**393.2**
2061 – 2065	6.1	39.1	40.9	252.6	4.8	28.6	2.7	18.3	**393.1**
2066 – 2070	6.4	41.2	40.9	259.9	4.8	28.8	2.7	18.3	**403.0**
2071 – 2075	6.8	43.4	40.9	289.8	4.8	32.4	2.7	18.4	**439.1**

Note: The five-year periods were selected for consistency with previously published regional reports.
Key:
CAFO = Concentrated Animal Feeding Operation

What follows is average monthly and seasonal demand by water use sector.

4.6.2 IRRIGATION ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SUBBASINS

Average monthly water demand for irrigation is concentrated in the Summer months of June, July, and August. The average monthly volumes show a steady increase from 1985, with a historical high of 277

MGD in July in the period between 2011 – 2015 (Table 4-7). The region experienced a drought in 2012, requiring farmers to irrigate heavily to protect crop yield. Average monthly irrigation water withdrawals are projected to continue increasing to a high of 332.8 MGD in July of the period 2071 – 2075. The shoulder season months of May and September also have higher use rates corresponding to the start and end of the growing season. October withdrawals are significantly lower than Summer withdrawals, though some water is still required for late-season crops, and water withdrawals trend upward over time. Water withdrawals in the off-season November – March show relatively lower water withdrawals through the entire study period and are not projected to increase over time. Water withdrawals reported in the off-season include purposes such as golf course and lawn irrigation and greenhouse irrigation. The facilities that report lawn irrigation are often country clubs, golf courses, and other recreational facilities. All water withdrawals at these facilities are lumped under one category. It is possible that these facilities do not necessarily irrigate lawns in the winter but have other water uses such as drinking water and sanitation. Additionally, some drainage-related irrigation may not have been labeled with that purpose and would not have been removed. April withdrawals show a growth trend over time similar to off-season months, but a higher rate of demand. Comparing monthly irrigation demand to seasonal demand in Table 4-8, use rates steadily increase over the period. The seasonal demand is between two and seven times greater than the demand in the highest non-Summer month, September.

Table 4-7. Irrigation Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	0.7	0.6	0.2	17.1	36.2	73.7	193.3	99.5	13.1	2.9	0.4	0.7
1986 – 1990	0.8	1.0	0.8	2.2	18.0	74.7	141.5	113.3	15.5	6.7	0.5	0.7
1991 – 1995	0.7	1.0	0.8	3.2	36.5	118.0	168.1	146.3	19.2	6.8	0.4	0.7
1996 – 2000	0.5	0.9	0.9	3.5	27.0	93.3	203.0	177.9	35.3	9.7	1.7	0.6
2001 – 2005	0.5	1.0	0.6	2.4	19.6	115.6	236.7	220.6	48.6	8.5	1.7	2.2
2006 – 2010	1.0	1.2	1.2	2.5	20.3	115.5	241.3	190.3	41.9	9.7	2.2	1.0
2011 – 2015	1.3	1.6	1.5	4.2	36.8	145.4	280.0	261.2	63.5	11.7	2.8	1.2
2016 – 2020	1.2	1.5	1.1	6.1	32.1	122.3	265.8	261.2	72.5	8.8	2.1	1.7
2021 – 2025	0.6	2.2	0.9	5.5	36.1	148.8	269.3	276.5	92.5	11.2	3.2	2.7
2026 – 2030	1.8	3.6	4.4	6.3	55.7	145.9	277.0	279.6	89.8	16.2	5.5	2.6
2031 – 2035	0.6	5.4	1.1	17.1	70.0	153.1	289.8	261.7	89.6	18.2	3.2	0.6
2036 – 2040	2.1	3.0	1.5	9.7	66.4	152.9	294.3	279.2	93.6	14.3	5.1	1.3
2041 – 2045	2.3	3.6	2.4	18.6	76.2	184.0	304.6	292.1	109.7	10.9	0.8	1.2
2046 – 2050	1.3	3.7	0.9	7.1	75.8	165.4	295.6	290.3	89.3	18.7	0.5	2.7
2051 – 2055	0.2	4.6	3.1	4.1	71.4	160.5	290.8	297.0	109.2	23.4	1.8	3.0
2056 – 2060	3.0	1.5	5.4	6.9	74.6	169.5	293.4	300.9	113.2	25.3	4.5	1.2
2061 – 2065	0.7	4.2	1.8	18.1	84.9	175.0	302.1	278.1	115.4	26.3	2.6	0.8
2066 – 2070	2.0	2.1	1.7	11.5	82.1	170.7	311.6	294.4	116.2	22.1	3.8	1.2
2071 – 2075	1.8	2.8	1.0	30.7	101.7	217.8	332.8	316.6	127.1	20.1	0.9	1.3

Notes: Darker colored shading indicates the highest withdrawal rates, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.

Table 4-8. Irrigation Average Seasonal Summer Historical and Projected Future Monthly Water Demand by 5-Year Period, All Subbasins, June – August, Millions of Gallons per Day

Period	Irrigation
1985	122.7
1986 – 1990	110.2
1991 – 1995	144.4
1996 – 2000	158.8
2001 – 2005	191.8
2006 – 2010	183.1
2011 – 2015	229.8
2016 – 2020	217.4
2021 – 2025	232.4
2026 – 2030	235.1
2031 – 2035	235.8
2036 – 2040	243.1
2041 – 2045	261.1
2046 – 2050	251.4
2051 – 2055	250.4
2056 – 2060	255.6
2061 – 2065	252.6
2066 – 2070	259.9
2071 – 2075	289.8

4.6.3 ENERGY PRODUCTION ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SUBBASINS

The historical record for energy production begins in 2001 due to data availability. Water withdrawal data reported through the IDNR SWWF database was augmented with supplemental data for the energy production sector. The SWWF data was used as a comparison tool, but alternative data sources and supplemental information informed the historical and projected energy production water demand. Historical withdrawals were modeled for the Study Area subbasins and counties based on historical power plant data, published forecasts of electricity generation trends, and estimated water use rates by generation technology.

Historical average monthly water demand for the energy production water use sector ranged from 18.6 MGD in April during 2016 – 2020 period to 36.7 MGD in July during the 2006 – 2010 period (Table 4-9). The majority of this water was used by a coal power plant located in Kankakee Kouts (Subbasin 03) and three natural gas power plants.[6] The coal plant is currently being phased out and expected to go offline in 2028 and be replaced by natural gas and renewable energy. By 2011, generation of electricity from the

[6] Two of the natural gas fired plants are small with low estimated water demand and one of those went offline in 2020. The third natural gas power plant opened in 2018. A fourth natural gas peaker plant will come online during phase out of the coal plant in combination with renewable energy sources.

coal plant began decreasing. Future projected energy production demand increases to 47.6 MGD in February of the 2071 – 2075 period.

Table 4-9. Energy Production Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001 – 2005	29.1	28.9	28.3	28.8	32.1	33.5	36.6	35.7	29.1	26.6	27	26.4
2006 – 2010	29.2	29.1	28.4	28.9	32.2	33.6	36.7	35.8	29.2	26.7	27.1	26.6
2011 – 2015	20.8	20.7	20.2	20.6	23.0	23.9	26.2	25.5	20.8	19.0	19.3	18.9
2016 – 2020	23.3	23.5	21.0	18.6	22.6	24.7	26.8	26.3	22.7	20.7	20.4	21.4
2021 – 2025	24.8	25.2	20.9	16.1	21.4	24.4	26.4	26.2	23.7	21.4	20.6	22.8
2026 – 2030	27.4	28.1	21.5	13.3	20.4	24.8	26.6	26.7	25.6	23.0	21.4	25.3
2031 – 2035	27.4	28.1	21.2	12.5	19.9	24.4	26.1	26.3	25.5	22.9	21.2	25.4
2036 – 2040	29.6	30.5	22.9	13.6	21.5	26.5	28.3	28.5	27.6	24.8	22.9	27.5
2041 – 2045	32.6	33.6	25.3	14.9	23.7	29.2	31.2	31.4	30.4	27.3	25.3	30.3
2046 – 2050	34.9	35.9	27.0	16.0	25.4	31.2	33.4	33.6	32.5	29.2	27.0	32.4
2051 – 2055	37.2	38.2	28.8	17.0	27.0	33.2	35.5	35.7	34.6	31.1	28.8	34.5
2056 – 2060	39.5	40.6	30.5	18.0	28.7	35.3	37.7	37.9	36.8	33.0	30.6	36.6
2061 – 2065	41.7	42.9	32.3	19.1	30.3	37.3	39.9	40.1	38.9	34.9	32.3	38.7
2066 – 2070	44.0	45.3	34.1	20.1	32.0	39.3	42.1	42.3	41.0	36.8	34.1	40.8
2071 – 2075	46.3	47.6	35.8	21.2	33.6	41.3	44.2	44.5	43.1	38.7	35.8	42.9

Notes: Darker colored shading indicates the highest withdrawal rates, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.

4.6.4 PUBLIC SUPPLY ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SUBBASINS

The population of the Study Area is estimated to be 315,800 in Indiana. Average monthly historical water demand for the public supply water use sector steadily increased from a low of 12.6 MGD in January and March of 1985 to a high of 25.4 MGD in July of 2005 (Table 4-10). Water use then decreased for a few periods until 2021 – 2025 when monthly average water withdrawals increased to a high of 25.2 MGD in June. Water withdrawals are projected to increase slightly throughout the rest of the study period with the highest average monthly projected withdrawal, 33.2 MGD, occurring in July of the period 2071 – 2075. Future projected public supply demand will not necessarily occur in the same counties and cities as historical demand, as population is projected to increase in some subbasins and decrease in others. Additionally, water utilities publish Preliminary Engineering Reports regarding water system improvements, some of which plan for upgrades to infrastructure as well as plans to develop additional, reliable high quality water supplies and expand their service areas.

Comparing seasonal public supply water withdrawals to average monthly water withdrawals, withdrawals are between 23% and 74% greater than in January when the monthly demand is the lowest (Table 4-11). Seasonal water withdrawals fluctuate between 20.2 MGD in 1986 to 1990 and 23.9 MGD in 2001 – 2005 through the entire historical period until 2020. Withdrawals during the period of 2021 – 2025 (which includes projections for two years) are estimated at 24.5 MGD and are expected to increase to 32.4 MGD in the last period 2071 – 2075.

Table 4-10. Public Supply Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	12.6	13.1	12.6	13.9	15.9	16.7	17.5	15.4	14.8	14.8	14.6	14.8
1986 – 1990	16.1	16.2	15.4	16.5	18.0	20.7	21.0	19.0	17.7	17.1	15.7	15.6
1991 – 1995	15.5	16.3	15.5	16.4	17.7	20.4	20.0	19.0	17.8	16.5	15.7	15.0
1996 – 2000	17.1	17.3	16.4	17.2	19.0	21.1	23.0	21.5	22.2	18.5	16.7	16.3
2001 – 2005	18.1	18.7	18.2	19.1	19.5	22.8	25.4	23.4	22.0	17.7	16.8	16.7
2006 – 2010	16.4	16.9	16.2	16.6	18.3	20.8	22.0	20.3	18.4	16.1	14.8	14.6
2011 – 2015	17.0	17.6	17.2	17.2	19.5	20.9	22.0	21.4	19.7	17.1	16.2	15.8
2016 – 2020	17.4	18.2	17.3	16.9	18.2	21.0	21.7	21.4	20.0	18.1	17.0	17.1
2021 – 2025	16.8	17.7	17.3	18.3	21.1	25.1	24.9	23.4	21.8	19.1	17.7	17.5
2026 – 2030	16.7	17.3	17.6	19.1	21.6	24.7	26.4	24.2	21.8	18.8	17.4	16.7
2031 – 2035	16.1	17.6	17.7	20.1	22.7	25.6	27.1	25.0	22.7	19.3	17.7	16.3
2036 – 2040	17.5	17.4	18.3	19.7	23.5	25.9	27.3	25.0	22.2	19.1	18.2	16.9
2041 – 2045	17.7	17.8	18.5	20.9	24.6	28.5	28.6	27.2	23.6	19.7	17.4	17.0
2046 – 2050	17.6	18.0	18.5	20.0	24.3	27.7	28.4	26.8	23.0	20.8	17.6	17.5
2051 – 2055	17.3	18.3	18.9	20.2	24.4	27.9	28.9	27.6	23.9	20.9	18.2	18.1
2056 – 2060	17.9	18.4	19.2	20.9	24.2	27.7	29.6	27.4	24.6	20.9	18.9	17.9
2061 – 2065	17.2	18.5	19.2	21.9	24.9	28.5	29.5	28.0	25.6	21.2	19.1	17.4
2066 – 2070	18.4	18.1	19.6	21.4	25.9	28.6	30.0	27.7	24.7	20.8	19.3	18.0
2071 – 2075	18.6	18.9	19.8	23.1	27.5	33.0	33.2	30.9	26.2	21.4	19.1	18.2

Notes: Darker colored shading indicates the highest withdrawal rates, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.

Table 4-11. Public Supply Average Seasonal Summer Historical and Projected Future Monthly Water Demand by 5-Year Period, All Subbasins, June – August, Millions of Gallons per Day

Period	Public Supply
1985	16.5
1986 – 1990	20.2
1991 – 1995	19.8
1996 – 2000	21.9
2001 – 2005	23.9
2006 – 2010	21.0
2011 – 2015	21.4
2016 – 2020	21.4
2021 – 2025	24.5
2026 – 2030	25.1
2031 – 2035	25.9
2036 – 2040	26.1
2041 – 2045	28.1
2046 – 2050	27.6
2051 – 2055	28.1
2056 – 2060	28.3
2061 – 2065	28.6
2066 – 2070	28.8
2071 – 2075	32.4

4.6.5 INDUSTRIAL ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SUBBASINS

Average monthly historical water demand in the industrial water use sector has ranged between a low of 6.6 MGD (January 1985) to a high of 29.0 MGD in October in the period of 1996 – 2000 (Table 4-12). Historical industrial water demand fluctuates due to the water demand in the aggregates mining industry (the largest single industry in the industrial sector). Due to limited data, the projection for industrial demand assumes a constant rate of increase in water withdrawals until 2050. After 2050, the future monthly average water use is projected to be constant. See Appendix C for additional discussion of industrial water demand forecast. The increase in water withdrawals between 2023 – 2050 is attributed to Kankakee Davis (Subbasin 02) which published specific water utility expansion data related to an industrial park in the Town of New Carlisle within St. Joseph County housing a data center (still under construction) and battery plant. Industrial water use patterns show little seasonal variability.

Table 4-12. Industrial Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	6.6	8.6	8.2	13.3	20.8	20.8	20.2	18.3	13.2	11.6	10.8	6.9
1986 – 1990	7.3	9.5	8.9	12.4	13.9	14.2	14.8	14.5	14.5	12.7	10.9	9.1
1991 – 1995	12.9	13.3	14.8	20.0	21.1	21.8	22.5	22.3	22.4	20.4	20.7	17.9
1996 – 2000	20.5	19.3	24.5	26.1	27.5	28.9	28.5	29.0	26.1	27.0	24.2	22.4
2001 – 2005	16.7	16.3	16.9	18.4	20.0	21.3	21.6	23.1	23.2	19.7	18.9	21.5
2006 – 2010	19.4	19	20.9	20.7	20.8	20.6	21.3	20.6	20.7	18.9	18.7	18.5
2011 – 2015	17.1	18	17.6	19.9	20.8	21.3	20.1	21.3	21.2	19.1	18.7	18.2
2016 – 2020	19.8	19.2	21.3	20.0	23.2	23.9	25.3	23.5	23.3	22.0	21.9	21.0
2021 – 2025	20.0	20.6	21.9	22.3	24.5	23.0	22.2	21.5	22.1	20.2	19.8	20.0
2026 – 2030	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9
2031 – 2035	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4
2036 – 2040	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9
2041 – 2045	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4	37.4
2046 – 2050	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9
2051 – 2055	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
2056 – 2060	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
2061 – 2065	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
2066 – 2070	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
2071 – 2075	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9

Notes: Darker colored shading indicates the highest withdrawal rates, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.

4.6.6 SELF-SUPPLIED RESIDENTIAL ANNUAL AVERAGE AND SEASONAL AVERAGE DEMAND, ALL SUBBASINS

Residents that source their own water from private wells and may also use septic tanks for wastewater disposal are classified as “self-supplied” (SS) and do not report water to the IDNR SWWF program as their pump capacities do not meet the statutory reporting requirement threshold of 100,000 gallons per day. In the Study Area, it is estimated that the self-served population is 178,000 people. An alternative approach was used estimate historical SS demand, from 2010 forward, to forecast water demand for this sector (see Appendix C).

Average monthly historical water demand for the self-supplied water use sector steadily was estimated to increase from a low of 11.1 MGD in March of 2011 – 2015 to a high of 18.4 MGD in June for the time period 2016 – 2020 (Table 4-13). Water withdrawals are projected to increase gradually throughout the forecast period. The highest average monthly water withdrawal is projected to be 20.1 MGD in June in the last period 2071 – 2075.

Table 4-13. Self-Supplied Residential Average Historical and Projected Future Monthly Water Demand by 5-Year Period, All Water Use Sectors, Millions of Gallons per Day

Period	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011 – 2015	11.3	11.2	11.1	11.9	15.4	18.5	15.4	17.0	15.2	14.0	13.5	13.0
2016 – 2020	11.3	11.2	11.0	11.8	15.3	18.4	15.3	16.9	15.1	13.9	13.4	12.9
2021 – 2025	11.6	11.4	11.3	12.1	15.6	18.8	15.6	17.3	15.4	14.3	13.7	13.3
2026 – 2030	11.8	11.7	11.6	12.4	16.1	19.3	16.0	17.7	15.9	14.7	14.1	13.6
2031 – 2035	12.0	11.9	11.7	12.6	16.3	19.6	16.3	18.0	16.2	14.9	14.3	13.8
2036 – 2040	12.1	11.9	11.8	12.6	16.4	19.8	16.4	18.2	16.3	15.1	14.4	13.9
2041 – 2045	12.1	12.0	11.8	12.7	16.5	19.8	16.4	18.3	16.4	15.1	14.4	13.9
2046 – 2050	12.1	12.0	11.8	12.7	16.5	19.9	16.4	18.3	16.5	15.1	14.4	13.9
2051 – 2055	12.2	12.0	11.8	12.7	16.6	19.9	16.5	18.3	16.6	15.2	14.5	13.9
2056 – 2060	12.2	12.0	11.9	12.7	16.6	19.9	16.5	18.4	16.6	15.2	14.5	13.9
2061 – 2065	12.2	12.0	11.9	12.7	16.7	20.0	16.5	18.4	16.7	15.3	14.5	14.0
2066 – 2070	12.2	12.0	11.9	12.8	16.7	20.0	16.6	18.4	16.7	15.3	14.5	14.0
2071 – 2075	12.2	12.0	11.9	12.8	16.7	20.1	16.6	18.5	16.8	15.3	14.6	14.0

Notes: Darker colored shading indicates the highest withdrawal rates, and lighter shading indicates the lowest. The five-year periods were selected for consistency with previously published regional reports.

5.0 Baseline Water Budget Component Estimates

A continuous time series was developed for each water budget component within every subbasin for both the recent historical period (2007–2023), using daily time steps, and the future planning horizon (2024–2075), using monthly time steps. The overall analytical framework used for this assessment is described in Chapter 3, while Chapter 4 details the development of water demand components and associated results. This chapter focuses on the development of historical and future time series for all other water budget components, providing additional detail and context for the individual framework elements introduced in Section 3.1.1.

5.1 Measured Streamflow

Measured streamflow represents observed flow conditions that integrate both natural hydrologic processes and human influences. Daily average streamflow data from USGS gaging stations were used to quantify total historical runoff from upstream watersheds, including surface runoff, baseflow, and non-consumptive return flows from water withdrawals (see Figure B-1 for gage locations). Return flows (e.g., wastewater) increase the total runoff, whereas the consumptive portion of withdrawals reduce runoff.

5.1.1 HISTORICAL

Historical streamflow for each subbasin was characterized using measured data from USGS gaging stations, as summarized in Table 3-1 and described in greater detail in Appendix B.1.

5.1.2 FUTURE

Future measured streamflow is not included as part of the future water budget. As discussed in Section 5.5, future analyses rely on simulated natural streamflow conditions derived from the historical natural streamflow record.

5.2 Instream Flow

For the purposes of this Study, instream flow[7] refers to the minimum portion of natural baseflow that must remain within a stream to sustain ecological health, support recreation, and maintain water quality. Rather than being omitted from the analysis, these flows are incorporated directly into the water availability calculations by reserving the statistically derived instream flow volume before determining the amount of water potentially available for withdrawal. In this way, water availability reflects only the portion of flow in

[7] The Indiana Natural Resources Commission is authorized to determine and establish minimum instream flows based on Indiana Code 14-25-7-14. The statute does not explicitly define minimum instream flows for river systems, but suggests that when values are established, they should be based on the varying low flow characteristics of streams and the importance of instream and withdrawal uses. Instream uses means any use of water that uses surface water in place, including commercial and recreational navigation, hydroelectric power generation, waste assimilation, fish and wildlife habitat, general recreation, and maintenance of environmental and aesthetic values.

excess of the instream flow requirement, ensuring that ecological and water quality needs remain protected.

5.2.1 HISTORICAL

Indiana's Water Shortage Plan (IDNR 2015) provides foundational guidance on defining minimum instream flow requirements. Historically, the 7Q10, the lowest seven-day average flow expected to occur once every ten years, has been recognized as the minimum flow necessary to protect water quality. This metric serves as a critical regulatory benchmark for determining treatment levels for permitted discharges to Indiana's rivers and streams. To proactively manage water resources and prevent flows from reaching the 7Q10 threshold, the Water Shortage Plan recommends initiating withdrawal reductions during drought conditions once flows decline to the Q80 level (the daily flow exceeded 80% of the time). Between May and October, reaching the Q80 threshold triggers local management actions to protect aquatic and riparian habitats. These may include enhanced monitoring of withdrawals, voluntary or mandatory reductions, or the development of local or regional policies that reflect community water-use priorities.

Consistent with previous regional water studies in Indiana (INTERA 2021a, Stantec 2025), this Study defines minimum instream flows for each subbasin using both the 7Q10 and Q90 metrics. The 7Q10 metric was applied during the typically drier months (June through November), aligning with IDNR's guidance, because it represents a more conservative low-flow condition based on a 7-day, once-in-10-years recurrence. In contrast, the Q90 (the daily flow exceeded 90% of the time) was applied during wetter months (December through May) because it reflects typical low-flow conditions during higher-flow seasons and provides a less conservative but seasonally appropriate threshold. Although the Water Shortage Plan does not specify minimum flow thresholds outside of shortage conditions, the Q90 is commonly used as a presumptive standard for maintaining environmental flow protection (Gleeson and Richter 2018).

To calculate 7Q10 and Q90 values for each subbasin, daily streamflow data from USGS gages were analyzed for the 1990–2020 period, reflecting recent climatic and hydrologic conditions (Blum et al. 2019) and consistent with other regional studies (Letsinger and Gustin 2024, Stantec 2025). Table 5-1 summarizes the results, showing substantial variation in instream flow values across the Study Area. The smaller upstream subbasins, including Subbasins 06 and 08, which covers portions of Newton and Benton Counties and communities such as Morocco and Earl Park) exhibit relatively low 7Q10 and Q90 values of approximately 1–2 MGD (2–3 cfs), while the downstream Subbasin 05 (Kankakee River at Momence, IL; includes portions of Lake, Porter, and Newton Counties and communities and towns like Crown Point and Lake Dalecarlia) demonstrates substantially higher values of approximately 318 MGD (492 cfs) for the 7Q10, and 541 MGD (837 cfs) for the Q90. These differences are expected and reflect the large contrast in drainage areas: Subbasin 05 is the downstream subbasin of the Kankakee River within the Study Area and drains a much greater contributing area than the smaller upstream subbasins 06 and 08. As a result, instream flow metrics for Subbasin 05 are orders of magnitude larger, consistent with the relative basin sizes.

Table 5-1. Instream Flow Values by Subbasin

Takeaway: Subbasins show big differences in instream flow requirements consistent with their relative drainage areas; the 7Q10 governs June – November, while Q90 supports December – May flows.

Subbasin	USGS streamgage	Assessment Period	7Q10 (cfs)	7Q10 (MGD)	Q90 (cfs)	Q90 (MGD)
01	05517000 Yellow River at Knox, IN	1990 – 2020	71	46	130	84
02	05515500 Kankakee River at Davis, IN	1990 – 2020	204	132	300	194
03	05517530 Kankakee River near Kouts, IN	1990 – 2020	354	229	586	379
04	05518000 Kankakee River at Shelby, IN	1990 – 2020	418	270	723	467
05	05520500 Kankakee River at Momence, IL	1990 – 2020	492	318	837	541
06	Synthetic[1] (Beaver, IN)	1990 – 2020	2	1	3	2
07	05525000 Iroquois River at Iroquois, IL	1990 – 2020	23	15	51	33
08	Synthetic[1] (Sugar, IN)	1990 – 2020	2	1	3	2

Note:
[1] A synthetic hydrograph was developed for Subbasins 6 and 8 since they are along the Indiana state boundary with no streamgage. Additional details are provided in Appendix B.1.

Key:
cfs = cubic feet per second
IL = Illinois
IN = Indiana
MGD = million gallons per day
USGS = U.S. Geological Survey

5.2.2 FUTURE

The same instream flow values were applied for both the historical and future assessment periods to provide consistency in the evaluation of water availability.

5.3 Reservoir Operations

Reservoir and dam operations upstream of a given location can influence downstream streamflow conditions by either increasing or decreasing natural flows. When inflows are captured and stored behind a dam, the downstream measured streamflow decreases relative to natural flow conditions. Conversely, when water is released from storage, measured streamflow downstream increases compared to conditions without such releases. However, reservoir operations were not considered in this Study, for the reasons outlined below and in Section 2.6.

5.3.1 HISTORICAL

Major dams within the Study Area were identified and screened using the USACE NID database based on their normal storage capacity. Sixteen reservoirs were initially identified and further evaluated according to their size, primary purpose, and data availability. Eight reservoirs with normal storage capacities of less than 1,000 acre-feet were excluded from further consideration, as their limited storage capacity is unlikely to have a measurable influence on regional water availability.

The remaining eight dams were determined to be primarily recreational lakes, off-stream settling basins, or small impoundments with minimal drainage areas relative to their associated subbasins. These facilities generally operate under near-steady-state conditions where inflows approximately equal outflows, typically lack publicly available operational records, and are not believed to significantly affect downstream hydrologic conditions. For these reasons, **reservoir operations were excluded from this Study's water budget components.** Table B-5 in Appendix B summarizes the identified dams and provides the rationale for their exclusion.

5.3.2 FUTURE

Because reservoir operations were excluded from the historical water budget analysis, they were likewise not incorporated into the future assessment to maintain methodological consistency.

5.4 Return Flows

Return flows represent the non-consumptive portion of water withdrawals that are discharged back to surface water or percolate into groundwater.

5.4.1 HISTORICAL

Historical return flow data for the public supply, energy production, and industrial and commercial sectors were obtained from discharge monitoring reports regulated under NPDES and compiled in the ECHO database (EPA 2025a). A detailed description of the data development process is provided in Appendix B.3 and Appendix B.4.

A total of 120 discharge locations were identified within the Study Area across Indiana and Illinois. Data extracted from ECHO included monthly, quarterly, or annual average discharges from permitted facilities spanning 2007–2023. Return flow coordinates were verified against the IDEM NPDES database to correct potential location errors. Each discharge was categorized by sector (public supply, energy production, or industrial/commercial) based on facility descriptions. Quarterly or annual values were disaggregated to daily estimates, and outliers were removed through temporal trend analysis and comparison with measured downstream flows.

Major return flows in the Kankakee Basin include cooling water from energy facilities, quarry dewatering discharges, wastewater treatment plant (WWTP) effluent, and industrial discharges. Return flows for rural or miscellaneous use sectors (identified in the SWWF database) could not be quantified due to insufficient documentation, inconsistent reporting frequency, and the highly heterogeneous nature of these categories, which include a mix of small facilities and enterprises that are not easily classified or readily linked to specific discharge locations. As a result, these return flows were not included in this analysis.

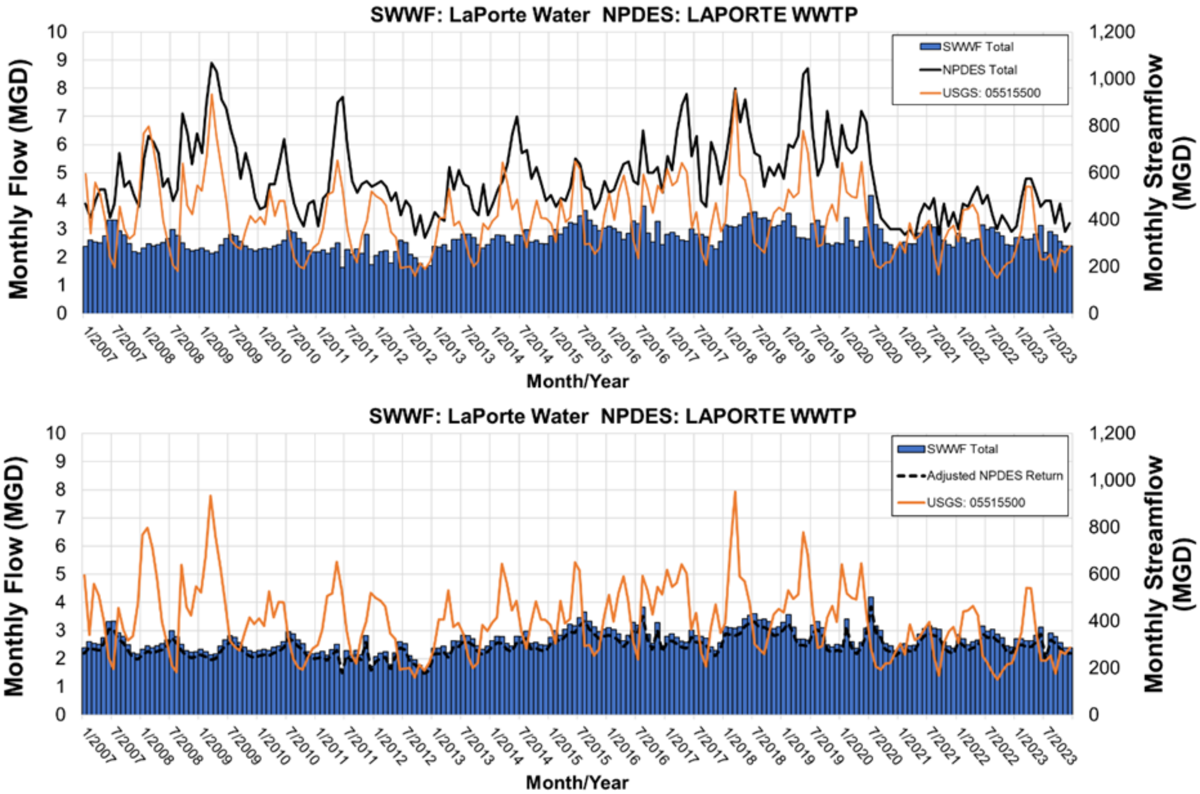
To verify consistency, monthly withdrawals from the SWWF database were compared with monthly reported return flows from the same sectors. Facility identifiers were matched between SWWF and ECHO datasets wherever possible, and additional documentation from IDEM's Virtual Cabinet was reviewed to resolve mismatches caused by differing ownership, reporting names, or operational changes (e.g., cases where industrial withdrawals are discharged through a public wastewater treatment system). Return flow volumes for energy production and industrial/commercial sectors were generally consistent with withdrawal volumes, except for a large coal-fired facility that reported steady, non-seasonal discharges likely related to pumped releases from a settling basin. To better represent consumptive use, return flows from all coal facilities were adjusted to 44% of monthly withdrawal volumes, based on sector-specific estimates by Harris and Diehl (2019).

Consistent with other regional water studies (Wiener et al. 2020, INTERA 2021a, Stantec 2025), reported WWTP return flows often exceeded associated withdrawals—particularly during wetter months—due to inflow and infiltration in combined or sanitary sewer systems. During storm events, rainfall-induced runoff inflates reported discharges, introducing stormwater components that are not true return flows. Including this stormwater component would artificially increase total return flow and decrease computed natural streamflow. Initial screening indicated that up to 41% of reported WWTP return flow volume could be attributed to stormwater contributions.

To address this, a correction procedure consistent with the North Central Indiana regional water study (Stantec 2025) was applied. For each of the ten major WWTPs, SWWF withdrawal and NPDES discharge datasets were paired and compared with downstream streamflow records for 2007–2023. Low-flow periods (indicating minimal stormwater influence) were used to establish a return-flow ratio, representing the non-consumptive portion of withdrawals. This ratio was then applied to the full time series to generate adjusted return flow volumes that more accurately represent true wastewater return flows.

Figure 5-1 illustrates an example of this comparison for the La Porte Water and La Porte WWTP system, showing the difference between reported and adjusted return flows relative to measured downstream streamflow.

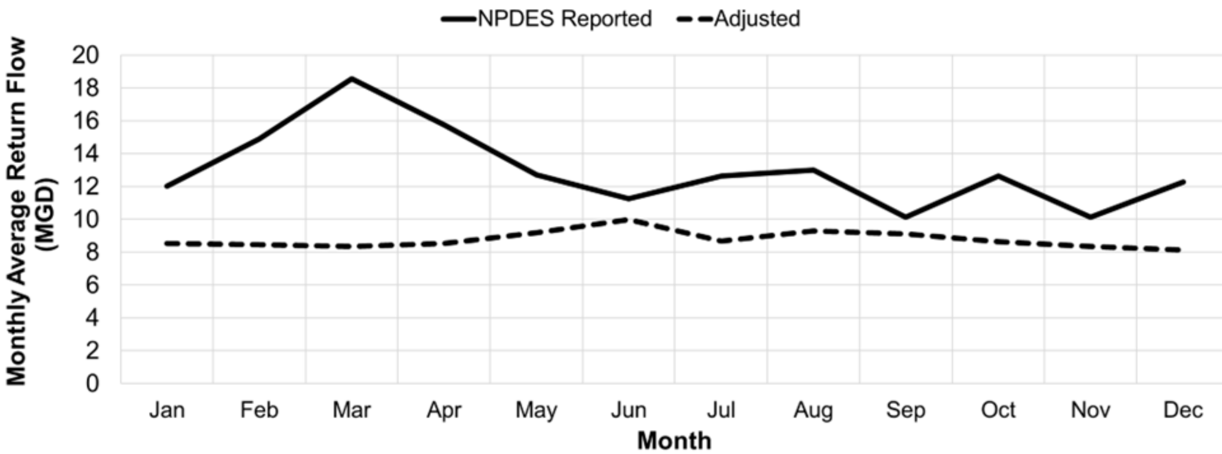
Figure 5-2 summarizes results for the ten largest WWTPs, demonstrating that reported return flows were reduced from 5.5 BG per year to 3.2 BG per year (a 41% reduction). The adjusted dataset corresponds to a consumptive-use factor of approximately 92% when compared to the average annual water withdrawals of 44 BG, consistent with the range of public-supply consumptive use ratios reported by the USGS for systems across the United States (USGS 2025a). Most adjustments occurred during wetter months. For all other sectors, estimated return flows were consistent with recent regional studies (Letsinger and Gustin 2024, Stantec 2025) as summarized in Table 5-2.



Key:
MGD = million gallons per day
NPDES = National Pollutant Discharge Elimination System
SWWF = Significant Water Withdrawal Facility
USGS = U.S. Geological Survey

Takeaway: Return flows often spike above withdrawals during wet periods, and the adjusted method corrects these storm-driven peaks to reflect true non-consumptive returns.

Figure 5-1. Monthly Water Withdrawals and Return Flows (left axis) and Measured Monthly Streamflow (right axis), for a Paired Public Water Supply Withdrawal and Wastewater Treatment Plant (La Porte Water and La Porte WWTP)



Key:
MGD = million gallons per day
NPDES = National Pollutant Discharge Elimination System

Takeaway: Stormwater adjustment removes inflated discharge peaks, yielding more reliable return flow volumes for the water budget.

Figure 5-2. Reported NPDES Return Flows and Adjusted Return Flows for the Ten Largest Wastewater Treatment Plans in the Study Area

Table 5-2. Historical Return Flow Estimates for Irrigation, CAFOs, and Self-Supplied Residential Sectors

Sector	Return Flow Assumption
Irrigation	80% of irrigation withdrawals are considered consumptive, either taken up by crops and livestock or lost through evapotranspiration, consistent with regional estimates of crop demand (Shaffer 2009, Shaffer and Runkle 2007). The remaining 20% is assumed to be return flow that first infiltrates into the earth and eventually returns to the stream as baseflow. To simplify the assessment, these return flows are assumed to occur instantaneously. The potential impact of agriculture drainage tiles is not accounted for in irrigation return flows, though Indiana has some of the highest percentage of cropland with drainage tiles in the country (Valayamkunnath et al., 2020). Future updates to the water availability method could evaluate whether the effect of drainage tiles supports the assumption of instantaneous irrigation return flow, or whether infiltration and runoff processes cause meaningful delays or losses that should be accounted for.
CFO/CAFO	80% of livestock withdrawals are considered consumptive for animal related operations, consistent with regional estimates for median consumption at livestock farms (Shaffer 2009). The remaining 20% is assumed to be return flow that first infiltrates into the earth and eventually returns to the stream as baseflow. To simplify the assessment, these return flows are assumed to occur instantaneously.
Self-Supplied Residential	Seasonal return flow estimates are based on regional consumptive-use factors for self-supplied residential use (Shaffer 2009) and are estimates as a percentage of withdrawals by season that are returned instantaneously: 100% in Winter, 98% in Spring, 81% in the Summer, and 93% in the Fall.

Key:
CAFO = Concentrated Animal Feeding Operation
CFO = Confined Feeding Operation

5.4.2 FUTURE

Future return flows for the public supply and industrial and commercial sectors were estimated using linear regression models developed for each subbasin. These regressions established statistical relationships between historical withdrawals and return flows, using either full-year or seasonal datasets depending on the strength of correlation and data availability. The resulting best-fit coefficients were applied to project future return flow volumes based on future withdrawal estimates provided by the demand forecasting analysis. Additional details on regression development and model performance are provided in Appendix E.

For the energy production sector, coal-fired power generation remains the primary near-term energy source within the Study Area. Based on U.S. Department of Energy, Energy Information Administration (EIA) data, regional coal facilities exhibit an average consumptive-use factor of 56%, meaning that approximately 44% of withdrawn water is returned to receiving water bodies. This consumptive-use factor was applied to coal facilities until their projected phase-out under the future baseline scenario.

Future water withdrawals for energy production were estimated using projected electricity demand and generation data from the Indiana Electricity Demand, Energy Efficiency, and Demand Response Forecast (SUFG 2023). These estimates incorporated energy demand growth, anticipated technology transitions, and withdrawal intensities by generation type. For each energy generation technology, a sector-specific consumptive-use factor was applied, and the remaining portion of withdrawals was assigned as return flow. Table 5-3 summarizes the assumed withdrawal intensities and estimated return flow percentages for each energy generation technology.

Table 5-3. Future Return Flow Estimates by Energy Generation Technology, Including Withdrawal Intensities and Corresponding Return-Flow Percentage

Takeaway: Estimation of future return flows depends heavily on energy technology, as each type uses and returns water at different rates.

Generation Type	Withdrawal Intensity (gallon/kWh)	Return Flows (% of withdrawals)	Source
Close Loop Cooling (Recirculating, coal)	1.15	44%	Harris and Diehl (2019)
Flat Panel Photovoltaic (PV)	0.00	0%	Meldrum et al. (2013)
Onshore Wind	0.00	0%	Meldrum et al. (2013)
Combined Cycle Cooling Tower	0.90	31%	EIA data average for Indiana

Key:
EIA = U.S. Department of Energy, Energy Information Administration
kWh = kilowatt hour

For all other water-use sectors, future return flows were estimated following the same approach and assumptions outlined in Table 5-2 and Section 5.4.2.

5.5 Natural Streamflow

Natural streamflow is defined as the daily average flow at a USGS gaging station that would occur in the absence of human influences, specifically withdrawals, return flows, and reservoir operations. Evaluating natural streamflow at each gage, and separating it into its baseflow and stormflow components, forms the foundation of the overall water-availability analysis framework used in this Study.

5.5.1 HISTORICAL

As illustrated graphically in Figure 3-2, historical daily natural streamflow was estimated by adjusting the measured USGS streamflow record in an attempt to remove anthropogenic influences. For each gage, daily natural streamflow was calculated by subtracting daily return flows, adding daily withdrawals.

5.5.2 FUTURE

Although the INCCIA provides simulated future streamflow data (Cherkauer et al. 2021), those outputs contain model-specific biases typical of individual GCMs. To minimize these biases, this Study applied a two-step bias-correction process similar to the approach used in the North Central Indiana regional water study (Stantec 2025): (1) hydrologic sequencing and (2) hydrologic change-factor application.

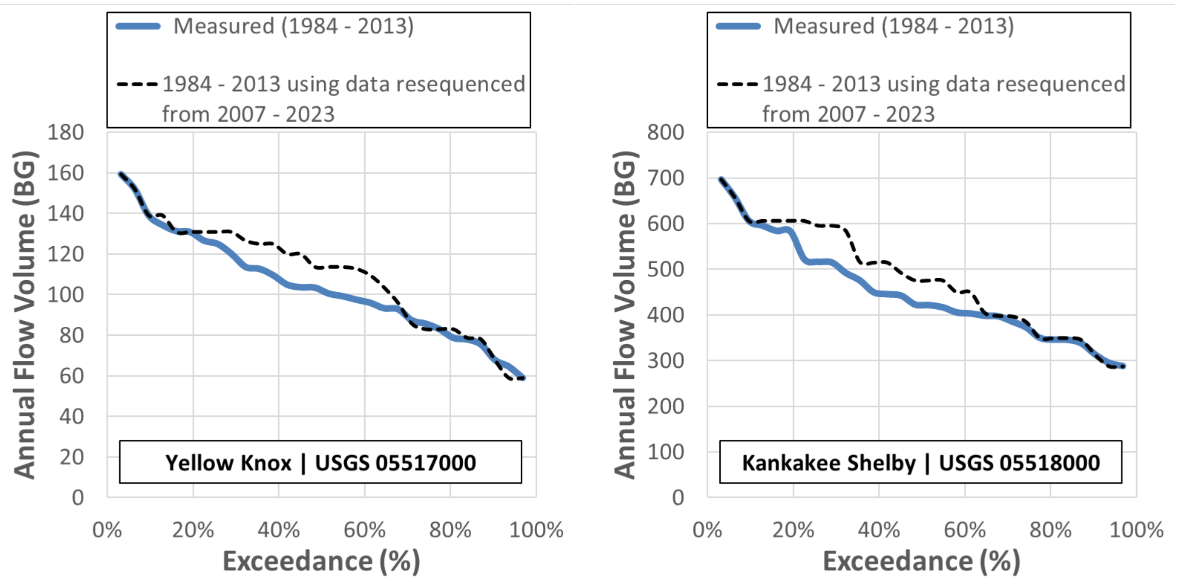
Hydrologic sequencing: The INCCIA modeled climate change effects by scaling a baseline historical period (1984–2013) to represent three future 30-year climate periods. Each simulated future period maintained the same temporal structure as the historical dataset but adjusted temperature and precipitation to reflect projected changes. Because this Study uses a more recent historical record (2007 – 2023), an alignment process was required to match the INCCIA baseline. Years from 2007 – 2023 were selected to best represent the hydrologic variability of earlier years (1984 – 2006). Seasonal flow volumes (Winter/Spring and Summer/Fall) were compared across the two time periods, and the years from 2007 – 2023 that most closely reproduced the range of seasonal flow conditions observed during 1984 – 2006 were identified. The comparison was performed using measured flows from 12 USGS streamgages in the Kankakee Basin, and the years that best matched the seasonal variability across these gages were selected as representative. Ultimately, six of the 12 gages were included for analysis of future natural streamflow in this Study. The final future hydrologic sequence used in this Study is presented in Table 5-4. Representative exceedance curves comparing measured historical streamflow with resequenced data (shown in Figure 5-3) demonstrate that the 2007–2023 record effectively reproduces the range of flows observed during the INCCIA baseline period and provide an adequate dataset for evaluating future hydrologic conditions.

Table 5-4. Future Streamflow Hydrologic Sequence Used to Align Historical Variability (1984–2013) with Representative Years from the 2007–2023 Period for Application to Future Years (2024 – 2075)

Takeaway: Historical years (1984 – 2013) are paired with recent years (2007 – 2023) that best match their seasonal flow patterns, ensuring future simulations (2024 – 2075) capture the full range of wet and dry conditions. Years 2007–2013 align with themselves because they fall within both the INCCIA historical baseline and the recent historical period used for resequencing.

Actual Historical Year[1]	Representative Year(s)	Future Year(s)	Actual Historical Year	Representative Year	Future Year(s)
1984	2018, 2010	2041, 2071	1999	2022	2026, 2056
1985	2017	2042, 2072	2000	2021	2027, 2057
1986	2011	2043, 2073	2001	2013	2028, 2058
1987	2023	2044, 2074	2002	2020	2029, 2059
1988	2023	2045, 2075	2003	2021	2030, 2060
1989	2013	2046	2004	2013	2031, 2061
1990	2016	2047	2005	2020	2032, 2062
1991	2009	2048	2006	2013	2033, 2063
1992	2013	2049	2007	2007	2034, 2064
1993	2019	2050	2008	2008	2035, 2065
1994	2011	2051	2009	2009	2036, 2066
1995	2011	2052	2010	2010	2037, 2067
1996	2015	2053	2011	2011	2038, 2068
1997	2019, 2014	2024, 2054	2012	2012	2039, 2069
1998	2020	2025, 2055	2013	2013	2040, 2070

Note:
[1]The INCCIA baseline historical period (Actual Historical Years) spans 1984–2013. For hydrologic sequencing, only the subset of years from 1984–2006 were used for pattern matching because 2007–2023 serves as the pool of representative years. Years 2007–2013 therefore appear in both the historical and representative periods, resulting in some self-pairings in the table.
Key:
INCCIA = Indiana Climate Change Impacts Assessment



Key:
BG = billion gallons
USGS = United States Geological Survey

Takeaway: Resequenced flows closely match the historical record, showing that the selected years capture both high and low flow behavior.

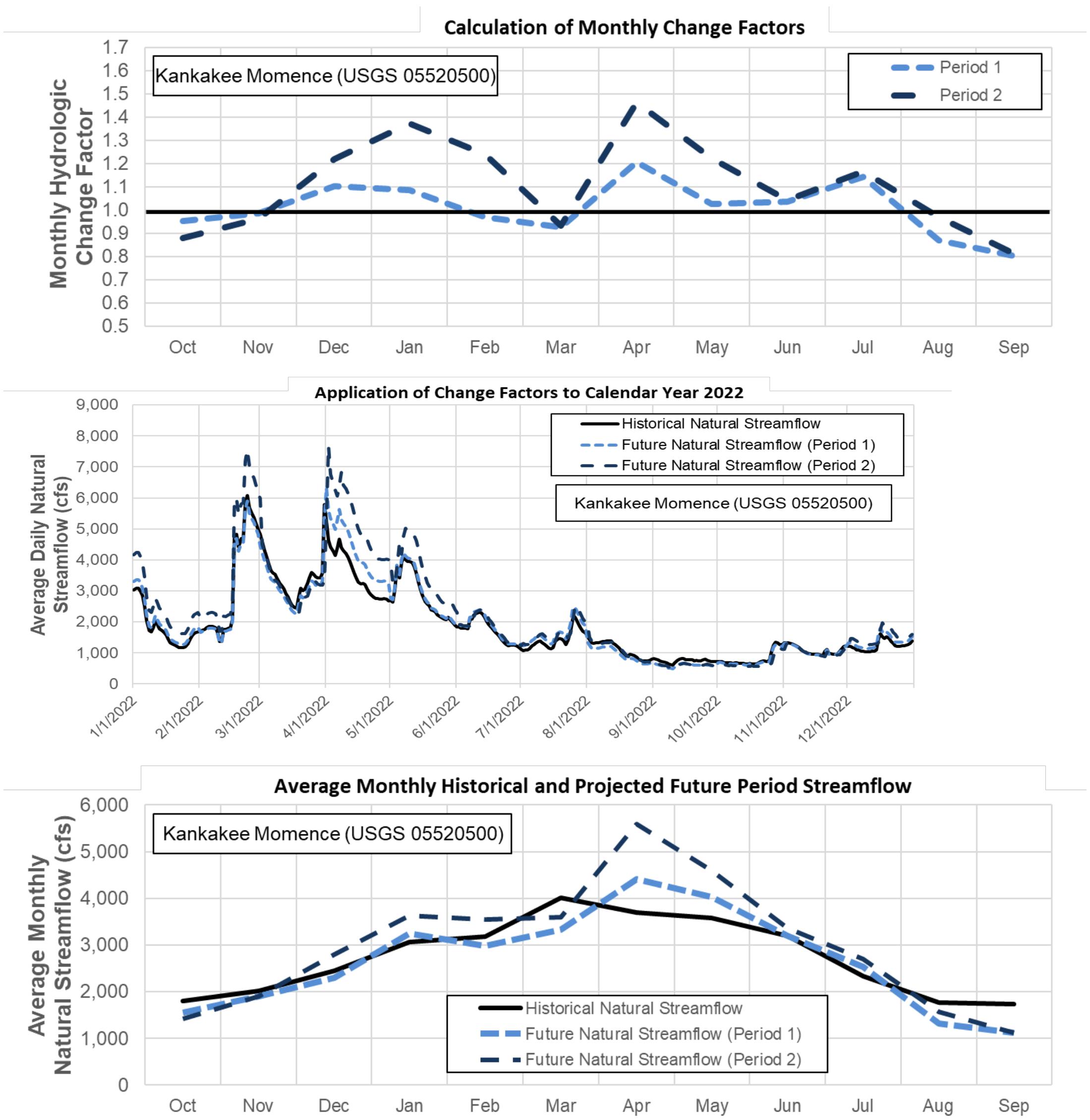
Figure 5-3. Representative Exceedance Curves of Measured Historical Streamflow (1984 – 2013) Compared with Resequenced Flows Derived from the 2007 – 2023 Record

Hydrologic change factor application: After sequencing, each year of future streamflow was adjusted using monthly hydrologic change factors derived from INCCIA model results. This process, analogous to the widely used Delta Method (Navarro-Racines et al. 2020), applies the relative difference between simulated future and historical flows to the observed historical dataset, producing a bias-corrected estimate of future natural streamflow. A change factor represents the ratio of future to historical modeled streamflow for each month, typically ranging from 0.5 to 1.5. Values greater than 1.0 indicate higher expected streamflow (wetter conditions), while values less than 1.0 indicate lower expected streamflow (drier conditions). These monthly factors were calculated for each subbasin based on simulations from the CESM1-CAM5 GCM under the RCP 8.5 emissions scenario, consistent with statewide and regional studies. Detailed information about this approach is explained in the North Central Indiana regional water study (Stantec 2025, Appendix F).

The hydrologic model used in the INCCIA simulated both historical and future streamflow using the same physical framework but with future temperature and precipitation scaled for three time periods: Period 1: 2011 – 2040; Period 2: 2041 – 2070; Period 3: 2071 – 2100.

For each gage, monthly average future simulated flow was divided by monthly average historical flow to derive a set of twelve change factors for each period. Each future year from 2024 – 2075 was paired with a representative historical year from the 2007 – 2023 period based on the hydrologic sequencing process. The monthly change factors were then applied to the daily natural streamflow of that assigned historical year, producing a future bias-corrected daily streamflow series. After 2040, Period 2 change factors were applied to represent mid-century climate conditions.

Figure 5-4 illustrates this process for streamgage USGS 05520500 (Kankakee River at Momence, IL), showing the implementation of monthly change factors, their application to the 2022 streamflow time series, and the resulting adjusted future natural streamflow for Periods 1 and 2. This two-step approach ensures that the projected future natural streamflow reflects both the historical seasonal hydrologic variability observed in the recent record and the anticipated climate-driven changes in temperature and precipitation identified in regional climate modeling.



Note: Figure illustrates monthly hydrologic change-factor calculations (top), application of those factors to the 2022 natural streamflow series (middle) and resulting monthly average future streamflow for Periods 1 and 2 compared to historical conditions (bottom). Period 1 = 2011 – 2040 and Period 2 = 2041 – 2070 as defined in Cherkauer et al. (2021).

Key:
cfs = cubic feet per second
USGS = U.S. Geological Survey

Takeaway: Climate change factors raise future Spring flows and reduce late-Summer and Fall flows, producing bias-corrected projections from historical natural streamflow.

Figure 5-4. Climate Change Factor Example for USGS 05520500 (Kankakee Momence)

5.6 Natural Baseflow

Natural baseflow represents the portion of streamflow sustained by groundwater discharge into the stream under natural, unaltered conditions. This is the flow that would occur in the absence of groundwater withdrawals and return flows. It originates from the fraction of precipitation that infiltrates into the subsurface, recharges aquifers, and later discharges to streams as groundwater outflow. Baseflow estimates are derived through a mathematical process referred to as baseflow separation, which partitions a natural streamflow hydrograph into two components:

- Baseflow, representing the sustained groundwater contribution to streamflow
- Stormflow, representing the shorter-duration, event-driven surface runoff response

Within the IFA's regional water availability framework (INTERA 2021a), natural baseflow is the fundamental element for quantifying available water supply. Consistent with prior Indiana regional water studies (INTERA 2021a, Letsinger and Gustin 2024, Stantec 2025), several baseflow separation techniques were evaluated to determine the most reliable approach specific to the hydrogeological setting of the Kankakee Basin. **The HYSEP Sliding Interval method (Sloto and Crouse 1996) implemented in the USGS Groundwater Toolbox (Barlow et al. 2015) was selected for this Study. This method was chosen because it:**

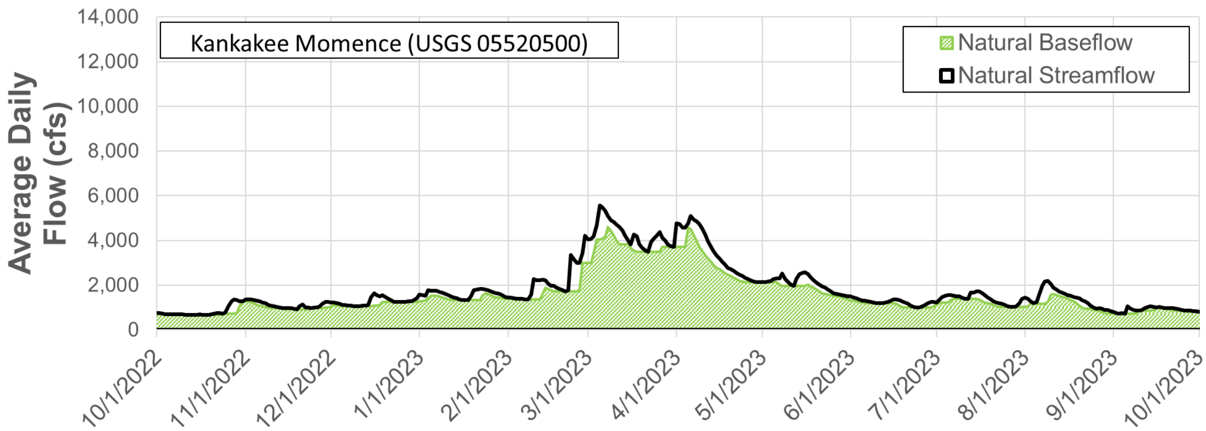
- **performs reliably across the Kankakee Basin's large, relatively flat watersheds where low topographic relief is less appropriate for other methods.**
- **reproduces realistic downstream patterns in baseflow, with relatively higher groundwater contribution in upstream subbasins compared to lower contribution in downstream reaches, consistent with basin hydrogeology and general patterns reflected in the USGS national Baseflow Index (BFI) dataset (Wolock 2003) as well as more recent conceptual and modeling advances in baseflow estimation (e.g., Konrad 2022).**
- **is straightforward to apply consistently across all subbasins without the need for parameter calibration.**

The HYSEP Sliding Interval method was the only method that reproduced physically consistent downstream trends in baseflow magnitudes among gaged subbasins. Compared to the other techniques evaluated in this Study, the HYSEP Sliding Interval method minimized occurrences of unrealistic conditions, such as downstream baseflow being lower than upstream, thereby preserving hydrologic consistency across the basin.

5.6.1 HISTORICAL

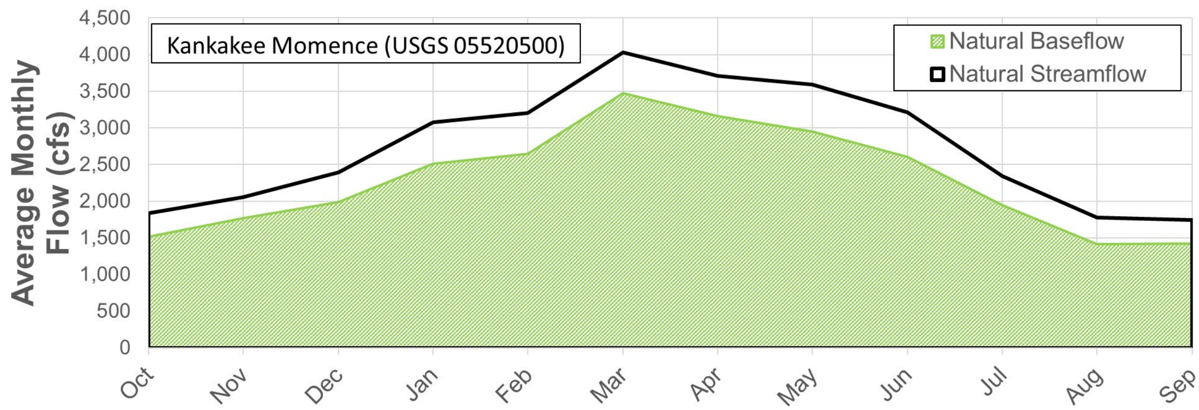
For the historical period, the HYSEP Sliding Interval method was applied to the estimated natural streamflow time series for each subbasin using the USGS Groundwater Toolbox. The resulting baseflow time series represents the historical long-term, continuous contribution of groundwater to streamflow under natural conditions.

An example of baseflow separation for Subbasin 05 (Kankakee Momence) is presented in Figure 5-5, which illustrates the partitioning of natural streamflow into its baseflow and stormflow components over the 2023 water year. The average monthly natural baseflow for the full 2007 – 2023 simulation period for Subbasin 5 is shown in Figure 5-6 to highlight the average seasonal pattern in groundwater contribution.



Key: cfs = cubic feet per second; USGS = U.S. Geological Survey

Figure 5-5. Baseflow Separation Example for Kankakee Momence in Water Year 2023



Key: cfs = cubic feet per second; USGS = U.S. Geological Survey

Figure 5-6. Baseflow Separation Example for Kankakee Momence for the Historical Simulation Period (2007 – 2023)

5.6.2 FUTURE

The same baseflow separation methodology was applied to the future estimated natural streamflow projections. Each subbasin's future natural streamflow time series served as input to the USGS Groundwater Toolbox, where the HYSEP Sliding Interval method was used to develop each corresponding future baseflow time series. This ensures methodological consistency between historical and future analyses, allowing direct comparison of baseflow trends under changing climate and hydrologic conditions.

6.0 Historical Water Availability Results

This chapter provides a summary of recent historical water availability from 2007 – 2023 using a variety of metrics, figures, and plots. Additional details on water availability for individual subbasins can be found in Appendix G.

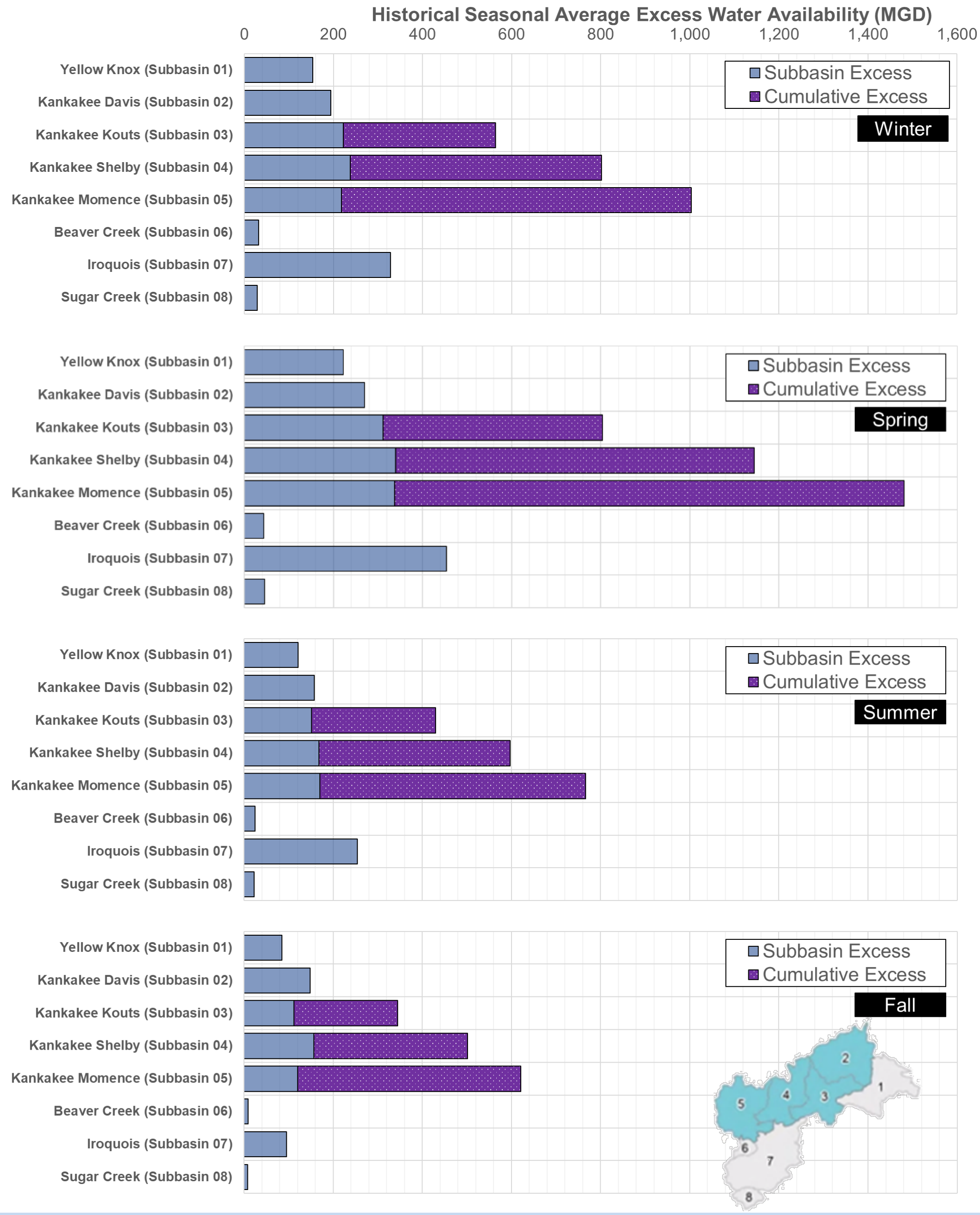
6.1 Water Availability Summary

Figure 6-1 illustrates the historical seasonal averages of subbasin (local) excess water availability and cumulative (regional and combined upstream) excess water availability for each of the eight subbasins. Each row contains two bars: the first represents subbasin excess water availability, or the water availability generated within each subbasin, and the second bar shows cumulative excess water availability upstream, or the water availability accumulated from all upstream subbasin. Subbasins without upstream subbasins (first-order tributary or headwater subbasins) only display the first bar, while downstream subbasins show both. The sum of the two bars represents the total cumulative excess water availability at each subbasin outlet. For example, for Kankakee Kouts (Subbasin 03; La Porte and Starke Counties, including Kouts and Wanatah),[8] the first bar indicates the locally generated water availability, while the second bar reflects the accumulated contributions from Yellow Knox (01; Marshall, St. Joseph, and Starke Counties) and Kankakee Davis (02; La Porte, Marshall, and St. Joseph Counties) upstream.

Seasonal differences are pronounced across the subbasins. Spring exhibits the highest excess water availability generated within each subbasin (EWA) due to elevated precipitation and runoff, followed by Winter, when baseflow contributions remain strong. Fall consistently represents the lowest availability, driven by reduced precipitation and increased evapotranspiration. Subbasins with larger drainage areas, particularly those along the mainstem Kankakee, show the highest cumulative water availability accumulated from all upstream subbasins (CWA), while smaller tributary basins such as Beaver Creek and Sugar Creek produce lower water availability but demonstrate clear local runoff responses.

Across all subbasins, average seasonal subbasin excess remains positive, with highest values in the Iroquois Subbasin (07), which includes portions of Jasper, Newton, and White Counties, during Winter, Spring, and Summer, reflecting strong sustained baseflow and wet-season inputs in that portion of the basin.

[8] For the presentation of results in Chapters 6 and 7, each subbasin will generally be referred to by subbasin name followed by the subbasin number in parentheses, e.g., Kankakee Momence (05). At times, groups of subbasins may be referred to in parentheses, e.g., subbasins along the Kankakee River (02, 03, 04, and 05).



Takeaway: Spring shows the most excess water, then Winter, Summer, and Fall, and cumulative excess grow downstream as upstream flows add in.

Key: MGD = million gallons per day

Figure 6-1. Historical Subbasin (local) and Cumulative (local+regional) Excess Water Availability by Subbasin and Season for Winter (top panel), Spring (second panel), Summer (third panel), and Fall (bottom panel)

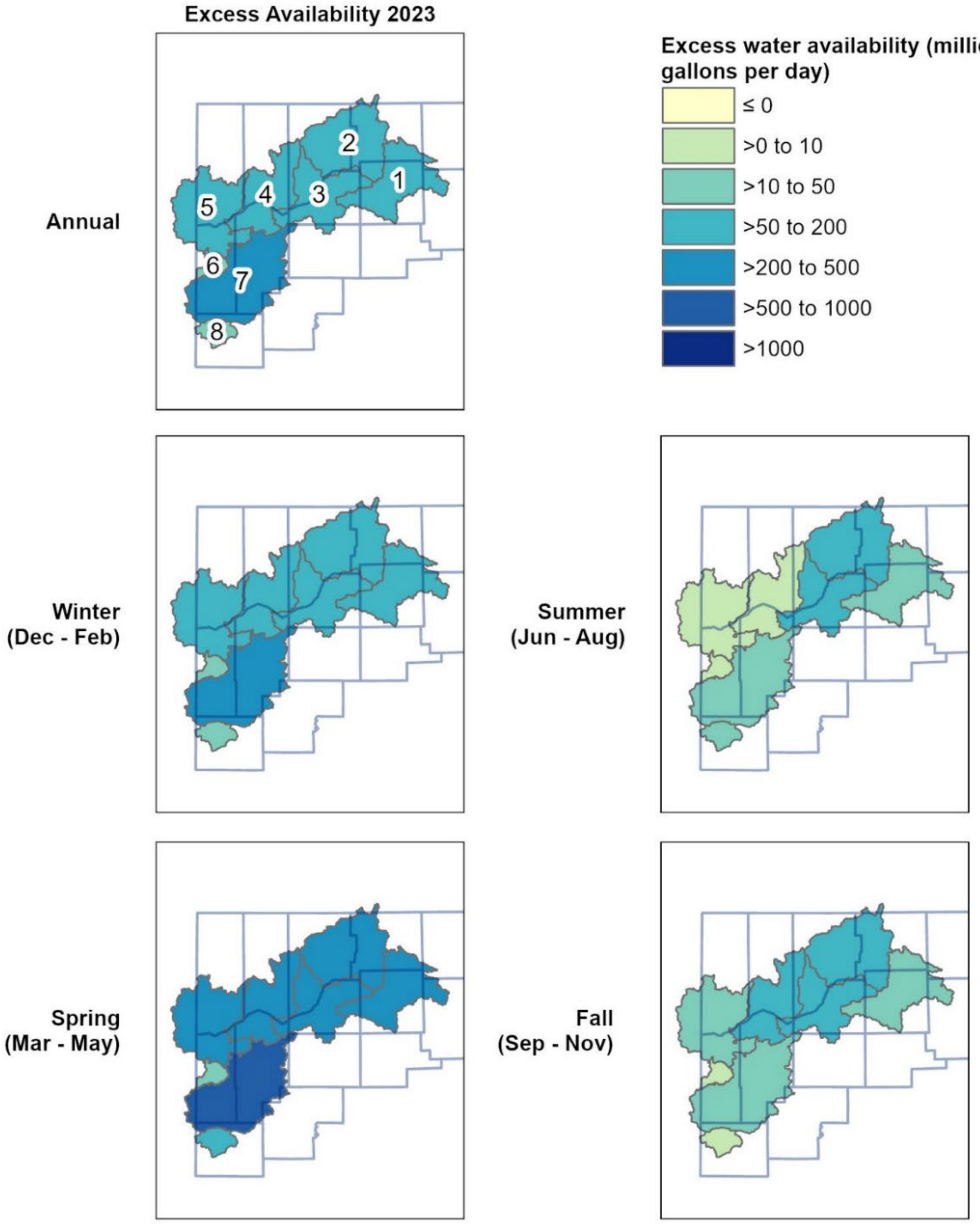
6.2 2023 Spatial Summary

Figure 6-2 and Figure 6-3 provide spatial summaries of excess water availability (local) and cumulative excess water availability (regional) for 2023, displayed at both annual and seasonal scales. The year 2023 was selected as a representative example to illustrate how water availability varies spatially across the Study Area. Later sections of this report show that water availability can fluctuate considerably from year to year.

In 2023, annual excess water availability generated within each subbasin (EWA) ranged from approximately 19 MGD in Beaver (06) to 233 MGD in Iroquois (07), reflecting substantial variability across subbasins. **Seasonal results show the highest values in Spring, driven by high precipitation and elevated natural baseflow, followed by Winter and Summer. Fall generally exhibits the lowest availability due to reduced runoff and receding baseflow. However, along the Kankakee mainstem subbasins (02–05), Fall availability slightly exceeds Summer values, likely a result of reduced Summer baseflows associated with higher consumptive demands during the growing season.**

Figure 6-3 illustrates the spatial distribution of cumulative excess water availability accumulated from all upstream subbasins (CEWA), which incorporates the flow contributions from upstream subbasins. As expected, **cumulative availability generated from upstream contributions increases from upstream to downstream along the Kankakee River, with Subbasins 02–05 which covers portions of La Porte, Marshall, Starke, Jasper, Newton, Porter, and Lake Counties, showing the highest overall values. In contrast, smaller tributaries such as Beaver Creek (06) and Sugar Creek (08) exhibit lower cumulative availability generated from upstream contributions, consistent with their smaller drainage areas. No subbasins showed negative cumulative values in 2023, either annually or seasonally.**

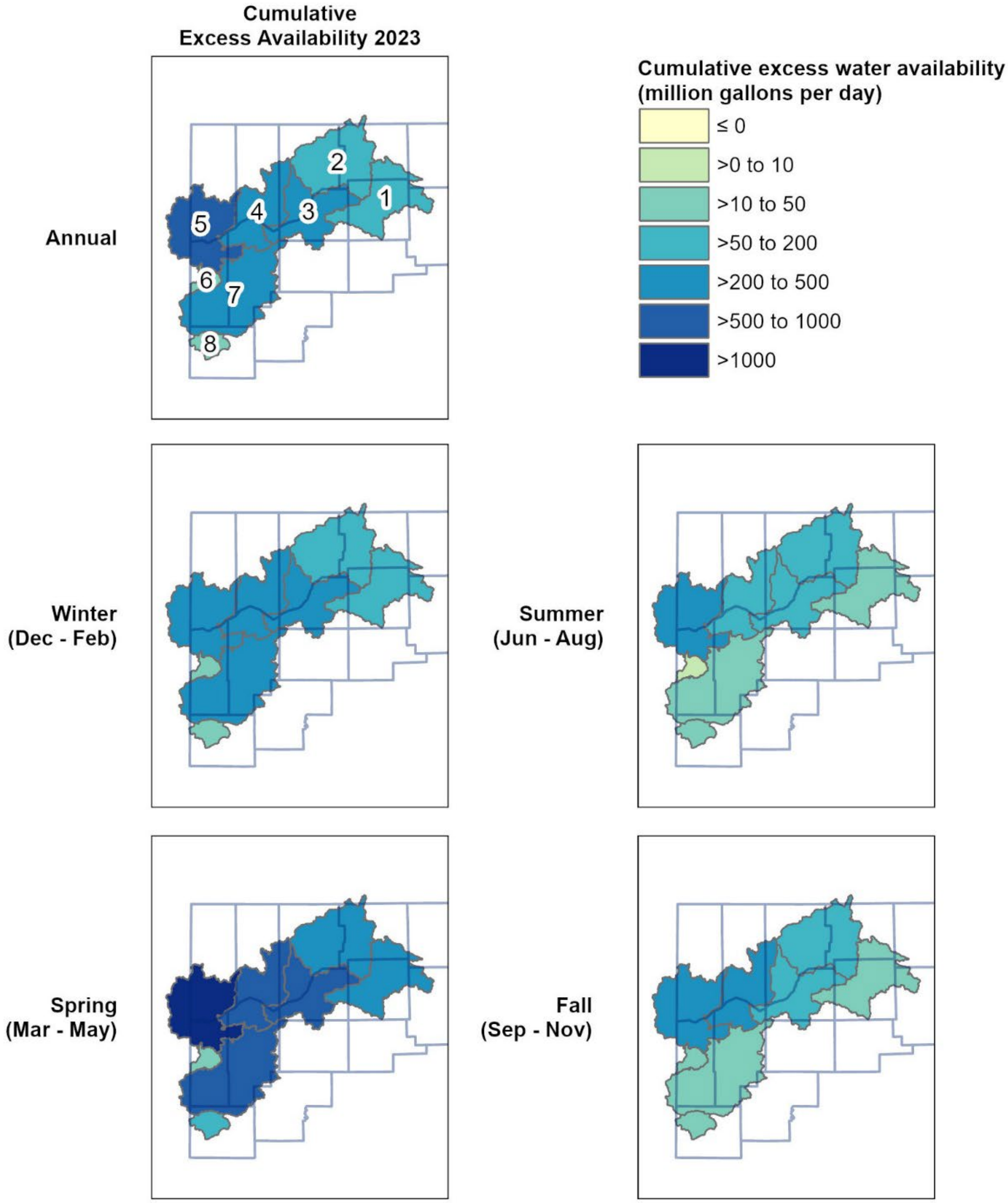
Understanding the distinction between excess and cumulative excess water availability is key for interpreting basin wide hydrologic conditions. Excess water availability represents locally generated surpluses or shortages within individual subbasins, which can identify areas that may experience greater relative water stress. Cumulative excess water availability, on the other hand, integrates flow contributions from upstream subbasins, providing a watershed-scale perspective of available resources. Viewed together, these metrics help identify which subbasins generate sufficient water locally and which depend on inflows from upstream to sustain water supply reliability and potential future development.



Note: The year 2023 was selected to provide a snapshot example of water availability for a year in recent history. Water availability differs substantially by year.

Takeaway: Excess water (locally generated) varies across the eight subbasins, with Spring highest everywhere, Winter and Summer following, and Fall lowest, except along the Kankakee mainstem, where Fall slightly exceeds Summer.

Figure 6-2. 2023 Average Excess Water Availability Generated Within Each Subbasin by Subbasin and Season



Note: The year 2023 was selected to provide a snapshot example of water availability for a year in recent history. Water availability differs substantially by year.

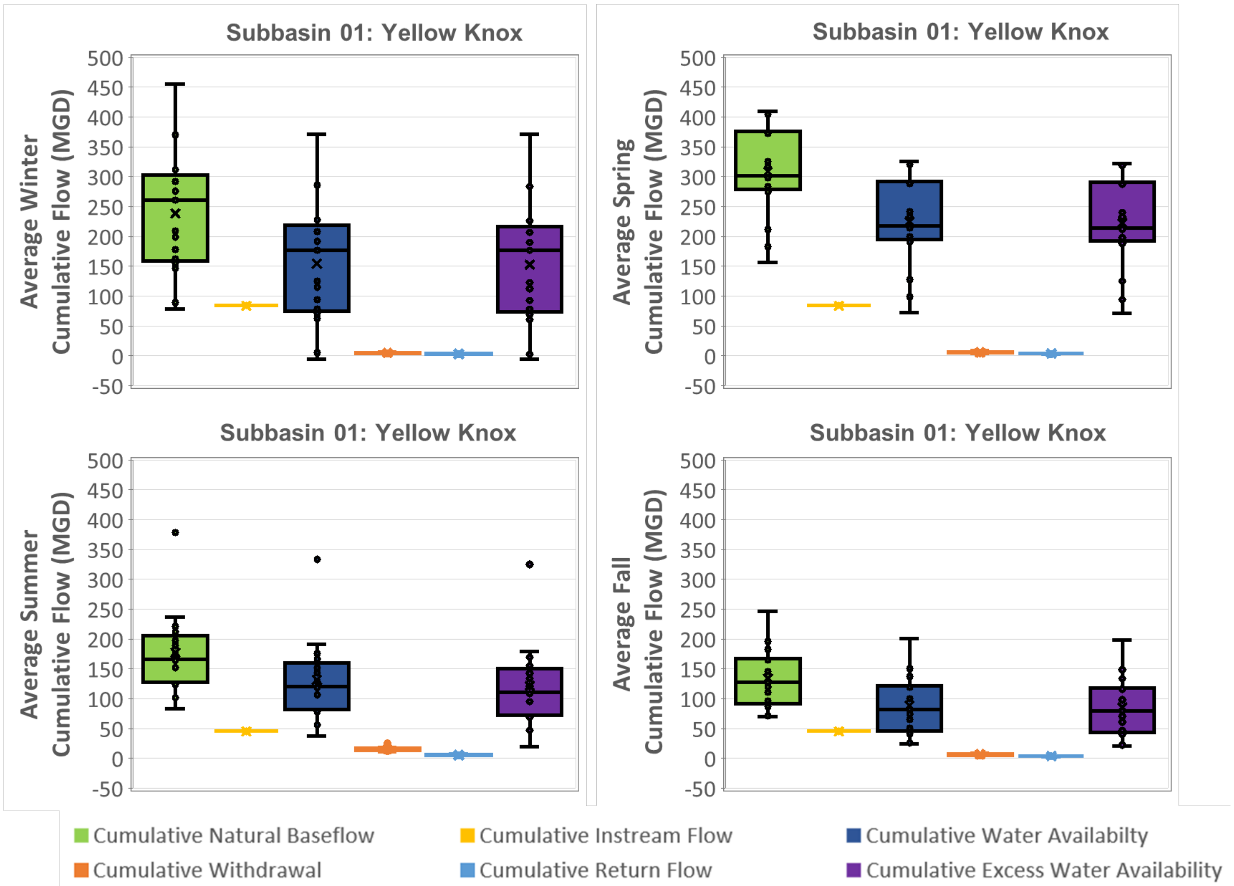
Takeaway: Mainstem Kankakee subbasins hold the highest cumulative excess water (regionally generated), reflecting the additive upstream-to-downstream contributions, with tributaries showing lower totals; all subbasins remained positive in 2023.

Figure 6-3. 2023 Average Cumulative Excess Water Availability Generated from All Upstream Contributions by Subbasin and Season

6.3 Summary of Cumulative Excess Water Availability (Watershed) Components

Figure 6-4 through Figure 6-6 summarizes the major components of the cumulative (local+regional) excess water availability water budget using box and whisker plots for three representative subbasins: Yellow Knox (Subbasin 01; including portions of Marshall, St. Joseph, and Starke Counties), Kankakee Momence (Subbasin 05; including portions of Lake, Porter, and Newton Counties), and Iroquois (Subbasin 07; including portions of Jasper, Newton, and White Counties). Figure 3-11 in Section 3.5.2. provides a review of how to read and interpret box and whisker plots. These examples illustrate differences between a first-order tributary in the Yellow River system (Subbasin 01), a mainstem Kankakee River subbasin with substantial upstream influence (Subbasin 05), and a first-order tributary in the Iroquois River system (Subbasin 07). Box and whisker plots of the components of cumulative excess water availability accumulated from all upstream contributions (CEWA) for all subbasins are provided in Appendix G. In all three subbasins, natural baseflow is the dominant driver of seasonal variation in the water budget. Other components, including withdrawals, return flows, and instream flow are comparatively minor.

For Yellow Knox (01), as shown in Figure 6-4, median natural baseflow varies from about 260 MGD in Winter to 300 MGD in Spring, declining to 170 MGD in Summer and 125 MGD in Fall. Withdrawals and return flows remain relatively small year-round, though withdrawals peak in Summer due to irrigation demand. Instream flow is defined using the Q90 metric for Winter/Spring and the 7Q10 metric for Summer/Fall, resulting in fixed values across the historical record. Because withdrawals and return flows are minimal relative to baseflow, cumulative water availability (baseflow minus instream flow) largely reflects seasonal baseflow patterns, and cumulative excess water availability generated from all upstream subbasins (CEWA) (which includes withdrawals and returns) follows a nearly identical trend. A single winter observation shows slightly negative cumulative excess water availability, indicating an isolated instance when baseflow briefly approached or fell below instream flow requirements in this first-order tributary subbasin.

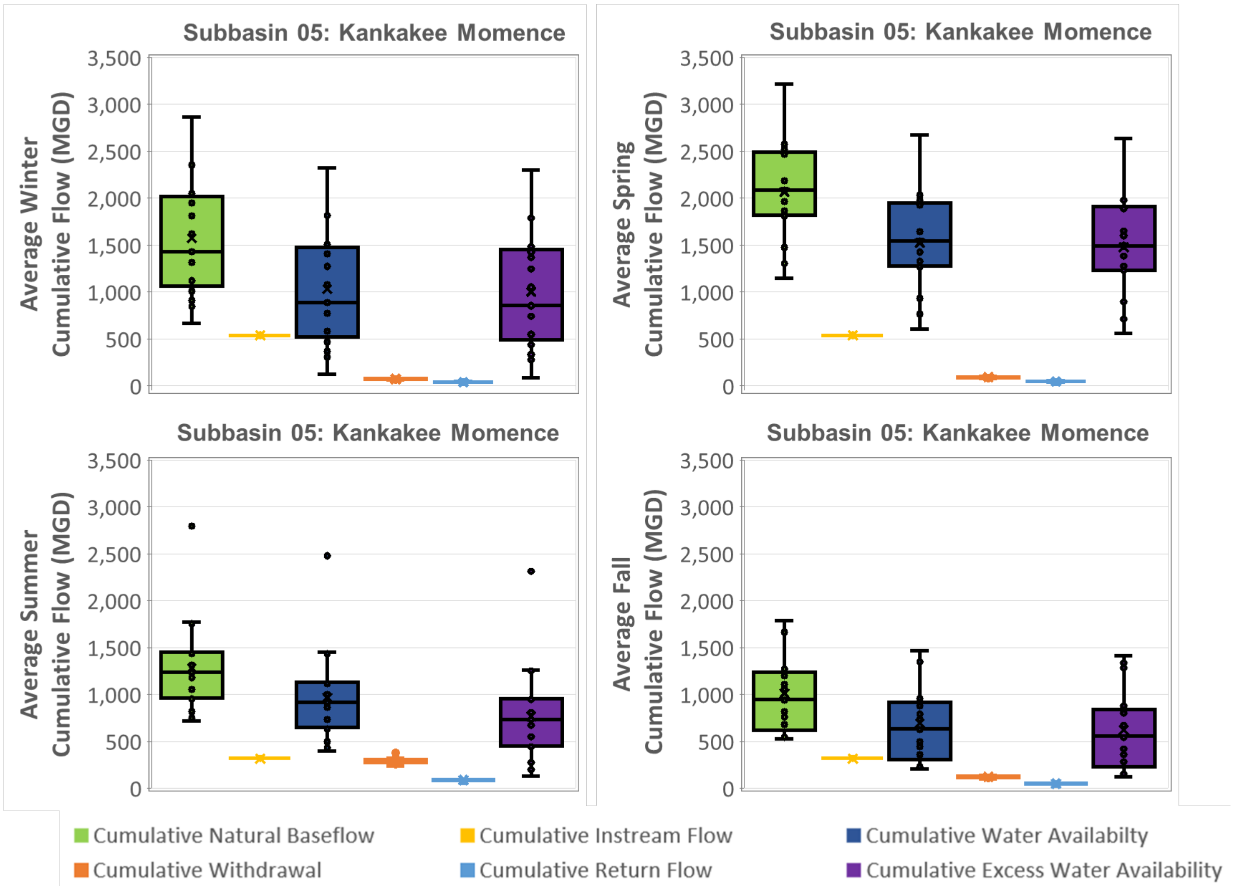


Key:
MGD = million gallons per day

Takeaway: Natural baseflow drives seasonal patterns of water availability, peaking during the groundwater-recharge seasons of Spring and Winter and dropping in Summer and Fall, with withdrawals and returns having only minor influence.

Figure 6-4. Box Plots of Historical Seasonal Cumulative Excess Water Availability Components for Yellow Knox (Subbasin 01) (2007 – 2023)

For Kankakee Momence (05), Figure 6-5 shows similar behavior but at a much larger scale, reflecting contributions from both the Kankakee and Yellow Rivers. Median natural baseflow ranges from approximately 1,430 MGD in Winter to 2,080 MGD in Spring, decreasing to 1,240 MGD in Summer and 950 MGD in Fall. Summer withdrawals are again the largest relative demand but remain small compared to total baseflow. Seasonal variability in cumulative water availability and cumulative excess water availability generated from all upstream subbasin contributions (CEWA) is driven primarily by baseflow fluctuations and instream flow requirements, with limited influence from anthropogenic components.

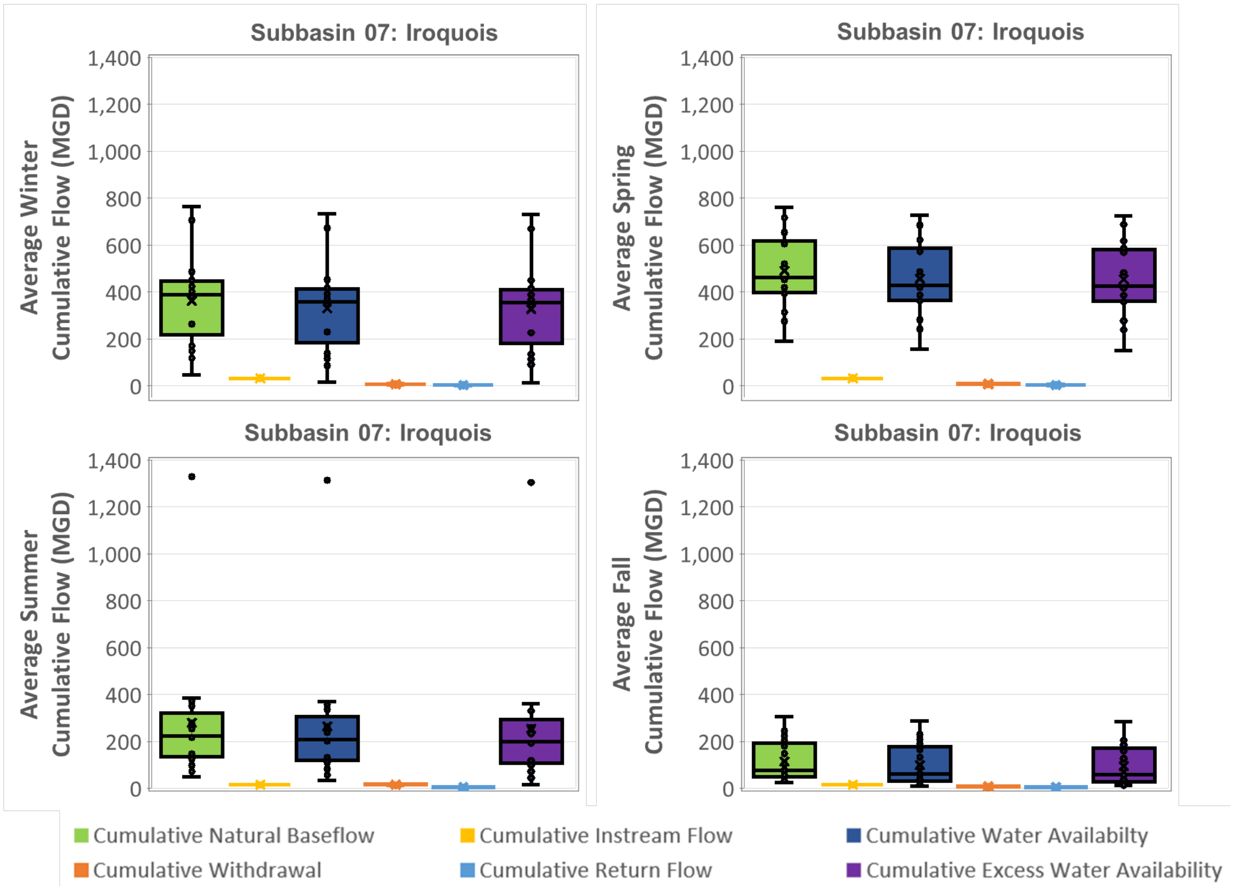


Key:
MGD = million gallons per day

Takeaway: For Kankakee Momence (Subbasin 05; covering portions of Lake, Porter, and Newton Counties), cumulative excess water availability generated from all upstream subbasins (CEWA) mirrors natural baseflow, highest in Spring and lowest in Fall, with withdrawals small. Magnitudes are far larger than Subbasin 01 because of upstream river contributions.

Figure 6-5. Box Plots of Historical Seasonal Cumulative Excess Water Availability Components for Kankakee Momence (Subbasin 05) (2007 – 2023)

For Iroquois (07), as a first-order tributary without upstream inflow, the Iroquois Subbasin (Figure 6-6) exhibits lower magnitudes and more pronounced seasonal variability. Median natural baseflow values range from 390 MGD in Winter to 460 MGD in Spring, dropping sharply to 220 MGD in Summer and 80 MGD in Fall. The reduction from wet to dry seasons is greater here than in Yellow Knox or Kankakee Momence, reflecting the basin’s bedrock geology and limited seasonal recharge capacity. Withdrawals and return flows remain small in all seasons. Fall represents the most constrained period, with cumulative excess water availability accumulated from all upstream subbasins (CEWA) ranging from roughly 50 MGD (lower quartile) to 190 MGD (upper quartile).



Key: MGD = million gallons per day

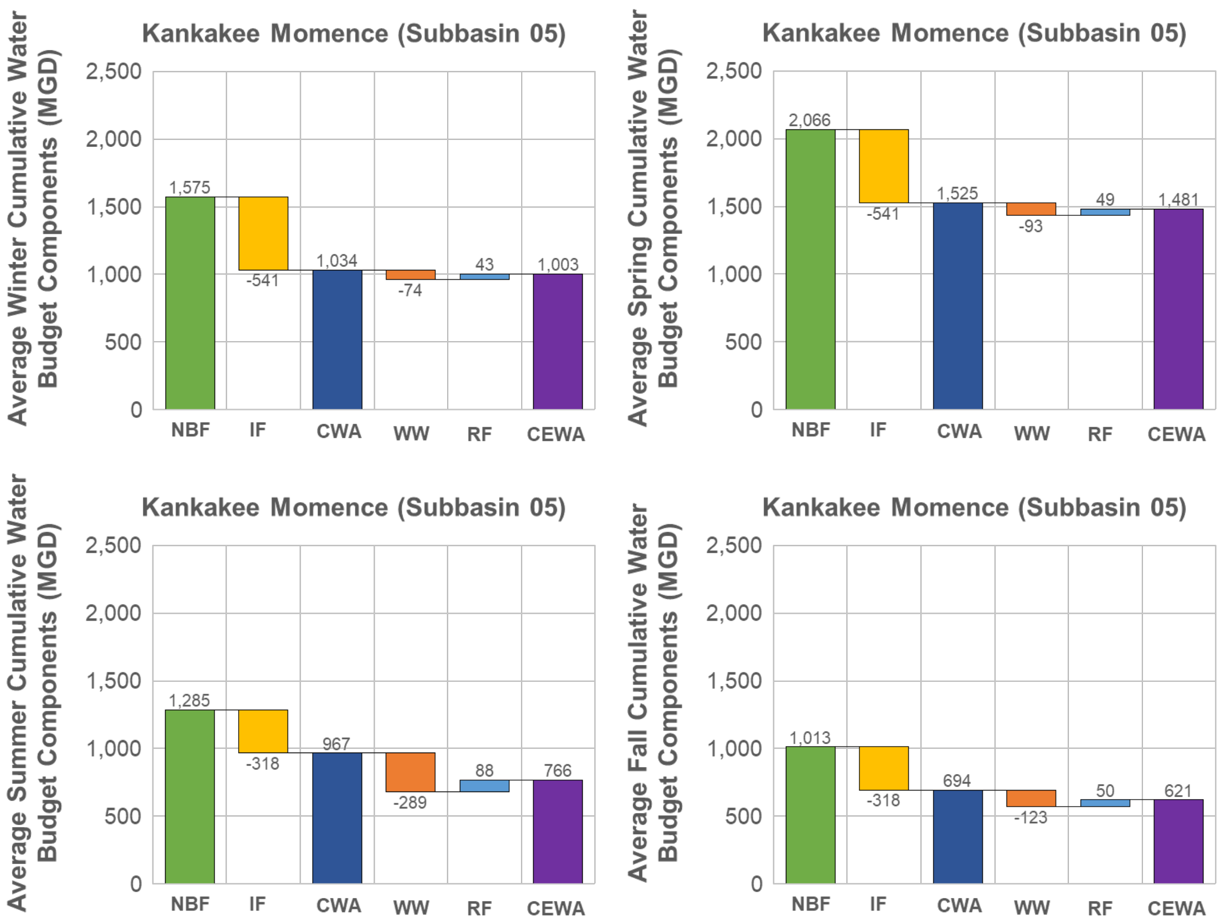
Takeaway: The Iroquois Subbasin (Subbasin 07, covering portions of Jasper, Newton, and White Counties) shows lower cumulative availability than Subbasin 05 but higher than Subbasin 01 due to its larger drainage area, with strong seasonality peaking in Spring and dropping by Fall.

Figure 6-6. Box Plots of Historical Seasonal Cumulative Excess Water Availability Components for Iroquois (Subbasin 07) (2007 – 2023)

Figure 6-7 summarizes the average cumulative water budget components for the most downstream subbasin, Kankakee Momence (Subbasin 05), providing a representative view of basin-wide seasonal patterns. Each plot is organized sequentially from left to right, beginning with natural baseflow as the primary water supply, followed by instream flow, which is subtracted to determine CWA. Water withdrawals (WW) are then subtracted from CWA and return flows (RF) are added to yield cumulative excess water availability accumulated from all upstream subbasin contributions (CEWA).

Across all seasons, cumulative water availability generated regionally exceeds water withdrawals, indicating that historical water supply has been at least twice the average water demand, even after accounting for instream flow requirements. The proportion of withdrawals relative to cumulative water availability varies seasonally, approximately 7% in Winter, 6% in Spring, 30% in Summer, and 18% in Fall, showing that less than half of the available supply is typically withdrawn during any season.

Consumptive use is highest in Summer, when about 70% of withdrawn water is consumed and the remaining 30% is returned to the stream, reflecting seasonal irrigation demand. On an annual basis, cumulative excess water availability generated from all upstream subbasins (CEWA) remains relatively stable as a fraction of natural baseflow, ranging from 61% in Summer and Fall to 72% in Spring. The absolute magnitude of CEWA varies considerably, from roughly 620 MGD in Fall to 1,480 MGD in Spring, primarily due to seasonal fluctuations in natural baseflow. Among all water budget components, instream flow represents the largest allocation throughout the year, highest during Winter and Spring, and lowest during Summer and Fall.



Key:

CEWA = cumulative excess water availability	CWA = cumulative water availability	IF = instream flow
MGD = million gallons per day	NBF = natural baseflow	RF = return flow
WW = water withdrawal		

Takeaway: At Kankakee Momence (Subbasin 05, including portions of Lake, Porter, and Newton Counties), the Kankakee River's most downstream point in Indiana, the water budget is dominated by natural baseflow, with instream flow (ecological needs) creating the largest reduction while withdrawals are far below total supply and are typically less than half of available water. Spring shows the highest cumulative excess water and Fall the lowest; with withdrawals ranging from just 6-7% of supply in Winter and Spring, to 30% in Summer, when consumptive-use peaks.

Figure 6-7. Historical Seasonal Cumulative Water Budget Components for Subbasin 05 (2007 – 2023)

6.4 Cumulative Excess Water Availability (Watershed) Data Summary

Seasonal cumulative excess water availability generated from all upstream subbasin contribution (CEWA) for all eight subbasins from 2007 through 2023 is summarized in Table 6-1 through Table 6-4, representing the Winter, Spring, Summer, and Fall seasons, respectively. These tables illustrate both seasonal and spatial variability in water availability, highlighting the influence of natural hydrologic conditions and human water-use patterns. Key findings include:

- **Seasonal trends: Consistent with Figure 6-3, Winter and Spring exhibit higher cumulative excess water availability (regional) due to greater natural baseflow, while Summer and Fall show lower values resulting from reduced baseflow and higher water withdrawals.**
- **Magnitude of variability: Cumulative excess water availability accumulated from upstream subbasin contributions (CEWA) varies by up to an order of magnitude within the same season for most subbasins. For example, at Kankakee Momence (Subbasin 05), Winter availability ranged from 91 MGD in 2021 to 2,299 MGD in 2008. This variability is driven primarily by differences in natural baseflow, which depends on factors such as geology, recharge potential, and climate, including antecedent conditions from preceding seasons.**
- **Spatial differences: Subbasins along the Kankakee River mainstem (Subbasins 03, 04, and 05) consistently demonstrate the highest cumulative excess water availability derived from upstream flows (CEWA) across all seasons, reflecting their larger drainage areas, higher baseflow contributions, and cumulative inflows from upstream subbasins.**
- **Low and negative values: Low cumulative excess water availability generated within upstream watersheds (CEWA) is observed in several subbasins during the Summer and Winter seasons, with a single subbasin (Subbasin 01) exhibiting negative values during one Winter (2021; see Figure 6-4). The effects on cumulative excess water availability coming from upstream (CEWA) of individual years with particularly dry or drought conditions are observed more easily for the Winter of 2021 and the Summer of 2012. In both seasons, relatively low amounts of precipitation and storm events led to low seasonal natural baseflow values in the 17-year recent historical analysis period. In Winter 2021, available water at Yellow Knox (Subbasin 01) was insufficient to meet all instream flow requirements (ecological need), resulting in a calculated negative cumulative excess water availability generated from upstream flow contributions (CEWA). At this location, seasonal natural baseflow for Winter 2021 was lower than minimum instream flow values.**
- **Overall condition: Except for Winter 2021 at Subbasin 01, which covers portions of Marshall, St. Joseph, and Starke Counties and cities and communities like Knox, cumulative excess water availability remained positive across all subbasins and seasons throughout the historical period.**

Table 6-1. Winter Historical Cumulative Excess Water Availability Accumulated from Upstream Subbasins (MGD)

Takeaway: Winter historical cumulative excess water is highest in the mainstem Kankakee subbasins, with strong baseflow and large drainage areas, and varies widely from the 2021 low, when Subbasin 01 which covers portions of Elkhart, Marshall, St. Joseph and Starke Counties and communities and cities like Knox and Lakeville experienced water scarcity/deficit/was not able to meet all needs in the subbasin or whatever, to the exceptionally wet Winter of 2008.

Subbasin	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Yellow Knox (01)	208	371	190	92	3	284	60	69	113	123	226	232	207	177	-6	177	78
Kankakee Davis (02)	250	387	308	172	88	259	63	127	143	189	316	231	225	272	61	136	60
Kankakee Kouts (03)	881	1,337	741	420	125	746	173	356	575	615	811	593	697	721	108	487	201
Kankakee Shelby (04)	1,350	1,750	1,063	619	205	1,146	279	473	673	815	1,053	813	1,058	1,089	204	750	283
Kankakee Momence (05)	1,786	2,299	1,482	744	277	1,427	440	549	857	1,053	1,247	854	1,485	1,368	91	759	336
Beaver (06)	53	76	35	26	12	24	12	14	23	44	37	42	45	35	1	34	23
Iroquois (07)	670	730	355	227	91	367	114	136	244	392	414	388	449	404	12	343	241
Sugar (08)	51	50	34	24	18	19	13	7	24	46	33	38	41	27	3	28	34

Notes:
Winter values are calculated as the average cumulative excess water availability from December through February.
Cells are colored consistent with the color scale in Figure 6-2.
Key:
MGD = million gallons per day

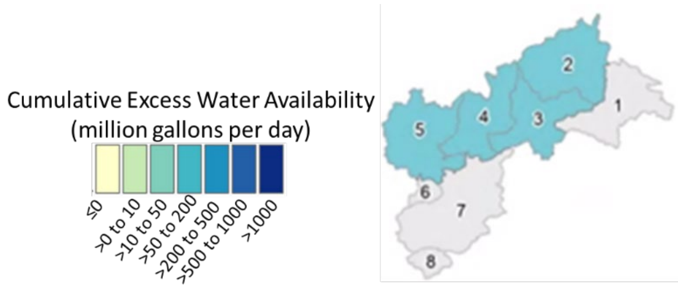


Table 6-2. Spring Historical Cumulative Excess Water Availability Accumulated from Upstream Subbasins (MGD)

Takeaway: Spring has the highest cumulative excess water availability of any season, with mainstem Kankakee subbasins showing the largest values and tributaries much lower, yet all subbasins remain positive across every Spring from 2007 – 2023.

Subbasin	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Yellow Knox (01)	198	294	319	188	323	94	214	215	125	213	238	288	321	212	72	241	233
Kankakee Davis (02)	225	326	491	230	289	160	188	276	184	274	345	448	328	286	107	210	233
Kankakee Kouts (03)	717	1,063	1,387	615	1,001	353	613	779	537	882	901	1,261	1,001	817	292	726	723
Kankakee Shelby (04)	1,104	1,477	1,988	899	1,456	545	862	1,079	675	1,119	1,289	1,743	1,446	1,242	500	1,075	948
Kankakee Momence (05)	1,384	1,890	2,637	1,237	1,933	713	1,229	1,494	895	1,504	1,601	1,982	1,931	1,649	563	1,280	1,259
Beaver (06)	53	35	74	44	64	18	48	41	28	36	53	32	59	43	29	38	44
Iroquois (07)	588	364	724	426	687	150	486	386	277	482	569	375	575	415	240	358	618
Sugar (08)	47	39	70	47	76	20	56	38	31	40	63	35	52	47	35	38	50

Notes:
Spring values are calculated as the average cumulative excess water availability from March through May.
Cells are colored consistent with the color scale in Figure 6-2.
Key:
MGD = million gallons per day

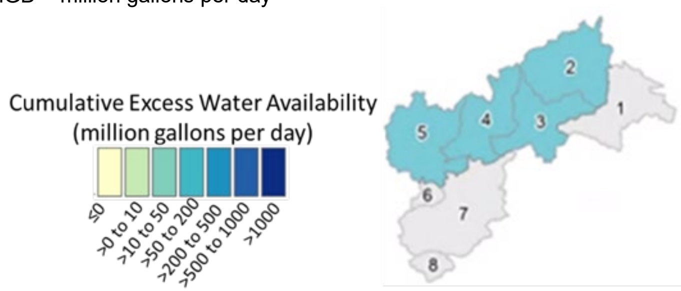


Table 6-3. Summer Historical Cumulative Excess Water Availability Accumulated from Upstream Subbasins (MGD)

Takeaway: Summer cumulative excess water availability is lower than Winter and Spring because of reduced baseflow and higher irrigation withdrawals, with mainstem subbasins highest, tributaries lowest, and 2012 marking the driest Summer, yet all subbasins remain positive.

Subbasin	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Yellow Knox (01)	102	110	74	133	156	20	179	95	325	108	146	121	143	69	170	71	48
Kankakee Davis (02)	110	84	191	185	218	34	144	195	265	181	179	179	294	146	138	61	77
Kankakee Kouts (03)	299	309	377	454	650	38	467	444	1,109	430	495	379	647	324	482	215	184
Kankakee Shelby (04)	390	459	536	640	957	37	628	619	1,594	539	658	494	941	481	715	281	192
Kankakee Momence (05)	448	550	670	948	1,250	127	735	957	2,317	732	735	446	1,258	561	812	277	201
Beaver (06)	6	23	13	36	22	2	28	31	113	30	25	11	26	12	29	9	8
Iroquois (07)	72	198	126	234	362	16	347	329	1,305	240	192	97	260	119	252	125	44
Sugar (08)	6	33	15	51	14	3	20	25	88	19	26	20	18	11	30	5	13

Notes:
Summer values are calculated as the average cumulative excess water availability from June through August.
Cells are colored consistent with the color scale in Figure 6-2.
Key:
MGD = million gallons per day

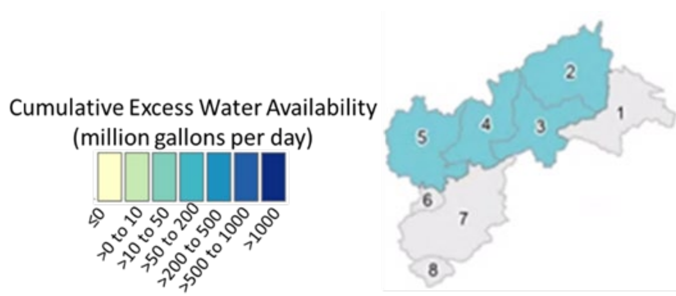
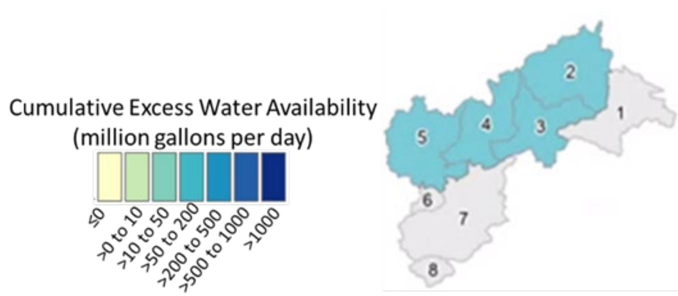


Table 6-4. Fall Historical Cumulative Excess Water Availability Accumulated from Upstream Subbasins (MGD)

Takeaway: Fall shows the lowest cumulative excess water availability of the year, with declining baseflow and lingering evapotranspiration; mainstem Kankakee subbasins remain highest, tributaries lowest, and all values stay positive, even in the dry Fall of 2012.

Subbasin	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Yellow Knox (01)	98	79	84	48	134	21	61	116	71	198	117	120	73	23	149	40	25
Kankakee Davis (02)	176	299	182	66	146	45	106	228	119	303	164	173	205	67	112	38	88
Kankakee Kouts (03)	395	643	356	92	334	56	253	636	279	837	419	369	375	113	396	117	183
Kankakee Shelby (04)	564	980	508	153	485	121	364	940	397	1,002	619	564	611	177	641	136	262
Kankakee Momence (05)	703	1,414	672	171	556	155	357	1,281	420	1,338	704	545	801	154	877	126	282
Beaver (06)	3	19	12	1	2	2	1	28	11	19	14	7	11	1	24	2	3
Iroquois (07)	37	185	60	13	46	22	26	285	57	224	159	83	127	14	205	46	29
Sugar (08)	2	12	11	1	0	3	0	26	13	12	16	9	3	1	22	2	2

Notes:
Fall values are calculated as the average cumulative excess water availability from September through November.
Cells are colored consistent with the color scale in Figure 6-2.
Key:
MGD = million gallons per day



6.5 Cumulative Excess Water Availability Exceedance

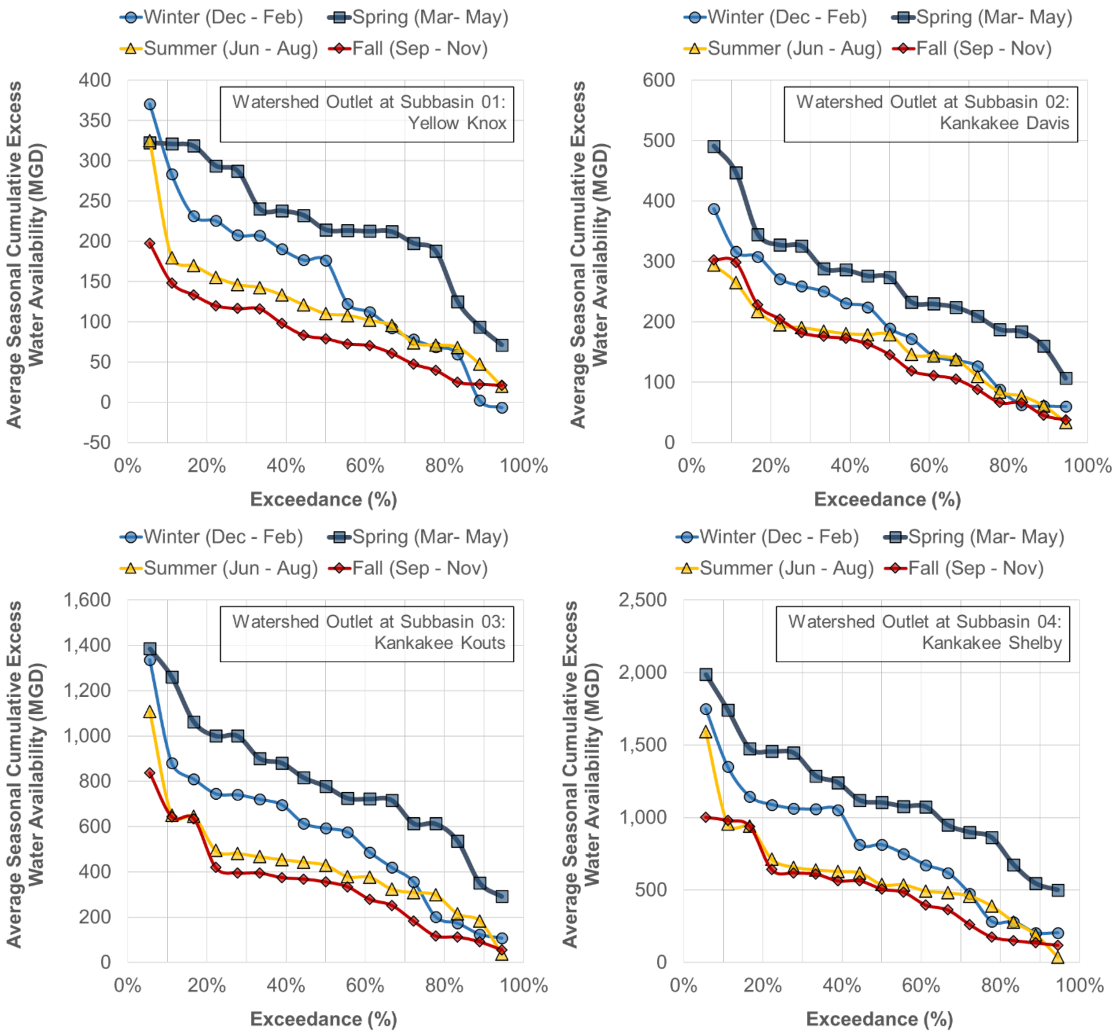
Exceedance curves of historical seasonal cumulative excess water availability generated from upstream subbasins (CEWA) (Figure 6-8 and Figure 6-9) illustrate how water availability varies under a full range of hydrologic conditions across the eight subbasins. These figures correspond to the data summarized in Table 6-1 through Table 6-4, reordered (ranked) by exceedance probability to depict the frequency with which different levels of water availability are equaled or exceeded. Refer to Figure 3-10 in Section 3.5.1 for an explanation of exceedance curves. Interpreting these curves provides insight into the relative magnitude and recurrence of seasonal water availability, which can inform long-term water-supply planning under wet, median, and dry conditions. **For instance, values at the 50 percent (i.e., median) exceedance probability reflect conditions that occur approximately every other year, whereas values at the 95 percent exceedance probability correspond to only low-flow or drought years.**

Across the basin, exceedance patterns display a clear seasonal hierarchy. **Spring consistently yields the highest cumulative excess water availability generated regionally (CEWA), driven by elevated precipitation and runoff from late-Winter snowmelt. Winter and Summer generally produce moderate availability, while Fall represents the most limited season, when evapotranspiration is high and baseflows recede. On average, Spring available water magnitudes at the median exceedance level are roughly double those observed in Fall.**

At higher exceedance probabilities (roughly 80 to 100 percent), seasonal curves begin to converge, indicating similar minimum-availability thresholds across much of the basin. The only exception occurs in Subbasin 01 (Yellow Knox), where Winter 2021 exhibited slightly negative cumulative excess water availability generated regionally (CEWA), an isolated instance not observed elsewhere.

Spatial variability is also apparent. Beaver Creek, Iroquois, and Sugar Creek (Subbasins 06, 07, and 08) located in southwestern portion of the Study area and covers portions of Newton, Jasper, and Benton Counties show distinct behavior compared to the mainstem Kankakee subbasins. In these southwestern watersheds, intense late-season rainfall in 2015 elevated Summer availability above typical levels, while Fall conditions remain notably limiting under dry scenarios (exceedance > 60 percent). These differences likely reflect localized hydrogeologic settings, smaller contributing drainage areas, and the influence of land-use patterns on runoff generation.

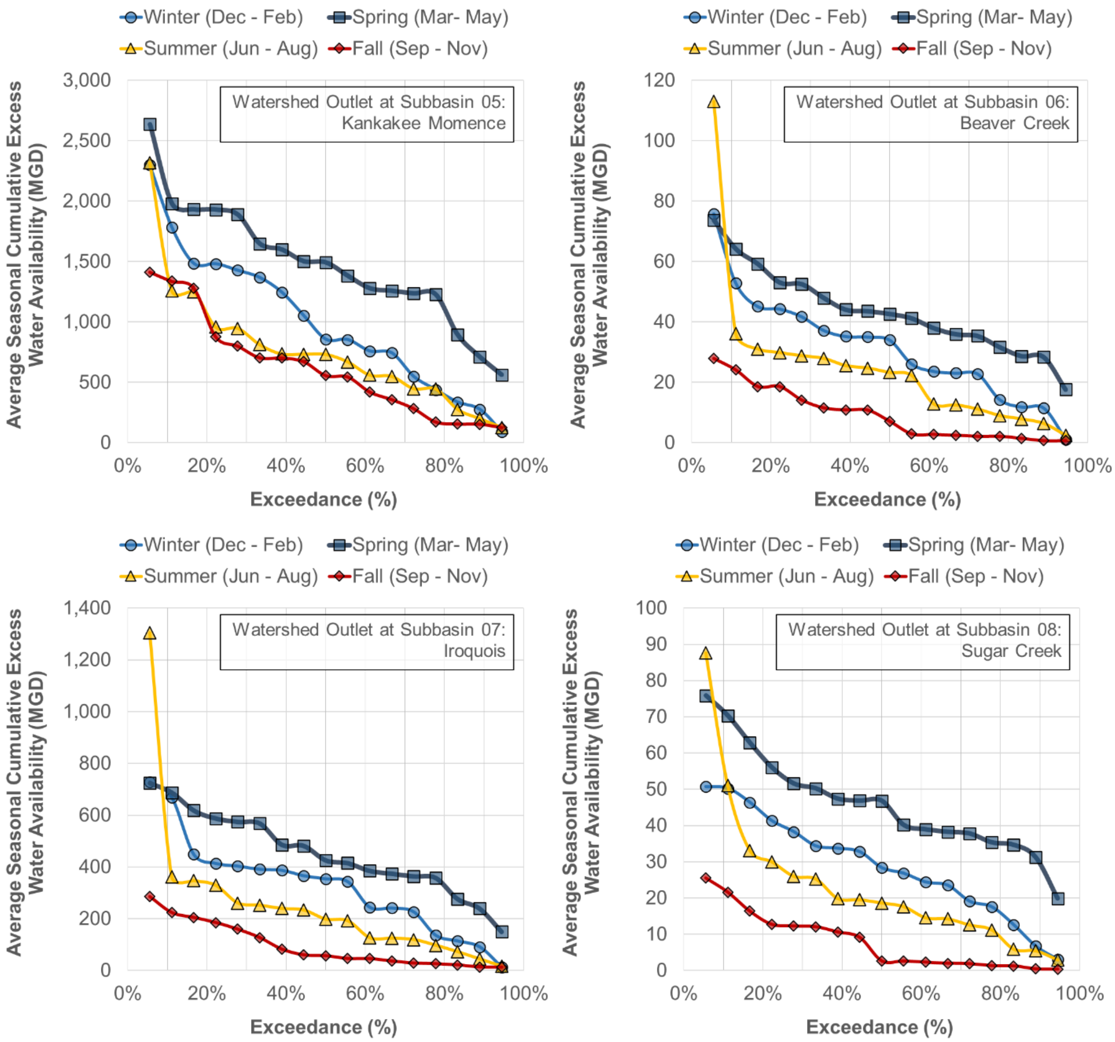
In contrast, the mainstem Kankakee subbasins (02, 03, 04, and 05), which include portions of La Porte, Marshall, St. Joseph, Starke and Lake Counties and cities and communities like La Porte, Knox, Kouts, and Crown Point display parallel seasonal curves, with Summer and Fall remaining closely aligned across exceedance probabilities, and at the 10–20% exceedance range, Fall values slightly exceed those of Summer. Within these subbasins, the transition from Spring to the Summer growing season corresponds to a pronounced decline in available water, highlighting how the timing of runoff and baseflow recession governs inter-seasonal variability in surface water supply potential. Subbasin 01 which includes Elkhart, Marshall, St. Joseph, and Starke Counties and cities and communities like Lakeville and Bremen also deviates from typical patterns observed elsewhere, showing both the lowest (Winter 2021) and highest (Winter 2008) seasonal cumulative excess water availability (watershed scale, CEWA) values in Winter, and is the only subbasin with negative seasonal cumulative excess water availability.



Key:
MGD = million gallons per day

Takeaway: Spring shows consistently highest availability across all exceedance levels, while Fall exhibits the lowest, particularly under dry-year conditions. Winter 2021 in Subbasin 01 (portions of Elkhart, Marshall, St. Joseph, and Starke Counties) produced slightly negative cumulative excess water availability (regional). These patterns highlight strong seasonal contrasts and localized hydrologic controls in the northeastern portion of the basin.

Figure 6-8. Exceedance Curves of Historical Average Seasonal Cumulative Excess Water Availability by Watershed Outlet from 2007 – 2023 for Subbasins 01 through 04



Key: MGD = million gallons per day

Takeaway: Winter and Spring generally provide the greatest cumulative excess water availability, while Summer and Fall represent the most limiting periods. Beaver, Iroquois, and Sugar Creek (first-order tributaries) display stronger seasonal variability than mainstem Kankakee subbasins. Across these southwestern tributaries, Fall remains the most hydrologically constrained season, emphasizing their sensitivity to reduced baseflow and limited drainage area.

Figure 6-9. Exceedance Curves of Historical Average Seasonal Cumulative Excess Water Availability by Watershed Outlet from 2007 – 2023 for Subbasins 05 through 08

6.6 Historical Water Availability Key Findings

Key findings from the analysis of recent historical water availability (2007–2023) highlight several important patterns and implications for water resource management in the Kankakee Basin:

Historical water supply generally exceeds demand across the basin: Most subbasins maintained positive cumulative excess water availability derived from upstream flows (CEWA) during all seasons and years, indicating that overall water supply has been sufficient to meet historical demand. However, availability varies substantially between the mainstem Kankakee subbasins and smaller tributaries, where seasonal fluctuations are more pronounced.

Negative cumulative excess water availability (regional) occurred only once in the historical record: A negative cumulative water availability indicating insufficient availability was estimated in Yellow Knox (Subbasin 01) during Winter 2021, when low seasonal precipitation and baseflow fell below minimum instream flow requirements. Apart from this single event, cumulative excess water availability remained positive across all subbasins throughout the 17-year historical period.

Low or negative cumulative excess water availability (regional) occurs in some seasons: Periods such as Summer 2012 and Winter 2021 represent the driest conditions in the record, driven by regional drought, reduced rainfall, and limited storm activity. These years resulted in the lowest natural baseflows observed, particularly in upstream and smaller tributaries such as Yellow Knox and Beaver Creek.

Different seasons in the historical period limit water availability in different ways: While Fall is typically the most limiting season for cumulative excess water availability accumulated from all upstream subbasins (CEWA), the Summer of 2012 was identified as the most constrained season across the entire historical timeframe analyzed. During this Summer, a regional drought characterized by record high temperatures increased water demand, while record low seasonal precipitation, low snowfall in the preceding Winter, and streamflow limited natural baseflow. This particular year underscores the importance of accounting for intra-annual and interannual variability, especially during extreme drought conditions that can exacerbate water scarcity.

Subbasins along the mainstem Kankakee River consistently show the highest availability: Downstream subbasins, Kankakee Kouts (03), Kankakee Shelby (04), and Kankakee Momence (05), exhibit the highest cumulative excess water availability derived from upstream flows (CEWA) across all seasons. This pattern reflects their larger drainage areas, higher sustained baseflows, and accumulation of water from upstream tributaries.

Natural baseflow remains the dominant driver of water availability: Seasonal and year-to-year differences in cumulative excess water availability generated regionally (CEWA) closely mirror changes in baseflow, confirming that hydrologic and geologic factors, such as recharge potential, groundwater storage, and seasonal precipitation, govern regional water supply more strongly than human influences.

Distinct seasonal patterns shape water availability across the basin: Spring consistently exhibits the highest cumulative excess water availability accumulated from all upstream subbasins (CEWA) due to precipitation and snowmelt-driven runoff, followed by Winter. Summer and Fall are more limited, reflecting higher evapotranspiration and irrigation-related water use. Notably, in the mainstem Kankakee subbasins, Fall values often exceed Summer levels, likely due to reduced irrigation withdrawals later in the year.

Cumulative availability increases downstream, highlighting basin connectivity: Cumulative Water availability increases along the Kankakee River from upstream to downstream, emphasizing the importance of hydrologic connectivity in sustaining water resources and supporting water supply reliability in the lower basin.

7.0 Future Water Availability Results

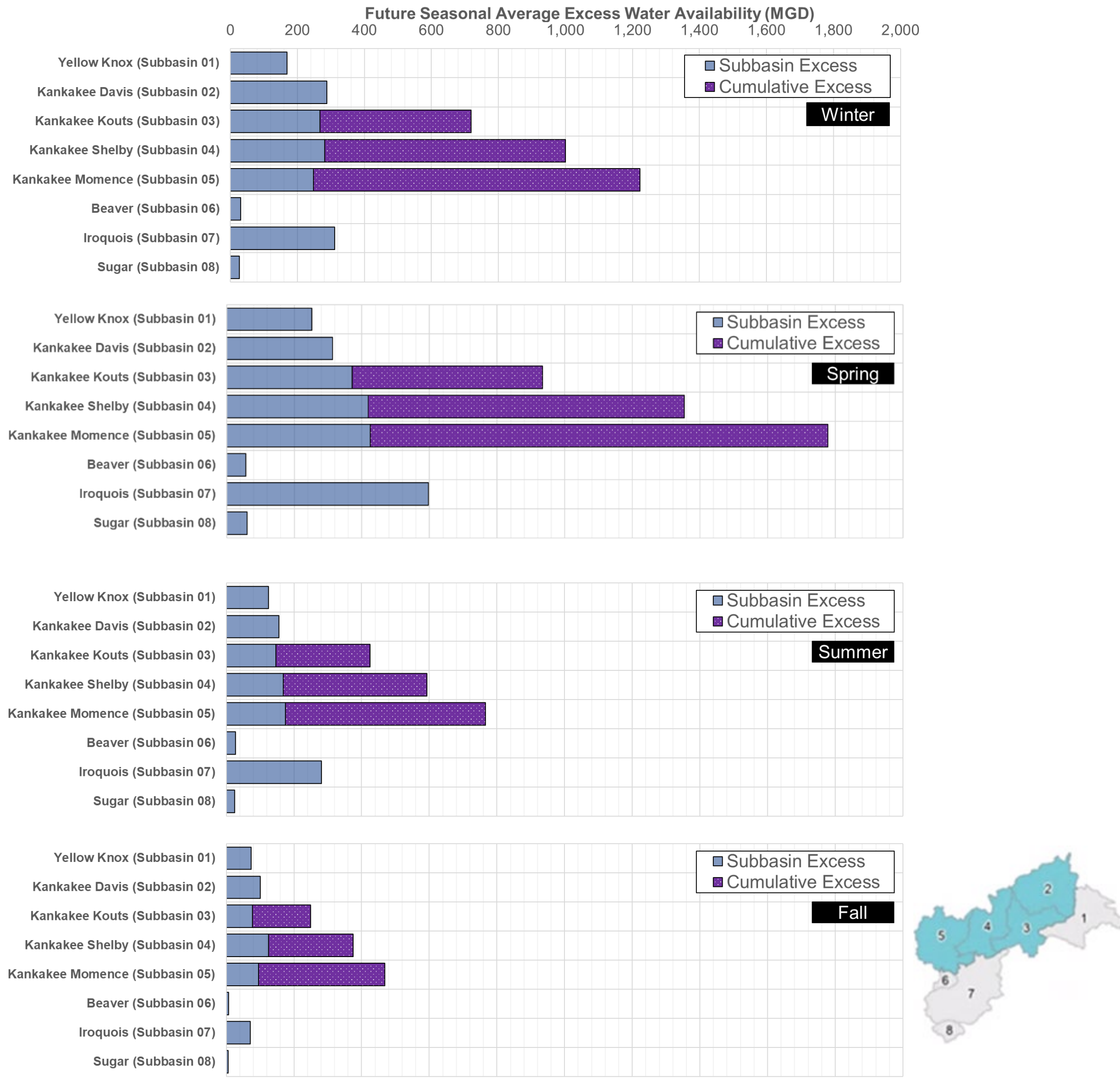
This chapter provides a relative comparison between future and historical water availability to illustrate how projected changes in water demand and climate may affect hydrologic conditions across the Study Area. Future conditions are summarized using data from 17 representative years between 2041 and 2075, generally centered around the 2060s. Each of these future years corresponds to one year from the recent 17-year historical period (2007–2023),[9] as described in Section 5.5.2. This approach allows for a consistent, year-by-year statistical comparison between historical and future conditions. The analysis reflects future baseline assumptions, including the effects of climate change on precipitation, temperature, and natural baseflow, as well as projected changes in water withdrawals and return flows. Additional information on future water availability is provided in Appendix G.

7.1 Future Water Availability Summary

Figure 7-1 presents the future seasonal averages of subbasin excess water availability (locally generated supply) and cumulative excess water availability (combined upstream and local supply) for each of the eight subbasins. Each row includes two horizontal bars: the first represents the water available within each subbasin, while the second shows the cumulative water availability from all upstream subbasins. Subbasins without upstream drainage areas display only the first bar. The sum of both bars represents the total cumulative excess water availability at each subbasin outlet.

Across all seasons, cumulative excess water availability (combined upstream and local supply) remains positive for all subbasins, indicating that projected future supplies are expected to exceed projected demands. Seasonal patterns are similar to historical trends: highest in Spring, followed by Winter and Summer, and lowest in Fall. Elevated Spring availability is primarily attributed to increased natural baseflow projected under future climate conditions. In contrast, Fall water availability is projected to decline, driven by reduced baseflow during drier late-season conditions. Spatial differences remain evident, with mainstem Kankakee River subbasins (03, 04, and 05), which cover portions of Counties like La Porte, Starke, Jasper, and Lake exhibiting the highest cumulative water availability compared to tributary subbasins.

[9] The future year, with corresponding historical year in parentheses, included: 2064 (2007), 2065 (2008), 2066 (2009), 2067 (2010), 2068 (2011), 2069 (2012), 2070 (2013), 2054 (2014, substituted for 2019), 2053 (2015), 2047 (2016), 2072 (2017, substituted for 2020), 2041 (2018, substituted for 2010), 2050 (2019), 2059 (2020), 2060 (2021), 2056 (2022), 2045 (2023). To ensure that all historical years from 2007–2023 were represented at least once, 2014, 2017, and 2018 were substituted for 2019, 2020, and 2010, respectively, which were already represented in the original future-year sequence.



Note: Cumulative excess water availability includes the sum of the bars labeled Subbasin Excess and Cumulative Excess. Mainstem Kankakee River subbasins include 02, 03, 04, and 05.

Key:
MGD = million gallons per day

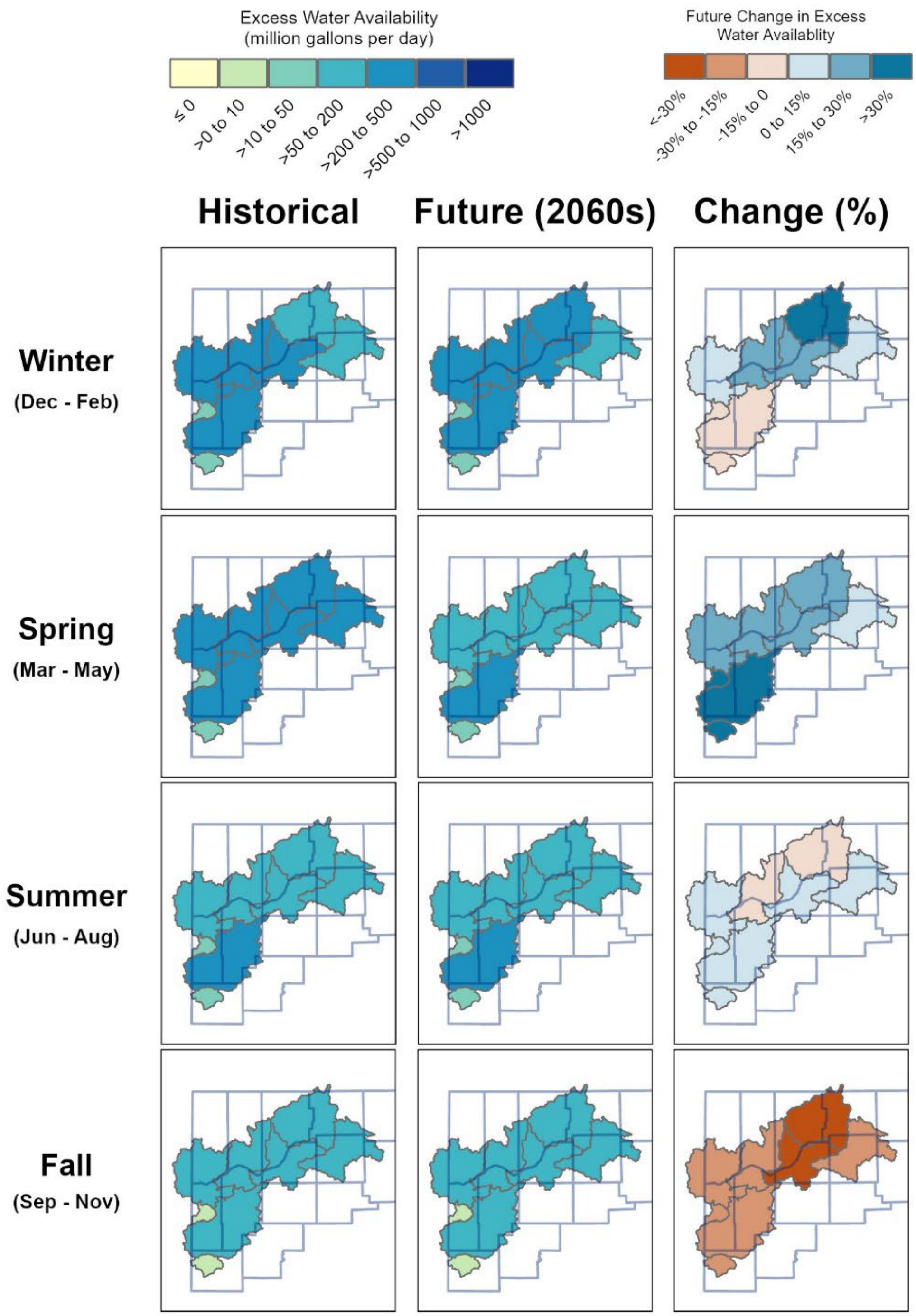
Takeaway: Winter, Spring, Summer, and Fall panels (top-to-bottom) illustrate that cumulative excess water availability remains positive across all subbasins and seasons. Seasonal patterns mirror historical conditions, with Spring showing the highest availability due to increased future natural baseflow, followed by Winter and Summer, while Fall exhibits the lowest availability under projected drier late-season conditions. Mainstem Kankakee River subbasins continue to display greater cumulative availability than tributary subbasins. These results indicate that, under baseline future climate and demand assumptions, projected supplies exceed projected demands across the Study Area.

Figure 7-1. Future Subbasin and Cumulative Excess Water Availability by Subbasin and Season

7.2 Projected Changes in Future Water Availability

This section provides an overview of projected changes in excess water availability (subbasin, local) and cumulative excess water availability (watershed, regional). Figure 7-2 presents a spatial comparison of historical and future (2060s) **excess water availability (subbasin, local)** by season, along with the corresponding percentage change. In several subbasins, the range of future water availability is similar to historical conditions, meaning that color differences on the maps may appear subtle even when percentage changes are significant. A numerical summary of historical and future seasonal averages for each subbasin is provided in Table 7-1 and Table 7-2. The following observations are provided for each season:

- **Winter:** Winter excess water availability (subbasin, local) is projected to increase in Subbasins 01 (Yellow Knox) through 05 (Kankakee Momence) which covers portions of Counties such as Marshall, Lake, La Porte, Porter, and Starke by approximately 10%, 49%, 27%, 18%, and 14%, respectively. These increases reflect higher projected streamflow and baseflow under wetter Winter conditions. Subbasins along the Kankakee mainstem and northern portions of the Study Area, which are underlain by outwash, till, and morainal deposits, are expected to respond more strongly to future precipitation increases. In contrast, the southwestern subbasins (06, 07, and 08) covering portions of Newton, Jasper, and White Counties are projected to experience small decreases (-4% to -6%) due to their more bedrock-dominated geology and smaller drainage areas, which limit recharge and baseflow response.
- **Spring:** The largest seasonal increases in excess water availability (subbasin, local) are projected for Spring, with all subbasins showing increases of at least 13%. This rise is primarily driven by higher projected baseflow and runoff associated with future precipitation and snowmelt.
- **Summer:** Summer excess water availability (subbasin, local) is expected to remain similar to historical levels, with modest increases (0%–12%) across most subbasins. The only exception is Subbasin 02 (Kankakee Davis, which includes portions of Marshall and La Porte Counties), where a small decrease (-1%) is projected due to higher Summer water demand offsetting gains in baseflow.
- **Fall:** All subbasins are projected to experience reductions in Fall excess water availability (subbasin, local) ranging from -15% to -32% compared to historical conditions. These reductions are attributed primarily to declines in projected Fall baseflow and higher seasonal water demands. The largest decreases are observed in Subbasins 02 and 03, consistent with findings from the INCCIA study (Cherkauer et al. 2021), which projected reduced late-season streamflow under future climate conditions. These results also align with observed historical trends described in Section 2.2.2.



Takeaway: Winter and Spring exhibit widespread increases in excess water availability (subbasin, local) driven by higher projected baseflow and precipitation; Summer projections show modest changes, with most subbasins remaining within ±10% of historical values; and Fall displays consistent decreases across all subbasins (-15% to -32%), reflecting expected declines in late-season baseflow under future climate conditions.

Figure 7-2. Overview of Historical (2007 – 2023) and Future (2060s) Excess Water Availability, and the Percentage Change over Time, by Subbasin and Season

Table 7-1. Historical and Future Winter and Spring Excess Water Availability and Their Percent Changes by Subbasin

Takeaway: Values represent seasonal averages from the historical period (2007–2023) and projected future period (2060s). Winter excess water availability (subbasin, local) is projected to increase by 10%-49% in Subbasins 01-05 due to wetter Winter conditions and enhanced recharge, while slight decreases are projected for southwestern subbasins (06-08). Spring shows the strongest increases basin-wide, with every subbasin exhibiting at least a 13% rise, reflecting elevated future precipitation, snowmelt, and baseflow contributions.

Subbasin	Winter Excess			Spring Excess		
	Historical (MGD)	Future (MGD)	% Change	Historical (MGD)	Future (MGD)	% Change
Yellow Knox (Subbasin 01)	153	168	10%	223	251	13%
Kankakee Davis (Subbasin 02)	193	288	49%	270	313	16%
Kankakee Kouts (Subbasin 03)	222	282	27%	311	385	24%
Kankakee Shelby (Subbasin 04)	237	281	18%	340	419	23%
Kankakee Momence (Subbasin 05)	218	248	14%	338	425	26%
Beaver (Subbasin 06)	32	30	-4%	43	57	31%
Iroquois (Subbasin 07)	328	311	-5%	454	597	31%
Sugar (Subbasin 08)	29	27	-6%	46	61	32%

Key:
MGD = million gallons per day

Table 7-2. Historical and Future Summer and Fall Excess Water Availability and Their Percent Changes by Subbasin

Takeaway: Seasonal averages compare historical (2007–2023) and projected future (2060s) conditions for all subbasins. Summer excess water availability (subbasin, local) remains generally consistent with historical levels, with several subbasins experiencing modest increases. Fall shows uniform reductions across all subbasins, ranging from -15% to -32%, driven primarily by declining projected Fall baseflow and elevated late-season water use. These results align with broader regional climate projections indicating drier late-season hydrologic conditions.

Subbasin	Summer Excess			Fall Excess		
	Historical (MGD)	Future (MGD)	% Change	Historical (MGD)	Future (MGD)	% Change
Yellow Knox (Subbasin 01)	122	124	2%	86	73	-15%
Kankakee Davis (Subbasin 02)	158	156	-1%	148	100	-32%
Kankakee Kouts (Subbasin 03)	152	158	4%	112	78	-31%
Kankakee Shelby (Subbasin 04)	168	169	0%	157	125	-20%
Kankakee Momence (Subbasin 05)	170	174	2%	120	95	-21%
Beaver (Subbasin 06)	25	28	12%	9	7	-22%
Iroquois (Subbasin 07)	254	280	10%	95	71	-26%
Sugar (Subbasin 08)	23	25	8%	8	6	-28%

Key:
MGD = million gallons per day

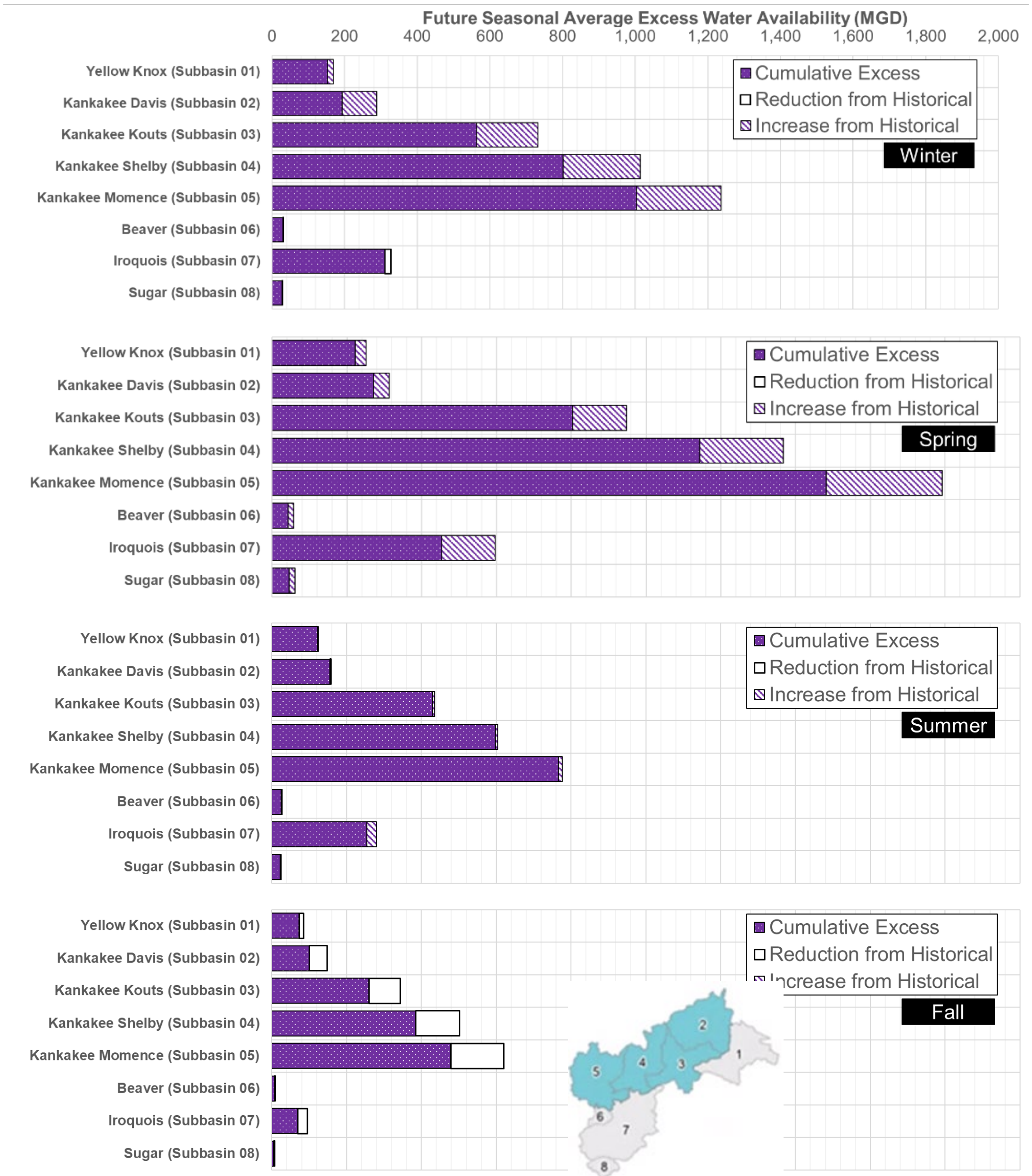
Projected changes in seasonal **cumulative excess water availability** (watershed, regional) compared to historical conditions are presented in Figure 7-3, while Figure 7-4 provides a spatial overview of both historical and future (2060s) conditions along with the corresponding percentage change. In many cases, future cumulative excess water availability (watershed, regional) falls within a similar range to historical values, so color differences may appear subtle even when percentage changes are meaningful. Numerical summaries for each season and subbasin are provided in Table 7-3 and Table 7-4. The following key observations highlight seasonal patterns across the Study Area:

- **Winter:** Cumulative excess water availability (watershed, regional) is projected to increase by approximately 10%, 49%, 30%, 27%, and 23% in Subbasins 01 (Yellow Knox) through 05 (Kankakee Momence) which covers portions of Counties such as Marshall, Lake, La Porte, Porter, and Starke, respectively. These increases reflect higher projected streamflow and baseflow relative to the historical period. In contrast, Subbasins 06, 07, and 08 are expected to experience small decreases (-4% to -6%), consistent with the patterns observed for Winter excess water availability.

- **Spring:** Among all seasons, Spring shows the most pronounced improvement in cumulative excess water availability (watershed, regional), with increases ranging from 13% to 32% across subbasins. This widespread rise is attributed to greater projected baseflow and streamflow under future climate conditions. The magnitude of increase tends to grow gradually from the upstream subbasins toward the downstream of the Kankakee River mainstem.

- **Summer:** During Summer, cumulative excess water availability (watershed, regional) is projected to decline slightly (-1%) in Subbasin 02, primarily due to increased water demand surpassing gains in Summer baseflow. All other subbasins show modest increases between 1% and 12%, as the increase in baseflow exceeds the expected rise in consumptive water use. The subbasins located along the Kankakee River mainstem exhibit the smallest positive change in Summer cumulative excess water availability (watershed, regional).

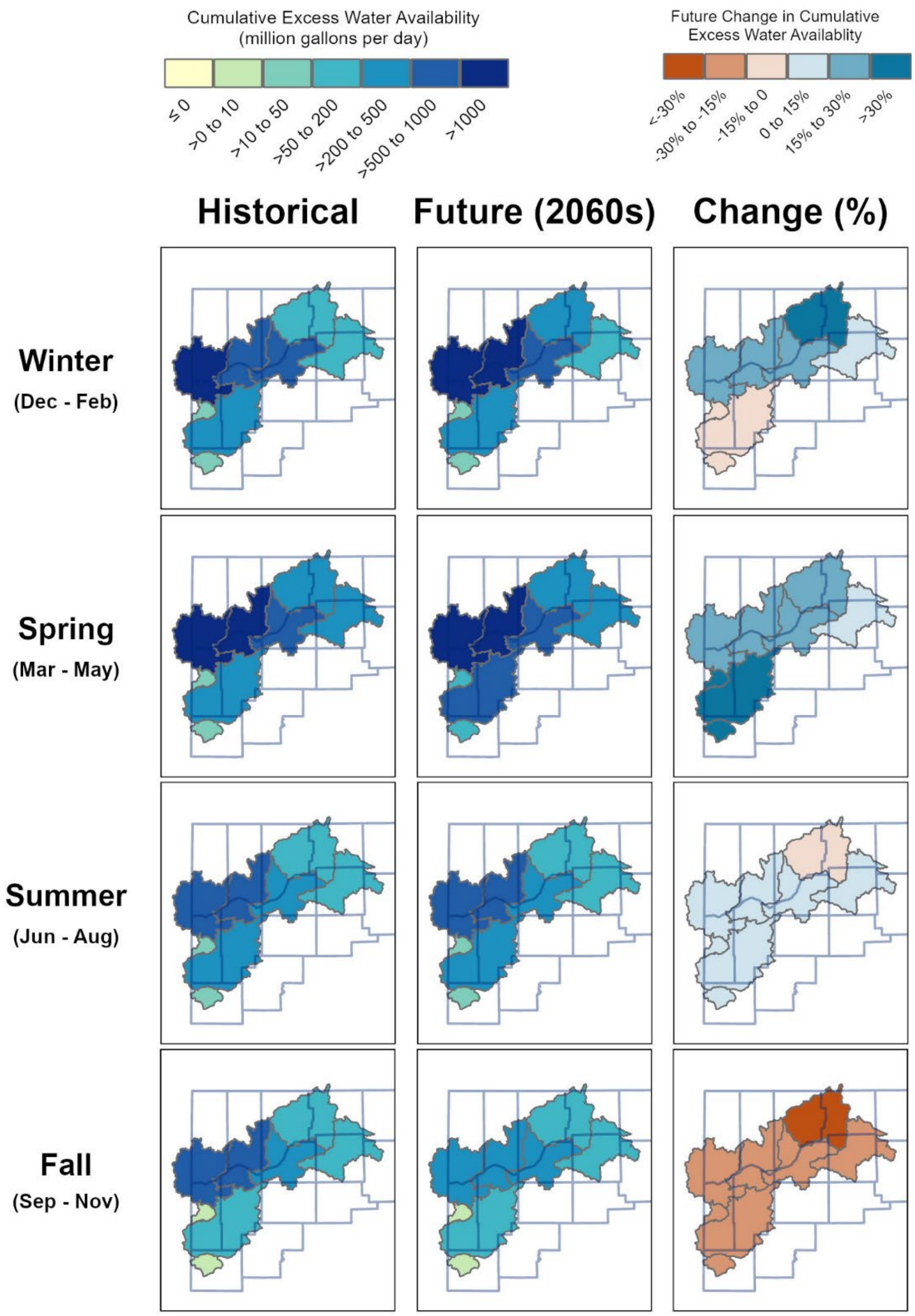
- **Fall:** In Fall, cumulative excess water availability (watershed, regional) is anticipated to decrease across all subbasins, with reductions ranging from -15% to -32% relative to historical conditions. These reductions are mainly driven by lower projected Fall baseflow. The largest decline is observed in Subbasin 02. The results align with findings from the INCCIA study (Cherkauer et al. 2021), which projected reduced Summer and Fall streamflows under future climate conditions, and are consistent with the long-term hydrologic trends discussed in Section 2.2.2.



Note: Mainstem Kankakee River subbasins include subbasins 02, 03, 04, and 05.

Takeaway: In the future, Winter and Spring cumulative excess water (regional) increases in every mainstem subbasin and most tributaries, while Fall declines everywhere due to reduced baseflow. Summer shows somewhat mixed results, with modest increases in most subbasins. Purple hatched bars indicate projected increases and white bars show decreases, with the largest gains appearing along the Kankakee mainstem in Winter and Spring and the largest Fall reductions centered on Subbasin 05.

Figure 7-3. Change from Historical (2007 – 2023) to Future (2060s) Cumulative Excess Water Availability by Subbasin and Season



Takeaway: Winter and Spring display widespread increases in regional water availability, especially in northern and mainstem Kankakee subbasins, while Summer shows relatively minor changes. Fall exhibits basin wide reductions, with the largest decreases in Subbasins 02 and 03. Although absolute changes can be visually subtle due to consistent color scaling, percentage changes highlight meaningful shifts in hydrologic conditions.

Figure 7-4. Overview of Historical (2007 – 2023) and Future (2060s) Cumulative Excess Water Availability, and the Percentage Change over Time, by Subbasin and Season

Table 7-3. Historical and Future Winter and Spring Cumulative Excess Water Availability

Takeaway: Winter and Spring both show consistent increases across Subbasins 01-05, reflecting higher projected streamflow and groundwater contributions. Subbasins 06-08 experience small Winter decreases but meaningful Spring increases. Spring exhibits the strongest basin wide positive change, ranging from 13% to 32%.

Subbasin	Winter Cumulative Excess			Spring Cumulative Excess		
	Historical (MGD)	Future (MGD)	% Change	Historical (MGD)	Future (MGD)	% Change
Yellow Knox (Subbasin 01)	153	168	10%	223	251	13%
Kankakee Davis (Subbasin 02)	193	288	49%	270	313	16%
Kankakee Kouts (Subbasin 03)	564	733	30%	804	948	18%
Kankakee Shelby (Subbasin 04)	801	1,014	27%	1,144	1,367	19%
Kankakee Momence (Subbasin 05)	1,003	1,237	23%	1,481	1,792	21%
Beaver (Subbasin 06)	32	30	-4%	43	57	31%
Iroquois (Subbasin 07)	328	311	-5%	454	597	31%
Sugar (Subbasin 08)	29	27	-6%	46	61	32%

Key:
MGD = million gallons per day

Table 7-4. Historical and Future Summer and Fall Cumulative Excess Water Availability

Takeaway: Summer conditions remain similar to historical levels, with modest increases in most subbasins and a slight decrease in Subbasin 02. Fall conditions show widespread reductions across all subbasins (-15% to -32%), driven largely by projected decreases in late-season baseflow and increased evaporative demand.

Subbasin	Summer Cumulative Excess			Fall Cumulative Excess		
	Historical (MGD)	Future (MGD)	% Change	Historical (MGD)	Future (MGD)	% Change
Yellow Knox (Subbasin 01)	122	124	2%	86	73	-15%
Kankakee Davis (Subbasin 02)	158	156	-1%	148	100	-32%
Kankakee Kouts (Subbasin 03)	430	435	1%	344	260	-25%
Kankakee Shelby (Subbasin 04)	598	604	1%	501	385	-23%
Kankakee Momence (Subbasin 05)	766	776	1%	621	479	-23%
Beaver (Subbasin 06)	25	28	12%	9	7	-22%
Iroquois (Subbasin 07)	254	280	10%	95	70	-26%
Sugar (Subbasin 08)	23	25	8%	8	6	-28%

Key:
MGD = million gallons per day

Figure 7-5 through Figure 7-8 illustrate how each component of the water budget contributes to projected changes in both excess water availability (subbasin, local) and cumulative excess water availability (watershed, regional) across seasons. The top panel of each figure represents local (subbasin-level) changes, while the bottom panel shows regional (cumulative or watershed-level) changes that include upstream contributions. Each chart displays changes in natural baseflow and consumptive demand (withdrawals minus returns). Instream flow is not shown, as it remained constant between the historical and future analyses (0 change in all seasons).

In these figures, bars extending to the right of the zero axis indicate positive changes, such as higher projected baseflow or reduced consumptive demand, leading to increased water availability. Bars extending to the left indicate negative changes, such as reduced baseflow or increased demand, resulting in decreased water availability. The net change in water availability for each subbasin is the combined effect of both components.

For example, in Figure 7-5, the Kankakee Momence (Subbasin 05) area shows a projected increase of approximately 234 MGD in Winter cumulative excess water availability (watershed, regional). This increase is largely driven by a 264 MGD rise in natural baseflow, primarily contributed from upstream subbasins along the Kankakee River (Subbasins 02, 03, and 04).

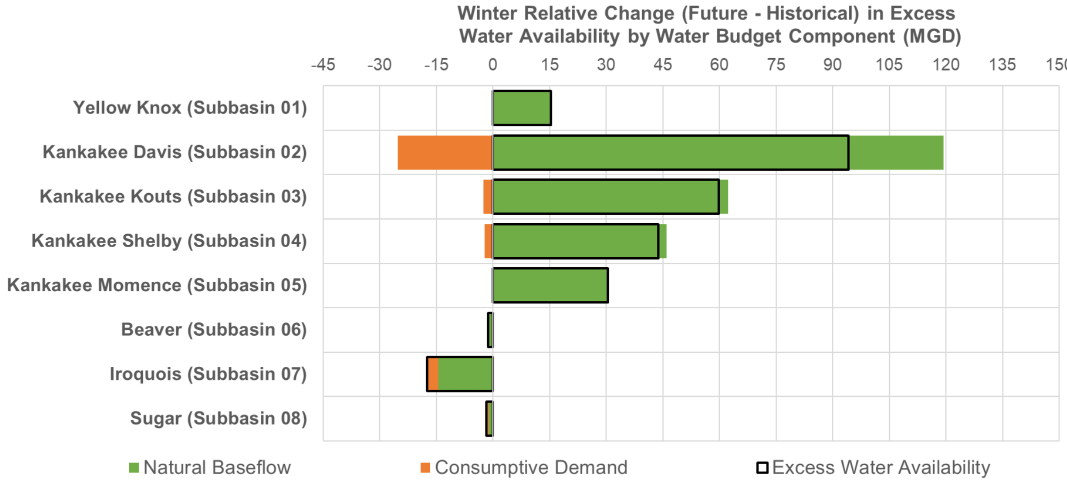
Overall, the dominant driver of projected future changes in water availability is variation in natural baseflow, which is closely linked to projected climate conditions. Increased Winter and Spring precipitation enhances baseflow, while reduced precipitation and higher air temperatures during Summer and Fall lower it. Seasonal changes in consumptive demand, particularly from agricultural and municipal uses, further influence these trends but to a lesser extent.

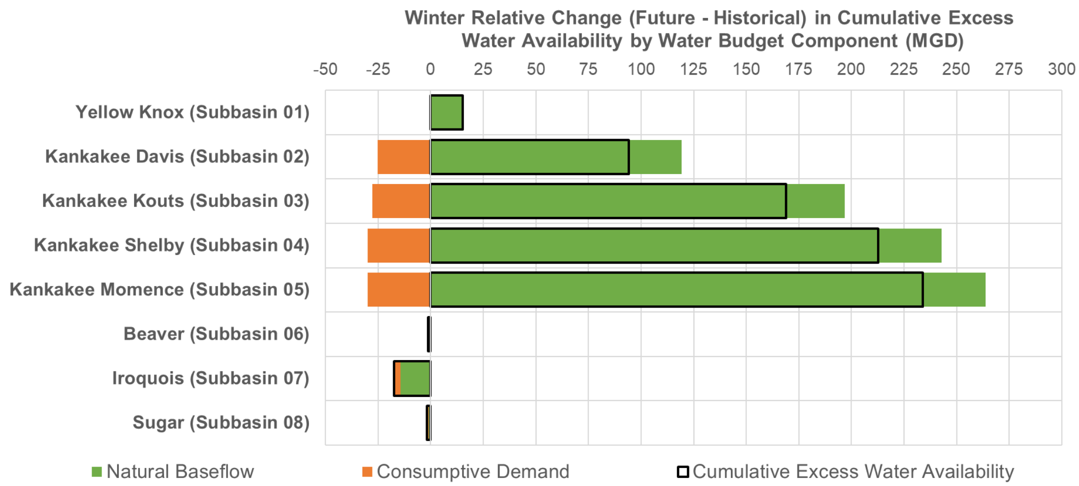
The following sections summarize the key seasonal patterns shown in Figure 7-5 through Figure 7-8:

- **Winter:** Projected Winter baseflow changes vary across the Study Area, with increases anticipated in the Yellow Knox (01), Kankakee Davis (02), Kankakee Kouts (03), Kankakee Shelby (04), and Kankakee Momence (05) subbasins. In contrast, the Beaver (06), Iroquois (07), and Sugar (08) subbasins in the southwestern portion of the study area are projected to experience declines in future Winter baseflow, leading to reductions in subbasin excess water availability. These subbasins show the largest decreases in projected Winter baseflow due to their geologic and hydrologic characteristics. Increases in Winter consumptive demand are mainly projected in subbasins with larger population centers and higher expected population growth, such as Kankakee Davis (02). Overall, cumulative excess water availability accumulated from all upstream subbasins along the Kankakee River mainstem is projected to increase from approximately 94 MGD in Subbasin 02 to 234 MGD in Subbasin 05, largely reflecting cumulative gains in Kankakee River baseflow.
- **Spring:** Higher projected Spring precipitation is expected to increase streamflow uniformly across the study area, resulting in higher natural baseflow that compensates for increases in consumptive demand in all subbasins. Cumulative consumptive demand increases are estimated to remain below 36% of the total cumulative natural baseflow increases. As a result, cumulative excess water availability (watershed, regional) is projected to rise by approximately 13 MGD in the smaller tributary subbasins and by 68 MGD to 310 MGD in the Kankakee River mainstem subbasins (02, 03, 04, and 05). Increased Spring precipitation and streamflow in the Kankakee Basin are also associated with a greater likelihood of high-flow events and overbank flooding, which can enhance recharge to near-river and floodplain aquifers. Floodplain inundation during high-water conditions has been shown to increase groundwater storage in Midwestern river

systems, supporting sustained baseflow during subsequent drier periods (Eberts and George 2000, Winter et al. 1998). Although floodplain recharge and groundwater storage processes are not modeled explicitly, their integrated effects are inherently reflected in the baseflow-based water availability framework used in this Study. The persistence of projected Summer baseflow increases in several subbasins is therefore consistent with enhanced groundwater recharge during wetter Winter and Spring conditions, including those associated with episodic flooding (Hamlet and Byun 2024, Indiana Climate Initiative 2023).

- **Summer:** Both baseflow and consumptive demand are projected to increase during the Summer months in most subbasins. The largest consumptive demand increases are anticipated in the Kankakee River subbasins (02, 03, 04, and 05), primarily due to higher irrigation demand. In Kankakee Davis (02), the projected increase in demand offsets gains in baseflow, leading to a decrease in subbasin excess water availability of approximately 2 MGD. Although natural baseflow increases across all subbasins, the corresponding rise in consumptive demand generally limits overall gains in water availability. Downstream subbasins along the Kankakee River mainstem and other tributaries are expected to experience modest increases in Summer cumulative excess water availability derived from upstream contributions, as higher natural baseflow exceeds projected consumptive use.
- **Fall:** Reductions in natural baseflow are projected throughout the study area during Fall, resulting in lower subbasin excess water availability across all subbasins. The smallest decline is projected in Kankakee Davis (02), where decreases in natural baseflow and increases in consumptive demand are nearly equivalent, leading to an estimated reduction of 48 MGD in excess water availability (subbasin, local). In subbasins with greater projected increases in consumptive demand, reductions in water availability are more pronounced. Along the Kankakee River mainstem, total decreases in Fall cumulative excess water availability (combined upstream and local supply) are projected to range from approximately 48 MGD upstream to 142 MGD downstream.

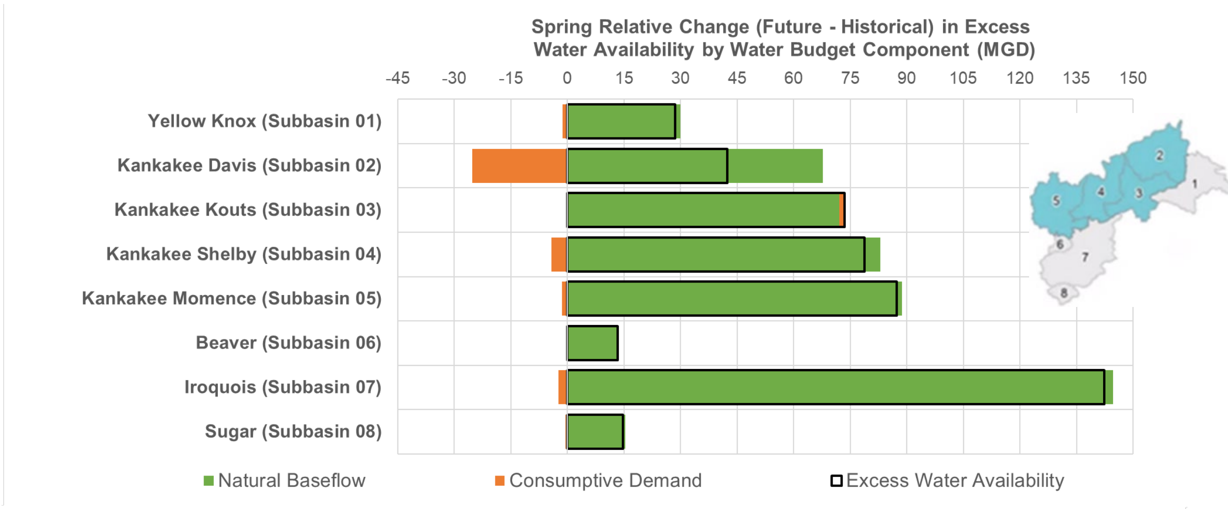


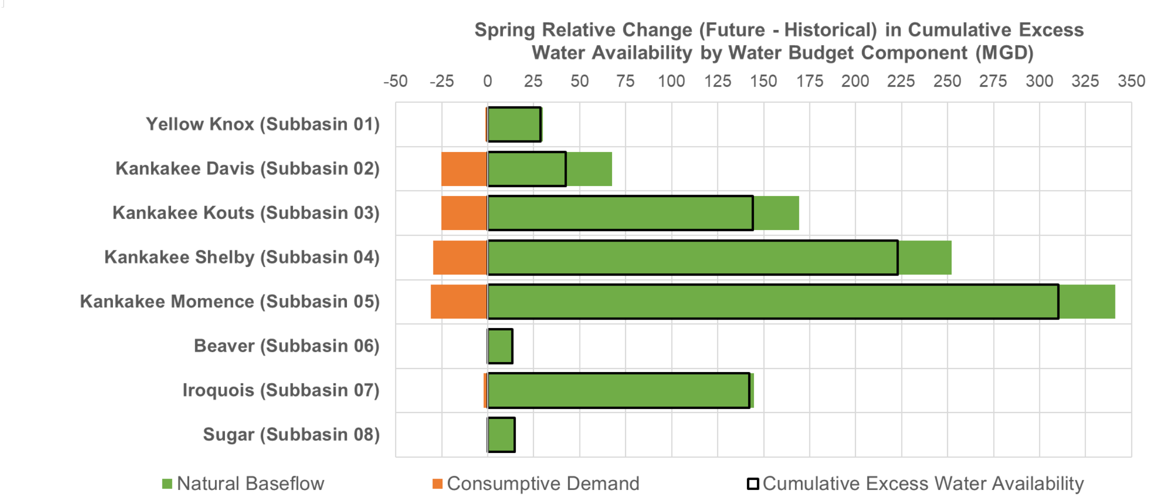


Note: Bars with positive values (to the right of the 0 value on the x-axis) indicate the water budget component has contributed to an increase in water availability into the future relative to historical conditions (e.g., increased baseflow, or decreased consumptive demand/increased return flow). Bars with negative values (to the left of the 0 value on the x-axis) indicate the water budget component has contributed to a decrease in water availability into the future relative to historical conditions (e.g., reduced baseflow, or increased consumptive demand/decreased return flow). The sum of positive and negative bars for each subbasin in the top plot will equal the total seasonal change in subbasin excess water availability from Table 7-1. The sum of positive and negative bars for each subbasin in the bottom plot will equal the total seasonal change in cumulative excess water availability from Table 7-3.

Takeaway: Winter increases in water availability are driven primarily by higher projected baseflow in Subbasins 01-05, with the largest cumulative gains occurring along the Kankakee River mainstem. Southwestern subbasins (06-08) show decreases due to reduced Winter baseflow.

Figure 7-5. Relative Difference Between Average Future and Historical Winter Water Budget Components; Subbasin (top) and Cumulative (bottom)

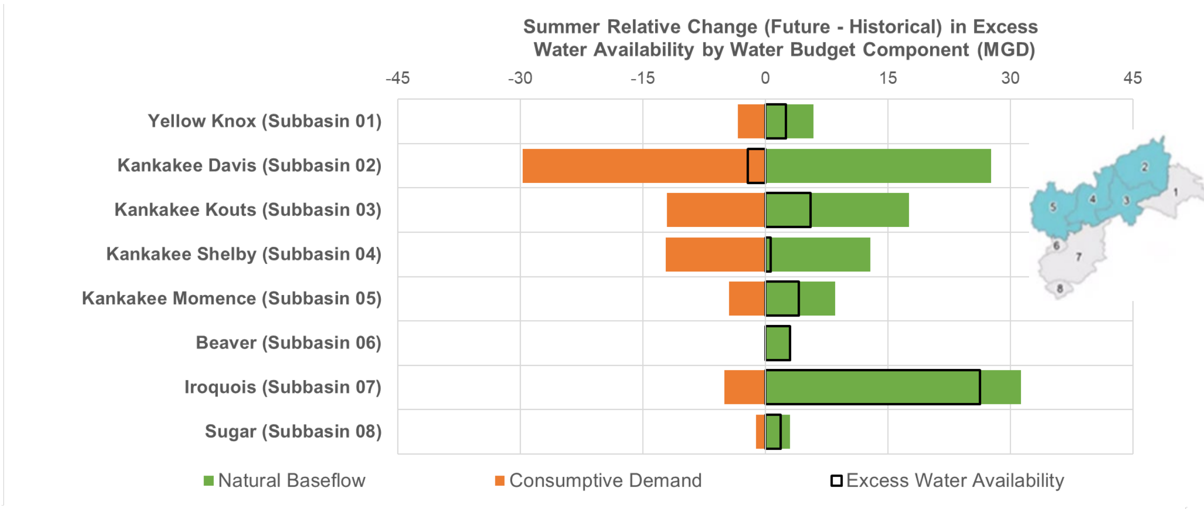


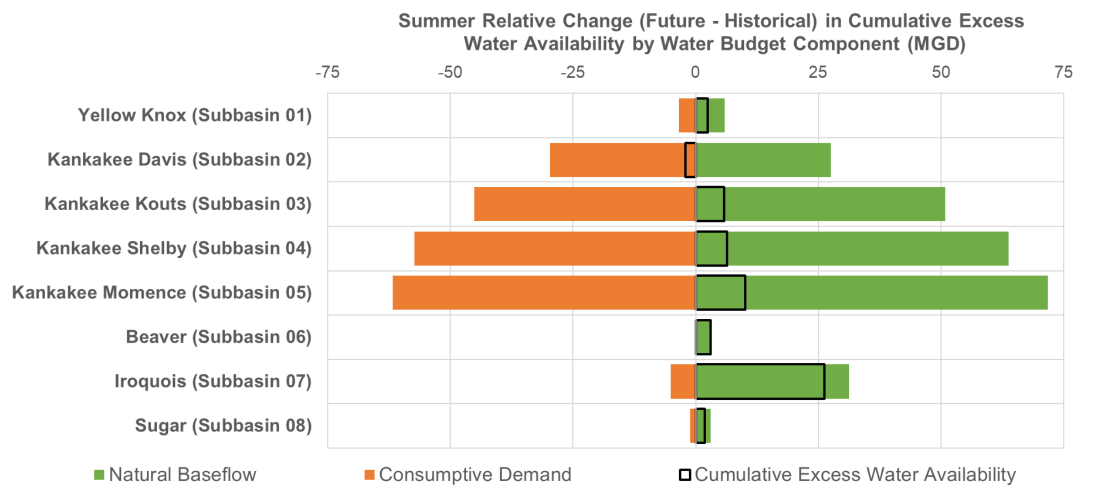


Note: Bars with positive values (to the right of the 0 value on the x-axis) indicate the water budget component has contributed to an increase in water availability into the future relative to historical conditions (e.g., increased baseflow, or decreased consumptive demand/increased return flow). Bars with negative values (to the left of the 0 value on the x-axis) indicate the water budget component has contributed to a decrease in water availability into the future relative to historical conditions (e.g., reduced baseflow, or increased consumptive demand/decreased return flow). The sum of positive and negative bars for each subbasin in the top plot will equal the total seasonal change in subbasin excess water availability from Table 7-1. The sum of positive and negative bars for each subbasin in the bottom plot will equal the total seasonal change in cumulative excess water availability from Table 7-3.

Takeaway: **Spring** exhibits the most consistent and widespread increases in both subbasin and watershed (or local and regional) water availability. Projected gains in natural baseflow substantially exceed increases in consumptive demand across all subbasins, resulting in cumulative increases of up to 310 million gallons per day in downstream mainstem areas.

Figure 7-6. Relative Difference Between Average Future and Historical Spring Water Budget Components; Subbasin (top) and Cumulative (bottom)

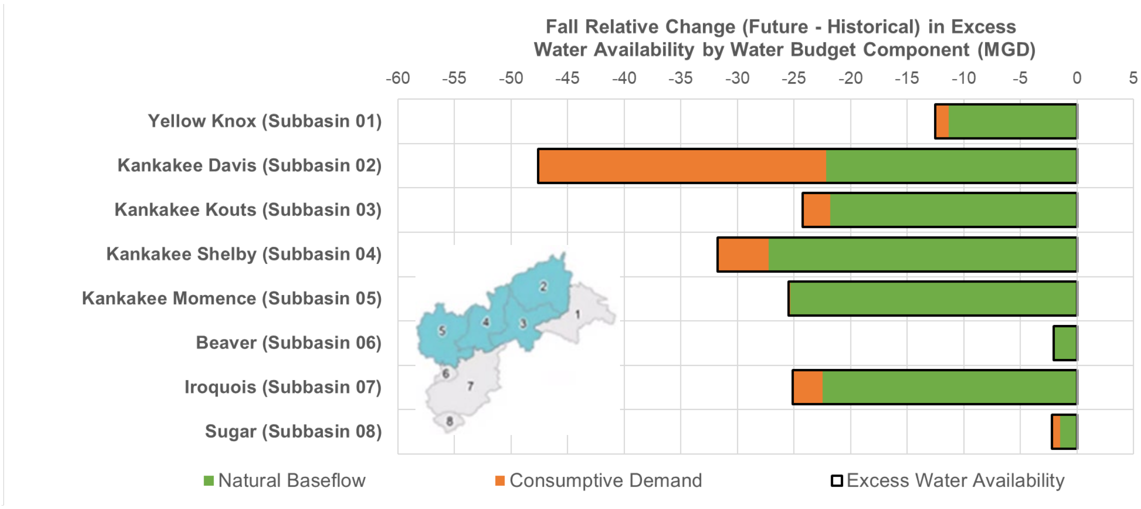


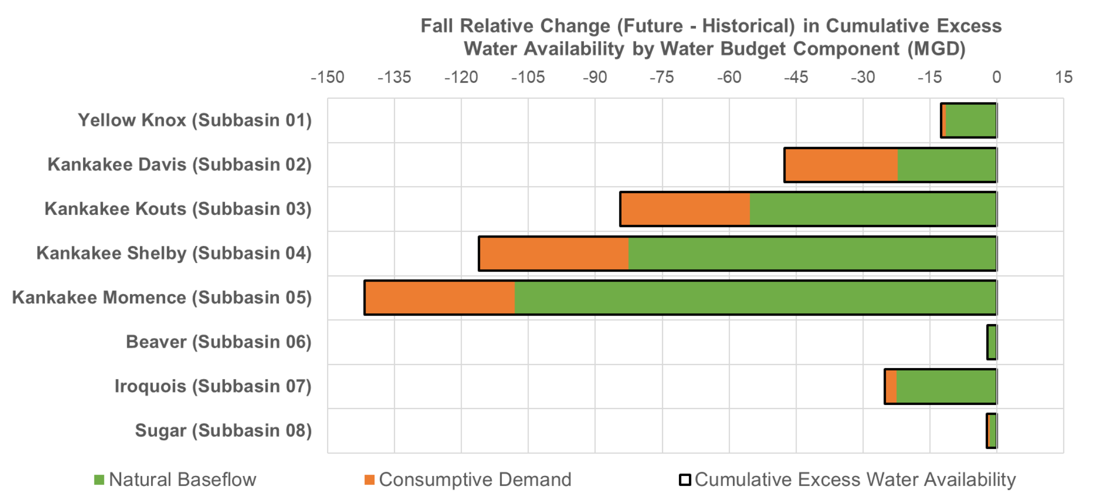


Note: Bars with positive values (to the right of the 0 value on the x-axis) indicate the water budget component has contributed to an increase in water availability into the future relative to historical conditions (e.g., increased baseflow, or decreased consumptive demand/increased return flow). Bars with negative values (to the left of the 0 value on the x-axis) indicate the water budget component has contributed to a decrease in water availability into the future relative to historical conditions (e.g., reduced baseflow, or increased consumptive demand/decreased return flow). The sum of positive and negative bars for each subbasin in the top plot will equal the total seasonal change in subbasin excess water availability from Table 7-2. The sum of positive and negative bars for each subbasin in the bottom plot will equal the total seasonal change in cumulative excess water availability from Table 7-4.

Takeaway: **Summer** shows moderate increases in natural baseflow across all subbasins, but these are partly offset by substantial increases in consumptive demand, especially in irrigation-intensive subbasins (02-05). As a result, Subbasin 02 shows a slight decline in excess water availability, while other subbasins experience modest cumulative gains.

Figure 7-7. Relative Difference Between Average Future and Historical Summer Water Budget Components; Subbasin (top) and Cumulative (bottom)





Note: Bars with positive values (to the right of the 0 value on the x-axis) indicate the water budget component has contributed to an increase in water availability into the future relative to historical conditions (e.g., increased baseflow, or decreased consumptive demand/increased return flow). Bars with negative values (to the left of the 0 value on the x-axis) indicate the water budget component has contributed to a decrease in water availability into the future relative to historical conditions (e.g., reduced baseflow, or increased consumptive demand/decreased return flow). The sum of positive and negative bars for each subbasin in the top plot will equal the total seasonal change in subbasin excess water availability from Table 7-2. The sum of positive and negative bars for each subbasin in the bottom plot will equal the total seasonal change in cumulative excess water availability from Table 7-4.

Takeaway: **Fall** shows consistent reductions in both subbasin and cumulative (watershed) excess water availability across all eight subbasins. Declines are largest along the Kankakee River mainstem, where reductions in natural baseflow combine with projected increases in consumptive demand, resulting in cumulative decreases of 48-142 million gallons per day.

Figure 7-8. Relative Difference Between Average Future and Historical Fall Water Budget Components; Subbasin (top) and Cumulative (bottom)

7.3 Projected Changes in Future Exceedance Values

Figure 7-9 and Figure 7-10 show seasonal exceedance curves of future cumulative excess water availability derived from upstream subbasin contributions for selected representative subbasins (Subbasins 1, 2, 5, and 7), plotted alongside the corresponding historical curves for comparison. These plots illustrate how the magnitude of available water associated with different exceedance levels may shift in the future, where such shifts are constrained since the historical climate record constrained climate projections downscaling and hydrologic modeling. Exceedance plots for all subbasins are provided in Appendix G.

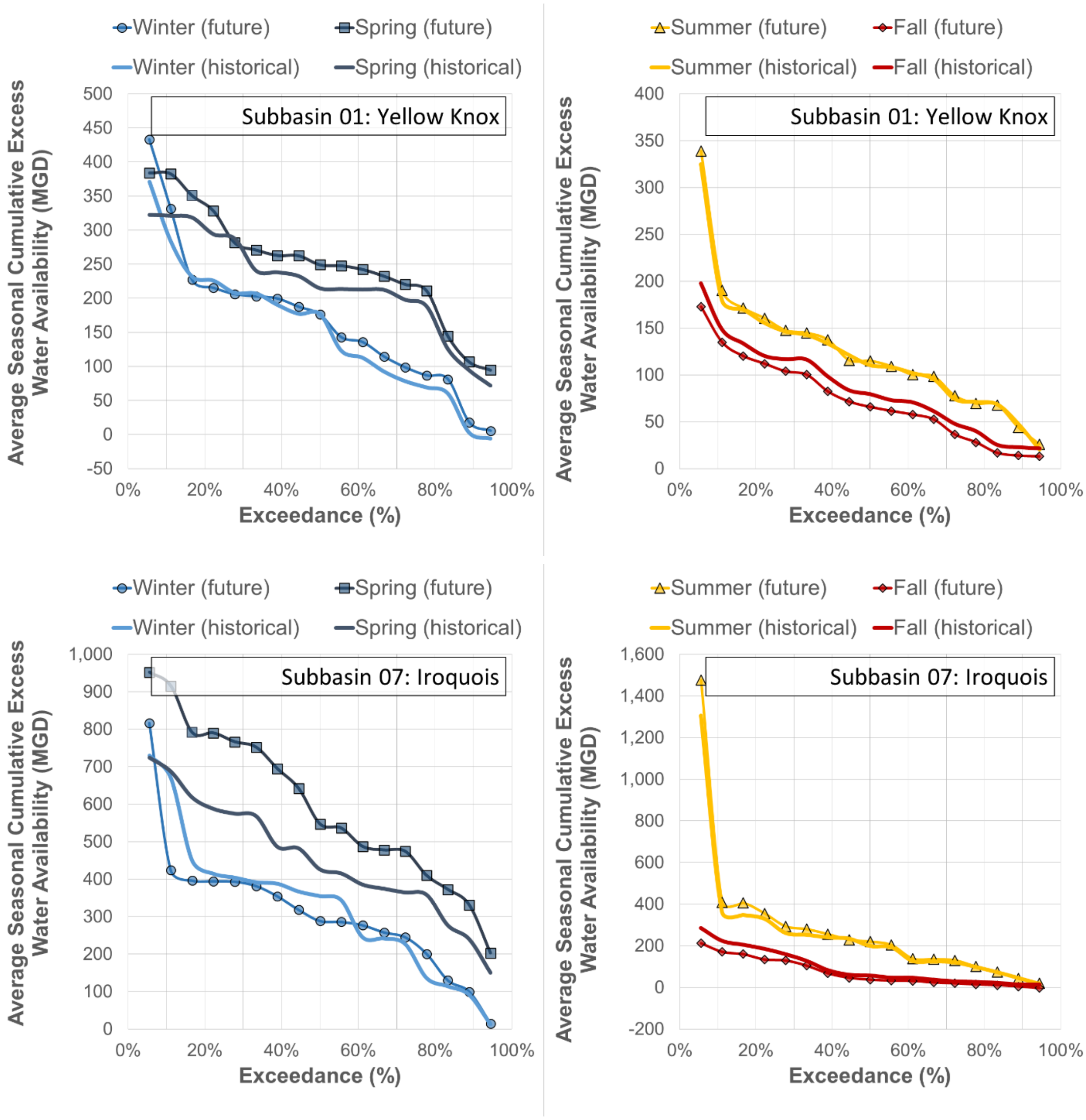
Taken together, the exceedance curves indicate a basin-wide shift toward increased cumulative excess water availability (regional) during the wet season (Winter and Spring) and a pronounced decline in Fall availability across a wide range of exceedance levels. The representative subbasins shown in Figures 7-9 and 7-10 include both first-order tributary systems (Yellow Knox (01) and Iroquois (07)) and mainstem Kankakee River subbasins (Davis (02) upstream and Momence (05) downstream), allowing comparison of seasonal responses across basin scale and along the upstream–downstream continuum of the river system.

- **Winter:** Future Winter cumulative excess water availability (watershed, regional) exhibits varying trends across the study area. In Yellow Knox (01), increases are concentrated at exceedance probabilities below 15% (wet conditions) and above 50% (dry conditions), suggesting that both future wet and dry Winters may experience more extreme streamflow events compared to historical conditions, while median conditions remain largely unchanged. In Iroquois (07), decreases are observed primarily at exceedance probabilities below 60%, indicating lower streamflow during future wet and median Winters, with minimal change expected during dry Winters (exceedance >60%). In Kankakee Davis (02), future cumulative excess water availability (watershed, regional) exceeds historical values across all exceedance intervals, implying wetter Winter conditions relative to the historical record. In Kankakee Momence (05), increases are most evident at exceedance probabilities below 50%, suggesting higher streamflow during future wet Winters. During the driest historical Winter in Yellow Knox (01) (95% exceedance), available water was insufficient to meet all instream flow requirements (ecological needs), but future conditions are projected to improve as increased baseflow reduces water deficits. Also, the wettest historical Winters in Yellow Knox (01) and Kankakee Davis (02) (5% exceedance) are expected to become even wetter in the future, exceeding both historical and future Spring conditions.
- **Spring:** Consistent trends are projected across all representative subbasins during Spring. Increases in projected cumulative excess water availability (watershed, regional) occur at all exceedance intervals, indicating that future Spring conditions are expected to be wetter than historical conditions for hydrologic year types, wet, median, and dry.
- **Summer:** Future and historical Summer exceedance curves are nearly identical across subbasins, suggesting limited changes in cumulative excess water availability (watershed, regional) under future wet, dry, and drought conditions. An exception is observed in Iroquois (07),

where the wettest future Summer conditions (5% exceedance) are projected to exceed even the wettest historical and future Spring and Winter values.

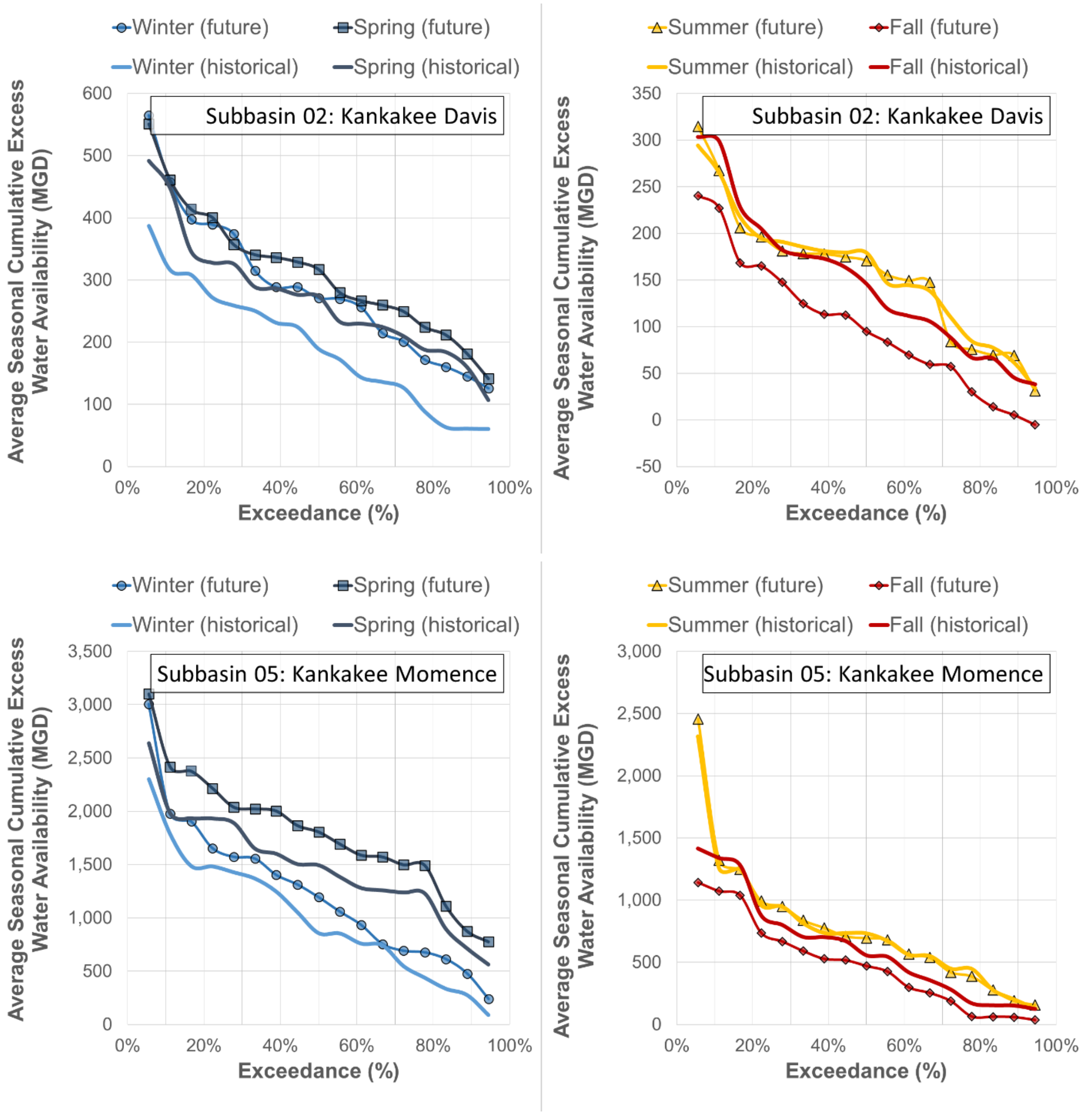
- **Fall:** Fall exhibits the largest overall reductions in cumulative excess water availability (watershed, regional) across all subbasins. Decreases are projected at nearly every exceedance interval, with reductions ranging from 15% to 127% relative to historical values. In Iroquois (07) and Kankakee Davis (02), drought conditions (90–95% exceedance) shift from small positive to negative cumulative excess water availability (watershed, regional), indicating that projected demands could reduce natural baseflow below instream flow requirements. At several subbasins, the historical 50% exceedance value aligns with the future 20–30% exceedance value, implying that water availability conditions typically experienced every other year historically may occur only once every four to five years in the future. Similarly, the median (50%) future Fall water availability corresponds to what was historically considered a dry year (75–85% exceedance). Overall, these results indicate that future Fall seasons are expected to be substantially drier, with a higher likelihood of water scarcity during typical hydrologic years.

To further highlight spatial variability during critical dry periods, Figure 7-11 compares historical and future Fall cumulative excess water availability (watershed, regional) at the 50%, 75%, and 95% exceedance levels. The results show a consistent decline in median (50% exceedance) Fall water availability across all subbasins. The Kankakee Davis (02), Kankakee Kouts (03), and Iroquois (07) subbasins exhibit the largest reductions relative to historical conditions. Under drought conditions (95% exceedance), these subbasins are projected to experience periods when available water is insufficient to meet instream flow requirements (ecological needs), suggesting potential water supply shortages and increased ecological stress in future Fall seasons.



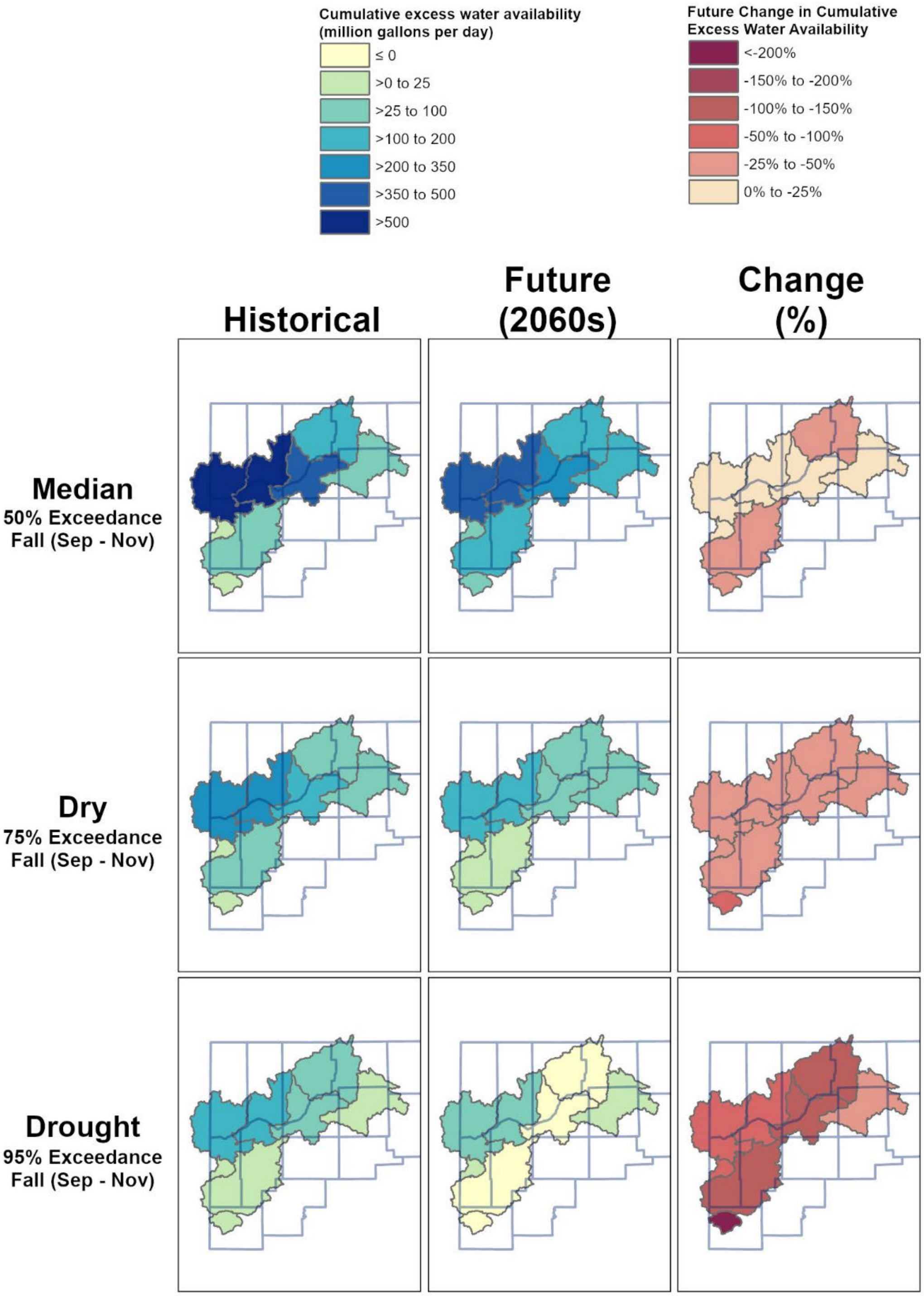
Takeaway: future Winter conditions becoming wetter at the wettest and driest ends of the exceedance curves in Yellow Knox (01), widespread Spring increases across both subbasins at all exceedance probabilities, minimal changes in Summer availability except for elevated wet-Summer values in Iroquois (07), and substantial Fall reductions across nearly the full exceedance range in both subbasins.

Figure 7-9. Historical and Future Cumulative Excess Water Availability Exceedance Curves for Relatively Small First Order Subbasins (Yellow Knox and Iroquois)



Takeaway: Winter and Spring curves exhibit consistent upward shifts, demonstrating higher future availability across nearly all exceedance intervals. Summer curves show only modest changes, with historical and future lines nearly overlapping. Fall curves show pronounced reductions from historical to future conditions across most exceedance probabilities, illustrating the projected late-season decline in cumulative excess water availability. These patterns highlight the strong climate-driven increases in wet-season flows and the persistent vulnerability of Fall water availability in the Kankakee River system. Note that y-axis scales differ among subbasins and reflect substantially larger cumulative excess volumes at downstream mainstem locations relative to upstream and tributary subbasins.

Figure 7-10. Historical and Future Cumulative Excess Water Availability Exceedance Curves for Relatively Large Upstream-Downstream Kankakee River Subbasins (Davis and Momence)



Takeaway: Fall regional excess water declines across all subbasins, with the sharpest reductions in Kankakee Davis (02), Kankakee Kouts (03), and Iroquois (07). Under drought-level conditions (95% exceedance), several subbasins shift from positive to negative values, signaling potential late-season shortages during drought conditions.

Figure 7-11. Changes Between Historical and Projected Future Fall Cumulative Excess Water Availability for Median (50%), Dry (75%), and Drought (95%) Conditions

7.4 Future Water Availability Key Findings

The analysis of future water availability highlights several important patterns and implications for regional water management in the Kankakee Basin.

Future water supplies are projected to remain generally abundant across most subbasins and seasons. Similar to historical conditions, cumulative (local+regional) excess water availability remains positive in most future years, with future supplies typically exceeding projected demands (including instream flow requirements). Wet season (Winter and Spring) baseflow is projected to increase under future climate conditions, leading to higher water availability during these periods.

Future Fall seasons represent the most critical period for potential supply shortages. Cumulative excess water availability (watershed, regional) in the Fall is projected to decline substantially across all subbasins, by approximately 15% to 127% relative to historical conditions, due to decreased baseflow and higher consumptive demands. Some subbasins are projected to experience conditions where available water is insufficient to meet all instream flow (ecological need) and use requirements during drought (95% exceedance) conditions, indicating potential increased water stress and heightened ecological vulnerability.

The region can support substantial increases in water demand while maintaining overall supply reliability. Even with projected increases in consumptive use of up to 25–30%, most subbasins are expected to retain positive excess water availability (subbasin, local) during typical conditions. This suggests that, under average hydrologic conditions, the Kankakee Basin's natural and managed systems are resilient to moderate growth in future demands.

Future droughts may shift several subbasins from positive to negative water availability. Under extreme dry conditions, particularly in the Fall, multiple subbasins transition from surplus to deficit, reflecting the compounding effects of lower precipitation, reduced baseflow, and elevated demand. These shifts underscore the importance of drought contingency planning and subbasin-scale water management coordination.

Downstream subbasins are projected to become increasingly dependent on upstream water availability. During future droughts, the Kankakee River subbasins (03, 04, and 05) are expected to rely more heavily on upstream excess flows from Yellow Knox (01) and Kankakee Davis (02) to sustain cumulative availability. This interdependence highlights the regional nature of water management and the need for coordinated allocation strategies during limiting periods.

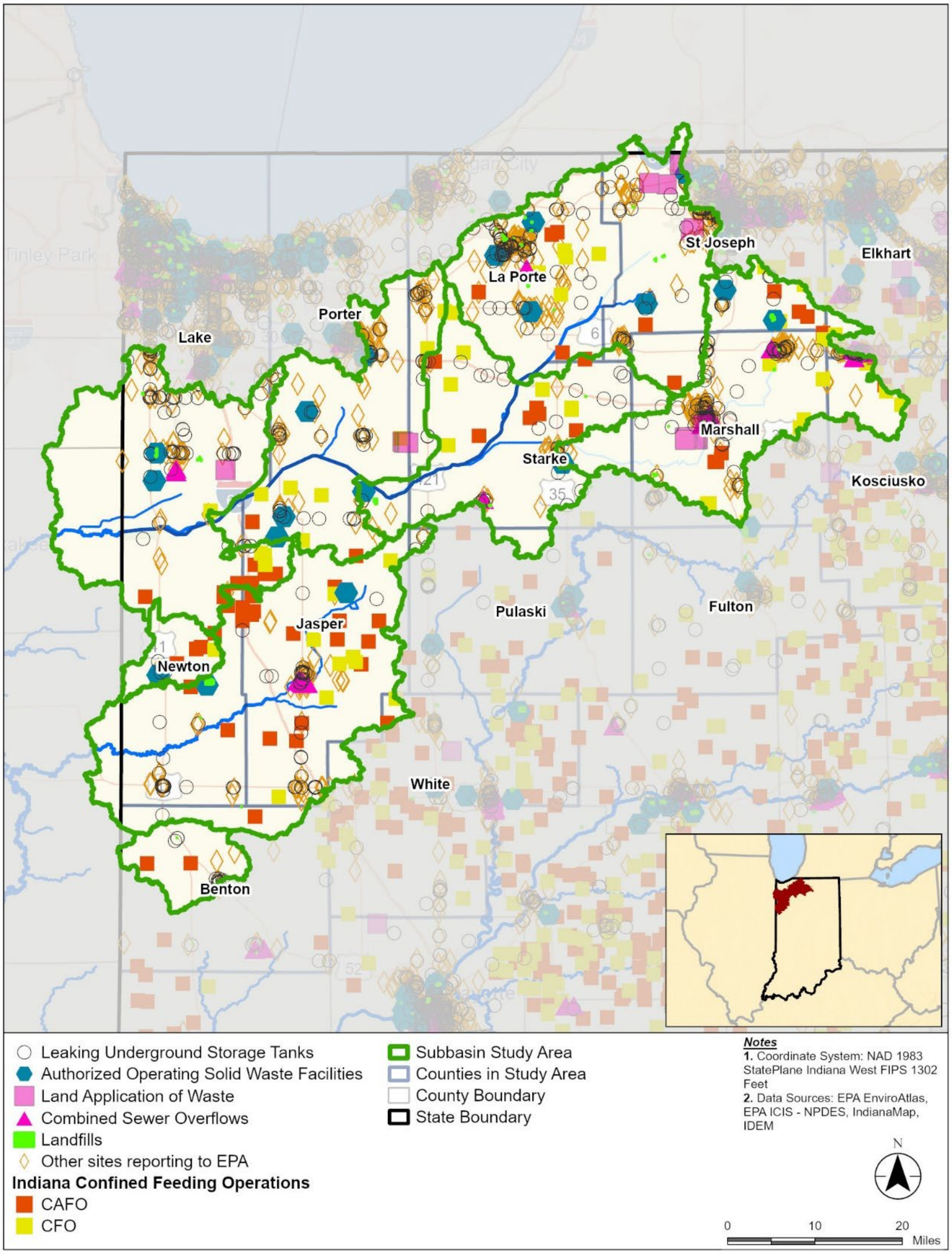
Future intra-annual variability in water availability is projected to increase. Seasonal contrasts intensify under future conditions, with wetter Spring and Winter periods followed by drier Fall periods. Although annual total flow volume is projected to increase, the concentration of precipitation into shorter, more intense wet periods may heighten seasonal stress on the water system, particularly during late-Summer and Fall months.

8.0 Water Quality

Water quality contamination is a well-documented concern in Indiana due to point and non-point sources, such as land use or regulated facilities, in addition to naturally occurring contaminants in subsurface geologic materials (e.g., Banaszak 1987, Risch et al. 2014, Letsinger 2017, IDEM 2025a, Letsinger and Gustin 2024). Figure 8-1 presents potential sources of surface and groundwater contamination in the Study Area; additional sources for consideration are highlighted in Appendix H. While water quality throughout the State has varied spatially and temporally with the introduction of regulations, improved infrastructure, and agricultural and industrial development, a 1990 study published by IDNR indicated the surface water quality was generally good in the Kankakee, Yellow, and Iroquois Rivers, although iron and manganese commonly were high and the rivers frequently were turbid (IDNR 1990).

Specific examples of pervasive origins of source water contamination have been highlighted by targeted state or federal regulations and include Combined Sewer Overflows (CSO), livestock feeding operations (CFOs and CAFOs), nutrients from agricultural runoff, and industry such as historical electric generating stations. CSOs are a known threat to water quality in the state as documented by numerous recent water quality studies and IDEM (Risch et al. 2014, IDEM 2022a). The data in Figure 8-1 documents that a potential source of contamination in the Basin is operating or retired CFOs/CAFOs. CAFOs are similar to CFOs but are larger scale livestock facilities (IDEM 2025b). CFOs are regulated by IDEM under the Confined Feeding Control Law, which is focused on regulating CFOs to protect water quality. CFOs and "Land Application of Waste" facilities (also shown in Figure 8-1) can be significant sources of nutrients, fertilizers, and pesticides that can be impactful to adjacent/underlying aquifers and groundwater as well as surface water runoff. Nutrient concentrations in surface and groundwaters, which are a concern for the Kankakee River Basin due to the large agricultural footprint, are discussed in additional detail below.

The following sections provide a summary of recent groundwater and surface water data collected in the State and the spatial distribution of contaminants and receptors of concern/interest. Temporal trends for specific contaminants and emerging contaminants are also highlighted in the Study Area for consideration and impact on current and future water supplies.



Notes: Data west of Indiana state line has been excluded.
"Other Sites reporting to EPA" include U.S. Environmental Protection Agency Superfund sites, Resource Conservation and Recovery Act Hazardous Waste Sites, Permitted Water Dischargers (National Pollutant Discharge Elimination System), Toxic Release Inventory.

Figure 8-1. Known Sources of Surface and Groundwater Contamination in Indiana

8.1 History, Trends, and Emerging Contaminants

Since 1957, IDEM has collected surface water quality data through the Fixed Station Monitoring Program (FSMP). The program is still active and has been adopted in the IDEM Water Quality Monitoring Strategy (WQMS), which is updated every four years. The Surface Water Quality Monitoring Strategy was developed in the 1990s to assess water quality in streams, lakes, and rivers through organized data collection and to satisfy the requirements of the Clean Water Act. As of 2022, there were 168 surface water sites across Indiana where water samples are collected monthly for laboratory analysis of several water chemistry parameters.

In conjunction, groundwater monitoring via IDEM's Groundwater Monitoring Network (GWMN) was established in 2008 to determine baseline groundwater quality across the state through random sampling of residential drinking water wells, better understand the regional groundwater and surface water nexus, and establish protocol for protecting source water and drinking water (IDEM 2022a). From 2008 through 2016, over 3,000 samples were collected from unique sites across the state including from 240 public water supplies (PWS) and over 1,200 private groundwater wells. These samples were analyzed for general chemistry, nitrate/ammonia, metals, Volatile and Semi- Volatile Organic Compounds (VOCs and SVOCs), degraded pesticides, and fungicides. The GWMN identified arsenic as the primary concern to drinking water quality in Indiana, and elevated arsenic levels have been reported in the Kankakee River Basin.

IDEM's WQMS program has resulted in a robust overview highlighting trends in Indiana waterways and groundwater for recent history. The program has been useful in implementing a successful protocol for Clean Water Act Section 303(d)-listed impaired waterways. The 303(d) list is used to prioritize the establishment of Total Maximum Daily Loads and has also helped to identify emerging water quality issues in source waters, such as per- and poly-fluoroalkyl (PFAS), and emerging trends in basin-wide ground- and surface-water quality conditions. The Indiana Water Resources Research Center, among others, is leading research on emerging contaminants in Indiana waters that may be a threat to environmental and human health (IWRRC n.d.).

Indiana's historical water quality monitoring has been motivated by water quality concerns, primarily related to industrial and point sources as well as naturally occurring constituents found in groundwater. The Kankakee River Basin, specifically, has a larger agricultural footprint compared to more urbanized areas of the State. Nitrate contamination of surface and groundwater is a concern associated with farming practices, agricultural runoff, CAFOs, and land application of waste facilities. Nitrates are a well-documented concern in the Basin, and recently, drinking water warnings have been issued by water providers downstream in the Basin in Illinois due to high nitrate concentrations (Kawash 2025). A 1990 study by IDNR indicated that nitrate concentrations in groundwater, at the time, were at or near background levels, but water in a few wells scattered throughout the basin contains nitrate levels exceeding the 10 milligrams per liter (mg/L) Maximum Contaminant Limit (MCL) (IDNR 1990).

Emerging contaminants in Indiana, not limited to the Study Area, may include Micro-plastics (i.e., plastic particles <5 millimeters in size), Pharmaceuticals, Trihalomethanes, PFAS, Cyanobacteria (harmful blue-green algae) (IWRCC n.d.). Cyanobacteria is directly linked to nutrient and nitrate concentrations and is therefore a particular concern to monitor for surface water bodies in the basin, discussed further below.

8.1.1 MICRO-PLASTICS

Research specific to micro-plastics in Indiana rivers and surface water in the Great Lakes region has recently been published (IWRRC 2018, Fuschi et al. 2022, Conrad et al. 2023). Micro-plastics can potentially harm aquatic organisms, though the human implications are not fully known. Micro-plastics have been found in all tested watersheds, and concentrations did not vary significantly with surrounding land use (Conrad et al. 2023). The sources, pathways, and transport of micro-plastics are still poorly understood but are an emerging public health concern.

8.1.2 CYANOBACTERIA

Cyanobacteria, also known as blue-green algae, occur naturally in a wide range of water bodies throughout Indiana and the United States. Blue-green algae presence has surged in freshwater bodies in Indiana in recent decades due to the influx of nutrients in the waterways and hotter average temperatures (often resulting in what are referred to as harmful algal blooms (HAB)). Not all species are toxic; however, if cyanotoxins are present in high concentrations, waterways can be rendered unsafe for contact by humans and animals. In 2022, IDEM developed a harmful algal bloom surveillance program for swimmable lakes and reservoirs that includes sampling at 21 swimming areas. Downstream on the Kankakee in Illinois, Public-Water-Supply Intakes are sampled routinely for four microcystin, cylindrospermopsin, anatoxin-a, and saxitoxin samples, between May and October, to monitor the presence of cyanobacteria.

HABs have been confirmed on the Illinois River, which is fed by the Kankakee River. To date, no major HAB events have been recorded on the Kankakee mainstem; but major tributaries, such as the Dixon West Place Ditch in St. Joseph County, have issued health advisories for the presence of blue-green algae.

8.1.3 PFAS

In 2021, IDEM began PFAS monitoring at Community Water Systems (CWS) throughout the state to understand the existence of PFAS in the state water supply and evaluate the effectiveness of conventional drinking water treatment. All raw water and treated water locations in a CWS supply are sampled and analyzed to assess the effectiveness of the state's drinking water treatment. For this PFAS monitoring study, surface water and groundwater samples from PWSs were collected by IDEM (2021 – 2025) and U.S. Environmental Protection Agency (EPA) (2023 – 2025) and analyzed for PFAS detection, regulatory level exceedance, and spatial distribution in the Study Area. 253 sample locations are present within the Study Area's counties and considered in this analysis. Results indicate that only one sample within the Kankakee Basin Study Area exceeded the Maximum Contaminant Limit (MCL (EPA 2025b) for PFAS. The EPA currently has National Primary Drinking Water MCL regulations for five PFAS contaminants (Table 8-1).

Table 8-1. Final EPA National Primary Drinking Water Regulations-PFAS MCL-April 26, 2024

Compound	Maximum Contaminant Level Goal (MCLG)	Maximum Contaminant Level (MCL)
PFOA	Zero	4.0 ppt
PFOS	Zero	4.0 ppt
PFNA	10 ppt	10 ppt
PFHxS	10 ppt	10 ppt
HFPO-DA (GenX)	10 ppt	10 ppt
Mixture of 2 or more: PFNA, PFHxS, PFBS, HFPO-DA	Hazard Index (HI) of 1	

Key:
EPA = U.S. Environmental Protection Agency
HFPO-DA = Hexafluoropropylene Oxide-dimer Acid
PFBS = Perfluorobutane Sulfonate
PFH_XS = Perfluorohexane Sulfonic Acid
PFNA = Perfluorononanoic Acid
PFOA = Perfluorooctanoic Acid
PFOS = Perfluorooctanesulfonic acid
ppt = parts per thousand

8.2 Study Area Surface Water Quality

EPA's Section 303(d) of the Clean Water Act (303(d)) listing of impaired waterways, data from 2024, indicates the most prevalent 303(d) impairment in the watershed is *E. coli*, followed by biological integrity. According to EPA, 'biological integrity' is a key parameter in assessing health and quality of a waterway and is measured using biological assessments of macroinvertebrates and fish communities as indicators. The 2024 data are predominately consistent with findings from a 2009 study conducted by Tetra Tech, which applied both historical and sampling data from the summer of 2008 by Illinois and Indiana for a TMDL analysis. The Clean Water Act and U.S. EPA regulations require that states develop TMDLs for waters on the Section 303(d) lists. The 2008 data indicate that most sites that were sampled in the basin experienced at least one violation of water quality standards with the reductions needed to achieve water quality standards range from zero to 99 percent (Tetra Tech 2009).

The 2009 Tetra Tech report also indicated that nonpoint sources are considered to be the primary sources of the 303(d) impairments in the Kankakee/Iroquois watershed. Nonpoint source pollution can be reduced by the implementation of Best Management Practices (BMPs). BMPs are practices used in agriculture, forestry, urban areas, and industry to reduce the potential for damage to natural resources from human activities (Tetra Tech 2009). These findings are consistent with the present-day surface and groundwater quality concerns relating to nutrient and nitrate concentrations from agricultural runoff.

A map of the 2024 303(d) impaired waterways in the basin is included in Appendix H. Annual updates to 303(d) help the EPA and the state to monitor and enforce discharge regulations for industrial, commercial, and public entities discharging to surface water bodies in the state and continue to improve quality of surface water for human and ecosystem health.

In 2023, IDEM published a 10-year trend analysis based on the state's FSMP data from 2011 – 2020, which supplements a previous 10-year trend analysis performed by the USGS with FSMP data from 2000 – 2010 (Risch et al. 2014, IDEM 2023). Four sampling sites from the Kankakee River Basin were utilized in the IDEM analysis and can provide insight on changing constituent trends in the basin. Statistically significant increases and decreases in the constituent concentration at the sampling sites in the basin over the 10-year analysis period are summarized in Table 8-2 below. Primary constituent increases in the Basin are in the nutrient category, which is consistent with the 303(d) impairment listings in the basin. Nutrients, including nitrogen, total phosphorus, and TSS were found to have increased at the sampling sites in the Basin while nitrate saw no significant change in concentration.

Table 8-2. 2011 – 2020 IDEM Stream Water Quality Trend Summary-Percent Change in Annual Median Concentration

Constituents		Kankakee River Basin
Nutrients	Nitrate	No significant changes
	Organic Nitrogen	Significant **increase** at 3 sites (25-50%)
	Total Phosphorus	Significant **increase** at 1 site (40%)
	TSS	Significant **increase** at all 4 sites (40 - 75%)
Ions	Chloride	Significant **decrease** at 2 sites (-10 & -15%)
	Sulfate	Significant **decrease** at 1 site
	Hardness	Significant **increase** at 1 site (-8%)
	TDS	Significant **decrease** at 1 site
Metals	Lead	Significant **increase** at 3 sites (5-95%)
	Iron	No significant changes
	Copper	Significant **decrease** at 1 site
	Zinc	Significant **increase** at 2 sites (50 - 200%)

Source: IDEM 2023
Key:
IDEM = Indiana Department of Environmental Management
TDS = total dissolved solids
TSS = total suspended solids

8.3 Study Area Groundwater Quality

Water quality is an important factor in assessing groundwater resource potential. IDEM maintains a groundwater quality database as part of a GWMN to determine the quality of groundwater in the state's aquifers, identify and expand monitoring in contaminated areas, and improve water quality monitoring. Factors that influence an aquifer's groundwater chemistry include the depth to bedrock, bedrock characteristics, the character of the overlying unconsolidated units, and the direction of groundwater flow (Hasenmueller et al. 2001). Arsenic and chloride are both naturally occurring constituents of groundwater in the Kankakee River Basin. Nitrate as nitrogen is also a constituent that can adversely impact the suitability of local groundwater resources.

Arsenic can be introduced into groundwater either through anthropogenic or geologic sources. Letsinger (2017) reported that arsenic can be sourced from a variety of human activities, including but not necessarily limited to the combustion of coal, sulfate aerosol fallout from coal combustion, borehole drilling allowing oxidation of arsenic sulfides, and alteration of groundwater flow paths due to well development, groundwater pumping, and aquifer storage and recovery. Arsenic is also sourced from the geologic materials through which groundwater is moving. Natural arsenic in groundwater is mobilized from either unconsolidated glacial deposits or near-surface, bedrock aquifers through chemical reactions.

A conservative constituent of surface and groundwater in Indiana, chloride is both naturally occurring and sourced from anthropogenic activities. Letsinger and Branam (2019) reported that anthropogenic sources of chloride originate at land surface and are related to the application of road salt along transportation corridors (roads and parking lots) where snow and ice are cleared. Chloride from these areas is transported to the subsurface and receiving waters by stormwater runoff, infiltration into shallow soils, and slow gradual recharge into aquifers. Chlorides related to CAFOs are also found around the State, although more commonly in surface waters. Due to these influences, chloride is more often found in unconsolidated aquifers than bedrock because of the proximity to the surface. Nevertheless, high concentrations of chloride have been found in bedrock aquifers.

Chloride, arsenic, and nitrate concentrations were analyzed to assess the suitability of groundwater for potential water supply. As shown in Figure 8-2, chloride is present across the Study Area. In general, the chloride concentration is below its Secondary Maximum Contamination Level (SMCL) of 250 mg/L, as defined by the EPA drinking standards. Figure 8-3 illustrates arsenic concentrations across the watershed. Arsenic is most present in the north-central portion of the Study Area, generally following the Yellow River. Arsenic has generally been detected at concentrations below the EPA's MCL of 0.01 mg/L, but there are locations where the MCL has been exceeded, particularly along and north of the Kankakee River. As shown in Figure 8.4, nitrate as nitrogen is present in groundwater throughout the area. However, nitrate concentrations have seldom been reported to exceed the EPA drinking water standard of 10 mg/L.

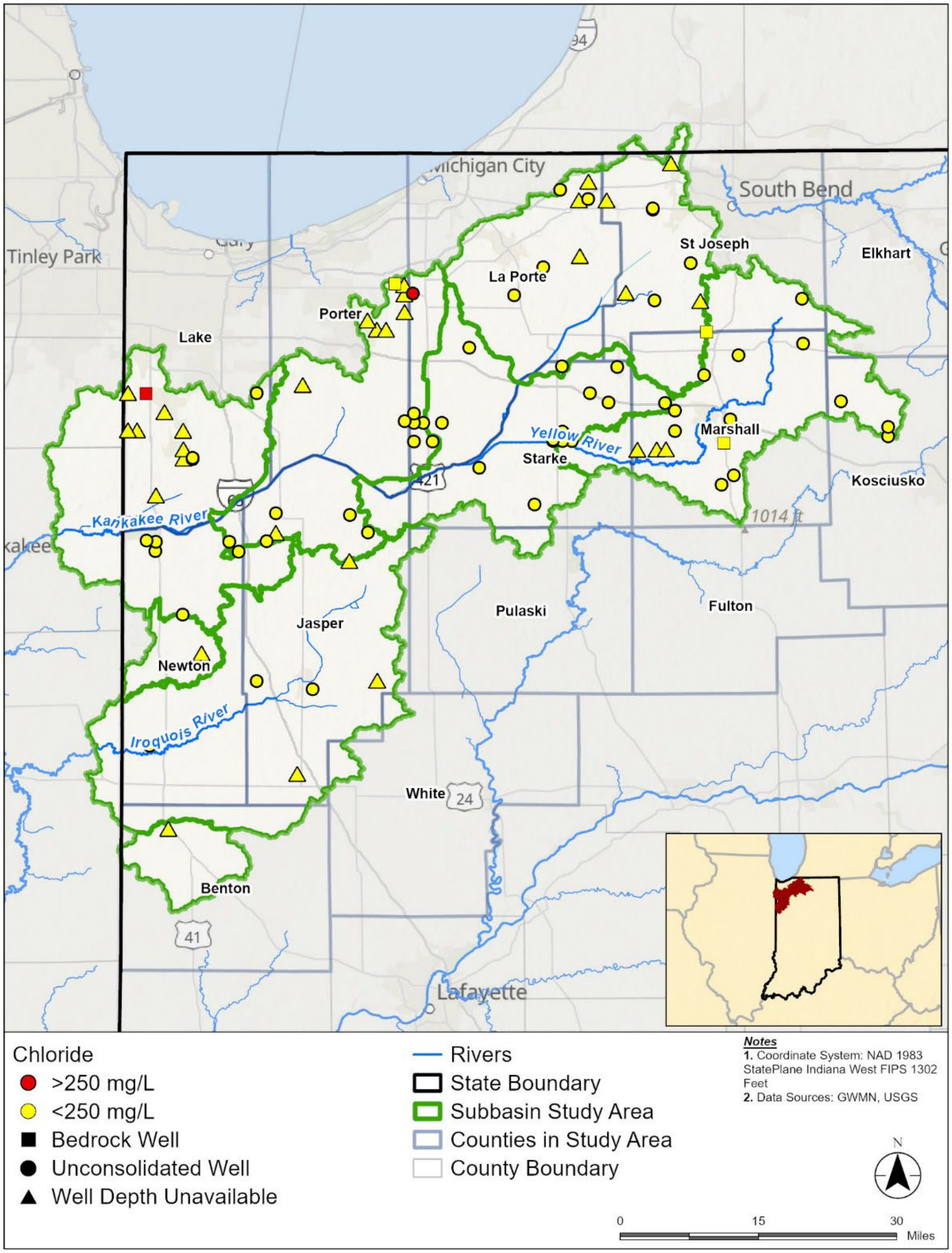


Figure 8-2. Chloride Concentrations in the Kankakee River Watershed, Indiana Department of Environmental Management Groundwater Monitoring Network

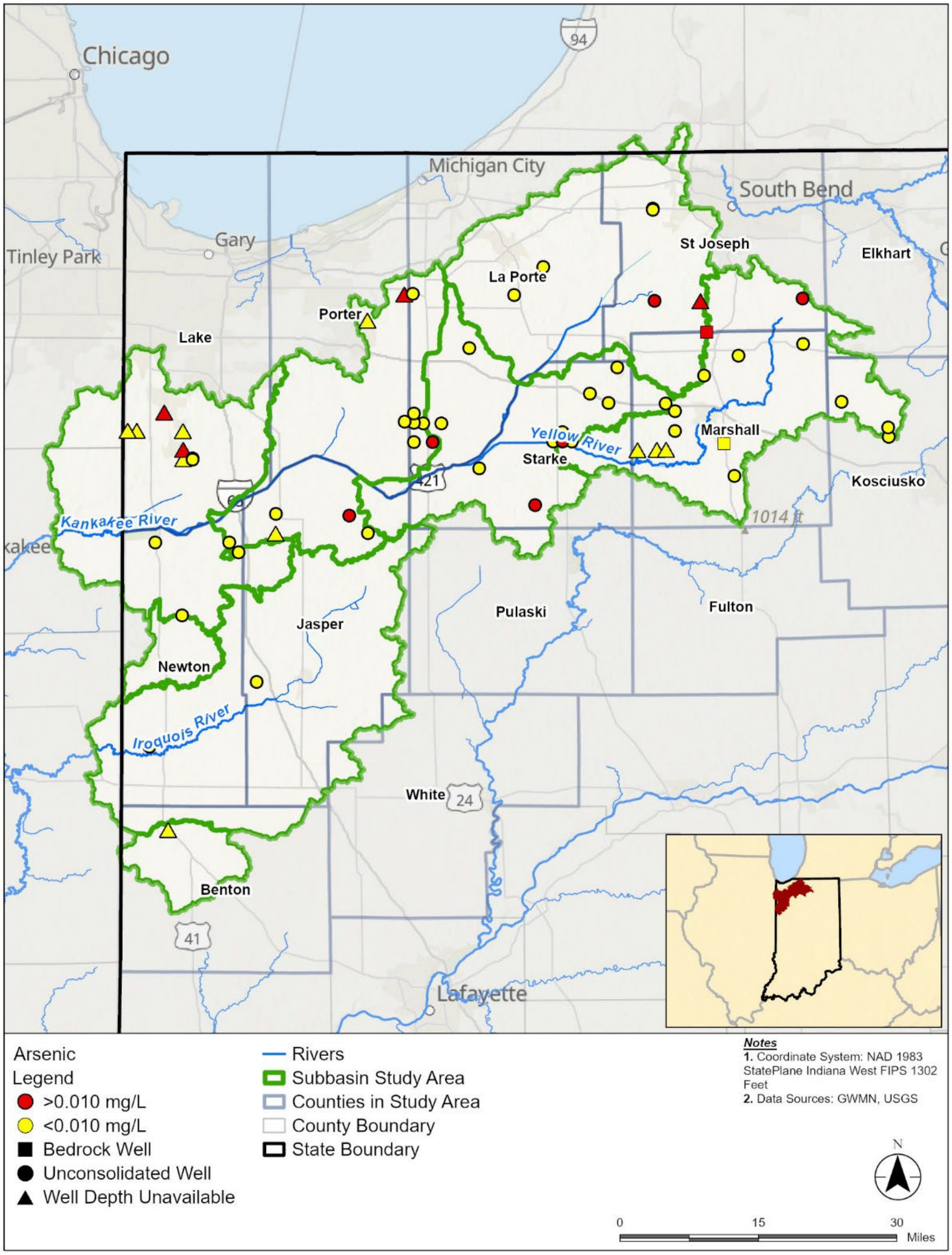


Figure 8-3. Arsenic Concentrations in the Kankakee River Watershed, Indiana Department of Environmental Management Groundwater Monitoring Network

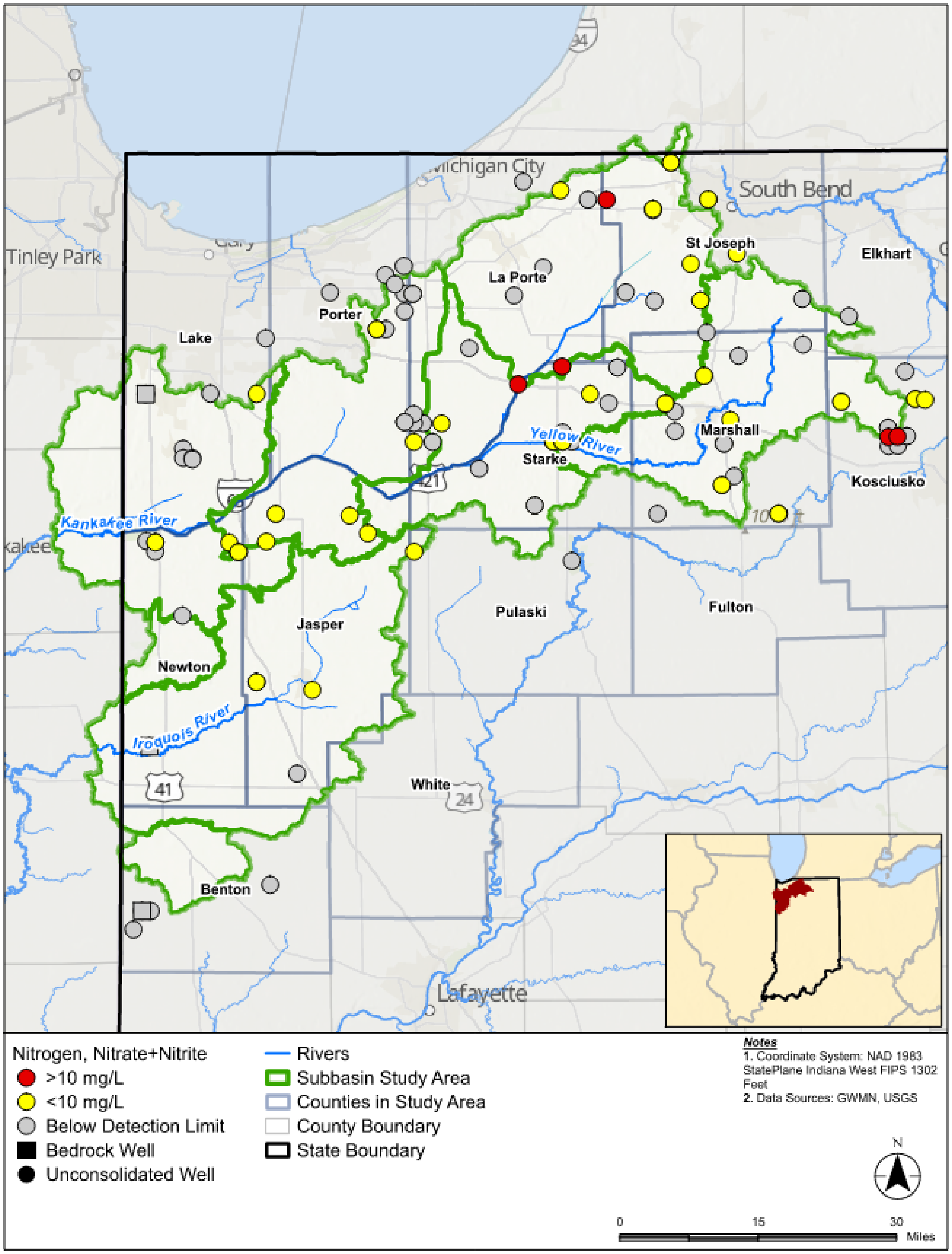


Figure 8-4. Nitrate as Nitrogen Concentrations in the Kankakee River Watershed, Indiana Department of Environmental Management Groundwater Monitoring Network

Groundwater in the Kankakee River Watershed is generally suitable for most purposes, but arsenic concentrations in some areas may be problematic for drinking water systems. Chloride concentrations in the Study Area are mostly below the SMCL, except for two sites along the northern watershed boundary. This condition suggests that chloride is not a major concern and indicates groundwater likely meets drinking water standards. Arsenic concentrations have more variability, with 13 sites that exceed the MCL across the northern portion of the watershed. Arsenic results that exceed 0.010 mg/L are typically found in wells completed in unconsolidated aquifers. Few if any of the arsenic exceedances in the Kankakee Basin were from bedrock aquifers. Nitrate concentrations that exceeded drinking water standards were found within the unconsolidated aquifers on the eastern half of the Basin.

9.0 Water Resource Risks, Opportunities, and Recommendations

This chapter highlights some key potential risks to water availability and suitability into the future and outlines a number of opportunities to more effectively manage and protect the region's finite water resources. Like many other regions of Indiana, the Kankakee Basin is projected to grow – slightly in population, and more significantly in economic productivity and in water demand. Fortunately, the Basin has generally abundant water resources, and this is projected to remain the case under most conditions in the future. The region can likely support increases in water demand (even beyond the future projected increases) while maintaining overall supply reliability. However, future projections of water availability under some conditions – notably in the Fall season in dry and drought years for certain subbasins – indicate potential water stress, meaning potential unsatisfied demands and/or heightened ecological stress.

Driven by numerous physical, economic, and political factors, Indiana is increasingly home to advanced manufacturing (such as semiconductors, biotech and pharmaceuticals, batteries, and electric vehicles) and data centers, and the Kankakee Basin is part of this evolving story statewide and nationally. In fact, the Kankakee Basin is a microcosm of the larger national trend, whereby the historical economic engine of agriculture is increasingly supplemented by new industry. For example, industrial water demand growth in the Kankakee Basin is projected to outpace agricultural water demand growth by a factor of five-to-one (with irrigation projected to increase approximately 30% from 2023 to 2075 and industrial demand projected to increase over 150% over that same time period). Accordingly, agriculture is projected to represent a slightly decreasing share of overall Kankakee Basin water demand in the future (from a 49% share of recent historical annual withdrawals to 43% by 2075), and industry is projected to nearly double its share in the future (9% to 17%). From the perspective of sustainable water management, this future trend merits attention, with some additional considerations below.

9.1 Risks

It is standard practice for water providers to actively manage existing and potential future risks. Aging infrastructure, a changing climate, a dynamic regulatory environment, legacy and emerging contaminants, an aging workforce, and affordability are repeatedly mentioned as concerns in water industry surveys nationwide. This Study focused on water availability and the suitability of available water for use.

Specific risks and uncertainties are identified and described below in three broad categories – Demand Growth Uncertainty, Water Availability Risks and Drivers, and Local Versus Regional/Upstream Contributed Water Availability.

9.1.1 DEMAND GROWTH UNCERTAINTY

This Study found that water demand for irrigation, industry, energy production, and public supply are all projected to increase over the study period, with industrial demand having the largest rate of increase.

Uncertainty is inherent in any projection of the future and will be discussed further, especially for the industrial sector.

To reduce risk caused by data uncertainty and to produce projections for industrial water demand with minimal speculation, this Study predicts that future industrial water use remains consistent with average historical use, unless there are specific published water utility expansion plans or specifically announced self-supplied industrial expansion plans.

Though not currently an overall large water user in the Kankakee Basin, data centers have the potential to increase water demand in the Kankakee Basin in the future. The number of data centers within the Primary Study Area Counties (counties with most of their land within the Kankakee Basin) grew by 36% between Q1 2019 (329 establishments) and Q3 2024 (448 establishments) (Indiana Dept. of Workforce Development 2024). During that time, La Porte County announced plans for a new $1 billion data center (City of La Porte 2024), and another 1200-acre, $11 billion facility is now operational in New Carlisle in St. Joseph County (Sigalos 2025).

Overall, the State of Indiana has cultivated data center development, though some communities are moving more cautiously. For example, the St. Joseph County Area Planning Commission and the County Council both voted against rezoning land just outside of the Indiana Enterprise Center for another data center (Kate 2025, Hall 2025); the New Carlisle Town Council argued that the proposal went against the Town's 2040 Comprehensive Plan. Similarly, Marshall County Commissioners passed several ordinances creating a two-year moratorium on solar, battery storage, data centers, and carbon capture (Bottorff 2025).

From a water demand planning perspective, recent studies found that variations in water use range across three orders of magnitude for both direct and indirect water use driven by data centers (e.g., Lei et al. 2025).

Within the irrigation or public supply sectors, the availability of suitable land serves to constrain future growth, and decades of historical data and experience can readily inform projections of future land use and future water use. This is not the case with advanced manufacturing and data centers, where a facility can use significantly more water per acre than other sectors and where there is often little lead time in regard to awareness about the location of planned facilities. Beyond siting, the water use of these facilities is an area of high uncertainty – a wide variety of options exist for cooling, cooling technology is rapidly improving, and data center operators have incentives to increase water efficiency and reduce water use. In other words, many facilities are, or will likely, adopt additional water conservation practices and technologies. In sum, it is hard to predict where and when advanced manufacturing and data center facilities will pop up, and even more difficult to accurately predict how much water they will require when they do.

Relatedly, water demand for energy production is another area of uncertainty. While the estimates used here are based on standardized methodology and data, the rate of growth of advanced manufacturing and data centers in Indiana may impact the rate of growth of energy production as well as the types of electric power generation serving the grid.

It is also worthwhile to acknowledge potential secondary effects from climate change that are not quantified in this Study. These include, for example, increased power demand for industrial and residential cooling, which could increase water demand, and more rapid development of irrigation wells and/or greater usage from existing wells to meet increased crop demand due to increasing rates of evapotranspiration (e.g., as discussed in Section 3.3.2). Note that there are techniques to better quantify and address this source of uncertainty, and this topic could be the subject of future study in the Basin. Furthermore, a limitation of this Study is that the frequency of future drought periods cannot be predicted with a high level of certainty, and thus the potential effects of an increased frequency or duration of drought periods relative to the recent historical period are not considered in the quantification or analysis of water demand. In other words, **water demand projections often result in a 'smoothed' overall trend that lacks the variability of actual historical usage, and this artifact can 'mask' what may likely be sharp peaks of irrigation water demand during future drought years.**

9.1.2 WATER AVAILABILITY RISKS AND DRIVERS

Future effects of climate change: Within the Study Area, the effects of future climate change are uncertain, and future projections of precipitation, air temperature, and other climate variables vary substantially across different models used by climate scientists. There is measurable evidence that air temperatures and wet season precipitation have been increasing over the past 100 years in Indiana (Section 2.1.2), and that as a result, hydrologic regimes are shifting with more streamflow in the wet season and less in the dry season (Section 2.2.2). Because future air temperatures, precipitation, and streamflow cannot be predicted with certainty, there is a high likelihood that future climate change will not conform specifically to the trends analyzed in this Study. A reasonable approach was implemented in this Study to illustrate potential future climate risks on water resources.

This Study used a conservative approach – that is, a measured approach was taken to avoid overstating potential future water availability for planning purposes. This included selecting a future climate change scenario that features high carbon and other emissions (i.e., a scenario on the high end of a range of projected future emissions scenarios; described further in Section 3.3.3), yielding projected increased air temperatures (i.e., increased future climate-sensitive water demands) and decreased natural baseflow during the drier Fall season (i.e., decreased water supply).

There is a risk, from a planning perspective, that future climate change could be more significant, and result in greater demands or reductions in baseflow, than is assumed in this Study (i.e., future conditions could be worse than the projections used in this Study). This 'high emissions' climate change **scenario was selected to increase confidence that future water availability quantified in this Study is not overestimated**. There is also a risk, however, that future climate change is not as significant as predicted (e.g., there is little additional change in future conditions relative to now), and if so, there may actually be more future water availability than projected in this Study.

Water quality: as presented in Chapter 8, both groundwater and surface water quality were analyzed as part of this Study, with the intent being to better understand the 'suitability' of available water resources to be developed for use.

Due to the elevated concentrations of some contaminants in some areas (e.g., *E.coli*, iron, manganese, arsenic, nitrate), there is a risk that existing or future water supplies may be adversely affected and require water treatment to continue to use or develop additional water supplies, along with associated cost increases to use the water. While industrial or agricultural development of groundwater with these water quality conditions may not be an issue, use of groundwater for public water supply may require treatment to protect public health if primary drinking water standards are exceeded, and water quality monitoring will be required to ensure the treatment system is protecting public health by maintaining reduced contaminant levels. This applies to groundwater obtained from both unconsolidated and bedrock aquifers.

Chloride and arsenic were analyzed to assess the suitability of groundwater for potential water supply; chloride is present across the Study Area, but generally at concentrations below the SMCL. This suggests that chloride is not a major concern and indicates groundwater likely meets drinking water standards. Arsenic is most present in the north-central portion of the Study Area, generally following the Yellow River. Arsenic has generally been detected at concentrations below the EPA's MCLs, but there are 13 locations where the MCL has been exceeded, particularly along and north of the Kankakee River. Very few samples have been analyzed for PFAS in the Basin, and only one groundwater sample exceeded the MCL (and no measurements exceeded the MCL in available surface water samples used in this Study). Lastly, there have been some exceedances of organic compounds noted in the statewide GWMN data.

The presence and levels of arsenic observed in historical samples in the Kankakee Basin is consistent with the findings of widespread sampling across midwestern glacial deposits (e.g., Thomas 2003). Arsenic in the region is derived from both anthropogenic and natural sources. Prolonged exposure to elevated arsenic levels can have human health impacts, and public water suppliers must ensure compliance with EPA MCLs for arsenic prior to distribution to users (IDEM n.d.). While elevated arsenic levels do not appear to be a widespread concern for future water resources development in the Basin, careful monitoring and treatment considerations are warranted to ensure continued public safety. In summary, surface water and groundwater resources in the Kankakee Basin are generally suitable for most purposes, but arsenic concentrations in some aquifers in some areas may be problematic for drinking water systems.

Development of future water supplies from surface water in the Study Area may also require site-specific sampling and monitoring to fully understand localized treatment needs. The Study Area contains stream segments with one or more Clean Water Act Section 303(d) listed impairments, primarily, *E. coli*, which is readily and commonly treated with conventional water treatment technology for water supply across the U.S. IDEM's robust surface water sampling program and trend tracking helps to assess the effectiveness of pollution prevention protocols or regulations in place and can help isolate emerging point sources of contamination and identify their spatial relationships to locations of projected future excess water availability.

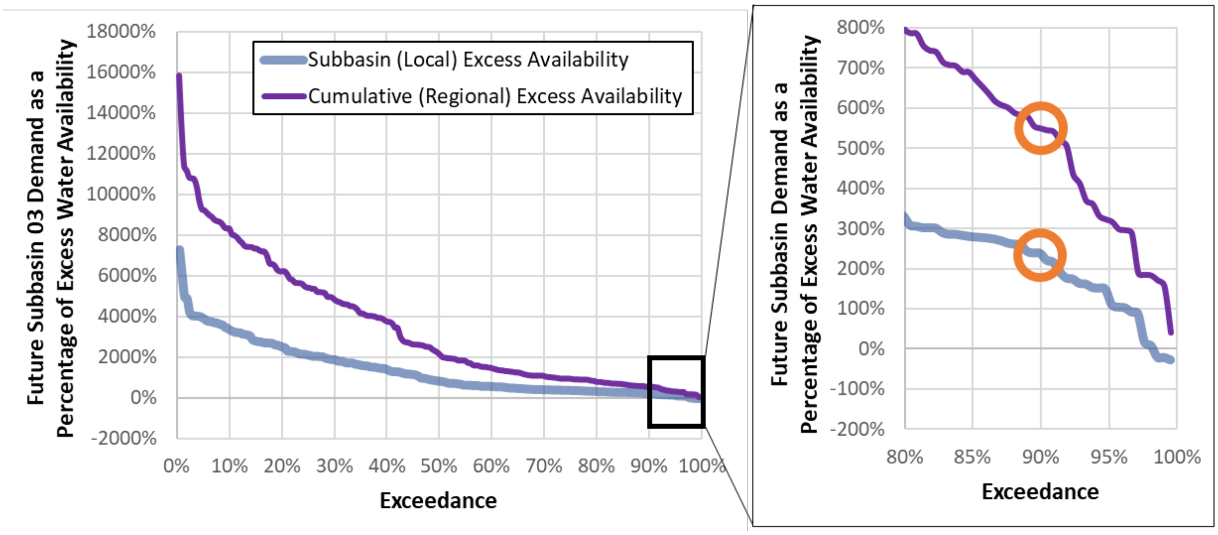
Emerging contaminants such as PFAS and micro-plastics found in the Study Area and surface water bodies in various parts of the state could introduce the need for new or advanced treatment technology in the future as these contaminants are better understood and more robust regulatory standards are developed.

Difficulty in predicting future conditions: Based on the availability of public data used for the water availability estimates, and to remain consistent with prior regional water studies in Indiana, the water availability analysis for this Study was conducted using a recent 17-year historical period of 2007 – 2023. This 17-year period is somewhat short of the 30-year standard used for representative climate conditions (e.g., NCEI 2024, WMO 2021). As reviewed in Section 2.2.2, measurable seasonal shifts in precipitation and streamflow have been observed in Indiana over the past 30 years, and these shifts are well represented in the most recent 17-year period. With respect to the frequency of extreme events like flooding and droughts, however, a 17-year period is a short period of record that may not contain flood or drought severity or duration that could be expected in the future. One limitation of this Study is that **the frequency of future drought periods (and flood events) cannot be predicted with any certainty.** Underrepresenting the frequency of historical dry seasons in a water availability analysis increases the risk that water availability determinations could be made presuming more water is available more frequently in the future than may actually occur.

9.1.3 LOCAL VERSUS REGIONAL/UPSTREAM CONTRIBUTED WATER AVAILABILITY

While it is often the case that water availability in downstream subbasins depends on upstream water availability, this is particularly significant in the Kankakee River Basin. An analysis of how much future demand could be met with either subbasin excess (i.e., from 'local sources' within a given subbasin) or cumulative excess availability (i.e., including regional contributions to a subbasin from upstream sources) is shown in Figure 9-1 as an example for Kankakee Kouts (Subbasin 03). For this analysis, the future subbasin (local) excess and cumulative (local+regional) excess availability for each subbasin was divided by consumptive demand (withdrawals minus return flows), resulting in a percentage that reflects how much future seasonal demand could be met from each source (local or regional). For example, if future subbasin excess availability was 20 MGD and future consumptive demand was 10 MGD for a given season, the subbasin could support 300% of future projected demand in that season (based on the already included 10 MGD of projected demand plus enough water for 20 MGD of additional demand on top of that). If future subbasin excess availability was negative, the local subbasin could not support the projected demand or any additional demand, and all future subbasin demand would be met by upstream cumulative (local+regional) excess water availability contributed to the subbasin.

All seasonal values throughout the future period for subbasin and regional water availability were organized as exceedance curves to evaluate the frequency with which future demands could be met with local and/or regional supplies. At median conditions (50% exceedance), for example, 723% of projected future Subbasin 03 water demands could be met within the subbasin and 2100% of projected future demands could be met when upstream contributions were included. This indicates that there would likely be abundant water in the system in a typical year that is well in excess of projected future demands. Water utilities typically operate to a high degree of reliability, however, with many water systems striving to meet a minimum 90% water supply reliability, meaning the water system can meet demand 90% of the time, and 10% of the time there may be a shortage (Tang and Wang 2025). At the 90% exceedance level (Figure 9-1, right hand side), 237% of projected future demands could be met with subbasin (local) excess water availability and 550% of projected future demands could be met with cumulative (local+regional) excess water availability.



Note: the orange circles in the figure at right highlight the future subbasins demand as a percentage of excess water availability at the 90% exceedance level, or, 90% reliability.

Figure 9-1. Future Kankakee Kouts (Subbasin 03) Demand as a Percentage of Subbasin and Cumulative Excess Water Availability

Summary results of how much future demand could be met with either subbasin (local) excess or cumulative (local+regional) excess water availability with a 90% reliability for all subbasins are shown in Figure 9-2. Most subbasins can meet 200% of their future projected demand with subbasin (local) excess availability, meaning the subbasins could meet twice the projected future demand from this study with a 90% reliability. Subbasin 05 is the only subbasin where 100% projected future demands cannot be met by subbasin excess availability alone with a 90% reliability, but can be met with cumulative excess availability. Any additional demand beyond that projected for Subbasin 05 would also be met with cumulative excess availability, or water that originated from upstream subbasins.

This analysis highlights the future projected dependency of downstream Kankakee River mainstem subbasins, particularly Subbasin 05, on cumulative (local+regional) excess availability contributed from upstream subbasins. **In other words, water resources development in upstream Subbasins 02, 03, and 04 will strongly influence the reliability of Subbasin 05 water supply in the future.** Upstream Subbasins 02, 03, and 04, however, have enough subbasin (local) excess availability to meet over 200% of future demand projected in this Study, providing a higher degree of certainty that the region will continue to provide a high degree of water supply reliability unless water resources development accelerates much more quickly than projected. Note that the Subbasin 02 demands included here already include projected water demand for the planned data center in St. Joseph County (and thus the >200% of demand that could be met from subbasin excess availability is on top of this projected demand.

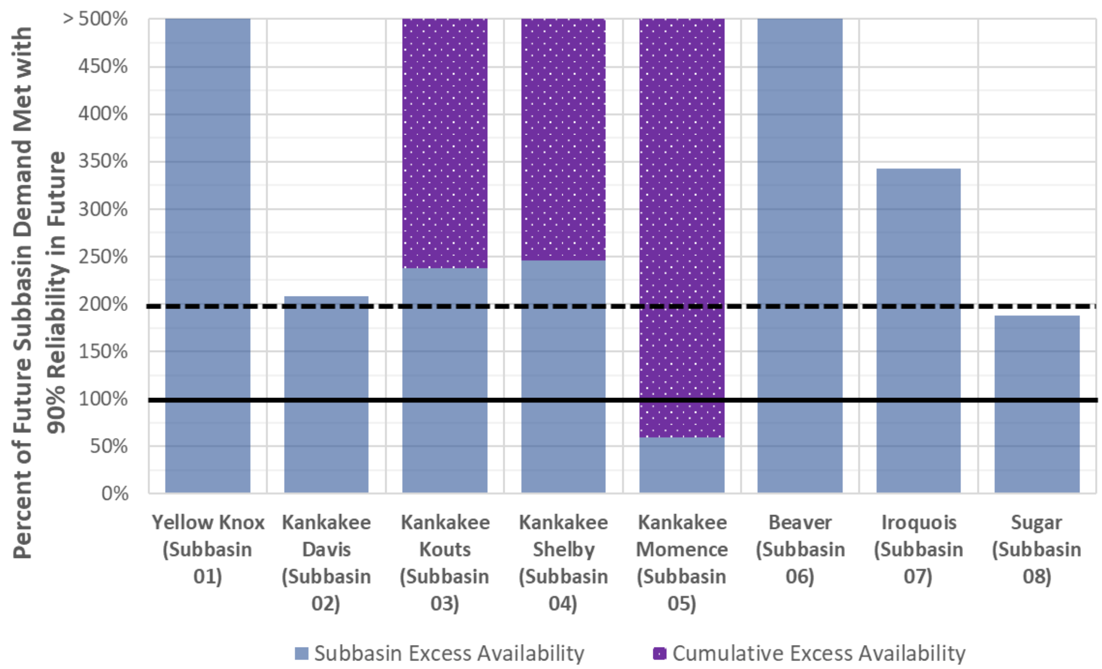


Figure 9-2. Future Kankakee Kouts (Subbasin 03) Demand, as a Percentage of Subbasin (Local) and Cumulative (Local+Regional) Excess Water Availability, That Could be Met with a 90% Reliability

9.2 Opportunities and Recommendations

This Study found that future water supplies in the Kankakee Basin are projected to remain generally abundant across most subbasins and seasons. Similar to historical conditions, cumulative (local+regional) excess water availability remains positive in most future years, with future supplies typically exceeding projected demands (including instream flow requirements). As such, the region can likely support substantial increases in water demand while maintaining overall supply reliability. Even with projected increases in consumptive use of up to 25–30%, most subbasins are expected to retain positive excess water availability during typical conditions. This suggests that, under average hydrologic conditions, the Kankakee Basin's natural and managed systems are resilient to moderate growth in future demands. So, in general, **the Kankakee Basin is projected to continue to have the available water supply to increase in population, increase in economic activity, and maintain a healthy ecological environment**.

That being said, **this Study also found that some subbasins, in some seasons, under some future conditions, have the potential for water supply shortages**. As discussed in Chapter 7, in the future some subbasins are projected to experience negative cumulative excess water availability under drought (95% exceedance) conditions, indicating the potential for experiencing unmet demands and heightened ecological stress.

Accordingly, six potential approaches are recommended that can individually and/or collectively contribute toward an increase in future available water supply to maintain or strengthen the people, environment, productivity, and economy of the Kankakee Basin in Indiana. This includes strategies to:

- Increase the supply of surface water and/or groundwater (recommendation 1)
- Decrease the demand for water (recommendation 2)
- Better understand and manage water as a limited resource (recommendations 3-6)

Included are strategies for water users, water providers, and local/regional and state entities. Note that these recommendations are listed in order of the above categories, not by priority. Also note that many of these recommendations are applicable in basins across the State, and some were included in the adjacent North Central Indiana Regional Water Study (Stantec 2025).

9.2.1 GROUNDWATER EXPLORATION AND DEVELOPMENT (1)

A total of 2,598 significant water withdrawal wells are currently registered in the Kankakee River Basin. Most of the registered wells are completed in the unconsolidated aquifers within the Kankakee River valley. However, additional opportunities for groundwater development exist within both the unconsolidated and bedrock aquifers.

The unconsolidated aquifers in the Study Area have good potential for further development. Groundwater development potential is highest in the northern and eastern portions of the Kankakee River Watershed. Areas in southern Lake and Porter Counties and northern Newton County seem particularly favorable given the relatively low current level of groundwater development in those areas. Similar observations apply to Marshall County to the east.

While the Kankakee and Outwash aquifers are the most utilized of the unconsolidated aquifers, further development of these aquifers still appears to be possible. The recharge rates in these aquifers are estimated to be 500,000 and 300,000 gpd/square mile, respectively (IDNR 1994). Significant water withdrawal facilities generally report pump capacities from 100 to 500 GPM, but many report pump capacities from 500 to over 1,500 GPM. The maximum yield of these aquifers is expected to range from 500 GPM to over 1,500 GPM (Figure 2-12). The water quality data in the area generally indicates groundwater meets EPA drinking water standards. The western portions of these aquifer systems are generally less utilized than the northern and eastern portions.

The Valparaiso Moraine, Eolian Sands, and Nappanee aquifer systems are estimated to produce yields up to 1,500 GPM. The estimated recharge rates for these aquifers range from 125,000 to 200,000 gpd/square mile. Water quality results in these aquifers generally meet EPA drinking water standards. These aquifer systems are much less utilized compared to the Kankakee and Outwash systems.

Of **the bedrock aquifers** in the Kankakee River Basin, groundwater is mainly supplied from the Silurian and Devonian Carbonate aquifer. This aquifer commonly yields between 100 to 1,000 GPM to local water wells and lies beneath a relatively thin veneer of unconsolidated deposits. While current development is focused on eastern Newton and western Jasper Counties, other areas in these counties as well as southern Lake, Starke, and Marshall Counties present opportunities for additional development. The locations of these less developed areas in the Silurian and Devonian Carbonate aquifer are illustrated on Figure 2-13.

The water use conflicts that arose from the development of Fair Oaks Farm and led to water rights legislation in Indiana in the 1980s are a permanent reminder of the need for reasonable groundwater management. Groundwater development in these lesser-used areas must be mindful of potential adverse impacts to neighboring users of both the Silurian and Devonian Carbonate Aquifer as well as the unconsolidated aquifers. Recommendations for future large groundwater developments are included in Section 9.2.6.

9.2.2 WATER CONSERVATION AND WATER USE EFFICIENCY (2)

In many communities, the 'low hanging fruit' when it comes to water resource planning and management is conserving the limited water supply that has already been developed and using existing water resources more efficiently. In comparative analysis of water management strategies, enhanced water conservation and water use efficiency often shows the greatest cost effectiveness (i.e., return on investment). Water conservation can be achieved passively, such as through ongoing improvements in the efficiency of water fixtures and appliances, or through residential densification, as denser developments include less outdoor space to be watered. Water conservation can also be enhanced through investment, regulations, requirements, and education.

Enhanced water conservation and water use efficiency could include:

- Enhanced utility leak detection, meter testing, and more aggressive capital improvement planning schedules to identify and replace aging and failing water distribution system infrastructure (thus minimizing the volume of non-revenue generating water that is 'lost' through leakage or seepage). Note that water utilities in Indiana are required to submit validated water loss audits every even-numbered year to the IFA, who is then required by IC 8-1-30.8 to complete a biennial legislative report that summarizes the compiled audit data (IFA 2024a). The 2024 audit included data from 446 PWSs, collectively serving over 4.9 million Hoosiers. From the survey, the median water loss (as a percentage by volume of water supplied) was 19%, with the 25th and 75th percentile water losses spanning a range of 10 to 30%. In total, the statewide annual cost of this 'non-revenue water' was nearly $200 million in 2024 (IFA 2024b).
- Incentives for residential water conservation and water use efficiency improvements, addressing end-use water demand both inside and outside of the home.
- From discussions with the agricultural community in Indiana, it is clear that significant efforts are underway to improve crop yields, crop resilience, and crop water use efficiency.
- Industrial water use efficiency for industrial water users to optimize on-site processes. For example, industries could be encouraged to adopt or enhance existing water cycling systems.
- Development of stormwater management practices that reduce runoff and provide supplemental water supplies.

- Analysis of water rate billing structures and the implementation of increasing block structure pricing, whereby the rate charged per unit of water increases as the volume of consumption increases.

9.2.3 DATA COLLECTION, MONITORING NETWORKS, AND MODELING (3)

Governor Braun's Executive Order (EO) 25-63 (April 2025) directs that the inventory of Indiana's water resources "shall include recommendations for the enhancement and optimization of Indiana's water monitoring and assessment networks in order to effectively measure and manage Indiana's water resources and to provide critical data where gaps currently exist."

Review of the surface water and groundwater data for the Kankakee Basin has led to the identification of a number of data gaps, particularly related to groundwater quantity and quality. Filling these data gaps would be helpful in fostering additional understanding of the water resources of the area. These data gaps and suggested improvements include the following:

- Groundwater level monitoring data for both the unconsolidated and bedrock aquifers is limited.
  - Six observation wells are currently used to monitor groundwater levels in the unconsolidated aquifers within the Study Area, and all six have long-term datasets.
    - Increase the number of water level observation wells to five per county and distribute them across the different aquifer types that are more utilized within each county.
    - Where the Kankakee River or its tributaries are present in a county, include two observation wells near the watercourse – one upstream and one downstream.
  - Four wells are currently used to monitor water levels in the bedrock aquifers within the Study Area.
    - Increase the number of water level observation wells to two per county and distribute them between the bedrock aquifers utilized.
- Groundwater quality monitoring is lacking or deficient within certain counties.
  - Historical water quality monitoring (from the IDEM Groundwater Monitoring Network) in Lake, Porter, La Porte, St. Joseph, Marshall, Kosciusko, Starke, Jasper, Newton, and Benton Counties was generally spatially widespread and of sufficient detail to identify issues. However, much of the latest monitoring data is from 2016. It would be valuable to continue a robust water quality monitoring program.
  - Increase the sampling and distribution of water quality samples collected in the other counties within the Study Area.
- Refine data reporting to the EPA under NPDES to better distinguish between CSOs and treated effluent discharge. For many facilities, these flows are reported as a singular dataset, making it

difficult to determine how much reported NPDES discharge was from treated effluent and how much was from stormwater.

- While analyses are underway in certain regions, the State of Indiana lacks a comprehensive scientific understanding of subsurface water resources, including information pertaining to aquifer extents, dimensions, and hydrogeologic parameters, aquifer capacity, water levels, aquifer recharge, and maximum sustainable groundwater yield. Scientific studies to better understand the State's aquifers (as distinct from aquifer types or aquifer systems) would enable more accurate analysis of current and future groundwater availability.

- Similarly, investments are underway in certain regions of the State to develop or enhance existing simulation models of regional water systems in order to assess the impacts of proposed water supply development projects and to test scenarios of water extraction, water storage, and water discharge. These efforts should be expanded to encompass regions of rapid development and/or regions of projected future water availability limitations and to better capture the dynamics of the complete hydrologic system.

9.2.4 COMMUNICATION, COORDINATION, AND EDUCATION (4)

As a particular resource becomes more limited in a region, public awareness, understanding, and appreciation of that resource inherently increases. This trend is currently being experienced in parts of Indiana regarding water resources. There are steps that can be taken by water suppliers as well as regional and state entities to facilitate, enhance, and support the public's water resources literacy, and there are also benefits for water resource management from increased public awareness and increased collaboration.

The importance of ongoing communication and coordination among water suppliers and large water users is particularly important in the Kankakee Basin because of the Local Versus Regional/Upstream Contributed Water Availability risk discussed in Section 9.1.3. As such, Basin water providers, particularly those in downstream subbasins, may benefit from establishing an informal or formal Kankakee Basin water supply planning group or otherwise pursuing avenues of increased coordination.

Example recommendations regarding strategies for communication, education, and outreach include the following:

- Promote and increase awareness of existing state-wide resources (such as existing infrastructure, plans, regulations, goals, and data).

- Develop and maintain websites where the public can monitor reservoir levels, stream levels, aquifer levels, precipitation totals, and drought forecasts.

- Collaborate with and support existing water utility and other communications campaigns on water conservation.

- Encourage local media coverage of water conservation issues and the importance of water conservation, especially during dry years.

- Provide water conservation information to the public at State and municipal buildings and other public places.
- Make information on water conservation available on State of Indiana and municipal websites and include links to information on water conservation.
- Tailor messages to resonate with water users and specific industries (e.g., by recognizing the values and needs of the target audience).
- Expand and/or modify existing academic and agricultural extension programs to further advance the topics of water conservation and water use efficiency.
- Partner with EPA Water Sense and participate in the EPA Water Sense sponsored “Fix a Leak Week.”
- Make water provider staff available to give presentations and/or workshops on the importance of water conservation and ways to save water to local organizations, schools, and civic groups.
- Develop and communicate clear and consistent public messaging on drought stages (e.g., recommended or required limitations on water usage, reduction goals, and the value of reductions).
- Increase communication and collaboration among water suppliers regarding drought contingency planning (e.g., alignment on the timing of drought declarations, the definition of drought stages, and even on voluntary and mandatory drought water use requirements).
- Create platforms, incentives, and forums for water suppliers and other entities involved in water management (e.g., academic researchers, stakeholder groups, large water users) to share best practices and lessons learned; to share and review monitoring data and to standardize data collection and reporting; to present and review water resource development plans; and to identify, discuss, and develop strategies to help mitigate potential adverse impacts from new water supply development.

9.2.5 WATER POLICY AND PRACTICE (5)

EO 25-63 (Office of Governor Mike Braun 2025) established the development of a water inventory that will include a statewide water planning framework for gathering input and integrating planning region needs. The water inventory is to be completed by December 31, 2026. The EO also established a plan to create a publicly available database to consolidate and share data on water resources. Through prior and current activities, IFA and DNR are well-positioned to advance additional legislative policy and water management practice efforts. Beyond items already mentioned in other sections, specific recommendations to this end include:

- Promote statewide legislation to determine, establish, and protect instream flows for ecological needs. For example, in 2007 the State of Texas passed Senate Bill 3, intended to answer three broad questions: (1) How much water is needed to sustain a sound ecological environment in the state's rivers and estuaries? (2) How can this water be protected? and (3) What is the appropriate balance between water needed to sustain a sound ecological environment and water needed for human or other uses? (TWDB n.d.)

- Consider promulgating more proactive assurances and protections for existing water users. Both Senate Bill 28 (2025) and (modified) Indiana Code 14-25-4 currently afford protections for water users who have experienced impacts, but neither manages nor prevents proposed future water withdrawals that may likely cause harm to others nearby. For example, the Michigan Natural Resources and Environmental Protection Act (Act 451; Michigan Legislature 1994) prohibits water withdrawals from causing excessive streamflow depletion, and the Michigan Department of Environment, Great Lakes, and Energy manages a Water Withdrawal Assessment Tool that estimates the potential impact a proposed water withdrawal may have on nearby waterways and requires permits for new significant water withdrawals (Michigan EGLE 2025).

Note that the North Central Indiana Regional Water Study (Stantec 2025) included two additional Water Policy and Practice recommendations: (1) establish and maintain regional water planning groups that include representation from across water sectors and water stakeholders; and (2) work toward implementing statewide water planning, to include future water supply and water demand analysis to support estimates of future water availability, and also identification and analysis of water management strategies, conducted using a standardized methodology for incorporating the effects of climate change, and updated on a periodic basis (e.g., 5- or 10-year intervals). EO 25-63 mandates that both of these recommendations be implemented.

9.2.6 RECOMMENDED FOLLOW-ON ANALYSES (6)

The following additional work is recommended to build upon the work completed through this Study. These additional analyses would be valuable to help reduce risk, increase the potential for success of future projects, and protect existing water users.

- Consider requiring a site-specific groundwater exploration study to support water supply development for proposed future large groundwater withdrawal facilities. This approach should consist of at least the following steps:
  - Review the available geologic and hydrogeologic data within an approximately five-mile radius of the proposed project site and identify locations and details of neighboring significant water withdrawal facilities and domestic wells.
  - Develop a groundwater exploration plan that identifies the target aquifer(s), the amount of water proposed for development, proposed drilling depths through the respective aquifer(s), test well locations and well design, observation well locations and design, well completion and development strategies, and step and constant rate aquifer testing durations and monitoring plan, including neighboring wells, surface waters, and springs as appropriate. The plan should also include water quality sampling of the potential water supply based on the intended use of the water.

  - Complete test and observation wells and perform aquifer testing with monitoring of existing surface water and groundwater resources, and water quality sampling, as warranted.
  - Prepare a groundwater exploration report that details the findings of the well drilling, reveals the aquifer testing results, monitoring results, production rates, and permeability associated with the tested aquifer(s), water quality, and includes at least analytical modeling of the proposed production well or wellfield layout to assess potential impacts of the proposed water supply production on neighboring users.

- Address the identified data collection, monitoring networks, and modeling data gaps.
- Consider additional studies of historic and paleohistoric drought in Indiana, including analysis of the frequency, duration, and intensity of past drought episodes, and analysis of whether these drought characteristics are stationary or non-stationary in time. Such studies can leverage recorded observations and indices (such as the Palmer Hydrologic Drought Index, the Palmer Drought Severity Index, streamflow, groundwater level, air temperature, and/or precipitation records) as well as reconstructed climate records from paleoclimate studies (such as isotopic analysis from lake sediments and/or tree ring data). These studies would enable a better understanding of the characteristics of past drought periods and could provide insight into the potential impacts of an increased frequency or duration of future droughts.
- Consider additional studies of projected future flooding and flood impact assessments in the Basin. Such analysis could leverage authoritative projections of extreme precipitation events in a changing climate, such as the forthcoming Atlas 15 dataset (NOAA 2025b), and could be informed by recent research, such as that from the Water Research Foundation on holistic approaches to flood mitigation planning and modeling under extreme events and climate impacts (Hersh et al. 2023). Topics of recent and active research in this space include enhanced modeling of rain-on-snow events, improved understanding of the impact of short-duration, high-intensity events (e.g., small convective thunderstorms, or “cloudbursts”), updated estimates of flood flow exceedance probabilities based on recent streamflow observations and the trends identified therein, and incorporation of innovative tools such as machine learning to better calibrate and refine hydrology and hydraulic models.
- Consider additional studies of aquifer recharge. Recharge rates are dynamic, and while existing historical estimates have provided a relative sense of how much water is being replenished in the aquifers, additional studies could shed light on the variability of recharge to different aquifers or different areas of the basin (especially in areas that have experienced significant land use/ land cover change such as large increases in impervious cover area). These studies could also provide supplemental information to guide future groundwater development initiatives.

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