



## Appendix A

### Mann-Kendall Trend Tests

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## 1 Mann-Kendall Trend Tests

Seasonal and annual trends in streamflow and groundwater levels were assessed using the Mann-Kendall test (Mann, 1945; Helsel, 2012; Helsel et al., 2020). A recent 30-year period was used to evaluate trends for active United States Geological Survey (USGS) gages, and the most recent available data were used for pertinent inactive gages. Trends were assessed based on a 5% significance level. Results including the trend (increasing or rising water levels, decreasing or declining water levels, or no trend) as well as the Sen's Slope indicating the strength of the trend are provided in **Table A-1** (groundwater levels) and **Table A-2** (streamflow). Additional data for the groundwater monitoring sites are presented in **Table A-3**.

Table A-1. Annual and seasonal trend statistics for groundwater elevations at USGS monitoring sites in the Ohio River and Southeast Indiana Region.

| USGS ID         | Well Name    | Years     | Annual |       | Winter |      | Spring |       | Summer |       | Fall |      |
|-----------------|--------------|-----------|--------|-------|--------|------|--------|-------|--------|-------|------|------|
|                 |              |           | T      | S     | T      | S    | T      | S     | T      | S     | T    | S    |
| 382323086044501 | HARRISON 8   | 1995-2024 | -      | -0.03 | o      | --   | -      | -0.03 | -      | -0.07 | o    | --   |
| 383012086124501 | WASHINGTON 2 | 1995-2024 | -      | -0.3  | -      | -0.3 | -      | -0.3  | -      | -0.4  | -    | -0.3 |
| 383403085352601 | CLARK 21     | 2020-2023 | -      | -2.2  | -      | -2.5 | -      | -2.3  | -      | -1.8  | -    | -1.8 |
| 394426085080601 | WAYNE 6      | 1994-2023 | +      | 0.03  | +      | 0.05 | +      | 0.04  | o      | --    | +    | 0.03 |

T = Mann-Kendall trend, significance level of 5%: o = no trend; + = increasing trend; - = decreasing trend.

S = Sen Slope, magnitude indicates the strength of the trend.

**Table A-2. Annual and seasonal trend statistics for stream discharge at USGS stream gages in the Ohio River and Southeast Indiana Region.**

| Gage     | Name                                         | Years     | Annual |       | Winter |      | Spring |      | Summer |      | Fall |      |
|----------|----------------------------------------------|-----------|--------|-------|--------|------|--------|------|--------|------|------|------|
|          |                                              |           | T      | S     | T      | S    | T      | S    | T      | S    | T    | S    |
| 03381700 | Ohio River at Old Shawneetown, IL-KY         | 2002-2023 | o      | --    | o      | --   | +      | 2113 | +      | 908  | -    | -552 |
| 03303280 | Ohio River at Cannelton Dam at Cannelton, IN | 1995-2024 | o      | --    | +      | 986  | o      | --   | o      | --   | o    | --   |
| 03294500 | Ohio River at Louisville, KY                 | 1995-2024 | +      | 393   | +      | 1283 | +      | 526  | +      | 350  | +    | 371  |
| 03277200 | Ohio River at Markland Dam Near Warsaw, KY   | 1995-2024 | +      | 302   | +      | 1050 | +      | 510  | +      | 195  | +    | 290  |
| 03216600 | Ohio River at Greenup Dam Near Greenup, KY   | 1984-2013 | +      | 160   | +      | 594  | +      | 399  | +      | 143  | o    | --   |
| 03275000 | Whitewater River near Alpine, IN             | 1995-2024 | +      | 1.2   | +      | 3.1  | +      | 4.2  | o      | --   | +    | 0.7  |
| 03275600 | East Fork Whitewater River at Abington, IN   | 1995-2024 | +      | 0.4   | +      | 1.3  | +      | 1.6  | o      | --   | +    | 0.2  |
| 03276000 | East Fork Whitewater River at Brookville, IN | 1988-2017 | +      | 3.6   | +      | 1.4  | +      | 2.6  | +      | 4.2  | +    | 3.5  |
| 03276500 | Whitewater River at Brookville, IN           | 1995-2024 | o      | --    | o      | --   | +      | 5.4  | -      | -3.6 | o    | --   |
| 03277000 | Laughery Creek near Farmers Retreat, IN      | 1943-1972 | o      | --    | o      | --   | -      | -0.9 | o      | --   | +    | 0.1  |
| 03291780 | Indian-Kentuck Creek near Canaan, IN         | 1995-2024 | -      | -0.01 | o      | --   | o      | --   | o      | --   | o    | --   |
| 03294000 | Silver Creek near Sellersburg, IN            | 1995-2024 | o      | --    | o      | --   | o      | --   | +      | 0.1  | +    | 0.1  |
| 03302220 | Buck Creek near New Middletown, IN           | 1995-2024 | +      | 0.2   | +      | 0.5  | +      | 0.4  | +      | 0.1  | +    | 0.2  |
| 03302500 | Indian Creek at SR 355 near Corydon, IN      | 1963-1992 | +      | 0.1   | +      | 0.7  | -      | -0.8 | o      | --   | +    | 0.2  |
| 03302800 | Blue River near Fredericksburg, IN           | 1995-2024 | o      | --    | o      | --   | -      | -1.7 | o      | --   | +    | 0.2  |
| 03303000 | Blue River near White Cloud, IN              | 1995-2024 | o      | --    | +      | 2.6  | o      | --   | o      | --   | +    | 0.7  |
| 03303300 | Middle Fork Anderson River at Bristow, IN    | 1995-2024 | o      | --    | +      | 0.3  | -      | -0.4 | +      | 0.03 | +    | 0.02 |
| 03322100 | Pigeon Creek at Evansville, IN               | 1960-1984 | +      | 1.7   | +      | 4.6  | +      | 3.4  | +      | 0.8  | +    | 1.2  |

T = Mann-Kendall trend, significance level of 5%: o = no trend; + = increasing trend; - = decreasing trend.

S = Sen Slope, magnitude indicates the strength of the trend.

Table A-3. Data on USGS groundwater monitoring wells.

| USGS ID         | Well Name    | Well Depth (feet) | Aquifer         | Confined     |
|-----------------|--------------|-------------------|-----------------|--------------|
| 382323086044501 | HARRISON 8   | 93                | Mississippian   | Yes          |
| 383012086124501 | WASHINGTON 2 | 143               | Mississippian   | Yes          |
| 383403085352601 | CLARK 21     | 62                | Not Reported    | Not Reported |
| 394426085080601 | WAYNE 6      | 49                | Sand and Gravel | No           |

## 2 References

- Mann, H.B. 1945. "Non-parametric tests against trend," *Econometrica* 13 (3): 245-259.
- Helsel, D. R., D. K. Mueller, and J. R. Slack. 2006. *Computer Program for the Kendall Family of Trend Tests*. U.S. Geological Survey Scientific Investigations Report 2005–5275.
- Helsel, D. R., R. M. Hirsch, K. R. Ryberg, S. A. Archfield, and E. J. Gilroy. 2020. *Statistical Methods in Water Resources*. U.S. Geological Survey Techniques and Methods, book 4, chap. A3. <https://doi.org/10.3133/tm4a3>.



## Appendix B

### Demand-Modeling Methodology

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## 1 Data, Transforms, and Model Structure

The withdrawal being modeled is reported monthly by facility under the Significant Water Withdrawal Facility (SWWF) program, aggregated to county × month and held internally in million gallons per year (MGY); reported quantities are converted to million gallons per day (MGD). Withdrawals and the climate drivers are deseasonalized before fitting using a multiplicative seasonal form (an STL decomposition for public supply, a multiplicative monthly climatology for the others), chosen because the seasonal swing scales with the overall level of demand rather than adding a fixed monthly offset. The growing-season moisture deficit ( $\text{Deficit} = \text{PET} - \text{AET}$ , potential minus actual evapotranspiration) is scaled by its standard deviation and shifted to stay non-negative; population and time are left unscaled; and income is detrended into a residual series (`logpci_resid`) to remove its collinearity with the time trend, so the income and time effects are not confounded. Each demand-model category is fit independently through the same pipeline, with the transform parameters stored and frozen with the fit; the deliverable forecasts are reseasonalized back to the monthly scale. The twelve monthly multipliers are held constant over the horizon, while the deseasonalized terms beneath them respond to seasonal anomalies in the climate inputs.

The model is a linear mixed-effects regression fit with R's `lme4` package: each fitting unit has its own random intercept and random slopes on the time trend, detrended income, and the deficit. The random effects are specified as uncorrelated (`lme4`'s `||` form), which drops the intercept–slope covariances; given the limited number of fitting units, this is the more stable choice and avoids over-parameterizing the random structure. This partial-pooling structure is used in place of fitting each unit its own regression, and the fitted random effects are retained in all diagnostics, forecasts, and sensitivity analyses.

For most categories, the fitting unit is the county or a partial county within the Study area. **Public supply is the exception: it is fit at the level of utility groups, not counties.** Utilities that buy and sell water to one another are merged into a single supplier group, so that wholesale water is counted once at the system that produces it rather than double-counted at both the seller and the buyer; the Ohio River and Southeast Indiana Region resolves into 39 such groups (G001–G048, with gaps where ids were retired or re-keyed). The public-supply random effects are estimated per group, and group-level demand is then allocated to counties by served population, apportioned through each group's service-area polygons, so that demand is placed where a group's customers live rather than at its intakes. Every other category is allocated by withdrawal location. Two categories bypass this regression pipeline. **Self-supplied residential** demand is computed directly rather than fit. Statewide public-water-utility service-area polygons are dissolved into a single “served” geometry, and 2020 American Community Survey block-group population (U.S. Census Bureau, 2021) is apportioned by area to each whole county and to the part of each county inside the served geometry; the difference is the unserved (private-well) population. Self-supplied demand is then the unserved population times a per-capita rate of 80 gallons per capita per day (GPCD; a conventional self-supplied domestic rate, after Dieter et al., 2018), applied uniformly across the region and converted to MGD. The served share and the per-capita rate are held constant over time, and the unserved population is carried forward with the county population projection, so the forecast scales with population alone and is spread evenly across the months. Three assumptions are worth flagging as caveats: “served” is a purely geometric test (a household inside a mapped utility boundary is counted as served whether or not it is actually connected, so it is not a utility-reported

service population); the per-capita rate is assumed, not calibrated; and service-area expansion over the fifty-year horizon is not modeled. **Energy production** is likewise handled outside the regression model as facility-level constants and announced schedules (**Section 3**).

## 2 Projecting the Future Drivers

The two socioeconomic drivers, population and per-capita income, are projected to 2070 from official county data extended with Shared Socioeconomic Pathway (SSP) scenarios.

Population is the primary driver of public supply and self-supplied residential demand. Demand is modeled on county-level time series, so population enters the fitted models at the county level. Census-block-level population is used as a spatial snapshot rather than as the modeled time series: it apportions county quantities to the sub-county units on which the analysis reports. Its main use is splitting each county into its in-project and out-of-project portions, so that for every county only the part inside the basin is counted; it also splits county results to HUC-8 watersheds and subdivides self-supplied residential demand into sub-county units.

Population is taken from the Indiana Business Research Center (IBRC) county projection through 2050. Beyond 2050, each county is extended on a single SSP scenario chosen county by county: the Socioeconomic and Data Applications Center county-level scenario (SSP1–SSP5) with the smallest error against that county’s IBRC trajectory over 2020–2050 is selected, rescaled to the county’s IBRC value at 2050, and carried forward. Because the match is made per county, the selected SSP can differ between counties (**Figures B-1** and **Figure B-2**); regional population stays roughly flat over the horizon.

Population also enters the analysis spatially, separately from the county time series on which the models are fit. Where a quantity must be resolved below the county scale, U.S. Census Bureau block-level population is apportioned by area to the target geometry. This area-apportionment splits each county into its in-project and out-of-project portions, so that only the part inside the basin is counted; it distributes county-level results to the subbasins; it separates the public-supply served population from the unserved, private-well population behind self-supplied residential; and it subdivides self-supplied residential demand into its sub-county parts. The block- counts supply this spatial snapshot, while the IBRC and SSP series above supply the change over time.

Per-capita income is the economic driver, a proxy for the commercial and industrial water use that scales with economic activity rather than with resident population. It is the primary driver of the industry sector, and it also stands in for the economic activity embedded in public supply. The ideal driver would be a direct measure of economic output such as gross domestic product (GDP) that covers both the historical and forecast period, but no such county-level GDP series exists, so per-capita income is used as the closest available proxy. It is an imperfect one: income measures residents’ earnings rather than industrial or commercial output, so it tracks this demand only loosely, a limitation made concrete in the public water supply forecast below.

Per-capita income is taken from the Bureau of Economic Analysis (BEA) county series and compounded forward at a single regional growth rate applied to every county, unlike population, which is matched county by county. SSP2-4.5 is adopted for the climate forcing because its warming matches current central estimates, but the SSP2 income figure (about 0.7 percent per year) implies a marked slowdown from the region’s long-run pace with no basis for expecting it; the central case therefore uses the

observed historical mean, about 1.44 percent per year over 1985–2023 (the same per-county income trend the model de-trends against), so projected income continues its historical trajectory rather than shifting to the lower SSP2 growth. **Figure B-3** shows the historical series against the SSP1–SSP5 growth pathways for reference.

Temperature and precipitation drive the weather-sensitive sectors, principally irrigation and, to a lesser degree, public supply. The models use derived climate predictors such as the growing-season moisture deficit rather than raw temperature and rainfall, because the deficit more directly represents the water that crops and landscapes need beyond what precipitation supplies. Historical climate comes from the observed PRISM record, and future climate comes from the downscaled (LOCA2) projections, with the central forecast driven by a single centrally positioned model, CNRM-CM6-1 under SSP2-4.5. A climate model projects the general trajectory and statistical behavior of future climate (its long-run trend and its typical year-to-year variability), not the weather of any particular calendar year. The forecasts therefore reproduce realistic year-to-year swings, but those swings represent the expected spread of conditions rather than a prediction that a given year will be wet or dry; the trend and the range are informative, while the value attached to any single year is not.

Additionally, some sectors rely on sector-specific factors that apply only to that sector. Public supply forecasts draw on utility-level information, including water-audit records of served population and use, to separate demand from withdrawal and to characterize per-customer use. Irrigated area for the agricultural irrigation model is taken from the USDA Census of Agriculture (irrigated farmland acreage, census years 2002 through 2022) and projected forward from its trend. These sector-specific inputs are introduced where they are used below.

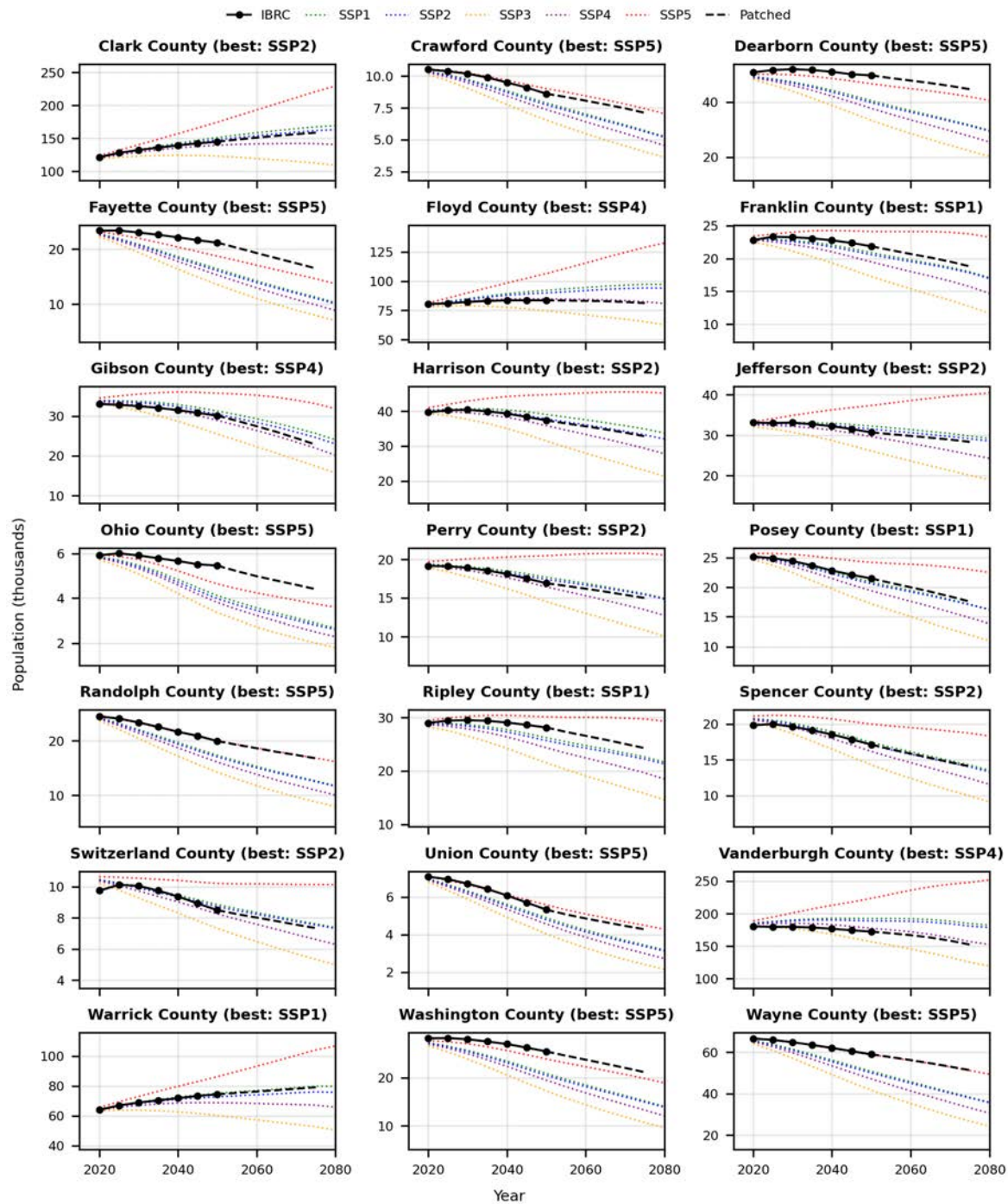


Figure B- 1. Population projection by county: the IBRC projection (solid, through 2050), the five SSP scenarios (dotted), and the selected SSP rescaled to the IBRC 2050 value and carried forward (dashed). The best-matching SSP, noted in each panel, can differ by county (page 1 of 2).

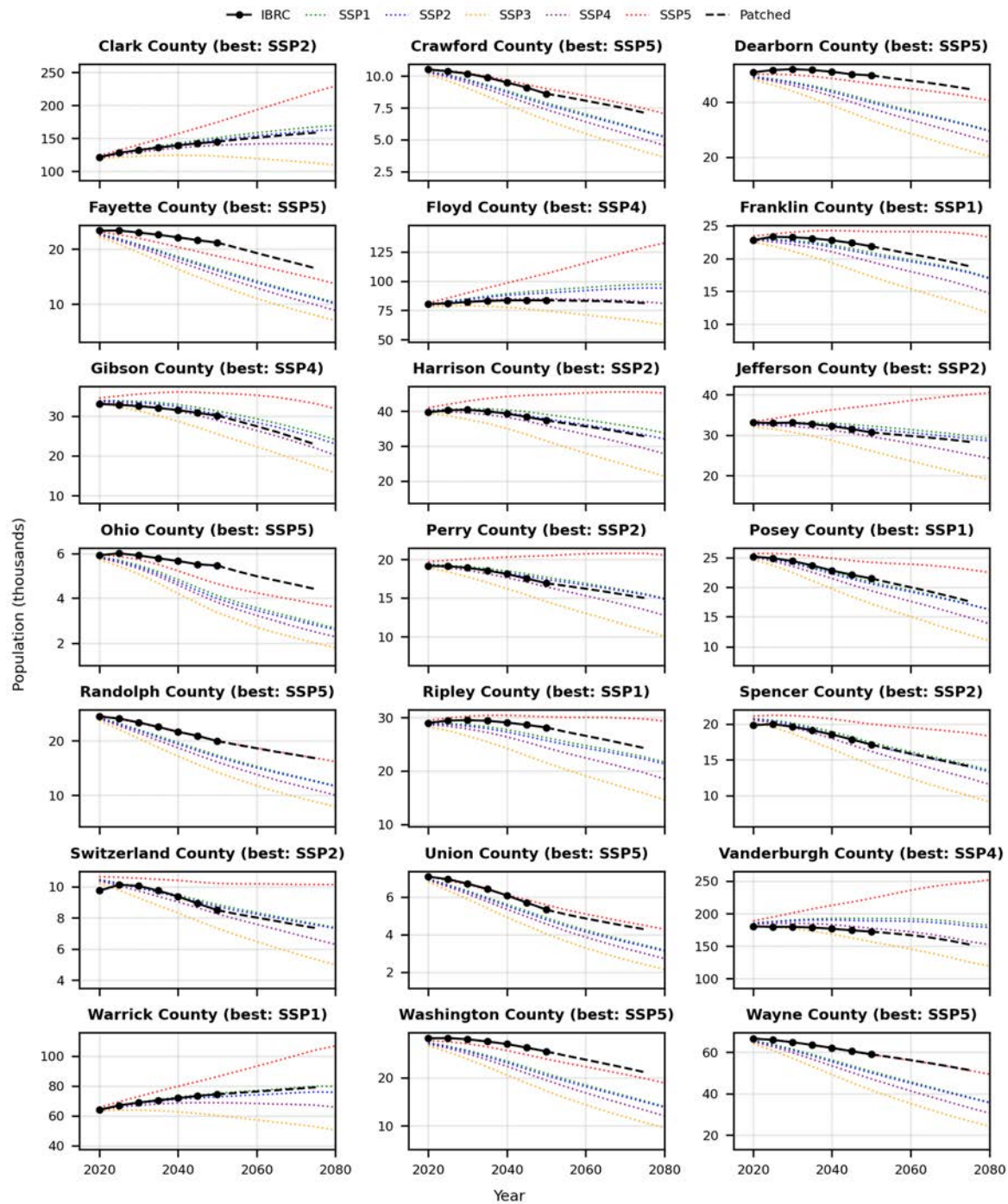


Figure B-2. Population projection by county: the IBRC projection (solid, through 2050), the five SSP scenarios (dotted), and the selected SSP rescaled to the IBRC 2050 value and carried forward (dashed). The best-matching SSP, noted in each panel, can differ by county (page 2 of 2).

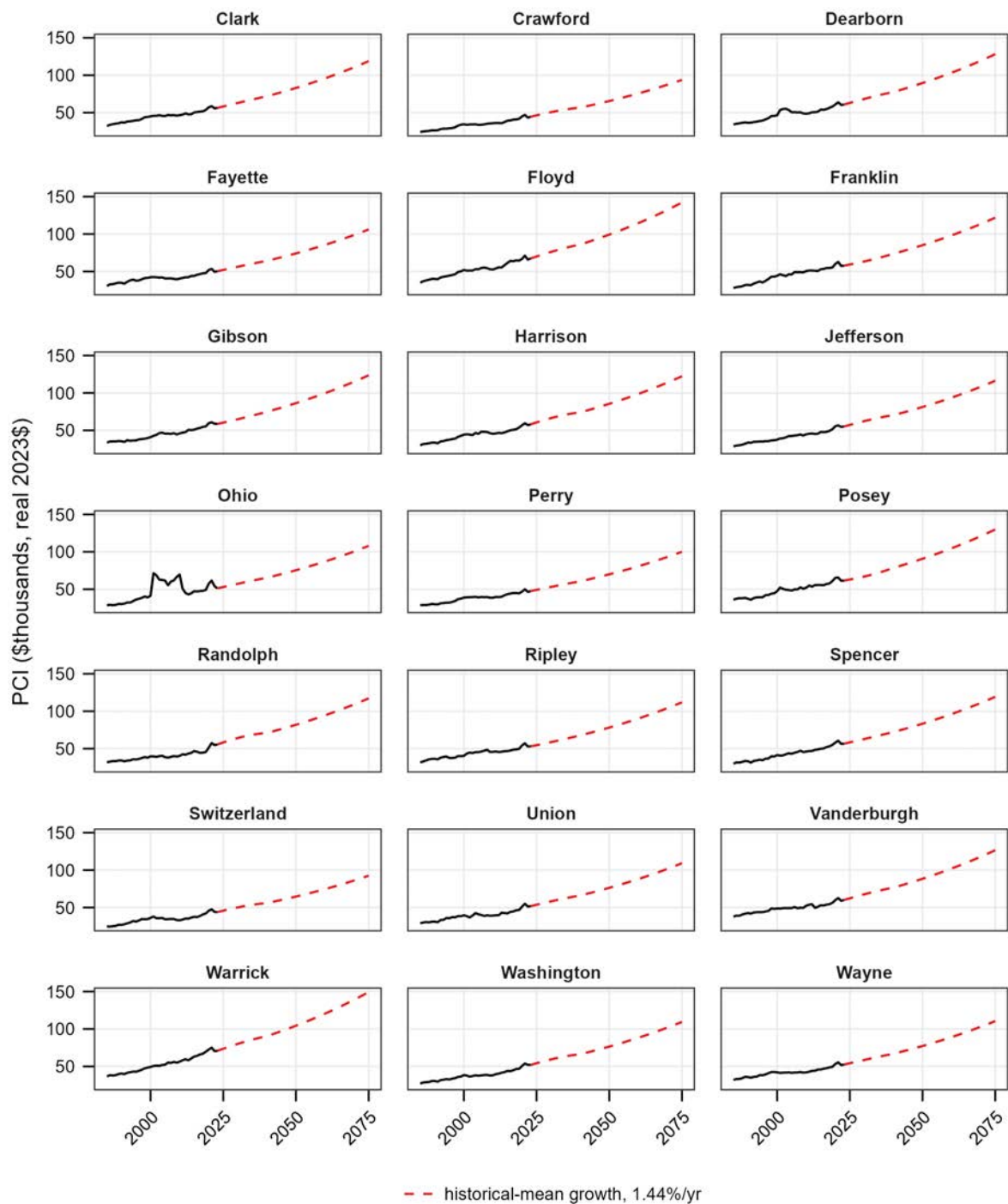


Figure B-3. Per-capita income by county: the BEA historical series with the SSP growth-rate extrapolations (SSP1-SSP5).

### 3 Model Selection

Rather than committing to a single equation, a large family of candidate models is fit for each use sector. The candidates differ in which drivers they include, how those drivers enter the model, and how demand is transformed before fitting. Working from a broad set of candidates, rather than one preferred specification, makes the eventual choice defensible and exposes how sensitive the forecast is to modeling decisions.

The candidate set is then narrowed using three screens:

- **Quality of fit.** How well the model reproduces the historical record, judged on standard goodness-of-fit measures rather than fit to any single county or year.
- **Stability.** Whether the model stays well-behaved when pushed beyond the range of the historical data. A model can fit the past closely yet produce implausible growth or collapse when extrapolated fifty years forward; such models are removed regardless of their historical fit.
- **Physical sensitivity.** Whether demand responds to changes in the drivers in the physically correct direction: for example, that demand rises with a hotter, drier growing season. This is a check on the model's overall response, not on the sign of any individual coefficient. A single physical variable can enter the model through more than one term: precipitation, for example, appears both as its own predictor and inside the moisture-deficit term. The coefficient on the standalone precipitation term can therefore carry an unexpected sign while the net response to a change in precipitation, summed across every term it feeds, is still in the correct direction. Sensitivity is therefore evaluated on the model's full response to a realistic change in conditions.

A further safeguard is applied inside the surviving models rather than as a screen. The fitted time term (demand's trend with time itself, separate from the changes driven by population, income, and climate) need not reflect any physical process, so the time term alone is held flat beyond 2030 rather than carried across the full horizon. Demand still changes after 2030 through the other drivers; only this bare time trend is capped, so that no category is projected fifty years past the observed record on the strength of a statistical time trend alone.

These screens leave a set of models that are all reasonable: they fit the history acceptably, extrapolate safely, and respond sensibly to their drivers. From that set, a single model is chosen for the reported forecast. The chosen model is not necessarily the one with the best historical fit. The aim is a model that represents the central tendency of the reasonable set, so that the reported forecast sits in the middle of what the credible models predict rather than at an optimistic or pessimistic extreme.

From the survivors, the forecast model is chosen. Goodness-of-fit is one of the selection criteria, not the only one: many specifications fit the historical record about equally well yet project very different futures, so fit alone cannot single out the model. Among the gate-surviving (kept) candidates, the study applies a central-pack rule: it first restricts to candidates whose fit (residual-scale root mean square error [RMSE]) is at least as good as the kept-set median, then selects the one whose aggregate 2070 projection is closest to the kept-set median projection, so the reported forecast is a strong fit that also sits in the body of the candidate spread rather than at an extreme. The chosen specifications are public supply `pclin_fw:main_re` (per-capita-linear, with the income term retained and a deficit-interaction climate term, group random intercept) and irrigation `palin_f:main_re` (per-capita-area-linear, which treats irrigated area as a demand scaler).

### 3.1 Accounting for Differences between Counties

Demand differs from one county to the next for reasons the drivers do not fully capture: local industry, soils, the mix of customers a utility serves, and historical patterns of use. A model fit to the whole region with a single relationship would either ignore these differences or be distorted by the largest counties.

The forecasts use a linear mixed-effects model. Such a model can be thought of as fitting one shared relationship for the region while allowing each county its own adjustment around that shared relationship. The shared part, known as the fixed effects, captures how demand responds to population, climate, and the other drivers, and is what allows the model to project into the future. The county-specific adjustment, known as the random effects, absorbs the persistent local differences in level and sensitivity so that each county's forecast starts from its own observed baseline rather than a regional average.

An alternative would be to fit a separate, independent model to each county. That is deliberately avoided. Many counties have short or sparse records and only a handful of large users, which is not enough data to estimate a county's response to climate and population on its own; fit county by county, those responses would be unstable and prone to chasing noise in the local record. The mixed model instead pools all counties to estimate the shared response, so that data-rich counties help inform data-poor ones, while still letting each county keep its own baseline. In effect it borrows strength across all counties to estimate the common response, without forcing every county to look identical.

### 3.2 Chosen-Model Specifications

The fitted models are linear mixed-effects regressions on the deseasonalized monthly series (Section 1). Both the fixed terms and the random slopes are chosen by a Bayesian Information Criterion (BIC) stepwise procedure. Each model therefore keeps only the predictors that improved the fit. Each also carries a per-unit random intercept and uncorrelated random slopes (lme4's `||` form). The region-wide base coefficients and each unit's total coefficient (base plus its random adjustment) are tabulated in **Table B- 3** through **Table B- 5**.

The predictor symbols are: `t` = time (years since 1984); `logpci_resid` = detrended log per-capita income; `deficit` = growing-season moisture deficit ( $PET - AET$ ); `w` =  $deficit \times season^2$ , the deficit-by-season interaction, and `w_lag1` its one-month lag; `season` = position within the year, bounded 0 to 1; `tmean` = mean temperature; `tmax` = mean daily maximum temperature; `ppt` = precipitation, and `ppt_lag1` its one-month lag; `pop` = served population; `ir_area` = irrigated area. Each equation also fits an intercept.

**Public supply.** Public supply is the one category fit above the county, at the level of the supplier group described in Section 1. lists every public water utility in the region: the extent of its service area, the population it serves, the places it serves, and whether it draws groundwater or surface water. Table B-2 gives the grouping itself, naming each supplier group, the utility it takes its name from, the other utilities that belong to it, and the counties they serve.

The utilities resolve into 49 supplier groups, of which 39 appear in the coefficient table. The other ten have no in-basin registered withdrawal to fit: most are small systems that withdraw nothing of their own, and a few draw from outside the region.

Withdrawal enters per capita and linearly, so the forecast follows served population directly; each group carries its own level and its own sensitivity to the drivers. The random unit is the supplier group, with random slopes on  $t$ ,  $\logpci\_resid$  and  $w$ :

$$\text{demand/pop} \sim t + \logpci\_resid + w + w\_lag1 + tmean + ppt + (1 + t + \logpci\_resid + w \mid \mid \text{group})$$

**Irrigation.** The sector is assembled from three components. No single one covers it; together they cover the 17 counties that carry in-basin irrigation withdrawal.

The mixed model is fit to four counties only, Spencer, Posey, Wayne and Franklin, the ones with an ongoing agricultural signal. It models log withdrawal per irrigated acre, on agricultural withdrawal alone, weighted by county mean demand, with a county random intercept and a random slope on season:

$$\log(\text{demand}/ir\_area) \sim \text{season} + tmax + ppt + ppt\_lag1 + (1 + \text{season} \mid \mid \text{county})$$

Vanderburgh has agricultural withdrawal as well but is held flat at its recent mean instead. Its irrigated-acreage record has three usable census points spanning an order of magnitude, so a per-acre rate there is denominator noise rather than signal.

Golf carries flat per-county levels and is the only component present in all 17 counties. Golf is about 40 percent of the sector's recent average, and most of it sits in counties with no agricultural irrigation at all. Five further counties hold registered agricultural irrigation facilities that have been dormant for a decade or more; golf carries those counties too. Farm acreage excludes golf courses, so golf is projected outside the per-acre basis and without a climate response.

**Industry.** Withdrawal, linear. This is the base behind the per-county split described below. The fixed part carries the  $\log(t):t$  interaction. The county random part includes slopes on terms that enter only as random effects, such as  $t$  and season:

$$\text{demand} \sim \log(t) + \logpci\_resid + \log(t):t + (1 + t + \log(t) + \logpci\_resid + \text{season} + \log(t):t \mid \mid \text{county})$$

Several categories are not forecast with the demand model above, because their behavior is governed by facility-level events rather than by the residential and economic drivers.

**Energy production** is the dominant category in the Region and is projected plant by plant, as facility-specific levels plus announced retirement and conversion schedules, each anchored on the plant's recent observed withdrawal (the 2019–2023 mean where available). The reason a statistical model is inappropriate is cooling-water type: once-through plants withdraw ten to a hundred times more water than recirculating (cooling-tower or cooling-pond) plants of the same capacity, because the entire condenser flow is drawn from the river and returned, so a county's energy-production withdrawal is set by which specific units are running and how they are cooled, not by any demand driver. The basin's once-through coal stations therefore carry hundreds of MGD that fall to near zero on retirement. The schedule (**Table 17** in the main text) is led by Clifty Creek in Jefferson County (once-through coal, about 1,160 MGD, operating under a power agreement to about 2040, then decommissioning through 2046), the once-through reductions at the Warrick/Culley complex (a unit retirement in 2026), the Rockport coal cessation in Spencer County (2028, with a partial gas-conversion residual), and the Gallagher ramp-down in Floyd County (retired 2021, with a declining ash-basin-closure dewatering residual to about 2028).

Three stations are held flat at small levels. Lawrenceburg in Dearborn County is a gas combined-cycle plant, still operating and contracted through 2034. Markland in Switzerland County is a hydroelectric

station with no retirement planned. Posey County is carried at a constructed 1.5 MGD. Its A.B. Brown coal units retired in October 2023, and no observed year yet reflects the site without them.

Four counties carry no in-basin energy-production withdrawal. Gibson and Pike Counties register only retired mines, and their generating stations draw from outside the basin. Vanderburgh County has had no utility-scale generating facility on the register since 2000. Wayne County's peaking plant is removed from its owner's 2023 resource plan.

**Industry** is fit with the demand model, but its county detail is handled specially. The forecast keeps the largest industrial counties individually and lumps the remaining counties into a single fitting unit; that lumped unit is then split back to its constituent counties in proportion to each county's recent five-year share of withdrawals, so every reporting county receives its own trajectory. The base specification is the linear-trend form ( $lin\_f:int\_re$ ), selected for stability: it holds its level under the 2030 trend cap rather than running away, and on counties whose industrial base has collapsed (notably Vanderburgh County, after the 2016 closure of its dominant facility) it drives demand toward zero unaided, so no separate closure overrides are imposed.

**Miscellaneous** is a small, heterogeneous category with no common driver. Withdrawals are usually related to temporary water users such as construction projects and are therefore difficult to project. It is not held at a flat constant; the Ohio River and Southeast Indiana Region record carries a modest upward trend concentrated in Dearborn County that no driver explains, so the category is projected with a custom trend store that reproduces that rise rather than a single constant. **Rural use** has two parts. The registered withdrawal is negligible and is carried as a flat post-2010 constant. Animal agriculture below the registration threshold (CAFO) is added to it, and accounts for almost all of the reported category and all its growth. CAFO demand is supplied externally as an annual county series rather than modeled here. **Self-supplied residential** is produced outside the regression model (population  $\times$  per-capita rate; **Section 1**).

Table B- 1. Public water utilities within the Ohio River and Southeast Indiana Water Region.

| Utility Name                            | Area (sq. miles) | Population Served | Density (people/sq. mile) | Towns/Places Served | Source/<br>*Purchased |
|-----------------------------------------|------------------|-------------------|---------------------------|---------------------|-----------------------|
| Aberdeen Pate Water Company, Inc.       | 121.21           | 4,787             | 39                        | Aurora              | GW                    |
| And-Tro Water Authority (PWSID 5262001) | 59.59            | 2,833             | 48                        | Tell City           | GW*                   |
| And-Tro Water Authority (PWSID 5262003) | 41.73            | 1,798             | 43                        | Tell City           | SW*                   |
| Aurora Utilities                        | 23.28            | 6,415             | 276                       | Aurora              | GW                    |
| Batesville Water Utility                | 16.88            | 7,323             | 434                       | Batesville          | SW                    |
| Birdseye Water System                   | 11.16            | 972               | 87                        | Birdseye            | SW*                   |
| Blue River Regional Water District      | 6.68             | 2,000             | 300                       | Marengo; Milltown   | GW                    |

| Utility Name                              | Area (sq. miles) | Population Served | Density (people/sq. mile) | Towns/Places Served | Source/<br>*Purchased |
|-------------------------------------------|------------------|-------------------|---------------------------|---------------------|-----------------------|
| Borden Tri-County Regional Water District | 102.84           | 11,637            | 113                       | Borden              | SW                    |
| Brookville Water Works                    | 1.97             | 2,800             | 1,422                     | Brookville          | GW                    |
| Cambridge City Municipal Water Works      | 3.98             | 1,900             | 477                       | Cambridge City      | GW                    |
| Canaan Utilities                          | 150.43           | 4,428             | 29                        | Canaan              | GW*                   |
| Cannelton Utilities                       | 3.24             | 1,658             | 511                       | Cannelton           | GW                    |
| Centerville Water Works                   | 2.11             | 2,533             | 1,203                     | Centerville         | GW                    |
| Chandler Water Works                      | 58.70            | 20,120            | 343                       | Newburgh            | GW                    |
| Charlestown Water Department              | 6.66             | 8,658             | 1,300                     | Charlestown         | GW                    |
| Chrisney Water Department                 | 8.68             | 823               | 95                        | Chrisney            | SW*                   |
| City of Boonville Utility                 | 40.69            | 10,260            | 252                       | Boonville           | GW                    |
| Connersville Utilities                    | 10.28            | 13,282            | 1,292                     | Connersville        | GW                    |
| Corydon Water Works                       | 6.93             | 5,716             | 825                       | Corydon             | GW                    |
| Crawford County Water Company, Inc.       | 55.91            | 2,678             | 48                        | Leavenworth         | GW*                   |
| Dale Water Works                          | 7.14             | 1,637             | 229                       | Dale                | SW*                   |
| Dillsboro Water Works                     | 8.06             | 2,000             | 248                       | Dillsboro           | GW*                   |
| Dublin Municipal Water Works              | 1.19             | 790               | 661                       | Dublin              | GW                    |
| Dupont Water Company                      | 91.69            | 3,865             | 42                        | Dupont              | GW*                   |
| East Washington Rural Water               | 226.50           | 8,613             | 38                        | Salem               | SW*                   |
| Edwardsville Water Corporation            | 56.73            | 10,442            | 184                       | Georgetown          | GW                    |
| Elberfeld Water Department                | 21.59            | 2,122             | 98                        | Elberfeld           | SW*                   |
| Elizabeth Water Company                   | 67.29            | 4,450             | 66                        | Elizabeth           | GW                    |
| English Water Works                       | 2.45             | 886               | 362                       | English             | SW*                   |
| Evansville Water Utility                  | 156.15           | 182,444           | 1,168                     | Evansville          | SW                    |
| Everton Water Corporation                 | 20.00            | 1,800             | 90                        | Connersville        | GW                    |
| Ferdinand Water Department                | 2.43             | 2,918             | 1,202                     | Ferdinand           | SW*                   |
| Finch Newton Water, Inc.                  | 72.48            | 2,672             | 37                        | Grandview           | SW*                   |
| Floyds Knobs Water Company, Inc.          | 10.76            | 6,100             | 567                       | Floyds Knobs        | GW*                   |
| Fort Branch Water Department              | 1.90             | 4,020             | 2,113                     | Fort Branch         | GW                    |

| Utility Name                          | Area (sq. miles) | Population Served | Density (people/sq. mile) | Towns/Places Served        | Source/<br>*Purchased |
|---------------------------------------|------------------|-------------------|---------------------------|----------------------------|-----------------------|
| Fountain City Water Works             | 0.28             | 735               | 2,634                     | Fountain City              | GW                    |
| Franklin County Water Association     | 174.23           | 8,200             | 47                        | Brookville                 | GW                    |
| Gentryville Water Utility             | 34.66            | 1,625             | 47                        | Gentryville                | SW*                   |
| Georgetown Water Department           | 5.61             | 3,605             | 643                       | Georgetown                 | GW*                   |
| German Township Water District Inc.   | 144.12           | 12,890            | 89                        | Evansville                 | SW*                   |
| Gibson Water, Inc.                    | 121.74           | 4,835             | 40                        | Haubstadt                  | SW*                   |
| Grandview Municipal Water Utility     | 0.93             | 765               | 826                       | Grandview                  | GW                    |
| Grantsburg Rural Water Company        | 2.09             | 250               | 120                       | Grantsburg                 | SW*                   |
| Greendale Utilities, City Of          | 5.17             | 5,092             | 985                       | Greendale                  | GW                    |
| Greenville Water Utility              | 12.91            | 4,920             | 381                       | Galena                     | GW*                   |
| Hagerstown Municipal Water Works      | 1.87             | 1,700             | 910                       | Hagerstown                 | GW                    |
| Hanover College                       | 0.35             | 1,250             | 3,598                     | Hanover                    | GW*                   |
| Hanover Water Department              | 1.99             | 2,597             | 1,304                     | Hanover                    | GW*                   |
| Haubstadt Water Dept.                 | 2.78             | 1,600             | 576                       | Haubstadt                  | SW*                   |
| Hogan Water Corporation               | 16.07            | 1,238             | 77                        | Mount Sinai;<br>Wilmington | GW*                   |
| Holland Water Works                   | 18.63            | 1,200             | 64                        | Holland                    | SW*                   |
| Holton Community Water Corp.          | 71.12            | 2,363             | 33                        | Holton                     | GW*                   |
| Hoosier Hills Regional Water District | 199.16           | 8,660             | 43                        | Milan                      | GW                    |
| Indiana American - Newburg            | 13.59            | 22,215            | 1,634                     | Newburgh                   | GW                    |
| Indiana American - Richmond           | 24.60            | 41,485            | 1,686                     | Richmond                   | SW                    |
| Indiana American - Southern Indiana   | 73.24            | 104,445           | 1,426                     | Jeffersonville             | GW                    |
| Indiana American - Yankeeetown        | 15.62            | 1,838             | 118                       | Yankeeetown                | GW*                   |
| Kent Water Company                    | 102.45           | 6,750             | 66                        | Madison                    | GW                    |
| L & M Regional Water District         | 1.42             | 450               | 317                       | Losantville;<br>Modoc      | GW                    |
| L.M.S. Conservancy District           | 51.25            | 5,375             | 105                       | Aurora                     | GW                    |

| Utility Name                               | Area (sq. miles) | Population Served | Density (people/sq. mile) | Towns/Places Served  | Source/<br>*Purchased |
|--------------------------------------------|------------------|-------------------|---------------------------|----------------------|-----------------------|
| Lake Santee                                | 2.18             | 1,500             | 689                       | Greensburg           | SW                    |
| Lanesville Water Works                     | 1.14             | 1,009             | 882                       | Lanesville           | GW*                   |
| Laurel Water Department                    | 0.37             | 560               | 1,499                     | Laurel               | GW                    |
| Lawrenceburg Municipal Utilities           | 9.82             | 5,000             | 509                       | Lawrenceburg         | GW                    |
| Leavenworth Water Company                  | 1.15             | 233               | 202                       | Leavenworth          | GW                    |
| Liberty Water Works                        | 6.01             | 2,133             | 355                       | Liberty              | GW                    |
| Lynn Water Company                         | 0.69             | 1,097             | 1,594                     | Lynn                 | GW                    |
| Lynnville Water Works                      | 2.65             | 1,200             | 452                       | Lynnville            | SW*                   |
| Madison Water Department                   | 16.78            | 15,323            | 913                       | Madison              | GW                    |
| Marysville Otisco Nabb Water Corp.         | 90.55            | 6,813             | 75                        | Otisco               | GW*                   |
| Milan Water Works                          | 1.92             | 1,980             | 1,033                     | Milan                | GW*                   |
| Milton Water Works                         | 0.54             | 650               | 1,202                     | Milton               | GW                    |
| Mount Vernon Water Works                   | 21.61            | 6,426             | 297                       | Mount Vernon         | SW                    |
| Napoleon Community Rural Water Corporation | 120.11           | 5,564             | 46                        | Napoleon             | SW*                   |
| New Pekin Water Utility                    | 9.49             | 2,150             | 227                       | Salem                | SW*                   |
| North Dearborn Water Authority             | 103.89           | 5,775             | 56                        | West Harrison        | GW                    |
| Oakland City Water Department              | 2.70             | 2,938             | 1,087                     | Oakland City         | SW                    |
| Oldenburg Water Works                      | 1.94             | 880               | 453                       | Laurel               | SW*                   |
| Osgood Water Department                    | 5.01             | 1,692             | 338                       | Osgood               | SW                    |
| Owensville Water Works                     | 16.21            | 2,148             | 133                       | Owensville           | GW                    |
| Palmyra Water Company                      | 37.52            | 4,425             | 118                       | Palmyra              | GW*                   |
| Patoka Lake Regional Water                 | 573.61           | 13,503            | 24                        | Dubois;<br>Loogootee | SW                    |
| Patoka Water Company, Inc.                 | 15.64            | 1,038             | 66                        | Taswell              | SW*                   |
| Patriot Water Department                   | 229.60           | 11,937            | 52                        | Patriot              | GW                    |
| Pike Gibson Water, Inc.                    | 268.00           | 10,000            | 37                        | Oakland City         | SW*                   |
| Pleasantview Water Company                 | 0.18             | 924               | 5,011                     | Connersville         | GW*                   |
| Posey Township Water Corp.                 | 95.36            | 3,500             | 37                        | Hardinsburg          | SW*                   |

| Utility Name                                       | Area (sq. miles) | Population Served | Density (people/sq. mile) | Towns/Places Served   | Source/<br>*Purchased |
|----------------------------------------------------|------------------|-------------------|---------------------------|-----------------------|-----------------------|
| Princeton Water Dept                               | 19.31            | 10,875            | 563                       | Princeton             | GW                    |
| Ramsey Water Company, Inc.                         | 141.61           | 16,475            | 116                       | Ramsey                | GW                    |
| Reo Water Corporation                              | 44.32            | 3,875             | 87                        | Richland City         | GW                    |
| Rising Sun Utilities                               | 3.98             | 2,400             | 603                       | Rising Sun            | GW                    |
| River Ridge Development Authority                  | 16.83            | 10,500            | 624                       | Charlestown           | GW                    |
| Riverside Water Company                            |                  | 2,220             |                           |                       |                       |
| Rockport Water                                     | 4.65             | 2,520             | 542                       | Rockport              | GW                    |
| Rural Membership Water Corporation of Clark Co     | 31.56            | 8,630             | 273                       | Henryville            | GW*                   |
| Ryker's Ridge Water Co, Inc.                       | 25.10            | 2,050             | 82                        | Madison               | GW*                   |
| Salem Water Works                                  | 28.69            | 8,200             | 286                       | Salem                 | SW                    |
| Santa Claus Water Utility                          | 35.93            | 3,683             | 103                       | Santa Claus           | SW*                   |
| Sellersburg Water                                  | 10.75            | 15,655            | 1,456                     | Jeffersonville        | GW                    |
| South Harrison Water Corporation                   | 172.45           | 9,057             | 53                        | Corydon               | GW                    |
| Spurgeon Water Works                               | 6.75             | 430               | 64                        | Spurgeon              | SW*                   |
| St. Henry Water Corporation                        | 66.92            | 3,293             | 49                        | Ferdinand             | SW*                   |
| St. Meinrad Utilities, Inc.                        | 1.71             | 658               | 386                       | St. Meinrad           | SW*                   |
| Stucker Fork Water Utility                         | 288.08           | 19,120            | 66                        | Austin                | SW                    |
| Sunman Water Works                                 | 3.84             | 1,058             | 276                       | Sunman                | GW                    |
| Tell City Water Department                         | 7.39             | 9,315             | 1,261                     | Tell City             | GW                    |
| Tennyson Water Utility                             | 114.59           | 4,158             | 36                        | Tennyson              | SW*                   |
| Tri-Township Water Corporation                     | 49.37            | 10,435            | 211                       | Lawrenceburg          | GW                    |
| Troy Municipal Utilities                           | 14.08            | 1,223             | 87                        | Troy                  | GW                    |
| Troy Township Water Association                    | 11.26            | 700               | 62                        | Troy Township         | GW*                   |
| Union City Water Works                             | 2.75             | 3,513             | 1,276                     | Union City            | GW                    |
| Valley Rural Utilities                             | 3.50             | 5,529             | 1,578                     | Lawrenceburg          | GW*                   |
| Versailles Water Works                             | 3.29             | 2,200             | 669                       | Versailles            | GW*                   |
| Vevay Water Department                             | 1.87             | 1,883             | 1,006                     | Vevay                 | GW                    |
| Washington Township Water Corporation of Clark Co. | 81.70            | 4,315             | 53                        | New Market;<br>Otisco | GW                    |
| Watson Rural Water Company                         | 21.62            | 15,750            | 729                       | Jeffersonville        | GW                    |

Table B- 2. Public water utility modeling group members.

| Group | Group Name                               | Utility                                  | County      | Population Served |
|-------|------------------------------------------|------------------------------------------|-------------|-------------------|
| G001  | Mount Vernon Water Works                 | Mount Vernon Water Works                 | Posey       | 8,900             |
| G002  | Evansville Water Utility                 | Cynthiana Water Works                    | Posey       | 599               |
| G002  | Evansville Water Utility                 | Elberfeld Water Department               | Warrick     | 650               |
| G002  | Evansville Water Utility                 | Evansville Water Utility                 | Vanderburgh | 182,444           |
| G002  | Evansville Water Utility                 | Fort Branch Water Department             | Gibson      | 3,800             |
| G002  | Evansville Water Utility                 | German Township Water District Inc.      | Vanderburgh | 12,890            |
| G002  | Evansville Water Utility                 | Gibson Water, Inc.                       | Gibson      | 4,750             |
| G002  | Evansville Water Utility                 | Haubstadt Water Dept.                    | Gibson      | 1,600             |
| G003  | Princeton Water Dept                     | Princeton Water Dept                     | Gibson      | 10,875            |
| G004  | Owensville Water Works                   | Owensville Water Works                   | Gibson      | 2,148             |
| G005  | Chandler Water Works                     | Chandler Water Works                     | Warrick     | 20,500            |
| G006  | Indiana American - Newburg               | Indiana American - Newburg               | Warrick     | 20,968            |
| G007  | City of Boonville Utility                | City of Boonville Utility                | Warrick     | 11,000            |
| G007  | City of Boonville Utility                | Indiana American - Yankeeetown           | Warrick     | 1,680             |
| G008  | Reo Water Corporation                    | Reo Water Corporation                    | Spencer     | 1,200             |
| G009  | Rockport Water                           | Rockport Water                           | Spencer     | 3,000             |
| G010  | American Electric Power - Rockport Plant | American Electric Power - Rockport Plant | Spencer     | 0                 |
| G011  | Troy Municipal Utilities                 | Troy Municipal Utilities                 | Perry       | 1,200             |
| G012  | Cannelton Utilities                      | Cannelton Utilities                      | Perry       | 1,658             |
| G013  | Tell City Water Department               | Tell City Water Department               | Perry       | 7,350             |
| G013  | Tell City Water Department               | Troy Township Water Association          | Perry       | 715               |
| G013  | Tell City Water Department               | Waupaca Foundry Inc.                     | Perry       |                   |
| G014  | Patoka Lake Regional Water               | And-Tro Water Authority - District 1     | Perry       | 3,130             |
| G014  | Patoka Lake Regional Water               | And-Tro Water Authority - District 2     | Perry       | 2,022             |
| G014  | Patoka Lake Regional Water               | Birdseye Water System                    | Dubois      | 972               |
| G014  | Patoka Lake Regional Water               | Chrisney Water Department                | Spencer     | 840               |

| Group | Group Name                 | Utility                                 | County   | Population Served |
|-------|----------------------------|-----------------------------------------|----------|-------------------|
| G014  | Patoka Lake Regional Water | Dale Water Works                        | Spencer  | 1,600             |
| G014  | Patoka Lake Regional Water | Department of Corrections (Branchville) | Perry    |                   |
| G014  | Patoka Lake Regional Water | Dubois Water Utilities                  | Dubois   | 10,000            |
| G014  | Patoka Lake Regional Water | Duff Water Corporation                  | Dubois   | 825               |
| G014  | Patoka Lake Regional Water | English Water Works                     | Crawford | 886               |
| G014  | Patoka Lake Regional Water | Ferdinand Water Department              | Dubois   | 17,700            |
| G014  | Patoka Lake Regional Water | Finch Newton Water, Inc.                | Spencer  | 2,300             |
| G014  | Patoka Lake Regional Water | Gentryville Water Utility               | Spencer  | 2,000             |
| G014  | Patoka Lake Regional Water | Grandview Municipal Water Utility       | Spencer  | 805               |
| G014  | Patoka Lake Regional Water | Grantsburg Rural Water Company          | Crawford | 250               |
| G014  | Patoka Lake Regional Water | Holland Water Works                     | Dubois   | 1,000             |
| G014  | Patoka Lake Regional Water | Huntingburg Municipal Water             | Dubois   | 6,490             |
| G014  | Patoka Lake Regional Water | Indiana Department of Natural Resources | Dubois   |                   |
| G014  | Patoka Lake Regional Water | Ireland Utilities, Inc                  | Dubois   | 4,300             |
| G014  | Patoka Lake Regional Water | Lynnville Water Works                   | Warrick  | 962               |
| G014  | Patoka Lake Regional Water | Oakland City Water Department           | Gibson   | 2,570             |
| G014  | Patoka Lake Regional Water | Orleans Water Works                     | Orange   | 2,500             |
| G014  | Patoka Lake Regional Water | Otwell Water Corporation #1             | Pike     | 11,240            |
| G014  | Patoka Lake Regional Water | Paoli Water Department                  | Orange   | 3,600             |
| G014  | Patoka Lake Regional Water | Patoka Lake Regional Water              | Dubois   | 13,503            |
| G014  | Patoka Lake Regional Water | Patoka Water Company, Inc.              | Crawford | 1,038             |

| Group | Group Name                           | Utility                                | County     | Population Served |
|-------|--------------------------------------|----------------------------------------|------------|-------------------|
| G014  | Patoka Lake Regional Water           | Pike Gibson Water, Inc.                | Pike       | 10,000            |
| G014  | Patoka Lake Regional Water           | Posey Township Water Corp.             | Washington | 3,500             |
| G014  | Patoka Lake Regional Water           | Santa Claus Water Utility              | Spencer    | 3,368             |
| G014  | Patoka Lake Regional Water           | Springs Valley Regional Water District | Orange     | 3,200             |
| G014  | Patoka Lake Regional Water           | Spurgeon Water Works                   | Pike       | 215               |
| G014  | Patoka Lake Regional Water           | St. Anthony Water Utility              | Dubois     | 1,800             |
| G014  | Patoka Lake Regional Water           | St. Henry Water Corporation            | Dubois     | 3,200             |
| G014  | Patoka Lake Regional Water           | St. Meinrad Utilities, Inc.            | Spencer    | 575               |
| G014  | Patoka Lake Regional Water           | Tennyson Water Utility                 | Warrick    | 4,200             |
| G014  | Patoka Lake Regional Water           | Winslow Water Works                    | Pike       | 764               |
| G015  | L & M Regional Water District        | L & M Regional Water District          | Randolph   | 450               |
| G016  | Union City Water Works               | Union City Water Works                 | Randolph   | 3,513             |
| G017  | Lynn Water Company                   | Lynn Water Company                     | Randolph   | 1,097             |
| G018  | Northeastern Wayne High School       | Northeastern Wayne High School         | Wayne      | 0                 |
| G019  | Fountain City Water Works            | Fountain City Water Works              | Wayne      | 735               |
| G020  | Indiana American - Richmond          | Indiana American - Richmond            | Wayne      | 38,175            |
| G020  | Indiana American - Richmond          | Richmond Mobile Home Park              | Wayne      | 150               |
| G021  | Centerville Water Works              | Centerville Water Works                | Wayne      | 2,707             |
| G022  | Hagerstown Municipal Water Works     | Hagerstown Municipal Water Works       | Wayne      | 1,650             |
| G023  | Cambridge City Municipal Water Works | Cambridge City Municipal Water Works   | Wayne      | 1,900             |
| G024  | Dublin Municipal Water Works         | Dublin Municipal Water Works           | Wayne      | 900               |
| G025  | Milton Water Works                   | Milton Water Works                     | Wayne      | 650               |
| G026  | Woodview Mobile Home Park            | Woodview Mobile Home Park              | Wayne      | 100               |

| Group | Group Name                               | Utility                                    | County   | Population Served |
|-------|------------------------------------------|--------------------------------------------|----------|-------------------|
| G027  | St. Jude Village Water Corporation       | St. Jude Village Water Corporation         | Fayette  | 38                |
| G028  | Connersville Utilities                   | Connersville Utilities                     | Fayette  | 13,298            |
| G028  | Connersville Utilities                   | Pleasantview Water Company                 | Fayette  | 600               |
| G029  | Liberty Water Works                      | Liberty Water Works                        | Union    | 2,133             |
| G030  | Liberty Country Club-Housing Development | Liberty Country Club-Housing Development   | Union    | 34                |
| G031  | Franklin County Water Association        | Franklin County Water Association          | Franklin | 9,802             |
| G031  | Franklin County Water Association        | Heritage Hills Campground                  | Union    | 525               |
| G032  | Brookville Water Works                   | Brookville Water Works                     | Franklin | 2,600             |
| G033  | Laurel Water Department                  | Laurel Water Department                    | Franklin | 560               |
| G034  | Everton Water Corporation                | Everton Water Corporation                  | Fayette  | 1,800             |
| G035  | Hoosier Hills Regional Water District    | Holton Community Water Corp.               | Ripley   | 950               |
| G035  | Hoosier Hills Regional Water District    | Hoosier Hills Regional Water District      | Ripley   | 14,951            |
| G035  | Hoosier Hills Regional Water District    | Lake Santee RWW                            | Decatur  | 1,500             |
| G035  | Hoosier Hills Regional Water District    | Milan Water Works                          | Ripley   | 1,980             |
| G035  | Hoosier Hills Regional Water District    | Napoleon Community Rural Water Corporation | Ripley   | 4,899             |
| G035  | Hoosier Hills Regional Water District    | Newhart Water Hauling                      | Ripley   |                   |
| G035  | Hoosier Hills Regional Water District    | Osgood Water Department                    | Ripley   | 1,620             |
| G035  | Hoosier Hills Regional Water District    | Sunman Water Works                         | Ripley   | 1,058             |
| G035  | Hoosier Hills Regional Water District    | Versailles Water Works                     | Ripley   | 1,784             |
| G036  | Batesville Water Utility                 | Batesville Water Utility                   | Ripley   | 7,300             |
| G036  | Batesville Water Utility                 | Oldenburg Water Works                      | Franklin | 880               |
| G037  | Tri-Township Water Corporation           | Aurora Utilities                           | Dearborn | 3,825             |
| G037  | Tri-Township Water Corporation           | Dillsboro Water Works                      | Dearborn | 2,000             |
| G037  | Tri-Township Water Corporation           | Greendale Utilities, City Of               | Dearborn | 5,092             |

| Group | Group Name                     | Utility                                        | County              | Population Served |
|-------|--------------------------------|------------------------------------------------|---------------------|-------------------|
| G037  | Tri-Township Water Corporation | Hogan Water Corporation                        | Dearborn            | 1,270             |
| G037  | Tri-Township Water Corporation | L.M.S. Conservancy District                    | Dearborn            | 5,325             |
| G037  | Tri-Township Water Corporation | Lawrenceburg Municipal Utilities               | Dearborn            | 5,000             |
| G037  | Tri-Township Water Corporation | North Dearborn Water Corporation               | Dearborn            | 5,600             |
| G037  | Tri-Township Water Corporation | Tri-Township Water Corporation                 | Dearborn            | 10,000            |
| G037  | Tri-Township Water Corporation | Twin Rivers Water Co.                          | Out of state (Ohio) |                   |
| G037  | Tri-Township Water Corporation | Valley Rural Utilities                         | Dearborn            | 5,000             |
| G038  | Rising Sun Utilities           | Rising Sun Utilities                           | Ohio                | 2,400             |
| G039  | Patriot Water Department       | Aberdeen Pate Water Company, Inc.              | Ohio                | 4,787             |
| G039  | Patriot Water Department       | Patriot Water Department                       | Switzerland         | 10,000            |
| G040  | Vevay Water Department         | Vevay Water Department                         | Switzerland         | 1,800             |
| G041  | Madison Water Department       | Canaan Utilities                               | Jefferson           | 4,500             |
| G041  | Madison Water Department       | Dupont Water Company                           | Jennings            | 3,865             |
| G041  | Madison Water Department       | Hanover College                                | Jefferson           | 1,250             |
| G041  | Madison Water Department       | Hanover Water Department                       | Jefferson           | 2,597             |
| G041  | Madison Water Department       | Kent Water Company                             | Jefferson           | 5,400             |
| G041  | Madison Water Department       | Madison Water Department                       | Jefferson           | 15,270            |
| G041  | Madison Water Department       | Ryker's Ridge Water Co, Inc.                   | Jefferson           | 2,000             |
| G042  | Salem Water Works              | East Washington Rural Water                    | Washington          | 8,458             |
| G042  | Salem Water Works              | New Pekin Water Utility                        | Washington          | 1,975             |
| G042  | Salem Water Works              | Salem Water Works                              | Washington          | 8,200             |
| G043  | Peek A Boo Lake (Spring)       | Peek A Boo Lake (Spring)                       | Washington          | 0                 |
| G044  | Stucker Fork Water Utility     | Marysville Otisco Nabb Water Corp.             | Clark               | 6,620             |
| G044  | Stucker Fork Water Utility     | Rural Membership Water Corporation of Clark Co | Clark               | 8,630             |

| Group | Group Name                          | Utility                                            | County   | Population Served |
|-------|-------------------------------------|----------------------------------------------------|----------|-------------------|
| G044  | Stucker Fork Water Utility          | Stucker Fork Water Utility                         | Scott    | 21,500            |
| G044  | Stucker Fork Water Utility          | Washington Township Water Corporation of Clark Co. | Clark    | 4,315             |
| G045  | Indiana American - Southern Indiana | Borden Tri-County Regional Water District          | Clark    | 11,310            |
| G045  | Indiana American - Southern Indiana | Charlestown Water Department                       | Clark    | 7,430             |
| G045  | Indiana American - Southern Indiana | Edwardsville Water Corporation                     | Floyd    | 10,442            |
| G045  | Indiana American - Southern Indiana | Floyds Knobs Water Company, Inc.                   | Floyd    | 7,909             |
| G045  | Indiana American - Southern Indiana | Greenville Water Utility                           | Floyd    | 4,850             |
| G045  | Indiana American - Southern Indiana | Indiana American - Southern Indiana                | Clark    | 80,393            |
| G045  | Indiana American - Southern Indiana | Lanesville Water Works                             | Harrison | 1,013             |
| G045  | Indiana American - Southern Indiana | River Ridge Development Authority                  | Clark    | 0                 |
| G045  | Indiana American - Southern Indiana | Riverside Water Company                            | Clark    | 2,220             |
| G045  | Indiana American - Southern Indiana | Sellersburg Water Department                       | Clark    | 15,655            |
| G045  | Indiana American - Southern Indiana | Watson Rural Water Company                         | Clark    | 15,750            |
| G046  | Blue River Regional Water District  | Blue River Regional Water District                 | Crawford | 2,000             |
| G047  | Crawford County Water Company, Inc. | Crawford County Water Company, Inc.                | Crawford | 2,580             |
| G047  | Crawford County Water Company, Inc. | Leavenworth Water Company                          | Crawford | 242               |
| G048  | Ramsey Water Company, Inc.          | Corydon Water Works                                | Harrison | 7,000             |
| G048  | Ramsey Water Company, Inc.          | Elizabeth Water Company                            | Harrison | 4,450             |
| G048  | Ramsey Water Company, Inc.          | Georgetown Water Department                        | Floyd    | 3,408             |
| G048  | Ramsey Water Company, Inc.          | Indiana Department of Natural Resources            | Harrison |                   |
| G048  | Ramsey Water Company, Inc.          | Palmyra Water Company                              | Harrison | 4,425             |

| Group | Group Name                     | Utility                          | County   | Population Served |
|-------|--------------------------------|----------------------------------|----------|-------------------|
| G048  | Ramsey Water Company, Inc.     | Ramsey Water Company, Inc.       | Harrison | 15,150            |
| G048  | Ramsey Water Company, Inc.     | South Harrison Water Corporation | Harrison | 8,732             |
| G049  | Indiana American - Rivers Edge | Indiana American - Rivers Edge   | Clark    | 610               |

Table B- 3. Public supply model equation coefficients.

| Utility Group      | Intercept       | Years Since 1984: (t) | Log Of Per-Capita Income: (logpci_resid) | Deficit-By-Season Interaction : (w) | Deficit One-Month Lag: (w_lag1) | Mean Temperature (tmean) | Precipitation (ppt) |
|--------------------|-----------------|-----------------------|------------------------------------------|-------------------------------------|---------------------------------|--------------------------|---------------------|
| <b>Region Wide</b> | <b>118.3378</b> | <b>-0.1261</b>        | <b>55.4050</b>                           | <b>5.9726</b>                       | <b>3.0554</b>                   | <b>-0.1539</b>           | <b>0.0178</b>       |
| <b>G001</b>        | 172.4816        | 4.5140                | 248.7767                                 | 7.0267                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G002</b>        | 163.2080        | -1.3026               | 32.6718                                  | 7.1470                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G005</b>        | 81.1088         | 0.1817                | 42.8835                                  | 5.8075                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G006</b>        | 76.2979         | 1.0851                | -95.0303                                 | 7.1538                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G007</b>        | 185.7089        | -2.2168               | -59.9399                                 | 4.5533                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G008</b>        | 43.9091         | 0.9279                | 58.5210                                  | 5.5460                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G009</b>        | 124.6657        | -0.8640               | -19.7734                                 | 5.5916                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G011</b>        | 118.0485        | 0.1749                | 33.8558                                  | 5.7106                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G012</b>        | 142.4235        | -1.1240               | 180.9167                                 | 5.9860                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G013</b>        | 149.8392        | 0.1432                | 57.2638                                  | 3.9272                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G014</b>        | 59.7618         | 1.5003                | 184.1909                                 | 6.6142                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G016</b>        | 112.9016        | 2.1959                | 149.1770                                 | 5.5930                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G017</b>        | 93.9828         | -0.5941               | -55.1636                                 | 5.7860                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G019</b>        | 87.4053         | -0.5248               | -12.5004                                 | 5.8472                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G020</b>        | 139.8167        | -0.3944               | 159.1018                                 | 7.1773                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G021</b>        | 81.8480         | 0.0330                | 68.4134                                  | 5.7196                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G022</b>        | 236.5119        | -2.1505               | 384.3730                                 | 6.1347                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G023</b>        | 226.1577        | -3.4527               | -67.1939                                 | 6.2062                              | 3.0554                          | -0.1539                  | 0.0178              |
| <b>G024</b>        | 160.3449        | -1.3544               | 102.6033                                 | 5.9368                              | 3.0554                          | -0.1539                  | 0.0178              |

| Utility Group | Intercept | Years Since 1984: (t) | Log Of Per-Capita Income: (logpci_resid) | Deficit-By-Season Interaction : (w) | Deficit One-Month Lag: (w_lag1) | Mean Temperature (tmean) | Precipitation (ppt) |
|---------------|-----------|-----------------------|------------------------------------------|-------------------------------------|---------------------------------|--------------------------|---------------------|
| G025          | 73.4849   | -0.2734               | -48.5593                                 | 6.1123                              | 3.0554                          | -0.1539                  | 0.0178              |
| G028          | 249.0076  | -3.1222               | 62.3879                                  | 7.2224                              | 3.0554                          | -0.1539                  | 0.0178              |
| G029          | 81.6446   | 2.2183                | 2.4182                                   | 5.9694                              | 3.0554                          | -0.1539                  | 0.0178              |
| G031          | 66.0470   | -0.1279               | 132.8858                                 | 6.2227                              | 3.0554                          | -0.1539                  | 0.0178              |
| G032          | 134.3273  | -0.8653               | -117.6358                                | 6.4817                              | 3.0554                          | -0.1539                  | 0.0178              |
| G033          | 136.2671  | 0.5060                | 29.6767                                  | 6.0529                              | 3.0554                          | -0.1539                  | 0.0178              |
| G034          | 52.4339   | 0.6749                | 25.2435                                  | 5.7047                              | 3.0554                          | -0.1539                  | 0.0178              |
| G035          | 52.9894   | 1.0824                | 48.9207                                  | 6.6786                              | 3.0554                          | -0.1539                  | 0.0178              |
| G036          | 186.7579  | -2.1078               | 209.2333                                 | 7.2867                              | 3.0554                          | -0.1539                  | 0.0178              |
| G037          | 87.8585   | 0.7340                | -47.0340                                 | 9.0008                              | 3.0554                          | -0.1539                  | 0.0178              |
| G038          | 130.4701  | -0.2434               | 49.6675                                  | 6.3921                              | 3.0554                          | -0.1539                  | 0.0178              |
| G039          | 58.7466   | 0.7674                | 43.3833                                  | 5.0070                              | 3.0554                          | -0.1539                  | 0.0178              |
| G040          | 135.4853  | -0.7684               | 96.7437                                  | 5.9085                              | 3.0554                          | -0.1539                  | 0.0178              |
| G041          | 131.1004  | -1.0987               | 97.9209                                  | 6.9770                              | 3.0554                          | -0.1539                  | 0.0178              |
| G042          | 98.9358   | 0.2511                | -88.7340                                 | 3.9485                              | 3.0554                          | -0.1539                  | 0.0178              |
| G044          | 69.0909   | 0.6686                | 78.6264                                  | 2.3802                              | 3.0554                          | -0.1539                  | 0.0178              |
| G045          | 121.8116  | 0.1915                | 8.3902                                   | 6.7148                              | 3.0554                          | -0.1539                  | 0.0178              |
| G046          | 61.8835   | 0.5377                | -56.3229                                 | 5.2988                              | 3.0554                          | -0.1539                  | 0.0178              |
| G047          | 134.6330  | -0.5715               | 183.9038                                 | 5.6697                              | 3.0554                          | -0.1539                  | 0.0178              |
| G048          | 95.7779   | -0.1490               | 56.5322                                  | 4.4363                              | 3.0554                          | -0.1539                  | 0.0178              |

Table B- 4. Irrigation model equation coefficients.

| County                    | Intercept      | Season         | Maximum Temperature: (tmax) | Precipitation: (ppt) | Precipitation One Month Lag: (ppt_lag1) |
|---------------------------|----------------|----------------|-----------------------------|----------------------|-----------------------------------------|
| <i>Base (region-wide)</i> | <b>-8.4507</b> | <b>-1.3876</b> | <b>0.0784</b>               | <b>-0.0028</b>       | <b>-0.0046</b>                          |
| Franklin                  | -8.6726        | -1.4222        | 0.0784                      | -0.0028              | -0.0046                                 |
| Posey                     | -10.9385       | -0.7772        | 0.0784                      | -0.0028              | -0.0046                                 |
| Spencer                   | -5.3833        | -2.3945        | 0.0784                      | -0.0028              | -0.0046                                 |
| Wayne                     | -8.8083        | -0.9566        | 0.0784                      | -0.0028              | -0.0046                                 |

Table B- 5. Industry model equation coefficients.

| County                    | Intercept     | Years Since 1984: (t) | Season        | Log of Years: log(t) | Log Of Per-Capita Income: (logpci_resid) | log(t):t      |
|---------------------------|---------------|-----------------------|---------------|----------------------|------------------------------------------|---------------|
| <b>Base (region-wide)</b> | <b>2.0925</b> | <b>0.0000</b>         | <b>0.0000</b> | <b>2.3924</b>        | <b>-0.9575</b>                           | <b>0.1528</b> |
| Clark                     | -1.7907       | -1.6620               | -0.0626       | 9.2828               | -22.2295                                 | 0.2615        |
| Crawford                  | 3.3621        | -0.9316               | 0.0018        | 2.9084               | 9.3923                                   | 0.1991        |
| Dearborn                  | 9.7400        | -0.8243               | -0.0116       | -0.4117              | -7.4975                                  | 0.2566        |
| Floyd                     | 0.4052        | -0.6319               | -0.0079       | 1.7148               | -0.6913                                  | 0.1291        |
| Other Counties            | 1.5955        | -0.8178               | -0.0019       | 1.5257               | 3.7606                                   | 0.1913        |
| Perry                     | -0.0162       | 0.0591                | -0.0067       | 0.3024               | 3.9881                                   | -0.0096       |
| Posey                     | 6.0195        | -0.9192               | -0.0042       | 3.5723               | 3.7663                                   | 0.1738        |
| Switzerland               | -0.7108       | 0.4036                | 0.9771        | 0.6377               | -4.3751                                  | -0.1233       |
| Vanderburgh               | -0.7384       | 0.2739                | -0.0118       | 0.3928               | -1.9810                                  | -0.0764       |
| Wayne                     | 3.0586        | -2.2040               | -0.0069       | 3.9992               | 6.2923                                   | 0.5255        |

## 4 Climate Forcing

Historical demand is driven by observed PRISM climate (PRISM Climate Group, Oregon State University), which provides the most accurate climate forcing for the historical period. The forecast is driven by an ensemble of global climate models (GCMs), statistically downscaled to the region by the Localized Constructed Analogs method (LOCA2; Pierce et al., 2023). The central forecast uses one of them, CNRM-CM6-1, under SSP2-4.5.

CNRM-CM6-1 is a central, not extreme, choice for the Region. It ranks near the front of the 24-model SSP2-4.5 ensemble on mean distance to the ensemble warm-mean across the project counties (second of 24) and carries the closest growing-season-deficit trend to the observed PRISM record, while sitting near the ensemble center across all three pairwise views of the projected growing-season climate (**Figure B-4** to **Figure B-6**): moisture deficit against temperature, precipitation against temperature, and precipitation against deficit. The circles in each legend are alternative ensemble averages: the plain 24-model mean, a mean weighted toward the models that reproduce observed climate best, and two means restricted to models in the IPCC likely and very likely climate-sensitivity ranges. CNRM-CM6-1 is the red star.

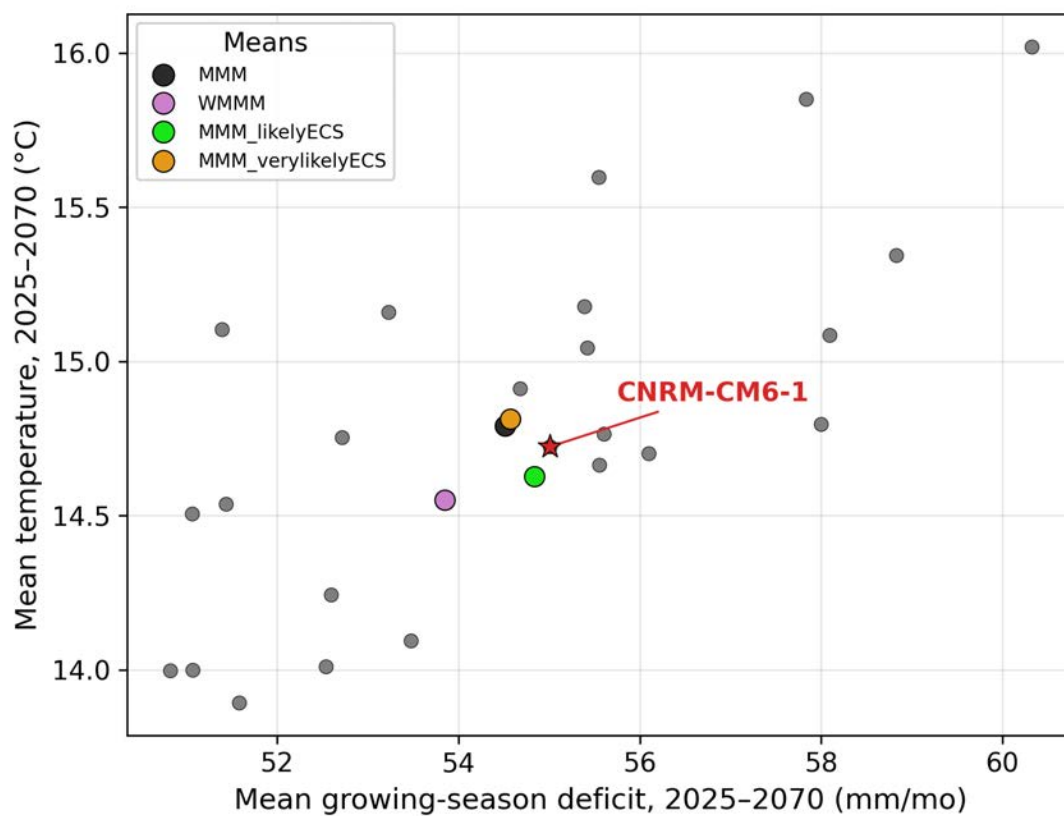


Figure B-4. Growing-season mean moisture deficit versus mean temperature (2025-2075) across the 24-model SSP2-4.5 GCM ensemble; the chosen model CNRM-CM6-1 (red star) sits near the center.

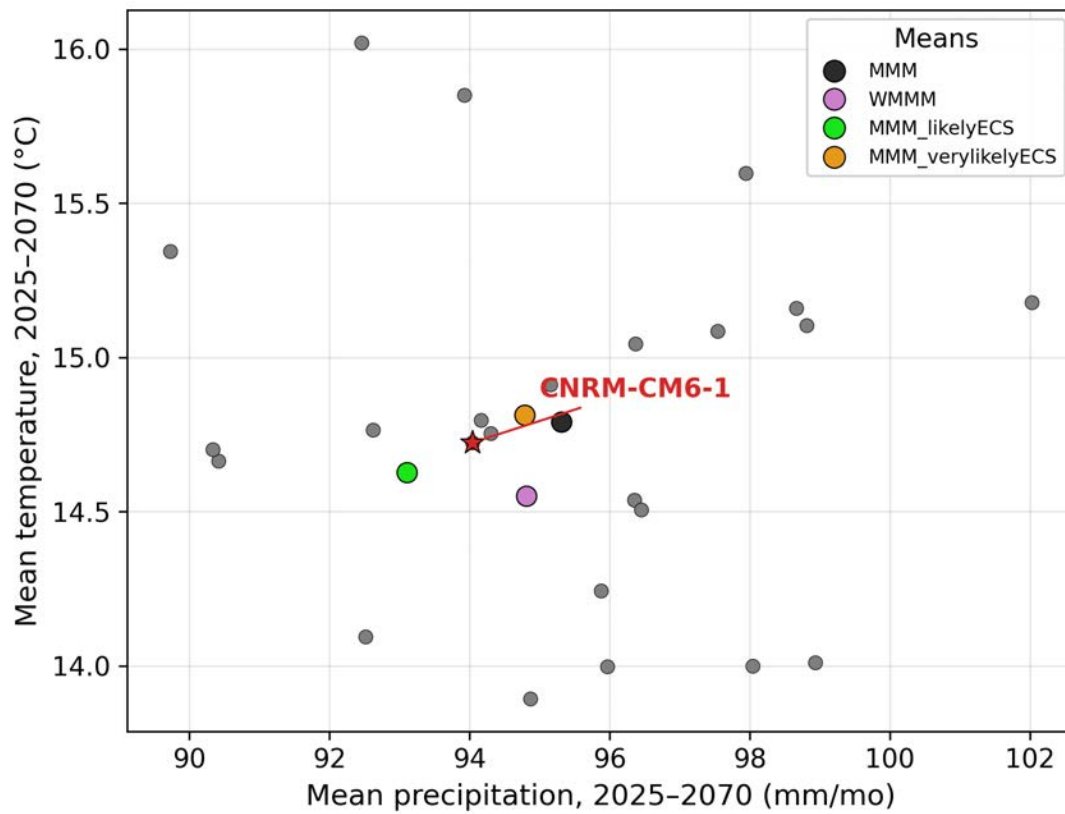


Figure B-5. Growing-season mean precipitation versus mean temperature (2025–2075) across the SSP2-4.5 GCM ensemble; CNRM-CM6-1 (red star) is near the center on both axes.

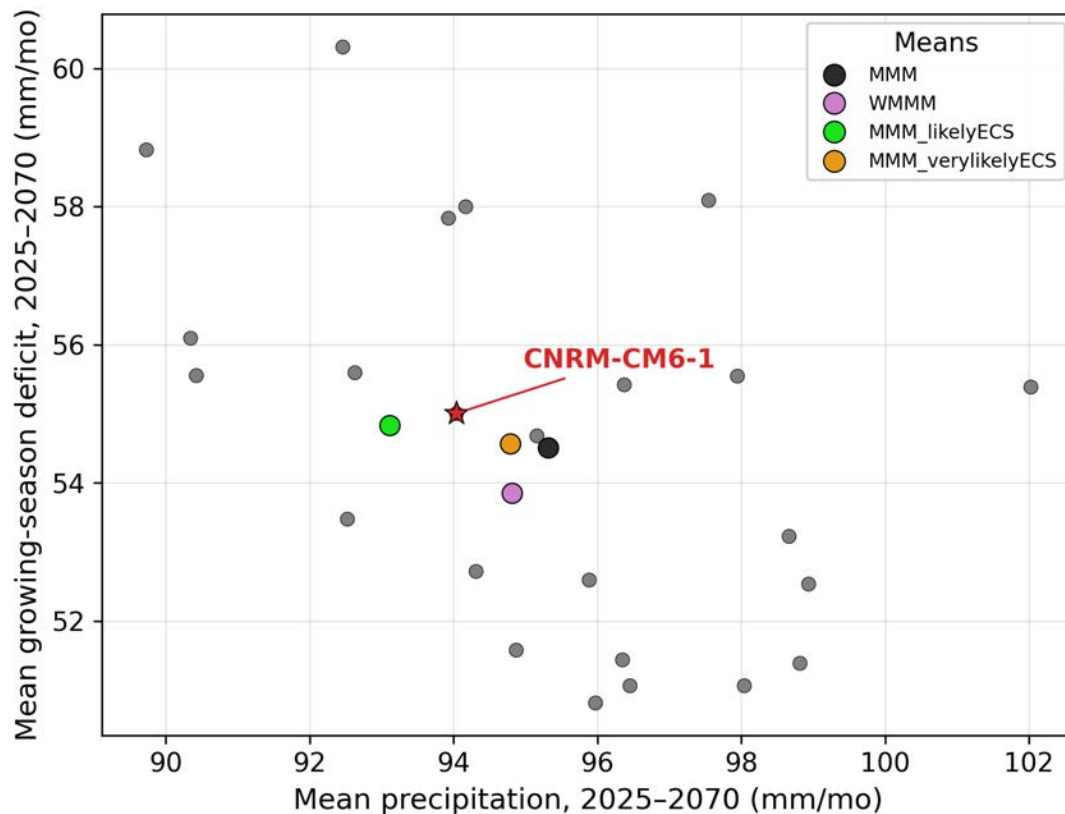


Figure B-6. Growing-season mean precipitation versus mean moisture deficit (2025–2075) across the SSP2-4.5 GCM ensemble; CNRM-CM6-1 (red star) is central on the deficit axis.

## 4.1 The Observed-to-Projected Splice

The historical period is forced with PRISM and the forecast with the GCM, so the join between them must not introduce a spurious jump. For the population-driven categories, the splice is innocuous: replacing direct GCM forcing with a delta-change forcing (observed climatology plus the GCM anomaly) moves their demand by a fraction of a percent, because they respond only weakly to climate anomalies once the seasonal cycle is removed.

For irrigation, the splice matters in principle, because irrigation responds steeply to the growing-season moisture deficit and the bias-corrected GCM ensemble tends to project a steeper growing-season warming-and-drying trend than the observed record shows: quantile-mapping bias correction anchors each model's distribution to observations over the training window but preserves the model's own trend (Cannon et al., 2015), and the region's observed summers have warmed less than global models reproduce (the U.S. Midwest "warming hole," attributed to twentieth-century cropland intensification; Mueller et al., 2016; Nikiel and Eltahir, 2019). In the Region, however, irrigation is a very small sector (a few MGD), so any splice-driven amplification of its trend has little effect on the regional total; and the larger limitation on the irrigation forecast is the reporting-coverage issue discussed in the main text

rather than the climate splice. The caveat is therefore noted but is second-order for this basin (Hausfather et al., 2022).

## 5 Monthly Withdrawal Forecasts by Category

The headline forecasts in the main report are annual averages. The monthly resolution that underlies them is shown here for each category, as the regional total and by county (history on observed PRISM climate, forecast on the chosen GCM, 1985–2070). The within-year seasonal cycle and its year-to-year variability are most pronounced in the weather-sensitive categories (**Figure B-6** through **Figure B-21**).

Public supply is modelled at the utility group rather than the county, and a group is not confined to the Region: its figures show the group's whole withdrawal, including water delivered to customers outside the Study area. Public supply is also the only category in which withdrawal and demand differ, withdrawal being taken at the wells and intakes while demand is placed where the customers live; every other category uses its water where it is withdrawn, so for those the two are the same quantity.

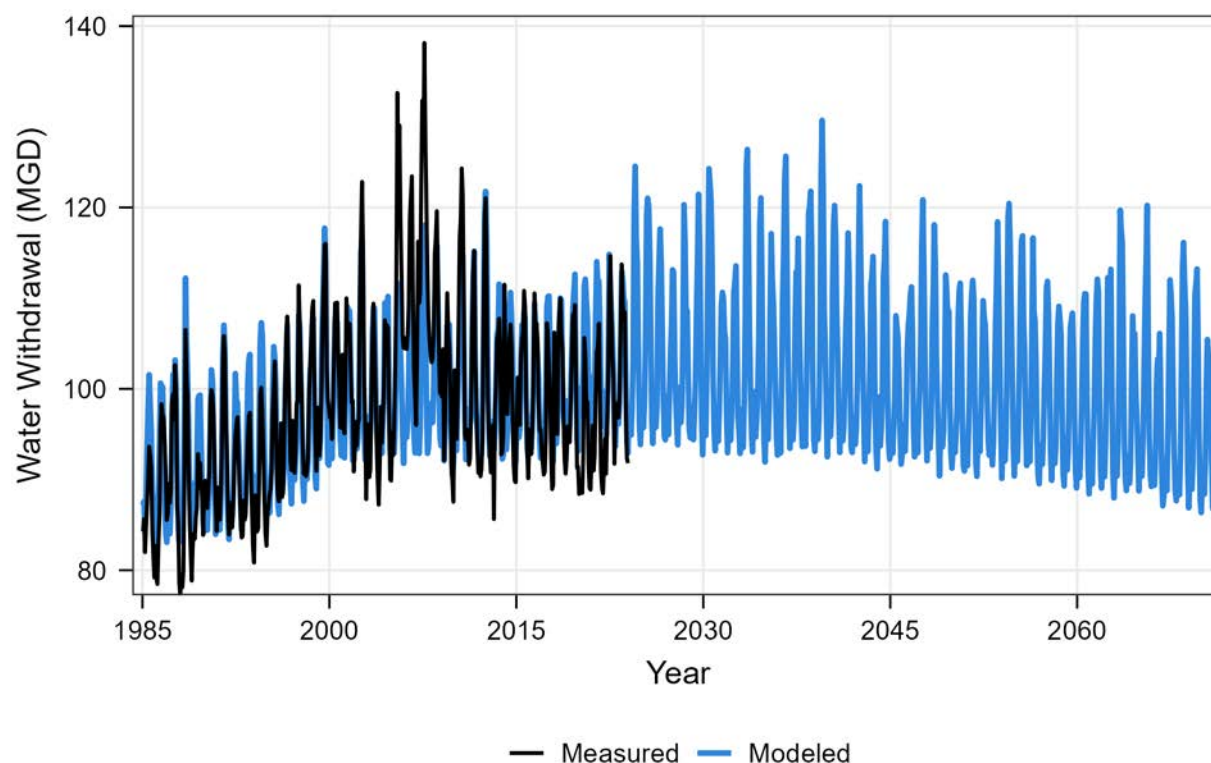


Figure B-7. Monthly public-supply withdrawal (MGD), regional total, 1985–2070.

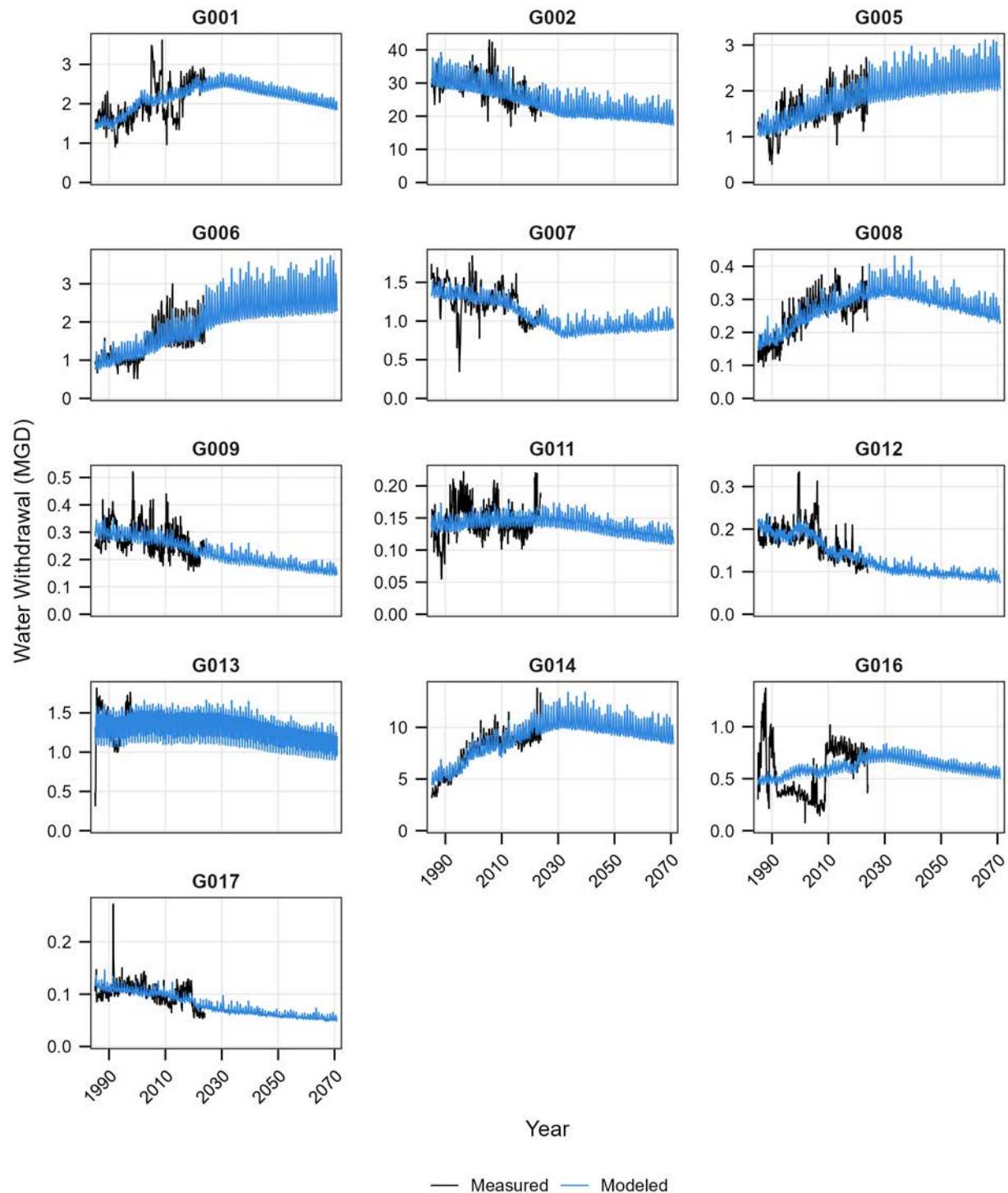


Figure B-8. Monthly public-supply withdrawal (MGD) by utility group, 1985–2070 (page 1 of 3).

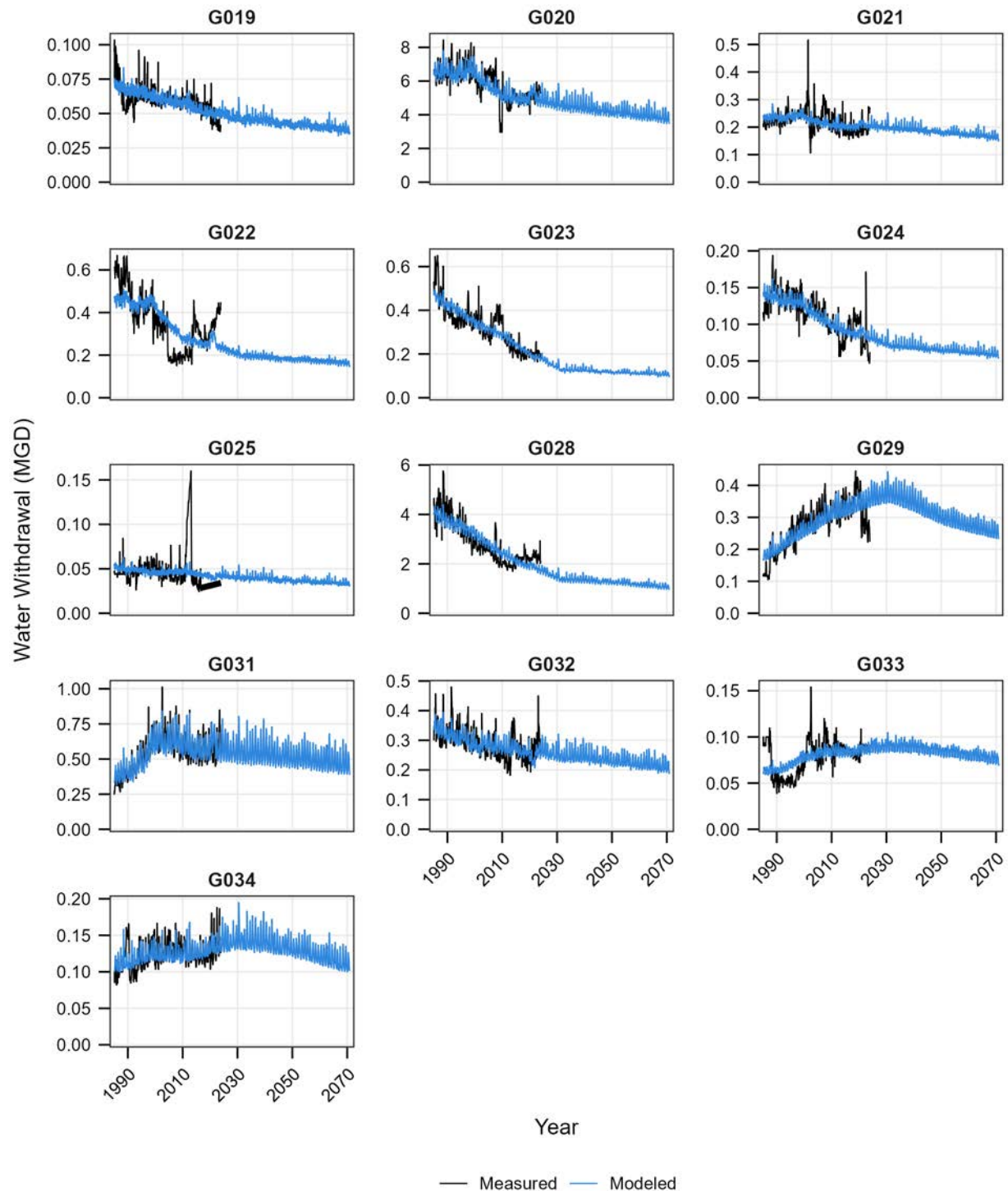


Figure B-9. Monthly public-supply withdrawal (MGD) by utility group (page 2 of 3).

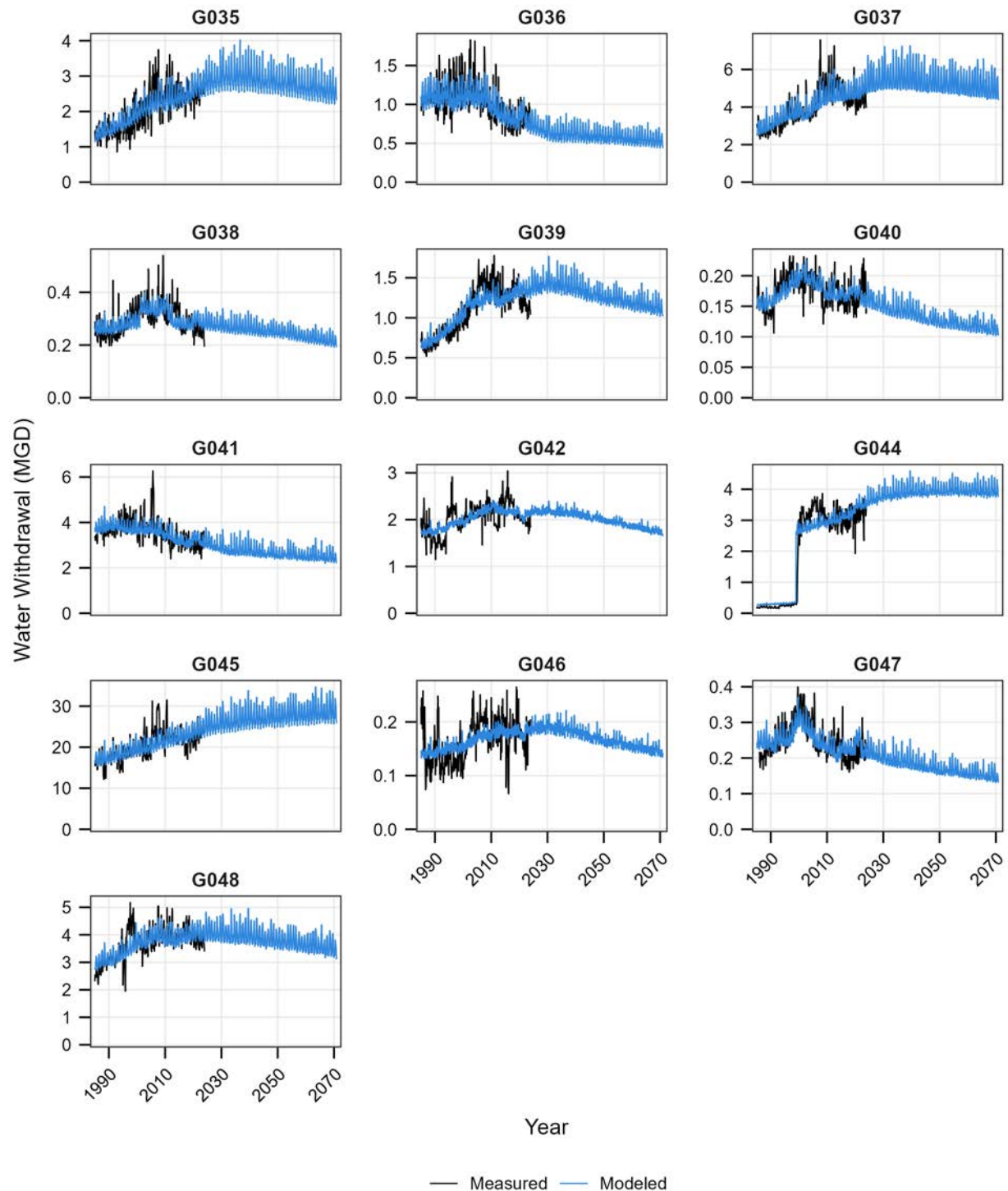


Figure B-10. Monthly public-supply withdrawal (MGD) by utility group (page 3 of 3).

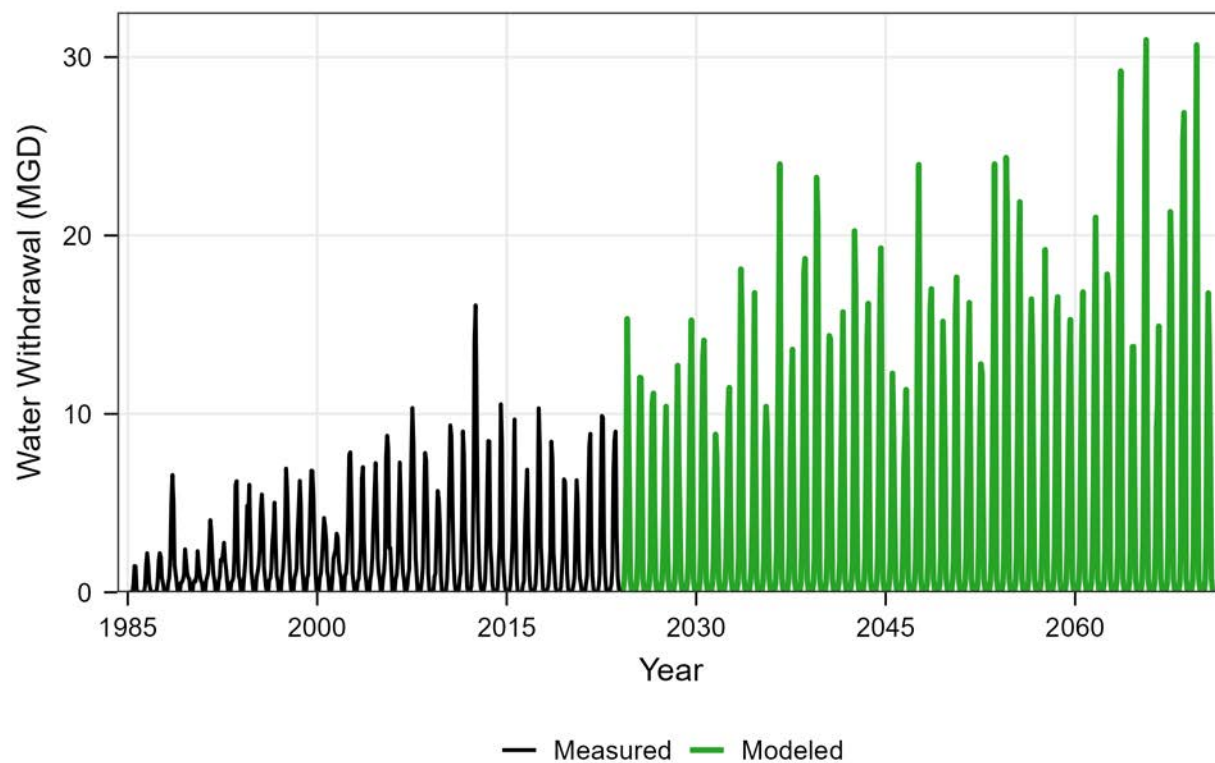


Figure B-11. Monthly irrigation withdrawal (MGD), regional total, 1985–2070.

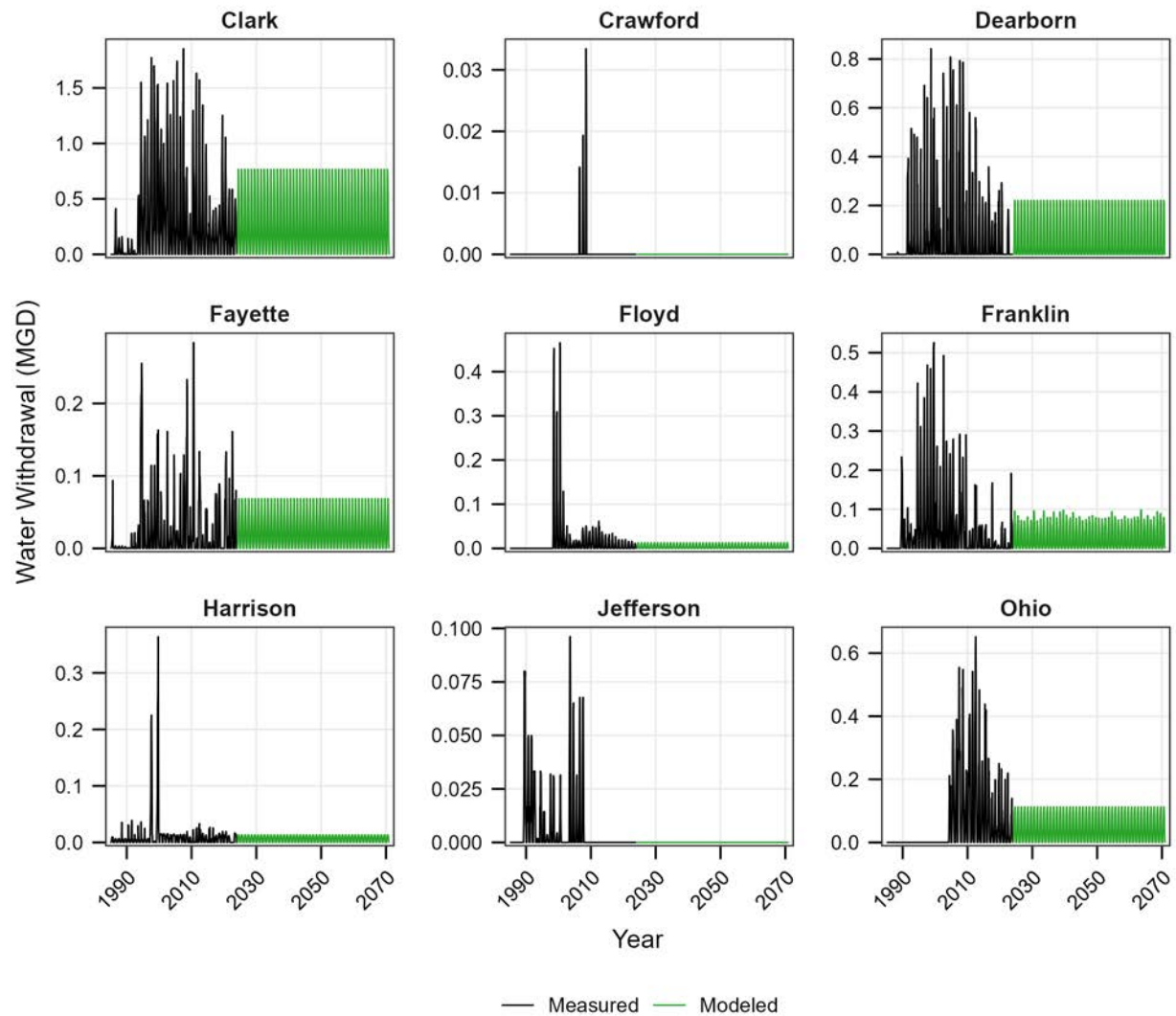


Figure B-12. Monthly irrigation withdrawal (MGD) by county, 1985–2070 (page 1 of 2).

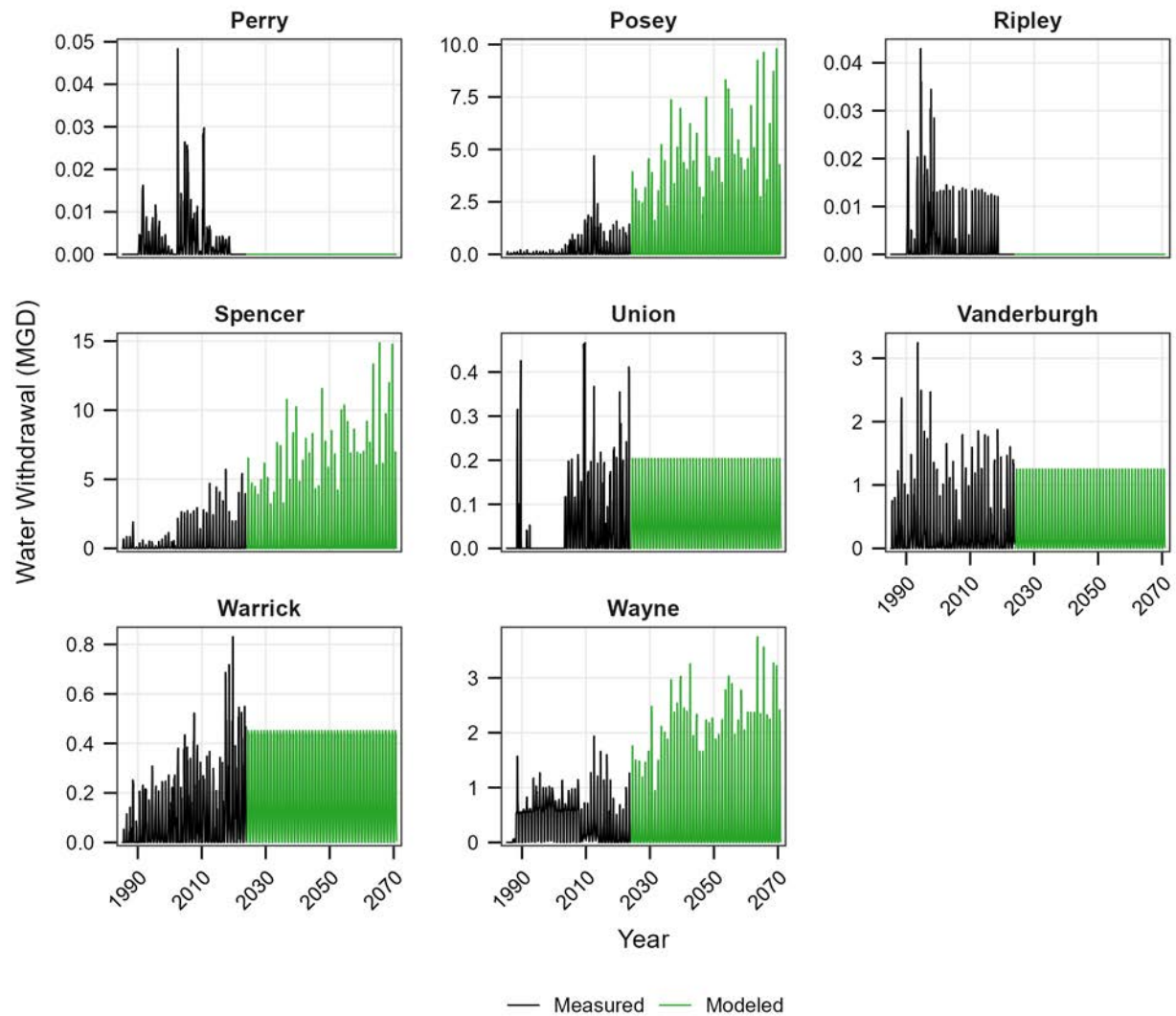


Figure B-13. Monthly irrigation withdrawal (MGD) by county, 1985-2070 (page 2 of 2).

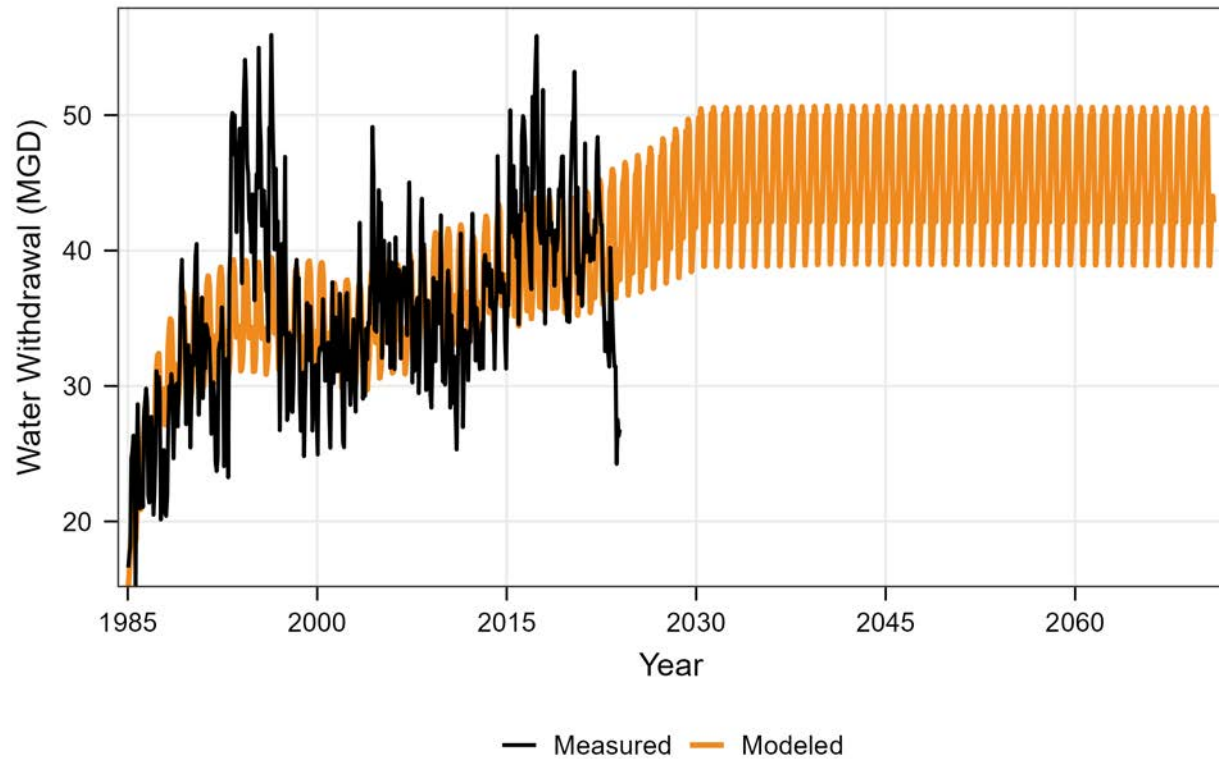


Figure B-14. Monthly industry withdrawal (MGD), regional total, 1985–2070.

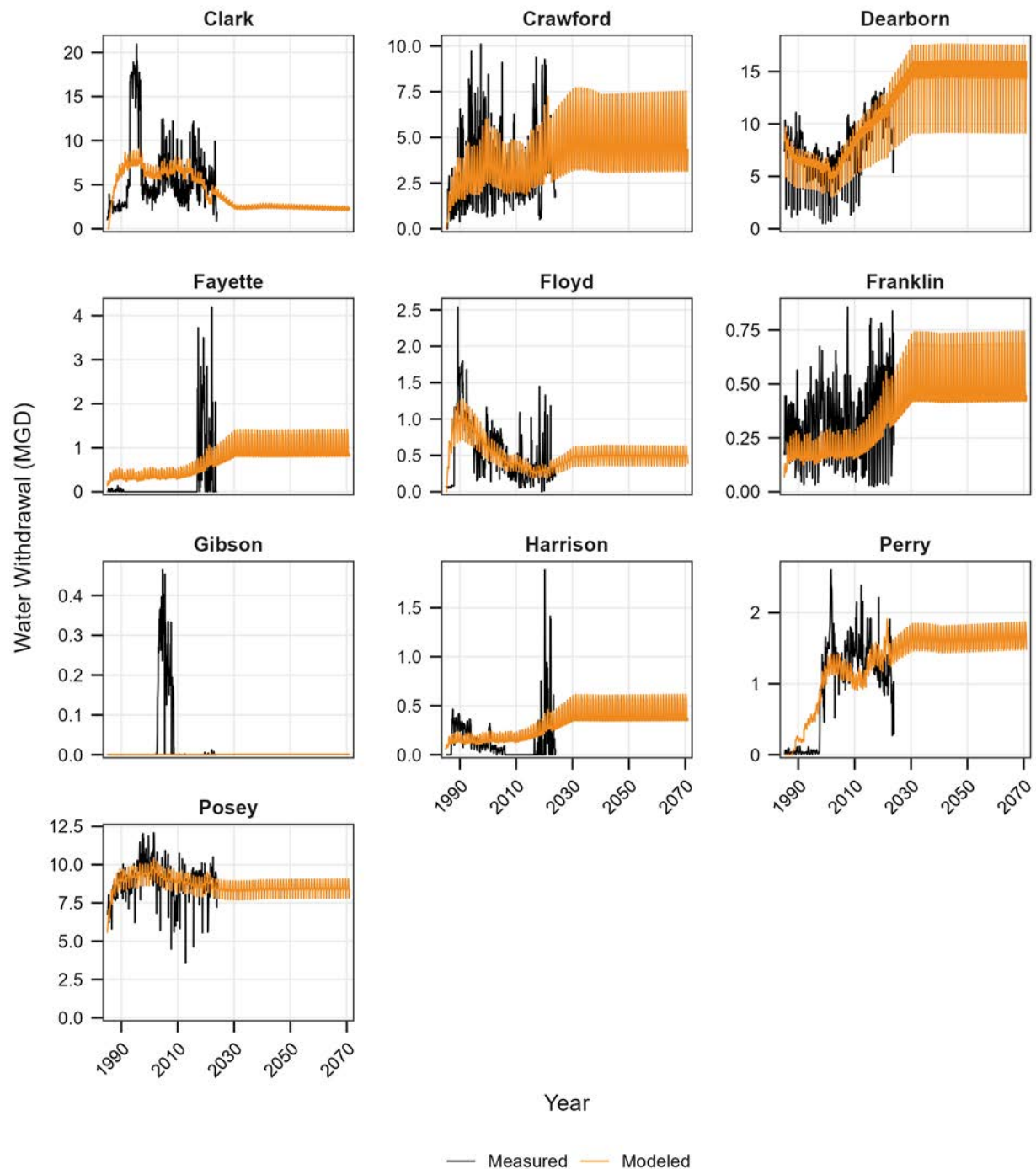


Figure B-15. Monthly industry withdrawal (MGD) by county, 1985-2070 (page 1 of 2).

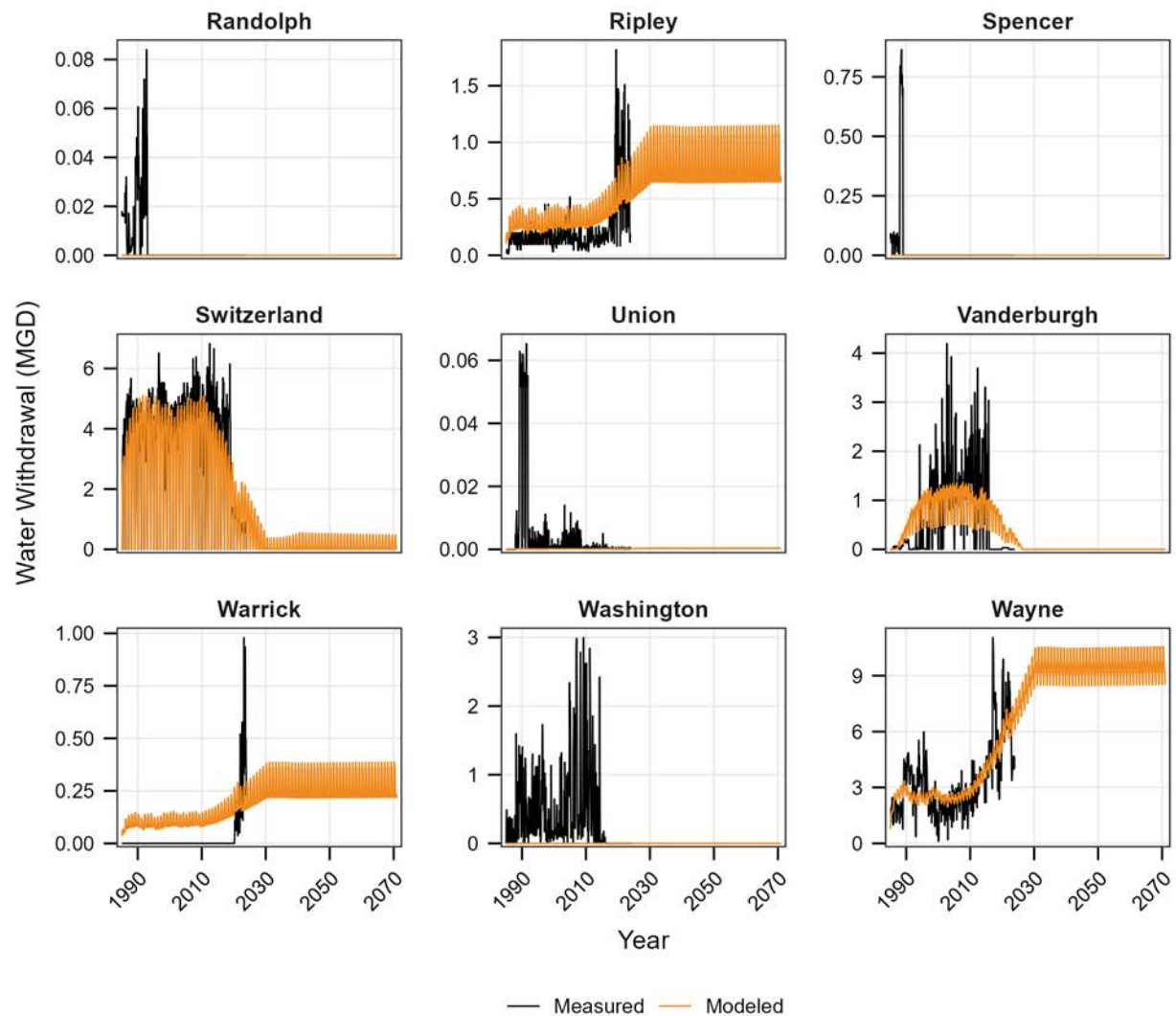


Figure B-16. Monthly industry withdrawal (MGD) by county (page 2 of 2).

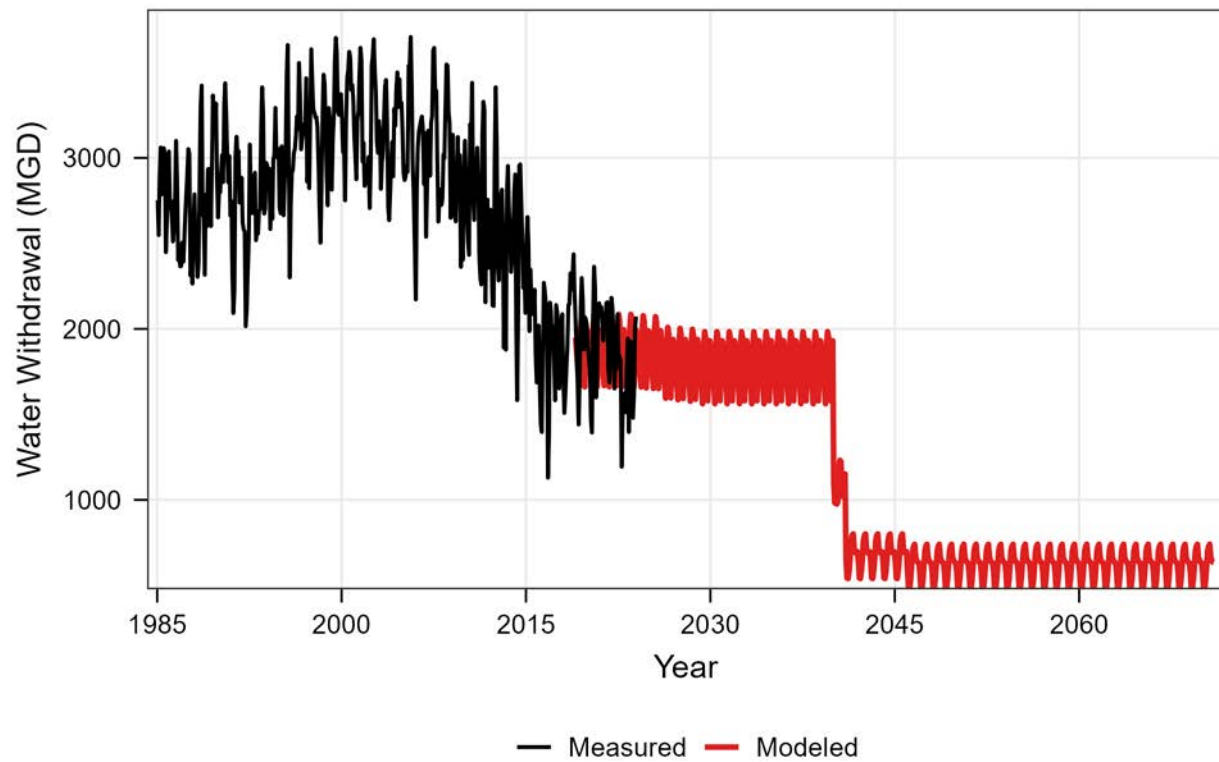


Figure B-17. Monthly power-generation withdrawal (MGD), regional total, 1985–2070.

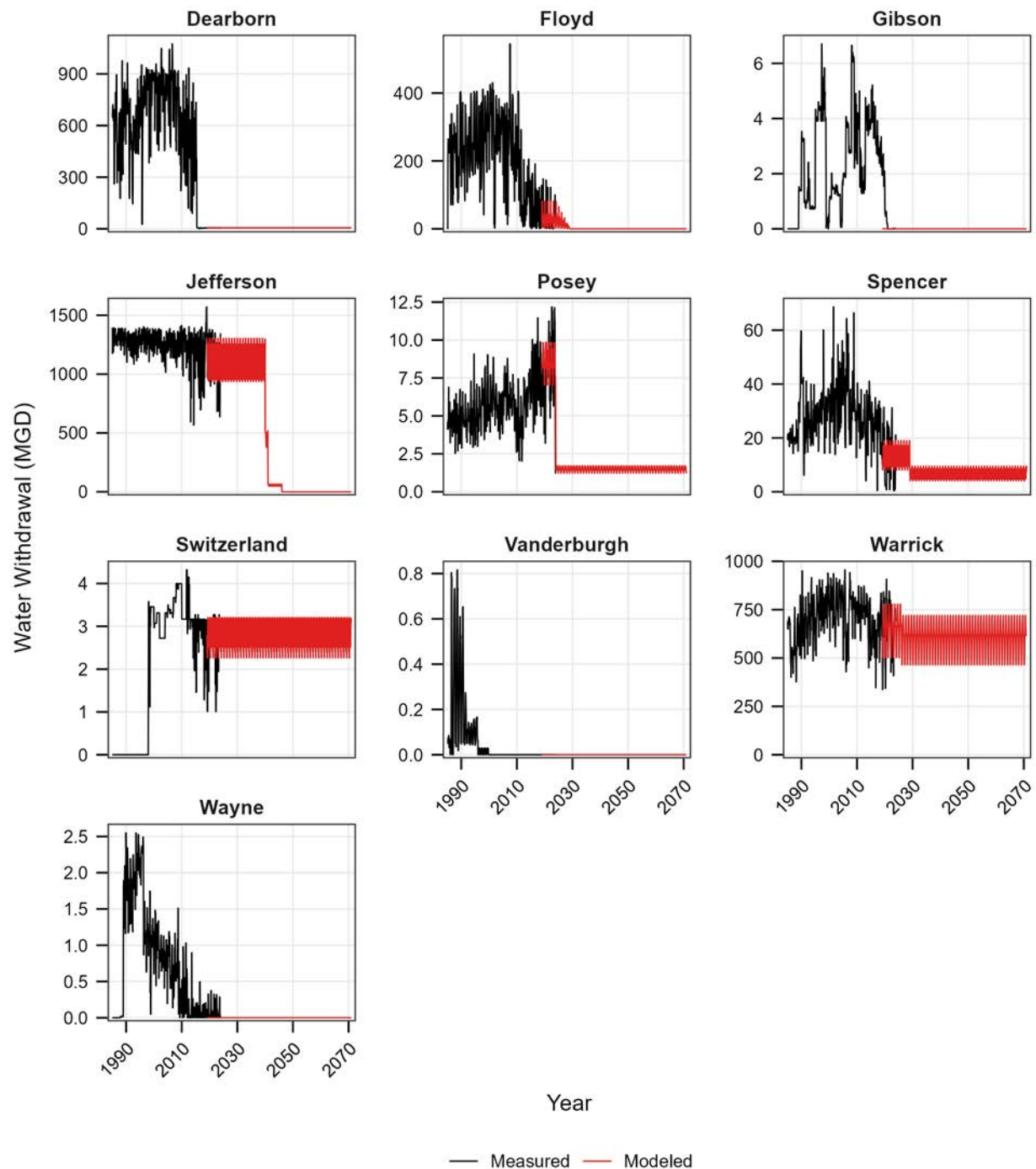


Figure B-18. Monthly power-generation withdrawal (MGD) by county, 1985-2070.

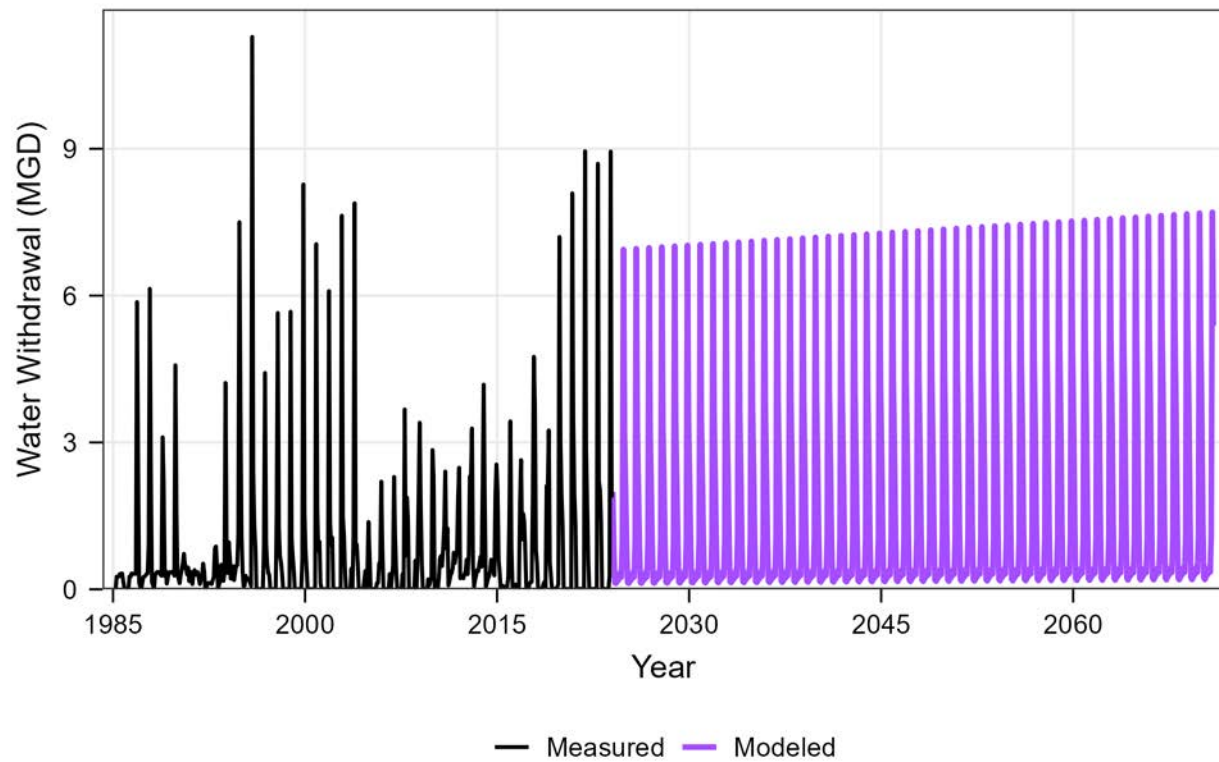


Figure B-19. Monthly miscellaneous withdrawal (MGD), regional total, 1985–2070.

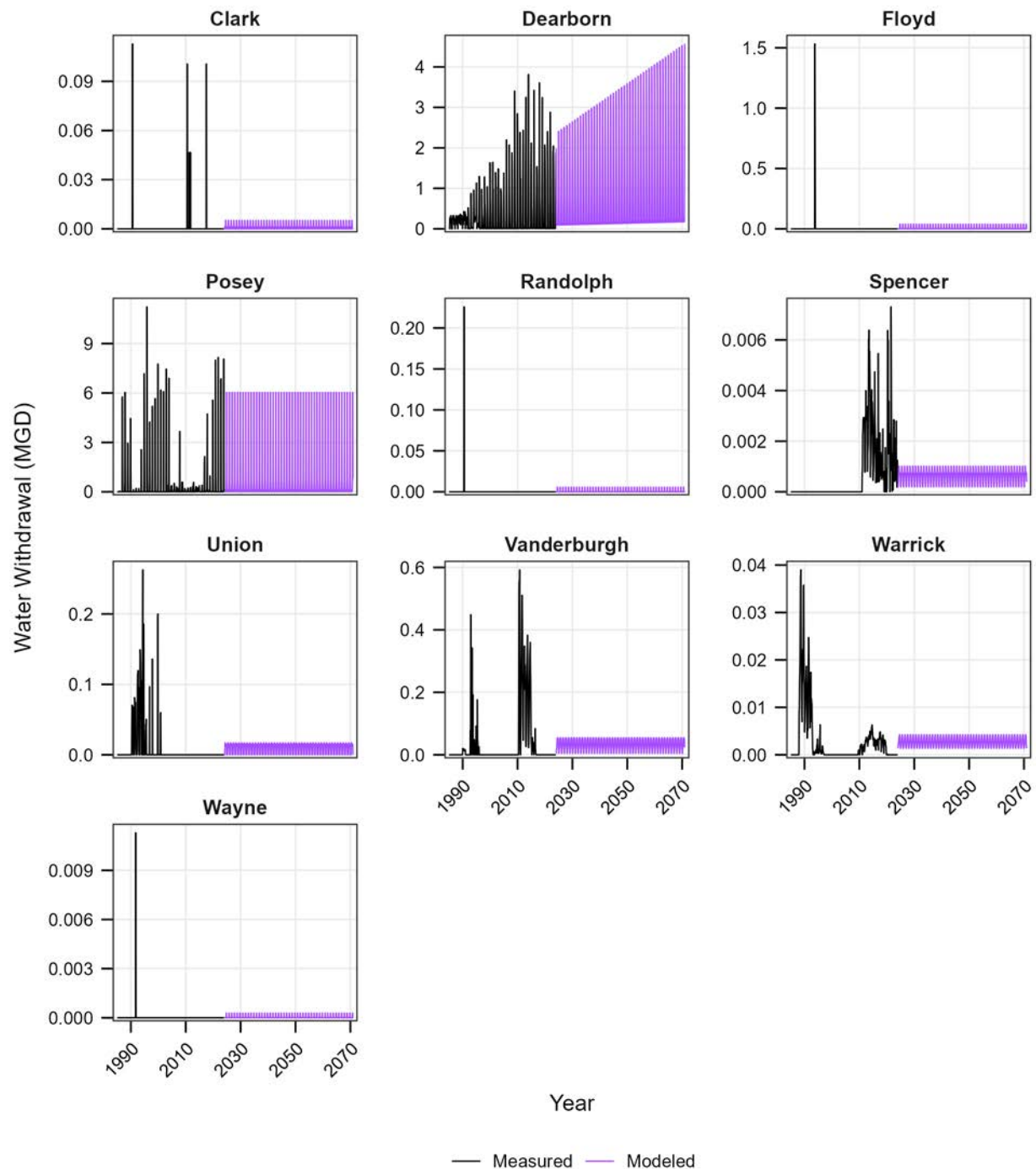


Figure B-20. Monthly miscellaneous withdrawal (MGD) by county, 1985-2070.

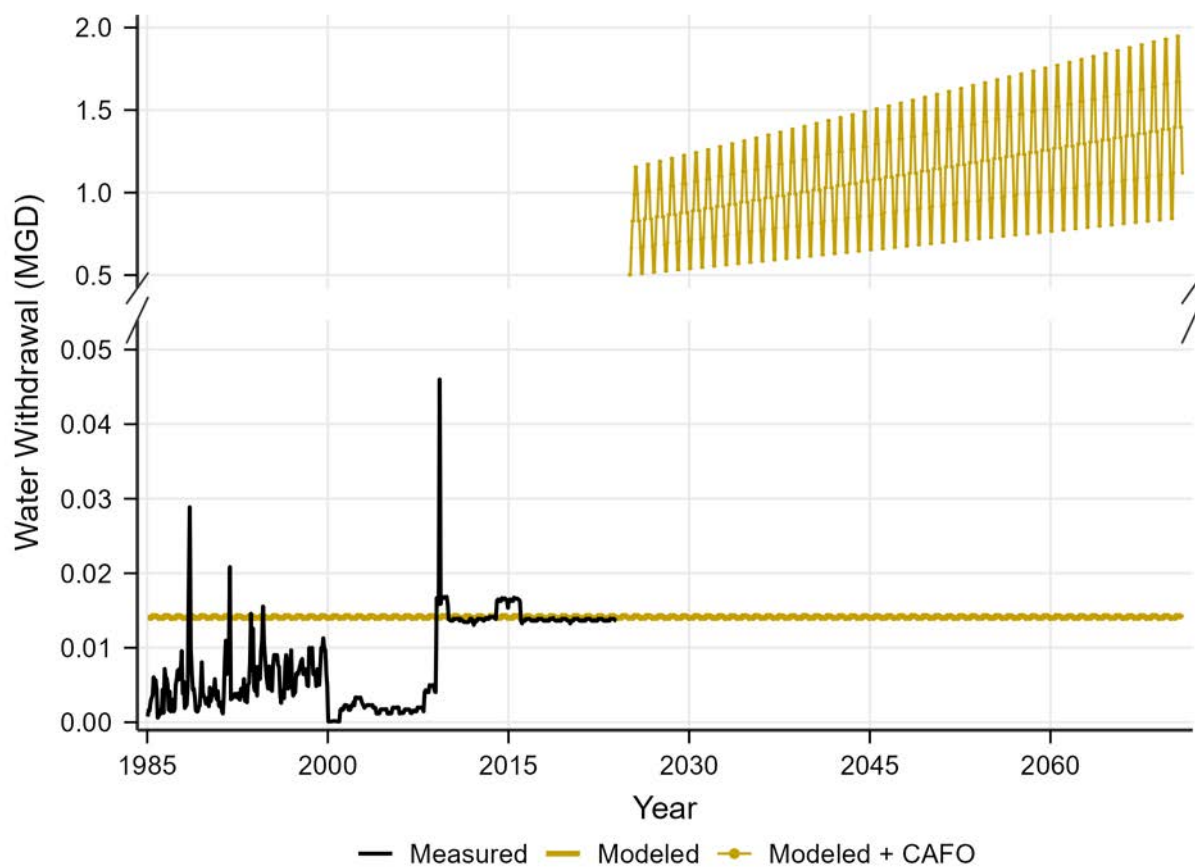


Figure B-21. Monthly rural-use withdrawal (MGD), regional total, 1985–2070.

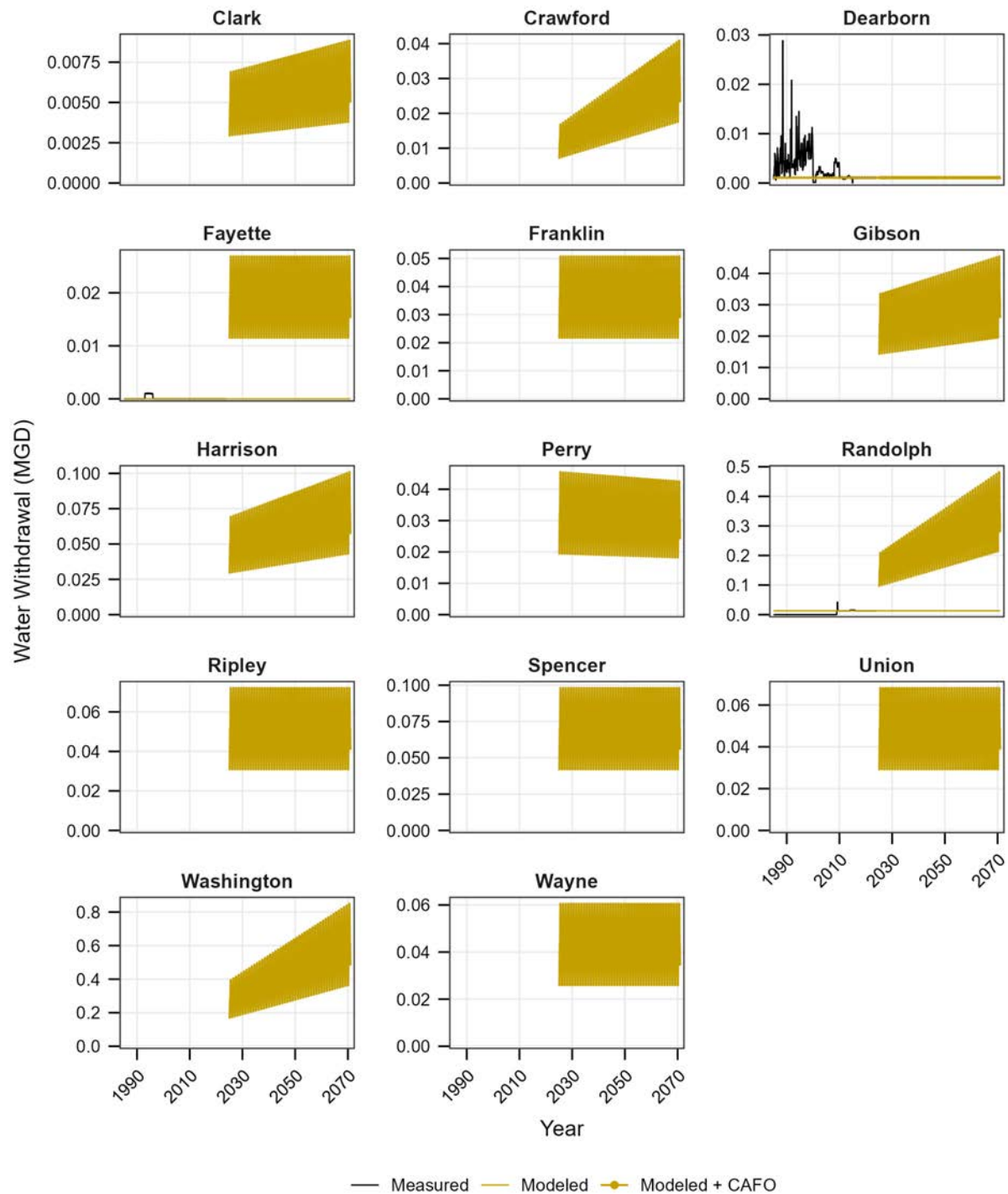


Figure B-22. Monthly rural-use withdrawal (MGD) by county, 1985–2070.

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## Appendix C

### Historical Water Availability

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## 1 Minor Sub-basins: Net Returns, Natural Streamflow and Natural Baseflow

Natural streamflow and natural baseflow were assessed for the minor sub-basins in the regions using the methods described in IFA (2021, Chapter 2). Measures of water availability were not assessed for the minor sub-basins; the purpose of analyzing the minor sub-basins is limited to evaluating the natural baseflow, which is then scaled up to the area of the major sub-basin in which the minor sub-basins occur. Water availability is then assessed and presented for the major sub-basins.

**Figure C-1** shows the minor sub-basins and their relation to the major sub-basins; details of the minor sub-basins are presented in **Table C-1**.

Net withdrawals are presented in **Figure C-2** and **Figure C-3**. In all cases, net withdrawals are relatively small. In Minor Sub-Basin 1 for example, the only net withdrawal is the estimated self-supplied consumptive use. Natural streamflow and natural baseflow are presented in **Figure C-4** and **Figure C-5** for the minor sub-basins.

Table C-1. Minor sub-basins in the Ohio River and Southeast Indiana Region.

| Minor Sub-Basin ID | USGS Site ID | Name                                      | Watershed Area (mi <sup>2</sup> ) | Minor Sub-Basin Area (mi <sup>2</sup> ) |
|--------------------|--------------|-------------------------------------------|-----------------------------------|-----------------------------------------|
| 1                  | 03291780     | Indian-Kentuck Creek near Canaan, IN      | 27.5                              | 27.5                                    |
| 2                  | 03294000     | Silver Creek near Sellersburg, IN         | 189                               | 189                                     |
| 3                  | 03302220     | Buck Creek near New Middletown, IN        | 65.2                              | 65.2                                    |
| 4                  | 03302800     | Blue River near Fredericksburg, IN        | 283                               | 283                                     |
| 5                  | 03303000     | Blue River near White Cloud, IN           | 427                               | 144                                     |
| 6                  | 03303300     | Middle Fork Anderson River at Bristow, IN | 39.8                              | 39.8                                    |

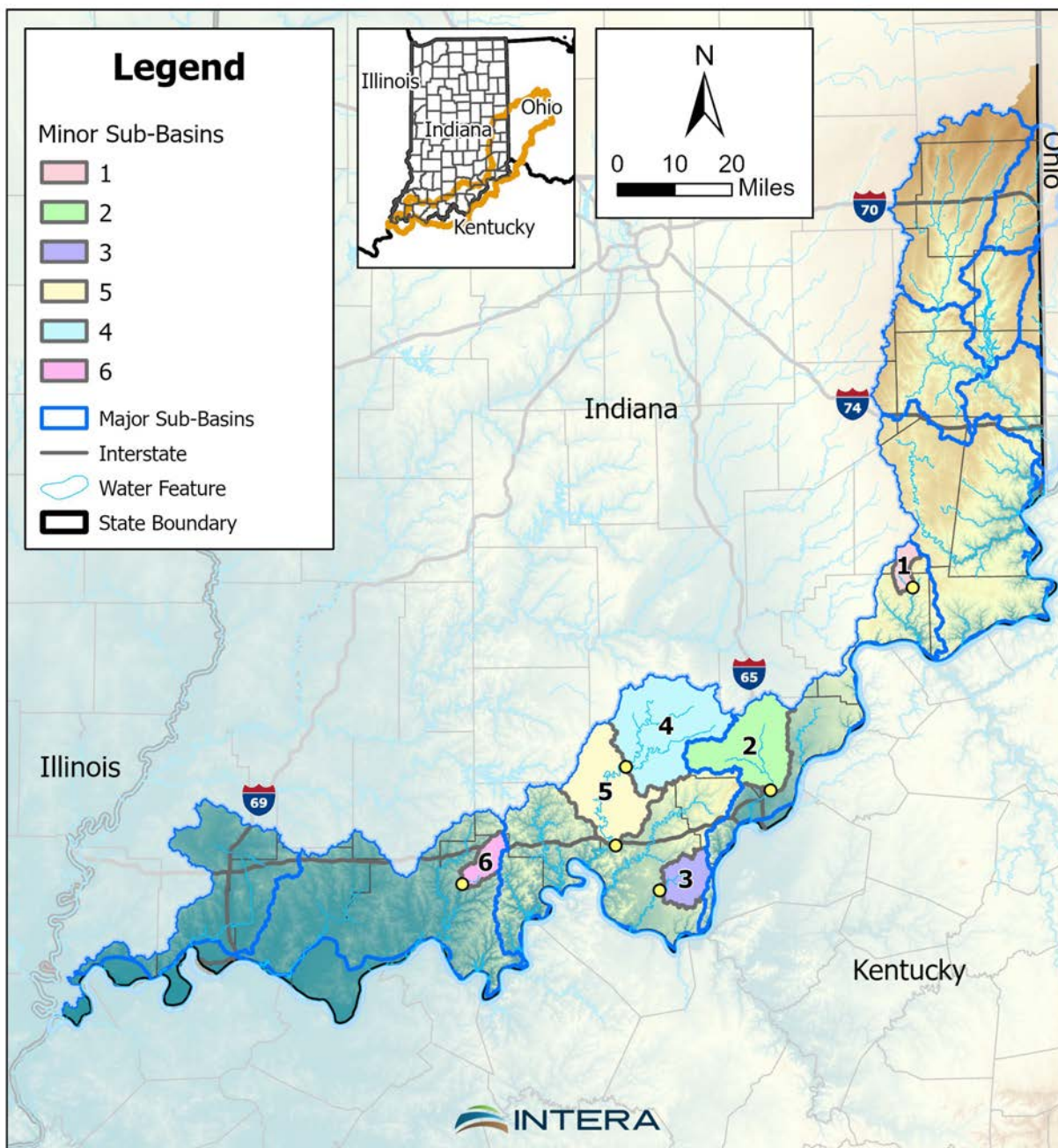


Figure C-1. Minor sub-basins and their relationship to the major sub-basins of the Ohio River and Southeast Indiana Region.

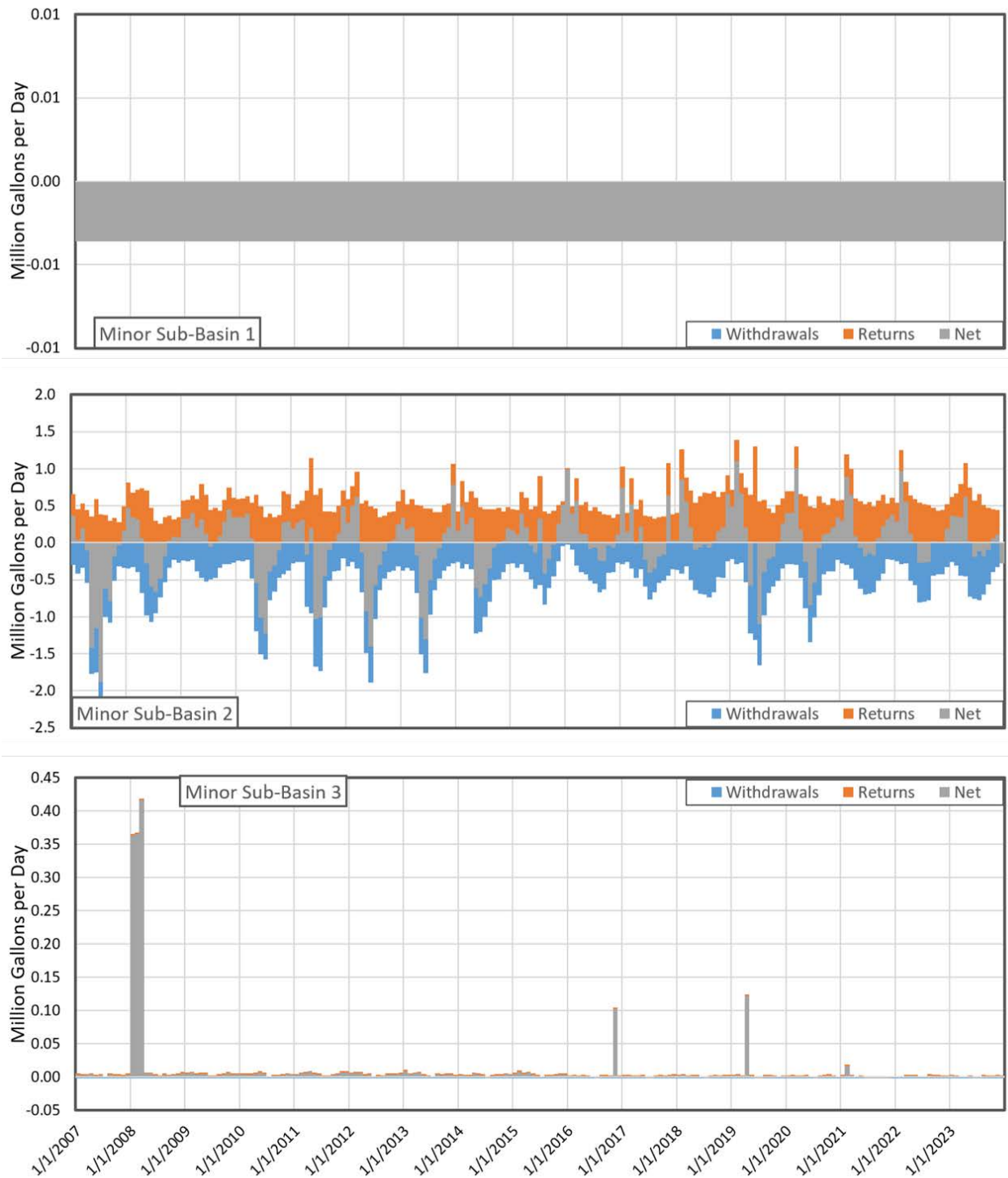


Figure C-2. Historical withdrawals, returns, and net returns for Minor Sub-Basins 1 through 3.



Figure C-3. Historical withdrawals, returns, and net returns for Minor Sub-Basins 4 through 6.

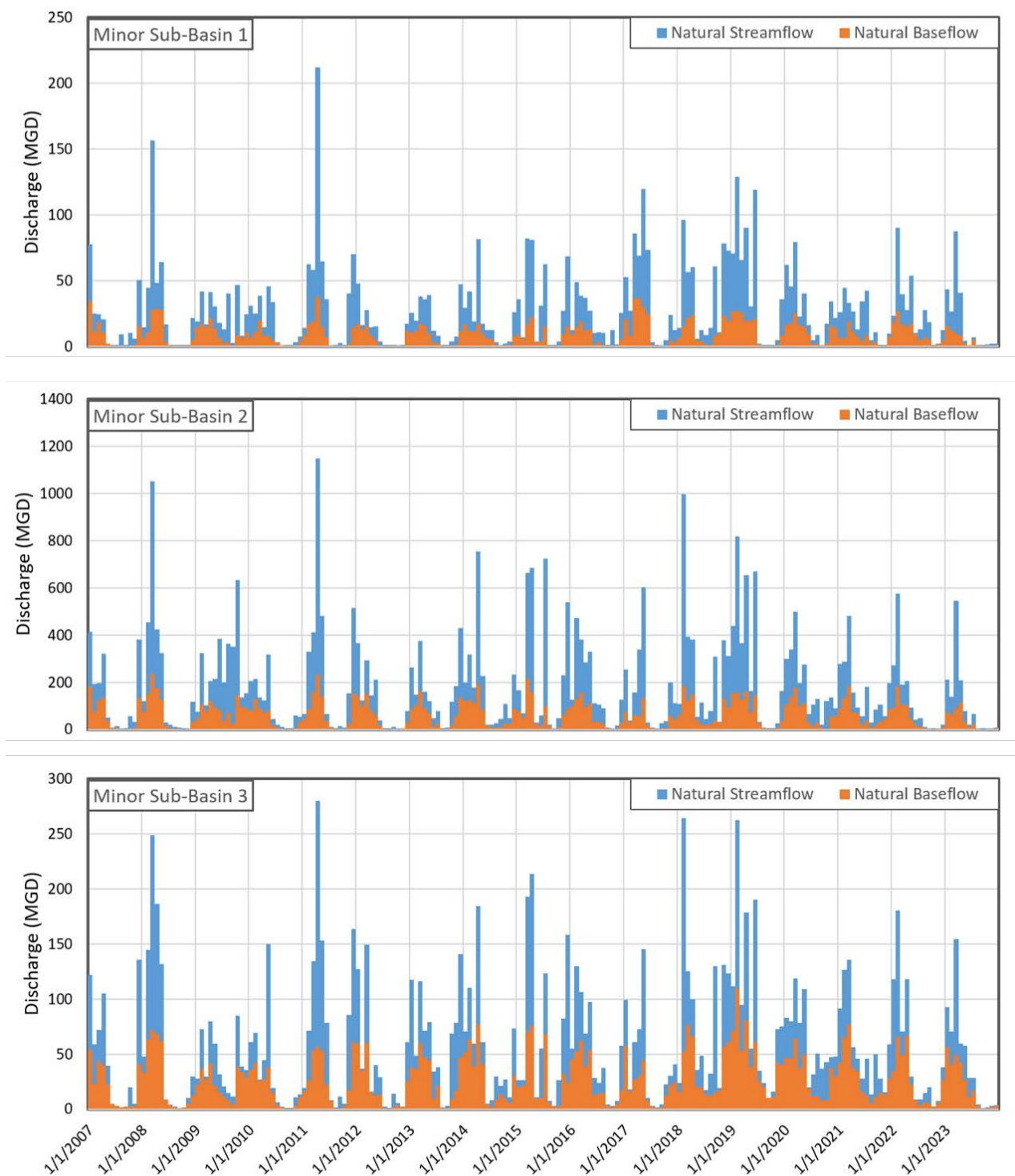


Figure C-4. Historical monthly average natural streamflow and natural baseflow at the outlets of Minor Sub-Basins 1 through 3.

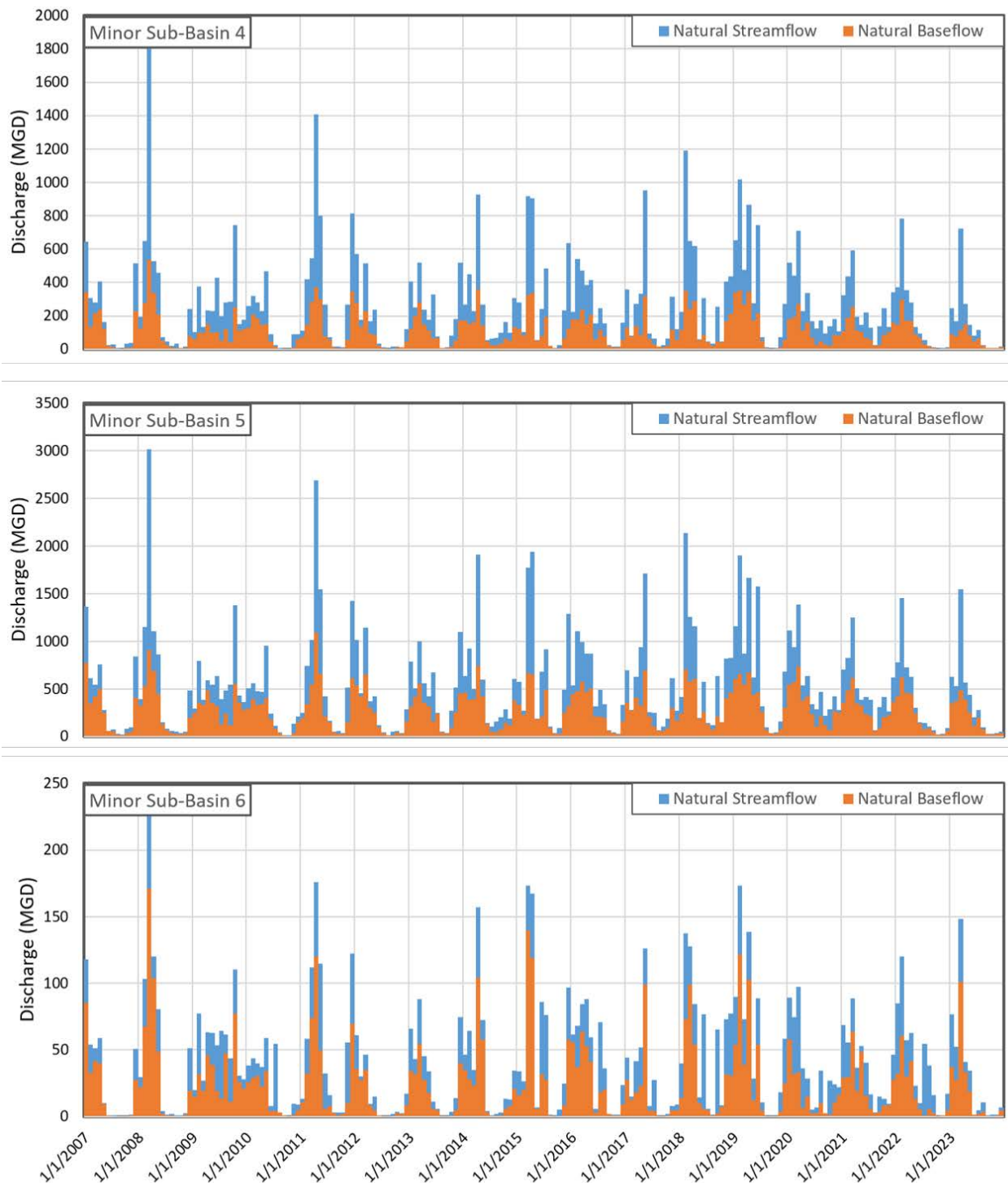


Figure C-5. Historical monthly average natural streamflow and natural baseflow at the outlets of Minor Sub-Basins 4 through 6.

## 2 Minor Sub-Basins: Analysis of Natural Baseflow

A comparison of the historical natural baseflow for groupings of minor sub-basins is presented in **Figure C-6**. The baseflows are normalized by the area of the contributing watershed. The results are grouped according to the major sub-basin in which the minor sub-basins lie. The similarity of the normalized results justifies scaling of the normalized values to the area of the major sub-basin to represent baseflow conditions throughout each major sub-basin.

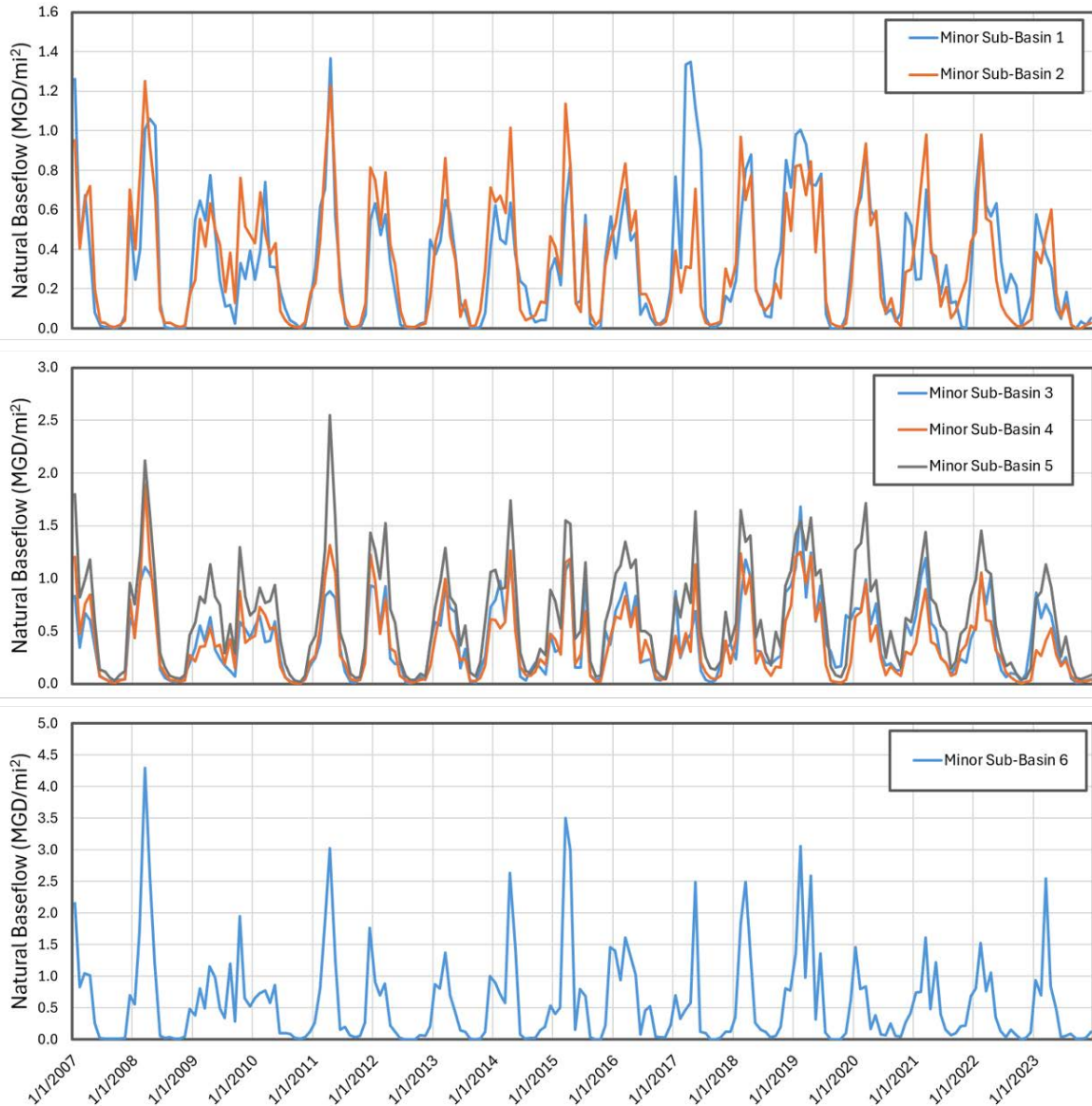


**Figure C-6.** Comparison of natural baseflow normalized by the contributing watershed area for minor sub-basins. Minor sub-basins within Major Sub-Basin 7 (top), Major Sub-Basin 8 (middle), and Major Sub-Basin 9 (bottom).

### 3 Major Sub-Basins

Major sub-basins in the Region are summarized in **Table C-2** and **Table C-3**; the basins are divided into groupings 1-5, which cover the Whitewater River Basin and are defined by the presence of a USGS stream gage, and 6-11, which are represented hydrologically by the minor sub-basins. **Table C-3** identifies the minor sub-basins associated with each major sub-basin. The major sub-basins are shown in **Figure C-7**.

**Table C-2.** Major sub-basins of the Whitewater River watershed.

| Major Sub-Basin ID | USGS Site ID | Name                                     | Watershed Area (mi <sup>2</sup> ) | Major Sub-Basin Area (mi <sup>2</sup> ) |
|--------------------|--------------|------------------------------------------|-----------------------------------|-----------------------------------------|
| 1                  | 03275000     | Whitewater River near Alpine             | 529                               | 529                                     |
| 2                  | 03275600     | East Fork Whitewater River at Abington   | 200                               | 200                                     |
| 3                  | 03276000     | East Fork Whitewater River at Brookville | 380                               | 180                                     |
| 4                  | 03276500     | Whitewater River at Brookville, IN       | 1224                              | 315                                     |
| 5                  | ungaged      | Whitewater River – downstream reach      | --                                | --                                      |

**Table C-3.** Major sub-basins and associated minor sub-basins outside the Whitewater River watershed.

| Major Sub-Basin ID | Name                   | Major Sub-Basin Area (mi <sup>2</sup> ) | Minor Sub-Basin ID | USGS Site ID | Name                                  | Watershed Area (mi <sup>2</sup> ) | Minor Sub-Basin Area (mi <sup>2</sup> ) |
|--------------------|------------------------|-----------------------------------------|--------------------|--------------|---------------------------------------|-----------------------------------|-----------------------------------------|
| 6                  | Middle Ohio            | 778                                     | --                 | --           | --                                    | --                                | --                                      |
| 7                  | Silver                 | 643                                     | 1                  | 03291780     | Indian-Kentuck Creek near Canaan      | 27.5                              | 27.5                                    |
|                    |                        |                                         | 2                  | 03294000     | Silver Creek near Sellersburg         | 189                               | 189                                     |
| 8                  | Blue-Sinking           | 1234                                    | 3                  | 03302220     | Buck Creek near New Middletown        | 65.2                              | 65.2                                    |
|                    |                        |                                         | 4                  | 03302800     | Blue River near Fredericksburg        | 283                               | 283                                     |
|                    |                        |                                         | 5                  | 03303000     | Blue River near White Cloud           | 427                               | 144                                     |
| 9                  | Lower Ohio             | 837                                     | 6                  | 03303300     | Middle Fork Anderson River at Bristow | 39.8                              | 39.8                                    |
| 10                 | Pigeon                 | 415                                     | --                 | --           | --                                    | --                                | --                                      |
| 11                 | Ohio River and Outwash | 493                                     | --                 | --           | --                                    | --                                | --                                      |

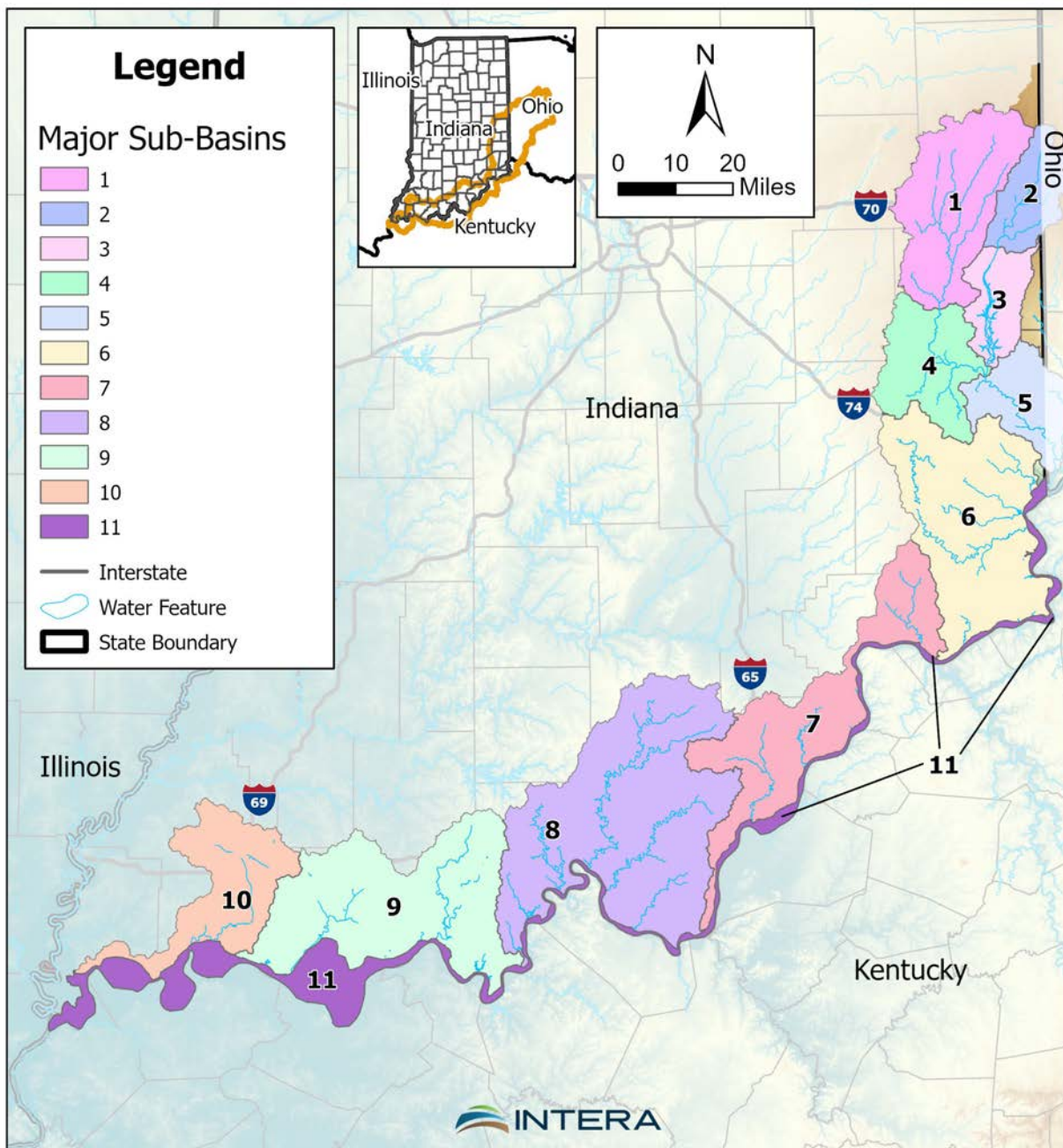


Figure C-7. The major sub-basins in the Ohio River and Southeast Indiana Region.

### 3.1 Brookville Reservoir Operations

Operations of the Brookville Reservoir are controlled by the Army Corps of Engineers, who provide some operational data online ([Brookville Lake Dam - Water Data - U.S. Army Corps of Engineers](#)). A complete record of the change in storage ( $q_{STOR}$  in the water availability analysis (IFA, 2021)) was developed from multiple sources, identified in **Table C-4**.

Table C-4. Data used to develop the historical record of  $q_{STOR}$ .

| Source                  | USGS Site ID | Period of data used                 | Data                               |
|-------------------------|--------------|-------------------------------------|------------------------------------|
| Army Corps of Engineers | --           | 2018 to 2025                        | Dam outflow                        |
| USGS                    | 03276000     | 2016 to 2018                        | Dam outflow                        |
| USGS                    | 03276000     | 2007 to 2025                        | Outflow stage                      |
| USGS                    | 03276000     | 1987 to 2025, post dam construction | Field measurements, flow and stage |
| USGS                    | 03275600     | 2007-2025                           | Inflow                             |

A scaling of the flow records at USGS gage 03275600 by drainage area was made to estimate the inflow to the Brookville Reservoir. Outflow from the reservoir was assessed by a combination of the first four items in **Table C-4**. The final timeseries of  $q_{STOR}$  was then developed from the compiled data as

$$q_{STOR} = outflow - inflow$$

The results, showing monthly averages, are illustrated in **Figure C-8**.

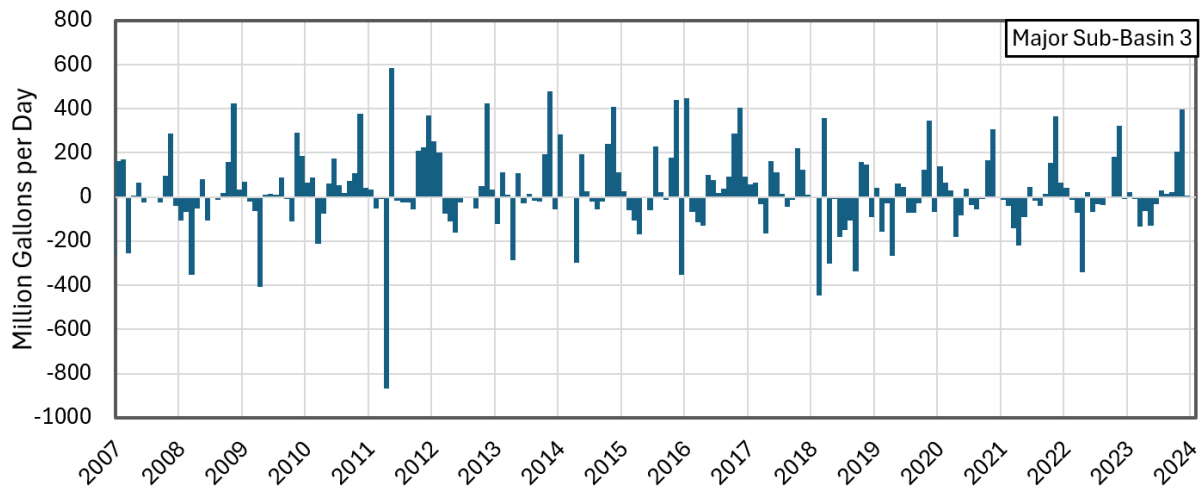


Figure C-8. Historical values of  $q_{STOR}$  reflecting operation of the Brookville Reservoir in Major Sub-Basin 3. Positive values indicate reservoir releases; negative values indicate an increase in reservoir storage.

## 3.2 Net Returns

Time series of withdrawals, returns, and net returns sorted by major sub-basin are presented in **Figure C-9** through **Figure C-12**.

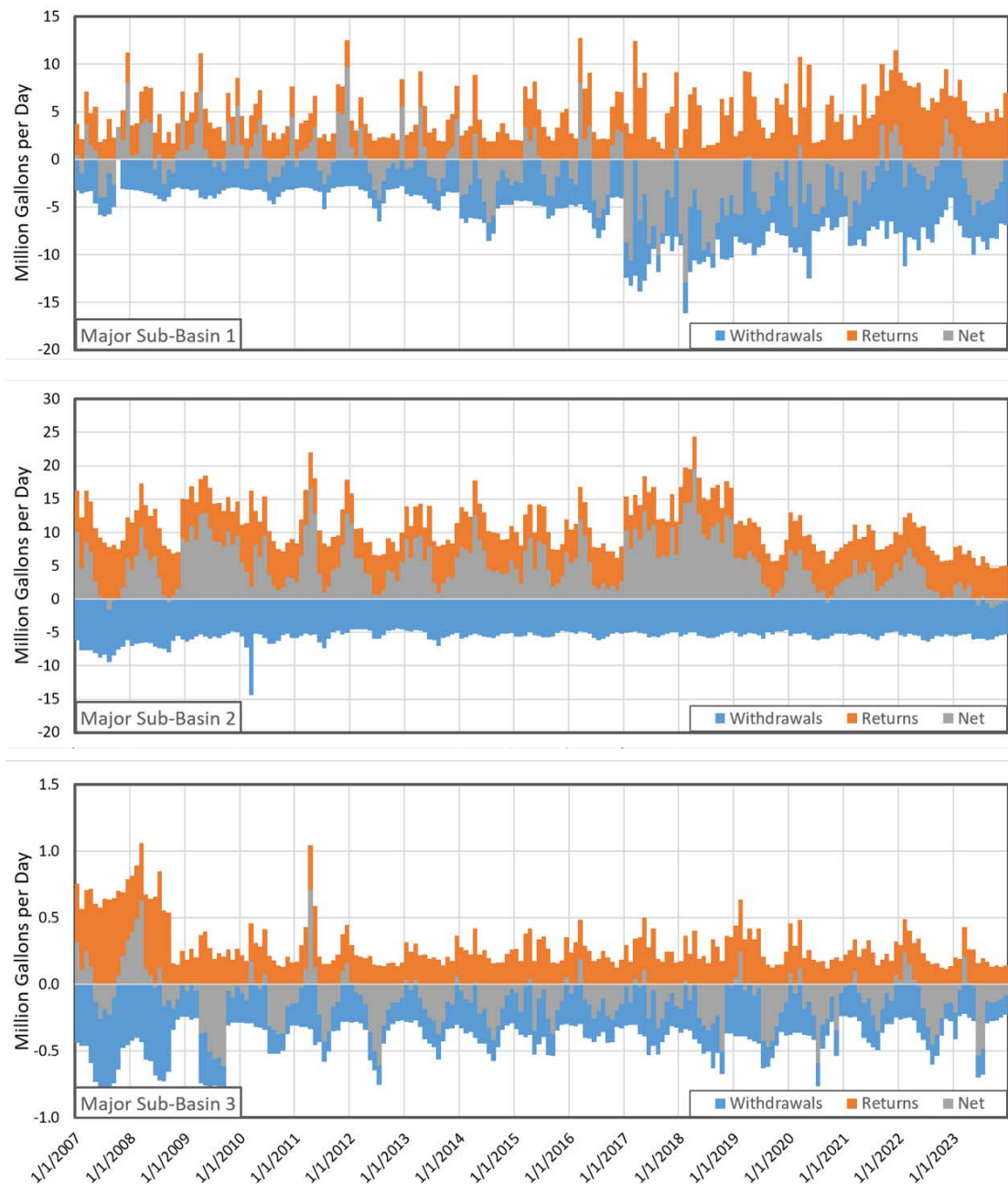


**Figure C-9.** Historical withdrawals, returns and net returns for Major Sub-Basins 1 through 3.

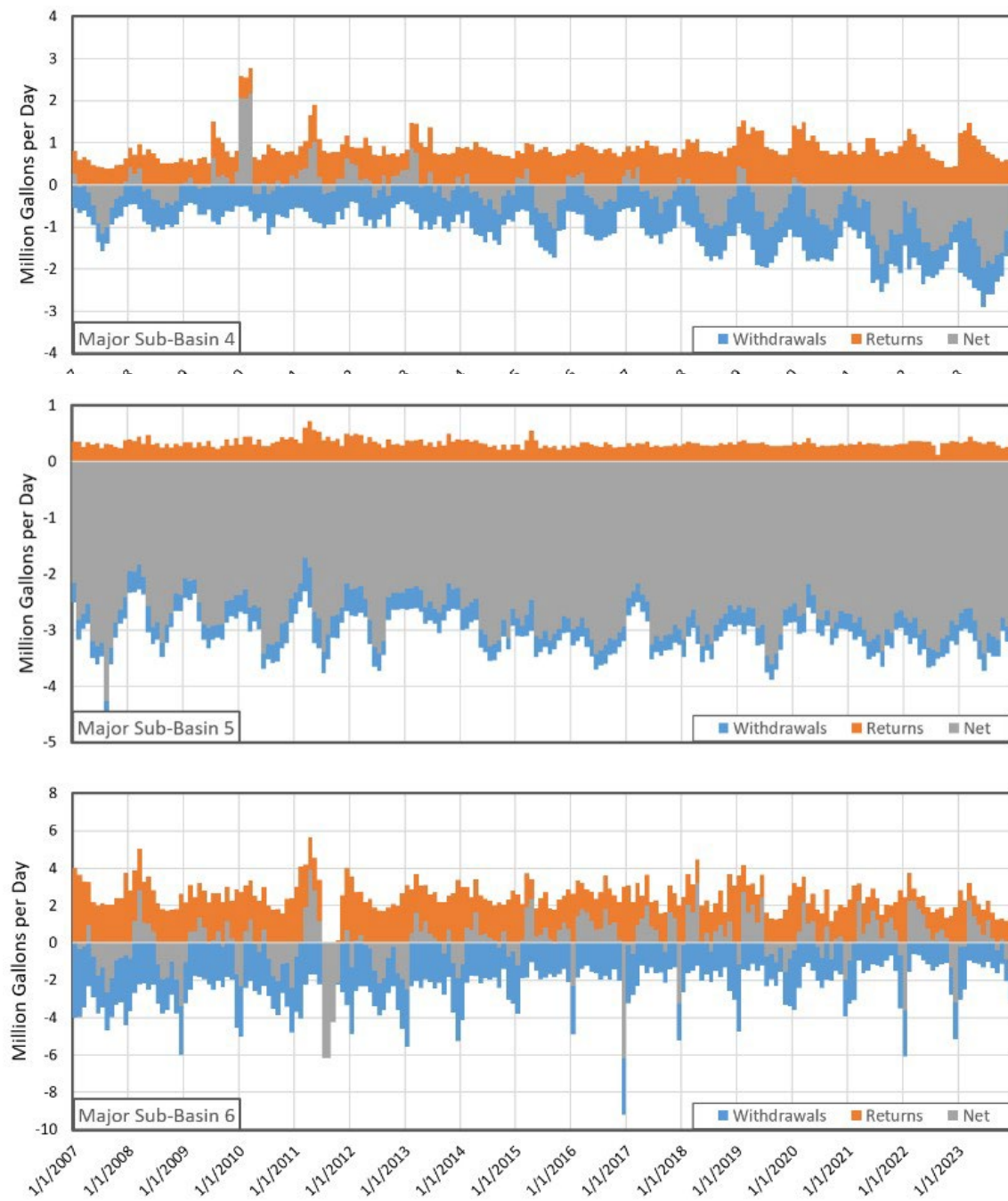


Figure C-10. Historical withdrawals, returns and net returns for Major Sub-Basins 4 through 6.



Figure C-11. Historical withdrawals, returns and net returns for Major Sub-Basins 7 through 9.

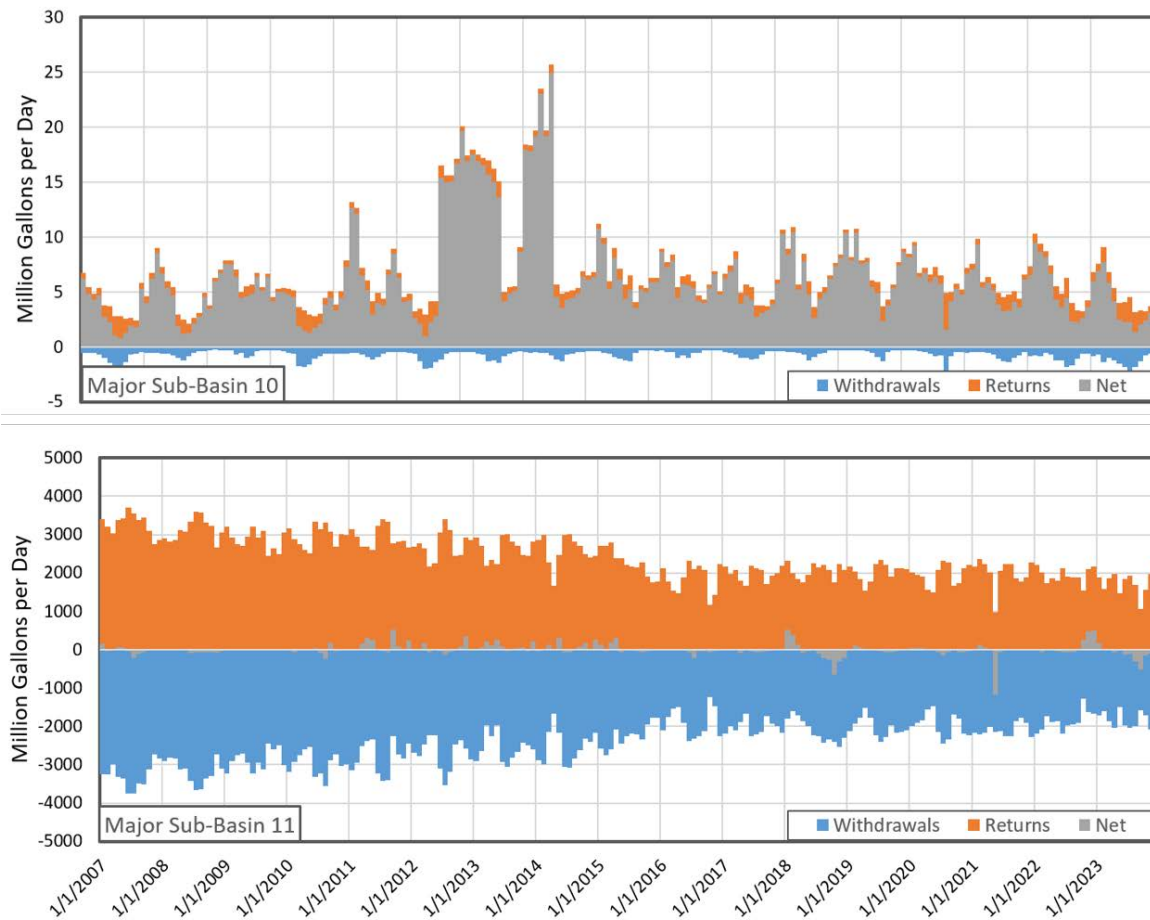


Figure C-12. Historical withdrawals, returns, and net returns for Major Sub-Basins 10 and 11.

### 3.3 Natural Baseflow: Whitewater River, Major Sub-Basins 1-4

Natural streamflow and natural baseflow are presented for major sub-basins in the Whitewater River watershed. A comparison of the natural baseflow time series developed for Sub-basins 1 through 4 is presented.

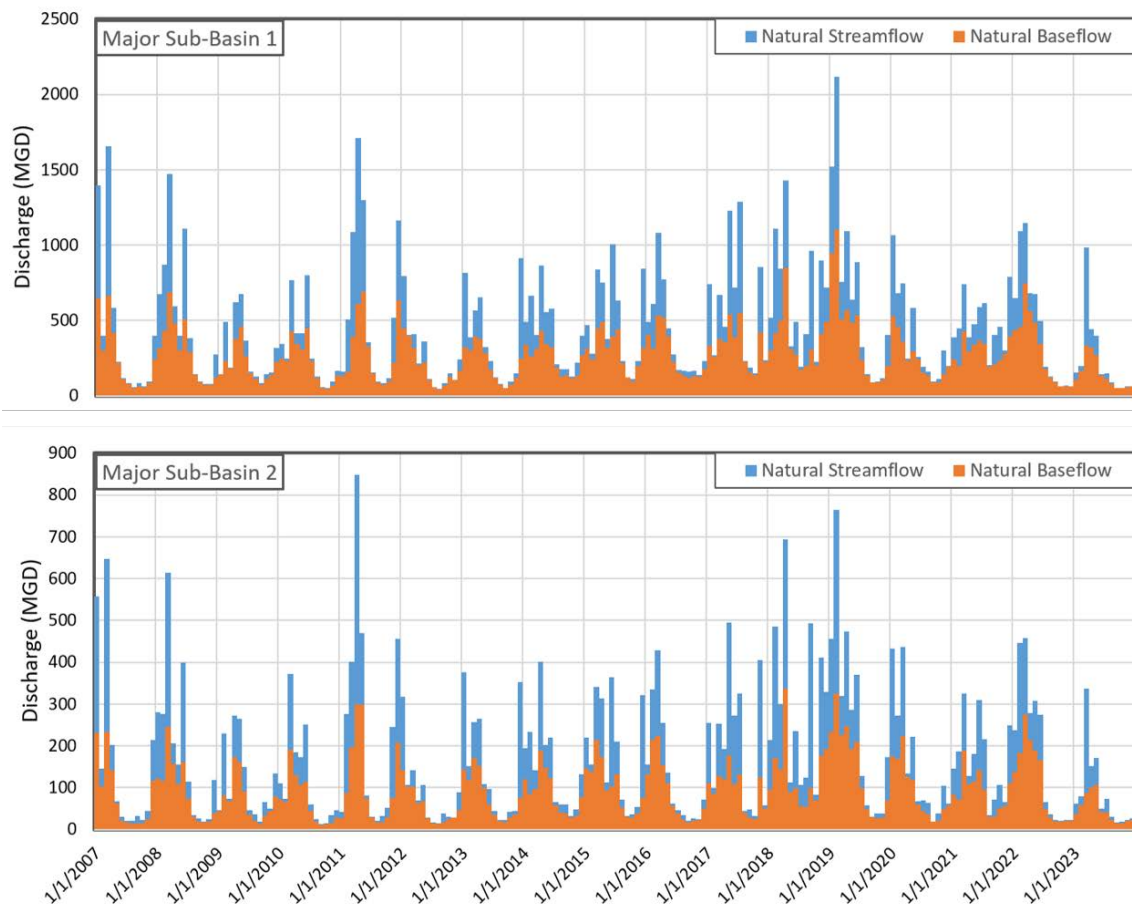


Figure C-13. Natural streamflow and natural baseflow at the outlets of Major Sub-Basins 1 and 2 in the Whitewater River watershed.

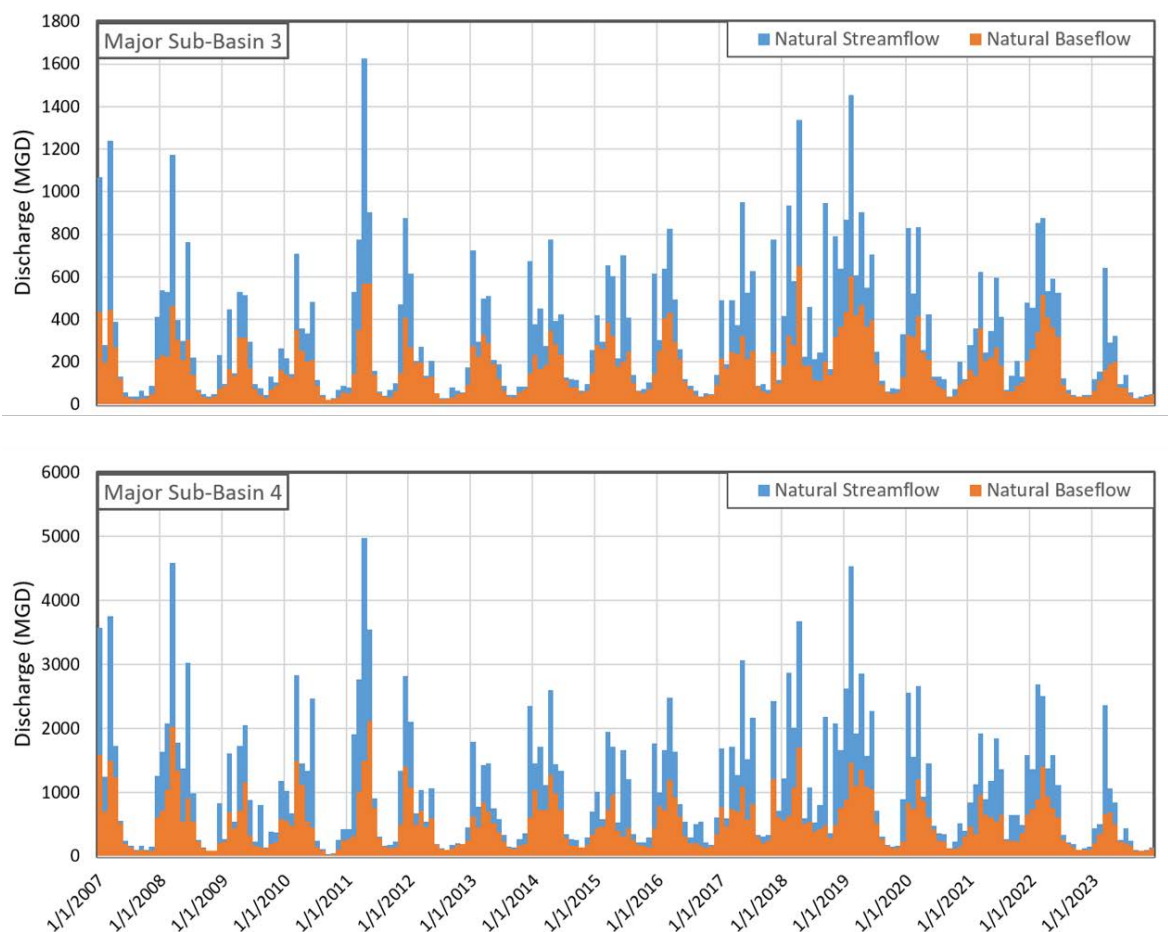


Figure C-14. Natural streamflow and natural baseflow at the outlets of Major Sub-Basins 3 and 4 of the Whitewater River watershed.

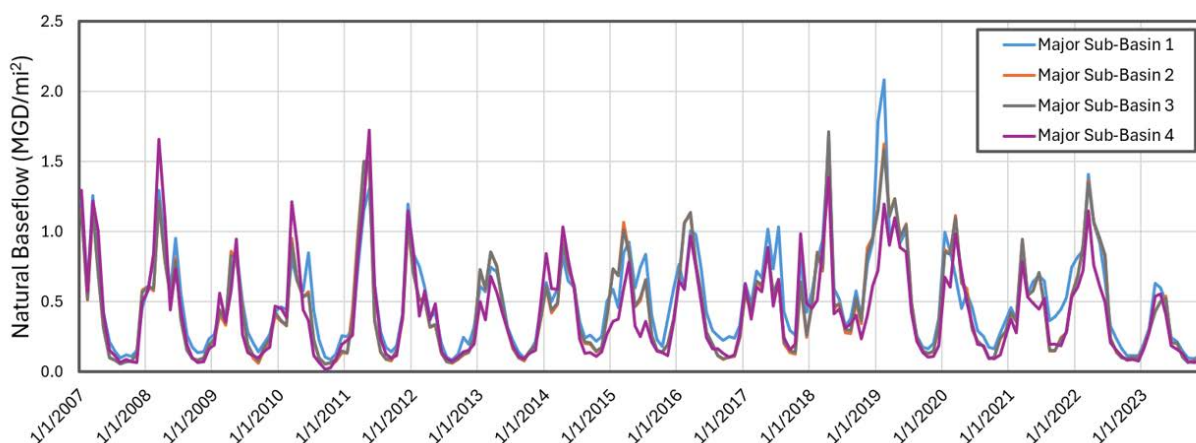


Figure C-15. Time series of historical natural baseflow for Major Sub-Basins 1 through 4. The discharge is normalized by contributing watershed area.

### 3.4 Natural Baseflow: Major Sub-Basins 6-10

An estimate of the historical natural baseflow in each major sub-basin was made based on the analysis of natural baseflow in the minor sub-basins. The natural baseflow in units of millions of gallons per day per square mile of contributing area were scaled by the area of each major sub-basin, resulting in the time series of natural baseflow presented in **Figure C-16** and **Figure C-17**.

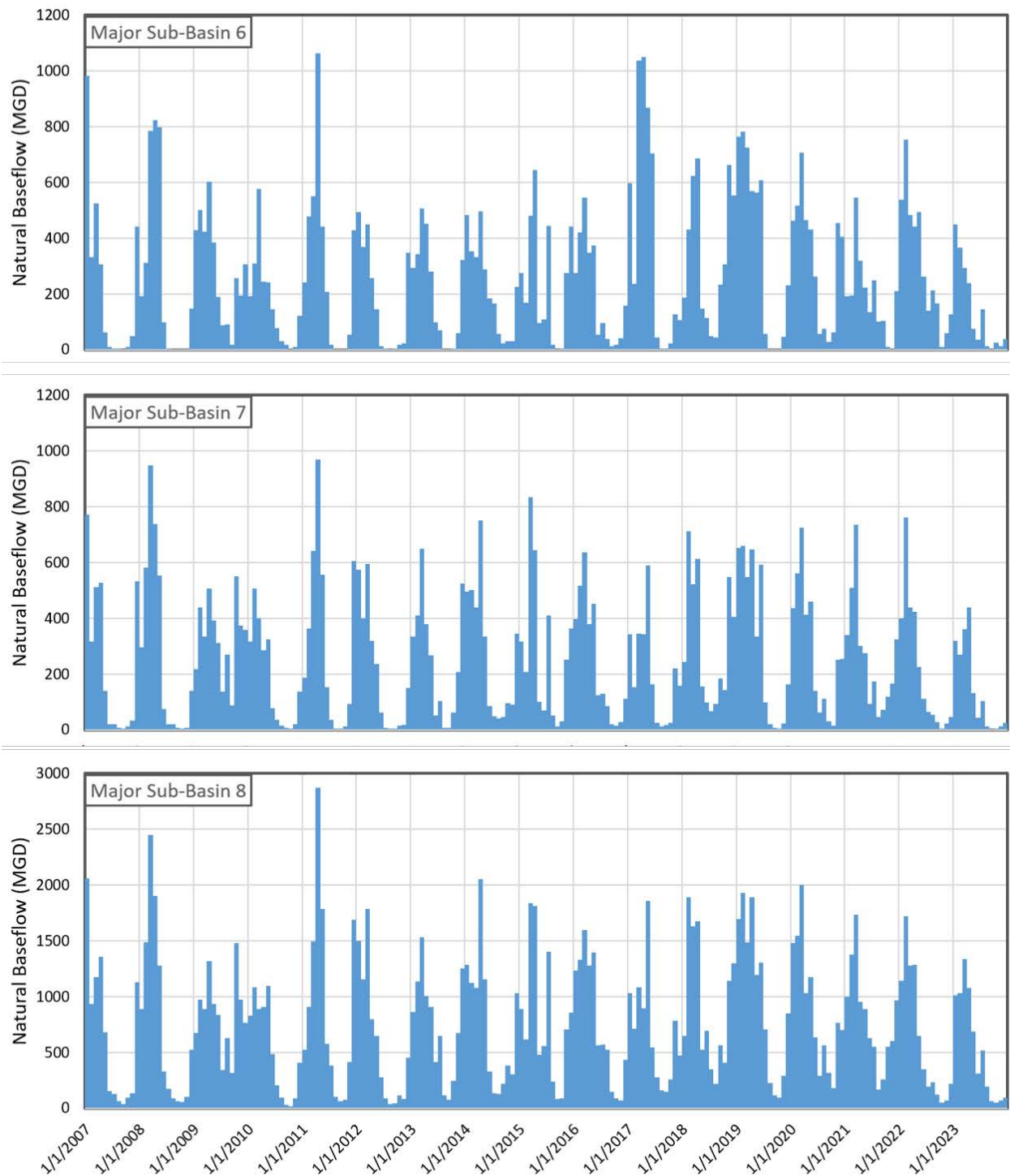


Figure C-16. Natural baseflow for Major Sub-Basins 6 through 8.

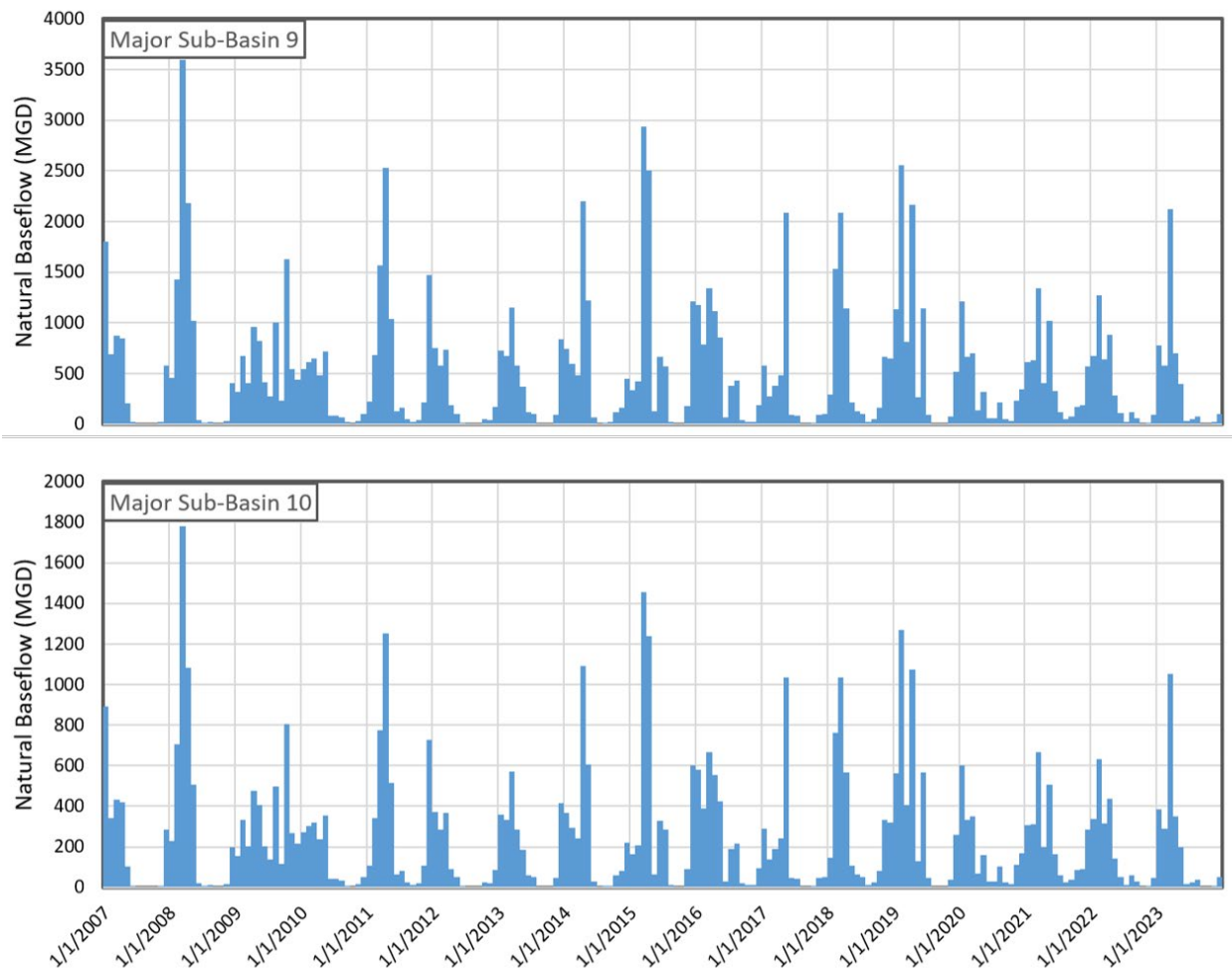


Figure C-17. Natural Baseflow for Major Sub-Basins 9 and 10.

### 3.5 CXS WA: Ohio River and Outwash (Major Sub-Basin 11)

Cumulative excess water availability for the Ohio River is assessed from USGS daily flow records at gages along the river (**Table C-5**). The following approximation is made to the definition and calculation of cumulative excess water (CXS WA) provided in IFA (2021):

$$q_{NBF} \approx q_{NSF}$$

The natural streamflow ( $q_{NSF}$ ) at a USGS gaging station is approximated as being equal to the natural baseflow ( $q_{NBF}$ ). Note that during low flow periods, this approximation is often true. After including this approximation into the analysis, the resulting definition of CXS WA is

$$Q_{CXS\ WA} \approx q_{USGS} - q_{IF}$$

The CXS WA at a USGS station is simply equal to the daily flow recorded at the station minus the instream flow requirement. The full period of record is used in the analysis for each station.

A summary of the minimum annual and seasonal CXS WA for each USGS station is provided in

Table C-6, along with the number of years of record used in the analysis, and **Figure C-18**. Results at each station are similar, generally decreasing in the upstream direction. The exception is the most downstream station at Shawneetown, where the values are significantly higher; this is due to the much shorter number of years (21) available for analysis at that location. The results at Louisville (station 03294500) are representative of the entire reach and are used to represent CXS WA in Major Sub-Basin 11. Based on 49 years of record, the approximate return period for the minimum seasonal values noted is 50 years. This represents a much less frequent seasonal drought condition than those evaluated for the other major sub-basins, which is approximately an 18-year recurrence interval.

Table C-5. USGS gaging station on the Ohio River and instream flow requirements. Stations are listed from downstream to upstream.

| Gage            | Name                                     | 7Q10 (MGD) | Q90 (MGD) |
|-----------------|------------------------------------------|------------|-----------|
| <b>03381700</b> | Ohio River at Old Shawneetown            | 10,043     | 24,689    |
| <b>03303280</b> | Ohio River at Cannelton Dam at Cannelton | 6,919      | 16,029    |
| <b>03294500</b> | Ohio River at Louisville                 | 6,510      | 14,154    |
| <b>03277200</b> | Ohio River at Markland Dam Near Warsaw   | 5,990      | 12,668    |

Table C-6. Minimum historical cumulative excess water availability at stations on the Ohio River.

| Gage            | Name                                     | Years | Annual (MGD) | Winter (MGD) | Spring (MGD) | Summer (MGD) | Fall (MGD) |
|-----------------|------------------------------------------|-------|--------------|--------------|--------------|--------------|------------|
| <b>03381700</b> | Ohio River at Old Shawneetown            | 21    | 81,100       | 69,700       | 107,500      | 14,600       | 6,700      |
| <b>03303280</b> | Ohio River at Cannelton Dam at Cannelton | 49    | 37,800       | 31,400       | 54,300       | 3,500        | 5,900      |
| <b>03294500</b> | Ohio River at Louisville                 | 49    | 36,700       | 33,800       | 54,400       | 3,400        | 4,300      |
| <b>03277200</b> | Ohio River at Markland Dam Near Warsaw   | 54    | 31,300       | 33,700       | 50,500       | 3,200        | 4,100      |

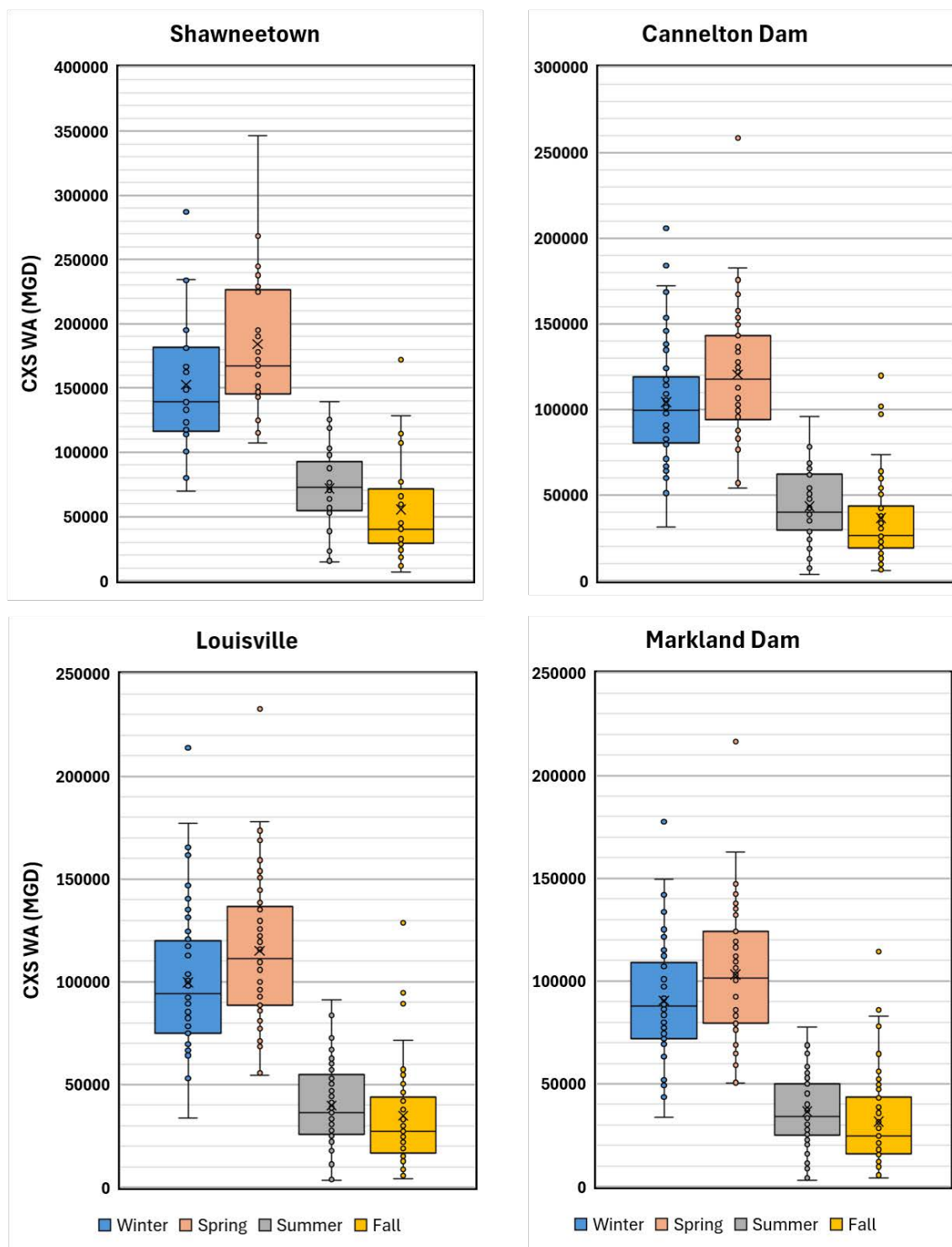


Figure C-18. Variations in seasonal cumulative excess water availability (CXSWA) at USGS stations on the Ohio River.

## 4 References

Indiana Finance Authority, (IFA) 2021. Central Indiana Water Availability, Central Indiana Water Study, Phase III: Water Availability, 397 p.



## Appendix D

### Water Availability Projections

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# 1 Climate Change Model and Natural Streamflow Projections

Estimates of future natural streamflow (NSF) are based on the Water-Balance Model (WBM) (Wolock and McCabe, 1999; McCabe and Wolock, 2011). The WBM is incorporated into the National Climate Change Viewer (NCCV, Alder and Hostetler, 2014; Hostetler and Alder, 2016) and produces estimates of NSF from inputs of temperature, precipitation, and potential solar radiation. The inputs are provided by the suite of Global Climate Models included in the NCCV. Output from a single global climate model was used to drive the streamflow model: CNRM-CM6-1, Scenario SSP2-4.5. More details on the choice of this global climate model are provided in **Appendix B**. Output from the hydrologic model includes a monthly timeseries of NSF, provided in inches per month on a HUC-8 spatial scale; the results were then scaled to each major sub-basin or watershed within the HUC-8.

## 2 Verification of the Statistical Properties of Model Results

The projections of natural streamflow obtained from the WBM for each HUC-8 were compared with historical natural streamflow data for the period 2007 to 2023 to validate the performance of the model. Flow duration curves were developed for each historical time series of monthly average natural streamflow and compared to the model results for the same period. Comparisons for the Whitewater HUC-8 are presented in **Figure D-1**. Model simulated results are very similar to the actual historical data for Major Sub-Basins 1 through 4. In particular, the comparison is favorable for large percent exceedances, which represent low flow conditions that are critical for assessing water availability.

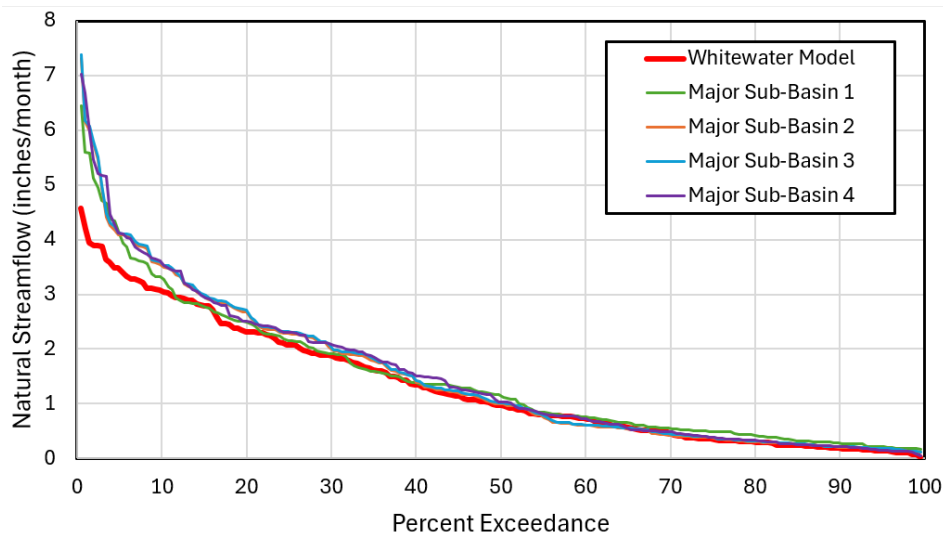


**Figure D-1.** Comparison of model simulated and historical flow duration curves in the Whitewater HUC-8.

Similar comparisons are made in **Figure D-2** and **Figure D-3** for the minor sub-basins. In each case, the model results for the HUC-8 are compared to either the minor sub-basins within that HUC-8, or the minor sub-basin used to evaluate historical natural baseflow in that HUC-8. In all cases, the high percent exceedance values show little bias, and the model results are used in water availability projections without bias correction.

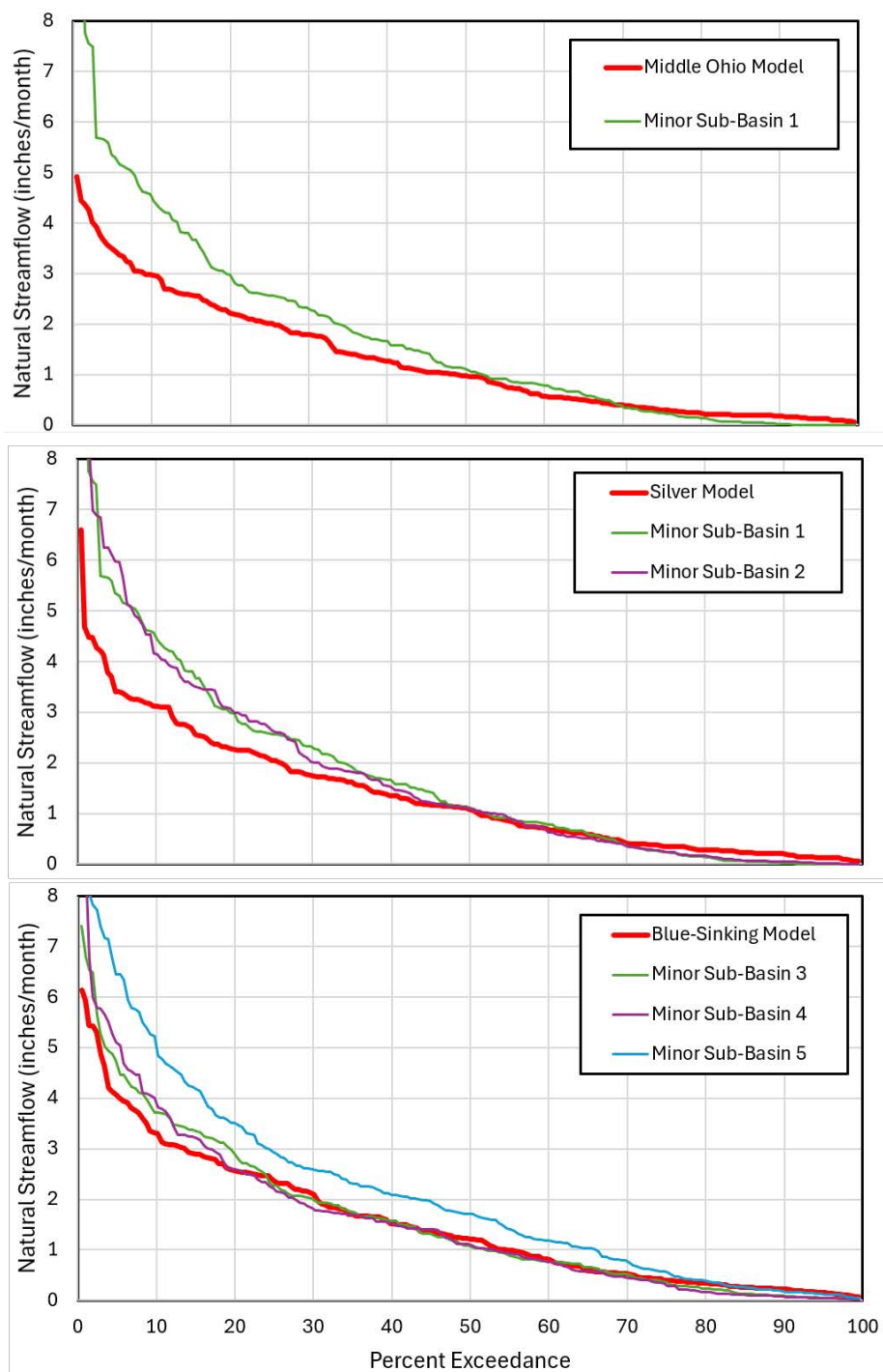


Figure D-2. Comparison of model simulated and historical flow duration curves for minor sub-basins and corresponding HUC-8: Middle Ohio, Silver-Little Kentucky, and Blue-Sinking.

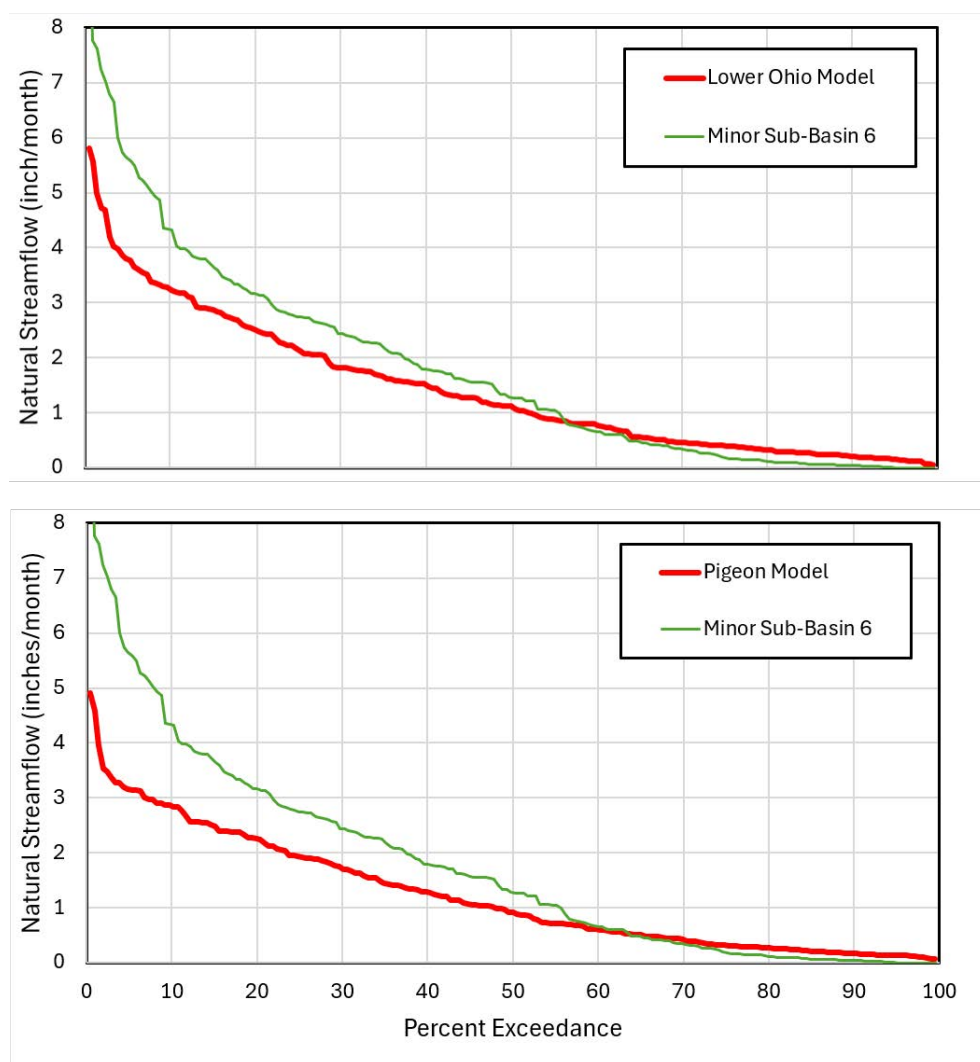


Figure D-3. Comparison of model simulated and historical flow duration curves for minor sub-basins and corresponding HUC-8: Lower Ohio and Highland-Pigeon.

### 3 Analysis of the Historical Seasonal Baseflow Index

As the projected NSF from the WBM is at a monthly timescale, standard baseflow separation techniques that rely on daily data cannot be used to estimate the natural baseflow. Instead, an analysis of the relationship between natural streamflow and the baseflow index (BFI) was conducted using the historical record (2007-2023). A strong seasonal relationship between natural streamflow and the baseflow index was identified in the major sub-basins of the Whitewater River watershed.

An example of this analysis is presented in the following figures. **Figure D-4** shows the relationship between seasonal NSF and the seasonal BFI for Major Sub-Basin 3 of the Whitewater River watershed: the Winter and Spring data are shown at the top, and Summer and Fall data are shown at the bottom. In the Winter and Spring, there is no clear correlation between BFI and NSF. As a result, a single average

value of BFI is used in those seasons. In contrast, a correlation can be seen in the Summer and Fall data with increasing BFI for decreasing NSF. The mathematical relationship between NSF and BFI for the major sub-basins of the Whitewater River watershed are summarized in **Table D-1**.

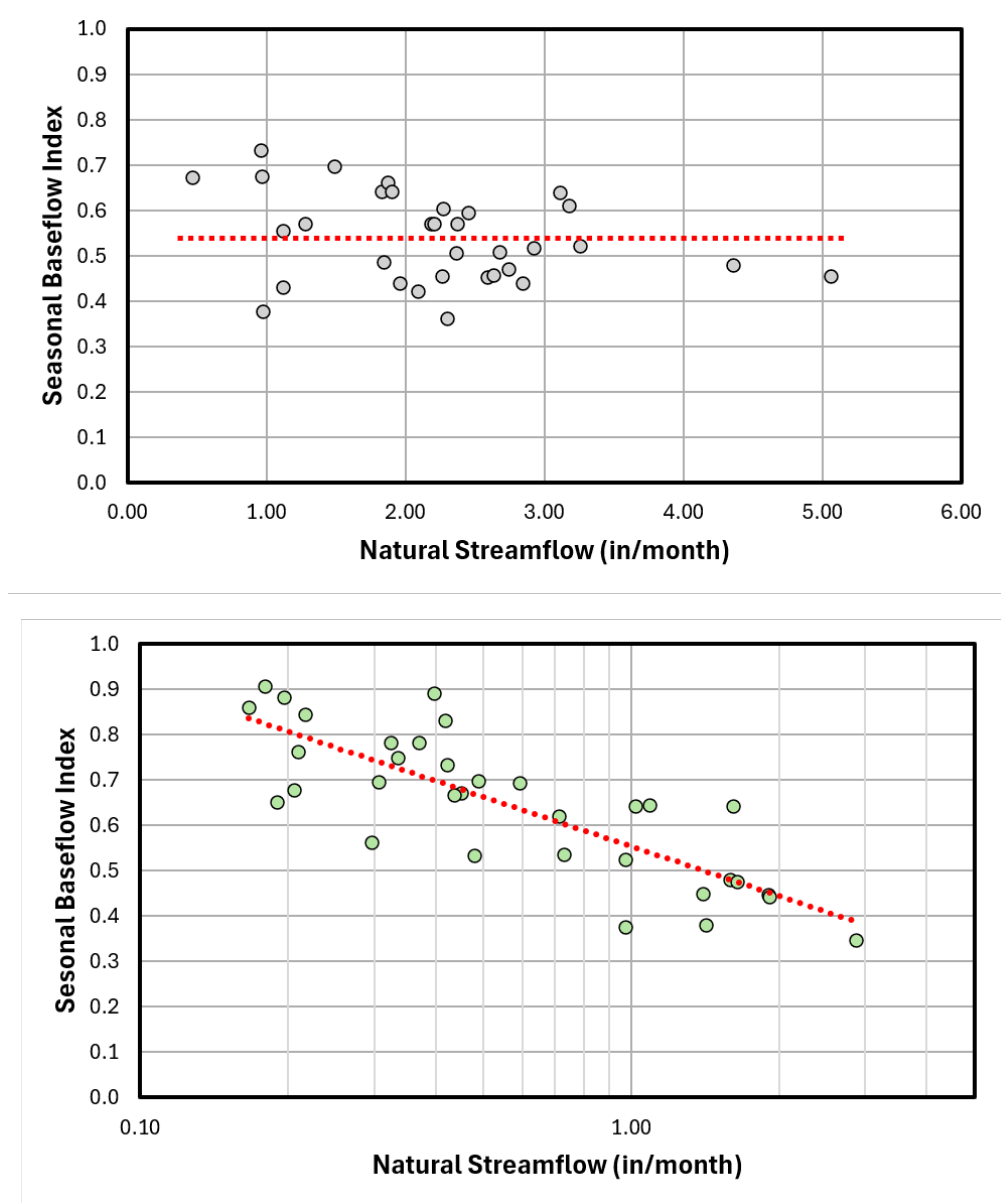


Figure D-4. Seasonal analysis of the baseflow index: (top) Winter and Spring baseflow indices are not correlated with natural streamflow; (bottom) Summer and Fall baseflow indices showing a strong correlation with natural streamflow. Data are from Major Sub-Basin 3 in the Whitewater River watershed.

**Table D-1.** Mathematical relationships between BFI and NSF for major sub-basins in the Whitewater River watershed.

| Major Sub-Basin ID | NSF (in/month) | BFI                                |
|--------------------|----------------|------------------------------------|
| 1                  | $\leq 1.0$     | $-0.153 \ln (\text{NSF}) + 0.6997$ |
|                    | $> 1.0$        | $-0.153 \ln (\text{NSF}) + 0.6997$ |
| 2                  | $\leq 1.0$     | $-0.158 \ln (\text{NSF}) + 0.5521$ |
|                    | $> 1.0$        | 0.55                               |
| 3                  | $\leq 1.0$     | $-0.157 \ln (\text{NSF}) + 0.5537$ |
|                    | $> 1.0$        | 0.54                               |
| 4                  | $\leq 1.0$     | $-0.178 \ln (\text{NSF}) + 0.4975$ |
|                    | $> 1.0$        | 0.49                               |
| 5                  | $\leq 1.0$     | $-0.178 \ln (\text{NSF}) + 0.4975$ |
|                    | $> 1.0$        | 0.49                               |

Historical data from minor sub-basins did not show a strong seasonal correlation between BFI and NSF; a single annual average BFI was used to separate future natural baseflow from future NSF for major sub-basins 6 through 10. Winter-Spring and Summer-Fall data are presented for Minor Sub-Basin 5 on a single graph in **Figure D-5** as an example. There is no apparent correlation between BFI and NSF for any of the seasons. Annual average baseflow indices applied to Major Sub-Basins 6 through 10 are presented in **Table D-2**. The last column of the table indicates the minor sub-basins(s) that were applied to the major sub-basins.

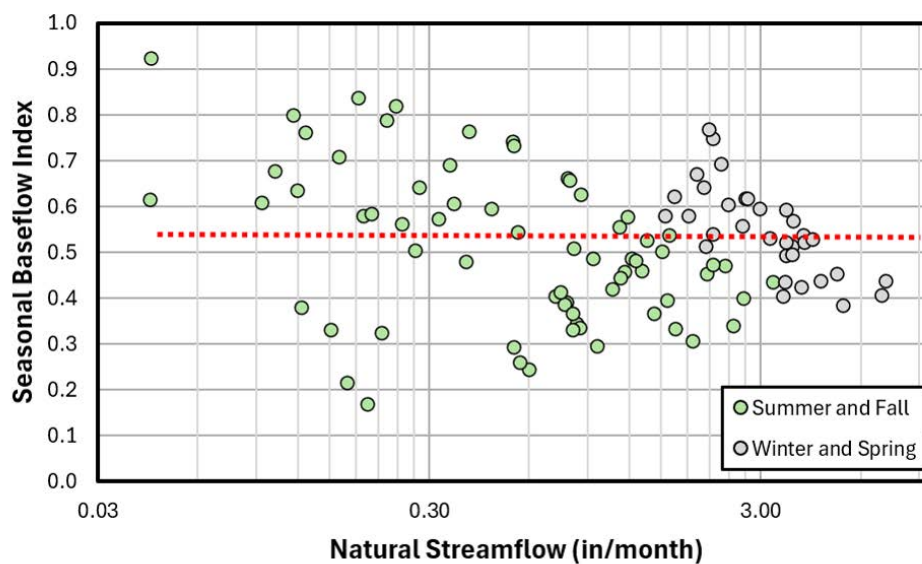


**Figure D-5.** Example of a case with no correlation between season baseflow index and Natural Streamflow. Data are for Minor Sub-Basin 5 in the Blue-Sinking Major Sub-Basin.

Table D-2. Annual average BFI for Major Sub-Basins 6 through 10.

| Major Sub-Basin ID | Name         | Annual BFI | Reference Minor Sub-Basin(s) |
|--------------------|--------------|------------|------------------------------|
| 6                  | Middle Ohio  | 0.33       | 1                            |
| 7                  | Silver       | 0.35       | 1,2                          |
| 8                  | Blue-Sinking | 0.50       | 3,5                          |
| 9                  | Lower Ohio   | 0.52       | 6                            |
| 10                 | Pigeon       | 0.52       | 6                            |

## 4 Consumptive Use Projections

Consumptive use factors were estimated on the scale of the major sub-basins during the analysis of historical water availability. Water withdrawal sectors were related to return flows through the standard industrial classification (SIC) code present in the National Pollutant Discharge Elimination System (NPDES) records. In this way, consumptive use factors were obtained for each withdrawal sector by major sub-basin. The resulting factors are presented in **Table D-3**.

A single annual average consumptive use coefficient was adequate for most sectors; no seasonal pattern was observed in withdrawals and returns. Public supply withdrawals and the corresponding returns at wastewater treatment plants within a sub-basin are often directly related. This is not always the case in the Ohio River and Southeast Indiana Water Region. Many municipalities import most of their public supply from distant sources and return the treated wastewater locally. Therefore, public supply withdrawals and wastewater treatment plant returns must be projected separately rather than combining them into a single consumptive use factor. Projected returns at local wastewater treatment plants are based on **projected demands** within a major sub-basin, rather than **projected withdrawals** within that sub-basin. These basins include 7, 8 and 9; relationships between projected demands and returns at wastewater treatment plants are presented in **Table D-4**, as well as energy production returns in Major Sub-Basin 7.

Major sub-basins in which public supply withdrawals are strongly correlated with wastewater treatment plant returns often exhibit seasonal patterns. Combined Sewer Overflow systems are present throughout the Ohio River and Southeast Indiana Water Region and therefore returns historically have exceeded withdrawals. Within these sub-basins, if returns historically exceed withdrawals throughout the year, a consumptive use factor of zero was applied to future public supply withdrawals. When returns and withdrawals exhibited seasonality with withdrawals exceeding returns during Summer and Fall, seasonal consumptive use coefficients were developed for those sub-basins.

A constant consumptive use factor of 0.13 was applied to all self-supplied residential withdrawals. Withdrawals at concentrated animal feeding operation (CAFO) are combined with the Rural Use sector. A consumptive use factor of 1.0 was applied to all projected irrigation withdrawals.

Table D-3. Consumptive use factors by major sub-basin.

| Major Sub-Basin | Season | Public Supply | Industry | Irrigation | Miscellaneous | Energy Production | Rural Use | Self-Supply |
|-----------------|--------|---------------|----------|------------|---------------|-------------------|-----------|-------------|
| 1               | All    | 0.00          | 1.00     | 1.00       | N/A           | N/A               | 1.00      | 0.13        |
| 2               | All    | 0.00          | 1.00     | 1.00       | N/A           | 0.00              | N/A       | 0.13        |
| 3               | Winter | 0.00          | 0.00     | 1.00       | N/A           | N/A               | N/A       | 0.13        |
|                 | Spring | 0.00          | 0.00     | 1.00       | N/A           | N/A               | N/A       | 0.13        |
|                 | Summer | 0.50          | 0.00     | 1.00       | N/A           | N/A               | N/A       | 0.13        |
|                 | Fall   | 0.50          | 0.00     | 1.00       | N/A           | N/A               | N/A       | 0.13        |
| 4               | Winter | 0.00          | 0.50     | 1.00       | 1.00          | N/A               | N/A       | 0.13        |
|                 | Spring | 0.00          | 0.50     | 1.00       | 1.00          | N/A               | N/A       | 0.13        |
|                 | Summer | 0.35          | 0.50     | 1.00       | 1.00          | N/A               | N/A       | 0.13        |
|                 | Fall   | 0.35          | 0.50     | 1.00       | 1.00          | N/A               | N/A       | 0.13        |
| 5               | All    | 1.00          | 0.00     | 1.00       | 1.00          | 1.00              | N/A       | 0.13        |
| 6               | All    | 0.00          | 0.00     | 1.00       | 1.00          | N/A               | 1.00      | 0.13        |
| 7               | All    | 0.00          | 0.50     | 1.00       | 1.00          | 0.00              | N/A       | 0.13        |
| 8               | All    | 0.00          | 0.00     | 1.00       | 1.00          | 1.00              | N/A       | 0.13        |
| 9               | All    | 0.00          | 1.00     | 1.00       | N/A           | N/A               | 1.00      | 0.13        |
| 10              | All    | 0.00          | 0.00     | 1.00       | 1.00          | N/A               | N/A       | 0.13        |

Table D-4. Additional projected returns related to projected public supply demands and energy production.

| Major Sub-Basin ID | Additional WWTP returns (MGD) | Additional EP returns (MGD) |
|--------------------|-------------------------------|-----------------------------|
| 7                  | Demand minus 13.5             | 12 (through 2040)           |
| 8                  | Demand minus 8.0              | --                          |
| 9                  | Demand minus 5.0              | --                          |

## 5 Brookville Reservoir

Future operations of the Brookville Reservoir (Franklin County, Indiana) are based on an average of annual operations from the historical period 2007-2023. While this does not reflect operational responses to projected flow variability, it does provide typical monthly operational constraints on the system. **Figure D-6** shows the variation of the monthly value of  $q_{STOR}$  throughout the historical period, 2007-2023: note the extreme low outliers in the record, reflecting periods of high inflow into the reservoir. The average monthly values of  $q_{STOR}$  (**Figure D-7**) are repeated annually from 2024 through 2070.

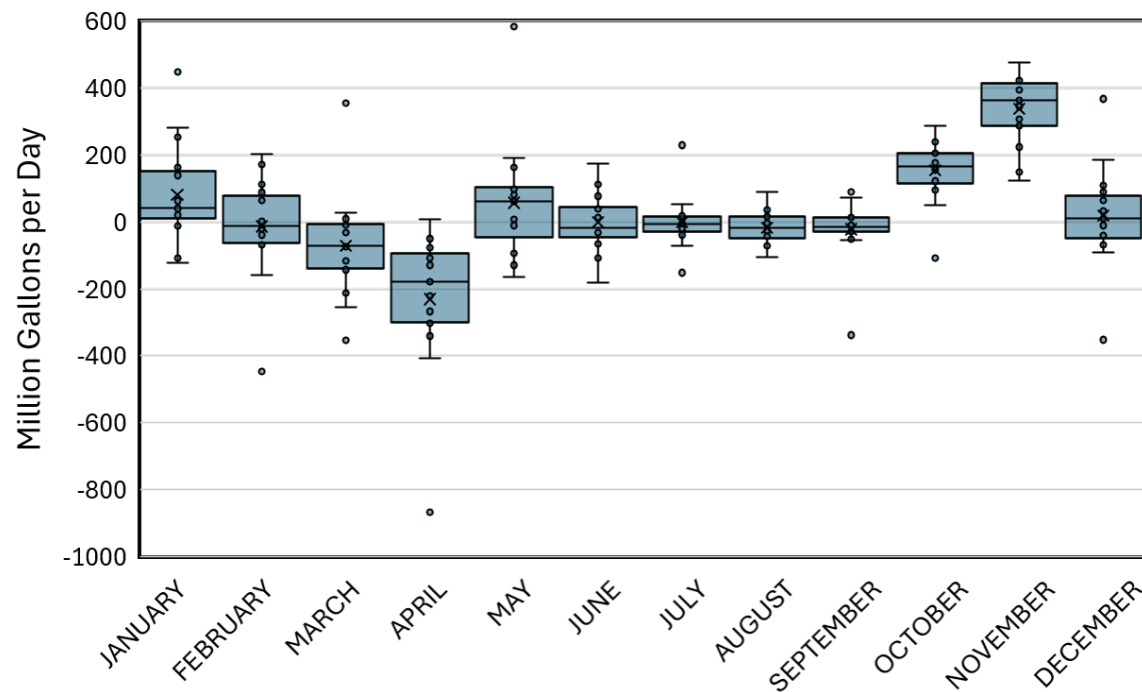


Figure D-6. The variation in monthly reservoir operations ( $q_{STOR}$ ) over the historical period, 2007-2023.

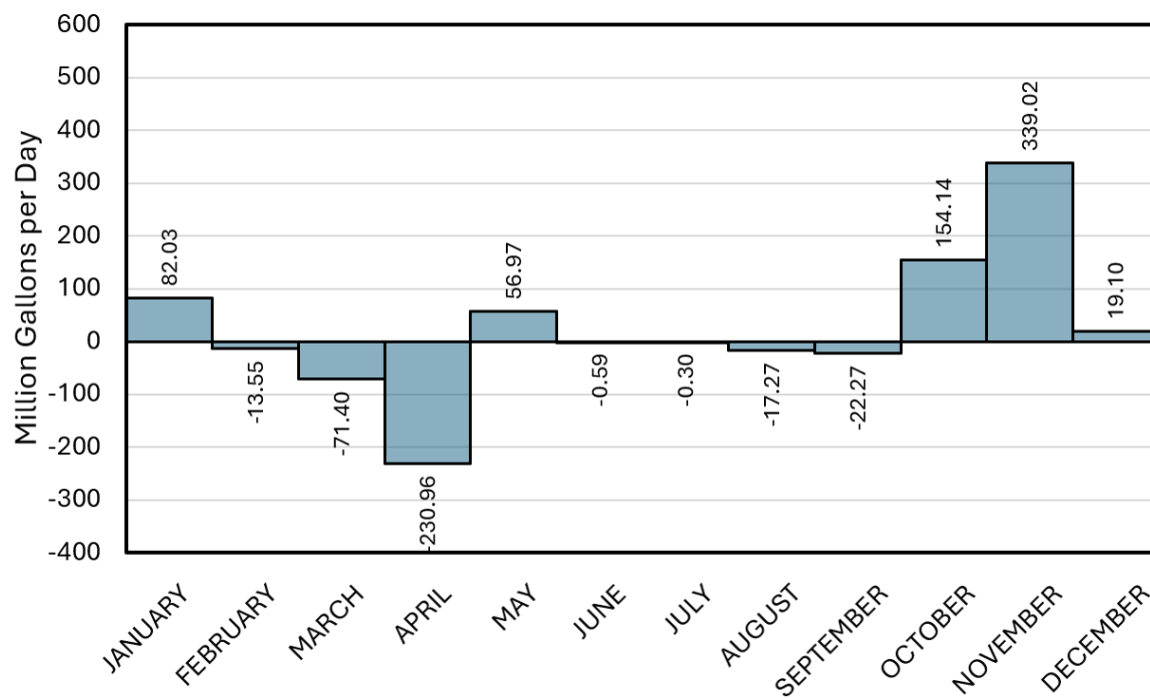


Figure D-7. The average monthly value of  $q_{STOR}$  at the Brookville Reservoir.

## 6 Ohio River Projections

Assessment of changes in streamflow and baseflow for the entire Ohio River Valley through Indiana due to climate change is not feasible for this project. Instead, use is made of a modeling study conducted jointly by the Huntington District of the U.S. Army Corps of Engineers, the Ohio River Basin Alliance, the Institute for Water Resources, the Great Lakes and Ohio River Division (USACE, 2017). The work was sponsored by the Institute for Water Resources through its Responses to Climate Change program. The scope of the project was more extensive than an evaluation of the impacts of climate change on water availability, including aquatic and terrestrial ecosystems, hydroelectric energy production, and infrastructure impacts including navigation and water supply.

The study used the World Climate Research Programme CMIP 3 modeling outputs as input into OHRFC hydrologic river model. The OHRFC used the Community Hydrologic Prediction System along with the Sacramento Soil Moisture Accounting Hydrologic Model (SAC-SMA) to generate the hydrologic response in an unnatural state: reservoir operations, water withdrawals, and consumptive use are included in the modeling, and therefore the results do not reflect natural flows. The model results predict future USGS flow measurements at various stations. While the GCM data used in the study has been superseded, hydrologic modeling remains state of the art, and the impact study itself has not been updated. The study presents results as a range of predicted changes to streamflow statistics; changes for the USGS station at Louisville, Kentucky are summarized in **Table D-5**.

The predicted changes are applied to the historical minimum, seasonal streamflow for the Ohio River at Louisville; results are summarized in **Table D-6**. A worst-case scenario is evaluated using the lowest percentage increase and highest percentage decrease and applying those changes to historical seasonal minimums. The results show that Fall minimum CXS WA increases through 2040 from a historic value of 4,300 MGD to 4,800 MGD and then decreases through 2070 to 2,700 MGD. While the historical analysis (see **Appendix C, section 3.5**) indicates that the Summer minimum CXS WA has been critical in the past, the study indicates that Fall is the critical season in the future. Even though this projection represents a 15% decrease in streamflow by 2070, the cumulative excess water availability is still very large, far exceeding the other major sub-basins in the Region.

Table D-5. Predicted net change in streamflow at Louisville, Kentucky through 2070.

| Parameter                       | Percent Change<br>(2011-2040) | Percent Change<br>(2041-2070) |
|---------------------------------|-------------------------------|-------------------------------|
| Mean annual streamflow          | +5 to +15%                    | +5 to +15%                    |
| Annual mean minimum streamflow  | +5 to +15%                    | -5 to +5%                     |
| March mean minimum streamflow   | -5 to +5%                     | +5 to +15%                    |
| October mean minimum streamflow | +5 to +15%                    | -15 to -5%                    |

**Table D-6.** Minimum seasonal streamflow, instream flow, and cumulative excess water availability (CXS WA) along the Ohio River near Louisville, Kentucky, for the historical period (1974–2024) and projected periods (2011–2040 and 2040–2070).

| Parameter                 | Historical<br>1974 –<br>2024<br>(MGD) | Projected<br>2011 –<br>2040<br>(MGD) | Projected<br>2040–<br>2070<br>(MGD) |
|---------------------------|---------------------------------------|--------------------------------------|-------------------------------------|
| Minimum Spring Streamflow | 68,600                                | 65,200                               | 78,900                              |
| Spring Instream Flow      | 14,200                                | 14,200                               | 14,200                              |
| Spring Minimum CXS WA     | 54,400                                | 51,000                               | 64,700                              |
| Minimum Fall streamflow   | 10,800                                | 11,300                               | 9,200                               |
| Fall Instream Flow        | 6,500                                 | 6,500                                | 6,500                               |
| Fall Minimum CXS WA       | 4,300                                 | 4,800                                | 2,700                               |

## 7 References

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## Appendix E

### Annual and Seasonal Summaries

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## 1 Natural Baseflow

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 (IFA, 2021, Chapter 2. Natural baseflow is the primary source of water availability. Seasonal and annual natural baseflows are presented in 5-year intervals, from 2010 to 2070 (**Table E-1** through **Table E-5**). The values represent the baseflow derived from the entire watershed upstream of the sub-basin outlet. Note that the natural baseflow is not estimated for Major Sub-Basin 11 (Ohio River and Outwash). Units are in millions of gallons per day (MGD).

Table E-1. Annual average natural baseflow (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 229.0 | 295.7 | 244.9 | 99.8  | 176.3 | 179.2 | 228.7 | 254.6 | 328.3 | 141.5 | 221.4 | 216.7 | 169.1 |
| 2               | 71.7  | 101.6 | 92.3  | 31.2  | 60.1  | 60.3  | 83.2  | 82.5  | 123.2 | 44.8  | 75.1  | 76.2  | 57.5  |
| 3               | 137.2 | 192.7 | 172.9 | 59.1  | 113.5 | 113.8 | 157.1 | 155.5 | 232.2 | 84.8  | 141.7 | 143.9 | 108.7 |
| 4               | 466.1 | 402.1 | 478.8 | 205.2 | 376.9 | 380.5 | 505.8 | 528.2 | 736.9 | 291.7 | 471.3 | 470.5 | 361.5 |
| 5               | 533.9 | 460.6 | 548.6 | 231.0 | 425.4 | 429.3 | 572.7 | 594.1 | 835.3 | 328.2 | 531.7 | 531.8 | 408.2 |
| 6               | 178.5 | 228.1 | 311.3 | 66.0  | 131.0 | 98.3  | 165.7 | 229.0 | 264.6 | 86.4  | 152.7 | 161.0 | 99.6  |
| 7               | 195.3 | 273.1 | 279.6 | 75.2  | 109.2 | 87.6  | 172.4 | 187.9 | 232.4 | 64.7  | 180.7 | 195.9 | 75.5  |
| 8               | 539.9 | 812.8 | 901.5 | 280.9 | 330.1 | 294.4 | 519.2 | 641.8 | 700.2 | 275.5 | 542.3 | 555.4 | 243.2 |
| 9               | 310.8 | 680.5 | 351.0 | 153.2 | 213.1 | 211.4 | 315.9 | 466.5 | 477.5 | 191.2 | 311.7 | 373.2 | 172.4 |
| 10              | 154.1 | 337.4 | 174.1 | 79.5  | 53.7  | 78.8  | 146.9 | 214.6 | 216.3 | 71.6  | 117.2 | 171.2 | 65.4  |



Table E-2. Winter average natural baseflow (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050   | 2055  | 2060  | 2065   | 2070  |
|-----------------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------|--------|-------|
| 1               | 236.0 | 274.8 | 394.0  | 74.4  | 260.3 | 256.4 | 327.7 | 266.9 | 442.2  | 244.1 | 312.7 | 399.9  | 157.2 |
| 2               | 72.6  | 119.7 | 137.1  | 23.5  | 92.7  | 84.7  | 120.1 | 84.6  | 169.9  | 76.9  | 105.7 | 145.8  | 49.8  |
| 3               | 143.1 | 228.9 | 256.2  | 44.6  | 174.7 | 159.8 | 226.4 | 159.3 | 320.0  | 145.1 | 199.1 | 274.6  | 94.2  |
| 4               | 538.9 | 408.9 | 596.1  | 154.8 | 567.5 | 537.9 | 726.2 | 546.8 | 1004.5 | 499.4 | 662.5 | 882.4  | 324.3 |
| 5               | 617.3 | 468.4 | 682.9  | 174.7 | 641.4 | 605.7 | 822.1 | 614.0 | 1139.5 | 560.8 | 746.5 | 998.2  | 364.9 |
| 6               | 267.4 | 225.3 | 401.1  | 35.1  | 237.3 | 122.7 | 295.6 | 190.8 | 329.3  | 133.2 | 187.5 | 295.2  | 56.3  |
| 7               | 390.6 | 292.2 | 382.9  | 40.2  | 193.2 | 92.8  | 276.3 | 137.5 | 288.9  | 78.8  | 237.8 | 382.0  | 25.6  |
| 8               | 888.2 | 853.6 | 1286.2 | 208.1 | 642.9 | 290.8 | 821.0 | 597.7 | 893.1  | 328.5 | 750.7 | 1186.6 | 77.1  |
| 9               | 528.4 | 399.1 | 803.9  | 84.4  | 420.1 | 248.3 | 463.3 | 448.7 | 626.6  | 183.0 | 474.5 | 778.4  | 64.0  |
| 10              | 262.0 | 197.9 | 398.6  | 14.9  | 80.2  | 96.3  | 208.0 | 261.7 | 261.4  | 29.6  | 125.0 | 360.8  | 41.5  |

Table E-3. Spring average natural baseflow (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010   | 2015   | 2020   | 2025  | 2030  | 2035  | 2040   | 2045  | 2050   | 2055  | 2060   | 2065  | 2070  |
|-----------------|--------|--------|--------|-------|-------|-------|--------|-------|--------|-------|--------|-------|-------|
| 1               | 358.7  | 418.7  | 299.8  | 216.1 | 280.1 | 316.2 | 416.9  | 336.5 | 505.5  | 210.2 | 363.6  | 320.2 | 350.9 |
| 2               | 142.4  | 159.4  | 156.4  | 66.7  | 95.8  | 110.6 | 159.6  | 115.9 | 204.0  | 66.5  | 129.8  | 112.8 | 127.1 |
| 3               | 267.7  | 295.7  | 290.7  | 126.0 | 180.8 | 208.7 | 300.6  | 218.4 | 384.4  | 125.9 | 244.5  | 212.9 | 239.8 |
| 4               | 1049.7 | 695.9  | 897.1  | 437.9 | 598.3 | 683.0 | 945.0  | 720.1 | 1180.7 | 432.3 | 793.2  | 694.5 | 772.3 |
| 5               | 1202.5 | 797.3  | 1027.7 | 491.4 | 674.9 | 771.2 | 1071.8 | 812.3 | 1342.9 | 485.9 | 896.4  | 784.4 | 873.5 |
| 6               | 354.1  | 404.1  | 534.9  | 172.8 | 216.6 | 197.1 | 292.3  | 261.4 | 469.9  | 158.3 | 284.9  | 264.4 | 250.6 |
| 7               | 337.5  | 524.7  | 533.6  | 206.0 | 176.5 | 165.7 | 323.5  | 268.0 | 407.6  | 135.2 | 333.4  | 312.8 | 193.9 |
| 8               | 965.6  | 1372.9 | 1404.4 | 732.2 | 500.9 | 427.9 | 984.4  | 831.2 | 1242.1 | 610.6 | 1024.7 | 802.3 | 593.1 |
| 9               | 616.5  | 1846.4 | 388.9  | 417.8 | 310.5 | 335.1 | 620.7  | 648.7 | 844.4  | 436.4 | 559.1  | 544.9 | 424.6 |
| 10              | 305.7  | 915.5  | 192.8  | 229.5 | 79.3  | 137.0 | 299.7  | 318.8 | 393.4  | 190.3 | 233.6  | 249.1 | 150.3 |



Table E-4. Summer average natural baseflow (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 264.8 | 350.7 | 176.9 | 79.1  | 69.4  | 99.2  | 113.1 | 221.1 | 256.5 | 69.9  | 132.0 | 92.1  | 109.2 |
| 2               | 58.9  | 95.2  | 46.5  | 25.0  | 22.1  | 31.1  | 35.0  | 69.2  | 84.7  | 22.2  | 40.4  | 28.8  | 33.9  |
| 3               | 111.3 | 183.0 | 89.0  | 47.5  | 42.0  | 59.1  | 66.5  | 131.1 | 159.9 | 42.2  | 76.8  | 54.7  | 64.5  |
| 4               | 222.0 | 337.6 | 293.6 | 164.8 | 145.5 | 205.4 | 232.0 | 451.9 | 537.9 | 146.3 | 268.7 | 190.2 | 224.8 |
| 5               | 254.3 | 386.7 | 336.4 | 186.1 | 164.5 | 231.7 | 261.2 | 507.6 | 605.7 | 165.3 | 302.0 | 214.4 | 253.3 |
| 6               | 83.8  | 191.0 | 129.3 | 42.8  | 40.7  | 53.4  | 54.1  | 223.5 | 214.3 | 36.4  | 107.7 | 54.7  | 62.0  |
| 7               | 42.7  | 178.2 | 103.7 | 43.0  | 35.0  | 58.0  | 65.8  | 168.1 | 194.1 | 29.2  | 117.7 | 55.7  | 55.6  |
| 8               | 259.3 | 735.6 | 496.2 | 147.8 | 107.5 | 226.7 | 199.3 | 505.1 | 552.9 | 116.1 | 299.9 | 124.2 | 172.4 |
| 9               | 79.0  | 417.3 | 109.1 | 84.5  | 74.2  | 124.8 | 134.9 | 350.2 | 359.9 | 105.8 | 151.4 | 85.9  | 128.1 |
| 10              | 39.2  | 206.9 | 54.1  | 55.9  | 25.2  | 55.7  | 58.1  | 158.5 | 168.2 | 47.2  | 66.0  | 39.9  | 44.1  |

Table E-5. Fall average natural baseflow (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010 | 2015  | 2020  | 2025 | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 56.6 | 138.4 | 109.1 | 29.5 | 95.6  | 45.0  | 57.0  | 194.2 | 108.9 | 41.7  | 77.3  | 54.5  | 59.0  |
| 2               | 13.0 | 32.1  | 29.0  | 9.7  | 29.6  | 14.6  | 18.2  | 60.1  | 33.9  | 13.6  | 24.4  | 17.5  | 19.0  |
| 3               | 26.9 | 63.1  | 55.9  | 18.4 | 56.3  | 27.8  | 34.7  | 113.3 | 64.5  | 25.8  | 46.4  | 33.3  | 36.1  |
| 4               | 53.8 | 166.0 | 128.6 | 63.3 | 196.3 | 95.7  | 119.9 | 394.1 | 224.6 | 88.7  | 160.9 | 115.1 | 124.7 |
| 5               | 61.6 | 190.1 | 147.3 | 71.9 | 221.1 | 108.5 | 135.6 | 442.4 | 253.2 | 100.6 | 181.6 | 130.3 | 141.1 |
| 6               | 8.9  | 92.1  | 179.8 | 13.1 | 29.2  | 19.9  | 20.9  | 240.3 | 45.1  | 17.7  | 30.5  | 29.7  | 29.8  |
| 7               | 10.2 | 97.3  | 98.1  | 11.6 | 32.1  | 33.7  | 24.2  | 177.8 | 39.2  | 15.6  | 34.0  | 33.1  | 27.1  |
| 8               | 46.4 | 289.1 | 419.3 | 35.7 | 68.9  | 232.2 | 72.2  | 633.0 | 112.5 | 47.0  | 93.9  | 108.3 | 130.1 |
| 9               | 19.2 | 59.1  | 102.3 | 26.3 | 47.5  | 137.3 | 44.7  | 418.3 | 78.8  | 39.4  | 61.7  | 83.5  | 72.9  |
| 10              | 9.5  | 29.3  | 50.7  | 17.6 | 30.0  | 26.2  | 21.6  | 119.3 | 42.2  | 19.1  | 44.2  | 34.8  | 25.6  |



## 2 Water Availability

Water Availability is the portion of natural baseflow generated within a sub-basin and remaining in the stream at the sub-basin outlet after instream flow requirements in the sub-basin are accounted for. Instream flows are minimum streamflows required to support the ecological health of the stream, recreational use, and water quality. Water availability within a sub-basin may be supplemented by flows released from reservoir storage. While the net baseflow generated in a sub-basin may be negative, the water availability in a sub-basin cannot be less than zero. Seasonal and annual water availability are presented by sub-basin in 5-year intervals, from 2010 to 2070 (**Tables Table E-6 through Table E-10**). Note that water availability is not estimated for Major Sub-Basin 11 (Ohio River and Outwash). Units are in millions of gallons per day (MGD).

Table E-6. Annual average water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 167.5 | 234.2 | 183.4 | 48.5  | 121.1 | 118.1 | 169.2 | 193.1 | 266.8 | 82.6  | 160.2 | 157.8 | 108.9 |
| 2               | 56.2  | 86.1  | 76.8  | 17.3  | 46.0  | 44.8  | 68.0  | 67.0  | 107.7 | 29.5  | 59.6  | 60.9  | 42.0  |
| 3               | 58.0  | 83.6  | 73.2  | 20.5  | 46.1  | 46.1  | 66.5  | 65.6  | 101.5 | 32.6  | 59.1  | 60.2  | 43.7  |
| 4               | 127.9 | 9.3   | 70.6  | 21.1  | 60.1  | 57.8  | 91.2  | 88.1  | 146.5 | 36.9  | 78.4  | 81.4  | 54.1  |
| 5               | 53.0  | 42.5  | 53.7  | 12.0  | 34.0  | 32.8  | 51.3  | 49.8  | 82.4  | 20.9  | 44.3  | 45.7  | 31.0  |
| 6               | 177.5 | 227.1 | 310.3 | 65.0  | 130.0 | 97.3  | 164.7 | 228.0 | 263.6 | 85.4  | 151.7 | 160.0 | 98.6  |
| 7               | 190.7 | 268.5 | 275.0 | 70.6  | 104.8 | 83.0  | 167.9 | 183.3 | 227.9 | 60.1  | 176.2 | 191.4 | 71.0  |
| 8               | 501.6 | 774.3 | 863.0 | 242.4 | 294.6 | 257.5 | 480.7 | 603.3 | 661.7 | 237.8 | 503.8 | 516.9 | 206.6 |
| 9               | 307.6 | 677.4 | 347.9 | 150.1 | 209.9 | 208.2 | 312.8 | 463.3 | 474.3 | 188.0 | 308.5 | 370.0 | 169.2 |
| 10              | 150.8 | 334.1 | 170.8 | 76.4  | 50.5  | 75.5  | 143.6 | 211.3 | 213.0 | 68.3  | 113.9 | 167.9 | 62.1  |



Table E-7. Winter average water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065   | 2070 |
|-----------------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|------|
| 1               | 158.0 | 196.8 | 316.0  | 20.5  | 204.4 | 178.4 | 249.7 | 188.9 | 364.2 | 166.1 | 234.7 | 321.9  | 84.3 |
| 2               | 51.6  | 98.7  | 116.1  | 7.3   | 77.4  | 63.7  | 99.1  | 63.6  | 148.9 | 55.9  | 84.7  | 124.8  | 29.1 |
| 3               | 63.5  | 102.2 | 112.1  | 14.1  | 75.9  | 68.1  | 99.3  | 67.7  | 143.1 | 61.3  | 86.4  | 121.8  | 37.4 |
| 4               | 123.8 | 0.0   | 0.0    | 9.5   | 106.3 | 85.7  | 136.1 | 84.6  | 206.2 | 74.1  | 114.7 | 171.8  | 38.4 |
| 5               | 57.5  | 38.5  | 65.8   | 5.0   | 58.7  | 46.8  | 74.9  | 46.2  | 114.0 | 40.4  | 63.0  | 94.9   | 20.8 |
| 6               | 265.4 | 223.3 | 399.1  | 33.1  | 235.3 | 120.7 | 293.6 | 188.8 | 327.3 | 131.2 | 185.5 | 293.2  | 54.3 |
| 7               | 381.8 | 283.4 | 374.1  | 31.4  | 185.0 | 84.0  | 267.5 | 128.7 | 280.1 | 70.0  | 229.0 | 373.2  | 16.8 |
| 8               | 833.2 | 798.6 | 1231.2 | 153.1 | 600.2 | 242.4 | 766.0 | 542.7 | 838.1 | 273.5 | 695.7 | 1131.6 | 29.9 |
| 9               | 522.1 | 392.8 | 797.6  | 78.1  | 413.8 | 242.0 | 457.0 | 442.4 | 620.3 | 176.7 | 468.2 | 772.1  | 57.7 |
| 10              | 255.4 | 191.3 | 392.0  | 9.2   | 74.3  | 89.7  | 201.4 | 255.1 | 254.8 | 23.0  | 118.4 | 354.2  | 34.9 |

Table E-8. Spring average water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015   | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050   | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|--------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|
| 1               | 280.7 | 340.7  | 221.8  | 138.1 | 202.1 | 238.2 | 338.9 | 258.5 | 427.5  | 132.2 | 285.6 | 242.2 | 272.9 |
| 2               | 121.4 | 138.4  | 135.4  | 45.7  | 74.8  | 89.6  | 138.6 | 94.9  | 183.0  | 45.5  | 108.8 | 91.8  | 106.1 |
| 3               | 118.3 | 129.3  | 127.3  | 52.2  | 78.0  | 91.1  | 134.0 | 95.5  | 173.3  | 52.4  | 107.7 | 93.1  | 105.7 |
| 4               | 387.8 | 37.3   | 270.6  | 59.9  | 101.4 | 122.1 | 191.5 | 129.3 | 254.9  | 60.1  | 149.1 | 125.3 | 145.5 |
| 5               | 131.8 | 80.3   | 109.6  | 32.4  | 55.6  | 67.2  | 105.8 | 71.1  | 141.2  | 32.6  | 82.2  | 68.9  | 80.2  |
| 6               | 352.1 | 402.1  | 532.9  | 170.8 | 214.6 | 195.1 | 290.3 | 259.4 | 467.9  | 156.3 | 282.9 | 262.4 | 248.6 |
| 7               | 328.7 | 515.9  | 524.8  | 197.2 | 167.7 | 156.9 | 314.7 | 259.2 | 398.8  | 126.4 | 324.6 | 304.0 | 185.1 |
| 8               | 910.6 | 1317.9 | 1349.4 | 677.2 | 445.9 | 372.9 | 929.4 | 776.2 | 1187.1 | 555.6 | 969.7 | 747.3 | 538.1 |
| 9               | 610.2 | 1840.1 | 382.6  | 411.5 | 304.2 | 328.8 | 614.4 | 642.4 | 838.1  | 430.1 | 552.8 | 538.6 | 418.3 |
| 10              | 299.1 | 908.9  | 186.2  | 222.9 | 72.7  | 130.4 | 293.1 | 312.2 | 386.8  | 183.7 | 227.0 | 242.5 | 143.7 |



Table E-9. Summer average water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030 | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 219.8 | 305.7 | 131.9 | 35.2  | 24.8 | 54.2  | 68.1  | 176.1 | 211.5 | 27.8  | 87.0  | 50.9  | 64.2  |
| 2               | 48.9  | 85.2  | 36.5  | 15.0  | 12.1 | 21.1  | 25.0  | 59.2  | 74.7  | 12.2  | 30.4  | 18.8  | 23.9  |
| 3               | 44.3  | 79.8  | 34.5  | 14.5  | 11.9 | 20.0  | 23.5  | 53.8  | 67.1  | 12.0  | 28.4  | 17.9  | 22.6  |
| 4               | 0.0   | 0.0   | 11.9  | 15.1  | 10.6 | 23.2  | 28.4  | 75.8  | 97.6  | 11.9  | 35.8  | 21.6  | 27.0  |
| 5               | 21.3  | 38.1  | 31.8  | 10.3  | 8.0  | 15.3  | 18.2  | 44.6  | 56.8  | 8.2   | 22.3  | 13.6  | 17.4  |
| 6               | 83.8  | 191.0 | 129.3 | 42.8  | 40.7 | 53.4  | 54.1  | 223.5 | 214.3 | 36.4  | 107.7 | 54.7  | 62.0  |
| 7               | 42.4  | 177.9 | 103.4 | 42.7  | 34.7 | 57.7  | 65.5  | 167.8 | 193.8 | 28.9  | 117.4 | 55.4  | 55.3  |
| 8               | 237.3 | 713.6 | 474.2 | 125.8 | 85.5 | 204.7 | 177.3 | 483.1 | 530.9 | 94.1  | 277.9 | 102.2 | 150.4 |
| 9               | 79.0  | 417.3 | 109.1 | 84.5  | 74.2 | 124.8 | 134.9 | 350.2 | 359.9 | 105.8 | 151.4 | 85.9  | 128.1 |
| 10              | 39.2  | 206.9 | 54.1  | 55.9  | 25.2 | 55.7  | 58.1  | 158.5 | 168.2 | 47.2  | 66.0  | 39.9  | 44.1  |

Table E-10. Fall average water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010 | 2015  | 2020  | 2025 | 2030 | 2035  | 2040 | 2045  | 2050 | 2055 | 2060 | 2065 | 2070  |
|-----------------|------|-------|-------|------|------|-------|------|-------|------|------|------|------|-------|
| 1               | 11.6 | 93.4  | 64.1  | 0.0  | 53.1 | 1.8   | 20.3 | 149.2 | 63.9 | 4.4  | 33.4 | 16.0 | 14.0  |
| 2               | 3.0  | 22.1  | 19.0  | 1.0  | 19.6 | 4.6   | 9.3  | 50.1  | 23.9 | 4.4  | 14.4 | 8.0  | 9.0   |
| 3               | 5.9  | 23.1  | 18.9  | 1.3  | 18.7 | 5.2   | 9.0  | 45.3  | 22.6 | 4.6  | 14.0 | 7.9  | 9.1   |
| 4               | 0.0  | 0.0   | 0.0   | 0.0  | 21.9 | 0.2   | 8.6  | 62.6  | 27.2 | 1.4  | 14.1 | 6.7  | 5.5   |
| 5               | 1.5  | 13.2  | 7.7   | 0.2  | 13.8 | 1.8   | 6.4  | 37.3  | 17.5 | 2.3  | 9.8  | 5.3  | 5.5   |
| 6               | 8.9  | 92.1  | 179.8 | 13.1 | 29.2 | 19.9  | 20.9 | 240.3 | 45.1 | 17.7 | 30.5 | 29.7 | 29.8  |
| 7               | 9.9  | 97.0  | 97.8  | 11.3 | 31.8 | 33.4  | 23.9 | 177.5 | 38.9 | 15.3 | 33.7 | 32.8 | 26.8  |
| 8               | 25.4 | 267.1 | 397.3 | 13.7 | 46.9 | 210.2 | 50.2 | 611.0 | 90.5 | 28.0 | 71.9 | 86.3 | 108.1 |
| 9               | 19.2 | 59.1  | 102.3 | 26.3 | 47.5 | 137.3 | 44.7 | 418.3 | 78.8 | 39.4 | 61.7 | 83.5 | 72.9  |
| 10              | 9.5  | 29.3  | 50.7  | 17.6 | 30.0 | 26.2  | 21.6 | 119.3 | 42.2 | 19.1 | 44.2 | 34.8 | 25.6  |



### 3 Excess Water Availability

Excess Water Availability is the portion of water availability within a sub-basin 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 sub-basin under natural baseflow conditions reduced by existing water use (i.e., existing withdrawals minus returns). A positive value indicates that there is unused water in the sub-basin, while a negative value indicates that more water is being used than is generated naturally within the sub-basin. Seasonal and annual excess water availability are presented by sub-basin in 5-year intervals, from 2010 to 2070 (**Tables Table E-11 through Table E-15**). Note that excess water availability is not estimated for Major Sub-Basin 11 (Ohio River and Outwash). Units are in millions of gallons per day (MGD).

Table E-11. Annual average excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 168.2 | 233.3 | 180.2 | 47.4  | 119.6 | 116.8 | 167.6 | 191.7 | 265.2 | 80.7  | 158.4 | 155.9 | 107.1 |
| 2               | 61.0  | 91.3  | 80.1  | 13.6  | 41.4  | 40.1  | 63.4  | 62.3  | 103.0 | 24.8  | 54.9  | 56.2  | 37.3  |
| 3               | 133.9 | 133.9 | 99.0  | 45.7  | 71.3  | 71.2  | 91.5  | 90.7  | 126.7 | 57.7  | 84.2  | 85.3  | 68.9  |
| 4               | 128.4 | 9.0   | 70.1  | 20.5  | 59.6  | 57.3  | 90.6  | 87.6  | 146.0 | 36.4  | 77.9  | 80.9  | 53.7  |
| 5               | 50.2  | 39.6  | 51.1  | 8.2   | 30.1  | 28.9  | 47.5  | 46.3  | 78.8  | 17.3  | 40.9  | 42.2  | 27.7  |
| 6               | 176.8 | 227.7 | 310.5 | 63.6  | 128.4 | 95.7  | 163.1 | 226.3 | 261.8 | 83.6  | 149.8 | 158.0 | 96.6  |
| 7               | 218.1 | 288.7 | 298.1 | 87.8  | 123.1 | 100.9 | 186.5 | 201.2 | 246.3 | 79.5  | 195.2 | 210.9 | 90.0  |
| 8               | 504.3 | 779.7 | 863.2 | 243.0 | 295.0 | 257.5 | 480.9 | 602.9 | 661.3 | 237.6 | 503.2 | 516.3 | 205.6 |
| 9               | 310.7 | 684.6 | 361.9 | 152.4 | 212.5 | 210.6 | 315.3 | 465.4 | 476.5 | 190.4 | 310.8 | 372.4 | 171.3 |
| 10              | 154.3 | 340.5 | 177.1 | 79.6  | 53.1  | 77.3  | 145.5 | 212.4 | 214.0 | 69.4  | 114.6 | 168.3 | 61.9  |



Table E-12. Winter average excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065   | 2070 |
|-----------------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|------|
| 1               | 160.1 | 194.3 | 312.0  | 20.2  | 204.1 | 178.1 | 249.4 | 188.6 | 363.9 | 165.8 | 234.4 | 321.6  | 84.0 |
| 2               | 58.1  | 103.0 | 122.2  | 4.0   | 73.2  | 59.5  | 94.9  | 59.4  | 144.7 | 51.6  | 80.5  | 120.6  | 24.8 |
| 3               | 177.2 | 130.0 | 156.9  | 44.7  | 106.5 | 98.6  | 129.4 | 98.3  | 173.7 | 91.8  | 116.5 | 152.4  | 67.9 |
| 4               | 125.3 | 0.0   | 0.0    | 8.9   | 106.0 | 85.4  | 135.8 | 84.2  | 205.9 | 73.8  | 114.4 | 171.5  | 38.1 |
| 5               | 55.1  | 35.8  | 63.2   | 1.7   | 55.2  | 43.4  | 71.5  | 42.8  | 110.7 | 37.2  | 59.8  | 91.8   | 17.8 |
| 6               | 264.2 | 222.8 | 398.9  | 30.6  | 232.5 | 117.7 | 290.4 | 185.5 | 323.8 | 127.5 | 181.7 | 289.2  | 50.1 |
| 7               | 410.3 | 307.3 | 403.7  | 46.8  | 201.5 | 100.8 | 284.6 | 145.8 | 297.3 | 87.5  | 246.7 | 391.0  | 34.6 |
| 8               | 835.7 | 803.7 | 1233.5 | 152.6 | 599.5 | 241.5 | 765.3 | 541.8 | 837.0 | 272.3 | 694.4 | 1130.2 | 28.3 |
| 9               | 525.3 | 398.5 | 812.4  | 79.6  | 415.6 | 243.8 | 458.8 | 444.1 | 622.0 | 178.4 | 469.8 | 773.7  | 59.1 |
| 10              | 260.6 | 197.6 | 400.1  | 11.1  | 75.8  | 90.9  | 202.5 | 256.0 | 255.5 | 23.4  | 118.7 | 354.3  | 34.5 |

Table E-13. Spring average excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015   | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050   | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|--------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|
| 1               | 283.4 | 343.6  | 219.9  | 137.3 | 201.2 | 237.4 | 338.0 | 257.5 | 426.4  | 131.0 | 284.5 | 241.2 | 271.8 |
| 2               | 126.8 | 145.4  | 140.8  | 41.9  | 70.0  | 84.7  | 133.8 | 90.1  | 178.2  | 40.6  | 103.9 | 86.9  | 101.2 |
| 3               | 42.9  | 37.4   | 50.0   | -28.0 | -2.3  | 10.8  | 53.8  | 15.2  | 93.0   | -27.9 | 27.5  | 12.8  | 25.5  |
| 4               | 388.4 | 37.3   | 270.1  | 59.4  | 101.0 | 121.7 | 191.1 | 128.9 | 254.5  | 59.7  | 148.7 | 124.9 | 145.1 |
| 5               | 129.2 | 77.6   | 107.2  | 29.0  | 51.9  | 63.5  | 102.2 | 67.7  | 137.8  | 29.2  | 78.9  | 65.7  | 77.0  |
| 6               | 352.4 | 403.6  | 534.3  | 169.7 | 213.4 | 193.8 | 289.0 | 258.0 | 466.6  | 155.0 | 281.5 | 261.1 | 247.2 |
| 7               | 358.2 | 535.9  | 546.8  | 213.4 | 185.4 | 174.5 | 332.8 | 276.8 | 416.5  | 144.8 | 342.7 | 322.8 | 204.0 |
| 8               | 913.8 | 1324.2 | 1348.3 | 676.5 | 445.1 | 371.8 | 928.5 | 774.8 | 1185.6 | 554.1 | 967.8 | 745.6 | 536.2 |
| 9               | 613.2 | 1850.1 | 399.5  | 413.4 | 306.5 | 331.0 | 616.6 | 644.3 | 840.0  | 432.0 | 554.6 | 540.6 | 420.3 |
| 10              | 303.9 | 917.4  | 193.7  | 225.3 | 75.2  | 132.2 | 295.0 | 313.2 | 387.6  | 184.6 | 227.5 | 243.3 | 143.7 |



Table E-14. Summer average excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030 | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 218.5 | 304.1 | 126.4 | 32.8  | 21.1 | 50.7  | 64.1  | 172.6 | 207.8 | 23.1  | 82.8  | 46.5  | 59.9  |
| 2               | 53.9  | 92.3  | 38.0  | 11.1  | 7.1  | 16.1  | 19.9  | 54.2  | 69.7  | 7.1   | 25.3  | 13.6  | 18.8  |
| 3               | 124.0 | 144.2 | 15.6  | 8.1   | 5.5  | 13.6  | 17.1  | 47.5  | 60.8  | 5.6   | 22.1  | 11.6  | 16.2  |
| 4               | -0.1  | -0.7  | 11.0  | 14.4  | 9.9  | 22.5  | 27.7  | 75.2  | 97.0  | 11.2  | 35.2  | 20.9  | 26.4  |
| 5               | 18.0  | 35.0  | 29.0  | 6.0   | 3.3  | 11.0  | 13.7  | 40.8  | 52.8  | 4.1   | 18.5  | 9.6   | 13.8  |
| 6               | 83.1  | 191.5 | 129.3 | 42.0  | 39.8 | 52.4  | 53.1  | 222.5 | 213.2 | 35.3  | 106.7 | 53.6  | 60.9  |
| 7               | 68.7  | 195.7 | 123.1 | 62.3  | 55.9 | 77.6  | 86.6  | 187.3 | 214.4 | 50.9  | 138.4 | 78.3  | 76.2  |
| 8               | 240.0 | 718.9 | 473.7 | 127.8 | 87.6 | 205.9 | 179.0 | 483.8 | 531.8 | 95.3  | 278.4 | 103.4 | 150.4 |
| 9               | 82.8  | 427.0 | 118.7 | 88.0  | 77.9 | 127.9 | 138.4 | 353.1 | 363.1 | 109.2 | 154.5 | 89.5  | 130.8 |
| 10              | 40.8  | 213.1 | 60.1  | 61.0  | 29.1 | 58.2  | 60.7  | 160.2 | 169.8 | 48.5  | 66.5  | 40.7  | 43.7  |

Table E-15. Fall average excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 10.9  | 91.4  | 62.7  | -0.8  | 52.1  | 0.9   | 19.0  | 148.0 | 62.7  | 2.9   | 32.0  | 14.3  | 12.7  |
| 2               | 5.1   | 24.6  | 19.6  | -2.5  | 15.2  | 0.2   | 4.9   | 45.6  | 19.5  | 0.0   | 9.9   | 3.5   | 4.5   |
| 3               | 191.5 | 224.1 | 173.3 | 157.9 | 175.3 | 161.8 | 165.7 | 201.9 | 179.3 | 161.3 | 170.7 | 164.6 | 165.8 |
| 4               | 0.0   | -0.6  | -0.8  | -0.6  | 21.3  | -0.4  | 8.0   | 62.0  | 26.6  | 0.8   | 13.6  | 6.2   | 5.0   |
| 5               | -1.5  | 10.2  | 4.9   | -3.7  | 9.9   | -2.1  | 2.5   | 33.7  | 13.9  | -1.3  | 6.2   | 1.9   | 2.2   |
| 6               | 7.5   | 92.7  | 179.7 | 12.1  | 28.1  | 18.7  | 19.7  | 239.1 | 43.8  | 16.4  | 29.2  | 28.3  | 28.4  |
| 7               | 35.4  | 115.9 | 118.8 | 28.5  | 49.5  | 50.8  | 42.0  | 195.0 | 57.2  | 34.6  | 53.1  | 51.7  | 45.2  |
| 8               | 27.5  | 271.8 | 397.3 | 15.0  | 47.8  | 210.7 | 50.9  | 611.1 | 90.8  | 28.6  | 72.3  | 86.2  | 107.5 |
| 9               | 21.4  | 62.9  | 117.0 | 28.7  | 50.0  | 139.5 | 47.3  | 420.3 | 81.0  | 42.0  | 64.1  | 85.6  | 74.8  |
| 10              | 12.1  | 34.0  | 54.4  | 21.0  | 32.4  | 28.0  | 23.9  | 120.3 | 43.3  | 21.0  | 45.6  | 35.0  | 25.6  |



## 4 Cumulative Excess Water Availability

Cumulative Excess Water Availability (CXS WA) is the Excess Water Availability (XS WA) summed over all upstream sub-basins. Sub-basins with negative XS WA are using the positive XS WA from upstream sub-basins to supply demand. Most values of CXS WA are positive; a negative value means that the streamflow falls below the instream flow requirements. The streamflow itself is always positive. Seasonal and annual cumulative excess water availability are presented by sub-basin in 5-year intervals, from 2010 to 2070 (**Tables Table E-16 through Table E-20**). The values of CXS WA for Major Sub-Basins 6 through 10 are identical to the corresponding XS WA values, as these basins have no upstream contributing sub-basins. Note that future time series for cumulative excess water availability is not estimated for Major Sub-Basin 11 (Ohio River and Outwash). Units are in millions of gallons per day (MGD).

Table E-16. Annual average cumulative excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 168.2 | 233.3 | 180.2 | 47.4  | 119.6 | 116.8 | 167.6 | 191.7 | 265.2 | 80.7  | 158.4 | 155.9 | 107.1 |
| 2               | 61.0  | 91.3  | 80.1  | 13.6  | 41.4  | 40.1  | 63.4  | 62.3  | 103.0 | 24.8  | 54.9  | 56.2  | 37.3  |
| 3               | 194.9 | 225.3 | 179.1 | 59.3  | 112.6 | 111.3 | 154.8 | 153.0 | 229.7 | 82.6  | 139.1 | 141.5 | 106.2 |
| 4               | 491.5 | 467.6 | 429.4 | 127.2 | 291.8 | 285.4 | 413.1 | 432.3 | 640.9 | 199.7 | 375.5 | 378.3 | 267.0 |
| 5               | 541.7 | 507.2 | 480.5 | 135.4 | 321.9 | 314.4 | 460.6 | 478.6 | 719.7 | 216.9 | 416.3 | 420.5 | 294.7 |
| 6               | 176.8 | 227.7 | 310.5 | 63.6  | 128.4 | 95.7  | 163.1 | 226.3 | 261.8 | 83.6  | 149.8 | 158.0 | 96.6  |
| 7               | 218.1 | 288.7 | 298.1 | 87.8  | 123.1 | 100.9 | 186.5 | 201.2 | 246.3 | 79.5  | 195.2 | 210.9 | 90.0  |
| 8               | 504.3 | 779.7 | 863.2 | 243.0 | 295.0 | 257.5 | 480.9 | 602.9 | 661.3 | 237.6 | 503.2 | 516.3 | 205.6 |
| 9               | 310.7 | 684.6 | 361.9 | 152.4 | 212.5 | 210.6 | 315.3 | 465.4 | 476.5 | 190.4 | 310.8 | 372.4 | 171.3 |
| 10              | 154.3 | 340.5 | 177.1 | 79.6  | 53.1  | 77.3  | 145.5 | 212.4 | 214.0 | 69.4  | 114.6 | 168.3 | 61.9  |



**Table E-17. Winter average cumulative excess water availability (MGD) in the Ohio River and Southeast Indiana Region.**

| Major Sub-Basin | 2010  | 2015  | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065   | 2070  |
|-----------------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|
| 1               | 160.1 | 194.3 | 312.0  | 20.2  | 204.1 | 178.1 | 249.4 | 188.6 | 363.9 | 165.8 | 234.4 | 321.6  | 84.0  |
| 2               | 58.1  | 103.0 | 122.2  | 4.0   | 73.2  | 59.5  | 94.9  | 59.4  | 144.7 | 51.6  | 80.5  | 120.6  | 24.8  |
| 3               | 235.3 | 233.1 | 279.1  | 48.7  | 179.7 | 158.1 | 224.2 | 157.7 | 318.4 | 143.5 | 197.0 | 272.9  | 92.8  |
| 4               | 520.7 | 427.4 | 591.1  | 77.8  | 489.8 | 421.6 | 609.4 | 430.5 | 888.2 | 383.1 | 545.7 | 766.0  | 214.8 |
| 5               | 575.8 | 463.1 | 654.3  | 79.5  | 545.0 | 465.0 | 680.9 | 473.3 | 998.9 | 420.2 | 605.5 | 857.8  | 232.6 |
| 6               | 264.2 | 222.8 | 398.9  | 30.6  | 232.5 | 117.7 | 290.4 | 185.5 | 323.8 | 127.5 | 181.7 | 289.2  | 50.1  |
| 7               | 410.3 | 307.3 | 403.7  | 46.8  | 201.5 | 100.8 | 284.6 | 145.8 | 297.3 | 87.5  | 246.7 | 391.0  | 34.6  |
| 8               | 835.7 | 803.7 | 1233.5 | 152.6 | 599.5 | 241.5 | 765.3 | 541.8 | 837.0 | 272.3 | 694.4 | 1130.2 | 28.3  |
| 9               | 525.3 | 398.5 | 812.4  | 79.6  | 415.6 | 243.8 | 458.8 | 444.1 | 622.0 | 178.4 | 469.8 | 773.7  | 59.1  |
| 10              | 260.6 | 197.6 | 400.1  | 11.1  | 75.8  | 90.9  | 202.5 | 256.0 | 255.5 | 23.4  | 118.7 | 354.3  | 34.5  |

**Table E-18. Spring average cumulative excess water availability (MGD) in the Ohio River and Southeast Indiana Region.**

| Major Sub-Basin | 2010  | 2015   | 2020   | 2025  | 2030  | 2035  | 2040  | 2045  | 2050   | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|--------|--------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|
| 1               | 283.4 | 343.6  | 219.9  | 137.3 | 201.2 | 237.4 | 338.0 | 257.5 | 426.4  | 131.0 | 284.5 | 241.2 | 271.8 |
| 2               | 126.8 | 145.4  | 140.8  | 41.9  | 70.0  | 84.7  | 133.8 | 90.1  | 178.2  | 40.6  | 103.9 | 86.9  | 101.2 |
| 3               | 169.7 | 182.8  | 190.8  | 13.9  | 67.7  | 95.6  | 187.5 | 105.3 | 271.2  | 12.8  | 131.4 | 99.7  | 126.7 |
| 4               | 841.6 | 563.7  | 680.8  | 210.6 | 369.9 | 454.7 | 716.6 | 491.6 | 952.0  | 203.5 | 564.6 | 465.8 | 543.6 |
| 5               | 970.8 | 641.2  | 788.0  | 239.5 | 421.8 | 518.2 | 818.8 | 559.3 | 1089.8 | 232.7 | 643.5 | 531.5 | 620.7 |
| 6               | 352.4 | 403.6  | 534.3  | 169.7 | 213.4 | 193.8 | 289.0 | 258.0 | 466.6  | 155.0 | 281.5 | 261.1 | 247.2 |
| 7               | 358.2 | 535.9  | 546.8  | 213.4 | 185.4 | 174.5 | 332.8 | 276.8 | 416.5  | 144.8 | 342.7 | 322.8 | 204.0 |
| 8               | 913.8 | 1324.2 | 1348.3 | 676.5 | 445.1 | 371.8 | 928.5 | 774.8 | 1185.6 | 554.1 | 967.8 | 745.6 | 536.2 |
| 9               | 613.2 | 1850.1 | 399.5  | 413.4 | 306.5 | 331.0 | 616.6 | 644.3 | 840.0  | 432.0 | 554.6 | 540.6 | 420.3 |
| 10              | 303.9 | 917.4  | 193.7  | 225.3 | 75.2  | 132.2 | 295.0 | 313.2 | 387.6  | 184.6 | 227.5 | 243.3 | 143.7 |



Table E-19. Summer average cumulative excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030 | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 218.5 | 304.1 | 126.4 | 32.8  | 21.1 | 50.7  | 64.1  | 172.6 | 207.8 | 23.1  | 82.8  | 46.5  | 59.9  |
| 2               | 53.9  | 92.3  | 38.0  | 11.1  | 7.1  | 16.1  | 19.9  | 54.2  | 69.7  | 7.1   | 25.3  | 13.6  | 18.8  |
| 3               | 177.9 | 236.5 | 53.6  | 19.1  | 12.6 | 29.7  | 37.1  | 101.6 | 130.4 | 12.7  | 47.4  | 25.2  | 35.1  |
| 4               | 396.3 | 539.8 | 190.9 | 66.4  | 43.6 | 102.9 | 128.9 | 349.4 | 435.2 | 47.1  | 165.4 | 92.6  | 121.3 |
| 5               | 414.3 | 574.9 | 219.9 | 72.4  | 46.9 | 113.8 | 142.6 | 390.2 | 488.0 | 51.2  | 183.9 | 102.3 | 135.2 |
| 6               | 83.1  | 191.5 | 129.3 | 42.0  | 39.8 | 52.4  | 53.1  | 222.5 | 213.2 | 35.3  | 106.7 | 53.6  | 60.9  |
| 7               | 68.7  | 195.7 | 123.1 | 62.3  | 55.9 | 77.6  | 86.6  | 187.3 | 214.4 | 50.9  | 138.4 | 78.3  | 76.2  |
| 8               | 240.0 | 718.9 | 473.7 | 127.8 | 87.6 | 205.9 | 179.0 | 483.8 | 531.8 | 95.3  | 278.4 | 103.4 | 150.4 |
| 9               | 82.8  | 427.0 | 118.7 | 88.0  | 77.9 | 127.9 | 138.4 | 353.1 | 363.1 | 109.2 | 154.5 | 89.5  | 130.8 |
| 10              | 40.8  | 213.1 | 60.1  | 61.0  | 29.1 | 58.2  | 60.7  | 160.2 | 169.8 | 48.5  | 66.5  | 40.7  | 43.7  |

Table E-20. Fall average cumulative excess water availability (MGD) in the Ohio River and Southeast Indiana Region.

| Major Sub-Basin | 2010  | 2015  | 2020  | 2025  | 2030  | 2035  | 2040  | 2045  | 2050  | 2055  | 2060  | 2065  | 2070  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1               | 10.9  | 91.4  | 62.7  | -0.8  | 52.1  | 0.9   | 19.0  | 148.0 | 62.7  | 2.9   | 32.0  | 14.3  | 12.7  |
| 2               | 5.1   | 24.6  | 19.6  | -2.5  | 15.2  | 0.2   | 4.9   | 45.6  | 19.5  | 0.0   | 9.9   | 3.5   | 4.5   |
| 3               | 196.6 | 248.7 | 193.0 | 155.4 | 190.5 | 162.0 | 170.6 | 247.6 | 198.8 | 161.3 | 180.6 | 168.1 | 170.3 |
| 4               | 207.5 | 339.6 | 254.9 | 154.0 | 263.9 | 162.5 | 197.6 | 457.6 | 288.1 | 165.0 | 226.2 | 188.6 | 188.0 |
| 5               | 205.9 | 349.8 | 259.7 | 150.3 | 273.8 | 160.5 | 200.0 | 491.4 | 302.0 | 163.7 | 232.3 | 190.5 | 190.2 |
| 6               | 7.5   | 92.7  | 179.7 | 12.1  | 28.1  | 18.7  | 19.7  | 239.1 | 43.8  | 16.4  | 29.2  | 28.3  | 28.4  |
| 7               | 35.4  | 115.9 | 118.8 | 28.5  | 49.5  | 50.8  | 42.0  | 195.0 | 57.2  | 34.6  | 53.1  | 51.7  | 45.2  |
| 8               | 27.5  | 271.8 | 397.3 | 15.0  | 47.8  | 210.7 | 50.9  | 611.1 | 90.8  | 28.6  | 72.3  | 86.2  | 107.5 |
| 9               | 21.4  | 62.9  | 117.0 | 28.7  | 50.0  | 139.5 | 47.3  | 420.3 | 81.0  | 42.0  | 64.1  | 85.6  | 74.8  |
| 10              | 12.1  | 34.0  | 54.4  | 21.0  | 32.4  | 28.0  | 23.9  | 120.3 | 43.3  | 21.0  | 45.6  | 35.0  | 25.6  |



## Appendix F

### County Fact Sheets

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# 1 Clark County

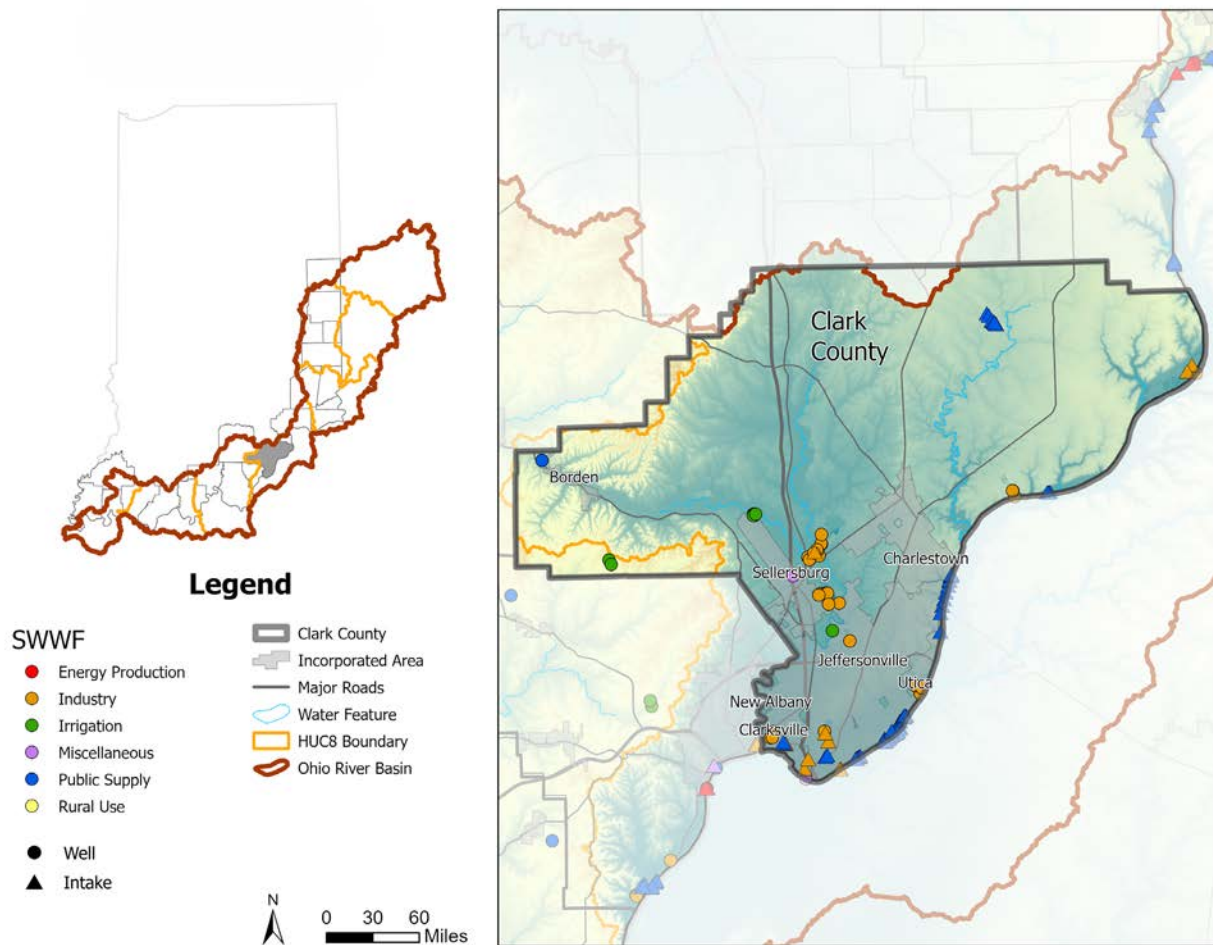


Figure F-1. Water withdrawal locations in Clark County, Ohio River and Southeast Indiana Region (1985–2023). Clark County lies partially within the Region.

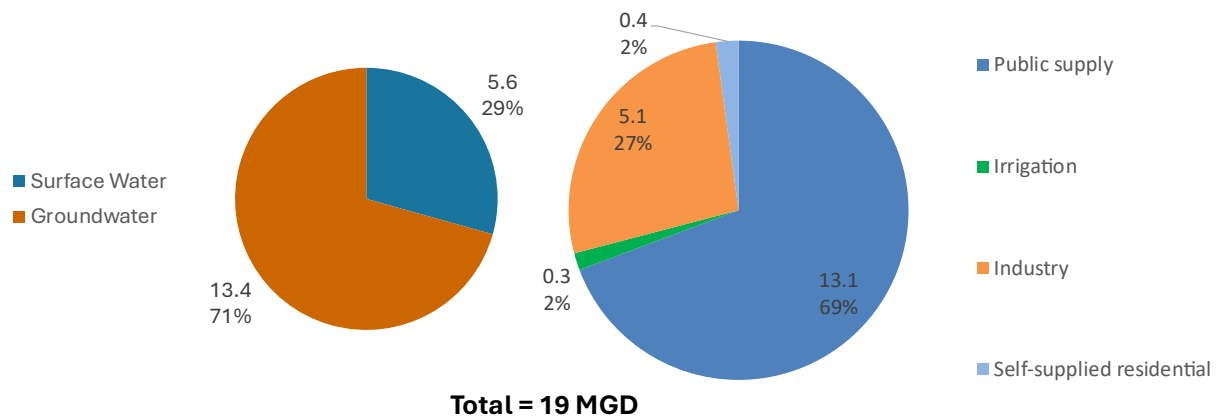


Figure F-2. 2020 water demand in MGD in Clark County. Clark County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

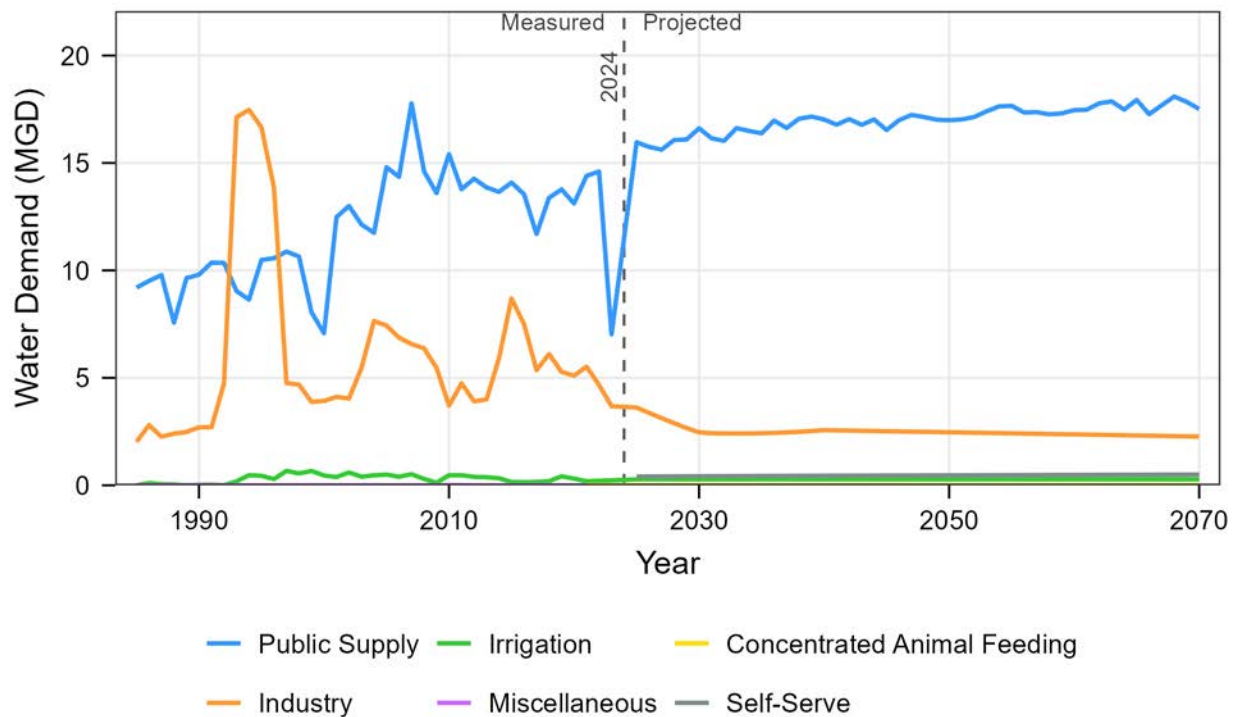


Figure F-3. Historical and forecasted water demands in Clark County in MGD from 1985-2070. Clark County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 2 Crawford County

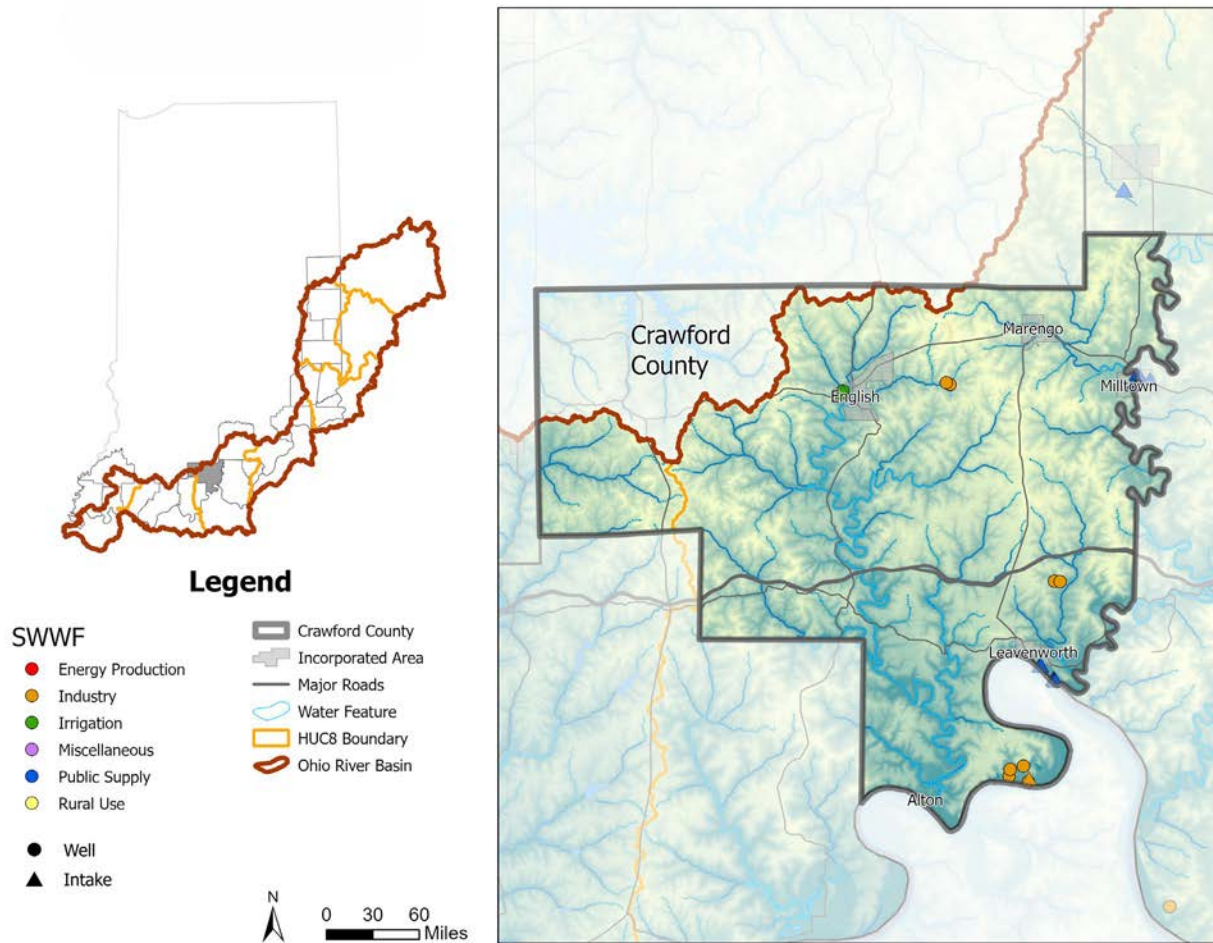


Figure F-4. Water withdrawal locations in Crawford County, Ohio River and Southeast Indiana Region (1985–2023). Crawford County lies partially within the Region.

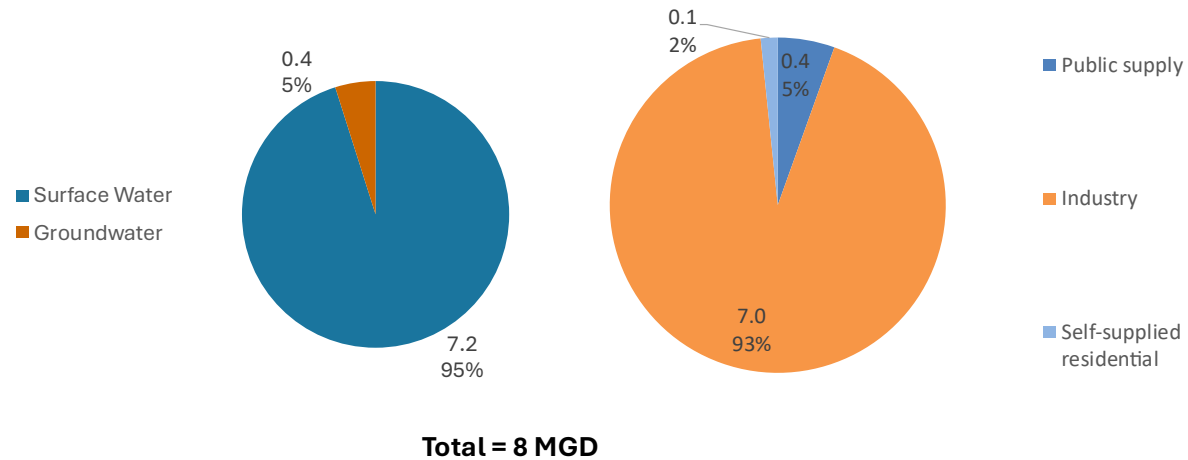


**Figure F-5.** 2020 water demand in MGD in Crawford County. Crawford County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

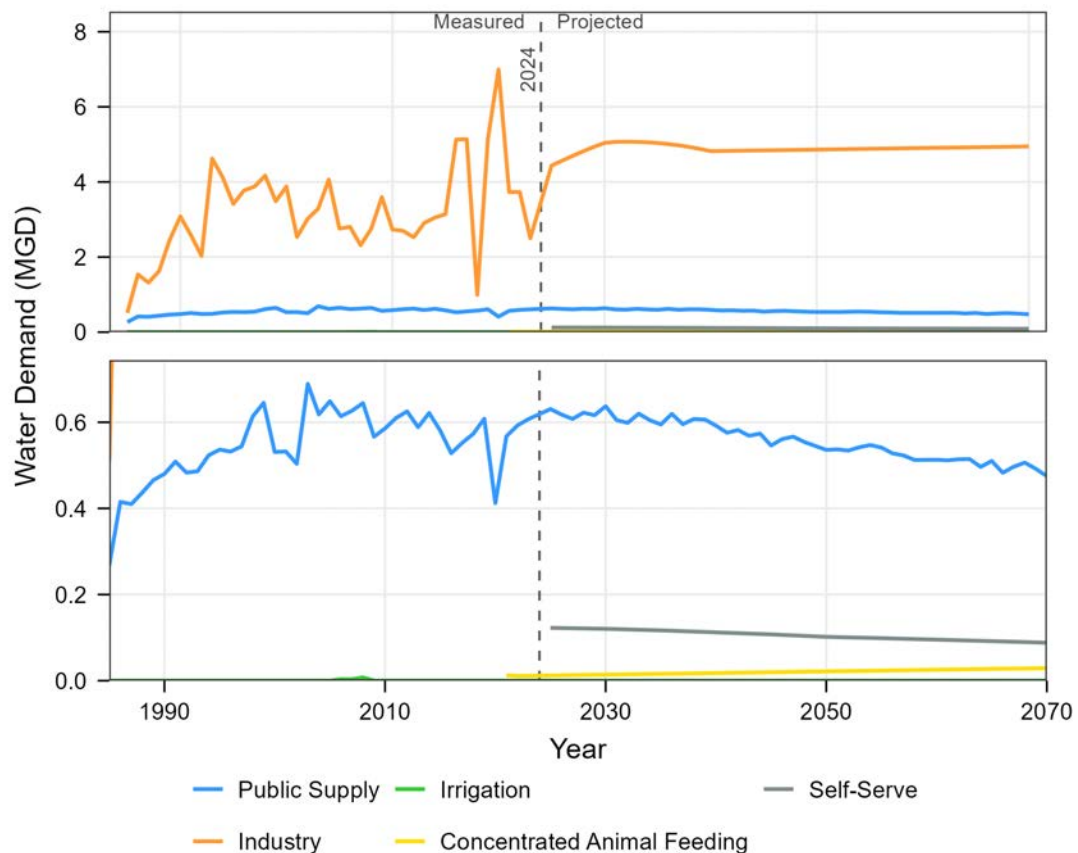


**Figure F-6.** Historical and forecasted water demands in Crawford County in MGD from 1985-2070. Crawford County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

### 3 Dearborn County

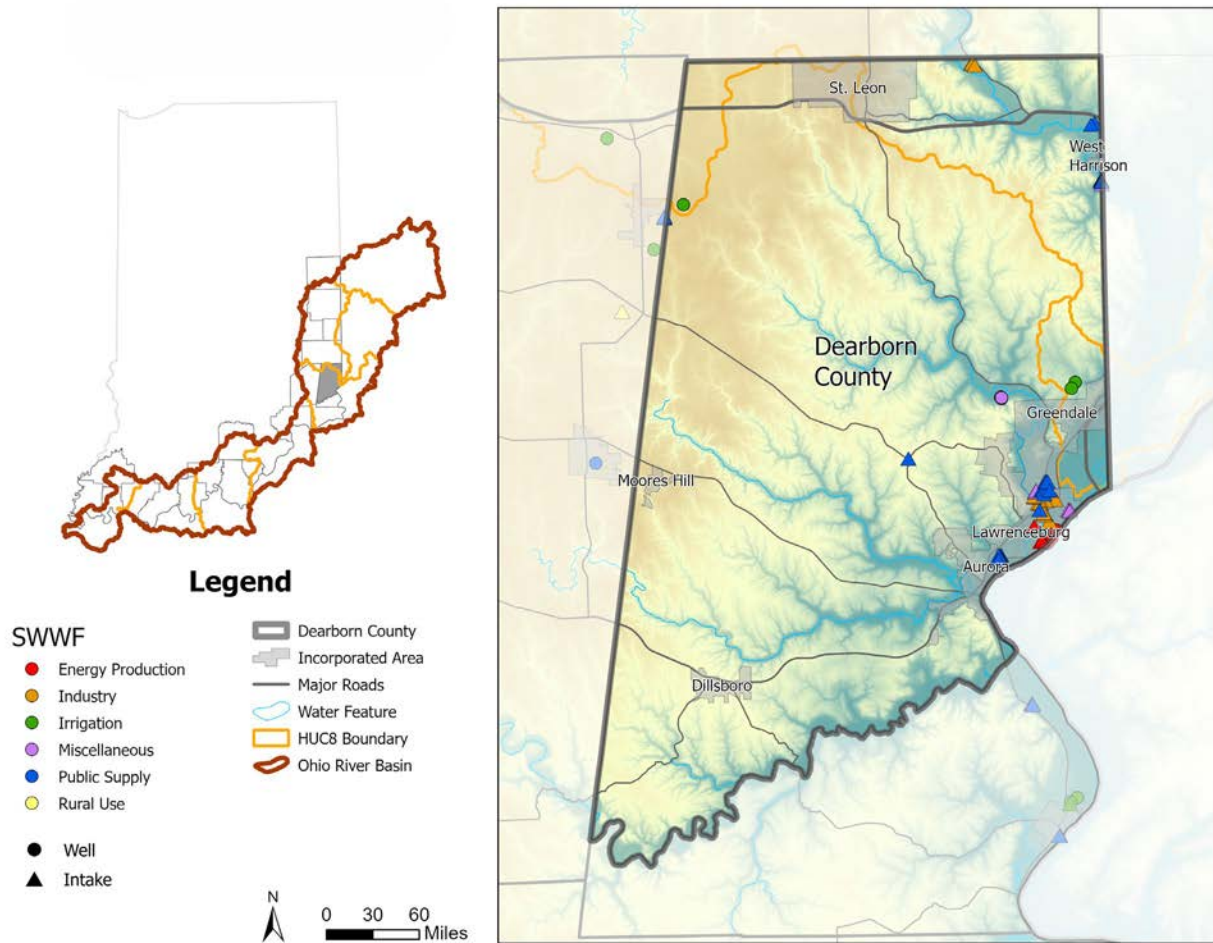


Figure F-7. Water withdrawal locations in Dearborn County, Ohio River and Southeast Indiana Region (1985–2023).

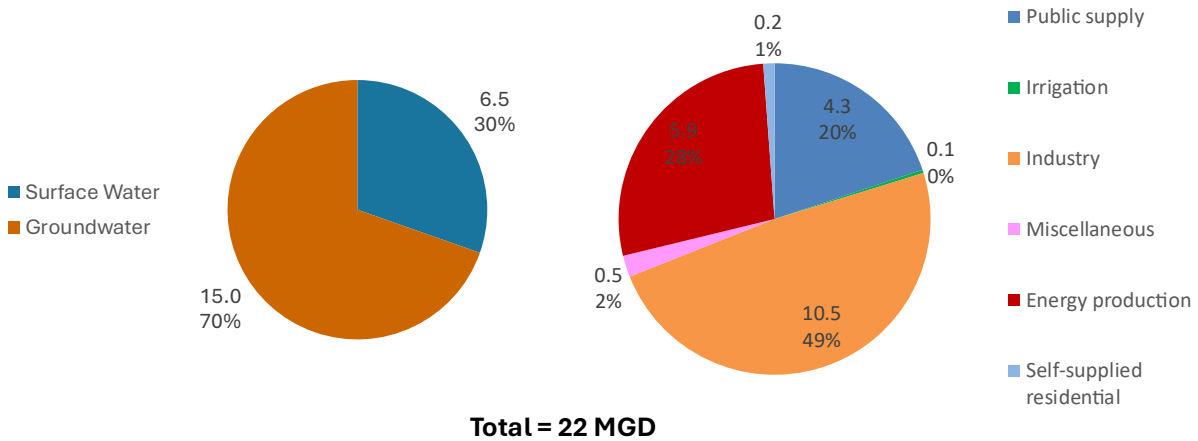


Figure F-8. 2020 water demand in MGD in Dearborn County. Demands below 0.05 MGD are not shown.

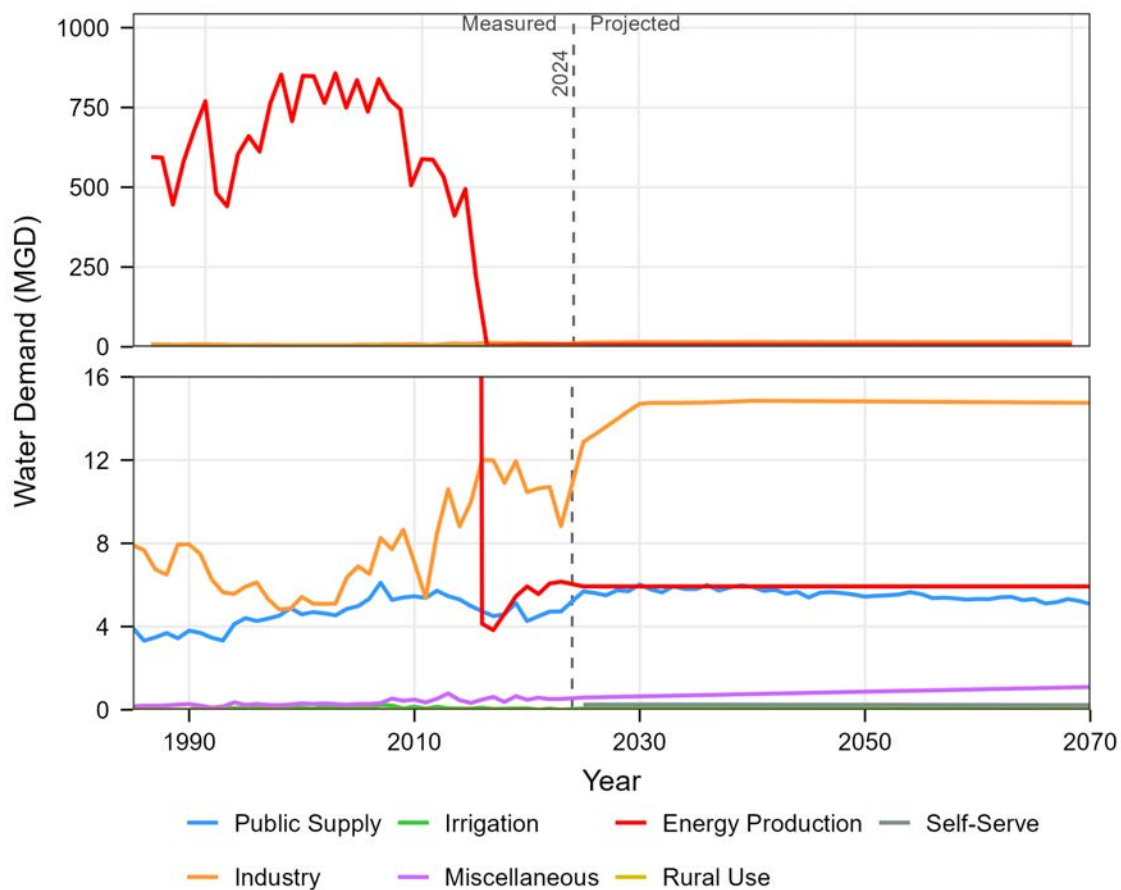


Figure F-9. Historical and forecasted water demand in Dearborn County in MGD from 1985-2070.

## 4 Fayette County

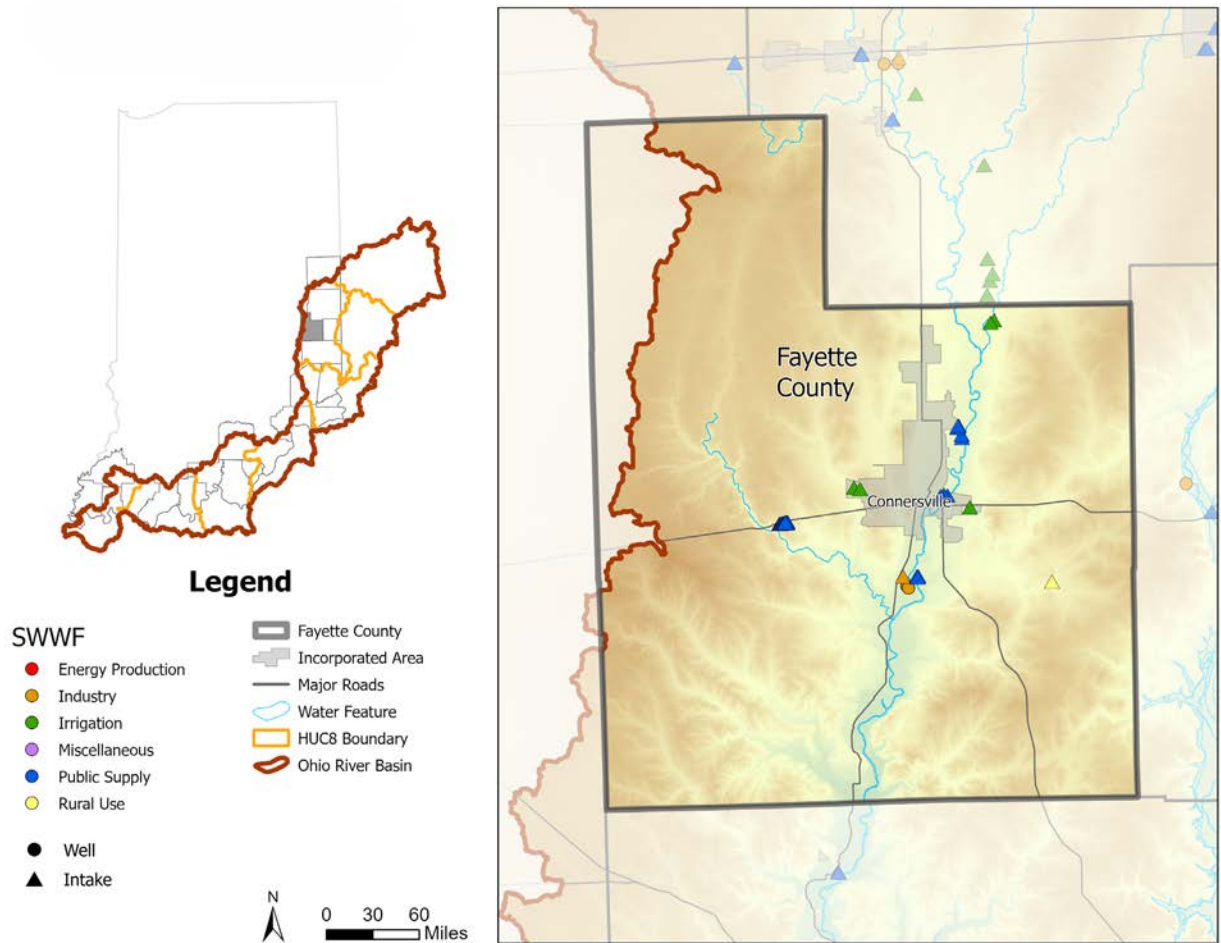


Figure F-10. Water withdrawal locations in Fayette County, Ohio River and Southeast Indiana Region (1985–2023). Fayette County lies partially within the Region.

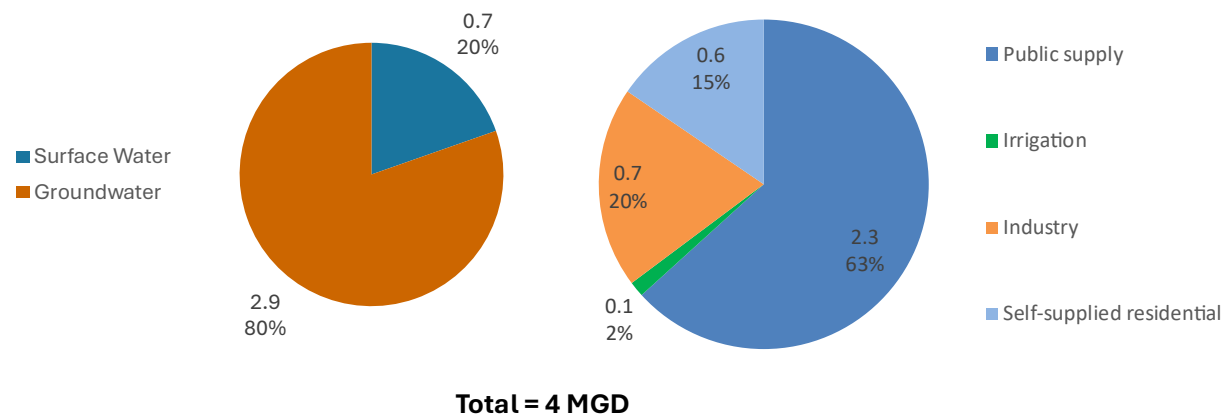


Figure F-11. 2020 water demand in MGD in Fayette County. Fayette County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

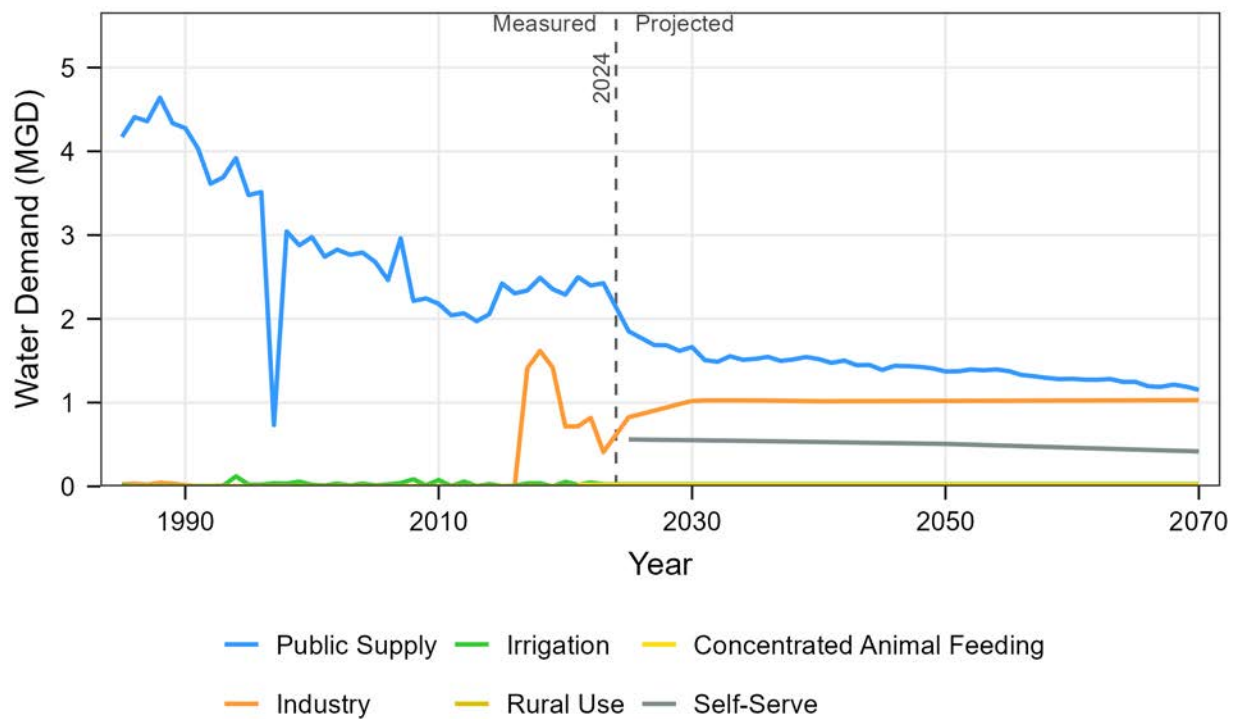


Figure F-12. Historical and forecasted water demands in Fayette County in MGD from 1985-2070. Fayette County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 5 Floyd County

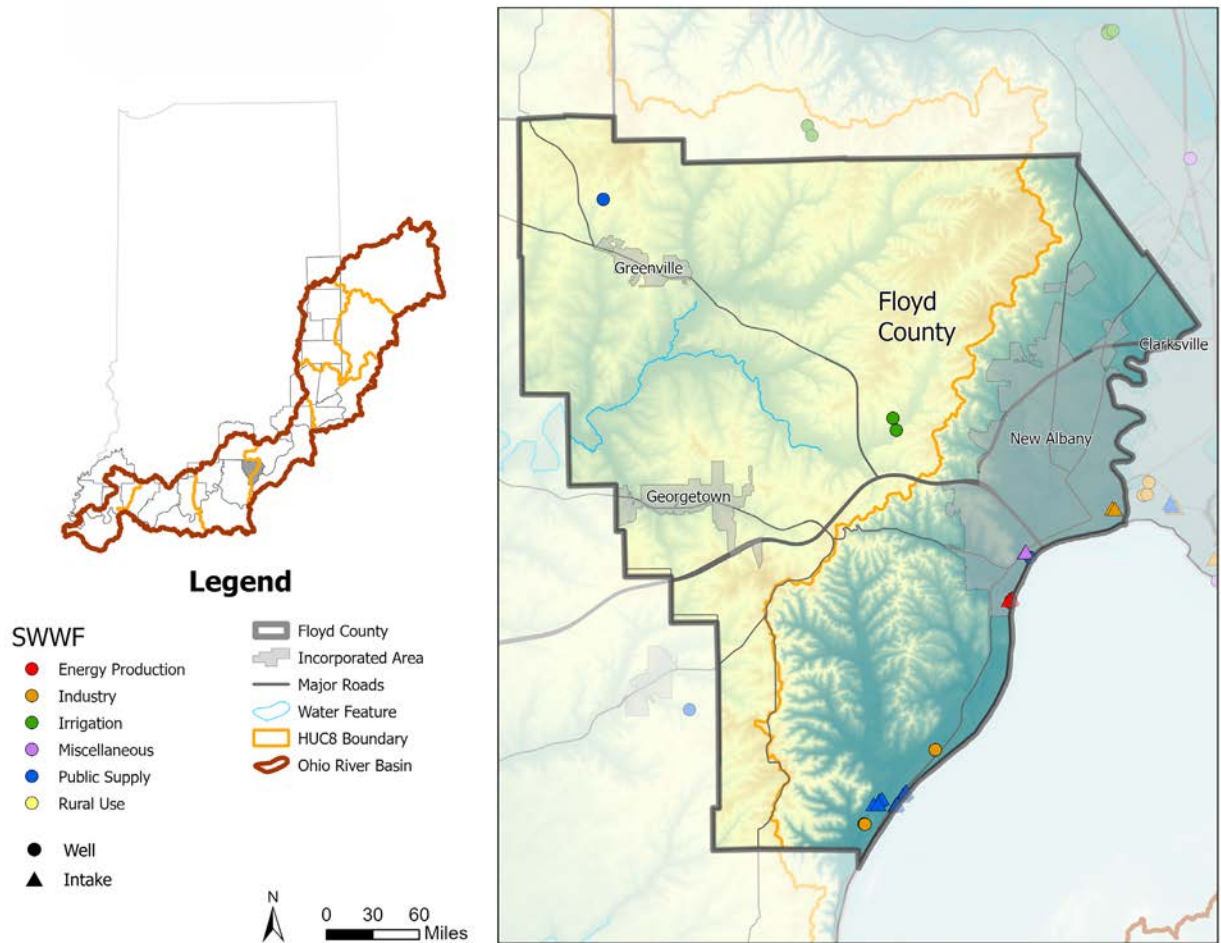


Figure F-13. Water withdrawal locations in Floyd County, Ohio River and Southeast Indiana Region (1985–2023).

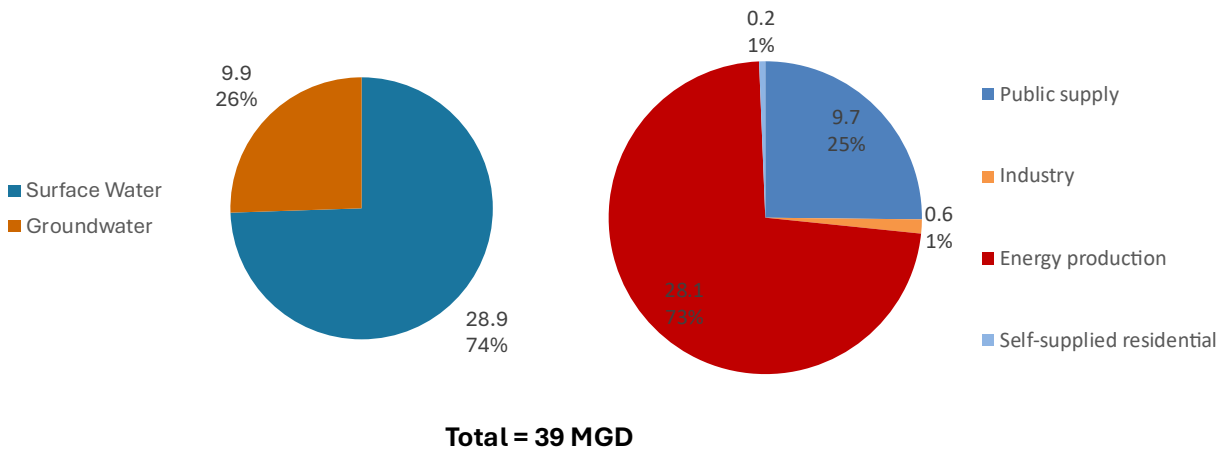


Figure F-14. 2020 water demand in MGD in Floyd County. Demands below 0.05 MGD are not shown.

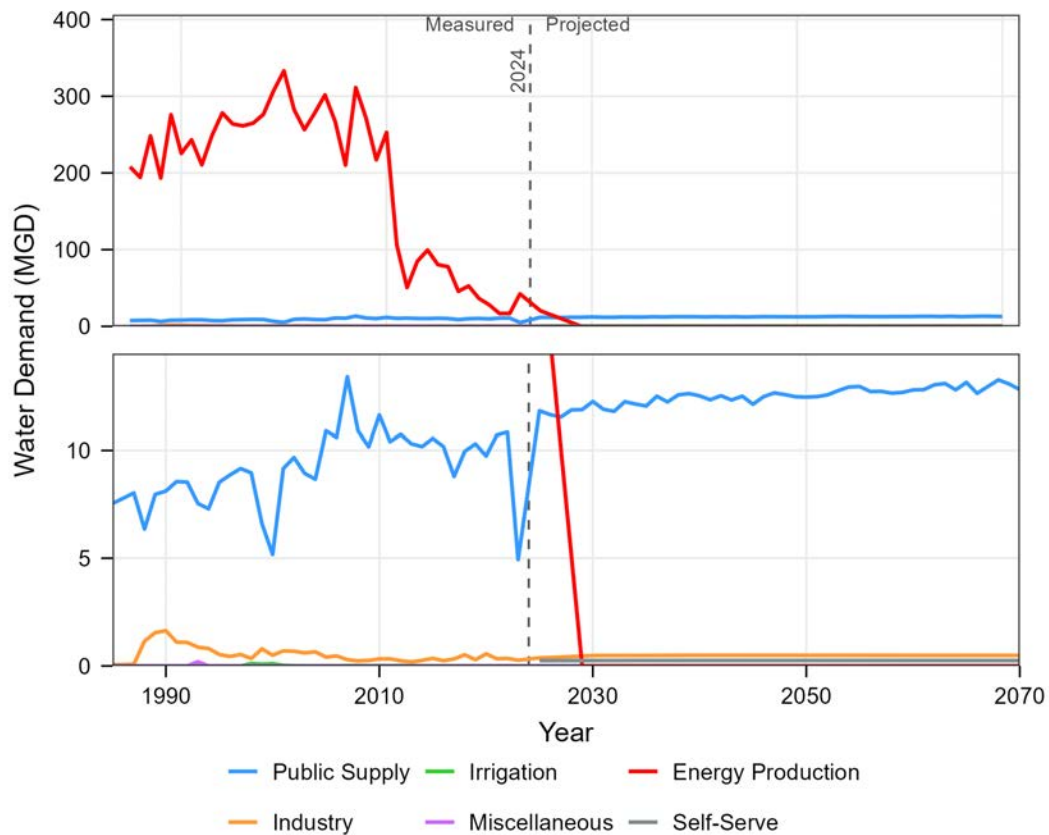


Figure F-15. Historical and forecasted water demand in Floyd County in MGD from 1985-2070.

## 6 Franklin County

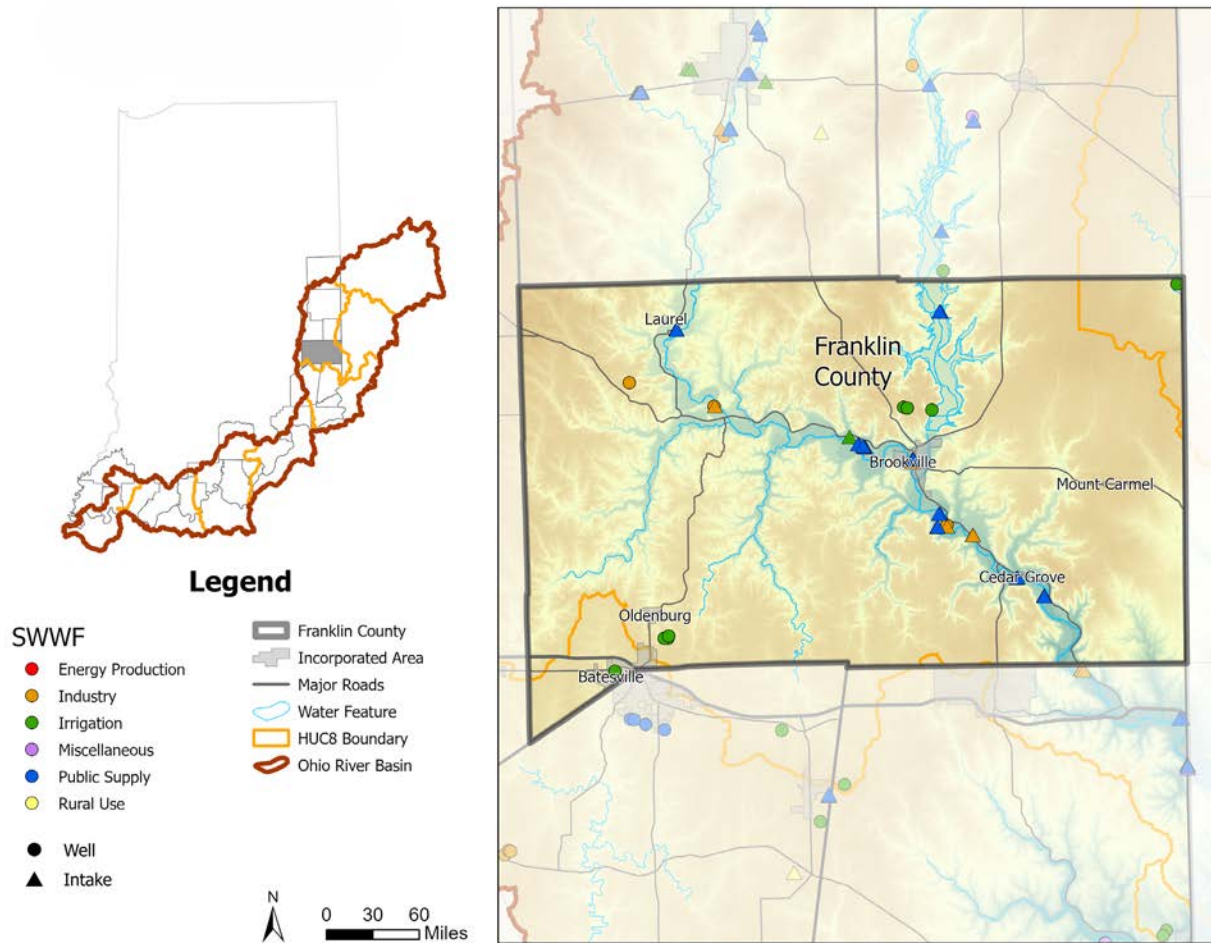


Figure F-16. Water withdrawal locations in Franklin County, Ohio River and Southeast Indiana Region (1985–2023).

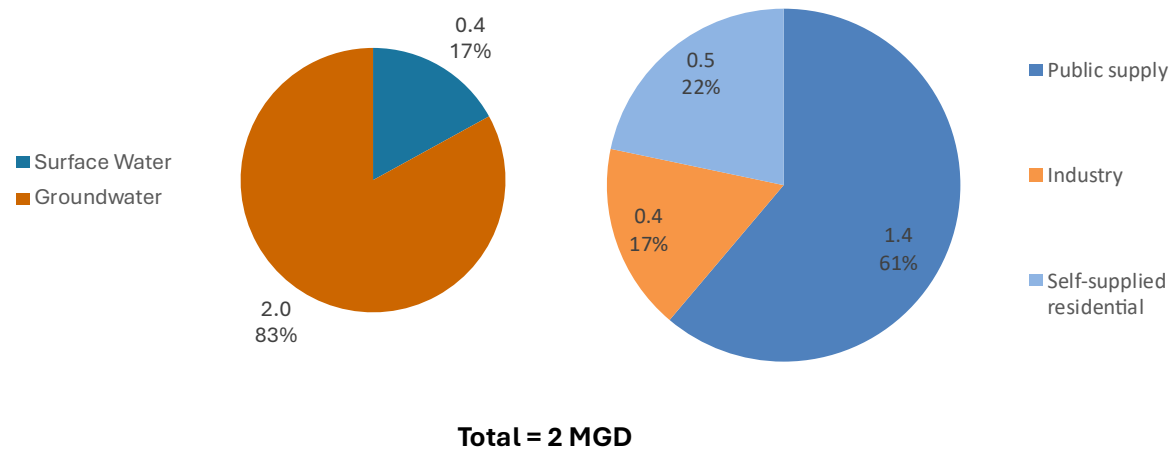


Figure F-17. 2020 water demand in MGD in Franklin County. Demands below 0.05 MGD are not shown.

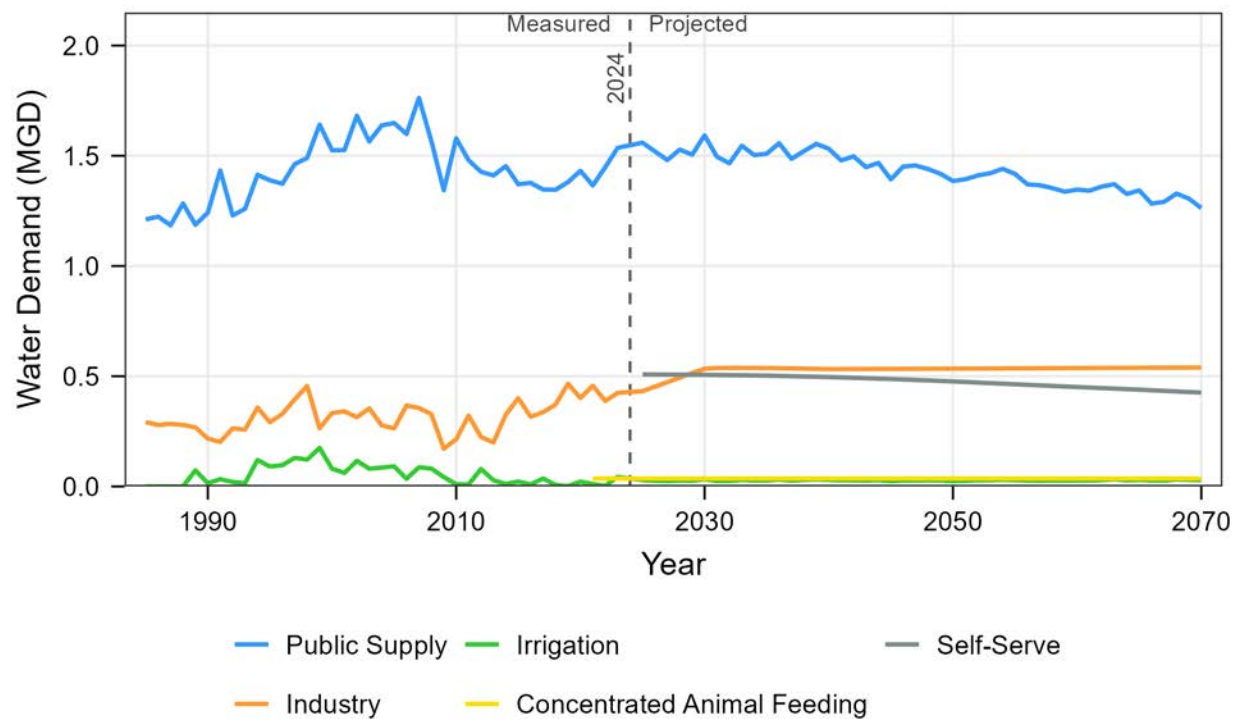


Figure F-18. Historical and forecasted water demand in Franklin County in MGD from 1985-2070.

## 7 Gibson County

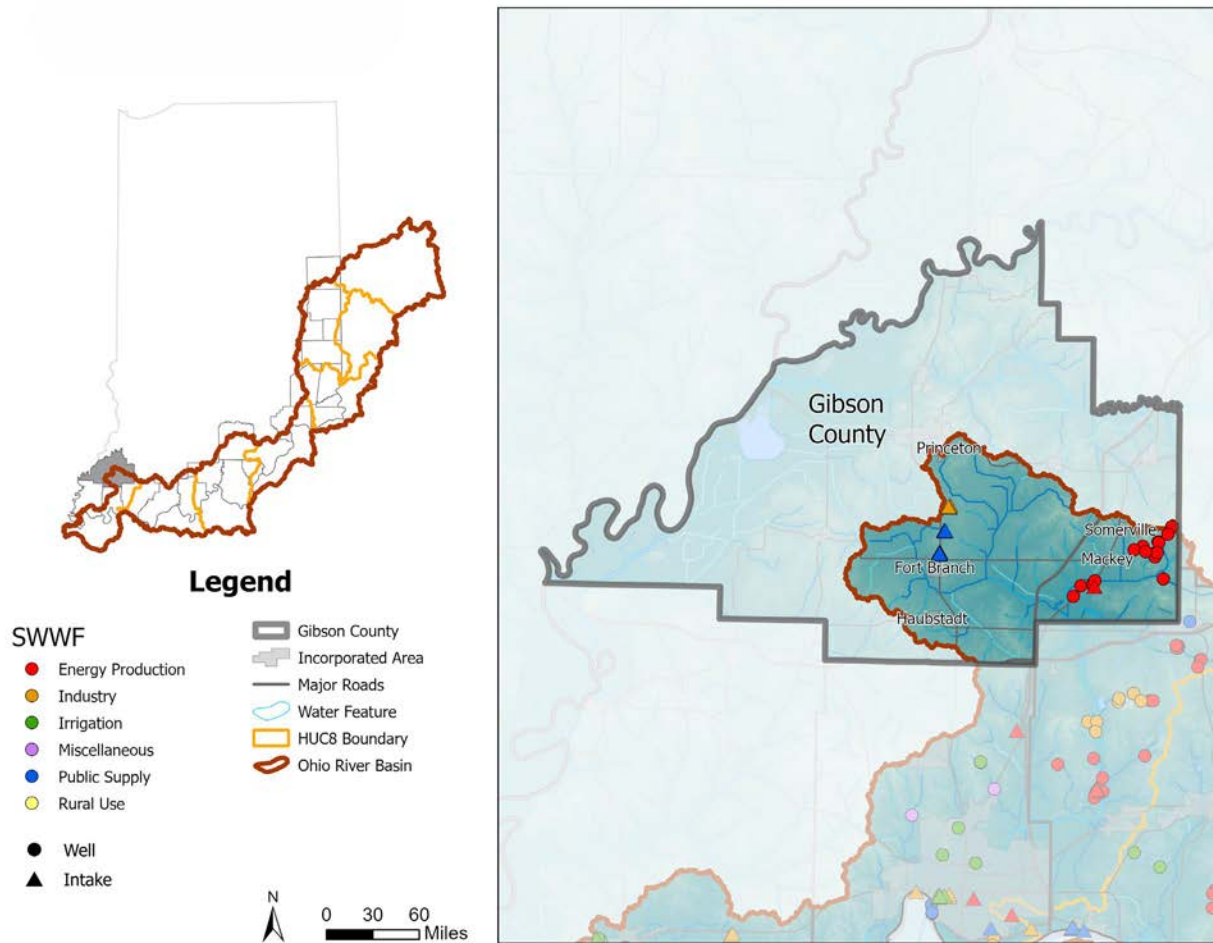


Figure F-19. Water withdrawal locations in Gibson County, Ohio River and Southeast Indiana Region (1985–2023). Gibson County lies partially within the Region.

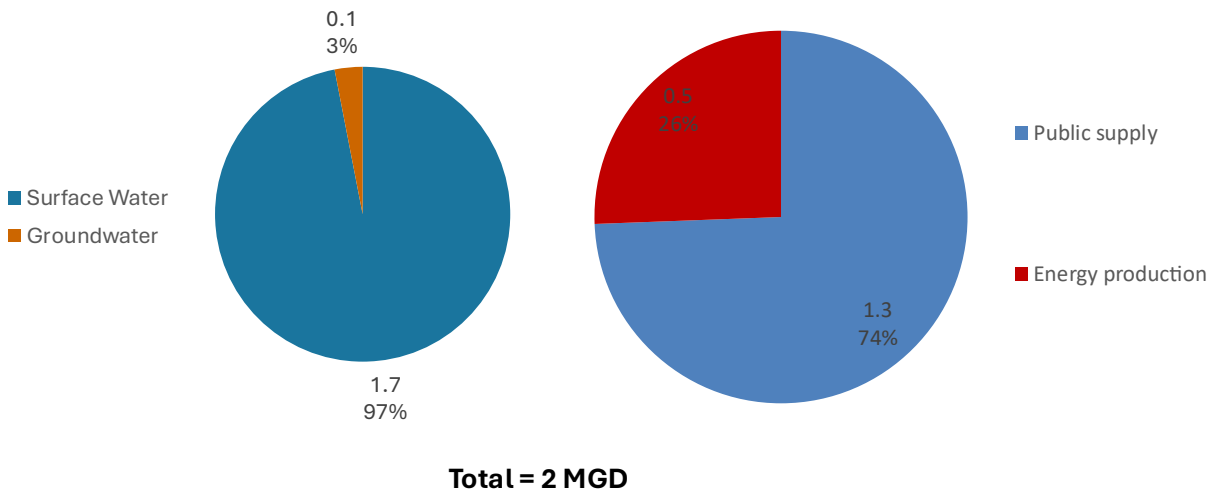


Figure F-20. 2020 water demand in MGD in Gibson County. Gibson County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

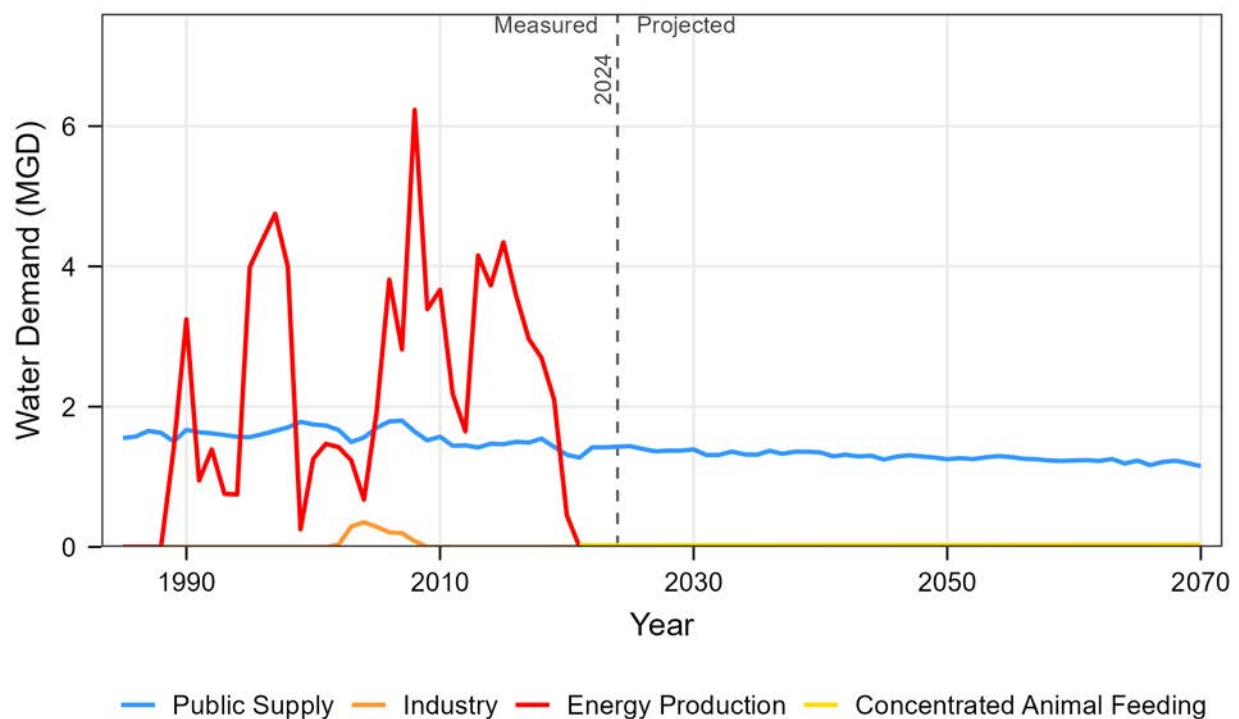


Figure F-21. Historical and forecasted water demands in Gibson County in MGD from 1985-2070. Gibson County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## Harrison County

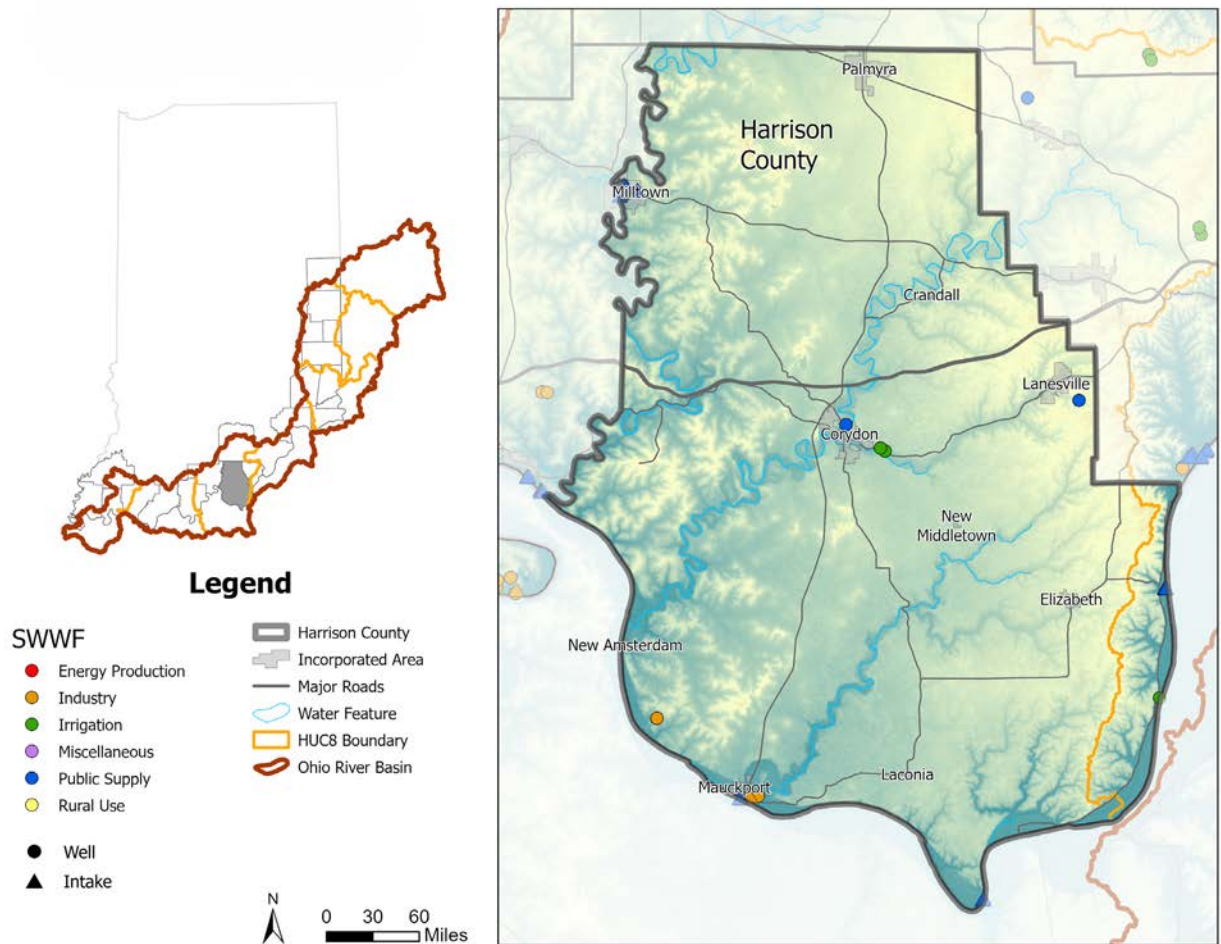


Figure F-22. Water withdrawal locations in Harrison County, Ohio River and Southeast Indiana Region (1985–2023).

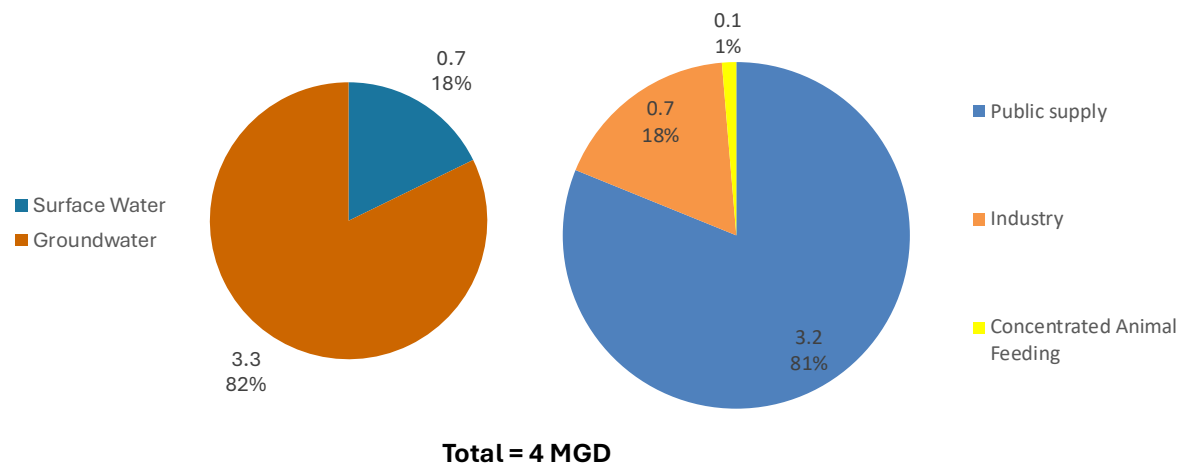


Figure F-23. 2020 water demand in MGD in Harrison County. Demands below 0.05 MGD are not shown.

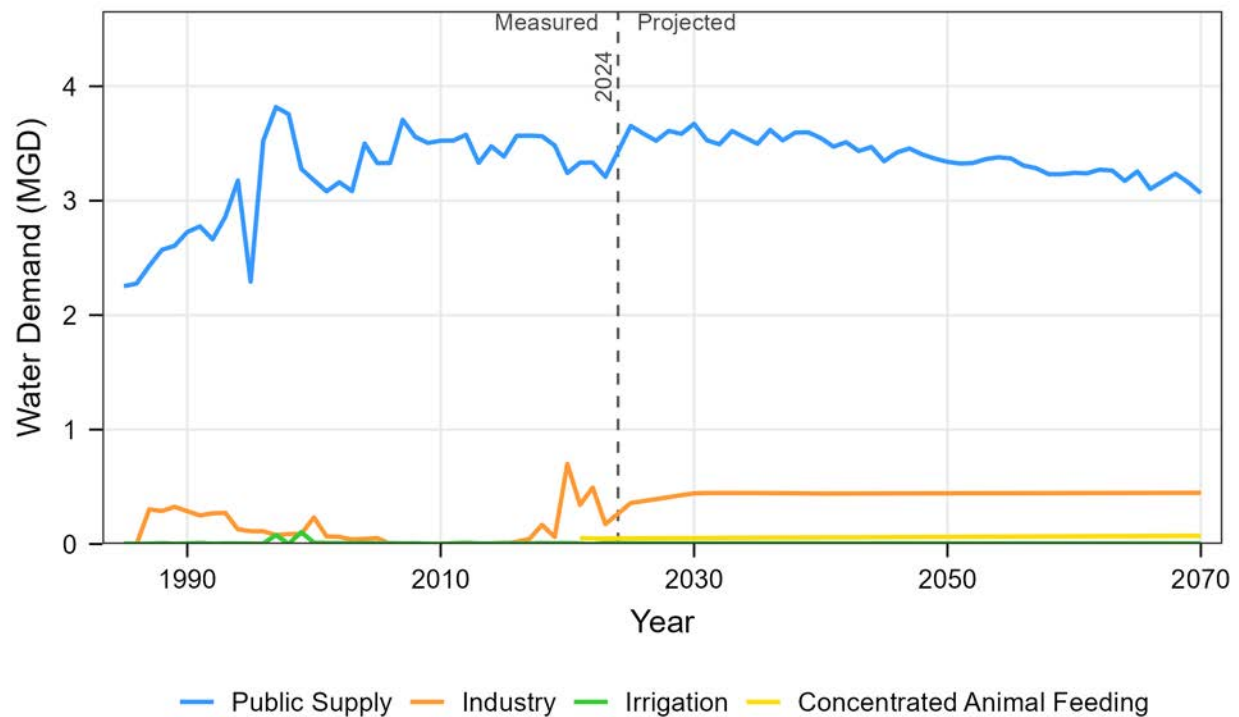


Figure F-24. Historical and forecasted water demand in Harrison County in MGD from 1985-2070.

## 8 Jefferson County

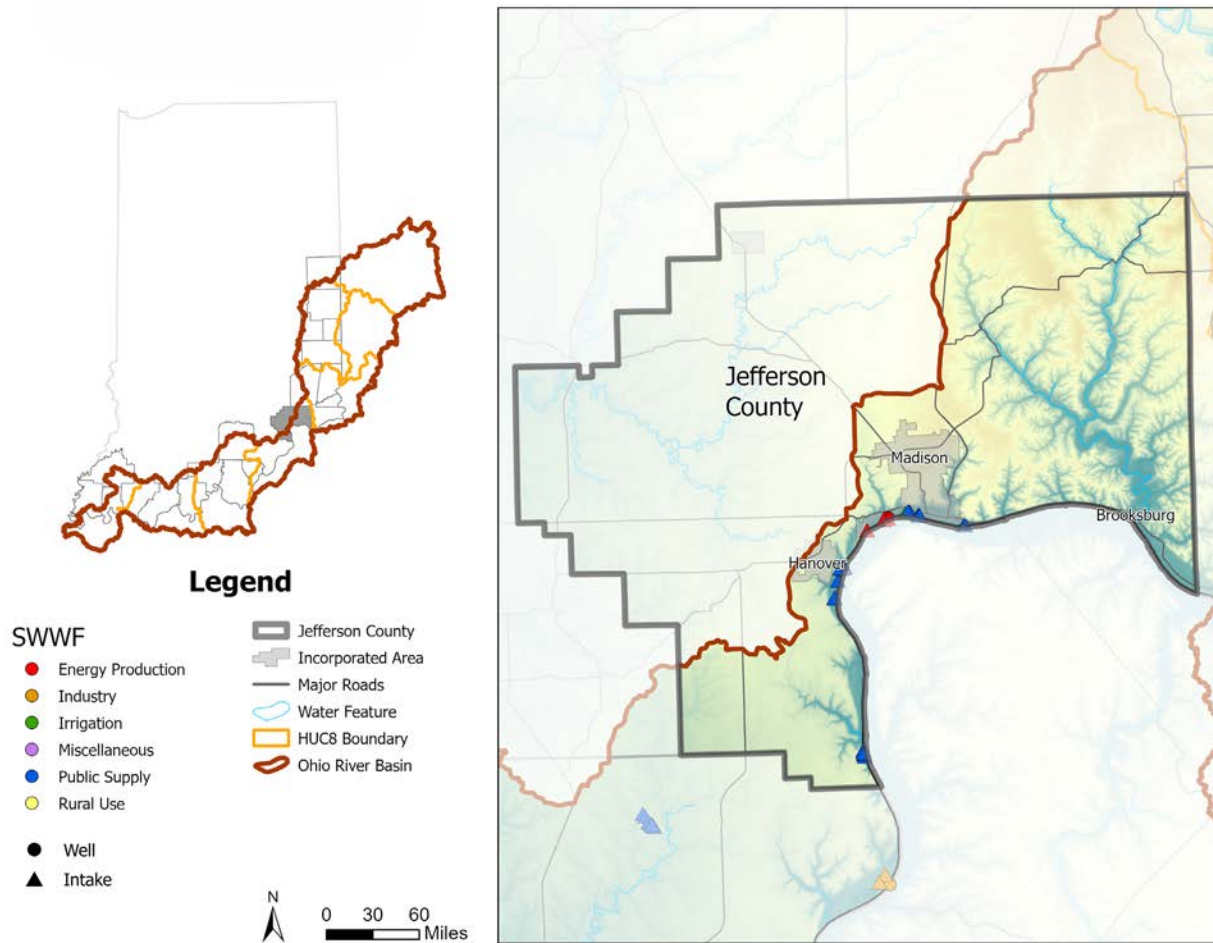


Figure F-25. Water withdrawal locations in Jefferson County, Ohio River and Southeast Indiana Region (1985–2023). Jefferson County lies partially within the Region.

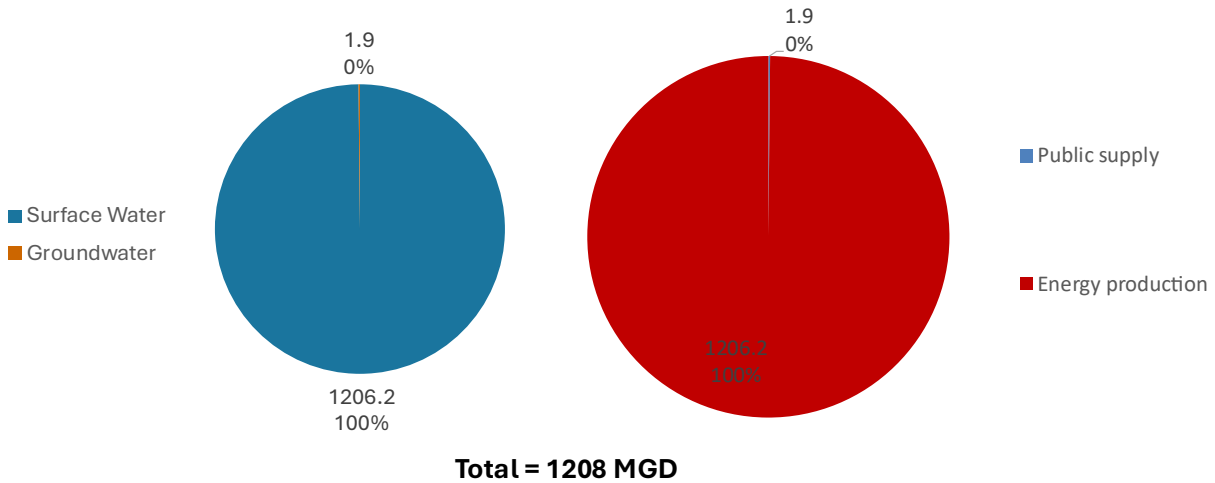


**Figure F-26.** 2020 water demand in MGD in Jefferson County. Jefferson County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

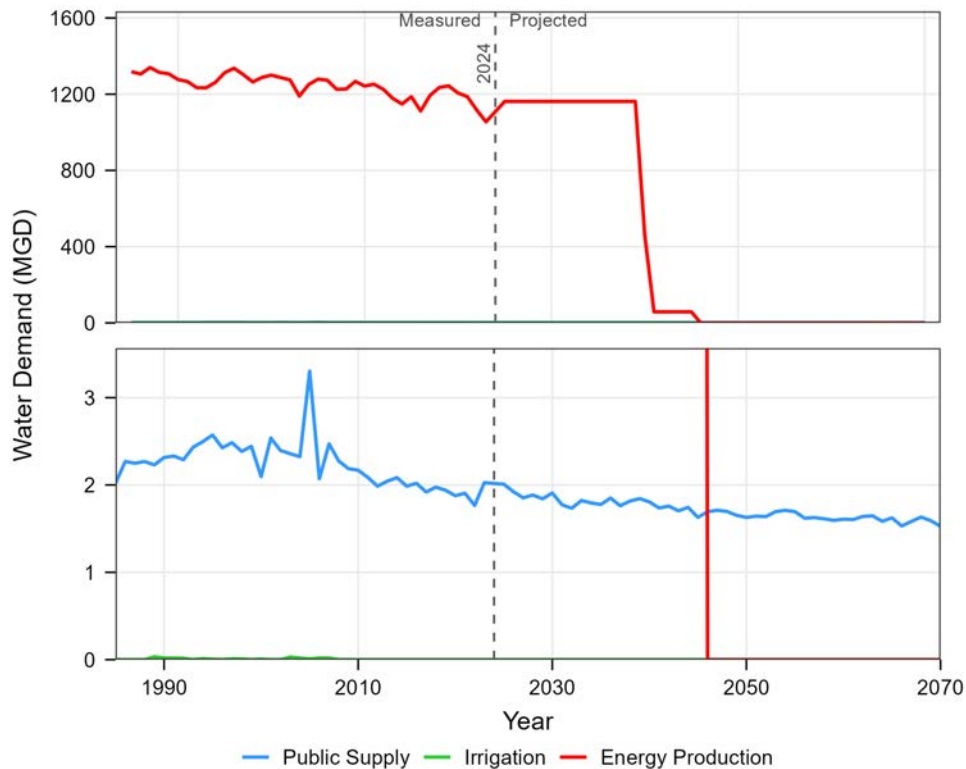


**Figure F-27.** Historical and forecasted water demands in Jefferson County in MGD from 1985-2070. Jefferson County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 9 Ohio County

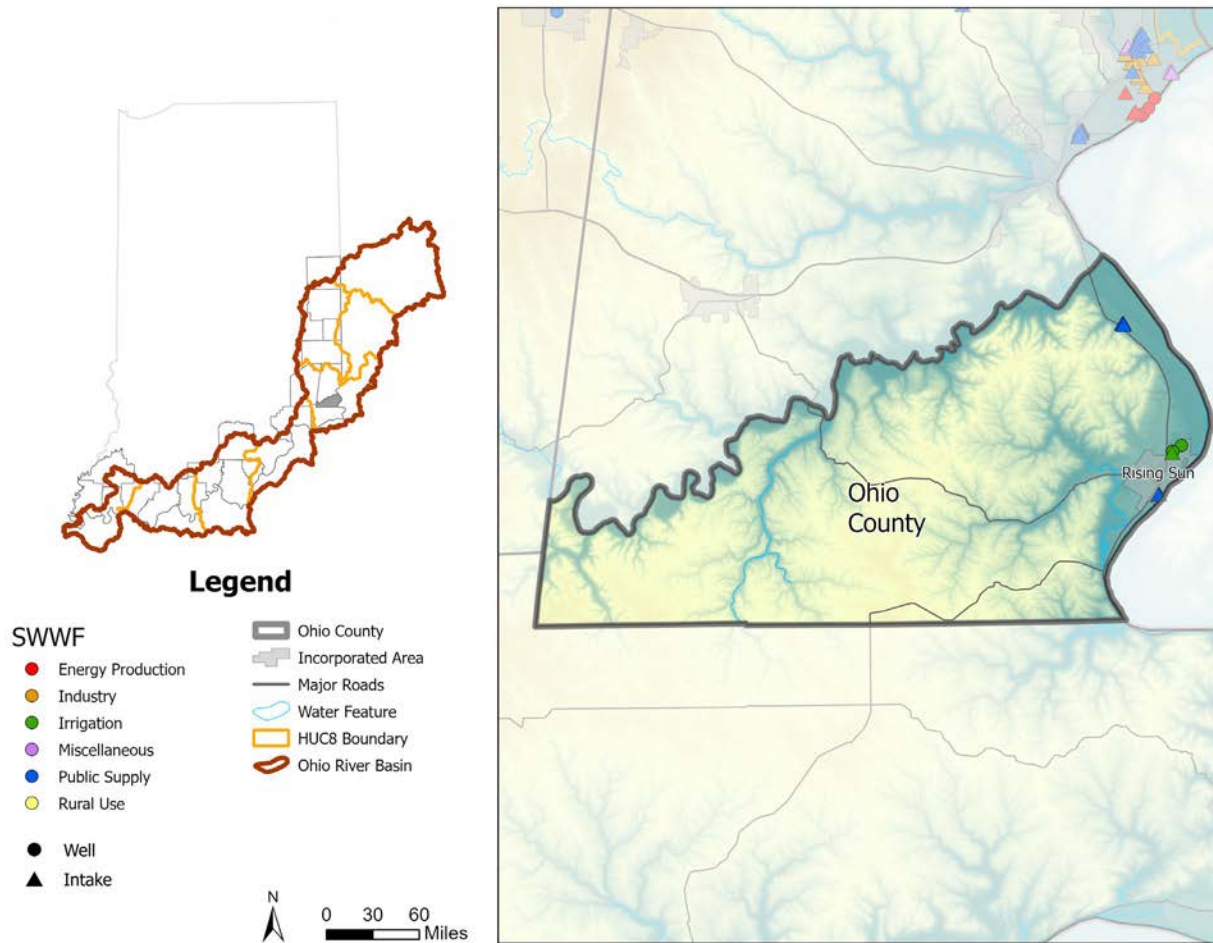


Figure F-28. Water withdrawal locations in Ohio County, Ohio River and Southeast Indiana Region (1985–2023).

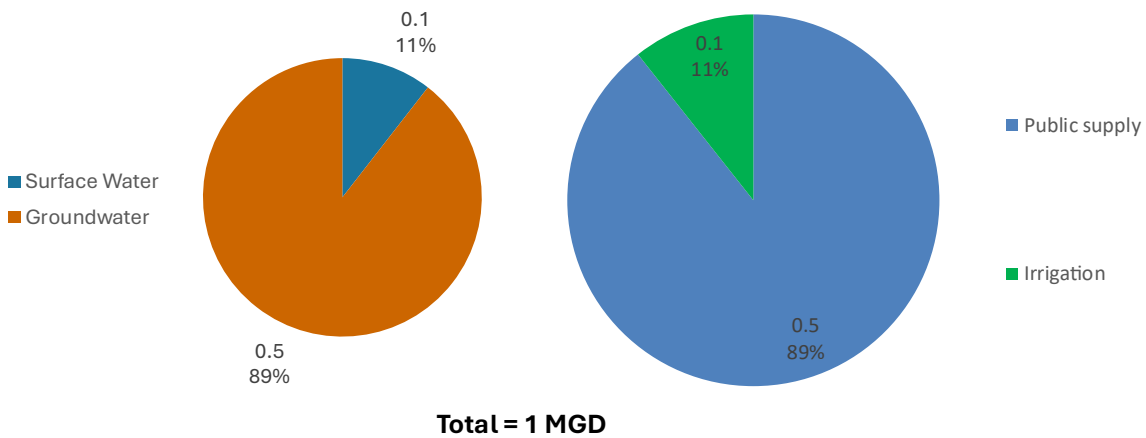


Figure F-29. 2020 water demand in MGD in Ohio County. Demands below 0.05 MGD are not shown.

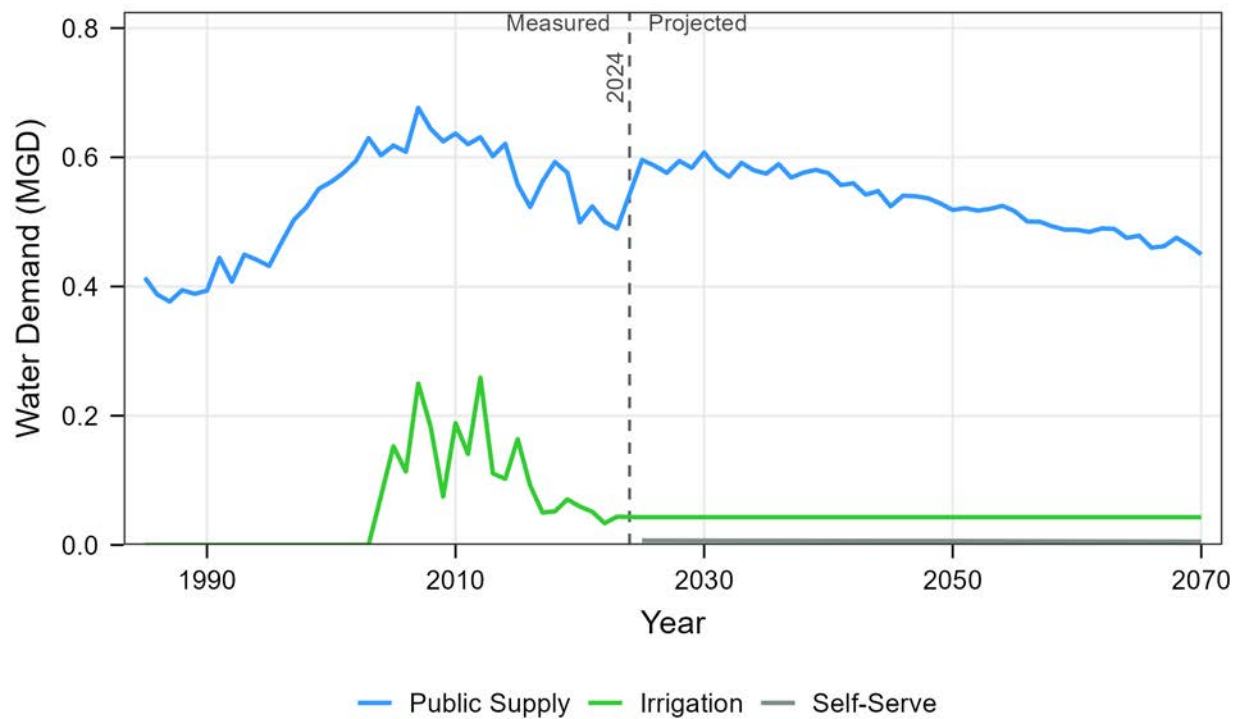


Figure F-30. Historical and forecasted water demand in Ohio County in MGD from 1985-2070.

## 10 Perry County

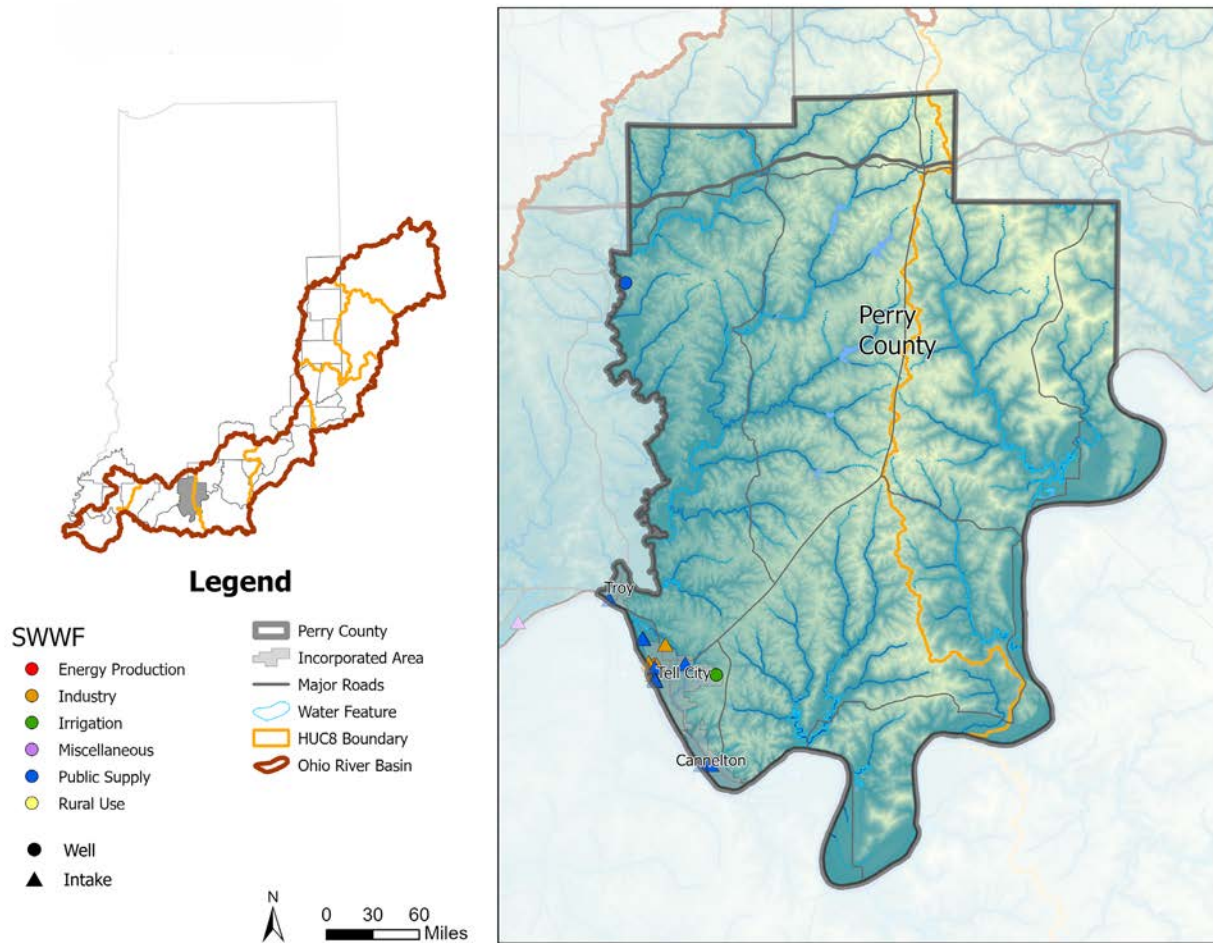


Figure F-31. Water withdrawal locations in Perry County, Ohio River and Southeast Indiana Region (1985–2023).

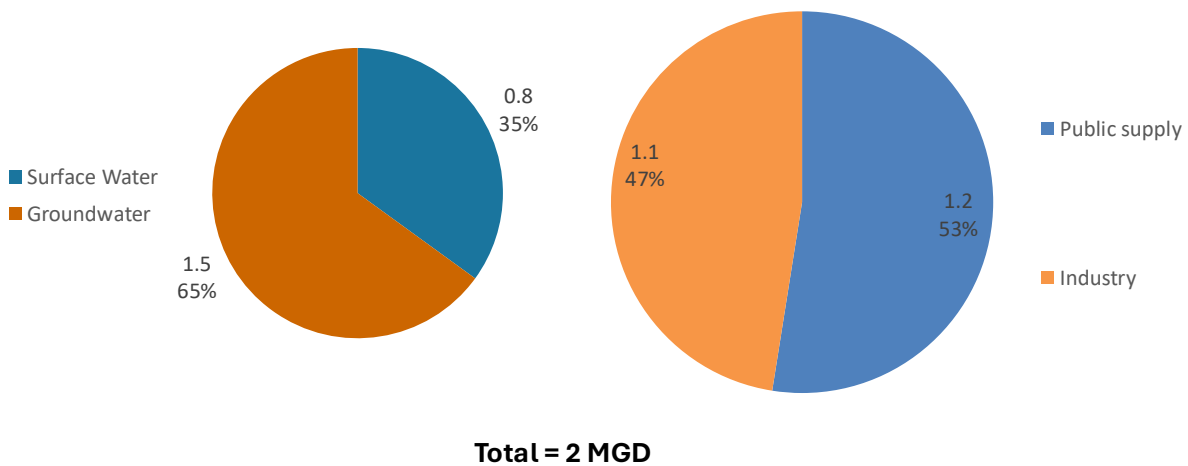


Figure F-32. 2020 water demand in MGD in Perry County. Demands below 0.05 MGD are not shown.

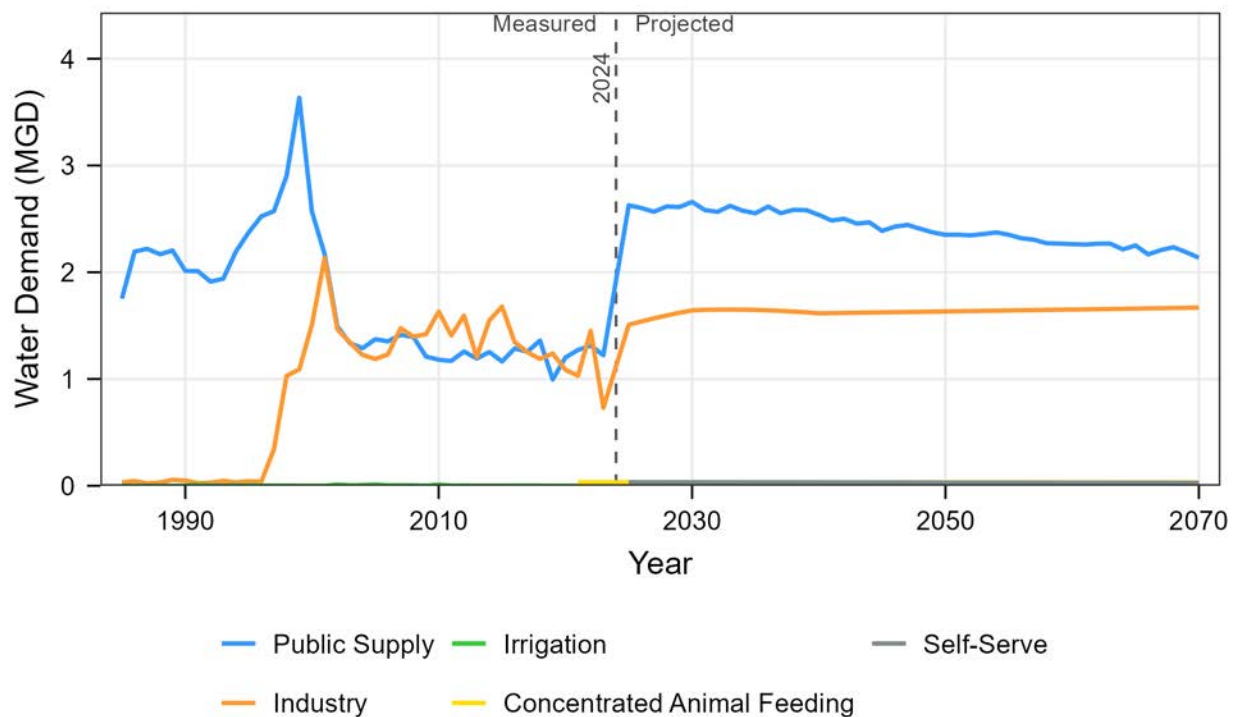


Figure F-33. Historical and forecasted water demand in Perry County in MGD from 1985-2070.

## 11 Posey County

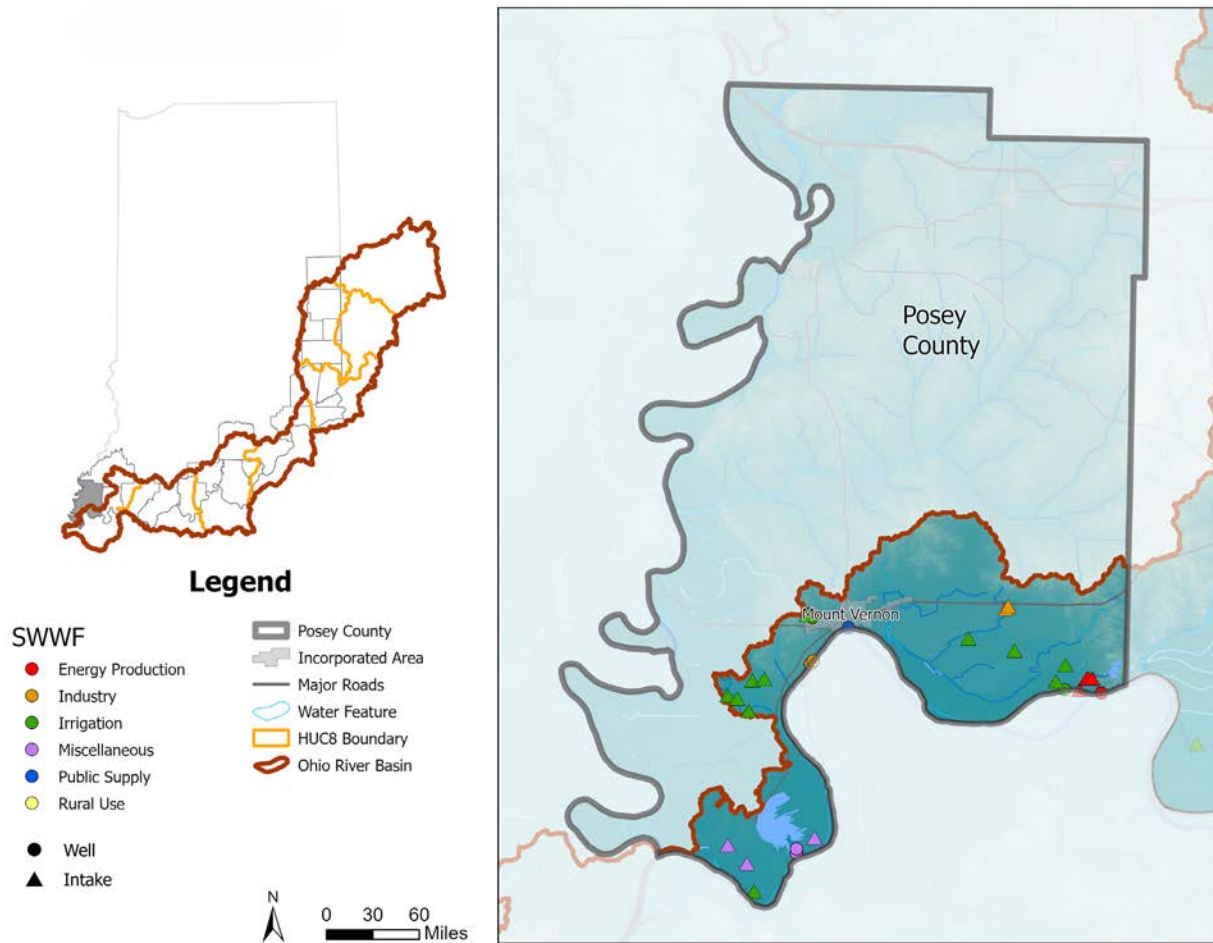


Figure F-34. Water withdrawal locations in Posey County, Ohio River and Southeast Indiana Region (1985–2023). Posey County lies partially within the Region.

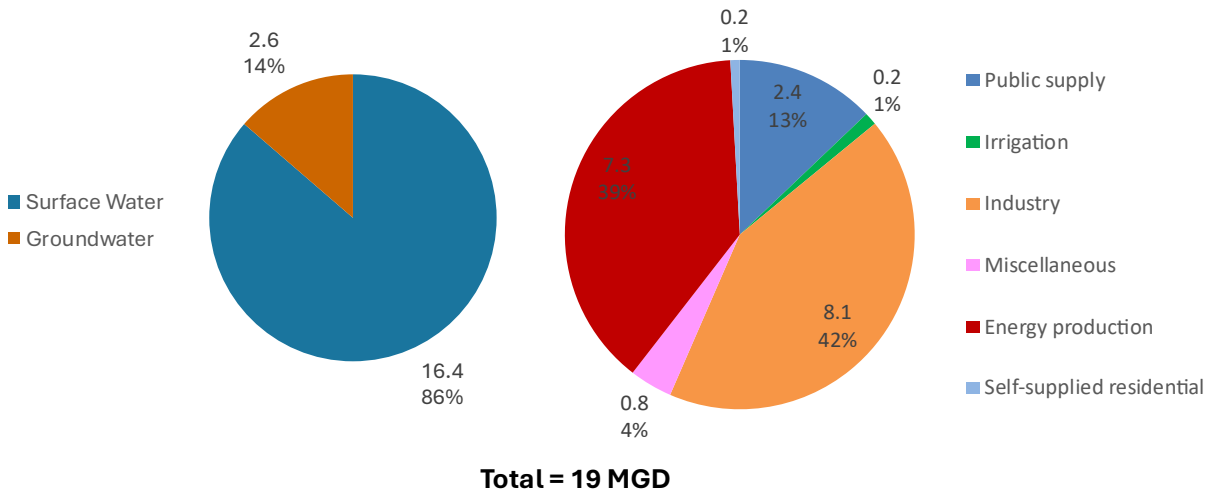


Figure F-35. 2020 water demand in MGD in Posey County. Posey County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

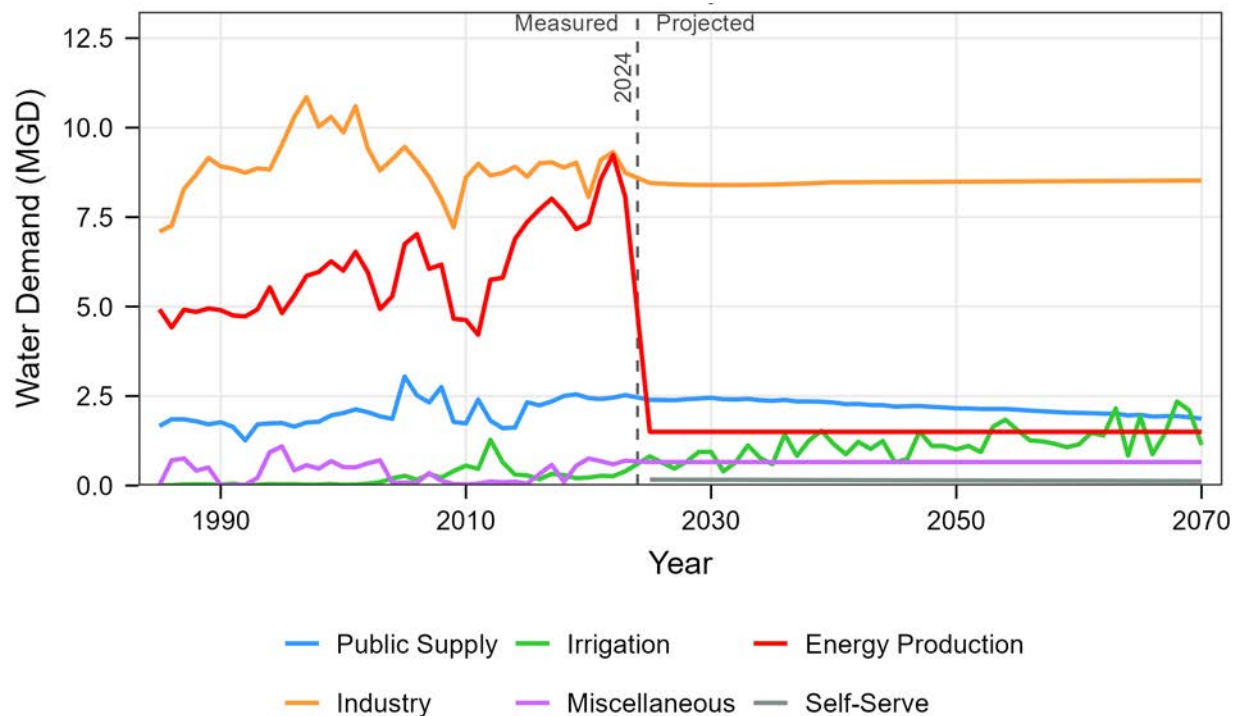


Figure F-36. Historical and forecasted water demands in Posey County in MGD from 1985-2070. Posey County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## Randolph County

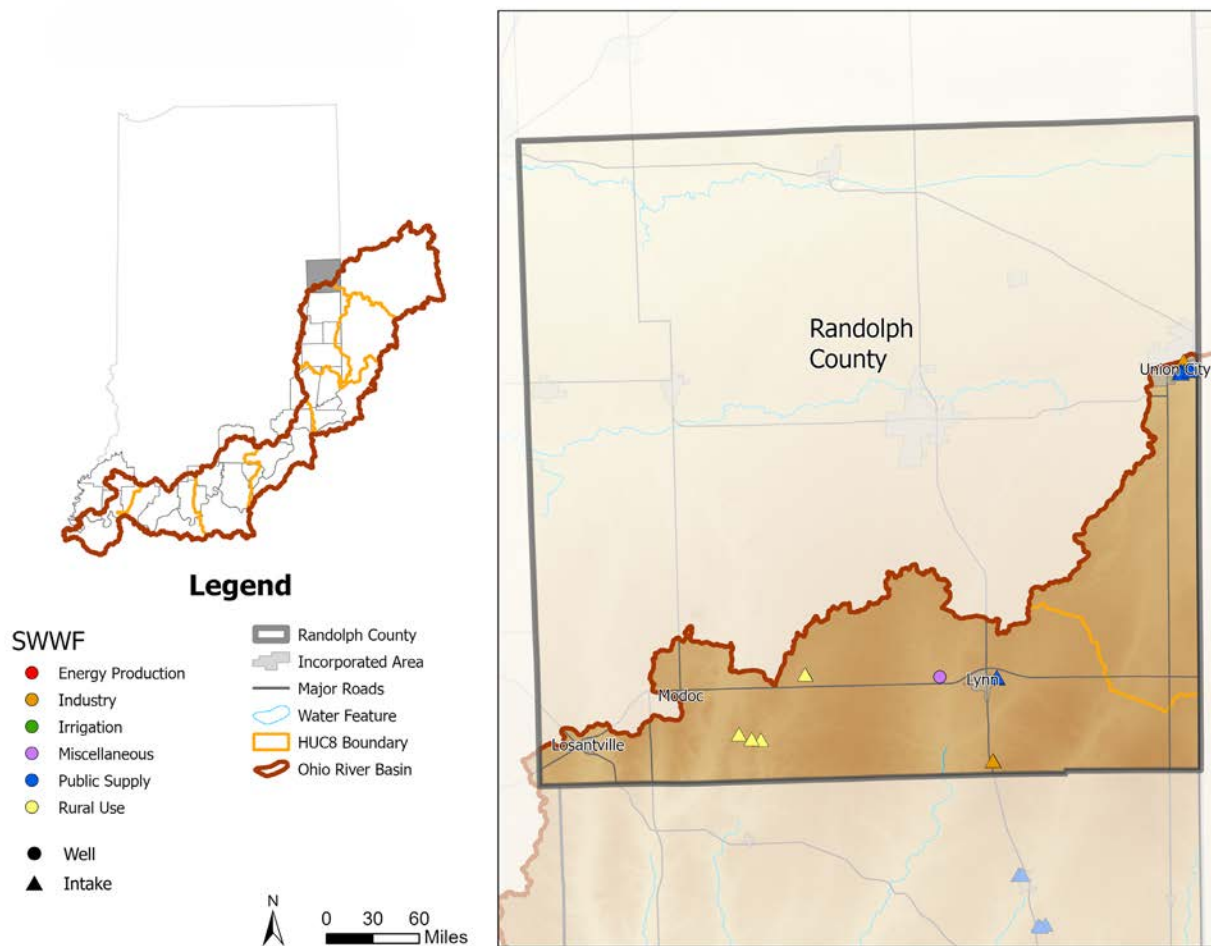


Figure F-37. Water withdrawal locations in Randolph County, Ohio River and Southeast Indiana Region (1985–2023). Randolph County lies partially within the Region.

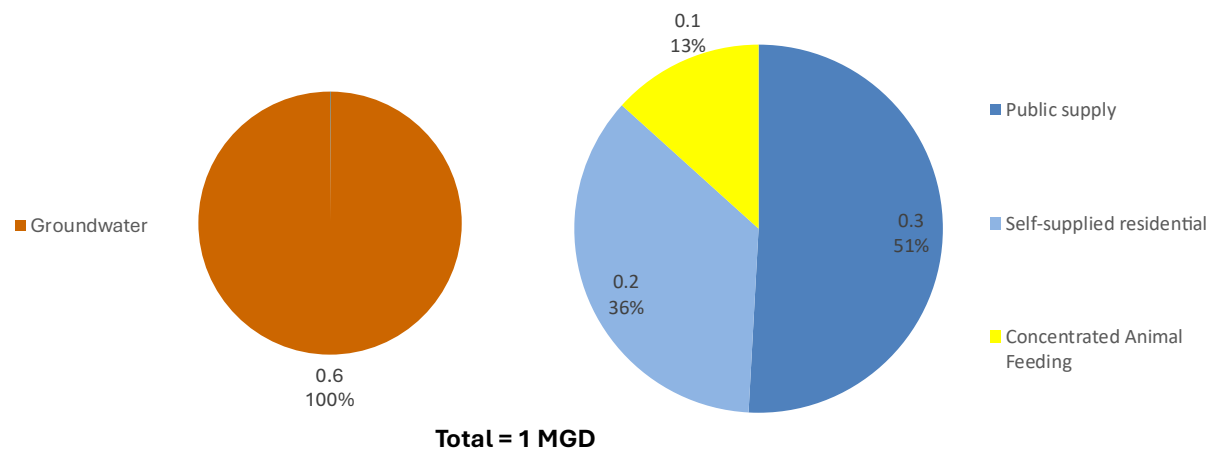


Figure F-38. 2020 water demand in MGD in Randolph County. Randolph County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

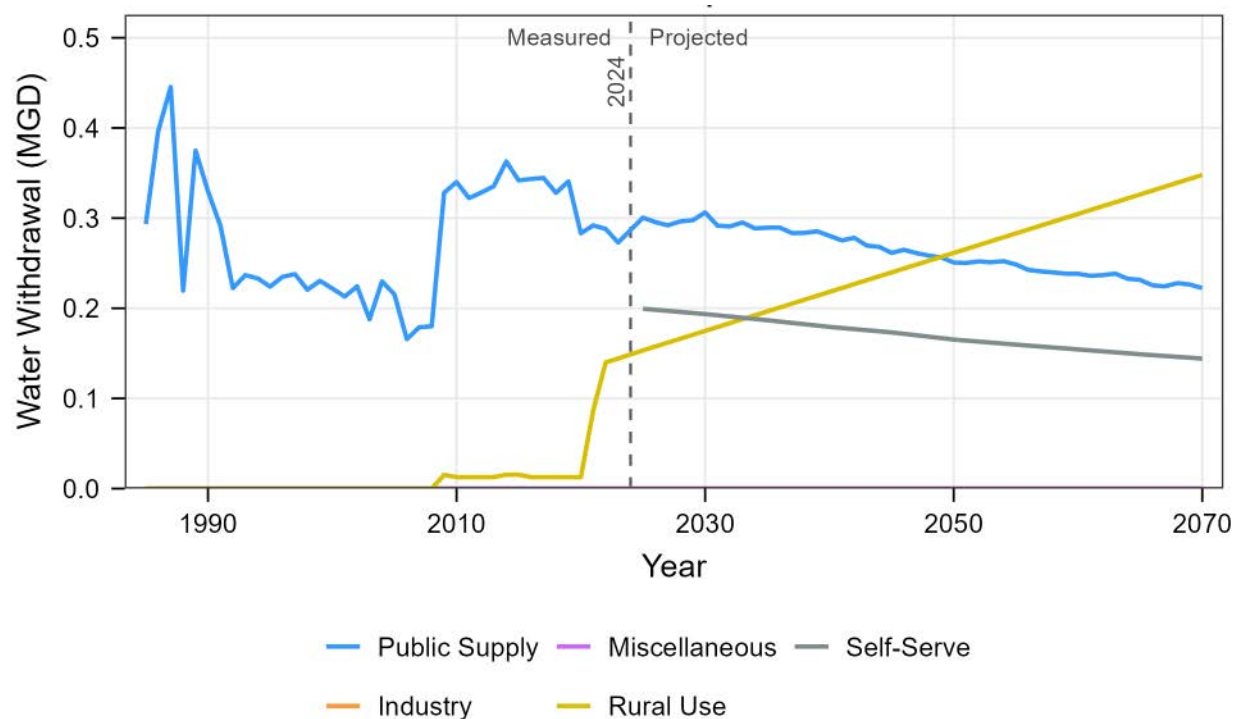


Figure F-39. Historical and forecasted water demands in Randolph County in MGD from 1985-2070. Randolph County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 12 Ripley County

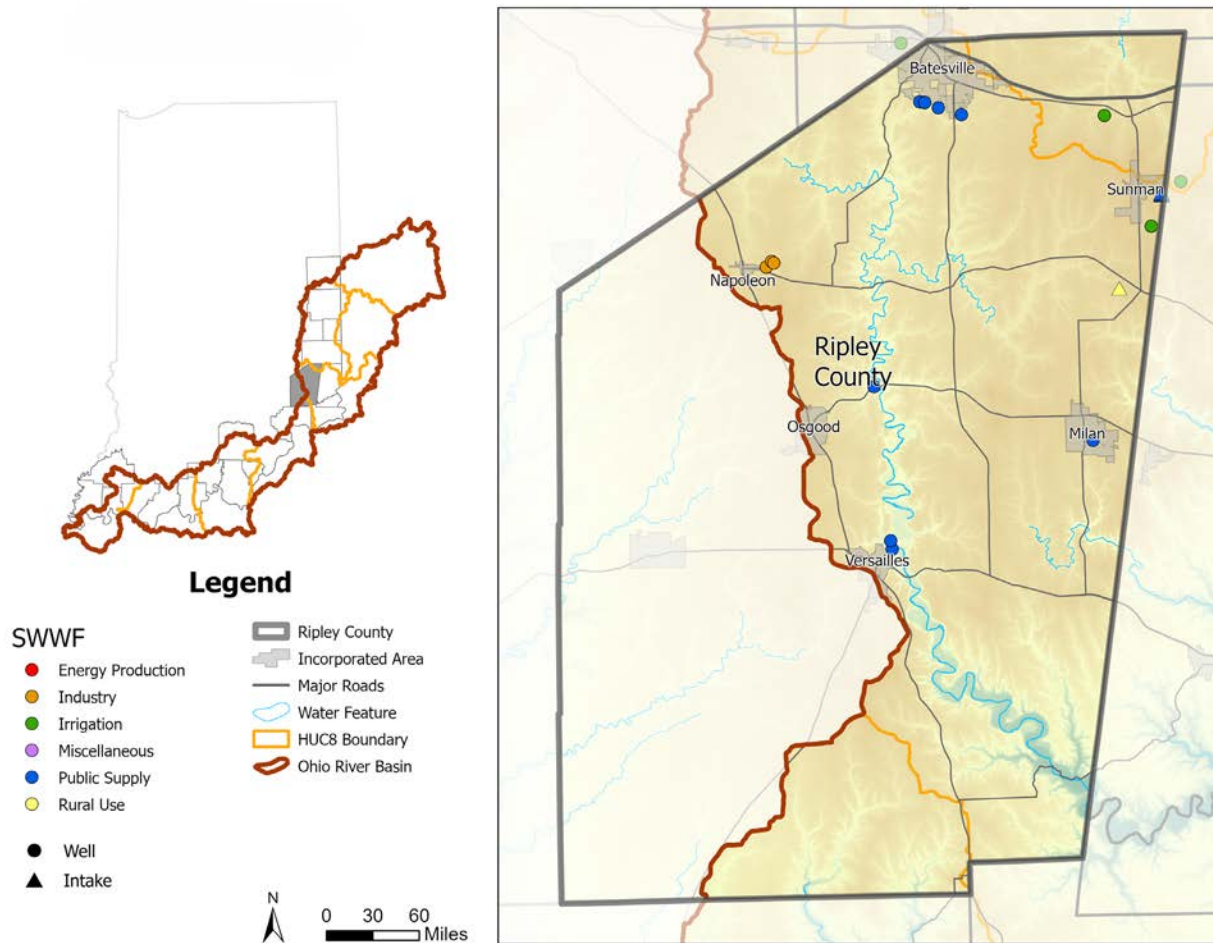


Figure F-40. Water withdrawal locations in Ripley County, Ohio River and Southeast Indiana Region (1985–2023). Ripley County lies partially within the Region.

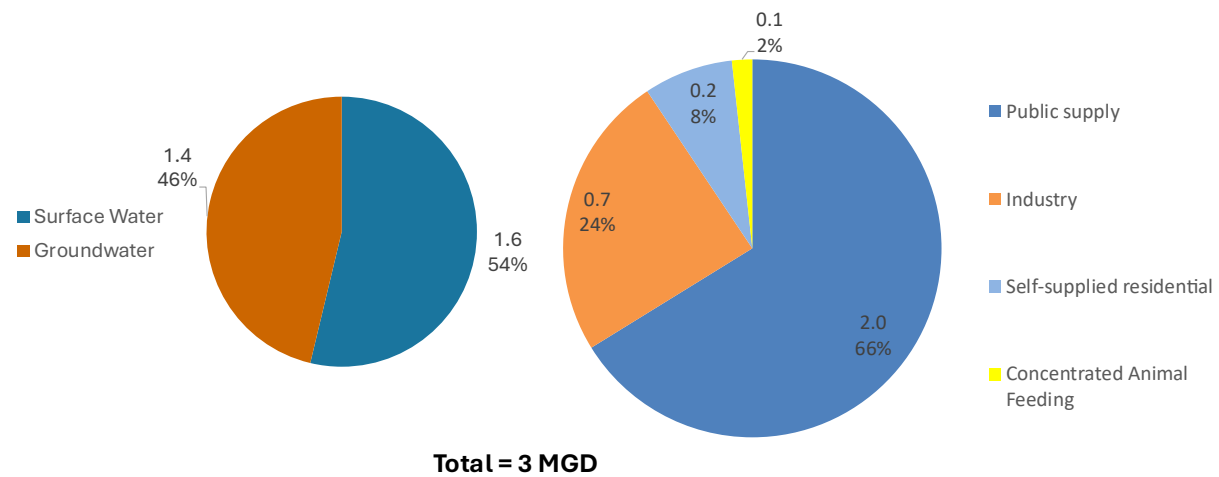


**Figure F-41.** 2020 water demand in MGD in Ripley County. Ripley County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

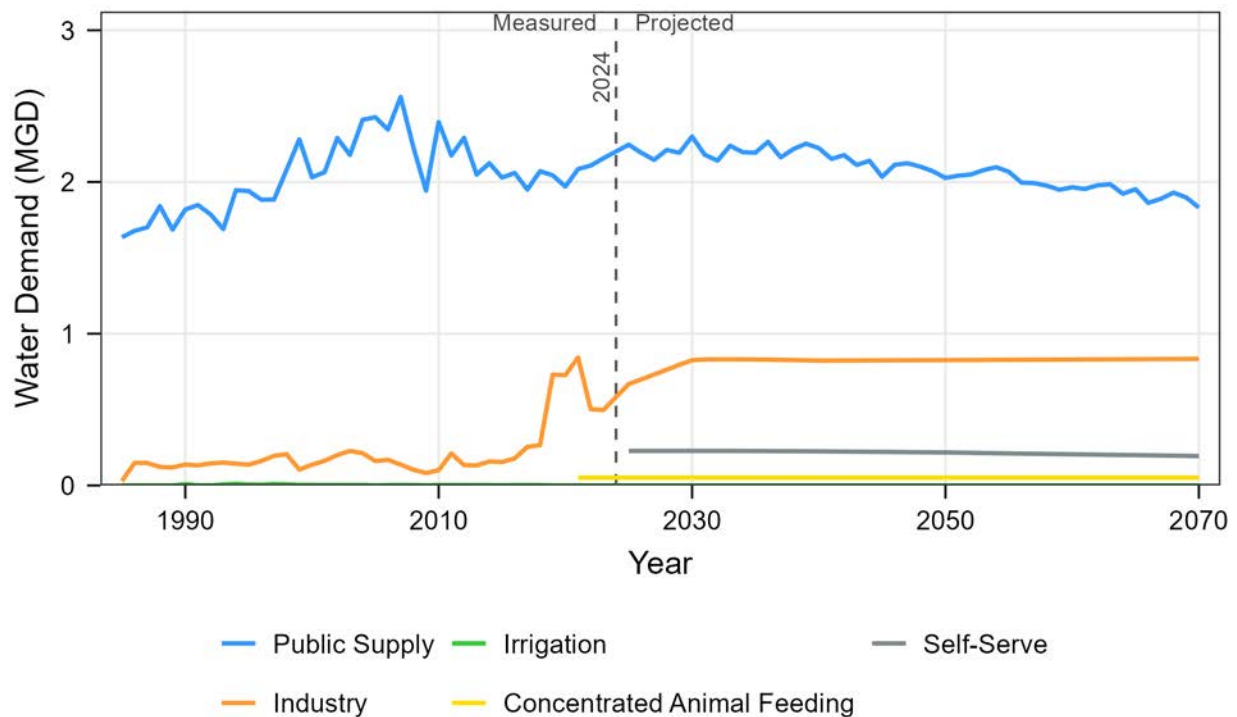


**Figure F-42.** Historical and forecasted water demands in Ripley County in MGD from 1985-2070. Ripley County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 13 Spencer County

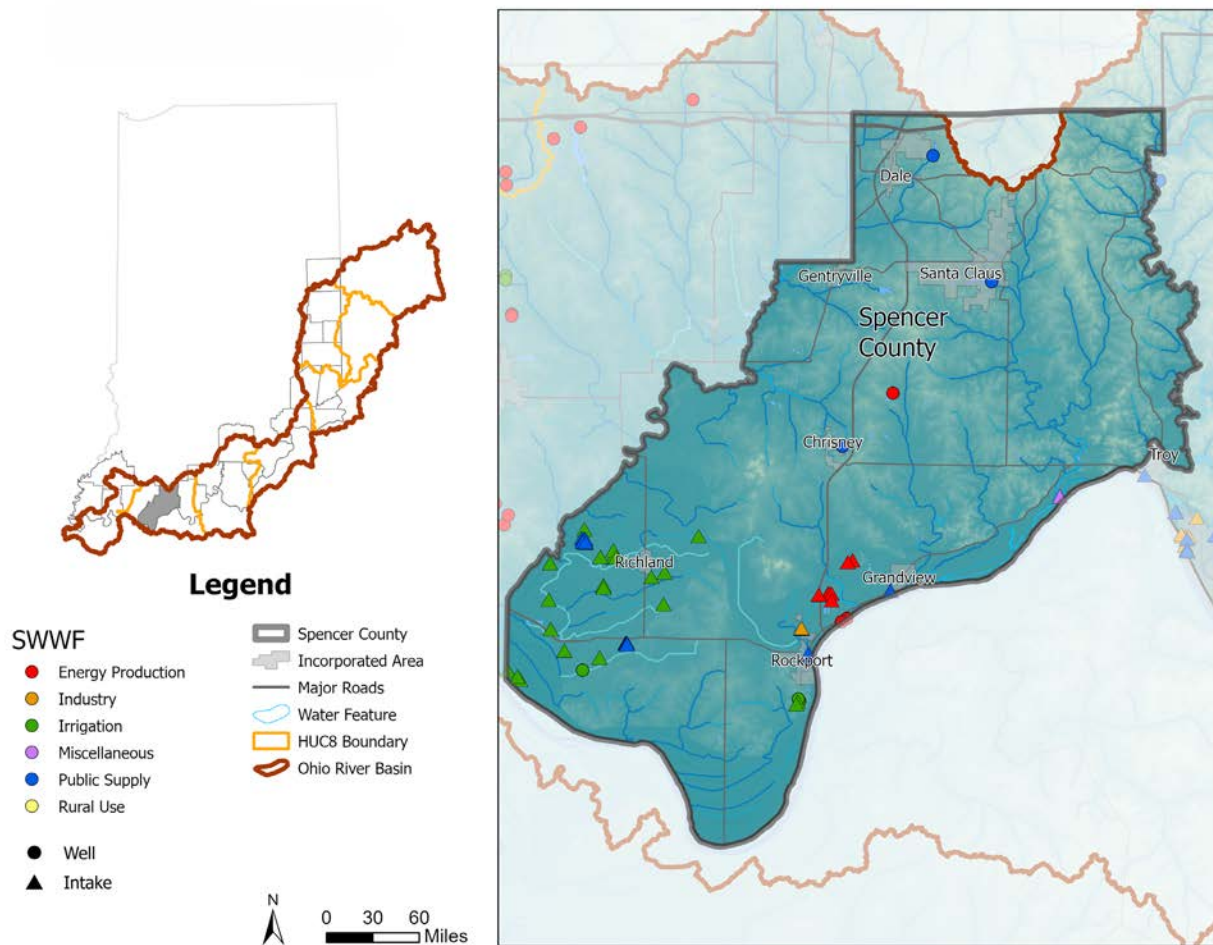


Figure F-43. Water withdrawal locations in Spencer County, Ohio River and Southeast Indiana Region (1985–2023). Spencer County lies partially within the Region.

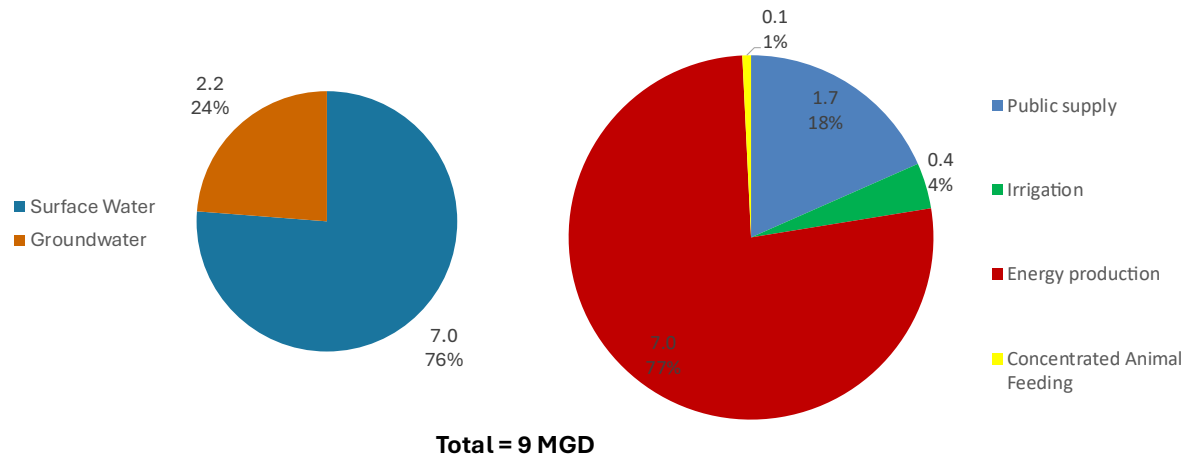


**Figure F-44.** 2020 water demand in MGD in Spencer County. Spencer County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

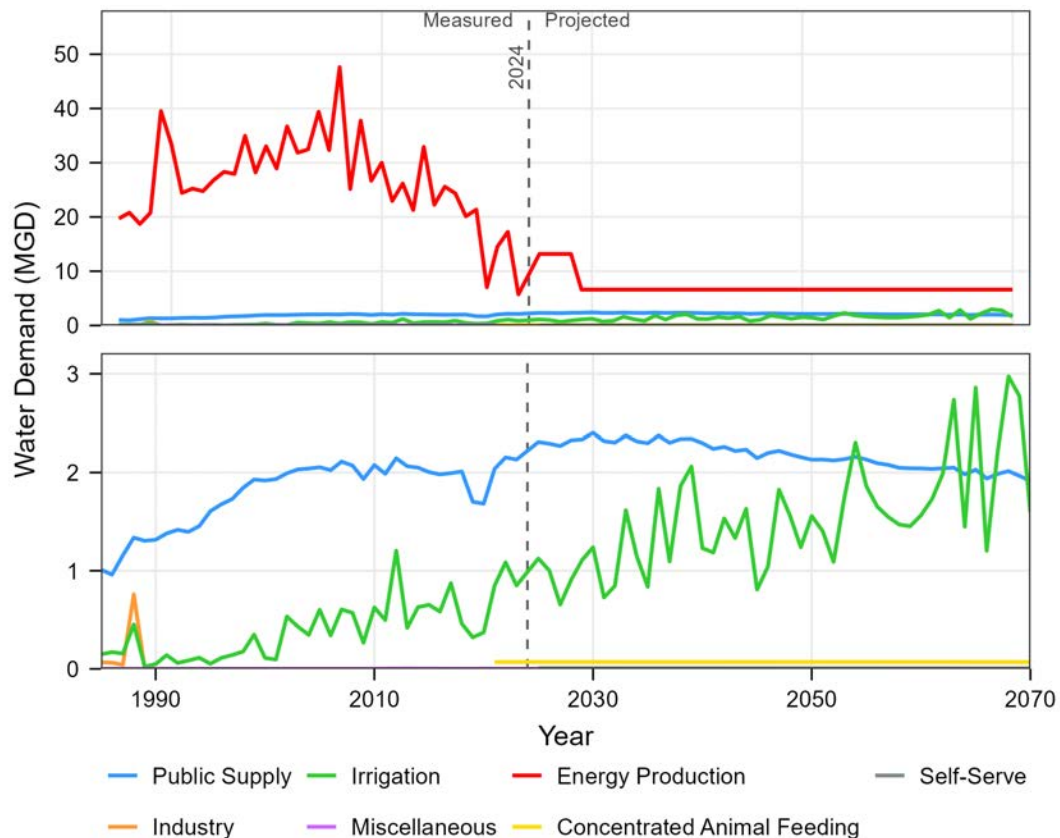


**Figure F-45.** Historical and forecasted water demands in Spencer County in MGD from 1985-2070. Spencer County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 14 Switzerland County

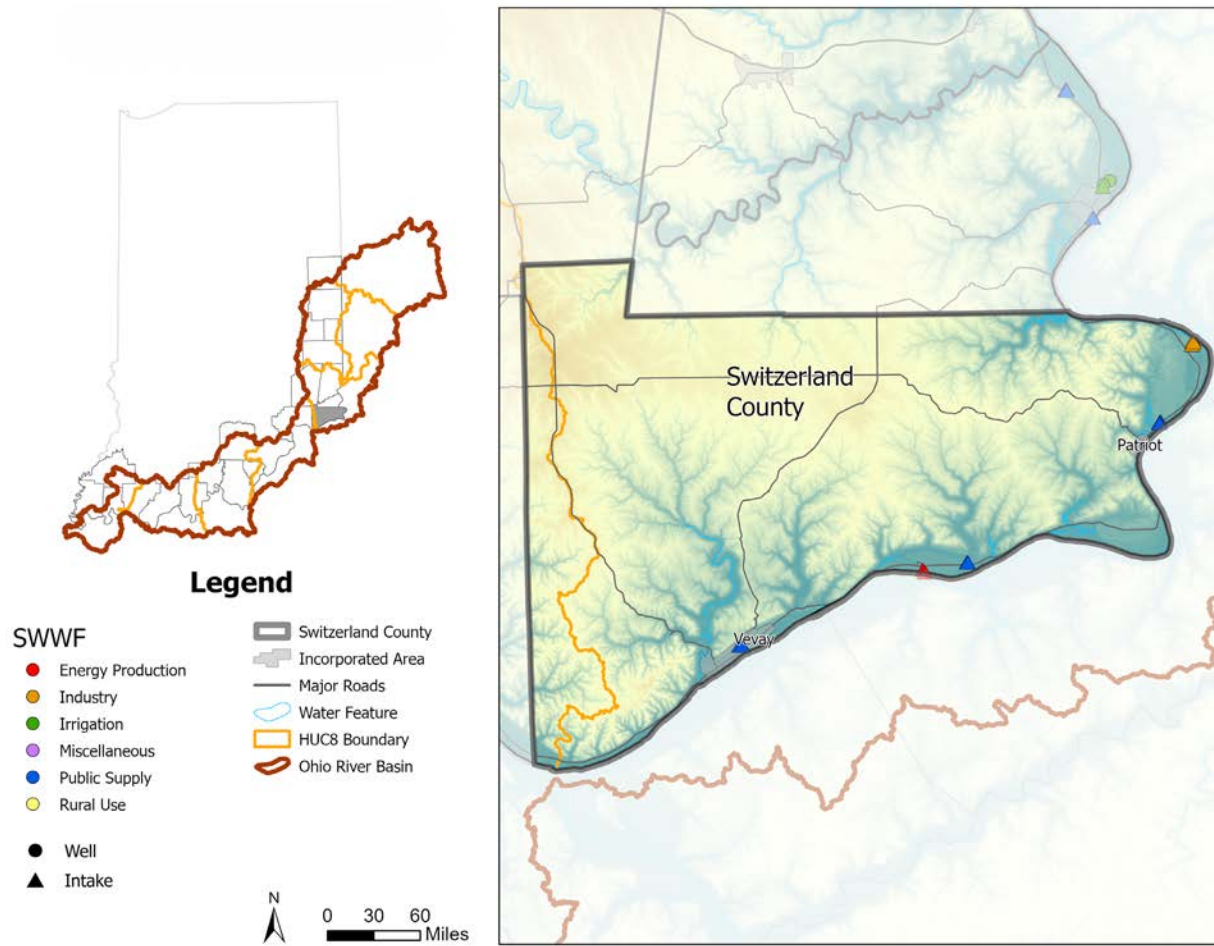


Figure F-46. Water withdrawal locations in Switzerland County, Ohio River and Southeast Indiana Region (1985–2023).

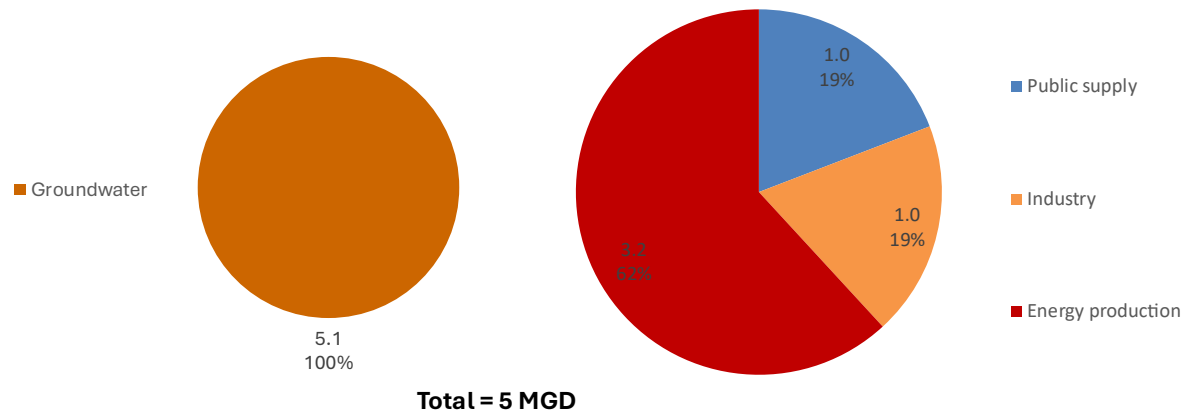


Figure F-47. 2020 water demand in MGD in Switzerland County. Demands below 0.05 MGD are not shown.

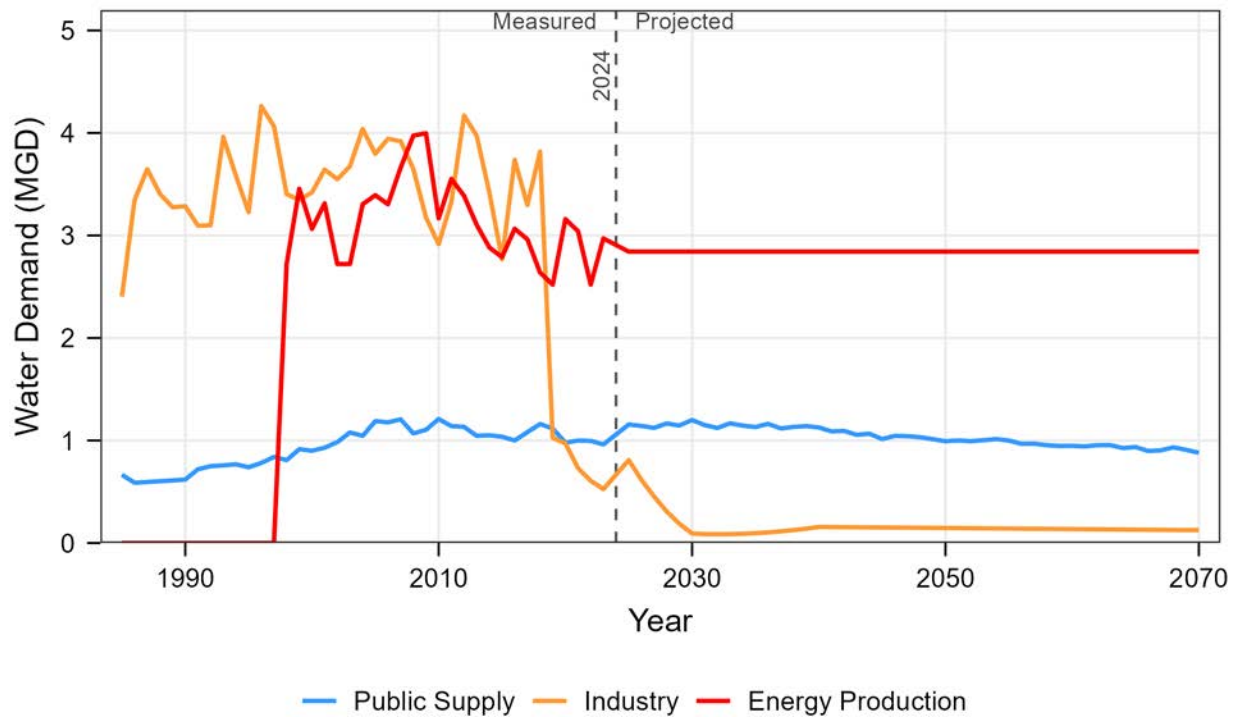


Figure F-48. Historical and forecasted water demands in Switzerland County in MGD from 1985-2070.

## 15 Union County

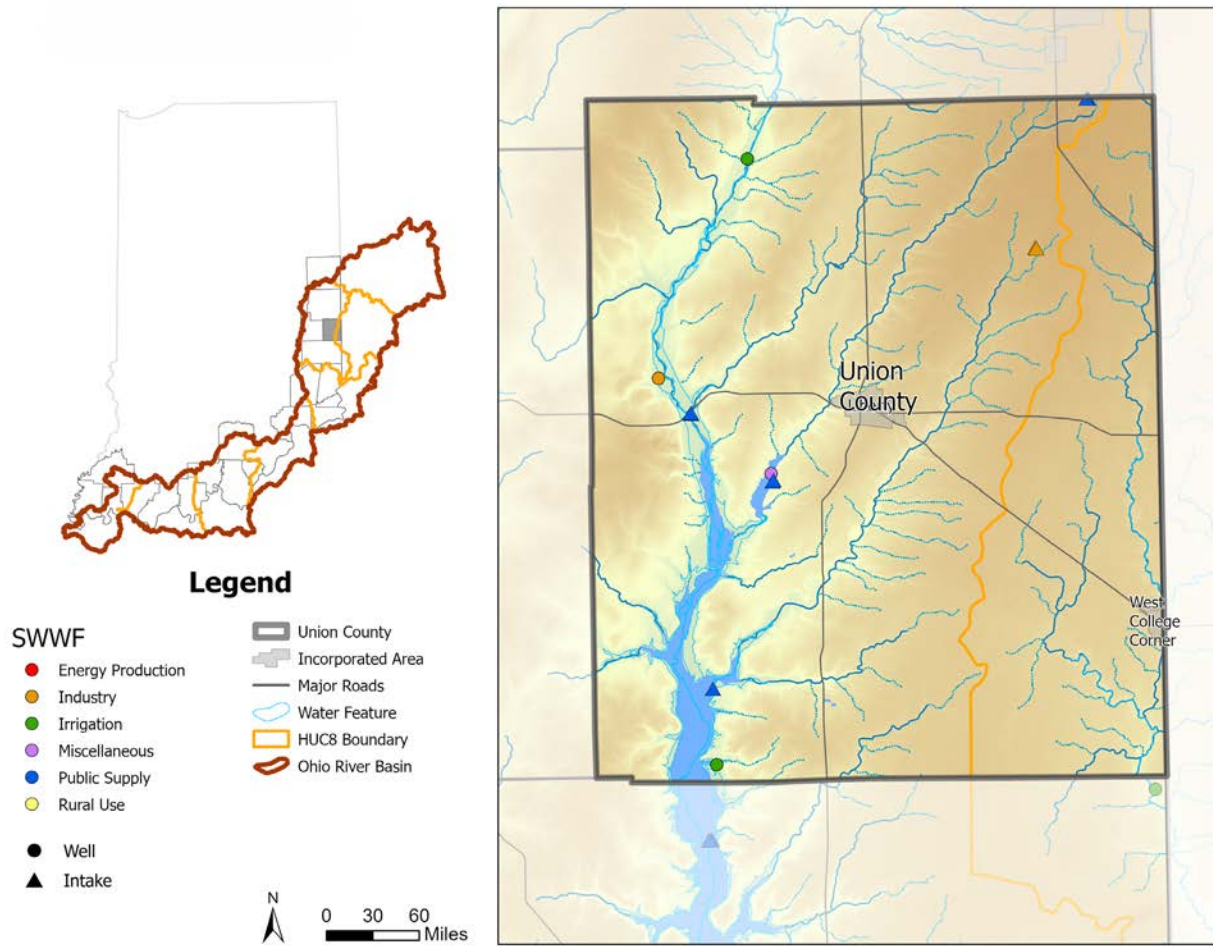


Figure F-49. Water withdrawal locations in Union County, Ohio River and Southeast Indiana Region (1985–2023).

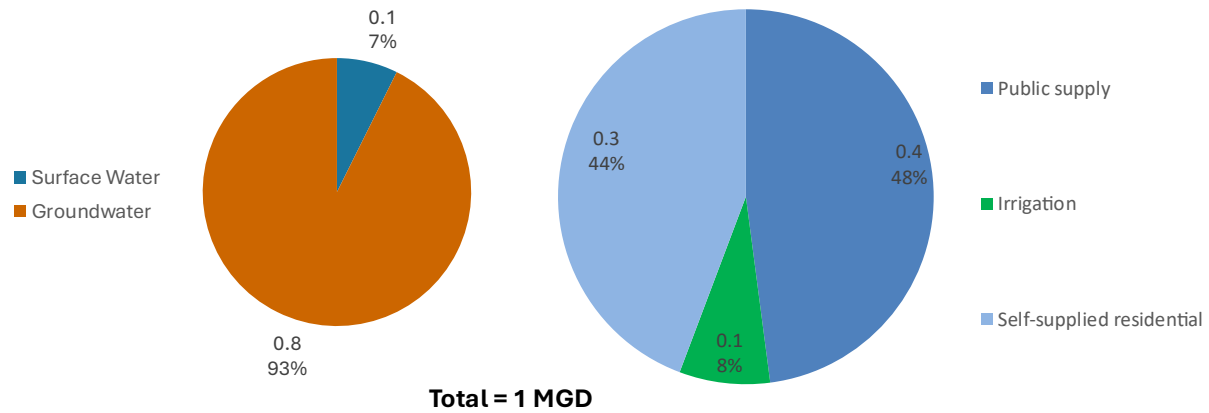


Figure F-50. 2020 water use and source for Union County, uses below 0.05 MGD not shown.

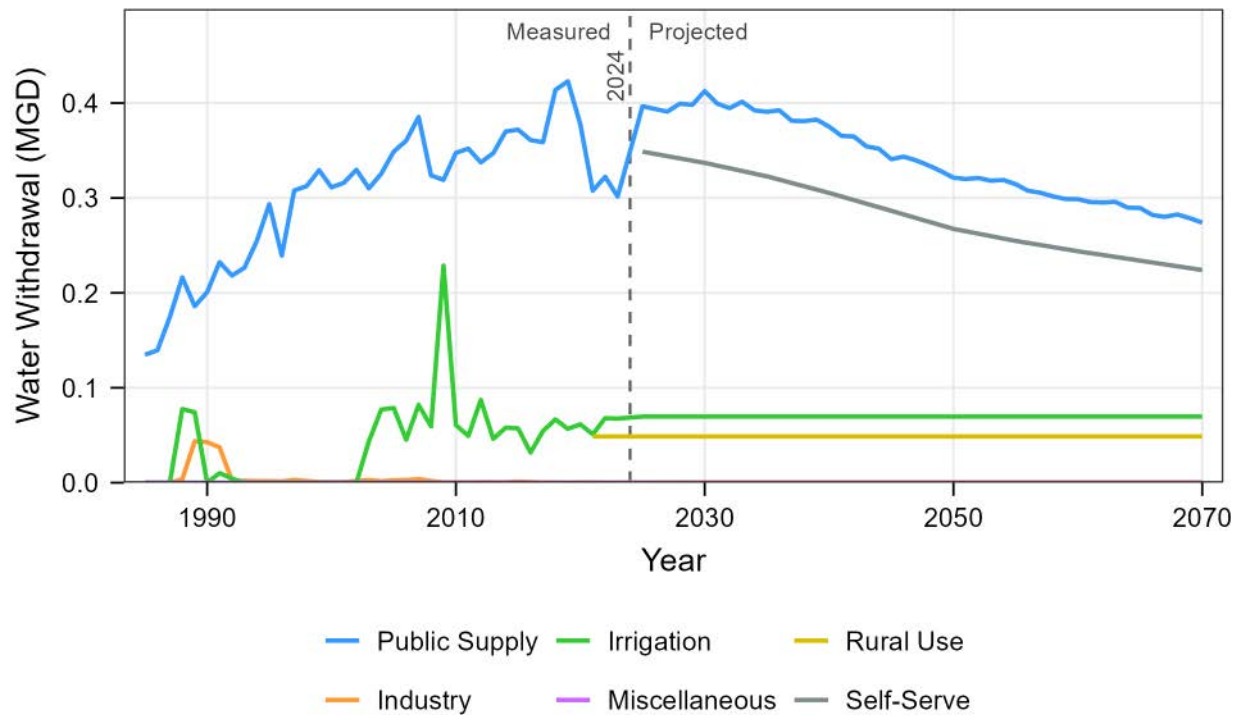


Figure F-51. Historical and forecasted water demands in Union County in MGD from 1985-2070.

## 16 Vanderburgh County

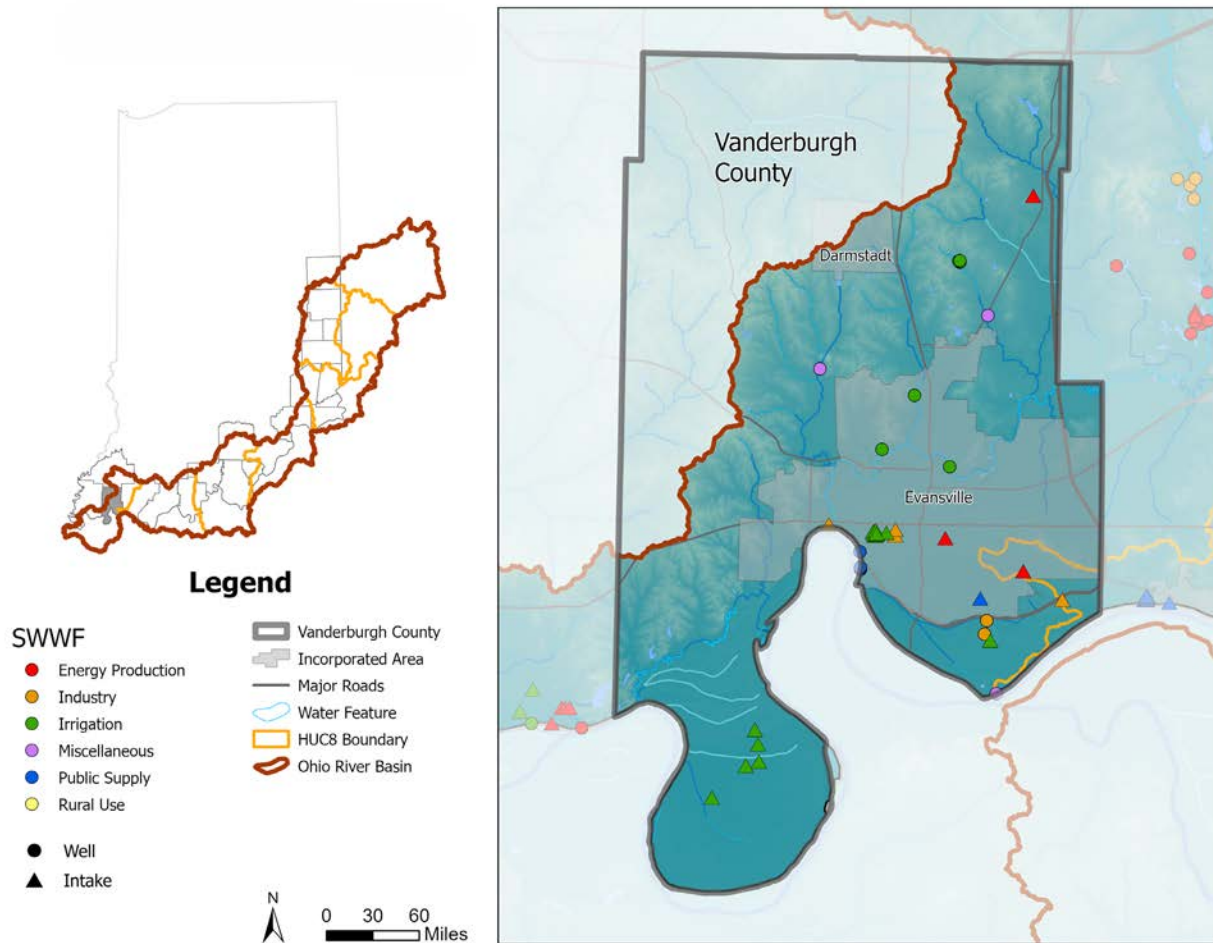


Figure F-52. Water withdrawal locations in Vanderburgh County, Ohio River and Southeast Indiana Region (1985–2023). Vanderburgh County lies partially within the Region.

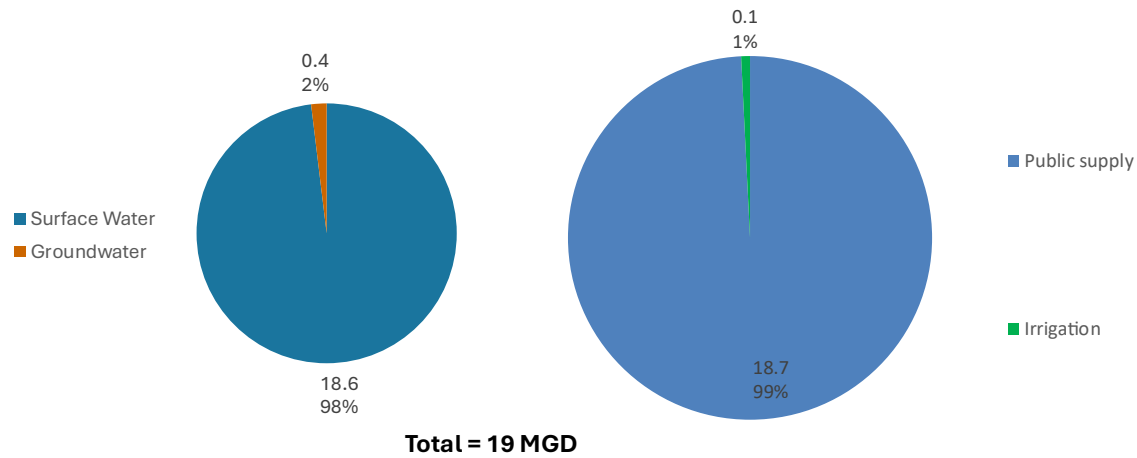


**Figure F-53.** 2020 water demand in MGD in Vanderburgh County. Vanderburgh County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

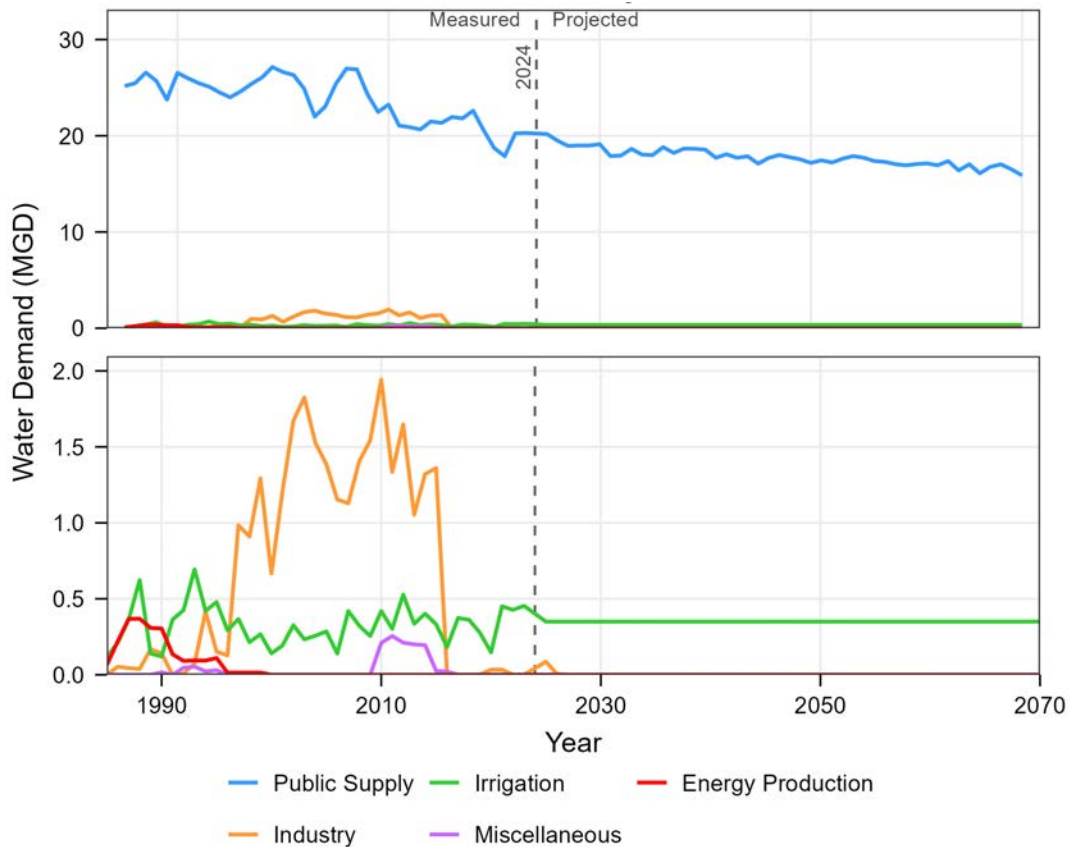


**Figure F-54.** Historical and forecasted water demands in Vanderburgh County in MGD from 1985-2070. Vanderburgh County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 17 Warrick County

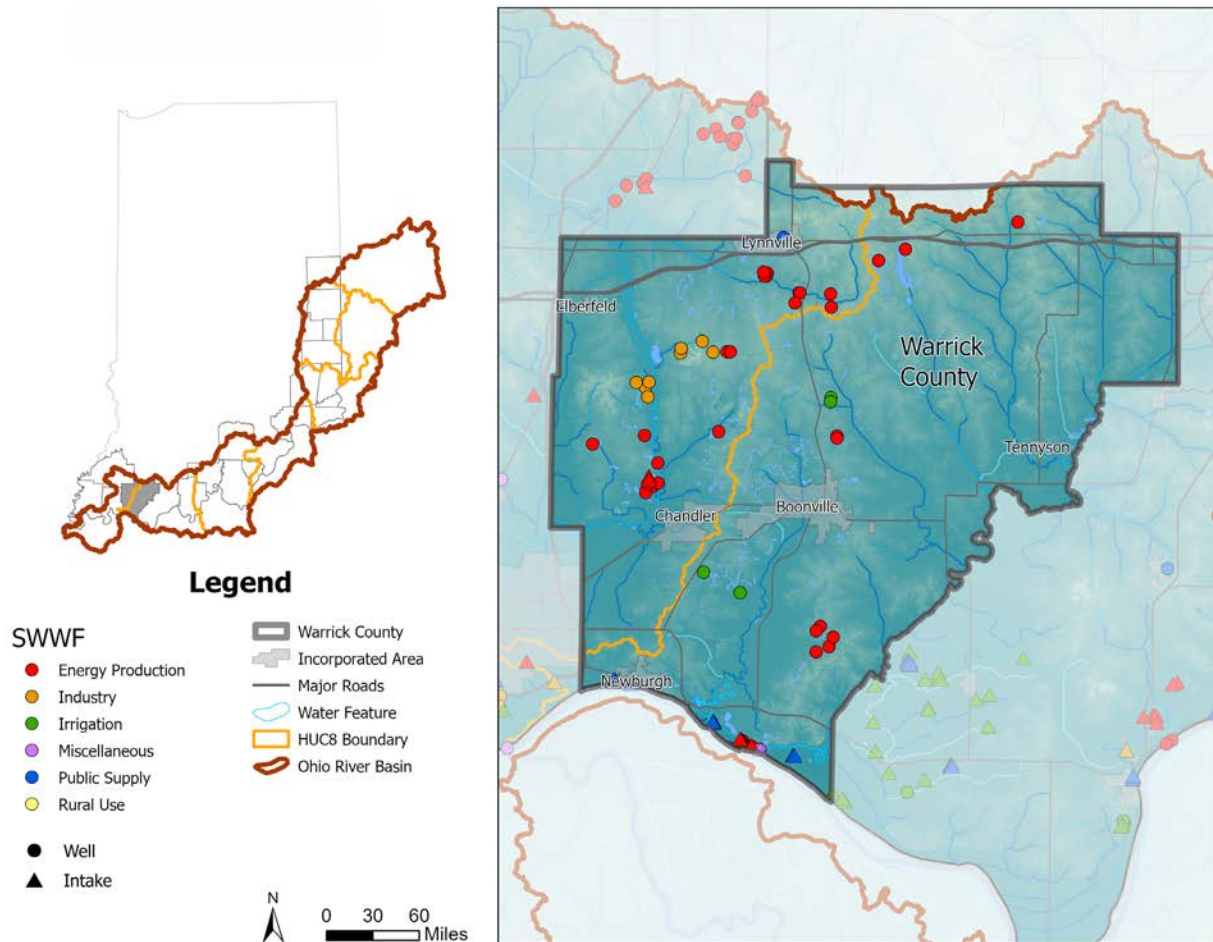


Figure F-55. Water withdrawal locations in Warrick County, Ohio River and Southeast Indiana Region (1985–2023). Warrick County lies partially within the Region.

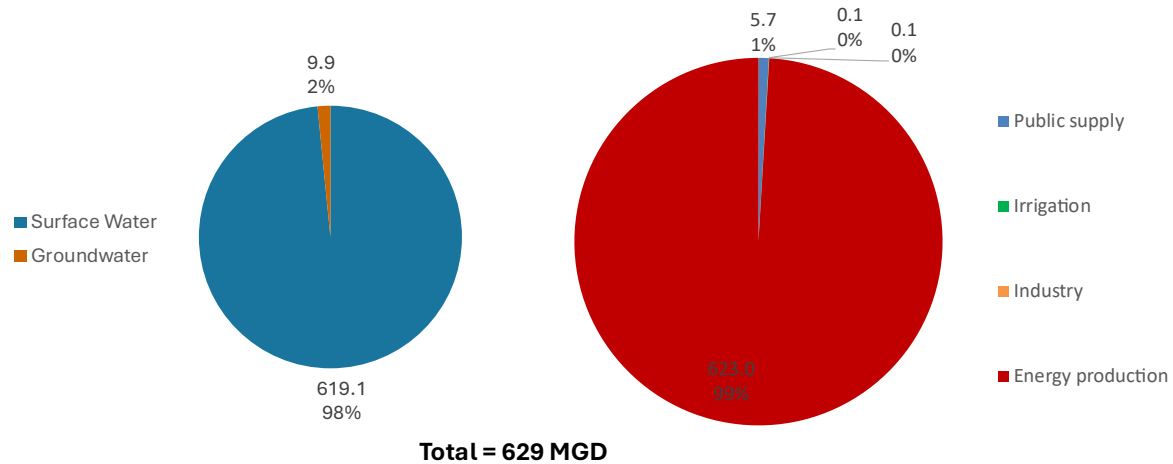


Figure F-56. 2020 water demand in MGD in Warrick County. Warrick County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

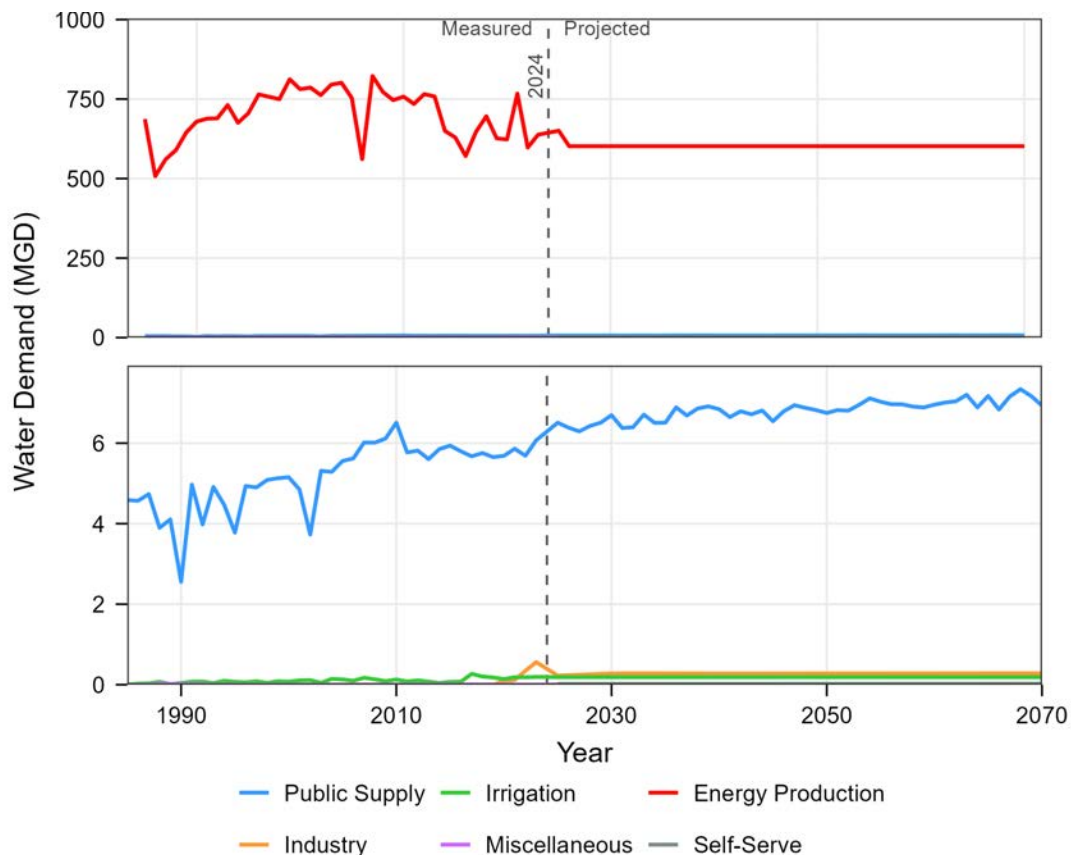


Figure F-57. Historical and forecasted water demands in Warrick County in MGD from 1985-2070. Warrick County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 18 Washington County

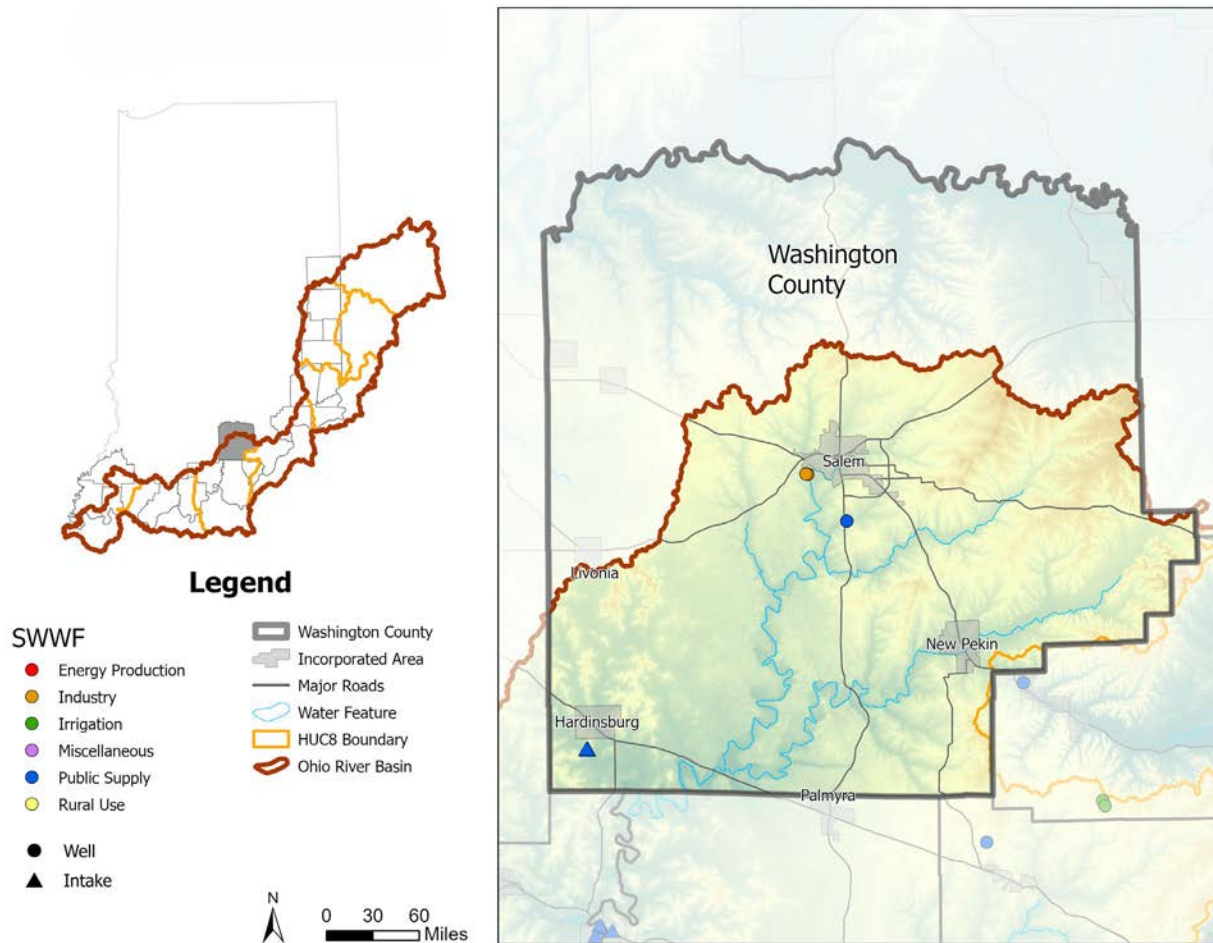


Figure F-58. Water withdrawal locations in Washington County, Ohio River and Southeast Indiana Region (1985–2023). Washington County lies partially within the Region.

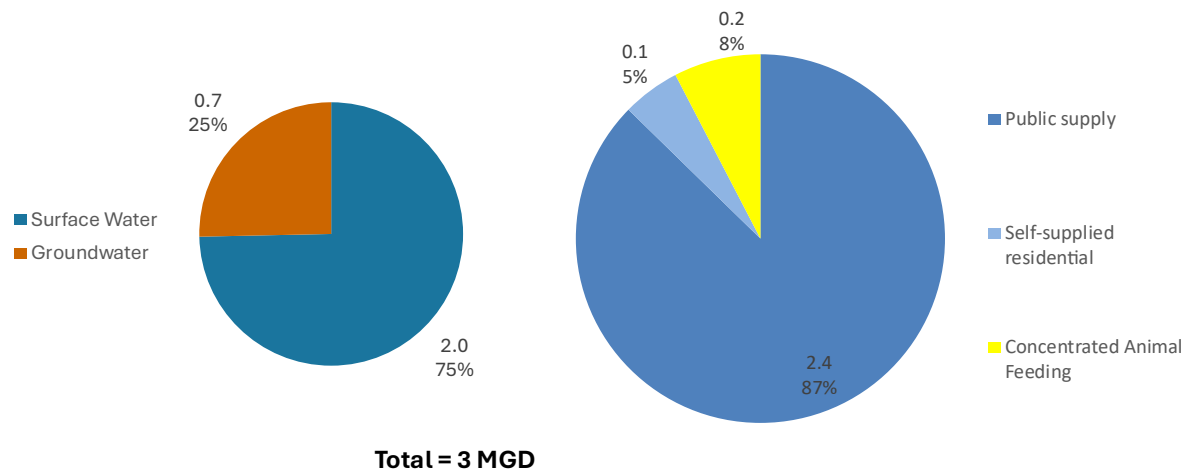


**Figure F-59.** 2020 water demand in MGD in Washington County. Washington County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

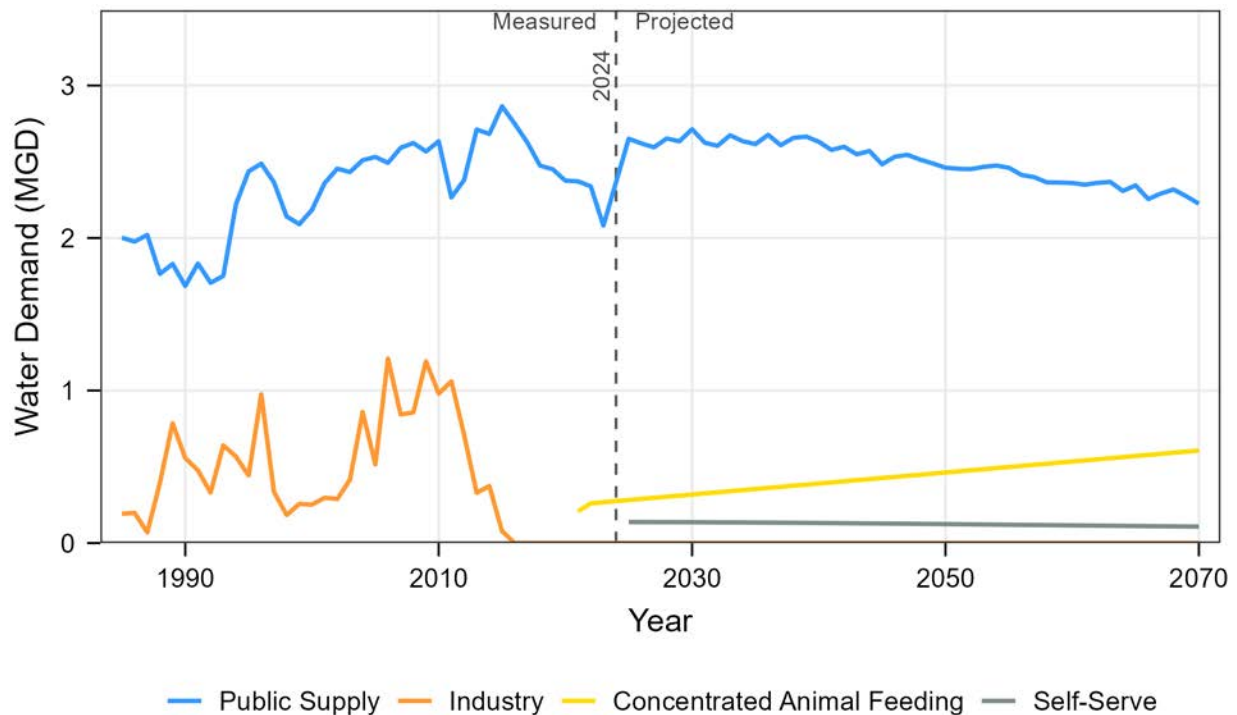


**Figure F-60.** Historical and forecasted water demands in Washington County in MGD from 1985-2070. Washington County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented.

## 19 Wayne County

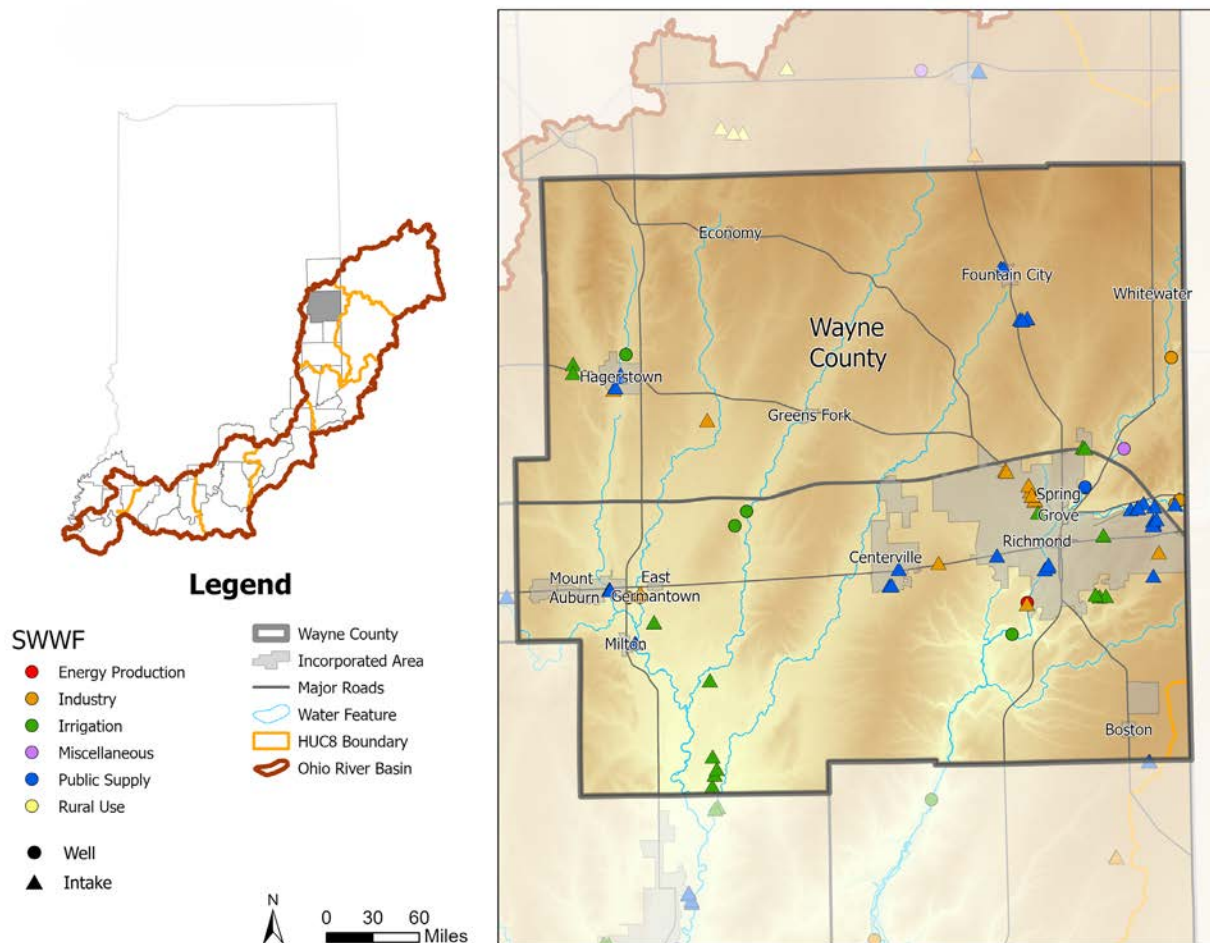


Figure F-61. Water withdrawal locations in Wayne County, Ohio River and Southeast Indiana Region (1985–2023). Wayne County lies partially within the Region.

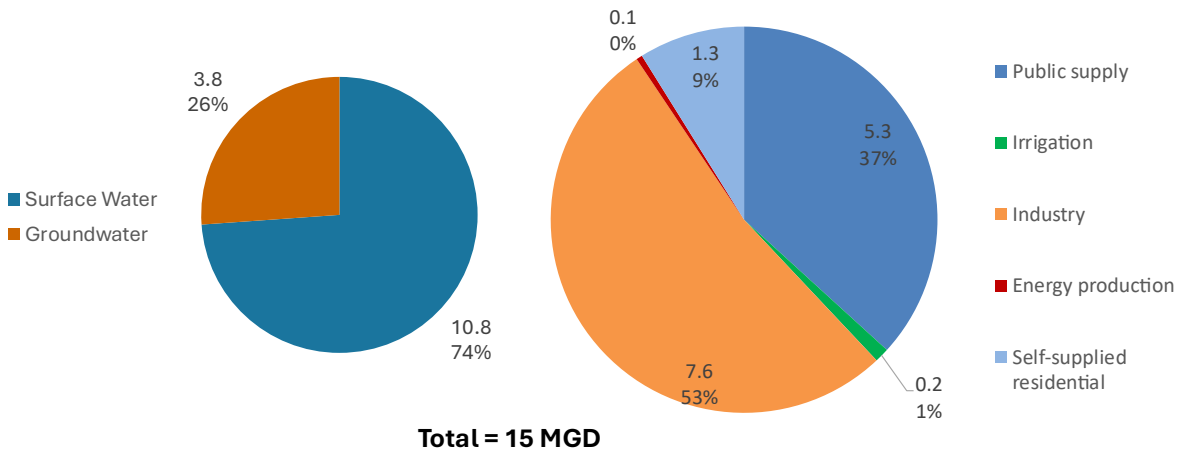


Figure F-62. 2020 water demand in MGD in Wayne County. Wayne County lies partially within the Ohio River and Southeast Indiana Region. Only data from within the Region are presented. Demands below 0.05 MGD are not shown.

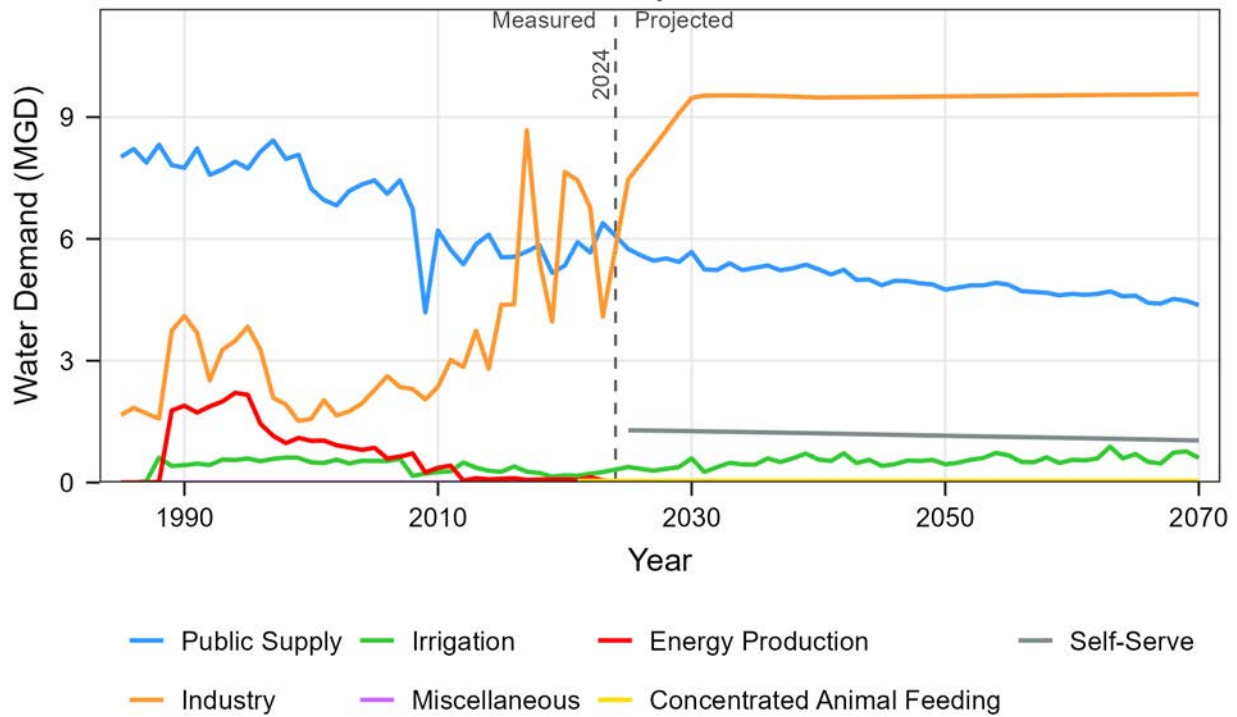


Figure F-63. Historical and forecasted water demand in Wayne County in MGD from 1985-2070.