Illinois Water Supply/Demand Estimates, Data Visualization Platform, and Modeling Advancements

Devin Mannix & Daniel Abrams - ISWS

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Illinois Department of Natural Resources

ILLINOIS
Illinois State Water Survey
PRAIRIE RESEARCH INSTITUTE

Presentation Layout

- Tiered Assessments for Supply and Demand in Illinois
- Illinois Water Budget Vista

Tiered Assessments for Supply and Demand in Illinois

Study Objectives

- Illinois updated its State Water Plan in 2022, with the following mission: "*For state agencies to develop a concise plan for addressing the water issues facing the state in an efficient and unified front*"

- Illinois Department of Natural Resources Office of Water Resources (IDNR-OWR) teamed with the Illinois State Water Survey (ISWS) to "*ensure Illinois has a* ***sustainable water supply*** *for all communities and users*."

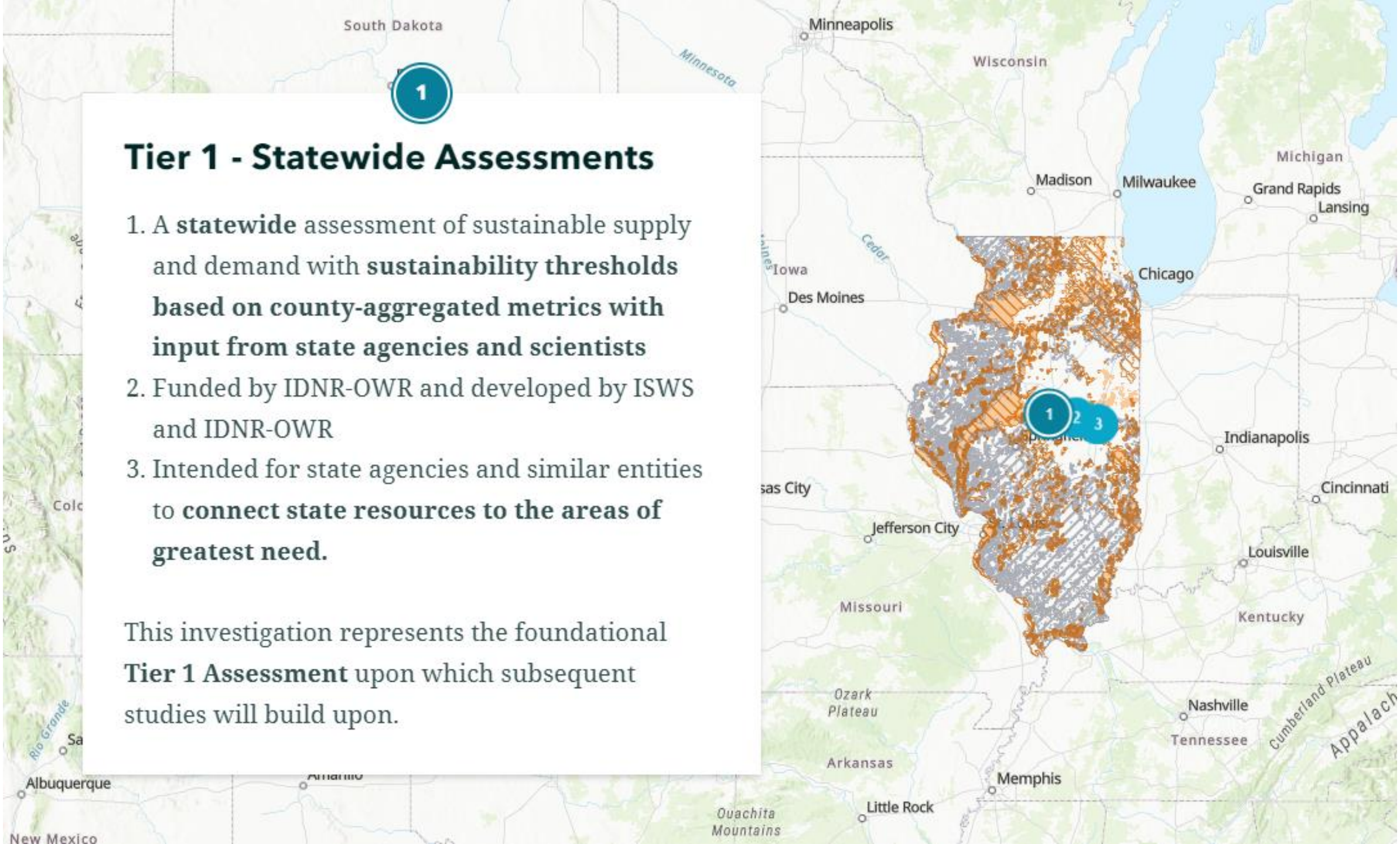
Sustainable Water Supply

- Sustainability is ultimately defined by finding a balance between **Supply** and **Demand.**
  - **Supply** can broadly be defined by *the net water input into the environment and the total water reserves available*.
  - **Demand** includes *the total water usage from a variety of sectors, including public supplies, private wells, commercial, industrial, agricultural, power generation, and other sources*.
- Previous water supply investigations have focused on regional studies, with input from regional stakeholders to evaluate sustainability and risks in their regions.

Tiered Assessment Approach

- However, three things became clear during earlier studies:
  1. Consensus on sustainability targets at different scales is elusive.
  2. A uniform statewide assessment was needed to better target state resources to the areas of greatest need.
  3. The assessment framework needed to be flexible to allow updates based on the latest science and stakeholder needs.

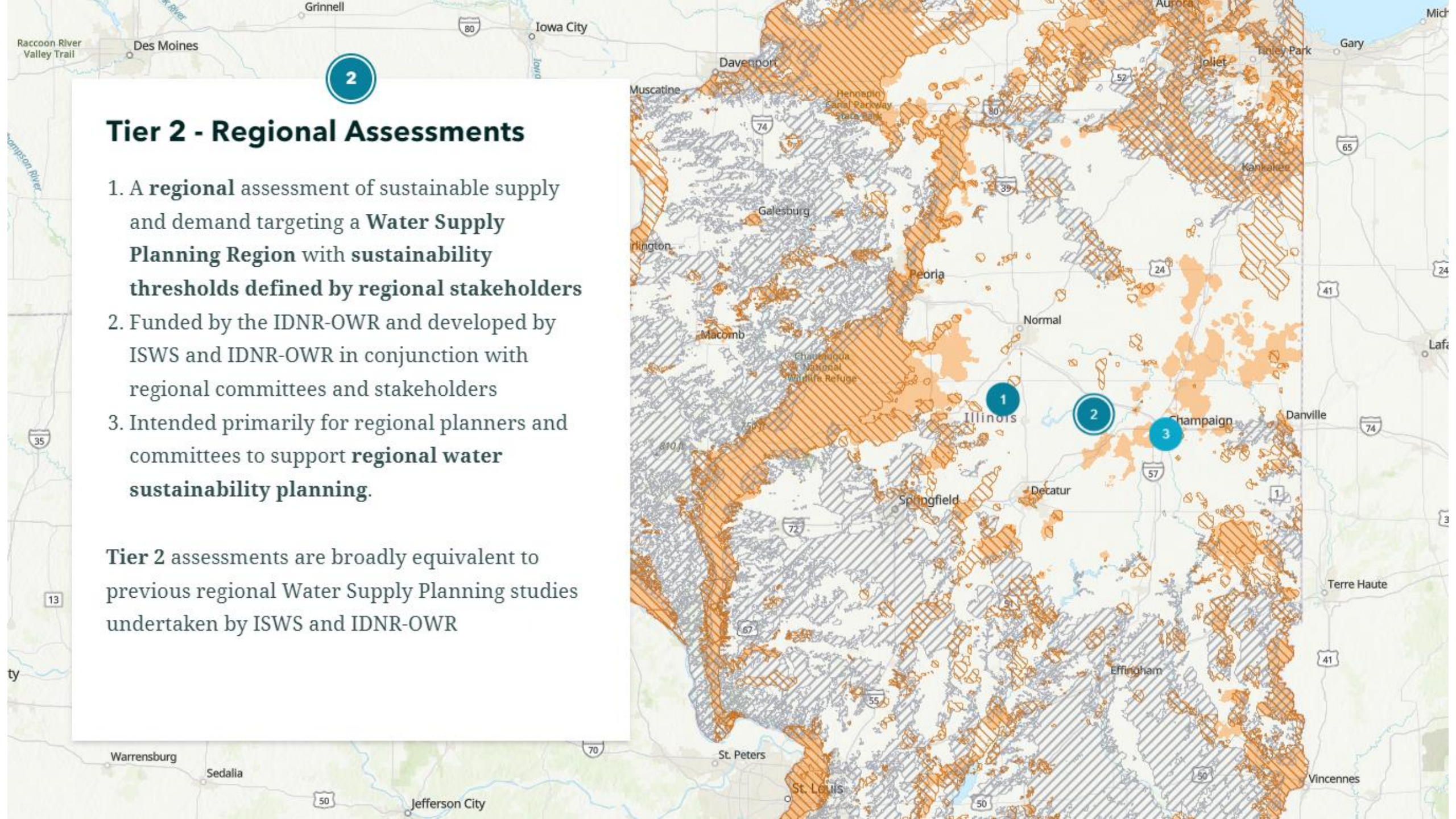
- To meet these goals, we developed the Water Supply Planning **Tiered Assessment** approach to better allocate resources towards understanding needs at different scales.



Tier 1 - Statewide Assessments

1. A **statewide** assessment of sustainable supply and demand with **sustainability thresholds based on county-aggregated metrics with input from state agencies and scientists**
2. Funded by IDNR-OWR and developed by ISWS and IDNR-OWR
3. Intended for state agencies and similar entities to **connect state resources to the areas of greatest need.**

This investigation represents the foundational **Tier 1 Assessment** upon which subsequent studies will build upon.



Tier 2 - Regional Assessments

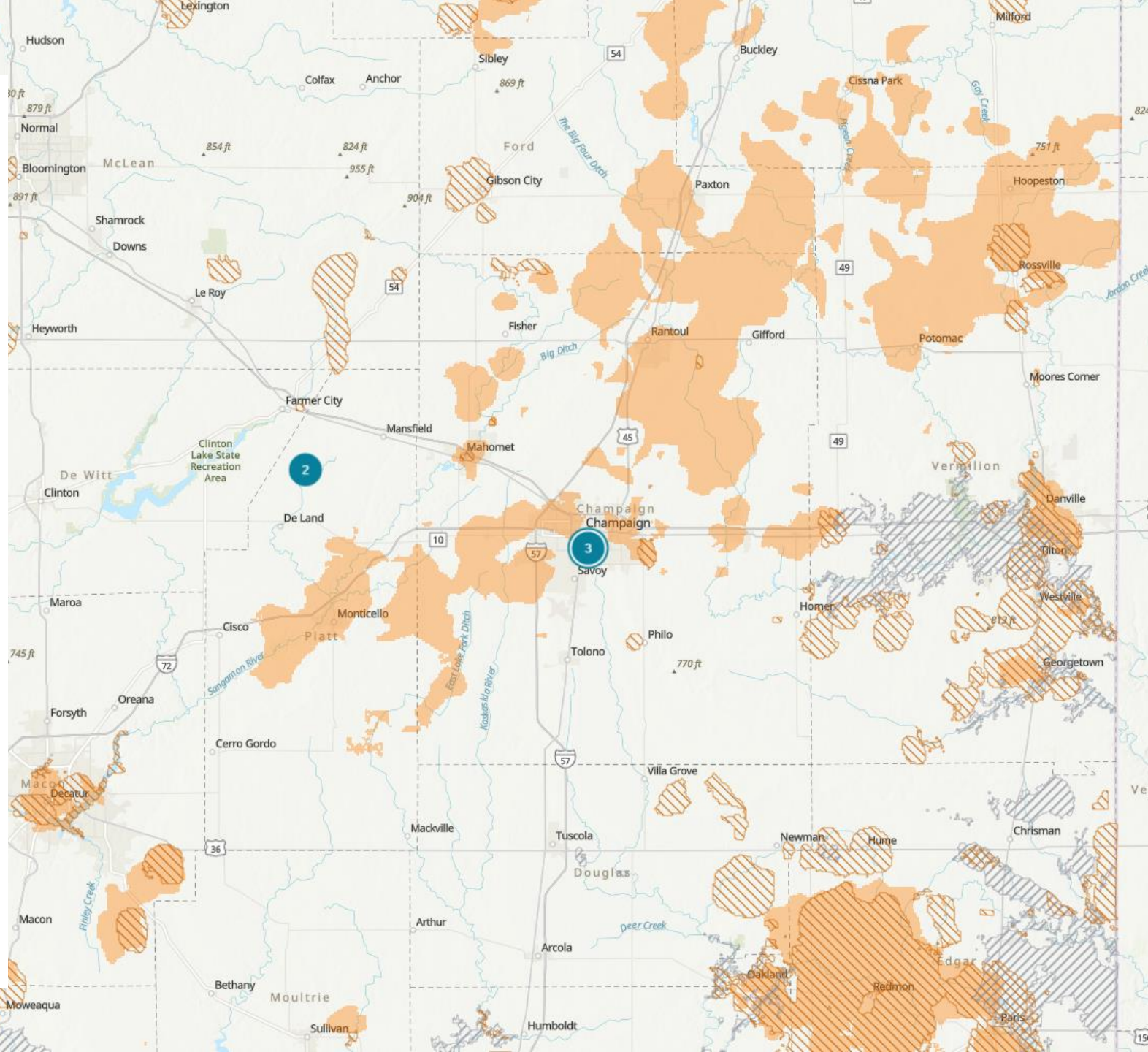
1. A **regional** assessment of sustainable supply and demand targeting a **Water Supply Planning Region** with **sustainability thresholds defined by regional stakeholders**
2. Funded by the IDNR-OWR and developed by ISWS and IDNR-OWR in conjunction with regional committees and stakeholders
3. Intended primarily for regional planners and committees to support **regional water sustainability planning**.

Tier 2 assessments are broadly equivalent to previous regional Water Supply Planning studies undertaken by ISWS and IDNR-OWR

Tier 3 - Sub-regional / Local Assessments

1. A **sub-regional or local** assessment of water resources that might include **assessments of specific users or points of withdrawal and consideration for planning horizons.**
2. Generally funded by local sources, with potential IDNR-OWR support for vulnerable communities.
3. Developed by ISWS and IDNR-OWR in conjunction with county and local partners intended to **support local water sustainability planning.**

As described above, **Tier 3** investigations have no upper limit to the level of detail and might include expertise beyond water resources. However, **Tier 3** assessments will generally not be funded by IDNR-OWR as many of these details fall outside the purview of IDNR-OWR objectives.



Tier 1 Methods - Demand

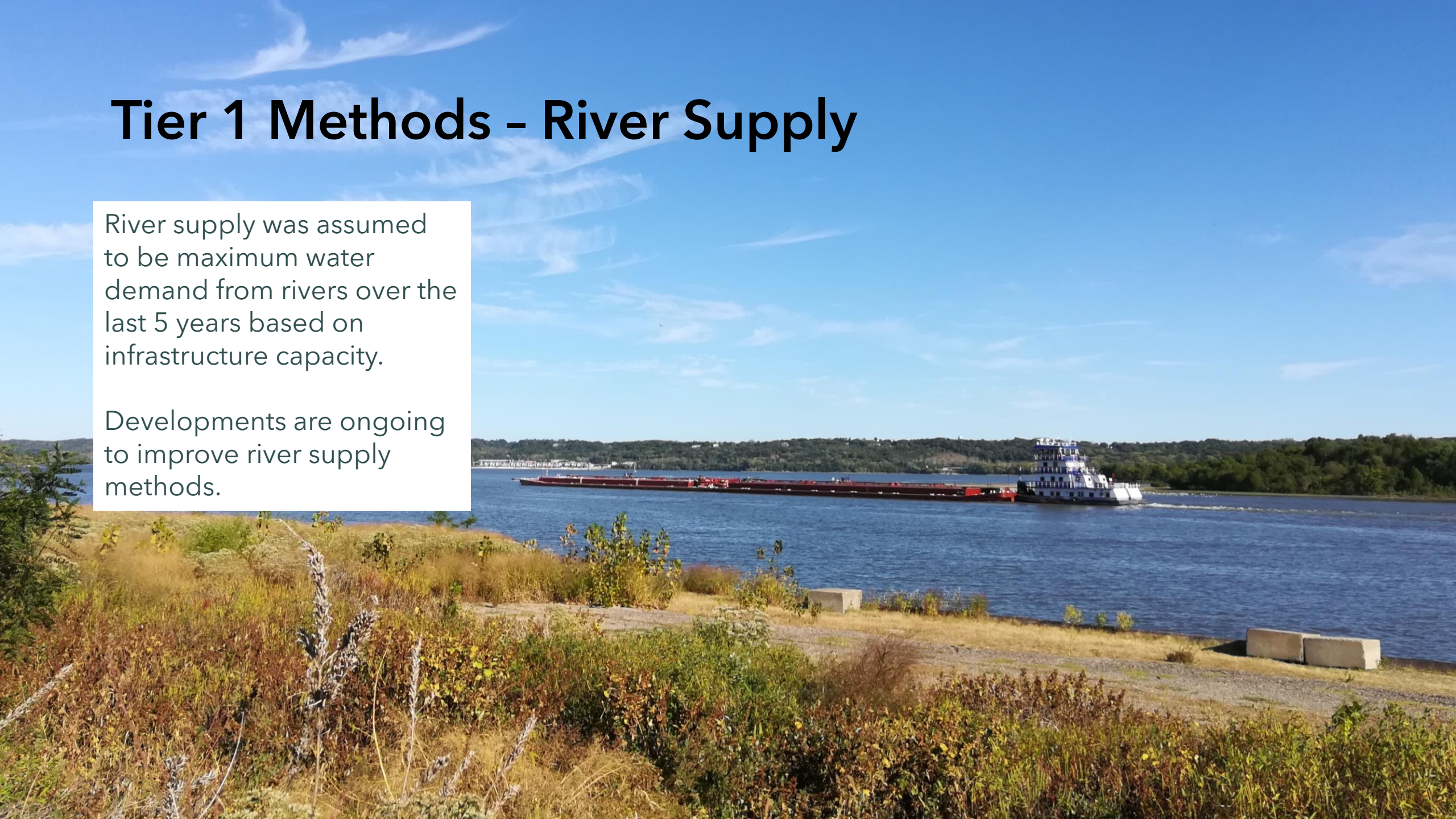
- Water **demand** was obtained from the Illinois Water Inventory Program (IWIP) and divided by sector, including *public supply, commercial and industrial, agricultural,* and *power generation*.
  - Groundwater demands were further divided based on well depth
    - < 500 ft were considered *shallow*
    - >500 ft were considered *deep*
  - Surface water demands were further divided based on type, broadly categorized into either *river*, *reservoir*, or *Lake Michigan* sources.

- Future demands were estimated for public supplies by calculating the current gallons per capita water usage using reported demands and 2020 Census population data, then estimated through 2070 using population projections provided by IDNR-OWR. Other demand sectors were held constant at 2020 levels due to complexities anticipating these demands without local input.

Tier 1 Methods – River Supply

River supply was assumed to be maximum water demand from rivers over the last 5 years based on infrastructure capacity.

Developments are ongoing to improve river supply methods.

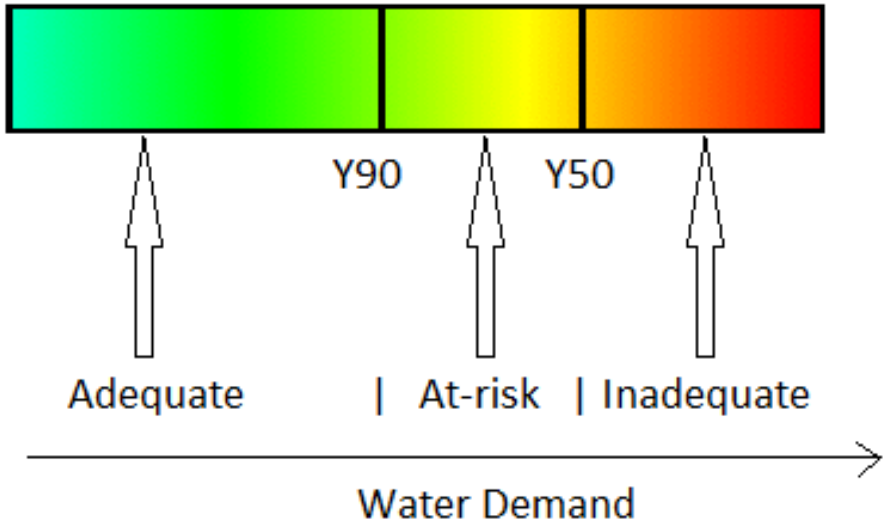


Tier 1 Methods – Reservoir Supply

Reservoir supply is evaluated based on the maximum amount of water withdrawals to maintain supply during critical drought, known as safe yield.

This uses a risk-based yield method accounting for uncertainty by comparing facility water demands to the 50 and 90 percent confidence yields (Y50 and Y90).

Basically, for Y50, there is a 50% chance that the true reservoir yield is less than calculated. Facilities where withdrawals exceed this threshold are considered Inadequate as there is a high likelihood the supply will be insufficient during critical drought.



Tier 1 Methods – Lake Michigan Supply

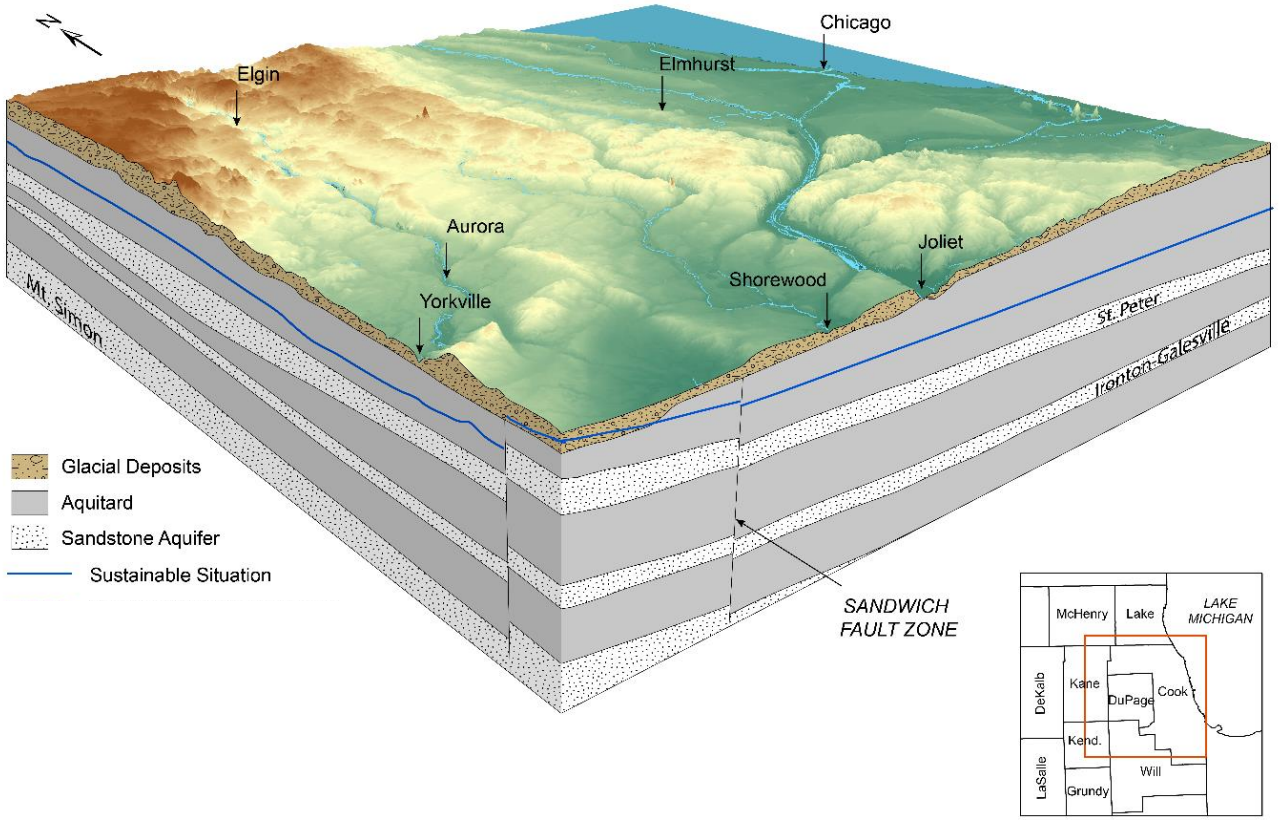
Lake Michigan supply is evaluated based on current IDNR-OWR allocation permittees during the water year 2017.

Lake Michigan is unique in having a maximum allocation as determined by a previous Supreme Court decree, the supply is unavailable to those without both existing infrastructure and approved permits.

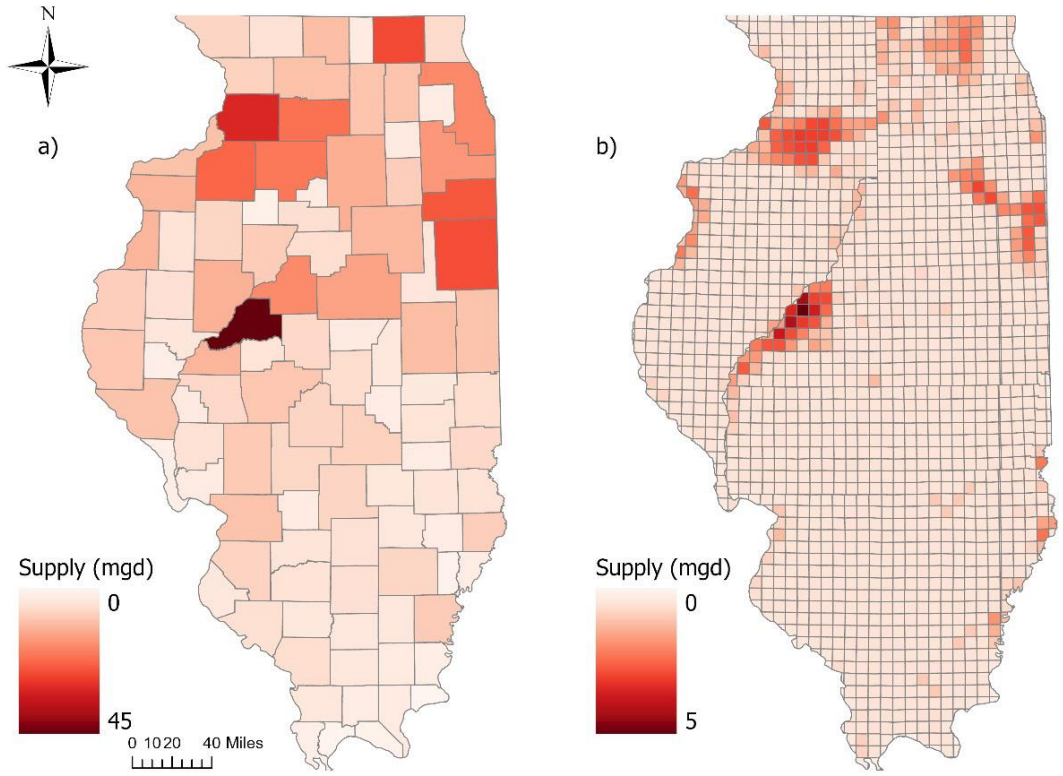
Tier 1 Methods – Deep Groundwater Supply

Deep groundwater supply is evaluated using a MODFLOW groundwater flow model calculating the maximum sustained recharge rate to the sandstone aquifers without allowing dewatering of the St. Peter. This recharge rate is at its physical maximum anywhere the water level is below the top of the aquitard.

Where the sandstone aquifers are shallower, they are evaluated using the same methods as the shallow groundwater supply.

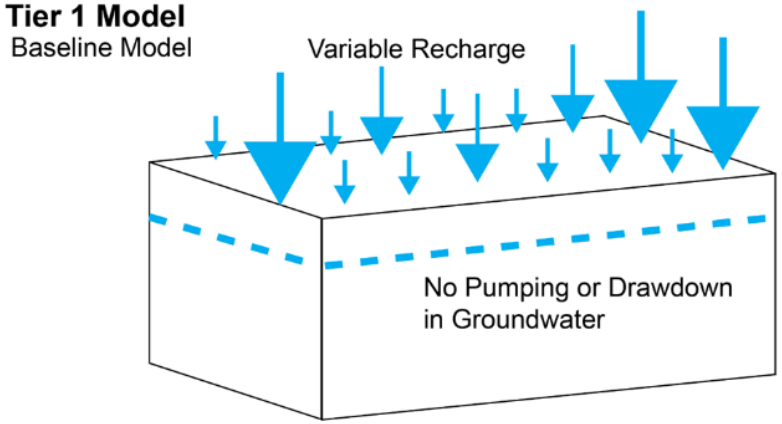


Tier 1 Methods – Shallow Groundwater Supply



Shallow groundwater supply is guided by a study in Michigan by Zorn et al. (2012) showing that aquatic ecology can be impacted by a 10-20% reduction in natural groundwater discharge to streams.

As the shallow groundwater model is under development, 15% of total modeled recharge is used as a proxy for a sustainable supply. This 15% value is calculated from the sum of predevelopment recharge by county.



Tier 1 Limitations

- As discussed previously, **Tier 1 Assessments** are **not intended for use in local and regional planning**.

- Evaluating sustainability on the county level means missing extreme high and low values- *there are likely local areas within counties experiencing challenges*.

- As several methods are under development, supply numbers will be updated as new results become available. As new **Tier 2** or **Tier 3 Assessments** are completed, they are expected to supersede **Tier 1** results until at least methods are updated.