Hazen

Ohio Environmental Protection Agency

Ohio Water Development Authority

Ohio Department of Natural Resources

MID-OHIO REGIONAL MORPC PLANNING COMMISSION

Central Ohio Regional Water Study Update: Modeling Approach

August 28, 2024

Meeting Objectives

- Achieve mutual understanding of modeling approach
- Discuss model scenarios and forthcoming model outputs
- Provide a status/schedule update on the overall study

Agenda

Modeling Approach

- Surface water supplies
- Groundwater supplies
- Infrastructure capacities
- Current and future water demands

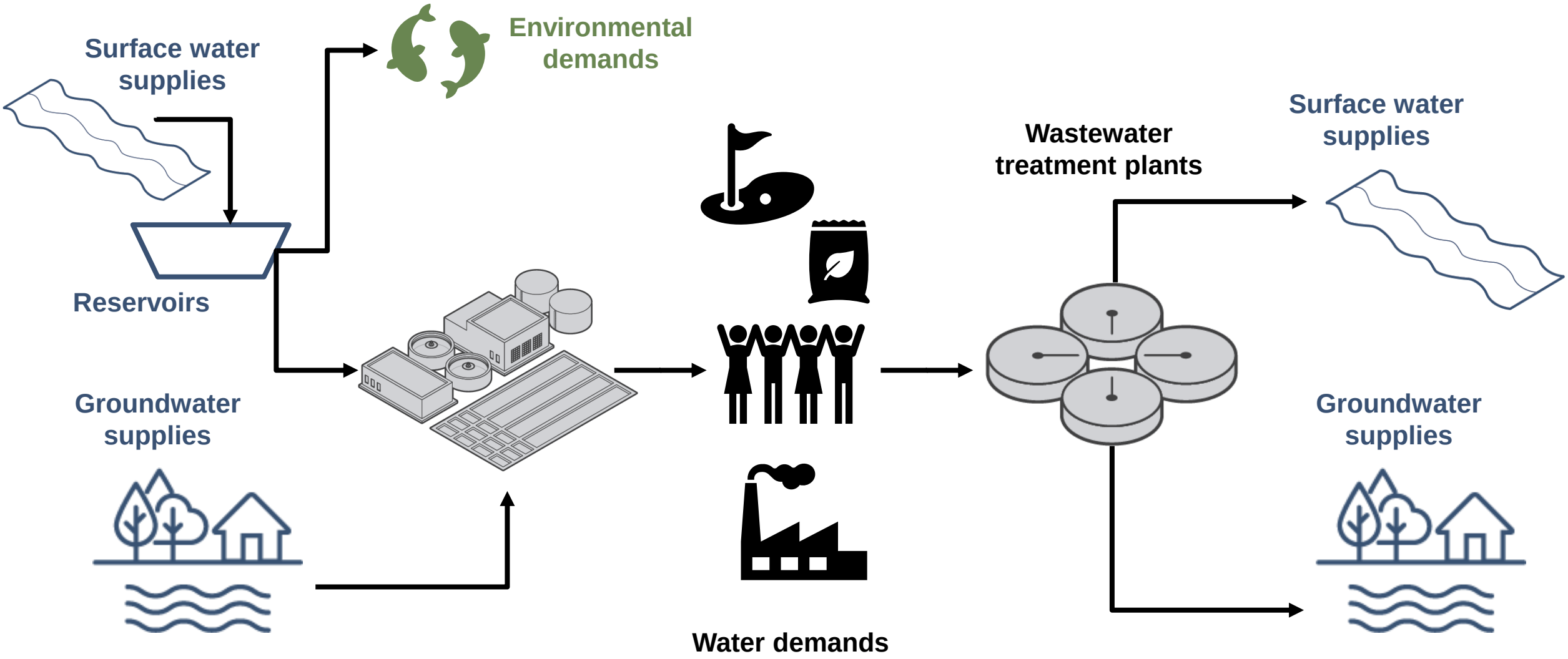
Scenario Planning

- Drivers of uncertainty
- Model scenarios
- Model outputs
- Project options and scoring

Status Update

Modeling Approach

Model Components

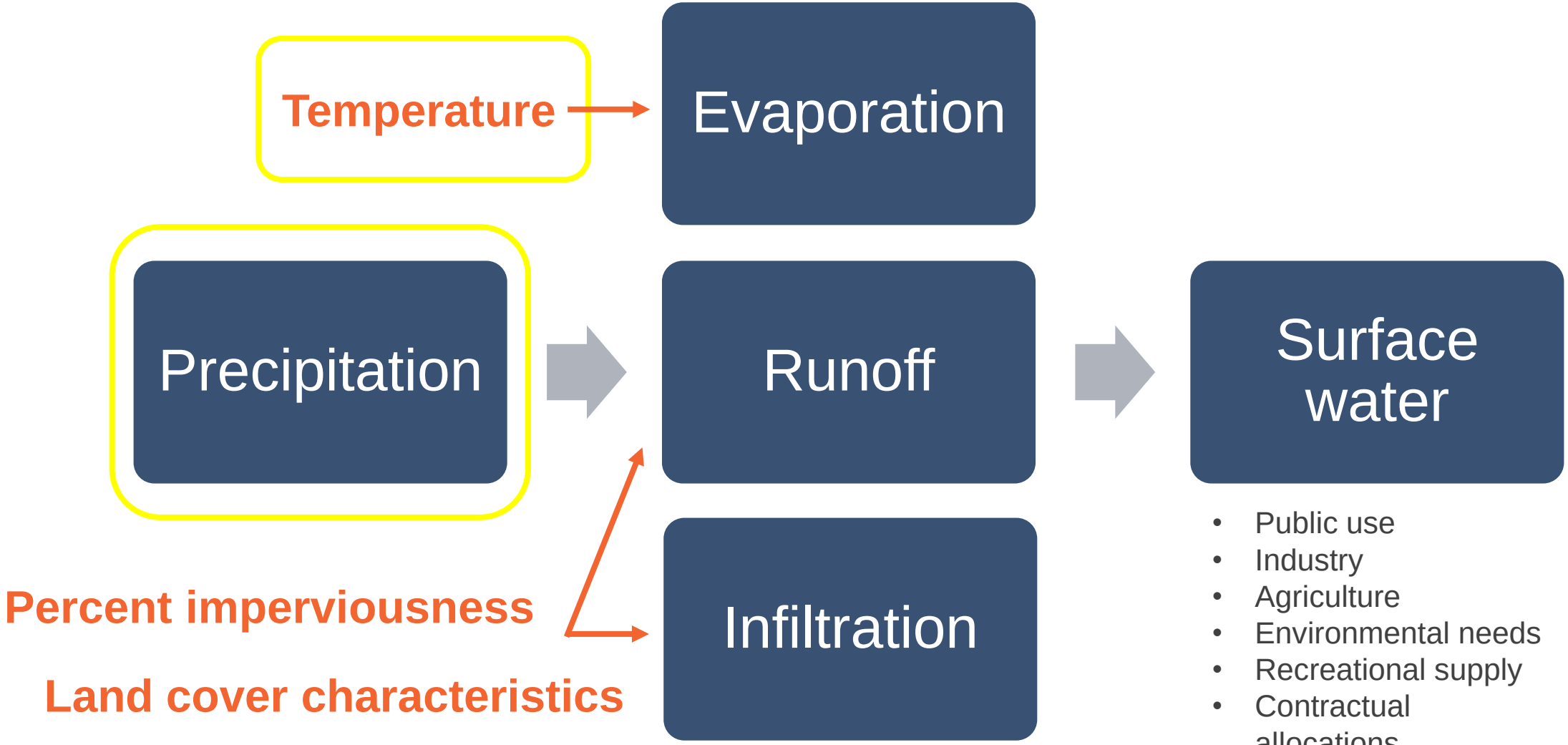


Modeling Approach

Surface water supplies

Surface water flows are estimated with a hydrologic model

US EPA Storm Water Management Model (SWMM)

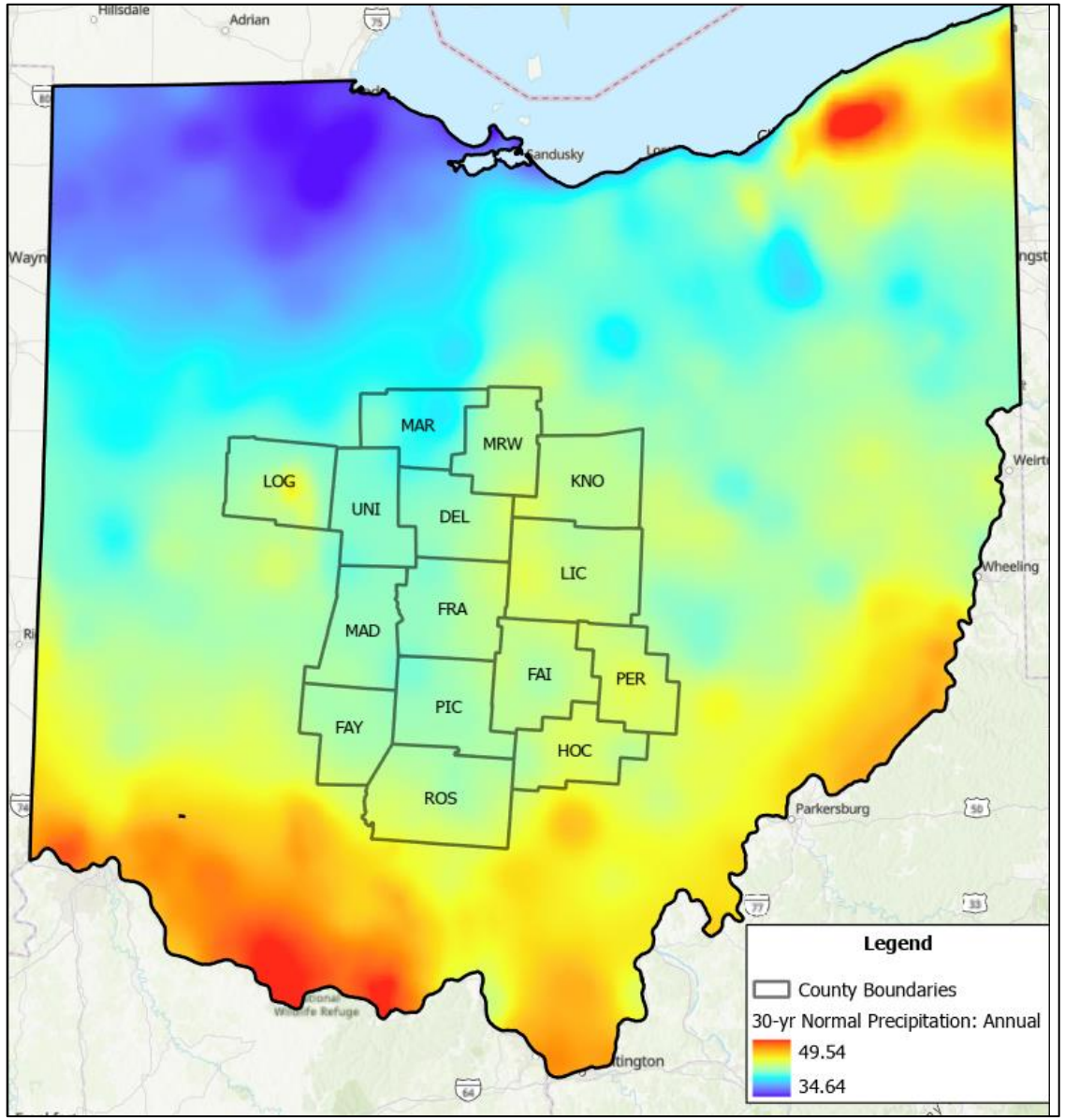


- Public use
- Industry
- Agriculture
- Environmental needs
- Recreational supply
- Contractual allocations

Meteorology

Hydrology Model Inputs

- Meteorological inputs include:
  - Precipitation/Snow Melt
  - Temperature
    - Evaporation - Derived from Temperature
- Data Source: Parameter-Elevation Regressions on Independent Slopes Model (PRISM)
  - Nation-wide 4km gridded datasets
    - *1981 - present*
  - Grids are developed using U.S. Station data (including major NOAA networks)
  - Provides daily spatial and temporal coverage
- **Precipitation inputted as multiple timeseries (one per HUC10) at a daily timestep**



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Hydrology Model Inputs

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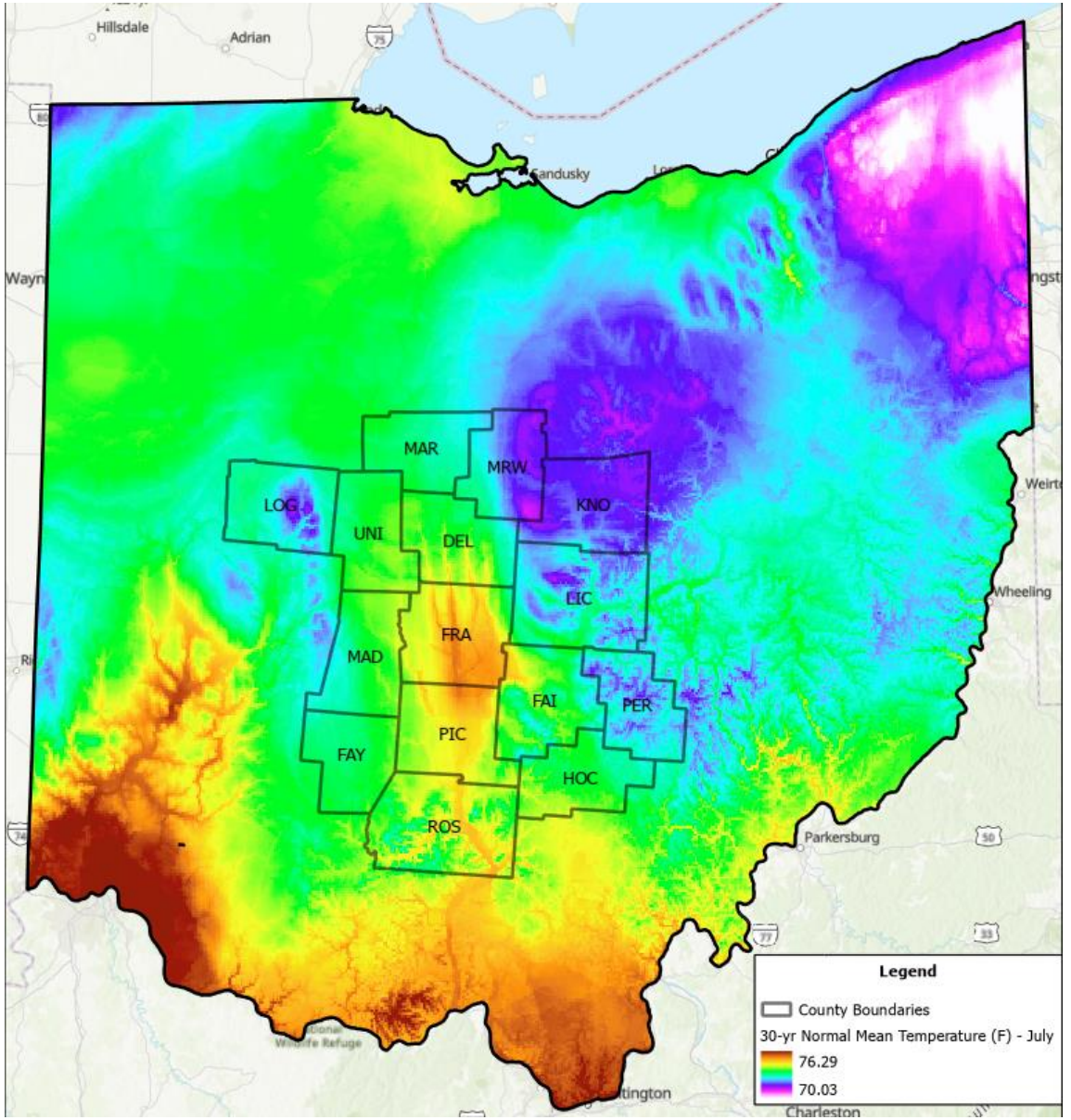
  - Precipitation/Snow Melt
  - Temperature
    - Evaporation - Derived from Temperature
- Data Source: Parameter-Elevation Regressions on Independent Slopes Model (PRISM)
  - Nation-wide 4km gridded datasets
    - *1981 - present*
  - Grids are developed using U.S. Station data (including major NOAA networks)
  - Provides daily spatial and temporal coverage
- **Temperature inputted as one, spatially averaged timeseries at a daily timestep**



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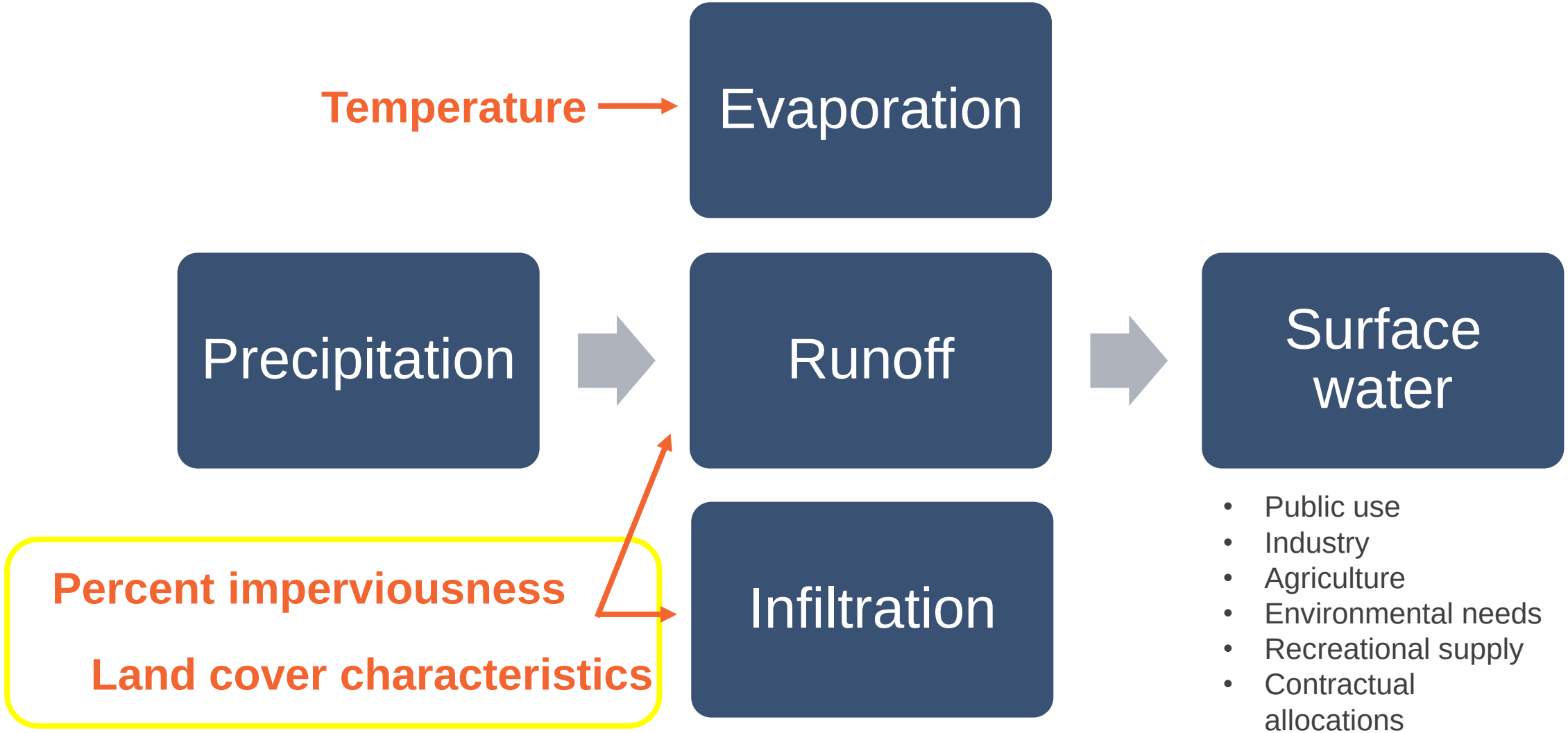
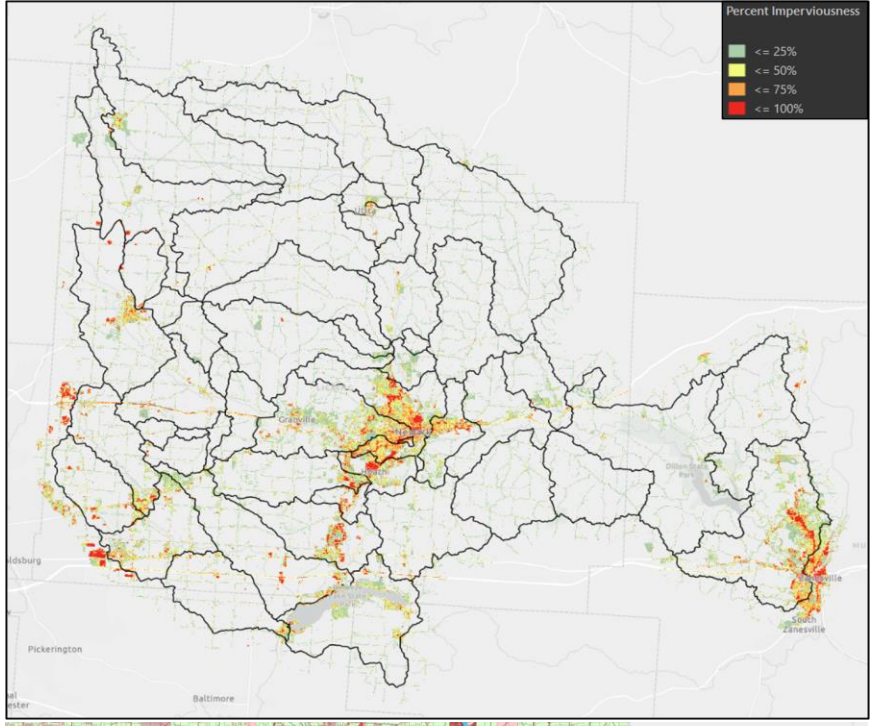


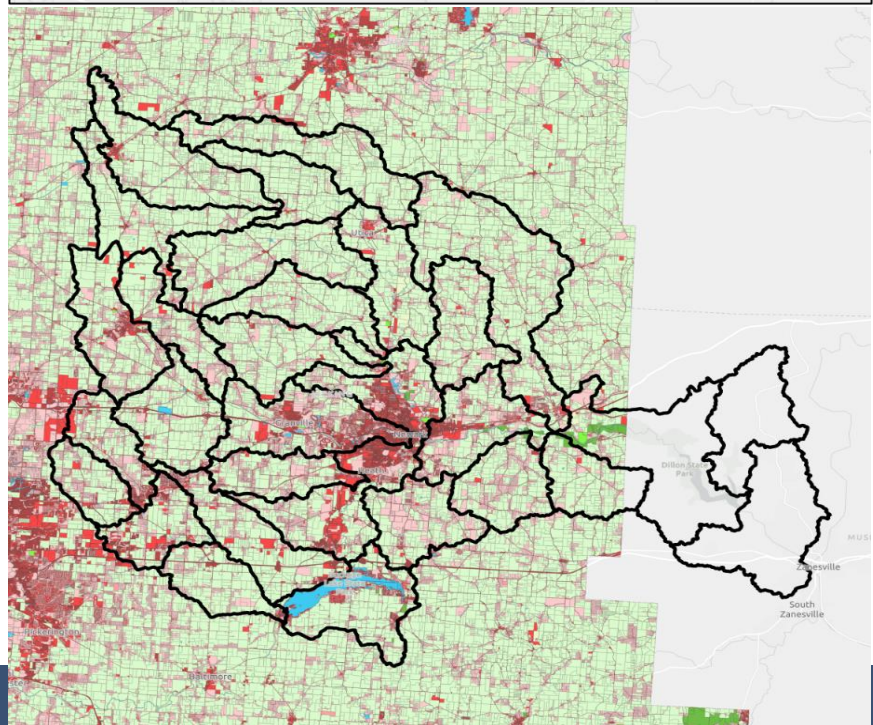
Subcatchment Surface Characteristics

Hydrology Model Inputs

- Populating surface characteristics
  - National Land Cover Database (NLCD) Imperviousness used to define baseline imperviousness
  - MORPC land use/land cover dataset used to determine relative changes to imperviousness for future time periods

NLCD Value	Description	Percent Imperviousness (HEC-RAS)	Percent Imperviousness (Estimated)	Percent Imperviousness (HSPF Report)
11	Open Water	100	100	0
21	Developed, Open Space	0	4	10
22	Developed, Low Intensity	20	16	35
23	Developed, Medium Intensity	40	37	65
24	Developed, High Intensity	60	41	90
31	Barren Land	0	5	0
41	Deciduous Forest	0	0	0
42	Evergreen Forest	0	0	0
43	Mixed Forest	0	1	0
52	Shrub/Scrub	0	0	0
71	Grassland/Herbaceous	0	9	0
81	Pasture/Hay	0	1	0
82	Cultivated Crops	0	0	0
90	Woody Wetlands	50	0	0
95	Emergent Herbaceous Wetlands	75	0	0



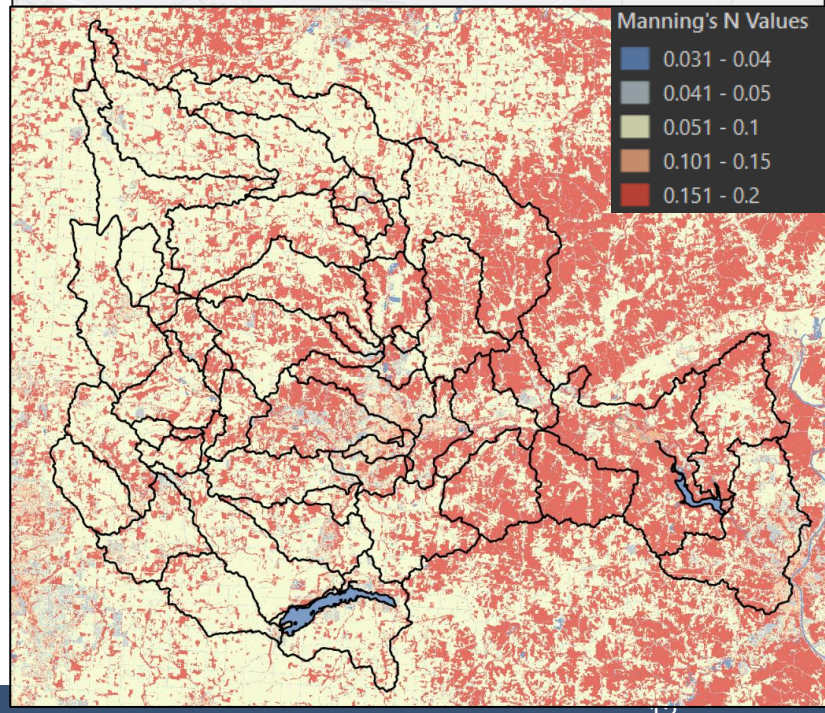


Subcatchment Surface Characteristics

Hydrology Model Inputs

- Populating surface characteristics
  - **Roughness values defined based on NLCD values**
  - **Spatial weighting of n-values within subcatchments based on NLCD classification**

NLCD Value	Description	n (HEC-RAS)	n (NRCS)	n (CORWS)
11	Open Water	0.035	0.04	0.04
21	Developed, Open Space	0.035	0.04	0.05
22	Developed, Low Intensity	0.08	0.1	0.10
23	Developed, Medium Intensity	0.12	0.08	0.15
24	Developed, High Intensity	0.15	0.15	0.20
31	Barren Land	0.03	0.025	0.03
41	Deciduous Forest	0.1	0.16	0.20
42	Evergreen Forest	0.15	0.16	0.20
43	Mixed Forest	0.12	0.16	0.20
52	Shrub/Scrub	0.05	0.1	0.20
71	Grassland/Herbaceous	0.04	0.035	0.10
81	Pasture/Hay	0.045	0.03	0.08
82	Cultivated Crops	0.05	0.035	0.08
90	Woody Wetlands	0.07	0.12	0.15
95	Emergent Herbaceous Wetlands	0.045	0.07	0.10



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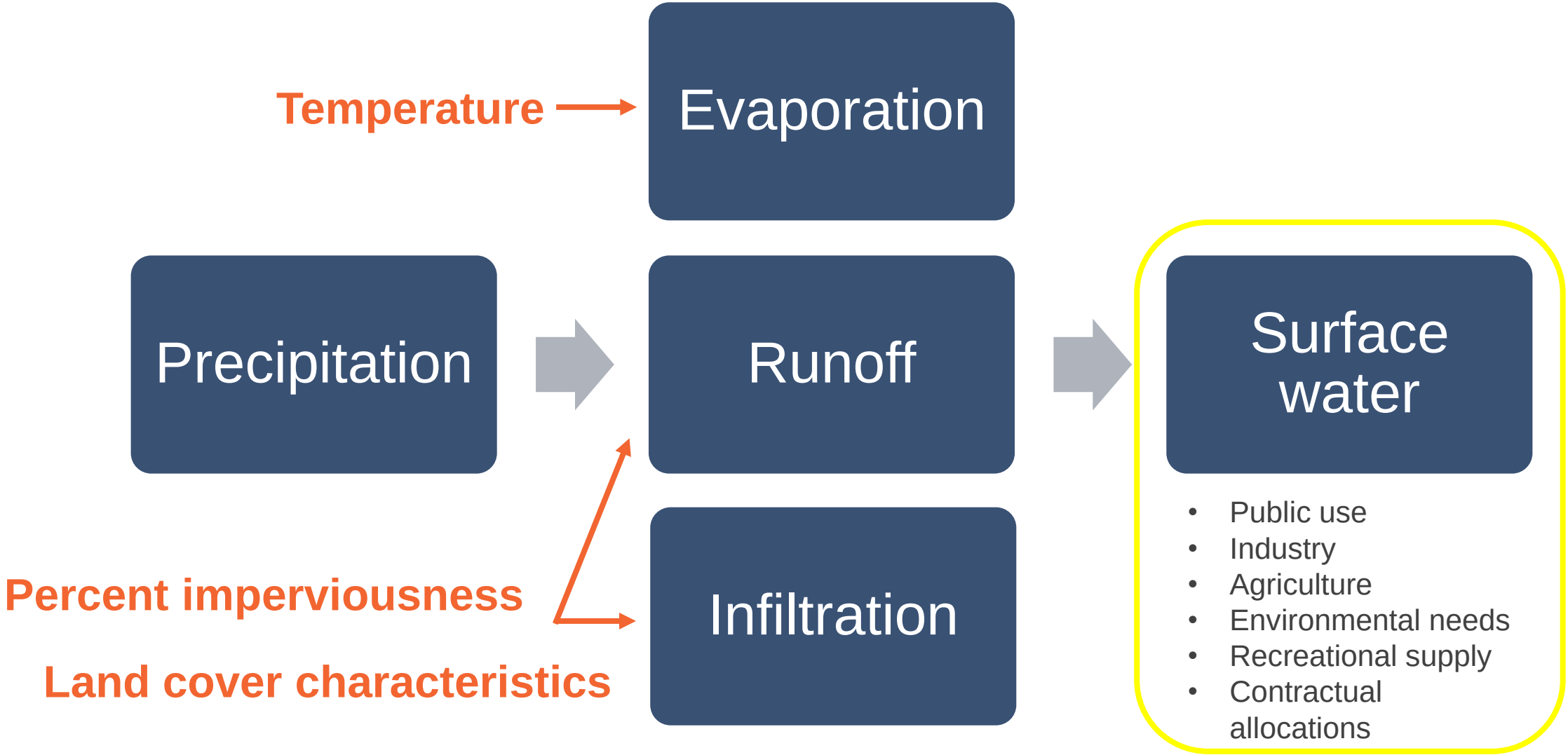
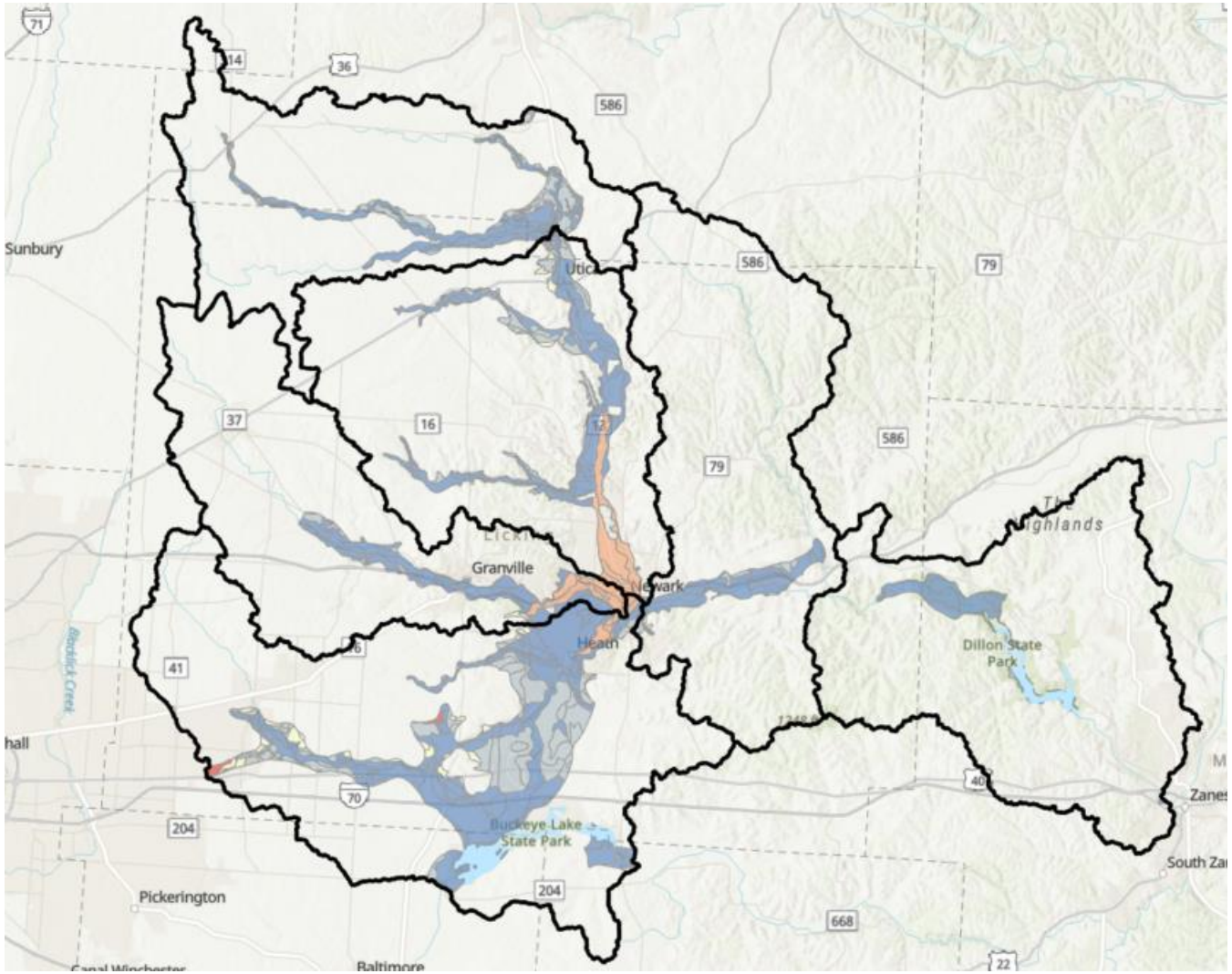


Modeling Approach

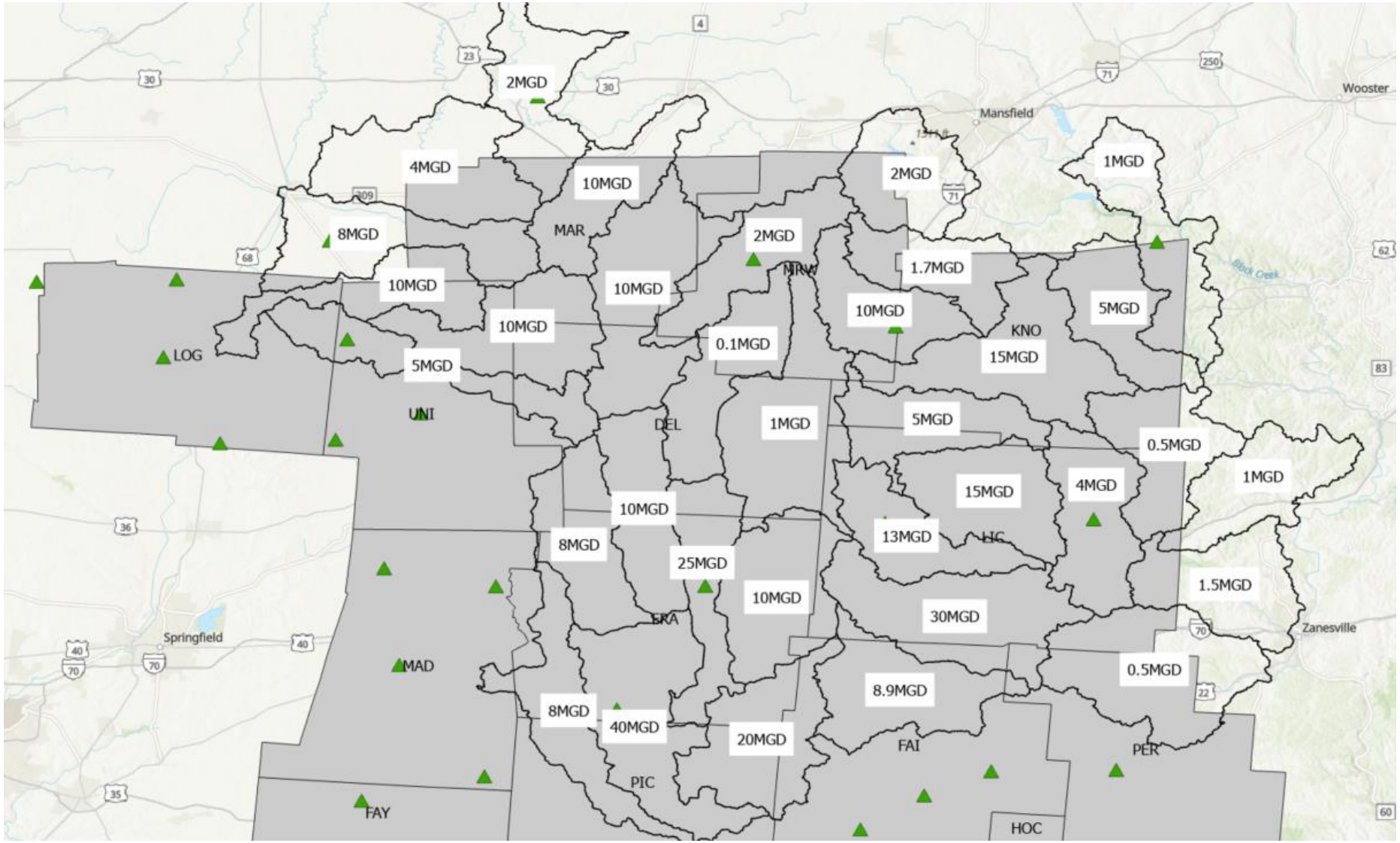
Groundwater supplies

Groundwater supply estimates are based on recharge



- Groundwater supply estimated based on:
  - **High yield aquifer spatial footprint (area)**
  - **30-year average recharge rate (depth of water per day)**
  - **Area x depth = volume of groundwater available per day**

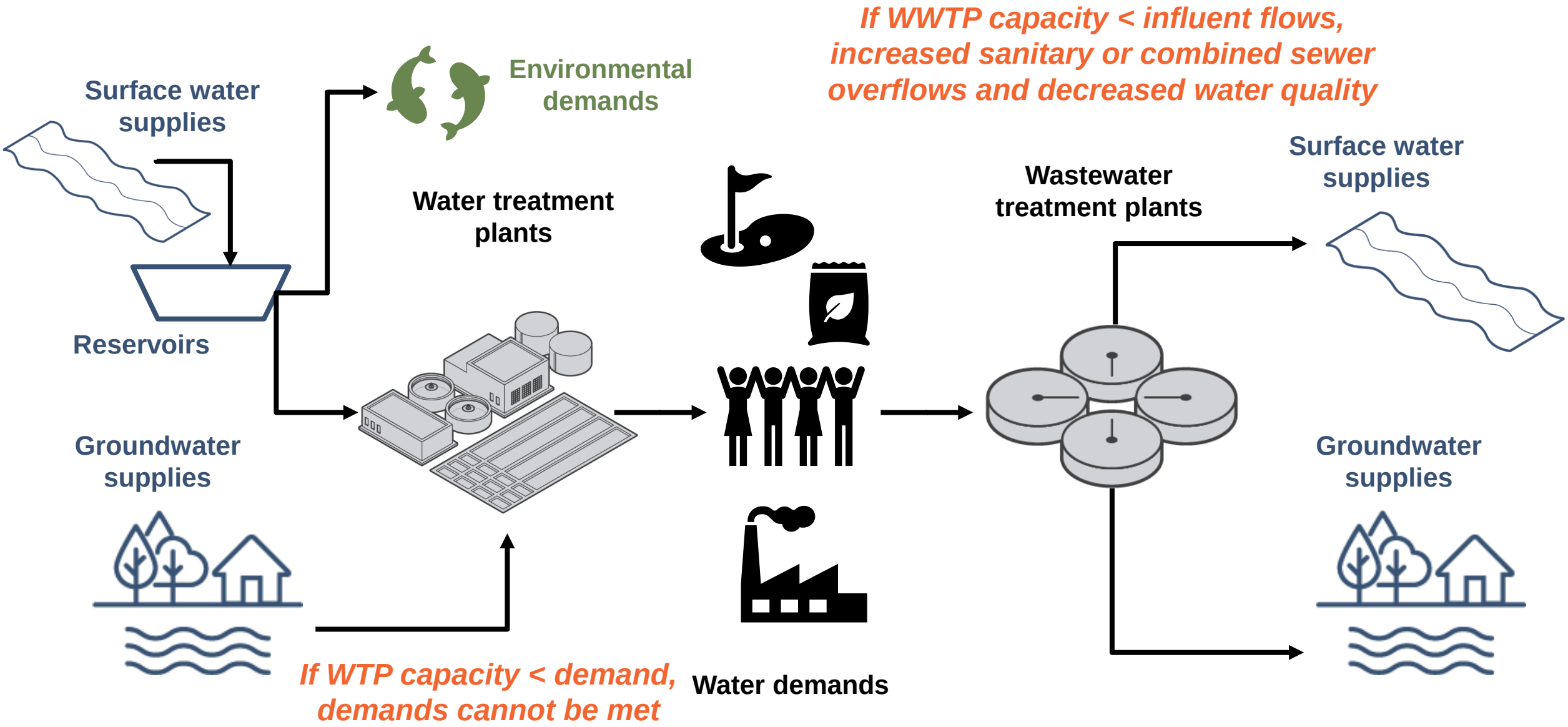
Groundwater supply estimates are based on recharge



Modeling Approach

Infrastructure Capacities

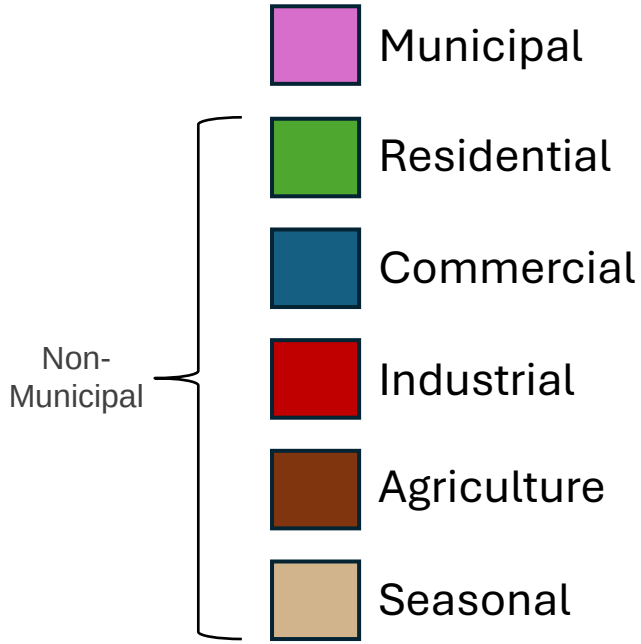
Model Components



Modeling Approach

Current and future water demands

Water Demand Types



- Municipal Demands are identified as public water systems that serve a community.
- Non-Municipal Demands are identified as public non-community (transient and non-transient) and private withdrawals > 100,000 gpd.

Current and Future Water Municipal Demands

Current Water Demands

- Recent groundwater and surface water withdrawal data
  - **Both raw water withdrawals and withdrawals going to treatment**
- Recent water treatment plant production data

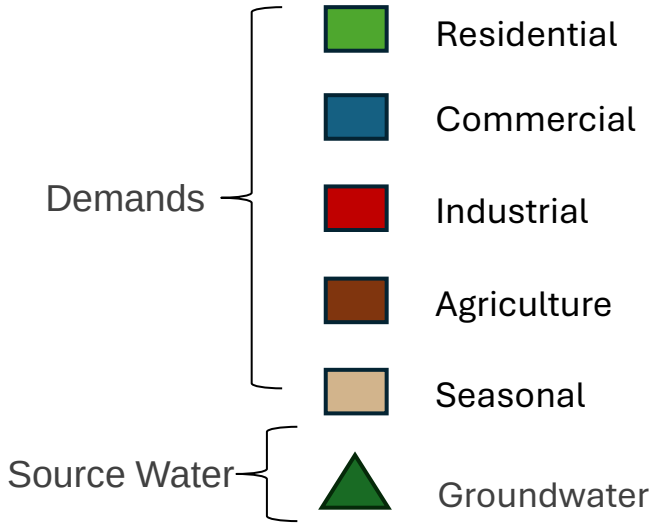
Future Water Demands

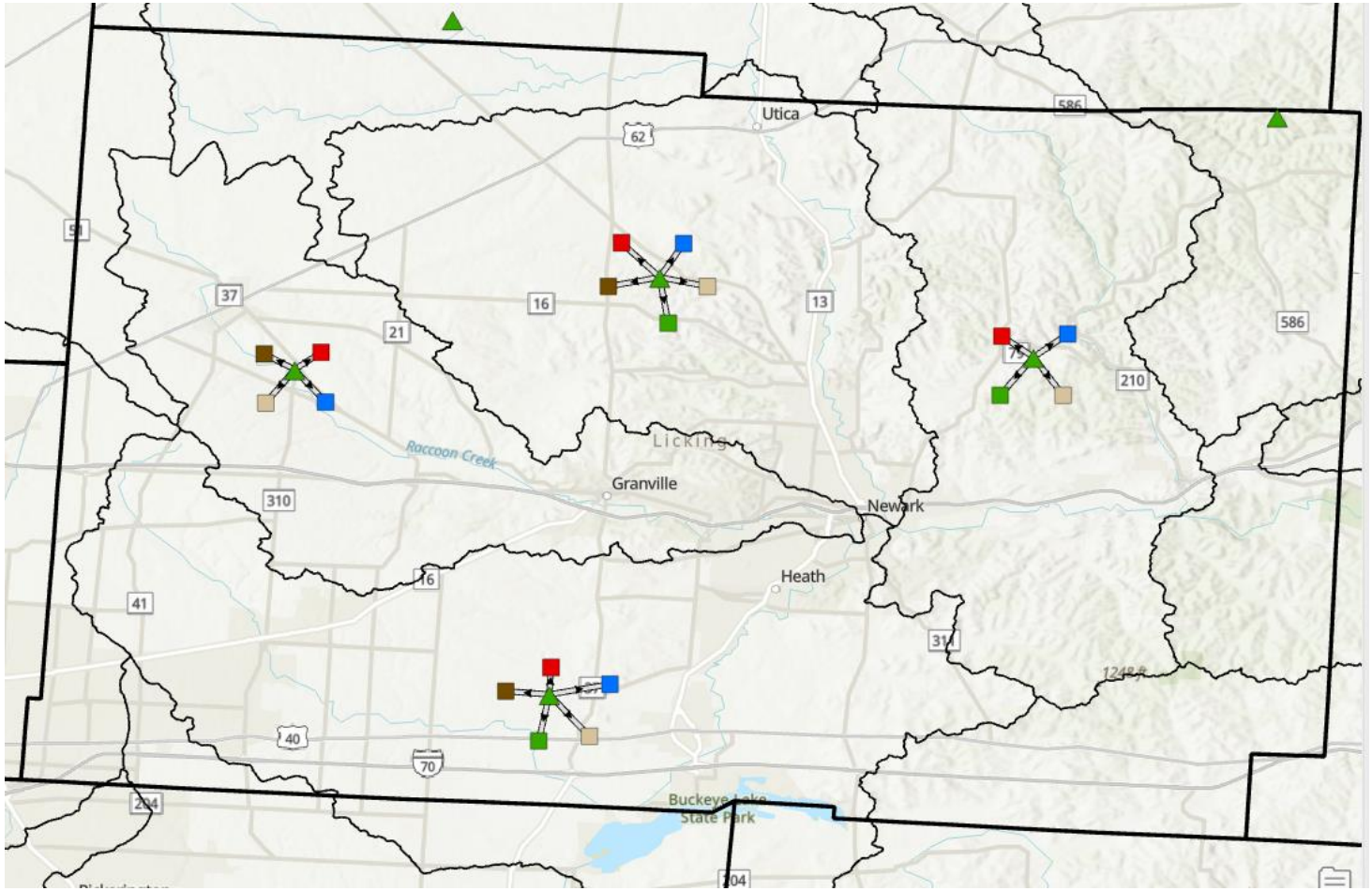
- Current per capita water usage = current water treatment plant production ÷ population
- **Future water use =** Current per capita water usage x population projections

Current and Future Non-Municipal Demands

- Demand categories will be aggregated by source (groundwater or surface water source) and type

- Demands change in each category depending on scenario and past population growth





Licking County- Groundwater

Scenario Planning

Scenario Planning

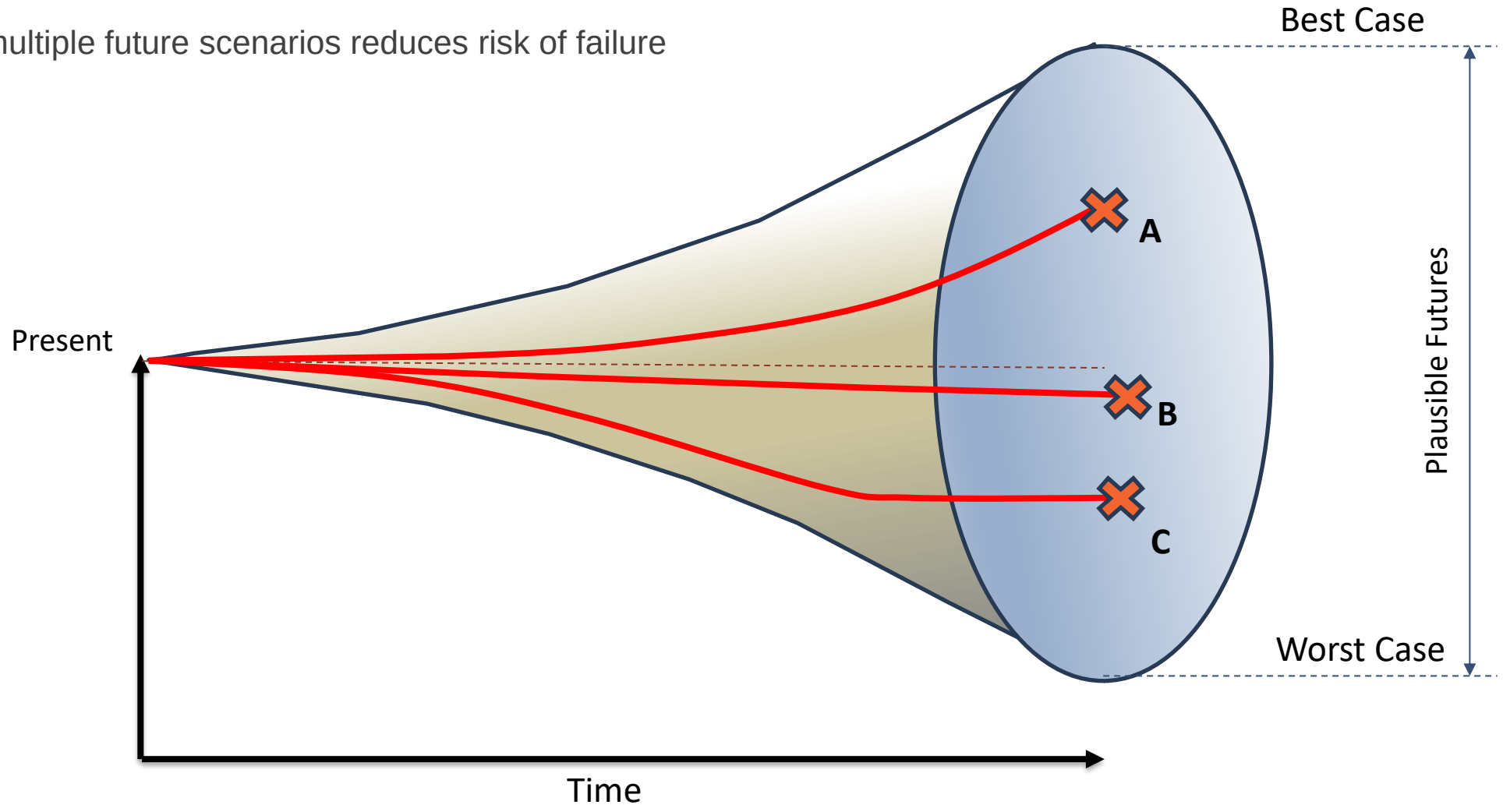
- Integrated resource model focal question:

"What is the extent to which current and projected drinking water, process water, and wastewater needs can be met in the 15-county area, considering supply availability, drinking water treatment capabilities and capacity, wastewater treatment capabilities and capacity, and receiving stream health with planned development?"

- Objective:
  - **Answer this focal question for a range of possible future conditions or "scenarios" in which the 15-county area will exist**
- Scenarios:
  - **Scenarios differ based on the trajectory that a given driver of uncertainty is assumed to take**

Scenario Planning

Planning for multiple future scenarios reduces risk of failure



Scenario Planning

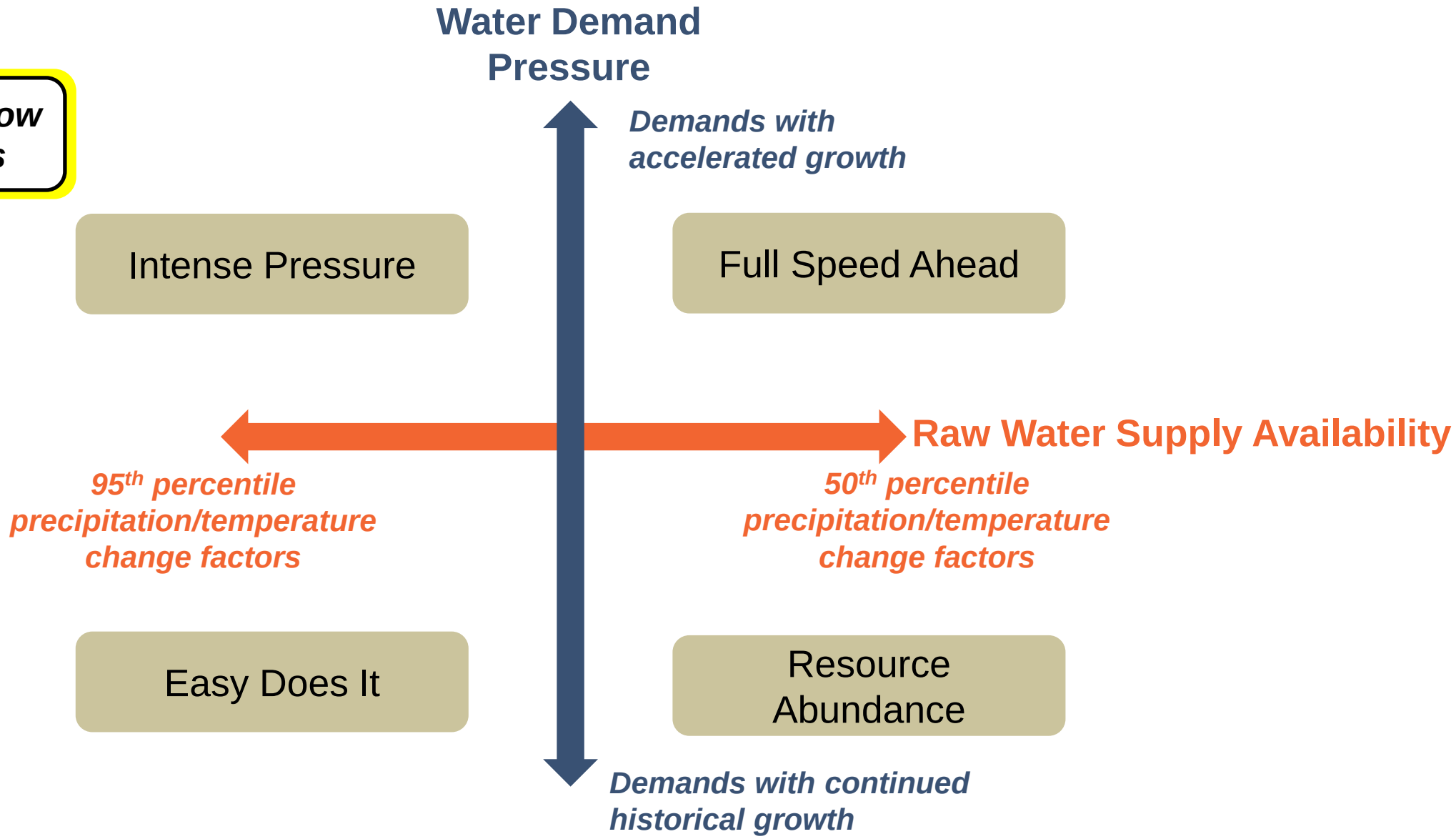
Drivers of Uncertainty

- Changes in population and demographics
- Customer values affect water usage
- Customers' willingness to pay
- Land use and development preferences
- Water saving and technological developments
- Condition and/or maintenance requirements of critical assets
- New technologies
- Urban land use practices
- Availability of infrastructure funding
- Unemployment rate
- Affordability of housing
- Industrial and commercial water usage
- National and/or regional economic conditions
- Construction costs
- Streamflow or hydrologic conditions
- Groundwater hydrologic conditions
- Future climate conditions
- Frequency and/or severity of drought events
- Water quality conditions of surface waters
- Water quality conditions of groundwater
- Regulatory requirements for environmental protection
- Increasing competition for water resources
- Regionalization of water services
- Regulatory requirements for drinking water
- Political climate

Scenario Planning

Model Scenarios

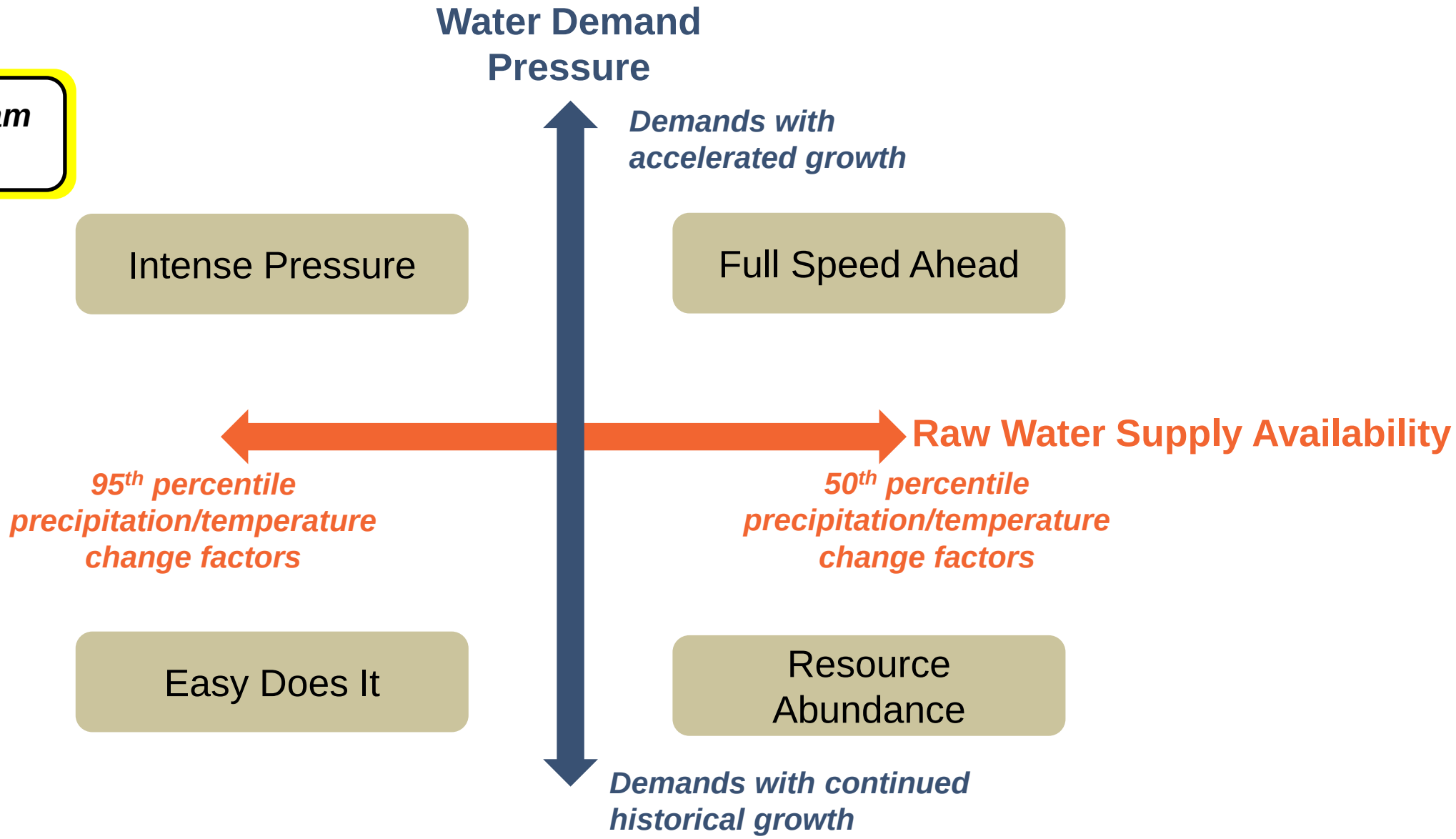
No in-stream flow requirements



Scenario Planning

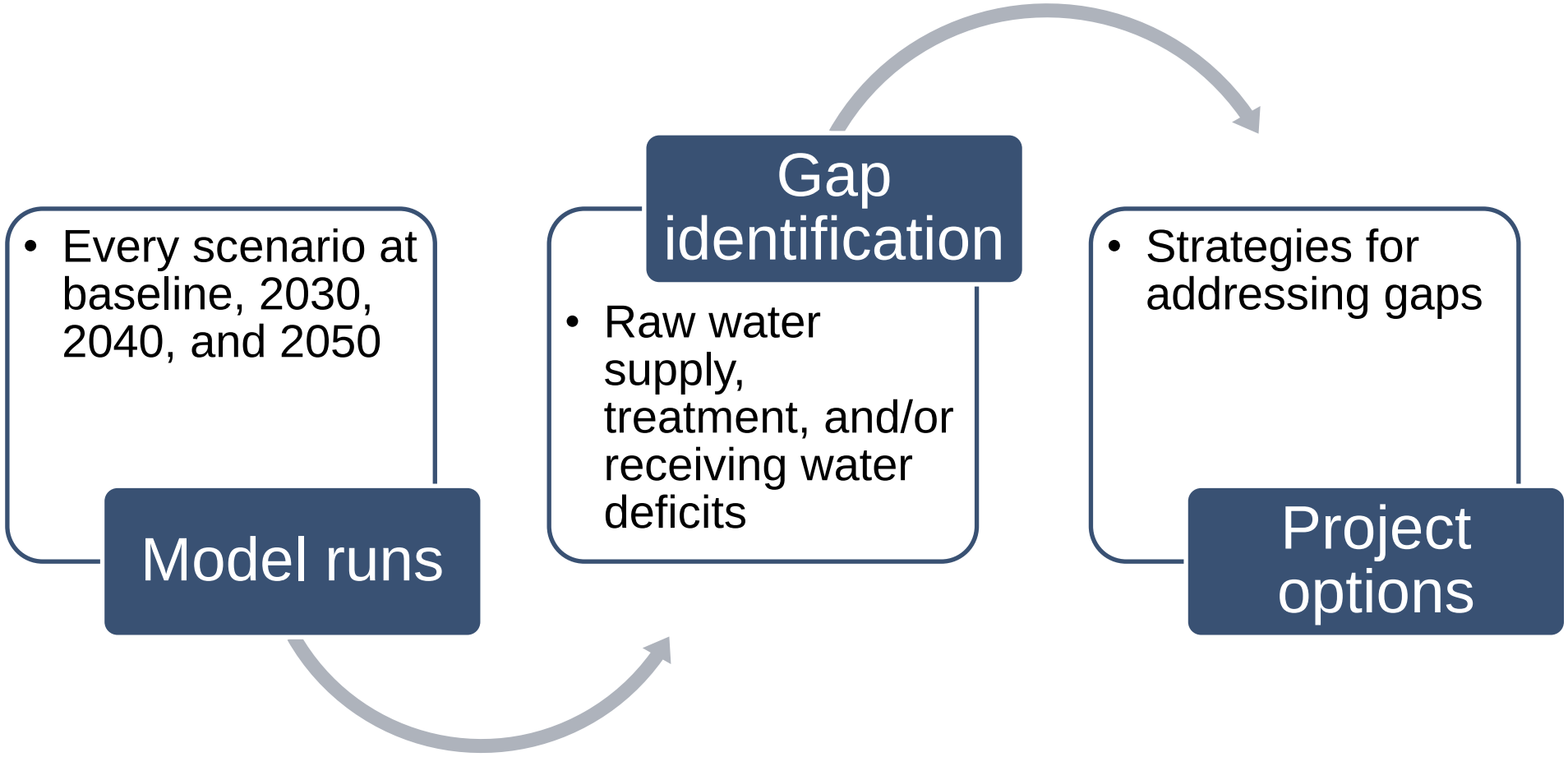
Model Scenarios

Protect in-stream requirements



Scenario Planning

Model Scenarios



World of Options for Project Options

New and/or expanded:
- *Intake*
- *Reservoir*
- *Transfer*

Surface water supply development

Groundwater supply development

Water treatment plant

Wastewater treatment plant

Reclaimed water supply development

Policy

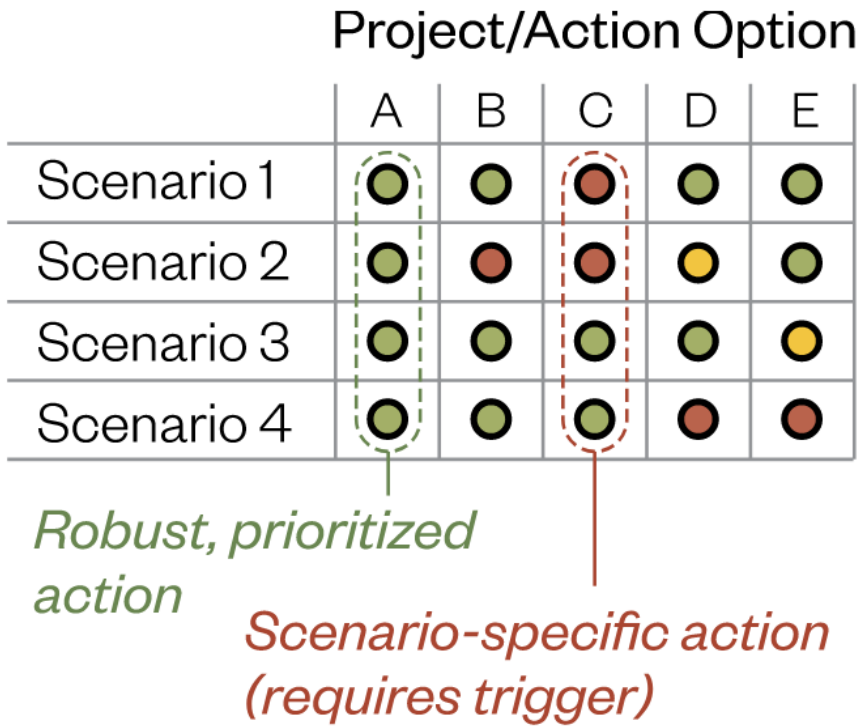
Example policies:
- *Development incentives, moratoriums*
- *Demand management*

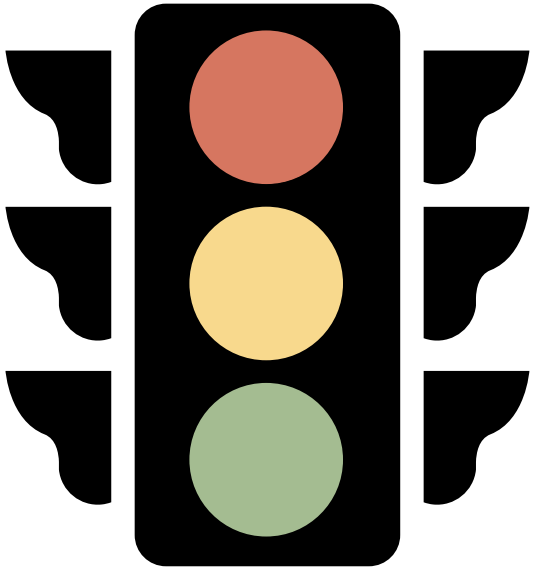
Scenario Planning

Development and Evaluation of Project Options

Project options for filling gaps will be evaluated in terms of:

1. Favorability across future scenarios



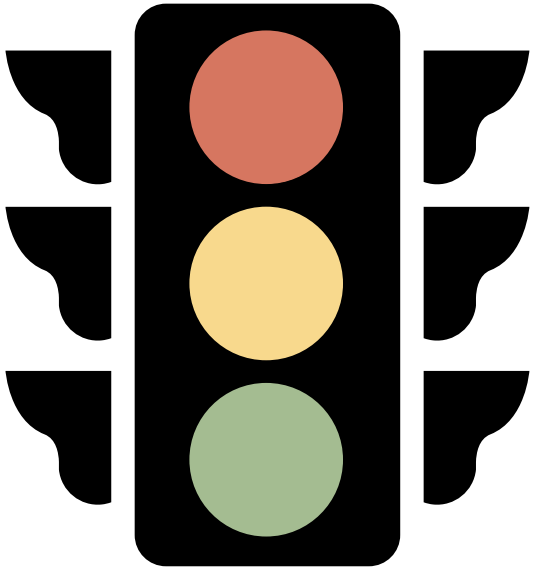


Scenario Planning

Development and Evaluation of Project Options

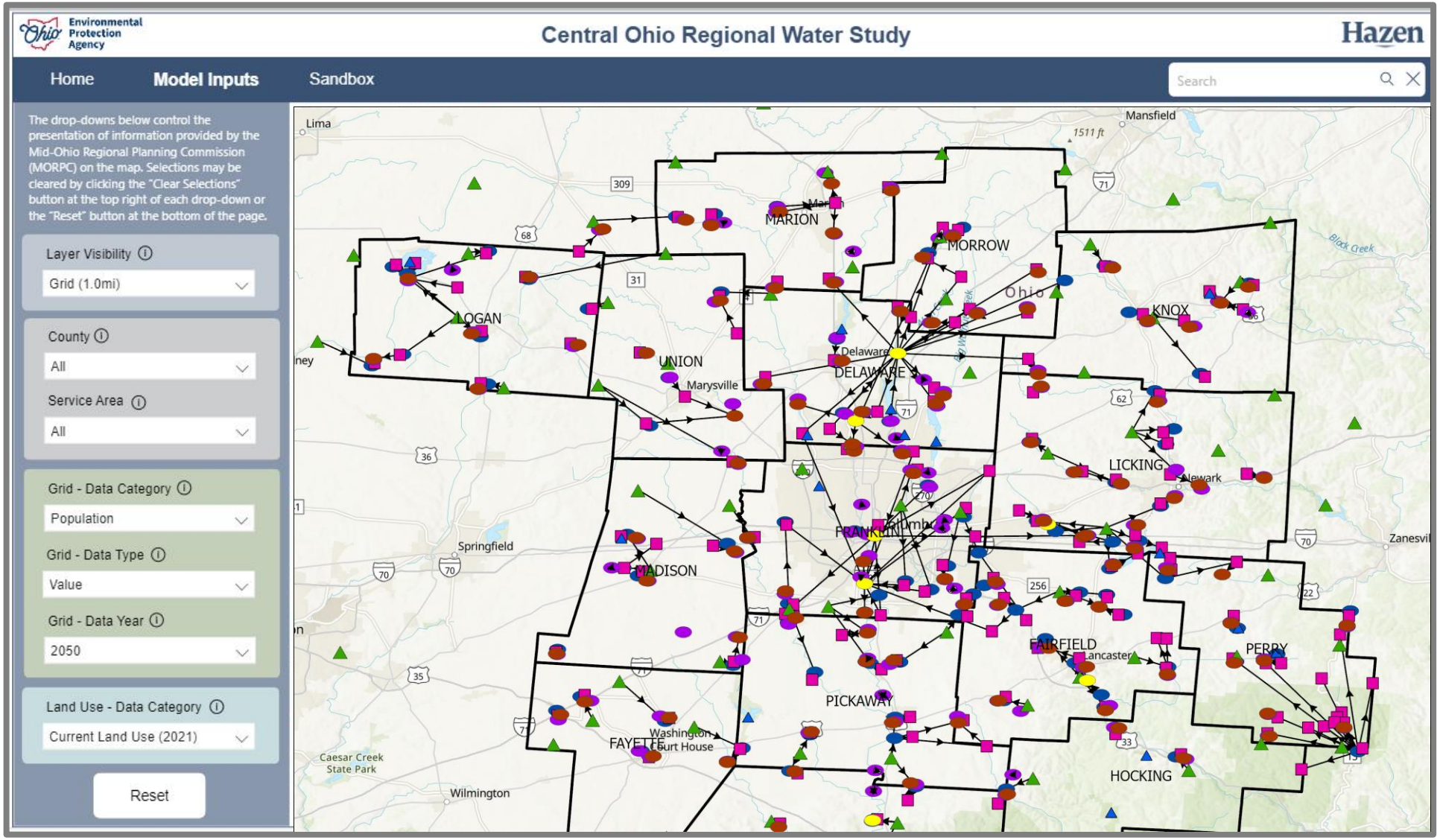
Project options for filling gaps will be evaluated in terms of:

1. Favorability across future scenarios,
2. Favorability across gaps,
3. Life cycle cost (relative to the extent to which a project fills a gap),
4. Water quality impact (with respect to environmental conditions, treated wastewater, and/or treated drinking water), and
5. Implementation timeline (impacted by the need for regulatory development, upfront evaluations, design complexity, construction complexity, and other factors).



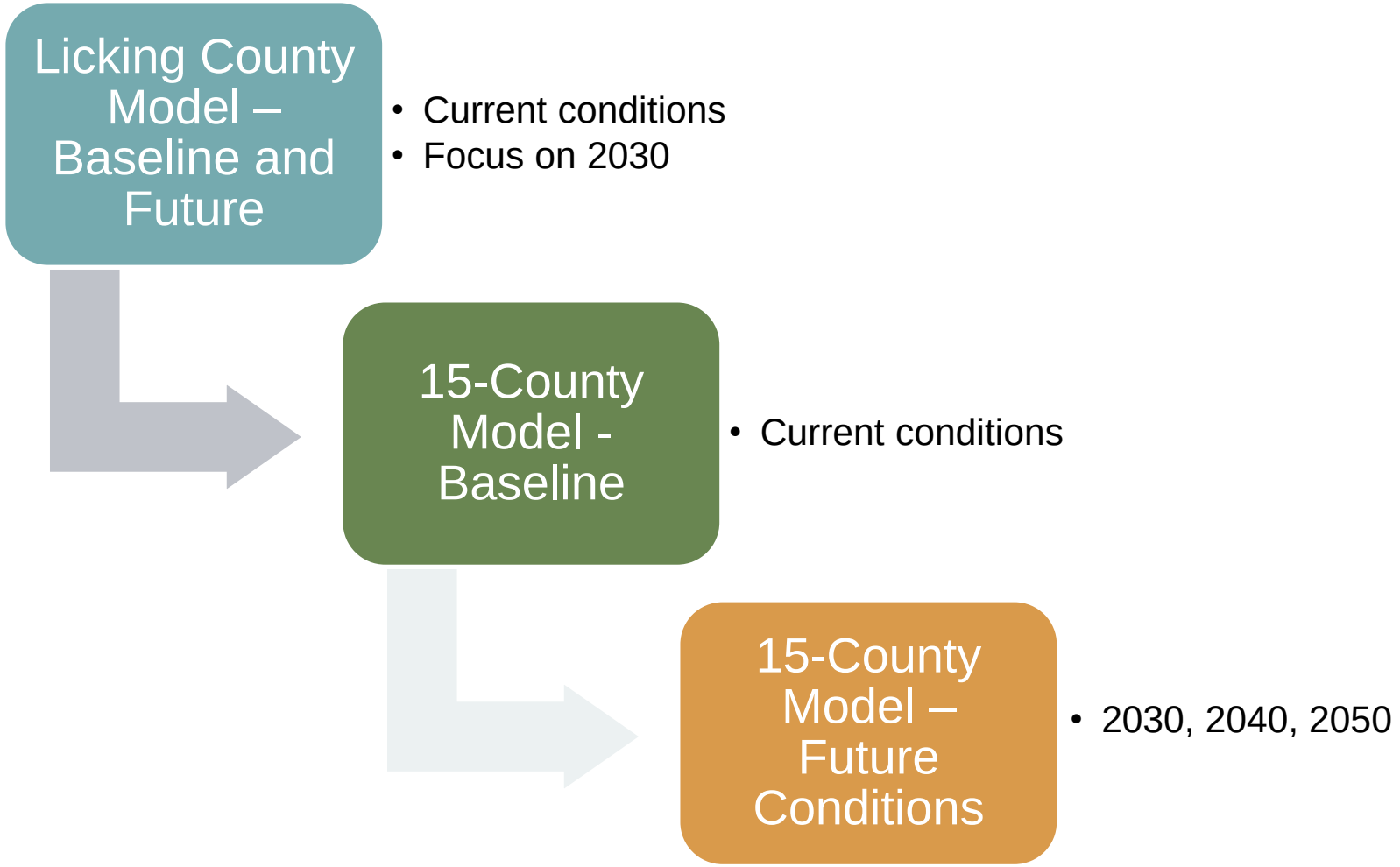
Forthcoming Dashboard

- Accessible via website
- Enables user exploration of:
  - **Population projections**
  - **Water demand projections**
  - **Model scenarios and associated "gaps"**
  - **Project options and associated "gap" filling**



Status Update

Forthcoming Milestones



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RWS DEMOGRAPHIC & DEVELOPMENT INPUTS

Dave Dixon
Director, Data Analytics & Strategy | MORPC
August 28th, 2024

MID-OHIO REGIONAL
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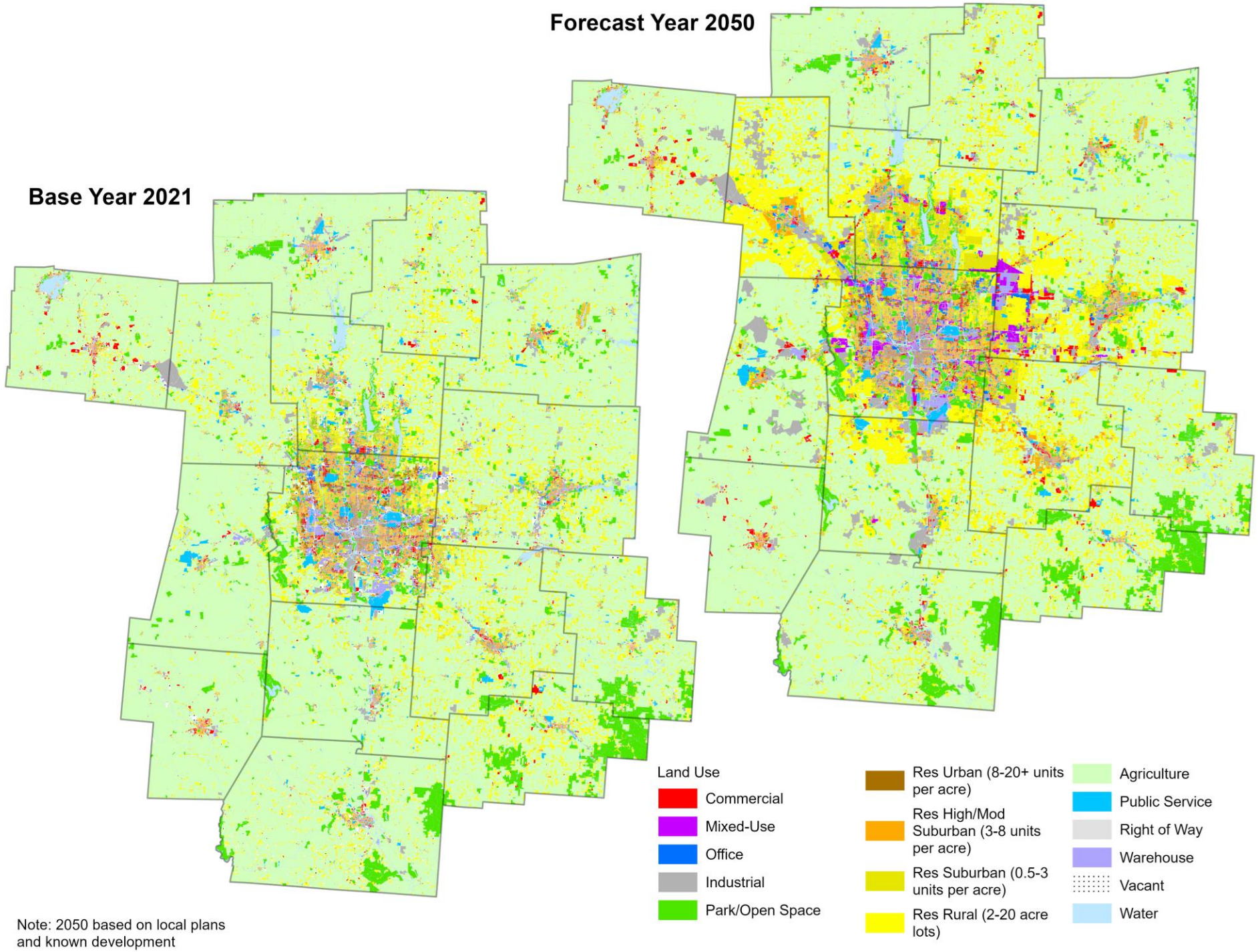
Expanded 15-County Land Use



Note: 2050 based on local plans and known development

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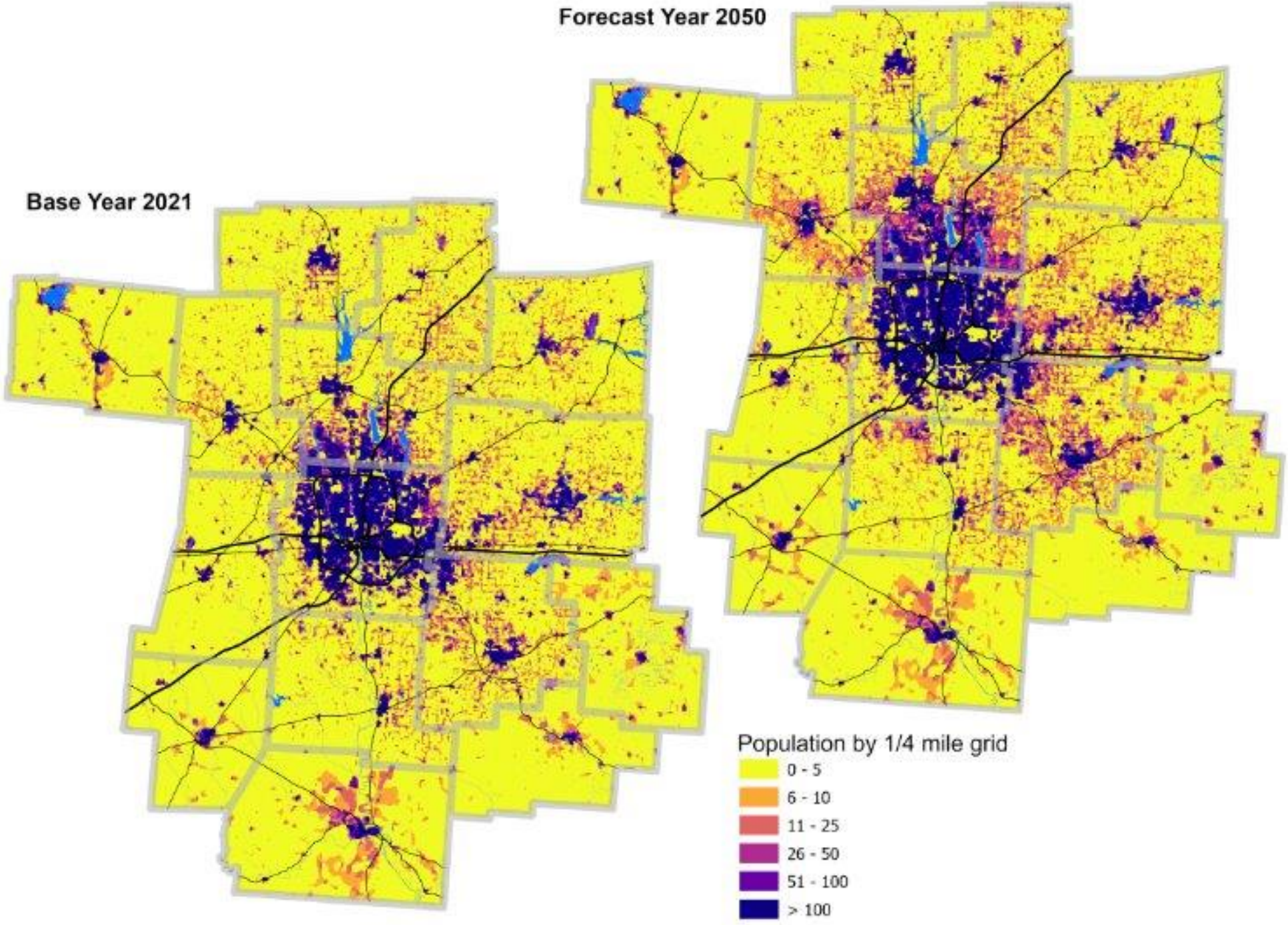
Expanded 15-County Population Forecasts



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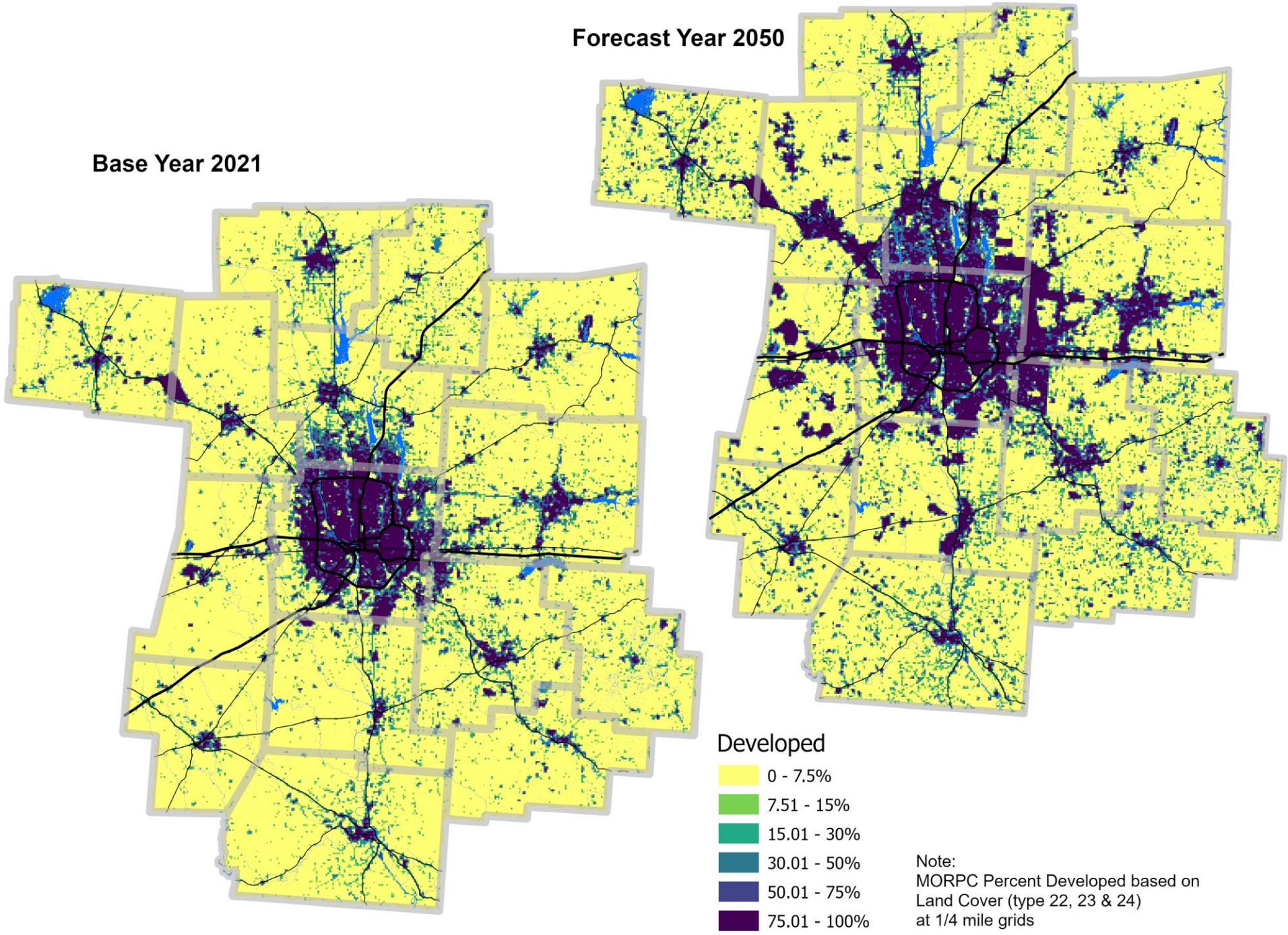
Expanded 15-County Population Forecasts



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