SC DEPARTMENT of ENVIRONMENTAL SERVICES

Water Demand Projection Methodologies

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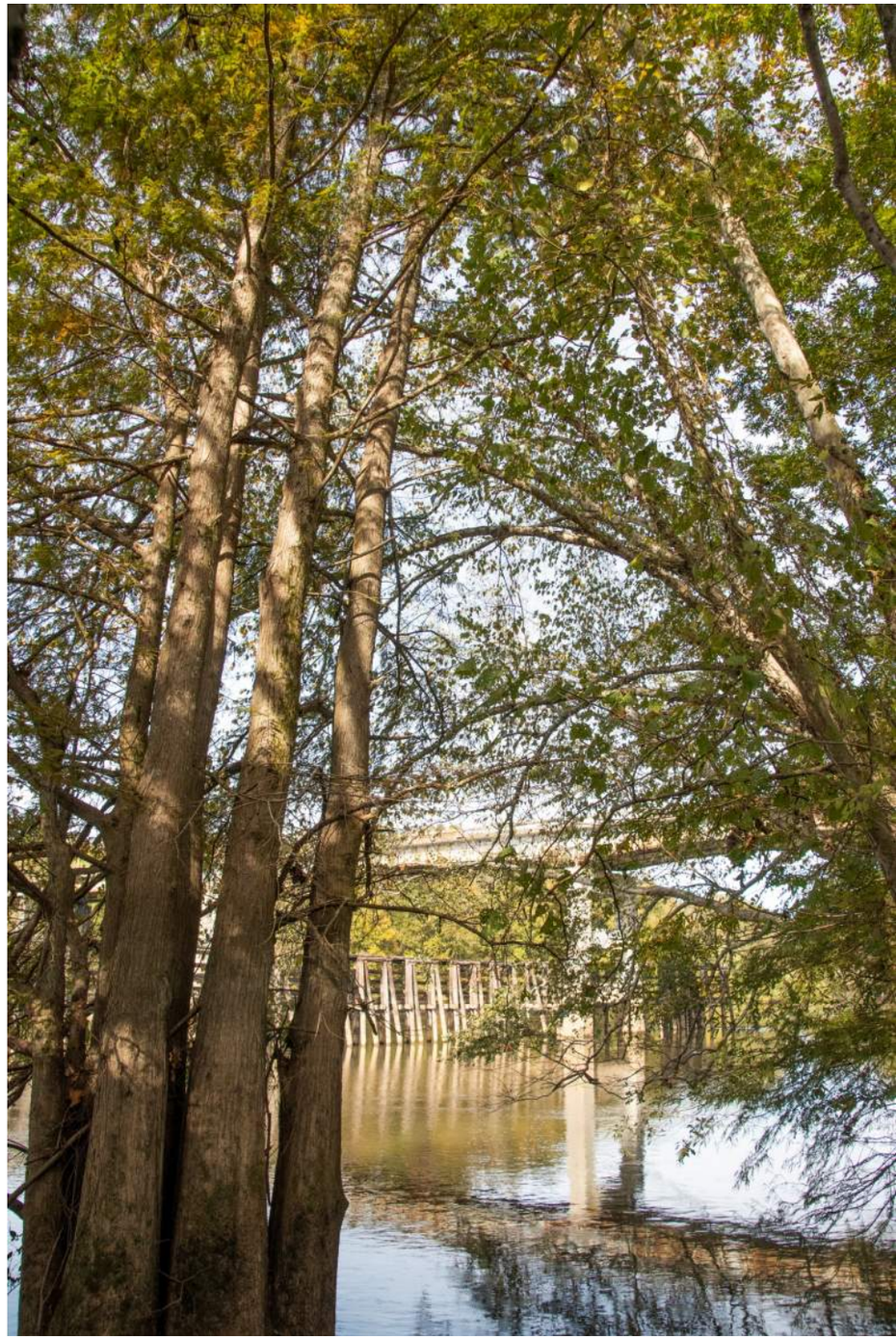
March 11, 2025

Santee River Basin Council

Meeting #4, Moncks Corner, SC



Forecasts vs Projections

Forecast

- Educated guess.
- Based on expected conditions and actions.
- Timeframe limited by predictability of future conditions.
- Aim to be accurate.

Projection

- Extrapolation of trend.
- Based on hypothetical scenarios.
- Timeframe can extend beyond the limits of effective forecasting.
- Aim to be informative.

Projection Methodologies

- Methods described in the following report:
  - **Pellet, A. *Projection Methods for Off-stream Water Demand in South Carolina*. SC Department of Natural Resources. 2019. 61 pages.**
  - Minor revisions to methods have been made for some basins.
- General equation:

Projected Demand = (Baseline Demand) X (Driver Variable)

- Three projection scenarios based on different combinations of Baseline Demand estimates and Driver Variable growth rates.
- **Baseline Demand**: based on either *monthly median* water demands or *monthly maximum* water demands as determined from 2013-2023 reported water use.

Driver Variables

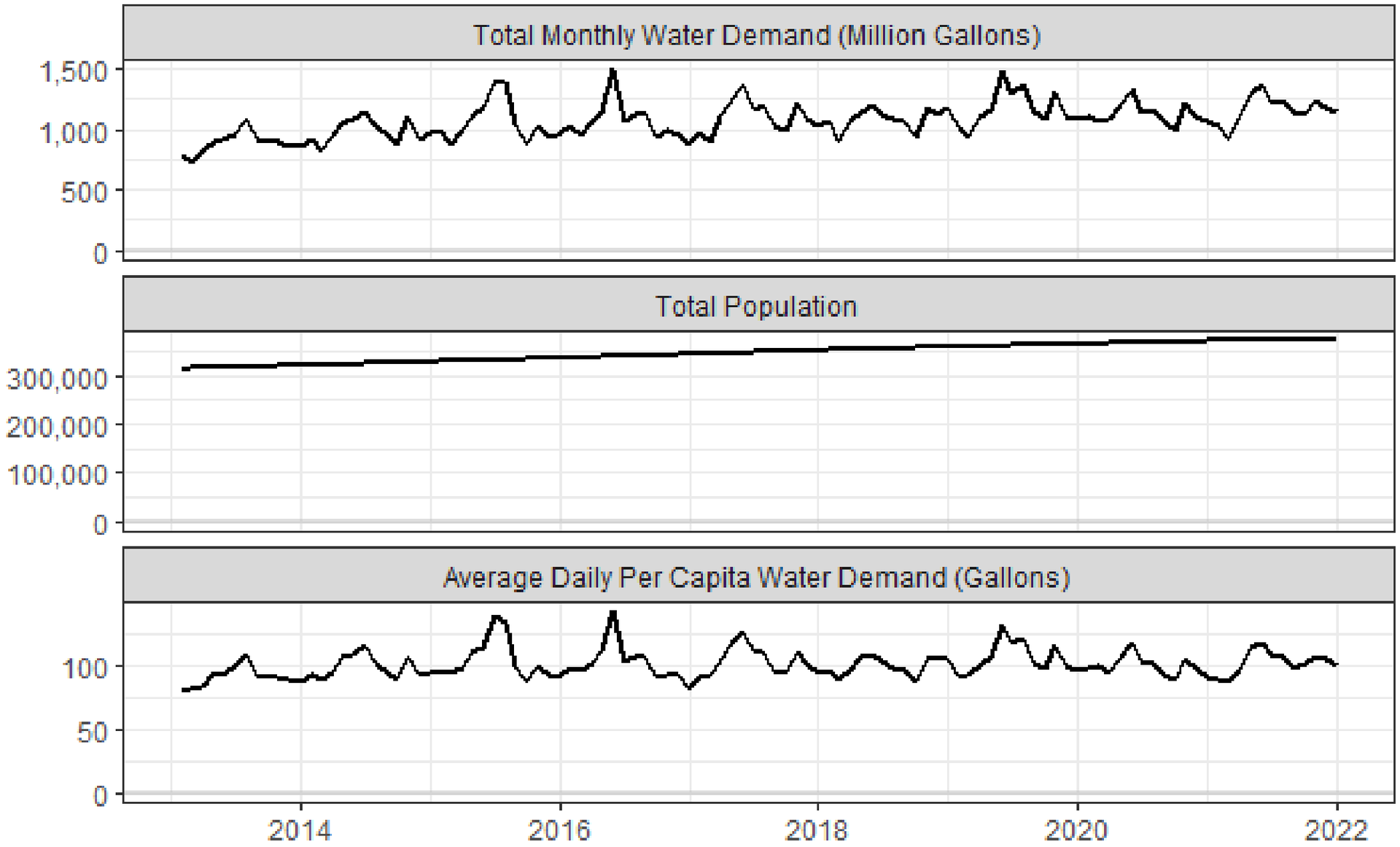
Water Use Category	Driver Variable
Public Water Supply	Population
Manufacturing/Industry	Economic Growth
Thermo-electric Power	Electricity Production
Agriculture/Golf Courses	Irrigated Acres

Projection Scenarios

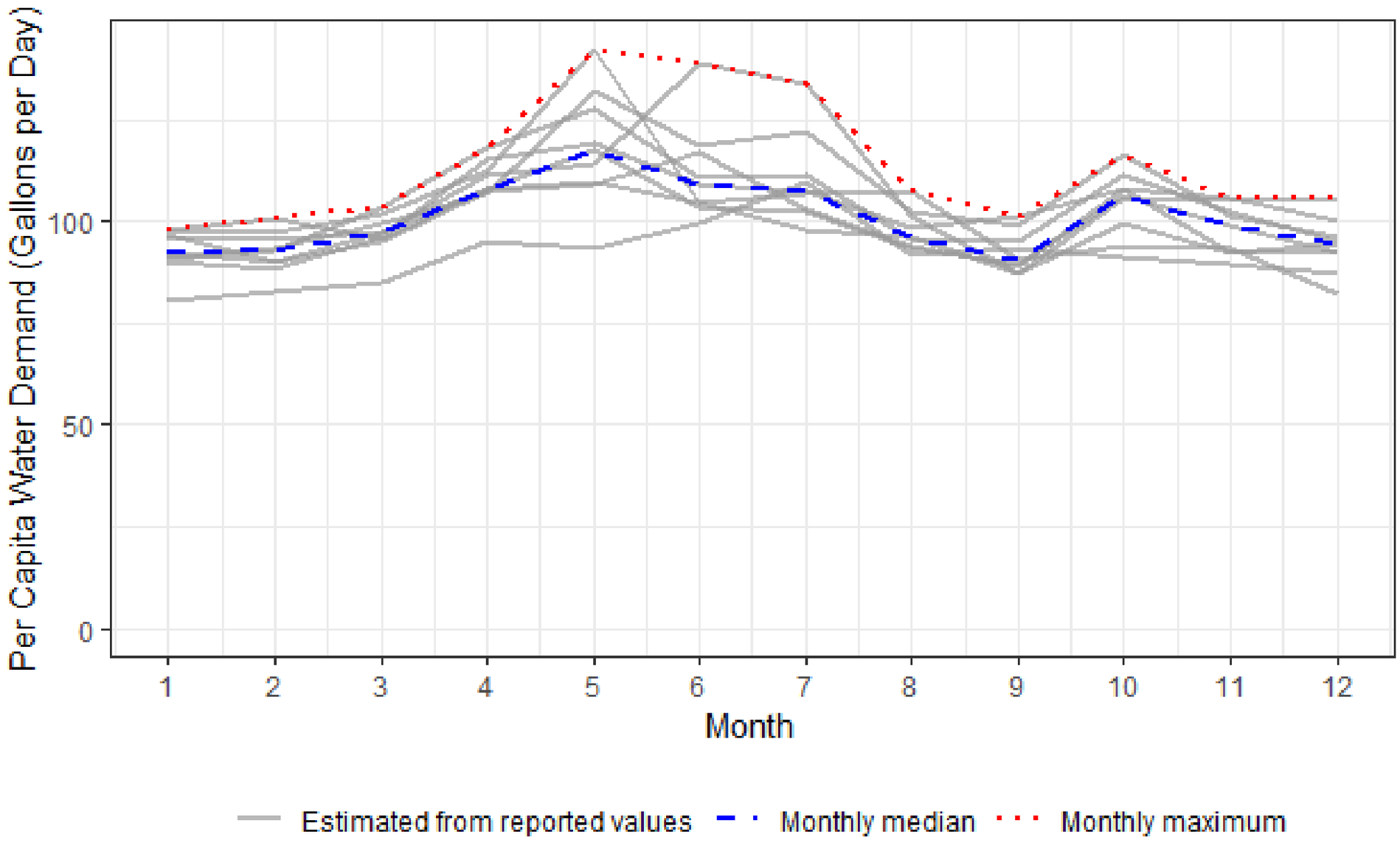
- **Moderate Projection Scenario**: Baseline Demand is based on *monthly median* withdrawal volumes and a "moderate" (business-as-usual) growth rate for the Driver Variable.
- **High Demand Projection Scenario**: Baseline Demand is based on *monthly maximum* withdrawal volumes and an "aggressive" growth rate for the Driver variable.
- **High Growth Projection Scenario** (*for comparison purposes only*): Baseline Demand is based on *monthly median* withdrawal volumes and an "aggressive" growth rate for the Driver Variable (*not* used in surface water simulations).

Assumptions behind "moderate" and "aggressive" growth rates for each Driver Variable will be presented.

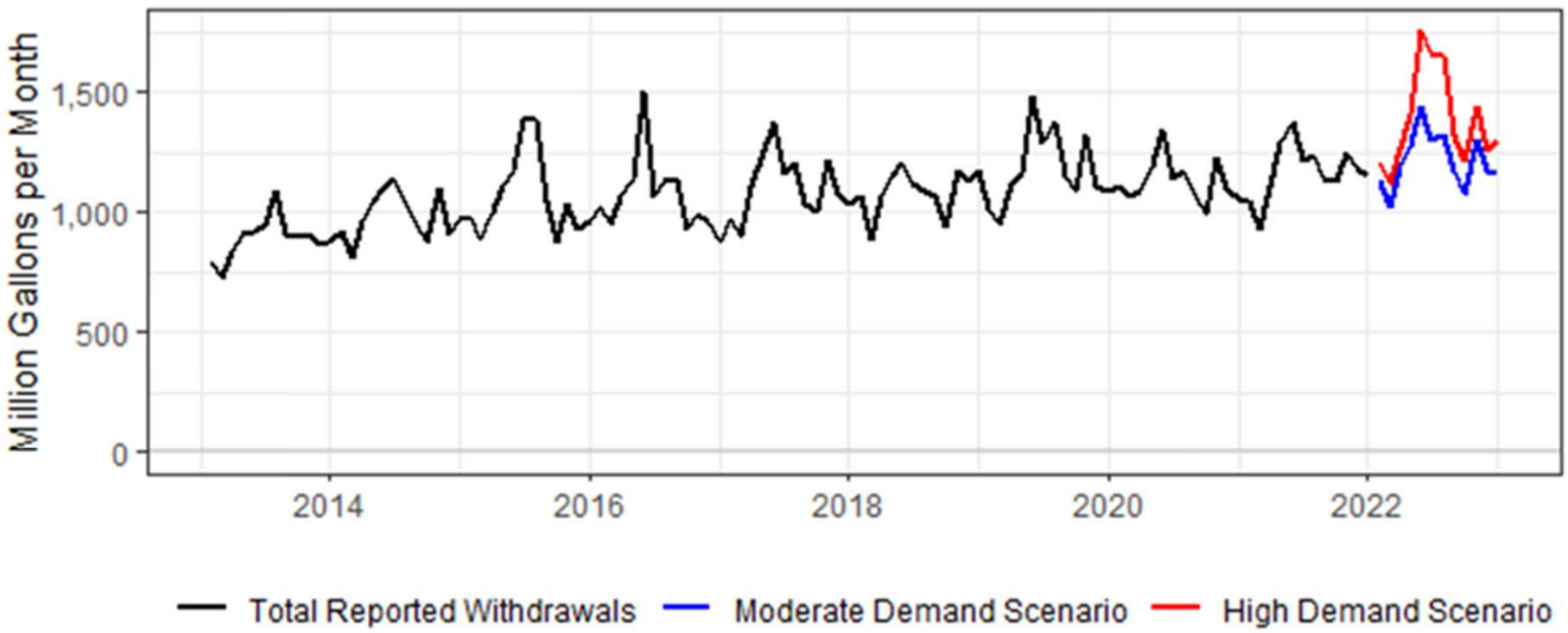
Public Water Supply – Baseline Demands



Public Water Supply – Baseline Demands



Public Water Supply Baseline Demands - Example



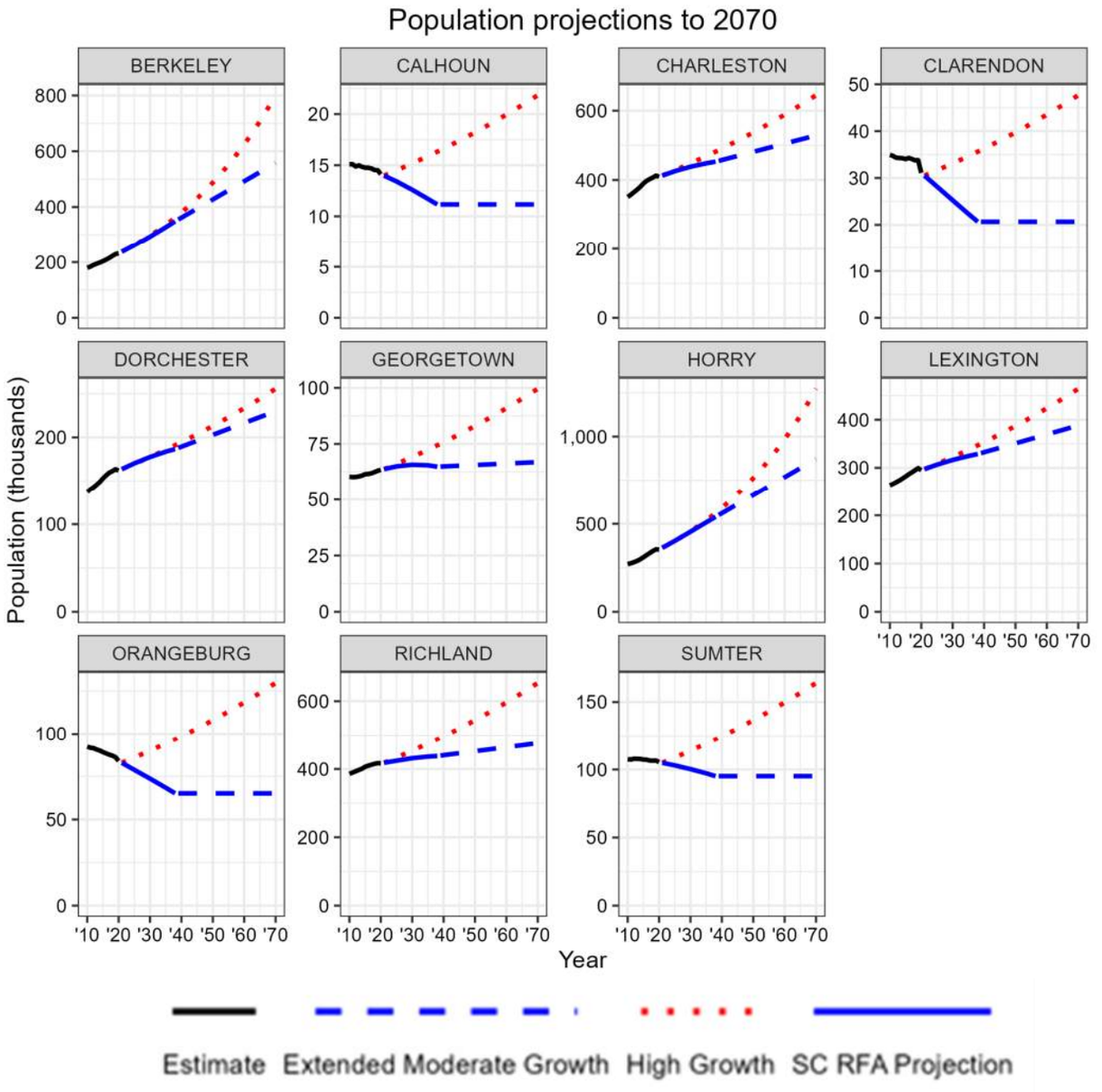
Population Projections

Moderate Projection Scenario

- SC Office of Revenue and Fiscal Affairs projections through 2038 are applied.
- After 2038, counties with positive growth rates are linearly extrapolated.
- For counties with negative growth rates, growth rates are set to 0 after 2038.

High Growth and Demand Projection Scenarios

- Average annual growth rates lower than the state average (0.83%) are set equal to the state average.
- All county growth rates are increased by 10%.



Manufacturing – Driver Variables

- Moderate Projection Scenario:
  - Uses projected Annual Economic Growth Rates from the US Energy Information Agency (EIA).
  - Negative growth rates are set to zero until 2050, 0.3% growth rate is applied from 2051-2070.
- High Growth and High Demand Projection Scenarios:
  - If Sector growth rate is less than the national average (2.1%), then the national average rate is applied.
  - If Sector growth rate is greater that the national average, the growth rate is increased by 10%.
- Growth rates range from 0.3% to 2.6% depending on the economic sector.
  - Over 50 years, that leads to a total increase from 6% to over 234%.
- Note: even with economic growth, actual water demand for many manufacturing sectors has declined as industrial processes become more efficient and manufacturers develop higher-value products.

Manufacturing – Driver Variables

2023 Projected Annual Economic Growth Rates from the US Energy Information Agency

Food Products	1.1%
Beverages and Tobacco Products	-0.2%
Textile Mills and Products	-0.1%
Wood Products	0.1%
Furniture and Related Products	1.3%
Paper Products	0.3%
Printing	-0.1%
Chemical Manufacturing	1.7%
Bulk Chemicals	1.2%
Inorganic	0.5%
Organic	1.2%
Resin, Synthetic Rubber, and Fibers	1.4%
Agricultural Chemicals	1.2%
Other Chemical Products	2.1%
Petroleum and Coal Products	0.2%
Petroleum Refineries	0.3%
Other Petroleum and Coal Products	-0.5%
Plastics and Rubber Products	1.5%
Stone, Clay, and Glass Products	0.8%
Glass and Glass Products	0.7%
Cement and Lime	0.7%
Other Nonmetallic Mineral Products	0.9%
Primary Metals Industry	1.1%
Iron and Steel Mills and Products	0.5%
Alumina and Aluminum Products	1.1%
Other Primary Metal Products	2.0%
Fabricated Metal Products	1.3%
Machinery	1.4%
Computers and Electronics	2.4%
Transportation Equipment	1.4%
Electrical Equipment	2.3%
Miscellaneous Manufacturing	0.9%

Santee Manufacturing Growth Rates

Name	Industry Sector	Moderate Scenario (EIA projections)	High Demand Scenario
INEOS	Chemical Manufacturing	1.20%	2.10%
Ingevity	Chemical Manufacturing	1.20%	2.10%
DAK - Columbia	Chemical Manufacturing	1.40%	2.10%
Maguro	Computers and Electronics	2.40%	2.64%
DEVRO INC	Food Products	1.10%	2.10%
Cooper River Partners	Miscellaneous Manufacturing	0.90%	2.10%
Albany	Paper Products	0.30%	2.10%
Michelin	Plastics and Rubber Products	1.50%	2.10%
NUCOR - Berkeley	Primary Metals Industry	0.50%	2.10%
CMC	Primary Metals Industry	0.50%	2.10%
Chargeurs	Textile Mills and Products	0% - 0.30%	2.10%

Agricultural Growth Rates

- Moderate Scenario:
  - Withdrawals projected to grow 38% (0.65% average annual growth rate) over 50-year Planning Horizon.
  - Source: *Brown, Thomas C., Romano Foti, and Jorge A. Ramirez, 2013. Projected freshwater withdrawals in the United States under a changing climate. Water Resources Research, Vol. 49, 1259- 1276.*
- High Growth and High Demand Scenarios:
  - Withdrawals projected to grow 44% (0.72 average annual growth rate) over the 50-year planning horizon.
  - Source: *Crane-Droesch, Andrew, Elizabeth Marshall, Stephanie Rosch, Anne Riddle, Joseph Cooper, and Steven Wallander. Climate Change and Agricultural Risk Management Into the 21st Century, ERR-266, U.S. Department of Agriculture, Economic Research Service, July 2019.*

Thermoelectric*, Golf, Mining, and Other Categories

- For other planning basins, there typically has been no projected growth for these categories – Monthly Baseline Demand stays constant over the Planning Horizon:
  - Moderate and High Growth Demand Scenarios – monthly median demand for 2013-2023 period.
  - High Demand Scenario – monthly maximum demand for the 2013-2023 period.
- Feedback requested from Santee RBC sector representatives to evaluate validity of these assumptions.

*** Thermoelectric Demands are based on Integrated Resource Plans developed by individual power utilities and feedback they provide.**

Considerations for Thermoelectric Water Demand Projections

- VC Summer expansion – estimates of additional consumptive use is needed.
- Power plant decommissioning:
  - Duke Energy's Cliffside Steam Station (Broad basin – NC): 2030 (Unit 5), 2048 (Unit 6)
  - Santee Cooper's Winyah Generating Station (Santee basin) – 2030
  - Dominion's Wateree Station (Catawba basin) – 2028
  - Dominion's Williams Station (Santee basin) – 2030
- New plants or additional capacity:
  - Some new generation likely outside of the Santee basin.
  - Solar energy capacity expected to continue to grow.

Water Demand Projections for Thermoelectric Power – Proposed Approach

- Assumptions:
  - All power plants slated for decommissioning will be on schedule and their water withdrawals will be removed from future projections.
  - VC Summer will expand its nuclear energy capacity – will need to set reasonable estimates of consumptive use.
  - Duke will add a new power plant in the Broad basin at their Cherokee site near Gaffney (consumptive use estimates already provided for the Broad basin planning effort and included in their surface water assessment).
  - Consider additional consumptive use from CT turbines planned for Dominion's Parr Hydroelectric facility (Broad basin) and for the Williams Generating Station (Santee basin) – consumptive use expected to be small but will follow up with Dominion.
  - No new thermoelectric power plants in the lower Santee basin.
- Uncertainty can be evaluated during the surface water availability assessment by testing "what if" scenarios.

Questions?

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