

# State of Tennessee Regional Water Supply Planning Pilot Studies

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# Project Overview

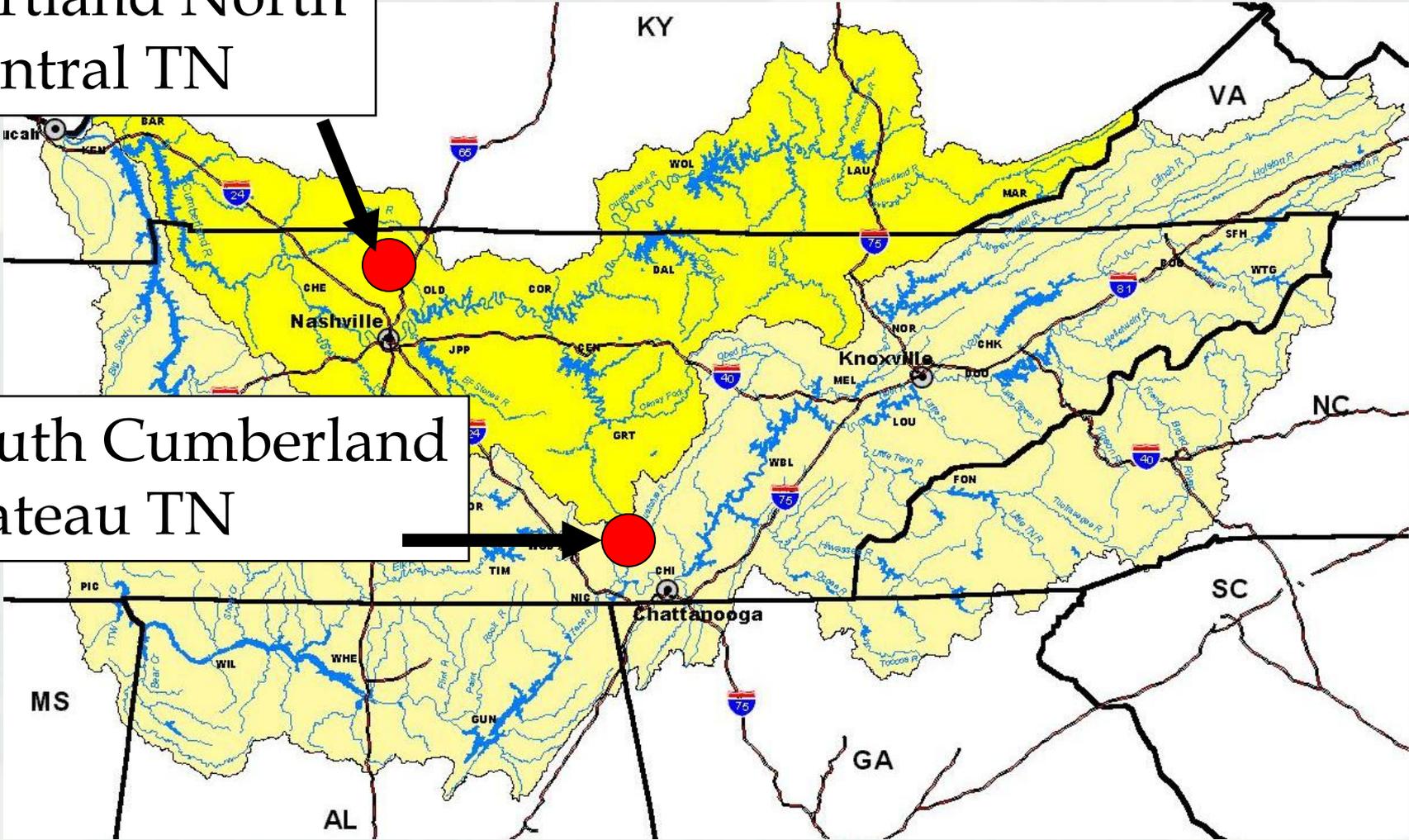
- **Two Pilot Areas - Drought of 2007**
  - ▶ North Central Tennessee
  - ▶ Southern Cumberland Plateau
- **Source Water Development Focused**
- **Stakeholders and Communities Involved**
  - ▶ 4 Pilot Area Specific Meetings to Date
- **Robust Planning Team**
  - ▶ State, Federal, NGO, Academia



# Pilot Areas

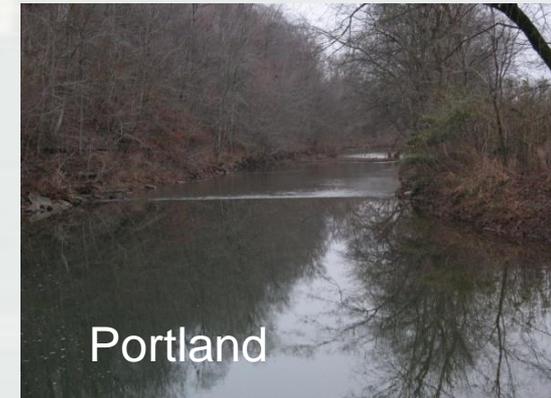
Portland North  
Central TN

South Cumberland  
Plateau TN



# Regional Water Supply Planning

- Sustainably match water sources with current & future needs
- Regional approach and multi-utility district focus
- Collaborative effort



# Pilot Study Objectives / Goals



TWRA

- Ensure the ability of water resources to sustain all uses
- Recommend source, conservation, and efficiency alternatives to meet water supply needs of pilot areas for 20 years
- Provide information for capital financing and management planning
- Provide information for development and growth decisions
- Serve as model for regional water resource planning statewide



Drinking Water



# Regional Planning Partners



**US Army Corps of Engineers**  
Nashville District



**Tennessee Advisory Commission on Intergovernmental Relations**



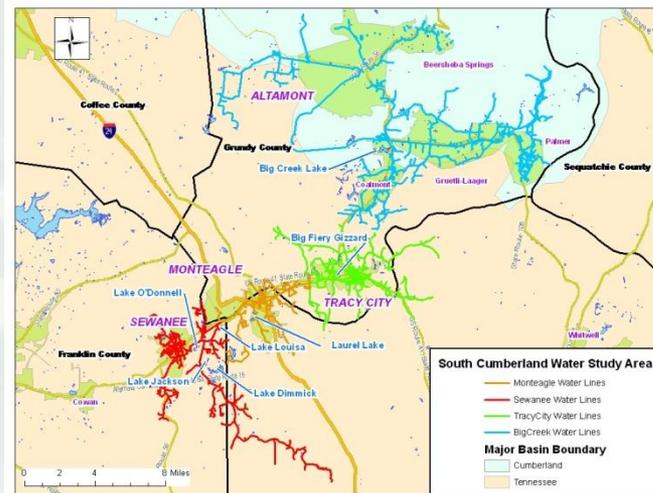
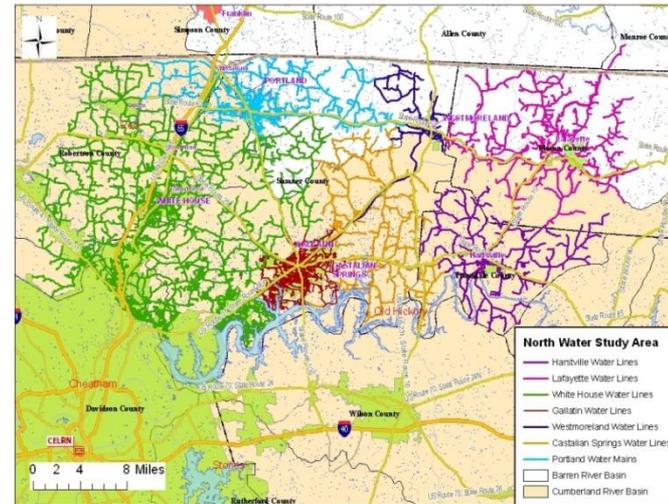
**Tennessee Association of Utility Districts**



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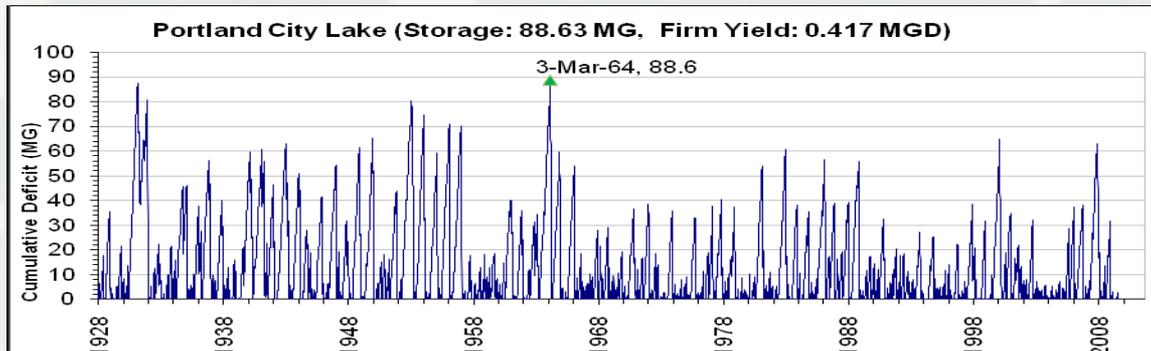
# Describing the Study Areas

- Collect data on existing water sources – stage, storage, flow, etc...
- Delineate distribution systems and utility interconnections
- Document current utility source demands and regional water transfers
- Leverage GIS



# Existing Water Source Yields

- Hydrologic models of watersheds generate inflow sequences to reservoirs
- Analyze inflow sequence, identify critical drought, and compute firm yield (Sequent Peak Algorithm)
- Firm yield = the yield at which cumulative deficit is exactly equal to the reservoir's available storage capacity



- Firm yield computations are dependent upon accurate estimates of available storage in the reservoir
- Available storage may be influenced by physical intake elevation, environmental protection requirements, water quality, treatability, risk considerations, or other factors



# Water Demand Projections

- **Driven by Population Growth**
  - ▶ Projections from UT Center for Business and Economic Research (CBER)
  - ▶ Growth in utility population served in direct proportion to CBER growth estimates
- **Commercial and Industrial Use**
  - ▶ Proportional to population growth and density
  - ▶ Statewide evaluation of ratio of commercial/industrial to residential water use
  - ▶ Increases to 1:1 ratio at 1000 persons/sq. mile



# North Central

## Water Demand Projections

- Individual Utility Demands Through 2030 in Million Gallons per Day (Average)

Utility	2005	2010	2020	2030
White House*	11.00	12.00	15.20	17.30
Gallatin*	6.50	7.11	8.92	10.10
Portland*	1.86	2.05	2.61	2.99
Westmoreland	0.41	0.46	0.61	0.71
Castalian Springs/Bethpage	1.03	1.15	1.52	1.78
Total Raw Water Demand:		21.16	26.73	30.39

\* Average Daily Raw Water Withdrawals



# South Cumberland Plateau Water Demand Projections

- Individual Utility Demands Through 2030 in Million Gallons per Day (Average)

Utility	2005	2010	2020	2030
Sewanee*	.294	.303	.330	.349
Monteagle*	.433	.434	.431	.434
Tracy City*	.470	.471	.467	.471
Big Creek*	.867	.881	.910	.940
Griffith Creek	.079	.079	.078	.078
Foster Falls	.034	.034	.034	.034
Cagle-Fredonia	.129	.141	.177	.201
<b>Total Raw Water Demand:</b>		<b>2.089</b>	<b>2.138</b>	<b>2.194</b>

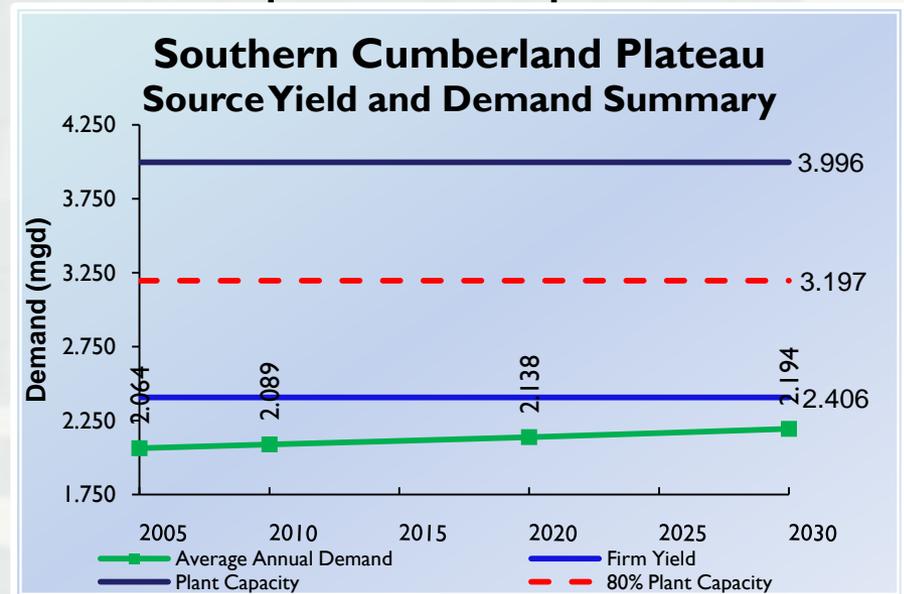
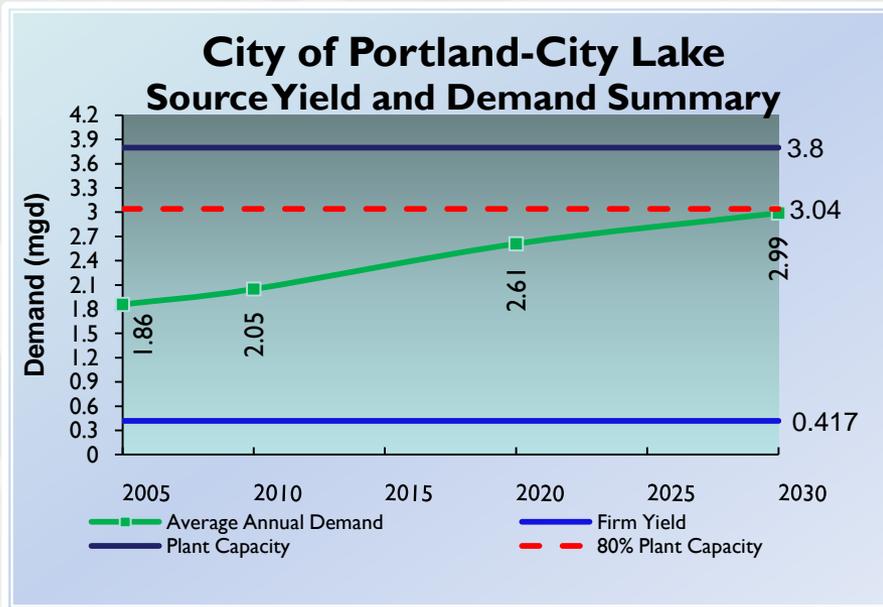


\* Average Daily Raw Water Withdrawals

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# Study Area Needs

- Demand represents the total water use for an individual utility or entire study area region
- Need is the difference between a water source(s) firm yield and the projected demand at a particular point in time



# Pilot Area Need Statements

## ■ North Central

- ▶ Principle water source is Old Hickory Lake
  - Satisfies 90% of study area existing demand
- ▶ Portland satisfies demand using small sources
  - Purchases finished water as needed
  - No formal contracts: security is not provided
- ▶ Pilot area demand projected to increase from 21 MGD to 30 MGD by 2030
  - Sufficient raw water in Cumberland system
  - USACE policy implementation may dictate withdrawal fees



# Pilot Area Need Statements

- South Cumberland Plateau
  - ▶ Raw water supply strained in 2007
    - Monteagle managed drought by purchasing from adjacent utilities and establishing temporary sources
  - ▶ Utility interconnections well established
    - Paramount to region's ability to manage drought
  - ▶ Pilot area demand projected to increase from 2.1 MGD to 2.2 MGD by 2030
    - Composite yield of existing sources barely sufficient
    - Indicate need for source development



# Alternatives

- Developed With Stakeholder Input
- Suite of potential alternatives
  - ▶ Demand Management
    - Pricing, Unaccounted for water loss, Construction standards, Re-use, Education
    - Drought Mitigation Strategies
  - ▶ Existing Source Improvement
    - Improve water sharing within region through existing or new connections
    - Raise existing impoundments
- New Source Development
  - Groundwater – Wells or springs
  - Storage – New or Converted Reservoir
  - Pipeline



# Water Source Alternatives

## ■ North Central

- ▶ Interconnection – White House to Portland
- ▶ Caney Fork Creek Dam – New Reservoir
- ▶ Groundwater - Wells

## ■ South Cumberland

- ▶ Interconnections - Regional
- ▶ Big Creek Dam – New Reservoir
- ▶ Ramsey Lake – Purchase Existing Lake
- ▶ Big Fiery Gizzard – Raise Existing Dam
- ▶ Pipeline – TN River

Big Fiery Gizzard Dam



# Temporal Evaluation of Systems and Alternatives

- OASIS Model
  - ▶ Evaluate Reliability of Existing and Alternative Water Sources
    - Temporal relationship between:
      - ▷ Utility and source
      - ▷ Utilities and interconnections
      - ▷ Utilities and regional sources
    - Incorporates:
      - ▷ Reserve storage
      - ▷ Seasonal demand patterns
      - ▷ Drought mitigation measures



# Alternative Screening Protocol

- Tier 1:
  - ▶ Reliable Capacity
    - Need met with minimal risk
  - ▶ Project Cost
    - Feasibility, Design, Construction
  - ▶ Implementability
    - Permitting, Public Acceptance, Property Acquisitions, Constructability
  - ▶ Flexibility
    - Phased Implementation, Drought Resistance



# South Cumberland Tier 1 Evaluation

Alternative	Reliable Capacity	Cost	Implementability	Flexibility
Interconnections	-	\$	+	+
Reservoir on Big Creek	++	\$\$\$	-	-
Raise Big Fiery Gizzard Lake	-	\$	+	-
Raise Big Fiery + Modified Release Schedule	+	\$	+/-	-
Purchase Ramsey Lake	+	\$\$	+/-	-
Raise Big Fiery + Ramsey	+	\$\$	+	+
Pipeline to S. Pittsburgh	+	\$\$\$	-	+/-

- Based Upon the Tier 1 Qualitative Evaluation: Purchasing Ramsey Lake, Raising Big Fiery Gizzard with a Modified Release Schedule or a Combination of Raising Big Fiery Gizzard and Purchasing Ramsey Lake Appear to be the Preferred Alternative for the Region
- Tier 2 Evaluation Warranted



# North Central Tier 1 Evaluation

Alternative	Reliable Capacity	Cost	Implementability	Flexibility
Caney Fork Creek Reservoir	+	\$\$\$	-	-
Interconnection	+	\$	+	+
Groundwater	-	\$\$	+	+

- Based Upon the Tier 1 Qualitative Evaluation, the Portland to White House Interconnection Alternative Appears to be the Preferred Alternative for North Central Tennessee



# Alternative Screening Protocol

- Tier 2:
  - ▶ Cost
    - End user costs
  - ▶ Water Quality
    - Raw and Finished
  - ▶ Environmental
    - Benefits and Impacts
  - ▶ Other Factors
    - Multiple Purposes



# Supplemental Investigations

- Evaluation of Financial Conditions
  - ▶ Ability of utilities to implement alternatives
  - ▶ Ability of utilities to serve as regional provider
- Energy Audits - White House and Big Creek Utilities
  - ▶ Identify potential energy savings
  - ▶ Equipment operation, maintenance, replacements
- Existing/Proposed Source Water Quality
  - ▶ Chemical stratification survey
    - Raw water quality
    - Treatability
    - Release water quality



# Next Steps

- Tier 2 Evaluation and Selection of Preferred Regional Alternatives
- Reports
  - ▶ 2 Pilot Area Specific
  - ▶ Regional Water Supply Planning Guidance
- Implementation of Alternatives
  - ▶ Funding Acquisition
  - ▶ Funding for Feasibility Studies



# Next Steps

- Statewide OASIS License
  - ▶ Hosted at TTU
    - Technical Support and Training
    - Web Based Access Portal
  - ▶ Facilitate Future Regional Studies
  - ▶ Support Regional Planning Guidance
  - ▶ Enable Adaptive Management of Initial Pilot Studies



# Questions??



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