Partners in this Regional Planning Pilot

US Army Corps of Engineers
Nashville District

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Tennessee Association of Utility Districts

TENNESSEE
DEPARTMENT OF ECONOMIC & COMMUNITY DEVELOPMENT

Tennessee Department of Agriculture

tacir

Tennessee Advisory Commission on Intergovernmental Relations

The Nature Conservancy
Protecting nature. Preserving life.

Tennessee Tech UNIVERSITY

TVA

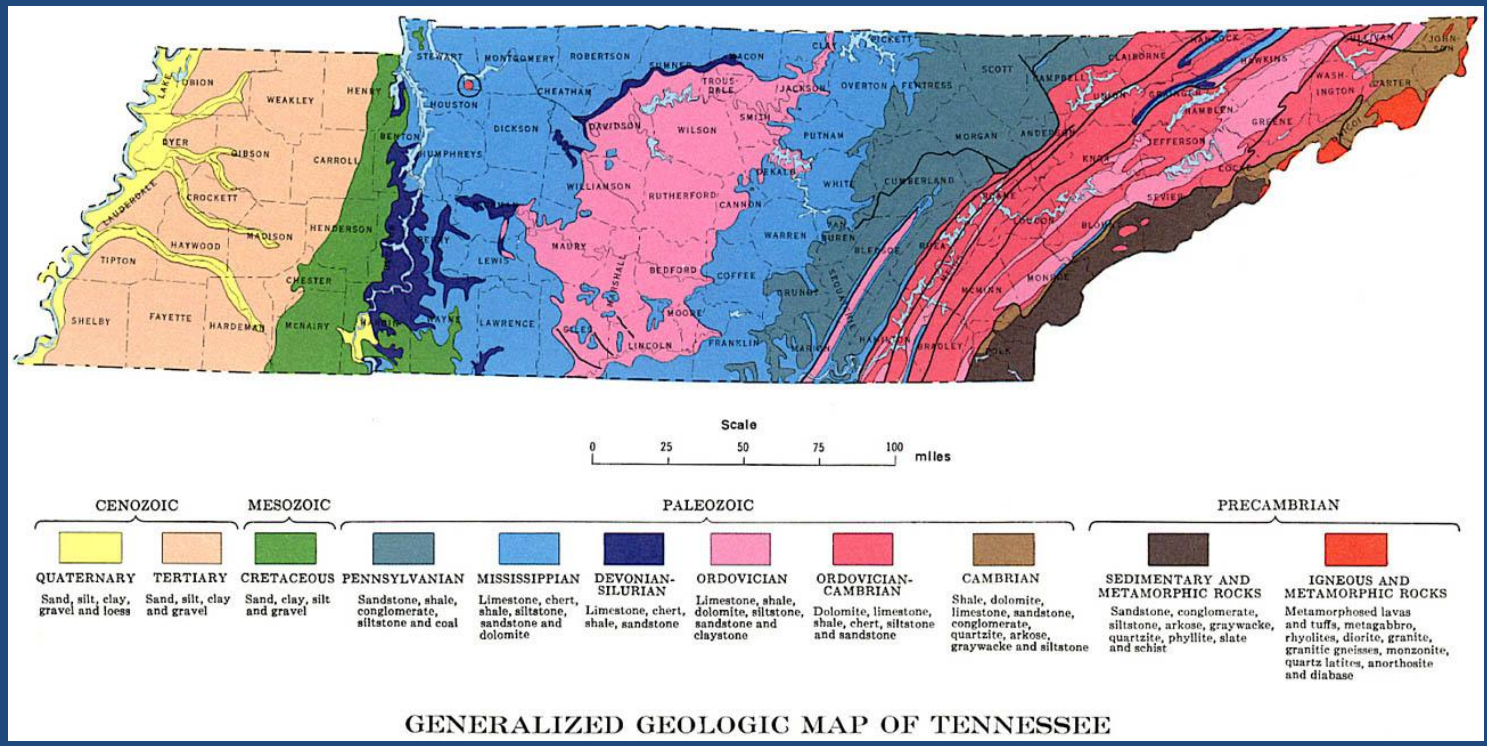
TENNESSEE WILDLIFE RESOURCES AGENCY

LAND TRUST FOR TENNESSEE
Life. Land. Legacy.

Tennessee Duck River Development Agency
March 3, 1965

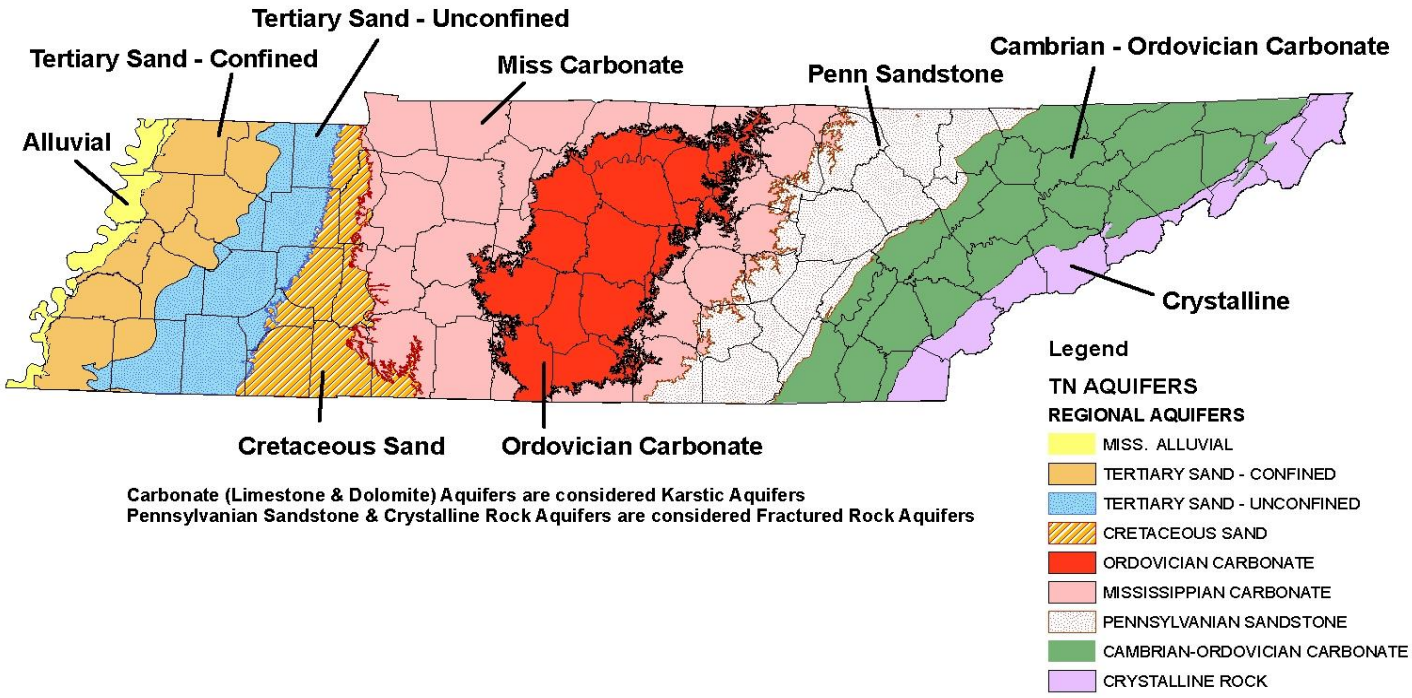
68-221-702. Declaration of policy and purpose. — Recognizing that the waters of the state are the property of the state and are held in public trust for the benefit of its citizens, it is declared that the people of the state are beneficiaries of this trust and have a right to both an adequate quantity and quality of drinking water.

Geology of Tennessee



GENERALIZED GEOLOGIC MAP OF TENNESSEE

Aquifers of Tennessee



Carbonate (Limestone & Dolomite) Aquifers are considered Karstic Aquifers
Pennsylvanian Sandstone & Crystalline Rock Aquifers are considered Fractured Rock Aquifers

Community System

Public water system serving at least
15 connections by year round residents
Or serving at least 25 year round residents

Noncommunity System

Nontransient

A public water system that regularly
Serves at least 25 of the same persons
For more than 6 months of the year
(generally industries and schools)

Transient

A public water system that regularly
Serves at least 25 individuals at least
60 days a year
(generally campgrounds, restaurants,
Churches, etc.)

Profile of Public Water Systems

Total Daily Average Production (Community)
693 Million GPD Surface Water
273 Million GPD Ground Water

Community: 490 Systems

148 Surface Water Systems serving 3,408,000 pop.

192 Ground Water Systems serving 1,532,000 pop.

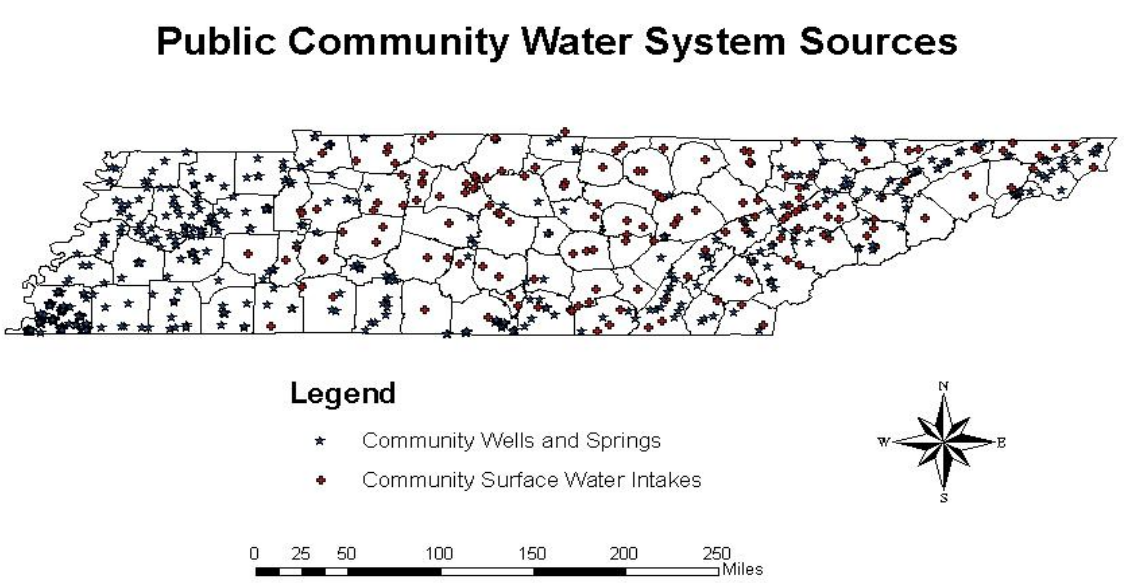
150 Purchasing Systems serving 744,000 pop.

Noncommunity: 420 Systems

10 Surface Water Systems

410 Ground Water Systems

Water Systems in Tennessee



490 Community Public Water Systems serving 94% of State's Population

148 Surface Water; 192 Ground Water; 149 Purchase Only

Community Systems with Above Ten Million GPD Average Daily Production

NAME	SOURCE TYPE	Gallons per Day
MEMPHIS LIGHT, GAS, & WATER	GW	151,600,000
NASHVILLE WATER DEPT #1	SW	98,850,000
TENN-AMERICAN WATER COMPANY	SW	38,265,000
KNOXVILLE UTILITIES BOARD-KUB	SW	35,819,000
HARPETH VALLEY U D	SW	22,869,000
CLARKSVILLE WATER DEPARTMENT	SW	15,240,000
KINGSPORT WATER DEPT	SW	14,545,600
JACKSON WATER SYSTEM	GW	14,111,000
JOHNSON CITY WATER DEPT	SW	12,885,000
COOKEVILLE WATER DEPT	SW	12,693,000
FIRST UTIL DIST OF KNOX COUNT	SW	12,506,000
EASTSIDE UTILITY DISTRICT	SW	11,010,000
MURFREESBORO WATER DEPARTMENT	SW	10,634,000

Typical Ground Water Threats

Chemical contaminants

Petroleum Products and Derivatives

Gasoline

Benzene, Toluene, Xylene

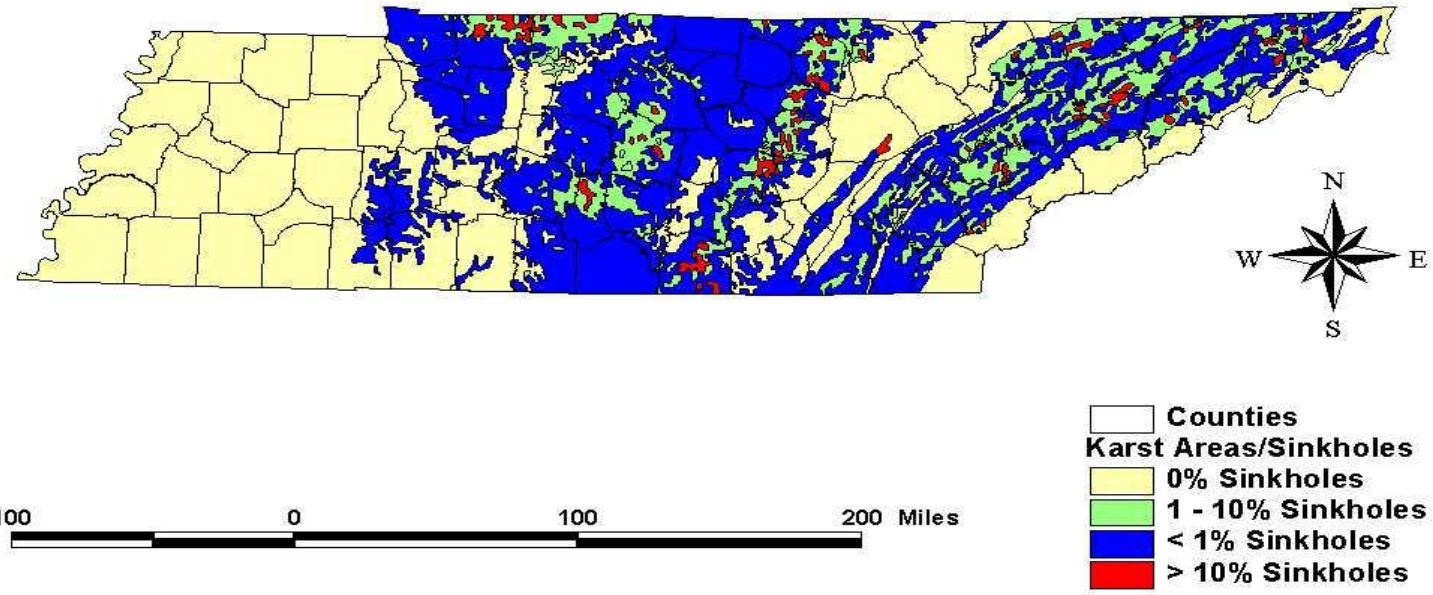
Chlorinated Solvents

Trichloroethylene, Dichloroethylene, Trichloroethane, …

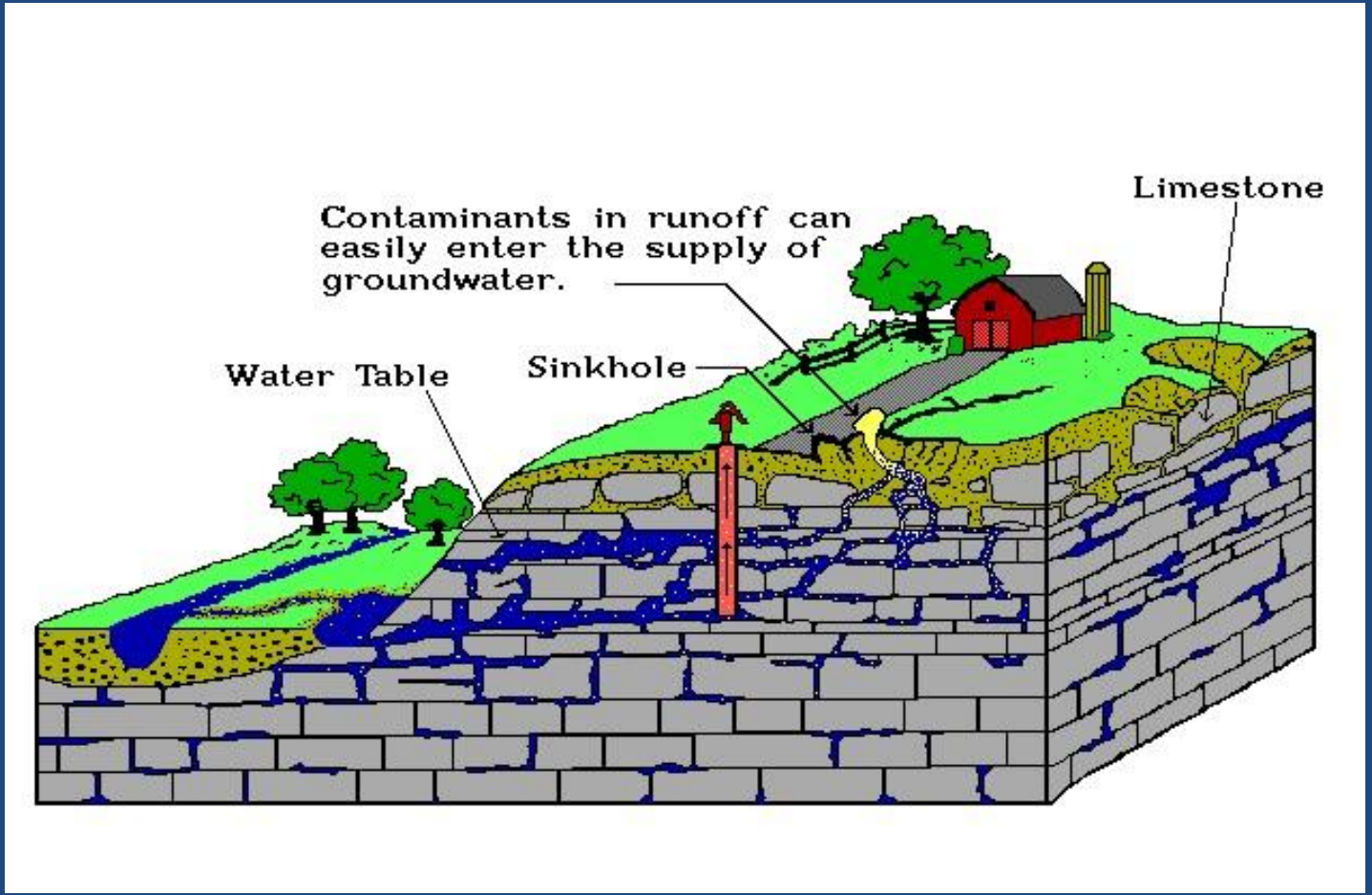
Ground Water Under the Direct Influence

Surface Water Contaminants + Ground Water Contaminants

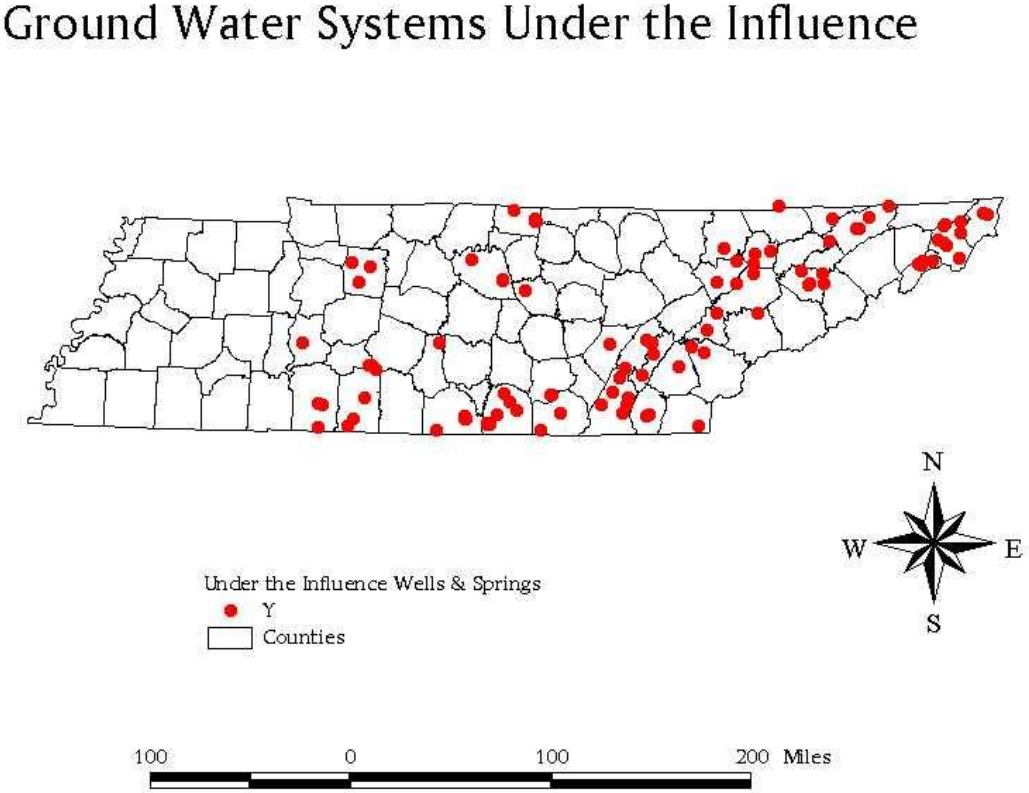
Karst Areas of Tennessee



Hollow Ground

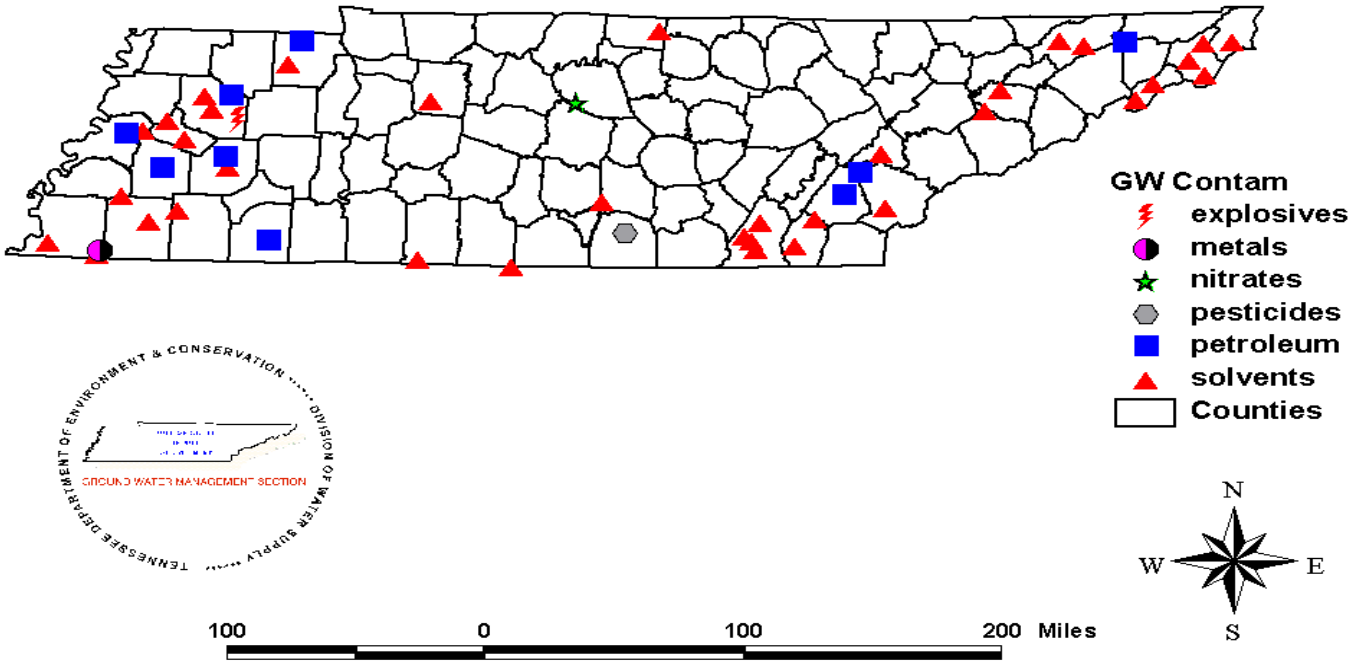


TDEC Video
Hollow Ground: Land of Caverns, Sinkholes and Springs
www.state.tn.us/environment/videos/#water



Public Ground Water Systems showing impact from surface water (bacteria, insect parts, etc.)

Ground Water Contamination at Public Water Systems



Typical Surface Water Threats

Organic contaminants

- Nutrients (Nitrates, Organic Carbon)
- Pesticides
- Microbes (bacteria, viruses & protozoa)

Accidental Spills/Releases

Water Supply Challenges for the Future

Increasingly complex treatment requirements

Increasingly complex human impacts

Absence of Regional Planning

What is the water resources regional planning pilot?

- Sustainably matching water sources with current & future needs
- Regional approach and multi-utility district focus
- Collaborative effort
- Areas selected based on 2007 drought stresses

Chattanooga Times Free Press

Photo of Laurel Lake by Meghan Brown

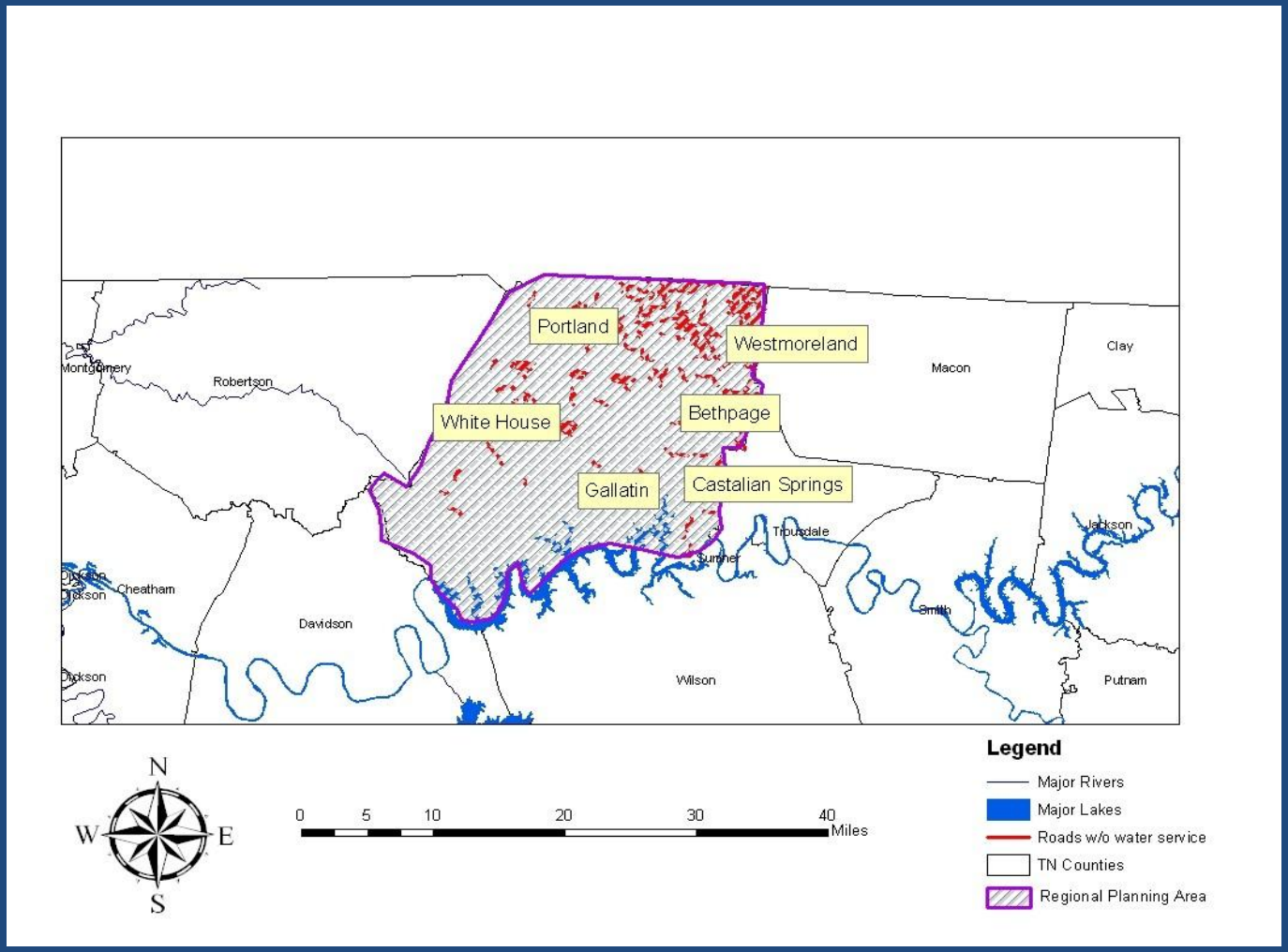
What are the objectives / goals of the pilot?

- Ensure ability of water resources to sustain all uses
- Recommend source, conservation, efficiency and delivery alternatives to address water supply needs for a minimum of twenty years
- Provide information useful to capital financing source and management planning
- Provide information useful for development and growth decisions
- Serve as model for statewide water resources regional planning

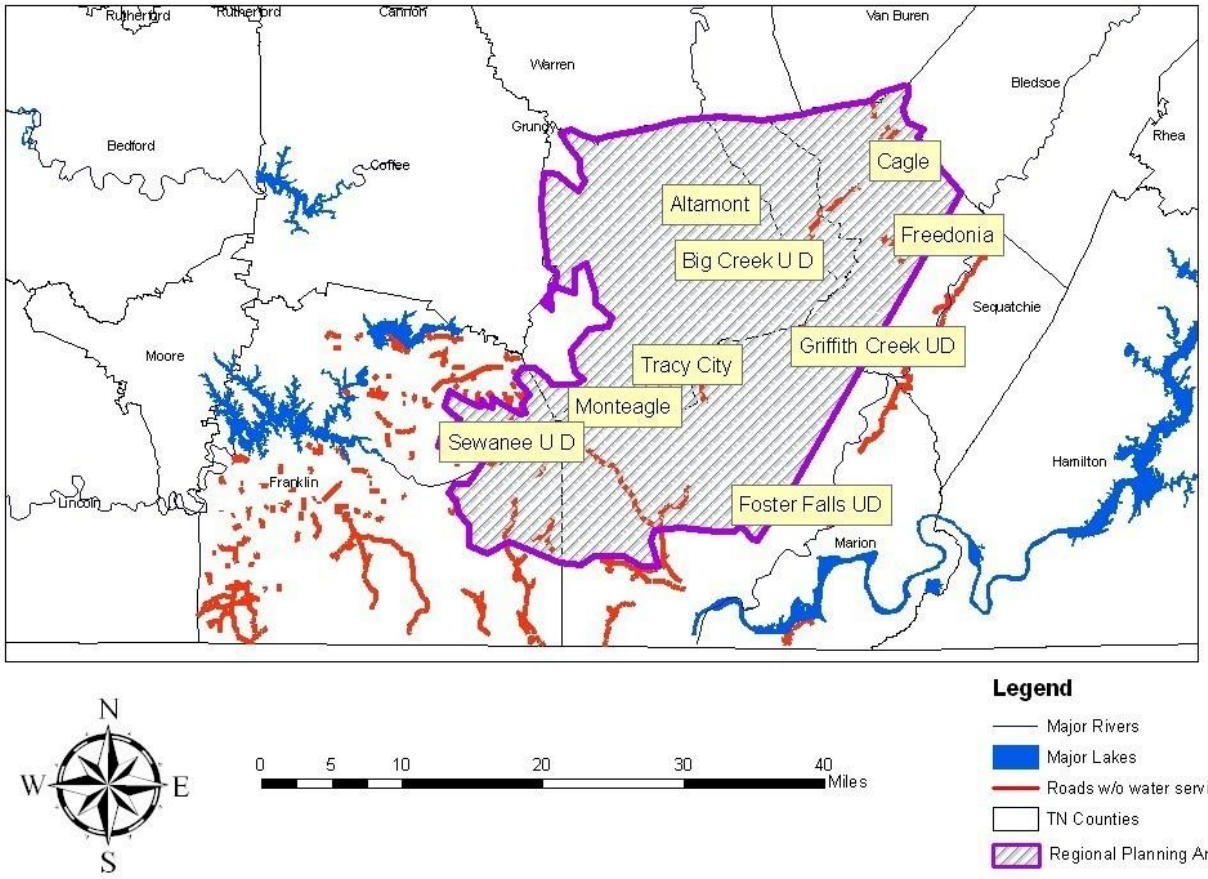
What are the benefits of water resources regional planning?

- Utilities, municipalities and counties work together to address water resource / supply issues
- Addresses needs of the region while minimizing demand on resources
- Funding advantages
- More immediate, effective drought response
- Increases sustainability by eliminating duplicate solutions and promoting efficiencies

North Central Pilot Area



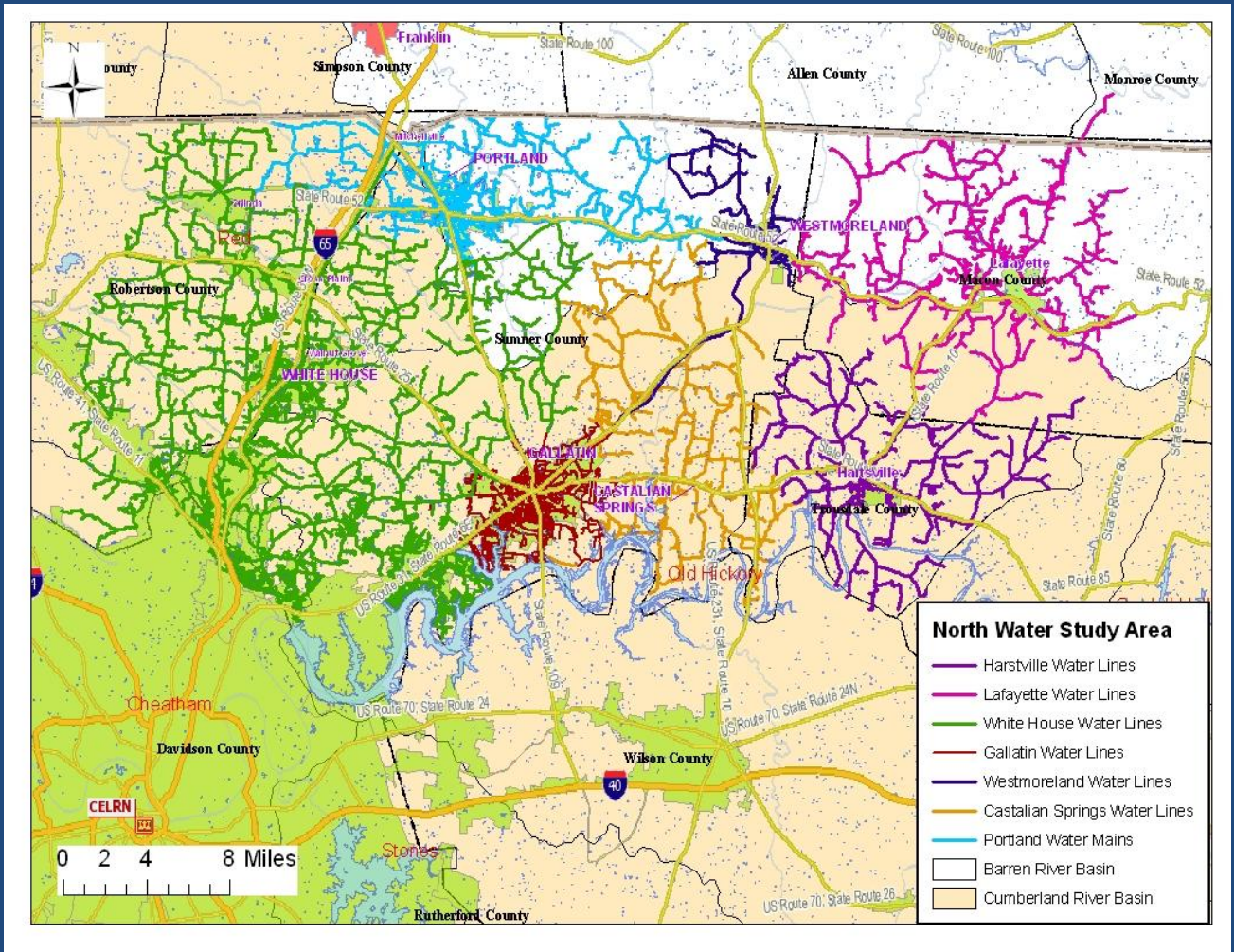
South Cumberland Pilot Area



Elements of the water resources regional planning pilot

- Baseline information on the pilot area
- Assessment of the environment and ecological sensitivities
- Identification of the current water use and the structural capacities of the water systems
- Land use patterns

North Central TN Area



North Central TN Water Sources

- Cumberland River/Old Hickory Lake
- Whites Spring & Adams Spring
- Barren River
- West Fork Drakes Creek
- Portland City Lake

North Central TN Water Sources

Utility	Water Supply Source	Storage Capacity (MG)
Gallatin	Cumberland River- Old Hickory Lake	152,000
Hartsville	Cumberland River- Old Hickory Lake	152,000
Lafayette	Whites Spring (Primary), Adams Spring (Secondary), Barren River (Emergency)	-
Portland	West Fork Drakes Creek (Primary)	-
	Portland City Lake (Emergency)	115.7
White House	Cumberland River- Old Hickory Lake	152,000

North Central TN Water Use

WATER SYSTEMS	TREATMENT PLANT CAPACITY (MGD)	SOURCES/BUYERS/ SUPPLIERS	AVERAGE WITHDRAWAL (MGD)	WATER PURCHASED (MGD)	WATER SOLD (MGD)	GROSS WATER USE (MGD)
Castalian Springs-Bethpage U.D.	-	Gallatin (seller)	-	0.861	-	0.895
		Hartsville (seller)	-	0.0167	-	
		Westmoreland (seller)	-	0.0174	-	
Gallatin	16.1	Cumberland-Old Hickory Lake	7	-	-	5.7
		Castalian Springs/Bethpage (buyer)	-	-	0.861	
		Westmoreland (buyer)	-	-	0.4	
		White House (summer buyer)	-	-	-	-
Hartsville/ Trousdale	1.7	Cumberland River	0.9	-	-	0.845
		Castalian Springs /Bethpage (buyer)	-	-	0.0167	
		South Side U.D. (buyer)	-	-	0.0284	
		Cordell Hull U.D. (buyer)	-	-	0.01	

North Central TN Water Use

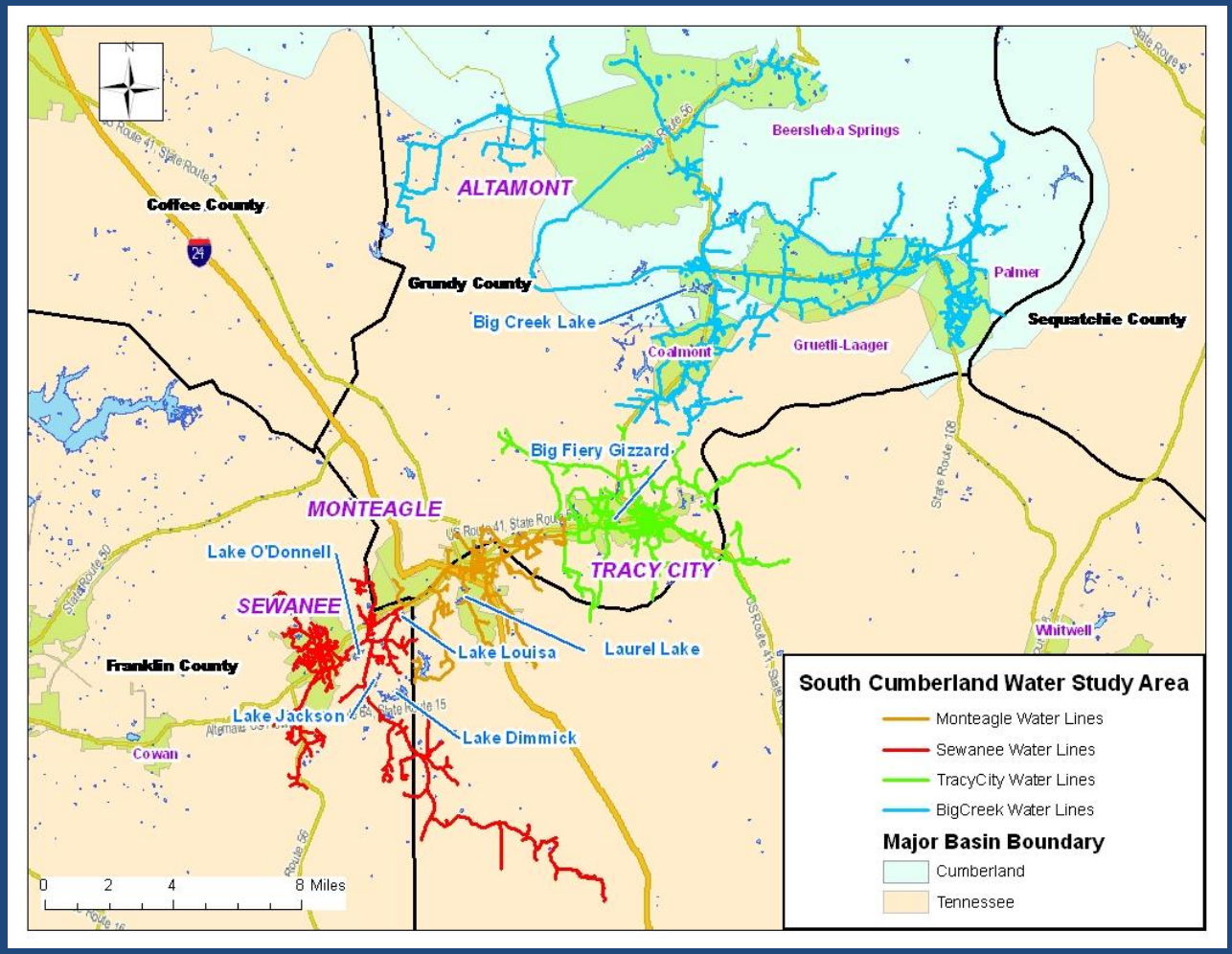
WATER SYSTEMS	TREATMENT PLANT CAPACITY (MGD)	SOURCES/ BUYERS/ SUPPLIERS	AVERAGE WITHDRAWAL (MGD)	WATER PURCHASED (MGD)	WATER SOLD (MGD)	GROSS WATER USE (MGD)
Lafayette*	2.4	Whites Spring	1	-	-	1.3
		Adams Spring	0.3	-	-	
		Barren River (emergency)	-	-	-	
Portland	3	Portland City Lake	0.5 (2 months per year)	-	-	2
		West Fork Drakes Creek	2 (10 months per year), 1.5 (2 months per year)	-	-	
Westmoreland	-	Gallatin (seller)	-	0.4		0.383
		Castalian Springs/Bethpage (buyer)	-	-	0.0167	
White House	20	Old Hickory Lake	10	-	-	10
		Gallatin (seller)	-	1 (summer)	-	
		Springfield (seller)	-	0.25 (summer)	-	

* Lafayette has emergency connections to Westmoreland and Hartsville; Table does not show all emergency connections between utilities

North Central TN Inter-Basin Transfer Permits

Utility District	Originating Watershed	Receiving Watershed	Quantity Permitted (MGD)
Gallatin U.D.	Lower Cumberland River	Barren River	0.75
Lafayette U.D.	Barren River	Upper Cumberland River	0.25
White House U.D.	Lower Cumberland River	Barren River	1.751

Utility Districts' Distribution Systems – South Cumberland



Existing Demand and Dependencies – South Cumberland

WATER SYSTEMS	TREATMENT PLANT CAPACITY (mgd)	SOURCES/BUYERS/ SUPPLIERS	Withdrawal (mgd)	Water Purchased (mgd)	Water Sold (mgd)	Gross Water Use (mgd)
Big Creek	1.5	Big Creek Reservoir	1	-	-	0.765
		Cagle/Fredonia (buyer)	-	-	0.17	
		Griffith Creek (buyer)	-	-	0.065	
Monteagle	1	Lake Laurel	0.35	-	-	0.405
		Lake Louisa	-	-	-	
		Tracy City (seller)	-	0.055	-	
Sewanee	0.56	Lake O'Donnell	0.325	-	-	0.325
		Lake Jackson (Secondary)	(water is pumped from Jackson into O'Donnell)	-	-	
		Lake Dimmick (Emergency)	(water is pumped from Dimmick into Jackson)	-	-	
Tracy City	0.936	Fiery Gizzard	0.45	-	-	0.35
		Foster Falls (buyer)	-	-	0.045	
		Monteagle (buyer)	-	-	0.055	

Elements of the water resources regional planning pilot

- Population and water demand projections
- Economic assessment
- Alternative(s) recommendation

Critical Drought Analysis for Study Area – South Cumberland

Standardized Precipitation Index – Drought identification based exclusively on precipitation conditions, computed with monthly data. Probability of occurrence for rainfall totals of selected duration. Example: For a 3-month duration SPI in March, the index value is reflective of the probability of occurrence of the total precipitation for Jan - Mar, compared with all other Jan - Mar totals in the record.

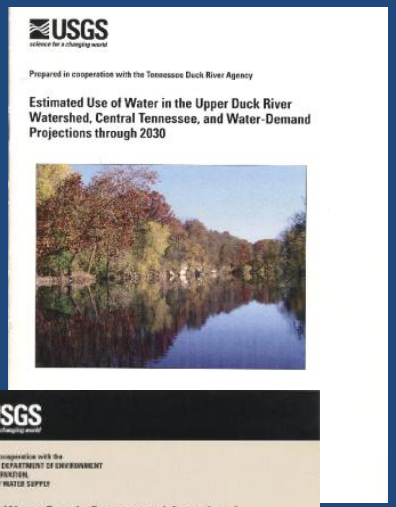
SPI Values	
2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-.99 to .99	near normal
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry

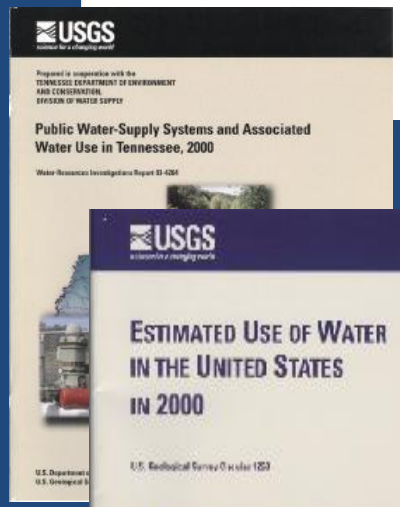
Drought	3	6	9	12	15	18	24	30	36	42	48	54	60
1930-1934	-2.50	-3.02	-3.20	-3.27	-3.02	-3.08	-2.92	-2.52	-1.96	-1.92	-2.09	-1.91	-1.92
1939-1942	-2.65	-2.81	-2.51	-2.04	-2.06	-1.97	-2.41	-2.38	-2.53	-2.33	-2.13	-2.32	-2.22
1944-1945	-3.98	-2.78	-2.00	-1.95	-1.39	-1.54	-1.56	-1.26	-1.32	-1.42	-1.81		
1960-1961	-2.56	-2.50	-2.04	-1.88	-1.55	-1.45	--	--	--	--	--	--	--
1963-1964	-3.22	-1.79	-1.21	--	--	--	--	--	--	--	--	--	--
1986-1988	-2.14	-2.65	-2.46	-2.29	-2.65	-2.49	-1.93	-1.95	-1.92	-2.01	-1.96	-2.06	-1.78
2007-2009	-2.97	-2.84	-3.31	-3.07	-3.24	-2.80	-2.91	-2.76	-2.63	-2.25	-2.02	-1.89	-1.19

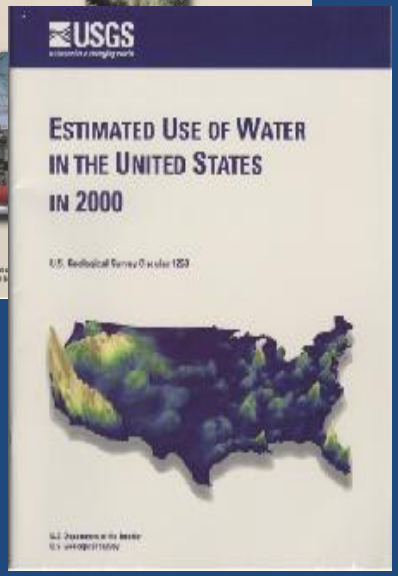
Critical 3 to 6 Months Duration SPI Values for Droughts at Monteagle Station

U.S. Geological Survey Water-Use Information

- Work with states to collect, check, and analyze water-use information nationwide
- Publish 5-year summary reports
- How much water is available; how much is used?
- What activities affect water availability?
- How does water-use affect surface or groundwater systems?
- What improvements can be made in how water use information is collected, stored, analyzed, and published?







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USGS Water-Use Information for Supply Planning

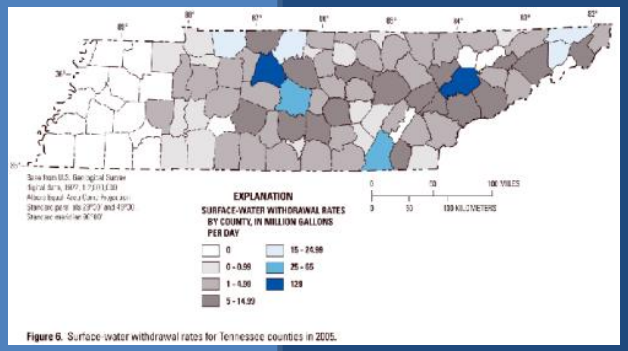

Figure 6. Surface-water withdrawal rates for Tennessee counties in 2005.

- Checking and verifying information, QA/QC, analysis of public supply records.
- Historical comparisons and analyses for trends in public supply records
- Comparing and validating public supply records against billing records by survey for 2005
- Estimating water use for agriculture irrigation and golf courses
- Collating input sets for demand forecast models.
- Identifying principal drivers (economics etc.)

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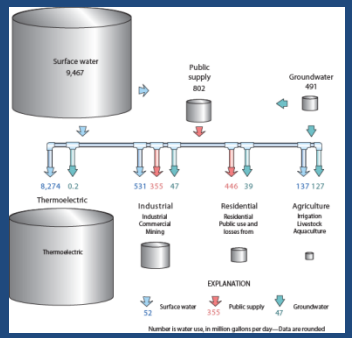
USGS Water-Use Demand Forecasting



- Forecast demand using model (IWR-MAIN)
- Key drivers: population, employment, and climate
- Forecasting method: constant use rates for residential, commercial and industrial sectors
- Assumptions: 2005 water system survey data includes all types of water use
- Projections: 20-50 years into future
- Application: Develop and evaluate conservation scenarios, etc.

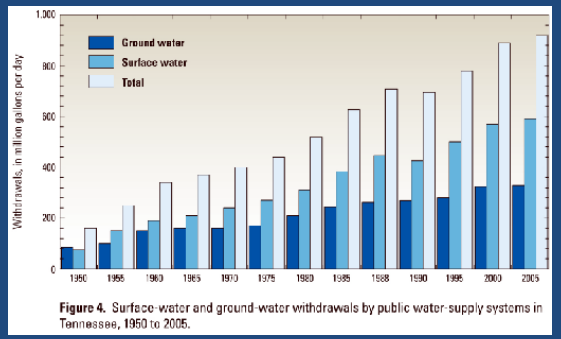


Figure 4. Surface-water and ground-water withdrawals by public water-supply systems in Tennessee, 1950 to 2005.

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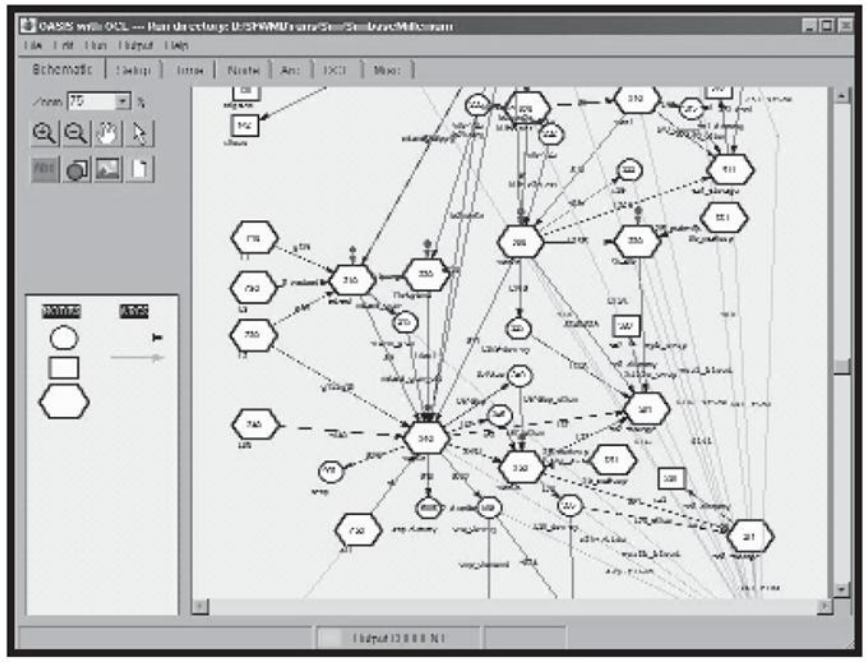
Looking at whole systems: OASIS

- Define hydrology
- Sources and sinks
- Inter-connections



Example of the Graphical User Interface (GUI) from OASIS

Microsoft Access

File Edit View Insert Format Records Tools Window Help

Reservoir S-A-E : Table

rowID	Node Number	Elevation	Elevation Units	Storage	St
1	120	100	feet	100	acf
2	120	105		600	
3	120	110		1720	
4	120	115		3770	
5	120	120		7370	
6	120	125		13230	
7	120	130		22930	
12	120	131		500000	
8	150	0	feet	0	acf
9	150	1		20	
10	150	45		990	
11	150	45.1		992	
13	150	170		4870	

Static data is kept in a relational database such as Microsoft Access

- Optimize system design

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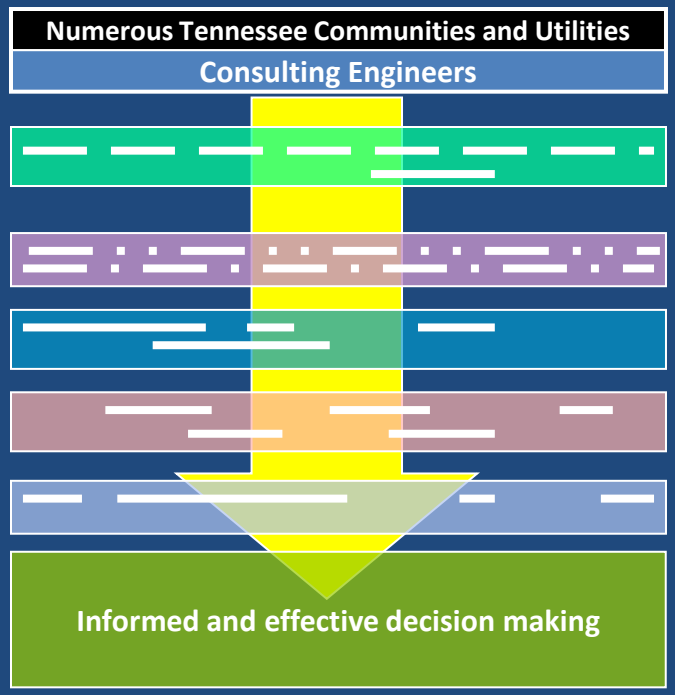
A context for decision making: OASIS

- Expandable within and across regions
- State-wide consistency and support
- A framework for collecting and sharing information



Facilitation, policy, and oversight

System data and description

Economic projections and analysis

Alternatives and structural analysis

Environmental limitations and decision support

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Status of the Pilot

Preferred alternative

Spring 2010

- Multi-agency team working on specific assignments
- Baseline study final and posted on website
- Two meetings held with UDs and some elected officials / Two public meetings
- Alternative evaluation in late 2009 / early 2010

Water Resources Regional Planning

Website / Email address

http://tn.gov/environment/regionalplanning/

For any comments or questions related to the pilot contact us at: regional.planning@tn.gov