December 2011

North Central Tennessee Regional Water Resources Planning Study

North Central Tennessee Regional Water Resources Planning Study

Contributors

Tennessee Department of Environment & Conservation

- Elaine Boyd, Director of Strategic Management
- Alan Leiserson, Director of Legal Services
- Paul E. Davis, Director, Division of Water Pollution Control
- Alan Schwendimann, Director, Division of Water Supply
- Lee Keck, Environmental Manager
- Robert Baker, Assistant Manager, Natural Resources Section
- Richard Cochran, Environmental Specialist/ Geographic Information Systems Coordinator
- Richard Urban, Environmental Field Office Manager
- Tom Moss, Deputy Director, Division of Water Supply
- Jimmy R. Smith, Environmental Specialist

Tennessee Department of Economic & Community Development

- Kendrick J. Curtis, Geographic Information Systems Manager

Tennessee Wildlife Resources Agency

- David McKinney, Chief of Environmental Services
- Kimberly Elkin, In-stream Flow Biologist

Tennessee Advisory Commission on Intergovernmental Relations

- Lynnisse Roehrich-Patrick, Associate Executive Director
- Bill Terry, Senior Research Associate
- Ben Smith, Senior Research Associate
- Ethel Detch, Senior Research Associate
- Dianna Y. L. Miller, Research Associate

Tennessee Association of Utility Districts

- Bob Freudenthal, Executive Director
- Greg Sanford, Utility Master Planning Consultant (Gresham, Smith and Partners)

HydroLogics Inc.

- Brian McCrodden, Vice-President/Business Manager
- Casey Caldwell, Water Resources Engineer

The Nature Conservancy

- Sally Palmer, Director of Science

U.S. Army Corps of Engineers, Nashville District

- Ben Rohrbach, Chief, Hydrology and Hydraulics Branch
- Sue L. Ferguson, Project Manager
- Mario Beddingfield, Hydraulic Engineer
- Lars Hanson, Water Resources Engineer (GKY & Associates, Inc.)

U.S. Geological Survey Water Science Center

- W. Scott Gain, Director
- John A. Robinson, Hydrologist
- Michael W. Bradley, Assistant District Chief, Hydrologic Studies

The Water Resources Technical Advisory Committee wishes to thank Paul Sloan, former Deputy Commissioner of the Tennessee Department of Environment and Conservation, for supporting its creation and its work. The technical working group for the water resources planning pilot study that is the subject of this report extends its special gratitude to Commissioner Sloan for his advice and guidance.

Photo Descriptions and Credits

Front Cover:
Background: White House, TN Greenway - John Phelan
Top Right: The still quiet beauty of White House, Tennessee - Matt Hatfield
Second from Top: Interstate 65 interchange at White House
Third From Top: Portland, TN Strawberry Festival
Fourth from Top: Portland, TN Field - Ross Winchel
Fifth from Top: Aerial photo of North Central Middle TN

Back Cover:
Historic Cold Springs School, built in 1857. This one-room school house was originally located near the Cold Springs that created Portland's city lake.

Department of Environment and Conservation, Authorization #327333, #100 copies, 10/10. , "This public document was promulgated at a cost of $7.48 per copy."

Preface

The drought of 2007 and 2008 was one of the most severe on record, and it was a harsh reminder that while the water supply in this state is abundant, it is not unlimited. Many of Tennessee's 458 community public water systems were confronted by limits of their capacity to provide water to meet the demand. Fortunately, system failures were avoided through the work of a drought emergency task force hosted at the Tennessee Emergency Management Agency and the cooperation among public water systems made possible by their prior investments in interconnecting their systems.

Although only the small, Marion County community of Orme ran completely out of water,[1] the drought elevated the need to update the Tennessee Department of Environment and Conservation's drought management plan, as well as each of our community public water systems' emergency drought response plans, and to develop a model for long-term, regional water resource planning that could be used anywhere in the state. These needs prompted TDEC to form the technical advisory committee authorized by Tennessee's Water Resources Information Act. With the help and advice of the committee, TDEC revised its drought management plan and is now working with community public water systems as they update their drought response plans.

Two study areas were chosen as pilots to support development of a regional water resource planning model: the southern end of the Cumberland Plateau and the northern part of Middle Tennessee. What follows is the second of these two pilots, the North Central Tennessee Regional Water Resource Planning Study. Most of the water utilities in the North Central study area rely on Old Hickory Lake as their source. Consequently, they weathered the 2007-2008 drought without too much difficulty. Portland, which relies on smaller, local sources was hit harder by the drought, but was able to manage by using existing interconnections with systems that draw their water from Old Hickory Lake. Those interconnections were adequate to manage that drought, but will not be sufficient in the future as the Portland area grows.

The objective of the study was to identify the most cost-effective, sustainable way to meet the water supply needs of the study area through 2030. It is an attempt to align sustainable water sources to current and future uses of water within the region over the next 20 years. Doing that required nearly two years of work to develop the data and information necessary to make a sound and defensible recommendation. The study did not address extending service to areas without public water, nor did it include analysis of wastewater handling capacities or needs.

These pilot studies have made clear the complexity of regional water issues; the need for broad collaboration among local, state, and federal partners; and the need to include with regional water plans the tools needed to make adjustments as circumstances change. Although each of these pilots presented its own, distinct challenges, the same process was successfully applied by the study team. As we look to make water resource planning available to other regions across the state, it will be essential to recognize each region's unique set of issues, but the general principles and technical approaches used in these pilots are suited to the challenges of other regions across the state as well.

[1] The sources could not produce enough water to pressurize the city's water system.

Executive Summary

The Study Area

Situated between Nashville and the Kentucky state line, partly on the Highland Rim and partly in the Central Basin, the North Central Tennessee study area covers most of Sumner County and the eastern section of Robertson County. Its geography, ecology, population, land use and development patterns, and utilities are all important factors in assessing current and potential water sources to determine how best to project and meet the area's water supply needs.

The Western Highland Rim, comprising all of Robertson County and more than half of Sumner County, is a broad, undulating tableland. The Rim's rugged escarpment running west-southwest across Sumner County forms the boundary between the Rim and the Central Basin. It is the area north of that escarpment where adequate water is of greatest concern. Three major watersheds converge in the study area: the Barren River, the Red River, and Old Hickory Lake. The Barren River flows north to Kentucky and is part of the Ohio River watershed. The Red River originates in Tennessee, drains portions of southern Kentucky, then meets the Cumberland River near Clarksville. The portions of both the Barren River and the Red River watersheds that lie within the study area are the headwater areas where streams are relatively small. By contrast, Old Hickory Lake, a U.S. Army Corps of Engineers lock and dam project, lies on the main stem of the Cumberland River, well down river from the headwaters of the Cumberland River Basin. Because of its location downstream of several Corps dam and reservoir projects (Center Hill, Dale Hollow, and Lake Cumberland), Old Hickory Lake, though relatively shallow, is more than adequate to meet the region's water supply needs.

Population 1980 through 2010

	Robertson County	Sumner County
1980	37,021	85.790
1990	41,492	103,281
2000	54,433	130,449
2010	66,283	160,645
Growth Rate	79.1%	87.3%

Portland is the only water utility in the study area that does not rely on Old Hickory Lake as its principal water supply source. Instead, Portland draws the majority of its water from West Fork Drakes Creek and supplements that source from Portland City Lake, located on a small, spring-fed tributary of West Fork Drakes Creek, when flow in the creek is too low to support withdrawals. Because these sources are small, headwater streams, there is some concern that water supply could become a significant limiting factor for growth and development in the Portland area. Sumner County is the 10th most densely populated county in Tennessee, having more than quadrupled in size since 1960. Robertson County has begun to grow nearly as rapidly and, in fact, grew more rapidly from 1990 to 2000. All governmental entities in the study area have active planning commissions allowing them to plan for future population and development and to link the land-use and water-supply planning processes. Sumner County's long-range plan specifically considers water supply.

Median Household Income (2009)

Tennessee	$41,715
Robertson	$50,539
Sumner	$54,012

Currently, water for domestic and industrial use is produced by three major water systems: Gallatin Public Utilities, Portland Public Works Department, and White House Utility District. Two smaller utilities in the study area (Castalian Springs-Bethpage Water Utility District and Westmoreland Public Works Department) have no water supply source of their own and provide water to their customers by purchasing finished water from other systems. North Central Tennessee is an area of relatively low water rates and relatively high household incomes. Even so, the study team placed considerable emphasis on the cost of the various water supply source alternatives evaluated in an effort to ensure that rates can remain low in comparison with incomes.

Reliable yield is not all of the water that could be withdrawn from a lake. It is the amount that should be used in planning to minimize the risk of running out.

In addition, there are environmental concerns that must be considered. According to the Tennessee Department of Environment and Conservation's Natural Heritage Program, there are 31 rare species on the list for Sumner County including 4 invertebrate animals, 15 vertebrate animals, 11 vascular plants, and one other type. Several very sensitive native fish and mussel species are located in the smaller rivers, creeks, and streams in the region. Efforts to protect the aquatic habitats of these species benefit those who rely on them as their water supply source. Sumner County's long-range comprehensive plan emphasizes the importance of sustainable development patterns and the management of natural land cover to protect clean, healthy drinking water supplies. Setting these areas aside and protecting them from disturbance preserves the diversity of species in the watersheds and helps shield the water supply from harmful contaminants associated with construction. As noted in Sumner County's land use plan, these strategies also advance good source water protection policies.

Meeting the Area's Water Needs

During the 2007-2008 drought, Portland was the only water system in the North Central study area that suffered serious shortages. The other utilities in the study area, both Gallatin and White House Utility District, as well as the smaller utilities that buy finished water wholesale, have a much more sustainable water supply in Old Hickory Lake. Because drought is one of the biggest risks to Portland's water supply, and its potential for growth is consequently somewhat constrained, the study team focused mainly on alternatives to ensure that Portland can sustainably meet its water supply needs through the 2030 planning horizon. The study team estimates Portland's current withdrawal needs at 2.05 million gallons per day growing to 2.99 million gallons per day by 2030. Operated as a system, Portland's two water supply sources can provide a firm yield of only 2.28 million gallons per day. Reliable yield estimates, which are designed to reduce drought risk by preserving 20% of the total storage in City Lake even in the worst drought, are 2.02 million gallons per day with no drought mitigation measures enacted and 2.25 million gallons per day with such measures in place. Clearly, avoiding unacceptable shortages during severe drought or other water supply emergency will require access to more water.

Increased conservation and demand management could postpone or reduce the need to develop new water supply sources. Unaccounted for water loss rates in the study area are relatively high, indicating that the utilities could manage their drinking water treatment and distribution systems more efficiently.

If as expected, the state standard for acceptable unaccounted for water losses[2] is reduced in the future, these utilities may have to increase efficiency in order to avoid sanctions. Anticipating this move, many of them are already stepping up efforts to account for and reduce losses.

Four alternatives to supply additional water to the Portland area were evaluated by the study team:

2009 Unaccounted for Water Losses

Utility	Percent of Finished Water
Castalian Springs-Bethpage Utility District	25.0%
Gallatin Public Utilities	21.8%
Portland Public Works Department	32.7%
Westmoreland Public Works Department	30.0%
White House Utility District	26.4%

- Building a new water supply reservoir on Caney Fork Creek
- Drilling wells for groundwater
- Building a raw water pipeline to Old Hickory Lake
- Purchasing finished water from White House Utility District

These alternatives were evaluated against the criteria of sufficiency, cost, implementability, flexibility, raw and finished water quality, environmental benefits and impacts, and other relevant factors. Sufficiency is a threshold criterion. If an alternative does not have sufficient reliable yield to meet projected needs, then it should not be considered further. The groundwater alternative could not meet this test. The remaining three alternatives were evaluated further through a two-tiered process. Tier One, in addition to sufficiency, considered general estimates of cost; implementability, considering the need for permits, public acceptance, property acquisition, and ease of construction; and flexibility, which is a matter of whether the project can be completed in phases with the costs spread over time to make it more affordable while still meeting the region's water supply needs, as well as its drought resistance. Tier Two scrutinized costs more closely and considered the remaining criteria of water quality, potential environmental benefits or impacts, and other relevant factors.

Based on these criteria, the alternative selected by the study team is contracting with White House Utility District to purchase finished water as needed and on a schedule amenable to both parties. This alternative can meet Portland's needs through the planning horizon of 2030, it is the least expensive by a significant margin, and it can be accomplished relatively quickly, which is an important factor given that Portland's current water sources are barely sufficient to meet today's reliability requirements. Although it was selected primarily because it can meet Portland's needs at the least cost, this alternative, as a form of regionalization, is also the most easily implemented and flexible alternative. It can grow as Portland grows, through and well beyond the 2030 planning horizon.

[2] In accordance with Tennessee Code Annotated §§ 7-82-702 and 68-221-1009(a), the Utility Management Review Board and the Water and Wastewater Financing Board have set an excessive water loss percentage at 35%. That means that any water system reporting a water loss of 35% or higher (using the current method) in its annual financial statements will be referred to the appropriate board for further action. This determination was made at the joint meeting of the Boards held on October 7, 2010. See http://www.comptroller1.state.tn.us/UMRB/ and http://www.comptroller1.state.tn.us/WWFB/ accessed online 28 March 2011.

Next Steps

Although the preferred alternative for this regional pilot study centers on Portland and White House, all of the utilities in the region would benefit from increased efforts to conserve water and manage water supply demands. With unaccounted for water percentages between 20% and 35%, all of the utilities in the study area can extend their current water sources and reduce costs by reducing leaks and line flushing. They can improve their financial condition by reducing unbilled water and by improving energy efficiency. These measures and a coordinated system of drought management will require community outreach and education, as will the rate increases that will likely be necessary in Portland to fund the improvements required to implement the preferred alternative.

Optimizing the amount and timing of Portland's finished water purchases from White House will require engineering studies. Various implementation strategies are possible, involving different infrastructure upgrades and, therefore, different costs. Determining the optimal schedule for sales between the two utilities will be an iterative process in which the capital and operating costs—and their effects on water rates—must be estimated. Scenarios tested by the engineers working for the parties will need to consider ways to

- fit capital improvements into existing capital improvement plans,
- avoid dramatic increases in water bills,
- phase improvements to avoid paying for excess capacity, and
- increase the capacity of interconnections in response to commercial or industrial development.

Ease of financing these improvements may be one of the key advantages of the preferred alternative. There are a number of potential funding sources for the design and construction work required. The federally authorized Drinking Water State Revolving Fund (DWSRF) loans can be used for the proposed infrastructure upgrades needed to more effectively share water in the region. TDEC staff is in the process of modifying the DWSRF scoring criteria to give greater priority to projects that support a regional planning effort to ensure greater flexibility and water supply security over broader areas. They are also exploring opportunities for additional federal funding assistance that may result from the October 2010 U.S. Environmental Protection Agency (EPA) announcement of a new drinking water and drinking water sustainability policy. And the project may be eligible for U.S. Department of Agriculture Rural Development or U.S. Army Corps of Engineers funding. Repaying any loans that may be required to implement the preferred alternative will have to be funded by customers, as will any increased operating and maintenance costs. Rate studies will be essential to ensuring that these costs are shared equitably between current and future customers.

While the engineering and rate studies are being done and funding is being sought, Portland and White House should be working out the details of the water purchase agreement they will need to implement the preferred alternative. The existing contract between White House Utility District and Simpson County Utility District (Kentucky) could serve as starting point for their discussions.

As a final note, the U.S. Army Corps of Engineers, one of the partners in this study, is engaged in a water availability study to determine the extent to which water utilities and industries using Old Hickory Lake as their source are adversely affecting the authorized purposes of the lake or relying on storage in upstream reservoirs where the Corps charges for water supply reallocations. In the meantime, there is a moratorium on new intakes and increased withdrawals. This should not be an impediment to moving forward on the preferred alternative; staff at the Corps' Nashville District have indicated that they are prepared to consider, case by case, proposals for new or increased withdrawals from Old Hickory Lake that carry the support of TDEC's Division of Water Supply, and other federal or state agencies that may be asked to provide funding for those projects.

Chapter 1. Description of the Study Area

1.1 Introduction

Situated between Nashville and the Kentucky state line, the North Central Tennessee study area comprises most of Sumner County and the eastern section of Robertson County. The study area's location allows access to a very reliable surface water supply source: Old Hickory Lake on the Cumberland River. Water for domestic and industrial use is produced by the area's three major water systems: Gallatin Public Utilities, Portland Public Works Department, and White House Utility District. Two smaller utilities in the study area (Castalian Springs-Bethpage Water Utility District and Westmoreland Public Works Department) have no water supply source of their own and provide water to their customers by purchasing finished water from Gallatin. Except for Portland, which uses its interconnections with Westmoreland and White House only in emergencies, the water systems in the study area are part of a regional system that is interconnected and shares a single water source.[3]

The study area's location allows access to one of the most reliable surface water supply sources in the state: Old Hickory Lake on the Cumberland River. Currently, Portland is the only water utility in the study area that does not rely exclusively on Old Hickory Lake. Instead, it takes most of its water from West Fork Drakes Creek, supplementing it with water from Portland City Lake when the flow in West Fork Drakes Creek is insufficient to meet its needs. Portland has considered a number of options to improve water supply security and accommodate growth in the area.

The purpose of this study is to identify and evaluate alternative methods for meeting demand so that all of the water utilities in the study area may have continued access to sufficient, clean water through 2030. Properly assessing the suitability of potential water supply sources requires a sound understanding of the area's geography, ecology, population, land use and development patterns, and water utilities. This chapter lays that groundwork for the North Central Tennessee study area.

1.2 The Geography of the Region

Bordered on the north by the Kentucky state line, the North Central Tennessee study area lies partly on the Western Highland Rim and partly in the Central Basin. The Western Highland Rim, comprising all of Robertson County and more than half of Sumner County, is a broad, undulating tableland. Elevations generally range from around 750 feet in the western part of the study area in Robertson County up to 1,080 feet in the eastern part of Sumner County. The Highland Rim's rugged escarpment running west-southwest across Sumner County forms the boundary between the Highland Rim and the Central Basin. Its average difference in surface elevation is 300 to 350 feet. The Sumner County part of the

[3] The Hendersonville Utility District, which relies on Old Hickory Lake as its water supply source, was not included in the study area because its service area is limited to the city of Hendersonville. The district is interconnected with White House Utility District but only to provide emergency service to the portion of Hendersonville that is served by White House.

Central Basin consists of wide, north-south stream valleys and scattered ridges and hills. The valleys range in elevation from 450 feet in their lower parts to 550 feet near the lower slopes of the Highland Rim escarpment. Elevations of the hills and ridges in the basin range around 800 to 900 feet. All of Robertson County and more than two-thirds of Sumner County are in the Cumberland River Basin. The remaining one third of Sumner County, the northeastern part, is drained by the west and middle forks of Drakes Creek of Kentucky, which is in the Barren River Basin.[4] The bounds of the study area are shown in Figure 1-1 below.

North Central Tennessee Regional Planning Study

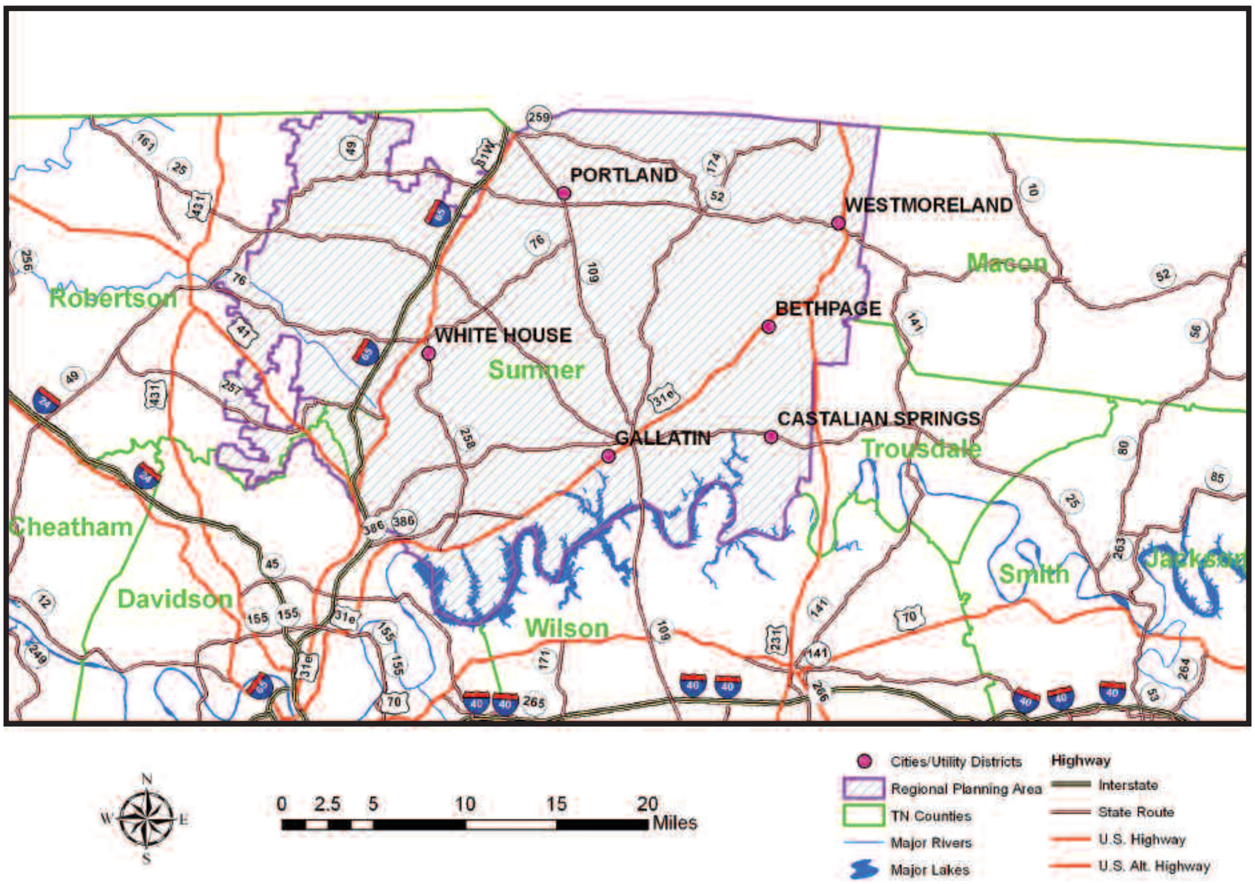


Figure 1-1. The North Central Tennessee Study Area and Its Utilities

Average annual rainfall varies from a minimum of 45 inches in the Central Basin to 50 to 55 inches in the surrounding hilly Highland Rim. The climate of the North Central Tennessee study area is characterized by warm, humid summers, relatively mild winters, and generally abundant rainfall, the majority of which occurs in the winter and spring.[5] The study area encompasses portions of three major watersheds: the Barren River, Old Hickory Lake, and the Red River. The Barren River flows north to Kentucky and is part of the Ohio River watershed. Old Hickory Lake is a U.S. Army Corps of Engineers lock and dam project on the main

---

[4] Tennessee Division of Geology, Department of Environment and Conservation. (2009) *Bulletin 86: Tennessee Topography.*

[5] Office of the State Climatologist at the University of Tennessee, *Climate of Tennessee*, accessed online at http://climate.tennessee.edu/Climate%20of%20TN.pdf, 8 March 2011.

stem ofthe Cumberland River. The Red River originates in Tennessee, drains portions of southern Kentucky, then meets the Cumberland River near the city of Clarksville. These watersheds are not only significant resources for Tennessee, but for the state of Kentucky as well. (See Figure 1-2.)

North Central Tennessee Regional Planning Study

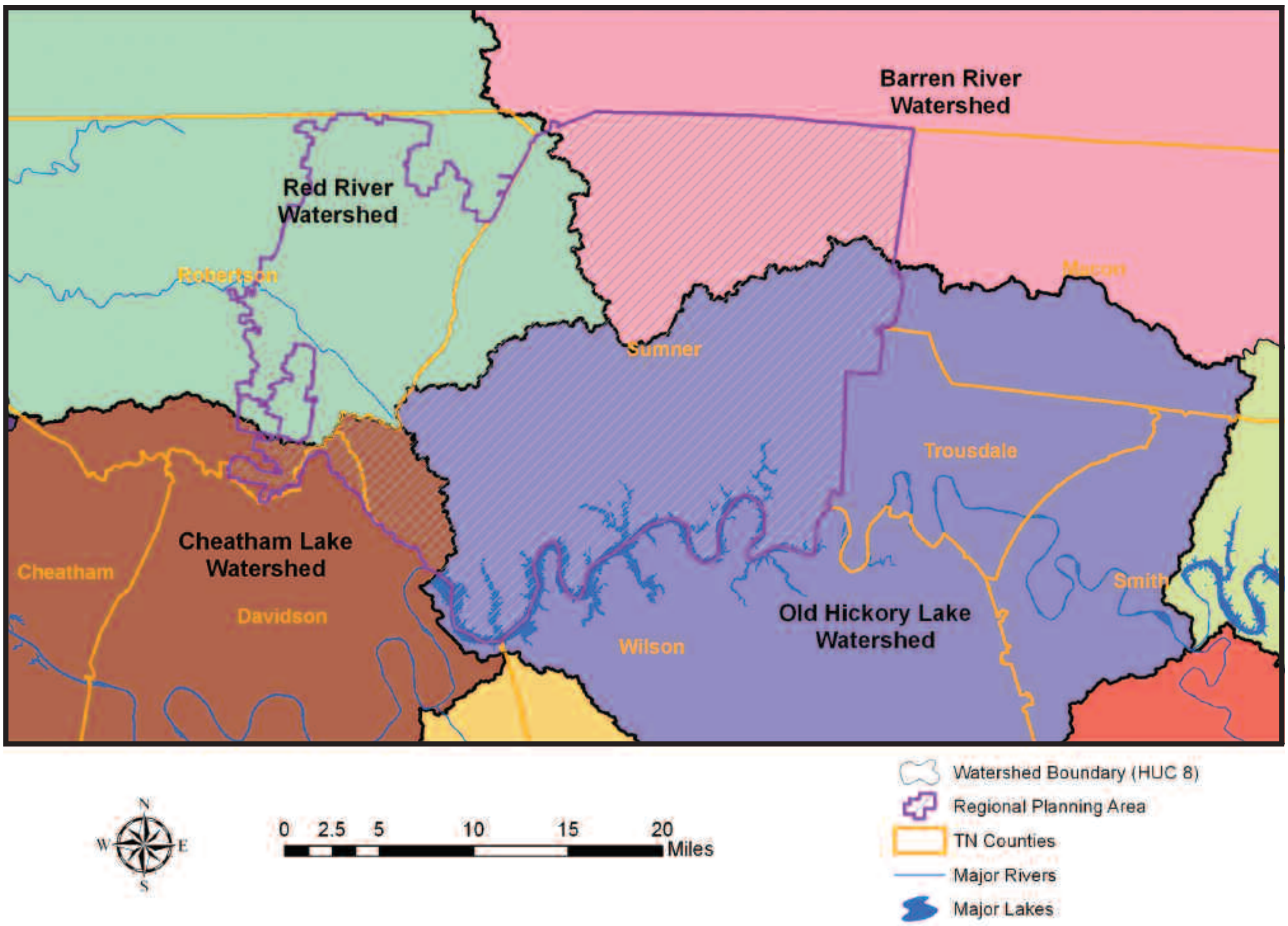


Figure 1-2. Watersheds of the North Central Tennessee Study Area

1.3 The Ecology of the Region

The predominantly limestone geology of the North Central study area historically supported a variety of grassland plant communities, woodlands, and forest types. Today the land cover is a mix of agricultural lands (mainly pasture) and oak-hickory forest and woodland types, with a small percentage in urban development. According to the Tennessee Department of Environment and Conservation's Natural Heritage Program, there are 31 rare species on the list for Sumner County including 4 invertebrate animals, 15 vertebrate animals, 11 vascular plants, and one other type.[6]

[6] Tennessee Department of Environment and Conservation, Division of Natural Areas, Tennessee Rare Animals List, accessed online at http://tn.gov/environment/na/pdf/animal_list.pdf, 27 April 2011. See also Tennessee Department of Environment and Conservation, Division of Natural Areas, Tennessee Rare Plant List, accessed online at http://tn.gov/environment/na/pdf/plant_list.pdf, 27 April 2011.

Several very sensitive native fish and mussel species are located in the smaller rivers, creeks, and streams in the region.[7]

Although the study area includes no large natural areas or parks, there is one small natural area, Taylor Hollow, on the Highland Rim that is owned by the Nature Conservancy. Considered unique to Middle Tennessee because of its biological diversity and undisturbed character, this natural area comprises 173 acres and access is restricted. Bledsoe Creek State Park is located south of the Highland Rim escarpment on Old Hickory Lake. Sumner County's *2035 Comprehensive Plan* discusses the significance of the area's natural and cultural resources and sets a goal to identify and protect critical resources. The plan emphasizes the importance of sustainable development patterns and the management of natural land cover to protect clean, healthy drinking water supplies.[8] Setting these areas aside and protecting them from disturbance preserves the diversity of species in the watersheds and helps shield the water supply from harmful contaminants associated with construction. As noted in Sumner County's land use plan, these strategies also advance good source water protection policies.

Tennessee's water quality standards afford special protection to waters deemed Exceptional Tennessee Waters based on water quality, the value of recreational uses, important ecological characteristics, and outstanding scenery, among others. These characteristics led to the designation of several streams as Exceptional Tennessee Waters, which must be considered when assessing new water supply sources.

1.4 The Population of the Region

Sumner County is the 10th most densely populated county in Tennessee. It grew significantly over the last fifty years, more than quadrupling in size since 1960. Robertson County is currently the 23rd most densely populated county in the state. Although its population remains much smaller than Sumner's, it has begun to grow nearly as rapidly and, in fact, grew more rapidly from 1990 to 2000. See Table 1-1.

Table 1-1. Population Growth in Robertson and Sumner Counties 1960 to 2010

Place	1960	1970	1980	1990	2000	2010
Robertson	27,335	29,102	37,021	41,492	54,433	66,283
10-year Growth Rate	*1.2%*	*6.5%*	*27.2%*	*12.1%*	*31.2%*	*21.8%*
Sumner	36,217	56,256	85,790	103,281	130,449	160,645
10-year Growth Rate	*8.0%*	*55.4%*	*52.5%*	*20.4%*	*26.3%*	*23.1%*

Source: U.S. Bureau of the Census.

[7] Tennessee Wildlife Resources Agency, Tennessee's Comprehensive Wildlife Conservation Strategy, accessed online at http://www.wildlifeactionplan.org/pdfs/action_plans/tn_action_plan.pdf, 27 April 2011.

[8] *2035 Comprehensive Plan: Sumner County's Blueprint to the Future*. Adopted on 27 July 2010 by the Sumner County Regional Planning Commission. Found online at http://sites.google.com/site/sumnerplanning.

The fastest growing city in the study area is White House, which has more than quadrupled in size since 1980. White House straddles the line between Robertson and Sumner counties, and its population is split nearly in half between them. Portland is the second fastest growing city in the study area, nearly tripling in size since 1980, but Gallatin remains the largest city in the area and is growing nearly twice as fast as the state as a whole. The portion of Goodlettsville in Sumner County has nearly tripled in size since 1980, but the city as a whole is less than twice as big as it was in 1980. (See Table 1-2.)[9]

Table 1-2. Population of Cities and Counties in the Study Area Select Years 1980 through 2010

	Year				Growth Rate
	1980	1990	2000	2010	1980-2010
Tennessee	4,591,120	4,877,203	5,689,276	6,346,105	38.2%
Robertson County*	37,021	41,492	54,433	66,283	79.0%
As a Percent of the State Total	0.8%	0.9%	1.0%	1.0%	
Cross Plains	655	1,255	1,381	1,714	161.7%
Millersville (part)	…	119	978	1,463	
Orlinda	382	488	594	859	124.9%
Portland (part)	…	…	…	57	
Ridgetop (part)	1,195	1,130	1,042	1,826	52.8%
White House (part)	1,134	1,705	3,085	4,945	336.1%
Unincorporated	18,641	19,021	24,193	27,321	46.6%
Sumner County*	85,790	103,281	130,449	160,645	87.3%
As a Percent of the State Total	1.9%	2.1%	2.3%	2.5%	
Castalian Springs**	…	…	…	556	
Gallatin	17,191	19,019	23,230	30,278	76.1%
Goodlettsville	1,942	2,782	4,625	5,602	188.5%
Millersville (part)	…	3,330	4,330	4,977	
Portland (part)	4,030	5,731	8,458	11,423	183.4%
Westmoreland	1,754	1,655	2,093	2,206	25.8%
White House (part)	1,091	1,547	4,135	5310	386.7%
Unincorporated	33,012	36,357	42,751	49,288	49.3%
Total for Cities in Multiple Counties					
Goodlettsville***	8,327	10,947	13,780	15,921	91.2%
Millersville	…	3,449	5,308	6,440	
Portland	4,030	5,731	8,458	11,480	184.9%
Ridgetop***	1,225	1,185	1,083	1,874	53.0%
White House	2,225	3,252	7,220	10,255	360.9%

* Some of the populations of Robertson and Sumner counties lie outside the study area.

** Castalian Springs is an unincorporated census district place.

*** Remainder is in Davidson County.

Source: U.S. Bureau of the Census.

[9] Hendersonville is not part of the study area.

1.5 The Land Use and Development Patterns of the Region

As shown in Figure 1-3, 71% of the land in Sumner County is timberland, agricultural, vacant, or covered by water. Public and semi-public lands, which consist of mostly undeveloped public parks, comprise only 2% of the area. Residential land makes up nearly 20% of the county. Most of the remaining 7% is used for commercial, industrial, utility, or transportation purposes; the use is unknown for 2.4% of the land in the county.

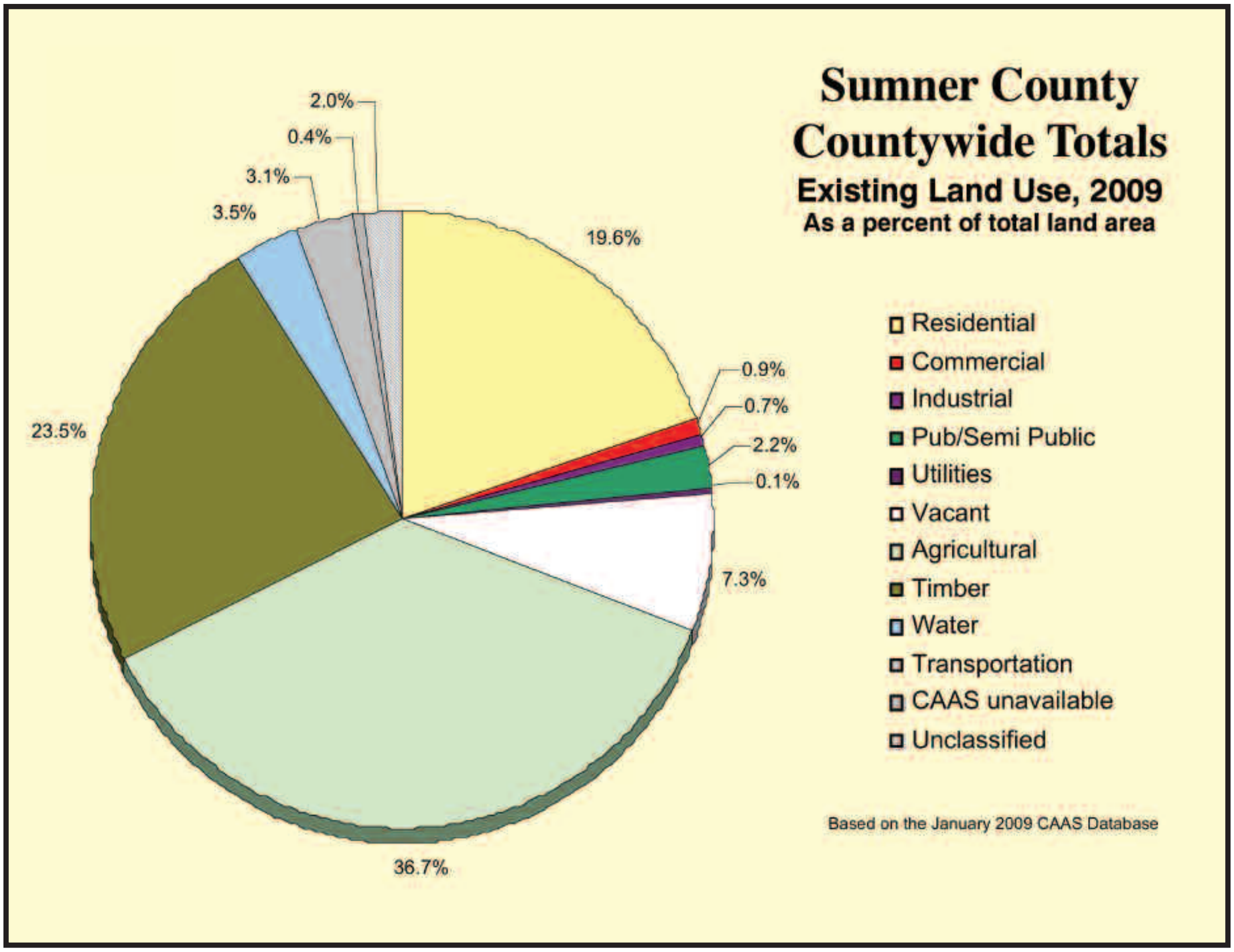


Figure 1-3. Existing Land Uses in Sumner County

Source: Tennessee Department of Economic and Community Development, Office of Local Planning Assistance, 2009.

When suburban development started to expand outside of Nashville and Davidson County in the 1950s, land use in Sumner County was predominantly agricultural. According to the Tennessee Statistical Abstract, Gallatin was the largest city in the county in 1960 and had a population of 7,901. The only other incorporated cities were Portland, Mitchellville, and Westmoreland. All were relatively small. Today, development that was once separated by open or agricultural land has become more interconnected as the population has increased. In addition to population growth, a great deal of the industrial growth in the region has taken place in Portland. The city has expanded westerly to the I-65 corridor along state highways 109 and 52, annexing into Robertson County.

The amount of land developed over time and the percentage breakdown by land use category can be derived from property tax data. In 2009, developed land in Sumner County represented 26% of the total land area. Developed land includes residential, commercial, industrial, public, and semi-public land uses and excludes vacant, agricultural, and timber tracts as well as highways and railroad rights-of-way. Table 1-3 shows the acreage for each type of land use in Sumner County in 2009 broken down by the year in which a structure was first placed on it.

Table 1-3. Sumner County Acreage by Decade of Development and by Land Use Type in 2009

	Decade When First Structure Was Built*								
Land Use	**Before 1950**	**1950**	**1960**	**1970**	**1980**	**1990**	**2000**	**Unknown**	**Total**
Commercial	205	105	418	302	586	492	763	165	3,036
Industrial	38	60	353	519	565	610	325	4	2,474
Public/Semi-Public	266	18	41	139	101	61	121	7,497	8,013
Residential	4,767	2,816	6,349	9,789	10,072	12,091	12,932	9,980**	68,796
Unclassified	1,358	381	798	839	830	1,152	690	1,542	7,590
Unavailable								73	73

* Decade of development is based on the year recorded for the oldest existing structure on the parcel.

** Of the nearly 10,000 residential acres for which an actual year built is not reported, 76% (7,626 acres) have one or more mobile homes located on the property. For this reason, they are included in the residential category. The remaining 24% (2,353 acres) of the residential area with no actual year built reported is comprised of developed lots with ancillary structures or uses such as garages, pools, or pool houses on separate lots.

Source: Tennessee Department of Economic and Community Development analysis of data from the Division of Property Assessment, Tennessee Office of the Comptroller.

As shown in Table 1-4, all governmental entities in the study area have a planning commission and have adopted subdivision regulations and zoning ordinances—a clear indication that each government has the ability to plan for future population and development and to link the planning process to water supply planning to assess long-term water needs. Some governments in the area have long-range plans. Those plans may include sections on water supply and growth issues and may influence policy decisions.

Table 1-4. Status of Planning in the North Central Study Area, 2010

County/City	Planning Commission	Long-Range Plan	Subdivision Regulations	Zoning
Robertson Co.	Yes	No	Yes	Yes
Sumner Co.	Yes	Yes	Yes	Yes
Cross Plains	Yes	No	Yes	Yes
Gallatin	Yes	Yes	Yes	Yes
Millersville	Yes	Yes	Yes	Yes
Portland	Yes	Yes	Yes	Yes
Orlinda	Yes	No	Yes	Yes
Ridgetop	Yes	No	Yes	Yes
Westmoreland	Yes	Yes	Yes	Yes
White House	Yes	Yes**	Yes	Yes

* Based on local interviews.
** Includes only the Sumner County portion of the city.
Source: Tennessee Department of Economic and Community Development, Office of Local Planning Assistance, 2010.

Traditionally, local planning departments and commissions are concerned mainly with the arrangement of the land uses across the community and regulating new development. While long-range plans sometimes do (and always should) examine the ability of water and wastewater treatment plants to meet future demands, the adequacy of the supply source is rarely considered. Yet the importance of planning for future water supplies cannot be overstated. In the absence of local government planning, all responsibility for planning for future water supplies falls to the utilities that provide the water, and there is no formal coordination between the providers and the governments. While all utilities have that responsibility even with government planning, the lack of government involvement means that development is not linked to an essential planning process.

1.6 The Utilities of the Region[10]

There are three major water utilities in the study area. Two smaller water utilities purchase finished water from the major utilities and are dependent on them for the water they distribute in their service areas. All three of the major utilities have developed their own raw water sources and have the capacity

[10] *Water Resources Regional Planning Pilot Study for North Central Tennessee, Phase I,* prepared by the U.S. Army Corps of Engineers District, Nashville Corps of Engineers, in conjunction with the Tennessee Department of Environment and Conservation. March 2009.

to meet drinking water quality standards. Over time and through experience managing periods of drought, the three systems have developed significant interconnections for sharing water resources during summer shortages and emergencies.

- Gallatin Public Utilities provides water to more than 13,000 residential, business, and industrial customers [11] in the city of Gallatin and the surrounding area in Sumner County. Gallatin is the main wholesale water seller to Castalian Springs-Bethpage Utility District, which has close to 3,800 customers, and to Westmoreland, which has nearly 1,500 customers. Gallatin also sells water to White House Utility District during the summer. Gallatin is located in the Cumberland River Basin.

- Portland Public Works Department operates the city's water and wastewater systems. It serves its own residents as well as portions of northwest Sumner and northeast Robertson counties.[12] Portland has approximately 6,600 customers. Its service area lies partly in the Cumberland River Basin and partly in the Barren River Basin.

- White House Utility District is one of the largest water and sewer utilities in the state, serving a population of 76,500 with nearly 29,000 connections over a 600-square-mile area that includes portions of Sumner, Davidson, and Robertson counties. The largest water district in the state by geographic area, its service area extends from White House north toward Portland, south toward Gallatin and Hendersonville, and west into the eastern portions of Robertson County. White House sells water wholesale to Simpson County Utility District in Kentucky. White House purchases water on peak use days during the summer from Gallatin and from Springfield in Robertson County. White House Utility District is located in the Cumberland River Basin.

Table 1-5 on the next page shows average withdrawals by source, as well as average purchases and sales between water systems in the North Central study area.

---

[11] The number of customers is not the population served. Rather it is based on metered water sales, including households, which may have multiple residents.

[12] http://www.cityofportlandtn.gov/ContentPage.aspx?WebPageId=14830&GroupId=3443. Accessed on 14 September 2010.

Table 1-5. Water Withdrawals, Sales, and Purchases in the North Central Study Area*

	Withdrawals		Purchases		Sales	
Water System	**Source**	**Average Withdrawal** (million gallons per day)	**From**	**Average Purchase** (million gallons per day)	**To**	**Average Sale** (million gallons per day)
Gallatin	Old Hickory Lake	7	None		Castalian Springs-Bethpage U.D. Westmoreland White House U.D. *(summer)*	0.861 0.4 1**
Portland	Portland City Lake West Fork Drakes Creek 1.5 *(2 months/year)*	0.5 *(2 months/year)* 2.0 *(10 months/year)*	None***		None	
White House U.D.	Old Hickory Lake	10	Gallatin *(summer)* Springfield *(summer)*	1** 0.25	Simpson County U.D., Kentucky *(summer)*	1.6
Castalian Springs-Bethpage U.D.	None****		Gallatin Hartsville Westmoreland	0.861 0.0167 0.0174	None	
Westmoreland	None****		Gallatin	0.4	Castalian Springs/Bethpage U.D.	0.0174

* As reported by the utilities.

** Up to one million gallons per day on peak usage days.

*** Has emergency connections to Westmoreland and to White House Utility District, but does not routinely buy water from either.

**** Purchases finished water from water systems whose source is Old Hickory Lake.

1.6.1 Water Supply Sources

Table 1-6 lists the water supply sources for the three major utilities in the North Central Tennessee study area. The usable storage capacity of Portland City Lake is 88.6 million gallons based on documents from Tennessee's Safe Dams Program and verified by hydrographic surveys of the lake performed for this study. Usable storage is the amount of water available given the depth of the water supply intakes and any contract limitations that may apply.

Table 1-6. North Central Tennessee Water Supply Sources

Utility	Water Supply Source
Gallatin Water Department	Old Hickory Lake
Portland Public Water Department	West Fork Drakes Creek (Primary) Portland City Lake (Emergency)
White House Utility District	Old Hickory Lake

The sale of water between utility districts across basin boundaries listed in Tennessee's Inter-basin Water Transfer Act[13] requires a permit. Two utilities in the North Central study area have inter-basin transfer permits that allow them to sell water to utilities in other watersheds (see Table 1-7).

Table 1-7. Inter-Basin Transfer Permits in the Study Region

Utility	Originating Watershed	Receiving Watershed	Quantity Permitted (million gallons per day)
Gallatin Public Utilities selling to Westmoreland	Lower Cumberland River	Upper Cumberland River	0.75
White House Utility District selling to Portland and to Simpson County Utility District in Kentucky	Lower Cumberland River	Barren River	1.751

---

[13] Public Chapter 854, Acts of 2000, codified at Tennessee Code Annotated, Title 69, Chapter 7, Part 2. See http://www.state.tn.us/environment/wpc/basin/ for more information.

1.6.2 Water Rates

North Central Tennessee is an area of relatively low water rates and relatively high household incomes. According to a recent survey of water prices in Tennessee,[14] Gallatin adopted new water rates effective July 1, 2009 raising the price for 5,000 gallons inside the city limits to $18.58. This price was still lower than 72% of the 252 water systems included in the 2009 statewide survey. Portland's price of $18.93 for 5,000 gallons inside town limits was lower than 71% of the systems in the statewide survey. The White House Utility District price for 5,000 gallons, using new rates effective April 1, 2009, was $33.10. Using this same statewide survey, based on inside water rates for cities and uniform rates for utility districts, the White House Utility District price for 5,000 gallons was lower than only 25% of the 252 systems included in the survey. This statewide survey of water prices did not include rates charged to customers outside the city or town limits, so there may be an inherent comparison bias against utility districts providing service over expansive geographic areas. Rates charged by municipal utilities to customers outside their city limits are typically higher than rates charged to city or town residents. For this reason, White House Utility District conducted its own statewide survey of those water rates in December, 2008. In that survey, a water quantity of 5,394 gallons was selected for statewide comparisons. The White House Utility District April 1, 2009, price for 5,394 gallons was $35.27, which was lower than 52% of the 298 water systems included in that survey.

Based on data from 2009, median household incomes are relatively high in the North Central Tennessee study area. Only two Tennessee counties, Williamson and Wilson, have higher median household incomes than Sumner County. Robertson County's income ranks a healthy 9th among the state's 95 counties. Water rates by comparison are affordable in the North Central study area, but it must be kept in mind that incomes vary considerably among customers, so keeping rates low is important. See Appendix A for analysis of the affordability of water prices in the North Central study area.[15]

Median Household Income (2009)	
Tennessee	$41,715
Robertson	$50,539
Sumner	$54,012

[14] Allen & Hoshall. 2009. *Tennessee Water and Sewer Rate Survey*. Memphis, TN.

[15] See Appendix A, Table 6, and related text.

Chapter 2. Assessment of Utilities and Current Sources

2.1 Introduction

Residents of the North Central Tennessee study area rely on both groundwater and surface water. Self-supplied users—those who are not served by a public water utility—rely mainly on groundwater. Two of the three major water suppliers rely on Old Hickory Lake. Portland, the smallest of the three and the one situated furthest from Old Hickory Lake, relies mainly on West Fork Drakes Creek, but also uses Portland City Lake when the creek runs low.

During the 2007-2008 drought, Portland was the only water system in the North Central study area that suffered serious shortages. The other utilities in the study area, both Gallatin and White House Utility District, as well as the smaller utilities that buy finished water wholesale, have a much more sustainable water supply in Old Hickory Lake. Because drought is one of the biggest risks to Portland's water supply, and its potential for growth is consequently somewhat constrained, the study team focused mainly on alternatives to ensure that Portland can sustainably meet its water supply needs through the 2030 planning horizon. The U.S. Army Corps of Engineers, Nashville District (the Corps), and the Tennessee Department of Environment and Conservation (TDEC) collected information on the quality and capacity of existing water supply sources.

Firm Yield. A firm yield was calculated for Portland City Lake, the only reservoir other than Old Hickory Lake in the study area. The firm yield of a reservoir is typically defined as the maximum amount of water that could have been delivered every day during the worst drought in recorded history, or the "historical drought of record" leaving no reserve storage. It is ***the most water that could be had during the worst drought***. The firm yield estimates presented in this chapter are based on simulated rainfall and runoff from the watershed and the corresponding reservoir response, given its usable storage capacity.[16,17]

Typically, the firm yield of all of the water sources in the study area would be calculated. However, the firm yield of Old Hickory Lake was not determined because it would require analysis of the entire Cumberland River system, the operation of upstream projects—both lock and dam projects and tributary dam and reservoir projects—and assessment of all of the authorized uses for all of those projects, which was beyond the scope of this study.

Reliable Yield. In addition to the firm yield for the individual reservoirs, the reliable yield for Portland as a whole, which is the only utility that uses more than one source, was determined. The reliable yield was defined as the maximum amount of water that could have been delivered every day during the worst drought in recorded history while preserving 20% of the usable storage in a reservoir or system of

[16] As noted in Chapter 1, usable storage is the amount of water available given the depth of the water supply intakes and any contract limitations.

[17] Two models were used to develop the reservoir yield estimates: The Hydrologic Modeling System developed by the Corps' Hydrologic Engineering Center (see http://www.hec.usace.army.mil/software/hec-hms/ for more information) and the Operational Analysis and Simulation of Integrated Systems (OASIS) model developed by Hydrologics, Inc. (see http://www.hydrologics.net/water_system_evaluation.html for more information).

reservoirs. It is ***the largest amount of water you should plan on being able to withdraw in order to minimize the risk of running out***. The concept of reliable yield accounts for uncertainty in the accuracy of data sources and models, assumptions about climate variability, and potential water quality and treatability issues that may develop during extreme drought. It also reduces the risk that a system would completely deplete its resources in the event of a drought more severe than the worst drought on record.

The **firm yield** of a water supply source is the most that could be taken from it in the worst drought on record.

The **reliable yield** of a water supply source is used for planning purposes to account for uncertainty and minimize the risk of running out of water in the future.

Because usable storage is only one of several factors that go into calculating yield, a 20% reserve does not translate directly into a 20% difference in yield. A different reserve percentage could be used in calculating reliable yield depending on the level of certainty about the accuracy of data and the effects of climate variability, as well as the risk tolerance of the water system and community. For systems with multiple sources, the reliable yield is based on existing operating guidelines and criteria.

Stream Reliability. Obviously, a stream has no storage capacity; the water is constantly moving, and there is no means of reserving it in place. Firm yield cannot be calculated for a stream source because there is no significant storage on which to base the calculations. Instead of a direct yield calculation, the reliability of a stream to provide a certain volume of water may be evaluated by determining the number of days in any given year that the estimated amount flowing in a stream is likely to be less than a specified amount. As with reservoirs, the most severe drought on record is the basis for analyzing the reliability of a stream source.

For systems with multiple sources, the sum of the yield (firm or reliable) of individual sources will usually be less than the yield of the same sources operated as a system. In a system the differing emptying and refilling times for each source can be accounted for. Thus, while some sources may be depleted others may still have water and still others are refilling.

Firm yield represents a theoretical bound of water availability. Reliable yield, however, allows for the uncertainty of data and calculations and is the best target for planning growth and development. Water supply systems cannot be managed with perfect knowledge of how long droughts will last, and they cannot operate with perfect efficiency each day.

2.2 Utilities and Current Sources[18]

Drinking water is provided by utilities, so utilities and their sources must be the focus of any effort to identify unmet needs and alternative ways to meet them. The first step in determining the need for new water supply sources is assessing the capacity of existing sources, utility by utility. With most of the study area served by Old Hickory Lake, which has more than enough capacity to meet current, and projected, water supply needs, yield is an issue only for Portland, which does not rely on Old Hickory Lake.

---

[18] Information about the public water utilities in the study area in this chapter is derived primarily from a series of reports prepared by GKY Associates in cooperation with the U.S. Army Corps of Engineers District, Nashville Corps of Engineers, and Tetra Tech Inc.:
Water Resources Regional Planning Pilot Study for Portland/North Central Tennessee, Phase II, Critical Drought Evaluation. (September 2009)
Water Resources Regional Planning Pilot Study for Portland/North Central Tennessee, Phase II, Existing Sources Firm Yield Analysis. (March 2010)
Water Resources Regional Planning Pilot Study for North Central Tennessee, Phase II, Water Conservation Summary. (August 2010)
Water Resources Regional Planning Pilot Study for Portland/North Central Tennessee, Phase II, Alternative Sources Yield Analysis. (November 2010)
Additional information about the utilities' unaccounted for water volumes and percentages is found in Appendix B.

2.3 Old Hickory Lake—The Region's Main Water Source

Old Hickory Lake, the water source for all of the utilities in the study region except Portland, is one of several lock and dam projects on the Cumberland River and is located in portions of Davidson, Sumner, Wilson, Trousdale, and Smith Counties. The originally authorized purposes of Old Hickory Lake are navigation and hydropower. Additional purposes, added at Congressional direction, include recreation, fish and wildlife, and water quality. Although storage space is not allocated for water supply, either permanently or temporarily, water is withdrawn for municipal and industrial purposes.

The average storage capacity of Old Hickory Lake is 136,850 million gallons (420,000 acre-feet). Its minimum and normal tail-water surface elevations are 382 feet and 385 feet, respectively. Minimum and normal headwater surface elevations are 442 feet and 445 feet. The water surface elevation behind Old Hickory Dam is normally maintained within the hydropower pool limits (442 to 445 feet), and all normal releases are made through the turbines. Flood flows pass through gates atop the 355-foot long spillway. Current consumptive water supply use from Old Hickory Lake is about 39 million gallons per day. This is a small fraction of the historical average minimum flow required to support the authorized purposes of Old Hickory Lake, which has been around 5,844 million gallons per day.

As with all lock and dam projects, Old Hickory Lake does not store water long term. It is operated to pass inflows and maintain depth sufficient for navigation and hydropower production. The vast majority of water passing through Old Hickory Lake is supplied by discharges from tributary reservoirs upstream. For these reasons, any evaluation of the yield of Old Hickory Lake would require studying the entire Cumberland River system and the operation of upstream projects to ensure that all of the purposes for which those projects were authorized would not be affected. Such a study would involve technical, legal, and policy considerations that are beyond the scope of this regional water supply study.

2.3.1 Gallatin Public Utilities

Gallatin has two intakes built in 1954 located in the original channel of the Cumberland River before the lake was impounded. The intakes are 13 feet and 28 feet below the normal lake elevation of 445 feet. The withdrawal location for both is just downstream of the South Water Avenue bridge (State Route 109) over the Cumberland River. The original intake, built in 1925, still exists but is not used. Gallatin Public Utilities meets safe drinking water standards.

Gallatin's primary conservation strategies are attention to leakage and unaccounted for water with some educational outreach, but there are no active conservation programs. All meters are manual, and there are separate ones for swimming pools and irrigation, but the pricing is the same as for drinking water. Flushing is metered, and water used to fight fires is estimated. Gallatin Public Utilities' website includes tips on detecting leaks, summertime outdoor watering, and some general household water conservation. Gallatin's unaccounted for water percentage was 21.8% in 2009, well below the state standard of 35% set in October 2010.

2.3.2 White House Utility District

White House draws its water from Old Hickory Lake near the dam. The intake is at the head of a cove just northeast of the dam, not in the main stem of the lake. There is a small park and a marina in the area. The utility district is an approved public water system and meets safe drinking water standards.

According to management, conservation efforts are focused mainly on improving the distribution system and treatment processes. White House's large distribution system (over 1,000 miles of distribution mains), high pressure variations, rocky soils, and breaks in old cast iron and PVC pipes contributed to an unaccounted for water percentage of 50% in 2002, well above the state standard of 35%. Since 2002, White House has succeeded in reducing its percentage to 26.4% by improving its distribution system and the way it's managed.

White House also has some education programs, providing tips for conservation and detecting and preventing leaks on billing statements, a frequently asked questions section on its website, and a link to H2OUSE.org, a water conservation website that offers guidance on the most effective ways for consumers to save water and money. WHUD does not have conservation pricing.

2.4 Portland and Its Water Supply Sources

Portland operates its water supply sources as a system to provide a reliable flow that is greater than can be achieved by the sources individually. Portland draws the majority of its water from West Fork Drakes Creek. Portland City Lake, which lies on a small, spring-fed tributary of West Fork Drakes Creek, is used as an emergency supply when flow in the creek is too low to support withdrawals. This occurs on average for two months during the summer. Both sources are located in the headwaters area of the Barren River watershed. Operated as a system, the two can provide a firm yield of 2.28 million gallons per day. Reliable yield estimates, preserving 20% of the total storage in City Lake during the worst drought in history, are 2.02 million gallons per day with no drought mitigation measures enacted and 2.25 million gallons per day with demand reduction measures in place. (West Fork Drakes Creek and Portland City Lake are further described in the sections that follow.)

Portland has an emergency connection to White House Utility District in the south and west end of its service area and to Westmoreland. As Portland's service area lies outside the Old Hickory Lake watershed, use of those connections depend on the inter-basin transfer permitted by the state. During the 2007 and 2008 droughts, Portland issued a mandatory cutback on water usage and used its emergency connections to White House Utility District. Utility officials evaluated their lake source daily to determine whether declaration of emergency status was necessary. They came close to determining it was an emergency, but ultimately did not.

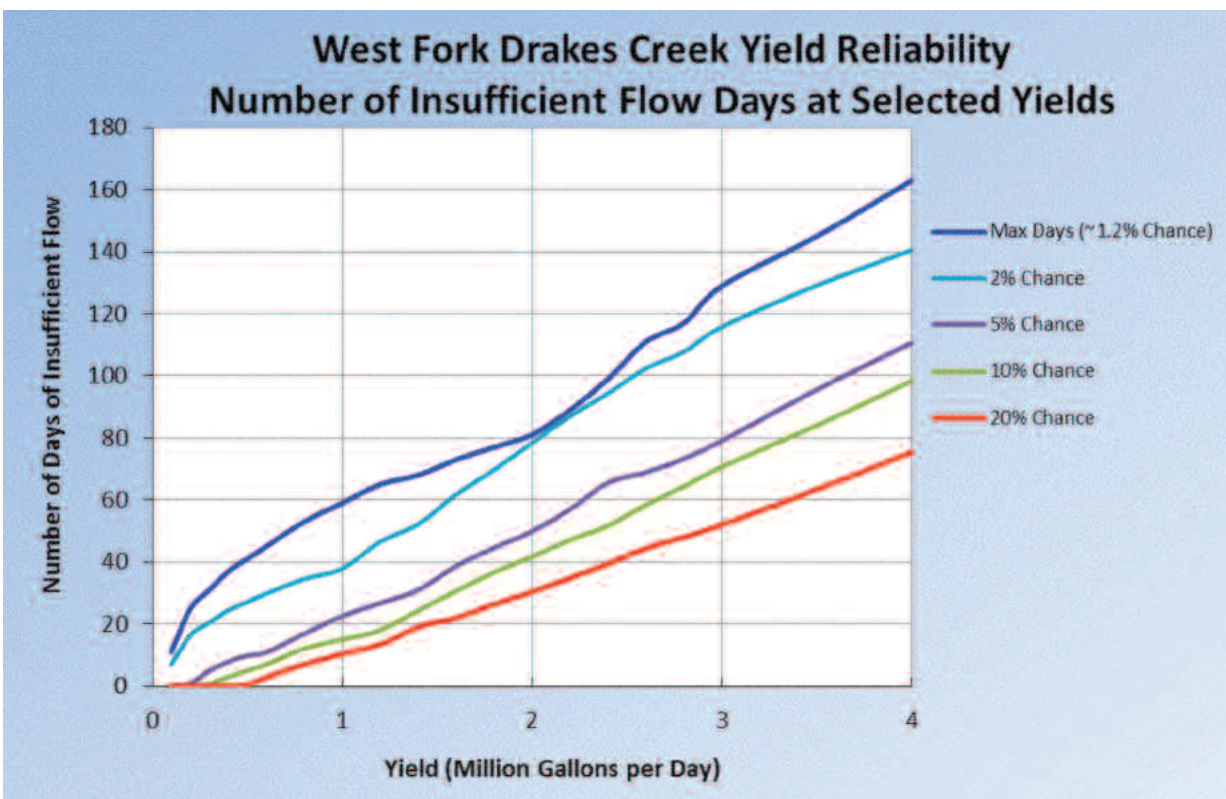
Constraints on expansion of Portland's water system are its limited raw water supply and small-gauge rural lines. Portland has an approved water supply system and meets safe drinking water standards. Portland's conservation efforts are focused mainly on reducing system losses. The city is upgrading to automatically read meters and adding zone meters to aid in identifying leaks and to better understand and control non-revenue water. Water used for flushing and for firefighting is estimated. Portland bills water on a two-tiered, inclining block schedule, but it is not designed specifically to encourage conservation. Its unaccounted for water percentage was 32.7% in 2009, just below the 35% state standard.

2.4.1 West Fork Drakes Creek

West Fork Drakes Creek flows from south to northwest, and though it is not a large stream as it flows past Portland, has enough flow to be used as a water source. This headwater stream is largely unregulated by control structures or dams. As a result, stream flow varies widely over the year. The stream's watershed is about 62.5 square miles and extends southward to hills that make up the northernmost portion of the Highland Rim Escarpment. The watershed is characterized by a mix of land uses, in including residential and commercial development in the central and southern parts of the city and light residential, rural and agricultural uses in the central and eastern portions of the watershed. The more southern portions of the watershed—the headwaters area—have similar land uses, but a significant portion of that area is forested. A tributary to West Fork Drakes Creek has been identified as impacted by impoundment, but West Fork Drakes Creek itself is not impaired.

Portland's intake is roughly 2.5 miles northeast of downtown; its average daily raw water withdrawal is approximately 2 million gallons per day. Figure 2-1 plots various risk levels, indicated by the colored lines, and the number of days that West Fork Drakes Creek will not have sufficient flow to yield between 0 and 4 million gallons per day. As shown by that graph, there is a 20% chance (red line) that the stream will not yield 2 million gallons for about 30 days in any given year. There is a 2% chance (light blue line) that it cannot yield 2 million gallons for 75 days of the year. As the required yield increases, the number of days that stream flow is likely to be insufficient to meet that need likewise increases. The worst case, based on the driest period on record in the area, is depicted by the dark blue line. Based on that record, the maximum number of days in any year the stream would not provide 2 million gallons is 80 days. If 3 million gallons were needed, then the maximum number of days the stream could not provide that amount would increase to 130, and at 4 million gallons per day, the number of days of insufficient flow would be more than 160.

Figure 2-1. Yield Reliability of West Fork Drakes Creek



2.4.2 Portland City Lake

Portland's other water source, which serves largely to supplement the yield of West Fork Drakes Creek, is a small impoundment named City Lake. The lake's watershed is quite small, slightly more than one square mile, and drains to the east. Development in the area is mixed with farms and low to medium residential densities in its western portion and forests and fields closer to the lake. The lake itself is roughly 24 acres in size and about 28 feet deep. Its overflow spillway is uncontrolled. Its capacity, according to TDEC's Safe Dams Program, is 88.6 million gallons, and its average inflow is about 1.1 million gallons per day based on the precipitation record for January 1, 1928, to July 31, 2009, and hydrologic models.

Portland City Lake's firm yield was evaluated as though it were a constant use water supply reservoir. The critical drought period began in April 1963, reached its peak in March 1964, and lasted approximately 11 months. The lake's firm yield–the greatest amount of water the lake would have provided during that drought—was estimated at 417,000 gallons per day.

Chapter 3. Projected Water Withdrawals and Unmet Needs

3.1 Introduction

Understanding and anticipating current and future water needs is essential to effective water supply planning. Water supply systems that are too small can limit economic development. Systems that are too large can be costly and wasteful. Even if grants can be acquired for infrastructure improvements, the customers of the utilities will have to pay the cost of operating and maintaining them. If water use doesn't grow fast enough to generate sufficient revenue to pay these costs at current rates, the rates may have to be raised, which means existing customers will be paying for growth.

Future water supply needs can be projected based on current raw water withdrawals and population growth rates. Current water withdrawals for the study area were derived from two sources: monthly operation reports and water system surveys submitted by the utilities to the Department of Environment and Conservation. Population projections for the study were based on the work of the University of Tennessee's Center for Business and Economic Research (CBER). CBER is the State Data Center for the U.S. Census Bureau and routinely projects population growth for counties and cities.[19] Their most recent projections are available through 2030, which matches the study team's 20-year planning horizon. Like all projections, these include some amount of uncertainty. Actual population counts for every city and county are made only once every ten years; in between, populations are estimated. When these projections were made, the latest estimates did not include the effects of the recent economic downturn, which introduced more uncertainty. Utility managers and planners in the study area will want to review them, customize them to their service areas, and update them as time goes by and conditions change. They will want to be especially mindful of the possibility that growth will be higher or lower than these projections suggest.

3.2 Population Projections

The North Central study area includes most of Sumner County and the eastern part of Robertson County. Population projections for the service areas of the utilities in the study are not available; consequently, projections for the utilities had to be based on those for the counties in which they lie. Like much of Middle Tennessee, Robertson and Sumner counties have experienced considerable growth over the past decade and are expected to continue to grow faster than the state as a whole through 2030. From 2000 to 2010, Sumner County's population grew 23.8%; it is expected to grow 31.9% from 2010

[19] For more information about the population projections, see *Population Projections for the State of Tennessee: 2010-2030*, a joint publication of the Center for Business and Economic Research and the Tennessee Advisory Commission on Intergovernmental Relations released in June 2009 and published online at http://www.state.tn.us/tacir/population.html.

through 2030. Robertson County is smaller and has grown more slowly in the past, but it is expected to grow more rapidly over the next 20 years. Robertson County grew 21.3% from 2000 to 2010 and is expected to grow nearly 40% larger by 2030. Both Portland and White House are expected to grow even faster than either county, with Portland remaining larger and growing more rapidly than White House. The unincorporated areas of both counties are expected to grow more rapidly than some of their incorporated areas, but based on past patterns, the faster growing unincorporated areas are likely to be annexed by adjacent cities. (See Table 1-1 in Chapter 1 and Table 3-1 below.)

Table 3-1. Projected Population in the North Central Study Area

Year	Actual 2010	Projected 2020	Projected 2030	Growth Rate 2010-2030
Tennessee	6,346,105	6,860,231	7,397,302	16.6%
Robertson County*	66,283	78,938	92,591	39.7%
As a Percent of the State Total	*1.04%*	*1.15%*	*1.25%*	
Cross Plains	1,714	1,928	2,216	29.3%
Millersville (part)	1,463	1,493	1,762	20.4%
Orlinda	859	805	922	7.3%
Portland (part)	57	150	187	228.1%
Ridgetop (part)	1,826	1,927	2,156	18.1%
White House (part)	4,945	5,235	6,262	26.6%
Unincorporated	27,321	33,054	38,423	40.6%
Sumner County*	160,645	190,388	211,946	31.9%
As a Percent of the State Total	*2.53%*	*2.78%*	*2.87%*	
Gallatin	30,278	35,195	39,538	30.6%
Goodlettsville (part)	5,602	5,711	7,609	64.5%
Millersville (part)	4,977	6,916	7,817	57.1%
Mitchellville	189	279	318	68.3%
Portland (part)	11,423	14,123	16,221	42.0%
Westmoreland	2,206	2,854	3,207	45.4%
White House (part)	5,310	6,849	7,814	47.2%
Unincorporated	49,288	58,483	64,368	30.6%
Total for Cities Lying in Two Counties				
Goodlettsville**	15,921	19,651	20,762	50.7%
Millersville	6,440	8,409	9,579	48.7%
Portland	11,480	14,273	16,408	42.9%
Ridgetop**	1,874	2,052	2,299	22.7%
White House	10,255	12,084	14,076	37.3%

* Some of the populations of Robertson and Sumner counties lie outside the study area.

** Remainder is in Davidson County.

Source: U.S. Bureau of the Census, 2010 Decennial Census; Center for Business and Economic Research, University of Tennessee, June 2009.

3.3 Current and Projected Water Withdrawals

The utilities' monthly operation reports were used to tabulate each water system's gross raw water withdrawals, amount of water sold or purchased, and net amount of water used internally. The water system surveys provided information about the amount of total finished water distributed, including water sold to other water-supply systems. The surveys also included the number of accounts and the amount of water billed to residential, commercial, and industrial customers, and the amount used for purposes such as firefighting, line flushing, maintenance, and other public uses or losses. From 2010 to 2030, raw water withdrawals by the three major utilities in the North Central study area are projected to increase from 21.2 to 30.4 million gallons per day, or about 46%, assuming current usage patterns. These withdrawals include water supplied to the two smaller utilities in the study area. The projected increases in raw water withdrawals, totaling 9.2 million gallons per day for the study area, by category are

- finished water sold to residential customers, 3.2 million gallons per day (31% of the total);
- finished water sold to commercial and industrial customers, 2.4 million gallons per day (23% of the total); and
- treatment and non-revenue water, 3.6 million gallons per day (37% of the total).

Table 3-2 provides more detailed projections of raw water withdrawals for the individual utilities in the study area. See Appendix C for further explanation of how they were developed.

Table 3-2. Projected Raw Water Withdrawals by Public Water Systems in the North Central Tennessee Study Area, Actual 2005 and Projected 2010, 2020, and 2030

				Projected					
		Actual 2005		2010		2020		2030	
Utility	Water Supply source	Population Served*	Raw Water Withdrawals (Million gallons per day)	Population Served*	Raw Water Withdrawals (Million gallons per day)	Population Served*	Raw Water Withdrawals (Million gallons per day)	Population Served*	Raw Water Withdrawals (Million gallons per day)
Gallatin Public Utilities	Old Hickory Lake	40,078	6.50	43,445	7.11	53,045	8.92	59,040	10.10
Portland Public Water Department	Drakes Creek and City Lake	14,862	1.86	16,110	2.05	19,671	2.61	21,893	2.99
White House Utility District	Old Hickory Lake	61,459	11.00	66,622	12.00	81,345	15.20	90,537	17.30
Study Area Totals		116,399	19.40	126,177	21.20	154,061	26.70	171,470	30.40

* Estimated based on customer accounts and average household size.

3.4 Projected Unmet Water Supply Needs

Comparing the projected raw water withdrawals to the reliable yield of existing sources (from Chapter 2) produces an estimate of the potential unmet need in the region that takes risk into account. This can be done at a regional level to determine the potential for meeting the study area's needs by sharing water supply sources. In this case, however, Portland is the only utility in the study area that does not use Old Hickory Lake as its source, and consequently, is the only utility that cannot reliably meet its raw water needs. Figure 3-1 compares Portland's projected raw water withdrawals, the estimated reliable yield from its two sources, and its existing treatment plant capacity. Treatment capacity is sufficient to handle projected raw water withdrawals through the planning horizon, but increases beyond that period will likely trigger the state's treatment plant expansion planning requirement. The reliable yield of West Fork Drakes Creek and City Lake, at 2.02 million gallons per day, is approximately equal to current withdrawals and 970,000 gallons per day less than projected withdrawals for 2030 (2.99 million gallons per day). This unmet need does not take into consideration the potential reductions that would be possible with increased conservation and demand management. Even with such measures in place, however, during a reoccurrence of the critical historical drought, Portland may not be able to make sufficient withdrawals from its current raw water sources and needs to develop additional sources to provide at least another million gallons per day by 2030.

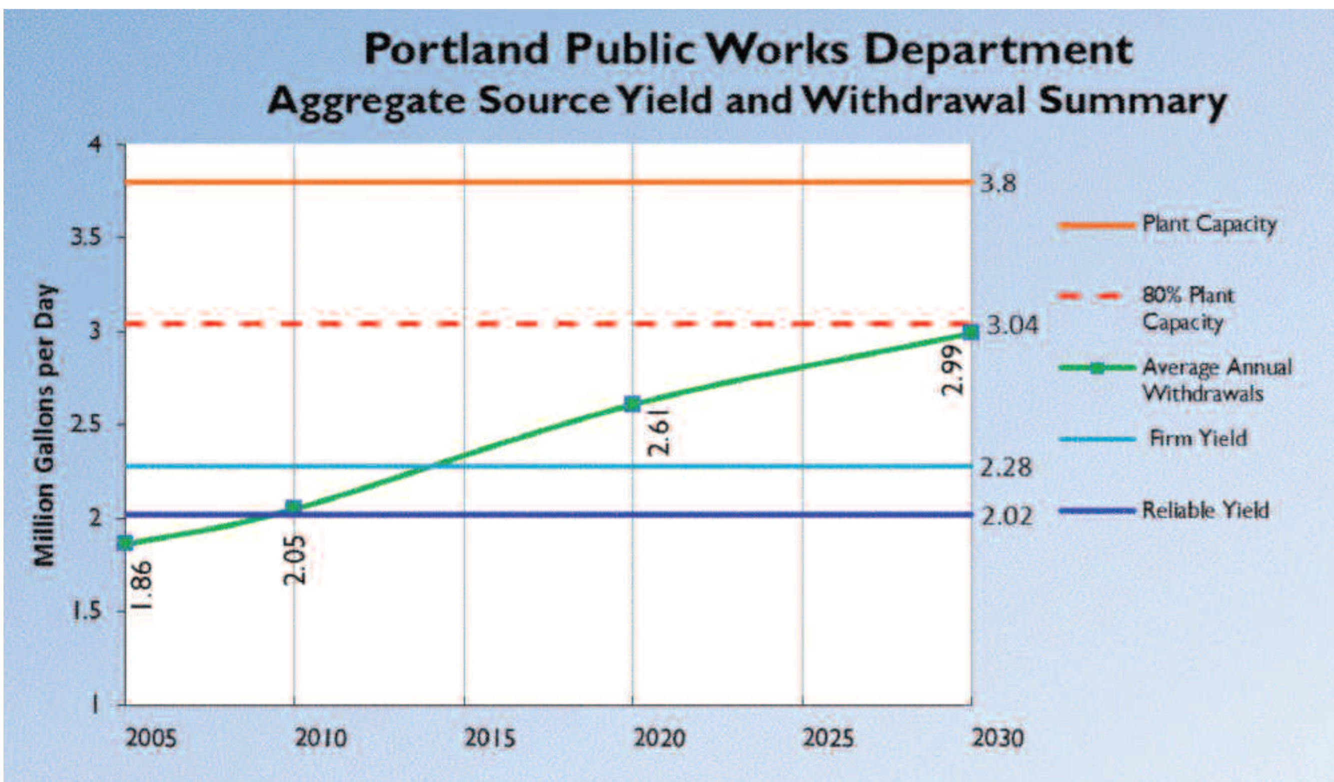


Figure 3-1. Aggregate Source Yield and Withdrawal Summary for Portland

Chapter 4. Identification of Potential Sources and Means of Meeting Projected Needs

4.1 Introduction

The 2007-2008 drought raised serious concerns about the ability of Portland's water supply system to meet increasing customer needs. While raw water withdrawals by the major utilities in the study area are expected to grow from 21.2 million gallons per day in 2010 to 30.4 million gallons per day in 2030, most of that growth is expected to be in the areas served by Gallatin and White House. Because these utilities draw their raw water from Old Hickory Lake, there is little concern that they will be unable to accommodate that growth. But Portland's sources are not sufficient to meet current demand in a severe drought based on the planning standard adopted by the study team. As demand continues to increase in the Portland area, existing resources do not provide an acceptable margin of safety.

A list of potential alternatives to meet Portland's needs was developed with the assistance of stakeholders in the study area through a series of meetings with local government officials, utility managers, and the public. The alternatives fell into three categories:

- conservation and demand management,
- regionalization or water sharing among utilities, and
- development of new sources.

The study team reviewed these alternatives in depth to determine which one or combination would be most likely to meet future needs in the most sustainable way at the least possible cost. The remainder of this chapter gives an overview of the alternatives.[20] Other alternatives may become evident in the future, and changing circumstances may require consideration of them. The process developed by the study team and described in this report should be followed to determine their potential to meet the region's needs in a sustainable, cost-effective manner.

- Three structural alternatives have been considered by Portland:
- Building a new water supply reservoir on Caney Fork Creek
- Drilling wells for groundwater
- Building a raw water pipeline to Old Hickory Lake

[20] For more information about the alternatives, see *Water Resources Regional Planning Pilot Study for Portland/North Central Tennessee, Phase III—Water Supply Alternatives Assessment*, prepared by GKY & Associates and Tetra Tech Inc. in cooperation with the U.S. Army Corps of Engineers, Nashville District (November 2010) and Appendix D.

The third option considered by Portland suggested a fourth, regionalization in the form of a water supply contract with White House Utility District, taking advantage of White House's existing pipeline to Old Hickory Lake. Estimated costs for all four alternatives are summarized in Table 4-1.

Table 4-1. Summary of Estimated Costs for Structural Water Supply Source Alternatives

Alternative	Estimated Cost* (in millions)
Building Caney Fork Creek Reservoir	$ 13.2
Drilling Groundwater Wells	$ 4.0
Building Raw Water Pipeline to Old Hickory Lake	$ 13.7
Regionalization—Contract with White House U.D.	$ 4.7

* Estimated costs include construction and both operational and maintenance costs over the estimated 50-year life cycle of the projects at their 2010 present value based on an interest rate of 4.375% except in the case of groundwater wells. Operational and maintenance costs were not developed for the groundwater alternative because it could not provide sufficient water to meet projected withdrawal needs.

As noted in Chapter 1, the scope of this study is water supply sources, and estimated costs presented here do not include the cost of treating water and delivering it to customers.

4.2 Conservation and Demand Management

Conserving water and managing, even restricting, its use are the main strategies that sustained many Tennessee utilities through the drought of 2007 and 2008. They are common strategies in times of drought, and they are becoming more commonplace in times of normal rainfall because they can reduce costs—both for utilities and for customers—and postpone the need to invest in expensive, new water supply sources and treatment plant expansions. For some utilities, the most effective way to reduce pressure on existing water supply sources is reducing the amount of water lost through leaks and flushing to save both water and money by reducing the amount of raw water that must be treated but can't be billed. As noted in Chapter 2, the utilities in the North Central Tennessee study area are making similar efforts but all could benefit from adopting additional measures to conserve water and reduce current costs, including

- metering all water use, even use that isn't billed, to support leak detection efforts and minimize the amount of water that can't be accounted for;
- pricing water to promote conservation, for example by adopting an inclining block rate schedule and higher rates for landscape irrigation;
- installing landscaping that requires less water with less turf, more mulch, and timed or moisture-sensing irrigation systems;
- replacing old fixtures and appliances that require more water than newer models; and
- reusing or recycling water, using treated wastewater for irrigation, groundwater recharge, etc.

All of the utilities in the North Central study area could benefit from further conservation and demand management. Options such as those listed here are described further and resources for more information about them are included in Appendix E.

Of course, extreme droughts require more aggressive measures as outlined in the study area utilities' drought management plans. For purposes of evaluating alternatives to meet Portland's needs, the study assumed such drought restrictions could reduce projected withdrawals by 20%, bringing the deficit described in Section 3.4 below 600,000 gallons per day. Alternatives were measured against this standard.

4.3 Regionalization—Contract with White House

As noted in Chapter 3, maintaining and improving the ability to share water supply sources is paramount to utilities' ability to meet demand in a drought or as the area grows. Regionalization can extend limited sources to meet projected water supply needs routinely as well as during emergencies. Most of the utilities in the North Central study area are already operating as part of an interconnected region that shares the same source: Old Hickory Lake. Castalian Springs-Bethpage Utility District and Westmoreland buy all of their finished water from other utilities. White House Utility District, which sells finished water to Simpson County Utility District in Kentucky, also buys finished water from Gallatin and Springfield, typically in the summer when demand is unusually high.

Of the many options available for conserving water, leak detection is a logical first step. If a utility does what it can to conserve water, customers will tend to be more cooperative in other water conservation programs, many of which hinge on individual efforts.

Leak Detection and Water Loss Control
National Drinking Water Clearinghouse

Portland is not part of this regional water supply sharing system except to meet emergency needs. Consequently, it is the only utility in the study area that needs a new water supply source to meet demand through the 2030 planning horizon. Because they rely on Old Hickory Lake as their source, either of the other larger utilities in the study area (Gallatin and White House) could meet Portland's needs. Both have small connections to Portland and a history of providing water when Portland's own sources fall short, but neither connection is large enough to routinely meet Portland's growing needs. Existing connections to White House would require fewer upgrades than the connection to Gallatin, which is through Westmoreland. The connection between Gallatin and Westmoreland, though sufficient to meet Westmoreland's needs through the planning horizon, would have to be significantly upgraded to meet the needs of both Westmoreland and Portland.

Description of the Alternative. This alternative involves development of a contract and improved connections between Portland and White House similar to White House's current arrangement with Simpson County Utility District. The contract between White House and Simpson County spells out in detail both the water supply sharing arrangements between the two utilities and the manner in which the cost of developing, operating, and maintaining a system large enough to meet Simpson County's finished water needs are allocated between the two utilities. White House revamped its accounting system to make that possible. White House's treatment plant and its connection to Old Hickory Lake, as well as its connections to Portland, would have to be upgraded, but those upgrades and their costs could be spread over time to meet both utilities' needs as they grow and to minimize the need to increase water rates to finance the alternative. Costs would have to be carefully allocated between the systems to ensure that each system's customers paid only their fair share.

Design of the Alternative. This alternative could be designed in a number of ways, but for purposes of developing an initial ball-park cost estimate, the study team assumed that Portland would continue to operate its own system as it has in the past and that the connection to White House should support transfers of 582,000 gallons of finished water per day at designated drought trigger points. As much as 700,000 to 800,000 gallons were transferred through existing connections during the 2007-2008 drought. Minimum and maximum potential transfer rates were used to estimate infrastructure needs and develop conceptual capital improvements. Routinely transferring 582,000 gallons per day would require about 6,500 linear feet of 30-inch pipe along Center Point Road, 16,000 feet of 24-inch pipe from Tyree Springs to New Hope Road, 26,000 feet of 20-inch pipe from New Hope to Shun Pike, 40,300 feet of pipe from Shun Pike to Mulloy Tank and 12,000 feet of 16-inch pipe from Mulloy Tank to the US 31 connection. In addition, a new tank, two booster stations, and expansion of White House's treatment plant would be needed before 2030.

Potential Costs. The total cost allocated to Portland for improvements in White House's system, including both capital and operating costs, is about $4.5 million. Since some of the infrastructure would also serve other customers, Portland's estimated costs were proportioned based on its share of the total daily flow in a particular section of pipe. This capital cost or "capacity fee" represents a portion of the infrastructure required to withdraw, treat, pump, store, and deliver water to Portland. It should be noted that there are many potential routes for the connection and methods for calculating the capacity fee. Adding operation and maintenance costs incurred directly by Portland for a booster station at the purchase point brings the total to $4.7 million. Estimates do not include the feasibility study costs that may be associated with moving this alternative from planning to design and construction.

4.4 New Source Development

Three new source alternatives were considered: building a new dam and reservoir on Caney Fork Creek, drilling a series of groundwater wells, and building a raw water pipeline to Old Hickory Lake.

4.4.1 Building Caney Fork Creek Reservoir

Initial planning for a new water supply reservoir to serve Portland began in the late 1990s. A site on Caney Fork Creek roughly 750 feet upstream of its confluence with West Fork Drakes Creek was selected, and several dam alternatives at that Caney Fork Creek location were submitted in a feasibility study report. Contractors began work on a preliminary design the following year. That design is the basis for the alternative considered here and for the Aquatic Resource Alteration Permit applied for by Portland in 2007.

Description of Alternative. The dam on Caney Fork Creek would be in a rural area east of Portland. The preliminary design would impound about 483 million gallons at a normal pool elevation of 687 feet. About 468 million gallons would be available for water supply. The proposed normal pool elevation would inundate a surface area of roughly 135 acres. Figure 4-1 shows the location of the proposed reservoir in relation to the Portland's existing water supply sources. Figure 4-2 shows the drainage areas for the proposed reservoir, the existing Portland City Lake, and the West Fork Drakes Creek intake. The 17.3 square mile drainage area for the proposed reservoir lies entirely within the 62.5 square mile drainage area of the existing intake on West Fork Drakes Creek. Discharge from the Caney Fork Creek Dam would be used to improve the reliability of flow at the existing West Fork intake.

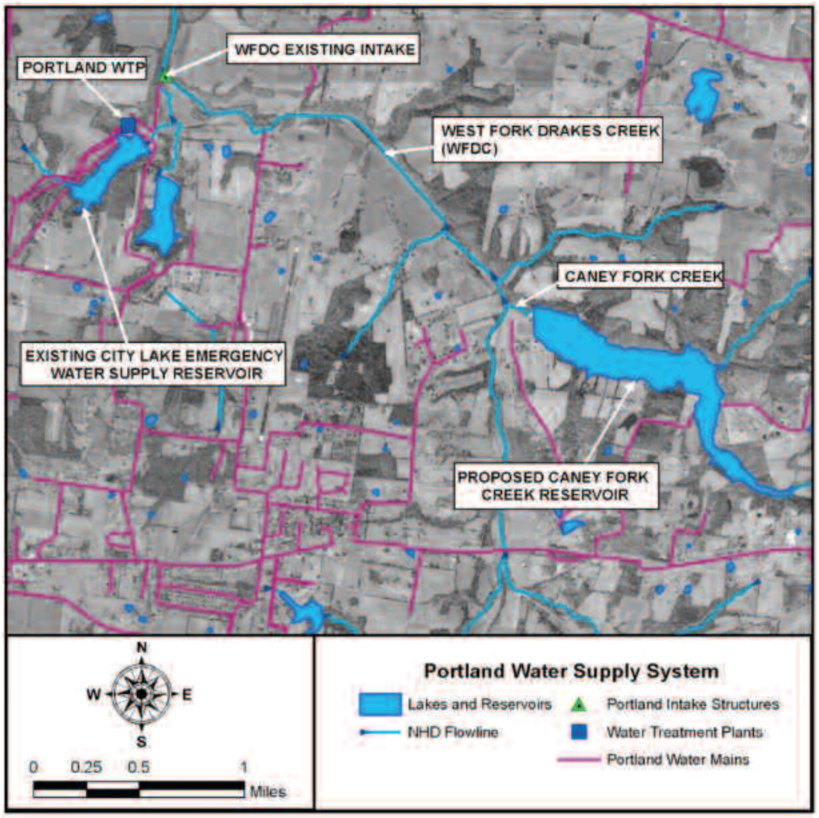


Figure 4-1. Locations of Portland's Existing and Proposed Water Supply Sources

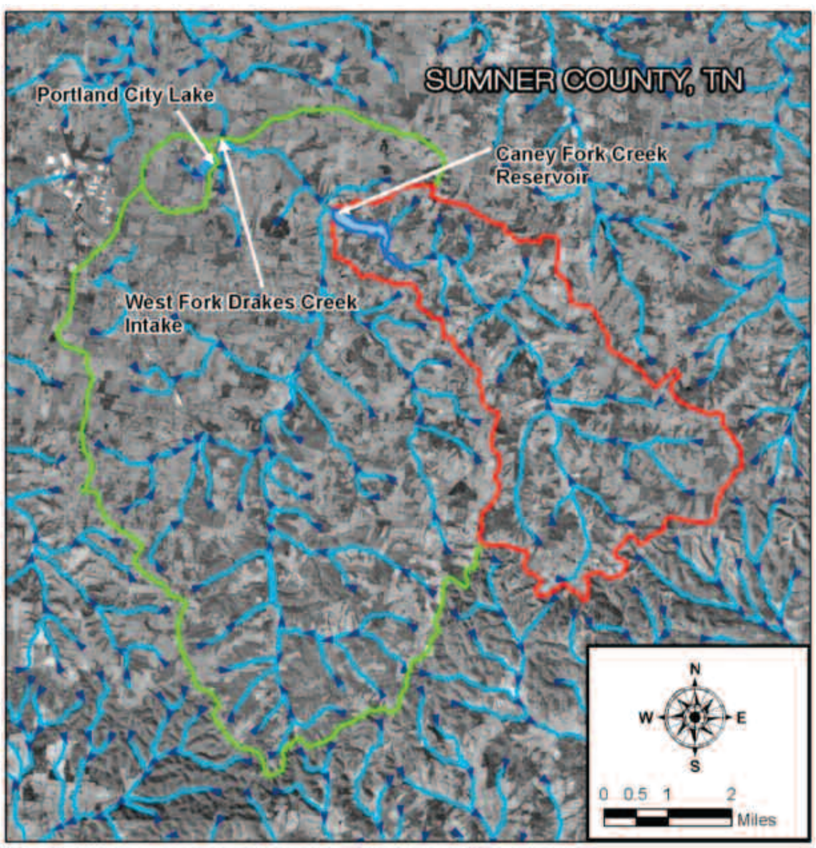


Figure 4-2. Drainage Areas for Portland's Existing and Proposed Water Sources

Design of the Alternative. The dam would consist of a non-uniform, compacted earthen embankment and roller-compacted concrete dam. The roller-compacted concrete section of the dam would include two spillways to control the normal pool elevation. Caney Fork Creek reservoir's primary purpose would be to ensure adequate water supply during low flow conditions in West Fork Drakes Creek. The reservoir as designed would provide a minimum daily release both to maintain environmental conditions in the receiving channel and to meet water supply needs.

Potential Costs. The total investment cost for this alternative is estimated at $13.2 million including the present value of operational costs. The city owns the land required for the lake.

4.4.2 Drilling Groundwater Wells

Development of a groundwater source for Portland was described in a 1979 U.S. Army Corps of Engineers report.[21] For this alternative, Portland would meet future needs by constructing wells and treatment and transmission facilities to supplement its existing system. The city drilled 11 test wells in the area in 1999. The results were disappointing, indicating that limestone formations in the study area are less soluble and restrict ground water movement more than originally thought. The rock formations did not contain sufficient fractures to store large quantities of water. Although a few test wells did have yields of 220,000 gallons per day, they had poor water quality with high sulfur content.

Description of the Alternative. Wells would be located about three miles northwest of Portland in an area identified by the U.S. Geological Survey as having high potential for development of a groundwater source. A well field would be built, and additional wells would be added to meet growing needs.

Design of the Alternative. Because test wells indicated that this alternative could not meet Portland's projected needs, no further design work was done.

Potential Costs. The capital cost of this alternative, based on estimates from the Corps' 1979 report updated to reflect 2010 values, would be $4.0 million. Operation and maintenance costs were not developed for this alternative because it cannot meet Portland's projected needs.

4.4.3 Building Raw Water Pipeline to Old Hickory Lake

A raw water pipeline from Portland to Old Hickory Lake has been proposed to meet Portland's projected water supply needs. As proposed, the pipeline would be capable of delivering 1.0 million gallons per day to Portland's water treatment plant.

Description of Alternative. A raw water pipeline would be built from Portland's water treatment plant to the Old Hickory Lake. The intake for the pipeline would be in the backwater of the lake east of Douglas Bend Road and south of U.S. Highway 31E. The proposed route could follow existing road rights-of-way for approximately 21 miles. This alternative was developed to a conceptual level only with no preliminary design. It is important to note that the 500-foot elevation difference between Old Hickory Lake and the Portland water treatment plant adds significantly to the operation and maintenance costs of this alternative because of the energy required to pump the water up to Portland.

[21] U.S. Army Corps of Engineers. 1979. *Metropolitan Region of Nashville, Tennessee, Urban Study*.

Design of the Alternative. The pipeline would be ductile iron, 10 inches in diameter, and constructed primarily within existing road rights-of-way using conventional, open-cut excavation and installation techniques. Approximately 110,000 linear feet of pipeline, an intake structure, and associated pumps and piping, would be needed. The supply line would follow U.S Highway 31E, Harris Lane, State Route 386, State Route 109, Butler Road, Fountainhead Road, Old Gallatin Road, Tom Ferrell Road, cross-country to Deasy Lane, Old Parkers Chapel Road, cross-country to Portland Lake Road, ending at the existing water treatment plant.

Potential Costs. The estimated cost for the pipeline including construction, engineering, contingencies, and booster stations is approximately $10,950,000. Including the expansion of Portland's water treatment plant brings the total to about $13.7 million. The estimates include operation and maintenance costs, but not the feasibility study costs that would be associated with moving from planning to design and construction.

Chapter 5. Evaluation and Selection of Alternatives

5.1 Introduction

Selecting the best alternative requires thorough study and a fair comparison. Each alternative must be measured against the same criteria. The study team adopted the criteria used in the Duck River Agency's regional water supply study, which involved extensive input from all of the stakeholders and the public, with one modification as indicated below:

- ***Sufficiency***—the ability of the source to support the study area's projected need, in this case, Portland's need for an additional 970,000 gallons per day
- ***Cost***
- ***Implementability***—the presence or absence of known obstacles or challenges
- ***Flexibility***—capacity for phased implementation, drought resistance, and adaptability to changed conditions
- ***Raw and Finished Water Quality***
- ***Environmental Benefits and Impacts***
- ***Other Relevant Factors***—a broader criterion than recreation, which was used in the Duck River study

This chapter describes the study team's two-tiered analysis of the alternatives presented in Chapter 4. Except as otherwise indicated, information used in the analyses presented here is found in the sources listed at the beginning of Chapter 4.

5.2 Tier 1 Criteria and Evaluation

Sufficiency is a threshold criterion that compares yield to raw water needs. If the reliable yield of an alternative is insufficient to supply the projected raw water withdrawal needs of the study area, then there is no need to evaluate it further. The following standards were applied and had to be met for every utility or the alternative was rejected:

- a 20% reserve of usable storage remains in each reservoir in the system for all years of the historical rainfall/drought record and
- no drought plan is triggered more often than once every 7 to 8 years.[22]

Only one of the alternatives described in Chapter 4 failed the sufficiency test. The groundwater alternative could not provide the water that Portland needs and so was not considered further. Usable storage, the first prong of the two-prong sufficiency test applies only to reservoirs, and the one reservoir alternative evaluated (building a dam on Caney Fork Creek) passed it.

Sufficiency was not modeled for the two pipeline alternatives—a direct pipeline from Portland to Old Hickory Lake and a contract with White House Utility District to access the lake through its pipeline—because a pipeline to Old Hickory Lake could be engineered and built to provide the necessary water supply capacity. As noted in Chapter 2, consumptive water supply withdrawals from Old Hickory Lake are currently a small fraction of the average historical minimum flow required to support its authorized purposes. The increased withdrawals for the region through 2030 are an even smaller fraction of the minimum flows. Thus, the study team considered Old Hickory Lake to be capable of providing the raw water withdrawals.

5.2.2 Tier 1: Cost

The Tier 1 evaluation of costs is a qualitative assessment of the estimates for each of the alternatives presented in Chapter 4. Table 5-1 below recaps the cost estimates from Chapter 4.

Table 5-1. Summary of Estimated Costs for Water Supply Source Alternatives that Meet the Sufficiency Requirement

Alternative	Estimated Cost* (in millions)
Regionalization—Contract with White House Utility District	$ 4.7
Building Caney Fork Creek Reservoir	$ 13.2
Building Raw Water Pipeline to Old Hickory Lake	$ 13.7

* Includes both construction costs and operational costs over a 50-year life cycle. Net present values of costs were based on an interest rate of 4.375%.

Contracting with White House Utility District to reach Old Hickory Lake is the least expensive alternative. Estimated costs for the proposed reservoir and direct pipeline alternatives are more than twice as expensive.

[22] The primary modeling tool used to evaluate water supply sufficiency is the OASIS model used to determine reliable yield (see Chapter 2). Details of the analysis, methodology, and results are described further in Appendix F.

5.2.3 Tier 1: Implementability

The implementability of an alternative is a measure of the relative ease with which it can be accomplished in time to meet projected needs. This criterion considers whether regulatory permitting (including environmental considerations), public acceptance, property acquisition, or constructability issues could stymie or delay implementation of the alternative.

Permitting is a large part of implementability. Tennessee dams are regulated by the Safe Dams Section of TDEC's Division of Water Supply, which is responsible for certifying, inspecting, and approving dams, and by TDEC's Division of Water Pollution Control, which is responsible for protecting surface waters. The following permits or documents may be required for any of the alternatives:

- Aquatic Resource Alteration Permit (ARAP) or Section 401 Water Quality Certification for stream alteration from the Division of Water Pollution Control (TDEC)
- Section 404 Permit from the U.S. Army Corps of Engineers (Corps)
- Safe Dams Certificate from the Division of Water Supply (TDEC)
- Stormwater Discharge Permit for the construction site from the Division of Water Pollution Control (TDEC)
- Inter-basin Transfer Permit from the Division of Water Pollution Control (TDEC)

Regionalization—Contract with White House Utility District. There are no outstanding implementability concerns with regard to improving interconnections, installing new pumps, or constructing the additional storage tanks needed to increase water transfers to Portland from White House. Structure, roadway, land, and environmental impacts would be consistent with those of any routine infrastructure improvement. Implementability concerns could be associated with the need for greater cooperation and coordination between the utilities or in contract negotiation. Because White House has successfully negotiated a similar contract with Simpson County Water Utility in Kentucky, there should be no reason that the legitimate concerns of both parties could not be resolved in this case as well. Many Tennessee utilities have similar contractual arrangements. This is the only alternative that could be implemented immediately to supplement Portland's current capacity; however, although existing connections have been used in emergencies, based on information provided by White House, they need to be upgraded to support routine transfers.

Other implementability concerns stem mainly from the current moratorium on new water supply intakes and increased withdrawals from existing intakes at Old Hickory Lake. The moratorium was issued by the Corps because of concerns that existing withdrawals from the lake may be adversely affecting the authorized purposes of the lake. The moratorium will allow the Corps to assess these concerns and determine, consistent with the Water Supply Act of 1958, whether and how much to charge for water supply withdrawals from the lake. Charges for water supply withdrawals, if instituted, may affect water rates across the region and will affect the costs associated with this and any other alternative involving withdrawals from the Cumberland River. This concern applies equally to the direct raw water pipeline discussed below.

Building Caney Fork Creek Reservoir. This alternative raises several implementability concerns related both to the area that would be inundated by the new lake and the effect of the dam on downstream waters. The proposed lake will flood agricultural land, public land, roads, timberlands, and wet-

---

[23] Rules of the Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Rule 1200-4-3-.06, available online at http://state.tn.us/sos/rules/1200/1200-04/1200-04-03.20110531.pdf.

lands. Approximately 640 feet of Martin Road, including the bridge over Caney Fork Creek, as well as an unnamed farm road, would be inundated. The National Wetlands Inventory indicated that about 1.85 acres of wetland area would be inundated.

Even more importantly, Caney Fork Creek is an Exceptional Tennessee Water because of the extraordinary biological diversity of the aquatic life in the stream. Under Tennessee law,[23] degradation of Exceptional Tennessee Waters cannot be authorized unless (1) there is no reasonable alternative to the proposed activity that would render it non-degrading and (2) the activity is in the economic or social interest of the public. When Portland applied for an Aquatic Resource Alteration Permit for the dam in 2007, TDEC determined that the proposal did not establish that there was no reasonable alternative to degrading the stream. This is a highly significant implementability concern because, as described in this chapter, there are other reasonable alternatives.

Building Raw Water Pipeline to Old Hickory Lake. Implementability concerns about the proposed 21-mile long raw-water pipeline from Portland to Old Hickory Lake stem mainly from the moratorium on new water supply intakes at Old Hickory Lake and the potential for future water supply charges. This is the same concern discussed more fully in relation to contracting with White House Utility District, which draws its water from Old Hickory Lake. Lesser implementability concerns include the difficulty of obtaining easements or purchasing property for the pipeline, but these issues would not be unique to this project and should not be difficult to overcome. Most of the proposed project construction is along existing road right-of-ways, and no significant environmental impacts are anticipated.

5.2.4 Flexibility

The flexibility of an alternative is a matter of whether it can be implemented in phases, with costs spread over time, while still reliably meeting projected regional water supply needs. This criterion also considers an alternative's resistance to drought.

Regionalization—Contract with White House Utility District. The regionalization alternative is perhaps the most flexible. Existing infrastructure can be improved as demand grows, and new infrastructure can be brought on line as needed. If need be, fairly large volumes of water can be provided immediately through existing interconnections as they were in 2007 and 2008, although as already noted, those connections would need to be upgraded to support more regular transfers. Capacity can be expanded if the actual growth in demand is greater than projected, for example if a new industry locates in Portland's service area. Moreover, the allocation of costs between customers of Portland and of White House can be adjusted to meet future needs as each area grows. Projecting growth is always difficult, but it is even harder given the current, very uncertain economic conditions. In contrast to the other alternatives, with this alternative, Portland would not have to pay in the immediate future for capacity that it may not need for two decades or more.

Building Caney Fork Creek Reservoir. The proposed new reservoir would have to be built in a single phase and so is not flexible in that respect. It is also limited in its capacity to support future growth. While the reservoir could reliably meet projected needs through the 2030 planning horizon, there is a point beyond which Portland may grow that could not be supported by the proposed reservoir, largely because of its relatively small watershed.

Building Raw Water Pipeline to Old Hickory Lake. A pipeline to the Cumberland River, with its associated pumps and storage tanks, cannot be phased in or built in increments. A second pipe could, however, be added later to increase capacity. There is some flexibility in determining a route for the pipeline. The connection to Old Hickory Lake makes this alternative highly resistant to drought and allows for capacity expansion beyond the current projected need.

5.2.5 Tier 1 Evaluation Summary

As Table 5-2 below indicates, the groundwater alternative could not provide sufficient capacity and so was eliminated from further study. The new reservoir was evaluated further, but was eliminated in the Tier 1 evaluation mainly because it is unlikely that a permit could be approved given the remaining alternatives and its high cost and inflexibility are also factors that weigh against it. Only two alternatives warranted Tier 2 evaluation.

Table 5-2. Tier 1 Evaluation Summary

Alternative	Sufficiency	Cost	Implementability	Flexibility
Groundwater	-	*	*	*
Regionalization—Contract with White House Utility District	+	$$	+/-	+
Building Caney Fork Creek Reservoir	+	$$$	-	-
Building Raw Water Pipeline to Old Hickory Lake	+	$$$	+/-	-

* Alternative failed to meet the sufficiency standards and was eliminated from further evaluation.

5.3 Tier 2 Criteria and Evaluation

Tier 2 criteria included examination of the storage remaining in a critical drought—an extension of the sufficiency analysis; refinement of costs; and consideration of the quality of the raw and finished water for the alternative, any potential environmental benefits and impacts, and any other factors relevant to a decision. Other factors included whether an alternative could serve multiple purposes, such as releases from a dam that could improve the stability of downstream resources or the recreational attractiveness of the area; whether an alternative allows for economic growth or provides for the study area beyond the planning horizon; and whether the alternative makes-financial sense for the utilities and their customers. The study team also considered any updates or additional details obtained on the Tier 1 criteria.

Table 5-3 summarizes the evaluation. It is important to note that this study did not have the resources to completely answer many of the Tier 2 questions; however, enough information was available to eliminate some alternatives and recommend others for more detailed study.

Table 5-3. Tier 2 Evaluation Summary

Alternative	Cost (millions)	Water Quality	Environmental Benefits or Impacts	Other Factors
Regionalization—Contract w/White House Utility District	$4.7 to $23.5	Potential Improvement	Slight impacts from infrastructure construction	Requires Cooperation Between Entities
Portland Raw Water Pipeline to Cumberland River	$13.7 to $27	No Anticipated Change	Slight impacts from pipeline construction	High Maintenance Costs for Amount and Frequency of Use

5.3.1 Storage Remaining During Critical Drought

For the Tier 2 analysis, the study team considered a range of water quantities to better assess the relative cost of the two alternatives that came out of the Tier 1 analysis. On the low end, the new source would provide only the minimum amount needed by 2030—about 582,000 additional gallons of finished water—as described in Chapter 4. Portland would continue to operate as it does now and supplement its current sources either by purchasing a small amount from White House Utility District or by pumping a similarly small amount of raw water to its current treatment plant from Old Hickory Lake as described in Chapter 4. After reviewing these options with Portland and White House, the study team extended its analysis to include higher usage levels based on various peaks that do not involve the conservation and demand management strategies assumed in its initial analysis. It is important to note that the team endorses conservation and demand management as an essential water- and money-saving strategy. These larger volumes of water were evaluated in order to determine whether and where the costs of the two alternatives might converge. Some of these volumes require increases in capacity far larger than is required by the amount projected using the method described in Chapter 3 and Appendix C.

Three additional water usage levels were considered by the study team in Tier 2 beyond the need projected in Chapter 3:

- 1.22 million additional gallons per day to meet the U.S. Geological Survey's (USGS) *peak month* estimate with no demand reduction measures
- 2.44 million additional gallons to meet the utilities' own *peak week* projection with no demand reduction measures
- 3.27 million additional gallons to meet the utilities' own *peak day* projection with no demand reduction measures

The latter two estimates, the ones provided by the utilities, are based on higher population growth rates as well as higher water usage levels. None of these three usage estimates involve the demand management measures that are typically implemented during a drought to conserve water. Estimated costs to provide all four water usage levels considered by the study team are presented in Table 5-4.

Table 5-4. Comparison of Estimated Costs to Provide Various Volumes of Finished Water

	Cost (in millions)			
Alternative	**0.58 Million Gallons***	**1.22 Million Gallons****	**2.44 Million Gallons****	**3.27 Million Gallons****
Regionalization—Contract w/White House Utility District	$4.7	$8.9	$18.8	$23.8
Portland Raw Water Pipeline to Cumberland River	$13.7	$15.8	$23.3	$27.0

* Includes operations and maintenance costs for 50-year life cycle; does not include cost of producing finished water.
** Does not include operations and maintenance costs or cost of producing finished water.

All project information available to the study team was conceptual, so cost estimates considered would change if further engineering work were done. And estimates of certain types of costs, including potential real estate costs, were not available. Even so, the cost estimates that were currently available are consistent with the conceptual design stage of project development.

The regionalization alternative is by far the cheapest to implement and the most economically feasible at the withdrawal volumes projected by the USGS for the study team. Costs begin to converge at the very high-end estimate provided by the utilities. It is important to emphasize that the costs shown in Table 5-3 and in the first column of Table 5-4 for both alternatives are for sufficient infrastructure to meet the need currently projected through 2030. The regionalization alternative allows new capacity to be added and the cost spread over time as demand increases. Costs in Table 5-3 do not include the continuing cost of purchasing or producing finished water or the cost of distributing it to customers.

5.3.2 Water Quality

The quality of the treated water for each alternative was also considered. No substantial change in finished water quality is expected with the Portland pipeline alternative, although it may require adjustments in treatment processes at Portland's water plant because the water chemistry and quality of Old Hickory Lake differs from Portland's current water sources.[24] As noted, Portland's water treatment plant uses conventional processes. White House Utility District currently uses a combination of conventional and membrane filtration processes, and future upgrades are expected to be membrane filtration. Because membrane filtration produces higher quality finished water, Portland's water supply could be improved by purchasing water from White House.

5.3.3 Environmental Benefits or Impacts

Slight environmental impacts could result from construction of the regionalization and raw water pipeline alternatives. Both could be built within existing road rights-of-way with minimal new disturbance.

5.3.4 Other Relevant Factors

Both Tier 2 alternatives would meet the region's water supply needs beyond the 2030 planning horizon. The regionalization alternative would require White House Utility District and Portland to agree on contract terms for sharing the cost of capital and operational improvements and for the pricing of purchased water. Operation and maintenance costs for the direct, raw water pipeline could be significant and would need further study. If Portland chose that option, it would likely continue to rely primarily on West Fork Drakes Creek and City Lake because of the expense—mainly energy costs—of operating the pipeline. Even when the pipeline was not in use, it would have some operation and maintenance costs, including a base electrical capacity charge that would apply regardless of whether pumps were being used or sitting idle.

[24] See Appendix G, Water Supply Lake Study—North Central, Tennessee Department of Environment and Conservation, Division of Water Pollution Control.

5.4 Selection of Preferred Alternative

The alternative selected by the study team is regionalization through a contract with White House Utility District for Portland to purchase finished water as needed and on a schedule amenable to both parties. This alternative would provide enough water for the planning horizon of 2030, it is the least expensive by a significant margin, and it could be accomplished relatively quickly, which is an important factor given that Portland's current water supply sources are barely sufficient to meet today's reliability requirements. Although it was selected primarily because it can meet Portland's needs at the least cost, this alternative, as a form of regionalization, is also the most easily implemented and flexible alternative. It can grow as Portland grows, through and well beyond the 2030 planning horizon.

Although conservation and demand management alone cannot meet the water supply needs of the study area through the planning period, the study team recommends that all utilities in the region pursue this and further regionalization, including regional drought planning. These relatively low-cost strategies make the best use of existing and new water supply sources and improve the region's drought resistance.

Chapter 6. Next Steps

6.1 Introduction

This chapter lays out the steps required to implement the preferred alternative for the twenty-year planning horizon. Making it happen and making it affordable will require no small amount of cooperation and coordination. The water suppliers and many other agencies will be involved, as will the entire community, which in the end must bear the cost of meeting the region's water supply needs. Accomplishing all of this will require considerable planning. These next steps are offered as a starting point for that process. They will need to be evaluated by the community and adapted to their circumstances.

Although Portland is the only utility in the study area that needs additional water supply capacity to ensure that it can meet its customers' needs, all of the utilities in the region could benefit from increased efforts to make the most efficient use of its current water resources. And while the study team is confident that Old Hickory Lake has sufficient capacity to meet the needs of the region through 2030, it is possible that the U.S. Army Corps of Engineer's water availability study will find that utilities drawing water from the lake should be charged for their withdrawals. Should that be the case, increased conservation and demand management will reduce those withdrawals and save their customers money. The study team strongly urges all utilities in the study area to work together to implement these strategies. Likewise, the study team recommends adoption of a regional drought management plan and further efforts to work together as a region to optimize use of their water supply sources and treatment capacities through interconnectivity and sharing.

6.2 Water Conservation and Demand Management

Although the preferred alternative for this regional pilot study centers on Portland and White House, this section applies to all the water suppliers in the region. They all would benefit from increased efforts to conserve water and manage water supply demands. Conservation and demand management are essential to making the best use of current and future water supply sources. With unaccounted for water percentages between 20% and 35%, all of the utilities in the study area can extend their current water sources and reduce costs by reducing leaks and flushing. They can improve their financial condition by reducing unbilled water and by improving energy efficiency. As part of this study, an energy audit was provided to White House Utility District. The method and results are described in Appendix H. Other area utilities should review the report for ideas to improve their own energy efficiency. As noted in Chapter 2, all area utilities' unaccounted for water percentages are within the 35% limit adopted by the

Utility Management Review Board and the Water and Wastewater Financing Board, but that limit is likely to be reduced in the future as utilities across the state improve their efficiency.[25]

- Strategies for conserving water and managing demand include
- adopting active leak prevention, detection, and repair programs;
- metering unbilled water to better account for and manage all types of water usage;
- informing and educating the public about conservation;
- pricing water to encourage conservation;
- providing incentives for retrofitting and replacing old fixtures and appliances; and
- adopting water efficiency codes and ordinances.

These and other options presented in Chapter 4 are described more fully in Appendix E. Many of these strategies can be implemented without inconveniencing customers or the systems themselves. Adopting any of them, however, necessarily involves learning new ways of doing business. The potential to keep water bills low by postponing structural investments makes them worth the effort.

6.3 Commitment to a Regional Approach

This regional water supply planning pilot has been a collaborative effort from the start. Managers of the study area's major utilities and their state and local elected leaders, as well as members of local communities, were fully engaged in early study findings about water needs and in formulating reasonable alternatives. All of the utilities in this study area except Portland are already sharing a regional water supply source, and the team's recommendation is that Portland join them. Accessing Old Hickory Lake through a contract with White House Utility District is a model regional solution that improves water supply security and Portland's ability to respond to unanticipated growth opportunities and takes advantage of economies of scale. As users of a shared source and members of an extended community in the Sumner and Robertson County area, all of the utilities in the area would benefit from adopting a regional drought management plan as was done in the South Cumberland study area. The Tennessee Department of Environment and Conservation's *Guidance for Developing Community Water System Drought Management Plans*[26] gives them the tools to do that.

The utilities of the North Central study area also already act as a region to the extent that they maintain interconnections that allow them to share water as needed in emergencies. To benefit more routinely from regional collaboration, area utilities need a formal inter-utility communication and coordination plan for sharing water supply sources and treatment capacity. To assist them in developing and evaluating water-sharing scenarios, Tennessee Technological University (TTU) will provide access to the hydrologic model (OASIS) used to develop the preferred alternative. TTU will offer training and help utilities update the analysis presented in this report. Arriving at an agreement to share water more routinely to improve water supply security throughout the region will require extensive communication among the parties and a strong commitment to successful, continued cooperation. Before executing a formal agreement, the interested parties should draft a memorandum of agreement that, when signed by the appropriate local officials, will identify the steps to be taken to create the agreement and demonstrate the commitment to follow through. The University of North Carolina's Environmental Finance Center has published a useful guide, *Crafting Inter-local Water Agreements,* that covers topics to consider in preparing inter-local agreements.[27]

---

[25] The American Water Works Association (AWWA) recommends a shift in focus away from unaccounted for water to non-revenue water (for their assessment of the issues, see http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47866) and has developed a recommended water audit method that includes a set of performance indicators for non-revenue water and water losses (see http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=48055). The state's two water utility regulatory boards have adopted the AWWA's water loss methodology for use in financial statements received after January 1, 2013.

[26] Found online at http://tn.gov/environment/dws/pdf/droughtmgtplan_guidance.pdf.

[27] Found online at http://www.efc.unc.edu/publications/2009/water_partnership_tips.pdf.

6.4 Permitting

As noted in Chapter 5, the U.S. Army Corps of Engineers is engaged in a water availability study to determine whether existing withdrawals are adversely affecting the authorized purposes of Old Hickory Lake and, if so, how much to charge for those water supply withdrawals. In the meantime, there is a moratorium on new intakes and increased withdrawals. This should not be an impediment to moving forward on the preferred alternative; staff at the Corps' Nashville District have indicated that they are prepared to consider, case by case, proposals for new or increased withdrawals from Old Hickory Lake that carry the support of TDEC's Division of Water Supply, and other federal or state agencies that may be asked to provide funding for those projects.

6.5 Engineering Studies

Optimizing the amount and timing of Portland's finished water purchases from White House will require engineering studies to determine the costs of (1) continuous, base water demand purchases, where water would be purchased even during periods of abundance, and (2) seasonal and emergency purchases, where capacity charges for standby infrastructure would occur even during periods when no water is purchased. Each of those strategies involves different infrastructure upgrades and, therefore, different costs. Some combination of the two could be chosen, and the decision may depend on the withdrawal projection Portland chooses to work from. The study team recommends the city revisit population projections in light of current economic conditions, which were not taken into account when the projections described in Chapter 3 were made. The study team also strongly urges Portland to consider use of demand and distribution system management measures to reduce peak needs in order to control both capital and operating costs. In the end, however, the choice of projection methods and the water use figure to base their plans on is Portland's to make.

Determining the optimal schedule for transfers will be an iterative process in which the capital and operating costs—and their effects on water rates—will be estimated. Scenarios tested by the engineers working for the parties will need to consider ways to

- fit capital improvements into existing capital improvement plans,
- avoid dramatic increases in water bills,
- phase improvements to avoid paying for excess capacity, and
- increase the capacity of interconnections in response to commercial or industrial development.

All of the utilities in the study area will have access to OASIS, the hydrologic model provided as part of this pilot to support regional drought planning. Portland and White House can use OASIS to model various scenarios to determine which one or combination will best meet the needs of both parties. They will need to work together to determine appropriate capital improvement plans and how best to fund and phase them in. Water system managers and engineers for both utilities will need to agree on a work plan for completing the necessary engineering studies.

6.6 Project Financing

Ease of financing may be one of the key advantages of the study team's preferred alternative. There are a number of potential funding sources for the design and construction work required. While EPA policy currently prohibits the use of Drinking Water State Revolving Fund (DWSRF) loans to build water supply dams and reservoirs, the loans can be used for the proposed infrastructure upgrades needed to more effectively share water in the region. As noted in Chapter 5, this alternative offers considerably more flexibility in meeting Portland's future needs as they grow rather than making an upfront investment in a separate pipeline that would likely have to be sized at the outset to meet needs projected far into the future, possibly as far as 50 years into the future to match the life expectancy of such a pipeline. As calculated by the study team, Portland's needs would be a relatively small part of White House's total capacity—much less than White House is currently providing to Simpson County Utility District—and could be expanded gradually as Portland grows rather than having to be developed all at once based on highly uncertain 50-year growth projections. Moreover, TDEC staff is in the process of modifying the DWSRF scoring criteria to give greater priority to projects that support a regional planning effort to ensure greater flexibility and water supply security over broader areas. They are also exploring opportunities for additional federal funding assistance that may result from the October 2010 U.S. Environmental Protection Agency (EPA) announcement of a new drinking water and drinking water sustainability policy. And the project may be eligible for U.S. Department of Agriculture Rural Development or U.S. Corps of Engineers funding.

6.7 Rate Studies

Although some funding assistance may be available in the form of loans, Portland water customers must expect to pay a significant portion of costs to expand their water supply regardless of the alternative chosen. Operating costs are not eligible for grants or loans, and loans must be repaid with revenue from customer charges. Whether the expected costs are financed on a pay-as-you-go basis or by borrowing, customers will likely see some changes in their bills. Since the alternative can be phased over the next twenty years and much of the infrastructure will belong to White House, Portland's share of the costs could be addressed through internal rate increases or through development or capacity fees for new customers added to the system. The advantage of development fees is that growth in customers pays for growth in the system so that costs are shared appropriately between new and existing customers. Likewise, because White House has its own expansion needs aside from those it may take on in a new partnership with Portland, both utilities will need new rate studies to ensure that the customers of each pay only their fair share of the costs of expanding the region's water supply. Guidance for studying revenue needs and adopting rate increases can be found in MTAS' *How Any City Can Conduct a Utility Rate Study and Successfully Increase Rates*.[28] Guidance for choosing among various rate structures can be found in *Meeting Water Utility Revenue Requirements: Financing and Ratemaking Alternatives*, a publication of the National Regulatory Research Institute.[29] Appendix A includes basic information from both of these guides.

6.8 Water Purchase Contract

While the engineering and rate studies are being done and funding is being sought, the utilities should be working out the details of the water purchase agreement they will need to implement the preferred alternative. White House Utility District's recent experience negotiating an agreement with Simp-

---

[28] Found online at
http://www.mtas.utk.edu/KnowledgeBase.nsf/0/9c55533bf2c336ac85257412004ce8ee/$FILE/How%20Any%20City%20Can%20Conduct%20a%20Utility%20Rate%20Study%20bw.pdf.

[29] Found online at http://nrri.org/pubs/water/93-13.pdf.

son County Utility District (Kentucky) could serve as a model for their discussions. White House and Portland should begin by reviewing the Simpson County contract and its implementation to determine which provisions they want to replicate and which they want to revise. Portland and White House water managers will need to meet regularly to work on the contract and may want to consider enlisting the services of a neutral facilitator. If they decide that would be useful, TDEC will assist with identifying sources for those services. The terms of the long-term water purchase contract will put Portland on the path to a safe and secure water supply that will meet its current and future needs.

6.9 Long-range Planning

Planning is essential to coordinate government services with development and guide it to ensure the best possible outcomes for local residents. Planning programs can be tailored to fit the particular needs of any community, taking into account local culture and traditions. One essential element in planning for new developments is ensuring that utilities are available to support them. Planning commissions in the region should require letters of availability from the appropriate utility before approving new developments to assure buyers that adequate utilities will be available when a lot is purchased for building purposes. Such a requirement is typically implemented through subdivision regulations adopted by the local planning commission. Those cities and counties that enforce a zoning ordinance may also require a letter of availability as a part of a request for a rezoning amendment or approval of a site plan. These mechanisms ensure that land-use and water supply planners work together to support the needs of their communities. While growth can be projected, unexpected surges can occur. The recommendations made by the study team and the planning process developed in this report will enable the water supply systems to respond to unanticipated growth and other unknowns in a responsible manner.

The interrelationship of water resources and land use is one of the hottest topics in growth planning today. The primary focus of this regional water supply planning pilot has been on quantity, but quality is equally important and becomes more of a factor as development occurs. Because Sumner County, including the Portland area, is growing rapidly, the associated development will affect both water quality and quantity as impervious surfaces replace more and more raw land. Land development's effects on the water resources can be reduced with low-impact development, which can promote the natural movement of water in a watershed and restore water supplies. Planning commissions can affect these issues through flexible regulations on new development.

6.10 Communication and Community Engagement

State law requires water utilities to operate on an enterprise basis. Consequently, water customers must pay for all debt service and operational costs. While grants may help with construction costs, the remaining costs of infrastructure improvements to meet projected withdrawal needs will eventually affect customers' monthly bills. They will need to understand the process that led to those changes and the benefits of a more secure water supply, one that is less susceptible to drought, and one that supports the growth and development the community desires. A robust, multi-faceted public involvement program to inform water customers is needed.

Residents in unserved households need help understanding the factors that a utility must consider when determining whether to extend water supply lines. They need to be informed of the implications for themselves and for the entire service area, both up-front and operational costs, including the line flushing required to ensure that the quality of the water they receive is the same as customers in more densely populated areas.

The utilities in the region also can work together to educate their customers about the conservation and demand management practices recommended here. Conserving water and even reusing it can help reduce overall water demand, saving both water and money. These laudable conservation efforts require the understanding and acceptance of the community. If requested, TDEC will work with the parties to a regional agreement to develop an effective community engagement plan to make these practices possible.

Community engagement, however, is not a one-way street. Utilities also benefit from their customers' suggestions and comments about proposed changes. Customers may have valuable ideas about demand management, conservation methods, the availability of water conserving appliances, or incentives to reduce consumption. Engaging with the community is essential to successful demand and drought management.

---

[30] Arnold, Craig Anthony, ed. 2005. *Wet Growth: Should Water Law Control Land Use?* Washington, DC: Environmental Law Institute.

[31] U.S. Environmental Protection Agency, *Low Impact Development,* accessed online at http://www.epa.gov/owow/NPS/lid, 25 April 2011.

North Central
Regional Water Resources Planning Study

Appendices

If viewing in electronic format, click on the Appendix label, e.g. Appendix A, to open and view all materials in that Appendix.

Appendix A:	Unaccounted for Water Loss Report
Appendix B:	USGS Appendix/Water Demand and Projections to 2030
Appendix C:	Opinions of Probable Cost
Appendix D:	Water Conservation and Demand Management in the North Central Study Area
Appendix E:	Assessment of Water Supply Sufficiency
Appendix F:	Water Supply Lake Study—North Central
Appendix G:	Energy Conservation Study at White House Utility District
Glossary of Terms	

Material for the appendices listed above can be found in the electronic version of the Planning Study posted to the TDEC website at: www.tn.gov/environment/regionalplanning

Water Resources Technical Advisory Committee

The Water Resources Technical Advisory Committee was authorized in the Tennessee Water Resources Information Act of 2002. Members of this committee serve as an advisory group to the Tennessee Department of Environment and Conservation by making recommendations on water resources issues in response to requests from the department. The committee will assess each issue in some detail to provide insight from diverse perspectives with the objective of helping to refine and improve water management policies or options for the department.

2002 Tennessee Water Resources Information Act

69-7-309. Technical advisory committee. The commissioner shall appoint a technical advisory committee, the number of members to be determined by the commissioner, that shall advise the commissioner on the status of the state's water resources and future planning efforts. The technical advisory committee shall be composed of representatives of federal, state, and local agencies and of appropriate private organizations, including not for profit organizations. No member of this committee is entitled to a salary for duties performed as a member of the committee. No member is entitled to reimbursement for travel and other necessary expenses incurred in the performance of official duties.

Member	Agency Represented
Bob Freudenthal	Tennessee Association of Utility Districts
Scott Davis	The Nature Conservancy of Tennessee
W. Scott Gain	U.S. Geological Survey
Dennis George	Center for the Management, Utilization and Protection of Water Resources (Tennessee Technological University)
Dan Hawk	Tennessee Department of Economic and Community Development
Michael Hughes	Watauga River Regional Water Authority
Elmo Lunn	Former Director of the Water Authority of Dickson County and the Former Director of the TDEC Water Management Division
John McClurkan	Tennessee Department of Agriculture
David McKinney	Tennessee Wildlife Resources Agency
Doug Murphy	Tennessee Duck River Development Agency
Lynnisse Roehrich-Patrick	Tennessee Advisory Commission on Intergovernmental Relations
Bob Sneed	U.S. Army Corps of Engineers, Nashville District
Gary Springston	Tennessee Valley Authority
Brian Sutherland	U.S. Department of Agriculture Rural Development
Brian Waldron	University of Memphis Ground Water Institute


HISTORIC
COLD SPRINGS
1857
1933