4.6 Groundwater Resources

4.6.1 Introduction

Surface water and groundwater resources are interconnected within much of the TVA Power Service Area. Depending on the season, between 13 and 33 percent of precipitation percolates into the ground, recharging groundwater aquifers (Zurawski 1978). Changes in reservoir elevations can lead to changes in groundwater elevations; the aquifer response depends on the geology and hydrogeology of the shallow aquifers exposed to infiltration from surface waters. The key issue associated with changes in groundwater levels is their effects on groundwater use and wetland areas.

Resource Issues
▶ Changes in groundwater levels and their effects on groundwater use and wetland areas

This section provides an overview of conditions at reservoirs and tailwater areas, and a summary of existing groundwater use and its projected use to 2030. Impacts on the use of groundwater were evaluated for all groundwater resources within 1 mile of TVA reservoirs and tailwaters. The potential zone of groundwater influence from changes in TVA reservoir and tailwater elevations was calculated based on the properties of shallow aquifers within each physiographic region.

4.6.2 Regulatory Programs and TVA Management Activities

The Tennessee Water Quality Control Act of 1977 prohibits the “alteration of the physical, chemical, radiological, biological, or bacteriological properties of any waters of the state,” including groundwater, by any person or entity without first obtaining a permit to do so. Permitting authority is given to the Tennessee Water Quality Control Board via the Division of Water Supply of the Tennessee Department of Environment and Conservation (TDEC).

TDEC is also responsible for enforcement of the Water Resources Information Act of 2002 and the Tennessee Safe Drinking Water Act of 2002. These acts require public notice for any groundwater withdrawals in the state and prohibit “heavy pumping or other heavy withdrawals of water from a public water system or its water supply source in a manner that would interfere with existing customers’ normal and reasonable needs or threaten existing customers’ health and safety.” Similar programs exist in the other Valley states.

4.6.3 Hydrogeology of the Tennessee Valley

The six distinct physiographic regions of the Tennessee River region (Figure 4.1-02) can be used as a framework for discussing groundwater resources in the region (Zurawski 1978). The hydraulic properties of the aquifers in each physiographic region depend on the nature of the aquifer material, as summarized in Table 4.6-01.

Table 4.6-01 Summary of Aquifer Properties for the Physiographic Regions in the Tennessee River Region

Physiographic Region	Transmissivity (ft^2/day)[2]		Specific Yield[3]	
	Representative Value	Range	Representative Value	Range
Coastal Plain	500	10 to 10,000	0.2	0.1 to 0.3
Highland Rim	320	1 to 100	0.2	0.1 to 0.3
Central Basin	79	1 to 500	0.2	0.1 to 0.3
Cumberland Plateau	480	10 to 5,000	0.2	0.1 to 0.3
Sequatchie Valley [1]	79	1 to 100	0.2	0.1 to 0.3
Valley and Ridge	140	10 to 5,000	0.2	0.1 to 0.3
Blue Ridge	120	10 to 500	0.2	0.1 to 0.3

1 The Sequatchie Valley is a geologically distinct area located in the Cumberland Plateau Physiographic Region.

2 Values for transmissivity, a measure of resistance to groundwater flow, are taken from the following Tennessee-specific literature sources: Brahana and Broshears (2001), Broshears and Bradley (1992), Hoos (1990), Wolfe et al. (1997), and Zurawski (1978). In addition, wider-ranging data compilations were consulted to broaden the range of properties, including the following: Lohman (1979), Freeze and Cherry (1979), De Marsily (1986) and Kruseman and de Ridder (1990).

3 Values for specific yield, a measure of aquifer water storage volume, were obtained from Lohman (1979), Freeze and Cherry (1979), and Spitz and Moreno (1996).

Reservoirs and the associated tailwaters of the Tennessee River Valley span six physiographic regions, including the Highland Rim, Coastal Plain, Cumberland Plateau (including the geologically distinct Sequatchie Valley), Blue Ridge, Central Basin, and Valley and Ridge. The location, size, and ranges in water levels of the reservoirs and tailwaters of the Tennessee River system—and the reservoir characteristics—are identified in Table 2.1-01 and in Appendix A. Table 3.3-01 contains current operating guidelines, including flood levels, drawdown rates, and reservoir levels throughout the year. Minimum flows of the mainstem and tributary tailwaters are listed in Appendix A, Table A-03. Appendix D2 contains additional supporting information for this resource.

4.6.4 Groundwater Use

Existing Conditions

Groundwater supplies in the Tennessee River watershed are used for industry, public and domestic supplies, and irrigation. The median daily public use of groundwater in the Tennessee River watershed during the past 35 years is 245 million gallons per day (mgd); the daily public use in 2000 was 215 mgd (Hutson et al. 2003, Bohac 2003). In addition to the public groundwater wells identified in Hutson et al. (2003) and Bohac (2003), there could be other private wells that that are close to Tennessee Valley reservoirs and tailwaters and were not included in these inventories. Figure 4.6-01 depicts the intensity of groundwater use.

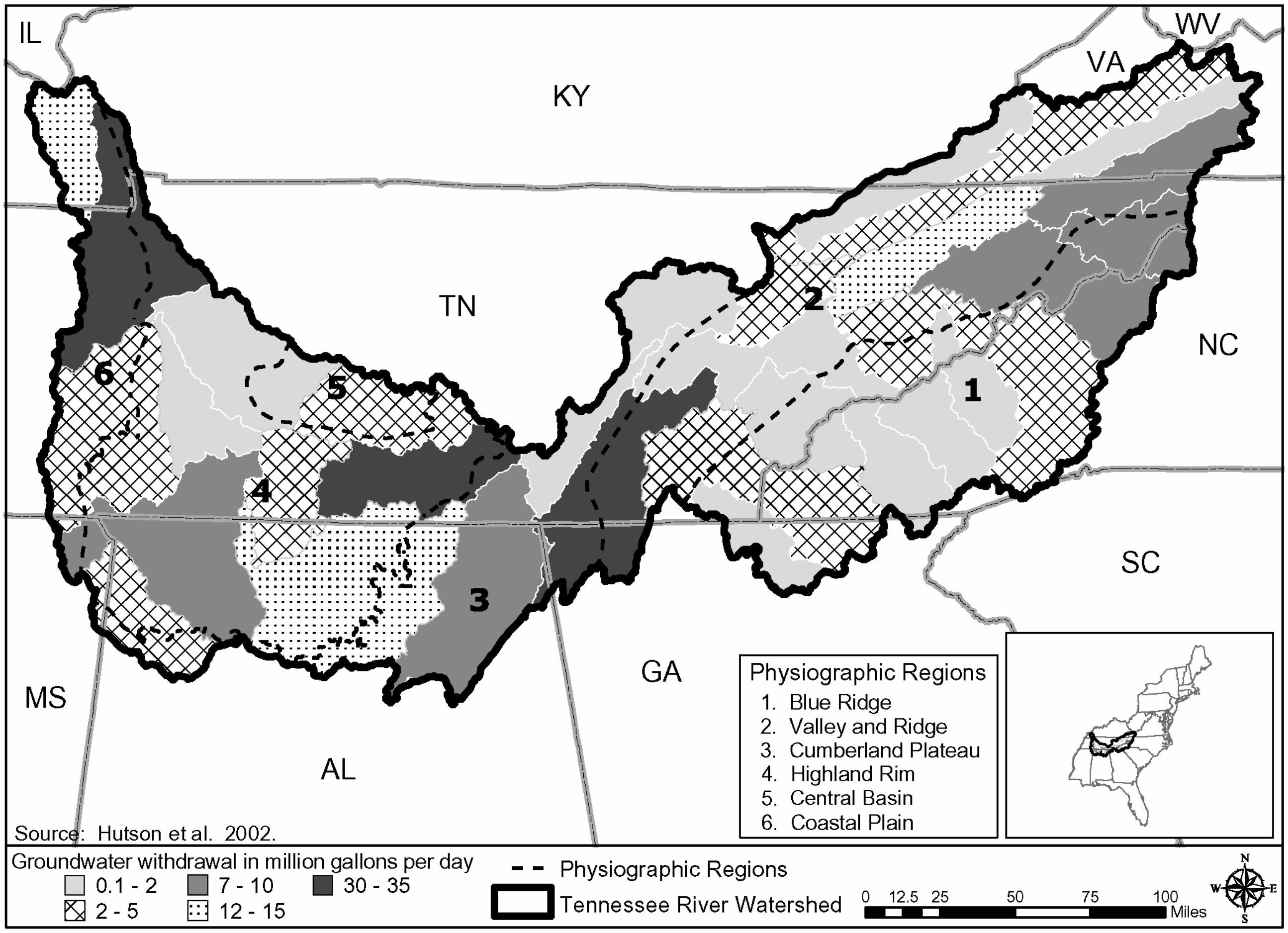

Figure 4.6-01 Groundwater Withdrawals by Hydrologic Unit in the Tennessee Valley Region in 2000

The greatest groundwater withdrawals occur near the major population centers of the Tennessee Valley region. Public groundwater withdrawals in 2000 within 1 mile of the reservoirs and tailwaters of the Tennessee River watershed are listed in Table 4.6-02 and totaled 7.04 mgd in 2000. These withdrawals represent approximately 3 percent of the total public groundwater use.

Table 4.6-02 Public Groundwater Supplies within 1 Mile of Reservoir and Tailwater Areas

Reservoir	Physio-graphic Region	2000 Groundwater Withdrawals for Wells Situated within 1 Mile of Reservoirs		2000 Groundwater Withdrawals for Wells within 1 Mile of Reservoir Tailwater Areas		2000 Groundwater Withdrawals for Reservoir Catchment Basin (mgd)
		Number of Wells	2000 Withdrawals (mgd)	Number of Wells	2000 Withdrawals (mgd)	
Mainstem Reservoirs						
Kentucky	HR/CP	1	0.015	0	–	54.94
Pickwick	HR/CP	0	–	2	2.372	5.41
Wilson	HR	0	–	0	–	3.36
Wheeler	HR/CU	1	1.44	0	–	45.82
Guntersville	CU	0	–	0	–	7.86
Nickajack	CU/SV/VR	0	–	0	–	9.86
Chickamauga	VR	2	0.266	1	0.004	24.02
Watts Bar	VR	2	0.57	2	0.584	1.11
Fort Loudoun	VR	2	0.007	1	0.039	1.6
Tributary Reservoirs						
Norris	VR	3	0.52	0	–	3.42
Melton Hill	VR	0	–	0	–	1.58
Douglas	VR	3	0.044	1	0.006	11.98
South Holston	VR	0	–	0	–	8.01
Boone	VR	0	–	0	–	–
Fort Patrick Henry	VR	1	0.004	0	–	–
Cherokee	VR	6	0.125	0	–	13.00
Watauga	BR	2	0.046	0	–	9.40
Wilbur	BR	0	–	0	–	–
Fontana	BR	0	–	0	–	1.13
Tellico	VR	0	–	0	–	0.57
Chatuge	BR	0	–	0	–	0.18
Nottely	BR	0	–	0	–	0.55
Hiwassee	BR	0	–	0	–	0
Apalachia	BR	0	–	0	–	0

Table 4.6-02 Public Groundwater Supplies within 1 Mile of Reservoir and Tailwater Areas (continued)

Reservoir	Physio-graphic Region	2000 Groundwater Withdrawals for Wells Situated within 1 Mile of Reservoirs		2000 Groundwater Withdrawals for Wells within 1 Mile of Reservoir Tailwater Areas		2000 Groundwater Withdrawals for Reservoir Catchment Basin (mgd)
		Number of Wells	2000 Withdrawals (mgd)	Number of Wells	2000 Withdrawals (mgd)	
Tributary Reservoirs (continued)						
Blue Ridge	BR	0	–	1	0	0.05
Ocoee #1	BR	0	–	0	–	1.11
Ocoee #2	BR	0	–	0	–	
Ocoee #3	BR	1	0.053	0	–	
Tims Ford	HR	2	0.945	0	–	2.8
Normandy	HR/CB	0	–	0	–	2.11
Great Falls	HR	0	–	0	–	–
Upper Bear	CU	0	–	0	–	0.16
Bear Creek	CU	0	–	0	–	
Little Bear Creek	HR	0	–	0	–	
Cedar Creek	HR	0	–	0	–	1.13
Total		**26**	**4.035**	**8**	**3.005**	**211.16**

Notes:

CU = Cumberland Plateau.
SV = Sequatchie Valley.
CP = Coastal Plain.
HR = Highland Rim.
VR = Valley and Ridge.
BR = Blue Ridge.
CB = Central Basin.

Future Trends

Groundwater use has been in decline for the past 10 years but is anticipated to remain constant over the next 30 years (Hutson et al. 2003, Bohac 2003). New drinking water regulations will require substantial capital improvements at existing water supply systems. These costs are anticipated to result in consolidation of small public supply water systems, which have historically sought out surface water supplies to replace existing groundwater supplies. This factor and recent declines in groundwater use in the region support the use projections for 2030.