# 5.6 Groundwater Resources

## 5.6.1 Introduction

This section assesses the potential effects of future reservoir operations on groundwater resources in the Tennessee River watershed.

## 5.6.2 Impact Assessment Methods

Assessment of the surface water and groundwater interactions involved two phases: (1) an initial screening-level analysis to determine the zone of surface water influence on groundwater resources, and (2) a reservoir-specific analysis to determine potential effects on specific public groundwater wells situated within the zone of surface water influence identified in the screening-level analysis.

### Screening-Level Analysis

A screening-level analysis was performed to determine the zone of surface water influence on groundwater resources adjacent to each TVA reservoir and tailwater. The calculation used an analytical model to represent the natural condition and assumed a sudden change in reservoir elevation that propagates through groundwater. (See Appendix D2 for additional information about the assessment of surface water and groundwater interactions.)

The furthest distance from the reservoirs where a change in reservoir elevation could be discerned in the groundwater zone was calculated. For this analysis, “no effect” represents a change in groundwater elevation less than or equal to 0.1 foot that was caused by a change in reservoir elevation. The screening-level analysis used January 1 (minimum pool) and June 1 (maximum pool) elevations and a duration of 150 days as inputs to the calculation. This range in elevation provided an upper bound for changes in groundwater levels. None of the reservoir operations policy alternatives would produce a greater change in groundwater levels than those predicted by the screening-level analysis.

Within the boundary of the screening-level analysis, the potentially affected groundwater resources were identified from the U.S. Geological Survey (USGS) database of public, commercial, agricultural, and industrial groundwater wells within the Tennessee River Valley region (Hutson et al. 2003, Bohac 2003). Any reservoir with potentially affected wells was further analyzed as described in the following sections.

In addition to the groundwater wells identified in Hutson et al. (2003) and Bohac (2003), there could be other private wells not included in these inventories that are close to Tennessee Valley reservoirs and tailwaters and could potentially be affected by changes in reservoir operations. The results of the analysis for public groundwater wells are expected to be generally representative of the effects to these private wells.

**Table 5.6-01 Public Groundwater Wells within Zones of Influence of TVA Reservoirs**

| TVA Reservoir | Calculated Zone of Influence (feet) | Public Wells within Zone of Influence of Reservoir |
|---|---|---|
| Apalachia | 1,050 | 0 |
| Bear Creek | 2,200 | 0 |
| Blue Ridge | 1,150 | 0 |
| Boone | 1,300 | 0 |
| Cedar Creek | 1,850 | 0 |
| Chatuge | 1,150 | 0 |
| Cherokee | 1,350 | 3 |
| Chickamauga | 1,140 | 0 |
| Douglas | 1,400 | 2 |
| Fontana | 1,325 | 0 |
| Fort Loudoun | 1,075 | 2 |
| Fort Patrick Henry | 1,050 | 0 |
| Great Falls | 1,870 | 0 |
| Guntersville | 1,600 | 0 |
| Hiwassee | 1,325 | 0 |
| Kentucky | 1,600 | 1 |
| Little Bear Creek | 1,820 | 0 |
| Melton Hill | 1,100 | 0 |
| Nickajack | 1,820 | 0 |
| Normandy | 1,800 | 0 |
| Norris | 1,350 | 1 |
| Nottely | 1,250 | 0 |
| Ocoee #1 | 1,050 | 0 |
| Ocoee #2 | 0 | 0 |
| Ocoee #3 | 1,040 | 1 |
| Pickwick | 2,050 | 0 |
| South Holston | 1,330 | 0 |
| Tellico | 1,100 | 0 |
| Tims Ford | 1,875 | 1 |
| Upper Bear Creek | 2,090 | 0 |
| Watauga | 1,150 | 0 |
| Watts Bar | 1,100 | 2 |
| Wheeler | 1,650 | 0 |
| Wilbur | 1,150 | 0 |
| Wilson | 1,125 | 0 |

Note: The “zone of influence” is the zone of surface water influence on groundwater resources. No influence (0) is defined as changes in groundwater levels of less than 0.1 foot.

Table 5.6-01 gives the zone of groundwater influence for each TVA reservoir and the number of public wells located within this zone. For the following reservoirs, at least one public water supply well was located within the calculated zone of influence and was identified for further analysis: Cherokee, Douglas, Fort Loudoun, Kentucky, Norris, Ocoee #3, Tims Ford, and Watts Bar. Results were also used to identify wetlands potentially affected by reservoir and tailwater water level changes associated with the policy alternatives (see Section 5.8, Wetlands).

#### Reservoir-Specific Analysis

Reservoirs containing public wells within the zone of surface water influence on groundwater were further analyzed with respect to the reservoir operations policy alternatives. For each of the reservoir areas chosen for further analysis, the closest public well to the reservoir was designated as the most sensitive groundwater resource. The distances from these wells to the reservoirs were determined. In addition, median monthly changes in reservoir water levels were determined for all the alternatives. For all alternatives, the potential monthly change in groundwater levels at the wells closest to the reservoirs was calculated.

Any increase in groundwater levels resulting from a change in reservoir operations was considered a beneficial effect on groundwater resources. A decrease in groundwater levels of more than 3 feet resulting from a change in reservoir operations was considered an adverse effect on groundwater resources if the change occurred at or near reservoir minimum pool. This 3-foot threshold was based on the typical seasonal and annual changes in groundwater elevations attributable to non-reservoir influences and variation in groundwater use patterns.

### 5.6.3 Base Case

The Base Case would continue existing conditions to the year 2030. Since this alternative does not include a physical change and groundwater usage was assumed to remain fairly constant, there would be no adverse consequence to groundwater resources.

### 5.6.4 Reservoir Recreation Alternative A, Reservoir Recreation Alternative B, Tailwater Recreation Alternative, and Tailwater Habitat Alternative—Reservoirs

Reservoir-specific analyses indicated that Reservoir Recreation Alternative A, Reservoir Recreation Alternative B, the Tailwater Recreation Alternative, and the Tailwater Habitat Alternative would most likely produce increases in water levels at public wells close to the reservoirs. The greatest increases would be at Cherokee, Douglas, and Norris Reservoirs under all four of these alternatives. The least amount of change would most likely occur at Watts Bar, Fort Loudoun, and Kentucky Reservoirs under all of these alternatives. As groundwater levels under Reservoir Recreation Alternative A, Reservoir Recreation Alternative B, the Tailwater Recreation Alternative, and the Tailwater Habitat Alternative would increase, impacts on groundwater resources associated with these alternatives would be slightly beneficial.

### 5.6.5 Summer Hydropower Alternative, Equalized Summer/Winter Flood Risk Alternative, and Commercial Navigation Alternative—Reservoirs

Reservoir operations under the Summer Hydropower Alternative, Equalized Summer/Winter Flood Risk Alternative, and Commercial Navigation Alternative potentially could decrease groundwater levels from existing conditions near some reservoirs. For these alternatives, the greatest calculated decreases in groundwater levels at nearby public wells would be at Tims Ford under the Equalized Summer/Winter Flood Risk Alternative (7 feet) and at Fort Loudoun Reservoir under the Summer Hydropower Alternative (3 feet) and the Equalized Summer/Winter Flood Risk Alternative (2 feet). The predicted decreases at Fort Loudoun are under the 3-foot threshold and would have slightly adverse effects on groundwater resources. Further analysis of Tims Ford shows groundwater levels surrounding the reservoir to be higher than any potential water levels in the reservoir. The decreases in groundwater levels calculated for Tims Ford Reservoir are, therefore, highly unlikely to occur.

### 5.6.6 Preferred Alternative

The monthly difference from existing conditions in groundwater levels at the wells closest to those reservoirs identified in the screening-level analysis for further evaluation was calculated for the Preferred Alternative. According to the calculations, the Preferred Alternative would most likely produce an increase or no change in groundwater levels and water levels at public wells close to the reservoirs. The greatest increases would be at Cherokee, Douglas, and Norris Reservoirs. Consequently, impacts on groundwater resources associated with the Preferred Alternative would be slightly beneficial. The increases are slightly less than those for Reservoir Recreation Alternatives A and B, the Tailwater Recreation Alternative, and the Tailwater Habitat Alternative.

### 5.6.7 All Policy Alternatives—Tailwaters

Rivers have a much narrower zone of influence on groundwater because of the substantial difference in the volume of water in any given river reach compared to that in a reservoir (Freeze and Cherry 1979). The preceding analysis concluded that effects on groundwater resources near all reservoirs would be slightly adverse to slightly beneficial. Furthermore, all the policy alternatives would maintain minimum levels of water in tailwaters for navigation and other beneficial uses. Therefore, tailwater impacts on groundwater resources would essentially not change under any policy alternative.

### 5.6.8 Summary of Impacts

Table 5.6-02 provides a summary of impacts on groundwater resources by policy alternative. The Preferred Alternative, Reservoir Recreation Alternative A, Reservoir Recreation Alternative B, the Commercial Navigation Alternative, the Tailwater Recreation Alternative, and the Tailwater Habitat Alternative would result in either a slightly beneficial or slightly adverse effect on public groundwater resources near TVA reservoirs, depending on the reservoir. The Summer Hydropower Alternative and Equalized Summer/Winter Flood Risk Alternative could

potentially cause water levels at public wells close to Tims Ford and Fort Loudoun Reservoirs to decrease, although not substantially. Private or domestic wells not identified in Hutson et al. (2003) and Bohac (2003) that are within the zone of influence could also be adversely affected by changes in reservoir operations under all the policy alternatives. Essentially no change would occur on groundwater resources near tailwaters under any policy alternative.

**Table 5.6-02 Summary of Impacts on Groundwater Resources by Policy Alternative**

| Alternative | All Reservoirs[1] | All Tailwaters |
|---|---|---|
| Reservoir Recreation A | Slightly beneficial | No change |
| Reservoir Recreation B | Slightly beneficial | No change |
| Summer Hydropower | Slightly adverse | No change |
| Equalized Summer/Winter Flood Risk | Slightly adverse | No change |
| Commercial Navigation | Slightly adverse | No change |
| Tailwater Recreation | Slightly beneficial | No change |
| Tailwater Habitat | Slightly beneficial | No change |
| Preferred | Slightly beneficial | No change |

[1] Reservoirs that would be affected by alternatives would include Cherokee, Douglas, Fort Loudoun, Kentucky, Norris, Tims Ford, and Watts Bar. All other reservoirs would not be affected by the alternatives.

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