# Appendix D4

## Wetlands

D4a. Methods for Identifying and Categorizing Potentially Affected Wetlands

D4b. Methods to Compare the Potential Effects of Alternatives on Wetlands

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## D4a.1 Creation of a Groundwater Area of Influence Layer

A geographic information system (GIS) coverage of the 35 reservoirs and the connecting waters (Barkley Reservoir and Tombigbee Waterway) included in the Reservoir Operations Study (ROS) was developed by TVA. This coverage was used as a base for both the threatened and endangered species analysis and the wetlands study. Reach identification (ID) codes assigned by TVA were used to distinguish between the reservoirs and tailwaters. The coverage was annotated to include the reservoir and tailwater names and reach ID codes. Individual polygon coverages were created for each reservoir and tailwater. For each reservoir, a groundwater influence buffer was created based on the “distance of no effect from elevation change” calculated for the Groundwater Resources analysis (Sections 4.6 and 5.6). Table D4a-01 provides a list of the physiographic regions and buffer distances used in the wetland analysis.

For each tailwater, a groundwater area of influence polygon was created by: (1) buffering the tailwater with the same “distance of no effect from elevation change” used for the upstream reservoir (see Table D4a-01), (2) converting this buffer polygon to a grid, (3) using the grid as a mask while selecting out those areas of the digital elevation model (DEM) that were less than or equal to the (tailwater headwater elevation + 20 feet) and setting them equal to 1, (4) converting the 0/1 grid to a polygon coverage, and (5) reselecting only those polygons with a value of 1 directly connected to the tailwater. The headwater elevations used in the DEM comparison are shown in Table D4a-02.

The State Soil Geographic Database (STATSGO) provided supplemental information on hydric soils for the seven states included in the Tennessee River Valley: Tennessee, Georgia, Alabama, Virginia, North Carolina, Mississippi, and Kentucky. After creating coverage of mapping unit ID (MUID) polygons for the Tennessee Valley, attributes from the “comp” tables associated with each state’s spatial layer were joined in. Each MUID, or soil mapping unit, consists of between 1 and 21 soil components (generally equivalent to a soil series). Each of these components is flagged Y/N for hydric properties, and the percentage of the MUID area that contains that particular component was calculated. For each MUID within the Tennessee Valley, the percentages of those components designated as being hydric were summed. This yielded a range from 0 to 81 percent hydric.

A cutoff value of 50 percent was used for hydric versus non-hydric MUIDs (this cutoff value also approximated the natural break in the data). Those MUIDs with hydric soil composing 50 percent or more of the area were selected to append to the groundwater influence buffers of the applicable reservoirs and tailwaters (Kentucky Reservoir and tailwater, Barkley Reservoir and tailwater, Pickwick tailwater, Guntersville Reservoir, and Nickajack tailwater).

### Table D4a-01 Buffer Distances Used to Determine Reservoir Zones of Groundwater Influence

| Reservoir | Reach ID | Physiographic Region | Buffer Distance (ft) |
|---|---|---|---|
| Apalachia | 38 | Blue Ridge | 1,050 |
| Barkley | 78 | Highland Rim | 1,600 |
| Bear Creek | 24 | Cumberland Plateau | 2,200 |
| Blue Ridge | 48 | Blue Ridge | 1,150 |
| Boone | 67 | Valley and Ridge | 1,300 |
| Cedar Creek | 29 | Highland Rim | 1,850 |
| Chatuge | 42 | Blue Ridge | 1,150 |
| Cherokee | 63 | Valley and Ridge | 1,350 |
| Chickamauga | 13 | Valley and Ridge | 1,140 |
| Douglas | 74 | Valley and Ridge | 1,400 |
| Fontana | 60 | Blue Ridge | 1,325 |
| Fort Loudoun | 17 | Valley and Ridge | 1,075 |
| Fort Patrick Henry | 66 | Valley and Ridge | 1,050 |
| Great Falls | 76 | Highland Rim | 1,870 |
| Guntersville | 9 | Cumberland Plateau | 1,600 |
| Hiwassee | 39 | Blue Ridge | 1,325 |
| Kentucky | 2 | Highland Rim | 1,600 |
| Little Bear Creek | 31 | Highland Rim | 1,820 |
| Melton Hill | 52 | Blue Ridge | 1,020 |
| Nickajack | 11 | Cumberland Plateau | 1,850 |
| Normandy | 22 | Highland Rim | 1,800 |
| Norris | 54 | Valley and Ridge | 1,350 |
| Nottely | 50 | Blue Ridge | 1,250 |
| Ocoee #1 | 44 | Blue Ridge | 1,050 |
| Ocoee #2 | 45 | Blue Ridge | 0 |
| Ocoee #3 | 46 | Blue Ridge | 1,040 |
| Pickwick | 4 | Coastal Plain | 2,050 |
| South Holston | 69 | Valley and Ridge | 1,330 |
| Tellico | 55 | Valley and Ridge | 1,100 |
| Tims Ford | 34 | Highland Rim | 1,875 |
| Upper Bear Creek | 26 | Cumberland Plateau | 2,100 |
| Watauga | 72 | Blue Ridge | 1,150 |
| Watts Bar | 15 | Valley and Ridge | 1,100 |
| Wheeler | 7 | Highland Rim | 1,650 |
| Wilbur | 71 | Blue Ridge | 1,150 |
| Wilson | 6 | Highland Rim | 1,125 |

**Table D4a-02 Headwater Elevations Used in the Determination of the Tailwater Areas of Groundwater Influence**

| Tailwater | Reach ID | Headwater Elevation (ft) |
|---|---|---|
| Apalachia | 37 | 1,204 |
| Barkley | 77 | 351 |
| Bear Creek | 23 | 571 |
| Blue Ridge | 47 | 1,555 |
| Cedar Creek | 28 | 581 |
| Chatuge | 41 | 1,883 |
| Cherokee | 62 | 935 |
| Chickamauga | 12 | 633 |
| Douglas | 73 | 876 |
| Fontana | 59 | 1,276 |
| Fort Loudoun | 16 | 741 |
| Fort Patrick Henry | 65 | 1,204 |
| Great Falls | 80 | 722 |
| Guntersville | 8 | 558 |
| Kentucky | 1 | 302 |
| Little Bear Creek | 30 | 620 |
| Melton Hill | 51 | 741 |
| Nickajack | 10 | 597 |
| Normandy | 21 | 800 |
| Norris | 53 | 817 |
| Nottely | 49 | 1,624 |
| Ocoee | 43 | 738 |
| Pickwick | 3 | 364 |
| South Holston Dam | 68 | 1,479 |
| Tims Ford | 33 | 754 |
| Tombigbee Waterway | 79 | 413 |
| Upper Bear Creek | 25 | 784 |
| Watts Bar | 14 | 682 |
| Wilbur | 70 | 1,643 |
| Wilson | 5 | 413 |

## D4a.2 Creation of Wetland Layers and Selection of Potentially Affected Wetlands

National Wetland Inventory (NWI) data for the ROS study area were obtained from the U.S. Fish and Wildlife Service. The NWI wetlands were originally mapped at a scale of 1:24,000. Electronic NWI data were prepared and projected to the TN State Plane Coordinate System (NAD 82) by TVA. The data included polygon and linear features in separate coverages. All palustrine system polygons were selected. To pick up connected features that might lie outside the groundwater influence boundary, these polygonal features were merged if they were within 40 feet of this boundary. The merged polygons (clumps) of wetlands that lay wholly within or intersected the groundwater influence boundary were identified for each reservoir and tailwater. Individual palustrine polygons that lay within the selected merged/clumped features were selected. Polygons representing wetlands within the riverine and lacustrine systems (Cowardin classes Emergent [EM], Flat [FL], Aquatic Bed [AB], Unconsolidated Shore [US], and Unconsolidated Bottom Temporarily to Semi-Permanently Flooded [UBA, UBC, UBF, UBG, UBW, UBY, or UBZ]) were selected where they were wholly or partially within each groundwater influence boundary. All linear palustrine system features were selected and clipped to the groundwater influence boundary of each reservoir and tailwater. The lengths of the palustrine linear features within the groundwater influence area were multiplied by a maximum width of 60 feet to provide area estimates. Counts and areas of the selected polygons and linear features were summarized by Cowardin classification. The results for each reservoir and tailwater were summed to provide a summary of all potentially affected wetlands surrounding each reservoir/tailwater.

## D4a.3 Categorization of Fringe Wetlands

All lacustrine and riverine polygons were selected. All lacustrine and riverine linear features were selected and buffered by a maximum width of 60 feet. The lacustrine and riverine polygons and buffered linear features were merged to provide a coverage of reservoirs and rivers. Palustrine polygons that intersected the reservoirs and rivers contained within each groundwater influence area were categorized as shoreline fringe wetlands.

## D4a.4 Categorization of Island Wetlands

Palustrine polygons that lay completely within the reservoirs and rivers contained within each groundwater influence area were categorized as island wetlands.

## D4a.5 Categorization of Surface-Water Isolated Wetlands

The National Hydrologic Dataset (NHD) (USGS 2003) coverages for the seven states of interest were compiled as a base. All NHD rivers/streams were selected, buffered by 1 foot, and appended to the NWI reservoirs and rivers coverage developed for the fringe and island wetland categorization. The affected linear palustrine features were buffered by 60 feet and appended to the merged/clumped palustrine polygon coverage.

All grouped palustrine features touching water were reselected and then the inverse of this set was used to determine which individual palustrine polygons and linear features to categorize as surface-water isolated.

## D4a.6 Determination of Undeveloped Upland Area within the Groundwater Area of Influence

An estimate of the remaining undeveloped upland acreage (UU) around each reservoir was calculated by using grids with a cell size of 98.4 feet on each side and the following formula:

UU = groundwater area of influence – reservoir area – NWI polygons – NWI linear features buffered by 60 feet – urban/developed land

The urban/developed land layer used in this calculation was created by selecting low-intensity residential, high-intensity residential, and high-intensity commercial/industrial/transportation from the National Land Cover Dataset (NLCD).

## D4a.7 System-Wide Totals

Because some of the same wetlands may be affected by adjacent reservoirs and tailwaters (thereby causing an overlap effect when the numbers for each reservoir and tailwater are added together), a series of system-wide calculations was performed. The groundwater influence areas for the 35 reservoirs, connecting waters, and 30 tailwaters were merged together into a single system-wide groundwater area of influence coverage. This system-wide groundwater influence area was then used in the processes described above to calculate system-wide counts and areas for potentially affected wetlands, fringe, island, and isolated wetlands, as well as to estimate the area of remaining undeveloped upland within the groundwater influence zone.

## D4a.8 Reference

U.S. Geological Survey (USGS). 2003. National Hydrography Database. http://nhd.usgs.gov/.

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