

APPENDIX I

TVA Reservoir Rating Method

TVA monitors ecological conditions at 69 sites on 31 reservoirs throughout the Tennessee River Valley. Each site is monitored every other year unless a substantial change in the ecological health score occurs during a two-year cycle. If that occurs, the site is monitored the next year to confirm that the change was not temporary. Roughly half the sites are sampled each year on an alternating basis.

The overall health rating of TVA reservoirs is based on five ecological indicators:

- **Dissolved oxygen.** A good rating means there is enough oxygen dissolved in the water to support a healthy population of fish and other aquatic life. Oxygen is as important to aquatic life as it is to life on land. Dissolved oxygen is monitored monthly from spring to autumn (April through September).
- **Chlorophyll.** Chlorophyll is a measure of the amount of algae in the water. A good rating means that growth of algae is within the expected range. If levels of algae are too low, the reservoir's food web can be affected. If levels are too high, water treatment costs may increase, and oxygen supplies in the bottom layer of water may be depleted by decaying algae. Growth of algae depends primarily on the amounts of nitrogen, phosphorus, and other nutrients in the water. Both dissolved oxygen and chlorophyll are measured from the mid-channel of the reservoir. Chlorophyll-*a*, like dissolved oxygen, is measured monthly from spring to autumn.
- **Fish.** A good rating means there is a large number and variety of healthy fish. Sampling is conducted near the shoreline or littoral zone. Fish assemblage sampling is conducted in autumn (September - November).
- **Bottom life.** A good rating means that a variety of animals live on the reservoir bottom (worms, insects, and snails, for example). Benthic macroinvertebrates are collected from transects across the full width of the sample area, including overbanks if present. From 1990 through 1994, benthic macroinvertebrates were sampled in early spring (February - April) to avoid aquatic insect emergence. Sampling was switched to autumn/early winter (October through early December) beginning in 1995.
- **Sediment.** The quality of the sediment at mid-channel is based on chemical analysis and examination. A good rating means that the reservoir bottom is free of pesticides and PCBs and that concentrations of metals are within expected background levels. Sediments are monitored once in mid-summer.

TVA reservoirs are divided into 4 classes to evaluate fish and benthos. One class includes the reservoirs on the Tennessee River plus two navigable reservoirs on tributaries of the Tennessee River. The remaining three classes include the reservoirs in the Blue Ridge Ecoregion, those in the Ridge and Valley Ecoregion, and those on the Interior Plateau Ecoregion. Run of the river reservoirs were not subdivided by ecoregion because most of the water flowing through them comes from upstream and does not originate within the ecoregion where the reservoir is physically located.

When monitoring ecological conditions at each reservoir, TVA takes samples from up to four locations, depending on the reservoir's size. These sites are classified as:

- **Forebay.** The deep, still water near a dam.
- **Mid-reservoir.** The middle part of a reservoir, where a transition occurs from a river-like environment to a reservoir-like environment.
- **Embayment.** A very large slough or cove. (TVA monitors only four embayments: Hiwassee River on Chickamauga Reservoir; Big Sandy River on Kentucky; Bear Creek on Pickwick; and Elk River on Wheeler.)
- **Inflow.** The river-like area at the extreme upper end of a reservoir.

Ecological Health Rating Methods

This evaluation system looks at each of the five key indicators separately, then combines these ratings into a single composite score for the reservoir.

Dissolved Oxygen - Rating is based on a multidimensional approach that includes dissolved oxygen concentrations throughout the water column (WCDO) and near the bottom (BDO) of the reservoir. The dissolved oxygen rating (ranging from 1 or "poor" to 5 or "good") at each sampling location is based on monthly measurements (April through September for the run-of-the-river reservoirs and from May through October for tributary reservoirs). The WDO rating is the six month average of the portion of the reservoir cross-sectional area at the sample location that has a dissolved oxygen concentration less than 2.0 mg/L. The BDO rating is the six month average of portion of the reservoir cross-sectional bottom length that has a dissolved oxygen concentration less than 2.0 mg/L. The final dissolved oxygen rating is the combination of the WDO and BDO average.

Chlorophyll - Scoring criteria were created separately for each of the two classes of reservoirs. The rating scale is based on expected levels of productivity for each reservoir. Reservoirs that are expected to be oligotrophic receive the highest ratings for low chlorophyll concentrations while reservoirs expected to be mesotrophic receive the highest ratings for an intermediate range of chlorophyll values. For reservoirs expected to be mesotrophic, the rating is reduced for high chlorophyll concentration and low chlorophyll concentrations if an environmental factor (such as turbidity, toxicity, and/or retention time) inhibits primary production. A sliding scale is used to evaluate the seasonal average chlorophyll concentration for each reservoir class.

Fish Assemblage - Twelve metrics are used to determine the Reservoir Fish Assemblage Index (RFAI). The same 12 metrics are used for all reservoirs, while specific scoring ranges for each metric may vary by reservoir class.

Benthic Macroinvertebrates - Seven characteristics or metrics are used to evaluate benthic macroinvertebrates in all reservoirs. The scoring criteria for each metric were developed from the data base on TVA reservoirs. Some specific metrics vary between tributary and run-of-the-river reservoirs due to differences in thermal stratification and dissolved oxygen concentrations.

Sediment Quality - Since 1995, sediment quality scoring criteria have been based on sediment analysis for metals (As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn), organochlorine

pesticides, and PCBs. Results for sediment analysis are compared with sediment guidelines adapted from EPA Region 5 to determine the sediment quality rating.

The ecological health scoring method is designed such that four of the indicators (dissolved oxygen, chlorophyll, benthos, and fish) are equally weighted, with each indicator assigned a rating ranging from 1 (poor) to 5 (excellent). The fifth indicator, sediment quality, receives half the weight of the other indicators and is assigned a rating ranging from 0.5 (poor) to 2.5 (excellent).

The overall reservoir health rating is determined by taking the sum of the ratings from all sites, dividing by the maximum possible rating for that reservoir, and expressing the result as a percentage. A percentage basis is used because the number of sites monitored varies according to the reservoir size and configuration. Only the forebay is monitored in small tributary reservoirs and up to four sites (forebay, transition zone, inflow, and embayment) are sampled in selected run-of-the-river reservoirs. Also, the number of indicators varies at different sites (i.e., sediment and chlorophyll are not sampled at the inflows on run-of-the-river reservoirs). This approach provides a range of scores from 22 to 100 percent and applies to all reservoirs regardless of the number of indicators or sites sampled. This range is divided into three categories: Poor (less than 59), Fair (59-72), and Good (greater than 72).

APPENDIX II

Overview of the HRWC Volunteer Monitoring Program

HRWC began a volunteer monitoring program in the fall of 2002. Currently, a group of about 50 volunteers called *Ani'ama'*, a Cherokee word meaning, "The Water People", collect and test water samples on the third Saturday of each month as part of western North Carolina's Volunteer Water Information Network (VWIN). The Coalition has two teams: One group samples 11 sites on streams in the Lake Chatuge watershed; the second samples 10 sites in the Lake Nottely watershed.

Volunteers record the time and date of collection, air and water temperature, rainfall in the past three days, the observed water flow rate, and general condition of the stream. They test the dissolved oxygen level at the site and collect six bottles of water to be transported to Asheville under refrigeration on the following Monday. The laboratory at the University of North Carolina at Asheville (UNCA) tests for ammonia, nitrates, phosphates, turbidity, total suspended solids (TSS), conductivity, alkalinity, pH, copper, lead, and zinc. The lab staff also calculates dissolved oxygen saturation, a function of temperature and altitude.

The results of the testing done at UNCA are sent via e-mail to the Coalition office each month. The teams gather biannually for a presentation of the data and to discuss issues within monitored watersheds. HRWC receives a report annually from the UNCA Environmental Quality Institute summarizing the data and comparing it to other sites across the southern Appalachian region. Currently, the Coalition has more than four years of data from the sites located on tributaries to Lake Chatuge. Many of these monitoring locations (indicated by an asterisk) are sites where professional water quality sampling was also conducted for the study discussed in Section 4 of this document:

Hiwassee River*	Fodder Creek*	Geisky Creek
Hightower Creek*	Hog Creek*	Eagle Fork Creek
Scataway Creek	Woods Creek	Lower Shooting Creek*
Upper Bell Creek*	Upper Shooting Creek	

A free copy of the most recent report may be obtained by contacting the Coalition office: hrwcoalition@brmemc.net or (828) 837-5414; toll-free 877-863-7388.

History of VWIN

In February of 1990, volunteers began monthly sampling of 27 stream sites in Buncombe County, NC. The program expanded to 45 sites by November of that same year. Today, there are more than 220 monthly monitoring sites in western NC and north GA spread across the southern Appalachian region. The University of North Carolina at Asheville, Environmental Quality Institute supports the VWIN program, providing technical assistance through laboratory analysis of water samples, statistical analysis of water quality results, and written interpretation of the data. There are 10 organizations with a collective total of more than 600 volunteers involved.

APPENDIX III

Detailed Project Budget for all Three Phases of Implementation

	Action Plan Management Strategies	Phase I (Yrs 1-5)	Phase II (Yrs 6-10)	Phase III (Yrs 11-15)	Match & In-Kind	TOTAL
Point Source Strategies	Implement aggressive nutrient reduction strategies at the Hiwassee WWTP	*	*	*	\$1,500,000	\$1,500,000
	Develop a proactive plan for handling sewage leaks and spills	\$1,000	-	-	\$500	\$1,500
Agricultural Strategies	Identify sites for agricultural BMPs	\$7,500	-	-		\$7,500
	Eliminate unrestricted cattle access from streams/lake (50 animals)	\$50,000	\$50,000	\$50,000		\$150,000
	Improve "Fair" pastures to "Good" (250 ac)	\$75,000	\$125,000	\$40,000		\$240,000
	Improve "Poor" pastures to "Fair" (50 ac)	\$135,000	\$200,000	\$90,000		\$425,000
Development Strategies	Identify sites for commercial BMPs	\$8,000	-	-		\$8,000
	Install stormwater BMPs for TP reduction in existing commercial areas (80 ac)	\$90,000	\$170,000	\$170,000	\$50,500	\$480,500
	Identify sites for residential BMPs	\$10,000	-	-		\$10,000
	Install stormwater BMPs for TP reduction in existing residential areas (585 ac)	\$60,000	\$130,000	\$100,000	\$25,000	\$315,000
	Identify demonstration sites for watershed-friendly new developments	\$500	\$500	\$500		\$1,500
General Re-Vegetation	Revegetate bare, eroding cuts behind homes/buildings (1 ac/10 buildings)	\$16,700	\$16,000	\$16,500		\$49,200
	Plant 1000 linear ft of riparian buffer	\$8,300	\$8,000	\$8,000		\$24,300
Project Mgmt. & Education	Bi-annual newsletter project updates	\$2,500	-	-		\$2,500
	Annual project status report	\$500	\$2,000	\$2,000		\$4,500
	Restoration Coordinator Position	\$100,000	\$140,000	\$150,000	\$40,000	\$430,000
	Education program	\$10,000	-	-		\$10,000
Monitoring & Evaluation	Monthly stream monitoring	\$17,000	\$17,000	\$18,000		\$52,000
	Assess the ecological health of the lake	*	*	*	\$100,000	\$100,000
	Re-evaluate and update the Action Plan	\$8,000	\$6,500	\$5,000		\$19,500
		\$600,000	\$865,000	\$650,000	\$1,716,000	\$3,831,000

APPENDIX IV

General Contact Information for Agencies

Agriculture

USDA Natural Resources Conservation Service:

Part of the US Department of Agriculture (USDA), formerly called the Soil Conservation Service. Technical specialists work with landowners on private lands to conserve natural resources, helping farmers and ranchers develop conservation plans unique to their land and needs; administer several federal agricultural cost share and incentive programs; provide assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conduct soil surveys; offer planning assistance for local landowners to install best management practices; and offer farmers technical assistance on wetlands identification.

County, State	District Conservationist	Phone	Email	Address
Towns/Union, GA	Doug Towery	706-745-2794 x3	doug.towery@ga.usda.gov	185 Welborn Street, Box 3 Blairsville, GA 30512
Cherokee/Clay, NC	Glenn Carson	828-837-6417 x3	glenn.carson@nc.usda.gov	225 Valley River Ave., Ste. J Murphy, NC 28906
Chestatee-Chattahoochee RC&D Council	Joe Riley (Acting)	706-894-1591	joe.riley@ga.usda.gov	170 Scoggins Drive Demorest, GA 30535
Southwestern NC RC&D Council	Tim Garrett	828-452-2519	tim.garrett@nc.usda.gov	P. O. Box 1230, Waynesville, NC 28786

Soil & Water Conservation Districts:

Boards and staff under the administration of the GA or NC Soil and Water Conservation Commissions. In NC, Districts are responsible for: administering the *NC Agricultural Cost Share Program* at the county level; identifying areas needing soil and/or water conservation treatment; allocating cost share resources; signing cost share contracts with landowners; providing technical assistance for the planning and implementation of BMPs; and encouraging the use of appropriate BMPs to protect water quality.

County	Local Contact	Email	Phone	Address
Towns/Union, GA	Jim Dobson Board Chairman	none	706-745-2517	PO Box 925 Blairsville, GA 30512
Cherokee Co., NC	Michael Stiles ACSP Technician	micheal.stiles@ cherokeecounty-nc.gov	828-837-6417 x3	225 Valley River Ave., Ste. J Murphy, NC 28906
Clay Co., NC	Glen Cheeks ACSP Technician	glen.cheeks@ nc.nacdnet.net	828-389-9764	PO Box 57 Hayesville, NC 28904

Construction/Stormwater

The following agencies and contacts are currently responsible for administration of erosion and sediment control programs associated with construction operations. [Please note that Union County, GA has a local sediment & erosion control officer that should be contacted prior to contacting the GA EPD.]

County	Contact	Email	Phone	Address
Towns County, GA	GADNR - Environmental Protection Division	Matt.Sherwood@dnr.state.ga.us	(770) 387-4935	16 Center Road Cartersville, GA 30121 [PO Box 3250, 30120]
		Bert.Langley@dnr.state.ga.us	(770) 387-4929	
Clay County, NC	NCDENR - Division of Land Resources	Rick.Allred@ncmail.net Janet.Boyer@ncmail.net	(828) 296-4500	2090 U.S. Highway 70 Swannanoa, NC 28778
Clay County, NC	NCDENR - Division of Water Quality	Starr.Silvis@ncmail.net Roger.Edwards@ncmail.net	(828) 296-4500	2090 U.S. Highway 70 Swannanoa, NC 28778

Education

These agencies provide practical, research-based information and programs to help individuals, families, farms, businesses and communities.

County	Contact	Email	Phone	Address
Towns County, GA	Robert Brewer	rbrewer@uga.edu	(706) 896-2024	67 Lakeview Circle Hiawassee, GA 30546 [PO Box 369]
Clay County, NC	Silas Brown	silas_brown@ncsu.edu	(828)389-6305	55 Riverside Circle Room 108 Hayesville, NC 28904
	GA Mtn. Research & Education Center	gamtnstn@uga.edu	(706) 745-2655	2564 GA Mountain Experiment Station Rd. Blairsville, GA 30512
	Institute for Continuing Learning	icl@yhc.edu	(706) 379-5194	Young Harris College P. O. Box 68 Young Harris, GA 30582

General Water Quality

Agency	Contact	Email	Phone	Address
NC Division of Water Quality - Basinwide Planning Program	Dave Toms	dave.toms@ncmail.net	(919) 733-5083 ext. 577	1617 Mail Service Center Raleigh, NC 27699-1617
GA Environmental Protection Division - Watershed Protection	Becky Champion	becky.champion@dnr.state.ga.us	(770) 387-4935	16 Center Road Cartersville, GA 30121 [PO Box 3250, 30120]
Tennessee Valley Authority	Linda Harris	lbharris@tva.gov	(423) 876-4178	1101 Market St., PSC 1E Chattanooga, TN 37402
	Scott Lea	jslea@tva.gov	(423) 876-6739	

APPENDIX V

HRWC History, Services Provided & Governance

HRWC is a local, non-governmental, conservation nonprofit organization that works to facilitate water quality improvements in lakes and streams throughout the upper Hiwassee River watershed within Towns and Union counties in north GA and Cherokee and Clay counties in NC. For more than 10 years HRWC has provided water quality education, funding for and implementation of voluntary watershed restoration projects, services in coordinating communication between various agencies working in our area, watershed planning, and opportunities for citizens to volunteer. The HRWC leadership believes that for water resources to truly be protected, citizens within a watershed must understand and participate in protection and restoration efforts. However, the organization does not get involved in legislative or political campaign advocacy.

HRWC currently has four major program areas: Watershed Restoration, Lake/Watershed Planning, Water Quality Education, and Volunteer Opportunities. Overall goals have been established as follows:

- ◆ Accomplish actual on-the-ground water quality/habitat improvements within priority watersheds;
- ◆ Plan for future water quality improvements using a watershed-based approach;
- ◆ Educate watershed residents about local water quality issues and encourage behavior that results in positive watershed/water quality responses; and
- ◆ Give citizens within the watershed opportunities to get directly involved in the protection and improvement of water quality.
- ◆ Maintain and grow an efficient, effective, fiscally sound organization.

The Coalition provides the following “services” to the 4-county coverage area:

- √ conducts ongoing studies and maintains a general awareness of ecological conditions of the watershed area,
- √ collects water quality data and acts as a clearinghouse for data collected by various agencies within the watershed,
- √ coordinates stream restoration work and other water quality improvement projects in priority watersheds,
- √ facilitates communication between government agencies for a range of activities within the Hiwassee River basin,
- √ provides technical assistance to local governments and the general public,
- √ maintains an active volunteer program, and
- √ provides general public outreach and environmental education.

Additional services provided to HRWC members include:

- √ provides technical assistance associated with permitting and implementation of construction and post-construction-stormwater best management practices,
- √ provides guidance for permitting associated with 404/401 issues and assistance in locating mitigation sites,
- √ maintains current list of local contractors and engineering firms with a good track record for compliance with governmental rules and regulations,
- √ generates significant publicity directed to the regional conservation community and beyond,
- √ helps in locating funding sources for water quality improvements associated with specific projects within the watershed area,
- √ sometimes provides a forum for communication between government agencies and businesses and sometimes acts as a liaison, and
- √ provides general technical assistance and programming related to water quality.

The HRWC Board of Directors is composed of at least nine members to include an appointed representative from the Cherokee (1), Clay (1), and Blue Ridge Mountain (2) Soil & Water Conservation Districts and the Cherokee, Clay, Towns and Union County Commissions. The eight appointed representatives then appoint at least one At-Large Director. Up to six additional At-Large Directors may also be appointed to ensure adequate representation of the communities served by the Coalition, as long as geographic diversity is not compromised and Directors residing in one county do not constitute a majority. The 10-member **2007 HRWC Board of Directors** is as follows:

Gilbert Nicolson, Chairperson
Appointed by Clay County Board of Commissioners
Clay County, NC

Norm Bennett, Vice-Chairperson
Appointed by Blue Ridge Mountain Soil & Water Conservation District
Towns County, GA

Andrew Blankenship, Secretary
Appointed by the Clay County Soil & Water Conservation District
Clay County, NC

Brenda Hull, Treasurer
At-Large
Clay County, NC

Silas Allen
Appointed by the Cherokee County Board of Commissioners
Cherokee County, NC

Eddie Bradley
Appointed by the Towns County Commissioner
Towns County, GA

Jim Carringer
Appointed by the Cherokee County Soil & Water Conservation District
Cherokee County, NC

Harold Coleman
At-Large
Cherokee County, NC

Jim Dobson
Appointed by the Blue Ridge Mountain Soil & Water Conservation District
Union County, GA

Bud Hill
Appointed by the Union County Commissioner
Union County, GA