TOTAL MAXIMUM DAILY LOADS (TMDLs)

For
Chlordane
And Polychlorinated Biphenyls (PCBs)
In
Boone Reservoir

South Fork Holston River Watershed (HUC 06010102)
And
Watauga River Watershed (HUC 06010103)

Sullivan and Washington Counties, Tennessee

FINAL

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LIST OF ABBREVIATIONS

ADB	Assessment Database
BCF	Bioconcentration Factor
BMP	Best Management Practices
CFR	Code of Federal Regulations
EFO	Environmental Field Office
GIS	Geographic Information System
HRT	Hydraulic Retention Time
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NHD	National Hydrography Dataset
NPS	Non-point Source
NPDES	National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyl
RM	River Mile
RMCF	Ready Mixed Concrete Facility
STP	Sewage Treatment Plant
STATSGO	State Soil and Geographic Database
SWPPP	Storm Water Pollution Prevention Plan
SSURGO	Soil Survey Geographic Database
TDA	Tennessee Department of Agriculture
TDEC	Tennessee Department of Environment & Conservation
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility

SUMMARY SHEET

BOONE RESERVOIR (TN06010102006_1000)

Total Maximum Daily Load for Chlordane and Polychlorinated Biphenyls (PCBs) as Identified on the State of Tennessee's *2006 303(d) List*

Impaired Waterbody Information:

State: Tennessee
Counties: Sullivan and Washington
Watersheds: South Fork Holston River Watershed (HUC 06010102) and Watauga River Watershed (HUC 06010103)
Constituents of Concern: Chlordane and Polychlorinated Biphenyls (PCBs)

Waterbody ID	Impaired Waterbody	Miles/Ac
TN06010102006_1000	Boone Reservoir	4400 ac

Designated Uses: Domestic water supply, fish & aquatic life, industrial water supply, irrigation, livestock watering & wildlife, and recreation.

Applicable Water Quality Standard (Chlordane): Most stringent numerical criteria applicable to fish & aquatic life use classification.

Toxic Substances (Chlordane): The waters shall not contain substances or a combination of substances including disease-causing agents which, by way of either direct exposure or indirect exposure through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), physical deformations, or restrict or impair growth in fish or aquatic life or their offspring.

Applicable Water Quality Standard (PCBs): Most stringent numerical criteria applicable to recreation use classification.

Toxic Substances (PCBs): The waters shall not contain toxic substances, whether alone or in combination with other substances, that will render the waters unsafe or unsuitable for water contact activities including the capture and subsequent consumption of fish and shellfish, or will propose toxic conditions that will adversely affect man, animal, aquatic life, or wildlife. Human health criteria have been derived to protect the consumer from consumption of contaminated fish and water. The water and organisms criteria should only be applied to those waters classified for both recreation and domestic water.

TMDL Development

General Analysis Methodology:

- Composite fish tissue samples are collected and analyzed for constituents of concern. Existing loads of chlordane and PCBs in the water column are estimated from the fish tissue concentrations using the Bioconcentration Factors defined by the U.S. Environmental Protection Agency.

- Maximum allowable loads are based on the product of the median winter pool volume and the water quality criteria established by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control.

- TMDLs are established by dividing the maximum allowable loads by the hydraulic retention time.

- Waste Load Allocations (WLAs) are derived for point source dischargers of chlordane and/or PCBs.

- Load Allocations are established for non-point sources using a mass-balance approach.

Critical Conditions: Methodology takes into account all flow conditions.

Seasonal Variation: Methodology addresses all seasons.

Margin of Safety (MOS): 20% (Explicit).

TMDLs/Allocations

Waterbody ID	Impaired Waterbody	Pollutant	TMDL	WLA	LA	MOS	***Required Load Reduction****
			[lb/day]	**[lb/day]**	**[lb/day]**	**[lb/day]**	***[%]***
TN06010102006_1000	Boone Reservoir	Chlordane	0.03	0.00	0.024	0.006	*0.0*
		PCBs	0.005	0.00	0.004	0.001	*89.9*

*Note: Load reduction required to achieve TMDL.

TOTAL MAXIMUM DAILY LOADS (TMDLs)
FOR CHLORDANE AND PCBs
BOONE RESERVOIR (TN06010102006_1000)

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology-based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Impaired waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those waterbodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses, and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and non-point sources in order to restore and maintain the quality of water resources (USEPA, 1991).

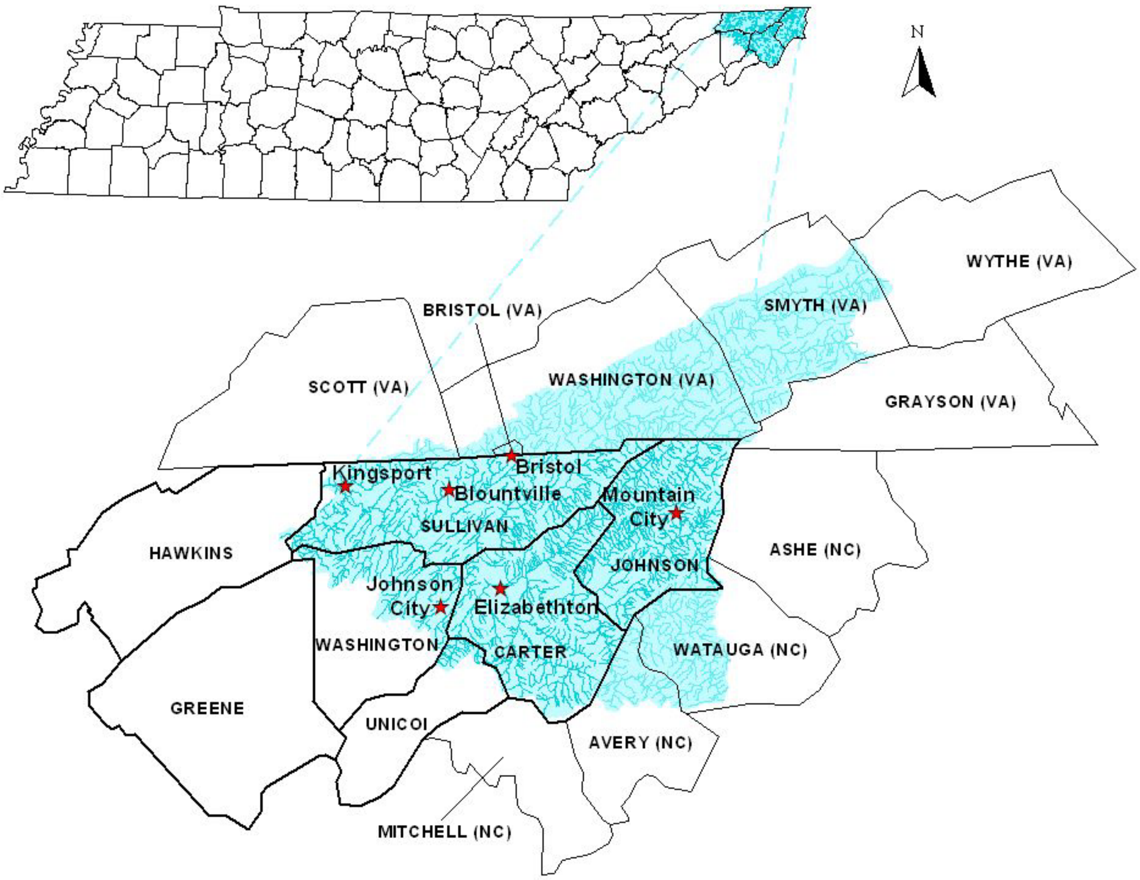
2.0 WATERSHED DESCRIPTION

Boone Reservoir is located in Sullivan and Washington counties of northeastern Tennessee. Tennessee Valley Authority, who completed construction of Boone Dam in 1952, maintains the reservoir. One arm of the reservoir runs along the South Fork Holston River and the other arm along the Watauga River. Therefore, Boone Reservoir is actually located within two 8-digit Hydrologic Unit Code watersheds.

The South Fork Holston River Watershed, Hydrologic Unit Code (HUC) 06010102, is located in Virginia and East Tennessee. The Watauga River Watershed, HUC 06010103, lies within North Carolina and East Tennessee (ref.: Figure 1). The information (including figures and tables) presented hereafter in this document is for the Tennessee portions of the watersheds only. These adjacent watersheds include parts of Carter, Greene, Hawkins, Johnson, Sullivan, Unicoi, and Washington counties in Tennessee. The South Fork Holston and Watauga River Watersheds are both positioned within two Level III ecoregions (Blue Ridge Mountains and Ridge and Valley). There are seven Level IV subecoregions in the South Fork Holston River Watershed (ref.: Figure 2), five of which are also in the Watauga River Watershed (USEPA, 1997).

The Tennessee portion of the South Fork Holston River Watershed has approximately 866 miles of streams and 12,884 reservoir/lake acres (based on the USEPA/TDEC Assessment Database (ADB)) and drains approximately 546 square miles to the Tennessee River. The parts of the Watauga River Watershed within Tennessee contain approximately 1,087 miles of streams and 6,499 reservoir/lake acres (ADB), which drain approximately 665 square miles to Boone Reservoir.

Figure 1 Location of South Fork Holston and Watauga River Watersheds



Land use distribution is based on the 1992 Multi-Resolution Land Characteristic (MRLC) satellite imagery databases. Table 1 summarizes land use for the combined South Fork Holston and Watauga River Watersheds, as shown in Figure 3.

Figure 2 Level IV Ecoregions in the South Fork Holston and Watauga River Watersheds

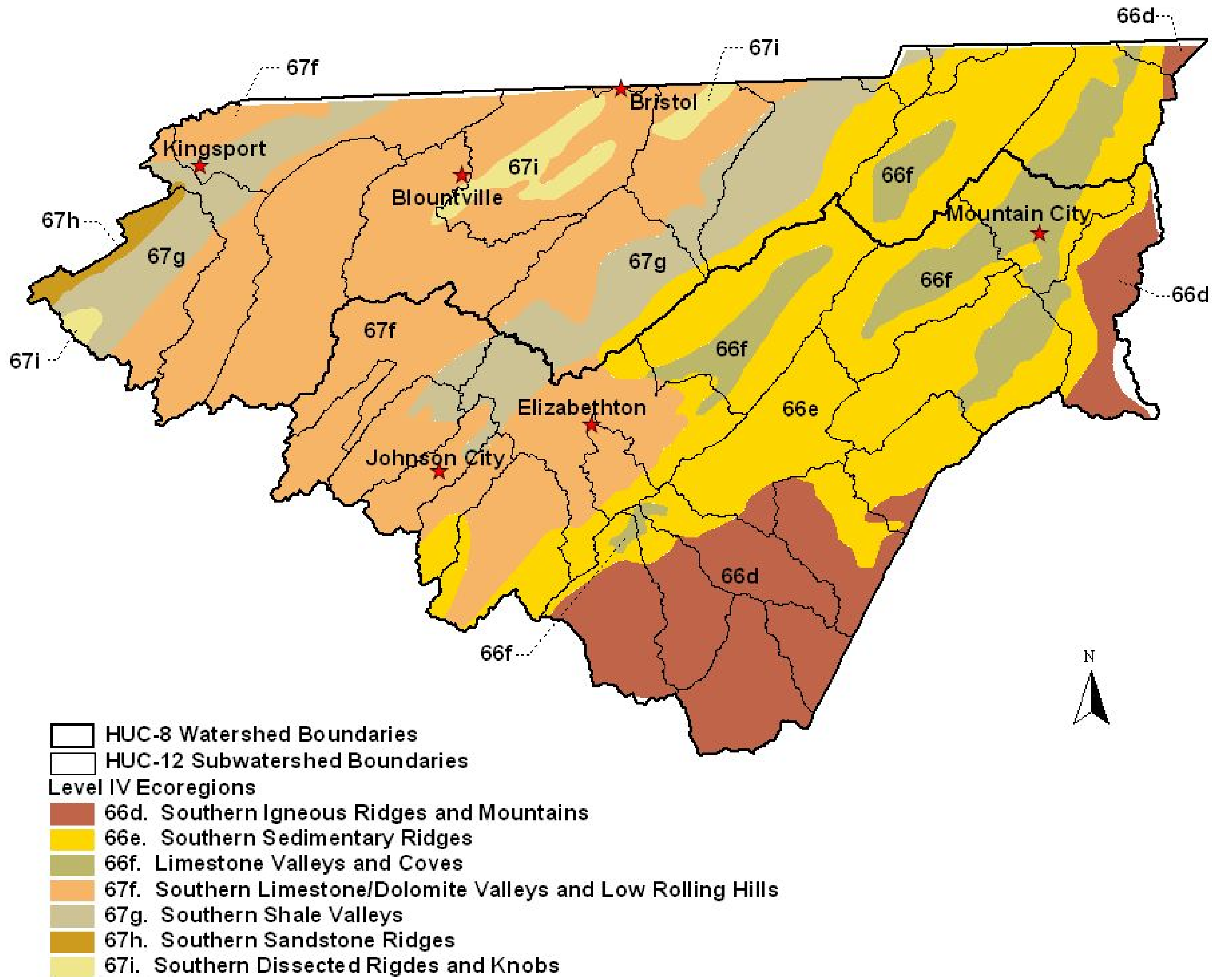


Figure 3 Land Use in the South Fork Holston and Watauga River Watersheds

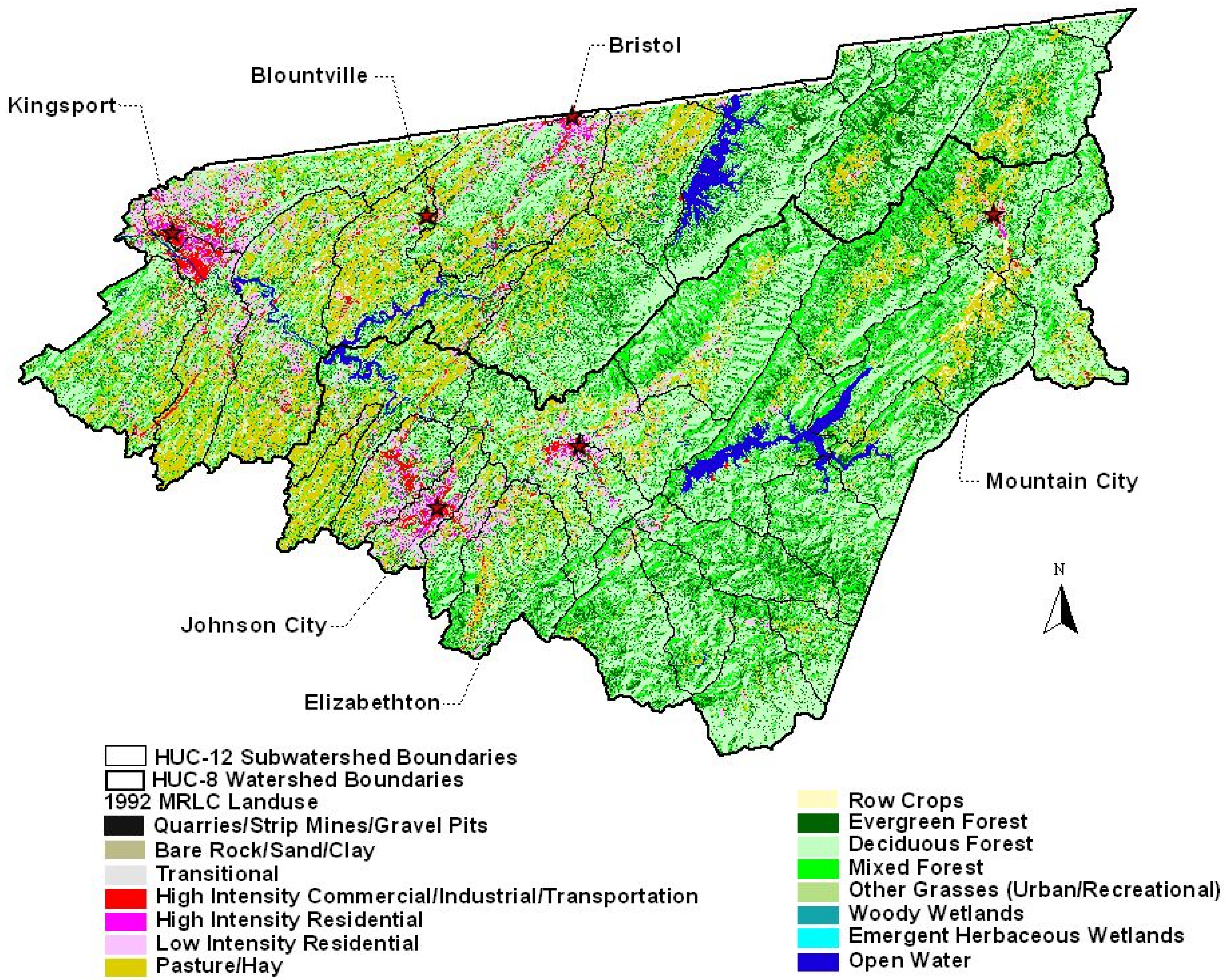


Table 1 Land Use Distribution – South Fork Holston and Watauga River Watersheds

Land Use	Area		[% of watersheds]
	[acres]	[mi^2]	
Bare Rock/Sand/Clay	1,588	2.48	0.20
Barren	21	0.03	0.00
Deciduous Forest	315,131	492.39	40.65
Emergent Herbaceous Wetlands	350	0.55	0.05
Evergreen Forest	112,787	176.23	14.55
High Intensity Commercial/Industrial/Transportation	12,350	19.30	1.59
High Intensity Residential	4,595	7.18	0.59
Low Intensity Residential	35,512	55.49	4.58
Mixed Forest	149,073	232.93	19.23
Open Water	15,474	24.18	2.00
Other Grasses	8,738	13.65	1.13
Pasture/Hay	99,624	155.66	12.85
Quarries/Strip Mines/Gravel Pits	164	0.26	0.02
Row Crops	16,898	26.40	2.18
Transitional	1,464	2.29	0.19
Woody Wetlands	1,386	2.17	0.18
Total	**775,156**	**1,211.18**	**100.00**

Note: A spreadsheet was used for this calculation and values are approximate due to rounding.

3.0 PROBLEM DEFINITION

The designated use classifications for Boone Reservoir include domestic water supply, fish & aquatic life, industrial water supply, irrigation, livestock watering & wildlife, and recreation. The State of Tennessee's *2006 303(d) List* (TDEC, 2006) identified Boone Reservoir (TN06010102006_1000) in the South Fork Holston and Watauga River Watersheds as not fully supporting designated use classifications due to elevated levels of chlordane and polychlorinated biphenyls (PCBs) in fish tissue samples. Contaminated sediment has been identified as the source of pollutant causes associated with both impairments. The 2006 303(d) listing for Boone Reservoir is summarized in Table 2 and the waterbody is shown in Figure 4. Assessment information excerpted from the Assessment Database (ADB) is also listed in Table 2. ADB information may be accessed at:

http://gwidc.memphis.edu/website/dwpc/

Figure 4 Location of Boone Reservoir Chlordane and PCB Impairments (Documented on the *2006 303(d) List*)

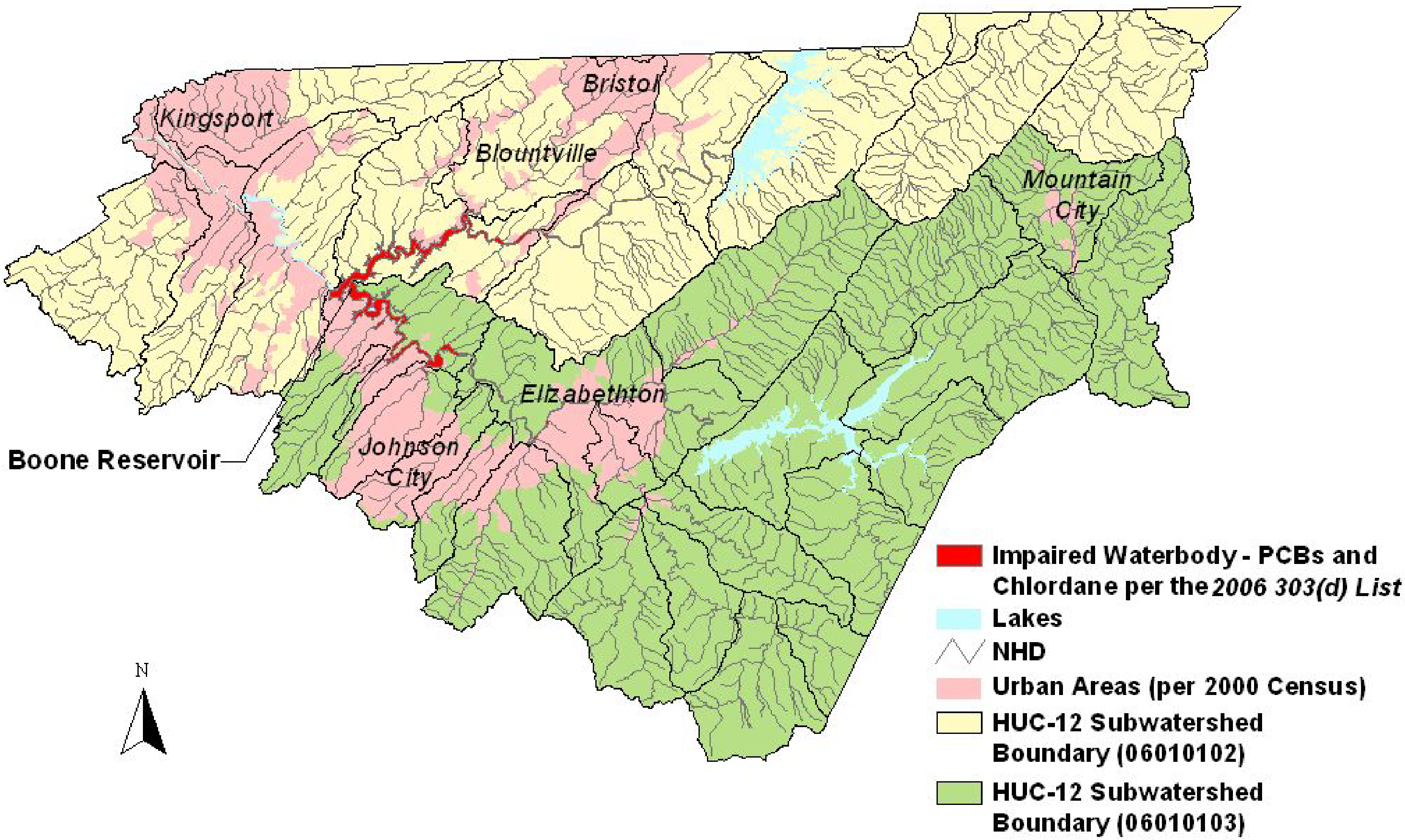


Table 2 *2006 303(d) List* - Stream Impairment Due to Chlordane and PCBs

Waterbody ID	Waterbody	Miles/ Acres	Cause (Pollutant)	Source (Pollutant)	Assessment Comments
TN06010102006_1000	Boone Reservoir (on the South Fork Holston River in Sullivan and Washington counties)	4400 ac	PCBs Chlordane	Contaminated Sediment	TDEC and TVA fish tissue monitoring. TDEC chemical station at mile 18.8, 22.5, 26.2, 27.5, 29.5, 30.8, 34.3, & 35.1. TVA sampling station at mile 27.0. TVA sampling station at SFH mile 28.2, 30.8, 33.0, 34.3 & Beaver Creek embayment. Fish tissue advisory. Some concerns about biomass.

3.1 Chlordane

Chlordane is a synthetic, chlorinated organic compound with broad applications as an insecticide. Pure chlordane is a mixture of stereoisomers primarily in the cis (alpha) and trans (gamma) forms. Technical grade chlordane, on the other hand, is a formulary of various chlorinated hydrocarbons (e.g. heptachlor, chlordene, and nonachlor) in addition to the cis and trans isomers. Chlordane was widely used in the United States for termite control and as an insecticide for agricultural crops, home lawns, and gardens. Due to rising concerns over the product's safety, however, the U.S. Environmental Protection Agency began to restrict the use of chlordane on food crops, lawns, and gardens as early as 1978.

Chlordane is an environmentally persistent and bioaccumulative substance, which has been classified as a probable human carcinogen. Although it can still be manufactured in the United States, the Environmental Protection Agency canceled commercial use of chlordane in 1988. Large amounts of chlordane were already widely distributed throughout the environment by the time its usage ended. According to *Toxicological Review of Chlordane* (USEPA, 1997a), "[Chlordane] residues still exist in soils and sediments and chlordane bioaccumulates in fatty tissue of fish and humans; this bioaccumulation is a source of current concern."

3.2 Polychlorinated Biphenyls (PCBs)

PCBs are a group of 209 distinct chlorinated biphenyl compounds. These 209 synthetic organic compounds vary not only in their physical and chemical properties, but also in toxicity (USEPA, 1999). PCBs exist as individual congeners or in the form of commercial mixtures known as Aroclors. Due to their chemical stability, polychlorinated biphenyls were used in a variety of commercial practices especially electrical and heat transfer processes.

PCBs were legally manufactured in the United States until the U.S. Environmental Protection Agency banned their production in 1979. Prior to this ban, PCBs were commonly used in transformers, capacitors, coatings, adhesives, and an assortment of other products. The manufacturing ban on PCBs did not require all PCB-containing materials to be removed from use. Therefore, some PCBs may still be utilized commercially. Before strict disposal regulations were established, large amounts of PCBs were discarded improperly. So, although the production of PCBs has ceased, these chemicals are widely distributed throughout the environment.

As stated in *Fact Sheet: Polychlorinated Biphenyls Update: Impact on Fish Advisories* (USEPA, 1999):

> Currently, the major source of PCBs is environmental reservoirs from past releases. PCBs have been detected in soil, surface water, air, sediment, plants, and animal tissue in all regions of the earth. PCBs are highly persistent in the environment with reported half-lives in soil and sediment ranging from months to years.

Once in the sediment, PCBs can enter the aquatic food chain. PCBs are fat-soluble chemicals with the potential to concentrate in fish tissue. As a result, humans may be exposed to PCBs through the consumption of contaminated foods, primarily contaminated fish. Studies have demonstrated adverse health effects resulting from PCB exposure. PCBs are classified as probable human carcinogens and among other things have been shown to be toxic to the immune system, the reproductive system, the nervous system, and the endocrine system.

To protect fish consumers, the Tennessee Department of Environment and Conservation, Division of Water Pollution Control currently issues 2 types of fish consumption advisories. A "do not consume" advisory targets the general population and warns that no one should eat specific fish from a particular body of water. The "precautionary advisory" specifies that atypical consumers (those who are more sensitive to contaminated fish consumption) should not consume the fish species named, and all other people should limit consumption to one meal per month (TDEC, 2004). A precautionary advisory for carp and catfish was posted for Boone Reservoir.

4.0 TARGET IDENTIFICATION

These TMDLs are being proposed for Boone Reservoir, which is impaired because chlordane and PCBs in fish tissue samples were detected at levels that exceed the applicable water quality criteria. In order for a TMDL to be established, a numeric "target" protective of the uses of the water must be identified to serve as the basis for the TMDL. Numerical criteria, applicable for chlordane and PCBs have been established in *Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-3 General Water Quality Criteria, January 2004* (TDEC, 2004) to preserve the various use classifications.

4.1 Chlordane Target

The fish & aquatic life designated use classification will provide the basis for the chlordane TMDL. While numeric criteria also exist under the recreation designated use, TMDLs developed to protect fish & aquatic life will protect all other use classifications for the identified waterbody from adverse alteration due to chlordane loading. Under the fish & aquatic life designated use classification, the Tennessee water quality criterion continuous concentration (CCC) for chlordane is 0.0043 μg/L and the criterion maximum concentration (CMC) is 2.4 μg/L. Due to the bioaccumulative nature of the chlordane impairment, the more stringent continuous concentration criterion will serve as the appropriate target for the TMDL.

4.2 PCB Target

The recreation designated use classification will provide the basis for this PCB TMDL. While numeric criteria exist under the fish & aquatic life designated use, TMDLs developed to protect recreation will protect all other use classifications for the identified waterbody from adverse effects due to PCB loading. The Tennessee water quality criteria for individual PCB Aroclors and total PCBs are both 0.00064 μg/L under the recreation designated use classification. This value is the same for organism only and water & organism consumption. So, 0.00064 μg/L will serve as the appropriate target for the TMDL.

5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Fish tissue samples were collected from the sites shown in Figure 5. According to the methodology outlined in Section 7.1, the water column concentrations and the existing loads of chlordane and PCBs in the water column were predicted from composite fish tissue data.

5.1 Chlordane Water Quality Assessment and Deviation

Using fish tissues samples from the sites along both arms of the reservoir, the concentration of chlordane in the water column was estimated through the Bioconcentration Factor defined by the U.S. Environmental Protection Agency (ref.: Appendix A). The annual water column concentrations were geometrically averaged and compared to the applicable water quality criterion. The existing concentration was based on the fish data corresponding to the highest annual average concentration (ref.: Table 3). Accordingly, the amount of chlordane in the water column was estimated to be 0.0014 μg/L, which is less than the 0.0043 μg/L target value.

5.2 PCBs Water Quality Assessment and Deviation

The existing concentration of PCBs in the water column was estimated through the Bioconcentration Factor defined by the U.S. Environmental Protection Agency (ref.: Appendix B). This data is presented in Table 4. According to the fish species with the highest geometric mean of PCB concentrations, the existing water column concentration was calculated to be 0.0064 μg/L, which is greater than the 0.00064 μg/L target value.

Table 3 Existing Concentration of Chlordane in Boone Reservoir Predicted from Fish Tissue Samples

Fish Species	Sample Year	Sampling Site Location	Total Chlordane in Fish Sample (ppm)	Calculated Water Column Concentration (µg/L)	Annual Average (Geomean) Water Column Concentration (µg/L)
Carp	1991	Watauga RM 4	0.100	0.0014	0.0014
	1994	SF Holston 22	0.025	0.0004	0.0004
	1999	SF Holston 27	0.047	0.0007	0.0006
		Watauga RM 6.5	0.037	0.0005	
		Geomean	**0.046**	**0.0006**	
Bass	1991	Watauga RM 4	0.079	0.0011	0.0011
		Geomean	-	-	
SM Bass	1994	SF Holston RM 22	0.012	0.0002	0.0002
		Geomean	-	-	
LM Bass	1999	SF Holston RM 19	0.066	0.0009	0.0004
		SF Holston RM 27	0.012	0.0002	
		Watauga RM 6.5	0.032	0.0005	
		Geomean	**0.029**	**0.0004**	
(Channel) Catfish	1991	Watauga RM 4	0.079	0.0011	0.0011
	1994	Watauga RM 4	0.044	0.0006	0.0006
		SF Holston RM 22	0.047	0.0007	
	1999	SF Holston RM 19	0.047	0.0007	0.0006
		SF Holston RM 27	0.045	0.0006	
		Watauga RM 6.5	0.034	0.0005	
	2001	SF Holston RM 19	0.020	0.0003	0.0004
		SF Holston 27	0.060	0.0009	
		Watauga RM 6.0	0.020	0.0003	
	2005	SF Holston RM 19	0.050	0.0007	0.0007
		SF Holston RM 19	0.080	0.0011	
		Watauga RM 6.5	0.030	0.0004	
		Geomean	**0.048**	**0.0006**	

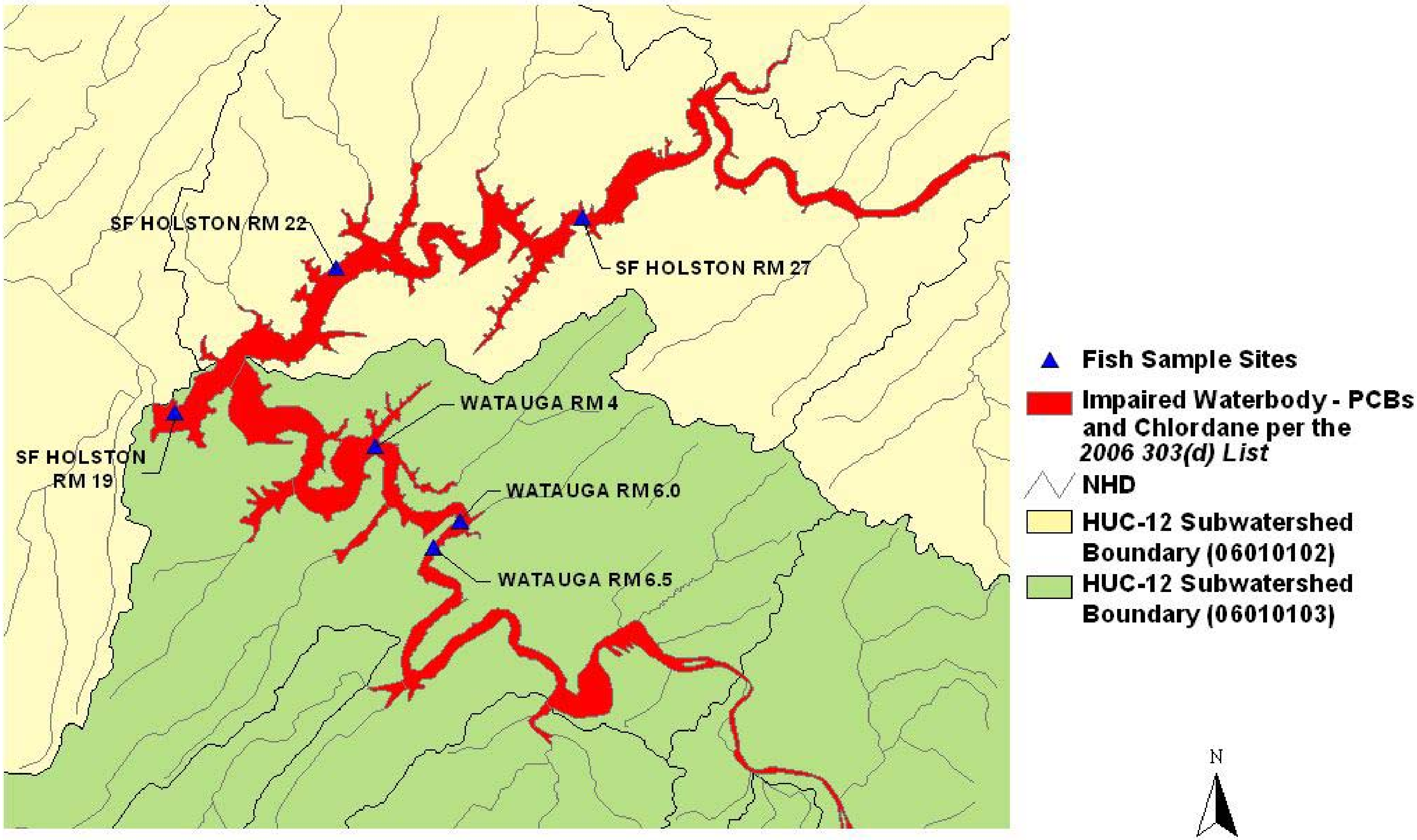
Note: For data 1999 and before - Total chlordane was calculated as the sum of alpha chlordane, gamma chlordane, cis-nonachlor, and trans-nonachlor. For data after 1999 – Total chlordane also includes oxychlordane and chlordene.

Table 4 Existing Concentrations of PCBs in Boone Reservoir Predicted from Fish Tissue Samples

Fish Species	Sample Year	Sampling Site Location	PCBs in Fish Sample (ppm)	Calculated Water Column Concentration (µg/L)
LM Bass	1999	SF Holston RM 19	0.062	0.0020
		SF Holston RM 27	0.044	0.0014
		Watauga RM 6.5	0.060	0.0019
		Geomean	**0.055**	**0.0018**
(Channel) Catfish	1999	SF Holston RM 19	0.117	0.0038
		SF Holston RM 27	0.172	0.0055
		Watauga RM 6.5	0.110	0.0035
	2001	SF Holston RM 19	0.200	0.0064
		SF Holston RM 27	0.300	0.0096
		Watauga RM 6.0	0.100	0.0032
	2005	SF Holston RM 19	0.400	0.0128
		SF Holston RM 19	0.500	0.0160
		Watauga RM 6.5	0.200	0.0064
		Geomean	**0.201**	**0.0064**
Carp	1999	SF Holston RM 19	0.153	0.0049
		SF Holston RM 27	0.178	0.0057
		Watauga RM 6.5	0.161	0.0052
		Geomean	**0.164**	**0.0052**

Note: Data presented is representative of PCB Aroclor 1260 – other Aroclors may have been below detection limits.

Figure 5 Sample Collection Sites in Boone Reservoir along the South Fork Holston and Watauga Rivers



6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of pollutants in the watershed and the amount of pollutant loading contributed by each of these sources. According to the Clean Water Act, sources are broadly classified as either point or non-point sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Regulated point sources include: 1) municipal and industrial wastewater treatment facilities (WWTFs); 2) storm water discharges associated with industrial activity (which includes construction activities); and 3) certain discharges from Municipal Separate Storm Sewer Systems (MS4s). For the purposes of these TMDLs, all sources of pollutant loading not regulated by NPDES are considered non-point sources.

6.1 Point Sources

There are numerous permitted dischargers in the South Fork Holston and Watauga River Watersheds. However, there are currently no permitted point source dischargers with existing allocations for chlordane or PCBs.

6.2 Non-point Sources

Assessments have named contaminated sediment as the source of chlordane and PCB impairments in Boone Reservoir. According to the U.S. Environmental Protection Agency, “Because PCBs have very low solubility in water and low volatility, most PCBs are contained in sediments that serve as environmental reservoirs from which PCBs may continue to be released over a long period of time. PCBs may be mobilized from sediments if disturbed (e.g., flooding, dredging)” (USEPA, 1999).

Historical data contains very little information regarding point or non-point sources of chlordane and PCBs. Therefore, until site-specific data proves otherwise, these TMDLs will consider contaminated sediment in the reservoir bed as the primary source of chlordane and PCB contamination in Boone Reservoir.

7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOADS

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations) and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma\ \text{WLAs} + \Sigma\ \text{LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

7.1 Analysis Methodology

TMDL analyses were performed at various sites to evaluate waterbodies identified as impaired on the *2006 303(d) List* due to elevated levels of chlordane and PCBs in fish tissue samples. The TMDL for PCBs in the water column, and the corresponding required load reduction, were calculated according to the following procedure:

- Fish tissue samples were collected and analyzed as defined in *The Results of Fish Tissue Monitoring in Tennessee 1992-1997* (TDEC).

- The geometric mean of the concentrations of PCBs in the fish tissue samples was calculated. If several species were analyzed from the same waterbody, the fish species with the highest geometric mean (ref.: Table 4) was used to estimate the concentration of PCBs in the water column:

$$C_{water} = \frac{C_{fish}}{BCF} \times 1{,}000$$

Where C_{fish}= Fish tissue concentration (mg/kg)
C_{water} = Water column concentration (μg/L)
BCF = Bioconcentration factor (31,200 L/kg)
1,000 = Conversion factor (μg/mg)

- Assuming uniform distribution, the existing total PCB load of the reservoir was computed as the product of the median winter pool volume and the calculated water column concentration (ref.: Section 5.2):

Existing Load = C_{water} x Winter Pool Volume x Unit Conversion Factor

- The maximum allowable amount of PCBs in the reservoir at any time, was determined by the product of the water quality target concentration (ref.: Section 4.2) and the median winter pool volume:

Maximum Allowable Load = C_{target} x Winter Pool Volume x Unit Conversion Factor

- The TMDL was calculated by dividing the maximum allowable load of PCBs in the reservoir at any time by the hydraulic retention time (HRT).

$$\text{TMDL} = \frac{\text{Maximum Allowable Load}}{\text{HRT}}$$

- A percent reduction, corresponding to the TMDL, was computed based on the existing load and the maximum allowable load:

$$\% \text{ Reduction} = \frac{(\text{Existing Load}) - (\text{Maximum Allowable Load})}{(\text{Existing Load})} \times 100\%$$

- A 20% explicit margin of safety was incorporated into the TMDL.

- Waste load and load allocations were calculated using the TMDL value.

Similar methodology was followed for chlordane. However, in order to fairly compare the existing loads to the TMDL, the chlordane-specific normalized Bioconcentration Factor and default lipid composition (ref.: Appendix A) which were utilized to develop the fish & aquatic life designated use criteria were also used to calculate existing water column concentrations.

7.2 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) into the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, a 20% explicit margin of safety was utilized to account for uncertainties.

7.3 Seasonal Variation

Chlordane can persist in the environment for many years and since there are no known sources of additional chlordane loading, the mass of chlordane contained in the reservoir bed is assumed to be constant over short periods of time. So the concentration of chlordane should be inversely proportional to the volume of water in the reservoir. Determination of chlordane loads using the median winter pool volume (when reservoir levels generally are lowest) accounts for periods when the chlordane concentrations would theoretically be the greatest. Similar logic applies to PCBs, which also persist in the environment for many years and for which no sources of additional loading could be identified. Therefore, the TMDLs will provide year-round protection of water quality standards.

7.4 TMDLs for the Impaired Waterbody

For Boone Reservoir the median winter pool volume between 1972 and 1999 was 96,600 ac-ft. The hydraulic retention time is 37 days. TMDLs were derived according to the methodology described in Section 7.1.

PCBs:

$$\text{Maximum Allowable Load} = 0.00064\ \mu g/L \times 96{,}600\ \text{ac-ft} \times (1.23\times10^{6})\ L/\text{ac-ft} \times (2.205\times10^{-9})\ lb/\mu g$$
$$\text{Maximum Allowable Load} = 0.17\ lb$$

$$\text{TMDL} = 0.17\ lb / 37\ \text{days} = 0.005\ lb/day$$

Using the estimated water column concentration specified in Section 5.2, the existing load was calculated:

$$\text{Existing Load} = 0.0064\ \mu g/L \times 96{,}600\ \text{ac-ft} \times (1.23\times10^{6})\ L/\text{ac-ft} \times (2.205\times10^{-9})\ lb/\mu g = 1.68\ lb$$

The percent reduction corresponding to the TMDL was computed from the existing load and maximum allowable load:

$$\%\ \text{Reduction} = \frac{(1.68\ lb) - (0.17\ lb)}{(1.68\ lb)} \times 100\% = 89.9\%$$

Chlordane:

$$\text{Maximum Allowable Load} = 0.0043\ \mu g/L \times 96{,}600\ \text{ac-ft} \times (1.23\times10^{6})\ L/\text{ac-ft} \times (2.205\times10^{-9})\ lb/\mu g$$
$$\text{Maximum Allowable Load} = 1.13\ lb$$

$$\text{TMDL} = 1.13\ lb\ /\ 37\ \text{days} = 0.03\ lb/day$$

The existing load was calculated from the estimated water column concentration (ref.: Section 5.1):

$$\text{Existing Load} = 0.0014\ \mu g/L \times 96{,}600\ \text{ac-ft} \times (1.23\times10^{6})\ L/\text{ac-ft} \times (2.205\times10^{-9})\ lb/\mu g = 0.37\ lb$$

Since the calculated existing load is below the maximum allowable load, no load reduction is necessary for chlordane to satisfy the TMDL.

The TMDL values represent the maximum allowable daily loading of chlordane and PCBs. Furthermore, these values assume that the pollutants will be uniformly distributed throughout the waterbody. Such conditions may or may not exist, and in either case the localized concentration of either pollutant in Boone Reservoir should not exceed water quality target values. The TMDLs and percent reductions are summarized in Table 5.

7.5 Development of Waste Load Allocations and Load Allocations

7.5.1 Waste Load Allocations

There are currently no permitted point source dischargers with existing allocations for chlordane or PCBs. Zero waste load allocations are being provided.

7.5.2 Load Allocations

The load allocation requires the contribution from non-point sources to be less than or equal to the TMDL target value. In the absence of point sources,

$$LA = TMDL - MOS$$

Table 5 TMDLs and Allocations for Boone Reservoir (TN06010102006_1000)

Waterbody ID	Impaired Waterbody	Pollutant	TMDL	WLA	LA	MOS	***Required Load Reduction****
			[lb/day]	**[lb/day]**	**[lb/day]**	**[lb/day]**	***[%]***
TN06010102006_1000	Boone Reservoir	Chlordane	0.03	0.00	0.024	0.006	*0.0*
		PCBs	0.005	0.00	0.004	0.001	*89.9*

*Note: Load reduction required to achieve TMDL.

Incorporating the 20% MOS into the TMDL restricts the chlordane loading in Boone Reservoir to 0.024 lb/day. Likewise, once the MOS is accounted for, the PCB loading in the waterbody is limited to 0.004 lb/day. The allocations for Boone Reservoir are also provided in Table 5.

8.0 IMPLEMENTATION PLAN

8.1 Point Sources

There are currently no NPDES permitted facilities with an existing allocation to discharge chlordane or PCBs to Boone Reservoir. Waste load allocations can be determined, if needed, once the fish tissue concentrations indicate that the reservoir is no longer impaired for elevated levels of chlordane and/or PCBs.

8.2 Non-point Sources

The Tennessee Department of Environment & Conservation (TDEC) has no direct regulatory authority over most non-point source discharges. Voluntary, incentive-based mechanisms will be used to implement non-point source management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the impaired waterbody.

Boone Reservoir was listed as impaired on the *2006 303(d) List* as not fully supporting designated use classifications due, in part, to elevated levels of chlordane. However, fish tissue samples dating back to 1991 suggest that the levels of chlordane are below the applicable fish & aquatic life criterion (ref.: Table 3). When calculated according the recreation designated use (ref.: Appendix A), the chlordane in the water column is also estimated to be less than the human health criterion (TDEC, 2004). Although the levels of chlordane in carp and catfish were near the water quality threshold for plausible-upper-limit carcinogenic risk in 1991, chlordane in samples collected since then has been significantly lower. Boone Reservoir was also placed on the *2006 303(d) List* for high levels of PCBs. It is suspected that the presence of elevated PCBs and near-threshold values of chlordane together warranted the initial issuance of a precautionary fish advisory due to chlordane in 1993. However, because the concentration of chlordane measured in fish tissue samples has remained below the water quality criteria, the fish advisory due to chlordane pollution should be reconsidered. The fish samples with levels of chlordane near the water quality threshold for plausible-upper-limit carcinogenic risk were all collected in 1991 at mile 4.0 of the Watauga River. Therefore, future fish monitoring should include this location on the Watauga River if possible. This should provide sufficient evidence as to whether or not Boone Reservoir should be delisted for chlordane.

Contaminated sediments were listed as the likely source for chlordane and PCB contamination in Boone Reservoir. There are generally two options to prevent chlordane and/or PCBs contained in the sediment from being released to the reservoir: 1) avoid disturbing the sediment or 2) remediate contaminated sites. If the sediment remains undisturbed, these pollutants should degrade over time. On the other hand, if the sediment <u>must</u> be disturbed, remediation efforts will be necessary to control the load of chlordane and PCBs in the reservoir so that the water quality criteria are not exceeded. Strategies to identify sites with elevated levels of chlordane and PCBs may be helpful for implementing controls to prevent the contaminants from being released into the reservoir. As less of the contaminants become biologically available the concentrations of chlordane and PCBs measured in fish tissue samples should theoretically decline. Due to the bioaccumulative nature of both chlordane and PCBs, however, continued fish tissue monitoring is advised to ensure that contamination decreases as time passes.

8.3 Evaluation of TMDL Effectiveness

The effectiveness of these TMDLs will be assessed within the context of the State of Tennessee's rotating Watershed Approach. The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring, assessment, TMDLs, WLAs/LAs, and permit issuance (ref.: http://www.state.tn.us/environment/wpc/watershed/). Watershed monitoring and assessment activities will provide information by which the effectiveness of chlordane and PCB load allocations can be evaluated. Continued fish tissue sampling will be necessary to monitor the efficacy of the proposed TMDLs. These TMDLs will be reevaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed TMDLs for chlordane and PCBs in Boone Reservoir were placed on Public Notice for a 35-day period and comments were solicited. Steps taken in this regard included:

1) Notice of the proposed TMDLs was posted on the Tennessee Department of Environment and Conservation website (ref.: Appendix C). The notice invited public and stakeholder comments and provided a link to a downloadable version of the TMDL document.

2) Notice of the availability of the proposed TMDLs (similar to the website announcement) was included in one of the NPDES permit Public Notice mailings, which was sent to interested persons or groups who had requested this information.

3) A letter was sent to identified water quality partners in the South Fork Holston and Watauga River Watersheds advising them of the proposed chlordane and PCB TMDLs, stating the document's availability on the TDEC website, and inviting comments. These partners included:

   Beaver Creek Watershed Association
   Boone Watershed Partnership
   Friends of Fort Patrick Henry
   Holston River Watershed Alliance
   Kingsport Citizens for a Cleaner Environment
   Natural Resources Conservation Service
   Tennessee Department of Agriculture
   Tennessee Valley Authority
   Tennessee Wildlife Resources Agency
   The Nature Conservancy

United States Army Corps of Engineers
United States Fish and Wildlife Service
United States Forest Service
United States Geological Survey
Virginia Department of Environmental Quality

4) A draft copy of the proposed TMDLs was sent to the following MS4s:

TNS075183	Bristol
TNS075281	Elizabethton
TNS075370	Johnson City
TNS075728	City of Jonesborough
TNS075388	Kingsport
TNS075671	Sullivan County
TNS077585	Tennessee Department of Transportation
TNS075787	Washington County

Written comments were received from one party during the public comment period. These comments are included in Appendix D and responses from the Division of Water Pollution Control are contained in Appendix E.

10.0 FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/

Technical questions regarding these TMDLs should be directed to the following members of the Division of Water Pollution Control staff:

Jamie L. Austin, Watershed Management Section
E-mail: Jamie.Austin@state.tn.us

Bruce R. Evans, P.E., Watershed Management Section
Email: Bruce.Evans@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
E-mail: Sherry.Wang@state.tn.us

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APPENDIX A

Development of Water Quality Criteria for Chlordane

FRESHWATER AQUATIC LIFE CRITERIA

The U.S. Environmental Protection Agency lists freshwater aquatic life criteria for chlordane in *National Recommended Water Quality Criteria* (USEPA, 2006). Two components of the aquatic life criteria were published:

> The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

These criteria are intended for broad application, but "are intended to be protective of the vast majority of the aquatic communities in the United States" (USEPA, 2006).

Criterion Continuous Concentration

The CCC is based on criterion published in *Ambient Water Quality Criteria for Chlordane* (USEPA, 1980) where the Final Residue Value procedure was utilized:

> The Freshwater Final Residue Value is derived by dividing the FDA action level of 0.3 mg/kg by the geometric mean of the normalized BCF values (4,702) and by a percent lipid value of 15 for freshwater species.

The Tennessee Department of Environment and Conservation has adopted the current national recommended criteria as the statewide water quality criteria for chlordane under the fish & aquatic life designated use classification (TDEC, 2004). For the purpose of developing this chlordane TMDL, the freshwater aquatic life criterion continuous concentration was found to be the most stringent. Therefore, existing water column concentrations of chlordane were calculated in a manner that reflected the methodology utilized in developing the national criteria:

$$C_{water} = \frac{C_{fish}}{(4{,}702 \times 15)} \times 1{,}000$$

Where C_{water} = Water column concentration (μg/L)
C_{fish} = Fish tissue concentration (mg/kg)
4,702 = Geomean of normalized BCF values (L/kg)
15 = Percent lipid (freshwater species)
1,000 = Conversion factor (μg/mg)

The State of Tennessee recognizes, as noted in *National Recommended Water Quality Criteria* (USEPA, 2006), "Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria. Therefore, the Agency anticipates that future revisions of this CCC will not be based on the FRV procedure". Consequently, future TMDLs will consider subsequent revisions made to national/state water quality criteria.

HUMAN HEALTH CRITERIA

The human health criteria also needed to be considered when developing the TMDL because a fish consumption advisory was issued for chlordane contamination. To protect human health, limits for chlordane in the consumption of water & organism and organism only are presented in *National Recommended Water Quality Criteria* (USEPA, 2006). The U.S. Environmental Protection Agency recommends a water quality limit of 0.00080 µg/L of chlordane for the consumption of water & organism and 0.00081 µg/L for organism only (USEPA, 2006). These values are calculated according to a 10^{-6} risk level. The State of Tennessee assumes a 10^{-5} risk level and, under the recreation designated use classification, the corresponding criteria are 0.0080 µg/L for water & organism and 0.0081 µg/L for organism only. In order to determine deviations from the target value, it was necessary to compute the existing concentrations according to the methodology utilized when setting the state and/or national criteria. Therefore, the water column concentrations were also predicted using the weighted average Bioconcentration Factor [normalized BCF value (4,702) and "an adjustment factor of 3…[to account for]…the 3.0 percent lipids that is the weighted average for consumed fish and shellfish" (USEPA, 1980)]:

$$C_{water} = \frac{C_{fish}}{(14{,}100)} \times 1{,}000$$

Where C_{water} = Water column concentration (µg/L)
C_{fish} = Fish tissue concentration (mg/kg)
14,000 = Weighted average BCF (L/kg)
1,000 = Conversion factor (µg/mg)

Table A-1 lists the water column concentrations of chlordane predicted using the human health consumption methodology. The predicted water column concentrations were compared to the more stringent of the applicable State of Tennessee water quality criteria under the recreation designated use and none of the samples were found to exceed the criterion. The TMDL was established using the fish & aquatic life criteria, which proved to be more stringent than either of the limits set by the State of Tennessee to protect human health (ref.: Section 4.0).

Table A-1 Estimated Concentration of Chlordane According to Human Health Criteria

Fish Species	Sample Year	Sampling Site Location	Total Chlordane in Fish Sample (ppm)	Calculated Water Column Concentration (µg/L)	Annual Average (Geomean) Water Column Concentration (µg/L)
Carp	1991	Watauga RM 4	0.100	0.007	0.007
	1994	SF Holston 22	0.025	0.002	0.002
	1999	SF Holston 27	0.047	0.003	0.003
		Watauga RM 6.5	0.037	0.003	
		Geomean	**0.046**	**0.003**	
Bass	1991	Watauga RM 4	0.079	0.006	0.006
		Geomean	-	-	
SM Bass	1994	SF Holston RM 22	0.012	0.001	0.001
		Geomean	-	-	
LM Bass	1999	SF Holston RM 19	0.066	0.005	0.002
		SF Holston RM 27	0.012	0.001	
		Watauga RM 6.5	0.032	0.002	
		Geomean	**0.029**	**0.002**	
(Channel) Catfish	1991	Watauga RM 4	0.079	0.006	0.006
	1994	Watauga RM 4	0.044	0.003	0.003
		SF Holston RM 22	0.047	0.003	
	1999	SF Holston RM 19	0.047	0.003	0.003
		SF Holston RM 27	0.045	0.003	
		Watauga RM 6.5	0.034	0.002	
	2001	SF Holston RM 19	0.02	0.001	0.002
		SF Holston 27	0.06	0.004	
		Watauga RM 6.0	0.02	0.001	
	2005	SF Holston RM 19	0.05	0.004	0.003
		SF Holston RM 19	0.08	0.006	
		Watauga RM 6.5	0.03	0.002	
		Geomean	**0.048**	**0.003**	

Note: For data 1999 and before - Total chlordane was calculated as the sum of alpha chlordane, gamma chlordane, cis-nonachlor, and trans-nonachlor. For data after 1999 – Total chlordane also includes oxychlordane and chlordene.

APPENDIX B

Development of Water Quality Criteria for PCBs

CARCINOGENIC RISK LEVEL

According to Section 304(a) of the Clean Water Act, the U.S. Environmental Protection Agency presented three separate criteria for carcinogens at risk levels corresponding to 10^{-7}, 10^{-6}, and 10^{-5} in the 1980 *Ambient Water Quality Criteria for Polychlorinated Biphenyls* (USEPA, 1980a). Within select sections of the 2000 Human Health Methodology (USEPA, 2000a), the U.S. EPA states:

> Both 10^{-6} and 10^{-5} are appropriate targets for health protection of the general population and that highly exposed populations should not exceed a 10^{-4} risk level. The incremental cancer risk levels are *relative*, meaning that any given criterion associated with a particular cancer risk level is also associated with specific exposure parameter assumptions (*i.e.,* intake rates, body weights). EPA recommends adoption of water quality standards that include water quality criteria based on either the 10^{-5} or 10^{-6} risk level if the State or authorized Tribe has identified the most highly exposed subpopulation, has demonstrated that the chosen risk level is adequately protective of the most highly exposed subpopulation, and has completed all necessary public participation. States and authorized Tribes also have flexibility in how they demonstrate this protectiveness and obtain such information. A State or authorized Tribe may use existing information as well as collect new information in making its determination as to an appropriate level of protection.

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control designates a 10^{-5} risk level for all carcinogenic pollutants. A public fishing advisory will be considered when the calculated risk of additional cancers exceeds 10^{-4} for typical consumers or 10^{-5} for atypical consumers. (TDEC, 2004).

Human Health Criteria for Carcinogenic Pollutants

U.S. Environmental Protection Agency has developed equations for deriving human health criteria for carcinogenic pollutants. As published in *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance – Revision of Polychlorinated Biphenyls (PCBs) Criteria; Final Rule* (USEPA, 1999a), the human health criterion for organism and water consumption is as follows:

$$HHC = \frac{R \times W}{q \times [WC + (FC \times BCF)]} \times 1{,}000$$

Similarly, the human health criterion for organism only consumption is listed below:

$$HHC = \frac{R \times W}{q \times FC \times BCF} \times 1{,}000$$

Where HHC = Human health criterion (µg/L)
R = Risk Level
W = Human Body Weight (kg)
q = Cancer Slope Factor $(mg/kg \cdot day)^{-1}$
WC = Water Consumption (L/day, applicable to drinking water supply)
FC = Fish Consumption (kg/day)
BCF = Bioconcentration Factor (L/kg)
1,000 = Conversion Factor (µg/mg)

State Water Quality Criteria for PCBs

National recommended water quality criteria are published pursuant to Section 304(a) of the Clean Water Act. The national criteria provide guidance for states to use when adopting water quality standards. EPA's current national recommended water quality criteria for PCBs equal 0.000064 µg/L for both organism only and water & organism designations. These values were derived using the above equations for Human Health Criteria when, as listed in the 1999 PCB Criteria (USEPA, 1999a) and updated in the 2000 Human Health Methodology revision (USEPA, 2000a):

$R = 1x10^{-6}$
W = 70 kg
$q = 2\ (mg/kg \cdot day)^{-1}$
WC = 2 L/day
FC = 0.0175 kg/day
BCF = 31,200 L/kg

Because the State of Tennessee sets the plausible-upper-limit risk of cancer associated with PCBs at the 10^{-5} risk level, the corresponding state water criteria are 0.00064 µg/L (http://www.epa.gov/waterscience/criteria/wqcriteria.html). For the purposes of this TMDL, the state water quality criteria for PCBs were used to determine the target value.

APPENDIX C

Public Notice Announcement

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL

PUBLIC NOTICE OF AVAILABILITY OF PROPOSED TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR CHLORDANE & POLYCHLORINATED BIPHENYLS FOR BOONE RESERVOIR IN THE SOUTH FORK HOLSTON RIVER WATERSHED (HUC 06010102) AND WATAUGA RIVER WATERSHED (HUC 06010103), TENNESSEE

Announcement is hereby given of the availability of Tennessee's proposed Total Maximum Daily Loads (TMDLs) for chlordane and polychlorinated biphenyls (PCBs) for Boone Reservoir in the South Fork Holston and Watauga River Watersheds located in East Tennessee. Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters on their impaired waters list. TMDLs must determine the allowable pollutant load that the water can assimilate, allocate that load among the various point and nonpoint sources, include a margin of safety, and address seasonality.

Boone Reservoir was identified on Tennessee's *2006 303(d) List* as not supporting designated use classifications due to elevated levels of chlordane and polychlorinated biphenyls (PCBs) in fish tissue samples. Contaminated sediments are the source of pollutant causes associated with both impairments. Using a mass-balance approach, the TMDLs utilize Tennessee's general water quality criteria, fish tissue sampling data collected from Boone Reservoir, Bioconcentration Factors defined by the U.S. Environmental Protection Agency, and an appropriate Margin of Safety (MOS) to establish chlordane and PCB loading levels which will result in lower fish tissue concentrations and the attainment of water quality standards.

The proposed chlordane and PCB TMDLs may be downloaded from the Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/proposed.shtml

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

Jamie L. Austin, Watershed Management Section
Telephone: 615-253-5348

Bruce R. Evans, P.E., Watershed Management Section
Telephone: 615-532-0668

Sherry H. Wang, Ph.D., Watershed Management Section
Telephone: 615-532-0656

Persons wishing to comment on the TMDLs are invited to submit their comments in writing no later than April 23, 2007 to:

Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

All comments received prior to that date will be considered when revising the TMDL for final submittal to the U.S. Environmental Protection Agency.

The TMDL and supporting information are on file at the Division of Water Pollution Control, 6th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee. They may be inspected during normal office hours. Copies of the information on file are available on request.

APPENDIX D

Public Comments Received

April 23, 2007

PUBLIC COMMENT ON DRAFT TMDL FOR CHLORDANE AND PCB'S

Location– South Fork Holston and Watauga River Watersheds

The City of Johnson City wishes to comment on the "*Draft of Proposed Total Maximum Daily Load for Chlordane and Polychlorinated Biphenyls (PCB's) South Holston and Watauga River Watershed, Tennessee".* Johnson City owns and operates three Publicly Owned Treatment Works (POTW's) within these watersheds. This proposed TMDL identifies both chlordane and PCB's as being present in the soil, surface water, air, sediment, plants and animal tissue within this watershed.

The source of this pollutant is stated to be from past releases. Regulated point sources are identified as: 1) municipal and industrial wastewater treatment facilities; 2) storm water associated with industrial activity (which includes construction activities); and 3) certain discharges from MS4's. There no longer exist any permitted point sources for these compounds, and the current source is named as sediment.

For reasons as stated in the proposed TMDL language and summarized herein the City of Johnson City has concern about this TMDL due to potential requirements being added to Final TMDL's which require sampling/monitoring plans (required already for MS 4's) with no ability to affect any changes due to sample results. The already recommended best management (BMP) practice for these sources is to stabilize where they are and not disturb the sediment; much like we manage pre-existing asbestos in-place with management plans to continue its' use until disposal is necessary and can be conducted cost efficiently.

Since these compounds are no longer being manufactured, used, or stored in our watershed, and are already known to be established in the sediments there is only a limited amount of affect that can be accomplished with further regulations. We feel that a TMDL on such compounds that are already heavily regulated not in use and not approved for use is an unfair burden on already strained financial and staffing resources.

APPENDIX E

Response to Public Comments

<u>Response to City of Johnson City email dated 4/23/07:</u>

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology-based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Boone Reservoir was listed on the State of Tennessee's *2006 303(d) List,* as not fully supporting designated use classifications due to elevated levels of chlordane and PCBs in fish tissue samples. For that reason, these TMDLs are being proposed as required under Section 303(d) of the Clean Water Act. The Division of Water Pollution Control agrees that there are currently no permitted point source dischargers of chlordane or PCBs (ref.: Section 6.0). Therefore, the Final TMDLs for chlordane and PCBs in Boone Reservoir impose no additional monitoring requirements for point sources. Instead the Division recommends leaving the sediment in the reservoir undisturbed to control the loads of chlordane and PCBs contributed by non-point sources.