Sampling and Analysis Plan

Roanoke River Basin PCB TMDL Development (Virginia)

FINAL

Prepared for
U.S. Environmental Protection Agency – Region III
Virginia Department of Environmental Quality
U.S. Fish and Wildlife Service

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1.0 Introduction

1.1 Impairment Summary

Virginia's 303(d) list includes several waterbodies in the Roanoke River Basin that were listed as impaired due to elevated Polychlorinated Biphenyl (PCB) concentrations that have been found in fish tissue and sediment samples. The Virginia Department of Environmental Quality (DEQ) first collected information on PCB levels in the Roanoke Basin in 1971. Fish tissue and sediment sampling for PCBs in the Roanoke Basin resumed in 1993 and a rotating basin monitoring schedule is currently ongoing as part of the Statewide Fish Tissue and Sediment monitoring program. The Virginia Department of Health (VDH) has issued fish consumption advisories for several sections of the Roanoke (Staunton) River and tributaries since 1998 based on the fish tissue data collected by DEQ.

Section 303(d) of the Clean Water Act requires states to develop Total Maximum Daily Loads (TMDLs) for waters that do not meet water quality standards. The objective of the Roanoke PCB TMDL study is to identify the sources of PCB contamination in the watershed and to determine the reductions required to achieve water quality standards for PCB impaired segments.

The impairment listings for stream and reservoir segments in the Roanoke Basin are based on the culmination of studies and data collected to date. TMDL development requires a complete review of existing data in order to assess data gaps and propose additional monitoring, as needed. A Preliminary Data Review and Source Assessment was completed on 1/3/05 and revised on 2/4/05. This document presents all available PCB data and source information collected during this initial review. Fish Tissue data collected since 1993 is emphasized in this report due to differences in the analytical methods as compared to the older (1971) data.

Additional information on known and possible PCB sources in the watershed from past studies was recently collected and included in a source assessment data inventory. Based on this information and further analyses of the PCB data fish tissue and sediment data collected to date, additional data needs and proposed monitoring stations are detailed in this Sampling and Analysis Plan (SAP). Additional monitoring is needed to help identify PCB sources in the watershed for TMDL development and implementation planning. This draft SAP will be refined over the next couple months based on available funding and further review of data needs required to complete TMDL development. A Quality Assurance Program Plan (QAPP) will be developed concurrently to support additional PCB sampling and other TMDL monitoring activities in the watershed.

In 1971 the Virginia State Water Control Board (SWCB) conducted a study to determine the extent of pesticides in the environment. Elevated PCBs concentration in fish tissue samples from the Roanoke and Dan Rivers were found and the results were published in a 1973 report (Wallmeyer, 1973).

Between 1979 and 1991, the SWCB and the U.S. Environmental Protection Agency (EPA) conducted a variety of studies that included some additional monitoring of fish collected from the Roanoke River. Some of the fish samples indicated a persistent presence of PCBs in several areas of the Roanoke River. In late 1992, the Virginia Department of Health (VDH) recommended collecting additional fish in the Roanoke River to better characterize the extent of PCB contamination. An extensive fish tissue study was conducted by the SWCB from February to August 1993 and a final report was issued June 1996. Elevated levels of PCBs were detected in fishes collected from several sites on the Roanoke River.

Additional sampling in the Roanoke River and Dan River was conducted in 1998 and 1999. Based on these data, the VDH issued health advisories for sections of the Roanoke and Dan Rivers where fish showed levels of PCBs greater than the VDH screening level of 600 ppb. The initial PCB fish consumption advisory was issued for the Roanoke (Staunton) River on 7/24/98. The advisory for this segment was modified on 3/26/99 to include three additional fish species. On 12/2/99 the fish consumption advisory was extended to include the 29-mile segment upstream to the Leesville Dam. The entire segment extends from Leesville Dam downstream to the Dan River confluence.

DEQ continued fish tissue sampling efforts in 2000 and 2002. These data resulted in the issuance of a fish consumption advisory for the Roanoke River from the Niagara Dam downstream to Smith Mountain Lake on 10/29/03. The VDH adopted new fish consumption advisory guidelines on 12/13/04 that include a "do not eat" PCB concentration threshold of 500 ppb and a limited consumption (not more than 2 meals/month) PCB concentration range between 50 and 500 ppb. These guidelines resulted in modifications to the existing Roanoke River fish consumption advisories and the issuance of an advisory for the Upper Roanoke River from the confluence of the North and South Forks of the Roanoke River (near the Lafayette gauging station) downstream to the Niagara dam. The Upper Roanoke advisory also includes Peters Creek upstream to the Rt. 460 bridge crossing and Tinker Creek upstream to the confluence with Deer Branch (near Rt. 115). In addition, Smith Mountain Lake from the Niagara dam downstream to Smith Mountain Dam and the Blackwater River arm upstream to the Rt. 122 bridge are included in the advisory area. The Dan River and Kerr Reservoir advisories were also updated on 12/13/04. Note that DEQ sampled the Roanoke River basin in 2004. These results will be available in the spring of 2005.

The current fish consumption advisories concern the following species:

- Roanoke River (all species – no more than 2 meals/month): Carp, Redbreast Sunfish, Redhorse Sucker, Smallmouth Bass, Largemouth Bass, Rock Bass, and Bluehead Chub.
- Smith Mountain Lake/Blackwater River section: Flathead Catfish greater than 32 inches – do not eat. All other species – No more than 2 meals/month: Flathead Catfish less than 32 inches, Striped Bass, Gizzard Shad, Redhorse Sucker, Largemouth Bass, and Carp.
- Roanoke (Staunton) River: Carp and Flathead Catfish greater than 32 inches – do not eat. All other species – No more than 2 meals/month: Flathead Catfish less than 32 inches, Gizzard Shad, Golden Redhorse Sucker, Striped Bass, Channel Catfish, Walleye, White Bass, Largemouth Bass, Redhorse Sucker, Redbreast Sunfish, Smallmouth Bass, Quailback Carpsucker, Spotted Bass, White Perch, Bluehead Chub, Sunfish Species, Bluegill Sunfish, Rock Bass

Under a Memorandum of Understanding between DEQ and the VDH, all data generated by the Virginia Fish Tissue and Sediment Contaminants Monitoring Program are provided to the VDH as soon as possible after the data are received from the analytical lab. The VDH reviews the data and provides recommendations to DEQ regarding whether or not there is a potential for an unacceptable risk to human consumers and whether there is a need for follow-up tissue studies. The VDH is also responsible for deciding when there is a need for issuing a fish consumption advisory to the public regarding the potential risk associated with eating locally caught fish.

The collection of additional fish tissue and sediment data since 1993 has resulted in a growing list of river and lake segments that are considered impaired due to human health and aquatic life concerns. DEQ 2004 303(d) PCB impaired segments and the current VDH fish consumption advisory segments (issued on 12/13/04) along the Roanoke River mainstem and tributaries upstream of the Dan River confluence are shown in Figure 1.1 and Table 1.1.

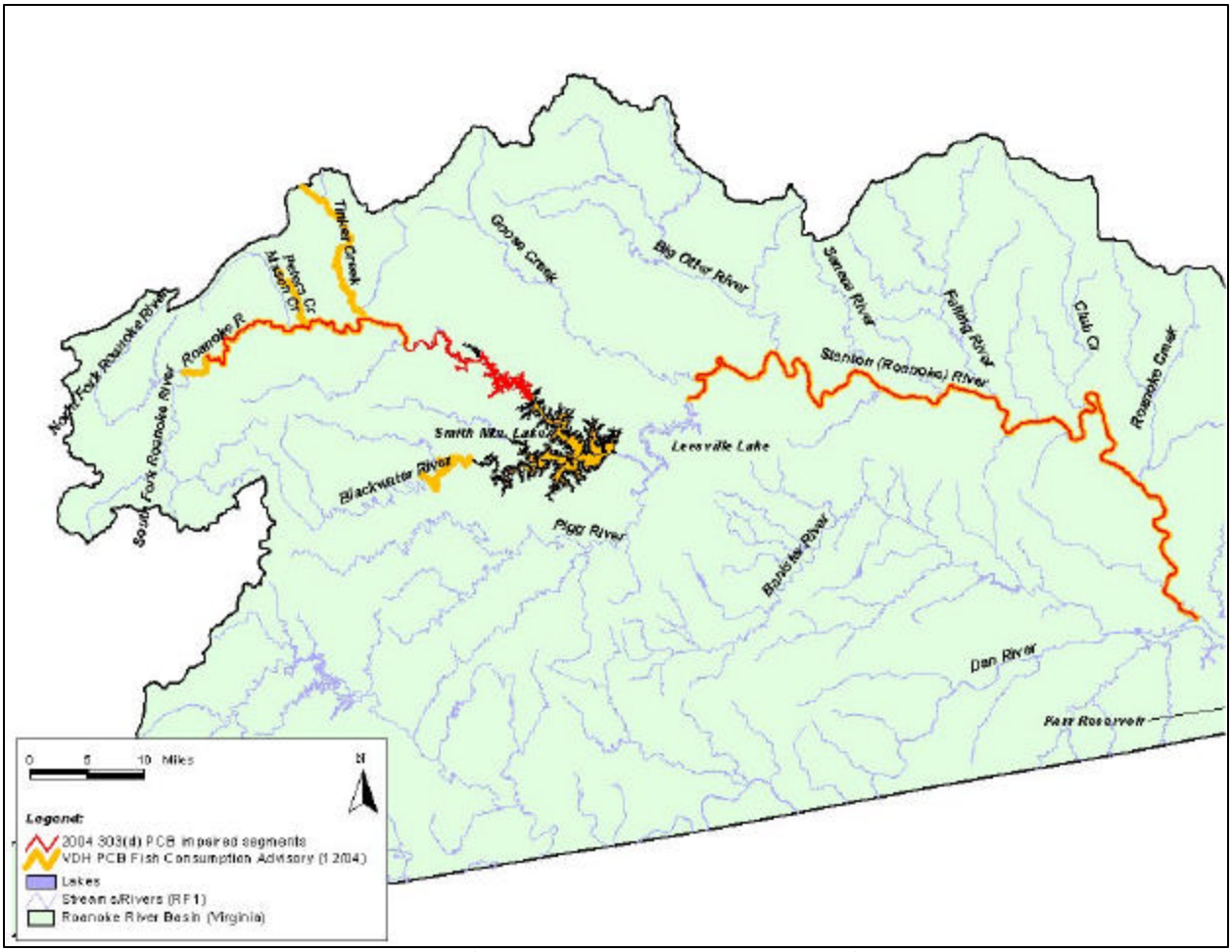

Figure 1.1 PCB impaired segments and fish consumption advisories (as of 12/13/04)

Table 1.1 PCB impaired segment descriptions and fish consumption advisories (as of 12/13/04)*

Water-body	Segment Description	County/ City	Miles/ Acres	Initial Listing	TMDL Due	VDH Advisory 12/13/04
Roanoke River	Near Dixie Caverns – Rt. 11 bridge near Rt. 419	Roanoke, Salem	11.68 miles (combined 2 segments from 2002)	2002	2014	Advisory extends upstream to the confluence of the North and South Forks of the Roanoke River
Roanoke River	Rt. 11 bridge near Rt. 419 – Mason Cr. confluence	Salem	1.2 miles	2002	2014	
Roanoke River	Mason Cr. confluence – Roanoke Regional STP outfall	Roanoke City, Salem	9.87 miles	1996 (PCBs 2002)	2006	Advisory includes Peters Creek (upstream to the Rt. 460 bridge) and Tinker Creek (upstream to the Rt. 122 bridge)
Roanoke River	Roanoke Regional STP outfall – Niagara Dam	Roanoke, Roanoke City	2.24 miles	1996 (PCBs 2002)	2006	
Roanoke River	Niagara Dam – Back Cr. mouth	Bedford, Roanoke	3.35 miles	2002	2006	

Water-body	Segment Description	County/ City	Miles/ Acres	Initial Listing	TMDL Due	VDH Advisory 12/13/04
Smith Mtn. Lake	Back Cr. mouth – Falling Cr. mouth	Bedford, Franklin, Roanoke	378 acres	1998 (PCBs 2002)	2010	
Smith Mtn. Lake	Falling Cr. mouth – Upstream of Beckys Cr. mouth	Bedford, Franklin	2,871 acres	2002	2014	12/13/04 advisory includes the entire lake and the Blackwater arm upstream to the Rt. 122 bridge
Staunton (Roanoke) River	Leesville Dam – Pipeline crossing 5.4 miles downstream of Rt. 360 bridge	Charlotte, Halifax, Campbell, Pittsylvania	83.9 miles (combined several 2002 segments); 1998 upstream limit was Seneca Cr. mouth	1998	2010	
Staunton (Roanoke) River	Pipeline crossing 5.4 miles downstream of Rt. 360 bridge – Kerr Reservoir	Halifax, Charlotte	4.49 miles	1998	2010	

* 2004 303(d) segment information shown

1.2 Endangered Species Concerns

In addition to the human health concerns associated with environmental PCB exposure, there are concerns about the effects of PCB pollution on biota in the Roanoke River basin. The resident bald eagle population and the endangered Roanoke Logperch (*Percina rex*) have been identified by the Virginia Branch of the United States Fish and Wildlife Service (USFWS) as species that are potentially at risk from the effects of PCB contamination. The Roanoke Logperch is a federally endangered species that only occurs in the Upper Roanoke drainage, Pigg River, Smith River, and larger tributaries. The Orangefin Madtom (*Nocturus gilberti*) is also only found locally and is listed as threatened in Virginia and as a species of special concern nationally.

Bald eagles may also suffer from exposure to PCBs through eating fish that have high PCB levels (C. Kane, 2004). Bioaccumulation is the net accumulation of a substance by an organism as a result of uptake from all environmental sources (i.e. water and food consumption). PCBs ingestion has been found to correlate to various effects on birds including; poor reproduction, endocrine disruption behavior, altered embryonic development and death (Smits and Bartolotti, 2001; Fernie et al., 2001(a); Fernine et al., 2001(b); Fernie et al., 2000; Ludwig et al., 1996). Embryos have been identified as the most sensitive developmental stage.

2.0 Review of Existing Data

2.1 Past Studies

The following PCB data summary was developed based on a compilation of the fish tissue, sediment, and water quality samples collected and analyzed by DEQ since 1967. DEQ collected fish tissue samples from the Roanoke River and tributaries in 1971, 1993, 1998, 1999, 2000, 2002, and 2004. Sediment samples were collected from 1996 through 2000 and again in 2002. Fish tissue and sediment data collected in 2004 will be available late summer 2005. Fish tissue PCB data collected in 1971 and

presented in the 1973 report, The Occurrence of Polychlorinated Biphenyls in the Roanoke and Dan Rivers-A Preliminary Report, are not included in this report because of differences in the analytical methods used. Table 2.1 presents the available PCB data sources for the Roanoke Basin.

Table 2.1 PCB data sources for the Roanoke River Basin

Dataset	DEQ Data Source	Period of Record	No. of Samples included in the referenced dataset	No. of Samples in Roanoke River Basin
PCB water column data	Parameter specific dataset submitted by DEQ	1967-2004	21,889	21,889
PCB fish tissue data	File: 1993-2002fish-pcb-ocp.xls	1993-2003	3,162	1,124
PCB sediment data	File: sediment-pcb1995-2002.xls	1995-2002	622	181
1973 VA State Water Control Board PCB Study of the Roanoke and Dan Rivers	DEQ report	1971		
PCB Concentrations in Fish Tissue Collected in the Roanoke and Dan Rivers: Summary of the Data from the 1998-1999 Studies and a Comparison with Historic Data	DEQ report	1971, 1998-1999		

2.1.1 PCB Criteria

All waters in Virginia have the designated uses of contact recreation, propagation of fish and game, and production of edible and marketable natural resources such as fish (9 VAC 25-260-10). Virginia's water quality standards for PCBs include numeric criteria for individual PCB Aroclors for the protection of aquatic life and a total PCB criterion to protect human health from toxic effects through fish consumption. Both are expressed as water column concentrations. These numeric concentrations are based on criteria developed by EPA as issued in its 1999 Final Rule: Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance--Revision of Polychlorinated Biphenyls (PCBs) Criteria (USEPA, 1999(a)).

The EPA criteria took into consideration cancer studies that strengthen the case that all PCBs mixtures can cause cancer. EPA used this information to develop a range of dose response slopes, changing the single-dose cancer potency factor of 7.7 per mg/kg-d to a range from 0.07 per mg/kg-d (lowest risk and persistence) to 2.0 per mg/kg-d (high risk and persistence). The reassessment uses information on environmental processes to provide guidance on choosing an appropriate slope for representative classes of environmental mixtures and different exposure pathways.

DEQ has also developed numeric criteria for total PCB levels in fish tissue based on EPA cancer risk assessment studies. DEQ uses a PCB screening value of 54 ppb for fish tissue, which is based on information originally developed and published by EPA in 1993 and revised in 1995. Typical screening value calculations use the following assumptions: a 10^{-5} risk level adopted by the SWCB; a human body weight of 70 kg (average adult body weight), a lifetime fish consumption rate of 6.5 g/d (general U.S. population), and a reference dose for non-carcinogenic and an oral dose slope for carcinogenic effects (EPA Integrated Risk Information System - IRIS database system) (USEPA, 1997). Fish containing a contaminant at or below the screening value concentration are considered to pose minimal risk to the

average consumer. The VDH adopted new fish consumption advisory guidelines on 12/13/04 that include a "do not eat" PCB concentration threshold of 500 ppb and a limited consumption (not more than 2 meals/month) PCB concentration range between 50 and 500 ppb.

VADEQ currently uses a consensus-based sediment quality guideline (MacDonald et al.) known as a Probably Effects Concentration (PEC) for total PCBs (676 ppb) to assess sediment contamination. In spite of the uncertainty associated with sediment quality guidelines, this screening value is considered to be protective of aquatic organisms exposed to PCBs in the sediment.

The USFWS conducted a study in the summer of 2003 to determine the acceptable concentration of PCBs in bald eagle eggs and forage fish (Kane, 2004). The reported NOAEL (No Observed Adverse Effect Level) for bald eagles eggs was a total PCB concentration of 0.04 ug/g (wet weight). NOAEL is defined as the greatest concentration or amount of a chemical, found by experiment or observation, that causes no detectable adverse alteration of morphology, functional capacity, growth, development, or life span of the target (WHO 1979). Considering potential bioaccumulation in the food chain, the acceptable total PCB concentration in forage fish was calculated to be 0.004522 ug/g (4.5 ppb). This value represents the Total Dietary Concentration (TDC) of PCBs in forage fish that would meet the above NOAEL. All PCB criteria and guidelines currently under consideration for use as a TMDL target are presented in Table 2.2.

Table 2.2 Applicable water quality, fish tissue, and sediment criteria/guidelines for PCBs

Criteria		**Aquatic Life (ppb)**		**Human Health (ppb)**	
		Fresh Water			
		Acute	Chronic	Public Water Supplies	All Other Surface Waters
Water Column					
PCB-1260			0.014		
PCB-1254			0.014		
PCB-1248			0.014		
PCB-1242			0.014		
PCB-1232			0.014		
PCB-1221			0.014		
PCB-1016			0.014		
PCB Total				0.0017	0.0017
Fish Tissue					
DEQ Fish Tissue Screening Level					54
VDH Fish Tissue Screening Level (12/13/04)	Limited Consumption				50-500
	Do not eat				500
USFWS		4.5 ppb (Total Dietary Concentration for forage fish)			
Sediment					
PEC sediment quality guideline		676 ppb in sediment			

2.1.2 Fish Tissue and Sediment Monitoring Stations

Fish Tissue and sediment samples are collected by DEQ as part of the Virginia Fish Tissue and Sediment Contaminants Monitoring Program. Under this program, data are collected to assess the human health risks for individuals who may consume fish from state waters and to identify impaired aquatic ecosystems. The sampling program is charged with monitoring every major watershed in the state of Virginia at least once within a 2-3 year cycling period. In addition to "routine" samples taken as a part of

the standard cycling period, monitoring at study sites may take place as part of the special Virginia Environmental Emergency Response Fund (VEERF) or in the case of a special request approved by DEQ (VADEQ, 2004).

From 1993 to 2002, 88 fish tissue and 207 sediment stations were sampled in the Roanoke River Basin (including the Dan River watershed and downstream tributaries). Of these, 27 fish tissue and 50 sediment stations were identified as priority stations because of their location on the Roanoke River mainstem (including the North and South Forks) or on a PCB impaired segment or lake section, according to the 2004 303(d) list. Fish tissue station locations and a summary of available data are presented in Figure 2.1 and Table 2.3. Sediment station locations and a summary of available data are presented in Figure 2.2 and Table 2.4. Station tables include all tributary stations.

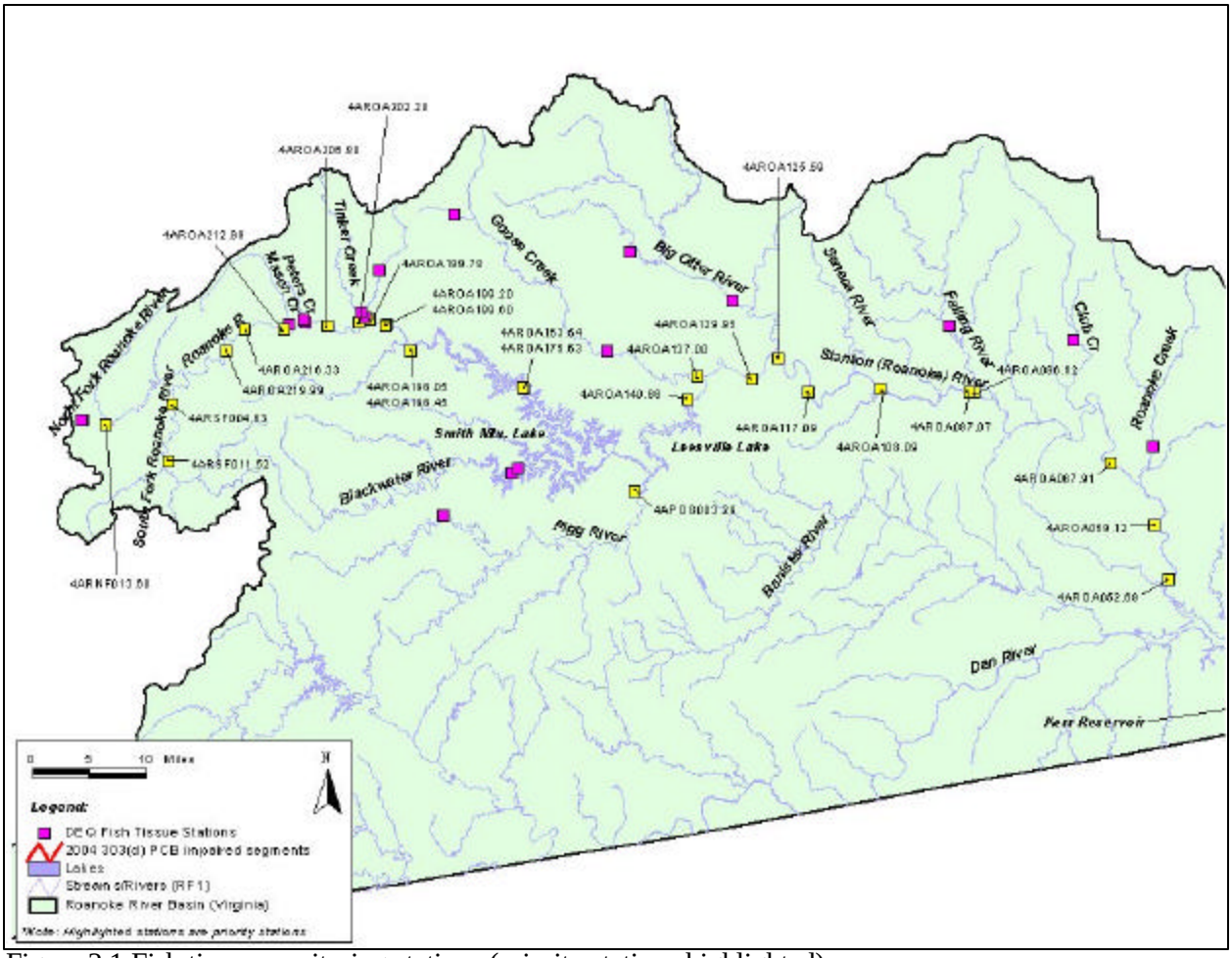

Figure 2.1 Fish tissue monitoring stations (priority stations highlighted)

Table 2.3 Fish tissue data summary

Station ID	Station Description	Begin Date	End Date	*Total Fish Analyzed	**Total PCB Samples
4ARSF011.52	South Fork Roanoke River	7/14/1993	7/14/1993	38	34
4ARSF004.63	South Fork Roanoke River near Rt. 636	10/15/1999	10/15/1999	19	3
4ACDN002.53	Cedar Run near Rt. 603	5/28/2002	5/28/2002	16	2
4ARNF013.60	North Fork Roanoke River	7/13/1993	5/28/2002	84	45
4AROA219.99	Roanoke River near Glenvar	6/16/1993	5/29/2002	59	42
4AROA216.33	Roanoke River below Koppers, Salem	10/19/1999	7/23/2002	56	9
4AROA212.99	Roanoke River, Salem near Rt. 11 bridge	7/7/1999	7/7/1999	28	3
4AMSN000.60	Mason Creek near A.R. Burton Tech.	7/7/1999	7/7/1999	39	4
4APEE001.04	Peters Creek, Roanoke at Shenandoah Ave. bridge	7/6/1999	7/6/1999	28	3
4APEE000.49	Peters Creek	5/29/2002	5/29/2002	20	3
4AROA206.80	Roanoke River near Rt. 11 bridge (Ghent Park)	7/8/1999	8/22/2002	57	8
4AROA202.20	Roanoke River near 13th Street bridge	7/22/2002	7/22/2002	19	3
4AGLA005.04	Glade Creek near Rt. 636 bridge, Bonsack	7/24/2002	7/24/2002	19	3
4ATKR000.69	Tinker Creek near Rt. 24, Roanoke/Vinton line	8/18/1999	8/18/1999	25	3
4ATKR000.17	Tinker Creek near Rt. 24	5/29/2002	5/29/2002	22	4
4AROA199.78	Roanoke River just above Niagara Dam	8/21/2002	8/21/2002	36	8
4AROA199.60	Roanoke River above Niagara Dam	10/18/1999	10/18/1999	23	4
4AROA199.20	Roanoke River just upstream Niagara Dam	7/13/1993	7/13/1993	40	40
4AROA196.45	Roanoke River (Smith Mt. Lake) at Hardy	9/15/1999	9/15/1999	40	5
4AROA196.05	Roanoke River near Hardy	8/21/2002	8/21/2002	41	9
4AROA175.63	Roanoke River (Smith Mt. Lake) at Hales Ford	11/17/1998	10/2/2002	94	16
4AROA163.54	Smith Mountain Lake near Hales Ford	6/9/1993	6/9/1993	41	39
4ABWR019.75	Blackwater River near Smith Mountain Lake	6/9/1993	6/9/1993	45	45
4ABWR010.92	Blackwater River at Smith Mountain Lake	11/18/1998	9/17/2002	80	13
4APGG048.61	Pigg River below Rocky Mount at Rt. 707 Ford	9/29/1999	9/29/1999	18	2
4APGG003.29	Pigg River near Leesville Lake	2/10/1993	9/23/1999	72	52
4AROA140.66	Leesville Lake	11/19/1998	9/24/1999	72	11
4AGSF002.16	South Fork Goose Creek near Rt. 607 bridge, Montvale	5/30/2002	5/30/2002	11	2
4AGSE013.78	Goose Creek near Rt. 732 gaging station	8/18/1999	8/18/1999	36	2

Station ID	Station Description	Begin Date	End Date	*Total Fish Analyzed	**Total PCB Samples
4AROA137.00	Roanoke River near Leesville Tail Race	10/23/1998	10/23/1998	48	9
4AROA129.95	Roanoke River near Rt. 29 bridge at Altavista	6/10/2002	6/10/2002	19	5
4ALOR007.94	Little Otter River near Rt. 784 gaging station, below Be	8/17/1999	5/30/2002	47	6
4ABOR012.18	Big Otter River near Rt. 682 gaging station	8/19/1999	8/19/1999	21	3
4AROA125.59	Roanoke River downstream Altavista	10/22/1998	10/22/1998	73	14
4AROA117.09	Roanoke River near Taber	10/20/1999	10/27/1999	29	4
4AROA108.09	Roanoke River near Long Island	2/9/1993	10/21/1998	125	63
4AROA097.07	Roanoke River near Brookneal	2/9/1993	4/24/2002	175	61
4AROA096.62	Roanoke River near Brookneal (site #74)	5/9/2000	5/9/2000	10	2
4AFRV010.99	Falling River near Rt. 643 gaging station	8/26/1999	8/26/1999	12	2
4ACUB010.96	Cub Creek near Rt.40 gaging station	9/13/1999	9/13/1999	16	3
4AROA067.91	Roanoke River near Rt. 746	8/5/1999	8/5/1999	34	5
4AROC050.35	Roanoke Creek near Saxe	8/27/1999	8/27/1999	23	1
4AROA059.12	Roanoke River near Rt. 360 - Clover	5/3/1993	5/2/2002	179	70
4AROA052.69	Roanoke River near Clover Landing	3/31/1999	5/13/1999	120	21

* Total Fish Analyzed is the total number of individual fish collected at a station over its entire sampling period

**Total PCB Samples is the total number of individual PCB values recorded for the sampled media at a sampling station over its entire sampling period

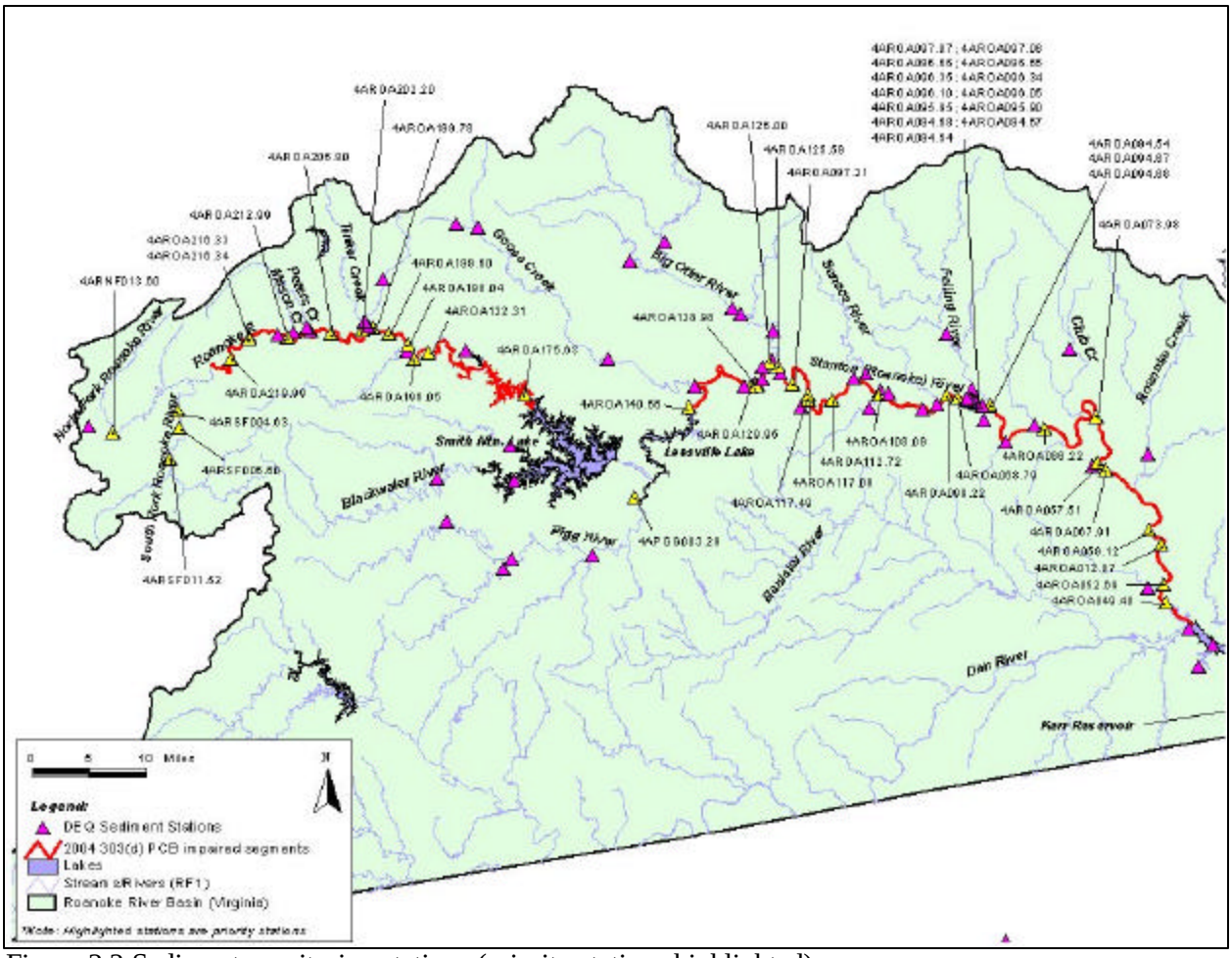

Figure 2.2 Sediment monitoring stations (priority stations highlighted)

Table 2.4 Sediment data summary

Station ID	Station Description	Begin Date	End Date	*Total PCB Samples
4ACDN002.53	Cedar Run near Rt. 603	5/28/2002	5/28/2002	1
4ACDN002.20	Cedar Run near Rt. 603	6/30/1999	6/30/1999	1
4ARNF013.60	North Fork Roanoke River near Rt. 603	6/30/1999	5/28/2002	3
4ARSF011.52	South Fork Roanoke River	7/23/1996	7/23/1996	1
4ARSF006.60	South Fork Roanoke River	7/23/1996	7/23/1996	1
4ARSF004.63	South Fork Roanoke River near Rt. 636	6/29/1999	6/29/1999	1
4AROA219.99	Roanoke River near Glenvar	5/29/2002	5/29/2002	1
4AROA216.34	Roanoke River	8/6/1997	8/6/1997	1
4AROA216.33	Roanoke River, Salem below Koppers	7/1/1999	7/1/1999	0
4ASYD000.01	Snyders Branch	5/29/2002	5/29/2002	1
4AROA212.99	Roanoke River, Salem near Rt. 11 bridge	7/7/1999	7/7/1999	1
4AMSN000.60	Mason Creek near A.R. Burton Tech.	7/7/1999	7/7/1999	1

Station ID	Station Description	Begin Date	End Date	*Total PCB Samples
4APEE001.04	Peters Creek, Roanoke at Shenandoah Ave bridge	7/16/1999	7/16/1999	1
4APEE000.49	Peters Creek	5/29/2002	5/29/2002	2
4AROA206.80	Roanoke River at Wasena Park near Rt. 11 bridge	7/8/1999	7/22/2002	2
4AROA202.20	Roanoke River at 13th Street bridge	7/22/2002	7/22/2002	1
4AGLA005.04	Glade Creek near Rt. 636 bridge, Bonsack	7/24/2002	7/24/2002	1
4ATKR000.69	Tinker Creek near Rt. 24, Roanoke/Vinton line (A) -- !!!	8/18/1999	8/18/1999	2
4ATKR000.17	Tinker Creek near Rt. 24	5/29/2002	5/29/2002	2
4AROA199.78	Roanoke River just above Niagara Dam	8/21/2002	8/21/2002	1
4AROA199.60	Roanoke River above Niagara Dam	10/18/1999	10/18/1999	1
4AROA198.04	Roanoke River	8/6/1997	8/6/1997	1
4ABAA000.03	Back Creek at Rt. 618 (Rutrough Road)	7/29/1999	7/29/1999	1
4AROA196.05	Roanoke River (SMLake) near Hardy	9/15/1999	8/21/2002	2
4ABDA002.57	Beaverdam Creek at Rt. 1535 Hemlock Shore Drive	7/29/1999	7/29/1999	1
4AROA175.63	Roanoke River (SMLake) near Hales Ford bridge	9/14/1999	10/2/2002	2
4AGILOO5.06	Gills Creek near Road off Rt. 668	7/27/1999	7/27/1999	1
4AMEE000.63	Maggodee Creek at Rt. 122	7/27/1999	7/27/1999	1
4ABWR010.92	Blackwater River at Smith Mt Lake	9/13/1999	9/17/2002	1
4APGG048.81	Pigg River below Rocky Mount near Rt. 707 Ford	9/29/1999	9/29/1999	1
4ACNT001.20	Big Chestnut Creek at Rt. 715	7/26/1999	7/26/1999	1
4APGG032.21	Pigg River	8/19/1997	8/19/1997	0
4ASNW000.60	Snow Creek at Kirby Ford off Rt. 809	7/26/1999	7/26/1999	1
4APGG003.29	Pigg River near Leesville Lake	9/23/1999	9/23/1999	1
4AROA140.66	Roanoke River (Leesville Lake-Lower Lake site)	9/24/1999	9/24/1999	0
4AGSF002.16	South Fork Goose Creek near Rt. 607 bridge, Montvale	5/30/2002	5/30/2002	1
4AGNE000.16	North Fork Goose Creek near Road Rt. 751	7/22/1999	7/22/1999	1
4AGSE013.78	Goose Creek near Rt. 732 gaging station	8/18/1999	8/18/1999	0
4AGSE000.20	Goose Creek	10/23/1998	10/23/1998	0
4AROA137.00	Roanoke River near Leesville Tail Race	10/23/1998	10/23/1998	0
4ASCE000.24	Sycamore Creek near Pocket Road	7/30/1999	7/30/1999	0
4AROA129.95	Roanoke River near Rt. 29 bridge at Altavista	6/10/2002	6/10/2002	1
4AROA128.98	Roanoke River at Rt. 668 near Altavista Park	7/30/1999	7/30/1999	1
4ALYH000.02	Lynch Creek near Altavista Park	7/30/1999	7/30/1999	1

Station ID	Station Description	Begin Date	End Date	*Total PCB Samples
4ARAB000.05	Reed Creek at Rt. 668 near Altavista	7/30/1999	7/30/1999	0
4AXXZ000.05	Unnamed Tributary, just west of Altavista STP -- !!!	7/30/1999	7/30/1999	1
4AXCN000.20	Unnamed Tributary at Rt. 29 Substation Altavista	7/30/1999	7/30/1999	1
4AROA126.00	Roanoke River upstream of Big Otter River	10/22/1998	10/22/1998	1
4ALOR007.94	Little Otter River near Rt. 784, below Bedford	8/17/1999	5/30/2002	2
4ABOR024.91	Big Otter River near Road off Rt. 297	7/22/1999	7/22/1999	1
4ABOR012.18	Big Otter River near Rt. 682	8/19/1999	8/19/1999	1
4ABOR011.27	Big Otter River	7/13/1996	7/13/1996	1
4ABOR003.18	Big Otter River	7/15/1997	7/15/1997	1
4ABOR000.20	Big Otter River	10/22/1998	10/22/1998	1
4AROA125.59	Roanoke River downstream Altavista	10/22/1998	10/22/1998	1
4AMRC000.39	Mill Creek near Rt. 640	7/30/1999	7/30/1999	1
4AROA122.31	Roanoke River	7/13/1996	7/13/1996	1
4AROA117.49	Roanoke River	7/15/1997	7/15/1997	2
4AROA117.09	Roanoke River near Taber	10/20/1999	10/20/1999	1
4ABHE001.01	Beechtree Creek near Rt. 631	7/30/1999	7/30/1999	1
4AROA112.72	Roanoke River	7/15/1997	7/15/1997	1
4ASEN000.18	Seneca Creek near Rt. 704	8/6/1999	8/6/1999	1
4ASSC002.85	Straightstone Creek near Rt. 761	8/3/1999	8/3/1999	0
4AHIL000.60	Hill Creek at Rt. 633	8/6/1999	8/6/1999	0
4AROA108.09	Roanoke River near Long Island	10/21/1998	10/21/1998	1
4AXXX001.30	Unnamed Tributary at Rt. 633 Green Hill	8/3/1999	8/3/1999	0
4ABHA000.33	Buffalo Creek at Rt. 639	8/3/1999	8/3/1999	0
4AWPP000.60	Whipping Creek near Road off Rt. 614	8/3/1999	8/3/1999	1
4AROA099.22	Roanoke River	7/31/1997	7/31/1997	1
4AROA097.21	Roanoke River	6/19/1996	6/19/1996	1
4AZZZ097.08	Unnamed trib near Rt. 501,north side	6/2/1999	6/2/1999	1
4AZZZ097.07	Unnamed trib near Rt. 501,south side	6/2/1999	6/2/1999	1
4AROA097.07	Roanoke River near Brookneal	10/26/1998	4/24/2002	3
4AROA097.06	Middle Roanoke River at Rt. 501	6/2/1999	6/2/1999	0
4AZZZ096.71	Unnamed trib across from Tanyard Branch,south side	6/2/1999	6/2/1999	1
4AROA096.66	Downstream of lagoon outfall	6/2/1999	6/2/1999	0
4ATAB000.05	Tanyard Branch, downstream of lagoon	6/2/1999	6/2/1999	0
4AROA096.65	Downstream of Tanyard Branch	6/2/1999	6/2/1999	1

Station ID	Station Description	Begin Date	End Date	*Total PCB Samples
4AROA096.35	Downstream of Hatchery Water Intake	6/2/1999	6/2/1999	0
4AROA096.34	Directly across from site of sample # 10	6/2/1999	6/2/1999	0
4AZZZ096.27	Unnamed tributary across from Hatchery	6/2/1999	6/2/1999	1
4AROA096.10	South bank, upstream of Hatchery culvert	6/2/1999	6/2/1999	0
4AROA096.05	North bank, upstream of rusty culvert	6/2/1999	6/2/1999	0
4AROA095.95	North bank, downstream of last set of Hatchery Ponds	6/3/1999	6/3/1999	0
4AROA095.90	South bank,across from sample #16 of Roanoke River	6/3/1999	6/3/1999	0
4AZZZ095.38	Unnamed tributary downstream of sample # 17	6/3/1999	6/3/1999	1
4AROA094.68	Middle, just downstream of RR Bridge trestle	6/3/1999	6/3/1999	0
4AROA094.67	North bank, downstream of Railroad (RR) Bridge	6/3/1999	6/3/1999	0
4AROA094.54	Downstream of RR Bridge,south side of sandy island	6/3/1999	6/3/1999	0
4AFRV010.99	Falling River near Rt. 643 gaging station	8/26/1999	8/26/1999	0
4AFRV003.12	Falling River, downstream of lagoon outfall	6/3/1999	6/3/1999	0
4ACBA000.12	Catawba Creek at Rt. 626	7/23/1999	7/23/1999	1
4ATIP000.42	Turnip Creek near Road off Rt. 649	7/23/1999	7/23/1999	1
4AROA086.22	Roanoke River	7/17/1997	7/17/1997	1
4ACUB010.96	Cub Creek near Rt. 40 gaging station (B)	8/4/1999	9/13/1999	1
4AROA073.98	Roanoke River	8/6/1997	8/6/1997	1
4AROA068.79	Roanoke River	6/19/1996	6/19/1996	1
4AHTA000.80	Hunting Creek at Rt. 617	7/27/1999	7/27/1999	0
4AROA067.91	Roanoke River near Rt. 746 bridge	8/5/1999	8/5/1999	1
4AROC005.35	Roanoke Creek near Saxe	8/27/1999	8/27/1999	0
4AROA059.12	Roanoke River near Clover	10/27/1998	4/17/2002	2
4AROA057.51	Roanoke River	6/19/1996	6/19/1996	1
4AROA052.69	Roanoke River, upstream Kerr Reservoir	3/31/1999	3/31/1999	1
4ADIF002.02	Difficult Creek at Rt. 716	7/22/1999	7/22/1999	1
4AROA049.40	Roanoke River	8/6/1997	8/6/1997	1
4AROA012.07	Roanoke River	6/12/1996	6/12/1996	1

**Total PCB Samples is the total number of individual PCB values recorded for the sampled media at a sampling station over its entire sampling period

2.1.3 Water Quality Monitoring Stations

From 1967 to 2004, 429 water quality stations were sampled for PCBs in the Roanoke River Basin (including the Dan River watershed and downstream tributaries). Of these, 53 were identified as priority stations, as discussed above. Water quality station locations and a data summary are presented in Figure 2.3 and Table 2.5. Note that the water quality station data summary table includes all tributary stations. Water column data typically has limited value in assessing potential PCB sources in the watershed given that PCBs are hydrophobic, readily adsorb to sediment particles, and accumulate in animal tissues. Laboratory detection limits for the analysis of total PCBs varied during this time period. Only three stations recorded PCB observations above laboratory detection limits: 4ABLE000.00 (0.3 µg/l) 4AROA036.56 (0.7 µg/l) 4AROA046.34 (3.0 µg/l). All three stations are located in Kerr Reservoir.

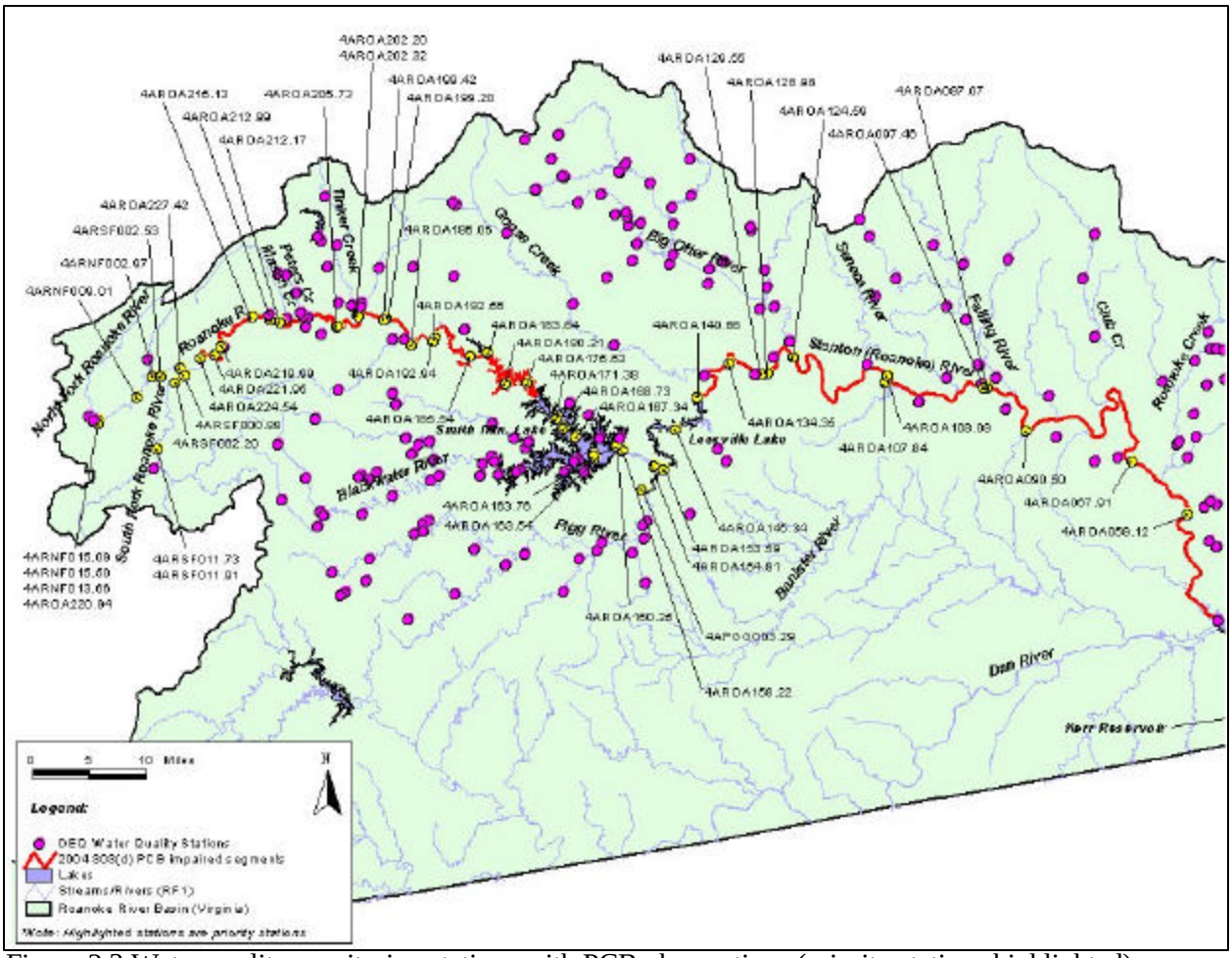

Figure 2.3 Water quality monitoring stations with PCB observations (priority stations highlighted)

Table 2.5 Water column PCB data summary

Station ID	Station Description	Begin Date	End Date	Sample Type
4ACDN001.12	Rt. 723 Bridge	7/5/01	5/28/03	AMBNT
4ACDN000.01	Confluence of Cedar Run and Wilson Cr.	7/16/03	11/15/04	AMBNT
4AWLN000.40	ROUTE 603 BRIDGE - MONTGOMERY COUNTY	11/14/89	11/15/04	AMBNT
4ARNF015.50	Above Rt. 603 and behind church	11/8/01	11/8/01	AMBNT
4ARNF015.09	BELOW RT. 603 BRIDGE	7/22/99	5/28/03	AMBNT
4ARNF013.66	ROUTE 603 BRIDGE NEAR ELLETT - MONTGOMER	3/16/70	11/15/04	AMBNT
4ARNF009.01	Sisson & Ryan property off Rt. 687	11/8/01	11/8/01	AMBNT
4ABDC002.36	Rt. 629 BRIDGE	7/5/01	5/28/03	AMBNT
4ARNF002.97	ROUTE 603 BRIDGE	6/16/82	4/14/99	AMBNT
4AELT000.86	ROUTE 639 AT BRIDGE	6/16/82	5/4/83	AMBNT
4ARSF011.91	ROUTE 637 BRIDGE AT GAGE	6/16/82	5/4/83	AMBNT
4ARSF011.73	RT. 637 BRIDGE AT GAGE	7/22/99	6/6/01	AMBNT
4ARSF002.53	RT. 460/11 BRIDGE AT ELLISTON ABOVE GREE	3/16/70	7/30/70	AMBNT
4ARSF002.20	PRIVATE BRIDGE UPSTREAM FROM GREEN HILL	8/27/92	6/6/01	AMBNT
4ARSF000.88	RT. 460/11 BRIDGE BELOW GREEN HILL, INC.	7/20/79	6/16/88	AMBNT
4AROA227.42	RT. 773 AT GAGING STA. IN LAFAYETTE	3/16/70	11/16/04	AMBNT
4AROA224.54	ROUTE 639 BRIDGE NEAR DIXIE CAVERNS - RO	7/15/03	11/16/04	AMBNT
4AROA221.95	Above Rt. 639 Bridge near Wabun	4/25/02	4/25/02	AMBNT
4AROA220.94	Rt. 639 Bridge south of Wabun	7/15/03	11/16/04	AMBNT
4AROA219.99	ROUTE 612 BRIDGE ABOVE SALEM AT WABUM	1/16/68	7/30/70	AMBNT
4ADRR000.21	RT. 612/639 BRIDGE	6/16/82	11/16/04	AMBNT
4AROA215.13	Mill Lane Bridge, Salem, VA	7/15/03	11/16/04	AMBNT
4ASYD000.60	SALEM RESIDENCY HIGHWAY SHOP BRIDGE	6/9/82	5/24/83	AMBNT
4AROA212.99	ROUTE 11 BRIDGE ABOVE EATON, INC.	9/26/67	7/26/71	AMBNT
4AROA212.17	ROUTE 11 BRIDGE BELOW EATON, INC.	2/6/68	11/16/04	AMBNT
4AMSN000.67	ROANOKE BOULEVARD BRIDGE	6/23/82	11/16/04	AMBNT
4AMDL000.34	Downstream of Brambleton Ave. behind She	7/15/03	11/16/04	AMBNT
4APEE005.98	NEAR HANGING ROCK ON RT. 1404 STORM EVEN	6/19/84	10/9/84	AMBNT
4APEE004.98	RT. 628 BRIDGE	1/2/75	6/8/79	AMBNT
4APEE003.05	PEACHTREE ROAD BRIDGE STORM EVENT 205J	6/19/84	10/9/84	AMBNT
4APEE001.04	SHENANDOAH AVENUE BRIDGE	6/23/82	11/16/04	AMBNT
4APEE000.49	MILLER STREET BRIDGE STORM EVENT 205J	6/19/84	10/9/84	AMBNT
4APEE000.00	10 YARDS ABOVE CONFUENCE	11/15/74	11/8/77	AMBNT
4AMUR001.63	FISHBURN PARK OFF ROUTE 221	6/9/82	5/1/01	AMBNT
4AORE000.19	WILEY DRIVE (GREENWAY) - CITY OF ROANOKE	8/27/92	11/17/04	AMBNT
4AROA205.73	Franklin Road Bridge, Roanoke, VA	7/21/03	11/17/04	AMBNT
4ALCK002.17	Orange Ave. Bridge	8/6/02	11/17/04	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4ALCK000.38	N & W PARKING LOT BRIDGE	6/23/82	11/17/04	AMBNT
4AROA202.32	Upstream of 14th St. Bridge	5/3/04	5/3/04	AMBNT
4AROA202.20	13TH. ST. BRIDGE ABOVE ROANOKE STP	3/16/70	11/9/04	AMBNT
4ATKR015.88	OFF RT. 779 INTERSECT RT. 675 AT GAGING	3/16/70	11/17/04	AMBNT
4ATKR009.30	RT. 11 BRIDGE AT HOLLINS	8/8/01	11/17/04	AMBNT
4ACRV006.19	CARVIN COVE RESERVOIR STATION AT DAM RO	6/30/77	10/19/00	AMBNT
4ACRV005.58	STA. #9, RT 115 BRIDGE (ROANOKE COUNTY)	8/8/01	8/8/01	AMBNT
4ACRV001.88	Brookside Park off Rt. 623 Hollins	10/25/01	6/9/03	AMBNT
4AGLA004.39	LAYMAN RD. (RT. 606)	8/8/01	11/17/04	AMBNT
4AGLA000.20	WALNUT AVENUE BRIDGE	6/30/82	11/17/04	AMBNT
4ATKR000.69	RT. 24 BRIDGE ABOVE TOWN OF VINTON	3/16/70	11/17/04	AMBNT
4AROA199.42	SPILLWAY NIAGRA RESERVOIR (ROANOKE CO)	8/31/77	8/31/77	AMBNT
4AROA199.20	BLUE RIDGE PARKWAY BR. BELOW ROANOKE	9/26/67	5/18/83	AMBNT
4ABAA012.75	Rt. 676 Bridge	7/21/03	11/17/04	AMBNT
4ABAA002.61	GAGE NEAR DUNDEE, RT. 660 BRIDGE	7/18/79	6/4/01	AMBNT
4ABAA000.03	END RT. 618 CONFL. WITH ROANOKE RIVER	7/21/03	11/17/04	AMBNT
4AROA196.05	SMITH MTN. LAKE, MCVEIGH FORD	8/12/75	6/5/03	AMBNT
4AROA192.94	SMITH MTN LAKE #2A-TOP-HARDYS FORD #2C-B	4/25/83	6/5/03	AMBNT
4AROA192.55	SMITH MTN. LAKE, HARDYS FORD	6/29/72	11/9/04	AMBNT
4AROA185.54	SMITH MTN. LAKE, LYNVILLE	6/29/72	10/26/73	AMBNT
4AXKD003.34	BEAVERDAM RESERVOIR-100' FROM DAM BEDFOR	7/30/90	8/22/02	AMBNT
4ABDA011.79	Lick Mountain Rd. off of Rt. 635	10/23/01	10/23/01	AMBNT
4ABDA003.63	STA #7 OFF RT.757 (BEDFORD COUNTY)	9/20/93	11/9/04	AMBNT
4AROA183.64	SMITH MTN LK 3A-TOP,3B-MID,3C-BOT CONF B	4/25/83	6/5/03	AMBNT
4AROA180.21	STATION 12 CONFLUENCE WITH INDIAN CRK	4/24/85	6/5/03	AMBNT
4AROA175.63	SMITH MTN. LAKE, HALES FORD	6/29/72	6/5/03	AMBNT
4AROA171.38	SMITH MTN. LAKE - BUOY 15R	6/29/72	10/26/73	AMBNT
4AXUO000.49	Free Flowing to SML above backwaters	3/31/04	3/31/04	AMBNT
4AROA168.73	SMITH MTN. LAKE - BUOY 12R	6/29/72	6/15/76	AMBNT
4AROA167.34	BUOY 12	4/25/85	6/10/03	AMBNT
4AXML000.56	Off Rt. 684 near Red Valley	4/14/03	11/5/03	AMBNT
4AGIL023.22	RT. 657 BRIDGE NEAR HEADWATERS (FRANKLIN	5/30/91	6/19/03	AMBNT
4AGIL008.56	Above Rt. 834 Bridge near Crossroads	4/18/02	4/18/02	AMBNT
4AGIL008.30	RT. 834 BRIDGE NEAR BOOKER T.WASHINGTON	5/30/91	6/19/03	AMBNT
4AGIL004.46	RT. 668 BRIDGE	8/16/01	10/17/01	AMBNT
4AGIL003.59	ABOVE STRIPERS LANDING	5/10/84	10/21/86	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4AGIL002.39	SMITH MT. LAKE STA #23,BUOY 11A (FRANKLI	5/10/84	6/23/03	AMBNT
4AMEE021.13	RT. 613 BRIDGE BELOW CONFLUENCE WITH FOR	5/28/91	10/5/04	AMBNT
4AMEE009.86	RT. 635 BRIDGE, FRANKLIN CO	7/22/99	10/5/04	AMBNT
4AMEE007.85	RT. 687 BRIDGE ABOVE MOLLIE BRANCH (FRAN	5/28/91	8/11/99	AMBNT
4AMHA001.79	OFF RT. 697 ABOVE FOOT BRIDGE (FRANKLIN	5/28/91	8/11/99	AMBNT
4AMHA001.59	OFF RT. 697 BELOW FOOT BRIDGE (FRANKLIN	5/28/91	8/11/99	AMBNT
4AMHA000.01	OFF RT. 687 AT CONFLUENCE WITH MAGODEE C	5/28/91	8/11/99	AMBNT
4AMEE004.90	Maggodee Cr. Rt. 697 Bridge	7/22/99	10/5/04	AMBNT
4AMEE002.38	ROUTE 698 FORD - FRANKLIN COUNTY	5/30/91	4/19/99	AMBNT
4ATEL001.02	RT. 697 BRIDGE (FRANKLIN CO.)	6/4/91	10/5/04	AMBNT
4AXKF000.40	UPPER KINSEY FARM PR. DR. OFF RT. 735 (F	4/19/93	9/1/93	AMBNT
4AXKF000.20	LOWER KINSEY FARM PR.DR. OFF RT. 735 (FR	4/19/93	9/1/93	AMBNT
4ALLE005.22	RT. 697 BRIDGE (FRANKLIN CO.)	5/29/91	10/5/04	AMBNT
4ABNR009.36	RT. 643 BRIDGE N. OF MONTE VISTA (FRANKL	5/20/91	8/26/99	AMBNT
4ABNR004.56	RT. 742 BRIDGE NEAR DILLONS MILL (FRANKL	5/20/91	5/27/03	AMBNT
4ABNR000.40	ROUTE 740 BRIDGE SW OF RETREAT (FRANKLIN	5/20/91	10/5/04	AMBNT
4AGCR000.01	RT. 739 BRIDGE AT ALGOMA (FRANKLIN CO.)	5/20/91	5/27/03	AMBNT
4ABSF001.15	RT. 641 BRIDGE E. OF CALLAWAY (FRANKLIN	5/20/91	10/5/04	AMBNT
4ABWR061.20	RT. 641 BR. E. OF CALLAWAY (FRANKLIN CO)	5/20/91	10/5/04	AMBNT
4ABWR054.81	RT. 734 BRIDGE (FRANKLIN CO.)	5/29/91	5/27/03	AMBNT
4ABWR045.80	RT. 812 BRIDGE SE OF GOGGINSVILLE (FRANK	5/29/91	10/5/04	AMBNT
4ABWR032.32	RT. 122 BRIDGE AT GAGE (FRANKLIN CO)	7/23/79	1/22/03	AMBNT
4ABWR029.51	Downstream of Rt. 221 Bridge	5/26/04	5/26/04	AMBNT
4ABWR019.75	SMITH MTN.LAKE,BROOKS MILL BR.RT.834 FRA	3/17/70	10/5/04	AMBNT
4AFGC002.52	RT. 834 BRIDGE, FRANKLIN CO	8/10/99	5/7/01	AMBNT
4ABWR018.20	SMITH MTN. LAKE, BUOY 18B FRANKLIN COUNT	6/29/72	6/29/72	AMBNT
4ABWR017.42	SMITH MTN LAKE-STA #21,BUOY 50 (FRANKLIN	4/13/83	6/23/03	AMBNT
4ABWR015.06	SMITH MTN. LAKE, BUOY 15B- FRANKLIN COUN	5/27/75	6/15/76	AMBNT
4ABWR010.92	SMITH MTN. LAKE, BUOY 11B - FRANKLIN COU	6/29/72	6/29/72	AMBNT
4ABWR010.55	SMITH MTN LAKE-STA #22,BUOY 23 (FRANKLIN	4/13/83	6/23/03	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4ABSA000.62	CONFLUENCE WITH LITTLE BULL RUN	5/1/85	6/23/03	AMBNT
4ABWR002.50	SMITH MTN LK #7A-TOP #7B-MIDDLE #7C-BOTT	4/13/83	6/23/03	AMBNT
4ACOA000.60	COOL BRANCH NEAR CONF. OF BLACKWATER RIV	5/1/85	6/23/03	AMBNT
4ABWR000.88	SMITH MOUNTAIN LAKE, BUOY 1B	6/29/72	6/29/72	AMBNT
4AROA163.76	SMITH MTN LK 6A-TOP,6B-MID,6C-BOT CONF B	4/13/83	6/10/03	AMBNT
4AROA163.54	SMITH MTN. LAKE - BUOY 6R	6/29/72	10/26/73	AMBNT
4ACCK004.26	Surry Dr. Bridge	8/16/01	6/19/03	AMBNT
4ACCK001.80	SMITH MOUNTAIN LAKE-1.8 MILES FROM MOUNT	10/14/87	6/10/03	AMBNT
4AROA160.25	SMITH MTN. LAKE - BUOY 2R	6/29/72	10/14/87	AMBNT
4AWTH000.40	SMITH MOUNTAIN LAKE - 0.40 MILE FROM MOU	10/14/87	6/10/03	AMBNT
4AROA158.22	SMITH MTN LK #5A-TOP DAM #5B-MID DAM #5C	4/13/83	6/10/03	AMBNT
4AROA154.91	LEESVILLE LAKE #4A-TOP/CONFLUENCE W/CLAY	7/14/77	6/17/86	AMBNT
4APGG074.87	STA #18 RT. 908 FORD (FRANKLIN COUNTY)	7/26/01	10/6/04	AMBNT
4APGG068.49	Rt. 756 Bridge	7/26/01	10/25/04	AMBNT
4ASDA010.16	RT. 40 BRIDGE AT FERRUN BELOW FJ COLLEGE	11/14/67	7/30/70	AMBNT
4ASDA009.79	RT. 623 BR ABOVE FERRUM STP OUTFALL	7/11/88	10/6/04	AMBNT
4ASDA009.77	OFF RT. 864, BELOW FERRUM STP OUTFALL	7/11/88	6/19/01	AMBNT
4ASDA007.24	Rt. 40 Bridge near Ferrum	9/24/01	10/6/04	AMBNT
4APGG057.85	ROUTE 220 BRIDGE AT ROCKY MOUNT ABOVE ST	3/16/70	7/30/70	AMBNT
4APGG057.84	BELOW BUS. RT. 220 BRIDGE ABOVE RONILE	6/25/02	6/25/02	AMBNT
4APGG055.72	ROUTE 220 BYPASS BELOW ROCKY MOUNT	3/16/70	6/26/79	AMBNT
4APGG052.73	RT. 713 BRIDGE UPSTREAM ROCKY MT STP(FRA	3/22/94	10/25/04	AMBNT
4ADOE002.47	Rt. 720 Bridge	7/11/01	5/27/03	AMBNT
4ACTO001.01	Off Rt. 761 near Canton Creek Church	5/23/02	5/23/02	AMBNT
4ALNT001.00	Off of Rt. 810 near Sydnorsville	5/2/02	5/2/02	AMBNT
4ACNT001.32	RT. 715 BRIDGE	4/7/97	10/25/04	AMBNT
4APGG030.62	Rt. 646 Bridge	7/26/94	10/25/04	AMBNT
4ASNW010.08	Rt. 651	8/31/04	10/25/04	AMBNT
4APAA000.24	LaPrade farm below Rt. 629	10/17/01	10/17/01	AMBNT
4ASNW000.60	KIRBY FORD BRIDGE - PITTSYLVANIA COUNTY	1/13/92	10/25/04	AMBNT
4APGG016.06	Rt. 626 Bridge	8/11/03	10/25/04	AMBNT
4ATMA004.60	BURTON LAKE (AT DAM) - PITTSYLVANIA CO	7/25/89	7/27/94	AMBNT
4ATMA001.46	Rt. 644 Bridge	8/11/03	10/25/04	AMBNT
4AHPN001.62	Rt. 785 Bridge	8/11/03	10/25/04	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4APGG008.87	Off Rt. 40 at USGS gage	8/11/03	10/25/04	AMBNT
4APGG008.42	RT. 40 BRIDGE, NEAR GAGING STATION	3/17/70	6/23/88	AMBNT
4AFRY006.08	Rt. 40 Bridge	4/8/03	10/30/03	AMBNT
4APGG003.29	ROUTE 605 BRIDGE	1/13/92	10/25/04	AMBNT
4AROA153.59	LEESVILLE LAKE #3A-TOP-CONFLUENCE W/ PIG	7/14/77	6/12/03	AMBNT
4AROA145.34	LEESVILLE LK #2A-RMP BEDFORD/CAMPBELL CO	7/14/77	6/12/03	AMBNT
4AOWC005.36	STA #17 RT. 760 BRIDGE (PITTSYLVANIA COU	9/20/93	10/25/04	AMBNT
4AOWC004.37	Below Rt. 940 Near Owens Mill Hunt Club	11/7/01	11/7/01	AMBNT
4AROA140.66	LEESVILLE LK #1A-TOP #1B-MIDDLE #1C-BOT	7/14/77	6/12/03	AMBNT
4AGSF002.60	Rt 897 Bridge	6/25/02	6/25/02	AMBNT
4AGSF002.16	RT. 607 BR. BELOW FUEL STORAGE, MONTVALE	11/15/74	6/8/88	AMBNT
4AGSE037.78	STA #22 RT. 755 BRIDGE (BEDFORD COUNTY)	7/26/94	11/9/04	AMBNT
4AGSE022.55	RT 24 BRIDGE AT GAGE	7/26/94	5/22/01	AMBNT
4AGSE013.78	GOOSE CREEK AT GAGE NEAR HUDDLESTON ON R	7/9/79	6/23/88	AMBNT
4AGSE000.20	RT. 630 BRIDGE AT LEESVILLE	3/17/70	7/9/01	AMBNT
4AROA134.35	South of Rt. 43 and above Alta Vista	6/3/02	5/27/03	AMBNT
4ASCE000.26	ROUTE 924 BRIDGE - PITTSYLVANIA COUNTY	8/12/92	6/9/03	AMBNT
4AROA129.55	ROUTE 29 BRIDGE, AT GAGE - PITTSYLVANIA	11/13/91	11/17/04	AMBNT
4AROA128.98	ROUTE 668 BRIDGE AT ALTAVISTA	1/22/68	5/13/70	AMBNT
4AFRZ000.20	BUSINESS ROUTE 29, ALTAVISTA - CAMPBELL	9/14/92	3/16/99	AMBNT
4ASCB004.58	"BEDFORD RESERVOIR" STATION AT DAM (BEDF	8/6/91	8/26/96	AMBNT
4ALSA004.32	PEAKS OF OTTER LAKE CENTER (BEDFORD CO)	7/12/78	7/12/78	AMBNT
4ALSA001.40	Rt. 43 Bridge	8/16/01	5/27/03	AMBNT
4ASCB000.16	Bridge on Rt.43 intersection43&682	4/27/00	4/27/00	
4ACMP000.88	Bridge on Rt.684 intersection of684&688	4/27/00	4/27/00	
4ASEE003.16	RT. 680 BRIDGE, NEAR PENICKS MILL	3/16/70	5/27/03	AMBNT
4ABOR041.27	Bridge on Rt.43 intersection of 43&682	4/27/00	4/27/00	
4ABOR034.32	Rt. 644 Bridge	3/11/03	11/9/04	AMBNT
4ABOR033.41	Bridge on Rt.644 intersection of 644&673	4/27/00	4/27/00	
4AXMB000.18	Bridge on Rt.644 intersection 644&673	4/27/00	4/27/00	
4ABOR033.22	Downstream of Rt. 644 Bridge	3/11/03	11/24/03	AMBNT
4AOSL000.18	Bridge on Rt.644 intersection of 644&674	4/27/00	4/27/00	
4ABNF001.06	RT. 644 BRIDGE	7/26/94	1/2/03	AMBNT
4ABOR029.74	Bridge on Rt.221 intersection 221&670	4/25/00	4/25/00	
4AECR016.99	Bridge on Rt.664 juction of 668&663	4/25/00	4/25/00	
4AECR007.62	Bridge on Rt.643 intersection of 643&705	4/25/00	4/25/00	
4AECR003.02	STA #11 RT. 668 BRIDGE (BEDFORD COUNTY)	9/21/93	5/22/01	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4ABOR024.46	Bridge 460 near intersection 460&706	4/25/00	4/25/00	
4ALOR021.92	Bridge on Rt.838 intersection 838&43	4/26/00	4/26/00	
4ALOR018.96	Bridge on Rt.122 N. intersection 122&211	4/26/00	4/26/00	
4ALOR014.75	RT. 718 BR ABOVE BEDFORD STP OUTFALL DIS	8/2/88	11/9/04	AMBNT
4AJHN001.38	OFF RT. 718 BELOW STP	4/23/69	6/11/79	AMBNT
4AJHN000.01	confluence of Johns Creek and LOtter Riv	3/21/00	4/26/00	
4AJHN000.00	CONFLUENCE WITH LITTLE OTTER RIVER	7/17/69	8/14/73	AMBNT
4ALOR014.33	BELOW BEDFORD STP OUTFALL - BEDFORD COUN	8/14/91	4/26/00	AMBNT
4ALOR010.78	RT. 460 BRIDGE	5/1/73	4/26/00	AMBNT
4ALOR008.64	RT. 784 BRIDGE,BEDFORD CO	7/17/96	5/27/03	AMBNT
4AWEL001.14	Bridge on Rt.722 intersec tion 722&747	4/26/00	4/26/00	
4AMCR004.60	STA #15 RT. 804 BRIDGE (BEDFORD COUNTY)	8/20/92	5/27/03	AMBNT
4ABOR019.84	Upstream of Cobbs Creek Mouth	4/6/04	4/6/04	AMBNT
4AFNG001.06	Bridge on Rt. 714 near intersection of R	4/25/00	4/25/00	
4ABOR016.26	RT. 24 BRIDGE	3/5/97	5/3/01	AMBNT
4AORR002.63	Downstream of Rt. 713 Bridge	4/6/04	4/6/04	AMBNT
4ABWA008.53	Along Rt. 623 near New London	4/2/03	4/2/03	AMBNT
4ABWA007.87	Bridge on Rt. 623 near intersection of R	4/25/00	4/25/00	AMBNT
4ABWA002.47	RT 639, ROCK BARN ROAD	8/12/03	9/30/04	AMBNT
4ABWA002.00	Below Rt. 24 Bridge	7/10/03	11/9/04	AMBNT
4AFCA003.38	RT. 24 BRIDGE	4/23/69	5/23/77	AMBNT
4AFCA001.40	STA #13 RT. 696 BRIDGE (CAMPBELL COUNTY)	7/26/94	6/26/03	AMBNT
4ABOR008.32	Across pasture from end of Rt. 709, belo	4/24/00	4/24/00	
4ATBL000.40	Ford of gravel farm road between feedlot	4/24/00	4/24/00	
4ABOR000.73	RT. 29 BRIDGE	7/9/79	6/23/88	AMBNT
4ABOR000.62	ROUTE 712 BRIDGE, NEAR CONFLUENCE WITH R	9/14/92	11/17/04	AMBNT
4AROA124.59	ROUTE 640 BRIDGE - CAMPBELL COUNTY	4/23/69	6/11/01	AMBNT
4AXUP000.06	Upstream of Rt. 698 Crossing E. Little S	4/6/04	4/6/04	AMBNT
4ASEN000.40	ROUTE 704 BRIDGE, ABOVE LONG ISLAND	9/14/92	6/10/03	AMBNT
4AROA108.09	RT. 761 BRIDGE - MAIN CHANNEL OF ROANOKE	2/23/93	6/9/03	AMBNT
4AROA107.84	ABOVE BROOKNEAL , ROUTE 761 BR. NEAR LON	3/28/75	8/6/79	AMBNT
4AWPP002.53	WHIPPING CREEK, RT 633	8/12/03	9/30/04	AMBNT
4ACOR000.21	BELOW BURLINGTON - BROOKNEAL OUTFALL CAM	9/14/92	6/9/03	AMBNT
4AROA097.46	ROANOKE RIVER AT BROOKNEAL GAGE , RT. 50	9/11/79	9/30/04	AMBNT
4AROA097.07	ROUTE 501 AT BROOKNEAL	4/23/69	5/13/70	AMBNT
4AMEY018.02	ABOVE RUSTBURG STP OUTFALL - CAMPBELL CO	10/13/88	4/26/90	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4AMEY017.87	ABOVE RUSTBURG STP OUTFALL - CAMPBELL CO	5/24/90	6/11/91	AMBNT
4AMEY016.24	PRIVATE ROAD OFF RT. 655, BELOW RUSTBURG	12/28/88	4/26/90	AMBNT
4AMEY016.00	PRIVATE ROAD OFF RT. 655, BELOW RUSTBURG	5/24/90	6/10/03	AMBNT
4AMEY010.46	Mollys Creek at Rt. 654 bridge	8/12/03	9/30/04	AMBNT
4AFSF004.56	RT 604	8/12/03	9/30/04	AMBNT
4AFRV 017.71	ROUTE 615 BRIDGE - CAMPBELL COUNTY	6/7/90	11/26/02	AMBNT
4AFRV010.99	NARANA GAGE RT. 643	10/9/79	9/30/04	AMBNT
4ALRV009.74	LITTLE FALLING R., RT 615	8/12/03	9/30/04	AMBNT
4APLP000.45	Brookneal Res. 500 yds from dam	4/8/02	10/24/02	AMBNT
4APLP000.40	"BROOKNEAL RESERV" STATION AT DAM (CAMPB	6/11/81	6/10/03	AMBNT
4AFRV002.78	Off Rt. 600 Below Brookneal STP	9/14/92	3/13/03	AMBNT
4ACRE002.52	CHILDREY CR RT. 632 BRIDGE	9/19/90	2/26/01	AMBNT
4AROA090.50	ROUTE 620 SOUTH OF BROOKNEAL	3/17/70	12/13/73	AMBNT
4ATIP002.55	TURNIP CREEK, RT. 619 BRIDGE	9/29/94	6/10/03	AMBNT
4AEIS002.07	DOWN FROM COOK LANE,S OF RT784	4/28/03	11/25/03	AMBNT
4ABUB000.06	Big Cub Creek @ Rt. 701	8/4/03	10/12/04	AMBNT
4ACUB017.46	RED HOUSE ROAD	8/4/03	10/12/04	AMBNT
4ACUB010.96	ROUTE 40 BRIDGE - CHARLOTTE COUNTY	2/3/99	10/12/04	AMBNT
4AHTA003.26	STATION 1 - CONNER LAKE (PORTION OF HUNT	7/26/78	8/3/93	AMBNT
4AHTA000.77	Hunting Creek @ Rt. 617	8/4/03	10/12/04	AMBNT
4AROA067.91	RT.746 BRIDGE (WATKINS BRIDGE) NEAR RAND	7/2/90	10/12/04	AMBNT
4ASRN005.14	KEYSVILLE RESERVOIR (LAKE) -CHARLOTTE CO	8/15/90	6/17/02	AMBNT
4ALRO006.42	RT. 40 BRIDGE	4/1/81	6/7/90	AMBNT
4AACC004.87	Ash Camp Cr @Private Rd 0.6 mi from Rt40	9/20/01	12/11/02	AMBNT
4AACC002.60	STA 1 - RT. 654 BRIDGE	4/23/69	12/11/02	AMBNT
4AACC001.75	0.85 mi dwnstream of rt 654 bridge	5/8/02	5/8/02	AMBNT
4AACC001.15	Ash Camp Cr 1.15 mi above Roanoke Cr	12/17/01	1/28/02	AMBNT
4ALRO003.34	RT. 47 BRIDGE	4/11/77	6/3/03	AMBNT
4AWFC002.12	WARDS FORK CREEK, RT. 645 BRIDGE	9/29/94	10/12/04	AMBNT
4ARES001.30	reeses creek @ unnamed rd N of rte 623	11/5/03	11/5/03	AMBNT
4ATWT009.63	SCS ROANOKE CR. WATERSHED DAM #72A, NEAR	8/1/95	8/1/95	AMBNT
4ATWT008.59	new REF dwnstrm of Town Lk @ power lines	11/5/03	11/5/03	AMBNT
4ATWT006.40	STA 1 - RT. 47 BRIDGE	4/23/69	11/6/03	AMBNT
4ATWT003.36	STA. 2 - RT. 642 BRIDGE - COUNTY OF CHAR	11/6/03	11/6/03	AMBNT
4ATWT000.32	Twittys Creek @ Sylvan Hill Rd.	8/4/03	10/12/04	AMBNT
4AROC005.35	ROANOKE CREEK AT THE CONFLUENCE WITH TWI	8/28/01	6/3/03	AMBNT
4AHEN004.74	above Rt. 612, Charlotte Co.	10/18/01	10/18/01	AMBNT

Station ID	Station Description	Begin Date	End Date	Sample Type
4AHEN002.16	HORSEPEN CREEK, RT. 637 BRIDGE	9/29/94	6/3/03	AMBNT
4ABES001.21	Berles Cr. @ Rt. 631, DSS Vaughan Farm	6/28/00	10/25/00	AMBNT
4ASLA002.69	Sandy Cr. @ Rt. 607	6/28/00	10/25/00	AMBNT
4ASLA001.52	Sandy Creek @ Rt. 608	7/8/03	11/8/04	AMBNT
4AROA059.12	ROUTE 360 BRIDGE, EAST OF CLOVER	1/22/68	11/8/04	AMBNT
4AXMC000.54	UT Buffalo @ Rt. 605	6/28/00	10/25/00	AMBNT
4ABNN001.85	Buffalo Creek @Rt. 608	6/28/00	10/25/00	AMBNT

2.2 Fish Tissue and Sediment PCB Results

Fish tissue and sediment samples were collected and analyzed by DEQ under the Fish Tissue and Sediment Monitoring Program and various special studies. These data were compiled and summarized in order to help identify spatial and temporal trends that will assist in the identification of potential PCBs sources in the Roanoke River Basin. Note that the mobility and seasonal migration patterns of various fish species can limit the conclusions that can be drawn from analyzing the spatial distribution of PCB concentrations in fish tissue samples. The location of dams, tributaries, and other physical characteristics can influence the PCB signature in fish tissue samples. These and other factors are also considered in the analysis of sediment PCB data. PCBs typically adsorb to sediment particles, which are transported into streams and rivers through erosion, stormwater runoff, and other processes. Although the instream transport of sediment can cause uncertainty as to the source of contamination, its movement is relatively predictable and the presence of PCBs can be assumed to be an indicator of an upstream source (active or legacy). Areas with high fish tissue and sediment concentrations provide the strongest evidence of local PCB contamination problems. Data analysis observations are noted at the end of this section.

The Roanoke River Basin was divided into three sections for data analysis purposes. The Upper Roanoke section includes the area from the headwaters (North and South Forks of the Roanoke River) downstream to Niagara Dam (below the City of Roanoke). The Middle Roanoke section includes all monitoring stations from Niagara Dam downstream to Leesville Dam. The Lower Roanoke section includes the Staunton (Roanoke) River from Leesville Dam downstream to Kerr Reservoir (confluence with the Dan River). Fish tissue and sediment PCB results are shown using graduated symbols in Figures 2.4 through 2.6. The symbols representing fish tissue stations vary in size according to the maximum total PCB concentration observed across all fish species collected and analyzed for the entire sampling period at each monitoring station. The data intervals shown in the legend correspond with the DEQ PCB fish tissue screening value (54 ppb) and the current VDH fish consumption advisory levels (50/500 ppb). Current VDH fish consumption criteria are listed in Table 2.6. Sediment station symbols also vary in size according to the maximum total PCB concentration observed in sediment samples collected and analyzed for the entire sampling period at each monitoring station. The data intervals shown in the legend correspond with the sediment quality guidelines including the freshwater consensus-based Probable Effects Concentration (PEC) (676 ppb) and NOAA's Effects Range-Median screening value (180 ppb), which was also used for comparison purposes.

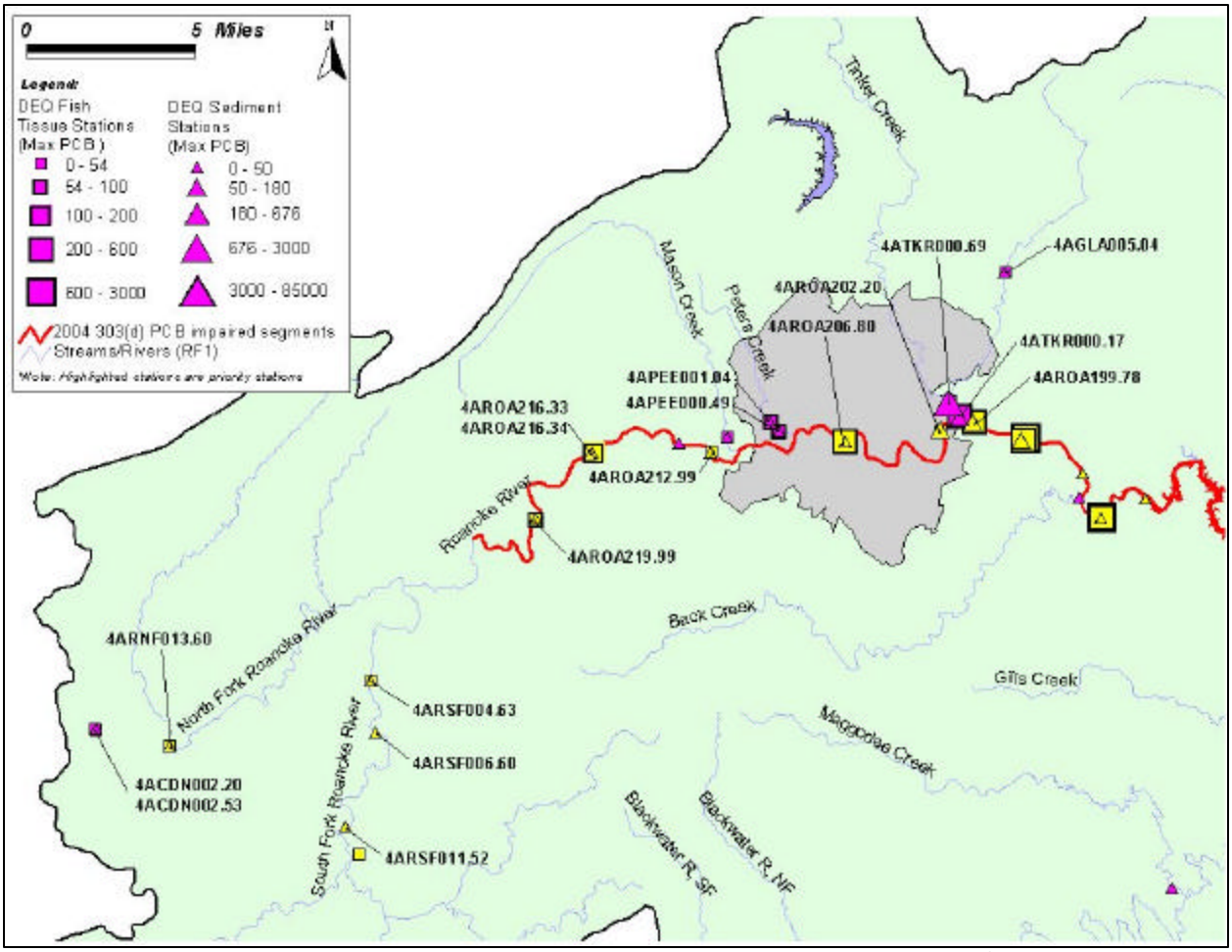

Figure 2.4 Maximum PCB concentrations observed at Upper Roanoke sediment and fish tissue monitoring stations

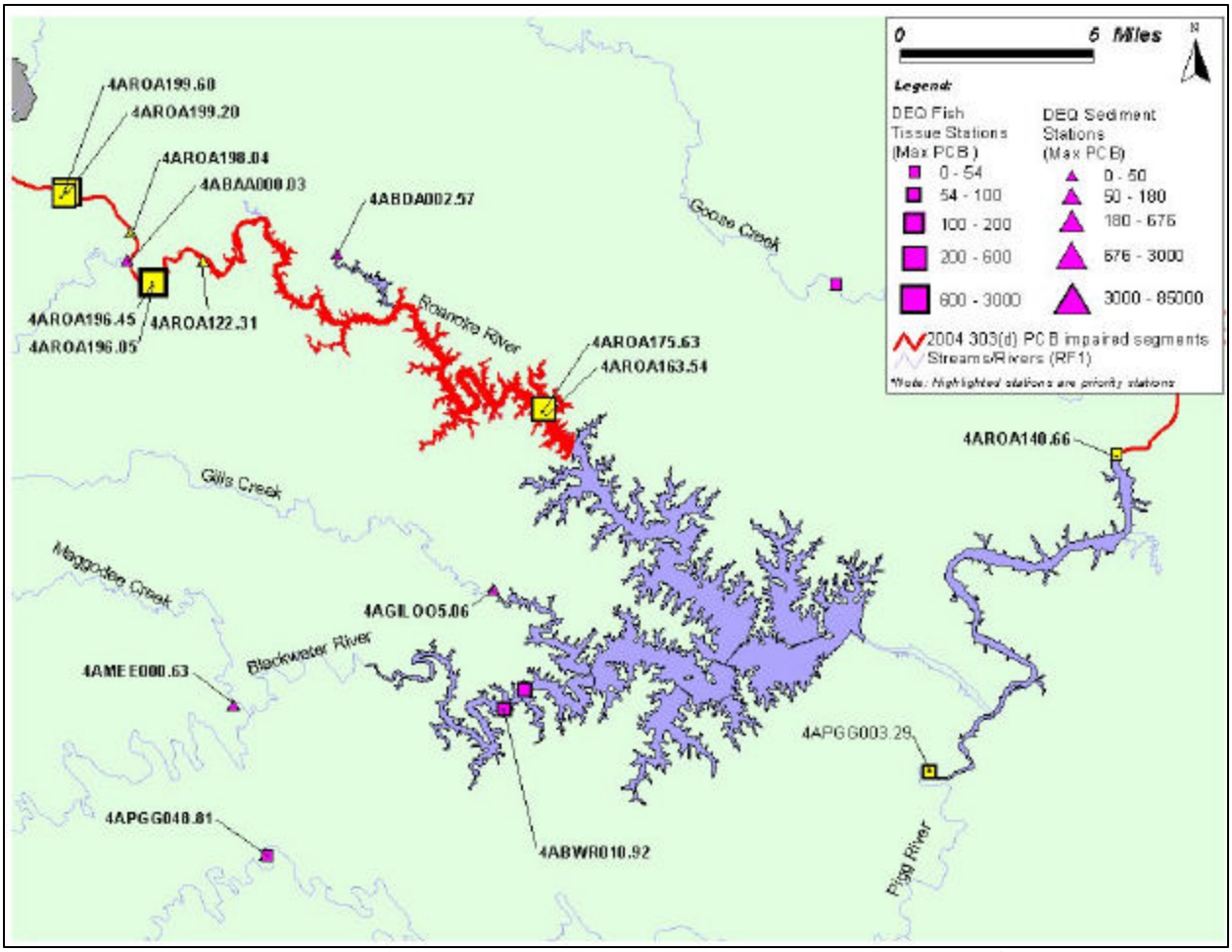

Figure 2.5 Maximum PCB concentrations observed at Middle Roanoke sediment and fish tissue monitoring stations

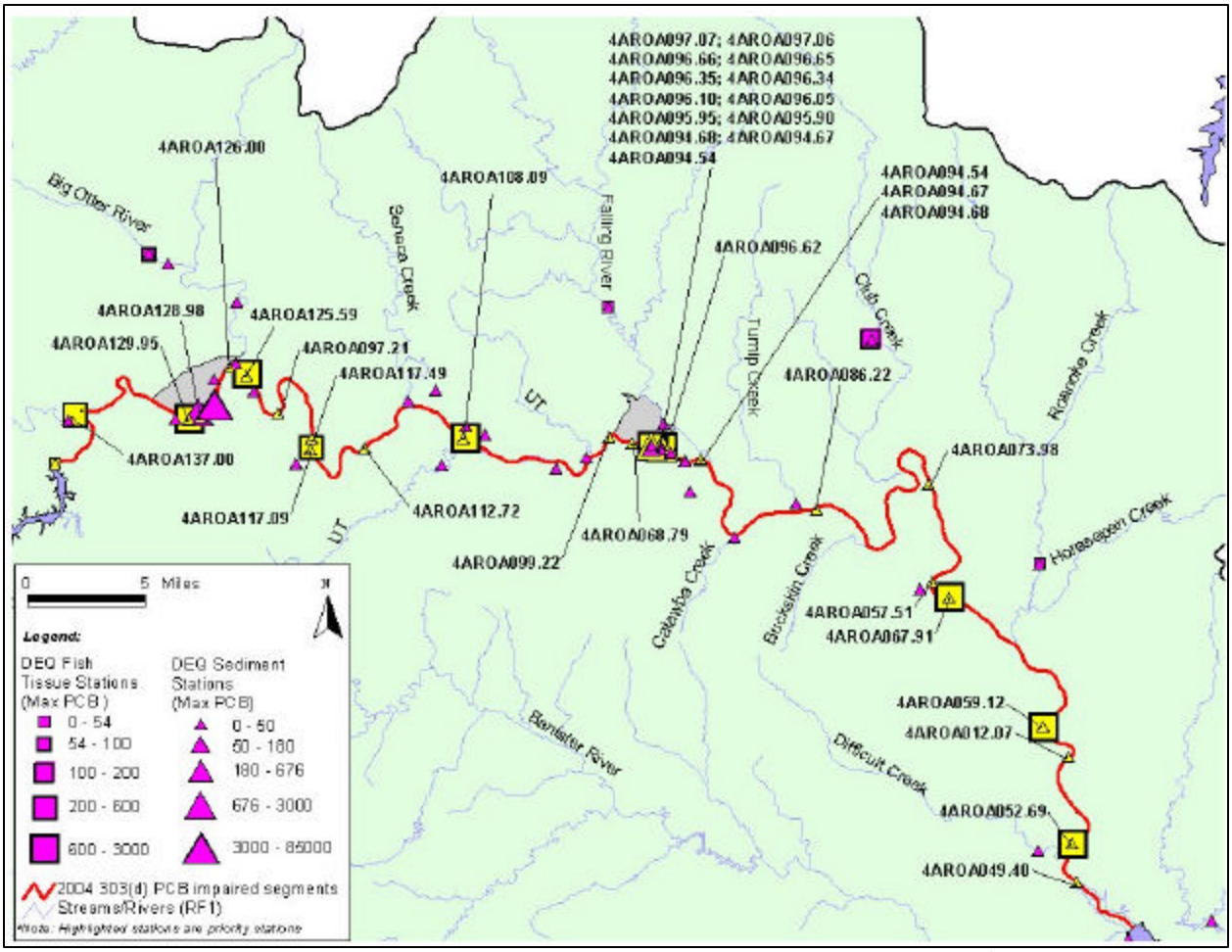

Figure 2.6 Maximum PCB concentrations observed at Lower Roanoke sediment and fish tissue monitoring stations

Figures 2.7 through 2.10 present the average total PCB concentrations for each fish species collected at priority (mainstem) fish tissue sampling stations over the entire sampling period (fish species abbreviations are presented in Tables 2.6 through 2.8). The sampling date shown represents the most recent sampling event that occurred at each station. Within each species, stations are presented in an upstream – downstream progression for spatial analysis purposes, according to the station river-mile code. The number displayed at the top of each bar represents the sample count. The absence of a number indicates that the data point represents a single sample. The DEQ fish tissue screening level (54 ppb) and current VDH fish consumption advisory levels (50/500 ppb) are also shown. Tables 4.6 through 4.8 present the average total PCB concentration by sample year for each fish species collected at priority fish tissue sampling stations.

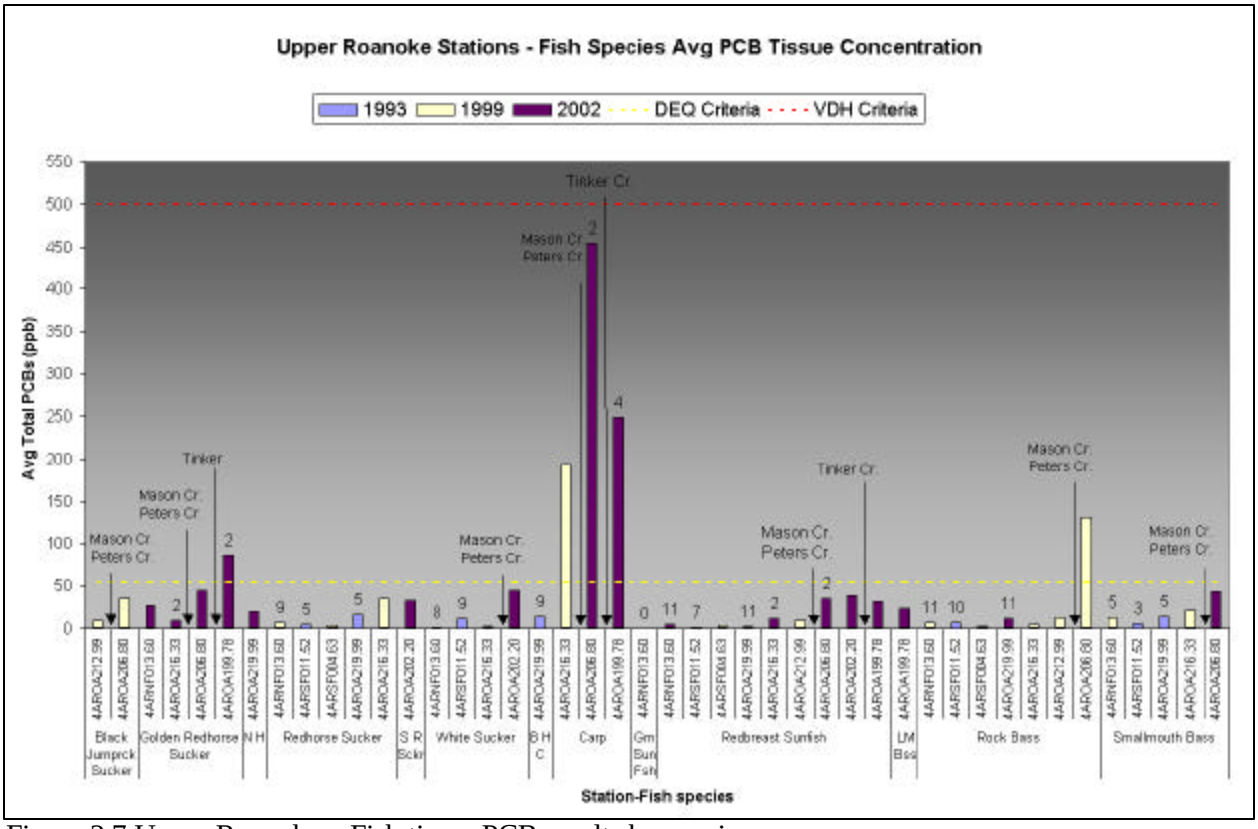

Figure 2.7 Upper Roanoke – Fish tissue PCB results by species

Table 2.6 Upper Roanoke – Fish Tissue PCB results by species/sample year

Upper Roanoke			Average Total PCB (ppb (wet weight basis))		
			Sampling Year		
Fish Species Name	Species Abbreviation	DEQ Site	1993	1999	2002
Black Jumprock Sucker	Black Jumprck Sucker	4AROA212.99		9.659	
		4AROA206.80		35.317	
Bluehead Chub	B H C	4AROA219.99	14.000		
Carp	Carp	4AROA216.33		192.323	
		4AROA206.80			454.128
		4AROA199.78			249.298
Golden Redhorse Sucker	Golden Redhorse Sucker	4ARNF013.60			26.625
		4AROA216.33			9.679
		4AROA206.80			44.717
		4AROA199.78			86.533
Green Sunfish	Grn Sun Fsh	4ARNF013.60			
Largemouth Bass	LM Bss	4AROA199.78			23.740
Northern Hogsucker	N H	4AROA219.99			20.270
Redbreast Sunfish	Redbreast Sunfish	4ARNF013.60	5.030		2.036
		4ARSF011.52	1.271		
		4ARSF004.63		3.824	
		4AROA219.99	2.770		2.542
		4AROA216.33		16.682	5.846
		4AROA212.99		9.924	
		4AROA206.80		38.739	30.290
		4AROA202.20			38.687
		4AROA199.78			30.985
Redhorse Sucker	Redhorse Sucker	4ARNF013.60	5.875	13.605	
		4ARSF011.52	4.440		
		4ARSF004.63		3.034	
		4AROA219.99	16.000		

Upper Roanoke			Average Total PCB (ppb (wet weight basis))		
			Sampling Year		
Fish Species Name	Species Abbreviation	DEQ Site	1993	1999	2002
		4AROA216.33		34.686	
Rock Bass	Rock Bass	4ARNF013.60	7.880	1.727	
		4ARSF011.52	7.040		
		4ARSF004.63		2.913	
		4AROA219.99	11.660		6.606
		4AROA216.33		4.380	
		4AROA212.99		13.058	
		4AROA206.80		130.466	
Shorthead Redhorse Sucker	S R Sckr	4AROA202.20			32.660
Smallmouth Bass	Smallmouth Bass	4ARNF013.60	15.375	5.488	
		4ARSF011.52	5.300		
		4AROA219.99	14.220		
		4AROA216.33		21.531	
		4AROA206.80			43.275
White Sucker	White Sucker	4ARNF013.60	1.443		3.423
		4ARSF011.52	11.456		
		4AROA216.33			2.093
		4AROA202.20			44.067

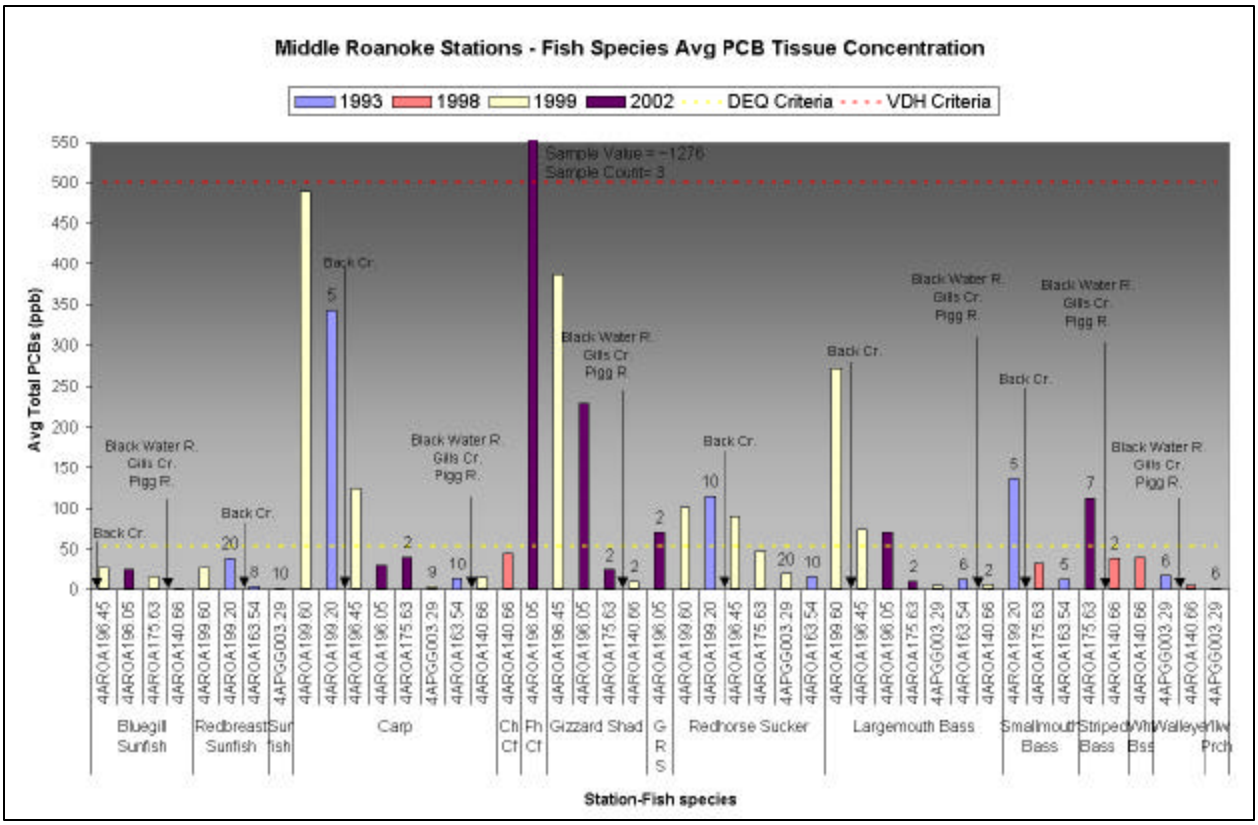

Figure 2.8 Middle Roanoke – Fish tissue PCB results by species

Table 2.7 Middle Roanoke – Fish Tissue PCB results by species/sample year

Middle Roanoke			**Average Total PCB (ppb (wet weight basis))**			
			Sampling Year			
Fish Species Name	Species Abbreviation	DEQ Site	1993	1998	1999	2002
Bluegill Sunfish	Bluegill Sunfish	4AROA196.45			26.283	
		4AROA196.05				24.576
		4AROA175.63			16.025	
		4AROA140.66			1.542	
Carp	Carp	4AROA199.60			488.942	
		4AROA199.20	343.140			
		4AROA196.45			123.984	
		4AROA196.05				30.921
		4AROA175.63			45.105	35.165
		4APGG003.29	2.538		10.741	
		4AROA163.54	13.500			
		4AROA140.66			14.619	
Channel Catfish	Ch Cf	4AROA140.66		44.972		
Flathead Catfish	Fh Cf	4AROA196.05				1276.417
Gizzard Shad	Gizzard Shad	4AROA196.45			386.407	
		4AROA196.05				228.695
		4AROA175.63		37.625		11.347
		4AROA140.66		6.851	12.737	
Golden Redhorse Sucker	G R S	4AROA196.05				70.265
Largemouth Bass	Largemouth Bass	4AROA199.60			271.885	
		4AROA196.45			73.651	
		4AROA196.05				70.524
		4AROA175.63			9.089	10.156
		4APGG003.29			4.435	
		4AROA163.54	12.633			
		4AROA140.66		1.879	9.502	
Redbreast Sunfish	Redbreast Sunfish	4AROA199.60			26.478	
		4AROA199.20	39.040			
		4AROA163.54	3.150			
Redhorse Sucker	Redhorse Sucker	4AROA199.60			100.541	
		4AROA199.20	114.570			
		4AROA196.45			89.938	
		4AROA175.63			47.666	
		4APGG003.29	20.379		1.105	
		4AROA163.54	15.840			
Smallmouth Bass	Smallmouth Bass	4AROA199.20	135.900			
		4AROA175.63		32.873		
		4AROA163.54	12.580			
Striped Bass	Striped Bass	4AROA175.63		111.946		111.270
		4AROA140.66		39.037		
Sunfish	Sun fish	4APGG003.29	0.900			
Walleye	Walleye	4APGG003.29	17.033			
		4AROA140.66		4.822		
White Bass	Wht Bss	4AROA140.66		40.027		
Yellow Perch	Yllw Prch	4APGG003.29	2.020		0.181	

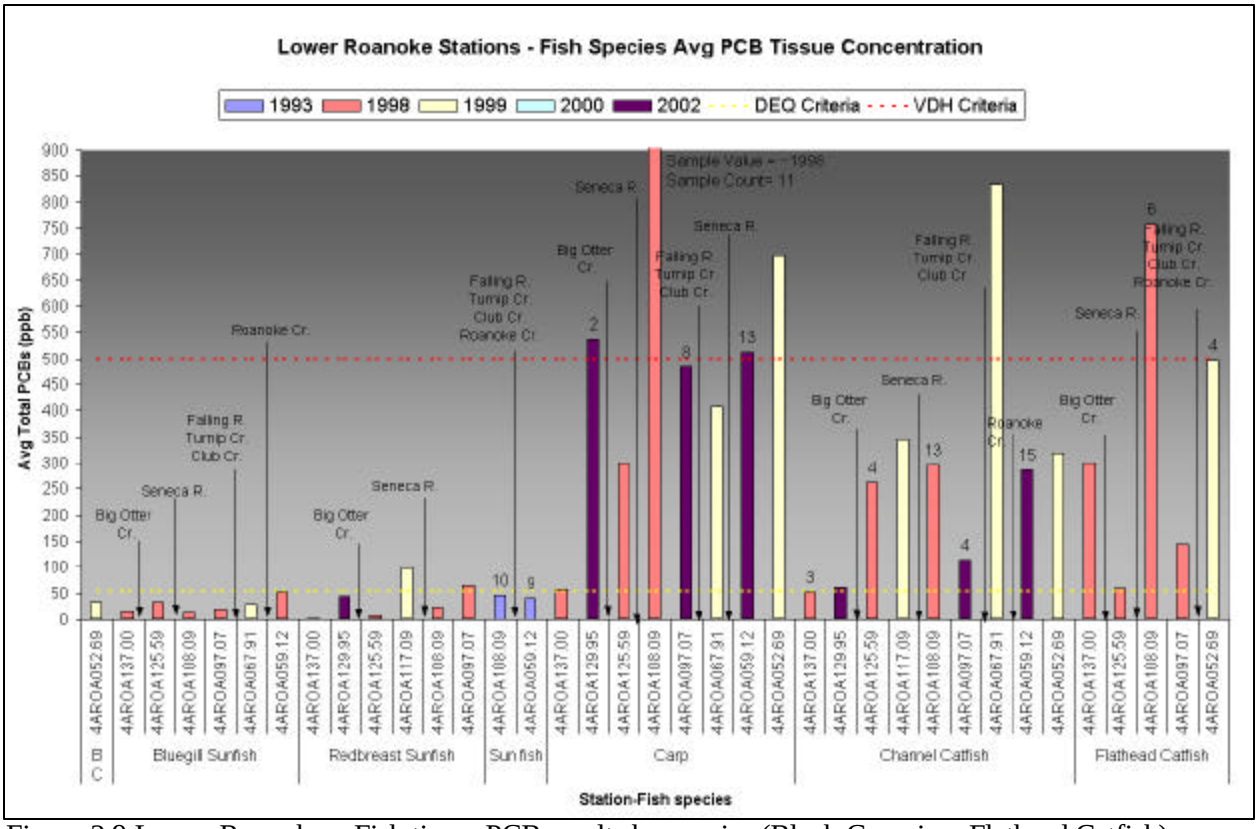

Figure 2.9 Lower Roanoke – Fish tissue PCB results by species (Black Crappie – Flathead Catfish)

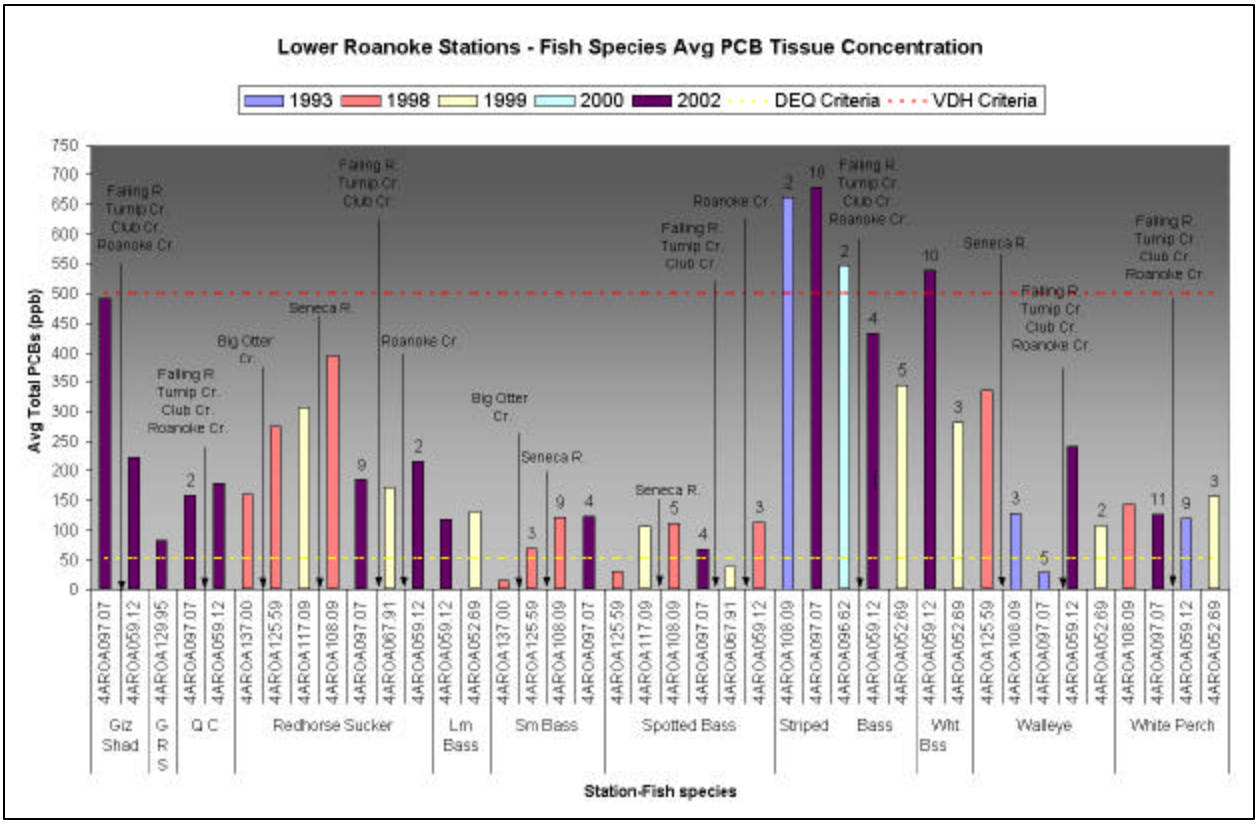

Figure 2.10 Lower Roanoke – Fish tissue PCB results by species (Gizzard Shad – White Perch)

Table 2.8 Lower Roanoke – Fish Tissue PCB results by species/sample year

Lower Roanoke			Average Total PCB (ppb (wet weight basis))				
			Sampling Year				
Fish Species Name	Species Abbreviation	DEQ Site	1993	1998	1999	2000	2002
Black Crappie	B C	4AROA052.69			32.027		
Bluegill Sunfish	Bluegill Sunfish	4AROA137.00		14.399			
		4AROA125.59		31.471			
		4AROA108.09		12.879			
		4AROA097.07		19.643			
		4AROA067.91			27.998		
		4AROA059.12		51.534			
Carp	Carp	4AROA137.00		56.062			
		4AROA129.95					536.732
		4AROA125.59		300.622			
		4AROA108.09	1058.210	976.779			
		4AROA097.07	479.800	297.267			700.341
		4AROA067.91			409.007		
		4AROA059.12	551.050	129.323			513.452
		4AROA052.69			699.023		
Channel Catfish	Channel Catfish	4AROA137.00		51.886			
		4AROA129.95					61.471
		4AROA125.59		262.577			
		4AROA117.09			344.968		
		4AROA108.09	260.000	416.841			
		4AROA097.07		115.949			109.634
		4AROA067.91			833.628		
		4AROA059.12	283.833	279.768			301.971
		4AROA052.69			318.138		
Flathead Catfish	Flathead Catfish	4AROA137.00		299.923			
		4AROA125.59		58.079			
		4AROA108.09		757.684			

Lower Roanoke			Average Total PCB (ppb (wet weight basis))				
			Sampling Year				
Fish Species Name	Species Abbreviation	DEQ Site	1993	1998	1999	2000	2002
		4AROA097.07		144.748			
		4AROA052.69			497.110		
Gizzard Shad	Giz Shad	4AROA097.07					490.980
		4AROA059.12					224.504
Golden Redhorse Sucker	G R S	4AROA129.95					83.095
Largemouth Bass	Lm Bass	4AROA059.12					119.273
		4AROA052.69			132.751		
Quillback Carpsucker	Q C	4AROA097.07		144.536			174.190
		4AROA059.12					179.001
Redbreast Sunfish	Redbreast Sunfish	4AROA137.00		1.423			
		4AROA129.95					43.416
		4AROA125.59		8.263			
		4AROA117.09			99.530		
		4AROA108.09		23.066			
		4AROA097.07		64.097			
Redhorse Sucker	Redhorse Sucker	4AROA137.00		160.536			
		4AROA125.59		275.602			
		4AROA117.09			307.929		
		4AROA108.09		396.668			
		4AROA097.07	138.886	498.005			194.449
		4AROA067.91			171.216		
		4AROA059.12		388.245			44.815
Smallmouth Bass	Sm Bass	4AROA137.00		14.443			
		4AROA125.59		70.008			
		4AROA108.09	48.475	716.638			
		4AROA097.07		120.045			132.857
Spotted Bass	Spotted Bass	4AROA125.59		30.759			
		4AROA117.09			106.538		
		4AROA108.09	130.950	37.131			
		4AROA097.07		60.525			91.197
		4AROA067.91			38.766		
		4AROA059.12		113.723			
Striped Bass	Striped Bass	4AROA108.09	661.300				
		4AROA097.07	903.800				454.020
		4AROA096.62				546.300	
		4AROA059.12					432.803
		4AROA052.69			343.563		
Sunfish	Sun fish	4AROA108.09	46.280				
		4AROA059.12	39.289				
Walleye	Walleye	4AROA125.59		336.545			
		4AROA108.09	129.200				
		4AROA097.07	27.640				
		4AROA059.12					241.852
		4AROA052.69			109.226		
White Bass	Wht Bss	4AROA059.12	578.338				379.555
		4AROA052.69			282.629		
White Perch	White Perch	4AROA108.09		144.347			
		4AROA097.07	121.960				178.857
		4AROA059.12	120.111				
		4AROA052.69			156.225		

Sediment total PCB concentrations for priority monitoring stations located in the Upper and Middle Roanoke regions are presented in Figure 2.11. Lower Roanoke average sediment concentrations are presented in Figure 2.12. All sampling dates are shown in each graph; therefore, each data point represents one observation. Stations are presented in an upstream – downstream progression for spatial analysis purposes, according to station river-mile code. Sediment PCB screening values are shown for comparison: The freshwater consensus-based PEC (676 ppb), NOAA Effects Range-Low (ER-L, 22.7 ppb), and NOAA Effects Range-Median (ER-M, 180 ppb). These data are also presented in Tables 2.9 and 2.10.

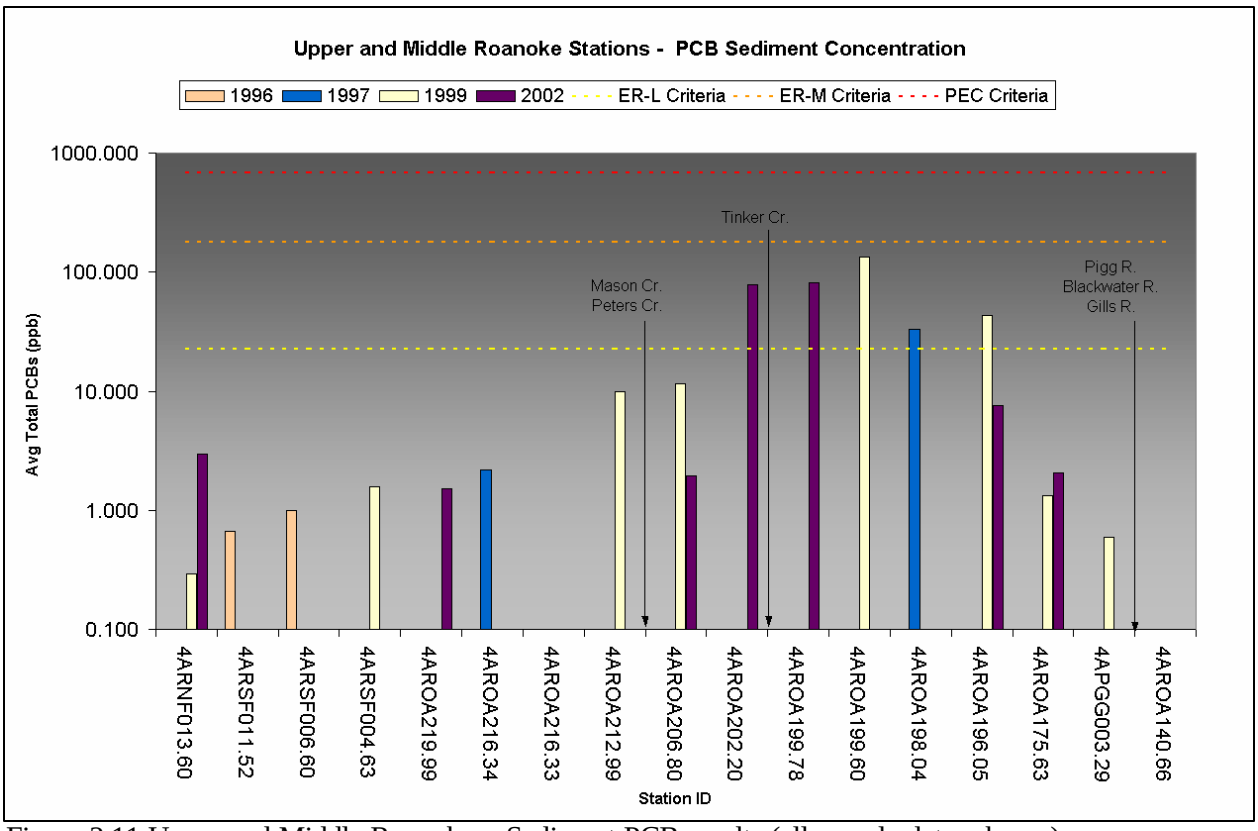

Figure 2.11 Upper and Middle Roanoke – Sediment PCB results (all sample dates shown)

Table 2.9 Upper and Middle Roanoke – Sediment PCB results by sample year

Upper and Middle Roanoke	**Average Total PCB (ppb (dry weight basis))**			
	Sampling Year			
DEQ Site	1996	1997	1999	2002
4ARNF013.60			0.292	2.937
4ARSF011.52	0.660			
4ARSF006.60	1.000			
4ARSF004.63			1.571	
4AROA219.99				1.526
4AROA216.34		2.193		
4AROA216.33				
4AROA212.99			9.977	
4AROA206.80			11.650	1.936
4AROA202.20				77.835
4AROA199.78				81.868
4AROA199.60			133.375	
4AROA198.04		33.099		
4AROA196.05			42.986	7.516
4AROA175.63			1.339	2.041
4APGG003.29			0.595	
4AROA140.66				

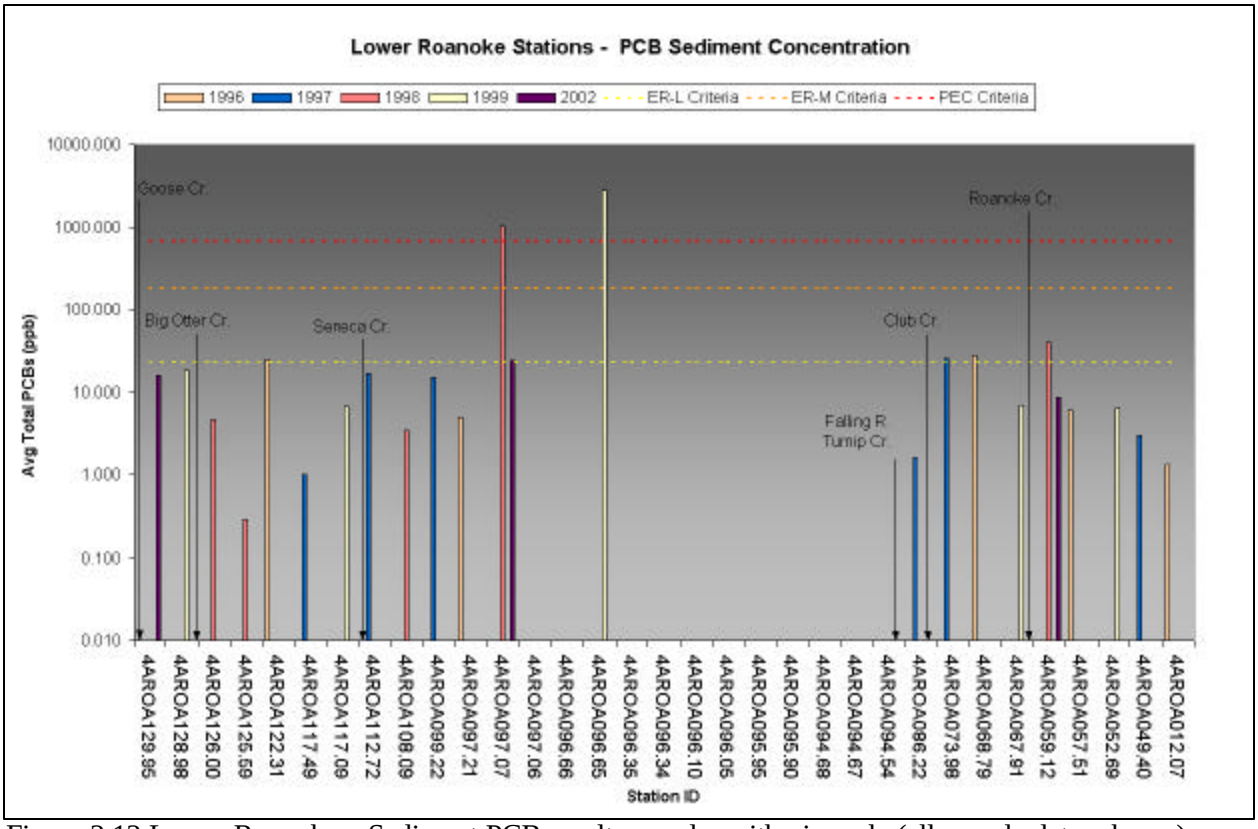

Figure 2.12 Lower Roanoke – Sediment PCB results on a logarithmic scale (all sample dates shown)

Table 2.10 Lower Roanoke – Sediment PCB results by sample year

Lower Roanoke	**Average Total PCB (ppb (dry weight basis))**				
	Sampling Year				
DEQ Site	1996	1997	1998	1999	2002
4AROA129.95					15.619
4AROA128.98				17.948	
4AROA126.00			4.710		
4AROA125.59			0.290		
4AROA122.31	25.090				
4AROA117.49		0.000			
4AROA117.09				6.689	
4AROA112.72		16.605			
4AROA108.09			3.438		
4AROA099.22		14.722			
4AROA097.21	4.920				
4AROA097.07			1021.404		24.441
4AROA097.06					
4AROA096.66					
4AROA096.65				2730.000	
4AROA096.35					
4AROA096.34					
4AROA096.10					
4AROA096.05					
4AROA095.95					
4AROA095.90					
4AROA094.68					
4AROA094.67					

Lower Roanoke	Average Total PCB (ppb (dry weight basis))				
	Sampling Year				
DEQ Site	1996	1997	1998	1999	2002
4AROA094.54					
4AROA086.22		1.621			
4AROA073.98		26.182			
4AROA068.79	28.430				
4AROA067.91				6.806	
4AROA059.12			40.801		8.672
4AROA057.51	5.950				
4AROA052.69				6.400	
4AROA049.40		3.038			
4AROA012.07	1.320				

2.2.1 Data Analysis Notes

Upper Roanoke Segment (headwaters to Niagara backwaters)

- Carp had the highest average PCB concentrations.
- In general, average fish tissue PCB concentration levels are higher at stations located further downstream. High maximum fish tissue PCB concentrations are observed along the entire DEQ impaired segment, but become >200 ppb downstream of Peters Creek.
- Higher PCB levels were noted downstream of Peters Creek for the following species: Black jumprock sucker, golden redhorse sucker, white sucker, carp, redbreast sunfish, rock bass, and smallmouth bass
- Increasing concentration was not due to temporal variation in the data collected, as evidenced by the 1999 data collections for rock bass and black jumprock suckers.
- Average PCB concentrations exceeded the DEQ impairment threshold (54 ppb) at stations 4AROA216.33, 4AROA206.80 (rock bass), 4AROA199.78 (redhorse sucker and golden redhorse sucker). Fish tissue concentrations for carp exceeded the DEQ threshold at each of these stations.
- Average sediment PCB concentrations did not exceed the EPA threshold value of 676 ppb.
- The highest average concentrations were observed at stations 4AROA199.60 (Niagara backwaters), 199.78 (below Tinker Creek mouth), and 4AROA202.20 (above Tinker Creek mouth and downstream of Peters Creek).
- An increasing trend in average sediment PCB concentration was noted downstream of Peters Creek at station 4AROA206.80. The only location of high sediment PCB concentrations is on and directly up- and downstream of Tinker Creek. High fish tissue PCB concentrations on and directly downstream of Tinker reinforce the probability of a source on Tinker Creek or one of its tributaries (e.g. Glade Creek).
- High fish tissue concentrations recorded at stations upstream of Tinker Creek could be related to the probable source on Tinker or maybe the result of an additional upstream source. This is suggested by the sediment station ROA202.20 directly upstream of Tinker. Additionally, high fish tissue PCB concentrations recorded at stations on Peters Creek suggest a possible PCB source.

Middle Roanoke Segment (Niagara backwaters downstream to Leesville Dam)

- Flathead catfish, carp, and gizzard shad had the highest average PCB concentrations
- High fish tissue PCB concentrations are observed along entire DEQ impaired segment. Average concentration exceeded the DEQ threshold at individual stations for all species, except yellow perch, walleye, channel catfish, and all sunfish species.
- Stations located upstream of Niagara dam (backwaters area) and downstream of Tinker Creek had the highest average PCB concentration (stations 4AROA199.60, 4AROA199.20, 4AROA106.05, and 4AROA196.45). This may be a depositional area with high PCBs in sediment.

- Striped bass had the highest average concentration at station 4AROA175.63 (Smith Mountain Lake)
- Average sediment PCB concentrations did not exceed the EPA threshold value of 676 ppb. The only station to record high sediment PCB concentrations in the Middle Roanoke is located directly downstream of Tinker Creek.
- Sediment concentrations decrease downstream of Smith Mountain Lake in the Upper/Middle Roanoke segment.
- Existing tributary data does not suggest a PCB source in the Middle Roanoke upstream of Smith Mountain Lake. The nonexistence of a PCB source in the Middle Roanoke is reinforced by the percentage of fish species with high fish tissue PCB concentrations that decrease as you move further downstream.
- High PCB fish tissue concentrations were recorded at stations near the mouth of the Blackwater River and Pigg River. This is probably due to fish migration given that available tributary data do not indicate a possible upstream source.

Lower Roanoke Segment (Leesville Dam downstream to Kerr Reservoir)

- The highest average PCB concentrations in the Roanoke River Basin were noted for lower Roanoke stations.
- The majority of fish species had average concentrations greater than the DEQ impairment threshold. Sunfish species had the lowest concentrations overall.
- Carp, channel catfish, flathead catfish, gizzard shad, and sucker species had the highest PCB concentrations.
- Station 4AROA108.09 (below Seneca Creek) recorded the highest PCB concentrations.
- An increasing trend for was observed for stations 4AROA125.59 and 4AROA108.09 (near Long Island) downstream of Altavista.
- Lower concentrations were noted at Station 4AROA097.07, except for striped bass
- Consensus-based PEC exceedances were recorded at stations 4AROA097.07 and 4AROA096.65.
- Average sediment PCB concentrations were lower at stations located below Altavista. These data do not correspond with high fish tissue concentrations that were observed at these stations (e.g. 4AROA108.09).
- High PCB concentrations were recorded at two fish tissue stations in the Big Otter River watershed (1 station on the Big Otter River and 1 station on a tributary to the Little Otter River). The Little Otter River flows through the City of Bedford. Sediment data collected at stations on the Big Otter River and its tributaries do not indicate an existing PCB source in this area.
- Club Creek recorded high fish tissue PCB concentrations, although sediment concentrations were low. The high fish tissue concentrations are likely due to fish migration based on available sediment data.

3.0 Source Assessment Findings

DEQ conducted several site investigations and special studies in recent years to assess the spatial extent of PCB contamination and to identify contributing sources. To help identify PCB sources in the Roanoke River Basin an inventory was created to organize all existing data related to past and present efforts to identify and characterize facilities/sites where PCBs were used or stored. Much of this information came from special studies and PCB source investigations conducted by DEQ in 1999/2000 in response to the initial fish consumption advisory for the Staunton River. The information compiled includes various memos and other correspondence, public meeting records, site investigations, DEQ monitoring data and special studies, pollution complaint records, solid waste facility information, VPDES facility information, Toxic Substance Control Act (TSCA) data , Comprehensive Environmental Response Compensation and Liability Act (CERCLA) records, Resource Conservation and Recovery Act (RCRA) database records,

and other available information collected to date. This information was examined in conjunction with the PCB fish tissue and sediment monitoring data in order to identify all potential sources of PCBs in the Roanoke River watershed and those areas that require additional monitoring for source identification and TMDL development.

To prioritize the selection of sampling locations, facilities and sites identified in the PCB source inventory were grouped into one of three categories: known sources, possible sources, and unlikely sources. Although PCBs are no longer manufactured, these chemicals persist in the environment and bioaccumulate through the food chain. Current sources of PCBs can include contaminated sediments, PCB contamined soils that washoff from upland areas, leachate from landfills and industrial disposal areas, leaking transformers and storage containers, and a variety of other sources.

A total of 56 current or historical facilities/sites were identified in the PCB source inventory as potential sources of PCBs to the Roanoke/Staunton River. DEQ records for permitted solid waste facilities that may have stored or handled PCBs were recently reviewed by Tetra Tech and DEQ personnel and are included in this list. In addition, effluent sampling for PCBs was conducted at 15 outfall locations (representing 10 VPDES facilities) in 1972, 4 of which were included in the current list of 56 potential PCB sites. DEQ also previously compiled a list of 68 VPDES facility outfalls that were proposed for effluent sampling in 1999/2000. The recent proposed effluent study included 6 outfalls associated with 5 facilities that are referenced in the current list of potential PCB sites and another 2 outfalls that appear to represent the current locations of 2 facilities included in the 1972 effluent monitoring list.

3.1 Known Sources

BGF Industries in Altavista is the only known source of PCBs in the watershed. BGF Industries (formerly Burlington Industries) was discovered to be a source of PCBs to the Staunton River through site investigations and monitoring conducted by DEQ, EPA, and BGF personnel. Historic contamination of the site was the result of the operation, maintenance, and eventual removal of an oil circulation system, which included a 1000-gallon holding tank that served as the reservoir for PCB containing oil used in the fabric production process when Burlington Industries was in operation (VADEQ, 1999(a)). PCB contamination of the surrounding land area occurred from spills and leaking storage containers and contaminated soils were transported to the Staunton River through soil erosion. Effluent monitoring conducted during the time when Burlington operated at the site also found detectable PCB concentrations (1972 effluent monitoring).

The identification of BGF Industries as a legacy source of PCBs was based on site investigations and the results from a special study conducted by DEQ in October of 1999. As part of an investigation into the level of PCB contamination on and around the BGF Industries site, soil and water samples were collected and analyzed by BGF Industries. Results included analyses of soil, subsoil, ground water, sediment and surface water samples. Elevated PCB concentrations were found in samples collected onsite and in a stormwater ravine that drains directly to the Staunton River. Monitoring results for BGF Industries are presented in Table 3.1.

Table 3.1 BGF Industries PCB sampling results (10/7/99 sampling, Total PCBs)

Station ID	Sample Type	Sample Location	Results	Units
SD101	soil/sediment	Background	<60	ppb
SD201	water	Sanitary sewer *	5.2	ppb
SD301	soil/sediment	Manhole near ravine	4700	ppb
SD401	soil/sediment	Junction Box	32570	ppb
SD501	soil/sediment	Edge of concrete pad	34450	ppb
SD601	soil/sediment	Soil	61270	ppb
SD801S	soil/sediment	Ravine mouth surface	130100	ppb
SD801B	soil/sediment	Same location as SD801S (2-6 in. depth)	184540	ppb
SD802S	soil/sediment	Sediment in mouth of storm line **	135960	ppb
SD802B	soil/sediment	Same location as SD802S (2-6 in. depth)	697460	ppb
SD803S	soil/sediment	24 ft. downstream of culvert mouth	3072750	ppb
SD803B	soil/sediment	Same location as SD803S (1-10 in. depth)	860160	ppb
SD804S	soil/sediment	3ft. left of SD804S	114490	ppb
SD804B	soil/sediment	Same location as SD804S (3-6 in. depth)	23270	ppb

* The sanitary sewer sample is the only water sample in these results. All other samples are from soils and sediments on an adjacent to the BGF site
** This figure was revised 1/13/00 after re-analysis of initial data

3.2 Possible Sources

Several other industrial facilities and landfill sites in the Altavista area were investigated in 1999 and 2000 as possible PCB sources. Site visits were conducted at the Lane Furniture site in Altavista by DEQ personnel in 1999. A Phase II site assessment found detectable levels of PCBs in soil samples, although the results were less than TSCA cleanup levels. Two abandoned landfill sites were identified during site investigations and interviews with Lane Furniture staff. Barrels and other industrial waste were noted during site visits. Sampling of these landfills was planned, but not conducted due to safety concerns (M. Scanlan, 2000). These landfills are also referenced as the East and West Town Dumps in other documents and correspondence from DEQ.

The Altavista STP was also investigated because the plant received discharges from local industries that historically contained PCBs. High PCB levels were found in residual biosolids collected from the wastewater storage pond (emergency overflow pond). PCBs were not detected in surface water and groundwater samples collected from monitoring wells located around the pond. Soil sampling was also conducted at various locations at the Altavista STP. These results are discussed below. A Voluntary Remediation Report (VRP) was submitted to DEQ in September 2003 and is currently under review. Remediation recommended in the VRP includes consolidation of the biosolids and containment by a vegetative cap (Draper Aden Associates, 2003). In addition, area oil distributors were interviewed by DEQ in December 1999 and PCB use surveys were completed and submitted by several existing facilities in 2000, including: Shrader Bridgeport, Burlington Industries (Hurt, Va), A.O. Smith Electrical Products, Watts Petroleum, W.H. Hardy Oil, and other possible sources.

As a follow up to the Altavista site investigations performed in 1999 and 2000, DEQ collected soil samples for PCB testing in June/July 2000 throughout the Altavista/Hurt area. The sampling plan initially targeted 13 facilities and other sites, most of which were sampled at multiple locations (VADEQ,

1999(b)). PCB monitoring results from this investigation are presented in Table 3.2. The East and West Town Dumps (see Lane Furniture landfills above) were originally included in the sampling plan, but were not sampled due to safety concerns. Of the 11 sites sampled, 10 were found to have soil PCB contamination (the Norfolk Southern train wreck site was found to have non-detectable levels of PCBs and is characterized as an unlikely source). Samples collected at the Altavista STP had the highest PCB concentrations. All sampling locations at this facility recorded PCB concentrations above the EPA action level of 50 ppm. No other facilities/sites monitored recorded concentrations above this threshold.

Table 3.2 Altavista/Hurt Area PCB Sampling Results (6/22/00 and 7/6/00, Total PCBs)

Facility/Site	Sample Type	Monitoring Date	Sample Location	Results	Units
Altavista WWTP	soil/sediment	6/22/2000	STP 17	263453	ug/kg
			STP17 dup.	451362	ug/kg
			STP 16	600944	ug/kg
Shrader Bridgeport International (low levels)	soil/sediment	6/22/2000	Schrader 24	780	ug/kg
			Schrader 25	145	ug/kg
			Schrader 26	<1	ug/kg
			Schrader 27	37	ug/kg
Lane Furniture Company	soil/sediment	7/6/2000	Lane 1	15302	ug/kg
			Lane 4	398	ug/kg
			Lane 5	334	ug/kg
			Lane 6	195	ug/kg
			Lane 7	4625	ug/kg
Burlington Industries	soil/sediment	7/6/2000	Burlington 31	<1	ug/kg
			Burlington 32	1286	ug/kg
			Burlington 32A	128	ug/kg
			Burlington 32A dup.	132	ug/kg
			Burlington 33	<1	ug/kg
			Burlington 34	1288	ug/kg
A. O. Smith	soil/sediment	6/22/2000	A. O. Smith	83	ug/kg
Blanks Exxon	soil	6/22/2000	Oildistr11A	227	ug/kg
Hardy Texaco	soil	6/22/2000	Oildistr8	11134	ug/kg
			Oildistr8A	3022	ug/kg
Watts Chevron	soil	6/22/2000	Oildistr9	1081	ug/kg
			Oildistr10	1704	ug/kg
English Construcation	soil	7/6/2000	English18	26	ug/kg
			English19	267	ug/kg
Altavista Oil Distributor Wet Area/ Lynch Creek	soil/sediment	6/22/2000	Oildistr11	230	ug/kg
			Oildistr12	1192	ug/kg
			Oildistr12A	2909	ug/kg
			Oildistr13	855	ug/kg
			Oildistr14	561	ug/kg
Norfolk Southern Train Wreck	Soil	7/6/2000	Wreck20	<1	ug/kg
			Wreck21	<1	ug/kg
East town dump-Altavista (see Lane Furniture discussion above)	Not Sampled due to safety concerns				
West town dump-Altavista (see Lane Furniture discussion above)	Not Sampled due to safety concerns				

Prior to 1999 several facilities in the Altavista area not included in more recent studies were monitored for PCBs (Table 3.3). PCBs were not detected in any of the samples collected, however, two facilities (LG&E and Multitrade) were included in the proposed January 2000 effluent study list (discussed below) and the other two facilities (Magne tek and Abbott Laboratories) were referenced as one of several significant industrial users that may have contributed PCBs to the Altavista STP through past industrial discharges (Scanlan, 1998). Other industrial discharges listed in the Industrial Waste Survey (IWS) for the Altavista STP include BGF Industries, Lane Furniture, and Shrader Bridgeport International.

Table 3.3 Altavista Facilities Monitored Prior to 1999.

Facility/Site	Sample Type	Monitoring Date	Sample Location	Results	Units
LG&E	NA	early-mid 90s	NA	NA	NA
Multitrade	NA	early-mid 90s	NA	NA	NA
Magne Tek, Inc.	effluent	Oct-94	NA	<0.001	mg/L
Abbott Laboratories	effluent	1994	NA	ND	NA

In 1971 and 1972 DEQ conducted PCB studies that included sampling of industrial and municipal discharges in the Roanoke region. Effluent PCB results from 15 outfalls (representing 10 facilities) sampled in this study and found to contain PCBs are presented in Table 3.4. Note that 6 of the outfalls sampled represent historical monitoring of several facilities included in the June/July 2000 Altavista/Hurt PCB source investigation (soil testing) including Burlington Industries in Altavista, the historical site of BGF Industries (Bailey, 1975).

Table 3.4 DEQ Outfall PCB Sampling (1972)

Facility/Site	Sample Type	Monitoring Date	Sample Location	Aroclor/ Congener	Results	Units	Comments
Brookneal Falls R. STP	effluent	1/10/1972	St. 1	PCB 1248	0.7	ug/L	Location may be similar to know n facility location Brookneal, Town of - Falling River Lagoon (proposed PCB sampling locations list)
Brookneal Roanoke River STP	effluent	1/10/1972	ST. 2	PCB 1248	1.5	ug/L	Location may be similar to known facility location Brookneal, Town of - Staunton River Lagoon (proposed PCB sampling locations list)
Brookneal Burlington Sanitory Waste	effluent	1/10/1972	St. 4	PCB 1242	1	ug/L	
Hurt VA Burlington Ind. Discharge	effluent	1/10/1972	St. 5	PCB 1248	0.5	ug/L	Same location as current Burlington Industries in Hurt, VA
Altavista STP	effluent	1/10/1972	St. 6	PCB 1248	8	ug/L	Same location as current Altavista STP
U.S. Gypsum, Danville	effluent	1/14/1972		PCB 1248	3.7	ug/L	not part of watershed focus
Westinghouse S. Boston Sanitary Waste	effluent	3/6/1972	manhole	PCB 1242	87	ug/L	not part of watershed focus
Westinghouse S. Boston Neutralization Plant Waste	effluent	3/6/1972		PCB 1242	200	ug/L	not part of watershed focus

Facility/Site	Sample Type	Monitoring Date	Sample Location	Aroclor/ Congener	Results	Units	Comments
Ragland Car Wash Halifax Co.	effluent	3/6/1972	spillway	PCB 1242	2.1	ug/L	probably not part of watershed focus
Ragland Car Wash Halifax Co.	effluent	3/6/1972	grease trap	PCB 1242	0.76	ug/L	probably not part of watershed focus
Burlington Weaving Plant, Altavista	effluent	8/17/1972	manhole effluent	PCB 1248	43	ug/L	Historic location of current BGF Industries
Lane Furniture Company	effluent	8/17/1972	plant 4, manhole on Pittsylvania & N&W overpass	PCB 1242	52	ug/L	Same location as current Lane Furniture
Lane Furniture Company	effluent	8/17/1972	plant 4, manhole in from of Personnel Gate (Charlotte Ave)	PCB 1248	9.3	ug/L	Same location as current Lane Furniture
Altavista STP	effluent	8/17/1972		PCB 1248	3	ug/L	Same location as current Altavista STP
Brookneal, Roanoke R. STP	effluent	8/16/1972	Tanyard Br.	PCB 1248	3	ug/L	Location may be similar to known facility location Brookneal, Town of - Staunton River Lagoon (proposed PCB sampling locations list)

Another effluent study was planned in January 2000 to include dischargers in the Staunton River watershed. The study has not been conducted to date. The outfalls and associated facilities included in this proposed study are considered possible sources and are presented in Table 3.5.

Table 3.5. DEQ Proposed Outfall PCB Monitoring List

Facility/Site	Comments
Appalachian Power Company (AEP) - APCO Leesville Hydroelectric Plant – 001	
Appalachian Power Company (AEP) - APCO Leesville Hydroelectric Plant - 005	
Williams Energy Ventures, Inc. - Williams Energy Ventures, Inc. - 001	
Chevron U.S.A. Products Company - Montvale Light Oil Terminal - 002	
Amerada Hess Corporation - Amerada Realty - 001	
Colonial Pipeline Co., Inc. - Roanoke Montvale - 001	
Blue Ridge Stone Corp. - Blue Ridge - 001	
Amoco Oil Company - Amoco Oil Co. - Montvale Terminal - 001	
Motiva Enterprise LLC - Motiva Enterprises, Montvafe Sales Terminal - 001	
Blue Ridge Wood Preserving, Inc. - Moneta Plant - 001	
Bedford, City of - Bedford WTP - 001	
Gunnoe Sausage Co., Inc. - Bedford - 001	
T/W Properties - Hill City Swim & Tennis Club - 001	
Campbell Co. Util. & Ser. Auth. - Otter River WTP -	
Blue Ridge Stone Corp. - Lawyers Road - 001	
Altavista, Town of - Aftavista WTP - 001	
Burlington Industries-Klopman Div. - Hurt Finishing Plant - 001	Identified above
Furniture Brands International - Lane Company (The), Altavista – 001	Identified above
Multitrade of Pittsylvania Co., LP - Hurt Facility – 001	Identified above
Multitrade of Pittsylvania Co., L P - Hurt Facility – 002	Identified above
LG&E-Westmoreland - Altavista - Altavista Plant – 001	Identified above
Dan River, Inc. - Brookneal Plant - 001	
Burruss Co., Inc. (The) - Burruss Timber Products – 001	

Facility/Site	Comments
Brookneal, Town of - Brookneal WTP - 003	
Appomattox,Town of - Appomattox Trickling Filter - 001	
Family Health Initiatives, Inc. - Woodhaven Nursing Home STP - 001	
Bedford County Schools - Montvale Elem. Sch. (New) - 001	
Camp Virginia Jaycee Inc. - Camp Virginia Jaycee STP - 001	
Bedford County Schools - Thaxton ES - 001	
Bedford County Schools – Staunton R. HS - 001	
Blue Ridge Regional Jail Authority - Smith Mountain Lake Correctional Unit 24 - 001	
Bedford County Schools - Otter River ES - 001	
Alum Springs Association - Alum Springs Shopping Center - 001	
Bedford County Schools - Liberty High School - 001	
Bedford, City of - Bedford STP - 001	
Bedford County Schools - Body Camp ES - 001	
Echols Creek, Inc. - Dillions Trailer Park - 001	
Bedford County Schools - New London Acad - 001	
McMasters, Keith (Mr. & Mrs.) - Briarwood Village STP - 001	
Department of Corrections - Rustburg FU #9 - 001	
Campbell Co. Util. & Ser. Auth. - Rustburg STP – 001	
US Trails, Inc. - Thousand Trails Lynchburg Preserve STP – 001	
Allavista, Town of – Altavista STP - 001	Identified above
Brookneal, Town of - Staunton River Lagoon – 001	Location may be similar to 1972 monitored outfall (Brookneal Roanoke River STP)
Brookneal, Town of - Falling River Lagoon – 001	Location may be similar to 1972 monitored outfall (Brookneal Falls R. STP)
WestPoint Stevens, Inc. - EXPIRED - Keysville Plant - EXPIRED PERMIT - 001	
Halifax County Public Schools - Clays Mill Elementary School - 001	
Keysville, Town of - Municipal STP - 001	
Charlotte County School Board - Bacon Districy Elementary School - 001	
Charlotte County School Board - Phenix Elementary School - 001	
WestPoint Stevens, Inc. - Drakes Branch Plant – 001	
Colonial Pipeline Co. – Hancock Station - 001	
VA Dept. Conservation & Recreation - Staunton River State Park WTP – 001	
Charlotte County School Board - Jeffress Elementary School - 001	
Charlotte County - Charlotte County Annex – 001	
Dallas. Averette A. - Southern Mobile Home Park - 001	
Dunaway, Shirley I. - Residential STP - 001	
Halifax County - Clover Municipal STP - 001	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 006	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 008	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 005	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 007	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 001	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 003	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 002	
Old Dominion Electric Coop. & VEPCO - Clover Power Station - 004	
Drajes Branch, Town of - Municipal STP - 001	
Tharpe, J. R. - J. R. Tharoe Trucking Co., Inc. – 001	

Sampling conducted in the Brookneal area showed high PCB concentrations and was the only area on the Staunton River with elevated sediment PCB concentrations. Several local facilities are considered

possible PCB sources, including Dan River Inc., the Brookneal Hatchery, and Foster Fuels. Additional sampling and investigation of these facilities is needed to determine if these or other local sites are PCB sources. Note that Dan River Inc. is included in the DEQ proposed outfall PCB monitoring list.

For the Upper Roanoke watershed, several facilities have been identified as possible PCB sources based on industry type and the source information collected to date. Possible industrial sources (active or legacy) include American Viscose Co., Evans Chemical, Old Salem Tannery, Roanoke Electric Steel, Norfolk Sothern Railroad facilities, and various industrial shops and storage facilities located along the Roanoke River and its tributaries. EPA conducted a review of CERCLIS facilities in the Roanoke River Basin in 1999 and 2005. PCBs were detected in soil samples collected from American Viscose Co., Evans Chemical, and Old Salem Tannery. Sampling was also conducted along the Roanoke River by the U.S. Army Corps of Engineers for the Roanoke River Flood Control Study. PCBs were detected in riverbank samples collected for this study (Scanlan. 1998). Channel widening plans were altered to stop at the American Viscose site due to high PCB concentrations noted in an old industrial landfill located onsite. This facility is located within the 1-year floodplain. In addition, the flood of 1985 washed approximately 1,500 drums into the Roanoke River. Unclaimed drums (approximately 300) were disposed in the Dixie Caverns Landfill, according EPA CERCLIS review records (1999). At least one drum was found to contain high PCB levels. In addition, EPA's PCB Transformer database includes 2 sites in the watershed, both sites are not located in close proximity to PCB impaired segments and only list 1 transformer at each site.

Local landfills are also considered possible PCB sources. The Dixie Caverns landfill located in western Roanoke County is a Superfund site that closed in 1976. The landfill received municipal and industrial wastes. EPA cleanup activities included excavation of the sludge pit, remediation of a large fly ash pile (contained heavy metals), and removal of discarded drums. Based on a 5-year review, PCB contamination was not considered significant and pollutant mobility offsite is limited. Other landfills that may have received PCB containers and other equipment include the Thomas Brothers landfill (Roanoke County) and Thompson landfill in Montgomery County. Solid waste facility records maintained in DEQ's CEDS database were also recently reviewed by Tetra Tech and DEQ personnel. Several of the facilities mentioned above are permitted by DEQ. Additional solid waste facilities were identified in this review as possible legacy PCB sources (see monitoring section). Facilities located in the Upper Roanoke watershed and solid waste facilities identified as possible sources are presented in Table 3.6.

Table 3.6. Upper Roanoke Industrial and Solid Waste Facilities Identified as Possible PCB Sources

Facility/Site	Sample Type	Monitoring Date	Sample Location	Aroclor/ Congener	Results	Units	Comments
PCB Transformer-Graham White	No monitoring						PCB transformer site (EPA database - 1 transformer)
PCB Transformer-JPS Converter	No monitoring						PCB transformer site (EPA database - 1 transformer)
American Viscose Co.	soil	NA	Test pit	PCB 1260	752	ug/kg	
	soil	NA	Adjacent to Roanoke River	PCB 1260	2200	ug/kg	
Dixie Caverns	No monitoring						
Thompson Landfill	soil	NA	NA	NA	NA	NA	Was referenced as sampled
Roanoke River Drum Site	No monitoring						
Roanoke River Floodway	No monitoring						
Evans Chemical	No monitoring						

Facility/Site	Sample Type	Monitoring Date	Sample Location	Aroclor/ Congener	Results	Units	Comments
Roanoke Electric Steel	No monitoring						
Old Salem Tannery	No monitoring						
Thomas Bros. Landfill	No monitoring						
Botetourt Co. Landfill - Old	No monitoring						Solid waste facilitiy (DEQ)
City of Bedford (old City landfill)	No monitoring						Solid waste facilitiy (DEQ)
City of Salem Sanitary Landfill	No monitoring						Solid waste facilitiy (DEQ)
Environmental Options	No monitoring						Solid waste facilitiy (DEQ)
Franklin County Landfill	No monitoring						Solid waste facilitiy (DEQ)
LCM Transfer Station	No monitoring						Solid waste facilitiy (DEQ)
Thomas Brothers Debris Landfill	No monitoring						Solid waste facilitiy (DEQ)
Roanoke Regional (Rutrough Rd)	No monitoring						Solid waste facilitiy (DEQ)
Safety Kleen Systems Inc.	No monitoring						Solid waste facilitiy (DEQ)
Rubatex International	No monitoring						Solid waste facilitiy (DEQ)
Vinton Landfill	No monitoring						Solid waste facilitiy (DEQ)
Roanoke Electric Steel	No monitoring						Solid waste facilitiy (DEQ)
Norfolk Southern	No monitoring						Solid waste facilitiy (DEQ)
Bedford County – Old	No monitoring						Solid waste facilitiy (DEQ)
Webster Brick	No monitoring						Solid waste facilitiy (DEQ)
Riverdale Development (previously American Viscose)	No monitoring						Solid waste facilitiy (DEQ)
AEP facility	No monitoring						Solid waste facilitiy (DEQ)
Evans Paint	No monitoring						Solid waste facilitiy (DEQ) (Also listed as Evans Chemical)
Progress Rail Services	No monitoring						Solid waste facilitiy (DEQ)
Matthews Electroplating	No monitoring						Solid waste facilitiy (DEQ)

Other possible sources that have been identified through discussions with DEQ personnel include AEP field stations and storage facilities which may have stored old PCB transformers, Norfolk Southern switch stations, the Roanoke STP (may have received industrial PCB discharges), and other miscellaneous facilities that may have stored or used PCBs. Need to identify these sites and possible PCB contamination problems, if they exist.

3.3 Unlikely Sources

Unlikely sources represent facilities/sites that have been recently monitored for PCB contamination and were found to have non-detectable levels. Two sites identified in the source inventory can be characterized as unlikely sources: the Norfolk Southern Train Wreck Site, sampled as part of the summer 2000 Altavista/Hurt investigation, and an unnamed closed landfill adjacent to the Blue Ridge Parkway near Roanoke, Virginia sampled by USGS (Ebner et al., 1999). These sites and their monitoring results are presented in Table 3.7. In addition, the following four facilities were sampled in the 1972 effluent study, but were not included in the January 2000 effluent discharger list: Klopman Mills, Piedmont Mfg. Co., Wood Car Wash, and Ross Laboratories (Bailey, 1975). It is assumed that additional testing is not needed for these facilities.

Table 3.7 Facilities Characterized as Unlikely Sources of PCBs

Facility/Site	Sample Type	Monitoring Date	Sample Location	Aroclor/ Congener	Results	Units
Norfolk Southern Train Wreck	Soil	7/6/2000	Wreck20	TPCB	<1	ug/kg
	Soil		Wreck21	TPCB	<1	ug/kg
Closed landfill adjacent to the Blue Ridge Parkway near Roanoke, VA	water/sediment	3/1999, 9/1999	NA	PCB 1016	ND	ppb
				PCB 1221	ND	ppb
				PCB 1232	ND	ppb
				PCB 1242	ND	Ppb
				PCB 1248	ND	Ppb
				PCB 1254	ND	Ppb
				PCB 1260	ND	Ppb

3.4 Ongoing Source Identification Efforts

VADEQ is currently in the process of assessing potential PCB sources in the Roanoke River watershed through interviews of various facilities that because of current or legacy business operations have been identified by as having the potential to have stored or used PCBs in the past. This information will be used along with additional PCB monitoring as detailed in Section 5.0 to further identify and define likely PCB sources in the watershed.

4.0 Methods

Additional PCB data will be collected at selected monitoring locations in the watershed to help identify active and legacy PCB sources for TMDL development. Sampling will include the use of semi-permeable membrane devices (SPMDs) and a high resolution-low detection level analysis method (1668A) to assess water column PCB concentrations, as well as effluent concentrations at selected facility outfalls. These sampling and analysis methods have been used in similar PCB source identification studies and are more effective than traditional water column sampling and analysis. Sediment core sampling may also be conducted in future monitoring efforts to help identify sediment "hot spots" in the watershed, which are depositional areas that contribute PCBs to the water column and biota. Method 1668A can also be used to detect PCB concentrations in sediment samples. This Final SAP will become a part of the overall Quality Assurance Project Plan (QAPP) for the project. Standard operating procedures (SOPs), quality assurance objectives, monitoring equipment, sampling protocols, and analytical methods will be discussed in detail in the QAPP. A brief description of these methods is provided below.

4.1 SPMDs

Lipid-containing SPMDs represent an innovative passive sampling technology for monitoring and assessing trace levels of hydrophobic organic contaminants, including PCBs. SPMDs are constructed from layflat tubing of low-density polyethylene (LDPE). Only dissolved (readily bioavailable) organic contaminants diffuse through the membrane and are concentrated through time. The sequestration media consist of both the thin film/plug of a large molecular weight (> 600 daltons) neutral lipid such as triolein and the LDPE membrane. Contaminant residues concentrated in SPMDs are simultaneously recovered and separated from the lipid in intact SPMDs (after carefully cleaning the exterior surface of the membrane) by dialysis in an organic solvent.

As part of the final sampling plan developed by VADEQ in consultation with Tetra Tech, 25 SPMDs will be deployed throughout the watershed at selected sampling locations, as detailed in Section 5.0. The objective of the SPMD monitoring is the collection of water column concentrations of PCBs in order to assess current water quality conditions and aid in the identification of existing PCB sources.

Advantages of using SPMDs:

- Mimics the bioconcentration of organic contaminants in fatty tissues of organisms
- Provides a highly reproducible passive in situ sampler for monitoring contaminant levels, which is largely unaffected by many environmental stressors that affect biomonitoring organisms
- Enables in situ concentration of trace organic contaminant mixtures for toxicity assessments and toxicity identification evaluation (TIE)

Limitations of Conventional Sampling Methods:

- Analysis of excised water and air samples reflects residue composition only at the moment of sampling and may fail to detect episodic contamination
- Quality control and physical difficulties are often encountered when large volumes of water and air must be collected and extracted for quantifying and assessing trace organic contaminants
- Concentrations of truly dissolved or readily bioavailable contaminants are not accurately measured by most conventional approaches
- Aquatic toxicity data, and threshold limit values for airborne exposures are based on dissolved or vapor phase concentrations, not total residue levels
- Standard low volume (< 4 L) techniques often fail to detect trace levels of bioconcentratable contaminants and seldom recover enough residue mass for bioassays
- Biomonitoring organisms may not accurately reflect environmental contaminant concentrations, because of residue metabolism/depuration and the effects of environmental stressors on organism health

4.2 High Resolution-Low Detection Sampling

High resolution-low detection sampling incorporates EPA analytical method 1668A. Method 1668 was developed by EPA's Office of Science and Technology for congener-specific determination of PCB congeners designated as toxic by the World Health Organization. Revision A of Method 1668 has been expanded to include congener-specific determination of more than 150 chlorinated biphenyl (CB) congeners. The toxic PCBs and the beginning and ending level-of-chlorination CBs are determined by isotope dilution high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). The remaining CBs are determined by internal standard HRGC/HRMS. Method 1668A is applicable to aqueous, solid, tissue, and multi-phase matrices. 2.5 L samples are required for this type of testing (EPA, 1999(b)).

The final sampling plan provides for effluent and ambient water quality sampling at selected locations in the watershed. Effluent monitoring is planned at facilities in the Roanoke watershed that have been identified as possible PCBs sources in Section 3.2. Ambient water quality sampling is also proposed at several USGS flow gaging stations to allow for the estimation of PCB loads at different points along the mainstem of the Roanoke River. These locations are detailed in Section 5.0.

4.3 Sediment Monitoring

Sediment core sampling may be used to provide additional information on sediment "hot spots" and legacy sources of PCBs in the watershed, depending on the results from the proposed SPMD, ambient water quality, and effluent sampling. Possible sediment monitoring locations include the backwaters area just above Niagara and Leesville dams, Smith Mountain Lake, and selected locations around Altavista and Brookneal. Sediments in these depositional areas have built-up overtime and can provide historical information on PCB contamination and the potential for resuspension/bioavailability. Analysis of sediment cores would use Method 1668A, as discussed above.

5.0 Monitoring

The primary objective of the SAP is to identify additional PCB monitoring needs for source identification. Additional data collection may be needed in the future depending on the initial sampling results and for modeling purposes.

DEQ submitted a list of monitoring stations to be considered for the Roanoke River Basin PCB TMDL study. Proposed sampling locations were identified based on the results from previous monitoring studies and knowledge of known and possible PCB sources in the watershed. The design of the sampling plan was tailored to re-assess known hotspots and to address data gaps identified by previous monitoring studies. The proposed monitoring stations, their relationship to possible upstream PCB sources and previous monitoring efforts, and the type of monitoring to be conducted are presented in Table 5.1. Stations are presented in an upstream-downstream progression and grouped by the Roanoke River subwatershed that they are located in (upper, middle, or lower). In addition, each station was designated as either a primary or follow-up station. Sampling will be conducted at all primary stations in Fall 2005. Data gaps will be assessed after reviewing the sampling results and additional monitoring at primary and follow-up stations will be conducted in the future as needed.

Table 5.1 DEQ proposed monitoring stations

Station ID	Station Description	SPMD	Effluent	Ambient
Upper Roanoke Primary Stations				
4AROA227.42	Located approximately 0.26 miles downstream of the confluence of the North and South Forks of the Roanoke River. This station will provide information on possible PCB sources located on the North or South Forks. Co-located with USGS Gage Station-Lafayette, VA.	x		x
4AROA219.00	Located approximately 0.99 miles downstream of fish tissue and sediment station 4AROA219.99. Co-located with USGS Gage Station-Glenvar, VA.	x		x
4AROA215.13	Located in Salem City below Green Hill Park, above Mason's Creek.	x		
4AMSN000.67	Located near the mouth of Mason Creek, upstream of DEQ sediment and fish tissue station 4AMSN000.60 in the City of Salem. Depending on field evaluation this station maybe closer to the confluence of the	x		

Station ID	Station Description	SPMD	Effluent	Ambient
	Roanoke River.			
4APEE000.00	Located near the confluence of the Roanoke River. This station is below fish station 40PEE000.49 and the sediment and fish station 4APEE001.04. This station is below Roanoke Electric Steel and Shaffer's Crossing.	x		
4AROA207.08 Roanoke River downstream of Peters Creek	Located on the Roanoke River below Peters Creek. This station is located in the City of Roanoke This station is located upstream of Wasena Park near Memorial Bridge and below Evans Paint.	x		
Roanoke Electric Steel Corporation	Located on the Roanoke Electric Steel Corporation outfall. Facility located on the 2400 block of Patterson Ave SW near the riverfront in the City of Roanoke.		x	
Western Virginia Water Authority Regional WPCP	Located on the Western Virginia Water Authority Regional WPCP outfall. Facility located at 1402 Bennington St SE in the City of Roanoke.		x	
4AROA204.76	This station is located downstream of Ore Branch, near Virginia Scrap Iron Company and above American Viscose (now the Roanoke Industrial Park).	x		
4AROA202.20	Co-located with DEQ sediment and fish tissue station 4AROA202.20. This station is located below American Viscose and upstream of the Roanoke STP	x		
4ATKR000.69	Co-located with DEQ sediment and fish tissue station 4ATKR000.69. This station maybe moved closer to the confluence depending on field evaluation.	x		
4AROA200.06 Roanoke River downstream of Tinker Creek	Located on the Roanoke River below Tinker Creek and approximately 0.60 miles downstream of the Roanoke STP.	x		
Upper Roanoke Follow-up Stations				
Barnhardt Creek	Located at the mouth of Barnhardt Creek. This stream is a tributary to the Roanoke River, downstream of the Mason Creek confluence.			
Mud Lick Creek	Located at the mouth of Mud Lick Creek. This stream flows into the Roanoke River, upstream of the Peters Creek confluence			
Murray Run	Located at the mouth of Murray Run. This stream is a tributary to the Roanoke River, just upstream of the Ore Branch confluence			
Ore Branch	Located at the mouth of Ore Branch. This small stream flows through industrialized areas in the City of Roanoke			
Lick Run	Located at the mouth of Lick Run. This stream drains a large portion of the City of Roanoke, including several possible PCB source facilities and other sites.			
Tinker Creek Above City of Roanoke	Located on Tinker Creek north of the Roanoke City limits.			
Glade Creek	Located at the mouth of Glade Creek, near Walnut Avenue. This Tinker Creek tributary drains commercial/industrial areas in the City of Roanoke and the Town of Vinton.			
Middle Roanoke Primary Stations				
4AROA199.20	Located below Niagara Dam upstream of an old Roanoke County landfill. This station is co-located with DEQ fish tissue station 4AROA199.20 and USGS Gage Station-Niagra, VA., adjacent to the Blue Ridge Parkway in Roanoke County.	x		x
4AROA196.98	Located at Explore Park below the confluence with Back Creek. A closed Roanoke Regional landfill is located upstream of this station.	x		
Middle Roanoke Follow-up Stations				
Back Creek	Co-located with DEQ sediment station 4ABAA000.03, located near the mouth of Back Creek. The Roanoke Regional Landfill is located along Back Creek and contributes runoff to this sampling point.			
4ABWR019.75	Located on the Blackwater River where the backwaters of the Smith Mountain Lake Dam begin.			
4APGG003.29	Located on the Pigg River at the Route 605 bridge.			

Station ID	Station Description	SPMD	Effluent	Ambient
Lower Roanoke Primary Stations				
4AROA137.00 Below Leesville Lake Dam	Co-located with DEQ station 4AROA0137.00, just downstream of Goose Creek below the Leesville Lake Dam. The APCO Leesville Hydroelectric Plant is located at the dam site. Goose Creek includes several possible PCB source sites in the upper portion of its watershed. The upper and middle Roanoke River subwatersheds (including the Blackwater River and Pigg River) drain to this site.	x		
4AROA128.97 US of Altavista	Approximately co-located with existing DEQ sediment station 4AROA128.98. This station is located upstream of BGF Industries and several possible PCB sources in the Altavista/Hurt area.	x		
Burlington Industries LCC Hurt Plant	Located on the Burlington Industries outfall approximately 0.08 miles downstream of the Sycamore Creek Roanoke River confluence.		x	
4ALYH000.21 Lynch Creek	Located near the mouth of Lynch Creek in the Town of Altavista. DEQ sediment station 4ALYH000.02 was sampled in 1999 at the proposed location. This station will provide information on possible PCB sources located in the Lynch Creek watershed including: Blanks Exxon, Hardy Texaco, Watts Chevron, the Altavista oil distributor wet area, in addition to possibly capturing runoff from BGF Industries, A. O. Smith, an Schrader Bridgeport.	x		
4AROA128.94 Lane West Landfill	Located on the eastern bank of Lynch Creek in Altavista along the northern bank of the Staunton River. This landfill was originally scheduled to be monitored in the summer of 2000, according to Altavista/Hurt facility surveys, but was not sampled due to safety concerns	x		
Altavista Town - Wastewater Treatment Plant	Located on the Altavista WTP outfall in the town of Altavista at the confluence of Reed Creek and the Roanoke River near Ricky Van Shelton Drive.			
Upstream of BGF Industries	Stormwater grab sample upstream of BGF Industries to isolate from stormwater flow through/around BGF site.			x
4AXLN000.05 X-trib of Roanoke (BGF)	Located on an unnamed tributary that flows through the BGF Industries site to the Staunton River.	x		
4AROA128.21 Lane East Landfill	Located on the northern bank of the Staunton River, near DEQ sediment station 4AXXZ000.05. This landfill was originally scheduled to be monitored in the summer of 2000, according to Altavista/Hurt facility surveys, but was not sampled due to safety concerns.	x		
4AROA125.59 DS of Altavista	Co-located with DEQ sediment and fish tissue station 4AROA125.59 on the Roanoke approximately 0.65 miles below the Big Otter River confluence. This station captures the runoff and flow from the facilities/sites located in the Altavista/Hurt area and will also provide information on possible contributions from the Big Otter River watershed.	x		
4ABOR000.62 Big Otter River at Route 712	Located approximately 0.62 miles upstream of the mouth of the Big Otter River. This station captures the runoff and flow from the facilities/sites located in the Big Otter River subwatershed.	x		
4AROA097.76 US of Brookneal	Located on the Staunton River approximately 0.70 miles upstream of DEQ sediment station 4AROA097.06. This location captures the runoff and flow from the portion of the watershed upstream of the Town of Brookneal.	x		
Dan River Inc. - Brookneal	Located on the Dan River Inc. outfall in the town of Brookneal near Corporation Branch and Mattox Street.		x	
4ACOR000.21 Corporation Branch	Located on Corporation Branch, which is a small tributary that flows through Brookneal to the Staunton River. Dan River Inc. is located along the tributary, directly upstream of the proposed sampling location	x		
4AFRV002.78 Falling River DS of Brookneal STP at Route 40	Located approximately 0.34 miles downstream of DEQ sediment station 4AFRV003.12 near Route 40.	x		

Station ID	Station Description	SPMD	Effluent	Ambient
4AROA090.50 DS of Brookneal	Located on the Stanton River directly above the mouth of Catawba Creek. This location captures the runoff from possible PCB sources located in Brookneal, including Dan River Inc., the Town of Brookneal Staunton River Lagoon, and the Brookneal Hatchery.	x		
4AROA067.91 at Route 746 Scuffletown Road near Randolph	Co-located with DEQ sediment and fish tissue station 4AROA067.91 approximately 8.85 miles downstream of the Club Creek Roanoke River confluence. This location captures discharges from facilities located in the Keysville/Drakes Branch Virginia area.	x		x
4AROA059.12 at Route 92 Clover Road near Clover	Co-located with DEQ sediment and fish tissue station 4AROA059.12 approximately 5.33 miles downstream of the Horsepen Creek Roanoke River confluence. This location captures discharges from facilities located in the Clover Virginia area.			x

Known and possible PCB sources referenced in Section 3.0 for which locational information was available were plotted in GIS. These facilities/sites were cross referenced with existing monitoring data to examine the spatial relationships between known and possible PCB sources in the watershed, sediment and fish tissue PCB monitoring results, and the proposed PCB monitoring stations. Because of the large number of possible PCB sources in the watershed, focus maps were developed for priority areas including the City of Roanoke and vicinity, the Altavista/Hurt area, and the Brookneal area (Figures 5.1, 5.3, and 5.4 respectively). The facilities/sites identified in these areas are included on the regional maps, but are not labeled. The two regional maps also show the proposed monitoring stations, PCB source information, and previous sampling results for the Upper-Middle Roanoke watershed (Figure 5.2) and the Staunton River (Lower Roanoke) watershed (Figure 5.5). Note that the scale for the fish tissue and sediment symbols is not presented in the legend for the regional maps due to space limitation, however, the scale is the same as presented in the focus maps.

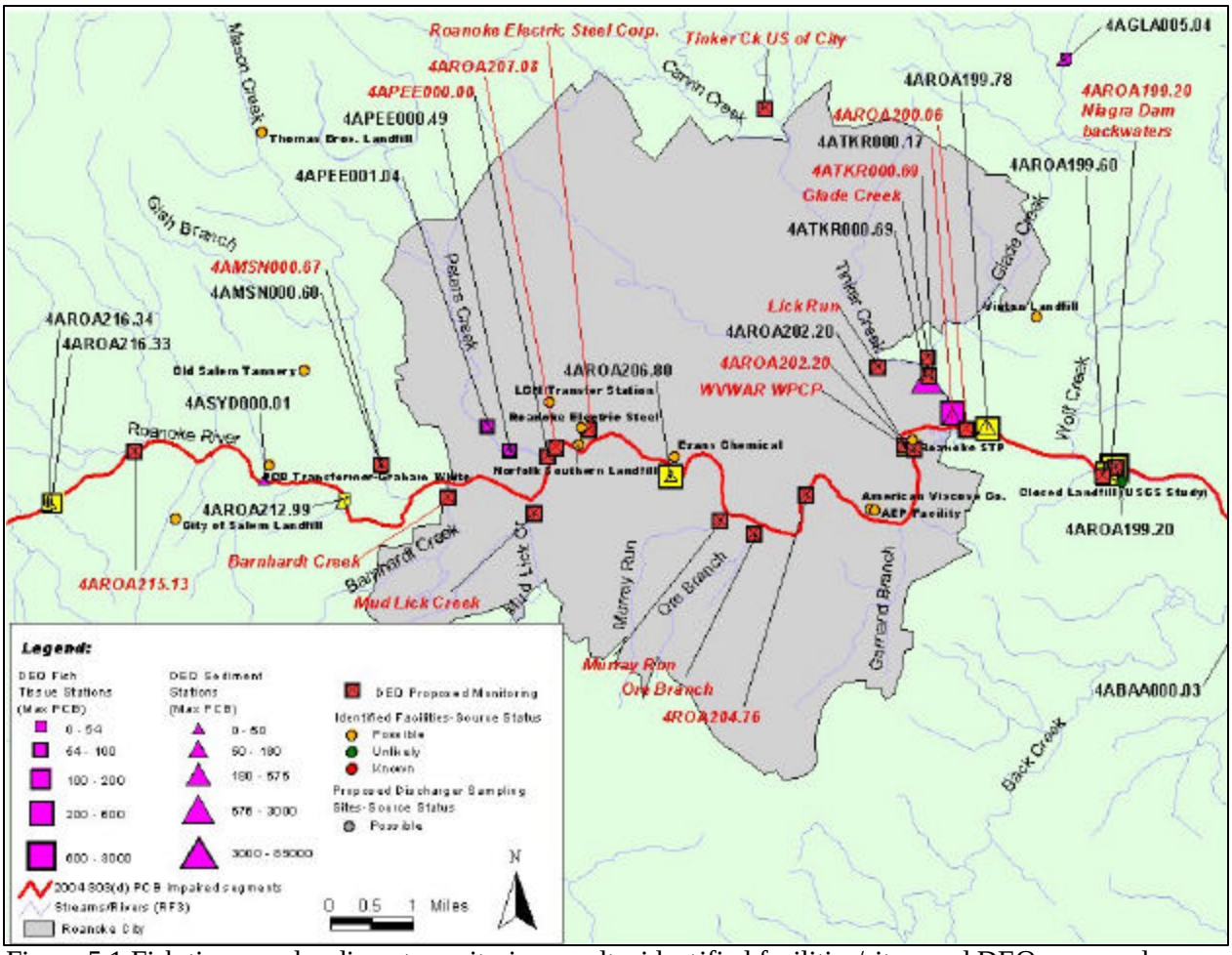

Figure 5.1 Fish tissue and sediment monitoring results, identified facilities/sites, and DEQ proposed monitoring locations in and around the City of Roanoke

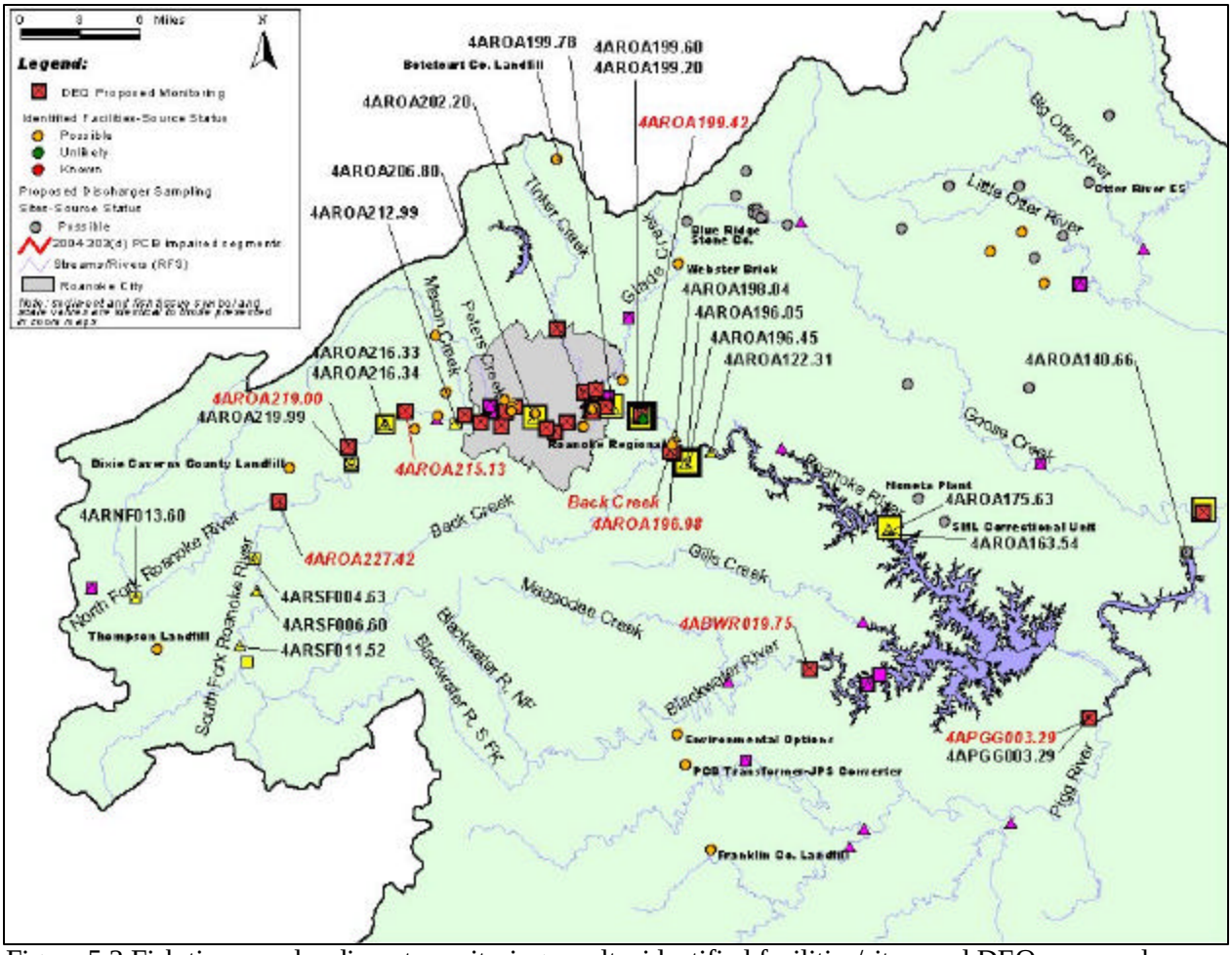

Figure 5.2 Fish tissue and sediment monitoring results, identified facilities/sites, and DEQ proposed monitoring locations in Upper-Middle Roanoke River watershed

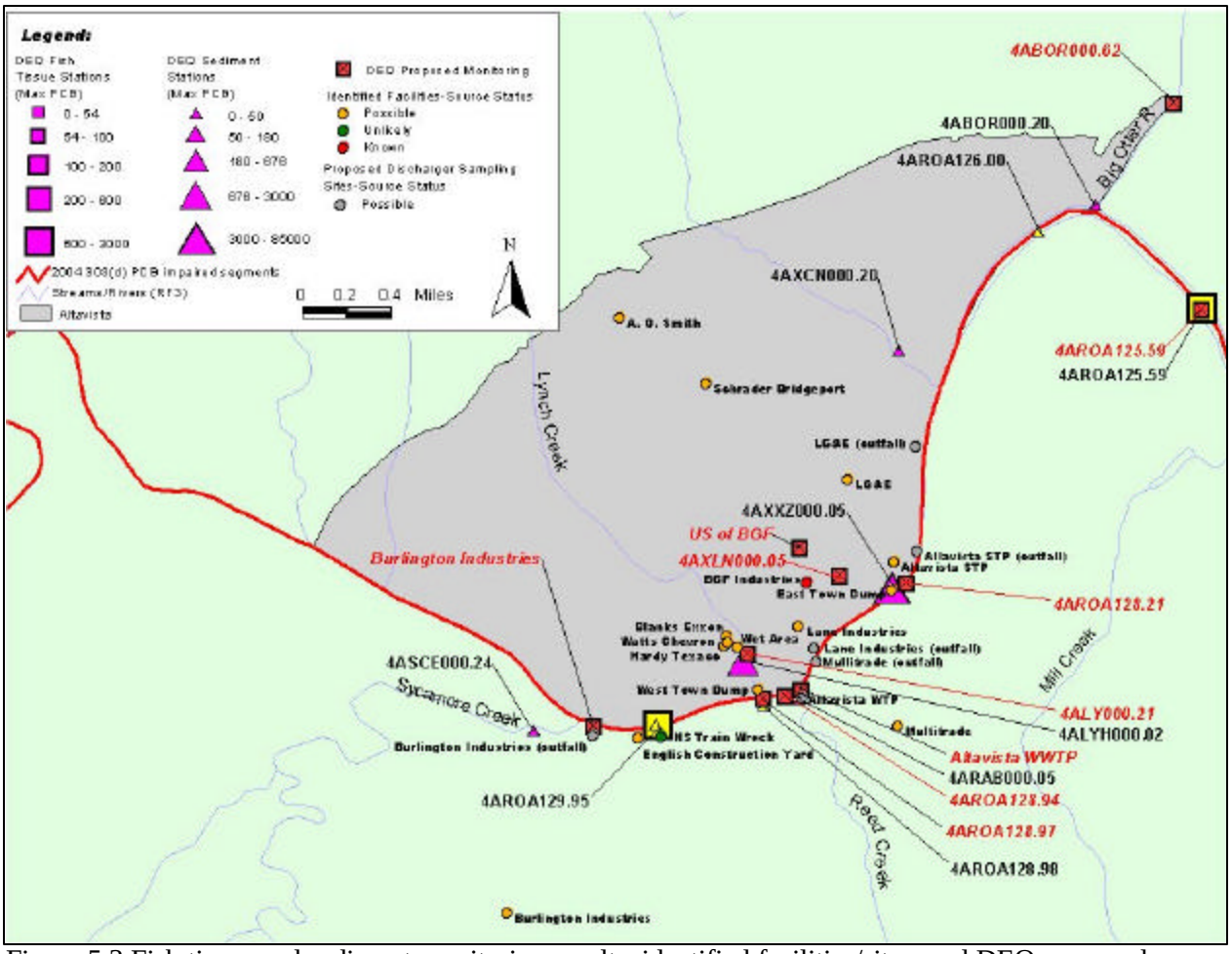

Figure 5.3 Fish tissue and sediment monitoring results, identified facilities/sites, and DEQ proposed monitoring locations in the Altavista/Hurt area

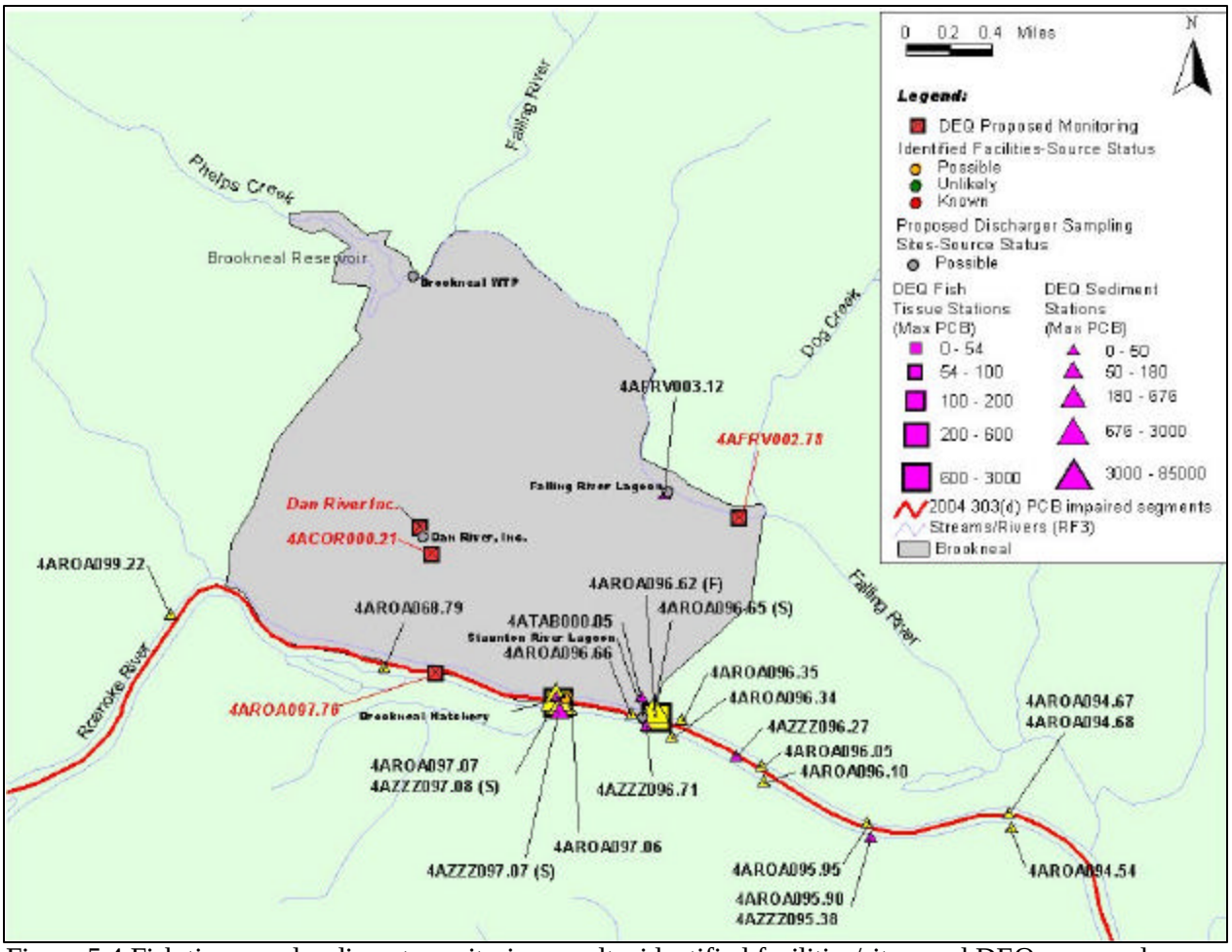

Figure 5.4 Fish tissue and sediment monitoring results, identified facilities/sites, and DEQ proposed monitoring locations in and around the Town of Brookneal

Figure 5.5 Fish tissue and sediment monitoring results, identified facilities/sites, and DEQ proposed monitoring locations in the Staunton River watershed

6.0 Coordination of Activities and Schedule

Several groups and agencies will coordinate the PCB sampling efforts for this study, primarily EPA Region 3, VADEQ, and Tetra Tech. VADEQ is coordinating the sampling effort and will be responsible for overseeing the sampling, as well as the shipping and processing of PCB samples to be analyzed by the EPA Environmental Service Center in Fort Meade, Maryland. SPMDs will be provided by Environmental Sampling Technologies (EST) in St. Joseph, Missouri. VADEQ will collect and ship SPMD samples back to EST for sample dialysis, clean up, and preparation of samples to be submitted to the EPA laboratory. Ambient water, effluent, and sediment samples will also be collected by VADEQ and sent to the EPA laboratory for Method 1668a analysis. EPA Region 3 will oversee the analysis of all PCB samples and the interpretation of results to be submitted for TMDL development.

Sampling will include the collection of flow measurements, total suspended solids (TSS), total organic carbon (TOC), and total dissolved organic carbon (DOC) data for modeling purposes. Samples collected for laboratory analysis of conventional water quality parameters will be shipped to Virginia Division of

Consolidated Laboratory Services (DCLS) in Richmond, Virginia. Additional field measurements for temperature, dissolved oxygen (DO), conductivity, and pH will also be recorded for general characterization of water quality conditions. The percentage of sand/silt/clay in bottom sediments will also be measured at each monitoring station. Sediment samples will be collected mid-stream and along the bank (as necessary) to determine the sediment particle size distribution for use in characterizing sediment transport capacity and PCB migration downstream. Monitoring is expected to take place in October 2005 (after QAPP approval) with the analytical results to be provided prior to model calibration.

7.0 Equipment

Equipment needs will be defined in the Standard Operating Procedures (SOPs) included in the Final QAPP. SPMDs will be supplied by ETS Labs.

8.0 References

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