

# **Changes in Streamflow and Water Quality in Selected Nontidal Basins in the Chesapeake Bay Watershed, 1985-2004**

By Michael J. Langland, Jeff P. Raffensperger, Douglas L. Moyer, Jurate M. Landwehr, and Gregory E. Schwarz

**Appendix 2.1.** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

Scientific Investigations Report 2006–5178

U.S. Geological Survey  
2006



**Appendix 2.1.** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

[Site number, USGS station identification number; –, not statistically significant; nd, no data]

**(A) Total Nitrogen**

Site name	Map ID (fig. 1)	Site number	Percentile					Mean
			10th	25th	50th	75th	90th	
<b>River Input Monitoring Program Sites</b>								
CHOPTANK RIVER NEAR GREENSBORO, MD	8	01491000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT CONOWINGO, MD	7	01578310	–	–	-0.70	-0.63	-0.62	-0.70
PATUXENT RIVER NEAR BOWIE, MD	11	01594440	-0.68	-0.79	-0.81	-0.80	-0.88	-0.83
POTOMAC RIVER AT CHAIN BRIDGE, AT WASHINGTON, D.C.	23	01646580	–	–	–	–	–	–
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	25	01668000	–	–	–	–	–	–
MATTAPONI RIVER NEAR BEULAHVILLE, VA	26	01674500	–	–	–	–	–	–
PAMUNKEY RIVER NEAR HANOVER, VA	28	01673000	0.62	0.55	0.67	–	–	0.54
JAMES RIVER AT CARTERSVILLE, VA	30	02035000	-0.59	-0.53	-0.73	-0.78	-0.60	-0.68
APPOMATTOX RIVER AT MATOACA, VA	32	02041650	–	–	–	–	–	–
<b>Multi-Agency Nontidal Monitoring Program Sites</b>								
SUSQUEHANNA RIVER AT TOWANDA, PA	1	01531500	–	-0.54	-0.52	-0.57	-0.42	-0.62
SUSQUEHANNA RIVER AT DANVILLE, PA	2	01540500	–	-0.67	-0.63	-0.63	-0.57	-0.71
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA	3	01553500	-0.61	-0.53	–	–	–	–
JUNIATA RIVER AT NEWPORT, PA	4	01567000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT MARIETTA, PA	5	01576000	–	–	–	–	–	–
CONESTOGA RIVER AT CONESTOGA, PA	6	01576754	–	–	–	–	–	–
NORTH BRANCH PATAPSCO RIVER AT CEDARHURST, MD	9	01586000	–	–	–	–	–	–
PATUXENT RIVER NEAR LAUREL, MD	10	01592500	–	–	–	–	–	–
GEORGES CREEK AT FRANKLIN, MD	12	01599000	-0.68	-0.68	-0.73	-0.67	-0.57	-0.79
WILLS CREEK NEAR CUMBERLAND, MD	13	01601500	-0.45	–	-0.48	-0.57	–	-0.50
POTOMAC RIVER AT PAW PAW, WV	14	01610000	–	–	-0.53	-0.56	-0.48	-0.54
CONOCOHEAGUE CREEK AT FAIRVIEW, MD	15	01614500	-0.55	–	-0.65	–	–	-0.51
ANTIETAM CREEK NEAR SHARPSBURG, MD	16	01619500	-0.69	-0.61	-0.60	-0.52	-0.49	-0.61
SOUTH RIVER NEAR WAYNESBORO, VA	17	01626000	–	–	–	–	–	–
SOUTH FORK SHENANDOAH RIVER AT FRONT ROYAL, VA	18	01631000	–	-0.48	–	–	–	-0.57
NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, VA	19	01634000	–	0.49	–	–	0.69	0.46
MONOCACY RIVER AT BRIDGEPORT, MD	20	01639000	–	–	–	–	–	–
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD	21	01643000	–	–	–	–	–	–
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE, MD	22	01651000	–	–	-0.61	-0.72	-0.59	-0.72
ROBINSON RIVER NEAR LOCUST DALE, VA	24	01666500	–	–	–	–	–	–
NORTH ANNA RIVER AT HART CORNER NEAR DOSWELL, VA	27	01671020	–	–	–	–	–	–
JAMES RIVER AT BENT CREEK, VA	29	02026000	–	–	–	–	–	–
JAMES RIVER NEAR RICHMOND, VA	31	02037500	–	–	–	–	–	-0.45

#### 4 Changes in Streamflow and Water Quality in Selected Nontidal Basins in the Chesapeake Bay Watershed, 1985-2004

**Appendix 2.1. (Continued)** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

[Site number, USGS station identification number; –, not statistically significant; nd, no data]

##### **(B) Nitrite plus Nitrate**

Site name	Map ID (fig. 1)	Site number	Percentile					Mean
			10th	25th	50th	75th	90th	
<b>River Input Monitoring Program Sites</b>								
CHOPTANK RIVER NEAR GREENSBORO, MD	8	01491000	–	–	0.45	–	–	0.47
SUSQUEHANNA RIVER AT CONOWINGO, MD	7	01578310	–	–	–	–	–	–
PATUXENT RIVER NEAR BOWIE, MD	11	01594440	-0.49	-0.68	-0.80	-0.80	-0.77	-0.75
POTOMAC RIVER AT CHAIN BRIDGE, AT WASHINGTON, D.C.	23	01646580	–	–	–	-0.52	–	–
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	25	01668000	-0.45	–	–	–	–	–
MATTAPONI RIVER NEAR BEULAHVILLE, VA	26	01674500	–	–	–	–	–	–
PAMUNKEY RIVER NEAR HANOVER, VA	28	01673000	0.58	0.57	0.82	0.67	0.62	0.72
JAMES RIVER AT CARTERSVILLE, VA	30	02035000	-0.57	–	–	–	–	–
APPOMATTOX RIVER AT MATOACA, VA	32	02041650	–	–	–	–	–	–
<b>Multi-Agency Nontidal Monitoring Program Sites</b>								
SUSQUEHANNA RIVER AT TOWANDA, PA	1	01531500	–	–	–	–	–	–
SUSQUEHANNA RIVER AT DANVILLE, PA	2	01540500	–	–	-0.47	–	–	–
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA	3	01553500	–	–	–	–	–	–
JUNIATA RIVER AT NEWPORT, PA	4	01567000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT MARIETTA, PA	5	01576000	–	–	–	–	–	–
CONESTOGA RIVER AT CONESTOGA, PA	6	01576754	–	–	–	–	–	–
NORTH BRANCH PATAPSCO RIVER AT CEDARHURST, MD	9	01586000	nd	nd	nd	nd	nd	nd
PATUXENT RIVER NEAR LAUREL, MD	10	01592500	nd	nd	nd	nd	nd	nd
GEORGES CREEK AT FRANKLIN, MD	12	01599000	nd	nd	nd	nd	nd	nd
WILLS CREEK NEAR CUMBERLAND, MD	13	01601500	nd	nd	nd	nd	nd	nd
POTOMAC RIVER AT PAW PAW, WV	14	01610000	nd	nd	nd	nd	nd	nd
CONOCOCHIEGUE CREEK AT FAIRVIEW, MD	15	01614500	–	–	–	–	–	–
ANTIETAM CREEK NEAR SHARPSBURG, MD	16	01619500	nd	nd	nd	nd	nd	nd
SOUTH RIVER NEAR WAYNESBORO, VA	17	01626000	nd	nd	nd	nd	nd	nd
SOUTH FORK SHENANDOAH RIVER AT FRONT ROYAL, VA	18	01631000	nd	nd	nd	nd	nd	nd
NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, VA	19	01634000	nd	nd	nd	nd	nd	nd
MONOCACY RIVER AT BRIDGEPORT, MD	20	01639000	nd	nd	nd	nd	nd	nd
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD	21	01643000	nd	nd	nd	nd	nd	nd
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE, MD	22	01651000	nd	nd	nd	nd	nd	nd
ROBINSON RIVER NEAR LOCUST DALE, VA	24	01666500	nd	nd	nd	nd	nd	nd
NORTH ANNA RIVER AT HART CORNER NEAR DOSWELL, VA	27	01671020	nd	nd	nd	nd	nd	nd
JAMES RIVER AT BENT CREEK, VA	29	02026000	nd	nd	nd	nd	nd	nd
JAMES RIVER NEAR RICHMOND, VA	31	02037500	nd	nd	nd	nd	nd	nd

**Appendix 2.1. (Continued)** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

[Site number, USGS station identification number; – , not statistically significant; nd, no data]

**(C) Total Phosphorus**

Site name	Map ID (fig. 1)	Site number	Percentile					Mean
			10th	25th	50th	75th	90th	
<b>River Input Monitoring Program Sites</b>								
CHOPTANK RIVER NEAR GREENSBORO, MD	8	01491000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT CONOWINGO, MD	7	01578310	–	–	–	-0.49	–	–
PATUXENT RIVER NEAR BOWIE, MD	11	01594440	-0.64	-0.74	-0.76	-0.74	-0.80	-0.73
POTOMAC RIVER AT CHAIN BRIDGE, AT WASHINGTON, D.C.	23	01646580	–	–	–	–	–	–
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	25	01668000	–	–	–	–	–	–
MATTAPONI RIVER NEAR BEULAHVILLE, VA	26	01674500	–	–	–	–	–	–
PAMUNKEY RIVER NEAR HANOVER, VA	28	01673000	0.73	0.76	0.63	0.52	–	0.63
JAMES RIVER AT CARTERSVILLE, VA	30	02035000	-0.75	-0.75	-0.74	-0.80	-0.73	-0.80
APPOMATTOX RIVER AT MATOACA, VA	32	02041650	0.58	0.61	0.62	–	–	0.59
<b>Multi-Agency Nontidal Monitoring Program Sites</b>								
SUSQUEHANNA RIVER AT TOWANDA, PA	1	01531500	-0.66	–	-0.44	–	–	–
SUSQUEHANNA RIVER AT DANVILLE, PA	2	01540500	-0.51	-0.69	-0.53	–	–	–
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA	3	01553500	-0.47	-0.67	-0.75	–	–	–
JUNIATA RIVER AT NEWPORT, PA	4	01567000	-0.45	–	–	–	–	–
SUSQUEHANNA RIVER AT MARIETTA, PA	5	01576000	–	–	–	–	–	–
CONESTOGA RIVER AT CONESTOGA, PA	6	01576754	-0.56	-0.53	-0.47	-0.50	–	-0.54
NORTH BRANCH PATAPSCO RIVER AT CEDARHURST, MD	9	01586000	–	-0.49	–	-0.64	–	-0.62
PATUXENT RIVER NEAR LAUREL, MD	10	01592500	0.47	–	–	0.55	0.62	-0.58
GEORGES CREEK AT FRANKLIN, MD	12	01599000	–	–	-0.66	-0.71	-0.45	-0.67
WILLS CREEK NEAR CUMBERLAND, MD	13	01601500	–	–	–	–	–	–
POTOMAC RIVER AT PAW PAW, WV	14	01610000	–	–	–	–	–	–
CONOCOCHIEGUE CREEK AT FAIRVIEW, MD	15	01614500	-0.68	-0.69	-0.73	–	-0.66	–
ANTIETAM CREEK NEAR SHARPSBURG, MD	16	01619500	-0.63	-0.74	-0.69	-0.46	-0.62	-0.63
SOUTH RIVER NEAR WAYNESBORO, VA	17	01626000	-0.76	-0.75	-0.74	-0.82	-0.77	-0.84
SOUTH FORK SHENANDOAH RIVER AT FRONT ROYAL, VA	18	01631000	-0.80	–	–	-0.45	–	–
NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, VA	19	01634000	–	–	–	0.80	0.67	0.52
MONOCACY RIVER AT BRIDGEPORT, MD	20	01639000	–	–	–	–	–	-0.59
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD	21	01643000	–	–	–	–	–	–
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE, MD	22	01651000	–	–	–	-0.46	–	–
ROBINSON RIVER NEAR LOCUST DALE, VA	24	01666500	-0.71	-0.71	-0.71	-0.70	–	-0.57
NORTH ANNA RIVER AT HART CORNER NEAR DOSWELL, VA	27	01671020	-0.84	-0.88	-0.88	-0.78	-0.61	-0.82
JAMES RIVER AT BENT CREEK, VA	29	02026000	-0.72	-0.64	-0.86	-0.71	-0.80	-0.87
JAMES RIVER NEAR RICHMOND, VA	31	02037500	-0.76	-0.81	-0.80	-0.78	-0.73	-0.83

## 6 Changes in Streamflow and Water Quality in Selected Nontidal Basins in the Chesapeake Bay Watershed, 1985-2004

**Appendix 2.1. (Continued)** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

[Site number, USGS station identification number; –, not statistically significant; nd, no data]

### (D) Dissolved Inorganic Phosphorus

Site name	Map ID (fig. 1)	Site number	Percentile					Mean
			10th	25th	50th	75th	90th	
<b>River Input Monitoring Program Sites</b>								
CHOPTANK RIVER NEAR GREENSBORO, MD	8	01491000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT CONOWINGO, MD	7	01578310	–	–	–	–	–	–
PATUXENT RIVER NEAR BOWIE, MD	11	01594440	–	-0.57	-0.74	-0.76	-0.82	-0.76
POTOMAC RIVER AT CHAIN BRIDGE, AT WASHINGTON, D.C.	23	01646580	–	–	–	–	–	–
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	25	01668000	-0.80	-0.77	–	–	–	–
MATTAPONI RIVER NEAR BEULAHVILLE, VA	26	01674500	-0.76	-0.66	–	–	–	–
PAMUNKEY RIVER NEAR HANOVER, VA	28	01673000	0.49	0.60	–	–	–	–
JAMES RIVER AT CARTERSVILLE, VA	30	02035000	-0.66	-0.68	-0.70	-0.73	-0.72	-0.73
APPOMATTOX RIVER AT MATOACA, VA	32	02041650	-0.82	-0.78	–	–	–	–
<b>Multi-Agency Nontidal Monitoring Program Sites</b>								
SUSQUEHANNA RIVER AT TOWANDA, PA	1	01531500	nd	nd	nd	nd	nd	nd
SUSQUEHANNA RIVER AT DANVILLE, PA	2	01540500	nd	nd	nd	nd	nd	nd
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA	3	01553500	nd	nd	nd	nd	nd	nd
JUNIATA RIVER AT NEWPORT, PA	4	01567000	nd	nd	nd	nd	nd	nd
SUSQUEHANNA RIVER AT MARIETTA, PA	5	01576000	nd	nd	nd	nd	nd	nd
CONESTOGA RIVER AT CONESTOGA, PA	6	01576754	nd	nd	nd	nd	nd	nd
NORTH BRANCH PATAPSCO RIVER AT CEDARHURST, MD	9	01586000	nd	nd	nd	nd	nd	nd
PATUXENT RIVER NEAR LAUREL, MD	10	01592500	nd	nd	nd	nd	nd	nd
GEORGES CREEK AT FRANKLIN, MD	12	01599000	nd	nd	nd	nd	nd	nd
WILLS CREEK NEAR CUMBERLAND, MD	13	01601500	nd	nd	nd	nd	nd	nd
POTOMAC RIVER AT PAW PAW, WV	14	01610000	nd	nd	nd	nd	nd	nd
CONOCOHEAGUE CREEK AT FAIRVIEW, MD	15	01614500	-0.68	-0.85	-0.76	-0.81	-0.75	-0.86
ANTIETAM CREEK NEAR SHARPSBURG, MD	16	01619500	nd	nd	nd	nd	nd	nd
SOUTH RIVER NEAR WAYNESBORO, VA	17	01626000	nd	nd	nd	nd	nd	nd
SOUTH FORK SHENANDOAH RIVER AT FRONT ROYAL, VA	18	01631000	–	–	–	–	–	–
NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, VA	19	01634000	0.64	0.72	0.57	0.68	0.72	0.60
MONOCACY RIVER AT BRIDGEPORT, MD	20	01639000	nd	nd	nd	nd	nd	nd
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD	21	01643000	nd	nd	nd	nd	nd	nd
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE, MD	22	01651000	nd	nd	nd	nd	nd	nd
ROBINSON RIVER NEAR LOCUST DALE, VA	24	01666500	nd	nd	nd	nd	nd	nd
NORTH ANNA RIVER AT HART CORNER NEAR DOSWELL, VA	27	01671020	nd	nd	nd	nd	nd	nd
JAMES RIVER AT BENT CREEK, VA	29	02026000	nd	nd	nd	nd	nd	nd
JAMES RIVER NEAR RICHMOND, VA	31	02037500	nd	nd	nd	nd	nd	nd

**Appendix 2.1. (Continued)** Spearman rho for (A) total nitrogen, (B) nitrite plus nitrate, (C) total phosphorus, (D) dissolved inorganic phosphorus, and (E) suspended sediment or total suspended solids concentration at the 9 River Input Monitoring Program sites and the 23 Multi-Agency Nontidal Monitoring Program sites in the Chesapeake Bay watershed, 1985-2004.

[Site number, USGS station identification number; – , not statistically significant; nd, no data]

**(E) Suspended Sediment or Total Suspended Solids**

Site name	Map ID (fig. 1)	Site number	Percentile					Mean
			10th	25th	50th	75th	90th	
<b>River Input Monitoring Program Sites</b>								
CHOPTANK RIVER NEAR GREENSBORO, MD	8	01491000	–	–	–	-0.60	–	–
SUSQUEHANNA RIVER AT CONOWINGO, MD	7	01578310	-0.46	-0.68	-0.62	–	–	–
PATUXENT RIVER NEAR BOWIE, MD	11	01594440	-0.50	-0.62	–	-0.54	–	–
POTOMAC RIVER AT CHAIN BRIDGE, AT WASHINGTON, D.C.	23	01646580	–	–	–	–	–	–
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	25	01668000	0.66	–	–	–	–	–
MATTAPONI RIVER NEAR BEULAHVILLE, VA	26	01674500	–	–	–	–	–	–
PAMUNKEY RIVER NEAR HANOVER, VA	28	01673000	–	–	–	–	–	–
JAMES RIVER AT CARTERSVILLE, VA	30	02035000	–	–	–	-0.57	–	–
APPOMATTOX RIVER AT MATOACA, VA	32	02041650	–	–	–	–	–	–
<b>Multi-Agency Nontidal Monitoring Program Sites</b>								
SUSQUEHANNA RIVER AT TOWANDA, PA	1	01531500	–	–	–	–	–	–
SUSQUEHANNA RIVER AT DANVILLE, PA	2	01540500	–	–	–	–	–	–
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA	3	01553500	–	–	–	–	0.54	0.54
JUNIATA RIVER AT NEWPORT, PA	4	01567000	–	–	–	–	–	–
SUSQUEHANNA RIVER AT MARIETTA, PA	5	01576000	–	–	–	–	–	–
CONESTOGA RIVER AT CONESTOGA, PA	6	01576754	–	–	-0.52	–	–	–
NORTH BRANCH PATAPSCO RIVER AT CEDARHURST, MD	9	01586000	–	–	–	–	–	–
PATUXENT RIVER NEAR LAUREL, MD	10	01592500	–	–	–	–	–	–
GEORGES CREEK AT FRANKLIN, MD	12	01599000	–	–	–	–	–	–
WILLS CREEK NEAR CUMBERLAND, MD	13	01601500	–	–	–	–	–	–
POTOMAC RIVER AT PAW PAW, WV	14	01610000	–	–	–	–	–	–
CONOCOCHIEGUE CREEK AT FAIRVIEW, MD	15	01614500	–	0.51	–	–	–	–
ANTIETAM CREEK NEAR SHARPSBURG, MD	16	01619500	–	–	–	–	–	–
SOUTH RIVER NEAR WAYNESBORO, VA	17	01626000	–	–	–	–	–	–
SOUTH FORK SHENANDOAH RIVER AT FRONT ROYAL, VA	18	01631000	–	-0.54	–	–	–	–
NORTH FORK SHENANDOAH RIVER NEAR STRASBURG, VA	19	01634000	–	–	–	–	–	–
MONOCACY RIVER AT BRIDGEPORT, MD	20	01639000	–	–	–	–	-0.49	-0.54
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD	21	01643000	–	–	–	–	–	–
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE, MD	22	01651000	–	–	–	–	–	-0.50
ROBINSON RIVER NEAR LOCUST DALE, VA	24	01666500	–	-0.46	–	–	–	–
NORTH ANNA RIVER AT HART CORNER NEAR DOSWELL, VA	27	01671020	–	–	–	–	–	–
JAMES RIVER AT BENT CREEK, VA	29	02026000	-0.54	-0.68	–	–	–	–
JAMES RIVER NEAR RICHMOND, VA	31	02037500	–	–	–	–	–	–