Appendix F:
U.S. Geological Survey Conowingo Outflow Suspended Sediment Data Report

APPENDIX F: Introduction

This Assessment was computer-model intense and the models required data to estimate physical processes accurately. Data gaps were identified by the experts involved in this scoping of this effort. One of the data gaps identified was a need for updated chemical and physical measures of suspended sediment flowing through Conowingo Dam. U.S. Geological Survey (USGS) supplemented their current sample collection at Susquehanna River at Conowingo, MD (USGS station ID 01578310) that is supported by the USGS-DNR Maryland River-Input Monitoring Program (RIM) and the USGS National Stream-Quality Accounting Network (NASQAN). During four storm-flow events in Water-Year 2010 (October 1, 2010 - September 30, 2011) large-volume samples were collected to support analysis of detailed suspended-sediment size fractions and physical and chemical measures of sediment. The results of this monitoring are presented in this appendix.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

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From: Jeffrey Chanat, MD-DE-DC Water Science Center, Baltimore, MD

To: Bruce Michael, Director, Resource Assessment Service, Maryland Department of Natural Resources, Annapolis, MD

SUBJECT: Suspended-sediment chemistry, concentration, and particle-size analysis data, Susquehanna River at Conowingo, Maryland (USGS 01578310)

Mr. Michael,

I'm pleased to transmit tables of suspended-sediment chemistry, concentration, and particle size analysis data for 10 samples collected during 4 high-flow events during water year 2011, including the near-record events of September, 2011. I trust that these data will prove valuable to the team working on stored sediments in the Susquehanna reservoir system. All data tabulated herein are stored in the National Water Information System (NWIS; http://waterdata.usgs.gov/nwis), and are accessible to you through that medium as well.

The USGS anticipates publication of these data in an Open-File Report, which will include a complete discussion of methods. Briefly, samples were collected along a representative cross-section from the catwalk on Conowingo Dam and composited in a large carboy. Sample-collection methods were identical to those used for the River-Input Monitoring program (RIM), and a separate sample was collected for water chemistry at the same time the sediment samples were collected. Separate subsamples were drawn for chemical analysis, and for determination of suspended-sediment concentration and particle-size distribution. Chemical analyses of the suspended sediment were performed at the USGS Georgia Water Science Center's Sediment Partitioning Laboratory under the direction of Art Horowitz. These results are tabulated in separate tables based on analysis method. Suspended-sediment concentration and particle-size analyses were determined at the USGS Kentucky Water Science Center's Sediment Laboratory. Data reported herein represent all available concentration and distribution results corresponding to the tabulated sediment chemistry samples, as well as a few historic high-flux events for which comparable data were available.

Please feel free to contact either myself (517-485-0418) or Joel Blomquist (443-498-5560) with any questions you may have.

Table 1. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by inductively coupled plasma-atomic emission spectrometry, Georgia WSC Sediment-Partitioning Research Lab (method PLA21; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Copper (ppm)	Zinc (ppm)	Chromium (ppm)	Cobalt (ppm)	Nickel (ppm)	Barium (ppm)	Vanadium (ppm)	Lithium (ppm)
10/3/2010	0915		43	250	67	34	62	530	88	62
12/3/2010	1030		42	270	81	47	73	650	120	74
3/8/2011	1000		-	-	-	-	-	-	-	-
3/12/2011	1215		-	-	-	-	-	-	-	-
3/12/2011	1215	Replicate	-	-	-	-	-	-	-	-
9/8/2011	1100		42	260	83	43	64	530	110	67
9/8/2011	1100	Replicate	41	250	85	42	62	510	100	66
9/10/2011	0930		42	220	100	34	53	640	130	81
9/11/2011	0930		42	230	95	40	60	590	120	74
9/12/2011	0900		38	210	110	38	61	650	140	83

Table 1- continued. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by inductively coupled plasma-atomic emission spectrometry, Georgia WSC Sediment-Partitioning Research Lab (method PLA21; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Beryllium (ppm)	Molybdenum (ppm)	Phosphorus (ppm)	Strontium (ppm)	Tin (ppm)	Thallium (ppm)	Uranium (ppm)	Iron (percent)
10/3/2010	0915		2.5	<5	1,500	390	<5	<250	<250	3.6
12/3/2010	1030		3.5	<2	1,400	150	5	<100	<100	4.7
3/8/2011	1000		-	-	1,400	-	-	-	-	5.0
3/12/2011	1215		-	-	1,200	-	-	-	-	4.2
3/12/2011	1215	Replicate	-	-	1,200	-	-	-	-	4.4
9/8/2011	1100		3.0	<1	1,100	90	4	<50	<50	4.4
9/8/2011	1100	Replicate	2.9	<1	1,100	88	5	<50	<50	4.3
9/10/2011	0930		3.4	<1	900	110	4	<50	<50	5.3
9/11/2011	0930		3.1	<1	960	110	6	<50	<50	4.9
9/12/2011	0900		3.2	<1	940	130	5	<50	<50	5.4

Table 1-continued. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by inductively coupled plasma-atomic emission spectrometry, Georgia WSC Sediment-Partitioning Research Lab (method PLA21; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Manganese (ppm)	Aluminum (percent)	Titanium (percent)	Calcium (percent)	Potassium (percent)	Magnesium (percent)	Sodium (percent)	Total Sulfur (percent)
10/3/2010	0915		2,500	6.1	0.34	5.6	2.2	2.2	3.2	2.2
12/3/2010	1030		3,000	8.2	0.50	1.3	2.5	1.1	0.5	0.35
3/8/2011	1000		3,400	8.5	-	-	-	-	-	-
3/12/2011	1215		2,100	7.0	-	-	-	-	-	-
3/12/2011	1215	Replicate	2,200	7.3	-	-	-	-	-	-
9/8/2011	1100		1,900	8.4	0.57	-	-	-	-	-
9/8/2011	1100	Replicate	2,000	8.6	0.57	-	-	-	-	-
9/10/2011	0930		1,900	9.3	0.58	-	-	-	-	-
9/11/2011	0930		1,800	8.5	0.56	-	-	-	-	-
9/12/2011	0900		1,800	9.3	0.60	-	-	-	-	-

Table 2. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by atomic absorption spectrophotometry, Georgia WSC Sediment-Partitioning Research Lab (method AA096; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Silver (ppm)	Lead (ppm)	Cadmium (ppm)
10/3/2010	0915		<2.5	50	0.5
12/3/2010	1030		<1.0	43	0.7
3/8/2011	1000		-	-	-
3/12/2011	1215		-	-	-
3/12/2011	1215	Replicate	-	-	-
9/8/2011	1100		1.2	46	0.9
9/8/2011	1100	Replicate	0.7	45	0.7
9/10/2011	0930		0.5	45	0.6
9/11/2011	0930		1.3	45	0.8
9/12/2011	0900		1.1	40	0.5

Table 3. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by hydride generation inductively coupled plasma-atomic emission spectrometry, Georgia WSC Sediment-Partitioning Research Lab (method HY018; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Arsenic (ppm)	Antimony (ppm)	Selenium (ppm)
10/3/2010	0915		11	2.1	0.9
12/3/2010	1030		14	1.3	0.8
3/8/2011	1000		-	-	-
3/12/2011	1215		-	-	-
3/12/2011	1215	Replicate	-	-	-
9/8/2011	1100		13	1.5	1.1
9/8/2011	1100	Replicate	10	1.6	0.9
9/10/2011	0930		20	1.4	1.5
9/11/2011	0930		17	1.1	1.2
9/12/2011	0900		19	1.1	1.2

Table 4. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by cold vapor atomic absorption spectrophotometry, Georgia WSC Sediment-Partitioning Research Lab (method CV026; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Mercury (ppm)
10/3/2010	0915		-
12/3/2010	1030		0.16
3/8/2011	1000		-
3/12/2011	1215		-
3/12/2011	1215	Replicate	-
9/8/2011	1100		0.18
9/8/2011	1100	Replicate	0.21
9/10/2011	0930		0.10
9/11/2011	0930		0.10
9/12/2011	0900		0.07

Table 5. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310), determined by combustion, Georgia WSC Sediment-Partitioning Research Lab (method CMB02; Horowitz and others, 2001).

[-, not available; <, less than; ppm, parts per million; QA, quality assurance]

Date	Time	QA Type	Total organic carbon (percent)	Total carbon (percent)	Total nitrogen (percent)
10/3/2010	0915		-	-	-
12/3/2010	1030		3.8	4.1	0.47
3/8/2011	1000		3.8	4.2	0.40
3/12/2011	1215		4.7	5.1	0.36
3/12/2011	1215	Replicate	4.7	4.9	0.34
9/8/2011	1100		3.5	3.2	0.26
9/8/2011	1100	Replicate	3.4	3.2	0.27
9/10/2011	0930		2.4	2.2	0.18
9/11/2011	0930		2.7	2.5	0.20
9/12/2011	0900		1.8	1.9	0.19

Reference:

Horowitz, A.J., Elrick, K.A., and J.J. Smith, 2001, Estimating suspended sediment and trace element fluxes in large river basins: methodological considerations as applied to the NASQAN programme, Hydrological Processes, v. 15, p 1107-1132.

Table 6. Particle-size distribution, suspended-sediment concentration, and instantaneous discharge for observations made during selected periods of high suspended-sediment flux, Susquehanna River at Conowingo, Maryland (USGS 01578310).

[Progressively darker shading from left to right indicates transitions between semi-quantitative categories "sand", "silt", and "clay", respectively; cfs, cubic feet per second; mg, milligrams; L, liter]

Date	Time	Percent of sample with sieve diameter less than indicated value in millimeters										Suspended-sediment concentration, in mg/L	Instantaneous discharge, in cfs
		1	0.5	0.25	0.125	0.0625	0.031	0.016	0.008	0.004	0.002		
8/8/1979	1200		100	99	98	97	94	88	83	71	67	17	34,300
3/22/1980	1030			100	99	99	98	97	95	81		49	173,000
3/23/1980	1415					100	99	98	91	76		113	220,000
3/23/1980	1430					100	94	94	86	71		123	217,000
3/23/1980	1830				100	99	98	96	95	81		132	207,000
3/23/1980	1831					100	99	98	94	77		107	207,000
3/23/1980	2030					100	96	94	91	75		138	217,000
3/31/1980	1030	100	99	99	99	98	95	89	88	82		43	151,000
3/31/1980	1031		100	99	98	98	97	97	95	83		35	151,000
4/2/1980	1130					100	98	93	83	65		40	225,000
4/2/1980	1131			100	99	99	99	98	92	78		31	225,000
2/13/1981	1200								100	83		173	185,000
2/13/1981	1500					100	98	97	94	79		183	164,000
2/13/1981	1700					100	99	97	92	78		194	139,000
2/14/1981	1100							100	97	79		144	146,000
2/17/1984	1305					100	98	95	88	73	57	235	415,000
1/27/2010	1545					98						263	310,000
12/3/2010	1030					98						141	276,000
3/8/2011	1000					97						129	274,000
3/12/2011	1215					90						937	453,000
4/18/2011	0945					98						206	255,000
4/30/2011	1145					96						184	316,000
9/8/2011	1100			100	99	94	83	65	47	36	27	2,980	617,000
9/10/2011	0930			100	99	97	91	84	71	63	51	741	481,000
9/11/2011	0930			100	99	94	84	72	59	48	30	1,150	388,000
9/12/2011	0900	100	99	97	94	88	81	76	68	61	52	332	233,000