Attachment A-3:
Additional Information for Estimation of Full Sediment Storage Capacity in Conowingo Reservoir

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Additional Information for Estimation of Full Sediment Storage Capacity in Conowingo Reservoir

The following information is provided to help the Lower Susquehanna River Assessment Project in their efforts to study sediment loads from behind a series of hydroelectric dams and associated reservoirs, located on the lower Susquehanna River draining into the northern Chesapeake Bay. Information provided includes the methodology used for the estimation of a full sediment storage capacity (SSC) condition in the Conowingo Reservoir. An estimation of full SSC condition is presented using 2008 and 2011 bathymetry data in the procedure outlined below.

Procedure for Estimating Conowingo Reservoir Full Sediment Storage Capacity Bathymetry

1) U.S. Geological Survey (USGS) bathymetry data from 2008 (Langland, 2009) URS Corporation and Gomez and Sullivan Engineers (GSE) bathymetry data from 2011 (URS Corporation and Gomez and Sullivan Engineers, 2012) were plotted and compared. An example plot for cross section 25 is shown in figure C1.
2) Full SSC bathymetry was calculated from cross-sectional areas and volumes (depth) previously determined in Reed and Hoffman (1996) using the same transect lengths and widths as used in the previous bathymetry studies (table C1) (Langland, 2009; URS Corporation and Gomez and Sullivan Engineers, 2012).
3) Using the full SSC volume from step #2, the cross-sectional area remains constant so only the depth changes. Changing the depth results in a new estimated volume. The mean depth from the 2011 bathymetry was adjusted to approximate the full SSC for transects 18 through 26, the area of continuing deposition in the Conowingo Reservoir (figure C2). Transects above 18 (upper and middle areas of the reservoir) are considered in a dynamic-equilibrium state and have a limited capacity to store and scour sediment based on the SSC in table C1.
4) Comparing 2008 and 2011 bathymetry data, individual depth readings along each transect were adjusted to approximate the mean depth of sediment deposition (figure C3, table C1) and the SSC.

5) Latitude and longitude data were added.

6) New SSC full condition data set were provided to the U.S. Army Corps of Engineers (USACE), 2/13/2013, for use in the 2-D model for full bathymetry simulations.

The result of the above procedure was to add an additional 6.2 million tons of sediment in the lower section of Conowingo Reservoir. The results of the 2011 bathymetry indicated approximately 7 million tons of sediment were needed to reach 100 percent capacity with sediment (attachment A, table 4).

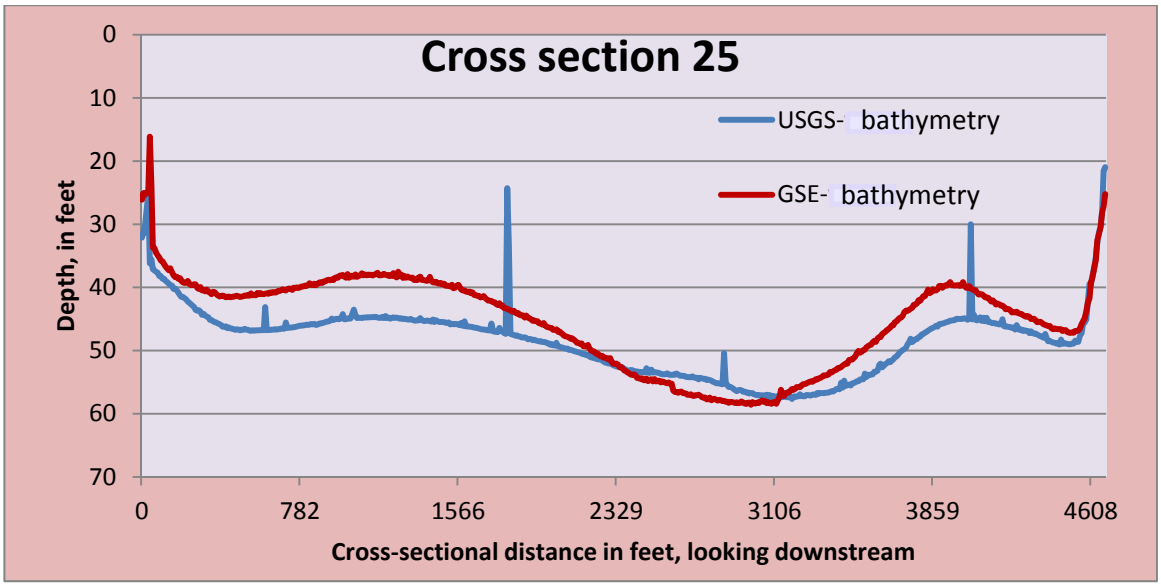

Figure C1. Differences in bathymetry (depth to bottom) comparing a 2008 U.S. Geological Survey (USGS) study (Langland, 2009) and a 2011 URS Corporation and Gomez and Sullivan Engineers (GSE) study (URS Corporation and Gomez and Sullivan Engineers, 2012) for cross section number 25. Red lines above blue lines indicate deposition and red below blue indicate possible scour.

Table C1. Cross-sectional areas and volumes used to estimate the sediment storage capacity (SSC). A blue shaded row indicates change to full depth compared to 2011 depth.
[L; length, W; width, D; depth, ft; feet, ft^2; square feet]

Cross section number	Dimensions			Mean Water Depths and Volumes						Estimated Sediment Storage Capacity (SSC)			
	Length ft	Width ft	L X W ft^2	2008 depth ft	2011 depth ft	2008 area (L X D) ft^2	2011 area (L X D) ft2	2008 volume (acre ft)	2011 volume (acre ft)	SSC	Full depth ft	Full XC area (L X D) ft^2	Full Volume (acre feet)
26	4750	2425	11,518,750	55.5	53.4	263,625	253,650	14,676	14,121	230	48.1	228,4755	12,719
25	4610	1915	8,828,150	49.6	47.3	228,656	218,053	10,052	9,586	200	41.3	190,393	8,370
24	4450	2400	10,680,000	41.7	39.7	185,565	176,665	10,224	9,734	150	33.7	149,965	8,263
23	3520	2175	7,656,000	35.6	34	125,312	119,680	6,257	5,976	110	30.3	110,176	5,325
22	3380	2162	7,307,560	32.1	30.6	108,498	103,428	5,385	5,133	100	29.8	100,724	4,999
21	3350	2085	6,984,750	30.7	29.7	102,845	99,495	4,923	4,762	100	29.7	99,495	4,762
20	3560	2187	7,785,720	29.5	28.1	105,020	99,680	5,273	5,005	100	28.0	100,036	5,022
19	5240	2625	13,755,000	22	21.1	115,280	110,564	6,947	6,663	100	21.1	110,564	6,663
18	5000	2525	12,625,000	21	20.5	105,000	102,500	6,086	5,942	100	20.1	100,500	5,826
17	6180	2550	15,759,000	21	20.8	129,780	128,544	7,597	7,525	110	20.8	128,544	7,525
16	5300	2570	13,621,000	20	19.9	106,000	105,470	6,254	6,223	100	19.9	105,470	6,223
15	5050	2530	12,776,500	21	21	106,050	106,050	6,159	6,159	100	21	106,050	6,159
14	4710	3150	14,836,500	20	20	94,200	94,200	6,812	6,812	98	20	94,200	6,812
13	4700	3175	14,922,500	20	20	94,000	94,000	6,851	6,851	98	20	94,000	6,851
12	6510	3420	22,264,200	16	15.9	104,160	103,509	8,178	8,127	100	15.9	103,509	8,127
11	7600	1900	14,649,000	14	14	106,400	106,400	4,708	4,708	105	14	106,400	4,708
10	6540	1400	9,800,000	15	15	98,100	98,100	3,375	3,375	100	15	98,100	3,375
9	6900	2130	13,930,200	16	15.9	110,400	109,710	5,117	5,085	110	15.9	109,710	5,085
8	6350	2430	16,767,000	14	14.2	88,900	90,170	5,389	5,466	100	14.2	90,170	5,466
7	6810	2775	17,621,250	17	15	115,770	102,150	6,877	6,068	110	16	108,960	6,472
6	6700	2600	17,706,000	15	14.8	100,500	99,160	6,097	6,016	100	14.8	99,160	6,016
SUM	111,210	51,129	271,794,080	526.7	510.8	2,594,061	2,521,178	143,238	139,335	2411	490	2,430,725	134,751
AVERAGE	5,296	2,435	12,942,575	25	24	123,527	120,056	6,821	6,635	115	23.4	116,052	6,433

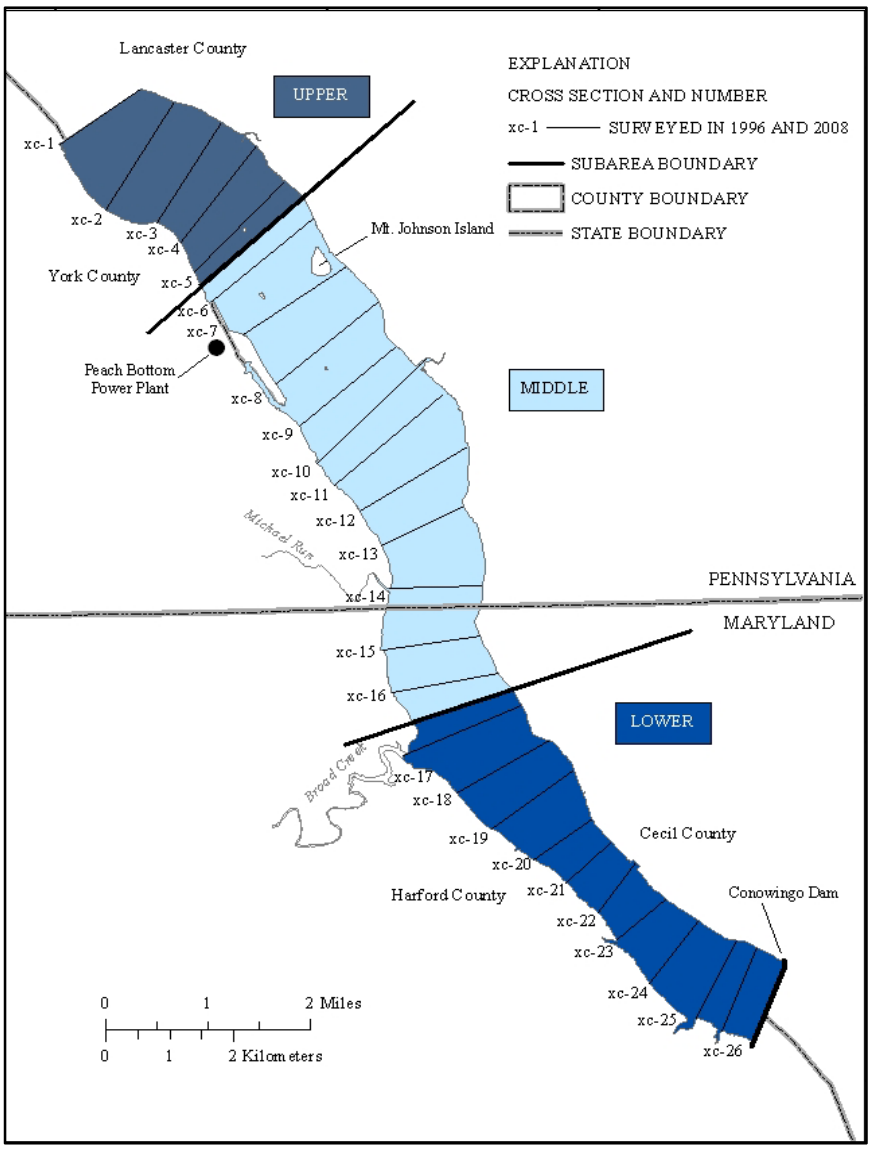

Figure C2. Locations of the surveyed cross sections in relation to the Upper, Middle, and Lower sections of Conowingo Reservoir in 2008 and 2011.

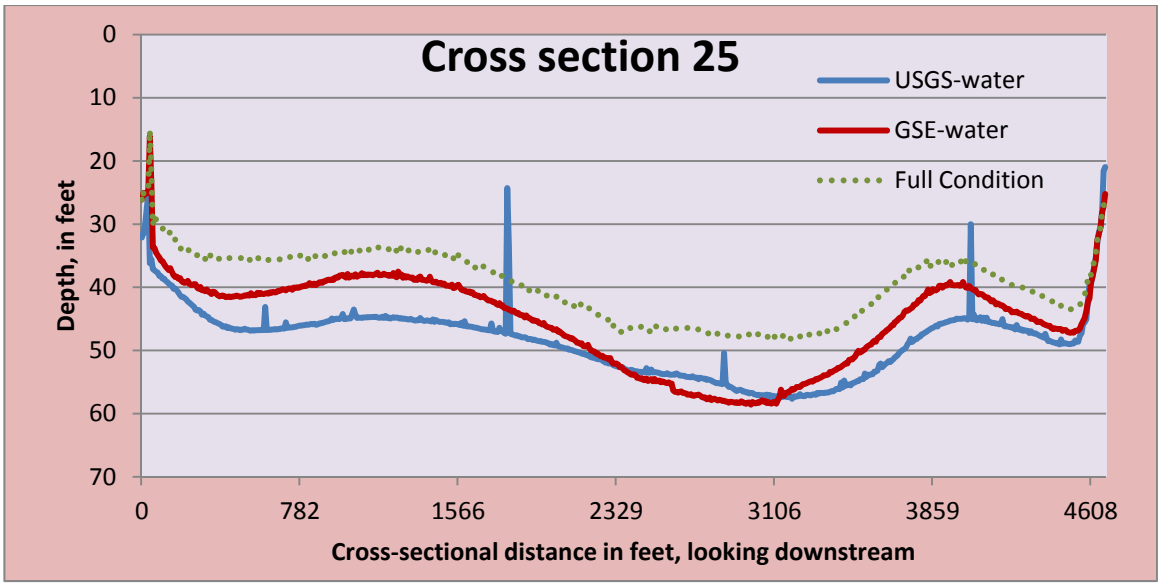

Figure C3. Differences in bathymetry (depth to bottom) comparing a 2008 U.S. Geological Survey (USGS) study (Langland, 2009), a 2011 URS Corporation and Gomez and Sullivan Engineers (GSE) study (URS Corporation and Gomez and Sullivan Engineers, 2012), and the estimated full condition for cross section number 25.

References

URS Corporation and Gomez and Sullivan Engineers. 2012. Sediment introduction and transport study (RSP 3.15) (Appendix F). Kennett Square, PA: Exelon Generation, LLC.

Langland, Michael J., 2009, Bathymetry and sediment-storage capacity change in three reservoirs on the Lower Susquehanna River, 1996-2008: U.S. Geological Survey Scientific Investigations Report 2009-5110, 21 p. (Also available at *http://pubs.usgs.gov/sir/2009/5110/*.)