UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

DEC 3 0 2014

Mr. D. Lee Currey, Director
Science Services Administration
Maryland Department of the Environment
1800 Washington Blvd., Suite 540
Baltimore, Maryland 21230-1718

Dear Lee Currey:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the Total Maximum Daily Load (TMDL) report, *Total Maximum Daily Loads of Polychlorinated Biphenyls in the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments in Cecil County, Maryland*. The TMDL report was submitted by the Maryland Department of the Environment (MDE) to EPA for final review on September 29, 2014, and received on October 6, 2014. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address impairments of water quality as identified in Maryland's Section 303(d) List.

The Elk River Oligohaline Tidal Chesapeake Bay Segment (MD-ELKOH) was included on Maryland's 2012 Integrated Report as impaired for nutrients (1996) and PCBs in fish tissue (2002). The C&D Canal Oligohaline Tidal Chesapeake Bay Segment (MD-C&DOH) was included on Maryland's 2012 Integrated Report as impaired by nutrients (1996), arsenic (1996), cadmium, (1996), silver (1996), and PCBs in fish tissue (2002). Water Quality Analyses of arsenic, cadmium, and silver in the C&D Canal were approved by the EPA in November 2005 (MDE 2005). The Chesapeake Bay TMDL, which was approved by the EPA in December 2010, has addressed the nutrient listing for the Elk River and the C&D Canal. This TMDL addresses only the PCB impairment.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) be designed to attain and maintain the applicable water quality standards; (2) include a total allowable loading and as appropriate, wasteload allocations for point sources and load allocations for nonpoint sources; (3) consider the impacts of background pollutant contributions; (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated); (5) consider seasonal variations; (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality); and (7) be subject to public participation. In addition, these TMDLs considered reasonable assurance that the TMDL allocations assigned to the nonpoint sources can be reasonably met. The enclosure to this letter describes how the PCB TMDLs for the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments satisfy each of these requirements.

As you know, any new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL's wasteload allocation pursuant to 40 CFR §122.44(d)(1)(VII)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please do not hesitate to contact Ms. Helene Drago, TMDL Program Manager, at 215-814-5796.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Melissa Chatham, MDE-SSA
Jay Sakai, MDE-WMA

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Decision Rationale
Total Maximum Daily Loads of Polychlorinated Biphenyls in the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments in Cecil County, Maryland

Jon M. Capacasa, Director
Water Protection Division

Date: 12/29/2014

Decision Rationale
Total Maximum Daily Loads of Polychlorinated Biphenyls in the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments in Cecil County, Maryland

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the State where technology based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a Margin of Safety (MOS) that may be present in a waterbody without exceeding water quality standards.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDLs for total Polychlorinated Biphenyls (tPCB) in the Elk River and C&D Canal watersheds of the Chesapeake Bay Segments. These TMDLs were established to address impairments of water quality, caused by PCBs, as identified in Maryland's 2002 (fish tissue) Section 303(d) List for water quality limited segments. The Maryland Department of the Environment (MDE) submitted the report, *Total Maximum Daily Load of Polychlorinated Biphenyls in the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments in Cecil County, Maryland,* dated July 2014, to EPA for final review on September 29, 2014, and received on October 6, 2014.

EPA's review determined that the TMDLs meet the following seven regulatory requirements pursuant to 40 CFR Part 130:

1. The TMDL is designed to implement applicable water quality standards.
2. The TMDL includes a total allowable load as well as individual wasteload allocations (WLAs) and load allocations (LAs).
3. The TMDL considers the impacts of background pollutant contributions.
4. The TMDL considers critical environmental conditions.
5. The TMDL considers seasonal environmental variations.
6. The TMDL includes a MOS.
7. The TMDL has been subject to public participation.

In addition, these TMDLs considered reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

II. Summary

Since the Elk River and the C&D Canal were identified as impaired for PCBs in fish tissue, the overall objective of the tPCB TMDL is to ensure that the "fishing" designated use, which is protective of human health related to the consumption of fish, in the Elk River and the C&D Canal is supported. The TMDLs specifically allocate the allowable total PCB (tPCB) loading to the Elk River Oligohaline and the C&D Canal Oligohaline Tidal Chesapeake Bay Segments. The annual average TMDLs and maximum daily load (MDL) for tPCBs for the Elk River and C&D Canal Chesapeake Bay Segments are presented in Tables 1 and 2. Individual annual and maximum daily WLAs for permitted point sources are provided in Tables 3 and 4.

Table 1. Summary of tPCB Baseline Loads, TMDL Allocations, Load Reductions and Maximum Daily Loads (MDLs) in the Elk River

PCB Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
Direct Atmospheric Deposition	58.4	17.5%	58.4	0.0%	0.304
Maryland Non-regulated Watershed Runoff[1]	115.2	34.5%	58.0	49.7%	0.302
Big Elk Creek Tributary[2]					
Maryland	33.6	10.1%	16.9	49.7%	0.008
Pennsylvania	67.6	20.2%	34.0	49.7%	0.117
Delaware Upstream Watershed	3.2	1.0%	1.6	50.0%	0.008
Pennsylvania Upstream Watershed	19.8	5.9%	10.0	49.5%	0.052
Contaminated Sites	0.9	0.3%	0.9	0.0%	0.005
Nonpoint Sources/LAs	***298.7***	***89.4%***	***179.8***	***39.8%***	***0.936***
WWTPs	14.5	4.3%	0.9	93.8%	0.008
NPDES Regulated Stormwater[1]	20.9	6.3%	10.5	49.8%	0.055
Point Sources/WLAs	***35.4***	***10.6%***	***11.4***	***67.8%***	***0.063***
MOS (5%)	-	-	***10.1***	-	***0.052***
Total	***334.1***	***100.0%***	***201.3***	***39.7%***	***1.051***

Notes: [1] Load applies to the direct drainage portion of the watershed only.
[2] Although these loads are reported here as a single nonpoint source value, they could include both point and nonpoint source loads.

Table 2. Summary of tPCB Baseline Loads, TMDL Allocations, Load Reductions and MDLs in the C&D Canal

PCB Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
Direct Atmospheric Deposition	4.0	9.1%	4.0	0.0%	0.021
Maryland Non-regulated Watershed Runoff[1]	20.3	46.0%	10.2	49.8%	0.053
Delaware Upstream Watershed[2]	17.6	39.9%	8.9	49.4%	0.046
Nonpoint Sources/LAs	***41.9***	***95.0%***	***23.1***	***44.9%***	***0.120***

PCB Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
WWTPs	0.2	0.5%	0.2	0.0%	0.002
NPDES Regulated Stormwater[1]	2.0	4.5%	1.0	50.0%	0.005
Point Sources/WLAs	***2.2***	***5.0%***	***1.2***	***45.1%***	***0.007***
MOS (5%)	-	-	1.3	-	0.007
Total	**44.1**	**100.0%**	**25.6**	**42.0%**	**0.134**

Notes: [1] Load applies to the direct drainage portion of the watershed only.

[2] Although these loads are reported here as a single nonpoint source value, they could include both point and nonpoint source loads

Table 3. Elkton Wastewater Treatment Plant (WWTP) tPCB WLA, MDL, and Load Reduction

Facility Name	NPDES #	tPCB Water Column Endpoint (ng/L)	Design Flow (MGD)	tPCB Baseline Load (g/year)	tPCB WLA (g/year)	tPCB MDL (g/day)	Load Reduction (%)
Elkton WWTP	MD0020681	0.14	3.2	14.19	0.62	0.005	95.6

Table 4. NPDES Regulated Stormwater tPCB Baseline Loads, WLAs, and MDLs by Watershed

Watershed	tPCB Baseline Load (g/year)	tPCB WLA (g/year)	tPCB MDL (g/day)
Elk River	20.9	10.5	0.055
C&D Canal	2.0	1.0	0.005

Table 5. NPDES Regulated Stormwater Permit Summary for the Elk River and the C&D Canal Watersheds [1]

MDE Permit	NPDES	Facility	City	County	Watershed
05-SF-5501	MDR055501	State Highway Administration (MS4)	State-wide	All Phase II (Cecil)	C&D Canal/Elk River
09-GP-0000	MDR100000	MDE General Permit to Construct	All	All	C&D Canal/Elk River
03-IM-5500	MDR055500	Cecil County Phase II MS4	County-wide	Cecil	C&D Canal/Elk River
03-IM-5500	MDR055500	Town of Elkton Phase II MS4	City-wide	Cecil	Elk River
02-SW-0433	MDR000433	Terumo Medical Corporation	Elkton	Cecil	Elk River
02-SW-0611	MDR000611	W.L. Gore & Associates, Inc. Elk Creek	Elkton	Cecil	Elk River
02-SW-0924	MDR000924	Norton Petroleum Corporation	Elkton	Cecil	Elk River
02-SW-1319	MDR001319	SHA - Elkton Shop	Elkton	Cecil	Elk River
02-SW-2075	MDR002075	Elkton Recycling, Inc.	Elkton	Cecil	Elk River

02SW0402	MDR000402	Elkton WWTP	Elkton	Cecil	Elk River
02SW0678	MDR000678	Luqui-box Corporation	Elkton	Cecil	Elk River
02-SW-1363	MDR001363	Elk Neck State Park	Northeast	Cecil	Elk River

Note: [1] Although not listed in this table, some individual process water permits incorporate stormwater requirements and are accounted for within the NPDES Stormwater WLA, as well as additional Phase II permitted MS4s, such as military bases, hospitals, etc.

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically based strategy that considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a MOS value. The option is always available to refine the TMDL for resubmittal to EPA for approval if environmental conditions, new data, or the understanding of the natural processes change more than what was anticipated by the MOS.

III. Background

The Elk River watershed is located in Cecil County in the Upper Eastern Shore region of the Chesapeake Bay watershed. Watersheds which drain directly into the tidal portion of the Elk River include Little Elk Creek, Lower Elk River, and Upper Elk River. The northernmost portion of the Little Elk Creek watershed extends into Pennsylvania. The easternmost portion of the Upper Elk River watershed extends into Delaware. The Big Elk Creek watershed is located east of the Little Elk Creek with its northern most portion extending into Pennsylvania, flows directly into the non-tidal portion of the Upper Elk River watershed and will therefore be considered a tributary of the Elk River within the framework of this TMDL. The Bohemia River flows into the lower tidal portion of the Elk River for which a PCB TMDL was developed and approved by EPA in 2009. A model segment has been created for the Bohemia River within the water quality model for the Elk River and the C&D Canal to account for exchanges between the Bohemia River and the Elk River. Load reductions assigned in the Elk River and the C&D Canal TMDL will also demonstrate that water quality within the Bohemia River is met, thus supporting the previously approved TMDL.

The C&D Canal is located within the Back Creek watershed in Cecil County in the upper Eastern Shore region of the Chesapeake Bay watershed, with the easternmost portion extending into Delaware. It has been reported that 90% of the flow in the 14-mile long C&D Canal is from the Chesapeake Bay to Delaware Bay (Ward et al. 2009).

According to the USGS 2006 land cover data, land use in both the Elk River watershed and the C&D Canal watershed is predominately forest and agriculture. The land use distribution in the Elk River watershed includes the Big Elk Creek watershed and upstream watersheds in Delaware and Pennsylvania. The land use distribution in the C&D Canal watershed includes the upstream watershed in Delaware. In the Elk River, forest land use occupies approximately 41.7% while 34.1% is agriculture, 15.5% is urban, and 8.7% is water/wetlands. In the C&D Canal, agriculture land use occupies approximately 46% while 23.8% is forest, 19% is urban, and 11.2% is water/wetlands.

Maryland Water Quality Standards specify that all surface waters of the State shall be protected for water contact recreation, fishing, and the protection of aquatic life and wildlife (COMAR 2013a). Additionally, the surface water use designation for Elk River and the C&D Canal watersheds is USE II - *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2013b). Water Quality Analyses of arsenic, cadmium, and silver in the C&D Canal were approved by the EPA in November 2005 (MDE 2005). The Chesapeake Bay TMDL, which was approved by the EPA in December 2010, has addressed the nutrient listing for the Elk River and the C&D Canal.

The Maryland Department of the Environment (MDE) has identified the waters of the Elk River Oligohaline Tidal Chesapeake Bay Segment (*Integrated Report* Assessment Unit ID: MD-ELKOH) on the State's 2012 Integrated Report as impaired for nutrients—nitrogen and phosphorus (1996), and PCBs in fish tissue (2002). MDE has identified the waters of the C&D Canal Oligohaline Tidal Chesapeake Bay Segment (*Integrated Report* Assessment Unit ID: MD-C&DOH) on the State's 2012 Integrated Report as impaired by nutrients—nitrogen and phosphorus (1996), arsenic (1996), cadmium, (1996), silver (1996), and PCBs in fish tissue (2002). Water Quality Analyses of arsenic, cadmium, and silver in the C&D Canal were approved by the EPA in November 2005 (MDE 2005). The Chesapeake Bay TMDL, which was approved by the EPA in December 2010, has addressed the nutrient listing for the Elk River and the C&D Canal.

PCBs do not occur naturally in the environment. Therefore, unless existing or historical anthropogenic sources are present, their natural background levels are expected to be zero. The linkage between the "fishing" designated use and PCB concentrations in the water column is via the uptake and bioaccumulation of PCBs by aquatic organisms. Humans can be exposed to PCBs via consumption of aquatic organisms, which over time have bioaccumulated PCBs.

CWA Section 303(d) and its implementing regulations require that TMDLs be developed for waterbodies identified as impaired by the State where technology based and other required controls do not provide for attainment of water quality standards. The PCB TMDLs submitted by MDE are designed to allow for the attainment of the Elk River and C&D Canal watershed's designated uses, and to ensure that there will be no PCB impacts affecting the attainment of these uses. Refer to Tables 1 and 2 above for a summary of allowable loads.

Since the Elk River and C&D Canal were identified as impaired for PCBs in fish tissue, the overall objective of the tPCB TMDLs established in this document is to ensure that the fishing designated use, which is protective of human health related to the consumption of fish, is supported. However, the TMDLs will also ensure the protection of all other applicable designated uses. This objective was achieved via the use of extensive field observations and a water quality model. The model simulates the tPCB dynamic interactions between the water column and bottom sediments within the Elk River, the C&D Canal, the Chesapeake Bay, and the Maryland/Delaware Boundary of the C&D Canal.

In 1993, 2003, and 2010, monitoring surveys were conducted by MDE to measure water column tPCB concentrations at tidal and non-tidal stations in the Elk River and the C&D Canal. Sediment samples were also collected at tidal stations to characterize tPCB sediment concentrations. MDE collected several composite and individual fish tissue samples for PCB analysis in the Elk River and C&D Canal in 1999, 2000, 2002, 2004, and 2006.

As part of the analysis, both point and nonpoint sources of PCBs have been identified throughout the Elk River and the C&D Canal. Nonpoint sources of PCBs in the Elk River include: 1) tidal influence from the Chesapeake Bay mainstem, 2) direct atmospheric deposition, 3) runoff from non-regulated watershed areas, 4) the Big Elk tributary, upstream watersheds in Pennsylvania and Delaware, 5) exchanges between the Bohemia River and the Elk River, 6) exchanges between the C&D Canal and the Elk River, and 7) contaminated sites. Nonpoint sources of PCBs in the C&D Canal include: 1) tidal influence at the Maryland/Delaware boundary in the C&D Canal, 2) direct atmospheric deposition, 3) runoff from non-regulated watershed areas, 4) exchanges between the C&D Canal and the Elk River, and 5) Delaware upstream watershed. The transport of PCBs from bottom sediments to the water column through resuspension and diffusion can also be a major source of PCBs in the estuarine systems; however under the framework of this TMDL it is not considered a source.

Nonpoint sources include loads from:

Resuspension and Diffusion from Bottom Sediments – The water quality model, applying observed tPCB concentrations in the water column and sediment, predicts a net tPCB transport of 8,282 g/year and 950 g/year from the water column to the bottom sediment in the Elk River and the C&D Canal, respectively. Even if resuspension and diffusion from bottom sediments served as a source of PCBs to the water column, the load contribution is resultant from other point and nonpoint source inputs (both historic and current) and is not considered to be a directly controllable (reducible) source. Therefore, it was not assigned a baseline load or allocation.

Tidal Influence – The water quality model applying the observed tPCB concentrations measured near the mouth of the Lower Elk River, predicts a net tPCB transport of 31,662 g/year from the Bay to the Elk River. Even though tidal influence from the Chesapeake Bay mainstem serves as a source of PCBs to the Elk River, the load contribution is resultant from historic and present point and nonpoint source inputs throughout the Upper Chesapeake Bay watershed, and it is therefore not considered to be a directly controllable (reducible) source. The water quality model applying the observed tPCB concentrations at the boundary between Maryland and Delaware within the C&D Canal, predicts a net tPCB transport of 18,411 g/year from Maryland to Delaware at the State boundary within the C&D Canal. Even if the Delaware portion of the C&D Canal served as a source of PCBs to the Maryland portion through the tidal boundary, the load contribution would be resultant from other point and nonpoint source inputs within the Delaware watershed, and would therefore not be considered a directly controllable (reducible) source. Consequently, tidal influences will not be assigned a baseline load or allocation within the TMDL.

Atmospheric Deposition – There is no recent study of the atmospheric deposition of PCBs to the surface of the Elk River and the C&D Canal. Based on a Chesapeake Bay Program (CBP) 1999 study, the 1.6 $\mu g/m^2$/ year tPCB depositional rate for non-urban areas was used for this TMDL since non-urban land use comprises the majority of the Elk River and the C&D Canal watersheds. In addition, this rate is within the range of measurements from an extensive atmospheric deposition monitoring program conducted in the Delaware River estuary by the Delaware River Basin Commission. Loads were calculated for both, the direct atmospheric deposition to the surface of the waterbodies and for direct deposition to the drainage watershed. The direct atmospheric deposition load to the surface of the surfaces of the Elk River (58.2 g/year) and the C&D Canal (4.0 g/year) was calculated by multiplying the total surface areas of the Elk River (36.4 km^2) and the C&D Canal (2.5 km^2) and the deposition rate of 1.6 $\mu g/m^2$/year. Similarly, the atmospheric deposition load to the embayment's watershed was calculated by multiplying 1.6 $\mu g/m^2$/year by the watershed areas of 277.50 km^2 (MD part of Elk River) and 36.24 km^2 (MD part of C&D Canal) resulting in a load of 444.0 g/year and 58.0 g/year, respectively. Applying the PCB pass-through efficiency estimated by Totten, et al. (2006) of approximately one percent, the atmospheric tPCB load to the Elk River and C&D Canal, from the Maryland part of the direct drainage watershed, is approximately 4.4 g/year and 0.6 g/year, respectively. This load, however, is inherently modeled as part of the non-regulated watershed runoff/NPDES Regulated Stormwater direct drainage loads described below.

Contaminated Sites – Contaminated sites refers to areas with known PCB soil contamination, as documented by state or federal hazardous waste cleanup programs (i.e., state or federal Superfund programs). A total of twelve contaminated sites have been identified within the direct drainage area of the Elk River watershed. No sites have been identified in the C&D Canal watershed. The sites have been identified with PCB soil concentrations at or above method detection levels, as determined via soil sample results contained within MDE Land Management Administration's (LMA) contaminated site survey and investigation records. The median tPCB concentration of the site samples was multiplied by the soil loss rate, which is a function of soil type, pervious area, and land cover, to estimate the tPCB edge of field (EOF) load. A sediment delivery ratio was applied to calculate the final edge-of-stream (EOS) load. The contaminated site tPCB baseline load is estimated to be 0.87 g/year.

Non-Regulated Watershed Runoff – tPCB loads were calculated for samples collected at ten watershed monitoring stations using observed tPCB concentration and daily flow from a USGS gage (USGS 1495000). The relationship between loads and flows was developed via regression analysis for each monitoring station. With this relationship, the tPCB load corresponding to any flow can be estimated. The specific non-regulated watershed runoff tPCB load only corresponds to the direct drainage areas of the Elk River and C&D Canal watersheds. Therefore, the load is based on average daily flow information from a USGS gage within these direct drainage areas only. Additionally, the load specifically corresponds to the non-urbanized areas (i.e., primarily forest and agricultural areas) within the direct drainage portion of the Elk River and the C&D Canal watersheds. The non-regulated watershed runoff tPCB baseline loads were estimated by multiplying the percentage of non-urban land use within the direct drainage portion of the watersheds by the total direct drainage watershed tPCB baseline loads for the Elk River and C&D Canals. The non-regulated watershed runoff tPCB baseline loads for the Elk

River and the C&D Canal watersheds are 115.9 g/year and 20.3 g/year respectively. As five of the contaminated sites (Dwyer Property, Herron Area 3, Herron Area 4, Reginald Thompson Property, and Old Elkton Dump) are located within the non-urbanized area, their total tPCB load (0.66 g/year) is subtracted from the Elk River total load, resulting in a non-regulated watershed runoff tPCB baseline load of 115.2 g/year for the Elk River.

Big Elk Creek Tributary – The Big Elk Creek watershed flows directly into the non-tidal portion of the Upper Elk River watershed and will therefore be considered a tributary of the Elk River within the framework of this TMDL. The baseline tPCB load from Big Elk Creek (101.2 g/year) for the Maryland portion is estimated based on the same methodology used to calculate the non-regulated watershed runoff tPCB baseline load. The loads are presented as single values, representing the total tPCB load at the outlet of the individual basins. However, it could include both point and nonpoint sources, but for the purposes of this analysis, will be treated as a single nonpoint source load. The baseline tPCB load from the Pennsylvania portion of the tributary is estimated based on an average tPCB concentration from data collected at a monitoring station near the state line between Pennsylvania and Maryland and the average flow for this portion of the watershed.

Delaware and Pennsylvania Upstream Watersheds – A portion of the direct drainage area to the Elk River extends into Delaware and Pennsylvania and a portion of the direct drainage area to the C&D Canal extends into Delaware. Upstream watershed loads from these jurisdictions are assigned a baseline load. These loads will be reported as a non-point source, even though it may include both point and non-point sources. The baseline tPCB loads are estimated based on an average tPCB concentration from data collected at monitoring stations near the state lines for Delaware and Pennsylvania and average flows for the upstream watersheds.

Point sources include loads from:

Industrial Process Water Facilities – Industrial process water facilities were identified if they are within the direct drainage area of the applicable watersheds and have the potential to discharge PCBs. The sites were identified using guidance developed by Virginia for monitoring point sources in support of TMDL development. The State has identified specific types of permitted industrial and municipal facilities based on their Standard Industrial Classification (SIC) codes as having the potential to contain PCBs within their process water discharge (VADEQ 2009). The Alliant Techsystems Operations LLC was identified within the Elk River watershed. However, the facility was considered *de minimis*, as the average flow for the facilities was well below 1 Million Gallons per day (MGD). Therefore no baseline load or allocation was assigned within this TMDL.

Municipal Wastewater Plants – Eleven WWTPs have been identified within the direct drainage of the Elk River and the C&D Canal watersheds. Two of the facilities' outfalls, Elkton and Harbour View, were sampled by MDE for PCB analysis. As no tPCB effluent concentration data is available for the remaining facilities, their concentrations were estimated based on the median tPCB effluent concentration from 13 WWTPs monitored by MDE in the Chesapeake Bay watershed (MDE 2006). Their baseline tPCB loadings were calculated based on their daily

monitoring record (DMR) average discharge flows and the estimated median tPCB concentration.

NPDES Regulated Stormwater – MDE estimates pollutant loads from NPDES regulated stormwater areas based on urban land use within a given watershed. The 2006 USGS spatial land cover, which was used to develop CBP's Phase 5.3.2 watershed model land use, was applied in this TMDL to estimate the NPDES Regulated Stormwater tPCB Baseline Load. The Maryland portion of the Elk River and the C&D Canal watersheds are located in Cecil County. The NPDES stormwater permits within the watersheds include: (i) the area covered under Cecil County's Phase II jurisdictional MS4 permit, (ii) the State Highway Administration's Phase II MS4 permit, (iii) the town of Elkton Phase II MS4 permit, (iv) state and federal general Phase II MS4's, (v) industrial facilities permitted for stormwater discharges, and (vi) construction sites).

The NPDES regulated stormwater tPCB baseline loads of the two watersheds (21.1 g/year for the Elk River and 2.0 g/year for the C&D Canal) were estimated by multiplying the percentages of urban land use (11.3 % for the Elk River and 9 % for the C&D Canal) within the direct drainage portion of the watersheds by the total direct drainage watershed tPCB baseline loads. Since two of the identified contaminated sites are located within the urban land use area of the Little Elk Creek watershed, and five of the identified contaminated sites are located within the urban land use area of the Upper Elk River watershed, their total load of 0.21 g/year is subtracted from the NPDES Regulated Stormwater tPCB baseline load, resulting in a final NPDES Regulated Stormwater tPCB baseline load of 20.9 g/year for the Elk River watershed.

A tidally averaged multi-segment one-dimensional transport model was applied to simulate the tPCB dynamic interactions between the water column and bottom sediments within the Elk River, the C&D Canal, the Chesapeake Bay, and the Maryland/Delaware Boundary of the C&D Canal. The system was divided into 20 segments and the watershed into 20 subwatersheds. To determine what percent reduction of the total load is necessary for both the Elk River and the C&D Canal to meet their respective water quality and sediment TMDL endpoints, different scenario runs were conducted with various open boundary conditions. It was demonstrated that a minimum reduction of 43% is required to the baseline load in order to achieve the TMDL when the Bay boundary water column concentration is set at the TMDL endpoint of 0.14 ng/L. The simulation results indicate for the Elk River, with a reduction ranging from 49.5% and 50.0% for all watershed sources including those of Delaware and Pennsylvania, it will take approximately 43 years to meet the TMDL endpoints and thus be supportive of its designated use. The simulation results indicate for the C&D Canal, with a reduction ranging from 49.4% and 50.0% for all watershed sources including those in Delaware, it will take approximately 40 years to meet the TMDL endpoints and thus be supportive of its designated use.

IV. Discussion of Regulatory Conditions

EPA finds that MDE has provided sufficient information to meet all of the seven basic requirements for establishing a PCB TMDL for the Elk River and the C&D Canal watersheds. Additionally, MDE provided reasonable assurance that the TMDLs can be met. EPA's approval

is outlined according to the regulatory requirements listed below.

1) The TMDLs are designed to implement applicable water quality standards.

Water Quality Standards consist of three components: designated and existing uses; narrative and/or numerical water quality criteria necessary to support those uses; and an anti-degradation statement. Maryland Water Quality Standards specify that all surface waters of the State shall be protected for water contact recreation, fishing, and the protection of aquatic life (COMAR Title 26 Subtitle 08, Chapter 2). Additionally, the surface water use designation for Elk River and the C&D Canal watersheds is USE II - *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting*. Within the Big Elk Creek watershed, an upstream tributary of the Elk River, there are currently two stream segments identified as Tier II waters, Gramies Run and Big Elk Creek. These streams require the implementation of Maryland's anti-degradation policy to ensure protection of water quality (COMAR, 2011b; MDE 2010).

The State of Maryland has adopted three separate water column tPCB criteria: a criterion for the protection of human health associated with the consumption of PCB contaminated fish, as well as fresh water (14ng/L) and salt water (30ng/L) chronic tPCB criteria for the protection of aquatic life. As the Elk River and C&D Canals are tidal systems, the saltwater aquatic chronic criterion is applied for assessing these waters. The Maryland human health tPCB criterion is set at 0.64 ng/L, ppt. The mean water column tPCB concentration for tidal samples in the Elk River and the C&D Canal exceed the human health criteria of 0.64 ng/L; however, none of the tidal water column samples in the Elk River and the C&D Canal exceed the salt water chronic aquatic life tPCB criterion of 30 ng/L.

In addition to the water column criteria, fish tissue monitoring data can serve as an indicator of PCB water quality conditions. The Maryland fish tissue monitoring data is used to issue fish consumption advisories/recommendations and determine whether Maryland waterbodies are meeting the "fishing" designated use. Currently Maryland applies a tPCB fish tissue listing threshold of 39ng/g. When tPCB fish tissue concentrations exceed this threshold, the waterbody is listed as impaired for PCBs in fish tissue in Maryland's Integrated Report as it is not supportive of the "fishing" designated use. The tPCB concentrations for all fish tissue samples (several species of fish including American eel, brown bullhead, channel catfish, largemouth bass, striped bass, white perch and yellow perch were collected) exceed the listing threshold, demonstrating that a PCB impairment exists within the listed waters.

Since the overall objective of the tPCB TMDLs for the Elk River and the C&D Canal, is to ensure the support of the "fishing" designated use, the tPCB fish tissue listing threshold (39 ng/g) was translated into an associated water column tPCB threshold concentration to apply within this analysis as the water column TMDL endpoint. This was accomplished using the Adjusted Total Bioaccumulation Factor (Adj-tBAF) of 280,520 L/kg for the Elk River and 276,678 L/kg for the C&D Canal. A total Bioaccumulation Factor (tBAF) is calculated per fish species, and subsequently the tBAFs are normalized by the median species lipid content and median dissolved tPCB water column concentration in the species home range to produce the Adj-tBAF per species. The most environmentally conservative of the Adj-tBAFs is then selected

to calculate the water column TMDL endpoint tPCB concentration. This final water column tPCB concentration was subsequently compared to the water column tPCB criteria concentrations, to ensure that all applicable criteria would be attained. Based on this analysis, the water column tPCB concentration and TMDL endpoint of 0.14 ng/L for the Elk River and the C&D Canal derived from the tPCB fish tissue listing threshold, is more stringent than both the human health water column tPCB criterion of 0.64 ng/L and the saltwater aquatic life chronic tPCB criterion of 30 ng/L.

Similarly, the tPCB fish tissue listing threshold was also translated into an associated tPCB sediment concentration to provide a sediment TMDL endpoint that is protective of the "fishing" designated use within the Elk River and the C&D Canal. For the Elk River, using an Adjusted Sediment Bioaccumulation Factor of 33.9 resulted in a sediment tPCB concentration of 1.15ng/g. For the C&D Canal, using an Adjusted Sediment Bioaccumulation Factor of 41.8 resulted in a sediment tPCB concentration of 0.93 ng/g.

EPA believes these are reasonable and appropriate water quality goals.

2) *The TMDLs include a total allowable load as well as individual wasteload allocations and load allocations.*

Total Allowable Load

EPA regulations at 40 CFR §130.2(i) state *that the total allowable load shall be the sum of individual WLAs for point sources, LAs for nonpoint sources, and natural background concentrations*. The TMDLs for tPCBs for Elk River and the C&D Canal Chesapeake Bay Segment watersheds are consistent with 40 CFR §130.2(i), because the total loads provided by MDE equal the sum of the individual WLAs for point sources and the land-based LAs for nonpoint sources.

The allowable load was determined by first estimating a baseline load calculated from model-estimated tPCB loads from point and nonpoint sources using monitoring data. The water quality model developed for simulating ambient sediment and water column tPCB concentrations within the Elk River and C&D Canal was used to determine the specific load reductions for each reducible source category that would result in simulated tPCB concentrations in the sediment and water column that meet the TMDL endpoints. The allowable load was calculated as 201.3 and 25.6 g/year for the Elk River and C&D Canal, respectively.

This load is considered the maximum allowable load the watershed can assimilate and still attain water quality standards. The allowable load was reported in units of grams/year for the average annual load and in grams/day for the long term daily load. Expressing TMDLs using these units is consistent with Federal regulations at 40 CFR §130.2(i), which states that *TMDLs can be expressed in terms of either mass per time, or other appropriate measure*. The average annual and maximum daily tPCB TMDLs are presented in Tables 1 and 2.

Load Allocations

The TMDL summary in Tables 1 and 2 contain the LAs for the Elk River and C&D Canal. According to Federal regulations at 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loadings should be distinguished.

The model results show that in order to meet the "fishing" designated use in the Elk River and C&D Canal, a tPCB load reduction ranging between 49.4% and 50.0% from these sources is required to achieve the TMDL. Given that the contaminated site baseline load constitutes a relatively small percentage of the Total Baseline Load (0.3%) and that a number of contaminated sites have already undergone some degree of remediation, these sites were not subjected to any reductions. A reduction to atmospheric deposition is also not applied in the Elk River and the C&D Canal. Loads associated with resuspension and diffusion from bottom sediments, tidal influences from the Chesapeake Bay mainstem and the Maryland/Delaware boundary in the C&D Canal are not considered to be directly controllable within the framework and the TMDL and are thus not assigned baseline loads or allocations. Exchanges between the Elk River and the C&D Canal are accounted for internally within the modeling framework and thus not assigned a baseline load or allocation. In addition, the load associated with exchanges between the Bohemia River and the Elk River was defined by a previously approved PCB TMDL, and is thus not assigned a baseline load or allocation in the TMDL. Also, the tidal influence from the Chesapeake Bay mainstem is neither a current source of PCBs to the embayment under current conditions, nor is it deemed to be directly controllable within the framework of the TMDL. Therefore, this source will also not be assigned an allocation or a required reduction.

Wasteload Allocations

Point sources of PCBs in the Elk River and the C&D Canal watersheds include eleven WWTPs, one industrial process water discharger, and stormwater discharges regulated under Phase II of the NPDES stormwater program.

The only WWTP that requires a reduction in order to achieve the TMDL is the Elkton WWTP, which has a tPCB baseline load of 14.19 g/year. Its WLA is calculated by multiplying the water column TMDL endpoint tPCB concentration of 0.14 ng/L by its design flow of 3.2 MGD, resulting in a WLA of 0.62 g/year. The elevated tPCB concentration in wastewater are believed to be primarily due to external sources (e.g., source water, atmospheric deposition, and stormwater runoff) infiltrating into the wastewater collection system through broken sewer lines and connections.

No baseline load or WLA was assigned for the industrial process water facilities, because the only facility identified within the watershed was considered *de minimis* under the analysis, as its average flow was below 1 MGD.

The NPDES Regulated Stormwater WLAs were established by reducing the NPDES

regulated stormwater baseline loads proportionally to the non-regulated watershed runoff baseline loads, after the WLAs for the remaining source sectors were set, until the TMDL was achieved. The NPDES regulated stormwater WLAs are 10.5 and 1.0 g/year for the Elk River and C&D Canal, respectively. This corresponds to a 49.8% and 50.0% reduction for the Elk River and the C&D Canal, respectively

Federal regulations at 40 CFR §122.44(d)(1)(vii)(B) require that, for an NPDES permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the State and approved by EPA. There is no express or implied statutory requirement that effluent limitations in NPDES permits necessarily be expressed in daily terms. The CWA definition of "effluent limitation" is quite broad (effluent limitation is "any restriction on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources ...)." See CWA 502(11). Unlike the CWA's definition of TMDL, the CWA definition of "effluent limitation" does not contain a "daily" temporal restriction. NPDES permit regulations do not require that effluent limits in permits be expressed as maximum daily limits or even as numeric limitations in all circumstances, and such discretion exists regardless of the time increment chosen to express the TMDL. For further guidance, refer to Benjamin H. Grumbles memo (November 15, 2006) titled *Establishing TMDL Daily Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al., No. 05-5015 (April 25, 2006) and implications for NPDES Permits.*

EPA has authority to object to the issuance of an NPDES permit that is inconsistent with WLAs established for that point source. It is also expected that MDE will require periodic monitoring of the point source(s) through the NPDES permit process, in order to monitor and determine compliance with the TMDL's WLAs. Based on the foregoing, EPA has determined that the TMDLs are consistent with the regulations and requirements of 40 CFR Part 130.

3. The TMDLs consider the impacts of background pollutant contributions.

PCBs do not occur naturally in the environment. Therefore, unless existing or historical anthropogenic sources are present, their natural background levels are expected to be zero. The TMDLs consider the impact of background pollutants by considering land uses within the direct drainage portions of the Elk River and C&D Canal watersheds.

4. The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR § 130.7(c)(1) require TMDLs to account for critical conditions for stream flow, loading, and water quality parameters. The intent of the regulations is to ensure that: (1) the TMDLs are protective of human health, and (2) the water quality of the waterbodies is protected during the times when they are most vulnerable. Critical condition are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[1]. Critical conditions are a combination of environmental factor (e.g. flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical

condition in the waterbody, an attempt is made to use a reasonable worst-case scenario condition.

The TMDLs are protective of human health at all times; thus it implicitly accounts for seasonal variations as well as critical conditions. Bioaccumulation of PCBs in fish is driven by long-term exposure through respiration, dermal contact, and consumption of lower order trophic level organisms. The critical condition defined by acute exposure to temporary fluctuations in PCB water column concentrations during storm events is not a significant pathway for uptake of PCBs. Since PCB levels in fish tissue become elevated due to long-term exposure, it has been determined that the selection of the annual average tPCB water column and sediment concentrations for comparison to the endpoints applied within the TMDL, adequately considers the impact of critical conditions on the "fishing" designate use in the area.

5) The TMDLs consider seasonal environmental variations.

The TMDLs are protective of human health at all times; thus it implicitly accounts for seasonal variations. In the Elk River and C&D Canal, monitoring of PCBs was conducted on a quarterly basis to account for seasonal variation in establishing the baseline condition for ambient water quality and estimation of watershed loadings. Since PCB levels in fish tissue become elevated due to long-term exposure, it has been determined that the selection of the annual average tPCB water column and sediment concentrations for comparison to the endpoints applied within the TMDL, adequately considers the impact of seasonal variations on the "fishing" designate use in the Elk River and C&D Canal watersheds.

6) The TMDLs include a Margin of Safety.

The requirement for a MOS is intended to add a level of conservatism to the modeling process in order to account for uncertainty. Based on EPA guidance, the MOS can be achieved through two approaches. One approach is to reserve a portion of the loading capacity as a separate term, and the other approach is to incorporate the MOS as part of the design conditions.

Uncertainty within the model framework included the estimated rate of decline in tPCB concentrations within the Chesapeake Bay mainstem and at the Maryland/Delaware boundary in the C&D Canal, as well as the initial condition of mean tPCB concentrations that was selected for the model. In order to account for these uncertainties, MDE applied an explicit MOS of 5%.

7) The TMDLs have been subject to public participation.

MDE provided an opportunity for public review and comment on the PCB TMDLs for the Elk River and C&D Canal watersheds. The public review and comment period was open from July 17, 2014 through August 15, 2014. Copies of the draft documents were placed in the Cecil County Public Library – Elkton Central Library and on the internet. MDE received one set of written comments. All the comments were satisfactorily addressed by MDE.

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[1] EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

V. Discussion of Reasonable Assurance

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR §122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the State and approved by EPA. Furthermore, EPA has the authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

The TMDLs presented in this report call for reductions in PCB loads from diffuse sources present throughout the Elk River and C&D Canal watersheds. A portion of the direct drainage areas to the Elk River and C&D Canal fall within the upstream watershed of Delaware and Pennsylvania. In future implementation a multi-stage cooperative effort may be necessary in order to achieve the reductions established by this TMDL. Since PCBs are no longer manufactured and their use has been substantially restricted, it is reasonable to expect that with time PCB concentration in the aquatic environment will decline. As previously applied in other PCB TMDLs developed by Maryland in the Chesapeake Bay region, it is assumed that water column tPCB concentrations decrease at a rate of 6.5% per year at the tidal boundary of the Elk River with the Chesapeake Bay mainstem. For the other open boundary, the model adopts the water column tPCB concentration declining rate in the C&D Canal of 4% per year. Given this rate of decline, the tPCB levels in the Elk River and the C&D Canal are expected to decline over time due to natural attenuation, such as the burial of contaminated sediments with newer, cleaner materials and through biodegradation.

One alternative for reducing the tPCB concentrations in the water column that MDE may consider is removal of PCB-contaminated systems (i.e., dredging – specifically, additional dredging outside of that which is already currently conducted for the navigational channels). However, dredging is the least desirable alternative because of its potential biological destruction.

PCBs are still being released to the environment via accidental fires, leaks, disposal of PCB containing products, etc. Therefore, an adaptive approach of implementation is anticipated, with subsequent monitoring to assess the effectiveness of the ongoing implementation efforts to manage potential risks to both recreational and subsistence fish consumers.

A collaborative approach involving MDE and the identified NPDES permit holders as well as those responsible for nonpoint PCB runoff throughout the Elk River and the C&D Canal watersheds will be used to work toward attaining the WLAs and LAs presented in this report. The reductions will be implemented in an adaptive and iterative process that will: (1) identify specific sources, or areas of PCB contamination, within the embayment's watershed, and (2) target remedial action to those sources with the largest impact on water quality, while giving consideration to the relative cost and ease of implementation. The implementation efforts will be periodically evaluated, and if necessary, improved, in order to further progress toward achieving the water quality goals.

Under certain conditions, EPA's NPDES regulations allow the use of non-numeric, Best Management Practices (BMP) water quality based effluent limits (WQBELs). BMP WQBELs can be used where "numeric effluent limitations are infeasible; or the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA (CFR 2011c)." For example, impervious surface restoration efforts have been known to result in total suspended solids (TSS) reduction efficiencies. Since PCBs are known to adsorb to sediments and their concentrations correlate with TSS concentrations, any significant restoration requirements, which will lead to a reduction in sediment loads entering the Elk River and C&D Canal, will also contribute toward PCB load reductions and meeting PCB water quality goals. Other BMPs that focus on PCB source tracking and elimination at the source rather than end-of-pipe controls are also warranted.

Where necessary, the source characterization efforts will be followed with pollution minimization and reduction measures that will include BMPs for reducing runoff from urban areas, identification and termination of ongoing sources (e.g., industrial uses of equipment that contain PCBs), etc. The identified NPDES regulated WWTP and stormwater control agency permits will be expected to be consistent with the WLAs presented in this report. Numerous stormwater dischargers are located in the Elk River and the C&D Canal watersheds including a Municipal Phase II MS4, the SHA Phase II MS4, a city Phase II, industrial facilities, State and Federal Phase II MS4s, and any construction activities on areas greater than one acre.

Since a number of contaminated sites have already undergone some degree of remediation and their baseline loads constitute a relatively small percentage of the total baseline loads in the Elk River, these sites are not intended to be targeted during the initial stages of implementation and thus at this point were not subjected to any reductions. However, if in the future it becomes clear that the TMDL goals cannot be achieved without load reductions from these sites, additional reduction measures might need to be considered.

Given the persistent nature of PCBs, the difficulty in removing them from the environment, and the significant reductions necessary in order to achieve water quality goals in the Elk River and the C&D Canal, effectiveness of the implementation effort will need to be reevaluated throughout the process to ensure progress is being made toward reaching the TMDLs. MDE also periodically monitors and evaluates concentrations of contaminants in recreationally caught fish, shellfish, and crabs throughout Maryland. MDE will use these monitoring programs to evaluate progress towards meeting the "fishing" designated use.

For more details about Reasonable Assurance for this TMDL refer to Section 6.0 of the TMDL report.