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

JAN 08 2016

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

Dear Mr. Currey:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the report, *Total Maximum Daily Loads of Polychlorinated Biphenyls in the West River and Rhode River, Mesohaline Segments, Anne Arundel County, Maryland* (the "TMDL Report"). The TMDL Report was submitted by the Maryland Department of the Environment (MDE) to EPA for final review on September 15, 2014, and received on September 22, 2014. The Total Maximum Daily Load (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 Maryland Department of the Environment (MDE) has identified the waters of the West River and Rhode River Mesohaline Chesapeake Bay Segments (Integrated Report Assessment Unit ID: MD-WST-RHMH-02131004) on the State's Integrated Report as impaired by Polychlorinated Biphenyls (PCBs) in fish tissue (2006). The TMDL established by MDE will address the total PCB (tPCB) listing for the waters of the West and Rhode Rivers Mesohaline Chesapeake Bay Segments.

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, this TMDL considered reasonable assurance that the allocations assigned to the point and nonpoint sources can be reasonably met. The enclosure to this letter describes how the tPCB TMDL for the West

River and Rhode River Mesohaline Chesapeake Bay Segments watershed satisfies 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, at 215-814-5796.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Melissa Chatham, MDE-SSA
Lynn Y. Buhl, MDE-WMA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Decision Rationale
Total Maximum Daily Loads of Polychlorinated Biphenyls in the West River and Rhode River, Mesohaline Segments, Anne Arundel County, Maryland

Jon M. Capacasa, Director
Water Protection Division

Date: JAN 08 2016

Decision Rationale
Total Maximum Daily Loads of Polychlorinated Biphenyls in the West River and Rhode River, Mesohaline Segments, Anne Arundel 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 (WQS). 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 discharged to 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 (PCB) in the West River and Rhode Rivers Mesohaline Chesapeake Bay Segments (will be referred from this point on as "West and Rhode Rivers"). The TMDL was established to address impairments of water quality, caused by PCBs in fish tissue as identified in Maryland's 2006 Section 303(d) List for water quality limited segments. The Maryland Department of the Environment (MDE) submitted the report, *Total Maximum Daily Loads of Polychlorinated Biphenyls in the West River and Rhode River, Mesohaline Segments, Anne Arundel County, Maryland,* dated July 2014, to EPA for final review September 15, 2014, and received on September 22, 2014.

EPA's rationale is based on the TMDL report and information contained in the computer files provided to EPA by MDE. 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

The TMDL specifically allocates the allowable total PCB (tPCB) loading to the West River and Rhode Rivers watershed. There are 5 permitted point sources of PCB included in the WLA. The fact that the TMDL does not assign WLAs to any other sources in the watershed should not be construed as a determination by either EPA or MDE that there are no additional sources in the watershed that are subject to the National Pollutant Discharge Elimination System (NPDES) program. In addition, the fact that EPA is approving this TMDL does not mean that EPA has determined whether some of the sources discussed in the TMDL, under appropriate conditions, might be subject to the NPDES program. The annual average TMDLs and maximum daily load (MDL) for tPCBs for the West River and Rhode Rivers are presented in Table 1. An aggregate WLA has been provided for NPDES regulated stormwater which are listed in Table 2.

Table 1: Summary of Baseline tPCB Baseline Loads, TMDL Allocations, Load Reductions, and Maximum Daily Loads (MDLs) in the West and Rhode Rivers Watershed

Source	Baseline Load (g/year)	Baseline Percentage (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
Chesapeake Bay Mainstem Influence	1,081.5	96.83	456.5	57.8	2.009
Direct Atmospheric Deposition	22.6	2.03	22.6	0	0.099
Non-regulated Watershed Runoff	11.0	0.99	11.0	0	0.048
Nonpoint Sources	***1,115.2***	***99.85***	***490.1***	***56.1***	***2.156***
Anne Arundel County–Mayo Water Reclamation WWTP	0.2	0.01	0.2	0	0.001
NPDES Regulated Stormwater Aggregate (see Table 2)	1.6	0.14	1.6	0	0.007
Point Sources	***1.7***	***0.15***	***1.7***	***0***	***0.008***
MOS (5%)	-	-	***25.9***	-	***0.114***
Total	**1,116.9**	**100.00**	**517.7**	**53.6**	**2.279**

Table 2. Summary NPDES Regulated Stormwater Permit Summary for the West and Rhode Rivers Watershed[1]

MDE Permit	NPDES	Facility	City	County
05-SF-5501	MDR055501	State Highway Administration (MS4)	State-wide	All Phase I (Anne Arundel)
09-GP-0000	MDR100000	MDE General Permit to Construct	All	All
04-DP-3316	MD0068306	Anne Arundel Phase I MS4	County-wide	Anne Arundel
02-SW-1744	MDR001744	Anne Arundel County-Mayo Water Reclamation Facility	Edgewater	Anne Arundel

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 West and Rhode Rivers are located in Anne Arundel County, Maryland, on the Western Shore of the Chesapeake Bay. The West River is approximately 4 miles in length, with a watershed area of approximately 19,865 acres (80 square kilometers). Rhode River, one major tributary with a length about 4 miles, connects to the mouth of West River. The tidal range is 1.11 feet (0.34 meters) based on the United States National Oceanic and Atmospheric Administration tidal station in Kent Point, MD.

According to the United States Geological Survey's (USGS) 2006 land cover data (USGS 2013), which was specifically developed to be applied within the Chesapeake Bay Program's (CBP) Phase 5.3.2 watershed model, land use in the West River watershed (including the Rhode River) is a mixture of forest, urban, and agriculture. Forest occupies approximately 32.2% of the watershed, while 35.3% is water/wetland, 12.4% is urban, and 20.1% is agriculture.

The designated use of the tidal portion of the West River 8-digit basin which includes the Rhode River watershed (Basin Code: 02131004) is Use II – *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2013b). The Maryland Department of the Environment (MDE) has identified the tidal portion of the West River 8-digit basin which includes the Rhode River watershed (Integrated Report Assessment Unit ID: MD-WST-RHDMH-02131004) on the State's 2012 Integrated Report as impaired by PCBs in fish tissue (2006). The Maryland Department of the Environment (MDE) has identified the waters of the West River Mesohaline Chesapeake Bay Segment (Integrated Report Assessment Unit ID: MD-WSTMH) on the State's 2012 Integrated Report as impaired by nutrients (nitrogen & phosphorus) (1996 & 2012), total suspended solids (1996), and fecal coliform (1996). MDE has identified the waters of the Rhode River Mesohaline Chesapeake Bay Segment (Integrated Report Assessment Unit ID: MD-RHDMH) on the State's 2012 Integrated Report as impaired by nutrients (nitrogen & phosphorus) (1996 & 2012), fecal coliform (1996). MDE has identified the watershed of the West River (Integrated Report Assessment Unit ID: MD-02131004) on the State's 2012 Integrated Report as impaired by total suspended solids (2012) and sulfates (2012). The Fecal coliform TMDLs for the restricted areas in the West River watershed were approved by the EPA in 2006. The Chesapeake Bay nutrient and sediment TMDLs, which was approved by the EPA in December 2010, has addressed the nutrient and sediment impairment listing for the West and Rhode Rivers Mesohaline Chesapeake Bay Segments. The TMDL established herein by MDE will address the total PCB (tPCB) listing for the waters of the West and Rhode Rivers Mesohaline Chesapeake Bay Segments. The total suspended solid and sulfates impairment listing for the 1st- through 4th-order streams in the West River 8-digit watershed (MDE 2012) will be addressed at a future date.

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 West and Rhode Rivers Tidal Chesapeake Bay Segment watershed's designated uses, and to ensure that there will be no PCB impacts affecting the attainment of these uses. Refer to Table 1 above for a summary of allowable loads.

Since the West and Rhode Rivers were identified as impaired for PCBs in fish tissue, the overall objective of the tPCB TMDL established in this document is to ensure that the "fishing" designated use, which is protective of human health related to the consumption of fish, in the river is supported. However, this TMDL will also ensure the protection of all other applicable designated uses within the river. This objective was achieved via the use of extensive field observations and a one-segment Tidal Prism Model. The model incorporates the long term influences of freshwater discharge, dispersion, and exchanges between the water column and bottom sediments, thereby representing the dynamic transport within the West and Rhode Rivers.

MDE collected fish tissue samples for PCB analysis in the West and Rhode Rivers and their watershed in 2002, 2003, 2011, and 2012. The tPCB concentrations in all 4 fish tissue composite samples collected in 2002 and 2003 exceed the listing threshold; 3 out of 7 fish tissue composite samples collected in 2011 and 2012 (common carp and white perch) exceed the listing threshold, demonstrating that a PCB impairment exists within the West and Rhode Rivers. In 2011 and 2012, monitoring surveys were conducted by MDE to measure water column tPCB concentrations at tidal and non-tidal monitoring stations throughout the West and Rhode Rivers and their watershed. The non-tidal tPCB water column concentration data is required to characterize loadings from the watershed. Sediment samples were collected at tidal stations in 2011 to characterize tPCB sediment concentrations.

Both point and nonpoint sources of PCBs have been identified throughout the West and Rhode Rivers watershed. 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 387 g/year from the water column to the bottom sediment in the West and Rhode Rivers under baseline condition. 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 would not be assigned a baseline load or allocation.

Chesapeake Bay Mainstem Tidal Influence – The West River embayment is highly influenced by tidal exchange of PCBs from the Chesapeake Bay mainstem. The tidal prism model, using observed tPCB concentrations measured at the mouth of the West and Rhode Rivers and within the West and Rhode Rivers embayment, predicts a gross tPCB input of 1,082 g/year from the bay to the river and a gross tPCB output of 1,232 g/year from the river to the bay. These loads result in a net tPCB transport of 150 g/year from the river to the bay. However, with the attenuation of tPCB concentration in the Chesapeake Bay mainstem, this net transport of PCBs from the River to the Bay could shift in the future.

Atmospheric Deposition – There is no recent study of the atmospheric deposition of PCBs to the surface West and Rhode Rivers. CBP's Atmospheric Deposition Study (US EPA 1999) estimated a net deposition of 16.3 micrograms/square meter/year (μg/m^2/year) of tPCBs for urban areas and a net deposition of 1.6 μg/m^2/year of tPCBs for regional (non – urban) areas. In the Delaware River estuary, an extensive atmospheric deposition monitoring program conducted by the Delaware River Basin Commission (DRBC) found PCB deposition rates ranging from 1.3 (non – urban) to 17.5 (urban) μg/m^2/year of tPCBs (DRBC 2003). Since urban land use comprises less than one fifth of the West and Rhode Rivers watershed (12%), the 1.6 μg/m^2/year tPCB depositional rate for non-urban areas resultant from CBP's 1999 study is appropriate for the West and Rhode Rivers. Therefore, this value was used in the development of this TMDL. The direct atmospheric deposition load to the surface of the river of 22.6 g/year was calculated by multiplying the surface area of the river (14.2 km^2) and the deposition rate of 1.6 μg/m^2/year.

The atmospheric deposition load to the direct watershed can be calculated by multiplying 1.6 μg/m^2/year by the watershed area of 66.2 km^2, and by applying a PCB pass-through efficiency estimated by Totten et al. (2006). However, this load is accounted for within the loading from the watershed and is inherently modeled as part of the non-regulated watershed runoff and the National Pollutant Discharge Elimination System (NPDES) Regulated Stormwater loads described below.

Non-Regulated Watershed Runoff – The non-regulated watershed runoff tPCB load corresponds to the non – urbanized areas (*i.e.*, primarily forest, agricultural and wetland areas) of the watershed. MDE collected water column samples for PCB analysis at 5 non-tidal monitoring stations in West and Rhode Rivers. To calculate the watershed flow, the daily flow rates from January 1, 2004 to December 31, 2013 at the nearest United States Geological Survey (USGS) station located at Patuxent River near Bowie (USGS 01594440) were obtained and the mean flows were calculated. The flow from West and Rhode Rivers watershed (29.3 cubic feet per second) was calculated by dividing its closest USGS station mean flow (399 cubic feet per second) by the USGS drainage area (901 km^2), and multiplying this quotient by the watershed area (66.3 km^2). The West and Rhode Rivers watershed baseline tPCB loading (12.6 g/year) was calculated by multiplying its average flow and mean measured tPCB concentration (0.481 ng/L). The mean measured tPCB concentration is the average of all the concentration data at the 5 watershed stations. As mentioned above, about 1.1 g/year of the West and Rhode Rivers watershed's baseline load is attributed to atmospheric deposition to the land surface of the direct drainage, and is inherently captured within the total watershed tPCB baseline load of 12.6 g/year. The non-regulated watershed runoff tPCB baseline load (11.0 g/year) was estimated by multiplying the percentage of non – urban land use (87.6 %) within the watershed by the total watershed baseline load (12.6 g/year).

Point sources include loads from:

Industrial Process Water Facilities – Industrial process water facilities are included in

Maryland's PCB TMDL analyses if they are located within the applicable watershed, and if they have the potential to discharge PCBs. Four industrial discharges were identified within the West and Rhode Rivers watershed; one "non-construction dewatering discharge," two marinas, and one aquaculture facility. These four facilities have no potential to discharge PCBs, therefore, there is no PCB load from these four industrial facilities.

Wastewater Treatment Plant – There is a one waste water treatment plant (WWTP) in the West and Rhode Rivers watershed: Anne Arundel County Mayo Water Reclamation Facility WWTP. No tPCB effluent concentration data is available for this facility, so the concentration was estimated based on the median tPCB effluent concentration from 13 WWTPs monitored by MDE in the Chesapeake Bay watershed (MDE 2006). The baseline tPCB loadings from this facility was calculated based on the discharge monitoring record (DMR) average discharge flows and the estimated median tPCB concentration. Table 3 provides information on the data used in calculating the baseline loads.

Table 3: Summary of Municipal WWTP tPCB Baseline Loads

Facility Name	NPDES #	Average Concentration (ng/L)	Average Flow (MGD)	tPCB Baseline Load (g/year)
Anne Arundel County–Mayo Water Reclamation WWTP	MD0061794	0.906	0.493	0.163

NPDES Regulated Stormwater – MDE estimates pollutant loads from NPDES regulated stormwater areas based on urban land use classification 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 West and Rhode Rivers watershed is entirely located within Anne Arundel County, Maryland. The NPDES stormwater permits within the watershed include: (i) the area covered under Anne Arundel County's Phase I jurisdictional MS4 permit, (ii) the State Highway Administration's Phase I MS4 permit, (iii) and state and federal general Phase II MS4s, (iv) industrial facilities permitted for stormwater discharges, and (v) construction sites (Table 2, above, includes a list of all NPDES regulated stormwater permits). The NPDES Regulated Stormwater tPCB Baseline Load (1.6 g/year) was estimated by multiplying the percentage of urban land use (12.4%) of the direct drainage by the total direct drainage baseline load (12.6 g/year).

A tidal prism model that incorporates the influences of both fresh water discharge and tidal flushing was used to simulate the dynamic interactions between the water column and bottom sediments within the West and Rhode Rivers embayment and the Chesapeake Bay mainstem (MDE 2005, Kuo et al.2005). Within the West and Rhode Rivers embayment, the tidal exchange with the Chesapeake Bay mainstem, freshwater inputs, exchanges with the atmosphere due to deposition and volatilization, and the exchange with the bottom sediments through diffusion, resuspension, and settling are the dominant processes affecting the transport of PCBs in the water column. The burial of PCBs to deeper inactive layers of sediment and exchanges at the sediment-water column interface through diffusion, resuspension, and settling are the dominant processes affecting the transport of PCBs in the bottom sediments.

The observed average tPCB concentrations in the water column and sediment (2011, 2012) were used to characterize the initial (baseline) model conditions. Based on the study of Ko and Baker (2004), on average the tPCB concentrations in the Upper Chesapeake Bay are decreasing at a rate of 6.5% per year. As a conservative estimation, this study assumes a PCB attenuation rate of 5.0% per year at the boundary between the West and Rhode Rivers and the Chesapeake Bay mainstem. All other inputs (i.e., fresh water inputs, tidal exchange rates, sediment and water column exchange rates, atmosphere deposition, and burial rate) were kept constant.

The model was initially run for 30,000 days to predict the time needed for the water column tPCB concentration to meet the site-specific tPCB water column TMDL endpoint. The results indicated that when the site-specific water column TMDL endpoint (0.61 ng/L) was met, the tPCB sediment concentration was still higher than the site-specific sediment TMDL endpoint (4.1 ng/g). Consequently, the model was run again for 30,000 days to predict the time needed for the sediment concentrations to reach the TMDL endpoint. After 6,137 days (about 16.8 years) the tPCB sediment concentration reached 4.1 ng/g, at which time the water column tPCB concentration was equal to 0.24 ng/L.

The Chesapeake Bay mainstem tidal influence is the primary source of tPCB baseline loads resulting in the PCB impairment in the West and Rhode Rivers embayment. Attainment of the site-specific tPCB water quality TMDL endpoints is expected to take place over time as the Chesapeake Bay mainstem tPCB concentrations continue to decline, which also results in the natural attenuation of tPCB levels in the surface layer of the sediments (i.e., the covering of contaminated sediments with newer, less contaminated materials, flushing of sediments during periods of high stream flow, and biodegradation). Assuming that the tPCB concentrations in the Chesapeake Bay mainstem will continue to decline, at or above the current rate of 5% per year, no additional tPCB reductions will be necessary to meet the "fishing" designated use in the West and Rhode Rivers embayment.

IV. Discussion of Regulatory Conditions

EPA finds that MDE has provided sufficient information to meet all seven of the basic requirements for establishing a PCB TMDL for the West River and Rhode Rivers watershed. EPA, therefore, approves this PCB TMDL for the West River and Rhode Rivers watershed. This approval is outlined below according to the seven regulatory requirements.

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

WQS 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 WQS 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). The designated use of the West and Rhode Rivers is Use II – *Support of Estuarine and Marine*

Aquatic Life and Shellfish Harvesting (COMAR 2013b). There are no "high quality", or Tier II, stream segments (Benthic Index of Biotic Integrity [BIBI] and Fish Index of Biotic Integrity [FIBI] aquatic life assessment scores > 4 [scale 1-5]) located within the direct drainage portions of the West and Rhode Rivers (COMAR 2014).

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 and salt water chronic tPCB criteria for the protection of aquatic life. The freshwater aquatic life chronic criterion is used to assess non-tidal systems while the saltwater aquatic life chronic criterion is used to assess tidal systems. As the West and Rhode Rivers are tidal systems, the saltwater aquatic life chronic criterion is applied for assessing these waters. The Maryland human health tPCB criterion is set at 0.64 nanograms/liter (ng/L), or parts per trillion (ppt) (COMAR 2013c; US EPA 2013a). The Maryland fresh and salt water chronic aquatic life tPCB criterion are set at 14 ng/L and 30 ng/L, respectively (COMAR 2013c; US EPA 2013a). The water column mean tPCB concentration in the West and Rhode Rivers exceeds the human health tPCB criterion of 0.64 ng/L; however, none of the water column samples exceed the salt water aquatic life tPCB criterion of 30 ng/L.

In addition to the water column criteria, fish tissue monitoring 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. Only data results from the analysis of skinless fillets, the edible portion of fish typically consumed by humans, is used for assessment purposes and development of this TMDL. Currently Maryland applies 39 ng/g as the tPCB fish tissue listing threshold, based on a fish consumption limit of 4 meals per month. 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 (MDE 2012). MDE collected fish tissue samples for PCB analysis in the West and Rhode Rivers and their watershed and the tPCB concentrations in several of the samples exceeded the listing threshold, demonstrating that a PCB impairment exists within the West and Rhode Rivers.

The tPCB fish tissue listing threshold was translated into an associated tPCB water column concentration to provide a TMDL endpoint as the water quality model only simulates tPCB water column and sediment concentration and does not incorporate a food web model to predict tPCB fish tissue concentrations. This was accomplished using the Adjusted Total Bioaccumulation Factor (Adj-tBAF) of 64,256 L/kg for the West and Rhode Rivers. 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 their home range to produce the Adj-tBAF per species. The most environmentally conservative of the Adj-tBAFs is then selected to calculate the TMDL endpoint water column concentration. This final water column tPCB concentration was then compared to the water column tPCB criteria concentrations, to ensure that all applicable criteria within the embayment would be attained. Based on this analysis, the water column tPCB concentration of 0.61 ng/L, derived from the tPCB fish tissue listing threshold, is selected as the TMDL endpoint for the river, which is more stringent than the value of 0.64 ng/L for human health, and the fresh and salt water chronic aquatic life tPCB criteria of 14 ng/L and 30 ng/L, respectively.

Similarly, in order to establish a tPCB TMDL endpoint for the sediment in the river, a target tPCB sediment concentration was derived from the tPCB fish tissue listing threshold as the water quality model only simulates tPCB sediment concentrations and not tPCB fish tissue concentrations to apply within this analysis as the sediment TMDL endpoint concentration. This was done using the Adjusted Sediment Bioaccumulation Factor (Adj-SediBAF) of 9.55 (unit-less) for the river. Similar to the calculation of the water column Adj-tBAF, a sediment Bioaccumulation Factor (SediBAF) is calculated per fish species, and subsequently the SediBAFs are normalized by the median species lipid content and median organic carbon tPCB sediment concentration in their home range to produce the Adj-SediBAF (see Appendix B for further details regarding the calculation of the Adj-SediBAF). The most environmentally conservative of the Adj-SediBAFs is then selected to calculate the sediment TMDL endpoint tPCB concentration. Based on this analysis, the tPCB level of 4.1 ng/g derived from the fish tissue listing threshold is set as the sediment TMDL endpoint.

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.***

<u>Total Allowable Load</u>

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 TMDL for PCBs West and Rhode Rivers Tidal Chesapeake Bay Segment watershed is 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 tidal prism model developed for simulating ambient sediment and water column tPCB concentrations was used to determine the specific load reductions that would result in simulated tPCB concentrations in the sediment and water column that meet the TMDL endpoints. Model simulation results show that both the water column and sediment PCB targets will be met in about 16.8 years with only natural attenuation of tPCB concentration at the Chesapeake Bay mainstem. Therefore, no reduction is assigned to the watershed loads, including non-point source and point source loads from the watershed. When the targets met, the tPCB load from the Chesapeake Bay mainstem will be reduced by about 57.8% from its baseline load, including an explicit 5% Margin of Safety. The allowable load was calculated as 517.7 g/year.

The allowable 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 maximum 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 Table 1.

Load Allocations

The TMDL summary in Table 1 contains the LAs for the West and Rhode Rivers watershed. 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.

LAs have been assigned to the following nonpoint sources in order to meet the "fishing" designated use in the West and Rhode Rivers: direct atmospheric deposition to the surface of the rivers, non-regulated watershed runoff, and the Chesapeake Bay mainstem Influence. The PCB loads from the Chesapeake Bay mainstem are the major source for the West and Rhode Rivers embayment, which account for about 96.83% of total baseline loads to the Rivers. Model simulation results show that both the water column and sediment PCB targets will be met in about 16.8 years with only natural attenuation of tPCB concentration at the Chesapeake Bay mainstem. Therefore, no reduction is assigned to the watershed loads, including non-point source and point source loads from the watershed. When the targets met, the tPCB load from the Chesapeake Bay mainstem will be reduced by about 57.8% from its baseline load, including an explicit 5% Margin of Safety.

Wasteload Allocations

There are 5 permitted point sources within the West and Rhode Rivers watershed that could convey tPCBs loads to the West and Rhode Rivers watershed. Point Sources include one WWTP, and four stormwater discharges regulated under Phase I and Phase II of the NPDES stormwater program which are included in the WLAs.

The WWTP and NPDES Regulated Stormwater WLAs for the West and Rhode Rivers watershed is 0.2 g/year and 1.6 g/year, respectively. See discussion above on how the baseline loads were calculated. No reduction was assigned to the point source loads from the watershed.

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.

The TMDLs consider the impact of background pollutants by considering land uses.

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 conditions 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 factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions 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 and therefore, they implicitly account for seasonal variations as well as critical conditions. 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 and critical conditions on the "fishing" designated use in the West and Rhode Rivers. Furthermore, the water column TMDL endpoint is also supportive of the "protection of aquatic life" designated use at all times, as it is more stringent than the freshwater chronic tPCB criterion.

5) The TMDLs consider seasonal environmental variations.

Monitoring of PCBs was conducted on a quarterly basis to account for seasonal variation in establishing the baseline condition for ambient water quality in the West and Rhode Rivers and estimation of watershed loadings. As mentioned above, the TMDLs are protective of human health at all times, therefore, they implicitly account for seasonal variations as well as critical

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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.

conditions. Also, 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 and critical conditions. Furthermore, the water column TMDL endpoint is also supportive of the "protection of aquatic life" designated use at all times, as it is more stringent than the freshwater chronic tPCB criterion

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 includes the estimated rate of decline in tPCB concentrations within the Chesapeake Bay mainstem 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 5% MOS, in order to provide an adequate and environmentally protective TMDL.

7) The TMDLs have been subject to public participation.

MDE provided an opportunity for public review and comment on the PCB TMDL for the Back River embayment watershed. The public review and comment period was open from August 5, 2014 through September 3, 2014. MDE received no comments.

A letter was sent to the U.S. Fish and Wildlife Service pursuant to Section 7(c) of the Endangered Species Act, requesting the Service's concurrence with EPA's findings that approval of this TMDL does not adversely affect any listed endangered and threatened species, and their critical habitats.

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.

As mentioned above, the Chesapeake Bay mainstem tidal influence and resuspension and diffusion from the bottom sediments have been identified as the two major sources of tPCBs to the West and Rhode Rivers embayment. Since the loads from resuspension and diffusion from bottom sediments are not considered to be directly controllable (reducible) loads and are considered as internal loads within the modeling framework of the TMDL, they are not included in the tPCB baseline load and TMDL allocation. Given that PCBs are no longer manufactured, and their use has been substantially restricted, it is reasonable to expect that with time PCB concentrations in the aquatic environment will decline. In this study, it is assumed that the tPCB concentrations in the Chesapeake Bay mainstem are decreasing at a rate of 5% per year as used in the Back River PCB TMDL study (MDE, 2011b). Other processes, such as the burial of contaminated sediments with newer, less contaminated materials, flushing of sediments during periods of high stream flow, and biodegradation will contribute to this natural attenuation.

MDE's Environmental Assessment and Standards Program will periodically monitor and evaluate concentrations of contaminants in recreationally caught fish, shellfish, and crabs throughout Maryland. This information will be used to evaluate the PCB impairment in the West and Rhode Rivers embayment on an ongoing basis. Any future monitoring should include congener specific analytical methods. Ideally, the most current version of EPA Method 1668 should be used or other equivalent methods capable of providing low-detection level, congener specific results. In establishing the necessity and extent of data collection within Maryland, MDE will collaborate with the affected stakeholders, and take into account data that is already available as well as the proper characterization of intake (or pass through) conditions, consistent with NPDES program "reasonable potential" determinations and the applicable provisions of the Environment Article and COMAR for permitted facilities. Similar approaches may be applicable for all upstream jurisdictions with regards to PCB monitoring and stakeholder collaboration.

A new Chesapeake Bay Watershed Agreement was signed on June 16, 2014 which includes goals and outcomes for toxic contaminants including PCBs (CBP 2014). Implementation of the toxic contaminant goal and outcomes under the new Bay agreement as well as discovering and minimizing any existing PCB land sources throughout the Chesapeake Bay watershed via future TMDL development and implementation efforts could further help to meet water quality goals in the West and Rhode Rivers.

PCBs are still being released to the environment via accidental fires, leaks, or spills from older PCB-containing equipment; potential leaks from hazardous waste sites that contain PCBs; illegal or improper dumping; and disposal of PCB containing products (*e.g.*, transformers, old fluorescent lighting fixtures, electrical devices, or appliances containing PCB capacitors, old microscope oil, and old hydraulic oil) into landfills that are not designed to handle hazardous waste. MDE will continue to monitor PCB levels in fish and evaluate the PCB impairment in the West and Rhode Rivers embayment on an ongoing basis.

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