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

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

APR 2 6 2013

Dear Mr. Currey:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the report, *Total Maximum Daily Loads of Phosphorus in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland.* The TMDL report was submitted by the Maryland Department of the Environment (MDE) to EPA for final review on September 25, 2012 and received on October 1, 2012. 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 Double Pipe Creek Watershed (MD-02140304) has been identified on Maryland's Section 303(d) List as impaired by nutrients (1996 listing), impacts to biological communities (2002 listing), and PCB in tissue (2008 listing). All impairments are listed for non-tidal streams. The 1996 nutrients listing was refined in the 2008 Integrated Report to identify phosphorus as the specific impairing substance. TMDLs for sediment and fecal coliform were approved by EPA in 2008 and 2009, respectively. The listings for impacts to biological communities and PCB in fish tissue will be addressed separately at a future date. This TMDL addresses the Phosphorus listing only.

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 Phosphorus TMDL for the Double Pipe Creek 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, TMDL Program Manager, at 215-814-5796.

Sincerely,

for Jon M. Capacasa, Director
Water Protection Division

Enclosure

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

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

Decision Rationale
Total Maximum Daily Load of Phosphorus in the Double Pipe Creek Watershed Frederick and Carroll Counties, Maryland

Jon M. Capacasa, Director
Water Protection Division

Date: 4/26/13

Decision Rationale
Total Maximum Daily Load of
Phosphorus in the Double Pipe Creek Watershed
Frederick and Carroll Counties, 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 discharged to a water quality limited waterbody.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for Phosphorus in the Double Pipe Creek watershed. The TMDL was established to address impairments of water quality, caused by phosphorus, as identified in Maryland's Section 303(d) List for water quality limited segments. The Maryland Department of the Environment (MDE) submitted the report, *Total Maximum Daily Load of Phosphorus in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland,* dated August 2012, to EPA for final review on September 25, 2012 and was received on October 1, 2012. The TMDL in this report addresses the Phosphorus impairment in the Double Pipe Creek watershed as identified on Maryland's Section 303(d) List. The basin identification for the Double Pipe Creek watershed is MD-02140304.

EPA's rationale is based on the TMDL Report and information in the computer files provided to EPA by MDE. EPA's review determined that the TMDL meets 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, this TMDL considered reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

II. Summary

The TMDL specifically allocates the allowable Phosphorus loading to the Double Pipe Creek watershed. There are thirty one permitted point sources, and an allocation for general

permit for Concentrated Animal Feeding Operations (CAFOs) which are 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 Phosphorus TMDL is presented as an average annual load in pounds per year because it was calculated so as to not cause any Phosphorus related impacts to aquatic life. The maximum daily Phosphorus Load is presented in pounds per day. The calculation of the maximum daily loads is explained in Appendix B of the TMDL report. The average annual Double Pipe Creek watershed TMDL is summarized in Table 1 below. The TMDL is the sum of the LAs, CAFO WLA, NPDES Stormwater WLA, Process Water WLA, and MOS. The LAs include nonpoint source loads generated within the Double Pipe Creek watershed. The maximum daily load is presented in Table 2. Individual annual and maximum daily WLAs for permitted point sources are provided in Table 3.

Table 1. Double Pipe Creek Watershed Average Annual TMDL of Phosphorus (lbs/yr)

TMDL (lbs/yr)		LA		WLA						MOS
				CAFO WLA	+	NPDES Stormwater WLA	+	Process Water WLA	+	
128,328	=	112,555	+	461	+	9,001	+	6,310	+	Implicit
				15,772						

Table 2. Double Pipe Creek Watershed Maximum Daily Loads of Phosphorus (lbs/day)

MDL (lbs/day)		LA		WLA						MOS
				CAFO WLA	+	NPDES Stormwater WLA	+	Process Water WLA	+	
918	=	797	+	3	+	64	+	54	+	Implicit
				121						

Table 3. Wasteload Allocations for Process Water Point Sources in the Double Pipe Creek Watershed

Facility	NPDES ID Number	WLA (lbs/yr)	MDL (lbs/day)
Process Water Point Source			
Westminster WWTP	MD0021831	4,568	38.8
Union Bridge WWTP	MD0022454	1,742	14.8
New Windsor WWTP	MD0022586		
Pleasant Valley WWTP	MD0066745		
Runnymede WWTP	MD0065927		
Bowling Brook Preparatory School	MD0067571		
Sheetz Store #177	MDG915060		
LaFarge – Medford Quarry	MDG490226		

Lehigh Cement Company	MDG492448		
Medford Quarry (Reichlin Tract)	MDG498000		
Thomas, Bennett & Hunter, Inc.- Westminster Concrete	MDG490433		
Stambaugh's Incorporated	MDG499720		
NPDES Regulated Stormwater Point Sources			
Municipal Phase II MS4	MDR055500	2,112	17.95
Carroll County Phase I	MD0068331	2,329	19.80
Frederick County Phase I	MD0068357	301	2.60
SHA Phase I MS4	MD0068276	653	0.06
"Other NPDES Regulated Stormwater"[1]	N/A	3,605	30.64
NPDES Regulated Animal Feeding Operations	--	461	39.19

1 See Table 4 below for the list of Other NPDES Regulated Stormwater Facilities

Table 4. NPDES Regulated Stormwater Permits in the Double Pipe Creek Watershed

Permit Number	Facility	NPDES Group
MD0068357	Frederick County MS4	County Phase-I
MD0068331	Carroll County MS4	County Phase-I
MD0068276	State Highway Administration MS4	SHA Phase-I
MDR055500	City of Taneytown MS4	Municipal Phase-II
MDR055500	City of Westminster MS4	Municipal Phase-II
MDR055500	Town of New Windsor MS4	Municipal Phase-II
MDR055500	Town of Union Bridge MS4	Municipal Phase-II
--	MDE General Permit to Construct	Other NPDES Reg SW
02SW0029	Marada Industries, Inc. – Plant 1	Other NPDES Reg SW
02SW0662	Bark Hill Landfill	Other NPDES Reg SW
02SW0663	Bachman Valley Tire Facility	Other NPDES Reg SW
02SW0665	John Owings Landfill	Other NPDES Reg SW
02SW0920	Universal Forest Products Eastern Division	Other NPDES Reg SW
02SW1098	Hahn Transportation, Inc. – Union Bridge	Other NPDES Reg SW
02SW1456	Babylon Vault Company, Inc.	Other NPDES Reg SW
02SW1821	IMRM Western Carroll Site	Other NPDES Reg SW
02SW1861	Carroll County Maintenance Facility	Other NPDES Reg SW
02SW3013	Almega Manufacturing Corp.	Other NPDES Reg SW
02SW3014	Introl Company, Inc.	Other NPDES Reg SW

Note: Although not listed, some individual permits from the Process Water Point Sources incorporate stormwater requirements and are accounted for within the NPDES stormwater WLA.

The TMDL is a written plan 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

Double Pipe Creek is located within Frederick and Carroll Counties, Maryland and encompasses approximately 193 square miles. The watershed consists of two sub-basins: Big

Pipe Creek, which makes up 58% of the total watershed area, and Little Pipe Creek, which makes up 42% (McCoy and Summers 1992). These branches are free flowing (non-tidal) streams that conjoin to form Double Pipe Creek. Double Pipe Creek discharges into the Monocacy River at Rocky Ridge, MD, which eventually empties into the Middle Potomac River near the town of Dickerson, MD. The watershed is mostly rural consisting primarily of crop land and forest. There are several minor urban areas within the basin, including Taneytown, Manchester, Union Bridge, and New Windsor, and one major urban area, the city of Westminster. The landuse distribution is as follows: crop land (44.2%), forest (30.9%), regulated urban land (16.4%), and pasture (8.1%).

Because the Double Pipe Creek stream system empties into the Maryland 8-digit (MD 8-Digit) Upper Monocacy River watershed, loads generated within the double Pipe Creek watershed impact downstream conditions within the mainstem of the MD 8-Digit Upper Monocacy River watershed.

The Double Pipe Creek watershed lies within the north central Piedmont Plateau Physiographic Province of Maryland. It is characterized by gently rolling to steep uplands with streams of average to steep gradient, which drain in a southerly direction into the lower valleys of the Piedmont (MDE 2007b).

The Double Pipe Creek Watershed (MD-02140304) has been identified on Maryland's Section 303(d) list as impaired by nutrients (1996 listing), impacts to biological communities (2002 listing), and PCB in tissue (2008 listing) (MDE 2010a). All impairments are listed for non-tidal streams. Because scientific research supports that phosphorus is generally the limiting nutrient in freshwater aquatic systems, the 1996 nutrients listing was refined in the 2008 Integrated Report to identify phosphorus as the specific impairing substance (MDE 2008). TMDLs for sediment and fecal coliform were approved by EPA in 2008 and 2009, respectively. The listings for impacts to biological communities and PCB in fish tissue will be addressed separately at a future date. This TMDL addresses the Phosphorus listing only.

The designated use of Double Pipe Creek and its tributaries is Use I-P (*Water Contact Recreation, Protection of Nontidal Warm Water Aquatic Life, and Public Water Supply*), One tributary, Bear Branch (and its tributaries) from the stream's confluence with Bennett Creek is designated as III-P (*Water Contact Recreation, Protection of Nontidal Cold Water Aquatic Life, and Public Water Supply*). The remaining tributaries of Double Pipe Creek include Big Pipe Creek, Little Pipe Creek, Meadow Branch and Sam's Creek are designated as Use IV-P (*Water Contact Recreation, Protection of Aquatic Life, Recreational Trout Waters and Public Water Supply*) (COMAR 2012a,b,c,d).

The Double Pipe Creek watershed aquatic health scores, consisting of the Benthic Index of Biotic Integrity (BIBI) and Fish Index of Biotic Integrity (FIBI), indicate that the biological metrics for the watershed exhibit a significant negative deviation from reference conditions (Roth *et al.* 2005). The Biological Stressor Identification (BSID) analysis for the Double Pipe Creek watershed identified both phosphorus and nitrogen as potential stressors (MDE 2011). Both total phosphorus and orthophosphate show a significant association with degraded biological conditions. As much as 15% of the biologically impacted stream miles in the

watershed are associated with high total phosphorus and 14% are associated with high orthophosphate. Similarly, according to the BSID analysis, 65% of the biologically impacted stream miles in the Double Pipe Creek watershed are associated with high total nitrogen concentrations. An analysis of observed TN:TP ratios show, however, that phosphorus is the limiting nutrient in Double Pipe Creek. Because nitrogen generally exists in quantities greater than necessary to sustain algal growth, excess nitrogen *per se* is not the cause of the biological impairment in Double Pipe Creek, and the reduction of nitrogen loads would not be an effective means of ensuring that the Double Pipe Creek watershed is free from impacts on aquatic life from eutrophication. Therefore, load allocations for the Double Pipe Creek Nutrient TMDL will apply only to total phosphorus.

Biological results from both the Department of Natural Resources (DNR) CORE/TREND and Maryland Biological Stream Survey (MBSS) at a station on the Big Pipe Creek, the larger of the two main tributaries to Double Pipe Creek, and another station located just below the confluence of Big Pipe and Little Pipe Creeks indicate that mainstem water quality can be classified as Good to Good/Very Good. Based on this information, MDE concluded that the nutrient impairment in the Maryland portion of the Double Pipe Creek watershed is restricted to the lower order streams of the watershed.

Currently, in Maryland there are not specific numeric criteria that quantify the impact of nutrients on the aquatic health of nontidal streams systems; therefore, a reference watershed TMDL approach was used, which resulted in the establishment of a *phosphorus loading threshold.* This threshold is based on a detailed analysis of phosphorus loads from watersheds that are identified as supporting aquatic life (i.e., reference watersheds) based on Maryland's biocriteria (Roth *et al.* 1998, 2000; Stribling *et al.* 1998; MDE 2008). The resulting loads are considered the maximum allowable loads the watershed can receive without causing any nutrient related impacts to aquatic health.

Low levels of dissolved oxygen are sometimes associated with the decay of excess primary production and therefore nutrient over-enrichment. The dissolved oxygen (DO) concentration to protect Use I-P waters "may not be less than 5 milligrams per liter (mg/l) at any time" and to protect Use III-P waters "may not be less than 5 mg/l at any time, with a minimum daily average of not less than 6 mg/l" (COMAR 2012e). The monitoring data indicate that under current conditions, the water quality standard for DO is being met in Double Pipe Creek.

A data solicitation for nutrients was conducted by MDE in November 2009, and all readily available data from 1998 up to the time of the TMDL development have been considered. A total of 31 stations were monitored in the Double Pipe Creek watershed for water quality by MDE and DNR's MBSS and CORE/TREND programs between 1998 and 2007. Two of these stations were monitored by both MDE and DNR. Of these 31 stations, 15 were sampled during the growing season, May 1 through October 31.

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 objective of the TMDL is to ensure that there will be no phosphorus impacts affecting aquatic life, thereby establishing a

phosphorus load that supports the Use I-P/Use III-P/Use IV-P designations for the Double Pipe Creek watershed.

The computational framework chosen for the Double Pipe Creek watershed TMDL was the Chesapeake Bay Program Phase 5.3.2 (CBP P5.3.2) Watershed Model. The spatial domain of the CBP P5.3.2 Watershed Model segmentation aggregates to the Maryland 8-digit watersheds which is consistent with the impairment listing.

In order to quantify the impact of phosphorus on the aquatic health of non-tidal stream systems, a reference watershed TMDL approach was used, that resulted in the establishment of a *phosphorus loading threshold* for watersheds within the Highland and Piedmont physiographic regions. Reference watersheds were determined based on Maryland's biocriteria methodology. The biocriteria methodology assesses biological impairment at the 8-digit watershed scale based on the percentage of MBSS monitoring stations, translated into watershed stream miles, which are degraded. Individual monitoring station impairment is determined based on BIBI/FIBI scores lower than the Minimum Allowable IBI Limit (MAL), which is calculated based on the average annual allowable IBI value of 3.0 (on a scale of 1 to 5). Applying the MAL threshold helps avoid classification errors when assessing biological impairment (Roth *et al.* 1998, 2000, Stribling *et al.* 1998, MDE 2010).

Comparison of watershed phosphorus loads to loads from reference watersheds requires that the watersheds be similar in physical and hydrological characteristics. To satisfy this requirement, Currey *et al.* (2006) selected reference watersheds only from the Highland and Piedmont physiographic regions. This region is consistent with the non-coastal region that was identified in the 1998 development of FIBI and subsequently used in the development of BIBI (Roth *et al.* 1998, Stribling *et al.* 1998).

To reduce the effect of the variability within the Highland and Piedmont physiographic regions, the watershed phosphorus loads were then normalized by a constant background condition: the all forested watershed condition. This new normalized term, defined as the *forest normalized phosphorus load*, represents how many times greater the current watershed phosphorus load is than the *all forested phosphorus load.* The *forest normalized phosphorus load* for this TMDL is calculated as the current watershed phosphorus load (calculated using the CBP P5.3.2 2009 Progress Scenario) divided by the *all forested phosphorus load.* Twelve reference watersheds were selected from the Highland/Piedmont region. Reference watershed *forest normalized phosphorus loads* were calculated using CBP P5.3.2 2009 Progress Scenario landuse and phosphorus loads. The median and 75th percentile of the reference watershed *forest phosphorus loads* were calculated and found to be 7.18 and 8.71 respectively. The median value of 7.18 was established as the *phosphorus loading threshold* as an environmentally conservative approach to develop this TMDL. Double Pipe Creek's forest normalized load exceeds the *forest normalized reference phosphorus load* (also referred to as the *phosphorus loading threshold*), indicating that the Double Pipe Creek watershed is receiving loads above the maximum allowable load the watershed can sustain without causing any phosphorus related impacts to aquatic health.

The Double Pipe Creek watershed baseline nutrient loads are estimated using the landuse and EOS phosphorus loading rates from the CBP P5.3.2 2009 Progress Scenario. The 2009 Progress Scenario represents current land-use, loading rates, and BMP implementation simulated using precipitation and other meteorological inputs from the period 1991-2000 to represent variable hydrological conditions, thereby addressing annual changes in hydrology and capturing wet, average and dry years. The period 1991-2000 is the baseline hydrological period for the Chesapeake Bay TMDL. Watershed loading calculations, based on the CBP P5.3.2 segmentation scheme, are represented by multiple CBP P5.3.2 model segments within each MD 8-digit watershed. The phosphorus loads from these segments are combined to represent the baseline condition. The Maryland point source nutrient loads are estimated based on discharge monitoring data and existing permit information. The total baseline phosphorus load for the Double Pipe Creek watershed is 201,916 lbs per year.

The allowable load for the impaired watershed is calculated as the product of the *phosphorus loading threshold* (determined from watersheds with healthy biological communities) and the Double Pipe Creek *all forested phosphorus load.* The resulting load is considered the maximum allowable load the watershed can sustain without causing any nutrient related impacts to aquatic health. The Double Pipe Creek watershed average annual TMDL of phosphorus is 128,328 lbs/yr. The Double Pipe Creek watershed TMDL contribution is further subdivided into point and nonpoint source allocations and is comprised of a Load Allocation (LA) of 112,555 lbs/yr, a CAFO Wasteload Allocation (CAFO WLA) of 461 lbs/yr, an NPDES Stormwater Wasteload Allocation (NPDES Stormwater WLA) of 9,001 lbs/yr, and a Process Water Wasteload Allocation (Process Water WLA) of 6,310 lbs/yr. See Tables 1 and 2 above. More details regarding the calculation of the baseline and allowable phosphorus load can be found in Sections 2 and 4 of the TMDL report.

IV. Discussion of Regulatory Conditions

EPA finds that MDE has provided sufficient information to meet all seven of the basic requirements for establishing a Phosphorus TMDL for the Double Pipe Creek watershed. EPA, therefore, approves this Phosphorus TMDL for the Double Pipe Creek watershed. This approval is outlined below according to the seven regulatory requirements.

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. The designated use of the Double Pipe Creek and its tributaries is Use I-P (*Water Contact Recreation, Protection of Nontidal Warm Water Aquatic Life, and Public Water Supply*), III-P (*Water Contact Recreation, Protection of Nontidal Cold Water Aquatic Life, and Public Water Supply*) or Use IV-P (*Water Contact Recreation, Protection of Aquatic Life, Recreational Trout Waters and Public Water Supply*) (COMAR 2012a,b,c,d).

Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards for the protection of aquatic life in free-flowing non-tidal waters, therefore, a reference watershed TMDL approach was used. Phosphorus loads compatible with water quality standards

are determined by comparing current phosphorus loading rates (lbs/ac/yr) in the Double Pipe Creek watershed with the nutrient loading rates in unimpaired watersheds in the Piedmont and Highland ecoregions of Maryland. The Chesapeake Bay Program's (CBP) Phase 5.3.2 Watershed Model (P5.3.2) were be used to determine the phosphorus loads in both Double Pipe Creek and the unimpaired watersheds that were be used to set the phosphorus TMDL for Double Pipe Creek.

Low levels of dissolved oxygen are sometimes associated with the decay of excess primary production and therefore nutrient over-enrichment. The dissolved oxygen (DO) concentration to protect Use I-P waters "may not be less than 5 milligrams per liter (mg/l) at any time" and to protect Use III-P waters "may not be less than 5 mg/l at any time, with a minimum daily average of not less than 6 mg/l" (COMAR 2012e). The monitoring data indicate that under current conditions, the water quality standard for DO is being met in Double Pipe Creek.

Reduction in phosphorus loads are expected to result in improved benthic and fish communities, by either improving habitat conditions or restoring energy pathways to patterns to those typical of healthy biological communities in the Piedmont and Highland ecoregions. The TMDL, however, will not completely resolve the impairment to biological communities within the watershed. Because the BSID watershed analysis identifies other possible stressors (*i.e.*, conductivity, inadequate riparian habitat, and sediment related stressor) as impacting the biological conditions, this impairment remains to be fully addressed through the Integrated Report listing process and the TMDL development process, such that all impairing substances identified as impacting biological communities in the watershed are reduced to levels that will meet water quality standards, as established in future TMDLs for those substances (MDE 2009a).

The objective of this TMDL is to establish phosphorus loads that will be protective of the Use I-P/Use III-P/Use IV-P designations for the Double Pipe Creek watershed, and more specifically, these loads will be at a level the watershed can sustain without causing nutrient related impacts to aquatic health. 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 TMDL for phosphorus for the Double Pipe Creek 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.

As discussed above, the allowable load for the impaired watershed is calculated as the product of the *phosphorus loading threshold* and the Double Pipe Creek *all forested phosphorus load.* The Phosphorus TMDL for the Double Pipe Creek watershed was calculated to be 128,328

lbs/yr. This load is considered the maximum allowable load the watershed can sustain and support aquatic health. The Phosphorus TMDL and allocations are presented as mass loading rates of pounds per year for the average annual load and pounds per day for the maximum daily load. Expressing TMDLs as annual average and maximum daily mass loading rates 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, toxicity, or other appropriate measure.* The annual average annual and maximum daily Phosphorus loads are presented in Tables 1 and 2, respectively.

In order to attain the TMDL loading cap calculated for the watershed, reductions to phosphorus baseline loads will be applied to the controllable sources. Significant phosphorus reductions will be required in the Double Pipe Creek watershed to meet the phosphorus allocations assigned to the Potomac Tidal Fresh Bay Water Quality Segment by the Chesapeake Bay TMDL, established by the EPA on December 29, 2010. To ensure consistency with the Bay TMDL, and therefore efficiency in the reduction of phosphorus loads, reductions will be applied to the same controllable sources identified in Maryland's Watershed Implementation Plans (WIPs) for the Bay TMDL. The controllable sources include: (1) regulated developed land; (2) high till crops, low till crops, hay, and pasture; (3) harvested forest; (4) unregulated animal feeding operations and CAFOs; and (5) industrial process water sources and municipal wastewater treatment plants. Additional sources might need to be controlled in order to ensure that the water quality standards are attained in the Chesapeake Bay as well as in the Double Pipe Creek. An overall reduction of 36% for phosphorus from current estimated loads will be required to meet TMDL allocations and attain Maryland water quality standards.

Load Allocations

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 TMDL summary in Table 1 contains the LA for the Double Pipe Creek watershed.

The nonpoint source nutrient loads generated within the Double Pipe Creek watershed are calculated as the sum of corresponding land-use edge-of-stream (EOS) loads within the watershed and represent a long-term average loading rate. Individual land-use EOS loads are calculated as a product of the land-use acreage and the average annual simulated phosphorus yields (lbs/ac/yr), 1991-2000 from the 2009 Progress Scenario (US EPA, 2010). The 2009 Scenario represents current land-use, loading rates, and BMP implementation simulated using precipitation and other meteorological inputs from the period 1991-2000 to represent variable hydrological conditions. The 1991-2000 simulation period represents the baseline loading rates in the TMDL for Chesapeake Bay segments.

In the Double Pipe Creek watershed, crop, pasture, nurseries, and unregulated animal feeding operations were identified as the predominant nonpoint controllable sources. Forest is the primary non-controllable source, as it represents the most natural condition in the watershed. Direct atmospheric deposition on water is a minor source which to a large extent originates outside the watershed. Atmospheric deposition will be reduced by existing state and federal

programs and will not be addressed in this TMDL.

The Double Pipe Creek Phosphorus TMDL requires a 32% reduction in phosphorus loads from nonpoint sources. Table 5 below provides one possible scenario for the distribution of the annual phosphorus nonpoint source loads between different land-use categories in the Double Pipe Creek watershed.

Table 5: Double Pipe Creek Phosphorus TMDL Allocation by Nonpoint Source Category

General Category	Nonpoint Source Category[1]	Baseline Load (lbs/yr)	TMDL (lbs/yr)	Reduction (%)
Forest	Forest	5,463	5,463	0%
	Harvested Forest	329	164	50%
AFOs	Animal Feeding Operations	3,646	500	86%
Pasture	Pasture	16,862	8,943	47%
Crop	Crop	104,445	68,076	35%
Nursery	Nursery	34,073	29,385	14%
Septic	Septic	0	0	0%
Atmospheric Deposition	Non-tidal Atmospheric Deposition[2]	24	24	0%
Total		**164,842**	**112,555**	**32%**

[1] The source categories represent aggregates of multiple sources (e.g., crop source is an aggregate Of high till, low till, hay, and nursery sources).

[2] No reduction – based on 2025 federal atmospheric deposition strategies.

Wasteload Allocations

There are thirty one permitted point sources in this watershed. Detailed allocations are provided for those point sources included within the NPDES process WLA and the regulated stormwater WLA. The types of permits identified include NPDES regulated individual industrial, individual municipal, general mineral mining, general industrial stormwater, general municipal separate storm sewer systems (MS4s). The types of NPDES permits can be grouped into two categories: process water and stormwater. The WLA also includes an allocation for CAFOs.

The NPDES process water category includes those loads from major publically-owned WWTPs, minor municipal WWTPs and industrial facilities whose permits have total phosphorus limits, minor municipal WWTPs with no phosphorus permit limits, and industrial facilities which based on the process involved are expected to discharge nutrients.

There are six municipal WWTPs in the Double Pipe Creek watershed. Municipal WWTPs are assigned phosphorus WLAs as follows: (1) if the design flow of a facility is greater than 0.5 MGD and therefore is slated for upgrade to 'Enhanced Nutrient Reduction' (ENR), then the facility is given a WLA based on its design flow and the anticipated average annual ENR concentrations of 0.3 mg/l TP; (2) if the design flow of the facility is 0.5 MGD or less and has TP concentration limits, then that facility is assigned a WLA based on its Maryland Tributary Strategy Cap flow and the permit limit; and (3) if the facility does not have permit limits, it is

assigned a WLA based on its Maryland Tributary Strategy Cap flow and an assumed maximum average annual concentration of 3 mg/l TP. The Tributary Strategy Cap flow is the design flow of the facility or the projected 2020 flow (projected from 2003 actual discharge flows and Maryland Department of Natural Resources growth rates by county), whichever is less.

Six industrial facilities discharging process water in the Double Pipe Creek watershed were judged to have the capacity to discharge TP in their process water. All of these facilities are minor. Under the Chesapeake Bay TMDL, industrial facilities capable of discharging phosphorus in their process water were given a WLA based on the results of monitoring required by their permits or professional judgment. In addition, allocations for minor municipal WWTPs (with design flows less than 0.5 MGD) and for minor industrial facilities are presented in the Chesapeake Bay TMDL as a watershed-wide aggregate WLA. A similar approach was adopted for the Double Pipe Creek Phosphorus TMDL, and all minor municipal and minor industrial process water facilities allocations are represented as a watershed-wide WLA.

Based on the Maryland Tributary Strategy Cap flow and permit limits or the allocation under the Chesapeake Bay TMDL, applied to the Double Pipe Creek Phosphorus TMDL, it will result in a 42% reduction in phosphorus loads from process water sources.

The stormwater category includes all NPDES regulated stormwater discharges. These include both general Phase I and II stormwater permits. These stormwater permits are regulated based on Best Management Practices (BMPs) and do not include nutrient limits. In the absence of nutrient limits, the baseline loads for these NPDES regulated stormwater discharges are calculated using phosphorus loading rates and acreages from developed land-uses within the watershed. The Double Pipe Creek NPDES stormwater WLA is based on reductions applied to the controllable phosphorus loads from the regulated developed landuse in the watershed, with credit provided to existing BMPs in place. The Double Pipe Creek NPDES stormwater WLA requires an overall reduction of 64% for phosphorus.

Starting in 2009, Maryland began the process of permitting CAFOs. CAFOs are medium to large animal feeding operations that have some artificial conveyance like a swale or ditch to discharge runoff from feedlots to surface water. Recent EPA regulations require CAFOs to have a NPDES permit. Maryland also designates large animal feeding operations which do not discharge or propose to discharge as "Maryland Animal Feeding Operations" (MAFOs). It is anticipated that on review many MAFOs will require CAFO permits. Several operators in the Double Pipe Creek watershed have filed notices of intent (NOI) to apply for permits under Maryland's CAFO or MAFO regulations. Based on the NOIs filed by the reporting deadline of February, 2009, CBP estimates that the current average annual phosphorus load from CAFOs in the Double Pipe Creek watershed is 1,001 lbs/yr

Under Maryland's regulations (COMAR 26.08.01, 26.08.03, and 26.08.04), CAFOs are required to fulfill the conditions of a general permit. These conditions include instituting a Comprehensive Nutrient Management Plan (CNMP) which meets the Nine Minimum Standards to Protect Water Quality. The general permit also prohibits the discharge of pollutants, including nutrients, from CAFO production areas except as a result of event greater than the 25-year, 24-hour storm. The Double Pipe Creek Phosphorus TMDL requires a 54% reduction in phosphorus

loads from CAFOs.

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 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 the phosphorus load from natural sources such as forested land. The CBP P5.3.2 model also considers background pollutant contributions by incorporating all 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.

[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.

Since the premise of the reference watershed approach is that the reference watershed is meeting water quality standards even under critical conditions, then the phosphorus loading rates derived from the reference watershed protects water quality standards under critical conditions. Also, the loading rates used in the TMDL were determined using the HSPF model, which is a continuous simulation model with a simulation period 1991-2000. The ten year simulation period encompasses seasonal variations and a range of hydrological and meteorological conditions. Also, the biological monitoring data used to determine the reference watersheds also integrates the stress effects over the course of time and thus inherently addresses critical conditions.

5) The TMDLs consider seasonal environmental variations.

In the Double Pipe Creek Phosphorus TMDL, seasonality is captured in two respects. First, it is implicitly included through the use of the biological monitoring data. Second, the MBSS dataset included benthic sampling collected in the spring and fish sampling collected in the summer. Thus, this analysis has captured both spring and summer flow conditions.

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. MDE has adopted an implicit MOS for this TMDL.

It is proposed that the estimated variability around the reference watershed group used in this analysis already accounts for such uncertainty. Analysis of the reference watershed group *forest normalized phosphorus loads* indicates that approximately 75% of the reference watersheds have a value less than 8.71. Also, 50% of the reference watersheds have a value less than 7.18. Based on this analysis the *forest normalized reference phosphorus load* (also referred to as the *phosphorus loading threshold*) was set at the median value of 7.18. This is considered an environmentally conservative estimate, because 50% of the reference watersheds have a load above this value (7.18), which when compared to the 75% value (8.71), results in an implicit MOS of approximately 18%.

7) The TMDLs have been subject to public participation.

MDE provided an opportunity for public review and comment on the Phosphorus TMDL for the Double Pipe Creek watershed. The public review and comment period was open from July 23, 2012 through August 22, 2012. MDE received six sets of written comments. The comments were considered and addressed appropriately.

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.

The Double Pipe Creek Phosphorus TMDL is expected to be implemented as part of a staged process recently developed by Maryland. This staged process is designed to achieve both the nutrient reductions needed within the Double Pipe Creek watershed and to meet target loads consistent with the Chesapeake Bay TMDL, established by EPA in 2010 (US EPA 2010a) and scheduled for full implementation by 2025. The Bay TMDL requires reductions of nitrogen, phosphorus and sediment loads throughout the Bay watershed to meet water quality standards that protect the designated uses in the Bay and its tidal tributaries. The nutrient reductions for the Bay TMDL are independent of those needed to implement any TMDLs developed to address nutrient-related impairments in Maryland's non-tidal waterbodies, although their reduction goals and strategies do overlap. For example, the implementation planning framework, developed by the Bay watershed jurisdictions in partnership with EPA, provides a staged approach to achieving Bay TMDL nutrient reduction goals that is also applicable to implementation of nutrient TMDLs in local non-tidal watersheds. In short, nutrient reductions required to meet the Chesapeake Bay TMDL will also support the restoration and protection of local water quality.

Once the Bay TMDL nutrient target loads for the Double Pipe Creek watershed have been met, MDE will revisit the status of nutrient impacts on aquatic health in Double Pipe Creek, based on any additional monitoring data available and any improvements in the scientific understanding of the impacts of nutrients on aquatic life in free-flowing streams. The results of this reassessment will determine whether additional phosphorus reductions are needed in the watershed, or whether the Double Pipe Creek Phosphorus TMDL goals have in fact been met.

In addition, MDE plans to use a series of legislative actions and funding programs to support TMDL implementation. Some of these include:

- Maryland recently enacted significant new legislation that requires Phase I MS4 jurisdictions to establish, by July 1, 2013, an annual stormwater remediation fee and a local watershed protection and restoration fund to support implementation of local stormwater management plans.

- Maryland has also enacted significant new legislation to increase the Bay Restoration Fund to provide financing for wastewater treatment plant upgrades and on-site septic system improvements, as well as legislation to guide growth of central sewer and septic systems.

- In response to the WIP and the increased burden on local governments to achieve nutrient reduction goals, Maryland has continued to increase funding in the Chesapeake and Atlantic Coastal Bays Trust Fund.

- Additional potential funding sources for implementation include Maryland's Agricultural Cost Share Program (MACS) which provides grants to farmers to help protect natural resources, and the Environmental Quality and Incentives Program, which focuses on implementing conservation practices and BMPs on land involved with livestock and production.

For more details about these and other legislative actions and funding programs, refer to Section 5.0 of the TMDL report.