

**Comment Response Document
Regarding the Total Maximum Daily Load (TMDL) of Sediment for the Patapsco River
Lower North Branch Watershed, Baltimore City and Baltimore, Howard, Carroll and
Anne Arundel Counties, Maryland**

The Maryland Department of the Environment (MDE) has conducted a public review of the proposed TMDL of sediment for the Patapsco River Lower North Branch Watershed. The public comment period was open from May 21, 2009 through June 19, 2009. MDE received two sets of written comments.

Below is a list of commentors, their affiliation, the date comments were submitted, and the numbered references to the comments submitted. In the pages that follow, comments are summarized and listed with MDE's response.

List of Commentors

Author	Affiliation	Date	Comment Number
Steve Stewart	Baltimore County Department of Environmental Protection and Resource Management	June 19, 2009	1-4
Hala Flores	Anne Arundel County Watershed Assessment and Planning Program	June 10, 2009	5-22

Comments and Responses

1. The commentor references the 1st paragraph of page 3, which states that the nontidal Patapsco River is a free flowing stream. The dam that forms the Liberty Reservoir makes the Patapsco a non-free flowing stream, but rather a flow regulated stream.

Response: This language has been removed from the TMDL. The sentence now reads: "The nontidal Patapsco River originates in Carroll County, Maryland and flows 58 miles until it empties into the tidal Patapsco River."

2. The commentor references the 1st paragraph on Page 19, which indicates that the mainstem is not impaired by sediment. This would imply that the impairments are in the tributaries to the mainstem in segment 2. The degree of sediment impairment is likely to vary by tributary and the associated land use in each tributary. Does MDE have more detailed modeling analysis for the tributaries, or would MDE be able to provide assistance to the local governments to analyze the tributaries to set specific reduction targets for each tributary?

Response: As detailed in the TMDL, the modeling analysis is done at the Chesapeake Bay Program Phase 5 (CBP P5) watershed model segment level, which aggregates to the Maryland 8-digit (MD 8-digit) watershed scale. The CBP P5 segment would be the most detailed level of modeling that MDE has available, but it does not specify sediment loadings to individual tributaries. This more detailed information is not presented in the TMDL because the assessment unit of the impairment listing and consequently the TMDL is the MD

FINAL

8-digit watershed. MDE will provide the modeling results per individual CBP P5 model segment to the county as requested, but this information will not be included in the actual TMDL report itself.

Neither the Clean Water Act (CWA) nor current U.S. Environmental Protection Agency (EPA) regulations obligate states to develop detailed implementation plans as part of the TMDL development or approval process. Instead, the goal of a TMDL is to determine the maximum amount of a given pollutant that a waterbody can assimilate and still attain its designated uses. Therefore, specific remediation plans are beyond the scope of this TMDL, and consequently, a detailed implementation plan is not available for the county to use in determining specific reduction targets for individual tributaries in TMDL segment 2.

Deciding what types of remedial activities or best management practices (BMPs) should be implemented and where these activities should be concentrated will need to be addressed during the implementation phase of the TMDL process. For this particular watershed, since reductions were solely applied to regulated stormwater sources, TMDL implementation will occur primarily via the municipal separate storm sewer system (MS4) permitting process for both large and medium jurisdictions. Thus, the implementation plans the county is referring to will most likely take the form of the Stormwater Wasteload Allocation (SW-WLA) implementation plans that are now required to be developed by large and medium Phase I MS4 jurisdictions as part of their permit requirements. For more information regarding TMDL implementation in Maryland, please refer to *Maryland's 2006 TMDL Implementation Guidance for Local Governments* (MDE 2006).

MDE does recognize that impairment level can vary throughout the 8-digit assessment unit. Information is provided in the TMDL that indicates where probable sediment impacts could be present throughout the watershed. This information includes monitoring stations, with both biological and physical sediment related habitat information, and also detailed land use information with categories (e.g. urban, agricultural) consistent with sediment budgets. The combination of these two data sources can help to identify areas for potential sediment reductions and/or to develop a more spatially refined monitoring strategy for implementation. Additionally, many local jurisdictions have additional monitoring and land use data at a local level that can be useful in completing a detailed assessment of sediment impacts.

3. The commentor references the implementation section on page 35 and states that street sweeping, inlet cleaning, increases in urban canopy cover, and reforestation should be included in the discussion of restoration options. These BMPs should be included in addition to the discussion of riparian buffers.

Response: MDE strives to continually update and improve the *Assurance of Implementation* section of the TMDL. We appreciate your input on this section and will be glad to include the above mentioned activities in the TMDL report.

4. The commentor states that in Tables 2 and 3 of Technical Memorandum for *Significant Sediment Point Sources in the Patapsco River Lower North Branch Watershed*, it appears as

FINAL

though the allocations for the Baltimore City and Baltimore County MS4 permits are reversed. This assumption is based on the relative sizes of the drainage areas.

Response: This error, in Tables 2 and 3 of the technical memorandum *Significant Sediment Point Sources in the Patapsco River Lower North Branch Watershed*, has been acknowledged by MDE and subsequently corrected. Additionally, there have been several changes made to Table 1, based on information received during the public review period internally from MDE - Water Management Administration's (WMA) Permitting Division. These changes have also been made in the relevant sections of the main report as well, primarily Appendix B. The following facility has been removed from the list of point sources, as its most recent permit does not include Total Suspended Solids (TSS) limits and is therefore, by definition (see Sections 2.2.2 and 4.6 of the main report), considered *de minimis*: Diageo North America (National Pollutant Discharge Elimination System (NPDES)# MD0001813). Furthermore, the following facilities have been added to the list of point sources, based on a re-evaluation of current permit limits: the State Highway Administration (SHA) – Hanover Complex (NPDES# MD0069469), Machado Construction Company, Inc. (NPDES# MD0054585), Jones Quarries (NPDES# MDG499703), and Vinci Pit #1 (NPDES# MDG499881). Lastly, the permit design flows for the following general mining permits were also corrected and their allocations subsequently adjusted: Lafarge - Marriottsville Quarry (NPDES# MDG490220), The Belle Grove Corporation (NPDES# MDG499741), The Belle Grove Corporation - Thomas Avenue (NPDES# MDG499743), and Rockville Fuel & Feed Company - Plant 5 (NPDES# MDG499770). The result of these changes is an increase in the total Process Water Baseline Load and equivalent Wasteload Allocation (WLA) from 10.0 tons/yr to 11.5 tons/yr. The 1.5 ton/yr increase in the Process Water WLA requires an equivalent decrease in the SW-WLA from 13,054.4 ton/yr to 13,052.9 ton/yr. This change is reflected throughout the applicable tables and text in the main report, and the specific changes to individual NPDES stormwater permit allocations can be seen in Tables 2 and 3 of the point source technical memorandum.

5. The commentor references the following text from the TMDL report describing the general analytical methodology: "Currently in Maryland, there are no specific numeric criteria that quantify the impact of sediment on the aquatic health of non-tidal stream systems. In order to quantify the impact of sediment on the aquatic health of non-tidal stream systems, a reference watershed TMDL approach was used and resulted in the establishment of a sediment loading threshold (Currey et al. 2006)." The commentor then goes on to reference specific procedures and findings of the TMDL methodology by stating that MDE selected various reference watersheds within the Highland and Piedmont physiographic regions. Based on the sediment TMDL methodology report, the normalized sediment yields (Tons/Acre/Year) for these reference watersheds were not lower than the normalized sediment yields from the impaired watersheds. Subsequently, the commentor specifically references the description of Figure 1 in the sediment TMDL methodology document, which states, "[The figure] indicates that there is minimal difference between healthy and impaired watersheds when using the sediment yield". Thus, no inductive reasoning pertaining to the required degree of sediment reduction for impaired watersheds could be drawn by comparing normalized sediment yields of impaired and reference watersheds. In order to resolve this predicament, the reference

FINAL

watershed and impaired watershed sediment loads (Tons/Year) were divided by their respective background conditions (i.e., the “all forested” sediment load). The commentor concludes by stating that it is not clear as to why this was done. Specifically, the following is unclear: 1) the relationship between the forest normalized sediment load and the watershed’s assimilative capacity for sediment; and 2) what the justification for selecting the “all forested condition” was as the datum/goal, since by dividing the current watershed sediment load (ton/yr) by the all forested sediment load (ton/yr), the result is no longer a sediment TMDL (ton/yr) but rather a dimensionless representation of the degree of watershed urbanization.

Response: During the development of the nontidal sediment TMDL methodology, MDE reasonably concluded that the lack of difference between the sediment yields (ton/ac/yr) of the reference and impaired watersheds was due to the difference in natural background conditions in each individual watershed. These differences can include variables such as physiographic region, geological properties, and soil types. Therefore, it was necessary to develop a more robust methodology than direct comparison of yields or loads between reference and impaired watersheds to determine the numeric sediment TMDL endpoint.

The normalization by the all-forested sediment load was conducted since the sediment load expected from an “all-forested condition” was assumed to be the best representation of a watershed’s natural background condition. Therefore, this normalization would indicate to what extent the current watershed sediment load is greater than the natural background sediment load for a given watershed, thereby creating a dimensionless factor that subsequently eliminated the problem of varying natural background conditions between watersheds. As hypothesized, the results of this comparison provided a quantifiable distinction between reference and impaired watershed sediment loads. To provide further credibility to the analysis, this concept has been applied in several other TMDLs approved by the EPA (e.g., Navarro River and Trinity River, both in California).

The relationship between the forest normalized sediment load and the sediment assimilative capacity of a given watershed is based on an analysis of the forest normalized sediment loads for a group of reference watersheds, which were determined based on biological conditions. Based on the 2008 *Integrated Report of Surface Water Quality in Maryland* (Integrated Report) biological listing methodology, this group of reference watersheds were determined to have “good” biological conditions (i.e., they were not listed as impaired for biology on the Integrated Report). This implies that the sediment loads associated with the group of reference watersheds are supportive of aquatic life, and therefore the sediment loading threshold was determined based on a measure of central tendency of this group of reference watersheds. Thus, the sediment assimilative capacity is based on the relationship between the reference watershed forest normalized sediment load and observed biological conditions.

MDE agrees that dividing the current watershed sediment load (ton/yr) by the all forested sediment load (ton/yr) does not result in a sediment TMDL, nor is it supposed to result in a sediment TMDL. The forest normalized sediment load calculation is used to determine the difference between the sediment load associated with a watershed’s current conditions and its natural conditions, (i.e., an all forested scenario). This deviation from the all-forested

FINAL

condition is due to any conversion from forest land use, which includes, but is not limited to, conversion to crop, pasture, and urban land uses. An acceptable level of deviation from natural conditions is determined by analyzing reference watersheds (i.e., those watershed determined to be supportive of aquatic life). This value, determined to be 3.3 times the all forested sediment load, is termed the sediment loading threshold. The sediment loading threshold is then multiplied by the all forested sediment load of the watershed to calculate the watershed sediment TMDL. Thus, it is not only urban watersheds, such as the Patapsco River Lower North Branch, that have elevated sediment loads based on the CBP P5 model applied in this analysis, but also highly agricultural watersheds, or any watershed that deviates from primarily forested conditions, tend to have elevated sediment loads above natural conditions.

Finally, the analysis does in fact represent a TMDL for sediment, rather than land use conditions (i.e., urban) as seemingly proposed by the commentor. It is true that sediment loadings are partly determined based on land use conditions, and therefore it is not possible to fully separate the two. However, it can not be said that the two characteristics are one and the same, since modeled sediment loadings do incorporate BMP factors specific to a given CBP P5 model segment land use to offset the baseline sediment loadings estimated from land use acreages, sediment loading rates, and sediment delivery factors. Therefore, in a highly urban watershed, the degree of watershed urbanization can be offset by BMPs in place on the ground and captured in the modeling framework via the BMP factor. It is not solely the amount of development/urbanization in a watershed that the required TMDL reductions are representative of, but rather it is representative of the absolute amount of anthropogenic land use in combination with the treatment of the area.

6. The commentor states that the TMDL end point computed from such normalization procedures, as referenced in comment 5, seeks to return the watershed to an all forested condition.

Response: The TMDL endpoint used in this analysis will ensure there will be no sediment related impacts to aquatic life in the Patapsco River Lower North Branch watershed. While the calculation of the TMDL does involve the comparison of the current watershed load to its all-forested condition, the TMDL value is not equivalent to an all-forested condition, but rather is more than three times the sediment load of the all forested condition. Via the reference watershed analysis, it was determined that not even the reference watersheds have sediment loads equivalent to an all-forested condition, but watersheds that support aquatic life (i.e. reference watersheds) have a median sediment load of approximately 3.3 times their all-forested condition. Therefore, the TMDL is in no way seeking to return the watershed to an all-forested condition, but to a condition that supports the aquatic life designated use.

As per the response to Comment 5, the TMDL does not specify a degree of urbanization from an all forested condition that will support aquatic life. Rather, it specifies the sediment load associated with varying land use conditions, the effects of which may be mediated by a host of BMPs and other factors offsetting the water quality impacts due to the conversion of forested land use (i.e., treatment levels of developed land use), whereby there will be no sediment related impacts to aquatic health. Thus, the TMDL endpoint does not seek to restore

FINAL

the watershed to an all forested condition, but rather it aims to restore the watershed to whatever combination of land use conditions, BMPs, and treated developed area results in a sediment load that does not create any sediment related impacts to aquatic life.

7. The commentor claims that the values adopted from the reference watershed analysis represent an impervious/urban TMDL rather than a sediment TMDL.

Response: Please see the responses to Comments 5 and 6.

8. The commentor states that the new (dimensionless) approach was not applied in the historic development of sediment TMDLs, such as the Anacostia River Sediment TMDL, where the reference watershed approach yielded favorable results with no need to employ further normalization.

Response: MDE originally began listing 8-digit watersheds as impaired for sediment on the Integrated Report in 1996. In 2002, the 8-digit watershed listings were revised so as to specify the type of waterbody impaired by sediment (i.e., nontidal, tidal, impoundment). Since then, sediment TMDLs have been completed for impoundments, non-tidal watersheds, and one watershed with both non-tidal and tidal segments, the Anacostia River, to address these refined listings. Each of these waterbody types has a different endpoint and therefore requires a unique TMDL development methodology. For the impoundment sediment TMDLs, the endpoint is based on the lifespan of the impoundment relative to sedimentation. In the Anacostia River sediment TMDL, the endpoint used was the tidal “water clarity” standard. The TMDL did contain a nontidal component, for which a reference watershed approach was originally proposed, but it was subsequently determined that the tidal water clarity endpoint was the limiting endpoint even for the nontidal areas. However, the reference watershed methodology would have required approximately the same reductions as the applied water clarity endpoint. All non-tidal sediment TMDLs, aside from the Anacostia River, use the narrative criteria of “supporting aquatic life” as the endpoint, and have used the forest-normalized sediment load methodology to calculate the numeric TMDL endpoint. This methodology has been applied since 2006, and several sediment TMDLs have been approved by the EPA since that time. Additionally, similar methodologies, using normalization techniques based on background natural conditions, have been applied and approved by other states and the EPA (e.g., the Navarro River and Trinity River, both in California).

9. The commentor states that since biological indices were used as the TMDL qualifying parameters, it is recommended that the Benthic and Fish Index for Biotic Integrity (BIBI/FIBI) scores be examined statistically against the modeled sediment loads. The sediment load that corresponds to a desired biological score could be adopted as the target TMDL end-point.

Response: Based on the use of the reference watersheds to determine the sediment loading threshold, the BIBI/FIBI scores are inherently included in the target TMDL endpoint.

FINAL

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 Maryland Biological Stream Survey (MBSS) monitoring stations, translated into watershed stream miles, that are degraded. Individual monitoring station very poor to poor condition 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). The percentage of sites in very poor to poor condition is then compared to the distribution found in the reference sites.

The sediment loading threshold is based on a statistical measure of central tendency of the reference watershed group (i.e., those watersheds considered to have "good biological conditions" similar to reference sites) forest normalized sediment loads. As described in the TMDL report, this threshold was determined to be 3.3 times the all-forested condition. Therefore, the sediment load that corresponds to a watershed supporting aquatic life (i.e., similar to reference sites) is 3.3 times the all-forested load of any particular watershed.

10. The commentor references Table 1 on page 7 of the TMDL report and asks MDE to show the land use distribution per land use type and the associated acres by MS4 jurisdiction. The commentor further states that this information is needed for review and comparison against available local jurisdiction high resolution data.

Response: MDE realizes and appreciates the need for information at the local level and will provide this information to the county as requested; however, the listing and assessment scale of the TMDL is the MD 8-digit watershed and this is the appropriate level of information to be provided in the actual TMDL report. Additionally, the information that MDE will provide to the county will only depict the urban land use breakdown by MS4 jurisdiction. This breakdown will align with the SW-WLA breakdown that can be found in the point source technical memorandum (i.e., urban land use will be broken into Phase I MS4 area, Phase II MS4 area, SHA Phase I MS4 area, and "Other" Regulated Stormwater area). MDE considers a portion of the urban land use to fall under a local government's MS4 jurisdiction. Other nonurban land uses (i.e., forest, crop, and pasture) are not considered as falling under any regulated stormwater entity's purview, and consequently, MDE does not have this scale of data for these nonurban land uses. If the county desires, MDE can provide the nonurban land use breakdown in the watershed by actual county area, but MDE does not consider this area to fall under the responsibility of any regulated stormwater entity.

11. The commentor references Table 2 on page 11 of the TMDL report and asks MDE to add the land area in acres associated with each land use. There are more land uses listed here than in Table 1. It is pertinent that local jurisdictions identify, verify, and track these acres against their high resolution land cover/land use information.

Response: After close evaluation, three discrepancies were found between Tables 1 and 2. First, Table 2 includes "High Till with Manure" and "High Till Without Manure" land uses. Because these two land uses have the same EOF rates, they have now been combined into one land use category, "High Till". Second, Table 2 includes a "Natural Grass" category.

FINAL

This land use is no longer being used in the CBP P5 watershed model, and has now been eliminated from the table. Finally, Table 2 did not include “Nursery” land use. These inconsistencies between the two tables were typographical errors on the part of MDE. All of the identified corrections have been made to Table 2, and the two tables now include the same land uses.

12. The commentor references Table 4 on page 16 and asks MDE to please show all quantities in the table by MS4 jurisdiction.

Response: Please see the response to Comment 10.

13. The commentor states that the SHA is a separate NPDES MS4 regulated stormwater entity and subsequently asks that MDE show the SHA statistics separately in all tables where Counties are listed. Ideally, the SHA component within each County could be listed.

Response: MDE is aware that SHA is a separate NPDES regulated stormwater entity, and this has been reflected in the analysis. MDE has calculated the urban land use area associated with the various NPDES regulated stormwater entities, including SHA, in the watershed. The urban land use associated with each permitted stormwater entity was then used in conjunction with the urban land use *edge-of-field* (EOF) erosion rates and CBP P5 segment specific sediment delivery ratios to calculate the individual SW-WLAs found in tables 2 and 3 of the technical memorandum *Significant Sediment Point Sources in the Patapsco River Lower North Branch Watershed*, which includes the watershed wide SHA SW-WLA.

Currently, there are no tables in the report showing county level statistics. The closest breakdown of the analysis to a county level resolution occurs in Tables 2 and 3 of the point source technical memorandum that show MS4 jurisdiction SW-WLAs, which is actually a finer scale resolution than the county level. As per the response to Comment 10, a breakdown of nonurban land uses per MS4 jurisdiction is not available, nor is it applicable; however, the data that will be sent to the county in response to the request in Comment 10 will indicate the amount of SHA owned urban land in each applicable watershed county. Thus, MDE will be providing the county with all available SHA statistics relevant to the TMDL as requested here in Comment 13. However, these SHA statistics, aside from their actual SW-WLA, will be excluded from the TMDL report, since the listing and assessment scale of the TMDL is the MD 8-digit watershed and this is the appropriate level of information to be provided.

14. The commentor claims that Anne Arundel County has identified approximately 3,427 acres of State/Federally owned parcels (i.e., Baltimore Washington International (BWI) - Thurgood Marshall airport, etc.) within the county’s portion of the Patapsco River Lower North Branch watershed. These parcels are not considered NPDES MS4 Regulated Stormwater Point Sources. The commentor then points out that the Anne Arundel county MS4 jurisdiction also does not include SHA owned lands, which is a separate regulated NPDES MS4 Stormwater Point Source, as well as Federal roads, such as the Baltimore Washington Parkway, which are also excluded from the County’s purview for impervious surface management. The percent imperviousness of these non-County controlled parcels is

FINAL

21.7%. This constitutes 17% of the total impervious cover within the Anne Arundel County portion of the Patapsco River Lower North Branch watershed. This is a major contribution that requires mitigation and thus load allocations and reductions for Anne Arundel County need to be adjusted to exclude these areas.

Response: MDE is aware of the significant land area that is state and federally controlled (i.e., BWI Thurgood Marshall Airport) within the Anne Arundel county portion of the Patapsco River Lower North Branch watershed. Contrary to the county's claim, however, the urban portions of many of these state and federally owned lands are considered NPDES regulated stormwater entities. These state and federal lands may be permitted via Phase II general MS4s or as Phase I industrial facilities; either way, they are accounted for within the "Other" Regulated SW-WLA in Tables 2 and 3 of the technical memorandum *Significant Sediment Point Sources in the Patapsco River Lower North Branch Watershed*. MDE has estimated there to be 1,040 urban land use acres under the purview of "Other" Regulated Stormwater sources within the Anne Arundel County portion of the Patapsco River Lower North Branch watershed.

As mentioned in the response to Comment 13, SHA owned areas within both Anne Arundel county and all of the other watershed counties have been separately accounted for distinct from the county MS4's jurisdiction. Consequently, SHA has been assigned its own individual SW-WLA, as is the case with all state and federally owned lands, as accounted for in the "Other" Regulated Stormwater described above. MDE has estimated that "Other" Regulated Stormwater sources constitute approximately 22% of the total impervious area in the Anne Arundel County portion of the Patapsco River Lower North Branch watershed, which is very similar to the 17% that Anne Arundel county has calculated. Thus, MDE has already excluded both SHA and state and federally controlled urban land use areas from the original Anne Arundel County MS4 SW-WLA, so there is no need to adjust this allocation.

15. The commentor references Table 5 on page 20 of the TMDL report and asks that MDE add the BIBI and FIBI scores to all 33 MBSS round one and round two monitoring stations. This information was not found in the TMDL document or the supporting Biological Stressor Identification (BSID) report. The county is also requesting that the Geographic Information System (GIS) shapefiles, which indicate the monitoring station locations, as well as the monitoring results associated with all the stations be sent to the County to supplement local monitoring efforts/plans.

Response: All MBSS information is available, upon request, from the Maryland Department of Natural Resources (DNR). For more information, please access the MBSS website, <http://www.dnr.state.md.us/streams/mbss/> or call 877-620-8367.

The individual MBSS station results are not included in the TMDL because the TMDL analysis does not use the actual data. Rather, the TMDL applies the results of two other analyses that use the data – the Integrated Report Biological Listing methodology, which identifies whether or not an impairment exists, and the BSID report, which identifies the probable causes of an impairment. The Round 2 data will be added to the BSID report.

FINAL

MDE does not have a GIS shapefile containing site locations and monitoring results. The map in Figure 4 of the TMDL was plotted using the latitude and longitude values provided in Table 5.

16. The commentor references the text in the TMDL report that states, “The computational framework chosen – for quantifying the sediment load - was the CBP P5 watershed model target EOF land use sediment loading rate calculations combined with a sediment delivery ratio”. The commentor then asks if any “ground truthed” assessment of sediment sources and sinks was conducted within the watershed to supplement the modeling approach? Additionally, the commentor asks if the TMDL included any screening/detail level assessment that aims to rate the relative contribution of sediment from specific reaches and sub-watersheds and therefore consequently identifies the high-risk places and processes to target.

Response: The EOF erosion rates are based on Natural Resources Inventory (NRI) empirical data, and the urban loading rates were estimated from existing model studies including watersheds located in the Maryland Piedmont region. While there is no specific sediment load model validation, the best available data was applied to determine land use specific sediment loading rates. “Ground Truthing” of the sediment impairment, as the cause of the aquatic life impacts, was conducted via the BSID analysis using local MBSS data to identify that there was excessive sediment transport in the basin.

A detailed level assessment of the relative contribution of sediment from specific reaches and sub-watersheds is expected to occur during the implementation phase of the TMDL process (i.e. the SW-WLA implementation plans required by the MS4 permitting process, as per the recently finalized Montgomery County Phase I MS4 renewal permit). Currently, modeling data is not available at the catchment scale to determine high-risk areas; however, MBSS data could be used to identify these areas by considering sites where sediment stressors were identified. Additionally, finer scale/resolution local data could be used in the development of the SW-WLA implementation plans to refine the TMDL analysis by pointing out these high-risk areas.

17. The commentor references page 13 of the TMDL, which states that based on the findings from the Anacostia River Sediment TMDL streambank erosion analysis, MDE developed a formula for estimating the percent of erosional sediment load resultant from streambank erosion. The formula is empirical and primarily relies on the degree of upland imperviousness. This load is a part of, not explicit from, the EOF modeled sediments loads. Thus, the commentor questions whether this empirical formula has been verified/validated for use outside the Anacostia River watershed, and, if so, what are the results? Additionally, the commentor asks how this formula quantifies sediment loadings from mass wasting and near-bed/bank sediment movements, since it appears to rely on United State Geological Survey (USGS) data pertaining to TSS measurements.

FINAL

Response: The text in Section 2.2.1 of the TMDL main report has been revised to state, “Using CBP P5 urban sediment EOF target values, MDE developed a formula for estimating the percent of erosional sediment resultant from streambank erosion”. This text should clarify that even though Equation 2.2 was based on the general findings from the Anacostia River Sediment TMDL streambank erosion analysis (i.e., streambank erosion increased as imperviousness within the watershed increased), the equation was not developed specifically for the Anacostia River, nor was it developed based on the actual quantitative results of the Anacostia River streambank erosion analyses. More accurately, the equation was based on the assumption that as upland sources decrease (i.e. impervious surface increases), channel erosion increases. After the equation was developed, it was tested and verified on the Anacostia River, the results of which were in agreement with the more complex methods used in the Anacostia TMDL to determine streambank erosion loads. As stated in the TMDL, this equation is empirical and is not intended to quantify specific physical sediment transport processes.

18. The commentor asks what subsequent modeling/monitoring is planned by MDE to determine TMDL compliance?

Response: MDE is currently discussing what subsequent modeling/monitoring might be useful to determine TMDL compliance. The future plans should be finalized soon. In the meantime, it is anticipated that much of compliance monitoring/modeling will be handled through the MS4 permitting process and the required development of SW-WLA implementation plans, as per the now finalized Montgomery County Phase I MS4 renewal permit.

19. The commentor asks MDE to include the sediment event mean concentration values utilized in the CBP model for estimating the EOF urban sediment loads within the TMDL report. Local jurisdictions will often need to estimate the sediment loads in the future based on future scenario land use development conditions adopted under the general development planning/comprehensive zoning process. For consistency purposes, it will be pertinent for local jurisdictions to employ the same methodology/coefficients/calibration techniques that were used in estimating the sediment TMDL end point.

Response: For detailed information on the sediment event mean concentration values utilized in the CBP model for estimating the EOF urban sediment loads, please see CBP’s documentation of this subject matter. It can be found on their website at: http://www.chesapeakebay.net/model_phase5.aspx?menuitem=26169. http://archive.chesapeakebay.net/pubs/subcommittee/nsc/sedwg/A_Summary_Report_of_Sediment_Processes.pdf (US EPA 2008).

20. The commentor references page 18 of the TMDL report, specifically the Patapsco River Lower North Branch Watershed Monitoring Stations section, whereby the document states that 35 water quality monitoring stations were used to characterize the Patapsco River Lower North Branch watershed. Of these 35 stations, 33 are biological/physical habitat stations. The

FINAL

commentor then asks MDE to specify if there are any continuous flow/sediment monitoring stations, and, if so, what are their locations within the watershed?

Response: The collection of sufficient instantaneous TSS concentration and flow data is extremely difficult due to high cost and limited site access during high flow events. Subsequently, MDE is not aware of any continuous flow/sediment monitoring stations within the Patapsco Lower North Branch Watershed. No continuous flow/sediment monitoring stations are associated with this Sediment TMDL effort.

21. The commentor references the *Load Allocations Between Point and Nonpoint Sources* section on page 30 of the TMDL report, which states that reductions were only applied to the regulated urban storm water sources in TMDL segment 2. Furthermore, reductions were only applied to urban areas developed prior to 1985. The commentor then asks the following: 1) how did the state incorporate the age of development within the loading model; 2) what are the methods for estimating the age of development; and 3) what was the source for the data? Furthermore, the commentor states that, for many reasons, it is questionable whether the age of development is an appropriate measure for the need to perform urban mitigation. After all, BMPs implemented between 1985-2000 primarily addressed flood control requirements rather than water quality/pollutant reduction. Also, some developments built prior to 1985 may feature open section roadway design with roadside swales, cluster lots, disconnected rooftops, and adequate forested buffers that may qualify as meeting “fully or partially” water quality through environmental site design credits. The Chesapeake Bay Program’s urban BMP database coupled with assessments of the landcover/imperviousness and their connectivity to the stream and a field inventory of stream erosion/headcut would provide a more reliable way of forecasting areas that require mitigation.

Response: CBP land use exists for every year of the CBP P5 model simulation (1985-2005). Therefore, the amount of both impervious and pervious urban land use in the year 1985 of the model simulation provides a close estimate of how much of the current urban land use area (2005 land use applied within the analysis) was developed prior to 1985 (may not be exact due to redevelopment, reforestation, etc.). Thus, MDE was able to divide the total 2005 urban land use into the amount developed prior to 1985, between 1985 and 2002, and between 2002 and 2005. These three time periods correspond to the different eras of stormwater management in the state of Maryland, whereby different stormwater management regulations were in place. Furthermore, MDE’s Stormwater Management Program has calculated the average TSS reduction efficiencies for BMPs in place during these respective time periods.

The actual loading analysis used to determine the baseline load to the watershed system was not able to apply this information since the BMPs in place today are already accounted for in the model via the BMP factor per CBP P5 model segment, as determined from the urban BMP tracking database. However, the land use information per stormwater management era and the estimated average BMP efficiency information per era, in conjunction with current MS4 permitting requirements, was used to determine the maximum feasible reductions that can be expected from regulated stormwater sources by applying reductions that were

FINAL

consistent with the average BMP efficiencies to solely the pre-existing urban area, which in this case was pre-1985 urban land use. For detailed information on the source and development of the CBP P5 land use, please see Section 4 of the report entitled *Chesapeake Bay Phase 5 Community Watershed Model* available at http://www.chesapeakebay.net/model_phase5.aspx?menuitem=26169. http://archive.chesapeakebay.net/pubs/subcommittee/nsc/sedwg/A_Summary_Report_of_Sediment_Processes.pdf (US EPA 2008).

The commentor is correct that the age of development is not 100% accurate in determining the areas where mitigation needs to be performed. Furthermore, the commentor is also correct in asserting that BMPs implemented between 1985 and 2000 were largely for flood control purposes and that some developments prior to 1985 may have incorporated BMPs to some extent, prior to the state adopting any sort of stormwater management regulations. However, MDE contends that the age of development provides a close approximation of those areas where mitigation needs to be performed, especially at the 8-digit watershed scale, since for the most part, development that occurred prior to 1985 did not incorporate any flow/sediment control BMPs. Additionally, MDE actually defines the current maximum feasible reductions from regulated stormwater sources to be all development prior to 2002, since, as the commentor pointed out, the stormwater regulations and associated BMPs in place during this time primarily addressed flood control. However, relative to the Patapsco River Lower North Branch Sediment TMDL, the TMDL loading capacity was achieved after applying reductions solely to the pre-1985 urban land use, and therefore no further reductions were required from the urban area developed between 1985 and 2002. In other watersheds, this may not be the case.

22. The commentor states that the TMDL document does not include a sediment allocation and associated required reduction table(s) by pollutant source and MS4 jurisdiction.

Response: The sediment TMDL allocation and required reduction table(s) by non-urban pollutant sources appear in Table 1 of the technical memorandum *Significant Sediment Nonpoint Sources in the Patapsco River Lower North Branch Watershed*, since MDE does not consider non-urban land uses to fall under the purview of an MS4 jurisdiction as per the response to Comment 10. The sediment TMDL allocation and required reduction table(s) by MS4 jurisdiction appear in Tables 2 and 3 of the technical memorandum *Significant Sediment Point Sources in the Patapsco River Lower North Branch Watershed*.

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FINAL

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