The 2008 Integrated Report of Surface Water Quality in Maryland

Submitted in Accordance with Sections 303(d), 305(b) and 314 of the Clean Water Act

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EXECUTIVE SUMMARY

Maryland's 2008 Integrated Report (IR) is submitted in compliance with sections 303(d), 305(b) and 314 of the federal Clean Water Act (CWA). This biennial report describes ongoing efforts to monitor, assess, track and restore the chemical, physical and biological integrity of Maryland waters. This report presents the current status of water quality in Maryland by placing all waters of the State into one of five categories.[1] In addition, the report provides information about the progress on addressing impaired waters (Categories 4 & 5) by documenting:

- Completed TMDLs, which re-categorize impairments from Category 5[1] (impaired and needs a TMDL: aka the "list of impaired waters") to Category 4 (TMDL completed, but still impaired).
- Analyses of new water quality data that shows previously impaired areas are attaining standards. This can result from remediation, changes in water quality standards, or improved monitoring and/or data analysis. Two examples worth noting for this report are the Water Quality Analyses submitted for Jones Falls and Patapsco River Lower North Branch.[2]
- Development of new assessment methodologies and watershed segmentation that enhances use of available data and provides more consistency with management and implementation strategies. Two major examples include (1) revision of Chesapeake Bay impairments from 3 large main Bay segments into 5 main Bay segments and 48 tidal tributaries and (2) revised methods for analyzing non-tidal biological data that aggregate 340 small impaired areas into 70 larger areas.

The 2008 IR incorporates a number of changes this year; these include: substantial database reformatting for consistency with EPA's assessment database; implementation of new biological, bacterial, and fish tissue assessment methodologies; fully phasing in of the new Chesapeake Bay segmentation and designated uses for assessment purposes; and, fuller integration of the CWA sections 305(b) and 303(d). These changes are part of an on-going effort to improve Maryland's reporting and assessment activities required under the CWA. Further, Maryland continues to work closely with EPA's Chesapeake Bay Program (CBP) and other state partners (VA, PA, D.C., NY, and DE) on the assessment process for the new Chesapeake Bay water quality criteria. Maryland has adopted an assessment process facilitated by the CBP and agreed upon by consensus of the partner states, resulting in 52 revised impairment listings for Bay segments based on a change in assessment methodology. The current Chesapeake Bay assessments will continue to evolve as new assessment methodologies are developed and as additional data are collected. More details on the Chesapeake Bay assessments can be found at http://www.chesapeakebay.net/baycriteria.htm.

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[1] The Integrated Report places all waters of the State into one of five "categories": Category 1 indicates that a water body is meeting all standards, Category 2 means it is meeting some but not all, Category 3 indicates that there is insufficient data to determine whether standards are being met, Category 4 means that water quality standards are not being met but a TMDL is not needed, either because it has already been completed, other more immediate fixes are available, or the impairment is not load related, and finally, Category 5 indicates that a water body is impaired and a TMDL is needed.

[2] The WQA for Jones Falls and Patapsco River Lower North Branch are located in Appendix 1 and 2, respectively.

Of particular note this reporting cycle is a new impairment listing for trash in the Baltimore Harbor. This is only the second trash impairment in Maryland, the other being in the Anacostia River. Other notable changes for this cycle include modifications to the biological assessment methodology used to determine attainment of aquatic life use standards in non-tidal waters. This new methodology, developed in cooperation with the Department of Natural resources (DNR), uses Maryland Biological Stream Survey data to estimate the impaired stream miles within an 8-digit watershed instead of assessing 12-digit subwatersheds based on single samples. As a result of this change in assessment methodology, 340 impaired 12-digit watersheds (approx. 11 sq. miles on average) have been reassessed at the 8-digit watershed level resulting in 44 8-digit watershed impairments (approx. 90 sq. miles each, See Figure 1).[3] This new methodology is more consistent with the biological assessment methodology for Chesapeake Bay and better meets EPA's needs for estimates of impaired stream mileages. The methodology incorporates improved error estimates and provides consistent assessment results for Maryland's 8-digit watershed management scale.

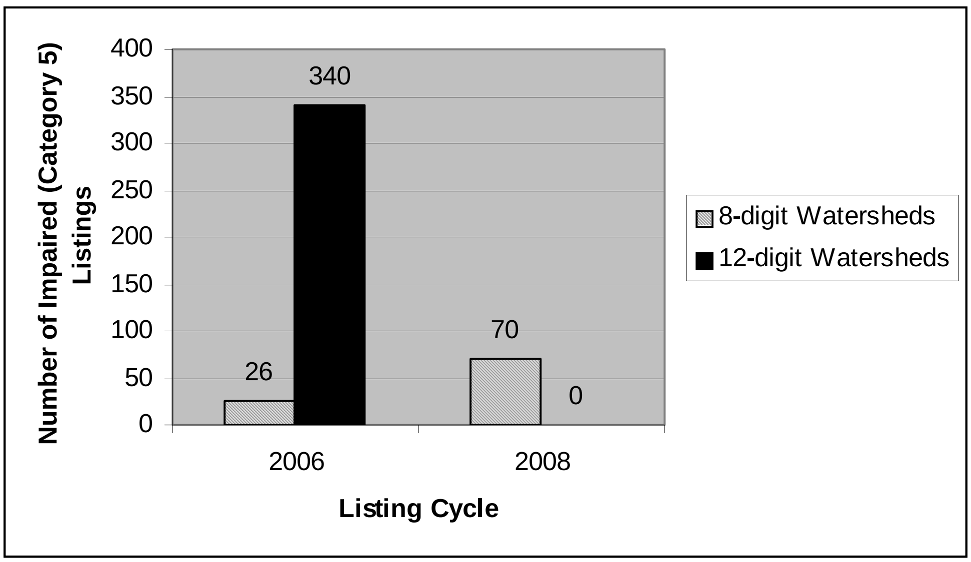


Figure 1: Change in the number of non-tidal biological impairment listings (Category 5) per watershed scale as a result of the change in methodology. The actual area assessed as impaired is roughly equal between 2006 and 2008.

There are 48 additions to the list of Category 5 waters in 2008. Eighteen of the listings are new PCB listings, six of which are the result of lowering the PCB threshold (to 39 parts per billion) adopted by MDE for human health protection. Twelve total suspended solids listings are the result of Chesapeake Bay submerged aquatic vegetation assessments based on the new segmentation. Eight listings (7 metals and 1 pH) are associated with an acid mine drainage impairment in the Upper North Branch Potomac River and George's Creek. Also, there are 4 fecal coliform listings in non-beach areas, 2 Bay segment listings as a result of bioassessments, 2 new listings for the Nanticoke River Oligohaline (NANOH) open water designated use, 1 new

[3] These 44 8-digit listings are not technically considered new listings since these listings resulted simply from a change in methodology and not as a result of new data.

listing in Baltimore Harbor for trash, and 1 new non-tidal biological listing in the Port Tobacco River.

There have also been 58 waters removed from the list of impaired waters ("delistings") in 2008 that have resulted either due to new data indicating that water quality is being supported or due to changes in listing methodologies (excluding the changes to the biological listings mentioned above). Fourteen of these delistings are in Chesapeake Bay segments that are now meeting the shallow-water submerged aquatic vegetation use. Another 20 have been delisted as a result of fecal coliform or enteroccocus levels that are meeting water contact or shellfish designated uses. The remaining 24 delistings are a combination of waters that meet aquatic life standards for metals, pesticides, PCBs and sediment-related parameters. Since early listings were based on limited data (especially from 1996 and 1998), it is not possible, in many cases, to attribute the reasons these waters now meet standards to a particular restoration action. It is possible that the extensive restoration practices that have been applied statewide might be playing a contributory role but it may also be true that these listings were made inappropriately to begin with.

Table 1: Category 5 Listing Status From 2006 to 2008

IR Year/Status	Category 5 Listings
2006 Total Category 5 Listings	**669**
2008 New Listings	+48
2008 New Delistings	-57*
2008 Changes from Revised Non-tidal Biological Assessment Methodology	-340
2008 large-scale (8-digit) additions from the Revised Non-tidal Biological Assessment Methodology	+44
2008 Approved TMDLs	-23
2008 Changes from New Chesapeake Bay Assessment Methodology and Designated Uses	+52
2008 Grand Total Category 5 Listings	**393**

*This number does not include MD-EASMH-Little_Greenwood_Creek as that was an erroneous listing in the draft 2008 IR.

Figure 2 shows a breakdown, by pollutant group, of the current (2008) impaired water listings.

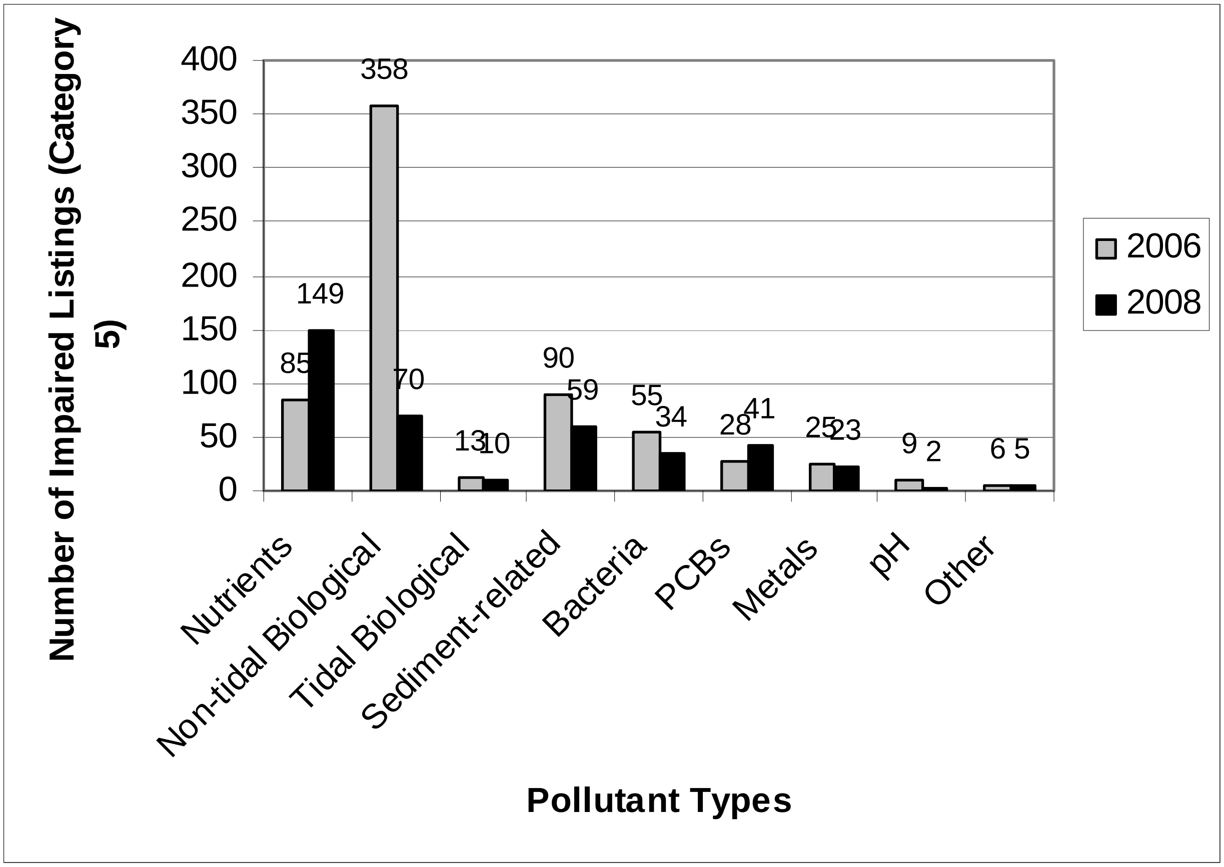


Figure 2: Comparison of the Number of Impaired Listings (Category 5) Between Listing Cycles per Pollutant Group. *(Non-tidal Biological listings for 2006 include both 8-digit and 12-digit biological listings.)*

There have been some notable developments in Maryland's water programs since the last IR reporting cycle in 2006. Maryland completed a total of 104 Total Maximum Daily Loads and Water Quality Analyses in 2006 and 2007.[4] Fifty-two of the 104 meet specific requirements of the memorandum of understanding with EPA that sets TMDL production schedules for Maryland's submission of TMDLs to EPA. To make additional improvements to the next IR, DNR and MDE have also initiated discussions to re-evaluate Maryland's comprehensive water monitoring strategy for consistency with current priorities and goals.

Other notable new restoration programs or actions taken by the State include:

- placement of new requirements for nutrient load limits in wastewater treatment plant permits to meet the goals of the State's Tributary Strategies and TMDLs;

[4] Of these 104 TMDLs and WQAs, only 8 were TMDLs that resulted in delistings for 2008. All other TMDLs were accounted for previously on the Final 2006 Integrated List. All WQAs were either accounted for in 2006 or were included in the delistings count for 2008 (-57 in the Table 1).

- passage of legislation (House Bill 1141) to require the State to work closely with local jurisdictions to include water quality and quantity considerations in their local comprehensive land use plans;
- passage of the Stormwater Management Act of 2007 to require environmental site design and low impact development practices on all new developments and redevelopment projects to the maximum extent practicable;
- passage of the Healthy Air Act of 2006, which requires the State's major power plants to significantly reduce emissions of nitrogen and sulfur oxides, and mercury; and
- creation of the Chesapeake Bay 2010 Trust Fund to provide a dedicated source of funding for nonpoint source nutrient and sediment control projects necessary to meet the goals of Maryland's Chesapeake Bay Tributary Strategies.

To further improve the effectiveness of these and other efforts related to water quality improvement in Maryland, Governor O'Malley has also established an interactive accountability process, called BayStat, where all of the Cabinet Secretaries, and Governor's senior staff meet regularly to review progress and evaluate efforts to restore the Chesapeake Bay, make certain that we are taking the most cost effective actions in a timely manner and to increase public awareness of, and participation in, efforts to restore the vitality of the Bay.

PREFACE

Maryland's Integrated Report, when approved by the US Environmental Protection Agency, will satisfy Sections 303(d), 305(b) and 314 of the federal Clean Water Act (CWA). The following lists the requirements of these sections.

Clean Water Act §303(d) (Impaired waters) Requirements

- A list of water quality-limited (impaired) waters still requiring TMDL(s), pollutants causing the impairment and priority ranking for TMDL development (including waters targeted for TMDL development within the next two years).
- A description of the methodology used to develop the list.
- A description of the data and information used to identify waters, including a description of the existing and readily available data and information used.
- A rationale for any decision to not use any existing and readily available data and information.
- Other reasonable information such as demonstrating good cause for not including a waters on the list.

Clean Water Act §305(b) (Water quality inventory) Requirements

- A description of the quality of all waters in the State and the extent to which the quality of waters provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water.
- An estimate of the extent to which control programs have or will improve water quality, and recommendations for future actions necessary and identifications of waters needing action.
- An estimate of the environmental, economic and social costs and benefits needed to achieve the objectives of the CWA and an estimate of the date of such achievement.
- A description of the nature and extent of nonpoint source pollution and recommendations of programs needed to control each category of nonpoint sources, including an estimate of implementation costs.
- An assessment of water quality of all publicly owned lakes as specified in §314(a)(1).

Clean Water Act §314 (Clean Lakes) Requirements

- An identification and classification according to eutrophic condition of all publicly owned lakes.
- A description of procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes.
- A description of methods and procedures, in conjunction with appropriate federal agencies, to restore the quality of such lakes.
- Methods and procedures to mitigate the harmful effects of high acidity, including innovative methods of neutralizing and restoring buffering capacity of lakes and methods of removing from lakes toxic metals and other toxic substances mobilized by high acidity.

- A list and description of those publicly owned lakes for which uses are known to be impaired and those in which water quality has deteriorated as a result of high acidity that may be due to acid deposition.
- An assessment of the status and trends of water quality in lakes, including but not limited to, the nature and extent of pollution loading from point and nonpoint sources and the extent to which the use of lakes is impaired as a result of such pollution, particularly with respect to toxic pollution.

PART A: Introduction

In Maryland, the Departments of Natural Resources (DNR) and the Environment (MDE) are the two principal agencies responsible for water resources monitoring, assessment and protection. DNR is the primary agency responsible for ambient water monitoring and assessment. MDE sets water quality standards, regulates discharges to Maryland waters through multiple permits, enforcement and compliance activities, and develops Total Maximum Daily Loads (TMDLs) for impaired waters. Historically, DNR reported water quality monitoring and assessment results via annual §305(b) reports and updates mandated by the federal Clean Water Act (CWA), while MDE reported polluted waters using the CWA's biennial §303(d) List. Since 2002 and in compliance with Environmental Protection Agency guidance on 303(d) listing and 305(b) reporting, these formerly independent responsibilities have evolved into a combined reporting structure called the Integrated Report (IR).

The IR utilizes five reporting categories that not only include impaired waters requiring TMDLs, but also waters that are clean or need additional monitoring data to make an assessment. These categories are:

I. **Category 1:** water bodies that meet all water quality standards and no use is threatened;

II. **Category 2:** water bodies meeting some water quality standards but with insufficient data and information to determine if other water quality standards are being met;

III. **Category 3:** Insufficient data and information are available to determine if any water quality standard is being attained. This can be related to having an insufficient quantity of data and/or an insufficient quality of data to properly evaluate a water body's attainment status.

IV. **Category 4:** one or more water quality standards are impaired or threatened but a TMDL is not required or has already been established. The following subcategories are included in category 4:
   - **Subcategory 4a:** TMDL already approved or established by EPA;
   - **Subcategory 4b:** Other pollution control requirements (*i.e.*, permits, consent decrees, etc.) are expected to attain water quality standards; and,
   - **Subcategory 4c:** Water body impairment is not caused by a pollutant.

V. Category 5: Water body is impaired, does not attain the water quality standard, and a TMDL or other acceptable pollution abatement initiative is required. This is the part of the List historically known as the 303(d) List.

A.1 Data Sources and Minimum Requirements

Section 130.7(B)(5) of the Clean Water Act requires that states "assemble and evaluate all existing and readily available water quality-related data and information" when compiling their Integrated Report. This includes but is not limited to the following:

(i) Waters identified by the State in its most recent Section 305(b) Report as "partially meeting" or "not meeting" designated uses;

(ii) Waters for which dilution calculations or predictive models indicate non-attainment of applicable water quality standards;

(iii) Waters for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions; and,

(iv) Waters identified by the State as impaired in a nonpoint source assessment submitted to EPA under section 319 of the CWA or in any updates of the assessment.

With the integration of sections 305(b) and 303(d) of the Clean Water Act and the adoption of a multi-category reporting structure, Maryland has developed a two-tiered approach to data quality. Tier 1 data is used to determine impaired waters (*e.g.*, Category 5 waters or the traditional 303(d) List) and is subject to the highest data quality standards. Maryland waters identified as impaired using Tier 1 data may require a TMDL or other regulatory actions. These data should be accompanied by a Quality Assurance Project Plan (QAPP) consistent with EPA data guidance specified in *Guidance for Quality Assurance Project Plans. Dec 2002. EPA /240/R-02/009* available at http://www.epa.gov/quality/qs-docs/g5-final.pdf. Tier 1 data analysis must also be consistent with Maryland's Listing Methodologies.

Tier 2 data are used to assess the general condition of surface waters in Maryland and may include volunteer monitoring, land use data, visual observations of water quality condition, or data not consistent with the Maryland's Listing Methodologies. Such data may not have a QAPP or may have one that is not consistent with EPA guidance. Waters with this level of data may be placed in Categories 2 or 3 of the List, denoting that water quality is generally good or that there are insufficient data to make an assessment, respectively. However, Tier 2 data alone are not used to make impairment decisions (*i.e.*, Category 5 listings requiring a TMDL) because the data are of insufficient quantity and/or quality for regulatory decision-making.

MDE supports the use of computer models and other innovative approaches to water quality monitoring and assessment. Maryland and the Bay partners have also relied heavily on the Chesapeake Bay model to develop loading allocations, assess the effectiveness of best management practices, and guide implementation efforts. Several different modeling approaches have also been used in TMDL development. With the growing number of biological impairments in Category 5 of the List, Maryland will be relying more heavily on land use analyses, GIS modeling, data mining, and other innovative approaches to identify stressors, define ecological processes, and develop TMDLs.

Maryland has increased its efforts to make Integrated Reporting data available to the public in a real time environment. The Integrated Report database is now available online at http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/303d_search/. References to and summaries of the data used for impairment determinations are also included to give the public a better understanding of why specific decisions were made.

A.1.1 Quality control of water quality datasets

Data quality in Maryland's water monitoring programs are defined through implementation of the agency's quality control program (e.g., DNR's and MDE's Quality Management Plan), Quality Assurance Project Plan (QAPP) for each monitoring program and field and laboratory Standard Operating Procedures (SOP). Water monitoring programs conducted under contract to the US Environmental Protection Agency (EPA) must have QAPPs approved by the EPA Regional or Chesapeake Bay Program QA Officer prior to initiating monitoring activities.

Details in each program's QAPP define data quality indicators by establishing quality control samples and measurement performance criteria as part of the program's planning and development. Such measures help ensure there is a well-defined system in place to assess the quality of the data that are collected.

Water monitoring programs conducted by a local agency, educational institution, consultant or citizen group may not have a QAPP. Unless there are contractual requirements, water monitoring QAPPs for these groups are not reviewed or approved by the State. While it is recommended that a QAPP or equivalent planning document be developed, some water quality monitoring programs may have no QAPP or documentation about necessary quality control data. For State analysts to review these contributed data with any confidence the quantitative aspects of these data need to be defined.

Some of the data quality aspects that need to be considered include:

- **Precision** - How reproducible are the data? Are sample collection, handling and analytical work done consistently each time samples are collected and processed?
- **Accuracy/Bias** - How well do the measurements reflect what is actually in the sample? How far away are results from the "true" value, and are the measures consistently above or below this value?
- **Representativeness** - How well do the sample data characterize ambient environmental conditions?
- **Comparability –** How similar are results from other studies or from similar locations of the same study, or from different times of the year, etc.? Are similar sampling and analytical methods followed to ensure comparability? Do observations of field conditions support or explain poor comparability?

- **Completeness –** Is the quality and amount of data collected sufficient to assess water quality conditions or can these data be appended to other, existing data collected at the same site or nearby to provide enough information to make an assessment decision?
- **Sensitivity -** Are the field and/or laboratory methods sensitive enough to quantify parameters at or below the regulatory standards and at what threshold can an analytical measure maintain confidence in results?

QAPPs will likely not address all of these issues and there are often no quantitative tests or insufficient QC data available to do so. In these instances, best professional judgement may be required as these aspects can be difficult to address, even if there is a monitoring QAPP. For some issues, there is no quantitative test and often little, if any, quality assurance data are provided with contributed data. In most instances, an analyst's review of available monitoring program documentation and data are subjective. Once data quality is considered acceptable (or at least not objectionable), the dataset review process moves to a more quantitative review stage.

A.1.1.1 Water quality data review

The designated uses defined in Code of Maryland Regulations are assessed by relatively few field and analytical measures. Water temperature, dissolved oxygen, pH, turbidity, water clarity (Secchi depth or light extinction), acres of estuarine grasses, ammonium, and certain bacteria levels define the principal data used to assess criteria attainment. Various measures of nitrogen and phosphorus as nutrients have not been defined in terms of criteria, although exceedance of oxygen criteria or nuisance levels of algae are attributed to high nutrients as a pollutant. Except for special studies or as a discharge permit requirement, metals, inorganic and organic parameters defined as criteria are not routinely measured due to the high cost of analysis and because few of these substances are found in ambient conditions at levels exceeding criteria.

Water quality datasets reviewed for assessing use support are first examined in terms of QAPP or other reports that define monitoring objectives and quality control. For selected parameters, the data are reviewed for sufficient sample size, data distribution (type and outliers/errors) and spatial and temporal distribution in the field. Censored data and field comments are examined for unusual events that may affect data quality (e.g., storm event). Data are examined for seasonality and known correlations (e.g., conductivity and salinity) are reviewed. Censored data are noted and may be excluded from the analysis.

Not all water quality criteria are assessed using this approach. Some assessments are conducted by other State programs using peer-reviewed or defined interstate methods and are not re-evaluated using other approaches. Examples include; assessment of algal samples, the State's statistical non-tidal living resource survey (MD Biological Stream Survey), fish kill and bacterial assessments, bathing and shellfish harvesting restrictions, and toxic contaminants in fish tissue, shellstock and sediments.

Some criteria assessments are conducted externally. In these circumstances, the assessment methods are peer reviewed and results are provided to the State. Criteria assessed in this manner are not re-evaluated. Examples include, for Maryland's Chesapeake Bay and tidal tributaries, benthic community criteria (Versar, Inc. and Old Dominion University), aquatic grass coverage

(VA Institute of Marine Science) and dissolved oxygen (US Environmental Protection Agency's Chesapeake Bay Program).

PART B: Background

B.1 Total Waters

Maryland is fortunate to have an incredible diversity of aquatic resources. The low-lying, coastal plain region in the eastern part of the State includes the oceanic zone as well as the estuarine waters of both the Coastal and Chesapeake Bays. Moving further west and up through the rolling hills of the Piedmont region, the tidal influences give way to flowing streams and the Liberty, Loch Raven and Prettyboy reservoir systems. Along the western borders of the State is the Highland region where resides the State's highest peaks, and which includes three distinct geological provinces (the Blue Ridge, the Ridge and Valley province, and the Appalachian Plateaus). Estimates of Maryland's total surface waters across these regions are given in Table 2.

Table 2: Scope of Maryland's Surface Waters.

	Value	**Scale**	**Source**
State population	5,618,344	N/A	MD Dept. Planning, 2007
Surface area - land (mi^2) **- total ($mi_{2)}$**	9,844 12,193	Unknown	MD Dept. Natl. Res., 2001
Rivers and streams (mi)	10,820	1:100,000 NHD Coverage	MDE, 2008
Lakes, reservoirs (number / ac) **- all lakes/reservoir** **- significant, publicly-owned**	 947 lakes / 77,965 60 lakes / 21,168	 1:100,000 (RF3) Unknown	 US EPA, 1991 MDE, 2003; 2005
Estuaries/bays (mi^2)	2,522	Unknown	Cronin, 1971 / estimate
Ocean coast (mi^2)	109	1:100,000 NHD Coverage	MDE, 2008
Wetlands - freshwater (ac) **- tidal (ac)**	346,135 252,273	Unknown Unknown	Tiner and Burke, 1995 Tiner and Burke, 1995

B.1.1 Water Quality Standards

A water body is considered "impaired" when it does not support its designated use [see Code of Maryland Regulations §26.08.02 at http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.htm#Subtitle08]. Maryland's Water Quality Standards (WQS) support the following designated use classes:

1. **Use I waters*:** Water contact recreation, and protection of nontidal warmwater aquatic life;
2. **Use II waters# *:** Support of estuarine and marine aquatic life and shellfish harvesting;
3. **Use III waters*:** Nontidal cold water; and,
4. **Use IV waters*:** Recreational trout waters. *Uses I, II, III, and IV can also serve as public drinking water sources.

#See Section B.1.1.1 for details on Chesapeake Bay water quality criteria.

Each of the four use classes consists of narrative and numeric water quality criteria. Narrative criteria require, among other things, that all water bodies in Maryland shall "provide water quality for the designated uses of: water contact sports; play and leisure time activities where individuals may come in direct contact with the surface water; fishing; propagation of fish, other aquatic life, and wildlife; and, agricultural and industrial water supply"[5]. Numeric Water Quality Criteria establish threshold values, usually based upon risk analyses or dose-response curves, for the protection of human health and aquatic life. These apply to pollutants that can be monitored and quantified to known levels of precision and accuracy, such toxics concentrations, pH, and nutrients.

The Federal Clean Water Act and its amendments require that States update their water quality standards every three years, subject to review and approval by the US Environmental Protection Agency (http://www.mde.state.md.us/wqstandards/). Water quality standards are updated through changes to the regulatory language in COMAR and go through a public review process.

[5] Source: COMAR 26.08.02.02(1a-1f)

B.1.1.1 Water Quality Standards for Chesapeake Bay and its Tidal Tributaries

Maryland has detailed water quality standards for Chesapeake Bay and its tidal tributaries to protect both aquatic resources and to provide for safe consumption of shellfish. The newly revised aquatic resource protection standards are subcategories under Use II waters and establish five designated uses (see Figure 3), including:

1. **Seasonal Migratory Fish Spawning and Nursery Designated Use** - includes waters of the Chesapeake Bay and its tidal tributaries that have the potential for or are supporting the survival, growth, and propagation of balanced populations of ecologically, recreationally, and commercially important anadromous, semi-anadromous and tidal-fresh resident fish species from February 1 through May 31.
2. **Seasonal Shallow-Water Submerged Aquatic Vegetation Designated Use –**includes tidal fresh, oligohaline and mesohaline waters of the Chesapeake Bay and its tributaries that have the potential for or are supporting the survival, growth, and propagation of rooted, underwater bay grasses in tidally influenced waters between April 1 and October 1.
3. **Open-Water Fish and Shellfish Designated Use** - includes waters of the Chesapeake Bay and its tidal tributaries that have the potential for or are supporting the survival, growth, and propagation of balanced, indigenous populations of ecologically, recreationally, and commercially important fish and shellfish species. This subcategory applies to two distinct periods: summer (June 1 to September 30) and October 1 through May 31. In summer, the open-water designated use in tidally influenced waters extends from shoreline to adjacent shoreline, and from the surface to the bottom or, if a pycnocline exists (preventing oxygen replenishment), to the upper measured boundary of the pycnocline. October 1 through May 31, the boundaries of this use include all tidally influenced waters from the shoreline to adjacent shoreline and down to the bottom, except when the migratory spawning and nursery designation (MSN) applies.
   NOTE 1: If a pycnocline exists but other physical circulation patterns, such as the inflow of oxygen-rich oceanic bottom waters, provide oxygen replenishment to the deep waters, this use extends to the bottom. This is mostly prevalent in the Virginia portion of the Bay.
4. **Seasonal Deep-Water Fish and Shellfish Designated Use -** includes waters of the Chesapeake Bay and its tidal tributaries that have the potential for or are supporting the survival, growth, and propagation of balanced, indigenous populations of important fish and shellfish species inhabiting deep-water habitats from June 1 through September 30:
   NOTE 1: In tidally influenced waters located between the measured depths of the upper and lower boundaries of the pycnocline, where a pycnocline is present and presents a barrier to oxygen replenishment; or
   NOTE 2: From the upper boundary of the pycnocline down to the sediment/water interface at the bottom, where a lower boundary of the pycnocline cannot be calculated due to the depth of the water column.
   NOTE 3: From October 1 to May 31, criteria for *Open Water Fish and Shellfish Subcategory* apply.

5. **Seasonal Deep-Channel Refuge Designated Use** - includes waters of the Chesapeake Bay and its tidal tributaries that have the potential for or are supporting the survival of balanced, indigenous populations of ecologically important benthic infaunal and epifaunal worms and clams, which provide food for bottom-feeding fish and crabs. This subcategory applies from June 1 through September 30 in tidally influenced waters where a measured pycnocline is present and presents a barrier to oxygen replenishment. Located below the measured lower boundary of the pycnocline to the bottom.
   NOTE: From October 1 to May 31, criteria for *Open Water Fish and Shellfish Subcategory* apply.

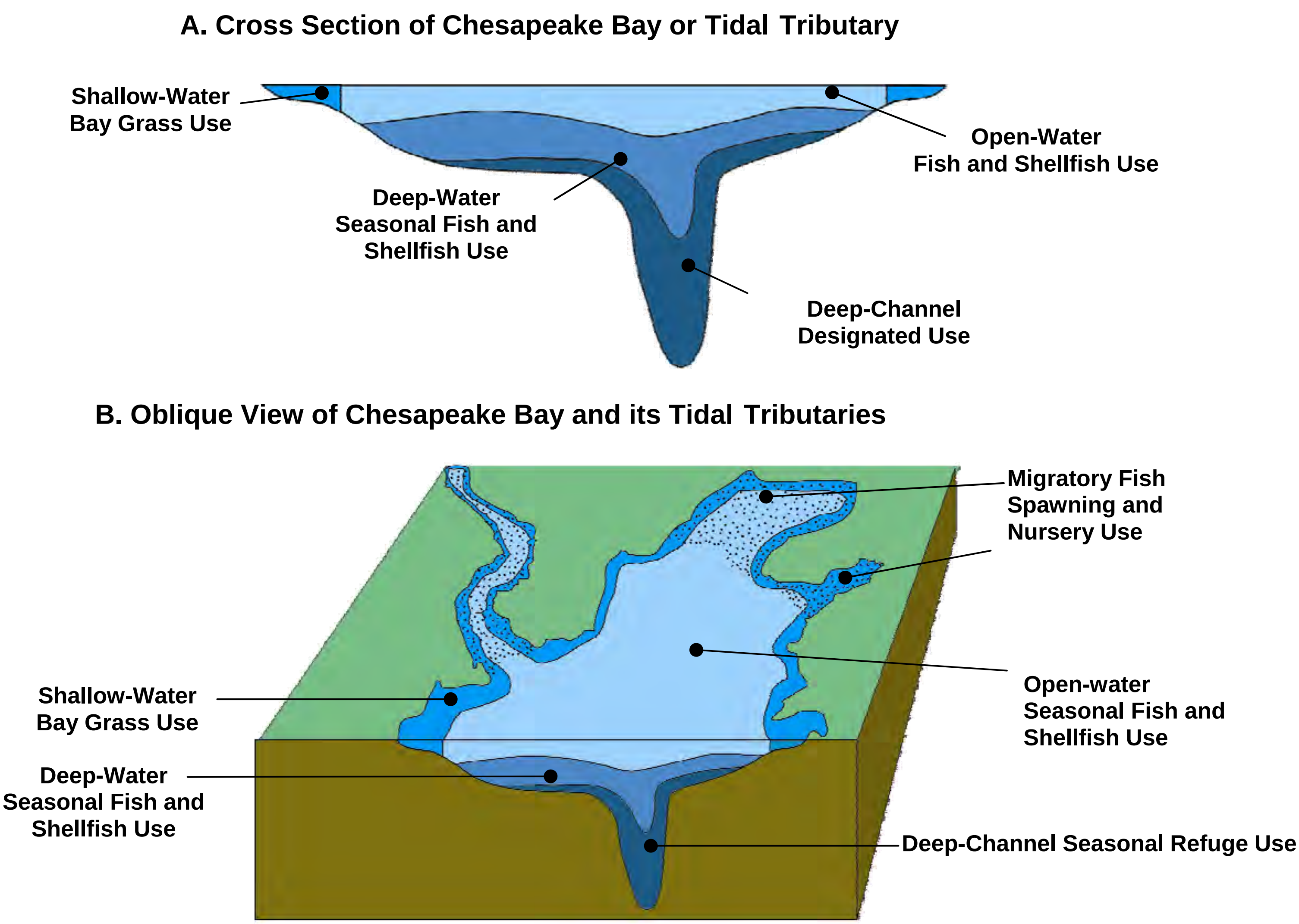


Figure 3: Illustration of the designated uses for Chesapeake Bay (Chesapeake Bay Program, 1998). Uses are both overlapping and three-dimensional.

B.2 Water Pollution Control Programs

Maryland implements a host of water pollution control programs, many of which are funded by federal dollars under the Clean Water Act. Some programs are administered by different state agencies within Maryland, as well as by local jurisdictions like counties and municipalities. Some of the programs administered by MDE are briefly cited below and web links are provided for access to more detailed information.

B.2.1 Permits

MDE is responsible for administering several permit programs to reduce the impacts of surface water and groundwater discharges on state waters. More detailed information on the state's water permits is available at http://www.mde.state.md.us/Permits/WaterManagementPermits/index.asp.

B.2.2 Tier II Waters and Antidegradation

Recently, Maryland has implemented antidegradation regulations to better protect state waters where data indicates that water quality is significantly better than required to support the applicable designated uses (COMAR 26.08.02.04). MDE is also developing detailed implementation guidance to help regulated entities better understand and implement these regulations. This important program aims to protect high quality waters by requiring more rigorous permit application reviews and by severely restricting the amount of buffering capacity (i.e., assimilative capacity) that can be used by a discharger. More information on Tier 2 can be found at http://www.mde.state.md.us/ResearchCenter/Data/waterQualityStandards/Antidegradation/index.asp

B.2.3 Grant Programs

A number of financial assistance programs are offered and/or facilitated by the Maryland Department of the Environment. Funding may be in the form of grants, loans, or direct payments for specific projects. More detailed information on the range of programs administered by the Department can be found at http://www.mde.state.md.us/businessinfocenter/grants/index.asp

B.2.4 Total Maximum Daily Loads (TMDLs)

Waters listed on Category 5 of this Integrated Report may require what is called a Total Maximum Daily Load or TMDL. A TMDL is an estimate of the amount or load of a particular pollutant that a water body can assimilate and still meet water quality standards. After a total load has been developed, upstream discharges will be further regulated to ensure the prescribed loading amounts are attained. More information on Maryland's TMDL program can be found at http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/index.asp

B.2.5 Drinking Water Supply and Protection

The MDE is charged with ensuring that all Marylanders have a safe and adequate supply of drinking water. The Department has programs to oversee both public water supplies, which serve about 84 percent of the population's residential needs, and individual water supply wells, which serve citizens in most rural areas of the State. More information on Maryland's Water Supply Programs can be found at (http://www.mde.state.md.us/Programs/WaterPrograms/Water_Supply/index.asp)

B.2.6 Corsica River targeted watershed

The Corsica River Watershed Project is a pilot program designed to demonstrate that a tidal tributary of Chesapeake Bay can be successfully restored. The goal of this targeted watershed restoration is to remove the Corsica River from the Impaired Waters List. For more information, go to http://www.dnr.state.md.us/watersheds/tw/corsica/.

B.2.7 Program Coordination

State agency staff participate in many work groups, committees, task forces, and other forums to coordinate and communicate state efforts with interested stakeholders. Coordination with the Chesapeake Bay program and participation by state staff in the associated subcommittees continues to be a nexus for Maryland's water quality restoration activities. The Interagency TMDL Workgroup, chaired by MDE, and which includes the Departments of Natural Resources, Agriculture, Planning and Transportation and the University of Maryland, addresses needs for enhanced coordination between agencies (i.e.,data-sharing, TMDL project selection and review, and TMDL implementation planning, etc.) stemming from the accelerated TMDL production schedule, as well as for federal (Section 319) funding guidance for watershed restoration plans that can be used to develop TMDL implementation plans. State staff also meet regularly with other groups, such as the State Water Quality Advisory Committee and the Maryland Water Monitoring Council, to ensure program coordination with local and federal government agencies, as well as the private sector, academia, and Maryland's citizens.

In advance of updating the Maryland's water monitoring strategy for 2009, MDE has also taken a lead on assembling an interagency work group with the Department of Natural Resources to review current monitoring program goals and objectives. This conversation has begun well in advance of the reporting deadline to give monitoring agencies time to reevaluate strategic program goals, evaluate program effectiveness in meeting those goals, and reach consensus on recommendations for enhancing programs prior to compiling the next state monitoring strategy report.

B.3 Cost/Benefit Assessment

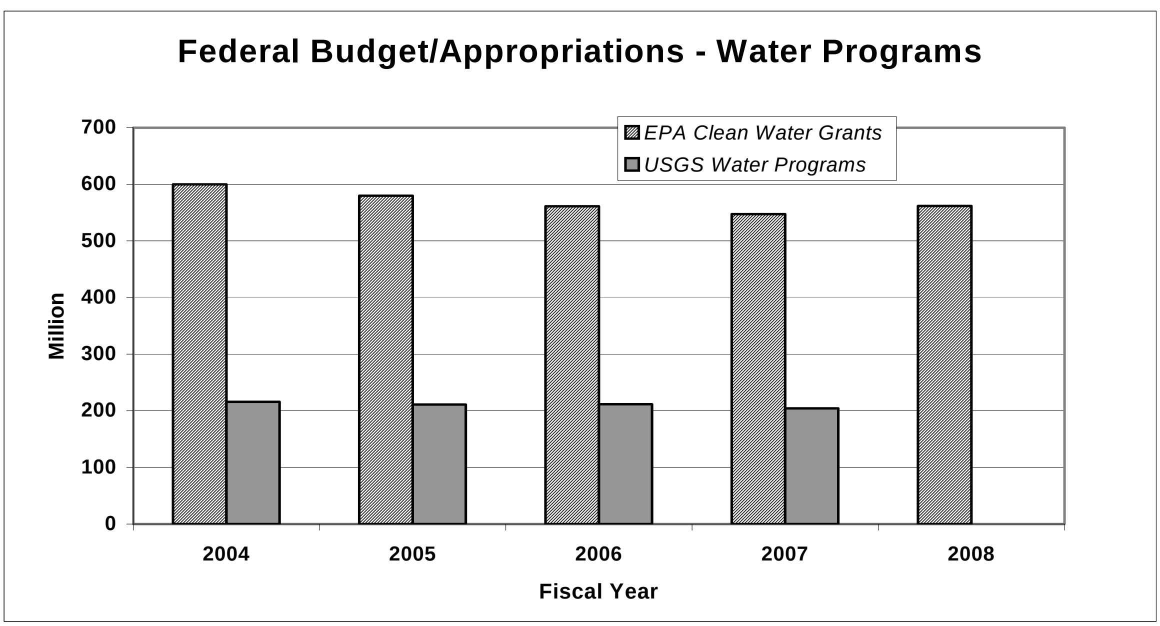
One specific reporting requirement of the Clean Water Act - §305(b), is a cost-benefit analysis of water pollution control efforts to ensure that the benefits of these programs are worth the costs. Economists have defined various ways to measure water quality benefits (e.g., Smith and Desvousges, 1986) and a number of agencies have produced estimates of water quality values based on uses (e.g., flood control value of wetlands – Leschine et al., 1997) or specific activities (e.g., recreational fishing - US Fish and Wildlife Service, 1998). Data for these efforts often are difficult to obtain, the results are complex or often address only a single use, and comparability between States or regions can be impossible.

B.3.1 Program costs

A substantial level of federal funding for water pollution control efforts comes from some agencies (US Environmental Protection Agency) while funding for aquatic resource protection and restoration may be substantially provided by other federal agencies (e.g., US Fish and Wildlife Service). Funds usually are transferred to States through a variety of appropriations – for example, certain provisions of the federal Water Pollution Control Act and its amendments provide for grants to States, including Sections 104(b) (NPDES), 106 (surface- and ground water monitoring and permitting), 117 (Chesapeake Bay Program), 319 (nonpoint source pollution control), and 604(b) (water quality planning). These funds often provide seed money or low-interest loans that must be matched by State or local funds or documented in-kind efforts used on the project. A summary of federal water quality/aquatic resource-related grants to State agencies is shown in Figure 4.

While some new water programs are occasionally initiated, overall, there has been a general decline of federal funding available to States for various water quality-related programs. The figure below shows a summary of EPA budget data from traditional water grants (Clean Water Act §106, §319, §104b planning, wetlands, targeted watersheds (including Chesapeake Bay), public water supply, beach monitoring and wastewater operator training). The USGS water program summary includes the federal share of joint funding agreements with State/local agencies and other entities).

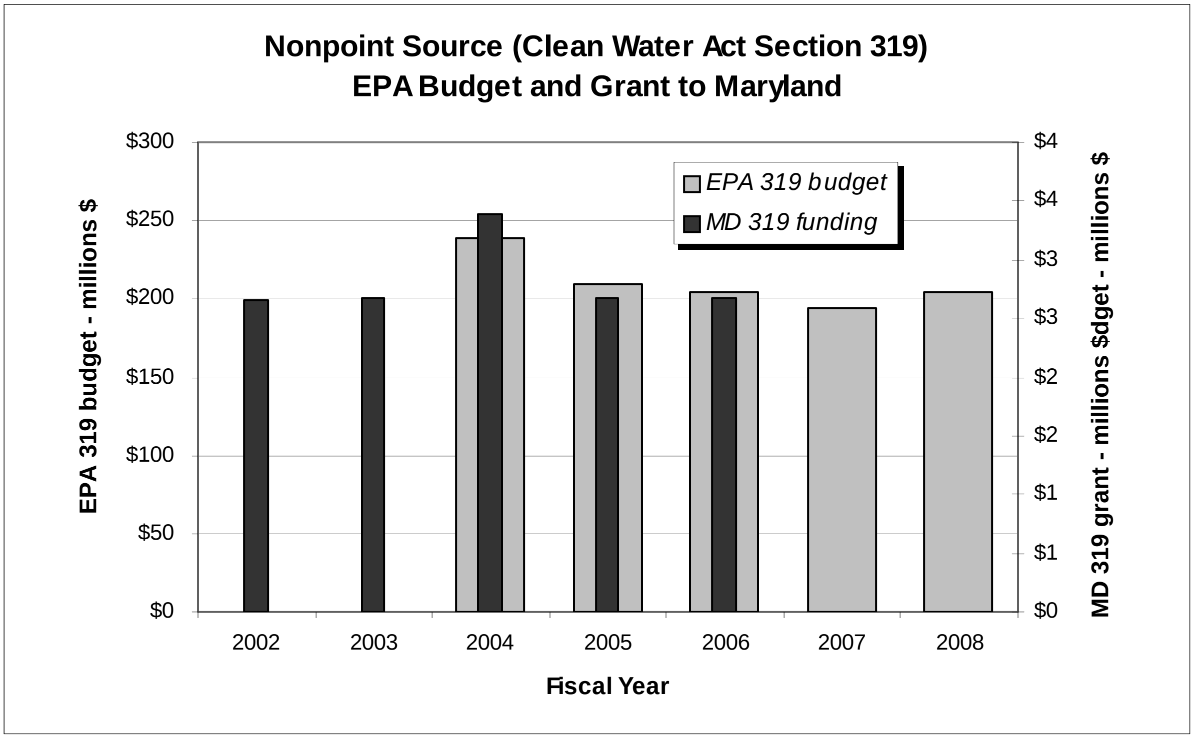
Figure 4: Federal Budget Appropriations to Water Programs (2004-2008)



Source: Association of State and Interstate Water Pollution Control Administrators, 2005, 2008

Although the changes appear gradual, the loss for State programs is increased when programs that require matching funds are reduced. An example of the impact of national funding variance in §319 funding appropriation and what Maryland received is shown in Figure 5.

Figure 5: Federal non-point source total budget allocation including the Maryland grant amount.



Source: Association of State and Interstate Water Pollution Control Administrators, 2005, 2008; MD Dept. Emvironment, 2006, 2007

As the federal funding for water programs vary and program costs increase annually, maintenance of nearly every water program activity requires either an increased share from State/local budgets or reductions in program function.

B.3.2 Program benefits

Clean water offers many valuable uses to individuals and communities as direct and indirect economic benefits. Beautiful beaches, whitewater rivers, and calm, cool lakes add to aesthetic appeal and contribute to a recreation and tourism industry. A plentiful supply of water and good quality drinking water encourages economic growth and development, increased waterfront property values, and water-based recreational opportunities and commerce. But while environmental quality ranks high in the public's perception of livable communities, an economic valuation of each of these benefits is difficult to develop.

Most often, economic benefits are determined for single uses (e.g., fishing). For example, more than 500,000 Maryland residents are anglers (about one in 10) and residents comprise 70 percent of the State's anglers. In 1996, these anglers spent $475 million in the State on fishing expenses -

an average of $664 per angler per year. Most of these expenses (56 percent) were trip-related (food, lodging, transportation, equipment rental). Equipment costs accounted for another large portion (39 percent) and other items (membership dues, magazines, permits, stamps and leases) amounted to $27 million (US Fish and Wildlife Service, 1998).

B.3.3 Summary

Water pollution control efforts are very costly. Much of the federal funds provided to the State and cost-shared with additional State and local funds are used to implement local pollution control and/or restoration programs. On an annual basis, the funds available are but a fraction of the estimated cost.

EPA needs to clearly define meaningful, accessible, available and comparable cost and benefit information that would meet Congress' intent in assessing value of the Clean Water Act's §305(b). A pilot State or regional program or a national study with recognized economists and federal and State participation could help simplify the complexities of this economic analysis.

B.4 Special State Concerns and Recommendations

Chesapeake Bay touches virtually every watershed within Maryland's borders and continues to be the focal point for water quality planning and restoration efforts across the State. Waste water treatment plant upgrades, tributary strategies (http://www.dnr.State.md.us/bay/tribstrat/), Total Maximum Daily Loads (TMDLs), Section 319 grants, and other federal, State, and local funding sources continue to be the primary tools used for Chesapeake Bay restoration initiatives. However, there are some exciting new legislative initiatives in Maryland (i.e., the 2010 Trust Fund) that will generate tens of millions of dollars annually for Chesapeake Bay restoration activities. A dedicated source of funding for pollution abatement initiatives will be critical as the State places increasing emphasis on TMDL implementation and tracking programmatic effectiveness in restoring water quality.

In addition to the Bay work, Maryland is increasingly engaged in protecting its high quality waters. Over the past year, MDE has increased its outreach to local governments by identifying high quality waters in their jurisdictions needing special protection (COMAR 26.08.02.04) and raising awareness on the need for antidegradation reviews.. These efforts have been a part of a larger State strategy (House Bill 1141) requiring local governments to include both water quantity and quality considerations in their comprehensive planning. Maryland also continues its targeted watershed work in the Corsica River to better understand how watersheds respond to restoration and determine recovery lag times between restoration activities and statistically valid water quality improvements. More targeted watershed restoration projects will occur as funding becomes available.

Maryland faces many emerging issues in the effort to reduce the amount of pollutants entering the Bay. Due to military Base Re-alignment and Closure (BRAC) initiated by the federal government, more people are expected to move into the Bay watershed with expansion of Aberdeen Proving Grounds and Fort Meade. Proactive planning efforts between the State and local jurisdictions are required to address the infrastructure needs to accommodate BRAC associated population growth. Another emerging issue of state concern is detection of endocrine disrupting chemicals in Maryland waters. These chemicals are being studied for effects on fish reproduction and, in some cases, have been linked to low reproductive success. These substances will be increasingly investigated to determine the magnitude of their effect on fish stocks and whether it is feasible to control them at the source.

To achieve its water quality goals, Maryland will have to find innovative ways to ramp up both restoration and protection efforts. The limiting factors for restoration activities continue to be funding constraints, as well as decentralization of water quality programs. The State's efforts to increase environmental funding as well as current efforts to better align monitoring and assessment programs through a coordinated state monitoring strategy will help to address these limiting factors. However, increased funding from the federal side as well as a more coordinated, centralized authority accountable to project successes and failures are necessary for continued progress. On the protection side, the State must continue to implement its antidegradation policy for high quality waters as well as develop clarifying guidance and regulations consistent with both water quality goals and the State's Smart Growth Initiative. To do this effectively, Maryland will have to work more closely with local jurisdictions and the public and be willing to face any legal challenges associated with land use planning decisions.

PART C: Surface Water Monitoring and Assessment

C.1 Monitoring Program

In September 2004, Maryland completed the last update of its comprehensive water monitoring strategy (http://www.mde.state.md.us/assets/document/water/WQPlanning_MonitoringStrategy_Sep04.pdf). Maryland's water quality monitoring programs are designed to support State Water Quality Standards (Code of Maryland Regulations Title 26, Subtitle 08) for the protection of both human health and aquatic life. This strategy identifies the programs, processes and procedures that have been institutionalized to ensure State monitoring activities continue to meet defined programmatic goals and objectives. The strategy also discusses current data management and quality assurance/quality control procedures implemented across the State to preserve data integrity and guarantee that data are of sufficient quality and quantity to meet the intended use.

In the Fall of 2007, MDE initiated monitoring strategy discussions with the Department of Natural Resources in anticipation of a revised strategy for 2009-2010. By starting this conversation well in advance of the reporting deadline, the State has built plenty of time into the process to allow a hard look at its current strategy, revisit programmatic goals and assumptions, and work towards developing a revised monitoring strategy that can effectively measure program effectiveness in meeting clearly defined goals.

C.2 Assessment Methodologies

Starting in 2002, Maryland developed and solicited public review of the assessment methodologies used to document the State's interpretation of its water quality standards (WQS) and which establish statistically based approaches for determining water body impairment. These methodologies are designed to provide consistency and transparency in Integrated Reporting so that the public and other interested stakeholders understand why listing decisions are made and can independently verify listing decisions. The assessment methodologies are living documents that can be revised as new statistical approaches, technologies, or other improved methods are identified. When changes are proposed to the methodologies, Maryland allows for public review and comment via the biennial Integrated Report.

For this 2008 reporting cycle, several assessment methodologies (Non-tidal biological, bacteria and the toxics assessment methodology with respect to fish tissue) have been revised and are open for public review and comment. These revised methodologies are discussed in sections C.2.1 – C.2.3 below.

C.2.1 Non-Tidal Biological Listing Methodology

The new biological listing methodology (BLM) for non-tidal streams has changed markedly from the previous version in order to address the shortcomings of the old methodology as well as to maintain consistency at the watershed management scale that the State currently uses (8-digit watershed). Some of the principle differences between the old BLM and the new involve the scale of listing, the method used to calculate watershed impairment, and the ability to estimate the size and number of stream miles impaired in Maryland. As a result, the new BLM provides assessments at the 8-digit watershed scale only, to be consistent with a probabilistic monitoring scheme (MBSS). Increasing efforts are being directed toward these watersheds to protect exceptional water quality where it exists and to remedy those parts of the watershed that may be experiencing degradation. Streams exhibiting site-specific, small-scale impairments (within larger 'Non-degraded' watersheds) will be targeted by the State for local restoration efforts and for future protection by using the Antidegradation Policy Implementation Procedures (COMAR 26.08.02.04-1). Often, these smaller-scale water quality issues can be better addressed through non-TMDL initiatives such as riparian landowner education and other grassroots outreach efforts. MDE has already initiated such activities in parts of the Deer Creek watershed. In addition, in the future, MDE will be focusing on potential temperature impairments in Class III (Waters supporting naturally reproducing trout populations) waters by working with landowners to increase riparian buffer shading.

Table 3 highlights some of the major differences between the previous biological listing methodology and the new proposed methodology. The details of the new proposed methodology begin after Table 3.

Table 3: Differences between the previous Biological Listing Methodology and the new proposed listing methodology.

Methodology Characteristic	Previous Bio. Listing Methodology	Proposed Bio. Listing Methodology
Method for producing an 8-digit Watershed Assessment	Uses mean IBI scores calculated from all the stations within the watershed along with a confidence interval to provide a watershed assessment. Implies that approximately half of the stations have IBI scores below this mean IBI score.	This method calculates whether the proportion of degraded stream miles is significantly different than the reference conditions (i.e. healthy stream, <10% degraded). This method also uses confidence intervals but, in addition, it takes into account additional error estimates to increase confidence in the assessment.
Scale of Assessment/Listing	Assesses and lists at the 8-digit and 12-digit watershed scales. Often leads to confusion when, in the same watershed, the 8-digit assessment and 12-digit assessments do not agree.	Assesses and lists only at the 8-digit watershed scale (state management scale). This maintains consistency with how other listings are made, how TMDLs are developed, and how implementation is targeted. Is consistent with a probabilistic

		monitoring design (MBSS).
Description of Impairment at the 8-digit watershed scale	None. If an 8-digit watershed is classified as impaired (Category 5), then it is assumed that every stream mile within the watershed is impaired. With the mean IBI scores provides information only on the magnitude of impairment.	Provides proportion and number of stream miles impaired. This allows for more accurate accounting and enables trend analysis. Allows for the fact that not all streams in a watershed are the same. Possibly useful for BAYSTAT.
Refinement of Area (smaller than an 8-digit watershed) Assessed as Impaired	Assesses at the 12-digit watershed scale (11 sq. mile area), but does so based on a single IBI score from a single station. Implies that all stream miles within the entire 12-digit watershed are impaired. Not consistent with a probabilistic monitoring design. Provides no information on the extent of impairment (i.e. miles of stream).	Assesses at the 8-digit watershed scale but provides proportion and number of stream miles degraded within the watershed. Using the converse one can also obtain the proportion and number of stream miles that are supporting the aquatic life designated use.
Error Estimation	Utilizes coefficient of variation to estimate variability of IBI scores. Captures temporal variability only.	Minimum sample size incorporates measure of spatial representativeness (similarity index), temporal variability and a target value for degradation.
Minimum Data Requirements	Must have 10 stations within a watershed to make an assessment at the 8-digit watershed scale.	As a general rule, the minimum sample size is 8. However, if n<8 common sense is used to list when appropriate (see section III.b.5. Watershed Assessment: The Null Hypothesis).

C.2.1.1 Biological Assessment of Water Quality for Non-Tidal Streams

C.2.1.1.1 Executive Summary

As mandated by the Clean Water Act (CWA), the Maryland Department of the Environment (MDE) is required to describe the methodology used to assess use support and define impaired waters (CWA sections 305b/303d). The assessment methodology should be consistent with the state's WQSs, describe how data and information were used to make attainment determinations, and report changes in the assessment methodology since the last reporting cycle (US EPA 2006).

The MDE is proposing a refinement to the current biological listing assessment methodology. The revised approach maintains consistent application at a single water quality management spatial scale (i.e., MD 8-digit watersheds), maximizes the advantages of a probabilistic monitoring design, includes a report on the level of impact within the stream system (i.e., stream miles), and considers the uncertainty in various components of the assessment approach. This contrasts with the current methodology that reports at multiple watershed scales (i.e., 8 and 12-digit watersheds), but does not have consistency at these multiple spatial scales and does not fully maximize the probabilistic monitoring design, which is the foundation for the Maryland index of biological integrity (IBI) assessments.

The revised biological listing method is consistent with the watershed approach of the original method, but does not assess the condition of watersheds based on single sites. Southerland et al. (2007) demonstrated that IBI results from single sites are not representative of 12-digit or larger watersheds. Therefore, the revised listing method focuses on assessing the condition of 8-digit watersheds with multiple sites by measuring the percentage of stream miles that are degraded. Use of the percentage of degraded stream miles allows quantification of the extent of degradation in a watershed and comparison with a reference watershed. The power of these comparisons increases with the number of sites sampled in the watershed.

The revised methodology follows this process: First is a review of the biological monitoring data quality that removes sites for listing decisions where either the Fish or Benthic IBI is not applicable (e.g., tidal waters, blackwater streams). Once this step has been completed, the next step is the watershed assessment, where a watershed is evaluated based on comparison to a reference condition that accounts for variability in sampling design (i.e. spatial variability and temporal variability) and establishes a target value for degradation. During this step of the assessment, a watershed that is significantly different than reference condition is listed as impaired (Category 5) on the Integrated List (formerly known as the 303d List). If a watershed is not determined to be different than reference condition, the assessment must have an acceptable precision before the watershed is listed as attaining (Category 1 or 2) the biological water quality criterion. If the precision is not acceptable then the watershed is listed as inconclusive (Category 3) and designated for further monitoring. Finally, if a watershed is classified as impaired (Category 5) then a stressor identification procedure is completed to determine if a Total Maximum Daily Load (TMDL) is necessary.

This document describes how biological data is assessed for the purposes of the Integrated [combined 303(d) and 305(b)] Report. The methodology considers all existing and readily available data and information, and explains the analytical approaches used to infer watershed conditions at the 8-digit scale.

C.2.1.1.2 Background

All of the State’s waters must be of sufficient quality to provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow for recreational activities in and on the water (40 CFR §130.11). Biological criteria (biocriteria) provide a tool with which water quality managers may directly evaluate whether such balanced populations are present. Maryland’s biocriteria uses two multi-metric indices of biological integrity (IBI), one based on fish communities (F-IBI) and the other on benthic (bottom) communities of macroinvertebrates (B-IBI). These indices are developed from reference sites that consider regional differences in biological communities. These indices, as described below, are based on characteristics of fish and benthic communities commonly used to assess the ability of streams to support aquatic life, and can be calculated in a consistent and objective manner. Both indices will be used in Maryland to evaluate biological data for the Clean Water Act requirements.

The condition of all streams could in principle be measured through a census (i.e., without the need to resort to inferring condition), but would require visiting every length of stream in the State. The reality is that monitoring cannot be conducted on every stream in the State due to resource constraints. Also, the sampling of a targeted non-random stream segment does not provide an unbiased estimate on the conditions of streams within a larger assessment unit. As a result the Department of Natural Resources (DNR) Maryland Biological Stream Survey (MBSS) program, on which the biocriteria methods are based, uses a statewide probability-based design to assess the biological condition of first, second, third, and fourth order, non-tidal streams (determined based on the solid blue line shown on U.S. Geological Survey 1:100,000-scale maps) within Maryland's 8-digit watersheds (Klauda et al. 1998, Roth et al. 2005). MBSS sites are sampled within a 75-meter segment of stream length. Individual sampling results are considered representative at the 75-meter segment, but because of design, the data can be used to estimate unbiased conditions of streams within an assessment unit. The MBSS conducted two rounds of sampling between 1995 and 2004: the first round of MBSS sampling was designed to assess major drainage basins (i.e., Maryland 6-digit) on 1:250,000-scale maps; and the second round was designed to assess smaller (i.e., Maryland 8-digit) watersheds on 1:100,000-scale maps. The use of random assignment of sampling locations within the population of first, second, third and fourth-order streams support the assessment of all of the State's waters.

The results of biological sampling will be applied for management and regulatory purposes (i.e., CWA §303(d)) at the same spatial resolution (i.e., 8-digit watersheds) used in the assessment effort (CWA 305(b)). If a watershed is determined to be impaired, corrective action must be taken. That action may begin with additional monitoring and evaluation to determine the cause of the impairment (i.e., stressor identification). Once the stressor has been identified, it may be appropriate to develop an estimate of the TMDL of the stressor that can be assimilated by the body of water and still allow it to achieve the water quality standards.

C.2.1.1.3 Rationale for Changing Approach

The current listing methodology uses the average watershed IBI score, for both fish and benthic communities, to determine watershed impairment. While the average IBI score does provide information on the magnitude of the degradation it does not give an indication of the extent of degradation (e.g., length of stream) found within a watershed, a current EPA requirement for integrated reporting. In addition, the current method utilizes a smaller scale assessment (i.e., 12-digit watershed) that classifies a 12-digit watershed (approximately 11 square miles) as impaired if one low IBI value from one site (i.e., 75 meter sample) is present. This site-level listing scale negates the advantage of the random monitoring design and the ability to report on the total stream system. Moreover, Southerland et al. (2007) assessed the average variability of the F-IBI and B-IBI scores at different spatial scales, and demonstrated that single site IBI scores are not representative at the 12-digit watershed scale.

Therefore, MDE requires a biocriteria assessment approach that meets the following criteria:

1. Maintains consistent application at the current water quality management spatial scale (i.e., MD 8-digit watersheds);
2. Maximizes the advantages of a probabilistic monitoring design;

3. Includes a report on the extent of impact within the stream system (i.e., number of stream miles not supporting the aquatic life designated use);
4. Considers the uncertainty in various components of the assessment approach.

Addressing these four key items ensures accurate regulatory decisions regarding water quality in Maryland. Justification for these criteria is first that the Maryland Integrated [combined 303(d) and 305(b)] Report process typically uses a watershed-based water quality management scale for listing purposes. The advantages of this listing scale are (1) an appropriate water quality management scale specific to the pollutant or designated use; (2) promotes consistency with subsequent TMDL development; (3) allows for further spatial refinements during the TMDL development process, where more data may be available; and (4) promotes the use of probabilistic monitoring designs. Next, for biological assessment, Maryland uses a robust statewide random monitoring design that allows the State to estimate, with a specified confidence, the condition of 1st through 4th order streams within a watershed assessment unit.

Third, the biological reporting metric should be changed so that the extent of degradation in stream miles (or proportion of stream miles) can be applied in listing, a metric that is unavailable in the current biocriteria listing methodology. Identifying the extent of degraded stream miles within an assessment unit is consistent with EPA Integrated reporting requirements and meets EPA EMAP reporting recommendations. Using a watershed-based approach and reporting the extent of degraded conditions also allows the converse estimate, i.e., the extent of non-degraded or healthy streams. This allows the inclusion and identification of high quality (Tier II) waters that may be present in assessment units (8-digit watersheds) that are listed as impaired.

Finally, addressing uncertainty is critical to making accurate water quality management decisions that has significant implications on water quality improvement funding. Therefore, it is recommended that the biological listing method incorporate the uncertainty that results from the temporal and spatial variability in the sampling design. Addressing these four key items involves revising MDE's current biological listing methodology.

C.2.1.1.4 Revised Biological Listing Method

This section describes the revised biocriteria listing approach. Figure 6 illustrates the critical steps in the listing process. The first step is vetting the biological monitoring data and removing sites from consideration for listing decisions where either the F-IBI or B- IBI is not applicable (e.g., tidal waters, blackwater streams). This process is described in detail in section 3.1. Once this step has been completed, the next step is the watershed assessment, where a watershed is evaluated based on comparison to a reference condition that accounts for variability in sampling design (i.e. spatial variability and temporal variability) and establishes a target value for degradation. During this step of the assessment, a watershed that is significantly different than reference condition is listed as impaired (Category 5) on the Integrated List. If a watershed is not determined to be significantly different from reference conditions, the assessment must have an acceptable precision (margin of error) before the watershed is listed as attaining (Category 1 or 2) the water quality criterion. If the precision is not acceptable, the watershed is listed as inconclusive (Category 3). Details of this process are explained in section 3.2. Finally, if a watershed is identified as inconclusive (Category 3) then an evaluation of additional monitoring options are considered. Suggestions for this process are listed in section 3.3. If a watershed is classified as impaired (Category 5), then a stressor identification procedure is completed to determine if a TMDL is necessary. This process is described in section 3.4.

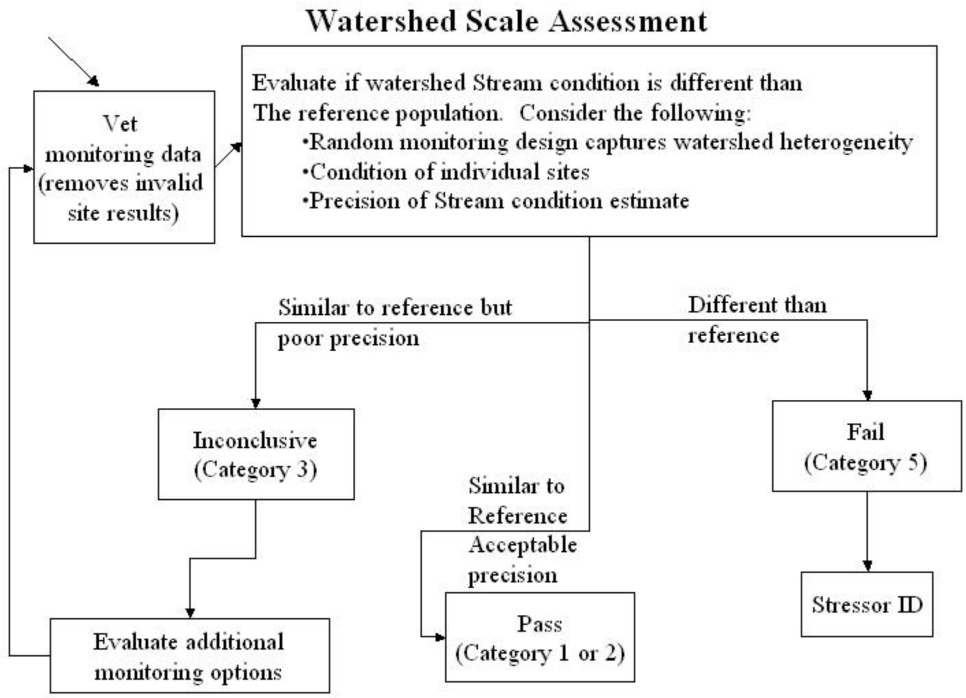


Figure 6: Watershed scale assessment procedure for determining biological impairment.

The revised biological listing method is consistent with the watershed approach of the original method, but does not assess the condition of watersheds based on single sites. Southerland et al. (2007) demonstrated that IBI results from single sites are not representative of 12-digit or larger watersheds. Therefore, the revised listing method focuses on assessing the condition of 8-digit watersheds with multiple sites by measuring the percentage of stream miles that are degraded. Use of the percentage of degraded stream miles allows quantification of the extent of degradation in a watershed and comparison with a reference watershed.

C.2.1.1.4.1 Vetting Monitoring Data

In all cases, State biologists may use professional judgment in evaluating biological results. However, to aid in the data review, a set of rules is used to guide the data vetting process. These rules evaluate specific data parameters such as flow, catchment size, and buffer width to determine if the IBIs are reliable indicators of current watershed conditions. As a specific example, if there was a temporary or significant natural stressor such as drought or flood, sample results were evaluated to determine whether IBI scores resulted from anthropogenic influences or natural conditions. The final master database contains all biological sites considered valid for use in the listing process. The following rules for eliminating site results were developed by MDE with help from DNR to address situations when the IBIs are not representative of stream condition.

(a) Watersheds with less than 300 acres often have limited fish habitat and naturally low fish diversity. As a result, the F-IBI will not be used for listing decisions at these sites unless the score is significantly greater than 3.

(b) Due to the unique chemistry of blackwater streams and the lack of defined blackwater reference conditions, the IBIs tend to underrate this stream type. For this reason, all blackwater sites (dissolved organic carbon > 8 mg/l and either pH <5 or acid neutralizing capacity (ANC) <200 μeq/L) with either the B-IBI or F-IBI indeterminate or significantly less than 3 will not be used. If the B-IBI and the F-IBI are significantly greater than 3, the stream will be rated as meeting the aquatic life designated use.
(c) If the number of organisms in a benthic sample is less than 60, that sample will not be used unless the B-IBI is significantly greater than 3 or supporting data (e.g., habitat rating, water quality data) indicate impairment and there is no evidence of sampling error or unusual natural phenomena.
(d) Heavy rain and runoff events (e.g., heavy rains, sudden heavy snowmelt) can scour the streambed and transport fish and/or benthics out of a stream segment. As such, samples taken within two weeks of such events may be considered invalid in the best professional judgment of State biologists and not used for evaluation of stream condition.
(e) The IBI scores of stream sampling sites that are tidally influenced will not be used to determine designated use attainment.
(f) The IBI scores of streams affected by excessive drought or intermittent conditions will not be used in listing decisions. Other sampling sites influenced by low flow conditions may also not be used.
(g) The IBI scores of sampling sites that are dominated by wetland-like conditions (e.g., no flowing water, shallow, abundant organic matter) may be considered invalid in the best professional judgment of State biologists.
(h) The IBI scores of streams impounded by beaver dams may be considered invalid. For example, a site within a natural impoundment that was created by beaver activity between the spring benthic macroinvertebrate sampling and the summer fish sampling. Man-made alterations to selected stream segments (e.g., channelization, dredging) should be noted, but they do not invalidate the IBIs.
(i) Sampling sites where the results may be skewed due to sampling error will not be used for assessment purposes.

In addition to these cases, State biologists may use best professional judgment to evaluate any streams sampled under conditions that are not characterized by reference stations.

C.2.1.1.4.2 Watershed Assessment Procedure

Desirable properties for any assessment or listing methodology are clarity and transparency. While water quality evaluations often deal with complex issues, the priorities for this listing methodology are that it be objective, transparent, and quantitative. Specifically, the revised biological assessment methodology should: 1) use a scientifically defensible numeric indicator (IBI) based on reference sites, 2) produce unbiased results for the assessment units, 3) follow a clear and logical framework and 4) be robust enough to yield the same results when applied by multiple analysts.

The revised listing methodology uses the scientifically robust F- and B- IBI developed by the MBSS program and documented in Southerland et al. (2005). To obtain unbiased results, we invoked a quantitative component to address temporal variability and sampling uncertainty from the MBSS monitoring design. In this report, variability is the year-to-year change in stream conditions that results from non-anthropogenic variation (e.g., climate, hydrology) and uncertainty is the result of inferring condition from the limited number at sites that can be sampled; given available resources. Finally, the listing method employs an assessment approach that is transparent and can be understood by a wide audience.

Reference Sites and Conditions

Reference sites are the foundation for biological assessment. Using reference sites that are minimally disturbed is critical to IBI development because reference conditions define the scoring criteria applied to the individual metrics (Figure 7). Selection of metrics for inclusion in the IBIs is based on how well they distinguish between reference and degraded sites. In Maryland, reference and degraded sites are identified using lists of abiotic criteria. A complete list of criteria for reference and degraded conditions can be found in Southerland et al. (2005).

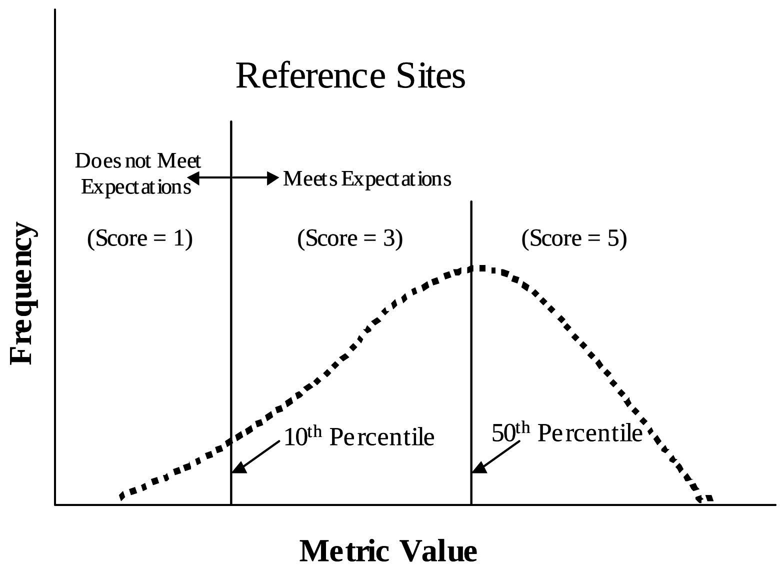


Figure 7: Scoring Criteria based on reference site distribution.

Once reference sites have been identified, they are sequestered into groups at minimal natural ecological variability by geography and stream type. The MBSS dataset provided enough reference sites (approximately 40) for F-IBI development in each of four naturally different stream types: Coastal Plain, Eastern Piedmont, warmwater Highlands, and coldwater Highlands. For the B-IBI, the coldwater stratum was not used because, unlike fish, benthic macroinvertebrates assemblages are not typically depauperate in minimally disturbed coldwater streams.

The MBSS computes the IBI as the average of individual metric scores for a site (see Southerland et al. 2005). Individual metric scores are based on comparison with the distribution of metric values at reference sites within each geographic stratum (Figure 7). Metrics are scored 1 (if < 10^{th} percentile of reference value), 3 (10^{th} to 50^{th} percentile), or 5 (> 50^{th} percentile). The final IBI scores are calculated as the average of the scores and therefore range from 1 to 5.

Year-to-Year Variability
All streams, regardless of anthropogenic changes, experience natural variability. These changes are a result of variability in precipitation and corresponding flows that result in fluctuation in the physical characteristics of the stream systems (Grossman et al. 1990). MBSS sentinel sites used to evaluate the natural year-to-year variability represent the best (based on physical, chemical and biological data) streams in Maryland. Sentinel sites are present in all regions (highland, eastern piedmont and coastal plain) and stream orders (1st through 3rd). Most importantly, they are located in catchments that are not likely to experience a change in anthropogenic disturbances over time.

The year-to-year variability of the sentinel sites was examined by comparing the annual IBI values for individual sites over a five-year monitoring period. The coefficient of variation was used to compare site results since this normalizes the site variability to the mean site score. There were a total of 17 sites that had five years of B-IBI scores and 15 sites with five years of F-IBI scores. The average coefficient of variation was approximately 9 percent for the B-IBI and 13 percent for the F-IBI. Therefore, it can be expected that over a five-year period the standard deviation of year-to-year IBI scores will vary by 9 – 13 percent of the mean score.

Spatial Uncertainty of Stream Condition
The condition of all streams could in principle be measured through a census (i.e., without the need to resort to inferring condition), but would require visiting every length of stream in the State. The reality is that monitoring cannot be conducted on every foot or even mile of streams in a state due to resource constraints. Also, the sampling of a targeted non-random stream segment does not provide an unbiased estimate on the conditions of streams within a larger assessment unit. Therefore, MDE uses the MBSS dataset which is a statewide probability-based sample survey for assessing biological condition of 1st through 4th order, non-tidal streams in Maryland (Klauda et al. 1998, Roth et al. 2005) within Maryland's 8-digit watersheds. MBSS sites are randomly selected from the 1:100,000-scale stream network and sampled within a 75-m segment of stream length. Individual sampling results are considered representative at the 75-m segment, but because of design the data can be used to estimate unbiased conditions of streams within an assessment unit.

Realizing that randomly selected sampling sites may not always proportionately represent the assessment unit in which they are selected, MDE investigated the relationship between the number of sampling sites and the representation of watershed heterogeneity (See Appendix A). Generally, it was found that when approximately 10 sites were sampled within a watershed, that the average percent similarity between the number of sites within each land use were 85 percent similar to the stream mileage found within those same land uses (within the same watershed). Using this information as a guide, and a precision level of 25 percent, a minimum sample size of 8 samples was developed so as to capture both spatial heterogeneity and sample uncertainty for the watershed assessments.

Developing a Target Value for Degradation

Using the scoring criteria at reference sites, an IBI > 3 indicates the presence of a biological community with attributes (metric values) comparable to those of reference sites, while an IBI < 3 means that, on average, metric values fall short of reference expectations. Because a metric score of 3 represents the 10^{th} percentile threshold of reference conditions, IBI values less than 3 represent sites that are suspected to be degraded. In contrast, values greater than or equal to 3 (i.e., fair or good) indicate that most attributes of the community are within the range of those at reference sites. However, Southerland et al. (2005) reported that "good" water quality was found at reference sites with low IBIs and that the distribution of reference and degraded site IBI values overlap, thus sites with a metric below the 10^{th} percentile of reference sites (used for scoring) may have good quality waters. It is therefore recommended that an average site IBI score, based on a minimum of three consecutive years of data, be compared to the threshold of 3.

The State recognizes that in most cases three years of data will not be available. If less than three years of data are available, the year-to-year variability will be based on the information from sentinel sites. Given the natural variation of IBI scores in time, it is expected that a site with an average score of 3 will likely have a distribution of annual values above and below 3 (Figure 8). For these cases the coefficient of variation in combination with an assumed normal distribution is used to determine the minimum detectable difference and the subsequent minimum allowable limit (MAL). The MAL decreases the likelihood of a type I error, classifying a site is degraded when it is actually in good condition, given there is only one sample in time. The following formula is applied to estimate the MAL:

$$MAL = IBI_{avg} - z * IBI_{avg} * CV$$

where

MAL = Minimum Allowable IBI Limit to determine if a site is degraded
IBI_{avg} = Average annual allowable IBI value (3 for B-IBI and F-IBI)
z = Standard normal score (1.28 for 90 percent one-sided confidence interval)
CV = Coefficient of variation

The minimum allowable limit for the F-IBI is 2.5, assuming a coefficient of variation of 13 percent, while the minimum allowable limit for the B-IBI is 2.65, assuming a coefficient of variation of 9 percent.

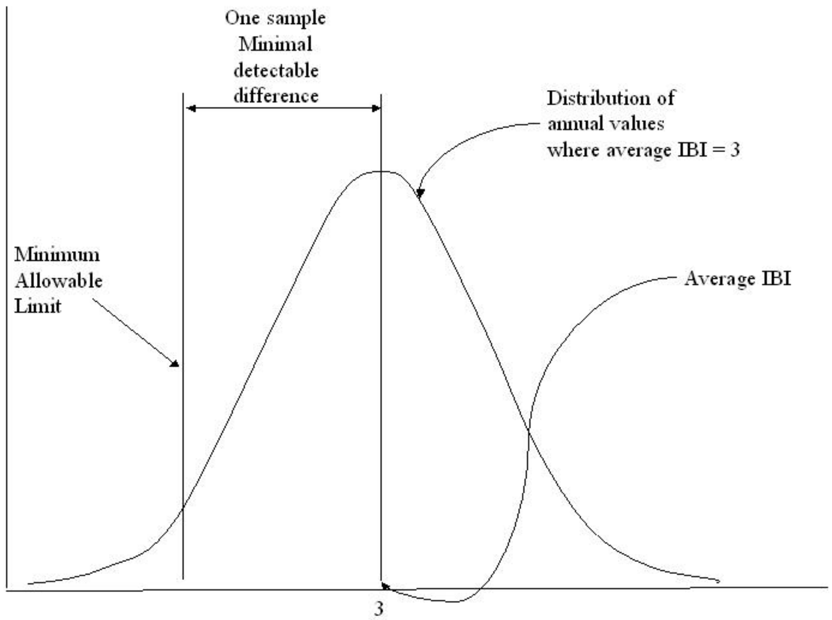


Figure 8: Distribution of annual values at site with average IBI of 3.

Watershed Assessment: The Null Hypothesis

The watershed assessment method tests the null hypothesis that the candidate assessment unit does not violate narrative criteria for the support of aquatic life. In the watershed assessment method there is a general sample size provision to ensure that the random monitoring sites generally represent the spatial heterogeneity in the Maryland 8-digit assessment units. This sample size helps control the type II error (false negative - classifying a water body as meeting criteria when it does not) and an alpha level is set to control the type I error (false positive - listing a water body as impaired when it is not).

To test the null hypothesis (i.e., assess a watershed), the exact binomial confidence intervals are calculated using the monitoring data in an assessment unit. Calculation of the binomial confidence intervals requires the total number of monitoring sites, the number of sites that are degraded, and the confidence level. The null hypothesis is that the populations of streams in the assessment unit are similar to the population of reference sites, which equates to less than 10 percent of the streams classified as degraded. A degraded site is defined as a site with either the benthic or F-IBI score below the specified threshold of 3 or MAL. With small sample sizes the type II error rate is typically large and can result in accepting the null hypothesis when it is not true (classifying a watershed as meeting criteria when it does not). To reduce the type II error rate, a required precision is specified in the method. The three possible outcomes are as follows:

- Null hypothesis accepted but precision is low: If the lower confidence limit is less than or equal to 10 percent but half the width of the confidence interval is greater than 25 percent (low precision), the watershed will be classified as inconclusive and assigned to Category 3 of the Integrated list and considered for future monitoring.
- Null hypothesis accepted and precision is acceptable: If the lower confidence limit is less or equal to 10 percent and half the width of the confidence interval is less than 25 percent

(acceptable precision), the watershed will be classified as pass and assigned to Category 2 on the Integrated list.
- Null hypothesis rejected: If the lower confidence limit is greater than 10 percent the watershed will be classified as failing and assigned to Category 5 on the Integrated list.

To further reduce possible listing errors, the development of the methodology took into account the spatial distribution of the random monitoring sites as compared to the spatial heterogeneity of landscape features in the watershed. To do so, the Maryland 8-digit watershed landscape heterogeneity was determined using landscape clusters (groups of similar landscape conditions) that incorporate land use, land use change, soil erodibility, slope, precipitation, and population density (US EPA 2007). For all assessment units, the distribution of streams within landscape clusters were compared to the distribution of MBSS round 1 and round 2 monitoring sites. Results indicate that, on average, approximately 85 percent of the heterogeneity in 8-digit watersheds is captured with ten monitoring stations (see appendix A).

To ensure clarity and transparency, the assessment method was summarized in a simple lookup table (Table 4). The table incorporates (1) testing the null hypothesis that the candidate assessment unit does not violate narrative criteria for the support of aquatic life; (2) applying 90 percent exact binomial confidence intervals; (3) requiring a precision of 25 percent; and (4) ensuring that the monitoring sites capture the watershed landscape heterogeneity. Considering the watershed/monitoring site similarity analysis results and the required statistical precision for a definitive classification, a watershed can be reasonably assessed if there are at least eight random monitoring sites. However, if less then eight sites are within an 8-digit watershed and three of them are classified as degraded the watershed will be classified as not supporting aquatic life and placed on Category 5 of the Integrated List. The rationale is that if five more samples were collected (to total eight) then the watershed would be listed on Category 5 regardless of the results at the new sites. Likewise, if there are less than eight monitoring sites but at least six sites are not degraded then the watershed will be classified as supporting aquatic life and placed in Category 2. Similarly, the rationale is that if two more sites were added to the monitoring design the watershed would be listed on Category 2 regardless of the new site results. However, it is recommended that at least eight sites be used for future monitoring designs.

Table 4: Biocriteria Assessment Table.

Total Number of Random Sites in Assessment Unit	Maximum Number of Degraded Samples in Assessment Unit to be Classified as Pass (Category 2)	Minimum Number of Degraded Samples in Assessment Unit to be Classified as Fail (Category 5)
≤7	(c)	3 (d)
8-11	2	3
12-18	3	4
19-25	4	5
26-32	5	6
33-40	6	7
41-47	7	8
48-55	8	9
56-63	9	10
64-71	10	11
72-79	11	12

Notes:

a. Using 90 percent one-sided exact binomial confidence intervals.
b. Classification of pass must have a precision <25 percent.
c. If n<=7 and at least 6 samples are not degraded then watershed classified as Pass (Category 2).
d. If n<=7 and 3 or more samples are degraded then watershed classified as Fail (Category 5).

Reporting for the Integrated Report will be as follows: If a watershed is determined to not meet criteria based on biological data, the watershed will be identified in the Integrated List database as "Not supporting aquatic life uses", Category 5. A watershed determined to meet criteria, or for which the data are inconclusive, will be identified in the Integrated List in categories 2 ("Fully supporting aquatic life uses") or 3 ("Inconclusive"), respectively.

C.2.1.1.4.3 Data Use Limitations

For Integrated Reporting assessments, only biological data from the most recent 10-year moving window will be used so as to ensure the use of accurate and up-to-date information. For instance, for the 2010 IR cycle, only biological data collected between the years 2000 and 2009 (Round II and Round III) will be used for assessment. Round 1 data (1995-1997) would no longer be used to update the 8-digit watershed assessments.

As the MBSS Program continues to collect more data around the State, they may continue to refine and enhance the respective benthic and fish IBIs in order to better discriminate between healthy and degraded stream conditions. In doing so, the IBI scores from an older site may change depending on what metrics are used and how the IBI is calculated. To keep assessments transparent and repeatable for regulatory purposes, MDE will not reassess sites sampled prior to 2008 using IBIs (fish or benthic) created after 2005. In essence, all IBIs from sites sampled prior to 2008, will be frozen at their current values. New sites sampled in 2008 or 2009 may be reanalyzed with a new IBI should one be developed.

C.2.1.1.4.4 Future Monitoring Priorities

Future monitoring will focus on the watersheds determined to be inconclusive in the final assessment. The watersheds will be categorized based on the number of samples (i.e., 7 having highest priority and 0 having lowest). To allow for the most efficient use of resources, consideration will also be given to the number of stations monitored by the DNR during the Round 3 MBSS sampling being conducted from 2007 to 2009.

Following this categorization of watersheds, monitoring prioritization will be based on the following factors. Firstly, the watersheds with the largest percentage of perennial non-tidal 1^{st} through 4^{th} order stream miles/drainage area will receive preference over basins with a large percentage of tidal stream miles/drainage area. Secondly, the available data for each watershed will be evaluated and best professional judgment applied to determine whether obvious causes of low IBI scores exist due to natural conditions (i.e., a high percentage of intermittent or blackwater streams in the watershed) and/or anthropogenic influences. In these cases, the watershed will be addressed by a Water Quality Analysis or referred for further stressor identification.

C.2.1.1.4.5 Stressor Identification

If a watershed is determined to be impaired based on biological data, the cause of the impairment(s) will then be determined by a review of all relevant chemical, physical, and physical habitat data. If the source of the impairment(s) cannot be determined from the data, an on-site evaluation of the watershed may be undertaken including more detailed diagnostic testing such as sediment and water column chemistry, and toxicity and geomorphic analyses. Habitat evaluation during sampling, along with chemical and physical data, will be used to evaluate the potential causes of impairments. It may be determined in some cases that the appropriate remedy is stream restoration rather than reduction of a specific chemical pollutant.

C.2.1.1.5 Use of Non-MBSS data

Given that a key use of these procedures is for the Integrated list of impaired waters, and that the State is required to consider all readily available data. MDE recognizes the need to incorporate local biological data into the assessment process. Counties or other water monitoring programs that intend to submit their data to support decisions made using the biological framework should carefully follow the general guidelines below.

- Data collected using MBSS (field, laboratory and IBI protocols) or comparable methodology must be:
  - Documented to be of good quality;
  - Can be fully integrated with MBSS data;
  - Provided in a format readily available for merging into the MBSS database;

    - Contain the additional habitat, physical, and chemical information that the MBSS provides that allow for vetting.

- If MBSS methodology is not used but data are documented to be of good quality, in accordance with guidance and technical direction from the State, data will be used to supplement fully integrated MBSS and local data.

Data not meeting the requirements stated above may be helpful for non-regulatory purposes (e.g., targeting, education). Such data will be stored and documented for these uses. State biologists may refer submitters to information sources that will help them to improve the quality of their monitoring data.

C.2.1.1.5.1 Using Biological Data for Tier II Designation

As specified in COMAR [26.08.02.04-1] biological assessment data will be used for the purpose of identifying Tier II waters to be protected under the Department's Anti-degradation Policy Implementation Procedures. According to these regulations, when biological assessment data indicates that water quality is within 20 percent of the maximum attainable value of the index of biological integrity, those waters will be assigned a Tier II designation. For data sampled and scored according to MBSS protocols, this equates to having both a fish and benthic IBI score of 4 or greater at a single site. Using these two pieces of biological information sampled during different seasons of the year helps to independently validate the high quality status of a segment.

Tier II segments can exist in watersheds that are listed as impaired (Category 5) by the methodology spelled out in this document, despite Section 26.08.02.04-1D(2) of the Anti-degradation Procedures. This section states "Water bodies included in the List of Impaired Waters (303(d) List) are not Tier II waters for the impairing substance." The biological listing methodology only assesses the biological condition of streams at the 8-digit watershed scale (approximately 90 square miles) and calculates the percentage of stream miles impaired within this larger scale. As a result, it is possible for smaller stream segments located within 'impaired' (Category 5) 8-digit watersheds to be of Tier II quality due to local variation in stressors and land use. Since local water quality conditions are better characterized through site-specific monitoring, individual stations are used to identify and designate Tier II segments regardless of the watershed assessment result. For maps of current Tier II waters please refer to http://www.mde.state.md.us/ResearchCenter/Data/waterQualityStandards/Antidegradation/index.asp.

C.2.1.1.6 Watershed Assessment Summary

MBSS Round 2 data were collected in 2000-2004 at sites allocated randomly among all nontidal streams present on 1:100,000-scale maps. The number of sites sampled in individual MD 8-digit watersheds varied generally with the length of nontidal streams in each watershed. To increase the number of sites in each watershed, MBSS Round 2 data were supplemented with Round 1 data collected in 1995-1997. MBSS Round 1 data were collected on nontidal streams present on 1:250,000-scale maps and therefore sampled larger streams slightly more often than if a finer scale map was used. Using the assessment approach described here, however, supplementing Round 2 data with Round 1 data does not significantly bias the assessment of nontidal streams at the scale of 8-digit watersheds.

Using the MBSS round 1 and round 2 (2000-2004) data as input into the listing method, a total of 113 out of 138 Maryland 8-digit watersheds were assessed for biological impairments. Table 5 and Figure 9 present a summary of the 2008 watershed assessment. Details of the biological assessment analysis are presented in Table 6. A comparison between the previous biocriteria method (average IBI) and the revised biocriteria method (percent stream mile) is presented in Table 7.

In summary, 25 watersheds do not have any monitoring data. Using the 1:100,000 stream coverage, eight of the watersheds were reported to have no 1st through 4th order non-tidal wadeable streams. All of these State watersheds have very limited land areas and no permanent, natural surface drainages are developed. The remaining 17 watersheds without any data only accounted for 2 percent (148 miles) of the total wadeable stream miles in Maryland. The 17 watersheds for which no data has been collected, but that have non-tidal wadeable streams will be placed in Category 3 on the 2008 Integrated list and prioritized for additional monitoring.

A total of 70 watersheds were classified as impaired and will be placed on Category 5 of the 2008 Integrated list. These watersheds represent 74 percent (6,813 miles) of the wadeable streams in Maryland. Within these watersheds, a total of 51 percent (3,494/6,813 miles) of the streams are degraded.

A total of 24 watersheds were classified as similar to reference conditions and fully supporting the aquatic life use. These watersheds account for 19 percent (1,750 miles) of the wadeable streams in Maryland. These 24 watersheds will be placed in Category 2 of the 2008 Integrated List.

The remaining 19 watersheds were classified as inconclusive and account for 5 percent (488 miles) of Maryland's wadeable. These watersheds were classified as inconclusive because either the monitoring data does not capture the heterogeneity of the watershed or the uncertainty is too high for the watershed to be classified as passing. These watersheds will be placed in Category 3 of the 2008 Integrated List and will be targeted for additional monitoring.

Table 5: Summary of 2008 Watershed Assessments Using MBSS Rounds 1 and 2 Data.

Integrated Report Final Status	Number of 8-digit Watersheds	Stream Miles (a)	% of Total Stream Miles (a/9,199)	Stream Miles with F or B-IBI<3 (b)	% of Stream Miles with F or B-IBI<3 (b/a)	% of Total Stream Miles with F or B-IBI<3 (b/9,199)	Integrated Report of Watershed Stream Miles Impaired (c)	Integrated Report of % of Total Watershed Stream Miles Impaired (c/9,199)
Category 2	24	1,750	19%	234	13%	3%	0	0
Category 3 (Inconclusive)	19	488	5%	183	37%	2%	NA	NA
Category 3 (No data)	25	148	2%	0			NA	NA
Category 4 or 5	70	6,813	74%	3,494	51%	38%	3,494	38%
Total	**138**	**9,199**	**100%**	**3,911**	**43%**	**43%**	**3,494**	**38%**

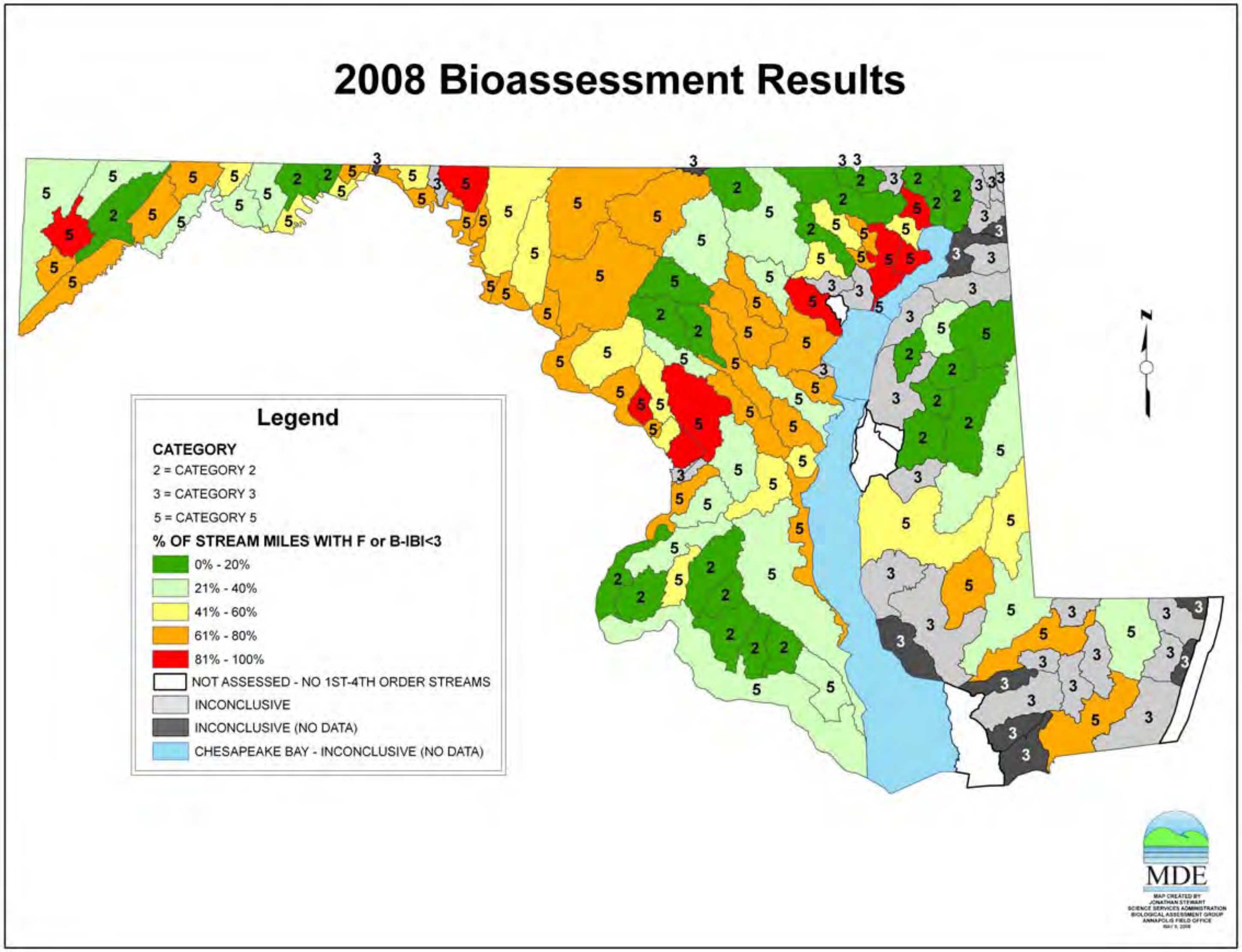


Figure 9: Summary of 2008 Watershed Assessment Using MBSS Rounds 1 and 2 Data.

Table 6: 2008 Biological Assessment for Maryland 8-digit Watersheds.

MDE8DIGT	MDE8NAME	Percent Stream Mile Assessment						
		Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2050301	Conewago Creek	n=0						
2120201	L Susquehanna River	Fail	83%	49%	98%	73%	6	5
2120202	Deer Creek	Pass	11%	5%	19%	1%	46	5
2120203	Octoraro Creek	Pass	8%	1%	29%	-2%	12	1
2120204	Conowingo Dam Susq R	Inc	20%	2%	58%	10%	5	1
2120205	Broad Creek	Pass	12%	3%	28%	2%	17	2
2130101	Atlantic Ocean	n=0						
2130102	Assawoman Bay	n=0						
2130103	Isle of Wight Bay	Inc	50%	14%	86%	40%	4	2
2130104	Sinepuxent Bay	n=0						
2130105	Newport Bay	n=0						
2130106	Chincoteague Bay	n=0						
2130201	Pocomoke Sound	n=0						
2130202	Lower Pocomoke River	Fail	63%	34%	85%	53%	8	5
2130203	Upper Pocomoke River	Fail	35%	21%	50%	25%	23	8
2130204	Dividing Creek	Inc	0%	0%	44%	-10%	4	0
2130205	Nassawango Creek	Inc	40%	11%	75%	30%	5	2
2130206	Tangier Sound	n=0						
2130207	Big Annemessex River	n=0						
2130208	Manokin River	Inc	50%	5%	95%	40%	2	1
2130301	Lower Wicomico River	Fail	71%	40%	92%	61%	7	5
2130302	Monie Bay	n=0						
2130303	Wicomico Creek	n=0						
2130304	Wicomico River Head	Inc	20%	2%	58%	10%	5	1
2130305	Nanticoke River	Fail	35%	21%	50%	25%	23	8
2130306	Marshyhope Creek	Fail	55%	32%	76%	45%	11	6
2130307	Fishing Bay	n=0						
2130308	Transquaking River	Fail	67%	33%	91%	57%	6	4
2130401	Honga River	n=0						
2130402	Little Choptank	n=0						
2130403	Lower Choptank	Fail	45%	24%	68%	35%	11	5
2130404	Upper Choptank	Fail	38%	26%	50%	28%	32	12
2130405	Tuckahoe Creek	Pass	19%	10%	33%	9%	26	5
2130501	Eastern Bay	n=0						
2130502	Miles River	Inc	50%	5%	95%	40%	2	1
2130503	Wye River	Pass	15%	4%	36%	5%	13	2
2130504	Kent Narrows	n=0						
2130505	Lower Chester River	Inc	33%	3%	80%	23%	3	1
2130506	Langford Creek	Pass	14%	1%	45%	4%	7	1
2130507	Corsica River	Pass	8%	1%	27%	-2%	13	1
2130508	Southeast Creek	Pass	0%	0%	19%	-10%	11	0
2130509	Middle Chester River	Fail	36%	22%	52%	26%	22	8
2130510	Upper Chester River	Fail	20%	11%	32%	10%	30	6
2130511	Kent Island Bay	n=0						

MDE8DIGT	MDE8NAME	Percent Stream Mile Assessment						
		Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2130601	Lower Elk River	n=0						
2130602	Bohemia River	Inc	67%	20%	97%	57%	3	2
2130603	Upper Elk River	Inc	33%	3%	80%	23%	3	1
2130604	Back Creek	n=0						
2130605	Little Elk Creek	Inc	17%	2%	51%	7%	6	1
2130606	Big Elk Creek	Inc	17%	2%	51%	7%	6	1
2130607	Christina River	Inc	100%	32%	100%	90%	2	2
2130608	Northeast River	Pass	14%	4%	34%	4%	14	2
2130609	Furnace Bay	Pass	11%	1%	37%	1%	9	1
2130610	Sassafras River	Inc	25%	3%	68%	15%	4	1
2130611	Stillpond-Fairlee	Inc	20%	2%	58%	10%	5	1
2130701	Bush River	Fail	100%	56%	100%	90%	4	4
2130702	Lower Winters Run	Fail	70%	45%	88%	60%	10	7
2130703	Atkisson Reservoir	Fail	56%	30%	79%	46%	9	5
2130704	Bynum Run	Fail	80%	55%	95%	70%	10	8
2130705	Aberdeen Proving Ground	Fail	83%	49%	98%	73%	6	5
2130706	Swan Creek	Fail	57%	28%	83%	47%	7	4
2130801	Gunpowder River	n=0						
2130802	Lower Gunpowder Falls	Fail	54%	33%	74%	44%	13	7
2130803	Bird River	Inc	100%	32%	100%	90%	2	2
2130804	Little Gunpowder Falls	Pass	15%	7%	27%	5%	27	4
2130805	Loch Raven Reservoir	Fail	27%	18%	37%	17%	45	12
2130806	Prettyboy Reservoir	Pass	16%	6%	32%	6%	19	3
2130807	Middle River - Browns	n=0						
2130901	Back River	Fail	100%	90%	100%	90%	21	21
2130902	Bodkin Creek	Inc	100%	32%	100%	90%	2	2
2130903	Baltimore Harbor	Fail	69%	55%	81%	59%	26	18
2130904	Jones Falls	Fail	36%	22%	52%	26%	22	8
2130905	Gwynns Falls	Fail	79%	65%	88%	69%	28	22
2130906	Patapsco River L N Br	Fail	61%	48%	72%	51%	33	20
2130907	Liberty Reservoir	Fail	22%	16%	29%	12%	77	17
2130908	S Branch Patapsco	Fail	20%	12%	30%	10%	40	8
2131001	Magothy River	Fail	67%	33%	91%	57%	6	4
2131002	Severn River	Fail	35%	21%	52%	25%	20	7
2131003	South River	Fail	80%	55%	95%	70%	10	8
2131004	West River	Fail	57%	28%	83%	47%	7	4
2131005	West Chesapeake Bay	Fail	71%	55%	84%	61%	21	15
2131101	Patuxent River lower	Fail	38%	27%	50%	28%	37	14
2131102	Patuxent River middle	Fail	41%	25%	59%	31%	17	7
2131103	Western Branch	Fail	38%	24%	53%	28%	24	9
2131104	Patuxent River upper	Fail	73%	54%	88%	63%	15	11
2131105	Little Patuxent River	Fail	70%	56%	82%	60%	27	19
2131106	Middle Patuxent River	Pass	20%	8%	39%	10%	15	3
2131107	Rocky Gorge Dam	Fail	24%	11%	42%	14%	17	4
2131108	Brighton Dam	Pass	11%	4%	23%	1%	27	3

MDE8DIGT	MDE8NAME	Percent Stream Mile Assessment						
		Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2139996	Upper Chesapeake Bay	n=0						
2139997	Middle Chesapeake Bay	n=0						
2139998	Lower Chesapeake Bay	n=0						
2140101	Potomac River L tidal	Fail	38%	15%	66%	28%	8	3
2140102	Potomac River M tidal	Pass	15%	4%	36%	5%	13	2
2140103	St. Mary's River	Fail	23%	13%	37%	13%	26	6
2140104	Breton Bay	Pass	14%	1%	45%	4%	7	1
2140105	St. Clements Bay	Pass	15%	4%	36%	5%	13	2
2140106	Wicomico River	Pass	17%	5%	39%	7%	12	2
2140107	Gilbert Swamp	Pass	14%	4%	34%	4%	14	2
2140108	Zekiah Swamp	Pass	15%	8%	26%	5%	33	5
2140109	Port Tobacco River	Fail	50%	29%	71%	40%	12	6
2140110	Nanjemoy Creek	Pass	20%	8%	39%	10%	15	3
2140111	Mattawoman Creek	Fail	26%	13%	43%	16%	19	5
2140201	Potomac River U tidal	Fail	62%	40%	80%	52%	13	8
2140202	Potomac River MO Cnty	Fail	67%	56%	76%	57%	42	28
2140203	Piscataway Creek	Fail	33%	17%	53%	23%	15	5
2140204	Oxon Creek	Inc	100%	32%	100%	90%	2	2
2140205	Anacostia River	Fail	84%	73%	91%	74%	37	31
2140206	Rock Creek	Fail	56%	38%	72%	46%	18	10
2140207	Cabin John Creek	Fail	100%	75%	100%	90%	8	8
2140208	Seneca Creek	Fail	59%	47%	71%	49%	32	19
2140301	Potomac River FR Cnty	Fail	79%	62%	90%	69%	19	15
2140302	Lower Monocacy River	Fail	61%	54%	69%	51%	83	51
2140303	Upper Monocacy River	Fail	62%	53%	71%	52%	58	36
2140304	Double Pipe Creek	Fail	65%	54%	75%	55%	43	28
2140305	Catoctin Creek	Fail	47%	30%	65%	37%	17	8
2140501	Potomac River WA Cnty	Fail	73%	60%	84%	63%	30	22
2140502	Antietam Creek	Fail	59%	47%	71%	49%	32	19
2140503	Marsh Run	Fail	67%	33%	91%	57%	6	4
2140504	Conococheague Creek	Fail	85%	64%	96%	75%	13	11
2140505	Little Conococheague	Inc	29%	8%	60%	19%	7	2
2140506	Licking Creek	Fail	43%	17%	72%	33%	7	3
2140507	Tonoloway Creek	n=0						
2140508	Potomac River AL Cnty	Fail	56%	30%	79%	46%	9	5
2140509	Little Tonoloway Creek	Fail	67%	40%	87%	57%	9	6
2140510	Sideling Hill Creek	Pass	20%	5%	45%	10%	10	2
2140511	Fifteen Mile Creek	Pass	4%	0%	13%	-6%	28	1
2140512	Town Creek	Fail	23%	11%	38%	13%	22	5
2141001	Potomac River L N Branch	Fail	21%	12%	31%	11%	39	8
2141002	Evitts Creek	Fail	50%	30%	70%	40%	14	7
2141003	Wills Creek	Fail	63%	43%	79%	53%	16	10
2141004	Georges Creek	Fail	76%	58%	89%	66%	17	13
2141005	Potomac River U N Branch	Fail	62%	46%	76%	52%	21	13
2141006	Savage River	Pass	7%	3%	16%	-3%	41	3

MDE8DIGT	MDE8NAME	Percent Stream Mile Assessment						
		Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
5020201	Youghiogheny River	Fail	29%	22%	38%	19%	65	19
5020202	Little Youghiogheny R	Fail	63%	46%	78%	53%	19	12
5020203	Deep Creek Lake	Fail	100%	75%	100%	90%	8	8
5020204	Casselman River	Fail	29%	19%	42%	19%	34	10

Table 7: Comparison Between Previous Biocriteria Method (average IBI) and New Biocriteria Method (percent stream mile).

			Average IBI Listing Methodology									Percent Stream Mile Listing Methodology						
MDE8DIGT	MDE8NAME	Total MBSS Sites	Final Status using Average IBI	Average BIBI	BIBI (LCL)	BIBI (UCL)	BIBI n	Average FIBI	FIBI LCL	FIBI UCL	FIBI n	Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2050301	Conewago Creek	0	n=0									Inc						
2120201	L Susquehanna River	6	n<10	3.39	2.59	4.19	6	2.20	1.33	3.07	5	Fail	83%	49%	98%	73%	6	5
2120202	Deer Creek	46	Pass	4.00	3.85	4.15	46	3.94	3.77	4.10	38	Pass	11%	5%	19%	1%	46	5
2120203	Octoraro Creek	12	Pass	3.60	3.26	3.93	12	3.68	3.32	4.05	10	Pass	8%	1%	29%	-2%	12	1
2120204	Conowingo Dam Susq R	5	n<10	3.00	2.57	3.43	5	3.93	3.51	4.36	5	Inc	20%	2%	58%	10%	5	1
2120205	Broad Creek	17	Pass	3.45	3.24	3.66	17	3.67	3.41	3.92	12	Pass	12%	3%	28%	2%	17	2
2130101	Atlantic Ocean	0	n=0									Inc						
2130102	Assawoman Bay	0	n=0									Inc						
2130103	Isle of Wight Bay	4	n<10	2.71	2.24	3.19	4	3.50	2.83	4.17	2	Inc	50%	14%	86%	40%	4	2
2130104	Sinepuxent Bay	0	n=0									Inc						
2130105	Newport Bay	0	n=1									Inc						
2130106	Chincoteague Bay	0	n=1									Inc						
2130201	Pocomoke Sound	0	n=0									Inc						
2130202	Lower Pocomoke River	8	n<10	2.50	2.19	2.81	8	2.93	2.54	3.33	5	Fail	63%	34%	85%	53%	8	5
2130203	Upper Pocomoke River	23	Inc	3.16	2.94	3.37	22	3.73	3.52	3.94	22	Fail	35%	21%	50%	25%	23	8
2130204	Dividing Creek	4	n<10	4.71	4.56	4.86	4	4.00	3.85	4.15	4	Inc	0%	0%	44%	-10%	4	0
2130205	Nassawango Creek	5	n<10	3.47	2.66	4.28	5	3.92	3.01	4.82	4	Inc	40%	11%	75%	30%	5	2
2130206	Tangier Sound	0	n=0									Inc						
2130207	Big Annemessex River	0	n=0									Inc						
2130208	Manokin River	2	n<10	3.57	2.84	4.30	2	3.00	2.27	3.73	2	Inc	50%	5%	95%	40%	2	1
2130301	Lower Wicomico River	7	n<10	2.76	2.38	3.13	7	3.17	2.76	3.57	6	Fail	71%	40%	92%	61%	7	5
2130302	Monie Bay	0	n=0									Inc						
2130303	Wicomico Creek	0	n=1									Inc						
2130304	Wicomico River Head	5	n<10	3.91	3.32	4.51	5	3.59	2.99	4.18	5	Inc	20%	2%	58%	10%	5	1
2130305	Nanticoke River	23	Inc	3.32	3.06	3.58	23	3.11	2.82	3.40	18	Fail	35%	21%	50%	25%	23	8
2130306	Marshyhope Creek	11	Inc	3.26	2.81	3.71	11	3.48	2.99	3.98	9	Fail	55%	32%	76%	45%	11	6
2130307	Fishing Bay	0	n=1									Inc						
2130308	Transquaking River	6	n<10	2.48	2.24	2.72	6	3.25	2.96	3.54	4	Fail	67%	33%	91%	57%	6	4
2130401	Honga River	0	n=0									Inc						

			Average IBI Listing Methodology									Percent Stream Mile Listing Methodology						
MDE8DIGT	MDE8NAME	Total MBSS Sites	Final Status using Average IBI	Average BIBI	BIBI (LCL)	BIBI (UCL)	BIBI n	Average FIBI	FIBI LCL	FIBI UCL	FIBI n	Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2130402	Little Choptank	0	n=1									Inc						
2130403	Lower Choptank	11	Inc	3.05	2.66	3.44	11	3.56	3.03	4.08	6	Fail	45%	24%	68%	35%	11	5
2130404	Upper Choptank	32	Inc	3.20	2.94	3.45	32	3.74	3.44	4.03	24	Fail	38%	26%	50%	28%	32	12
2130405	Tuckahoe Creek	26	Pass	3.59	3.35	3.84	26	4.05	3.81	4.30	25	Pass	19%	10%	33%	9%	26	5
2130501	Eastern Bay	0	n=0									Inc						
2130502	Miles River	2	n<10	3.29	2.19	4.38	2	1.83	0.74	2.93	2	Inc	50%	5%	95%	40%	2	1
2130503	Wye River	13	Pass	3.90	3.54	4.26	13	3.67	3.27	4.06	11	Pass	15%	4%	36%	5%	13	2
2130504	Kent Narrows	0	n=0									Inc						
2130505	Lower Chester River	3	n<10	2.81	2.28	3.34	3	2.17	1.52	2.82	2	Inc	33%	3%	80%	23%	3	1
2130506	Langford Creek	7	n<10	3.33	2.89	3.77	7	3.93	3.41	4.45	5	Pass	14%	1%	45%	4%	7	1
2130507	Corsica River	13	Pass	4.04	3.77	4.32	13	4.30	3.97	4.63	9	Pass	8%	1%	27%	-2%	13	1
2130508	Southeast Creek	11	Pass	3.65	3.30	3.99	11	4.19	3.80	4.57	9	Pass	0%	0%	19%	-10%	11	0
2130509	Middle Chester River	22	Inc	3.09	2.91	3.27	22	3.32	3.13	3.50	21	Fail	36%	22%	52%	26%	22	8
2130510	Upper Chester River	30	Pass	3.75	3.51	3.99	30	3.93	3.68	4.18	28	Fail	20%	11%	32%	10%	30	6
2130511	Kent Island Bay	0	n=0									Inc						
2130601	Lower Elk River	0	n=0									Inc						
2130602	Bohemia River	3	n<10	2.33	1.53	3.13	3	3.50	2.52	4.48	2	Inc	67%	20%	97%	57%	3	2
2130603	Upper Elk River	3	n<10	3.71	2.61	4.82	3	3.67	2.56	4.77	3	Inc	33%	3%	80%	23%	3	1
2130604	Back Creek	0	n=0									Inc						
2130605	Little Elk Creek	6	n<10	3.44	3.14	3.75	6	3.67	3.36	3.97	6	Inc	17%	2%	51%	7%	6	1
2130606	Big Elk Creek	6	n<10	3.85	3.18	4.52	6	4.27	3.53	5.00	5	Inc	17%	2%	51%	7%	6	1
2130607	Christina River	2	n<10	2.17	1.95	2.38	2	2.67	2.67	2.67	1	Inc	100%	32%	100%	90%	2	2
2130608	Northeast River	14	Pass	3.29	3.06	3.53	14	4.13	3.89	4.37	13	Pass	14%	4%	34%	4%	14	2
2130609	Furnace Bay	9	n<10	3.92	3.48	4.36	9	4.14	3.64	4.64	7	Pass	11%	1%	37%	1%	9	1
2130610	Sassafras River	4	n<10	2.86	2.48	3.24	4	4.33	3.89	4.77	3	Inc	25%	3%	68%	15%	4	1
2130611	Stillpond-Fairlee	5	n<10	3.23	2.96	3.50	5	3.33	3.03	3.63	4	Inc	20%	2%	58%	10%	5	1
2130701	Bush River	4	n<10	1.58	1.26	1.90	4	3.83	3.38	4.29	2	Fail	100%	56%	100%	90%	4	4
2130702	Lower Winters Run	10	Inc	2.17	1.86	2.47	10	3.78	3.45	4.10	9	Fail	70%	45%	88%	60%	10	7
2130703	Atkisson Reservoir	9	n<10	2.67	2.18	3.15	8	4.26	3.80	4.72	9	Fail	56%	30%	79%	46%	9	5
2130704	Bynum Run	10	Inc	1.83	1.48	2.18	10	3.85	3.48	4.22	9	Fail	80%	55%	95%	70%	10	8

			Average IBI Listing Methodology									Percent Stream Mile Listing Methodology						
MDE8DIGT	MDE8NAME	Total MBSS Sites	Final Status using Average IBI	Average BIBI	BIBI (LCL)	BIBI (UCL)	BIBI n	Average FIBI	FIBI LCL	FIBI UCL	FIBI n	Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2130705	Aberdeen Proving Ground	6	n<10	2.05	1.65	2.44	6	1.33	0.77	1.89	3	Fail	83%	49%	98%	73%	6	5
2130706	Swan Creek	7	n<10	2.70	2.19	3.22	7	3.93	3.32	4.54	5	Fail	57%	28%	83%	47%	7	4
2130801	Gunpowder River	0	n=1									Inc						
2130802	Lower Gunpowder Falls	13	Fail	2.33	1.93	2.74	13	3.20	2.74	3.66	10	Fail	54%	33%	74%	44%	13	7
2130803	Bird River	2	n<10	2.00	1.15	2.85	2	3.00	2.15	3.85	2	Inc	100%	32%	100%	90%	2	2
2130804	Little Gunpowder Falls	27	Pass	3.69	3.51	3.87	27	3.63	3.43	3.84	21	Pass	15%	7%	27%	5%	27	4
2130805	Loch Raven Reservoir	45	Pass	3.88	3.68	4.07	45	3.32	3.09	3.54	34	Fail	27%	18%	37%	17%	45	12
2130806	Prettyboy Reservoir	19	Pass	3.75	3.52	3.98	19	3.96	3.73	4.20	18	Pass	16%	6%	32%	6%	19	3
2130807	Middle River - Browns	0	n=0									Inc						
2130901	Back River	21	Fail	1.66	1.53	1.78	21	1.95	1.82	2.08	20	Fail	100%	90%	100%	90%	21	21
2130902	Bodkin Creek	2	n<10	2.14	1.78	2.51	2	1.33	0.97	1.70	2	Inc	100%	32%	100%	90%	2	2
2130903	Baltimore Harbor	26	Fail	2.40	2.12	2.68	26	2.65	2.30	2.99	17	Fail	69%	55%	81%	59%	26	18
2130904	Jones Falls	22	Inc	3.22	2.87	3.58	22	2.68	2.29	3.06	19	Fail	36%	22%	52%	26%	22	8
2130905	Gwynns Falls	28	Fail	2.26	2.03	2.49	28	2.94	2.70	3.19	24	Fail	79%	65%	88%	69%	28	22
2130906	Patapsco River L N Br	33	Fail	2.30	2.05	2.56	33	2.88	2.59	3.16	27	Fail	61%	48%	72%	51%	33	20
2130907	Liberty Reservoir	77	Pass	3.35	3.21	3.50	77	4.22	4.07	4.37	70	Fail	22%	16%	29%	12%	77	17
2130908	S Branch Patapsco	40	Pass	3.21	3.02	3.40	38	4.36	4.16	4.56	37	Fail	20%	12%	30%	10%	40	8
2131001	Magothy River	6	n<10	2.43	1.99	2.87	6	2.44	1.82	3.07	3	Fail	67%	33%	91%	57%	6	4
2131002	Severn River	20	Inc	3.43	3.15	3.70	20	3.09	2.80	3.38	18	Fail	35%	21%	52%	25%	20	7
2131003	South River	10	Inc	2.54	2.32	2.77	10	3.67	3.25	4.08	3	Fail	80%	55%	95%	70%	10	8
2131004	West River	7	n<10	2.06	1.68	2.44	7	NA	NA	NA	0	Fail	57%	28%	83%	47%	7	4
2131005	West Chesapeake Bay	21	Fail	3.18	2.88	3.47	20	2.12	1.79	2.46	15	Fail	71%	55%	84%	61%	21	15
2131101	Patuxent River lower	37	Pass	3.69	3.49	3.89	37	3.30	3.06	3.54	25	Fail	38%	27%	50%	28%	37	14
2131102	Patuxent River middle	17	Inc	3.42	3.07	3.77	17	3.04	2.67	3.42	15	Fail	41%	25%	59%	31%	17	7
2131103	Western Branch	24	Inc	3.05	2.85	3.24	24	3.70	3.49	3.91	20	Fail	38%	24%	53%	28%	24	9
2131104	Patuxent River upper	15	Fail	2.41	2.16	2.66	15	2.33	2.06	2.61	12	Fail	73%	54%	88%	63%	15	11
2131105	Little Patuxent River	27	Fail	2.11	1.89	2.33	27	3.27	3.04	3.50	25	Fail	70%	56%	82%	60%	27	19
2131106	Middle Patuxent River	15	Pass	3.49	3.23	3.75	15	3.49	3.20	3.77	13	Pass	20%	8%	39%	10%	15	3
2131107	Rocky Gorge Dam	17	Pass	3.56	3.26	3.85	17	3.52	3.21	3.83	15	Fail	24%	11%	42%	14%	17	4
2131108	Brighton Dam	27	Pass	3.77	3.56	3.97	27	3.61	3.40	3.82	25	Pass	11%	4%	23%	1%	27	3

			Average IBI Listing Methodology									Percent Stream Mile Listing Methodology						
MDE8DIGT	MDE8NAME	Total MBSS Sites	Final Status using Average IBI	Average BIBI	BIBI (LCL)	BIBI (UCL)	BIBI n	Average FIBI	FIBI LCL	FIBI UCL	FIBI n	Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2139996	Upper Chesapeake Bay	0	n=0									Inc						
2139997	Middle Chesapeake Bay	0	n=0									Inc						
2139998	Lower Chesapeake Bay	0	n=0									Inc						
2140101	Potomac River L tidal	8	n<10	4.00	3.76	4.24	8	2.42	2.08	2.76	4	Fail	38%	15%	66%	28%	8	3
2140102	Potomac River M tidal	13	Pass	3.86	3.51	4.21	12	4.21	3.85	4.58	11	Pass	15%	4%	36%	5%	13	2
2140103	St. Mary's River	26	Pass	3.53	3.26	3.79	20	3.54	3.29	3.78	23	Fail	23%	13%	37%	13%	26	6
2140104	Breton Bay	7	n<10	3.98	3.48	4.48	7	3.78	3.01	4.55	3	Pass	14%	1%	45%	4%	7	1
2140105	St. Clements Bay	13	Pass	4.16	3.85	4.47	13	3.59	3.22	3.96	9	Pass	15%	4%	36%	5%	13	2
2140106	Wicomico River	12	Pass	4.02	3.68	4.37	12	3.63	3.20	4.05	8	Pass	17%	5%	39%	7%	12	2
2140107	Gilbert Swamp	14	Inc	3.69	3.38	4.00	14	3.10	2.73	3.47	10	Pass	14%	4%	34%	4%	14	2
2140108	Zekiah Swamp	33	Pass	4.05	3.82	4.28	33	4.01	3.75	4.27	26	Pass	15%	8%	26%	5%	33	5
2140109	Port Tobacco River	12	Inc	3.38	2.97	3.79	11	2.93	2.47	3.38	9	Fail	50%	29%	71%	40%	12	6
2140110	Nanjemoy Creek	15	Pass	3.98	3.67	4.29	15	3.90	3.54	4.26	11	Pass	20%	8%	39%	10%	15	3
2140111	Mattawoman Creek	19	Pass	3.77	3.50	4.04	19	3.48	3.17	3.78	15	Fail	26%	13%	43%	16%	19	5
2140201	Potomac River U tidal	13	Fail	2.58	2.31	2.85	13	3.21	2.92	3.51	11	Fail	62%	40%	80%	52%	13	8
2140202	Potomac River MO Cnty	42	Fail	2.27	2.10	2.45	42	3.40	3.22	3.57	41	Fail	67%	56%	76%	57%	42	28
2140203	Piscataway Creek	15	Inc	2.87	2.58	3.16	15	3.49	3.18	3.80	13	Fail	33%	17%	53%	23%	15	5
2140204	Oxon Creek	2	n<10	1.29	0.92	1.65	2	1.00	0.63	1.37	2	Inc	100%	32%	100%	90%	2	2
2140205	Anacostia River	37	Fail	2.02	1.84	2.21	37	3.28	3.09	3.48	33	Fail	84%	73%	91%	74%	37	31
2140206	Rock Creek	18	Fail	2.39	2.14	2.63	18	3.40	3.14	3.66	16	Fail	56%	38%	72%	46%	18	10
2140207	Cabin John Creek	8	n<10	1.54	1.29	1.80	8	2.50	2.21	2.79	6	Fail	100%	75%	100%	90%	8	8
2140208	Seneca Creek	32	Fail	2.44	2.24	2.64	32	4.07	3.84	4.29	24	Fail	59%	47%	71%	49%	32	19
2140301	Potomac River FR Cnty	19	Fail	2.01	1.82	2.21	19	2.98	2.75	3.21	14	Fail	79%	62%	90%	69%	19	15
2140302	Lower Monocacy River	83	Fail	2.37	2.26	2.48	82	3.91	3.80	4.03	69	Fail	61%	54%	69%	51%	83	51
2140303	Upper Monocacy River	58	Fail	2.50	2.36	2.65	57	3.63	3.48	3.78	54	Fail	62%	53%	71%	52%	58	36
2140304	Double Pipe Creek	43	Fail	2.33	2.18	2.48	42	3.76	3.60	3.93	35	Fail	65%	54%	75%	55%	43	28
2140305	Catoctin Creek	17	Fail	2.71	2.49	2.92	17	3.03	2.75	3.32	10	Fail	47%	30%	65%	37%	17	8
2140501	Potomac River WA Cnty	30	Fail	2.63	2.43	2.84	30	1.92	1.66	2.17	20	Fail	73%	60%	84%	63%	30	22
2140502	Antietam Creek	32	Fail	2.47	2.27	2.67	31	3.47	3.26	3.67	29	Fail	59%	47%	71%	49%	32	19
2140503	Marsh Run	6	n<10	2.04	1.74	2.34	6	3.27	2.94	3.60	5	Fail	67%	33%	91%	57%	6	4

			Average IBI Listing Methodology									Percent Stream Mile Listing Methodology						
MDE8DIGT	MDE8NAME	Total MBSS Sites	Final Status using Average IBI	Average BIBI	BIBI (LCL)	BIBI (UCL)	BIBI n	Average FIBI	FIBI LCL	FIBI UCL	FIBI n	Final Status Using % Stream Miles	% Stream Miles with possible Degradation	% (LCL)	% (UCL)	% Difference from Reference	Total Sites	Sites Degraded
2140504	Conococheague Creek	13	Fail	2.25	1.99	2.51	13	2.69	2.43	2.96	13	Fail	85%	64%	96%	75%	13	11
2140505	Little Conococheague	7	n<10	3.07	2.60	3.54	7	4.13	3.57	4.69	5	Inc	29%	8%	60%	19%	7	2
2140506	Licking Creek	7	n<10	3.57	3.01	4.13	7	2.20	1.54	2.86	5	Fail	43%	17%	72%	33%	7	3
2140507	Tonoloway Creek	0	n=0									Inc						
2140508	Potomac River AL Cnty	9	n<10	3.39	3.02	3.76	9	2.17	1.61	2.72	4	Fail	56%	30%	79%	46%	9	5
2140509	Little Tonoloway Creek	9	n<10	2.56	2.18	2.93	9	3.24	2.81	3.66	7	Fail	67%	40%	87%	57%	9	6
2140510	Sideling Hill Creek	10	Pass	3.28	3.02	3.53	10	3.67	3.38	3.95	8	Pass	20%	5%	45%	10%	10	2
2140511	Fifteen Mile Creek	28	Pass	4.04	3.91	4.16	28	4.16	4.00	4.32	16	Pass	4%	0%	13%	-6%	28	1
2140512	Town Creek	22	Pass	3.47	3.27	3.66	22	3.64	3.41	3.88	15	Fail	23%	11%	38%	13%	22	5
2141001	Potomac River L N Branch	39	Inc	3.59	3.42	3.77	39	3.17	2.95	3.38	26	Fail	21%	12%	31%	11%	39	8
2141002	Evitts Creek	14	Fail	2.70	2.42	2.98	14	3.29	2.97	3.60	11	Fail	50%	30%	70%	40%	14	7
2141003	Wills Creek	16	Fail	2.88	2.49	3.27	16	2.36	1.94	2.78	14	Fail	63%	43%	79%	53%	16	10
2141004	Georges Creek	17	Fail	2.79	2.43	3.16	17	2.33	1.94	2.72	15	Fail	76%	58%	89%	66%	17	13
2141005	Potomac River U N Branch	21	Fail	2.93	2.66	3.20	21	2.40	2.12	2.68	20	Fail	62%	46%	76%	52%	21	13
2141006	Savage River	41	Pass	4.09	3.98	4.21	41	4.09	3.97	4.20	39	Pass	7%	3%	16%	-3%	41	3
5020201	Youghiogheny River	65	Pass	3.48	3.34	3.62	64	3.47	3.32	3.62	55	Fail	29%	22%	38%	19%	65	19
5020202	Little Youghiogheny R	19	Fail	3.12	2.89	3.34	19	2.23	1.97	2.49	14	Fail	63%	46%	78%	53%	19	12
5020203	Deep Creek Lake	8	n<10	2.41	1.96	2.85	8	1.55	1.07	2.02	7	Fail	100%	75%	100%	90%	8	8
5020204	Casselman River	34	Pass	3.21	3.02	3.41	34	3.26	3.06	3.46	34	Fail	29%	19%	42%	19%	34	10

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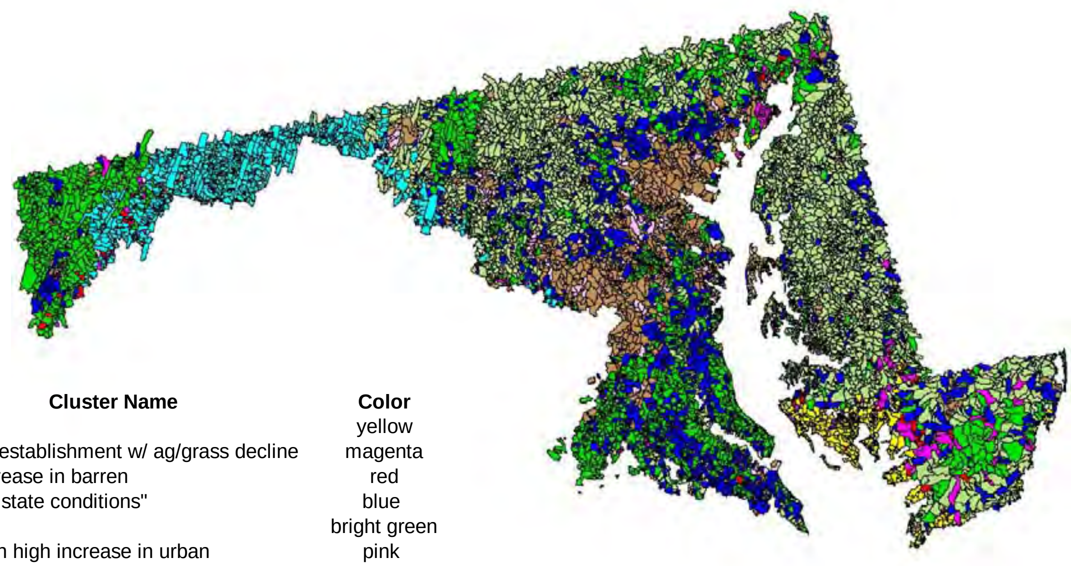
C.2.1.1.7 Evaluating the Spatial Representation of the Monitoring Data

An analysis of MBSS data representation of each 8-digit watershed determines if stream monitoring stations adequately capture watershed landscape heterogeneity and can thus be used to support a biological assessment. Watershed landscape heterogeneity is assessed using the distribution of landscape clusters (groups of similar landscape conditions) that incorporate land use, land use change, soil erodibility, slope, precipitation, and population density (US EPA 2007). Nine distinct cluster types were identified and are presented in Figure 10.



Cluster	Cluster Name	Color
1	Wetland	yellow
2	Forest re-establishment w/ ag/grass decline	magenta
3	Large increase in barren	red
4	"Baseline state conditions"	blue
5	Forested	bright green
6	Urban with high increase in urban	pink
7	Forest with wide range in slopes	cyan
8	Agriculture	soft green
9	Urban with more modest increase in urban	brown

Figure 10 Landscape similarity in Maryland.

The Nine cluster groups can be described as follows: Cluster 1 watersheds are dominated by wetlands and concentrated in the southwest corner of the Delmarva Peninsula. Cluster 2 watersheds are characterized by forest re-growth in former agricultural and grass lands. Cluster 3 watersheds are characterized by large increases in barren. They are mainly scattered around the margins of the Chesapeake Bay with another concentration in the westernmost portion of the panhandle. Cluster 4 is perhaps best labeled as "baseline state condition," since all cluster means are close to the average. Cluster 4 watersheds are scattered throughout the State. Cluster 5 and 7 watersheds are dominated by forest with the main difference being that cluster 7 watersheds have a broader range of slopes. Clusters 6 and 9 are dominated by urban land use, with cluster 6 having a much higher rate of urban increase. Cluster 8 watersheds are dominated by agriculture.

Representation of watershed heterogeneity is assessed by determining if the distribution of sample stations within cluster groups is proportional to the distribution of stream length within cluster groups. A Percent Similarity Index (PSI), also called the Renkonen Index (Krebs 1989), is calculated using proportions of 1st through 4th order streams within clusters and proportions of monitoring stations within clusters. Despite the simplicity of this measure, it is a robust quantitative similarity coefficient and is commonly used in ecological research when comparing communities using species proportions. The PSI ranges from 0 percent (no similarity) to 100 percent (complete similarity). The index is calculated as

$$PSI = \sum_{i=S} \text{minimum} \left(p_i^{\text{Streams}}, p_i^{\text{Stations}}\right)$$

where
- p_i^A is the percentage of 1^{st} – 4^{th} order streams in cluster i
- p_i^B is the percentage of monitoring stations in cluster i
- i is a cluster type
- S is the number of cluster types occurring in a watershed (sum of proportions must equal 100 percent within a watershed)

A plot of the similarity between the watershed landscape clusters and the number of MBSS round 1 and round 2 monitoring sites in an 8-digit watershed is presented in Figure A-2. It is clearly evident that more sites results in a higher watershed percent similarity index. Also, Figure A-2 illustrates that percent similarity index has a large range for watersheds with less then ten sites but begins to reach an average of about 85 percent when the number of sites are greater than eight.

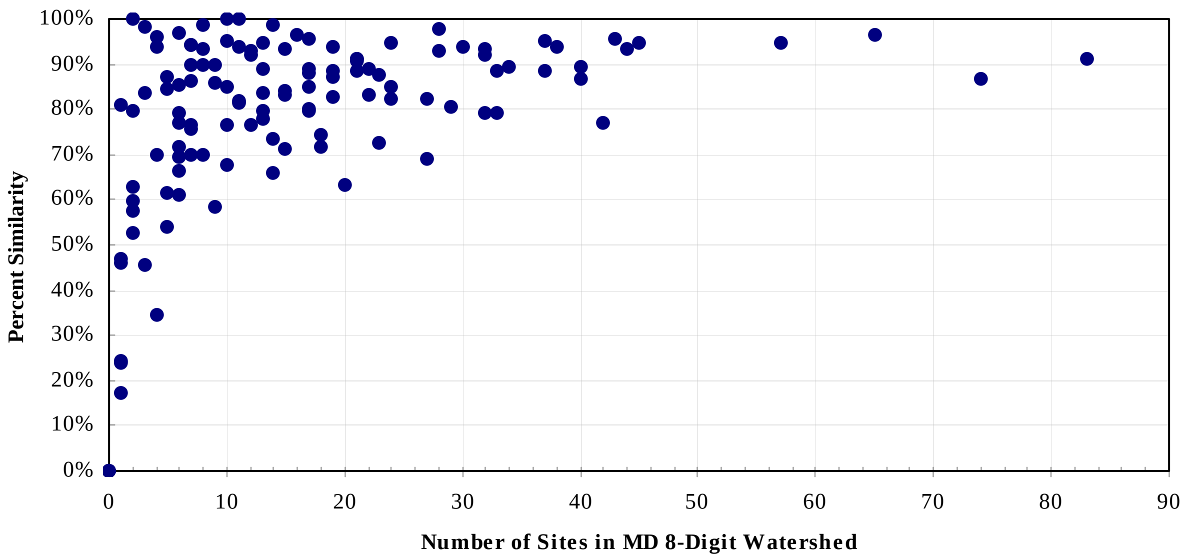


Figure A-2. Watershed Percent similarity index vs. number of sites in a Maryland 8-digit watershed.

C.2.2 Bacterial Listing Methodology

The major change to the bacterial assessment methodology this cycle concerns how impaired waters listings are made for recreational waters (see Section C.1.2.2.1). In all cases, waters showing signs of bacterial contamination will require a sanitary survey before an impairment decision is made. Sanitary surveys can often find and fix the source of the bacterial problem, thus obviating the need for a TMDL.

The rules used by MDE to interpret data and apply the water quality standards are discussed below in three sections. Each of those sections describes the application to a distinct water use: shellfish harvesting; recreational waters; and beaches. Although in each case a bacteriological indicator applies, the criterion and in some cases the indicator itself differs according to the requirements of the National Shellfish Sanitation Program (NSSP), water quality standards, or public health requirements. Data collected and analyzed using approved methods and in accordance with strict QA/QC guidelines may be utilized for decision making with respect to attainment status. All available data will be considered but may be used for prioritization, additional study, or revised monitoring.

C.2.2.1 Interpretation Of Fecal Coliform Data In Use II, Shellfish Harvesting Areas

(1) RESTRICTED:
Those areas restricted to shellfish harvesting because they do not meet state requirements for Use II waters or do not meet the strict requirements under the National Shellfish Sanitation Program (NSSP) are listed. These requirements are found in the *National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish*, 2003 revision. Copies can be obtained from the U.S. Department of Health and Human Services, PHS, FDA or on FDA's website: USFDA/CFSAN NSSP- Guide for the Control of Molluscan shellfish 2003. Data used to determine these restrictions include routine bacteriological water quality sampling, sanitary survey, and strict adherence to the NSSP procedures, protocols and requirements. In summary, fecal coliform MPN/100 ml must have a median of less than 14 and a 90^{th} percentile of less than 49.
(1A)
Those areas restricted to shellfish harvesting because they are located in the vicinity of a wastewater treatment plant (WWTP) outfall but where there is <u>no evidence of actual bacteriological impairment</u> are not listed. This restriction is an important application of the principals and practices of public health protection and is required under the NSSP. MDE also evaluates treatment plant performance and its impact to shellfish harvesting waters. These administrative closures are not based on water quality criteria but are designed to be protective buffer areas in case of a system failure. <u>These areas meet the bacteriological portion of the standard</u>.
(1B)
The upper Chesapeake Bay is restricted to shellfish harvesting for administrative reasons and is not listed. This area is designated as Use II waters; however there is insufficient shellfish resource for harvesting due to the fresh water input from the Susquehanna River. Since there are no oysters or clams to harvest and the NSSP requirements for sanitary survey is not met, the area is classified as restricted. In order to protect shellfish waters directly below this area, the shellfish harvesting water designation is a valuable protective measure. <u>Water quality is routinely monitored in this area for fecal coliform and meets the bacteriological portion of the standard</u>. If the collected data shows violations with state standards (notwithstanding the fact that the area is under an administrative closure or restriction) it will be listed appropriately.

(2) CONDITIONALLY APPROVED WATERS:
Before being opened for conditional harvesting, areas need to meet the stringent shellfish bacteriological standards. However, those areas classified as conditionally approved are closed to harvesting for three days following a rainfall event of greater than or equal to one inch in twenty-four hours. This happens an average of 10 - 15 times per year when it is not completely certain that bacterial levels are not elevated in response to rain. The rest of the time, these areas meet the water quality standards for Use II waters and are determined to meet the designated use.

(3)APPROVED WATERS:
Areas classified as approved for harvesting meet the water quality standards for Use II waters.

C.2.2.2 Interpretation Of Bacteria Data For General Recreational Use

Maryland has implemented the EPA recommended enterococcus (marine or freshwater and *E. coli* (freshwater only) standards for all waters except shellfish harvesting waters, where the more stringent FDA standard must be met.

According to EPA's *Ambient Water Quality Criteria for Bacteria -1986*, the indicators E. coli and enterococcus have been found through epidemiological studies to have the best quantifiable relationship between the density of an indicator in the water and the potential human health risks associated with swimming in sewage contaminated waters. "Indicator organisms are a fundamental monitoring tool used to measure both changes in environmental (water) quality or conditions and the potential of hard-to-detect pathogenic organisms. An indicator organism provides evidence of the potential presence or absence of a pathogenic organism that survives under similar physical, chemical, and nutrient conditions. (EPA Beach Guidance, June 2002).

Maryland's bacteria indicator criterion is a conservative measure, which protects the public from the potential risks associated with swimming and other primary contact recreation activities. A few high values of the indicators may or may not be indicative of impairment. Therefore, it is necessary to evaluate the results from indicator organisms from multiple sampling events over time to adequately quantify water quality conditions.

C.2.2.2.1 Recreational Waters

Step 1 - A steady state geometric mean will be calculated with available data from the previous year where there is at least 5 representative sampling events. The data shall be from samples collected during steady state, dry weather conditions and during the beach season (Memorial Day through Labor Day) to be representative of the critical condition (highest use). If the resulting steady state geometric mean is greater than 35 cfu/100 ml enterococci in marine/estuarine waters, 33 cfu/100 ml enterococci in freshwater or 126 cfu/100 ml *E. coli* in freshwater, the water body will be included for further assessment. If fewer than 5 representative sampling events for an area being assessed are available, data from the previous two years will be evaluated.

Step 2 – Once a preliminary list is assembled, a steady state geometric mean will be calculated with available data from the previous two (2) to five (5) years. The data shall be from samples collected during steady state, dry weather conditions and during the beach season (Memorial Day through Labor Day) to be representative of the critical condition (highest use). If the resulting geometric mean is greater than 35 cfu/100 ml enterococci in marine/estuarine waters, 33 cfu/100 ml enterococci in freshwater or 126 cfu/100 ml *E. coli* in freshwater, the water body will be listed in Category 3 of the Integrated Report as requiring more data.

Category 3 of the Integrated Report
When waters are listed in Category 3 (insufficient data) of the Integrated Report, a sanitary survey must be conducted to identify potential sources of pathogenic bacteria. If the sanitary survey identifies significant sources of pathogenic bacteria and they are not corrected, the waters will be moved to Category 5 (Impaired) of the Integrated Report. If the sanitary survey is conducted and any potential sources of pathogenic bacteria are remedied, the waters will be removed from Category 3 and placed in Category 2 (Supporting some designated uses) of the Integrated Report.

Category 5 of the Integrated Report
For waters listed in Category 5, a sanitary survey must be conducted if it was not conducted before or after the waters were listed in Category 3 of the Integrated Report. A water body can be removed from Category 5 (A) if it meets the steady state geometric mean standard referenced in C.1.2.2.1 and (B) if a sanitary survey is conducted at the water body and there are no sources of pathogenic bacteria found, or if sources of pathogenic bacteria are remedied.

C.2.2.2.2 Beaches

Beaches are designated as "Beaches" from Memorial Day through Labor Day (Beach Season). During this period, beaches are monitored closely using a tiered approach based on risk to human health since these are places identified as areas where people are likely to swim. High, Medium, and Low priority beaches are monitored weekly, biweekly, and monthly, respectively. Low priority beaches will be re-evaluated regularly to determine if they should be prioritized higher or removed from the list of beaches. This will mean that eventually, all beaches will have more than the necessary number of sampling events performed to adequately assess them.

MDE has delegated the authority for monitoring and notifying the public regarding beach water quality conditions to local health departments. MDE's role is to assure that beaches state-wide are managed uniformly. MDE maintains a database of all beaches in Maryland including latitude and longitude coordinates of the endpoints identifying the beach segment, sanitary survey information provided by the local health departments, and monitoring results (all beach monitoring samples are submitted to the Department of Health and Mental Hygiene (DHMH) for laboratory analysis). This data, along with all other available data will be used to determine which areas are to be listed as impaired.

The listing methodology for all general recreational use also applies to beaches (Section C.1.2.2). The single sample maximum criteria applies only to beaches and is to be used for closure and advisory decisions based on short term exceedences of the geometric mean portion of the standard.

C.2.2.3 Discussion

It is critical that the sampling be carried out in a way that is representative of conditions in time and space. Per EPA's *Ambient Water Quality for Bacteria - 1986* , the calculated "densities are for steady state dry weather conditions." A sampling event means samples taken at a beach, or other waterbody to characterize bacterial concentrations with the number and placement of sampling stations sufficient to characterize conditions in the full extent of the beach area or waterbody. High spatial and temporal variability suggest that infrequent or moderately elevated bacteriological levels alone do not necessarily represent a human health risk or impairment. The bacteriological standard is descriptive and includes numerical criteria. The intent of the criteria is to allow the 'number' to be judged in conjunction with the sanitary survey that identifies probable sources of bacteria and allows regulators to assess the probability of human health risk. The standard recognizes the inherent variability of the bacterial measurement and recognizes the inadequacies of indicator organisms. The Most Probable Number (MPN) or Colonies Forming Units (CFU) test used to determine the level of bacteria is not a direct count but a statistical estimation subject to a high degree of variability.

C.2.3 Toxics Assessment Methodology

The only change to the toxics listing methodology for this cycle is the use of a more conservative polychlorinated biphenyl (PCB) threshold for making fish tissue listings. The 2006 PCB threshold concentration used for fish tissue listing was reduced from 88 parts per billion (ppb) (i.e., ng/g – wet weight) to 39 ppb (i.e., ng/g – wet weight) to be more protective of public health, particularly with respect to sensitive populations (children and women of child bearing age).

C.2.3.1 Background

The designated uses define the water quality goals of a water body. At a minimum, the Maryland Department of the Environment (MDE) must provide water quality for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water, where attainable (CWA Section 101(a)(2)). The MDE is required to adopt water quality criteria that protect designated uses. Such criteria must be based on sound scientific rationale, must contain sufficient parameters to protect the designated uses, and can be expressed in either numeric or narrative form. Narrative criteria are descriptions of the conditions necessary for a water body to attain its designated use, while numeric criteria are concentration values deemed necessary to protect designated uses. Narrative criteria can be used to assess water quality, and also to establish pollutant-specific discharge limits where there are no numeric criteria or where such criteria are not sufficient to protect the designated use.

Although several approaches exist to assess water quality (e.g. numeric criteria, whole effluent toxicity (WET), etc.), few approaches exist to assess sediment quality due to its complexities. Nevertheless, sediments are an integral component of aquatic ecosystems, providing habitat, feeding, spawning, and rearing areas for many aquatic organisms and are, therefore, protected under the narrative criteria. Furthermore, sediment quality can affect whether or not waters are attaining designated uses. Consequently, it is necessary and appropriate to assess and protect sediment quality, as an essential component of the total aquatic environment, to achieve and maintain designated uses. The difficulty lies in implementing the narrative criteria, which is qualitative in nature. To circumvent this obstacle, MDE is implementing an approach to quantitatively interpret narrative criteria statements, and determine water quality standard violations from contaminated sediments.

C.2.3.2 Introduction

Under Section 303(d)(1) of the federal Clean Water Act (CWA), the MDE is required to establish Total Maximum Daily Loads (TMDLs) for those water body segments that do not meet applicable water quality standards and are therefore considered "impaired". To achieve this, MDE is required to consider all existing and readily available water quality data and information, and develop methods to interpret this data for each potential impairing substance (e.g., pH, nutrient, fecal coliform, etc.).

EPA does not provide guidance for interpreting water quality data for the purposes of developing the 303(d) list. However, EPA does provide guidance on making "use support determinations" for the State Water Quality Assessments (305(b) Report) (EPA 1997). In general, MDE adopted the 305(b) guidance for identifying water body segments impaired due to chemical contaminants. Even though the Department will adhere to these methods as closely as possible, there may be instances where our determinations may vary based on scientifically defensible decisions. It is important to note that there may be situations that do not support an impairment determination from chemical contaminants, but rather from another stressor (*e.g.* dissolved oxygen, biocriteria), and would therefore be addressed elsewhere. This document provides the specific methodology used by MDE for identifying water body segments impaired due to *chemical contaminants*.

It is not the intent of this methodology to include waters that do not meet water quality criteria solely due to natural conditions or physical alterations of the waterbody not related to anthropogenic pollutants. Similarly, it is not the intent of this chapter to include waters where designated uses are being met and where water quality criteria exceedances are limited to those parameters for which permitted mixing zones or other moderating provisions (such as site-specific alternative criteria) are in effect. The Department will examine these situations on a case-by-case basis, and evaluate the context under which the exceedance exists. Determination of compliance with water quality criteria may be facilitated through special analyses (e.g. normalization of metals to common reference element to determine anthropogenic influences), or monitoring (e.g. compliance monitoring for mixing zones).

MDE considers all existing readily available chemical, toxicological, and biological data from water column, sediments, and fish tissue in determining if a water body segment should be classified as impaired due to chemical contaminants and listed on the 303(d) list. As a result, MDE has divided the impairment evaluation process into three media categories (Water Column, Sediment, and Fish Tissue). The Department will evaluate the Monitoring Plans, Quality Assurance, and Quality Control programs of data providers, and will use best professional judgment to include/exclude data where documentation does not exist.

C.2.3.3 Water Column

Ambient water column contaminant data are screened against numerical ambient water quality criteria if available. These water quality criteria are utilized because they represent science-based threshold effect values and are an integral part of the Maryland's water quality standards program. These criteria are divided into the following categories that directly relate to Maryland's surface water use designation classification (COMAR 26.08.02):

All surface waters of the state (USE DESIGNATIONS - I, II, III, & IV)

- *Criteria for the protection of aquatic life*
    - *Fresh water (Chronic & Acute)*
    - *Saltwater (Chronic & Acute)*
- *Criteria for the protection of human health from fish tissue consumption (Organism Only)*

Surface waters used for public water supply (USE DESIGNATION - P)

- *Criteria for the protection of human health from fish tissue consumption & drinking water (Water + Organism)*
- *Drinking water only (Maximum Contaminant Levels-MCLs)*

EPA does not provide guidance in interpreting water column data for the purposes of developing the 303(d) list but does for the development of the 305(b) report (Maryland's Water Quality Inventory). The 305(b) guidance states that, with a minimum of 10 samples over a three-year period, the designated use is not supported if >10 percent (i.e. 2 out of 10) of the samples exceed the appropriate benchmark (EPA 1997). MDE had adopted this rule to identify waterbodies impaired by chemical contaminants. In other words, with a minimum of 10 samples over a three-year period, an impairment would exist if >10 percent of the samples exceed the criteria. An appropriate statistical procedure (e.g. confidence interval approach) will be applied if sample size for a segment is deemed adequate. If there are less than 10 samples for a given area, MDE interprets the available data on a case-by-case basis and determines if an impairment exists. In such cases, a number of factors are considered such as:

- *The magnitude of the criteria exceedance for any one contaminant,*
- *The number of criteria exceeded,*
- *Water column bioassay (toxicity) data indicating toxicity to test organisms.*
- *Data Quality*

If it is determined that a potential impairment exists, but there is insufficient data to make an impairment determination, the segment will be placed on Part 3 (Insufficient data), or Part 4 (Impaired/Threatened but TMDL not required due to forthcoming compliance or previous completion of a TMDL). Segment will then be prioritized for additional monitoring. In these instances, the Department will use its best professional judgment based on the available data to make its determination.

In the case that no criteria are available for a particular contaminant or no criteria are exceeded, other impairment indicators (*e.g.,* ambient water column toxicity data) will be evaluated using best professional judgment. During this evaluation process, if toxicity is indicated, a Toxicity Identification Evaluation (TIE) maybe considered to further identify the possible contaminant source(s) causing toxicity. A TIE is a comprehensive approach used in the Whole Effluent Toxicity (WET) Program to identify possible causes of toxicity. When warranted, MDE will also utilize spatial and temporal trend analyses as an additional evaluation tool for making impairment determinations.

As mentioned previously, MDE considers all existing and readily available data, including independent studies conducted by sources external to MDE. These ambient water column data are screened to determine if they are of acceptable quality (i.e., documented methods and an acceptable QA/QC plan).

If the data are unacceptable (i.e., poor or no QA/QC) but suggest an exceedance of the appropriate criteria, the segment is targeted for additional monitoring, and evaluated using other approaches.

In many cases, there may be no ambient water quality data (chemical or toxicity) available for an impairment evaluation. In such cases, MDE will apply a weight-of-evidence approach using other data as described below.

C.2.3.4 Sediment

Protecting sediment quality is an important part of restoring and maintaining the biological integrity of our State's waters. Sediment is an integral component of aquatic ecosystems, providing habitat, feeding, spawning, and rearing areas for many aquatic organisms. Sediment also serves as a reservoir for chemical contaminants and therefore a source of chemical contaminants to the water column and organisms. Chemicals that do not easily degrade can accumulate in sediments at much higher levels than those found in the water column.

Contaminated sediments can cause adverse effects in benthic or other sediment-associated organisms through exposure to pore water or direct ingestion of sediments or contaminated food. In addition, natural and human disturbances can release chemical contaminants to the overlying water, where water column organisms can be exposed. Sediment contaminants can reduce or eliminate species of recreational, commercial, or ecological importance, either through direct effects or by affecting the food supply that sustainable populations require. Furthermore, some chemical contaminants can bioaccumulate through the food chain and pose human health risks even when sediment-dwelling organisms are not themselves impacted. This specific pathway will be addressed later in the fish tissue approach.

MDE is using the following comprehensive weight-of-evidence approach in making impairment determinations. This approach, also referred to as the Sediment Quality Triad, consists of three components (Chapman, 1992):

- Ambient Sediment bioassays - to measure toxicity
- *In situ* biological variables - to measure alteration of resident biota (*e.g.*, change in benthic community structure)
- Ambient Sediment chemistry - to measure chemical contamination

These components provide complementary data to each other, that when combined may provide an efficient tool in determining an impairment. However, each component has its limitations, which necessitates a sound scientific interpretation of the data and best professional judgment on a case-by-case basis. The scientific community, in fact, has previously indicated that sediment assessments are strongest when the three data components are used in combination to balance their relative strengths and weaknesses (Chapman 1992, Long et al. 2000, Anderson et al. 2001, Ingersoll et al. 1997, EPA 1997).

<u>C.2.3.3.1 Ambient Sediment Bioassay Data</u>

Ambient sediment bioassays are a type of biological data, in which test organisms are exposed under controlled conditions to the field collected sediment sample. Although we have confidence in this type of data because of the controlled conditions, it can be inconsistent, especially where toxicity is minimal or subtle. Laboratory artifacts, although generally controlled, can produce false results. For this reason, at least two or more non-microbial tests are required to exhibit toxicity to determine that the potential for adverse effects from contaminated sediment is high.

This type of data is essential in assessing sediment contaminants. If toxicity is exhibited to the tested benthic/epibenthic organisms, it is generally considered indicative of water quality that is incapable of supporting aquatic life, which is in violation of our State's water quality standards. Furthermore, it also suggests that the adverse effects observed in the toxicity tests may be related to chemical contaminants because other non-contaminant related causes (e.g. dissolved oxygen, pH, temperature) are controlled in the laboratory setting. In addition, the information from this data component is quantitative and can be correlated to the toxicity of other sediments or chemicals to the test species. For this reason, the greatest weight is given to toxicity test data among the three data components.

However, a limitation of this data is that it does not identify the causative pollutant, which necessitates the need for sediment chemistry data. The sediment chemistry data provides the best link for establishing an impairment determination resulting from contaminant exposure, which is the basis of this document. Additionally, the laboratory conditions under which bioassays are conducted may not accurately reflect field conditions of exposure to toxic chemicals, and thus introduces uncertainties when extrapolating to population dynamics. This point is important to understand because while attempting to control for non-contaminant related stressors (e.g., dissolved oxygen, pH, temperature), contaminants in the sediments may be rendered toxic to the test organisms that would not be toxic under field conditions, thus providing a false positive result (e.g., sulfide and ammonia in sediments, pH shift for metals).

C.2.3.3.2 Sediment Chemistry Data

Although EPA has been working on sediment quality criteria (SQC) for many years, no final numeric water quality criteria have been published. This is due to the difficulty in determining the fraction of the chemical contaminant that is biologically available to exert its toxic effect on the exposed population and in establishing a criteria derivation process that could be shown to be consistent with other evaluative tools. In fact, the EPA has redirected their efforts to derive equilibrium sediment guidelines (ESGs), rather than criteria, for the following five substances; acenaphthene (EPA 1993a), fluoranthene (EPA 1993b), phenanthrene (EPA 1993c), dieldrin (EPA 1993d), and endrin (EPA 1993e).

In the absence of such guidelines, a set of screening values devised by National Oceanic and Atmospheric Administration (NOAA) has been generally accepted as a screening tool to evaluate the likelihood of adverse effects (Long and Morgan, 1990/NOAA, 1991; Long *et al*., 1995). The Effects Range-Median (ER-M) values are defined as the median (50^{th} percentile) of the distributions of the effects data for a particular contaminant. However, these values should only be used to screen sediments for levels of possible concern, and should not be construed to indicate an adverse effect in the absence of additional corroborative data (Long and MacDonald, 1998). In their development of a classification scheme for the National Sediment Quality Inventory, EPA also recognized the limitations of the ER-Ms by requiring that the bulk sediment chemistry data exceed two separate sediment benchmarks in classifying sediments as Tier I (probable adverse effects to aquatic life and human health) (EPA 1996).

In the absence of EPA ESGs and NOAA ER-M values, sediment quality benchmarks (SQBs) were derived by MDE for non-ionic organic substances using the EPA-recommended equilibrium partitioning approach, (***e.g*.,** alpha-BHC, beta-BHC, lindane, chlordane, chlorpyrifos, heptachlor, etc.) see Table 10. This is also consistent with EPA's National Sediment Quality Inventory. MDE will compare sediment chemistry data according to the described thresholds in the following order:

a) EPA ESGs,
b) NOAA ER-M values,
c) MDE derived SQBs, and
d) Other toxicological sediment benchmarks (*i.e.*, toxicity data)

Both the quality of sediment chemistry data and associated screening thresholds are considered when conducting an evaluation. Once the quality of data has been established, the potential for adverse effect from contaminated sediment is said to be high if either of the following conditions are met:

1. The sediment chemistry data exceeded the EPA ESG, or

2. The sediment chemistry data exceeded the ER-Ms or other screening values by a factor of two[6] for any one contaminant, or

3. The mean ER-M quotient[7] is greater than 0.5 (Long et al. 2000 & Anderson et al. 2001), or

4. The sediment chemistry data exceeded more than 5 ER-Ms[8] (Long et al. 2000 & Anderson et al. 2001).

Furthermore, various environmental conditions in the sediment can have a profound effect on the availability and toxicity of the sediments to aquatic environment (e.g., AVS for metals, organic carbon for organics, etc.). If data on these parameters are available, MDE will use best professional judgment to interpret the effects of these parameters on the sediment chemistry data.

When the measured chemical exceeds the appropriate sediment threshold, any observed adverse effects to the test species may be due to the measured chemical with the likelihood increasing as the chemical concentration increases. When a chemical is measured at a level below the threshold, any observed adverse effects are not likely to be due to the measured chemical. It is recognized, however, that sediments are rarely, if ever contaminated by a single chemical. Therefore, in cases where a chemical is measured at a level below a threshold, the sediment may still cause adverse effects. Such cases could include, for example, contaminated sediments where chemicals not covered by a threshold are creating or contributing to toxicity, or where bioaccumulation or biomagnification up the food chain is a concern (EPA 2000).

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[6] The factor of two was derived as the geometric mean of the ratios for those substances for which ER-Ms and SQCs were available; acenaphthene (ER-M/SQC ratio=4.6), fluoranthene (ER-M/ESG ratio=0.6), and phenanthrene (ER-M/ESG ratio=1.6). Although it was possible to calculate a ratio for dieldrin (ER-M/ESG ratio=25), it was not considered because the ratio was greater than 5 times the highest of the other three ratios. This condition serves the purpose of confirming the severity of contamination for any one contaminant above background concentrations, and therefore demonstrating the potential for impairing that segment.

[7] An ER-M quotient is calculated as the ambient sample concentration over the ER-M (toxicity weighted average).

8 Long et al.,(2000) showed that there is a much higher probability (>48%) that samples would be toxic in which six or more ERM values are exceeded or in which mean ERM quotients exceed 0.5.

The mere exceedence(s) of a sediment threshold, however, does not in itself establish an adverse effect from toxicity, but helps to identify the chemical that might be responsible for any observed adverse effects from toxicity. Given these limitations, MDE does not believe that the exceedence(s) of sediment thresholds are appropriate as sole indicators of use attainment. Instead, we recommend using all three data components as a basis for interpreting narrative criteria and developing pollutant reduction strategies.

C.2.3.3.3 Biological Benthic Assessment Data

In freshwater, MDE currently uses biological community data independently in making an impairment determination. The methodology dealing with biological assessments is addressed elsewhere under the biocriteria framework. This type of data is generally considered a good water quality indicator, because it measures a community (population) response to water quality and integrates through time and cumulative impacts. Thus, if this assessment data or other types of assessment data (e.g. Chesapeake Bay restoration goals) do not indicate an alteration (or degradation) of the biological benthic community, the water body is not considered for an impairment determination, despite data from the other components because:

1. It is supportive of aquatic life (at a community level), and thus meets its designated use,
2. The biological assessment component is a more rigorous method of assessing water quality than chemical and bioassay data which may be highly dependent on uncontrollable variables
3. It measures a community response to water quality rather than subjective endpoints from the other components (e.g. ER-M, significant level of toxicity, toxicity to one species)
4. It is consistent with the biological assessments method developed elsewhere

It is more likely to observe an alteration of the biological community where none should be present (false positive) than not to observe alteration of the biological community where one should present (false negative). Anderson et al., 2001 found that laboratory toxicity tests were indicative of benthic impacts in Los Angeles and Long Beach Harbor stations in California. Single and multivariate correlations showed significant positive relationships between amphipod survival in laboratory toxicity tests and measured benthic community structure in field samples. For this reason, MDE would further investigate the chemistry and toxicity data where an alteration of the biological community has been observed. These data would be used to confirm that the community effect is due to exposure to contaminants and to identify the probable contaminant of concern. However, although biological assessment data alone could indicate an impairment, it would not necessarily result in a “toxics” impairment determination. This is because non-contaminant effects (e.g., competition, predation, sediment type, salinity, temperature, recent dredging) may confound interpretation of this data with respect to chemical contamination by toxics (Anderson et al., 2001).

C.2.3.3.4 Weight-of-Evidence Approach (Sediment Quality Triad)

A comprehensive approach using multiple assessment methods helps eliminate false conclusions brought about by relying solely on one method of evaluation. Consequently, MDE would assess sediment quality, and thus an impairment determination, using a weight-of-evidence approach (Winger, et al., 2001). Biological assessments could be used to supplement findings of impaired waters, or as a prioritization tool to determine where additional testing should be performed. These components provide complementary data to each other, which when combined may provide an efficient tool in determining an impairment. However, each component has its limitations, which necessitates a sound scientific interpretation of the data and best professional judgment on a case-by-case basis. Consequently, the individual use of these data components as sole indicators of use attainment is inappropriate. Instead, we recommend using all three data components as a basis for interpreting narrative criteria and developing pollutant reduction strategies.

Sediment chemistry data provide information on contamination, and when used with sediment thresholds or other indicators, also provide insight into potential biological effects. However, they provide little insight on the bioavailability of the contaminant unless data on other mitigating factors (e.g. AVS for metals, organic carbon for organic contaminants) are collected simultaneously. Sediment bioassays are an important component of sediment assessment because they provide direct evidence of sediment toxicity. However, they do not identify the causative pollutant. Additionally, the laboratory conditions under which bioassays are conducted may not accurately reflect field conditions of exposure to toxic chemicals. *In situ* biological studies (such as benthic community composition analyses) are useful because they account for field conditions. However, interpretation with respect to chemical contamination may be confounded by non-contaminant effects. Because each component alone has limitations, the Triad approach uses all three sets of measurements to assess sediment contamination. Table 8. lists possible conclusions that can be drawn from various sets of test results, followed by possible listing decisions.

Table 8: Possible Conclusions Provided by Using the Sediment Quality Triad Approach (Chapman, 1992).

Scenario	**Toxicity**	**Chemistry**	**Community Alteration**	Possible Conclusions	**Listing Decision**
1	+	+	+	Strong evidence for chemical contaminant-induced degradation.	**List (Part 5)**
2	-	-	-	Strong evidence for absence of chemical contaminant-induced degradation.	**Do not list for toxics**
3	-	+	-	Chemical contaminants are not bioavailable.	**Do not list for toxics**
4	+	-	-	Unmeasured chemical contaminants or conditions may exist that have the potential to cause degradation.	**Do not list for toxics Additional monitoring**
5	-	-	+	Alteration is probably not due to chemical contaminants.	**Do not list for toxics**
6	+	+	-	Chemical contaminants are likely stressing the system.	**<u>List (Part 3)</u> Additional monitoring**
7	+	-	+	Unmeasured chemical contaminants are causing degradation.	**List (Part 3) Additional monitoring**
8	-	+	+	Chemical contaminants are not bioavailable or alteration is not due to contaminants.	**Do not list for toxics Additional monitoring**

"+" Indicates measured difference between test and control or reference conditions.
"–" Indicates no measurable difference between test and control or reference conditions.

As indicated in Table 8, there may be scenarios where sediment chemistry data, sediment bioassays, and benthic community analyses produce conflicting results. In these scenarios, the interpretation becomes more complex, but it does not necessarily indicate that any of the data sets are “wrong”, although this possibility should not be ruled out without sound evidence.

Scenario #1: This decision is due to the overwhelming evidence of impairment from all three data components.

Scenario #2: This decision is based on the overwhelming lack of evidence from all three data components.

Scenario #3: Without evidence of toxicity or a degraded biological community, the most likely conclusion is that the chemical contaminants, although elevated, are not bioavailable. If the biological community data shows no adverse effect, the water quality is deemed to be supportive of aquatic life and its designated use is fully supported.

Scenario #4: The basis for this decision is due to the biological community response, and is supported by sediment chemistry. The clear results from the healthy biological community and the lack of chemical concentrations consistent with toxic impacts suggests that the toxicity test results may be anomalous, due to artifacts and not to chemical contaminants. It is possible that there are unmeasured contaminants, but the impact is not sufficient to impair the designated use, as demonstrated by the biological community. However, if the magnitude of the effect observed in the bioassays were severe (e.g. <50 percent survival), the Department may re-evaluate its listing decision. Nevertheless, additional monitoring would be required to confirm the findings of the Triad, and to determine if further actions are required.

Scenario #5: Without evidence of toxicity or elevated chemical concentrations, the most likely conclusion is that the degraded biological community is not due to chemical contaminants. This scenario, however, will be captured by other decision rules.

Scenario #6: Where a good tool exists for evaluating the biological community, it is usually a good indicator of water quality in general and is very sensitive because it integrates impacts from different stressors as well as impacts through time. Practical experience has shown that where “IBI”-type indicators are considered, they indicated impairments not supported by the other data components (i.e., toxicity and chemistry). Therefore, where biological community data of this type exist showing non-degraded biological communities, it will be considered as sufficient evidence of a supported designated use, despite the implications of toxicity and chemistry.

However, where no such data exists or where those indicators are not applicable, the Department will apply its best professional judgment, but will likely determine that the designated use is not supported.

Scenario #7: The basis for this decision is the adverse response observed from the toxicity and biological community data. In this scenario, the water quality is not supportive of aquatic life and is likely due to a chemical contaminant(s) with no applicable chemical threshold or some unmeasured chemical contaminant. This scenario would require listing on Part 3 of the new 303(d) list. Additional monitoring would be required to determine the impairing substance(s).

Scenario #8: The basis of this decision is the absence of effect in the bioassays. Although the biological community show adverse effects, the lack of toxicity in the tests are indicative that the adverse effect is not due to chemical contaminants, or that they are not bioavailable. If chemical contaminants were truly affecting the designated use, the impacts of those contaminants should have been observed in the bioassay. These bioassays control for confounding factors such as low D.O., or habitat impacts. This scenario, however, will be captured by other decision rules.

The scientific community has indicated that in order to obtain a reliable and consistent assessment, data from all three components (i.e., toxicity, chemistry, and biological community) are required (Chapman 1992, Ingersoll et al. 1997, Long et al. 1998, Long et al. 2000 and Anderson et al. 2001). However, if data are not available for all three components, the Department will use its discretion but will consider an impairment determination if;

a) the magnitude of any single indicator is overwhelmingly suggesting an impairment determination,
b) a toxicity test shows toxicity and is confirmed either by chemistry data or a degraded biological community, its designated use is not likely supported and an impairment determination will likely be concluded.
c) All other cases are considered to present insufficient evidence of impairment and will be prioritized for additional monitoring as resources become available.

Under the Triad approach, MDE would evaluate appropriate lethal and sublethal sediment bioassays. A finding of toxicity may trigger a sediment chemistry analysis, if one has not already been performed. Sediment chemistry data would be used to support an impairment determination. The chemical analysis should be performed on samples originating from the same composited homogenate used for the bioassays, so that paired data can be obtained (Chapman, 1992). The chemistry data can be compared to sediment thresholds to help determine which chemicals may be causing toxicity. If no sediment thresholds are exceeded, sediment Toxicity Identification Evaluation (TIE) should be performed to determine a chemical cause if possible.

Chemistry data themselves are useful in determining sediment contamination trends, and may also help identify areas that may have the potential for adverse impacts. MDE uses sediment chemistry data, as an effective prioritization tool to help determine which sediments should be targeted for additional monitoring. That is, other factors being equal, sediments with chemical concentrations exceeding sediment thresholds would have higher priority for further testing compared with sediments that meet the sediment thresholds. Chemical concentrations exceeding these thresholds could also indicate the need to monitor and assess water column concentrations for those chemicals. Sediment chemistry alone should not, however, be used to make an impairment determination.

C.2.3.4 Fish Tissue

Section 101(a)(2) of the Clean Water Act established as a national goal the attainment of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water." This is commonly referred to as the "fishable/swimmable" goal of the Act. Additionally, Section 303(c)(2)(A) requires water quality standards to protect the public health and welfare, enhance the quality of water, and serve the purposes of the Act. Environmental Protection Agency (EPA), along with Maryland Department of the Environment (MDE), interprets these regulations to mean that not only should waters of the State support thriving and diverse fish and shellfish populations, but they should also support fish and shellfish which, when caught, are safe to consume by humans.

Some of the contaminants found in Maryland waters (mainly mercury and PCBs) tend to bioaccumulate to elevated levels in the tissues of gamefish (e.g. largemouth bass) and bottom-feeders (e.g. catfish). When tissue levels of a specific contaminant are elevated to increase the risk of chronic health effects, the State has the responsibility to issue a fish consumption advisory. *Fish consumption advisories* are designed to protect the general as well as sensitive populations (i.e., young children; women who are or may become pregnant). In addition to such advisories, which stop at 4 meals per month, the Department provides *fish consumption recommendations*, which stop at 8 meals per month. These additional recommendations are issued in order to protect the frequent fish consumers.

It has been accepted that when a fish consumption advisory (not a recommendation) is issued for a waterbody, the designated use of that waterbody is not being supported. This usually results in listing a waterbody as impaired for the specific contaminant. To determine if a waterbody is impaired, a sample weighted mean of the contaminant level in the edible portion of the common recreational fish species is compared to the established threshold/criterion. If the threshold/criterion is exceeded, the waterbody's designated use is not met, and the waterbody is listed as impaired. For the contaminants that do not have an existing criterion (e.g. PCBs), MDE has defined "fishable" as the ability to consume AT LEAST 4 meals per month of common recreational fish species by a 70 kg individual. In such cases, the fish tissue concentration threshold used for impairment listing is the concentration that results in 4 meals per month advisory (see Contaminant Thresholds Section).

C.2.3.4.1 Data Requirements

Data requirements for listing a waterbody as impaired are similar to the data requirements for issuing a fish consumption advisory. These include:

1. All available data (measured in the edible portion of fish and shellfish) should be used when making impairment decisions.
2. The data needs to be collected from the specific waterbody in question.
3. The size of the fish sampled should be within the legal slot limit. If no slot limit exists for a specific species, best professional judgment for a minimum size of a given species will be applied.
4. Minimum data requirement: 5 fish (individual or composite of the same resident species) for a given waterbody. At times, in order to protect more sensitive populations MDE might issue an advisory that is based on an incomplete dataset (less than 5 fish of the same species), existence of such an advisory does not automatically result in an impairment listing. In other words, the minimum data requirement needs to be met in order to list a waterbody as impaired.

5. Species used to determine impairment should be representative of the waterbody. Migratory and transient species may be used if they are the dominant recreational species, but should only be used in conjunction with resident species, especially in the case of tidal rivers of the Chesapeake Bay.
6. To ensure that the impairment is temporally relevant, impairments based on the minimum required samples should be re-sampled prior to TMDL development.

C.2.3.4.2 Contaminant Thresholds

The acceptable contaminant thresholds are based on a risk assessment calculation that incorporates numerous risk parameters such as contaminant concentration, reference dose/cancer slope factor, exposure duration, lifetime span, and for some contaminants, cooking loss.

Table 9: The concentration thresholds/criterion for the contaminants of concern are currently.

Contaminant	Threshold/Criterion	Bases	Group
Mercury[9]	300 ppb (ng/g – wet weight)[10]	EPA/MDE Fish Tissue Human Health Consumption Criteria	-
PCBs	39 ppb (ng/g – wet weight)	4 meals/month concentration level	70 kg Individual

Over time, advances in science may require changes in risk assessment parameters that may increase or decrease the currently used contaminant thresholds, and consequently the levels at which impairment decisions are made. When this happens, waterbodies that were listed as impaired may no longer be considered impaired, or new waterbodies may need to be listed.

[9] Per EPA recommendation, total mercury concentrations, as opposed to methylmercury, will be used in MDE fish consumption risk-calculation. This approach is deemed to be most protective of human health and most cost-effective.

[10] Currently MDE is in the process of proposing changes to the methylmercury fish tissue criterion through the Triennial Review process. The criterion is expected to be lowered to 235 ppb to create greater consistency in the methods used by the Department to: (1) determine impairments, (2) establish TMDL targets, and (3) issue fish consumption advisories. This change is not expected to increase the number of listings, as most Maryland mercury fish tissue impairments have been identified in the past with the use of this value.

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Table 10: Table of Sediment Screening Values.

Contaminant	*Sediment Screening Values (ppb)*		
	EPA SQCs	**NOAA ERMs**	**MDE SQBs**
α-BHC			4,357
Acenaphthylene		640	
Acenaphthene	2,300	500	
Anthracene		1,100	
Arsenic		70,000	
β-BHC			9,406
Benz(a)anthracene		1,600	
Benzo(a)pyrene		1,600	
Cadmium		9,600	
Chlordane		6	51
Chlorpyrifos			4,214
Chromium		370,000	
Chrysene		2,800	
Copper		270,000	
DDT Sum		46	
Dibenz(a,h)anthracene		260	
Dieldrin	200	8	3,616
Endrin	7.6		7,368
Fluoranthene	3,000	5,100	
Fluorene		540	
Heptachlor			1,433
Heptachlor epoxide			1,433
Hexachlorobenzene			6,114,892
Lead		218,000	
Mercury		710	
Methyl naphthalene, 2-		670	
Naphthalene		2,100	
Nickel		51,600	
p,p-DDD (TDE)		20	
p,p-DDE		27	
p,p-DDT		7	
PAHs (High MW)		9,600	
PAHs (Low MW)		3,160	
PAHs (Total)		44,792	
PCB (Polychlorinated Biphenyl)		180	
Phenanthrene	2,400	1,500	
Pyrene		2,600	
Silver		3,700	
Zinc		410,000	

C.2.4 Combined and Sanitary Sewer Overflows

Bacteria released during single or rare combined sewer overflows, sanitary sewer overflows or other releases will dissipate naturally after several weeks. However, repeated sewage releases of significant size may result in violations of the water quality standards, particularly if the volumes are large or frequent and the water bodies are small, slow-moving or poorly flushed. Under such spill conditions, violations are presumed to have occurred even in the absence of actual monitoring data. If a TMDL is scheduled to be developed for a water body that has previously been identified as impaired, additional data relative to spill events will be collected. Notwithstanding such documented spill events, if the water quality is consistent with the bacterial standard at that time, a Water Quality Analysis demonstrating the lack of such an impairment will be completed (rather than a TMDL) and the water body will become eligible for de-listing. However, if data indicate that water quality standards are not being met, a TMDL will be completed. Table 11 and Table 12 give an inventory of combined sewer overflows and sanitary sewer overflows respectively.

C.2.4.1 Methodology

Based on data in MDE's spill databases, if any water body segment has received more than two spills greater than 30,000 gallons over a 12-month period, that water body will be considered impaired and therefore listed as requiring a TMDL. This listing methodology will be applied only in the absence of bacterial monitoring data; if such monitoring data are available, the decision methodology for bacteria will apply.

Table 11: Summary of combined sewer overflows that occurred 3 or more times over the past 5 years.

Receiving Waters	NPDES Permit	# Exceedences (≥30,000 gallons) from 2003 thru 2007	City/County
Evitts Creek	MD0021598	11	City of Cumberland/Allegany County
North Branch Potomac River	MD0021598	304	City of Cumberland/Allegany County
Wills Creek	MD0021598	130	City of Cumberland/Allegany County
Gwynns Falls	MD0021601	21	Baltimore City
Choptank River	MD0021636	269	City of Cambridge/Dorchester
Braddock Run	MD0067547	178	La Vale/Allegany
George’s Creek	MD0067384	33	Westernport/Allegany
George’s Creek	MD0067407	192	Dept. Public Works/Allegany
George’s Creek	MD0067423	55	Frostburg/Allegany
Jenning’s Run	MD0067423	31	Frostburg/Allegany

Table 12: Summary of sanitary sewer overflows that occurred 3 or more times over the past 5 years.

Receiving Waters	Owner of Collection System	# Exceedences (≥30,000 gallons) from 2003 thru 2007	City/County
Anacostia River	Washington Suburban Sanitation Commission	3	Prince George’s County
Antietam Creek	City of Hagerstown WWTP	10	City of Hagerstown/Washington County
Broad Creek	Washington Suburban Sanitation Commission	10	Prince George’s County
Chesapeake Bay	Calvert County DPW	5	Calvert County
Chesapeake Bay	Town of North Beach DPW	4	Town of North Beach/Calvert County

Receiving Waters	Owner of Collection System	# Exceedences (≥30,000 gallons) from 2003 thru 2007	City/County
Conococheague Creek	Conococheague WWTP	3	Washington County
Dorsey Run	Maryland Environmental Service	3	Anne Arundel
Evitts Creek	Allegany County	11	City of Cumberland/Allegany County
Falls Creek	Washington County	4	Washington County
Flat Run	City of Emmitsburg WWTP	19	City of Emmitsburg/Frederick County
George's Creek	Allegany County	46	Allegany County
Gwynns Falls	Baltimore City	71	Baltimore City
Hamilton Run	Washington County	5	Washington County
Herring Run	Baltimore City	30	Baltimore City
Hunting Creek	Thurmont WWTP	4	Town of Thurmont/Frederick County
Jennings Run	Allegany County	39	Allegany County
Jones Falls	Baltimore City	16	Baltimore City
Little Youghiogheny	Garrett County	8	Garrett County
Maiden Choice Creek	Baltimore County	28	Baltimore County
Mattawoman Creek	Charles County	3	Charles County
Mill Creek	Town of Perryville (WWTP)	5	Town of Perryville/Cecil County
Moores Run	Baltimore County	5	Baltimore City
North Branch Potomac River	Allegany County (Cresaptown Pumping Station)	96	Allegany County
Northeast Creek	Baltimore County	16	Baltimore County
Patapsco River	Baltimore County	3	Baltimore County

Receiving Waters	Owner of Collection System	# Exceedences (≥30,000 gallons) from 2003 thru 2007	City/County
Pea Vine Run	Allegany County (Mill Run Pump Station)	42	City of Cumberland/Allegany County
Piscataway Creek	Washington Suburban Sanitation Commission	3	Prince George' County
Pocomoke River	Worcester County	3	Worcester County
Port Tobacco River	Town of La Plata	5	Town of La Plata/Charles County
Rock Creek	City of Frederick	7	City of Frederick/Frederick County
Swan Creek	City of Aberdeen	20	City of Aberdeen/Harford County
West Branch	Baltimore County	11	Baltimore County
Western Branch	Washington Suburban Sanitation Commission	3	Prince George's County
Wills Creek	Allegany County	51	Allegany County

C.2.5 Chesapeake Bay assessments

Maryland continues to work with EPA's Chesapeake Bay Program and Region 3, as well as other Bay partners (particularly Virginia) to refine the Chesapeake Bay assessments. Although water quality criteria have been established for the Bay (specifically for water clarity and dissolved oxygen), there are still some criteria (7-day mean, 1-day mean and the instantaneous minimum for dissolved oxygen) that are not being assessed due to the lack of sufficient data for decision-making or because of a lack of consensus on how best to interpret the available data. For other parameters, such as chlorophyll a, the State has not yet adopted numeric criteria. Due to the volume of technical material regarding Chesapeake Bay assessments, these methodologies are not included here. However, Maryland feels it necessary to provide a brief explanation of the reference curves utilized for Water quality assessments. The following passage, provided by Richard Batiuk of EPA, describes, in general terms, how the reference curves were derived and what rules were followed when using them for assessment.

C.2.5.1 Guide to Chesapeake Bay Water Quality Criteria Reference Curves

C.2.5.1.1 Background

As published in the original 2003 Chesapeake Bay water quality criteria document (U.S. EPA 2003), EPA and the watershed jurisdictional partners agreed that it is possible that some spatial and temporal criteria exceedances could be observed, without necessarily having significant effects on ecological health or on the designated use of a portion of the Chesapeake Bay. Such exceedances are referred to as 'allowable exceedances.' Such exceedances have been provided for in EPA national guidance for assessing criteria attainment (U.S. EPA 1997). Ten percent of the samples collected at a point are allowed to reflect nonattainment of water quality criteria without indicating nonattainment of designated uses. These criteria exceedances are considered 'allowable exceedances' that had limited impact on the designated use. The 10-percent rule is not directly applicable in the context of the CFD methodology for defining criteria attainment because it was designed for samples collected at one location and, therefore, is only reflective of time, not space (either surface area or volume).

A more appropriate approach for defining 'allowable exceedances' in the CFD context is to develop a reference curve (described below) that identifies the amount of spatial and temporal criteria exceedance that can occur without causing significant ecological degradation. Such curves can be based on biological indicators of ecological health that are separate from the criteria measures themselves. Biological indicators can be used to identify areas of the Chesapeake Bay and its tidal tributaries that have healthy ecological conditions and supportive water quality conditions. CFDs can be developed for those areas as well. Since healthy ecological conditions exist in the selected areas, CFDs developed for the area would reflect an extent and pattern of criteria exceedance that did not have significant ecological impact. Thus, the reference curve approach takes the development of criteria levels beyond those developed in a laboratory setting and provides actual environmental context. Small incidents of spatial and temporal criteria exceedance that do not have ecological impacts are identified and allowed in the assessment of criteria attainment.

Detailed descriptions of the development and application of the reference curves are provided in the sections "Defining the Reference Curve" on pages 168-178 and "Plot of Spatial Exceedance vs. the Cumulative Frequency" on pages 161-165 and in the 2003 Bay criteria document (U.S. EPA 2003). Further refinements and improvements to both the development of the reference curves as well as their application in determining criteria attainment were developed by the partners and published by EPA in the 2007 addendum to the original 2003 Bay criteria document (U.S. EPA 2007).

C.2.5.1.2 Dissolved Oxygen Criteria Biological Reference Curves

The open-water and deep-water dissolved oxygen criteria biological reference curves were derived by identifying summer-time records of dissolved oxygen data for specific Chesapeake Bay Program segments supporting healthy benthic infaunal populations as derived by application of the partners' index of biotic integrity. As described in detail on pages 39-42 in U.S. EPA 2007, the identified dissolved oxygen data, divided out by the applicable designated use, were used to derive the published biological reference curves.

For attainment assessment of the open-water dissolved oxygen criteria during non-summer months, a default reference curve has been published by EPA given the lack of a biological index applicable during these non-summer seasons (see page 42 in U.S. EPA 2007).

C.2.5.1.3 Water Clarity Criteria Biological Reference Curves

For the water clarity criteria, biological reference curves were derived using water clarity data from Chesapeake Bay Program segments characterized as having historically abundant underwater bay grasses (SAV) and thriving or increasing in coverage as described on page 173-176 and Appendix H in the 2003 Bay criteria document (U.S. EPA 2003). Separate biological reference curves were published for low salinity (tidal fresh-oligohaline) and high salinity (mesohaline-polyhaline) habitats.

C.2.5.1.4 Rationale for Zero Exceedances Beyond Allowable Exceedances

The 2007 Bay criteria addendum document contained the following text on page 90:
"Across all Bay criteria, non-attainment is defined as any percentage of non-attainment (even less than 1 percent) given that the CFD-based criteria attainment assessment method already factors in the small percentage of circumstances (in time and space) in which the criteria may be exceeded and still fully protect the tidal-water designated use."

The application of the above described reference curves as an integral component of the assessment of criteria attainment has already built-in the accounting for the allowable exceedances. In combination with EPA's recommendation that the reference curve be evaluated only at the temporal axis points in the assessment curve (see pages 15-16 in U.S. EPA 2007), any measured percentage of non-allowable exceedances of the criteria should be considered as non-attainment of the criteria.

Those interested in the more detailed technical aspects of this discussion can refer to the Bay Program's Web site at http://www.chesapeakebay.net/baycriteria.htm**.**

In summation, full implementation of all Bay standards is not complete and future listing changes may occur due to revised methodologies and not necessarily as a result of changes in water quality conditions. However, much of the Bay and its tributaries have previously been listed as impaired for either sediments and/or nutrients and will remain listed (now for total suspended solids, total nitrogen, and/or total phosphorus) until all criteria can be assessed and shown to meet standards.

C.2.6 Guidelines for Interpreting Dissolved Oxygen and Chlorophyll *a* Criteria in Maryland's Seasonally Stratified Water-Supply Reservoirs

C.2.6.1 Dissolved Oxygen

C.2.6.1.1 Introduction

Maryland's non-tidal water quality standards provide for a minimum dissolved oxygen (DO) criterion of 5.0 mg/l for all waters at all times (COMAR 26.08.02.03-3A(2)), except as resulting from natural conditions (COMAR 26.08.02.03A(2)). Bottom waters in thermally stratified lakes may naturally become depleted of DO during periods of stratification (Wetzel 2001).

New standards approved for the State's tidal waters, including the Chesapeake Bay, recognize the significance of thermal/salinity stratification, and the physical and natural impact thereof on deeper waters. The new standards for estuarine waters recognize three layers: (1) open water (surface); (2) deep water (below the upper pycnocline); and (3) deep channel (bottom waters).

All of Maryland's water-supply reservoirs undergo periods of seasonal thermal stratification similar to that in Chesapeake Bay. In the absence of a standard specifically addressing stratified lakes, MDE (1999) developed an interim interpretation of the existing standard, utilizing the percentage of oxygen saturation in the hypolimnion as a metric. This document updates that interim interpretation, providing a framework for additional technical analyses with respect to hypolimnetic DO in thermally stratified lakes.

C.2.6.1.1 Background

In idealized cases, lakes stratify into three distinct layers—the epilimnion, metalimnion and hypolimnion. The epilimnion is the well-mixed surface layer of relatively warm water. The metalimnion, the middle layer, is a zone of a distinct downward temperature gradient. The hypolimnion is the bottom layer of relatively cold and undisturbed water. Various analytical methods, typically involving measurement of temperature change over depth, exist to identify and define these layers (Wetzel 2001).

Thermal stratification is a seasonal phenomenon resulting from the lower density of warm surface waters, beginning in late spring or early summer, intensifying as summer progresses, decreasing in early fall, and finally ending with the fall turnover, as the lake becomes thermally uniform with depth. Therefore, data from May or June will generally show less stratification and higher hypolimnetic DO levels than data from August and September.

Often, stratified lakes do not exhibit this idealized separation into three distinct layers, but may still exhibit clear temperature gradients from surface to bottom. This phenomenon may be particularly true in the case of artificial impoundments, given the variability in basin and watershed morphometry and geometry. The formulaic determination of the exact point at which one layer grades into another may thus be difficult or impossible, and in such cases, managers may need to explore alternative methodologies or resort to professional judgment.

Various factors affect the 'natural' degree of oxygen depletion in a lake or impoundment. These include the degree or 'strength' of stratification; the morphometry of the water body itself (*i.e.*, the depth and geometry of the basin); and watershed characteristics, such as watershed size, land cover, and naturally occurring allochthonous loads of organic material.

Chapra (1997) describes hypolimnetic DO saturation as a function of lake trophic status[11]. This relationship, upon which Maryland based its interim interpretation, is summarized in Table 13 below.

[11] When conducting analyses specifically to assess lake trophic status, Maryland generally uses other, more reliable, metrics (e.g., chlorophyll *a* concentration).

Table 13: Relationship between Lake Trophic Status and Dissolved Oxygen Saturation in the Hypolimnion of a Thermally Stratified Lake.

Trophic Status	Hypolimnetic Dissolved Oxygen Saturation
Eutrophic	0% - 10%
Mesotrophic	10% - 80%
Oligotrophic	80% - 100%

Adapted from Chapra (1997)

Maryland has no natural lakes; all are artificial impoundments—typically either larger, water-supply reservoirs, or smaller, recreational-use lakes. [In this document, the terms "lake" and "impoundment" are used interchangeably.] In impoundments, the factors outlined above (especially basin morphometry and watershed size) differ inherently from those in natural lakes. Natural lakes are typically deepest in the center with a gradual increase in depth to that point, while impoundments are usually deepest at the downstream extent—the point of impoundment—and exhibit an abrupt increase in depth at that point. Watershed size is also often proportionately greater in the case of impoundments, resulting in a correspondingly larger 'natural' load of watershed-derived materials (Wetzel 2001). For these reasons, Chapra's saturation-based method may not apply well to impoundments.

C.2.6.1.2 Dissolved Oxygen Guidance for Thermally Stratified Lakes in Maryland

MDE is adopting the following general approach to establish dissolved oxygen guidelines for lakes exhibiting seasonal thermal stratification:

- A minimum dissolved oxygen concentration of 5.0 mg/l will be maintained in the surface layer at all times, including during periods of thermal stratification, except during periods of overturn or other naturally-occurring disruption of stratification.

- A minimum dissolved oxygen concentration of 5.0 mg/l will be maintained throughout the water column during periods of complete and stable mixing.

- Hypolimnetic hypoxia will be addressed on a case-by-case basis. In the event of hypoxia observed in the deeper portions of lakes during stratification, Maryland will conduct an analysis to determine if current loading conditions result in a degree of hypoxia that significantly exceeds (in terms of frequency, magnitude and duration) that associated with natural conditions in the lake and its watershed. This analysis may vary from one lake to another in terms of type, approach and scope. Examples may include a review of setting, source assessment and land use, so as to assess current loads; a comparison of estimated current loads exported from the watershed with analogous load estimates under 'natural' land cover; and model scenario runs simulating natural conditions. This list is not exhaustive, and Maryland expressly reserves the right to determine and conduct the most appropriate type of analysis on a case-by-case basis.

The primary application of this approach is for use in conducting analyses to support development of Total Maximum Daily Loads (TMDLs) and Water Quality Analyses (WQAs), in satisfaction of the State's obligations under Section 303[d] of the federal Clean Water Act (CWA). It is also envisioned that these guidelines, or natural outgrowths thereof, may be used in the context of listing and inventorying water bodies under Sections 303 and 305 of the CWA.

C.2.6.2 Chlorophyll **a**

C.2.6.2.1 Introduction and Background

Maryland's General Water Quality Criteria prohibit pollution of waters of the State by any material in amounts sufficient to create a nuisance or interfere directly or indirectly with designated uses. Maryland's water quality standards presently do not impose a limit on the concentration of nutrients in the water column.[12] Rather, Maryland manages nutrients indirectly by limiting their effects expressed in terms of excess algal growth and low DO. In impoundments, chlorophyll *a* concentrations serve as a useful surrogate for quantifying the effects of excess nutrient loading.

[12] Maryland does limit the ammonia form of nitrogen from wastewater treatment plants, due to its toxic effects on some aquatic organisms.

In establishing chlorophyll *a* guidelines for water-supply reservoirs, Maryland has adopted a two-pronged approach. First, a chlorophyll *a* concentration of 10 µg/l is generally recognized as a boundary between mesotrophic and eutrophic conditions (Carlson, 1977). In water-supply reservoirs, preventing a shift to eutrophic conditions reduces the frequency, duration and magnitude of nuisance conditions—e.g., algal scums (Walker, 1984). Secondly, a mean concentration of chlorophyll a not to exceed 10 µg/l is correlated with an absence of instantaneous values exceeding 30 µg/l (see Figure 11). Exceedences of the 30 µg/l threshold are associated with a shift to cyanobacteria (blue-green algae) assemblages, and associated taste/odor treatment costs. Thus, maintaining chlorophyll a concentrations below these respective values ensures that the drinking water designated use will be supported.

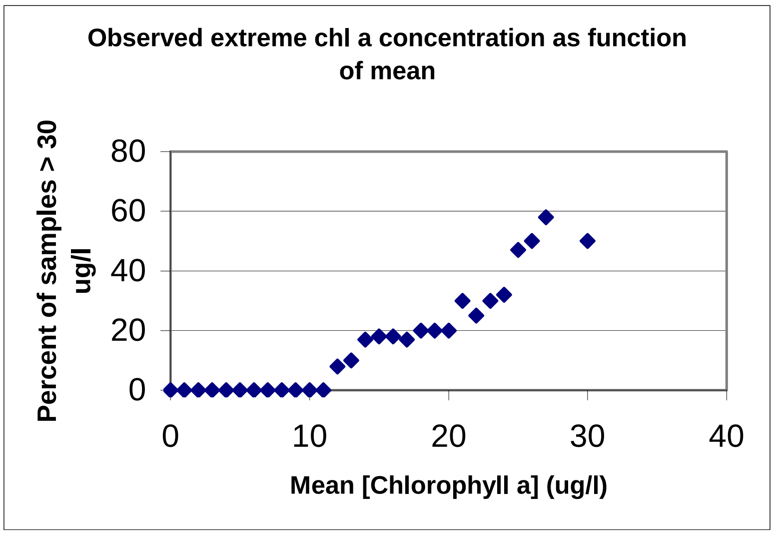

Figure 11: Correlation of instantaneous and growing season mean Chlorophyll *a* concentrations (adapted from Walker, 1984).

C.2.6.2.2. Chlorophyll *a* Guidelines for Water-Supply Reservoirs in Maryland

MDE is adopting the following general approach to establish chlorophyll *a* guidelines for water-supply reservoirs:

- Mean concentrations of chlorophyll *a* in representative surface waters shall be maintained at 10 µg/l or less. This may be as measured over a growing season, as a 30-day moving average, or in any other period appropriate to the impoundment of interest.

- The 90th percentile of chlorophyll *a* in representative surface waters shall be maintained at 30 µg/l or less.

C.2.7 Decision Process for pH and Mine Impacted Waters

All pH impairments are identified based on COMAR §26.08.02.03, which states that: "Normal pH values may not be less than 6.5 or greater than 8.5" in Use I, IP, II, III, IIIP, IV, or IVP waters. It is undesirable to incorrectly identify a water body as impaired when the observed condition is of a natural origin. Factors such as the presence of a peat or black water bog or swamp would be considered as natural conditions, and therefore, not impaired under the CWA §303(d) listing process.

Another natural condition which should not be used to identify a water body as pH impaired is an abundance of algae or aquatic plants that elevate pH levels above 8.5 as a result of photosynthetic-driven chemical reaction, unless the condition is being caused by a defined nutrient enrichment source. Certain conditions in close proximity to limestone springs may also have natural pH values outside of the standards. Streams that do not meet the criterion for pH, and which cannot be demonstrated to have failed as a result of natural conditions, will be listed as impaired.

Streams influenced by abandoned coal or clay mining operations (those that predate the permitting authority or designated as "pre-law") and having a pH below 6.5 would be listed as impaired.

The decision process for evaluating pH in Maryland waters is summarized in the following flowchart shown in Figure 12.

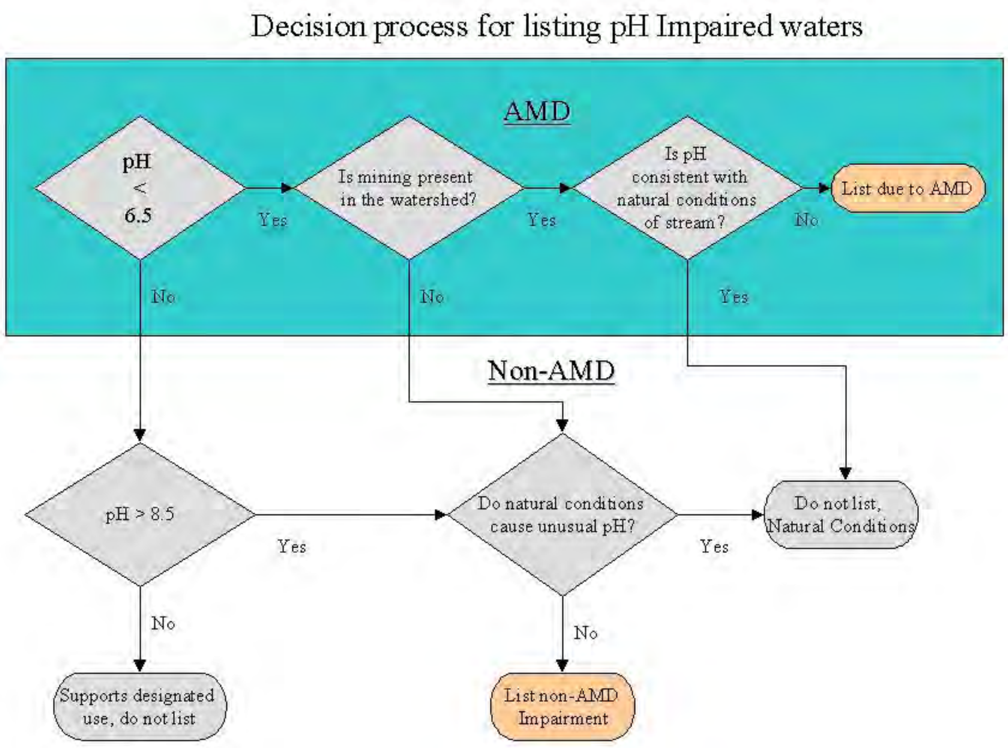

Figure 12: Flow chart of pH decision process.

1. The flow chart applies to Maryland 8-digit watersheds evaluated for the Integrated Report.
2. Ideally, an impairment decision should be based on a sufficient number of samples to adequately characterize potential diurnal and seasonal variations.
3. If 10 percent or more of the samples violate the pH numeric criteria and cannot be traced to naturally occurring conditions, the 8-digit stream watershed will be considered to not meet the standards for its designated uses and listed as impaired.
4. If less than 10 percent of the samples violate the pH numeric criteria, best professional judgement will be used to determine if the 8-digit watershed should be listed as impaired. In the event the waterbody is not listed, additional samples will be collected for future consideration.

C.2.8 Non-Tidal Assessment Methodology for Solids

There are numerous impairments for "sediments" in the IR. Many of these were assessed and projected based on land use and the likelihood of such impairments. Unfortunately the term "sediments" does not accurately inform the public as to the nature of the impairment, nor provide helpful guidance to those who need to develop TMDLs to remediate the problem.

In this current list, impairments previously listed for sediments, and new impairments evaluated for this report will be determined and listed as described below.

C.2.8.1 Free-flowing Streams - Water Clarity

Impairing substance: Total Suspended Solids (TSS)
Measure: Turbidity as measured in Nephelometer Turbidity Units (NTUs)
Criterion: Turbidity criteria are addressed in COMAR §26.08.02.03-3(A)(5):

(5) Turbidity
(a) Turbidity may not exceed levels detrimental to aquatic life.
(b) Turbidity in the surface water resulting from any discharge may not exceed 150 units at any time with 50 units as a monthly average. Units shall be measured in Nephelometer Turbidity Units.

C.2.8.2 Free-Flowing Streams - Erosional and Depositional Impacts (limited to 1st through 4th order streams)

Impairing substance: Total Suspended Solids (TSS)
Measure: Biocriteria. The application of biocriteria for assessment decisions for the Integrated Report is addressed elsewhere in this document.
Criterion: Addressed under the narrative criteria:

26.08.02.02(B) Specific designated uses.
(1) Use I: Water Contact Recreation, and Protection of Aquatic Life. This use designation includes waters which are suitable for:
(c) The growth and propagation of fish (other than trout), **other aquatic life**, and wildlife
(4) Use III: Natural Trout Waters. This use designation includes waters which have the potential or are:
(a) Suitable for the growth and propagation of trout; and
(b) Capable of supporting self-sustaining trout populations and **their associated food organisms**.
(5) Use IV: Recreational Trout Waters.
(a) Capable of holding or supporting adult trout for put-and-take fishing; and
(b) Managed as a special fishery by periodic stocking and seasonal catching.

Waters must be protected for these designated uses (26.08.02.02(A)). Key phrases supporting the use of biocriteria to protect against impacts from eroded or deposited sediments are highlighted.

- If Maryland Biological Stream Survey (MBSS) data indicate impairment, the habitat data related to sediments will be assessed.
- If there is no indication of a sediment problem (e.g., embeddedness does not indicate a problem), the listing will be for "degraded aquatic community".
- If there does appear to be a sediment problem, it will be listed for soils or sediment.

C.2.8.3 Impoundments

Maryland has no natural lakes. This decision rule covers reservoirs and other manmade lakes. Estuaries, such as Chesapeake Bay will be covered under new regulations currently being developed and which specifically address water clarity and sediment.

<u>C.2.8.3.1 Water Clarity</u>

Impairing substance: Sedimentation/siltation
Measure: Turbidity as measured in Nephelometer Turbidity Units (NTUs)
Criterion: Turbidity criteria are addressed in COMAR §26.08.02.03-3(A)(5):

(5) Turbidity
(d) Turbidity may not exceed levels detrimental to aquatic life.
(e) Turbidity in the surface water resulting from any discharge may not exceed 150 units at any time with 50 units as a monthly average. Units shall be measured in Nephelometer Turbidity Units.

If turbidity exceeds the indicated levels, chlorophyll shall also be measured. If chlorophyll is high, the impairment will be attributed to nutrient enrichment (eutrophication), rather than solids. Exceptions may be made and professional judgment applied in areas where soil and local geologic conditions would normally have high sediment runoff.

C.3 Assessment Results

There are a total of 48 new listings for this cycle. Eighteen of the listings are a result of the new lower PCB (39 parts per billion) limit adopted for human health protection. Twelve listings are the result of Chesapeake Bay segments that were never listed for sediment impairment but have now been assessed as not meeting the shallow water submerged aquatic vegetation use. Eight listings (7 metals and 1 pH) are associated with an acid mine drainage impairment in the Upper North Branch Potomac River and George's Creek. Also, there are 4 fecal coliform listings in non-beach areas, 2 Bay segment listings as a result of bioassessments, 2 new listings for the Nanticoke River open water designated use, 1 new listing in Baltimore Harbor for trash, and 1 new non-tidal biological listing in the Port Tobacco River. Table 14 below provides detailed information regarding these new listings.

Table 14: New Impairment (category 4b and 5 only) listings for 2008.

AU_ID	Basin_Name	Listing Scale	Designated_Use	Cause
MD-02120204-Conowingo_Pool	Conowingo Dam Susquehanna River	Impoundments	Fishing	PCB in Fish Tissue
MD-02130805	Loch Raven Reservoir	River Mainstem	Water Contact Sports	Fecal coliform
MD-02130906	Patapsco River Lower North Branch	River Mainstem	Water Contact Sports	Fecal coliform
MD-02130906	Patapsco River Lower North Branch	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02131104	Patuxent River Upper	River Mainstem	Water Contact Sports	Fecal Coliform
MD-02140109	Port Tobacco River	1st thru 4th order streams	Aquatic Life and Wildlife	Combination Benthic/Fishes Bioassessment
MD-02140202	Potomac River Montgomery County	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02140304	Double Pipe Creek	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02140501	Potomac River Washington County	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02140502	Antietam Creek	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02140504	Conococheague Creek	Non-tidal 8-digit watershed	Fishing	PCB in Fish Tissue
MD-02141004_MAINSTEM	George's Creek	Non-tidal Segment(s)	Aquatic Life and Wildlife	pH
MD-02141005-JENNINGS_RANDOLF_RESEVOIR	Upper North Branch	Impoundments	Fishing	PCB in Fish Tissue

AU_ID	Basin_Name	Listing Scale	Designated_Use	Cause
	Potomac River			
MD-021410050039	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Iron
MD-021410050039	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Manganese
MD-021410050040	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Manganese
MD-021410050048	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Aluminum
MD-021410050048	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Iron
MD-021410050048	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Manganese
MD-021410050049	Upper North Branch Potomac River	Subwatershed	Aquatic Life and Wildlife	Manganese
MD-05020201-CHERRY_CREEK	Youghiogheny River	Non-tidal Segment(s)	Water Contact Sports	Fecal Coliform
MD-BACOH	BACOH - Back River Oligohaline	Chesapeake Bay segment	Fishing	PCB in Fish Tissue
MD-BIGMH	BIGMH - Big Annemessex River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-CB1TF	CB1TF - Northern Chesapeake Bay Tidal Fresh	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-CB3MH	CB3MH - Upper Chesapeake Bay Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-CB5MH	CB5MH - Lower Chesapeake Bay Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-CHOMH2-02130403	CHOMH2 - Choptank River Mesohaline	Chesapeake Bay segment	Fishing	PCB in Fish Tissue

AU_ID	Basin_Name	Listing Scale	Designated_Use	Cause
	mouth 2			
MD-CHOOH	CHOOH - Choptank River Oligohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-CHOOH-02130404	CHOOH - Choptank River Oligohaline	Tidal subsegment	Fishing	PCB in Fish Tissue
MD-CHSMH	CHSMH - Lower Chester River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-EASMH	EASMH - Eastern Bay Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-ELKOH	ELKOH - Elk River Oligohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-GUNOH-02130803	GUNOH - Gunpowder River Oligohaline	Tidal subsegment	Fishing	PCB in Fish Tissue
MD-LCHMH	LCHMH - Little Choptank River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-NANMH	NANMH - Lower Nanticoke River Mesohaline	Chesapeake Bay segment	Fishing	PCB in Fish Tissue
MD-NANMH	NANMH - Lower Nanticoke River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-NANOH	NANOH - Upper Nanticoke River Oligohaline	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Nitrogen (Total)
MD-NANOH	NANOH - Upper Nanticoke River Oligohaline	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Phosphorus (Total)
MD-PATMH	PATMH -	Tidal	Aquatic Life and	Debris/Floatables/Trash

AU_ID	Basin_Name	Listing Scale	Designated_Use	Cause
	Patapsco River Mesohaline	subsegment	Wildlife	
MD-PAXMH-OH-02131101	Lower Patuxent River	Chesapeake Bay segment	Fishing	PCB in Fish Tissue
MD-PAXOH	PAXOH - Middle Patuxent River Oligohaline	Chesapeake Bay segment	Fishing	PCB in Fish Tissue
MD-POCMH	POCMH - Lower Pocomoke River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-POCOH-02130202	POCOH - Middle Pocomoke River Oligohaline	Tidal subsegment	Fishing	PCB in Fish Tissue
MD-POTMH	POTMH - Lower Potomac River Mesohaline	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)
MD-POTMH-02140104	POTMH - Lower Potomac River Mesohaline	Tidal subsegment	Fishing	PCB in Fish Tissue
MD-SEVMH	SEVMH - Severn River Mesohaline	Chesapeake Bay segment	Aquatic Life and Wildlife	Estuarine Bioassessments
MD-SOUMH	SOUMH - South River Mesohaline	Chesapeake Bay segment	Aquatic Life and Wildlife	Estuarine Bioassessments
MD-WICMH- 02130301	WICMH - Wicomico Creek Mesohaline	Tidal subsegment	Fishing	PCB in Fish Tissue

There were a total of 58 delistings during this cycle, primarily on the basis of new assessments/data or water quality analyses (WQAs), Table 15. Water quality analyses are completed when state scientists collect detailed information for a listed water body in anticipation of a TMDL and find that the water body is not impaired. New assessments are simply a reanalysis of more recent water quality data collected by ongoing monitoring and assessment programs. Data for the Jones Falls and Patapsco River Lower North Branch WQAs are presented in Appendices 1 and 2.

Of the delistings that were not based on WQAs or reassessments, eleven delistings occurred because of errors in the original listing. Four of these were shellfish areas (fecal coliform) that were delisted because the area was never suitable for the shellfish harvesting use (too shallow, no access, lack of resource). Two other listings (MD-02140305, MD-02141001) were assessed using an inappropriate listing methodology. The Scott Creek impairment is in the Pennsylvania portion of the watershed and should have never been listed in Maryland. The Zekiah Swamp non-tidal nutrient (total phosphorus and total nitrogen) listing was inappropriately listed for the non-tidal portion of Zekiah Swamp when it should have been for the tidal portion. The Lower Chester River PCB listing was inadvertently based upon Middle Chester River data and has accordingly been delisted. For the MD-EASMH_Little_Greenwood_Creek tidal subsegment, the Department never had any data for this specific tidal creek and this segment was inadvertently listed using data for an adjacent segment. The MD-CHSMH-Bogles_Wharf_Beach segment in the Lower Chester River was moved to Category 3 because it is not a public beach and has no apparent sources of bacteria. Additional data must be collected or a secondary water contact standard developed before this area can be listed.

Table 15: New Delistings for 2008.

Assessment Unit	Basin Name	Listing Scale	Parameter	**Reason for Delisting** 1. Based on new data, State determines water quality standard is being met 2. EPA concurrence of WQA 3. Error in original listing 4. Further monitoring is needed	Notes
MD-POTMH-COMBS_CREEK	MD-POTMH – Potomac River Mesohaline	Tidal Shellfish Area	Fecal coliform	3	Innapropriately assessed for the shellfish harvesting use, met all water contact criteria
MD_POTMH-ST.CLEMENTS_BAY 2	MD-POTMH – Potomac River Mesohaline	Tidal Shellfish Area	Fecal coliform	3	Innapropriately assessed for the shellfish harvesting use, met all water contact criteria
MD-FSBMH-Tedious_Creek	MD-FSBMH – Fishing Bay Mesohaline	Tidal Shellfish Area	Fecal coliform	3	Innapropriately assessed for the shellfish harvesting use, met all water contact criteria
MD-HNGMH-Tar_Bay	MD-HNGMH – Hongo River Mesohaline	Tidal Shellfish Area	Fecal coliform	3	Innapropriately assessed for the shellfish harvesting use, met all water contact criteria

MD-02140305	Catoctin Creek	River Mainstem	Fecal coliform	3	Innappropriate methodology used and lack of adequate data
MD-02141001	Lower North Branch Potomac	River Mainstem	Fecal coliform	3	Innappropriate methodology used and lack of adequate data
MD-EASMH_Little_Greenwood_Creek	MD-EASMH – Eastern Bay Mesohaline	Tidal subsegment	Fecal coliform	3	Never had any monitoring data specifically for this area
MD-021309041032	Jones Falls	Subwatershed	Copper	1	WQA completed 6/22/07, will be submitted with 2008 list.
MD-021309061012	Patapsco River Lower North Branch	Subwatershed	Lead - water column	1	WQA completed 6/22/07, will be submitted with 2008 list.
MD-021309061012	Patapsco River Lower North Branch	Subwatershed	Copper - water column	1	WQA completed 6/22/07, will be submitted with 2008 list.
MD-05020203	Deep Creek Lake	River Mainstem	Fecal coliform	1	above Deep Creek Lake
MD-BOHOH	BOHOH - Bohemia River Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal.
MD-BSHOH	BSHOH - Bush River Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal.
MD-C&DOH	C&DOH - C&D Canal Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal.
MD-CB2OH	CB2OH - Northern Chesapeake Bay Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal. Previous listing for Sediment/TSS in watershed 02130611 has been delisted based on data showing that the water clarity criteria has been met.

MD-CHSOH	CHSOH - Middle Chester River Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets the restoration goal. This listing supersedes the sediment/TSS listings for the portions of the watersheds 02130509, 02130508, 02130505, and 02130510 that are within CHSOH.
MD-CHSOH-ChesterRiver_Yacht_Countryclub_Beach	Southeast Creek	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria
MD-FSBMH	FSBMH – Fishing Bay Mesohaline	Chesapeake Bay Segment	Total Suspended Solids (TSS)	1	The SAV/water clarity goal has been met for this segment. This listing captures the previous Sediment/TSS listing for watershed 02130308.
MD-GUNOH	GUHOH – Gunpowder River Oligohaline	Chesapeake Bay Segment	Total Suspended Solids (TSS)	1	The SAV/water clarity goal has been met for this segment. This listing captures the previous Sediment/TSS listings for watersheds 02130801 and 02130803.
MD-MATTF	MATTF - Mattawoman Creek Tidal Fresh	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal. This listing supercedes the previous Cat. 5 Sediment/TSS listing for watershed 02140111.
MD-NANMH-COVE_ROAD_BEACH	NANMH - Lower Nanticoke River Mesohaline	Public Beach	Fecal Coliform	1	See "ListingReview_old98_listings.doc" information for data for 2008 listing cycle.

MD-NORTF	NORTF - North East River Tidal Fresh	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets the restoration goal. This listing supercedes the previous Sediments/TSS listing for watershed 02130608.
MD-PAXMH-BUZZARD_ISLAND_CREEK	PAXMH - Lower Patuxent River Mesohaline	Tidal Shellfish Area	Fecal Coliform	1	MDE began sampling station 09-01-023 in May 2004.
MD-PAXMH-GOLDEN_BEACH-BOATRAMP	PAXMH - Lower Patuxent River Mesohaline	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria
MD-PAXMH-GOLDEN_BEACH-COMMUNITY	PAXMH - Lower Patuxent River Mesohaline	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria
MD-PAXMH-MILL_CREEK	PAXMH – Lower Patuxent River Mesohaline	Tidal Shellfish Area	Fecal Coliform	3	Mill Creek erroneously listed twice.
MD-PAXOH	PAXOH - Middle Patuxent River Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets the restoration goal. This listing supersedes the previous Sediment/TSS listing for watershed 02131101.
MD-PAXTF	PAXTF - Upper Patuxent River Tidal Fresh	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal. This listing supersedes the previous Sediment/TSS listing for watershed 02131102.
MD-POTMH-ST.CLEMENTSHORES_COMMUNITY_BEACH	POTMH - Lower Potomac River Mesohaline	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria
MD-POTMH-WICOMICOSHORES_LUCKTONPT_BEACH	POTMH - Lower Potomac River Mesohaline	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria

MD-RHDMH	RHDMH – Rhode River Mesohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	The SAV/water clarity goal has been met for this segment. This listing was split from the previous Sediment/TSS listing for watershed 02131004.
MD-SASOH	SASOH - Sassafras River Oligohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	SAV meets restoration goal. This listing supersedes the previous Sediment/TSS listing for watershed 02130610.
MD-SEVMH	SEVMH – Severn River Mesohaline	Chesapeake Bay segment	Total Suspended Solids (TSS)	1	The SAV/water clarity goal has been met for this segment. This listing supersedes the previous Sediment/TSS listing for watershed 02131002.
MD-SOUMH-ANNAPOLIS_LANDING_BEACH	SOUMH - South River Mesohaline	Public Beach	Enterococcus	1	Beach meets water contact recreation criteria
MD-02120204-SCOTT_CREEK	Conowingo Dam Susquehanna River	Non-tidal Segment(s)	Fecal coliform	3	Sewage discharge from Delta PA. Creek headwaters near Maryland line, tributary of PA waterbody (Muddy Creek)
MD-CHSMH-OH-02130505	Lower Chester River	Tidal subsegment	PCB in Fish Tissue	3	This was an erroneous listing. The data used for this listing was actually gathered from the Middle Chester watershed.

MD-CHSMH-Bogles_Wharf_Beach	Lower Chester River	Public Beach	Enterococcus	4	Area not primary water contact, may be natural state. Sanitary survey -remote area, no significant sources of bacteria. KE Co. no longer monitors b/c not used as beach. Will revisit area when secondary contact standard is developed.
MD-02130704	Bynum Run	Non-tidal 8-digit watershed	Nitrogen (Total)	2	
MD-02131104	Patuxent River upper	Non-tidal 8-digit watershed	Nitrogen (Total)	2	
MD-02131106	Middle Patuxent River	Non-tidal 8-digit watershed	Nitrogen (Total)	2	
MD-02140512	Town Creek	Non-tidal 8-digit watershed	Nitrogen (Total)	2	
MD-02130704	Bynum Run	Non-tidal 8-digit watershed	Phosphorus (Total)	2	
MD-02131104	Patuxent River upper	Non-tidal 8-digit watershed	Phosphorus (Total)	2	
MD-02131106	Middle Patuxent River	Non-tidal 8-digit watershed	Phosphorus (Total)	2	
MD-02140512	Town Creek	Non-tidal 8-digit watershed	Phosphorus (Total)	2	
MD-02140512	Town Creek	Non-tidal 8-digit watershed	Total Suspended Solids (TSS)	2	
MD-02141001	Lower North Branch Potomac River	Non-tidal 8-digit watershed	Cadmium	2	
MD-02141003	Wills Creek	Non-tidal 8-digit watershed	Cyanide	2	
MD-02141005	Upper North Branch Potomac River	Non-tidal 8-digit watershed	Phosphorus (Total)	2	
MD-02141005	Upper North Branch Potomac River	Non-tidal 8-digit watershed	Nitrogen (Total)	2	

MD-PAXMH-OH-02131101	Lower Patuxent River	Tidal subsegment	Chlorpyrifos	2	This listing captures the previous chlorpyrifos listing (and WQA) for watershed 02131101.
MD-PAXOH-PATUXENT_RIVER	PAXOH - Middle Patuxent River Oligohaline	Tidal Shellfish Area	Fecal Coliform	2	
MD-PAXTF-02131102	Patuxent River Middle	Chesapeake Bay segment	Chlorpyrifos - water & sediments	2	This listing only applies to the Middle Patuxent River (02131102).
MD-POTMH-02140108	Zekiah Swamp	Tidal subsegment	Copper	2	A WQA was approved for Copper, Lead, Selenium, and Zinc in the Zekiah Swamp portion of POTMH.
MD-POTMH-02140108	Zekiah Swamp	Tidal subsegment	Selenium	2	A WQA was approved for Copper, Lead, Selenium, and Zinc in the Zekiah Swamp portion of POTMH.
MD-POTMH-02140108	Zekiah Swamp	Tidal subsegment	Zinc	2	A WQA was approved for Copper, Lead, Selenium, and Zinc in the Zekiah Swamp portion of POTMH.
MD-POTMH-02140108	Zekiah Swamp	Tidal subsegment	Lead	2	A WQA was approved for Copper, Lead, Selenium, and Zinc in the Zekiah Swamp portion of POTMH.
MD-02140108	Zekiah Swamp	Non-tidal 8-digit watershed	Nutrients	3	This nutrient listing is now appropriately captured by the total phosphorus and total nitrogen listings for AU MD-POTMH

C.3.1 Total Maximum Daily Loads

Maryland continues to make progress completing TMDLs for waters listed as impaired on category 5 if the IR. Total Maximum Daily Loads determine the sources of pollution for an identified impairment as well as the estimated reductions necessary to bring the waterbody back into compliance with Water Quality Standards. Table 16 lists the waterbodies with TMDLs completed since the last IR cycle while Table 17 lists those waters for which TMDLs will likely be initiated over the next two years.

Table 16: 2008 Approved TMDLs in Category 4a of the IR. This does not include TMDLs completed for only a portion of a Bay segment. TMDLs completed for parts of Bay segments are identified in the notes for Category 4a listings (see section F.4).

Cycle First Listed	Assessment Unit ID	Basin /Subasin Name	Water Type Detail	Designated Use	Cause	Sources
1996	MD-EASMH-Wye_River	Wye River	Tidal shellfish area	Water contact sports	Fecal coliform	Wildlife Other than Waterfowl
2006	MD-EASMH-WYE_RIVER2	Wye East River and Quarter Cove	Tidal shellfish area	Water contact sports	Fecal coliform	Wildlife Other than Waterfowl
1996	MD-SEVMH-MILL_CREEK	Mill Creek	Tidal shellfish area	Water contact sports	Fecal coliform	Wastes from pets
1996	MD-SEVMH-SEVERN_RIVER	Severn River	Tidal shellfish area	Water contact sports	Fecal coliform	Wastes from pets
1996	MD-SEVMH-WHITEHALL_MEREDITH_CREEKS	Whitehall and Meredith Creeks	Tidal shellfish area	Water contact sports	Fecal coliform	Wastes from pets
2006	MD-021410030098-JENNINGS_RUN	Jennings Run	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
2006	MD-021410030099-JENNINGS_RUN	Jennings Run	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
2006	MD-021410030099-UT1_JENNINGS_RUN	UT1 Jennings Run	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
2002	MD-021410030099-UT2_JENNINGS_RUN	UT2 Jennings Run	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
1996	MD-	Three Forks	Non-tidal 8-	Aquatic Life and	Low pH	Acid mine drainage

Cycle First Listed	Assessment Unit ID	Basin /Subasin Name	Water Type Detail	Designated Use	Cause	Sources
	021410050048	Run	digit watershed	Wildlife		
1996	MD-02141005	Upper North Branch Potomac River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
2004	MD-02141006-AARONS_RUN	Aarons Run	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
1996	MD-02141004	Georges Creek	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
1996	MD-05020204	Casselman River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Low pH	Acid mine drainage
2002	MD-02130904	Jones Falls	Non-tidal 8-digit watershed	Water Contact Sports	Fecal Coliform	Discharges from Municipal Separate Storm Sewer Systems (MS4)
1996	MD-02140205	Anacostia River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Urban Runoff/Storm Sewers
2002	MD-02140205	Anacostia River	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2004	MD-ANATF	ANATF - Anacostia River Tidal Fresh	Chesapeake Bay segment	Water Contact Sports	Fecal Coliform	Wastes from Pets
1996	MD-ANATF	ANATF - Anacostia River Tidal Fresh	Chesapeake Bay segment	Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	Total Suspended Solids (TSS)	Channel Erosion/Incision from Upstream Hydromodifications
2006	MD-ANATF	ANATF - Anacostia River Tidal Fresh	Chesapeake Bay segment	Fishing	PCB in Fish Tissue	Upstream Source
1996	MD-ANATF	ANATF - Anacostia River Tidal Fresh	Chesapeake Bay segment	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Channel Erosion/Incision from Upstream Hydromodifications
2002	MD-02130901-HERRING_RUN	Back River	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2002	MD-02140207	Cabin John Creek	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
1996	MD-CHSOH	CHSOH - Middle Chester River Oligohaline	Chesapeake Bay segment	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Nitrogen (Total)	Agriculture

Cycle First Listed	Assessment Unit ID	Basin /Subasin Name	Water Type Detail	Designated Use	Cause	Sources
1996	MD-CHSOH	CHSOH - Middle Chester River Oligohaline	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Phosphorus (Total)	Agriculture
1996	MD-CHSOH	CHSOH - Middle Chester River Oligohaline	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Nitrogen (Total)	Agriculture
1996	MD-CHSOH	CHSOH - Middle Chester River Oligohaline	Chesapeake Bay segment	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Phosphorus (Total)	Agriculture
1996	MD-CHSTF	CHSTF - Upper Chester River Tidal Fresh	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Nitrogen (Total)	Agriculture
1996	MD-CHSTF	CHSTF - Upper Chester River Tidal Fresh	Chesapeake Bay segment	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Phosphorus (Total)	Agriculture
1996	MD-CHSTF	CHSTF - Upper Chester River Tidal Fresh	Chesapeake Bay segment	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Nitrogen (Total)	Agriculture
1996	MD-CHSTF	CHSTF - Upper Chester River Tidal Fresh	Chesapeake Bay segment	Open-Water Fish and Shellfish Subcategory	Phosphorus (Total)	Agriculture
1996	MD-02141002	Evitts Creek	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Agriculture
2002	MD-02141004	Georges Creek	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2002	MD-02130905	Gwynns Falls	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
1996	MD-HNGMH-Back_Creek	Honga River	Tidal Shellfish Area	Shellfishing	Fecal Coliform	Wastes from Pets
1996	MD-05020202	Little Youghiogheny River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Agriculture
1996	MD-02130805-	Loch Raven Reservoir	Impoundments	Aquatic Life and Wildlife	Phosphorus (Total)	Urban Runoff/Storm Sewers

Cycle First Listed	Assessment Unit ID	Basin /Subasin Name	Water Type Detail	Designated Use	Cause	Sources
	Loch_Raven_Reservoir					
1996	MD-02130805-Loch_Raven_Reservoir	Loch Raven Reservoir	Impoundments	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Agriculture
1996	MD-CHOMH1-San_Domingo_Creek_NE_Branch	Lower Choptank River	Tidal Shellfish Area	Shellfishing	Fecal Coliform	Manure Runoff
1996	MD-CHOMH2-LOWER_CHOPTANK_RIVER_MAINSTEM	Lower Choptank River	Tidal Shellfish Area	Shellfishing	Fecal Coliform	Manure Runoff
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Areas	Seasonal Deep-Water Fish and Shellfish Subcategory	Phosphorus (Total)	Municipal Point Source Discharges
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Area	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Nitrogen (Total)	Municipal Point Source Discharges
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Areas	Seasonal Deep-Water Fish and Shellfish Subcategory	Nitrogen (Total)	Municipal Point Source Discharges
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Area	Open-Water Fish and Shellfish Subcategory	Nitrogen (Total)	Municipal Point Source Discharges
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Area	Open-Water Fish and Shellfish Subcategory	Phosphorus (Total)	Municipal Point Source Discharges
1996	MD-PATMH	PATMH - Patapsco River Mesohaline	Non-navigation Channel Area	Seasonal Migratory Fish Spawning and Nursery Subcategory.	Phosphorus (Total)	Municipal Point Source Discharges
2002	MD-02140203	Piscataway Creek	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2002	MD-POTMH-OH-02140101	Potomac River Lower Tidal	Tidal subsegment	Fishing	PCB in Fish Tissue	Upstream Source
2002	MD-POTOH-TF-02140102	Potomac River Middle	Tidal subsegment	Fishing	PCB in Fish Tissue	Upstream Source

Cycle First Listed	Assessment Unit ID	Basin /Subasin Name	Water Type Detail	Designated Use	Cause	Sources
		Tidal				
2002	MD-POTTF-02140201	Potomac River Upper tidal	Tidal subsegment	Fishing	PCB in Fish Tissue	Upstream Source
1996	MD-021308060313-Prettyboy_Reservoir	Prettyboy Reservoir	Impoundments	Aquatic Life and Wildlife	Phosphorus (Total)	Agriculture
2002	MD-02140206	Rock Creek	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2004	MD-TANMH-LAWS_UPPER-THOROFARE	TANMH - Tangier Sound Mesohaline	Tidal Shellfish Area	Shellfishing	Fecal Coliform	Manure Runoff
1996	MD-02141005	Upper North Branch Potomac River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Livestock (Grazing or Feeding Operations)
1996	MD-02130304	Wicomico River Headwaters	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
2002	MD-02141003	Wills Creek	River Mainstem	Water Contact Sports	Fecal Coliform	Non-Point Source
1996	MD-02141003	Wills Creek		Aquatic Life and Wildlife	Total Suspended Solids (TSS)	Urban Runoff/Storm Sewers
1996	MD-05020201	Youghiogheny River	Non-tidal 8-digit watershed	Aquatic Life and Wildlife	pH, Low	Acid Mine Drainage

Table 17: TMDLs Anticipated over the next two years.

Assessment Unit ID	Basin Name	Cause	Status	Project	Projected Submittal Date
MD-CB1TF-02120201	Tidal Lower Susquehanna River	Cadmium	Under Development	WQA	2008
MD-02131105	Little Patuxent River	Cadmium	Under Development	WQA	2008
MD-PATMH-Bodkin_Creek	Bodkin Creek	Copper	Under Development	TMDL	2008
MD-021309061012	Patapsco River Lower North Branch	Copper - water column		WQA	2008
MD-POCMH-POCOMOKE_SOUND-RIVER	Lower Pocomoke River	Fecal Coliform	Under Development	TMDL	2008
MD-02130204	Dividing Creek	Fecal Coliform	Draft Complete (In Interagency Review)	TMDL	2008
MD-02140502	Antietam Creek	Fecal Coliform	Draft Complete (In Internal SSA Review)	TMDL	2008
MD-02140504	Conococheague Creek	Fecal Coliform	Draft Complete (In Internal SSA Review)	TMDL	2008
MD-05020203	Deep Creek Lake	Fecal Coliform		303(d) delisting due to new data	2008
MD-02130906	Patapsco River Lower North Branch	Fecal Coliform	Under Development	TMDL	2008
MD-POCOH-POCOMOKE_SOUND-RIVER	Lower Pocomoke River	Fecal Coliform	Under Development	TMDL	2008
MD-02130907	Liberty Reservoir	Fecal Coliform	Under Development	TMDL	2008
MD-02130806	Prettyboy Reservoir	Fecal Coliform	Under Development	TMDL	2008
MD-05020201-CHERRY_CREEK	Youghiogheny River	Fecal Coliform	Under Development	TMDL	2008
MD-NORTF	NORTF - North East River Tidal Fresh	Lead	Under Development	WQA	2008

Assessment Unit ID	Basin Name	Cause	Status	Project	Projected Submittal Date
MD-PATMH-Bodkin_Creek	PATMH - Patapsco River Mesohaline	Lead	Under Development	WQA	2008
MD-021309061012	Patapsco River Lower North Branch	Lead - water column		WQA	2008
MD-ANATF	ANATF - Anacostia River Tidal Fresh	Nitrogen (Total)	Draft Complete (Will Start Public Review Shortly)	TMDL	2008
MD-ANATF	ANATF - Anacostia River Tidal Fresh	Nitrogen (Total)	Draft Complete (Will Start Public Review Shortly)	TMDL	2008
MD-02140205	Anacostia River	Phosphorus (Total)	Draft Complete (Will Start Public Review Shortly)	TMDL	2008
MD-ANATF	ANATF - Anacostia River Tidal Fresh	Phosphorus (Total)	Draft Complete (Will Start Public Review Shortly)	TMDL	2008
MD-ANATF	ANATF - Anacostia River Tidal Fresh	Phosphorus (Total)	Draft Complete (Will Start Public Review Shortly)	TMDL	2008
MD-02140303	Upper Monocacy River	Total Suspended Solids (TSS)	Draft Complete (Will Start Interagency Review Shortly)	TMDL	2008
MD-02140304	Double Pipe Creek	Total Suspended Solids (TSS)	Draft Complete (Has been through Public Review; Will be Submitted to EPA after Lower and Upper Monocacy finish Public Review)	TMDL	2008
MD-02140502	Antietam Creek	Total Suspended Solids (TSS)	Draft Complete (In Interagency Review)	TMDL	2008
MD-02140504	Conococheague Creek	Total Suspended Solids (TSS)	Draft Complete (In Interagency Review)	TMDL	2008
MD-02140302	Lower Monocacy River	Total Suspended Solids (TSS)	Draft Complete (Will Start Interagency Review Shortly)	TMDL	2008

Assessment Unit ID	Basin Name	Cause	Status	Project	Projected Submittal Date
MD-PATMH-Bodkin_Creek	PATMH - Patapsco River Mesohaline	Zinc	Under Development	WQA	2008
MD-02131106	Middle Patuxent River	Zinc	Under Development	WQA	2008
MD-05020202	Little Youghiogheny River	Fecal Coliform	Under Development	TMDL	2009
MD-02130805	Loch Raven Reservoir	Fecal Coliform	Under Development	TMDL	2009
MD-PATMH-FURNACE_CREEK	PATMH - Patapsco River Mesohaline	Fecal Coliform	Under Development	TMDL	2009
MD-PATMH-MARLEY_CREEK	PATMH - Patapsco River Mesohaline	Fecal Coliform	Under Development	TMDL	2009
MD-PAXMH-MILL_CREEK2	PAXMH - Lower Patuxent River Mesohaline	Fecal Coliform	Draft Complete (In Internal SSA Review)	TMDL	2009
MD-02140205	Anacostia River	Heptachlor Epoxide	Under Development	TMDL	2009
MD-02130106-T	Chincoteague Bay	Nitrogen (Total)	Under Development	TMDL	2009
MD-02130103-T-ISLE_OF_WIGHT_BAY	Isle of Wight Bay	Nitrogen (Total)	Under Development	TMDL	2009
MD-02130102-T-ASSAWOMAN_BAY	Assawoman Bay	Nitrogen (Total)	Under Development	TMDL	2009
MD-02130104-T	Sinepuxent Bay	Nitrogen (Total)	Under Development	TMDL	2009
MD-02140205	Anacostia River	PCBs - water	Under Development	TMDL	2009
MD-02130102-T-ASSAWOMAN_BAY	Assawoman Bay	Phosphorus (Total)	Under Development	TMDL	2009
MD-02130103-T-ISLE_OF_WIGHT_BAY	Isle of Wight Bay	Phosphorus (Total)	Under Development	TMDL	2009
MD-02130104-T	Sinepuxent Bay	Phosphorus (Total)	Under Development	TMDL	2009
MD-02130907-Liberty_Reservoir	Liberty Reservoir	Phosphorus (Total)	Under Development	TMDL	2009
MD-02130106-T	Chincoteague Bay	Phosphorus (Total)	Under Development	TMDL	2009

Assessment Unit ID	Basin Name	Cause	Status	Project	Projected Submittal Date
MD-02130704	Bynum Run	Total Suspended Solids (TSS)	Under Development	TMDL	2009
MD-02130904	Jones Falls	Total Suspended Solids (TSS)	Under Development	TMDL	2009
MD-02130905	Gwynns Falls	Total Suspended Solids (TSS)	Under Development	TMDL	2009
MD-02130906	Patapsco River Lower North Branch	Total Suspended Solids (TSS)	Under Development	TMDL	2009
MD-02130907-Liberty_Reservoir	Liberty Reservoir	Total Suspended Solids (TSS)	Under Development	TMDL	2009
MD-PATMH-Middle_Harbor	PATMH - Patapsco River Mesohaline	Zinc - sediments	Under Development	TMDL	2009
MD-PATMH-CURTIS_BAY_CREEK	PATMH - Patapsco River Mesohaline	Zinc - sediments	Under Development	WQA	2009
MD-CHSTF-Duck_Neck_Beach	Upper Chester River	Fecal Coliform	Under Development	TMDL	2008*
MD-BOHOH	BOHOH - Bohemia River Oligohaline	PCB in Fish Tissue	Under Development	TMDL	2008*
MD-SASOH	SASOH - Sassafras River Oligohaline	PCB in Fish Tissue	Under Development	TMDL	2008*
MD-CHSMH-02130507	Corsica River	PCB in Fish Tissue	Under Development	TMDL	2008*
MD-NORTF	NORTF - North East River Tidal Fresh	PCB in Fish Tissue	Under Development	WQA	2008*
MD-02140303	Upper Monocacy River	Phosphorus (Total)	Under Development	TMDL	2008*
MD-02140304	Double Pipe Creek	Phosphorus (Total)	Under Development	TMDL	2008*
MD-02140302	Lower Monocacy River	Phosphorus (Total)	Under Development	TMDL	2008*
MD-05020203	Deep	Phosphorus	Under	TMDL	2009*

Assessment Unit ID	Basin Name	Cause	Status	Project	Projected Submittal Date
	Creek Lake	(Total)	Development		
MD-05020203-Deep_Creek_Lake	Deep Creek Lake	Phosphorus (Total)	Under Development	TMDL	2009*

C.3.2 Assessment Summary

The summary tables provided in this section are submitted for consistency with EPA guidance and to help EPA fulfill its mandate to provide nationwide assessment results. However, many of these tables are too coarse to provide meaningful statewide trends or track Maryland's progress in meeting CWA goals. Maryland's Baystat program (http://www.baystat.maryland.gov/) provides the most useful indicators for water quality tracking and trends in the State and readers are encouraged to visit that site for more relevant information.

Table 18: Size of Surface Waters Assigned to Reporting Categories. Maryland utilizes a multi-category report structure for the IR which can potentially report a single assessment unit in multiple listing categories. As a result, summing assessment unit sizes across categories for a water body type will exceed the total waterbody area for the State.

Waterbody Type	Category							Total in State	Total Assessed
	1	2	3	4a	4b	4c	5		
River/stream miles	0	3,767.5	971.8	1,245.6	5.1	0	5,342.9	10,275.5	10,275.5
Lake/pond acres	0	12,445	4,663	9,112.9	0	0	12,886	20,413.9	20,413.9
Estuarine square miles	0	962.46	1,338.7	523.74	0.33	0	1,946.35	3,034.6	3,034.6
Ocean coast miles	0	0	108.7	0	0	0	0	108.7	108.7
Freshwater wetland	Not Assessed								
Tidal wetland acres	Not Assessed								

C.3.3 Split Water Body Segments

The State has split water bodies or assessment units where data and information are supportive. For example, a listing originally may have been made for a large watershed and more detailed information is now available demonstrating that the watershed is comprised of smaller, hydrologically distinct subwatersheds. In these cases, the State will split this watershed into several subwatershed scale listings that better align with TMDL development. A summary of the assessment units that were split during the 2008 cycle is included in Table 19.

Table 19: Summary of Newly Split Assessment Units in the 2008 IR.

Water Body	Pollutant(s)	Split Details	Rationale
Lower Choptank	BOD	Now two assessment units: **MD-02130403-UTLC** and **MD-02130403-**	Two separate TMDLs

River (02130403)		**TOWN_CREEK**	developed and waters are not hydrologically connected.
Lower Choptank River (CHOMH1)	Fecal Coliform	Now two assessment units: **MD-CHOMH1-San_Domingo_Creek_NW_Branch** and **CHOMH1-San_Domingo_Creek_NE_Branch**	Two separate TMDLs developed for separate shellfish areas
Lower Patuxent River (PAXMH)	Fecal Coliform	Now two assessment units: **MD-PAXMH-WASHINGTON_PERSIMMON_CREEK** and **MD-PAXMH-TRENT_HALL_CREEK**	Two separate TMDLs developed for separate shellfish areas
Wills Creek (02141003)	pH	Now four assessment units: **MD-021410030098-JENNINGS_RUN, MD-021410030099-JENNINGS_RUN, MD-021410030099-UT1_JENNINGS_RUN, and MD-021410030099-UT2_JENNINGS_RUN**	Four separate TMDLs established for these areas.
Upper North Branch Potomac River (02141005)	pH	Now two assessment units: **MD-021410050048** and **MD-02141005**	Two separate TMDLs established for these areas.
Baltimore Harbor (PATMH)	Total nitrogen and total phosphorus	Now separate assessment units for the navigation channel and the non-navigation channel areas: 6 of the PATMH nitrogen and phosphorus listings are for the non-navigation channel areas for the open water, deep water and migratory spawning and nursery designated uses; 2 PATMH listings (1 for nitrogen and 1 for phosphorus) are for the navigation channel deep channel designated use.	A nutrient TMDL will be approved by EPA for only the non-navigational channel areas of the Harbor
Wye River (EASMH, 02130503)	Fecal Coliform	These are split out as 2 separate shellfish harvesting areas, one of which has already had a TMDL completed: **MD-EASMH-Wye_River** and **MD-EASMH-WYE_RIVER2**.	Two separate TMDLs will be established for these areas.
Miles River (EASMH, 02130502)	Fecal Coliform	These are split out as 2 separate shellfish harvesting areas, one of which has already had a TMDL completed: **MD-EASMH-Miles_River** and **MD-EASMH-Miles_River2**.	Two separate TMDLs will be established for these areas.

C.3.4 Estuarine Assessments

This section provides assessment results and water quality summaries for Maryland's estuarine systems that include both the Chesapeake and Coastal Bays. The Chesapeake Bay assessments continue to evolve as new criteria and assessment methodologies are implemented and as Maryland phases in the new salinity-based segmentation. Comparatively, the Coastal Bays fall behind the Chesapeake in terms of public awareness and resource allocation for monitoring and assessment activities.

C.3.4.1 Chesapeake Bay

The previous 2006 Integrated Report used a transitional approach to incorporate the new Chesapeake Bay salinity-based assessment units. Basically, two lists were maintained, one that held assessments for the historical tidal watershed-based assessment units and one that displayed the status of the newer salinity-based assessment units. As a result, these two sets of assessment units overlapped both in time and in space. The 2008 IR has now fully phased in the salinity-based assessment units. In doing so, Maryland has been careful to retain all original listings and to continue to track TMDL development documented using the historical watershed-assessment units. Because the watershed-based assessment unit boundaries do not always align with those of the salinity-based assessment units (example shown in Figure 13), Maryland has produced Table 20 to help illustrate how historical watershed-based listings have been transferred to the new salinity-based assessment units. All historical watershed-based listings have been transferred to the Bay segment that comprises the largest percentage of that watershed. Historical listings did not change for any body of water based on this segmentation conversion unless more current and accurate assessment information was available.

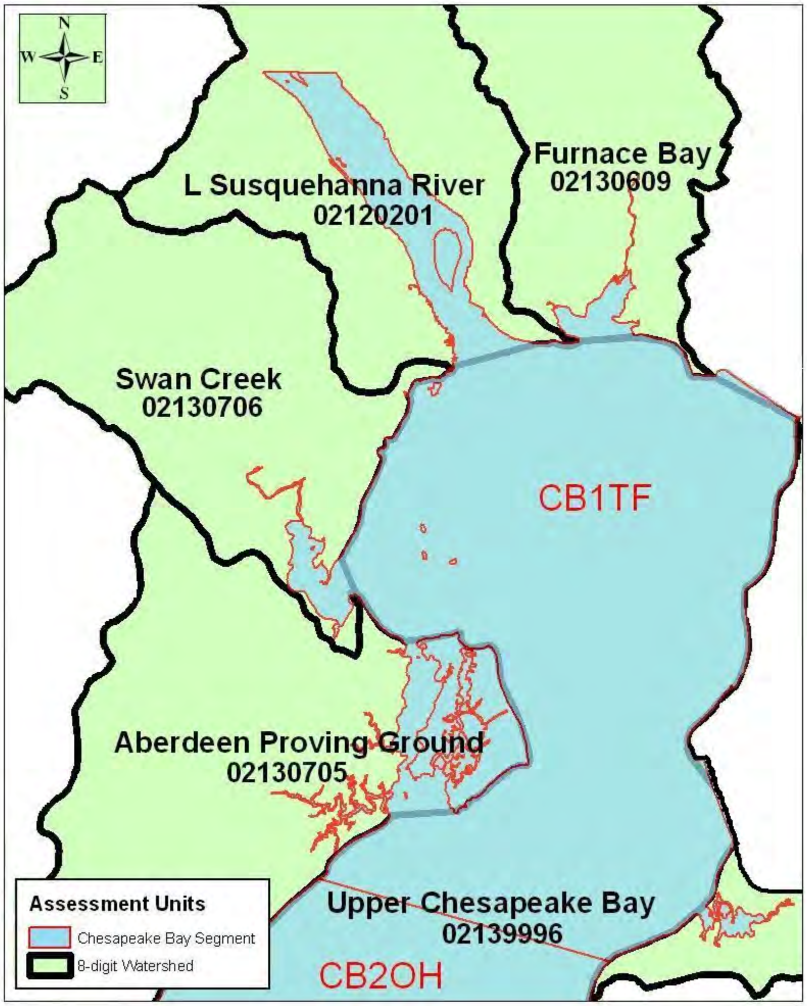

Figure 13: This map displays a single example of how the new salinity-based Ches. Bay segments can overlap with the tidal areas of multiple 8-digit watershed segments. This particular example shows the bay segment CB1TF (red outline) overlapping the Lower Susquehanna, Furnace Bay, Swan Creek, Aberdeen Proving Grounds, and Upper Ches. Bay watersheds (black outline).

Table 20: Explanation of how listings from the historical watershed-based assessment units were transferred to the new salinity-based assessment units. It is worth reiterating here that all previous 'Sediment' listings are now expressed as TSS listings and all previous tidal 'Nutrients' listings are now split out into total phosphorus and total nitrogen listings.

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
Lower Susquehanna River (02120201)	Cat. 2 Nutrients	MD-CB1TF	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. Comments added to listing that WQA completed for Lower Susquehanna portion and TMDL approved for Swan Creek portion. Sediment listing now TSS based on SAV data.
	Cat. 5 Sediments				
Furnace Bay (02130609)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments				
Swan Creek (02130706)	Cat. 4a Nutrients				
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Aberdeen Proving Ground (02130705)	Cat. 5 Nutrients				
	Cat. 5 Sediments				
Upper Chesapeake Bay (02139996)	Cat. 5 Nutrients				
Northeast River (02130608)	Cat. 4a Nutrients	MD-NORTF	Cat. 4a Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 4a Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Upper Elk River (02130603)	Cat. 5 Nutrients	MD-ELKOH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. Sediments/TSS listing combined.
	Cat. 5 TSS		Cat. 5 Total Phosphorus	Open Water	
Lower Elk River (02130601)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 TSS				
Back Creek (02130604)	Cat. 5 Nutrients	MD-C&DOH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Bohemia River (02130602)	Cat. 4a Nutrients	MD-BOHOH	Cat. 4a Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
				M. Spawning Nursery	
			Cat. 4a Total Phosphorus	Open Water	
				M. Spawning Nursery	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Upper Chesapeake Bay (02139996)	Cat. 5 Nutrients	MD-CB2OH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. Comments added to listing that TMDLs have been approved for Stillpond, Worton, and Fairlee Creek. Cat. 2 for TSS based on new SAV data.
Middle Chesapeake Bay (02139997)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
Stillpond (02130611)	Cat. 4a Nutrients				
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Sassafras River (02130610)	Cat. 4a Nutrients	MD-SASOH	Cat. 4a Total Phosphorus	Open Water	Nutrient listing split to show different DUs affected. New data show that sediments/TSS is not impairing segment.
				M. Spawning Nursery	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Bush River (02130701)	Cat. 5 Nutrients	MD-BSHOH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Gunpowder River (02130801)	Cat. 5 Nutrients	MD-GUNOH	Cat. 5 Total Nitrogen	Open Water	Nutrients listing split. Comments indicating that WQA approved for Bird River (Cat. 2). New data show that sediments/TSS is not impairing segment.
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Bird River (02130803)	Cat. 2 Nutrients		Cat. 2 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Middle River-Browns Creek (02130807)	Cat. 5 Nutrients	MD-MIDOH	Cat. 5 Total Nitrogen	Open Water	Sediment listings combined.
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Gunpowder River (02130801)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 Sediments				

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
Back River (02130901)	Cat. 4a Nutrients	MD-BACOH	Cat. 4a Total Nitrogen	Open Water	Nutrient listing split. As of April 2008, according to COMAR, BACOH did not have the Shallow-water SAV DU. However, this segment was listed historically for sediments so the listing must remain until new data proves otherwise.
				M. Spawning Nursery	
			Cat. 4a Total Phosphorus	Open Water	
	Cat. 5 Sediments			M. Spawning Nursery	
			Cat. 5 TSS	Aquatic Life and Wildlife	
Baltimore Harbor (02130903)	Cat. 5 Nutrients	MD-PATMH	Cat. 5 Total Nitrogen	Open Water	Comments added to listings that TMDLs for TP and TN approved for all DUs except for the Deep Channel use in Baltimore Harbor portion of PATMH. No TMDL yet for Bodkin Creek portion.
				M. Spawning Nursery	
				Deep Water	
	Cat. 5 Sediments		Cat. 5 Total Nitrogen	Deep Channel	
Bodkin Creek (02130902)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
				M. Spawning Nursery	
				Deep Water	
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Deep Channel	
			Cat. 5 TSS	Shallow Water SAV	
Magothy River (02131001)	Cat. 5 Nutrients	MD-MAGMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Middle Chesapeake Bay (02139997)	Cat. 5 Nutrients	MD-CB3MH	Cat. 5 Total Nitrogen	Open Water	Cat. 5 for TSS due to new data that assesses all of these watersheds.
Lower Chesapeake Bay (02139998)	Cat. 5 Nutrients			Deep Water	
Lower Chester River (02130505)	Cat. 5 Nutrients			Deep Channel	
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Kent Island Bay Area	Cat. 5 Nutrients			Deep Water	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
(02130511)	Cat. 5 Sediments			Deep Channel	
			Cat. 5 TSS	Shallow Water SAV	
Lower Chester River (02130505)	Cat. 5 Nutrients	MD-CHSMH	Cat. 5 Total Nitrogen	Open Water	Comments will show that TMDL was approved for Corsica River and WQA was approved for Langford Creek portion. Sediment/TSS listings combined.
	Cat. 5 sediments			Deep Water	
Corsica River (02130507)	Cat. 4a Nutrients			Deep Channel	
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Langford Creek (02130506)	Cat. 2 Nutrients			Deep Water	
	Cat. 5 Sediments			Deep Channel	
			Cat. 5 TSS	Shallow Water SAV	
Middle Chester River (02130509)	Cat. 4a Nutrients	MD-CHSOH	Cat. 4a Total Nitrogen	Open Water	Cat. 4a for Nutrients because the watershed 02130505 comprises only a small downstream portion of CHSOH. New data show that sediments/TSS is not impairing segment.
	Cat. 5 Sediments			M. Spawning Nursery	
Southeast River (02130508)	Cat. 4a Nutrients		Cat. 4a Total Phosphorus	Open Water	
	Cat. 5 Sediments			M. Spawning Nursery	
Lower Chester River (02130505)	Cat. 5 Nutrients		Cat. 2 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Upper Chester River (02130510)	Cat. 4a Nutrients				
	Cat. 5 Sediments				
Upper Chester River (02130510)	Cat. 4a Nutrients	MD-CHSTF	Cat. 4a Total Nitrogen	Open Water	Nutrient listing split.
				M. Spawning Nursery	
			Cat. 4a Total Phosphorus	Open Water	
	Cat. 5 Sediments			M. Spawning Nursery	
			Cat. 5 TSS	Shallow Water SAV	
Severn River (02131002)	Cat. 5 Nutrients	MD-SEVMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
South River	Cat. 5 Nutrients	MD-SOUMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
(02131003)			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
West River (02131004)	Cat. 5 Nutrients	MD-RHDMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
West River (02131004)	Cat. 5 Nutrients	MD-WSTMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Eastern Bay (02130501)	Cat. 5 Nutrients	MD-EASMH	Cat. 5 Total Nitrogen	Open Water	Sediment listings combined.
	Cat. 5 Sediments			Deep Water	
Kent Narrows/Prospect Bay (02130504)	Cat. 5 Nutrients			Deep Channel	
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Wye River (02130503)	Cat. 5 Nutrients			Deep Water	
	Cat. 5 Sediments			Deep Channel	
Miles River (02130502)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Lower Choptank River (02130403)	Cat. 5 Nutrients	MD-CHOMH1	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Lower Choptank River (02130403)	Cat. 5 Nutrients	MD-CHOMH2	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Upper Choptank River (02130404)	Cat. 5 Nutrients	MD-CHOOH	Cat. 5 Total Nitrogen	Open Water	Sediment listings combined.
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Lower Choptank River (02130403)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Upper Choptank River (02130404)	Cat. 5 Nutrients	MD-CHOTF	Cat. 5 Total Nitrogen	Open Water	Sediment listings combined.
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
Tuckahoe Creek (02130405)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Little Choptank River (02130402)	Cat. 5 Nutrients	MD-LCHMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
			Cat. 5 TSS	Shallow Water SAV	
Lower Chesapeake Bay (02139998)	Cat. 5 Nutrients	MD-CB4MH	Cat. 5 Total Nitrogen	Open Water	Cat. 5 for TSS due to new data that assesses all of these watersheds.
				Deep Water	
Kent Island Bay Area (02130511)	Cat. 5 Nutrients			Deep Channel	
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
West Chesapeake Bay (02131005)	Cat. 5 Nutrients			Deep Water	
				Deep Channel	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Patuxent River Lower (02131101)	Cat. 5 Nutrients	MD-PAXMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
				Deep Water	
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments			Deep Water	
			Cat. 5 TSS	Shallow Water SAV	
Patuxent River Lower (02131101)	Cat. 5 Nutrients	MD-PAXOH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Patuxent River Middle (02131102)	Cat. 5 Nutrients	MD-PAXTF	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is not impairing segment.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Western Branch (02131103)	Cat. 4a Nutrients	MD-WBRTF	Cat. 4a BOD	Open Water	TMDL found that BOD was cause of low DO. Segment has always been listed for
				M. Spawning Nursery	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
	Cat. 5 Sediments		Cat. 5 TSS	Aquatic Life and Wildlife	sediments/TSS but does not have the SAV DU.
Lower Chesapeake Bay (02139998)	Cat. 5 Nutrients	MD-CB5MH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split. New data show that sediments/TSS is impairing segment.
				Deep Water	
				Deep Channel	
			Cat. 5 Total Phosphorus	Open Water	
				Deep Water	
				Deep Channel	
			Cat. 5 TSS	Shallow Water SAV	
Potomac River Lower Tidal (02140101)	Cat. 5 Nutrients	MD-POTMH	Cat. 5 Total Nitrogen	Open Water	Cat. 5 for Nutrients with comments indicating that TMDL was approved for Breton Bay portion. Sediments/TSS listings consolidated.
	Cat. 5 Sediments				
St. Mary's River (02140103)	Cat. 5 Nutrients			Deep Water	
	Cat. 5 Sediments				
Breton Bay (02140104)	Cat. 4a Nutrients			Deep Channel	
	Cat. 5 Sediments				
St. Clement's Bay (02140105)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments				
Wicomico River (02140106)	Cat. 5 Nutrients			Deep Water	
	Cat. 5 Sediments				
Zekiah Swamp (02140108)	Cat. 5 Sediments			Deep Channel	
Gilbert Swamp (02140107)	Cat. 5 Nutrients				
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Potomac River Lower Tidal (02140101)	Cat. 5 Nutrients	MD-POTOH1	Cat. 5 Total Nitrogen	Open Water	Sediments/TSS listings consolidated.
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Potomac River Middle Tidal (02140102)	Cat. 5 Nutrients		Cat. 5 TSS	Shallow Water SAV	
	Cat. 5 Sediments				
Port Tobacco River	Cat. 4a Nutrients	MD-POTOH2	Cat. 4a Total Nitrogen	Open Water	Nutrient listing split.

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
(02140109)				M. Spawning Nursery	
			Cat. 4a Total Phosphorus	Open Water	
				M. Spawning Nursery	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Nanjemoy Creek (02140110)	Cat. 5 Nutrients	MD-POTOH3	Cat. 5 Total Nitrogen	Open Water	Same as the 8-digit watershed listings.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Potomac River Middle Tidal (02140102)	Cat. 5 Nutrients	MD-POTTF	Cat. 5 Total Nitrogen	Open Water	Sediments/TSS listings consolidated. Now have data for all tidal portions of segment POTTF.
	Cat. 5 Sediments				
Potomac River Upper Tidal (02140201)	Cat. 5 Nutrients				
	Cat. 5 Sediments		Cat. 5 Total Phosphorus	Open Water	
Oxon Run (02140204)	Cat. 5 Nutrients				
	Cat. 5 Sediments				
Potomac River MO. County (02140202)	No previous tidal listings.		Cat. 5 TSS	Shallow Water SAV	
Mattawoman Creek (02140111)	Cat. 4a Nutrients	MD-MATTF	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
				M. Spawning Nursery	
			Cat. 5 Total Phosphorus	Open Water	
				M. Spawning Nursery	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Piscataway Creek (02140203)	Cat. 5 Nutrients	MD-PISTF	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Anacostia River (02140205)	Cat. 5 Nutrients	MD-ANATF	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 4a TSS	Shallow Water SAV	
Honga River (02130401)	Cat. 5 Nutrients	MD-HNGMH	Cat. 5 Total Nitrogen	Open Water	Nutrient listing split.
			Cat. 5 Total Phosphorus	Open Water	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Lower Chesapeake Bay (02139998)	Cat. 5 Nutrients	MD-TANMH	Cat. 5 Total Nitrogen	Open Water	New data show all portions of TANMH impaired for nutrients and sediments/TSS. Comments added that TMDL for nutrients was approved for Lower Wicomico River portion.
Tangier Sound (02130206)	Cat. 5 Nutrients Cat. 5 Sediments				
Fishing Bay (02130307)	No previous tidal listings		Cat. 5 Total Phosphorus	Open Water	
Lower Wicomico River (02130301)	Cat. 4a Nutrients Cat. 5 Sediments				
Monie Bay (02130302)	No previous tidal listings		Cat. 5 TSS	Shallow Water SAV	
Fishing Bay (02130307)	No previous tidal listings	MD-FSBMH	Cat. 3 Total Nitrogen	Open Water	Cat. 3 for nutrients with comments that Transquaking and Chicamacomico River portions have an approved TMDL. New data show that sediments/TSS is not impairing segment.
Transquaking River (02130308)	Cat. 4a Nutrients		Cat. 3 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 2 TSS	Shallow Water SAV	
Nanticoke River (02130305)	No previous tidal listings	MD-NANMH	Cat. 3 Total Nitrogen	Open Water	New data show that NANMH is impaired for Sediments/TSS. Insufficient data to assess for nutrient impairment.
			Cat. 3 Total Phosphorus	Open Water	
			Cat. 5 TSS	Shallow Water SAV	
Nanticoke River (02130305)	No previous tidal listings	MD-NANOH	Cat. 5 Total Nitrogen	Open Water	New data show all portions of NANOH as impaired. Added comments that TMDL
Marshyhope Creek	Cat. 4a Nutrients		Cat. 5 Total Phosphorus	Open Water	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
(02130306)	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	was approved for Marshyhope portion.
Nanticoke River (02130305)	No previous tidal listings	MD-NANTF	Cat. 5 Total Nitrogen	Open Water	New data indicate nutrient impairment. No data on sediments/TSS.
			Cat. 5 Total Phosphorus	Open Water	
Lower Wicomico River (02130301)	Cat. 4a Nutrients	MD-WICMH	Cat. 5 Total Nitrogen	Open Water	New data indicate nutrient and TSS impairments throughout WICMH. Comments added that nutrient TMDLs were approved for the watersheds 02130301 and 02130303 portion of WICMH.
	Cat. 5 Sediments				
Monie Bay (02130302)	No previous tidal listings		Cat. 5 Total Phosphorus	Open Water	
Wicomico Creek (02130303)	Cat. 4a Nutrients				
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Manokin River (02130208)	Cat. 4a Nutrients	MD-MANMH	Cat. 4a Total Nitrogen	Open Water	TMDL found that BOD and nitrogen were the cause of low DO.
				M. Spawning Nursery	
			Cat. 4a BOD	Open Water	
				M. Spawning Nursery	
	Cat. 5 Sediments		Cat. 5 TSS	Shallow Water SAV	
Big Annemessex River (02130207)	No previous tidal listings	MD-BIGMH	Cat. 3 Total Nitrogen	Open Water	Still insufficient data to assess for nutrients. New data indicate TSS impairment.
			Cat. 3 Total Phosphorus	Open Water	
			Cat. 5 TSS	Shallow Water SAV	
Pocomoke Sound (02130201)	No previous tidal listings	MD-POCMH	Cat. 3 Total Nitrogen	Open Water	Still insufficient data to assess for nutrients. New data indicate TSS impairment.
			Cat. 3 Total Phosphorus	Open Water	
			Cat. 5 TSS	Shallow Water SAV	

Previous 8-digit Tidal Watershed Assessment Units	2006 8-digit Tidal Watershed Listings	New Ches. Bay Assessment Unit	New 2008 Ches. Bay Segment Listings	New Designated Uses Assessed	Explanation
Pocomoke Sound (02130201)	No previous tidal listings	MD-POCOH	Cat. 5 Total Nitrogen	Open Water	Cat. 5 for Nutrients and TSS based on the previous listing and on new data for the Pocomoke Sound portion as well.
Lower Pocomoke River (02130202)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments		Cat. 5 TSS	Aquatic Life and Wildlife	
Lower Pocomoke River (02130202)	Cat. 5 Nutrients	MD-POCTF	Cat. 5 Total Nitrogen	Open Water	Sediments/TSS listings consolidated.
	Cat. 5 Sediments				
Dividing Creek (02130204)	Cat. 5 Nutrients		Cat. 5 Total Phosphorus	Open Water	
	Cat. 5 Sediments				
Nassawango Creek (02130205)	Cat. 5 Nutrients		Cat. 5 TSS	Aquatic Life and Wildlife	
	Cat. 5 Sediments				

This new listing scheme results in a number of changes since 2006. First, to be more consistent with EPA's Assessment Database reporting system, Maryland now lists the specific cause(s) of impairment rather than a more general cause such as nutrients and sediments. As such, all previous generic nutrient listings have now been converted to listings for total nitrogen and total phosphorus for estuarine segments. In the same manner, all estuarine listings for sediment now specify the cause as total suspended solids (TSS) to better identify the actual pollutants addressed by a TMDL. A second important change from the 2006 Bay reporting system is that there are now 5 possible designated uses that may be assessed (for nutrient or sediment related impairments) for each Bay segment whereas the previous system only assessed the aquatic life use for nutrient and sediment impairments. These new designated uses are the shallow-water SAV, open water, deep water, deep channel and migratory spawning and nursery uses. In order to show whether a Chesapeake Bay segment is meeting these uses, Maryland has decided to list each segment-designated use-pollutant combination as a separate record on the Integrated Report. The last important change to note from previous lists is that, in most cases, the number of tidal Chesapeake Bay listings has decreased. This has resulted due to the larger size of the new Bay segments. In many cases one Bay segment overlaps the tidal portions of multiple 8-digit watersheds. However, even though there are fewer listings using the new Bay segmentation, the surface area of water listed as impaired has not changed. In reality, this new segmentation scheme and the assessments that have been developed for it, have vastly improved the confidence in which listing decisions are made. A summary of the assessment results for Maryland's estuarine waters are given in Tables 21 - 25.

Table 21: Size of Estuarine Waters per Category According to Pollutant.

Size of Estuarine Area (sq. miles) per Category according to Pollutant Type							
	Category on the Integrated List						
Cause	**Cat. 1**	**Cat. 2**	**Cat. 3**	**Cat. 4a**	**Cat. 4b**	**Cat. 4c**	**Cat. 5**
Arsenic		0.96					
BOD, Biochemical oxygen demand				31.28			
Cadmium		27.88					4.30
Chlordane				41.36			
Chlorpyrifos		43.22					
Chromium		20.66					2.9
Copper		40.30			Point*		1.03
Cyanide					Point*		
Debris/Floatables/Trash							0.09
Estuarine Bioassessments		694.66	333.05				1,310.99
Fecal coliform		115.96	9.87	47.58			20.03
Lead		28.25					7.14
Mercury					Point*		
Nickel		6.26			Point*		
Nitrogen (Total)		372.76	863.41	102.04			1097.48
Oil spill - PAHs					0.33		
PCBs		40.14		356.92			283.36
Phosphorus (Total)		372.77	863.42	80.76			1100.90
Selenium		0.03					
Silver		0.96					
Total Suspended Solids (TSS)[#]		296.63		0.09			386.23
Toxics							2.00
Zinc		15.29					5.53

Point* - These listings are remnants of the 304(L) list and were originally listed due to the presence of point sources. Thus these listings have no associated sizes.

[#]The total size of areas assessed for TSS do not total the area assessed for the Shallow Water designated use (DU) due to TSS listings for the aquatic life DU.

Table 22: Size of Estuarine Waters in Linear Distance per Category According to Pollutant.

Size of Estuarine Linear Distance (shoreline distance in miles) per Category according to Pollutant Type							
	Category on the Integrated List						
Cause	**Cat. 1**	**Cat. 2**	**Cat. 3**	**Cat. 4a**	**Cat. 4b**	**Cat. 4c**	**Cat. 5**
Debris/Floatables/Trash							9.50
Enterococcus		0.49	0.39				0.66
Fecal coliform		0.15					0.22

Table 23: Designated Use Support Summary for Maryland's Estuarine Waters.

Designated Use		Size of Estuarine Waters (square miles)				
		State Total	Total Assessed	Supporting - Attaining WQ Standards	Not Supporting - Not Attaining WQ Standards	Insufficient Data and Information
Aquatic Life and Wildlife		2,522.40	2,150.19	689.11	1461.08	304.14
Fishing		2,522.40	670.5	40.1	630.4	1,824.5
Water Contact Recreation	General Recreational Waters	2,522.40	2.14	1.44	0.7	2,520.26
	Public Beaches**	185	185	174	5	6
Shellfish Harvesting		2,136.2	2,136.2	2,059.34	67.8	9.06
Migratory Spawning and Nursery***		1,323.4*	97.0	0	97.0	1,226.3
Shallow Water SAV***		667.6	667.6	296.6	371.0	0
Open Water***		2,326.3	2,244.1	1,403.7	758.2	82.2
Deep Water***		1,369.7*	1,369.7	1,191.6	178.1	0
Deep Channel***		1,297.5*	1,297.5	1,004.7	292.7	0

Note:
*Areas are based on total segment surface area. Surface area sizes for each specific designated use have not been defined.
**Public Beach results are reported as the number of beaches, not as surface area or linear extent of water affected.
***Chesapeake Bay specific uses.

Table 24: Size of Estuarine Waters Impaired by Various Sources.

Waterbody Type - Estuary	
Sources	Water Size in Square Miles
Agriculture	162.84
Channel Erosion/Incision from Upstream Hydromodifications	0.09
Contaminated Sediments	246.07
Industrial Point Source Discharge	2.95
Manure Runoff	19.89
Municipal Point Source Discharges	41.94
Pipeline Breaks	0.33
Source Unknown	1915.66
Upstream Source	356.92
Urban Runoff/Storm Sewers	14.29
Wastes from Pets	22.15
Wildlife Other than Waterfowl	5.81

Table 25: Attainment Results for the Chesapeake Bay Calculated Using a Probabilistic Monitoring Design.

Project Name	Chesapeake Bay Benthic Assessment
Owner of Data	Chesapeake Bay Program and Versar Inc.
Target Population	Tidal waters of the Chesapeake Bay (reporting only the MD portion)
Type of Waterbody	Chesapeake Bay Estuary
Size of Target Population	2341.23 (only the MD portion)
Units of Measurement	Square Miles
Designated use	Aquatic Life
Percent Attaining	29.7%
Percent Not-Attaining	56.0%
Percent Nonresponse	14.3%
Indicator	Biology - Estuarine Benthic macroinvertebrate IBI
Assessment Date	4/1/2008
Precision	unknown

C.3.4.2 The Coastal Bays

Maryland's Coastal Bays, the shallow lagoons nestled behind Ocean City and Assateague Island, comprise a complex ecosystem. Like many estuaries, Maryland's Coastal Bays display differences in water quality ranging from generally degraded conditions within or close to tributaries to better conditions in the more open, well-flushed bay regions. Showing the strain of nutrient enrichment, the Coastal Bays exhibit high nitrate levels in the freshwater reaches of streams, excess algae, chronic brown tide blooms, macroalgae blooms, and incidents of low dissolved oxygen. Although seagrass coverage has leveled off over the past three years, large increases in seagrass area have taken place since the 1980s.

Like water quality, the status of Coastal Bays living resources is mixed. While the bays still support diverse and abundant populations of fish and shellfish, human activities are affecting their numbers. Forage fish, the major prey item for gamefish, have been in steady decline since the 1980s and reports of fish kills, usually the result of low oxygen levels, are increasing. Hard clam densities are lower than historic levels but have been generally stable over the past 10 years. Blue crab populations are fluctuating but do not appear to be in decline, despite a relatively new parasite causing summer mortality in some areas. Oysters, which were historically abundant in the Coastal Bays, remain only as small, relict populations. Bay scallops have recently returned after being absent for many decades and are now found throughout the bays, although numbers are low.

In terms of overall water quality, living resources, and habitat conditions, the bays were given the following ranking from best to worst: Sinepuxent Bay, Chincoteague Bay, Assawoman Bay, Isle of Wight Bay, Newport Bay, and St. Martin River. For more information, refer to the 2004 State of the Coastal Bays Report (http://dnrweb.dnr.state.md.us/pressroom/MCB.pdf)

C.3.4.3 2007 National Estuary Program Coastal Condition Report

In spring of 2007, the US Environmental Protection Agency (EPA) released its third in a series of coastal environmental assessments which focused on conditions in the 28 National Estuary Program (NEP) estuaries (online at: www.epa.gov/owow/oceans/nepccr). In this Coastal Condition Report (CCR), four estuarine condition indicators were rated for individual estuaries:

• water quality (e.g., dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll a, water clarity, and dissolved oxygen);
• sediment quality (e.g., sediment toxicity, sediment contaminants, and sediment total organic carbon);
• benthic index and;
• fish tissue contaminants index

For each of these four key indicators, a score of good, fair, or poor was assigned to each estuary which were then averaged to create overall regional and national scores. Based on these calculations, the overall condition of the nation's NEP estuaries as generally fair. Estuaries in the Northeast Coast region where Maryland's two NEP estuaries are located (Coastal Bays; Chesapeake Bay), the water quality index was rated as fair; sediment quality, benthic, and fish tissue contaminants indices were poor and overall condition estuaries were rated poor. Altogether, NEP estuaries showed the same or better estuarine condition than US coastal waters overall.

The report describes a number of major environmental concerns that affect some or all of the nation's 28 NEP estuaries. The goal of this report is to provide a benchmark for analyzing the progress and changing conditions of the NEPs over time. The top three issues, which also affect Maryland's estuaries include:

• Habitat loss and alteration (including dredging and dredge-disposal activities; construction of groins, seawalls, and other hardened structures; and hydrologic modifications);
• Declines in fish and wildlife populations (associated with habitat loss, fragmentation or alteration, water pollution from toxic chemicals and nutrients, overexploitation of natural resources, and introduction of invasive species); and
• Excessive nutrients (nitrogen and phosphorus runoff from agriculturally and residentially applied fertilizers and animal wastes, discharges from wastewater treatment plants, leaching from malfunctioning septic systems, and discharges of sanitary wastes from recreational boats).

C.3.5 Lakes Assessment - Clean Water Act §314 (Clean Lakes) Report

In the federal Clean Water Act (CWA), §314 addresses the Clean Lakes program, which was designed to identify publicly owned lakes, assess their water quality condition, implement in-lake and watershed restoration activities and develop programs to protect restored conditions. This section also requires regular reporting of State efforts and results.

In Maryland, all significant (> 5 acres surface area), publicly-owned lakes are man-made impoundments. A number of specific assessment, planning and restoration activities in Maryland were funded by §314 as early as 1980 until Congress rescinded Clean Lakes funding in 1996. The US Environmental Protection Agency encouraged States to use funds in the §319 (Nonpoint Source Program) to address Clean Lakes priorities, however, no Clean Lake projects have been funded in Maryland through this program because of limited funding and higher priorities (e.g., Chesapeake Bay restoration, Total Maximum Daily Loads).

C.3.5.1 Trophic status

One measure of lake water quality is through classification by overall level of productivity ("trophic condition"). This measure often is based on relative nutrient levels which can affect not only biological community structure, but also certain physical characteristics of lakes:

- **oligotrophic lakes** - usually deep, with low levels of nutrients, plankton and low production rates - often serve well as drinking water sources or as lakes for boating or swimming, but having limited gamefish populations.
- **eutrophic lakes** - generally shallow, with high plankton levels and production rates - often supporting sportfishing for some species, but oxygen may be depleted below the thermocline and during periods of ice cover and may result in fish kills. Diurnal oxygen and pH levels may vary widely. Sportfishing for some fish species may be excellent, but water clarity will be reduced.
- **mesotrophic lakes** - have moderate productivity levels between the above two classifications and serve well as recreational lakes for fishing, boating and swimming activities.

Two other lake trophic classes not found in Maryland include: **dystrophic** or "bog" lakes characterized as having low nutrient levels, but very high color from humic materials and often acidified, and **hypereutrophic** lakes characterized by extremely high nutrient/productivity levels.

The most recent Statewide trophic survey of Maryland's significant, publicly-owned lakes was conducted in 1991 and 1993. For this survey, 58 lakes were identified as meeting the definition of significant, publicly-owned lakes. Since then, two other lakes have been added to this listing:
- Big Piney Reservoir (*Allegany Co.; Casselman River segment)* - 110 ac. Frostburg water supply reservoir that was being rebuilt during this survey when public access was restricted, and
- Lake Artemesia - (*Prince George's Co.; Anacostia River segment*). - a recreational lake created from Metro construction

In addition to publicly-owned lakes, water quality issues at a number of privately-owned lakes have been evaluated and water quality determined to be impaired and either needing a TMDL or just having had a TMDL completed and approved. These include: LaTrappe Pond, Lake Linganore, Lake Lariat, Atkisson Reservoir, and Millington Wildlife Ponds. Trophic condition has not been determined for these lakes.

The State's 60 significant, publicly-owned lakes, surface area, owners and trophic status, and a summary of the trophic status of privately owned lakes are provided in Tables 26 and 27 respectively.

Table 26: Trophic status Maryland's significant, publicly-owned lakes

BASIN	LAKE NAME	SIZE (acres)	OWNER/MANAGER	TROPHIC ASSESSMENT
02120204	Conowingo Pool	2,936.0	Exelon Generation Co.	Meso/Eutrophic
02130103	Bishopville Pond	5.7	Worcester Co.	Eutrophic
02130106	Big Mill Pond	60.2	Worcester Co.	Eutrophic
02130203	Adkins Pond	17.2	MD State Hwy/Wicomico Co.	Eutrophic
02130301	Coulbourn Pond	8.6	Wicomico Co.	Meso/Eutrophic
02130301	Mitchell Pond #2	8.6	City of Salisbury	Eutrophic
02130301	Mitchell Pond #3	5.8	City of Salisbury	Eutrophic
02130301	Schumaker Pond	48.6	City of Salisbury	Meso/Eutrophic
02130301	TonyTank Lake	42.0	Wicomico Co.	Eutrophic
02130301	TonyTank Pond	41.3	MD State Hwy Admin.	Eutrophic
02130303	Allen Pond	35.8	Somerset/Wicomico Co.	Meso/Eutrophic
02130304	Johnson Pond	104.0	City of Salisbury	Eutrophic
02130304	Leonards Mill Pond	45.9	Wicomico Co.	Eutrophic
02130306	Chambers Lake	9.4	Town of Federalsburg	Meso/Eutrophic
02130306	Smithville Lake	40.0	MD DNR	Meso/Eutrophic
02130405	Tuckahoe Lake	86.0	MD DNR	Eutrophic
02130503	Wye Mills Community Lake	61.5	MD DNR	Eutrophic
02130509	Urieville Community Lake	35.0	MD DNR	Meso/Eutrophic
02130510	Unicorn Mill Pond	48.0	MD DNR	Meso/Eutrophic
02130702	Edgewater Village	7.2	Harford Co.	Eutrophic
02130805	Loch Raven Reservoir	2,400.0	Baltimore City	Mesotrophic
02130806	Prettyboy Reservoir	1,500.0	Baltimore City	Mesotrophic
02130904	Lake Roland	100.0	Baltimore City	Eutrophic
02130907	Liberty Reservoir	3,106.0	Baltimore City	Mesotrophic
02130908	Piney Run Reservoir	298.0	Carroll Co.	Meso/Eutrophic
02131001	Lake Waterford	12.0	Anne Arundel Co.	Meso/Eutrophic
02131103	Allen Pond	9.5	City of Bowie	Eutrophic
02131104	Laurel Lake	12.0	City of Laurel	Meso/Eutrophic
02131105	Centennial Lake	50.0	Howard Co.	Eutrophic
02131105	Lake Elkhorn	49.0	Columbia Assn.	Eutrophic
02131105	Lake Kittamaqundi	107.0	Columbia Assn.	Eutrophic
02131105	Wilde Lake	23.0	Columbia Assn.	Eutrophic
02131107	Duckett Reservoir	773.0	Wash. Suburban Sanitary Comm.	Meso/Eutrophic
02131108	Triadelphia Reservoir	800.0	Wash. Suburban Sanitary Comm.	Mesotrophic
02140103	St. Mary's Lake	250.0	MD DNR	Meso/Eutrophic
02140107	Wheatley Lake	59.0	Charles Co.	Mesotrophic
02140111	Myrtle Grove Lake	23.0	MD DNR	Eutrophic
02140203	Cosca Lake	11.0	MD-NCPPC	Eutrophic
02140205	Greenbelt Lake	21.5	City of Greenbelt	Eutrophic
02140205	Pine Lake	5.0	MD-NCPPC	Meso/Eutrophic
02140205	Lake Artemesia	38.0	MD-NCPPC	Unknown
02140206	Lake Bernard Frank	56.0	MD-NCPPC	Eutrophic
02140206	Lake Needwood	74.0	MD-NCPPC	Eutrophic
02140208	Little Seneca Lake	505.0	Wash. Suburban Sanitary Comm.	Mesotrophic
02140208	Clopper Lake	90.0	MD DNR	Mesotrophic
02140303	Hunting Creek Lake	46.0	MD DNR	Mesotrophic
02140501	Big Pool (C&O Canal)	92.4	National Park Service	Meso/Eutrophic
02140502	City Park Lake	5.2	City of Hagerstown	Mesotrophic
02140502	Greenbrier Lake	27.0	MD DNR	Oligo/Mesotrophic
02140508	Blairs Valley Lake	32.2	MD DNR	Meso/Eutrophic
02141002	Lake Habeeb	208.5	MD DNR	Oligo/Mesotrophic
02141005	Wm. Jennings Randolph Reservoir	952.0	Army Corps of Engineers	Oligo/Mesotrophic
02141006	Savage River Reservoir	360.0	Upper Potomac River Assn.	Oligo/Mesotrophic
02141006	New Germany Lake	13.0	MD DNR	Meso/Eutrophic
05020201	Youghiogheny River Lake	593.0	Army Corps of Engineers	Meso/Eutrophic
05020201	Herrington Lake	41.5	MD DNR	Mesotrophic
05020202	Broadford Lake	138.0	Town of Oakland	Meso/Eutrophic
05020203	Deep Creek Lake	4,500.0	MD DNR	Oligo/Mesotrophic
05020204	Cunningham Lake	20.0	Univ. Maryland	Mesotrophic
05020204	Big Piney Reservoir	110.0	City of Frostburg	Unknown

Source: MD Department of the Environment, 1993; 1995

Table 27: Trophic status summary of Maryland's significant, publicly-owned lakes

	Number of lakes	Lake size (acres)
Total lakes	60	21,167.6
Lakes assessed	58	21,009.6
Dystrophic	0	0.0
Oligotrophic	0	0.0
Oligotrophic-Mesotrophic	5	6,047.5
Mesotrophic	11	8,572.7
Mesotrophic-Eutrophic	19	5,380.0
Eutrophic	23	1,009.4
Hypereutrophic	0	0.0
Unknown	2	158.0

Source: MD Department of the Environment, 1993; 1995

C.3.5.2 Pollution control programs

Various existing point and nonpoint source management programs described in this report can be effective in managing pollutant inputs directly to lakes and to lake watersheds. Unlike other water types, lakes have features that complicate the water management process, but also provide more options than other waterbody types. These factors include "residence time" - the time it takes a water parcel to pass through the lake, seasonal stratification and ability of some lake managers to control water levels or to selectively bypass certain layers or water masses.

Unless the impoundment is a run-of-the-river system, lakes (and estuaries) have a longer residence time than free-flowing streams, allowing organic and inorganic substances in the water more time to interact with the biota (primary producers) and sediments. If the lakes are large enough to develop seasonal stratification, new water masses develop, in-lake residence time is modified, and water movements altered. The ability to manage water levels and withdrawals provides management options, but adds to the complexity of managing lake waters for the best possible uses.

Most lakes in Maryland do not have comprehensive lake or watershed management plans that address point and nonpoint source pollution, land cover, or management options that would address pollution control in-lake or in the lake watershed. In most instances, pollutant sources are not a result of direct waste discharges to a lake or its immediate watershed, but are in the watershed upstream of the lake. While large water supply systems invest in lake management plans, often their effectiveness in addressing pollution sources in the watershed varies as the watershed areas often are not controlled by the lake owners. Effective lake management plans require a cooperative relationship with land managers (public agencies and private land owners) in upstream watershed areas to develop cooperative agreements addressing land use, pollution control and funding priorities to protect lake resources.

C.3.5.3 Lake restoration programs

One aspect of the now un-funded §314 Clean Lakes Program was to provide funding for lake restoration activities. After the Clean Lakes Program was de-authorized in 1996, restoration funding for lakes was added to the §319 Nonpoint Source Program as a fundable activity. Grant requirements, priorities and limited funding in this program, however, do not allow for much needed in-lake reclamation activities (e.g., removal/dredging of excess sediments and nutrients, aquatic vegetation control, aquatic and wildlife habitat enhancement, and shoreline stabilization).

Without a directed management program and federal funding support and with comparatively low priority for accessing State water management funding, current lake restoration activities generally are initiated by lake managers (often the owners). With few lake management plans in place, there is often little planning activity or actual effort to address lake water issues until they become severe (and more difficult and costly to address). Lake managers can take advantage of expert resources available from various State agencies (DNR, MDA, MDE), federal agencies (EPA, US Dept. Agriculture) and non-governmental organizations (e.g, North American Lake Management Society; regional lake management organizations in PA and VA) to assist in developing lake management plans and finding available funding sources.

C.3.5.4 Acidification of lakes

Poorly buffered lakes or lakes in mining areas are subject to acidification due to atmospheric deposition or through acid mine drainage. Although several of Maryland's significant, publicly-owned lakes receive acid mine drainage or naturally acidic drainage through free-flowing tributaries (Deep Creek Lake, Jennings Randolph Reservoir), dilution and natural buffering prevent these lakes from becoming acidified.

The MD Bureau of Mines has worked with the US Department of Interior's Office of Surface Mining Reclamation and Enforcement which has partially funded several projects in Cherry Creek (*Garrett Co*.), a major tributary to Deep Creek Lake that is impacted by high acidity from acid mine drainage (AMD) from abandoned mines and low-lying wetlands/bogs. Completion of these AMD projects have measurably reduced mineral acidity, though natural organic acidity from the wetlands remain. Studies of the lake have shown that acidic inflow to Deep Creek Lake, even before AMD projects were installed, is quickly buffered by a natural limestone layer such that water quality of Cherry Creek is not a threat to water quality of the lake.

Wm. Jennings Randolph Reservoir (*Garrett Co.; Upper North Branch Potomac River segment*) receives acid mine drainage from numerous tributaries directly to the lake and to the upstream river from both Maryland and West Virginia. Constructed primarily to manage flows for downstream water quality, the lake volume varies considerably. Although the lake was designed to manage an expected acidic layer, data show that acidic stratification did not occur. The lowest pH levels in the lake rarely were acidic and water quality below the dam was good enough to support a trout hatchery in the tailwaters of the dam. As AMD is managed upstream of the lake, pH levels, even in the river above the lake rarely are acidic and, with gradually increasing productivity, the lake supports an excellent sportfishery.

Information about acidification in small lakes and privately-owned lakes is not widely known, but water quality impacts can be significant and restoration can be successful. Lake Louise (Garrett Co.; Casselman River segment), a privately-owned, 30-acre lake, had a renowned trout fishery. In the 1970's, sulphide-bearing fill material was used in the construction of Interstate 68 through the upper lake watershed. Acidic leachate from this material entered tributaries to the lake, which suffered severe degradation of the ecosystem and loss of the sport fishery within a two-year period. In the 1990's, the State Highway Administration installed a passive treatment system in the upper lake watershed in an effort to reduce the acidic runoff. In 1999, following restoration of water quality in the lake, an aquatic resource restoration program was implemented to re-establish the aquatic community and sport fishery (*http://www.al.umces.edu/Research%20Aquatic%20Ecology/projlakelouise.htm*).

C.3.5.5 Lake status and trends

Maryland agencies do not include lakes in their ambient monitoring programs, although contaminants in selected fish species are tested in some reservoirs on a triennial basis (MDE). Infrequent sampling is done to address fish kills and algal bloom complaints (DNR, MDE) and some water sampling is done to provide input for pollutant loading models (Total Maximum Daily Loads) (MDE). Some water supply reservoirs have routine water monitoring programs in their lakes (e.g., Baltimore City, Washington Suburban Sanitary Commission reservoirs) and, at times, some local agencies and citizen groups will establish monitoring programs in some lakes. Based on available data a summary of the status of Maryland lakes and reservoirs is given in Table 28.

Table 28: Designated use support summary: Maryland lakes and reservoirs (acres), 2007

Designated Use	Size of Impoundments				
	Total Impoundment Acres	Total Assessed	Supporting - Attaining WQ Standards	Not Supporting - Not Attaining WQ Standards	Insufficient Data and Information
Aquatic Life and Wildlife	19,521.9	19,521.9	1,113.0	12,637.9	5,771.0
Fishing	19,521.9	19,521.9	1,456.0	15,884.0	2,181.9
Water Contact Recreation (number of beaches used instead of lake acres)	28	28	28	0	0

<u>C.3.5.5.1 Causes and sources of impairment</u>

Primary causes why lakes do not fully support their uses include toxic metals - primarily mercury which restricts fish consumption, and low oxygen conditions, which reduces available habitat for aquatic organisms. Low oxygen levels are a result of an accelerated eutrophication process caused by nutrients entering the lake or by nutrients being released from sediments. Other causes include pesticides (chlordane) in fish tissue causing a listing as a consumption advisory of selected species, low pH, excessive siltation and aquatic vegetation.

Table 29: Size of Impoundments per Category According to Pollutant.

Size of Impoundments per Category according to Pollutant Type							
	Category on the Integrated List						
Cause	**Cat. 1**	**Cat. 2**	**Cat. 3**	**Cat. 4a**	**Cat. 4b**	**Cat. 4c**	**Cat. 5**
Arsenic		3708					
Cadmium		3708					
Chlordane				98			
Chromium (total)		5113					
Chromium, hexavalent		1508					
Copper		3708					
Lead		6621					
Methylmercury - fish tissue		5019	98	8167			3091
Nickel		3708					
Nitrogen (Total)		27					
PCB in Fish Tissue		2200					4626
Phosphorus (Total)		1113	4565	4555.93			8082
Sedimentation/Siltation		298		2708			3740
Selenium		3708					
Zinc		1508					

As lake water quality is reflective of conditions in the watershed, there are numerous sources of pollutants that may keep a lake from meeting its intended use, Table 30. Overall, one of the principal lake problems is due to the accelerated eutrophication process that characterize most reservoir systems. Nutrients and sediments from various natural and land use activities in the watershed upstream of these impoundments flow into the lake. Nutrients in lake sediments can be recycled into the water column under certain conditions and decomposition of organic material in the sediments can reduce oxygen levels in a stratified lake's deep layer (hypolimnion).

In 2002, metals (methylmercury) and PCBs from fish tissue samples in a number of publicly-owned and private lakes were found at levels that could affect human health if enough fish taken from these systems are consumed. The Department of the Environment identified these lakes and species of affected fish using suggested consumption limits for fish taken from these waters (*http://www.mde.state.md.us/assets/document/fish/advisory_summary.pdf*). Other sources of pollutants include natural conditions (including waterfowl, upstream sources), municipal waste discharges, and urban runoff.

Table 30: Source of impairment: Maryland lakes and reservoirs (acres), 2007

Waterbody Type - Impoundment	
Sources	**Water Size in Acres**
Agriculture	4,126
Atmospheric Depositon - Toxics	11,258
Contaminated Sediments	3,661
Municipal Point Source Discharges	223.93
Non-Point Source	336
Source Unknown	9,047
Urban Runoff/Storm Sewers	2,331

In the Baltimore City water supply reservoirs (Loch Raven, Prettyboy, Liberty Reservoirs), historical trends from an extensive water quality monitoring effort show that total phosphorus concentrations in monitored streams and from wastewater treatment plants have been declining and algal levels in all three reservoirs have gradually improved during the past 15-18 years. Steadily increasing nitrate levels over this period appear to be leveling off. All three reservoirs are still in various states of eutrophication and need further improvement and continued protection. Sedimentation is monitored periodically to assess the practical storage capacity of these systems - last reported as: Loch Raven Reservoir losing about 11 percent of its original volume followed by Prettyboy Reservoir (losing 7.5 percent), and Liberty Reservoir (losing 3.3 percent) (Reservoir Technical Group, 2004).

C.3.5.5.2 National Lake Survey

As part of a national effort to assess the quality of the nation's waters in a statistically-valid manner, EPA used their waterbody database and randomly identified lakes in each state (stratified by State, EPA Region and ecological region). In Maryland, 40 lakes were targeted from which only four would be sampled. EPA requested that Maryland collect field water quality, sediment and habitat data from these sites using nationally-consistent sampling/recording protocols. DNR biologists were trained by EPA and the selected lakes were intensively sampled one time during the late summer 2007 (along with one lake sampled by EPA biologists as a reference lake and one additional lake sampled as a replicate for QC purposes). Water, sediment and biological samples were sent to national labs for analysis and field data were submitted to EPA. The smallest level of reporting with data from Maryland lakes will be at the regional or national level and won't be available until 2009.

C.3.5.5.3 Total Maximum Daily Loads

Pollutant loading models and pollutant caps (Total Maximum Daily Loads - TMDLs) have been defined and approved by EPA for 18 public and privately-owned lakes in Maryland through 2006 for substances including: methylmercury, phosphorus and total suspended solids (**Section F.4**). Another eight (8) lakes are identified as impaired and need TMDLs for pollutants including nutrients, phosphorus, total suspended solids, methylmercury and PCBs. One lake (Edgewater Village Lake) which cannot meet water quality standards even under the most stringent of controls is slated for a change in designated use (i.e., a Use Attainability Analysis).

C.3.6 Non-tidal Rivers and Streams Assessment

Maryland has two major monitoring programs for assessing non-tidal waters. One is the probabilistic Maryland Biological Stream Survey (MBSS) and the other is the CORE/TREND program for assessing water quality trends at fixed locations. The MBSS program uses fish and aquatic insects as indicators of aquatic health while the CORE/TREND program focuses on conventional water quality parameters (temperature, pH, etc.) as well as nutrient species. The following summaries highlight the results of these programs.

Table 31: Statewide results for the MBSS Program.

Project Name	Maryland Biological Stream Survey
Owner of Data	MD Dept. of Natural Resources (MANTA)
Target Population	All 1st through 4th order nontidal wadeable streams in MD
Type of Waterbody	1st through 4th Order Wadeable Streams
Size of Target Population	9,199.3
Units of Measurement	Miles
Designated use	Aquatic Life
Percent Attaining	19.0%
Percent Not-Attaining	30.6%
Percent Nonresponse	50.4%
Indicator	Biology - freshwater fish and benthic macroinvertebrate IBIs
Assessment Date	4/1/2008

C.3.6.1 Trend Monitoring

Various statistical approaches are used to define changes in water quality over time to document annual/seasonal variability and how water quality changes in response to water management programs. In the past, EPA has sought to incorporate trend results into the State's assessment methodology, however, an increasing or declining trend in water quality may not signify "improvement" or "degradation". Water quality trend results are not used in the State's water quality assessment or watershed listing process.

Ambient water quality data often do not support the statistical requirements for using parametric statistics. Data transformations (e.g., using statistically significant streamflow-concentration regression residuals) and non-parametric approaches, such as seasonal Kendall's tau (to address seasonality) and LOWESS smoothing (to adjust for serial correlation) may be necessary. Recently, as more data have been collected, some trend results are found to be better explained using a polynomial approach to document reversals in water quality trends (often explaining water quality improvements that are being surpassed by increased watershed development).

Maryland's baseline CORE monitoring program has collected water quality samples from significant non-tidal streams (fourth order and larger) in Maryland each month since the early 1980's. At some sites, samples have been collected regularly since the middle 1970's. Status and trends in water quality condition are determined annually at 54 locations for selected parameters. Trends based on CORE data are determined for a 20-year period (Calendar Year 1986-2006) using the Seasonal Kendall's tau, a statistical test that addresses seasonal variation. These data are not adjusted for streamflow.

The US Geological Survey (USGS) also conducts long-term sampling for nutrient species and sediments at four non-tidal River Input monitoring stations on Susquehanna River (Conowingo Dam), Potomac River (Little Falls), Patuxent River (Governor's Bridge Road) and Choptank River (Red Bridges Road). Regression trends based on USGS data are determined over a nearly similar 22-year period (Water Year 1984-2006). Results presented here are not adjusted for streamflow to provide a level of comparability.

In most instances, there are no statistically significant, long-term trends in water quality conditions. Where they occur, significant trends are summarized below:

- **Temperature** - significant increasing trends observed at four stations (Georges Creek, Susquehanna River, Potomac River at Little Falls, and upper Patuxent River); significanrt decreasing trends in temperature were detected on the lower Patapsco River (US Route 1).
- **pH** - Increasing trends were evident at 37 percent of the sites. Decreasing trends were observed on Catoctin Creek (MD route 464), Gunpowder River between Prettyboy and Loch Raven Reservoirs, and the Choptank River.
- **Conductivity** - Increasing trends were observed in two thirds (67 percent) of the stations; decreasing trends occurred at three sites; two located in the lower free-flowing Potomac River (Point of Rocks and Whites Ferry) and a third site located on the lower Susquehanna River.
- **Suspended solids** - Decreasing trends observed at four stations (Gwynns and Jones Falls, upper/lower Patapsco River, and upper/middle/lower Monocacy River); an increasing trend was observed on the lower Susquehanna River.
- **Turbidity** - Decreasing trends occurred at 65 percent of these stations; four sites in western Maryland (Braddock Run, Casselman River, Cherry Creek, and the lower Youghiogheny River at Friendsville) were found to have increasing trends.
- **Total nitrogen –** Decreasing trends observed at 79 percent of the stations; with an increase observed on the Choptank River. The USGS analysis of results from the Patuxent River (near Bowie) showed a significant, declining trend.

- **Ammonium –** Decreasing trends were observed at 25 percent of all stations; an increasing trend was observed for the Choptank River - reflecting the increasing Total Nitrogen trend there.
- **Total phosphorus –** Twenty-four sites had decreasing trends - predominantly in the eastern Upper Potomac Basin and the urban/agricultural corridor north of Washington and Baltimore. On the Choptank River, analysis of both MD and USGS datasets showed increasing trends in overlapping, long-term datasets.

C.3.6.1.1 Overall Non-tidal River and Stream Assessment Results

Other monitoring projects initiated on an ad-hoc basis have helped to supplement the MBSS and Core Trend Monitoring programs and have helped to assess for other pollutants not captured by these assessments. Tables 32 – 34 provide statewide assessment data for non-tidal rivers and streams.

Table 32: Extent of River/Stream Miles per Category According to Pollutant.

Number of River Miles per Category according to Pollutant Type							
	Category on the Integrated List						
Cause	Cat. 1	Cat. 2	Cat. 3	Cat. 4a	Cat. 4b	Cat. 4c	Cat. 5
Aluminum		121.53	15.32				10.89
Arsenic		424.59					
BOD, Biochemical oxygen demand		88.00					
BOD, carbonaceous		226.32		136.72			
BOD, nitrogenous		226.32		136.72			
Cadmium		651.05					152.82
Chromium (total)		137.64					
Chromium, hexavalent		209.66					
Chromium, trivalent		225.03					
Combination Benthic/Fishes Bioassessments		1762.9	3,893.05				3480.55
Copper		454.10					
Cyanide		68.39					
Debris/Floatables/Trash							171.19
Enterococcus							17.80
Fecal coliform		291.14	78.5	156.25			291.98
Heptachlor Epoxide							171.19
Iron			121.53				26.21
Lead		516.02					
Manganese		106.58					41.16
Mercury		276.85					
Methylmercury - fish tissue							226.46
Nickel		424.59					
Nitrogen (Total)		1272.23	146.30				
PCB in Fish Tissue			67.30				1159.60

PCBs - water							171.19
pH, High							88.00
pH, Low		435.07	6.14	785.78	5.10		14.35
Phosphorus (Total)		1272.23	146.30	43.53			3389.31
Selenium		424.59					
Silver		147.74					
Total Suspended Solids (TSS)		258.22		1052.62			3277.48
Zinc		486.60					76.61

Table 33: Designated Use Support Summary for Non-tidal Rivers and Streams.

Designated Use	Size of River/Stream Miles				
	Total River miles	Total Assessed	Supporting - Attaining WQ Standards	Not Supporting - Not Attaining WQ Standards	Insufficient Data and Information
Aquatic Life and Wildlife	10,820	9,199.3	1,516.2	3,911.0	5392.8
Fishing	10,820	1,728.4	0	1,728.4	9091.6
Water Contact Recreation	10,820	1,417.1	701.3	637.2	9481.5
Agricultural Water Use	10,820	10,820	10,820	0	0
Industrial Water Use	10,820	10,820	10,820	0	0

Table 34: Summary of Sizes of Waters Impaired by Various Sources.

Waterbody Type - River	
Sources	Water Size in Miles
Acid Mine Drainage	835.50
Agriculture	133.59
Atmospheric Depositon - Toxics	226.46
Contaminated Sediments	1159.60
Discharges from Municipal Separate Storm Sewer Systems (MS4)	7.90
Livestock (Grazing or Feeding Operations)	596.07
Municipal Point Source Discharges	53.34
Non-Point Source	231.73
Source Unknown	5742.26
Urban Runoff/Storm Sewers	322.96

C.3.7 Wetlands Program

MDE received a grant from the U.S. Environmental Protection Agency in 2005 to develop a statewide wetland monitoring and assessment strategy. The Maryland Department of Natural

Resources (DNR) was a co-applicant for the grant but resigned from active participation under the grant in 2008. Both agencies participated in discussions and work groups for the Mid-Atlantic work group for wetland monitoring, as well as participated on a national advisory group. There are multiple objectives for Maryland's wetland monitoring and assessment program, which will be related to other regulatory and non-regulatory wetland management programs:

1) Meet 305(b) reporting requirements;
2) Improve existing wetland and waterway regulatory programs;
3) Provide additional information for targeting wetland/waterway restoration and protection efforts;
4) Comply with TMDL requirements, if applicable;
5) Develop use designations and water quality standards for wetlands;
6) Assist in evaluating the effectiveness of compensatory mitigation and voluntary restoration projects;
7) Improve our ability to comprehensively assess landscape and watershed function;
8) Develop the capability to study and assess the status of wetland condition over time; and,
9) Make wetland condition and functional value information available for use in federal, State, local and citizen group-driven natural resource conservation and restoration efforts (examples include Tributary Strategies, TMDL implementation plans, Green Infrastructure Assessment, Strategic Forest Lands Assessment, etc.).

Maryland has made some strides in the development of tools for the assessment of landscapes, including wetlands, for the condition of the habitats these landscapes provide. These tools may have a place in the development of wetland condition monitoring. Several pilot projects have taken place or are underway, including those in the Nanticoke and Patuxent watersheds; tidal wetlands of the Nanticoke watershed; and wetlands in the Piedmont region. A work group of State agency representatives has met several times to discuss goals for the strategy. There is a general consensus to monitor for both wetland condition and function. A draft system for classifying wetlands for monitoring purposes was prepared by MDE and DNR.

The next steps are to convene a larger work group of State, federal, and local agency representatives; university researchers; and other stakeholders to receive input on strategy development. An analysis of existing wetland methods for applicability in Maryland will continue. A pilot field study will also be undertaken. The final strategy is scheduled for completion in 2009.

C.3.8 Invasive aquatic species

'New' species of viruses, animals, and everything in-between (e.g., amphibians, reptiles, birds, insects, plants, fish, shellfish, even jellyfish) are being introduced at an ever increasing rate into Maryland. Since colonization in fact, new species have been introduced through a variety of pathways, including the ship ballast, in packing materials, and through deliberate import for various uses. While most of these introduced species are beneficial or benign, about 15 percent become invasive - showing a tremendous capacity for reproduction and distribution throughout its new environment. These invasive species can have a negative impact on environmental, economic, or public welfare priorities

Many introduced species once thought to be beneficial (e.g., grass carp, mute swans, and nutria) have demonstrated invasive characteristics and are proving difficult to control - out-competing native species (species of plants and animals that have evolved in the State and have developed mutually-sustaining relationships to each other over geologic time) for food, shelter, water or other resources, as well as affecting economic interests and human welfare.

Some of the many aquatic invasive species that have recently consumed a significant level of State and federal agency resources include:

- mute swans *(Cygnus olor)*
- nutria *(Myocaster coypus)*
- zebra mussels *(Dreissena polymorpha)*
- Hydrilla (*Hydrilla verticillata*)
- water chestnut *(Trapa patens)*
- phragmites *(Phragmites australis)*
- purple loosestrife *(Lythrum salicaria)*
- wavyleaf basketgrass (*Oplismenus hirtellus* ssp. *undulatifolius*)
- Chinese mitten crab *(Eriocheir sinensis)*
- several species of crayfish
- snakehead *(Channa argus)*

Several invasive species of mussels that can affect water quality and use of waters (obstructing water intakes) have been found in the Susquehanna River watershed in Pennsylvania and/or New York (D. Heicher, pers. comm., 2007). Their presence in these headwaters to Chesapeake Bay ultimately may result in their introduction into Maryland in the future. These include the Zebra mussel (*Dreissena polymorpha*) and Quagga mussel (*Dreissena rostriformis*) status

Information about these and other invasive species are available online from the Department of Natural Resources (http://www.dnr.state.md.us/invasives/), the Smithsonian Research Center, and the US Department of Interior's Fish and Wildlife Service and Geological Survey.

In 2007, the Department of Natural Resources created an Invasive Species Matrix Team to study and direct scientifically-based policy and management responses to the ecological, economic, and public health threats of invasive species in Maryland's native ecosystems (contact Jonathan McKnight at: 410-260-8539; mailto: jmcknight@dnr.state.md.us or Dr. Ron Klauda at: 410-260-8615; mailto:rklauda@dnr.state.md.us). Specific objectives of this intra-agency team are to:

- Provide recommendations to the Secretary on invasive species policies and regulations.
- Develop a framework for surveillance and monitoring programs designed to detect invasive species introductions and track their dispersal.
- Coordinate rapid response efforts when new invasive species are detected.
- Recommend agency actions and public education programs to prevent new introductions and control the increase/spread of invasive species into non-infested landscapes/waters.
- Develop a list of non-native species introductions into Maryland.

- Share and interpret data, knowledge, and experience on invasive species within Maryland, as well as other state, local, interstate, and federal agencies.
- Develop an Invasive Species Management Plan for Maryland, in cooperation with other organizations, that provides a coordinated, multi-agency strategy to achieve the objectives listed above.

C.3.9 Public Health Issues

C.3.9.1 Waterborne Disease

In the *Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water - United States, 2003-2004* (US Centers for Disease Control, 2006), data was summarized from the Waterborne Disease and Outbreak Surveillance System, which tracks the occurrences and causes of waterborne disease and outbreaks associated with recreational water (both natural and artificial (e.g., pool, spa) waters are included. During 2003 and 2004, waterborne disease and outbreaks associated with recreational water were reported by more than half of the States.

One bacterial outbreak of gastroenteritis in an unnamed lake in Maryland in July 2003 resulted in 65 people reporting an illness. In this case, both *Shigella* and *Plesiomonas* was determined to be the cause associated with fecal accidents (5 - 10 diapers were reportedly retrieved from the lake each week) and sewage contamination as the source of the bacterial contamination.

This report also identified illnesses due to the naturally-occurring aquatic bacteria, *Vibrio sp.* The cases are associated with recreational water (no evidence that contact with seafood or marine life might have caused infection) in 16 States. Five cases of illness were reported from *Vibrio sp.* infections with one death in Maryland waters in 2003-2004. These entailed three different *Vibrio* species isolated from these occurrences, including: *Vibrio alginolyticus* (2 cases, 1 death); *Vibrio parahaemolyticus* (1 case), *Vibrio vulnificus* (2 cases). In this report, nearly all *Vibrio* patients reported that they were exposed to coastal recreational water mostly during the summer and most frequently during July and August. Activities associated with *Vibrio* infections included swimming, diving, or wading in water, walking or falling on the shore or rocks and boating, skiing, or surfing.

C.3.9.1.1 Research Summary

In 2006, US Environmental Protection Agency's (EPA) Office of Research and Development and Office of Water published a series of papers summarizing the research conducted on waterborne disease in the last 10 years. The work includes research supported by EPA and others and is limited to gastrointestinal illness as the health effect of concern. The 1996 Safe Drinking Water Act Amendments mandated that EPA and the US Centers for Disease Control (CDC) and Prevention conduct five waterborne disease studies and develop a national estimate of waterborne disease. In response, EPA, CDC, and other authors produced a series of papers that reviews the state of the science, methods to make a national estimate of waterborne disease, models that estimate waterborne illness, and recommendations to fill existing data gaps. The papers represent the most comprehensive review conducted in the last 25 years and the first publication of modeling information that estimates waterborne illness on a national level. The

papers have been published and are online at:
http://www.epa.gov/nheerl/articles/2006/waterborne_disease.html.

C.3.9.2 Drinking Water

The Maryland Department of the Environment (MDE) is charged with ensuring that all Marylanders have a safe and adequate supply of drinking water. The Department has programs to oversee both public water supplies, which serve about 84 percent of the population's residential needs, and individual water supply wells, which serve citizens in most rural areas of the State. Marylanders use both surface water and ground water sources to obtain their water supplies. Surface water sources such as rivers, streams, and reservoirs serve approximately two-thirds of the State's 5.1 million citizens. The remaining one-third of the State's population obtains their water from underground sources. For more details on the State's drinking water programs, go to http://www.mde.state.md.us/Programs/WaterPrograms/Water_Supply/index.asp

C.3.9.3 Shellfish Harvesting Area Closures

Maryland's Chesapeake Bay waters have long been known for their plentiful shellfish. To protect this valuable resource and safeguard public health the Maryland Department of the Environment is responsible for regulating shellfish harvesting waters.

Shellfish include clams, oysters, and mussels. The term shellfish does not include crabs, lobsters, or shrimp. Shellfish are filter-feeding animals: they strain the surrounding water through their gills which trap and transfer food particles to their digestive tract. If the water is contaminated with disease-causing bacteria, the bacteria are also trapped and consumed as food. If shellfish are harvested from waters which the Department has restricted (closed) and eaten raw or partially cooked, they have the potential to cause illness. Therefore, it is mandatory for oysters and clams to be harvested from approved (open) shellfish waters only.

Shellfish harvesting waters which are open or approved for harvesting are those where harvesting is permitted anytime. Areas which are conditionally approved mean that shellfish harvesting is permitted except for the three days following a rain event of greater than one inch in a twenty-four hour period. Runoff from such a rainfall can carry bacteria into surface waters from adjacent land. Information about which areas have conditional closures is updated daily on the web and via a phone message. Click http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/shellfish_advisory/ to find out which conditional closures are in effect or call 1-800-541-1210.

The Department of the Environment has also created maps that summarize oyster & clam harvesting waters as of June 1, 2007 (http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/pop_up/shellfishmaps.asp). The maps depict the classification of shellfish growing waters of the State as restricted, conditionally approved, or approved.

Also shown in the maps are Shellfish areas closed as reserves and sanctuaries by the Department of Natural Resources (DNR). Sanctuaries are areas which are closed to shellfish harvest and often contain oyster restoration projects to help enhance oyster populations for their environmental benefits. These areas are permanent closures. Reserves are areas which are restored, then opened for periodic harvest when certain criteria are met.

C.3.9.4 Toxic contaminants Fish consumption advisories

The Maryland Department of the Environment (MDE) is responsible for monitoring and evaluating contaminant levels in fish, shellfish and crabs in Maryland waters. The tissues of interest for human health include the edible portions of fish (fillet), crab (crabmeat and "mustard"), and shellfish ("meats"). Such monitoring enables MDE to determine whether the specific contaminant levels in these species are within safe limits for human consumption. Results of such studies are used to issue consumption guidelines for recreationally caught fish, shellfish, and crab species in Maryland (see our http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/). Additionally, since fish, shellfish, and crabs have the potential to accumulate inorganic and organic chemicals in their tissues (even when these materials are not detected in water), monitoring of these species becomes a valuable indicator of environmental pollution in a given waterbody.

C.3.9.4.1 Fish Tissue Monitoring

The Maryland Department of the Environment has monitored chemical contaminant levels in Maryland's fish since the early 1970s. The current regional watershed sampling areas divide the State waters into four watersheds:

- Western Maryland watershed,
- Chesapeake Bay tributary watershed,
- Coastal Bays watershed, and
- Baltimore/Washington urban watershed.

Maryland routinely monitors watersheds within these four zones on a 5-year cycle. When routine monitoring indicates potential hazards to the public and environment, additional monitoring of the affected area may be conducted to verify the initial findings and identify the appropriate species and size classes associated with harmful contaminant levels. Findings from such studies (See http://www.mde.state.md.us/CitizensInfoCenter/Fishandshellfish/risk/index.asp) are the basis for the fish consumption guidelines (find our guidelines at: http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/index.asp#).

The types of fish sampled include important predatory game species (such as small mouth bass and striped bass), common recreational panfish species (white perch, bluegill, crappie) as well as, bottom dwelling, accumulator species with relatively high fat content (such as carp, catfish and American eel). Also, periodically MDE conducts intensive surveys of contaminant levels in selected species in specific water bodies. Past targets of intensive surveys conducted in Patapsco River/Baltimore Harbor included: white perch, channel catfish, eel, and striped bass.

C.3.9.4.2 Shellfish Monitoring

Since the 1960's, the Maryland Department of the Environment has been surveying metal and pesticide levels in oysters and clams from the Chesapeake Bay and its tributaries. Prior to 1990, this effort was conducted every one or two years. In response to low levels of contaminants found and very little change from year to year, the bay-wide monitoring is conducted every three years. This allows MDE to devote its limited resources towards intensive surveys.

During the last monitoring season, MDE collected and tested 500 oysters from 20 locations within the Maryland portion of the Chesapeake Bay. While there were no chemical contaminants at levels of concern in any of the oysters sampled, recreational harvesters should still be aware of possible bacterial contamination and avoid shell-fishing in areas that are closed to commercial shellfish harvesting.

C.3.9.5 Harmful Algal Blooms

Algae are a natural and critical part of our Chesapeake and Coastal Bays ecosystems. Algae, like land plants, capture the sun's energy and support the larger food web that leads to fish and shellfish. They occur in a size range from tiny microscopic cells floating in the water column (phytoplankton) to large mats of visible "macroalgae" that grow on bottom sediments.

Algae may become harmful if they occur in an unnaturally high abundance or if they produce a toxin. A high abundance of algae can block sunlight to underwater bay grasses, consume oxygen in the water leading to fish kills, produce surface scum and odors, and interfere with the feeding of shellfish and other organisms that filter water to obtain their food. Some algal species can also produce chemicals that are toxic to humans and aquatic life. Fortunately, of the more than 700 species of algae in Chesapeake Bay, less than 2 percent of them are believed to have the ability to produce toxic substances.

Both the Departments of Environment and Natural Resources respond to reports of fish kills and nuisance algae blooms (see http://www.dnr.state.md.us/bay/hab/ and http://www.mde.state.md.us/Programs/MultimediaPrograms/environ_emergencies/FishKills_MD/index.asp). Results for 2007 are not yet in, but 2006 only saw 1 fish kill induced by a toxic algae bloom and since 1984 there have been only 6 occurrences. Both MDE and DNR will continue to work with the Bay Program to develop, where appropriate, standards or other measures to protect both human health and aquatic life from harmful algal blooms.

C.3.9.6 Bathing Beach Closures

The Maryland Department of the Environment works with local health departments to enhance beach water quality monitoring and improve the public notification process regarding beach water quality in Maryland. In October 2000, the U.S. Environmental Protection Agency (EPA) passed the Beaches Environmental Assessment and Coastal Health (BEACH) Act and provided funding to improve beach monitoring in coastal states. Maryland's Beaches Program was established to protect the health of Marylanders at public bathing beaches. The program has evolved further to comply with the requirements of the federal BEACH Act of 2000. This program is administered by MDE; however, the responsibility of monitoring and public notification of beach information is delegated to the local health departments (http://www.mde.state.md.us/CitizensInfoCenter/Health/beaches_healthdepts.asp). To protect the health of citizens visiting beaches across Maryland, MDE's Beaches Program is working to standardize and improve recreational water quality monitoring in the State. The following key objectives outline EPA's and Maryland's Beaches Program:

1. Provide better public information regarding beach water quality; and

2. Promote scientific research to better protect the health of beach users.

The BEACH Act allows states to define and designate marine coastal waters (including estuaries) for use for swimming, bathing, surfing, or similar water contact activities. The State of Maryland defines beaches in the Code of Maryland Regulations (COMAR, http://www.dsd.state.md.us/comar/). In COMAR, beaches means, "natural waters, including points of access, used by the public for swimming, surfing, or other similar water contact activities." Beaches are places where people engage in, or are likely to engage in, activities that could result in the accidental ingestion of water. In Maryland, the beach season is designated from Memorial Day to Labor Day.

Maryland's water quality standards and regulations for beaches are published in COMAR 26.08.09 and 26.08.02.03. Some points included are:

1. *E. coli* and *Enterococci* are the bacteriological indicators for beach monitoring;

2. Prioritization of monitoring of beaches based on risk; and

3. All beaches, whether permitted or not, now receive protection.

C.3.10 Other Data Sources

Both MDE and the Department of Natural Resources received and reviewed water quality data from other local, non-profit and volunteer monitoring organizations. A list of those organizations is provided below.

1. Baltimore Harbor watershed Association (http://www.baltimorewaters.org/index.html)
2. Baltimore County (http://www.baltimorecountymd.gov/Agencies/environment/index.html)
3. Montgomery County (http://www.montgomerycountymd.gov/deptmpl.asp?url=/content/dep/monitoring/home.asp)
4. Alliance for Chesapeake Bay (http://www.alliancechesbay.org/)
5. Stream Waders (http://www.dnr.state.md.us/streams/mbss/w_faq.html)
6. South River Federation (http://www.southriverfederation.net/)
7. District of Columbia (http://www.dchealth.dc.gov/doh/site/default.asp)
8. Baltimore City (http://www.ci.baltimore.md.us/)
9. Audubon Naturalist Society (http://www.audubonnaturalist.org/)

10. Maryland Coastal Bays Program (http://www.mdcoastalbays.org/)
11. Susquehanna Flats Stream Monitoring Program
12. Talbot County Creekwatchers
13. Port Tobacco River Conservancy (http://porttobaccoriver.org/)
14. Chester River Association (http://www.chesterriverassociation.org/)

PART D: Ground Water Monitoring and Assessment

Senate Joint Resolution No. 25 of 1985 requires the Maryland Department of the Environment (MDE) to provide an annual report on the development and implementation of a Comprehensive Ground Water Protection Strategy in the State and on the coordinated efforts by state agencies to protect and manage ground water. The most recent report provides an overview of the Fiscal Year 2007 activities and accomplishments of State programs that are designed to implement Maryland's Comprehensive Ground Water Protection Strategy.

Since the development of the original strategy, a variety of state programs at MDE, the Maryland Department of Agriculture (MDA) and the Maryland Department of Natural Resources (DNR) have endeavored to achieve this goal. These programs continue to be strengthened by the implementing agencies and this report is prepared annually to describe programmatic activities from all three state agencies that contribute toward protecting ground water resources and characterizing the quality and quantity of these resources.

Ground water remains an abundant natural resource that serves as a significant source of drinking water in Maryland. About 31 percent of the State's population depends on ground water for drinking water supply, and ground water also serves as a critical source of base flow to the State's rivers and streams and a major source of freshwater to the Chesapeake Bay. As population continues to grow in Maryland, the demand for additional ground water supplies is increasing. The ongoing ground water protection efforts described in this report must be continued and strengthened to ensure that this important resource is protected for future generations.

Specific accomplishments for Fiscal Year 2007 (July 1, 2006 – June 30, 2007) are highlighted below:

- The Advisory Committee on the Management and Protection of the State's Water Resources met eight times during FY 2007. The Committee continues to evaluate the complex issues related to managing Maryland's water supply resources. The Committee issued an Interim Report in June 2006, and will publish a final report by July 1, 2008.

- The Maryland Department of Planning and MDE have published written guidance to assist local governments in developing a Water Resources Element for inclusion in their Comprehensive Plans, in accordance with HB 1141, which was signed into law in 2006. The Water Resources Element will ensure that local comprehensive plans fully integrate water resources issues and potential solutions, including insuring that water resources are adequate to meet water supply needs and assimilate treated wastewater.

- The Bay Restoration Fund (BRF) has awarded grants totaling approximately nine million dollars to ten jurisdictions. The grants will finance approximately 700 septic system upgrades. The highest priority was given to proposals that directly address failing onsite sewage disposal systems in either the Chesapeake Bay Critical Area or the Maryland Coastal Bays Critical Area, although grants are not limited to these areas only.

- MDE produced the video, "Onsite Sewage Disposal Systems – Protecting Your System – Preserving the Bay". This video, which won a prestigious Aegis Award for video production, teaches homeowners about the care of septic systems and about the connection between septic systems and the Bay while also informing property owners about the availability of BRF funds to upgrade septic systems.

- As of the summer of 2006, MTBE is no longer being added to gasoline being supplied to Maryland. This removal was a business decision by the gasoline suppliers and not a regulatory mandate. MTBE was replaced with ethanol to meet EPA reformulated gasoline standards. It is expected that this change will reduce MTBE levels in groundwater over the long term.

- MDE's Oil Control Program improved protection of ground water from contamination by motor fuel by enacting a specialized tank inspection program which requires owners of certain underground storage systems in Maryland to have the storage system inspected by a certified private inspector. The inspector must conduct a detailed site inspection and report to MDE.

- MDE's Oil Control Program also improved protection in High Risk Groundwater Use Areas of certain counties by requiring additional water quality monitoring. Facilities that fail to perform these tests face MDE enforcement actions and the cut off of their fuel supply.

- Senate Bill 970 was signed into law on May 8, 2007 and codified as Chapter 365. This new law exempts most small water users (5,000 gallons per day or less) from the requirement to obtain a water appropriation permit and provides specified penalties for misappropriation or misuse of water. The new law will allow MDE to better allocate resources to address larger and more complex permits, and to better enforce existing permit requirements.

- Phase I work continued on the Regional Coastal Plain Assessment of the Maryland Coastal Plain. Activities included developing a "beta" version of an aquifer information system (a prototype of which was delivered to the Maryland Department of the Environment) and documenting the hydrogeologic characteristics of the aquifer system. The study expected to be completed in 2013, and will facilitate scientifically sound management of the ground water resources in the Maryland Coastal Plain.

- MDE has entered into consent agreements with several communities that have committed to growth that existing water supplies can't support. The consent agreements lay out plans for controlling growth, reducing demand, and developing new water sources.

Those stakeholders interested in the full groundwater report can send an email request to 303d@mde.state.md.us.

PART E: Public Participation

MDE utilizes a public participation process for Integrated Report (IR) similar to that used for promulgation of new regulations. The Administrative Procedures Act mandates that a minimum of 45 days from the date of publication in the Maryland Register must be allowed for the adoption of new regulations [see Annotated Code of Maryland, State Government Article, § 10-111(a)]. Thirty of those 45 days must be available for public review and comment. The Department feels that public participation is a vital component of IR development and therefore grants 45 days for public review alone. The draft Integrated Report is made available in both electronic and hard copy format to the public via the Internet (www.mde.state.md.us), through distribution to local libraries, and by direct mailing (see Informational Public Meeting Announcement on next page).

During this open comment period for the IR, informational public meetings are held in the western (Hagerstown), eastern (Salisbury), and central (Baltimore) regions of the State to facilitate dialogue between MDE and stakeholders concerning the format, structure, and content of the draft IR. MDE also engages interstate river basin commissions, Maryland tributary teams, and watershed councils during the public comment period and gives full presentations on the Maryland Integrated Report as requested.

Comments or questions may be directed in writing to the Department. All comments submitted during the public review period are fully addressed in a comment response document included with the final List submitted for EPA approval. Sufficient time is built into IR development to allow MDE to receive and fully respond to all public comments on the List.

E.1 Informational Public Meeting Announcement: Maryland's Draft 2008 Integrated Report

The federal Clean Water Act requires that States assess the quality of their waters every two years and publish a list of waters not meeting the water quality standards set for them. This list of impaired waters is included in the State's biennial Integrated Report (IR). Impaired waters identified in Category 5 of the IR may require the development of Total Maximum Daily Loads (TMDLs). The Maryland Department of the Environment (MDE) is announcing the availability of the Draft 2008 IR for public review and comment. The public review period will run from **March 12 to April 28, 2008**. The Draft IR is being posted on MDE's website at http://www.mde.state.md.us and will be advertised in the Maryland Register. Copies of the document will also be available at selected county library branches statewide; a list of those libraries will be available on MDE's web site or by calling Ms. Linda Watson at (410) 537-3906. The Draft IR may also be requested in writing from Ms. Watson at the address below.

The Department will host three informational public meetings. The public is cordially invited to attend a meeting in a region of their choice. Any hearing impaired person may request an interpreter to be present at the meeting by giving five (5) working days notice to Matthew Rowe at mrowe@mde.state.md.us or by calling (410) 537- 3578. Comments or questions may be directed in writing to Linda Watson MDE, Science Services Administration, 1800 Washington Blvd., Baltimore Maryland 21230, emailed to 303d@mde.state.md.us, or faxed to the attention of Ms. Linda Watson at 410-537-3873 on or before **April 28, 2008**. After addressing all comments received during the public review period, a final List will be prepared and submitted to the US EPA for approval.

Eastern Shore Region
Location: Salisbury
Date: April 22, 2008
Time: 6:00-8:00
Wicomico Co. Library
Room 1
122 S. Division St.
Salisbury, MD 21803
(410) 749-5171
This meeting is co-sponsored by the Lower Eastern Shore Tributary Team.

Directions: From Business Route 50, turn south on Division Street. The library is three blocks down on the right, across from the fire department.

Western Maryland Region
Location: Hagerstown
Date: April 14, 2008
Time: 6:00-8:00
University System of Maryland
at Hagerstown, Room 124
32 W. Washington St.
Hagerstown, MD 21740
(240) 527-2060
This meeting is co-sponsored by the Upper Potomac Tributary Team.

Directions: From points east, take I-70 west to the Route 40 West Hagerstown exit. Proceed east approximately two miles to Washington Ave. Continue east until you merge with West Washington Street. Parking is located on both sides of the street.

Central Region
Location: Baltimore
Date: April 15, 2008
Time: 6:00-8:00
MDE Headquarters
1800 Washington Blvd.
Baltimore MD, 21230
(410) 537-3873

This meeting is co-sponsored by the Patapsco/Back River Tributary Team.

Directions: From points North, take I-95 South. Go through the Fort McHenry Tunnel. Exit at Exit 53 (I-395/Martin Luther King Boulevard). Follow signs to Martin Luther King Boulevard to the right. Get into the left lane after exiting. At the first traffic light, make a left onto Washington Boulevard. Follow Washington Boulevard for approximately one mile. Cross over Monroe Street. Make a right into the Red parking lot. Meeting will take place in the Aqua Meeting room on the first floor.

E.2 Attendance Lists from Informational Public Meetings

MDE

Integrated Report Public Meeting Sign-in Sheet
Hagerstown, MD April 14, 2008

please print

Name	Address	Affiliation	email
Bruce Michael		DNR	bmichael@dnr.state.md.u
Mike Thompson		Wash Co Planning	mthompson@washc
DAVID SWAIN		WASH CO DWQ	dswain@washco-md.n
Julie Pippel		Wash Co. Div. of Env. Mngt.	jpippel@washco
Emilie Cooper		WMRC&D/DNR	ecooper@dnr.state.md

Integrated Report Public Sign-in Sheet
Maryland Department of the Environment (Central): April 15, 2008

(Please Print)

Name	Address	Affiliation/Representing	Phone Number	E-mail Address
Erik Rifkin	10 E. Lee St.	Rifkin & Asso.	410-685-2737	erifkin1022@[illegible]
Dave Brownlee	150 Main St, Prince Frederick 20678	Calvert Co. Dept. Planning & Zoning	410-535-1600 x2338	brownldc@co.cal.md.us
Steve Stewart	401 Bosley Ave. Towson, MD 21204	Balt. Co. DEPRM	410-887-4488 x240	sstewart@baltimorecountymd.gov
desrée stover	3169 Keswick Rd. Baltimore, MD 21211	MDE		dstover@towson.edu
Susan Overstreet	3430 Court House Dr. Ellicott City, MD 21043	HoCo DPZ	410-313-4345	soverstreet@howardcountymd.gov
George Harmen		MDE	410-537-3856	
Meo Curtis	Mont Co DEP Ste120 255 Rockville Pike Rockville, MD 20850	MCDEP	240-777-7711	meosotis.curtis@montgomerycountymd.gov
Matthew Rowe	1800 Wash. Blvd.	MDE	(410) 537-3578	
Sleem Carrison		DNR		scarrison@dnr.state.md.us

SIGN-IN SHEET 4/22/08

2008 INTEGRATED REPORT MEETING

NAME	AFFILIATION	EMAIL
MATT ROWE	MDE	mrowe@mde.state.md.u
Angel Valdez	MDE	avaldez@mde.state.md
Sherm Garrison	MD DNR	sgarrison@dnr.state.md.u
Michael Weldon	MD DNR	mweldon@dnr.state.m
John Hill	MDE	jhill@mde.state.md.
Erik Rifkin	-	erifkin102@aol.com
matt stover	MDE	

* greencommuting challenge

E.3 Comment-Response for the 2008 Integrated Report

List of Commentors

Author	Affiliation	Date Received
Susan McDowell	United States Environmental Protection Agency, Office of Standards, Assessment and Information Management	April 22, 2008
Kim Coble	Chesapeake Bay Foundation	April 29, 2008

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION III, 1650 Arch Street, Philadelphia, Pennsylvania 19103-2029, Susan McDowell, Office of Standards, Assessment and Information Management, 215-814-2739, McDowell.Susan@epamail.epa.gov

GENERAL COMMENTS

EPA Comment:
The Draft Integrated Report (IR) overall format was well organized and comprehensive in its content. Upon our review, we did notice a variety of formatting issues related to the numbering of tables and figures. In particular, Part C requires reconciliation of the numbering/labeling of tables and figures to align with the text references. For example, on page 40, the text refers to a look-up Table 1. The table immediately following the reference is Table 4 (page 41), labeled Biocriteria Assessment Table. This kind of discrepancy can found throughout the report.

MDE Response: These formatting issues have been rectified.

EPA Comment:
EPA requests that MDE provide a table or descriptive paragraph summarizing Maryland's compliance for the period 2006-2008 with the *Memorandum of Understanding between the State of Maryland and the United States Environmental Protection Agency Region III regarding Sections 303(d) and 303(e) of the Clean Water Act,* including all revisions thereto.

MDE Response: Attached, per request. Please see the following tables.

Status of 1996/1998 High Priority Listings

Below is a table listing the 1996/1998 High Priority Listings to be addressed. While TMDLs have not been completed, other information has been gathered as progress toward TMDL development. Maryland has completed 66 of 93 1996/1998 high priority listings (71%). Since funding sources are limited, a number of complicated high priority listings have been delayed, particularly PCBs. However, now that the majority of bacteria (high priority pollutant type) TMDLs have been completed with BST studies, those funding sources are being redirected to PCB monitoring and TMDL development (another high priority pollutant type).

Year Listed	Basin Name	8-digit Basin Number	Waterbody Type	Priority	Impairment	Current Status	Target YR
1996	Lower Susquehanna River	02120201	Tidal portion	High	Cadmium	WQA in Interagency Review	2008
1996	Assawoman Bay	02130102	Tidal portion	High	Nutrients	Watershed Model is completed. Water quality model is under development.	2009
1996	Isle of Wight Bay (open water)	02130103	Tidal portion	High	Nutrients	Watershed Model is completed. Water quality model is under development.	2009
1996	Sinepuxent Bay	02130104	Tidal portion	High	Nutrients	Watershed Model is completed. Water quality model is under development.	2009
1996	Chincoteague Bay	02130106	Tidal portion	High	Nutrients	Watershed Model is completed. Water quality model is under development.	2009
1998	Pocomoke Sound	02130201	Tidal Shellfish Area	High	Bacteria	Initial draft started waiting for additional information from VA	2008
1998	Nanticoke River (Cove Road Beach)	02130305	Public Beaches	High	Bacteria	2008 303(d) list moving to Category 2	2008
1998	Upper Choptank River (Choptank Marine Beach)	02130404	Public Beaches	High	Bacteria	2008 303(d) list moving to Category 2	2008
1996	Northeast River	02130608	Tidal portion	High	Lead	WQA in Interagency Review	2008
1996	Aberdeen Proving Ground	02130705	Tidal portion	High	Toxic Substances	2001 attempted to gather additional data, however, APG facility was unable to give much information or all outside sampling. Additional issues, resource availability for monitoring and modeling.	2011

Status of 1996/1998 High Priority Listings

Year Listed	Basin Name	8-digit Basin Number	Waterbody Type	Priority	Impairment	Current Status	Target YR
1996	Lower Gunpowder Falls	02130802	Nontidal portion	High	Nutrients	Methodology currently in development. Scheduled for 2009.	2009
1996	Little Gunpowder Falls	02130804	Nontidal portion	High	Nutrients	Methodology currently in development. Scheduled for 2009.	2010
1998	Back River	02130901	Tidal portion	High	PCBs	2005 Clam Study Conducted, TMDL under development	2010
1998	Baltimore Harbor (Furnace Creek)	02130903	Tidal portion	High	Bacteria	Listing refined based on County data. Additional monitoring 2008 for TMDL development use. Under Development for 2008.	2009
1998	Baltimore Harbor (Marley Creek)	02130903	Tidal portion	High	Bacteria	Listing refined based on County data. Additional monitoring 2008 for TMDL development use. Under Development for 2008.	2009
1998	Bear Creek	02130903	Tidal portion	High	PCBs	2005 Clam Study Conducted, TMDL under development	2010
1998	Curtis Bay/Creek	02130903	Tidal portion	High	PCBs	2005 Clam Study Conducted, TMDL under development	2010
1998	Northwest Branch, Inner Harbor	02130903	Tidal portion	High	PCBs	2005 Clam Study Conducted, TMDL under development	2010
1998	Curtis Bay/Curtis Creek	02130903	Tidal portion	High	Zinc	Under Development	2009
1998	Middle Harbor	02130903	Tidal portion	High	Zinc	Under Development	2009
1998	Patuxent River Lower (Buzzard Island Creek)	02131101	Tidal Shellfish Area	High	Bacteria	2008 303(d) list moving to Category	2008
1998	Patuxent River Lower (Mill Creek)	02131101	Tidal Shellfish Area	High	Bacteria	In Public Review	2008
1996	Little Patuxent River (Little Patuxent River/Dorsey Run E of Rt. 1)	02131105	Nontidal portion	High	Cadmium	WQA in Interagency Review	2008
1996	Middle Patuxent River	02131106	Nontidal portion	High	Zinc	WQA in Interagency Review	2008

Status of 2002 High Priority Listings

Below is a table listing the 2002 High Priority Listings to be addressed. While TMDLs have not been completed, other information has been gathered as progress toward TMDL development. Maryland has completed 17 of 33 2002 high priority listings (52%). Since funding sources are limited, a number of complicated high priority listings have been delayed, particularly PCBs. However, now that the majority of bacteria (high priority pollutant type) TMDLs have been completed with BST studies, those funding sources are being redirected to PCB monitoring and TMDL development (another high priority pollutant type).

Cycle First Listed	Waterbody Name	Basin Name	Basin Code	Water Type Detail	Cause	Notes	TMDL Development Status	Current Target Year*
2002	Tidal Lower Susquehanna River	Tidal Lower Susquehanna River	02120201	Tidal subsegment	PCB in Fish Tissue	This listing only applies to the tidal Lower Susquehanna portion (02120201) of CB1TF.	2005 Clam Study Conducted	2010
2002	Corsica River	Corsica River	02130507	Tidal subsegment	PCB in Fish Tissue	This listing only applies to the Corsica River (02130507) portion of CHSMH.	2005 - Clam Study Conducted, 2007 - Corbicula Study conducted	2009
2002	Middle Chester River	Middle Chester River	02130509	Tidal subsegment	PCB in Fish Tissue	This PCB impairment only applies to the Middle Chester portion of CHSOH.	2005 Clam Study Conducted	2013
2002	Lower Elk River	Lower Elk River	02130601	Tidal subsegment	PCB in Fish Tissue	This listing only applies to the Lower Elk (02130601) portion of ELKOH.	2005 Clam Study Conducted	2010

Status of 2002 High Priority Listings Status of 2002 High Priority Listings

Cycle First Listed	Waterbody Name	Basin Name	Basin Code	Water Type Detail	Cause	Notes	TMDL Development Status	Current Target Year*
2002		BOHOH - Bohemia River Oligohaline	02130602	Chesapeake Bay segment	PCB in Fish Tissue		2005 Clam Study Conducted	2009
2002	Upper Elk River	Upper Elk River	02130603	Tidal subsegment	PCB in Fish Tissue	This listing only applies to the Upper Elk (02130603) portion of ELKOH.	2005 Clam Study Conducted	2010
2002		C&DOH - C&D Canal Oligohaline	02130604	Chesapeake Bay segment	PCB in Fish Tissue	This is the more refined listing that was split off from the original 6 digit listing for the Elk River.	Monitoring scheduled for 2009.	2010
2002		NORTF - North East River Tidal Fresh	02130608	Chesapeake Bay segment	PCB in Fish Tissue	This listing only applies to watershed 02130608.	2005 Clam Study Conducted	2009
2002		SASOH - Sassafras River Oligohaline	02130610	Chesapeake Bay segment	PCB in Fish Tissue		2005 Clam Study Conducted	2009
2002		BSHOH - Bush River Oligohaline	02130701	Chesapeake Bay segment	PCB in Fish Tissue		2007 Corbicula study conducted. Additional monitoring scheduled for 2011.	2012

Cycle First Listed	Waterbody Name	Basin Name	Basin Code	Water Type Detail	Cause	Notes	TMDL Development Status	Current Target Year*
2002	LAKE ROLAND	Jones Falls	02130904	Impoundments	PCB in Fish Tissue		2005 Clam Study Conducted	2013
2002		Liberty Reservoir	02130907	Impoundments	Methylmercury - fish tissue		TMDL done in 2002 held at EPA due to comments from the public	
2002		SOUMH - South River Mesohaline	02131003	Chesapeake Bay segment	PCB in Fish Tissue		2005 Clam Study Conducted	2011
2002	POTOMAC RIVER DAM #4	Potomac River Washington County	02140501	Impoundments	Methylmercury - fish tissue		TMDL started but technical diffulties due to large watershed size	
2002		Lower North Branch Potomac River	02141001	Non-tidal 8 digit watershed	Methylmercury - fish tissue		Free-flowing stream no method yet developed.	
*These dates are subject to change due to resource limitations or technical issues.								

SPECIFIC COMMENTS

EPA Comment: Assessment Methodologies, Section C.2.1., Non-tidal Biological Listing Methodology
This new methodology represents a significant change from previous listing cycles. To assist in making the transition, EPA requests that the 2008 IR include a crosswalk table that illustrates the clear fate of the 2006 12-digit Category 5 listings relative to the current 2008 8-digit Category 5 listings.

MDE Response: The following table presents a crosswalk between the 2006 category 5 12-digit listings and the corresponding 2008 8-digit listings (all categories included to show which listings subsumed the former 12-digit watershed listings). It is important to note that MDE underwent an extensive data review process in 2007 designed to exclude data that was not representative of the sample site (See Section **"**III.a. Vetting Monitoring Data" of the Non-tidal Biological Listing Methodology). This resulted in dropping some of the very stations that were used to assess 12-digit watersheds as impaired (category 5) in the 2006 Integrated Report. So although a certain watershed may appear to have had quite a few 12-digit watershed listings (i.e. Fifteenmile Creek), it may be the case that some of the stations that led to these listings have since been excluded from assessments.

2006 12-Digit SubBasin Biological Listings (Category 5 only)				**Corresponding 2008 8-Digit Basin Biological Listings**					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021202010318	5	Lower Susquehanna River	2002	2002	02120201	Lower Susquehanna River	5	12-digit listings now subsumed by 8-digit listing	2008
021202010319	5	Lower Susquehanna River	2002						
021202020325	5	Deer Creek	2006		02120202	Deer Creek	2	Relisted from category 3a to category 2	
021202020328	5	Deer Creek	2006						
021202020330	5	Deer Creek	2004						
021202020332	5	Deer Creek	2002						
021202030344	5	Octoraro Creek	2006		02120203	Octoraro Creek	2		2008
021202030347	5	Octoraro Creek	2002						
021202040335	5	Conowingo Dam Susquehanna	2002		02120204	Conowingo Dam Susquehanna	3		

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
		River				River			
021202050339	5	Broad Creek	2002		02120205	Broad Creek	2		
021202050340	5	Broad Creek	2006						
021202050343	5	Broad Creek	2006						
021301030690	5	Isle of Wight Bay	2004		02130103	Isle of Wight Bay	3		
021301050682	5	Newport Bay	2006		02130105	Newport Bay	3		
021301050683	5	Newport Bay	2006						
021301050685	5	Newport Bay	2004						
021301060671	5	Chincoteague Bay	2004		02130106	Chincoteague Bay	3		
021301060680	5	Chincoteague Bay	2004						
021302010621	5	Pocomoke Sound	2006		02130201	Pocomoke Sound	3		
021302030646	5	Upper Pocomoke River	2004	2002	02130203	Upper Pocomoke River	5	12-digit listings now subsumed by 8-digit listing	2008
021302030648	5	Upper Pocomoke River	2002						
021302030652	5	Upper Pocomoke River	2002						
021302030654	5	Upper Pocomoke River	2002						
021302030655	5	Upper Pocomoke River	2002						
021302040663	5	Dividing Creek	2004		02130204	Dividing Creek	3		
021302040664	5	Dividing Creek	2006						
021302040665	5	Dividing Creek	2004						
021302040666	5	Dividing Creek	2006						
021302050667	5	Nassawango Creek	2006		02130205	Nassawango Creek	3		

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021302050669	5	Nassawango Creek	2002						
021302080657	5	Manokin River	2006		02130208	Manokin River	3		
021302080659	5	Manokin River	2006						
021302080660	5	Manokin River	2006						
021302080661	5	Manokin River	2006						
021303010558	5	Lower Wicomico River	2004	2002	02130301	Lower Wicomico River	5	12-digit listings now subsumed by 8-digit listing	2008
021303010559	5	Lower Wicomico River	2006						
021303010560	5	Lower Wicomico River	2002						
021303010561	5	Lower Wicomico River	2002						
021303010562	5	Lower Wicomico River	2002						
021303020544	5	Monie Bay	2006		02130302	Monie Bay	3		
021303030565	5	Wicomico Creek	2002		02130303	Wicomico Creek	3		
021303040569	5	Wicomico River Headwaters	2004		02130304	Wicomico River Headwaters	3		
021303050581	5	Nanticoke River	2004	2004	02130305	Nanticoke River	5	12-digit listings now subsumed by 8-digit listing	2008
021303050583	5	Nanticoke River	2004						
021303050584	5	Nanticoke River	2004						
021303050586	5	Nanticoke River	2004						
021303050587	5	Nanticoke River	2004						
021303060601	5	Marshyhope Creek	2006	2002	02130306	Marshyhope Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021303060603	5	Marshyhope Creek	2006						
021303060607	5	Marshyhope Creek	2006						

2006 12-Digit SubBasin Biological Listings (Category 5 only)					Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed		Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021303060609	5	Marshyhope Creek	2006							
021303060614	5	Marshyhope Creek	2006							
021303060615	5	Marshyhope Creek	2002							
021303070552	5	Fishing Bay	2006			02130307	Fishing Bay	3		
021303080595	5	Transquaking River	2006							
021303080596	5	Transquaking River	2006							
021303080597	5	Transquaking River	2002		2002	02130308	Transquaking River	5	12-digit listings now subsumed by 8-digit listing	2008
021303080599	5	Transquaking River	2006							
021303080600	5	Transquaking River	2006							
021304020450	5	Little Choptank River	2006							
021304020452	5	Little Choptank River	2006			02130402	Little Choptank River	3		
021304020454	5	Little Choptank River	2006							
021304030459	5	Lower Choptank River	2002		2002	02130403	Lower Choptank River	5	12-digit listings now subsumed by 8-digit listing	2008
021304030463	5	Lower Choptank River	2002							
021304030464	5	Lower Choptank River	2002							
021304030465	5	Lower Choptank River	2006							
021304030469	5	Lower Choptank River	2006							

<table>
<tr><th colspan="4">2006 12-Digit SubBasin Biological Listings (Category 5 only)</th><th colspan="6">Corresponding 2008 8-Digit Basin Biological Listings</th></tr>
<tr><th>Subbasin Code</th><th>2006 Listing Category</th><th>Basin Name</th><th>Cycle First Listed</th><th>Cycle First Listed</th><th>Basin Code</th><th>Basin Name</th><th>2008 Listing Category</th><th>Action</th><th>Action Year</th></tr>
<tr><td>021304030470</td><td>5</td><td>Lower Choptank River</td><td>2006</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>021304030471</td><td>5</td><td>Lower Choptank River</td><td>2002</td></tr>
<tr><td>021304040473</td><td>5</td><td>Upper Choptank River</td><td>2002</td><td rowspan="13">2002</td><td rowspan="13">02130404</td><td rowspan="13">Upper Choptank River</td><td rowspan="13">5</td><td rowspan="13">12-digit listings now subsumed by 8-digit listing</td><td rowspan="13">2008</td></tr>
<tr><td>021304040483</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040485</td><td>5</td><td>Upper Choptank River</td><td>2004</td></tr>
<tr><td>021304040486</td><td>5</td><td>Upper Choptank River</td><td>2004</td></tr>
<tr><td>021304040487</td><td>5</td><td>Upper Choptank River</td><td>2004</td></tr>
<tr><td>021304040490</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040496</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040504</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040505</td><td>5</td><td>Upper Choptank River</td><td>2004</td></tr>
<tr><td>021304040508</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040509</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040514</td><td>5</td><td>Upper Choptank River</td><td>2002</td></tr>
<tr><td>021304040515</td><td>5</td><td>Upper Choptank River</td><td>2006</td></tr>
<tr><td>021304050517</td><td>5</td><td>Tuckahoe Creek</td><td>2002</td><td rowspan="3"></td><td rowspan="3">02130405</td><td rowspan="3">Tuckahoe Creek</td><td rowspan="3">2</td><td rowspan="3">12-digit listings now subsumed by 8-digit listing</td><td rowspan="3"></td></tr>
<tr><td>021304050529</td><td>5</td><td>Tuckahoe Creek</td><td>2002</td></tr>
<tr><td>021304050534</td><td>5</td><td>Tuckahoe Creek</td><td>2002</td></tr>
</table>

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021304050536	5	Tuckahoe Creek	2002						
021304050537	5	Tuckahoe Creek	2002						
021304050538	5	Tuckahoe Creek	2006						
021304050540	5	Tuckahoe Creek	2006						
021305020439	5	Miles River	2006		02130502	Miles River	3		
021305020442	5	Miles River	2006						
021305030436	5	Wye River	2002		02130503	Wye River	2	Moved from category 3a to category 2	2008
021305030437	5	Wye River	2002						
021305050388	5	Lower Chester River	2004		02130505	Lower Chester River	3		
021305050389	5	Lower Chester River	2002						
021305050391	5	Lower Chester River	2004						
021305060405	5	Langford Creek	2004		02130506	Langford Creek	2	12-digit listings now subsumed by 8-digit listing	2008
021305060406	5	Langford Creek	2002						
021305060409	5	Langford Creek	2004						
021305070395	5	Corsica River	2006		02130507	Corsica River	2	Moved from category 3a to category 2	2008
021305080398	5	Southeast Creek	2002		02130508	Southeast Creek	2		
021305080399	5	Southeast Creek	2004						
021305090411	5	Middle Chester River	2006	2002	02130509	Middle Chester River	5	12-digit listings now subsumed by 8-digit listing	2008
021305090412	5	Middle Chester River	2004						
021305090414	5	Middle Chester River	2004						
021305090415	5	Middle Chester River	2002						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021305100418	5	Upper Chester River	2006	2006	02130510	Upper Chester River	5	12-digit listings now subsumed by 8-digit listing	2008
021305100419	5	Upper Chester River	2006						
021305100420	5	Upper Chester River	2006						
021305100423	5	Upper Chester River	2006						
021305100425	5	Upper Chester River	2006						
021306020365	5	Bohemia River	2002		02130602	Bohemia River	3		
021306020366	5	Bohemia River	2002						
021306030373	5	Upper Elk River	2006		02130603	Upper Elk River	3		
021306050382	5	Little Elk Creek	2006		02130605	Little Elk Creek	3	12-digit listings now subsumed by 8-digit listing	2008
021306050383	5	Little Elk Creek	2002						
021306060386	5	Big Elk Creek	2002		02130606	Big Elk Creek	3		
021306070381	5	Christina River	2002		02130607	Christina River	3		
021306080374	5	Northeast River	2004		02130608	Northeast River	2		
021306080375	5	Northeast River	2002						
021306080376	5	Northeast River	2004						
021306090380	5	Furnace Bay	2002		02130609	Furnace Bay	2	Moved from category 3a to category 2	
021306100355	5	Sassafras River	2004		02130610	Sassafras River	3		
021306100357	5	Sassafras River	2004						
021306110349	5	Stillpond-Fairlee	2004		02130611	Stillpond-Fairlee	3		
021306110352	5	Stillpond-Fairlee	2004						
021307011128	5	Bush River	2006	2002	02130701	Bush River	5	12-digit listings now subsumed by 8-digit listing	2008
021307011129	5	Bush River	2002						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021307021130	5	Lower Winters Run	2002	2002	02130702	Lower Winters Run	5	12-digit listings now subsumed by 8-digit listing	2008
021307031132	5	Atkisson Reservoir	2002	2002	02130703	Atkisson Reservoir	5	12-digit listings now subsumed by 8-digit listing	2008
021307031133	5	Atkisson Reservoir	2002						
021307031134	5	Atkisson Reservoir	2002						
021307041131	5	Bynum Run	2002	2002	02130704	Bynum Run	5	12-digit listings now subsumed by 8-digit listing	2008
021307051125	5	Aberdeen Proving Grounds	2004	2002	02130705	Aberdeen Proving Ground	5	12-digit listings now subsumed by 8-digit listing	2008
021307051126	5	Aberdeen Proving Ground	2002						
021307061135	5	Swan Creek	2002	2002	02130706	Swan Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021308010293	5	Gunpowder River	2004		02130801	Gunpowder River	3		
021308030295	5	Bird River	2004		02130803	Bird River	3		
021308040298	5	Little Gunpowder Falls	2006		02130804	Little Gunpowder Falls	2	Moved from category 3a to category 2	2008
021308040299	5	Little Gunpowder Falls	2004						
021308050300	5	Loch Raven Reservoir	2004	2002	02130805	Loch Raven Reservoir	5	12-digit listings now subsumed by 8-digit listing	2008
021308050302	5	Loch Raven Reservoir	2002						
021308050303	5	Loch Raven Reservoir	2002						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021308050306	5	Loch Raven Reservoir	2004						
021308050308	5	Loch Raven Reservoir	2004						
021308050309	5	Loch Raven Reservoir	2004						
021308050310	5	Loch Raven Reservoir	2004						
021308060313	5	Prettyboy Reservoir	2002		02130806	Prettyboy Reservoir	2	Delisted based on new data	2006
021308060314	5	Prettyboy Reservoir	2004						
021308060317	5	Prettyboy Reservoir	2004						
021309021000	5	Bodkin Creek	2004		02130902	Bodkin Creek	3		
021309041032	5	Jones Falls	2006	2006	02130904	Jones Falls	5	12-digit listings now subsumed by 8-digit listing	2008
021309041033	5	Jones Falls	2006						
021309041034	5	Jones Falls	2006						
021309041036	5	Jones Falls	2006						
021309071046	5	Liberty Reservoir	2002	2002	02130907	Liberty Reservoir	5	12-digit listings now subsumed by 8-digit listing	2008
021309071048	5	Liberty Reservoir	2004						
021309071054	5	Liberty Reservoir	2002						
021309071056	5	Liberty Reservoir	2004						
021309071057	5	Liberty Reservoir	2002						
021309071058	5	Liberty Reservoir	2004						
021309071059	5	Liberty Reservoir	2002						
021309071061	5	Liberty Reservoir	2006						
021309071062	5	Liberty Reservoir	2002						
021309081023	5	South Branch Patapsco River	2002	2002	02130908	South Branch Patapsco River	5	12-digit listings now subsumed by 8-	2008

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021309081024	5	South Branch Patapsco River	2002					digit listing	
021309081027	5	South Branch Patapsco River	2002						
021309081028	5	South Branch Patapsco River	2004						
021309081031	5	South Branch Patapsco River	2006						
021310011004	5	Magothy River	2002	2002	02131001	Magothy River	5	12-digit listings now subsumed by 8-digit listing	
021310011005	5	Magothy River	2002						
021310030992	5	South River	2004	2002	02131003	South River	5	12-digit listings now subsumed by 8-digit listing	2008
021310030994	5	South River	2002						
021310030995	5	South River	2002						
021310040983	5	West River	2002	2002	02131004	West River	5	12-digit listings now subsumed by 8-digit listing	2008
021310040985	5	West River	2002						
021310050976	5	Other West Chesapeake Bay	2002	2002	02131005	Other West Chesapeake Bay	5	12-digit listings now subsumed by 8-digit listing	2008
021310050977	5	Other West Chesapeake Bay	2002						
021310050978	5	Other West Chesapeake Bay	2002						
021311010874	5	Patuxent River lower	2002	2002	02131101	Patuxent River lower	5	12-digit listings now subsumed by 8-digit listing	2008
021311010877	5	Patuxent River lower	2006						
021311010878	5	Patuxent River lower	2006						
021311010882	5	Patuxent River lower	2002						
021311010883	5	Patuxent River lower	2006						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021311010889	5	Patuxent River lower	2006						
021311010890	5	Patuxent River lower	2002						
021311010892	5	Patuxent River lower	2006						
021311010894	5	Patuxent River lower	2002						
021311010895	5	Patuxent River lower	2002						
021311010896	5	Patuxent River lower	2002						
021311010899	5	Patuxent River lower	2002						
021311010902	5	Patuxent River lower	2002						
021311020908	5	Patuxent River middle	2002	2002	02131102	Patuxent River middle	5	12-digit listings now subsumed by 8-digit listing	2008
021311020910	5	Patuxent River middle	2006						
021311020914	5	Patuxent River middle	2002						
021311020915	5	Patuxent River middle	2006						
021311030920	5	Western Branch	2006	2006	02131103	Western Branch	5	12-digit listings now subsumed by 8-digit listing	2008
021311030922	5	Western Branch	2006						
021311030923	5	Western Branch	2006						
021311030924	5	Western Branch	2006						
021311030925	5	Western Branch	2006						
021311030926	5	Western Branch	2006						
021311030929	5	Western Branch	2006						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021311060958	5	Middle Patuxent River	2004		02131106	Middle Patuxent River	2		
021311060962	5	Middle Patuxent River	2004						
021311060963	5	Middle Patuxent River	2004						
021311070941	5	Rocky Gorge Dam	2006	2004	02131107	Rocky Gorge Dam	5	12-digit listings now subsumed by 8-digit listing	2008
021311070942	5	Rocky Gorge Dam	2004						
021311070944	5	Rocky Gorge Dam	2004						
021311070945	5	Rocky Gorge Dam	2004						
021311080967	5	Brighton Dam	2002		02131108	Brighton Dam	2		
021311080968	5	Brighton Dam	2002						
021401010698	5	Potomac River Lower tidal	2004	2004	02140101	Potomac River Lower tidal	5	12-digit listings now subsumed by 8-digit listing	2008
021401010702	5	Potomac River Lower tidal	2006						
021401010705	5	Potomac River Lower tidal	2004						
021401020789	5	Potomac River Middle tidal	2004		02140102	Potomac River Middle tidal	2	Moved from category 2 to category 3a	2008
021401020791	5	Potomac River Middle tidal	2004						
021401030709	5	St. Mary's River	2004	2002	02140103	St. Mary's River	5	12-digit listings now subsumed by 8-digit listing	2008
021401030710	5	St. Mary's River	2004						
021401030711	5	St. Mary's River	2006						
021401030714	5	St. Mary's River	2004						
021401030715	5	St. Mary's River	2006						
021401030716	5	St. Mary's River	2002						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021401030717	5	St. Mary's River	2004						
021401030718	5	St. Mary's River	2004						
021401030719	5	St. Mary's River	2004						
021401040723	5	Breton Bay	2004		02140104	Breton Bay	2	Moved from category 3a to category 2	2008
021401050726	5	St. Clements Bay	2002		02140105	St. Clements Bay	2		
021401060732	5	Wicomico River	2006		02140106	Wicomico River	2	12-digit listings now subsumed by 8-digit listing	2008
021401060734	5	Wicomico River	2006						
021401060739	5	Wicomico River	2002						
021401070745	5	Gilbert Swamp	2004		02140107	Gilbert Swamp	2	12-digit listings now subsumed by 8-digit listing	2008
021401070746	5	Gilbert Swamp	2004						
021401070750	5	Gilbert Swamp	2002						
021401070751	5	Gilbert Swamp	2004						
021401080754	5	Zekiah Swamp	2004		02140108	Zekiah Swamp	2	12-digit listings now subsumed by 8-digit listing	2008
021401080755	5	Zekiah Swamp	2004						
021401080760	5	Zekiah Swamp	2006						
021401080764	5	Zekiah Swamp	2002						
021401080766	5	Zekiah Swamp	2002						
021401080767	5	Zekiah Swamp	2002						
021401080769	5	Zekiah Swamp	2004						
021401090773	5	Port Tobacco River	2006		02140109	Port Tobacco River	5	Moved from category 3a to category 5	2008
021401100776	5	Nanjemoy Creek	2004		02140110	Nanjemoy Creek	2	Moved from category 3a to category 2	2008
021401100777	5	Nanjemoy Creek	2004						
021401100778	5	Nanjemoy Creek	2004						
021401100779	5	Nanjemoy Creek	2006						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021401110781	5	Mattawoman Creek	2002	2002	02140111	Mattawoman Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021401110783	5	Mattawoman Creek	2004						
021401110784	5	Mattawoman Creek	2002						
021401110786	5	Mattawoman Creek	2004						
021401110787	5	Mattawoman Creek	2002						
021402040805	5	Oxon Run	2004	2008	02140204	Oxon Run	3	12-digit listings now subsumed by 8-digit listing	2008
021402070841	5	Cabin John Creek	2006	2006	02140207	Cabin John Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021403020223	5	Lower Monocacy River	2004	2002	02140302	Lower Monocacy River	5		
021403030240	5	Upper Monocacy River	2002	2002	02140303	Upper Monocacy River	5	12-digit listings now subsumed by 8-digit listing	2008
021403030242	5	Upper Monocacy River	2004						
021403030243	5	Upper Monocacy River	2002						
021403030244	5	Upper Monocacy River	2002						
021403030245	5	Upper Monocacy River	2002						
021403030247	5	Upper Monocacy River	2006						
021403030249	5	Upper Monocacy River	2002						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021403030250	5	Upper Monocacy River	2002						
021403030251	5	Upper Monocacy River	2002						
021403030252	5	Upper Monocacy River	2002						
021403030253	5	Upper Monocacy River	2002						
021403030254	5	Upper Monocacy River	2002						
021403030255	5	Upper Monocacy River	2002						
021403030256	5	Upper Monocacy River	2004						
021403030257	5	Upper Monocacy River	2002						
021403030259	5	Upper Monocacy River	2002						
021403030260	5	Upper Monocacy River	2002						
021403050213	5	Catoctin Creek	2006	2006	02140305	Catoctin Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021403050214	5	Catoctin Creek	2006						
021403050215	5	Catoctin Creek	2006						
021403050216	5	Catoctin Creek	2006						
021403050217	5	Catoctin Creek	2006						
021403050218	5	Catoctin Creek	2006						
021403050219	5	Catoctin Creek	2006						
021405030185	5	Marsh Run	2004	2004	02140503	Marsh Run	5	12-digit listings now subsumed by 8-digit listing	2008
021405050175	5	Little Conococheague	2006		02140505	Little Conococheague	3	Relisted at the 8 digit level, 12 digit	2006

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
		Creek						supporting	
021405060169	5	Licking Creek	2006	2002	02140506	Licking Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021405060171	5	Licking Creek	2002						
021405080110	5	Potomac River Allegany County	2006	2002	02140508	Potomac River Allegany County	5	12-digit listings now subsumed by 8-digit listing	2008
021405080113	5	Potomac River Allegany County	2004						
021405080114	5	Potomac River Allegany County	2004						
021405080115	5	Potomac River Allegany County	2004						
021405080118	5	Potomac River Allegany County	2004						
021405080120	5	Potomac River Allegany County	2002						
021405090153	5	Little Tonoloway Creek	2002	2002	02140509	Little Tonoloway Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021405090154	5	Little Tonoloway Creek	2002						
021405100147	5	Sideling Hill Creek	2008		02140510	Sideling Hill Creek	2	Moved from category 3a to category 2	2008
021405100150	5	Sideling Hill Creek	2004						
021405100152	5	Sideling Hill Creek	2002						
021405110134	5	Fifteen Mile Creek	2002		02140511	Fifteen Mile Creek	2		
021405110136	5	Fifteen Mile Creek	2002						
021405110138	5	Fifteen Mile Creek	2004						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021405110140	5	Fifteen Mile Creek	2002						
021405110141	5	Fifteen Mile Creek	2002						
021405110142	5	Fifteen Mile Creek	2004						
021405110144	5	Fifteen Mile Creek	2002						
021405120122	5	Town Creek	2004	2002	02140512	Town Creek	5	12-digit listings now subsumed by 8-digit listing	2008
021405120123	5	Town Creek	2002						
021405120124	5	Town Creek	2004						
021405120126	5	Town Creek	2004						
021405120127	5	Town Creek	2002						
021405120128	5	Town Creek	2004						
021405120129	5	Town Creek	2004						
021410010054	5	Lower North Branch Potomac River	2006	2006	02141001	Lower North Branch Potomac River	5	12-digit listings now subsumed by 8-digit listing	2008
021410010055	5	Lower North Branch Potomac River	2006						
021410010056	5	Lower North Branch Potomac River	2006						
021410010057	5	Lower North Branch Potomac River	2006						
021410010059	5	Lower North Branch Potomac River	2006						
021410010062	5	Lower North Branch Potomac River	2006						

2006 12-Digit SubBasin Biological Listings (Category 5 only)				Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed	Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
021410010064	5	Lower North Branch Potomac River	2006						
021410010067	5	Lower North Branch Potomac River	2006						
021410010068	5	Lower North Branch Potomac River	2006						
021410010069	5	Lower North Branch Potomac River	2006						
021410010071	5	Lower North Branch Potomac River	2006						
021410010073	5	Lower North Branch Potomac River	2006						
021410060079	5	Savage River	2006		02141006	Savage River	2		
021410060080	5	Savage River	2004						
021410060083	5	Savage River	2004						
050202010001	5	Youghiogheny River	2004	2002	05020201	Youghiogheny River	5	12-digit listings now subsumed by 8-digit listing	2008
050202010002	5	Youghiogheny River	2002						
050202010005	5	Youghiogheny River	2002						
050202010009	5	Youghiogheny River	2002						
050202010011	5	Youghiogheny River	2002						
050202010015	5	Youghiogheny River	2004						

2006 12-Digit SubBasin Biological Listings (Category 5 only)					Corresponding 2008 8-Digit Basin Biological Listings					
Subbasin Code	2006 Listing Category	Basin Name	Cycle First Listed		Cycle First Listed	Basin Code	Basin Name	2008 Listing Category	Action	Action Year
050202010017	5	Youghiogheny River	2004							
050202010019	5	Youghiogheny River	2002							
050202030027	5	Deep Creek Lake	2002		2002	05020203	Deep Creek Lake	5	12-digit listings now subsumed by 8-digit listing	2008
050202030029	5	Deep Creek Lake	2002							
050202040030	5	Casselman River	2002		2002	05020204	Casselman River	5	12-digit listings now subsumed by 8-digit listing	2008
050202040031	5	Casselman River	2002							
050202040033	5	Casselman River	2004							
050202040034	5	Casselman River	2004							
050202040038	5	Casselman River	2002							

<u>EPA Comment: Assessment Methodologies, Section C.2.1 Non-tidal Biological Listing Methodology</u>

We are aware that the new methodology will result in approximately 417 stream miles that were previously listed as impaired but are now integrated within a larger watershed listed as attaining water quality standards. We appreciate MDE's efforts to target these waters for local restoration efforts and protection through use of Maryland's Antidegradation Policy Implementation Procedures (COMAR 26.08.02.04-1). States may select the spatial resolution of their assessment units, provided that: (1) the State document its selection; and (2) the assessment unit is larger than the sampling station but small enough to represent a homogenous standard attainment within the assessment unit. Nevertheless, because Maryland previously used a smaller assessment unit, Maryland previously has reported these stream miles as water quality limited segments. While we recognize Maryland's decision to use a larger assessment unit to reflect a greater confidence level in the data, we strongly urge that MDE track its progress toward attaining water quality standards at the more localized level represented by the previously listed waters. We believe that such tracking is consistent with the goals of Section 305(b). Accordingly, we request that MDE provide periodic status reports to be included in future Integrated Reports.

MDE Response: While MDE agrees to track progress at the 12-digit scale, the Department wants to make it clear that site level tracking for these waters is not related to an impaired (category 5) status. Maryland's rationale for scaling back up to the 8-digit unit (approximately 90 square mile watersheds) for biological assessments is supported by the following: (1) the 12-digit watershed assessments used in the 2002, 2004 and 2006 Integrated Reports were based on too few data (i.e., the coefficient of variation is too high – Southerland et. al., 2007) to support a listing; (2) many sites used for these listings should never have been used because they violated the conditions/exceptions defined in the biological assessment methodology; (3) the non-tidal biological assessment methodology was inconsistent with the biological assessment methodology used for Chesapeake Bay (i.e., the Bay assessments default to a larger assessment unit and allow limited criteria exceedance in both space and time); and, (4) Maryland's watershed management, TMDL development, and water quality modeling efforts are all targeted at the 8-digit watershed scale.

Given this 8-digit scale management framework, Maryland will first prioritize/track restoration and/or protection activities at this scale. This will necessarily require addressing/tracking progress on site level impairments that help restore the larger impaired watershed. The State will direct resources toward addressing and tracking sites in non-impaired 8-digit watersheds only after first addressing the 8-digit impairments. These site level restoration efforts will be performed in conjunction with a larger strategy to protect high quality (Tier II) waters and prevent degradation of waters currently meeting their designated use.

<u>EPA Comment: Assessment Methodologies, Section C.2.2 Bacterial Listing Methodology</u>

The new bacteria assessment methodology includes a change this cycle regarding listings for impaired recreational waters. Prior to an impairment decision, MDE will require a sanitary survey to locate the source and remedy the problem, thereby negating the need for a Total

Maximum Daily Load (TMDL). Please provide us with an explanation (including examples) of the situations and any other rationale that prompted MDE to utilize this methodology.

MDE Response: MDE recently established a new method to conduct sanitary surveys or sometimes called pollution source surveys that utilizes GIS Data and includes electronic capture of all the data. This new tool gives a much better over-all picture of actual and potential sources of bacteria that impact water quality. In 2005 an assessment of water quality at seven Maryland beaches showed that they should be included on Maryland's list of impaired waters. At this time we were launching our new method for pollution source surveys\sanitary surveys and began conducting them at these seven locations. Out of the seven beaches, remediation of the pollution sources identified at four of the sites, using the new survey tool, resulted in an improvement in bacteriological water quality and the sites did not have to be listed as impaired, based on data collected the following beach season (2006). One of the sites remains on the impaired list and two of the sites met water quality standards in 2006 beach season (no survey done for these two). We were very impressed with the results from our pollution source survey method and saw it as a way to improve water quality in a timely fashion and prevent "flip-flopping" listings due to bacteria water quality variability at some locations from one season to the next, and use limited resources wisely. Our sanitary survey tool provides a great opportunity to get the local health department and community involved and actually improve the water quality at these sites and not merely list them as impaired.

At the same time our participation in EPA's activities associated with the Beach Act, included dialog with EPA and other States that a pollution source survey was being done in other parts of the country (Great Lakes for example) with some success. In addition, there continues to be a lot of discussion regarding the use of the current standard in waters not impacted by untreated sewage (the vast majority of Maryland waters). Examples include EPA's "Experts Scientific Workshop on Critical Research and Science Needs for the Development of New or Revised Recreational Water Quality Criteria", the Annapolis Protocol Report, and EPA's Critical Science Plan for the Development of Revised Recreational Water Quality Criteria.

<u>EPA Comment: Assessment Methodologies, Section E.3 Category 3 Waters</u>

For this cycle, we are aware of 5 waters that have been placed in Category 3 based on this new methodology. These waters will require a sanitary survey before an impairment decision will be made. EPA expects that MDE will ensure that sanitary surveys for these waters will be conducted prior to the next listing cycle, so that these waters will not appear in Category 3 on the 2010 Section 303(d) based upon lack of a sanitary survey and requests that MDE commit to conducting sanitary surveys for these waters prior to the next listing cycle.

MDE Response: Our intent in the revised listing methodology was to complete the sanitary survey prior to the next listing cycle, ("4.4.3.2 Part 3 of the 303(d) List, a sanitary survey <u>must</u> be conducted…..") and we have no problem with committing to conducting the sanitary surveys for these waters.

<u>EPA Comment: Assessment Results, Section C.3 – Table 14</u>
A review and crosswalk of the IR Tables and the 303(d) list revealed a few inconsistencies including the following:

> MD-02141004_Mainstem (George's Creek) in included on Table 14 (New Category 5 Listings). On the 303(d) list, it is labeled as Category 4b.

MDE Response: The label for this table has been updated to "Table 14: New Impairment (category 4b and 5 only) listings for 2008."

<u>EPA Comment: Assessment Results, Section E.5 Category 5 Waters</u>
MD- MD-02131107 (Rocky Gorge Dam) is listed as a Category 5 on the 303(d) list but the action stated is" moved from category 2 to 3a".

MDE Response: This has been corrected.

<u>EPA Comment: Assessment Results</u>
Chesapeake Bay SAV listings

> EPA requests data to support the delisting of four Chesapeake Bay segments: RHDMH, SEVMH, FSBMH and GUNOH.

MDE Response: Because of space considerations this data was not included with the regular Integrated Report submittal. However, this data was provided to EPA on April 23, 2008.

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CBF Comment: Assessment Results, Section C.3– Table 14: New Delistings for 2008 and E.2 Category 2 Waters

The Chesapeake Bay Foundation does not support the proposed action to move Chromium (CR) in the Inner Harbor (Northwest Branch and Bear Creek) of the Patapsco River from Category 5 (waterbodies impaired by one or more pollutants requiring a TMDL) to Category 2 (surface waters that are meeting some standards and have insufficient information to determine attainment of other standards). In March 2008, CBF conveyed our concerns in a detailed letter to the Department regarding this proposed change in listing the Harbor for Cr (see attached).

CBF remains willing to discuss the results of the toxicological studies conducted by the Johns Hopkins University researchers and MDE staff regarding our concerns, and respectfully requests that this listing change be removed from the Integrated Report.

MDE Response: The Department is now anticipating receipt of additional chromium data and therefore will postpone any delisting actions regarding chromium in the Baltimore Harbor.