

chapter i

Introduction

BACKGROUND

In 1987, the governors of Maryland, Virginia and Pennsylvania; the Mayor of the District of Columbia, the U.S. Environmental Protection Agency (EPA) administrator and the chair of the Chesapeake Bay Commission signed the Chesapeake Bay Agreement. This historic agreement stated that a 40 percent reduction in nutrients entering the Chesapeake Bay would be necessary to restore its health (Chesapeake Executive Council 1987). The goal targeted a 40 percent reduction of controllable nutrient loads from point and nonpoint sources from 1985 levels by the year 2000. The partners to the Chesapeake Bay Agreement committed that once achieved, these levels of reduced nutrient loads would continue to be maintained into the future.

In spite of the widespread implementation of best management practices (BMPs) and enhanced treatment technologies across the Chesapeake Bay watershed, nutrient- and sediment-related water quality problems have persisted. Figure I-1 illustrates the listed nutrient- and/or sediment-impaired waterbodies in the Chesapeake Bay watershed. Maryland's portion of the Chesapeake Bay and its tidal tributaries were listed on its 1996 and 1998 Clean Water Act (CWA) Section 303(d) lists of impaired waters. In May 1999, EPA Region III included Virginia's portion of the Chesapeake Bay and portions of several tidal tributaries on Virginia's 1998 CWA Section 303(d) list. Delaware listed its tidally influenced portions of the Chesapeake Bay waters on their 1996 and 1998 lists, and the District of Columbia listed its Chesapeake Bay waters in 1998. Streams and rivers also are listed for nutrient and/or sediment in the nontidal portions of the Chesapeake Bay watershed in all seven Chesapeake Bay watershed jurisdictions, including West Virginia and New York.

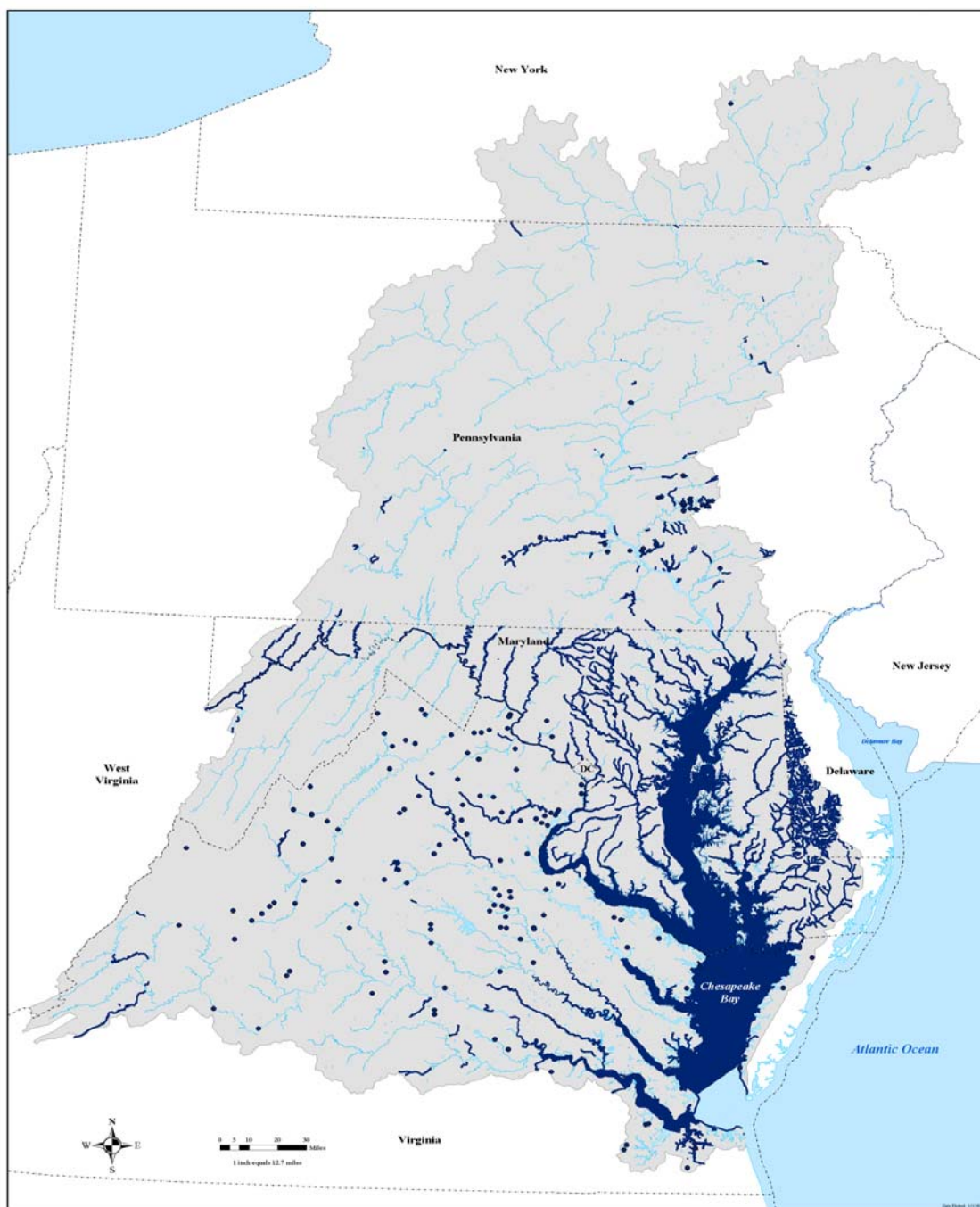


Figure I-1. Nutrient, sediment and dissolved oxygen impaired waterbodies in the Chesapeake Bay watershed from the 1998 303(d) list illustrated as points (•), linear (–) or area (solid blue) events.

Source: Chesapeake Bay Program website <http://www.chesapeakebay.net>.

The new *Chesapeake 2000* agreement was developed in response to a comprehensive assessment of the Chesapeake Bay's restoration needs and delineated an ambitious list of new restoration commitments (Chesapeake Executive Council 2000). The significant focus on restoration of Chesapeake Bay water quality resulted from the listing of most of the Chesapeake Bay and its tidal tributaries on the 303(d) list of impaired waters. Subsequently, the governors of Delaware, New York and West Virginia signed a Memorandum of Understanding with Maryland, Virginia, Pennsylvania, the District of Columbia and the EPA committing to implement the Water Quality Protection and Restoration section of the agreement (Chesapeake Bay Watershed Partners 2001).

Chesapeake 2000 specifies a goal to remove the Chesapeake Bay and its tidal tributaries from the list of impaired waterbodies for nutrients and sediments by 2010. Thus, the development of a total maximum daily load (TMDL) for the entire Chesapeake Bay was delayed until 2011, anticipating that the Chesapeake Bay Program partners can cooperatively achieve water quality standards by that time, making a baywide TMDL unnecessary.

Chesapeake 2000 lists the following specific commitments as steps to achieve its water quality goal of eliminating nutrient- and sediment-related impairments from tidal waters:

1. By 2001, define water quality conditions (i.e., criteria) necessary to protect aquatic living resources and then assign load reductions for nitrogen, phosphorus and sediment to each major tributary;
2. By 2002, complete a public process to develop and begin implementing revised Tributary Strategies to achieve and maintain the assigned loading goals; and
3. By 2003, jurisdictions with tidal waters will use their best efforts to adopt new or revised water quality standards consistent with the defined water quality conditions.

Although the above commitments still stand, the schedule has changed. The current schedule that all seven watershed jurisdictions and the EPA agreed to calls for:

- Final definitions of water quality conditions (i.e., criteria) by April 2003;
- Development of new and revised tributary strategies by April 2004; and
- Adoption of new and revised state water quality standards by 2005.

To implement and coordinate these actions, the Chesapeake Bay Program formed the Chesapeake Bay Water Quality Steering Committee, composed of senior managers from the EPA, state environmental and agricultural agencies, the Chesapeake Bay Commission, interstate river basin commissions, the environmental community and wastewater treatment operators. Under the Water Quality Steering Committee, a Use Attainability Analysis (UAA) Workgroup was convened to collaboratively assess the attainability of the refined designated uses for the Chesapeake Bay and its tidal tributaries.

TECHNICAL SUPPORT DOCUMENT

This document provides the Chesapeake Bay jurisdictions⁴ with information to assist them in adopting water quality standards to protect aquatic life in the Chesapeake Bay and its tidal tributaries against nutrient and sediment enrichment impairments. Part of the jurisdictions' water quality standards development process may be to conduct use attainability analyses. The *Technical Support Document* may be used to assist states in developing their individual UAAs and state-specific documents. While a UAA is traditionally a process conducted independently by a state, the multi-stakeholder Water Quality Steering Committee decided to provide information on a watershed-wide scale to promote coordination and consistency across all jurisdictions.

OBJECTIVES

The EPA developed the *Technical Support Document* to:

- Document why it appears that the current designated uses for protecting aquatic life cannot be attained in all parts of the Chesapeake Bay and its tidal tributaries due to irremediable natural and human-caused conditions;
- Document the rationale and scientific basis for the refined designated uses for the Chesapeake Bay and its tidal tributaries;
- Document that the refined designated uses are potentially attainable; and
- Provide technical background information for the four Chesapeake Bay jurisdictions with tidal waters to use in developing their own jurisdiction-specific UAAs.

STRUCTURE AND CONTENT

Chapter II provides background information regarding Chesapeake Bay tidal-water quality problems caused by excess nutrients and sediments. *Chapter III* demonstrates that two factors—natural conditions and irremediable, human-generated conditions—provide sufficient evidence that the current designated uses cannot be met in certain portions of the Chesapeake Bay and its tidal tributaries.

Chapter IV provides information that jurisdictions may use in adopting refined tidal-water designated uses based on the habitat quality needs of the plants and animals that inhabit the different Chesapeake Bay tidal-water habitats and the Bay and its tidal rivers' natural physical processes and features. The refined designated uses are subcategories of current aquatic life

⁴ The jurisdictions that will develop and adopt revised water quality standards in response to this effort are those with Chesapeake Bay and tidal tributary waters listed as state waters: Maryland, Virginia, Delaware and the District of Columbia.

protection uses, protected by new Chesapeake Bay regional criteria for dissolved oxygen and, where appropriate, chlorophyll *a* and water clarity (U.S. EPA 2003a). This chapter also presents the scientific basis underlying the geographic and temporal extent ('boundaries') of the refined designated uses and documents that the refined designated uses protect uses existing since November 1975, as required by the EPA Water Quality Standards regulation.

Assessments of the technological attainability of the refined designated uses— migratory spawning and nursery habitat, open-water habitat, deep-water habitat and deep-channel habitat— were conducted by comparing model-simulated water quality responses (measured as dissolved oxygen criteria attainment) of four level-of-effort scenarios (or tiers) to the nutrient and sediment reductions accomplished at each level. The water quality responses are summarized in *Chapter V* in a series of 'attainability tables,' that show which Chesapeake Bay tidal waters achieve attainment for dissolved oxygen for each of the recommended refined designated uses. Attainability of the shallow-water habitat designated use is assessed by examining the historical and recent distributions of underwater bay grasses.

Chapter VI provides an overview of the estimated costs for each set of tiered levels of implementation scenarios. This information is used also to conduct economic impact analyses, which also are described in Chapter VI. The objective is to provide the jurisdictions with preliminary estimates of the types of potential impacts that could occur as a result of implementing the tier scenarios throughout the watershed. However, it may be necessary for states to perform more comprehensive analyses for their own state-specific UAAs. At the basinwide level, economic impacts were not considered in determining the boundaries of designated uses. Rather, it will be up to the individual jurisdictions conducting their own UAAs to determine where there may be substantial and widespread social and economic impacts and to adjust their final use boundary delineations as a result. The present economic information and methodologies are intended only to assist the states with that decision.

The *Technical Support Document* is a compilation of basinwide guidance on UAA-related analyses and was assembled collaboratively by the relevant jurisdictions; it does not represent a regulation or a set of mandatory requirements. The EPA encourages jurisdictions to use the information in this document and, when appropriate, to perform additional analyses relevant to their respective water quality standards development process. The general descriptions provided here may not apply to all circumstances. Interested parties may raise questions and objections about the substance of the *Technical Support Document* and its specific applications. The EPA and other decision-makers retain the discretion to adopt approaches that differ from those described in this document, where appropriate.

The *Technical Support Document* does not include a determination as to whether the refined designated uses are attainable in specific areas; such decisions belong to the states. Instead it provides information based on scientific data to show that revisions of the current designated uses may be justified and that the refined designated uses are viable in many areas of the Chesapeake Bay and its tidal tributaries.

It should be noted that the *Technical Support Document* presents information that is current at

the time of publication, and its analyses are works in progress. The EPA expects Chesapeake Bay jurisdictions with Bay tidal waters to continue related analyses and to seek assistance from the EPA and their Chesapeake Bay Program partners during their tributary strategy development and water quality standards adoption processes.

Resource constraints prevented a full evaluation of many issues such as local cost and impact assessments, physical implementation constraints for technologies and potential cap load impacts. However, the EPA anticipates that the four jurisdictions with Chesapeake Bay tidal waters will explore such issues in greater detail, where appropriate, during their respective water quality standards development processes.

APPROACH TO REFINING TIDAL-WATER DESIGNATED USES

The *Chesapeake 2000* agreement and the subsequent six-state, District of Columbia and EPA memoranda of understanding challenged the Chesapeake Bay watershed jurisdictions to “define the water quality conditions necessary to protect aquatic living resources” and to have the jurisdictions with tidal waters “use their best efforts to adopt new or revised water quality standards consistent with the defined water quality conditions.” Against this backdrop of a renewed commitment to restore Chesapeake Bay water quality, the Chesapeake Bay Program partners determined that the current underlying tidal-water designated uses must be refined to better reflect desired Chesapeake Bay water quality conditions.

Federal water quality standards regulations establish that states must specify appropriate water uses to be achieved and protected. Current designated uses applied to the waters of the Chesapeake Bay and its tidal tributaries do not fully reflect natural conditions and are too broad in their definition of ‘use’ to support the adoption of more habitat-specific aquatic life criteria. Furthermore, they change across jurisdictional borders in the same body of water.

Under the federal water quality standards regulation, states may adopt subcategories of uses, seasonal uses and may remove uses under certain conditions (including natural, physical and socio-economic conditions). If a state wishes to remove or establish a subcategory of a designated use that requires less stringent water quality criteria, it must conduct a use attainability study. States must also demonstrate that all water uses present on or after November 28, 1975, will always be protected. With publication of the *Technical Support Document*, the EPA encourages states to consider refining and subcategorizing their general aquatic life protection use applied to Chesapeake Bay tidal waters, found in current state water quality standards.

The EPA, in close collaboration with the Chesapeake Bay Water Quality Steering Committee, published new Chesapeake Bay regional water quality criteria for dissolved oxygen, water clarity and chlorophyll *a* (U.S. EPA 2003a). Portions of the Chesapeake Bay criteria are either equal, more, or less stringent than the current dissolved oxygen criteria adopted by the Chesapeake Bay jurisdictions in their water quality standards. Each jurisdiction that currently

lists Chesapeake Bay tidal waters as state waters (Maryland, Virginia, Delaware and the District of Columbia) is responsible for submitting its own UAA to justify changes to state water quality standards for the Chesapeake Bay tidal waters. This *Technical Support Document* provides the jurisdictions with the necessary information for conducting their own UAAs.

Determining Attainment of Current Designated Uses Is Not Feasible

The EPA Water Quality Standards Regulation (40 CFR 131.3) defines a UAA as:

A structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological and economic factors as described in Section 131.10(g).

A UAA is *required*, according to Section 131.10 (j) of the EPA Water Quality Standards Regulation, when:

1. The state designates or has designated uses that do not include the uses specified in Section 101(a)(2) of the Act; or
2. The state wishes to remove a designated use that is specified in Section 101(a)(2) of the Act or to adopt subcategories of uses specified in Section 101(a)(2) that require less stringent criteria.⁵

In conducting a UAA, a state must be able to demonstrate that attaining the designated use is not feasible due to one or more of the six factors in Section 131.10(g) listed below:

1. Naturally occurring pollutant concentrations prevent the attainment of the use;
2. Natural, ephemeral, intermittent or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of a sufficient volume of effluent without violating state water conservation requirements to enable uses to be met;
3. Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original

⁵Section 101(a)(2) Federal Water Pollution Control Act states that "...it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

condition or to operate such modification in a way that would result in the attainment of the use;

5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to chemical water quality, preclude attainment of aquatic life protection uses; and
6. Controls more stringent than those required by sections 301(b)(1)(A) and (B) and Section 306 of the Act would result in substantial and widespread economic and social impacts.

The *Technical Support Document* focuses on the current designated uses in Chesapeake Bay tidal waters for the protection of aquatic life.⁶ Chapter III provides scientific information that the states may use in determining whether current tidal-water designated uses in Maryland, Virginia, Delaware and the District of Columbia, with corresponding dissolved oxygen criteria of 4 mg/l and 5 mg/l, are not achievable in all portions of the Chesapeake Bay and tidal tributaries.

Factors 1 and 3, above, are applied in demonstrating why it appears that the current uses may not be met in certain portions of the Chesapeake Bay and its tidal tributaries. States may rely on one or more of the factors to demonstrate that attaining the current designated use is not feasible. Factors 4 and 5 concerning unalterable hydrologic modifications and natural physical conditions that would preclude attainment may also explain why the current designated uses are unattainable in certain tidal-water habitats of the Chesapeake Bay. The *Technical Support Document* does not explore these two factors in as great of detail as factors 1 and 3; however, the jurisdictions may choose any of the preceding six factors in conducting their state-specific UAAs.

Justifying the Refined Tidal-Water Designated Uses

A UAA is not required to justify application of the refined designated uses, particularly for areas in which the uses (criteria) will be more stringent than current ones. The Chesapeake Bay Program's Water Quality Steering Committee decided, however, it was as important to document attainability of the more protective refined designated uses as it was to justify changes to current designated uses.

⁶Specifically, all state waters in Maryland are protected for Use I or water contact recreation and protection of aquatic life. All state waters in Virginia are designated for the following uses: "...recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish." Delaware state waters are designated for protection of "fish, aquatic life and wildlife" with similar provisions for "protection and propagation of fish, shellfish and wildlife" in District of Columbia's waters.

Due to the shortcomings of current designated uses applied to Chesapeake Bay and its tidal tributaries, the Chesapeake Bay Program watershed partners concluded that the underlying tidal-water designated uses need to be refined to reflect a greater understanding of the complex Chesapeake Bay system and the needs of its living resources. Specifically, the partners recommend that the following five refined aquatic life designated uses be applied to the appropriate habitats in the Chesapeake Bay and its tidal tributaries:

- Migratory fish spawning and nursery;
- Open-water fish and shellfish;
- Deep-water seasonal fish and shellfish;
- Deep-channel seasonal refuge; and
- Shallow-water bay grass.

The first four designated use subcategories were derived chiefly to address seasonally distinct habitats and living resource communities with widely varying dissolved oxygen requirements. The shallow-water bay grass designated use would occur seasonally in conjunction with the part of the year-round open-water use habitat for waters that borders the land along the tidal portions of the Chesapeake Bay and its tributaries. It is intended to protect underwater bay grasses where the water clarity criteria will apply.

The same factors used to show why it appears the current designated uses are unattainable can also be applied in the development of the refined designated uses. Factors 1 (natural conditions) and 3 (irremediable human-generated conditions) were used to determine appropriate boundaries for the refined designated uses. The Chesapeake Bay Program partners also took into consideration factors 4 and 5 as part of the analysis for delineating the boundaries for the refined designated uses. The monitoring data and model-simulated outputs described in Chapter IV show that there are certain hydrologic and physical features that exist in the Chesapeake Bay tidal waters today—some natural and some man-made, such as the shipping channels—which directly influence the horizontal as well as vertical extent of the designated use boundaries.

Assessing Attainability of the Refined Tidal-Water Designated Uses

The question of whether the refined designated uses are attainable is a challenging one. There is no precise approach or existing guidance for answering this question. The challenge is particularly large for an area as large and complex as the Chesapeake Bay and its watershed, with its heterogeneous habitats and its vulnerability to pollutants from point and nonpoint sources. The concept of attainability encompasses technological, economic and even political and legal perspectives. The *Technical Support Document* addresses these viewpoints to a limited extent. The states ultimately need to make their final determinations by applying information tailored to their respective jurisdictions. This document specifically addresses technological attainability of the migratory spawning and nursery, open-water, deep-water, deep-channel (based on dissolved oxygen criteria attainment) and the shallow-water designated uses (based on past and recent observed underwater bay grass distributions). Because the Chesapeake Bay

chlorophyll *a* criteria were published in narrative form, attainability of the open-water designated use was not assessed for this parameter.

From a legal perspective, ‘existing uses’ are, by definition, attainable. By regulation, they must be protected by designated uses in water quality standards (40 CFR 131.10[g], 131.10[h][1] and 131.10[i]). Further, at a minimum, uses are considered attainable if they can be achieved by implementing effluent limits (referred to as best available technology or BAT) required under sections 301(b) and 306 of the Clean Water Act and by implementing cost-effective and reasonable best management practices (BMPs) (40 CFR 131.10[d] and 131.10[h][2]).

Once a use is designated (as in the case of the Chesapeake Bay), it is presumed to be attainable and may not be removed unless the state conducts a UAA and can demonstrate that attaining the designated use is not feasible based on one of the six use removal factors (40 CFR 131.10[g][1][6]). If a state conducts a UAA and demonstrates that one or more of the six factors are met for a particular designated use, the state may remove the use. However, the state may not remove an existing use and must revise water quality standards to reflect uses actually attained (40 CFR 131.10[i]). In addition, designated uses not satisfying any of the six use removal factors may not be removed.

As 40 CFR 131.2 states:

...water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water and take into consideration their use and value of public water supplies, propagation of fish, shellfish, and wildlife, recreation in and on the water...

If the use removal factors are cited to remove a designated use, the state must adopt an ‘appropriate’ use or uses in place of the one removed (40 CFR 131.10[a]). Attainable uses are appropriate uses and may be expressed as subcategories of use. Because the use removal factors are designed to determine whether to remove a designated use when it is not attainable, they serve the purpose equally effectively when considering whether a use is attainable and should be designated.

The Chesapeake Bay Program partners have devised a valuable tool for exploring attainability from a technological perspective—a range of level-of-effort scenarios that represent degrees of nutrient and sediment load reduction through simulated implementation of best management practices (BMPs) and wastewater treatment upgrades. These scenarios begin with Tier 1, which represents the current level of implementation in the watershed, including regulatory requirements implemented through the year 2010, up to a scenario representing ‘limits of technology’ referred to as the E3 scenario or ‘everything, everywhere by everybody,’ which is acknowledged to be physically implausible. Tier 2 and Tier 3 scenarios also were developed to represent intermediate levels between the Tier 1 and E3 scenarios.

Each tier represents a nitrogen, phosphorus and sediment load reduction determined by the technologies and levels of implementation assigned to it.⁷ These tiers are artificial constructs of technological levels of effort and *do not represent actual programs that the jurisdictions will eventually implement to meet the water quality standards*. These tiers are an assessment tool to determine potential load reductions achievable by various levels of technological effort and were modeled to determine water quality responses. Chapter V provides the results of the water quality model analyses for dissolved oxygen by tier, presented in a series of ‘attainability tables,’ that estimate the level of attainment achieved within the designated use boundaries. These analyses shows that most segments of the Chesapeake Bay and its tidal tributaries realize attainment at E3. This attainment is also true for Tier 3 where, if nonattainment does exist, it is generally at levels less than one percent, except for Chesapeake Bay Program segment CB4MH or Middle Central Chesapeake Bay (see Table V-6) where 8.51 percent nonattainment in deep-water remains.

Chesapeake Bay Program partners have used the E3 scenario to represent human-caused conditions that cannot be remedied. The partners agree that reductions at E3 are not achievable and that the load reductions represented by Tier 3 are technologically achievable. Therefore, if a proposed use can be attained at load reductions equal to or greater than Tier 3, but less than E3, that use should be designated. The jurisdictions may still, through their own analyses, show that irremediable human-caused conditions prevent use attainment, or explain why the uses cannot be attained based on substantial and widespread economic or social impacts, or other factors in 40 CFR 131.10(g). However, the analyses published in this *Technical Support Document* show that the refined designated uses can potentially be attained in the Chesapeake Bay and its tidal tributaries.

Chapter V also addresses the attainability of the shallow-water designated use. Restoration of underwater bay grasses to areas supporting “the propagation and growth of balanced, indigenous populations of ecologically, recreationally and commercially important fish and shellfish inhabiting vegetated shallow-water habitats” is ultimately the best measure of attaining the shallow-water bay grass designated use. This document provides the states with two means by which to determine the return of water clarity conditions necessary to support restoration of underwater bay grasses and, therefore, attainment of the shallow-water designated use.

Consideration of Economic and Social Impacts

The sixth factor to consider when conducting a UAA listed under Section 131.10(g) (“Controls more stringent than those required by Sections 301[b] and 306 of the Act would result in substantial and widespread economic and social impact”) also has been addressed to a limited extent in the *Technical Support Document*. The information presented in Chapter III justifying why current designated uses cannot be met does not require reliance on the substantial and

⁷ Sediment reduction is only estimated where it is incidental to implementation of BMPs directed toward nutrient loading reductions.

widespread economic and social impact factor as part of the justification to change the uses. Furthermore, the Chesapeake Bay Program partners delineated the use boundaries for the Chesapeake Bay and its tidal tributaries based on estuarine living resources and their habitats, not on economic impact information.

Conversely, it is logical to ask if the designated uses are affordable. The *Technical Support Document* does not attempt to provide conclusions on affordability because the Chesapeake Bay Program partners judged it premature to specify thresholds for substantial and widespread economic and social impacts. On a regional, state or large watershed scale, economic impacts can be mitigated by cost-share, loans or new federal or state funding programs. Cost and economic analyses to show impacts that would preclude attainment of these refined uses must be more comprehensive and rigorous than the present analyses.

JURISDICTION WATER QUALITY STANDARDS AND TRIBUTARY STRATEGY DEVELOPMENT PROCESS

Upon publication of the *Regional Criteria Guidance*, the Chesapeake Bay tidal-water jurisdictions of Maryland, Virginia, Delaware and the District of Columbia began their respective water quality standards development and adoption processes. At the same time, all Chesapeake Bay watershed jurisdictions, including Pennsylvania, West Virginia and New York collaboratively allocated caps on nutrient and sediment loads necessary to meet these anticipated water quality standards (i.e., Chesapeake Bay regional criteria and refined designated uses) (U.S. EPA 2003b). States are scheduled to adopt water quality standards by 2005. Local watershed load reduction action plans (referred to as ‘tributary strategies’), based on achieving the *Chesapeake 2000* nutrient and sediment cap load allocations, will be completed by April 2004. The development of tributary strategies will provide area-specific information that jurisdictions can use in their water quality standards adoption process. To promote consistency, jurisdictions will need to work cooperatively during their tributary strategy development and water quality standards adoption processes, particularly where tributary basins include more than one state in the Chesapeake Bay watershed, such as the Potomac River basin.

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