APPENDIX 26

COMMENTS ON DEQ'S PROPOSED CHLOROPHYLL-*A* STANDARD FOR THE JAMES RIVER

SUMMARY

VAMWA scientists have been involved with the efforts to derive chlorophyll-*a* standards since the criteria derivation process was initiated by the Chesapeake Bay Program in 2000. Over this time, VAMWA has put a great deal of effort into evaluating various methods for deriving and expressing chlorophyll-*a* standards, with a sincere desire to identify appropriate methods if possible. Chlorophyll-*a* has been of special interest to VAMWA from the beginning of the process, due to the scientific challenges of quantitatively linking chlorophyll-*a* to designated uses in a manner that is not simply redundant of dissolved oxygen and water clarity standards.

Throughout this process VAMWA's major objective has been to ensure that—if and when chlorophyll-*a* standards were proposed—they represent scientifically-defensible regulations with tangible benefits to the environment and the public. Unfortunately, Virginia's proposed chlorophyll-*a* standards for the James River are deeply and fatally flawed on many levels, and have validated all of VAMWA's previously-expressed concerns about how a poorly-fashioned chlorophyll-*a* standard could lead to mismanagement of water quality and a waste of public resources. Major shortcomings of the regulation include the following:

- The proposed chlorophyll-*a* criteria are scientifically invalid, and are not based on demonstration of benefits to aquatic life or the public.
- Regulators have attempted to justify the proposed standard by numerous unsubstantiated and questionable claims regarding the impacts of chlorophyll-*a* on living resources of the James River.
- The proposed chlorophyll-*a* criteria could actually harm living resources such as oysters, striped bass, largemouth bass, and menhaden. These potential impacts have not been evaluated by regulators.
- The proposed criteria are based on a highly subjective and poorly defined interpretation of the algal "balance" concept, without consideration of overall ecological impacts.
- Analysis of monitoring data demonstrates that much higher—and less burdensome—chlorophyll-*a* criteria would provide equivalent algal "balance".
- The proposed numbers were heavily influenced by a pre-determined load allocation, the reverse of the process intended by the Clean Water Act.
- More scientifically-defensible methods that point to alternate chlorophyll-*a* criteria for the tidal fresh water region were not utilized.
- Regulators have not performed an analysis of alternatives to the proposed criteria, some of which are likely to represent superior environmental protection with much lower socioeconomic impacts.

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The DEQ's technical support document on chlorophyll-*a* criteria (hereafter abbreviated as the TSD) failed to demonstrate aquatic life impairments in the lower James River that would justify the proposed standard. This segment generally does not experience nuisance or toxic blooms, and concerns in this segment are more related to potential trends in the (low) occurrence of potential bloom forming species, rather than any demonstration that the current algal composition is inherently unhealthy. VAMWA recommends that the lower James River be addressed by a phased adaptive management approach that includes consideration of food quantity requirements for oysters.

Of all the general and specific claims made by DEQ in the technical support document, the only category that VAMWA found to be partially substantiated were related to relatively high cyanophytes—including *Microcystis aeruginosa*—in the tidal freshwater segment of the James River. Monitoring data provide no evidence of adverse food quality impacts or toxicity. However, even if one accepted DEQ's description of this impairment, analysis of the monitoring data demonstrate that alternate chlorophyll-*a* criteria would provide equivalent protection against cyanophytes and *superior* protection of zooplankton and fish.

In summary, VAMWA believes that DEQ has largely ignored the data-based relationships between chlorophyll-*a* and designated uses in the criteria setting process. Instead, DEQ has compiled a range of low chlorophyll-*a* concentrations without connections to designated uses, and made a highly subjective selection of values, heavily influenced by a pre-determined load allocation, and without regard to potential harm to oysters and other fisheries. VAMWA encourages DEQ to instead base chlorophyll-*a* criteria on direct relations with designated uses where potential HABs commonly occur, and to take an anti-degradation or adaptive management approach to prevent the increases in potential HABs in segments where they are currently very rare. Such an approach could save Virginia hundreds of millions of dollars while providing comparable or superior ecological benefits.

VAMWA's opposition to the proposed chlorophyll-*a* standard should be considered in light of its general support of the dissolved oxygen and water clarity standards, which are also expected to require major expenditures by VAMWA members. Similarly, we recognize and appreciate the state's desire to address the James River in a progressive fashion. Protection of the water quality and living resources of Virginia tributaries, including the James River, is core to the VAMWA's mission. VAMWA sincerely desires to work with state agencies in a cooperative manner to put the James River on a positive path forward.

Specific comments follow below:

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1. DEQ has mischaracterized the status of the James River and benefits to be expected from the proposed chlorophyll-a standards.

In an effort to justify the proposed chlorophyll-*a* standards, the state has made numerous claims regarding the current status of the James River. The state's overall interpretation of the status of the river is highly negative, and in fact much more negative than any reports that preceded DEQ's push for chlorophyll-*a* standards (e.g., Virginia Secretary of Natural Resources, 2000; Dauer and others, 2003). DEQ's TSD makes frequent and liberal use of terms such as "undesirable", "nuisance", and "unhealthy", often without an objective basis for such claims. Positive aspects of the aquatic life status were largely ignored in the TSD. And the analyses presented in the TSD include almost no examination of the direct relations between chlorophyll-*a* and the claimed impairments, to demonstrate that the proposed criteria have any relation to the stated impairment.

(a) The TSD ignores favorable biological indicators and mischaracterizes the likely effects of the proposed chlorophyll-a standards on aquatic life uses.

Much of the TSD is devoted to discussion of various algal indicators. At various junctions, DEQ makes the leap that these algal indicators have impaired various other biota such as SAV, clams, menhaden, and oysters. Most of these claims are unsupported by the data and the scientific literature. Contrary to suggestions of the TSD, there is no evidence that fish, crabs, oysters, clams, menhaden, or even zooplankton abundance are impaired by excess chlorophyll-*a* in the James River. If DEQ has actual data or evidence that this is occurring, we encourage them to make this information publicly known.

In fact, this river has many favorable biological indicators unmentioned by the TSD:

- The James River benthic macroinvertebrate community is the healthiest in the Chesapeake Bay Region (Virginia Secretary of Natural Resources, 2000).
- Fish data collected by the Virginia Department of Game and Inland Fisheries in 1998-99 demonstrated high abundance and diversity metrics, indicating a high quality fish community (Malcolm Pirnie, 2001)
- The river is a productive game fishery, hosting numerous tournaments including those for striped and largemouth bass.
- There is not a single study cited by DEQ or elsewhere that demonstrates that the algal community composition (or "balance") is inadequate to support desired levels of living resources at higher trophic levels.

The abundance and diversity of fish and benthic macroinvertebrates in the James River is not surprising, given high dissolved oxygen conditions and a phytoplankton composition represented by favorable dominance and abundance levels of diatoms, chlorophytes, and cryptophytes (Dauer and others, 2003). The major challenges to living resources in the James River are:

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- High levels of inorganic turbidity that hinder SAV growth (discussed further in comment 1-e)
- The diseases MSX and Dermo that affect oyster populations.
- Non-native species such as the blue catfish that compete with other species.

Chlorophyll-*a* driven nutrient load reductions are not expected to significantly affect any of these problems, and in fact may harm larval fish and oysters by imparting food quantity limitations (discussed further in comment 9).

(b) The James River rarely experiences nuisance or toxic algal blooms.

In presentations and their TSD, DEQ makes liberal use of the term "bloom" without adequate scientific definition. The document seems to refer to any increase in chlorophyll-*a* above some arbitrary level (not specified in the TSD) as an undesirable "bloom", regardless of whether the bloom has any harmful effects to other biota or would be even detectable by an observer. Most algal blooms are natural and not harmful, occurring in response to various environmental stimuli. In the context of designated use attainment, it is *harmful algal blooms* that are of concern, particularly nuisance or toxic blooms.

Nuisance blooms are exceedingly rare on the James River. Even in the tidal freshwater region, where chlorophyll-*a* levels are the highest, there is little to no visible expression of the algae. For example, aesthetic monitoring performed by the Hopewell Regional Wastewater Treatment Facility (HRWTF) and VIMS in 2004 showed no discernable change in the appearance of the water between March, when chlorophyll-*a* levels were very low, and late summer/early fall, when chlorophyll-*a* levels peak (Moore and others, elec. comm. 2004).

A review of the TSD reveals that DEQ was hard-pressed to identify examples of nuisance bloom conditions on the James River. The 1983 bloom that affected the Richmond water supply (cited on p. 12) actually originated in non-tidal waters that would not be covered by the proposed chlorophyll-*a* standard. The only other cited example was a reference to a photograph of a visible bloom in 2004, provided to DEQ by the Chesapeake Bay Foundation. While this photograph may in fact represent a "mahogany tide" as speculated—perhaps caused by the unusually high flow conditions of the summer 2004—the very fact that DEQ had no stronger evidence for nuisance conditions is a demonstration of how rare this condition is on the James River.

Table 1 lists the potentially harmful thresholds of several potentially toxic algal taxa, as cited by the USEPA Chesapeake Bay Program's *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries* (2003). Although previous reviews by VAMWA have shown that some of these thresholds are excessively conservative and not necessarily representative of aquatic life impairments, for the purposes of the present discussion these thresholds will be considered representative of "potential harmful algal blooms".

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A review of Virginia CBP algal monitoring data reveals that potentially harmful dinoflagellate blooms are exceedingly rare in the James River. For example, in the 18-year record of algal monitoring in the James River, there has been only one incidence of the dinoflagellate *Prorocentrum minimum* exceeding the threshold, and none for *Cochlodinium heterolobatum* or *Karlodinium micrum*.

The absence of toxic blooms in the Bay is well-documented. For example:

- NOAA (1997) reported no "biological resource impacts due to nuisance or toxic algal blooms" in the lower James River.
- In a review of the occurrence of potentially phytoplankton blooms in the Chesapeake Bay, Marshall (1996) states that
    - "Blooms were not associated with toxin production, major fish kills, [or] shellfish poisoning."
    - "There is an apparent absence of toxin related events at this time in the Chesapeake Bay"

TABLE 1
Thresholds Representing Potential Harmful Algal Blooms
As Cited by USEPA (2003)

Species	Algal Group	Salinity Regime	Potentially harmful threshold cited by USEPA CBPO (2003) (count/mL)
Prorocentrum minimum	Dinoflagellate	Mesohaline-polyhaline	3,000
Cochlodinium heterolobatum	Dinoflagellate	Mesohaline-polyhaline	500
Karlodinium micrum	Dinoflagellate	Mesohaline-polyhaline	10,000
Microcystis aeruginosa	Cyanophyte	Freshwater-oligohaline	10,000

A concern has been expressed for the lower James River by Dr. Harry Marshall's (ODU) communications regarding an increasing trend in the number of dinoflagellate taxa identified, including the occurrence of some potentially toxic taxa—although generally at low, non-harmful levels. It must be emphasized that this trend does not represent an aquatic life impairment, but rather concern over a potential future impairment. VAMWA agrees that such a trend, if real, would provide reason for ensuring that it does not continue to the point that impairments actually occur, preferably using an adaptive management approach (for more on adaptive management of harmful algal blooms, see comment 10). However, there has been no demonstration that the proposed chlorophyll-*a* criteria have any relation to the occurrence of these taxa.

DEQ must examine the basis of the alleged increase in toxic dinoflagellate taxa, to ensure that is it not merely caused by statistical sampling effects and/or an increase in the ability of analysts to recognize such taxa over time. The probability of observing rare minority taxa increases as sample data increase. For example, when discussing the occurrence of minority estuarine algal taxa in the tidal freshwater James River, Marshall and Burchardt (1996) state that

> ...the recording of estuarine taxa was probably enhanced by the extensive sampling base, which provided more opportunities to be recorded for this region;. e.g., during storm events and periods of low discharge. However, the majority of these taxa occurred in <2% of collections.

Hence, the total number of distinct taxa observed will almost always increase with time in a monitoring program. Discussion of trends in the occurrence or abundance of potentially toxic taxa must be supported with statistical trend analysis.

In the tidal freshwater James River, DEQ's claims regarding harmful algal blooms center on *Microcystis aeruginosa*. This species does not occur in concentrations sufficient to cause visible or nuisance blooms in the James River. There is no evidence that it occurs in toxic strains or harms any other aquatic life. For example, *Microcystis aeruginosa* abundance actually correlates in a positive manner with mesozooplankton abundance in the Bay system (Figure 1). However, even if one accepted DEQ's definition of this impairment, analysis of the direct relations between *Microcystis aeruginosa* (and cyanophytes in general) and chlorophyll-*a* points to very different chlorophyll criteria than proposed by DEQ (see comment 7-e).

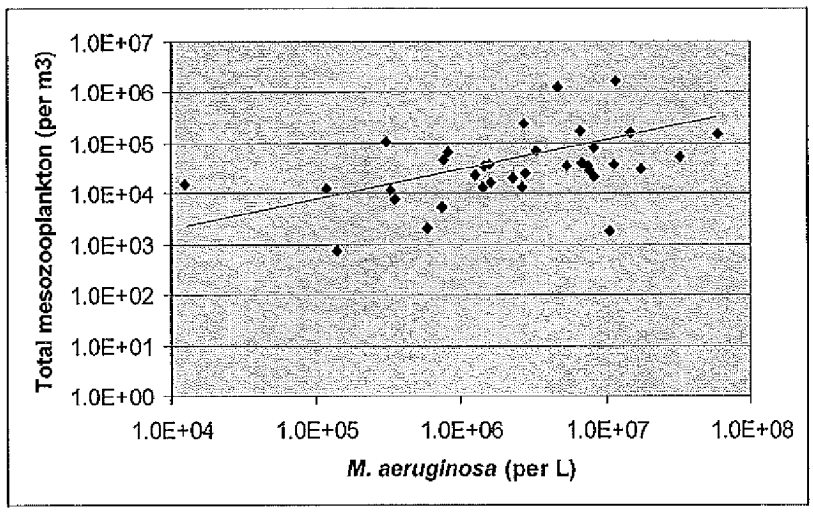

Figure 1. Total mesozooplankton v. *Microcystis aeruginosa* abundance in Chesapeake Bay and tributaries. From Plankton Goals Database (Buchanan and others, 2002).

In the TSD, DEQ makes the point that improvements in water clarity could be accompanied by an increase in undesirable blooms, given nutrient availability. The state has not proposed any plan to significantly reduce the resuspension-dominated turbidity of the James River. However, given the hope that turbidity could be reduced in the future, VAMWA finds this a valid point and agrees that an increase in undesirable blooms should be prevented. However, once again this does not lead to the proposed chlorophyll-*a* criteria. Prevention of an increase in blooms could be addressed by an anti-degradation

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approach, or a phased adaptive management approach. This would likely still lead to nutrient reductions if light conditions were actually expected to improve.

(c) The "food quality" arguments are overstated and not substantiated.

There is no evidence presented nor demonstration made that the food quality of the James River is of insufficient "quality" to support desired living resources. The numerous statements regarding "food quality" in the TSD are largely unsubstantiated, and seem based on several overgeneralizations and misconceptions that have been difficult to dispel.

The concept of linking chlorophyll-*a* criteria to "food quality", while once promising, has not come to fruition. A draft version of the EPA criteria document attempted to derive chlorophyll-*a* criteria primarily based on food quality impacts to zooplankton, which would presumably then affect higher trophic levels. This approach—and the associated chlorophyll criteria—were severely criticized during independent scientific and stakeholder reviews, and were ultimately withdrawn. For example, a reviewer Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) labeled the idea that high chlorophyll-*a* levels can be associated with measurable food quality impacts as "overstated and not substantiated" (USEPA CBPO, 2002):

Similarly, the CBP's Chlorophyll-*a* Task Group was unable to derive any *a priori* definition of acceptable v. unacceptable phytoplankton composition relative to food quality requirements for upper trophic levels. While it was acknowledged that specific phytoplankton species could be harmful or non-nutritious, generalizations such as "dinoflagellates are poor food where as diatoms are good food" were not found to have a firm scientific basis.

With this background, VAMWA was dismayed to find that DEQ's TSD has perpetuated the shaky overgeneralizations about chlorophyll-*a* and food quality. Such statements are likely to mislead the public into believing that the proposed chlorophyll-*a* criteria would have a measurable positive impact on higher trophic levels, which has not been demonstrated in any fashion.

Because zooplankton feed directly on phytoplankton, a phytoplankton composition that represented unacceptable food quality would first be expected to manifest itself as a reduction in zooplankton. This in turn could affect higher trophic levels that feed on zooplankton. For example, a minimum of 20,000 m^{-3} total mesozooplankton has been cited as favorable for larval fish (Jacobs, 2003). If the proposed chlorophyll-*a* levels were representative of "poor food quality", one would expect mesozooplankton abundance to decline when chlorophyll-*a* exceeded the criteria.

In fact, actual monitoring data indicate that this is not the case. Graphical and statistical analysis of data from the Plankton Goals Database (Buchanan and others, 2002) demonstrates no suppression of mesozooplankton when chlorophyll-*a* exceeded the criteria proposed by DEQ (Figures 2-7; Table 2). In fact, in the tidal freshwater regime, meozooplankton were significantly *lower* when chlorophyll-*a* was below the proposed

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criteria (i.e., in non-attainment), as was the probability to have sufficient mesozooplankton to support larval fish—despite higher cyanophyte abundance at higher chlorophyll-*a* concentrations.

VAMWA does not dispute that certain phytoplankton taxa can be less nutritious to consumers, nor that it may be possible in the future to establish stronger linkages between nutrient inputs, other environmental variables, and food web dynamics. However, VAMWA strongly challenges the concepts that the present algal composition has been demonstrated to be of insufficient quality to support desired living resources, or that the proposed chlorophyll-*a* criteria are based on documented food quality benefits to aquatic life uses.

TABLE 2
Results of Wilcoxon Rank-Sum Test of Mesozooplankton Abundance Above and Below Proposed Chlorophyll-a Criteria
[Analysis based on 1985-2002 data compiled in Plankton Goals Database (Buchanan and others, 2002)]

Salinity	Season	Proposed Chl-*a* Criterion (µg/L)	Median Total Mesozooplakton Below Criterion (per m^3)	Median Total Mesozooplakton Above Criterion (per m^3)	Significantly different at α=0.05?
Tidal Freshwater	Spring	15	5,500	44,200	Yes
	Summer	20	1,430	24,098	Yes
Oligohaline	Spring	15	11,300	13,900	No
	Summer	15	13,700	16,900	No
Mesohaline	Spring	10	10,700	12,300	No
	Summer	10	7,400	8,100	No

(d) The phytoplankton reference community and phytoplankton IBI are more indicators of turbidity than absolute measures of the health of the algal community.

The TSD references phytoplankton reference communities (Buchanan and others, submitted for publication) and the related phytoplankton IBI (Lacouture and others, in prep.) as basis for statements that the algal community in portions of the James River is "poor" or "degraded". The original phytoplankton reference community work had the reasonable purpose to examine the variability in certain plankton metrics with certain other environmental variables, such as light, salinity, and nutrient concentrations. It has long been VAMWA's concern that this work would then be misapplied in the context of water quality management and standards, and unfortunately it appears these concerns are being justified. Following is a summary of VAMWA's previous comments and concerns with the manner in which the phytoplankton reference community and associated IBIs are being applied:

As stated in the DEQ TSD, "the phytoplankton reference community approach does not demonstrate any direct relationship between chlorophyll-*a* concentrations and designated use impairments" (p. 16). Similarly, the related IBI suffers from a similar lack of linkage

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with designated uses. There has not even been a demonstration that chlorophyll-*a* is a statistically meaningful predictor of phytoplankton composition for most season-salinity regimes.

It should be understood that the phytoplankton reference communities and associated IBIs do not represent *a priori* definition of "good" or "bad" algal compositions, based on observable ecological effects. Rather, they represent a *substitute* for such a definition, given the Chesapeake Bay Program's inability to define ecological impacts of different algal compositions. The use of these metrics for direct water quality management or standards development therefore represents circular logic: "This is the water quality we want to get the phytoplankton composition we want, which was itself derived from an *a priori* definition of the water quality we want."

As an example of this circular logic, note that the phytoplankton IBI is calculated using many highly correlated measures of biomass—including chlorophyll-*a* itself. By definition, the IBI will be worse when chlorophyll-*a* is high. Any attempt to justify chlorophyll standards on the basis of phytoplankton IBI scores therefore represents a tautology.

Results of the phytoplankton reference community approach make it clear that light, rather than nutrient concentrations, was the important controlling variable for phytoplankton communities. As stated by Buchanan and others (in press):

> The strong similarities between the better-best) [i.e., high light, low nutrient concentrations] and mixed-better-light [i.e., high light levels regardless of nutrient concentrations] in mesohaline and polyhaline waters...attests to the overall importance of water clarity for phytoplankton. As long as light levels are classified as "better", DIN and PO4 concentrations evidently do not need to be below...limitation thresholds before features characteristic of the better-best phytoplankton communities appear.

With this in mind, it can be concluded the relatively high turbidity of the James River is the primary reason that the phytoplankton community would differ from other tributaries. Non-algal suspended solids are the major cause of low light conditions throughout the James River, and nutrient reductions driven by chlorophyll-*a* criteria would not be expected to cause shifts from "worst/poor" light conditions to "better/best" light conditions. This suggests that attainment of the chlorophyll-*a* criteria would not cause the phytoplankton reference community to be significantly different, particularly in the mesohaline and polyhaline segments.

Low light conditions are also likely to be the primary cause of the asymmetric chlorophyll-*a* distribution in the water quality bins with lower light, either because low light conditions favor certain mixotrophic, bloom-forming taxa (Mullholland, 2004), or light-limited algae bloom when light become temporarily more available. Similarly, low light conditions favor blue-green algae in freshwater systems (Wilbur, 1983).

Conversely, improved light conditions would be expected to significantly affect the phytoplankton composition even if chlorophyll-*a* concentrations remained the same. Nutrient load reductions would likely be required to prevent an increase in chlorophyll-a

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if light conditions were expected to significantly improve. However, this would indicate the need for an anti-degradation or phased adaptive management approach to nutrient controls, rather than the concept that chlorophyll-*a* reductions are necessary or useful for achieving a particular phytoplankton composition.

Ironically, the major contribution of the phytoplankton reference community work in this context is to demonstrate that chlorophyll-driven nutrient controls would not be expected to achieve a particular phytoplankton composition in the James River. VAMWA encourages DEQ to re-evaluate the reference community and IBI work with a focus on the actual implications for nutrient and turbidity management. These or related metrics might have some utility as part of a phase adaptive management approach. However, they should not be used to justify chlorophyll-*a* standards.

(e) Algae are not a significant impairment to SAV in the James River.

In several places, the TSD attempts to justify the proposed chlorophyll-*a* criterion on the basis of water clarity and SAV. Virginia is in the process of adopting separate criteria for water clarity/SAV, and the EPA CBPO criteria document only calls for chlorophyll-*a* criteria where "algal related impairments are expected to persist even after the...dissolved oxygen and water clarity criteria have been attained." (USEPA CBPO, 2003). Therefore, it is clear that chlorophyll-*a* criteria are not necessary to protect or restore SAV in the James River. While this is sufficient justification for DEQ to remove the SAV-related justifications for chlorophyll-*a* criteria, VAMWA would also like to take this opportunity to address several other misconceptions regarding SAV included in the TSD.

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The potential depth of SAV growth is not sensitive to chlorophyll-*a* reduction in the James River. For example, application of the Gallegos Diagnostic Tool (Gallegos, 1998) demonstrates that even a 50-percent reduction in chlorophyll-*a* from current levels would

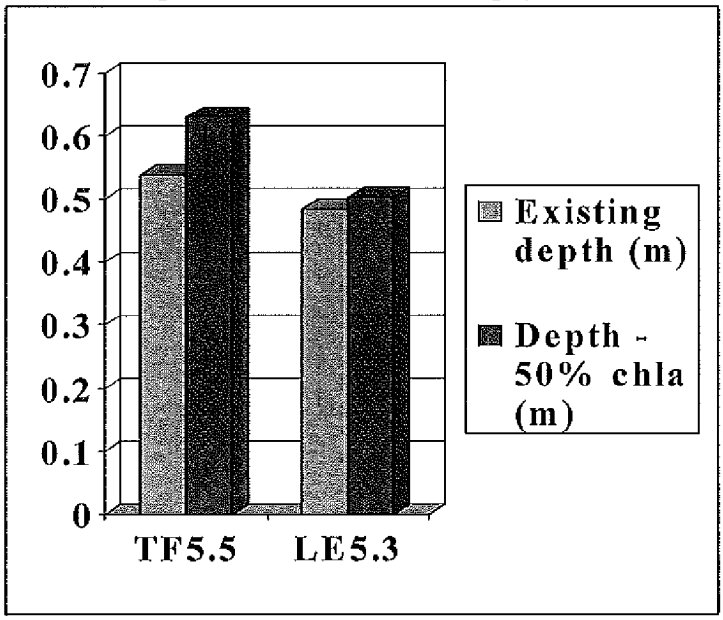

Figure 8: Application of the Gallegos Diagnostic Tool to predict the change in the potential depth of SAV growth from 50% reduction in chlorophyll-*a* at James River monitoring stations TF5.5 and LE5.3.

not expand the potential depth of SAV growth by as much as 0.1 m, due to the prevalence of inorganic suspended solids (Figure 8). Even complete removal of chlorophyll-*a* in the tidal freshwater segment was predicted to be insufficient for SAV growth to one meter or greater (Moore, 2000). VAMWA is unaware of any model results that demonstrate a significant benefit of the proposed chlorophyll-*a* criteria to SAV in the James River, with or without sediment reduction.

HRWTF and VIMS have conducted SAV transplantation studies in the James River for several years (Moore, 2000; 2001; 2002, 2003; 2004). Results included:

- There is already sufficient light for SAV to grow in the shallows. Survival was limited not by chlorophyll-*a* or even water clarity, but by herbivory and salinity effects.
- Overall water clarity changed little between high chlorophyll-*a* and low chlorophyll-*a* seasons/years, nor between high flow and low years. Resuspension of sediment was cited as a major source of turbidity.
- There was no evidence of significant epiphytic growth on SAV.

If significant reductions in the inorganic turbidity of the James River were somehow achieved in the future, the potential depth of SAV growth might become more sensitive to the algal component of water column turbidity. Anti-degradation and phased adaptive management approaches would prevent the occurrence of light-blocking blooms.

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Regardless, SAV should be addressed by the SAV/water clarity criteria, not by chlorophyll-*a* criteria.

2. The lower James River has a balanced phytoplankton community composition and moderate chlorophyll-*a* concentrations.

Throughout much of the TSD, DEQ makes highly general statements about the James River, (e.g., "The tidal James River has very high chlorophyll-*a* levels in comparison to 40 other estuaries", p. 7) and then provides an example from the upper tidal segment. However, many of these generalizations simply are not true for the lower James River. It is critical to distinguish the upper and lower James River segments for water quality management purposes. While concerns over cyanophytes and *Microcystis* in the tidal freshwater segment have some merit and should be addressed by approaches described in comment 7-e and 10, statements that the algal composition of the lower James River is "out-of-balance" do not withstand scrutiny of the monitoring data.

On p. 6 of the TSD, it is stated that "the York River maintains a population of flora considered 'least-impaired' or desirable with a balance phytoplankton composition for comparison." Even if one were to accept this definition of "desirable" (which VAMWA does not for reasons given in comment 1), the data reveal that overall abundance and proportion of the major phytoplankton taxa in the lower James River is almost identical to that of the lower York River (Figure 9). Both communities are dominated by diatoms (~75%), with less than 5% dinoflagellates by abundance. In fact, the lower York River actually had a higher proportion of dinoflagellates than the lower James River.

Hypothesis testing (alpha = 0.05) of 1985-2003 CBP data (Table 3) indicates that:

- Chlorophyll-*a* concentrations in the polyhaline segments of the James and York Rivers <u>were not significantly different</u> in spring or summer.

- Chlorophyll-*a* concentrations in the mesohaline York River <u>were significantly higher</u> than in the mesohaline James River, both in spring and summer.

TABLE 3
Results of Wilcoxon Rank-Sum Test of Chlorophyll-a Concentrations in the Lower James and Lower York Rivers
[Based on 1995-2003 monitoring data of the Chesapeake Bay Program]

Salinity	Season	Median Chl-*a* (µg/L)		Significantly different at α=0.05?
		James	York	
Mesohaline	Spring	6.2	10.3	Yes
	Summer	4.7	13.7	Yes
Polyhaline	Spring	9.0	9.2	No
	Summer	8.5	8.0	No

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It is unclear why DEQ is justifying chlorophyll-*a* reductions in the lower James River on the basis of algal "balance" considering that the chlorophyll-*a* concentrations here are actually lower than DEQ's example of a "balanced" system, and the phytoplankton community composition is basically the same.

3. DEQ concerns regarding the phytoplankton composition of the upper tidal freshwater segment are overstated.

In an evaluation of phytoplankton monitoring data from three Bay Program monitoring sites in the tidal freshwater James River, Marshall (2001) stated:

> [The] algae were dominated by diatoms, followed by chlorophytes, and cyanobacteria in both abundance and biomass, with diatoms the major contributor to the algal biomass at these sites...the phytoplankton species composition is considered common for the period of collection, and representative of what riverine algae may occur for this region...In conclusion, the results of analyzing monthly collections at the three river sites, indicate a diverse phytoplankton composition within these waters that was dominated by diatoms. (Marshall, 2001)

Notice the dissimilarity in tone of this description, which pre-dates DEQ's push for numeric chlorophyll-*a* criteria, to the dire portrayal of the DEQ TSD. The algal composition remains dominated by diatoms throughout most of the year. Even in the summer and fall, when cyanophytes can reach a significant proportion of the total abundance, ≥90% on average of the algal biomass was composed of diatoms and other taxa that DEQ labels as "favorable". There is no evidence that this particular composition is an inadequate food source or has harmful effects on other aquatic life.

It is reasonable for DEQ to raise points about the cyanophyte abundance and occurrence of *Microcystis aeruginosa* in the tidal freshwater segment. In fact, in all of DEQ's discussions related to a potential "imbalance" in the algal composition of the James River, the present proportion of cyanophytes and occurrence of *Microcystis aeruginosa* in the tidal freshwater segment were the only points deemed valid, considering that many cyanophytes including *Microcystis* have been shown to be capable of forming toxic blooms in other freshwater systems. However, we believe even this concern is overstated in terms of an existing designated use impairment, and does not justify the proposed chlorophyll-*a* criteria, for several reasons:

- As discussed in comment 1-b, cyanophytes do not occur in sufficient concentration to form nuisance blooms. [By contrast, the 2004 blooms on the Potomac River were associated with chlorophyll-*a* concentrations in the hundreds or even thousands of μg/L (Maryland DNR, 2004)]
- As discussed in comment 1-c, zooplankton and fish data do not indicate any food quality impairments associated with cyanophytes or *Microcystis* in this segment; mesozooplankton are abundant and peak at relatively high chlorophyll-*a* levels.
- As discussed in comment 4, natural physical and chemical factors of the tidal freshwater James River—such as high turbidity from resuspension—probably

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favor a higher proportion of cyanophytes in the tidal freshwater James River relative to other segments and tributaries.

- As discussed in comment 7-e, even if one accepted DEQ's definition of the impairment, a direct examination of the relations between chlorophyll-*a*, cyanophytes, and *Microcystis* shows that alternate chlorophyll-*a* criteria are warranted.

DEQ correctly points out that *Microcystis aeruginosa* has been observed to exceed the 10,000/mL threshold that was cited by USEPA (2003) as potentially harmful to zooplankton. However deleterious effects on zooplankton are not actually observed in the James River. The explanation is probably a combination of several factors: (1) the strains of *Microcystis aeruginosa* in the tidal freshwater James River have not been demonstrated to be toxic; (2) even toxic forms do not necessarily produce high concentrations of toxins (Kristen, 1996; Oh *et al.*, 2000; Whitton and Potts, 2000); and (3) the 10,000/mL threshold is highly uncertain and probably an extremely conservative indicator of aquatic life impacts. As stated by VAMWA (2003):

> The 10,000/mL *M. aeruginosa* threshold was selected as the geometric mean of two studies (Lampert, 1981; Fulton and Paerl, 1987) that differed by two orders of magnitude as to the threshold of effects. The paucity of studies that allow determination of a threshold and the large disagreement in the two available studies seriously undermine confidence in this value. In fact, the 1,000/mL threshold obtained from Lampert (1981) was from a study of effects on a single species (*Daphnia*) only. The Fulton and Paerl (1987) study examined effects on larger number of species and found a threshold of 100,000/mL. Even this value was not associated with an overall decline in zooplankton, but a shift in taxa from those inhibited by *M. aeruginosa* to those that gained a competitive advantage.

A potentially legitimate concern has been expressed in both the TSD regarding an increasing trend in cyanophytes over the last few years. We agree that is it not desirable that such a trend should continue. However, the proposed chlorophyll-*a* criteria are an inappropriate means to address such a trend. To highlight this point, consider that the increasing trend in cyanophytes was concurrent with major <u>reductions</u> in nutrient inputs to the tidal freshwater segment, due to voluntary nutrient control projects instituted by major point sources.

It is highly likely that the increase in cyanophytes is at least partially caused by a concurrent decrease in the nitrogen-to-phosphorus ratio (Figure 10), which tends to favor nitrogen-fixing cyanophytes. An examination of the input decks of the 2004 James River tributary strategy reveals that the strategy calls for similar levels of reduction in point source nitrogen and phosphorus loads from 2003 levels, suggesting that the overall summer N:P ratio would not necessarily change from current levels that (evidently) favor a relatively high proportion of cyanophytes. This provides an example of how blind application of the proposed chlorophyll-*a* criteria—disregarding the complex environmental controls on phytoplankton dynamics—could provide either no benefit or even a detriment.

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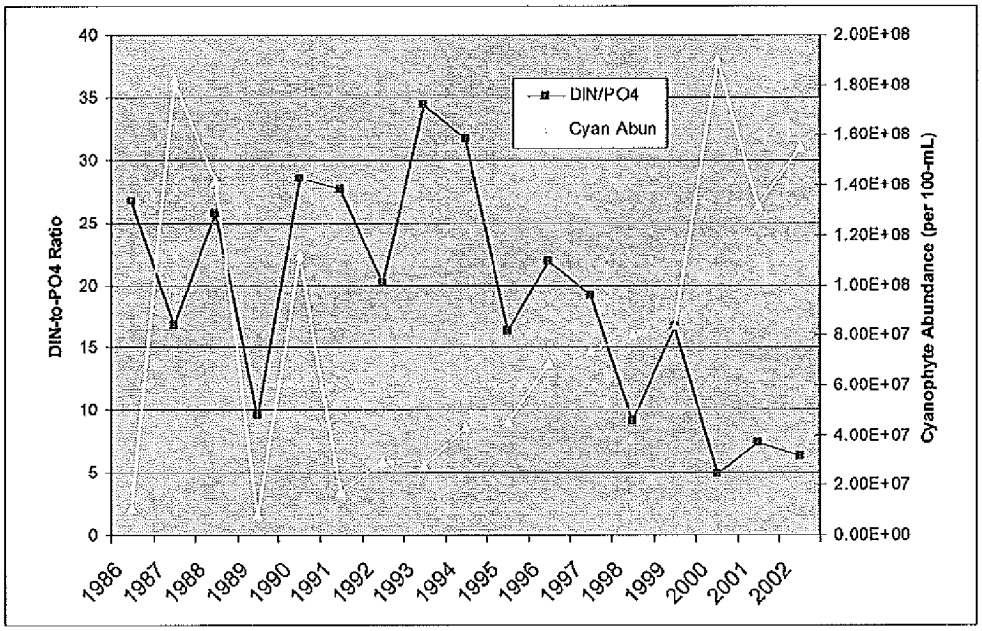

Figure 10: Trends in the DIN/PO4 ratio and cyanophyte abundance at station TF5.5

The TSD also refers to the 2004 nuisance blooms on the Potomac River, with the concern that James River could possibly develop similar conditions. As mentioned above, this condition would be prevented by an anti-degradation, phased adaptive management approach, or alternate numeric chlorophyll-*a* criteria for the tidal freshwater segment as discussed in comment 10.

It should also be understood that the upper tidal James River and upper tidal Potomac River are very different systems and respond to nutrient loading in very different manners. For example, the extremely wet summer of 2004 was accompanied by nuisance bloom conditions on the Potomac River, while simultaneously the tidal freshwater James River actually had unusually low chlorophyll-*a* concentrations (Moore, in preparation), probably due to greater flushing rates. Analogies between the two systems should therefore be stated with caution.

4. A more objective definition of "balanced aquatic life" is required that relates to overall ecological health.

VAMWA is very concerned that DEQ is misapplying the concept of "balanced aquatic life" in the context of water quality standards. Without an objective definition of balance, DEQ is free to interpret almost any algal indicator as an "imbalance" and justify costly regulations on the basis, regardless of whether or not the indicator is a proven measure of ecological health. Like most biological communities, the algal community has a great deal of variability with season, location hydrology, salinity, and other environmental

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variables. Many of these differences in algal composition do not necessarily constitute an aquatic life impairment.

The TSD makes extensive use of ratings of both water quality and planktonic variables in the TSD, such as those utilized in ODU status/trend monitoring reports, phytoplankton reference communities, or phytoplankton IBIs. These ratings are not based on *a priori* definitions of what is healthy or unhealthy for the ecosystem, but are simply based on differences between other tributaries. Most of these indicators are unproven measures of ecological health, and higher trophic levels may be completely insensitive to them.

But a more fundamental point is that relative differences between very different tributaries do not necessarily constitute designated use impairments. Any number of chemical or hydraulic, or morphometric differences between tributaries might cause differences in algal composition. For example, the tidal freshwater segments of the York and James Rivers would not be expected to be highly similar even in the absence of anthropogenic influences. These two rivers have few similarities either in terms of their watershed characteristics, channel characteristics, or hydraulics. It is not reasonable to define differences in their algal communities as impairments.

As one example of an important difference between rivers, the upper tidal James River is likely to always be more turbid than the upper York due to a larger drainage area that includes higher slopes, a higher stream gradient, and a higher proportion of erodible Piedmont soils. Cyanophytes are favored by high turbidity conditions (Wilbur, 1983), and so the tidal freshwater James may naturally have a higher proportion of cyanophytes relative to the tidal freshwater York River. Marshall and Alden (1990) attributed many of the differences in phytoplankton composition between the tidal freshwater Rappahannock, York, and James Rivers to differences in the salinity gradient:

> The environmental conditions associated with the downstream oligohaline-mesohaline gradient appear to override the importance of relatively close geographic proximity and seasonal variability in the overall influence on these phytoplankton communities.

If DEQ liberally defines "out of balance" on the basis of differences in algal composition between tributaries, the James River is likely to always remain "out of balance" regardless of chlorophyll-*a* concentrations. Although relative differences between tributaries are of scientific interest, in the Clean Water Act framework, water quality criteria represent thresholds above which actual impairments to designated uses can be demonstrated to occur.

In making this comment, VAMWA is not completely dismissing the concept of "balance" in algal communities, but calling for a more rigorous, objective definition that goes beyond just relative differences and considers <u>actual impacts of the algal composition on overall ecological health or other designated uses</u>. According to this definition, an "imbalanced" algal composition is one which results in toxic, nuisance, food quality, or food quantity impacts. In other words, an "imbalanced" algal composition must be defined based on harm to aquatic life.

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DEQ has taken a highly legalistic interpretation of the standard and interprets any difference in the algal community from some other condition as an imbalance indicative of an aquatic life impairment, regardless of whether fish, oysters, clams, or even zooplankton are harmed by the difference. This is unfortunate not only for the regulation under discussion, but also sets a disturbing precedent for future water quality standards. This action would essentially provide the public no protection from DEQ imposing costly regulations that have no tangible environmental benefits.

5. The argument that chlorophyll-*a* criteria are necessary because segments of the James River are "eutrophic" amounts to empty reasoning.

Building upon comment 4, part of DEQ's argument for the proposed chlorophyll-a standards is that chlorophyll-*a* in the tidal freshwater segment is high, relative to other locations (TSD, p. 6-7). This particular argument is equivalent to the empty reasoning that chlorophyll-*a* is too high because chlorophyll-*a* is high. The same can be said for the argument that chlorophyll-*a* is too high because chlorophyll-*a* is rated "poor", or because the upper James has chlorophyll-*a* concentrations categorized as "eutrophic".

The paradigm that eutrophic or high-chlorophyll systems are inherently unhealthy is derived from other settings where high chlorophyll-*a* concentrations are associated with low DO, nuisance blooms, or toxic blooms. The James River does not commonly experience any of these problems, notwithstanding *Microcystis* issues that can be addressed by the approach described in comment 7-e. Similarly, the paradigm that mesotrophic conditions are inherently desirable does not necessarily apply to the James River. In the absence of DO problems or toxic blooms, eutrophic conditions are actually preferred for most warmwater fisheries because of the greater food supply (for more on food quantity concerns, see comment 9) found with these conditions. DEQ must focus on demonstrable designated use impairments instead of relative chlorophyll-*a* levels, and abandon the unsubstantiated paradigm that mesotrophic is "desirable" whereas eutrophic is "undesirable".

6. Data analysis reveals that the proposed chlorophyll-*a* criteria are inappropriate for the stated purpose of achieving balanced algal composition.

Even accepting (for the purposes of the present argument) DEQ's concept of algal-related impairments, DEQ has failed to demonstrate that chlorophyll-*a* is a useful management measure for the "balance" of the algal community or that the specific proposed chlorophyll-*a* criteria values correspond to attainment of "balance". Rather, the values are appear to be more rooted in the hazy belief that lower is better.

VAMWA performed independent analyses of the balance of the James River phytoplankton community under different chlorophyll-*a* conditions, using the 2004 Phytoplankton IBI database. Specifically, the relative abundance of the major phytoplankton taxa were examined when chlorophyll-*a* was (1) less than the proposed criteria; and (2) between the proposed criteria and twice the proposed criteria (Table 4). The exception was for the summer tidal freshwater segment, where 35 μg/L has been

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identified as a threshold above which cyanophytes and *Microcystis aeruginosa* become more abundant (see comment 9). For the season-salinity regime combination, the higher chlorophyll-*a* interval considered was between the proposed criteria (20 µg/L) and 35 µg/L. The non-parametric Wilcoxon rank sum test was applied to determine if lower chlorophyll-*a* concentrations were associated with significantly different proportions of selected taxa between the two intervals.

TABLE 4
Chlorophyll-*a* Intervals for Comparison of Algal Balance

Station	Season	Chla Interval in "Attainment" (µg/L)	Chla Interval in "Non-Attainment" (µg/L)
LE5.5	Spring	0-10	10-20
	Summer	0-10	10-20
RET5.2	Spring	0-15	15-30
	Summer	0-15	15-30
TF5.5	Spring	0-15	15-30
	Summer	0-20	20-35

Results of this analysis are presented in Figures 11-13 and in Table 5. The general conclusion is that the balance of the phytoplankton community under "non-attaining" conditions are *at least* as favorable as those under "attaining" conditions, even if one accepts the dubious overgeneralization that diatoms are "good" whereas dinoflagellates and cyanophytes are "bad". The spring diatom bloom in the mid-to-lower estuary caused the proportion of diatoms to increase with chlorophyll-*a*, such that the proportion of diatoms was actually higher in the non-attaining chlorophyll-*a* interval than the attaining chlorohypll-a interval. In other season-salinity combinations, there were no significant differences in the proportion of key taxa.

TABLE 4
Results of Wilcoxon Rank-Sum Tests Comparing Proportions of Phytoplankton Taxa in Lower and Higher Chlorophyll-*a* Intervals, 1985-2003
[see Table 3 for definitions of chlorophyll-*a* intervals]

Station	Season	Taxon	Result, α=0.05
TF5.5	Spring	%Diatoms	No significant difference between lower and higher chl-a intervals.
		%Cyanophytes	No significant difference between lower and higher chl-a intervals.
	Summer	%Diatoms	No significant difference between lower and higher chl-a intervals.
		%Cyanophytes	No significant difference between lower and higher chl-a intervals.
RET5.2	Spring	%Diatoms	Higher in 15-30 µg chl-*a*/L interval than 0-15 µg chl-*a*/L
		%Cyanophytes	No significant difference between lower and higher chl-a intervals.
	Summer	%Diatoms	No significant difference between lower and higher chl-a intervals.
		%Cyanophytes	No significant difference between lower and higher chl-a intervals.
LE5.5	Spring	%Diatoms	Higher in 10-20 µg chl-*a*/L interval than 0-10 µg chl-*a*/L
		%Dinoflag.	No significant difference between lower and higher chl-a.
	Summer	%Diatoms	No significant difference between lower and higher chl-a.
		%Dinoflag.	No significant difference between lower and higher chl-a.

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These results provide clear evidence that (1) the proposed chlorophyll-*a* criteria cannot be expected or assumed to result in favorable changes in the balance of the phytoplankton community; (2) significantly higher chlorophyll-*a* criteria—with much different socioeconomic implications—would be environmentally equivalent.

As discussed in previous comments, the phytoplankton community composition is probably more a function of alternate environmental variables (including turbidity, salinity, temperature, nutrient ratios and other chemical/physical characteristics) than chlorophyll-*a*.

7. The proposed chlorophyll-*a* criteria values are technically erroneous, and are primarily based on concepts that have either failed previous technical reviews or not even undergone independent scientific reviews.

In setting the actual criteria values, DEQ relied on a hodgepodge of tabulated values (Table 11 of the TSD) mainly derived from the USEPA CBPO Bay criteria document, communications from selected scientists involved in the unsuccessful efforts to derive numeric Chesapeake Bay Program chlorophyll-*a* criteria, preliminary estimations as to what concentrations were attainable, a table the USEPA CBPO brought to one of the Technical Advisory Group (TAC) meetings (primarily based on the Bay criteria document), and "professional judgment". The fact that so many sources were included in developing the criteria is testament to the fact that none of these sources were defensible in and of themselves. The concept that multiple lines of non-evidence add up to evidence is one that VAMWA has opposed throughout this process. Neither DEQ's proposed criteria nor the sources from which they were derived have been shown to be founded in defensible science by independent reviews. Most of the so-called lines of evidence are simply various means of quantifying the left side of the chlorophyll-*a* frequency distribution without any link to designated use impairments.

Specific comments on the validity of DEQ's justifications for the proposed criteria follow below.

(a) USEPA CBPO's efforts to derive numeric chlorophyll-a criteria were unsuccessful.

The DEQ TSD relies heavily on text and tabulated chlorophyll-*a* values from the USEPA CBPO criteria document. It should be understood that this document represents a well intended but ultimately failed attempt to derive numeric chlorophyll-*a* criteria. DEQ is well aware of this, having served on the Chlorophyll-*a* Task Group. The first draft of the CBPO criteria document (July 2001) emphasized the "Phytoplankton Reference Community Approach" along with other secondary sources of information such as historical values, literature values, and contributions to light attenuation and low dissolved oxygen. After the first review period it was recognized that this primary line of evidence (phytoplankton reference communities / water quality binning) lacked sufficient linkage between chlorophyll-*a* and designated uses.

As such, they are not appropriate for criteria derivation. These inappropriate lines of evidence include:

Historical concentrations: VAMWA's most fundamental concern with the historical data approach is that it does not define impairments of designated uses. Even perfect knowledge of what concentrations were at some point in the past does not allow us to identify the concentrations above which impairments occur, nor does it demonstrate a direct relation between chlorophyll-*a* and those impairments. Criteria derived by reference to some past condition could be highly overprotective or simply ineffective.

The second concern related to historical data is associated with the spotty / infrequent nature of the data collections and questions regarding their representative nature, which limit the usefulness of the dataset used the Harding and Perry (1997) to characterize historical chlorophyll-*a* concentrations in the lower Bay system. The role of historical levels of filter feeding grazers also should be taken into consideration when comparing chlorophyll-*a* values of the past with contemporary measurements. Two important filter-feeding species (the menhaden and the oyster) were in much greater abundance during the 1950s-1960s than during present times. Potentially lower chlorophyll-*a* values of the past (if genuine) probably reflected to some degree the greater ability of these species to consume algae, as opposed to a condition that justifies bottom-up controls.

Phytoplankton reference community concentrations: See comment 1-d for discussion of why this line of evidence in inappropriate for deriving chlorophyll-*a* criteria. It is unclear why this line of evidence would even be included in the tabulation of values used to derive chlorophyll-*a* criteria if DEQ admits that "the phytoplankton reference community approach does not demonstrate any direct relationship between chlorophyll-*a* concentrations and designated use impairments" (TSD, p. 16).

(c) The proposed chlorophyll-a criteria were heavily influenced by a pre-determined nutrient load allocation, the reverse of the process intended by the Clean Water Act.

The line of evidence labeled *attainable concentrations* represented USEPA's advice to DEQ regarding what chlorophyll-*a* concentrations are attainable in the James River. This advice was erroneous in that it was based on 10-year seasonal average chlorophyll-*a* concentrations, whereas actual attainment would be assessed by the cumulative frequency distribution approach (CFD) applied to 3-year increments of monitoring data. Conclusions based on 10-year data sets will provide erroneous attainment conclusions since 10-year data sets will likely mitigate the impacts of data variability that a 3-year data set cannot mitigate. The latest model runs from the Chesapeake Bay Program indicate that the James River would not be in attainment with the proposed chlorophyll-*a* criteria, even assuming full implementation of the 2004 James River tributary strategy. (Linker, L. 2004, handout materials from 6 Oct 2004 meeting of the CBP Modeling Subcommittee meeting).

But the more fundamental problem with the use of attainable concentrations to set criteria is that it represents "backing into" criteria based on a pre-ordained load allocation,

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In an attempt to correct this problem further analyses were conducted to link chlorophyll-*a* and mesozooplankton abundance. The resulting second draft of the criteria document (May 2002) emphasized these "food quality" connections as the next primary line of evidence. We supported that approach and provided data analysis to assist in the effort. Although this method seemed promising at first, a significant number of adverse review comments were received from a wide range of other reviewers including ourselves and STAC, demonstrating that chlorophyll-*a* was not a useful predictor of food quality impacts.

Ultimately, the CBPO Chlorophyll-*a* Task Group correctly concluded that they lacked a defensible technical basis for numeric chlorophyll-*a* criteria, and published a narrative criterion instead. The chlorophyll-*a* values that had been tabulated in previous drafts were repackaged and included in the EPA criteria document, in case they might provide some insight to states that might make additional attempts to link chlorophyll-*a* to designated uses. VAMWA expressed concerns about including these values in the criteria document, fearing that they could be misunderstood or misused by states. Unfortunately these fears are being realized.

One highly disturbing development is the new interpretation that regulators have since made of the failure of the USEPA CBPO to derive chlorophyll-*a* criteria, suggesting that the only reason that USEPA did not publish numeric criteria is that such numbers must be site-specific. Having served on the Task Group, VAMWA recognizes such statements as misleading.

EPA-recommended concentrations: With this background, the EPA-recommended concentrations of Table 11 in the TSD do not represent an independent line of evidence, but merely point back to the failed approaches compiled in the Bay criteria document; historical concentrations, reference communities, trophic-state classification, etc. VAMWA finds it completely unacceptable that USEPA CBPO would have insufficient technical basis to publish chlorophyll-a criteria for public review but then arrive at a DEQ TAC meeting with a table of "recommended criteria", completely circumventing the normal review process for 304(a) criteria.

It is revealing that DEQ's proposed criteria are as much as double the EPA-recommended concentrations for some season-salinity regimes, based primarily on attainability concerns. Just as revealing is the fact that EPA representatives then endorsed DEQ's proposed criteria in public hearings, despite some values being twice what EPA had recommended. While some groups might claim that this indicates that the proposed criteria are too high, it actually points to the extreme subjectiveness and lack of technical basis for the proposed criteria.

(b) Most of the chlorophyll-a values are not based on any threshold of impairment or direct link to designated uses, but on various reference condition methods that merely characterize the low end of the chlorophyll-a frequency distribution.

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instead of basing load allocations on criteria needed to protect designated uses. An examination of Table 11 of the TSD reveals that for most of the season-salinity combinations, Virginia's recommended criteria were set at the supposed attainable concentration rounded up to the nearest integer that was a multiple of five.

One of VAMWA's chief concerns with the proposed chlorophyll-*a* criteria is that Virginia is using it to justify a pre-determined load allocation or level of effort for the James River, such as to attain a load allocation similar to the 2003 PSC agreement, or justify a level of nutrient control similar to tributaries that have more direct impact on the Chesapeake Bay. While VAMWA recognizes some of the political and legal pressures with which the state is dealing, DEQ must base water quality criteria only on sound science and defensible linkages to designated uses.

(d) Water quality criteria must be based on thresholds above which designated use impairments are demonstrated to occur.

The common fatal flaw of all the chlorophyll-*a* values derived from the approaches discussed above is that they do not represent thresholds above which designated use impairments have been demonstrated/predicted to occur. VAMWA finds it distressing that this fundamental requisite of water quality criteria is being ignored in favor of reference condition methods and unfounded concepts that lower chlorophyll-*a* levels are intrinsically better for the environment. Imagine if criteria for copper or dissolved oxygen were derived by similar reference condition methods instead of by cause-effect considerations. The copper criterion would be likely at the limit of detection, and the dissolved oxygen criterion would be near saturation. Both would be highly overprotective and essentially useless in the context of water quality management.

(e) Linkages of chlorophyll-a to HABs have promise but must be revised.

Linkages of chlorophyll-*a* to HABs represent the lone approach discussed in the TSD that has promise for deriving defensible criteria. VAMWA has made efforts in the past to assist DEQ in making these linkages. In Spring 2004, VAMWA proposed a monitoring approach that would allow the state to identify the chlorophyll-*a* concentration at which nuisance blooms occurred. DEQ staff rejected this approach upon the basis that they were required to produce recommendations to the State Water Control Board in June 2004, and therefore did not have time to implement the monitoring strategy.

Secondly, municipal groups used data from the Phytoplankton IBI database to identify the chlorophyll-*a* concentrations at which cyanophytes and *Microcystis aeruginosa* exceed specific thresholds in the tidal freshwater James River, and presented these results to the TAC. It was logical to believe that DEQ might favor such an approach, because it directly correlated the chlorophyll-*a* concentration to the cyanophyte and *Microcystis*-related impairments claimed by DEQ (notwithstanding VAMWA's concerns regarding whether a tangible impairment actually existed).

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This analysis identified a threshold of about 35 µg/L for the tidal freshwater James River (Figures 14-16). *Microcystis aeruginosa* was not observed to exceed the 10,000/mL threshold below this chlorophyll threshold. Cyanophytes also have a very low incidence of exceeding values that had been identified by other researchers as potentially suppressing zooplankton at this chlorophyll threshold. As discussed in comment 6, the proportion of cyanophytes in the 20-35 µg/L chlorophyll-*a* range was not significantly different from the proportion in the 0-20 µg/L range. And as discussed in comment 1, the mesozooplankton (i.e., larval fish food) abundance was much higher in the 20-35 µg/L interval than in the 0-20 µg/L range. Therefore, it appears that a criterion of 35 µg/L provides not just equivalent but superior protection of aquatic life in this segment, compared with 15-20 µg/L.

DEQ did include some of these results in the TSD as Figure 21. Similarly, the TSD clearly states that "at the phytoplankton monitoring station in this segment (TF5.5), [exceedance of cyanophyte thresholds] begin to occur in the 35-40 µg liter^{-1} chlorophyll *a* range." (p. 18). Unfortunately, it does not appear that these results were actually used to derive the criteria or even included in Table 11 of the TSD under the two columns devoted to HAB-related concentrations. The 35-40 µg/L threshold is quite clear and represents DEQ's only potential linkage of chlorophyll-*a* with designated uses for this segment. It is unclear why DEQ is ignoring this threshold in the James River criteria derivation process.

Given the lack of nuisance blooms or observable/predictable food quality impacts in the tidal freshwater segment, even a 35-40 µg/L criterion would be conservative. Nuisance blooms are typically associated with chlorophyll-*a* concentrations higher than the 35-40 µg/L range. For example, a report on the 1983 *Microcystis aeruginosa* bloom on the Potomac River (MWCOG, 1984) documents that surface scums of this taxon were observed only when chlorophyll *a* concentrations exceed 50 µg/L to over 200 µg/L. Similarly, the 2004 blooms on the Potomac River were associated with chlorophyll-*a* concentrations in the hundreds or even thousands of µg/L (Maryland DNR, 2004).

Table 11 of the TSD includes two HAB-related columns of chlorophyll-*a* concentrations, but neither of these were based on the actual thresholds observed for the James River. The values cited for the TF1 and TF2 segments appear to be derived from the USEPA criteria document that did not consider James-specific data. As discussed in previous comments, the tidal freshwater James River is very different from many other segments, and cannot be assumed to have thresholds identical to those observed in a Bay system-wide analysis. James River-specific data show that a 35-40 µg/L chlorophyll a standard would be a protective range for the tidal freshwater summer, as discussed above. Cyanophytes including *Microcystis* are not abundant in the spring season in the segment, so a spring numeric criteria is not necessary unless it were based on anti-degradation.

For the high salinity segments of the James River, a threshold of 25 µg/L chlorophyll-*a* was cited in Table 11 of the TSD, based primarily on the prevention of *Prorocentrum minimum* blooms that could impair oysters. As discussed in comment 1-b, potentially

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harmful blooms of *Prorocentrum minimum* are exceedingly rare in the James River. Regardless, DEQ did not use this value when developing the criteria.

Given the rarity of actual toxic blooms in the lower James River, the best approach for this segment would be a phased adaptive management approach that monitors the response of the algal community to nutrient reductions elsewhere in Bay system, including the upper tidal James River. If numeric criteria are derived for the lower James River, they must be based either on anti-degradation or direct relations with harmful algal blooms.

8. The proposed chlorophyll-*a* criteria are more stringent than any used by adjacent jurisdictions, and go beyond federal requirements.

It is worth noting that the proposed chlorophyll-*a* criteria for the James River—in the 10-20 μg/L range—are significantly more stringent than those used by adjacent jurisdictions such as Washington DC (25 μg/L), North Carolina (40 μg/L), and Maryland (50 μg/L previously used for TMDLs, although they will not be adopting numeric chlorophyll-*a* criteria). This despite the fact that the James River has little impact on the Chesapeake Bay, has relatively high dissolved oxygen, and history of toxic or nuisance blooms, unlike many of the tributaries which less stringent goals have been applied.

The Virginia Regulatory Town Hall document states that the proposed standards are not more stringent than federal requirements. This is both technically and legally incorrect. Federal numeric 304(a) criteria for chlorophyll-*a* do not exist. Even under the presumption that USEPA would pressure Virginia to derive numeric standards, the specific criteria proposed in no way represent a federal requirement.

9. The chlorophyll-*a* criteria could actually harm oysters and fish populations by imparting food quantity limitations.

The concept that nutrient-related criteria can impart food quantity limitations on fisheries is well established. For example, the Virginia Academic Advisory Committee's (AAC) report to DEQ on freshwater nutrient criteria includes extensive discussion of the relations between nutrients and fisheries, including the statement that "to sustain quality fisheries, nutrient management is critical; excessive nutrients limit habitat, while low nutrient levels limit food supply" (Zipper and others, 2004). Unfortunately DEQ's TSD includes no analysis or discussion of potential food supply impacts, and seems to assume that none would exist. VAMWA is very concerned that DEQ has not considered potential food quantity effects on oysters, fish, or other consumers in the context of chlorophyll-*a* criteria. Several lines of evidence indicate that this could be a very real problem, as outlined below:

Oysters: Oyster modeling simulations recently sponsored by the Chesapeake Bay Program Modeling Subcommittee indicated that efforts to restore oysters to the James River could be limited by available food. The model algorithm suggested that the James River was currently supporting all the oysters it could based on the available food

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quantity. Light limitations on algal growth were assumed to be an important factor in preventing the algal biomass that would be necessary to support significantly higher oyster biomass (C. Cerco, presentation materials for the 6 Oct 2004 Modeling Subcommittee meeting).

It is reasonable to ask if this simulated food limitation is real, considering that the oyster biomass of the James River is thought to have been higher under lower historical nutrient loading levels. However, the paradox can potentially be explained by the fact that larger, older oysters grow more slowly and have lower food concentration requirements. Without harvesting and disease mortality, a mature oyster population would require lower food concentrations than a young oyster population of the same biomass (C. Cerco, pers. comm., 6 Oct 2004). Similarly, an abundant, established population of mature oysters could sustain itself with lower growth and larval recruitment rates than would be required to expand a small, young oyster population. Thus, in terms of *restoring* oysters to an area, the food limitation problem is likely real.

Dekshenieks and others (1993), drawing on oyster larval growth rate measurements of Rhodes and Landers (1973), demonstrated that maximum larval *Crassostrea virginica* growth rates occurred at a food concentration of about 3 mg C /L. Assuming that the majority of the food was comprised of algal biomass and a typical carbon:chlorophyll-*a* ratio of 80:1, this would correspond to a chlorophyll-*a* concentration of over 35 μg/L. Larval growth rates were reduced to about one-quarter of the maximum rate when food concentration fell below 1.0 mg C/L, corresponding to about 12 μg/L chlorophyll-*a*. Dekshenieks and others (1993) then used a model to demonstrate that variations in food supply could have significant implications for larval development time, with major consequences for adult populations, and conclude with following statement:

> ...management strategies for an oyster fishery must be broad enough to include habitat effects on larval survivorship, which ultimately determine recruitment to the adult population.

Similarly, oyster modeler Eric Powell of Rutgers University has indicated that oyster larva generally require values of 20 μg/L chlorophyll-*a* for optimum growth during the summer months, and that suppressing values to less than 10 μg/L could do "serious harm" (E. Powell, elec. comm.. 10 Dec 2004). Eileen Hofman of ODU has stated that, based on her research, oyster larva are very sensitive to food concentration and that a maximum value of 10 μg/L is "not good for adult oysters and certainly not good for oyster larva" (E. Hofman, elec. comm., 14 Dec 2004).

Although the restoration of oysters to the James River is undoubtedly a complex problem with many facets, <u>potential food quantity limitations must be considered by DEQ as part of an alternatives analysis</u> in addition to other concerns regarding food quality and HABs that are discussed elsewhere.

<u>*Larval fish and zooplankton*</u>: Monitoring data indicate that the implementation of the proposed chlorophyll-*a* criteria would actually reduce total mesozooplankton abundance in the tidal freshwater segment of the James River (Figures 2-3; Table 2). This fraction of

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the zooplankton population is a critical food supply for many organisms including larval fish. For example, a review of the literature by Jacobs (2003) indicated that a minimum of 20,000 m^{-3} total mesozooplankton were required for optimum recruitment of larval fish (Jacobs, 2003). The probability of observing at least 20,000 m^{-3} total mesozooplankton was significantly less when the proposed criteria was attained than when it was exceeded. Hence, the proposed chlorophyll-*a* criteria could have adverse impacts on striped bass, largemouth bass, and other fish populations of the James River.

We refer DEQ to the generalized model of Ney (1996) as presented in the AAC's report (Zipper and others, 2004) on nutrient criteria to DEQ (Figure 17). According to this model, fish populations increase in response to nutrient loading until the positive effects of abundant food supply begin to be outweighed by negative impacts—most importantly habitat loss due to low dissolved oxygen in bottom waters. However, considering that the tidal freshwater James River has relatively high dissolved oxygen concentrations and no nuisance blooms, the most beneficial nutrient/chlorophyll-*a* levels for fisheries in this system would be higher than proposed. For comparison, freshwater ponds and reservoirs that are professionally managed for warmwater fisheries are often fertilized to achieve chlorophyll-*a* concentrations of 40-60 μg/L (M. Maccina, Auburn University, elec. comm., 27 Jan 2005).

It has already been demonstrated that chlorophyll-*a* criteria in the 35-40 μg/L range would prevent impacts from *Microcystis* or cyanophytes (if such actually occur in the James River), and would provide a more abundant food supply than criteria in the 15-20 μg/L range. In combination with present high dissolved oxygen levels, one cannot conclude that chlorophyll criteria in the 15-20 μg/L range are more defensible than in the 35-40 μg/L range.

Dr. Dennis Devries is a noted fisheries scientist at Auburn University with expertise in fish—zooplankton relations. Upon a review of information presented in this comment, Dr. Devries stated that an adaptive management approach would be preferred for the tidal freshwater James River, and that initial chlorophyll-*a* standards under this approach should not be set to suppress chlorophyll-a below 20 μg/L, given potential adverse impacts to the fishery of this segment (D. Devries, pers. comm., 21 Jan 2004).

In higher salinity segments, total mesozooplankton abundance generally has no statistical relation with chlorophyll-*a* concentration. However, considering that the tidal freshwater segment represents the spawning and nursery grounds for fish that populate the higher salinity segments as adults, the proposed chlorophyll-*a* criteria could have negative impacts on the fisheries of the lower James as well.

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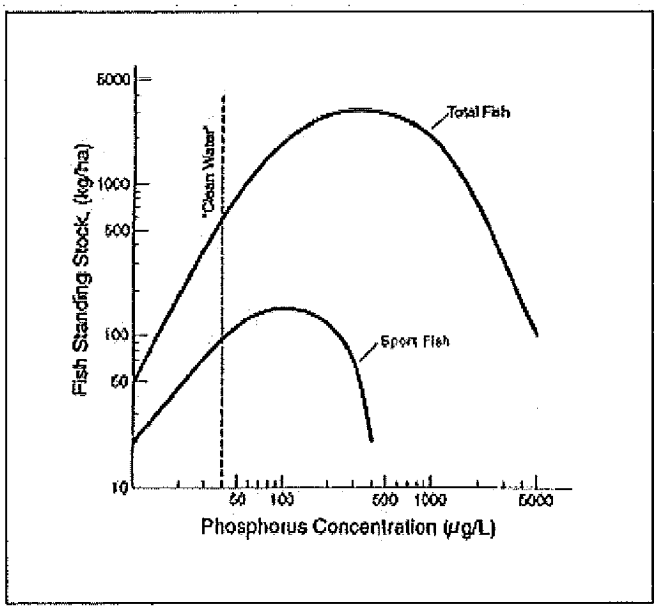

Figure 17. Generalized relation of total fish and sport fish standing stock with total phosphorous concentration in temperate latitude reservoirs, from Ney (1996) as reproduced in Zipper and others (2004).

Menhaden: The chlorophyll-*a* criteria could also have negative implications for menhaden, which can feed directly on phytoplankton. Menhaden actually seek out high algae densities for feeding, with the highest menhaden populations observed in conjunction with chlorophyll maxima of estuaries (Friedland and others, 1996). As stated by Gottlieb (1998):

> Menhaden schools, particularly postmetamorphic juveniles, tend to congregate in areas with the highest levels of phytoplankton biomass.

Although the filtering efficiency of menhaden varies with phytoplankton size, models of menhaden ecology indicate a direct relationship between primary production or biomass and menhaden growth (Durbin and Durbin, 1983; Gottlieb, 1998). It is unclear why DEQ would make the unreferenced assumption that chlorophyll-*a* reductions resulting from implementation of the criteria would benefit menhaden, when this fish actually seeks out high chlorophyll-*a*.

10. The complexity and unpredictability of harmful algal blooms favors an adaptive management approach rather than blind nutrient controls.

As noted in previous comments, DEQ has largely ignored the data-based relationships between chlorophyll-*a* and potentially harmful algal blooms in the criteria setting process. Instead, DEQ has compiled a range of low chlorophyll-*a* concentrations without connections to designated uses, and made a highly subjective selection of values, heavily influenced by a pre-determined load allocation. In previous comments, VAMWA has

encouraged DEQ to instead base chlorophyll-*a* criteria on direct relations with designated uses where potential HABs occur, and to take an anti-degradation or adaptive management approach to prevent the increases in potential HABs in segments where they are currently very rare. Such an approach could save Virginia billions of dollars while providing comparable or superior ecological benefits.

One reason an adaptive management approach is preferred—as opposed to a simplistic nutrient reduction approach driven by chlorophyll criteria—is that the ability to control estuarine HABs by nutrient management is not well understood or even firmly established. Blooms occur in response to a complex set of physiological stimuli and are not necessarily predictable or manageable. In fact, it is unknown if the magnitude of anthropogenic nutrient loads is a major factor driving occurrences of potential HAB-forming species in the Chesapeake Bay. Anthropogenic nutrient enrichment is one among many factors that has been cited as a potential cause of increase in reporting of HABs worldwide. Others include:

- Increased monitoring and scientific awareness of toxic species
- Increased use of coastal waters for shell fisheries/fisheries
- Increased worldwide transport of cells, cysts, and shellfish stock
- Climatic/meteorological conditions

As stated by Donaghy and Osborn (1997:

> A growing body of laboratory, field, and theoretical work suggests that the dynamics of harmful algal blooms...are frequently controlled not only by physiological responses to local environmental conditions as modified by trophic interactions, but also by a series of interactions between biological and physical processes occurring over an extremely broad range of temporal scales. All too frequently, major gaps in our ability to identify, measure, and model the underlying biological and physical processes...have prevented the quantitative assessment of the importance of these factors in causing past blooms...

Similarly, Beltrami (1995) states that:

> Unusual bloom episodes appear to occur in an erratic manner and are seemingly unpredictable in duration and severity. The extent to which such blooms are actually due to deterministic mechanisms...is an open issue.

As discussed in comment 3, a shift in nutrient ratios caused by well-intended nutrient reductions may be a major factor in the increasing cyanophyte trend in the tidal freshwater James River (see Figure 10). Some authors (e.g., Hodgkiss and Ho, 1997) have also concluded that nutrient ratios are more important than absolute nutrient concentrations to regulating dinoflagellate blooms. For example, *Prorocentrum minimum* has a very low critical cell quota for nitrogen and has been shown to be able to out-compete other phytoplankton groups as nutrients become limiting (Roelke and Buyukates, 2001). During low frequencies of nitrate supply, uptake and growth rate of *P. minimum* become uncoupled, and *P. minimum* is able to form a large internal pool of nitrogen that constitutes a competitive advantage under low-nitrogen conditions (Sciandra, 2002).

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Similarly, Mulholland (2004) has demonstrated that many potential bloom formers in Virginia waters have competitive advantages over other taxa under light-limiting conditions due to their mixotrophic nature; i.e., ability to utilize organic nitrogen and carbon. Given the high turbidity of the lower James River, major reductions in inorganic nutrient inputs from point sources might even increase the competitive ability of these taxa. This is a more complex management problem than simply attaining a particular chlorophyll-*a* concentration.

These findings do not support the simplistic paradigm that lower nutrients result in fewer HABs. HABs and the occurrence of potential HAB taxa must be tracked as part of an adaptive management strategy for the James River and other tributaries. Adaptive management is a systematic, iterative process of setting goals, taking actions, evaluating results, and adjusting goals. This approach is particularly appropriate for situations (as with chlorophyll-*a* management) in which a high degree of uncertainty exists between implementation and ecological responses. USEPA, Virginia DEQ, and other agencies have endorsed this as a common-sense approach to environmental management.

It must also be considered that by virtue of its position near the lower Bay, the lower James River will be affected by nutrient reduction driven by DO and clarity standards throughout the Bay system, as well as by nutrient control projects in the upper tidal James River. Implementation of DO and water clarity standards provides an excellent opportunity to monitor changes in chlorophyll *a*, HAB frequency/magnitude, aesthetics, etc. and further evaluate the benefits of numeric chlorophyll-*a* targets. Virginia's water quality standards must be reviewed and revised as necessary every 3 years as part of the Triennial Review process. This existing process provides sufficient opportunity to use adaptive management techniques along with ongoing research.

11. Virginia should perform a UAA on these Standards as called for by USEPA. Further, Virginia should indicate to it's Bay Program Partners that funds to obtain the water quality standards now being proposed in Maryland have not been identified and the standards require a full use attainability analysis including the costs in Virginia.

The chlorophyll-*a* standards are being proposed along with other regulations to meet the commitments the State of Virginia has made under the Chesapeake Bay Agreement. The cost of meeting the chlorophyll-*a* standard cannot be separated from the total cost of these combined regulations. The Virginia Department of Planning and Budget economic impact analysis for these regulations is summarized as follows:

Virginia Department of Planning and Budget
Economic Impact Analysis

	$Millions - Capital	
Urban Stormwater cost	$1,000	
Other Non-point	$975	
Total Non-Point		$1,975

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POINT		$946
Other		$247
Total		$3,168

As shown, the economic impact analysis for the implementation theses regulations used a total cost of about $3 billion. These cost estimates are seriously flawed and out of date. In December 2004, officials the Secretary of Natural Resources presented the following estimate of capital costs to the Chesapeake Bay Commission:

Assistant Secretary for Chesapeake Bay Coordination
Virginia Chesapeake Bay Costs - December 2004

Source	Capital Cost $ Millions	Total Nitrogen Reduction (Millions lbs/yr)	Total Phosphorus Reduction (Millions lbs/yr)	Capital $/Pound-Nitrogen	Ratio - Cost of Others/Ag
Forest	2	1.1	0.02	$2	0.04
Agriculture	**694**	**13.9**	**2.03**	**$50**	**1**
Point Source	1,098	8.9	0.87	$123	2.5
Mixed Open	323	1.6	0.35	$202	4
Septic	74	0.1	0	$740	15
Urban	**5,874**	**4.1**	**0.81**	**$1,433**	**29**
					0
Total	8,065	28.7	4	$281	6

As shown, the estimates are now over $8 billion. These costs now include an almost 6-fold increase in urban stormwater costs. The USEPA highest estimated cost in its 2003 Attainability Analysis for attaining Chesapeake Bay Uses was $7.7 Billion[1] (a total estimate for all Bay States.) The cost in Virginia alone now exceeds USEPA's previous baywide cost estimate. Further, costs in Maryland and Pennsylvania have increased so the total estimated cost is approaching $30 billion dollars. Funding for these extreme increases in Virginia costs have not yet been identified. It should be clear to DEQ that the almost $6 billion in urban stormwater costs cannot be borne by local government.

In its 2003 Attainability Analysis, USEPA indicated the following:

"..states will need to conduct more rigorous economic analysis than the analysis performed by the Chesapeake Bay Program."

This admonition to do a rigorous economic analysis was made when the baywide cost estimate was ¼ of the current estimates. No such analysis has been done. These Virginia regulations cannot proceed without a full understanding of these costs and an understanding of who will pay the costs and if they are affordable. Clearly, a rigorous

[1] Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability, October 2003 Table 3.

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use attainability analysis must be conducted. It is now necessary to assess the attainability of the goals set out by the Bay Program. Further, Virginia should indicate to it Bay Program Partners that funds to obtain the water quality standards now being proposed in Maryland have not been identified and the standards require a full use attainability analysis including the costs in Virginia.

12. The Bay Program goal of 175 million pounds per year needs to be re-assessed for cost effectiveness and quantifiable benefit.

The current Baywide goal of 175 million pounds per year was set without consideration of affordability or cost benefit. Further, the original selection of the 175 million pound per year target was set when it was believed that the newly identified water quality criteria and uses would be obtained in all of the naturally obtainable areas. More recent model revisions have indicated that this is not the case. The 175 million target will not obtain full use in the bay segment referred to as CB4. Chesapeake Bay Program Office Model runs of the Bay indicated that virtually all the obtainable uses are obtained at around 200 million pounds per year with the exception of Bay segment CB4. Based on the most recent modeling data there appears to be no basis in science for the selection of the 175 target. It does not obtain full uses in CB4, and all obtainable uses in other segments documented at 175 are obtained at 200 million pounds per year.

In December 2004, the Chesapeake Bay Commission (CBC, 2004) issued a report on cost effective controls. This analysis included capital and annual costs to arrive at cost per pound figures for various controls. This report indicates that the cost effective level of control is at a level of about 200 million pounds per year with an average unit cost of under $5 per pound with various controls summarized as follows:

Cost Effective Controls from CBC December 2004 Report
Note these are $/# costs including annual and capital costs.

		Nitrogen M#/y	$/ Pound	$ M/ Year	Cost as % of WWTP $	Other//Ag Cost
	WWTP	35	$8.56	$299.6	100%	2.8
	NMP	13.6	$1.66	$22.6	19%	0.6
	ENM	23.7	$4.41	$104.5	52%	1.5
	Cons till	12	$1.57	$18.8	18%	0.5
	cover crops	23.3	$3.13	$72.9	37%	1.0
Everything		107.6*	$4.82	$518.5	56%	1.6
Ag alone	67%	72.6	$3.01	$218.9	35%	1.0

*Of the 107.6 m#/yr total reduction there is a reduction of 80.4 M#/yr delivered to the bay. The year 2002 load was 278 M #/yr for a net of 278-80.4 or about 198 M#/yr

We note in the CBC report that WWTP controls are the least cost effective of the controls recommended. WWTP controls are about three times the average cost of agricultural controls and almost twice as expensive as the most expensive agricultural controls. While we agree that controls on WWTPs are an important part of restoring the Bay, it is clear that much less expensive controls are available on agriculture and most (almost ¾)

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of the cost effective pounds to remove are also in agriculture. These facts have not been made clear to the public.

To go beyond these cost effective levels of control identified by the CBC, Virginia's tributary strategies call for nitrogen controls on urban stormwater. The minimum unit cost identified for urban stormwater abatement according to the CBC Report is urban forest buffer replacement at a cost of $53 per pound. This is more than 10 times the cost of the average cost effective control. Further, we question the feasibility of effectively restoring forest buffers in Virginia's urban environments.

The CBC Report and the Virginia Tributary Strategy cost estimates appears to indicate that going beyond cost effective controls is extremely costly and may be infeasible. We have been unable to identify from this public process quantifiable benefits for controls beyond the cost effective strategies identified by the Chesapeake Bay Program. Clearly, the DEQ and Secretary of Natural Resources believe there are such benefits. However, to make a rational choice on how the public's money is spent we believe these costs and benefits should be identified and publicly reviewed. We ask that the actual quantifiable benefits of moving beyond the CBC cost effective controls be publicly aired and discussed.

13. The state has failed to consider alternative, potentially much more beneficial approaches for nutrient management in the James River.

The selection of numeric chlorophyll-*a* for the James River is wrought with uncertainty and subjectivity. This is evident in by the fact that DEQ felt free to as much as double EPA's recommended values. VAMWA's analysis (see comment 6) has demonstrated that even doubling DEQ's proposed criteria in most season-salinity regimes would provide equivalent "balance" of the algal community as determined by proportions of the major phytoplankton taxa.

In light of this subjectivity and uncertainty, small changes in the proposed criteria—on the order of a few µg/L—could have enormous implications for the socioeconomic burden of compliance. VAMWA believe is it critical that DEQ perform an analysis to determine what magnitudes of load reductions and associated costs would be required to attain different levels of chlorophyll-*a*. Instead, DEQ has selected values based on only one scenario the 2004 tributary strategy.

VAMWA is aware of the CBPO-led efforts in 2003 to evaluate a range of loading options for the Bay as a whole. These analyses were oriented towards the determination of loads that would result in compliance of the mainstem Bay—and segment CB4 in particular—with proposed DO standards. This is in no way a substitute for a James River-specific analysis focused on chlorophyll-*a* standards.

The state should request modeling runs for a range of conditions between progress-to-date and the loading deck of the 2004 tributary strategy, including (1) nutrient controls associated of the 2000 tributary strategy; and (2) the effects of the implementation of DO

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and clarity standards—along with nutrient control projects in the tidal freshwater James River—on chlorophyll-*a* in the lower James River. This analysis would not be a substitute for defining direct relationships between chlorophyll-*a* and specific designated uses. But it would provide critical information that is necessary to help deal with the inevitable subjectivity and uncertainty associated with these standards.

In addition to examining the load-cost-chlorophyll curves, the results of each scenario should be interpreted with regard to the absolute and incremental benefits to aquatic life and other designated uses:

a. What is the magnitude and percentage reduction in chlorophyll-*a* values?

b. What is the total and incremental cost of the load reduction alternative?

c. Based on the observed variability of the James River plankton composition with chlorophyll-*a*, what is the expected shift in algal composition?

d. Is there sufficient scientific information to project that this shift in algal composition would have a measurable impact on fisheries?

e. How do the resulting chlorophyll-*a* values relate to thresholds for harmful algal blooms?

f. How do the resulting chlorophyll-*a* values relate to nuisance conditions that might impair recreation?

g. How do the resulting chlorophyll-*a* values relate to food requirements for adult and larval oysters (higher salinity segments)?

h. How do the resulting chlorophyll-*a* values relate to mesozooplankton abundance and, relatedly, food requirements for larval fish (lower salinity segments)?

VAMWA understands that these questions may be answered with varying degrees of precision and accuracy. While is obviously not practical to accurately predict numbers of fish or oysters under each scenario, the intent is to move beyond highly general or unsubstantiated statements about potential benefits to more rigorous statements based on the available scientific information. We encourage DEQ to consider the types of quantitative information discussed throughout this comment document, including HAB thresholds, mesozooplankton thresholds, larval food requirements, and direct, data-based relations between chlorophyll-*a*, plankton communities, and other environmental variables

SUMMARY

The state should retain the narrative chlorophyll-a standard, withdraw the proposed numeric chlorophyll-*a* criteria, and take the following course of action:

1. Derive a clear definition of the term "imbalance" with respect to plankton communities based on the demonstrable capacity of algal composition or biomass to impair designated

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uses by way of toxicity, nuisance conditions, or (pending additional research) food quality impacts.

2. Re-evaluate numeric chlorophyll-*a* criteria for the tidal freshwater summer James River to prevent cyanophyte/*Microcystis* impacts while protecting zooplankton abundance and fish larvae. Previous analyses have indicated that the appropriate chlorophyll-*a* threshold is 35-40 µg/L.

3. Perform an alternatives analysis to evaluate the sensitivity of chlorophyll-*a* to various nutrient management strategies. Evaluate scenario results not only with respect to cost but also the absolute and incremental benefits/detriments to aquatic life uses.

4. Design and implement a phased adaptive management program for algal conditions in the James River that will track changes in response to nutrient and sediment control projects throughout the Bay system.

Thank you for your consideration of these comments. VAMWA looks forwards to working with DEQ to implement these recommendations in a constructive, collaborative fashion.

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August 24, 2005

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Re: Nutrient-Related Water Quality Regulations

Dear Ms. Daub and Mr. Kennedy:

We appreciate the opportunity to comment on the following pending regulations:

1. Water Quality Standards (9 VAC 25-260)

2. Water Quality Management Planning Regulation (9 VAC 25-40)

3. Regulation for Nutrient Enriched Waters and Dischargers Within the Chesapeake Bay Watershed (9 VAC 25-720)

We recognize that the current rulemakings are critical matters affecting the health of the Chesapeake Bay and its tributaries. We also recognize the tremendous commitment required of the Commonwealth, our members and their ratepayers in this effort. Accordingly, it is important that this effort be accomplished in the most effective and most economical way possible. We ask that DEQ and the Board fully consider all of VAMWA's comments and requests.

This letter constitutes our comments for the latest phase of this ongoing rulemaking process. We expressly incorporate by reference as if set forth fully herein (1) our earlier written comments submitted during the public comment periods during the course of this rulemaking (on file with DEQ) and (2) the proceedings of June 28, 2005 before the State Water Control Board on the above-referenced regulations. In addition, we note for the record our agreement with the August 2005 written comments of two our member agencies, the Hampton Roads

Sanitation District and the Hanover County, and such comments are hereby incorporated by reference as well.

Public Process & Public Participation Deficiencies

We are compelled to begin with the serious procedural problems and what we consider to be broken promises following the June 28, 2005 State Water Control Board meeting.

Following extensive presentation and discussion at the June 28 Board meeting, the Board adopted and suspended the pending regulations. This was done in part because the Board had only very recently received DEQ's recommendations (and therefore was understandably not fully acquainted with the substance of DEQ's recommendations and their impacts) and to allow further comment by the pubic, which had similarly been deprived any notice or opportunity to comment on radical changes (drastically more stringent wasteload allocations) in the pending regulations.

Prior to taking that action, the Board had received written presentation materials (Exhibits 1 and 2) and oral testimony from VAMWA, which was presented by our legal counsel, Mr. Christopher Pomeroy. During the course of the presentation and deliberations on June 28, DEQ Director Burnley gave VAMWA assurances to the effect that all of its requests listed as recommendations in its presentations would be honored, except for the VAMWA's recommendation of no action at this time (on the latter point, DEQ would continue to recommend that the Board use the "adopt-and-suspend" procedure).

Also prior to taking action, Board Chairman Wampler inquired of VAMWA whether a 30-day comment period would be adequate. We responded in the affirmative on the condition that the water quality modeling listed among VAMWA's recommendations and previously agreed to by DEQ be provided before the start of the comment period.

In response to a query from the Chair, the DEQ Director agreed to this condition after consulting with EPA's representative, Mr. Rich Batiuk, in open session on the record. (EPA, which controls the model, indicated that this condition would be met.) Accordingly, VAMWA concurred with the 30-day comment period on those terms, and ultimately the Board voted to proceed accordingly.

The referenced modeling was designed to evaluate whether our members' facilities should receive higher WLAs than set forth in the pending regulations. We are disappointed that the Department has not provided the modeling in a timely manner for this comment period. That fact significantly diminishes the value of this public comment period to our organization.

On July 11, 2005, VAMWA provided Model Scenario Technical Details (Exhibit 3) to DEQ in writing. These model scenarios were tailored to help answer important, unanswered questions.

In a meeting on July 21, 2005 involving the DEQ Director and several staff members as well as VAMWA members, technical consultants and counsel, the DEQ Director reported, much to our surprise, that it would take 18 months or 2 years to complete the requested modeling. (The Director has told us that these statements were made on the basis of information from EPA.) The meeting closed with an agreement to meet again when appropriate EPA staff were available (Mr. Batiuk was on vacation). The second meeting was later set for August 12, 2005.

Much to our dismay, DEQ initiated the comment period on July 25, 2004 notwithstanding its modeling commitments. We are at a complete loss to understand why DEQ would begin the comment period without having lived up to its very recent commitment and what we understood to be a clear direction from the Board.

Curiously, EPA was able to quickly provide two other model runs that DEQ requested. These appear to have been done in a matter of weeks rather than months or years. That was the same type of turnaround that VAMWA had anticipated for its modeling requests, which had only minor but important point source load variations between the runs.

At best, the claim of 18 months to 2 years was a severe miscalculation, given the speed with which EPA has produced the other two model runs to DEQ.

At worst, it raises very serious questions about the integrity of this process.

Did DEQ or EPA know during the June 28 Board meeting, when all the experts and top management were present, that they could not honor the modeling commitments that they and the Board made at that meeting?

If the ten model runs (less of if York and James runs are performed by the computer simultaneously) really take two years (*i.e.*, an average of about two months each), how could any knowledgeable EPA or DEQ staff present at the meeting have allowed Director Burnley to make this promise? There are two rivers, and under the above-stated timelines it seems that the timeline would not be feasible for even ONE model run on ONE river.

We acknowledge that before making the modeling commitment both Chairman Wampler and Director Burnley tried to avoid this problem. We recall Director Burnley asking EPA management present at the Board meeting if this timeline for

modeling was feasible and that EPA specifically assured Director Burnley that it in fact was feasible.

But, to make matters worse, why did DEQ start the comment period on July 25 knowing that DEQ or EPA would not provide any of the requested modeling runs for months at best? Clearly the comment period should not have begun on July 25.

It appears that a number of modeling runs could actually have been done quickly. VAMWA had committed, and has since worked with DEQ and EPA, to narrow the scope of its request. The comment period should have been deferred slightly (or extended sufficiently) to allow time for the modeling to be completed. Going forward, there should be 30 days of comment after the modeling is done to honor the June 28 commitments.

If the promised modeling could not have been done quickly, DEQ should at a minimum develop a schedule for conducting the modeling and arrange a subsequent 30-day comment period that DEQ and VAMWA could jointly recommend the Board at the September 2005 Board meeting.

These concerns were provided to DEQ by email on July 27 (Exhibit 4).

At the July 21 meeting we asked Director Burnley to resolve this problem. On July 27, we provide these concerns in writing to the Director (by forwarding Exhibit 4 by email) and provided recommendations on how to fix the problem. We have yet to receive any indication as to how the problem would be fixed and the June 28 commitments honored.

That said, there was a further meeting on August 12 to narrow the scope of the modeling. VAMWA provided further information in writing on August 15 (Exhibit 5), as requested by DEQ, and additional information on August 18 (Exhibit 6). We assume DEQ and EPA are proceeding with these model runs.

Accordingly, we request the completion of the subject modeling consistent with the commitments made at the June 2005 and the subsequent meetings and correspondence between DEQ and VAMWA on the specifics of the model runs. Further, we request that the Board order a public comment period on all of the above-referenced regulations to be held following the completion of the modeling. In our view, this is necessary simply to honor the commitments made on the record at the June 2005 Board meeting.

Substantive Issues

Further comments regarding the substantive provisions of the regulations are organized as follows:

- Attachment A – James River Chlorophyll-a Criteria
- Attachment B – Point source regulations

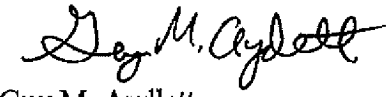
Notwithstanding the names of these two attachments, we request that this entire letter with all exhibits and attachments be included in the record for each rulemaking.

Request for Distribution to the Board

We request that DEQ provide a copy of these comments to all Board members two weeks in advance of the Board meeting when these regulations will be considered. If DEQ will not agree to do so, we respectfully request a reply to that effect so that we can arrange distribution of this letter accordingly.

We appreciate the opportunity to submit these comments and we appreciate the substantial efforts that the DEQ has devoted to development of the regulations and the other elements of its Chesapeake Bay and statewide nutrient programs. The final standards and resulting WLAs, combined with the 2005 legislation, will bring about substantial progress on the Bay restoration.

Sincerely,



Guy M. Aydlett
President

cc: VAMWA Members
Christopher D. Pomeroy, Esq.

Enclosures:
Exhibits 1 through 6
Attachments A and B

VIRGINIA ASSOCIATION OF MUNICIPAL WASTEWATER AGENCIES, INC.
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O'Brien & Gere
Olver Incorporated
R. Stuart Royer & Associates
Stearns & Wheler
URS Corporation
Wiley & Wilson

LEGAL COUNSEL
Christopher D. Pomeroy
AquaLaw PLC

August 15, 2005

By FAX (698-4019) & U.S. Mail

Robert G. Burnley, Director
Virginia Department of Environmental Quality
P.O. Box 10009
Richmond, Virginia 23240

Re: York and James River Water Quality Modeling

Dear Director Burnley:

We appreciated the opportunity to meet with DEQ and the United States Environmental Protection Agency (EPA) staff, along with representatives of the Chesapeake Bay Foundation and the James River Association, on August 12, 2005. This letter discusses a streamlined approach to additional modeling for the York and James rivers as well as related procedural issues.

In review, on July 11, 2005, VAMWA submitted a request for additional modeling based on the DEQ and EPA's commitment made at the June 28, 2005 State Water Control Board meeting. VAMWA's leadership, technical consultant and legal counsel met with you and other DEQ staff on July 21, 2005, to discuss the modeling scenarios and other aspects of the load allocation process.

At the July 21 meeting, you expressed concern about the scope of VAMWA's modeling request. You expressed concern (based on information provided to you by EPA) that the modeling involved would take 18 months or 2 years. You since clarified in response to an email from our legal counsel that your recollection is that you represented the period of time as being 18 months, and you went on in the email to explain that 18 months is based on 6 months of fulltime work by 3 staff.

You further requested, and VAMWA agreed, to another meeting with DEQ staff and EPA (Rich Batiuk). While VAMWA continues to believe that the original scope was reasonable and appropriate to the scientific inquiry at hand, VAMWA agreed to discuss streamlining its modeling request. The meeting was set as soon as possible after July 21 (August 12, 2005) based on the need to secure the attendance of Mr. Batiuk, who was taking an undoubtedly well-deserved vacation during the intervening period.

VAMWA expressed concern that, as agreed before the State Water Control Board at its June 28 meeting, that the modeling would be provided before the start of the additional public comment period now underway. You indicated at that meeting that you would consider how to meet that commitment. However, the

Exhibit 5

comment period began a few days later on July 25. VAMWA is very concerned at this point that the comment period has begun, and we look forward to hearing from you regarding how DEQ will honor the June 28 commitment. VAMWA's position remains the same as at the June 28 Board meeting, which is that we need the modeling results for a meaningful opportunity to participate in the comment period.

At the August 12 meeting, there was extensive discussion of the scope of additional modeling. This letter will document VAMWA's opinion on the most critical additional model runs that should be performed. In attempting to accommodate DEQ and EPA's request for a smaller number of model runs, we have prioritized our 11 requested model runs to a list of 5, as follows:

Model Runs Needed for the York River

Scenario	Description	Nutrient assumptions		Suspended sediment assumptions	Northern Bay assumptions
		Municipal PS[1]	NPS		
1	BNR - lower P	TN: 8 mg/L TP: 1 mg/L	VA TS 2005	VA TS 2005	Allocation
2	BNR – higher P	TN: 8 mg/L TP: 2 mg/L	VA TS 2005	VA TS 2005	Allocation

[1]Assumes Totopotomoy WWTP at design flow of 10 MGD.

Model Runs Needed for the James River

Scenario	Nutrient assumptions[1]				Suspended sediment assumptions	Northern Bay assumptions
	AFL municipal PS[1]	TF municipal PS	LE	NPS		
1	TN: 8 mg/L TP: 0.5 mg/L	June 2005 Allocation	--	VA TS 2005	VA TS 2005	Allocation
2	TN: 8 mg/L TP: 0.5 mg/L	TN: 5 mg/L TP: 0.5 mg/L	--	VA TS 2005	VA TS 2005	Allocation
3	Set based on previous runs	Set based on previous runs	6.4 Mlb TN/yr	VA TS 2005	VA TS 2005	Allocation

[1]Assumes Richmond, Lynchburg, and Hopewell held at June 2005 Allocation for all scenarios

We hope that this will help facilitate the timely delivery of information and a resolution to the issue of when the comment begins and ends relative to the delivery of the model runs. We were pleased to hear from EPA that this streamlined request could actually be completed in only a matter of weeks. We also hope this will help lead to good decisions regarding wasteload allocations for the York and James rivers. If you staff has any questions about the details of these model runs, please have them contact Clifton Bell (757-873-4465) or Will Hunley (757-460-4252).

Sincerely,

Guy M. Aydlett
President

Copy to:

VAMWA James River Tributary Team
VAMWA York River Tributary Team
Mr. Clifton Bell
Ellen Gilinsky, PhD
Mr. Alan Pollock
Christopher D. Pomeroy, Esq.
Mr. Rick Weeks
Mr. Clyde Wilber

Pomeroy, Chris

From: Pomeroy, Chris

Sent: Wednesday, July 27, 2005 10:05 AM

To: 'Pollock,Alan'

Cc: Gilinsky,Ellen; Kennedy,John; Butt,Arthur; Daub,Elleanore; Hoffman,Frederick; batiuk.richard@epa.gov; Linker,Rick; Frahm,Kathy; cbell@pirnie.com; Guy M. Aydlett (E-mail)

Subject: RE: Follow Up from DEQ - VAMWA Meeting

Alan,

Thanks for your note. Absolutely VAMWA looks forward to meeting with DEQ and EPA to discuss what VAMWA views as continuing problems with the one-of-its-kind chlorophyll regulation proposed for the James.

I am glad to see EPA is able to quickly provide model runs like the two referenced in your email. That's the same type of turnaround VAMWA had hoped for its modeling requests that were agreed to by the State Water Control Board and the DEQ Director during the record discussion at the Board's June 28 meeting. However, when VAMWA representatives met with Director Burnley, you and others last week, Director Burnley told us -- apparently on information from EPA -- that VAMWA's request for approximately 10 model runs (with only minor but important variations between the runs) would take TWO YEARS.

This claim of 2 years is hard to believe given the speed with which EPA has produced the two model runs referenced in your email below. Worse, assuming the two-year claim is true, that raises very serious questions about the integrity of this process. As you know, VAMWA agreed before the Board at its June 28 meeting to a short 30-day comment period. That agreement by VAMWA was specifically and explicitly based on contemporaneous assurances before the Board by Director Burnley that the modeling VAMWA needed would be provided BEFORE the start of that comment period.

If 10 runs really take two years (i.e., an average of about two months each), how could any knowledgeable EPA or DEQ staff present at the meeting have allowed Director Burnley to make this promise? There are two rivers, and now it seems that the timeline is not be feasible for even ONE model run on ONE river.

To make matters worse, why start the comment period on July 25 knowing that DEQ or EPA won't provide any of the requested modeling runs for months at best. Clearly the comment should not have begun on July 25.

It appears to VAMWA that either:

(1) A number of modeling runs can actually be done quickly (As you know, VAMWA has committed to work with DEQ and EPA to narrow the scope of its request.) If this is true, the commit period should be stayed (or extended sufficiently) to allow time for the modeling to be completed. There should be 30 days of comment after the modeling is done. These activities should be completed before the next Board meeting.

(2) If the promised modeling cannot be done quickly, I would propose that all parties work together to develop a schedule for conducting the modeling and conducting a subsequent 30-day comment period and, further, that that DEQ and VAMWA jointly recommend this the State Water Control at its next meeting.

By the way, if it sounds like I'm placing the all the blame for this fiasco on Director Burnley, I'm not. I'll be the first one to acknowledge that before making this commitment Director Burnley tried to avoid this problem -- my recollection is that he asked EPA management present at the Board meeting if this timeline for modeling was feasible and that EPA specifically assured Director Burnley that it in fact was feasible. I know Director Burnley is aware of the comment period start date / modeling problem and considering how to fix it. I will follow up with him directly with these suggestions.

Christopher D. Pomeroy
AquaLaw PLC

Exhibit 4

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Chris@AquaLaw.com

-----Original Message-----
From: Pollock,Alan [mailto:aepollock@deq.virginia.gov]
Sent: Tuesday, July 26, 2005 5:14 PM
To: cbell@pirnie.com
Cc: Pomeroy, Chris; Gilinsky,Ellen; Kennedy,John; Butt,Arthur; Daub,Elleanore; Hoffman,Frederick; batiuk.richard@epa.gov; Linker,Rick; Frahm,Kathy
Subject: Follow Up from DEQ - VAMWA Meeting

Cliff,
As a follow up to last Thursday's meeting, let's place August 12 on our calendars for the meeting to discuss the CFD process and further James river scenario runs. We've contacted EPA and I believe that date is okay with them, although final confirmation will need to wait until Rich Batiuk's return from leave on August 1. My sense is this could be a long meeting so we could start early [~9AM].....also, if Rich stays overnight in Richmond [the public meetings on the regs are on August 11] we would not have to wait for him to drive down from Annapolis. We will work out the details in early August [I guess, next week]

As I mentioned to Chris yesterday, we have concerns with the premise used in both the July 11 VAMWA modeling letter as well as the July 21 handout re setting the TF James river point source allocations. VAMWA is questioning application of the CFD for assessing attainment of the seasonal mean chlorophyll criteria. As I understand your position, in its place you suggest using the seasonal mean values over a three year period, as was done in Appendix B of the James River Alternatives Analysis - June 23, 2005

From the beginning of VA's regulatory process for the Ches Bay standards, the implementation approach contemplated for assessing attainment of the numeric chlorophyll criteria has been the CFD approach. As you know, the current effective Bay standards in VA include that approach. The original proposed chlorophyll criteria for the James, as well as the revised proposal acted on by the Board at their June meeting also rely on the CFD attainment approach. EPA and DEQ will gladly review the CFD approach with you and VAMWA members on August 12 and why we believe it is the most appropriate assessment tool to use.

Model output shown in Appendix B of the James River Alternatives Analysis is the model estimated 3 and 10 year averages for each season in each of the segments. Averaging water quality data over large river segments [the James river lower TF segment is about 26 miles in length] would allow significant stretches of the river to exceed the criteria, but have the entire segment considered in attainment. In a simplistic example, the standard would be attained if 13 miles had low chlorophyll levels [< 5 ug/l] and the other 13 miles was high [40-50 ug/l]. We have concerns about how protective a standard would be if attainment was assessed in that way.

Finally, EPA completed the model run that includes the point source allocations adopted/suspended by the Board on June 28. We have not yet posted the results or emailed them out to all of the stakeholders. Evidently, the model run did not use the adjusted point source loads above the fall line which are <100,000 pounds/year different from the Trib Strategy run. I've attached the model results we have for your information, but caution that some change might occur once the correct loads are used. The new model scenario is titled - **VATS JR Alternate**. As you can see, using the CFD approach the revised loadings would attain ~23 ug/l in the lower tidal fresh James in the summer.

Feel free to contact me if you want to discuss any of these issues.....we should receive the final model results in a few days which we will pass along and post on the website.....we look forward to the meeting on August 12.

alan

Alan E. Pollock
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City of Roanoke
South Central Wastewater Authority
County of Spotsylvania
County of Stafford
Upper Occoquan Sewage Authority
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Fauquier County Water & Sanitation Auth.
Frederick County Sanitation Authority
City of Fredericksburg
Town of Front Royal
Town of Kilmarnock
Town of Leesburg
County of Powhatan
Rapidan Service Authority
Town of South Boston
Sussex Service Authority
Town of Tappahannock
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LEGAL COUNSEL
Christopher D. Pomeroy
AquaLaw PLC

July 11, 2005

By FAX (698-4019) and Email (rgburnley@deq.state.va.us)

Robert G. Burnley, Director
Virginia Department of Environmental Quality
P.O. Box 10009
Richmond, Virginia 23240

Re: York River and James River Water Quality Modeling

Dear Director Burnley:

We appreciate your commitment at the State Water Control Board (SWCB) meeting of June 28, 2005 for DEQ to allow for additional nutrient-related water quality modeling of the York and James Rivers. The purpose of this letter is follow up on VAMWA's presentation and the related discussion at the SWCB meeting.

The enclosed Model Scenario Technical Details document provides the specifics of the model runs we are requesting. For maximum efficiency and usefulness, the requested model runs were devised to build upon past work, including the James River Alternatives Analysis that we received shortly before the June 28 meeting. If your staff has any questions about this technical information, they may directly contact Clifton Bell (757-873-4465) or Will Hunley (757-460-4252).

We appreciate your arranging for this modeling. As we stated at the SWCB meeting, we believe a 30-day comment period will be sufficient if we can have the results of this technical work before the comment period begins.

Sincerely,

Guy M. Aydlett
President

Enclosure

Exhibit 3

Copy to:

Mr. Rick Weeks, DEQ
Ms. Kathy R. Frahm, DEQ
Mr. Alan E. Pollock, DEQ
VAMWA Board of Directors
VAMWA York and James River Tributary Teams
Mr. Clifton Bell, P.E., P.G., Malcolm Pirnie, Inc.
Mr. Clyde Wilber, P.E., Greeley and Hansen
Christopher D. Pomeroy, Esq., AquaLaw PLC

MODEL SCENARIO TECHNICAL DETAILS

YORK RIVER

Previous model runs have provided evidence that the lower York River would be in attainment with dissolved oxygen (DO) standards at different WLAs than reflected in the suspended Water Quality Management Planning regulation. For example, the 2003 "confirmation" run showed attainment at higher overall WLAs than the suspended regulation. Additional model runs are required to more directly link the WLAs with actual attainment of DO standards in the York River. The requested York River model runs (Table 1) were developed to bracket a range of potential WLAs and thus allow interpolation of WLAs that would result in attainment of DO standards. Two of the scenarios are intended to explore the effect of higher phosphorus WLAs on DO attainment, given the apparent lack of phosphorus limitation in the lower York River.

Table 1. Model scenarios needed for York River.

Scenario	Description	Nutrient assumptions		Suspended sediment assumptions	Northern Bay assumptions
		PS	NPS		
1	Low rate BNR - lower P	Option 12-1	VA TS 2005	VA TS 2005	Allocation
2	Low rate BNR - higher P	Option 12-2	VA TS 2005	VA TS 2005	Allocation
3	BNR - lower P	Option 8-1	VA TS 2005	VA TS 2005	Allocation
4	BNR - higher P	Option 8-2	VA TS 2005	VA TS 2005	Allocation

Notes:
Option 12/1 represents 12 mg/L TN and 1 mg/L TP.
Option 12/2 represents 12 mg/L TN and 2 mg/L TP
Option 8/1 represents 8 mg/L TN and 1 mg/L TP.
Option 8/2 represents 8 mg/L TN and 2 mg/L TP.

The nitrogen and phosphorus loads associated with these model runs are compiled in Attachment A. Note that these loads reflect an adjustment of the design flow of Totopotomoy WWTP to 10 MGD, based on anticipated capacity by 2010. Hanover County will be submitting additional justification of this adjustment to DEQ.

For loads other than the POTWs, we understand the loads presented in 2005 Tributary Strategies are *the appropriate loads to use, and the other model assumptions will remain identical.*

Also, presumably that DEQ itself plans to evaluate the environmental responses associated with the suspended regulation for the York; therefore, we have not listed this run as an additional item.

JAMES RIVER

The additional recommended WLA scenarios for the James River were developed in part by review of the results of the James River Alternative Analysis. VAMWA appreciates the effort that DEQ and USEPA staff put into the Alternatives Analysis, and the requested models runs are neither intended to duplicate that effort nor require another effort of similar magnitude. In our view, the Alternatives Analysis was very useful for identifying the chlorophyll-*a* responses to a

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wide range of nutrient loading scenarios. The requested modeling runs, in contrast, are needed to determine the water quality benefits of specific WLA scenarios.

One of the main reasons that VAMWA is requesting these additional model runs is to allow the setting of WLAs in the proper order; that is, setting the allocations for the above fall line (AFL) and tidal freshwater (TF) first, and then exploring the responses of the lower James River to nutrient controls in that segment. This order is required because WLAs in the upper James River will affect the lower James River, although the reverse is not true. We therefore recommend that the additional modeling runs for the James River be performed in two stages: the first to set WLAs for the AFL and TF discharges, and the second to examine the appropriate controls in the lower James River.

We appreciate that DEQ has made it clear that the chlorophyll-*a* criteria represent seasonal mean values, which has addressed some of our previous concerns regarding food availability for higher trophic levels. However, we question whether the cumulative frequency distribution (CFD) assessment approach is compatible with the expression of the criterion as a seasonal mean with a three-year assessment period. As such, model predictions of attainment should be evaluated by examination of the seasonal mean values over three-year assessment periods (as represented in Appendix B of the James River Alternatives Analysis) rather than by a 10% exceedance curve under the CFD approach.

Upper James River Scenarios

Examination of Appendix B of the James River Alternatives Analysis shows that the seasonal mean chlorophyll-*a* criteria could be attained in the tidal freshwater James River by scenarios other than the VATS. For example, Appendix B indicates that the 3-year running average chlorophyll-*a* concentration would always be below the criteria for Scoping Run B, and significantly below the criteria for Scoping Run D. Both these scenarios include wasteload allocations that are less stringent than those of the suspended regulation for many dischargers. Even without additional model runs, the results of the Alternatives Analysis could be used to justify significant adjustments to the suspended WLAs. However, we anticipate that both DEQ and other stakeholders would desire model output that more precisely represents the WLAs that might actually be assigned.

The proposed scenarios for the upper James River (Table 2) are intended to explore: (1) higher WLAs in the AFL area, given lower flows and delivery factors and lesser environmental response; and (2) slightly higher WLAs in the TF segment. VAMWA presumes that DEQ plans to evaluate the environmental responses associated with the suspended regulation for the James; therefore, we have not listed this run as an additional item.

AR0037445

Table 2. Model scenarios needed for the upper James River.

Scenario	Regional nutrient removal assumptions			NPS controls	Northern Bay assumptions
	AFL	TF	LE		
1	Option 12-1.5	Option 8-1	1996	VA TS 2005	Allocation
2	Option 8-1	Option 8-1	1996	VA TS 2005	Allocation
3	Option 8-1	Option 6-0.5	1996	VA TS 2005	Allocation
4	Option 8-1	Allocation	1996	VA TS 2005	Allocation

Notes:
Option 12-1.5 reflects 12 mg/L TN and 1.5 mg/L TP.
Option 8-1 reflects 8 mg/l TN and 1 mg/l TP (except for facilities where other exceptions have been made)
Option 6-0.5 reflects 6 mg/L TN and 0.5 mg/L TP (except for facilities where other exceptions have been made)
'Allocation' represents the allocation of the suspended regulation.

VAMWA anticipates that some stakeholders might advocate dropping the summer chlorophyll-*a* criterion back to 20 µg/L in the TF1 segment if model results showed that it was attainable as a seasonal mean. However, 25 µg/L is a more scientifically defensible value based on multiple lines of evidence, including:

1. The observed decline in mesozooplankton when chlorophyll-a drops below 20 µg/L. Considering that cyanobacteria do not become more prevalent until 35-40 µg/L, this indicates that the lower mesozooplankton levels in this range are a food quantity rather than a food quality effect, and the appropriate seasonal mean is between 20 and 35 µg/L, to both maintain higher mesozooplankton levels while lowering cyanobacterial levels.

2. The bulk of the warmwater fisheries literature—including work compiled by DEQ's Academic Advisory Committee (AAC)—indicates that warmwater fisheries are supported by average chlorophyll concentrations of 25 µg/L or higher. In fact, the AAC has recommended a median chlorophyll value of 25 µg/L for warmwater reservoirs. Considering that median chlorophyll values are typically lower than mean chlorophyll values, the appropriate mean for chlorophyll in warmwater fisheries could be even higher. However, recognizing the cyanobacteria issues the TF James, we believe a summer mean of 25 µg/L is appropriate.

VAMWA will be making these points during the next round of comments on the chlorophyll-*a* criteria. However, we raise them in the context of model scenarios because of how model predictions may be used to determine WLAs.

Lower James River Model Scenarios

The James River Alternatives Analysis indicated the following preliminary observations for the lower estuary region (relative to proposed chlorophyll-*a* criteria expressed as 3 yr seasonal averages – Appendix B):

- The oligohaline, mesohaline, and polyhaline segments indicated attainment during the summer across all alternative scenarios.
- During the spring the oligohaline segment indicated attainment across all alternative scenarios.

AR0037446

- During the spring season the mesohaline and polyhaline segments indicated non-attainment for the alternative scenarios while attainment was observed with VATS. However, the difference in chlorophyll between "Scoping A" (lower estuary loadings at 1996 loadings) and the proposed criteria values were increased only 2-3 µg/l. VAMWA seriously questions the ecological significance that would result from this difference relative to the costs of attainment, especially given DEQ and VIMS clear statements the chlorophyll criteria are intended to represent little or no change (antidegradation) for this segment. In addition, as discussed below VAMWA questions the degree to which this small difference was influenced by lower estuary loading variations.

- A comparison between VATS (present allocations) and VATS Alternative (HRSD at 5 mg/l TN and 0.5 mg/l TP) indicated that chlorophyll-*a* was generally unresponsive to changes in nutrient reduction within the LE segment. For example, the average chlorophyll-*a* value (of 3 yr periods) in the mesohaline spring combination changed only 0.3 µg/l while the nutrient loads varied by 1.5 million lbs of TN per year. This yields a response factor of 0.2 µg/l chlorophyll-*a* change per million lbs of TN reduction. This represents a rather "flat" response. However, additional analyses are needed to confirm whether the slope of this response varies over a wider range of loading values.

- A comparison of the alternative scenarios indicated that chlorophyll-*a* responses in the lower estuary appear more responsive to changes in nutrient loading from upriver than in the region itself. For example, a comparison of the 2002 Assessment, Tier 1, and "Scoping A" scenarios indicated a range of seasonal average chlorophyll a values from 15 to 12 µg/l. However, within these scenarios the highest chlorophyll-*a* values were associated with lesser nutrient loadings from the lower estuary. This indicates that chlorophyll-*a* responses in the lower estuary were driven to a large extent by factors other than lower estuary load variations. Additional analyses are needed to quantify these effects.

Given the above interpretations of the Alternatives Analysis and recent developments regarding allocations, VAMWA finds that additional model runs are essential for the lower estuary. The specifics of these analyses are provided in Table 3. As previously discussed these additional model runs are justified to (1) isolate the effects of the upper estuary on the lower estuary, and (2) isolate the effects of the lower estuary on itself. For these reasons the VAMWA proposes a two phase approach to establishing appropriate load allocations for the James River. More specifically, after the AFL and TF WLAs are determined, additional scenarios (Table 3) are recommended to explore the benefits of various levels of BNR treatment at lower James treatment facilities. These recommended scenarios for the lower estuary will bracket a wide range of nutrient loads and chlorophyll responses associated with 1996 levels to the presently proposed allocations. These results as well as those of the existing Alternatives Analysis are needed for VAMWA to effectively comment on the proposed criteria and associated loading allocations.

AR0037447

Table 3. Model scenarios needed for the lower James River.

Scenario	Description	Regional nutrient removal assumptions			NPS controls	Northern Bay assumptions
		AFL	TF	LE		
1	1996	Based on upper James runs	Based on upper James runs	1996	VA TS 2005	Allocation
2	Low rate BNR			Option 12-1.5	VA TS 2005	Allocation
3	Moderate BNR			Option 10-1.5	VA TS 2005	Allocation

Notes:
1996 reflects 1996 loads (1996 flows and concentrations)
Option 12-1.5 reflects 12 mg/l TN and 1.5 mg/l TP
Option 10-1.5 reflects 10 mg/l TN and 1.5 mg/l TP

Once again, VAMWA appreciates the willingness of DEQ and USEPA to apply the modeling tools in hand to help us make the best decisions regarding WLAs for the York and James River. We would be glad to meet with DEQ staff at any time to discuss these requested model runs, their results, or any other aspect of this process.

AR0037448

York River Scenarios

Facility	Design Flow (MGD)	Option 12/1		Option 12/2		Option 8/1		Option 8/2	
		TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)
Caroline County STP	0.50	18,276	1,523	18,276	3,048	12,184	1,523	12,184	3,046
Gordonsville STP	0.94	34,360	2,863	34,360	5,727	22,906	2,863	22,906	5,727
Ashland WWTP	2.00	73,106	6,092	73,106	12,184	48,737	6,092	48,737	12,184
Doswell WWTP	6.75	246,732	20,561	246,732	41,122	164,488	20,561	164,488	41,122
HRSD - York River STP	15.00	548,293	45,691	548,293	91,382	365,529	45,691	365,529	91,382
Parham Landing WWTP	3.00	109,659	9,138	109,659	18,276	73,106	9,138	73,106	18,276
Totopotomoy WWTP	10.00	365,529	30,461	365,529	60,921	243,686	30,461	243,686	60,921
West Point STP	0.60	21,932	1,828	21,932	3,655	14,621	1,828	14,621	3,655
HRSD Mathews Courthouse STP	0.10	3,655	305	3,655	609	2,437	305	2,437	609

Upper James River Scenarios

Scenario	Regional nutrient removal assumptions			NPS Controls	Northern Bay assumptions	AFL		TF	
	AFL	TF	LE			TN (mg/l)	TP (mg/l)	TN (mg/l)	TP (mg/l)
1	Option 12-1.5	Option 8-1	1998	VA TS 2005	Allocation	12	1.5	8	1
2	Option 8-1	Option 8-1	1998	VA TS 2005	Allocation	8	1	8	1
3	Option 8-1	Option 6-0.5	1998	VA TS 2005	Allocation	8	1	6	0.5
4	Option 8-1	Allocation	1996	VA TS 2005	Allocation	8	1	Allocation	Allocation

James River Reach	Facility	Design Flow (MGD)	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
			TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)
AFL	Buena Vista	2.25	82,244	10,280	54,829	6,854	54,829	6,854	54,829	6,854
AFL	Clifton Forge	2.00	73,106	9,138	48,737	6,092	48,737	6,092	48,737	6,092
AFL	Covington	3.00	109,659	13,707	73,106	9,138	73,106	9,138	73,106	9,138
AFL	Lex-Rockbridge Reg.	3.00	109,659	13,707	73,106	9,138	73,106	9,138	73,106	9,138
AFL	Alleg. Co.-Lower Jackson	1.50	54,829	6,854	36,553	4,569	36,553	4,569	36,553	4,569
AFL	Low Moor	0.50	18,276	2,285	12,184	1,523	12,184	1,523	12,184	1,523
AFL	Amherst	0.60	21,932	2,741	14,621	1,828	14,621	1,828	14,621	1,828
AFL	Lake Monticello	0.99	36,187	4,523	24,125	3,016	24,125	3,016	24,125	3,016
AFL	Lynchburg	22.00	804,183	100,520	536,019	67,014	536,019	67,014	536,019	67,014
AFL	RWSA-Moores Creek	15.00	548,293	68,537	365,529	45,691	365,529	45,691	365,529	45,691
AFL	Powhatan Cor. Center	0.47	17,180	2,147	11,453	1,432	11,453	1,432	11,453	1,432
AFL	Crewe	0.50	18,276	2,285	12,184	1,523	12,184	1,523	12,184	1,523
AFL	Farmville	2.40	87,727	10,966	58,485	7,311	58,485	7,311	58,485	7,311
TF	Falling Creek	10.10	246,123	30,765	246,123	30,765	184,592	15,383	123,041	9,228
TF	Henrico Co.	75.00	1,827,644	228,455	1,827,644	228,455	1,370,733	114,228	913,668	68,525
TF	Hopewell	50.00	***1,827,336***	152,304	***1,827,336***	152,304	***1,827,336***	76,152	1,827,336	45,683
TF	Proctors Creek	27.00	657,952	82,244	657,952	82,244	493,464	41,122	328,920	24,669
TF	Richmond	45.00	1,096,402	137,073	1,096,402	137,073	***1,096,402***	***68,525***	1,096,402	68,525
TF	South Central	23.00	560,477	70,060	560,477	70,060	420,358	35,030	280,192	21,014
TF	Chickahominy WWTP	0.40	9,747	1,218	9,747	1,218	7,311	609	4,934	123

Loading values in bold italic were set to the current allocation due to special exceptions made for those facilities related to CSO and/or industrial wastewaters.

Lower James River Scenarios

Facility	Design Flow (MGD)	1996 Loads		Option 12-1.5		Option 10-1.5	
		TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)
HRSD-Boat Harbor	25.00	Previously compiled by DEQ		913,822	114,228	761,518	114,228
HRSD-James River	20.00			731,057	91,382	609,215	91,382
HRSD-Williamsburg	22.50			822,440	102,805	685,366	102,805
HRSD-Nansemond	30.00			1,096,586	137,073	913,822	137,073
HRSD-Army Base	18.00			657,952	82,244	548,293	82,244
HRSD-VIP	40.00			1,462,115	182,764	1,218,429	182,764
HRSD-Ches/Eliz[a]	24.00			1,526,409	108,674	1,526,409	108,674

[a]Loads for this facility were kept at the current allocation.

Nutrient Allocations:
What Happened to the "Previously Established Levels"?

Virginia Association of
Municipal Wastewater Agencies

June 28, 2005

Introduction

- Extensive revisions released just 3 business days ago
- VAMWA strongly supports additional public comment on entire regulation package <u>before</u> final action
- Focus in this presentation is on York and James River allocations
  - But there are numerous additional issues for comment period

Exhibit 2

AR0037452

Representations to the Public and General Assembly

- "the allocations assigned to the York and James basins are considered "interim" until the adoption of the amendments to the Virginia Water Quality Standards. … <u>After the standards are adopted</u> and the river basin allocations are established, the final point source allocations will be assigned to the significant dischargers in those basins."
  - Secretary Murphy Statement (August 27, 2004) (Ex. A)

Representations (Cont.)

- "Once the new water quality standards have been adopted in the form <u>and analysis done to determine necessary nutrient and sediment reductions to meet the new standards</u>, final allocations will be assigned to these two basins."
  - Secretary Murphy Statement (August 27, 2004) (Ex. A)
- **Similar statements in May 24, 2005 DEQ Guidance Memo No. 05-2009 (VPDES Nutrient Limits)**

Last Minute Major Policy Change

- Suddenly and contrary to all prior statements, water quality standards will <u>not</u> be the basis for York and James allocations
- Rather than dealing with the public comments and following through on the Water Quality Standards process (including the James Alternatives Analysis), this is an end run around around those critical steps with a one-size-fits all approach
- Staff's stated basis for this change is the Murphy Statement (August 27, 2004) (Ex. A)

Major Policy Change (cont.)

- General portions of the August 27, 2004 Murphy Statement were used, ***but the portions specific to the York and James were ignored***
- Why wasn't this decision to disregard portions of the August 2004 statement disclosed in the November 2004 proposed regulation?
- The lawful objective (meeting Water Quality Standards through wasteload allocations) is being dropped in favor of technology standards (4mg/l TN, 0.3mg/l TP)
  - Contrary to Va. Code § 62.1-44.15:1

The James River Surprise

- New allocations are based on most stringent levels ever discussed for James
- Especially above the fall line, where discharged nutrients are attenuated while water flows downstream
- VAMWA's comments on James River chlorophyll standard earlier today apply here
  - Incorporated by reference

York River Nitrogen Allocation Problems

- Can the same environmental benefit be achieved with less stringent, less costly controls?
- The "confirmation run" based on 8mg/l TN showed <u>full attainment</u> for dissolved oxygen
  - DEQ's data show this was already more stringent than necessary
  - Why did DEQ make it even more stringent last week?

The biggest York River issues are not even mentioned in the Response to Comments or your Board memo

AR0037455

York River Nitrogen Allocations Were Overly Stringent at the Start

- Cap: 5.7 million pounds
- Allocated: 5.1 million pounds
- *Unused: 600,000 pounds*
  - April 2004 Draft Tributary Strategy

And Then DEQ Made Them Even More Stringent

	PS TN WLAs	Change
Proposed Regulations	1,093,000	----
March 2005 Trib Strat	994,000	(99,000)
Today's Regulations	828,000	(166,000)

<u>Total Loss Since February 2005: 24%</u>

265,000 pounds per year of the proposed point source nitrogen allocation has evaporated in just 4 months

AR0037456

York River Phosphorus Allocations Are Overly Stringent

- York River is not phosphorus limited
- Dissolved oxygen attainment is not sensitive to phosphorus reductions
- What benefits are there to spending public dollars to building "Tier 3+" (0.3 mg/l) phosphorus removal technology?
- Why not advanced treatment at 1 – 1.5 mg/l?

VAMWA's General Recommendations

- Take no final action today on WQMP and Technology Regulations
- Provide public with access to the computer models
- Conduct second round of public comment on these proposals in their entirety
- Provide a reasonable amount of time for affected parties to review the final recommendations before they come before the Board again
- Address again at future Board meeting

AR0037457

VAMWA's York River Recommendations

- Request staff to:
  - Restore WLAs to at least proposed regulation levels
  - Assign unused 600,000 pounds of N to point sources
  - Model and determine whether higher nitrogen and phosphorus basin caps will meet water quality standards
  - Increase phosphorus allocations because York is not phosphorus limited

VAMWA's James River Recommendations

- For James River, take no final action on wasteload allocations until the chlorophyll standard is decided.
- Model and determine benefits of 4mg/l TN and 0.3mg/l TP at facilities located above the fall line

AR0037458

New James River Regulations:

What Does the Environment & the Public Get for $4.6 Billion ?

presented by
Virginia Association of Municipal Wastewater Agencies

State Water Control Board Meeting
June 28, 2005

Where Is VAMWA Coming From?

- *VAMWA's local government members are true leaders working for clean water*
  - 20 "BNR" upgrades completed
  - Point source N down 37% since 1985 (2002)
  - Point source P down 56% since 1985 (2002)
  - *Many more "BNR and "ENR" upgrades under development*

Exhibit 1

Where Is VAMWA Coming From? (cont.)

- *VAMWA is advancing good legislation to "save the Bay" efficiently and effectively*
- HB 2862 (Bryant)/SB 1275 (Watkins) (2005)
  - New General Permit & Trading Program
  - Praised by Governor Warner
  - Praised by EPA Water Administrator Grumbles (Ex. A)
    - "second state in the country"/"first legislation of its kind" in Bay
    - "Faster", "lower cost", and "provides accountability"
    - "will go a long way toward reducing nutrient flow
    - *"a model ... for watersheds across the country."*

The Bay Program's Load Allocation Agreement

- *"[A]llocations for Virginia's York and James River basins were set* <u>at the *previously established* tributary nutrient cap load levels</u> *since each basin has minimal impact on mainstem Bay water quality conditions, and their influence on tidal water quality is predominantly local."*
- *"Furthermore, these reductions are projected* <u>*to eliminate excessive algae conditions*</u> *(measured as chlorophyll a) throughout the Bay and its tidal tributaries."*
  - Secretary Murphy Memo (Spring 2003) (Ex. B)

AR0037460

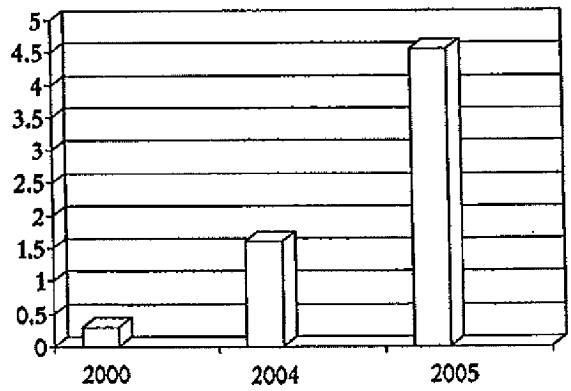
"Previously Established Levels"

- 2000 James River Tributary Strategy
- $299 million nutrient and sediment cleanup plan
- Included $164 million for point source nutrient technology

Where Are We Today?

In an Environment of Skyrocketing Costs

VA's Cost Estimates for James River Strategy (in Billions)



AR0037461

Why Are Costs So Much Higher?

- Virginia' new sediment goals and NPS requirements
- Virginia agreed to do more in order to relieve upstream states (PA, WV, NY) of the "polluter pays" principle
- Through state cost estimate corrections, urban storm water cost have climbed to astronomical levels
- State applied the same allocation to a bigger area

- *Chlorophyll-a Criteria ...*

Costs of the Proposed Chlorophyll-a Criteria

- Costs of new requirements for point sources have TRIPLED from "previously established levels"

- Up from $164 million <u>to</u> $501 million

- With these criteria, about HALF of Virginia's point source WQIF money will be spent in the James

  - Senate Joint Resolution 5009 (Ex. C)

AR0037462

Words Versus Reality

- Words
  - *"The proposed criteria represent little change from current average seasonal conditions…DEQ staff believe the best course of action is to pursue an antidegradation approach for the lower James…"* (DEQ Memo)
- Reality
  - The proposed criteria and associated load allocations are *far more stringent* than "antidegradation"
  - They require spending *at least $200 million* in the lower James River communities alone for point source controls.

What's To Be Gained by Tripling Spending by Point Sources?

- The James has little to no impact on Bay water quality
- The James already has good dissolved oxygen
- Turbidity that harms underwater grasses (SAV) is sediment-dominated; it is not sensitive to nutrients
- There is a lack of evidence of
  - Nuisance or toxic effects from algal blooms
  - Nutrient-related impairments to fish, oysters, crabs, etc.
  - That proposed criteria will improve the algal composition of the lower James River

AR0037463

What's To Be Gained? (cont.)

There's plenty of good food for fish, oysters and crabs

"...suspended food particles in the James River are so rich in carbon, phosphorus and nitrogen that it is unlikely that even a 50% reduction in chlorophyll-a would result...in dietary limitations to upper level consumers."

- DEQ's Response to Comments (June 2005)

Chlorophyll-a Criteria Are Highly Subjective At Best

- Non-traditional parameter; not directly toxic
- After a 3-year Bay Program effort, the chlorophyll criteria flunked a peer review organized by the CBP's Scientific and Technical Advisory Committee
  - Consequently EPA recommended no specific numeric criteria for chlorophyll-a
  - They just listed table with a wide range of values

Information on good chlorophyll levels is highly indirect and does not mandate any specific numeric levels.

AR0037464

So Where Does This Regulation Leave Virginians?

- With <u>no tangible benefits</u> to people or fish
- With <u>high uncertainty</u> of the actual benefits of modest algal community composition changes
- With <u>high costs</u> to the public to implement to those low levels
- With the James <u>using WQIF grant dollars</u> needed in northern tributaries for meaningful improvements

Searching For a Better Way: *The Alternatives Analysis*

- Compromise on SB 809 (Williams)
- Goals
  - "A thorough evaluation of the potential alternatives to support making the best decision possible"
  - "Provide valuable environmental benefits" and "avoid excessive expenditures for only marginal or no benefit"
- Agreement included an opportunity for public review and comment <u>BEFORE</u> adoption of chlorophyll standards

AR0037465

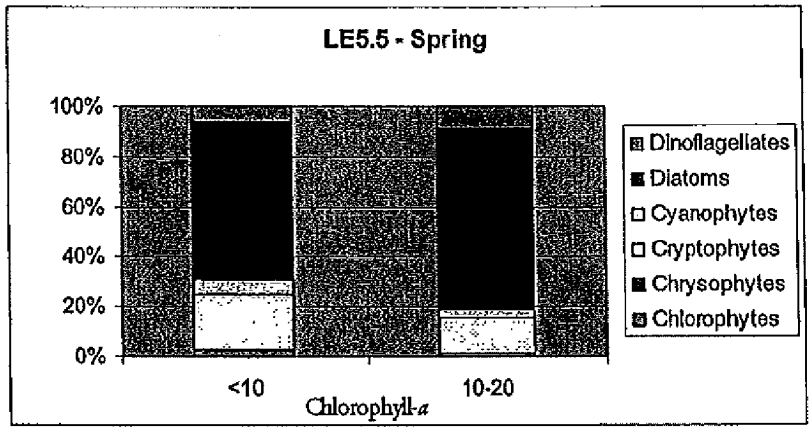
VAMWA's Goals & Recommendations

- Goals shared with DEQ
  - Reduce blue-green algae in upper tidal James
  - Protect existing good water quality in the lower tidal James
- Ensure meaningful benefits gained for dollars spent
- Use adaptive management to take one logical step at a time
- Give due consideration of the Alternatives Analysis results ***and public comments BEFORE ADOPTING*** the regulation

Extra Slides

AR0037466

Example from the lower James River



Adaptive Management

- A common-sense approach for environmental management in situations of
  - High uncertainty
  - High costs
- A specific, systematic approach for setting goals, implementation, monitoring, and revisiting goals.
- Critical for nutrient management in the James River.
- Can be used in conjunction with standards—but more than a pick-a-number exercise.

AR0037467

POLLUTION LIMITS

New Program Can Speed Bay Restoration

WASHINGTON.

Virginia has become the second state in the country to adopt a nutrient trading program. The first legislation of its kind within the Chesapeake Bay, the new law sets a watershed limit on the amount of pollution that can pour into the Bay. It encourages pollutant reductions at lower cost because it allows facilities whose pollution control costs are relatively high to use reductions created by another facility that has lower control costs. Water quality standards remain the same.

BENJAMIN GRUMBLES

Virginia is creating a system that will go a long way toward reducing nutrient flow into the Bay. The state is also supplementing the existing Water Quality Improvement Fund with an additional $50 million to support nutrient-removal technology that significantly reduces the concentration of nitrogen and phosphorus through advanced treatment of wastewater. In the next fiscal year, Virginia will spend nearly $100 million to reduce nutrient pollution in the Bay from all sources.

Other states have undertaken nutrient trading on a smaller scale. In 2002, Connecticut established a Nitrogen Credit Exchange Program. In the first year of exchanges, 39 of the 79 participating municipal treatment plants achieved greater nitrogen reductions than required, and the state realized a total reduction of more than 15,000 pounds of nitrogen.

VIRGINIA'S NEW law allows point-source dischargers within each of the state's five major Chesapeake Bay tributary basins to collectively reduce the amounts of nitrogen and phosphorus delivered to the Bay. The state will issue a general permit to about 120 eligible point source dischargers within the Bay watershed. This permit will apply only to nitrogen and phosphorus, and trades may take place between facilities in the same river basin. The facilities will still have to meet existing limits for chemical pollutants discharged in their wastewater.

The general permit, which is expected to be approved in 2006 by the State Water Control Board, will allow the state to achieve nutrient reductions faster than would have been possible otherwise. Individual facility permits have a five-year term, so it would take at least five years to reissue every individual permit with the appropriate nutrient limits. The ger eral permit may well cut pollution faste as it will apply nutrient limits to all facil ties at the same time.

The state's trading framework pr vides accountability through the wate shed permit and annual reporting, whil continuing to impose existing limits o other, often chemical, pollutants throug permits for individual facilities.

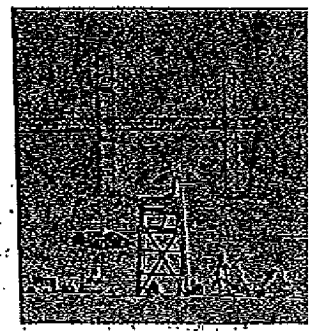
The Chesapeake Bay, whose wate shed includes a growing population of most 16 million, is a national enviro mental treasure that must be protecte And Bay residents are vital to the regio al economy: Virginia's annual commerci harvest is worth about $500 million.

TRADING PROGRAMS that help co trol air pollution have a successful tra record that will apply to nutrient tradi as well. The Acid Rain Program has e ceeded expectations in terms of reduc emissions, reduced costs, and faster tin lines: It has also rewarded greater e ciency and encouraged industry to plore alternative technologies.

Virginia has taken great strides in reduction of nutrients from its devel ment of new tidal water quality st dards, which the EPA fully supports, the regulatory actions that will serve the basis for the trading program. Commonwealth also has demonstra the power of cooperation and consu tion by bringing together such st holder groups as the Chesapeake Foundation and the Association of nicipal Wastewater Agencies to ach workable and effective solutions.

Virginia's new program can serve model not only for the Chesapeake partners but also for watersheds ac the country.

Benjamin Grumbles is the assis administrator for the Office of Wate the Environmental Protection Agency



Ex. A

To: Principal Staff Committee Members and Representatives of Chesapeake Bay "Headwater" States

From: W. Tayloe Murphy, Jr., Chair
Chesapeake Bay Program Principals' Staff Committee

Subject: Summary of Decisions Regarding Nutrient and Sediment Load Allocations and New Submerged Aquatic Vegetation (SAV) Restoration Goals

For the past twenty years, the Chesapeake Bay partners have been committed to achieving and maintaining water quality conditions necessary to support living resources throughout the Chesapeake Bay ecosystem. In the past month, Chesapeake Bay Program partners (Maryland, Virginia, Pennsylvania, the District of Columbia, the Environmental Protection Agency and the Chesapeake Bay Commission) have expanded our efforts by working with the headwater states of Delaware, West Virginia and New York to adopt new cap load allocations for nitrogen, phosphorus and sediment.

Using the best scientific information available, Bay Program partners have agreed to allocations that are intended to meet the needs of the plants and animals that call the Chesapeake home. The allocations will serve as a basis for each state's tributary strategies that, when completed by April 2004, will describe local implementation actions necessary to meet the *Chesapeake 2000* nutrient and sediment loading goals by 2010.

This memorandum summarizes the important, comprehensive agreements made by Bay watershed partners with regard to cap load allocations for nitrogen, phosphorus and sediments, as well as new baywide and local SAV restoration goals.

Nutrient Allocations

Excessive nutrients in the Chesapeake Bay and its tidal tributaries promote undesirable algal growth, and thereby, prohibit light from reaching underwater bay grasses (submerged aquatic vegetation or SAV) and depress the dissolved oxygen levels of the deeper waters of the Bay.

As a result, Bay watershed states and the District of Columbia, with the concurrence of EPA, agreed to cap annual nitrogen loads delivered to the Bay's tidal waters at 175 million pounds and annual phosphorus loads at 12.8 million pounds. It is estimated that these allocations will require a reduction, from 2000 levels, of nitrogen pollution by 110 million pounds and phosphorus pollution by 6.3 million pounds annually.

The partners agreed upon these load reductions based upon Bay Water Quality Model projections of

Ex. B

attainment of proposed water quality criteria for dissolved oxygen. The model projects these load reductions will eliminate the persistent summer anoxic conditions in the deep bottom waters of the Bay. Furthermore, these reductions are projected to eliminate excessive algae conditions (measured as chlorophyll *a*) throughout the Bay and its tidal tributaries.

The jurisdictions agreed to distribute the baywide cap load for nitrogen and phosphorus by major tributary basin (Table 1) and jurisdiction (Table 2). This distribution of responsibility for load reductions was based on three basic principles:

1. Tributary basins with the highest impact on Bay water quality would have the highest reductions of nutrients.
2. States without tidal waters – Pennsylvania, New York and West Virginia – would be provided some relief from Principle 1 since they do not benefit as directly from improved water quality in the Bay and its tidal tributaries.
3. Previous nutrient reductions would be credited towards achievement of the cap load allocations.

The nine major tributary basins were separated into three categories based upon their impact on water quality in the Bay. Each basin within a category was assigned the same percent reduction of anthropogenic load. Basins with the highest impact on tidal water quality were assigned the highest percentage reduction of anthropogenic load.

After applying the above calculations and Principle 2, New York, Pennsylvania and West Virginia allocations were set at "Tier 3" nutrient load levels. Additionally, allocations for Virginia's York and James River basins were set at previously established tributary strategy nutrient cap load levels since each basin has minimal impact on mainstem Bay water quality conditions, and their influence on tidal water quality is predominantly local.

These rules resulted in shortfalls to the baywide cap load allocation of 12 million pounds of nitrogen and 1 million pounds of phosphorus. EPA committed to pursue the Clear Skies initiative which is estimated to reduce the nitrogen load to Bay tidal waters by 8 million pounds per year. Bay watershed states agreed to take responsibility for the remaining 4 million pounds of nitrogen and 1 million pounds of phosphorus. The nutrient cap load allocations in tables 1 and 2 reflect these agreements.

The allocations for nitrogen and phosphorus were adopted with the concept of "nitrogen equivalents" and a commitment to explore how actions beyond traditional best management practices might help meet Bay restoration goals. A nitrogen equivalent is an action that results in the same water quality benefit as removing nitrogen. The Chesapeake Bay Program will evaluate how to account for tidal water quality benefits from continued and expanded living resource restoration, such as oysters and menhaden, to offset the reductions of watershed based nutrient and sediment loads. Seasonal fluctuations for biological nutrient removal implementation, nutrient reduction benefits from shoreline erosion reductions, implementation of enhanced nutrient removal at large wastewater treatment plants, and trade-offs between nitrogen and phosphorus will also be evaluated.

Baywide SAV Restoration Goal

To set new SAV restoration goals, scientists and resource managers from state and federal agencies agreed to use data from the single best year of observed SAV growth to estimate the historical long-term bay grass coverage in Chesapeake Bay. Data were collected from aerial photographs taken between 1938 and 2000. From 3-4 years in the 1938 -1964 period, and more than 20 years of data since 1978, new baywide SAV restoration goal acreage was determined by totaling the single best year acreage from each Chesapeake Bay Program segment.

The states have adopted 185,000 acres as the new baywide SAV restoration goal to be achieved by 2010 – consistent with the goals of *Chesapeake 2000*. The achievement of the baywide goal, as well as the local tributary basin and segment specific restoration goals summarized in Table 3, will be based on the single best year SAV acreage within the most recent three-year record of survey results. This new acreage goal has been added to the recently adopted strategy to accelerate the protection and restoration of SAV in the Chesapeake Bay; and Maryland and Virginia have agreed to develop an implementation plan for this strategy by April 2004.

Sediment Allocations

Sediments suspended in the water column reduce the amount of light available to support healthy and extensive SAV communities. With regards to the sediment allocations, the partners agreed that a primary reason for reducing sediment loads to the Bay is to provide suitable habitat for restoring SAV. The jurisdictions also agreed that nutrient load reductions are critical for SAV restoration as well as improving oxygen levels. As a result, the states linked the establishment of sediment cap load allocations to the proposed water clarity criteria and to the new SAV restoration goals.

Unlike nutrients - where loads from virtually all parts of the Bay watershed affect Bay mainstem water quality - impacts from sediments are predominantly seen at the local level. For this reason, local SAV acreage goals have been established and sediment allocations are targeted towards achieving those restoration goals.

The partners recognize that the current understanding of sediment sources and their impact on the Bay is not yet complete. We have only a basic understanding of land-based sediments that are carried into local waterways through stream bank erosion and runoff, but a more limited knowledge about near shore sediments that enter the Bay and its tidal rivers directly through shoreline erosion or shallow-water resuspension. Consequently, sediment allocations are currently focused on land-based sediment cap loads by major tributary basin (Table 1) and jurisdiction (Table 2).

Most land-based best management practices which reduce nonpoint sources of phosphorus will also reduce sediment runoff. Therefore, the jurisdictions agreed to land-based sediment allocations that represent the sediment loading likely to result from implementation management actions required to achieve the phosphorus cap load allocations.

The sediment allocation was set equal to the tier level for phosphorus allocation for each jurisdiction-basin. This is referred to as the 'phosphorus equivalent' land-based sediment reduction. If the 'phosphorus equivalent' land-based sediment reductions were found to be more than necessary to achieve the local SAV acreage goals, then the land-based sediment allocations were raised to that necessary to achieve the SAV goal. The tidal fresh Susquehanna Flats and tidal fresh Potomac River are two examples where this modified approach was applied. If, in the development of their tributary strategies, tributary teams conclude that the land-based sediment allocations need revisions, the tributary teams may identify an alternate land-based allocation working with all the jurisdictions within the effected basin. For example, a jurisdiction may select different nonpoint source management actions than those prescribed in the tier approach to reach the phosphorus goal; the jurisdiction may adjust the sediment goal accordingly so long as SAV restoration and protection is not compromised.

It is likely that reduction in nutrients and land-based sediments alone will not be sufficient to achieve the local SAV goals for many areas of the Bay. In these areas, tributary teams will be asked to further assess varied and innovative methods to achieve SAV re-growth. Such methods may include, but are not limited to SAV planting, offshore breakwaters, shore erosion controls, beach nourishment, establishment of oyster bars, and other actions as appropriate.

Support to State Tributary Strategies

The partners have agreed to complete their nutrient and sediment reduction strategies by April 2004. To assist in the development of tributary strategies, the Chesapeake Bay Program Office will provide an array of technical analyses, water quality and watershed modeling, cost-effectiveness and economic assessment support to the tributary strategy teams through the states.

The jurisdictions agreed that it is critical to work together to assure the aggregate of control actions recommended within the nutrient and sediment strategies yield the load reductions and the Bay and tidal tributary water quality improvements desired.

Reevaluation of the Allocations

The nutrient and sediment cap load allocations adopted by the jurisdictions are the best scientific estimates of what will be needed to attain proposed water quality criteria and tidal water designated uses described in guidance published by EPA. Over the next two years, Maryland, Virginia, Delaware and the District of Columbia will promulgate new water quality standards based on the guidance published by EPA.

Although the public process for adopting water quality standards varies among the states, each state's process will provide opportunities for considering and acquiring new information at the local level. States may choose to explore a number of issues during their adoption process, such as the economic impact of water quality standards and specific designated use boundaries.

While the allocations adopted at this time will provide the basis for tributary strategies, these allocations

may need to be adjusted to reflect final state water quality standards. Furthermore, planned Bay model refinements - directed towards estimating water quality benefits from filter feeding resources (e.g., oysters and menhaden) and better understanding the sources and effects of sediments - will increase our understanding of the relationship between nutrient and sediment reductions and living resource responses in the Bay. For these reasons, the states agreed to a reevaluation of these allocations no later than 2007.

As partners, the jurisdictions committed to correcting the nutrient and sediment related problems in the Bay and its tidal tributaries sufficiently to remove them from the list of impaired waters under the Clean Water Act. Although the states agreed to do their utmost to remove the Bay from the federal list of impaired waters by 2010, they recognize that it will be difficult to meet projected water quality standards in all parts of the Bay by that time. A key reason for this difficulty is that once nutrient reduction practices are installed, it may be years or even decades before the Bay benefits from these reductions. The jurisdictions intend to have programs in place and functioning by 2010 such that when fully implemented all parts of the Bay are expected to become eligible for delisting.

I would like to express my appreciation to all the partners in this effort for their hard work and commitment to restoration of the Chesapeake Bay. We have agreed to nutrient and sediment reductions which will result in profound improvements in the water quality, habitat and living resources of the Bay.

Attachments

INTRODUCED

043359840

SENATE JOINT RESOLUTION NO. 5009

Offered April 20, 2004

Requesting the Secretary of Natural Resources to study the nitrogen and phosphorous load allocations for the James River Basin and to provide draft tributary plans for the Chesapeake Bay watershed. Report.

Patron—Watkins

Referred to Committee on Rules

WHEREAS, the Chesapeake Bay and its tributary rivers, streams, and creeks are a precious natural resource of immeasurable value to the citizens of the Commonwealth; and

WHEREAS, the Commonwealth and its local governments, businesses, and citizens have demonstrated a strong commitment to improving water quality and have made significant progress in reducing the amounts of nitrogen, phosphorous, and sediment in the Chesapeake Bay watershed; and

WHEREAS, the Secretary of Natural Resources is in the process of revising the Commonwealth's tributary plans, which provide the blueprint for efforts to reduce nitrogen, phosphorous, and sediment; and

WHEREAS, the revised tributary plans propose spending $3.2 billion to implement the tributary plans, by regulatory mandate or otherwise, by 2010; and

WHEREAS, the revised tributary plans lack critical elements required by state law, concerning scientific documentation to support certain recommended actions, state and local benefits, implementation responsibilities, state funding commitments and sources, and cost-effectiveness; and

WHEREAS, the revised tributary plans propose to invest, or mandate the investment of $1.6 billion, or half of the total $3.2 billion cost in the James River Basin alone, even though the James River meets water quality standards for dissolved oxygen essential for aquatic life and the Department of Environmental Quality has determined that the James River does not adversely effect water quality in the Chesapeake Bay; and

WHEREAS, while the primary water quality challenge in the James River is reducing high levels of light blocking suspended sediments that prevent the growth of desirable underwater grasses, the revised tributary plan for the James River imposes substantially more stringent requirements to remove "orphan" pounds of nitrogen that, to benefit the Bay, should be removed in the Susquehanna River basin according to Chesapeake Bay Program science; and

WHEREAS, the revised tributary plan will result in the citizens and businesses of the James River basin incurring tens to hundreds of millions of dollars in costs, without documented benefits to the public and the environment, above the costs for meeting the existing plan, which is still being implemented; now, therefore, be it

RESOLVED by the Senate, the House of Delegates concurring, That the Secretary of Natural Resources be requested to study the nitrogen and phosphorous load allocations for the James River Basin and provide draft tributary plans for the Chesapeake Bay watershed. The draft tributary plans shall be developed pursuant to § 2.2-219 of the Code of Virginia, including scientific documentation to support the recommended actions, state and local benefits, implementation responsibilities, state funding commitments and sources, and cost-effectiveness of the various measures.

Technical assistance shall be provided to the Secretary of Natural Resources by the Department of Environmental Quality and the Department of Conservation and Recreation.

The Secretary of Natural Resources shall submit to the Senate Committee on Agriculture, Conservation and Natural Resources and the House Committee on Agriculture, Chesapeake and Natural Resources no later than November 1, 2004, (i) a report of his findings and recommendations for the nitrogen and phosphorous load allocations for the James River Basin, and (ii) revised draft tributary plans for the Chesapeake Bay watershed. The Secretary of Natural Resources shall appear before each committee to present his findings and recommendations prior to issuing final revised tributary plans; and, be it

RESOLVED FURTHER, That, while the revised tributary plans are being completed, the Secretary of Natural Resources is encouraged to continue seeking nitrogen, phosphorous, and sediment reductions necessary to meet existing tributary plans through non-regulatory means.

INTRODUCED

SJ5009

4/20/04 16:17

Ex. C

051646848

SENATE BILL NO. 811
Offered January 12, 2005
Prefiled January 10, 2005

A BILL to amend and reenact § 62.1-44.15 of the Code of Virginia, relating to the adoption of a water quality standard for chlorophyll.

Patron—Williams

Referred to Committee on Agriculture, Conservation and Natural Resources

Be it enacted by the General Assembly of Virginia:
1. That § 62.1-44.15 of the Code of Virginia is amended and reenacted as follows:

§ 62.1-44.15. Powers and duties.

It shall be the duty of the Board and it shall have the authority:

(1) [Repealed.]

(2) To study and investigate all problems concerned with the quality of state waters and to make reports and recommendations.

(2a) To study and investigate methods, procedures, devices, appliances, and technologies that could assist in water conservation or water consumption reduction.

(2b) To coordinate its efforts toward water conservation with other persons or groups, within or without the Commonwealth.

(2c) To make reports concerning, and formulate recommendations based upon, any such water conservation studies to ensure that present and future water needs of the citizens of the Commonwealth are met.

(3a) To establish such standards of quality and policies for any state waters consistent with the general policy set forth in this chapter, and to modify, amend, or cancel any such standards or policies established and to take all appropriate steps to prevent quality alteration contrary to the public interest or to standards or policies thus established, except that a description of provisions of any proposed standard or policy *intended to be* adopted by regulation which are more restrictive than applicable federal requirements, together with the reason why the more restrictive provisions are needed, shall be provided to the standing committee of each house of the General Assembly to which matters relating to the content of the standard or policy are most properly referable. *In addition, whenever the Board considers the adoption of a numerical chlorophyll standard or policy, or numerical chlorophyll translator related to any narrative standard or policy, the Board shall provide to the committees a full range of alternatives together with a comprehensive analysis of the benefits, detriments, and economic and social costs associated with each alternative.* The Board shall, from time to time, but at least once every three years, hold public hearings pursuant to subsection B of § 2.2-4007 but, upon the request of an affected person or upon its own motion, hold hearings pursuant to § 2.2-4009, for the purpose of reviewing the standards of quality, and, as appropriate, adopting, modifying, or canceling such standards. Whenever the Board considers the adoption, modification, amendment or cancellation of any standard, it shall give due consideration to, among other factors, the economic and social costs and benefits which can reasonably be expected to obtain as a consequence of the standards as adopted, modified, amended or cancelled. The Board shall also give due consideration to the public health standards issued by the Virginia Department of Health with respect to issues of public health policy and protection. If the Board does not follow the public health standards of the Virginia Department of Health, the Board's reason for any deviation shall be made in writing and published for any and all concerned parties.

(3b) Except as provided in subdivision (3a), such standards and policies are to be adopted or modified, amended or cancelled in the manner provided by the Administrative Process Act (§ 2.2-4000 et seq.).

(4) To conduct or have conducted scientific experiments, investigations, studies, and research to discover methods for maintaining water quality consistent with the purposes of this chapter. To this end the Board may cooperate with any public or private agency in the conduct of such experiments, investigations and research and may receive in behalf of the Commonwealth any moneys that any such agency may contribute as its share of the cost under any such cooperative agreement. Such moneys shall be used only for the purposes for which they are contributed and any balance remaining after the conclusion of the experiments, investigations, studies, and research, shall be returned to the contributors.

(5) To issue, revoke or amend certificates under prescribed conditions for: (a) the discharge of sewage, industrial wastes and other wastes into or adjacent to state waters; (b) the alteration otherwise of the physical, chemical or biological properties of state waters; (c) excavation in a wetland; or (d) on and

INTRODUCED

SB811

1/26/05 6:42

Ex. 7

SB 811 (WILLIAMS)
ALTERNATIVES ANALYSIS FOR CHLOROPHYLL-*A* STANDARDS

Introduction

Given questionable benefits, potential ecological detriments, and high costs of the proposed chlorophyll-a water quality standard for the James River, there should be a thorough evaluation of the potential alternatives to support making the best decision possible under the circumstances.

The alternatives analysis should evaluate the benefits, detriments and costs of a range of nutrient loading scenarios and the corresponding predicted chlorophyll-*a* levels. The results would provide vastly better information for setting standards to provide valuable environmental benefits and for helping avoid excessive expenditures for only marginal benefits or no benefit.

More specifically, an alternatives analysis would identify levels of nutrient reduction expected to result in significant benefits (and distinguish them from efforts that show diminishing returns or even adverse effects). It would include an evaluation of how different chlorophyll-*a* levels would be expected to impact oysters, larval fish and other aquatic life uses.

Alternatives to Be Evaluated

The Chesapeake Bay water quality model will be used to simulate a range of nutrient load scenarios and associated chlorophyll-*a* levels in the James River. Model output will be post-processed by season and salinity regime to identify chlorophyll-*a* concentrations that would be attained using the Chesapeake Bay Program's cumulative frequency distribution (CFD) assessment procedure. Specific model scenarios to be evaluated include:

Alternative A – Current Progress (Done)
This alternative represents nutrient loads from the 2000-2004 timeframe. Such a model run should have already been performed by the Chesapeake Bay Program.

Alternative B – BNR Equivalent in the Tidal Freshwater (Update)
This alternative represents a level of nutrient loading consistent with the 2000 James River Tributary Strategy. (Note: This alternative as well as C – E below should also take into account nutrient reductions performed outside the James River basin to meet the new dissolved oxygen (DO) and water clarity standards.)

Alternatives C and D – Intermediate Scenarios (New)
At least two alternatives will be analyzed that represent levels of nutrient reduction intermediate between alternative B (2000 Tributary Strategy) and alternative E (Draft 2004 Tributary Strategy). These alternatives should address the different impacts of loads from the free-flowing, upper tidal and lower tidal portions of the river.

Alternative E – 2004 Tributary Strategy (Done)
This alternative represents the draft 2004 James River Tributary Strategy. This model run has already been performed.

Ex. E

Graphical Presentation & Evaluation of Results

Results of the above alternatives will be evaluated by tabulating and charting the chlorophyll-*a* concentration attained versus the nutrient load and associated cost of implementation. Figures 1 and 2 below provide hypothetical examples of such graphs for the downstream tidal freshwater segment (TF1) (summer) and the polyhaline segment (summer), respectively. (Note: The 90th percentile of the 2000-2004 chlorophyll-*a* data is plotted on these charts to illustrate chlorophyll-a levels representing current conditions, whereas other points charted here are hypothetical values for illustration only).

The chlorophyll-load-cost figures will be interpreted with respect to:

(a) alternatives that would result in significant decreases in chlorophyll-*a*;
(b) alternatives that indicate diminishing returns on expenditures; and
(c) chlorophyll-*a* concentrations relative to both harmful algal bloom thresholds and food requirements for oysters and larval fish.

The following questions will be addressed for each alternative in the sequence ranging from Alternative A (current conditions) to the alterative representing the draft 2004 Tributary Strategy:

1. What is the magnitude and percentage reduction in chlorophyll-*a* values?
2. What is the total and incremental cost of the load reduction alternative?
3. Based on the observed variability of the James River plankton composition with chlorophyll-*a*, what is the expected shift in algal composition?
4. Is there sufficient scientific information to project that this shift in algal composition would have a measurable impact on fisheries?
5. How do the resulting chlorophyll-*a* values relate to thresholds for harmful algal blooms?
6. How do the resulting chlorophyll-*a* values relate to nuisance conditions that might impair recreation?
7. How do the resulting chlorophyll-*a* values relate to food requirements for adult and larval oysters (higher salinity segments)?
8. How do the resulting chlorophyll-*a* values relate to mesozooplankton abundance and, relatedly, food requirements for larval fish (lower salinity segments)?

* * *

AR0037477

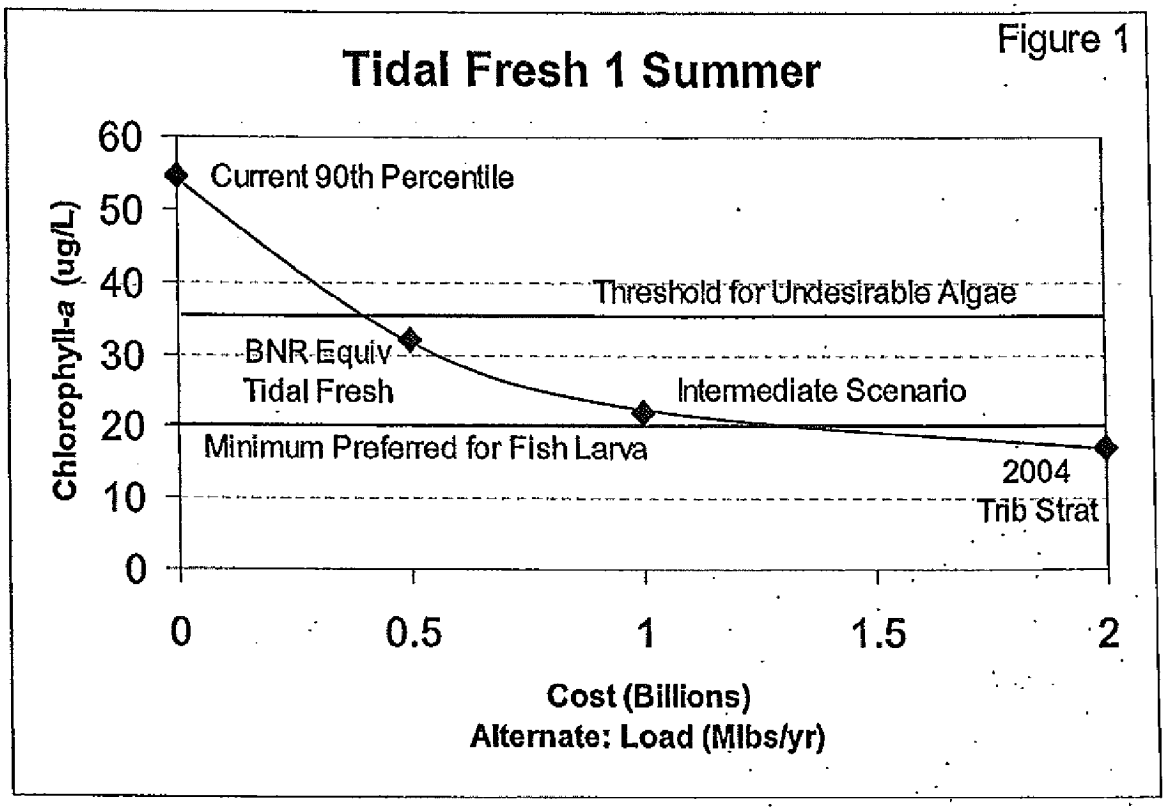


Figure 1
Tidal Fresh 1 Summer
Chlorophyll-a (ug/L)
60
50
40
30
20
10
0
Current 90th Percentile
Threshold for Undesirable Algae
BNR Equiv
Tidal Fresh
Intermediate Scenario
Minimum Preferred for Fish Larva
2004
Trib Strat
0
0.5
1
1.5
2
Cost (Billions)
Alternate: Load (Mlbs/yr)

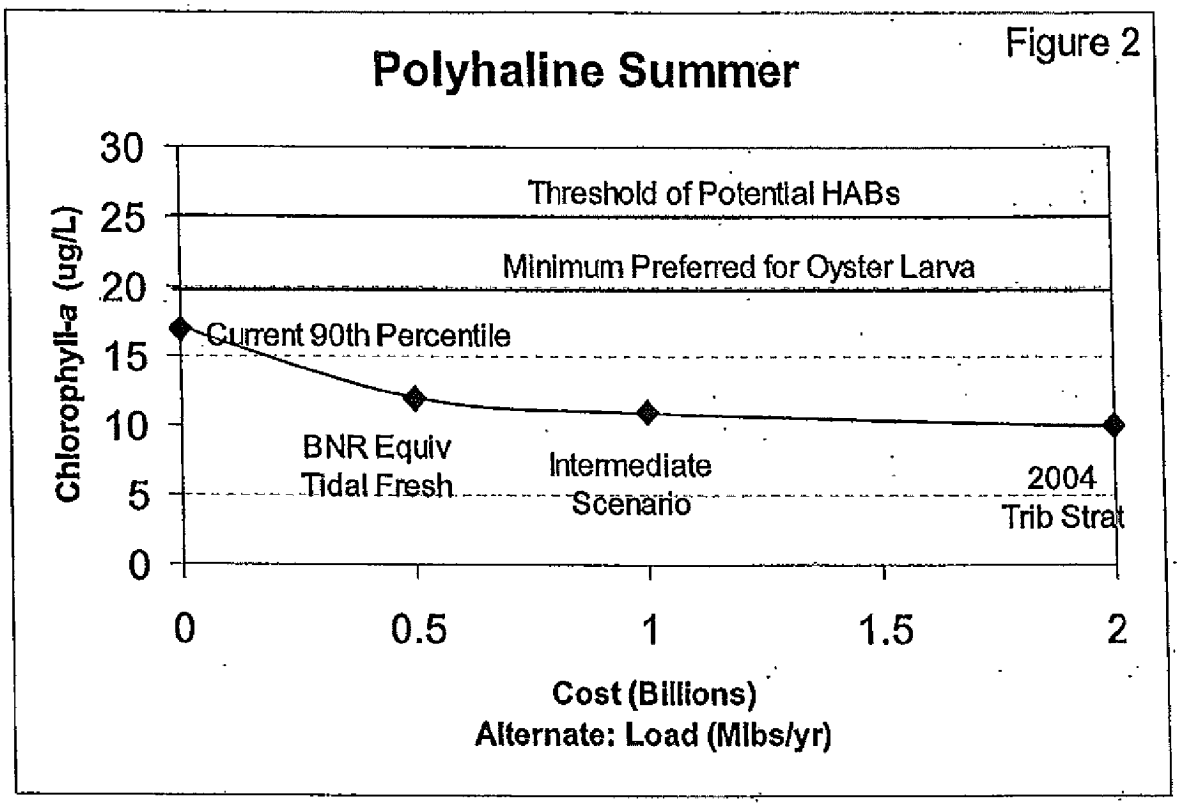


Figure 2
Polyhaline Summer
Chlorophyll-a (ug/L)
30
25
20
15
10
5
0
Threshold of Potential HABs
Minimum Preferred for Oyster Larva
Current 90th Percentile
BNR Equiv
Tidal Fresh
Intermediate
Scenario
2004
Trib Strat
0
0.5
1
1.5
2
Cost (Billions)
Alternate: Load (Mlbs/yr)

AR0037478

ATTACHMENT B
TO VAMWA'S AUGUST 24, 2005 COMMENTS

POINT SOURCE REGULATIONS:

WATER QUALITY MANAGEMENT PLANNING REGULATION (9 VAC 25-40)

AND

REGULATION FOR NUTRIENT ENRICHED WATERS AND DISCHARGERS WITHIN THE CHESAPEAKE BAY WATERSHED (9 VAC 25-720)

YORK RIVER WASTELOAD ALLOCATIONS

It has been recognized since the early 1990s that the York River has no significant impact on main stem Chesapeake Bay water quality. The York simply joins the Bay at a point too close to the mouth of the Bay for the York to have a significant impact, and modeling has proven this point. Therefore, York River water quality management is appropriately focused on the River itself.

During the Tributary Strategy development process, extensive comments were submitted to the Commonwealth by VAMWA, HRSD and others to the effect that the proposed point source wasteload allocations (WLAs) for the York River basin were overly stringent.

In March 2005, the Board adopted long-anticipated water quality standards ("WQS") for dissolved oxygen and water clarity for the main stem section of the York River and the Secretary issued the York River Tributary Strategy. At the time of our April 25, 2005 comments on the pending regulations, our main concern was that neither appeared to be planning the necessary technical evaluations to revise the York River allocations on the basis of the water quality standards.

We were both surprised and disappointed to learn that was the case. Those revisions had long been promised – promised in writing and in various statements before the General Assembly – by the Secretary of Natural Resources and other high level appointees from the time Chesapeake Bay Program partners adopted new nitrogen and phosphorus load goals in the spring of 2003 through and include the 2005 General Assembly session.

We are left with no choice but to conclude that those promises and commitments simply have not been honored. We are relying on this Board to restore our trust in the regulatory process by doing what is right.

What appears to have occurred is that water quality standards have been ignored in favor of the arbitrary application of a selected portion of the Secretary's August 27, 2004 Policy, which has resulted in the WLA becoming even more stringent than under the Tributary Strategy (March 2005).

AR0037479

In our view, this is a misapplication of Secretary Murphy's August 27, 2004 policy at the expense of a specific commitment contained therein to base the WLAs on water quality standards. Instead, a different provision from that policy statement has been applied. Consequently, DEQ has taken, or the Secretary has required, application of an across-the-board policy statement originally prepared solely for the northern tributaries, which have a greater impact on Bay water quality and thus a meaningful opportunity to improve Bay water quality.

More specifically, that policy required use of an overly-stringent concentration or technology basis (contrary to Va. Code § 62.1-44.15:1) for calculating the June 2005 version of the regulations and in particular the WLAs for nitrogen (based on 4 mg/l) and phosphorus (based on 0.3 mg/l).

We firmly believe that the available assimilative capacity for nutrients in the York River is more than sufficient for the Board to allocate TN and TP to municipal wastewater treatment plants on the basis 8 mg/l TN and at least 1 to 2 mg/l TP coupled with 2010 design flows (including 10 mgd for Hanover County's Totopotomoy WWTP).

We along with our affected members have explained this position in earlier and current comments on the record in this rulemaking. Those members include Hanover County, HRSD and the Rapidan Service Authority. We hereby incorporate by reference the August 2005 written comments of those three organizations as our own as if set forth fully herein, and we urge DEQ and the Board to consider those comments.

Our June 28, 2005 presentation illustrated this problem. Here is our current understanding of the nitrogen loadings involved:

York River Nitrogen Cap Load	5,700,000
March 2005 York River Tributary Strategy	5,131,539
Unallocated Load in the 2005 Tributary Strategy	568,127
York River Allocations After June 2005 Cut	4,904,137
Unallocated Load After June 2005 Cut	795,863

All of the model runs to date confirm what is obvious from the above figures, namely that there is no valid technical or policy basis for cutting the York WLAs to the levels presented by DEQ at the June 2005 Board meeting. Instead, the science indicates the need to investigate whether more assimilative capacity exists and higher allocations would be protective.
Our technical comments from the April 2005 comment period continue to apply and remain unaddressed by DEQ.

In addition to the above points, which tend to emphasize nitrogen WLAs, we must highlight the fact that the regulations contain stringent phosphorus restrictions even though the York is not phosphorus limited. This is one of the issues intended to be resolved by VAMWA's June, July and August 2005 modeling requests.

AR0037480

We are also compelled to point out that it is not "equitable" for DEQ to claim, as it does, that facilities in other areas of the state will have their allocations based on the same or similar technology concentrations (e.g., 3 or 4 mg/l TN) and therefore the York River facilities should be regulated in the same manner. For many of those areas, the science justifies that level of regulation. However, this is not the case for the York River.

One acceptable solution to VAMWA, that is, one course of action by DEQ and the Board that would be reasonable under the circumstances, would be to allocate TN and TP to municipal wastewater treatment plants – in the York River – on the basis 8 mg/l TN and 2 mg/l TP coupled with 2010 design flows (including 10 mgd for Hanover County's Totopotomoy WWTP). We would still encourage DEQ to proceed with the modeling for any refinements to these allocations.

Otherwise, we insist that DEQ live up to the commitments made at the June 2005 Board meeting and we urge that the Board defer any further action on these regulations accordingly.

JAMES RIVER WASTELOAD ALLOCATIONS

Our chief concerns regarding the James River allocations relate to their underlying basis (the chlorophyll-a criteria), which are explained (again) in that portion of today's comments. In addition, we hold very similar objections to application of the Secretary's policy to derive WLAs in the above-fall-line area based on 4mg/l TN and 0.3 mg/l TP. The necessity for these allocations, which is suspect given the very slight impacts of the relative small delivered loads from this area, as well as other allocations in other downstream areas, was to be examined by the post-June 28, 2005 modeling which has not yet been performed. This issue is addressed at length throughout these comments and our prior record submissions. Pending completion of that modeling we recommend that above-fall-line WLAs be based on 8mg/l TN, tidal fresh WLAs be based on 5 mg/l TN and lower estuary WLAs be based on true antidegradation levels as defined in HRSD's submissions.

"BUBBLING" AND WASTELOAD ALLOCATIONS FOR "NON-SIGNIFICANT" DISCHARGES

Recent legislation referenced above provides that non-significant dischargers are deemed to be covered under the Chesapeake Bay nutrients VPDES general permit at the time it is issued and are required to offset only those load increases attributable to future expansions. Va. Code § 62.1-44.19:15.A. The legislation also allows RSA to "bubble" the allocations for all of our facilities to manage them collectively. To do this, we need to know the WLAs for Madison WWTP in order to sum them with those of our other facilities.

Accordingly, the regulation should specifically state for non-significant facilities that "current permitted POTWs (as of July 1, 2005) have TN and TP WLAs based on their current permitted capacities and TN and TP concentrations reflecting no additional or special treatment." (*e.g.*,

18.7 mg/L TN as currently assumed by DEQ for facilities with no data). This is not only in accordance with the legislation, but is also consistent with what we understand to be the DEQ's original intent and is much more fair approach in the context of the entire regulation.

MISCELLANEOUS

In our earlier comments, we have provided extensive comments on numerous aspects of these regulations. We wish to highlight our continuing concerns regarding:

- Lack of intake credits reflecting the intake of nutrients with municipal water supplies.

- Requirements for concentration limits (DEQ should retain discretion consistent with the HB 2862's permissive as opposed to mandatory language; however, if DEQ retains mandatory concentration limits, we would support inclusion of the option to use an alternative compliance method.)

We continue to support the following concept of recognizing the lack of bioavailability.

In addition, the basin allocation tables should state that they contain the WLAs "for the listed facilities" rather than "for the basin." This is necessary for consistency with other requirements applicable to "non-significant dischargers.

Thank you for the opportunity to submit these comments. We appreciate the substantial efforts that DEQ has devoted to development of the regulations and the other elements of its Chesapeake Bay and statewide nutrients programs.

ATTACHMENT A
TO VAMWA'S AUGUST 24, 2005 COMMENTS

JAMES RIVER CHLOROPHYLL-*A* CRITERIA
AND RELATED MANAGEMENT ISSUES

INTRODUCTION

These comments address the suspended water quality standards for the James River. DEQ responses to the first round of comments and James River Alternatives Analysis included new information and clarified some of the issues raised by VAMWA.

In general, we believe the criteria for the summer TF1 segment of at least 25 μg/L is reasonable, and has the potential to improve the algal community of that segment. For other segments, we do not believe the criteria values have been shown to represent meaningful thresholds of impairment, either with regard to the algal community or other designated uses. Nor do they represent antidegradation of the lower James River as was intended by DEQ. Model results show that these standards could result in large public expenditures with little to no ecological benefit. For these reasons, we recommend alternative nutrient management strategies for the higher salinity portions of the James River.

Our comments below summarize our outstanding technical concerns and recommendations, and also include new comments/recommendations based on information that has come to light since the last comment period.

TECHNICAL COMMENTS ON THE CHLOROPHYLL-*A* CRITERIA

1. *The proposed criteria for the summer TF1 segment should be at least 25 μg/L.* As our previous comments have shown, we believe that the TF1 segment has the best technical case for chlorophyll-*a* targets. This is because a direct relation can be demonstrated between chlorophyll-*a* and the prevalence of potentially harmful cyanophytes. We understand that more recent model runs suggest that 22-23 μg/L might be attainable in this segment. However, we recommend that DEQ retain the 25 μg/L target for the following reasons.

(a) It may be more ecologically protective. As detailed in previous comments, cyanophytes become more prevalent when chlorophyll-*a* approaches 40 μg/L. Due to the morphology of the segment, under all loading scenarios there will be a region of TF1 segment below the Appomattox River segment with a higher probability of having chlorophyll-*a* above this threshold. But monitoring data from the tidal freshwater segments also clearly show lower (detrimental) zooplankton values when chlorophyll-*a* falls below 20 μg/L. In combination with the large body of literature that shows that warmwater freshwater fisheries can increase in productivity up to 20-40 μg/L (or higher), this provides evidence that the productivity of the TF1 segment could be maximized by having the greatest proportion of the segment between 20 and 35 μg/L, rather than less than 20 μg/L.

AR0037483

The lower zooplankton associated with lower chlorophyll-*a* in the segment is verifiable both graphically and statistically. Our previous comments show how statistical hypothesis testing confirmed that mesozooplankton abundance—and the likelihood of mesozooplankton abundance that favors striped bass larva—was significant lower in TF segments when chlorophyll-*a* did not exceed the cited criteria. The relation is evident in multiple tidal freshwater segments from the Bay region (Figure 1). Although there are limited data for assessing this relation in the James TF1 segment, the mesozooplankton abundance data that are available confirm it (Figure 2). There is no evidence that nutrient reduction will cause this consistent and unsurprising pattern for the freshwater segments to cease to exist.

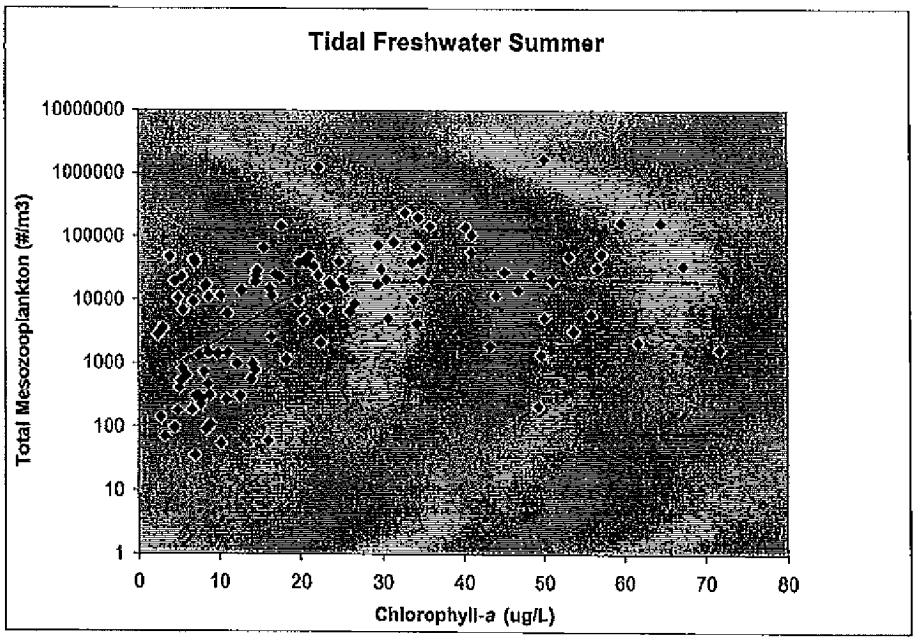


Figure 1: Mesozooplankton abundance v. chlorophyll-*a* concentrations (1984-1999) from the Plankton Goals Database.

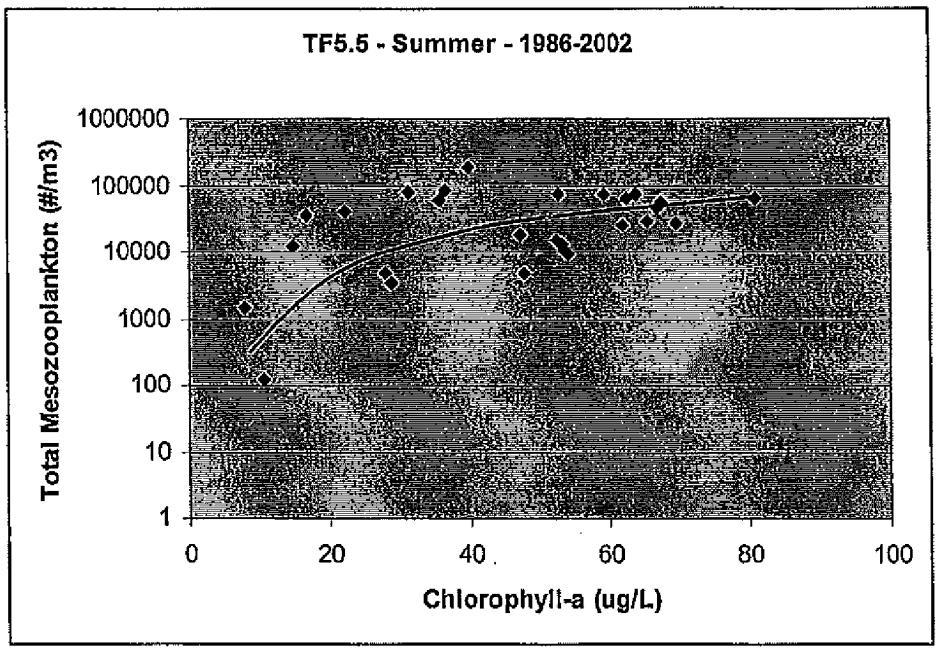


Figure 2: Mesozooplankton abundance v. chlorophyll-*a* concentration at station TF5.5. Data obtained from the Chesapeake Bay Program data hub.

The concept that total productivity is related to primary productivity is well-established for lakes and reservoirs (e.g., Downing and others, 1990; Hanson and Leggett, 1982; Ney, 1996; Ney and others, 1990). As noted by the VIMS letter to DEQ (Roger Mann, writt. comm., 2005), the concept is more uncertain in estuarine and marine settings. In fact, VAMWA has made no claim of a similar chlorophyll-zooplankton relations for mesohaline or polyhaline segments, because such relations are not supported by the monitoring data. But that fact that TF segments do show such a relation is evidence that these regimes share characteristics with other freshwater systems that have extended retention times. It should be clarified that VAMWA is not claiming that lower chlorophyll-*a* concentrations would necessarily "starve" living resources, merely that total productivity could be less than optimal.

Virginia Academic Advisory Committee (AAC) concluded that a seasonal *median* of 25 µg/L was protective of excellent fisheries for Virginia lakes and reservoirs (Zipper and others, 2005). Considering that mean chlorophyll-*a* values are typically higher than median values, and that the target was considered environmentally conservative by the AAC, this emphasizes the point that warmwater freshwater fisheries have been shown to favor relatively high chlorophyll-*a* levels. Indeed, the paradigm that the least amount of anthropogenic nutrient inputs would correspond to the most productive system (commonly applied to the higher salinity portions of the Bay system) simply does not apply to these systems. We repeat the conclusion of Dr. Dennis DeVries (professor of fishery science at Auburn University) that an adaptive management approach for the tidal freshwater James

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River should not seek to suppress chlorophyll-*a* concentrations below 20 μg/L for optimal fisheries (D. Devries, pers. comm., 21 Jan 2004).

DEQ had previously responded to our concerns about zooplankton/productivity in this segment in several manners, which we address below:

(i) One response was that upon attaining the phytoplankton reference community, zooplankton would be more abundant across the range of chlorophyll-*a*. There does not appear to be any evidence for this statement for tidal freshwater communities. The lower zooplankton under lower chlorophyll-*a* conditions appears to be a food quantity rather than quality effect, because cyanophytes do not represent a large proportion of the available biomass at this chlorophyll-*a* range.

To illustrate this point, consider that in the technical support document for the chlorophyll-a criterion, DEQ stated that the "York River maintains a population of flora considered "least- impaired" or desirable with a balanced phytoplankton community for comparison." (Virginia DEQ, 2004). In its response to VAMWA comments, DEQ clarified that they were referring to the tidal freshwater York system. Yet the summer mesozooplankton abundance (and zooplankton food availability index) is significantly higher in the tidal freshwater James River than in the tidal freshwater York system (Figure 3). In fact, the mean summer (1987-2002) total mesozooplankton abundance in the summer James River (44,500/m^3) was more than twice the abundance in the upper York system (21,000/m^3), based on data from the CBP Plankton Database. Although much of the Virginia mesozooplankton data during this period may underestimate the actual abundance, the relative pattern is clear: attainment of the "least-impaired" phytoplankton community (or lowest chlorophyll-*a* levels) is not associated with the highest zooplankton food availability index in the tidal freshwater systems.

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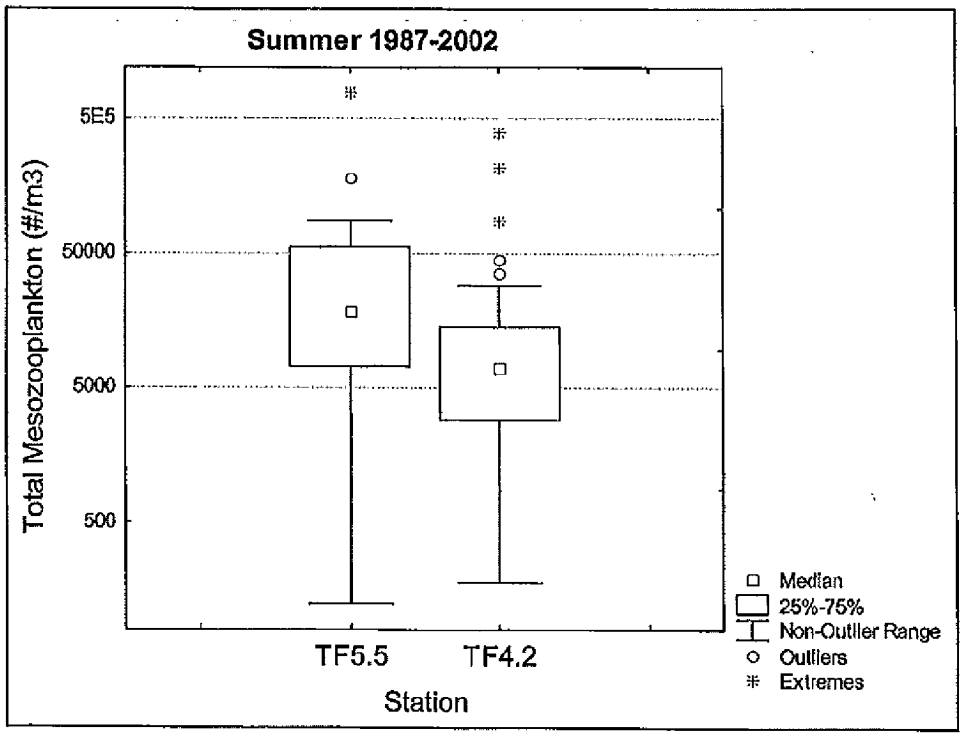

Figure 3: Box-and-whisker plot of total mesozooplankton abundance (summer 1987-2000) in the tidal freshwater James River (TF5.5) and tidal freshwater Pamunkey River (TF4.2). Data obtained from the CBP Plankton Database.

Regardless, attainment of the reference community is largely dependent upon attaining high water clarity, which modeling results show is not realistic for the tidal freshwater James River.

(ii) We believe the Bukaveckas (2000) analysis commissioned by DEQ was an interesting exercise. However, we do not believe that a simple elemental ratio analysis based on thresholds derived from the Ohio River is sufficient to refute the relation observed from actual monitoring data in the TF1 segment, nor to dismiss the productivity concept that is well established for freshwater systems with longer retention times than nontidal streams such as the Ohio River.

(iii) VIMS stated that "we do not believe the proposed chlorophyll standards pose a threat to the long-term productivity of...the James River." (Roger Mann, writt. comm., 2005) We agree that is unlikely that a seasonal mean chlorophyll-*a* of 20 μg/L would be associated with a significant productivity loss at any specific location. However, as applied using the CFD approach, attainment of a 20 μg/L standard at the chlorophyll-a peak in the TF1 segment would require chlorophyll-*a* significantly below 20 μg/L throughout much of the segment, and it is unclear if this was even considered by VIMS.

(iv) DEQ's responses also pointed out that the zooplankton food availability index was poor in certain monitoring years. Protection of zooplankton food availability from both food quality and food quantity effects is VAMWA's intent. We agree that it is possible that such lower zooplankton food availability could be caused at least in part by excessive cyanophytes at elevated chlorophyll-*a* concentrations. But Baywide monitoring clearly show that lower zooplankton food availability is also associated with very low chlorophyll concentrations in the tidal freshwater systems. These segments should be managed to balance these effects.

(b) *Attainability of lower chlorophyll-a targets is highly questionable*. DEQ originally based its decision to raise the TF1 summer target from 20 to 25 μg/L on model predictions of attainability. We believe that reason is still valid, for the following reasons:

(i) Given uncertainty associated with the model, its predictions are probably no more accurate than to the nearest 5 μg/L for this segment, if not higher. In other words, it cannot be confidently stated that 23 μg/L is attainable but 20 μg/L is not.

(ii) Predictions of attainability have been based on an evaluation of a 10-year assessment period, but some individual 3-year assessment periods would likely still be in non-attainment of lower criteria.

In briefing materials to the SWCB, DEQ stated that 25 μg/L was expected to provide significant environmental benefits to this segment. Although the actual responses of plankton and other living resources remains uncertain, we believe there is sufficient technical justification for retaining the 25 μg/L standard (as compared to any lower concentration) under an adaptive management approach.

2. *The chlorophyll-a criteria are scientifically unsupported in oligohaline, mesohaline, and polyhaline segments*. Our previous comments had raised the point that the magnitude of the chlorophyll-*a* criteria have no meaningful relation to impairments of designated uses, being largely derived from an assortment of highly indirect methods that failed to demonstrate direct relations between the proposed criteria and actual impairments. As a result, the criteria magnitudes are highly arbitrary and subjective.

In reviewing DEQ's response to this comment, we find no new information that refutes this basic conclusion. DEQ's response does acknowledge that the "reference community information may not be useful in regards to...higher trophic level designated uses", but indicates that DEQ does believe the criteria are useful for achieving the reference community composition. However, once again the direct relation has not been demonstrated; DEQ has made no demonstration that achieving the specific chlorophyll-*a* numbers proposed is either necessary or sufficient for achieving the reference community composition. In fact, the evidence suggests that the reference community is not an appropriate definition of a "balanced, indigenous community" for the James River and would not be achieved even with attainment of the proposed criteria (as discussed in comment 3).

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3. *Virginia lacks an appropriate definition of "balanced" algal community for the James River.* VAMWA recognizes the importance of "balanced, indigenous population of aquatic life", including phytoplankton. However, we do not believe that DEQ or USEPA have derived a useful definition of such a community, nor demonstrated that the proposed chlorophyll-*a* standards are a useful tool for achieving a balanced community. DEQ has relied heavily on the phytoplankton reference community concept as defined by Buchanan (2005), and the associated phytoplankton IBI. Both have important technical problems which limit their usefulness for regulatory management of the James River.

(a) We reiterate previous comments that the phytoplankton reference community and P-IBI do not represent *a priori* definition of an ecologically healthy community, but simply represent the community loosely associated with certain light and nutrient concentrations defined by regulators to represent desirable conditions. As such, water quality management on this basis is highly circular. Other phytoplankton communities may be also be "balanced", supportive of overall ecological health, or even more representative of natural conditions in the James River.

(b) We reiterate previous comments that the phytoplankton reference community can be shown to be largely a function of water clarity. The James River Alternatives Analysis clearly shows only minimal gains in water clarity of the James River, even with highly speculative assumptions about the potential for shoreline erosion control. While it may be reasonably expected that chlorophyll-*a* standards would reduce overall phytoplankton biomass, there is no hard evidence that major shifts in the algal community composition would necessarily occur.

The exception is probably the TF1 segment, where a direct relation between chlorophyll-*a* and cyanophyte abundance can be demonstrated. But even in this segment, high turbidity, channel morphology, and other natural characteristics are likely to cause phytoplankton communities to be different than the reference community.

(c) The reference community actually has higher dinoflagellates for the higher salinity segments in most seasons. The primary publication referenced by DEQ for the lower James reference community (Buchanan 2005) does not link impaired conditions with increasing or high dinoflagellate levels; rather, the data show overall static or increased dinoflagellates at compliance level conditions (Table 3 of reference). This is in apparent contradiction with statements by regulators that reductions to compliance level chlorophyll-*a* levels would concurrently bring about a "balanced" phytoplankton community that is in part defined by lower dinoflagellate abundance.

(d) The P-IBI metrics include two parameters directly related to total algal biomass, including chlorophyll-*a* itself. Therefore, attempting to justify chlorophyll-*a* criteria using the P-IBI is highly circular and auto-correlated.

(e) The P-IBI metrics for the mesohaline and polyhaline James are inherently biased toward negative scores. For several parameters the only possible score is a "BAD" value of '1'. For example, in the summer polyhaline James total biomass above the 95th percentile is given a

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"BAD" score of '1'. However, low attainment level, total biomass values are not given a positive "GOOD" score of '5' or even the median score of '3'. This is not the case for other salinity ranges and seasons where 100% of the criterion values are evaluated as Good, Bad, or Mixed.

(f) Even if these apparent biases are accepted -and we do not accept them- for the sake of discussion, the P-IBI classification efficiency for the James River is far below the classification efficiency for the whole Bay (Table 1). The median classification efficiency for the whole Bay is 75.4%; whereas the median for the James River is only 58.4%. The classification efficiency is particularly poor in the Lower James River summer where the P-IBI classifies good and bad sites correctly only 40% of the time for the mesohaline and 27% of the time for the polyhaline. The spring mesohaline combination shows a classification efficiency of only 51%. This low level of confidence is disturbing because this season and segment combination is a "driver" for the proposed nutrient allocations for the lower James River region.

TABLE 1
Classification Efficiency of the Phytoplankton IBI: Whole Bay and James River

Season	Salinity Zone	Whole Bay P-IBI Classification Efficiency	James River Data P-IBI Classification Efficiency
Spring	Tidal Fresh	68.9%	59.6%
Spring	Oligohaline	70.5%	85.7%
Spring	Mesohaline	75.3%	50.9%
Spring	Polyhaline	84.4%	57.1%
Summer	Tidal Fresh	77.7%	82.8%
Summer	Oligohaline	75.5%	69.2%
Summer	Mesohaline	73.0%	40.0%
Summer	Polyhaline	80.7%	27.3%

(g) Chlorophyll-*a* is a very poor predictor of P-IBI in the mesohaline and polyhaline segments, as evidenced by extremely an extremely weak graphical relations (Figure 4). This weak relation is remarkable considering the inherent bias by inclusion of chlorophyll-*a* and total biomass in the P-IBI calculation. These weak relations bring into serious doubt whether attainment of specific chlorophyll-*a* standards would result in major changes in P-IBI scores.

(h) PIBI methods have not been approved as biocriteria under Virginia's Adminstrative Process Act process. It is essential that the DEQ subject the P-IBI measure to the APA process if the measure is to be used as a key element of regulatory actions.

(i) As discussed in comment 7, the James River Alternatives Analysis showed miniscule changes in seasonal mean chlorophyll-*a* concentrations in the higher salinity segments. Even if chlorophyll-a was a good predictor of the P-IBI in these segments (which it is not as

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discussed above), it could be concluded that no significant changes in the P-IBI would take place.

VAMWA recommends that DEQ continue to use the P-IBI to evaluate status and trends but not to directly support regulatory actions. If it is desired to base chlorophyll-*a* standards upon the concept of a "balanced" phytoplankton community, DEQ should derive a definition of such a community based on the proportion and biomass of harmful/toxic taxa.

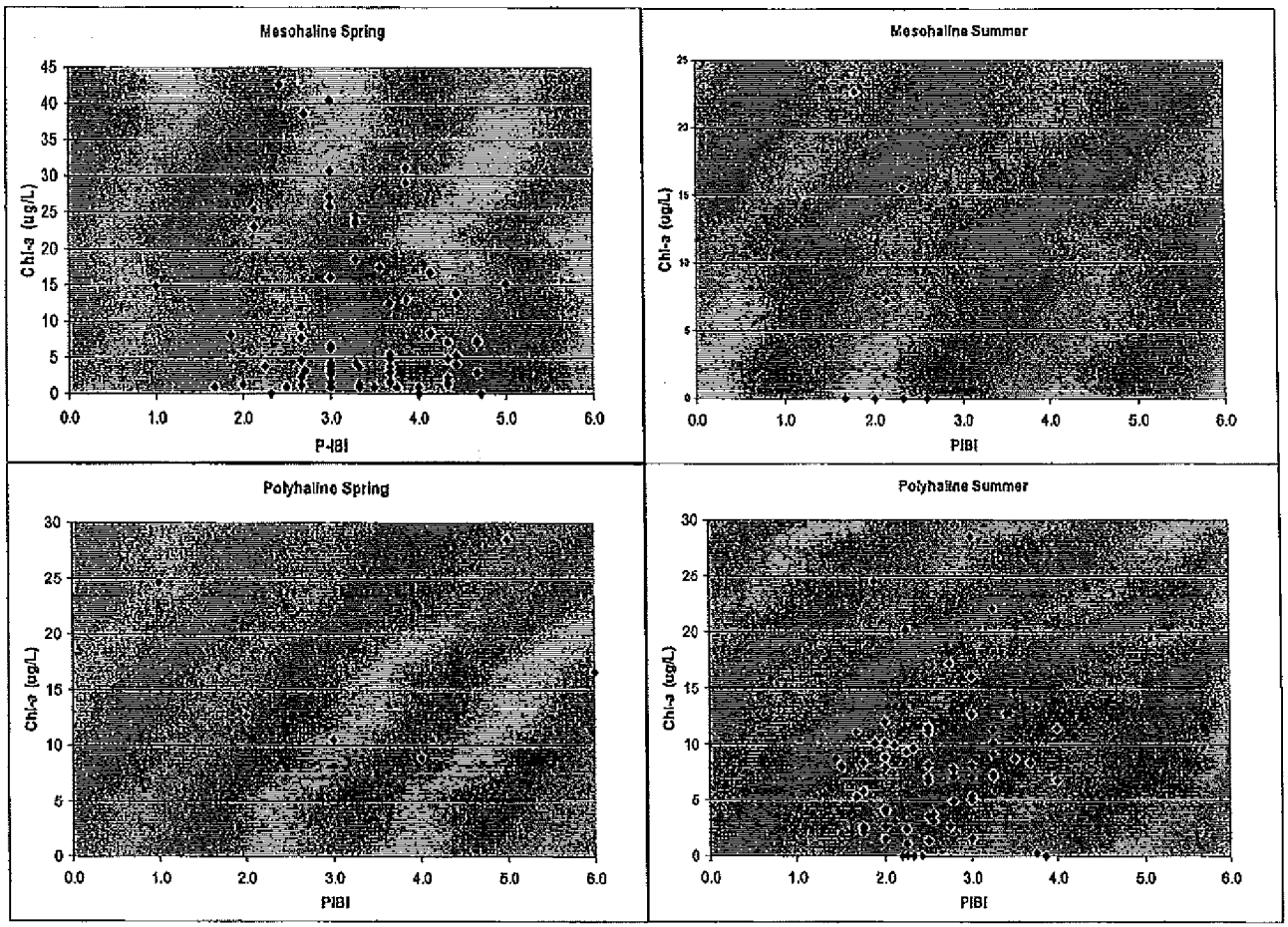

Figure 4: Chlorophyll-a v. phytoplankton IBI. Data from Microsoft Excel workbook title "Phytoplankton IBIs by Station" provided by DEQ.

4. *The nutrient-related impacts to the James River and benefits of the chlorophyll-a criteria appear to have been overstated*. As our previous comments indicated, VAMWA has agreed that nutrient reduction in association with some sort of chlorophyll-*a* target has the potential to reduce cyanophyte biomass in the tidal freshwater James River. Although it is not clear that the current levels of cyanophytes actually limit to upper trophic levels, we believe that the current levels of cyanophytes would represent a relatively clear departure from a "balanced, indigenous

population" of phytoplankton, and that there is a potential environmental benefit from their reduction. However, we believe that most of the other cited benefits of the chlorophyll-*a* standards were overstated or not adequately substantiated. Specifically:

(i) Although the DEQ responses include valuable information on the status of fisheries, it does not strongly implicate nutrients/chlorophyll-*a* as a major cause of fisheries problems on the James River. Rather, poor recruitment years for largemouth bass were more confidently associated with drought conditions, which caused "tidal rivers throughout the region [to] experience similar declines in largemouth bass populations" (VDGIF, 2004). Predation by the invasive blue catfish is cited as another major impact to fisheries, which has nothing to do with nutrients or chlorophyll-*a*.

(ii) The DEQ responses cite poor status of benthic macroinvertebrates at selected locations. The status of benthic macroinvertebrates in the James River has been firmly linked to sediment and habitat characteristics. For example, Diaz (1989) stated that "The overwhelming influence of the physical environment in the estuarine portion of the river masks all but very local effects of pollution...On the whole, the low species diversity in the tidal freshwater James River is attributable not to pollution but to the general lack of diverse habitats..."

(iii) There has been no evidence presented that the chlorophyll-*a* criteria will have any significant benefits to oysters or crabs. Oyster populations are limited primary by disease. Despite the claimed chlorophyll-*a* impairments of the James River, this estuary has some of the highest oyster densities in the Bay system, and within the available oyster habitat, oyster density is highest where chlorophyll-*a* is also highest (in the upper mesohaline segment) (Cerco and Noel, 2005). Similarly, no convincing linkage has been presented between the proposed chlorophyll-*a* reductions and improvements to crab populations.

(iv) Continuing references to SAV benefits are inconsistent with water quality modeling results and other information that predict negligible benefits to SAV from chlorophyll-*a* reduction. For example, as stated in the James River Alternatives Analysis, "Scoping Scenario D has a greater reduction of nutrients and the same level of sediment reduction as the VATS scenarios". Yet the two scenarios predict almost identical levels of SAV acreage for all segments, certainly within the error of the model.

(v) VAMWA believes that it is reasonable to hypothesize that a reduction in cyanophytes in the tidal freshwater James River might provide some food quality benefits to higher trophic levels. However DEQ responses present no evidence that the phytoplankton composition of the higher salinity segments is insufficient to support desired levels of living resources, or that that attainment proposed criteria would significant alter food quality of this region.

DEQ has summarized the analysis of Dr. Paul Bukaveckas (2005) to state that, *"suspended matter in the James River is rich in its algal carbon fraction and its phosphorus and nitrogen content. All three metrics exceeded values reported for consumer thresholds."* While we believe that this study has limitations for understanding trophic dynamics in the James River (as mentioned in comment #1), it argues against food quality limitations of this system under current conditions.

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For the higher salinity segment, the food quality argument focuses on speculation that reference conditions increase the fraction of diatoms in the total phytoplankton population. Even if this speculation was fact, Buchanan (2005) does not show an increase in diatoms at reference conditions; of the four seasons and salinity regimes analyzed for median reference conditions, 5 show increases diatoms, 5 show decreased diatoms, and 6 show no change at all (Table 3). Furthermore, of the evaluations of maximal diatom biomass, 2 show increases diatoms, 7 show decreased diatoms, and 7 show no change at all (Table 3 of reference). Consequently, the information available shows attainment of the proposed phytoplankton reference community does not provide the secondary benefit claimed.

Despite the above concerns VAMWA agrees that the concerns that have been raised by the DEQ regarding the potential for increased algal blooms and/or HABs in the lower estuary in the future. The DEQ has recognized that there is considerable uncertainty with regard to the effectiveness of nutrient controls to address HABs. However, VAMWA concurs with the DEQ that the establishment of anti-degradation based nutrient loadings represent a reasonable and prudent precaution related to these concerns.

We ask that DEQ show restraint with such claim regarding the benefits of this regulation, with clear differentiation between benefits that are likely (e.g., reduction of cyanophyte biomass in the tidal freshwater segment), possible (improvements to fisheries in this segment from reduced cyanophytes), and unlikely (significant changes to oysters, crabs, SAV, etc.). Such differentiation by DEQ is necessary to avoid having mislead the public and decision makers about any benefits from this regulation.

5. *Problems with the cumulative frequency distribution (CFD) approach in conjunction with the chlorophyll-a standard.* At the time of our previous comments, our assumption was that the proposed criteria would be evaluated using the cumulative frequency distribution (CFD) approach, as described by USEPA in Chapter 6 of the Regional Criteria Document which specifically uses chlorophyll-*a* as an example of how the calculation would be performed. Under this approach, a segment is deemed to be violation of the standards if the criterion is exceeded by a limited frequency or area—using a 10% time-space curve if no other reference curve is available. Under such an approach and example provided, the criteria would be akin to a maximum value to be infrequently exceeded.

In their response, DEQ stated that the chlorophyll-*a* values represent seasonal means. While VAMWA views this as a positive change with respect to the potential for food quantity limitation, we have technical concerns about whether it is appropriate for attainment with a seasonal mean to be evaluated using the CFD approach. These concerns include the following:

(a) Under any 3-year assessment period, the CFD curve would have be developed with only three data points representing percent areal exceedance for a given segment. This does not include the two artificial intercept points that do not represent real observations. We strongly question the statistical validity of developed a CFD curve with only three observed points, and question whether such a curve can be confidently distinguished from a continuous reference curve. Unless the three points were all much higher or lower than the reference curve, questions of attainment would be highly influenced by the angular shape of the 3-point

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curve. This seems to represent a poor fit of the seasonal average concept into the CFD approach.

USEPA has previously indicated the intention to develop a statistical significance test for use with the CFD. However, this work is not complete. While this problem would apply to DO, clarity, and chlorophyll-*a* criteria, it most egregious for chlorophyll-*a* because of lack of sufficient data to develop a smooth CFD curve (as with DO), and the lack of a back-up biological criterion (as with water clarity).

(b) Unlike for dissolved oxygen and water clarity, no biological reference curve exists. The arbirtrary 10-percent reference curve is more stringent than used with either of the other two standards. Once again, USEPA's work to allow proper application of the CFD approach with chlorophyll-*a* standards is incomplete. This has important implications because, as stated in the James River Alternative Analysis Report, "It is believed this may have created more [model predictions of] non-attainment than would be expected from a true reference curve."

(c) This approach could lead to a very small portion of a segment exerting a great deal of control over attainment decisions. This might be appropriate for a standard associated with acute localized effects, such as dissolved oxygen. However, this is not the case for seasonal mean chlorophyll-*a* criteria, which represents an attempt to characterize what is generally healthy for different regions of the James River over relatively long periods of time.

In the TF1 segment, attainment would likely be controlled by the chlorophyll-*a* peak downstream of the Appomattox River comfluence. As discussed in comment 1, this could lead to undesirably low chlorophyll-*a* concentrations elsewhere in the segment. For the higher salinity segment, control by these small areas has the potential to greatly increase implementation costs with little to no environmental benefit. For example, a small region of a segment might meet 12 μg/L (but not 10 μg/L), even though the segment as a whole might meet 10 μg/L.

We recommend that DEQ consider alternative assessment approaches that do not have the statistical problems mentioned above. One approach would be simple spatial averaging, in addition to the seasonal averaging that is already proposed. Such an approach would still require substantial nutrient and chlorophyll-*a* reductions.

6. *DEQ has not proposed a true adaptive management approach*. VAMWA has long advocated an adaptive management approach for nutrient management in the James River. In addressing this issue in their responses to previous comments, DEQ claims to be employing an adaptive management approach, citing the Chesapeake 2000 Agreement, standards adoptions/review process, and monitoring programs. Under DEQ's definition, any of DEQ's Clean Water Act programs would be labeled as "adaptive management". But as commonly used in the environmental field, adaptive management is fundamentally different from the traditional water quality standards setting process. As stated by Schaeffer and Luzadis (2000),

> Adaptive management is an ecosystem-based natural resource management strategy that acknowledges uncertainty and recognizes that policies are experiments from

> which individuals should learn in a process of knowledge-building...Adaptive management's emphasis on learning recognizes this uncertainty and allows for, indeed encourages, readjustment throughout the process. The direct feedback loop between science and management and the deliberate emphasis on management as an experiment distinguish adaptive management from traditional incremental policy-making.

The triennial review process alone can hardly be said to encourage readjustment of goals. In practical terms, once wasteload allocations to meet the proposed criteria are adopted, they could be extremely difficult to change due to anti-backsliding, anti-degradation, and the general difficulty of gaining regulatory approval to explicit changes in water quality standards. In short, VAMWA sees very little that can be said to be "adaptive" about the proposed standards or process.

Adaptive management and related non-traditional methods of water quality management specific approaches incorporate both regulatory and non-regulatory elements. Such approaches have specific goals and timetables for revisiting and revising those goals. The whole adaptive management concept was specifically founded for situations where there is a high degree of scientific uncertainty and costs, as for nutrient management in the James River. Even DEQ responses and the James River Alternative Analysis repeatedly acknowledge uncertainty in many aspects of the actual effects/benefits of the proposed chlorophyll-*a* criteria to designated uses, including doubts about whether the reference community concept has meaning for higher trophic levels.

In our view, a true adaptive management approach would involve adopting chlorophyll-*a* criteria for the specific segment (TF1) where there is a high confidence in a direct linkage between chlorophyll-*a* and an actual use impairment. Non-regulatory approaches and anti-degradation policies should be used elsewhere to track chlorophyll-*a* reductions and any ecological changes that will result from nutrient reductions in the James and entire Bay system.

7. Modeling shows flat environmental responses to nutrient reduction in the mesohaline and polyhaline James River. The James River Alternatives Analysis (June 23, 2005) and James River Alternatives Analysis Addendum (August 11, 2005) provide significant insights into factors that influence chlorophyll values in the lower estuary.

(a) Local nutrient reduction effects on chlorophyll are minimal. The James River Alternatives Analysis Addendum (dated August 11, 2005) provided a comparison between chlorophyll conditions between scenarios termed "VATS" and "VATS Alternative". These two model scenarios varied the level of loading reduction at HRSD James River facilities (by 1.5 million lbs TN per year) with leaving the other assumptions constant (such as above fall line loadings, tidal freshwater region loadings, suspended sediment reduction, etc.). The comparison can be viewed as a sensitivity analysis on the effectiveness of HRSD nutrient loading reductions to decrease chlorophyll within the lower estuary segments. The results provided in Appendix 3 (pp 20) for the mesohaline spring season indicated that the seasonal average chlorophyll values (measured as average of 3 year periods) between these scenarios were 7.47 and 7.16 ug/l for "VATS" and "VATS Alternative", respectively. These results

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indicate a seasonal average chlorophyll difference of 0.3 μg/l chlorophyll-*a*, or 0.2 μg/l chlorophyll a per million lbs of total nitrogen removed by HRSD. This level of chlorophyll-*a* reduction is miniscule in relation to the high costs necessary to remove the nitrogen. The Bay Journal estimated costs for nitrogen removal at $8.56 per pound per year. This translates to $4.3 million per 0.1 ug/l reduction in spring seasonal average chlorophyll within the segment.

In terms of CFD based attainment, "VATS" and "VATS Alternative" indicated that the chlorophyll a concentration at which full attainment (i.e "A") was achieved did not vary (pp 28). Both indicated CFD attainment at 11 μg/l.

We interpret these modeling results to indicate that chlorophyll values in the lower estuary are not sufficiently sensitive or cost effective to nutrient reduction to merit further reduction. The measures of plankton health (i.e. P-IBI, etc.) discussed above have not been shown to be related to chlorophyll even over a wide range in results, as discussed in comment 3. Given these circumstances we can reasonably assume that chlorophyll values or CFD based attainment is not significantly affected by load variations on the order of 1.5 M lbs/yr of TN.

(b) Upstream nutrient sources affect chlorophyll levels in the lower estuary as much as local sources. The James River Alternatives Analysis Addendum (dated August 11, 2005) also provided a comparison between chlorophyll-*a* conditions between scenarios termed "VATS" and "VATS JR Alternate". These two model scenarios varied the level of combined above fall line and tidal freshwater nutrient loading (by 1.5 million lbs TN per year) with leaving the other assumptions constant (such as lower estuary loadings, suspended sediment reduction, etc.). This comparison can be viewed as a sensitivity analysis on the response of lower estuary chlorophyll-*a* levels to increases in above fall line and tidal freshwater nutrient loadings. The results provided in Appendix B (pp 20) for the mesohaline spring season indicated that the seasonal average chlorophyll-*a* values (measured as average of 3 year periods) between these scenarios were 7.47 and 7.80 ug/l for "VATS" and "VATS JR Alternate", respectively. These results indicate a seasonal average chlorophyll difference of 0.31 ug/l, or a response factor of 0.2 μg/l chlorophyll-*a* per million lbs of total nitrogen increase. Although the response factor is small it is approximately the same as the one described above except in the reverse (chlorophyll-*a* values increase rather than decrease).

In terms of CFD based attainment "VATS" and "VATS JR Alternative" indicated that the chlorophyll-*a* concentration at which full attainment (i.e "A") was achieved varied by 1 μg/l (pp 28).

(c) Projection of other alternatives. The above results indicate that more cost effective nutrient allocation scenarios should be evaluated for the lower James River. Based on the information presented (and assuming linear responses) variations in total nitrogen loading at levels of 1 million lbs/yr TN can be expected to result in (a) 3-year average chlorophyll responses of 0.2 μg/l, and (2) zero to 1 μg/l differences in CFD-based chlorophyll-*a* attainment. Both of the results are within the ability of the model to reliably predict.

8. *VAMWA recommends both nutrient and suspended sediment controls*. The DEQ response to the last set of comments (letter dated June 2005) stated that VAMWA recommends suspended

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sediment controls only. This reflects an apparent misunderstanding of our position on sediment controls. The point we sought to make is that problems with water clarity are largely due to sediment. The results of the James River Alternatives Analysis serve to confirm this. Therefore, it makes sense to focus the control measures on the dominant source of the problem.

In the response to comments both DEQ and VIMS stated concerns that reducing only sediment might result in future problems with algal blooms. VAMWA tends to agree. However, we also find this scenario would not result from our management recommendations, which include nutrient reductions to reduce chlorophyll-a in the tidal freshwater segment, as well as a water quality anti-degradation approach for the higher salinity segments. Non-point source sediment reductions will be needed to attain water clarity standards regardless of the implementation of chlorophyll-*a* standards, will concurrently reduce nutrients. Model results show the doubt of attaining major increases in water clarity in the James River, and they also predict that chlorophyll-*a* concentrations would only *decrease* under the load scenarios recommended by VAMWA's.

SUMMARY OF RECOMMENDATIONS

VAMWA recommends that the Board adopt a criterion of at least 25 μg/L for the summer TF1 segment, and employ a true adaptive management approach that considers the possibility of both food quality and quantity effects in this segment. DEQ should use anti-degradation policies and non-regulatory approaches to manage nutrient loads in other segments. If it is desired to adopt numeric chlorophyll-*a* criteria for these segments in the future, they should be based on a clear definition of phytoplankton goals that are appropriate for the James River, realistic, and meaningful in an overall ecological context.

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Pomeroy, Chris

From: Morel, Meghan
Sent: Thursday, August 18, 2005 11:40 AM
To: aepollock@deq.state.va.us; rfweeks@deq.state.va.us; eglilnsky@deq.virginia.gov
Cc: Pomeroy, Chris; whunley@hrsd.com
Subject: Model Run Tables for the York and James Rivers

Dear all,

Chris asked me to pass on the following documents regarding model runs for the York and James Rivers.
In considering your question about these runs, we have acquired more useful information allowing us to limit the scenarios to only 3. Please see and review the attached tables.

In addition, please feel free to contact Will Hunley with any questions or concerns this afternoon. His contact information is as follows:
Tel: (757) 460-4252 or whunley@hrsd.com

Kind regards,

Meghan Morel

Meghan F. Morel
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Exhibit 6

Model Runs Needed for the York River

Scenario	Description	Nutrient assumptions		Suspended sediment assumptions	Northern Bay assumptions
		Municipal PS[1]	NPS		
1	BNR - lower P	TN: 8 mg/L TP: 1 mg/L	VA TS 2005	VA TS 2005	Allocation
2	BNR – higher P	TN: 8 mg/L TP: 2 mg/L	VA TS 2005	VA TS 2005	Allocation

[1]Assumes Totopotomoy WWTP at design flow of 10 MGD.

Model Runs Needed for the James River

Scenario	Nutrient assumptions[1]				Suspended sediment assumptions	Northern Bay assumptions
	AFL municipal PS[1]	TF municipal PS	LE[2]	NPS		
1	TN: 8 mg/L TP: 0.5 mg/L	VATS JR (TN and TP)	VATS JR (TN and TP)	VA TS 2005	VA TS 2005	Allocation
2	TN: 8 mg/L TP: 0.5 mg/L	TN: 5 mg/L TP: 0.5 mg/L	VATS JR (TN and TP)	VA TS 2005	VA TS 2005	Allocation
3	TN: 8 mg/L TP: 0.5 mg/L	TN: 5 mg/L TP: 0.5 mg/L	TN: 6.7 M lbs/yr TP: VATS JR	VA TS 2005	VA TS 2005	Allocation

[1]Assumes Richmond, Lynchburg, and Hopewell held at VATS JR for all scenarios. VATS JR refers to loading assumptions employed in "VATS JR Alternate" contained in the James River Alternatives Analysis Addendum (August 11, 2005).

[2] Refer to attached table of HRSD by plant loadings for both TN and TP for scenario #3.

HRSD anti-deg loadings for the James River and Lower Chesapeake Bay

James River Loads:

	TN	TP
AB	875,700	54,820
BH	1,009,291	76,139
JR	1,003,324	60,911
NP	1,082,944	91,367
VI	793,993	121,822
WB	476,773	68,525
SUM	5,242,025	473,584

Lower Chesepeake Bay Loads:

	TN	TP
CE	1,488,559	108,674

Notes:
TN reflects average of 2001-2004 annual loads
TP reflects VATS JR (design flows*1 mg/l TP conc.)
Units are M lbs/yr