GUIDANCE FOR PROTECTING SUBMERGED AQUATIC VEGETATION IN CHESAPEAKE BAY FROM PHYSICAL DISRUPTION

prepared by

Submerged Aquatic Vegetation Workgroup of the
Living Resources Subcommittee,
Chesapeake Bay Program

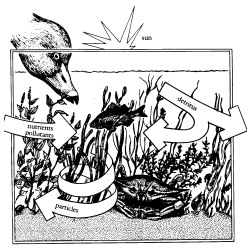

Illustration by E. Kasmer from *Chesapeake Bay: Introduction to an Ecosystem, 1989*

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EXECUTIVE SUMMARY

The underwater vascular plants that make up the submerged aquatic vegetation (SAV) community in Chesapeake Bay are widely regarded as keystone species and primary indicators of water quality conditions in the Bay. Although SAV communities currently have some protection from dredging and construction activities in most areas of the Bay and its tidal tributaries, the protection of existing SAV beds and potential SAV habitats from adverse impacts should be evaluated in all cases. State and federal agencies with resource management responsibilities for shallow water habitats within Chesapeake Bay and its tidal tributaries should consider the following protective measures in their decision making processes:

! **Protect SAV and potential SAV habitat from physical disruption. Implement a tiered approach to SAV protection, giving highest priority to protecting Tier I and Tier II areas, but also protecting Tier III areas from physical disruption.** These areas correspond to areas mapped with SAV in aerial surveys since 1971 (Tier I restoration goal) and the shallowest waters (to one meter mean low water [MLW], Tier II restoration target), and to deeper potential SAV habitat (to two meters MLW, Tier III restoration target).

! **Avoid dredging in Tier I and Tier II areas**, except in a limited manner for public access, maintenance dredging, and in some circumstances, erosion protection.

! **Avoid dredging within Tier III areas.** If disruption of these areas is unavoidable, it should be minimized.

! **Avoid dredging, filling, or construction activities that create additional turbidity sufficient to impact nearby SAV beds during the SAV growing season.** If these activities are unavoidable, any reduction in Secchi depths compared to pre-disturbance levels should be minimized.

! **Establish an appropriate undisturbed buffer around SAV beds to minimize the direct and indirect impacts on SAV from activities that significantly increase turbidity.** If dredging must occur inside recommended buffers, it should be done outside the SAV growing season.

! **Preserve natural shorelines.** Stabilize shorelines, when needed, with marsh plantings as a first alternative. Use structures that cause the smallest increase in local wave energy where planting vegetation is not feasible.

! **Educate the public about the potential negative effects of recreational and commercial boating on SAV and how to avoid or reduce them.**

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INTRODUCTION

This document provides guidance for Chesapeake Bay resource managers and others on how existing submerged aquatic vegetation (SAV) and tidal shallow water habitats with potential for supporting SAV in the Bay can be fully protected, given current human uses of and demands on the Bay. In preparing this guidance document, the Submerged Aquatic Vegetation (SAV) Workgroup of the Chesapeake Bay Program's Living Resources Subcommittee reviewed, summarized, and compared current state and federal policies and guidelines for protection of or minimizing impacts on SAV. Next, the workgroup identified key management issues facing the protection of existing and future SAV resources. Finally, building on current state and federal guidelines and policies, the workgroup identified guidance to first avoid, then minimize, direct impacts to SAV in the Bay and its tidal tributaries. This guidance document should be used by all local, state, and federal agencies making decisions that influence the ability of SAV to survive and flourish in Chesapeake Bay.

The underwater vascular plants that make up the submerged aquatic vegetation community in Chesapeake Bay are widely regarded as keystone species of the shallow water ecosystem and primary indicators of water quality conditions in the Bay. The high ecological value of SAV includes providing food for waterfowl; shelter for adult and young fish, shellfish, and invertebrates; absorbing nutrients and oxygenating the water column; and reducing wave energy and promoting settling of suspended sediments [13]. SAV also are indicators of good water quality. Extensive research in Chesapeake Bay showed that SAV tended to grow best where water clarity was high and nutrient, chlorophyll, and suspended sediment levels were low [1].

In recognition of the ecological importance of SAV and its role as a bellwether of the success of broader restoration programs, in 1989, the CBP's Executive Council established a Submerged Aquatic Vegetation Policy [4] and committed to a policy implementation plan [5] to achieve as its goal:

> *a net gain in SAV distribution, abundance, and species diversity in the Chesapeake Bay and its tidal tributaries.*

A basic tenet of this policy is the protection of existing SAV:

> *from further losses due to increased degradation of water quality, physical damage to the plants, or disruption to the local sedimentary environment.*

This policy reflects the broader goal and objective set forth in the 1987 Chesapeake Bay Agreement [3], reiterated in 1992 amendments to the Agreement [6]:

> *Goal: Provide for the restoration and protection of the living resources, their habitats and ecological relationships.*

> *Objective: Restore, enhance, protect, and manage submerged aquatic vegetation [3].*

The Chesapeake Bay Program developed a three-tiered framework of SAV restoration goals or targets [1]:

> Tier I: restoration or establishment of SAV in areas of historic (1971-present) distribution
> Tier II: restoration or establishment of SAV in potential habitat to a depth of one meter
> Tier III: restoration or establishment in potential habitat to a depth of two meters

These goals imply protection of currently unvegetated habitat. In 1993, the Chesapeake Executive Council adopted an "interim SAV restoration goal" of 114,000 acres Baywide, corresponding to the Tier I SAV goal [7].

Through the SAV policy, its signatories--Pennsylvania, Maryland, Virginia, the District of Columbia, the U.S. Environmental Protection Agency, and the Chesapeake Bay Commission--committed to:

> *use existing regulatory and resource management programs, and develop new programs, to limit permanent and irreversible, direct and indirect impacts to submerged aquatic vegetation and their habitats. Only in rare circumstances will losses of submerged aquatic vegetation be considered justifiable [4].*

This policy is, by necessity general; in actuality, "permanent and irreversible direct and indirect impacts" are assessed or determined by regulatory agencies with direct authority on a case by case basis. Pressure to compromise small, seemingly insignificant SAV beds is immense, making long term policy commitments difficult to achieve.

This guidance document focuses on impacts of shallow water dredging and construction activities on SAV and SAV habitats. The guidance is provided to strengthen, and to achieve greater consistency among, the decision-making processes at the local, state, and federal levels. The guidance provided here draws on the strengths of existing decision-making policies and processes for avoiding, or minimizing if avoidance is not possible, negative impacts on SAV and their shallow water habitats.

This report updates and expands the portions of the *Chesapeake Bay Submerged Aquatic Vegetation Policy Implementation Plan* [5] that specifically address SAV protection. The guidance presented in this report represents the consensus of the Chesapeake Bay Program's Living Resources Subcommittee and its Submerged Aquatic Vegetation Workgroup.

Categories	Maryland	Virginia	US Army Corps of Engineers (Baltimore District)[2]	US Environmental Protection Agency	US Fish and Wildlife Service	National Marine Fisheries Service
Dredging of new channels	Not allowed in water ≤ 3 ft. at MLW (see Appendix A for exceptions)	Limit channels to minimum dimensions necessary; avoid SAV	Not allowed in waters ≤ 2 ft. MLW in main channel, ≤ 1.5 ft. MLW in spurs; presence of SAV overrides these parameters	Generally, no new dredging except in historic channels	Avoid shallow water habitats; not recom-mended in areas without piers and historical deepwater access	Not recommended within existing SAV beds or adjacent shallows with potential for bed expansion
Dredging in SAV beds	Allowed in areas where there were historic channels	Usually not allowed	Prohibited upstream of 1.5-2' contour and in existing beds (see text for exceptions); channel dimensions may be res-tricted where slumping occurs	Allowed in channels or historic channels only; not recommended otherwise	Not recommended	Not recommended
Timing restrictions on dredging	Prohibited within 500 yards of SAV beds, April 15-October 15	Restrictions may be placed if in prox-imity to living resources	April 1-June 30; April 15-October 15 (species with two growing seasons)	March 31-June 15	March-June	Species-dependent; April 15-October 15 for most species; April 1-June 30 for horned pondweed
Dredging in areas that historically supported SAV	Not recommended where SAV occurred during the previous growing season	Considered during the application review process	Depends on depths and why SAV disappeared. Check soils.	Not recommended	Not recommended	Not recommended where SAV has been documented during the past 2-3 growing seasons
Dredging near SAV beds/buffer zones	See timing restrictions on dredging above	Considered during the application review process	3' buffer/1' dredged be-low existing bottom; 15' buffer from MHW & for SAV w. dense tuber mats	3' buffer/1' dredged	3' buffer/1' dredged below existing bottom	Recommend buffers around existing beds; no dredging in areas with potential bed expansion
Depositing dredged material on SAV	Prohibited	Locate to minimize impacts	Recommend against		Recommend against	Recommend against
Pier Construction	Pier out to avoid dredging of SAV beds; minimize pier dimensions	Limit to minimum necessary for water access, locate to avoid SAV	Pier out, construct community piers or mooring piles to avoid dredging of SAV beds; maintain suitable pier height above SAV		Pier out to avoid dredging of SAV beds; construct community rather than multiple individual piers	Maintain 1:1 ratio of deck width to deck height above MLW
Marina development near SAV	Prohibited in areas ≤4.5' unless dredged from upland and adverse impacts to SAV are minimized	Undesirable near SAV, or in waters less than 3' at MLW	Avoid historical SAV beds for new marina construction; maintain buffer for marina expansion	Avoidance of SAV recommended	Avoid	Recommend against new marinas or expansion in existing beds or adjacent shallows with potential for bed expansion
SAV harvest	Permit required					Limited harvest of Hydrilla in the Potomac

CURRENT SAV PROTECTION ISSUES

All state and federal agencies that are involved in the management of shallow water habitats in Chesapeake Bay and its tidal tributaries have their own unique set of SAV protection regulations and policies. These regulations and policies are summarized in Table 1 and provided in detail in Appendix A. These existing regulations and policies, although beneficial for the protection of SAV, must also be considered in all shallow water areas providing SAV habitats. As such, and in order to achieve the restoration and protection goals set forth in the Chesapeake Bay Program's policy statements and agreements, the following six issues must be considered:

1. Dredging/development in potential SAV areas. Current regulations and policies provide varying levels of protection from dredging of existing SAV beds (Table 1; Appendix A), but much less or no protection is provided for potential SAV habitat, where SAV could expand in the future. SAV responds to light, energy, and water quality conditions during its growing seasons. For this reason, SAV beds may be ephemeral from year to year. In addition, conditions may return that promote recovery of SAV in historically vegetated, but currently unvegetated, areas.

Few official policies exist regarding protection of unvegetated areas with documented historical SAV coverage (Table 1, Appendix A). Maryland's policies protect areas three feet deep or less at mean low water (MLW), and deeper areas with documentation of SAV in the previous growing season. The National Marine Fisheries Service (NMFS) recommends protection of areas having SAV in at least two years during the period from 1985 through the present. Previously vegetated areas may be treated as existing beds by NMFS even if growth has not occurred for four or five years (or more), if those areas were historically important to SAV and supported perennial tuber-forming species. Other agencies consider past occurrence of SAV in the process of approving or recommending denial of a permit.

2. Mitigation. The National Environmental Policy Act (NEPA, 40 CFR 1508.20) defines mitigation as five steps: (1) environmental impact avoidance; (2) minimization; (3) rectification (through repair, rehabilitation, or restoration); (4) reduction or elimination of impacts; and (5) compensation by replacing or providing substitute resources or environments. State and federal agencies currently interpret these five steps as a desirable sequence, and recommend avoidance of impacts altogether as the preferred approach to mitigation. Restoration and creation of SAV beds are not usually recommended, as the technology to create or restore SAV beds generally has not proven successful over the long term, given adverse water quality conditions, inappropriate physical settings and other factors.[1]

3. Water quality. Negative impacts of dredging and marine construction on SAV via reduced water quality are indirectly addressed in many of the regulations and policies covering shallow water habitats (Table 1; Appendix A). The time of year and buffer

[1] The SAV Workgroup is revising a draft report on SAV transplanting in Chesapeake Bay [14] and will be completing it in the near future.

restrictions on dredging are designed to reduce the adverse impacts of increased turbidity on SAV growing nearby. However, specific levels of water quality needed for SAV growth were established for Chesapeake Bay, and they should also be included in SAV regulations and policies. Water quality habitat requirements of SAV for four salinity regimes in the Bay were established using all available scientific information (Table 2) [1, 10]. Improving water quality to meet these habitat requirements is the Chesapeake Bay Program's preferred approach to promoting increases in SAV abundance and distribution to historic levels. A driving force behind the Chesapeake Bay Program, since its inception in 1983, has been to reduce loads of nutrients entering the Bay, which should increase water clarity, thus promoting SAV survival.

Table 2. Chesapeake Bay water quality habitat requirements for SAV restoration to one meter depth.[1]

Salinity Regime[2]	Light Attenuation Coefficient (Kd; m^{-1})	Secchi depth (m)[3]	Total Suspended Solids (mg/l)	Chlorophyll *a* (g/l)	Dissolved Inorganic Nitrogen (mg/l)	Dissolved Inorganic Phosphorus (mg/l)	Critical Life Period
Tidal Fresh	< 2	> 0.7	< 15	< 15	-	< 0.02	April - October
Oligohaline	< 2	> 0.7	< 15	< 15	-	< 0.02	April - October
Mesohaline	< 1.5	> 1.0	< 15	< 15	< 0.15	< 0.01	April - October
Polyhaline	< 1.5	> 1.0	< 15	< 15	< 0.15	< 0.02	March - November

1 Sources: [1, 10]. m = meters, mg/l = milligrams per liter, g/l = micrograms per liter. See Glossary for definitions of the habitat requirements. The SAV habitat requirements are applied as median values over the April-October critical life period for the tidal fresh, oligohaline and mesohaline salinity regimes. For the polyhaline salinity regimes, the SAV habitat requirements are applied as median values from combined March-May and September-November data. Light attenuation coefficient (or Secchi depth) should be applied as the primary habitat requirement; the remaining habitat requirements should be applied to help explain regional or site-specific causes of water column and leaf surface light attenuation, which should be directly managed.

2 Tidal fresh = salinity <0.5 parts per thousand (ppt); oligohaline = 0.5-5 ppt; mesohaline = >5-18 ppt; and, polyhaline = > 18 ppt.

3 The Secchi depth habitat requirement is calculated: Secchi depth = 1.45/light attenuation coefficient (Kd). This represents the *minimum* median Secchi depth that will permit SAV growth.

Excess nutrients and chronically high turbidity levels play key roles in the decline of SAV. High nutrient levels reduce water clarity by fueling algae blooms and also harm SAV by promoting the growth of epiphytes on SAV leaves [1, 10]. Therefore, any upland activities, such as reforestation or implementation of best management practices, that reduce inputs of

nutrients and sediments to the Bay and its tributaries will help SAV restoration. Consideration of current and historic SAV occurrence in permitting and mitigation decision making, as well as during development and implementation of nutrient reduction strategies, can speed the process of SAV recovery.

High water turbidity, as indicated by April-October median Secchi depth readings less than 0.7-1.0 m (Table 2), is not conducive to SAV survival in the Bay and its tidal tributaries. Any activities that decrease seasonal median Secchi depths below this level in an area of current, historical, or potential SAV, should be avoided or minimized if avoidance is impossible.

4. Shoreline stabilization. Shoreline stabilization practices, especially bulkheading, may significantly increase local physical energy regimes by preventing dissipation of natural wave energies. This may result in loss of nearby SAV beds or may prevent recovery of SAV with improving water quality conditions. The Virginia Marine Resources Commission [24], and the Maryland Department of Natural Resources [18] both recommend shoreline stabilization methods that cause the smallest increase in local wave energy. Both agencies recommend nonstructural methods whenever possible (such as marsh creation), and using stone revetments or rip-rap where vegetation cannot be used. Both documents discourage construction of new bulkheads in most locations.

5. Competing uses of shallow water areas. There are several competing uses of shallow water habitats that may have negative impacts on SAV and SAV habitats. There is not enough information to recommend protection policies for these competing uses at this time, but all are important enough to warrant further study. It is hoped that SAV protection policies for these uses can be addressed in future guidance documents.

Boating. The state and federal agencies listed in Table 1 do not have policies regarding destruction of SAV by commercial and recreational boating activities. Indeed, when SAV populations (particularly those of exotic or invasive species) reach levels that inhibit boating, control programs have been endorsed and funded. Research on boating impacts in several Chesapeake Bay tributaries documented the relative effects of boat type, boat speed, water depth, and sediment type on light attenuation in shallow areas [21, 22]. SAV conservation may warrant boating regulations, but regulations may not find public acceptance or reasonable means of enforcement. Public education on this issue may be the most appropriate long-term solution. Signage and informational pamphlets may be appropriate in known high impact areas. Boat pump-out facilities are also required to protect water quality, at both existing and new marinas.

Aquaculture. Aquaculture should be avoided in historical and potential SAV habitats to one meter depth MLW (including all areas in the Tier I restoration goal and the Tier II restoration target [1]). Issues related to aquaculture and SAV include: shading from floating racks, impacts from on-bottom racks, and possible nutrient enrichment effects. A decision on aquaculture permits must weigh the public and private benefits and detriments between an aquaculture operation and maintenance or recovery of SAV.

***Clam dredging*.** Dredging for soft shell clams can significantly increase local turbidity [11, 16], and it is done near or in SAV beds in some areas, such as the mouth of the Chester River. Thus, there are negative impacts on SAV. In general, the increases in turbidity associated with clam dredging are less extensive on sandy substrates and more extensive and persistent on silt or clay substrates [11, 16].

Crab scraping. Blue crabs are harvested in Chesapeake Bay with a scrape that cuts off a considerable portion of the leaves of SAV (and flowers or seeds if present), although it does not usually uproot the plants. Crab scraping is common in Tangier Sound, where it is used to catch soft crabs and "peelers" (crabs that will shed soon). Crabs tend to seek out the protection of SAV beds when shedding, so most scraping is done in SAV beds. The long-term effects of scraping on eelgrass may be more severe if done when flowers and/or seeds are present [12]. The severity of its effects on SAV also depends on whether new growth appears at the base of the plant (basal meristem) or at the ends of the stems (apical meristem). Most crab scraping is currently done in beds of eelgrass, a basal meristem species. Crab scraping would be more limiting to the growth of apical meristem species such as widgeongrass, sago pondweed, and most other Chesapeake Bay SAV.

Haul seining. Haul seines are nets used to catch striped bass, carp, and other fish in some shallow areas of Chesapeake Bay. If seines are drawn through SAV beds, they can cause physical disruption of SAV. The extent of any damage currently is not known.

6. Equal protection for all SAV species. All species of SAV in Chesapeake Bay provide similar ecological value and merit equal protection from physical disruption. Introduced and/or more ephemeral SAV species, sometimes considered less valuable, provide most or all of the ecological benefits of the native and/or more persistent SAV species. The presence of any SAV species in an area indicates habitat that is probably suitable for other SAV species. The SAV restoration goals and targets and water quality habitat requirements recently developed for Chesapeake Bay SAV apply to all the SAV species observed and recorded in each salinity zone [1].

Studies found that introduced and/or ephemeral species have equal or higher ecological value, compared with other SAV, and we do not yet know all the values of many species. For example, horned pondweed (*Zannichellia palustris*), a native pioneer species in tidal fresh to moderately brackish waters that dies back in early summer, was favored over more persistent SAV species in Eastern Bay as cover for several species of small, schooling fish [17]. Similarly, the introduced SAV hydrilla (*Hydrilla verticillata*), sometimes considered a nuisance because it impedes boating and swimming, was found to provide valuable fish habitat in the Potomac River [15] and in the Upper Bay [20]. Hydrilla changed water quality in the Potomac River in ways that could benefit living resources [2].

RECOMMENDED SAV PROTECTION GUIDANCE

Protect SAV and potential SAV habitat from physical disruption. Implement a tiered approach to SAV protection, giving highest priority to protecting Tier I and Tier II areas but also protecting Tier III areas from physical disruption. These areas correspond to areas mapped with SAV in aerial surveys since 1971 (Tier I restoration goal, adopted as a goal by the Chesapeake Executive Council in 1993 [7]) and the shallowest waters (to one meter MLW, Tier II restoration target). Deeper potential SAV habitat (to two meters MLW, Tier III restoration target) also should be included[1].

- **Avoid dredging in Tier I and Tier II areas, except in a limited manner for public access, maintenance dredging, and in some circumstances, erosion protection.**

- **Avoid dredging within Tier III areas. If disruption of these areas is unavoidable, it should be minimized.** Allowable impacts should be rare [4] and should be shown to be in the public interest.

Avoid dredging, filling, or construction activities that create additional turbidity sufficient to impact nearby SAV beds during the SAV growing season. If these activities are unavoidable, any reduction in Secchi depths, compared with predisturbance levels, should be minimized. If dredging or other activity that increases turbidity is permitted during the SAV growing season, Secchi depths should minimally remain or be managed to be not less than an April-October median Secchi depth of 0.7-1.0 m (see Table 2) [1].

Establish an appropriate undisturbed buffer around SAV beds to minimize the direct and indirect impacts on SAV from activities that significantly increase turbidity. Buffer width should be based on the time of year, method of dredging, sediment composition and local hydrology, method of disposal of dredged material, and size of the tributary. Undisturbed buffers around SAV beds should be widest during the SAV growing season, when beds should be a minimum of 500 yards wide for dredging methods and sediments that are likely to produce major increases in local turbidity. Outside of the SAV growing season, narrower buffers can be established, but the buffer should be at least three feet wide for each one foot of sediment removed. If dredging must occur inside recommended buffers, it should be done outside the SAV growing season.

Preserve natural shorelines. Stabilize shorelines, when needed, with marsh plantings as a first alternative. Use structures that cause the smallest increase in local wave energy where planting vegetation is not feasible. The current Best Management Practices (BMPs) for shoreline stabilization should be followed [18, 24].

Educate the public about the potential negative effects of recreational and commercial boating on SAV and how to avoid or reduce them. Consider signage and educational pamphlets in high impact areas.

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GLOSSARY

aquaculture - The propagation and rearing of aquatic species in controlled or selected environments (National Aquaculture Act, P.L. 96-362).

Best Management Practices (BMPs) - Management practices that help insure project integrity for the design life of the project, while minimizing the potential adverse impacts associated with construction and maintenance [18, 24].

bulkhead - A vertical structure or partition, usually running parallel to the shoreline, for the purpose of retaining upland soils, while protecting them from wave action [24]. Usually constructed of pressure-treated lumber or concrete.

Chesapeake Bay Commission - A group of state legislators and governors' appointees from the three states in the Chesapeake Bay Program (Maryland, Virginia, and Pennsylvania) that discusses, coordinates, and drafts environmental legislation that affects the Chesapeake Bay and its watershed.

Chesapeake Bay Program - The Chesapeake Bay Program is the cooperative partnership among the states of Maryland, Pennsylvania, Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the U.S. Environmental Protection Agency, representing the federal government; and participating citizen advisory groups. The Chesapeake Bay Program was established in 1983 under the *Chesapeake Bay Agreement.*

Chesapeake Executive Council - The top policy making body of the Chesapeake Bay Program. Made up of the governors of Maryland, Virginia and Pennsylvania, the mayor of the District of Columbia, the Administrator of the U.S. Environmental Protection Agency, and the chair of the Chesapeake Bay Commission. They meet annually to approve new initiatives, review the progress, and set long term priorities and goals of the Chesapeake Bay Program.

chlorophyll *a* - A measure of the photosynthetic pigment in a water sample, mainly from the phytoplankton (algae) suspended in it. More chlorophyll indicates more phytoplankton. Phytoplankton reduce water clarity. One of the SAV habitat requirements (see Table 2) [1, 10].

clam dredging - A commercial fishing technique used in Maryland to harvest soft shell clams. A hydraulic dredge mounted on the side of a boat uses jets of water to stir up about one foot of sediment. Any the clams in the sediment are transported up a conveyor belt to the boat.

competing uses - Uses of the same habitat or resource that are incompatible to some extent.

crab scrape - A metal frame with a light mesh bag attached that is dragged along the bottom to collect soft crabs and peelers (crabs that will shed soon). It is usually used in SAV beds because crabs often shed there.

Dissolved Inorganic Nitrogen (DIN) - A measure of the nitrogen in water available for plant growth. Calculated from the sum of filtered nitrite (NO_2), nitrate (NO_3), and ammonia (NH_4). One of the SAV habitat requirements (see Table 2) [1, 10].

Dissolved Inorganic Phosphorus (DIP) - A measure of the phosphorus in water available for plant growth. Equivalent to filtered orthophosphate (PO_4). One of the SAV habitat requirements (see Table 2) [1, 10].

dredge material - Bottom sediments removed during dredging.

dredging - Removal of bottom sediments, usually to deepen the water to permit navigation. Dredging can also refer to certain commercial fishing techniques, for example, clam dredging, oyster dredging, and crab dredging.

epiphytes - A plant growing on another plant; in this document, they refer to algae growing on SAV leaves or stems. They can reduce light available to the SAV, harming the SAV.

ground truthing - Surveys done on the ground to check information from aerial photography. This is done as part of the baywide SAV aerial survey program to verify SAV bed locations and to identify the species they contain.

habitat requirements - Environmental conditions that are necessary to support the survival and growth of plants or animals [13]. See "SAV habitat requirements."

haul seining - Using a seine to catch fish in shallow water. The seine is a long net with floats on top and weights on the bottom that is pulled through the water, and may be hauled up on shore to remove the fish from it.

historical SAV habitat - An area of shallow water in Chesapeake Bay and its tidal tributaries where SAV has been recorded by aerial surveys since 1971. The overlay of these areas is the Tier I restoration goal [1, 7].

light attenuation coefficient (Kd) - The rate at which sunlight is reduced in intensity per meter in the water column. It is usually measured for the light wavelengths used by plants in photosynthesis, called Photosynthetically Active Radiation (PAR). It can be converted to a Secchi depth using the equation: Secchi depth = 1.45/Kd [1]. One of the SAV habitat requirements (see Table 2) [1,10].

Mean High Water (MHW) - The average height of high tidal waters over a 19-year period [24].

Mean Low Water (MLW) - The average height of low tidal waters over a 19-year period [24].

maintenance dredging - Dredging to maintain existing navigation channels with documented historic boat use. In some circumstances, this may include areas not previously dredged.

mitigation - Environmental impact avoidance, minimization, rectification (through repair, rehabilitation, or restoration), reduction or elimination, and compensation by replacing or providing substitute resources (NEPA, 40 CFR 1508.20).

revetment - A facing of stone, concrete, etc., built to protect a scarp, eroding bank, or shore structure against erosion by waves or currents [18].

rip-rap - Stone used for shoreline stabilization. The stone should be hard and angular and of such a quality that it will not disintegrate on weathering, with individual stones no longer than three times their minimum dimension [24]. Filter cloth is placed beneath the stones to retain soils.

SAV (Submerged Aquatic Vegetation) - Vascular plants that, except for some flowering structures, live and grow below the water surface [4]. The term, as used in Chesapeake Bay, sometimes includes muskgrass (Characeae), a family of quasi-rooted algae that resemble vascular SAV, but no other algae [19]. "Submersed" may be used instead of submerged [10].

SAV bed - An area on the bottom of a water body colonized by one or more species of SAV, in varying density [19].

SAV growing season - April 1 - October 31 in areas of Chesapeake Bay where surface salinity is usually below 18 parts per thousand (ppt). In areas with higher salinity (polyhaline, over 18 ppt), found only in Virginia, the growing season is March 1 - May 31 and September 1 - November 30 [1].

SAV habitat requirements - Minimum water quality levels that SAV need to grow, as determined by research in several areas of Chesapeake Bay [1, 10, 13]. The requirements are based on the average (median) surface values over the SAV growing season. Habitat requirements include five parameters (Table 2). Light attenuation coefficient (Kd) is a measure of how rapidly the ambient light is reduced for each meter below the surface, in $meters^{-1}$, and can be approximated by a calculation using Secchi depth (Table 2). Total suspended solids (TSS) is a measure of the dried weight of solids retained by a 0.7 micron filter, in milligrams per liter. Chlorophyll *a* (CHLA) is a measure of the chlorophyll content of the algae retained on a 0.7 micron filter, in micrograms per liter. Dissolved inorganic nitrogen (DIN) is a measure of the dissolved nitrate, nitrite, and ammonia concentration in the water, in milligrams per liter. Dissolved inorganic phosphorus (DIP) is a measure of the dissolved orthophosphate concentration in the water, in milligrams per liter.

SAV tiers - Tier I restoration goal: Areas of Chesapeake Bay and its tidal tributaries with SAV mapped in aerial surveys since 1971, totaling 114,000 acres [1, 7]. Tier II restoration target: Potential SAV habitat in Chesapeake Bay and its tidal tributaries to one meter depth MLW [1]. Tier III restoration target: Potential SAV habitat in Chesapeake Bay and its tidal tributaries to two meter water depth MLW [1].

Secchi depth - A measure of water clarity; the depth at which a white and black or all white disk just disappears from view as it is lowered in the water column. Habitat requirements for light attenuation coefficient (Kd) have been established for SAV, which can be converted to Secchi depth (see Table 2) [1, 10].

shallow water - Waters that are one meter (approx. three feet) deep or less at mean low water. Can include waters up to two meters (approx. six feet) deep at MLW, which are potential SAV habitat in Chesapeake Bay (see SAV Tier III definition).

total suspended solids - A measure of the amount of organic and inorganic solids suspended in the water column, in milligrams per liter. One of the SAV habitat requirements (see Table 2) [1, 10].

turbidity - A measure of suspended solids or dissolved materials in the water column that reduce water clarity, thus reducing light available to SAV. Usually measured in tidal areas by its effects on water clarity, as Secchi depth or light attenuation coefficient.

Appendix A

CURRENT PROTECTIVE POLICIES AND GUIDELINES

Current guidance to avoid or minimize impacts to SAV in Chesapeake Bay and its tidal tributaries exist as both regulatory guidelines and unwritten policy. State and federal agency programs and legislative mandates are discussed below and are summarized for general comparison below and in Table 1. Pennsylvania is not included because it does not contain any tidal tributaries of Chesapeake Bay. Local agencies may also have input on activities that affect SAV, but a review of their policies is beyond the scope of this document.

STATES AND THE DISTRICT OF COLUMBIA

Maryland

The Maryland Department of Natural Resources, Water Resources Administration, Tidal Wetlands Division, regulates dredging and filling activities as well as construction activities (piers, shoreline protection, etc.) in tidal and tidally influenced wetlands and shallow water areas. Maryland's Tidal Wetlands Regulations (adopted 2-14-94) provide both direct and indirect protection to SAV. Permit or license applications are required to "first avoid and then minimize the loss of tidal wetlands." Permits and licenses are evaluated by the Department of Natural Resources in part by the degree that the permitted action would affect "shallow water areas suitable to support submerged aquatic vegetation."

Applications for dredging permits must include a dated map that delineates where SAV beds currently occur and details of how the SAV was sampled to determine its distribution. Dredging is not generally allowed in less than three feet of water unless: (1) historic boat use since 1972 can be documented by photographs or historic depths can be documented on navigation charts or bathymetric surveys; (2) "the proposed channel represents the smallest dimension necessary to connect a basin created from upland, or is a public boat ramp to navigable waters"; (3) "the proposed channel is necessary for construction of shore erosion control projects"; or (4) "otherwise determined by the Department."

In currently unvegetated areas, dredging is generally not allowed if SAV was present during the previous year. Dredged channel alignments are required to "first avoid and then minimize impacts to shellfish beds, submerged aquatic vegetation, and vegetated tidal wetlands" and "shall be located the maximum distance feasible" from these sensitive areas. Deposition of dredged materials on SAV beds is prohibited. Dredging is not allowed within 500 yards of SAV beds from April 15 through October 15.

Maryland guidelines also cover SAV protection regarding new development. New marinas, or expansion of existing marinas, is prohibited in areas where natural depths are less than

4.5 feet "unless the marina basin is excavated from upland" and adverse impacts to SAV and other resources are minimized.

Maryland law indirectly protects some areas of SAV habitat from disturbance by hydraulic clam dredging by prohibiting clam dredging within a certain distance from shore. This distance varies by county (NRA 4-1038, Annotated Code of Maryland). There are no water depth restrictions.

Protection of SAV is further implicitly mandated through several programs. The Maryland Critical Areas Law (NRA 8-1801 et seq., Annotated Code of Maryland) provides strict guidelines for any new development in "land and water areas within 1,000 feet beyond the landward boundaries of state or private wetlands and the head of tide" and in the waters and wetlands of the Chesapeake Bay below the head of tide. The Department of Natural Resources Power Plant Research and Environmental Review Division is responsible for reviewing all federal activities to assure their consistency with the provisions of the Maryland Coastal Zone Management Plan (authorized through the Coastal Zone Management Act, 16 U.S.C. 1451-1464), including the protection of SAV.

Maryland also protects SAV and SAV habitat through regulation of water quality. A state Water Quality Certification Program (COMAR 26.08.02) under Section 401 of the Clean Water Act (133 U.S.C. 1341-1987) is administered by the Department of the Environment to assure that discharges of pollutants into state waters meet established state water quality standards. The Department of the Environment also issues National Pollutant Discharge Elimination Program (NPDES; 40 CFR 122.26) permits for discharge of pollutants from a point source into navigable waters.

Virginia

The Virginia Marine Resources Commission (VMRC), under Chapter 12 of Title 28.2 of the Code of Virginia, regulates any encroachments in, on, over, or under state-owned subaqueous bottoms. VMRC's Subaqueous Guidelines [23] are designed, among other things, to minimize impacts on aquatic habitats. The guidelines state that: "dredging in shellfish areas, both public and private, beds of submerged aquatic vegetation and other highly productive areas is discouraged"; authorized overboard disposal of dredged material must be located so as to minimize impacts on SAV; locations of jetties, groins, and breakwaters must not "unduly disturb marine resources [including SAV]"; and "alteration of submerged aquatic vegetation...should be minimized wherever possible in the planning and location of submerged structures."

Separate guidelines and criteria for marina, boat mooring facilities, and placement of sandy dredged materials on beaches are also provided by VMRC. Marinas or community facilities for boat mooring "should not be sited close to areas of very high natural resource value such as...seagrass communities." The dredging of access channels should be limited to "minimum dimensions for navigation and should avoid sensitive areas such as... seagrass

beds." These guidelines also state that "piers and wharves crossing vegetated wetlands and seagrass areas should be limited to the minimum necessary for water access." Projects to place dredged sand on coastal beaches must be engineered to minimize environmental impacts to natural resources, including SAV.

In evaluating coastal permits, an environmental assessment is provided to VMRC by the Virginia Institute of Marine Science of the College of William and Mary (VIMS) to address impacts and recommend ways that those impacts can be minimized. VIMS' review takes into consideration impacts to SAV.

Protection of SAV through water quality regulation is accomplished by the Virginia Department of Environmental Quality (VDEQ), Office of Water Resources Management. VDEQ administers Virginia's Water Protection Permit Program (VR 680-15-02) and the VPDES permit program (VR 680-14-01) and adopts water quality standards and requirements. Section 404 permits are reviewed by VDEQ as well.

Local Wetlands Boards in Virginia also provide some protection to SAV from indirect impacts such as upland erosion. These boards review projects in tidal wetlands for environmental impacts and their minimization in a public interest review.

Virginia's Chesapeake Bay Preservation Act (Chapter 21, Section 10.1 2100-2115, Code of Virginia) parallels Maryland's Critical Areas Law to indirectly protect SAV through the lessening of developmental impacts to shoreline areas and coastal wetlands. Protection or restrictive measures directly regarding SAV are not specifically outlined in the Act. Water quality impact assessments required of local assistance boards may address other sensitive environmental areas, including SAV beds, at their discretion.

Delaware

Delaware has regulations concerning disruption of SAV by dredging or marina construction, published by the Delaware Department of Natural Resources and Environmental Control (DNREC) [8, 9]. The regulations state that prohibited dredging projects include:

> Dredging of biologically productive areas, such as . . . submerged aquatic vegetation, if such dredging will have a significant or lasting impact on the biological productivity of the area [8, pg. 15].

There are no time of year or SAV buffer restrictions, and a definition of "significant or lasting impact" is not provided. Dredging in SAV beds has not been an issue recently, because there are very few or no SAV currently growing in Delaware's tidal waters. Recent eelgrass plantings in coastal bays by DNREC became established but were destroyed by conflicting recreational uses.

"General siting considerations" for Delaware boat docking facilities include:

> Structures should be constructed to avoid dredging or filling, with minimal impact on aquatic vegetation and wetlands, and without dead-end or poorly flushed lagoons.
>
> Docks and piers should extend out from the shoreline far enough so as to eliminate need for dredging and filling, and provide sufficient height to allow light to penetrate to vegetation underneath and alongside [8, pg. 17].

Specific Delaware regulations on marinas and SAV provide that:

> Applicants [for marina permits] must demonstrate that short- and long-term impacts to SAV have been avoided, and unavoidable impacts have been minimized and can be compensated for [9, pg. 21].
>
> Compensation shall be required in a ratio of 2:1 for SAV beds disturbed, unless the applicant can demonstrate. . .that a smaller area can provide the same ecological productivity and function [9, pg. 25].

The compensated areas must "employ the same species (flora and fauna) as the ones disturbed" and must achieve the same "average density and average shoot height" as the bed that was disturbed [9, pg. 25]. Replanting is required if the compensation SAV beds fail, paid for with a ten-year bond for twice the estimated replanting cost, released after five years if the compensation is successful [9, pg. 26].

Nonstructural shoreline erosion control measures are "preferred" in situations where they are feasible, and the structural measures recommended where needed are revetments and gabions [8, pg. 18].

District of Columbia

Other than general, unwritten guidance, no policies exist in the District of Columbia regarding avoidance or minimization of impacts to SAV during dredging, marina construction or expansion, or other activities.

The District's involvement with SAV has largely been based on control of hydrilla, *Hydrilla verticillata*. With the invasion of hydrilla in the upper tidal Potomac River in the 1980's, the District of Columbia entered into a multiagency program to harvest this exotic species annually as a means of control. The Potomac Aquatic Plant Control Program currently includes the Metropolitan Washington Council of Governments, the Commonwealth of Virginia, the State of Maryland, and the Army Corps of Engineers as partners. Protection to native plant species is provided by prohibiting other control or eradication measures, such as herbicide application, and by strictly limiting the amount and locations of

mechanical harvesting. Specific regulations concerning SAV harvest were published on April 15, 1994, on pages 1971-1977 of the District of Columbia Register.

FEDERAL AGENCIES

Submerged aquatic vegetation is afforded increased protection under Section 404 of the Clean Water Act (33 U.S.C. 1341-1987) and Section 10 of the Rivers and Harbors Act (33 U.S.C. 403), which regulate the discharge of dredged or fill material into the nation's waters. Authority for administering the Clean Water Act rests with the U.S. Environmental Protection Agency; a federal permit program is delegated to and administered by the U.S. Army Corps of Engineers. Potential impacts on Special Aquatic Sites, such as submerged aquatic vegetation, are considered in the permit review process. The Rivers and Harbors Act is administered by the Corps; Section 10 of the Act regulates, through a permit program, all activities in navigable waters including dredging and placement of structures.

Permit applications under the Clean Water and Rivers and Harbors Acts are routinely reviewed by the U.S. Army Corps of Engineers and by the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS). Comments from the latter agencies are provided to the Corps of Engineers to recommend approval (often with recommended conditions or project modification) or denial of individual permits. Consultations among agencies on environmental impacts of federal and other projects are also required through the provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) and the National Environmental Policy Act (42 U.S.C. 4231-4370a).

In the permit review and approval processes, special consideration is made for the protection and preservation of SAV. Other than the legislative mandates given above, the federal agencies have no written policies specific to SAV protection. Guidelines that the regulatory agency (Corps) and the commenting agencies (EPA, USFWS, and NMFS) use to make their decisions and recommendations are summarized below and in Table 1. Guidelines in most cases are specific to physical alterations accompanying dredging and direct impacts.

U.S. Army Corps of Engineers

Guidelines and general policies of the Corps of Engineers Baltimore District include the following:

1. No dredging is permitted in SAV beds, unless the dredging is:
    a. within an existing entrance channel;
    b. within historic channels;
    c. within an existing slip at a marina; or

d. in a sparsely vegetated area where no more than one foot of dredged material is to be removed.

2. A 15-foot buffer area is required for species that have dense tuber mats.

3. For every foot of depth to be dredged below the existing bottom, there must be three feet of buffer around the SAV.

4. In areas that have SAV in or adjacent to the dredge area, channels may be restricted in their width or depth to prevent slumping of the substrate and potential loss of SAV.

5. A time of year restriction, usually recommended by a commenting resource agency (e.g., USFWS or NMFS), is imposed on dredging adjacent to SAV beds. This restriction usually protects SAV during the period of optimal growth and reproduction (April 1-June 30). If the species has two growing seasons, the usual time restriction is April 15 through October 15.

6. Where possible, construct a pier out to the channel to avoid dredging of SAV, as long as general navigation is not impeded.

7. To preserve potential SAV habitat, dredging of main channels generally should end at the 2 foot MLW contour; spur channels should generally end at the 1.5 foot MLW contour.

8. Dredging must be at least 15 feet from MHW.

Guidelines and general policies may be different in other Corps districts.

U.S. Environmental Protection Agency

Guidelines EPA uses in their review process include:

1. Time of year restrictions on dredging of March 31 through June 15.

2. Avoidance and/or minimization of dredging in existing SAV beds wherever "practicable." No dredging through SAV beds.

3. Generally, no new dredging in shallow water areas that were not dredged in the past. This restriction is project-specific and may be modified depending on resources and issues involved.

4. Buffers established landward of a contiguous contour line at a specific depth (Mean Low Water, MLW) and/or at a distance of 15 ft at Mean High Water (MHW; recommended buffer varies on a case-by-case basis).

5. Recommended avoidance of SAV beds for dredging and/or boat slips in marina project proposals.

U.S. Fish and Wildlife Service

Guidelines USFWS uses in their review process include:

1. Minimum 3:1 no-dredge buffer around existing SAV beds. That is, allow a three-foot lateral buffer for every one foot of vertical dredged material removal in the dredged channel.

2. No new dredging in areas around piers unless there was historical deepwater access.

3. Construct piers out to the channel to avoid shallow water habitat; construct community piers instead of several single piers.

4. Minimize width and depths of dredged channels and spur channels.

5. Dredging restricted March to June.

6. Stake SAV beds prior to dredging.

7. Require a post-dredging survey to ensure channels were dredged to depths allowed in the permit.

8. No dredging within 15-20 feet of MHW shoreline, bulkheads, or tidal marsh, except in existing marinas.

9. Upland dredged material disposal sites preferred.

NOAA National Marine Fisheries Service

Guidelines NMFS uses in their review process include:

1. Protect, where practical, existing beds of SAV against impacts associated with dredging, fill, pile-supported platforms, marina development, and other activities. Existing beds are defined as those that currently support SAV, or supported SAV during the past two to three growing seasons. Previously

vegetated areas may be treated as existing beds even if growth has not occurred for four or five years (or more), if those areas were historically important to SAV and supported perennial tuber-forming species.

2. Where practical, protect areas that may support expansion of SAV from development activities (especially dredging) in areas adjacent to existing SAV beds of similar depth and physical/sedimentary quality . Depth contours should be determined by observing depths over which the majority (or greatest density) of SAV is occurring.

3. Provide additional protection to perennial species and/or those species with extensive root or rhizome systems, native non-nuisance species, and species with high ecological values (for example, eelgrass, widgeon grass, wild celery, and redhead grass).

4. Recommend ground-truthing surveys by competent consultants or agency staff for large projects to delineate beds. Where species with variable season-to-season distribution (such as horned pondweed) are known to predominate, surveys within a year of the permit review period are preferred.

5. In general, maintain a no-dredge shoreline buffer within all predominantly shallow, but nonvegetated, areas where dredging is proposed to permit SAV establishment or vegetative expansion of existing beds; generally, 15 feet from the dredge cut to the MHW shoreline or the MLW line is recommended.

6. Minimize dredging in nonvegetated shallows capable of supporting SAV through extension/construction of open pile piers and limit dredging to only that necessary for access and mooring.

7. Restrict dredging in the vicinity of SAV from April 15 to October 15. When horned pondweed is the only species present, restrict dredging from April 1 through June 30.

8. Minimize impacts to SAV during maintenance dredging of existing channels or marinas.

9. Construct shoreline stabilization and beach nourishment structures landward of SAV beds.

10. Deny the following proposed activities, if within SAV beds or immediately adjacent areas with potential for bed expansion: new marinas, marina expansions. aquaculture, artificial reefs, open-water dredge disposal, pile-supported platforms, ramps and marine railways.

11. Construct open-pile piers over nonvegetated areas (if practical) or maintain a 1:1 ratio of deck width to deck height (above MLW).

12. Avoid laying pipelines and cables in vegetated areas, if practical, or return post-construction bottom within existing SAV beds to preexisting elevations and sediment types.

13. Harvesting is not recommended, except in the Potomac River for hydrilla.

OTHER CONSIDERATIONS

Dredging and other development in the shallows and nearshore areas of the Chesapeake Bay and its tributaries is considered by state and federal agencies on a case-by-case basis. Permit decisions and recommended modifications are influenced by a number of additional factors including:

- Past precedents for or against development of an area (i.e., past development history, including permits approved or denied).

- Future precedents that may be set for or against development by the permit in question.

- The amount of existing development (numbers of marinas, boat use, numbers of existing piers, extent of current bulkheading, etc.).

- Potential for recovery of an area for SAV, considering present development and habitat and water quality conditions.

- Historical boating access.

- Special biological issues, such as endangered species, special or important biological functions or values, or contaminants.

- The interests of the public, i.e., socioeconomic considerations.