Chesapeake Bay Program
Science. Restoration. Partnership.

Submerged Aquatic Vegetation Outcome
Management Strategy
2015–2025, v.3

Water stargrass (Heteranthera dubia) in the clear waters of the upper Potomac River, Maryland on July 28th, 2019. (Photo by Brooke Landry/Maryland Department of Natural Resources)

I. Introduction

Submerged aquatic vegetation (SAV), or underwater grasses, provide significant benefits to aquatic life and serve critical functions in the Chesapeake Bay ecosystem. Underwater grasses provide food, habitat and nursery grounds for a number of commercially and ecologically important finfish and shellfish, such as striped bass and blue crabs, and migratory waterfowl. They reduce erosion by slowing currents and softening waves, anchor bottom sediments and help keep the water clear by absorbing nutrients and trapping sediments. Through photosynthesis, underwater grasses act as a carbon sink by taking in carbon dioxide. This contributes to the reduction of greenhouse gas emissions and reduces the potential for climate change impacts. Likewise, underwater grasses also produce oxygen, which helps sustain other aquatic life. Increasing the abundance of underwater grasses in the Bay and its rivers will dramatically improve the entire Bay ecosystem.

II. Goal, Outcome and Baseline

This management strategy identifies approaches for achieving the following goal and outcome:

Vital Habitats Goal

Restore, enhance and protect a network of land and water habitats to support fish and wildlife, and to afford other public benefits, including water quality, recreational uses and scenic value across the watershed.

Submerged Aquatic Vegetation (SAV) Outcome

Sustain and increase the habitat benefits of SAV (underwater grasses) in the Chesapeake Bay. Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay-wide necessary for a restored Bay. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025

This outcome was derived by the Chesapeake Bay Program's SAV Workgroup and is based on observed historical SAV abundance and distribution throughout the Bay and its rivers.

Baseline and Current Condition

The Bay Program's SAV Workgroup has reviewed the historic record and photographic evidence from the 1930s to present and determined that the Bay has historically supported at least 185,000 acres of SAV. The most critical action for restoring SAV is to achieve the Water Quality Goal (reduce pollutants to achieve the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health). In most cases, as water clarity improves, SAV will reestablish without the need for direct restoration (planting or seeding). However, as the Water Quality Outcomes are met, there will be places where water clarity is sufficient but there is no longer a seed source for natural recolonization of SAV. Therefore, the workgroup supports efforts to plant or seed SAV each year in areas of the Bay deemed likely for success. This restoration effort is intended to stimulate natural SAV bed growth to aid in reaching the Bay-wide abundance goal of 185,000 acres. Actively restoring SAV each year will provide future seed sources and improve physical conditions for further SAV recruitment. Additionally, continuous seed bank restoration and planting will encourage the expansion of SAV propagule production facilities, increase expertise among restoration practitioners and provide opportunities for citizen and student engagement.

SAV constitutes one of the most important biological communities in estuaries. SAV has historically contributed to the high primary and secondary productivity of the Bay, but increased nutrient and sediment inputs from the watershed caused Bay-wide declines in the mid-1900s. Hurricane Agnes in 1972 and Tropical Storm Lee and Hurricane Irene in 2011 further stressed the resource. SAV has recovered somewhat since that time with improved watershed nutrient and sediment management, but not to historic levels.

Since 1976, the workgroup has served the larger Bay community by providing technical expertise and applied research findings to resource managers in an effort to inform the restoration and protection

agenda. Please refer to the Chesapeake Bay Program's site (https://www.chesapeakeprogress.com/abundant-life/sav) for the current status of SAV abundance.

III. Participating Partners

Team Lead: Vital Habitats Goal Team

Workgroup Lead: Submerged Aquatic Vegetation Workgroup

- SAV Workgroup chair
  - Prepares biennial workplan and management strategy, coordinates and leads workgroup efforts
- SAV Workgroup
  - Implements the SAV Management Strategy and the biennial workplan

Opportunities for Cross-Goal Team and Workgroup Collaboration:

- Sustainable Fisheries Goal Team
- Water Quality Goal Team
- Climate Resiliency Workgroup
- Black Duck Action Team (Habitat Goal Team)
- Maintain Healthy Watersheds Goal Team
- Communication Workgroup
- Plastic Pollution Action Team

Participating agencies **(Signatories in bold)**

High Level of Participation:

- **Maryland Department of Natural Resources**
  - Chairs SAV Workgroup and coordinates SAV Workgroup efforts
  - Conducts SAV monitoring, restoration, and research
  - Financially supports Bay-wide SAV Survey
  - Utilizes SAV data for project reviews requiring permits and/or mitigation when those projects impact SAV habitat.
- **Virginia Department of Environmental Quality**
  - Uses SAV data for project planning and to evaluate the value and function of shallow-water habitats
  - Tracks shallow water use criteria achievements
- **Virginia Marine Resource Commission**
  - Financially supports Bay-wide SAV Survey
  - Utilizes SAV data for permits required for mitigation if a project impacts existing SAV beds or historic SAV presence
  - Uses SAV data for project planning

  - Tracks shallow water use criteria achievements
- **D.C.'s District Department of the Environment**
  - Conducts SAV research, monitoring and restoration
- **U.S Environmental Protection Agency**
  - Financially supports Bay-wide SAV Survey and SAV research projects
- **Maryland Department of the Environment**
  - Financially supports Bay-wide SAV Survey
  - Utilizes SAV data for project reviews, permits and mitigation if a project impacts existing SAV beds
  - Tracks shallow water use criteria achievements
- **Virginia Institute of Marine Science**
  - Conducts and financially supports Bay-wide SAV survey
  - Utilizes SAV data for project reviews, permits and mitigation if a project impacts existing SAV beds
  - Tracks shallow water use criteria achievements
- **University of Maryland/University of Maryland Center for Environmental Science (UMCES)**
  - Conducts SAV research
- **St. Mary's College**
  - Conducts SAV research
- **Old Dominion University**
  - Conducts SAV research
- **Smithsonian Environmental Research Center**
  - Conducts SAV monitoring and research

Medium Level of Participation:

- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- National Oceanic and Atmospheric Administration
- U.S Army Corps of Engineers

Likely Participating Jurisdictions:

- Maryland
- Virginia
- Washington, D.C.

Likely Participating Federal Partners:

- Fish and Wildlife Service
- National Oceanic and Atmospheric Administration
- U.S. Geological Survey
- U.S. Army Corps of Engineers

Local Engagement

Non-profit groups, such as the Chesapeake Bay Foundation, have been historically involved in education and outreach regarding SAV, as well as active SAV restoration projects, in partnership with schools and state and local agencies. Other non-profits, such as riverkeepers and local watershed organizations, are also playing an increasing role in the SAV Workgroup and contributing to SAV monitoring and restoration efforts, as well as education and outreach.

IV. Factors Influencing Success

Many factors, both natural and anthropogenic and with wide-ranging levels of impact and management potential, influence the attainment of SAV goals. A thorough understanding of these factors is essential to promote natural recovery of SAV and SAV restoration success:

1. **Habitat Conditions and Availability**

   High-quality habitat conditions are vital to the success of SAV recovery and restoration efforts. Good quality habitat conditions for SAV are defined by shallow water (2 meters or less) with sufficient water quality (clear water, appropriate salinity and nutrients), appropriate wave and current conditions and sediment for the species being targeted for restoration. For example, eelgrass grows in the high-salinity waters of the lower Bay, while sago pondweed prefers the brackish waters of the mid-Bay. Most importantly, water clarity is necessary for productive SAV habitat. Water clarity varies in time as a function of precipitation (as it affects run-off and consequently sediment and nutrient pollution entering the Bay).

   Additionally, the Bay is considered at high risk for sea level rise, increased water temperatures and extreme weather events from climate change, which will influence SAV habitat conditions and availability. Climate change and sea level have little management potential at the local scale. The SAV Workgroup, however, advocates for management approaches that alleviate the impact from some climate stressors (e.g. minimize shoreline hardening/modification to allow inland migration of SAV as water levels increase). Also, heat-tolerant, lower-light tolerant and canopy-forming SAV species can be used in restoration efforts if it is anticipated that impacts associated with climate change will affect a particular restoration site.

   Aside from water clarity and climate change impacts, shallow-water use conflicts are also arising as an area of concern as SAV recovers in areas throughout the Bay. Aquaculture and other commercial fishing activities, living shoreline installation and SAV removal for navigational purposes are some examples of these potential conflicts.

2. **Protection of Existing and Recovering SAV**

   Anthropogenic activities, including dredging, propeller scarring, fishing and aquaculture practices, as well as the introduction of invasive species and marine debris, can cause direct physical disturbance to SAV. Indirect impacts from localized water quality degradation associated with activities such as

shoreline alteration, sedimentation from changes in land use, or in-water activities like clam dredging also influence the health of SAV beds.

Effective and enforceable regulations are necessary to adequately protect SAV. The adequate protection of existing and recovering SAV is necessary to reach the 185,000-acre Bay-wide SAV restoration goal. As new threats and conflicts (e.g. shellfish aquaculture, climate change impacts, SAV harvesting) emerge simultaneously with recovering SAV populations, the efficacy of existing regulations may diminish.

3. **SAV Restoration Potential and Activity**

There are a number of reasons to actively restore SAV, but direct restoration of SAV by planting whole plants or seeds is a multi-step, labor-intensive and expensive venture, and success is based on a number of factors, ranging from appropriate site selection (controllable) to future unpredictable weather events (uncontrollable). Ecosystem modeling can aid in the site- selection process and can be advantageous for a number of habitat restoration applications, but the current version of the Chesapeake Bay Shallow Water model does not work well for SAV because of limited nearshore habitat quality and bathymetry data. As such, SAV restoration planning in the Bay also involves extensive site-visits and habitat suitability determination that contributes to the overall effort involved.

Additionally, limited information is available regarding the habitat requirements of seedlings as compared to persistent SAV populations. Evidence does suggest, however, that SAV seedlings require better water clarity than mature plants, so SAV restoration in areas that otherwise meet SAV habitat requirements will not necessarily be successful. As such, past SAV planting and seeding efforts in the Bay saw limited long-term success. As water quality has improved with improved watershed nutrient and sediment management plans, however, small-scale efforts to actively restore SAV have been more successful.

Unfortunately, even in ideal habitat conditions with reduced human impacts, the limited availability of source seeds, plants and propagules (from laboratories, nurseries and wild collection), as well as the minimal availability of funding for restoration projects and restoration science research, has limited the SAV Workgroup and its partners' ability to implement expansive SAV restoration projects.

4. **SAV Research and Monitoring**

Annual Bay-wide SAV monitoring is essential to reaching the 185,000-acre SAV restoration goal. Annual monitoring data allow for adaptive management of SAV throughout the Bay should it become necessary, and it is the only way to show with certainty that efforts to protect and restore SAV are effective. The protection of existing SAV is, likewise, only possible with monitoring and distribution data, and is a priority management strategy for increasing and sustaining the habitat benefits of SAV in the Chesapeake Bay. For example, the annual SAV survey shows when activities

like propeller dredging, clamming, aquaculture and shoreline or near-shore development are negatively impacting SAV. In response, management and enforcement agencies are able to react in a relatively timely manner before extensive damage can be done. Additionally, long-term annual monitoring data facilitate trends analyses and synthesis work and reveals additional research needs**.**

Long-term SAV monitoring at multiple levels of detail is also important in guiding appropriate SAV research activities. Currently, SAV monitoring in the Chesapeake Bay is limited primarily to the Bay-wide annual survey, which is a broad-scale assessment that characterizes SAV acreage and density.

Although some more advanced monitoring occurs, a coordinated, higher level monitoring effort is necessary for an integrated monitoring approach that would guide priority research activities and efforts. SAV research is also limited by funding availability.

5. **Public Perception, Knowledge and Engagement**
   Public perception of SAV affects its health: during periods of SAV recovery and high abundance, some members of the public perceive it as a nuisance and consequently take measures to deter its growth or directly remove it. Human activities can be managed through education, outreach and regulation.

V. Current Efforts and Gaps

While there are numerous factors influencing the success of SAV recovery and restoration throughout the Bay, extensive efforts are being made to address those factors and to identify what additional efforts and actions are necessary to reach the 185,000 acre SAV restoration goal.

1. **Habitat Conditions and Availability**

   Successful recovery and restoration of SAV in the Bay are dependent upon improved water clarity and habitat conditions. Water clarity improvements are being made by meeting pollutant allocations set by the Chesapeake Bay TMDL and through the work of the Water Quality and Maintain Healthy Watersheds Goal Implementation Teams.

   Recent increases in SAV may be attributed to the Chesapeake Bay TMDL and concurrent improvements in water clarity. SAV coverage increased from 97,668 acres in 2016 to an estimated 104,893 acres in 2017, the most SAV ever recorded since the monitoring began in 1984. Due to record rainfall and freshwater inputs into the Bay in 2018, mapped SAV coverage decreased to 99,511 acres (though there was likely more SAV in areas that remained unmapped in 2018). However, the persistence of SAV observed following these events suggests increasing resilience to these stressors, which is an indication that the Chesapeake Bay TMDL and other restoration actions are working. Currently, SAV in the Chesapeake Bay is achieving 54 percent of the 185,000-acre goal.

   Climate change research—assessing the potential associated symptoms of climate change (e.g. sea level rise) as well as the influence of those impacts on SAV (e.g. how will sea level rise affect SAV?)—

is being conducted by multiple agencies and organizations in the Chesapeake Bay Watershed. Additional analyses are required, however, to fully evaluate the potential for SAV to continue providing essential ecosystem services and to meet its restoration goal in the face of these multiple stressors.

Additionally, shallow-water use conflicts (e.g. an expanding aquaculture industry) may impact habitat availability for SAV. In order to reach our Bay-wide SAV restoration goals, adequate shallow water habitat (adequate space and adequate water clarity) must remain available for SAV to expand into.

2. **Protection of Existing and Recovering SAV**

SAV provides numerous ecosystem benefits, and the consequences of losing those services in exchange for other uses, such as aquaculture or living shorelines, is not thoroughly understood. Anthropogenic activities on land and in the water continue to directly and indirectly impact SAV recovery throughout the Bay.

Maryland, Virginia and the District of Columbia all have at least some regulations in place that protect existing SAV from harmful practices, including dredging and filling, nearshore construction and commercial fishing. But it is unclear if those regulations will adequately protect new and expanding SAV beds as they recover throughout the Bay. A review of all the statutes, regulations and policies that affect SAV in the Chesapeake Bay was completed in 2019. The review included multiple recommendations that should be considered for more thorough protection of SAV in the Bay.

3. **SAV Restoration Potential and Activity**

Academic institutions, organizations and agencies in Maryland, Virginia and Washington, D.C. currently work to actively restore SAV in appropriate areas throughout the Chesapeake Bay using seeds and, in some limited cases, adult plants. Based on recent successes in small-scale SAV restoration attempts associated with improved water quality conditions, it is appropriate to increase these small-scale efforts in number and geographic extent to accelerate the recovery of SAV throughout the Bay. There is limited capacity, however, to restore SAV without engagement of additional organizations to assist with the effort.

4. **Research and Monitoring**

Long-term SAV monitoring and distribution data are critical for management purposes and tracking restoration progress. SAV monitoring also provides opportunities for citizen outreach and educational experiences. Because of this, SAV Workgroup members actively engage in a variety of SAV monitoring activities each year. These activities include the annual Bay-wide SAV survey, which is chronically under-funded, and the Chesapeake Bay SAV Watchers program, which provides volunteer scientists with an engaging and educational experience with SAV while also generating useful data for Bay scientists and managers. In addition to the Chesapeake Bay SAV Watchers program, multiple agencies and organizations have permanent SAV transects throughout the Bay

where more in-depth data is collected and that are surveyed regularly, but not using a standardized protocol. To standardize data collection at these and other sites throughout the Bay, a Sentinel Site monitoring program would be advantageous and together with the Bay-wide aerial survey and the SAV Watchers Program would inform conservation, restoration and management strategies for the Bay as a whole.

Chesapeake Bay Program partner scientists and others in the region are currently conducting research in SAV biology, ecology, genetics, restoration and the impacts of climate change on SAV. Because limited funding is available for SAV research, extensive gaps in our knowledge base remain. Additionally, although research is being conducted, it is not immediately available to the public or SAV workgroup members, so is not always considered when making research-related or management decisions.

5. **Public Perception, Knowledge and Engagement**

   In an effort to educate the public about the benefits of SAV and improve the public's perception of SAV, the SAV Workgroup works with the Chesapeake Bay Program communications team on annual press releases of SAV acreage and goal-attainment, community-based social marketing campaigns, and produces SAV-related web and social media content throughout the year. Although these materials reach residents throughout the Chesapeake Bay watershed, some negative public opinions regarding SAV remain.

VI. Management Approaches

The partnership will work together to carry out the following management approaches and specific actions identified in the biennial workplan to achieve the SAV outcome. These approaches seek to address the factors affecting our ability to meet the goal and the gaps identified above.

The following five approaches have been identified as critical to the success of SAV restoration goals.

1. **Support Efforts to Conserve and Restore Current and Future SAV *Habitat* and *Habitat Conditions* in the Chesapeake Bay**

   In order to meet current and future SAV restoration goals, it is essential to meet water clarity standards in areas and at depths that are designated by Maryland, Virginia and the District of Columbia for the application of those criteria (i.e., SAV shallow water use). The water clarity standards reflect the light requirements that are necessary for the growth and maintenance of SAV populations throughout the shallow waters of the Chesapeake Bay and its tidal tributaries. This strategy is being implemented by meeting pollutant allocations set by the Chesapeake Bay TMDL and through the work of multiple Chesapeake Bay Program groups, including the Water Quality Goal Implementation Team and the Healthy Watersheds Goal Implementation Team.

   Additionally, the Bay is considered at high-risk for impacts related to climate change, several of which have the capacity to affect SAV. The SAV Workgroup supports measures that aim to minimize

and mitigate those impacts (e.g. minimize shoreline hardening/modification to allow inland migration of SAV as water levels increase), as well as impacts associated with shallow-water use conflicts that may reduce the habitat availability for current and future SAV.

2. **Protect Existing and Recovering SAV in the Chesapeake Bay**
   The SAV Workgroup will protect existing SAV by supporting efforts to characterize threats and develop protection measures, establish protection area criteria, minimize the effects of invasive species and human impacts, evaluate SAV protection laws and regulations and update when necessary, and increase understanding of the potential effects of sea-level rise and other climate-change impacts on SAV populations. Protecting existing SAV beds will also help ensure continued seed and propagule sources for natural recovery.

3. **Restore SAV in the Chesapeake Bay**
   The SAV Workgroup will lead and support efforts to actively restore SAV where possible, targeting sites with suitable habitat quality and high potential to benefit living resources, as well as vulnerable coastal communities and infrastructure.

4. **Enhance SAV Monitoring and Research in the Chesapeake Bay Watershed**
   The SAV Workgroup will enhance SAV monitoring and research by developing a hierarchical and integrated SAV monitoring program and by supporting and tracking research that advances our understanding of SAV restoration, recovery and resilience.

5. **Enhance Citizen Involvement, Education and Outreach in the Chesapeake Bay Watershed**
   The SAV Workgroup will expand efforts to educate and engage the public about the critical importance of SAV and include citizen scientists and volunteers in SAV monitoring and restoration efforts.

VII. Monitoring Progress

Monitoring programs are critical to understanding year to year fluctuations in living resource distribution and abundance. SAV distribution in the Chesapeake Bay is assessed using annual aerial surveys, and abundance acreage is derived from the imagery taken during the aerial survey. Continued annual Bay-wide monitoring is the top funding priority for SAV resource management as it provides information vital to managing water quality and tracking restoration progress. The most recent SAV distribution data and survey-related information are available at the Virginia Institute of Marine Science website.

VIII. Assessing Progress

In 2018, an estimated 99,511 acres of SAV were mapped in the Chesapeake Bay, achieving 54 percent of the 185,000-acre outcome. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025. The 2017 target of 90,000 acres was exceeded initially in 2015 and has remained above this target to date.

Increased resources and capacity for SAV and water clarity restoration are required to hasten progress toward this goal. Please refer to the Chesapeake Progress SAV site (https://www.chesapeakeprogress.com/abundant-life/sav) for the current status of bay grass abundance and to the Data Dashboard (https://gis.chesapeakebay.net/sav/) for segment specific SAV information.

IX. Adaptive Management

The partnership will use the following approaches to ensure adaptive management:
The SAV Workgroup will meet each year to track progress toward the 185,000- acre goal, as well as share progress and discuss any new challenges or opportunities. The workgroup will use this time to review performance assessment information and adjust management strategies if appropriate. As new issues are identified, the workgroup will collectively develop strategies to overcome barriers to restoration, as well as identify trends, priority areas and research needs.

X. Biennial Workplan

The SAV Workgroup develops a biennial workplan to support the SAV Management Strategy. The workplan is revised every 2 years and includes the following information:

- Each key action
- Timeline for the action
- Expected outcome
- Partners responsible for each action
- Estimated resources

Lessons Learned

1. Monitoring –
While the annual Bay-wide aerial survey is one of the best SAV monitoring programs in the world, it has become apparent over the last several years that a need existed for more detailed species and habitat information. As such, in 2018-2019, the SAV Workgroup (in collaboration with UMCES/IAN) developed a volunteer-based ground survey program, the Chesapeake Bay SAV Watchers, that supplements the Bay-wide aerial survey by providing species and other habitat data. A new action in the 2020-2021 Workplan is to develop a third, higher level SAV Sentinel Site Program. Together, the aerial survey, the SAV Watchers program and the SAV Sentinel Site Program will form a coordinated three-tiered hierarchical monitoring program for SAV, enabling the CBP partnership to more effectively and efficiently conserve and restore SAV in the Bay.

2. Policy –
As SAV recovers in areas throughout the Bay in response to improvements in water clarity facilitated by the TMDL, instances of shallow water use conflicts continue to arise. In 2018-2019, the Chesapeake Legal Alliance worked with the SAV Workgroup to review all current statutes and regulations protecting SAV in the Bay. A new action in the 2020-2021 Workplan builds on that effort to act on the recommendations made in the regulatory review where feasible.

3. Alignment of the Management Strategy, Logic & Action Table and Workplan -
The 'factors influencing success' as well as the 'current efforts and gaps' sections of the previous L&A Table did not align with the SAV Management Strategy. The 2020-2021 Workplan was developed to more closely align with the factors influencing success, the current efforts and gaps and the management approaches identified in V3 of the SAV Management Strategy.