

*Guidance on Surveys
for Potential Impacts
to Submerged Aquatic Vegetation*

**Office of Resilience and Coastal Protection
Florida Department of Environmental Protection**

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1.0 Introduction

1.1 Purpose of Monitoring Guidance

The purpose of this document is to provide guidance on Florida Department of Environmental Protection-approved monitoring protocols to document potential impacts to submerged aquatic vegetation (SAV) that can be used to make the permitting process more efficient, predictable and consistent. Aspects of this document are intended to be scalable and adaptable to work for a wide range of projects statewide. This document is intended to assist those applying for permits issued by the Beaches Inlets and Ports Program (BIPP) in Tallahassee, including Joint Coastal Permits (JCP) and Environmental Resource Permits (ERP). The Submerged Lands and Environmental Resource Coordination program has reviewed this guidance and determined it is generally applicable to ERPs that are issued by district offices, water management districts and other delegated local governments. However, each project is unique and coordination with the department (including BIPP staff, district office staff and aquatic preserve staff, depending upon the project location) is strongly encouraged during the planning phase prior to an applicant's decision to use this guidance document. For example, if *Halophila johnsonii* may be present in the project area, then more intensive sampling may be required by the department (and/or by federal agencies) to be compliant with the South Atlantic Regional Biological Opinion (SARBO; NMFS 2020) and the Final Recovery Plan for Johnson's Seagrass (NMFS 2002).

This document is not currently adopted by rule or statute. Requirements (e.g., protocols, timelines and deliverables) described herein will only become binding on applicants/permittees who choose to accept them as a means of fulfilling regulatory requirements, as monitoring requirements that will be included as specific conditions of permits. Means and methods other than those described herein may be proposed by the applicant and will be subject to review and acceptance by the department under applicable rules and statutes.

1.2 Regulatory Basis for Monitoring

Submerged aquatic vegetation is an economically and ecologically valuable natural resource. In fact, seagrasses are deemed essential to the oceans, gulfs, estuaries and shorelines of the state according to Section 253.04(3)(a) Florida Statutes (F.S.). Therefore, these resources are managed and regulated by the state, including the department (FWC 2003). Construction can negatively impact SAV (Erftemeijer

and Lewis 2006; Short et al. 2017). Direct impacts can occur as a result of removal of SAV via dredging or burial of SAV from filling. Construction can cause physical damage to SAV outside the dredge or fill template (authorized boundaries), including mechanical damage due to equipment or anchoring. Additionally, projects may cause shading, sedimentation and other changes to water quality (e.g., turbidity, salinity or temperature) that could adversely affect SAV.

The department requires reasonable assurance the permitted activities will not adversely affect the habitat of fish, wildlife and listed species, including SAV habitats, pursuant to Section 373.414(1)(a)2, Florida Statutes (F.S.), and Sections 62-330.301(1)(d) and 62-330.302(1)(a)2, *Florida Administrative Code* (F.A.C.), and Section 10.2.2(a) of the ERP Applicant's Handbook Volume 1. Therefore, information on SAV habitats within the potential influence of projects is required to be provided with applications for ERP and JCP projects to provide reasonable assurance the rules and statutes of the department will be met. Information on SAV within the influence of projects can be used to identify and implement practicable measures to avoid or minimize potential impacts to fish and wildlife habitats, pursuant to Section 10.2.1 of the ERP Applicant's Handbook Volume 1 and Subsection 18-21.004(2)(i), F.A.C. If impacts to SAV are unavoidable, then mitigation shall be required to ensure no net loss of functions, pursuant to Section 373.414(1)(b), 18-21(2)(i), F.A.C., and Section 10.3.1 of the ERP Applicant's Handbook Volume 1. If compensatory mitigation is required to offset impacts to SAV, then surveys are required to provide information necessary to implement the Uniform Mitigation Assessment Method (UMAM), Rule 62-345 F.A.C., which describes how the department calculates the amount of compensatory mitigation needed to offset impacts to surface waters, including SAV habitats (pursuant to Section 373.414(18), F.S.). Moreover, the department may require monitoring of SAV habitats as a condition of ERP and JCP permits to document potential unauthorized impacts to resources that may occur as a result of construction activities, pursuant to Section 373.413(1), F.S and Section 62-4.070(3), F.A.C. The department has the authority to issue any permit with specific conditions necessary to provide reasonable assurance that department rules can be met, pursuant to Section 62-4.070(3) F.A.C.

1.3 Submerged Aquatic Vegetation

For the purpose of this document, "submerged aquatic vegetation" is defined as a benthic community comprised of any species of seagrass and/or rhizophytic macroalgae, including both calcareous and non-calcareous taxa. An analogous definition is used by the National Marine Fisheries Service to describe SAV, which is designated as an Essential Fish Habitat (NMFS 1998). Drifting macroalgal mats (drift algae) comprised of filamentous taxa that are ephemeral depositions on the benthos provide ecological

functions (Arroyo and Bonsdorff 2016); however, areas without any seagrass or rhizophytic macroalgae that contain only drift algae are not considered SAV for the purpose of this document.

The distribution of SAV is not static. Seagrass patches migrate and unvegetated areas between patches are important to the management and conservation of these resources (Fonseca et al. 1998).

Accordingly, this document defines “SAV habitat” as areas that are currently vegetated by SAV as well as currently unvegetated areas adjacent to SAV that have historically supported SAV and are capable of supporting SAV based on current conditions such as the water environment, sediment characteristics and light availability.

Please be advised, while this document is primarily intended to provide guidance for projects with marine and estuarine SAV, at the department’s discretion, this guidance may also be applied to/adapted for use on projects with freshwater SAV resources (e.g., *Vallisneria american*).

2.0 Survey Protocols

2.1 Timing of Surveys

Surveys should be completed during the peak growing season to capture the maximum spatial extent and cover of SAV. This is particularly important in portions of the state where seagrasses senesce over the winter. To be consistent with federal requirements, the department recommends surveys be completed between June 1 and Sept. 30. However, in some circumstances the department may allow surveys to be completed at other times during the growing season. For example, under some circumstances, the department may accept SAV surveys from April to October in most of the state and year-round surveys may be acceptable in Monroe County and southern Dade County. Applicants are strongly encouraged to coordinate with the department prior to initiating field work to schedule joint site inspections; early coordination is especially important if an application will be submitted outside of the growing season; it is imperative department staff have an opportunity to verify site conditions during the growing season.

2.2 Surveys for Planning and Permitting

All SAV resources within the influence of the project should be investigated (identified, mapped and characterized as prescribed in Sections 2.2.1 – 2.2.3) during the project planning and permitting process. A detailed description of the methods used to investigate SAV resources in the project area should be provided along with the information obtained through these efforts in the permit application. The results

of this SAV investigation will be used to evaluate unavoidable impacts, to identify practicable strategies to minimize impacts and to develop appropriate monitoring protocols for documenting potential unauthorized impacts. All SAV resources that may be directly or indirectly impacted by construction activities, including (but not limited to) placement of fill or subsequent equilibration of fill materials, dredging or dredging-related sloughing, shading by permanent or temporary structures, changes in hydrology, project-generated sedimentation, turbidity or other construction-related discharges should be surveyed. The survey should include all SAV resources within or adjacent to the dredge template, fill placement areas, mixing zones, submerged pipeline corridors, dredged material disposal area return water/discharge locations, ingress/egress or staging areas and any other area where project-related impacts are possible. Potential reference sites for comparison with the project area should also be investigated (identified, mapped and characterized as prescribed in Sections 2.2.1 – 2.2.3) during planning, if such sites will be used to evaluate background variability (Section 2.3.4).

2.2.1 Desktop Assessment of Available Information

A desktop assessment (DA) should be completed, during which all relevant information on SAV resources in the project area is compiled and reviewed. For example, historical aerial photography, imagery from unmanned aerial vehicles, side-scan sonar survey data and data from previous field surveys are potential sources of information. However, the apparent absence of SAV in aerial photographs or side-scan sonar should not be used as conclusive evidence that the project area does not contain SAV because some SAV taxa (notably *Halophila spp.*) cannot be detected using such methods. A summary of existing information on SAV in the project area shall be developed based on the results of this investigation and shall be submitted to the department with the permit application. Information obtained from this desktop assessment will be used to identify all potential SAV habitats (Section 1.3) within the project area and will be used to determine the spatial extent of the reconnaissance survey (Section 2.2.2). If information on SAV in the project area is not available or not adequate to identify potential SAV habitats, then the entire area under the influence of the project shall be assessed during the reconnaissance survey.

Any relevant information that is available on physical attributes of the project area should also be compiled and reviewed. Understanding environmental conditions, such as water depth, tidal height, current speed, wave exposure, fetch and flushing, can be useful for assessing the suitability of the project area for SAV as well as evaluating potential impacts of the proposed project on SAV resources; therefore, information on these parameters should be evaluated if available. Existing sources of data

such as bathymetric surveys, geotechnical investigations and water quality monitoring stations should also be reviewed as part of the desktop assessment.

2.2.2 Reconnaissance Survey

A reconnaissance survey (RECON) shall be conducted throughout all potential SAV habitats (Section 1.3) within the influence of the project to identify currently vegetated areas. The results of the desktop assessment should be used to inform this field effort, but the reconnaissance survey will not be limited to only those areas where SAV resources were previously reported. A grid of transects running perpendicular to and parallel with the proposed project boundaries is recommended for this purpose. Reconnaissance surveys may be completed using towed video, only if video is watched in real-time by observers on the vessel to ensure the camera is positioned at the appropriate angle and video is of sufficient quality to identify resources. Alternatively, video surveys may be completed by towed divers. In-water surveys by divers are preferred to video surveys in areas where water clarity is low, if resources are sparse or small in stature (and therefore unlikely to be detected on video); in this case, divers can traverse the area, visually assess resource boundaries and collect representative photos. If the project area is less than 0.25 acres in size, the distance between survey track lines shall be no greater than the visibility at the site at the time of the survey, such that the entire benthos is visually assessed for the presence of SAV. For larger projects, spacing between survey tracks should be minimized to the maximum extent practicable to thoroughly survey the benthos (e.g., transects spaced at 10-meter intervals). The coordinates of the survey track lines shall be reported along with the visibility of the site on the date of the survey. If SAV resources are identified during reconnaissance surveys, these resources shall be mapped and characterized (per Section 2.2.3).

2.2.3 Mapping and Characterization Survey

A mapping and characterization survey (MC) shall be completed, as described below (Sections 2.2.3.1 and 2.2.3.2) to investigate all areas with SAV that were identified during the reconnaissance survey (Section 2.2.2). The purpose of this survey is to provide information on site conditions for planning and permitting. The mapping and characterization survey may be completed by the monitoring firm immediately following the reconnaissance survey, so a separate field effort/remobilization is not required.

2.2.3.1 Mapping

The spatial distribution of SAV within the survey area(s) shall be mapped. The edge of each SAV patch shall be visually assessed by divers *in situ* and divers shall record the position of the edge as accurately as possible. The positioning data shall be recorded and the total acreage of SAV within each patch/bed shall be reported. For projects where SAV is extensive and continuous, it may be sufficient to delineate only the SAV edge that is proximate to the construction template (e.g., fill placement or dredged area). For example, if a continuous SAV bed is located in the nearshore adjacent to a beach nourishment project, then it may only be necessary to delineate the landward edge of the bed. The information obtained from this mapping effort shall be used to produce a georeferenced map showing the distribution of SAV taxa in the project area, which should be included in the permit application.

To ensure map products will be useful for planning and permitting, it is recommended the following mapping criteria be used for creating and submitting SAV map-related deliverables:

- All spatial information should be collected using a sub-meter accurate Differential Global Positioning System (DGPS) unit.
- Geographical information should be provided in the State Plane Coordinate System (SPCS) for Florida (NAD83) and coordinates (latitude and longitude) should be provided in decimal degrees to the fifth decimal place (hundred-thousandths).
- An ArcGIS Map Package (“.mpk” file format) or similarly detailed and complete data package (e.g., CAD “.dwg” file format) should be provided with spatial data and metadata.
- SAV areas with different species compositions and/or densities should be distinguished via symbology (e.g., coloration and fill patterns).
- Map figures should include a legend, metric scale bar and north arrow for reference.
- Map figures should be shown at an appropriate scale that allow features to be readily discerned on a standard-size printed page.
- Map figures should be overlaid on recent aerial imagery and should include polygons or lines depicting project boundaries and significant features (e.g., dredge or fill template, footprint of structures).

2.2.3.2 Characterization

An *in-situ* visual assessment shall be completed concurrently with the mapping effort to document the condition of each mapped SAV area. This visual assessment should document the following indicators of function: location and landscape support, water environment and community structure (as defined in

62-345.500 F.A.C.). Site conditions such as sediment type, sediment depth, salinity, water temperature, current speed and flushing should be noted. Water depth shall be measured, corrected for tidal height and reported in metric units. Apparent water quality issues such as harmful algal blooms and signs of eutrophic conditions, such as mats of cyanobacteria, should also be reported. Landscape features, such as other natural communities, shoals and man-made structures, within and adjacent to sites should be described. The proximity of the site to any channels should be noted as well as boat traffic and recreational use in and around the site. Anthropogenic impacts such as the presence of debris, propeller scars or vessel blowouts within and adjacent to sites should be described. Wildlife observed at the site and signs of wildlife, including evidence of bioturbation, should also be reported. A description of site conditions observed during this visual assessment should be provided in the permit application.

Community structure should be qualitatively assessed. The general condition of vegetation such as canopy height, flowering, epiphyte coverage and disease shall be described. SAV communities shall also be quantitatively evaluated within quadrats placed within SAV patches. Randomized placement of quadrats is preferred, but quadrats can be placed haphazardly, if randomization is not practicable. Quadrat placement shall not be biased. However, only vegetated areas shall be surveyed. Quadrats placed within bare areas within the SAV habitat should be noted and repositioned into areas containing SAV. Within each quadrat the cover-abundance (CA) of SAV shall be assessed as prescribed in Section 2.3.6.3. Replicate quadrat samples are necessary to adequately characterize the SAV community. It is recommended that a 1 m² (1 m x 1 m) quadrat be used for this survey; if a smaller quadrat is used, then additional quadrats should be sampled. At least 5 m² should be sampled in small areas (those less than 0.1 acres). For larger sites, it is generally recommended that at least 1 m² be sampled per 80 m² of the area to be surveyed, which is a density of approximately 50 (1 m x 1 m) quadrats per acre. A description of the community structure, including the species composition and percent cover of SAV based on quadrat data, shall be provided with the application.

Once SAV resources in the project area have been mapped and characterized, if any unavoidable impacts are expected to occur as a result of the proposed project, the applicant should coordinate with department staff on mitigation requirements. If compensatory mitigation is required, the applicant will need to develop a comprehensive mitigation plan. To facilitate this process, a separate guidance document has been developed for surveys associated with planning and implementing compensatory mitigation projects for SAV (DEP 2020).

2.3 Permit-Required Surveys for Documenting Potential Unauthorized Impacts

The purpose of this section is to provide guidance on monitoring to document potential unauthorized impacts that may occur as a result of permitted construction activities to provide reasonable assurance the project will not adversely affect SAV habitats, pursuant to Section 373.414(1)(a)2, F.S. As previously stated (Section 1.1), the requirements (e.g., protocols, timelines and deliverables) described herein are only binding on permittees who accept them as a means of fulfilling regulatory requirements, as monitoring requirements in a permit.

Generally, minimization measures and monitoring requirements are discussed during the planning phase of project development (pre-application phase) and are finalized in consultation with the department during the permitting process. The monitoring approach (i.e., scope and scale of surveys; Section 2.3.1 and 2.3.2) will depend upon the risk of impacts, which is based on the proximity of resources to construction activities, the type of construction activities, the duration of construction, site-specific conditions such as sediment grain size and local hydrology, as well as the minimization measures that will be employed to reduce potential impacts to SAV resources. For example, in some projects, turbidity curtains are used to contain sediments suspended by the project (or the mixing zone is truncated to exclude resources), a buffer is established around SAV within which no work is allowed and information (e.g., anchoring and spudding positions) is submitted to provide reasonable assurance that minimization measures are properly implemented.

2.3.1 Minimal Monitoring for Projects with Low-Risk of Impacts

Some projects have a relatively low risk of impacting SAV, either due to the nature of the project or because stringent minimization measures will be implemented to provide reasonable assurance that unauthorized impacts to SAV resources will be minimized or avoided. For low-risk projects, survey requirements can be minimized. In such cases, a pre-construction survey (including both a reconnaissance survey along with a mapping and characterization survey, as prescribed in Sections 2.2.2 and 2.2.3, respectively) should be completed. For such projects, an impact assessment (Sections 2.3.3 and 2.3.6.5) would also be required to document the severity and spatial extent of impacts to SAV, if construction-related impacts occur or are suspected to have occurred, so these impacts can be remediated and/or mitigated. If an impact assessment is not needed (Section 2.3.3), then no post-construction survey would be required.

2.3.2 Comprehensive Monitoring to Document Potential Unauthorized Impacts

If project-related impacts to SAV resources are reasonably likely to occur due to the nature of the project or because stringent minimization measures are not practicable, then the department will require comprehensive pre- and post-construction monitoring to document potential unauthorized impacts to SAV resources. The purpose of monitoring is to provide reasonable assurance that the spatial extent and severity of any unauthorized project-related impacts will be documented if they occur, so these impacts can be remediated and/or mitigated. Specifically, monitoring is intended to 1) identify all SAV resources in the project area, 2) map resources to document any changes in their spatial distribution/acreage and 3) quantitatively assess the condition of resources pre- and post-construction to document changes in community structure.

This monitoring approach requires a detailed SAV monitoring plan, which should be developed in coordination with (and approved by) the department before the permit application is determined to be complete. The information provided in this guidance document is intended to form the basis for such monitoring plans; the protocols and requirements described herein can be adapted on a project-specific basis depending upon site conditions and the type of construction activities that are proposed. Early coordination (during the planning/pre-application phase) between the applicant and the department on the monitoring plan is strongly recommended.

2.3.3 Monitoring Events – Survey Schedule

The number and timing of surveys required will depend upon the monitoring approach (Sections 2.3.1 and 2.3.2), the nature of the project and the construction schedule. Each project is unique; therefore, the survey schedule will be determined in coordination with the department during the planning/permitting process. However, all surveys should be completed during the growing season (per Section 2.1), unless otherwise approved in writing by the department prior to the initiation of survey work.

For low-risk projects, a pre-construction survey (i.e., reconnaissance, mapping and characterization; Sections 2.2.2 and 2.2.3) should be completed during the growing season immediately prior to construction. In some cases, the initial reconnaissance, mapping and characterization survey for planning/permitting purposes may be used to fulfil this pre-construction survey requirement. However, if site conditions are likely to have changed since the initial mapping and characterization survey (e.g., due to a major storm event or because the initial survey was completed more than one year prior to construction), then another survey event should be completed prior to construction. Additionally, an

impact assessment survey would be required if construction-related impacts occur or are suspected to have occurred, but if no impacts are suspected to have occurred, then no post-construction monitoring is required. The permittee should coordinate with the department to determine what surveys are needed for low-risk projects.

Projects requiring comprehensive monitoring shall be surveyed at least once before and after construction and an impact assessment would also be required if construction-related impacts occur or are suspected to have occurred. If comprehensive monitoring is required for dredging activities or any other construction activities authorized by ERP or JCP permits, then a pre-construction baseline survey shall be completed prior to construction. If construction occurs during the growing season, then SAV surveys shall be conducted immediately prior to construction and immediately after construction has been completed, within the same growing season. However, if construction occurs outside of the growing season, then monitoring shall be done during the growing season immediately prior to construction and the growing season immediately following construction; in this scenario, the post-construction survey(s) shall be done as close as possible to the same time of year as the pre-construction survey to avoid seasonal differences. In some cases, during construction surveys may be required. If construction continues for more than a year (extends over more than one growing season), then a survey shall be completed each growing season until construction has been completed.

Under some circumstances more than one post-construction survey may be required. An immediate post-construction survey may be required for some projects; for example, a survey must be completed within –one to three months post-construction for projects with *H. johnsonii* to be consistent with SARBO (NMFS 2020). Additionally, if a project is expected to have long-term effects on SAV resources, then additional annual surveys will be required. For example, post-construction monitoring annually for five years is typically required to document potential impacts for projects that are expected to alter the hydrology such that SAV may be adversely affected. For beach nourishment projects, annual surveys are typically completed for two years following the immediate post-construction survey to document potential impacts due to equilibration of fill materials over time; the duration of monitoring will depend upon the details of construction (e.g., density of fill), additional annual monitoring events may be required.

For all projects with SAV, an in-water visual assessment will be required if unauthorized impacts are observed or are likely to have occurred during construction. Events, activities or uses that will require an

impact assessment, including any unauthorized anchoring, storage, staging, discharge, or stockpiling of vessels or equipment within mapped SAV areas; a pipeline leak/rupture within 150 meters of SAV, or any other unauthorized or unanticipated construction-related events, activities, or uses that are suspected to have impacted SAV. The permittee shall complete an assessment of potential impacts to SAV (as prescribed in Section 2.3.6.5) as soon as practicable but no more than 15 days after identifying (or being notified of) the need for an impact assessment, unless a time extension is granted in writing by the department.

2.3.4 Monitoring Area(s)

If comprehensive monitoring is required to document potential unauthorized impacts (Section 2.3.2), then all SAV resources within the influence of the project for which mitigation has not been provided shall be monitored. Monitoring shall include all resources within areas that may be impacted by construction activities, including impacts due to placement of fill (or subsequent equilibration of fill materials), dredging (or dredging-related sloughing), project-generated sedimentation and turbidity and changes in hydrological conditions or water quality. The monitoring area shall include resources within or adjacent to construction areas, including the dredge template, fill placement area(s), mixing zone, submerged pipeline corridor(s), ingress/egress or staging areas and any other portions of the project area where project-related impacts are possible.

Surveys associated with dredge and fill projects are generally restricted to SAV resources within 150 meters of (or within the mixing zone for) the actual portions of the project area that will be affected by the construction event. However, under some circumstances (based on available information, analyses of potential impacts and best-professional judgment), the department may require monitoring to a distance less than or greater than 150 meters from construction activities. At the time of the pre-construction survey, if it is unknown which portions of the project will be constructed, then the entire project area should be monitored prior to construction; however, only those areas potentially influenced by construction activities would need to be surveyed post-construction.

If comprehensive monitoring is required, then a reference site (or sites) should also be surveyed so natural variability in SAV can be compared to potential changes in SAV within the project area. The use of a reference site is particularly important in areas where environmental factors beyond the control of the permittee are likely to influence the condition of resources during the monitoring period. For example, if the area is subject to periodic discharge of storm water, then reference sites are necessary to

distinguish changes in SAV due to project-related impacts from those associated with these discharge events. In such cases, at least one reference site shall be identified for comparison with the project area; however, the use of more than one reference site is recommended, if such sites are available. The reference site(s) should be located as close as possible to the project area without being within the potential influence of construction activities; best professional judgment shall be used to identify reference site(s) similar to the project area with respect to water environment and community structure. The reference site(s), if required, will be surveyed concurrently with surveys in the project area, using the same sampling design and methods used for the project area (Sections 2.3.5 and 2.3.6).

2.3.5 Sampling Design

If comprehensive monitoring is required (Section 2.3.2), then the sampling design for the project should be developed in consultation with the department during the planning and permitting process. The sampling design will be based on the nature of the project and site conditions that were documented during the mapping and characterization survey (Section 2.2.3). The sampling design will typically include the use of quadrat and/or transect-based survey methods. For small projects (e.g., dock or seawall installation or repair projects), it may be practicable to survey the entire area using a grid of quadrats or series of belt transects. In some project areas, quantitative assessments of SAV (Section 2.3.6.3) shall be completed using quadrats that are distributed in a random or stratified-random manner within the survey area(s). For example, the use of randomly placed quadrats is generally considered to be appropriate for large projects where discontinuous and distinct SAV patches are present and when SAV patches are expected to migrate under natural conditions within the landscape over the duration of the monitoring period. This design also may be applied when site conditions, such as very strong currents or very high boat traffic, prohibit the use of transects or in areas with very small SAV patches, where transect-based methods are not necessary to cover a representative proportion of the survey area.

The monitoring for some project areas may include the use of transect-based sampling methods. For example, transect-based methods are appropriate for areas where SAV forms continuous persistent beds and the distribution of SAV is not expected to shift during the monitoring period. Transects are generally established perpendicular to construction activities (e.g., dredge or fill area) to detect a potential gradient of impacts away from construction activities. For example, the use of shore-perpendicular transects is recommended for nourishment projects to detect potential cross-shore movement of materials as they equilibrate following placement in the beach fill template.

If the project is intended to be compliant with SARBO (NMFS 2020), then the sampling design shall be consistent with the “Recommendations for Sampling *Halophila johnsonii* at a Project Site” as provided in Appendix III of the Final Recovery Plan for Johnson’s Seagrass (NMFS 2002). For example, if *H. johnsonii* may be present in the project area, then a more intensive sampling design than that specified below will likely be required (e.g., sampling 10%-30% of the project area).

2.3.5.1 Data Collection in Randomly Placed Quadrats

The number of quadrats per SAV patch will depend upon the size and uniformity of the survey area. For this purpose, the applicant should use cover data collected during the characterization surveys (Section 2.2.3.2) to evaluate natural spatial variability in SAV cover at the site(s) and use this information to determine the minimum number of quadrats necessary to detect significant changes in SAV cover (e.g., conduct a power analysis; determine sample size based on the minimal detectable difference). For large projects, it is recommended at least 5% of the area be surveyed (Table 1), if practicable. The corresponding pre- and post-construction surveys shall sample the same number and sizes of quadrats for each patch, even if patch size has declined.

Table 1: Guidance on approximate number of quadrats to be sampled within SAV patches.

Patch size (acres)	Patch size (square meters)	Number of quadrats (1 m x 1 m)
<0.01	< 40	3
0.01 to 0.025	40 - 101	5
0.025 to 0.05	101 - 202	10
0.05 - 0.1	202 - 405	20
0.1 to 0.25	405 - 1012	50
0.25 to 0.5	1012 - 2024	100
0.5 to 1	2024 - 4047	200
> 1 acre	> 4047	300 or 5% of the area, whichever is less.

2.3.5.2 Data Collection Along Transects

The number, spacing and length of transects shall be determined in coordination with the department during permitting, based on the size of the project and distribution of SAV within the influence of authorized construction activities. All transects shall be established perpendicular to construction activities (e.g., dredge or fill area). Generally, it is recommended transects be spaced no more than 50 meters apart near dredging templates, including navigation channels and borrow areas. Cross-shore transects should be placed no more than 75 meters apart for monitoring beach restoration or nourishment projects. Once the positions of transects have been determined, transects shall be marked via the

installation of PVC pipe, sub-surface buoy, or other means, and the starting and ending positions of each transect shall be recorded as accurately as possible using a sub-meter DGPS. Once established, the position of transects shall remain consistent for all subsequent surveys. Markers used to identify transects shall be removed following the completion of the last monitoring event.

For all transects containing SAV, cover-abundance of SAV shall be documented within quadrats at regular intervals along the entire length of each transect. For example, for relatively small beds, quadrats could be positioned every 5 meters along the transects. When sampling larger SAV patches, such as those that extend the entire length of the standard 150-m mixing zone, quadrats shall be placed such that they extend over the entire area of potential impact. In this scenario, it is recommended quadrats be placed at 15 positions: 0, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150 meters along a 150-meter-long transect. Additional quadrats may be required if the mixing zone or area of potential influence extends beyond 150 m. During the pre-construction survey quadrat placement should be adjusted as necessary to maximize the number of quadrats containing SAV while maintaining space between quadrats. Once established, the positions of quadrats along transects should be consistent across surveys.

2.3.6 *Monitoring Methods*

2.3.6.1 *In-situ Delineation of SAV*

During the growing season prior to each construction event, a reconnaissance survey (Section 2.2.2) shall be conducted throughout all potential SAV habitats to identify currently vegetated areas that shall be delineated (DE) and surveyed pre- and post-construction to document any potential project-related impacts. During each monitoring event (pre- and post-construction), the edge of each SAV patch shall be delineated *in situ* by divers; divers shall visually assess and record the position of the edge as accurately as possible using a sub-meter accurate DGPS unit. A continuous track-line is preferred, but if this is not possible, then individual data points (waypoints) may be collected (e.g., at 5-meter intervals or major inflection points) to document the position of the edge. For projects where SAV is extensive and continuous, it may be sufficient to delineate only the SAV edge that is proximate to construction activities. Mapping methods should be coordinated with the department during permitting and finalized prior to completion of the monitoring plan and permit application.

2.3.6.2 Visual Assessment of Site Conditions

Site conditions should be visually assessed (VA) and indicators of function such as canopy height, epiphyte coverage, flowering, disease, drift algae, bioturbation, propeller scars, shoaling, water quality, clarity and visibility shall be observed and noted. Density of SAV shall be observed and reported as either sparse (<5% cover), moderate (25-50% cover), or dense (50-100% cover); if density varies within the site(s), this should be described in the reports. Any signs or indicators of potential impacts, such as sloughing, scouring, exposed rhizomes, burial or sediment accumulation shall be reported. A detailed description of the current conditions shall be provided, including a description of any visually conspicuous changes in the condition of resources compared to previous surveys. Representative photographs of each patch (or discrete area) shall be taken to document site conditions. Additionally, water depth shall be measured, corrected for tidal height and reported in metric units.

2.3.6.3 Quantitative Assessment of Cover-Abundance

The cover-abundance of SAV shall be visually assessed within 1 m² (1 m x 1 m) quadrats. The department shall be consulted regarding the possible use of smaller sized quadrats (0.25 m² or 0.5 m²); the use of smaller quadrats will typically require additional quadrats to be sampled. Generally, it is recommended that quantitative data be collected within a quadrat that is divided into 100 sub-units or “cells.” Cover-abundance (percent cover) of SAV is determined by counting the number of cells with SAV and calculating the percentage of cells within the quadrat with SAV. This method is preferred because it is highly repeatable and interobserver error is typically low. However, the use of subdivided quadrats (cell count method) may not be practicable at sites where long-bladed seagrass taxa are dense. Under certain circumstances, depending upon project-specific logistical constraints and site conditions, the department may accept rapid estimates of SAV cover. For example, the percent cover of SAV may be visually assessed and reported to the nearest 5% or reported using the Braun-Blanquet cover-abundance scores (Table 2). If Braun-Blanquet cover-abundance scores are recorded in the field, then data shall be converted to percent cover using a standard conversion table (Table 2) prior to performing data analysis. Cover-abundance methods shall be discussed during the planning and permitting process. Once cover-abundance methods have been approved by the department, these methods should remain consistent across all surveys and sites.

Drift algae can obscure SAV and dense accumulations of drift algae may smother SAV; therefore, reporting dense accumulations of drift algae is necessary to understand potential factors affecting SAV

resources in the project area. Drift algae within the quadrat shall be recorded in the field notes as sparse, moderate or abundant and then carefully removed prior to visually assessing rooted or anchored SAV taxa (seagrass and rhizophytic macroalgae, respectively). Once drift algae have been removed from the quadrat, the biologist shall assess the total cover-abundance of SAV, which is the total cover of all seagrass and rhizophytic macroalgae taxa. The total cover-abundance of all seagrass species and the total cover-abundance of all rhizophytic macroalgae genera shall also be reported. The biologist shall also report the cover-abundance of each seagrass species and each rhizophytic macroalgae genera present within the quadrat. The results of this assessment should be used to calculate the frequency of occurrence (percentage of all quadrats that contained SAV), the density (average cover-abundance for all quadrats sampled) and the abundance (average cover-abundance for only those quadrats containing SAV). These metrics shall be calculated for 1) all SAV, 2) all seagrass, 3) all rhizophytic macroalgae, 4) each seagrass species and 5) each rhizophytic macroalgae genera.

Table 2. Braun-Blanquet Cover-Abundance Scores and Conversions to Percent Cover.

Score	Description of Cover	Approximation of Percent Cover
0	Absent from quadrat	0
0.1	A solitary shoot, <5% cover	0.02
0.5	Few (<5) shoots, <5% cover	0.1
1	Many (>5) shoots, <5% cover	2.5
2	5 - 25% cover	15
3	25 - 50% cover	37.5
4	50 - 75% cover	62.5
5	75 - 100% cover	87.5

For some projects, the density of seagrass shoots shall be also be recorded and reported as another metric of SAV abundance. For example, if *H. johnsonii* is present (in accordance with SARBO; NMFS 2020) or if the project must be clearly in the public interest because the project is located within an Outstanding Florida Water. Seagrass shoots shall be counted within multiple 0.01 m² (10 cm x 10 cm) quadrats and the density of seagrass shoots shall be reported separately for all species present within quadrats.

2.3.6.4 Line Intercept Survey

For projects with a transect-based survey design (Section 2.3.5.2), a line intercept survey (LI) shall be conducted along each transect during each survey event. All transects shall be surveyed to document the linear extent (recorded to the nearest 0.1 m) of SAV present along (directly below) each transect line.

During each line intercept survey, a biologist shall swim the length of each transect and note the location and linear extent along the transect tape of bare substrate, rhizophytic macroalgae and seagrass (reported by species). During this survey, drift algae should be noted in the field observations as sparse, moderate or dense and then carefully removed to ensure no SAV is present underneath. Areas containing only drift algae shall be considered as bare substrate for the purposes of assessing net-cover of SAV. For segments along the transect where SAV taxa overlap, each shall be reported.

Total length of each transect shall be reported along with the percentage of that transect covered by each category of cover, which are defined as follows: 1) seagrass, 2) rhizophytic macroalgae and 3) areas with no SAV (bare substrate and areas containing only drift algae). The line intercept data shall also be used in conjunction with the delineation data (Section 2.3.6.1) to calculate the net-acreage of SAV coverage at each of the sites; net-acreage of SAV = (total acres of site) X (percentage of site covered by SAV). Reports shall include calculations for: 1) net-acreage of seagrass 2) net-acreage of macroalgae and 3) net-acreage of any SAV.

2.3.6.5 Impact Assessment Survey

The purpose of the impact assessment (IA) is to provide the information needed for the department to determine if corrective actions are necessary (such as the remediation of physical impacts or transplanting) and to calculate the amount of compensatory mitigation that may be required to offset unauthorized impacts using UMAM. The impact assessment is a targeted investigation of areas that are known or suspected to have been impacted by construction activities or secondary impacts associated with the project. For example, if the impact assessment is required because of unauthorized anchoring, then all anchoring locations located within mapped SAV areas should be investigated. If an impact assessment is required because a pipeline ruptures during construction, then all SAV areas that may have been affected by the rupture should be investigated. If an impact assessment is required because a construction vessel grounded or caused propeller scaring, then it may be helpful to use the contractor's vessel track-history as a starting point for investigating potential impacts.

The primary objective of the impact assessment is to document any visually conspicuous signs of impacts, such as physical damage to SAV caused by dredging equipment, boat groundings, propeller scars, anchors, scouring, sloughing, sediment accumulation and any other signs of impact. The magnitude of functional loss associated with impacts shall be observed and described. For example, information such as notable reductions in SAV biomass or the thickness of materials that were

accidentally deposited on the benthos should be reported. Representative photographs shall be collected to document the condition of SAV and signs of impacts in each investigated area.

The GPS coordinates for any locations with impacted SAV shall be recorded and reported. The spatial extent of impacts to SAV shall be documented and the acreage of impacts to SAV resources shall be reported. Survey data shall be used to produce a geo-referenced map of all impacted SAV areas, including vegetated areas and unvegetated SAV habitats (Section 1.3); map products should be compliant with the mapping criteria described in Section 2.2.3.1.

3.0 Quality Control/Quality Assurance

Measures shall be taken to ensure the production of high-quality data, which are accurate, complete and consistent. Data should only be collected by qualified biologists, who have cross-trained and completed *in-situ* calibration exercises to reduce interobserver error. The data management process should be well documented and transparent. Consistent methods should be used for all monitoring events to allow temporal comparisons to be made between datasets.

3.1 Qualifications for Biologists

To provide reasonable assurance surveys will accurately document the condition of SAV resources, all surveys should be conducted by qualified biologists with experience performing *in-situ* SAV surveys. The department recommends biologists have at least a Bachelor of Science (a graduate degree is preferable, but not required) from an accredited institution in either marine biology, biology with a concentration in marine sciences, environmental science with a minor in biology or a similar degree. Biologists should also have professional experience and expertise in surveying SAV (preferably for similar construction projects) and a scientific knowledge of SAV. Biologists should have experience collecting data while snorkeling and certification for self-contained underwater breathing apparatus (SCUBA) may be required if site conditions necessitate such equipment. The resumes for all biologists shall be submitted to the department at least 15 days before the initiation of surveys. The department will review this information, verify whether biologists meet the minimum qualifications and will provide written comments regarding any perceived deficits in qualifications or experience.

3.2 *In-situ* Calibration

If more than one biologist is responsible for *in-situ* data collection, then all biologists shall participate in cross-training and calibration activities to verify correct species identification and survey practices.

These Quality Assurance/Quality Control (QA/QC) activities should be completed at the beginning of each monitoring event. The results of these QA/QC activities shall reflect consistency of at least 90% for each SAV cover metric that will be used for the project (e.g., cell-counts, Braun-Blanquet scores and shoot counts); biologists should be able to positively identify all SAV taxa (i.e., 100% agreement on seagrass species and macroalgae genera). Copies of the field sheets used for these QA/QC activities should be submitted with the data deliverables (Section 4.2). If only one biologist will be collecting data for a project, then regular cross-training and calibration with other biologists is recommended but is not required.

3.3 Data Management

During data collection, biologists shall check their field datasheets to ensure completeness, legibility and accuracy. Biologists should initial each sheet after it has been checked in this manner. Once field datasheets are cleaned and dried at the office, data shall be entered into a project-specific Excel spreadsheet. The spreadsheet data shall be checked against the original datasheet (or a photocopy) to ensure data were transferred correctly. Any changes to datasheets shall be made in coordination with the biologist who collected the data; any changes to field sheets shall be done using a colored marker. Datasheets shall be electronically scanned, saved as PDF files and submitted to the department with the data deliverables (Section 4.2).

3.4 Amendment of Survey Protocols

Consistent data collection methods are necessary to evaluate changes in the condition of SAV resources over time. If any amendments to the sampling design or methods are necessary due to field conditions or any other reason, then the permittee and the monitoring firm shall contact resource staff in the permitting office that issued their permit (BIPP, District Office or other delegated permitting authority). Any changes to permitted monitoring requirements shall be coordinated with department staff and the permittee or their monitoring firm must receive written approval from the department prior to the implementation of revised protocols. Such coordination is necessary to ensure revised protocols fulfill the monitoring objectives and provide reasonable assurance to the department. Note: a permit modification may be required to authorize changes to survey protocols.

3.5 Addressing Potential Conflicts of Interest

Permittees who want to remain eligible for potential cost-sharing of monitoring costs for JCP projects must demonstrate there are no potential conflicts of interest or perceptions of such conflicting interests.

Therefore, monitoring data and statistical analysis must be provided directly and concurrently from the monitoring firm to the department, permittee, consultant(s) and local sponsor(s) to comply with the Florida Auditor General report 2014-064 and to be consistent with Section 287.057(17)(a)(1), F.S.

4.0 Notification and Reporting for Permit-Required Surveys

All correspondence related to the submittal of information, data deliverables, or reports for the project should be provided to the department's point-of-contact (POC) specified by the permit. For projects permitted by BIPP, the POC for such correspondence is the JCP Compliance Officer (JCPCompliance@floridadep.gov). All correspondence shall reference the permit number and project name. Additionally, correspondence should reference the number of the specific condition(s) of the permit and/or section(s) of the monitoring plan that requires the submittal of the information provided in each deliverable. Email correspondence is preferable when possible, but some deliverables may need to be submitted using other electronic delivery methods such as a file transfer protocol (FTP) website or delivery of an external hard drive. Regardless of the delivery mechanism, the permittee is responsible for ensuring the department receives all deliverables prior to permit-required deadlines.

4.1 Notification of Survey Initiation/Completion

The department's point of contact (POC) shall be notified via email before the initiation of each survey and provided with an approximate date that survey work will begin. The department's POC shall also be notified (via email within 48 hours) when survey work has been initiated and when each survey has been completed.

4.2 Submittal of Data

Data (field sheets and Excel spreadsheets), ArcView GIS files (including SAV delineations) and representative photographs shall be submitted no later than 45 days after each survey is complete. All data shall be carefully checked (as described in Section 3.0) before submittal. Digital photographs submitted to the department shall be organized (sorted within file folders) by location (e.g., project or reference site; patch, transect and/or quadrat position). Monitoring data and statistical analysis must be provided directly and concurrently from the monitoring firm to the department, permittee, consultants and local sponsors (Section 3.5).

4.3 Map Deliverables

Mapping data collected in the field (track-lines or waypoints) shall be reported along with the total acreage of SAV within each patch/bed during each survey. Pre- and post-construction delineation data shall be used to evaluate changes in the distribution and acreage of SAV over time. The post-construction SAV acreage shall be compared to the pre-construction SAV acreage. The information obtained from mapping efforts shall be used to produce a georeferenced map showing the distribution of SAV taxa in the project area. Map products should be compliant with the mapping criteria described in Section 2.2.3.1.

4.4 Submittal of Reports

4.4.1 Reporting for Projects with Low-Risk of Impacts

For low-risk projects with minimal monitoring, a report describing the results of the pre-construction SAV survey will typically be provided at least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required by the permit (Table 3). This pre-construction report shall include a georeferenced map of SAV boundaries based on the reconnaissance and mapping survey tasks, representative photographs and a description of the current condition of SAV based on the characterization survey. The information in this report shall be used by the permittee and their contractor to implement permit-required minimization measures. Moreover, this report shall also contain information on the pre-construction condition of SAV resources that could be used for UMAM if there are any unauthorized impacts. If an impact assessment is required, then an impact assessment report shall also be submitted (Section 4.7).

4.4.2 Reporting for Comprehensive Monitoring

For projects requiring comprehensive monitoring, the results of the pre-construction survey shall be provided at least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required by the permit (Table 3). A formal pre-construction report is not required, but the pre-construction deliverables shall include a georeferenced map of SAV boundaries based on the reconnaissance and mapping survey tasks, representative photographs, a description of site conditions based on the qualitative assessment and the data for the quantitative assessment of cover-abundance (and line intercept surveys, if required). A post-construction report shall be prepared and submitted to the department within 90 days of the completion of each post-construction survey (Table 3). This report shall include the results for each monitored metric; all data collected shall be reported. The report shall

describe the results of statistical analyses used to evaluate whether the spatial extent (acreage) and/or cover of SAV (as determined by quantitative assessments Section 2.3.6.3 and/or line intercept surveys Section 2.3.6.4) changed significantly between the pre- and post-construction surveys. Summary statistics, including the average and standard deviation, shall be presented. The report shall provide a comparison of pre- and post-construction data for each area (patch and/or transect) and for the entire project area. If monitoring is conducted at a reference site or sites, then the results of reference site surveys shall also be reported and compared with monitoring results for the project area. If an impact assessment is required, then an impact assessment report shall also be submitted (Section 4.7).

4.5 Evaluation of As-built Survey Results and Physical Monitoring Data

To determine if any unauthorized impacts to SAV resources have occurred as a result of construction activities, the permittee shall review the contractor's as-built (AB) survey results to ensure construction was completed in compliance with the specific conditions of the permit and authorized project drawings. If any substantial deviations from the authorized construction activities are identified during review the as-built results, then a detailed description of these deviations shall be provided. For some projects (e.g., channel dredging), the permittee will also need to provide an evaluation of physical monitoring (PM) data to determine if SAV resources were impacted. For example, the locations of any dredged areas that are not compliant with the authorized template shall be reported, including areas where there is evidence of dredging beyond the authorized template or sloughing beyond the authorized side-slopes. For nourishment projects, all beach profile data available at the time the post-construction report (Section 4.4.2) is being prepared should be evaluated to see if patterns in these data correspond to areas where SAV has changed; for example, evidence that the SAV edge shifted or that cover decreased near portions of the project where fill materials were lost or moved offshore.

The results of this evaluation of the as-built survey and physical monitoring data (AB/PM) will be used to determine whether an impact assessment is required for low-risk projects and to aid in the interpretation of post-construction survey results for projects with comprehensive monitoring. Therefore, timely submittal is important. The permit and/or monitoring plan will specify the timeline for providing this deliverable, which will depend upon the physical monitoring schedule. For example, the AB/PM evaluation may be required to be submitted with the post-construction report or 90 days after the completion of the post-construction physical monitoring event, whichever is later.

4.6 Notification of Impacts

If any unauthorized impacts to SAV occur (or are suspected to have occurred) as a result of construction activities authorized by this permit, then the permittee shall notify the department's POC via email as soon as practicable but no later than 24 hours from the time of discovery. This correspondence should include all available information on impacts and/or incident(s) that (may) have caused impacts.

4.7 Submittal of Impact Assessment Report

If an impact assessment is required (Section 2.3.3), the permittee shall submit an impact assessment report within 15 days of the completion of the impact assessment (Table 3), unless a time extension is granted in writing by the department. The impact assessment report shall provide all information necessary for the department to evaluate whether corrective actions are necessary and to calculate the amount of compensatory mitigation that may be required to offset unauthorized impacts using UMAM. The impact assessment report shall include a description and representative photographs of site conditions and SAV in the project area. Any visually conspicuous signs of impacts shall be documented in the report. The GPS coordinates for any locations with impacted SAV shall be reported. A geo-referenced map of impacted SAV areas shall also be provided to illustrate the spatial extent of impacts; map products should be compliant with the mapping criteria described in Section 2.2.3.1. The impact assessment report shall describe the severity of functional losses that were observed (e.g., degradation of community structure) and the acreage of impacts to SAV and SAV habitat (Section 1.3).

4.8 Submittal of Corrective Action Plan

If the permittee notifies the department (or the department notifies the permittee) that unauthorized impacts to SAV have occurred as a result of construction activities, then within 14 days of notification – unless an extension is granted in writing by the department – the permittee shall submit a draft corrective action plan describing actions that will be taken by the permittee to monitor, remediate and/or mitigate the unauthorized impacts. The corrective action plan shall be implemented by the permittee within 30 days of receiving notification the corrective action plan has been approved by the department, unless an extension is granted in writing by the department.

Table 3: Summary of monitoring events, survey tasks (DA: desktop assessment, RECON: reconnaissance, MC: mapping and characterization, DE: delineation, VA: visual assessment of site conditions; LI: line intercept and CA: cover-abundance; AB/PM: evaluation of as-built survey and physical monitoring data, IA: impact assessment) and deliverables that may be required for projects depending upon the monitoring approach.

Monitoring Approach	Monitoring Event	Surveys / Tasks	Deliverables	Timeline
Minimal monitoring for low-risk projects (2.3.1)	Planning (2.2)	DA (2.2.1); RECON (2.2.2); MC (2.2.3)	Permit Application (2.2)	Prior to completing the application
	Pre-construction (2.3.3)	RECON (2.2.2); MC (2.2.3)	Pre-Construction Report (4.4.1)	At least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required
	Evaluation of potential impacts during or post-construction	IA (2.3.3; 2.3.6.5); AB/PM (4.5)	Impact Assessment Report (4.7); AM/PM (4.5)	IA: Within 30 days of completing the Impact Assessment; AB/PM: as required by the permit
Comprehensive monitoring to document potential impacts (2.3.2)	Planning (2.2)	DA (2.2.1); RECON (2.2.2); MC (2.2.3)	Permit Application (2.2) and Monitoring Plan (2.3.2)	Prior to completing the application
	Pre-construction (2.3.3)	DE (2.3.6.1); VA (2.3.6.2); CA (2.3.6.3); LI (2.3.6.4) ¹	Pre-Construction Deliverables (4.4.2)	At least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required
	Post-construction ² (2.3.3)	DE (2.3.6.1); VA (2.3.6.2); CA (2.3.6.3); LI (2.3.6.4) ¹ ; AB/PM (4.5)	Post-Construction Report/Annual Report (4.4.2) AB/PM (4.5)	Post-Construction Report: within 90 days of completing the post-construction survey; AB/PM as required by the permit
	Impact Assessment (2.3.3)	IA (2.3.6.5)	Impact Assessment Report (4.7)	Within 30 days of completing the Impact Assessment

1: Line intercept surveys will be required for projects with a transect-based survey design (Section 2.3.5).

2: Additional surveys shall be required for dredging projects that extend over more than one growing season, substantially alter hydrological conditions and for beach nourishment projects; annual reports shall be submitted if additional surveys are conducted (Section 2.3.3).

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