

**STANDARD OPERATING PROCEDURE
FOR SAMPLING VEGETATION
IN WETLANDS**



WATER QUALITY

State of Utah
Department of Environmental Quality
Division of Water Quality

Revision 2.0
Effective August 2021

Foreword

Utah Division of Water Quality (DWQ) Standard Operating Procedures (SOPs) are adapted from published methods or developed by in-house technical experts. This document is intended primarily for internal DWQ use. This SOP should not replace any official published methods.

Any reference within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a product or service by DWQ. Additionally, any distribution of this SOP does not constitute an endorsement of a procedure or method.

Although DWQ will follow this SOP in most instances, there may be instances in which DWQ will use an alternative methodology, procedure, or process.

The methodology detailed below is the protocol followed by DWQ's monitoring staff and verified by DWQ's Quality Assurance officer.

Signature: *Benjamin Brown*
Benjamin Brown (Dec 2, 2021 17:46 MST)

Email: brbrown@utah.gov

Benjamin R. Brown
Monitoring Section Manager

Date

Signature: *Toby Hooker*
Toby Hooker (Dec 2, 2021 17:57 MST)

Email: tobyhooker@utah.gov

Toby Hooker
Quality Assurance Officer

Date

REVISION PAGE

Date	Revision #	Summary of Changes	Sections	Other Comments
9/9/2011	1	not applicable	not applicable	Creation of document, began document control/revision tracking
3/1/21	2	Updated to all wetland types.	All	Put into a new standardized format, began document control/revision tracking.

Table of Contents

1.0	Scope and Applicability	5
2.0	Summary of Method	5
3.0	Definitions	5
4.0	Health and Safety Warnings	5
5.0	Cautions	6
6.0	Interferences	6
7.0	Personnel Qualifications/Responsibilities	6
8.0	Equipment and Supplies	6
9.0	Procedures	7
10.0	Data and Records Management	9
11.0	Quality Assurance and Quality Control	9
12.0	References	9
13.0	Figures	11
14.0	Appendices	14

1.0 SCOPE AND APPLICABILITY

This document presents the standard operating procedure (SOP) for sampling wetland vegetation and applies to any Utah Division of Water Quality (UDWQ) monitor or non-UDWQ cooperator performing wetlands monitoring.

The cover and composition of the plant community is an important indicator of the overall ecological health of a wetland, and is used by the UDWQ as a key component in a multi-metric index (MMI) tool used to assess wetland condition. Vegetation provides protective habitat for macroinvertebrates and other organisms, stabilization of sediments, nutrient cycling and attenuation, and attenuation of other pollutants. Submerged aquatic vegetation (SAV), primarily sago pondweed (*Stuckenia pectinata*) and western fineleaf pondweed (*Stuckenia filiformis* ssp. *occidentalis*) also plays a critical role in wetland food webs, in particular, providing forage for migrating waterfowl (Miller and Hoven, 2007 and Hoven and Miller, 2009).

This SOP has been created for UDWQ monitoring and is based on a modification of procedures described in the following documents: previous reports from UDWQ on wetland sampling (UDWQ, 2015; UDWQ 2016), wetland sampling and analysis plans (UDWQ, 2019), EPA's Methods for Evaluating Wetland Condition Module #10 – Using Vegetation to Assess Environmental Conditions in Wetlands (2002), EPA's National Wetlands Condition Assessment (NWCA) Field Operations Manual (2010), and Daubenmire (1959).

2.0 SUMMARY OF METHOD

The procedure involves identifying all plant species present and making visual estimations of percent cover of each species and plant strata along a 100-m transect.

3.0 DEFINITIONS

IW: impounded wetland

FR: fringe wetland

m: meters

PVC: polyvinyl chloride

SAP: Sampling and Analysis Plan

SAV: submerged aquatic vegetation; for the purpose of this SOP, SAV includes vascular vegetation rooted in sediment for which most of the plant is submerged or floating on water

4.0 HEALTH AND SAFETY WARNINGS

Hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, it is recommended that the sampling be rescheduled. If hazardous conditions arise during sampling, such as lightning, high winds, rising water, or flash flood warning, personnel should cease sampling and move to a safe location.

When working in Utah and other warm climates, take steps to avoid heat induced illnesses such as heat stroke or heat exhaustion.

Use caution when working in waders as drowning hazards exist.

Take appropriate precautions when operating equipment and working on, in, or around water, as well as possibly steep and unconsolidated banks, bridges, or edges of ponds/lagoons. All field crews should follow DWQ health and safety procedures and be equipped with safety equipment such as proper wading gear, personal flotation devices (PFDs), gloves, first aid kits, cellular phone, etc.

5.0 CAUTIONS

Unknown samples should be collected and identified in the lab.

6.0 INTERFERENCES

Wave action, turbidity, and sediment plumes can interfere with observation of SAV. Additionally, algal mats can become “stacked up” or pushed to pond edges due to wind. Field conditions potentially affecting the measurement should be noted on the field sheets. If conditions inhibit the ability to make the SAV measurement, this should be noted in the field sheets and the site should be revisited.

Field personnel should attempt to minimize disturbance of sediments and should wait for any kicked-up sediment to settle or otherwise dissipate before making the percent cover estimation at each sampling point along the transect.

Boat propellers cause too much disturbance to the substrate and vegetation and should be left far enough away from sampling locations to prevent interfering with vegetation monitoring.

7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

DWQ personnel performing wetland vegetation sampling must be familiar with sampling techniques, safety procedures, proper handling, and record keeping. Samplers are responsible for attending refresher meetings held each spring/summer to review procedures and techniques. New staff will be trained in the field by DWQ trained personnel.

Cooperators are required to read this SOP annually and acknowledge they have done so via a signature page that will be kept on-file at DWQ along with the official hard copy of this SOP (see Appendix 1).

8.0 EQUIPMENT AND SUPPLIES

- Copy of this SOP
- PVC frame (1-m², dimensions 2 m by 0.5 m) with foam for flotation and markings
- Reel tape to measure transect
- GPS and Batteries

- Field sheet (check your project-specific SAP)
- Tablet with relevant data forms and applications
- Camera
- Plastic, high-sided utility sled for toting equipment
- Meter stick made of PVC and marked in centimeters
- Pencils and Sharpies

9.0 PROCEDURES

9.1 Setting up the Transect

9.1.1 Impound Wetlands

For IWs, use the list of randomly generated numbers or random number generating app to look up a set of 5 sampling points, which correlate to the number of paces (meters) from the transect start.

1. Locate the impoundment outlet.
2. Gather the equipment in the sled and walk approximately 100 m into the IW and away from the outlet. Transect start should be located where water is open (not crowded by emergent vegetation) and at or near the deepest pooling point in the impoundment (**Figure 1**).
3. Set up the 100 m transect perpendicular to the outflow, using reel tape.
4. Make sure each end of the transect is at least 50 m from any impoundment structures.
5. To minimize disturbance of sediments, individuals sampling the vegetation cover should move along the transect first, before others who are measuring different parameters.

9.1.2 Fringe Wetlands

1. Identify the water source to the fringe wetland and the predominant water flow path.
2. A 100-meter transect will be established perpendicular to the flow path at 100 meters downstream from the water source and centered on the water flow path (**Figure 1**).

Vegetation data will be gathered in a 1-m wide belt transect. To aid in cover estimation, the belt transects can be conducted in 10-20-m segments with data gathered at each end of the segment.

9.2 Vegetation Sampling

1. Starting point
 - a. In IWs, start at the western or northernmost end of the transect, pace off steps to the first sample location.
 - b. In FRs, start at the center point where the transect crosses the flow path.

2. Sample frame

- a. If using a PVC frame (IW), place the long side of the frame perpendicular to the transect at the established distance (m) along the transect, centered on the transect line (**Figure 2**). Look through the frame to identify all unique species present and estimate percent cover of each species, starting at the water surface, and then moving down through the water column. If necessary, vegetation for which cover has been estimated and recorded can then be moved out of the way to visualize submerged vegetation.
 - b. FR sampling requires two monitors, one at each end of the 10-20 meter belt transect. Each should stand at the segment end points and identify each species within a 1-meter belt between them (**Figure 3**).
3. Cover is estimated directly as the percentage (0 to 100%) of the plot area covered by the species or vegetation group under consideration. Use the continuous range of values from 0 to 100% when estimating cover for an entity. **Figure 4** is an excerpt from EPA's NWCA Field Operations Manual and may aid in estimating percent cover.
 4. Record the estimated percent cover of each species, and the following vegetation strata: SAV, floating vegetation, emergent vegetation, and algal mats. Also record SAV condition and height and water depth as indicated on the field sheet (**Appendix 2**).
 5. Gather voucher specimens for unknown species that will be identified in the shop. Vouchers should be given the label V##, each new unknown species encountered in the survey gets a different number. For example, the first unknown species would be labeled V01, the seventh would be V07.
 6. Ideal voucher specimens have flowers or seeds, leaves, and roots attached because those are critical features for identification. Vouchers should be placed in a paper bag that is labeled with the voucher ID, site name or monitoring location ID, and date. In the lab, vouchers should be pressed between sheets of newsprint in a plant press.
 7. Make note of potentially interfering conditions such as turbidity or wind.
 8. Repeat Steps 3-5 for the 4 remaining sampling points.

9.3 Supplemental Method to Perform Vegetation Sampling

Some field situations, primarily water levels too deep to safely allow wading, will necessitate using a boat to conduct the visual estimations of vegetation cover. This method will be performed in the same way as the previous method.

9.4 Site Photos

Photos should be taken during each site visit to qualitatively capture SAV, duckweed, and algae cover at the site and to aid in identification of unknown species.

Take a photo when prompted by field app or data sheet. If there are any project-specific photo requirements, they will be detailed in the SAP.

1. Take a photo of the field station ID on the field sheet before taking any site photos (in lieu of a photo logbook).
2. If a vantage point for the sampling site is available, take one or several photos of the overall study area, documenting general vegetation conditions. Also, note the observed general conditions on the field sheet.
3. Take one or several photos looking down over the PVC frame at the sampling points along the transect (greater heterogeneity of vegetation = more photos).
4. Standing at one end of the transect (choose the end that produces less glare on the photo, depending on the time of day), take a photo looking down to the other end of the transect.
5. Take any other photos that may aid in capturing conditions at the site.

Note: For a voucher specimen, take pictures of the whole plant, leaves and stems, and flowers or seeds following directions in the data gathering app.

10.0 DATA AND RECORDS MANAGEMENT

Project-specific data and records management requirements can be found in the project-specific SAP. Before leaving the field site, be sure that all required samples have been collected, labeled, and that all appropriate field sheets, field notes, and sample tracking forms have been filled out completely and accurately.

The data from the field forms is sent to the wetlands coordinator at the same time as the other field data collected for that day (ideally within 2 weeks from the date of the site visit).

11.0 QUALITY ASSURANCE AND QUALITY CONTROL

To ensure vegetation is labeled accurately, unknown specimens are collected in the field for further identification.

12.0 REFERENCES

Daubenmire, R.F. 1959. Canopy coverage method of vegetation analysis. *Northwest Science* 33: 43-64.

U.S. EPA. 2002. Methods for evaluating wetland condition: #10 Using vegetation to assess environmental conditions in wetlands. Office of Water, U.S. Environmental Protection Agency, Washington, D.C. EPA-822-R-02-020.

U.S. Environmental Protection Agency. 2011. National Wetland Condition Assessment: Field Operations Manual. U.S. Environmental Protection Agency, Washington, D.C. EPA-843-R-10-001.

Utah Division of Water Quality. 2015. Ecological characteristics of potential reference standard sites for Great Salt Lake impounded wetlands: 2014 & 2015 Survey. Online: <https://documents.deq.utah.gov/water-quality/standards-technical-services/gsl-website-docs/wetlands-program/wetland-monitoring-assessment/DWQ-2015-017187.pdf>

Utah Division of Water Quality. 2016. Ecological characteristics of Great Salt Lake fringe wetlands. Online: <https://documents.deq.utah.gov/water-quality/standards-technical-services/gsl-website-docs/wetlands-program/wetland-monitoring-assessment/DWQ-2016-018241.pdf>

Utah Division of Water Quality. 2019. Great Salt Lake Wetland Monitoring 2019-2020 Sampling and Analysis Plan: Version 2. Online: <https://documents.deq.utah.gov/water-quality/standards-technical-services/wetlands-program/wetland-monitoring-and-assessment/DWQ-2019-021042.pdf>

Related DWQ SOPs:

Standard Operating Procedure for the Collection of Macroinvertebrates in Wetlands

Standard Operating Procedure for the Collection of Sediment in Wetlands

Standard Operating Procedure for the Collection of Water Chemistry in Streams and Wetlands

Standard Operating Procedure for the Collection of Zooplankton Samples Using a Horizontal Tow

13.0 FIGURES

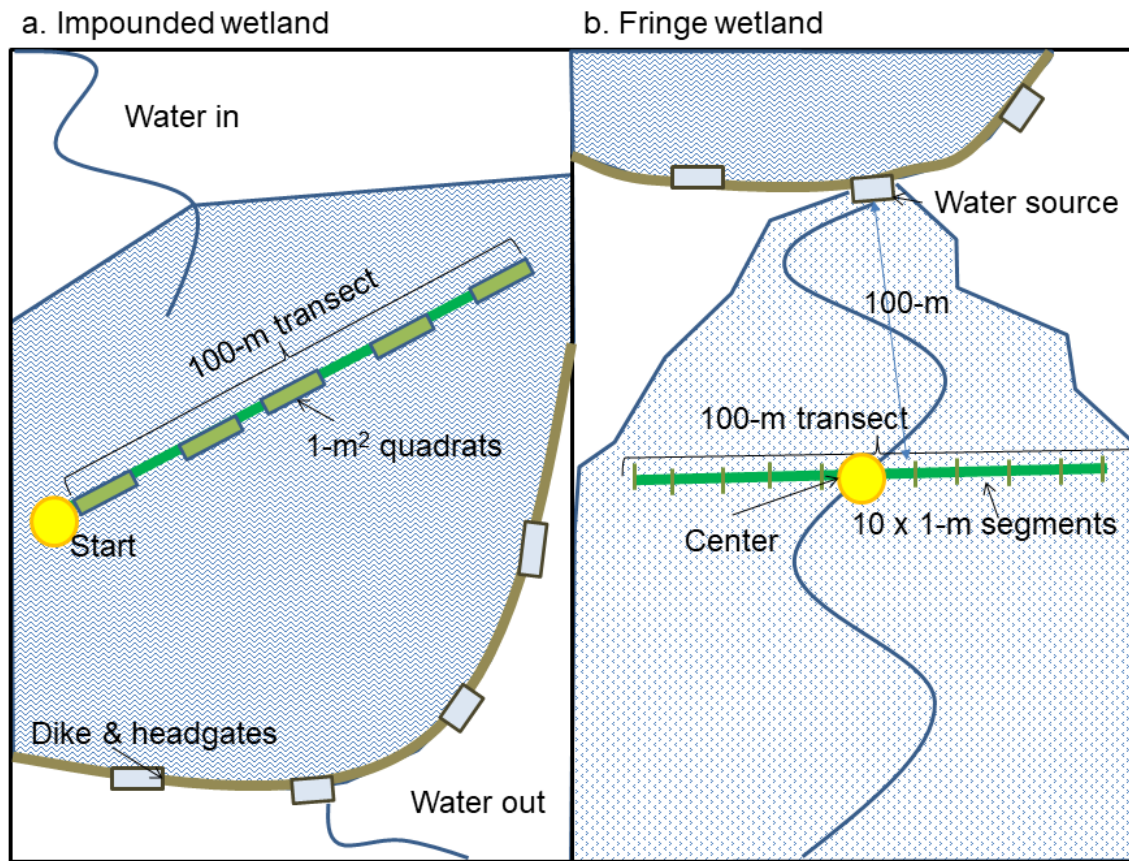


Figure 1. Transect location for vegetation sampling in impounded and fringe wetlands.



Figure 2. Example IW sample frame



Figure .3 Example FR Transect

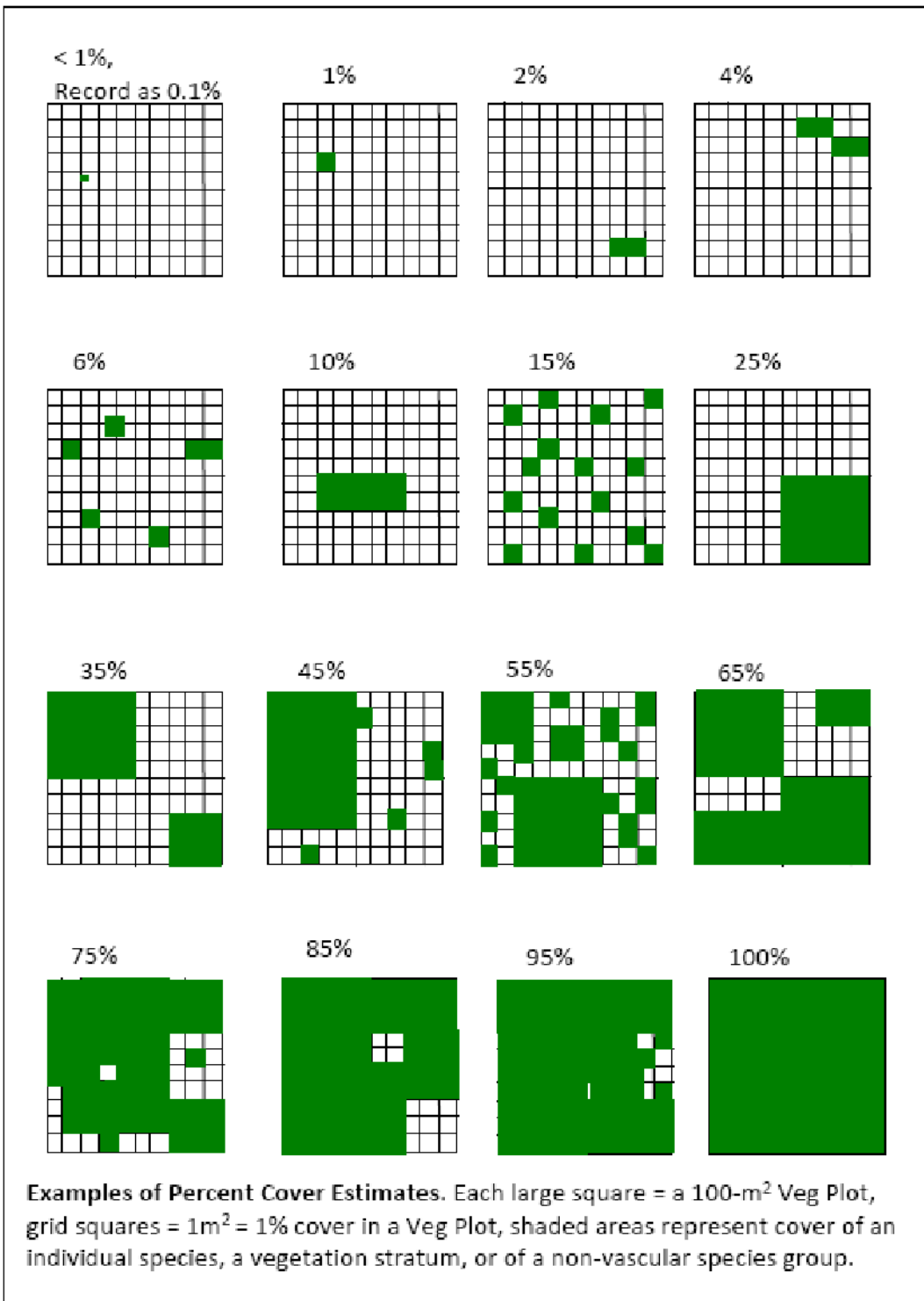


Figure 4. Percent cover estimation guidance (from EPA’s NWCA Field Operations Manual, 2011)

14.0 APPENDICES

APPENDIX 1 - SOP ACKNOWLEDGMENT AND TRAINING FORM

SOP Acknowledgement Form

This SOP must be read and acknowledged annually, and this form must be kept on file at DWQ.

Document Title:	
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement:

"I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved revision."

Date	Printed Name	Signature

SOP Training Form

Training is required for all new samplers and Refreshers are required annually.

Trainee: Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer: Sign below to acknowledge that training on this SOP was completed for the individual listed and that trainee is competent to perform the procedures described within.

Date	Trainee Printed Name	Trainee Signature	Trainer Printed Name	Trainer Signature

Management Approval

Printed Name:

Signature:

Date:

APPENDIX 2 – FIELD SHEET EXAMPLE

2019 IW SAV Sheet						
GPS coords of transect start						
Lat: _____						
Long: _____ Sampler(s): _____						
Wetland-Scale Cover Estimates ~200 m of sampling location						
%Algal mat		%SAV				
%Floating Aquatic Veg		%Bare mud/substrate				
%Emergent Veg		%Benthic mat				
Quadrat:	1	2	3	4	5	Average
Plot location along transect (m)						
Water depth (cm)						
Height of SAV (cm)						
SAV cover (%)						
¹ SAV condition						
Cover - Spp1:						
Cover - Spp2:						
Cover - Spp3:						
² Filamentous algae cover (%) [Surface]						
Epiphytic Alg. cover (%)						
Duckweed cover (%)						
¹ SAV condition: 0 = absent 1 = Decomposing/senescing, 2 = Intact, but stressed, 3 = Healthy, F = Flowers/Fruits ² Filamentous algae: Extent of algae on SAV and/or surface of pond in %; (x) = Veg Sample Collected						
<u>Plant Vouchers or Comments:</u>						
Fish Observed:						
Depth loose muck:						