

# STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF MACROINVERTEBRATES IN GREAT SALT LAKE WETLANDS

State of Utah  
Department of Environmental Quality  
Division of Water Quality

Revision 1  
Effective [DATE]

**REVISION PAGE**

Date	Revision #	Summary of Changes	Sections	Other Comments
[insert]	1	not applicable	not applicable	Adapted from GSL wetlands field manual and put into new standardized format, began document control/revision tracking

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## 1.0 SCOPE AND APPLICABILITY

This document presents the Standard Operating Procedure (SOP) for the collection of macroinvertebrate samples in the Great Salt Lake (GSL) wetlands, and applies to any Utah Division of Water Quality (DWQ) monitor or non-DWQ cooperator performing wetlands sampling. This SOP applies to both impounded and fringe class wetlands of the GSL and may be applied to similar wetland habitats.

Macroinvertebrates are a primary component of wetland food webs, providing food to birds and other wildlife (e.g., amphibians) in wetlands surrounding the GSL. In addition, different taxonomic groups of macroinvertebrates are sensitive to different pollutants and can act as key indicators of disturbance caused by stressor gradients (e.g., nutrient gradients) in wetland ecosystems. Macroinvertebrate data is therefore used by the DWQ as a key component in a multi-metric index (MMI) tool used to assess wetland condition (Utah DWQ, 2009).

## 2.0 SUMMARY OF METHOD

Macroinvertebrate samples are collected at 5 (five) randomly selected locations along a 100 meter transect in the open water of the target wetland area. Samples are collected using a standard dip net and preserved with alcohol for taxonomic identification.

## 3.0 DEFINITIONS

m - meter(s)

SAV - submerged aquatic vegetation

µm - micrometer(s), also called micron(s)

## 4.0 HEALTH AND SAFETY WARNINGS

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

## 5.0 CAUTIONS

Care should be taken to sample the water column and sediment-water interface without including excessive sediment in the sample. Areas with duckweed or surface mat algae should be avoided.

Rinse nets thoroughly with water between sites to avoid any potential cross contamination of samples and wetland systems.

Samples should be preserved in the field.

## 6.0 INTERFERENCES

Anything that makes the sample more difficult to visualize in the laboratory can cause interference with results. Try to minimize duckweed, algae, sediment, etc. in the sample.

High turbidity or dense SAV may also interfere with sample collection (net clogging or dragging).

Samples should not be exposed to freezing temperatures, extreme hot temperatures, or direct sunlight during storage.

Samples should be submitted to the lab in a timely manner (4-6 months suggested maximum holding time) to avoid degradation of benthic organisms and to aid identification.

## 7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

Monitors collecting wetland macroinvertebrate samples must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at DWQ along with the official hard copy of this SOP.

## 8.0 EQUIPMENT AND SUPPLIES

- \_\_\_\_\_ Copy of this SOP
- \_\_\_\_\_ Plastic, high-sided utility sled or float tube (fishing type) for toting equipment
- \_\_\_\_\_ Laser range finder or reel tape and PVC posts to mark ends of transect
- \_\_\_\_\_ Meter stick made of PVC and marked in centimeters for measuring water depth
- \_\_\_\_\_ D-net 500 µm mesh such as Wildco D-frame Multifilment 500 µm (EPA) Net (425-D52) from Cole Parmer (cat# YO-05491-32)
- \_\_\_\_\_ Sieve bucket with 500 µm mesh

- \_\_\_\_\_ Regular plastic bucket
- \_\_\_\_\_ Deionized water squeeze bottle
- \_\_\_\_\_ Polyethylene sample jars with plastic lids, quart and gallon sizes
- \_\_\_\_\_ 95% ethanol
- \_\_\_\_\_ Field sheet
- \_\_\_\_\_ Sample labels (for exterior) (**Figure 1**) and printed on “Rite in the Rain”<sup>®</sup> paper (for interior)
- \_\_\_\_\_ Chain of Custody (COC) forms
- \_\_\_\_\_ Printed list of sets of random numbers (from 0 to 100)
- \_\_\_\_\_ Clear strapping tape
- \_\_\_\_\_ Electrical tape
- \_\_\_\_\_ Pencils and Sharpies for labeling

**Figure 1. Sample label for macroinvertebrate samples**  
(U:\WQ\PERMITS\MONITORS\Labels\ BENTHOS JAR TAG (INTERIOR).doc)

<b>BENTHOS COMPOSITE SAMPLE</b>
SITE ID _____
SITE NAME _____
_____
COLLECTION DATE _____
SAMPLER TYPE _____
COLLECTOR(s) _____
# OF STATIONS _____
JAR _____ OF _____

## 9.0 PROCEDURE

### 9.1 Setting up the Transect

#### 9.1.1 Impounded Wetland

- 1) Prepare sample labels (**Figure 1**) and jars.
- 2) Gather all necessary equipment in the sled or float tube and walk into the IW away from the outlet.
- 3) Establish a transect about 5 meters farther into the impounded wetland (away from the outlet) from where other types of samples have already been collected to avoid sampling an area that has been previously disturbed.

- 4) Set up the 100 m transect perpendicular to the outflow, using laser range finder or reel tape. Using this technique, the transect will run East-West for a majority of GSL IW.
- 5) Make sure each end of the transect is at least 50 m from any impoundment.
- 6) Mark each end of the transect with a PVC post.

### 9.1.2 Fringe Wetland

Transect location and orientation to be determined on a project/site specific basis.

### 9.2 Sample Collection

- 1) Use the list of randomly generated numbers to look up a set of 5 random sampling points, which correlate to meters from the transect start.
- 2) Starting at the western or northernmost end of the transect, pace off steps to the lowest random number generated.
- 3) Measure and record water depth to the nearest 0.1 m with the metered PVC stick.
- 4) Using a 500  $\mu$ m D-frame net, sample the target area with a 1-m "sweep". A "sweep" consists of passing the net back and forth over the same 1-m length three (3) times using a figure eight type motion. Aim for the water column down to the sediment level, careful to keep the net below the surface of the water while tapping the bottom to dislodge and collect organisms in the sediment.
- 5) Once you have made your "sweeps", pick the net up out of the water immediately to prevent backwash and loss of sample.
- 6) Empty all the contents of the net, including vegetation, into the sieve bucket.
- 7) Carefully swirl the sieve bucket in the water to rinse sediment/mud from the sample.
- 8) Place the contents of the sieve bucket into the polyethylene sample jar(s).
- 9) Repeat Steps 2 through 8 for the 4 remaining random sampling points, compositing each individual sample into the same sample jar.

**\*Note about field sheets:** Typically, aquatic vegetation measurements are performed in conjunction with macroinvertebrate samples in the wetlands and the field sheet accompanying the document "Standard Operating Procedure for determining Percent Cover of Aquatic Vegetation in Great Salt Lake Wetlands" is used to record field observations (U:\WQ\PERMITS\MONITORS\GSL wetlands\2011 Field Forms\ 2011 GSLWet SAV Condition Sheet.pdf). If vegetation measurements are not performed

along with macroinvertebrate sampling, use the field sheet in **Appendix 3** to record field observations of aquatic vegetation during collection of macroinvertebrate samples.

### 9.3 Sample Processing and Preservation

- 1) Once the composite sample has been collected, return to the vehicle or staging area with the equipment and sample.
- 2) If the sample jar is greater than 50% full of material, the sample should be split into multiple jars (or the entire sample may be put into a larger jar) so that no one jar is more than 50% full. If the sample is divided into multiple jars, label sample appropriately to indicate the series of jars (e.g. jar 1 of 3, 2 of 3, and 3 of 3).
- 3) Fill out a "Rite in the Rain" label in pencil with the same information on it as the sample labels and place it in the each sample jar.
- 4) Fill each jar with 95% ethanol (leaving little to no headspace) and replace lid.
- 5) Seal each jar with electrical tape around the lid to prevent leakage.
- 6) Fill out sample label(s) appropriately, put it on the exterior of the jar(s) and cover the label(s) with clear tape.
- 7) Place jar(s) in a cooler to protect them from direct sunlight exposure.
- 8) Before using the net and sieve bucket at the next site, rinse them thoroughly with deionized or tap water to avoid any potential cross contamination of samples and wetland systems.
- 9) After returning from the field, fill out a COC form, and store the samples with the form on a shelf or in a box at room temperature for storage until delivery (samples may be delivered to the laboratory in batches).

### 9.4 Photographs

Photographs should be taken during macroinvertebrate sampling to gain a better understanding of the submerged aquatic vegetation habitat available for the macroinvertebrate community. First, take a photo of the field station ID on the field sheet before taking any site photos (in lieu of a photo logbook). Then, photograph the contents of the inside of the net, after it is pulled out of the water, for one or more sweeps along the transect (greater heterogeneity of net contents from one sample to another = more photos).

## 10.0 LABORATORY ANALYTICAL METHODS

Macroinvertebrate samples will be analyzed according to procedures outlined in "SOPs for analysis of aquatic macroinvertebrate samples collected from the Great Salt Lake

freshwater wetlands” (Gray, 2009). Macroinvertebrate samples will be examined for taxa present and community composition. Taxa will be identified to the lowest practical taxon. The methodology and quality assurance and quality control procedures for this analysis and analyzing laboratory can be obtained from:

Dr. Lawrence J. Gray, Senior Ecologist (ESA)  
Dept. of Biology, Utah Valley University, 800 W. University Parkway  
Orem, UT 84058  
(801) 863-8558  
FAX: (801) 863-8054  
[grayla@uvu.edu](mailto:grayla@uvu.edu)  
<http://research.uvu.edu/Gray/>

## **11.0 DATA AND RECORDS MANAGEMENT**

Note the date, time, sampler(s), and sampling method on the field sheet (see the note in **Section 9.2**) and COC form as indicated. Monitors should review the field sheet and COC form for completeness and accuracy in the field before leaving the site. Make sure the information on the paperwork is consistent with the information on the sample container label(s).

Upon returning to the office, both the monitor collecting the sample and the field team leader sign/initial that they have reviewed the field sheet. The field sheet is then scanned and the PDF file saved into the shared “Monitors” folder. The original form is placed in the project file. Additionally, a copy of the signed COC form is provided to the database manager.

## **12.0 QUALITY ASSURANCE AND QUALITY CONTROL**

Field replicates should be collected at a minimum rate of 1 replicate for every 10 regular samples, or at a frequency required by a program/project specific quality assurance plan or sampling and analysis plan. To perform the replicate sampling, conduct alternating sweeps along the same transect at ten (10) random sampling points instead of five (5). One set is for the regular composite sample; the other set is for the replicate composite sample. In other words, put the contents of one sweep into one sample jar; then put the contents of the next sweep into the second sample jar. Note on the field sheet or in the field notebook that a replicate was collected. Refer to the program/project specific quality assurance plan or sampling and analysis plan for performance goals for replicate samples.

## **13.0 REFERENCES**

Gray, L.J. 2009. Macroinvertebrates in the wetlands of the Great Salt Lake 2007. Submitted to Utah DWQ. Online at [http://www.deq.utah.gov/Issues/gslwetlands/docs/DEQ\\_GSLwetlands2007ReportLGray.pdf](http://www.deq.utah.gov/Issues/gslwetlands/docs/DEQ_GSLwetlands2007ReportLGray.pdf).

Gray, L.J. 2009. SOPs for analysis of aquatic macroinvertebrate samples collected from the Great Salt Lake freshwater wetlands. Submitted to Utah DWQ. Online at <http://www.deq.utah.gov/Issues/gslwetlands/docs/appendixCLJGrayStandardMethodsJuly2009.pdf>.

Utah Department of Environmental Quality, Division of Water Quality (DWQ). 2009. Development of an assessment framework for impounded wetlands of Great Salt Lake. Draft Report. November 2009. Online at <http://www.deq.utah.gov/Issues/gslwetlands/docs/FinalReport122209.pdf>.

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**Appendix 2 – COC form for macroinvertebrate samples analyzed by Dr. Larry Gray**  
 (U:\WQ\PERMITS\MONITORS\QAQC\Chain of Custody Forms\Wetlands\COC\_macroinvertebrates wetlands\_Gray lab.pdf)

UTAH DIVISION OF WATER QUALITY				MACROINVERTEBRATE CHAIN OF CUSTODY RECORD (Gray Lab, Utah Valley University)			
PROJECT: Great Salt Lake Wetlands – Macroinvertebrate Sample Collection				Net: D-net 500 µm mesh		Preservation: 95% Ethanol	
Sample Date Range:				Method: Open water, composite of 5 sweeps		Length of each sweep (m): 1	
Sample Number	Date Collected	Time Collected	STORET	Site Name	Water Depth (m)	Collector Initials	Remarks/Analysis Requested
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
Relinquished By:				Date:	Time:	REMARKS:	
Received By:				Date:	Time:		
Page ____ of ____							

**Appendix 3 – Field sheet to be used if NOT performing aquatic vegetation measurements on the day of macroinvertebrate sampling**

(U:\WQ\PERMITS\MONITORS\GSL wetlands\2011 Field Forms\GSL Wetlands Data Sheet.pdf)

**GSL Wetlands Data Sheet:  
Open Water Habitat Characteristics**

Wetlands Area \_\_\_\_\_

Site				
Date				
Time				
Water depth, m				
Height of SAV, m				
SAV Cover Class				
SAV Condition				
Fil. Algae Cover Class				
Duckweed Cover Class				

Water Depth: measured to the nearest 0.1 meter

SAV Height: nearest 0.1 meter (if extending to the surface, use water depth value)

SAV Cover Class: extent of SAV coverage of pond bottom

SAV Condition: 1 = decomposing 2 = intact, but stressed 3 = healthy

Filamentous Algae: extent of algae on SAV and/or surface of pond

Duckweed: extent of duckweed on surface of pond

Cover Class	1 = <25%	3 = 50-74%
	2 = 25-49%	4 = 75-100%

Note: Record "0" for cover class if attribute is completely absent.

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# STANDARD OPERATING PROCEDURE FOR COLLECTION OF SEDIMENT SAMPLES IN GREAT SALT LAKE WETLANDS

State of Utah  
Department of Environmental Quality  
Division of Water Quality

Revision 1  
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## 1.0 SCOPE AND APPLICABILITY

This document presents the standard operating procedure (SOP) for the collection of sediment samples in the Great Salt Lake (GSL) wetlands, and applies to any Utah Division of Water Quality (DWQ) monitor or non-DWQ cooperator performing wetlands sampling. Sediment samples collected in the GSL wetlands are typically analyzed for diatoms or chemical constituents.

Diatoms are increasingly used as indicators of water quality and the overall biological integrity of aquatic ecosystems (e.g., Dixit and Smol 1994, Hill et al. 2000, Pan et al. 2000). Diatoms assemblages are diverse with a composition that varies with changes in the physical (i.e., hydrology, chemical) and biological characteristics of their environment (Robinson et al. 2000, Earle et al. 1988). Most importantly in an assessment context, diatom composition is known to vary predictably with changes in water chemistry (Van Dam et al. 1994). As a result, the composition of diatoms can be used to directly quantify the biological integrity of wetland ecosystems.

The composition and relative abundance of pelagic diatom taxa varies seasonally, so a single collection from a water sample may not capture the average or most limiting abiotic conditions in a wetland. However, diatom collection from sediment integrates short-term variation and is likely a better indicator of wetland health. As diatoms die they settle to the bottom of wetlands. Long-term compositional changes are recorded in the sediment because diatoms have a silica shell that does not decompose and can be used to differentiate among diatoms species. The top 1 cm of sediment is collected to estimate changes in composition that have occurred over approximately a single productive season—spring through fall. Therefore these samples are ideally collected once per year at the end of the productive season.

Diatom composition also varies spatially within a wetland. Within site variation can provide insight into habitat heterogeneity, however DWQ is primarily concerned with among wetland comparisons, which is best accomplished by maximizing among-within-site compositional variation. To minimize within-site variation a total of 5 samples are collected and composited because this represents the approximate asymptote of increases in species richness with increasing numbers of composite samples (Weilhoefer and Pan 2006), which improves among site multivariate comparisons of biological composition (Cao et al. 2002).

Sediment chemistry plays an important role in wetlands ecosystems. Numerous studies (summarized in Hoven and Miller 2007) have shown that submergent and emergent vegetation in wetlands primarily derive their nutrient requirements from sediments rather than from the water column. Nutrients and chemical contaminants undergo sedimentation in wetlands where they can be stored for long periods altering both local and downstream water chemistry (Johnstone 1991). For many chemical parameters the temporal variability is lower in sediments, especially composite samples, than concentrations obtained from the water column, so sediment samples may provide a

more integrative measure of background chemical conditions than water chemistry alone.

This SOP has been created for DWQ GSL wetland monitoring purposes and is a modification of procedures described in *Survey of the Nation's Lakes: Field Operations Manual* (EPA, 2007).

## **2.0 SUMMARY OF METHOD**

### **2.1 Sediment Diatoms**

Each sample is comprised of a composite of 5 core samples (the top 1 cm of each core is retained). Core samples are collected with a modified KB coring device. The five core samples used in the composite are collected at five random points along a 100 m transect. The samples are combined into one 250 ml plastic container and stirred/shaken vigorously for 30 seconds to homogenize the sediment.

### **2.2 Sediment Chemistry**

Each sample is comprised of a composite of 5 core samples (10 cm of each core is retained). Core samples are collected with a modified diameter KB coring device. The five core samples used in the composite are collected at five random points along a 100 m transect. The samples are combined into one 1000 ml plastic container, stirred/shaken vigorously for 30 seconds to homogenize the sediment.

## **3.0 DEFINITIONS**

IW: impounded wetland(s)

PVC: polyvinyl chloride

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

cm: centimeter(s)

ml: milliliter(s)

m: meter(s)

## **4.0 HEALTH AND SAFETY WARNINGS**

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample

visit is recommended to be rescheduled. If hazardous weather conditions such as lightning arise during sampling, personnel should cease sampling and move to a safe location.

All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

## 5.0 CAUTIONS

Care should be taken to not place the corer into water that has a sediment plume caused by the sampler walking to the site and to not core into sediment that has been visibly disturbed. Also, attempt to avoid trapping submerged aquatic vegetation while coring.

## 6.0 INTERFERENCES

Disturbance of the sediment by sampler's footsteps may cause collection of a non-representative core sample (sediment thickness and organic layer may be altered). It is critical that the corer strikes minimally disturbed surface sediments, especially for diatom sampling.

## 7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

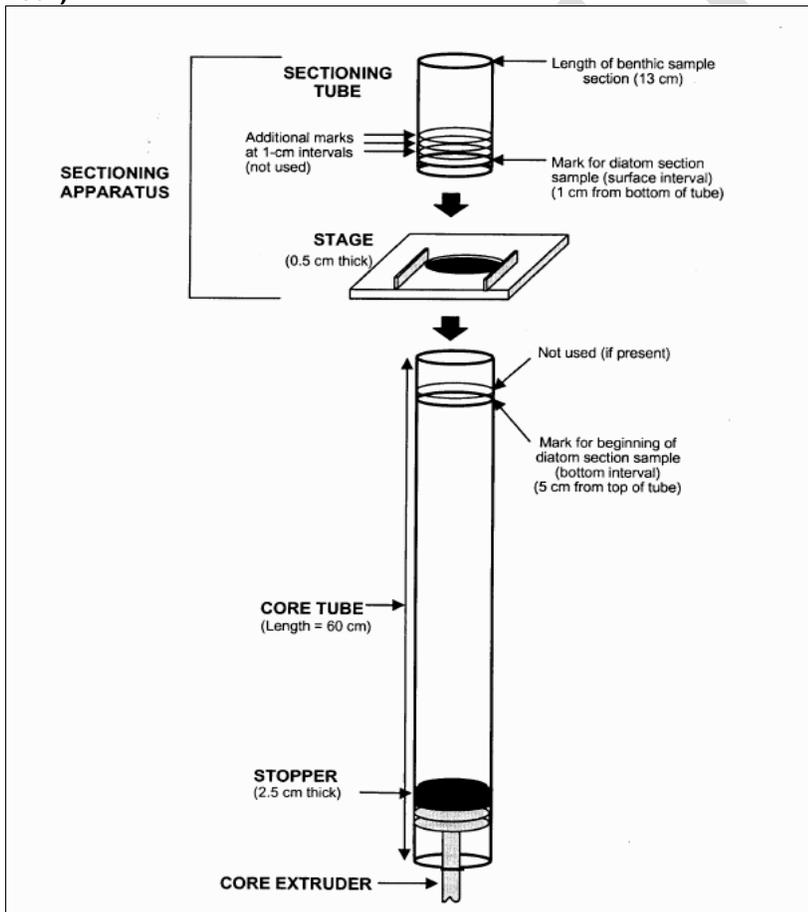
All personnel collecting wetlands sediment samples must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at DWQ along with the official hard copy of this SOP.

## 8.0 EQUIPMENT AND SUPPLIES

- \_\_\_\_\_ Copy of this SOP
- \_\_\_\_\_ Laser range finder or reel tape and PVC posts to mark ends of transect
- \_\_\_\_\_ Field sheet, field notebook, pens and pencils
- \_\_\_\_\_ Printed list of sets of random numbers (from 0 to 100)
- \_\_\_\_\_ Plastic, high-sided utility sled or float tube (fishing type) for toting equipment
- \_\_\_\_\_ 250 ml plastic jars for diatom samples (such as Cole Parmer item# SI-06101-40)
- \_\_\_\_\_ 1000 ml glass jars for chemistry samples (such as Cole Parmer item# SI-99535-44)

- \_\_\_\_\_ 6.35 cm-diameter modified KB sediment corer (**Figure 1**), stage, plunger, rubber corks and 1.5 inch plastic putty knife
- \_\_\_\_\_ Meter stick made of PVC and marked in centimeters for measuring water depth
- \_\_\_\_\_ Sample labels (**Figures 2 and 3**)
- \_\_\_\_\_ Sharpies, pens, and pencils
- \_\_\_\_\_ Chain of Custody (COC) forms (see **Appendix 2**)
- \_\_\_\_\_ Cooler and wet ice

**Figure 1. Illustration of the modified KB corer and sectioning apparatus (EPA, 2007).**



**Figure 2. Sample label for sediment diatom samples  
(U:\WQ\PERMITS\MONITORS\Labels\diatoms (5163or5523).doc)**

DIATOMS IN SEDIMENT - Rushforth Phycology
Site ID: _____
_____
STORET: _____ Replicate #: _____
Samplers: _____ Date: _____
Collection Method: _____ Composite of 5 cores (top 1 cm of each)

**Figure 3. Sample label for sediment chemistry samples  
(U:\WQ\PERMITS\MONITORS\Labels\ sed chem (5163or5523).doc)**

SEDIMENT CHEMISTRY Laboratory: _____
Site ID: _____
_____
STORET: _____ Replicate #: _____
Samplers: _____ Date: _____
Collection Method: _____
Analyses Requested: _____

## 9.0 PROCEDURE

### 9.1 Setting up the Transect

#### 9.1.1 Impounded Wetland

- 1) Prepare sample labels (**Figures 2 and 3**) and bottles for sediment diatom and/or sediment chemistry samples, depending on what samples are to be collected for the specific project.
- 2) Gather all necessary equipment in the sled or float tube and walk into the IW away from the outlet.
- 3) Establish a transect about 5 meters farther into the impounded wetland (away from the outlet) from where other types of samples have already been collected to avoid sampling an area that has been previously disturbed.
- 4) Set up the 100 m transect perpendicular to the outflow, using laser range finder or reel tape. Using this technique, the transect will run East-West for a majority of GSL IW.
- 5) Make sure each end of the transect is at least 50 m from any impoundment.
- 6) Mark each end of the transect with a PVC post.

#### 9.1.2 Fringe Wetland

Transect location and orientation to be determined on a project/site specific basis.

### 9.2 Sediment Sample Collection

#### 9.2.1 Sediment Diatoms

- 1) Use the list of randomly generated numbers to look up a set of 5 random sampling points, which correlate to meters from the transect start.
- 2) Starting at the western or northernmost end of the transect, pace off steps to the lowest random number generated.
- 3) Measure and record water depth to the nearest 0.1 m with the metered PVC stick.
- 4) Push the core sampler (just the core tube) into the surface sediment about 40 centimeters (about 15 inches).
- 5) Place a rubber stopper on the top of the corer such that suction prevents material from leaking out when the core is retrieved.

- 6) Push and tilt the corer to loosen/break the suction of the corer to the sediment on the outside of the corer. When the corer is relatively free from the surrounding sediment, pull the corer back to the surface.
- 7) Place the plunger into the bottom of the corer. Remove the rubber stopper from the top of the corer.
- 8) Allow the flocculent material within the core tube to settle.
- 9) Using the plunger, extrude the sample towards the top of the corer until the sediment surface is about an inch from the top and any loose flocculent material that did not settle out with the sediment is pushed out.
- 10) Affix the clean stage to the top of the corer and extrude the core till the surface sediment is just below the stage.
- 11) Use a plastic syringe to collect and discard the small amount of water from the surface of the sediment as carefully as possible.
- 12) Place the Plexiglas sectioning apparatus (marked with a line 1 cm from the bottom) on the stage directly over the coring tube. Slowly extrude the sediment core into the attached sectioning apparatus until the top of the sediment reaches the 1-cm line on the sectioning tube. Slide the top 1 cm section of sediment towards the opening on one side of the stage. If necessary, use a clean putty knife to slide the 1 cm core into the plastic container. Transfer the entirety of that centimeter of surface sediment into an appropriately labeled 250 ml plastic collection jar.
- 13) Repeat Steps 3 through 12 for the 4 remaining random sampling points, compositing each individual sample into the same collection jar. Rinse the corer and components with native water (at the point just sampled) between each sampling point to prevent carryover of sediment from one sampling point to another.
- 14) Return to the vehicle or staging area after collecting the composite sample. Seal the jar with electrical tape around the lid. Shake the sample vigorously for 30 seconds to homogenize.
- 15) Affix the sample label and cover with clear tape.
- 16) Place the sample container in a dark cooler on ice in the vehicle for transportation.
- 17) Between sampling sites, rinse the corer apparatus thoroughly with tap water or deionized water.
- 18) Upon returning from the field, fill out a COC form, and store the samples with the form in the freezer for storage until delivery (samples may be delivered to the

laboratory in batches). Alternatively, deliver the samples to the laboratory the day of sampling.

- 19) At the end of the sampling trip, all equipment (sampling devices, boats, and trailers, etc.) used in the collection of water samples from the waters of the state of Utah that come in direct contact with the waterbody must be cleaned and disinfected according to the document "Standard Operating Procedures to Prevent the Spread of Invasive Species".

### 9.2.2 Sediment Chemistry

NOTE: If collecting both sediment diatom samples and sediment chemistry samples, the samples can be collected at the same time. Use the same sampling locations along the transect for diatoms, but at each location, collect a second core for sediment chemistry at a slightly different, undisturbed point.

- 1) Use the list of randomly generated numbers to look up a set of 5 random sampling points, which correlate to meters from the transect start.
- 2) Starting at the western or northernmost end of the transect, pace off steps to the lowest random number generated.
- 3) Measure and record water depth to the nearest 0.1 m with the metered PVC stick.
- 4) Push the core sampler (just the core tube) into the surface sediment about 40 centimeters (about 15 inches).
- 5) Place a rubber stopper on the top of the corer such that suction prevents material from leaking out when the core is retrieved.
- 6) Push and tilt the corer to loosen/break the suction of the corer to the sediment on the outside of the corer. When the corer is relatively free from the surrounding sediment, pull the corer back to the surface.
- 7) Place the plunger into the bottom of the corer. Remove the rubber stopper from the top of the corer.
- 8) Allow the flocculent material within the core tube to settle.
- 9) Using the plunger, extrude the sample towards the top of the corer until the sediment surface is about an inch from the top and any loose flocculent material that did not settle out with the sediment is pushed out.
- 10) Affix the clean stage to the top of the corer and extrude the core till the surface sediment is just below the stage.

- 11) Use a plastic syringe to collect and discard the small amount of water from the surface of the sediment as carefully as possible.
- 12) Place the Plexiglas sectioning apparatus (marked with a line 10 cm from the bottom) on the stage directly over the coring tube. Slowly extrude the sediment core into the attached sectioning apparatus until the top of the sediment reaches the 10-cm line on the sectioning tube. Slide the top 10 cm section of sediment towards the opening on one side of the stage. If necessary, use a clean putty knife to slide the 10 cm core into the plastic container. Transfer the entirety of extruded sediment into an appropriately labeled 1000 ml plastic collection jar.
- 13) Gently remove any stems/roots found in the sediment sample.
- 14) Repeat Steps 3 through 13 for the 4 remaining random sampling points, compositing each individual sample into the same collection jar. Rinse the corer and components with native water (at the point just sampled) between each sampling point to prevent carryover of sediments from one sampling point to another.
- 15) Return to the vehicle or staging area after collecting the composite sample. Seal the jar with electrical tape around the lid. Shake the sample vigorously for 30 seconds to homogenize.
- 16) Affix the sample label and cover with clear tape.
- 17) Place the sample container in a dark cooler on ice in the vehicle for transportation.
- 18) Between sites, thoroughly rinse the sediment corer, stage and other collection devices between sites using tap water and a triple rinse with deionized water. If rinsing does not visibly remove sediment from the sampling equipment, use a brush and soap and water to scrub away any visible particles, followed by thorough rinsing with tap water and deionized water.
- 19) After returning from the field, fill out a COC form, and store the samples with the form in the freezer for storage until delivery or shipment (samples may be delivered to the laboratory in batches). Alternatively, deliver or ship the samples to the laboratory the day of sampling.
- 20) At the end of the sampling trip, all equipment (sampling devices, boats, and trailers, etc.) used in the collection of water samples from the waters of the state of Utah that come in direct contact with the waterbody must be cleaned and disinfected according to the document "Standard Operating Procedures to Prevent the Spread of Invasive Species".

## 10.0 LABORATORY ANALYSES

### 10.1 Sediment Diatoms

Diatom samples undergo an acid digestion to remove interfering organic matter from the sample. Next, slides are prepared and examined under a microscope. Species are counted and identified to the lowest practical taxon. Identification is made based on cell wall structure, symmetry, valve structure, and other physical characteristics and both standard taxonomic works and the laboratory's slide collections are referenced. Analysis is quantitative because of sample volume tracking during slide preparation and enumeration using digital microscopy. The specific methodology and quality assurance and quality control procedures for this analysis and analyzing laboratory can be obtained from:

Dr. Samuel R. Rushforth  
Rushforth Phycology, LLC  
Orem, UT  
(801) 225-5736  
[sam@rushforthphycology.com](mailto:sam@rushforthphycology.com)  
<http://rushforthphycology.com/201.html>

### 10.2 Sediment Chemistry

Sediment samples are typically analyzed for nutrients, metals, and/or trace elements using EPA or equivalent methods, depending on specific project goals. The specific methodology and quality control samples run for these analyses can be obtained from the analyzing laboratory. Multiple laboratories may analyze sediment chemistry samples depending on the contract for the project. Any laboratory utilized will have QA/QC procedures and documentation approved by DWQ.

## 11.0 DATA AND RECORDS MANAGEMENT

Note the date, time, sampler(s), and sampling method on the field sheet and COC form as indicated. Monitors should review the field sheet and COC form for completeness and accuracy in the field before leaving the site. Make sure the information on the paperwork is consistent with the information on the sample container label.

Upon returning to the office, both the monitor collecting the sample and the field team leader sign/initial that they have reviewed the field sheet. The field sheet is then scanned and the PDF file saved into the shared "Monitors" folder. The original form is placed in the project file.

The data from the field form is entered into the water quality database at the same time as the other field data collected for that day (ideally with 2 weeks from the date of the site visit).

## 12.0 QUALITY ASSURANCE AND QUALITY CONTROL

Field replicates for sediment samples should be collected at a minimum rate of 1 replicate for every 10 regular samples, or at a frequency required in a program/project specific quality assurance plan or sampling and analysis plan. To perform the replicate sampling, a repeat sampling should be performed along a second transect established at least 5 m toward open water from the first transect (to avoid disturbed sediments). Note on the field sheet or in the field notebook that a replicate was collected. Refer to the program/project specific quality assurance plan or sampling and analysis plan for performance goals for replicate samples.

**Comment [t1]:** Alternatively: To perform the replicate sampling, collect alternating core samples along the same transect at ten (10) random sampling points instead of five (5). One set is for the regular composite sample; the other set is for the replicate composite sample. In other words, put the contents of one core into one sample jar; then put the contents of the next core into the second sample jar. (This is what we're doing for bug sampling)

Another option is to collect 2 cores at each point along the transect (one of them is the regular, one is the replicate). But one concern is there could be too much disruption of the top 1 cm for the diatoms sample.

## 13.0 REFERENCES

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DRAFT









# STANDARD OPERATING PROCEDURE FOR DETERMINING PERCENT COVER OF AQUATIC VEGETATION IN GREAT SALT LAKE WETLANDS

State of Utah  
Department of Environmental Quality  
Division of Water Quality

Revision 1  
Effective [DATE]

**REVISION PAGE**

Date	Revision #	Summary of Changes	Sections	Other Comments
[insert]	1	not applicable	not applicable	Creation of document, began document control/revision tracking

DRAFT

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## 1.0 SCOPE AND APPLICABILITY

This document presents the standard operating procedure (SOP) for measuring percent areal cover of submerged aquatic vegetation (SAV), filamentous algae, and floating aquatic vegetation in the Great Salt Lake wetlands, and applies to any Utah Division of Water Quality (DWQ) monitor or non-DWQ cooperator performing wetlands monitoring.

Percent cover of SAV (and percent change in SAV cover) is an important indicator of the overall ecological health of a wetland, and is used by the DWQ as a key component in a multi-metric index (MMI) tool used to assess wetland condition. SAV provides protective habitat for macroinvertebrates and other organisms, stabilization of sediments, nutrient cycling and attenuation, and attenuation of other pollutants. 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).

Observations and visual estimations of the percent cover of algae, particularly algal mats, and floating vegetation, primarily duckweed, are performed concurrently with the SAV measurement.

This SOP has been created for DWQ monitoring and is based on a modification of procedures described in the following documents: Miller and Hoven (2007), Hoven and Miller (2009), 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 making visual estimations of percent cover of SAV (and algae and duckweed) within 5 randomly selected quadrants placed along a 100-m transect.

## 3.0 DEFINITIONS

IW: impounded wetland(s)

PVC: polyvinyl chloride

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

m: meters

#### 4.0 HEALTH AND SAFETY WARNINGS

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

#### 5.0 CAUTIONS

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.

#### 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 sheet/notebook. If conditions inhibit the ability to make the SAV measurement, this should be noted in the field notebook and the site should be revisited.

#### 7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

Monitors performing SAV measurements must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at UDWQ along with the official hard copy of this SOP.

#### 8.0 EQUIPMENT AND SUPPLIES

- \_\_\_\_\_ Copy of this SOP
- \_\_\_\_\_ PVC frame (1m<sup>2</sup>, dimensions 2 m by 0.5 m) with foam for flotation and markings to aid in % cover estimate (**Figure 1**)
- \_\_\_\_\_ Laser range finder or reel tape and PVC posts to mark ends of transect
- \_\_\_\_\_ Field sheet (**Appendix 2** is an example of a project-specific field sheet), field notebook, pens and pencils

- \_\_\_\_\_ Printed list of sets of random numbers (from 0 to 100)
- \_\_\_\_\_ Camera
- \_\_\_\_\_ Plastic, high-sided utility sled or float tube (fishing type) for toting equipment
- \_\_\_\_\_ Meter stick made of PVC and marked in centimeters for measuring water depth and SAV height

## 9.0 PROCEDURES

### 9.1 Setting up the Transect

#### 9.1.1 Impound Wetlands

- 1) Locate the pond outlet.
- 2) Gather the equipment in the sled or float tube and walk approximately 100 m into the IW and away from the outlet.
- 3) Set up the 100 m transect perpendicular to the outflow, using laser range finder or reel tape. Using this technique, the transect will run East-West for a majority of GSL IW.
- 4) Make sure each end of the transect is at least 50 m from any impoundment.
- 5) Mark each end of the transect with a PVC post. To minimize disturbance of sediments avoid moving within the two posts within the pond when setting up the transect. Individuals on each end of the transect should start > 100 m apart and then move toward each other to set the posts.

#### 9.1.2 Fringe Wetlands

Transect location and orientation to be determined on a project/site specific basis.

### 9.2 Performing the SAV Measurement and Associated Observations

- 1) Use the list of randomly generated numbers to look up a set of 5 random sampling points, which correlate to the number of paces (meters) from the transect start.
- 2) Starting at the western or northernmost end of the transect, pace off steps to the lowest randomly determined sample location.
- 3) Floating the PVC frame on the water surface, lay the long side of the frame perpendicular to the transect at the established distance (m) along the transect, centered on the transect line. Look through the frame and estimate percent cover, 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.

- 4) Cover is estimated directly as the percentage (0 to 100%) of the plot area covered by the vegetation group under consideration. Use the continuous range of values from 0 to 100% when estimating cover for an entity within the PVC frame. For values < 1%, record 0.1%. **Figure 2** is an excerpt from EPA's NWCA Field Operations Manual and although it is for a much larger assessment area (100m<sup>2</sup>), the figure may aid in estimating percent cover.
- 5) Record the estimated percent cover of SAV, floating vegetation, and algal mats, SAV height, and water depth as indicated on the field sheet (**Appendix 2**). Also make note of potentially interfering conditions such as turbidity or wind.
- 6) Repeat Steps 3-5 for the 4 remaining random sampling points.

### 9.3 Site Photos

Photos should be taken during each site visit to qualitatively capture SAV, duckweed, and algae cover at the site.

- 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) Using best judgment, take any other photos that may aid in capturing conditions at the site.

## 10.0 DATA AND RECORDS MANAGEMENT

All measurements of % cover vegetation, descriptions of the transect and random sampling points, and other field observations should be recorded on the field sheet.

Monitors must review the field sheet for completeness and accuracy in the field before leaving the site.

Upon returning to the office, both the monitor performing the measurement and the field team leader (or another reviewer if the field team leader performed the measurement) sign/initial that they have reviewed the field sheet. The field sheet is then scanned and

the PDF file saved into the shared "Monitors" folder. The original form is placed in the project file.

The data from the field sheet is uploaded into the water quality database staging area at the same time as the other field data collected for that day (ideally with 2 weeks from the date of the site visit).

## 11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Replicate field measurements will be performed at a minimum rate of 10% (1 replicate for every 10 regular measurements). To perform the replicate measurement, the other member of the field team should perform the percent cover estimation on a second transect established at least 5 m toward open water from the first transect (to avoid disturbed sediments). Record the replicate measurement in the appropriate area on the field sheet. Refer to the program/project specific quality assurance plan or sampling and analysis plan for performance goals for replicate measurements.

**Comment [t1]:** Alternatively: To perform the replicate sampling, conduct alternating measurements along the same transect at ten (10) random sampling points instead of five (5). One set is for the regular measurement; the other set is for the replicate measurement. (This is how we're doing the bug sampling)

## 12.0 REFERENCES

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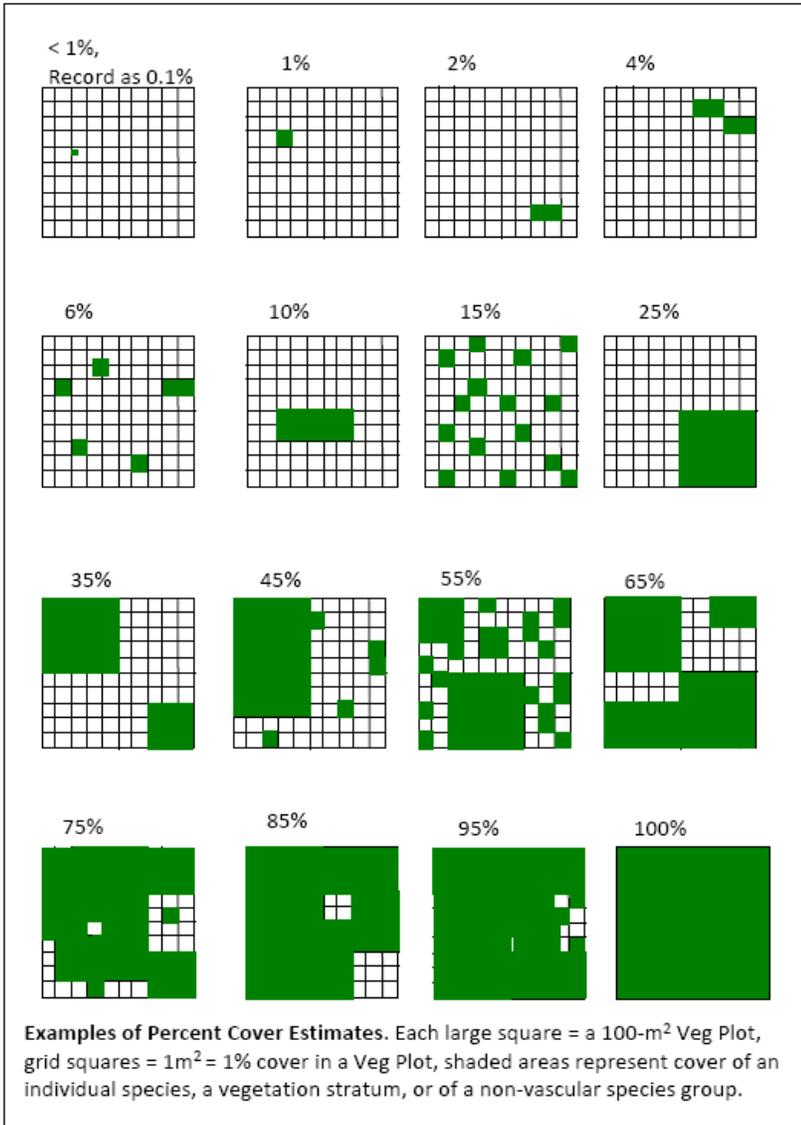
### 13.0 FIGURES

**Figure 1 – Photograph of PVC quadrant frame**

[insert photo]

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**Figure 2 – Percent cover estimation guidance (from EPA’s NWCA Field Operations Manual, 2011)**







**Appendix 2 – Field sheet example**

(U:\WQ\PERMITS\MONITORS\GSL wetlands\2011 Field Forms\2011 GSLWet SAV Condition Sheet.pdf)

**2011 GSL Impounded Wetlands SAV Condition Sheet**

Wetlands Area \_\_\_\_\_  
Date & Time \_\_\_\_\_ Sampler(s) \_\_\_\_\_

**Regular Measurement:**

Quadrant number	1	2	3	4	5	Average
Quadrant location along transect (m)						
Water depth (cm)						
Height of SAV (cm)						
SAV cover (%)						
<sup>1</sup> SAV condition						
<sup>2</sup> Filamentous algae cover (%)						
Duckweed cover (%)						

<sup>1</sup>SAV condition: 1 = Decomposing/senescing, 2 = Intact, but stressed, 3 = Healthy  
<sup>2</sup>Filamentous algae: Extent of algae on SAV and/or surface of pond (%)

**Replicate Measurement:**

Quadrant number	1	2	3	4	5	Average
Quadrant location along transect (m)						
Water depth (cm)						
Height of SAV (cm)						
SAV cover (%)						
<sup>1</sup> SAV condition						
<sup>2</sup> Filamentous algae cover (%)						
Duckweed cover (%)						

Other Observations or Comments:

# STANDARD OPERATING PROCEDURE FOR COLLECTION OF ZOOPLANKTON SAMPLES IN GREAT SALT LAKE WETLANDS USING A HORIZONTAL TOW

State of Utah  
Department of Environmental Quality  
Division of Water Quality

Revision 1  
Effective [DATE]

**REVISION PAGE**

Date	Revision #	Summary of Changes	Sections	Other Comments
[insert]	1	not applicable	not applicable	Adapted from GSL wetlands field manual and put into new standardized format, began document control/revision tracking

DRAFT

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## 1.0 SCOPE AND APPLICABILITY

This document presents the standard operating procedure (SOP) for collecting zooplankton samples in Great Salt Lake wetlands that are shallow enough to facilitate the need for a horizontal tow sampling technique. Shallow wetlands, for the purpose of this SOP, are defined as those that are not deep enough for standard plankton collection techniques using a vertical tow (a vertical tow collects an integrated water column sample, moving the net vertically through the water column but keeping the net at least 0.5 m from the bottom).

This SOP applies to any Utah Division of Water Quality (DWQ) monitor or cooperator performing wetlands sampling. This SOP was developed with assistance from Dr. Lawrence Gray (Utah Valley University) and is a modification of procedures described in the following documents: (Baker; et al. 1997 and U.S. EPA 1998).

Zooplankton are heterotrophic plankton and serve as the link between primary producers (phytoplankton) and predators, such as aquatic insects and fish. The abundance and species composition of the zooplankton are often good indicators of the physical, chemical, and habitat conditions of the GSL wetlands (Gray 2011).

This procedure, based on one sample collection point, gives a qualitative to semi-quantitative snapshot of zooplankton populations. In each wetland there may be spatial variation of zooplankton populations, especially if predatory fish are present in the open water. There may also be seasonal variation depending upon the reproductive periods of the species present.

## 2.0 SUMMARY OF METHOD

Zooplankton samples are collected with a standard zooplankton tow net (mesh size 243  $\mu\text{m}$ ) using a horizontal tow technique. Each sample is a composite consisting of five 5-meter tows. Net contents are rinsed into a sample container and preserved with 95% ethanol. Care is taken not to include bottom materials and areas with an abundance of duckweed or surface mat algae are avoided.

## 3.0 DEFINITIONS

DI – deionized or distilled water

m – meter(s)

ml – milliliter(s)

SAV – submerged aquatic vegetation

$\mu\text{m}$  – micrometer(s)

#### **4.0 HEALTH AND SAFETY WARNINGS**

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFD's), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

#### **5.0 CAUTIONS**

Care should be taken not to include bottom materials disturbed by wading or collection of benthic samples. Areas with duckweed or surface mat algae should be avoided.

Rinse nets thoroughly with DI water between sites to avoid any potential cross contamination of samples and wetland systems.

Samples should be preserved in the field.

Tow nets should be pulled at an appropriate, constant speed so that the net does not sink to the bottom.

#### **6.0 INTERFERENCES**

Anything that makes the sample more difficult to visualize in the laboratory can cause interference with results. Try to minimize duckweed, algae, sediment, etc. in the sample.

High turbidity or dense SAV may also interfere with sample collection (net clogging or dragging).

Samples should not be exposed to extreme cold or hot temperatures during storage (not in a hot vehicle or in a freezer).

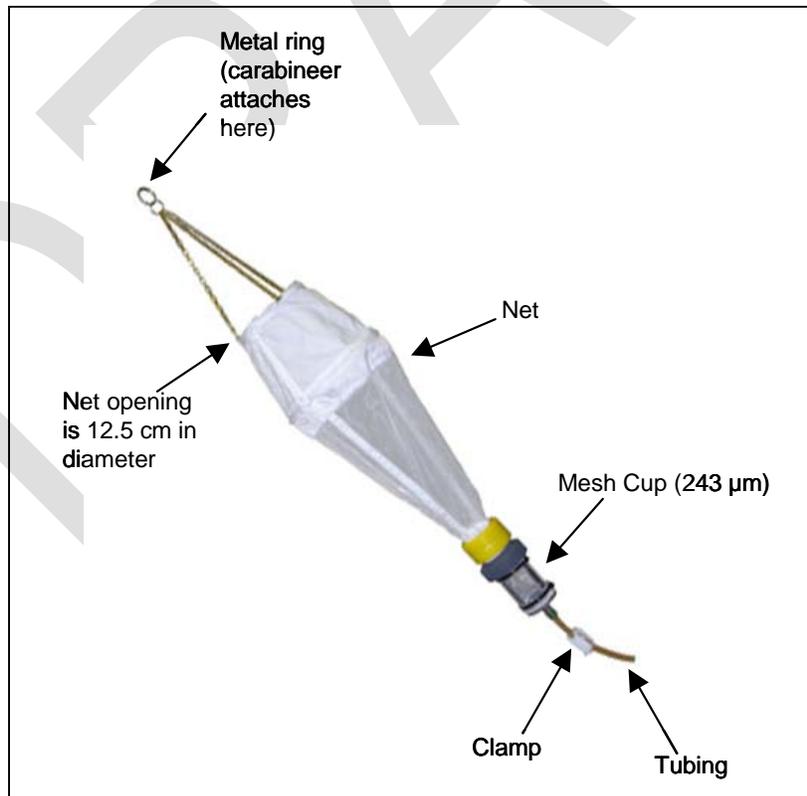
#### **7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES**

Monitors collecting zooplankton samples must read this SOP annually and acknowledge they have done so via a signature page (see **Appendix 1**). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new monitor is competent in carrying out this SOP. The signature page will be kept on-file at UDWQ along with the official hard copy of this SOP.

## 8.0 EQUIPMENT AND SUPPLIES

- \_\_\_ Plastic, high-sided utility sled or float tube (fishing type) for toting equipment
- \_\_\_ 243  $\mu\text{m}$  Wisconsin net with tube and clamp (**Figure 1**)
- \_\_\_ 7-8 m rope (marked off at every meter) with carabineer clip at one end
- \_\_\_ 250 ml plastic conical bottom centrifuge tubes (e.g. Corning 250ml polypropylene centrifuge tube, Fisher cat# 05-538-53)
- \_\_\_ 95% ethanol
- \_\_\_ DI rinse water in squirt bottles
- \_\_\_ Pencils and sharpies
- \_\_\_ Clear tape
- \_\_\_ Zooplankton sample labels (**Figure 2**)
- \_\_\_ Chain of Custody (COC) form (**Appendix 2**)
- \_\_\_ Field sheets and field notebook (Note: the same field sheet is used for both zooplankton and macroinvertebrate sampling)
- \_\_\_ Electrical tape
- \_\_\_ Cooler and wet ice

**Figure 1. Wisconsin net set up for zooplankton sampling**



## 9.0 PROCEDURE

### 9.1 Sample Collection

- 1) Prior to each use, carefully clean and thoroughly rinse the interior of the plankton net and mesh cup with DI water. Collections will be made using a 243- $\mu$ m mesh Wisconsin-style plankton net with a 12.5 cm opening.
- 2) Carefully inspect the net and mesh cup for holes or tears.
- 3) Attach the mesh cup (243- $\mu$ m) to the end of the net and secure.
- 4) Make sure the clamp is on the tubing and closed securely.
- 5) Attach the metal ring of the plankton net to a calibrated rope with markings every 1 m, using the carabineer.
- 6) Walk at least 5 m towards open water away from where macroinvertebrate collection took place (or any other activity disturbing bottom sediments).
- 7) Toss the 243  $\mu$ m mesh zooplankton net into the open water about 5 m out from the sampler, using a lasso technique. Care should be taken to place the net into water that has not been clouded up with the sediment you disturbed when walking.
- 8) Start pulling the net back once it is about half-way submerged (i.e. let the net settle into the water but do not let it sink). Pull the net back at an upward angle so that the opening does not dip downwards towards the bottom. The goal is to sample the water column, not the bottom or surface.
- 9) Once you have the net retrieved, pick it up out of the water immediately to prevent backwash and loss of sample. If vegetation is present in the net when you retrieve it, pull it out gently and discard.
- 10) Turn your body slightly to the right and repeat the toss as described above without emptying the net.
- 11) Repeat steps 7.0-10.0 until you have made a total of 5 tows (to form a composite sample).

### 9.2 Sample Processing and Preservation

- 1) Return to the vehicle or staging area with the net after collecting the sample.
- 2) Carefully remove the 243  $\mu$ m mesh cup from the net (clamp on tubing should be closed).
- 3) Hold the cup and tubing over a 250 ml centrifuge tube (hereafter referred to as the sample container) and open the clamp. Some water will drain from the tubing into the sample container.
- 4) Use just enough DI water to rinse the remaining sample from the mesh cup so that the sample container is three-fourths of the way full with sample + water.

- 5) Fill the sample container the rest of the way with 95% ethanol (leaving little to no headspace) and replace cap. Seal the jars with electrical tape around the lid to prevent leakage.
- 6) Prepare the sample label (**Figure 2**), attach the sample label to the sample container, and cover the label with clear tape.
- 7) Place samples in a cooler with wet ice. These samples do not need to be stored on ice but they cannot withstand high summer temperatures and should remain cool.
- 8) Before using the zooplankton net at the next site, rinse the net thoroughly with DI water to avoid any potential cross contamination of samples and wetland systems.
- 9) After returning from the field, fill out a COC form, and store the samples with the form on a shelf or in a box at room temperature for storage until delivery (samples may be delivered to the laboratory in batches).

**Figure 2. Sample label** (U:\WQ\PERMITS\MONITORS\Labels\zooplanktonHT\_Gray lab\_label.doc)

<u>ZOOPLANKTON</u> (95% ETOH) - Gray Lab	
Site ID:	_____
STORET:	_____ # Bottles: <u>1 of 1</u>
Samplers:	_____ Date: _____
Water Depth (m):	_____
Collection Method:	<u>Composite of 5 horizontal tows (each tow 5 m)</u>

## 10.0 LABORATORY ANALYTICAL METHODS

Zooplankton samples will be examined for taxa present and community composition. Taxa will be identified to the lowest practical taxon. At least 100-200 individuals will be counted and identified from each sample. The methodology and quality assurance and quality control procedures for this analysis and analyzing laboratory can be obtained from:

Dr. Lawrence J. Gray, Senior Ecologist (ESA)  
 Dept. of Biology, Utah Valley University, 800 W. University Parkway  
 Orem, UT 84058  
 (801) 863-8558  
 FAX: (801) 863-8054  
[grayla@uvu.edu](mailto:grayla@uvu.edu)  
<http://research.uvu.edu/Gray/>

## 11.0 DATA AND RECORDS MANAGEMENT

Note the date, time, sampler(s), and sampling method on the field sheet as indicated. Monitors should review the field sheet for completeness and accuracy in the field before leaving the site. Make sure information on the field sheet is consistent with the information on the sample container label.

Upon returning to the office, both the monitor collecting the sample and the field team leader sign/initial that they have reviewed the field sheet. The field sheet is then scanned and the PDF file saved into the shared "Monitors" folder. The original form is placed in the project file.

The data from the field form is entered into the water quality database at the same time as the other field data collected for that day (ideally with 2 weeks from the date of the site visit).

## 12.0 QUALITY ASSURANCE AND QUALITY CONTROL

Replicate zooplankton samples should be collected at a minimum rate of 1 replicate for every 10 regular samples. The replicate sample should be collected by the same field team member who performed the associated normal sample collection. To perform the replicate sampling, clean the net after processing the first sample, return the same location where first sample was located (or use two nets), turn about 45 degrees, walk another 5 m into open water, and collect the replicate sample following the procedures in **Section 9.1**. Note on the field sheet that a replicate was collected. Refer to the program/project specific quality assurance plan or sampling and analysis plan for performance goals for replicate measurements.

## 13.0 REFERENCES

Baker, John R., David V. Peck, and Donna W. Sutton (editors). 1997. Environmental Monitoring and Assessment Program Surface Waters: Field Operations Manual for Lakes. EPA 620-R-97-001. USEPA, Washington D.C.

Gray, L.J. 2011. Macroinvertebrate and zooplankton communities in the impounded wetlands of the Great Salt Lake May-November 2010. Completion Report prepared for the Utah Department of Environmental Quality, Division of Water Quality, SLC, UT.

U.S. Environmental Protection Agency. 1998. Lake and reservoir bioassessment and biocriteria: Technical guidance document. EPA 841-B-98-007. Office of Wetlands, Oceans and Watersheds, USEPA, Washington, D.C.





