DEVELOPMENT OF A FRAMEWORK APPLICABLE FOR MANAGED WETLANDS: STATE-AND-TRANSITION MODELS FOR WETLAND HABITAT ASSESSMENT AND MANAGEMENT

Addendums to 2015 Procedures Manual for 2016 Field Season

Beavertail Point, Grays Lake National Wildlife Refuge. Photo by A. Henry

INTERMOUNTAIN WEST WETLANDS WORKING GROUP

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Methodology for 2016 will follow the 2015 procedures manual except for changes as outlined below. New methods and additions are in red. Clarifications are also included for aspects where participants have had questions.

If you have questions during the 2016 field season, contact:
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CHAPTER 1: INTRODUCTION

Page 4 Study Area: We are excited to have four additional NWRs participate in the project during 2016, including three refuges in Region 6 and one refuge in the Pacific Southwest Region: Tule Lake NWR (R8), Ouray NWR (R6), Bear River MBR (R6), and Red Rock Lakes NWR (R6).

CHAPTER 2: SURVEYS AND MONITORING

Page 14, Ocular observations and Page 15, rake observations
It is very important to identify all vegetation present to the species level. If that is not possible (e.g., flowers, seeds, etc. are lacking), note in the comments what species it could be, rather than just genus spp. For example:

1. *Ranunculus* spp. could be one of the submerged aquatic species or a wet meadow emergent species that has germinated in a semi-permanently flooded wetland area during a dry period. The growth forms of these 2 groups of Ranunculus are very different, so please note in the comments if it is one of the submerged aquatic species. If you know the emergent Ranunculus species present at your location, please record those in the comments as potential species.
2. *Potamogeton* spp: Pondweeds can usually be narrowed down to one of several species depending on presence of floating leaves and shape of submerged leaves (see SAV cheat sheet attached to distribution email for characteristics). For example, if it is one the narrow-leaved Potamogeton with no floating leaves, please note the potential species it could be in the comments.

In addition, please collect a sample of the unidentified plant to see other participants can assist with identification. Unidentified vegetation should be placed in a plastic bag with some water to prevent it from shriveling up for keying out back in the office.

Page 14, Residual Vegetation: Continue to separate into 1 of 3 categories:

- RESID – TE; Tall emergent (e.g. hardstem or softstem bulrush, cattail),
- RESID – SE; Short emergent (e.g. alkali bulrush, Northwest Territory sedge), and
- RESID – Su; Submerged (**only** for current-year SAV on a mudflat).

Page 14-15, Clarification on Filamentous algae (FILAL)
The canopy cover of filamentous algae will not be included in the canopy cover estimate of wetland plants. Observers should record the cover of filamentous algae in one of two categories:

- FILAL-FL (floating); or
- FILAL-WC (water column; includes algae on the surface of SAV).

After percent cover of FILAL-FL and FILAL-WC is recorded, observers should the algae layer(s) until they can see and estimate canopy cover of wetland vegetation present. Algae can be relatively easily moved out of the way using your hand or canoe paddle. At points with considerable algae cover on the SAV you may not be able to clear it all away – try to look under the remaining algae to infer canopy cover of SAV assuming the FILAL is not there.

Note: plant-like algae (e.g., Chara spp. and Nitella spp.) is treated as submerged aquatic vegetation and should not be removed from the plot.

Page 14-15, Clarification of percent cover by strata
Floating (e.g., *Lemna* spp.) and floating-leaved species (e.g., *Potamogeton natans*) may obscure the observer's ability to see submerged vegetation in the water column. Observers should record aerial coverage of each species as it looks from above, even if the floating and/or floating-leaved species obscure other species. Once canopy cover has been estimated, record the obscured species in the comments for that point (you do not need to record percent cover of the obscured species, simply their presence).

The exception to this includes waterlily (*Nuphar* spp.) and smartweed (*Persicaria* spp.). that occurs at or above the surface of the water. If these species are present, ocular estimates will be made for two strata: 1) vegetation at or above the surface of the water, and 2) vegetation within the water column, including all species (SAV, waterlily stems, etc). For total cover, the ocular estimate of waterlily and/or smartweed at or above the water column will not be included. The percent cover of the strata within the water column (including submerged waterlily and smartweed) should still sum to 100%.

Page 18, Water depth
NEW: If the site is dry record negative water depth up to 15 cm below the soil surface.
In order to obtain measurements for hydroperiod metrics, we will be collecting "negative water depths" at dry sites where water is found within the first 6 inches (15 cm). When water is encountered at a dry site during soil sampling, measure the distance from the ground surface to the water surface after allowing sufficient time for water level to stabilize. This will be recorded as a negative distance. In contrast to previous years, for 2016 "0" water depth indicates that water level is at ground level whereas > -15 indicates that water was not found at the site.

POTENTIAL ADDITION: Water samples for Alkalinity and Nutrients
We are discussing the potential to collect addition water chemistry variables at the wetland unit level this year, but this has not been finalized.
Additional water chemistry sampling would occur at the wetland unit level, at an open water site. Alkalinity would be obtained in the field using a field kit. For chlorophyll a and nutrient samples, each station would need to collect a water sample at three intervals during the sampling season, and filter and freeze the sample. This would require purchasing sample bottles, filters, and a couple alkalinity field kits.

Page 18, Soil texture:
Soil texture by feel will be recorded for each plot. Use a soil corer to collect soil (~25 grams, slightly larger than a ping-pong ball) from the top 4 inches of the substrate. For deeper SAV sites, an Ekman dredge in combination with a canoe paddle can be used to obtain a soil sample. Note that most soils collected during the vegetation sampling will be wet. If the soil is too wet and puddles, let the water drain off before estimating soil texture by feel. Soil texture classes will be recorded for organic and mineral soils. Use the flow chart in Figure 6 and/or the soil textural triangle in Figure 7 to determine the soil texture and record the appropriate code from Table 3 on the datasheet.

NEW: Soil samples for Organic Carbon

At each open water plot (defined as containing no more than 10% emergent or moist soil vegetation), collect one sandwich-sized ziploc bag of substrate from the top 6 inches for analysis of organic content. Each sample should be placed in a cooler with ice and transferred to a freezer as soon as possible to prevent microbrial degradation of organic content post sample collection. *Contact Andrea to coordinate shipping of frozen soil samples after sampling is completed.*

Page 18 – 19, Soil chemical and physical characteristics and Soil Moisture/Temperature:
Optional for 2016. Note: the cost for this analysis and equipment will need to paid by individual stations.

Page 20, Figure 6, Texture by feel Flowchart
There is a typo in the code for Sandy Loam – it should be SaLo. Corrected figure below.

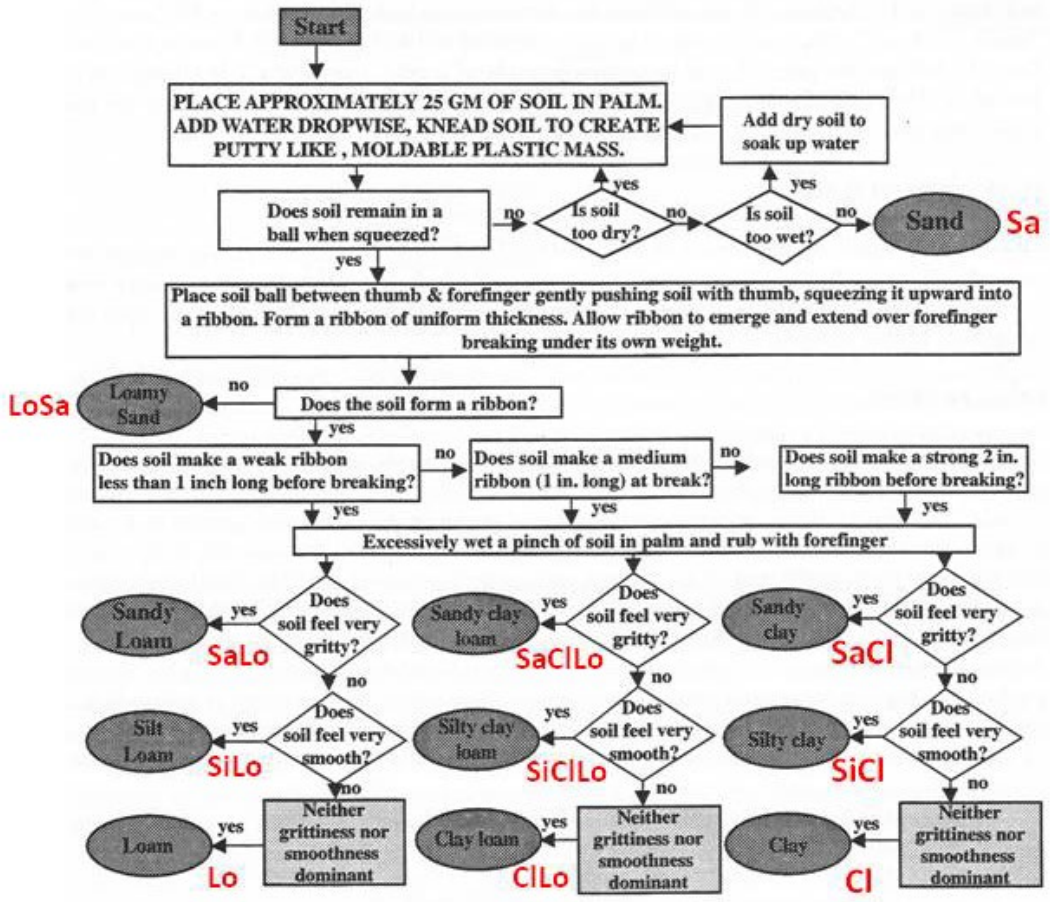

Figure 6. Flow chart for estimating soil texture by feel. Note that most soils collected during the vegetation sampling will be wet. If the soil is too wet and puddles, let the water drain off. There is no silt in this diagram but pure silt is uncommon and the difference between silt and silt loam is inconsequential in most routine wetland work (adapted from Thein 1979 by Richardson and Vepraskas 2001). Soil codes from Table 3 included in red.

Page 22, Soil Texture Classes

NEW – Organic soils should be classified as muck, mucky peat, or peat based on the characteristics in Table 3. Mineral and rhizome classes are the same as listed in the 2015 Procedures Manual.

Table 3. Soil texture classes.

Class	Code	Characteristic	
Organic		**Soil feels slippery or greasy when rubbed, has almost no internal strength, and stains fingers; highly decomposed organic material is almost always black.**	
		Proportion of Fibers Visible with a Hand Lens	
		Unrubbed	***Rubbed***
Muck (Sapric)	Oa	< 1/3	< 1/6
		Original plant remains are not recognizable; contains more mineral matter and is usually darker in color than peat.	
Mucky Peat (Hemic)	Oe	1/3 – 2/3	1/6 – 2/5
Peat (Fibric)	Oi	> 2/3	> 2/5
		Original plant remains are recognizable.	
Rhizomes	Rhiz	**Dense mat of rhizomes > 2 feet deep with no other discernible substrate type present**	
Mineral		**Soil feels gritty or sticky and resists compression; usually brown, red, yellow, or gray**.	
Sand	Sa	Does not remain in a ball when squeezed	
Loamy sand	LoSa	Remains in a ball when squeezed but does not form a ribbon	
Sandy loam	SaLo	Makes a weak ribbon (< 1 inch) and feels gritty	
Silt loam	SiLo	Makes a weak ribbon (< 1 inch) and feels very smooth	
Loam	Lo	Makes a weak ribbon (< 1 inch), neither grittiness nor smoothness dominant	
Sandy clay loam	SaClLo	Makes a medium ribbon (1 inch) and feels gritty	
Silty clay loam	SiClLo	Makes a medium ribbon (1 inch) and feels smooth	
Clay loam	ClLo	Makes a medium ribbon (1 inch), neither grittiness nor smoothness dominant	
Sandy clay	SaCl	Makes a strong ribbon (2 inches) and feels gritty	
Silty clay	SiCl	Makes a strong ribbon (2 inches) and feels very smooth	
Clay	Cl	Makes a strong ribbon (2 inches), neither grittiness nor smoothness dominant	

Page 22, Reminder for Wetland Hydrology, Depth and Duration of Flooding

Make sure staff gauges and/or data loggers are installed and working properly.

- Water levels at staff gauges should be read weekly if time permits
- Water levels at staff gauges should also be recorded on each day vegetation sampling is completed within that unit.

CHAPTER 3: DATA MANAGEMENT

Page 23, Data Forms and Data Storage

The data form has been slightly revised for 2016. **See excel attached to distribution email.** Contact Andrea or Adonia if you need the original excel file.

Changes to data form include:

1. Primary and secondary observers
    a. Include initials for observers doing double observer canopy cover estimates. The primary observer should be the more experienced observer (see Appendix V: Double Observer Sampling below for more information).
2. Classification of TS plots: Site Type
    a. Open Water
        Definition: < 10% cover of perennial emergent, emergent residual, and moist-soil vegetation
    b. Emergent
        Definition: >10% cover of perennial emergent and emergent residual vegetation
    c. Moist-soil
        Definition: No perennial emergent vegetation present; dominated by annual or ruderal vegetation characteristic of seasonal moist-soil wetlands.
    d. Other
        Please explain in the notes

A database will be provided to you for entering data collected in the field. *We are working on this and will distribute ASAP.*

APPENDIX V: DOUBLE-OBSERVER SAMPLING (page 42)

We will continue to quantify variation among observers in 2016.

Double-observer Sampling—The repeatability of our field methods will be assessed by estimating the amount of variation in ocular estimates among observers. We will use a double-observer approach to sample a subset of units for this purpose. The standard procedure is for one observer and one recorder when sampling wetland points. The double-observer method requires both individuals to record an estimate of canopy cover for each point. An observer's estimates must be independent from the second observer; therefore it is imperative that the observers do not discuss their estimates until both have recorded them. Also, observers should not change their estimates after discussing it with the other observer. The exception to this is for plant identification – it is allowable (recommended, in fact) for the two observers to discuss plant identification. This will minimize variation due to identification between observers.

Stations participating in double-observer sampling do not need to conduct double-observer sampling on all GRTS points at their station. We suggest conducting double-observer sampling on 25% of the total allocated sample size as an ordered subset. For example, if 120 points are to be sampled we suggest 30 points be done with double-observers. Further, in order to understand the variation among observers in open water versus emergent vegetation, we suggest using the GRTS ordered list to sample the first 15 that occurred in open water and the first 15 that occurred in tall emergent vegetation. In this example, if any points are dropped from the sample the double-observer subset can simply be extended using the PanelOne points. This may require some careful tracking of the GRTS order, but by doing so, it ensures a probabilistic sample from both emergent and open water plots (points).

For smaller units with only 30 points, we suggest collecting double-observer data from an ordered subset with a minimum of 10 points (with 5 open water and 5 emergent, if possible).

Conducting double-observer sampling is most efficient for those stations or crews where multiple individuals will be trained in plant identification and expected to conduct vegetation surveys. We recommend double observer sampling for as many units as time permits. For a station where a single individual will be the primary observer it is not likely worthwhile to attempt double-observer sampling. Do not conduct double-observer points at different times – that introduces spatial error associated with variation with GPS locations, something we are not interested in at this time.

When you enter double-observer observations please be sure to:

1. Have the most experienced observer recorded as the 'primary observer';
2. Record the initials of the primary observer and their canopy cover estimates in the left column;
3. Record the initials for the 'secondary observer' and their canopy cover estimates in the right column.

This allows us to query out the primary observer observations for standard analyses.

APPENDIX VII, GUIDE TO WETLAND VEGETATION FOR TARGET AND NON-TARGET HABITATS (pages 43-47)

These lists have been developed based on literature and field observations from 2014 and 2015. If you encounter circumstances that do not fit these categories, please contact Adonia so we can continue to refine the lists as needed.

TARGET

Semi-permanently Flooded Wetlands (SPF)		
Surface water persists throughout the growing season in most years (CCGL79)		
Deep Marsh: Maintain surface water throughout spring and summer, frequently into fall and winter, but in dought years often go dry by mid summer (SK72)		
For STM, the target also includes Intermittently Exposed where surface water is present throughout the year except during extreme drought (CCGL79)		
Indicator Species *If one or more of the emergent or SAV indicator species are present, regardless of cover (e.g., 1% or 100%) the plot should be sampled*		
Emergent Indicator Species	***Common Name***	***Reference***
Typha sp.	ALL cattail	SK72, CHHR72
Schoenoplectus heterochaetus	Slender bulrush	SK72
Bolboschoenus fluviatilis	River bulrush	SK72
Schoenoplectus acutus	Hardstem bulrush	SK72
Schoenoplectus tabernaemontani	Softstem bulrush	SK72
Schoenoplectus americanus	Olney bulrush	CHHR72
Nuphar sp.	ALL waterlily	
Phragmites australis	Common reed	SK72
Eleocharis acicularis (may be subm)	Needle spikerush	SK72
SAV Indicator Species	***Common Name***	***Reference***
Stuckenia sp.	ALL narrow pondweeds	SK72
Potamogeton sp.	ALL pondweeds	SK72
Zannichelia palustris	Horned pondweed	SK72
Ruppia sp.	ALL wigeon grass	SK72, CHHR72
Callitriche sp.	ALL water-starwort	SK72
Hipparus vulgaris	Mare's tail	SK72
Ranunculus aquatilis	White water crowfoot	SK72
Utricularia sp.	ALL bladderwort	SK72, CHHR72
Myriophyllum sp.	ALL milfoil	SK72
Elodea sp.	ALL waterweed	SK72
Ceratophyllum demersum	Coontail	SK72, CHHR72
Najas sp.	ALL naiads	CHHR72
Chara sp.	ALL muskgrass	SK72, CHHR72
Nitella sp.	ALL stoneworts	DeptEcol

TARGET (continued)

Semi-permanently Flooded Wetlands (SPF)		
Surface water persists throughout the growing season in most years (CCGL79)		
Deep Marsh: Maintain surface water throughout spring and summer, frequently into fall and winter, but in dought years often go dry by mid summer (SK72)		
For STM, the target also includes Intermittently Exposed where surface water is present throughout the year except during extreme drought (CCGL79)		
CONDITIONAL INDICATORS: Primary emergent shallow marsh species that can be SPF		
Shallow Marsh: Maintain surface water throughout spring and summer, but frequently dry during late summer and fall (SK72). NOTE: shallow marsh wetlands can be SPF or SF (CCGL79) and are often considered transitional between SPF and SF wetlands. ***Because these species can occur in SPF or SF wetlands, they are not considered an indicator species. Therefore the decision as to whether or not to sample a plot with one or more of these species will depend on your knowledge of the flooding regime (e.g., water level management and/or NWI), and other species present. If one of more of these species covers 50% or more of the plot, the plot should be sampled. If these species represent a minor portion of the plot (< 50%) which is otherwise dominated by seasonally flooded species, it should not be sampled.***		
Glyceria grandis	Tall mannagrass	SK72
Sparganium eurycarpum	Giant burreed	SK72, AKP03
Alisma triviale	Northern water plantain	SK72
Alisma gramineum	Narrowleaf waterplantain	SK72
Persicaria amphibia	Water smartweed	SK72
Beckmannia syzigachne	Slough grass	SK72
Scolochloa festucacea	River grass	SK72
Eleocharis palustris	Common spikerush	SK72, AKP03
Schoenoplectus pungens	Common threesquare	SK72
Bolboschoenus maritimus	Alkali bulrush	SK72
Puccinellia nuttalliana	Alkaligrass	SK72
Carex atherodes	Slough sedge	SK72
Carex utricularia	Northwest territory sedge	AKP03
Carex rostrata	Beaked sedge	WBLNO08
NOTE: If sedge seed heads are not present, these sedge species are tall, robust sedges, greater than 2 ft and often up to 4 ft tall.		
Common Semi-permanent Drawdown Species		
Annuals and/or ruderal perennial species characteristics of moist-soil wetlands may occur during natural or managed drawdown phases of a SPF wetland.		
Chenopodium sp.	Goosefoots	
Hordeum jubatum	Foxtail barley	
Rumex sp.	Dock	
Bidens sp.	Beggars ticks	
Kochia sp.	Kochia	
Polygonum/Persicaria sp.	Annual smartweeds	
Echinochloa sp.	Millet	

NON-TARGET

Seasonally Flooded Wetlands (SF)		
Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years (CCGL79)		
Shallow marsh: Surface water is present for an extended period in spring and early summer, but frequently dry during late summer and fall (SK72)		
Characteristic Species and Habitat Descriptions Typically dominated by grass and grass-like plants that are intermediate in height when compared to deep marsh and wet meadow/temporary wetlands (SK72)		
Examples from Grays Lake		
Juncus balticus	Baltic rush	AKP03
Mentha arvensis	Field mint	AKP03
Triglochin maritimum	Seaside arrowgrass	AKP03
Carex nebrascensis	Nebraska sedge	AKP03
Arnica chamissonis	Chamissio arnica	AKP03
Argentina anserina	Silverweed cinquefoil	AKP03
See also emergent shallow marsh species		

NON-TARGET

Temporarily Flooded Wetlands (TF)

Surface water is present for brief periods during the growing season (CCGL79)

Wet meadow: Surface water usually persists for a few weeks during the spring and following precipitation events (SK72)

Wetland low prairie: surface water normally present in early spring for a few days or up to 2 weeks (SK72)

Characteristic Species and Habitat Descriptions

Characterized by fine-texture grasses, rushes, and sedges of relatively low height with forbs common (SK72)

Characterized by plants that grow in uplands and wetlands (CCGL79).

Examples from Grays Lake

Deschampsia caespitosa	Tufted hairgrass	AKP03
Carex praegracilis	Clustered field sedge	AKP03
Aster campestris	Western aster	AKP03

Examples from Prairie Pothole Region

Poa palustris	fowl bluegrass	SK72
Carex praegracilis	Clustered field sedge	SK72
Symphyotrichum lanceolatum	lowland white aster	SK72
Calamagrostis stricta	Northern reedgrass	SK72
Spartina pectinata	Prairie cordgrass	SK72
Juncus balticus	Baltic rush	SK72
Hordeum jubatum	Foxtail barley	SK72
Distichlis spicata	Saltgrass	SK72

Examples from Montane Wet Meadow Group (NVCS)

Calamagrostis stricta	Northern reedgrass
Calamagrostis canadensis	Bluejoint reedgrass
Carex bolanderi	Bolander's sedge
Carex microptera	Small-wing sedge
Carex scopulorum	Mountain sedge
Deschampsia caespitosa	Tufted hairgrass
Juncus drummondii	Drummond's rush
Juncus nevadensis	Nevada rush
Camassia quamash	Camas
Rorippa alpina	Alpine yellowcress

NOTE: Some of these species may also occur in seasonally flooded wetlands.