Verification and Description of Fens in Washoe Meadows State Park, El Dorado County, California

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November 2011

Introduction

In 2010, with funding through a grant from Southern Nevada Public Land Management Act (SNPLMA), the California Native Plant Society Vegetation Program (CNPS) completed five vegetation plot surveys within the main fen at Washoe Meadows State Park, delineated the estimated fen boundary, and quickly visited the large openings to the north of the main fen, noting likely fen characteristics. The openings with fen characteristics were outlined prior to the work reported here as displayed in Figure 1.

Our primary objective for the subsequent fieldwork in 2011 was to verify other potential fen locations within Washoe Meadows. Our survey protocol was designed, in collaboration with the U.S. Forest Service Region 5, to address three criteria that define fens. One criterion is the requirement of at least 40 cm of peat in the upper 80 cm of the soil profile. This rule is based on the definition of a Histosol, which requires half or more of the top 80 cm to be organic (Soil Survey Staff 1999). Another primary criterion for fen determination is soil saturation for most of the year. The third criterion is the presence of typical wetland vegetation that occurs in fens.

Background and setting

In 2008 the vegetation at Washoe Meadows State Park (SP) was surveyed by Adrian Juncosa, a private consultant from Eco Synthesis. Along with other vegetation communities, Juncosa identified a large area as Fen Complex, in which he lumped a number of hydrophilic vegetation types including both fens and non-fens. This area is roughly 40 acres in size, located in the center of the southern half of Washoe Meadows SP. He described the Fen Complex as a mosaic of communities, with a central fen surrounded or entirely comprised of wetlands and hydrophyllic plant communities that are primarily groundwater supported. He went on to say:

> Fen Complex communities vary from small areas of open water (ponds) through sedge-dominated meadows to areas which generally resemble Lodgepole Pine – Mesic Type forest in structure, but are distinguished by the presence of certain distinctive species that are indicative of longer duration near-surface saturation (one notable example being big-leaved avens (*Geum macrophyllum*)), and/or by their proximity to wetter spring-supported vegetation.

Adrian also lumped into the fen complex description a small spring complex area in the southwestern part of the park. This area is a small spring flowing out of a barrel that forms a wet meadow and wet lodgepole area just down slope and that spreads out on the hillside. This area was also assessed in this assessment and was found to not be fen except for a small area that was inconclusive.

In 2010 the California Native Plant Society, spent 4 weeks assessing fens in the Lake Tahoe Basin. This included sites at Ed Z'berg Sugar Pine Pont SP and Washoe Meadows SP. At Washoe Meadows SP, CNPS surveyed a large fen located at the southern edge of the Fen Complex. At this same time, Jonathan Long, from the Tahoe Environmental Research Center, conducted a very rapid (~2 hour) scouting expedition to determine if more locations within the park should be formally surveyed for fens. Walking north from the verified fen, he located two additional potential fen locations; these were targeted for the 2011 surveys.

DPR staff has also located an underground creek located within the Fen Complex. This stream is partially covered by natural forest debris and tree roots with some windows where water can be seen. This small stream flows to the northeast out of the verified fen and then dissipates into the edge of dry meadow south of the barn. This area was also assessed in 2011.

The Fen was disrupted by gravel mining in the 1960's and 1970's. The area of fen generally trends NNE and site on low hills above the glacial outwash valley floor. Gravel mining cut into the face of this hillside below the main fen and intercepted the perched water table that supports the fen. This caused a seep to form which collects in a pool on the quarry floor at the base of the hill. This area was also assessed in 2011.

Fen Designation

It is worthy to note the difference between bogs and fens. Bogs are fed almost entirely by atmospheric precipitation, are formed by rain (ombrogenous) and fed by rain (Cooper and Wolf 2006). Fens are fed by groundwater, although they receive precipitation as well (Cooper and Wolf 2006). "In the Sierra Nevada the dry summer climate makes it impossible for ombrogenous bogs to occur…however, fens, which are ground water fed peatlands, are widespread and extremely varied" (Cooper and Wolf 2006).

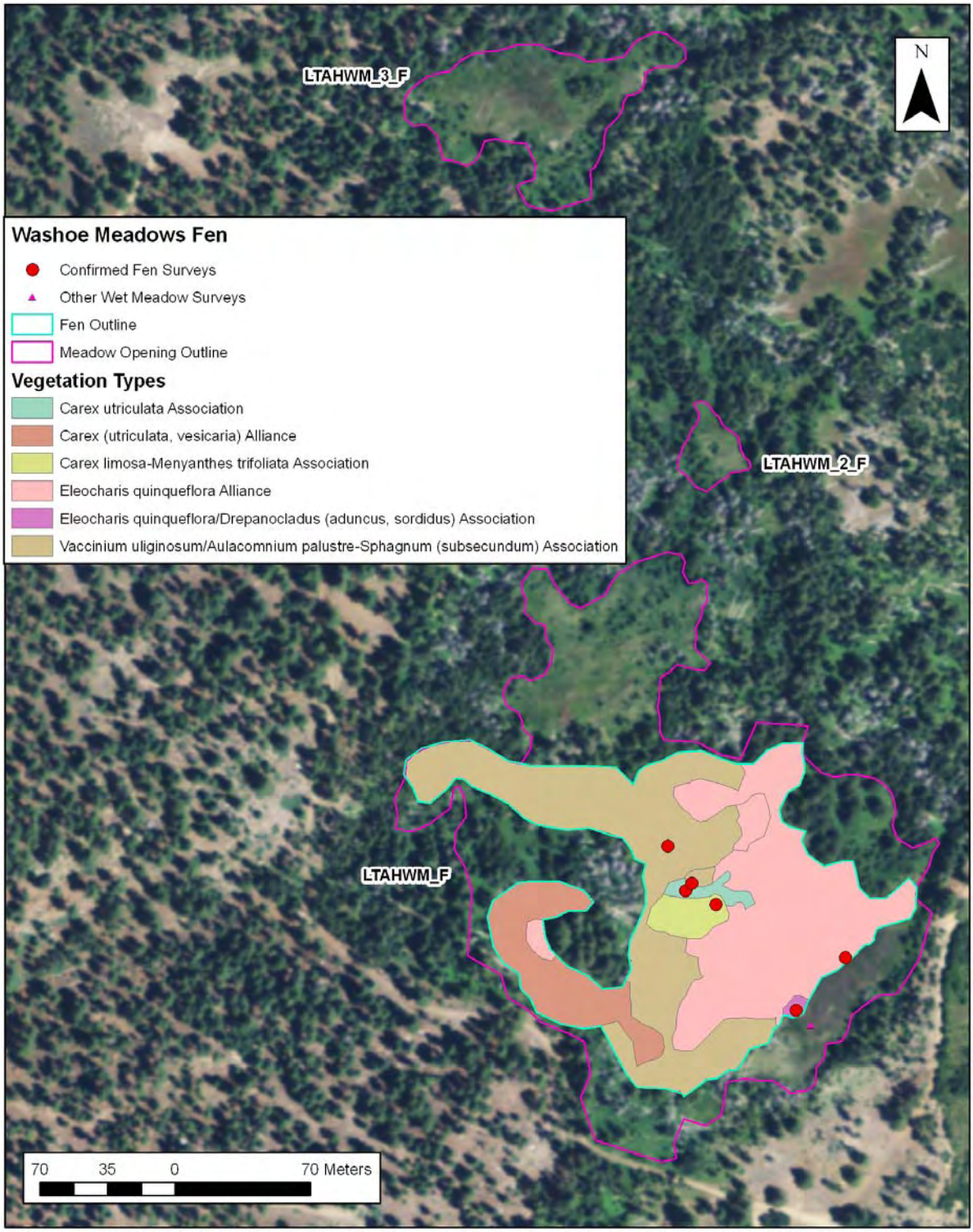
A fen is an ecosystem with organic soils that form where the long-term rate of organic matter production by plants exceeds the rate of decomposition due to water logging (Weixelman and Cooper 2009). They are areas where there is at least 40 cm of organic soils in the upper 80 cm of the soil profile (Weixelman et. al. 2007). They are widespread and extremely varied in their hydrologic, geomorphic, geochemical and ecological characteristics (Cooper and Wolf 2006). Fens are ground water fed peat-accumulating ecosystems that have perennially saturated soils, and whose hydrologic regime, geochemistry, and potential ecological characteristics are produced by the landscape that supplies its groundwater, as well as long-term issues of the site history, and the land and water management (Cooper and Wolf 2006).

Although the fen at Washoe Meadows SP encompasses some qualities similar to a Basin fen, it is more characteristic of a Sloping fen (also called soligeneous peatland). Sloping fens occur in valley bottoms where alluvial groundwater supports peat formation or at the base of slopes where groundwater discharges to the surface due to either (1) a break in the topography, or (2) a change in geology (Weixelman and Cooper 2009). This fen type is the most common type of fen in the Sierra Nevada and is usually underlain by springs, or a complex of ground water discharge points (Weixelman and Cooper 2009).

2010 Survey of Main Fen

As mentioned above, CNPS surveyed the main fen in 2010 with the same methods used in this assessment. Five plot samples were completed. The description of results as reported in Sikes et al. 2011 is included below, as is the original vegetation map (Figure 1):

> Three meadow openings exist at Washoe Meadows State Park. The park is surrounded by residential development. Due to time constraints, we were only able to survey the area denoted by the fen outline. The openings to the north show similar vegetation and suitable peat depth by soil probe, but we did not have time to confirm their status. The central opening where the survey points are located was already recognized as a fen, though existing survey data from 2002 by the Stanton group did not include soil information to confirm fen soil characteristics before this project. Washoe Meadows Fen is about 350 meters west of the Upper Truckee River. This large fen contains low relief mounded areas and floating mats. The eastern portion of the fen, mapped as *Eleocharis quinqueflora* Alliance has a notable patchwork of varied dominant species including *Carex echinata, C. utriculata, Juncus oxymeris*, and *Oreostemma alpigenum*, and regular occurences of *Vaccinium uliginosum*. The plot survey within that alliance at the southeast boundary of the fen was classified as an *Oreostemma alpigenum* Association but was merged into the larger area of matrix because its stand was too small in size to map. The Washoe Meadows Fen is rated highly for Conservation Significance because it is fairly undisturbed, supports rare taxa, and is well protected since it is on State Park land and within a Critical Aquatic Refuge. The average species richness per stand was high at 20 species out of 5 surveys. Four rare species are recorded: *Carex limosa, Eriophorum gracile, Meesia triquetra,* and *Tomentypnum nitens.* All of these except *Eriophorum* are dominant species in their stratum. The *Tomentypnum* was the dominant moss in a survey plot within the *Vaccinium* stand, with an estimated 51% cover. *Tomentypnum nitens* was collected at two adjacent stands in the fen. This species is only recently known from California and was also collected at Angora Creek Fen in the LTB.



Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 1. Vegetation of the Washoe Meadows Fen after 2010 fieldwork, Angora Creek Subwatershed of the Upper Truckee River, Washoe Meadows State Park.

Methods

Locations for assessment were determined by a combination of previous knowledge, interpretation of aerial imagery, and information gathered by State Park staff and consultants on wetland characteristics. Surveys were completed in August 2011, when plants were phenologically active and/or fruits were mature. The CNPS field crew consisted of Kendra Sikes (CNPS Ecologist) and Danielle Roach (CNPS field ecologist). David Toren (California Academy of Sciences) provided identification for the bryophytes collected from the study sites. Additional photos were taken in October 2011 by Ashli Lewis, Environmental Services Intern for the State Park. Soil sample analysis was performed by Soil, Water, Forage Analytical Laboratory of Oklahoma State University.

Sampling was implemented using an Expanded Draft Protocol for USFS R5 Fen Surveys, version August 2010, after CNPS staff incorporated previous versions of the USFS R5 Fen Survey Protocols with portions of the USFS Colorado peatland protocol. This expanded survey protocol includes two parts. The first part focuses on characterizing the meadow complex or site, and is completed once per location. If the same locations are surveyed again in subsequent years, the first part of the protocol would also be completed again. The second part of the protocol is plot-based and focuses on visibly 'homogenous' stands of vegetation within the fen/meadow complex. Even small fen meadows often have multiple stands of vegetation, which are determined by species composition, abundance and environmental/site history factors. For each site, our goal was to survey each vegetation type present, while taking into account previous surveys. Therefore multiple stand or plot surveys were usually performed in each site. Stand surveys included percent cover data of all species present in each plot. Appendix 1 contains copies of the datasheets. Appendix 2 contains the field survey protocols.

Soil samples were collected from soil pits at plot locations to confirm organic carbon (OC) content in some cases. Samples from at least one soil pit per opening were analyzed to confirm peat development and fen status. Results are displayed in Table 3. However, if we were certain that peat development was insufficient (i.e. <<40 cm of peat) to be identified as a fen site, then soil samples were not analyzed.

In general, the Lake Tahoe Basin (LTB) soil is very low in clay content (S. Gross, pers. comm.. 2011), so particle size was not taken into account when testing soils for histosol determination. However, to be defined as organic, soil OC must be greater than 18% if the soil is greater than 60% clay, and it must be greater than 12% OC if without clay (Soil Survey Staff 1999). For intermediate amounts of clay, the amount of OC must be > 12 + (0.1 *% clay) (Soil Survey Staff 1999). For example, a soil that is 20% clay would be classified as mineral if OC is less than 14%, and as organic if OC is greater than 14%.

In the field, we estimated the extent of each fen using a soil probe (identifying boundaries/areas of at least 40 cm of peat depth), drawing the outline on printed aerial imagery, and/or using a GPS to mark the edges. Back in the office we combined the GPS data with aerial imagery (NAIP 2009) in GIS to allow heads up computer digitizing of the information recorded in field sketches and GPS-traced outlines. The fen delineations are based on our best estimate of the extent of the area that meets the criteria for being a fen, with emphasis on peat depth using a soil probe. Each meadow

outline has been used as a general indicator of the size of the fen and wet meadow complex, but was not based on a specific scientific definition of a meadow.
In addition, vegetation types were identified based on previous classification results and field keys by CNPS to determine vegetation alliance and/or association names (Sawyer et al. 2009, Sikes et al. 2010, Sikes et al. 2011). Vegetation type names were assigned to each of the stand surveys.

Results

Seven separate sites within Washoe Meadows State Park were assessed for their fen characteristics (Figure 2), with 13 vegetation plot surveys completed within them in 2011. One of these was simply an expansion of the main fen that was surveyed in 2010. All surveys included in these results are summarized in Table 1. Five out of seven sites were confirmed to contain fens. The total area assessed by CNPS in both years was about 17 acres, with 9.6 acres estimated as fen. In 2011, about 11 of those acres were assessed, adding 4 acres of fen to the total. The 2011 surveys include 82 vascular plant taxa and 15 moss taxa that were identified to the species or subspecies level. Since we also collected data in 2010, Appendix 3 provides a complete list of scientific and common names for the taxa identified in the existing and new surveys of fens and related wet meadow in Washoe Meadows State Park, including 106 vascular plants and 18 bryophytes.

Table 1. Plot surveys listed by site, including previous vegetation surveys with year and surveyor. Fen status is determined by either soil test results (Table 3) or estimated with a soil probe.

Site Name	Site ID	Plot Survey	Year Surveyed	Surveyor	Fen Status
Main Fen	LTAHWM_F	LTAHO063	2002	Stanton	uncertain
Main Fen	LTAHWM_F	LTAHO064	2002	Stanton	fen
Main Fen	LTAHWM_F	LTAHWM_F1	2010	CNPS	fen
Main Fen	LTAHWM_F	LTAHWM_F2	2010	CNPS	fen
Main Fen	LTAHWM_F	LTAHWM_F3	2010	CNPS	fen
Main Fen	LTAHWM_F	LTAHWM_F4	2010	CNPS	fen
Main Fen	LTAHWM_F	LTAHWM_F5	2010	CNPS	fen
N Ext. Main Fen	LTAHWM_F	LTAHWM_F6	2011	CNPS	fen
N Ext. Main Fen	LTAHWM_F	LTAHWM_F7	2011	CNPS	fen
Meadow 2	LTAHWM_2_F	LTAHWM_2_F1	2011	CNPS	fen
Meadow 3	LTAHWM_3_F	LTAHWM_3_F1	2011	CNPS	fen
Meadow 3	LTAHWM_3_F	LTAHWM_3_F2	2011	CNPS	fen
Meadow 3	LTAHWM_3_F	LTAHWM_3_F3	2011	CNPS	fen
Meadow 3	LTAHWM_3_F	LTAHWM_3_F4	2011	CNPS	fen
Meadow 4	LTAHWM_4_F	LTAHWM_4_F1	2011	CNPS	fen
Meadow 5	LTAHWM_5_F	LTAHWM_5_F1	2011	CNPS	fen
Quarry Floor	LTAHWM_MEUL_F	LTAHWM_MEUL_F1	2011	CNPS	not fen
Spring	LTAHWM_SP	LTAHWM_SP_F1	2011	CNPS	not fen
Spring	LTAHWM_SP	LTAHWM_SP_F2	2011	CNPS	not fen
Spring	LTAHWM_SP	LTAHWM_SP_F3	2011	CNPS	uncertain

No new special status plants were found as a result of our 2011 fieldwork. Four rare species were already known from Washoe Meadows Fen, and a fifth species, *Meesia uliginosa,* was discovered by Molly Ferry earlier in 2011 while conducting a rare plant survey. A list of these five special status taxa is provided in Table 2. Two of these species are California Rare Plant Rank (CRPR) 2 plants, which are rare in California but more common elsewhere. Two species are CRPR 4 plants, taxa to watch because they have such limited distribution. The number following the decimal point in the CRPR is the threat rank, where 0.2 indicates a moderate degree of threat, and 0.3 indicates a low degree of threat in California (CNPS 2011). The last moss in the table, *Tomentypnum nitens,* was recently identified as occurring in California, and in the LTB. It is not currently ranked, but we have requested its review from the CNDDB.

Several non-status species appear to be newly identified as occurring within Washoe Meadows State Park. These species were not found during our work in 2010, nor were they given on a 2009 plant list for the Park (E. Dean, pers. comm., 2009). Seven of these are nonvascular species: *Amblystegium serpens, Brachythecium frigidum, Leptobryum pyriforme, Marchantia polymorpha, Philonotis americana, Pohlia camptotrachela,* and *Riccardia chamedryfolia.* Three vascular plants appear to be newly identified from the Park: *Carex aurea, Juncus howellii,* and *Sorbus californica.* The rush, *J. howellii,* is easily confused with *J. orthophyllus* (Peter Zika, pers. comm. 2011), which appears on the 2009 plant list.

Table 2. Special status plants found in fens or wet meadows at Washoe State Park. If present, special status within the USFS is represented by "R5S" for taxa listed on the USFS Pacific Southwest Regional Forester's Sensitive Species List (USFS 2006) and "SI" for plants on the LTBMU Special Interest List. CRPR refers to California Rare Plant Rank, formerly known as the CNPS Inventory List.

Scientific Name	Common Name	Family	Global Rank	State Rank	USFS status	CRPR	No. of sites
Vascular Plants							
Carex limosa	mud sedge	Cyperaceae	G5	S3	SI	2.2	2
Eriophorum gracile	slender cottongrass	Cyperaceae	G5	S3.3		4.3	3
Non Vascular Plants							
Meesia triquetra	three-ranked hump moss	Meesiaceae	G5	S4	R5S	4.2	5
Meesia uliginosa	broad-nerved hump moss	Meesiaceae	G4	S2	R5S	2.2	1
Tomentypnum nitens	tomentypnum moss	Brachytheciaceae			SI		1

A total of 17 soil samples were submitted for analysis of Organic Carbon and Total Nitrogen in 2011. The samples came from eight soil pits at six sites (Table 3). Soil pits with multiple samples had their average Total Carbon (TC) content calculated according to the portion of the column that each sample represented. While a soil pit was also dug at the *Meesia uliginosa* site, the samples were not tested since in the areas of deepest peat only 25 cm of organic soil was found; the bottom of the pit was sand. One of the

eight pits returned results that the soil was not a histosol, and therefore the stand (Spring site, LTAHWM_SP_F2) was not considered to be a fen. One pit returned inconclusive results (Spring site, LTAHWM_SP_F3), since the TC% was within the histosol range depending on clay content. Included in Table 3 are the six soil samples from 2 plots within the main fen that were sampled in 2010.

Table 3. Results of soil analysis. Portion of column refers to the measurement of the soil core from the ground surface down, in centimeters. TC= Total Carbon. Refer to Figure 2 for site locations.

Site	Plot Survey	Portion of Column	Fraction of Column	TC%	TC% x fraction	Average TC%	Outcome
Mdw 2	LTAHWM_2_F1	0 - 40	1.00	37.96	37.96	37.96	confirmed
Mdw 3	LTAHWM_3_F2	0 - 40	1.00	26.58	26.58	26.58	confirmed
Mdw 4	LTAHWM_4_F1	0 - 20 20 - 35 35 - 40	0.50 0.38 0.13	22.92 22.20 7.67	11.46 8.33 0.96	20.74	confirmed
Mdw 5	LTAHWM_5_F1	0 - 16 16 - 35 35+	0.40 0.48 0.13	29.48 29.61 24.75	11.79 14.06 3.09	28.95	confirmed
Main	LTAHWM_F2	0 - 18 18 - 24 24+	0.45 0.15 0.40	37.99 29.60 42.86	17.10 4.40 17.15	38.64	confirmed
Main	LTAHWM_F3	0 - 12 12 - 32 32+	0.30 0.50 0.20	22.78 22.15 2.53	6.83 11.07 0.51	18.41	confirmed
N Ext. Main	LTAHWM_F6	0 - 30 30+	0.75 0.25	32.71 41.62	24.54 10.40	34.94	confirmed
N Ext. Main	LTAHWM_F7	0 - 15 15 - 33 33+	0.38 0.45 0.18	41.65 55.29 39.29	15.62 24.88 6.88	47.37	confirmed
Spring	LTAHWM_SP_F2	0 - 25 25+	0.63 0.38	9.77 2.95	6.10 1.11	7.21	NOT fen
Spring	LTAHWM_SP_F3	1 - 20 20+	0.50 0.50	19.80 13.91	9.90 6.96	16.86	inconclusive

Our vegetation classification of the surveys includes 11 alliances and 12 associations assigned to 20 stand samples from the Park (Table 4). Seven of these samples were classified and reported previously for Washoe Meadows State Park from data collected by Stanton et al. in 2002 and by CNPS in 2010 (Sikes et al. 2011), while 13 were newly keyed to type (per Sawyer et al. 2009 and Sikes et al. 2010). Four of the new surveys were assigned only an alliance-level classification since they did not fit well to existing associations. Newly reported for Washoe Meadows are the *Carex nebrascensis, Juncus arcticus, Juncus nevadensis, Narthecium californicum–Triantha occidentalis, Pinus contorta* ssp. *murrayana* and *Salix eastwoodiae* Alliances. Five associations newly reported for the Park include *Eleocharis quinqueflora/Philonotis fontana-Bryum pseudotriquetrum, Juncus arcticus var. balticus, Pinus contorta ssp murrayana/Carex spp., Carex nebrascensis,* and *Salix eastwoodiae* Associations. In addition, the *Carex angustata* Provisional Association is newly recognized by the authors based on significantly dominant cover of that species in the stand. The classification of vegetation types documented from Washoe Meadows is given in Table 4, which provides rarity

status (S-ranks) for alliances and a designation for association rarity according to the current state of knowledge (Todd Keeler-Wolf, pers. comm. 2011).

Table 4. Vegetation Classification of Alliances and Associations for fens (and related wet meadows) with number of samples in Washoe Meadows State Park. The rarity status of each Alliance is provided in bold font after its name, where S2 = Imperiled, 6-20 viable occurrences statewide, S3 = Vulnerable, 21-100 viable occurrences statewide, and S4 = Secure, > 100 viable occurrences statewide. Rare associations are marked with an asterisk (*). The confirmed fen stands classified to each vegetation type is given under Surveys. Surveys which were not confirmed as fens are shown in parentheses.

Alliance	Association	Surveys for fens (related)
WOODLAND		
Pinus contorta ssp. *murrayana* **S4**		
	Pinus contorta ssp. *murrayana/Carex* spp.	LTAHWM_F7
SHRUBLAND		
Salix eastwoodiae **S3**		
	Salix eastwoodiae *	LTAHWM_3_F2
Vaccinium uliginosum **S3**		
	Vaccinium uliginosum/Aulacomnium palustre–Sphagnum (subsecundum) *	LTAHWM_3_F4, LTAHWM_F2, LTAHWM_F5
HERBACEOUS		
Carex (utriculata, vesicaria) **S4**		LTAHWM_5_F1
	Carex angustata (Provisional)	(LTAHWM_SP_F3)
	Carex utriculata	LTAHWM_2_F1, LTAHWM_F1
Carex limosa **S3?**		
	Carex limosa–Menyanthes trifoliata *	LTAHO064
Carex nebrascensis **S4**		
	Carex nebrascensis	(LTAHWM_SP_F1)
Eleocharis quinqueflora **S4**		
	Eleocharis quinqueflora/Philonotis fontana–Bryum pseudotriquetrum *	LTAHWM_4_F1
	Eleocharis quinqueflora	(LTAHO063)
	Eleocharis quinqueflora/Drepanocladus (aduncus, sordidus) *	LTAHWM_F4
Juncus arcticus **S4**		(LTAHWM_MEUL_F1)
	Juncus arcticus var. balticus	LTAHWM_F6
Juncus nevadensis **S3**		(LTAHWM_SP_F2)
Narthecium californicum-Triantha occidentalis **S2?**		LTAHWM_3_F1
Oreostemma alpigenum–(Gentiana newberryi) **S4?**		
	Oreostemma alpigenum	LTAHWM_3_F3, LTAHWM_F3

Descriptions and Maps By Site Location

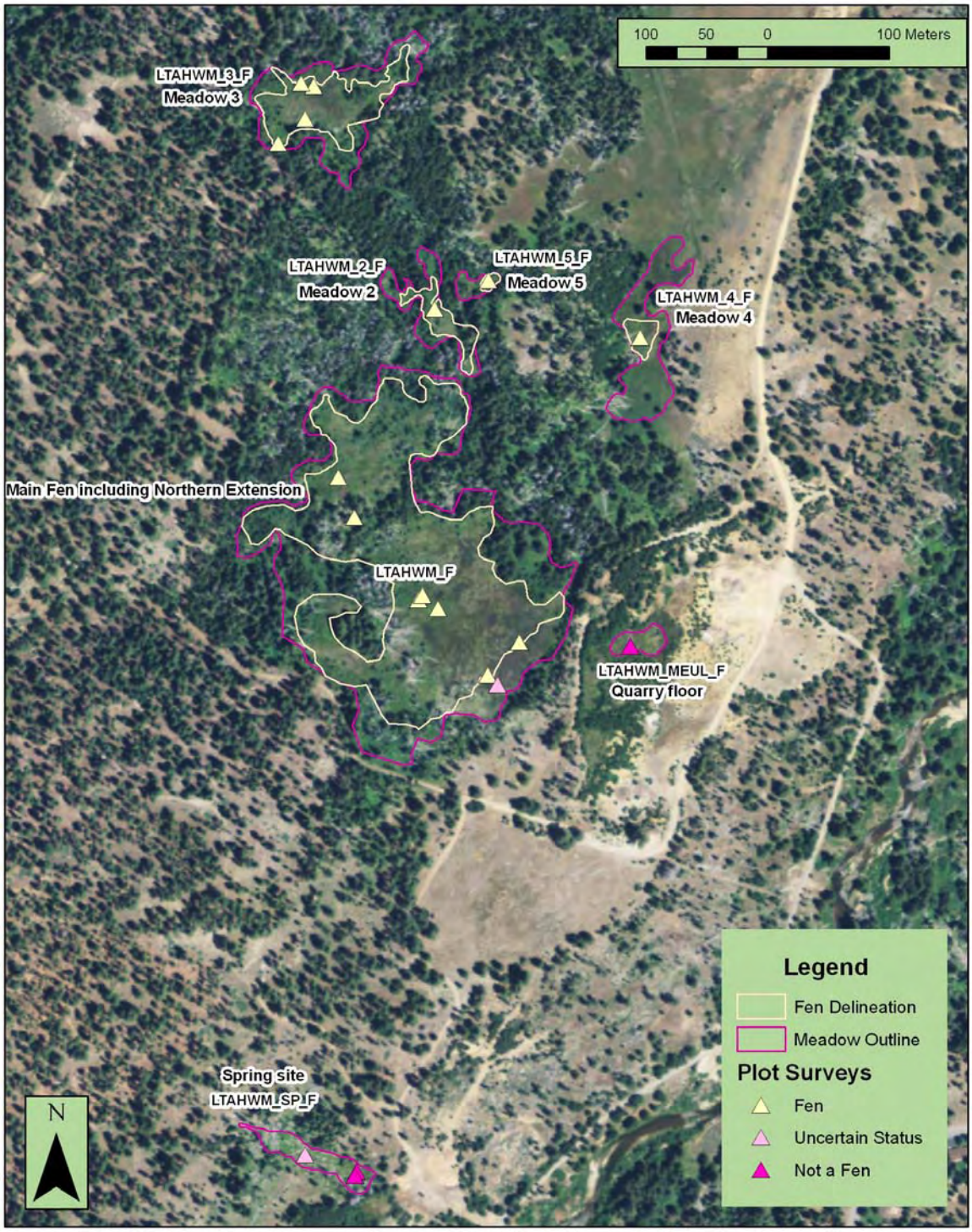
Seven separate sites within Washoe Meadows State Park were assessed for their fen characteristics in 2010 and 2011 (Figure 2). One of these was the northern extension of the main fen (assessed in 2010) and thus considered the same site. They are described below, listed from south to north. Following are individual maps showing the locations of survey plots and the areas assessed along with the estimated fen delineations (Table 5).

Table 5. The areas assessed and estimated as fen in 2010 and 2011.

		Area of Meadow Assessed		Area of Estimated Fen	
Meadow ID	Site Name	sq meters	acres	sq meters	acres
LTAHWM_2_F	Meadow 2	2617	0.65	1268	0.31
LTAHWM_3_F	Meadow 3	8201	2.03	4534	1.12
LTAHWM_4_F	Meadow 4	4565	1.13	608	0.15
LTAHWM_5_F	Meadow 5	558	0.14	162	0.04
LTAHWM_F	Main Fen incl. N. Ext.	49946	12.34	32384	8.00
LTAHWM_MEUL_F	Quarry floor	776	0.19	n/a	n/a
LTAHWM_SP_F	Spring	1820	0.45	n/a	n/a

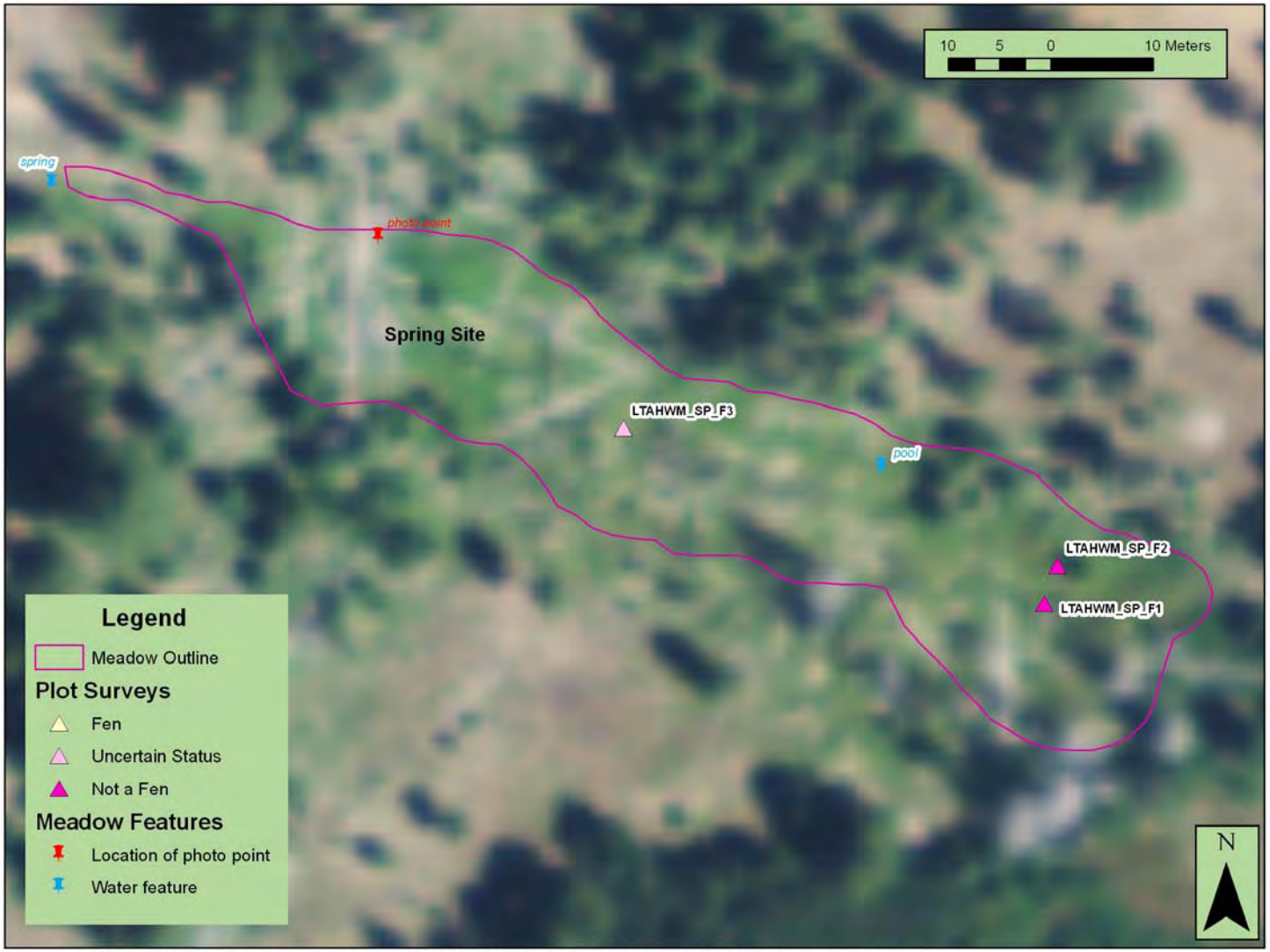
The **Spring site** (LTAHWM_SP; Figure 3) at Washoe Meadows is located about 350 m SSW of the main fen. The opening has many downed logs and a small pool that is the spring source for the meadow. We sampled in the areas identified with a soil probe to have the deepest non-mineral soil. No fen areas were confirmed, but one soil pit near the center of the opening had inconclusive results (Total Carbon 16.86%). Further soil analysis of clay content may confirm this location to be fen. The size of the vegetation stand and potential fen was the same size as the plot (LTAHWM_SP_F3), approximately 20 sq. m. While the stands at the east end of the opening, at the lowest point, seemed to have some organic soils, the analysis showed that peat/TC was not sufficient in content to be considered a fen. Vegetation types sampled in this meadow were *Carex nebrascensis* Association, *Carex angustata* Provisional Alliance, and *Juncus nevadensis* Alliance. Other species that dominated areas of the opening included *Allium vallidum, Carex utriculata, Equisetum arvense, Oxypolis occidentalis, Lupinus polyphyllus* and mats of the liverwort *Marchantia*. No special status species were recorded. Photos taken at the photo point are provided in Appendix 4.

The **Quarry Floor site** (LTAHWM_MEUL; Figure 4) is located behind a quarry pile, below and to the east of the main fen at Washoe Meadows State Park. It is on the former floor of a sand and gravel pit. All of the original soil was removed during mining in the 1960's. Seepage from the cut face of the quarry wall provides moisture and a seasonal small stream to support a small area of willow at the base of the slope. This area does not have enough peat to be a fen. The deepest areas of peat are about 25 cm in depth and are immediately adjacent to the small stream. A *Juncus balticus* stand was sampled in an area with the most peat development and was quite diverse. The rare moss *Meesia uliginosa* (CRPR 2.2) is growing primarily at the somewhat raised bases of pine saplings on an east facing slope which averages about 4 degrees. While this location has been affected in the past by quarrying activity, it should continue to increase peat development if left undisturbed. No active management beyond buffering the area from direct use is recommended.



Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 2. Overview of study area showing the seven sites assessed along with their names and meadow identification numbers.



Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 3. Spring site (Meadow LTAHWM_SP).

Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 4. Quarry Floor site (Meadow LTAHWM_MEUL)

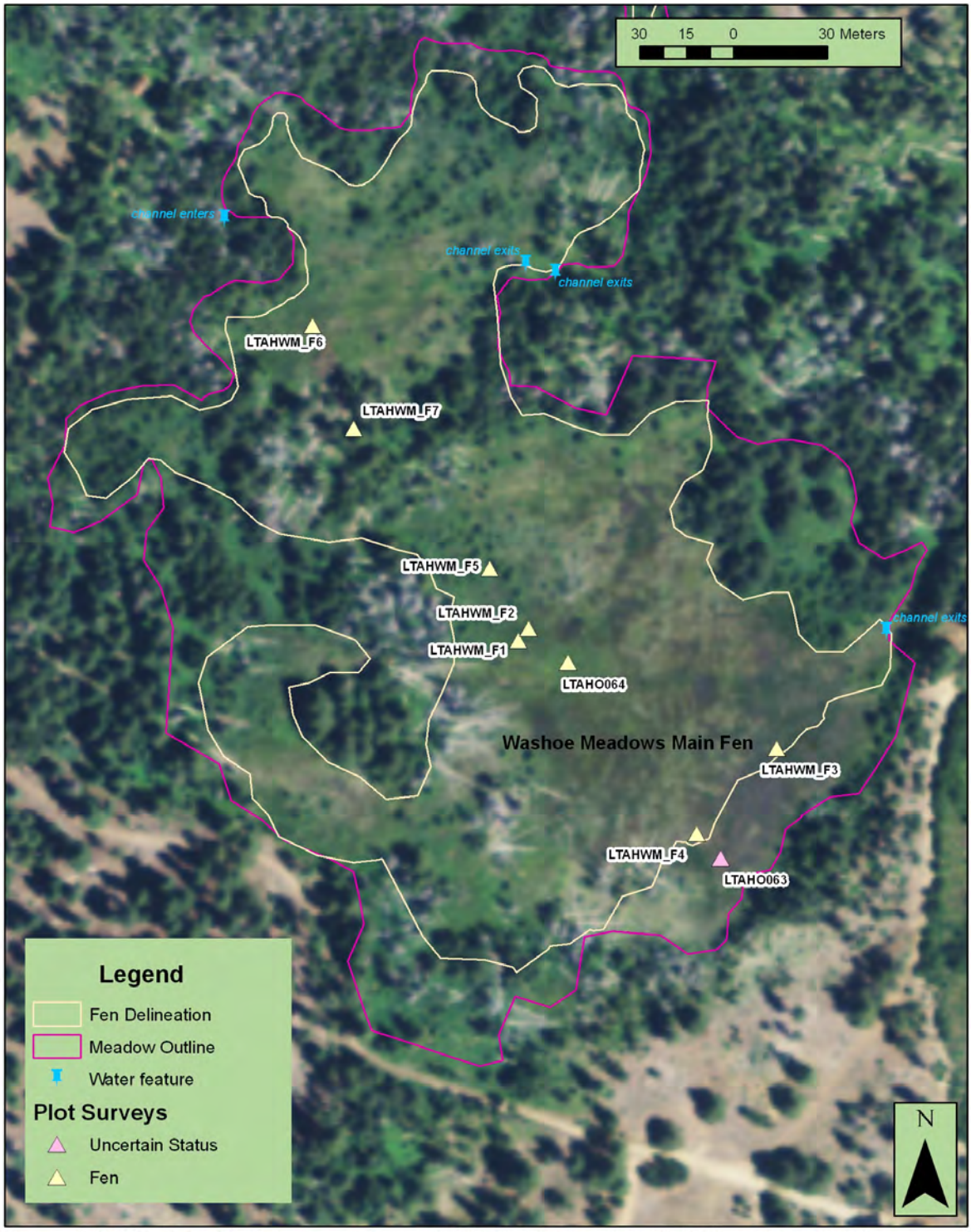
The **Northern Extension** of the main fen (LTAHWM_F; Figure 5) was found to be contiguous with the main fen in the Park, which is about 350 meters west of the Upper Truckee River. This large fen contains low relief mounded areas and floating mats. Though the two openings are separated by a strip of pine trees, fen characteristics continue into the *Pinus contorta* var. *murrayana* stand. Plot surveys were completed in this treed area and in a *Juncus balticus* stand in the open area to the north. This fen opening also had stands dominated by *Oreostemma alpigenum*, *Carex utriculata*, *Eleocharis quinqueflora*, and *Eriophorum gracile* (CRPR 4.3). All of the special status species in Table 2 occur in the main fen except for *Meesia uliginosa. Tomentypnum nitens* was the dominant moss in a 2010 survey plot within a *Vaccinium* stand, with an estimated 51% cover, and present in an adjacent stand. This species is only recently known from California and was also collected at Angora Creek Fen in the LTB.

Meadow 2 (LTAHWM_2F; Figure 6) is just north of the northern extension of the main fen. In this opening the fen vegetation communities include *Carex utriculata* Association, as well as stands dominated by *Juncus howellii*, *Vaccinium uliginosum,* and *Pinus contorta* var. *murrayana* with Labrador tea and huckleberry in the understory. *Meesia triquetra* is present (CRPR 4.2)

Meadow 5 (LTAHWM_5F; Figure 6) is an open area just northeast of Washoe Meadows Fen 2 that was confirmed as a fen. The plot sampled here is classified as the *Carex* (*utriculata, vesicaria*) Alliance in which there was a codominance of *Carex utriculata* and *C. angustata*. *Meesia triquetra* is present (CRPR 4.2).

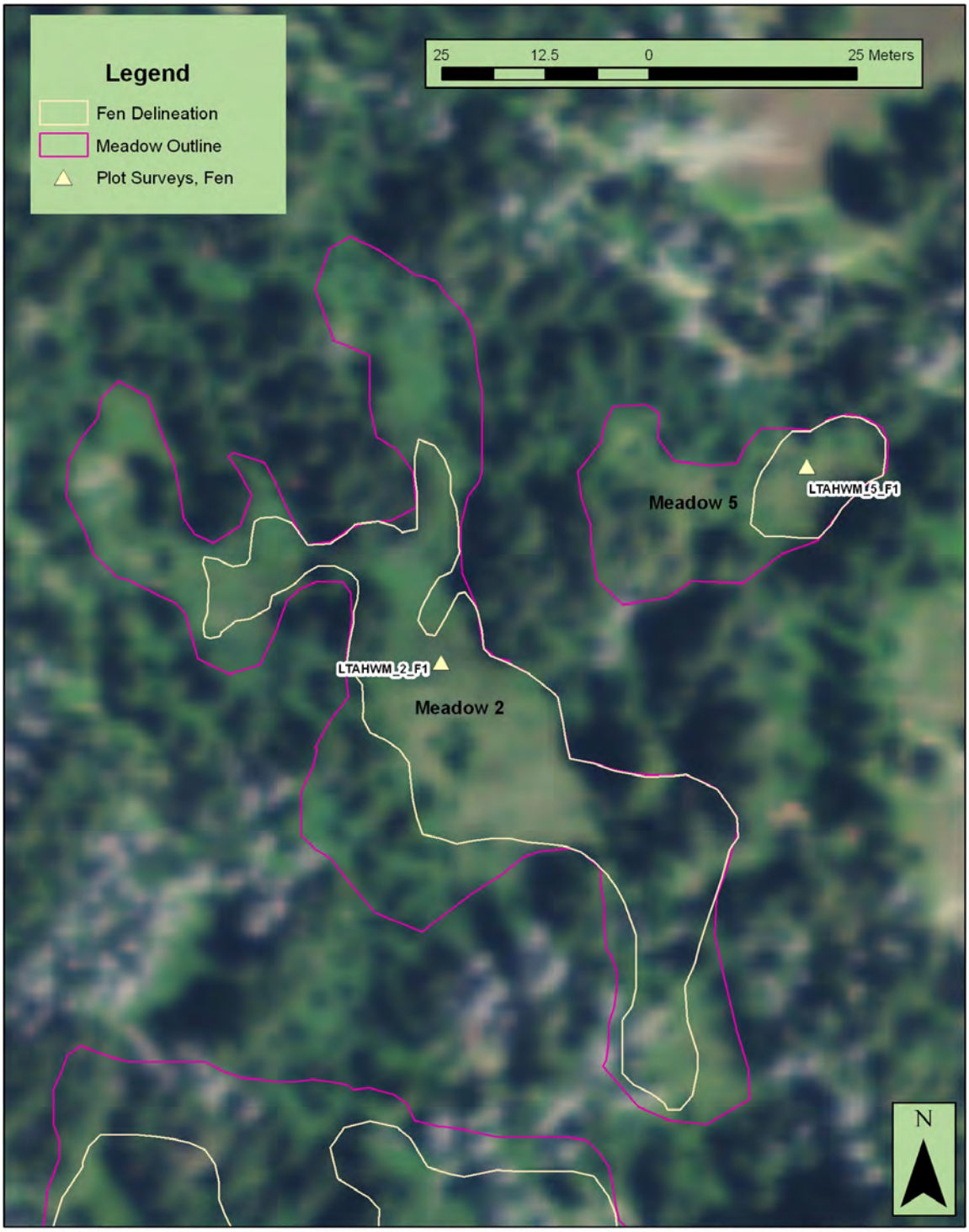
Meadow 4 (LTAHWM_4F; Figure 7) is located about 150 m east of Washoe Meadows 2. The area with the most peat is about 100 meters west of the dirt road. The saturated area between some fallen trees was confirmed to be fen. Our plot is classified as an *Eleocharis quinqueflora/Philonotis fontana-Bryum pseudotriquetrum* Association. Other dominant plants in the area include *Carex abrupta, Juncus nevadensis,* and *Mimulus guttatus*. *Meesia triquetra* is present (CRPR 4.2).

Meadow 3 (LTAHWM_3F; Figure 8) is located 250 m southwest of the old cabin site, and is the northernmost location sampled. This meadow contains a diversity of plant communities. The vegetation types sampled were *Oreostemma alpigenum, Vaccinium uliginosum/Aulacomnium palustre-Sphagnum (subsecundum),* and *Salix eastwoodiae* Associations, as well as a stand dominated by *Drosera rotundifolia* which is classified as the *Narthecium californicum-Triantha occidentalis* Alliance. Other dominant plants in the opening included *Pinus contorta* var. *murrayana*, *Juncus nevadensis*, *Carex capitata*, and *Pedicularis attollens*. Special status species recorded include *Carex limosa* (CRPR 2.2), *Eriophorum gracile* (CRPR 4.3), and *Meesia triquetra* (CRPR 4.2). In addition to the locations of special status plants, the map displays the location where a stream channel exits the fen and where a terrace has formed with different levels of peat on either side.



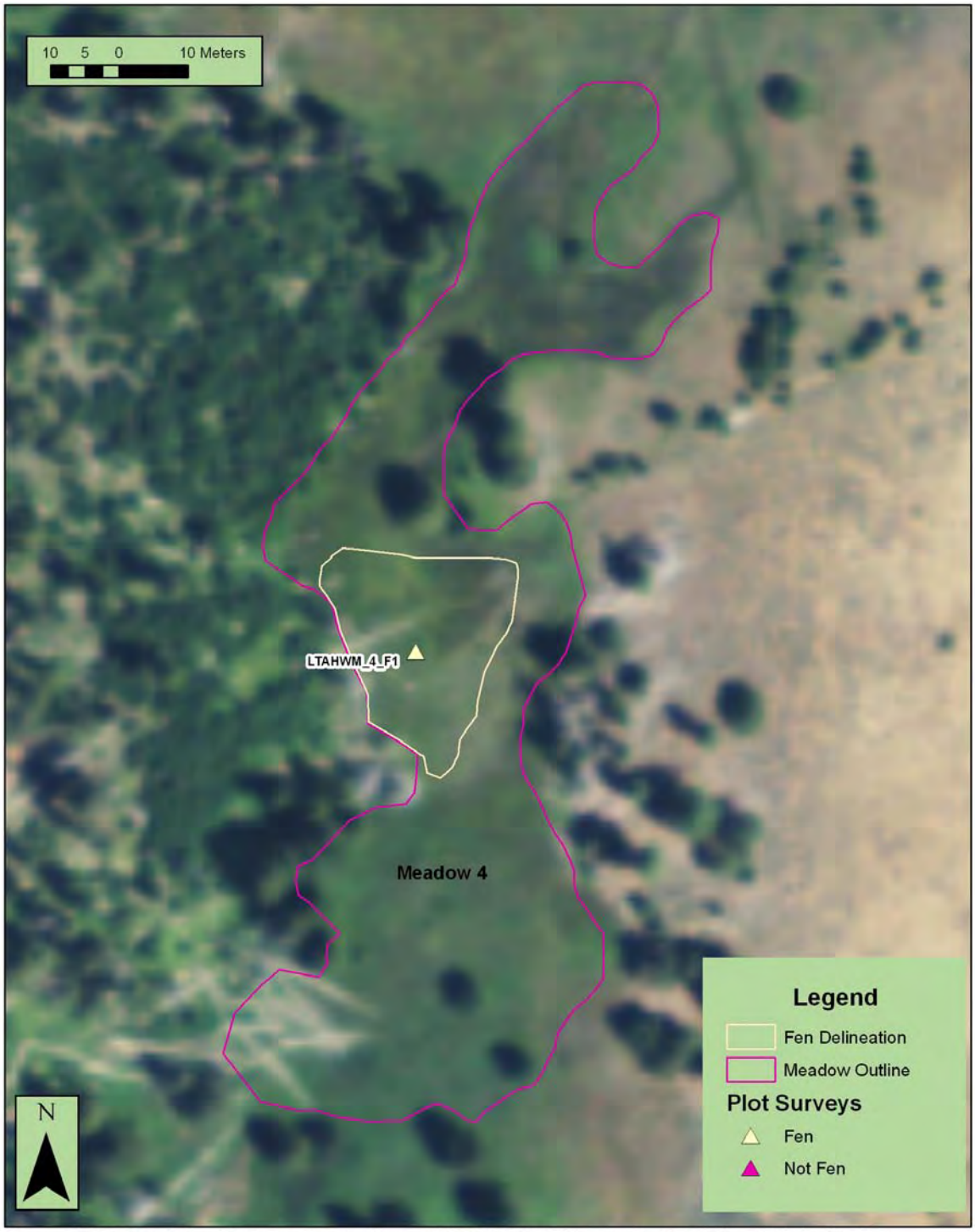
Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 5. Main fen at Washoe Meadows including the northern extension as well as 2010 and Stanton data points (Meadow LTAHWM_F).



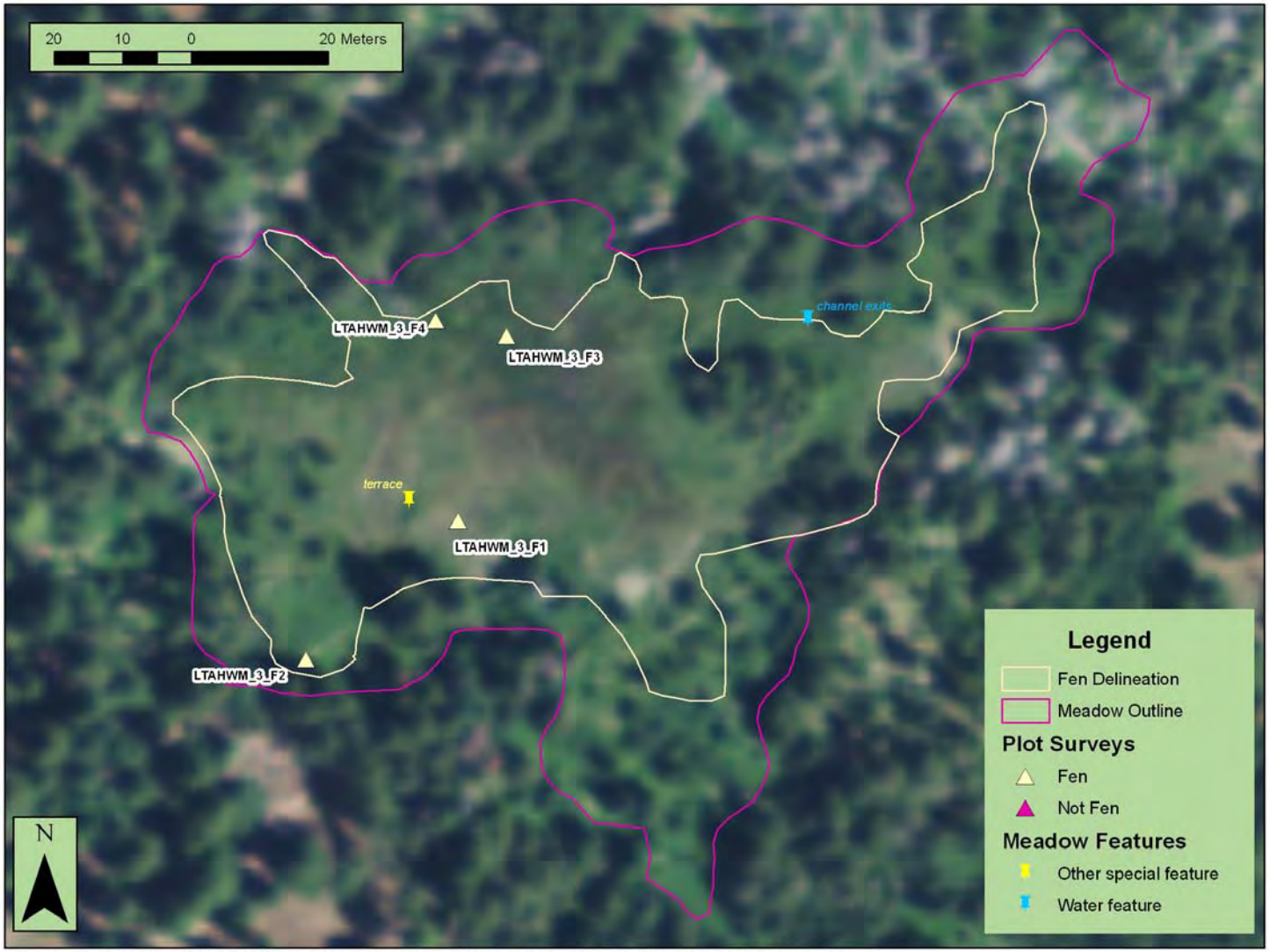
Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 6. Meadow 2 (LTAHWM_2F) and Meadow 5 (LTAHWM_5F).



Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 7. Meadow 4 (LTAHWM_4F).



Imagery: NAIP 2009, National Agriculture Imagery Program, USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah.

Figure 8. Meadow 3 (LTAHWM_3F).

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Appendix 1

Scans of Field Datasheets

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: Northern extension of main fen	**Date:** 18 Aug 2011 Aerial Photo #
Fen ID: UTAH WM_N	**Surveyors:** K. Sikes, D. Roach
Location info: Washoe Meadows St. Pk.	**Description:** Contiguous w/ main fen and almost contiguous with fen 2, varied topography, mature pines included. Bear seen. Pooled water in root hole of fallen pine.
Forest: State Park **District:**	
County: El Dorado T: 12 R: 18E Section: 19	**Quad:** Echo Lake **Elevation:** 1905 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	Photo #	View	Description

Surveyed Area Size: acres, **Entire meadow surveyed?** yes / no, %, **% of Meadow that is Fen:** 95%

# of Stands surveyed: 2 + 2010 1° H_2O source: **Meadow** **Seep** **Spring** **Drainage** 2° H_2O source: **Meadow** **Seep** **Spring** **Drainage**

# of Stands present: **List veg types present:** Juncus balticus, Carex utriculata, Aster alpigenus, Eleocharis quin., Pinus contorta, Eriophorum gracile present

Bedrock type:

Meadow Polygon delineated correctly? ☐ Accurate ☒ Not Accurate (Correct Map) ☐ New Polygon; Comments: extends to east

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☐ YES ☒ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO
- **CHANNEL(S) THROUGH SITE?** ☐ YES ☒ NO
- **SHRUB FEN PRESENT?** ☒ YES ☐ NO
- **TREED FEN PRESENT?** ☒ YES ☐ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☒ YES ☐ NO
- **TERRACE PRESENT?** ☐ YES ☒ NO
- **COMPLEXITY OF MICROTOPOGRAPHY**
  - ☐ 1 None
  - ☐ 2 Low. One raised feature.
  - ☐ 3 Moderate. Up to several separate raised features, or one complex feature.
  - ☒ 4 High. Numerous features and/or very well-developed network.of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)

- ☒ Subsurface, no incoming channel
- ☒ Surface channel inflow; # incoming: 2 could be more
- ☐ Spring(s) observed; # _____

STREAM FREQUENCY channels covered by veg

- ☐ 1 None
- ☐ 2 Low. One single thread
- ☒ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

STREAM SIZE

- ☒ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

WATER OUTFLOW (CHOOSE ALL THAT APPLY)

- ☐ Subsurface, no outgoing channel
- ☒ Surface channel outflow; # out: 2
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

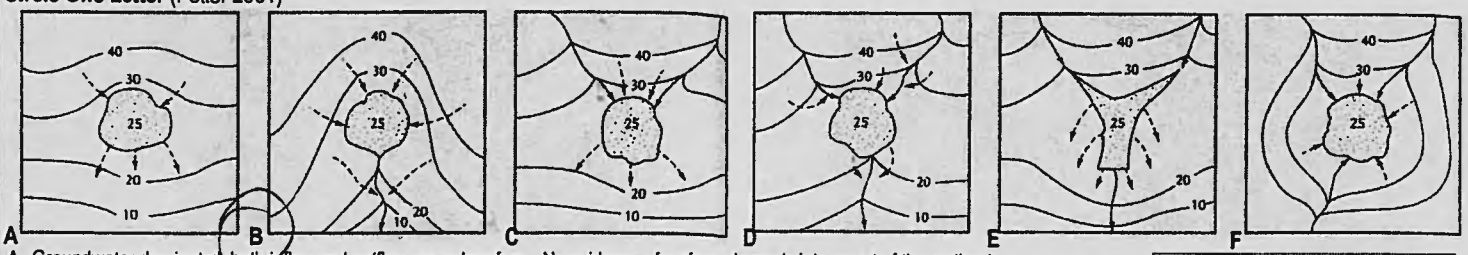
GULLY FREQUENCY

- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE

- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE

HYDROLOGIC ALTERATION ☒ NONE ☐ LOW ☐ MODERATE ☐ HIGH **IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION**

(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)

LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions

MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.

HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☒ NO DISTURBANCE IN POLYGON DISCUSSION

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION
potential dirt road within buffer				
↓ ROAD	human	2	3	including man fen
				about 1/2 of perimeter
				near road

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY	CAMPSITES	DEPOSITION (SEDIMENTATION)	DE-WATERING	(0 – NONE – NOT USED)	1 COVERS < 10%
BROWSING (WOODY PLANTS)	LITTER/ DUMPING/ TRASH	DITCHES (DUG BY MAN)	GROUNDWATER PUMPING	1 – LOW INTENSITY	2 COVERS ¼
GRAZING	ORV ACTIVITY / TRACKS	EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS)	SURFACE WATER DIVERSION	2 – MODERATE INTENSITY	3 COVERS ½
SMALL MAMMALS	BURIED UTILITY CORRIDORS			3 – HIGH INTENSITY	4 COVERS ¾
TRAILS/ FOOT TRAFFIC	DEVELOPMENT (> ROADS)	GROUND DISTURBANCE -(GENERAL)	DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW	4 – VERY HIGH INTENSITY	5 COVERS ALL
TRAMPLING/ HOOF PUNCH	POWER LINES	SOIL REMOVAL (PEAT MINING)	FLOODING (INCLUDING DAMS, DIKES)		
EXOTIC PLANT INVASION	ROADS (CONSTRUCTED)	TREE CUTTING / LOGGING			
FIRE					

★. **REQUIRED FIELDS.** †**BUFFER** IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

On the following page, provide a map sketch of the entire meadow polygon including:

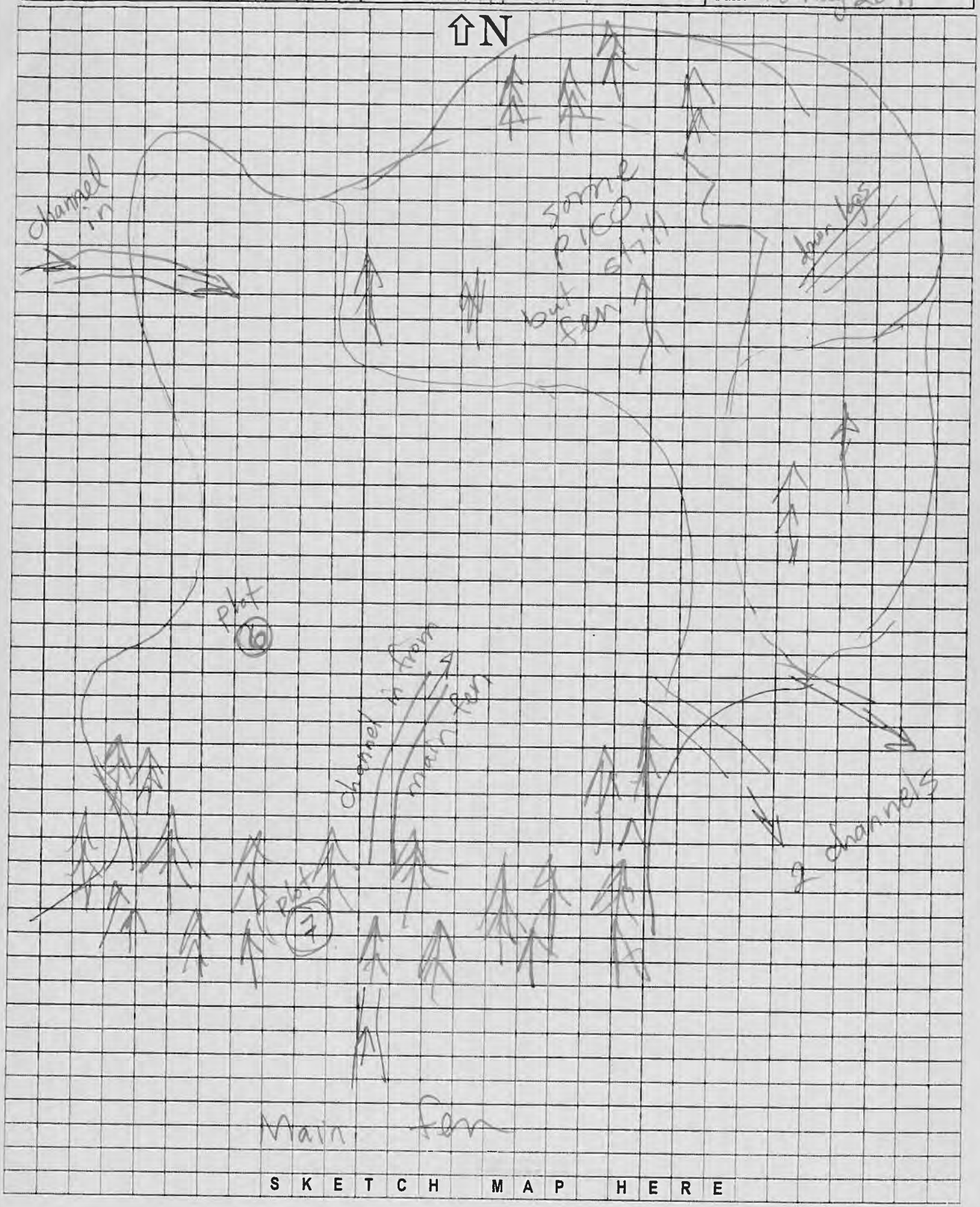
- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description
	The south

Northern Extension of main fen

Meadow Name:	Fen ID: LTAHWM-F	Date: 18 Aug 2011



LTAHWM_F7 1916 m

STAND/PLOT RECORD	Fen ID: LTAHWM	Date: 18 Aug 2011
GPS Coordinates: E 757927 N 4306188	UTM Zone: 10 / 11 HDOP 1.2	GPS datum: NAD83
Plot Number: 7	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or ____ degr,
	Estimated size of Fen Stand: >500 m² / acres	Aspect: NA
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / ____	

Photo #	View	Description
722	down	Soil core
723-726	N→W	from SW corner (Danielle at pit)
727	N	location of pit
728	E	looking towards plot showing closeness of pit
799	NE	to tree
(729)		across plot

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-15	very dark brown	ONBD	5	
15-33	" "	OBD	6	sticks + roots present
33+	brown	OBD	8	

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Pit dug at about ½ way point between SW + NW corner.

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	NA cm	Distance to standing or running water 6 m
Depth to Free Water in Pit (after ≥10 min)	7 cm	pH: 6.29 Electrical Conductivity ____ at T ____
Depth to Saturated Peat	0 cm	Root Zone temperature: 47.2 °F / C

Remarks: filled up fast, but not pooling up at feet. SW corner is actually at a water pool. Pit dug about 6 m from corner.

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100% some dry soil due to rodents

Water: <1 BA Stems: 2 Litter: 95 Rock (>2mm): Ø Fines (<2mm): <1 Bare Peat: 2 Cvrd Peat: Ø

Overall cover: Total % Non-Vasc cover: Ø Total % Vasc Veg cover: 80

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Pinus contorta	T	40	Chamerion angustifolium	F	7
Salix eastwoodiae	S	2	Galium aparine		<1
Vaccinium uliginosum		<1	Veronica serpyllifolia ssp. humifusa		<1
Ledum glandulosum		3	Mitella breweri		2
Sorbus californica (9 ft)		<1	Platanthera leucostachys		<1
Equisetum arvense		<1	Osmorhiza chilensis		<1
~~tall fescue/brome~~	G	<1	Sphenociadium capitellatum		1
~~fine Carex/Juncus~~ Carex disperma	G	8	Oxypolis occidentalis		<1
Remarks: (robust) Carex utriculata	M	14	Peridendia (Lemmonii or parishii)		<1
Ribes inerme (thorns)	S	<1	Epilobium ciliatum		<1
Orthilia secunda	F	<1	Thalictrum fendleri		<1
Veratrum californicum	F	<1	Fragaria virginica		<1
~~fine grass~~ Agrostis idahoensis	G	<1	Lonicera sp.		<1
~~Cirsium~~	F	<1			

Elymus trachycaulus ssp. subsecundus

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

Δ ID# on pt. LTAHWM_F6 1408

STAND/PLOT RECORD	Fen ID: ~~LTAHWM_NF1~~	Date: 8/18/11
GPS Coordinates: E 757911 N 4306218 UTM Zone: 10 / 11 ±Dof 0.9		GPS datum: Nad 83
Plot Number: LTAHWM 06	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or 1 degr,
	Estimated size of Fen Stand: 50 m² / acres	Aspect: 50° NE
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / 4x5	

Photo #	View	Description
0341	N	photos taken by Dense patch of Juncus in open area
0342	E	State Parks of fen. A small rivulet flows through stand
0343	S	(F6-N - F6-NE) only a few cm deep and no more than ½ ft wide
0344	W	Much Meesia triquetra and Dicranoloidus.
0345	NE	
	down	@ soil core

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-30	dark brown	ONBD	5	lot of the material mushy
31+	brown	ONBD	3	

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Nice peat and hole filled immediatly close to top but not quite. Peat @ feet is not peat, but damp.

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	— cm	Distance to standing or running water 1 m
Depth to Free Water in Pit (after ≥10 min)	5 cm	pH: 5.96 Electrical Conductivity ____ at T ____
Depth to Saturated Peat	0 cm	Root Zone temperature: 51.5 °F / C

Remarks: water filled pit immediatly but not to the top
Small rivulet through stand

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%
Water: 20 BA Stems: 2 Litter: 4 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 49 Cvrd Peat: 15
Overall cover: Total % Non-Vasc cover: 15 Total % Vasc Veg cover: 35

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Juncus balticus	G	20	Saxifraga oregana	F	2
Mimulus guttatus	F	3	Polygonum bistortoides	F	<1
Plantathera leucostachys	F	1	Ocosera rotundifolia	F	<1
Oxypolis occidentalis	F	3	Gentiana simplex (blue)	F	<1
Equisetum arvense	F	8	Trianthea occidentale	F	<1
Mimulus primuloides	F	3	Eleocharis quinqueflora	G	7
Aster alpigenus	F	2	(Calamagrostis)	G	<1
Pedicularis (parshii)	F	<1	Agrostis idahoensis	G	<1
Juncus howelii	G	2	Dicranocladus adunceus (614)	N	7
Carex utriculata	G	<1	Meesia triquetra	N	8
Epilobium (stolon)	F	<1	Carex vesicaria	G	2

Remarks:

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen
Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: Washoe Mdws Fen 2	**Date:** 17 Aug 2011 Aerial Photo #
Fen ID: LTAHWM_2	**Surveyors:** K. Sikes, D. Roach
Location info: Between northernmost and main fen	**Description:**
Forest: **District:** L	
County: El Dorado T: 12N R: 18E Section: 19	**Quad:** Echo Lake **Elevation:** 1924 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	Photo #	View	Description

Surveyed Area Size: .64 **acres,** **Entire meadow surveyed? yes / no,** .25 **%,** **% of Meadow that is Fen:** 60

# of Stands surveyed: 1 1° H_2O source: **Meadow Seep Spring Drainage** 2° H_2O source: **Meadow Seep Spring Drainage**

# of Stands present: **List veg types present:** Vaccinium uliginosum, Carex utriculata, Juncus hoveli, Vaccinium/Pine, Ledum-Vaccinium/Pine

Bedrock type:

Meadow Polygon delineated correctly? ☐ Accurate ☒ Not Accurate (Correct Map) ☐ New Polygon; Comments:

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☐ YES ☒ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO
- **CHANNEL(S) THROUGH SITE?** ☐ YES ☒ NO
- **SHRUB FEN PRESENT?** ☒ YES ☐ NO
- **TREED FEN PRESENT?** ☒ YES ☐ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☒ YES ☐ NO
- **TERRACE PRESENT?** ☐ YES ☒ NO
- **COMPLEXITY OF MICROTOPOGRAPHY**
  - ☐ 1 None
  - ☐ 2 Low. One raised feature.
  - ☒ 3 Moderate. Up to several separate raised features, or one complex feature.
  - ☐ 4 High. Numerous features and/or very well-developed network.of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)

- ☒ Subsurface, no incoming channel
- ☐ Surface channel inflow; # incoming: _____
- ☐ Spring(s) observed; # _____

WATER OUTFLOW (CHOOSE ALL THAT APPLY)

- ☒ Subsurface, no outgoing channel
- ☐ Surface channel outflow; # out: _____
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

STREAM FREQUENCY

- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

STREAM SIZE

- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

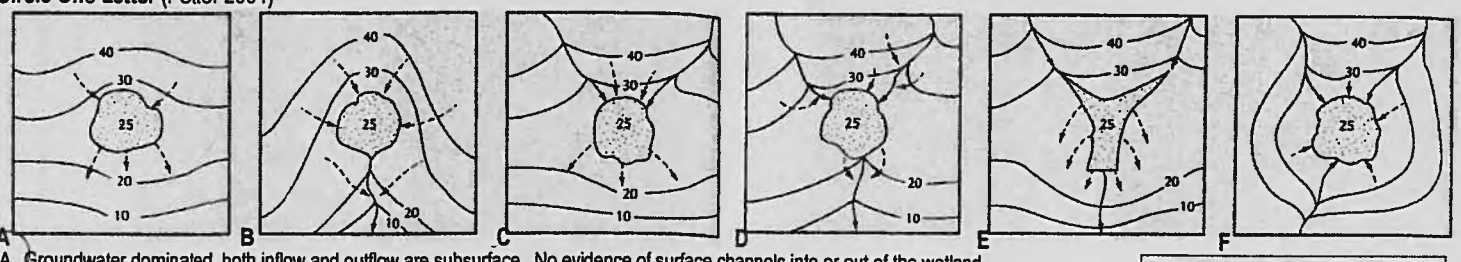
GULLY FREQUENCY

- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE

- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE

☐ HYDROLOGIC ALTERATION ☒ NONE ☐ LOW ☐ MODERATE ☐ HIGH IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION

(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)

LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions

MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.

HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☐ NO DISTURBANCE IN POLYGON DISCUSSION

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY BROWSING (WOODY PLANTS) GRAZING SMALL MAMMALS TRAILS/ FOOT TRAFFIC TRAMPLING/ HOOF PUNCH EXOTIC PLANT INVASION FIRE	CAMPSITES LITTER/ DUMPING/ TRASH ORV ACTIVITY / TRACKS BURIED UTILITY CORRIDORS DEVELOPMENT (> ROADS) POWER LINES ROADS (CONSTRUCTED)	DEPOSITION (SEDIMENTATION) DITCHES (DUG BY MAN) EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS) GROUND DISTURBANCE -(GENERAL) SOIL REMOVAL (PEAT MINING) TREE CUTTING / LOGGING	DE-WATERING GROUNDWATER PUMPING SURFACE WATER DIVERSION DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW FLOODING (INCLUDING DAMS. DIKES)	(0 – NONE – NOT USED) 1 – LOW INTENSITY 2 – MODERATE INTENSITY 3 – HIGH INTENSITY 4 – VERY HIGH INTENSITY	1 COVERS < 10% 2 COVERS ¼ 3 COVERS ½ 4 COVERS ¾ 5 COVERS ALL

★. REQUIRED FIELDS. †BUFFER IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

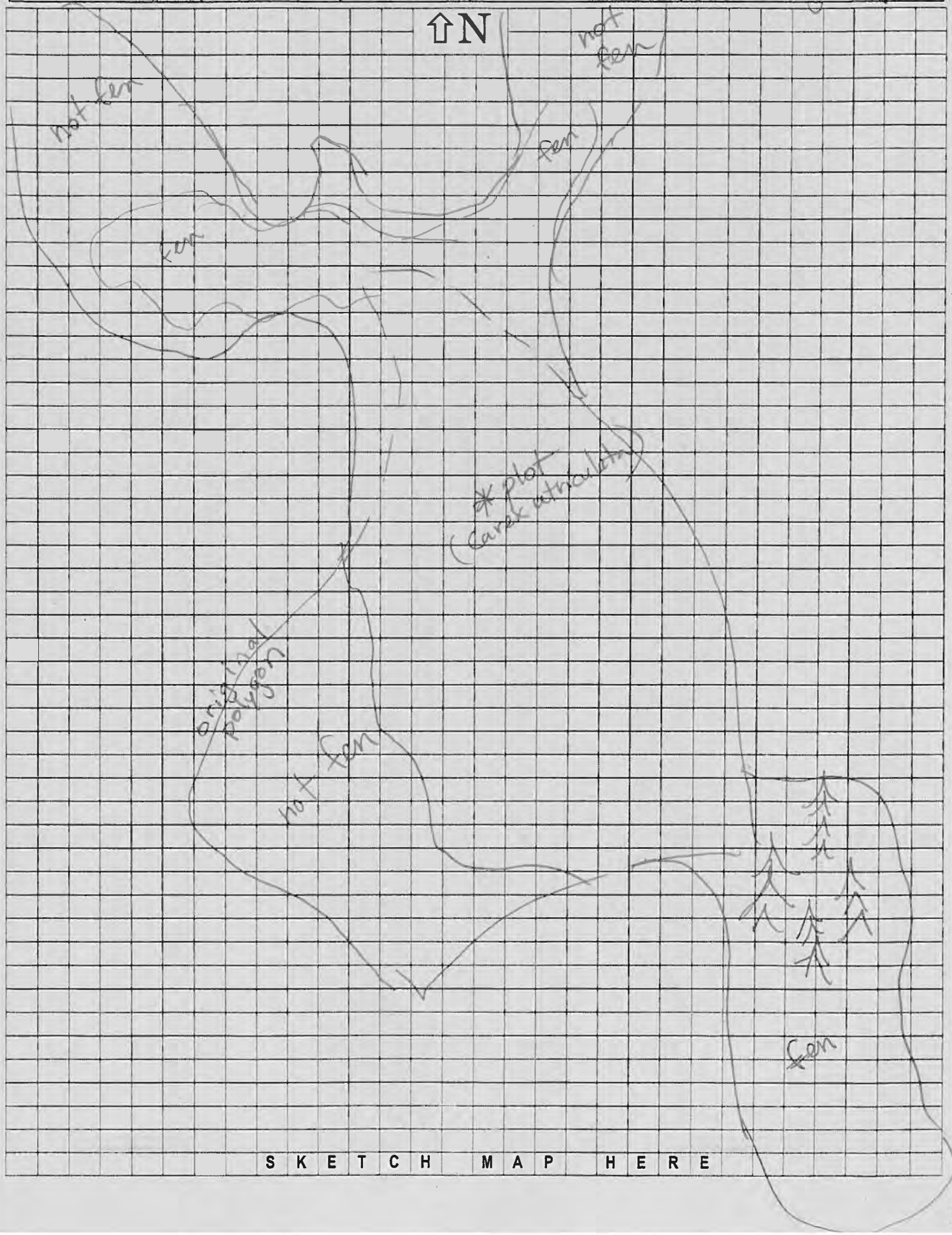
On the following page, provide a map sketch of the entire meadow polygon including:

- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description

Meadow Name: Washoe Meadows 2	Fen ID: LTAHWM_2 F	Date: 7 Aug 2 11



LTAHWM-2-F1 1924m

STAND/PLOT RECORD	Fen ID: LTAHWM2	Date: 17 Aug 2011
GPS Coordinates: E 757995 N 4306355 UTM Zone: 10 / 11 pg 22		GPS datum: NAD 83
Plot Number: 1	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or 0 degr,
	Estimated size of Fen Stand: 20 m² / acres	Aspect: NA
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / ____	

Photo #	View	Description
716-719	N→W	from SW corner
720	NE	" " across plot
721		photo of soil core

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
0-40cm	dk brown	ONBD	5	some reddish junks of wood pieces

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks:

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	NA cm	Distance to standing or running water 12 m
Depth to Free Water in Pit (after ≥10 min)	23 cm	pH: 6.05 Electrical Conductivity ____ at T ____
Depth to Saturated Peat	10 cm	Root Zone temperature: 59.6 °F / C

Remarks: Not filling quickly but sides are saturated and drip water when pressed

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

- [ ] Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- [ ] Recorded all plants & cover class
- [x] Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: Ø BA Stems: 2 Litter: 3 Rock (>2mm): Ø Fines (<2mm): Ø Bare Peat: 85 Cvrd Peat: 10

Overall cover: Total % Non-Vasc cover: 10 Total % Vasc Veg cover: 85

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Carex capitata	G	2	Hypericum anagalloides	F	1
Eriophorum gracile		7	Triantha occidentalis		3
Eleocharis quinqueflora		7	Oreostemma alsigenum		<1
Juncus howellii		12	Perideridia (lemmonii or parishii)		8
Carex utriculata		1	Mimulus primuloides		<1
Equisetum arvense		<1	Gentianopsis simplex		<1
Scirpus microcarpus		2	Saxifraga oregana		<1
Muhlenbergia filiformis		8	Bistorta bistortoides		<1
Vaccinium uliginosum	S		(Agrostis)	G	<1
			Drosera rotundifolia	F	<1
Carex echinata	G	<1	Meesia triquetra	N	2
			Drepanocladus sordidus	N	8
			Spiranthes romanzoffiana	F	<1

Remarks: Stand concentrated on Eriophorum

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

#22

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: ~~northmost~~ Washoe Meadows 3	**Date:** Aug 16, 2011 Aerial Photo #
Fen ID: LTAH WM_3	**Surveyors:** K. Sikes + D. Roach
Location info: SW from old cabin site approx. 200 m	**Description:** Opening definitely fen, with trees within fen on southern boundary and northern edge following treeline.
Forest: **District:**	
County: El Dorado T: R: Section:	**Quad:** **Elevation:** 1915 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	Photo #	View	Description
30165E		from GPS pt.			

more veg types could be surveyed

Surveyed Area Size: **acres,** **Entire meadow surveyed?** yes / no, ___ %, **% of Meadow that is Fen:** 100

# of Stands surveyed: 4 1° H_2O source: **Meadow Seep Spring Drainage** 2° H_2O source: **Meadow Seep Spring Drainage**

# of Stands present: **List veg types present:** Pinus contorta, Drosera/Eleocharis, Vaccinium/Aster, Pedicularis/Eleocharis, Vaccinium/Pine, Ledum/Pine, Juncus nevadensis-Drosera, Salix (tall), Carex capitata, Equisetum/Vaccinium/CAUT

Bedrock type:

Meadow Polygon delineated correctly? ☒ Accurate ☐ Not Accurate (Correct Map) ☐ New Polygon; Comments: OK, but fen extends beyond

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☐ YES ☒ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO
- **CHANNEL(S) THROUGH SITE?** ☐ YES ☒ NO
- **SHRUB FEN PRESENT?** ☒ YES ☐ NO
- **TREED FEN PRESENT?** ☒ YES ☐ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☒ YES ☐ NO
- **TERRACE PRESENT?** ☒ YES ☐ NO
- **COMPLEXITY OF MICROTOPOGRAPHY**
  - ☐ 1 None
  - ☐ 2 Low. One raised feature.
  - ☒ 3 Moderate. Up to several separate raised features, or one complex feature.
  - ☐ 4 High. Numerous features and/or very well-developed network.of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)
- ☒ Subsurface, no incoming channel
- ☒ Surface channel inflow; # incoming: 1
- ☐ Spring(s) observed; # ___

WATER OUTFLOW (CHOOSE ALL THAT APPLY)
- ☒ Subsurface, no outgoing channel
- ☒ Surface channel outflow; # out: 2
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

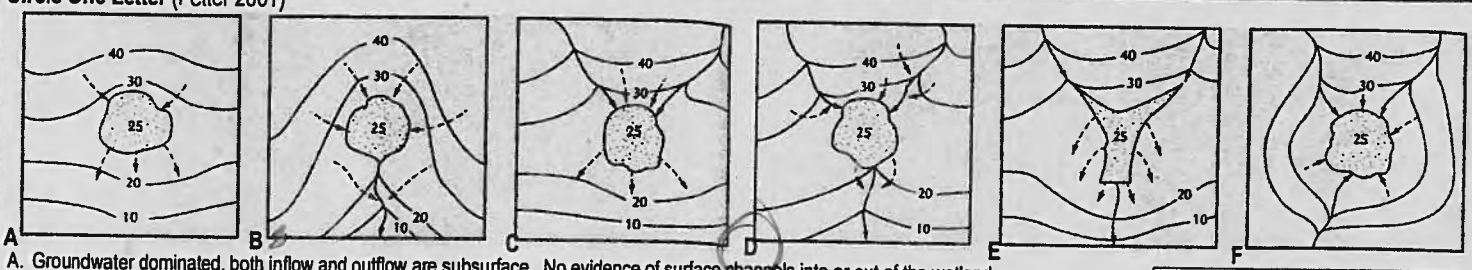
STREAM FREQUENCY channels not all way through
- ☐ 1 None
- ☐ 2 Low. One single thread
- ☒ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

STREAM SIZE
- ☒ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

GULLY FREQUENCY
- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE
- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE

HYDROLOGIC ALTERATION ☒ NONE ☐ LOW ☐ MODERATE ☐ HIGH IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION

(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)

LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions

MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.

HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☐ NO DISTURBANCE IN POLYGON DISCUSSION
wallow or soil pit (trampling)	bear/human	1	1	

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY BROWSING (WOODY PLANTS) GRAZING SMALL MAMMALS TRAILS/ FOOT TRAFFIC TRAMPLING/ HOOF PUNCH EXOTIC PLANT INVASION FIRE	CAMPSITES LITTER/ DUMPING/ TRASH ORV ACTIVITY / TRACKS BURIED UTILITY CORRIDORS DEVELOPMENT (> ROADS) POWER LINES ROADS (CONSTRUCTED)	DEPOSITION (SEDIMENTATION) DITCHES (DUG BY MAN) EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS) GROUND DISTURBANCE -(GENERAL) SOIL REMOVAL (PEAT MINING) TREE CUTTING / LOGGING	DE-WATERING GROUNDWATER PUMPING SURFACE WATER DIVERSION DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW FLOODING (INCLUDING DAMS. DIKES)	(0 – NONE – NOT USED) 1 – LOW INTENSITY 2 – MODERATE INTENSITY 3 – HIGH INTENSITY 4 – VERY HIGH INTENSITY	1 COVERS < 10% 2 COVERS ¼ 3 COVERS ½ 4 COVERS ¾ 5 COVERS ALL

★. REQUIRED FIELDS. †BUFFER IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

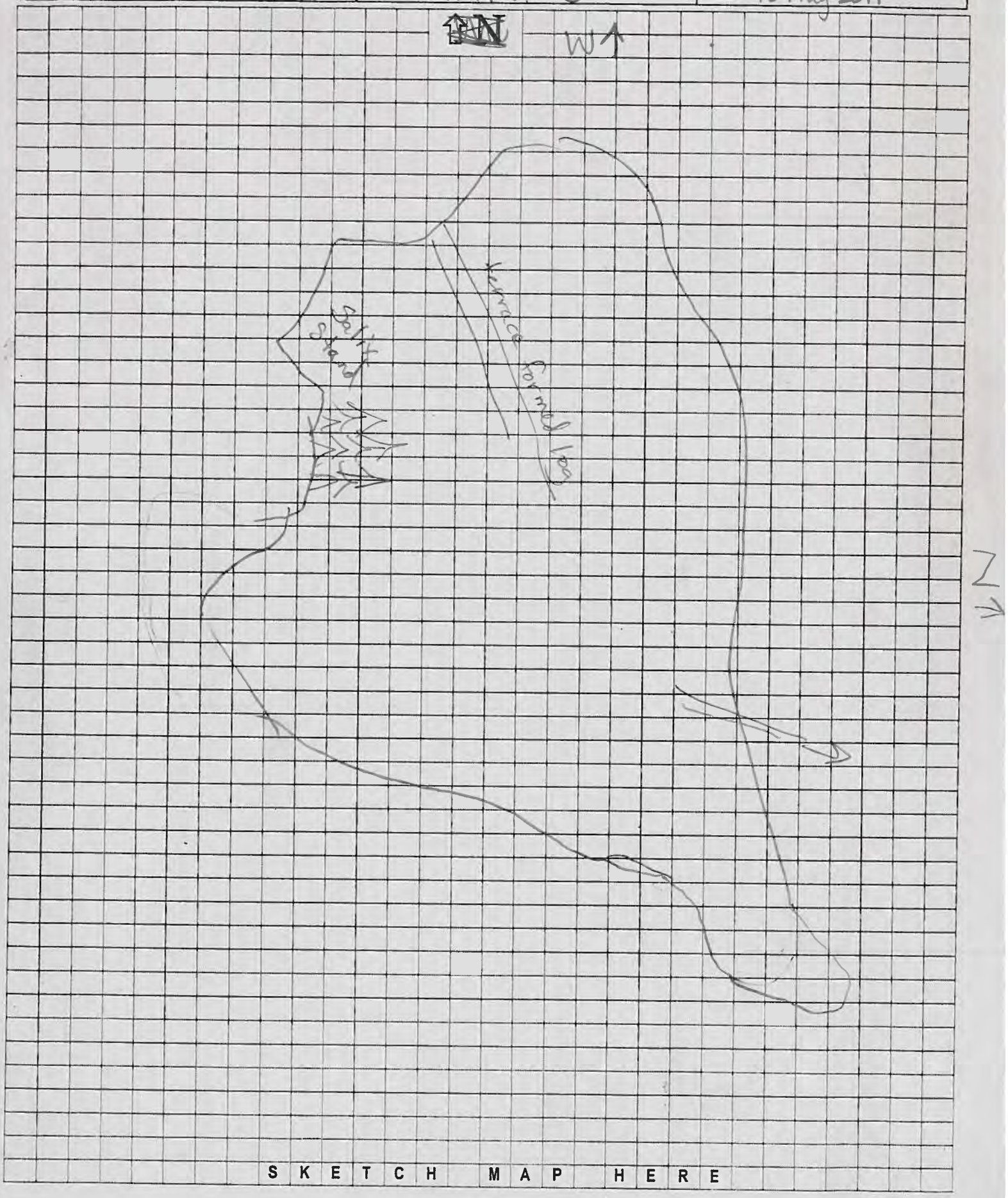
On the following page, provide a map sketch of the entire meadow polygon including:

- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description

Meadow Name: northmost	Fen ID: LTAHWM-3	Date: 16 Aug 2011



LTAHWM_3_F2 1928 m.

STAND/PLOT RECORD	Fen ID: LTAHWM-3	Date: 16 Aug 2011
GPS Coordinates: E 757862 N 4306494	UTM Zone: 10 / 11	GPS datum: NAD 83
Plot Number: 2	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or 0 degr,
	Estimated size of Fen Stand: 120 m² / acres	Aspect:
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / ____	

Photo #	View	Description
710-713	N→W	from SW corner
714	NE	across plot " "
715	down	soil core

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
0-40	dark brown	ONBD	5	sample taken

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks:

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	Ø cm	Distance to standing or running water 2 m
Depth to Free Water in Pit (after ≥10 min)	25 cm	pH: 6.19 Electrical Conductivity ____ at T ____
Depth to Saturated Peat	Ø cm	Root Zone temperature: 47.2 °F / C

Remarks: does not fill, but peat is well saturated all the way through

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

- [ ] Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- [ ] Recorded all plants & cover class
- [x] Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 6 BA Stems: 3 Litter: 15 Rock (>2mm): Ø Fines (<2mm): Ø Bare Peat: 69 Cvrd Peat: 7

Overall cover: Total % Non-Vasc cover: 7 Total % Vasc Veg cover: 80

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Lonicera involucrata	S	20	Tofieldia occidentalis	F	<1
Salix ♂ + ♀	S	3	Oxypolis occidentalis	F	6
Vaccinium uliginosum	S	4	Mimulus guttatus	F	1
Pinus contorta	T	18	Saxifraga oregana	F	1
Equisetum arvense	G	1	Epilobium ciliatum ssp. glandulosum (nodub)	F	<1
Carex angustata (grey green)	G	1	Veratrum californicum	F	1
Juncus howellii (ins #)	G	6	Platanthera leucostachys	F	1
Scirpus microcarpus	G	10	Chamerion angustifolium	F	2
Carex utriculata	G		Sphenosciadium capitellatum	F	<1

Remarks: Aconitum columbianum F <1; Peridridia Clemonii F <1; Carex echinata G <1; Juncus nevadensis (rd. #) G <1; Lonicera conjugialis S <1; Ledum glandulosum S <1; Lilium parvum F <1; Geranium richardsonii F <1

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

Calamagrostis stricta

tall spike grass G <1; Stellaria longipes F <1; Polygonum bistortoides F <1; Hypericum formosum v. scouleri F <1; Camassia quamash F <1; Plagiomnium medium

Bryum; Polemonium occidentale; Fragaria virginica; Aulacomnium palustre; Dracocephalum; branched Bryum; Brachythecium frigidum; skinny moss

#10 #11 #8 #9 KGS

LTAHWM_3_F1

1915

STAND/PLOT RECORD	Fen ID: LTAHWM3_01	Date: 8/16/11
GPS Coordinates: E 757883 N 4306518 UTM Zone: 10 / 11	Pdop 2.2	GPS datum: Nad 83
Plot Number: LTAHWM03_01	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ___ % or 1 degr,
	Estimated size of Fen Stand: 30 m² / acres	Aspect: 98° ESE
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / 4x5	

Photo #	View	Description
~~307~~	~~N~~	Photos retaken by State Parks. Small Drosera stand w/ Eleocharis and Mimulus primuloides w/ much Meesia triquitra surrounding the Drosera. Entire stand has standing water & mosses. Small patches of Vaccinium scattered in stand. Drosera is dense! Stand repeats in open area on South end
~~308~~	~~E~~	
~~309~~	~~S~~	
~~310~~	~~W~~	
~~311~~ 312	~~NE/Down~~	
	Down @ Soil	

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-3	Dark brown	ONBD	3	very thin layer of moss
3-33	light brown	OBD	3	
33+	Dark brown	OBD	7	

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks:

No samples available.

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season Yes

Depth of Surface Water	N/A cm	Distance to standing or running water	0.5 meters
Depth to Free Water in Pit (after ≥10 min)	3 cm	pH: 6.36	Electrical Conductivity ___ at T ___
Depth to Saturated Peat	0 cm	Root Zone temperature:	66.2 °F / C

Remarks:

May have filled up more in time standing water in plot but dying

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

- [ ] Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- [ ] Recorded all plants & cover class
- [x] Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 30 BA Stems: 1 Litter: 5 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 3 Cvrd Peat: 61 (39)

Overall cover: Total % Non-Vasc cover: 68 Total % Vasc Veg cover: 51

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Drosera rotundifolia	F	30	Carex limosa	G	<1
Eleocharis quinqueflora	G	6	Triantha occidentalis	F	<1
Mimulus primuloides	F	6	Meesia triquitra	N	45
Equisetum arvense	F	6	Carex utriculata	G	<1
Pedicularis sp.	F	1	Carex capitata	G	1
Vaccinium uliginosum	S	4	Drepanocladus sordidus (610)	N	15
Carex echinata	G	1	Moss (")	N	
Aster alpigenus	F	6	Polygonum bistortoides	F	<1
			Rosette	F	<1
			Pinus contorta var murrayana	T/Seedling	<1

Remarks:

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

LTAHWM_3_F3 1908

STAND/PLOT RECORD	Fen ID: LTAHWMIII_	Date: 8/16/11
GPS Coordinates: E 757890 N 4306542	UTM Zone: 10 / 11	GPS datum: Nad 83
Plot Number: LTAHWMIII_03	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ___% or 1 degr,
	Estimated size of Fen Stand: 200 m² / acres	Aspect: 98° W
PLOT PICTURES	Defined plot used?: yes / no	If yes, plot size (m²): 10 / 20 / 100 / 4x5

Photo #	View	Description
0314	N	Photos retaken by State Parks. Stand repeats across the open portion of fen toward the SE and E small patches to the SW. Half of stand is recently drying up and the other half still has standing water. Dense Aster alpigenus and some Drosera breneth
0315	E	
0316	S	
0317	W	
0318	NE	

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: No pit dug

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season Yes

Depth of Surface Water	0.5 cm	Distance to standing or running water	0 m slowly @ SW corner
Depth to Free Water in Pit (after ≥10 min)	NA cm	pH: 7.01	Electrical Conductivity ___ at T ___
Depth to Saturated Peat	0 cm	Root Zone temperature: 64.9	°F / C

Remarks: No pit dug

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

- ☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- ☐ Recorded all plants & cover class
- ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 45 BA Stems: 2 Litter: 3 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 40 Cvrd Peat: 10 (85)

Overall cover: Total % Non-Vasc cover: 10 Total % Vasc Veg cover: 45

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Aster alpigenus	F	25	Muhlenbergia filiformis	G	1
Triantha occidentalis	F	1	Polygonum bistortoides	F	<1
C Carex utriculata	G	1	basal lvs	F	<1
Equisetum arvense	F	3	Mimulus primuloides	F	3
vc Carex echinata	G	1	Epilobium sp.	F	<1
vc Carex capitata	G	1	Drepanocladus sordidus (G11)	N	10
Drosera rotundifolia	F	10	Vaccinium uliginosum	S	1
Eleocharis sp.	G	2	Saxifraga oregana	F	<1
			Oxalis occidentalis	F	1
			Peridridia sp	F	<1

Remarks:

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

LTAHWM_3_F4

1910

STAND/PLOT RECORD	Fen ID: LTAHWM III	Date: 8/16/11
GPS Coordinates: E 757877 N 4306538	UTM Zone: 10 / 11 PDOP 2.7	GPS datum: Nad 83
Plot Number: LTAHWM III_04	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or ____ degr,
	Estimated size of Fen Stand: 100 m² / acres	Aspect: SSE
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / 4x5	

Photo #	View	Description
319	N	Photos retaken by State Parks
310	E	
321	S	
322	W	
0323	NE	
0327	down	Soil

Stand of short (1ft) Vaccinium shrubs scattered w/ Aster & Juncus btwn. Presence of Drosera & Mecsia. Stand continues to West of point and NE adjacent to Pine stands

SOILS — Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-20	dark brown	ONBD	3	lots of roots (living) more mucky
20-40	light Brown	ONBD	2	more decomposing roots lighter water

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks:

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY — Determine if Soil is Saturated for a Good Portion of the Growing Season Yes

Depth of Surface Water	NA cm	Distance to standing or running water	3 meters
Depth to Free Water in Pit (after ≥10 min)	14 cm	pH: 5.91	Electrical Conductivity ____ at T ____
Depth to Saturated Peat	0 cm	Root Zone temperature: 62°	°F / C

Remarks: Pit was still filling after 10 min

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION — Check the vegetation sampling method used below:

- ☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- ☐ Recorded all plants & cover class
- ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 8 BA Stems: 2 Litter: 5 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 75 Cvrd Peat: 10

Overall cover: Total % Non-Vasc cover: 10 Total % Vasc Veg cover: 45

Plant Species Agrostis sp |G|<1	Strata	Cvr	Plant Species Calamagrostis stricta |G|<1	Strata	Cvr
Vaccinium uliginosum	S	25	Mimulus primuloides	F	6
Aster alpigenus	F	20	Saxifraga oregana	F	2
Trianthe occidentalis	F	1	Drosera rotundifolia	F	4
Juncus hallii	G	6	Carex echinata	G	<1
Polygonum bistortoides	F	<1	Eleocharis sp.	G	1
Pedicularis sp	F	1	Carex inteciata	G	<1
Equisetum arvense	F	4	Carex capillata	G	<1
Plantathera leucostedyis	F	<1	(red midrib tus)	F	<1
Remarks: Spiranthese porrifolia	F	<1	Mimulus guttatus	F	1
Pinus contorta var murrayana	T	<1	Pedicularis sp.	F	<1
Lonicera involucrata	S	<1	Drepanocladus aduncus (G13)	M	5
Aulacomnium palustre (G12)	M	1	Mecsia triquetra	M	5

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: Washoe Meadows 4	**Date:** 17 Aug 2011 Aerial Photo #
Fen ID: LTAH WM_4	**Surveyors:** K. Sikes, D. Roach
Location info: Washoe Meadows St. Pk	**Description:** Above ground channel draining from fen area above. Potentially fen area is between 2 fallen logs, not quite to tree line on eastern edge. And half way between log + tree island on north side. To tree line on west side.
Forest: **District:**	
County: El Dorado T: R: Section:	**Quad:** **Elevation:** 1900 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	Photo #	View	Description
330-331	N-W	from SW corner			
332	NE	" " across plot			

Surveyed Area Size: **acres,** **Entire meadow surveyed? yes / no,** ____ **%,** **% of Meadow that is Fen:**

# of Stands surveyed: 1 **1° H_2O source:** **Meadow Seep Spring Drainage** **2° H_2O source:** **Meadow Seep Spring Drainage**

# of Stands present: 5 **List veg types present:** Carex simulata, Mimulus guttatus (stream channel), Eleocharis quinqueflora, Juncus nevadensis, Juncus nevadensis (less fen-like area)

Bedrock type:

Meadow Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon; Comments: use imagery to draw

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon see GPS pts

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☐ YES ☒ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO ?
- **CHANNEL(S) THROUGH SITE?** ☒ YES ☐ NO
- **SHRUB FEN PRESENT?** ☐ YES ☒ NO
- **TREED FEN PRESENT?** ☐ YES ☒ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☐ YES ☒ NO
- **TERRACE PRESENT?** ☐ YES ☒ NO

COMPLEXITY OF MICROTOPOGRAPHY
- ☐ 1 None
- ☒ 2 Low. One raised feature.
- ☐ 3 Moderate. Up to several separate raised features, or one complex feature.
- ☐ 4 High. Numerous features and/or very well-developed network of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)
- ☐ Subsurface, no incoming channel
- ☒ Surface channel inflow; # incoming: 1
- ☐ Spring(s) observed; # ____

STREAM FREQUENCY
- ☐ 1 None
- ☒ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

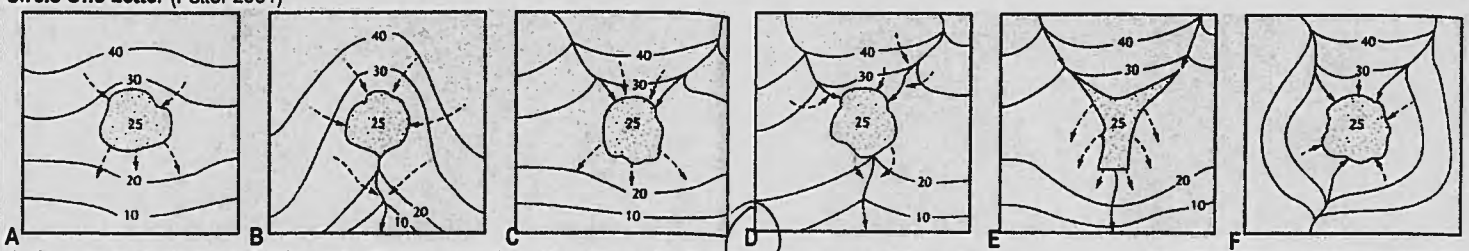
STREAM SIZE
- ☒ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

WATER OUTFLOW (CHOOSE ALL THAT APPLY)
- ☐ Subsurface, no outgoing channel
- ☒ Surface channel outflow; # out: 1
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

GULLY FREQUENCY
- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE
- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE
☐ HYDROLOGIC ALTERATION ☐ NONE ☐ LOW ☐ MODERATE ☐ HIGH IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION
(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)
LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions
MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.
HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☐ NO DISTURBANCE IN POLYGON DISCUSSION

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION
old railroad grade				historic

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY	CAMPSITES	DEPOSITION (SEDIMENTATION)	DE-WATERING	(0 – NONE – NOT USED)	1 COVERS < 10%
BROWSING (WOODY PLANTS)	LITTER/ DUMPING/ TRASH	DITCHES (DUG BY MAN)	GROUNDWATER PUMPING	1 – LOW INTENSITY	2 COVERS ¼
GRAZING	ORV ACTIVITY / TRACKS	EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS)	SURFACE WATER DIVERSION	2 – MODERATE INTENSITY	3 COVERS ½
SMALL MAMMALS	BURIED UTILITY CORRIDORS	GROUND DISTURBANCE -(GENERAL)	DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW	3 – HIGH INTENSITY	4 COVERS ¾
TRAILS/ FOOT TRAFFIC	DEVELOPMENT (> ROADS)	SOIL REMOVAL (PEAT MINING)	FLOODING (INCLUDING DAMS. DIKES)	4 – VERY HIGH INTENSITY	5 COVERS ALL
TRAMPLING/ HOOF PUNCH	POWER LINES	TREE CUTTING / LOGGING			
EXOTIC PLANT INVASION	ROADS (CONSTRUCTED)				
FIRE					

★. REQUIRED FIELDS. †BUFFER IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

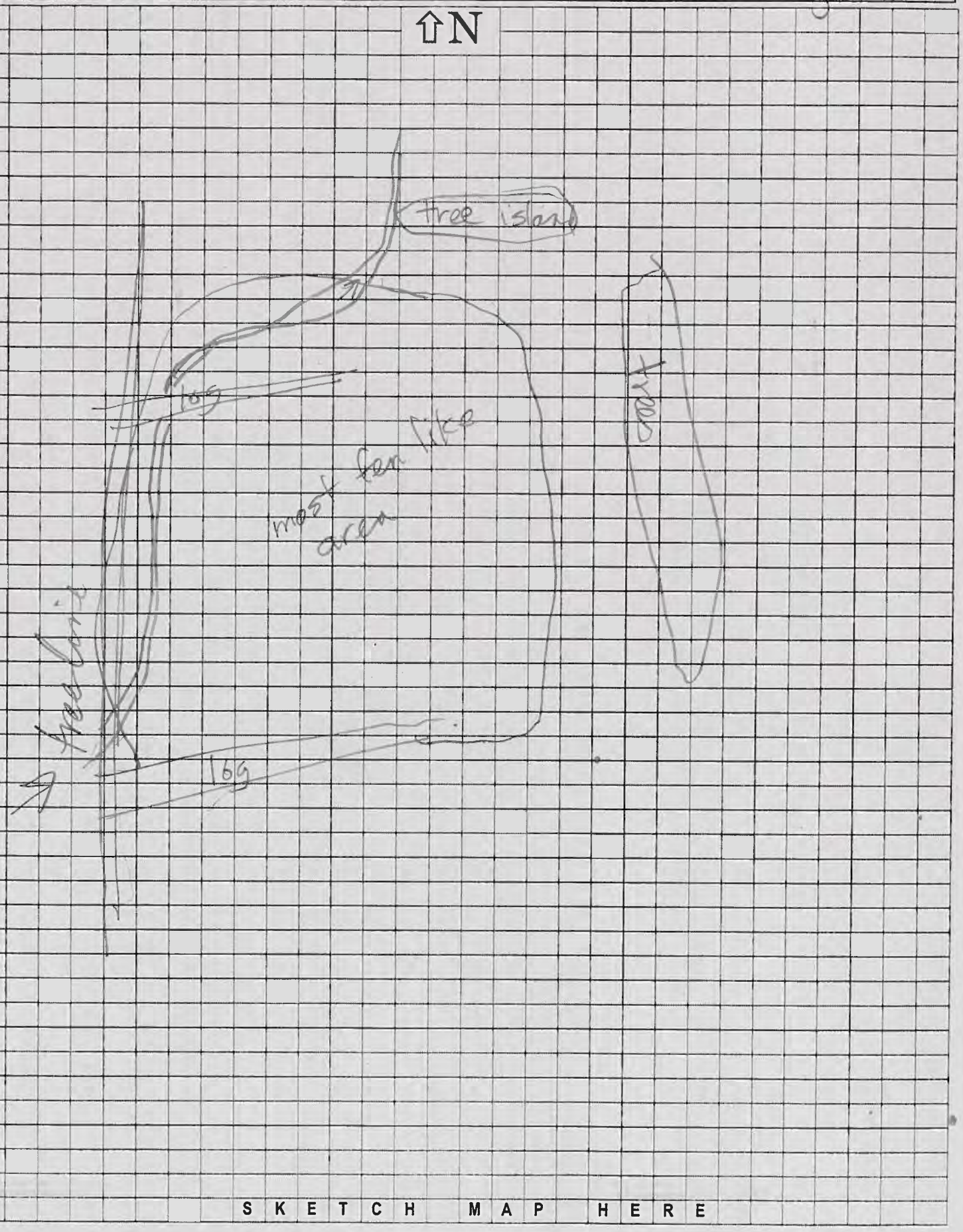
On the following page, provide a map sketch of the entire meadow polygon including:

- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description

Meadow Name:	Fen ID: LTAHWM3	Date: 17 Aug 2011



LTAHWM_4_F1 1899 m

STAND/PLOT RECORD	Fen ID: LTAHWM4_1	Date: 17 Aug 2011
GPS Coordinates: E 758159 N 4306334	UTM Zone: 10 / 11 Pdop 1.7	GPS datum: NAD83
Plot Number: 1	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or 0 degr,
	Estimated size of Fen Stand: 35 m² / acres	Aspect: —
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / _____	

Photo #	View	Description
334		soil core
332	NE	from SW corner, across plot
328-331	N→W	" "

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-20	very dk brown	ONBD	5	
20-35	brown	ONBD	5	
35-40	light brown	clay		w/ sand particles

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Seems like there is a layer of water under the surface, not enough soil there. Somewhat like a floating mat.

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	NA cm	Distance to standing or running water	12 m
Depth to Free Water in Pit (after ≥10 min)	2 cm	pH: 6.21	Electrical Conductivity _____ at T _____
Depth to Saturated Peat	0 cm	Root Zone temperature:	54.9 °F / C

Remarks: water pools around feet

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%
Water: Ø BA Stems: 2 Litter: 4 Rock (>2mm): Ø Fines (<2mm): Ø Bare Peat: 9 Cvrd Peat: 87
Overall cover: Total % Non-Vasc cover: 87 Total % Vasc Veg cover: 30

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
c Juncus howelli (iris-leaf)	G	2	Saxifraga oregana	F	7
d Carex (~~simulata~~) abrupta	G	15	Mimulus guttatus		3
b Juncus nevadensis (rd lf.)	G	1	Oreostemma alpigenus		<1
Equisetum arvense		<1	Gentianopsis simplex		<1
e Eleocharis quinqueflora	G	10	Mimulus primuloides		4
Plantathera leucostachys	F	<1	Drosera rotundifolia		<1
Muhlenbergia filiformis	G	<1	Polygonum bistortoides		1
Stellaria longipes	F	<1	Spiranthes romanzoffiana		<1
Remarks: Luzula comosa	G	1	Meesia triquetra	N	2
#16 Drepanocladus aduncus	N	20	Dodecatheon alpinum	F	<1
#15 ~~Bryum~~ Ptychostomum pallens	N	1	Philinotis fontana	N	64
c Epilobium sm. stolon	F	<1	Marchantia polymorpha	N	1

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen
Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

Trifolium sp. F <1

#13 #14

LTAHWM_S_F1 LTAHWM_5 1903

STAND/PLOT RECORD	Fen ID: LTAHWM II N	Date: 8/18/11
GPS Coordinates: E 758035 N 4306382	UTM Zone: 10 / 11 PDOP 2.2	GPS datum: NAD 83
Plot Number: 1 (LTAHWM II N)	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ___ % or 1 degr,
	Estimated size of Fen Stand: 30 m² / acres	Aspect: NE
PLOT PICTURES	Defined plot used?: yes / no	If yes, plot size (m²): 10 / 20 / 100 / 4x5

Photo #	View	Description
0354	down	@ Soil core Small opening w/ mixed species + patches of Drosera & moss
		Photos retaken lots of pooling water in plot
		by state parks and lots of moss btw Carex &
		Juncus, surrounded by PICO
0351	NE	and VAUL

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-16	dark brown	ONBD	3	live roots w/in
17-35	very dark brown	OBD	6	no live roots w/in, mushy
35+	Very Dark brown	Clay	9	Clayey @ bottom

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Peaty @ top and then mushy and at 40+ there was hard clay layer not sampled

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	— cm	Distance to standing or running water 0.5 m
Depth to Free Water in Pit (after ≥10 min)	8 cm	pH: 6.46 Electrical Conductivity ___ at T ___
Depth to Saturated Peat	0 cm	Root Zone temperature: 55.0 °F / C

Remarks: Pit filled immediately

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

- [ ] Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- [ ] Recorded all plants & cover class
- [x] Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 30 BA Stems: 2 Litter: 3 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 12 Cvrd Peat: 53 (47)

Overall cover: Total % Non-Vasc cover: 53 Total % Vasc Veg cover: 29

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Mimulus primuloides	F	6	Carex echinata	G	2
Triantha occidentalis	F	<1	Carex angustata	G	6
Saxifraga oregana	F	3	Carex cappitata	G	3
Mimulus guttatus	F	1	Carex utriculata	G	6
Drosera rotundifolia	F	1	Agrostis idahoensis	G	<1
Vaccinium uliginosum	S	2	Muhlenbergia filiformis	G	<1
Equisetum arvense	F	1	Juncus howellii	G	3
Veratrum californicum	F	<1	Dicranocladus sordidus (615)	N	53
Remarks: Oxypolis occidentalis	F	<1	Eleocharis quinqueflora	G	2
Aster alpigenus	F	1	Epilobium sp	F	<1
Polygonum bistortoides	F	1	Meesia triquetra	N	3
Pedicularis (Clemmonsii or parishii)	F	<1			

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: Spring at Washoe Meadows	**Date:** Aug 15, 2011 Aerial Photo #
Fen ID: LTAHWM_SP	**Surveyors:** K. Sikes + D. Roach
Location info: Washoe Meadow St. Pt. About 350 m SSW of main fen. See UTM of spring source at photo pt.	**Description:** Spring with obvious pool at source. Lots of down logs over channel flowing from spring. Fairly level at spring about 3°. Rivulets coming down from spring. Fenniest areas near bottom
Forest: Washoe **District:**	
County: El Dorado T: 12N R: 18E Section: 30	**Quad:** Echo Lake **Elevation:** 1916 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	~~Photo #~~	~~View~~	~~Description~~
699+700	SE	Spring source at GPS pt. for spring 757828E, 4305685N			
707	SE	B pt lower wetland area			
708	NW	pt B towards spring			

Surveyed Area Size: **acres,** **Entire meadow surveyed?** yes / no, %, **% of Meadow that is Fen:**

# of Stands surveyed: 3 1° H_2O source: **Meadow Seep Spring Drainage** 2° H_2O source: **Meadow Seep Spring Drainage**

# of Stands present: **List veg types present:** Carex utriculata, Allium vallidum, Carex angustata, Equisetum, Juncus nevadensis-Oxypolis, Marchantia mats, Lily w/ striped fruits, Lupinus polyphyllus

Bedrock type:

Meadow Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon; Comments:

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☒ New Polygon

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☒ YES ☐ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO
- **CHANNEL(S) THROUGH SITE?** ☐ YES ☒ NO
- **SHRUB FEN PRESENT?** ☐ YES ☒ NO
- **TREED FEN PRESENT?** ☐ YES ☒ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☒ YES ☐ NO
- **TERRACE PRESENT?** ☐ YES ☒ NO

COMPLEXITY OF MICROTOPOGRAPHY
- ☐ 1 None
- ☐ 2 Low. One raised feature.
- ☒ 3 Moderate. Up to several separate raised features, or one complex feature.
- ☐ 4 High. Numerous features and/or very well-developed network.of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)
- ☐ Subsurface, no incoming channel
- ☐ Surface channel inflow; # incoming: _____
- ☒ Spring(s) observed; # 1

WATER OUTFLOW (CHOOSE ALL THAT APPLY)
- ☒ Subsurface, no outgoing channel
- ☐ Surface channel outflow; # out: _____
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

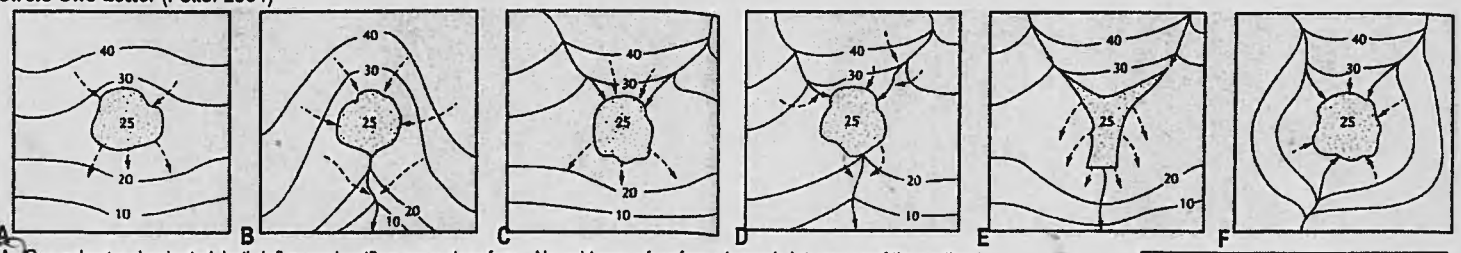
STREAM FREQUENCY
- ☐ 1 None
- ☐ 2 Low. One single thread
- ☒ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

STREAM SIZE
- ☒ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

GULLY FREQUENCY
- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE
- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE

☐ HYDROLOGIC ALTERATION ☐ NONE ☐ LOW ☐ MODERATE ☐ HIGH IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION

(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)

LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions

MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.

HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☐ NO DISTURBANCE IN POLYGON DISCUSSION
trunks of trees cut down				
barrel inside spring pool				

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY	CAMPSITES	DEPOSITION (SEDIMENTATION)	DE-WATERING	(0 – NONE – NOT USED)	1 COVERS < 10%
BROWSING (WOODY PLANTS)	LITTER/ DUMPING/ TRASH	DITCHES (DUG BY MAN)	GROUNDWATER PUMPING	1 – LOW INTENSITY	2 COVERS ¼
GRAZING	ORV ACTIVITY / TRACKS	EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS)	SURFACE WATER DIVERSION	2 – MODERATE INTENSITY	3 COVERS ½
SMALL MAMMALS	BURIED UTILITY CORRIDORS			3 – HIGH INTENSITY	4 COVERS ¾
TRAILS/ FOOT TRAFFIC	DEVELOPMENT (> ROADS)	GROUND DISTURBANCE -(GENERAL)	DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW	4 – VERY HIGH INTENSITY	5 COVERS ALL
TRAMPLING/ HOOF PUNCH	POWER LINES	SOIL REMOVAL (PEAT MINING)	FLOODING (INCLUDING DAMS. DIKES)		
EXOTIC PLANT INVASION	ROADS (CONSTRUCTED)	TREE CUTTING / LOGGING			
FIRE					

★. REQUIRED FIELDS. †BUFFER IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

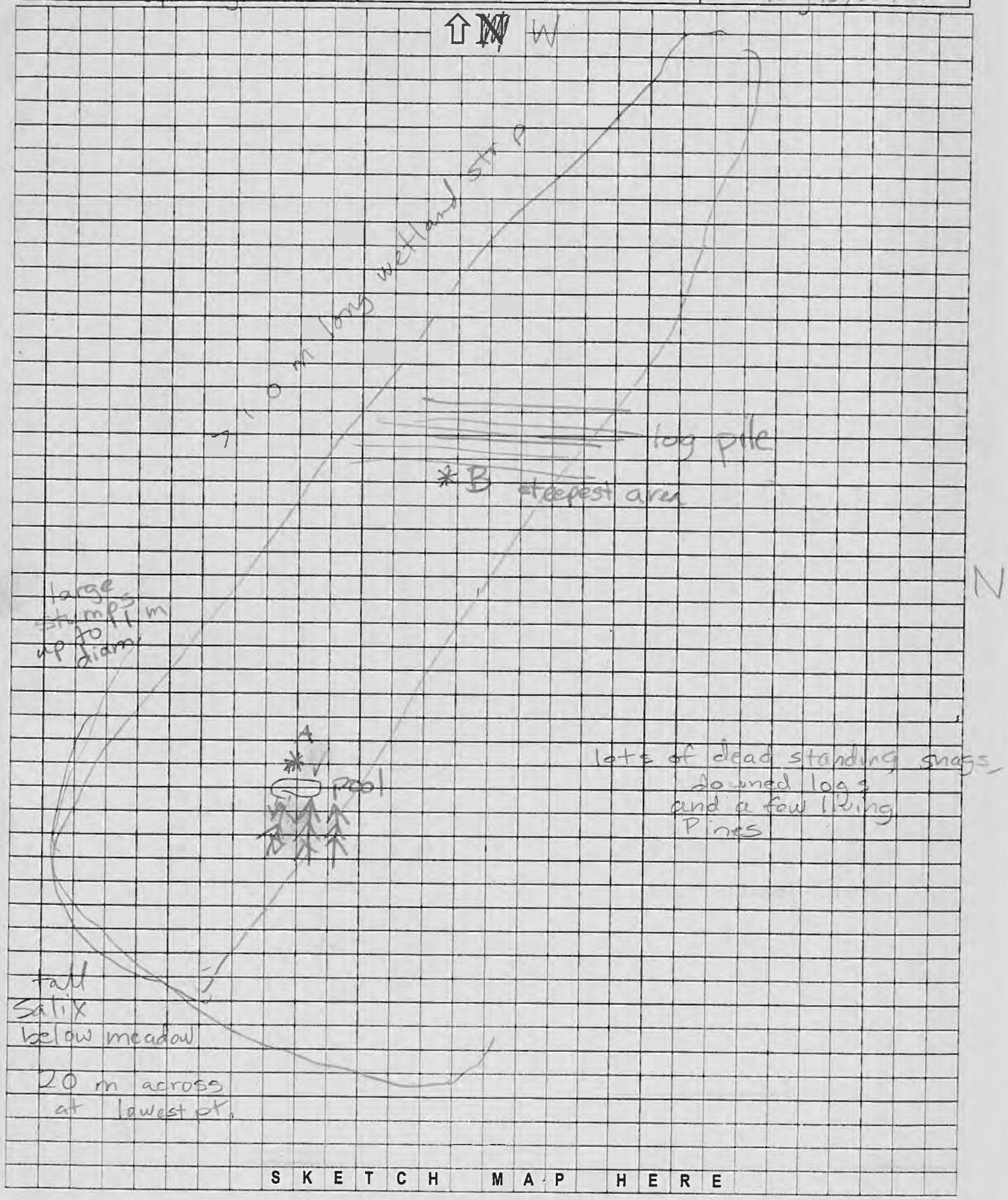
On the following page, provide a map sketch of the entire meadow polygon including:

- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description
A	pool location, GPS pt taken 757909 4305657
B	steepest pt., photos taken (707 & 708) 757860 4305680

Meadow Name: Spring	Fen ID: LTAHWM-SP	Date: Aug 15, 2011



SKETCH MAP HERE

LTAHWM_SP_F1

STAND/PLOT RECORD | Fen ID: LTAHWM_SP | Date: Aug 15, 2011

GPS Coordinates: E 757926 N 4305640 UTM Zone: 10 / 11 | GPS datum: NAD 83

Plot Number: 1 | Fen Type: Basin Mound Sloping Lava Not-fen | Slope: ____% or Ø degr,

Estimated size of Fen Stand: 50 m² / acres | Aspect: NA

PLOT PICTURES | Defined plot used?: yes / no | If yes, plot size (m²): 10 / 20 / 100 / _____

Photo #	View	Description
		At low end of wet meadow with single spring source 189/m
702-705	N→W	from SW corner
706	NE	Across plot diagonal

SOILS | Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Assume similar to #2 with soil pit dug. Probe similar

HISTIC SOILS PRESENT ? YES (NO) Uncertain (circle one)

HYDROLOGY | Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	1 cm	Distance to standing or running water	0 m
Depth to Free Water in Pit (after ≥10 min)	— cm	pH: _____	Electrical Conductivity _____ at T _____
Depth to Saturated Peat	— cm	Root Zone temperature:	55.5 °F / C

Remarks: Some standing water within plot and at SW corner. See plot #2 nearby data. No pit dug

WETLAND HYDROLOGY PRESENT ? (YES) NO Uncertain (circle one)

VEGETATION | Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 10% BA Stems: 2 Litter: 35 Rock (>2mm): Ø Fines (<2mm): Ø Bare Peat: 47 Cvrd Peat: 6

Overall cover: Total % Non-Vasc cover: 10 Total % Vasc Veg cover: 30

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Carex utriculata	G	10	Oxypolis occidentalis	H	2
Carex nebrascensis (amgustata)	G	13	Epilobium ciliatum	H	1
delicate ~~Carex/Juncus sp.~~	G	<1	Mimulus guttatus		1
Dodecatheon alpinum	H	<1	Geum macrophyllum		1
~~Grass delicate~~	G	<1	Galium trifidum		<1
Aster occidentalis	H	<1	Viola macloskeyii		<1
Cirsium vulgare	H	<1	Polygonum bistortoides		<1
Juncus nevadensis	G	7	Sidalcea oregana spicata		1

Remarks: Low pooling spot with higher ground on most sides

~~more robust grass~~	G	<1	Drepanocladus	N	2
~~Philinotis #2~~ Brachythecium frigidum	N	4	Pinus contorta (rooted outside)	T	3
Agrostis stolonifera			Asteraceae basal rosette	H	<1

Agrostis idahoensis

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES (NO) Uncertain (circle one)

LTAHWM-SP_F3

1901

STAND/PLOT RECORD	Fen ID: LTAHWMSP	Date: 8/15/11
GPS Coordinates: E 757884 N 4305662	UTM Zone: 10/11	GPS datum: Nad 83
Plot Number: LTAHWMSP03	Fen Type: Basin Mound Sloping Lava Not-fen?	Slope: ____% or 0 degr,
	Estimated size of Fen Stand: 20 m² / acres	Aspect: flat
PLOT PICTURES	Defined plot used?: yes / no If yes, plot size (m²): 10 / 20 / 100 / 4x5	

Photo #	View	Description
0299	N	Photos retaken by State Parks. Small stand between and around many fallen branches / trees and stumps
0300	S	
0301	E	
0302	W	
0303	NE	
709	Down	@ soil core

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
1-20	Very dark brown	ONBD	5	much root material w/in
20 +	Very dark brown	OBD	8	maybe a bit gravy (with clay?)

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks:

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	N/A cm	Distance to standing or running water 7 m
Depth to Free Water in Pit (after ≥10 min)	12 cm	pH: 6.64 Electrical Conductivity _____ at T _____
Depth to Saturated Peat	cm	Root Zone temperature: 54.1 °F / C

Remarks:

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%
Water: 1 BA Stems: 2 Litter: 91 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 2 Cvrd Peat: 4
Overall cover: Total % Non-Vasc cover: 4 Total % Vasc Veg cover: 40

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Carex angustata	G	27	Polemonium (occidentale)	F	2
Allium vallidum	F	1	Achillea millefolium	F	1
Polygonum bistortoides	F	<1	Mimulus guttatus	F	<1
Equisetum arvense	F	3	Galium aparine	F	1
Geum macrophyllum	F	1	(Cerastium stomaratum)	F	<1
Oxypolis occidentalis	F	<1	Epilobium sp.	F	<1
Juncus howell	G	1	Cirsium vulgare	F	<1
Veratrum californicum	F	3	Elymus trachycaulus subsecundus ssp	G	<1
Carex subfusca (Chorotl)	G	2	Poa bolanderi	G	<1
Fragaria virginiana	S	1	Standing snag	N	4
Rumex acetosella	F	<1	Poa pratensis ssp. pratensis	G	<1
Mimulus moschatus	F	<1	Mosses	S	<1

Remarks: Carex dispana

Stratum: T = Tree, S = Shrub, F = Forb G = Graminoid, M = Moss/ Lichen
Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

Very delicate Juncus G <1
flat lf bryophyte (Sikes #3) N <1
Hypericum anagalloides <1

Brachythecium frigidum
Drepanocladus (Sikes #4) N 1
very fine moss (Sikes #5) 2
leafy moss (Chiloscyphus / #1) <1

Luzula comosa
Santa Thera
Saxifraga oregana

LTAHWM_SP_F2

STAND/PLOT RECORD	Fen ID: LTAHWMSP_	Date: 8/15/11	elevation = 1905
GPS Coordinates: E 757929 N 4305640	UTM Zone: 10 / 11	PDOP 1.7	GPS datum: Nad 83
Plot Number: LTAHWMSP_02	Fen Type: Basin Mound Sloping Lava Not-fen ?		Slope: 0 % or _____ degr,
	Estimated size of Fen Stand: 20 m² / acres		Aspect: 120°
PLOT PICTURES	Defined plot used?: yes / no	If yes, plot size (m²): 10 / 20 / 100 / 4x5	

Photo #	View	Description
0294	N	Photos retaken by State Parks. Small stand w/ lots of large branches and recently exposed peat due to ~~water~~ ~~level~~ drying. Dryer portions w/ C. intricata present rest w/ J. nevadensis. A large stump near NW end of plot but not in plot. Adjacent to LTAHWMSP01
0295	S	
0296	E	
0297	W	
0298	NE	
	Down	@ soil core

SOILS — Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
0-25	very dark brown	OBD	8	sample
25+	" "	S	9	Sandy and Mucky, sample

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Very mucky with sediment/mineral at bottom of soil core. Very dark brown, all the way through

HISTIC SOILS PRESENT ? YES NO Uncertain (circle one)

HYDROLOGY — Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	NA cm	Distance to standing or running water	1 m
Depth to Free Water in Pit (after ≥10 min)	15 cm	pH: 6.67	Electrical Conductivity N/A at T N/A
Depth to Saturated Peat	0 cm	Root Zone temperature:	57.0 °F / C

Remarks: EC not working

WETLAND HYDROLOGY PRESENT ? YES NO Uncertain (circle one)

VEGETATION — Check the vegetation sampling method used below:

- [ ] Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
- [ ] Recorded all plants & cover class
- [x] Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%

Water: 8 BA Stems: 2 Litter: 30 Rock (>2mm): 0 Fines (<2mm): 0 Bare Peat: 50 Cvrd Peat: 10

Overall cover: Total % Non-Vasc cover: 10 Total % Vasc Veg cover: 20

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Juncus nevadensis	G	8	Carex intricata	G	2
Oxypolis occidentalis	F	8	Carex angustata	G	1
Mimulus guttatus	F	6	Dodecatheon (alpinum)	F	T
Epilobium ciliatum	F	T	Prunella vulgaris	F	T
Geum macrophyllum	F	1	Equisetum arvense	F	T
Juncus howellii	G	1	~~Juncus (rhizomatus) tha blasset~~	G	2
Triantha occidentale	F	T	Polygonum bistortoides	F	T
Ptychostomum pallens (601)	M	3	Brachythecium frigidum (603)	M	3
Brachythecium frigidum (602)	M	3	Drepanocladus aduncus (604)	M	1

Remarks:

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen

Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES NO Uncertain (circle one)

FEN SURVEY FORM Required fields are in **bold** **USFS REGION 5** **AUGUST 2010 VERSION.**

Meadow Name: Meesia uliginosa site	**Date:** 17 Aug 2011 Aerial Photo #
Fen ID: LTAHWM_MEUL	**Surveyors:** K. Sikes, D. Roach
Location info: Behind quarry pile and below main fen at Washoe Meadows St. Pk. Seeps from fen	**Description:** drainage channel. We took plot at deepest area, also another deep peat near top of opening.
Forest: **District:**	
County: El Dorado T: 12N R: 18E Section: 19	**Quad:** Echo Lake **Elevation:** 1884 ft / m

Overview Photos, all survey photos are filed at:

Photo #	View	Description	Photo #	View	Description

Surveyed Area Size: acres, **Entire meadow surveyed? yes / no, %, % of Meadow that is Fen:** Ø

# of Stands surveyed: **1° H_2O source: Meadow Seep Spring Drainage** **2° H_2O source: Meadow Seep Spring Drainage**

# of Stands present: **List veg types present:** Juncus balticus

Bedrock type:

Meadow Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☐ New Polygon; Comments:

Fen Polygon delineated correctly? ☐ Accurate ☐ Not Accurate (Correct Map) ☐ New Polygon

CHARACTERISTICS OF THE WHOLE MEADOW POLYGON

- **OPEN WATER PRESENT?** (NOT FLOWING) ☐ YES ☒ NO
- **FLOATING MAT PRESENT?** ☐ YES ☒ NO
- **CHANNEL(S) THROUGH SITE?** ☐ YES ☒ NO
- **SHRUB FEN PRESENT?** ☐ YES ☒ NO
- **TREED FEN PRESENT?** ☐ YES ☒ NO
- **HUMMOCKS OR PATTERNED GROUND PRESENT?** ☒ YES ☐ NO
- **TERRACE PRESENT?** ☐ YES ☒ NO
- **COMPLEXITY OF MICROTOPOGRAPHY**
  - ☐ 1 None
  - ☒ 2 Low. One raised feature.
  - ☐ 3 Moderate. Up to several separate raised features, or one complex feature.
  - ☐ 4 High. Numerous features and/or very well-developed network.of features.

WATER SOURCE / INFLOW (CHOOSE ALL THAT APPLY)

- ☒ Subsurface, no incoming channel
- ☐ Surface channel inflow; # incoming: ____
- ☐ Spring(s) observed; # ____

WATER OUTFLOW (CHOOSE ALL THAT APPLY)

- ☒ Subsurface, no outgoing channel
- ☐ Surface channel outflow; # out: ____
- ☐ Basin Topography, wetland surface below surrounding land along entire perimeter, NO OUTFLOW.

STREAM FREQUENCY

- ☐ 1 None
- ☒ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous streams and/or very well-developed network.

STREAM SIZE

- ☒ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

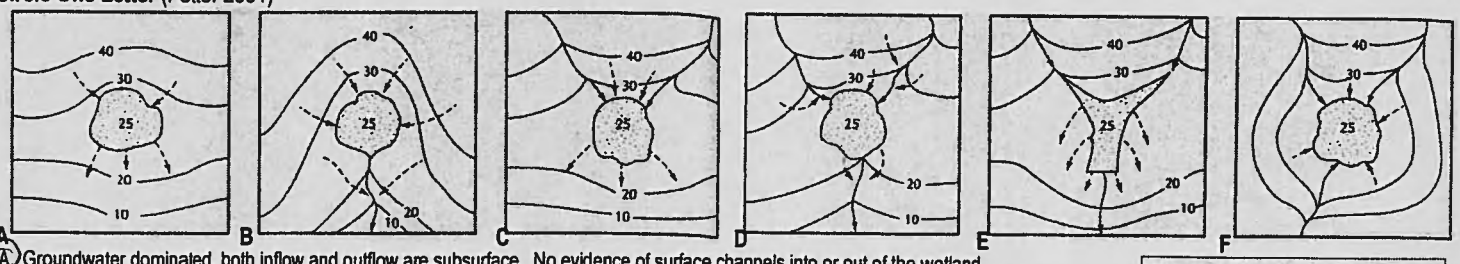
GULLY FREQUENCY

- ☒ 1 None
- ☐ 2 Low. One single thread
- ☐ 3 Moderate. Up to several separate features, or one thread with branching laterals.
- ☐ 4 High. Numerous gullies and/or very well-developed network.

GULLY SIZE

- ☐ SMALL - 1 meter wide and/ or < 50 cm deep
- ☐ LARGE – features large > 1 meter wide and/or > 50 cm deep.

Circle One Letter (Fetter 2001)



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

Water-table contour —— 30 ——
Stream ——→
Ground-water flow - - - - →

DESCRIPTION OF THE ENTIRE MEADOW POLYGON CONTINUES HERE

☐ HYDROLOGIC ALTERATION ☐ NONE ☐ LOW ☐ MODERATE ☐ HIGH IF PRESENT, SPECIFY USING DISTURBANCE CATEGORIES IN THE FOLLOWING SECTION

(dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow)

LOW = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions

MODERATE = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.

HIGH = such as 4-lane Hwy., large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

DISTURBANCE* IN POLYGON	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN POLYGON	☐ NO DISTURBANCE IN POLYGON DISCUSSION

DISTURBANCE* IN BUFFER†*	AGENT (IF KNOWN)	INTEN-SITY	EXTENT IN BUFFER	☐ NO DISTURBANCE IN BUFFER DISCUSSION
Created by cut bank				

*DISTURBANCE CATEGORIES (IF OTHER, PLEASE DESCRIBE)				INTENSITY	EXTENT
BEAVER ACTIVITY BROWSING (WOODY PLANTS) GRAZING SMALL MAMMALS TRAILS/ FOOT TRAFFIC TRAMPLING/ HOOF PUNCH EXOTIC PLANT INVASION FIRE	CAMPSITES LITTER/ DUMPING/ TRASH ORV ACTIVITY / TRACKS BURIED UTILITY CORRIDORS DEVELOPMENT (> ROADS) POWER LINES ROADS (CONSTRUCTED)	DEPOSITION (SEDIMENTATION) DITCHES (DUG BY MAN) EROSION (INCLUDING CHANNEL -INCISION & HEADCUTS) GROUND DISTURBANCE -(GENERAL) SOIL REMOVAL (PEAT MINING) TREE CUTTING / LOGGING	DE-WATERING GROUNDWATER PUMPING SURFACE WATER DIVERSION DRAINAGE FROM ABOVE - INCREASE IN WATER INFLOW FLOODING (INCLUDING DAMS. DIKES)	(0 – NONE – NOT USED) 1 – LOW INTENSITY 2 – MODERATE INTENSITY 3 – HIGH INTENSITY 4 – VERY HIGH INTENSITY	1 COVERS < 10% 2 COVERS ¼ 3 COVERS ½ 4 COVERS ¾ 5 COVERS ALL

★. REQUIRED FIELDS. †BUFFER IS THE AREA WITHIN THE CONTRIBUTING WATERSHED, UP TO 100 M FROM THE EDGE OF THE WETLAND COMPLEX.

On the following page, provide a map sketch of the entire meadow polygon including:

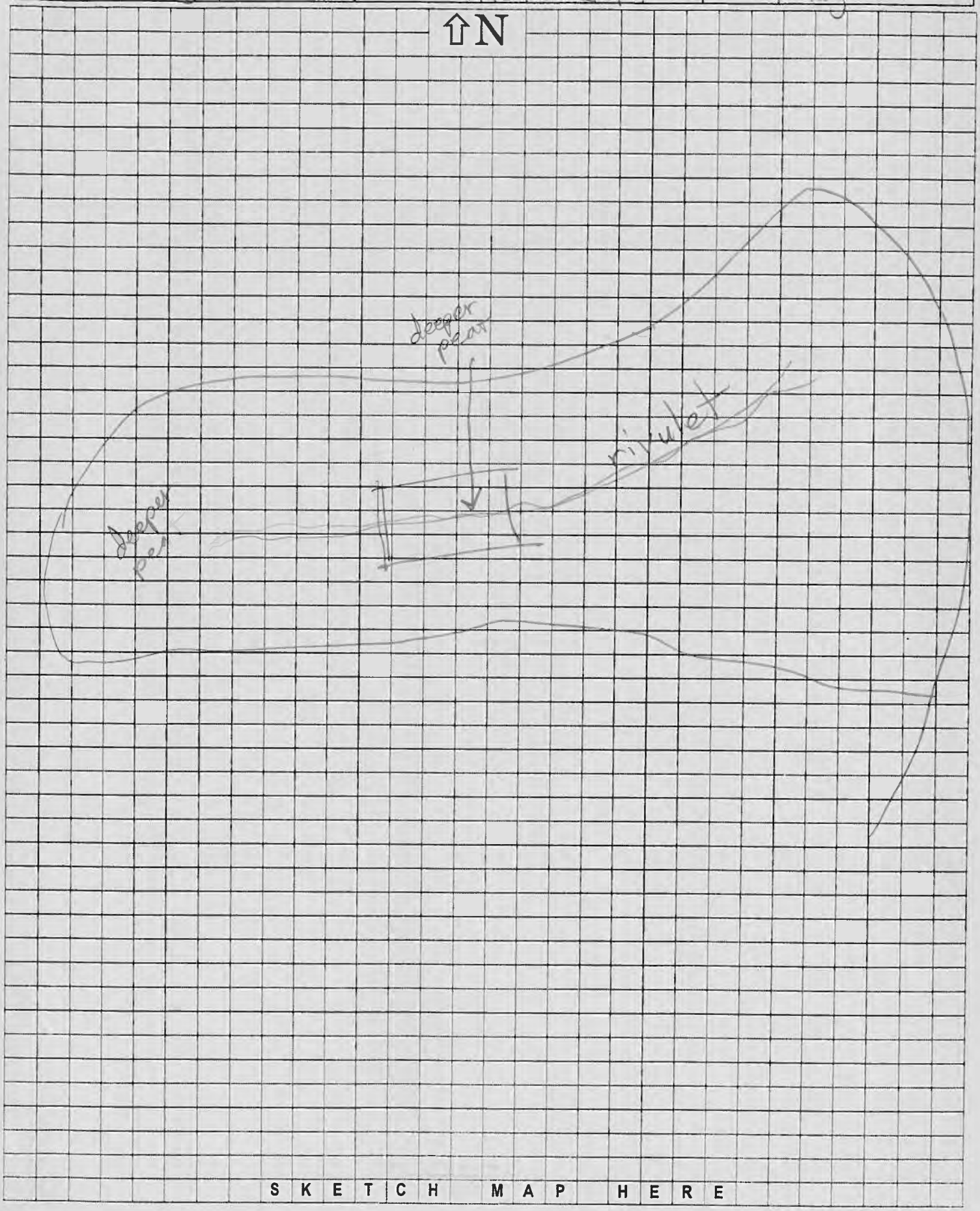
- Extent and arrangement of Stands, including tree or shrub stands & species where relevant,
- Soil pit and plot locations,
- Streams where they enter and exit the polygon (showing direction of water flow with an arrow),
- Major features such as open water, floating mats, boulder fields, terraces, dry areas, damage areas, or gullies,
- Locations of rare plants, including mosses

USE THE TABLE BELOW TO RECORD ELEMENTS OF THE MAP THAT REQUIRE FURTHER EXPLANATION

Label	Description

Meesia uliginosa

Meadow Name: Site	Fen ID: LTAH_MEUL_F1	Date: 17 Aug 2011



7:40

LTAHWM-MEUL-F1

1884 m

STAND/PLOT RECORD	Fen ID: LTAHWM-MEUL	Date: 17 Aug 2011
GPS Coordinates: E 758152 N 4306079	UTM Zone: 10 / 11 pdop 2.2	GPS datum: NAD83
Plot Number: 1	Fen Type: Basin Mound Sloping Lava Not-fen	Slope: ____% or 4 degr,
	Estimated size of Fen Stand: m² / acres	Aspect: E due,
PLOT PICTURES	Defined plot used?: (yes) / no	If yes, plot size (m²): 10 / (20) / 100 / 6x3/3 m

Photo #	View	Description
335		soil core
336-337	N & W	from SE corner
340	NE	across plot " "
		* Photos retaken by State Parks

SOILS Determine the Depth, Thickness (e.g. 0-25), Color and Texture of each Recognizable Horizon

Depth (cm)	Color	Texture	Von Post	Comments: (Type of Peat, Samples Taken)
0-25	reddish brown	ONBD	3	
25+	sand	Sand		

Texture: C = Clay, OBD = Organic-Broken Down, ONBD = Organic-Non-Broken Down, S = Sand, Si = Silt

Remarks: Pit dug near NW corner.

HISTIC SOILS PRESENT ? YES (NO) Uncertain (circle one)

HYDROLOGY Determine if Soil is Saturated for a Good Portion of the Growing Season

Depth of Surface Water	NA cm	Distance to standing or running water 1.5 m
Depth to Free Water in Pit (after ≥10 min)	2 cm	pH: 6.65 Electrical Conductivity _____ at T _____
Depth to Saturated Peat	Ø cm	Root Zone temperature: 55.8 (°F / C)

Remarks: water pools around feet

WETLAND HYDROLOGY PRESENT ? (YES) NO Uncertain (circle one)

VEGETATION Check the vegetation sampling method used below:

☐ Recorded the 3 Dominant Species within each Stratum and their Aerial Cover Class
☐ Recorded all plants & cover class ☒ Recorded all plants & estimated % cover (instead of class)

% Surface cover: = 100%
Water: 18 BA Stems: 2 Litter: 3 Rock (>2mm): Ø Fines (<2mm): 1 Bare Peat: 8 Cvrd Peat: 68
Overall cover: Total % Non-Vasc cover: 68 Total % Vasc Veg cover: 33

Plant Species	Strata	Cvr	Plant Species	Strata	Cvr
Juncus howellii			Carex utriculata	G	2
Pinus contorta	T	3	Saxifraga oregana	F	3
Juncus balticus	G	6	Trifolium repens		1
Equisetum arvense		<1	Mimulus primuloides		2
Salix eastwoodiae Rosy If	S	2	M. guttatus		1
Salix alabrons harrow	S	1	Epilobium (ciliatum)		<1
Juncus (inzula) flatlus	G	1	Platanthera leucostachys		1
Agrostis idahoensis fine		<1	Pedicularis attolens		<1
Juncus nevadensis		2	Fragaria virginica		<1
Remarks: Muhlenbergia filiformis		<1	Lupinus lepidus var sellulus		<1
Carex abrupta (C. simulata)		4	Drosera rotundifolia		2
Lotus purshianus var purshianus	F	<1	Spiranthes romanzoffiana		<1
Polygonum bistortoides	F	1	Gentianopsis simplex		<1
Antennaria corymbosa	F	<1			

Stratum: T = Tree, S = Shrub, F = Forb, G = Graminoid, M = Moss/ Lichen
Cover Class: T = Trace, 1 = 1-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, 6 = 95-100%

IS THIS SAMPLING POINT A FEN ? YES (NO) Uncertain (circle one)

#17 Philinotis americana N 43 Hypericum anagalloides <1
#18 Marchantia polymorpha N 22 Drepanocladus N 2 #49

#21 mixed collection Leptobryum + Bryum

N F
<1 <1
<1 <1
F F
C Aster occidentalis
Castilleja miniata

Appendix 2. Fen survey protocol and disturbance descriptions.

DRAFT PROTOCOL FOR USFS R5 FEN SURVEYS
Expanded August 2010 Version including Optional Vegetation Fields

A few practitioners have made suggestions which we have tried to incorporate to the existing field form while retaining the fields that have been collected in the past. We also wanted to help standardize the collecting process by giving more detailed information about how each field of the data sheet is used.

It is suggested that surveyors start by walking the entire fen meadow polygon, viewing the vegetation, hydrology conditions, and peat accumulation, and assessing which locations are most likely to be a fen when a full survey is completed. Try to identify discernible plant communities that are distinct from the others and of fairly uniform character. If time permits, a plot record for each homogeneous stand of vegetation would be ideal.

In addition to seeking out the most saturated conditions, we would like to encourage centering your plot in a homogenous stand of vegetation. The sample hole should be dug in a location that is clearly representative of that vegetation type, not in a transition zone. A stand is the basic physical unit of vegetation in a landscape and can be thought of as a plant community. It has no set size. A stand is defined by two main unifying characteristics:

1) It has compositional integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or indistinct.
2) It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. A fen may include multiple vegetation stands, one area dominated by one Carex and an adjacent stand dominated by another. By centering your sampling location within a single stand, the plant data you collect will be limited to a single vegetation type instead of generalizing the fen vegetation over multiple types.

Definition of each field on form:

The first section (first 3 pages) is filled out once for each polygon or meadow survey. It is suggested that the form be printed as a double-sided document with the first 2 sheets of paper (pages 1 through 4) stapled together before going out in the field. Several stands and soil samples may be taken within a single fen meadow. The additional pages of the data sheet are used to assess the individual stands within the larger meadow or fen complex. Check boxes are provided along the margins of the form to assist the recorder in completing all the included fields (they can be checked off as each portion is completed).

FEN SURVEY FORM	Required fields are in **bold**	**USFS REGION 5**	**AUGUST 2010 VERSION.**

Meadow Name: If a proper name has been assigned to this Meadow, please write it here. New fens may be assigned a name for future reference. It should be a name that has not already been used in your district. Examples of names used include “Grass Lake” or “Madia Fen”.

Date: Date of the sampling / survey.

Aerial photo # (optional): If you are using an aerial photo as reference, record its number or ID here.

Fen ID: This ID is a mix of characters and numbers that is chosen in accordance with the Forest's numbering system. This Fen_ID refers to the whole meadow polygon. The ID may be chosen in the office when the information is recorded digitally. Examples of IDs used in the past include 0506_51_Humbug, 0517_56_ANDMN, and 0515_504M109, where the first four numbers are the region number and forest number. This ID appears as both the Fen_ID and the FenID_fk in multiple tables of the Geodatabase.

Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded. Please note: The person recording the data on the form should circle their name/initials (this is helpful if there are questions later due to the handwriting).

Location: Please give a brief description of how to get to the spot that you are surveying. If no individual stands are surveyed, you will need to include your GPS information here.

Description: Please describe the overall fen meadow mentioning any significant or unique features. Especially include any information about features of the meadow that is not covered elsewhere on the datasheet.

Forest: Record the National Forest where the survey is occurring.

District: Record the Forest District if applicable.

County: Provide the county of the location in question.

T (Township; optional): Township number.

R (Range; optional): Range number.

Section (optional): Section number.

Quad: Name of quad map.

Elevation: Elevation of your location. Circle **ft** or **m** to denote the units that you are using.

Overview Photos (optional), all survey photos are filed at: In the field you can record your camera name here and replace it with the file path when photos are stored. This section is for recording overview fen meadow photos. There are other places to record photos of specific stands, and impacts or disturbances.

> **Photo #:** If you have taken photos of the overall fen meadow, write in the JPEG/frame number in the first column. If there are more than three photos taken, use the space to the right to record additional photos.
>
> **View:** Record the cardinal direction (E, NE, etc.) that the overview photo was taken in. Therefore if the photographer is facing east, the photo is taken towards the east. Mark the spot that the photo was taken on your map of the meadow.
>
> **Description:** Any description of what the photo is showing.

Surveyed Area Size (optional): This is the polygon that you will draw on your map, and may be a meadow opening with several fen stands sampled within it. If there is no meadow opening, but only a single pocket fen in a wooded area, this could be the same thing as the fen stand size. Estimate the

size of the surveyed area in acres. One acre is about the size of one football field or 4000 square meters (50 x 80 m). This is optional since there will be more accurate information about the size of the surveyed area if a GIS polygon is created to represent it.

Entire meadow surveyed? Circle yes or no. If no, include a percentage estimate of how much was completed. Since time is often limited, this field is included so that the surveyor can record whether there is more work left to do at this site.

% of Meadow that is Fen: Please estimate the percentage of the area surveyed that you have identified as a fen.

# of Stands surveyed: Record the number of fen samples that were taken at this meadow in this survey. This number should equal the number of plots that you take data on.

Primary and Secondary H20 source (optional): If known, circle the water source for the fen complex. The four options provided are Meadow, Seep, Spring, or Drainage. This information is called Meadow Type in the Fen Meadow Table of the Geodatabase.

- **Meadow:** the water source cannot be attributed to any of the other three choices and the fen is in a meadow opening.
- **Seep:** the water source appears to be overall seepage from the water table. That is, it is not attributable to a single point source (a spring) or even multiple springs but slowly filters out of the ground in an area.
- **Spring:** the water comes from the ground at a single point or a few points and is generally escapes at a greater volume and rate than a seep.
- **Drainage:** the water drains from the surrounding landscape because of the topography. A drainage is a topographic feature and may have an above-ground watercourse or not.

# of Stands present: Record the total number of distinct fen vegetation stands that are found in this meadow.

List veg types present: Use this space to list the different vegetation types that are seen as you walk around the entire meadow.

Bedrock type (optional): If known, give information on the geology of the area, specifically what bedrock underlies the fen meadow. This information may be most easily obtained afterwards using a geology map in GIS. Bedrock types which have been recorded previously include Andesite, Basalt, Calcareous, Crystalline, Gabbro, Glacial till, Granitic, Lacustrine, Marble, Metamorphic, Metavolcanic, Rhyolite, Sedimentary, Serpentine, Volcanic

Fen previously known? (optional): Circle whether the site had already been verified as a fen meadow.

If no, how discovered? (optional): Record what caused the visit to the area. Examples of answers: known location for *Meesia triquetra,* ground truth visit after analysis of aerials, or information from trail crew. This information can be recorded in the Source field in the Fen Meadow table of the Geodatabase.

Meadow Polygon Delineated Correctly?: The meadow polygon would be an existing potential fen polygon that was probably created using photo interpretation. After having walked through the polygon, decide whether the polygon was delineated correctly. Note whether uplands or wooded areas were included in the polygon. Also note whether adjacent wetlands, part of the same wetland complex, were not included. If necessary, re-delineate the polygon on the printed map. If the polygon was drawn by the crew (a new polygon), check New Polygon and draw it on the printed map.

Fen Polygon Delineated Correctly?: The fen polygon would be an existing fen polygon that was delineated after a previous visit. After having walked through the polygon, decide whether the

polygon was delineated correctly. Note whether wet meadow areas were included in the polygon or whether all fen areas were included. If necessary, re-delineate the polygon on the printed map. If the polygon was drawn by you (a new polygon), check New Polygon and draw it on the printed map.

Open Water Present (optional)? Check whether there is a pond or small lake within the polygon. Include only perennial water features.

Floating Mat Present (optional)? Check whether there is a floating mat included within the polygon.

Channels Through Site (optional)? Record whether perennial water-courses are apparent that **cross through the polygon from one side to another**.

Shrub Fen Present (optional)? Are there portions of the fen that are dominated by shrubs (at > 10% cover)?

Treed Fen Present (optional)? Are there portions of the fen that are dominated by trees (at > 10% cover)?

Hummocks or Patterned Ground Present (optional)? Is the microtopography of the fen surface simple? If it is basically flat (whether sloped or not) or can be represented by a simple curve, the answer to this question would be "no". If there is a more complex relief to the fen surface, including definite hummocks, berms, or terraces, the answer is "yes". Note that the presence of stream channels or gullies does not necessarily make the ground patterned.

Terrace Present (optional)? A terrace is a raised feature in a fen, where peat has formed a berm and the ground surface is at different levels on either side of the berm.

Complexity of Microtopography (optional). Choose the best option. We want to capture the extent of micro-topographical diversity in the fen meadow (including hummocks, berms or terraces). If you answered "no" for the patterned ground question, the answer would be "none" here.

Water Source / Inflow (optional). Choose ALL that apply. For surface channels and observable springs (if they exist), record the number that are incoming.

- Subsurface, no incoming channel
- Surface channel inflow; # incoming: _____
- Spring(s) observed; # _____

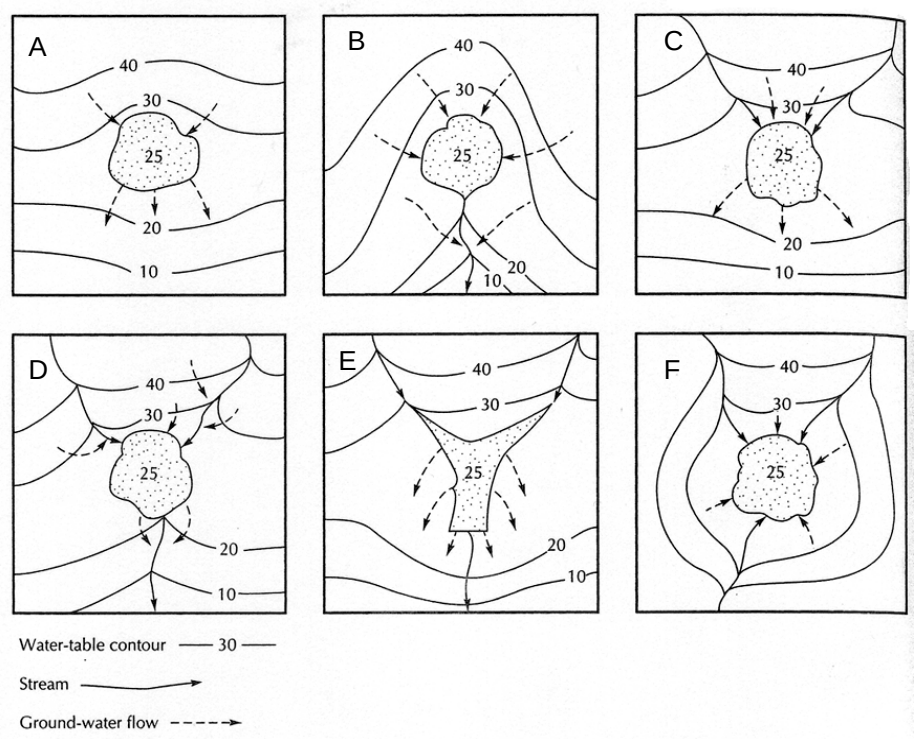
Water Outflow (optional). Choose ALL that apply. For surface channels, record the number that are outgoing.

- Subsurface, no outgoing channel
- Surface channel outflow; # out: _____
- Basin Topography, wetland surface below surrounding land along entire perimeter, No Outflow

Stream Frequency and Size (optional); Choose the best option. If Stream Frequency is None, than Stream Size is not recorded.

Gully Frequency and Gully Size (optional): Record gully frequency and size using the classes on the form. If Gully Frequency is None, then Gully Size is not recorded. A gully is a water channel that shows evidence of erosion (some sources say they are incised a foot or more below the ground surface).

Water Flow Pattern (Fetter Diagrams; optional). Circle the letter beside the diagram that best represents the water flow pattern into and from the polygon (Fetter 2001). See next page. Note that your answers to the Water Inflow and Outflow questions will determine the best diagram. Below the diagrams on the datasheet are descriptions of what they are meant to represent.



A. Groundwater dominated, both inflow and outflow are subsurface. No evidence of surface channels into or out of the wetland.
B. Groundwater inflow dominant. No surface channel inflow to wetland, but a surface channel outflow exists. Outflow may be perennial or intermittent.
C. Surface water inflow. No evidence of an outflow channel.
D. Surface water dominated. Evidence of both surface water inflow and outflow.
E. Impoundment, either man-made reservoir or natural fill associated with slumping or landslide. Similar to D. Reservoirs can not create a fen, but they may have inundated one.
F. Topographically a closed basin. Surface inflow, but no outflow. Do not confuse with A or C. Wetland surface is obviously lower than surrounding perimeter area.

----- END OF PAGE 1, CHARACTERISTICS OF ENTIRE MEADOW POLYGON -----
CONTINUES ON THE REVERSE

Hydrologic Alteration. (dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow) Choose best option. **If present, specify using disturbance categories in the following section.**

- **Low** = such as roads at or near grade, small diversion or ditches (< 30 cm deep) or small amount of flow additions
- **Moderate** = such as 2-lane road, low dikes, roads w/ culverts adequate for stream flow, medium diversion or ditches (30–100 cm deep) or moderate flow additions.
- **High** = such as 4-lane highway, large dikes, diversions, or ditches (>1 m deep) capable of lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions

Disturbance in Polygon: Categories of disturbance are provided below the table to record if present. If there is no disturbance evident in the polygon, check "No Disturbance in Polygon" on the far right of the table. See a separate document which describes the different intensities of disturbance for each category.

Agent (optional): Record the agent(s) causing the disturbance only if known. Some of the known agents are listed below:

ATV	Four-Wheel-Drive Vehicle	Snowmobile
Beaver	Humans	State Roads Department
Cattle	Moose	Wind
County Roads Department	Motorcycle	Water
Deer	Natural	
Elk	Sheep	

Intensity: Fill in an Intensity for any disturbance noted in the polygon. Use the number scale provided to the right of the list of categories. See a separate document for descriptions of these intensities for each category that is listed.

Extent in Polygon: Fill in an Extent for any disturbance noted in the polygon. Use the number scale provided to the right of the Intensity list.

Discussion (optional): Adjacent to any listed impacts, describe it in more detail or record the condition that results from that particular impact. Take photos of the disturbance if possible and list them here as well. If a particular stand (recorded further down the data sheet) appears to be affected, include that information. For grazing and evidence of impact look for recent "urine scalds" and for cow pies, etc. If cattle are presently visible, how many are there? Look for evidence of grazing intensity like wallows, pulled up tufts of grass or sedges, etc.

Disturbance in Buffer: As in the previous table, use the categories of disturbance that are provided below the table. The Buffer is the area of the immediate watershed, up to 100 m from the edge of the meadow polygon. If there is no disturbance evident in the buffer zone, check "No Disturbance in Buffer" on the far right of the table. See a separate document which describes the different intensities of disturbance for each category.

Agent (optional): Record the agent(s) causing the disturbance only if known. Some of the known agents are listed below:

ATV	Four-Wheel-Drive Vehicle	Snowmobile
Beaver	Humans	State Roads Department
Cattle	Moose	Wind
County Roads Department	Motorcycle	Water
Deer	Natural	
Elk	Sheep	

Intensity: Fill in an Intensity for any disturbance noted in the buffer. Use the number scale provided to the right of the list of categories. See a separate document for descriptions of these intensities for each category that is listed. The descriptions for buffer disturbances may be different than those for wetland disturbances.

Extent in Polygon: Fill in an Extent for any disturbance noted in the polygon. Use the number scale provided to the right of the Intensity list.

Discussion (optional): Adjacent to any listed impacts in the buffer zone, describe the disturbance briefly or provide any relevant notes.

INCLUDE MAP BELOW. Space is provided below the disturbance section of the general meadow data sheet to list features of the meadow polygon if desired. Draw the map sketch on the grid page provided.

----- END OF PAGE 2, MAP SKETCH OF ENTIRE MEADOW POLYGON -----
CONTINUES ON PAGE 3

MAP SKETCH: Fill out the Meadow Name, Fen ID, and Date as provided on the cover sheet / first page. Please sketch a map of the entire fen meadow. It is helpful to include the scale in your drawing. Please mark with a North arrow if North is not the top of the page. Provide details of the fen meadow, such as the locations of soil samples, extent of vegetation stands surrounding soil samples, other photo points, and major features such as streams, boulder fields, terraces, dry areas, locations of disturbance, gullies or channels, and rare plant locations.

----- END OF PAGE 3, INDIVIDUAL STAND RECORDS FOLLOW ON -----
PAGE 4 AND UNNUMBERED PAGES

STAND/PLOT RECORD: All the items on this page of the data sheet pertain to a single stand location within the meadow. It is usually represented by a single point in the geodatabase, though one has the option of delineating the stand with a GPS or in GIS as a Fen_Stands_poly within the greater Fen_Meadows polygon. Recall that the fen stand should be defined by a single homogeneous stand of vegetation, and that it may be continuous with adjacent stands of vegetation that also meet the definition of a fen. There may be multiple stands/plots taken within one meadow complex.

Fen ID: This is a repeat of the Fen ID from the cover page in case the pages get separated from one another.

Date: This is also redundant from the cover page in case it gets separated.

GPS Coordinates: Record UTMs next to their appropriate indicators. The easting is six digits long and the northing is 7 digits long. The GPS point should be located within the stand. If you are using a defined plot within the stand to do the vegetation survey, you should choose a standard location to take the GPS point, such as the center of a circular plot describing the stand, or the SW corner of a square or rectangular plot.

UTM Zone: Circle the appropriate number.

GPS datum: Double check and record the datum from your GPS unit. NAD83 is the preferred datum for this project.

Plot Number: This will most often be a single digit number, some individuals may prefer to use a letter code. It will correspond to a single point on the map (given by the above coordinates). In combination with the FenID, it will provide a unique plot number for the sample location. For example, there were 2 samples recorded at Alkali Flat in 2006. They were numbered plot 1 and 2 in meadow “0504_52_Alkali_Mdw”. Therefore the unique PlotNums in the Geodatabase are “0504_52_Alkali_Mdw1” and ”0504_52_Alkali_Mdw2”. If there have been previous surveys at that general location (not the specific point), you may need to choose a higher number, so that plot 1 from 2006 is not confused with the first plot from 2007.

Fen Type: Circle the geomorphic type which best describes the point that you are sampling. The choices are explained below.

- **Basin** fens are generally in a topographic depression with no surface water inlet or outlet. They are flat, without slope or aspect.
- **Mound** fens are raised areas of peat caused by a single source of upwelling water, typically they have a surface water outlet.
- **Sloping** fens are the most common type, where groundwater comes to the surface in multiple locations along a slope.
- **Lava** fens are a specialized type of sloping fen which is caused by a lava discontinuity and appear to be restricted to the southern Cascades (Lassen and Modoc NFs).
- **Not-fen** is the option to circle if the field personnel decide that the sampling point does not represent a fen.

Slope: Record the average percent slope of the vegetation stand surrounding your sample point. Use a clinometer or compass to measure the slope. Flat stands will have a slope of 0%. Percent slope is the preferred unit that has been used in the geodatabase. If it is necessary to record the slope in degrees, it can be translated to percent slope for data entry.
Percent slope = tan (degrees slope)*100

Estimated size of Fen Stand: Limit your estimate to the homogenous stand of vegetation surrounding your sampling point. Unless surveyed, the adjacent vegetation stand may or may not be considered a fen. Circle the units used for your estimate. You may also use a GPS or GIS to delineate the size of the homogenous fen stand within the greater meadow polygon. In the Geodatabase the polygon which describes a fen stand is a Fen_Stands_poly.

Aspect: Record the general cardinal direction of the slope of the vegetation stand surrounding your sample point. Use a compass, adjusted for declination, to confirm the exposure. Flat stands will not have an aspect, so you would enter “n/a”. This field will be entered as text rather than degrees. You may use up to 3 letters to record the direction. The cardinal directions may be translated to degrees for analysis in the following manner.
N = 360 degrees, NE = 45 degrees, NNE = 30 degrees, NEE = 60 degrees.

Defined plot used?: There is now an option to make your vegetation data plot-based. Circle yes or no, to whether you limited your survey to a set plot size. We have found that 20 sq meters, which could be a 4 x 5 m rectangle or a circle with a radius of 2.5 m, will usually fit into a homogenous herbaceous fen stand and provide a suitable defined area for sampling. Because woody vegetation has larger individual plants, a larger plot size is recommended, e.g., 100 sq meters.

If yes, plot size (m^2): Since there may be variation in district needs and goals we provide other options in addition the recommended 20 sq m standard size plot.

Plot Pictures: Any photos which are specific to the plot in question should be recorded here. Include a photo of the soil core with a measuring tape alongside it as well as photos taken from the GPS point towards each cardinal direction, N, E, S, and W. Attempt to include the horizon line and any plot tapes or marker flags in the photos. If the photos from the GPS point don’t give a good view of the stand, choose a location that will and record the direction from which it was taken (the point from which it was taken can be marked on the map).

Photo number: Write in the JPEG number in the first column.

View: Record the cardinal direction (E, NE, etc.) that the photo was taken in. Therefore if the photographer is facing east, the photo is taken towards the east. “Close-up” or “above” might also be entered here for photos of plants or soil cores.

Description: Record any details here of the photos in question.

SOILS:

- **If it has already been proven to the satisfaction of the surveyor that a portion of the meadow polygon is fen, and that this stand/plot record has similar characteristics, this section may be skipped in the interest of reducing disturbance to the fen.**
- To complete this section, use a narrow shovel with at least a 40 cm blade to bring up a soil core at the GPS point. It is helpful to have a tarp to lay the core on, to separate it from the ground surface. Attempt to extract the 40 cm or greater column of soil/peat intact, or lay down pieces in the order they are brought up. As mentioned earlier, it is useful to photograph the column with a measuring tape along side it (place 0 cm at the surface portion of the column). The idea is to have a deep enough core to find 40 cm of peat, so the core may be up to 80 cm if necessary. However, if you have a large enough sample with a 40-50 cm core, do not dig further. If you have the resources for testing in a soil lab, take a soil sample from each distinct horizon.
- **NOTE that if one is fairly certain that you have enough peat to make it a fen, that a small trowel core (i.e. 10 cm deep) will allow you to complete some of this portion as well as test the water in the next section.**

Depth: In this column record any recognizable horizons or layers in the soil core. For example, there may be three different layers, 0-15 cm, 15-20, 20-40+ cm. If you stop measuring but know that there is more of the same below the last layer you measured, you should use a "+" sign to indicate that.

Color: Record the color of each layer, this may be somewhat subjective, but should be consistent by surveyor. The following colors can be used and are taken from the Munsell color charts: Pinkish white, Pink, Yellow, White, Pale Yellow, Reddish Yellow, Olive Yellow, Brownish Yellow, Gray, Pinkish Gray, Light Gray, Light Brownish Gray, Dark Gray, Very Dark Gray, Brown, Very Pale Brown, Pale Brown, Light Yellowish Brown, Light Brown, Light Olive Brown, Olive Brown, Grayish Brown, Dark Yellowish Brown, Dark Grayish Brown, Strong Brown, Dark Brown, Very Dark Grayish Brown, Very Dark Brown, and Black.

Texture: Five texture codes are provided. For further description of texture use the comment field to describe. Peat can be divided into two categories, described as **ONBD** (Organic Non-Broken Down) which is the classic fibrous brown or light brown material like you would get if you purchased peat at a garden center, while **OBD** (Organic Broken Down) is darker, without obvious plant parts, and may be deeper in the column. As a "field characteristic" such organic soil material tends to rub clean when rubbed between finger and thumb, in contrast to dark clay which tends to spread like grease and to remain on the fingers.

The non-organic texture options include **Sand**, which has the largest particle size of the three, where individual grains are easily seen and felt. Sand is gritty to the touch. The particle size ranges from 0.05 - 2.0 mm. **Silt** consists of soil particles that are coarser that clay, but finer than sand. The particle size ranges from 0.002 - 0.05 mm. **Clay** is the finest textured of all the soil classes. Clay particles are smaller than 0.002 mm in diameter. Clay usually forms extremely hard clods or lumps when dry and is extremely sticky and plastic when wet. When containing the proper amount of moisture, clay is malleable and can be formed into a ribbon with the hand.

Von Post Value (optional): (National Wetlands Working Group 1997)
Choose the best value for each distinctive layer of the core.

Organic Non-Broken Down	**Organic Broken Down**
1. Undecomposed; plant structure unaltered; yields only clear water colored light yellow brown. 2. Almost undecomposed; plant structure distinct; yields only clear water colored light yellow brown. 3. Very weakly decomposed; plant structure distinct; yields distinctly turbid brown water, no peat substance passes between the fingers, residue not mushy. 4. Weakly decomposed; plant structure distinct; yields strongly turbid water, no peat substance escapes between the fingers, residue rather mushy. 5. Moderately decomposed; plant structure clear but becoming indistinct; yields much turbid brown water, some peat escapes between the fingers, residue very mushy.	6. Strongly decomposed; plant structure somewhat indistinct but clearer in the squeezed residue than in the undisturbed peat; about one third of the peat escapes between the fingers, residue strongly mushy. 7. Strongly decomposed; plant structure indistinct but recognizable; about half the peat escapes between the fingers. 8. Very strongly decomposed; plant structure very indistinct; about two thirds of the peat escapes between the fingers, residue almost entirely resistant remnants such as root fibers and wood. 9. Almost completely decomposed; plant structure almost unrecognizable; nearly all the peat escapes between the fingers. 10. Completely decomposed; plant structure unrecognizable; all the peat escapes between the fingers.

Comments: Use this area to further describe the soil layer or record that a sample was taken for analysis.

Remarks: Use this area for remarks that pertain to the entire soil column. Description should include signs of alkaline or basic mineralization such as travertine deposits nearby, sulphurous smell, other mineral deposits, or surrounding rock type. **If the soils section is not fully completed, record that information here along with an explanation** (e.g., "soil core data taken at plot #1")

Soil Sample Collection and Preparation
adapted from Warren Young, GMUG Soil Scientist
& Rod Chimner, Wetland Ecologist, Michigan Tech. 5/13/2009

1. **Field Sampling.** If desired, take a soil sample from the center of each distinct soil layer in the column. Each sample should be about 1 Cup.

2. **Field Preparation.** Place the sample in a plastic bag and label with the sampling depth, collection date, fen meadow ID, stand ID, and GPS location. As soon as possible, begin air drying the sample. Retain the original sample tag, remove all live roots and leaves, spread on non-colored newspaper and break open to facilitate drying. When the sample has air dried, transfer it <u>and</u> all sample site information to a clean paper bag. Retain the original sample bag and place it in the paper bag.

HISTIC SOILS PRESENT?: Circle yes if the soil is primarily organic material (histic). This question is addressing whether there is enough organic material to be considered a fen. Our working definition for a fen is that there is at least 40 cm of peat or organics in the top 80 cm of soil. In the Geodatabase several cases have entered "no" to this question, but still have "yes" to the sampling point being a fen.

HYDROLOGY: This section is used to determine if soil is saturated for a good portion of the growing season. See **SOILS** section above for discussion of reasons to skip this section if hydrology has been previously tested. Note that if there is standing water at the GPS point, the required fields in this section can be filled out without digging a pit.

Depth of Surface Water: If there is no standing water above the ground surface, enter "n/a". Otherwise provide the depth of the water in cm above the ground surface.
Depth to Free Water in Pit (after ≥ 10 min): Different values will be reached depending on how long you wait for the water in the pit to equilibrate. Wait as long as possible (at least 10 minutes) to measure this, and do it as the last thing before you return the soil column to the pit. Measure depth in centimeters from the ground surface to the top of the standing water that has accumulated in the hole. "Ground surface" is the average level of the low-vegetation mat (often moss) at the rim of the hole. If no water collects at the bottom of the pit, enter "n/a", and specify this in the remarks section.

Depth to Saturated Peat: Measure from the ground surface to a level on the side of the hole where water appears to be seeping out. You are trying to measure the level of the water table in this and the previous field.

Distance to standing or running water (optional): Measure or estimate this distance in meters from the GPS point. A rangefinder may be useful for this purpose. Standing water may include small pools or puddles. If there is no above-ground water present in the area, enter "n/a".

pH (optional): Measure the pH of the water that accumulates in the hole with a pH meter. In general, pH meters should be calibrated often, using a standard buffer solution.

Electrical Conductivity (optional): Take this measurement in the standing water of the soil pit. Electrical conductivity (EC) is a measure of the dissolved-ion concentration of the fen waters. The unit of measure is "microsiemens/cm". Some pH meters also measure EC. They may also need to be calibrated frequently. Record the temperature at which the EC is taken, since the value is directly affected by temperature.

Root zone temperature (optional): Measure with a soil thermometer inserted so the sensor is at a depth of 15 to 20 cm. Circle C or F for the units of temperature used. The Bishops' have been persuasive in arguing that this is a more standard measure than the temperature of the water in the soil pit. Water temperature in the hole tends to be inconsistent since sometimes water runs in from a surface pond which is warmer than the saturating water, and sometimes it flows up from the bottom and is cooler than the saturating water.

Remarks (optional): Use this space to make any comments about the amount of soil saturation or any specifics about the measurements that you took. Record the length of time allowed before the depth to free water in pit was measured, or other observations about how water filled the pit. Also, if there is any information on the water source that is specific to the fen, and not the larger complex, you would write that here.

WETLAND HYDROLOGY PRESENT? Answer yes, if the depth to free water or saturated peat is <20 cm, or if you think they would be in a normal year. This is our working definition for necessary saturation to be considered a fen.

VEGETATION: In addition to recording the dominant plants of the stratum, surveyors may also make a complete species list. Mark one of three options completed, all of which include recording the stratum when estimating cover. The sampling options include:

1) recording the three dominant species of each stratum that is present in the homogeneous stand or plot surrounding the GPS point,
2) recording all plants found in the stand or plot along with its cover class, or
3) recording all of the plant taxa as well as estimating percent cover (not just the cover class).

% Surface cover (optional): Record the abiotic substrates that cover the ground surface (optional for use with more complete vegetation information). The observer imagines "mowing off" all of the live vegetation at the base of the plants and removing it to estimate what remains covering the surface. Note that non-vascular cover (lichens, mosses, cryptobiotic crusts) is not estimated in this section, but that the observer should decide whether the mosses etc. are growing on peat or mineral soil, or a combination of the two, and include that area in the appropriate field. **The total should sum to 100%.**

% Water: Estimate the percent surface cover of running or standing water, ignoring the substrate below the water.

% BA Stems: Percent surface cover of the plant basal area, *i.e.*, the basal area of stems at the ground surface. The basal area of mosses is negligible. Note that for most vegetation types BA is 1-3% cover.

% Litter: Percent surface cover of litter (unattached plant material), duff, or wood on the ground.

% Rock: Percent surface cover of all rock, from bedrock down to gravel > 2mm.

% Fines: Percent surface cover of bare ground and fine sediment (e.g. dirt) < 2 mm in diameter, including that portion covered by mosses.

% Bare Peat: Percent surface cover of peat exposed to the air.

% Cvrd Peat: Percent surface cover of peat that is not bare but covered by non-vascular or vascular plant growth.

Overall cover (optional): Provide an estimate of cover for the two following categories (optional for more complete vegetation survey). Record a specific number for the total aerial cover or "bird's-eye view" looking from above for non-vascular and for vascular plants, estimating cover for the living plants only. Unattached litter/duff should not be included in these estimates. It may be helpful to initially choose a cover class and then refine your estimate to a specific percentage for the two categories below.

% Total Non-Vasc cover: The total cover of all lichens and bryophytes (mosses, liverworts, hornworts) on substrate surfaces including downed logs, rocks and soil, but not on standing or inclined trees.

% Total Vasc Veg cover: The total cover of all vascular vegetation. This is an estimate of the absolute vegetation cover, disregarding overlap of the various tree, shrub, and/or herbaceous layers and species.

Plant species: Record the full scientific name of the taxa here. Use Jepson Manual nomenclature for the vascular plants. If you are uncertain of the identification, the unconfirmed portion of the name can be put in parentheses. For example, you are certain it is a Sphagnum and think that it is S. subsecundum you should write it as "Sphagnum (subsecundum)". If you take a collection to help you identify it later, it is helpful to mark the taxon name with a "c" (for collected) or an "*". Be sure to update the datasheet if you further identify the plant.

Strata: Use one of the 5 stratum codes displayed on the data sheet.

- **T** = Tree, for woody plants which tend to grow with a single stem and reach over 5 m in height when grown under good conditions.
- **S** = Shrub, for woody plants that tend to grow with multiple stems and are usually under 5 m in height.
- **F** = Forb, for broad-leaved herbaceous vascular plants which are not grass-like and are not woody.
- **G** = Graminoid, for grass or grass-like herbaceous plants.
- **M** = Moss / Lichen for any non-vascular plant, including liverworts.

Cvr: Estimate the % absolute aerial cover for each species listed. Choose the cover class from the list provided on the data sheet. Cover classes are:
T = Trace; **1** = 1-5%; **2** = 5-25%; **3** = 25-50%; **4** = 50-75%; **5** = 75-95%; **6** = 95-100%
If you choose to provide specific percentages, they can always be converted to cover classes later. The sum of all species percent covers may total over 100% because of overlap.

Remarks: Use this area to list additional species if you need more space. Include any significant comments about the vegetation in the stand or information about adjacent species. If you think the stand is a certain vegetation type, or notice that a lot of the species are not wetland plants, you could indicate that here.

IS THIS SAMPLING POINT A FEN ? Taking all the plot specific fields on this page of the data sheet into account, considering plants, soils, and hydrology, would you call it a fen or not? Does it have at least 40 cm of histic soils within the top 80 cm, a saturated water table less than 20 cm from the surface in most years, and wetland vegetation?

Disturbance Factors and Intensities for Use in Fens
Note that there is an implied Intensity Class 0 (zero), meaning “none” or “absent,” that is usually not recorded.

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
Beaver Activity	Beaver	Wetland	One or a few small beaver dams in the past, now unused and the area behind the dams naturally revegetated; no side channels	One or a few small beaver dams currently being used with full ponds; or one medium-sized older dam now unused and the area behind the dam naturally revegetated; possibly a few old side channels	Many small (or one medium- to large-sized) beaver dams currently being used with full dams, or some of them breached and the ponds bare; a few side channels being built or used	Several medium- to large-sized beaver dams currently being used, some with full dams, and some of them breached and the ponds bare; side channels being built or used	
		Buffer	Few trees or shrubs cut and dragged from buffer in past; draglines revegetated with no erosion	Few trees or shrubs cut and dragged from buffer recently, draglines mostly revegetated but a little erosion into the wetland	Several to many trees or shrubs cut and dragged from buffer recently, some draglines revegetating but a few eroding into the wetland	Many shrubs or trees being cut and dragged from buffer currently or recently, most draglines not revegetating and eroding into the wetland	
Browsing (Woody Plants)	Elk, Deer, Moose, Cattle, Sheep	Wetland, Buffer	Clipping noticeable on up to half the shrubs, averaging light clipping (<¼ CYG); no shrub clipped >½ CYG; no reduction in natural height	More than half the shrubs moderately clipped (¼ -½ CYG), or all shrubs lightly to moderately clipped (¼-½ CYG); height reduction on a few shrubs	Most to all shrubs hedged (>½ CYG), or half the shrubs heavy hedged (>¾ CYG); height reduction noticeable on most shrubs	Most to all shrubs clubbed (growth turned inward), or all shrubs heavily hedged. Mostly >¾ CYG; height reduction obvious on most to all shrubs	CYG = Current Year’s Growth; height reduction estimated as compared with mature unbrowsed shrubs
Grazing	Elk, Deer, Moose, Cattle, Sheep	Wetland, Buffer	Clipping noticeable on some graminoids and forbs, averaging light clipping (<¼ CYG); all herbaceous plants of normal vigor and height	Clipping obvious on more than half the graminoids and forbs, average ¼-½ CYG; some plants show reduction in vigor and height	Clipping obvious on most graminoids and forbs, average >½ CYG; most plants show reduction in vigor in height, average height up to ½ of normal	Most graminoid individuals grazed >¾ CYG; vigor noticeably reduced; average height ½ - ¾ of normal	CYG = Current Year’s Growth; height reduction estimated as compared with mature unbrowsed plants
Small Mammal Activity	Mice, Voles, etc.	Wetland	Trace evidence of mammal activity including holes or burrowing. Low level of ground disturbance, <1% of the area	Evidence of mammal activity including holes or burrowing. Moderate amount of ground disturbance, 1-5% of the area	Evidence of mammal activity including holes or burrowing. High degree of ground disturbance, 5-25% of the area	Evidence of mammal activity including holes or burrowing. Very High degree of ground disturbance, >25% of the area	
Trails made by Foot Traffic	Elk, Deer, Moose, Cattle, Sheep, Humans	Wetland, Buffer	A few trails by animals or humans in past in 1-2 places, healing and becoming invisible; bare soil within to slightly above normal limits	Animal or human trails used nearly every year in a few places, getting deeper and wider each year; bare soil above normal limits across whole area	Animal or human trails used yearly or several times a year in several to many places, getting deeper and wider each year; bare soil well above normal limits across whole area	Animal or human trails common across whole area, used many times a year in several to many places, getting deeper and wider each year; bare soil well above normal limits across whole area	

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
Trampling / Hoof Punch	Elk, Deer, Moose, Cattle, Sheep	Wetland	Soil compaction noticeable in a few spots, water table near or somewhat below normal levels; a few post-holes or a few animal trails, occurring occasionally; no bare soil or hummocks apparent	Soil compaction noticeable in several large areas (or many small areas), covering ¼-½ of the area; water table somewhat below normal levels; a moderate amount of post-holing or animal trailing, occurring often; bare soil and hummocks visible	Soil compaction obvious in large areas, covering >½ of the area; water table below normal levels; post-holing and animal trails throughout the area, use occurring every year or two; bare soil and hummocks common, some trailing in hollows between hummocks	Soil compaction obvious, especially in hollows between hummocks; water table well below normal levels; post-holing common, occurring annually, animal trailing & bare soil common in hollows	Discussion of hummocks in Sanderson and March 1996, Cooper and MacDonald 2000, Lesica and Kannowski 1998
Trampling / Hoof Punch	Elk, Deer, Moose, Cattle, Sheep	Buffer	Soil mostly soft in rangelands and duff mostly intact in forests except for a few places; bare soil within to slightly above normal limits; a few pedestalled plants in rangelands	Soil hard in large areas of rangelands, duff missing in large areas of forests; bare soil above normal limits (>20% rangelands, >10% forests); pedestalled plants obvious	Soil hard in most rangelands, duff missing in most forests; bare soil well above normal limits (>30% rangelands, >15% forests); pedestalled plants common	Soil hard and unyielding in all rangelands, duff up to ½ missing in forests; bare soil much greater than normal (>40% rangelands, >20% forests); pedestalling of plants common or everywhere	
Exotic Plant Invasion		Wetland, Buffer	Some exotic plants evident, 2-10% total canopy cover of exotic plants	Exotic plants obvious, 10-20% total canopy cover of exotic plants	Exotic plants obvious, >20% total canopy cover of exotic plants	Exotic plants dominant or subdominant, >30% total canopy cover of exotic plants	See Kratz and others 2007
Fire	Natural, Humans	Buffer	One or a few burned spots >10 m from wetland edge, naturally revegetating	Several burned spots or one large burned area, >10 m from wetland edge, mostly revegetating naturally	Many burned spots or several large burned areas, some <10 m from wetland edge, some areas of bare soil and evident erosion	Many burned spots or several large burned areas, many <10 m from wetland edge, many areas of bare soil and evident erosion	See Kratz and others 2007
Camp Sites	Humans	Buffer	One or a few camp sites, used a few times a year, naturally revegetating, all sites and roads >10 m from wetland edge	One or a few camp sites, used every few weeks in season, some areas revegetating, some bare and eroding, most sites and roads >10 m from wetland edge but small areas <10 m	Several camp sites, used weekly in season, some areas revegetating, some bare and eroding, most sites and roads >10 m from wetland edge but small areas <10 m	Many camp sites, used weekly in season, most areas bare and eroding, large areas <10 m from wetland edge	
Litter / Dumping / Trash	Humans	Wetland, Buffer	Trace evidence of trash, <1% of the area	Evidence of trash affecting 1-5% of the area	Evidence of trash affecting 5-25% of the area	Evidence of trash affecting >25% of the area	
Off-Road Vehicle Tracks	ATV, Motorcycle, Snowmobile, 4WD	Wetland, Buffer	A few passes by vehicle evident in the past in 1-2 places, healing and becoming invisible; bare soil within to slightly above normal limits	Vehicle passes occurring every 3-5 years in 2-5 places, getting deeper and wider each time, not healing; bare soil somewhat above normal limits across whole area	Vehicle passes occurring every 1-2 years in >5 places, getting deeper and wider each time, not healing; bare soil well above normal limits across whole area	Vehicle passes occurring annually or several times each year in >10 places, getting deeper and wider each time, not healing; bare soil well above normal limits across whole area	

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
Buried Utility Corridors		Wetland	No buried utility lines in wetland, right-of-way covers part of wetland partially cleared, slight amount of human or ATV trailing in wetland from maintenance activities	Buried utility line across corner of wetland, trench for utility covered and revegetated and mostly healed, slight amount of human or ATV trailing in wetland from maintenance activities	Buried utility line across middle of wetland, trench for utility covered and partly revegetated but mostly not healed and some erosion, moderate amount of human or ATV trailing from maintenance activities in right-of-way in wetland	Buried utility line across middle of wetland, trench for utility partly covered but not revegetated, erosion is apparent, right-of-way continually used for maintenance	
		Buffer	Buried utility line crosses part of buffer, utility line and right-of-way all >10 m from wetland, right-of-way not cleared, slight amount of vehicle tracks or trails in buffer from maintenance activities	Buried utility line crosses buffer, utility line >10 m from wetland but part of right-of way <10 m from wetland, right-of-way partially cleared in buffer but > 10 m from wetland, moderate amount of vehicle tracks-trails-roads from maintenance activities in buffer	Buried utility line crosses buffer. utility line in part < 10 m from wetland and part of right-of-way <10 m from wetland, right-of-way cleared in buffer someplace <10 m from wetland, right-of-way with some bare soil and eroding, tracks-trails-roads from maintenance activities used often	Buried utility line crosses buffer, part of utility line and buffer <10 m from wetland, right-of-way cleared to wetland edge, right-of-way roads and trails actively eroding, tracks-trails-roads used often as part of maintenance	
Development in addition to roads or utilities		Buffer	Small structure (not a residence or full-size buliding) > 50 m from wetland complex edge	Small structure (not a residence or full-size building) within 50 m from wetland complex edge	Residence or Full-size building present in zone	Multiple buildings present in zone.	
Power Lines	Humans	Wetland	Power line over wetland, no structures in wetland, slight amount of human or ATV trailing from maintenance activities	Power line over wetland, no structures in wetland, moderate amount of human or ATV trailing from maintenance activities, some clearing activities in wetland	Power line over wetland, no structures in wetland, 4WD road in wetland from maintenance activities	Power line over wetland, structure in wetland	
		Buffer	Power line over buffer, no structures in buffer, slight amount of human or ATV trailing from maintenance activities, right-of-way not cleared in wetland	Power line over buffer, structure in buffer but >10 m from wetland, moderate amount of human or ATV trailing from maintenance activities, some clearing activities in buffer but >10 m from wetland	Power live over buffer, structure in buffer <10 m from wetland, 4WD road in buffer for maintenance, right-of-way intensively cleared to 10 m from wetland	Power line over buffer, structure in buffer at wetland edge, 4WD road in buffer right up to wetland edge, right-of-way intensively cleared right up to wetland edge	

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
Roads (constructed)	State, County, USFS	Wetland	N/A (presence of any road would be high or very high intensity)	N/A (presence of any road would be high or very high intensity)	Paved road with rock fill and gravel embankments crossing wetland, minimal erosion into wetland, somewhat disrupting water flow and dividing wetland into two parts	Gravel or fine-textured soil surface with fine-textured fill and embankments that erode regularly into wetland, disrupting water flow and dividing wetland into two parts	
		Buffer	One or two temporary natural-surface roads in past that were closed and revegetated, now restoring naturally, >10 m from wetland edge	One to several natural-surface or all-weather roads open and used several times a year, >10 m from wetland edge	Several natural-surface or all-weather roads open and used weekly; or one road <10 m from wetland edge	Several natural-surface or all-weather roads open and used several to many times a week; or one or more roads <10 m from wetland edge	All-weather road usually means gravel surface
Deposition (Sedimentation)		Wetland	Up to 2% of wetland covered by recent sediment deposit up to 1 cm thick	2 – 5% of wetland covered by recent sediment deposit 1 – 3 cm thick	5 – 15% of wetland covered by recent sediment deposit 3 – 5 cm thick	More than 15% of wetland covered by recent sediment deposit >5 cm thick	See Chimner and others 2008, Rocchio 2006a
		Buffer	Soil in rangelands mostly not moving from year to year and duff mostly intact in forests except for a few places; bare soil within to slightly above normal limits (<15% rangelands, <5% forests); a few pedestalled plants in rangelands, slight sediment margins around wetland in a few places	Soil in rangelands moving during large storms and runoff, duff missing in large areas of forests; bare soil above normal limits (>20% rangelands, >10% forests); pedestalled plants obvious, sediment margins around wetland obvious in several to many places	Soil in rangelands moving during large storms and runoff, duff missing in most forests; bare soil well above normal limits (>30% rangelands, >15% forests); pedestalled plants common; sediment margins around wetland obvious throughout	Soil in rangelands moving during storms of any size and during runoff, duff up to ½ missing in forests; bare soil much greater than normal (>40% rangelands, >20% forests); pedestalling of plants common or everywhere; sediment margins around wetland obvious throughout	
Ditches	Humans	Wetland	One or two shallow (<20 cm) ditches dug once in past, now beginning to restore naturally, water table at or slightly below normal levels (considering other factors, such as flooding)	One to several shallow ditches dug and maintained, still functional and draining water from wetland (or part of wetland), water table noticeably below normal levels, a few upland plants or weeds appearing in community being drained	One to several deeper (>20 cm) ditches dug and maintained, still functional and draining water from wetland (or part of wetland), water table noticeably below normal levels, upland plants or weeds obvious and beginning to share dominance with hydrophytes	One to several deeper (>20 cm) ditches dug and maintained, still functional and draining water from wetland (or part of wetland), water table well below normal levels, vegetation in community being drained very much drier – hydrophytes losing dominance to upland plants and weeds	

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
Erosion, (Channel Incision, Gullies, or Head Cuts)	Vehicles, Elk, Deer, Moose, Humans	Wetland	A few small eroding spots evident (trampling, trailing, tracks, etc.), beginning to revegetate, any channel < 20 cm wide and <5 cm deep	Several eroding spots obvious (trampling, wallows, trailing, tracks, etc.), some remaining exposed and eroding, any channel < 50 cm wide and <10 cm deep	Eroding spots large or common, or a gully or two 50-100 cm wide and 10-50 cm deep	Several gullies, some with headcuts, gullies > 1 m wide and > 50 cm deep	Headcuts are a type of erosion extending in an upstream direction.
Erosion	Vehicles, Elk, Deer, Moose, Humans	Buffer	A few rills >10 m from wetland, soil mostly covered in rangelands and duff mostly intact in forests except for a few places; bare soil within to slightly above normal limits (<15% rangelands, <5% forests); a few pedestalled plants in rangelands	A few to several apparent rills, a few <10 m from wetland, bare soil exposed in large areas of rangelands, duff missing in large areas of forests; bare soil above normal limits (>20% rangelands, >10% forests); pedestalled plants obvious	Many rills, often <10 m from wetland, possibly a headcut >10 m from wetland; soil hard in most rangelands, duff missing in most forests; bare soil well above normal limits (>30% rangelands, >15% forests); pedestalled plants common	Rills common, often < 10 m from wetland, or headcut eroding into wetland; soil hard and unyielding in all rangelands, duff up to ½ missing in forests; bare soil much greater than normal (>40% rangelands, >20% forests); pedestalling of plants common or everywhere	
Ground Disturbance (General)	Unknown	Wetland, Buffer	Low level of ground disturbance, <5% of the area	Moderate amount of ground disturbance, 5-15% of the area	High degree of ground disturbance, 15-25% of the area	Very High degree of ground disturbance, >25% of the area	May be used if the disturbance does not fit the other categories
Soil Removal (Peat Mining)	Humans	Wetland	Removal of upper soil horizons (including peat) in one or a few places in the past, now beginning to recover slowly	Peat mining of <10% of wetland, remainder of peat intact and functioning normally	Peat mining of >½ of wetland, remainder of peat intact and functioning normally, not floating or breaking loose from substrate	Peat mining of >¾ of wetland, remainder of peat dead or floating, no normally functioning peat remaining	See Kratz and others 2007
Soil Removal (Peat Mining)	Humans	Buffer	Removal of upper soil horizons in one or a few places, revegetated and beginning to naturally recover	Removal of upper soil horizons in one or a few places, leaving lower horizons bare and eroding	Removal of upper soil horizons in several to many places, leaving lower horizons bare and eroding	Removal of upper soil horizons common, leaving lower horizons bare and eroding	
Tree Cutting / Logging	Humans	Wetland	Most trees cut by hand in past, reduction in shade causing some increases in vascular plant and bryophyte cover, water table at or near natural levels	Trees cut by machinery, disruption of peat body and some erosion in a few small areas, water table at or near normal levels	Trees cut by machinery, disruption of peat body and evident erosion in one large area or a many small areas, water table changed from normal levels	Trees cut by machinery, disruption of peat body and evident erosion across much of wetland, water table very much changed from normal levels	If beaver have cut trees, use Disturbance 'Beaver Activity'
		Buffer	A few trees cut in a few patches >10 m from wetland margin, disturbance revegetating, no erosion into wetland	Large areas of buffer cut, a small area <10 m from wetland margin, disturbance mostly revegetating but some erosion into wetland	Large areas of buffer cut, a moderately large area <10 m from wetland margin, erosion into wetland obvious	Large areas of buffer cut, including most of area <10 m from wetland margin, erosion into wetland obvious and increasing	

Disturbance Factor	Possible Agents	Impact Area*	Intensity Class 1 Low	2 Moderate	3 High	4 Very High	Comments
De-watering	Humans	Wetland	[Dam or other structure has been breached in past], water is draining from wetland, but vegetation seems to be retaining water successfully and system appears stable, water table in wetland at or slightly below normal levels	[Dam or floodgate has been lowered or bypassed or breached], water is draining from wetland, water table noticeably below normal levels, a few upland plants or weeds appearing in community being drained, community losing stability	[Dam or floodgate has been lowered or bypassed or breached], water is draining from wetland, water table noticeably below normal levels, upland plants or weeds obvious and beginning to share dominance with hydrophytes, community obviously unstable, changing every year	[Dam or floodgate has been lowered or bypassed or breached], water is draining from wetland, water table well below normal levels, upland plants or weeds obvious and dominant with hydrophytes, community obviously unstable, changing every year	Lowering of water table
Groundwater pumping	Humans	Wetland, Buffer	Water is being removed from the water table beyond the 100 m buffer zone	Water is being removed from the water table between 50-100 m from the wetland.	Water is being removed from the water table < 50 m from the wetland.	Water is being removed from the water table inside the wetland.	Lowering of water table
Surface water diversion	Humans	Wetland, Buffer	Alteration of drainage pattern upslope that results in less water reaching the wetland. Estimated that less than 5% of surface inflow affected.	Alteration of drainage pattern upslope that results in less water reaching the wetland. Estimated that 5 to 25% of surface inflow affected.	Alteration of drainage pattern upslope that results in less water reaching the wetland. Estimated that 25-50% of surface inflow affected.	Alteration of drainage pattern upslope that results in less water reaching the wetland. Estimated that >50% of surface inflow affected.	Lowering of water table
Drainage from Above (Water Inflow Increase)	Humans	Wetland	One or two small drainage channels from road culverts or other drainage structures, most of water entering groundwater before reaching wetland, causing no apparent erosion into wetland, no apparent changes in wetland water table or vegetation	One to several small drainage channels, some surface water reaching wetland, some apparent erosion from these channels reaching wetland margins, water table near normal levels, changes in vegetation only along margins	One to several moderate to large drainage channels, surface water flowing into wetland, apparent erosion from these channels reaching wetland margins and beyond margins in a few places, water table above normal level, changes in vegetation along margins	One to several moderate to large drainage channels, surface water flowing into wetland, apparent erosion from these channels reaching wetland margins and into center of wetland, water table well above normal level, changes in vegetation along margins and in wetland center	
Flooding	Humans	Wetland	Floodgate, dam, or other structure has been permanently raised, or is being raised seasonally, water table 5-10 cm above normal levels, but vegetation seems to be stable and unchanged from normal	Floodgate, dam, or other structure has been permanently raised, or is being raised seasonally, water table 10-20 cm above normal levels, vegetation is changing to species characteristic of higher water tables	Floodgate, dam, or other structure permanently raised, water table >20 cm above normal levels, vascular plants drowned and dying, small pieces of peat dislodged and floating to surface	Floodgate, dam, or other structure permanently raised, water table >50 cm above normal levels, vascular plants drowned and dying, large pieces of peat dislodged and floating to surface	Raising of water table

* *Wetland* is the delineated fen or potential-fen polygon, composed of one to several community types, also called *wetland complex* or *fen complex*.
Buffer is the area within the contributing watershed within 100 m of the edge of the wetland

Version 25 Aug 2010

APPENDIX 3. List of plants identified in the fen vegetation surveys from the Washoe Meadows State Park with scientific names according to (Baldwin et al. 2012), and codes and common names per USDA-NRCS (2011). Taxa listed alphabetically by scientific name, with nonvascular plants listed first. In the last column, the **X**'s indicate taxa recorded during fieldwork for this project.

Stratum	Code	Scientific Name with Author	Common Name	Family	2011
Nonvascular	AMSE3	*Amblystegium serpens* (Hedw.) Schimp.	amblystegium moss	Amblystegiaceae	X
Nonvascular	AUPA70	*Aulacomnium palustre* (Hedw.) Schwägr.	aulacomnium moss	Aulacomniaceae	X
Nonvascular	BRFR70	*Brachythecium frigidum* (Müll. Hal.) Besch.	cold brachythecium moss	Brachytheciaceae	X
Nonvascular	DRAD2	*Drepanocladus aduncus* (Hedw.) Warnst.	drepanocladus moss	Amblystegiaceae	X
Nonvascular	MDRSO	*Drepanocladus sordidus* (Müll. Hal.) Hedenas		Amblystegiaceae	X
Nonvascular	LEPY70	*Leptobryum pyriforme* (Hedw.) Wilson	leptobryum moss	Bryaceae	X
Nonvascular	MAPO16	*Marchantia polymorpha* L.	liverwort	Marchantiaceae	X
Nonvascular	METR70	*Meesia triquetra* (L. ex Jolycl.) Ångstr.	meesia moss	Meesiaceae	X
Nonvascular	MEUL70	*Meesia uliginosa* Hedw.	meesia moss	Meesiaceae	
Nonvascular	2MOSS	Moss	unknown moss		
Nonvascular	PHAM13	*Philonotis americana* Dism.	American philonotis moss	Bartramiaceae	X
Nonvascular	PHFO6	*Philonotis fontana* (Hedw.) Brid.	philonotis moss	Bartramiaceae	X
Nonvascular	PLME4	*Plagiomnium medium* (Bruch & Schimp.) T. Kop.	intermediate plagiomnium moss	Mniaceae	X
Nonvascular	POCA44	*Pohlia camptotrachela* (Renauld & Cardot) Broth.	pohlia moss	Bryaceae	X
Nonvascular	PTPA70	*Ptychostomum pallens* (Sw.) J.R. Spence	bryum moss	Bryaceae	X
Nonvascular	MPTPS	*Ptychostomum pseudotriquetrum* (Hedw.) J.R. Spence & H.P. Ramsay	common green bryum moss	Bryaceae	X
Nonvascular	PTWE	*Ptychostomum weigelii* (Spreng.) J.R. Spence	Weigel's bryum moss	Bryaceae	
Nonvascular	RICH2	*Riccardia chamedryfolia* (With.) Grolle	liverwort	Aneuraceae	X
Nonvascular	TONI70	*Tomentypnum nitens* (Hedw.) Loeske	tomentypnum moss	Brachytheciaceae	
Herb	ACMI2	*Achillea millefolium* L.	common yarrow	Asteraceae	X
Herb	ACAMA	*Acmispon americanus* (Nutt.) Rydb. var. *americanus*	Spanish clover	Fabaceae	X
Herb	ACCO4	*Aconitum columbianum* Nutt.	Columbian monkshood	Ranunculaceae	X
Graminoid	AGID	*Agrostis idahoensis* Nash	Idaho bentgrass	Poaceae	X
Graminoid	AGROS2	*Agrostis* L.	bentgrass	Poaceae	X
Graminoid	AGST2	*Agrostis stolonifera* L.	creeping bentgrass	Poaceae	X
Herb	ALVA	*Allium validum* S. Watson	Pacific onion	Liliaceae	X

Stratum	Code	Scientific Name with Author	Common Name	Family	2011
Herb	ASTEXX	Asteraceae L.	unknown Asteraceae	Asteraceae	X
Herb	BIBI5	*Bistorta bistortoides* (Pursh) Small	American bistort	Polygonaceae	X
Graminoid	CAST36	*Calamagrostis stricta* (Timm) Koeler	slimstem reedgrass	Poaceae	X
Herb	CAQU2	*Camassia quamash* (Pursh) Greene	small camas	Liliaceae	X
Graminoid	CAAB2	*Carex abrupta* Mack.	abruptbeak sedge	Cyperaceae	X
Graminoid	CAAN15	*Carex angustata* Boott	widefruit sedge	Cyperaceae	X
Graminoid	CAAU3	*Carex aurea* Nutt.	golden sedge	Cyperaceae	X
Graminoid	CACA11	*Carex canescens* L.	silvery sedge	Cyperaceae	
Graminoid	CACA13	*Carex capitata* L.	capitate sedge	Cyperaceae	X
Graminoid	CADI6	*Carex disperma* Dewey	softleaf sedge	Cyperaceae	X
Graminoid	CAEC	*Carex echinata* Murray	star sedge	Cyperaceae	X
Graminoid	CAREX	*Carex* L.	unknown sedge	Cyperaceae	
Graminoid	CALI7	*Carex limosa* L.	mud sedge	Cyperaceae	X
Graminoid	CANE2	*Carex nebrascensis* Dewey	Nebraska sedge	Cyperaceae	X
Graminoid	CASI2	*Carex simulata* Mack.	analogue sedge	Cyperaceae	
Graminoid	CASU6	*Carex subfusca* W. Boott	rusty slender sedge	Cyperaceae	X
Graminoid	CAUT	*Carex utriculata* Boott	Northwest Territory sedge	Cyperaceae	X
Graminoid	CAVE6	*Carex vesicaria* L.	blister sedge	Cyperaceae	X
Herb	CAMI12	*Castilleja miniata* Douglas ex Hook.	giant red Indian paintbrush	Scrophulariaceae	X
Herb	CHANC	*Chamerion angustifolium* (L.) Holub ssp. *circumvagum* (Mosquin) Hoch	fireweed	Onagraceae	X
Herb	CIVU	*Cirsium vulgare* (Savi) Ten.	bull thistle	Asteraceae	X
Graminoid	DEDA	*Deschampsia danthonioides* (Trin.) Munro	annual hairgrass	Poaceae	
Herb	DOAL	*Dodecatheon alpinum* (A. Gray) Greene	alpine shootingstar	Primulaceae	X
Herb	DRRO	*Drosera rotundifolia* L.	roundleaf sundew	Droseraceae	X
Graminoid	ELQU2	*Eleocharis quinqueflora* (Hartmann) O. Schwarz	fewflower spikerush	Cyperaceae	X
Graminoid	ELEOC	*Eleocharis* R. Br.	spikerush	Cyperaceae	
Graminoid	ELTRT	*Elymus trachycaulus* (Link) Gould ex Shinners ssp. *trachycaulus*	slender wheatgrass	Poaceae	X
Herb	EPCI	*Epilobium ciliatum* Raf.	fringed willowherb	Onagraceae	X
Herb	EPCIG	*Epilobium ciliatum* Raf. ssp. *glandulosum* (Lehm.) Hoch & P.H. Raven	fringed willowherb	Onagraceae	X

Stratum	Code	Scientific Name with Author	Common Name	Family	2011
Herb	EPILO	*Epilobium* L.	willowherb	Onagraceae	**X**
Herb	EPOR2	*Epilobium oregonense* Hausskn.	Oregon willowherb	Onagraceae	
Herb	EQAR	*Equisetum arvense* L.	field horsetail	Equisetaceae	**X**
Graminoid	ERGR8	*Eriophorum gracile* W.D.J. Koch	slender cottongrass	Cyperaceae	**X**
Herb	2FORB	Forb (herbaceous, not grass nor grasslike)			**X**
Herb	FRVI	*Fragaria virginiana* Duchesne	Virginia strawberry	Rosaceae	**X**
Herb	GAAP2	*Galium aparine* L.	stickywilly	Rubiaceae	**X**
Herb	GATR2	*Galium trifidum* L.	threepetal bedstraw	Rubiaceae	**X**
Herb	GESI3	*Gentianopsis simplex* (A. Gray) Iltis	oneflower fringed gentian	Gentianaceae	**X**
Herb	GERI	*Geranium richardsonii* Fisch. & Trautv.	Richardson's geranium	Geraniaceae	**X**
Herb	GEMA4	*Geum macrophyllum* Willd.	largeleaf avens	Rosaceae	**X**
Herb	HYAN2	*Hypericum anagalloides* Cham. & Schltdl.	tinker's penny	Clusiaceae	**X**
Herb	HYFOS	*Hypericum formosum* Kunth var. *scouleri* (Hook.) J.M. Coult.		Clusiaceae	**X**
Graminoid		*Juncus balticus* Willd. subsp. *ater* (Rydb.) Snogerup	baltic rush	Juncaceae	**X**
Graminoid	JUEF	*Juncus effusus* L.	common rush	Juncaceae	
Graminoid	JUHO	*Juncus howellii* F.J. Herm.	Howell's rush	Juncaceae	**X**
Graminoid	JUNE	*Juncus nevadensis* S. Watson	Sierra rush	Juncaceae	**X**
Graminoid	JUOX	*Juncus oxymeris* Engelm.	pointed rush	Juncaceae	
Shrub	JUOC	*Juniperus occidentalis* Hook.	western juniper	Cupressaceae	
Shrub	KAPO	*Kalmia polifolia* Wagenh.	alpine laurel	Ericaceae	
Herb	LEMNA	*Lemna* L.	duckweed	Lemnaceae	
Herb	LIPA3	*Lilium parvum* Kellogg	Sierra tiger lily	Liliaceae	**X**
Shrub	LOCO5	*Lonicera conjugialis* Kellogg	purpleflower honeysuckle	Caprifoliaceae	**X**
Shrub	LOINI	*Lonicera involucrata* (Richardson) Banks ex Spreng. var. *involucrata*	twinberry honeysuckle	Caprifoliaceae	**X**
Shrub	LONIC	*Lonicera* L.	honeysuckle	Caprifoliaceae	**X**
Herb	LOTUS	*Lotus* L.	trefoil	Fabaceae	
Herb	LULES2	*Lupinus lepidus* Douglas ex Lindl. var. *sellulus* (Kellogg) Barneby	dwarf lupine	Fabaceae	**X**
Herb	LUPO2	*Lupinus polyphyllus* Lindl.	bigleaf lupine	Fabaceae	
Graminoid	LUCO6	*Luzula comosa* E. Mey.	Pacific woodrush	Juncaceae	**X**
Graminoid	LUZUL	*Luzula* DC.	woodrush	Juncaceae	**X**

Stratum	Code	Scientific Name with Author	Common Name	Family	2011
Herb	MIGU	*Mimulus guttatus* DC.	seep monkeyflower	Scrophulariaceae	**X**
Herb	MIMO3	*Mimulus moschatus* Douglas ex Lindl.	muskflower	Scrophulariaceae	**X**
Herb	MIPR	*Mimulus primuloides* Benth.	primrose monkeyflower	Scrophulariaceae	**X**
Graminoid	MUFI2	*Muhlenbergia filiformis* (Thurb. ex S. Watson) Rydb.	pullup muhly	Poaceae	**X**
Herb	ORALA3	*Oreostemma alpigenum* (Torr. & A. Gray) Greene var. *andersonii* (A. Gray) G.L. Nesom	tundra aster	Asteraceae	**X**
Herb	ORSE	*Orthilia secunda* (L.) House	sidebells wintergreen	Ericaceae	**X**
Herb	OSBE	*Osmorhiza berteroi* DC.	sweet cicely	Apiaceae	**X**
Herb	OXOC	*Oxypolis occidentalis* J.M. Coult. & Rose	western cowbane	Apiaceae	**X**
Herb		*Pectiantia breweri* (A. Gray) Rydb.	Brewer's miterwort	Saxifragaceae	**X**
Herb	PEAT	*Pedicularis attollens* A. Gray	little elephantshead	Scrophulariaceae	**X**
Herb	PELE5	*Perideridia lemmonii* (J.M. Coult. & Rose) T.I. Chuang & Constance	Lemmon's yampah	Apiaceae	
Herb	PERID	*Perideridia* Rchb.	yampah	Apiaceae	**X**
Tree	PICOM	*Pinus contorta* Douglas ex Louden var. *murrayana* (Balf.) Engelm.	Sierra lodgepole pine	Pinaceae	**X**
Herb	PLDIL	*Platanthera dilatata* (Pursh) Lindl. ex Beck var. *leucostachys* (Lindl.) Luer	Sierra bog orchid	Orchidaceae	**X**
Graminoid	POBO	*Poa bolanderi* Vasey	Bolander's bluegrass	Poaceae	**X**
Graminoid	POPR	*Poa pratensis* L.	Kentucky bluegrass	Poaceae	**X**
Graminoid	POACXX	Poaceae	unknown Poaceae	Poaceae	**X**
Herb	POOC2	*Polemonium occidentale* Greene	western polemonium	Polemoniaceae	**X**
Herb	PRVU	*Prunella vulgaris* L.	common selfheal	Lamiaceae	**X**
Shrub		*Rhododendron columbianum* (Piper) Harmaja	western Labrador tea	Ericaceae	**X**
Shrub	RIIN2	*Ribes inerme* Rydb.	whitestem gooseberry	Grossulariaceae	**X**
Herb	RUAC3	*Rumex acetosella* L.	common sheep sorrel	Polygonaceae	**X**
Shrub	SAEA	*Salix eastwoodiae* Cockerell ex A. Heller	mountain willow	Salicaceae	**X**
Shrub	SALUL	*Salix lucida* Muhl. ssp. *lasiandra* (Benth.) E. Murray	Pacific willow	Salicaceae	**X**
Herb	SAOR2	*Saxifraga oregana* Howell	Oregon saxifrage	Saxifragaceae	**X**
Graminoid	SCMI2	*Scirpus microcarpus* J. Presl & C. Presl	panicled bulrush	Cyperaceae	**X**
Herb	SIORS	*Sidalcea oregana* (Nutt. ex Torr. & A. Gray) A. Gray ssp. spicata (Regel) C.L. Hitchc.	Oregon checkerbloom	Malvaceae	**X**

Stratum	Code	Scientific Name with Author	Common Name	Family	2011
Shrub	SOCA8	*Sorbus californica* Greene	California mountain ash	Rosaceae	**X**
Herb	SPCA5	*Sphenosciadium capitellatum* A. Gray	woollyhead parsnip	Apiaceae	**X**
Herb	SPIRA2	*Spiranthes* Rich.	lady's tresses	Orchidaceae	
Herb	SPRO	*Spiranthes romanzoffiana* Cham.	hooded lady's tresses	Orchidaceae	**X**
Herb	STLO2	*Stellaria longipes* Goldie	longstalk starwort	Caryophyllaceae	**X**
Herb	SYSP	*Symphyotrichum spathulatum* (Lindl.) G.L. Nesom	western mountain aster	Asteraceae	**X**
Herb	THFE	*Thalictrum fendleri* Engelm. ex A. Gray	Fendler's meadow-rue	Ranunculaceae	**X**
Herb	TROCO2	*Triantha occidentalis* (S. Watson) Gates ssp. *occidentalis*	western false asphodel	Liliaceae	**X**
Herb	TRIFO	*Trifolium* L.	clover	Fabaceae	**X**
Herb	TRRE3	*Trifolium repens* L.	white clover	Fabaceae	**X**
Shrub	VAUL	*Vaccinium uliginosum* L.	bog blueberry	Ericaceae	**X**
Herb	VECA2	*Veratrum californicum* Durand	California false hellebore	Liliaceae	**X**
Herb	VESEH2	*Veronica serpyllifolia* L. ssp. *humifusa* (Dicks.) Syme	bright blue speedwell	Scrophulariaceae	**X**
Herb	VIMA2	*Viola macloskeyi* Lloyd	small white violet	Violaceae	**X**

Appendix 4

Photos Taken at Survey Sites

Name of Site	Fen Meadow ID	Pages
Washoe Meadows 2	LTAHWM_2F	4-1 to 4-3
Washoe Meadows 3	LTAHWM_3F	4-4 to 4-14
Washoe Meadows 4	LTAHWM_4F	4-14 to 4-16
Washoe Meadows 5	LTAHWM_5F	4-17 to 4-19
Northern Extension	LTAHWM_F	4-19 to 4-24
Meesia uliginosa site	LTAHWM_MEUL	4-25 to 4-27
Spring site	LTAHWM_SP	4-27 to 4-37

Plot number LTAHWM_2_F1, looking north from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_2_F1, looking east from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_2_F1, looking south from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_2_F1, looking west from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_2_F1, looking northeast from the SW corner of plot (Aug. 2011).

Plot number LTAHWM_2_F1, view of the soil core (Aug. 2011).

Plot number LTAHWM_3_F1, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F1, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F1, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F1, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F1, looking northeast from the SWcorner of plot (Oct. 2011).

Plot number LTAHWM_3_F2, looking north from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_3_F2, looking east from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_3_F2, looking south from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_3_F2, looking west from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_3_F2, looking northeast from the SW corner of plot (Aug. 2011).

Plot number LTAHWM_3_F2, view of soil core (Aug. 2011).

Plot number LTAHWM_3_F3, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F3, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F3, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F3, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F3, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_3_F4, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F4, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F4, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F4, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_3_F4, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_4_F1, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_4_F1, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_4_F1, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_4_F1, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_4_F1, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_5_F1, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_5_F1, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_5_F1, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_5_F1, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_5_F1, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_F6, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_F6, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_F6, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_F6, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_F6, looking northeast from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_F7, looking north from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_F7, looking east from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_F7, looking south from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_F7, looking west from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_F7, a view of soil pit adjacent to tree (Aug. 2011).

Plot number LTAHWM_F7, view of the soil core (Aug. 2011).

Plot number LTAHWM_MEUL_F1, looking north from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_MEUL_F1, looking east from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_MEUL_F1, looking south from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_MEUL_F1, looking west from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_MEUL_F1, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F1, looking north from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_SP_F1, looking east from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_SP_F1, looking south from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_SP_F1, looking west from the southwest corner of plot (Aug. 2011).

Plot number LTAHWM_SP_F1, looking northeast from the SW corner of plot (Aug. 2011).

Plot number LTAHWM_SP_F2, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F2, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F2, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F2, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F2, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, looking north from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, looking east from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, looking south from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, looking west from the southwest corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, looking northeast from the SW corner of plot (Oct. 2011).

Plot number LTAHWM_SP_F3, view of soil core (Aug. 2011).

Spring source with barrel in meadow LTAHWM_SP (Aug. 2011).

From spring facing ESE in meadow LTAHWM_SP (Aug. 2011).

Photo taken from steepest point in meadow LTAHWM_SP, facing ESE and downhill (Aug. 2011).

Photo taken from steepest point in meadow LTAHWM_SP, facing WNW and uphill (Aug. 2011).