Table 5.1—List of equipment and other gear for the field data collection.

2, 50 m measuring tapes

1, 100 m measuring tape

1, 3-m hand measuring tape

Range survey pins for anchoring tapes

1, Stadia rod

2, Clinometers or a laser level

Flagging

Clipboards

Pencils, pencil lead, sharpies

Field journals

File box for data sheets

Sampling Protocol & Data Sheets

Sampling protocols and data sheets for geomorphic, riparian vegetation, disturbance, and meadow data assessments

Maps and aerial images

Topographic maps for navigation to study watershed

Aerial images with dominant reach types in the upper, middle, and lower parts of the watershed delineated

GPS

Recreational grade GPS

Extra batteries and charger

Camera

Digital camera and extra data card, batteries, and battery charger

White board and markers to label photographs with date, watershed, watershed database code, and position in watershed

Species Lists

Great Basin riparian and meadow species (tables 7.3 and 9.5)

Regional floras and vegetation keys

Small rulers and hand lenses for plant identification

Plastic bags for collecting plants

Plant presses

Appendix 6—Information and Data Form for Assessing Stream Geomorphic Characteristics in the Field

This appendix includes the data form and information for collecting the stream geomorphic data. The geomorphic data are collected along the same stream reach as the riparian vegetation and disturbance data. These data are also collected when meadow complexes are sampled.

The geomorphic data are collected using form A.6.1. One form is used for each stream reach or meadow complex. At each sampled stream reach or meadow complex, identifying information is recorded on the data form. This includes the date, observer, watershed name, the watershed code in the Great Basin watershed database, location within the watershed (e.g., high, mid, low), and the reach length of the observations (typically 30 m). A GPS is used to record the UTM coordinates and elevation where the stream cross sectional profile is drawn for the sampled reach.

A complete description of the variables recorded and the specific measurements or scores used to describe each variable are in table A.6.1. The assessment involves collecting information on the current cross-sectional morphology of the valley (including the channel) and the longitudinal profile of the stream channel. Information is collected on the materials comprising the channel bed, banks, and valley fill, and the sediment mobility and availability of bed sediments. In addition, information is obtained on features that are indicative of the magnitude and rate of channel incision (e.g., knickpoints, headcuts, terraces), occurrence and amount of channel avulsion (e.g., filled or unfilled paleochannels), and the extent and mechanisms of bank erosion. Stream cross-section and bed material distribution data may be collected where more detailed data are desired.

A cross-sectional profile is drawn for each sampled reach at a representative location within the reach. An illustration of a cross-sectional profile of a stream channel is in fig. A.6.1. This drawing is used to identify the geomorphic positions used to sample riparian vegetation as described on the riparian vegetation data form A.7.1.

The data collected in the geomorphic assessment are used in the score sheets for assessing watershed sensitivity and resilience in appendix 10 and for rating ecological integrity in appendix 11.

Form A.6.1–GEOMORPHIC DATA	Date: Observer:
Watershed Name:	Database Code:
UTM Zone:	Elevation (m):
UTMs: Northing	Easting
Location in Basin: Low / Mid / High	Reach Length of Observations (m):

Definitions of terms and methods for the variables collected are in appendix A.6.2.
Use consistent units for all measurements.

Channel Character and Form

Flow Type: Perennial Ephemeral

Flow/Water Width (m): _____ **Flow Depth (m):** _____

Bankfull Channel Width (m): _____ **Bankfull Channel Depth (m):** _____

Channel Slope: distance (m): _____ clinometer height (m): _____

stadia height (m): _____ slope: _____

Sediment Size and Mobility

Bed Particle Size: approx. D_{50}: _____ approx. max. (ave. 10 largest) _____

Bank/Valley Fill Sediment Size (%): gravel/boulders mixed gravel/fines fines (<2 mm)

Bed Clast Immobility (% of channel bed): >75% 50-75% 10-50 % <10 %

Pebble Count Taken: yes no

Cross-section Taken: yes no

Sediment Availability

Bar Frequency (# per reach in channel): none few (1-2) common (3-4) many (>4)

Bar Extent (% of channel bed): none to 10% 10-20% 20-30% >30%

Gravel Bars on Valley Floor (# per reach): none few (1-2) common (3-4) many (>4)

Evidence of Incision within the study reach

Fan Steps at the Reach: yes no If yes, range in height(s) (m): _____

Knickpoints (# per reach): none few (1-2) common (3-4) 4 = many (>4)

Knickpoint Height (cm): none 0-25 cm 25-50 cm > 50 cm

Knickpoint Composition: bedrock boulders unconsol. sediment (gravel/silt/clay) roots

Inset Terraces (#): none 1 2 3 >/=4

Incision Depth (m): none 0-1 m 1-2 m >2 m deep

Bedrock Outcrops (% of channel bed): none localized (<25 %) extensive (>25 %)

Headcuts (# per reach): none few (1-2 per reach) common (3-4) many (>4)

Headcut Height (m): no headcuts 0-1 m 1-2 m > 2 m

Evidence of Avulsion and Avulsion Channels within the study reach

Anabranching Channels (# per reach): none few (1-2) common (2-4) many (>4)

Gravel Filled Channels (# per reach): none few (1-2) common (2-4) many (>4)

Gravel Aggradation/Debris Dams (# per reach): none few (1-2) common (2-4) many (>4)

Form A.6.1–GEOMORPHIC DATA	Date:
Watershed Name:	Database Code:
UTM Zone:	Elevation:
UTMs: Northing	Easting
Location in Basin: Low / Mid / High	Reach Length of Observations:

Sketch of Stream Cross-sectional Profile: See fig. A.6.1 for an example sketch of a cross-sectional profile. Include all topographic features as well as bars, bank characteristics, and other features of geomorphic significance. Include the vertical and horizontal scale. Where sampled reaches are near fan steps, headcuts, or other significant geomorphic features, also include a longitudinal sketch. See fig. 14 for an example of a longitudinal profile illustrating a fan step downstream of a meadow.

Figure A.6.1—Example sketch of a cross-sectional profile of a stream channel.

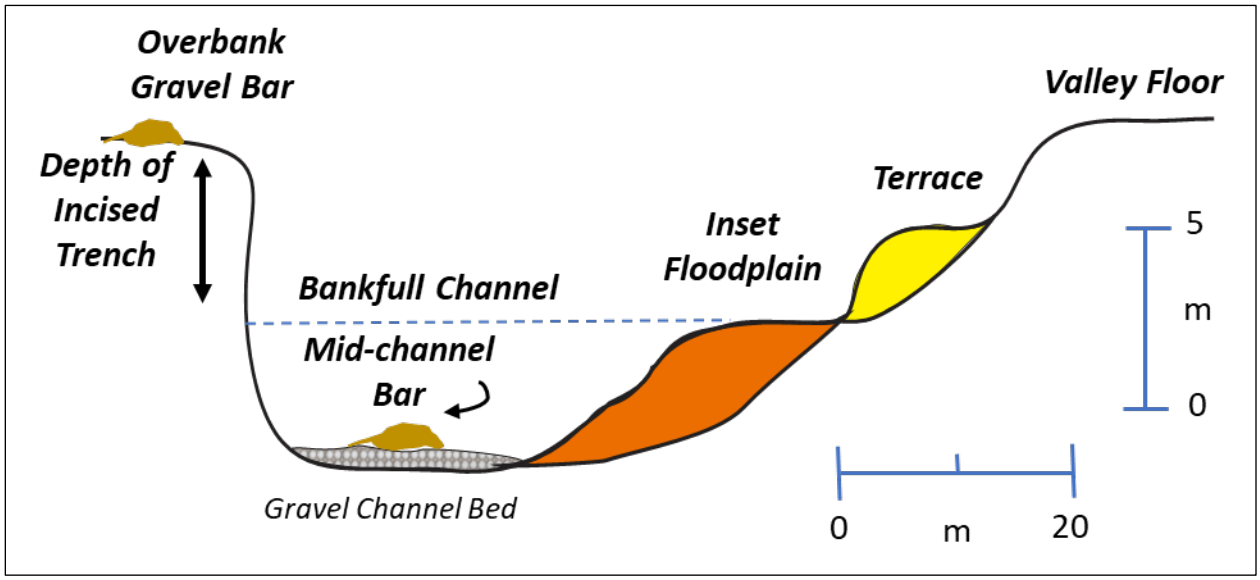

Table A.6.1—Descriptions of the variables used to assess stream reach geomorphic characteristics in the field.

- **Reach Length of Observations:** A stream reach is defined as a segment of the drainage network with homogenous channel and valley floor characteristics, including landforms (e.g., terraces, floodplains), channel bed features (pools and riffles, step and pools, bars, knickpoints, etc.), and sediment sizes. In the field, sample reaches are selected from the dominant watershed segments in the lower, middle, and higher portions of the watershed, which are predetermined in the office. The sample reach should be representative of the most common reach type within the dominant watershed segment. It should be long enough to include all valley, channel, and channel bed features that exist within the reach type. A typical study reach length is 30 m.
- **Channel Character and Form**
  - **Flow Type:** Describes the temporal variations in flow within the channel. Perennial flow – flow is present within the reach throughout the year; ephemeral flow – distinct periods of flow and dry conditions within the stream reach during the year.
  - **Flow /Water Width and Flow Depth:** The width of the water at the water's surface, and the maximum depth of the water in the channel.
  - **Bankfull:** The water level at which water is at the top of the stream bank and any further increase in water level would cause the water to "spill over" and inundate the adjacent terrace or floodplain. The bankfull channel is defined based on several parameters including: (1) the break in slope between the channel banks and the floodplain, defined as the first flat-lying, low-relief surface above the channel bed whose sediments are deposited by the modern channel; (2) the elevation of the highest depositional feature

within the channel (e.g., point bar, alternate bar, or central bar), where well-defined floodplains are absent; and (3) changes in the particle-size distribution and vegetation along the channel perimeter resulting from a change in the frequency of inundation and depositional processes.

  - **Bankfull Channel Width and Depth:** Bankfull channel width is the width of the channel at the bankfull water stage. Bankfull depth is the maximum depth of the channel measured from the bankfull stage to the thalweg (deepest part of the channel).
  - **Channel Slope:** Gradient (rise/run) of the channel measured along the thalweg of the stream. To calculate the percent slope, divide the elevation change (stadia or level height - clinometer height) by the distance measured. Multiply the resulting number by 100 to obtain the percentage slope.

- **Sediment Size and Mobility:** Particle size and mobility influences the ease with which the channel bed can be eroded and incised by flood flows. The variables used to evaluate sediment size and mobility can be estimated. Alternatively, pebble counts can be taken. Methods for collecting and analyzing particle size are in Bunte and Abt (2001).
  - **Bed Particle Size:** Particle size D_{50} is defined based on the intermediate diameters of at least 50 particles (clasts) randomly collected from the channel bed. The approximate maximum particle size is the average intermediate diameter of the 10 largest particles (clasts) in the sample reach.
  - **Bank/Valley Fill Sediment Size (%):** Describes the percent of the bank deposits consisting of gravel/boulders, mixed gravels/fines, and fines (<2 mm). In many cases, the channel banks will be composed of multiple alluvial stratigraphic units possessing

sediments of varying size. Where multiple units are present, the percent of each particle-size range should be assessed by considering all of the units collectively.

  - **Bed Clast Immobility (% of channel bed):** Describes the approximate percentage of clasts on the channel bed that have not been transported by floods occurring at least once every 5 to 10 years. Indicators of immobility include the degree to which clasts are coated by biofilms (algae), particle imbrication (the "stacking of clasts at an oblique angle in the channel bed), and sediment sources (e.g., glacial moraines, talus cones).

- **Sediment Availability:** Describes the amount of mobile sediment that is stored within the channel and that can be entrained and transported during low to moderate flood events. Large amounts of sediment are required for channel avulsions, whereas limited sediment relative to the available discharge leads to channel incision. Sediment availability is determined from three parameters.
  - **Bar Frequency (# per reach):** Bars represent accumulations of sediment within the channel. The number of bars describes the occurrence of in-channel bars composed of mobile bed materials within the channel in the sample reach. Bar number per reach is recorded as none, few (1-2), common (3-4), or many (>4).
  - **Bar Extent (% of channel bed):** Describes the percentage of the channel bed comprised of in-channel bars in the sample reach (e.g., point bars, alternate bars, glides, etc.). Bar extent within the channel bed is recorded as 0-10 %, 10-20 %, 20-30 %, or >30%.
  - **Gravel Bars on Valley Floor (# per reach):** Gravel accumulations on the valley floor are an indicator of the movement of large amounts of sediment during overbank floods. In some cases, these deposits are associated with channel aggradation (filling), which may or may not be associated with channel avulsion initiated by a localized aggradational

event. Number of gravel bars per reach is recorded as none, few (1-2), common (3-4), or many (>4).

- **Evidence of Channel Incision:** The degree and rate to which the channel has or is currently incising provides insights into its future response.
  - **Fan Steps:** Large side-valley alluvial fans that traverse the majority of the valley floor often produce "steps" or abrupt changes in the longitudinal profile of the channel bed (fig. 14). Where these occur, they should be noted, and the approximate height of the elevation change across the fan should be estimated using a clinometer.
  - **Knickpoints (# per reach):** Knickpoints, defined as abrupt, vertical or near vertical breaks in channel slope over a distance of a few meters are a direct indicator of ongoing channel incision. Number of knickpoints is recorded as none, few (1-2 per reach), common (3-4), or many (>4).
  - **Knickpoint Height (cm):** Knickpoint height is measured as the maximum distance from the top of the knickpoint to the channel bed at the foot of the knickpoint. Knickpoint height is dependent, in part, on the composition of the materials in which the knickpoint is formed. Cohesive and/or resistant materials tend to form higher knickpoints. However, the type of channel materials is also an indicator of the magnitude to which channel incision is likely to occur. Knickpoint height is recorded as the average height of the knickpoints at the sample reach, and ranges from no knickpoints, 0-25 cm, 25-50 cm high, or > 50 cm high.
  - **Knickpoint Composition:** Refers to the predominant type of material(s) with which the knickpoint is constructed. Common materials include bedrock, boulders, unconsolidated sediments (gravel, silt/clay), and roots.

- **Inset Terraces (#):** Terraces are formed during channel incision. The number of terraces within a valley is an indicator of the number of incision events that have occurred and may help approximate the length of time over which incision has occurred and the rate and timing of incision. Inset terraces indicate a period of lateral erosion and deposition (of an inset floodplain) prior to subsequent incision. Multiple incision events may occur prior to the development of an inset floodplain, precluding the presence of an indicative inset terrace. Additionally, lateral erosion after an incision event may remove evidence of one or more inset terraces. In the Great Basin, inset terraces of differing age often correspond to high magnitude flood events that are capable of eroding channel bed sediments and are occupied by differing vegetation communities. Evidence of a given inset terrace may exist on one or both sides of a channel. Surfaces of similar height above the thalweg on both sides of a channel should be considered parts of the same inset terrace. The number of inset terraces is recorded as none, few (1), common (2-3 per reach), or many (>4).
- **Incision Depth (m):** The depth of incision, or depth of the incised trench, is a measure of depth of channel incision below the valley floor. Incision depth is measured as the distance from the valley floor to the top of the inset floodplain, if a floodplain is present. If no floodplain is present, then it is the distance from the valley floor to the highest point on the channel bed. Deep, highly incised channels are typically associated with fine-grained channel bed and bank materials, and large-scale headcuts or knickpoints. Incision depth is recorded as none, 0-1 m, 1-2 m, or >2 m.
- **Bedrock Outcrops/Exposures (% of channel bed):** Describes the presence of bedrock within the channel bed and/or banks. The rate and depth of incision can be reduced along

some reaches by the occurrence of resistant bedrock outcrops. Where present, the percent of the channel bed consisting of bedrock should be recorded. Bedrock is recorded as none, localized (<25 % of channel bed), or extensive (>25 % of channel bed).

- **Headcuts (# per reach):** Headcuts are similar to knickpoints but are commonly associated with gully systems that are developed in previously unincised alluvial valleys devoid of an existing channel (see figs. 15, 21). They often represent a significant potential change in valley conditions by means of channel incision. Number of headcuts is recorded as none, few (1-2 per reach), common (3-4), or many (>4).
- **Headcut Height (m):** Headcut height is the maximum height of the headcut as measured from the incised channel bed to the valley floor. Headcut height is recorded as none, 0-1 m, 1-2 m, or >2 m.

- **Evidence of Avulsions and Avulsion Channels:** Avulsions indicate the abrupt change in channel position from one location to another on the valley floor. Several indicators of occurrence and frequency of avulsion are used to rate geomorphic sensitivity to this process.
  - **Anabranching Channels (# per reach):** Anabranching channels are typically formed by channel avulsion and are usually associated with relatively unstable channels characterized by local channel aggradation. The number of anabranching channels per reach is recorded as none, few (1-2 per reach), common (2-4), or many (>4).
  - **Gravel Filled Channels (# per reach):** Gravel-filled channels are segments of 'old' channel reaches that have been filled with gravel and no longer transmit water. The gravel fill found in most paleo-channels are found near the surface of the valley floor. While not all gravel-filled channels are associated with channel avulsions, they are the primary evidence of avulsions, and can be found at most sites where avulsion has

occurred in the Great Basin. The number of gravel filled channels in the reach are recorded as none, few (1-2), common (2-4), or many (>4).

- **Gravel Aggradation/Debris Dams (# per reach):** Accumulation (aggradation) of gravel behind piles of wood debris or woody riparian species is common in many Type A_1 basins. Avulsions are often associated with these gravel accumulations, and they result in partial blockage of the channel, particularly during the input of sediment from debris flows, landslides, and/or upstream valley incision. The number of gravel aggradation or debris dams per reach is recorded as none, few (1), common (2-4), or many (>4).

Reference

Bunte, K.; Abt, S.R. 2001. Sampling surface and subsurface particle-size distributions in wadable gravel-and cobble-bed streams for analyses in sediment transport, hydraulics and streambed monitoring. Gen. Tech. Rep. RMRS-GTR-74. Fort Collins: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 428 p.

Appendix 7—Information and Data Form for Assessing Riparian Vegetation in the Field

This appendix includes the data form and information for collecting the riparian vegetation data. The riparian vegetation data are collected along the same stream reach as the geomorphic and disturbance data.

The riparian vegetation are collected using data form A.7.1. One form is used for each sampled stream reach. At each sampled reach, identifying information is recorded on the data form. This includes the date, observer, watershed name, the watershed code in the Great Basin watershed database, location within the watershed (e.g., high, mid, low), and the reach length of the observations (typically 30 m). A GPS is used to record the UTM coordinates and elevation where the stream cross sectional profile is drawn for the sampled reach.

Descriptions of the variables recorded and the specific measurements or scores used to describe each variable are in table A.7.1. A list of the dominant riparian species in Great Basin riparian ecosystems and their wetland indicator status, successional status, and bank stability index is in table A.7.2. The vegetation assessment involves collecting information on any apparent decrease in the extent of the riparian area and the degree to which the riparian vegetation occurs in a post-incision trench. Data on the relative cover, vigor, mortality, wetland indicator status, successional status, and bank stability rating of the dominant riparian indicator species are collected for each geomorphic position (valley floor, inset terraces, flood plain). These data provide information on the responses of the riparian vegetation to recent or ongoing disturbances affecting groundwater tables, such as channel incision or avulsion, as well as other disturbances, such as inappropriate livestock grazing.

The riparian vegetation data collected during the field assessment are summarized for each geomorphic position and for the overall sampled reach as described on the data form and in table A.7.1. The data for the overall reach are included in the score sheets for assessing watershed sensitivity and resilience in appendix 10 and for rating ecological integrity in appendix 11. The interpretation of the data and combined scores is discussed in Task 5 in text.

Form A.7.1–RIPARIAN VEGETATION DATA	Date: Observer:
Watershed Name:	Database Code:
UTM Zone:	Elevation (m):
UTMs: Northing	Easting
Location in Basin: Low / Mid / High	Reach Length of Observation (m):

Vegetation type (circle dominant one): Subalpine-montane conifer (SC) *Populus tremuloides* (PT) Cold willow (CW) *Betula occidentalis* (BA) Warm willow (WW); Cottonwood (CT) *Artemisia* (AR) Other: _____ The dominant riparian vegetation types are in table A.3.1.

Decrease in riparian area extent due to incision or drying (circle one): none low (1-10%) moderate (10-30%) high (>30%)

Riparian plants only in incised trench (circle one): 0 = none, 1 = little, 2 = common, 3 = widespread

Record data for six stream geomorphic positions: FP (flood plain), T1 (terrace 1), T2 (terrace 2), T3 (terrace 3), VF (valley floor). See fig. A.6.1 for an illustration of the locations of the flood plain, inset terraces, and valley floor. Make sure the positions coincide with the stream cross sectional profile sketch on the geomorphic data form (A.6.1). Note that not all positions will occur in every sampled stream reach.

Dominant indicator species and aerial cover (%): record as trace < 1 (trace); 1-5; 5-25; 25-50; 50-75; 75-100.
Vigor and mortality of each species: record as high (H), moderate (M), or low (L) as described in table A.7.2.
Wetland Indicator Status (WIS), successional status (Succ), and bank stability (Stab) of each species: record the values for each species from the riparian species list (A.7.3). Descriptions are in table A.7.2.
Nativity of the species: record as yes (Y) or no (N) as indicated in the riparian species list (A.7.3).

Record the following data for the geomorphic position summaries:
Cover: estimate and record the average vegetation cover for the entire geomorphic position.
Vigor and Mortality: record value most indicative of response to disturbance for the geomorphic position as described in table A.7.2.
WIS, Succ, and Stab: record most common value for the geomorphic position.
Native: record total number of nonnative species at the geomorphic position.

Position	Dominant Indicator Species	Cover (%)	Vigor H/M/L	Mort H/M/L	WIS O/F/FW /FU/U	Succ E/M/L	Stab H/M/L	Native Y/N
FP								
FP								
FP								
FP								
FP								
FP								
Stream Bank Summary								
T1								
T1								
T1								
T1								
T1								
T1								
Terrace 1 Summary								

Form A.7.1–RIPARIAN VEGETATION DATA					Date:	Observer:		
Watershed Name:					Database Code:			
UTM Zone:					Elevation (m):			
UTMs: Northing					Easting			
Location in Basin: Low / Mid / High					Reach Length of Observation (m):			
Position	**Dominant Indicator Species**	**Cover (%)**	**Vigor H/M/L**	**Mort H/M/L**	**WIS O/F/FW /FU/U**	**Succ E/M/L**	**Stab H/M/L**	**Native Y/N**
T2								
T2								
T2								
T2								
T2								
T2								
Terrace 2 Summary								
T3								
T3								
T3								
T3								
T3								
T3								
Terrace 3 Summary								
VF								
VF								
VF								
VF								
VF								
VF								
Valley Floor Summary								
R**ecord the following data for the reach summary:** **Cover:** estimate and record the average vegetation cover for the entire sample reach. **Vigor and mortality:** record value most indicative of reach response to disturbance as described in table A.7.2. **WIS, Succ, and Stab:** record value most indicative of reach disturbance response as described in table A.7.2. **Native:** record total number of nonnative species observed for all positions.								
Reach Summary								
List the Indicator Species for the reach:								
Notes:								

Table A.7.1—Descriptions of the variables used to assess the riparian vegetation in the field.

- **Riparian Vegetation Type:** The dominant riparian vegetation types are in table A.3.1. Circle or list the dominant type on the form.
- **Riparian Area Extent:** Channel incision typically results in a drop in the water table and frequently, a decline in areal extent of the riparian area. Record decrease in riparian area extent as none (little evidence of a decrease in the size of the riparian area due to channel incision in the reach), low (some channel incision has occurred and there is evidence of a decrease in riparian extent of 1-10%); moderate (10-30%) (channel incision has resulted in a decrease of riparian area extent by as much as 30% in the reach) or high (incision has resulted in a decrease of riparian area extent greater than 30% in the reach).
- **Riparian Plants in Trench:** Following stream incision, riparian vegetation may occur only in the incised trench. Circle yes or no to indicate whether or not the riparian plants occur only in the incised trench.
- **Dominant indicator Species:** Indicator riparian species are those that provide information on water availability for a given geomorphic position, where water availability is determined by depth to groundwater and substrate characteristics. Identify and record the dominant indicator species for each geomorphic position by walking the entire extent of the sample stream reach. No additional information is needed for the geomorphic position summary. For the reach summary, list the species that are most indicative of the reach response to stream incision or avulsion. Note if the dominant indicator species also reflect anthropogenic disturbances such as livestock grazing in the notes section.

- **Aerial Cover:** The cover of riparian vegetation provides valuable information on response to disturbance. For each geomorphic position, estimate and record the average aerial cover (%) of each dominant indicator species as < 1 (trace); 1-5; 5-25; 25-50; 50-75; 75-100. For the geomorphic position summary, estimate and record the average vegetation cover for the geomorphic position as a whole. For the reach summary, estimate and record the average vegetation cover for the entire sample reach.
- **Vegetation Vigor:** Provides information on potential effects of decreases in water tables, insects, disease, weather extremes, or other disturbances, such as inappropriate grazing or recreational overuse. Reduced vigor is indicated by low height, production (leaf area or leader growth), or root growth and signs of stress, such as chlorosis or yellowing. For each geomorphic position, record the vigor of each dominant indicator species as high (later successional herbaceous and woody species are vigorous), moderate (later successional herbaceous and woody species are less vigorous than appropriate), or low (vigor of later successional herbaceous and woody species is low). For the geomorphic position and reach summaries, record the value that is most indicative of the reach response to disturbance. Note the apparent cause of any loss in vigor in the notes section.
- **Vegetation Mortality:** Increased mortality is indicated by patches of dying or dead herbaceous and/or woody species. Mature willows with good vigor often have dead stems and this should not be interpreted as a sign of increased mortality. For each geomorphic position, record the mortality of each dominant indicator species as high (later successional herbaceous and woody species show no evidence of increased mortality), moderate (later successional herbaceous and woody species show evidence of increased mortality), or low (mortality of later successional herbaceous and woody species is high). For the geomorphic

position and reach summaries, record the value that is most indicative of the reach response to disturbance. Note the apparent cause of any increase in mortality in the notes section.

- **Riparian or Wetland Indicator Status (WIS):** Descriptions of the wetland indicator status values are in table 2 and the indicator status values for the riparian species are in table A.7.3. WIS provides general insights into flow regimes, groundwater dynamics, and the responses of the riparian vegetation within the stream reach. For each geomorphic position, record the WIS value of each dominant indicator species from table A.7.3. For the geomorphic position summary, record the most common value. For the reach summary, record wetland indicator status as high (wetland obligate, facultative wetland, and facultative upland species are found on appropriate geomorphic positions), moderate (greater number of facultative upland and upland species than appropriate) or low (many more facultative upland and upland species than appropriate).
- **Successional Status:** Descriptions of the successional status values are in table 4 and the successional status values for the riparian species are in the table A.7.3. Successional status ratings for individual plants provide information on responses of the riparian ecosystems to past and present disturbance (table 4). Record the successional status value for each dominant indicator species from table A.7.3. For the geomorphic position summary, record the most common value. For the reach summary, record the average successional status as high (a large number or cover of late seral species with few mid and early seral species), moderate (a reduced number or cover of late seral species and an increase in mid and early seral species, or low (very low numbers or cover of late seral species – dominance by mid and early seral species). Note the apparent cause of any reduction in successional status in the notes section.

- **Bank Stability Rating:** The bank stability ratings are based on table 5 and values for the riparian species are in table A.7.3. Most perennial streams require 70% to 90% stabilizing cover (vegetation, large or anchored rock, anchored wood) to buffer the erosive force of water (Winward 2000; Burton et al. 2011). Root strength and rooting depth of the riparian vegetation on streambanks contributes to overall streambank stability. Record the bank stability rating for each dominant indicator species from table A.7.3. For the geomorphic position summary, record the most common value. For the reach summary, record the bank stability rating as high (a large proportion or cover of species with high stability ratings), moderate (a large proportion or cover of species with a medium stability rating), or low (a high proportion or cover of species with a low stability rating). Note the apparent cause of any loss of bank stability in the notes section.
- **Nativity:** Species designations as nonnative-invasive or noxious weed are in table A.7.3. Record all nonnative-invasive species and noxious weeds as nonnative. For the geomorphic position summaries, record the total number of nonnative species on the geomorphic position. For the reach summary, record the total number of nonnative species for the entire reach.

Table A.7.2–The dominant riparian species in Great Basin riparian ecosystems based on Swanson (2016). The information in this table is used to complete the riparian vegetation data form (A.7.1). Included are the scientific name, symbol, and common name (USDA 2020) of the dominant riparian species followed by their wetland indicator status, successional status, and stability index. Wetland indicator status (WIS): OBL = obligate; FAC = facultative; FACW = facultative wetland; FACU = facultative upland; UPL = upland (Lichvar and Minkin 2008). Successional status (Succ): E = early seral; M = mid-seral, L = late seral. Bank stability index (Stab): L = low stability; M = moderate stability; H = high stability (Burton et al. 2011; Swanson 2016). *Nonnative-invasive; **Noxious weed.

Species	Symbol	common name	Wetland Indicator Status (WIS)	Successional Status (Succ)	Stability Index (Stab)
Shrubs and Trees					
Acer glabrum	ACGL	Rocky Mountain maple	FAC	M	M
Acer negundo	ACNE2	boxelder	FACW	L	H
Alnus incana	ALIN2	mountain alder	FACW	L	H
Artemisia tridentata ssp. *tridentata*	ARTRT	basin big sagebrush		E	L
Baccharis salicifolia	BASA4	willow baccharis (mule-fat)	FAC	L	H
Betula occidentalis	BEOC2	water birch	FACW	L	H
Chrysothamnus viscidiflorus	CHVI8	yellow rabbitbrush		E	L
Cornus sericea	COSE16	red osier dogwood		L	H
Crataegus douglasii	CRDO2	black hawthorn	FAC	M	M
*Elaeagnus angustifolia***	ELAN	Russian olive	FAC	E	M
Ericameria nauseosa	ERNA10	rubber rabbitbrush		E	L
Ledum glandulosum	LEGL	trapper's tea (western Labrador tea)		M	M
Lonicera involucrata	LOIN5	black twinberry	FAC	M	M
Populus acuminata	POAC5	Lance leaf cottonwood		L	H
Populus angustifolia	POAN3	Narrowleaf cottonwood		L	H
Populus balsamifera ssp. *trichocarpa*	POBAT	Black cottonwood	FAC	L	H

Populus fremontii	POFR2	Fremont cottonwood		L	H
Populus tremuloides	POTR5	Quaking Aspen	FACU	L	H
Prunus virginiana	PRVI	chokecherry		L	H
Ribes aureum	RIAU	goldern currant	FAC	E	M
Ribes hudsonianum	RIHU	northern black currant	FACW	M	M
Ribes inerme	RIIN2	whitestem gooseberry	FAC	E	M
Rosa woodsii	ROWO	Wood's rose	FACU	E	M
Salix boothii	SABO2	Booth's willow	FACW	E	M
Salix drummondiana	SADR	Drummonds willow	FACW	E	M
Salix eastwoodiae	SAEA	Mountain willow		E	M
Salix exigua	SAEX	narrowleaf willow	FACW	E	M
Salix geyeriana	SAGE2	Geyer's willow	OBL	L	H
Salix lasiolepis	SALA6	Arroyo willow	FACW	E	M
Salix lemmonii	SALE	Lemmon's willow	FACW	E	M
Salix lucida	SALU	Shining(pacific/whiplash) willow		E	M
Salix lutea	SALU2	yellow willow	OBL	L	H
Salix orestera	SAOR	Sierra willow	FACW	E	M
Symphoricarpos spp.	SYMPH	snowberry		M	M
*Tamarix ramosissima***	TARA	saltcedar		E	H
Forbs					
Aconitum columbianum	ACCO4	Columbian monkshood		L	M
Angelica kingii	ANKI	King's angelica	FACW	M	M
Aquilegia formosa	AQFO	western columbine	FAC	L	L
Argentina anserina	ARAN7	silverweed cinquefoil	OBL	E	L
Arnica spp.	ARNIC	arnica		M	M
Artemisia cana	ARCA13	silver sagebrush	FACU	M	L
Caltha leptosepala	CALE4	White marsh marigold	OBL	E	M
Camassia quamash	CAQU2	common camas	FACW	M	M
*Cardaria draba***	CADR	whitetop		E	L
*Carduus nutans***	CANU4	nodding plumeless thistle	FACU	E	L
Chamerion angustifolium	CHAN9	fireweed		M	L
Cicuta douglasii	CIDO	western water hemlock	OBL	M	M
*Cirsium arvense***	CIAR4	Canada thistle	FACU	E	L
*Conium maculatum***	COMA2	poison hemlock	FACW	E	L
Dodecatheon spp.	DODEC	shootingstar		E	L
Epilobium glaberrimum	EPGL	glaucus willowherb	FACW	M	L
Erigeron spp.	ERIGE2	fleabain	FACW	L	M
Geranium viscosissimum	GEVI2	sticky geranium		E	M
Geum macrophyllum	GEMA4	largeleaf avens	FACW	E	L
Heracleum maximum	HEMA80	cow parsnip	FACW	L	M
Iris missouriensis	IRMI	Rocky Mountain iris	FACW	M	L
Iva axillaris	IVAX	poverty weed	FAC	E	L

Kalmia microphylla	KAMI	bog laurel	OBL	M	M
*Lepidium latifolium***	LELA2	broadleaved pepperweed	FAC	E	L
Maianthemum racemosum	MARA7	feathery false lily of the valley	FAC	L	L
Mentha arvensis	MEAR4	wild mint	FACW	M	L
Mertensia ciliata	MECI3	streamside bluebells	FACW	M	M
Mimulus primuloides	MIPR	primrose monkeyflower	FACW	M	L
*Nasturtium officinale**	NAOF	watercress	OBL	E	L
Pedicularis groenlandica	PEGR2	elephant head lousewort	OBL	L	L
*Plantago major**	PLMA2	common plantain	FAC	E	L
Polygonum bistortoides	POBI6	American bistort		M	L
Argentina anserina	ARAN7	silverweed cinquefoil	OBL	E	L
Potentilla gracilis	POGR9	slender cinquefoil	FAC	E	L
Ranunculus cymbalaria	RACY	alkali buttercup		M	L
Rudbeckia occidentalis	RUOC2	coneflower/blackhead	FAC	E	L
*Rumex crispus**	RUCR	curly dock	FAC	E	L
Rumex paucifolius	RUPA6	alpine sheep sorrel	FAC	E	L
Saxifraga odontoloma	SAOD2	brook saxifrage		M	L
Sphenosciadium capitellatum	SPCA5	woolyhead parsnip	FACW	E	L
Taraxacum officinale	TAOF	common dandelion	FACU	E	L
Thalictrum fendleri	THFE	Fendler's meadowrue	FAC	E	L
Urtica dioica	URDI	stinging nettle	FAC	M	L
Veratrum californicum	VECA2	California false hellebore	FACW	M	H
Veronica americana	VEAM2	American speedwell	OBL	M	M
Viola palustris	VIPA4	marsh violet	FACW	M	L
Grasses					
Agrostis exarata	AGEX	spike bentgrass		E	L
Agrostis scabra	AGSC5	rough bentgrass		E	L
*Agrostis stolonifera**	AGST2	creeping bentgrass		E	L
Alopecurus aequalis	ALAE	short-awned foxtail	OBL	E	L
*Bromus tectorum***	BRTE	cheatgrass		E	L
Calamagrostis canadensis	CACA4	blue-joint reedgrass	FACW	L	H
Calamagrostis stricta	CAST36	slimstem reedgrass	FACW	L	H
Catabrosa aquatica	CAAQ3	water whorlgrass		E	L
Deschampsia cespitosa	DECE	tufted hairgrass		L	M
Distichlis spicata	DISP	inland saltgrass	FAC	M	M
Leymus triticoides	ELTR3	beardless wildrye	FAC	E	M
Festuca rubra	FERU2	red fescue	FAC	M	M
Glyceria grandis	GLGR	American mannagrass	OBL	L	H
Glyceria striata	GLST	fowl mannagrass	OBL	L	M
Hordeum brachyantherum	HOBR2	meadow barley	FACW	E	L
Hordeum jubatum	HOJU	foxtail barley	FAC	E	L

Leymus cinereus	LECI4	basin wildrye	FAC	M	M
Muhlenbergia richardsonis	MURI	mat muhly	FAC	M	L
Phalaris arundinacea	PHAR3	reed canarygrass		E	M
Phleum alpinum	PHAL2	alpine timothy	FAC	E	L
*Phragmites australis**	PHAU7	common reedgrass	FACW	L	H
Poa pratensis	POPR	Kentucky bluegrass	FAC	E	L
Poa secunda	POSE	Sandberg bluegrass (rush blue grass)	FACU	E	L
*Polypogon monspeliensis**	POMO5	annual rabbitsfoot grass	FACW	E	L
Grasslike					
Carex aquatilis	CAAQ	water sedge	OBL	L	H
Carex athrostachya	CAAT3	slenderbeak sedge	FACW	L	H
Carex aurea	CAAU3	golden sedge	OBL	L	L
Carex canescens	CACA11	gray sedge	OBL	M	L
Carex disperma	CADI6	softleaf sedge	OBL	L	M
Carex douglasii	CADO2	Douglas' sedge	FAC	M	L
Carex lenticularis	CALE8	tufted sedge	OBL	L	M
Carex microptera	CAMI7	small-winged sedge	FAC	M	M
Carex nebrascensis	CANE2	Nebraska sedge	OBL	L	H
Carex pellita	CAPE42	wooly sedge	OBL	L	H
Carex praegracilis	CAPR5	cluster field sedge	FACW	L	H
Carex scopulorum	CASC12	mountain sedge	FACW	L	H
Carex simulata	CASI2	short-beaked sedge	OBL	L	H
Carex spp.	CAREXRH	rhizomatous sedge		L	H
Carex utriculata	CAUT	Northwest Territory sedge	OBL	L	H
Carex vesicaria	CAVE6	blister sedge	OBL	L	H
Eleocharis palustris	ELPA3	common spikerush	OBL	E	M
Eleocharis quinqueflora	ELQU2	fewflower spikerush	OBL	M	M
Equisetum arvense	EQAR	field horsetail	FAC	M	M
Equisetum hyemale	EQHY	scouringrush horsetail	FACW	M	M
Equisetum laevigatum	EQLA	smooth horsetail	FACW	E	L
Juncus arcticus	JUAR2	mountain (Baltic) rush		L	H
Juncus bufonius	JUBU	toad rush	FACW	E	L
Juncus ensifolius	JUEN	swordleaf rush	FACW	E	L
Juncus longistylis	JULO	longstyle rush	FACW	E	L
Juncus nevadensis	JUNE	Sierra rush	FACW	L	M
Juncus orthophyllus	JUOR	straightleaf rush	FACW	M	L
Juncus tenuis	JUTE	poverty rush	FACW	E	L
Schoenoplectus acutus	SCAC3	hardstem bulrush	OBL	L	M
Schoenoplectus pungens	SCPU10	threesquare bulrush	OBL	L	M
Schoenoplectus tabernaemontani	SCTA2	softstem bulrush	OBL	L	M
Scirpus microcarpus	SCMI2	panicled (small fruited) bulrush	OBL	L	M

Scirpus nevadensis	SCNE	Nevada bulrush	OBL	L	M
Triglochin maritima (or *palustris*)	TRMA20	arrowgrass		E	M
Typha latifolia	TYLA	broadleaf cattail	OBL	M	H

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Appendix 8—Information and Data Form for Assessing Disturbance in the Field

This appendix provides the data form for the disturbance assessment. Disturbance data are collected for assessments of both riparian and meadow ecosystems using the form A.8.1. One form is used for each reach. At each sampled stream reach, identifying information is recorded on the data form. This includes the date, observer, watershed name, the watershed code in the Great Basin watershed database, location within the watershed (e.g., high, mid, low), and the reach length of the observations (typically 30 m). A GPS is used to record the UTM coordinates and elevation where the stream cross section is drawn for the sampled reach.

Common disturbances in the Great Basin are described in the section on "What are the Effects of Human-caused Disturbances?" in Part 1 of this report. Disturbances that are not in the list provided as well as those present in the sample reach and adjacent upstream and downstream reaches are recorded. Any negative effects of the disturbance on the stream channel, stream bank, or riparian vegetation of the sample reach are then recorded. The effects of the disturbance are recorded as none (no negative effect); low (the disturbance is having a minor negative effect on the stream channel, stream banks, or vegetation); moderate (the disturbance is having a clear negative effect on geomorphic processes or riparian vegetation); and high (the disturbance has significantly altered geomorphic processes or the riparian vegetation in a negative way).

The disturbance data collected in the field are summarized for the sampled stream reaches in the ecological integrity form in appendix 11. Combining summaries of disturbance data with those for the geomorphic and vegetation data can provide a clear picture of the type and magnitude of disturbances and, thus, the types of management actions needed to improve the ecological conditions or integrity of the stream reach.

Form A.8.1– DISTURBANCE DATA	Date:	Observer:
Watershed Name:	Database Code:	
UTM Zone:	Elevation (m):	
UTMs: Northing	Easting	
Location in Basin: Low / Mid / High	Reach Length of Observations (m):	
Camera ID and Nos.		

Yes/No: enter **Y** if the disturbance is present in the sample reach or in adjacent upstream and downstream reaches and **N** if it is not.
Location of disturbance: record as sample reach/meadow (**SR/SM**), upstream (**UPS**), or downstream (**DST**).
Component(s) affected by disturbance: record as stream channel (**SC**), stream bank (**SB**), and/or riparian/meadow vegetation (**RV/MV**).
Negative effects of disturbance on sample reach: record as none (**N**), low (**L**), moderate (**M**), or high (**H**).
Other: list other disturbances affecting the stream reach, their location, and their relative effect.

Disturbance Type	Yes / No	Location	Component	Effect
Road in the valley bottom				
Road channel in-stream crossings				
Culverts				
Road captures (stream diverted onto road)				
Developed campsites				
Undeveloped campsites				
Human developments (houses/cabins)				
Mining activity on hillslopes (circle: historic, active)				
Mining activity in valley bottom (circle: historic, active)				
Surface water manipulation (ditches, spring boxes, etc.)				
Groundwater extraction (wells)				
Water diversion (dams/canals)				
Inactive beaver dams (erosion, low water quality, etc.)				
Active beaver dams (appropriate channel location, continued maintenance, redundant structures, etc.)				
Wildfire - Fire name/ date if known:				
Prescribed fire				
Livestock effects on vegetation (circle: sheep, cattle)				
Livestock effects on bank and channel				
Wild horse effects on vegetation				
Wild horse effects on bank and channel				
Other disturbances:				

Notes:

Table A.3.1--Descriptions of montane riparian and meadow ecosystems in the Great Basin.

Montane Riparian Ecosystems

Subalpine-Montane Conifer. This system occurs on stream terraces or trough-shaped floodplains. Common tree species at higher elevations with colder soils include *Pinus flexilis*, *Abies concolor*, *Abies lasiocarpa*, *Picea engelmannii*, and *Pseudotsuga menziesii*. *Pinus ponderosa* and *Juniperus scopulorum* can occur at more moderate elevations with warmer soils. *Pinus flexilis* occurs in the central part of the Great Basin, but most of these types are more common in in the eastern portion of the Great Basin. Common shrubs are *Cornus sericea*, *Rosa woodsia*, *Prunus virginiana*, and *Salix* spp. A wide variety of herbaceous species occur on these sites, with graminoids being more common on sites with finer textured soils and shallower depths to field capacity, and forbs occurring more often on site with a higher proportion of cobbles and greater depths to field capacity.

Subalpine-Montane *Populus tremuloides*. This type commonly occurs on trough floodplains but is also found on stream terraces and toe slopes. Soils are relatively cold. On sites with relatively shallow depth to field capacity (27 $\pm$ 27 cm in the eastern Sierra Nevada), graminoids occur in understory and willows and alder may be present. On sites where depth to field capacity is greater (53 $\pm$ 53 cm in the eastern Sierra Nevada) shrub species include *Salix* spp., *Alnus incana*, *Ribes* spp., and *Symphoricarpos* spp. Understory species can include *Osmorhiza* spp., *Thalictrum* spp., *Mertensia* spp., *Geranium* spp., *Ligusticum grayi*, *Aquilegia formosa*, *Aconitum columbianum*, *Poa wheeleri*, *Bromus marginatus*, and *Elymus* spp.

Subalpine-Montane Cold Willow. This ecological type typically occurs on trough floodplains or trough stream terraces but also occurs on gravelbars. These sites occur at higher elevation in areas with steeper valley slopes (2.5 to 8%). Soils are sandy and depth to field capacity is close

to the soil surface (about 10 to 50 cm). The dominant willow species are *Salix boothii*, *Salix lutea* x *Salix boothii*, *Salix lucida* ssp. *lasiandra,* and *Salix geyeriana*. Sites with fewer cobbles where field capacity is close to the soil surface tend to have understories dominated by graminoids. Sites with a higher percentage of cobbles in the soil layers and greater depths to field capacity tend to have understories dominated by forbs.

Montane *Betula occidentalis*. This type typically occurs on stream terraces or trough-shaped floodplains that tend to be found in canyon constrictions. Average soil temperatures tend to be warmer but exhibit a broad range. Soils typically have a high proportion of coarse fragments (gravels, cobbles, and boulders). Sites usually have a dense overstory *of Betula occidentalis*.

Lower Montane Warm Willow. This ecological type typically occurs on gravelbars but is also found on trough-shaped floodplains, stream terraces, and incised landforms (Riverine HGM Class). These sites have a tendency to be found at lower elevations with gentler valley slopes (1-5%). Sites are associated with gravel-bed streams, and depth to field capacity is relatively close to the surface (approximately 80 cm). Warm willow species dominate (*Salix exigua*, *S. lutea*, *S. lemmoni*, or *S. lasiolepis*). On very warm sites, exotic shrub species may include *Tamarix* spp. and *Elaeagnus angustifolia.* Sites with finer textured soils where field capacity is close to the soil surface tend to have understories dominated by graminoids; those with coarser textured soils and a high percentage of cobbles in the soil layers tend to have understories dominated by forbs. This system may occur on slopes, lakeshores, or around ponds where the vegetation is associated with groundwater discharge or a subsurface connection to lake or pond water and may experience overland flow but no channel formation (Slope, Lacustrine, or Depressional HGM Classes). It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplain swales and irrigation ditches.

Lower Montane Cottonwood. This type is most commonly found on stream terraces but also occurs on trough-shaped floodplains. Soils are relatively warm. Usually no more than 15% cobbles are found in any one soil horizon. Cottonwoods, either *Populus fremontii*, *Populus balsamifera* ssp. *trichocarpa*, or *Populus angustifolia* are overstory species. Understory shrubs may include *Salix* spp., *Prunus* spp., *Rhus trilobata*, *Cornus* spp., or *Artemisia* spp. Understory grasses and forbs may include *Achnatherum* spp., *Elymus* spp., *Leymus* spp., *Bromus carinatus, Bromus marginatus, Poa fendleriana, Lupinus* spp., *Geranium* spp., *Osmorhiza* spp., *Maianthemum* spp., *Aquilegia formosa, Thalictrum* spp., and *Aconitum columbianum.* This system can also occur on lakeshores or around ponds where the vegetation is associated with groundwater discharge or a subsurface connection to lake or pond water, and may experience overland flow but no channel formation (Slope, Lacustrine, or Depressional HGM Classes)

Lower Montane *Artemisia tridentata* ssp. *tridentata*. This type occurs along trough-shaped drainage ways and floodplains, stream terraces and toe slopes. This type may also occur in associations with incised or avulsed landforms. Soil temperatures are relatively warm. In systems that are not incised, field capacity is typically within a meter of the surface, but in incised systems field capacity is often greater than 1 m. Coarse fragments (gravels, cobbles, and boulders) are typically less than 60% by volume for unincised systems but can be greater than 60% for incised systems. The graminoids *Achnatherum* spp., *Leymus cinereus*, *Leymus triticoides*, or *Poa secunda* ssp. *juncifolia* are the most common grasses on unincised sites. Following incision, *Poa secunda* ssp. *secunda*, *Elymus elymoides*, and *Bromus tectorum* can be the most common grasses. This type may also occur at relatively high elevations in association with *Artemisia tridentata* ssp. *vaseyana.*

Meadow Complexes

Herbaceous wetlands associated with a relatively high water table (ranges from 0 cm to about 300 cm depth to water table) that typically lack prolonged standing water These herbaceous wetlands occur in association with seeps or springs and/or montane streams, and are located in geomorphic positions that allow the accumulation of fine-textured sediments. Sites may be dominated by *natural* groundwater inputs with fairly stable hydrology. Sites may exhibit ground water sapping, lowered water tables, and changes in vegetation composition when located adjacent to incising (downcutting) streams. Sites may also be controlled by *artificial* overland flow (surface or subsurface irrigation runoff or return flow) or artificial groundwater seepage (including from leaky irrigation ditches). Sites may be small or very large. These sites may be intentionally managed for hay production or may be the result of unintentional return flows, runoff, or seepage. Vegetation is dominated by native or non-native herbaceous species; graminoids (grasses, sedges, rushes) typically have the highest canopy cover. Species composition may be dominated by non-native hay grasses. Patches of emergent marsh vegetation and standing water are less than 0.1 ha in size and not the predominant vegetation.

Montane Meadow - Herbaceous wetlands associated with a high water table or overland flow. Sites are typically associated with snowmelt or elevated groundwater. Sites associated with the Flats or Slope HGM class are rarely subjected to high disturbance events such as flooding. Those associated with a stream channel are more tightly connected to overbank flooding from the stream channel (Riverine HGM Class) and may be affected by avulsion and/or incision. Sites vary in size; montane meadow vegetation may occur on stream terraces with elevated water tables. Vegetation is dominated by herbaceous species; graminoids typically have the highest canopy cover. Different plant community types are associated with different groundwater levels

and are indicated by species with different physiological tolerances for depth to water table (Castelli et al. 2000; Chambers et al. 2004; Lord et al. 2011).

- ***Meadows with perennial standing water —*** Depth to water table is +10 to 0 cm. Characteristic species include *Carex aquatilis*, *Carex utriculata*, *Scirpus microcarpus*, and *Senecio hydrophilus.*
- ***Wet meadow —*** Depth to water table is 5 to 30 cm. Characteristic species include *Carex nebrascensis*, *Deschampsia elongata,* and *Deschampsia cespitosa*.
- ***Mesic meadow —*** Depth to water table – 30 to 90 cm. Characteristic species include *Carex microptera*, Carex praegracilis, *Poa secunda juncifolia*, *Juncus arcticus* ssp. *littoralis*, and *Deschampsia cespitosa*. *Poa pratensis* is common; it is an indicator of historical heavy grazing and may not reflect the current grazing regime.
- ***Dry meadow —*** Depth to water table – 90 to 170 cm. Characteristic species include *Leymus triticoides*, *Elymus trachycaulus*, *Poa secunda juncifolia*, and *Muhlenbergia richardsonis*. *Poa pratensis* is common; it is an indicator of historical heavy grazing and may not reflect the current grazing regime.
- ***Dry shrub meadow —*** Depth to water table is 125 to 275 cm. Characteristic species include *Artemisia tridentata* ssp., *Carex douglassi,* and *Leymus cinereus*.

Irrigated Wet Meadow - Large herbaceous wetlands associated with a high water table that is controlled by artificial overland flow (irrigation). Sites typically lack prolonged standing water, but may have standing water early in the season if water levels are very high. Vegetation is dominated by native or nonnative herbaceous species; graminoids have the highest canopy cover. Species composition may be dominated by non-native hay grasses such as *Poa* spp.*, Alopecurus* spp.*, Phleum pratense*, and *Bromus inermis* spp. *inermis*. There

can be patches of emergent marsh vegetation and standing water less than 0.1 ha; these are not the predominant vegetation.

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