Appendix 4–Information and Data Form for Assessing Watershed Characteristics and Distinct Watershed Segments in the Office

This appendix provides the data form A.4.1 and information (table A.4.1) needed to assess the overall watershed characteristics, past and present disturbances, and species at risk within the watersheds. It also includes the information needed to determine the distinct watershed segments with the watershed and identify potential stream reaches and meadows for field analyses.

The information on watershed characteristics and past and present disturbances is used in the assessments of watershed sensitivity and resilience (appendix 10) and watershed integrity (appendix 11).

Form A. 4.1–WATERSHED CHARACTERISTIC AND DISTINCT WATERSHED SEGMENT DATA	
Date:	Recorder:
Mountain Range:	Watershed Name:
Database Code from the Great Basin watershed database:	
Watershed Characteristics	
Basin Type(s) (see fig. 12): A_1 A_2 B C	
Dominant Riparian Vegetation Types (see table A.3.1): ____ ____	
Meadows (see table A.3.1): number________ **types**____	
Mean Annual Precipitation (mm): ________________	
Watershed Area (km^2): ________________	
Basin Connectivity: 1 = <80% 2 = 80-90% 3 = 90-95% 4 = >95%	
Past Debris Flow Activity (# of flows): 0 = 0-10 1 = 10-20 2 = 20-40 3 = >40	
Past Debris Flow Activity (location in watershed): lower mid upper	
Fan Influence: number _________ % of valley width covered __________	
Fan Influence Summary: 0 = basin wide 1 = regional 2 = localized 3 = none	
Large-Scale Disturbances	
Wildfires: yes_____ no_____ date(s) of wildfires:__________ % watershed burned:__________	
Road Density:____	
Dams and Diversions (# and type): ____	
Other (e.g., mining, houses, etc.):____	
Species at Risk	
Record average probability of occurrence (APOC) or meters of stream (m)	
Species #1:	
Species #2:	
Species #3:	
Species #4:	
Species #5:	
Distinct Watershed Segments	
Determine distinct watershed segments for each basin type within the watershed. See examples in figures A.4.1, A.4.2, A.4.3.	
Distinct Watershed Segments (#): Basin Type 1 ________________ Basin Type 2 ________________	
Watershed Length (m): _________________	
Length of Each Watershed Segment in Basin Type 1 (m): 1 _____ 2 ______ 3______ 4 ______	
Length of Each Watershed Segment in Basin Type 2 (m): 1 _____ 2 ______ 3______ 4 ______	
Percentage of Each Watershed Segment in Basin Type 1 (%): 1 _____ 2 ______ 3 ______ 4 ______	
Percentage of Each Watershed Segment in Basin Type 2 (%): 1 _____ 2 ______ 3 ______ 4 ______	
Notes:	

Table A.4.1—Descriptions of the variables used to assess the watershed characteristics and distinct watershed segments in the office.

Watershed Characteristics

- **Basin Type(s):** The basin types and their characteristics are illustrated in fig. 12. Basin types can be subjectively determined from a combination of aerial photographs (e.g., found on Google Earth) and topographic maps on the basis of five parameters, including valley width, the number of side-valley alluvial fans, the percent of the valley width covered by side-valley fans, basin relief, and hillslope gradients. Type A basins have narrow valley floors that are often less 100 m wide and devoid of broad, low-relief alluvial surfaces (surfaces underlain by river sediments), have few, small side-valley alluvial fans, and exhibit high gradient hillslopes associated with high basin relief. Type A_1 basins are characterized by large quantities of highly mobile sediment, and high-magnitude floods result in frequent and extensive avulsion and widespread reworking of the valley floor. In Type A_2 basins, incision and lateral channel migration are limited by large bed and bank sediments that only can be entrained during exceptionally large flood events. In contrast, Type B basins have relatively wide (>100 m) valley floors with low-relief alluvial surfaces, numerous, large side-valley fans that often extend at least halfway across the valley floor, and moderate hillslope gradients and basin relief. Type C basins have much wider valley floors than the other two types and contain extensive low-relief alluvial surfaces (often measured in 100s of meters). Large side valley fans may be present, but because of high valley widths, the fans tend not to extend more than halfway across the valley floor (although exceptions exist). Relief and hillslope gradients are significantly lower than in the other basin types.
- **Dominant Riparian Vegetation:** The dominant vegetation types are in table A.3.1. Vegetation types are determined from aerial imagery, such as NAIP or Google Earth. It may be necessary to verify the vegetation types during the field visits.
- **Meadow Types:** The dominant meadow types are in table A.3.1. Identification of meadows at this stage ensures that both riparian stream reaches and meadows are included in the field sampling. It may be necessary to verify the meadow types during the field visits.
- **Mean Annual Precipitation (mm) and Watershed Area (km^2):** Data on these watershed characteristics are in the Great Basin Watershed database (table A.2.1). They can be accessed in ArcGIS Pro or ArcGIS Desktop at https://www.arcgis.com/home/search.html?q=greatbasinwatersheds. A description of how to use ArcGIS to access the data is in table A.2.2.
- **Basin Connectivity (%):** Data on basin connectivity are obtained directly from aerial imagery, such as NAIP or Google Earth. Disconnected reaches are characterized by lack of a distinct channel and occur most often on large alluvial fans and at the mouth of large tributaries with wide, low-gradient valley floors and thick alluvial deposits (fig. 9). Connectivity is calculated as the percentage of the total watershed area that is disconnected from the axial channel. It can be determined from aerial photographs by (1) identifying all tributary reaches along the drainage network that lack a channel and therefore have basin areas that are not physically linked to the axial stream by a channel, (2) measuring the watershed area upstream of the disconnected stream reach, and (3) summing the total area of disconnected channel and subtracting it from the total basin

area. The percentage of basin connectivity is recorded as: 1 = <80%, 2 = 80-90%, 3 = 90-95%, 4 = >95%.

- **Past Debris Flow Activity (# of past debris flows):** Data on debris flows are obtained directly from aerial imagery, such as NAIP or Google Earth. Debris flows are typically activated during major runoff events and are particularly common following disturbances to the watershed that remove vegetation from the hillslopes, such as wildfires or vegetation treatments. The response of the axial system to disturbance is often linked to the occurrence of debris flows on hillslopes because they delivery large quantities of sediment to the valley floor and channel system and result in extensive channel aggradation and/or re-working. The occurrence of debris flows depends on the climate, soil and sediment characteristics, hillslope gradients, plant successional processes within the watershed, and other variables. Past debris flows can be recognized on aerial photographs by the occurrence of (1) excavated (scoured) channels devoid of sediments on steep hillslopes which generally flow onto side-valley fans and (2) coarse, fan-shape deposits and linear levees (often consisting of large boulders) on side-valley fans (figs. 23a, 24a, b, c). The number of debris flows within the watershed is recorded as: 0 = 0-10; 1 = 10-20; 2 = 20-40; 3 = >40. In addition to the number of debris flows that have occurred, their distribution within the watershed should be recorded as lower, mid, and/or upper.
- **Fan Influence:** Fan influence refers to the effects of side-valley alluvial fans on the morphology and processes of the axial stream channel. Of primary interest is the spatial extent to which side-valley fans influence the longitudinal profile of the axial channel within the watershed, and whether one or more fans have created topographic steps that act as local base level controls. Determination of fan influence requires both office and field data. In the office, aerial photographs can be used to determine if side-valley fans are present and extend across most of the valley floor. If they do, then the number of fans and percentage of the valley floor covered is recorded. The overall fan influence is recorded as basin-wide (numerous step-forming fans throughout basin), regional (numerous step-forming fans located in specific parts of the basin), localized (few to common step-forming fans restricted to localized reaches of the valley floor), or none. If fans occur within a watershed, field observations are required to determine if the fans have affected the longitudinal profile of the axial channel by creating reaches downstream of the fan that are significantly lower than upstream reaches (i.e., topographic steps exist) (fig. 14).

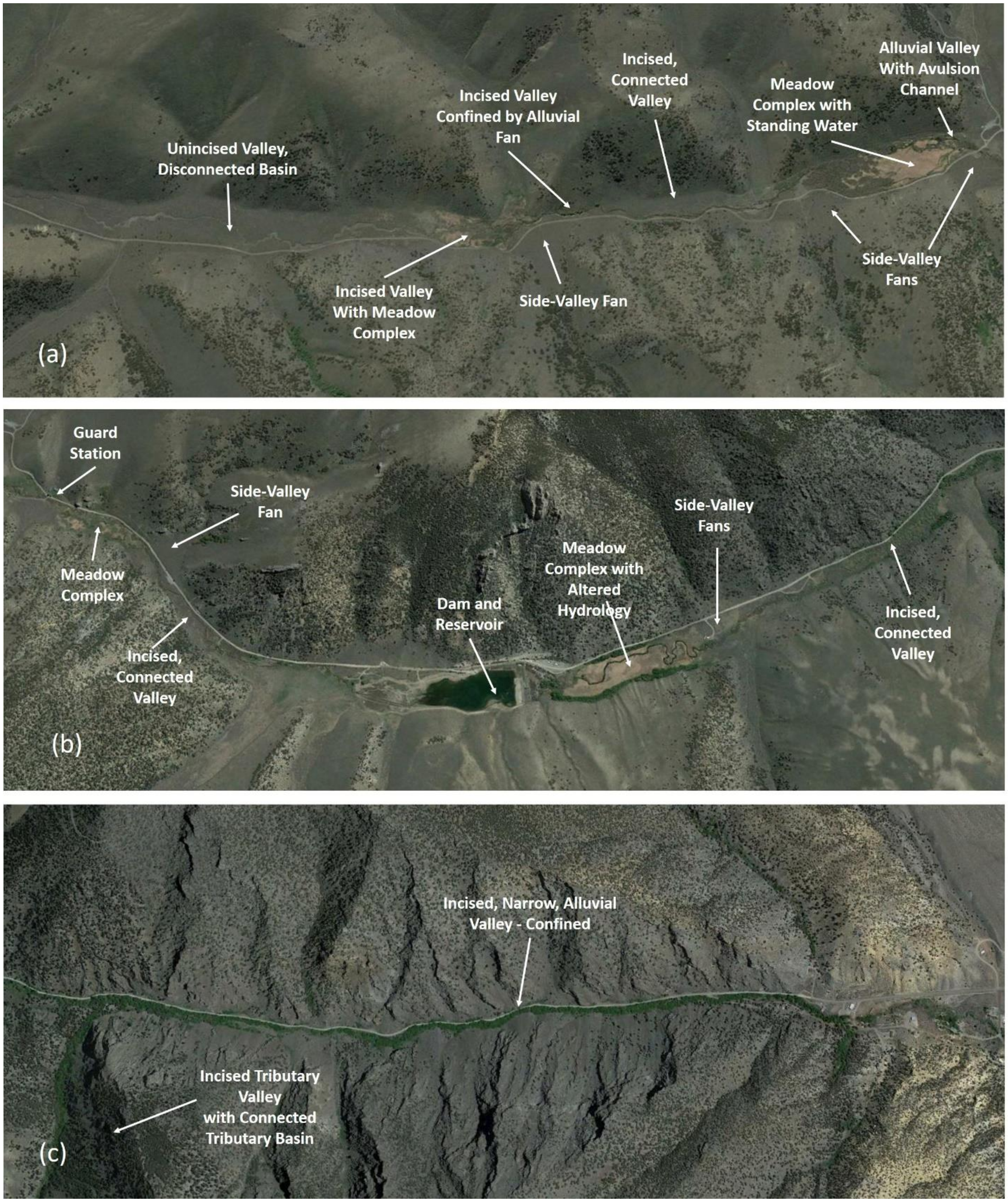
Large Scale Disturbance and Species at Risk

- Data on large scale disturbances and species at risk within the watersheds are in the Great Basin Watershed database (table A.2.1). They can be accessed in ArcGIS Pro or ArcGIS Desktop at https://www.arcgis.com/home/search.html?q=greatbasinwatersheds. A description of how to use ArcGIS to access the data is in table A.2.2. Detection of disturbances in the database or on aerial photos and topographic maps provides information on the responses of individual reaches to disturbance and is factored into management plans. Occurrence of species at risk provides information needed to prioritize watersheds for study and for conservation and restoration actions.

Distinct Watershed Segments

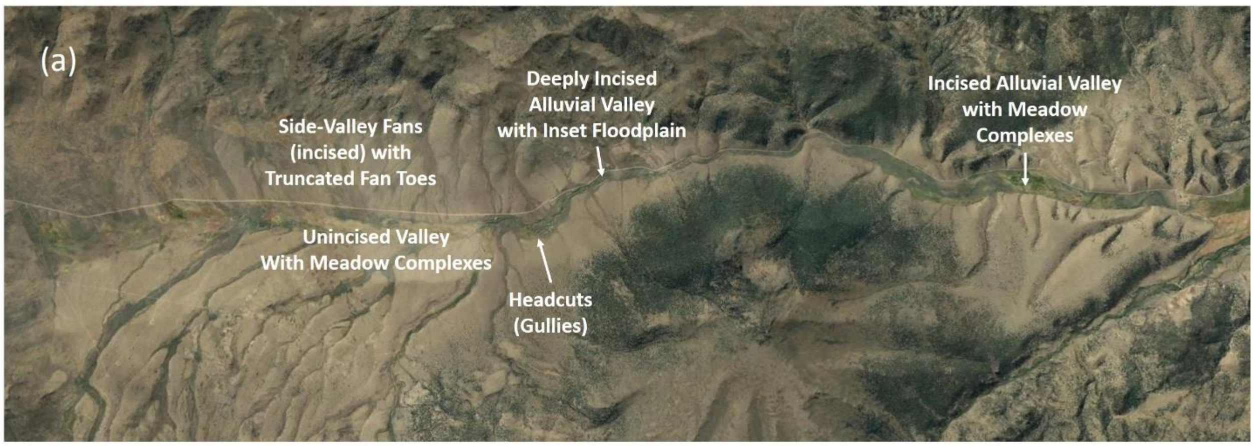
- **Distinct Watershed Segments (#):** The distribution of the distinct watershed segments are identified for each basin type within the watershed using aerial imagery, such as NAIP or Google Earth, combined with 1:24,000 scale topographic maps. Distinct watershed segments consist of relatively homogenous geological materials, valley morphometric characteristics, landforms, and riparian vegetation, and thus contain similar types of stream reaches. The parameters used to identify distinct watershed segments along the axial drainage network within a watershed include the type of valley fill (e.g., colluvium, alluvium, bedrock), existence of a well-defined and integrated channel (i.e., channelized vs. unchannelized reaches), depth of incision, channel pattern (i.e., meandering, braided, anabranching), presence of stable beaver dams, number and size of side-valley alluvial fans, occurrence of meadow complexes, vegetation types, and valley width and gradient. Aerial photos illustrating the geomorphic features of distinct watershed segments in different basin types are in figs. A.4.1, A.4.2, and A.4.3. The distinct watershed segments represent the dominant stream reach types and are used to select potential stream reaches in the higher, mid and lower elevational zones within the watersheds for field analyses. They are also used to identify potential meadows for field analyses in those watersheds where they occur.
- **Watershed Length/Length of Each Basin Type within the Watershed (m):** The length of the watershed can be obtained using the ruler tool in Google Earth, the distance measure tool in Google Maps, or the measure tool in ArcGIS. The length of the watershed includes the distance from the first appearance of a well-defined stream channel in the upper watershed to where the stream flows out of the canyon and onto the alluvial fan in the lower watershed.
- **Length of Each Watershed Segment (m):** The lengths of the distinct watershed segments can be obtained using the ruler tool in Google Earth, the distance measure tool in Google Maps, or the measure tool in ArcGIS.
- **Percentage of Each Watershed Segment (%):** The percentage of each distinct watershed segment within the watershed is calculated by dividing the length of the distinct watershed segment by the length of the watershed. Similarly, the percentage of each distinct watershed segment within a basin type is calculated by dividing the length of the distinct watershed segment by the length of the basin type.

Figure A.4.1–Aerial photographs illustrating the geomorphic features of the elevational zones within Kingston Canyon in central Nevada. (a) Higher elevations in Kingston Canyon are strongly influenced by side-valley alluvial fans and are categorized as Type B basins. A variety of different valley morphologic conditions exist and connectivity is moderate. In this elevational zone, logical sample sites include a representative stream reach in the incised, connected valley, the meadow complex in the incised valley, and depending on assessment objectives, the meadow complex with standing water. (b) The mid elevation in Kingston Canyon is also a Type B basin and it has significant human influence. In this zone logical sample sites are a representative stream reach in the incised alluvial valley and the meadow complexes. The meadow complex with altered hydrology due to the dam and reservoir may have altered ecological integrity. (c) In contrast to the high- and mid-portions of the watershed, the lower part of Kingston Canyon is a Type A_1 basin located in a narrow, bedrock-controlled valley and characterized largely by an incised alluvial channel. The lower basin is highly connected. Sampling one representative stream reach is sufficient for the lower elevation portion of the watershed. Images obtained from Google Earth on December 2, 2020.



Unincised Valley, Disconnected Basin
Incised Valley Confined by Alluvial Fan
Incised, Connected Valley
Meadow Complex with Standing Water
Alluvial Valley With Avulsion Channel
Incised Valley With Meadow Complex
Side-Valley Fan
Side-Valley Fans
(a)
Guard Station
Side-Valley Fan
Meadow Complex
Incised, Connected Valley
Dam and Reservoir
Meadow Complex with Altered Hydrology
Side-Valley Fans
Incised, Connected Valley
(b)
Incised, Narrow, Alluvial Valley - Confined
Incised Tributary Valley with Connected Tributary Basin
(c)

Figure A.4.2–Aerial photographs illustrating the geomorphic features in Indian Valley, Nevada. (a) Indian Valley is a Type C basin characterized by low-gradient, wide, alluvial valleys and incised side-valley fans that have been truncated. (b) A gully system is developing within the valley through migration of headcuts. Indian Valley is an area of conservation concern because it supports a population of Columbia spotted frog, which was a candidate species for listing under the Endangered Species Act from 1993-2015. Logical sample sites within Indian Valley include the unincised valley with meadow complexes, the gully system, and representative reaches in the deeply incised alluvial valley with an inset floodplain and the incised valley with an inset flood plain. Images obtained from Google Earth on December 2, 2020.



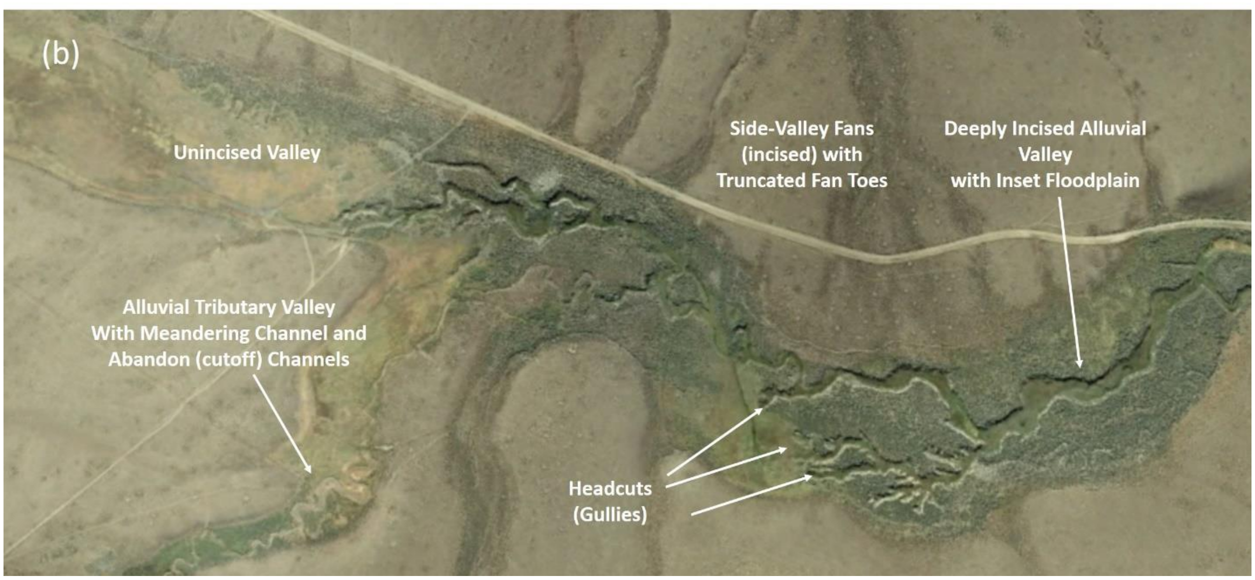


Fig. A.4.3–Aerial photographs illustrating the geomorphic features in McCoy Creek, Nevada. McCoy Creek is a Type A_1 basin characterized by steep slopes and a relatively narrow valley floor. The channel is characterized by coarse sediment and woody debris and there is evidence of channel avulsion. Geomorphic characteristics are relatively consistent throughout this small watershed, and sample locations are selected at high, mid, and low elevations within the watershed. Image obtained from Google Earth on December 2, 2020.