Little Blackfoot River Riparian Assessment

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Prepared For

Natural Resource Damage Program
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1 INTRODUCTION

Geum Environmental Consulting, Inc. (Geum) and River Design Group, Inc. (RDG) were contracted by the Natural Resource Damage Program (NRDP) to assess the riparian and fish habitats of the Little Blackfoot River and select tributaries in the Upper Clark Fork River Basin (UCFRB). This assessment identified factors affecting stream function and fish habitat in select reaches of the mainstem Little Blackfoot River and three tributaries to the Little Blackfoot River including Dog Creek, Snowshoe Creek and Spotted Dog Creek. The location of each assessment area is provided in Figure 1. This assessment work is a direct follow-up to the *Final Upper Clark Fork River Basin Aquatic and Terrestrial Resource Restoration Plan* (2012 Restoration Plans) (NRDP 2012). Based on the 2012 Restoration Plans, the Little Blackfoot River is considered a Priority 1 tributary to the Clark Fork River. Dog Creek, Snowshoe Creek, and Spotted Dog Creek are Priority 2 tributaries. Restoring riparian habitat is considered a high priority in the Restoration Plan for the lower Little Blackfoot River and these three tributaries. In addition, the Little Blackfoot River watershed is listed by the Department of Environmental Quality (DEQ) as impaired (2011) due to combinations of sediment, nutrients, and metals. The NRDP, Watershed Restoration Coalition (WRC) and partners will use this assessment to prioritize reaches for restoration projects. This assessment work is building on prior work completed by Montana Fish, Wildlife and Parks (MTFWP), DEQ and private contractors.

The 2012 Restoration Plans list the following proposed actions (listed in order of priority) for these tributaries that, when implemented, will improve the fishery of these tributaries as well as the mainstem of the Clark Fork River.

1. Riparian Habitat Protection/Enhancement Implementation: Riparian habitat protection and enhancement for the Little Blackfoot watershed will focus on the mainstem Little Blackfoot below Elliston to the confluence with the Clark Fork River; throughout Dog Creek; lower reach of Snowshoe Creek; the lower 6.6 miles of Spotted Dog Creek; and within the Spotted Dog Wildlife Management Area. Further data collection and other information gathering will first be performed to determine the specific type and location of the following actions: riparian fencing, off-stream water sources, grazing management strategies, long-term management agreements and/or permanent conservation easements, and roads and railroad erosion occurring along the streams.
2. Water Quantity: Flow needs for Little Blackfoot watershed will be addressed through the Flow Augmentation process described in Section 3.2.1 of the 2012 Restoration Plan.
3. Fish Passage: More than 30 irrigation diversions and road culverts in the Little Blackfoot River, Dog Creek, Snowshoe Creek and Spotted Dog Creek impair fish passage. A watershed evaluation will first be performed to determine the specific locations where

fish passage projects will be implemented. Redesign or retrofits of barriers will be completed and implemented where warranted.

4. Fish Entrainment: All irrigation diversions will be evaluated for fish entrainment. Screens for diversions will be designed and implemented where warranted.
5. Streambank and Channel Reconstruction: Channel reconstruction will be implemented only after implementation of other actions and subsequent evaluation determines reconstruction is warranted. A study of the lower 32 miles of the Little Blackfoot River found 30,000 feet of eroding streambanks and 5,000 feet of critical sediment sources. Streambank erosion along Dog Creek and Spotted Dog Creek identified active channel bank erosion and poor riparian vegetation health. All reaches will be evaluated for potential natural recovery or the need for active restoration treatments.

This report directly addresses Proposed Actions 1 and 5. Proposed Actions 2, 3 and 4 will be addressed by other studies. The specific goal of this assessment project is to provide the necessary information to help prioritize stream restoration activities being considered by NRDP in consultation with WRC and FWP for aquatic improvement in the lower Little Blackfoot River watershed, Dog Creek, Snowshoe Creek and Spotted Dog Creek. There are two primary objectives for this assessment project:

1) Evaluate the condition of riparian habitat in the lower Little Blackfoot River, Dog Creek, Snowshoe Creek and Spotted Dog Creek watersheds; and

2) Identify reach-specific problems and sources as well as opportunities for riparian and in-stream habitat improvements.

2 BACKGROUND

This assessment builds on prior work conducted within the Little Blackfoot River watershed. A similar assessment project was conducted in 2002 by Land and Water Consulting for the Deer Lodge Valley Conservation District (DLVCD) and the Little Blackfoot Watershed Group to describe restoration needs of the Lower Little Blackfoot River. The results of that assessment are documented in the report *Little Blackfoot River Physical Features Inventory and Riparian Assessment*. This earlier assessment does not include any of the tributary assessment reaches included in this current assessment. Montana FWP conducted riparian and fish population assessments in tributaries of the Upper Clark Fork River Basin (2009), including the tributaries that are part of this assessment effort. In 2011, DEQ completed the *Little Blackfoot River Watershed TMDLs and Framework Water Quality Improvement Plan* which listed the Lower Blackfoot River and many of its tributaries as impaired. In 2012, NRDP completed its Restoration Plan for the Upper Clark Fork River Basin.

In areas where previous assessments or data collection efforts overlap with current assessment reaches, related information was incorporated into the Results section for each assessment area. Appendix D provides a summary of select data from each of these related assessment efforts.

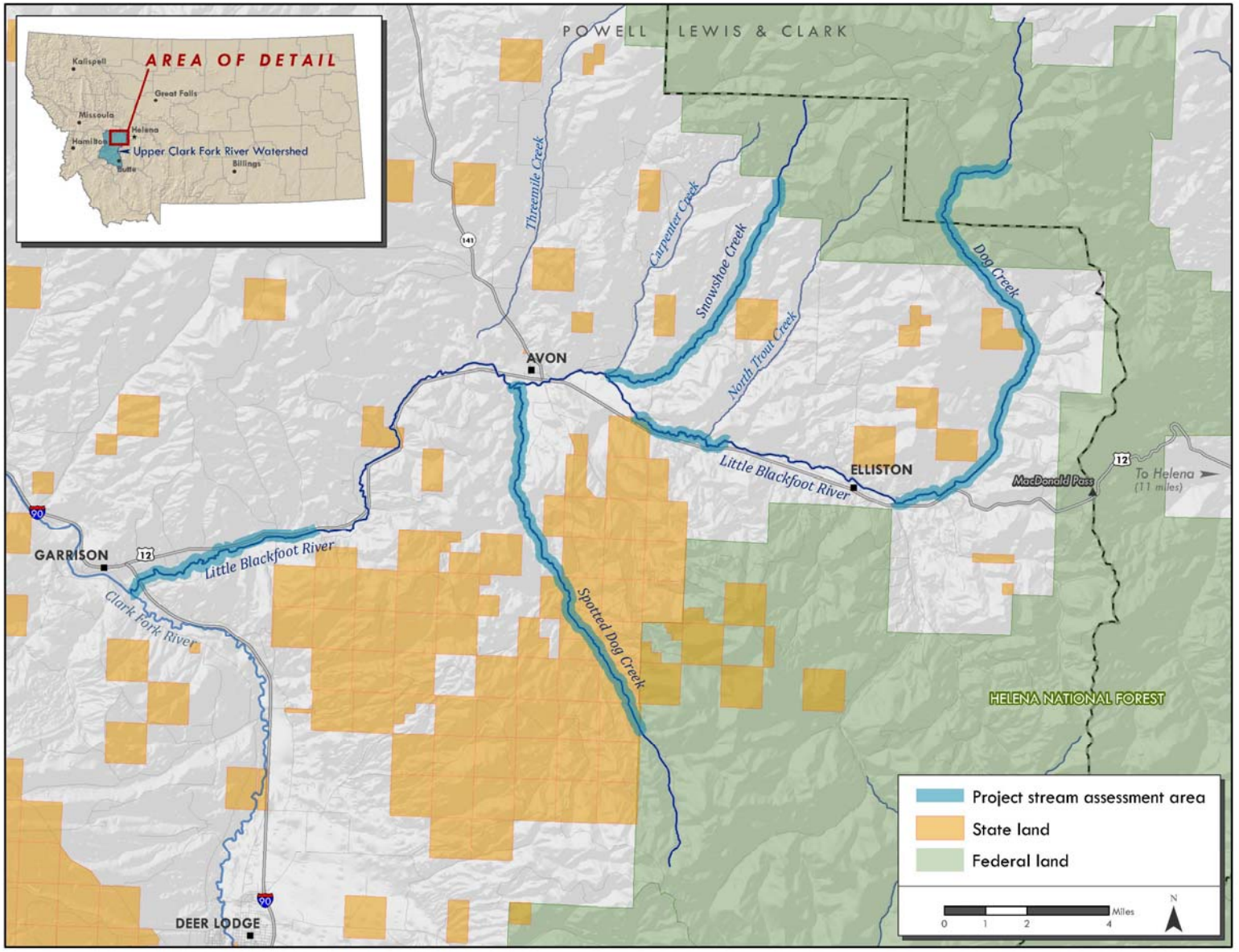


Figure 2-1. Overview of Little Blackfoot River watershed showing assessment areas.

3 METHODS

Riparian and fish habitat assessments evaluated current site conditions and identified and prioritized restoration opportunities for assessment reaches. Land access was coordinated by WRC. Based on access permission, each assessment area was divided into assessment reaches through interpretation of aerial photos. The main factors influencing assessment reach break selection included: property ownership, geomorphology, changes in channel types, changes in land use and the presence of infrastructure. Assessment reaches established during previous assessment work completed by FWP, DEQ and Land and Water overlap with some of the reaches established for this assessment. Reach breaks were adjusted as needed on the ground as needed to reflect actual conditions. The following data were collected within each assessment reach:

- USDA Natural Resources Conservation Service (NRCS) Riparian Assessments with supplemental attributes for fish habitat (NRCS 2012 and 2004) and a fish habitat metric developed by Montana Fish, Wildlife, and Parks (Lindstrom et al. 2008 and Liermann et al. 2009),
- Watershed Restoration Coalition bank erosion inventory,
- Photographs and photograph logs,
- Reach narrative summaries; and
- Identification of restoration opportunities.

Field forms used to complete the assessments are included in a separate document, *Little Blackfoot River Watershed Riparian Assessment, Sampling and Analysis Plan* (Geum 2014.) Amy Sacry, Restoration Ecologist with Geum, led the field assessment work completed during April and May 2014. Additional team members for field assessments included: Matt Daniels, Principal Engineer with River Design Group; Sarah Flynn, Biologist/Botanist with Geum; and Selita Ammondt, Restoration Ecologist with River Design Group. Molly Staats, Watershed Scientist with WRC and Will McDowell, Project Coordinator with WRC provided initial input on how these assessments have been completed for other watersheds in the Upper Clark Fork River Basin and also attended numerous assessments to provide quality control of field interpretation.

3.1 NRCS Riparian Assessments and Fish Habitat Scores

Riparian and fish habitat assessments were completed using the USDA Natural Resources Conservation Service (NRCS) Riparian Assessment Method (NRCS 2012), two supplemental attributes for fish habitat from the 2004 version of the NRCS Riparian Assessment Method

(NRCS 2004), and an additional fish habitat metric created by Montana Fish, Wildlife, and Parks (Lindstrom et al. 2008 and Liermann et al. 2009). The NRCS Riparian Assessment is a relatively rapid assessment method of the sustainability and function of the riparian corridor and aquatic habitat. Resulting assessment scores and sustainability ratings help identify issues limiting riparian function and aquatic habitat that can be used to develop restoration priorities (NRCS 2012).

Scores from these assessments are totaled to develop an overall NRCS Assessment score and rating along with a total fish habitat score for each assessed reach. The overall NRCS Assessment score was calculated by summing the 10 Riparian Assessment metrics and dividing by the total possible points based on the site potential or capability of each reach to generate an overall percentage score. This percentage was used to identify a stream health rating of Sustainable (80 to 100 percent), At Risk (50 to 80 percent), or Not Sustainable (less than 50 percent) for each reach.

The NRCS Riparian Assessment method does not include scores for the 2 supplemental fish habitat attributes. To generate scores for fish habitat, scores were added to these metrics. For supplemental attribute 1, aquatic life substrate habitats, scores of 10, 7, 3, and 0 were assigned to the four categories of substrate in descending order for the two different stream bottom types. For supplemental attribute 2, scores of 10, 7, 5, 3, and 0 were assigned to five habitat categories in descending order.

The scores from the 2 supplemental fish habitat attributes were combined with the FWP fish habitat metric to generate an overall percentage score for the fish habitat rating of each reach. Ratings for fish habitat used in this assessment are as follows: poor fish habitat (0 to 30 percent), fair fish habitat (greater than 30 and less than 80 percent), and good fish habitat quality (80 to 100 percent).

Bankfull width and depth measurements were collected at representative cross-sections within each assessment reach. However, in some locations these measurements were estimated due to high flows. The reach length, channel sinuosity, and channel slope were calculated in ArcGIS using aerial photographs to digitize the channel pattern and 10-meter digital elevation models for elevation. Channel types (Rosgen and Silvey 1996) were assigned to the reaches based on visual observations and the calculated channel sinuosity and slope. Plant communities were recorded for each reach according to the Nez Perce Riparian Community Type Codes (Overton et al. 1997)

3.2 Watershed Restoration Coalition (WRC) Bank Erosion Inventory

An inventory of eroding banks was completed for each assessment reach using methods developed by the WRC in 2011 and revised in 2013 to quantify actively eroding banks so that the importance of each reach can be evaluated relative to watershed sediment supply (Staats and McDowell 2014). The length and height of eroding banks was recorded throughout each reach for each side of the stream along with the source of erosion. The height of the bank was measured from the water surface. This information was used to calculate the total area (square feet) of eroding bank. The total length of eroding bank was also compared with the total length of streambank (including both banks) to generate a percent of linear bank erosion for each reach. Linear bank erosion was split into four general categories: 0-5%; 5.1-10%; 10.1-20% and >20.1%. These breaks were determined by evaluating the range of bank erosion percentages for all of the assessed areas and determining categories that characterized high, moderately high, moderate and low amounts of bank erosion.

3.3 Photographic Documentation

Digital photographs were taken at the upstream and downstream extent of each assessment reach. Additional photographs were taken throughout the assessment reaches to document conditions and at key locations such as irrigation diversion structures, tributary confluences, fence lines, or other features. Photographs at the reach extents generally included views looking upstream, downstream, and to the left and right of the channel. Photographs were taken with GPS cameras or a GPS device was used to record a point at each photograph location. These spatial data were used to generate latitude and longitude for each photograph location.

3.4 Reach Narrative

Data from riparian assessments, fish habitat assessments, bank erosion inventories, and photographic documentation were used to complete a reach narrative for each assessment reach. These narratives describe the overall assessment results, existing conditions, key impairments, possible causes of impairment, and potential restoration options associated with each assessment reach.

3.5 Remote Sensing

Existing spatial data sets were used to complete remote assessments of reaches that were inaccessible due to lack of landowner permission. Remote assessments were completed for all inaccessible reaches downstream of US Forest Service land on Dog Creek and Snowshoe Creek. Assessment forms were completed for each remotely assessed reach of these two tributary

streams. All of Spotted Dog Creek downstream of US Forest Service land was accessible and evaluated in the field. Along the Little Blackfoot River, remote assessments were only completed upstream and downstream of reaches that were accessible and evaluated in the field. Assessment forms were not completed for Little Blackfoot River remote assessments. Instead, these reaches were only evaluated to determine if there are conditions that may affect potential restoration of the accessible reaches. Reaches evaluated remotely are designated by an "R" following the Reach ID (e.g. Reach Dog-16-R).

Remote assessments used the following available spatial data:

- High resolution (1-meter or better) aerial imagery for both the most recent growing season (2013) and earlier time periods (as available);
- Hydrologic infrastructure data such as the locations of diversions, dams, or other structures that affect streamflow;
- Previous FWP and DEQ monitoring sites and associated data, including thermograph, fish sampling, and TMDL sites; and
- Assessment data from adjacent or similar reaches within the same watershed completed for this report.

Some questions from the NRCS Assessment and fish habitat attributes could not be evaluated using available spatial data and were noted as 'NA' on assessment forms including: Question 6 (noxious weeds), Question 9 (browse utilization), Supplemental Attribute 1 (aquatic life substrate habitats), and Supplemental Attribute 2 (fish habitats). An overall score was assigned to each reach. This score excluded the values for those questions that could not be answered using remote sensing.

The data sources and strategies used to evaluate the other components of the Riparian Assessment are summarized below.

Question 1: Stream Incision

Lateral indications of incision such as headcuts, channel widening, and the presence of developing riparian areas were identified through aerial imagery.

Question 2: Streambanks with Active Lateral Cutting

The presence and severity of lateral bank erosion were identified through repeat aerial imagery (i.e. comparing available historical imagery with current imagery). Some types of bank erosion were also visible on current aerial imagery.

Question 3: The Stream is in Balance with the Water and Sediment Supplied by the Watershed

Metrics related to planform (i.e. channel width, presence/absence of depositional features) were assessed using current aerial photography.

Question 4: Streambank with Vegetation having a Deep, Binding Root Mass

The presence of woody, near bank vegetation was assessed from current aerial photographs to inform conclusions regarding the presence of deep, binding root mass. Species diversity could not be reliably assessed; however, general vegetation cover types (shrub, deciduous, conifer, sedge/rush, grass) were evaluated.

Question 5: Riparian/Wetland Vegetative Cover

Riparian and wetland canopy cover was roughly assessed using aerial imagery and stability ratings were estimated by comparing observed general vegetation cover types and data from similar sites that were assessed on the ground.

Question 7: Disturbance-Caused Undesirable Plants in the Riparian Area

The presence of disturbance-caused undesirable plants was estimated based on trends observed in adjacent reaches and land use evident on current aerial photographs.

Question 8: Woody Species Establishment and Regeneration

The presence/absence of woody species was evaluated using current aerial photographs and the individual age classes were estimated based on the apparent size of the woody vegetation.

Question 10: Floodplain Characteristics for Dissipating Energy and Capturing Sediment

The presence of active or overflow channel and larger floodplain debris was evaluated from recent aerial photographs.

Fish Habitat Assessment

Only general fish habitat using the metric developed by FWP was estimated using aerial photographs. The existing vegetation community visible on current aerial photographs was to determine woody debris, overhanging vegetation, or other cover elements may be present and the presence of pools was estimate based on the channel pattern and data from adjacent reaches that were evaluated in the field.

3.6 Restoration Opportunities

For each assessment reach, restoration opportunities were identified based on limiting factors and restoration priorities described in the 2012 Restoration Plan (NRDP 2012). Restoration opportunities also consider the aquatic habitat prioritization completed to support the 2012 Plan. The 2012 Restoration Plans integrated Prioritization of Areas in the Upper Clark Fork River

Basin for Fishery Enhancement (Saffel et al. 2011). This report lists the criteria for rating the value of trout fisheries in the Upper Clark Fork River Basin (UCFRB) in relation to the three fishery goals for the UCFRB: 1) Restore the mainstem trout fishery by improving recruitment of fish from tributaries; 2) Replace lost trout angling in the mainstem by improving trout populations in tributaries; and 3) Maintain or improve native trout populations in the UCFRB to preserve rare and diverse gene pools, and improve the diversity and resiliency of the trout fishery. This prioritization ranked the Little Blackfoot River as having high potential to help achieve Goal 1 and Goal 2, and very high potential to help achieve Goal 1, 2 or 3. Lower Snowshoe, Lower Spotted Dog and Dog Creek all have high potential to help achieve Goal 1 and 2.

Flows were at, near or above bankfull during most of the assessments. For this reason, evaluating potential for some restoration actions was not feasible. For example, all reaches appeared to have sufficient flows, and many irrigation diversions were not active during the assessment period, so evaluating where dewatering might occur and potential effects of dewatering was not possible. Further, many of the recommended restoration actions should not be considered independent of each other. For example, implementing measures to stabilize and revegetate eroding streambanks is a common recommended restoration action for most assessment areas; however, these actions should only be considered in conjunction with changes in land management or implementing riparian protection measures in areas that are actively grazed.

Restoration actions are expanded on in more detail for assessment reaches that are located on state land or where landowners have expressed interest and willingness in implementing projects.

4 RESULTS

This section provides the results of the assessments by assessment area and assessment reach. Table 4-1 provides a summary of all of the assessment reaches included in this assessment with information on property owners, location, and reach length. Figure 4-1 shows the location of each assessment reach by assessment area.

Table 4-1. Summary of assessment reach locations, lengths and ownership.

Assessment Area	Reach ID	Reach Length (ft)	Reach Length (mi)	Begin Latitude / Longitude	End Latitude / Longitude
Little Blackfoot River	LBR-01	6,328	1.2	46.5762809092 / -112.495724342	46.5781341151 / -112.51527194
Little Blackfoot River	LBR-02	6,834	1.3	46.5781341151 / -112.51527194	46.5811956428 / -112.53611987
Little Blackfoot River	LBR-03	2,929	0.6	46.5811956428 / -112.53611987	46.5840178597 / -112.543485774
Little Blackfoot River	LBR-04	5,460	1.0	46.5400736809 / -112.704021143	46.5370578273 / -112.72443771
Little Blackfoot River	LBR-05	2,942	0.6	46.5370578273 / -112.72443771	46.535424502 / -112.735336969
Little Blackfoot River	LBR-06	1,517	0.3	46.535424502 / -112.735336969	46.5339757892 / -112.740798645
Little Blackfoot River	LBR-07	3,616	0.7	46.5339757892 / -112.740798645	46.5320340922 / -112.750732303
Little Blackfoot River	LBR-08	8,212	1.6	46.5320340922 / -112.750732303	46.526037324 / -112.76645282
Little Blackfoot River	LBR-09	7,270	1.4	46.526037324 / -112.76645282	46.5212463779 / -112.787317153
Little Blackfoot River	LBR-10	1,747	0.3	46.5212463779 / -112.787317153	46.519329564 / -112.79355658
Little Blackfoot River	LBR-11	2,347	0.4	46.519329564 / -112.79355658	46.5146223681 / -112.797509943
Dog Creek	Dog-01	1,065	0.2	46.6781342064 / -112.359188034	46.676002888 / -112.36170808
Dog Creek	Dog-01a-R	635	0.1	46.676002888 / -112.36170808	46.6752084012 / -112.363632865
Dog Creek	Dog-02	974	0.2	46.6752084012 / -112.363632865	46.6750545538 / -112.366111547
Dog Creek	Dog-02a-R	2,628	0.5	46.6750545538 / -112.366111547	46.6751471236 / -112.373480408
Dog Creek	Dog-03	1,999	0.4	46.6751471236 / -112.373480408	46.6745029882 / -112.379809428
Dog Creek	Dog-03a-R	10,979	2.1	46.6745029882 / -112.379809428	46.6560001285 / -112.3879161011
Dog Creek	Dog-03b-R	9,231	1.7	46.6560001285 / -112.3879161011	46.6415723674 / -112.371728725
Dog Creek	Dog-04-R	1,446	0.3	46.6415723674 / -112.371728725	46.6389006523 / -112.368596607
Dog Creek	Dog-04a-R	8,123	1.5	46.6389006523 / -112.368596607	46.6271398959 / -112.350594127
Dog Creek	Dog-05	2,503	0.5	46.6271398959 / -112.350594127	46.6225036301 / -112.348649835
Dog Creek	Dog-06	5,042	1.0	46.6225036301 / -112.348649835	46.6138508806 / -112.34125607
Dog Creek	Dog-07	3,764	0.7	46.6138508806 / -112.34125607	46.6058121502 / -112.345408588
Dog Creek	Dog-08	3,763	0.7	46.6058121502 / -112.345408588	46.6001665682 / -112.351007813
Dog Creek	Dog-09	2,650	0.5	46.6001665682 / -112.351007813	46.5965037688 / -112.354881696

Assessment Area	Reach ID	Reach Length (ft)	Reach Length (mi)	Begin Latitude / Longitude	End Latitude / Longitude
Dog Creek	Dog-10	1,911	0.4	46.5965037688 / -112.354881696	46.5918657236 / -112.356756265
Dog Creek	Dog-11a	891	0.2	46.5918657236 / -112.356756265	46.5896436753 / -112.357653293
Dog Creek	Dog-11b	2,395	0.5	46.5896436753 / -112.357653293	46.5836686825 / -112.360263184
Dog Creek	Dog-12a	4,963	0.9	46.5836686825 / -112.360263184	46.5731817889 / -112.364020665
Dog Creek	Dog-12b	1,759	0.3	46.5731817889 / -112.364020665	46.5696445187 / -112.368703900
Dog Creek	Dog-13a	1,427	0.3	46.569207384 / -112.369539149	46.5662096196 / -112.373008837
Dog Creek	Dog-13b	4,908	0.9	46.5662096196 / -112.373008837	46.5616914929 / -112.38901781
Dog Creek	Dog-14	706	0.1	46.5616914929 / -112.38901781	46.5612188173 / -112.391109087
Dog Creek	Dog-15-R	2,497	0.5	46.5612188173 / -112.391109087	46.5593593577 / -112.400267987
Dog Creek	Dog-16-R	2,670	0.5	46.5593593577 / -112.400267987	46.5573311819 / -112.409222879
Snowshoe Creek	SS-01	3,317	0.6	46.6696786311 / -112.475394612	46.6612621686 / -112.475502707
Snowshoe Creek	SS-02	4,786	0.9	46.6612621686 / -112.475502707	46.6506761101 / -112.48373305
Snowshoe Creek	SS-03	6,708	1.3	46.6506761101 / -112.48373305	46.6344912787 / -112.491644077
Snowshoe Creek	SS-04	3,590	0.7	46.6344912787 / -112.491644077	46.6273898777 / -112.497428951
Snowshoe Creek	SS-05	6,116	1.2	46.6273898777 / -112.497428951	46.616566189 / -112.505964595
Snowshoe Creek	SS-05a-R	5,000	0.9	46.616566189 / -112.505964595	46.61056856 / -112.514728118
Snowshoe Creek	SS-06	12,025	2.3	46.61056856 / -112.514728118	46.5977096635 / -112.535787201
Snowshoe Creek	SS-06a-R	10,217	1.9	46.5977096635 / -112.535787201	46.5982761306 / -112.555206121
Snowshoe Creek	SS-07	826	0.2	46.5982761306 / -112.555206121	46.5981826135 / -112.558221706
Spotted Dog Creek	SD-01a	3,601	0.7	46.4737149395 / -112.534923737	46.4811590511 / -112.540155094
Spotted Dog Creek	SD-01b	9,782	1.9	46.4811590511 / -112.540155094	46.4974822409 / -112.554422373
Spotted Dog Creek	SD-01c	5,174	1.0	46.4974822409 / -112.554422373	46.504892087 / -112.561205348
Spotted Dog Creek	SD-02	4,373	0.8	46.504892087 / -112.561205348	46.511892393 / -112.570793263
Spotted Dog Creek	SD-03	4,400	0.8	46.511892393 / -112.570793263	46.5214155984 / -112.574240139

Assessment Area	Reach ID	Reach Length (ft)	Reach Length (mi)	Begin Latitude / Longitude	End Latitude / Longitude
Spotted Dog Creek	SD-04	3,861	0.7	46.5214155984 / -112.574240139	46.5292129792 / -112.580811397
Spotted Dog Creek	SD-05	6,076	1.2	46.5292129792 / -112.580811397	46.5413884125 / -112.59215983
Spotted Dog Creek	SD-06	2,614	0.5	46.5413884125 / -112.59215983	46.5464093842 / -112.5956784
Spotted Dog Creek	SD-07	4,294	0.8	46.5464093842 / -112.5956784	46.5552417321 / -112.602660769
Spotted Dog Creek	SD-08	2,991	0.6	46.5552417321 / -112.602660769	46.5624496018 / -112.601801379
Spotted Dog Creek	SD-09/10	3,274	0.6	46.5624496018 / -112.601801379	46.5699107494 / -112.60223921
Spotted Dog Creek	SD-11	2,637	0.5	46.5699107494 / -112.60223921	46.5762552697 / -112.600834092
Spotted Dog Creek	SD-12	2,720	0.5	46.5762552697 / -112.600834092	46.5803558423 / -112.602571794
Spotted Dog Creek	SD-13	4,247	0.8	46.5803558423 / -112.602571794	46.5881103344 / -112.602416538
Spotted Dog Creek	SD-14	3,554	0.7	46.5881103344 / -112.602416538	46.5932267331 / -112.606583399

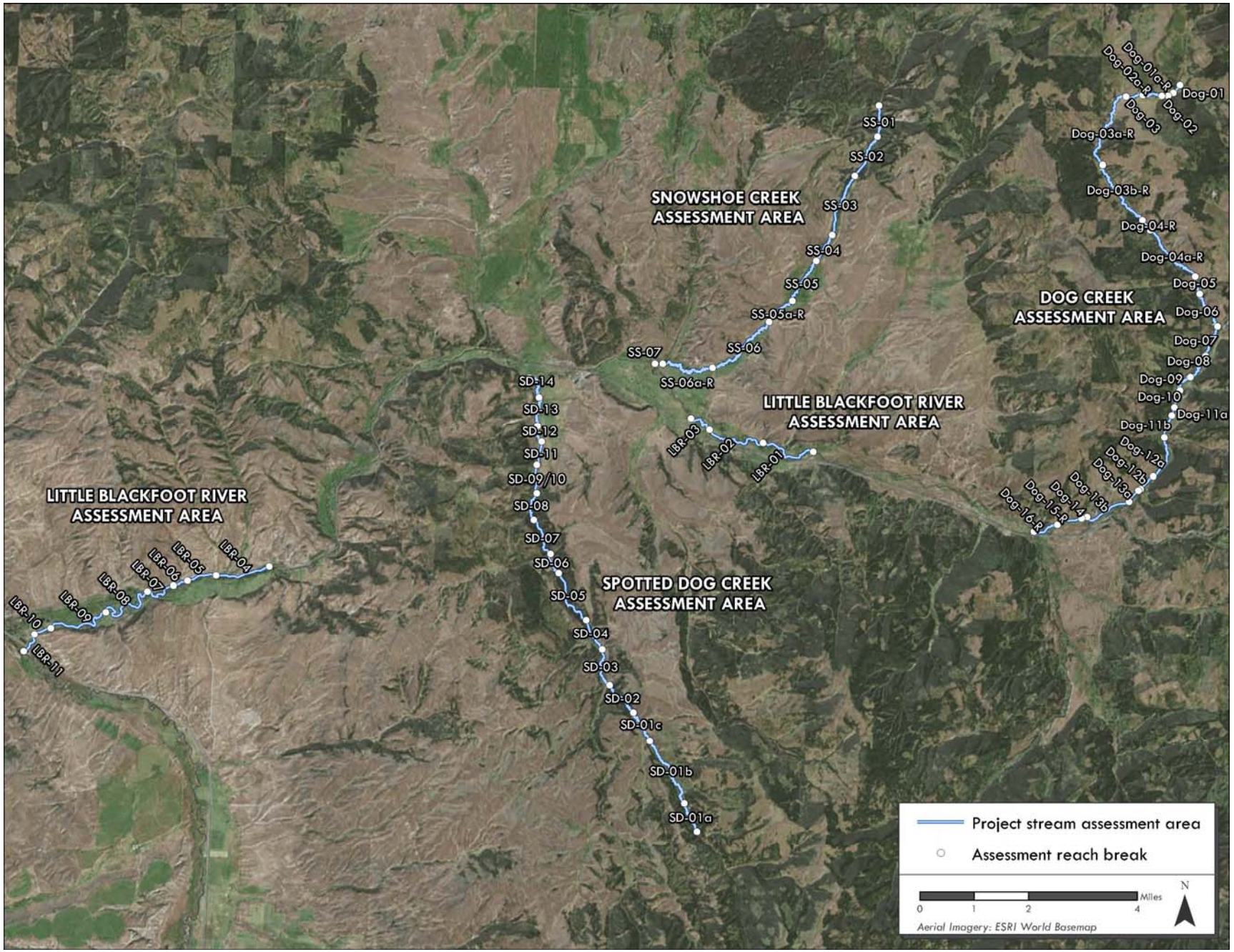


Figure 4-1. Location of assessment reaches within each assessment area.

4.1 Little Blackfoot River

The Little Blackfoot River drains approximately 413 square miles. The channel flows for approximately 47 miles before entering the Clark Fork River near Garrison. Land ownership along the Little Blackfoot River is comprised primarily of privately owned, agricultural lands in the lower 29 miles, and lands administered by the U.S. Forest Service with interspersed parcels of private ownership in the upper reaches. The major land uses in the Little Blackfoot River drainage include cattle grazing, hay production, timber harvest, mining and recreation. There are a number of irrigation diversions along the mainstem Little Blackfoot River. The riparian assessment conducted in 2001 (Land and Water Consulting 2002) indicated the presence of at least 30 diversions and eight pump sites in the lower 32 miles of the Little Blackfoot River.

Fish surveys were completed at seven sections of the Little Blackfoot River between late August and early October 2007 (MTFWP 2009). At RM 4.0 and 9.6 the trout community was made up of entirely brown trout. At RM 21.3 the trout community was slightly more diverse, with brown trout still dominant but westslope cutthroat trout and brook trout also present in limited numbers. At RM 26.7, the trout community was still comprised largely of brown trout, but brook trout and westslope cutthroat trout became proportionately more abundant than in downstream reaches. At RM 31.1, a notable shift in trout species composition was observed. At this site, westslope cutthroat trout became the most abundant trout species present. Brown trout were still common, but brook trout became rare. The most upstream site sampled at RM 40.1, westslope cutthroat trout were still the most abundant, but brook trout became equally plentiful and brown trout became rare.

According to the TMDL, the lower segment of the Little Blackfoot River (confluence of Dog Creek to confluence of Clark Fork River) is listed for sedimentation/siltation on the 2010 303(d) List. In addition, the lower segment of the Little Blackfoot River is also listed for alteration in stream-side or littoral vegetative covers, which is a non-pollutant commonly linked to sediment impairment. The lower Little Blackfoot River is listed based on sedimentation attributed to channelization by the road and railroad, channel modifications, haying near the channel, removal of riparian vegetation, and livestock grazing.

Water temperature was monitored at five locations along the Little Blackfoot River between July 11 and October 13, 2008 by FWP (MTFWP 2009). In general, water temperatures decrease in an upstream direction. Near the mouth, daily maximum water temperature exceeded 15°C on 61 days and 20 days exceeded 20°C (max 22.7°C). At the upstream most site, located at river mile 34.8, temperatures were notably cooler.

Table 2 summarizes the results of the assessments completed along the Little Blackfoot River including the channel type, percent bank erosion, NRCS score and rating and fish habitat score and rating. Figure 4-2 shows the NRCS rating by assessment reach. Figure 4-3 shows the percent bank erosion by reach. The mainstem Little Blackfoot River has been subject to many past manipulations. The assessment results indicate highly variable conditions along the Little Blackfoot River. Conditions range from near reference conditions, with wide connected floodplains to extremely channelized reaches with no floodplain connectivity. Numerous impairments were identified during this assessment. The most significant impacts include: channelization by the railroad, numerous roads, utilities and flood levees. This infrastructure, and measures taken to protect this infrastructure have severely limited natural channel migration in many areas. In locations where the Little Blackfoot River interacts with bank and infrastructure armoring, it has become aligned with the armoring in a straight, down-valley pattern. This is a result of the inability of the river to dissipate energy along the armored segments. In general, this process is caused by increased gradient, sustained velocity and upstream propagation of scour in the form of knick points that develop at the toe of the armoring. Upon becoming incised along the toe of the armored embankment, floodplain disconnection limits the ability of the river to laterally migrate and change its pattern. Floodplain and riparian vegetation clearing to support agriculture, primarily hay production and grazing, is extensive and has led to significant bank erosion and channel over-widening.

No reaches were remotely assessed to complete the NRCS Riparian Assessment form in the Little Blackfoot River assessment area; however, the reaches upstream of LBR-01; downstream of LBR-03 and upstream of LBR-04 were generally assessed through aerial photo interpretation to identify any factors that may limit restoration actions identified in assessed reaches. These areas are described under the results for adjacent reaches.

The primary restoration actions for the Little Blackfoot River include: 1) preservation and conservation of high quality habitat; 2) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 3) implementing streambank stabilization and revegetation measures; and 4) developing comprehensive restoration strategies for reaches with multiple constraints and land management issues.

Table 4-2. Summary of Little Blackfoot River assessment reach characteristics.

Reach ID	Reach Length (ft)	Channel Type	Primary Land Use	Linear Bank Erosion (%)	NRCS Score (%)	NRCS Rating	Fish Habitat Score (%)	Fish Habitat Rating
LBR-01	6,328	F, C	Grazing	13.7%	47%	Not sustainable	53%	Fair
LBR-02	6,834	C	Grazing	21.1%	48%	Not sustainable	80%	Good
LBR-03	2,929	C	Grazing	16.5%	82%	Sustainable	80%	Good
LBR-04	5,460	B	Grazing, Railroad right-of-way	20.9%	68%	At Risk	60%	Fair
LBR-05	2,942	B	ROW, Grazing, Agricultural	9.4%	82%	Sustainable	60%	Fair
LBR-06	1,517	C	Grazing, Railroad right-of-way	5.3%	80%	Sustainable	60%	Fair
LBR-07	3,616	C	Grazing	6.6%	93%	Sustainable	80%	Good
LBR-08	8,212	C	Grazing, Haying	10.7%	75%	At Risk	80%	Good
LBR-09	7,270	C, F	Grazing, Haying	10.6%	72%	At Risk	60%	Fair
LBR-10	1,747	F	Natural, Fenced riparian	24.9%	80%	Sustainable	50%	Fair
LBR-11	2,347	F, C	Transportation corridors, Campground, Residential	7.9%	68%	At Risk	57%	Fair

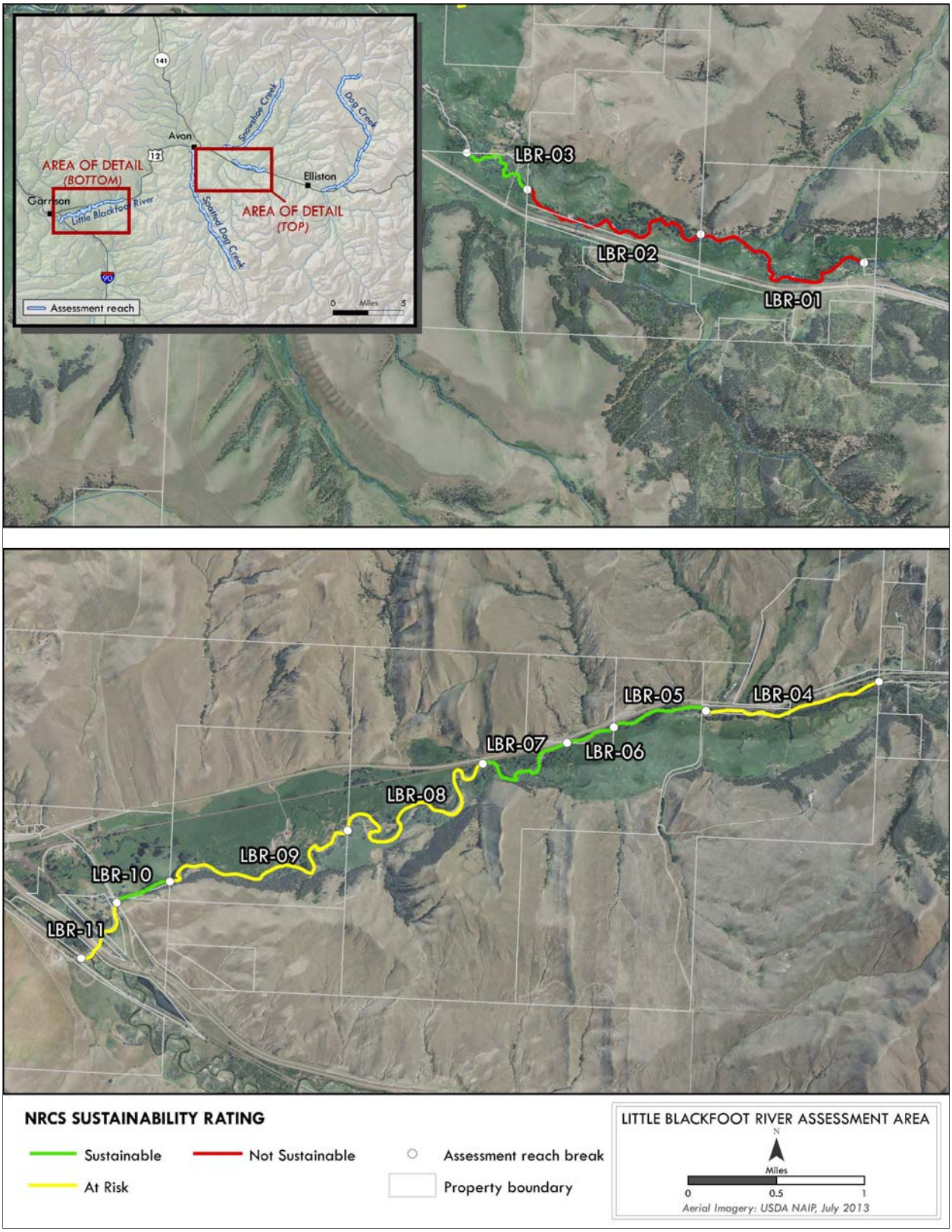


Figure 4-2. NRCS riparian assessment sustainability ratings results for the Little Blackfoot River assessment area.

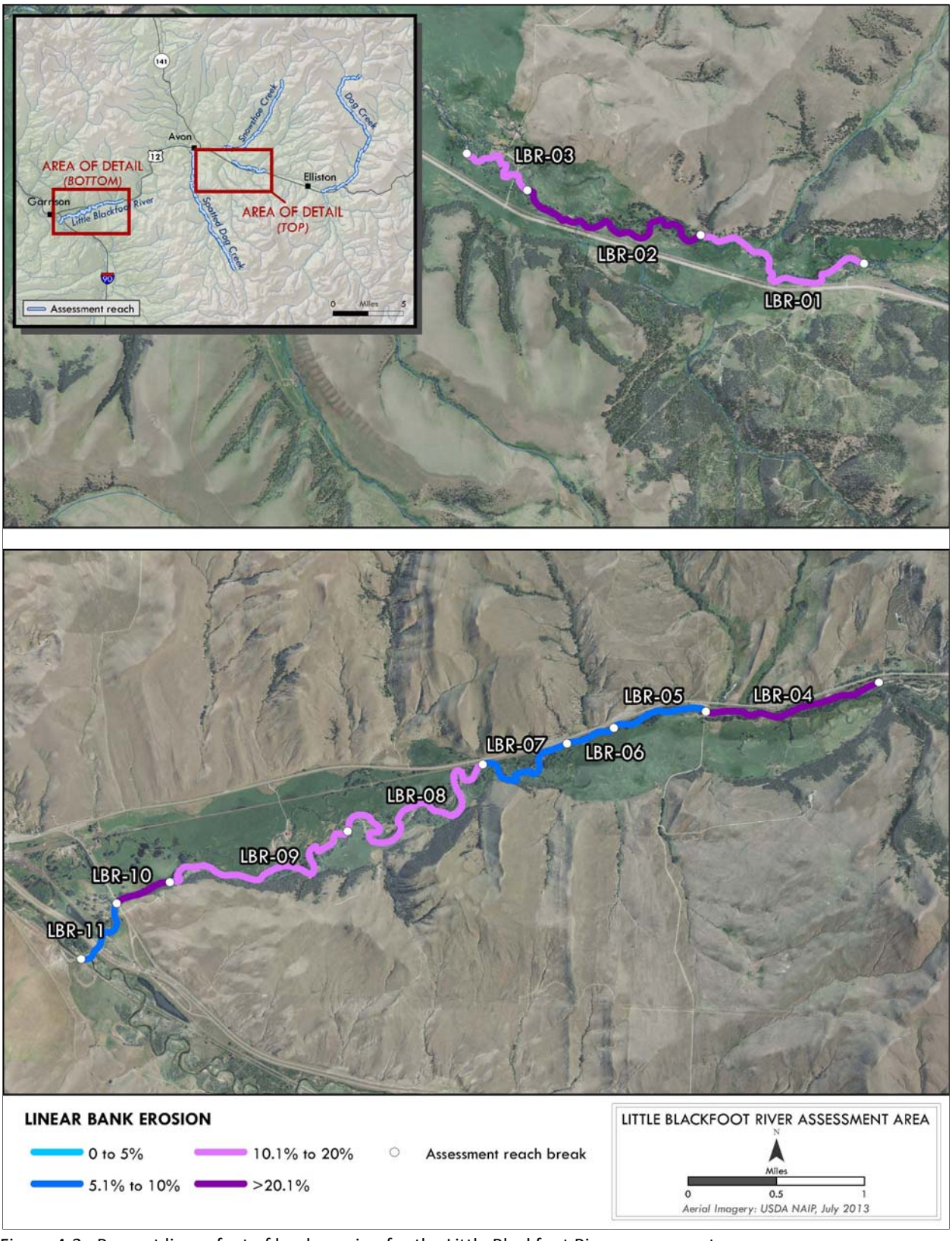


Figure 4-3. Percent linear feet of bank erosion for the Little Blackfoot River assessment area.

4.1.1 Reach LBR-01

NRCS Score: 47% - Not Sustainable; Fish Habitat: 53% - Fair; Bank Erosion: 13.7%
Reach LBR-01 is 6,328 feet in length and located on private land. LBR-01 was visually classified as an F channel type, with a C channel type developing in some sections of the reach. This classification is based on a bankfull width-to-depth ratio estimate of 25-75, a sinuosity of 1.3, a cobble/gravel dominated channel bed, and an estimated channel gradient of 0.2%. The channel is fairly unstable, with active and noticeable incision, and an extensive amount of human-induced erosion of inner and outer banks. Channel incision appears to be a result of manipulations to the channel to protect the railroad, utilities, diversion structures and hayfields. These manipulations consist primarily of riprap and floodplain levees. This channelization has resulted in the channel down-cutting, which is evidenced by loss of connectivity with the historical floodplain. At the incised channel elevation, some point bars and new floodplain surfaces have formed and the channel is more characteristic of a C channel type. The new depositional surfaces are typically on the inside of meander bends opposite eroding or stabilized outer banks. Some mid-channel or excessively large point bars surfaces are also present. Bank erosion is also common in this reach and is a result of channel incision, channel stabilization, clearing of woody vegetation in the floodplain for hay production and physical impact by livestock. There is one water diversion in this reach located near the upstream end of the reach.

The floodplain is characterized by mature black cottonwood with a dry understory of pasture grass, Wood's rose and snowberry. There is a single shrub-dominated, beaver-influenced area in the downstream portion of the reach that is dominated by willow, but overall the reach lacks signs of floodplain connectivity, with the floodplain dominated by dry herbaceous and shrub species. Streambanks are characterized by a low density of woody riparian vegetation consisting primarily of cottonwoods. There is evidence of moderate browse by cattle. Regeneration of desirable woody species, such as willows and cottonwoods, is low due to lack of connectivity between the channel and floodplain.

Flows at the time of the assessment were high, approximately 350 cfs, making fish habitat difficult to assess. In general, fish habitat appeared to consist of infrequent pools with limited cover. Small amounts of large woody debris are present in the reach but overhanging vegetation and undercut banks are severely limited in quantity and quality.

The trend for this reach appears to be declining. In locations where the Little Blackfoot River interacts with the bank armoring, it has become aligned with the armoring in a straight, down-valley pattern. This process is a result of the inability of the river to dissipate energy along the armored segments. In general, this process is caused by increased gradient, sustained velocity and upstream propagation of scour in the form of knickpoints that develop at the toe of the

armoring. Upon becoming incised along the toe of the armored embankment, floodplain disconnection limits the ability of the river to laterally migrate and change its pattern. The trend of channel incision will likely continue due to on-going bank stabilization required to protect the railroad and irrigation diversions. This will continue the trend of lost floodplain connectivity which reduces the function and resiliency of the floodplain over time.

The previous assessment of this reach by Land and Water in 2001 (Reach LBR08 and LBR09) identified similar issues including: straightened and entrenched channel with dropped water table, reduced vegetation productivity, prevalent weeds and cattle impacts actively degrading the vegetative condition. This assessment indicated that banks were stable due to presence of large rock and rootwads, but that the lack of connectivity and ability to dissipate overbank flows may threaten downstream areas. The Land and Water assessment resulted in an overall NRCS sustainability score of 61% and 77%. This reach overlaps with FWP (2009) Reach LBR RM 21.3 (2009) which indicated active erosion where riparian vegetation was absent and some areas of over-widening and braiding. The FWP assessment resulted in overall NRCS sustainability score of 70% for this reach. The lower score (47%) assigned in 2014 appears to be a result of assigning lower scores for stream incisement, lateral cutting and stream balance compared with previous assessments. This difference may be based on an actual decline in conditions in the reach or observer bias, but indicates a declining trend never the less.

Potential restoration actions within this reach include: 1) changing the existing land use (grazing/pasture) or changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion; 3) relocating the channel away from the railroad to address ongoing channel incision and the corresponding lack of floodplain connectivity; and 4) irrigation infrastructure improvements such as screening ditches, relocating diversion points or improving water diversion practices. Bank stabilization and revegetation projects should only be considered in areas where channel instability and incision will not limit the success of treatments. It is likely, that upon a more detailed evaluation of this reach, actively stabilizing and revegetating streambanks along the existing channel, at its existing elevation, may not be desirable. Although not evaluated in detail during the riparian assessment, it does appear that historic channel and floodplain features may be present in this reach that could be reactivated to restore the channel to a more advanced state of channel evolution and restore floodplain connectivity. Restoration actions considered in this reach may require coordination with Yellowstone Pipe Line Company and BNSF Railway in some areas.

Conditions in the reach upstream of Reach LBR-01, extending to the town of Elliston, Montana, and the confluence with Dog Creek, appear to have changed little in the last 20 years. The channel appears to be a steeper and more confined B channel type with reduced floodplain

area, which limits restoration potential. Through the town of Elliston, restoration potential is limited by numerous land owners and small parcel sizes. The primary land use in this area appears to be irrigation of relatively dry land. This reach corresponds with Reach LBR07 assessed by Land and Water in 2002. At that time, this reach was in generally very good condition with stable stream banks, excellent riparian vegetation and localized areas of high quality fish habitat. This assessment identified less than 5 percent of the reach had eroding banks and no critical sediment sources were observed. Through review of various aerial photos dating back to 1995 for this reach, it appears that this assessment is still consistent. Land and Water (2002) identified two major irrigation diversions in this reach. It is likely that there are opportunities to improve diversion and water use efficiency in this area. Due to the difference in channel types, this reach does not provide a good analog for potential restored conditions in Reach LBR-01; however, no factors that would limit potential restoration actions in downstream reaches were identified.

IMG_0102

IMG_0099

4.1.2 Reach LBR-02

NRCS Score: 48% - Not Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 21.1%

Reach LBR-02 is 6,384 feet in length and located on private land. LBR-02 was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 22.5, a sinuosity of 1.3, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.8%. The channel alternates through this reach between straightened sections that are actively incising and over-widened sections where mid-channel bars have formed. The channel incision appears to be a result of historical channel straightening and manipulations to prevent erosion of hayfields and pasture. Flood levees are present along the channel through some of the reach, some of which have been eroded through and may be supplying excess sediment to the reach. There are a high number of eroding banks in this reach, with bank erosion occurring on outside and inside banks and straight sections. Bank erosion is a result of

channel incision resulting from historical channelization and loss of streambank woody vegetation due to grazing and agriculture. One streambank appeared be treated very recently with riprap and willow cuttings to protect the Yellowstone Pipe Line buried gas line that was exposed due to channel incision (IMG_0700). Hurd Creek crosses under Hwy 12 from the south and enters the Little Blackfoot River in this reach. There are three water diversions in this reach and manipulation of the channel and streambanks occurs to maintain the location of diversion points. Beaver activity also may influence the effectiveness of water diversion points.

A large portion of the floodplain in this reach is dominated by dense stands of willows that are maintained by beaver activity with numerous small channels and ponds. Floodplain connectivity has been reduced by channel incision, but off channel beaver activity maintains floodplain diversity and cover by desirable woody vegetation. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, willow species, Wood's rose and common snowberry. There is a moderate distribution of age classes of woody species such as cottonwood and willow but minimal regeneration of woody riparian vegetation due to the lack of connected, stable depositional surfaces. The floodplain within the reach is grazed by cattle, but use appears to be limited and only light browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 350 cfs, making fish habitat difficult to assess. In general, there appeared to be infrequent pools formed by wood and lateral scour. Cover elements include small accumulations of wood, boulders and connected off-channel habitats. Overhanging vegetation and undercut banks are present but limited due to loss of woody vegetation in some areas and bank erosion.

This reach coincides with Reach LBR09 assessed by Land and Water in 2001 (Land and Water 2002). That assessment indicated that channel down-cutting had occurred but that the reach was in near optimal condition, indicating that bank erosion may have increased in this reach since 2001. The 2001 assessment resulted in an overall NRCS sustainability rating of 77%. The lower score (48%) assigned in 2014 appears to be a result of assigning lower scores for stream incisement, lateral cutting and stream balance compared with previous assessments. This difference may be based on an actual decline in conditions in the reach or partially due to observer bias, but indicates a declining trend never the less.

The trend for this reach appears to be declining. The trend of channel incision will likely continue due to on-going bank stabilization required to protect the railroad and irrigation diversions. This will continue the trend of lost floodplain connectivity which may reduce the function and resiliency of the floodplain over time, particularly if beaver activity does not continue in the reach.

Potential restoration actions within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion; 3) removing channel constraints such as floodplain levees to address ongoing channel incision and the corresponding lack of floodplain connectivity; 4) replacing existing riprap and bank stabilization measures with deformable, vegetation-based treatments that offer higher quality fish habitat; and 5) irrigation infrastructure improvements such as screening ditches, relocating diversion points or improving water diversion practices. Bank stabilization and revegetation projects should only be considered in areas where channel instability and incision will not limit the success of treatments. Channel incision becomes less in Reach LBR-02 in a downstream direction, with the channel and floodplain generally connected where if flows under Snowshoe Creek Road. There are many diverse floodplain areas in this reach that are currently connected to the channel or could be connected with the removal of floodplain levees or active channel restoration. Restoration actions considered in this reach may require coordination with Yellowstone Pipe Line Company and BNSF Railway in some areas.

IMG_0079

IMG_0070

4.1.3 Reach LBR-03

NRCS Score: 82% - Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 16.5%

Reach LBR-03 is 2,929 feet in length and located on land owned by the State of Montana. LBR-03 was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 14-30, a sinuosity of 1.4, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.6%. The channel in the upstream portion of this reach appears stable with a meandering plan form, well developed point bars and a connected floodplain. Grazing impacts and bank erosion increase in a downstream direction. There is no fence between this property and the downstream private property and cattle have full access to the left (south) side of the channel. There is one water diversion in this reach located just

below the Snowshoe Creek Road Bridge. The channel is eroding towards this ditch and there is approximately 10 feet between the streambank and the ditch. It appears that the entrance to this ditch may have been moved recently due to continued accumulations of woody debris.

The floodplain in the upper part of this reach is dominated by black cottonwood with a diverse understory of riparian shrubs, forbs and grasses. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, willow species, dogwood, chokecherry, Wood's rose and currant. There is a moderate distribution of age classes of woody species such as cottonwood and willow and some regeneration of cottonwoods and willows on point bar features. The floodplain within the reach is grazed by cattle, and light to moderate browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 350 cfs, making fish habitat difficult to assess. In general, there appeared to be infrequent pools formed by wood and lateral scour in the reach. Cover elements include accumulations of wood, boulders, overhanging vegetation, and undercut banks. Cover elements and pools are diverse but decrease in quantity in a downstream direction.

This reach coincides with Reach LBR10A assessed by Land and Water in 2001 (Land and Water 2002). That assessment indicated that the reach was relatively healthy with diverse aquatic habitat, generally stable banks, and good riparian vegetation with an active, accessible floodplain. There was some bank erosion present, but no critical sediment sources. This is consistent with observations made in 2014, although it is likely that bank erosion has increased since 2001 since no natural or active stabilization or revegetation of eroding banks has occurred in this reach. The 2001 assessment resulted in an overall NRCS sustainability rating of 77% and 64%. The higher score (82%) assigned in 2014 appears to be a result of assigning higher scores for lateral cutting and riparian cover. This difference may be based on an actual improvement in conditions in the reach or observer bias, but indicates a stable or improving trend never the less.

The overall trend of this reach is dynamically stable. Most of the reach exhibits a stable channel planform with a connected floodplain. Grazing impacts are resulting in erosion of outer banks and over time this may lead to increased sediment deposition in the reach and instability. Due to the existing high quality habitat in the floodplain in this reach, the benefits of excluding grazing and actively revegetating eroding streambanks would be high.

Potential restoration actions within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion; and 3) irrigation infrastructure improvements such as screening the diversion ditch.

Downstream of Reach LBR-03, generally extending to the town of Avon, Montana, the Little Blackfoot River appears to have been very dynamic with a very large active floodplain in the past. The reach has been extensively channelized and it appears that the reach has incised and lost connection with the floodplain. It also appears that aquatic habitat is extremely limited in this reach. The section near the confluences with Snowshoe Creek probably had very high ecological value and could be a high priority for restoration. This reach corresponds with Reach LBR10B assessed by Land and Water in 2002. Based on the results of that assessment very little appears to have changed in this reach over time. The 2002 assessment did indicate the presence of groundwater inflows in this reach, creating cold, clear water. This further indicates the high potential for restoration for this area. Conditions in this reach may influence potential upstream restoration actions if channelization results in further channel incision that may migrate upstream. At this time, it appears that channel incision is not active.

DSCN1181_194

DSCN1192_205

4.1.4 Reach LBR-04

NRCS Score: 68% - Sustainable; Fish Habitat: 60% - Fair; Bank Erosion: 20.9%

Reach LBR-04 is 5,460 feet in length and located on private land. LBR-04 was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate of 16, a sinuosity of 1.0, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.4%. The reach has a very low entrenchment ratio based on visual observation, and may fall outside of the range of a B channel. The channel has been straightened and channelized against the railroad, which runs parallel to the channel. Riprap was placed along the railroad to protect it from erosion. Some sections of riprap have revegetated with woody and herbaceous vegetation. The channel is entrenched approximately 4 feet below the historical floodplain surface and some new floodplain surfaces have formed at the new channel elevation. These surfaces are generally well vegetated with willows, alders and cottonwoods

along the north side of the channel. Cattle can access the surfaces that have developed along the south side of the channel limiting woody vegetation establishment. No water diversions were observed in this reach.

The historical floodplain surface located along the south side of the channel is dominated by black cottonwood with an understory of dominated by dry shrub species such as rose, snowberry and juniper. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, dogwood, Wood's rose and currant. There are numerous old channel features in the former floodplain. There is also an access road that runs through the floodplain. The floodplain within the reach is grazed by cattle, and light to moderate browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with only a few pools formed by woody debris accumulation in the channel. Cover elements include accumulations of wood, boulders, overhanging vegetation, and undercut banks, but these are severely limited.

This reach coincides with Reach LBR15B assessed by Land and Water in 2001 (Land and Water 2002). That assessment indicated that the reach was a long, straight channelized section adjacent to the railroad grade with a wide, shallow, entrenched channel and very poor fish habitat. This assessment indicated water quality issues in this reach along with the potential for shallow water may pose passage issues for fish. This is consistent with observations made in 2014, although issues related to low water could not be observed in 2014. The 2001 assessment resulted in an overall NRCS sustainability rating of 51%. The higher score (68%) assigned in 2014 appears to be a result of higher scores for riparian vegetation cover, stream balance, deep binding rootmass, and riparian vegetation cover. This difference may be based on an actual improvement in conditions, observations made during high flows, or observer bias, but indicates a stable or improving trend never the less. This reach also coincides with a reach used by DEQ for TMDL development (LBR 30-05). That assessment indicated 41% greenline shrub cover in this reach, which is consistent with observations made in 2014.

The overall trend of this reach is likely stable. Channel evolution processes have abandoned the historical floodplain, and the likelihood of reconnection by natural processes is low. The channel has incised due to channelization from stabilization measures installed to protect the railroad and possible channel relocation for agricultural purposes. There is bank erosion along the left bank of the channel opposite the railroad. There are a few new floodplain surfaces that have developed along the south side of channel but most lack woody vegetation. Further channel incision is not likely to occur but continued lateral adjustments will likely be accelerated by land use. The natural recovery potential of this reach is very low due to the confinement of the channel.

Potential restoration projects within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion; 3) construction of bank or channel structures to improve aquatic habitat, primarily large pools for migratory fish; and 4) active channel restoration and relocation to the south, or reactivation of former floodplain channels to reestablish floodplain connectivity and improve aquatic habitat.

The reach upstream of LBR-04, extending generally upstream to the Hwy 12 bridge over the Little Blackfoot River, is similar to the conditions within Reach LBR-04. There are numerous constraints related to the railroad, Highway 12, and land use. This reach corresponds with reach LBR15A assessed by Land and Water in 2002. Based on the results of that assessment and review of aerial photos dating back to 1995, very little appears to have changed in this reach over the last 20 years. Although very little has changed in this reach over time, the confinement of the channel is a potential risk to downstream restoration actions. Because there is little floodplain connectivity and the reach is primarily a sediment transport reach, a large flood event could result in routing of large amounts of sediment through this reach.

IMG_0540

IMG_0535

4.1.5 Reach LBR-05

NRCS Score: 82% - Sustainable; Fish Habitat: 60% - Fair; Bank Erosion: 9.4%

Reach LBR-05 is 2,942 feet in length and located on private land. LBR-05 was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate of 25, a sinuosity of 1.0, a gravel/cobble dominated channel bed, and an estimated channel gradient of 1.0%. The reach has a very low entrenchment ratio based on visual observation and may fall outside of the range of a B channel. The channel has been straightened and channelized against the railroad, which runs parallel to the channel. Riprap was placed along the railroad to protect it from erosion. Some sections of riprap have revegetated with woody and herbaceous vegetation. Along the south edge of the channel floodplain levees were

constructed, some of which are still present, others have been eroded through. The channel is entrenched approximately 2 feet below the historical floodplain surface and some new floodplain surfaces have formed at the new channel elevation. These surfaces are generally well vegetated with willows and cottonwoods and typically support small overflow channels and connected backwater areas at the downstream end of each feature. No water diversions were observed in this reach.

The historical floodplain surface located along the south side of the channel is dominated by black cottonwood with an understory of dominated by dry shrub species and pasture grasses. Outside of the narrow cottonwood dominated riparian corridor, the land use is primarily pasture and flood irrigated hay fields. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, dogwood, Wood's rose and currant. The floodplain along the south side of the channel is grazed by cattle, and light to moderate browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with only a few pools formed by lateral scour. Cover elements include boulders, overhanging vegetation, and undercut banks, but these are severely limited.

The overall trend of this reach is stable. The channel has incised due to channelization from stabilization measures installed to protect the railroad, flood levees, and possible channel relocation for agricultural purposes. A new, inset floodplain has developed along the new channel elevation and these features are well vegetated with woody vegetation. There are some eroding banks (9.4%) primarily due to removal of woody vegetation along the channel. Further channel incision is not likely to occur but continued lateral adjustments may continue. The natural recovery potential of this reach is very low due to the confinement of the channel.

Potential restoration projects within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion or replace existing riprap; and 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat.

IMG_0455

IMG_0460

4.1.6 Reach LBR-06

NRCS Score: 80% - Sustainable; Fish Habitat: 60% - Fair; Bank Erosion: 5.3%

Reach LBR-06 is 1,517 feet in length and located on Montana Department of Natural Resources and Conservation (DNRC) land. LBR-06 was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 20, a sinuosity of 1.0, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.2%. The reach has a very low entrenchment ratio based on visual observation. The channel has been straightened and channelized against the railroad, which runs parallel to the channel. Riprap was placed along the railroad to protect it from erosion. Some sections of riprap have revegetated with woody and herbaceous vegetation. Material has also been placed along the south side of the channel to reduce bank erosion and limit overbank flows. The channel is entrenched approximately 2 feet below the historical floodplain surface and some new floodplain surfaces have formed at the new channel elevation. These surfaces are moderately well vegetated with willows and cottonwoods. No water diversions were observed in this reach.

Very little woody vegetation is present along the south side of the channel and some banks are eroding (5.3% of total bank length). Very little woody vegetation is present along the south side of the channel and land use is primarily pasture and flood irrigated hay fields. The floodplain along the south side of the channel is grazed by cattle, and light to moderate browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with only a few pools formed by lateral scour. Cover elements include boulders, overhanging vegetation, and undercut banks, but are severely limited. The 2007 riparian assessment completed by FWP in

this reach indicated summer flows were very low in the sample reach and throughout the lower Little Blackfoot River.

The overall trend of this reach is declining. The channel has incised due to channelization from stabilization measures installed to protect the railroad, flood levees, and possible channel relocation for agricultural purposes. A new, connected floodplain has developed along the new channel elevation but woody vegetation cover on these surfaces is moderate. There is limited woody vegetation on the left bank and the elevation of these surfaces above the active channel limits the ability for these surfaces to natural recruit and support desirable woody vegetation. Further channel incision is not likely to occur but continued lateral adjustments may continue. The natural recovery potential of this reach is very low due to the confinement of the channel.

Potential restoration projects within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion or to replace existing riprap; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat.

IMG_0467

IMG_0468

4.1.7 Reach LBR-07

NRCS Score: 93% - Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 6.6%

Reach LBR-07 is 3,616 feet in length and located on private land. LBR-07 was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 15, a sinuosity of 1.4, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.1%. The channel in this reach appears stable with a meandering plan form, well developed point bars and a well vegetated, connected floodplain. Grazing occurs in the reach, but impacts are limited due to the diversity of the floodplain and dense vegetation. There is one water diversion in this reach on the north side of the channel, located at the downstream end (IMG_0485). This diversion feeds two ditches and also returns extra diverted flows back to

the main channel. There did not appear to be a diversion structure in the channel to feed this ditch; however, high flows at the time of assessment made it difficult to observe. It appears that a water diversion was present on the south side of the channel but the ditch entrance was recently blocked (IMG_0484).

The reach is characterized by a wide, diverse floodplain with a high density of woody riparian vegetation along the streambanks consisting of cottonwood, willow species, dogwood, chokecherry, Wood's rose and currant. All age classes of woody species such as cottonwood and willow are present and regeneration of cottonwoods and willows was observed on point bar features. The floodplain within the reach is grazed by cattle, and light browse of shrubs was observed.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, there appeared to be both shallow and deep pools formed by woody debris, overhanging vegetation, boulders and undercut banks. Numerous cover elements are present within the channel and within the floodplain.

The overall trend of this reach is dynamically stable. The reach is highly functioning in terms of aquatic habitat and floodplain diversity.

The potential restoration action within this reach is conservation and preservation.

IMG_0482

IMG_0484

IMG_0485

4.1.8 Reach LBR-08

NRCS Score: 75% - At Risk; Fish Habitat: 80% - Good; Bank Erosion: 10.7%

Reach LBR-08 is 8,211 feet in length and located on private land. LBR-08 was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 17.5-23, a sinuosity of 1.8, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.4%. The channel in this reach appears relatively stable with a meandering plan form, well developed point bars and a connected floodplain. The floodplain extent is reduced compared with Reach LBR-07 and channel instability increases in a downstream direction as eroding banks become more common. Grazing impacts and bank erosion increase in a downstream direction with most outside bends actively eroding or actively stabilized with various materials. Near the downstream end of the reach there is a risk of channel avulsion where a meander bend with a tight radius of curvature is present. Water was flowing across this meander bend during the time of assessment. The landowner is actively placing material at the overflow point to prevent an avulsion here. Localized areas of channel aggradation were observed that are exacerbating overbank flooding and disturbance to agricultural fields. Lateral migration rates appear to be driven by high sediment loads and decreased bank stability due to loss of vegetation. There is a gravel extraction pit in the avulsion path and some active head-cutting was observed (IMG_0497). There are no water diversions in this reach.

The floodplain is dominated by black cottonwood with a diverse understory of riparian shrubs, forbs and grasses. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, willow species, dogwood, chokecherry, Wood's rose and currant. There is a moderate distribution of age classes of woody species such as cottonwood and willow and some regeneration of cottonwoods and willows on point bar features. The floodplain within the reach is grazed by cattle, and light to

moderate browse of shrubs was observed. Some of the floodplain has been cleared of woody vegetation to support hay production and outer meanders are actively eroding into these areas.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, there appeared to be pools formed by wood and lateral scour in the reach. Cover elements include accumulations of wood, boulders, overhanging vegetation, and undercut banks. Cover elements and pools are diverse but decrease in quantity in a downstream direction.

The overall trend of this reach is declining. Much of the reach exhibits a stable planform with a connected floodplain, but instability increases in a downstream direction, and encroachment of pastures and hay fields with reduced vegetation has led to continued active bank stabilization which is increasing erosion and instability. Continued treatment of active bank margins in this reach is not a sustainable restoration strategy. As evidenced throughout the reach, the active margins are constantly changing and dominant river processes are not controlled effectively by dispersed bank treatments. If land use were to change, including actions to stabilize eroding streambanks, the natural recovery potential of this reach would be high due to the large area of potential floodplain.

The 2001 Land and Water assessment provides a comparison of the channel location in this reach between 1979 and 1995. The channel migrated significantly between 1979 and 1995, but has changed little since 1995, likely due to continual efforts to stabilize the channel. The 2013 aerial photos do show the increased risk of a potential channel avulsion in this reach through both the down valley and up valley migration of the channel at the upstream and downstream ends of the potential cutoff area.

Potential restoration actions within this reach include: 1) changing the existing land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing bank stabilization and revegetation measures to reduce bank erosion or to replace existing riprap; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; and 4) channel relocation and re-naturalization to allow channel movement and increase floodplain function and aquatic habitat. Prior to pursuing potential restoration actions in this reach, a comprehensive approach should be developed that integrates restoration treatments that are compatible with land uses. This approach could include compromises to balance river function and land use in order to demonstrate the potential benefits of restoration strategies in a localized area. The elements of this strategy would be developed collaboratively between the landowner and the project stakeholders. This reach generally supports a wide floodplain connected to the channel and may be an ideal place to implement pilot streambank projects. However, other issues such as dewatering, that could not be observed during this assessment may be limiting factors in this reach.

IMG_0490

IMG_0497

4.1.9 Reach LBR-09

NRCS Score: 72% - At Risk; Fish Habitat: 60% - Fair; Bank Erosion: 10.6%

Reach LBR-09 is 7,270 feet in length and located on private land. LBR-09 was visually classified as a C channel type in the upstream portion of the reach and an F channel type in the downstream portion of the reach. This classification is based on a bankfull width-to-depth ratio estimate of 18, a sinuosity of 1.3, a cobble dominated channel bed, and an estimated channel gradient of 0.4. The channel in the upstream portion of this reach has a meandering planform, but numerous attempts to stabilize the north side of the channel have resulted in instability including erosion of outside meanders and straight sections, mid-channel deposition and enlarged point bars. All outer meander bends on the north side of the channel are stabilized with various types of materials including channel alluvium, concrete blocks, bailing wire and angular riprap (IMG_0521). The floodplain extent is reduced compared with Reach LBR-08 with islands of woody vegetation only present within the meander belt width. The downstream portion of this reach is confined to the edge of valley and has a very low entrenchment ratio based on visual observation. The channel has incised through the lower part of the reach up to 4 feet. New floodplain surfaces have developed at the lower channel elevation and most are well vegetated with cottonwoods and willows. The north side of the channel is well stabilized with various forms of riprap. There is a riparian fence that extends along the north side of the channel for most of this reach (IMG_0528). No water diversions were observed in this reach.

Within the meander belt width, the floodplain is dominated by black cottonwood with a diverse understory of riparian shrubs, forbs and grasses. Outside of the meander belt width vegetation is primarily pasture grasses. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of cottonwood, willow species, dogwood and alder. All age classes of woody species such as cottonwood and willow are present and some regeneration of cottonwoods and willows on point bar features. Some of the floodplain

has been cleared of woody vegetation to support hay production and grazing, and outer meanders are either actively eroding into these areas or stabilized by various forms of riprap.

Flows at the time of the assessment were high, approximately 800 cfs, making fish habitat difficult to assess. In general, there appear to be few pools in this reach and cover elements are lacking due to channel over-widening and braiding or channel straightening and channelization. Cover elements are greatly reduced in the reach but include accumulations of wood, boulders, overhanging vegetation, and undercut banks.

The overall trend of this reach is declining. The continued stabilization of the north side of the channel has resulted in channel instability and erosion that will continue. If land use were to change, including actions to stabilize eroding streambanks, the natural recovery potential of this reach would be high due to the large area of potential floodplain.

Potential restoration actions within this reach include: 1) implementing bank stabilization and revegetation measures to reduce bank erosion or replace existing riprap; 2) changing land management or land uses to conserve a channel migration corridor that will allow the channel to naturally recover; 3) creating a riparian corridor in areas where land use has resulted in vegetation clearing; 4) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat. Prior to pursuing potential restoration actions in this reach, a comprehensive approach should be developed that integrates restoration treatments that are compatible with land uses. This approach could include compromises to balance river function and land use in order to demonstrate the potential benefits of restoration strategies in a localized area. The elements of this strategy would be developed collaboratively between the landowner and the project stakeholders.

IMG_0521

IMG_0528

4.1.10 Reach LBR-10

NRCS Score: 80% - At Risk; Fish Habitat: 50% - Fair; Bank Erosion: 24.9%

Reach LBR-10 is 1,747 feet in length and located on private land. This reach ends at the I-90 access road bridge where the USGS Garrison gage station is located. LBR-10 was visually classified as an F channel type. This classification is based on a bankfull width-to-depth ratio estimate of 24, a sinuosity of 1.0, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.04%. The reach has a very low entrenchment ratio based on visual observation. The channel has been straightened and channelized against the steep valley wall, which consists of numerous bedrock outcrops. There are floodplain levees along the north side of the channel and the channel is riprapped along the north side upstream of the bridge. The channel is entrenched approximately 4 feet below the historical floodplain surface and some new floodplain surfaces have formed at the new channel elevation. These surfaces are generally well vegetated with willows, alders and cottonwoods along the north side of the channel. The north side of the channel is fenced, leaving a 20 to 50 foot wide riparian corridor and the south side of the channel has limited access due to the steep valley wall. Most of the streambanks on the north side of the channel are actively eroding (24.9% of reach) and there is some mid-channel deposition in this reach, likely due to bank erosion. No water diversions were observed in this reach; however, a small ditch flows parallel to the channel through this reach, just outside of the floodplain levee (IMG_0445).

The historical floodplain surface located along the south side of the channel is dominated by black cottonwood with an understory of dry shrub species such as chokecherry, rose, currant, and snowberry. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks, dominated by alder, willow and dogwood on lower surfaces. Weed densities were higher in this reach compared with others, likely due to easy access from the road by fisherman. The only noxious weed species observed at the time of the assessment was spotted knapweed. There is one large old channel feature on the south side of the channel, outside of the floodplain levees with dense riparian vegetation and deep aquatic habitat (IMG_0443).

Flows at the time of the assessment were high, approximately 900 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with only a few pools formed by lateral scour. Cover elements are limited but include accumulations of wood, boulders, overhanging vegetation, and undercut banks.

The overall trend of this reach is declining. The north side of the channel will continue to actively erode as the channel continues to adjust to the lower channel elevation. The natural recovery potential of this reach is low due to confinement of the channel by floodplain levees.

Potential restoration projects within this reach include: 1) implementing bank stabilization and revegetation measures to reduce bank erosion; 3) restoring connectivity with the historical channel to provide off-channel habitat; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; and 4) weed control.

IMG_0441

IMG_0447

IMG_0443

IMG_0445

4.1.11 Reach LBR-11

NRCS Score: 68% - At Risk; Fish Habitat: 57% - Fair; Bank Erosion: 7.9%

Reach LBR-11 is 2,347 feet in length and located on private land. LBR-11 was visually classified as an F channel type. This classification is based on a bankfull width-to-depth ratio estimate of 23, a sinuosity of 1.2, a gravel/cobble dominated channel bed, an estimated channel gradient of 1.0% and a very low entrenchment ratio (based on visual observation). This reach begins at the I-90 access road bridge and ends at the confluence with the Clark Fork River. There is a lot of infrastructure in this reach, including three road bridges, two over I-90, and one railroad bridge. In addition, a very large flood levee was constructed along the north side of the channel to protect the campground located to the north of the river and this levee disconnects the river

from the historical floodplain. According to the landowner, this levee was built in 1981 after a very large flood event. Most of the channel through this reach is stabilized with riprap to protect infrastructure. This stabilization of the channel has resulted in channel incision up to 4 feet below this historical floodplain elevation. There are some large areas of deposition at the new channel elevation, some densely vegetated with willows, some vegetated with mature cottonwoods and some only sparsely vegetated. The landowner opposite the campground has attempted to plant along the channel with little success due to the high elevation of the floodplain above the active channel. The channel becomes connected to the floodplain again near the confluence with the Clark Fork River. Contaminated sediments (mine tailings) are noticeable along most of the left bank of the Little Blackfoot River downstream of the I-90 bridges (IMG_0422).

The historical floodplain surface has been heavily manipulated and now supports primarily residential or commercial structures and herbaceous species that are frequently mowed. There are some remnant cottonwood stands in the historical floodplain along the channel. The flood levees and riprap along the channel consist of primarily herbaceous, weedy species. The reach is characterized by a low density of woody riparian vegetation along the streambanks. Weed densities were higher in this reach compared with others, likely due to easy access from the road by fishermen. The only noxious weed species observed at the time of the assessment was spotted knapweed. Depositional features that have developed along the channel support numerous age classes of willows and cottonwoods.

During the time of this assessment flows were high, estimated to be approximately 900 cfs. Fish habitat consists of a reduced number of pools and cover elements. Small amounts of large woody debris are present but overhanging vegetation and undercut banks are severely limited in quantity and quality.

The overall trend of this reach is declining. The channel has incised due to channelization from stabilization measures installed to protect existing infrastructure. Bank erosion will likely continue which will result in accumulations of sediment in the channel that may or may not vegetate over time. The natural recovery potential of this reach is low due to confinement of the channel by floodplain levees.

Potential restoration projects within this reach include: 1) revegetating the riparian corridor, including constructed flood levees; 2) implementing bank stabilization and revegetation measures to replace existing riprap in select locations; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; and 4) weed control.

IMG_0413

IMG_0420

IMG_0425

IMG_0422

4.2 Dog Creek

Dog Creek is a tributary to the Little Blackfoot River that flows for approximately 16 miles before entering the Little Blackfoot River near the town of Elliston at river mile 26.1. Lands along Dog Creek are primarily in private ownership. While there are publicly owned lands in the upper portion of the watershed that are administered by the Bureau of Land Management and the U.S. Forest Service, numerous privately owned mining claims comprise the majority of upper Dog Creek. The primary land uses in the Dog Creek drainage include cattle grazing, timber harvest, recreation and historical mining.

Based on Lindstrom, et al. 2008 the Dog Creek fishery is comprised of a mix of native and non-native fish species. At river mile 1.3, trout composition was made up of both westslope cutthroat trout and brown trout, with brown trout being the most common. In addition to trout, longnose dace, mountain whitefish and longnose sucker and slimy sculpin were also

sampled at this location. At river mile 5.1, the trout community was dominated by brown trout with westslope cutthroat trout present but uncommon. Trout densities were low at this location, but may have been a result of inefficient sampling due to extensive beaver ponds throughout the area. At river mile 10.4, brown trout again dominated the trout community. Westslope cutthroat trout were also present, but uncommon. Mountain whitefish, slimy sculpin and longnose suckers were also present at this site. At river mile 13.8, the fish community shifted to primarily westslope cutthroat trout, with brown trout present, but uncommon. Although uncommon, a very large brown trout was sampled in this reach. Longnose suckers were also present in this reach.

The lower segment of Dog Creek (MT76G004_072) (Meadow Creek to confluence with Little Blackfoot River) is listed for sedimentation/siltation on the 2010 303(d) list. In addition, this segment is also listed for alteration in stream-side or littoral vegetative covers, which is non-pollutant commonly linked to sediment impairment. Lower Dog Creek is listed for sediment impairment based on overutilization of the riparian area by livestock, bank erosion associated with channelization from the railroad, and sediment inputs from the road.

Table 4-3 summarizes the results of the assessments completed along Dog Creek including the channel type, percent bank erosion, NRCS score and rating and fish habitat score and rating. Figure 4-4 shows the NRCS rating by assessment reach. Figure 4-5 shows the percent bank erosion by reach. The assessments results indicate a general decline in riparian and aquatic habitat in a downstream direction. Many of the upper assessment reaches are beaver complexes with diverse habitats. From approximately Reach Dog-11 downstream, the valley bottom becomes narrower and the railroad bisects much of the valley bottom, which has resulted in significant channelization of the stream resulting in incision and lost floodplain connectivity. Riparian grazing is also contributing to loss of riparian vegetation and bank erosion. The valley bottom widens again in Reach Dog-14, but the floodplain and channel have been highly manipulated due to land management and residential development.

The primary restoration actions for Dog Creek include: 1) preservation and conservation of high quality beaver complex habitat; 2) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 3) implementing streambank stabilization and revegetation measures; and 4) installing aquatic habitat enhancement structures.

Table 4-3. Summary of Dog Creek assessment reach characteristics. Green shaded cells indicate remotely-assessed reaches.

Reach ID	Reach Length (ft)	Channel Type	Primary Land Use	Linear Bank Erosion (%)	NRCS Score (%)	NRCS Rating	Fish Habitat Score (%)	Fish Habitat Rating
Dog-01	1,065	DA	Natural	0.0%	95%	Sustainable	47%	Fair
Dog-01a-R	635	DA/E	Natural, Grazing	NA	89%	Sustainable	NA	NA
Dog-02	974	E	Natural, Grazing	2.6%	85%	Sustainable	70%	Fair
Dog-02a-R	2,628	E	Natural, Grazing	NA	64%	At Risk	NA	NA
Dog-03	1,999	E	Grazing	NA	62%	At Risk	53%	Fair
Dog-03a-R	10,979	E	Grazing	NA	58%	At Risk	NA	NA
Dog-03b-R	9,231	E/DA	Natural	NA	96%	Sustainable	NA	NA
Dog-04-R	1,446	E/DA	Natural	NA	91%	Sustainable	NA	NA
Dog-04a-R	8,123	E/DA	Natural, Grazing	NA	85%	Sustainable	NA	NA
Dog-05	2,503	DA	Natural	0.0%	98%	Sustainable	90%	Good
Dog-06	5,042	E/B/DA	Light Grazing	1.5%	85%	Sustainable	100%	Good
Dog-07	3,764	DA/E	Grazing	2.8%	97%	Sustainable	100%	Good
Dog-08	3,763	DA/E	Grazing	2.5%	97%	Sustainable	100%	Good
Dog-09	2,650	DA	Natural, Grazing	1.8%	98%	Sustainable	90%	Good
Dog-10	1,911	F/C	Natural, Grazing	10.9%	68%	At Risk	43%	Fair
Dog-11a	891	F/C	Formerly grazed	37.0%	47%	Not sustainable	33%	Poor
Dog-11b	2,395	E/C	Transportation corridor, Grazing	10.0%	65%	At Risk	33%	Poor
Dog-12a	4,963	E	Natural/Minimal management	7.8%	83%	Sustainable	57%	Fair
Dog-12b	1,759	F/B	Natural/Minimal management	3.2%	72%	At Risk	43%	Fair
Dog-13a	1,427	G/F/B	Transportation corridor	9.5%	84%	Sustainable	53%	Fair
Dog-13b	4,908	B/G	Transportation corridor	4.0%	88%	Sustainable	59%	Fair
Dog-14	706	B	Grazing, Residential	8.9%	68%	At Risk	70%	Fair
Dog-15-R	2,497	B/F	Grazing	NA	58%	At Risk	NA	NA
Dog-16-R	2,670	E	Natural, Grazing	NA	81%	Sustainable	NA	NA

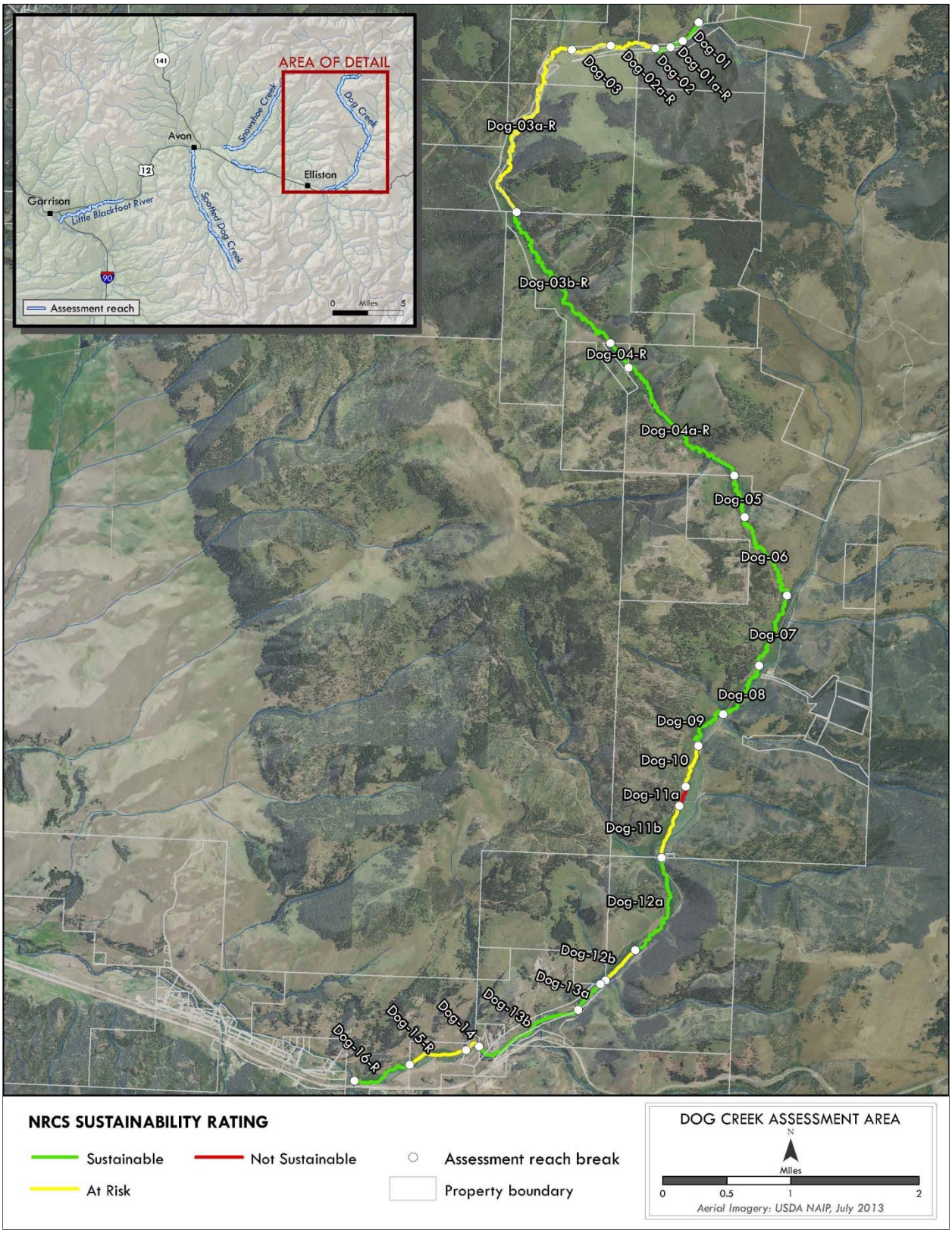


Figure 4-4. NRCS riparian assessment sustainability ratings results for the Dog Creek assessment area.

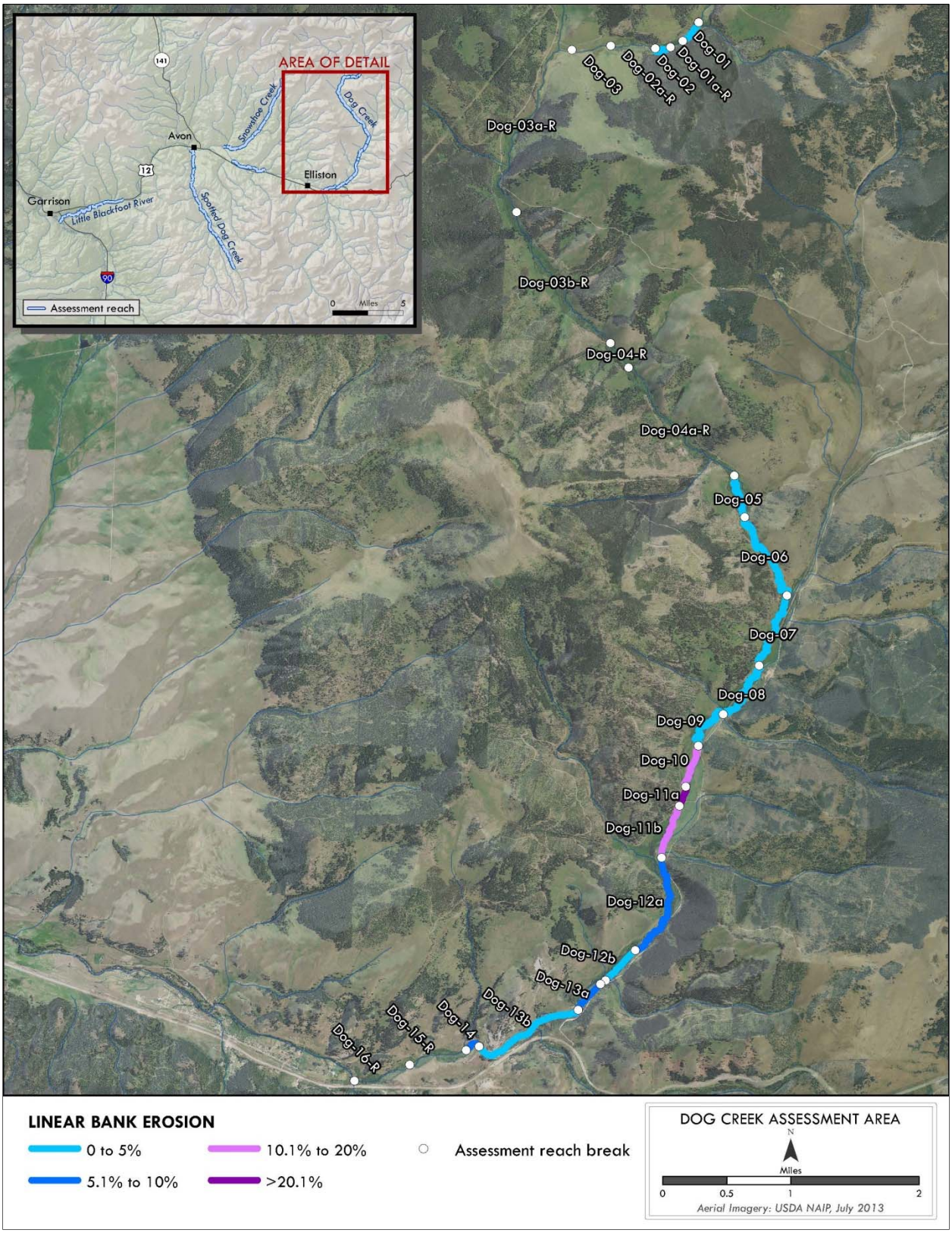


Figure 4-5. Percent linear feet of bank erosion for the Dog Creek assessment area.

4.2.1 Reach Dog-01

NRCS Score: 95% - Sustainable; Fish Habitat: 47% - Fair; Bank Erosion: 0.0%

Reach Dog-01 is 1,066 feet in length and located on private land. Dog-01 is a beaver complex that was visually classified as a DA channel type. There are multiple channels in this reach, but the primary channel observed had a bankfull width-to-depth ratio estimate of 5 to 40, a sinuosity of 1.1 and an estimated channel gradient of 1.3%. This reach is heavily influenced by beaver activity, resulting in a number of small, highly variable channels draining a large ponded area without a distinct main channel. Substrate consists primarily of silt and sand covered gravel channel beds. There are a number of small head-cuts present due primarily to beaver dam failure. Water levels were at or slightly above bankfull during the assessment making it difficult to accurately assess bank erosion, but minimal lateral erosion was observed and expected in this reach. There was also no evidence of over-widening of the stream.

At the time of this assessment, bankfull flows and high groundwater inundated or saturated the floodplain throughout the reach. Dense woody riparian vegetation, consisting primarily of willow species, dominates the reach. Middle age class willows, generally less than six feet tall, are the dominant woody vegetation with moderate regeneration of younger age classes. Mature and decadent age classes are rare, likely due to beaver activity.

High water levels associated with the beaver ponds and locally high groundwater limit human-caused impacts to this reach. This area is not protected from adjacent grazing and livestock use, but the area is likely too wet for sustained livestock access and associated impacts.

Fish habitat is diverse including large amounts of cover/shading due to riparian vegetation and overhanging banks, variable channel depths and a moderate amount of woody debris.

Overall, the trend in this reach is dynamically stable. The reach exhibits characteristics of a healthy and sustainable beaver/wetland complex and protection and conservation of this area should be a high priority.

Potential restoration actions include: 1) fencing to protect the reach from adjacent grazing land use; and 2) conservation and preservation.

DSCN1285_298

DSCN1276_289

4.2.2 Reach Dog-01a-R

NRCS Score: 89% - Sustainable; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-01a-R is 635 feet in length and located on private land. Reach Dog-01a-R is a beaver complex that was visually classified as a DA channel type with some sections having characteristics of an E channel type. The reach is heavily influenced by beaver activity, resulting in a number of small, highly variable channels without a distinct main channel. The estimated width-to-depth ratio for this reach varies significantly in a range of 5-40, with a sinuosity of 1.13, and a channel gradient of 1.0%.

This reach was remotely assessed, but is similar to field-assessed reaches immediately upstream and downstream (Dog-01 and Dog-02). These reaches are characterized by a well-connected floodplain with dense and diverse riparian vegetation, and little to no bank erosion or channel incision. Small headcuts may be present due to beaver dam failure, but geomorphic impacts are minimal.

This area is not protected from adjacent grazing and livestock use, but a wide riparian buffer area (approximately 300 feet wide) and the existing hydrology likely result in ponding or saturated soils throughout much of the year making this area too wet for sustained livestock access and associated impacts.

Dense riparian vegetation throughout the reach suggest that cover components for fish habitat such as woody debris, root wads, and overhanging vegetation are likely to be present and providing good fish habitat.

The trend in this reach is dynamically stable. Overall, this reach exhibits the characteristics of a healthy and sustainable beaver/wetland complex and protection and conservation of this area should be a high priority.

Potential restoration actions include: 1) fencing to protect the reach from adjacent grazing land use; and 2) conservation and preservation. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.3 Reach Dog-02

NRCS Score: 85% - Sustainable; Fish Habitat: 70% - Fair; Bank Erosion: 2.6%

Reach Dog-02 is 974 feet in length and located on a combination of public and private land. This reach was visually classified as an E channel type. The estimated width-to-depth ratio for this reach is approximately 4, with a sinuosity of 1.6, a gravel-dominated channel bed, and an estimated channel gradient of 0.7%.

This reach transitions from a beaver-influenced wetland complex at the upstream extent of the reach to a drier floodplain with more grazing impacts and agricultural land use downstream. Floodplain connectivity remains high within much of the reach, evidenced by small overflow channels and surface ponding, and a wide riparian buffer dominated by dense riparian shrubs and sedges. Groundwater seeps from the base of the hillslope on the east side of the stream contributing to high groundwater levels in the floodplain. Small headcuts and minimal amounts of erosion are present in the vicinity of two old beaver dams, and there is a minimal amount of lateral erosion due to livestock access in the downstream portions of the reach, and overall reach stability is high.

Fish habitat is diverse, including cover/shading from riparian vegetation and overhanging banks and relatively clean gravel substrate intermixed with some fines in the vicinity of beaver dams. Channel depths are variable, and instream complexity elements primarily consist of smaller woody debris, as beaver activity has somewhat limited the presence of large shrubs and woody debris immediately adjacent to the channel.

The trend in this reach is dynamically stable. Overall, this reach exhibits the characteristics of a healthy and sustainable beaver/wetland complex and protection and conservation of this area should be a high priority. Minimal grazing and livestock access impacts are present in the downstream portions of the reach.

Potential restoration actions include: 1) fencing to protect it from adjacent grazing land use; 2) conservation and preservation.

DSCN1252_265

DSCN1259_272

4.2.4 Reach Dog-02a-R

NRCS Score: 64% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-02a-R is 2,628 feet in length and located on private land. This reach was visually classified as an E channel type. The estimated width-to-depth ratio for this reach is approximately 4, with a sinuosity of 1.42, and an estimated channel gradient of 0.5%.

Reach Dog-02a-R transitions from a predominantly natural alignment and riparian floodplain area upstream to a somewhat modified planform at the downstream extent where land use becomes entirely agricultural (grazing and/or haying). The channel appears stable throughout this reach, and floodplain connectivity appears high, with evidence of current and historical traces, and a fairly wide floodplain area with moderate riparian vegetation cover. Connectivity appears somewhat diminished in the very downstream portions where land use becomes agricultural, and riparian vegetation largely disappears. Some outer banks show signs of erosion, likely due to livestock access and degraded streambank vegetation. There is evidence that this area is accessible by livestock, and there are numerous inclusions of predominantly herbaceous vegetation (likely pasture grasses) intermixed with otherwise healthy riparian shrub communities throughout the reach.

Fish habitat could not be assessed remotely, but the presence of moderate riparian vegetation throughout much of the reach indicates that cover components such as woody debris, root wads, and overhanging vegetation are likely to be present and providing good habitat. Channel type and planform appear appropriate for the condition, and indicate that aquatic habitat complexity is not severely diminished.

The overall trend of this reach appears to be dynamically stable. Although there are impacts in this reach including agricultural land encroachment and associated livestock access, the channel plan form appears stable. With continued grazing pressure this trend could change.

Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.5 Reach Dog-03

NRCS Score: 62% - At Risk; Fish Habitat: 53% - Fair; Bank Erosion: NA

Reach Dog-03 is 1,999 feet in length and located on private land that is surrounded by private lands with different ownership that were not accessible at the time of this assessment. This reach was visually classified as an E channel type. The estimated width-to-depth ratio is approximately 4, with a sinuosity of 1.25, and an estimated channel gradient of 1.4%. This reach was visually assessed from an adjacent parcel where landowner access was granted. The area is managed for livestock grazing and there are not fences delineating parcels with different land ownership. The channel appears to be relatively stable with no apparent signs of down-cutting or incision. Flows were at or slightly above bankfull at the time of assessment making it difficult to accurately evaluate lateral cutting and erosion, but it is expected that some bank erosion is occurring along outer meander bends or in other locations associated with livestock use, such as crossings that are visible on aerial photographs. High flows were able to access some of the floodplain, but there is little floodplain roughness to dissipate energy or sediment in the reach. The floodplain may be narrower than historical conditions based on the presence of historical channels visible on aerial photographs that are no longer connected to the current hydrology.

A few mature willows are present along portions of the streambanks and some willow regrowth was observed on at least one inside meander bend at the upstream extent of the reach, but overall woody vegetation cover is low in the reach. Some sedges, rushes, or riparian wetland grasses may also be present on streambanks providing some deep binding root mass. However, it is expected that much of the vegetation cover along the channel is dominated by pasture grasses or grazing induced vegetation species. It is suspected that utilization of shrubs is occurring due to livestock browse based on the distribution of woody species in the reach, but this was not directly observed.

Fish habitat is estimated to be fair in the reach. Based on conditions observed in upstream reaches, gravel substrate is likely present. Upstream beaver dams may be contributing sediment to the reach, but without significant roughness elements in the reach it is not clear if this sediment is retained in the reach and covering coarser substrate in the channel. It is expected that many cover elements are lacking from the reach such as overhanging vegetation, undercut banks, or woody debris. It is also expected that some pools are present, but that shallow pools are more common than deep pools in the reach.

The overall trend in this reach is likely declining. Past and current land use have led to the removal or loss of woody vegetation throughout much of the riparian area impacting streambank and channel conditions. Willow regrowth was observed in this reach indicating that natural vegetation recovery may be possible in the reach if grazing impacts are reduced.

Restoration options may be limited for the reach based on the short reach length and different landownership surrounding the parcel making the reach inaccessible for this project. Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; and 2) stabilization and revegetation of streambanks.

DSCN1261_274

DSCN1266_279

4.2.6 Reach Dog-03a-R

NRCS Score: 58% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-03a-R is 10,979 feet in length and is located on both public and private lands. This reach was visually classified as an E channel type transitioning to a DA channel type. The estimated width-to-depth ratio for this reach is 15, with a sinuosity of 1.6, and an estimated channel gradient of 0.8%.

The floodplain throughout upstream portions of this reach appears to be managed for livestock grazing and woody riparian vegetation is largely absent within these area. Some floodplain connectivity is indicated by the presence of side channel traces that are visible in the aerial imagery, but the lack of riparian vegetation within the floodplain suggests that there is little potential for sediment trapping or energy dissipation during overbank flows. Moderate levels of bank erosion are visible, likely due to livestock access and lack of streambank vegetation, and the channel has become over-widened in some areas. In downstream portions of the reach, Dog Creek runs along the toe of a large slope, and mature riparian shrubs and trees become prevalent along the left bank. Floodplain connectivity appears greater in these downstream

areas, with wet herbaceous vegetation and increasing floodplain shrub cover evident. Beaver activity appears likely within downstream-most portions of the reach (below the road crossing), where healthy riparian vegetation is abundant, and the channel transitions into an anastomosed stream type with secondary channels and surface ponding. Conditions within the lower portions of this reach suggest that natural recovery of upstream areas would be likely if grazing pressure and livestock access were removed.

Fish habitat could not be assessed remotely, but a lack of streambank vegetation suggests that cover components such as woody debris, root wads, and overhanging vegetation may be limited within this reach.

This reach overlaps with the 2009 FWP assessment reach RM 10.4. The results of this assessment indicated cattle grazing as prevalent with small areas of bank erosion where deep binding root mass is absent. The overall NRCS sustainability score for this reach was 77.14%. The difference in score is related to lower scores for stream incisement, active lateral cutting and stream balance. This reach also overlaps with DEQ 2011 TMDL Reach Dog 11-09 which indicates slumping banks and hillslope erosion and that the upstream fenced area had dense riparian vegetation and that unfenced areas exhibited bank erosion and channel widening.

The overall trend of this reach is likely declining. Impacts from agricultural land encroachment and associated livestock access have resulted in vegetation and bank erosion.

Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; and 2) evaluating the road crossing for fish passage and geomorphic stability issues. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.7 Reach Dog-03b-R

NRCS Score: 96% - Sustainable; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-03b-R is 9,231 feet in length and located on private land. This reach was visually classified as an E/DA channel type. The estimated width-to-depth ratio for this reach varies significantly in a range of 5-40, with a sinuosity of 1.4, and an estimated channel gradient of 0.7%. Based on floodplain and vegetative patterns observed in other Dog Creek reaches, Reach Dog-03b-R appears to be well-connected and heavily influenced by beaver activity, as evidence by the presence of a wide, densely vegetated riparian area, numerous secondary channels, and surface ponding. The channel appears to be over-widened in some areas, likely as a byproduct of beaver activity (i.e. dam failure), but bank erosion does not appear to be increasing and overall the stream appears stable. Dense riparian vegetation is present throughout the reach, and species and age class diversity appear high.

Fish habitat could not be assessed remotely, but the presence of dense riparian vegetation throughout much of the reach indicates that cover components such as woody debris, root wads, and overhanging vegetation are likely to be present and providing good habitat. Channel type and planform appear appropriate for the condition, and indicate that aquatic habitat complexity is not severely diminished.

The overall trend of this reach is dynamically stable. There appears to be minimal human-caused impacts to this reach. There is a farm road that borders the western edge of the floodplain, but neither the road nor the adjacent pasture lands appear to be infringing on the riparian area. It is unclear whether the riparian area is actively protected from grazing impacts or livestock access.

Potential restoration actions within this reach include: 1) evaluate land use and need for fencing; and 2) preservation and conservation. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.8 Reach Dog-04-R

NRCS Score: 91% - Sustainable; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-04-R is 1,446 feet in length and located on private land. This reach was visually classified as an E/DA channel type. The estimated width-to-depth ratio for this reach varies significantly and ranges from 5-40, with a sinuosity of 1.2, and an estimated channel gradient of 1.3%. Reach Dog-04-R was inaccessible for field assessment due to road conditions, and was therefore remotely assessed. Access for potential restoration efforts has been granted by the landowner, if necessary. This reach is characterized by a well-vegetated floodplain, and floodplain connectivity appears high. The channel is slightly straightened along the toe of the eastern hillslope, but secondary channels indicate the ability for natural migration throughout the floodplain. Based on conditions in adjacent reaches, beaver activity can be assumed within this reach, as evidenced by secondary channels, surface ponding, and an intermittently anastomosed channel. There is no visual evidence of streambank erosion, and the channel appears stable throughout the reach.

Fish habitat could not be assessed remotely, but the presence of dense riparian vegetation throughout much of the reach indicates that cover components such as woody debris, root wads, and overhanging vegetation are likely to be present and providing good habitat. Channel type and planform appear appropriate for the condition, and indicate that aquatic habitat complexity is not severely diminished.

The overall trend of this reach is dynamically stable. There appears to be minimal human-caused impacts to this reach and this reach appears to be at or near its potential.

Potential restoration actions within this reach include: 1) preservation and conservation. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.9 Reach Dog-04a-R

NRCS Score: 85% - Sustainable; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-04a-R is 8,123 feet in length and located on private land. This reach was visually classified as an E/DA channel type. The estimated width-to-depth ratio for this reach varies significantly and ranges from 5-40, with a sinuosity of 1.3, and an estimated channel gradient of 0.5%. This reach transitions from a wide wetland/beaver complex upstream, to a narrower valley downstream (approx. 200-250 feet in width), located between a large hillslope on the east and a terrace to the west. Despite being somewhat confined, the floodplain is well-vegetated with riparian trees and shrubs, and floodplain connectivity within the narrow valley appears high. Based on conditions in adjacent reaches, beaver activity can be assumed within this reach, as evidenced by secondary channel and an intermittently anastomosed channel. There are some small areas of channel straightening and minimal bank erosion along the eastern hillslope, but these areas do not appear to threaten the overall stability of the reach. There is a road crossing near the middle of the reach.

Fish habitat could not be assessed remotely, but the presence of dense riparian vegetation throughout much of the reach indicates that cover components such as woody debris, root wads, and overhanging vegetation are likely to be present and providing good habitat. Channel type and planform appear appropriate for the condition, and indicate that aquatic habitat complexity is not severely diminished.

The overall trend of this reach is dynamically stable. There appears to be minimal human-caused impacts to this reach and this reach appears to be at or near its potential.

Potential restoration actions within this reach include: 1) evaluating the road crossing for fish passage and geomorphic stability issues; and 2) preservation and conservation. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment.

4.2.10 Reach Dog-05

NRCS Score: 95% - Sustainable; Fish Habitat: 90% - Good; Bank Erosion: 0.0%

Reach Dog-05 is 2,503 feet in length and located on private land. This reach was visually classified as a DA channel type (anastomosed stream). The channel within this reach is heavily influenced by beaver activity, resulting in numerous small, highly variable channels without a distinct main channel. The estimated width-to-depth ratio for this reach varies significantly in a range of 5-40, with a sinuosity of 1.4, a silt and sand channel bed, and an estimated channel

gradient of 2.3%. The floodplain within this reach is well-connected, with numerous braided channels, surface ponding, and water flowing over the floodplain surface during the time of assessment.

This reach is characterized by a healthy intact riparian area that is being influenced by beaver activity. Riparian vegetation cover is high, with diverse species and age classes present consisting primarily of willows and sedges. Banks appear stable and well-vegetated, and woody vegetation regeneration is high, with active colonization of developing floodplain areas in between channel braids. Sandhill cranes were observed utilizing this area during the time of assessment.

During the time of this assessment flows were high, estimated to be approximately 100 cfs. Fish habitat is diverse including large amounts of cover/shading due to riparian vegetation and overhanging banks, variable channel depths and a moderate amount of large woody debris.

The overall trend of this reach is dynamically stable. This reach exhibits the characteristics of a healthy and sustainable beaver/wetland complex. There are minimal human-caused impacts within this reach.

Potential restoration actions within this reach include: 1) preservation and conservation.

IMG_027616

IMG_027618

4.2.11 Reach Dog-06

NRCS Score: 85% - Sustainable; Fish Habitat: 100% - Good; Bank Erosion: 1.5%

Reach Dog-06 is 5,402 feet in length and located on private land. This reach was visually classified as an E/DA channel type with an approximate 1,000-foot section of straightened B channel. The estimated width-to-depth ratio for this reach varies from greater than 40 in the anastomosed (DA) sections to approximately 12 in the straightened B section. The channel has

an overall sinuosity of 1.4, a variable channel bed composed of sand, silt, gravel and cobble, and an estimated channel gradient of 0.7%.

The floodplain within this reach is well-connected, with numerous braided channels, surface ponding, and water flowing over the floodplain surface during the time of assessment. The upstream portion of the reach exhibits minor incision and some areas of bank erosion in the vicinity of the bridge crossing (at the reach break between Dog-05 and Dog-06). Downstream portions of the reach are characterized by a healthy riparian area that is being influenced by beaver activity, with moderate riparian vegetation cover, and diverse species and age classes consisting primarily of willows, sedges, and rushes. Banks in the downstream portions of the reach are stable and well-vegetated, and woody vegetation regeneration is high, particularly in downstream portions of the reach where past grazing impacts were observed.

During the time of this assessment flows were high, estimated to be approximately 100 cfs. Fish habitat is exceptional throughout this reach, with a diverse range of aquatic habitat types observed in both the main and secondary channels. Instream complexity and near bank cover is high, with variable substrate types and an even distribution of deep and shallow pools. During the time of assessment, large fish (>12”) were observed utilizing this reach.

The overall trend in this reach is stable and possibly improving. The limited grazing impacts observed in the downstream portions of the reach do not appear ongoing. The sole human-caused impact within this reach is channel modification in the vicinity of the upstream bridge which has led to channel incision and bank erosion.

Potential restoration actions in the reach include: 1) addressing channel modifications in the vicinity of the bridge through bank stabilization and re-naturalization; and 2) conservation and preservation.

IMG_027721

IMG_027726

4.2.12 Reach Dog-07

NRCS Score: 97% - Sustainable; Fish Habitat: 100% - Good; Bank Erosion 2.8%
Reach Dog-07 is 3,764 feet in length and located on private land. This reach was visually classified as a DA/E channel type. The estimated width-to-depth ratio for this reach varies from greater than 40 in the anastomosed sections to approximately 12 for the E channel portions. The channel exhibits a sinuosity of 1.2, a variable channel bed composed of gravel, sand, silt and clay, and an estimated channel gradient of 0.9%.

The floodplain within this reach is well-connected, with numerous braided channels, surface ponding, and water flowing over the floodplain surface during the time of assessment. The historical floodplain throughout this reach is bisected by a railroad, but the riparian area remains healthy and intact with dense and diverse riparian vegetation. Anastomosed portions of the reach are the result of current beaver activity, but channel stability and function remains high. There are localized areas of bank erosion and channel modification at the downstream reach break, in the vicinity of the rail bridge, but these impacts are minor and do not appear to threaten the stability of the reach as a whole.

During the time of this assessment flows were high, estimated to be approximately 120 cfs. Similar to the upstream Reach Dog-06, fish habitat is good throughout this reach, with a diverse range of aquatic habitat types observed in both the main and secondary channels. Instream complexity and near bank cover is high, with variable substrate types and a nice distribution of deep and shallow pools.

The overall trend of this reach is stable and possibly improving. This reach exhibits the characteristics of a healthy and sustainable stream with intermixed beaver complexes. Human-cause impacts in the vicinity of the rail bridge do not appear to require attention at this time.

Potential restoration actions in the reach include: 1) conservation and preservation.

IMG_027727

IMG_027828

4.2.13 Reach Dog-08

NRCS Score: 97% - Sustainable; Fish Habitat: 100% - Good; Bank Erosion: 2.5%

Reach Dog-08 is 3,763 feet in length and located on private land. This reach was visually classified as a DA/E channel type. The estimated width-to-depth ratio for this reach varies from greater than 40 in the anastomosed sections to approximately 12 for the E channel portions. The channel exhibits a sinuosity of 1.5, a variable channel bed composed of gravel, sand, silt and clay, and an estimated channel gradient of 0.6%.

The floodplain within this reach is well-connected, with multiple channels, surface ponding, and water flowing over the floodplain surface during the time of assessment. The upstream portion of the reach exhibits minor incision and some areas of bank erosion in the vicinity of the railroad crossing (at the reach break between Dog-07 and Dog-08). Downstream portions of the reach are characterized by a healthy riparian area that is being influenced by beaver activity, with high riparian vegetation cover, and diverse species and age class composition consisting primarily of willows, sedges, and rushes, with some intermixed cottonwoods and aspens. Banks in the downstream portions of the reach are stable and well-vegetated, and woody vegetation regeneration is high.

During the time of this assessment flows were high, estimated to be approximately 140 cfs. Fish habitat continues to be high quality throughout this reach, with a diverse range of aquatic habitat types observed in both the main and secondary channels. Instream complexity and near bank cover is high, with variable substrate types and a nice distribution of deep and shallow pools.

This reach overlaps with the 2009 FWP assessment reach RM 5.1. The results of this assessment indicated extensive beaver activity and a wide floodplain with willow and sedge

dominated vegetation communities and excellent aquatic habitat. The overall NRCS sustainability score for this reach was 95.71%, similar to the results of the 2014 assessment.

The overall trend of this reach is stable and possibly improving. This reach exhibits the characteristics of a healthy and sustainable stream with intermixed beaver complexes, and continued stability likely relies on the continued presence of beavers and limited grazing access to the riparian area. Human-caused impacts at the upstream rail bridge crossing are minor and localized, and do not require attention at this time. Drainage from a tributary entering from the east contained an unidentified, gelatinous orange substance. The tributary channel east of the road was highly disturbed and appeared to have been placer mined. It also appeared that a catchment was constructed at the outlet of the tributary. Past mining impacts may still be current limiting factors on restoration in this area.

Potential restoration actions in the reach include: 1) investigating the historical mine tailings for potential leaching and contamination; and 2) conservation and preservation.

IMG_027832

IMG_027830

4.2.14 Reach Dog-09

NRCS Score: 98% - Sustainable; Fish Habitat: 90% - Good; Bank Erosion: 1.8%

Reach Dog-09 is 2,650 feet in length and located on private land. This reach was visually classified as a DA channel type. The channel within this reach is heavily influenced by beaver activity, resulting in a number of small, highly variable channels without a distinct main channel. The estimated width-to-depth ratio for this reach varies significantly in a range of 5-40, with a sinuosity of 1.6, a gravel and small cobble channel bed, and an estimated channel gradient of 0.6%.

The floodplain within this reach is well-connected, with numerous braided channels, surface ponding, and water flowing over the floodplain surface during the time of assessment. This

reach is characterized by a healthy riparian area that is being influenced by beaver activity, with high riparian vegetation cover, and diverse species and age class composition consisting primarily of willow species and sedges. Streambanks appear stable and well-vegetated, and woody vegetation regeneration is high. A railroad berm runs along the eastern edge of the floodplain, and appears to limit the natural morphology of some secondary channels, but does not threaten the stability of the reach as a whole.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat quality remains high within this reach, with a diverse range of aquatic habitat types observed in both the main and secondary channels. Instream complexity and near bank cover is high, substrate is primarily stony with some areas of embeddedness, and pools of variable depth are frequent throughout the reach. Negative water quality indicators include the presence of algae and high turbidity, but flows were estimated to be near bankfull during the time of assessment.

The overall trend of this reach is stable. The reach is near its potential. There are limited grazing impacts in the downstream portions of the reach, and the channel is constrained at the upstream and downstream railroad bridge crossings, but these impacts do not appear to threaten the overall stability of the reach.

Potential restoration actions include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish, and 2) conservation and preservation.

DSCN1099_112

IMG_0022

4.2.15 Reach Dog-10

NRCS Score: 68% - At Risk; Fish Habitat: 43% - Fair; Bank Erosion: 10.9%

Reach Dog-10 is 1,911 feet in length and located on private land. This reach was visually classified as an F channel type with some sections developing C channel characteristics. The estimated width-to-depth ratio for this reach is approximately 12.9, with a sinuosity of 1.1, a gravel and cobble-dominated bed, and an estimated channel gradient of 0.6%. The entrenchment ratio was very low based on visual observation. The floodplain and associated riparian area within this reach is has been severely reduced due to agricultural encroachment to the west and the railroad to the east. Total floodplain width is less than 100 feet throughout the majority of the reach. Floodplain narrowing and channel straightening along the railroad berm has led to channel incision and some areas of erosion, although the channel appears to be stabilizing in its current, incised condition. Much of the bank along the railroad has been stabilized by riprap. There are some banks that are actively eroding.

The riparian area has been fenced to exclude grazing along the western edge of the floodplain, and within the fenced area, riparian vegetation exhibits a high density with moderate woody regeneration. Riparian vegetation consists primarily of willow species and sedges, with small areas of Canada thistle throughout the reach. This reach corresponds with DEQ sediment and habitat assessment site DOG12-04. This assessment identified a greenline understory shrub cover of approximately 40%.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat is somewhat diminished within this reach, characterized by infrequent and shallow pools, a lack of instream habitat complexity, and limited overhanging bank vegetation. Substrate is slightly embedded with gravel and small cobble interspersed with fines.

The overall trend of this reach is improving. The channel appears to be stabilizing in its current alignment and elevation, with some developing floodplain areas where banks have eroded or slumped. The reach potential is altered from the historical condition, but with continued exclusion of grazing impacts, this reach could potentially stabilize as a B or C channel type with a well-vegetated, narrow riparian corridor. Human-caused impacts are due primarily to agricultural and railroad infrastructure encroachment.

Potential restoration actions in this reach include: 1) maintaining the existing riparian fence; and 2) implementing bank stabilization and revegetation treatments. The presence of the railroad may limit the feasibility or efficacy of potential restoration efforts.

DSCN1107_120

IMG_0035

IMG_0030

4.2.16 Reach Dog-11a

NRCS Score: 47% - Not Sustainable; Fish Habitat: 33% - Poor; Bank Erosion: 37.0%
Reach Dog-11a is 891 feet in length and located on private land. This reach was classified as a predominantly F channel type, with sections developing characteristics of C channel type. The estimated width-to-depth ratio for this reach is approximately 10-11, with a sinuosity of 1.1, a gravel and cobble-dominated bed, and an estimated channel gradient of 0.5%. The channel within this reach has been disconnected from the historical floodplain to the east by a railroad berm, and despite high flows during the time of assessment, floodplain connectivity was severely diminished due to channel straightening and incision.

Riparian vegetation cover is low, and streambank vegetation has been diminished by grazing and adjacent agricultural encroachment. Undesirable pasture grasses dominate this reach, and bank erosion is extensive due to riparian vegetation removal and bank trampling caused by livestock. Despite these impacts, the stream appears to be stabilizing in its current, modified

alignment and a narrow, inset floodplain is developing with moderate willow regeneration. Although rated as 'Not Sustainable' given the existing condition and adjacent land use, there may be potential for a narrow riparian corridor to develop if ongoing grazing impacts are addressed.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat is poor within this reach, due primarily to a lack of vegetative cover and instream habitat complexity. The majority of observed pools are small and/or shallow, and existing substrate is slightly embedded.

The overall trend of this reach is likely declining. The channel appears to be stabilizing in its current alignment and elevation, with some developing floodplain areas where banks have eroded or slumped. The reach potential is altered from the historical condition, but continued grazing is limiting recovery of woody vegetation. If grazing were excluded, this reach could potentially stabilize as a B or C channel type with a well-vegetated, narrow riparian corridor. Human-caused impacts are due to channel modifications and proximity of the railroad, in addition to heavy grazing and livestock utilization of the riparian area.

Potential restoration actions in this reach include: 1) addressing channel and bank impacts associated with the upstream railroad bridge; 2) addressing bank erosion through stabilization and active revegetation treatments, 3) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 4) planting a riparian corridor along the channel; and 5) installing aquatic habitat structures to increase pool frequency and cover.

DSCN1116_129

DSCN1118_131

4.2.17 Reach Dog-11b

NRCS Score: 65% - At Risk; Fish Habitat: 33% - Poor; Bank Erosion: 10.0%

Reach Dog-11b is 2,395 feet in length and located on private land. This reach was classified as a predominantly E channel type, with sections developing characteristics of C channel type. The estimated width-to-depth ratio for this reach is approximately 9, with a sinuosity of 1.1, a large gravel and small cobble-dominated bed, and an estimated channel gradient of 0.5%. The upper approximately 1,500 feet of this reach exhibit some floodplain connectivity, but the accessible floodplain is narrow and bisected on the west by the railroad. Downstream portions of the reach have been straightened along the railroad and are incised, with little to no floodplain connectivity. The historical floodplain, including intact channels, is located to the west of the railroad. Despite significant channel modifications in this area, the channel appears stable in its new alignment and elevation.

Desirable riparian vegetation (willows and sedges) are more prevalent within the upstream floodplain with moderate regeneration, but diminish throughout the straightened section, where undesirable pasture grasses become dominant and riparian shrubs are limited to small areas along the streambanks. There is a moderate amount of erosion in upstream portions of the reach, primarily due to livestock access, while downstream areas are heavily rip-rapped along the railroad berm and there is no evidence of ongoing erosion.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat is poor within this reach, due primarily to a lack of vegetative cover and instream habitat complexity. The majority of observed pools are small and/or shallow, and existing substrate is slightly embedded.

The overall trend of this reach is likely stable to declining. The channel appears to be stabilizing in its current alignment and elevation, with some developing floodplain areas where banks have eroded or slumped. The reach potential is altered from the historical condition, but continued grazing is limiting recovery of woody vegetation. If grazing were excluded, this reach could potentially stabilize as a B or C channel type with a well-vegetated, narrow riparian corridor. Human-caused impacts within this reach are due to channel modifications and proximity of the railroad, in addition to grazing and livestock utilization of the riparian area.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) addressing bank erosion through stabilization and active revegetation treatments, 3) installing aquatic habitat structures to increase pool frequency and cover; and 4) considering reconnection of the channel with the historical floodplain. Proximity of the railroad may limit potential restoration efforts within this reach.

DSCN1120_133

DSCN1122_135

4.2.18 Reach Dog-12a

NRCS Score: 83% - Sustainable; Fish Habitat: 57% - Fair; Bank Erosion: 7.8%

Reach Dog-12a is 4,963 feet in length and located on private land. This reach was visually classified as an E channel type. The estimated width-to-depth ratio for this reach is 12.5, with a sinuosity of 1.26, a cobble-dominated channel bed, and an estimated channel gradient of 1.0%. The upper approximately 750 feet of the reach is similar to Reach 11b, with the channel confined against the railroad and incised approximately 2 feet below the floodplain. A small unnamed tributary enters this reach from the east. There is an 8-foot high headcut at the confluence of this tributary with Dog Creek, further indicating the extent of channel incision in Dog Creek. There are some new floodplain surfaces forming at the new channel elevation. Both riprap and bank erosion are common in this upper section. Most of the reach is characterized by a meandering E channel type that was historically an active beaver complex. The floodplain has numerous diverse features and evidence of increased beaver activity historically.

The floodplain is characterized by dense woody vegetation, primarily willows. Streambanks are also densely vegetated through most of the reach. The reach appears to not be grazed or only grazed infrequently. The railroad borders the floodplain to the west and Dog Creek Road borders the floodplain to the east.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat is fair within this reach, due primarily to a lack of cover elements such as woody debris and overhanging woody vegetation. Some pools are present, formed primarily by lateral scour and dense woody vegetation. Substrate is primarily small cobble with deposition of sand and silts along channel margins. Cobble is partially embedded with some larger cobble and boulders present.

The overall trend of this reach is likely stable. The incised portion of the channel appears to be stabilizing in its current alignment and elevation, with some developing floodplain areas where banks have eroded or slumped. Human-caused impacts within this reach are due to channel modifications and proximity of the railroad and road.

Potential restoration actions in this reach include: 1) addressing bank erosion through stabilization and active revegetation treatments. Proximity of the railroad may limit potential restoration efforts within this reach.

DSCN1126_139

IMG_0046

4.2.19 Reach Dog-12b

NRCS Score: 72% - At Risk; Fish Habitat: 43% - Fair; Bank Erosion: 3.2%

Reach Dog-12b is 1,759 feet in length and located on private land. This reach was visually classified as an F channel type, with some less entrenched sections characteristic of a B channel type. The estimated width-to-depth ratio for this reach is 12.8, with a sinuosity of 1.0, a cobble-dominated channel bed, and an estimated channel gradient of 1.3%. This reach is confined between the hillslope to the east and railroad berm to the west, and is incised approximately 2-3 feet below the historical floodplain, resulting in poor floodplain connectivity. Despite straightening and incision, the channel appears to be stabilizing in its current alignment. There is some bank erosion into the adjacent hillslope but overall erosion throughout this reach is minimal. The western banks (along the railroad berm) are rip-rapped throughout much of the reach, and riparian vegetation is limited to a narrow fringe along the channel. Riparian vegetation is denser on the historical floodplain terrace, but this area is largely disconnected from the channel in its current condition. The floodplain widens in the downstream portion of the reach, with increased willow and riparian shrub cover, but the channel remains confined and entrenched along the railroad berm.

During the time of this assessment flows were high, estimated to be approximately 150 cfs. Fish habitat is uniform within the reach, characterized by infrequent and shallow pools, a lack of instream habitat complexity, and limited overhanging bank vegetation. There is some overhanging vegetation and boulders that provide cover. Substrate is slightly embedded with gravel and small cobble interspersed with fines. During high flows, the reach likely functions as a migration corridor, but otherwise provides limited habitat.

The overall trend in this reach is stable. This reach has been significantly altered from its natural condition by the railroad berm, which has led to channel incision. Despite these impacts, the reach appears to be stable in its current alignment and elevation.

Due to the constraints within this reach, no feasible restoration actions were identified.

IMG_0048

DSCN1132_145

4.2.20 Reach Dog-13a

NRCS Score: 84% - Sustainable; Fish Habitat: 53% - Fair; Bank Erosion: 9.5%

Reach Dog-13a is 1,427 feet in length and located on private land. This reach was visually classified as having G, F and B channel types. The estimated width-to-depth ratio for this reach is 10-16, with a sinuosity of 1.0, a cobble-dominated channel bed, and an estimated channel gradient of 1.8%.

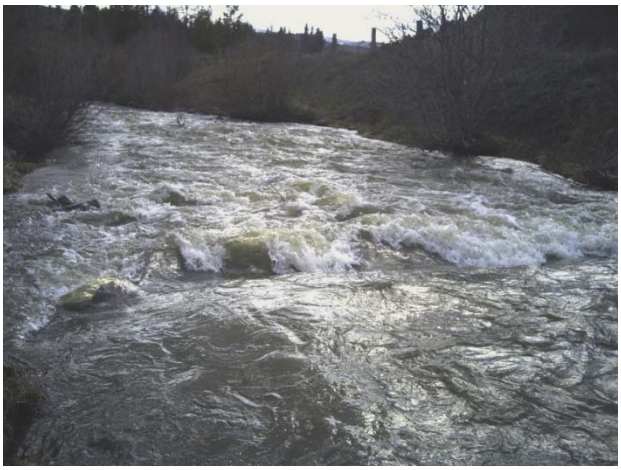
This reach is similar to Reach Dog 12b (immediately upstream), characterized by a steep gradient, lack of sinuosity, and confinement between the hillslope to the east and railroad berm to the west. The channel has been straightened along the rail berm and stabilized with rip-rap along the right bank. Floodplain connectivity is minimal, and riparian vegetation is limited to sparse shrub cover along the left bank. This reach appears to have stabilized in its current alignment, and despite its reduced floodplain and riparian habitat potential, should be able to function as a sediment transport and fish migration corridor.

During the time of this assessment flows were high, estimated to be approximately 200 cfs. Fish habitat is somewhat diminished within this reach, characterized by infrequent and shallow pools, a lack of instream habitat complexity, and limited overhanging bank vegetation. Substrate, however is clean and shows no signs of embeddedness, contributing to the ability of this reach to act as a migration corridor.

The overall trend in this reach stable. This reach has been significantly altered from its natural condition by the railroad berm, which has led to channel incision. Despite these impacts and localized areas of high bank erosion, the reach appears to be stable in its current alignment and elevation.

Potential restoration actions in this reach include: 1) channel relocation and reconnection with the historic floodplain. However, due to the constraints within this reach, this action is likely not feasible and would be prohibitively expensive.

IMG_027836



IMG_027837

4.2.21 Reach Dog-13b

NRCS Score: 88% - Sustainable; Fish Habitat: 59% - Fair; Bank Erosion: 4.0%

Reach Dog-13b is 4,908 feet in length and located on private land. This reach was visually classified as B and G channel types. The estimated width-to-depth ratio for this reach is 14, with a sinuosity of 1.1, a cobble-dominated channel bed, and an estimated channel gradient of 1.5%.

This reach is similar to upstream reaches (Dog 12b, Dog 13a), characterized by a steep gradient, lack of sinuosity, and confinement between the hillslope to the east and railroad berm to the west. The channel has been straightened along the railroad berm and stabilized with rip-rap along the right bank in some areas, but exhibits greater planform diversity and floodplain connectivity in some areas where overbank flows were observed during the time of

assessment. Riparian vegetation cover is moderate and comprised of a diverse range of tree, shrub and herbaceous species with good age class distribution. Banks are largely stable, and only two small areas of erosion were noted. There is one steep hillslope with the potential for mass wasting into the stream, but the slope is high above the stream, and this risk appears low.

During the time of this assessment flows were high, estimated to be approximately 200 cfs. Fish habitat is somewhat diminished within this reach, characterized by infrequent and shallow pools, a lack of instream habitat complexity, and limited overhanging bank vegetation. Substrate, however is clean and shows no signs of embeddedness, and this reach likely functions as a fish migration corridor.

This reach overlaps with the 2009 FWP assessment reach RM 1.3. The results of this assessment indicated that vegetation scores were lowered due to the presence of grasses and weeds. This assessment also indicated that aquatic habitat was reduced due to shallow pools with little cover and a high amount of sediment accumulation. The overall NRCS sustainability score for this reach was 70.00%. The higher score assigned in 2014 (88%) is likely due to the fact that aquatic habitat could not be effectively evaluated due to high flows and weeds could not be effectively evaluated due to timing of the assessment very early in the growing season.

The overall trend in this reach stable. This reach has been significantly altered from its natural condition by transportation infrastructure (rail and roads), and there is a railroad bridge near the downstream extent of the reach. Despite these impacts, there is no sign of continued channel incision and the reach appears to be efficiently routing sediment and water.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish, 2) weed control; 3) installing aquatic habitat structures to increase pool frequency and cover; and 4) realigning the channel away from the railroad to increase floodplain connectivity and restore a more natural planform. Active restoration in this reach may be prohibitively expensive and unfeasible given the infrastructural constraints.

IMG_027844

DSCN1134_147

4.2.22 Reach Dog-14

NRCS Score: 68% - At Risk; Fish Habitat: 70% - Fair; Bank Erosion: 8.9%

Reach Dog-14 is 706 feet in length and located on private land. This reach was visually classified as a B channel type. The estimated width-to-depth ratio for this reach is 14, with a sinuosity of 1.3, a cobble-dominated channel bed, and an estimated channel gradient of 1.7%. Floodplain connectivity is limited throughout this reach due to the presence of roads and residential development. Floodplain vegetative cover is limited to small areas along the channel, with agricultural and residential land use limiting vegetation potential within the historical floodplain. There is one large eroding terrace within this reach that is contributing to some over-widening of the channel, and lack of riparian vegetation poses a risk to long-term channel stability (IMG_0054). The landowner has attempted to restore woody vegetation at the top of this terrace with little success. Noxious weeds and undesirable pasture grasses and upland species are present in small areas throughout the reach.

During the time of this assessment flows were high, estimated to be approximately 200 cfs. Fish habitat within this reach is characterized by moderate vegetative cover and overhanging banks, relatively clean substrate with some fine material embeddedness, and a few shallow pools with instream woody debris providing aquatic habitat complexity. There is an accumulation of woody debris as a result of the eroding terrace that is providing cover and quality habitat in this reach.

The overall trend of this reach is likely declining due to erosion of the high terrace that is likely to continue and land management that is limiting the extent of riparian vegetation. This reach has been significantly altered from its natural condition by adjacent land use and residential development.

Potential restoration actions in this reach include: 1) stabilization of the eroding terrace, and 2) active or passive streambank revegetation treatments to increase riparian vegetation cover and overall bank stability. The landowner has indicated a desire to address ongoing bank erosion in this reach.

IMG_0053

IMG_0054

4.2.23 Reach Dog-15-R

NRCS Score: 55% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-15-R is 2,497 feet in length and located on private land. This reach was visually classified as an F channel type with B potential. Based on channel conditions in similar upstream reaches, the estimated width-to-depth ratio for this reach is 12.5. Channel sinuosity is 1.3, and the estimated channel gradient is 1.0%.

Reach Dog-15-R was remotely assessed due to lack of property access. The channel within this reach appears straightened and somewhat incised, with sparse riparian vegetation limited to areas immediately along the channel. Land use within the historical floodplain appears agricultural (grazing or haying), and the lack of floodplain riparian vegetation or presence of secondary channels/channel traces indicate that floodplain connectivity is likely limited. Small areas of bank erosion are visible within this reach, primarily where riparian streambank vegetation is absent. A riparian assessment performed within this reach for the 2011 TMDL (DEQ 2011) additionally mentions a high degree of channelization, and erosion cause by irrigation return flows.

Fish habitat could not be assessed remotely, but lack of vegetative cover and apparent stream channelization indicate that habitat is likely simplified and this reach may act primarily as a migration corridor. Channel substrate was not able to be determined remotely.

This reach overlaps with the 2011 TMDL reach DOG 13-03. Observations made during this assessment indicated that return flows were seeping back into the channel from both banks and that bank erosion could be attributed to oversaturated banks and historical grazing practices.

The overall trend of this reach is likely declining. The reach has been significantly altered from its natural condition by adjacent land use. The absence of riparian vegetation and lack of a defined riparian corridor suggest that this reach may be in decline.

Potential restoration actions in this reach include: 1) modifying the adjacent land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish and expand the riparian corridor width; and 2) addressing bank erosion through stabilization and active revegetation treatments. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment. If significant bank erosion is present, the continued delivery of fine sediment may influence active restoration actions downstream.

4.2.24 Reach Dog-16-R

NRCS Score: 55% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach Dog-16-R is 2,670 feet in length and located on private land. This reach was visually classified as an E channel type. Based on channel conditions in similar upstream reaches, the estimated width-to-depth ratio for this reach is 12.5. Channel sinuosity is 1.1, and the estimated channel gradient is 1.1%.

Reach Dog-16-R was remotely assessed due to lack of property access. The channel within this reach is largely unconfined within upstream portions of the reach, but appears to have been straightened in the approximately 400-foot section above the confluence with the Little Blackfoot River. This section of stream runs adjacent to a railroad berm, and shows evidence of channel incision with small areas of erosion where riparian vegetation is absent. Upstream of this area, the channel appears stable with access to a large floodplain area colonized by dense riparian vegetation.

Fish habitat could not be assessed remotely, but the presence of dense vegetative cover and a natural channel morphology throughout upstream portions of the reach indicate that aquatic habitat is likely fair to good. Channel substrate was not able to be determined remotely.

The overall trend of this reach is likely stable. This reach exhibits minor impacts near the downstream confluence related to railroad infrastructure, but overall appears to be relatively stable and near its potential. Channel modifications, land use, and impaired habitat immediately upstream of this reach may threaten long-term stability, but aerial imagery indicates a distinct boundary between land uses in the vicinity of the upstream reach break.

Potential restoration actions within this reach include: 1) evaluating the need for fencing or other exclusion/preservation measures to ensure that upstream land use does not infringe on the healthy riparian area within this reach; and 2) addressing bank erosion through stabilization and active revegetation treatments. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment. If significant bank erosion is present, the continued delivery of fine sediment may influence active restoration actions downstream.

4.3 Snowshoe Creek

Snowshoe Creek is a tributary to the Little Blackfoot River that flows for approximately 10 miles before entering at Little Blackfoot River Mile 17.4. A majority of the lands along Snowshoe Creek are privately owned. Publicly owned lands administered by the U.S. Forest Service are limited to headwaters portions of the watershed. However, within this area there are several privately owned mining claims along the stream. There is a 25-acre private reservoir located oat River Mile 6.3. The reservoir provides irrigation storage and appears to support a trout fishery likely dominated by brown trout and westslope cutthroat trout. The dam and outlet appear to be an upstream fish migration barrier. The primary land uses in the Snowshoe Creek drainage are hay production, cattle grazing/pasturing, timber harvest and historical mining. Fish sampling done in 2007 near River mile 2.1 found the trout community was made up entirely of brown trout. Above the reservoir at river mile 9.2, both westslope cutthroat trout and brown trout were found. Westslope cutthroat trout comprised over half of the fish observed within the site, brown trout were slightly larger.

Snowshoe Creek (MT76G004_080) is listed for sedimentation/siltation on the 2010 303(d) List. In addition, this segment is also listed for alteration in stream-side or littoral vegetative covers and low flow alterations, which are non-pollutants commonly linked to sediment impairment. Snowshoe Creek is listed based on sedimentation attributed to logging, road construction, mining, grazing, and hay production.

Table 4-4 summarizes the results of the assessments completed along Snowshoe Creek including the channel type, percent bank erosion, NRCS score and rating and fish habitat score and rating. Figure 4-6 shows the NRCS rating by assessment reach. Figure 4-7 shows the percent bank erosion by reach. The assessments results indicate a general decline in riparian and aquatic habitat condition in a downstream direction, but also highly variable conditions along Snowshoe Creek. The upper assessment reaches are located in a narrow canyon with significant constraints from roads and historical mining activities. There is an on-channel reservoir in the upper reaches that presents a migration barrier to fish. Below the reservoir, the channel flows through another canyon reach with historical mining impacts. The stream then flows into a wide, low gradient valley bottom where agricultural practices have a

significant influence on riparian and aquatic habitat conditions. Bank erosion and reduced floodplain and riparian habitat increase significantly in the lower reaches.

The primary restoration actions for Snowshoe Creek include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 3) implementing streambank stabilization and revegetation measures; and 4) installing aquatic habitat enhancement structures.

Table 4-4. Summary of Snowshoe Creek assessment reach characteristics. Green shaded cells indicate remotely-assessed reaches.

Reach ID	Reach Length (ft)	Channel Type	Primary Land Use	Linear Bank Erosion (%)	NRCS Score (%)	NRCS Rating	Fish Habitat Score (%)	Fish Habitat Rating
SS-01	3,317	B, F, G	Grazing	8.4%	38%	Not sustainable	53%	Fair
SS-02	4,786	E, F, B	Grazing	5.5%	85%	Sustainable	43%	Fair
SS-03	6,708	B, E	Grazing, Natural	1.6%	83%	Sustainable	80%	Good
SS-04	3,590	E	Grazing	4.0%	78%	At Risk	80%	Good
SS-05	6,116	E	Haying, Grazing	2.6%	85%	Sustainable	80%	Good
SS-05a-R	5,000	E	Grazing	NA	55%	At Risk	NA	NA
SS-06	12,025	E	Grazing	8.5%	58%	At Risk	70%	Fair
SS-06a-R	10,217	E	Grazing	NA	55%	At Risk	NA	NA
SS-07	826	E	Grazing	6.2%	63%	At Risk	57%	Fair

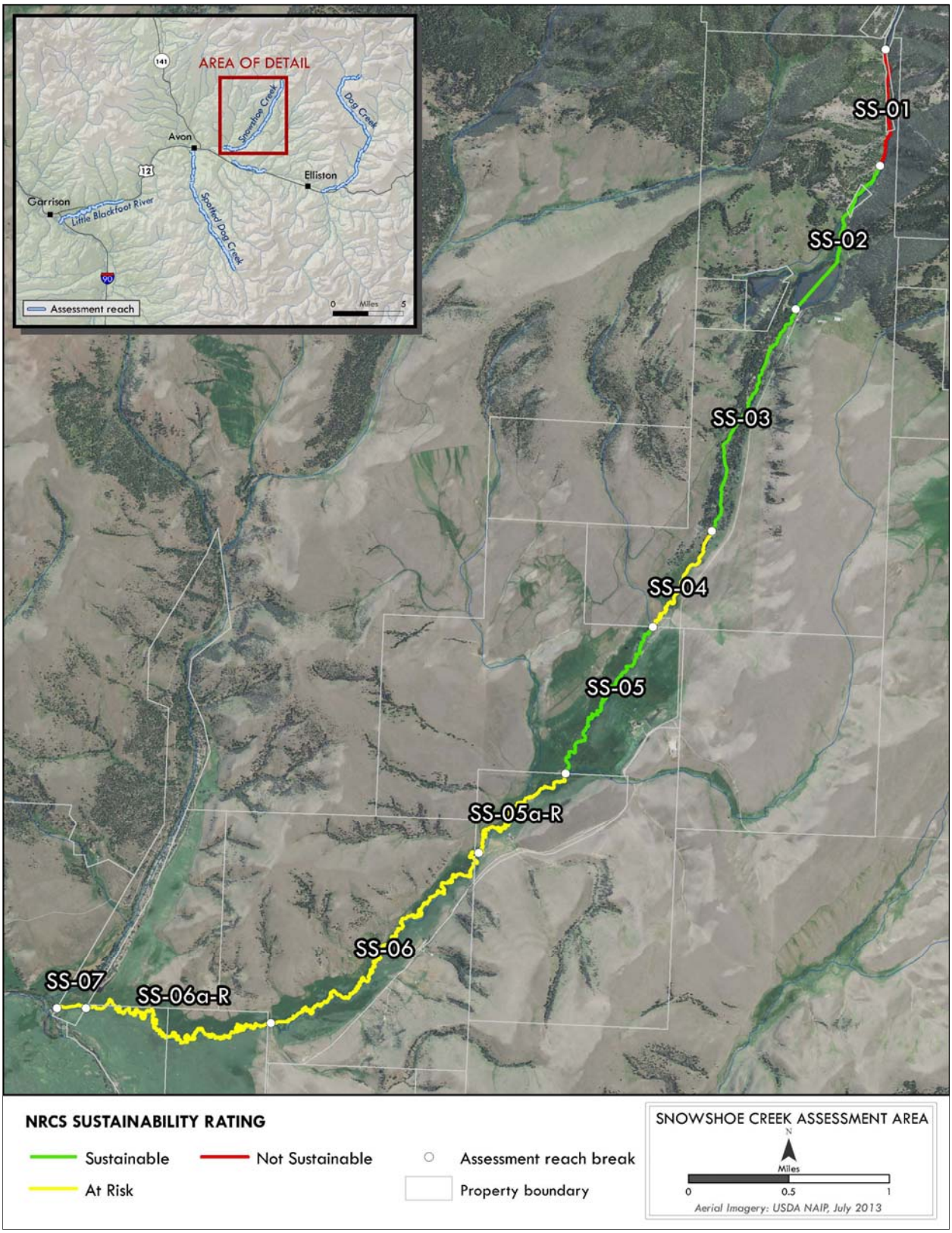


Figure 4-6. NRCS riparian assessment sustainability ratings results for the Snowshoe Creek assessment area.

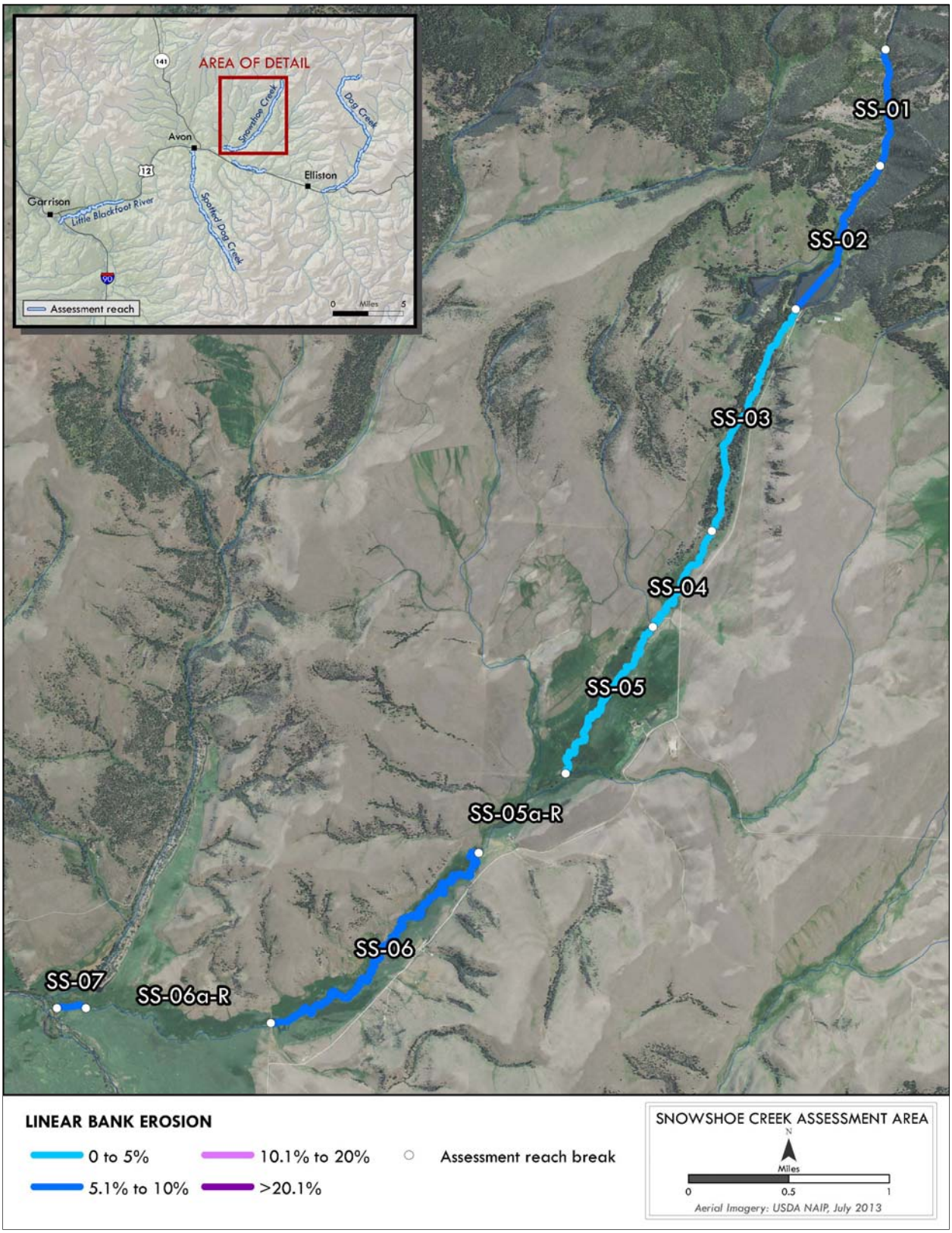


Figure 4-7. Percent linear feet of bank erosion for the Snowshoe Creek assessment area.

4.3.1 Reach SS-01

NRCS Score: 38% - Not Sustainable; Fish Habitat: 53% - Fair; Bank Erosion: 8.4%
Reach SS-01 is 3,317 feet in length and located on private land. Reach SS-01 was visually classified as B, F, and G channel types. This classification is based on an estimated width-to-depth ratio of 4, with a sinuosity of 1.1, a gravel-dominated channel bed, and an estimated channel gradient of 3.9%. The channel is extremely unstable, characterized by gully sections resulting from historical placer mining that resulted in large piles of dredge material along the channel. The location of the forest access road in the narrow valley bottom further confines the channel. There is a moderate amount of human-induced lateral erosion and some over-wide and shallow sections of the stream. The reach is moderately impacted by livestock in the form of bed and bank trampling and over-widening of the channel. Observed erosion and sedimentation are attributed to road encroachment, historical mining impacts, grazing, and ongoing channel incision. A combination of grazing and loss of floodplain connectivity have additionally degraded the riparian vegetation within this reach, reducing habitat, cover and shade.

The channel is deeply incised (up to 10 feet in some areas), and has extremely limited floodplain connectivity. This reach is characterized by a moderate density of woody riparian vegetation consisting primarily of willow species and cottonwoods. Moderate browse of woody vegetation by cattle was observed with minimal regeneration and a moderate distribution of age classes of woody species. The slopes adjacent to the stream are dominated by conifers.

During the time of this assessment flows were moderately high and estimated to be approximately 5 cfs. Fish habitat is characterized by a low number of deep pool habitat elements, high substrate quality, small amounts of cover/shading due to riparian vegetation and overhanging banks, and a low percentage of large woody debris.

The overall trend of this reach is declining. This reach is highly unstable due to the lateral constraints imposed by the existing road along the right bank, and dredge piles resulting from historical mining activities along the left bank. Grazing in the riparian area is limiting establishment of woody vegetation in some areas.

Potential restoration actions in this reach include: 1 changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) implementing active streambank stabilization and revegetation measures; and 3) removing dredge piles and realigning the channel away from the road to improve channel stability. Active restoration would likely prohibitive costly given the current infrastructure constraints.

IMG_0159

IMG_0168

IMG_1074

4.3.2 Reach SS-02

NRCS Score: 85% - Sustainable; Fish Habitat: 43% - Fair; Bank Erosion: 5.5%

Reach SS-02 is 4,786 feet in length and located on private land. This reach was visually classified as E, F, and B channel types. This classification is based on an estimated width-to-depth ratio of 5, with a sinuosity of 1.1, a gravel-dominated channel bed, and an estimated channel gradient of 1.7 percent. Livestock grazing occurs throughout the reach with many areas of bank trampling, but overall active lateral cutting on streambanks is minimal. At the upstream extent of the reach, the channel flows out of an unstable and confined reach into a wider valley bottom where sediment is deposited supporting sedge-dominated herbaceous wetlands that provide a lot of water storage. Snowshoe Creek Road crosses the stream at approximately the mid-point of the reach. The culvert at this road crossing appears to be undersized, and has been partially buried with sediments limiting the flow or water and sediment. It may be a barrier to fish passage at some flows. Upstream of the road crossing, the

channel is generally over-widened and shallow due to grazing and some woody vegetation removal. Downstream of the road crossing, multiple channels flows through a well vegetated willow complex before flows reconcentrate into a single channel along the northwest edge of the valley where there are localized areas of entrenchment. Sediment deposition, channel braiding, and beaver huts are present where this willow complex transitions into pond habitat formed by a small, privately owned reservoir called Lois Lake. There are a few small headcuts present in the willow complex, but they are not representative of the overall reach conditions. The reservoir is a complete barrier to upstream fish passage. There is one water diversion in this reach, located just upstream of Snowshoe Creek Road (IMG_0182).

Overall the reach supports a willow-dominated vegetation community, with inclusions of sedge-dominated wetlands. Woody vegetation is slightly limited and combined with some localized area channel incision, the energy dissipating and sediment capture functions are slightly limited.

During the time of this assessment flows were moderately high and estimated to be approximately 5 cfs. Fish habitat is characterized by a low number of pools or cover elements for most of the reach. Woody vegetation is lacking immediately along the channel in the upstream portion of the reach, but cover is slightly higher below the road through the willow complex.

The overall trend in this reach is likely stable. The reservoir has a significant influence on the reach conditions and is creating a large wetland complex. Outside of the reservoir influence, the effects of grazing have resulted in the removal of some riparian vegetation and localized channel erosion. If grazing pressure increases it is likely the conditions in this reach will decline.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) replacing the undersized culvert; and 3) providing fish passage above the reservoir.

IMG_0182

IMG_0186

IMG_0205

4.3.3 Reach SS-03

NRCS Score: 83% - Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 1.6%

Reach SS-03 is 6,708 feet in length and located on private land. This reach was visually classified as B and E channel types. This classification is based on an estimated width-to-depth ratio of 6.3 to 13.6, with a sinuosity of 1.1, a gravel-dominated channel bed, and an estimated overall channel gradient of 3.1%. This gradient is likely representative of the B channel portion of the reach only, with the lower end closer to 1.0% similar to Reach SS-04. At the upstream extent of the reach, the channel flows out of the reservoir and enters where a narrow canyon with some relatively steep sections before entering a wider, low gradient floodplain. Dredge piles consisting of large rock from historical placer mining confine portions of the channel in the middle of the reach. Livestock grazing is present throughout the reach, but is more common in the downstream portion of the reach where there is a wider floodplain and valley bottom. Overall, the channel is relatively stable throughout this reach with a few locations where there

are drops in the channel below over-widened sections. The channel is well connected to the floodplain with active flow observed in secondary channels and overbank flow onto the floodplain during the assessment. Minimal bank erosion was observed, consisting of hillslope erosion in upstream confined reaches and localized areas of bank trampling or erosion at livestock access or crossing points.

The upstream portion of the reach consists of a conifer-dominated community through the narrow canyon reach where there is little evidence of browse on trees and shrubs. The downstream portion of the reach is a cottonwood-dominated community with more evidence of livestock browse, particularly on younger age class trees and shrubs. Woody species regeneration is occurring and all age classes of trees and shrubs are present in the reach.

Flows at the time of the assessment were moderately high and estimated to be 15 cfs. Fish habitat quality is good with overhanging vegetation, large woody debris, and root wads providing habitat. Pools and overhanging vegetation are present, but may be somewhat limited from the potential.

The overall trend of this reach is stable. The reach currently supports many channel and floodplain functions and has high potential for natural recovery.

Potential restoration actions in this reach include: 1) removing historical dredge piles where they confine the channel and limit floodplain access; and 2) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish.

DSCN1215_228

DSCN1239_252

4.3.4 Reach SS-04

NRCS Score: 78% - At Risk; Fish Habitat: 80% - Good; Bank Erosion: 4.0%

Reach SS-04 is 3,590 feet in length and located on private land. This reach was visually classified as an E channel type with a short section of B channel. This classification is based on an estimated width-to-depth ratio between 2.3 and 3.5, with a sinuosity of 1.2, a gravel-dominated channel bed, and an estimated channel gradient of 1.0%. While the reach score falls into the At Risk category, the overall reach condition is generally sustainable with some impacts to the channel and floodplain related to grazing. Some sections of the channel are over-widened, but overall channel dimensions are appropriate for the landform setting and lateral erosion is relatively low. Grazing impacts increase in a downstream direction, and the loss of riparian vegetation has resulted in at least one potential avulsion hazard area near a stream crossing. There is one water diversion in this reach. Overflow from the irrigation ditch on the east side of the stream is resulting in an active headcut. The irrigation diversion structure also appears to act as a fish passage barrier.

Cottonwood forest dominates the upstream extent of the reach and then transitions to a shrub dominated community with willows, alders, red-osier dogwood, birch and rose through the middle of the reach. Woody riparian vegetation is lacking from the downstream extent of the reach with sedges along the channel and grasses dominating the riparian area. This is resulting in accelerated erosion of streambanks in some areas, particularly outer meander bends. The channel is slightly entrenched in the downstream extent of the reach. All age classes of woody species are present in the reach indicating natural regeneration is occurring, but younger plants show signs of heavy browse and mature shrubs are umbrella shaped from both browse and physical impacts.

Flows at the time of the assessment were moderately high and estimated to be 15 cfs. Fish habitat throughout the reach is good with generally narrow and deep channel conditions although pool habitats are somewhat limited. Cover elements are present, but woody vegetation and overhanging vegetation is lacking along the banks. Trees and shrubs provide shade for the channel through the upstream and middle portions of the reach.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) addressing potential avulsion risk near livestock crossings in the downstream portion of the reach; and 3) modifying the irrigation ditch to restore geomorphic stability and ensure fish passage.

IMG_0128

IMG_0134

IMG_0127

4.3.5 Reach SS-05

NRCS Score: 85% - Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 2.6%

Reach SS-05 is 6,116 feet in length and located on private land. This reach was visually classified as an E channel type, with short sections of C channel type. This classification is based on an estimated width-to-depth ratio between 2.3 and 10, with a sinuosity of 1.4, a gravel-dominated channel bed, and an estimated channel gradient of 1.0%. In the upper portion of the reach, the channel has incised from the historical floodplain as evidenced by drops where springs enter the channel. This has reduced the width of the potential riparian and wetland width throughout the reach. However, a narrower riparian corridor and streambank vegetation are forming at the new channel elevation. The Sinuosity and floodplain connectivity increase in the lower half of the reach. Lateral bank erosion is occurring in association with channel incision and a loss of riparian vegetation that has left some streambanks higher and drier than historical conditions. Numerous springs are located adjacent to the channel and one spring contributes approximately 2 to 3 more cubic feet per second of water to the channel. The

valley bottom in this reach has evidence of past draining, including drainage ditches that run perpendicular to the valley bottom.

The floodplain is dominated by a mix of cottonwood, willows, sedges and rushes. In incised areas, riparian areas are dominated by pasture grasses. All age classes of woody vegetation including cottonwood, willows, alder, and birch are present along the channel but seedlings are limited. Browse from livestock exceeds more than half of the second year growth and some willows have umbrella shaped growth form resulting from browse and physical impacts.

Flows at the time of the assessment were moderately high and estimated to be 10 cfs. Fish habitat in the reach is good with a mix of habits including undercut banks, deep and shallow pools, and some woody debris and overhanging woody vegetation that provide cover. Aquatic habitat conditions are limited by channel incision through some of the reach where there are also long sections of uniform habitat and loss of woody vegetation. Pool formation was correlated with lateral scour in sections of high sinuosity. The bed was composed of moderately clean gravels that appeared to be mobile under higher flows. Several fish were observed using pools and undercut bank habitats. The landowner reports that larger fish have been observed in a larger tributary spring creek that enters the stream just below the end of the reach.

The overall trend in this reach is likely stable. The geomorphic condition appears to be supporting good aquatic habitat and creating conditions that could support more woody vegetation. Actions that improve vegetation conditions will have the greatest effect on site conditions. In addition, actions that concentrate flows in the main channel will also contribute to flushing flows and improve pool development. Recovery potential is high because of the numerous springs and the presence of natural woody vegetation regeneration.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) repairing and/or replace existing riparian fence along the east side of the channel; 3) fencing spring habitat adjacent to the channel to enhance habitat and late season flows; 4) active revegetation of a riparian corridor along the channel; 5) filling historical ditches and floodplain drainage features that draw water away from the channel; 6) installing aquatic habitat enhancement structures; and 7) relocation and reconnection of channel with floodplain in the upper portion of reach.

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IMG_0254

IMG_0238

4.3.6 Reach SS-05a-R

NRCS Score: 55% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach SS-05a-R is 5,000 feet in length and located on private land. This reach was visually classified as an E channel type. This classification is based on an estimated width-to-depth ratio between 4 and 10, with a sinuosity of 1.61, and an estimated channel gradient of 0.65 percent. This reach was remotely assessed, but is similar to Reaches SS-05 and SS-06 that were assessed in the field. Based on aerial photographs, the channel appears to be somewhat incised, potentially with headcuts. Adjacent land uses including livestock grazing and haying, have reduced woody vegetation cover along the channel that is likely contributing to channel instability and lateral bank erosion. Portions of the channel appear to be over-wide in association with livestock crossings.

Woody vegetation that likely includes willows is present along portions of the channel, but overall the reach is dominated by herbaceous vegetation communities. The simplified

vegetation community and lack of woody debris likely limit the system's ability to dissipate energy associated with flood flows and capture sediment.

Flows at the time of the assessment were moderately high and estimated to be 25 cfs. Fish habitat could not be assessed remotely, but it is expected that overall aquatic habitat is good, but cover elements such as overhanging vegetation and undercut banks may be lacking, particularly in the downstream portion of the reach.

The overall trend in this reach is likely stable or declining. Land use impacts appear to be influencing conditions in this reach similar to upstream and downstream reaches.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) addressing bank erosion through stabilization and active revegetation treatments. No major limiting factors to restoration actions in adjacent reaches were identified during the remote assessment. If significant bank erosion is present, the continued delivery of fine sediment may influence active restoration actions downstream.

4.3.7 Reach SS-06

NRCS Score: 58% - At Risk; Fish Habitat: 70% - Fair; Bank Erosion: 8.5%

Reach SS-06 is 12,025 feet in length and located on private land. This reach was visually classified as an E channel type. This classification is based on an estimated width-to-depth ratio between 3 and 7.5, with a sinuosity of 1.7, a gravel dominated channel bed, and an estimated channel gradient of 0.4%. The channel throughout the reach shows some signs of instability including headcuts, some of which may be associated with former beaver dam locations. Lateral erosion is prevalent throughout the reach associated primarily with the loss of woody vegetation along the channel, but also hillside erosion where the channel abuts terrace features.

Willows are the dominant woody vegetation with all age classes of present, although mature shrubs are the most abundant. Livestock browse appears to target younger seedling and sapling plants and mature plants have signs of physical impacts resulting in umbrella shaped growth form. Evidence of concentrated livestock use is present in some of the willow stands that are higher in elevation relative to the channel elevation. Some woody vegetation also appears to be cut by beavers although active beaver huts did not appear to be present in the reach. Portions of the channel that may have been associated with former beaver dams have lower, well connected floodplain benches and some connected side channels. The downstream extent of the reach is lower gradient and more connected with the floodplain with less bank erosion.

Portions of the reach have good aquatic and fish habitat where shrub vegetation is dense along the channel providing overhanging vegetation cover. Pools, undercut banks, and small woody debris are also present in the reach. Substrate conditions vary throughout the reach depending on the channel gradient, the presence of headcuts and local erosion. Clean gravel is present in portions of the reach.

This reach overlaps with the 2009 FWP assessment reach RM 2.1. The results of this assessment indicated that the channel is incised but stabilizing at a new elevation. Observations also included the prevalence of pasture grasses throughout the reach, a lack of vegetation on outer banks and bank erosion. Aquatic habitat was good but the lack of riparian vegetation and sediment accumulation reduced overall scores. The overall NRCS sustainability score for this reach was 77.94%, similar to the results of the 2014 assessment. This score is higher than the 2014 score of 58% but descriptions of the conditions in the reach are similar between assessments.

The overall trend of this reach is declining due to on-going grazing that is limiting vegetation establishment and bank recovery. There are also active headcuts in the reach that indicate channel instability. If grazing were reduced, natural recovery potential for the reach appears to be high, although it would require some channel evolution due to active headcuts. Some eroding streambanks appear to be revegetating naturally as sod mats fall from the top of the bank and re-establish herbaceous vegetation along the channel margin.

Potential restoration actions for this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) addressing bank erosion through stabilization and active revegetation treatments active revegetation or streambank stabilization, particularly in association with hillside erosion; 3) evaluating potential for channel realignment and reconnection to the floodplain to address channel instability; and 4) evaluating the irrigation diversion structure near the upstream extent of the reach for fish entrainment risk.

DSCN1166_179

DSCN1171_184

4.3.8 Reach SS-06a-R

NRCS Score: 55% - At Risk; Fish Habitat: NA; Bank Erosion: NA

Reach SS-06a-R is 10,217 feet in length and located on private land. This reach was visually classified as an E channel type. This classification is based on an estimated width-to-depth ratio of approximately 9, with a sinuosity of 2.1, and an estimated channel gradient of 0.6%.

This reach was remotely assessed, but is similar to Reach SS-06 that was assessed in the field. Based on aerial photographs the channel appears to be incised and headcuts may be present. Woody vegetation is lacking along the channel and lateral bank erosion is likely occurring. Some over-widening may be occurring in association with eroding outer meander bends with some point bar development or enlargement. Existing land use including livestock grazing and haying have resulted in the loss of woody vegetation along the channel.

The vegetation in the floodplain is dominated by herbaceous species. Some shrubs, likely willows, are visible on aerial photographs.

Fish habitat could not be remotely assessed, but it is expected that overall aquatic habitat is good. Previous assessments associated with developing the TMDL noted pools and near bank vegetation supporting aquatic habitat (DEQ 2011). However, current aerial photography shows large areas lacking woody vegetation cover and shading along the channel.

The overall trend in this reach is likely stable or declining. Land use impacts appear to be contributing ongoing erosion and suppressed woody vegetation cover along the channel, threatening the stability of this reach.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; and 2) addressing bank erosion through stabilization and active revegetation treatments. No major limiting factors to

restoration actions in adjacent reaches were identified during the remote assessment. If significant bank erosion is present, the continued delivery of fine sediment may influence active restoration actions downstream.

4.3.9 Reach SS-07

NRCS Score: 63% - At Risk; Fish Habitat: 57% - Fair; Bank Erosion: 6.2%

Reach SS-07 is 826 feet in length and located on private land. This reach was visually classified as an E channel type. This classification is based on an estimated width-to-depth ratio greater than 12, with a sinuosity of 1.1, a gravel dominated channel bed, and an estimated channel gradient of 0.64%.

The channel is relatively stable through this reach; however, a beaver dam is located near the bottom of the reach which may contribute to instability in the future if it fails. Lateral erosion is present with slumping banks that are re-establishing vegetation along the water's edge. The inset floodplain is disconnected from the historical floodplain. An old diversion structure is located on a high streambank at the former channel elevation. Sediment is accumulating upstream of the beaver dam, covering the gravel substrate that is present in the upstream portion of the reach. Willows are present along the channel, with only the decadent age class missing. Livestock browse is present, but generally not extensive.

Flows at the time of the assessment were moderately high and estimated to be 20-30 cfs. Overall fish habitat in this reach is fair with some deep pools and a few shallow pools; however, most cover elements are lacking or absent including overhanging vegetation, undercut banks, and woody debris.

The overall trend of this reach is declining due to channel incision and grazing which has reduced woody vegetation cover and bank instability. Many banks lack deep binding root mass and could erode with a large flood event or continued land use impacts.

Potential restoration actions in this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2) removal of a wooden bridge that used to span the channel has fallen in the channel and should be removed; and 3) addressing bank erosion through stabilization and active revegetation treatments; and 4) evaluating potential to reconnect and expand floodplain at confluence with Little Blackfoot River.

DSCN1144_157

DSCN1153_166

4.4 Spotted Dog Creek

Spotted Dog is a tributary to the Little Blackfoot River that flows for approximately 14 miles before entering at Little Blackfoot River Mile 14.8. The lower 5.5 miles of Spotted Dog flows primarily through privately owned lands. The middle five miles flows through land managed by Montana Fish Wildlife and Parks. The upper four miles of stream lies within lands administered by the U.S. Forest Service. The primary land uses in the Spotted Dog Creek drainage are cattle grazing, timber harvest, and hay production in the lower reaches. There is a 16-acre private reservoir located on the stream at river mile 5.5. The dam and outfall limit all upstream fish migration. In the lower portion of the watershed, the trout community is comprised primarily of brown trout, although westslope cutthroat trout and brook trout are also present. Slimy sculpin and longnose sucker also occurred in the lower reach. At river mile 4.6, brown trout, westslope cutthroat trout and brook trout comprised the trout community in about equal numbers. Above the reservoir, on Forest Service land, the trout community is primarily westslope cutthroat trout with rare brook trout.

Lower Spotted Dog Creek (MT76G004_032) is listed for sedimentation/siltation on the 2010 303(d) List. In addition, this segment is also listed for alteration in stream-side or littoral vegetative covers, which is a non-pollutant commonly linked to sediment impairment. Lower Spotted Dog is listed for sediment impairment based on sedimentation attributed to agriculture and livestock grazing.

Table 4-5 summarizes the results of the assessments completed along Spotted Dog Creek including the channel type, percent bank erosion, NRCS score and rating and fish habitat score and rating. Figure 4-8 shows the NRCS rating by assessment reach. Figure 4-9 shows the

percent bank erosion by reach. The assessment results indicate variable riparian and aquatic habitat conditions throughout the assessment area. The upper reaches historically had significant beaver influence, but reduced beaver activity combined with on-going grazing impacts has resulted in a geomorphically unstable area. Below this area the channel flows through a canyon reach with high quality habitat before entering another highly manipulated reach ending with the channel flowing into a private reservoir. Below the reservoir the channel flows through another high quality canyon reach. Below this canyon reach, there is a small reach that was historically another on-channel reservoir. The stream then flows into another canyon reach. At the outlet of this canyon, there is another small on-channel water storage reservoir. Land management impacts increase significantly below this point, with long stretches of bank erosion, numerous diversion structures and greatly reduced woody riparian vegetation. There are only two main land managers on Spotted Dog Creek, Montana Fish, Wildlife and Parks and Spotted Dog Ranch.

The primary restoration actions for Spotted Dog Creek include: 1) preservation and conservation of high quality canyon habitat; 2) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 3) implementing streambank stabilization and revegetation measures; and 4) considering active restoration on Montana Fish, Wildlife and Parks property.

Table 4-5. Summary of Spotted Dog Creek assessment reach characteristics.

Reach ID	Reach Length (ft)	Channel Type	Primary Land Use	Linear Bank Erosion (%)	NRCS Score (%)	NRCS Rating	Fish Habitat Score (%)	Fish Habitat Rating
SD-01a	3,601	B/C	Grazing, Forested Pasture	18.7%	73%	At Risk	80%	Good
SD-01b	9,782	DA	Grazing	12.1%	80%	Sustainable	90%	Good
SD-01c	5,174	E/F	Grazing	16.1%	47%	Not sustainable	50%	Fair
SD-02	4,373	B	Grazing, State land	1.2%	90%	Sustainable	90%	Good
SD-03	4,400	B/C	Grazing	10.3%	60%	At Risk	50%	Fair
SD-04	3,861	E	Grazing, Reservoir	7.9%	58%	At Risk	40%	Poor
SD-05	6,076	B	Grazing, Natural (below reservoir)	1.3%	77%	At Risk	70%	Fair
SD-06	2,614	C	Former reservoir, Grazing	10.5%	58%	At Risk	50%	Fair
SD-07	4,294	B	Grazing, Natural	1.2%	83%	Sustainable	90%	Good
SD-08	2,991	B	Grazing, Natural	4.5%	83%	Sustainable	70%	Fair
SD-09/10	3,274	B/C	Grazing	9.8%	58%	At Risk	53%	Fair
SD-11	2,637	B/C	Grazing	8.7%	52%	At Risk	67%	Fair
SD-12	2,720	C	Grazing	1.7%	49%	Not sustainable	80%	Good
SD-13	4,247	E	Grazing	12.7%	65%	At Risk	70%	Fair
SD-14	3,554	E	Grazing	17.2%	63%	At Risk	70%	Fair

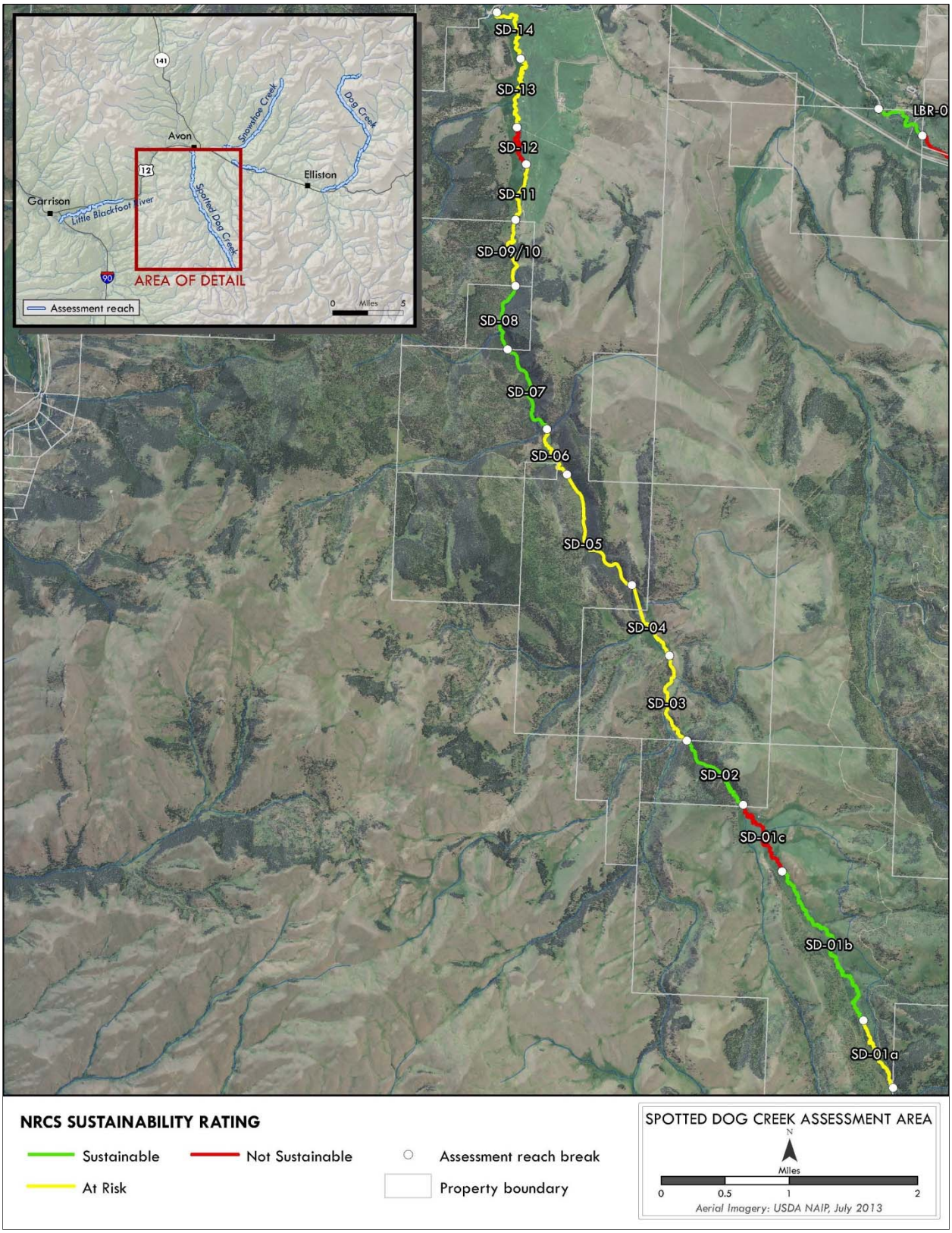

Figure 4-8. NRCS riparian assessment sustainability ratings results for the Spotted Dog Creek assessment area.

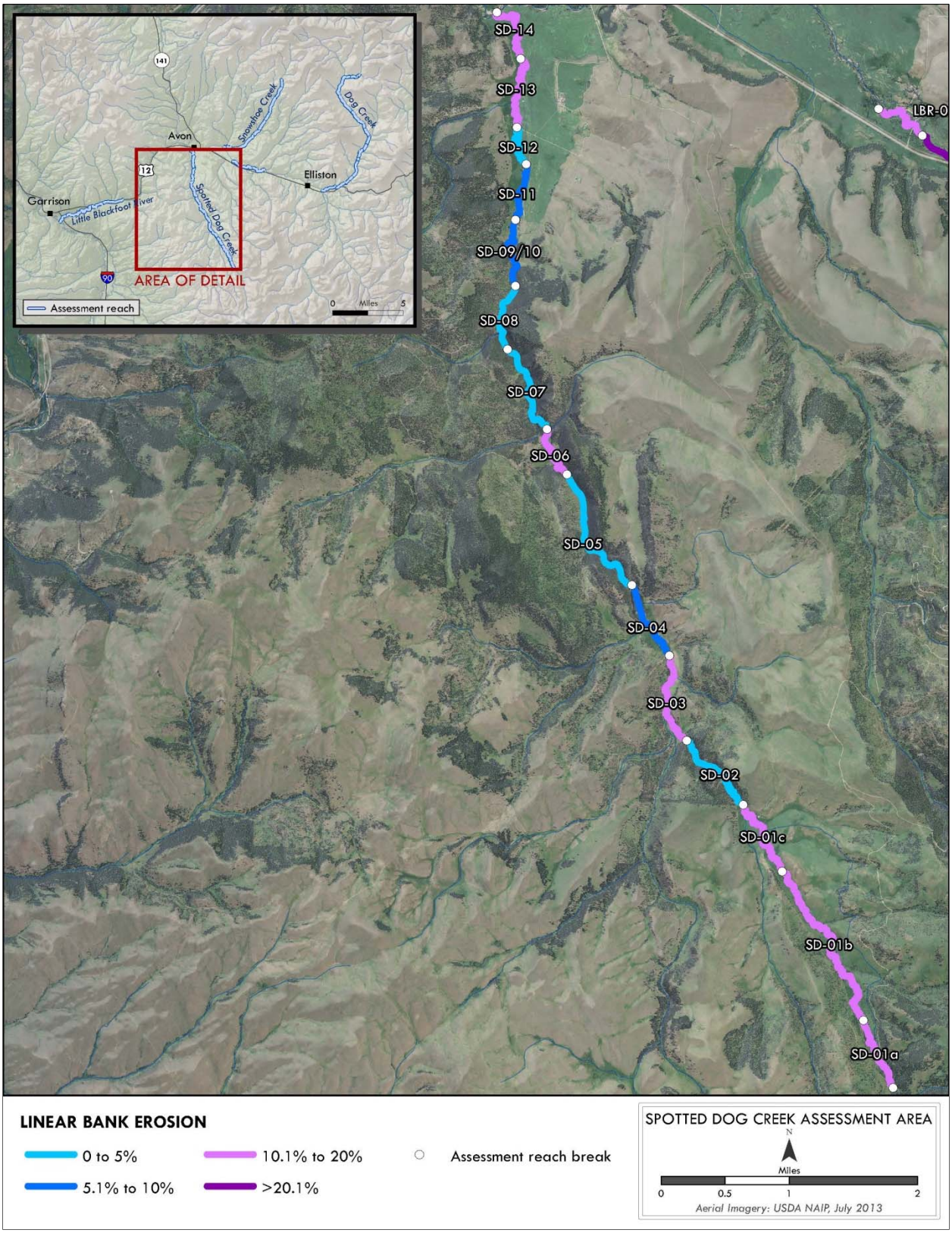

Figure 4-9. Percent linear feet of bank erosion for the Spotted Dog Creek assessment area.

4.4.1 Reach SD-01a

NRCS Score: 73% - At Risk; Fish Habitat: 80% - Good; Bank Erosion: 18.7%

Reach SD-01a is 3,601 feet in length and located on land owned by the Montana Fish, Wildlife and Parks. SD-01a was visually classified as a B channel type, with some sections of the reach having characteristics of a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 6-12, a sinuosity of 1.2, a cobble/gravel dominated channel bed, and an estimated channel gradient of 2.0%. This reach begins at Forest Service Rd 314. The culvert under this road appears undersized. This reach is in fairly good condition with good aquatic habitat. The reach is grazed by cattle which has led to removal of vegetation from streambanks and some physical damage to streambanks from hoof shear. This has resulted in some over-widened areas of the channel and mid-channel deposition. The channel is generally well connected with the floodplain and overflow channels were activated at the time of the assessment. There is one water diversion in this reach. The diversion structure is in good condition and does not appear to be a barrier to fish passage. The ditch bottom is vegetated with herbaceous vegetation and it is unclear if the diversion is still active. It also appears that channel spanning habitat structures may have been installed in the reach in the past. Many of these structures now have scour, bank erosion and small head cuts associated with them.

The floodplain is characterized by spruce with an understory of dogwood, willow alder, currant and a mix of dry and wet grasses and forbs. Streambanks are characterized by a low density of woody riparian vegetation consisting primarily of alder and dogwood. There is evidence of moderate browse by cattle. Regeneration of desirable woody species, such as willows is limited and the younger age class is greatly reduced due to grazing. There are some noxious weeds present in this reach, including Canada thistle and spotted knapweed. There is also houndstongue along the irrigation ditch.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, there are numerous cover elements present in the reach. Over-hanging vegetation and undercut banks are severely limited compared with undisturbed conditions. There appears to be an even mix of shallow and deep pools, but pools are reduced from undisturbed conditions due to channel over-widening in some areas. Pools are formed primarily by woody debris, boulders and lateral scour.

The trend for this reach appears to be declining. Continued grazing of the reach will likely continue causing channel widening and instability along with increased fine sediment inputs to the channel.

Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; 2)

implementing bank stabilization and revegetation measures to reduce bank erosion; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; 4) weed control; and 5) replace undersized culvert at top of reach.

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4.4.2 Reach SD-01b

NRCS Score: 80% - Sustainable; Fish Habitat: 90% - Good; Bank Erosion: 12.1%

Reach SD-01b is 9,782 feet in length and located on land owned by Montana Fish, Wildlife and Parks. SD-01b is a beaver complex and was visually classified as a DA channel type. This classification is based on a numerous stable channels. The main channel through this area was observed and has a bankfull width-to-depth ratio estimate of 7, a sinuosity of 1.4, a gravel/cobble dominated channel bed, and an estimated channel gradient of 1.6%. This reach is heavily influenced by current and past beaver activity and grazing. Where active beaver dams are present there is very diverse vegetation and aquatic habitat. Where there is not active beaver activity the channel has incised with high amounts of bank erosion, limited streambank vegetation and uniform aquatic habitat. This incision is likely a result of past beaver activity but is also influenced by a history of grazing that has removed woody vegetation along streambanks. Floodplain connectivity therefore varies throughout the reach, which some areas well connected and diverse and other areas disconnected and much drier and more impacted by grazing.

A large portion of the floodplain in this reach is dominated by dense stands of willows that are maintained by beaver activity with numerous small channels and ponds. Floodplain connectivity has been reduced by channel incision, but off channel beaver activity maintains floodplain diversity and cover by desirable woody vegetation. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of willow species, Wood's rose and currant. There is a moderate distribution of age classes of woody

species such as willow but minimal regeneration of woody riparian vegetation due to the lack of connected, stable depositional surfaces. The floodplain within the reach is grazed by cattle, and variable levels of browse were observed. Numerous cattle trails are present through the willow stands, and some willows, further from the channel are high-lined willows. In disconnected areas of the floodplain, willows are decadent and dry species are predominant.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, aquatic habitat is high quality in this reach due to the diversity created by the beaver dams and resulting ponds and multiple channels. The incised sections of channel have uniform habitat and lack cover elements and pools.

The trend for this reach is highly dependent on the continued presence and activity by beaver. Channel incision is active and will continue in the reach. In the absence of beaver, this will lead to loss of connectivity with the floodplain, increased bank erosion, increased fine sediment delivery to the channel and reduced aquatic habitat. If beaver remain active in the reach, floodplain connectivity will continue to be variable but not reduce the overall function and quality of the reach. The reach is likely declining due to continued grazing, which will continue to reduce woody riparian vegetation cover and contribute to bank instability and reduce resiliency of the floodplain to changing conditions. Although this reach scored a NRCS rating of 'sustainable', there are a number of issues in this reach that can potential degrade the current condition.

Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; and 2) implementing measures that may encourage continued beaver activity in the reach. Active stabilization and revegetation activities are not recommended for this reach due to the variability caused by on-going beaver activity.

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4.4.3 Reach SD-01c

NRCS Score: 47% - Not Sustainable; Fish Habitat: 50% - Fair; Bank Erosion: 16.1%
Reach SD-01c is 5,174 feet in length and located on land owned by the Montana Fish, Wildlife and Parks. Reach SD-01c was visually classified as an F channel type at the upper end and an E channel type at the lower end. This classification is based on a bankfull width-to-depth ratio estimate of 2.5-12, a sinuosity of 1.6, a gravel dominated channel bed, and an estimated channel gradient of 1.2%. This reach begins at a long section of channel that is actively incising as evidenced by the presence of a headcut near the start of the reach. This section is over 200 feet long, is characterized by erosion of both streambanks and is incised below the floodplain by up to 4 feet. It is likely the incision is the result of discontinued beaver activity in this reach combined with removal of woody vegetation from the floodplain due to cattle grazing. The headcut has been temporarily arrested by two successive beaver dams with approximately two to four foot vertical drops. Eventual failure of these dams will allow the headcut to propagate into Reach SD01B thus abandoning the existing floodplain and initiating the evolutional process of conversion from wetlands to various transitional alluvial channels as evidenced downstream. Below this section, the channel becomes more sinuous and regains connectivity with the floodplain. Bank erosion is still high in this portion of the reach due to the loss of woody streambank and floodplain vegetation. There is an abandoned bridge crossing the channel near the buildings that has accumulated sediment and woody debris over time. This has resulted in sediment deposition above the structure and channel braiding.

The floodplain is dominated by decadent willows and drier shrubs such as rose and currant. The understory is dominated by pasture grasses. Wet forbs and graminoids become dominant in a downstream direction. The reach is characterized by a low density of woody riparian vegetation along the streambanks, primarily willow species. There is a low distribution of age classes of woody species such as willow and younger age classes absent. The floodplain within

the reach is heavily grazed by cattle, with most willow exhibiting an umbrella shaped growth form.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, aquatic habitat was very uniform with little to no undercut banks and overhanging woody vegetation. Some shallow pools are present on the outside of meander bends, but these pools lack cover.

This trend of this reach is declining. The geomorphic condition is being affected by reduced beaver activity and lack of vegetation. In general, this reach is in various evolutionary states representing transition from a beaver controlled wetland-dominated system to an alluvial system. Field observations included active headcuts, channel widening, bank erosion, channel aggradation and inset floodplain development. Channel adjustments can be expected to continue in this reach until an equilibrium state is reached. Given the reduced beaver activity and vegetation in this reach, the potential condition for this reach is an E4 stream type. To reach this condition, the creek must re-work the former wetland-dominated, hummocky valley bottom into a wider, flatter, alluvial floodplain. During this transition, lateral migration, bank erosion and high sediment loads can be expected to continue for a long time.

Potential restoration actions within this reach include: 1) changing the land use (grazing/pasture) or resting the area from grazing to allow woody vegetation to establish; and 2) active restoration of the channel and floodplain. Any active restoration considered in this reach should consider the future role of beaver in this area. Active restoration can be implemented effectively in areas where beaver activity is prevalent as long as the uncertainty, risks and benefits of their role is acknowledged.

If fisheries values warrant, there are opportunities to address channel instability in Reach SD01C with active restoration. The objective of active restoration would be to modify the geomorphic condition to a more advanced evolutionary state with potential for faster recovery. Active restoration would reduce sediment loading to downstream reaches. Both actions would allow for future transition back to beaver-influenced wetland systems if woody vegetation can be established. The options for active restoration include:

- Establish a C4 stream type representing a temporary evolutionary state. This would be accomplished by treating most of the existing channel in place, installing structures to protect the banks, and grading higher banks to create a wider floodplain. This channel would be steeper and less sinuous than an E4 stream type. Achieving temporary stability in order to establish vegetation would be an objective for this action. This approach has risk in that continued adjustment and disturbance could be expected.

- Establish an E4 stream type representing a more advanced evolutionary state. This would be accomplished by re-aligning the channel to increase sinuosity, installing structures to protect the banks and grading the floodplain to establish a minimum belt width of about 250 feet. This approach would have less risk in that less adjustment and fewer disturbances could be expected.

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4.4.4 Reach SD-02

NRCS Score: 90% - Sustainable; Fish Habitat: 90% - Good; Bank Erosion: 1.2%

Reach SD-02 is 4,373 feet in length and located on land owned by the State of Montana. SD-02 was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate of 20, a sinuosity of 1.3, a cobble/gravel dominated channel bed, and an estimated channel gradient of 2.0%. This reach begins just below the buildings in Reach SD-01c where the channel enters a narrow canyon. This reach is in good condition with high quality aquatic habitat. The reach is grazed by cattle which has led to removal of vegetation from streambanks and some physical damage to streambanks from hoof shear, but impacts are generally minimal due to limited access into the canyon.

The floodplain is characterized by spruce with an understory of dogwood, willow alder, currant and a mix of dry and wet grasses and forbs. Streambanks are characterized by a moderate density of woody riparian vegetation consisting primarily of alder and dogwood. There is evidence of moderate browse by cattle. Regeneration of desirable woody species, such as willows is only somewhat reduced.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, there are numerous cover elements present in the reach. Over-hanging vegetation and undercut banks are somewhat limited compared with undisturbed conditions. There appears to be an even mix of shallow and deep pools, formed primarily by woody debris and boulders.

The trend for this reach appears to be static. Grazing in this reach will continue to reduce woody vegetation cover along the channel but this is not likely to cause geomorphic instability in the reach given the channel type.

Potential restoration actions within this reach include: 1) limiting cattle access into the canyon; 2) conservation and preservation of high quality habitat; and 3) increase large woody debris abundance in channel.

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4.4.5 Reach SD-03

NRCS Score: 60% - At Risk; Fish Habitat: 50% - Fair; Bank Erosion: 10.3%

Reach SD-03 is 4,400 feet in length and located on Montana Fish, Wildlife and Parks. Reach SD-03 was visually classified as a B channel type with some sections having C channel characteristics. This classification is based on a bankfull width-to-depth ratio estimate of 6.7-7.6, a sinuosity of 1.2, a gravel/cobble dominated channel bed, and an estimated channel gradient of 1.6%. The valley bottom in this reach appears to have been significantly in the past, possibly from logging and mining activities. There are large areas of fill that have been placed in the floodplain which has resulted in channel straightening and some incision. A new floodplain has formed at the new channel elevation. Many outer meander bends are actively eroding due to channel incision and the loss of woody vegetation due to livestock grazing. South Fork Spotted Dog Creek flows into Spotted Dog Creek in this reach.

The floodplain surface is dominated by herbaceous vegetation with sporadic shrubs, primarily willows and alder. The reach is characterized by a moderate density of woody riparian vegetation along the streambanks consisting of alder and willow. The reach is grazed by cattle and moderate levels of browse were observed on shrubs.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with only a few pools formed by lateral scour, overhanging vegetation. Cover elements include overhanging vegetation, and undercut banks, but are severely limited. There is some accumulation of fine sediment in the channel.

The overall trend of this reach is declining. Continued grazing will prevent woody vegetation from establishing which is needed to reduce erosion, stabilize the channel and improve aquatic habitat.

Potential restoration projects within this reach include: 1) changing the land use (grazing/pasture), changing the grazing regime to limit the duration or modify the timing of use, or installing riparian protection measures such as fencing; 2) implementing bank stabilization and revegetation measures to reduce bank erosion or replace existing riprap; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; and 4) weed control.

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IMG_0337

4.4.6 Reach SD-04

NRCS Score: 58% - At Risk; Fish Habitat: 40% - Fair; Bank Erosion: 7.9%

Reach SD-04 is 3,861 feet in length and located on Montana Fish, Wildlife and Parks and private land. LBR-04 was visually classified as an E channel type. This classification is based on a

bankfull width-to-depth ratio estimate of 7.5-20, a sinuosity of 1.2, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.3%. The channel in this reach is influenced by backwater effect of the reservoir. The channel is sinuous but there is little vegetation and the channel is over-widened. The channel becomes more sinuous before flowing into the reservoir. The storage and operation details of the reservoir is unknown. The reservoir outlet structure is a complete barrier to upstream movement of fish. Very little woody vegetation is present along the channel and most of the banks are actively eroding or have sign of damage from hoof shear. The channel is wide and shallow until it flows under a fence located on the property line where the channel width becomes much narrower.

Very little woody vegetation is present along the channel, but there are remnant willows spread throughout the floodplain. Many of these show sign of heavy browse. Herbaceous vegetation is predominant in the reach and includes sedges, rushes and pasture grasses.

Flows at the time of the assessment were high, approximately 60 cfs, making fish habitat difficult to assess. In general, aquatic habitat appeared very uniform with little to no pools or cover elements.

The overall trend of this reach is stable or declining. The reach is influenced by the backwater effect of the reservoir which helps maintain floodplain connectivity, but continued grazing will limit the recovery of woody vegetation in the reach which is needed to reduce channel over-widening and improve aquatic habitat.

Potential restoration projects within this reach include: 1) changing the land use (grazing/pasture), changing the grazing regime to limit the duration or modify the timing of use, or installing riparian protection measures such as fencing; 2) implementing bank stabilization and revegetation measures to reduce bank erosion or to replace existing riprap; 3) installing habitat enhancement structures to increase pool frequency and improve aquatic habitat; and 4) evaluating the potential to allow fish passage at the reservoir outlet.

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IMG_0354

IMG_0357

IMG_0360

4.4.7 Reach SD-05

NRCS Score: 77% - At Risk; Fish Habitat: 70% - Fair; Bank Erosion: 1.3%

Reach SD-05 is 6,076 feet in length and located on land owned by the State of Montana. SD-02 was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate of 10-14.7, a sinuosity of 1.2, a cobble/gravel dominated channel bed, and an estimated channel gradient of 1.8%. This reach begins at the reservoir outlet and flows into a narrow canyon. This reach is in good condition with high quality aquatic habitat. The reach is grazed by cattle which has led to removal of vegetation from streambanks and some physical damage to streambanks from hoof shear, but impacts are generally minimal due to limited access into the canyon.

The floodplain is characterized by spruce with an understory of dogwood, willow alder, currant and a mix of dry and wet grasses and forbs. Streambanks are characterized by a moderate density of woody riparian vegetation consisting primarily of alder and dogwood. There is

evidence of moderate browse by cattle. Regeneration of desirable woody species, such as willows is only somewhat reduced.

Flows at the time of the assessment were high, approximately 50 cfs, making fish habitat difficult to assess. In general, there are numerous cover elements present in the reach. Over-hanging vegetation and undercut banks are somewhat limited compared with undisturbed conditions. There appears to be an even mix of shallow and deep pools, formed primarily by woody debris and boulders.

This reach overlaps with the 2009 FWP assessment reach RM 4.6. The results of this assessment indicated that cattle impacts were observed throughout the reach along with recent timber harvest. The assessment also indicated that aquatic habitat is reduced by pocket water and a lack of large woody debris and bank cover. The overall NRCS sustainability score for this reach was 95.71%. Although this score is higher than the 2014 assessment score of 77% the description of impacts and conditions in the reach are very similar.

The trend for this reach appears to be static. Grazing in this reach will continue to reduce woody vegetation cover along the channel but this is not likely to cause geomorphic instability in the reach given the channel type.

Potential restoration actions within this reach include: 1) limiting cattle access into the canyon; 2) conservation and preservation of high quality habitat; and 3) increase large woody debris abundance in channel.

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IMG_0372

4.4.8 Reach SD-06

NRCS Score: 58% - At Risk; Fish Habitat: 50% - Fair; Bank Erosion: 10.5%

Reach SD-06 is 2,614 feet in length and located on private land. This reach was visually classified as a C channel type. This classification is based on a bankfull width-to-depth ratio estimate of 12 to 100, a sinuosity of 1.3, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.6 percent.

The reach was formerly a reservoir and it is likely that after the dam was removed, the channel cut through accumulated sediment, but it now appears vertically stable with no active down-cutting. There is some lateral instability with slumping and eroding banks, primarily on outside meander bends. Many eroding banks also have physical damage associated with livestock use which also results some over-wide channel segments. The channel may still be adjusting to incision through the reservoir sediments and there is abundant sediment in the channel overlaying coarser substrate. Although herbaceous vegetation dominates the floodplain, it appears to be relatively stable.

Woody vegetation is limited in the reach and was likely either removed prior to construction of the dam to create the reservoir, or it was drowned. Some willows are present at the edges of the valley suggesting that willows were historically more abundant. Nebraska sedge and arctic rush, common species in grazed wet meadows, are the dominate floodplain species that are effectively providing floodplain stability to the reach. Grazing induced species, such as bull thistle, are present with relatively high cover in the floodplain. The few woody plants that are present in the reach are heavily browsed with more than half of the second year growth showing signs of browse. The potential floodplain community is likely to support willows which would improve streambank stability, narrow the channel and improve aquatic habitat.

Flows at the time of the assessment were high, approximately 100 cfs. In general, habitat conditions were rated as fair, but most cover elements are missing from the channel and most of the substrate is covered with fine sediment. While a lot sediment is present in the channel, it doesn't appear to be causing the coarser substrate to be embedded. A few pools are present, but most of the reach consists of riffle habitat.

The overall trend of this reach is declining. The channel is over-widening in some locations and there is very little woody vegetation colonizing or regenerating to provide stability. Sedges are colonizing inside meanders and are present in the floodplain to trap fine sediment which may indicate some level of recovery. However, ongoing grazing continues to impact woody vegetation recovery and streambank erosion due to trampling.

Potential restoration actions within this reach include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 2) passively or actively revegetating streambanks; and 3) weed management.

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IMG_0375

4.4.9 Reach SD-07

NRCS Score: 83% - Sustainable; Fish Habitat: 90% - Good; Bank Erosion: 1.2%
Reach SD-07 is 4,294 feet in length and located on private land. This reach was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate of 15.3, a sinuosity of 1.2, a cobble dominated channel bed, and an estimated channel gradient of 1.6 percent.

The channel flows through a narrower canyon than upstream reaches with little sign of past incision. The channel is connected with the floodplain. There is some lateral erosion where channel flows against the hillside and few localized areas of bank trampling by cattle, but overall lateral bank erosion is in balance with the stream and its setting. The narrow valley limits human-induced erosion and livestock impacts are generally limited to wider floodplain areas where woody riparian vegetation is slightly less than its potential.

Douglas fir, alder, willows, and rose are the dominant woody species along the channel. Herbaceous species include native species, but also some grazing induced species such as dandelion and bull thistle. Some noxious weed are also present including houndstongue and spotted knapweed and are most common where there is a wider floodplain and some of the woody vegetation is limited. Overall livestock browse is generally light, but younger age classes are more heavily browsed than older individuals. Most age classes of woody species are present, but seedling/sapling age class is somewhat limited.

Flows at the time of the assessment were high, approximately 100 cfs. Fish habitat in the reach overall is good. The upstream portion of the reach has excellent habitat with cascades, boulder pools, and large woody debris. There are few pools in the lower portion of the reach and limited cover compared to the upstream portion of the reach.

The overall trend of this reach is stable. Due to the valley and channel type, it is not likely that continued grazing will degrade the channel. Increased woody vegetation cover in some locations and corresponding large woody debris inputs to the channel could potentially improve aquatic habitat, particularly in the downstream portion of the reach.

Potential restoration actions within this reach include: 1) limit cattle access into the canyon; 2) weed management to encourage recovery of native riparian species; and 3) potentially adding large woody debris to improve aquatic habitat.

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4.4.10 Reach SD-08

NRCS Score: 83% - Sustainable; Fish Habitat: 70% - Fair; Bank Erosion: 4.5%

Reach SD-08 is 2,991 feet in length and located on private land. This reach was visually classified as a B channel type. This classification is based on a bankfull width-to-depth ratio estimate between 13.3 and 16.7, a sinuosity of 1.1, a cobble dominated channel bed, and an estimated channel gradient of 1.3 percent.

This reach is similar to Reach SD-07 and the stream flows through a narrow, steep canyon. The reach break between SD-07 and SD-08 occurs at a parcel line where ownership changes. The narrow canyon naturally limits the floodplain extent and grazing impacts. However, grazing impacts are present particularly where there a slightly wider floodplain extents. The channel appears vertically stable and lateral erosion is primarily limited to some hillslopes and outer meander bends due to the naturally confined valley bottom. Sediment is efficiently moved through the system. However, there are some limitation to sediment capture related to removal of woody vegetation cover in some locations where there are now relatively large uniform surfaces dominated by herbaceous vegetation. These surfaces may have been manipulated in the past.

Douglas fir, alder, rose, willows, and dogwood are the dominant woody vegetation along the channel. The reach is generally dominated by woody vegetation cover, but there are some locations with limited woody vegetation cover. Most age classes of woody species are present, but the seedling/sapling age class is limited. Browse on woody species is relatively light and appears to target willows and alders. Grazing induced species are common distributed in the reach including yarrow, dandelion, bull thistle, clover, and timothy. Houndstongue, a noxious weed, is also present in the reach.

Flows at the time of the assessment were high, approximately 100 cfs. In general, aquatic habitat is good throughout the reach, but is relatively uniform consisting primarily of straight riffle habitat. There are limited pools and reduced presence of cover elements.

The overall trend of this reach is stable. The natural channel and valley type appear to support the current grazing land use without significant channel degradation.

Potential restoration actions within this reach include: 1) limit cattle access into the canyon; 2) weed management to encourage recovery of native riparian species; and 3) potentially adding large woody debris to improve aquatic habitat.

IMG_0400

IMG_0403

4.4.11 Reach SD-09/10

NRCS Score: 58% - At Risk; Fish Habitat: 53% - Fair; Bank Erosion: 9.8%

Reach SD-09/10 is 3,274 feet in length and located on private land. This reach was visually classified as B and C channel types, based on an estimated width to depth ratio between 16 and 18, a sinuosity of 1.2, a cobble dominated channel bed, and an estimated channel gradient of 1.3 percent.

This reach is a transition between where Spotted Dog Creek exits a narrow canyon and enters the wider valley bottom. The reach appears to be aggrading as water velocities slow at the transition from the canyon to the valley floor and colluvial sediment drops out of the water column also resulting in some over-widening of the channel, particularly in the downstream portion of the reach. At the start of the reach, land use transitions from occasional livestock grazing and natural conditions in the canyon upstream of the reach to more intensive livestock use. Overall the reach is relatively stable but some human manipulation such as irrigation diversions and vegetation clearing is present. There also signs of past floodplain and/or

channel manipulation where berms of coarse alluvium line the channel in upstream portions of the reach.

Moderate amounts of human induced bank erosion are present along the channel related to limited woody vegetation cover and livestock use as well as hillslope erosion. Cottonwoods and shrubs including willows, dogwood, and rose are present within a relatively narrow band along much of the channel with some scattered conifers. Much of the remaining floodplain area is dominated by herbaceous species that are primarily pasture grasses. Most of the cottonwoods are mature individuals with little evidence of natural recruitment and younger age classes. Livestock use may be trampling younger individuals and/or browse may be limiting regeneration. Browse is moderate with more than 25 percent of the second year growth on woody species showing signs of browse. Most of the browse is targeted to more palatable species such as willows and dogwoods and some shrubs show signs of physical impacts resulting in umbrella shaped growth form.

Overall fish habitat quality in the reach is fair due to limited cover and habitat features. Some areas of overhanging vegetation are present, but in general few undercut banks, pools, in-channel woody debris, and other habitat elements are missing or limited in the reach.

The overall trend in this reach is declining. Conditions in the reach appear to be slowly declining with continued livestock use and land use practices limiting woody vegetation regeneration.

Potential restoration actions for this reach include: 1) changing the land use, changing the grazing regime or timing of grazing or installing riparian protection measures to allow for natural recovery of the channel and riparian vegetation; 2) weed management; 3) streambank stabilization and revegetation projects at tall eroding banks (such as the one shown in DSCN1045_058 below); 4) evaluating the potential to re-design the irrigation diversion structure to narrow the channel upstream (assuming the intent of this structure is not to impound and store water).

DSCN1032_045

IMG_0409

DSCN1045_058

DSCN1049_062

4.4.12 Reach SD-11

NRCS Score: 52% - At Risk; Fish Habitat: 67% - Fair; Bank Erosion: 8.7%

Reach SD-11 is 2,637 feet in length and located on private land. This reach was visually classified as a B channel type with some sections that are a C channel type (transitioning to E characteristics downstream). This classification is based on an estimated bankfull width-to-depth ratio of 12 to 24, a sinuosity of 1.1, a gravel/cobble dominated channel bed, and an estimated channel gradient of 1.0 percent.

This reach begins at a fence line between two pastures where the channel enters the wider valley floor and ends generally where cottonwoods are no longer present along the channel. At the beginning of the reach, land use transitions to include haying within the riparian area in addition to livestock grazing. The stream channel is relatively vertically stable through the reach with no evidence of active down-cutting, but it is straighter than would be expected under natural conditions for the geomorphic setting. The width-to-depth ratio appears to be appropriate for the stream type and the channel is effectively transporting sediment. The

functional floodplain width appears to be narrower than historical conditions due to channel straightening and woody riparian vegetation removal. Moderate amounts of bank erosion are present that is generally associated with trampling and woody vegetation removal.

Cottonwoods are present at the upstream extent of the reach and their abundance declines in a downstream direction and most are mature individuals with little regeneration of younger age classes. Spare dogwoods, willows, and alder are present with sedges along the floodplain bench, but rose is also present indicating slightly drier floodplain conditions that may be resulting from the straighter channel alignment. Pasture grasses dominate the overall functional floodplain. Browse is very heavy in the reach with noticeable use of generally unpalatable species including rose and shrubs show clubbed shaped growth form.

Fish habitat is generally fair in the reach with some habitat features present such as large wood from the mature cottonwoods, some pools, and potential for undercut banks, but other cover elements are extremely limited or absent from the reach. Substrate in the reach may provide spawning habitat with few fines and mobile gravels.

The overall trend of this reach is declining. The reach is generally declining due to intensive livestock grazing that is limiting riparian vegetation and contributing to bank erosion. While the reach is rated as 'At Risk' it appears to be approaching unsustainable conditions.

Potential restoration actions for the reach include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 2) streambank revegetation or stabilization measures if natural recovery does not occur with passive measures; and 3) weed management.

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IMG_02755

4.4.13 Reach SD-12

NRCS Score: 49% - Not Sustainable; Fish Habitat: 80% - Good; Bank Erosion: 1.7%
Reach SD-12 is 2,720 feet in length and located on private land. This reach was visually classified as a C channel type with significant disturbance. This classification is based on an estimated bankfull width-to-depth ratio between 12 and 24, a sinuosity of 1.7, a gravel dominated channel bed, and an estimated channel gradient of 0.7 percent.

Previous assessments conducted within this reach include a 2007 Riparian Assessment completed by Montana Fish, Wildlife, and Parks (Lindstrom et al. 2008) and data collected to support the 2011 TMDL Assessment (DEQ 2011). The FWP riparian assessment included a portion of the channel within this reach, which they classified as a C channel type with E-channel tendencies.

This reach is generally vertically stable without evidence of active down-cutting. However, previous assessments noted evidence of historical down-cutting (Lindstrom et al. 2008). Extensive lateral instability is present with active bank erosion noted throughout the reach. Portions of the channel are over-widened related to livestock use and other land use disturbances. Some secondary channels present, but floodplain connectivity appears to be limited and insufficient for dissipating energy and capturing sediment. The TMDL sample location in Reach SD-12 met targets for fine sediment and channel form despite the overall impaired listing for sedimentation/siltation, but failed to meet targets for riparian shrub cover which is commonly linked to sediment impairment (DEQ 2011).

Mature willows and sedges dominated the vegetation community, however, willows are only scattered throughout the riparian area. While sedges are present along the channel, pasture grasses dominate much of the functional floodplain or riparian area. The 2009 FWP assessment also noted reed canarygrass along the channel. Regeneration of willows appears to be very limited with no seedling or saplings observed. Browse is very heavy, which is likely contributing to the lack of woody vegetation regeneration and physical damage is also occurring to mature willows, which have umbrella-shaped growth form.

During the time of this assessment flows were high and estimated to be approximately 150 cfs. Fish habitat was determined to be good based on the number of pools and their spacing, the presence of riffle-pool complexes, and numerous undercut banks. The existing channel pattern appears to support pool development even with minimal overhanging vegetation. The FWP assessment also document good fish habitat that lacked rootwads and overhanging vegetation to increase cover and shade. Gravel substrate was partially embedded and the FWP assessment also noted accumulation of fine sediment throughout their assessment reach. The

TMDL noted that their sample site in Reach SD-12 field to meet targets for pools, large woody debris frequency, and riparian shrub cover (DEQ 2011).

This reach overlaps with FWP reach RM1.2. This assessment resulted in an overall NRCS sustainability score of 56.67%, similar to the 2014 results. Both assessments identified similar conditions and impacts in the reach.

The overall trend of this reach is declining. In general this reach is declining due to continued livestock grazing and haying that is limited cover of woody riparian vegetation that is leading to extensive lateral bank erosion. The bank erosion in this reach and others in Spotted Dog Creek is impacting water quality as evidence by the TMDL listing for sedimentation/siltation.

Potential restoration options for this reach should include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 2) stabilization and revegetation of eroding banks; 3) weed control; and 4) evaluating the potential to screen unscreened irrigation diversions to reduce the risk of entrainment.

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IMG_027613

4.4.14 Reach SD-13

NRCS Score: 65% - At Risk; Fish Habitat: 70% - Fair; Bank Erosion: 12.7%

Reach SD-13 is 4,247 feet in length and located on private land. This reach was visually classified as an E channel type with signs of disturbance. This classification is based on a bankfull width-to-depth ratio estimate of 12, a sinuosity of 1.5, a gravel/cobble dominated channel bed, and an estimated channel gradient of 0.7 percent.

The channel in this reach flows through a livestock pasture that is seasonally hayed. The channel has lateral bank erosion and may have historically had localized vertical adjustments, but has now stabilized with riparian vegetation present at the current channel elevation. Most lateral erosion is due to loss of woody vegetation along the channel and livestock grazing.

Erosion is contributing to increased sediment delivery and deposition within and along the channel, creating larger than expected point bars and over-widening. The width-to-depth ratio is at the high end for the channel type. The floodplain is relatively wide through the reach and connected to the channel with some overflow channels and roughness elements, but overall energy dissipation and sediment capture ability is reduced due to loss of woody vegetation.

Willows, alders, and sedges are present along the channel and sedges are common throughout the floodplain, but pasture grasses and other grazing induced undesirable species are prevalent in the floodplain. Most willows are mature individuals with some young willows observed only on gravel bar features. Younger willows were all heavily browsed and mature willows have umbrella shaped growth form resulting from browse and physical damage.

During the time of this assessment flows were high, estimated to be approximately 50 cfs. Fish habitat consists of a numerous off-channel and connected side channels that are connected to the main channel. Some undercut banks may be present, but lateral erosion has reduced this cover element significantly. Root wads and woody debris are both limited in the reach.

The overall trend of this reach is declining. Continued livestock grazing is limiting woody vegetation establishment and contributing to continued lateral bank erosion.

Potential restoration projects within this reach include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 2) implementing bank stabilization and revegetation measures to address lateral bank erosion; 3) evaluating irrigation efficiency improvements such as pivots versus flood irrigating; and 4) evaluating unscreened diversion structures for fish entrainment risk.

DSCN1059_072

DSCN1064_077

DSCN1072_085

IMG_0013

IMG_0008

4.4.15 Reach SD-14

NRCS Score: 63% - At Risk; Fish Habitat: 70% - Fair; Bank Erosion: 17.2%

Reach SD-14 is 3,554 feet in length and located on private land. This reach was visually classified as an E channel type. This classification is based on a bankfull width-to-depth ratio estimate between 5 and 10, a sinuosity of 1.7, a gravel and small cobble dominated channel bed, and an estimated channel gradient of 0.7 percent.

The channel in this reach is more entrenched that upstream reaches, but generally appears to be vertically stable with a narrower floodplain established at the entrenched elevation. Lateral bank erosion is occurring throughout the reach due to loss of woody vegetation from grazing. Water diversion may also be contributing to drier floodplain conditions and bank erosion. Bank erosion and sediment deposition are particularly high near the confluence with the Little Blackfoot River at the downstream extent of the reach. Old channel scrolls indicate that this

area historically supported a wide, connected floodplain with a shrub-dominated vegetation community.

Willows are the dominant woody species with some alders in the floodplain. Sedges and rushes are also present, but pasture grasses are the dominant herbaceous species in the floodplain. A small number of spotted knapweed plants were the only noxious weeds noted at the downstream end of the reach at the confluence. Most woody vegetation consists of mature willows with some young willows only on lower surfaces along the channel. Young willows are heavily browsed and mature willows are umbrella shaped due to browse and physical damage.

During the time of this assessment flows were high and estimated to be approximately 50 cfs making it somewhat difficult to evaluate aquatic habitat. However, observed fish habitat features included overhanging vegetation, some pools and undercut banks. Habitat conditions appear to be better in the upstream portion of the reach versus the downstream portion of the reach. Substrate appeared to be well sorted with some areas of fine sediment accumulation and embedded substrate due to the fine sediments. Loss of woody vegetation, channel entrenchment, and bank erosion contribute to reduced fish conditions in the reach.

The overall trend of this reach is likely declining due to continued grazing and water withdrawals. A lot of the former riparian area near the confluence has converted to drier vegetation communities and natural recovery potential has declined due to drier conditions. Continued erosion is likely to cause increased instability and channel over-widening.

Potential restoration projects within this reach include: 1) changing the existing land use (grazing/pasture) or resting riparian areas from grazing to allow riparian vegetation to establish; 2) implementing bank stabilization and revegetation measures to address bank erosion; 3) potential channel re-naturalization to reactivate former channel alignments and improve floodplain connectivity; 4) evaluate diversion structures for potential improvements to reduce fish entrainment risk and/or fish passage issues; and 5) evaluate water withdrawals to improve instream flow volumes.

DSCN1079_092

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DSCN_1083_096

5 POTENTIAL RESTORATION ACTIONS

This section summarizes potential restoration actions identified for the Little Blackfoot River and tributaries included in this assessment. To achieve the goals of the NRDP 2012 Restoration Plans, the desired future condition for the Little Blackfoot River watershed is a landscape that maximizes ecological site potential by: restoring native riparian plant communities, providing preferred habitat for native aquatic and terrestrial species, and establishing sustainable river and floodplain morphology in the context of existing constraints. This section describes the potential condition, for each assessment area; potential constraints to achieving that condition and the restoration opportunities identified for each area.

5.1 Little Blackfoot River

5.1.1 Potential Condition

The potential condition for the Little Blackfoot River is a meandering riffle-pool channel with a gravel and cobble bed. River processes would be characterized by dynamically-stable disturbance regimes including lateral migration, bed mobility, scour and woody debris recruitment. The river would inundate its broad floodplain on an annual basis and the floodplain would consist of a range of complex geomorphic features including: wetlands, side channels, abandoned oxbows, and uplands. Riparian and floodplain habitat potential would be represented by a diverse mosaic of vegetation communities linked to geomorphic features, hydrologic conditions, and soil types. Vegetation communities would include: large stands of cottonwood with a diverse understory of shrub species, dense stands of willow, and large areas of emergent wetland dominated by sedges and rushes. Potential aquatic habitat would include diverse and complex hydraulic conditions (depth and velocity), clean substrates, vegetative bank cover, off-channel habitats, frequent pools for holding, and abundant woody debris. The assessed reach that best represents the potential condition is the C4 stream type in Reach LBR-07.

5.1.2 Restoration Constraints

There are numerous constraints to restoration of the mainstem Little Blackfoot River. Most of the land is privately owned and the predominant land use is agriculture, primarily grazing and hay production. Floodplain conversion to hayfield and long-term grazing has reduced cover of woody riparian vegetation, which in turn, has led to increased bank erosion and channel instability. In addition, there is extensive infrastructure along the Little Blackfoot River including Highway 12, numerous local road crossings and bridges, residential development and the BNSF railroad. In most areas where the river channel abuts this infrastructure, it is protected through bank stabilization measures, primarily riprap. This has resulted in

channelization over time, which has accelerated erosion and resulted in channel incision and loss of floodplain connectivity.

5.1.3 Restoration Actions to Achieve Potential Condition

Restoration actions were identified and developed for addressing sources of impairment and achieving potential conditions on the Little Blackfoot River. According to the 2011 Prioritization, restoration actions in the Lower Little Blackfoot River watershed have a very high potential for addressing all three fishery goals of: 1) restore the mainstem trout fishery by improving recruitment of fish from tributaries; 2) replace lost angling in the mainstem by improving trout fisheries in tributaries; and 3) maintain or improve native fish populations in the Upper Clark Fork River drainage. The Little Blackfoot River has high potential for helping address these goals due to it being a large tributary, the presence of migratory adults, high density of adults and juveniles, and having a productive native trout population. Table 5-1 summarizes the potential restoration actions for reaches assessed along the Little Blackfoot River.

Table 5-1. Summary of potential restoration actions for assessed reaches on the mainstem Little Blackfoot River.

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ bridge/ culvert issues	Fish Barrier	Streambank stabilization/ revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
LBR-01	Change grazing regime; Fence riparian area	Screen ditch; Improve diversion point	Not a concern at time of assessment	None	None	Bank stabilization/revegetation (requires fencing and areas with stable channel); Coordinate with Yellowstone pipeline and BNSF Railway on bank stabilization projects	None	Relocate channel away from railroad; Floodplain reconnection	With some active restoration could be high quality riparian and aquatic habitat
LBR-02	Change grazing regime; Fence riparian area	Screen ditches; Improve diversion points	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (would require fencing and areas with stable channel)	None	Restore floodplain connectivity	High quality shrub floodplain areas created and maintained by beaver activity; high potential for active restoration and floodplain reconnection
LBR-03	Install fence between LBR-03 and LBR-04 to restrict grazing or fence riparian area	Screen ditch	Some noxious weeds are present	None	None	Bank revegetation / stabilization (would require fencing)	None	Reach is functioning - high natural recovery potential if grazing is removed	High natural recovery potential - connected floodplain with cottonwood /shrub community

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ bridge/ culvert issues	Fish Barrier	Streambank stabilization/ revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
LBR-04	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization, but channel incision may limit effectiveness	Bank or channel structures to create pools for fish migration	Reactivate old side channels or relocate the channel to the south	Channelization limits natural recovery
LBR-05	Change grazing regime; Fence riparian area on south side	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (would require fencing on south side)	Bank or channel structures to create pools for fish migration	None	Channelization limits natural recovery
LBR-06	Change grazing regime; Fence riparian area on south side	None	Not a concern at time of assessment	None	None	Replace riprap with deformable banks	Bank or channel structures to create pools for fish migration	None	Channelization limits natural recovery
LBR-07	Grazing occurs but limited impact	None	Not a concern at time of assessment	None	None	None	None	None	Reach is near potential and high priority for conservation
LBR-08	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (replace existing stabilization measures)	Bank or channel structures to create pools for fish migration	Comprehensive strategy should be developed for this reach	High recovery potential, establish conservation easement/ corridor to allow channel to move

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ bridge/ culvert issues	Fish Barrier	Streambank stabilization/ revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
LBR-09	Change grazing regime; Fence riparian area on south side	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (replace existing stabilization measures)	Bank or channel structures to create pools for fish migration	Comprehensive strategy should be developed for this reach	High recovery potential, establish conservation easement/ corridor as riparian buffer and to allow channel to migration
LBR-10	None (riparian area is fenced)	None	Site is accessible to public for fishing and weed density is higher	None	None	Bank revegetation / stabilization (right bank)	Bank or channel structures to create pools for fish migration	Reconnection with historic floodplain channels; infrastructure limits other actions	Channelization limits natural recovery
LBR-11	No grazing	None	Site has high use and is within transportation right-of-ways and weed density is higher	None	None	Bank revegetation / stabilization (replace existing stabilization measures)	Bank or channel structures to create pools for fish migration	Levees and bridges (RR, I-90 & I-90 access ramps) limit actions	Channelization limits natural recovery

5.2 Dog Creek

5.2.1 Potential Condition

The potential condition in much of Dog Creek is influenced by the presence of beaver. In reaches with less cover by woody vegetation species, beaver influence would be less and the potential condition would be an alluvial system. In reaches dominated by woody vegetation species, beaver influence would be greater and the potential condition would be a wetland-dominated system consisting of multiple inter-connected channel segments.

For the potential condition without beaver influences, the stream type would be a highly sinuous, riffle-pool channel with a gravel bed and low width-to-depth ratio. Geomorphic processes would be characterized by low disturbance whereby stream hydraulics would be tempered by low gradients and a lack of woody debris. The river would inundate its broad floodplain on an annual basis and the floodplain would consist of a range of geomorphic features including expansive wetlands, floodplain swales, and uplands. Riparian and floodplain potential would be represented by a mix of herbaceous and woody vegetation communities linked to elevation relative to the channel, hydrologic conditions, and soil types. Vegetation communities would include: cottonwoods, willows, sedges and rushes in wet areas and grasses in dry areas. Woody vegetation would be limited to areas along the channel or where disturbance processes initiate woody vegetation colonization. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth and velocity), clean substrates for spawning, shady undercut banks, frequent pools, and cool water temperatures. The best representation of this potential condition is the E4 stream type found in many of the upper reaches; however, many of these reaches exhibit this condition due to human-related disturbances. This potential is also characterized by the C4 stream types found in the lower reaches of Dog Creek where potential channel gradient is slightly higher and sinuosity is slightly lower. The vegetation potential in these lower reaches would be cottonwood stands distributed based on the frequency and magnitude of flood disturbances.

For the potential condition with beaver influences, frequent beaver dams would impound the stream creating vast areas of seasonal and perennial inundation. Where present, stream segments would be characterized by multiple inter-connected channels with highly variable geometry. Geomorphic processes would be influenced by beaver dam construction causing backwatering and sedimentation, and beaver dam failure causing avulsions and head-cutting. Riparian and floodplain potential would be represented by a diverse mosaic of plant communities linked to the water table. Vegetation communities would include: dense willow stands, and herbaceous wetlands with variable hydrology dominated by sedges and rushes. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth

and velocity), variable substrates, shady undercut banks, plunge pools, and shallow juvenile rearing habitats. The best representation of this potential condition is found in the upper reaches of Dog Creek including Reaches Dog-01, Dog-05 and Dog-07 through Dog-09.

The potential in Dog Creek is severely limited by the location of the railroad in many reaches, with the railroad bisecting the floodplain and essentially creating confined reaches. The potential in these reaches is a steeper B channel with limited floodplain and riparian vegetation development. Beaver influences are not likely in these areas due to the steep channel gradient and reduced cover of woody vegetation.

5.2.2 Restoration Constraints

There are numerous constraints to restoration of Dog Creek. The upper reaches are characterized by large areas of intact beaver complexes and the only thing limiting habitat potential is grazing. Also in the upper reaches, land owners between multiple small parcels along the channel may limit restoration options and potential changes in land use. Most of Dog Creek is constrained by the presence of Dog Creek Road or by the BNSF Railway line that parallels the stream. The railroad is located within the historic floodplain along much of Dog Creek resulting in lost floodplain connectivity, channelization and channel incision. The railroad has completely altered the potential condition of Dog Creek in some areas and the channel is characterized by very uniform habitat and very little or no natural recovery potential. The lower portion of Dog Creek is constrained by residential development and land use, primarily grazing and hay production.

5.2.3 Restoration Actions to Achieve Potential Condition

Restoration actions were identified to address sources of impairment and achieve potential conditions in Dog Creek. According to the 2011 Prioritization, restoration actions in the Dog Creek watershed have high potential for addressing fishery goals of: 1) restore the mainstem trout fishery by improving recruitment of fish from tributaries; and 2) replace lost angling in the mainstem by improving trout fisheries in tributaries. Dog Creek has high potential for helping address these goals because it is a fishable stream, a moderate density of native trout are present, and there is intact connectivity with the Little Blackfoot River. Based on the results of this assessment, a number of restoration actions were identified to support reaching these goals. Table 5-2 summarizes the potential restoration actions for reaches assessed in Dog Creek.

Table 5-2. Summary of potential restoration actions for assessed reaches on the mainstem Little Blackfoot River.

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-01	Install fence to protect area from adjacent grazing land use	None	Not a concern at time of assessment	None	None	None	None	None	Extensive beaver complex with multiple dams, ponded areas and channels
Dog-01a-R	Install fence to protect area from adjacent grazing land use	None	Unknown	None	None	None	None	None	Wetland/beaver complex
Dog-02	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	None	None	Bank revegetation to address localized erosion (downstream end)	None	None	Well vegetated wetland/beaver complex – high natural recovery potential for impacted areas
Dog-02a-R	Change grazing regime; Fence riparian area	None	Unknown	None	None	Bank revegetation / stabilization (would require fencing)	None	None	Natural recovery potential appears high
Dog-03	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (would require fencing)	None	None	Restoration opportunities limited by small parcel size, and inaccessibility

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-03a-R	Change grazing regime; Fence riparian area (upstream portion of reach)	None	Unknown	Evaluate road crossing	Evaluate road crossing	Bank revegetation / stabilization (would require fencing)	None	None	Downstream end of reach high quality riparian vegetation; High natural recovery potential for upstream portion of reach if fenced
Dog-03b-R	Evaluate land use and need for fencing	None	Unknown	None	None	None	None	None	Reach appears healthy, but adjacent land use (grazing) may encroach if not protected
Dog-04-R	Evaluate land use and need for fencing	None	Unknown	None	None	None	None	None	Reach appears healthy, but adjacent land use (grazing) may encroach if not protected
Dog-04a-R	Evaluate land use and need for fencing	None	Unknown	Evaluate road crossing	Evaluate road crossing	None	None	None	Reach is primarily natural wetland/beaver complex
Dog-05	None	None	Not a concern at time of assessment	None	None	None	None	None	Reach is natural wetland/beaver complex

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-06	None	None	Not a concern at time of assessment	Bridge erosion	None	Bank stabilization associated with bridge	None	None	Upstream of bridge, reach is a healthy beaver complex
Dog-07	None	None	Not a concern at time of assessment	None	None	None	None	None	Reach is natural wetland/beaver complex
Dog-08	None	None	Not a concern at time of assessment	None	None	None	None	Investigate potential mine waste contamination	Reach is natural wetland/beaver complex
Dog-09	Change grazing regime; Fence riparian area (downstream portion of reach)	None	Not a concern at time of assessment	None	None	None	None	None	Reach is primarily a natural wetland/beaver complex with increased livestock impacts at downstream end
Dog-10	Maintenance of existing riparian fence	None	Not a concern at time of assessment	None	None	Bank revegetation / stabilization (railroad encroachment may limit actions)	None	None	Natural recovery potential limited by channel confinement

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-11a	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	Re-build channel at railroad bridge crossing	None	Bank revegetation / stabilization, Plant riparian corridor (would require fencing)	Bank or channel structures to increase diversity	Large area available for channel re-naturalization	Natural recovery potential limited by channel confinement and incision
Dog-11b	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	Railroad location may restrict actions	None	Bank revegetation / stabilization (would require fencing)	Bank or channel structures to increase diversity	Large area of historic floodplain available for channel re-naturalization	Natural recovery potential limited by channel confinement and incision
Dog-12a	No grazing apparent at time of assessment	None	Not a concern at time of assessment	Railroad and road location may restrict actions	None	Bank revegetation / stabilization	None	None	Natural recovery potential limited by channel confinement and incision upstream end; High natural recovery potential through former beaver complex
Dog-12b	No grazing apparent at time of assessment	None	Not a concern at time of assessment	Railroad location restricts actions	None	Existing riprap has revegetated	None	None	Natural recovery potential limited by channel confinement and incisions; Railroad limits potential actions

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-13a	No grazing apparent at time of assessment	None	Not a concern at time of assessment	Railroad location restricts actions	None	None	None	Potential for channel relocation and reconnection with historic floodplain but likely cost prohibitive.	Natural recovery potential limited by channel confinement and incisions; Railroad limits potential actions
Dog-13b	Change grazing regime; Fence riparian area	None	Large knapweed-dominated pasture at downstream end	Railroad and road location may restrict actions	None	None	Bank or channel structures to increase pools for migration	Potential for channel relocation and reconnection with historic floodplain but likely cost prohibitive.	Natural recovery potential limited due to channel incision
Dog-14	Change grazing regime; Fence riparian area	None	Not a concern at time of assessment	None	None	Bank stabilization/ revegetation at high eroding terrace ; Riparian planting	None	None	Natural recovery potential is high but limited by adjacent land uses
Dog-15-R	Change grazing regime; Fence riparian area	None	Unknown	None	None	Bank revegetation / stabilization	None	None	Natural recovery potential limited due to channelization and land use

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
Dog-16-R	Change grazing regime; Fence riparian area	None	Unknown	None	None	Bank revegetation / stabilization	None	None	Overall healthy reach with large wetland/beaver complex in upstream portion; natural recovery potential of downstream end may be limited by channelization

5.3 Snowshoe Creek

5.3.1 Potential Condition

The potential condition for the assessed portion of Snowshoe Creek is a highly sinuous, riffle-pool channel with a gravel bed and low width-to-depth ratio. Geomorphic processes would be characterized by low disturbance whereby stream hydraulics would be tempered by low gradients and a lack of woody debris. The river would inundate its broad floodplain on an annual basis and the floodplain would consist of a range of geomorphic features including expansive wetlands (supported by the channel and numerous springs originating on the valley floor), floodplain swales and uplands. Riparian and floodplain potential would be represented by a mix of herbaceous and woody plant communities linked to their elevation relative to the channel, hydrologic conditions, and soil types. Vegetation communities would include: a mix of cottonwood stands, willow stands, and emergent wetlands dominated by sedges and rushes. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth and velocity), clean substrates for spawning, shady undercut banks, frequent pools, and cool water temperatures. The best representation of this potential condition is the E4 stream type in the downstream portion of Reach SS-03. In the upper reaches with more confined valley types and steeper gradients, the potential condition would be a B stream type.

Beaver activity is now rare in Snowshoe Creek due to active management, but significant evidence of relatively recent and historic beaver influence was observed in lower reaches. If beaver activity increased in Snowshoe Creek it would influence the potential for the site. Beaver dams would impound the stream creating vast areas of seasonal and perennial inundation. Where present, stream segments would be characterized by multiple inter-connected channels with highly variable geometry. Geomorphic processes would be influenced by beaver dam construction causing backwatering and sedimentation, and beaver dam failure causing avulsions and head-cutting. The riparian area would include a diverse mosaic of plant communities linked to the water table. Vegetation communities would include dense stands of willows, and herbaceous wetlands with variable hydrology dominated by sedges and rushes. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth and velocity), variable substrates, shady undercut banks, plunge pools, and shallow juvenile rearing habitats.

5.3.2 Restoration Constraints

The primary restoration constraints in Snowshoe Creek are related to land use. All of the land within the assessment area is privately owned and is actively managed for grazing or hay production. To support these activities, the channel has been manipulated for a long period of time. Manipulations to the main channel include straightening and relocation, clearing of

vegetation, active removal of beaver and beaver dams, and impoundment for water storage. Some of these activities remain constraints to restoration, including vegetation clearing related to hay production and grazing, water withdrawals related to irrigation diversions, channel incision and beaver removal. Past and current beaver activities are present throughout the assessment area. Beaver activity is actively suppressed and habitat quality and restoration potential for many reaches would be improved if beaver activity were not restricted.

5.3.3 Restoration Actions to Achieve Potential Condition

Restoration actions were identified and developed for addressing sources of impairment and achieving potential conditions in Snowshoe Creek. According to the 2011 Prioritization, restoration actions in the Snowshoe Creek watershed have high potential for addressing fishery goals of: 1) restore the mainstem trout fishery by improving recruitment of fish from tributaries; and 2) replace lost angling in the mainstem by improving trout fisheries in tributaries. Snowshoe Creek has high potential for helping address these goals because it is a fishable stream with a moderate density of native trout, and generally maintains good connectivity with the Little Blackfoot River. Based on the results of this assessment, a number of restoration actions were identified that can support reaching these goals. Table 5-3 summarizes the potential restoration actions for reaches assessed in Snowshoe Creek.

Table 5-3. Summary of potential restoration actions for assessed reaches on Snowshoe Creek.

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SS-01	Change grazing regime; Fence riparian area	None	Not a priority at time of assessment	Road encroaches along most of channel	Active head cuts due to historic dredge impacts	Bank revegetation / stabilization (would require fencing)	None	Channel could be relocated and head-cuts addressed but likely cost prohibitive	Natural recovery potential limited by large head cuts and road location
SS-02	Change grazing regime; Fence riparian area	Diversion could be screened	Not a priority at time of assessment	Replace under-sized and damaged culvert	Reservoir complete barrier; culvert may be seasonal barrier	None	None	None	Natural recovery potential is high if grazing were removed
SS-03	Change grazing regime; Fence riparian area	Diversion could be screened	Not a priority at time of assessment	None	None	None	None	Remove dredge piles where limiting floodplain access	Natural recovery potential is high if dredge piles are removed and grazing is reduced
SS-04	Change grazing regime; Fence riparian area	Headcut at diversion point; diversion could be screened	Not a priority at time of assessment	Address avulsion risk at access road	Replace irrigation diversion that is likely a complete passage barrier	None	None	None	Natural recovery potential is high if grazing reduced

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SS-05	Change grazing regime; Fence riparian area and springs; Existing fence maintenance	None	Not a priority at time of assessment	None	None	Plant riparian corridor (would require fencing)	Bank or channel structures to create aquatic habitat diversity	Relocate channel is upper part of reach and reconnect floodplain	Natural recovery potential is high if grazing reduced
SS-05a-R	Change grazing regime; Fence riparian area	None	Not a priority at time of assessment	None	None	Active or passive revegetation of streambanks if adjacent land use is modified	None	None	Natural recovery potential is likely high
SS-06	Change grazing regime; Fence riparian area	Screen irrigation diversion	Not a priority at time of assessment	None	None	Active or passive revegetation of streambanks if adjacent land use is modified	None	Potential channel realignment and reconnection with floodplain	Natural recovery potential is high if grazing is reduced
SS-06a-R	Change grazing regime; Fence riparian area	Unknown	Unknown	None	Unknown	Active or passive revegetation of streambanks if adjacent land use is modified	None	Unknown, but likely potential for channel realignment and reconnection with floodplain	Unknown
SS-07	Change grazing regime; Fence riparian area	None	Not a priority at time of assessment	Remove old wooden bridge structure from channel	None	Bank revegetation / stabilization (would require fencing)	None	Potential to evaluate floodplain reconnection and expansion at confluence with Little Blackfoot River	Natural recovery potential limited by channel incision

5.4 Spotted Dog Creek

5.4.1 Potential Condition

The potential condition for Spotted Dog Creek varies throughout the assessed reaches depending on the valley and channel morphology that ranges from narrow, steep canyons to wide, open floodplains. Beaver use would also likely influence the potential of some reaches of the stream.

The potential condition in confined canyon reaches of Spotted Dog Creek would be a higher gradient, low to moderate sinuosity, riffle-pool channel with a gravel/cobble bed. Geomorphic processes would be characterized by low disturbance except in areas where colluvial hillslope processes interact with the channel by delivering sediment and debris. The floodplain would be narrow and sloping upward away from the channel. Potential vegetation communities include conifer dominated vegetation types with dogwood and alder the primary understory shrub species. Potential aquatic habitat would provide less diversity than more dynamic reaches due to the lack of pool and riffle sequences, but would still be characterized by pocket-water habitat consisting of smaller infrequent boulder pools, higher velocity cascades and clean coarse substrates. Habitat diversity increases greatly as large woody debris in the channel increases. The best representation of this potential condition is the B3 stream type found in Reach SD-07.

For the potential condition of unconfined valley morphology without beaver influences, the stream type would be a highly sinuous, riffle-pool channel with a gravel bed and low width-to-depth ratio. Geomorphic processes would be characterized by low disturbance whereby stream hydraulics would be tempered by low gradients and a lack of woody debris. The river would inundate its broad floodplain on an annual basis and the floodplain would consist of a range of geomorphic features including expansive wetlands, floodplain swales and uplands. Riparian and floodplain potential would be represented by a mix of herbaceous and woody plant communities linked to elevation relative to the channel, hydrologic conditions and soil types. Vegetation communities would include: cottonwoods, willows, sedges and rushes in wet areas and grasses in dry areas. Woody vegetation would be limited to areas along the channel or where disturbance processes initiate woody vegetation colonization. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth and velocity), clean substrates for spawning, shady undercut banks, frequent pools, and cool water temperatures. The best representation of this potential condition is the E4 stream type found in many of the lower reaches (SD-12, SD-13 and SD-14); however, many of these reaches exhibit this condition due to human-related disturbances.

For the potential condition of unconfined valley morphology with beaver influences, frequent beaver dams would impound the stream creating vast areas of seasonal and perennial

inundation. Where present, stream segments would be characterized by multiple inter-connected channels with highly variable geometry. Geomorphic processes would be influenced by beaver dam construction causing backwatering and sedimentation, and beaver dam failure causing avulsions and head-cutting. Riparian and floodplain potential would be represented by a diverse mosaic of plant communities linked to the water table. Vegetation communities would include dense stands of willow, and herbaceous wetlands with variable hydrology dominated by sedges and rushes. Potential aquatic habitat would be complex consisting of diverse hydraulic conditions (depth and velocity), variable substrates, shady undercut banks, plunge pools, and shallow juvenile rearing habitats. The best representation of this potential condition is found in Reach SD-01b.

5.4.2 Restoration Constraints

The main constraints to restoration actions in Spotted Dog Creek are related to on-going agricultural practices, primarily grazing. The upper reaches of Spotted Dog Creek are characterized by significant geomorphic instability due to reduced beaver activity over time. The geomorphic instability is exacerbated by on-going cattle grazing. The primary constraint to restoration in these upper reaches is the timeframe for recovery of these areas without active restoration. For much of the stream length, Spotted Dog Creek transitions between high quality reaches flowing through confined, steep canyons and unconfined reaches with extensive historic disturbance ranging from floodplain manipulation to water impoundment. The main constraints to restoration through these areas are related to current land use. The lower reaches are characterized by on-going agricultural activities, including cattle grazing, hay production, and water diversion.

5.4.3 Restoration Actions to Achieve Potential Condition

Restoration actions were identified to address sources of impairment and achieve potential conditions in Spotted Dog Creek. According to the 2011 Prioritization, restoration actions in the Spotted Dog Creek watershed have high potential for addressing fishery goals of: 1) restore the mainstem trout fishery by improving recruitment of fish from tributaries; and 2) replace lost angling in the mainstem by improving trout fisheries in tributaries. Spotted Dog Creek has high potential for helping address these goals because it is a fishable stream with a moderate density of native trout, and intact connectivity with the Little Blackfoot River. Based on the results of this assessment, a number of restoration actions were identified that can support reaching these goals. Table 5-4 summarizes the potential restoration actions for reaches assessed in Spotted Dog Creek.

Table 5-4. Summary of potential restoration actions for assessed reaches on Spotted Dog Creek.

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SD-01a	Change grazing regime; Fence riparian area	Screen diversion if still active	Manage noxious weeds	Replace undersized culvert at top of project	None	Bank revegetation / stabilization (would require fencing)	Bank or channel structures to increase diversity	None	Area has high natural recovery potential if grazing were reduced
SD-01b	Change grazing regime; Fence riparian area	None	Not a priority at time of assessment	None	None	Numerous eroding banks, but due to beaver presence should not be addressed	None	Measures to encourage continued beaver activity should be considered	Natural recovery potential depends on continued beaver activity
SD-01c	Change grazing regime; Fence riparian area	None	Manage noxious weeds	Remove old bridge that blocks flow and sediment movement	None	Bank revegetation / stabilization outside of areas of active channel incision	None due to geomorphic instability	Active restoration is needed in this reach to restore aquatic habitat and floodplain function	Natural recovery potential is low or requires a very long time period (channel evolution required)
SD-02	Limit cattle access into canyon	None	Not a priority at time of assessment	None	None	None	Add large woody debris to channel	None	Area is currently near potential

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SD-03	Change grazing regime; Fence riparian area	None	Manage noxious weeds	None	None	Bank revegetation / stabilization (would require fencing)	Bank or channel structures to increase diversity	None	Natural recovery potential is limited by channel confinement and entrenchment in some areas; other areas have high recovery potential if grazing is reduced
SD-04	Change grazing regime; Fence riparian area	None	Not a priority at time of assessment	None	Reservoir is complete barrier to fish migration	Bank revegetation / stabilization (would require fencing)	Bank or channel structures to increase diversity	Channel is over-widened and could be narrowed	None - reach is primarily a water storage reservoir
SD-05	Limit cattle access into canyon	None	Not a priority at time of assessment	None	None	None	Add large woody debris to the channel	None	Area is currently near potential
SD-06	Change grazing regime; Fence riparian area	None	Manage widespread bull thistle	None	None	Active or passive revegetation of streambanks	None	None - channel is recovering from historic use as a water storage reservoir	None - reach is recovering from historic use as a water storage reservoir

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SD-07	Limit cattle access into canyon	None	Manage noxious weeds	None	None	None	Add large woody debris to the channel	None	Area is currently near potential
SD-08	Limit cattle access into canyon	None	Manage noxious weeds	None	None	None	Add large woody debris to the channel	None	Area is currently near potential
SD-09/10	Change grazing regime; Fence riparian area	Evaluate possible modifications to impoundment structure	Manage noxious weeds	None	None	Active or passive revegetation of streambanks	None	None	Natural recovery potential is limited by land use
SD-11	Change grazing regime; Fence riparian area	None	Manage noxious weeds	None	None	Active or passive revegetation of streambanks	None	None	Natural recovery potential is limited by land use
SD-12	Change grazing regime; Fence riparian area	Screen diversion structure	Manage noxious weeds	None	None	Active or passive revegetation of streambanks	None	None	Natural recovery potential is limited by land use
SD-13	Change grazing regime; Fence riparian area	Evaluate irrigation efficiency; screen two diversions	Not a priority at time of assessment	None	None	Active or passive revegetation of streambanks	None	Large area available for potential channel re-naturalization	Natural recovery potential is limited by land use (water withdrawals)

Reach	Grazing Management	Water/ Irrigation Management	Weed Management	Road/ Bridge/ Culvert Issues	Fish Barrier	Streambank Stabilization/ Revegetation	Aquatic Habitat Enhancement	Channel Re-naturalization	Protection/ Conservation
SD-14	Change grazing regime; Fence riparian area	Evaluate irrigation efficiency	Not a priority at time of assessment	None	None	Active or passive revegetation of streambanks	None	Channel is over-widened and could be narrowed; Reconnection with the floodplain also possible	Natural recovery potential is limited by land use (water withdrawals)

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APPENDIX A. DETAILED RESULTS BY ASSESSMENT REACH

*Green shaded cells indicate remotely assessed reaches.

LITTLE BLACKFOOT RIVER																												
Reach ID	**Date(s) of Assessment**	**ID Team/ Observers**	**Map or Quad Name**	**Primary Land Use**	**Plant Community**	**Slope**	**Sinuosity**	**Rosgen Channel Type**	**BF Depth (ft)**	**BF Width (ft)**	**Width:Depth Ratio**	**Channel Substrate**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**NRCS Score (%)**	**NRCS Rating**	**Q1**	**Q2**	**Q3**	**Fish Habitat Score (%)**	**Fish Habitat Rating**
LBR-01	4/30/2014	A. Sacry, M. Daniels	Elliston NW / Avon NE	Grazing	BB2	0.2%	1.3	F, C	1.5-2	50-100	25-75	Cobble/Gravel	2	0	2	6	2	2	1	6	3	4	47%	Not sustainable	3	10	3	53%	Fair
LBR-02	4/30/2014	A. Sacry, M. Daniels	Avon NE	Grazing	BB2	0.8%	1.3	C	2	45	22.5	Gravel/Cobble	2	0	2	6	4	2	2	2	3	6	48%	Not sustainable	7	10	7	80%	Good
LBR-03	4/30/2014, 5/1/2014	A. Sacry, M. Daniels, S. Flynn	Avon NE	Grazing	BB2	0.6%	1.4	C	2-3	60, 42	30, 14	Small cobble/Gravel	8	5	4	6	4	2	1	8	3	8	82%	Sustainable	7	10	7	80%	Good
LBR-04	5/27/2014	A. Sacry	Luke Mountain SW	Grazing, RR ROW	BB2	0.4%	1.0	B	4	65	16.25	Cobble	6	0	6	6	4	2	2	8	3	4	68%	At Risk	3	10	5	60%	Fair
LBR-05	5/26/2014	A. Sacry	Luke Mountain SW	ROW, Grazing/Agricultural	BB2	1.0%	1.0	B	3	70	~25	Cobble	8	5	6	6	4	1	2	8	3	6	82%	Sustainable	3	10	5	60%	Fair
LBR-06	5/27/2014	A. Sacry	Luke Mountain SW	Grazing, RR ROW	BB2	0.2%	1.0	C	3-4	60-65	~20	Cobble	8	5	6	6	4	1	1	8	3	6	80%	Sustainable	3	10	5	60%	Fair
LBR-07	5/27/2014	A. Sacry	Luke Mountain SW/Garrison SE	Grazing	BB2	0.1%	1.4	C	4-5	60-65	~15	Cobble/Gravel	8	5	6	6	6	2	3	8	4	8	93%	Sustainable	7	10	7	80%	Good
LBR-08	5/27/2014	A. Sacry, M. Staats, W. McDowell	Garrison SE	Grazing, Haying	BB2	0.4%	1.8	C	3-4	70	17.5-23	Cobble	8	3	4	6	4	2	1	8	3	6	75%	At Risk	7	10	7	80%	Good
LBR-09	5/27/2014	A. Sacry, M. Staats, W. McDowell	Garrison SE	Grazing, Haying	BB2, SR4	0.4%	1.3	C, F	3-4	60-65	~18	Cobble	8	3	4	6	2	2	0	8	4	6	72%	At Risk	3	10	5	60%	Fair
LBR-10	5/20/2014	A. Sacry, S. Flynn	Garrison SE	Natural, Fenced Riparian	BB2	0.0%	1.0	F	2.5	60	24	Gravel/Cobble	8	3	4	6	6	1	2	8	4	6	80%	Sustainable	3	7	5	50%	Fair
LBR-11	5/20/2014	A. Sacry, S. Flynn	Garrison SE	Transportation corridors, Campground	BB2	1.0%	1.2	F, C	2.5-3	60-70	23	Cobble/Gravel	8	5	4	6	2	0	0	8	4	4	68%	At Risk	3	7	7	57%	Fair

DOG CREEK																														
Reach ID	**Date(s) of Assessment**	**ID Team/ Observers**	**Map or Quad Name**	**Primary Land Use**	**Plant Community**	**Slope**	**Sinuosity**	**Rosgen Channel Type**	**BF Depth (ft)**	**BF Width (ft)**	**Width:Depth Ratio**	**Channel Substrate**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**NRCS Score (%)**	**NRCS Rating**	**Q1**	**Q2**	**Q3**	**Fish Habitat Score (%)**	**Fish Habitat Rating**
Dog-01	5/19/2014	S. Flynn	Greenhorn Mountain SW	Natural	SR2	1.3%	1.1	DA	1+	2+	5-40	Silt/Sand-covered Gravel	8	8	6	6	6	3	3	6	3	8	95%	Sustainable	7	0	7	47%	Fair
Dog01a-R	5/28/2014	J. Wallace, S. Flynn, M. Daniels	Greenhorn Mountain SW	Natural, Grazing	SR2	1.0%	1.1	DA/E	1+	2+	5-40	NA	8	5	6	6	6	NA	2	6	NA	8	89%	Sustainable	7	NA	NA	NA	NA
Dog-02	5/19/2014	S. Flynn	Greenhorn Mountain SW	Natural, Grazing	SR2	0.7%	1.6	E	1-2	8-12	~4	Gravel	8	5	6	6	6	3	2	6	3	6	85%	Sustainable	7	7	7	70%	Fair
Dog-02a-R	5/28/2014	J. Wallace, S. Flynn, M. Daniels	Greenhorn Mountain SW	Natural, Grazing	SR2, GRD	0.5%	1.4	E	1-2	8-12	~4	NA	6	5	4	4	2	NA	1	6	NA	6	64%	At Risk	7	NA	NA	NA	NA
Dog-03	5/19/2014	S. Flynn	Greenhorn Mountain SW / Esmerelda Hill SE	Grazing	SR2/4, GRD	1.4%	1.2	E	NA	NA	NA	NA	8	5	4	4	2	3	0	6	3	2	62%	At Risk	3	10	3	53%	Fair
Dog-03a-R	5/30/2014	J. Wallace, S. Flynn, M. Daniels	Esmerelda Hill SE	Grazing	SR2/4, GRD	0.8%	1.6	E	1	15	15	NA	6	3	4	4	2	NA	0	6	NA	6	58%	At Risk	3	NA	NA	NA	NA
Dog-03b-R	5/30/2014	J. Wallace, S. Flynn, M. Daniels	Esmerelda Hill SE / Greenhorn Mountain SW	Natural	SR2	0.7%	1.4	E/DA	1+	2+	5-40	NA	8	8	6	6	6	NA	3	6	NA	8	96%	Sustainable	10	NA	NA	NA	NA
Dog-04-R	5/29/2014	J. Wallace, S. Flynn, M. Daniels	Greenhorn Mountain SW	Natural	SR2	1.3%	1.2	E/DA	1+	2+	5-40	NA	8	5	6	6	6	NA	3	6	NA	8	91%	Sustainable	10	NA	NA	NA	NA
Dog-04a-R	5/28/2014	J. Wallace, S. Flynn, M. Daniels	Greenhorn Mountain SW	Natural, Grazing	SR2	0.5%	1.3	E/DA	1+	2+	5-40	NA	8	5	6	6	6	NA	2	6	NA	6	85%	Sustainable	7	NA	NA	NA	NA
Dog-05	4/29/2014	M. Daniels, S. Ammondt	Greenhorn Mountain SW / MacDonald Pass NW	Natural	SR2	2.2%	1.4	DA	1+	2+	5-40	Silt/Sand	8	8	6	6	6	2	3	8	4	8	98%	Sustainable	10	7	10	90%	Good
Dog-06	4/29/2014	M. Daniels, S. Ammondt	MacDonald Pass NW	Light Grazing	SR2	0.7%	1.4	E/B/DA	1+	2+	5-40	Sand/Silt/Gravel/ Cobble	6	8	6	6	4	2	2	8	3	6	85%	Sustainable	10	10	10	100%	Good
Dog-07	4/29/2014	M. Daniels, S. Ammondt	MacDonald Pass NW	Grazing	SR2	0.9%	1.2	DA/E	1+	2+	5-40	Gravel/Sand/Silt/ Clay	8	8	6	6	6	2	3	8	3	8	97%	Sustainable	10	10	10	100%	Good
Dog-08	4/29/2014	M. Daniels, S. Ammondt	MacDonald Pass NW	Grazing	SR2	0.6%	1.5	DA/E	1+	2+	5-40	Gravel/Sand/Silt/ Clay	8	8	6	6	6	2	3	8	3	8	97%	Sustainable	10	10	10	100%	Good
Dog-09	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Natural, Grazing	SR2	0.6%	1.6	DA	2.9	18	6.2	Gravel/Small Cobble	8	8	6	6	6	2	3	8	4	8	98%	Sustainable	10	7	10	90%	Good
Dog-10	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Natural, Grazing	SR2	0.5%	1.1	F/C	1.5-2.5	16.5-25	10-11	Gravel/Cobble	8	3	4	6	2	2	0	8	4	4	68%	At Risk	3	7	3	43%	Fair
Dog-11a	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Formerly grazed	GR2	0.6%	1.1	F/C	1.7	22	12.9	Gravel/Cobble	6	0	4	6	0	3	0	4	3	2	47%	Not sustainable	0	7	3	33%	Poor
Dog-11b	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Transportation corridor/Grazing	SR2	0.5%	1.1	E/C	2-2.2	18-19	8.6-9	Large Gravel/Small Cobble	8	3	4	6	2	2	0	6	4	4	65%	At Risk	0	7	3	33%	Poor
Dog-12a	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Natural/Minimal management	SR4	1.0%	1.3	E	1.6	20	12.5	Cobble	8	5	4	6	4	2	3	8	4	6	83%	Sustainable	3	7	7	57%	Fair
Dog-12b	4/29/2014	A. Sacry, S. Flynn, W.McDowell	MacDonald Pass NW	Natural/Minimal management	SR4	1.3%	1.0	F/B	1.8-2	20-25	13.8	Cobble	8	5	4	6	2	2	2	6	4	4	72%	At Risk	3	7	3	43%	Fair
Dog-13a	4/29/2014	M. Daniels, S. Ammondt,	MacDonald Pass NW	Transportation corridor	SR2	1.8%	1.0	G/F/B	1.5-2.2	22-30	10-16	Cobble/Boulder	6	5	6	6	2	2	2	8	4	2	84%	Sustainable	3	10	3	53%	Fair

DOG CREEK																												
Reach ID	**Date(s) of Assessment**	**ID Team/ Observers**	**Map or Quad Name**	**Primary Land Use**	**Plant Community**	**Slope**	**Sinuosity**	**Rosgen Channel Type**	**BF Depth (ft)**	**BF Width (ft)**	**Width:Depth Ratio**	**Channel Substrate**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**NRCS Score (%)**	**NRCS Rating**	**Q1**	**Q2**	**Q3**	**Fish Habitat Score (%)**	**Fish Habitat Rating**
		W. McDowell																										
Dog-13b	4/29/2014	M. Daniels, S. Ammondt, W. McDowell	MacDonald Pass NW / Elliston SE	Transportation corridor	SR2, BB2	1.5%	1.1	B/G	2	30	14	Cobble	6	8	6	6	4	2	3	8	4	6	88%	Sustainable	3	10	3	59%	Fair
Dog-14	4/29/2014	A. Sacry, S. Flynn	Elliston SE	Grazing, Residential	BB2	1.7%	1.3	B	1.8	25	14	Cobble	8	3	4	6	2	2	2	6	4	4	68%	At Risk	7	7	7	70%	Fair
Dog-15-R	5/29/2014	J. Wallace, S. Flynn, M. Daniels	Elliston SE	Grazing	GR4, SR2	1.0%	1.0	B/F	2	25	12.5	NA	6	5	4	4	0	NA	0	6	NA	4	55%	At Risk	3	NA	NA	NA	NA
Dog-16-R	5/29/2014	J. Wallace, S. Flynn, M. Daniels	Elliston SE	Natural, Grazing	SR2, GR4	1.1%	1.1	E	2	25	12.5	NA	6	5	4	6	6	NA	2	6	NA	8	81%	Sustainable	10	NA	NA	NA	NA

SNOWSHOE CREEK																												
Reach ID	**Date(s) of Assessment**	**ID Team/ Observers**	**Map or Quad Name**	**Primary Land Use**	**Plant Community**	**Slope**	**Sinuosity**	**Rosgen Channel Type**	**BF Depth (ft)**	**BF Width (ft)**	**Width:Depth Ratio**	**Channel Substrate**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**NRCS Score (%)**	**NRCS Rating**	**Q1**	**Q2**	**Q3**	**Fish Habitat Score (%)**	**Fish Habitat Rating**
SS-01	5/1/2014	A. Sacry	Esmerelda Hill SW	Grazing	SR2	4.0%	1.1	B, F, G	1	4	4	Gravel	2	3	2	6	0	1	2	4	3	0	38%	Not sustainable	3	10	3	53%	Fair
SS-02	5/1/2014	A. Sacry	Esmerelda Hill SW	Grazing	SR2	1.7%	1.1	E, F, B	0.8	4	5	Gravel	8	5	4	6	6	8	3	6	3	2	85%	Sustainable	3	7	3	43%	Fair
SS-03	5/1/2014	S. Flynn	Esmerelda Hill SW	Grazing, Natural	CD1, BB2	3.1%	1.1	B, E	0.7	5-9.5	6.3-13.6	Gravel	8	5	4	6	6	2	1	8	2	8	83%	Sustainable	7	10	7	80%	Good
SS-04	4/30/2014	S. Flynn, A. Sacry	Esmerelda Hill SW	Grazing	BB2, SR2, GR2	1.1%	1.2	E	1-1.1	2.6-4	2.3-3.5	Gravel	8	5	6	6	4	2	1	8	1	6	78%	At Risk	7	10	7	80%	Good
SS-05	5/19/2014	A. Sacry	Esmerelda Hill SW / Avon NE	Haying, Grazing	SR4	1.0%	1.4	E	0.6-1.4	3-7	2.3-10	Gravel	6	5	6	6	6	3	2	8	3	6	85%	Sustainable	7	7	10	80%	Good
SS-05a-R	5/28/2014	J. Wallace, S. Flynn, M. Daniels	Avon NE	Grazing	SR4	0.6%	1.6	E	~1-1.5	~10	~4-10	NA (Gravel/Cobble likely)	6	3	4	4	2	NA	0	6	NA	4	55%	At Risk	7	NA	NA	NA	NA
SS-06	4/30/2014	S. Flynn, S. Ammondt	Avon NE	Grazing	SR2	0.3%	1.7	E	1.3-1.6	10.5-12	3-7.5	Gravel/Cobble with Sand & Silt	4	3	4	6	2	2	0	8	2	4	58%	At Risk	7	7	7	70%	Fair
SS-06a-R	5/28/2014	J. Wallace, S. Flynn, M. Daniels	Avon NE	Grazing	SR2, GR4	0.6%	2.1	E	1.2	11.2	9	NA (Gravel/Cobble with Sand/Silt likely)	6	3	4	4	2	NA	0	6	NA	4	55%	At Risk	7	NA	NA	NA	NA
SS-07	4/30/2014	S. Flynn, S. Ammondt	Avon NE	Grazing	SR2	0.6%	1.1	E	1.8-2.2	12-14	<12	Gravel/Cobble US; Silt/Sand DS	8	3	4	6	2	2	0	6	3	4	63%	At Risk	0	10	7	57%	Fair

SPOTTED DOG CREEK																													
Reach ID	**Date(s) of Assessment**	**ID Team/ Observers**	**Map or Quad Name**	**Primary Land Use**	**Plant Community**	**Slope**	**Sinuosity**	**Rosgen Channel Type**	**BF Depth (ft)**	**BF Width (ft)**	**Width:Depth Ratio**	**Channel Substrate**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**NRCS Score (%)**	**NRCS Rating**	**Q1**	**Q2**	**Q3**	**Fish Habitat Score (%)**	**Fish Habitat Rating**
SD-01a	5/19/2014	A. Sacry, M. Staats	Baggs Creek NE	Grazing, Forested Pasture	CC2	2.0%	1.2	B/C	1-2	12	6-12	Gravel/Cobble	8	3	4	6	4	2	2	6	3	6	73%	At Risk	7	7	10	80%	Good
SD-01b	5/19/2014	A. Sacry, M. Staats	Baggs Creek NE	Grazing	SR2	1.6%	1.4	DA	1.5	11	7	Gravel/Cobble	6	3	4	6	6	2	2	8	3	8	80%	Sustainable	10	7	10	90%	Good
SD-01c	5/19/2014	A. Sacry	Baggs Creek NE / Avon SE	Grazing	GRD, SR2	1.2%	1.6	E/F	1-2	5-12	2.5-12	Gravel	2	0	4	6	4	2	1	4	1	4	47%	Not sustainable	3	7	5	50%	Fair
SD-02	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SE / Avon SW	Grazing, State land	CC2	2.1%	1.2	B	1-2	20	20	Gravel/Cobble	8	8	6	6	6	3	2	6	3	6	90%	Sustainable	7	10	10	90%	Good
SD-03	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Grazing	SR2, GRD	1.6%	1.2	B/C	1.5-1.8	10-13	6.7-7.6	Cobble	8	3	6	6	2	2	0	4	3	2	60%	At Risk	3	7	5	50%	Fair
SD-04	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Grazing, Reservoir	SR2	0.3%	1.2	E	1-2	15-20	7.5-20	Cobble/Gravel	8	0	2	6	2	2	0	6	3	6	58%	At Risk	0	7	5	40%	Poor
SD-05	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Grazing, Natural (below reservoir)	CD1	1.8%	1.2	B	1.6-25	20-25	10-14.7	Cobble/Boulder/ Gravel	8	5	4	6	4	2	2	6	3	6	77%	At Risk	7	7	7	70%	Fair
SD-06	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Former reservoir, Grazing	GRD	0.6%	1.3	C	0.5-1.5	18-50	12-100	Gravel/Cobble	8	3	2	6	6	2	1	0	1	6	58%	At Risk	3	7	5	50%	Fair
SD-07	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Grazing, Natural	CD1	1.6%	1.2	B	1.5	23	15.3	Cobble	8	8	6	6	4	2	1	6	3	6	83%	Sustainable	7	10	10	90%	Good
SD-08	5/20/2014	A. Sacry, M. Staats, S. Flynn	Avon SW	Grazing, Natural	CD1	1.3%	1.1	B	1.5	20-25	13.3-16.7	Cobble	8	8	6	6	4	2	1	6	3	6	83%	Sustainable	7	7	7	70%	Fair
SD-09/10	4/28/2014	A. Sacry, M. Daniels, S. Flynn, S. Ammondt, W. McDowell, M. Staats	Avon SW / Avon NW	Grazing	SR2	1.3%	1.2	B/C	1.5-1.8	24-28	16-18	Cobble	8	3	4	6	2	2	0	2	2	6	58%	At Risk	3	10	3	53%	Fair
SD-11	4/28/2014	M. Daniels, S. Ammondt, M. Staats	Avon NW	Grazing	SR2	1.0%	1.1	B/C	1.5	18-20	11-13	Cobble/Gravel	8	3	6	6	0	2	0	2	0	4	52%	At Risk	3	10	7	67%	Fair
SD-12	4/28/2014	M. Daniels, S. Ammondt	Avon NW	Grazing	SR2	0.7%	1.7	E	1.3-1.5	15-20	12-24	Gravel	8	3	4	2	2	2	0	2	1	4	49%	Not sustainable	7	7	10	80%	Good
SD-13	4/28/2014	A. Sacry, S. Flynn	Avon NW	Grazing	SR2	0.7%	1.5	E	1.5	18	12	Gravel/Cobble	8	3	4	6	4	3	0	4	1	6	65%	At Risk	7	7	7	70%	Fair
SD-14	4/28/2014	A. Sacry, S. Flynn	Avon NW	Grazing	SR2	0.7%	1.7	E	1.5-2	13-15	5-10	Gravel/Small Cobble	8	3	4	6	4	2	0	4	1	6	63%	At Risk	7	7	7	70%	Fair

APPENDIX B. SUMMARY OF BANK EROSION BY REACH

*Green shaded cells indicate remotely assessed reaches for which erosion extents and sources could not be determined.

Stream Name	Reach ID	Reach Length (ft)	Total Bank Erosion (ft^2)	Linear Bank Erosion (ft)	Percentage of Linear Bank Erosion (%)	Primary Erosion Source
Little Blackfoot River	LBR-01	6,328	5,435	1,740	13.7%	CR
Little Blackfoot River	LBR-02	6,834	6,675	2,890	21.1%	CR
Little Blackfoot River	LBR-03	2,929	2,160	965	16.5%	CR
Little Blackfoot River	LBR-04	5,460	6,475	2,280	20.9%	CR
Little Blackfoot River	LBR-05	2,942	1,043	555	9.4%	CR
Little Blackfoot River	LBR-06	1,517	320	160	5.3%	CR
Little Blackfoot River	LBR-07	3,616	955	480	6.6%	CR
Little Blackfoot River	LBR-08	8,212	6,598	1,755	10.7%	CR
Little Blackfoot River	LBR-09	7,270	5,075	1,540	10.6%	CR
Little Blackfoot River	LBR-10	1,747	2,540	870	24.9%	CR
Little Blackfoot River	LBR-11	2,347	1,100	370	7.9%	CR
Dog Creek	Dog-01	1,065	0	0	0.0%	N/A
Dog Creek	Dog-01a-R	635	NA	NA	NA	N/A
Dog Creek	Dog-02	974	108	50	2.6%	CR
Dog Creek	Dog-02a-R	2,628	NA	NA	NA	N/A
Dog Creek	Dog-03*	1,999	NA*	NA*	NA*	N/A*
Dog Creek	Dog-03a-R	10,979	NA	NA	NA	N/A
Dog Creek	Dog-03b-R	9,231	NA	NA	NA	N/A
Dog Creek	Dog-04-R	1,446	NA	NA	NA	N/A
Dog Creek	Dog-04a-R	8,123	NA	NA	NA	N/A
Dog Creek	Dog-05	2,503	0	0	0.0%	N/A
Dog Creek	Dog-06	5,042	320	150	1.5%	CR
Dog Creek	Dog-07	3,764	375	210	2.8%	RD
Dog Creek	Dog-08	3,763	555	185	2.5%	RD
Dog Creek	Dog-09	2,650	225	96	1.8%	RD
Dog Creek	Dog-10	1,911	877	417	10.9%	CR
Dog Creek	Dog-11a	891	1,948	660	37.0%	CR
Dog Creek	Dog-11b	2,395	1,283	481	10.0%	CR
Dog Creek	Dog-12a	4,963	1,967	770	7.8%	CR
Dog Creek	Dog-12b	1,759	290	130	3.2%	TR
Dog Creek	Dog-13a	1,427	3,110	270	9.5%	RD
Dog Creek	Dog-13b	4,908	475	389	4.0%	CR
Dog Creek	Dog-14	706	920	126	8.9%	HS

Stream Name	Reach ID	Reach Length (ft)	Total Bank Erosion (ft^2)	Linear Bank Erosion (ft)	Percentage of Linear Bank Erosion (%)	Primary Erosion Source
Dog Creek	Dog-15-R	2,497	NA	NA	NA	N/A
Dog Creek	Dog-16-R	2,670	NA	NA	NA	N/A
Snowshoe Creek	SS-01	3,317	955	555	8.4%	LS-P
Snowshoe Creek	SS-02	4,786	570	525	5.5%	LS-P
Snowshoe Creek	SS-03	6,708	125	210	1.6%	HS
Snowshoe Creek	SS-04	3,590	240	285	4.0%	CR
Snowshoe Creek	SS-05	6,116	428	318	2.6%	LS-P
Snowshoe Creek	SS-05a-R	5,000	NA	NA	NA	CR
Snowshoe Creek	SS-06	12,025	2,642	2,037	8.5%	CR
Snowshoe Creek	SS-06a-R	10,217	NA	NA	NA	CR
Snowshoe Creek	SS-07	826	341	103	6.2%	CR
Spotted Dog Creek	SD-01a	3,601	2,278	1,345	18.7%	LS-P
Spotted Dog Creek	SD-01b	9,782	6,858	2,365	12.1%	CR
Spotted Dog Creek	SD-01c	5,174	4,240	1,670	16.1%	CR
Spotted Dog Creek	SD-02	4,373	145	105	1.2%	CR
Spotted Dog Creek	SD-03	4,400	2,820	909	10.3%	CR
Spotted Dog Creek	SD-04	3,861	793	610	7.9%	CR
Spotted Dog Creek	SD-05	6,076	339	162	1.3%	CR
Spotted Dog Creek	SD-06	2,614	651	547	10.5%	CR
Spotted Dog Creek	SD-07	4,294	975	100	1.2%	HS
Spotted Dog Creek	SD-08	2,991	3,303	270	4.5%	HS
Spotted Dog Creek	SD-09/10	3,274	2,416	645	9.8%	CR
Spotted Dog Creek	SD-11	2,637	713	457	8.7%	CR
Spotted Dog Creek	SD-12	2,720	60	95	1.7%	TR
Spotted Dog Creek	SD-13	4,247	2,125	1,080	12.7%	CR
Spotted Dog Creek	SD-14	3,554	2,668	1,225	17.2%	CR

* Reach Dog-03 was assessed in the field, but was inaccessible for erosion assessment due to lack of landowner permission on adjacent properties.

APPENDIX C. 2009 FISH WILDLIFE & PARKS ASSESSMENT RESULTS

In 2008, Montana Fish Wildlife & Parks performed NRCS riparian assessments on portions of the Little Blackfoot River and its tributaries. Reach characteristics and the results of these assessments are summarized in Tables 11-14 below. The table indicates which reaches overlap with the 2014 assessment reaches (Column heading: "2014 Assessment Reach"). These assessment data are summarized slightly differently than the data provided in Appendix A for the 2014 assessments, with questions and NRCS ratings grouped by geomorphological assessment results (Q1, 2, 3 & 10), riparian vegetation assessment results (Q4-9), and aquatic habitat assessment results (Q1) and overall rankings. Full details are provided in the 2009 document *An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase 2* (MTFWP 2009).

REACH CHARACTERISTICS

Stream	2014 Assessment Reach	2007 Assessment Location	River Mile	Date	Section Length (m)	Latitude - Top (DD)	Longitude - Top (DD)	Primary Land Use	Plant Community	Rosgen Channel Type	Substrate	Mean BF Depth (ft)	Mean BF Width (ft)	W/D Ratio
Dog Creek	Dog-13b	Lower - in right of way	1.3	8/30/2007	400	46.56127	-112.38528	Right of Way	Cottonwood/ Dogwood/ Willow	C	4>3	1.083	19.2	17.7
Dog Creek	Dog-08	Below Confluence w/ Uncle George Creek	5.1	8/23/2007	400	46.60318	-112.34697	Grazing	Willow/ Sedge	C	4	2.583	14	5.4
Dog Creek	Dog-03a-R	Above Forest Service Open Arch on Road # 571	10.4	8/14/2007	400	46.66097	-112.38914	Grazing	Willow/ Sedge/ Grass	E to Bc	3>4	0.833	14.6	17.5
Dog Creek	*NA*	Upper	13.8	8/14/2007	400	46.69358	-112.35572	Grazing/ Timber	Willow/ Sedge/ Bog Alder/ Lodgepole	B	4	1.75	8.6	4.9
Little Blackfoot River	LBR-07	Below Beck Hill Bridge	4.0	10/3/2007	1,000	46.53372	-112.74144	Agricultural/ Hay Fields/ Grazing	Willow/ Cottonwood	C	4>3>5	2.5	51.5	20.6
Little Blackfoot River	*NA*	Rest Area - FWP FAS	9.6	9/27/2007	1,200	46.56875	-112.66709	Agriculture/ Recreation/ Transportation	Willow/ Cottonwood	C	4>3	2.417	51.2	21.2
Little Blackfoot River	LBR-01	Above North Trout Creek Confluence	21.3	10/5/2007	1,000	46.57596	-112.49900	Hay Fields/ Grazing	Cottonwood/ Willow	C	4=3	2.167	39.9	18.4
Little Blackfoot River	*NA*	Above Highway 12 Bridge Near Elliston	26.7	8/30/2007	400	46.55329	-112.40235	Agricultural/ Grazing	Willow/ Grass/ Sedge/ Alder	C	4>3	2.057	46	22.4
Little Blackfoot River	*NA*	Above Sunshine Camp	31.1	8/30/2007	400	46.50311	-112.40434	National Forest/ Grazing	Doug Fir/ Alder/ Willow/ Dogwood/ Cottonwood/ Wild Rose/ Chokecherry	C	4>3	1.472	35	23.8
Little Blackfoot River	*NA*	Below Ontario Creek	34.9	8/24/2007	400	46.46136	-112.42018	National Forest/ Recreation	Spruce/ Alder/ Lodgepole/ Willow	B	3>4>2	1.667	28.1	16.9
Little Blackfoot River	*NA*	Above Kading Campground	40.1	8/24/2007	400	46.42034	-112.48999	National Forest/ Grazing	Willow/ Lodgepole/ Spruce/ Alder/ Grass/ Sedge	C	4>3	1.5835	14.5	9.2
Snowshoe Creek	SS-06	~ 2 miles above confluence w/ Little Blackfoot R.	2.1	8/15/2007	400	46.60279	-112.52469	Agricultural	Willow/ Sedge/ Horsetail/ Rose/ Dogwood/ Cattails	G	4>5>3	1	10.2	10.2
Snowshoe Creek	*NA*	Above Reservoir On Forest Service - upper exclosure	9.2	8/15/2007	400	46.68719	-112.46411	National Forest/ Grazing/ Historical Mining	Sedge/ Willow/ Spruce/ Lodgepole	E	4>5	0.833	2.6	3.1
Spotted Dog Creek	SD-12	Lower Spotted Dog Creek	1.2	8/21/2007	400	46.58048	-112.60248	Private Property/ Grazing/ Hay	Willow/ Alder/ Sedge/ Rush/ Pasture Grasses	C	4>3	0.792	14.65	18.5
Spotted Dog Creek	SD-05	Below Reservoir	4.6	8/21/2007	400	46.53736	-112.58921	Grazing/ Timber	Alder (sparse)/ Doug Fir/ Lodgepole	B	3>4>2	1.2085	21.5	17.8
Spotted Dog Creek	*NA*	Above North Fork Spotted Dog Creek Confluence	11.3	8/13/2007	400	46.46217	-112.52144	National Forest/ Grazing/ Historical Timber	Spruce/ Alder /Lodgepole	B	4>3	0.708	7.6	10.7

SUMMARY OF MTFWP 2008 NRCS ASSESSMENT: GEOMORPHOLOGY QUESTIONS														
Stream	**2014 Assessment Reach**	**2007 Assessment Location**	**River Mile**	**Q1 Potential**	**Q1 Actual**	**Q2 Potential**	**Q2 Actual**	**Q3 Potential**	**Q3 Actual**	**Q10 Potential**	**Q10 Actual**	**Total Potential**	**Total Actual**	**Rating (%)**
Dog Creek	Dog-13b	Lower - in right of way	1.3	8	8	8	8	6	6	8	8	30	30	100.00
Dog Creek	Dog-08	Below Confluence w/ Uncle George Creek	5.1	8	8	8	8	6	6	8	8	30	30	100.00
Dog Creek	Dog-03a-R	Above Forest Service Open Arch on Road # 571	10.4	8	8	8	5	6	6	8	6	30	25	83.33
Dog Creek	*NA*	Upper	13.8	8	8	8	8	6	6	8	8	30	30	100.00
Little Blackfoot River	LBR-07	Below Beck Hill Bridge	4.0	8	8	8	3	6	4	8	8	30	23	76.67
Little Blackfoot River	*NA*	Rest Area - FWP FAS	9.6	8	8	8	5	6	6	8	8	30	27	90.00
Little Blackfoot River	LBR-01	Above North Trout Creek Confluence	21.3	8	8	8	5	6	6	8	8	30	27	90.00
Little Blackfoot River	*NA*	Above Highway 12 Bridge Near Elliston	26.7	8	6	8	3	6	4	8	8	30	21	70.00
Little Blackfoot River	*NA*	Above Sunshine Camp	31.1	8	6	8	5	6	4	8	8	30	23	76.67
Little Blackfoot River	*NA*	Below Ontario Creek	34.9	8	8	8	8	6	6	8	8	30	30	100.00
Little Blackfoot River	*NA*	Above Kading Campground	40.1	8	8	8	8	6	6	8	8	30	30	100.00
Snowshoe Creek	SS-06	~ 2 miles above confluence w/ Little Blackfoot R.	2.1	8	6	8	5	6	6	6	6	28	23	82.14
Snowshoe Creek	*NA*	Above Reservoir On Forest Service - upper exclosure	9.2	8	8	8	8	6	6	8	8	30	30	100.00
Spotted Dog Creek	SD-12	Lower Spotted Dog Creek	1.2	8	8	8	3	6	6	8	8	30	25	83.33
Spotted Dog Creek	SD-05	Below Reservoir	4.6	8	8	8	8	6	6	8	8	30	30	100.00
Spotted Dog Creek	*NA*	Above North Fork Spotted Dog Creek Confluence	11.3	8	8	8	8	6	6	8	8	30	30	100.00

SUMMARY OF MTFWP 2008 NRCS ASSESSMENT: VEGETATION QUESTIONS																		
Stream	**2014 Assessment Reach**	**2007 Assessment Location**	**River Mile**	**Q4 Potential**	**Q4 Actual**	**Q5 Potential**	**Q5 Actual**	**Q6 Potential**	**Q6 Actual**	**Q7 Potential**	**Q7 Actual**	**Q8 Potential**	**Q8 Actual**	**Q9 Potential**	**Q9 Actual**	**Total Potential**	**Total Actual**	**Rating (%)**
Dog Creek	Dog-13b	Lower - in right of way	1.3	6	6	6	2	3	0	3	0	8	4	4	4	30	16	53.33
Dog Creek	Dog-08	Below Confluence w/ Uncle George Creek	5.1	6	6	6	6	3	2	3	2	8	8	4	3	30	27	90.00
Dog Creek	Dog-03a-R	Above Forest Service Open Arch on Road # 571	10.4	6	6	6	2	3	2	3	1	8	8	4	3	30	22	73.33
Dog Creek	*NA*	Upper	13.8	6	6	6	2	3	3	3	3	8	6	4	3	30	23	76.67
Little Blackfoot River	LBR-07	Below Beck Hill Bridge	4.0	6	6	6	2	3	0	3	0	8	8	4	3	30	19	63.33
Little Blackfoot River	*NA*	Rest Area - FWP FAS	9.6	6	6	6	4	3	0	3	0	8	8	4	4	30	22	73.33
Little Blackfoot River	LBR-01	Above North Trout Creek Confluence	21.3	6	6	6	2	3	0	3	0	8	4	4	3	30	15	50.00
Little Blackfoot River	*NA*	Above Highway 12 Bridge Near Elliston	26.7	6	6	6	2	3	0	3	0	8	8	3	3	29	19	65.52
Little Blackfoot River	*NA*	Above Sunshine Camp	31.1	6	6	4	0	3	0	3	1	8	6	4	2	28	15	53.57
Little Blackfoot River	*NA*	Below Ontario Creek	34.9	6	6	4	2	3	1	3	2	8	8	4	3	28	22	78.57
Little Blackfoot River	*NA*	Above Kading Campground	40.1	6	6	4	4	3	3	3	3	8	8	4	3	28	27	96.43
Snowshoe Creek	SS-06	~ 2 miles above confluence w/ Little Blackfoot R.	2.1	6	6	6	2	3	2	3	1	8	8	4	4	30	23	76.67
Snowshoe Creek	*NA*	Above Reservoir On Forest Service - upper exclosure	9.2	6	6	6	6	3	1	3	2	8	8	4	3	30	26	86.67
Spotted Dog Creek	SD-12	Lower Spotted Dog Creek	1.2	6	6	6	2	3	2	3	0	8	4	4	3	30	17	56.67
Spotted Dog Creek	SD-05	Below Reservoir	4.6	6	6	0	0	3	2	3	3	8	8	4	4	24	23	95.83
Spotted Dog Creek	*NA*	Above North Fork Spotted Dog Creek Confluence	11.3	6	6	4	4	3	3	3	3	8	8	4	4	28	28	100.00

SUMMARY OF MTFWP 2008 NRCS ASSESSMENT: AQUATIC HABITAT QUESTIONS AND OVERALL RATING									
Stream	**2014 Assessment Reach**	**2007 Assessment Location**	**River Mile**	**Q1 Potential**	**Q1 Actual**	**Rating (%)**	**Total Potential**	**Total Actual**	**Total Rating (%)**
Dog Creek	Dog-13b	Lower - in right of way	1.3	10	3	30.00	70	49	70.00
Dog Creek	Dog-08	Below Confluence w/ Uncle George Creek	5.1	10	10	100.00	70	67	95.71
Dog Creek	Dog-03a-R	Above Forest Service Open Arch on Road # 571	10.4	10	7	70.00	70	54	77.14
Dog Creek	*NA*	Upper	13.8	10	3	30.00	70	56	80.00
Little Blackfoot River	LBR-07	Below Beck Hill Bridge	4.0	10	7	70.00	70	49	70.00
Little Blackfoot River	*NA*	Rest Area - FWP FAS	9.6	10	10	100.00	70	59	84.29
Little Blackfoot River	LBR-01	Above North Trout Creek Confluence	21.3	10	7	70.00	70	49	70.00
Little Blackfoot River	*NA*	Above Highway 12 Bridge Near Elliston	26.7	7	3	42.86	66	43	65.15
Little Blackfoot River	*NA*	Above Sunshine Camp	31.1	7	3	42.86	65	41	63.08
Little Blackfoot River	*NA*	Below Ontario Creek	34.9	7	3	42.86	65	55	84.62
Little Blackfoot River	*NA*	Above Kading Campground	40.1	10	10	100.00	68	67	98.53
Snowshoe Creek	SS-06	~ 2 miles above confluence w/ Little Blackfoot R.	2.1	10	7	70.00	68	53	77.94
Snowshoe Creek	*NA*	Above Reservoir On Forest Service - upper exclosure	9.2	10	7	70.00	70	63	90.00
Spotted Dog Creek	SD-12	Lower Spotted Dog Creek	1.2	10	7	70.00	70	49	70.00
Spotted Dog Creek	SD-05	Below Reservoir	4.6	7	3	42.86	61	56	91.80
Spotted Dog Creek	*NA*	Above North Fork Spotted Dog Creek Confluence	11.3	10	10	100.00	68	68	100.00

APPENDIX D. 2002 LAND & WATER CONSULTING ASSESSMENT RESULTS & 2011 TMDL CHANNEL CHARACTERISTICS

SUMMARY OF 2002 EROSION AND RIPARIAN ASSESSMENT DATA FOR LITTLE BLACKFOOT RIVER ASSESSMENT REACHES THAT OVERLAP WITH 2014 REACHES								
2001 Assessment Reach	**2001 Assessment Reach Length (ft)**	**2014 Assessment Reach(es)**	**Coincident Reach Percentage (%)**	**2001 Linear Bank Erosion (ft)**	**2001 Percentage of Linear Bank Erosion (%)**	**2014 Percentage of Linear Bank Erosion (%)**	**2001 NRCS Score (%)**	**2014 NRCS Score (%)**
LBR08	20,506	LBR-01	20%	3,560	8.7%	13.8%	61%	47%
LBR09	9,351	LBR-01, LBR-02, LBR-03	100%	1,530	8.2%	13.8%, 22.7%, 16.5%	77%	47%, 48%, 82%
LBR10	10,171	LBR-03	6%	820	4.0%	16.5%	64%	82%
LBR15	15,585	LBR-04	35%	3,990	12.8%	20.9%	51%	68%
LBR16	26,576	LBR-05 through LBR-11	100%	9,617	18.1%	N/A	52%	N/A

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SUMMARY OF CHANNEL CHARACTERISTICS PROVIDED IN THE 2011 DEQ TMDL FOR REACHES THAT OVERLAP WITH 2014 REACHES											
Stream	**2009 TMDL Assessment Reach**	**Corresponding 2014 Assessment Reach**	**Mean Bankfull Width (ft)**	**Existing Stream Type**	**Potential Stream Type**	**Width:Depth Ratio**	**Entrenchment Ratio**	**Residual Pool Depth (ft)**	**Pools / Mile**	**LWD / Mile**	**Greenline % Shrub Cover**
Little Blackfoot River	LBR26-06	LBR-01	69.9	C3/C4	C4	36.5	4.9	2.5	26	211	52%
Little Blackfoot River	LBR27-06	*NA*	83.9	C3/C4	C4	45.1	6.5	3.2	24	92	41%
Little Blackfoot River	LBR30-05	LBR-04	76.2	B3/B4c/C3	C4	35.9	2.0	2.4	16	40	27%
Dog Creek	DOG11-09	Dog-03a-R	15.0	E4	E3/4	9.4	8.8	1.5	40	26	24%
Dog Creek	DOG12-04	Dog-10	23.4	B4c/C4/E4/F4	C4	16.4	6.4	1.7	32	11	45%
Dog Creek	DOG13-03	Dog-15-R	28.7	B4/F4b	C4	20.6	1.3	0.8	11	5	32%
Snowshoe Creek	SNOW08-01	*NA*	6.2	E4b	E4b	5.6	3.6	0.6	79	290	54%
Snowshoe Creek	SNOW18-05	SS-06a-R	11.2	E4	E4	9.0	5.0	1.5	111	37	24%
Spotted Dog Creek	SPOT01-01	*NA*	15.7	B4/C4/E4	B4	18.5	3.1	1.0	106	449	12%
Spotted Dog Creek	SPOT12-02	SD-12	22.2	B4/C4b	C4	16.0	6.5	1.7	45	26	7%