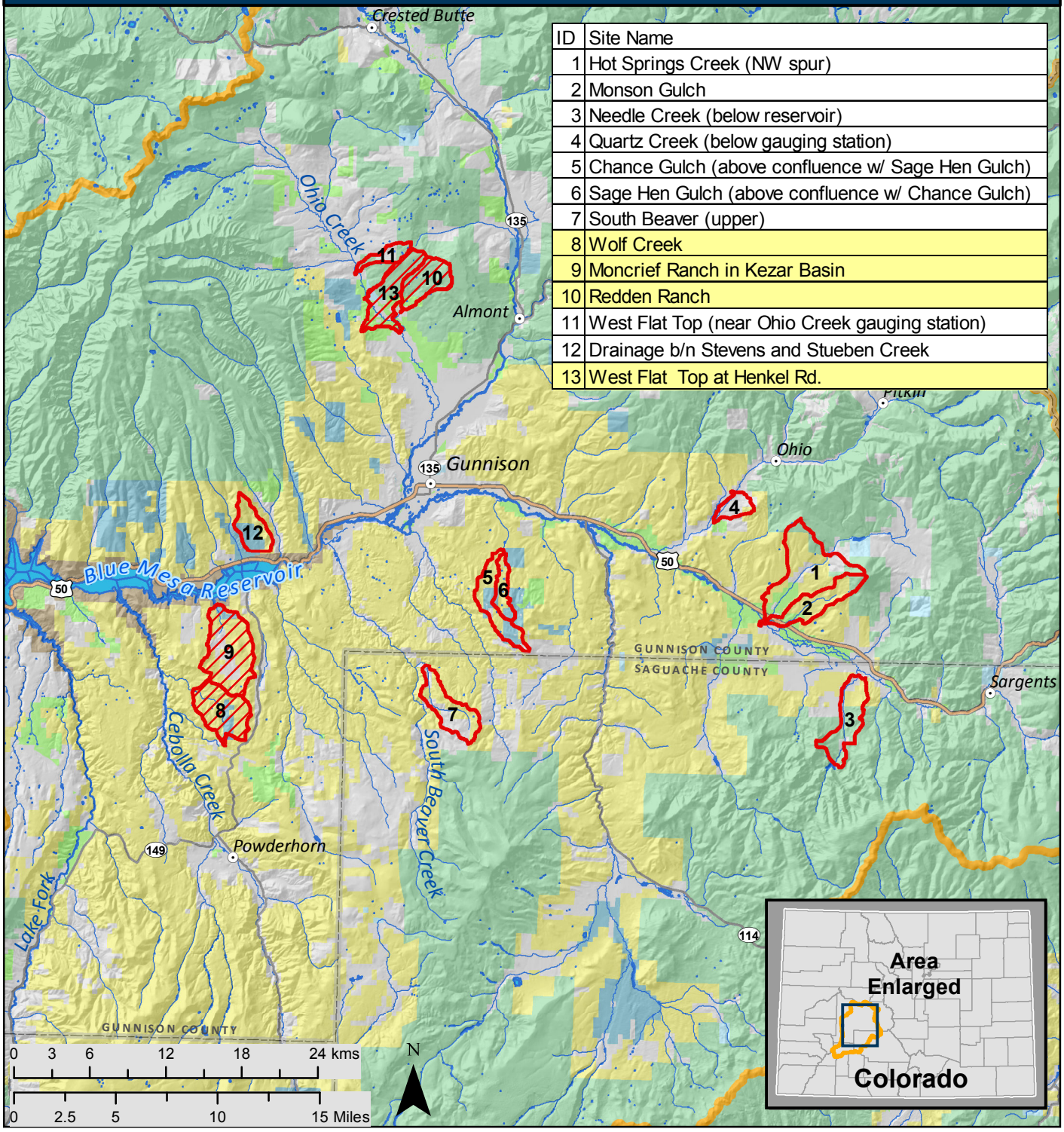
Map 1.

The Nature Conservancy
Protecting nature. Preserving life.™

Priority Restoration Sites
Upper Gunnison Basin
Gunnison Climate Working Group



ID	Site Name
1	Hot Springs Creek (NW spur)
2	Monson Gulch
3	Needle Creek (below reservoir)
4	Quartz Creek (below gauging station)
5	Chance Gulch (above confluence w/ Sage Hen Gulch)
6	Sage Hen Gulch (above confluence w/ Chance Gulch)
7	South Beaver (upper)
8	Wolf Creek
9	Moncrief Ranch in Kezar Basin
10	Redden Ranch
11	West Flat Top (near Ohio Creek gauging station)
12	Drainage b/n Stevens and Stueben Creek
13	West Flat Top at Henkel Rd.

Date: September 24, 2013
Map by J. Robertson & T. Chapman.
The Nature Conservancy.
Scale: 1:450,000
Sources: Land Ownership: COMaP v8 (CNHP 2010);
Transportation and Counties (ESRI 2010);
Rivers and Streams (NHD 2009).
Map document:
F_CO_GunnisonCC_PriorityCatchmentsMap8x11_20130910.mxd

2012-2013 Priority Restoration Sites
Priority Restoration Sites
Upper Gunnison Basin

Land Ownership
USFS
BLM
NPS
CPW
State
Private

Map 2.

Wolf Creek Ranch (Private) - East Fork and Middle Fork
Upper Gunnison Basin
Restoration Structures and Monitoring
Gunnison Climate Working Group

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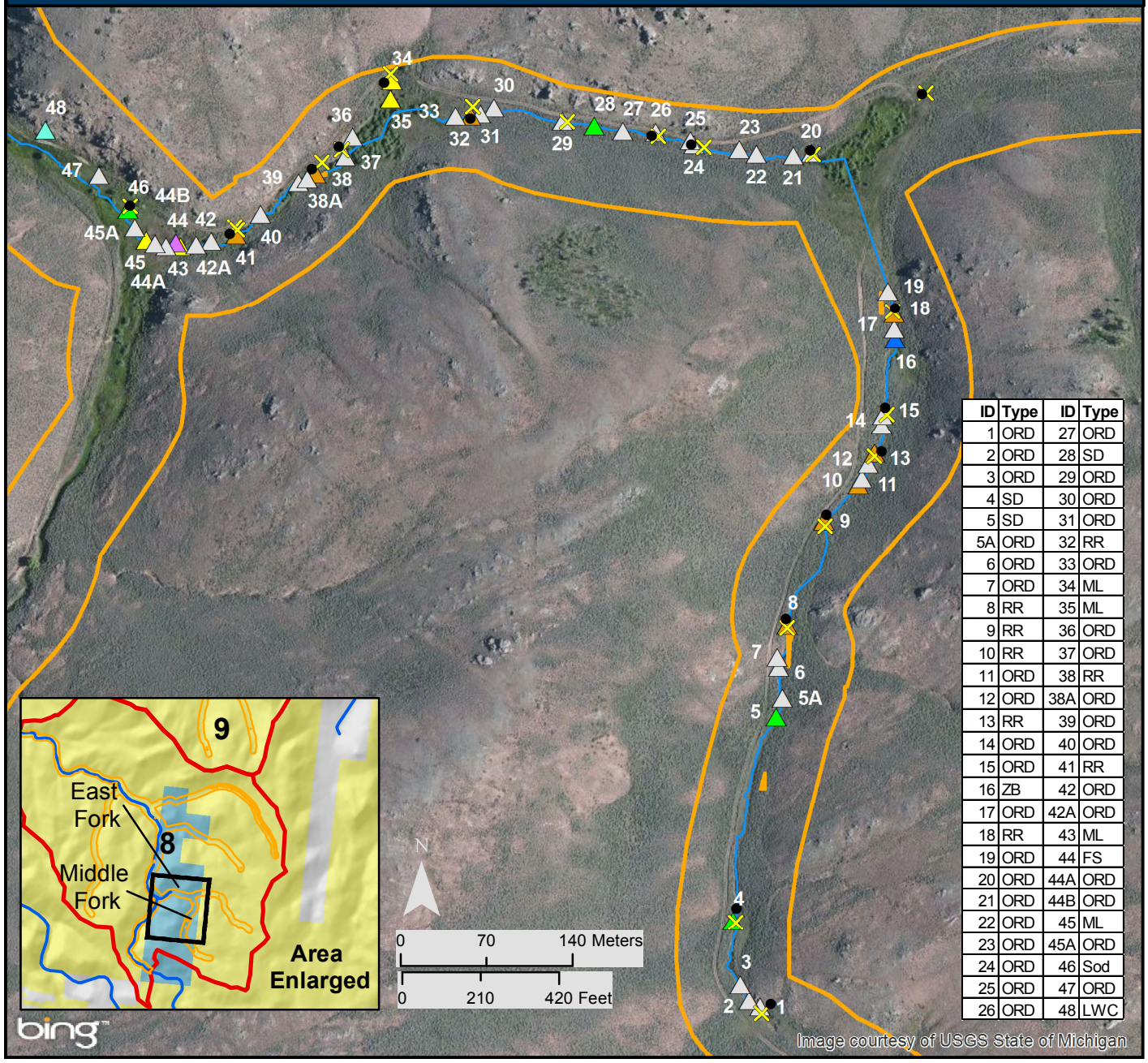

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5	SD	31	ORD
5A	ORD	32	RR
6	ORD	33	ORD
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8	RR	35	ML
9	RR	36	ORD
10	RR	37	ORD
11	ORD	38	RR
12	ORD	38A	ORD
13	RR	39	ORD
14	ORD	40	ORD
15	ORD	41	RR
16	ZB	42	ORD
17	ORD	42A	ORD
18	RR	43	ML
19	ORD	44	FS
20	ORD	44A	ORD
21	ORD	44B	ORD
22	ORD	45	ML
23	ORD	45A	ORD
24	ORD	46	Sod
25	ORD	47	ORD
26	ORD	48	LWC

Priority Restoration Sites
Gunnison Sage-Grouse Brood Rearing Habitat
Streams

Monitoring
Photo Point
Vegetation Transect

Structures
One Rock Dam (ORD)
Rock Rundown (RR)
Media Luna (ML)
Zuni Bowl (ZB)
Flow Splitter (FS)
Low Water Crossing (LWC)
Sod Dams (Sod)
Steel Dam (SD)

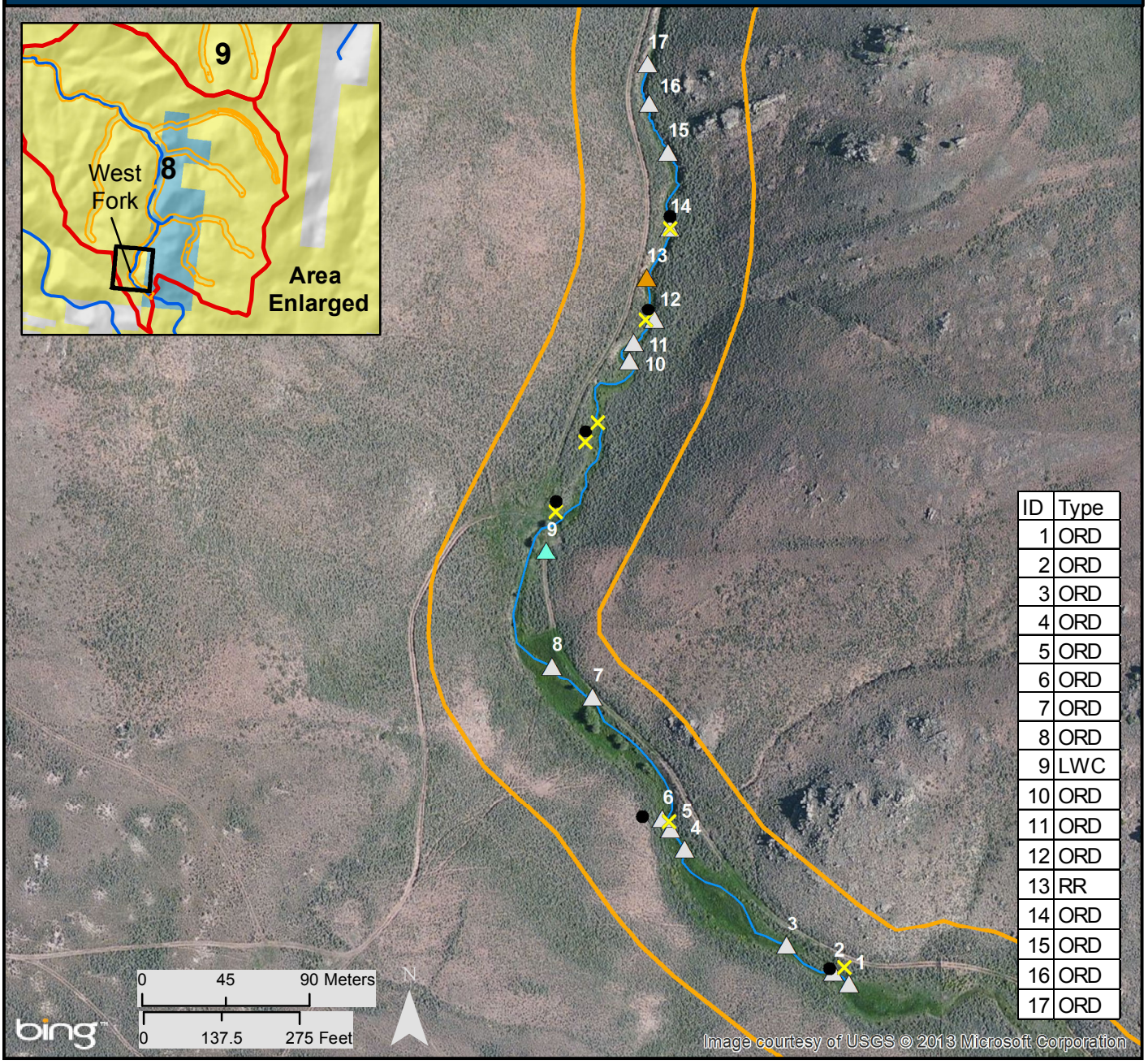
Land Management
USFS
BLM
NPS
CPW
State
Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.
Scale: 1:5,000
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document:
F_Gunnison_PrioritySites8_Wolf_Creek_Ranch__Structures_2013_8x11_201309.mxd

Map 3.

Wolf Creek (BLM) West Fork
Upper Gunnison Basin
Restoration Structures and Monitoring

Gunnison Climate Working Group



ID	Type
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3	ORD
4	ORD
5	ORD
6	ORD
7	ORD
8	ORD
9	LWC
10	ORD
11	ORD
12	ORD
13	RR
14	ORD
15	ORD
16	ORD
17	ORD

Priority Restoration Sites
Gunnison Sage-Grouse Brood Rearing Habitat
Streams

Monitoring
Photo Point
Vegetation Transect

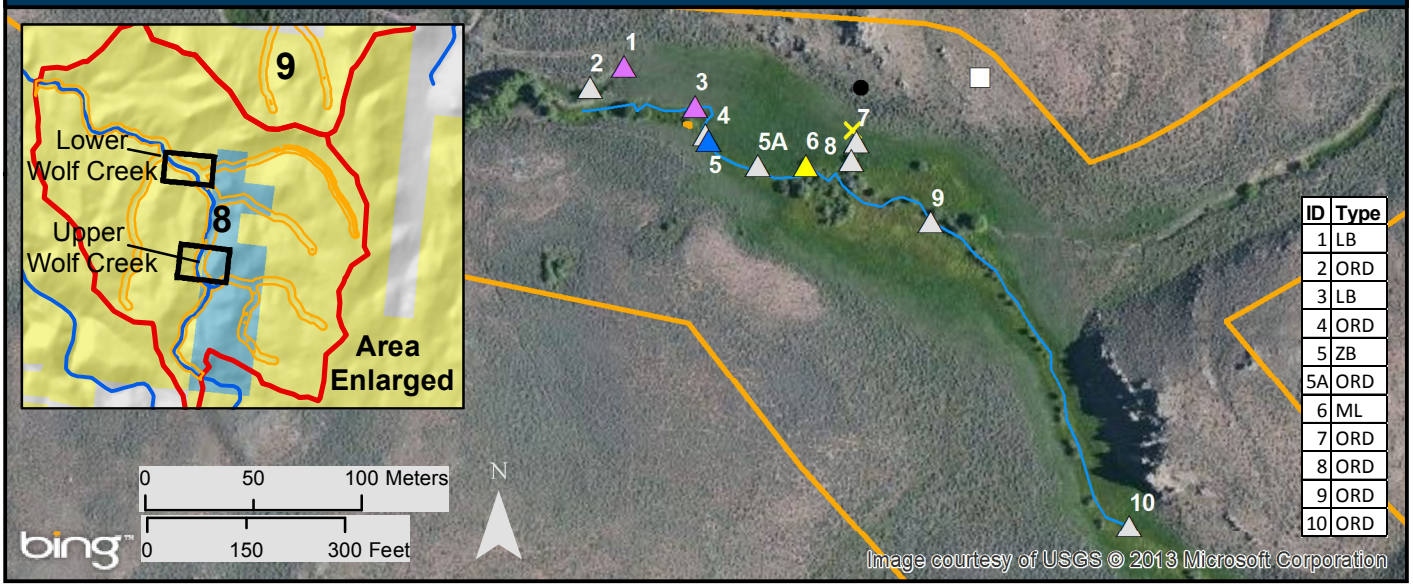
Structures
One Rock Dam (ORD)
Rock Rundown (RR)
Low Water Crossing (LWC)

Land Management
USFS
BLM
NPS
CPW
State
Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.
Scale: 1:3,300
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document:
F_Gunnison_PrioritySites8_Wolf_Creek_Ranch_WestFork_Structures_2013_8x11_201309.mxd

Map 4.

Wolf Creek (BLM) - Lower and Upper Wolf Creek
Upper Gunnison Basin
Restoration Structures and Monitoring
Gunnison Climate Working Group



ID	Type
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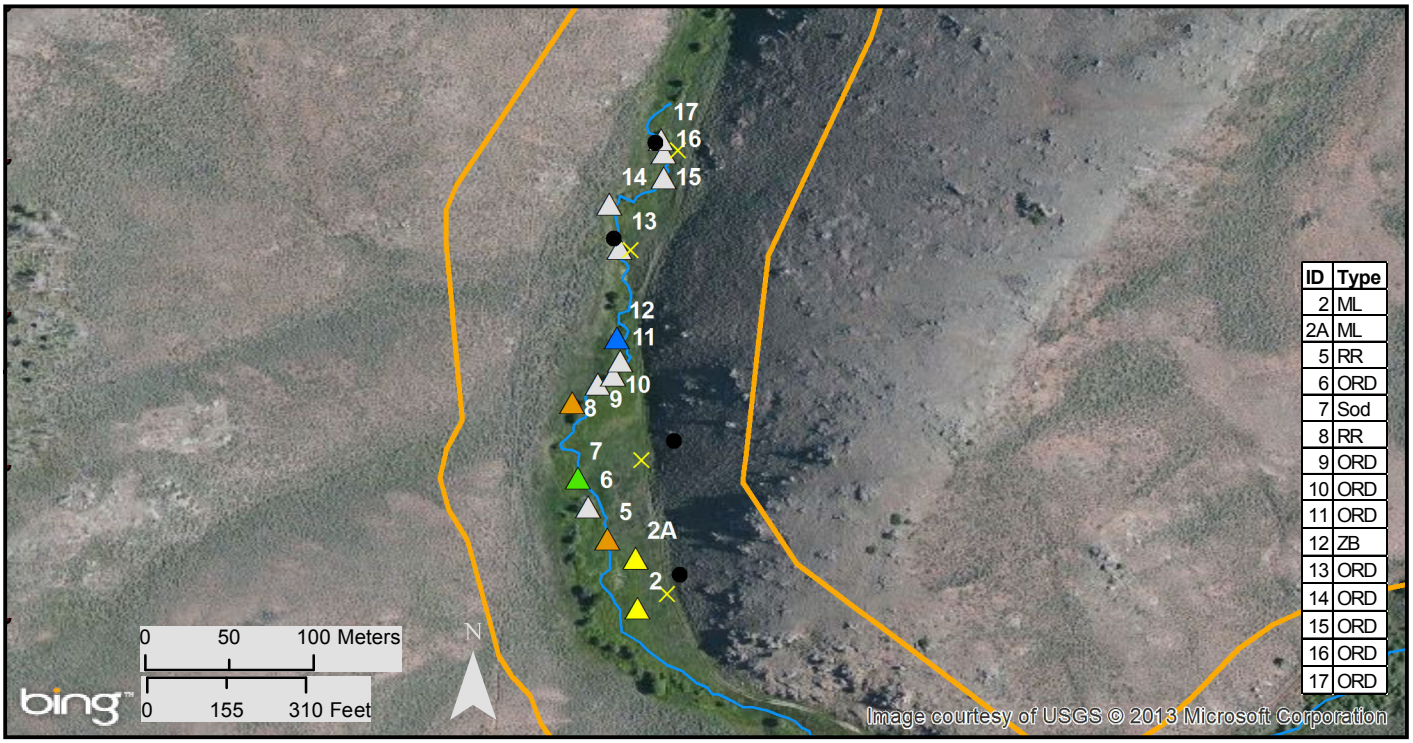
5A	ORD
6	ML
7	ORD
8	ORD
9	ORD
10	ORD



ID	Type
2	ML
2A	ML
5	RR
6	ORD
7	Sod
8	RR
9	ORD
10	ORD
11	ORD
12	ZB
13	ORD
14	ORD
15	ORD
16	ORD
17	ORD

Priority Restoration Sites

Gunnison Sage-Grouse Brood Rearing Habitat

Streams

Monitoring

- Photo Point
- Vegetation Transect
- Time Lapse Camera

Structures

- One Rock Dam (ORD)
- Rock Rundown (RR)
- Media Luna (ML)
- Zuni Bowl (ZB)
- Sod
- Layback (LB)

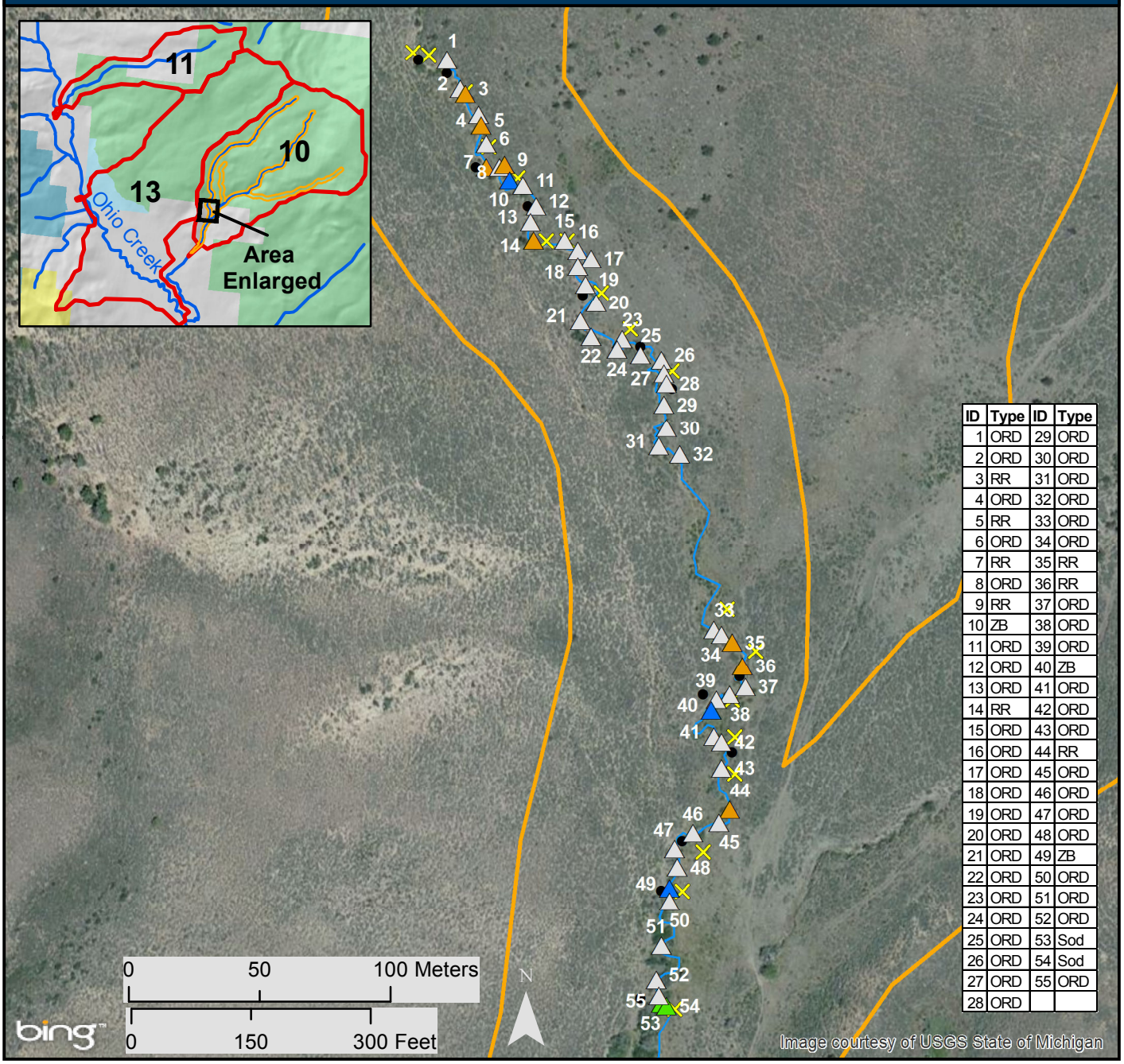
Land Management

- USFS
- BLM
- NPS
- CPW
- State
- Private

Date: 9/24/2013. Map by T. Chapman.
The Nature Conservancy.
Scale: 1:3,500 and 1;4,500
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document:
Gunnison_PrioritySites8_Wolf_Creek_BLM__Structures_2013_8x11_201309F.mxd

Map 5.

Redden Ranch (Private)
Upper Gunnison Basin
Restoration Structures and Monitoring
Gunnison Climate Working Group



ID	Type	ID	Type
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10	ZB	38	ORD
11	ORD	39	ORD
12	ORD	40	ZB
13	ORD	41	ORD
14	RR	42	ORD
15	ORD	43	ORD
16	ORD	44	RR
17	ORD	45	ORD
18	ORD	46	ORD
19	ORD	47	ORD
20	ORD	48	ORD
21	ORD	49	ZB
22	ORD	50	ORD
23	ORD	51	ORD
24	ORD	52	ORD
25	ORD	53	Sod
26	ORD	54	Sod
27	ORD	55	ORD
28	ORD		

Priority Restoration Sites
Gunnison Sage-Grouse Brood Rearing Habitat
Streams

Monitoring
Photo Point
Vegetation Transect

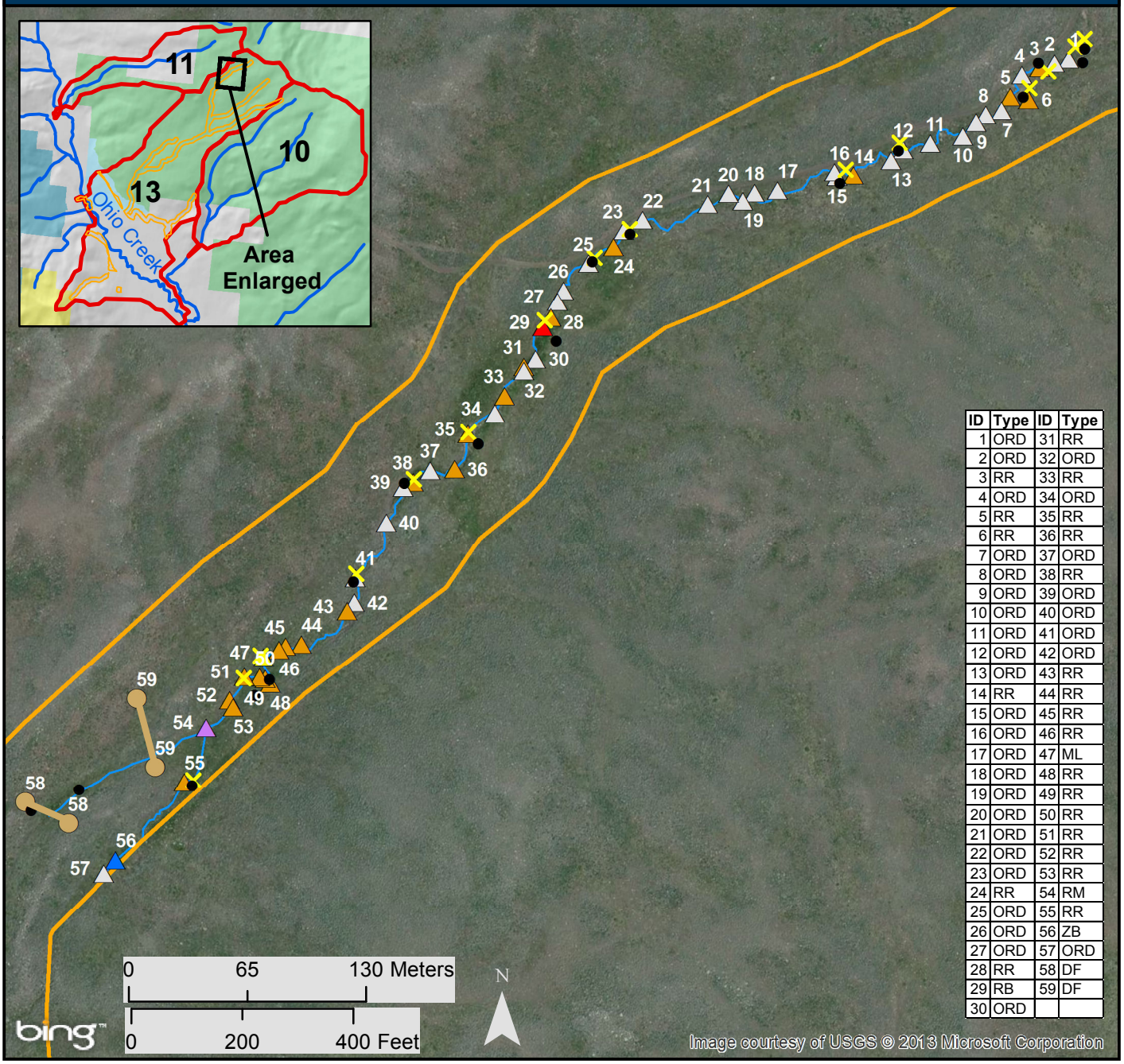
Structure
One Rock Dam (ORD)
Rock Rundown (RR)
Zuni Bowl (ZB)
Sod

Land Management
USFS
BLM
NPS
CPW
State
Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.Scale: 1:2,300
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document:
Gunnison_PrioritySites10_ReddenRanch_Structures_2013_8x11_201309F2.mxd

Map 6.

West Flat Top at Henkel Road - Section 36 (USFS)
Upper Gunnison Basin
Restoration Structures and Monitoring
Gunnison Climate Working Group



ID	Type	ID	Type
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7	ORD	37	ORD
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12	ORD	42	ORD
13	ORD	43	RR
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15	ORD	45	RR
16	ORD	46	RR
17	ORD	47	ML
18	ORD	48	RR
19	ORD	49	RR
20	ORD	50	RR
21	ORD	51	RR
22	ORD	52	RR
23	ORD	53	RR
24	RR	54	RM
25	ORD	55	RR
26	ORD	56	ZB
27	ORD	57	ORD
28	RR	58	DF
29	RB	59	DF
30	ORD		

Priority Restoration Sites
Gunnison Sage-Grouse Brood Rearing Habitat
Streams

Monitoring
Photo Point
Vegetation Transect

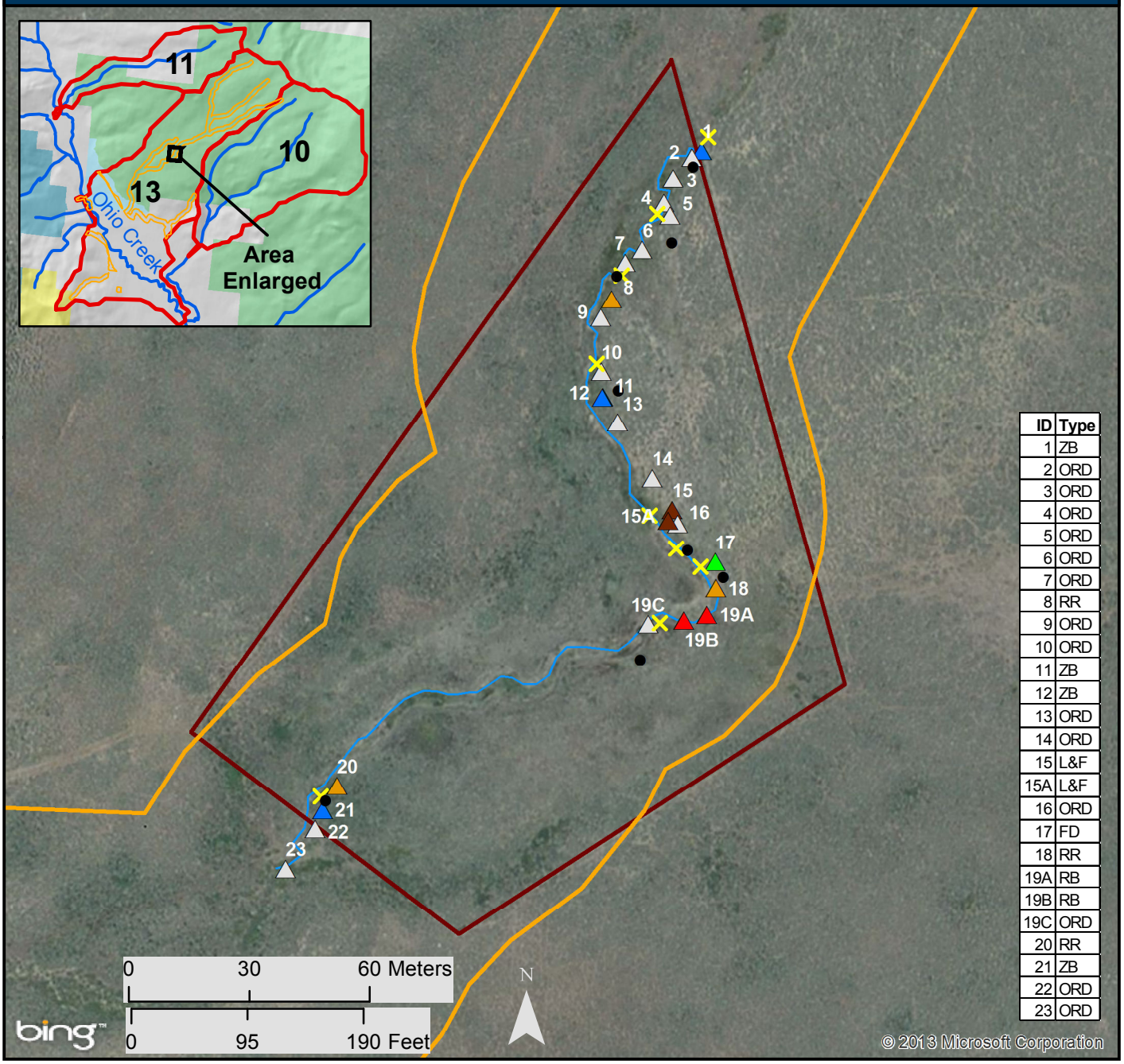
Structures
One Rock Dam (ORD)
Rock Rundown (RR)
Media Luna (ML)
Zuni Bowl (ZB)
Rock Mulch (RM)
Rock Baffle (RB)
Drift Fence (DF)

Land Management
USFS
BLM
NPS
CPW
State
Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.
Scale: 1:3,300
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document: Gunnison_PrioritySites13_Section36_WestFlatTopatHenkelRoad_Structures_2013_8x11_201309F.mxd

Map 7.

West Flat Top at Henkel Road - Exclosure (USFS), Upper Gunnison Basin
Restoration Structures and Monitoring
Gunnison Climate Working Group



ID	Type
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3	ORD
4	ORD
5	ORD
6	ORD
7	ORD
8	RR
9	ORD
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12	ZB
13	ORD
14	ORD
15	L&F
15A	L&F
16	ORD
17	FD
18	RR
19A	RB
19B	RB
19C	ORD
20	RR
21	ZB
22	ORD
23	ORD

Priority Restoration Sites
Gunnison Sage-Grouse Brood Rearing Habitat
Streams
Exclosure

Monitoring
Photo Point
Vegetation Transect

Structures
One Rock Dam (ORD)
Rock Rundown (RR)
Media Luna (ML)
Zuni Bowl (ZB)
Log and Fabric (L&F)
Rock Baffle (RB)
Filter Dam (FD)

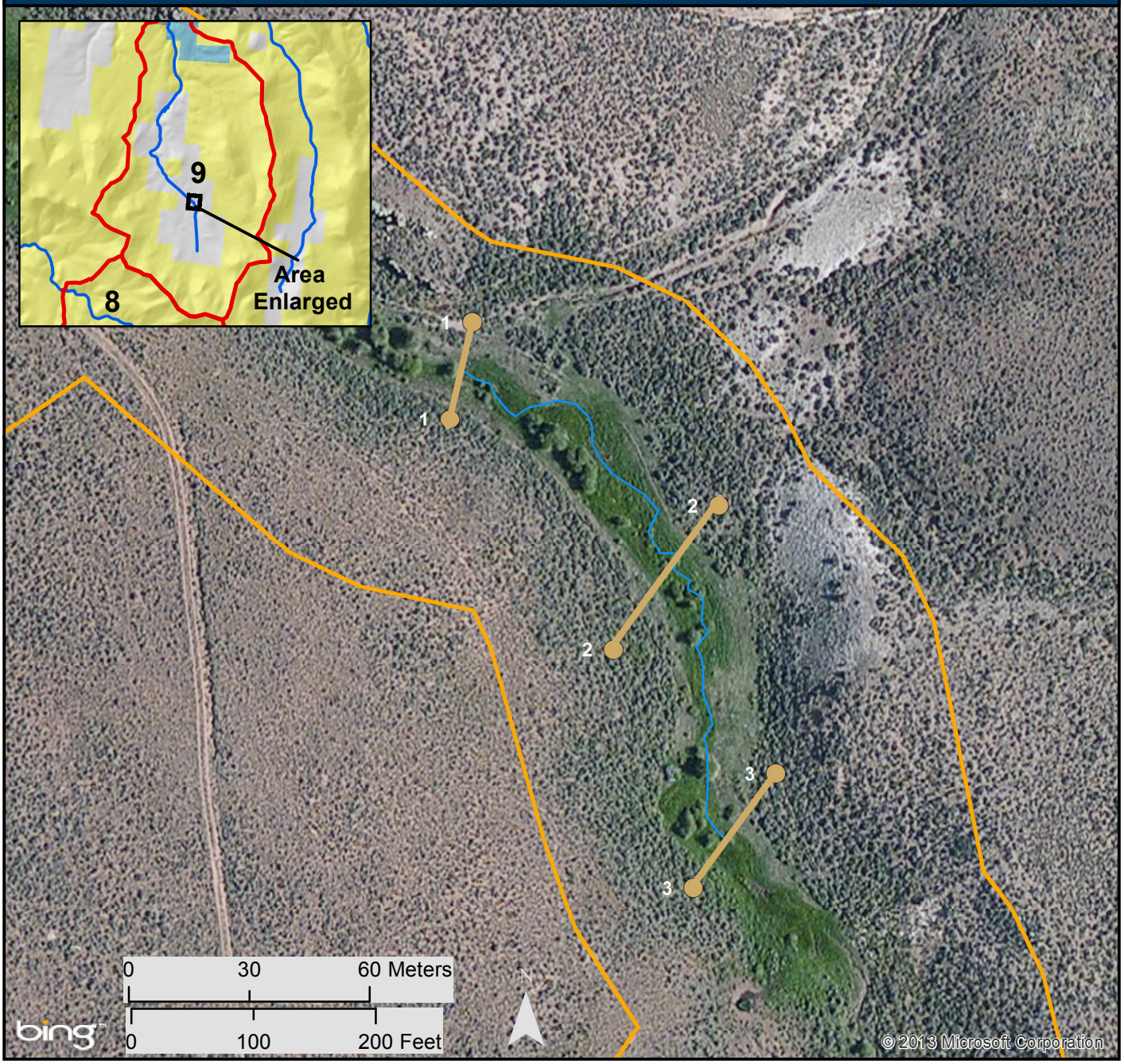
Land Management
USFS
BLM
NPS
CPW
State
Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.Scale: 1:1,500
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document: Gunnison_PrioritySites13_Exclosure_WestFlatTopatHenkel Road_Structures_2013_8x11_201309F.mxd

Map 8.

Moncrief Ranch in Kezar Basin
Upper Gunnison Basin
Restoration Structures and Monitoring

Gunnison Climate Working Group



Priority Restoration Sites

Gunnison Sage-Grouse Brood Rearing Habitat

Streams

Monitoring

Photo Point

Vegetation Transect

Structures

Drift Fence (DF)

Land Management

USFS

BLM

NPS

CPW

State

Private

Date: 9/24/2013. Map by T. Chapman, The Nature Conservancy.Scale: 1:1,500
Sources: Bing Maps Aerial Imagery (ESRI online);
Gunnison Basin Gunnison Sage-grouse Habitat Prioritization Tool (2012).
Map document: Gunnison_PrioritySites13_Exclosure_WestFlatTopatHenkel Road_Structures_2013_8x11_201309F.mxd

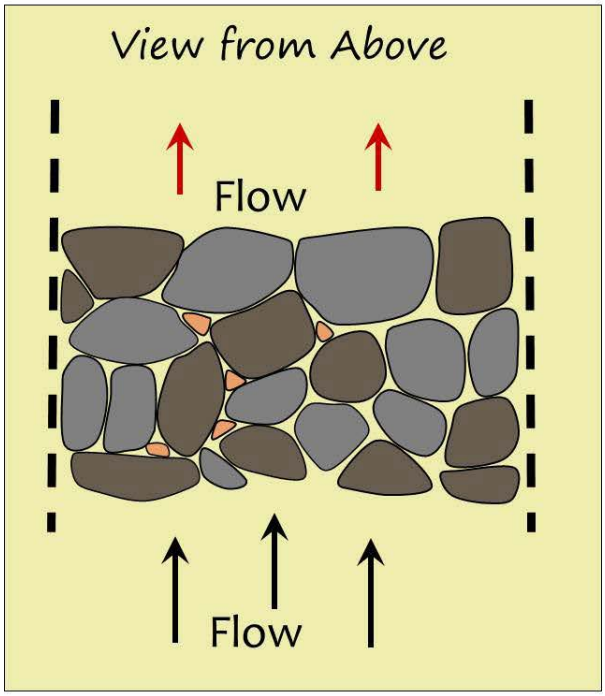
APPENDIX B

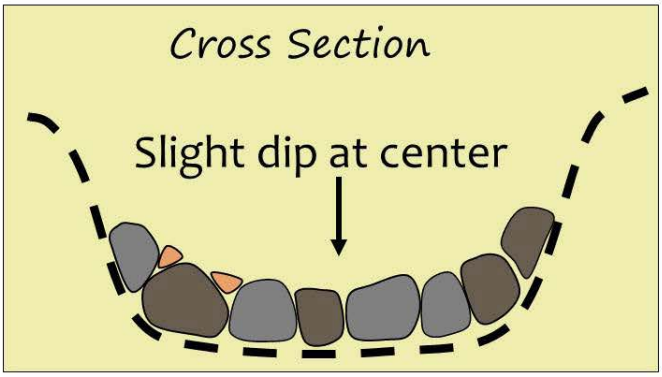
Restoration Structures (Materials developed by Bill Zeedyk, Tamara Gadzia, Quivira Coalition, and Craig Sponholtz, Dryland Solutions)

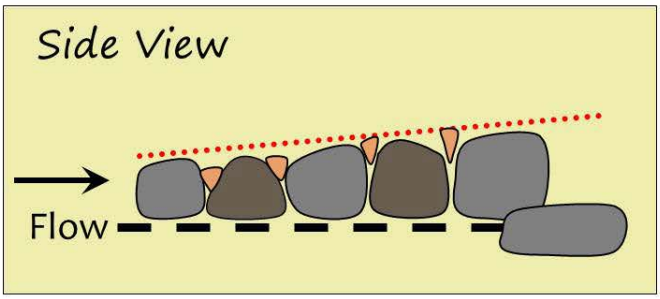
1. One Rock Dam
2. Filter Weir
3. Media Luna
4. Zuni Bowl
5. Plug and Pond
6. Rock Rundown
7. Log and Fabric Step Falls

One Rock Dam

= 1 rock high + uniform surface

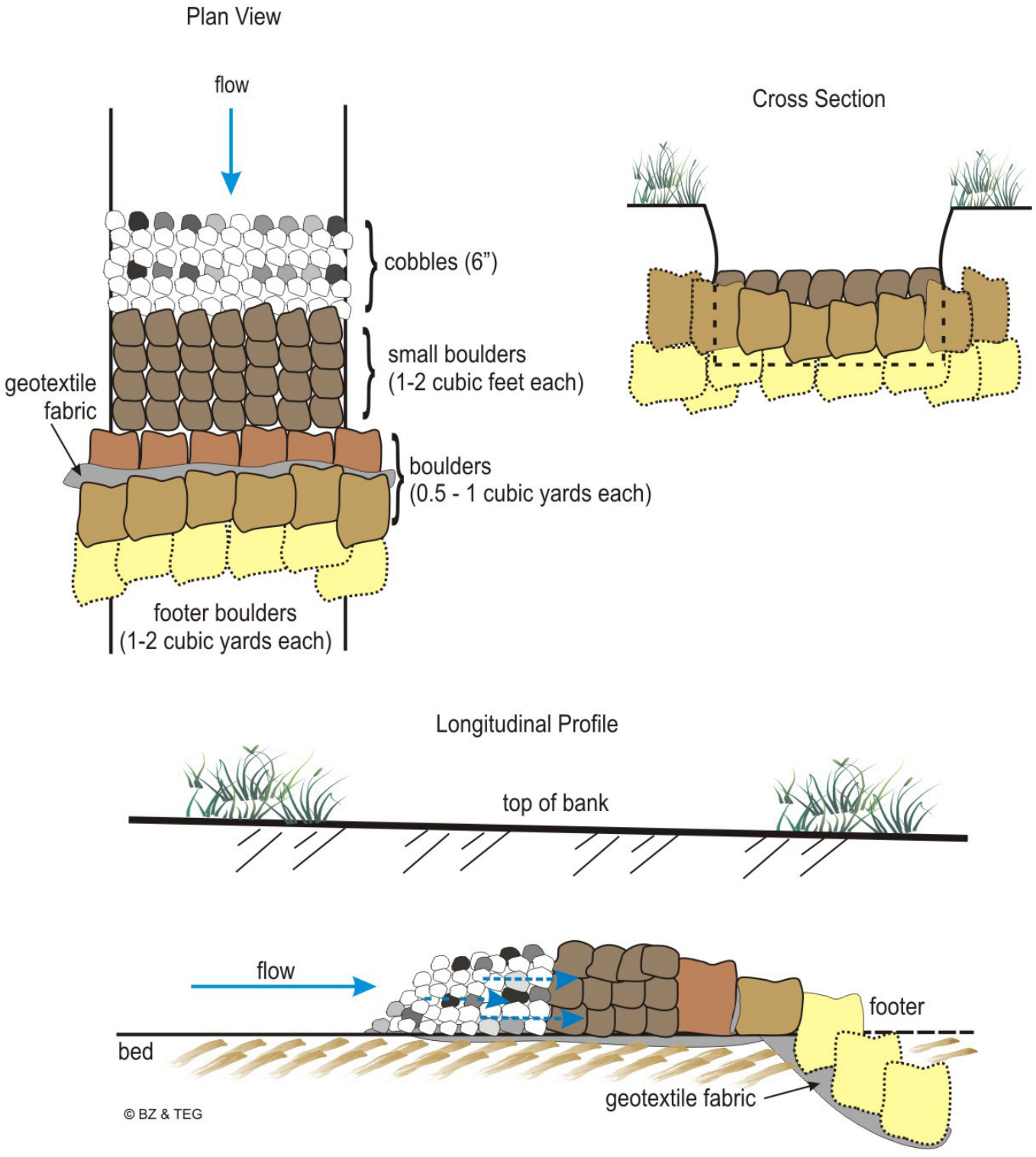






Gene Tatum and Glenda Muirhead, Albuquerque Wildlife Federation

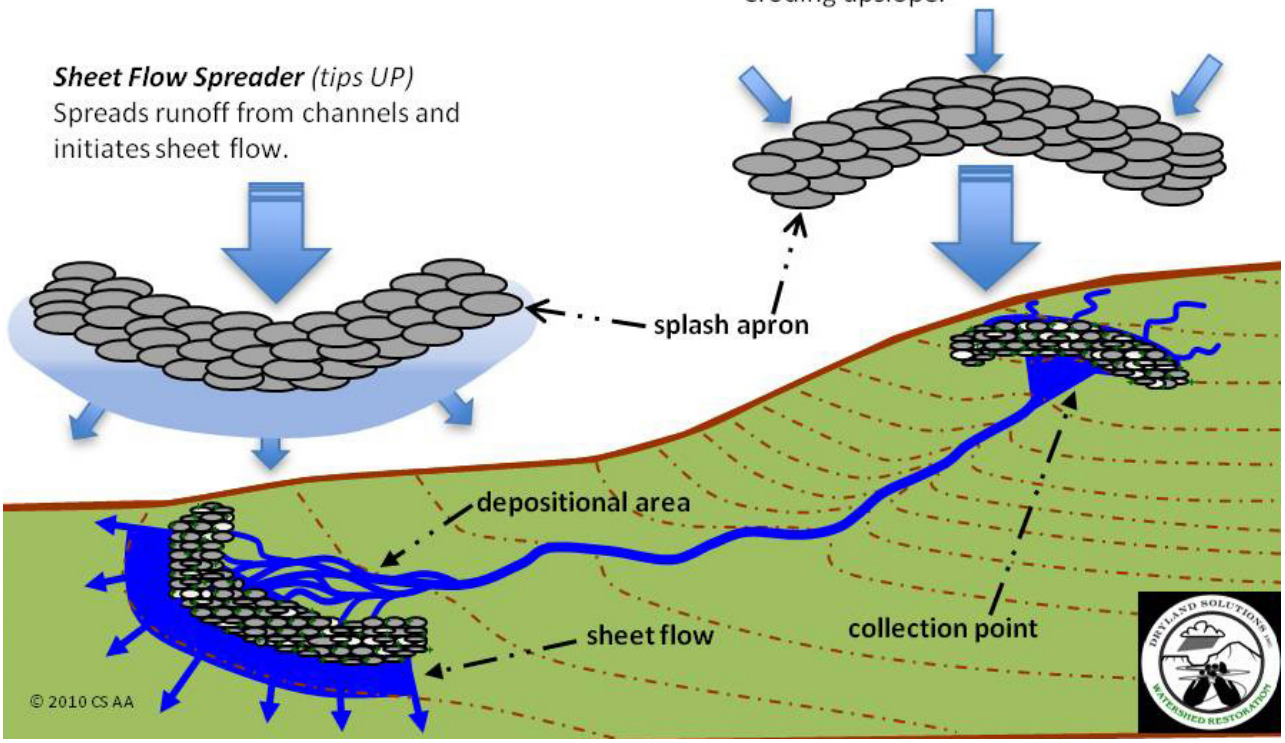
Filter Weir

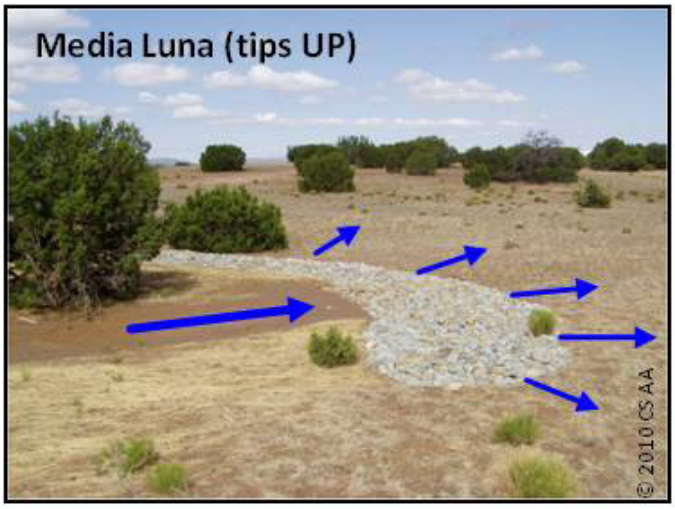

Plan View
flow
cobbles (6”)
small boulders
(1-2 cubic feet each)
geotextile
fabric
boulders
(0.5 - 1 cubic yards each)
footer boulders
(1-2 cubic yards each)
Cross Section
Longitudinal Profile
top of bank
flow
footer
bed
geotextile fabric
© BZ & TEG

MEDIA LUNA

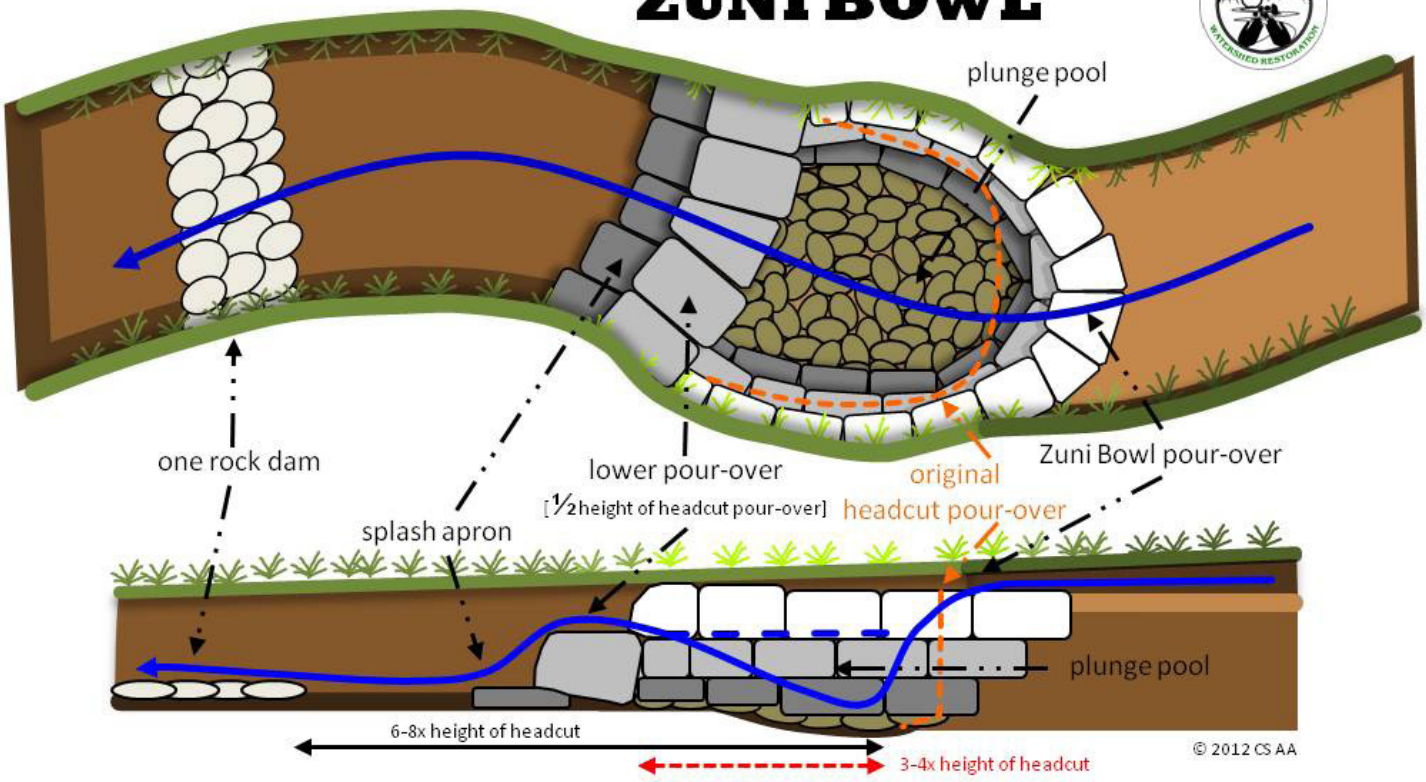
Sheet Flow Collector *(tips DOWN)*
Prevents developing rills and gullies from eroding upslope.

Sheet Flow Spreader *(tips UP)*
Spreads runoff from channels and initiates sheet flow.

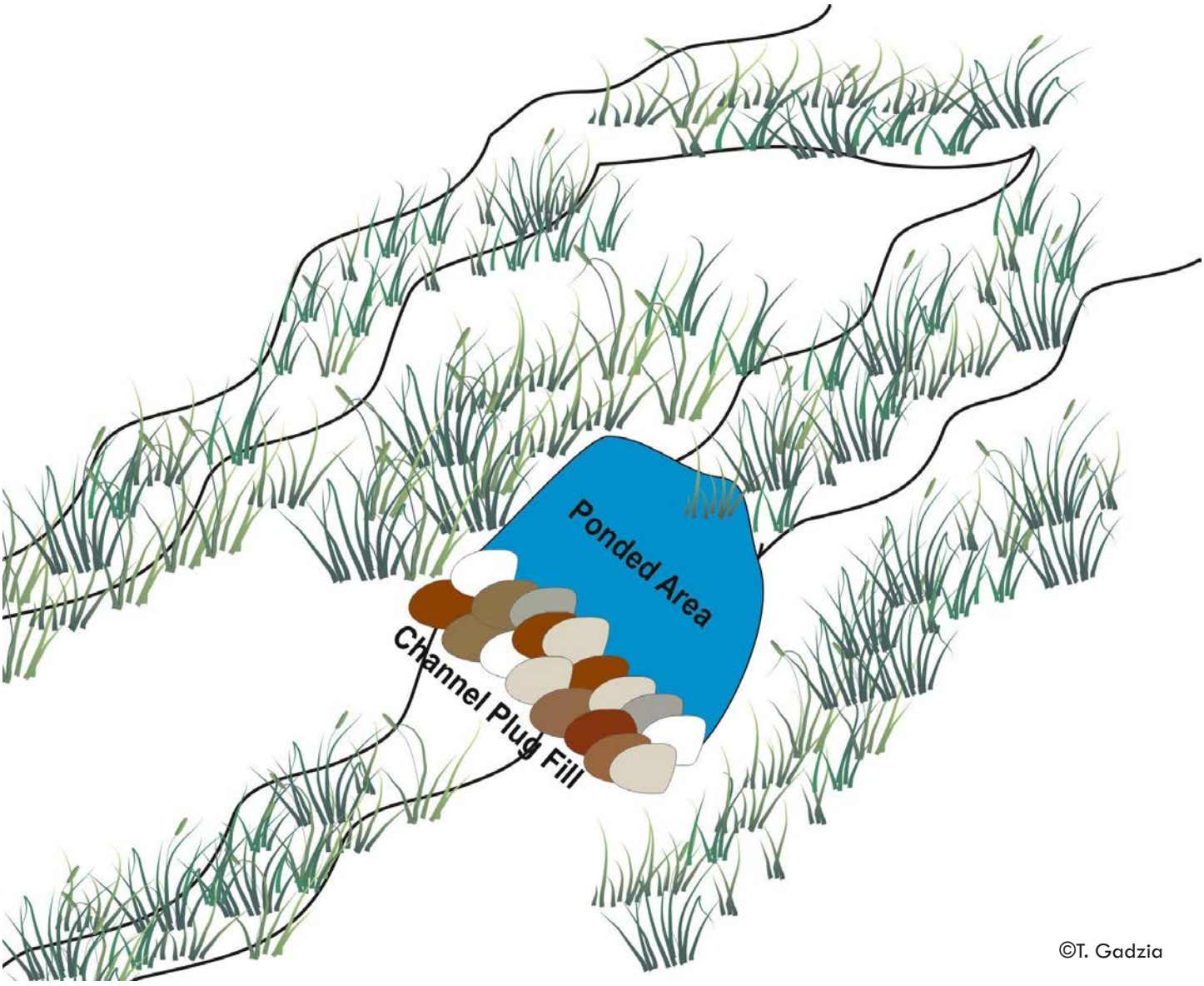




ZUNI BOWL


plunge pool
one rock dam
lower pour-over
[½height of headcut pour-over]
original
headcut pour-over
Zuni Bowl pour-over
splash apron
plunge pool
6-8x height of headcut
3-4x height of headcut
© 2012 CS AA

Plug and Pond



APPENDIX C

Drift Fence Specifications

By Jim Cochran, Gunnison County, Nathan Seward, Colorado Parks and Wildlife, Matt Vasquez, US Forest Service and Bill Zeedyk, Zeedyk Ecological Consulting

Summary:
The following is a set of specifications for demonstration drift fences in two locations – Moncrief Ranch, Kezar Basin and West Flat Top at Henkel Road, within the Upper Gunnison Basin, Colorado. The drift fences are as part of a larger restoration project to enhance resilience of riparian areas and wet meadows, important brood-rearing habitat for the Gunnison Sage-grouse. The drift fence design is intended to showcase a new method/technique of altering big game and cattle movements to help restore wet meadows within the sagebrush ecosystem. This is a project of the Gunnison Climate Working Group, a public - private partnership working to reduce the adverse impacts of climate change in the Gunnison Basin. The project team is interested in testing several different designs so we can evaluate construction costs, maintenance costs, effectiveness, and longevity over time, in addition to evaluating the effectiveness of this type of drift fence in restoring wet meadows/riparian areas.

Objectives:
The objectives of the demonstration drift fences are to:

1. Reduce wildlife and livestock trailing and the resultant soil compaction in wet meadows and riparian areas that serve as important brood-rearing habitat for the Gunnison Sage-grouse.
2. Alter livestock trailing and movement patterns, yet not contain them, withstand elk traffic and minimize threats/hazards to Gunnison Sage-grouse (mature birds and chicks).
3. Reduce further erosion in wet meadows and riparian areas.
4. Enlarge the wet meadow/riparian area and thus enhance the brood-rearing habitat

Minimum Standards for Proposed Drift Fences:
General and specific standards for the proposed drift fencing project are listed below. The Contractor shall follow general guidelines outlined in Hanophy (2009; Attachment B) and USFS specifications noted below for posts, driving depths, hole depths, etc. Our assumption is that one of the primary concerns is visibility of the new fences to the grouse, and to lesser degree cattle and elk.

Fences will meet the following general criteria:

- Be of the proper standard, location, orientation and alignment (follow flagged stakes marked by Bill Zeedyk) to change cattle movement patterns across the meadow, while serving as obstructions to movement.
- Be highly visible to Gunnison Sage-grouse so as not to impair grouse movements and to minimize risk of collision during flight.
- Not significantly increase the risk of predation by avian predators.
- Be highly visible to elk and resistant to damage by elk movements.

Specific standards include the following:

1. <u>The fences should consist of three-strands of smooth wire (barbless barb wire), with 5.5' steel T-posts set on 12-foot centers.</u>
    a. Use 1.33 pound/ft. (heavy duty) steel posts (standard of USFS).

b. The bottom wire shall be 20 inches above the ground surface, the middle wire 30 inches and the top wire 42 inches above the ground surface. Spec-heavy duty smooth wire (weighs 65+lbs per standard 1320 ft. spool). Lighter wires such as "gaucho" wire are not allowed.
c. The wires would be separated by two wooden stays at equal distances between posts, providing high visibility and enable grouse to fly over and other small animals to easily pass underneath.
d. On one fence at each location, use 5/8 inch aircraft cable or double the top wire by twisting two full strands together to strengthen the top strand, increase visibility and make it more resistant to elk damage.

2. Two wooden stays secured by minimum #11 wires to horizontal wires between T-posts keep the wire tight and increase visibility.

    a. Stays should be round 3-4 " diameter, 46" in height, consisting of lodgepole with the bark on, on four foot centers equally spaced between adjacent steel T-posts.

3. End posts to be wooden "H" braces installed according to US Forest Service standards.
    a. Posts will be modified to prevent or minimize their use as raptor perches at the USFS site to address potential site conditions that might be encountered, i.e., extremely rocky ground, use pressure-treated wooden H-braces modified to discourage raptor use.
    b. H-brace wood posts must be a minimum 6" diameter, 8 ft. tall, sunk to a minimum of 3 ft. Install one fence at each site with the ends being the "Amazing Brace" (with pre-fabricated metal frames) so that we can evaluate their cost effectiveness and lifespan.

4. Five foot 5 inch steel T-posts set on 12-foot centers, with posts set to a depth equal to depth of the flange top. Forest Service specifications regarding post depths:
    a. Metal posts (T-posts) shall be driven to a depth that the ground is even with or above the top of the blade (flange).
    b. Wood corner posts and brace posts shall be set a minimum of 36" into the ground. In locations where it is not reasonable to set corner posts due to extreme rocky conditions, 4'x4' rock boxes will be constructed on a leveled ground surface.
    c. All soil around posts shall be compacted to the same density as the surrounding soil.

5. For the West Flat Top drift fences, install anti-perch devices, i.e., nixalite anti-perch material to dissuade raptor perching on all posts. This site has few to no perches for raptors and thus we need to minimize perching opportunities. The Moncrief Ranch site has multiple existing perches for raptors so this is not an issue.

6. To improve fence visibility to elk at one fence at each site, use at least one of the following marking techniques at each site, i.e., fence marking flags; aircraft cable; square stays; round stays, to allow assessment of comparing cost and effectiveness. See below for details.

7. West Flat Top: Two drift fences with lengths of approximately 92 ft. and 96 ft. (add 10% for estimate). Total length of drift fences is 188 ft. West Flat Top USFS drift fence specifications are:

    a. The 92 ft. fence will be constructed with:
        - 6" diameter wooden H-braces at both ends
        - 3 strands of smooth wire
        - The top wire doubled/twisted.

    b. The 96 ft. fence will be constructed with:

- Prefabricated Amazing braces at both ends of the fence
- Consist of 3 strands of smooth wire
- Single top wire with 1" diameter PVC pipe, etc. as described earlier in the SOW.

8. Moncrief Ranch, Kezar Basin: Three drift fences with lengths of approximately 105 ft., 151 ft., and 108 ft. (add 10% for estimate). Total length of the three drift fences is 366 ft.

    a. The 105 ft. fence will be constructed with:
        - Sawn square stays

    b. The 151 ft. fence will be constructed with:
        - Round stays

    c. The 108 ft. fence will be constructed with:
        - One Amazing Brace

Project Locations and Fence Lengths
Two locations on the USFS site and three locations were selected for the construction of drift fences angled across the valley bottom and linking with existing livestock trails situated on upslope locations paralleling the valley bottom. Sites were selected to be representative of valley conditions, but modest in length in order to test the validity of the method at reasonable cost. Additional locations for future expansion were identified if the method proves effective. Selected locations will alter trailing patterns without preventing access for grazing.

Specific locations are:
1. West Flat Top at Henkel Road (Section 36), northwest of the town of Gunnison: This site is managed by the US Forest Service.
2. Moncrief Ranch, Kezar Basin, south of Blue Mesa Reservoir: This site is privately owned.

Terms and Conditions
1. Contractor will visit the site and work closely with USFS staff (Matt Vazquez) on the West Flat Top at Henkel Road sites and the Ranch Manager (Ted Harter) for the Moncrief Ranch regarding agency specifications, materials needed (USFS may have some fencing materials available, e.g., steel posts, pressure treated wood posts), and access to the sites.
2. Contractor will construct the fence according to the specifications outlined above. If technical questions arise regarding the specifications, contact Betsy Neely (TNC) who will work with the Project Team that includes: CPW (Nathan Seward), Gunnison County (Jim Cochran), the Moncrief Ranch Manager (Ted Harter), and the USFS (Matt Vasquez) at the West Flat Top at Henkel Road site.
3. Project Team and land owner/manager will visit the completed work to ensure terms of this Scope of Work are met.

Citation
Hanophy, W. 2009. *Fencing with Wildlife in Mind.* Colorado Division of Wildlife, Denver, CO. 36 pp.

APPENDIX D

Gunnison Basin Wetland Restoration Vegetation Monitoring
Renée Rondeau, Colorado Natural Heritage Program, September 2013

The goal of setting up the monitoring program for the riparian and wetland restoration projects was to determine if management objectives were met. The management and sampling objectives were:

Management objective 1: *Increase* the average cover and density of native sedges, rushes, willows, and wetland forbs (obligate and facultative wetland species) in the **restored** portion of the Wolf and Redden Creek properties between 2012 and 2014.

Sampling objective 1: We want to be 90% sure of detecting a 20% change in the absolute cover and density of sedges, rushes, and wetland forbs and will accept a 10% chance that change took place when it really did not (false-change error).

Management objective 2: *Decrease* the average cover of rabbitbrush, sagebrush, and other upland species in the **restored** portion of Wolf and Redden Creek properties between 2012 and 2014.

Sampling objective 2: We want to be 90% sure of detecting a 20% change in the absolute cover of rabbitbrush, sagebrush and other upland species and will accept a 10% chance that change took place when it really did not (false-change error).

Methods:

Redden Restoration site. We used a stratified random sample design by splitting the site into four subsections and randomly choosing one of the first four structures and then choosing every fourth structure thereafter (Table 1). Photos were only taken at the first randomly selected structure of each section. For other chosen structures we collected vegetation data by laying out transects just upstream of the structure (marked with wooden stakes at the beginning and end of the transect). At chosen media luna structures we layed out transects just below the structure. Most transects crossed a drainage (bank to bank) and the length was determined by estimating the sphere of influence that a structure will likely have; generally it included the expected new wetted area. Most transects were between 5 and 10 m long. We used the line-point-intercept method, a methodology accepted by BLM (AIM 2011) and the Forest Service. We collected cover data every 0.5 m along a transect, including bare ground, rock, or litter if the point was not occupied by a plant. Height and density were collected at every meter. Density was measured in a 10 cm x 10 cm quadrat placed on the right side of the tape. We counted number of graminoid and forb stems arising from the ground/quadrat. Height was collected by measuring the height of the tallest plant (we measured absolute height, not droop height) in the density square. Photos were taken from the 0 m mark and end of transect, with the transect line in the middle of the photo. UTM's and bearing of transect were noted for the beginning of each transect. Photo time was also noted. All 2012 data was collected on September 10 and 11th prior to any structures being built. All 2013 data was collected on August 19 and 20th. The 0 m mark was always on river left. Additional photos (labeled as photopoints) were taken, generally looking upstream (i.e. downstream of the transect) with the transect in the photo. This was meant to capture a view of the area that is most likely to change. UTM's (NAD83), time, date, weather, camera height, compass bearing were recorded for each photo.

Table 1. Redden Restoration Site had 54 structures. A stratified random sample design was used by dividing the site into four sections and randomly choosing four structures from each section. We

collected vegetation data and photos at randomly selected structures. Two control transects were placed above Section 1.

Section number	Structure Numbers	Randomly selected structure
1	1-15	3*,7,11,15
2	16-31	16*, 20, 24, 28
3	32-42	32*, 36, 39, 42
4	43-54	43* 46, 49, 53
Control	2 control transects	

*Photos only

Wolf Creek Middle and East Forks Restoration Site (all on private land). There were a total of 46 structures, 1-19 along an ephemeral creek (Middle Fork) and 20-46 along a spring-fed creek (East Fork). We randomly chose 7 structures on the Middle Fork and 10 on the East Fork (Table 2). Data collection was identical to that used at Redden (see above) and was collected in 2012 on September 12 and 18th prior to any structures being built, and August 27 and 28th in 2013.

Table 2. The Middle Fork and East Forks of Wolf Creek Restoration Site had 19 structures and 26 structures on the East Fork. Seven structures were randomly chosen from the Middle Fork and 10 from the East Fork. We collected vegetation data and photos at randomly selected structures. One control transect was placed above structure 20.

Creek Section	Structure Numbers	Randomly selected structure
Middle Fork	1-19	1, 4, 8, 9, 13, 15, 18
East Fork	20-46	20, 24, 26, 29, 32, 34, 37, 38, 41,46*
Control	1 control transects	Placed above structure 20 in a section above restored area and most similar to the Middle Fork portion

*Photos only

Wolf Creek West Fork, Upper Wolf, and Lower Wolf Restoration Site (all on BLM): There were a total of 45 structures, 17 along the West Fork, 19 along the Upper Wolf, and 10 along the Lower Wolf. We randomly chose one structure out of every three structures for each of the sections, with a total of 13 transects of which two were controls. See Table 3 for details. Data collection was identical to that used at Redden, Middle Fork, and East Forks (see above) and was collected in 2013 on August 1-3 either prior to any structures being built or with 1-2 days after a structure was built.

Table 3. Wolf Creek BLM Restoration Site had 45 structures on three sections. Eleven structures were randomly chosen. We collected vegetation data and photos at randomly selected structures. Two control transects were placed in Upper Wolf below the low water crossing.

Creek Section	Structure Numbers	Randomly selected structure
West Fork	1-17	2, 6, 9, 12, 14
Upper Wolf	0-18	2, 7, 13, 16,
Lower Wolf	1-10	6, 7
Control	2 control transects	Placed in Upper Wolf below low water crossing

Flat Top Restoration Site (all on USFS): There were a total of 82 structures, 23 within the exclosure unit and 59 in Section 36. We randomly chose one structure out of every three structures for the exclosure section and one out of every four structures for Section 36, with a total of 24 transects of which two were controls. See Table 4 for details. Data collection was identical to that used at Redden, Middle, East, and West Forks of Wolf Creek, Upper Wolf, and Lower Wolf (see above) and was collected in 2013 on August 1-3 either prior to any structures being built or with 1-2 days after a structure was built.

Table 4. Flat Top Restoration Site had 82 structures. A stratified random sample design was used by choosing one out of every three structures at the exclosure site and one out of every four structures at Section 36. The two drift fences had photopoints established. We collected vegetation data and photos at randomly selected structures. Two control transects were placed in Section 36 above the first structure.

Creek Section	Structure Numbers	Randomly selected structure
Exclosure	1-23	1, 5, 7, 10, 15, 16, 17, 19, 21
Section 36	1-57	3, 6, 12, 16, 23, 25, 29, 35, 38, 41, 47, 51, 55
Drift fences	58-59	Four photopoints
Control	2 control transects	Placed in Section 36 above the first structure

Table 5. Summary of vegetation transects and photopoints at all of the 2012 and 2013 restoration sites.

Site	No. of vegetation transects	No. of photopoints
Redden	12	16
Redden, control	2	2
Wolf Creek, Middle Fork	7	7
Wolf Creek, Middle Fork-Control	1	1
Wolf Creek, East Fork	9	12
Wolf Creek, West Fork	4	4
Wolf Creek, West Fork-Control	2	2
Wolf Creek, Upper Wolf	4	4
Wolf Creek, Lower Wolf	2	2
West Flat Top ,Section 36	13	17
West Flat Top ,Section 36-Control	2	2
West Flat Top, Exclosure	9	9
Moncrief Ranch	0	7
Total	67	78

Data Analysis

Data analysis could only be conducted on the sites with two years worth of data (Redden and Wolf Creek, private land). In order to assess meeting the management objectives, we pooled all wetland species and analyzed differences in cover between 2012 and 2013. Data was analyzed by stream reach. We conducted a normality test to determine if the data were normally distributed. If the data were normally distributed then we conducted a one-tailed paired T-Test to detect significant changes between 2012 and 2013. If the data were not normally distributed we conducted a Sign Ranked test. Height and density data was not species specific thus we could not analyze by wetland species; we conducted one-tailed paired T-test to detect significant differences between years.

Results

We identified over 100 species collectively, ranging from wetland obligates to upland species and natives to non-natives. Twenty-one species were considered wetland species and all others were considered upland species.

Wetland species cover. Wetland species cover at Redden significantly increased (P=0.025) between 2012 and 2013, increasing from 13 to 26%, while the wetland species cover in the control did not change between 2012 and 2013 (Figure 1). The wetland species cover on the Middle Fork of Wolf Creek exhibited an increase in cover between years however it was not significant (Figure 1b). The East Fork of Wolf Creek had a significant increase in cover (P=0.009) between years, from 53% in 2012 to 83% in 2013 while the control increased from 0 to 7% (Figure 1).

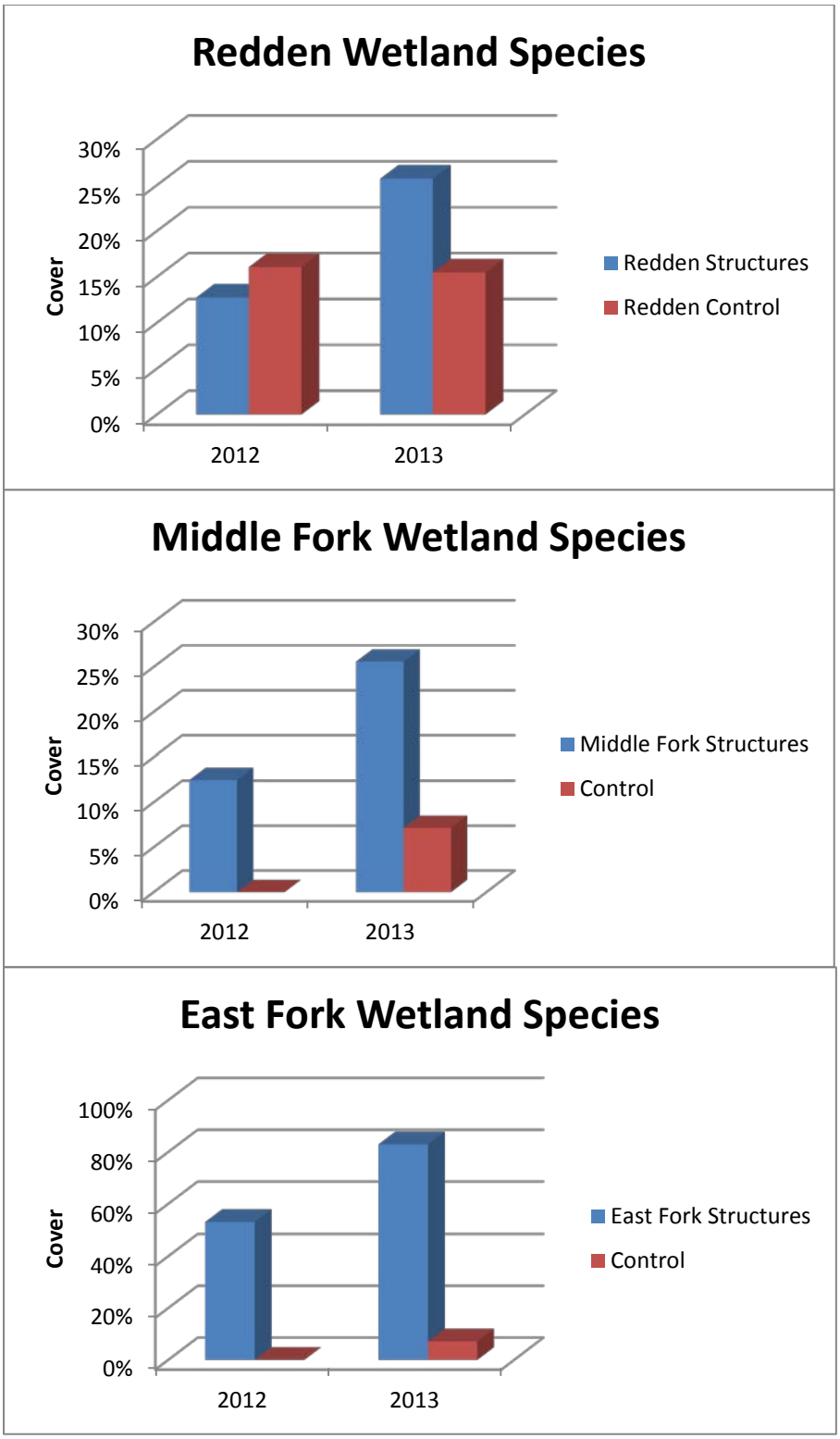


Figure 1. Wetland species cover from transects associated with the structures compared to control (no structures) for 2012 and 2013. Sample size: Redden n=12, control =2; Middle Fork n = 7, control = 1; East Fork n=8, control =1. Redden and East Fork structures had significant increases in wetland species between years ($P \leq 0.05$).

Height, Forb and Graminoid Density. The height was significantly taller in 2013 compared to 2012 regardless of treatment or site, i.e., no difference between structures and control (Table 6). Forb density is relatively low at all of the sites and significantly increased in 2013 regardless of treatment at Redden's and Middle Fork of Wolf Creek. At East Fork of Wolf Creek there was a significant increase in the forb density as it more than doubled in 2013 (P=0.02; Table 6). Graminoid density followed the same pattern as height as both the treated and controls increased (Table 6). The increases in 2013 were most likely due to an increase in precipitation rather than due to the structures as the control sites exhibited the same pattern.

Upland shrub species. We did not analyze our dataset for a decrease in shrub species as there were no apparent changes. We expect changes to occur over a three to five year period rather than a one year period. We did observe some dead sagebrush at the media luna sites at East Fork of Wolf Creek but this was an exception compared to other transects.

Table 6. Mean differences (2013-2012) by site for height, forb density, and graminoid density. Although there were significant increases in 2013, this was most likely due to an increase in precipitation since the same pattern was observed in the controls. Bolded numbers indicate a significant difference between years (P≤0.05) compared to the control.

Site	Height (cm)		Forb Density		Graminoid Density	
	2012	**2013**	**2012**	**2013**	**2012**	**2013**
Redden	9	16	0.7	1.2	5.4	8.6
Redden Control	7	14	0.3	0.6	3.5	7.5
Middle Fork, Wolf	9	15	1.5	1.5	3.1	10.1
East Fork, Wolf	22	28	**1.5**	**3.5**	6.7	13.2
Wolf Control	14	23	0.1	0.0	5.3	13.9

Photopoints. Photos provided additional evidence of changes due to the rock structures, including increase in sediments and vegetation cover. A sample of these is included in Attachment 1).

Conclusions

Wetland species composition significantly increased between 2012 and 2013 at two of the three reaches and the probability of this being the result of the structures rather than precipitation is quite high. Although the controls saw some change it was minor compared to the structure transects. The East Fork of Wolf Creek had the largest changes of any of the sites and is a reflection of the two active springs along this reach, whereas the other sites do not have active springs nor are they perennial. We did not detect significant differences between the treated and control areas when we analyzed the height and density data except for the forbs at East Fork of Wolf Creek. We expect this is due to the spring-fed nature of the creek and that given enough time we may see the same response at the other two sites. Given that the structures were in place just slightly less than one year, we find it quite promising that we were able to detect a positive response from building the structures and we expect this trend to continue and the changes to be even more distinct over the next few years.

Precipitation. Differences in monthly and annual precipitation between 2012 and 2013 were quite evident in that 2012 was a drier year than 2013 (Figure 2). No doubt that the higher rainfall in 2013 assisted with the rate of restoration that we observed at many of the structures, however there was ample evidence that the structures aided the restoration process more than the additional precipitation. This evidence is seen by comparing the control sites to the treated areas as well as reviewing the repeat photographs. The repeat photography backs up the data analysis. Many of the repeat photographs detected increases in sediments behind the structures, especially on the Redden property and the media lunas on the East Fork

(see photos in Attachment 1), whereas the control photopoints did not detect any additional sediment loading nor significant changes in the vegetation cover.

Monitoring Comments. The methods developed for monitoring the structures were designed to be repeatable, rapid, and meaningful and we believe we achieved this. We suggest that these transects be monitored again in subsequent years as we expect the changes to be even more evident than reported in this report. The height and density data is fairly laborious to collect and has a high observer bias and may not be critical to repeat as long as species cover data is detecting a change. This would reduce the amount of time needed to collect and analyze data. Collecting forb density data may be worthwhile given that we were able to detect a change within one year and forbs are critical for sage grouse. The photopoints provided photographic evidence that can assist with interpretation of the data analysis and should be conducted as close to the same time (month and hour) as the original photos were taken.

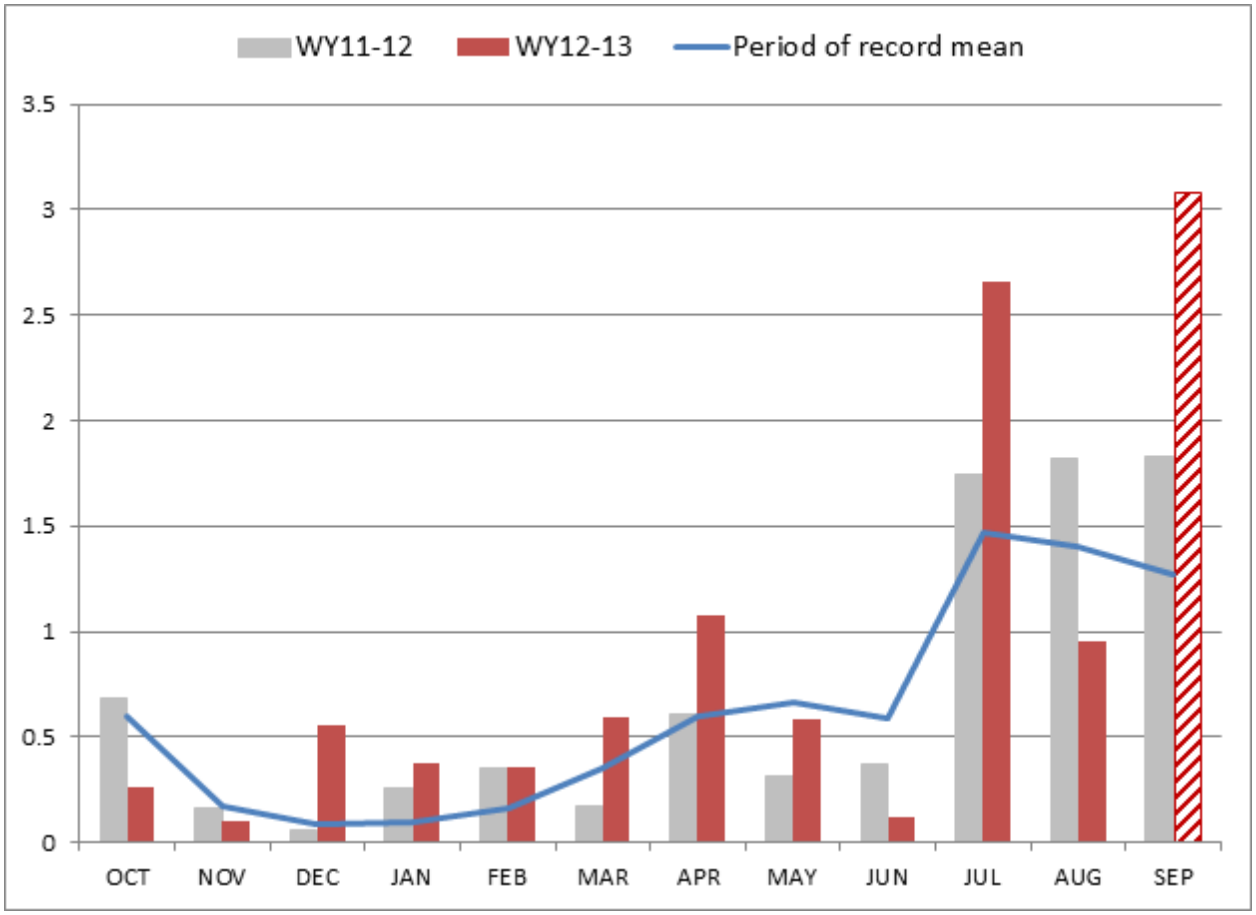


Figure 2. Monthly precipitation for water year's 2011-2012 and 2012-2013. Data from Huntsman Mesa weather station. The period of record mean is from June 1991 to September 2013.

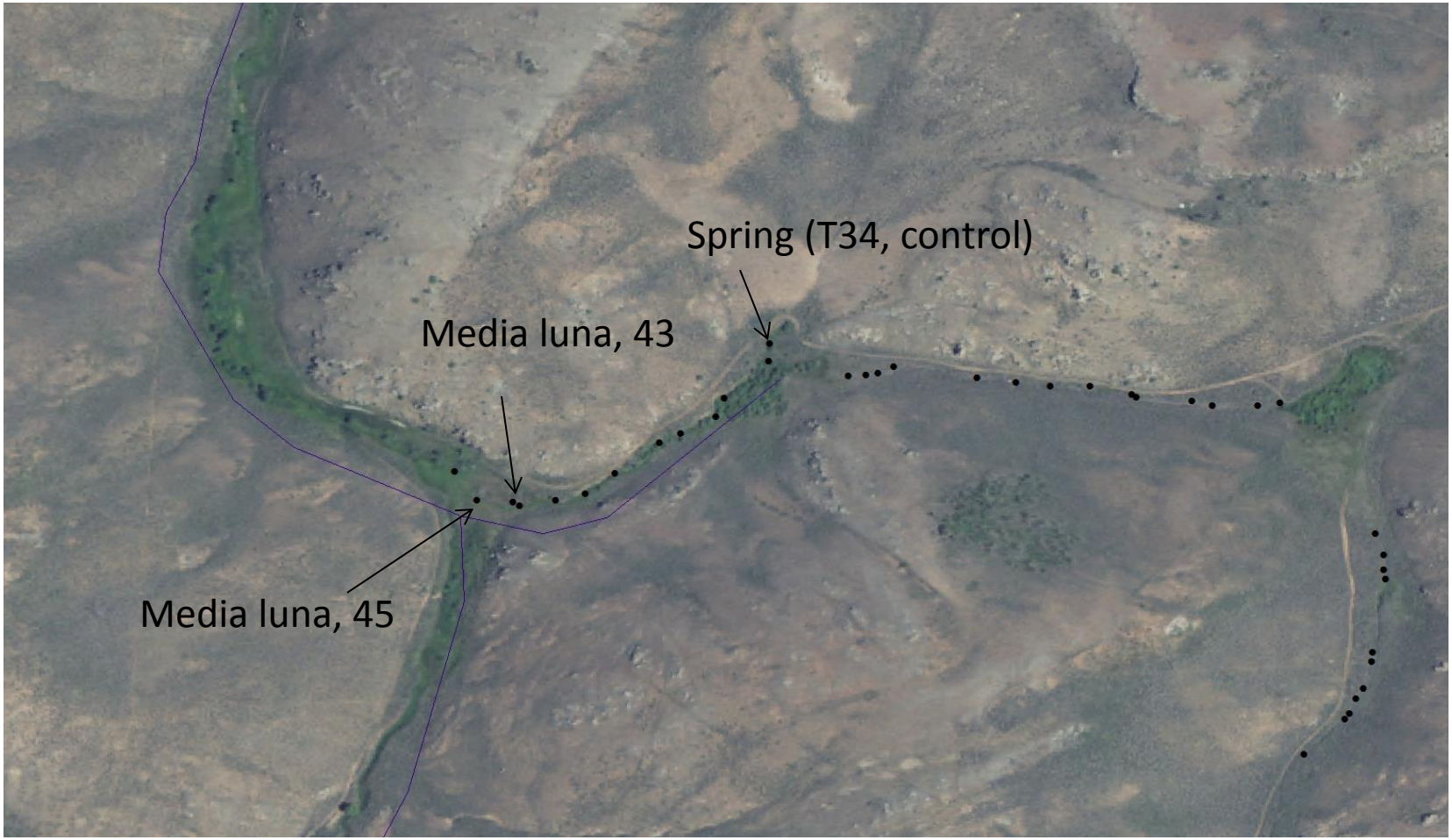
Appendix D: Attachment 1

Wet Meadow Restoration: Changes Over One Year

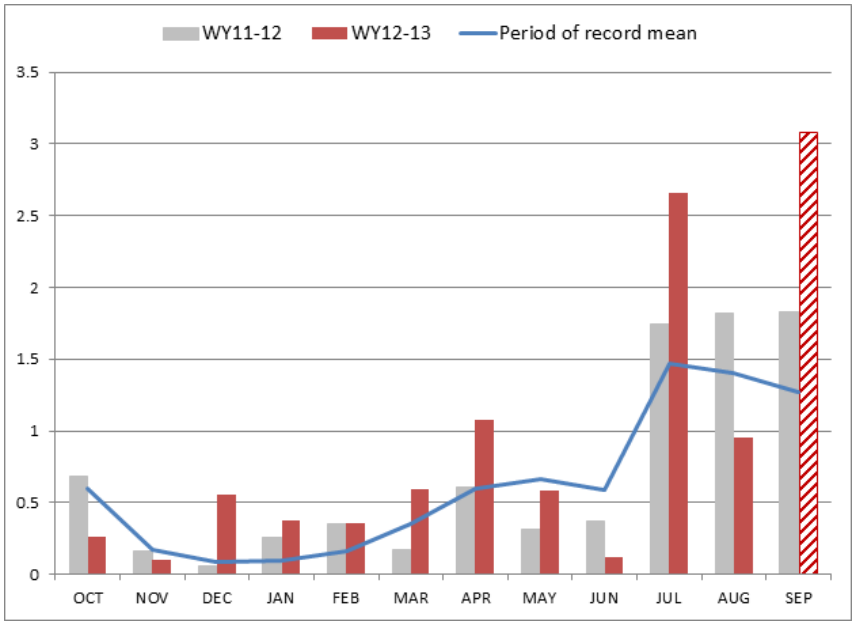
2012 vs 2013

Wolf Creek, Gunnison Basin

Wolf Creek, 2012 Structures



Monthly Precipitation (inches), 2012-2013

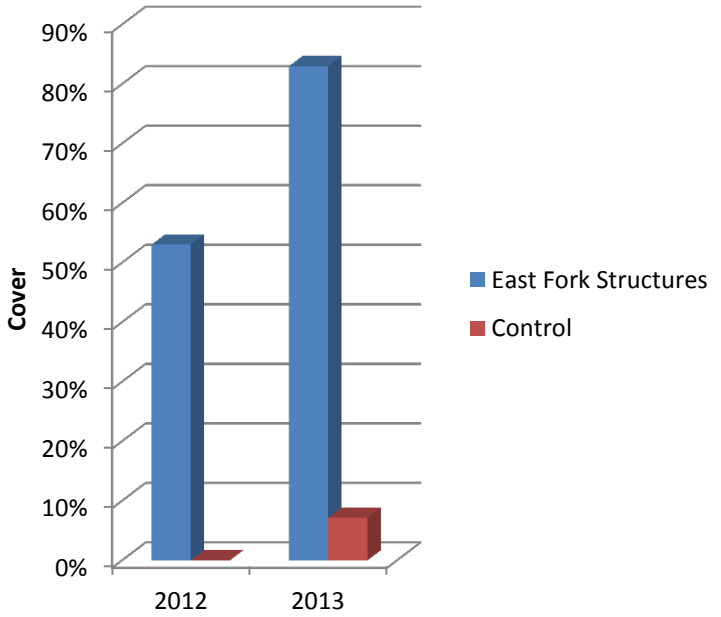


- Data are from Huntsman weather station
- In general, 2012 was considered a drier year than 2013
- Our control transects were established to detect changes associated with precipitation vs. restoration results

Wetland Species Positively Responded to Structures

- The canopy cover of wetland species significantly increased ($P \leq 0.05$) between 2012 and 2013 within the restored areas.
- The canopy cover slightly increased in the control (not restored).

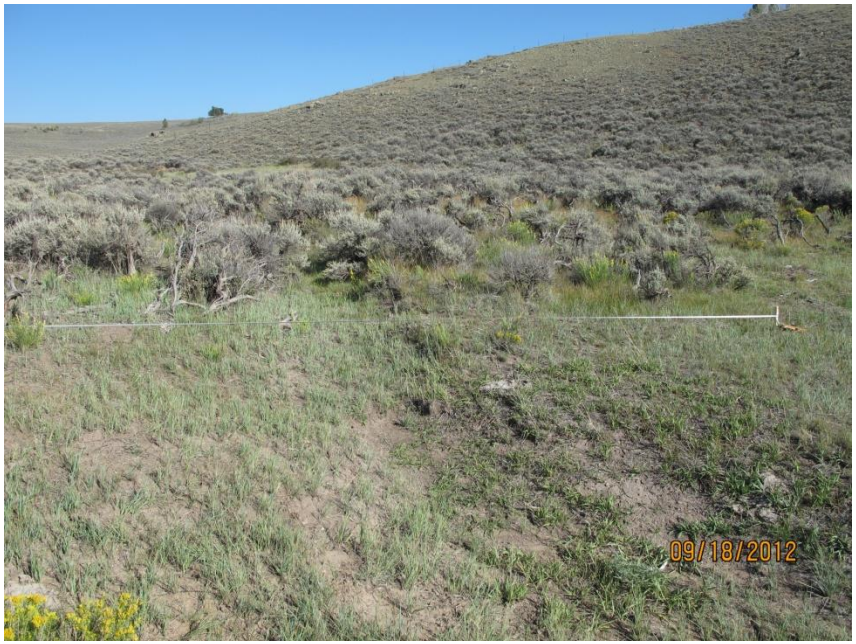
East Fork Wetland Species



Control: no structures built

Note: the new two track visible in the 2013 photo is part of the overall restoration plan. The original two-track bisected a wet meadow and the new two-track is now on the edge of the wet meadow. Transect photo: C01_0m

Control



We can see an increase in cover and height of western wheat grass in the 2013 repeat photo, due to increased precipitation.

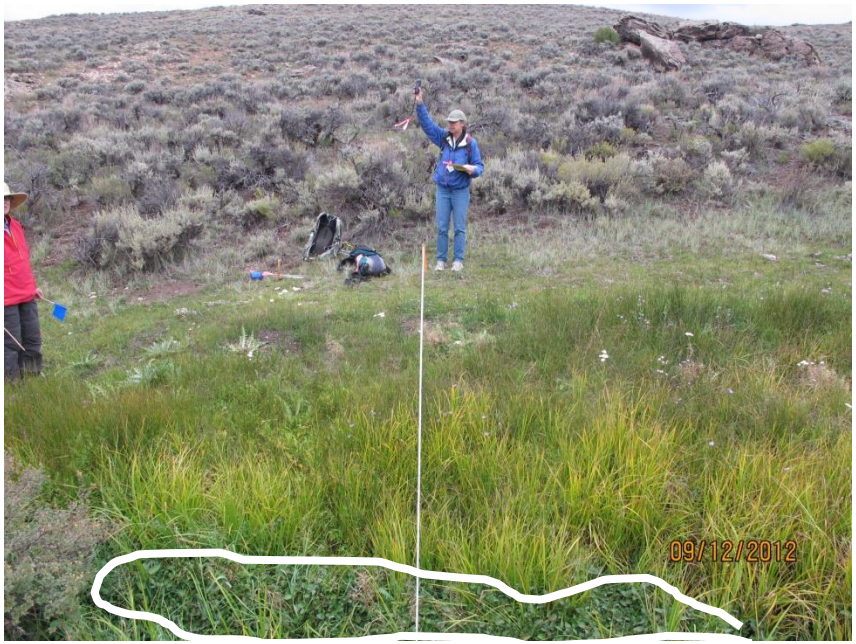
One Rock Dam on Ephemeral Stream, GWT29_0m

By 2013, sediments partially or completely covered many of the rocks. (Use the hammer to help locate the 2012 rocks and compare to the 2013 photo.)

Rock Run Down
GWT38_0m

The white polygon was dominated by *Carex utriculata* in 2012 (left photo) and by *Veronica* in 2013 (right photo); *Veronica* only occurs in running water hence more water in 2013; **wetland obligates went from 35% in 2012 to 50% in 2013.**

Rock Run Down
GWT38_end



The white polygon denotes the Veronica wormskadii area in 2012 (left) vs 2013 (right). At this site, **wetland obligates went from 35% in 2012 to 50% in 2013.**

Media Luna 43

October 2012

August 2013

The media luna was positioned to spread the water across the meadow. By 2013 the water had significantly spread across the meadow into areas that had once been saturated prior to the stream downcutting.

Media Luna, 43

October 2012

August 2013

This media luna spread the water across the meadow within one year of it's placement. Species composition will probably change within a year or two.

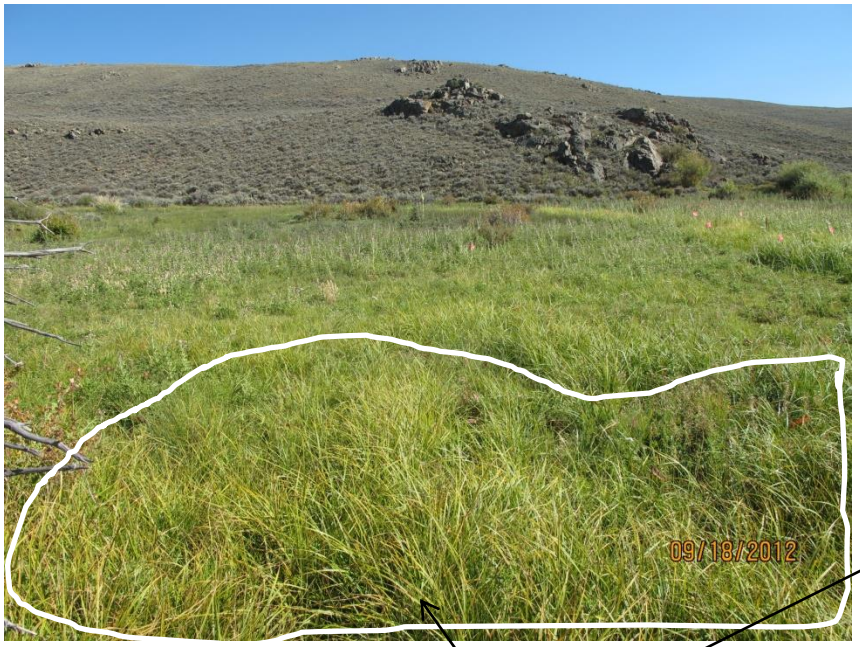
Media Luna, 45

October 2012

August 2013

We documented remarkable changes in the cover and height of the vegetation after one year of building the media luna. Species composition will most likely change within the next year or two.

Downstream of two media lunas, GWT46PP_a



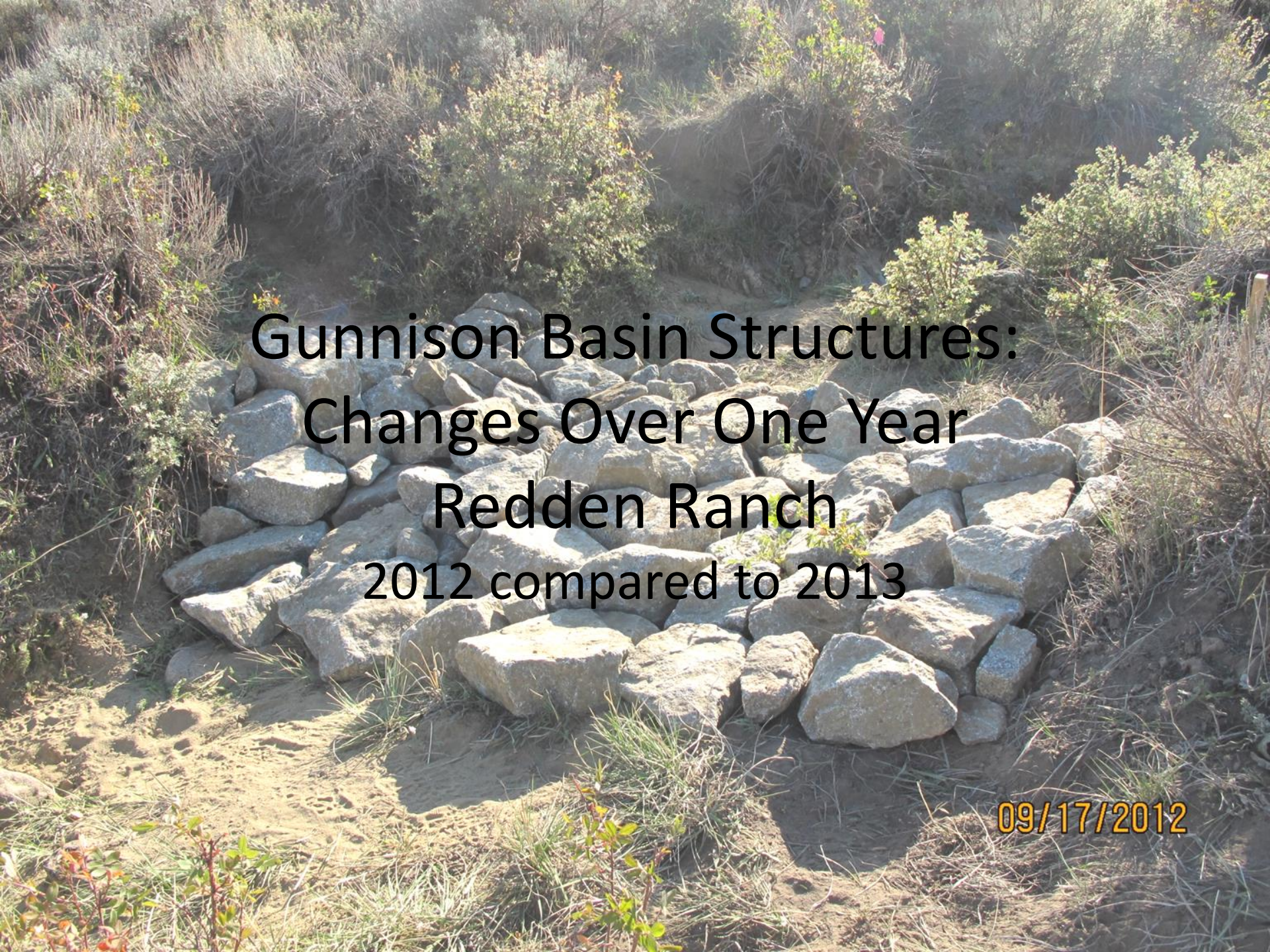
Carex utriculata, an obligate wetland species, expanded into new areas after the media luna was established.

Downstream of two media lunas, GWT46PP_b

Carex utriculata, an obligate wetland species, expanded in area after the media luna was established.

Downstream of two media lunas, GWT46PP_c

In 2012 (left photo) the white polygon was dominated by more xeric species and by 2013, one year after media lunas were established, the area was dominated by *Carex uticulata*, an obligate wetland plant



Gunnison Basin Structures: Changes Over One Year

Redden Ranch

2012 compared to 2013

Control, no structure
GTC02_0m

54% bare ground, liter or rock in 2012

The area within the white polygon is sparsely vegetated in 2012

33% bare ground, liter or rock in 2013

The area within the white polygon has more cover in 2013, due to higher rainfall

Control, no structure
GTC02_end

54% bare ground, liter or rock in 2012

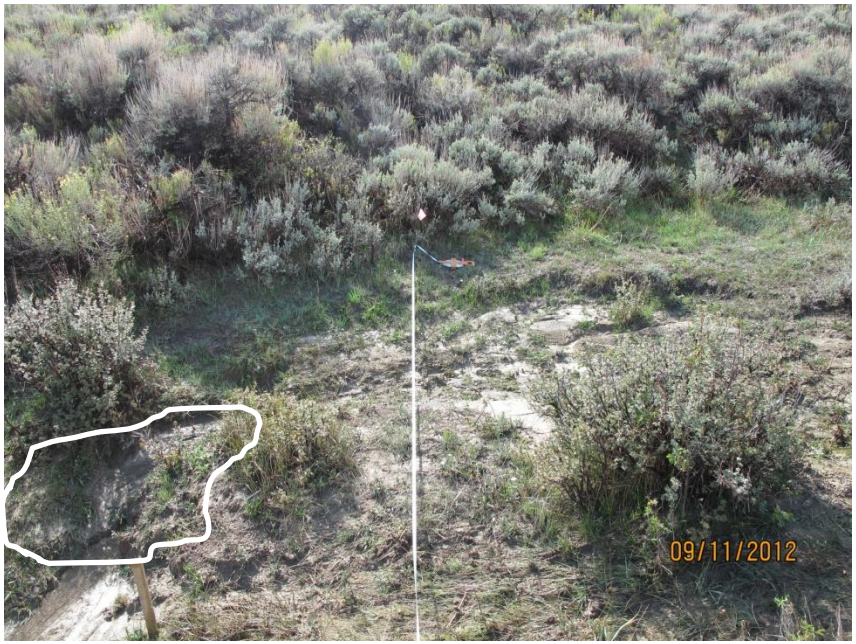
The area within the white polygon was sparsely vegetated in 2012

33% bare ground, liter or rock in 2013

The area within the white polygon is more densely vegetated in 2013, due to more rain

Control, no structure
GTC02PP

One Rock Dam on Ephemeral Stream GRT07_0m



The white polygon denotes the area where the one rock dam will be built

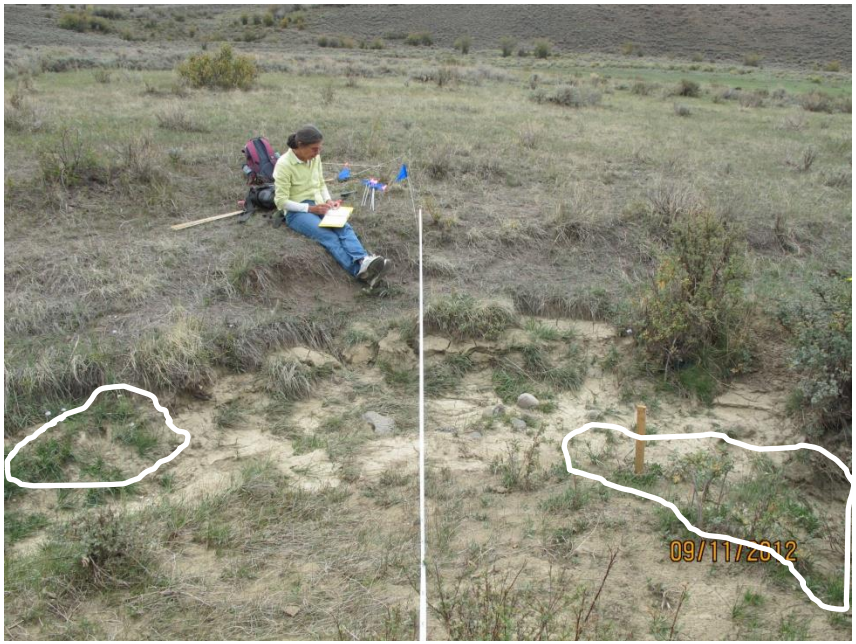
The white polygon represents the area where the one rock dam was built

GRT28_0m

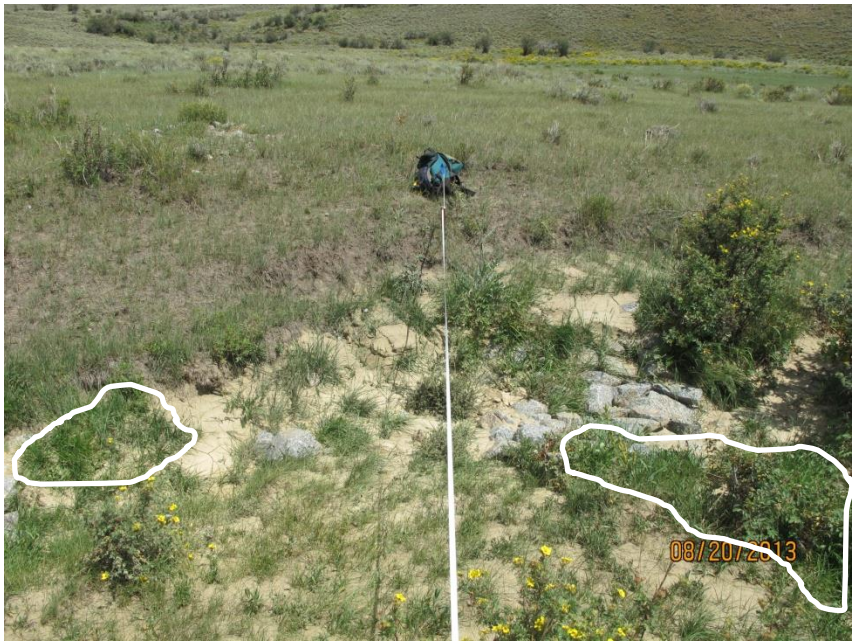
The are within the white polygon will be impacted by the one rock dam that was built shortly after this photo was taken

The area within the white polygon was impacted by the one rock dam

GRT28_end

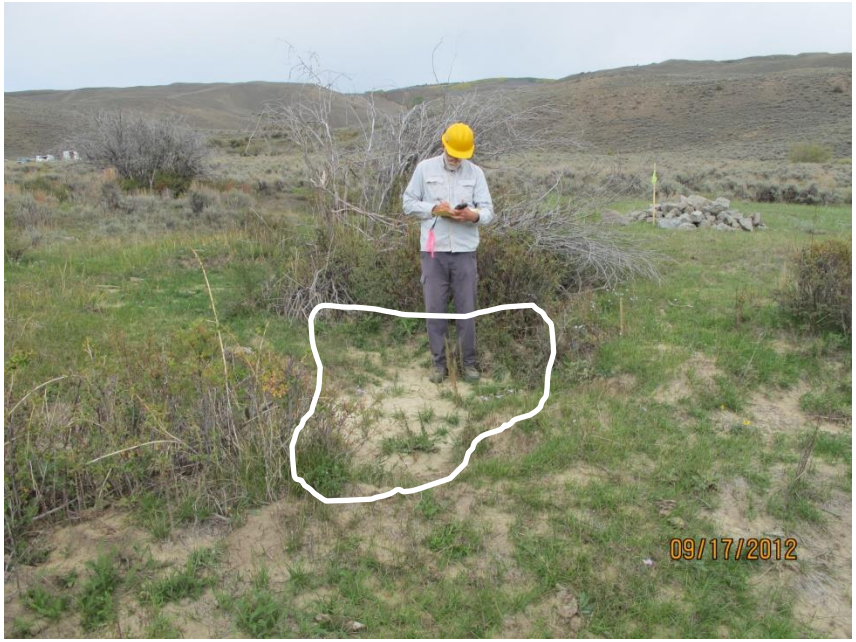


White polygons denote the area that will be impacted by the one rock dam

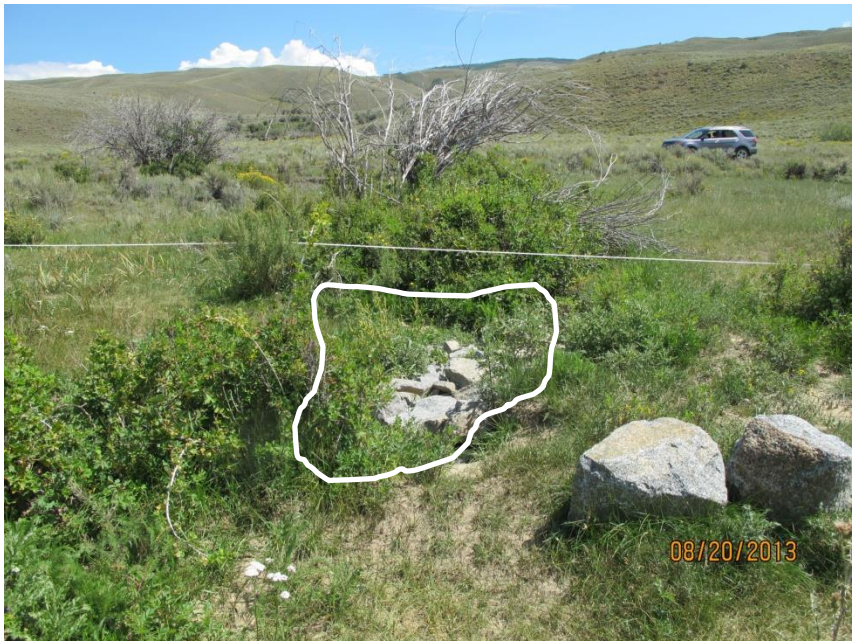


The white polygons denote the area impacted by the one rock dam one year after it was built

GRT46PP

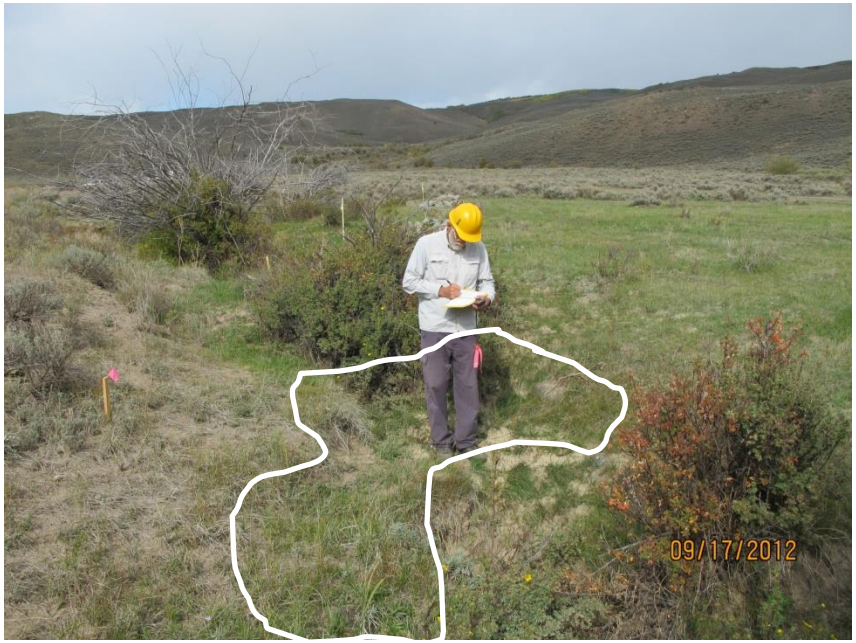


The white polygon denotes the area where the one rock dam was built shortly after this picture was taken



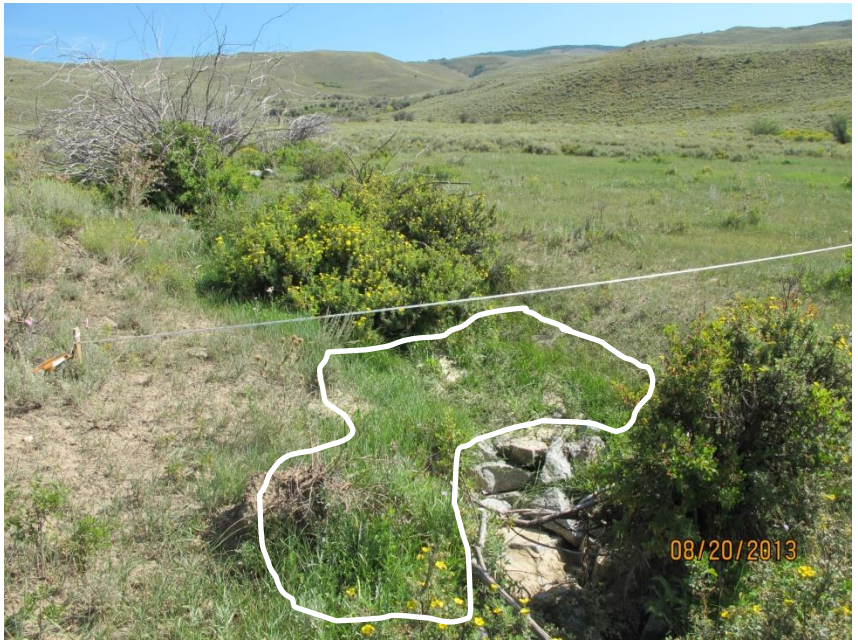
The white polygon denotes the area that was influenced by the one rock dam after one year

One Rock Dam on Ephemeral Stream GRT49PP



Bare ground and litter occupied 41% in 2012

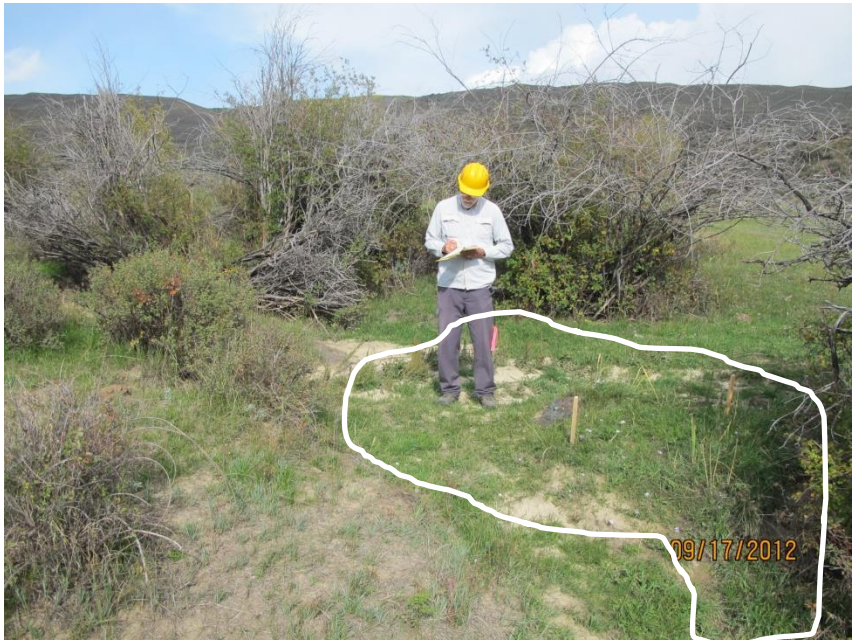
The white polygon represents the area that will be impacted by the one rock dam



Bare ground and litter occupied 6% in 2013

The white polygon represents the area impacted by the one rock dam after one year

One Rock Dam on Ephemeral Stream GRT53PP



The white polygon outlines the floodplain that the one rock dam will influence.

The white polygon outlines the floodplain that the one rock dam influenced after one year.

APPENDIX E

GEOMORPHOLOGICAL MONTORING REPORT
Prepared by Steve Vrooman, Keystone Restoration Ecology
September 2013

Introduction

Keystone Restoration Ecology (KRE) conducted geomorphological monitoring in the Upper Gunnison Basin on stream channels where restoration techniques were implemented to enhance wetland/riparian habitats important for Gunnison Sage Grouse brood rearing. The stream channel monitoring data will establish baseline conditions at the following restoration sites:

- Redden Ranch
- Wolf Creek Ranch
- Wolf Creek BLM
- West Flat Top at Henkel Road, including the Exclosure site

Restoration treatments were designed by Bill Zeedyk to use the resource of flowing water and sediment transport to restore wetland areas, fix gullies, and reduce head cutting. Most of these treatments involved small rock structures such as Zuni bowls and one rock dams to reconnect the stream channel with its floodplain and prevent further gullying. Over time these structures will capture sediment flowing in the channel during runoff events and fill in gullies. This will re-connect the channels to their floodplains and increase the riparian area. KRE established longitudinal profiles for each restoration channel to monitor channel elevations through time.

Methods

The geomorphology monitoring was set up to monitor the effects of restoration treatments in the sites. The longitudinal profiles run "along" the channel, from upstream to downstream, and were taken after the structures were built for an "As-Built Survey". Cross sectional transects were also placed above selected structures to more closely monitor the effects of those structures. These cross sections are marked on site with 2" by 2" wooden stakes and in most cases coordinate with a restoration treatment structure number. When possible we used benchmarks taken in 2012 by Zeedyk Consulting. These are rocks in the stream channel or on the terrace marked BM in blue paint. At Wolf Creek, the lower two reaches benchmarks were established by using 2x2 wooden stakes and taken as GPS points. No existing benchmarks were found at the Flat Top site, so 2x2 wooden stakes were used as benchmarks there too.

A sub-meter, hand-held Trimble Geoexplorer Global Positioning System (GPS) unit and self-leveling laser level unit with rod and sensor were used to collect elevational data along the stream channel. A two-person crew worked in tandem to collect a GPS position for each point surveyed with the laser level. Elevational data was then merged with GPS positions to provide distance, elevation, and exact location in the stream channel. As the grade of the channel descended down valley, the laser level was repositioned and turning points created to calibrate and establish a continuous longitudinal profile.

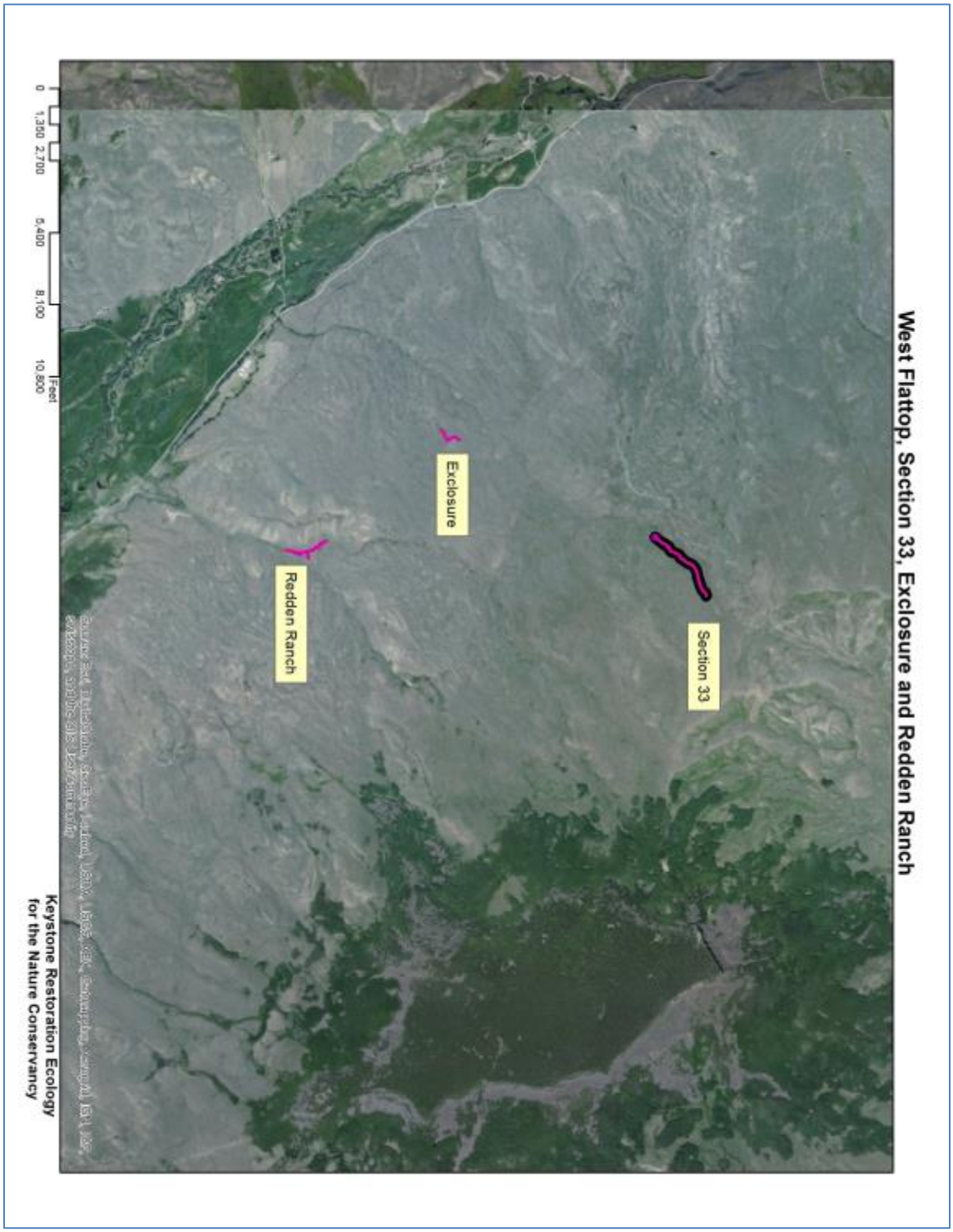
The methods used to take the geomorphology elevation data at these sites allowed Keystone Restoration Ecology to survey almost every reach that had been worked on in 2012 and 2013. The advantage to the method using the Trimble sub-meter GPS allows the survey team to not

"pull tapes" and continually replace 300 foot tapes down the channel. If 300 foot tapes were used, much less data would have been taken in the time available due to the time to move and re-lay the tapes. Perhaps only one or two sites would have been surveyed by the conventional methods.

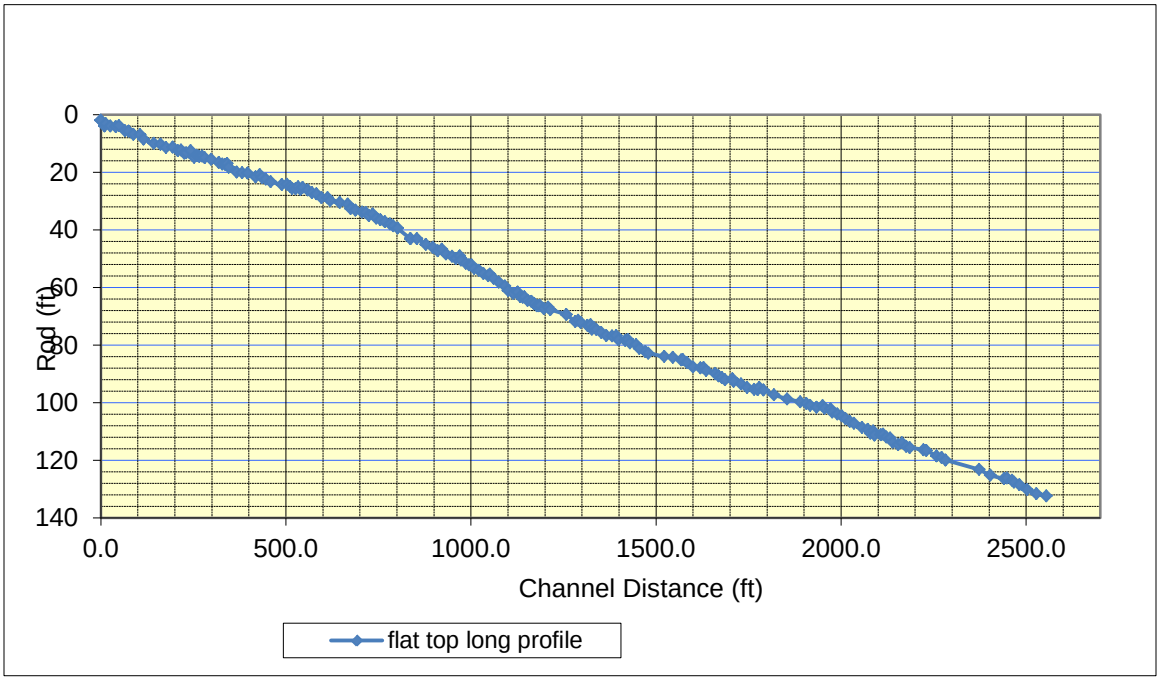
In addition, there is an accumulation of errors as a survey continues down a long channel, basically, it is impossible to lay the tapes in the same place each year. While this is not too significant, it can lead to errors in the data that do not happen when each elevational data point is "stationed" with a GPS. The data at 2000 feet down the longitudinal profile is as correct as the data at 200 feet.

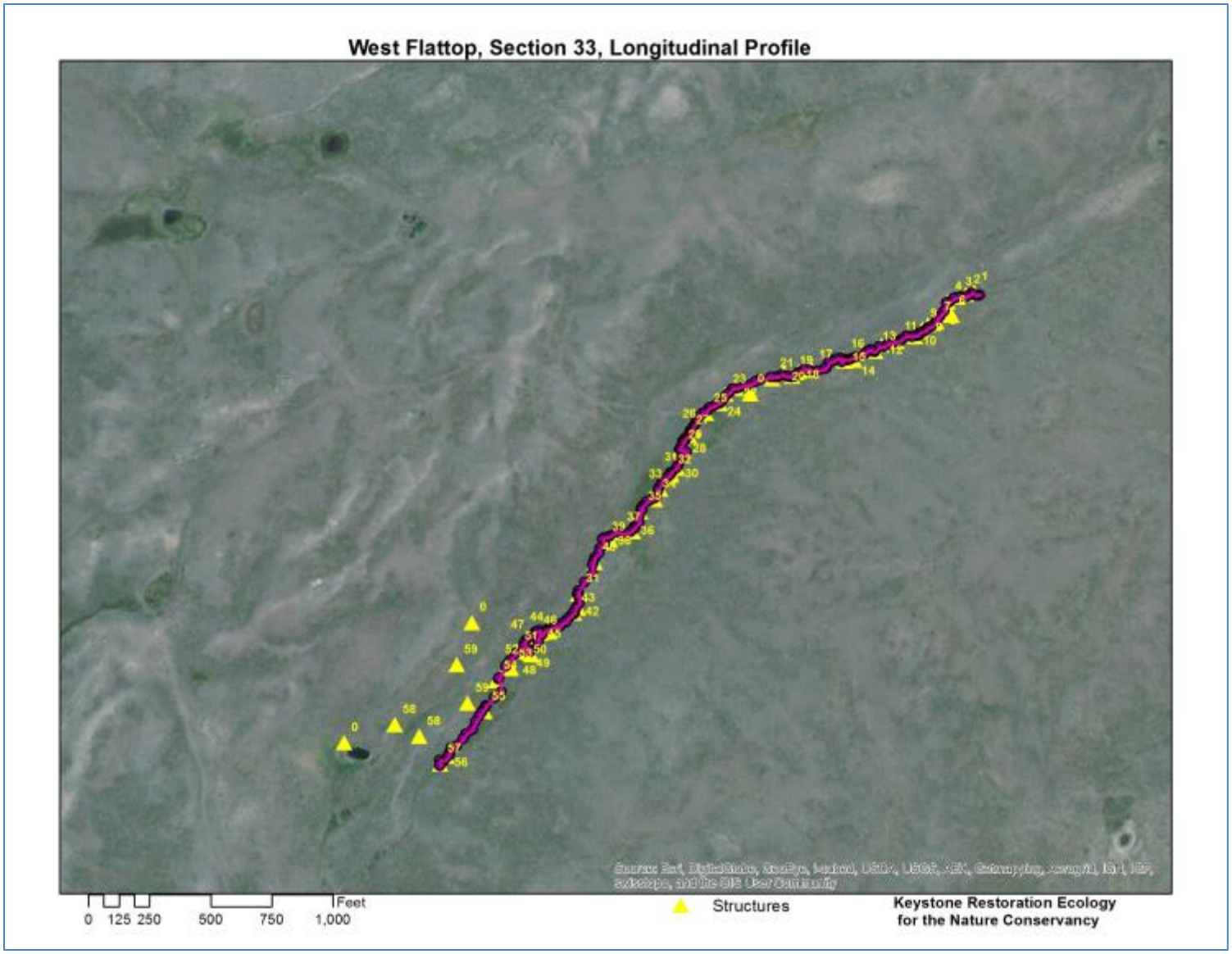
Re-taking this data requires the use of a professional grade GPS with sub-meter accuracy, which all agencies (BLM and Forest Service) have at their disposal. While re-taking the data will require some technical support, the advantages to the method allows for long reaches to be surveyed in a day. In addition, the cross sections can easily be re-surveyed with a measuring tape, not necessitating the use of a professional grade GPS.

Results: Forest Service Flat Top and Redden Ranch:
These two sites are off of Ohio Creek north of Gunnison. Flat Top Mountain dominates the area. Many small channels flow from Flat Top through sagebrush hills, the channels have intermittent springs and wet meadows in them that are used as brood-rearing habitat by Gunnison Sage Grouse.

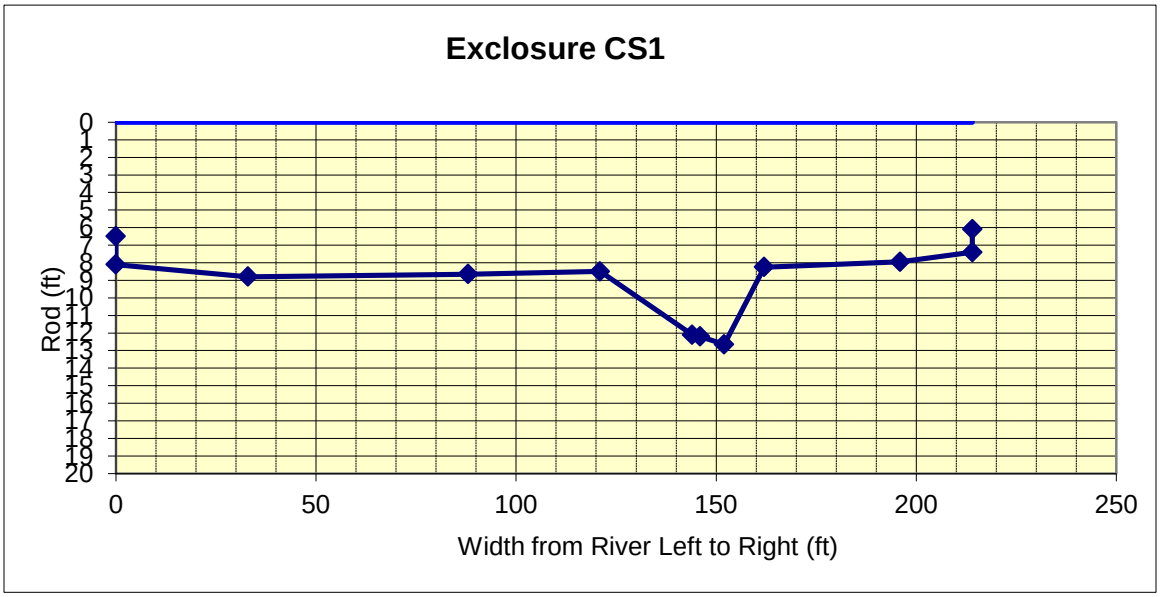


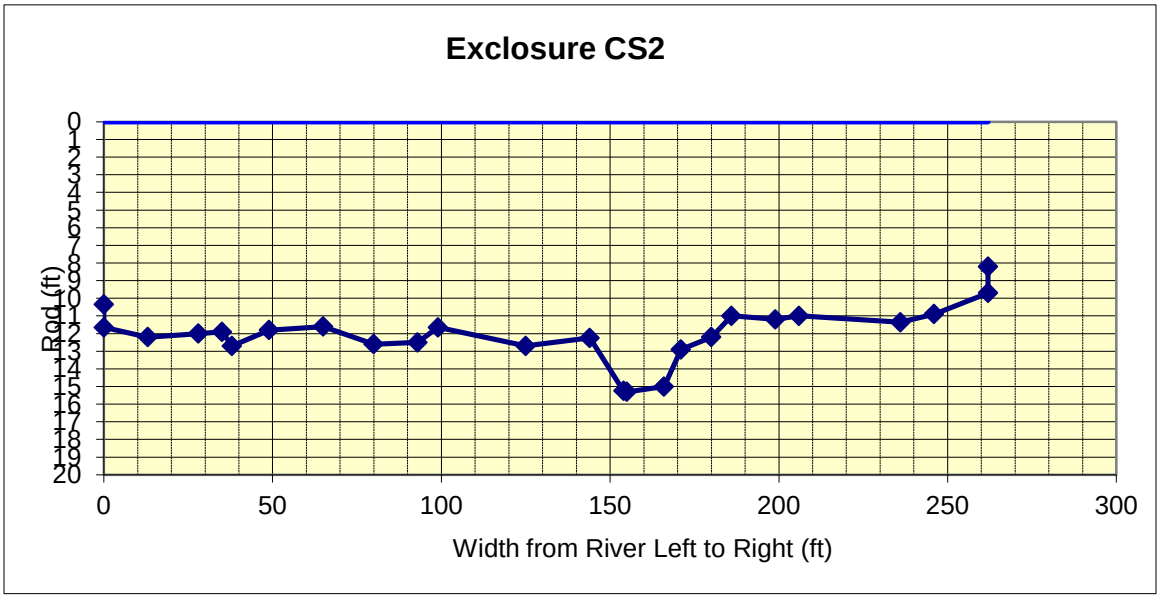
West Flat Top, Section 33: A longitudinal profile was taken of 2700 feet of the channel at the Section 33 restoration site. This small channel runs along Henkel Road, the access road to the site, and is relatively narrow and steep with a 5% slope. Structures such as one rock dams and rock rundowns were used to raise the grade of the channel and re-irrigate the narrow floodplain.

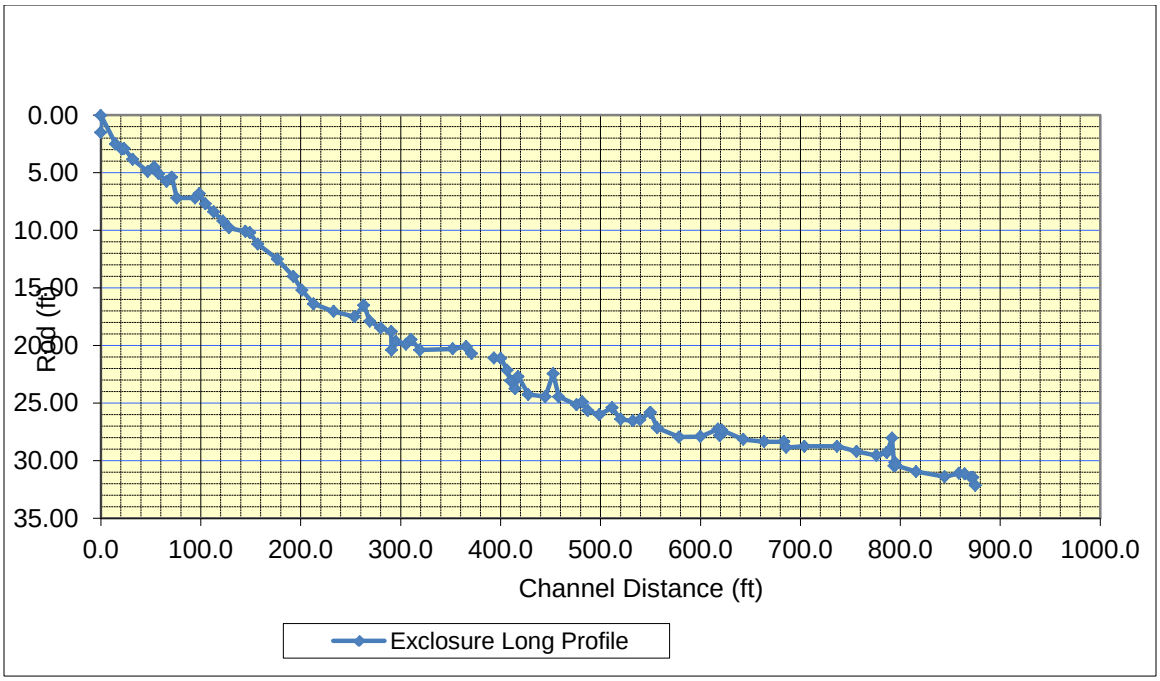



West Flattop, Section 33, Longitudinal Profile
0 125 250 500 750 1,000
Feet
Structures
Keystone Restoration Ecology
for the Nature Conservancy

Flat Top Exclosure Site:
A small exclosure fence that has been in place for decades was the location of another set of rock restoration structures. The exclosure site is deeply gullied, and because of this, two baffles were used to erode a steep bank and create floodplain at the new, gullied elevation of the channel. The cross sections show that the channel was once to the east side of the present gully, and this was a wet meadow or wetland.





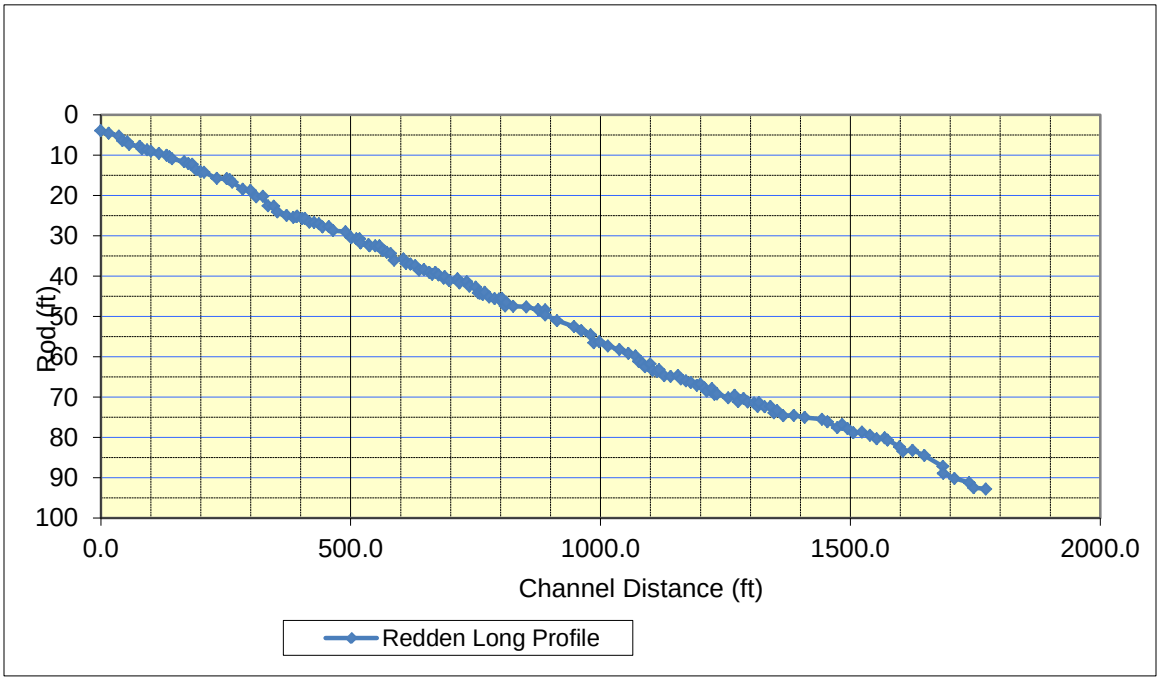


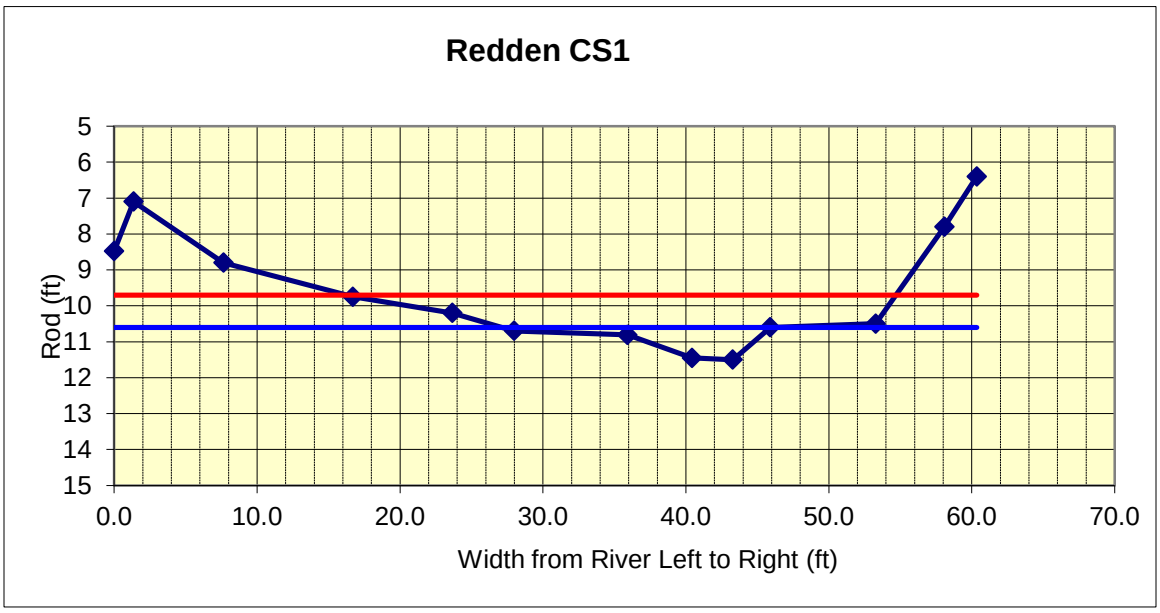
The longitudinal profile of the exclosure from fence line to fence line along the channel.


Flattop Exclosure Site Geomorphic Monitoring
BM1 rebar at fence 0.3 feet
ZB
ORD
ORD
ORD
ORD
ORD
ORD
RR
Other
ORD
ZBZB
ORD
ORD
Other
ORD
Other
RR
ORD
Other
RR
ZB
ORD
ORD
CS1
cs2
0
37.5
75
150
225
300
Feet
Keystone Restoration Ecology
for the Nature Conservancy

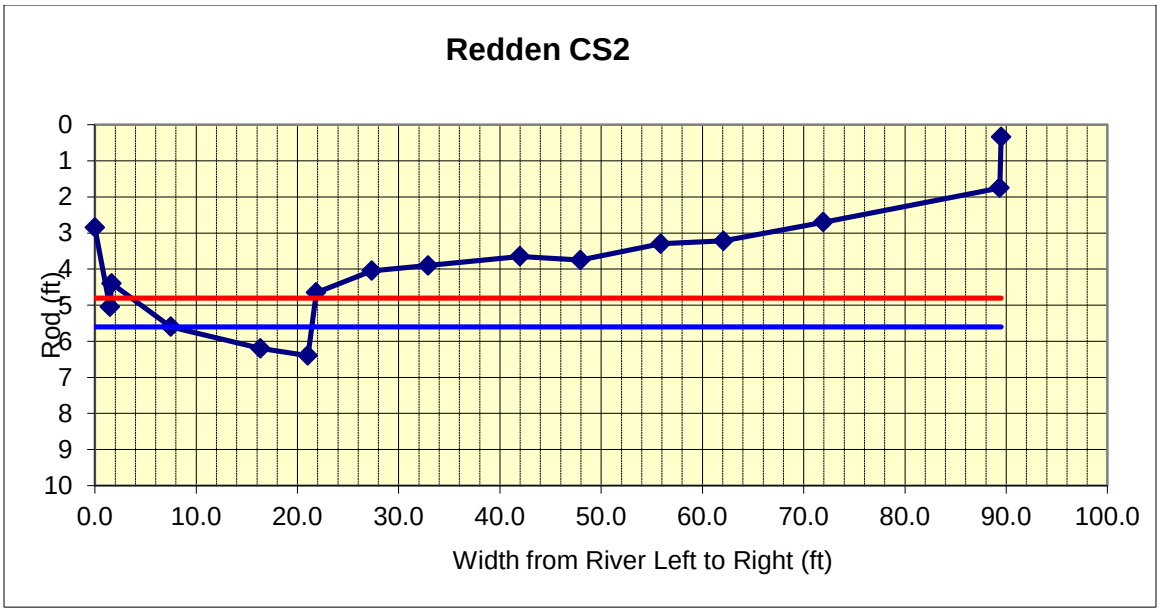
Redden Ranch

Keystone Restoration Ecology surveyed a longitudinal profile and cross sections at the Redden Ranch, below West Flat Top. The upper portion of the channel had already filled in behind the one rock dams installed in 2012 with sediment from gullied slopes uphill. This erosion, while damaging to the hill slope, is repairing a much more productive wet meadow by providing the necessary sediment to fill in the channel. The channel was surveyed by KRE for 1700 feet and has a 5.3% channel slope.

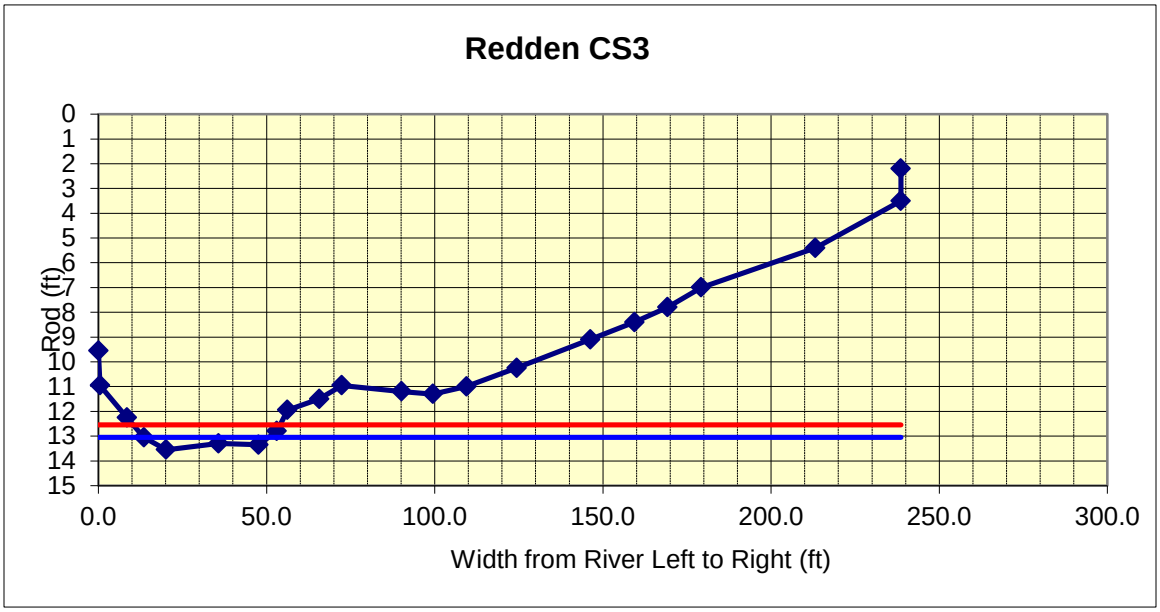




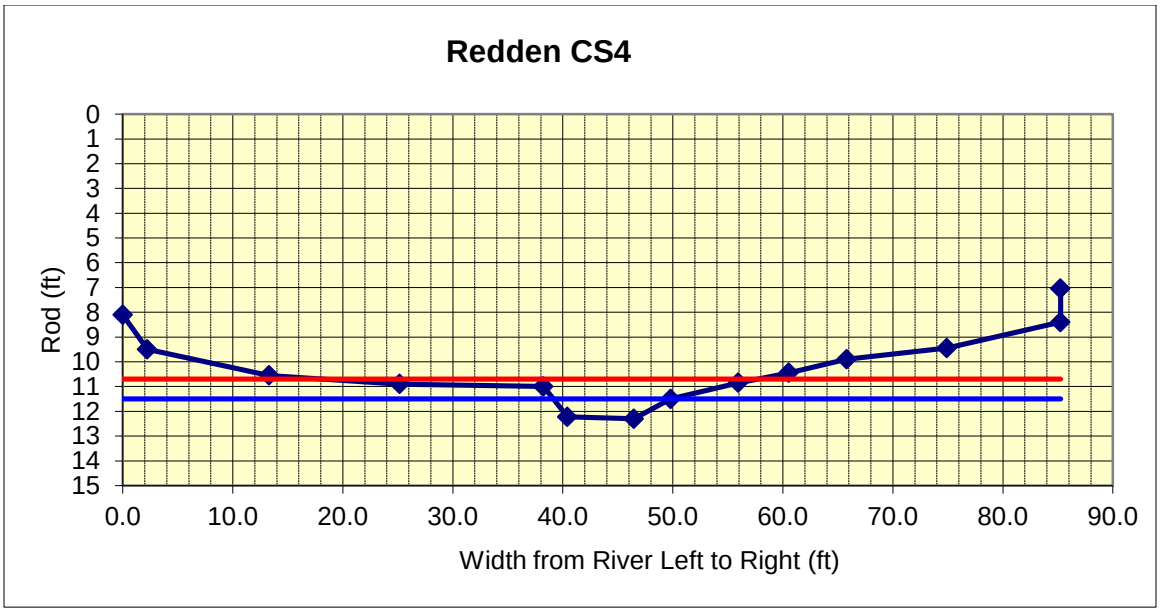
This site has filled in with sediment, and has a healthy channel shape with a floodplain.



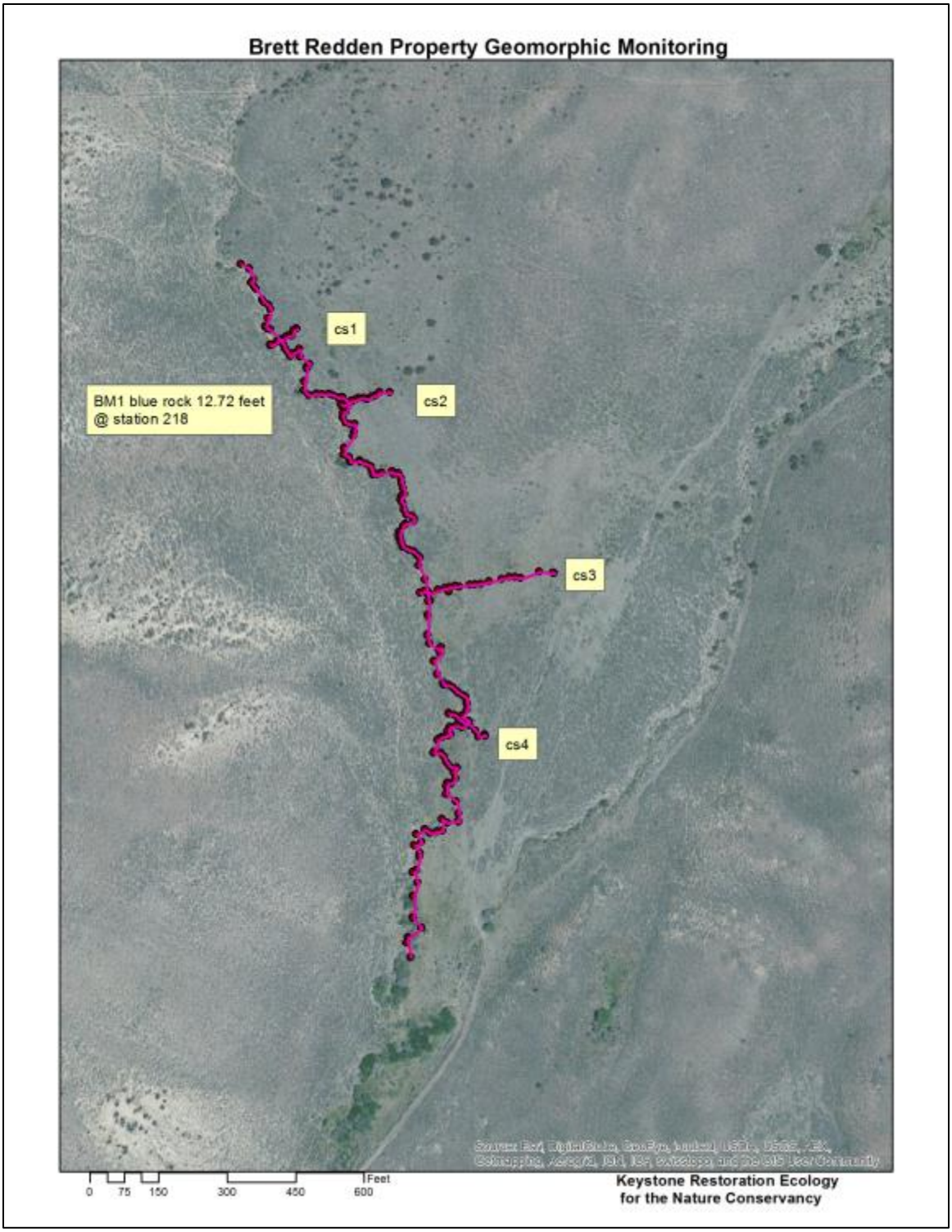
This site is still gullied, blue line is bankfull, red line "flood-prone width", an estimated 20 year storm, which could not overflow the banks of the gully at present.



Notice a swale at station 100 that was a former channel before the gullying, when the site was a wet meadow.

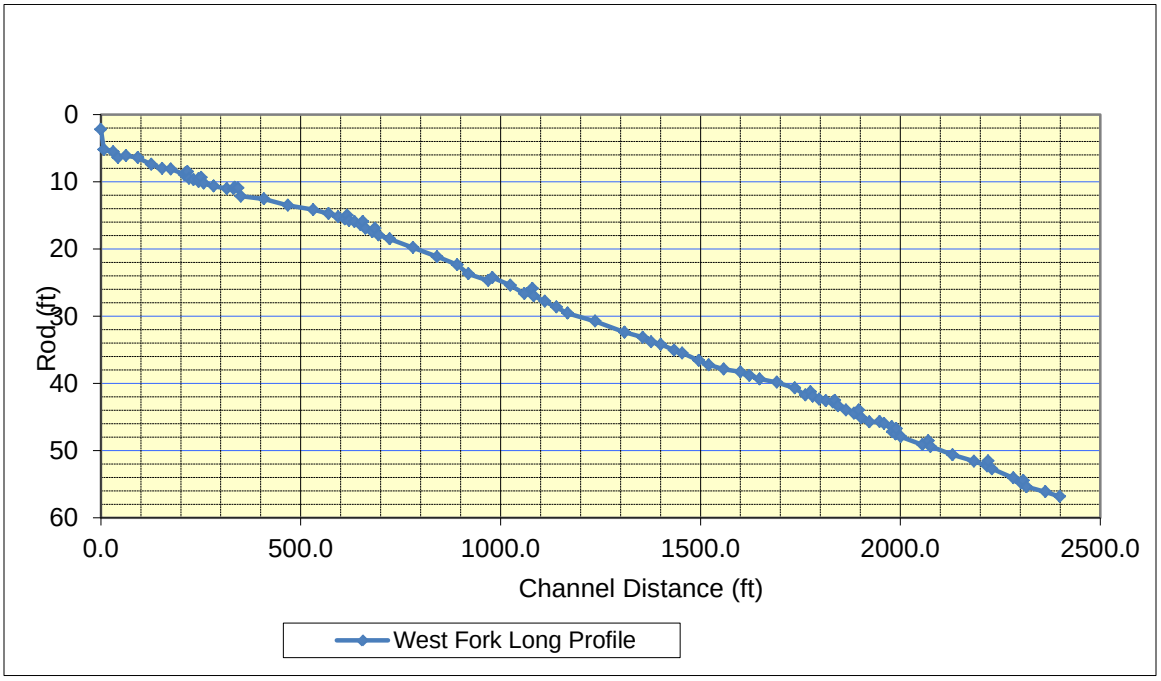


This cross section was taken low in the watershed at a point where the channel begins to braid around some willows. Raising the grade at this point could irrigate much of the former wet meadow between stations 10 and 40 on the cross section.

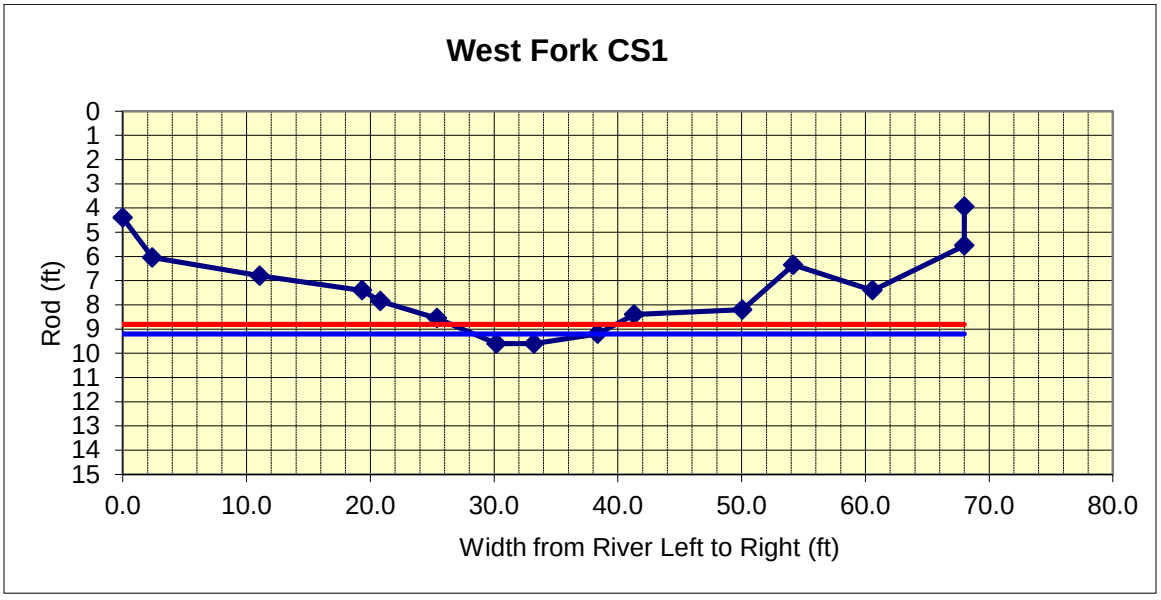

Brett Redden Property Geomorphic Monitoring
cs1
cs2
cs3
cs4
BM1 blue rock 12.72 feet
@ station 218
0
75
150
300
450
600
Feet
Keystone Restoration Ecology
for the Nature Conservancy

Wolf Creek Sites: Wolf Creek Ranch and Bureau of Land Management Properties:
These sites are south of Gunnison in rolling hills of sagebrush. There is a healthy spring that arises in the East Fork reach and flows into Upper and Lower Wolf Creek reaches. Three longitudinal profiles were taken, one on Wolf Creek Ranch, one on the East Fork and one on the Middle Fork Reach. A number of cross sections were taken as well. Gunnison Sage-grouse were seen during most site visits to this site.

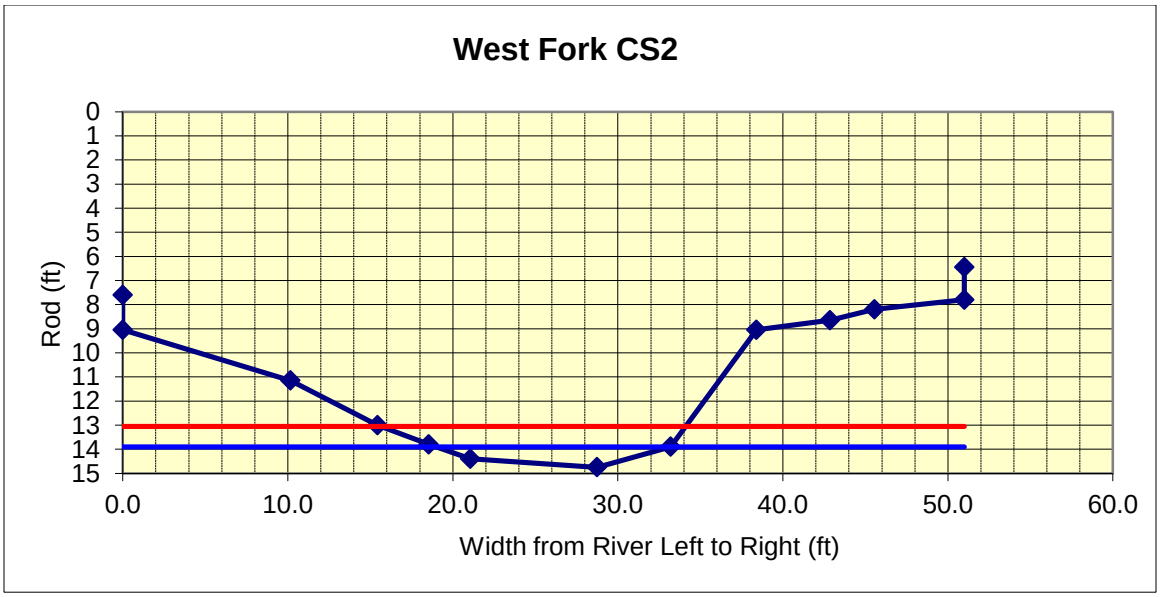
West Fork Site:



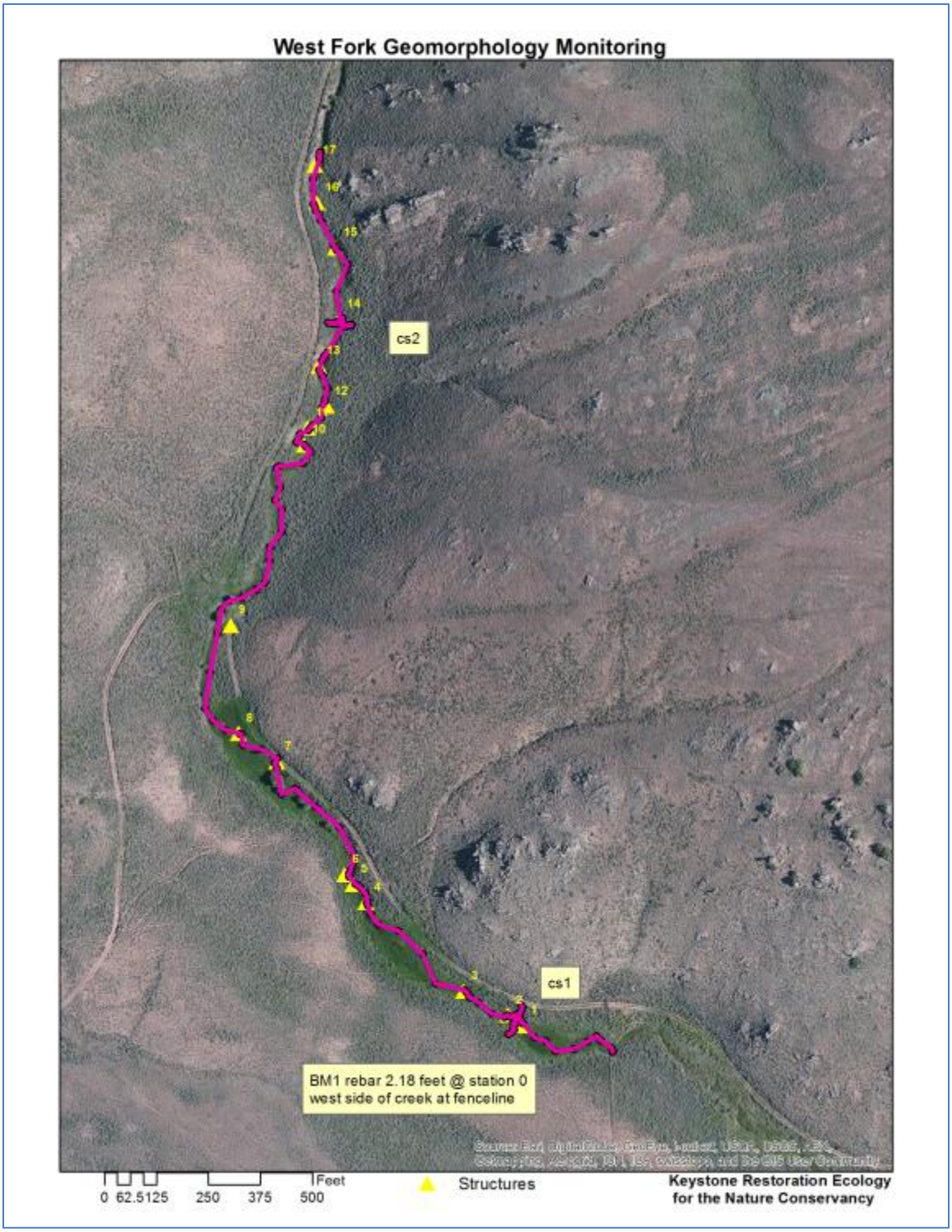
This longitudinal profile has an average 2.3% slope, the upper portion is a small channel through wet meadows. Due to the geology of the area, the lower portion runs through a natural gully between steep colluvial slopes.



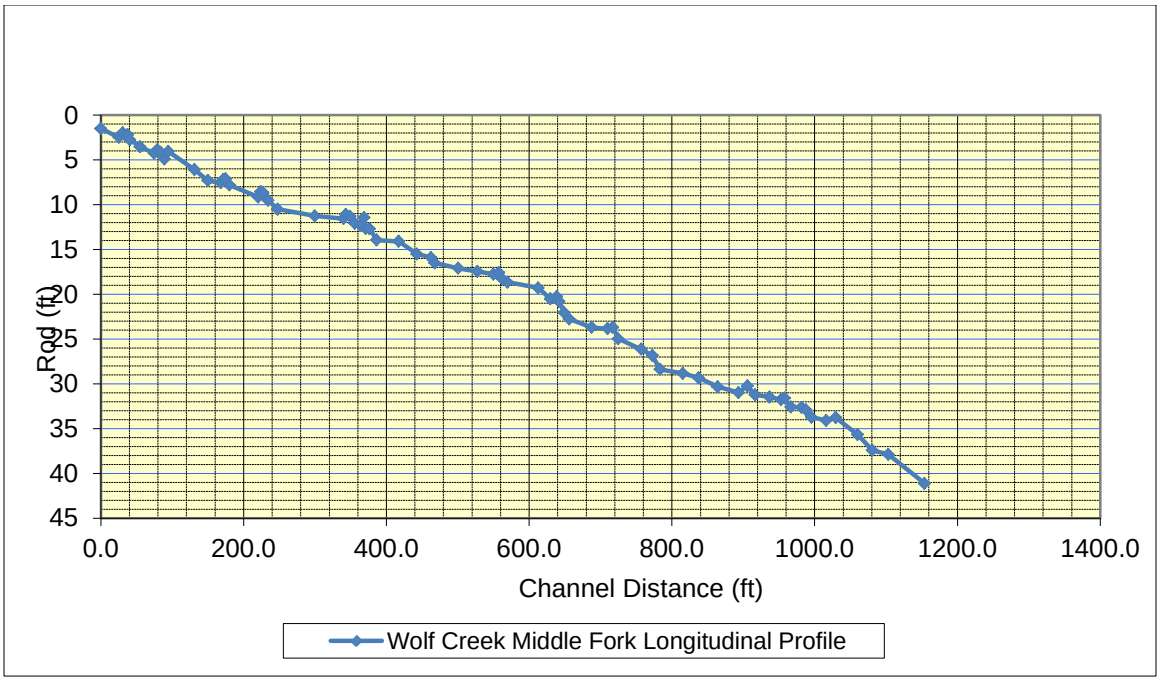
This cross section was placed in a location where we expected a large amount of sediment to fill in between several one rock dams.



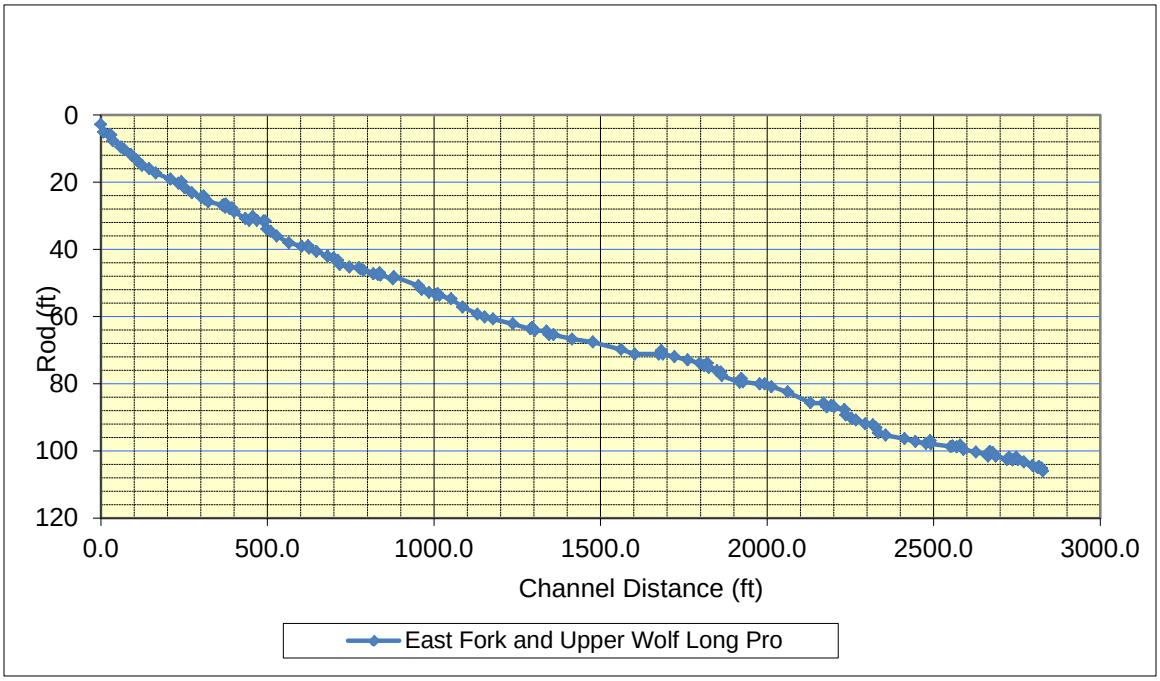
This cross section was in the lower, gullied portion of the site between steep hills on either side. This channel will fill in with sediment captured behind the one rock dam structures. This wet sediment will grow in with wetland vegetation and the defined channel will disappear (the area under the blue bankfull line should be filled in).



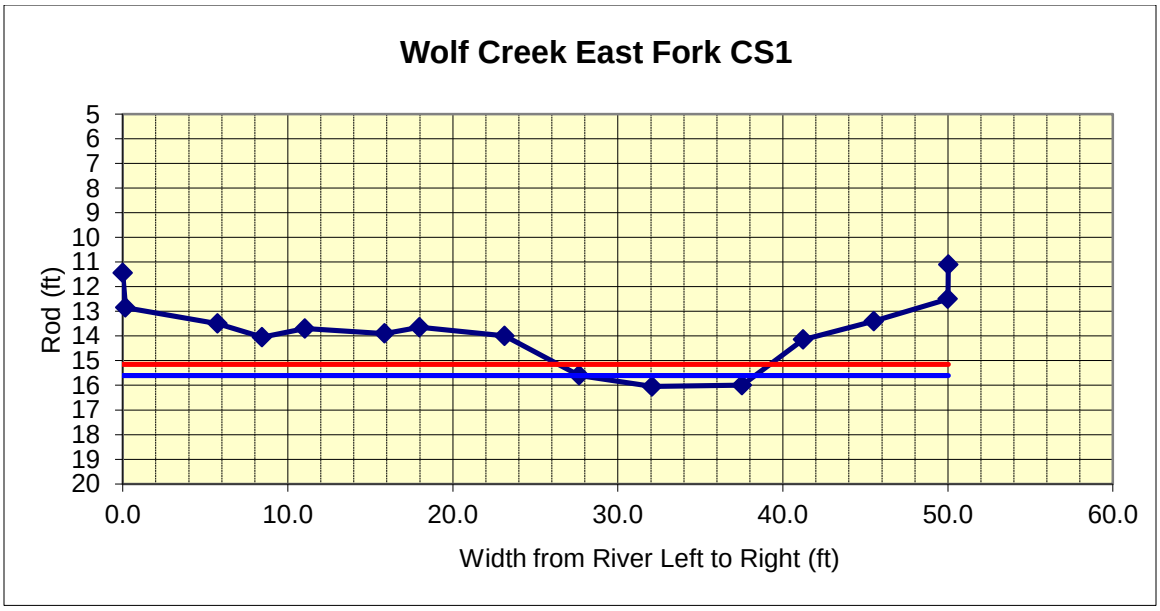
Wolf Creek: Middle Fork, East Fork and Upper Wolf:
This site is on Bureau of Land Management Property. Longitudinal profile 1 was surveyed in the Middle Fork Reach. Longitudinal profile 2 started at the spring (East Fork) and continued through the culverted road crossing to encompass the Upper Wolf Creek Reach.



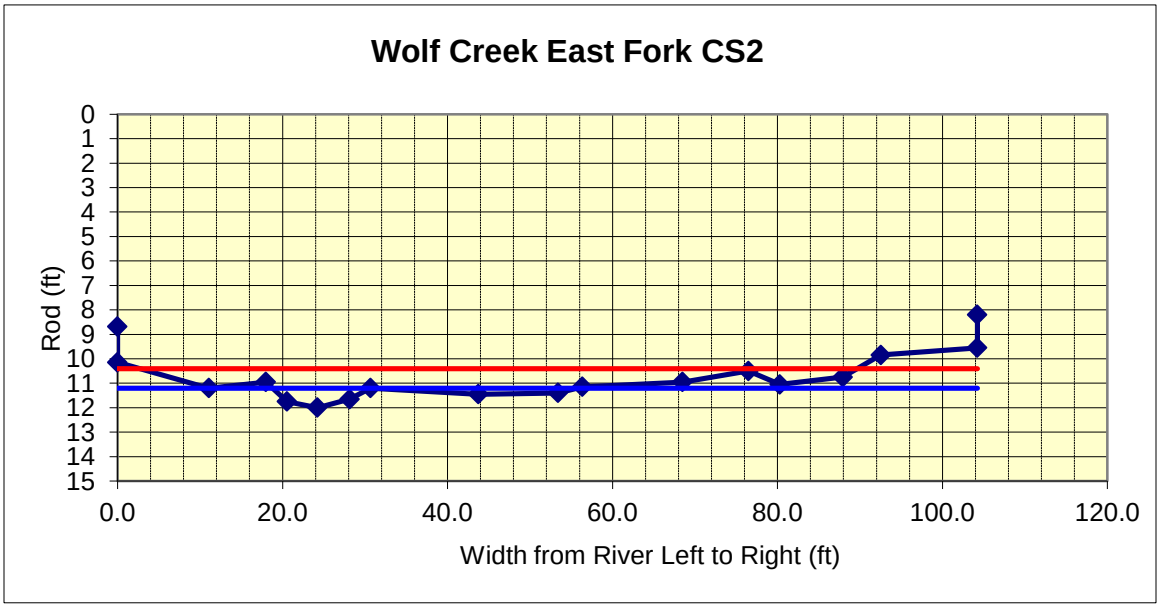
This profile shows the locations of many of the structures as "high points" in the profile. This profile is the tributary channel beginning at the road and running downstream to wide valley with the spring, where the Middle Fork begins.



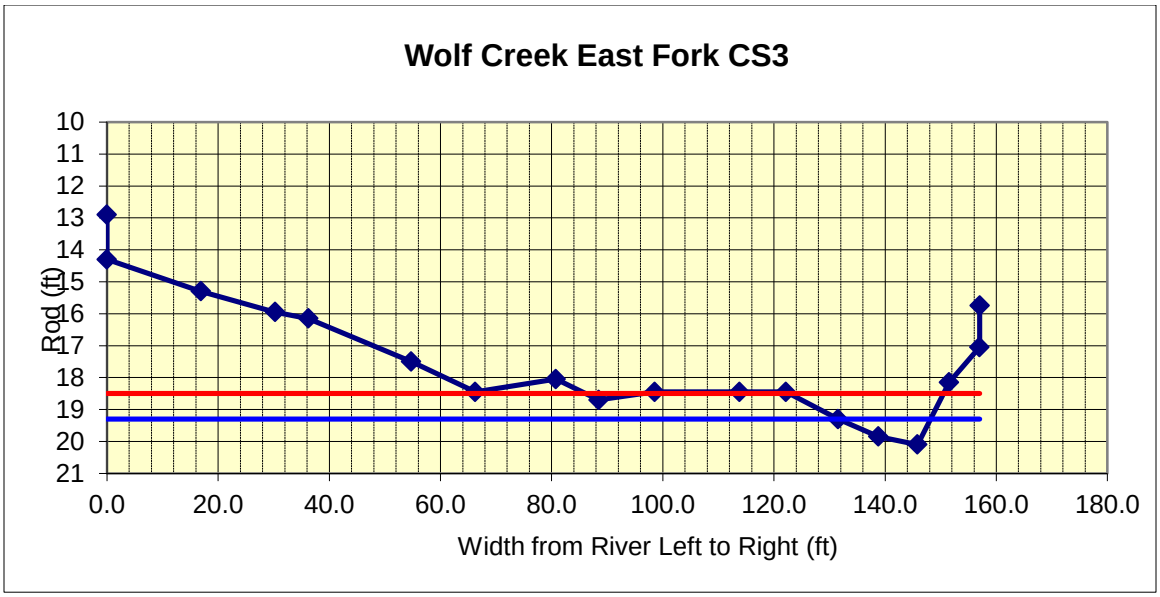
This profile starts at the spring at station 0, the wetland at the confluence runs from about 1000 to 1300. The culverted crossing is at 1350, where the Upper Wolf Reach begins, and runs downstream to the beginning of Lower Wolf Reach.



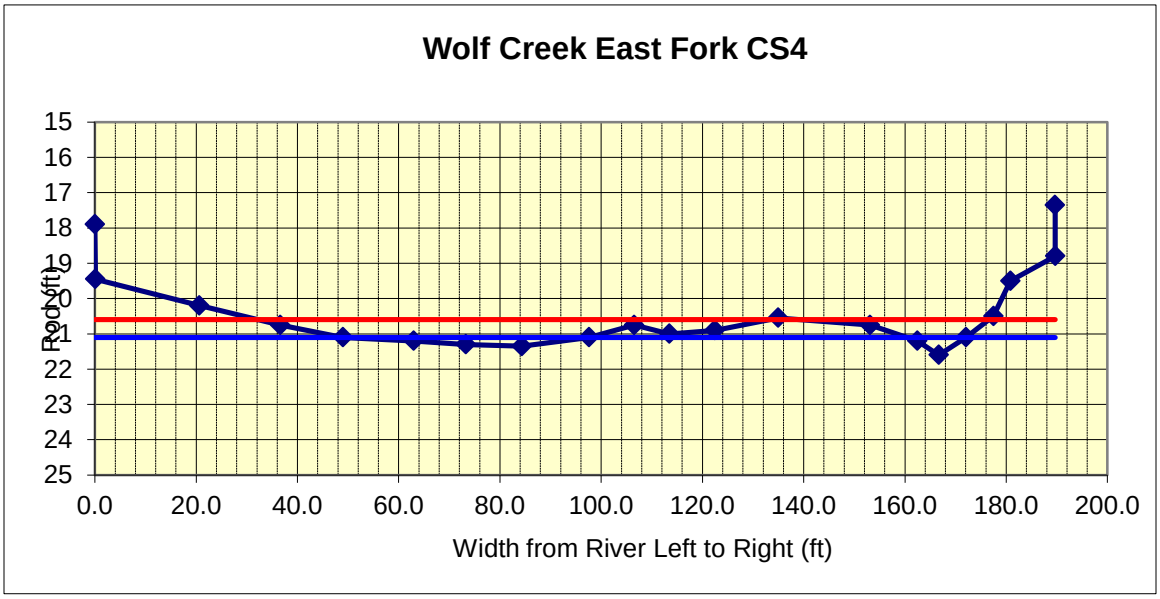
This cross section was taken in a narrow portion of the channel, upstream from the spring. However, the form of the channel may indicate that this area was once a slope wetland without defined channel through it (old channel to left at station 8 feet).



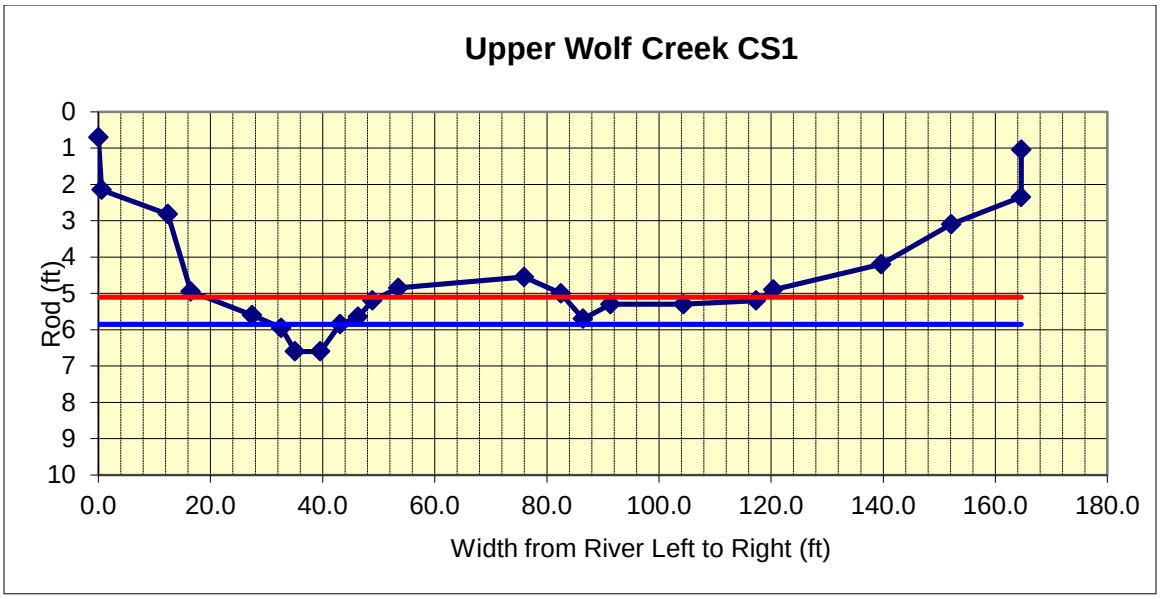
This cross section was taken where the channel enters the wide valley with the spring; this cross section runs across an alluvial fan feature with multiple channels in it. This cross section should continue to "aggrade" or gain elevation due to the braiding of the channel and accumulation of sediment from the growth of the alluvial fan.



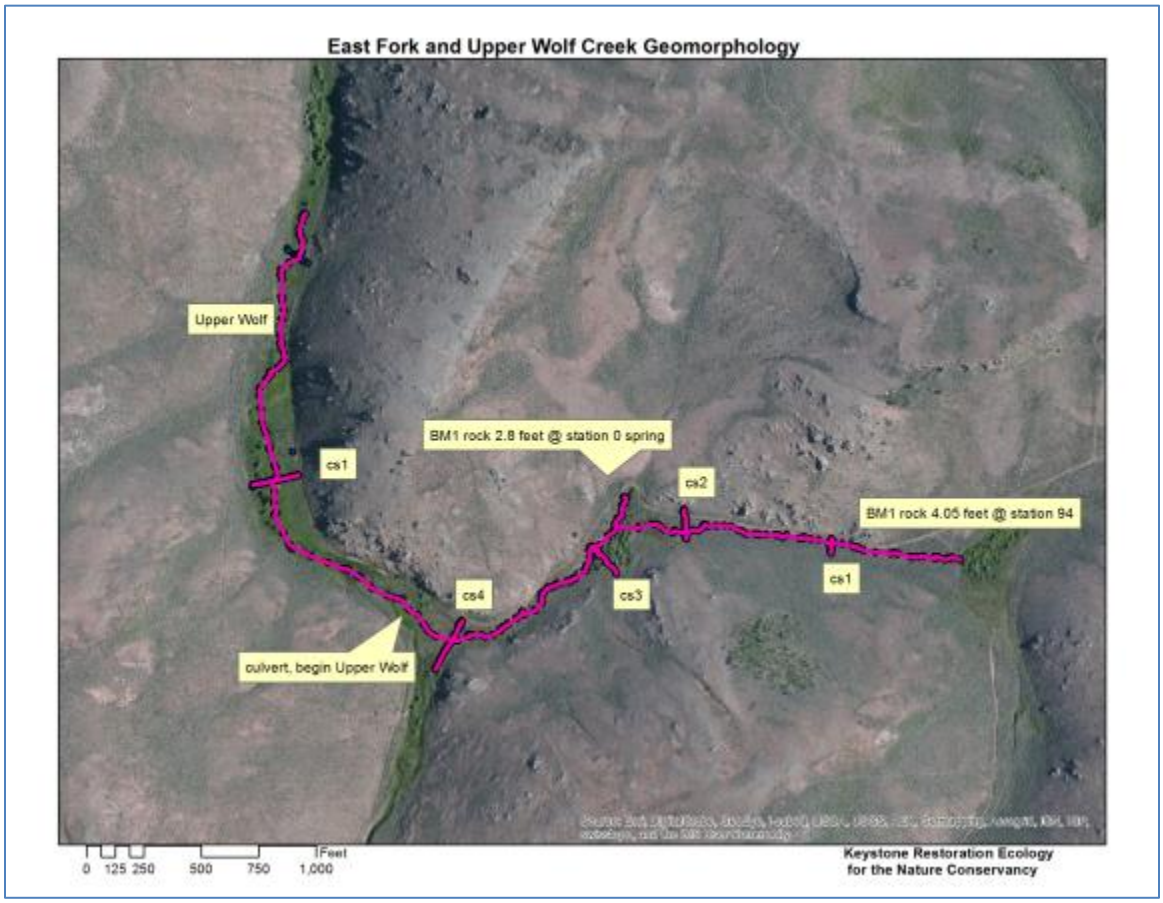
This cross section was taken at the end of the "spring valley", showing several channels which could contain the flow from the spring. Presently, the spring is flowing at station 150 on the cross section, in the lowest elevation channel.



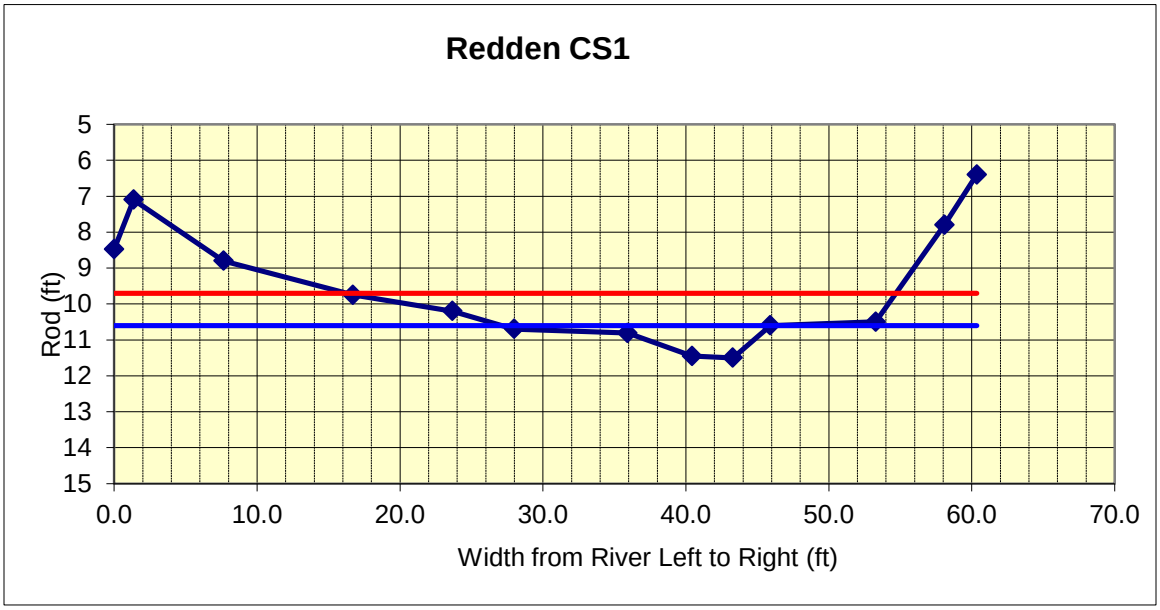
This cross section was taken near the confluence with Upper Wolf Creek, where the water spreads across the wetland. The water has spread throughout this cross section after the work was done in 2012. There is water in channels from station 60 to station 170.

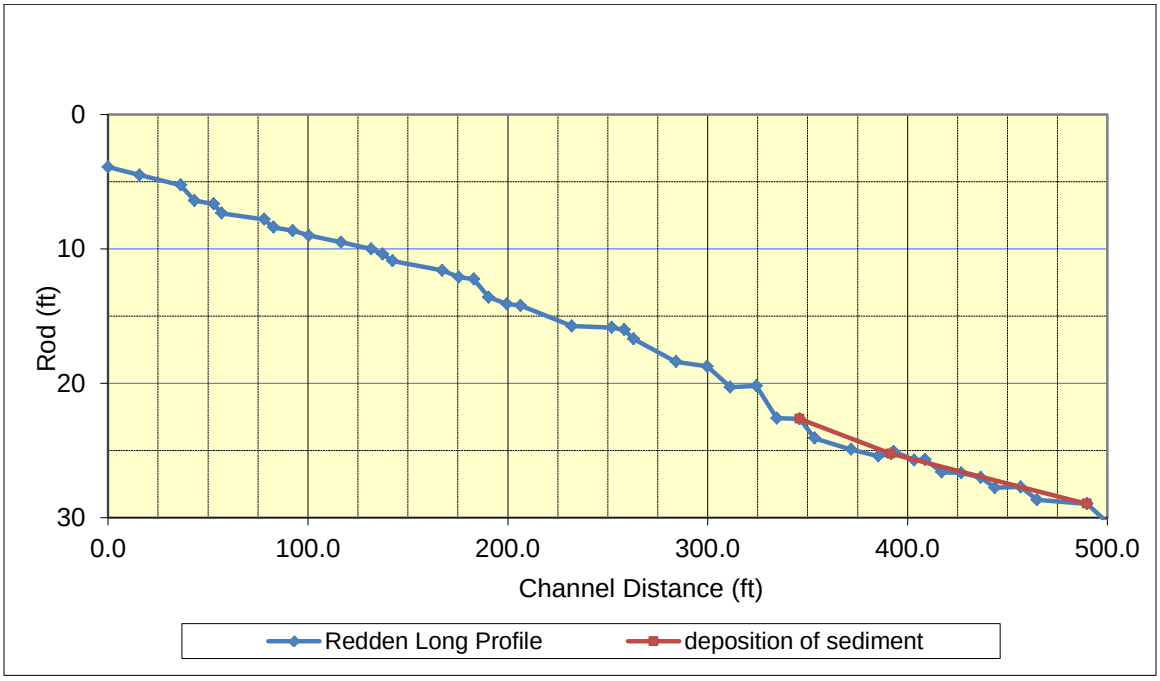


This cross section was taken above the first large "Media Luna" structure in the main channel of Wolf Creek, several hundred feet below the culvert. The water has already been spread across the valley and is not flowing in the lowest channel at station 40. The Media Luna runs from about 85 to 115 on the cross section.



Conclusions:
The geomorphic monitoring taken was performed as an "as-built" survey with data taken just after construction. This allowed for one monitoring event to capture both the "pre-treatment" elevation of the channels and the location and height of each structure.
The purpose of many of these structures is to capture sediments such as gravel and soil during flood events and to re-fill the gullied channel. Some of this sediment capture was seen on the Redden Ranch (built in 2012) at the upper end, the channel form has changed from a gullied channel to a channel with a floodplain.





The upper portion of this profile has filled in and "smoothed", as this sediment works downstream, it will fill in the area under the "deposition of sediment" line.

The two graphs shown above for the Redden Ranch show the effects of the restoration structures after one year of channel flooding and deposition. The cross section shows a channel that is un-gullied and has an active floodplain. The longitudinal profile shown has filled in with sediment and the structures are actually obscured under fresh sand and silt. This deposition will proceed from upstream (the sediment source) downstream through the longitudinal profile (the sediment sink).

Future Work:
Comparing this year's "as-built" data with surveys taken in the following years will show this deposition of sediment moving downstream through each treatment area. As the structures fill with sediment, additional layers of rock can be added onto the one rock dams to raise the grade even further and eliminate the channels. This will create slope wetlands out of formerly gullied channels.

In addition, the growth of wetland or wet-meadow vegetation, as being monitored by Renee Rondeau, will assist in capturing even more sediment. The fine roots and leaves of wetland vegetation will create a "comb effect" and remove finer sediment than can be caught in the spaces between the rocks of the restoration structures.

Other effects of the structures include the buffering of flood force leading to reduced erosion, growth of vegetation in and around the structure, raising of the water table and irrigation of the banks, and spreading floodwaters across a wide floodplain, which allows the floodwaters to irrigate a large area and soak into the groundwater.

A re-survey of this geomorphic monitoring by the US Forest Service and BLM in several years may show many of these changes. In a dry climate such as Gunnison, flood events are rare, and snowmelt events may not move as much sediment as brief, intense summer rainfall events. If another good "monsoon" season is seen, sediments should be transported downstream and captured behind the structures, beginning the processes of channel re-filling, water table increase and wetland plant growth. These changes will improve the important brood-rearing habitat of the Gunnison Sage-grouse in a number of ways such as improved cover, food sources, and watering places.

Appendix F

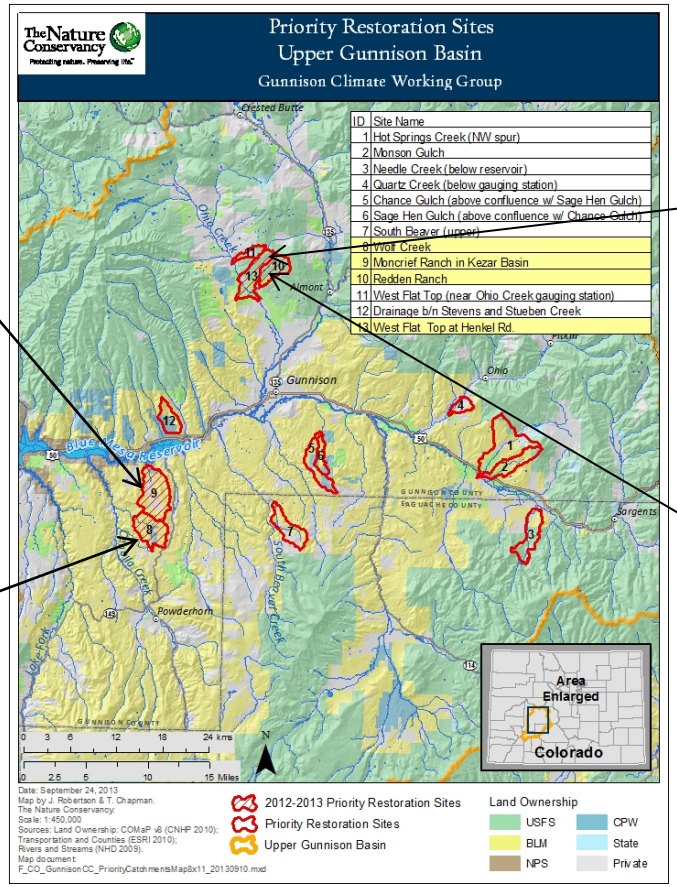
Project Photographs

2012-2013 Priority Restoration Sites Upper Gunnison Basin, Colorado

Moncrief Ranch in Kezar Basin

Wolf Creek (both private ranch & BLM lands)

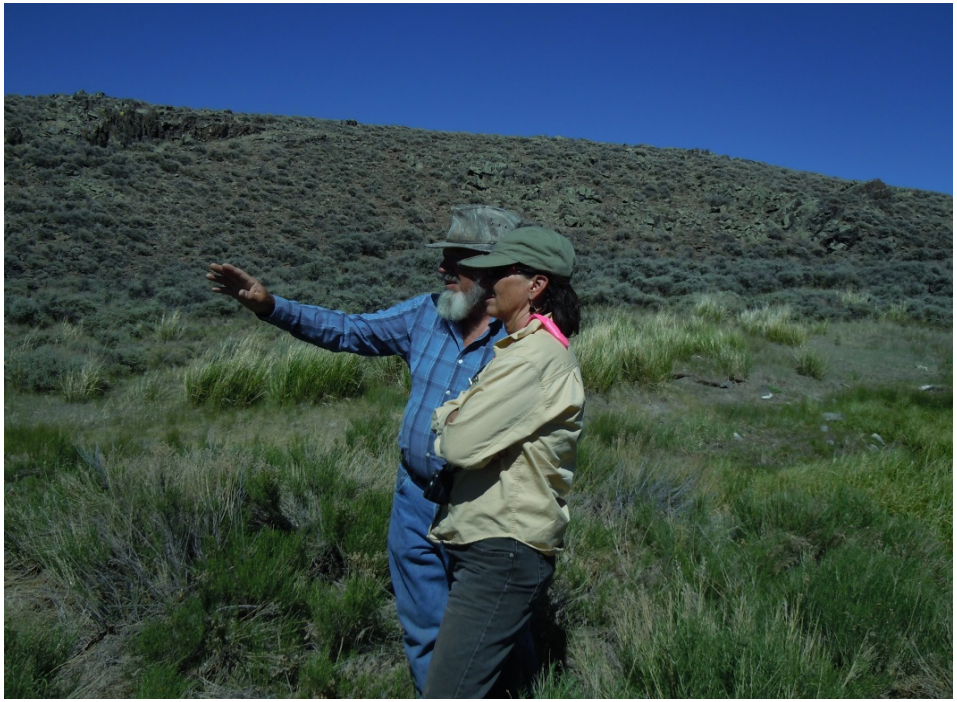
Map 1.



West Flat Top USFS

Redden Ranch
West Flat Top

Field Evaluate Priority Sites & Determine Restoration Needs



Design Treatments & Stake Structures

Deliver Rock & Logs Close to Structure Locations

Train Field Crews & Volunteers

Volunteers Build Structures

TNC staff volunteers start Media Luna at Wolf Creek Ranch

Bill Zeedyk & Nathan Seward, CPW, with volunteers complete Media Luna

Field Crews Build Structures

Western Colorado Conservation Corps (WCCC) build One Rock Dam at Lower Wolf Creek BLM

TNC's Southern Rockies Fire Use Module build Log and Fabric Structure at West Flat Top USFS

Western State Colorado University

students complete media luna & set up time lapse camera at Wolf Creek

C. Strijek 2013

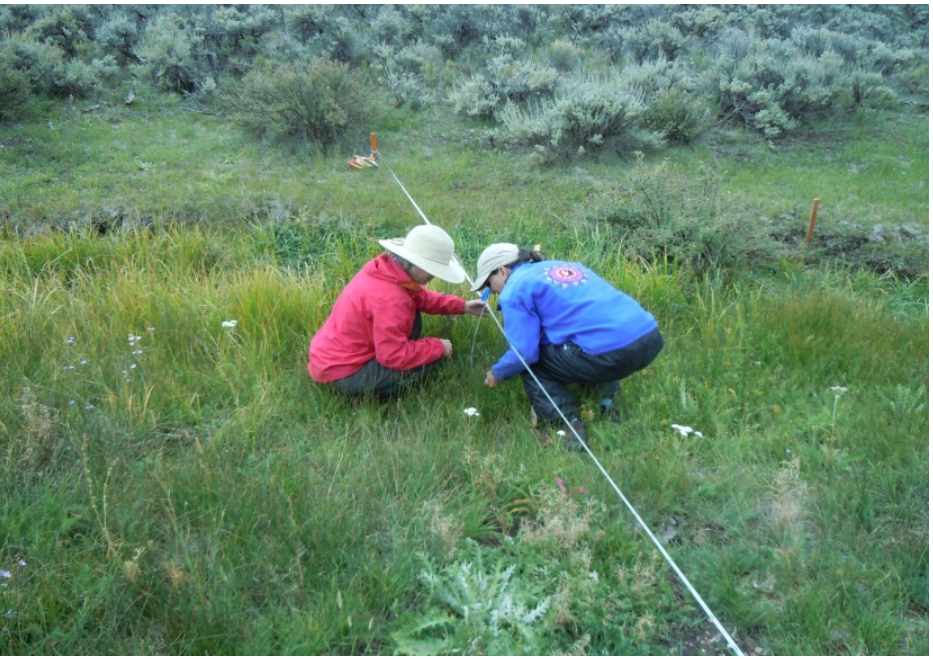
Low Water Crossings
Wolf Creek

Completed low water crossing at West Fork, Wolf Creek on BLM lands

Building low water crossing on Wolf Creek Ranch

Moncrief Ranch Manager inspects drift fences built to prevent livestock trailing in meadows

CNHP, BLM & USFS establish vegetation monitoring transects & photo-points



Bill Zeedyk establishes geomorphological monitoring to track sediment deposition from structures

Preliminary Results

Vegetation Monitoring Control (no treatment) Spring, Wolf Creek Ranch

September 10, 2012

July 31, 2013

Renee Rondeau, CNHP

Wolf Creek Ranch Media Luna #43:
Left: during construction in Oct. 2012
Right: 10 months later in Aug. 2013

October 2012

Betsy Neely

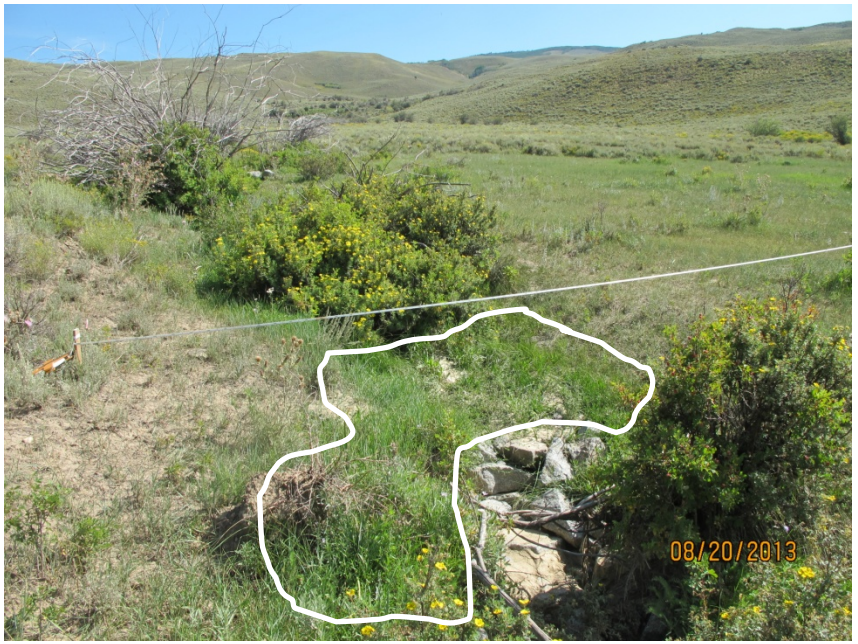
August 2013

Renee Rondeau, CNHP

Redden Ranch
One Rock Dam on Ephemeral Stream

Bare ground and litter occupied 41% in 2012

The white polygon represents the area that will be impacted by the one rock dam



Bare ground and litter occupied 6% in 2013

The white polygon represents the area impacted by the one rock dam after one year

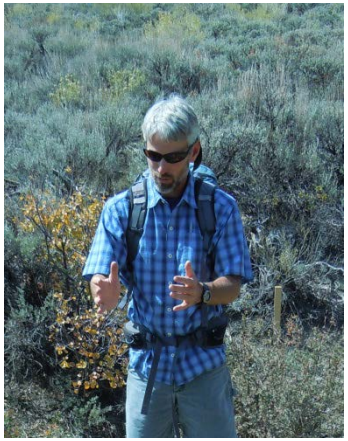
Renee Rondeau, CNHP, GRT49PP

Project Team

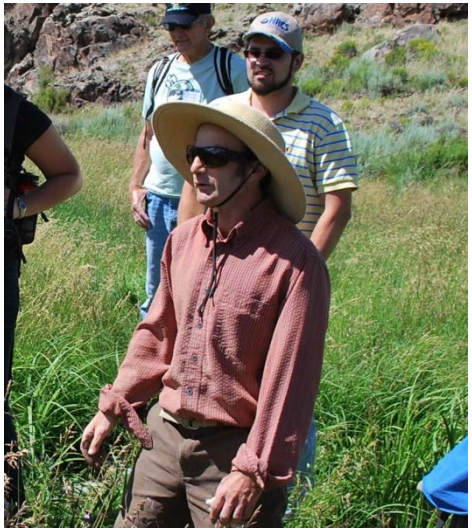
Renee Rondeau-CNHP

Gay Austin, BLM

Jim Cochran, Gunnison CO



Pat Magee, WSCU



Andrew Breibart, BLM,

Nate Seward, CPW (blue shirt)

Matt Vasquez, USFS

Bill Zeedyk, Zeedyk Ecological Consulting

Project Team, continued

Jonathan Coop, WSCU

Liz With , NRCS

Betsy Neely, TNC, Bill Zeedyk, & Brett Redden, Rancher

Christina Santana, NRCS

Ken Stahlnecker, NPS

Special Thanks to Brett Redden, Rufus Wilderson & Ted Harter!