MONTANA DEPARTMENT OF TRANSPORTATION
STREAM MITIGATION MONITORING REPORT

Little Rock Creek at Judith Slide Repair
Fergus County, Montana

Project Completed: 2013
Monitoring Report #1: December, 2014

Prepared for:

MONTANA MDT DEPARTMENT OF TRANSPORTATION
2701 Prospect Ave
Helena, MT 59620-1001

Prepared by:

CONFLUENCE
PO Box 1133
Bozeman, MT 59771-1133

MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #1:

YEAR 2014

Little Rock Creek at Judith Slide Repair
Fergus County, Montana

MDT Project Number: STPS 426-2(12) 15
Control Number: 7726000

SPA# MDT-R4-55-2012
USACE Permit No.: NOW-2011-01136-MTB

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Ave
Helena, MT 59620-1001

Prepared by:

Confluence Consulting, Inc.
P.O. Box 1133
Bozeman, MT 59771

December 2014

CCI Project No: MDT_.007

TABLE OF CONTENTS

TABLES AND FIGURES

APPENDICIES

Cover Photo: Little Rock Creek looking north (downstream) at the Judith Slide Repair site in 2014.

1.0 INTRODUCTION

As part of an emergency roadway repair, the Montana Department of Transportation (MDT) realigned a segment of Secondary Highway 426 (also known as S-426 or Hanover Road), around a land slide to provide a stable, paved roadway through the area and reduce annual road maintenance requirements. Due to the new road alignment, modification to a segment of Little Rock Creek, a tributary to the Judith River, was also necessary. This channel modification was approved by the U.S. Army Corps of Engineers, and does not require compensatory mitigation for stream impacts.

Although compensatory mitigation is not required, MDT requested monitoring of the reconstructed segments of Little Rock Creek to evaluate whether the stream restoration and revegetation techniques were successful in generating a stable, well vegetated channel with variable habitat elements. The following report provides the results of the first year of monitoring along this segment of Little Rock Creek. This project was constructed in 2013, therefore, these results provide documentation of the site's condition one year following the project's completion.

Specific project objectives outlined in the joint permit application for Little Rock Creek included:

- Removal of a 163" x 120" structural steel plate pipe and placement of a 12' x 12' reinforced concrete box culvert approximately 222 feet long to provide fish passage.
- Control spring seepage via interceptor trenches and slope armoring to route water into nearby ditches and culvert.
- Constructing 536 feet of new stream channel within the reclaimed segment of the former highway alignment.

Results of the first year monitoring at the Judith Slide Repair site are provided in Section 4, while Section 5 provides additional site observations that were not captured by the monitoring protocols. Additional reporting requirements including a topographic survey of the project site, a longitudinal profile, survey results at four perpendicular transects, a planting schematic from the design, photo documentation of the project site, and maps indicating the endpoints of riparian belt transects, perpendicular transect surveys and locations of noxious weed infestations are included as Appendices to this report.

2.0 SITE LOCATION

The project site is located near Lewistown in the NE ¼ NE ¼ of Section 27, Township 16 North, Range 16 East, and the NW ¼ NW ¼ of Section 26, Township 16 North, Range 16 East, in Fergus County, Montana (Figure 1).

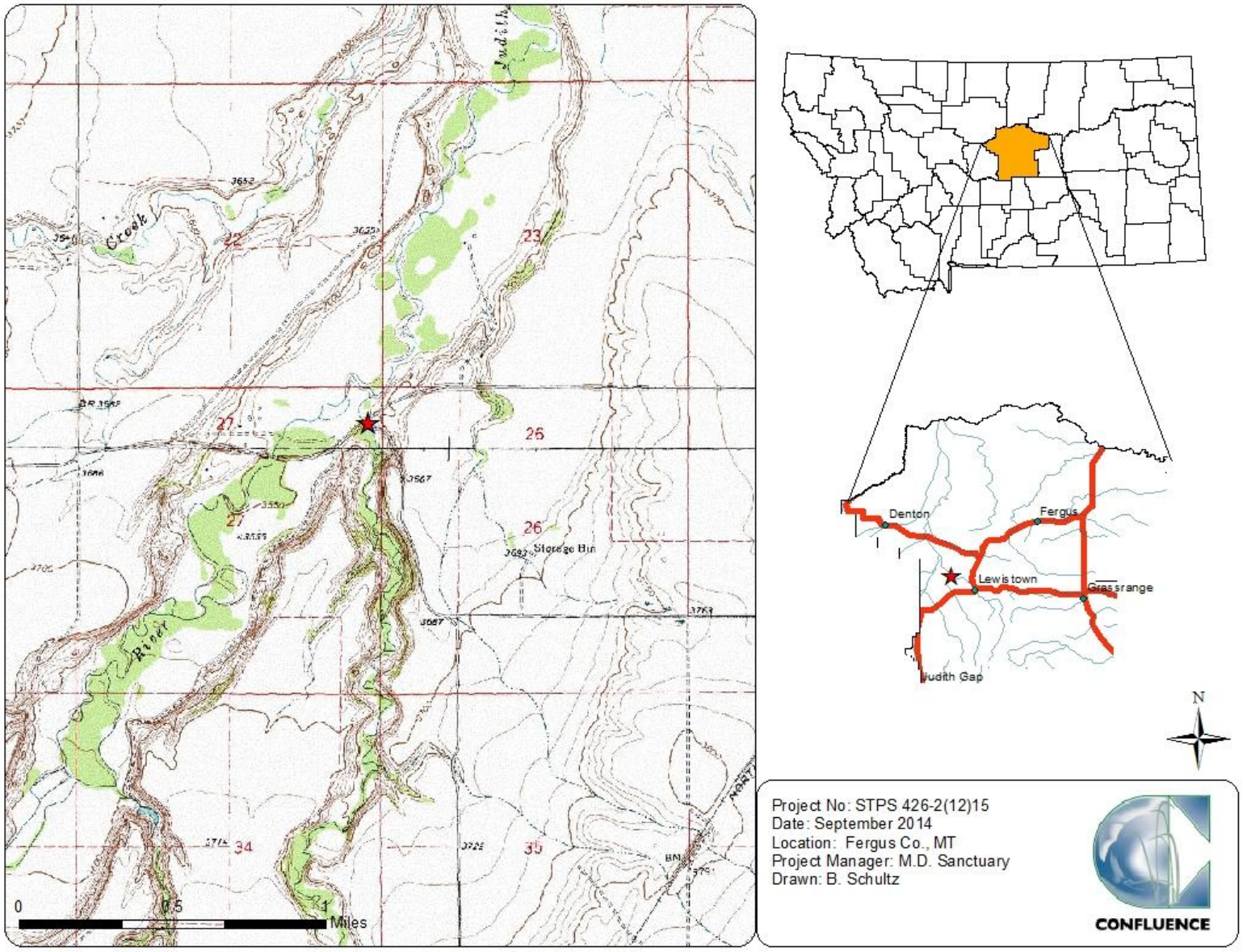


Figure 1. Project location of the Judith Slide Repair site.

3.0 MONITORING METHODS

Monitoring field crews visited the project site on July 29, 2014 while survey crews visited the site on August 12, 2014. The following data were collected at the Judith Slide Repair site:

3.1. Vegetation Inventories and Community Mapping

Two riparian belt transects were established; one on each side of the stream channel. The riparian transect on the right (east) bank runs parallel to the channel for 203 feet, while the riparian transect on the left (west) bank is 192 feet long. GPS points were logged at riparian transect endpoints, and each endpoint of the riparian transects was marked to allow for relocation during subsequent monitoring events. Field data collection at each riparian transect included areal percent cover of total vegetation, woody vegetation, and noxious weeds within 25 feet of the stream channel.

A vegetation inventory was conducted along both stream banks, and included documenting dominant species presence, percent cover of each species, and a list of all plant species observed within three feet of the active channel. The streambank vegetation inventory was conducted along approximately 630 feet of each bank, and extended 3 feet from the active channel. Plant species identified along the stream banks were assigned a stability rating index based on Burton *et al*., 2011.

The project site was visually inspected to document the presence of noxious weeds. All noxious weed infestations were mapped on aerial photographs, with species, and extents noted. Observations of isolated noxious weeds were noted in the species lists, but not mapped.

Based on the vegetation surveys and visual inspections, dominant vegetation communities within the project area were mapped on aerial photos to document vegetative establishment within upland and riparian zones.

3.2. Bank Erosion Inventory

Both stream banks within the project reach were visually inspected to document eroding banks. Each eroding bank within the project reach was photo-documented. Data collected at each eroding bank included bank length and potential causes of bank erosion.

3.3. Channel Surveys

Four perpendicular transects (cross sections) were surveyed; two at riffles and two at pools. Endpoints of each transect were marked with a pin, flagging, or stake for locating during subsequent monitoring events. Horizontal bank pins were placed on the left and right banks of the channel to allow for subsequent surveying at each transect to document any vertical or lateral adjustments. A longitudinal profile of the channel thalweg was surveyed to document bedform complexity and aquatic habitat conditions.

3.4. Photo-Documentation

The project site was photographed from several locations to document vegetation establishment and stream bank conditions within the project site. All sites selected for photo-documentation were recorded on field maps with headings noted to allow for repetition during subsequent monitoring years. Additional photos were taken facing upstream, downstream, left and right from the center of the channel, and at the endpoints of each perpendicular transect.

3.5. Wildlife Documentation

Wildlife use of the project reach was documented by creating a list of all bird, mammal, and herpetile species observed during the site visit. Wildlife species were identified through visual observation, scat, tracks, and observation of nests, burrows, dens, feathers, etc.

4.0 RESULTS

4.1. Riparian and Streambank Vegetation Inventory

Table 1 summarizes the areal percent cover of total vegetation, woody vegetation, and noxious weeds observed along each riparian and streambank transect. In 2014, the total percent cover was 58%, with 7% woody coverage and 42% bare ground. Noxious weeds comprised less than 1% of the project area.

Table 1. Percent cover of vegetation transects at the Judith Slide Repair site in 2014.

Belt Transect	Length (ft)	Total % Vegetation Cover	% Woody Cover	% Noxious Weed Cover
Right (East) Riparian	203	60%	0%	0%
Left (West) Riparian	192	50%	0%	0%
Riparian Subtotal		55%	0%	0%
Right (East) Stream bank	630	65%	47%	1%
Left (West) Stream bank	630	65%	47%	1%
Stream bank Subtotal		65%	47%	1%
Area Weighted Total		58%	7%	0.24%

Table 2 is a comprehensive list of 52 plant species observed during the initial monitoring event in 2014. Of the 52 plants observed, 22 (42%) were considered hydrophytic based on the 2014 National Wetland Plant List (NWPL) (Lichvar *et al*., 2014).

Table 2. Comprehensive list of plant species observed at the Judith Slide Repair site in 2014.

Scientific Name	Common Name	WMVC Indicator Status*
Achillea millefolium	Common Yarrow	FACU
Agastache urticifolia	Nettle-Leaf Giant-Hyssop	FACU
Algae, green	Algae, green	NL
Bromus japonicus	Japanese Brome	NL
Calamagrostis sp.	Reed Grass	NL
Carduus nutans	Nodding Plumeless-Thistle	UPL
Carex sp.	Sedge	NL
Chenopodium album	Lamb's-Quarters	FACU
Cirsium arvense	Canadian Thistle	FAC
Cynoglossum officinale	Gypsy-Flower	FACU
Descurainia sophia	Herb Sophia	NL
Elymus hispidus	Intermediate Wheatgrass	NL
Elymus repens	Creeping Wild Rye	FAC
Epilobium ciliatum	Fringed Willowherb	FACW
Euphorbia esula	Leafy Spurge	NL
Glyceria striata	Fowl Manna Grass	OBL
Helianthus annuus	Common Sunflower	FACU
Hordeum jubatum	Fox-Tail Barley	FAC
Kochia scoparia	Mexican Kochia	NL
Lactuca serriola	Prickly Lettuce	FACU
Lepidium latifolium	Broad-Leaf Pepperwort	FAC
Matricaria discoidea	Pineapple-Weed	FACU
Medicago lupulina	Black Medick	FACU
Medicago sativa	Alfalfa	UPL
Melilotus albus	White Sweetclover	NL
Melilotus officinalis	Yellow Sweet-Clover	FACU
Mentha arvensis	American Wild Mint	FACW
Myriophyllum sp.	Water-Milfoil	NL
Nasturtium officinale	Watercress	OBL
Onopordum acanthium	Scotch Thistle	NL

*Based on 2014 NWPL (Lichvar *et al*., 2014)

Table 2 (Continued). Comprehensive list of plant species observed at the Judith Slide Repair site in 2014.

Scientific Name	Common Name	WMVC Indicator Status*
Pascopyrum smithii	Western-Wheat Grass	FACU
Persicaria amphibia	Water Smartweed	OBL
Persicaria maculosa	Spotted Lady's-Thumb	FACW
Persicaria sp.	Smartweed	NL
Phalaris arundinacea	Reed Canary Grass	FACW
Poa palustris	Fowl Blue Grass	FAC
Poa pratensis	Kentucky Blue Grass	FAC
Polypogon monspeliensis	Annual Rabbit's-Foot Grass	FACW
Populus angustifolia	Narrow-Leaf Cottonwood	FACW
Prunus virginiana	Choke Cherry	FACU
Rumex acetosa	Garden Sorrel	FAC
Rumex crispus	Curly Dock	FAC
Rumex fueginus	Tierra del Fuego Dock	FACW
Salix exigua	Narrow-Leaf Willow	FACW
Scirpus microcarpus	Red-Tinge Bulrush	OBL
Sinapis arvensis	Corn Mustard	NL
Solidago canadensis	Canadian Goldenrod	FACU
Sonchus arvensis	Field Sow-Thistle	FACU
Symphoricarpos albus	Common Snowberry	FACU
Thlaspi arvense	Field Pennycress	UPL
Urtica dioica	Stinging Nettle	FAC
Veronica americana	American-Brooklime	OBL

*Based on 2014 NWPL (Lichvar *et al*., 2014)

Dominant species recorded along the riparian and stream bank transects were combined with visual observations in other areas to develop a vegetation community map (Figure 3, Appendix A). The primary plant species within the riparian zone are lamb's-quarter (*Chenopodium album)* and field pennycress (*Thlaspi arvense*), which occur above the coir encapsulated soil lifts. The space between the streambank transect and the upper coir layer was predominantly bare ground. Four vegetation community types were observed on site in 2014 (Figure 3, Appendix A) including:

Type 1: *Salix exigua / Phalaris arundinacea* Community
Type 2: *Elymus spp*. Community
Type 3: Bare Ground / *Salix exigua* Community
Type 4: *Chenopodium album / Thlaspi arvense* Community

4.2. Stream Bank Vegetation Inventory

During the initial monitoring event in 2014, 29 species were observed along the banks of Little Rock Creek (Table 3). Stability ratings were assigned to each species observed to determine overall bank stability. Stability ratings are based on a scale ranging from 1 to 10, and indicate a plant's ability to resist erosive forces based on root characteristics (Winward, 2000). Of the 29 plants observed, 17 have plant stability indices provided by Burton *et al*., while the remaining 12 do not. Scores for plants without stability indices are listed in Table 3 as N/A. Three of the 17 species (18%) having assigned stability indices scored 6 or higher. The dominant species observed along the banks were reed canary grass and narrow-leaf willow, which have a stability index of 9 and 5 respectively. Reed canary grass and narrow-leaf willow account for greater than 50% of the vegetative cover along the banks.

Table 3. Comprehensive list of plant species and accompanying stability index values (from Burton *et al*., 2011) for Little Rock Creek at the Judith Slide Repair site in 2014.

Streambank Species	Left Bank Upstream	Left Bank Downstream	Right Bank Upstream	Right Bank Downstream	WMVC Indicator Status**	Stability Index
*Phalaris arundinacea**	X	X	X	X	FACW	9
Scirpus microcarpus		X			OBL	8.5
Urtica dioica				X	FAC	8.5
Carex sp.			X	X	NL	5
Glyceria striata			X		OBL	5
*Salix exigua**	X		X		FACW	5
Veronica americana		X		X	OBL	5
Cirsium arvense			X	X	FAC	2
Cynoglossum officinale				X	FACU	2
Epilobium ciliatum	X		X		FACW	2
Euphorbia esula				X	NL	2
Melilotus albus	X		X		NL	2
Melilotus officinalis	X		X		FACU	2
Mentha arvensis			X		FACW	2
Nasturtium officinale		X		X	OBL	2
Poa palustris			X	X	FAC	2
Bare Ground	X	X	X	X	NL	1
Agastache urticifolia			X		FACU	N/A
Calamagrostis canadensis		X	X		NL	N/A
Chenopodium album		X		X	FACU	N/A
Lactuca serriola			X		FACU	N/A
Lepidium latifolium		X			FAC	N/A
Persicaria amphibia	X	X	X	X	OBL	N/A
Persicaria maculosa	X	X	X	X	FACW	N/A
Polypogon monspeliensis		X			FACW	N/A
Rumex acetosa		X			FAC	N/A
Rumex fueginus	X	X	X	X	FACW	N/A
Sonchus arvensis	X	X			FACU	N/A
Thlaspi arvense		X		X	UPL	N/A

4.3. Noxious Weed Inventory

Four Montana State-listed noxious weeds were observed within the reconstructed segment of Little Rock Creek (Table 4). Leafy spurge (*Euphorbia esula*) infestations observed are shown on Figure 3 in Appendix A. Weeds that were observed in trace amounts were not mapped. The combined cover of all four noxious weeds identified in 2014 was less than 1%. It should be noted that leafy spurge infestations were documented both up and downstream of the reconstructed stream channel.

Table 4. Montana State-listed noxious weeds identified at the Judith Slide Repair site in 2014.

Category*	Scientific Name	Common Name
Priority 2B	*Cirsium arvense*	Canadian Thistle
	Cynoglossum officinale	Gypsy-Flower
	Lepidium latifolium	Broad-Leaf Pepperwort
	Euphorbia esula	Leafy Spurge

*Based on the MSU Extenstion Services' Noxious Weed List, 2013

4.4. Bank Erosion Inventory

No eroding stream banks were identified at the Judith Slide Repair site in 2014. All stream banks were intact.

4.5. Perpendicular Transects

Two transects were surveyed at pools and two at riffles, with maximum depth and bankfull width for each indicated in Table 5. These results indicate variability in channel dimensions, with maximum depths ranging from 4.4 to 5.7 feet and widths ranging from 20.1 to 24.0 feet. The range of channel widths and depths observed by these transects indicates the establishment of variable habitat elements throughout the stream reach. Bankfull channel design depth along the reconstructed channel length was approximately 4.0 feet (Channel Change Typical Section Detail, Sheet 12), including the meandering v-ditch for low flows. These results, coupled with visual observations of the channel during low flows indicated the reconstructed channel segment provides good pool habitat features for fish in the form of outside meander bends and scour over the grade control features. The depth of these pools provide slow moving holding water for fish, and refuge from predators beneath undercut banks.

Table 5. Pool and riffle width and depth at Little Rock Creek stream mitigation site in 2014.

Transect	Type	Maximum Depth (ft)	Bankfull Width (ft)
		2014	2014
1	riffle	4.4	21.9
2	pool	5.2	24.0
3	riffle	4.4	21.0
4	pool	5.7	20.1
Average Riffles		**4.4**	**21.5**
Average Pools		**5.5**	**22.1**

4.6. Longitudinal Profile

The longitudinal profile of the channel thalweg reveals the presence of several pool features within the reconstructed channel segment, which are forming by a) scour against the outside meander bends, and b) plunging over rock weirs constructed across the channel width. The weir drop immediately downstream of the culvert appears to have filled in with a mix of gravel, sand, and silts following the most recent high flow event. Sediment deposition along the channel fringes immediately downstream of the culvert has also narrowed the channel to a width more closely matching the designed channel.

4.7. Wildlife Documentation

Four bird, two mammal, four fish, and one reptile species were observed in 2014 (Table 6). Several cows were grazing within the project reach during the monitoring event. Three identified fish species were observed, including brown trout, mountain whitefish, and sculpin. A fourth fish species was observed but not identified, and may have been a red shiner or dace, which are commonly found in the Judith River.

Table 6. Wildlife species observed at the Judith Slide Repair site in 2014.

Common Name	Scientific Name
Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Swallow sp.	*Tachycineta sp.*
Western Kingbird	*Tyrannus verticalis*
Mammals	
Cow	*Bovine sp.*
Deer (tracks)	*Odocoileus sp.*
Mink (tracks)	*Neovison vison*
Fish	
Brown Trout	*Salmo trutta*
Fish sp.	
Mountain Whitefish	*Prosopium williamsoni*
Sculpin	*Cottus sp.*
Reptiles	
Garter Snake	*Thamnophis sp.*

5.0 ADDITIONAL OBSERVATIONS

The first monitoring visit at this site occurred less than one year after completion of the project and after the first high flow event. The following is a list of additional observations made during the site visit.

1. Flood debris was observed along the upper banks and above the coir fabric, indicating the site was subject to a sizable discharge following construction.

Many creeks and ephemeral drainages in this region of Montana experienced large flood events during the spring of 2014, which were primarily attributed to low elevation snowmelt. Despite these discharges, the reconstructed segment of Little Rock Creek appears stable, with no significant lateral erosion or vertical head cuts noted. Stream bed material placed beneath the coir fabric along the outside of the meander bend (STA 11+25 to 11+75 on Figure 2, Appendix A) was subject to scouring forces during the flood event, and the lower layers of coir fabric have slumped into the void created by the transported bed material (see Photo 2, Appendix C). This has resulted in formation of an undercut bank with willow shoots growing above the lowest layer of coir.

2. Gravel deposition was observed at the downstream ends of the pools formed by scouring against the outside meander bends. In both instances, gravels deposited just upstream of a rock weir, and appear to be suitable for spawning.

3. All coir lifts appeared to be built using a single layer of fabric, with installation of a coir log along the leading edge of the lower two lifts. The relatively large mesh size of the coir fabric may allow for finer sized fill material (silt, clay, sand, fine gravel) to wash out from within the soil lift. Although the removal of materials from within the coir lifts was not observed along this project site, it has been observed in other projects, and is cause for banks to slump, sag, and drop in elevation.

4. Livestock grazing was evident within the project site, and livestock currently have access to the project area downstream of the new culvert. Livestock grazing may influence the successful establishment of vegetation within the riparian and upland areas of the project reach; however, the relatively steep bank slopes will likely prevent livestock from browsing the willow cuttings and vegetation establishing on the lower banks.

5. A “basin pool” was constructed immediately downstream of the new culvert, which incorporated a wider channel width, riprapped stream banks, and a weir drop at the culvert outlet. This pool filled in with stream bed material following the first year’s flood event. Several other pools were observed throughout the reconstructed channel segment; therefore, the lack of pool formation at this location is not problematic for overall habitat complexity. This pool may not have been successful due to:

    a. The invert elevation of the culvert outlet (3551.29’) matches that of the elevation of the downstream riffle, providing no gradient through the pool feature.
    b. The channel through this pool is straight, and otherwise has no features to generate scouring forces against.
    c. Channel width through this pool increases from 12’ at the culvert outlet to 44’ at the downstream riffle crest. Channel width then transitions back to 19’ as it enters the reconstructed channel. The abrupt change in channel

width within a straight alignment encourages sediment deposition along the channel fringes, which was observed during the monitoring event.

6. Overall, the site indicated relatively good plant establishment during the first growing season. Riparian and stream bank transects contained less than 50% bare ground overall and willow establishment along the stream banks indicated good survival of willow sprigs. Vegetation observed on the upper banks and riparian zones was primarily *Chenopodium album* and *Thlaspi arvense*. These species are primary succession plants and will likely phase out as other plant communities begin to establish. Of note, the design specified installing salvaged 6" thick wetland soil and wetland seed mix on the overbank slopes between the top of the coir lifts and the existing ground. This area lies roughly between 3 and 3.5 feet above the low water elevation, and will not likely support wetland species.

7. Placement of rocks within the new culvert provides variability in habitat and water velocities, and should be suitable for migratory fish wishing to move further upstream in Little Rock Creek. Fish were observed at the downstream end of the culvert; however, it was too dark to observe whether fish were utilizing the boulder habitat features within the culvert.

8. Although no observations of significant grade adjustments or head cuts were observed at the transition to the new channel, inspection of the longitudinal profile (Appendix B) indicates the reconstructed channel segment between STA 1250 and 1380 (at the downstream end of the reconstructed channel) is flatter than the overall grade of the surveyed channel segment. Gravel deposits were observed at the transition point between the reconstructed and original channel, which may be as a result of the flatter bed slope in this area. Photo point 5.3 on Page 3 of Appendix C shows these gravel deposits.

9. Leafy spurge was the only established weed observed; all other weed species were primarily singular plants. This species was noted upstream and downstream of the reconstructed stream project. Weeds should be closely monitored and steps should be taken by MDT and the local weed district to manage communities should they become established.

6.0 LITERATURE CITED

Burton, T.A., S.J. Smith, and E.R. Cowley. 2011. Riparian area management: Multiple indicator monitoring (MIM) of stream channels and streamside vegetation. Technical Reference 1737-23.BLM/OC/ST-10/003+1737. U.S. Department of the Interior, Bureau of Land Management, National Operations Center, Denver, CO. 155 pp.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. *The National Wetland Plant List. 2014 Update of Wetland Ratings*. Phytoneuron 2014-41:1-42.

Montana Department of Transportation, 2008. Montana Wetland Assessment Method. Helena, Montana.

Montana State University Extension website. Accessed in September 2014 at http://www.msuextension.org/invasiveplantsMangold/noxioussub.html

Winward, 2000. Monitoring the Vegetation Resources in Riparian Areas. Gen. Tech. Report RMRS-GTR.47. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station

Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Little Rock Creek at Judith Slide
Flathead County, Montana

CONFLUENCE
consulting incorporated

Legend

- Photo Points
- Riparian and Perpendicular Transect Endpoints
- Channel Thalweg
- Major Station (100')
- Minor Station (25')
- Pool and Riffle Transects
- Riparian Transects

2014 Monitoring
Judith Slide

Figure 2

Date: 11/13/2014

X:/MDT_.007/mains

CONFLUENCE
consulting incorporated

Legend

- Project Boundary
- Vegetation Community Boundary
- Channel Centerline
- Euphorbia esula
- 1 Salix/Phalaris Community
- 2 Elymus Community
- 3 Bare Gound/Salix Community
- 4 Chenopodium/Thlaspi Community

2014 Monitoring
Judith Slide

Figure 3

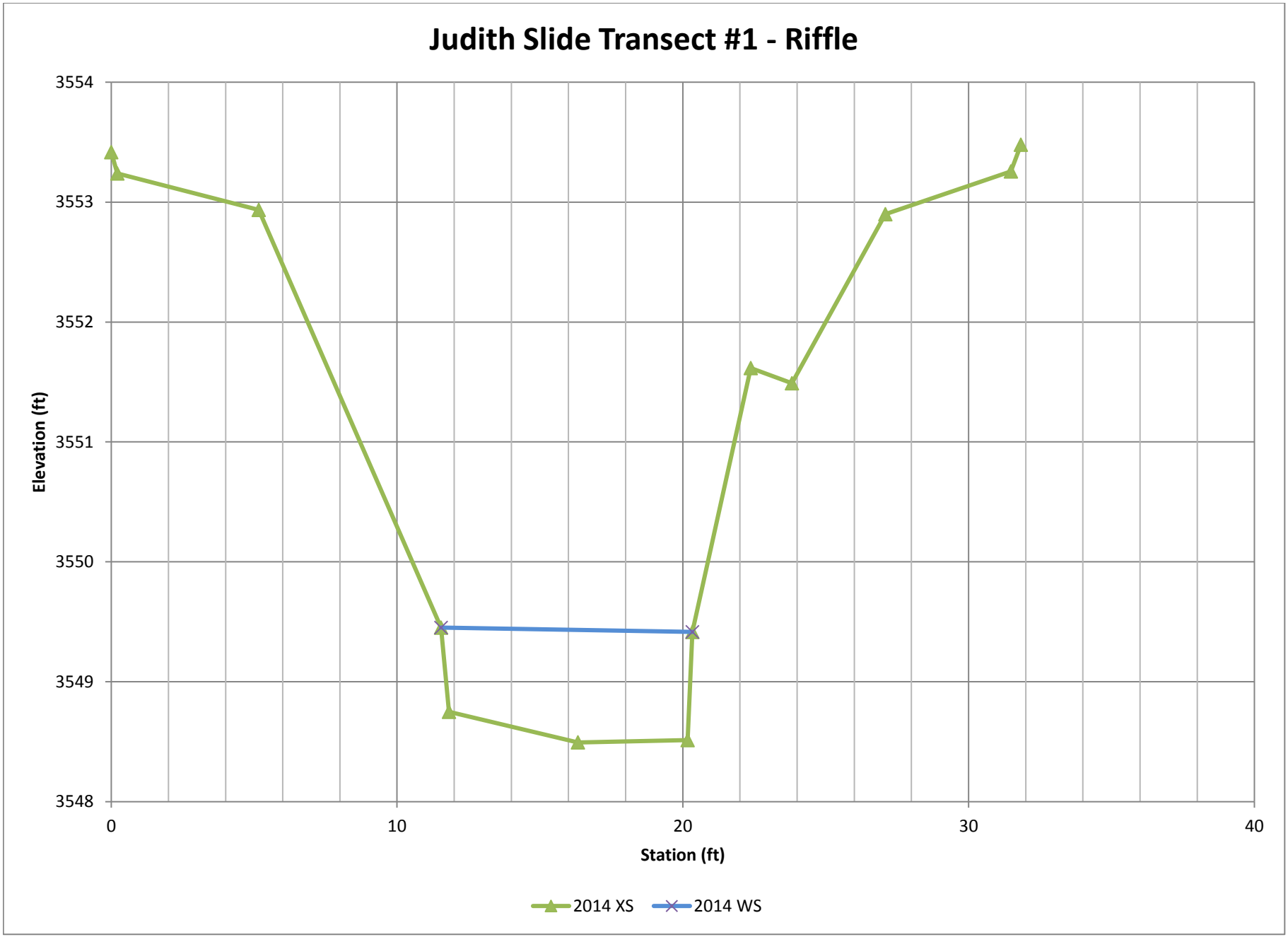
Date: 11/13/2014

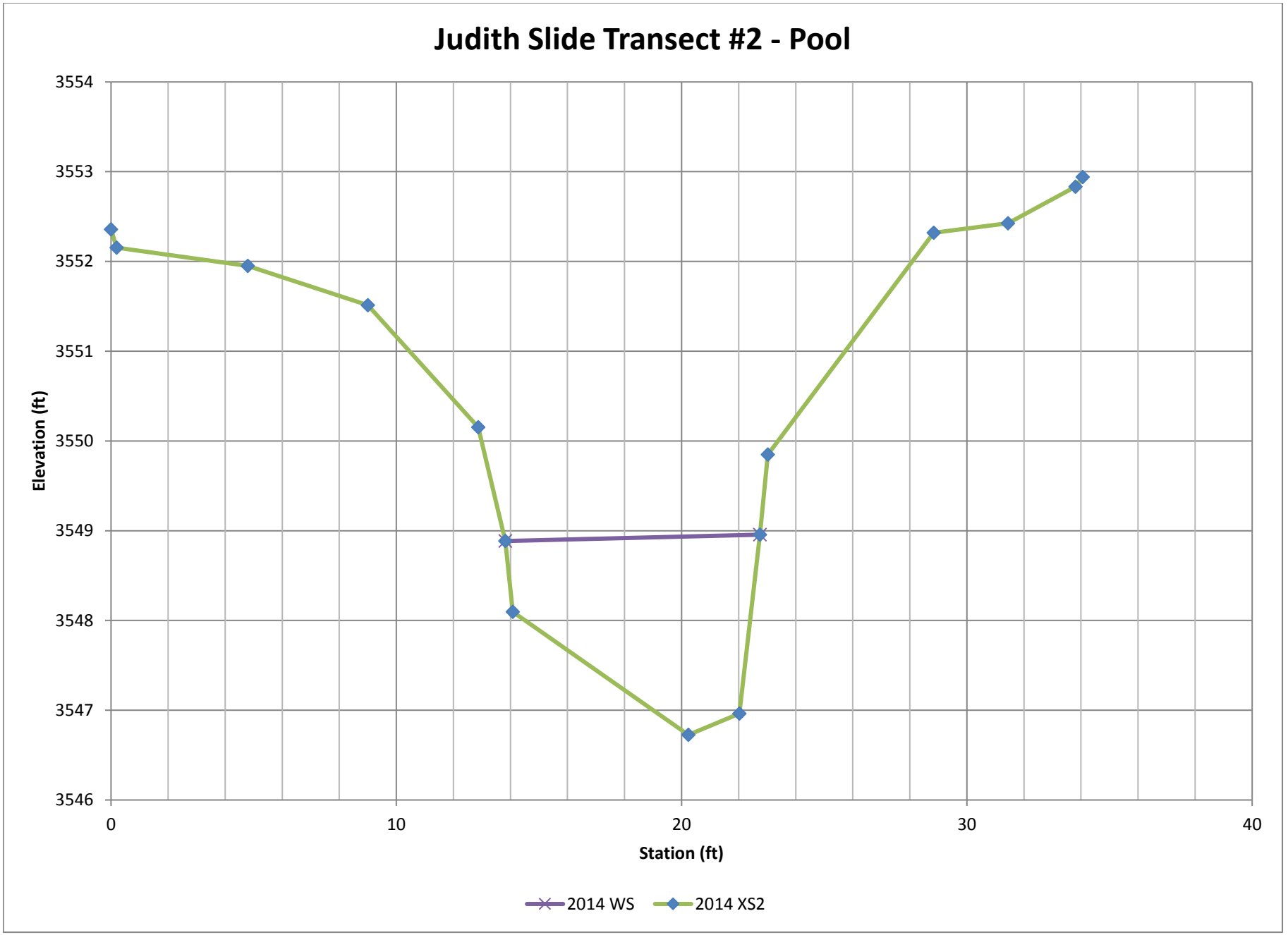
X:/MDT_.007/mains

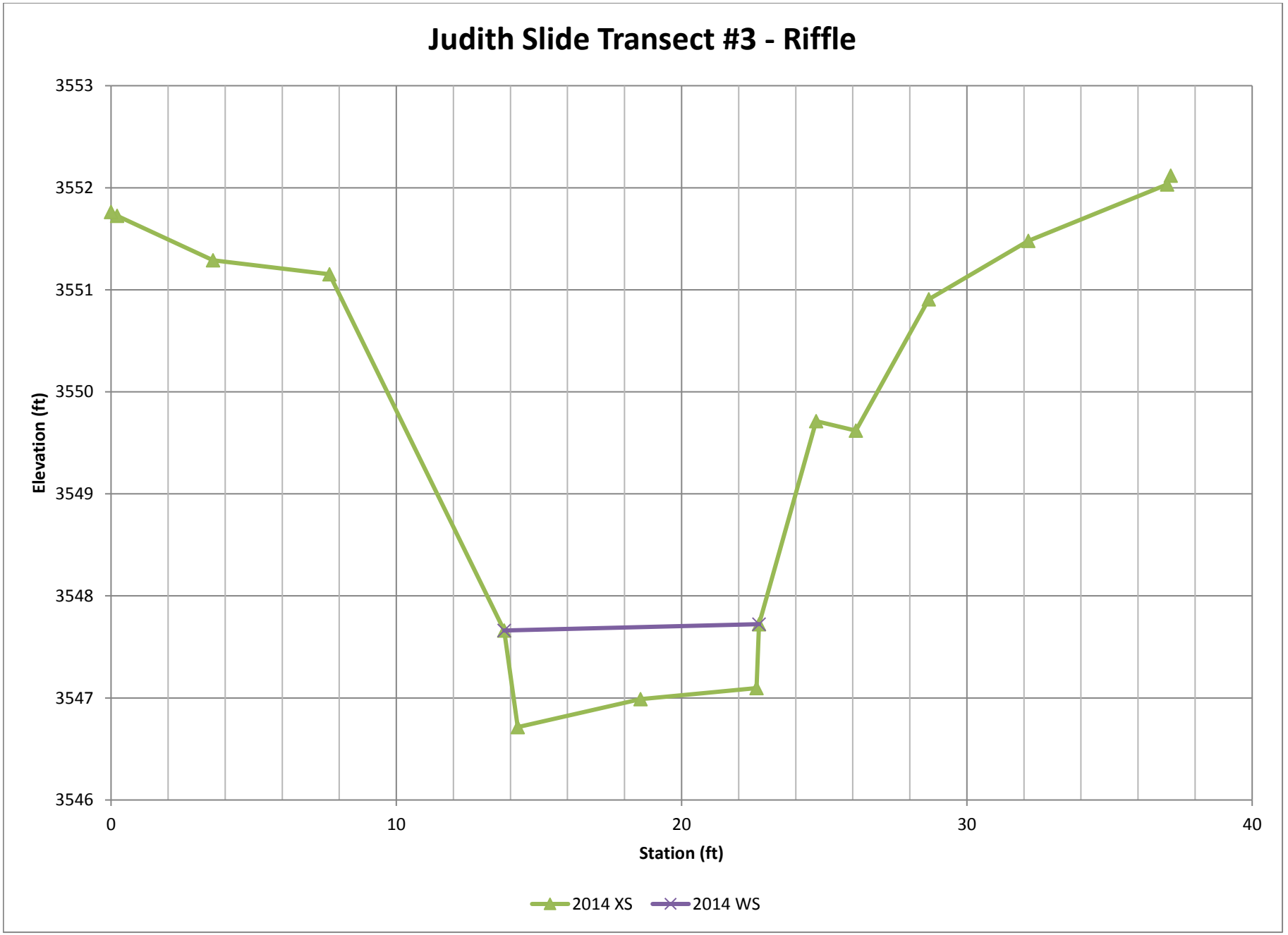
Appendix B

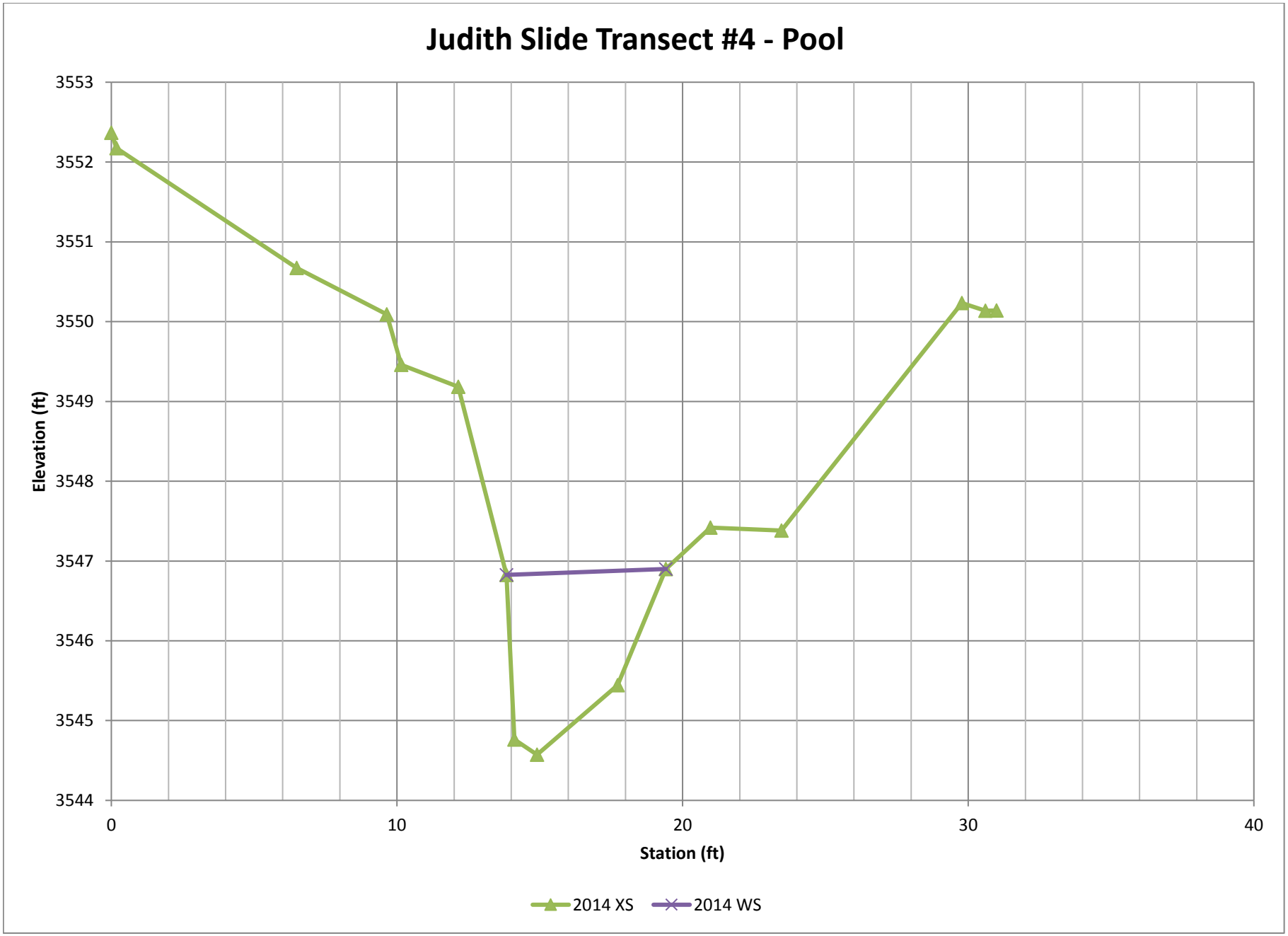
Perpendicular Transect Plots and Longitudinal Profile

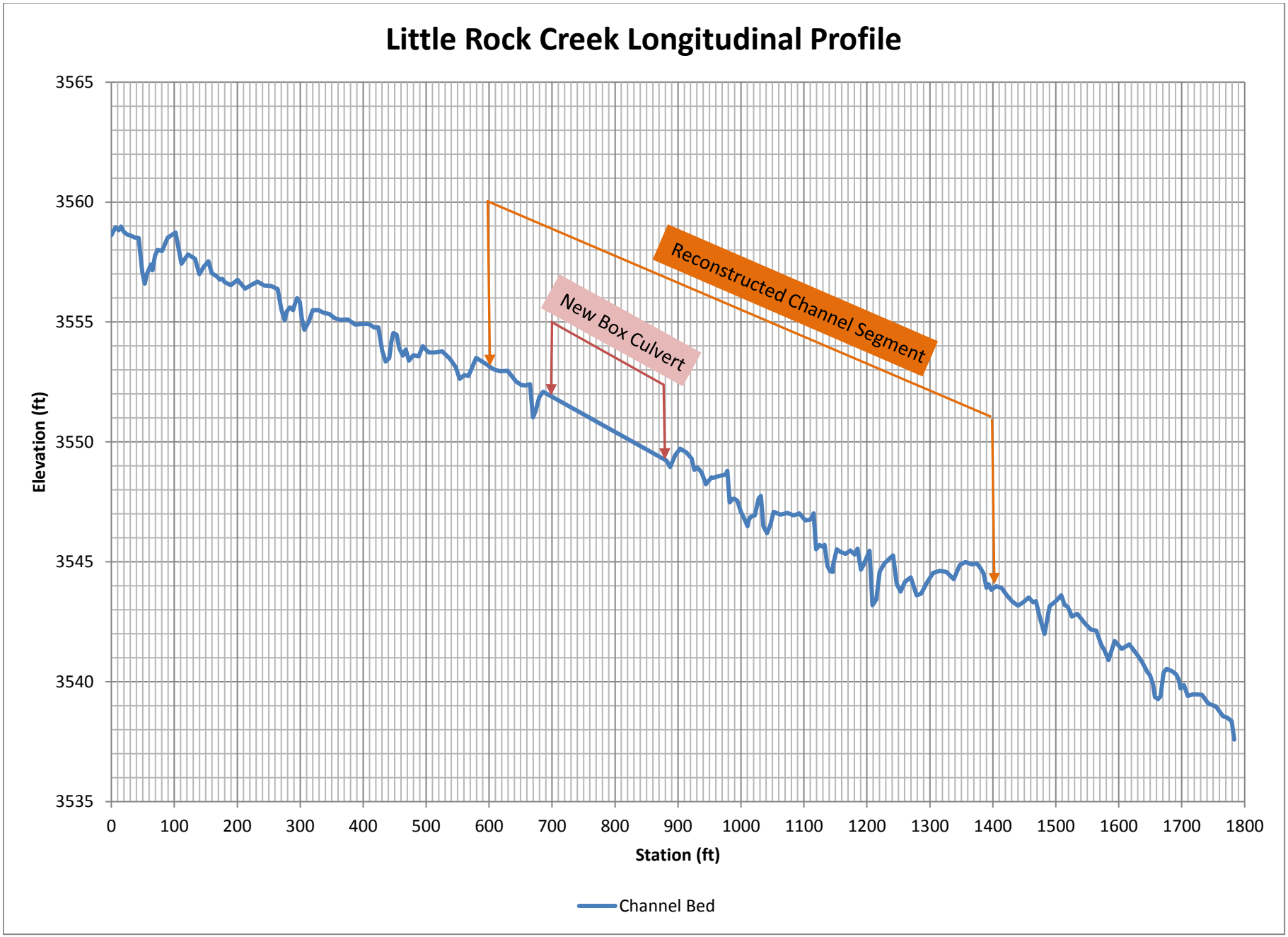
MDT Stream Mitigation Monitoring
Little Rock Creek at Judith Slide
Flathead County, Montana


Judith Slide Transect #1 - Riffle
3554
3553
3552
3551
3550
3549
3548
Elevation (ft)
0
10
20
30
40
Station (ft)
2014 XS
2014 WS


Judith Slide Transect #2 - Pool
Elevation (ft)
3554
3553
3552
3551
3550
3549
3548
3547
3546
0
10
20
30
40
Station (ft)
2014 WS
2014 XS2


Judith Slide Transect #3 - Riffle
3553
3552
3551
3550
3549
3548
3547
3546
Elevation (ft)
0
10
20
30
40
Station (ft)
2014 XS
2014 WS


Judith Slide Transect #4 - Pool
3553
3552
3551
3550
3549
3548
3547
3546
3545
3544
Elevation (ft)
0
10
20
30
40
Station (ft)
2014 XS
2014 WS


Little Rock Creek Longitudinal Profile
Elevation (ft)
3565
3560
3555
3550
3545
3540
3535
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Station (ft)
New Box Culvert
Reconstructed Channel Segment
Channel Bed

Appendix C

Project Area Photos

MDT Stream Mitigation Monitoring
Little Rock Creek at Judith Slide
Flathead County, Montana

PHOTO INFORMATION

PROJECT NAME: Judith Slide Repair

DATE: July 29, 2014 Monitoring Event

CONFLUENCE

Photo Point 1—2014
Description: Upstream end of project looking downstream. **Compass:** 0 (North)

Photo Point 2—2014
Description: Above culvert outlet, looking downstream.
Compass: 0 (North)

Photo Point 3.1—2014
Description: First bend in channel, looking upstream.
Compass: 180 (South)

Photo Point 3.2—2014
Description: Looking across channel at inside bend.
Compass: 225 (Southwest)

Photo Point 3.3—2014
Description: Looking downstream at left streambank.
Compass: 245 (West-Southwest)

Photo Point 3.4—2014
Description: Looking downstream at right streambank.
Compass: 270 (West)

PHOTO INFORMATION

PROJECT NAME: Judith Slide Repair

DATE: July 29, 2014 Monitoring Event

CONFLUENCE

Photo Point 4.1—2014
Description: Looking upstream.
Compass: 90 (South)

Photo Point 4.2—2014
Description: Looking upstream at right streambank.
Compass: 135 (Southeast)

Photo Point 4.3—2014
Description: Looking downstream.
Compass: 90 (East)

Photo Point 4.4 – 2014
Description: Looking downstream at left streambank.
Compass: 45 (Northeast)

Photo Point 5.1—2014
Description: Downstream end of project, looking up-stream. **Compass:** 180 (South)

Photo Point 5.2—2014
Description: Downstream end of project, looking at cattle crossing. **Compass:** 225 (Southwest)

PHOTO INFORMATION

PROJECT NAME: Judith Slide Repair

DATE: July 29, 2014 Monitoring Event

CONFLUENCE

Photo Point 5.3—2014
Description: Downstream end of project looking downstream. **Compass:** 270 (West)

Photo 1
Description: Rock weir 2, below culvert.

Photo 2
Description: Undercut bank with some sagging in coir lift. Gravel deposit on right point bar.

Photo 3
Description: Rock weir 4, below culvert.

Photo 4
Description: Rock weir 5, below culvert.

PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

PHOTO POINT 1 LOOKING DOWNSTREAM NORTH

PHOTO POINT 2 LOOKING DOWNSTREAM NORTH

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

PHOTO POINT 3 LOOKING UPSTREAM SOUTH

PHOTO POINT 3 LOOKING DOWNSTREAM WEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

PHOTO POINT 4 LOOKING UPSTREAM SOUTHEAST

PHOTO POINT 4 LOOKING DOWNSTREAM NORTHEAST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

PHOTO POINT 5 LOOKING UPSTREAM SOUTH

PHOTO POINT 5 LOOKING DOWNSTREAM NORTHWEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4 LT LOOKING DOWNSTREAM EAST

FENCE POST LOOKING UPSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4 RIGHT LOOKING UPSTREAM SOUTH

FENCE POST LOOKING DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T1 LEFT: LOOKING UPSTREAM SOUTH

T1 LEFT: LOOKING DOWNSTREAM NORTH

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T1 LEFT: LOOKING EAST TO T1 RIGHT

T1 RIGHT: LOOKING WEST TO T1 LEFT

T1: LOOKING UPSTREAM SOUTH FROM MIDDLE OF CREEK

T1: LOOKING DOWNSTREAM NORTH FROM MIDDLE OF CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T1 RIGHT: LOOKING UPSTREAM SOUTHWEST

T1 RIGHT: LOOKING DOWNSTREAM NORTH

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T2 LEFT: LOOKING UPSTREAM SOUTH

T2 LEFT: LOOKING DOWNSTREAM WEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T2 LEFT: LOOKING EAST TO T2 RIGHT

T2 RIGHT: LOOKING WEST TO T2 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T2: LOOKING UPSTREAM SOUTH FROM MIDDLE OF CREEK

T2: LOOKING DOWNSTREAM NORTHWEST FROM MIDDLE OF CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T2 RIGHT: LOOKING UPSTREAM SOUTH

T2 RIGHT: LOOKING DOWNSTREAM WEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T3 LEFT: LOOKING UPSTREAM SOUTHEAST

T3 LEFT: LOOKING DOWNSTREAM WEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T3 LEFT: LOOKING NORTH TO T3 RIGHT

T3 RIGHT: LOOKING SOUTH TO T3 LEFT

T3: LOOKING UPSTREAM SOUTHEAST FROM MIDDLE OF CREEK

T3: LOOKING DOWNSTREAM NORTHWEST FROM MIDDLE OF CREEK

T3 RIGHT: LOOKING UPSTREAM EAST

T3 RIGHT: LOOKING DOWNSTREAM WEST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4 LEFT: LOOKING UPSTREAM SOUTHEAST

T4 LEFT: LOOKING DOWNSTREAM NORTHEAST

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4 LEFT: LOOKING EAST TO T4 RIGHT

T4 RIGHT: LOOKING WEST TO T4 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4: LOOKING UPSTREAM SOUTHEAST FROM MIDDLE OF CREEK

T4: LOOKING DOWNSTREAM NORTHEAST FROM MIDDLE OF CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—JUDITH SLIDE

DATE: 8-12-14

T4 RIGHT: LOOKING UPSTREAM SOUTHEAST

T4 RIGHT: LOOKING DOWNSTREAM NORTHEAST

Appendix D

As-Built Topographic Survey

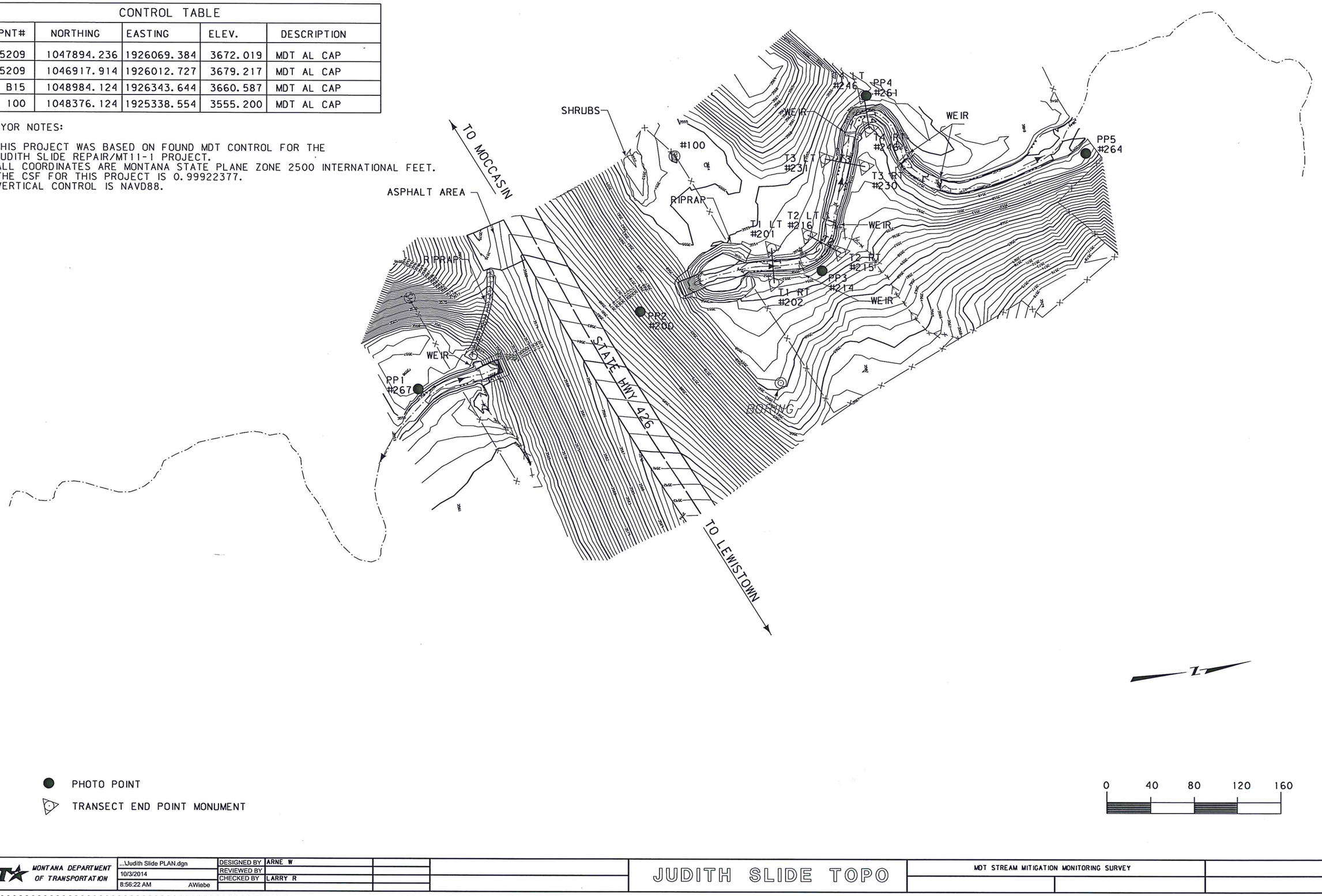
MDT Stream Mitigation Monitoring
Little Rock Creek at Judith Slide
Flathead County, Montana

CONTROL TABLE				
PNT#	NORTHING	EASTING	ELEV.	DESCRIPTION
A5209	1047894.236	1926069.384	3672.019	MDT AL CAP
B5209	1046917.914	1926012.727	3679.217	MDT AL CAP
B15	1048984.124	1926343.644	3660.587	MDT AL CAP
100	1048376.124	1925338.554	3555.200	MDT AL CAP

SURVEYOR NOTES:

1. THIS PROJECT WAS BASED ON FOUND MDT CONTROL FOR THE JUDITH SLIDE REPAIR/MT11-1 PROJECT.
   ALL COORDINATES ARE MONTANA STATE PLANE ZONE 2500 INTERNATIONAL FEET.
   THE CSF FOR THIS PROJECT IS 0.99922377.
   VERTICAL CONTROL IS NAVD88.

STAHLY ENGINEERING & ASSOCIATES
STAHLY
CIVIL ENGINEERS
STAHLY BUILDING
BILLINGS, MONTANA



● PHOTO POINT

TRANSECT END POINT MONUMENT

0 40 80 120 160

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\Judith Slide PLAN.dgn	DESIGNED BY	ARNE W		JUDITH SLIDE TOPO	MDT STREAM MITIGATION MONITORING SURVEY
2		10/3/2014	REVIEWED BY				
1		8:56:22 AM AWiebe	CHECKED BY	LARRY R			