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# MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

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*Clark Fork River  
Granite County, Montana*

*Project Completed: 2013  
Monitoring Report #2: December, 2014*



Prepared for:

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# **MONTANA DEPARTMENT OF TRANSPORTATION**

## **STREAM MITIGATION MONITORING REPORT:**

**YEAR 2014**

*Clark Fork River  
Granite County, Montana*

Permit No.  
MFWP: SPA MDT R2-14-2012  
USACE: NWO-2012-00831-MTH

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December 2014

CCI Project No: MDT\_.007

## TABLE OF CONTENTS

1.0	Introduction .....	1
2.0	Site Location .....	1
3.0	Monitoring Methods.....	3
4.0	Monitoring Results .....	3
4.1.	Bank Stability .....	3
4.2.	Woody Planting Establishment .....	3
4.3.	Vegetation Composition.....	4
4.4.	Photo Documentation .....	6
5.0	Comparison of Results to Performance Standards .....	6
5.1.	Woody Planting Survival.....	6
5.2.	Construction Details.....	7
6.0	Management Recommendations .....	7
7.0	Literature Cited .....	8

## FIGURES AND TABLES

Figure 1.	Project location of Clark Fork River bank stabilization site.....	2
Table 1.	Number of live and dead woody plant species observed along the Clark Fork River bank stabilization site in 2013 and 2014.....	4
Table 2.	Comprehensive list of plant species identified at the Clark Fork River site in 2013 and 2014.....	5
Table 3.	Montana State listed noxious weed species observed in 2014 at the Clark Fork River bank stabilization site.....	6
Table 4.	Performance results of Clark Fork bank stabilization project 2 years following construction.....	6

## APPENDICIES

Appendix A: Project Site Photos

Cover. View of Clark Fork River with riprap and willow plantings looking East (upstream).

## **1.0 INTRODUCTION**

The following report presents the second year of monitoring results of a bank stabilization project along the Clark Fork River approximately 24 miles west of Drummond, Montana. In 2013, the Montana Department of Transportation (MDT) requested authorization for placement of approximately 200 cubic yards of rip rap along 150 linear feet of the Clark Fork River to protect Interstate 90 from bank erosion. This report evaluates the monitoring results in comparison to project performance standards as required by the U.S. Army Corps of Engineers (USACE) in permit NW)-2012-00831-MTH.

The approved U.S. Army Corps 404 permit requires monitoring for three years post-construction, and outlines the following performance standards:

1. Minimum of 80 percent survival of plantings three years after planting.
2. Riprap must be covered with topsoil, seeded, and sprigged with willows above the ordinary high water mark.

Additional reporting requirements include:

1. Annual report detailing the extent of revegetation efforts and survival rates of plantings.
2. Photographs of the site prior to, during, and immediately following construction, as well as for three years post-construction, must be a part of the monitoring reports.

Inspection of the site in 2013 and again in 2014 provides the opportunity to determine whether the project is meeting, or moving toward the intended performance targets. The site will continue to be monitored for at least one more year to determine if any maintenance or modifications are required to meet all performance standards.

## **2.0 SITE LOCATION**

The project site is located north of the westbound lane of Interstate 90 between mile posts 137 and 138, and is 24 miles west of Drummond, MT. The site lies within Section 24, Township 11 North, Range 15 West, Granite County, Montana (Latitude: 46.170007°N; Longitude: -113.4392°W) (Figure 1).

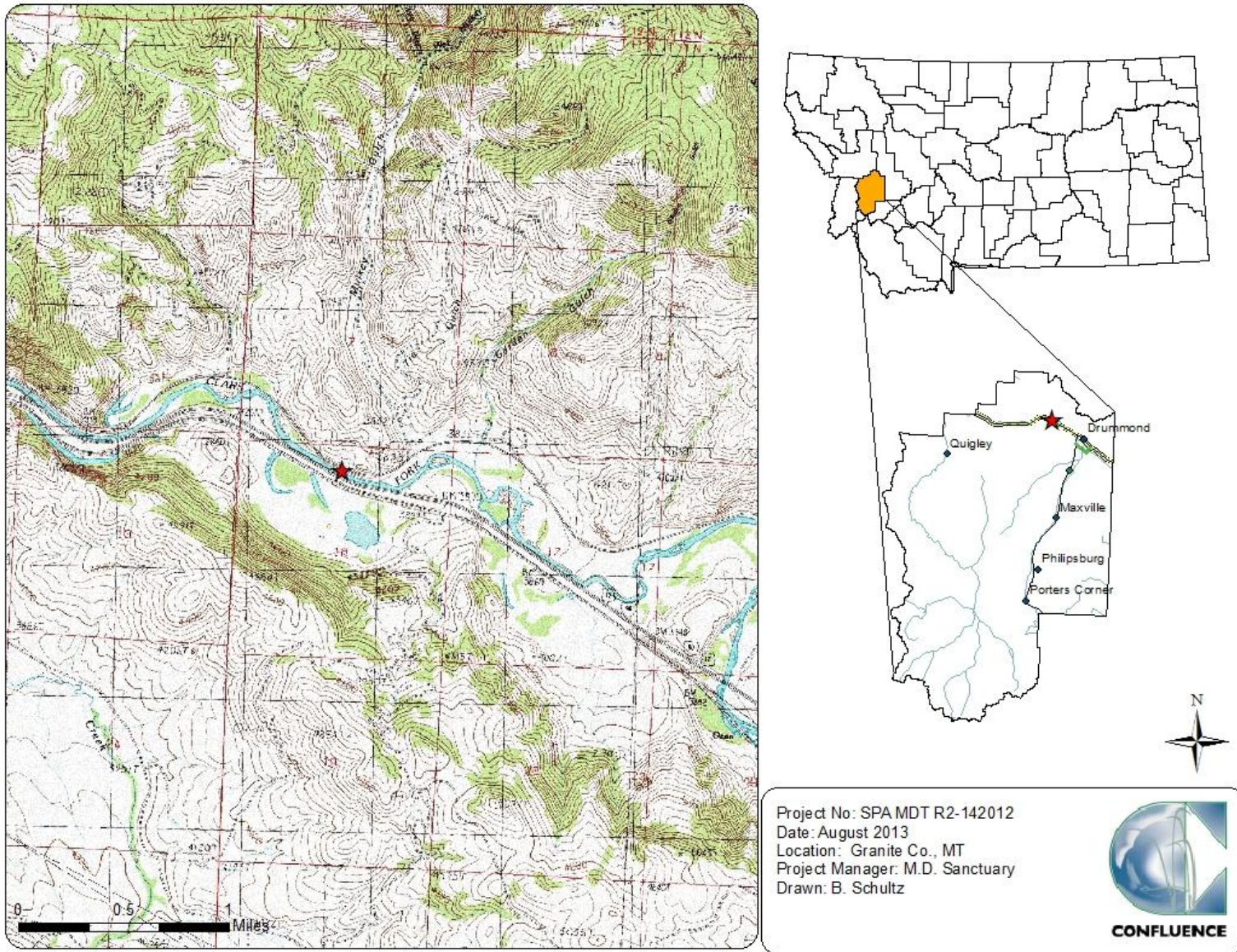


Figure 1. Project location of Clark Fork River bank stabilization site.

### **3.0 MONITORING METHODS**

The project site was inspected for the second year in July, 2014. Monitoring inspections included:

- Documenting the overall streambank stability,
- Recording the number of live and dead willow stems observed beneath and above the installed riprap,
- Documenting vegetation establishment throughout the site,
- Documenting any noxious and invasive species presence,
- Documenting site conditions by repeating photo points established in 2013.

### **4.0 MONITORING RESULTS**

#### **4.1. Bank Stability**

Inspection of the site in 2014 indicated minor shifting and movement of the smaller sized riprap installed on the bank, likely as a result of shear forces during spring runoff. Some of the smaller sized rock placed along the bank appeared to mobilize or slough, exposing some of the planted willow stems beneath the bank. All larger rock remained in place and overall, the bank remains stable. Placement of additional rock to maintain stability is not warranted at this time.

Bank erosion was observed just upstream of the riprapped bank in 2013. Monitoring in 2014 indicated the erosion extended approximately 15 feet further upstream and 3-4 feet laterally to the south (See Photo 7 in Appendix A). The upstream extend of the riprap has been keyed in approximately 15-20 feet further into the bank, and as a result, the erosion is not currently threatening to cut behind the riprap.

#### **4.2. Woody Planting Establishment**

Woody vegetation plantings included willow cuttings placed above and beneath the riprap. Willows installed beneath the riprap were placed vertically with the stems set in saturated substrate, then covered by a layer of soil and filter fabric. Rock was then placed on the fabric over the willow stems to secure the bank. This approach intended for willows to grow through the fabric and voids in the riprap, eventually establishing a vegetated bank. Additional willow cuttings were installed on the bank just above the riprap to serve as a buffer between the adjacent hill slope and the stabilized bank.

Willow stems approximately 36 inches tall were observed growing along the top of the riprap bank just above the uppermost layer of rock (See photos of willow establishment in Appendix A). These willows are approximately 24" taller than observed during the 2013 monitoring event, and indicate successful establishment. Dead willow stems were observed in 2013, but were not in 2014; presumably due to desiccation and decay two years following installation. Although no dead stems were observed in 2014, the number of dead stems estimated from 2013 has been included in the survival count to provide a more accurate result of survival (Table 1).

To date, willow cuttings planted beneath the riprap have largely been unable to successfully establish. Two willow stems were observed sprouting through the riprap, while an additional 50 dead stems were found in the voids between rock layers. It is possible some woody roots have established beneath the riprap and have yet to produce stems. Based on the total number of live and dead cuttings observed throughout the site, 85% of willow stems were successfully growing.

**Table 1. Number of live and dead woody plant species observed along the Clark Fork River bank stabilization site in 2013 and 2014.**

Year	Location	Total Plants Inspected	Surviving Plants	Plant Survival Rate
2013	Willows planted above riprap	345	260	75%
	Willows planted beneath riprap	0	0	N/A
	<b>Total - 2013</b>	<b>345</b>	<b>260</b>	<b>75%</b>
2014	Willows planted above riprap	275	275	100%
	Willows planted beneath riprap	52	2	4%
	<b>Total 2014</b>	<b>327</b>	<b>277</b>	<b>85%</b>

### 4.3. Vegetation Composition

Table 2 provides a comprehensive list of vegetative species identified at the Clark Fork River bank stabilization site. In 2014, 35 plant species were observed as compared to 14 species in 2013. Woody plants establishing above the riprapped bank included *Salix exigua* (narrow-leaf willow), *Salix drummondia* (Drummond's willow) and *Cornus alba* (red osier dogwood).

2014 monitoring indicated vegetation has become better established between the north edge of the highway and the stabilized bank (see Photos 5 and 6 in Appendix A). This area was likely used for equipment staging, and was poorly vegetated in 2013. Although vegetation is more established in this area, many of the observed species were weeds and undesirable species.

Three noxious weed species were observed within the site, and are summarized in Table 3. All weed species were found in trace amounts.

**Table 2. Comprehensive list of plant species identified at the Clark Fork River site in 2013 and 2014.**

Scientific Name	Common Name	WMVC Indicator Status
<i>Agropyron cristatum</i>	Crested Wheatgrass	NL
<b><i>Alopecurus arundinaceus</i></b>	<b>Creeping Meadow-Foxtail</b>	<b>FAC</b>
<b><i>Chenopodium album</i></b>	<b>Lamb's-Quarters</b>	<b>FACU</b>
<i>Cirsium arvense</i>	Canadian Thistle	FAC
<b><i>Cornus alba</i></b>	<b>Red Osier</b>	<b>FACW</b>
<b><i>Dactylis glomerata</i></b>	<b>Orchard Grass</b>	<b>FACU</b>
<i>Dasiphora fruticosa</i>	Golden-Hardhack	FAC
<b><i>Elymus repens</i></b>	<b>Creeping Wild Rye</b>	<b>FAC</b>
<b><i>Equisetum hyemale</i></b>	<b>Tall Scouring-Rush</b>	<b>FACW</b>
<b><i>Festuca idahoensis</i></b>	<b>Bluebunch Fescue</b>	<b>FACU</b>
<i>Helianthus annuus</i>	Common Sunflower	FACU
<i>Hordeum jubatum</i>	Fox-Tail Barley	FAC
<b><i>Kochia scoparia</i></b>	<b>Mexican Kochia</b>	<b>NL</b>
<i>Lactuca serriola</i>	Prickly Lettuce	FACU
<b><i>Linaria dalmatica</i></b>	<b>Dalmatian Toadflax</b>	<b>NL</b>
<b><i>Melilotus officinalis</i></b>	<b>Yellow Sweet-Clover</b>	<b>FACU</b>
<b><i>Onopordum acanthium</i></b>	<b>Scotch Thistle</b>	<b>NL</b>
<i>Panicum capillare</i>	Common Panic Grass	FAC
<i>Pascopyrum smithii</i>	Western-Wheat Grass	FACU
<b><i>Persicaria amphibia</i></b>	<b>Water Smartweed</b>	<b>OBL</b>
<i>Phalaris arundinacea</i>	Reed Canary Grass	FACW
<b><i>Phleum pratense</i></b>	<b>Common Timothy</b>	<b>FAC</b>
<b><i>Poa palustris</i></b>	<b>Fowl Blue Grass</b>	<b>FAC</b>
<i>Poa pratensis</i>	Kentucky Blue Grass	FAC
<i>Populus trichocarpa</i>	Narrow-Leaf Cottonwood	FACW
<b><i>Rumex crispus</i></b>	<b>Curly Dock</b>	<b>FAC</b>
<b><i>Salix drummondiana</i></b>	<b>Drummond's Willow</b>	<b>FACW</b>
<i>Salix exigua</i>	Narrow-Leaf Willow	FACW
<b><i>Sinapis arvensis</i></b>	<b>Corn Mustard</b>	<b>NL</b>
<b><i>Sonchus arvensis</i></b>	<b>Field Sow-Thistle</b>	<b>FACU</b>
<i>Tanacetum vulgare</i>	Common Tansy	FACU
<i>Thlaspi arvense</i>	Field Pennycress	UPL
<b><i>Trifolium pratense</i></b>	<b>Red Clover</b>	<b>FACU</b>
<b><i>Trifolium repens</i></b>	<b>White Clover</b>	<b>FAC</b>
<b><i>Verbascum thapsus</i></b>	<b>Great Mullein</b>	<b>FACU</b>

\*Based on 2014 NWPL (Lichvar *et al.*, 2014)  
New species identified in 2014 are **bolded**.



**Table 3. Montana State listed noxious weed species observed in 2014 at the Clark Fork River bank stabilization site.**

Category	Scientific Name	Common Name
Priority 2B	<i>Cirsium arvense</i>	Canadian Thistle
	<b><i>Linaria dalmatica</i></b>	<b>Dalmatian Toadflax</b>
	<i>Tanacetum vulgare</i>	Common Tansy

Based on the Montana Noxious Weed List, December 2013

New species identified in 2014 are **bolded**.

#### 4.4. Photo Documentation

Photographs were taken at the upstream and downstream extents, and several additional areas within the project area to capture the installed bank protection measures, and the extent and density of vegetation establishment along the riprap and within the project staging area adjacent to Interstate 90. Photographs taken in both 2013 and 2014 can be found in Appendix A.

### 5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Clark Fork River bank stabilization site is intended to document whether the project is meeting performance standards outlined in the permits issued for project construction. The second year of monitoring suggests both of the performance standards are being met two years post-construction (Table 2).

**Table 4. Performance results of Clark Fork bank stabilization project 2 years following construction.**

Parameter	Success Criteria	Status	Meeting Performance Criteria?
Woody planting survival	Minimum of 80% survival of plantings three years after planting.	85% of observed woody plantings have survived	Yes
Construction detail	Riprap must be covered with topsoil, seeded, and sprigged with willows above the ordinary high water mark.	Riprap has been covered with topsoil, seeded, and sprigged with willows above the ordinary high water mark	Yes

#### 5.1. Woody Planting Survival

The observed woody planting survival within the project reach was 85%, which meets the target performance standard of 80% two years following installation. Woody planting survival takes into account the total number of live and dead plantings observed within the project reach; as a result, this parameter improved as compared to the results documented in 2013. Woody plantings indicate much higher survival along the top of the riprap than those installed beneath the rock.

## **5.2. Construction Details**

The area above the riprap was reclaimed by seeding and sprigging woody cuttings through a layer of topsoil. This area indicates successful woody and herbaceous establishment as indicated by woody planting survival and improved herbaceous vegetation density as compared to the previous monitoring event. One additional noxious weed species was identified in 2014, bringing the total number observed within the site to three. Weed management efforts should reduce the potential for colonization by new species and spread of those currently inhabiting the site.

## **6.0 MANAGEMENT RECOMMENDATIONS**

Two years of annual monitoring of the Clark Fork River bank stabilization site indicates generally good results, with vegetation establishing well along the upper bank and access areas. Vegetation establishment along the lower segment of the riprapped bank has thus far shown limited establishment success. Vegetation monitoring at this site suggests good survival rates of willow sprigs above the top layer of rock. If willows continue to establish root systems beneath the riprap, it is hopeful they will extend additional shoots and stems through lower rock layers to provide additional benefits of shade and vegetative cover along the bank toe.

The upper streambank area and project staging area contained a large amount of weedy and undesirable species and approximately 30% bare ground (Photo 12, Appendix A). The majority of this area lies within the roadway clear zone, which is regularly mowed and used for maintenance activities. As such, this area is expected to take additional time to establish desirable species as compared to undisturbed areas. Weed control efforts along the roadway clear zone is suggested to prevent additional weed colonization.

An alternative willow installation technique that may improve willow establishment at the bank toe is described in a riparian revegetation manual offered by the NRCS (2007). This technique includes placing willow stems that extend through each layer of riprap. Willow stems may be placed at the toe of the bank up to approximately the 2-year water surface elevation to improve successful establishment of vegetative cover throughout the riprap.

Upstream of the project area is an eroding bank approximately forty-five feet in length (Photo 7, Appendix A). This bank does not currently appear to threaten the project area; however the eroding streambank should be monitored to determine if it becomes a threat to the stabilized streambank or the Interstate. If the bank continues to erode, placement of additional riprap may be recommended to maintain protection of the highway. If necessary, the extent of additional riprap installation should be evaluated based on anticipated erosive activity, flow direction, bar formation, existing bank materials, and vegetative composition.

## **7.0 LITERATURE CITED**

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 State University Extension website. Accessed in September 2014 at <http://www.msuxextension.org/invasiveplantsMangold/noxioussub.html>

United States Department of Agriculture. 2007. Planting willow and cottonwood poles under riprap. Technical Note Plant Materials No.21. USDA Natural Resources Conservation Service, Boise Idaho.

## **Appendix A**

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### Project Site Photos

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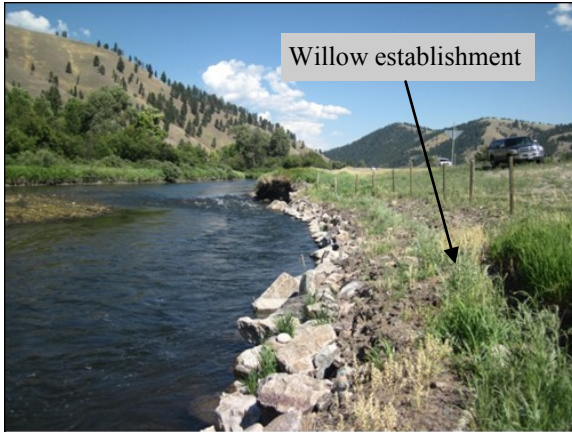
MDT Stream Mitigation Monitoring  
Clark Fork River  
Granite County, Montana

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**PHOTO INFORMATION**

PROJECT NAME: Clark Fork Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 1**  
**Description:** View upstream looking at revetment.  
**Taken in 2013**



**Photo 1**  
**Description:** View upstream looking at revetment.  
**Taken in 2014**



**Photo 2**  
**Description:** Toe of revetment looking upstream.  
**Taken in 2013**



**Photo 2**  
**Description:** Toe of revetment looking upstream.  
**Taken in 2014**



**Photo 3**  
**Description:** Middle of revetment looking upstream.  
**Taken in 2013**



**Photo 3**  
**Description:** Middle of revetment looking upstream.  
**Taken in 2014**

**PHOTO INFORMATION**

PROJECT NAME: Clark Fork Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 4**  
**Description:** Willow growth at top of revetment.  
**Taken in 2013**



**Photo 4**  
**Description:** Willow growth at top of revetment.  
**Taken in 2014**



**Photo 5**  
**Description:** Weedy streambank/work area.  
**Taken in 2013**



**Photo 5**  
**Description:** Weedy streambank/work area.  
**Taken in 2014**



**Photo 6**  
**Description:** Sandbar willow growth and bare ground.  
**Taken in 2013**



**Photo 6**  
**Description:** Sandbar willow growth and bare ground.  
**Taken in 2014**

**PHOTO INFORMATION**

PROJECT NAME: Clark Fork Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 7**  
**Description:** Eroding streambank at upstream extent.  
**Taken in 2013**



**Photo 7**  
**Description:** Eroding streambank at upstream extent.  
**Taken in 2014**



**Photo 8**  
**Description:** Middle of revetment looking downstream.  
**Taken in 2013**



**Photo 8**  
**Description:** Middle of revetment looking downstream.  
**Taken in 2014**



**Photo 9**  
**Description:** Looking downstream at revetment.  
**Taken in 2013**



**Photo 9**  
**Description:** Looking downstream at revetment.  
**Taken in 2014**

**PHOTO INFORMATION**

PROJECT NAME: Clark Fork Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 10**  
**Description:** Close-up of sandbar willow growth.  
**Taken in 2013**



**Photo 10**  
**Description:** Close-up of sandbar willow growth.  
**Taken in 2014**



**Photo 11**  
**Description:** Upstream extent of rip-rapped stream-bank.  
**Taken in 2013**



**Photo 11**  
**Description:** Upstream extent of rip-rapped stream-bank.  
**Taken in 2014**



**Photo 12**  
**Description:** Weedy and bare re-sloped work area.  
**Taken in 2013**



**Photo 12**  
**Description:** Weedy and bare re-sloped work area.  
**Taken in 2014**



**PHOTO INFORMATION**

PROJECT NAME: Clark Fork Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 13**  
**Description:** Looking downstream at revetment  
**Taken in 2013**



**Photo 13**  
**Description:** Looking downstream at revetment.  
**Taken in 2014**