MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

Sweathouse Creek Ravalli County, Montana

Year Project Completed: 2011

Monitoring Report #4: December, 2016



Prepared for:



Prepared by:



MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #4

YEAR 2016

Sweathouse Creek Ravalli County, Montana

MDT Project Number: NH 7-1(114)59 Control Number: CN 2015004

USACE Permit Number: NOW-1997-90821 SPA Number: MDT-R2-15-2010

Prepared for:

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Cover Photo: Realigned channel of Sweathouse Creek taken in July, 2016.

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1.0 INTRODUCTION

The following report presents results of the fourth year of post stream re-construction monitoring at the U.S. Highway 93 stream crossing at Sweathouse Creek near Victor, Montana. This report includes an evaluation of monitoring results in comparison to project performance standards outlined in the post-construction monitoring plan for the site. The project was constructed in 2011; therefore, these results provide documentation of the site's condition five years following the project's completion.

As part of the U.S. Army Corps of Engineers (USACE) 404 permit application, the Montana Department of Transportation (MDT) requested authorization for a bridge removal and replacement over Sweathouse Creek, a channel alignment modification on Sweathouse Creek, removal and replacement of six irrigation siphons, and wetland fill at various locations throughout the project. The Sweathouse crossing included replacing the 30-foot wide bridge with a 96-foot wide bridge, backfilling a 394-foot section of Sweathouse Creek and constructing a new channel alignment 397 feet long with three root wads on the left bank and four root wads on the right bank. The USACE permit requires 5 years of annual monitoring of streambank stability and riparian vegetation areal coverage.

Performance standards outlined in the mitigation plan for the Sweathouse Creek crossing at U.S. Highway 93 include:

1. Riparian vegetation coverage

- a) Minimum of 80% total vegetative coverage by the end of the third growing season
- b) Minimum of 50% areal coverage by woody species by the end of the third growing season.
- **2. Streambank stability** any unstable banks within the relocated channel segment will require corrective actions.

Additional reporting requirements included in the monitoring plan include:

- As-built survey as built drawings of the relocated channel at a 1:50 scale or smaller and planting schematic with a planted species list and number of plants planted.
- **4. Perpendicular transects** establishment of 4 transects 75' apart with surveyed cross sections and bank pins installed as permanent reference points.
- **5. Photo points** color photos at each monitoring station showing both banks and upstream and downstream views.

Monitoring methods used to document the site's conditions are described in Section 3; results of the fourth year of monitoring in 2016 are presented in Section 4, and are

compared to the adopted performance standards in Section 5. Additional site information including plots of perpendicular transect and longitudinal profile surveys, photo logs, and as-built schematics are included as appendices to this report.

2.0 SITE LOCATION

The project reach includes approximately 330 feet of Sweathouse Creek, extending 30 feet upstream and 200 feet downstream from the U.S. Highway 93 Bridge (100 feet beneath the bridge). The new bridge is approximately 0.25 miles north of Victor, Montana. The project site is located in Section 30, Township 8 North, Range 20 West in Ravalli County, Montana (Figure 1).

3.0 MONITORING METHODS

Monitoring field crews visited the project site on July 25, 2016 while survey crews visited the site on July 28, 2016. In order to document the site's condition as compared to the performance standards and meet all other monitoring requirements, the following data were collected:

3.1. Riparian Vegetation Inventory - Belt Transects

Visual estimates of total vegetation, woody vegetation, and noxious weeds were performed within riparian belt transects that extended 25 feet on either side of the active stream channel. Percent cover was recorded for each vegetation category based on ocular estimates. The belt transect on the right (south) bank runs parallel to the downstream extent of the project reach for 200 feet, while the riparian transect on the left (north) bank is 114 feet long (Figure 2, Appendix A).

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 eroding banks included bank length, photographs and potential causes of bank erosion.

3.3. Perpendicular Transects

Four perpendicular transects (cross sections) established in 2013 were re-surveyed to document whether the channel adjusted vertically or laterally. Transects were positioned at two riffles and two pools to document variability in aquatic habitat and channel dimensions. These habitat features did not necessarily exist 75' apart; therefore the spacing between transects varied from that suggested in the additional reporting requirements for this monitoring site.

3.4. Longitudinal Profile

A longitudinal profile of the channel thalweg was surveyed to document bedform complexity and aquatic habitat conditions present within the monitoring reach.

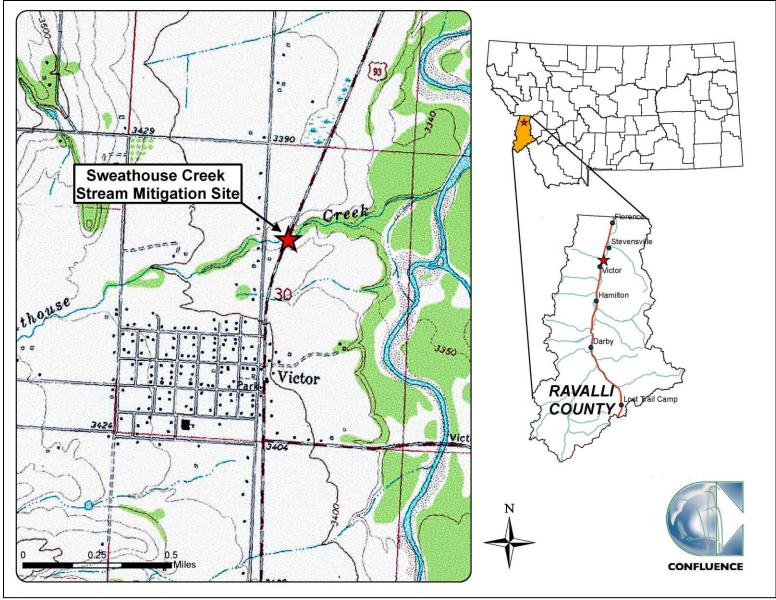


Figure 1. Project location of Sweathouse Creek stream mitigation site.

3.5. Photo-Documentation

Photos were taken at seven photo points established during the first monitoring event in 2013 to document vegetation establishment and stream bank conditions within the project site. Photos were also taken at each perpendicular cross section in the upstream and downstream direction, as well as toward each stream bank.

4.0 RESULTS

4.1. Riparian Vegetation Inventory

The two riparian belt transects included a 200-foot transect along the right (south) side of the channel running from the Highway 93 Bridge to the downstream extent of the project reach, and a 114-foot transect on the left (north) bank. The extents of the riparian transects are illustrated on Figure 2 in Appendix A. Table 1 summarizes the vegetation composition of each riparian transect, including areal percent cover of total vegetation, woody vegetation, and noxious weeds. In 2016, the total percent riparian cover remained at 97%, and included 86% cover by herbaceous species and 11% by woody species. Noxious weed cover rose from 4% in 2013 to 8% in 2016.

Table 1. Percent cover of riparian belt transects at the Sweathouse Creek site from 2013 through 2016.

Belt Transect	Length (ft)	Total % Riparian Cover			% Woody Cover			% Noxious Weed Cover					
		2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
Right (south bank)	200	97	96	97	97	14	10	12	12	5	5	5	7
Left (north bank)	114	98	98	98	98	7	7	10	10	3	3	8	10
Total	334	97	97	97	97	11	9	11	11	4	4	6	8

Table 2 includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas. In 2016, 116 species were observed, representing an increase of 17 species since 2015, 31 species since 2014, and 61 species since the initial monitoring event in 2013. In 2016, 53% of the species observed were hydrophytic based on the 2016 National Wetland Plant List (NWPL) (Lichvar et al., 2016).

Table 2. Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site from 2013 through 2016.

Status* Common Yarrow FACU Medicopo Jupulino Blusk Models, FACU Agropsor containum Created Wheatgrass N. I. Medicopo Jupulino Blusk Models, FACU Agrostis statum Rough Bert FAC Medicopo Jupulino Blusk Models PACU Agrostis statum Rough Bert FAC Medicopo Jupulino Blusk Models Security PACU Agrostis statum Rough Bert FAC Medicopo Jupulino PACU Agrostis statum PAC Medicopo Jupulino PAC Medicopo Jupulino PACU Agrostis statum PAC Medicopo Jupulino PAC Medicopo Jupulino PAC PACU Agrostis statum PAC Medicopo Jupulino PAC PACU P	Scientific Name	Common Name	WMVC Indicator	Scientific Name	Common Name	WMVC Indicator	
Agoposis satolom Rough Bent FAC Agrostis satolom/fara Agrostis sat			Status*			Status*	
Agorestis stocholfera FAC Mellifus albus White SweetColover FACU Algae, brown Algae, green Algae,							
Agrossis stoforifera Spreading Bent FAC Mellikus officinals Yrollow Sweet-Clover FACU Algae, puren Algae, brown Algae, brown Algae, brown Algae, puren Ni. Memba arransis American Will Mith FACW Algae, green Algae, green Ni. Memba arransis Sept Member/Pricerer CBIL Algae, green Ni. Algae, green Fact Algae, green Pack Algae, green Fact Algae, green Pack Algae, green Fact Algae, green Pack Alga							
Albere, brown Albere, brown Albere, brown Albere, brown Albere, green Al							
Abene, green Aloge, green Aloge	Agrostis stolonifera	Spreading Bent					
Abuse incana Abuse cincana Abu	Algae, brown	Algae, brown	NL	Mentha arvensis	American Wild Mint	FACW	
Alspecturs acqualis Short-ham Meadow-Fotali FAC Alsessum alyssoidies Rale Alyssum N.I. Alsessum alyssoidies Rale Alyssum N.I. Alessum alyssoidies Rale Alyssum N.I. Browns incomam Should be allyssim N.I. Pholisis animalities P.A. Ph	Algae, green	Algae, green	NL	Mimulus guttatus	Seep Monkey-Flower	OBL	
Alegecurus protentis Field Meadow-Fostal FAC Alegasum practicus Pale Ayasum N. Arctium minus Leser Burdock UPL Pascopryum artibus Vestern-Whated Grass FACU Pascopryum artibus Vestern-Whated OBL Parciards amphibia Carrow artibus Pacco OBL Pacc	Alnus incana	Speckled Alder	FACW	Myriophyllum sp.	Water-Milfoil	NL	
Alessum alvasoides Pale Alvasum N. Pascopyrum smithii Nestern-Wheel Grass FACU Partical are amphibia Partic	Alopecurus aequalis	Short-Awn Meadow-Foxtail	OBL	Oenothera villosa	Hairy Evening-Primrose	FAC	
Arctium minus Lesser Burdock UPL Persicaria amphibie Water Smartweed OBL british pumils Bottia pumils Bog Birch OBL Browns (sectorum) OBL Browns (sectorum) NL Calamagrostis canadensis Buejoint American (sectorum) NL Calamagrostis canadensis Buejoint Panding pompior Reed Canary Grass FACW Carex s. Sp. Sedge NL Pelanting pompior Great Plentain FACU Carex s. Spate Staki Crain Bedge OBL Pop By Balastris Ford Blee Grass FAC Carex strouted and Controllars a stocke Spated Knaywed NL Pop By Balastris Ford Blee Grass FAC Centatura stocke Spated Knaywed NL Pop By Balastris Ford Blee Grass FAC Centatura stocke Spated Knaywed NL Pop By Balastris Fac Cultura douglasti Northeed Grass Analysis and palastris Mentucky Blue Grass FAC Circuta douglasti Western Water-Hemlock OBL Paguatris and palastris Balastric Cherry FACU Circuta douglasti	Alopecurus pratensis	Field Meadow-Foxtail	FAC	Onopordum acanthium	Scotch Thistle	NL	
Betula pumila Bog Birch Chesopass And Chesologiass And Ch	, ,	Pale Alyssum					
Bomus tectorum Cheatgrass FACW Catamagrostis canadensis Lasty Tussock Sedge OBL Catamagrostis canadensis Lasty Tussock Sedge OBL Catamagrostis canadensis Lasty Tussock Sedge OBL Catamagrostis Ca	Arctium minus	Lesser Burdock	UPL	Persicaria amphibia	Water Smartweed	OBL	
Catemagnostis canadensis Buejoint FACW Phileum pratense Common Timothy FAC Corrox aqualitis Sedy Tussook Sedge NL Plantago Inaccolate English Plantain FAC Carex sp. Sedge NL Plantago Inaccolate English Plantain FAC Carex spice Stale-Grant Sedge OBL Papablustris Fow Blue Grass FAC Carex utriculate Northwest Territory Sedge OBL Papablustris Kentudy Blue Grass FAC Consum and December Spotted Knapweed NL Papablustris Kentudy Blue Grass FAC Cheropodium abum Lamb's Quarters FAC Papubus settlemiolides Quaking Aspen FACU Ciristum anyeare Canadian Thiatle FAC PAC Papubus teremiolides Quaking Aspen FACU Ciristum anyeare Bull Thististe FAC PACU Panunculus acris Tall Buttercup FAC Ciristum anyeare Bull Thististe FAC PAC Panunculus acris Tall Buttercup FAC Ciristum	Betula pumila	Bog Birch	OBL	Persicaria sp.	Smartweed	NL	
Carrex squaetilis Leafy Tussock Sedge NL Carrex spiata Stalk-Grain Sedge OBL Plantago major Great Plantain FAC Plantago major Great Plantain FAC Carrex stipata Stalk-Grain Sedge OBL NL Populus Plantago major Great Plantain FAC Pantago major Fac Pantago major	Bromus tectorum	Cheatgrass	NL	Phalaris arundinacea	Reed Canary Grass	FACW	
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Containing sport Containing	Carex stipata	Stalk-Grain Sedge	OBL	Poa palustris	Fowl Blue Grass	FAC	
Cerestium sp. Chickweed NL Chrenopodum album Lamb's-Quarters FACU Populus balsamifora Balsam Poplar FAC Chrenopodum album Lamb's-Quarters FACU Populus tremuloides Quaking Aspen FACU Ciristum valiagare Bull Thistle FAC Ciristum valiagare Bull Thistle FAC Ciristum valiagare Bull Thistle FACU Comus alba Red Osier FACW Comus alba Red Osier FACW Corner FACW Comus alba Red Osier FACW Corner FA	Carex utriculata	Northwest Territory Sedge	OBL	Poa pratensis	Kentucky Blue Grass	FAC	
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Cirsium vulgare	Cicuta douglasii	1	OBL			FACU	
Cirsium vulgare	Cirsium arvense	Canadian Thistle	FAC	Ranunculus acris	Tall Buttercup	FAC	
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	Lycopus asper	Rough Water-Horehound	OBL	Veronica americana	American-Brooklime	OBL	

^{*}Based on 2016 NWPL (Lichvar *et al.*, 2016) New species identified in 2016 are **bolded**.

One infestation of tall buttercup (*Ranunculus acris*), a Montana Listed Priority 2A noxious weed, and twenty-eight infestations of Montana Listed Priority 2B noxious weeds, including spotted knapweed (*Centaurea stoebe*), Canada thistle (*Cirsium arvense*), St. Johnswort (*Hypericum perforatum*), oxeye daisy (*Leucanthemum vulgare*), yellow toadflax (*Linaria vulgaris*), and common tansy (*Tanacetum vulgare*) were identified along the riparian corridor and are listed in Table 3. Cheatgrass (*Bromus tectorum*), a Montana Priority 3 regulated weed species was also identified in several locations across the site. Canada thistle, spotted knapweed, and oxeye daisy comprised the majority of noxious weed infestations observed across the site.

Each noxious weed occurrence was identified in areas less than 0.1 acre in size with cover classes ranging from trace (less than 1 percent) to low (1 to 5 percent). The extent of noxious weed coverage has increased at the site, with 23 new infestations mapped since 2014. An estimated 8% of the project area has been colonized by noxious weeds. Weeds were observed on both stream banks upstream and downstream of the Highway 93 Bridge with specific infestation locations provided in Figure 3, Appendix A.

Table 3. Montana State listed noxious weed and regulated species observed in 2016 at the Sweathouse Creek Stream Mitigation Site.

Category*	Scientific Name	Common Name		
Priority 2A	Ranunculus acris	Tall Buttercup		
	Centaurea stoebe	Spotted Knapweed		
	Cirsium arvense	Canada Thistle		
Priority 2B	Hypericum perforatum	St. Johnswort		
Phoney 2B	Leucanthemum vulgare	Oxeye Daisy		
	Linaria vulgaris	Yellow Toadflax		
	Tanacetum vulgare	Common Tansy		
Priority 3 State Regulated	Bromus tectorum	Cheatgrass		

^{*}Based on the Montana Dept. of Agriculture's Noxious Weed List, 2015. New species identified in 2016 are listed in **bold.**

4.2. Erosion Inventory

An erosion inventory conducted along both stream banks revealed no new erosion in 2016. In 2014, erosion was noted along a short segment of the right (south) bank where one of the coir logs separated from the bank and washed downstream. Monitoring of the site during the past two years has indicated no further bank erosion at this location (see Additional Photos 4 and 5 in Appendix C).

No bank erosion has been documented at Photo Point #2, where the upstream-most coir log was installed without keying it into the stream bank. To date this coir log remains intact and secured to the bank.

4.3. Perpendicular Transect Surveys

Two riffle and two pool transects have been surveyed each year since 2013 to document vertical and lateral adjustments to the reconstructed stream channel. Plots of each transect are included in Appendix B. Both pool transects indicate the channel has maintained deeper water habitat in the vicinity of the rootwads installed along the right bank. The channel is capable of scouring against these woody features, which provide cover and depth for use by fish. Many brook trout were observed using these pools as refugia during the monitoring event. Both riffle transects also appear to be maintaining channel width and depth, with only minor adjustments to the bed and bank elevations. Inspection of the surveyed transects indicates no evidence of either aggradation or degradation of the channel since monitoring of this site began in 2013.

4.4. Longitudinal Profile Surveys

A longitudinal profile surveyed down the length of the channel thalweg was repeated in 2016 (see profile in Appendix B). The thalweg elevation has remained relatively consistent throughout the project reach, with minor bed adjustments noticeable over the past three years. A riffle crest beneath the bridge has become lower by approximately 0.4 feet since 2014, which is likely due to settling of materials placed following construction. All other riffle crest elevations have remained consistent throughout the remainder of the project reach. Slight adjustments to bed elevation along the profile, such as those observed at the pools developing between STA 2+50 and 3+00 are most likely due to natural scour and depositional processes at play in a meandering channel, and are not attributed to channel instability within the project reach. The profile indicates the pool features along the right bank have maintained depth while the riffles have maintained a consistent channel slope. The channel planform is straight between STA 3+10 and 4+00, which is resulting in the extension of the riffle feature originally constructed at this location. Overall, the channel appears to be maintaining capacity and slope throughout the length of the project.

5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Sweathouse Creek Stream Mitigation site is intended to document whether the reconstructed segment of the channel is meeting performance standards outlined in the Sweathouse Creek mitigation monitoring plan. The fourth year of monitoring suggests two of the three performance standards are being met five years post-construction. Additional reporting requirements outlined in the monitoring plan including schematics of an as-built topographic survey, repetition of perpendicular transect surveys, and photo documentation of the site are included as appendices in this report.

Table 4. Performance results of Sweathouse Creek 5 years following construction.

Parameter	Success Criteria	Status	Meeting Performance Criteria?
	80% total vegetative cover after the 3rd year.	Project area has 97% vegetative cover.	Yes
Riparian Coverage	50% cover of woody vegetation after the 3rd year.	Project area has 11% woody cover (12% of south bank and 10% of north bank)	No
Stream Bank Stability	Unstable banks identified within the project reach will require corrective action	One eroding streambank was identified in 2014 but did not erode further in 2015 or 2016.	Corrective action does not appear necessary at this bank

5.1. Riparian Vegetation Coverage

Vegetation cover along the Sweathouse Creek Mitigation Site has consistently measured above 95% for the past four monitoring years, and exceeds the performance standard of 80% areal coverage. Vegetation has established well within the riparian zone (defined as within 25' of the stream banks), particularly along the north stream bank. Herbaceous vegetation along the south stream bank has also established well; although mowing has continued up to the edge of the channel by the adjacent landowner.

In 2016, percent cover of woody vegetation within the riparian corridor remained at 11%, the same as 2015, and an increase of 2% since 2014. However, it remains below the performance standard of 50% cover by the end of the third growing season. The willows planted beneath the coir logs along the right bank are in poor condition. Monitoring of the woody vegetation along this bank indicates the young willows are no longer thriving and mortality is increasing. This may be due to continued trimming of the willows by the adjacent landowner. No additional woody vegetation is establishing within the remainder of the 25-foot wide riparian zone along the right bank due to mowing activities. It is unlikely the mitigation site will be able to achieve the performance criteria for woody vegetation composition until the riparian areas along the right bank are replanted with woody shrubs and measures are taken to protect these species from removal. MDT biologists previously installed approximately 150 red-osier dogwood (Cornus alba), Woods' rose (Rosa woodsii), and willows (Salix spp.) within the riparian zone in an attempt to establish woody species composition; however, with the exception of willow stems installed in the stream banks, all woody vegetation installed in the riparian corridor has been removed from the south side of the project reach, presumably by frequent moving by adjacent landowner.

5.2. Bank Erosion Inventory

The 15-foot section of eroding bank along Sweathouse Creek identified in 2014 did not continue to erode in 2015 or 2016 and is not currently jeopardizing any woody structures installed along the south bank. This moderately eroding bank occurs between two root wads installed to protect the bank from lateral erosion. One of the coir logs placed to protect the upper bank washed out, exposing the upper bank to active flows. Vegetation along this bank has been consistently mowed, and woody vegetation

planted during the project's construction has only sparsely established along the bank toe. It does not appear corrective actions will be necessary to stabilize this bank unless future monitoring efforts indicate accelerated erosion.

6.0 OTHER OBSERVATIONS

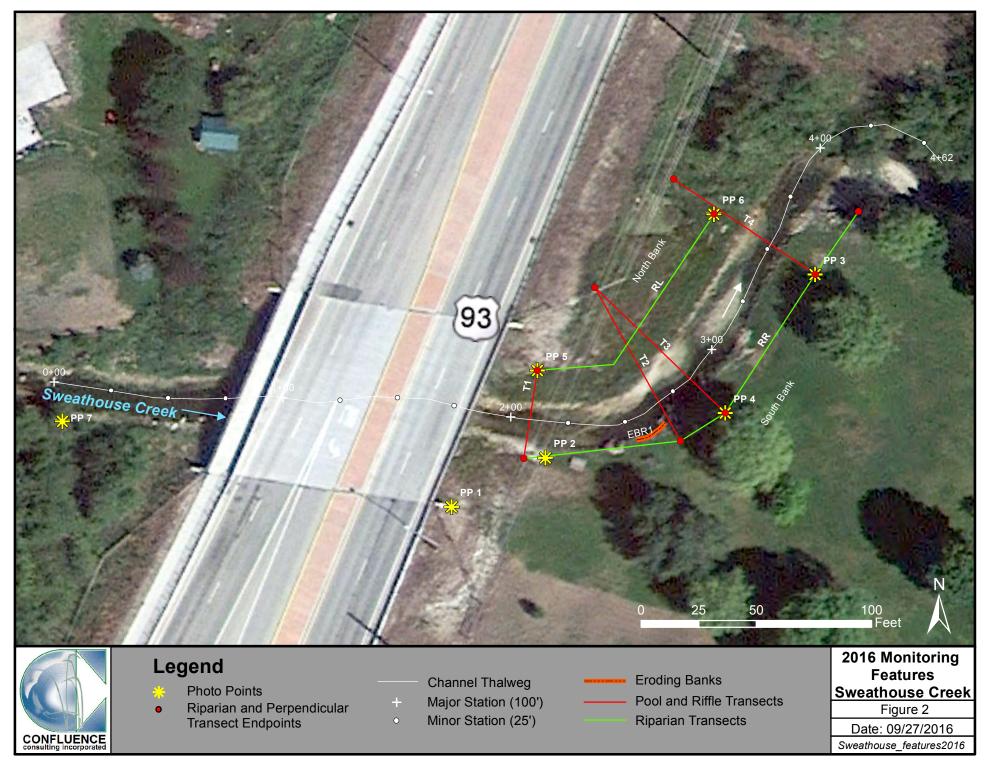
A pile of debris was observed on the south bank immediately downstream of the newly constructed bridge. Based on the photograph taken at Photo Point 2.1 in 2015, the landowner may use this area for burning household debris. This pile of debris lies within 25 feet of the highway edge and should be removed to allow for maintenance activities within the road right-of-way.

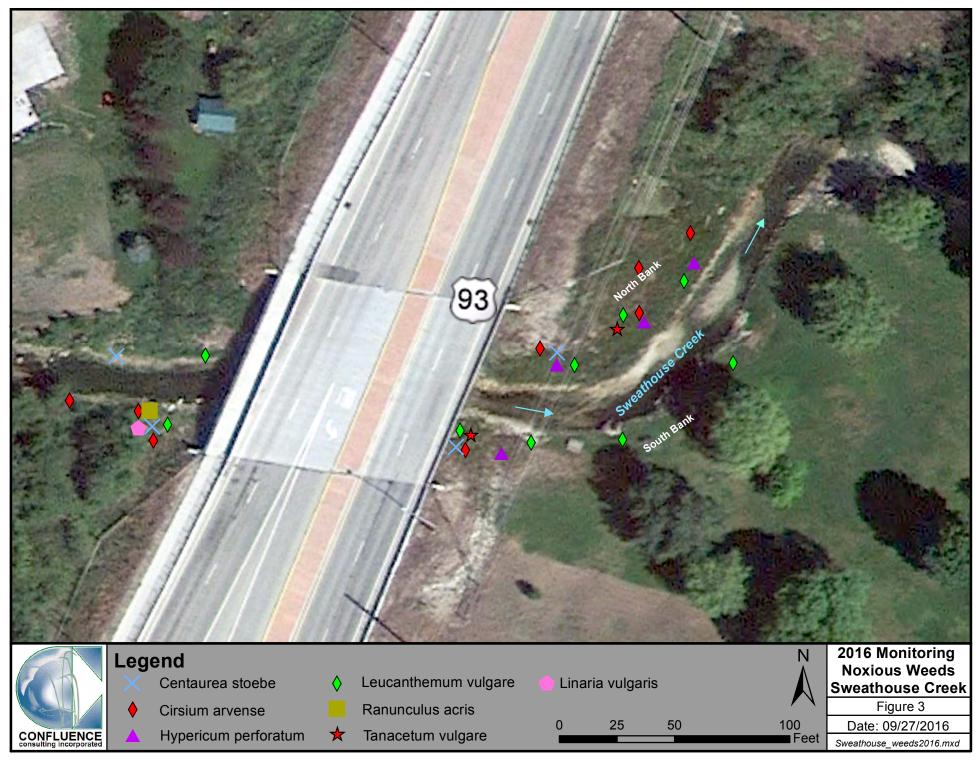
7.0 LITERATURE CITED

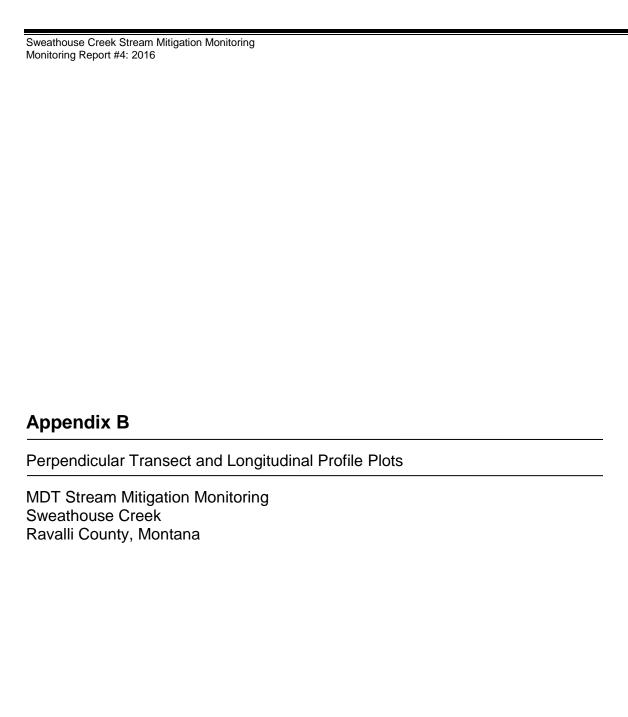
Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. *The National Wetland Plant List*: 2016 Update of Wetland Ratings. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X

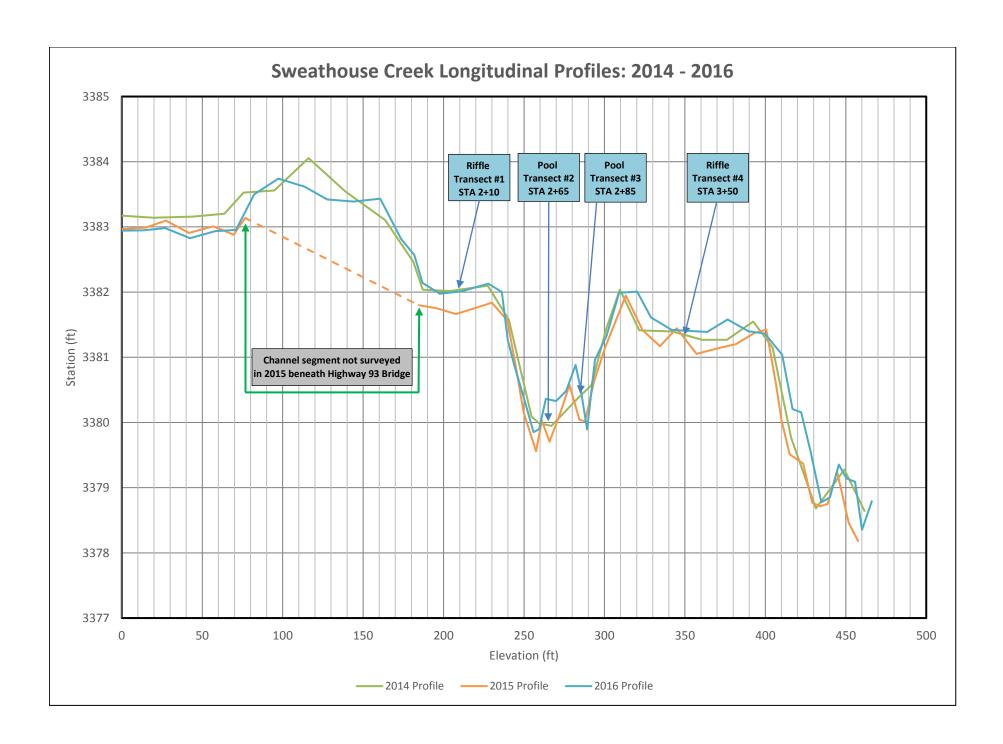
Montana Department of Agriculture. Montana Noxious Weed List. July 2015. Accessed September 2016 at http://agr.mt.gov/agr/Programs/Weeds/PDF/2015WeedList.pdf.

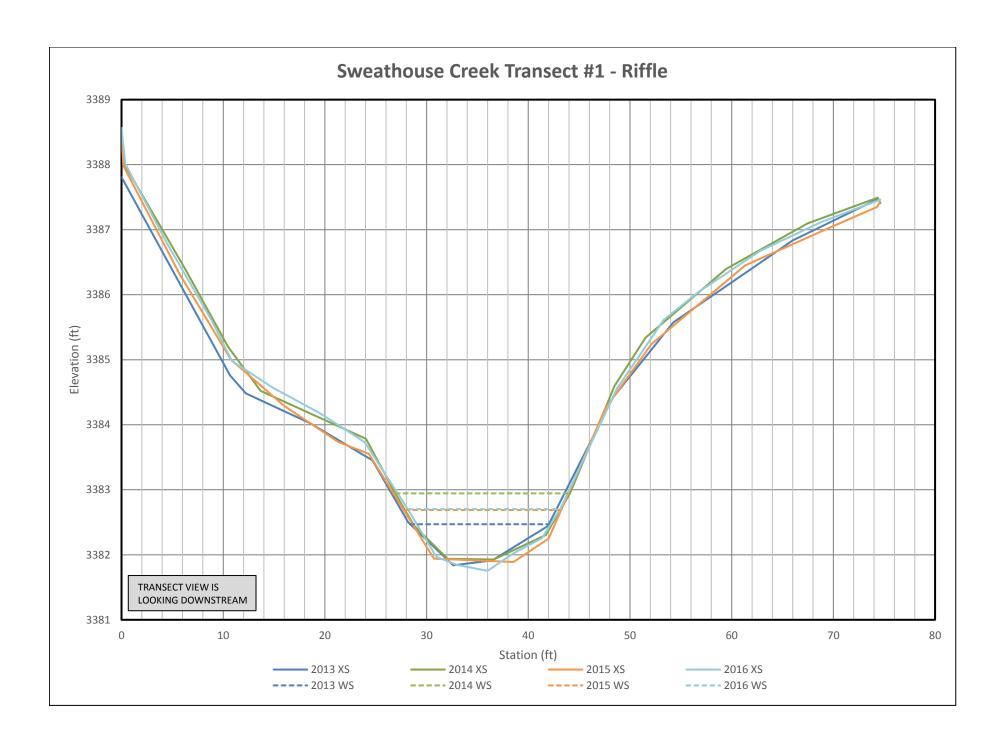
Sweathouse Creek Stream Mitigation Monitoring Monitoring Report #4: 2016 Appendix A Project Site Maps MDT Stream Mitigation Monitoring Sweathouse Creek Ravalli County, Montana

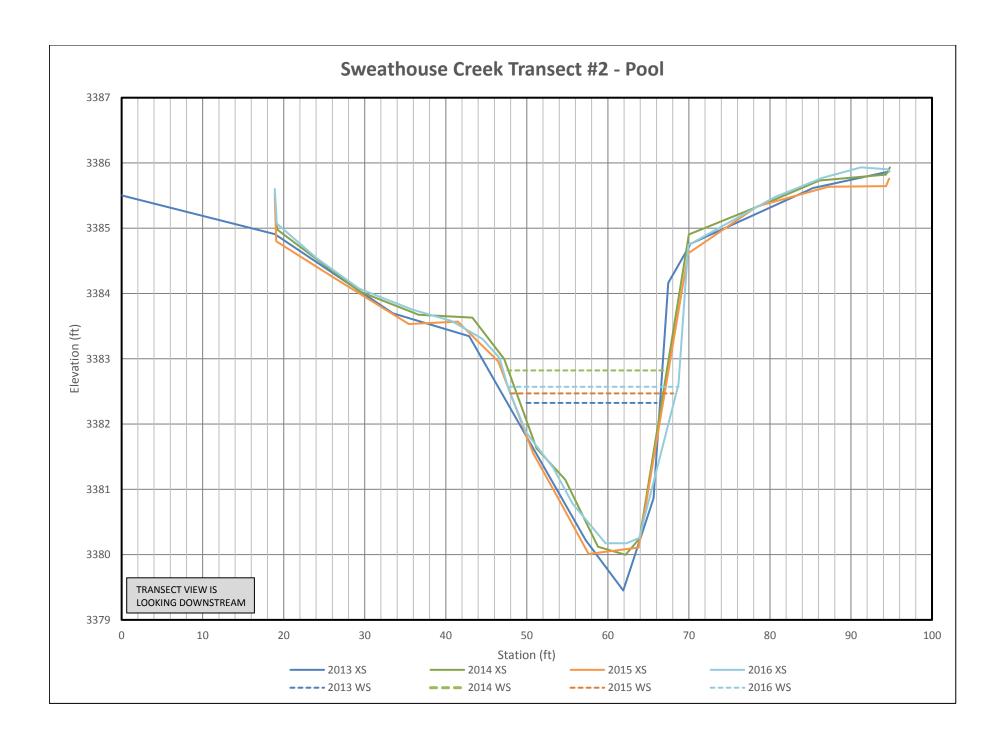


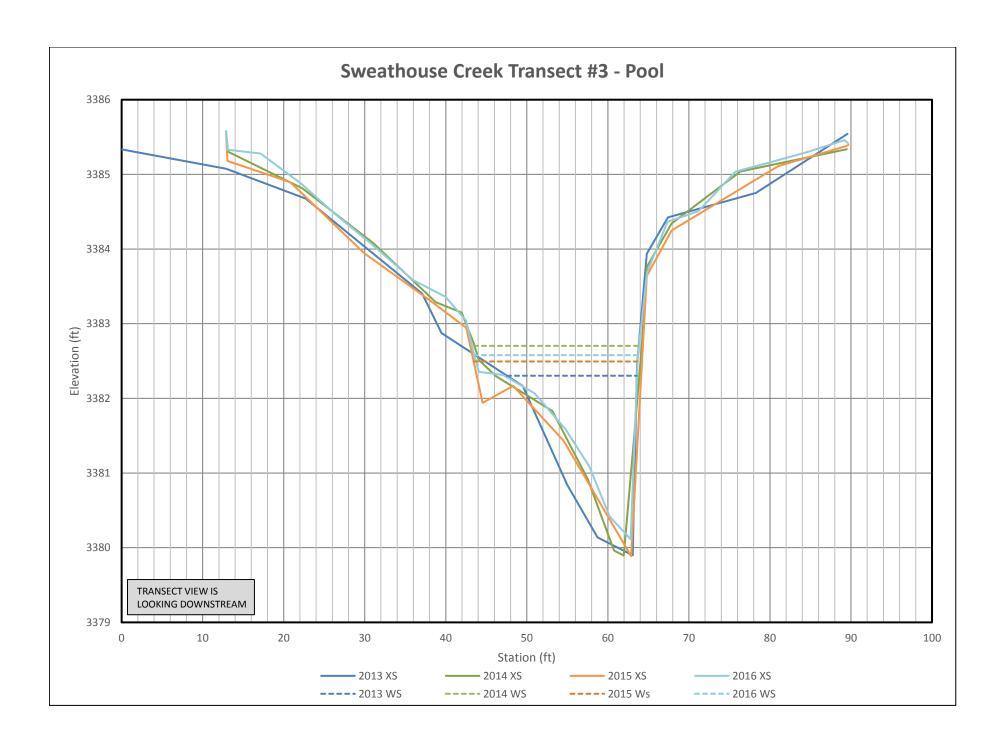


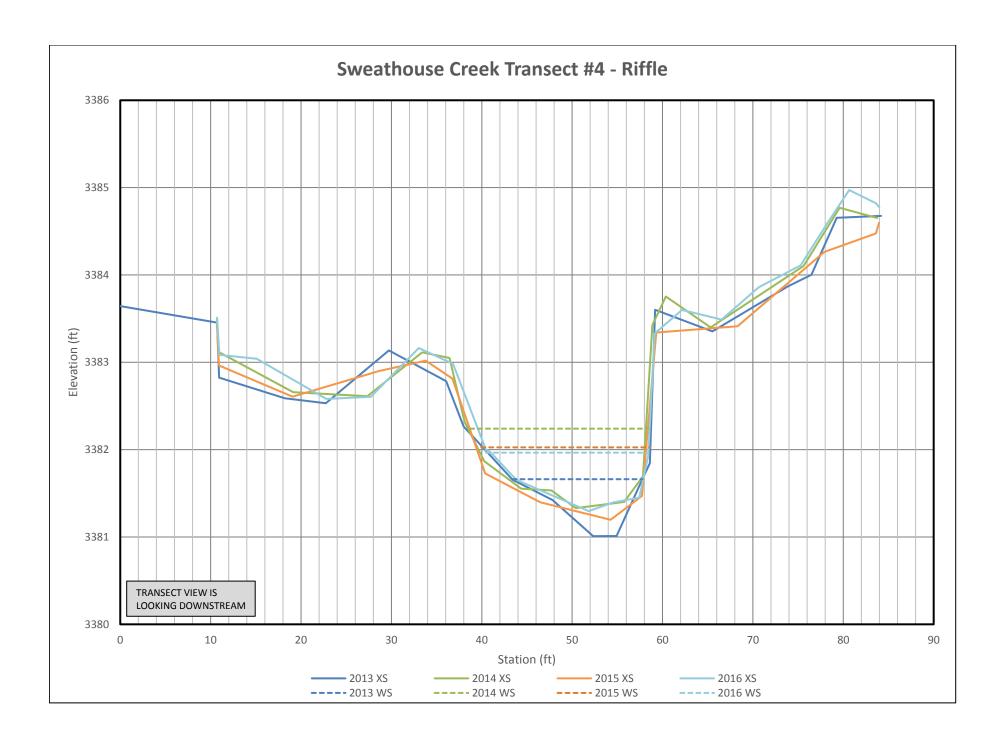


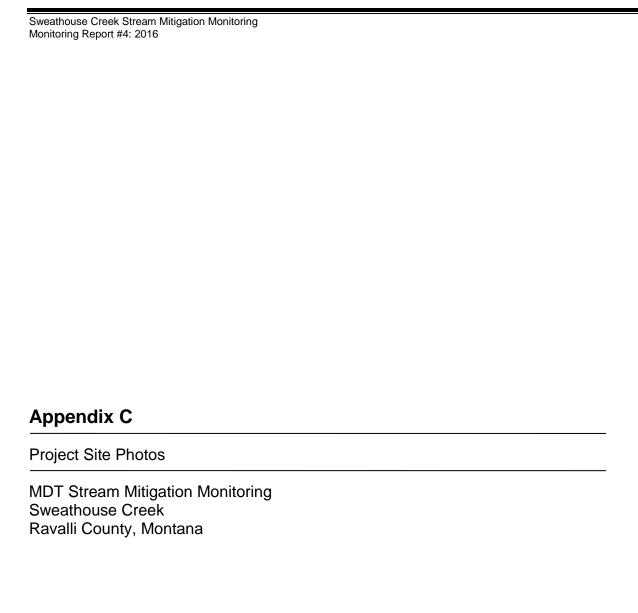












PROJECT NAME: Sweathouse Creek Stream Mitigation Site



Photo Point 1.1—2013
Description: View of north bank from bridge abutment.
Compass: 45 (Northeast)



Photo Point 1.1—2016
Description: View of north bank from bridge abutment.
Compass: 45 (Northeast)



Photo Point 1.2 —2013

Description: View of both banks looking downstream from bridge abutment. Compass: 68 (East-Northeast)



Photo Point 1.2 —2016

Description: View of both banks looking downstream from bridge abutment. Compass: 68 (East-Northeast)



Photo Point 2 —2013

Description: View of un-keyed coir log on south bank

Compass: 90 (East)



Photo Point 2 —2016

Description: View of un-keyed coir log on south bank

Compass: 90 (East)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site



Photo Point 3.1—2013

Description: Looking upstream from downstream end of project reach. Compass: 225 (Southwest)



Photo Point 3.1—2016

Description: Looking upstream from downstream end of project reach. Compass: 225 (Southwest)



Photo Point 3.2—2013

Description: View of downstream extent of project area. Compass: 45 (Northeast)



Photo Point 3.2—2016

Description: View of downstream extent of project area. Compass: 45 (Northeast)



Photo Point 3.3—2013

Description: View of the north bank looking across channel. Compass: 315 (Northwest)



Photo Point 3.3—2016
Description: View of the north bank looking across channel. Compass: 315 (Northwest)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site





Photo Point 4.1—2013
Description: View of both banks looking upstream.
Compass: 45 (Northeast)



Photo Point 4.1—2016
Description: View of both banks looking upstream.
Compass: 45 (Northeast)



Photo Point 4.2—2013

Description: View of north bank and point bar development. Compass: 315 (Northwest)



Photo Point 4.2—2016
Description: View of north bank and point bar development. Compass: 315 (Northwest)



Photo Point 4.3—2013
Description: View of both banks looking downstream.
Compass: 225 (Southwest)



Photo Point 4.3—2016
Description: View of both banks looking downstream.
Compass: 225 (Southwest)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site





Photo Point 5.1—2013
Description: View from north bank looking upstream underneath bridge. Compass: 270 (West)



Photo Point 5.1—2016
Description: View from north bank looking upstream underneath bridge. Compass: 270 (West)



Photo Point 5.2—2013 Description: View of south bank. Compass: 180 (South)



Photo Point 5.2—2016 Description: View of south bank. Compass: 180 (South)



Photo Point 5.3—2013 Description: View of vegetation on north bank. Compass: 90 (East)



Photo Point 5.3—2016
Description: View of vegetation on north bank.
Compass: 90 (East)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site



Photo Point 6.1—2013
Description: View of north bank vegetation.
Compass: 225 (Southwest)



Photo Point 6.1—2016
Description: View of north bank vegetation.
Compass: 225 (Southwest)



Photo Point 6.2—2013

Description: View of south bank looking across channel. Compass: 135 (Southeast)



Photo Point 6.2—2016
Description: View of south bank looking across channel. Compass: 135 (Southeast)



Photo Point 6.3—2013
Description: View looking across channel from north bank. Compass: 90 (East)



Photo Point 6.3—2016
Description: View looking across channel from north bank. Compass: 90 (East)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site



Photo Point 7.1—2013

Description: View of north streambank upstream of bridge. Compass: 68 (East-Northeast)



Photo Point 7.1—2016

Description: View of north streambank upstream of bridge. Compass: 68 (East-Northeast)



Photo Point 7.2—2013
Description: View looking downstream beneath bridge.
Compass: 90 (East)



Photo Point 7.2—2016
Description: View looking downstream beneath bridge.
Compass: 90 (East)



Photo Point 7.3 –2013

Description: View of north bank looking across stream channel. Compass: 0 (North)



Photo Point 7.3 –2016

Description: View of north bank looking across stream channel. Compass: 0 (North)

PROJECT NAME: Sweathouse Creek Mitigation Site



Additional Photo 1 - 2013

Description: Root wads along south streambank.

Compass: 45 (Northeast)



Additional Photo 1 - 2016

Description: Root wads along south streambank.

Compass: 45 (Northeast)



Additional Photo 2 - 2013

Description: Point bar formation on north side of channel. Compass: 250 (West-Southwest)



Additional Photo 2 - 2016

Description: Point bar formation on north side of channel. Compass: 250 (West-Southwest)



Additional Photo 3 - 2013

Description: Log structure along south streambank.

Compass: 110 (East-Southeast)



Additional Photo 3 - 2016
Description: Log structure along south streambank.
Compass: 110 (East-Southeast)

PROJECT NAME: Sweathouse Creek Stream Mitigation Site



Additional Photo 4 - 2013

Description: Eroding Bank EBR1 prior to bank collapse Compass: 90 (East)



Additional Photo 4 - 2016

Description: Eroding bank EBR1 along right (south bank). Compass: 90 (East)



Additional Photo 5: Eroding Bank EBR1 - 2015 Description: Looking upstream toward Highway 93 bridge from south bank.



Additional Photo 5: Eroding Bank EBR1 - 2016 Description: Looking upstream toward Highway 93 bridge from south bank.



Additional Photo 6 - 2015

Description: Willow cutting growth along north bank

Compass: 270 (West)



Additional Photo 6 - 2015
Description: Willow cutting growth along north bank
Compass: 270 (West)



PHOTOGRAPHIC INSPECTION INFORMATION Page 1 of 16

2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:

DATE: 7-28-16



TRANSECT 1 NORTH LOOKING SOUTH



TRANSECT 1 SOUTH LOOKING NORTH



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-28-16



TRANSECT 1 NORTH LOOKING UPSTREAM



TRANSECT 1 NORTH LOOKING DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

7-28-16 DATE:



TRANSECT 1 IN CREEK UPSTREAM



TRANSECT 1 IN CREEK DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

7-28-16 DATE:



TRANSECT 1 SOUTH LOOKING UPSTREAM



TRANSECT 1 SOUTH LOOKING DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

7-28-16 DATE:



TRANSECT 2 NORTH LOOKING SOUTHEAST



TRANSECT 2 SOUTH LOOKING NORTHWEST



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-28-16



TRANSECT 2 NORTH LOOKING UPSTREAM



TRANSECT 2 NORTH LOOKING DOWNSTREAM



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2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:



TRANSECT 2 IN CREEK UPSTREAM



TRANSECT 2 IN CREEK DOWNSTREAM



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2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:



TRANSECT 2 SOUTH LOOKING UPSTREAM



TRANSECT 2 SOUTH LOOKING DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-28-16



TRANSECT 3 NORTH LOOKING SOUTHEAST



TRANSECT 3 SOUTH LOOKING NORTHWEST



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2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:

DATE: 7-28-16



TRANSECT 3 NORTH LOOKING UPSTREAM



TRANSECT 3 NORTH LOOKING DOWNSTREAM



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2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:



TRANSECT 3 IN CREEK UPSTREAM



TRANSECT 3 IN CREEK DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE



TRANSECT 3 SOUTH LOOKING UPSTREAM



TRANSECT 3 SOUTH LOOKING DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE



TRANSECT 4 NORTH LOOKING EAST



TRANSECT 4 SOUTH LOOKING WEST



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE



TRANSECT 4 NORTH LOOKING UPSTREAM



TRANSECT 4 NORTH LOOKING DOWNSTREAM



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2016 MDT STREAM MITIGATION—SWEATHOUSE PROJECT NAME:



TRANSECT 4 IN CREEK UPSTREAM



TRANSECT 4 IN CREEK DOWNSTREAM



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PROJECT NAME: 2016 MDT STREAM MITIGATION—SWEATHOUSE



TRANSECT 4 SOUTH LOOKING UPSTREAM



TRANSECT 4 SOUTH LOOKING DOWNSTREAM

Sweathouse Creek Stream Mitigation Monitoring Monitoring Report #4: 2016 Appendix D As Built Surveys & Planting Schematics MDT Stream Mitigation Monitoring Sweathouse Creek Ravalli County, Montana

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