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# MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

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*Sweathouse Creek  
Ravalli County, Montana*

*Year Project Completed: 2011  
Monitoring Report #2: Submitted December, 2014*



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# **MONTANA DEPARTMENT OF TRANSPORTATION**

## **STREAM MITIGATION MONITORING REPORT #2:**

**YEAR 2014**

*Sweathouse Creek  
Ravalli County, Montana*

MDT Project Number: NH 7-1(114)59  
Control Number: CN 201 5004

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

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December 2014

CCI Project No: MDT\_.007



## TABLE OF CONTENTS

1.0	Introduction .....	1
2.0	Site Location .....	2
3.0	Monitoring Methods.....	2
3.1.	Riparian Vegetation Inventory - Belt Transects.....	2
3.2.	Bank Erosion Inventory.....	2
3.3.	Perpendicular Transects.....	2
3.4.	Longitudinal Profile .....	2
3.5.	Photo-Documentation .....	4
4.0	Results .....	4
4.1.	Riparian Vegetation Inventory.....	4
4.2.	Erosion Inventory.....	8
4.3.	Perpendicular Transect Surveys.....	8
4.4.	Longitudinal Profile Surveys .....	8
5.0	Comparison of Results to Performance Standards .....	8
5.1.	Riparian Vegetation Coverage.....	9
5.2.	Bank Erosion Inventory.....	10
6.0	Management Recommendations .....	10
6.1.	Woody Vegetation Establishment.....	10
6.2.	Coir Log/fabric Installation .....	10
7.0	Literature Cited .....	11

## TABLES AND FIGURES

Figure 1.	Project location of Sweathouse Creek stream mitigation site. ....	3
Figure 2.	Site map of Sweathouse Creek project site.....	Appendix A
Figure 3.	Map of weed locations at Sweathouse Creek site.....	Appendix A
Table 1.	Riparian vegetation belt transect results, Sweathouse Creek in 2013 and 2014. ....	4
Table 2.	Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site in 2013 and 2014.....	5
Table 3.	Montana State listed noxious weed and regulated species observed in 2014 at the Sweathouse Creek Stream Mitigation Site. ....	7
Table 5.	Performance results of Sweathouse Creek 3 years following construction.....	9

## **APPENDICIES**

Appendix A: Project Site Map

Appendix B: Perpendicular Transect Plots and Longitudinal Profile

Appendix C: Project Site Photos

Appendix D: As-Built Surveys & Planting Schematics

Cover Photo: Newly constructed stream bank on Sweathouse Creek.

## 1.0 INTRODUCTION

The following report presents the results of the second year of post stream reconstruction monitoring at the U.S. 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. Mitigation is to be monitored for five years to evaluate compliance toward meeting performance standards. The project was constructed in 2011; therefore, these results provide documentation of the site's condition three years following the project's completion.

As part of the U.S. Army Corps 404 permit application, the Montana Department of Transportation (MDT) requested authorization for a bridge removal and replacement over Sweathouse Creek, a channel modification on Sweathouse Creek, removal and replacement of six irrigation siphons, and wetland fill at various locations thought the project. The Sweathouse crossing included: replacing the 30 foot wide bridge with a 96-foot wide bridge, filling in a 394-foot section of Sweathouse Creek and constructing a new channel 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.

Mitigation performance standards outlined for the Sweathouse Creek crossing at U.S. 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:

3. **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.

Results of the second year of monitoring in 2014 are presented in Section 4, and are compared to the adopted performance standards in Section 5. Section 6 provides management recommendations for this and future projects to maximize the potential for meeting all performance criteria. Additional site information including perpendicular transect 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. 93 Bridge 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 24, 2014 while survey crews visited the site on July 23, 2014. The following data were collected at the Sweathouse Creek stream mitigation site:

### **3.1. Riparian Vegetation Inventory - Belt Transects**

Riparian belt transects established during the first monitoring event in 2013 were re-surveyed to document areal percent cover of total vegetation, woody vegetation, and noxious weeds. 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) were re-surveyed to document whether the channel adjusted vertically or laterally at two riffles and two pools.

### **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.

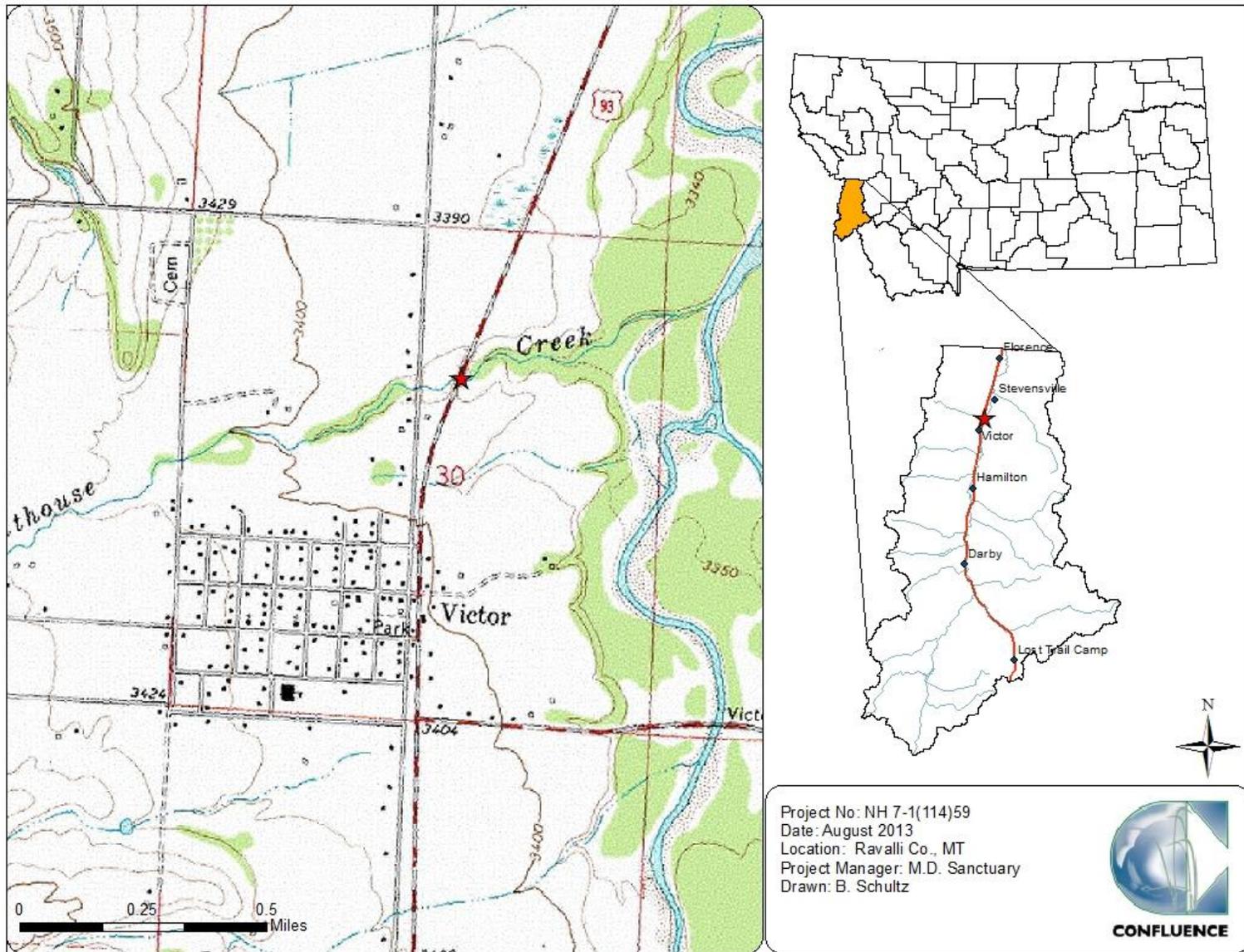


Figure 1. Project location of Sweathouse Creek stream mitigation site.

### 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 vegetative composition of each riparian transect, including areal percent cover of total vegetation, woody vegetation, and noxious weeds. In 2014, the total percent riparian cover was 97%, and included 88% cover by herbaceous species and 9% by woody species. Noxious weed coverage remained consistent with the 2013 results at 4% total cover.

**Table 1. Riparian vegetation belt transect results, Sweathouse Creek in 2013 and 2014.**

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

Table 2 includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas. In 2014, 86 species were observed, representing an increase of 31 species from the previous monitoring event. In 2014, 59% of the species observed were hydrophytic based on the 2014 National Wetland Plant List (NWPL) (Lichvar et al, 2014).

**Table 2. Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site in 2013 and 2014.**

Scientific Name	Common Name	WMVC Indicator Status*
<i>Achillea millefolium</i>	Common Yarrow	FACU
<i>Agropyron cristatum</i>	Crested Wheatgrass	NL
<i>Algae, brown</i>	Algae, brown	NL
<i>Algae, green</i>	Algae, green	NL
<i>Alnus incana</i>	Speckled Alder	FACW
<b><i>Alopecurus aequalis</i></b>	<b>Short-Awn Meadow-Foxtail</b>	<b>OBL</b>
<b><i>Alopecurus pratensis</i></b>	<b>Field Meadow-Foxtail</b>	<b>FAC</b>
<b><i>Alyssum alyssoides</i></b>	<b>Pale Alyssum</b>	<b>NL</b>
<b><i>Betula pumila</i></b>	<b>Bog Birch</b>	<b>OBL</b>
<i>Bromus tectorum</i>	Cheatgrass	NL
<b><i>Carex aquatilis</i></b>	<b>Leafy Tussock Sedge</b>	<b>OBL</b>
<i>Carex sp.</i>	Sedge	NL
<b><i>Carex stipata</i></b>	<b>Stalk-Grain Sedge</b>	<b>OBL</b>
<i>Carex utriculata</i>	Northwest Territory Sedge	OBL
<b><i>Centaurea stoebe</i></b>	<b>Spotted Knapweed</b>	<b>NL</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>
<i>Dactylis glomerata</i>	Orchard Grass	FACU
<i>Dasiphora fruticosa</i>	Golden-Hardhack	FAC
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	NL
<b><i>Eleocharis palustris</i></b>	<b>Common Spike-Rush</b>	<b>OBL</b>
<i>Elymus cinereus</i>	Great Basin Wildrye	NL
<i>Elymus repens</i>	Creeping Wild Rye	FAC
<i>Epilobium ciliatum</i>	Fringed Willowherb	FACW
<b><i>Equisetum arvense</i></b>	<b>Field Horsetail</b>	<b>FAC</b>
<b><i>Geum macrophyllum</i></b>	<b>Large-Leaf Avens</b>	<b>FAC</b>
<i>Glyceria grandis</i>	American Manna Grass	OBL
<i>Glyceria striata</i>	Fowl Manna Grass	OBL
<i>Hordeum jubatum</i>	Fox-Tail Barley	FAC
<i>Hypericum perforatum</i>	Common St. John's-Wort	FACU
<b><i>Juncus balticus</i></b>	<b>Baltic Rush</b>	<b>FACW</b>
<b><i>Juncus compressus</i></b>	<b>Round-Fruit Rush</b>	<b>OBL</b>
<i>Juncus effusus</i>	Lamp Rush	FACW
<i>Juncus ensifolius</i>	Dagger-Leaf Rush	FACW
<b><i>Juncus sp.</i></b>	<b>Rush</b>	<b>NL</b>
<b><i>Lemna minor</i></b>	<b>Common Duckweed</b>	<b>OBL</b>

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

**Table 2 (continued). Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site in 2013 and 2014.**

<b>Scientific Name</b>	<b>Common Name</b>	<b>WMVC Indicator Status</b>
<b><i>Lepidium latifolium</i></b>	<b>Broad-Leaf Pepperwort</b>	<b>FAC</b>
<i>Leucanthemum vulgare</i>	Ox-Eye Daisy	FACU
<i>Leymus cinereus</i>	Great Basin Lyme Grass	FAC
<b><i>Lupinus sp.</i></b>	<b>Lupine</b>	<b>NL</b>
<i>Medicago lupulina</i>	Black Medick	FACU
<i>Medicago sativa</i>	Alfalfa	UPL
<b><i>Melilotus albus</i></b>	<b>White Sweetclover</b>	<b>NL</b>
<i>Melilotus officinalis</i>	Yellow Sweet-Clover	FACU
<b><i>Mentha arvensis</i></b>	<b>American Wild Mint</b>	<b>FACW</b>
<i>Mimulus guttatus</i>	Seep Monkey-Flower	OBL
<b><i>Myriophyllum sp.</i></b>	<b>Water-Milfoil</b>	<b>NL</b>
<i>Onopordum acanthium</i>	Scotch Thistle	NL
<i>Pascopyrum smithii</i>	Western-Wheat Grass	FACU
<i>Persicaria amphibia</i>	Water Smartweed	OBL
<b><i>Persicaria sp.</i></b>	<b>Smartweed</b>	<b>NL</b>
<i>Phalaris arundinacea</i>	Reed Canary Grass	FACW
<i>Phleum pratense</i>	Common Timothy	FAC
<i>Plantago lanceolata</i>	English Plantain	FACU
<i>Plantago major</i>	Great Plantain	FAC
<b><i>Poa palustris</i></b>	<b>Fowl Blue Grass</b>	<b>FAC</b>
<i>Poa pratensis</i>	Kentucky Blue Grass	FAC
<b><i>Populus angustifolia</i></b>	<b>Narrow-Leaf Cottonwood</b>	<b>FACW</b>
<i>Populus balsamifera</i>	Balsam Poplar	FAC
<i>Populus tremuloides</i>	Quaking Aspen	FACU
<i>Ranunculus aquatilis</i>	White Water-Crowfoot	OBL
<i>Ranunculus sp.</i>	Buttercup	NL
<b><i>Rumex acetosa</i></b>	<b>Garden Sorrel</b>	<b>FAC</b>
<i>Rumex crispus</i>	Curly Dock	FAC
<b><i>Salix amygdaloides</i></b>	<b>Peach-Leaf Willow</b>	<b>FACW</b>
<i>Salix babylonica</i>	Chinese Willow	FACW
<i>Salix boothii</i>	Booth's Willow	FACW
<i>Salix drummondiana</i>	Drummond's Willow	FACW
<i>Salix exigua</i>	Narrow-Leaf Willow	FACW
<i>Salix lasiandra</i>	Pacific Willow	FACW
<b><i>Schoenoplectus acutus</i></b>	<b>Hard-Stem Club-Rush</b>	<b>OBL</b>
<i>Scirpus microcarpus</i>	Red-Tinge Bulrush	OBL
<i>Scrophularia lanceolata</i>	Lance-Leaf Figwort	FAC

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

**Table 2 (continued). Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site in 2013 and 2014.**

Scientific Name	Common Name	WMVC Indicator Status
<i>Silene latifolia</i>	Bladder Campion	NL
<i>Silene vulgaris</i>	Maiden's-tears	NL
<b><i>Solanum dulcamara</i></b>	<b>Climbing Nightshade</b>	<b>FAC</b>
<b><i>Solidago canadensis</i></b>	<b>Canadian Goldenrod</b>	<b>FACU</b>
<i>Tanacetum vulgare</i>	Common Tansy	FACU
<i>Taraxacum officinale</i>	Common Dandelion	FACU
<b><i>Thlaspi arvense</i></b>	<b>Field Pennycress</b>	<b>UPL</b>
<i>Trifolium pratense</i>	Red Clover	FACU
<i>Trifolium repens</i>	White Clover	FAC
<i>Typha latifolia</i>	Broad-Leaf Cat-Tail	OBL
<i>Verbascum thapsus</i>	Great Mullein	FACU
<b><i>Veronica americana</i></b>	<b>American-Brooklime</b>	<b>OBL</b>

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

The vegetation inventory along Sweathouse Creek identified six Montana state-listed noxious weeds and one state-regulated species (Table 3). All noxious weeds were observed in trace amounts, with locations shown on Figure 3 in Appendix A.

**Table 3. Montana State listed noxious weed and regulated species observed in 2014 at the Sweathouse Creek Stream Mitigation Site.**

Category*	Scientific Name	Common Name
Priority 2A	<i>Lepidium latifolium</i>	Broad-Leaf Pepperwort
Priority 2B	<i>Centaurea stoebe</i>	Spotted Knapweed
	<i>Cirsium arvense</i>	Canadian Thistle
	<i>Hypericum perforatum</i>	Common St. John's-Wort
	<i>Leucanthemum vulgare</i>	Ox-Eye Daisy
	<i>Tanacetum vulgare</i>	Common Tansy
Priority 3 State Regulated	<i>Bromus tectorum</i>	Cheatgrass

\*Based on the MSU Extension Services' Weed List, 2013

## **4.2. Erosion Inventory**

One eroding stream bank was documented along the right (south) bank between the first and second root wads downstream of the Highway 93 Bridge (Photo 4 in Appendix C). Erosion along this bank appeared due to scour of gravels and cobbles that had been placed beneath the coir logs to construct the bank. Movement of these cobbles has resulted in a 15-foot segment of the bank to undercut, loss of one coir log, and bank calving adjacent to a second coir log. Erosion along this bank is considered moderate due to a relatively short eroding segment and lateral migration rate. The top of the poorly vegetated bank is now exposed to stream flows that will continue to scour against this bank during high flows. Willow cuttings installed along the toe of this bank, as well as the entire length of the right (south) bank have been trimmed, and the herbaceous vegetation planted on the top of the bank has been consistently mowed. Trimming and mowing of all vegetation up to the stream bank was also noted in 2013. Trimming of willow cuttings can have a beneficial effect on establishing roots; however, trimming too much of the stem and leaves may result in reduced vigor and the inability of the cutting to effectively photosynthesize. Many of the cuttings appear to be establishing roots in the bank, which will help to provide long term stability.

## **4.3. Perpendicular Transect Surveys**

Four perpendicular transects within the project were re-surveyed, including two pools and two riffles. Plots for each surveyed transect are included in Appendix B. Repetition of these transects indicate relatively minor adjustments to the bed and banks. Both pools appear to be maintaining deeper water habitat by scouring against woody structures installed on the right bank. Riffles also largely maintained bed elevations and channel dimensions, indicating relatively good sediment and bedload transport. No evidence of erosion was noted at any of the surveyed transects. Perpendicular transects will be re-surveyed during subsequent monitoring events to document bar formation, pool depths, or lateral channel movements.

## **4.4. Longitudinal Profile Surveys**

A longitudinal profile of the channel thalweg is also included in Appendix B, Inspection of this profile indicates the presence of one long pool extending from STA 2+30 downstream to STA 3+10. This section of the channel has several root wads installed along the bank to encourage scour and pool development. Both pool transects surveyed lie within this segment of the channel. A second pool is developing on the next meander bend downstream, where the longitudinal profile ends. Continued monitoring of the channel bed elevation will document whether and aggradation or degradation is occurring within the project reach.

## **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 second year of monitoring suggests one of the three performance standards is being met three years post-construction. Total vegetative cover within the riparian zone remains above the

80% minimum standard; although the percent cover attributed to woody vegetation (9%) remained well below the established target of 50%. One relatively short stream bank was identified as eroding, and may require corrective actions. 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 3 years following construction.**

Parameter	Success Criteria	Status	Meeting Performance Criteria?
Riparian Coverage	80% total vegetative coverage after the 3rd year.	Project area has <b>97%</b> vegetative cover.	Yes
	50% coverage of woody vegetation after the 3rd year.	Project area has <b>9%</b> woody cover (10% of south bank and 7% of north bank)	No
Stream Bank Stability	Unstable banks identified within the project reach will require corrective action	One eroding streambank, with moderate severity, was identified in 2014.	Corrective action may be required at eroding bank

### 5.1. Riparian Vegetation Coverage

Total riparian vegetative cover, measured at 97%, exceeds the performance standard of 80% areal coverage. Vegetation is establishing 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 it is being mowed to the edge of the channel by the adjacent landowner.

Woody riparian vegetation, measured at 9% of the total cover, currently does not meet the performance standard of 50% coverage by the end of the third growing season. Many of the willow cuttings installed along the toe of both banks have survived, which is an encouraging sign toward long-term vegetative bank stability. These willows provide a fairly consistent, but very thin band of woody vegetation along the edge of the stream bank; however, little to no additional woody vegetation is establishing within the remainder of the 25-foot wide riparian zone.

Woody vegetation cover on the north (not mowed) bank is 7%, while the cover on the south (mowed) bank is 10%. The higher percent woody cover on the south bank is due to successful establishment of the thin band of willow cuttings along the entire bank, whereas a shorter segment of the north bank exhibits successful willow growth. There has been minimal development of voluntary woody species along the north stream bank. Based on these data, woody plants installed within the riparian buffer zones had relatively poor survival rates. Woody plants that did survive installation remain relatively small and have yet to provide enough cover to meet the performance criteria for this category.

The adjacent landowner to the south of the creek has continued to mow all vegetation up to the edge of the bank; therefore, it is likely any small woody vegetation installed away from the edge of the south bank has been largely eliminated. The ability to meet the woody vegetation cover criteria will largely depend on cooperation of the adjacent

landowner to maintain an intact riparian buffer. MDT biologists installed approximately 150 dogwood, Wood's rose, and willows within the riparian zone in an attempt to establish woody species composition; however, it appears much of this woody vegetation has been removed due to frequent mowing on the south bank, or did not survive on the north bank. Given the relatively low woody species composition on both sides of the channel, supplemental woody vegetation plantings on both banks will be necessary to achieve the target percent cover of 50%.

## **5.2. Bank Erosion Inventory**

One 15-foot section of Sweathouse Creek within the project reach showed signs of active erosion. This moderately eroding bank occurs between two root wads installed to protect the bank from lateral erosion. Coir logs placed to protect the upper bank have collapsed or been 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. As a result of this bank, corrective actions are necessary to maintain 100% stability within the project reach.

## **6.0 MANAGEMENT RECOMMENDATIONS**

### **6.1. Woody Vegetation Establishment**

As noted in Section 5, woody vegetation establishment within the project reach is mainly limited to a thin band of willows establishing from cuttings installed along the toe of the banks. Willow cutting survival rates appear relatively high, which is encouraging for long term bank stability. Survival of additional woody plantings within the riparian zone appears marginal, and may be partially attributed to mowing on the south bank. Installation of additional plantings such as willow, alder, Wood's rose, chokecherry, or water birch is recommended within the riparian zones on both sides of the channel to improve overall percent cover of woody species. If additional cuttings are installed, they should be placed at a minimum depth equivalent to the low water elevation.

Monitoring observations noted the landowner south of the project reach is mowing all of the vegetation down to the stream bank (Photo Point 6.2). In order to maintain long term bank stability downstream of the bridge, it is important to maintain a healthy, unmowed vegetative buffer between the lawn and the stream bank to promote root growth and soil stability between and downstream of the root wads. It is recommended that MDT establish an agreement with the adjacent landowner to maintain a minimum buffer of 25' from the banks to encourage establishment of deep-rooted woody and herbaceous vegetation. In addition to erosion prevention, establishment of a riparian buffer would help protect water quality in Sweathouse Creek by filtering any adjacent herbicide or fertilizer applications.

### **6.2. Coir Log/fabric Installation**

Design details for Sweathouse Creek included a sequence for installing erosion control blankets along both sides of the channel. Inspection of the coir fabric revealed the

contractor adhered to the design sequence and constructed an encapsulated soil lift by backfilling over the leading edge of the fabric, wrapping the fabric around the soil, and securing the back edge of the coir into a key trench. The upstream extent of the coir fabric on the south bank was exposed (Photo Point 2.1), revealing the outer corner of the soil lift. This location may be susceptible to erosion, as it is the upstream extent of the bioengineered bank. It is important to key the upstream end of coir fabric soil lifts back into the streambank to prevent the leading edge of the fabric from unraveling. Additional design details for keying in the upstream extent of the fabric soil lifts are recommended to improve stability in these susceptible areas.

## **7.0 LITERATURE CITED**

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## **Appendix A**

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### Project Site Maps

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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## Legend

-  Photo Points
-  Riparian and Perpendicular Transect Endpoints

-  Channel Thalweg
-  Major Station (100')
-  Minor Station (25')

-  Eroding Banks
-  Pool and Riffle Transects
-  Riparian Transects

## 2014 Monitoring Sweathouse Creek

Figure 2

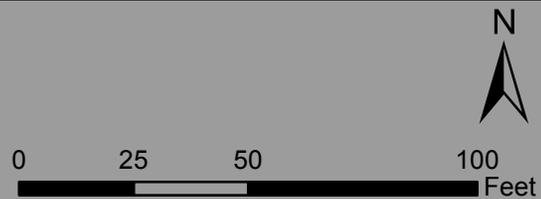
Date: 09/26/2014

X:/MDT\_.007/mains



**Legend**

- × Centaurea stoebe
- ◇ Cirsium arvense
- ★ Tanacetum vulgare
- ▲ Hypericum perforatum
- ◇ Leucanthemum vulgare
- Lepidium latifolium



**2014 Monitoring Sweathouse Creek**

Figure 3

Date: 11/03/2014

X:/MDT\_.007/mains

## **Appendix B**

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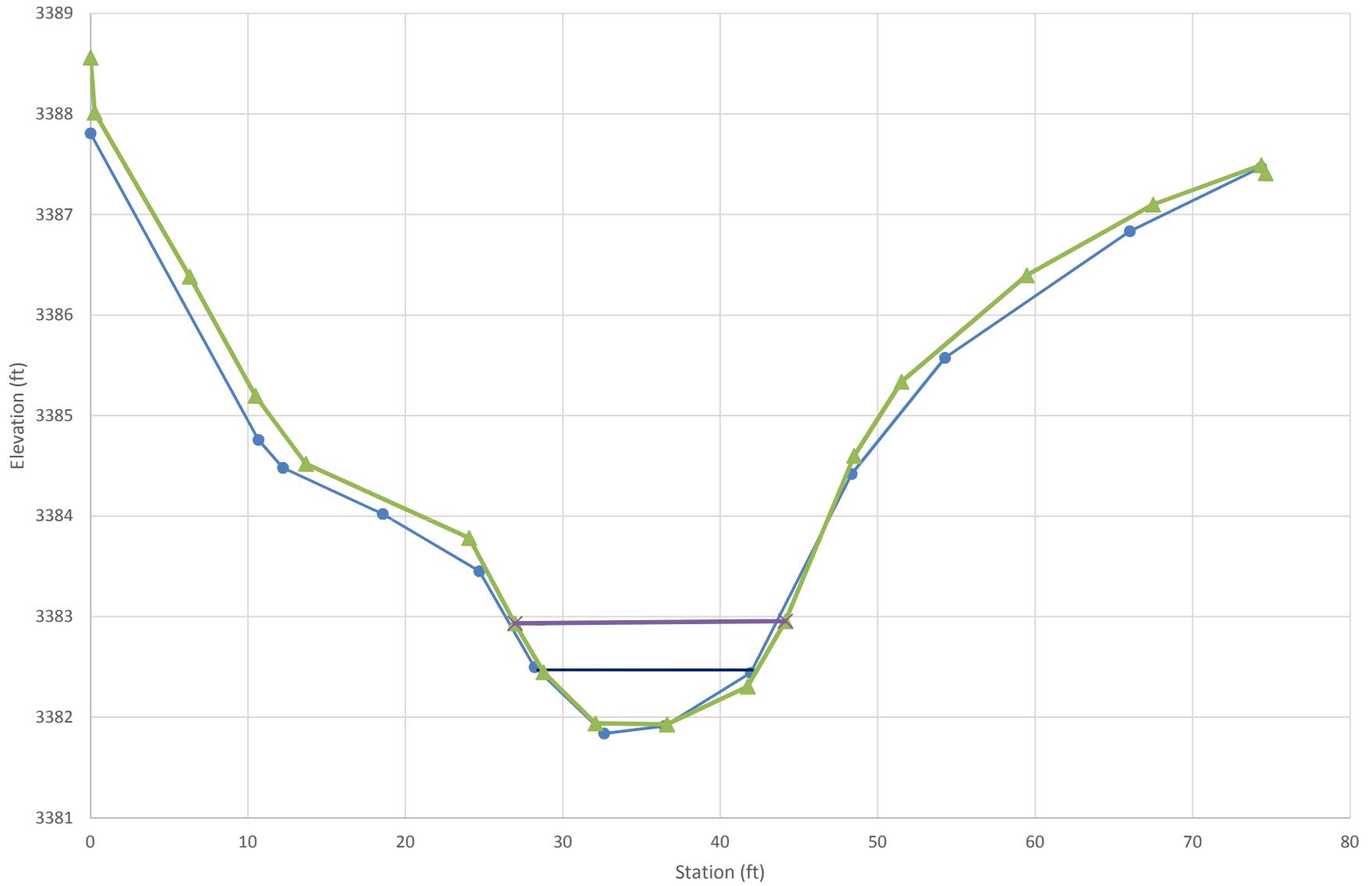
### Perpendicular Transect Plots and Longitudinal Profile

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

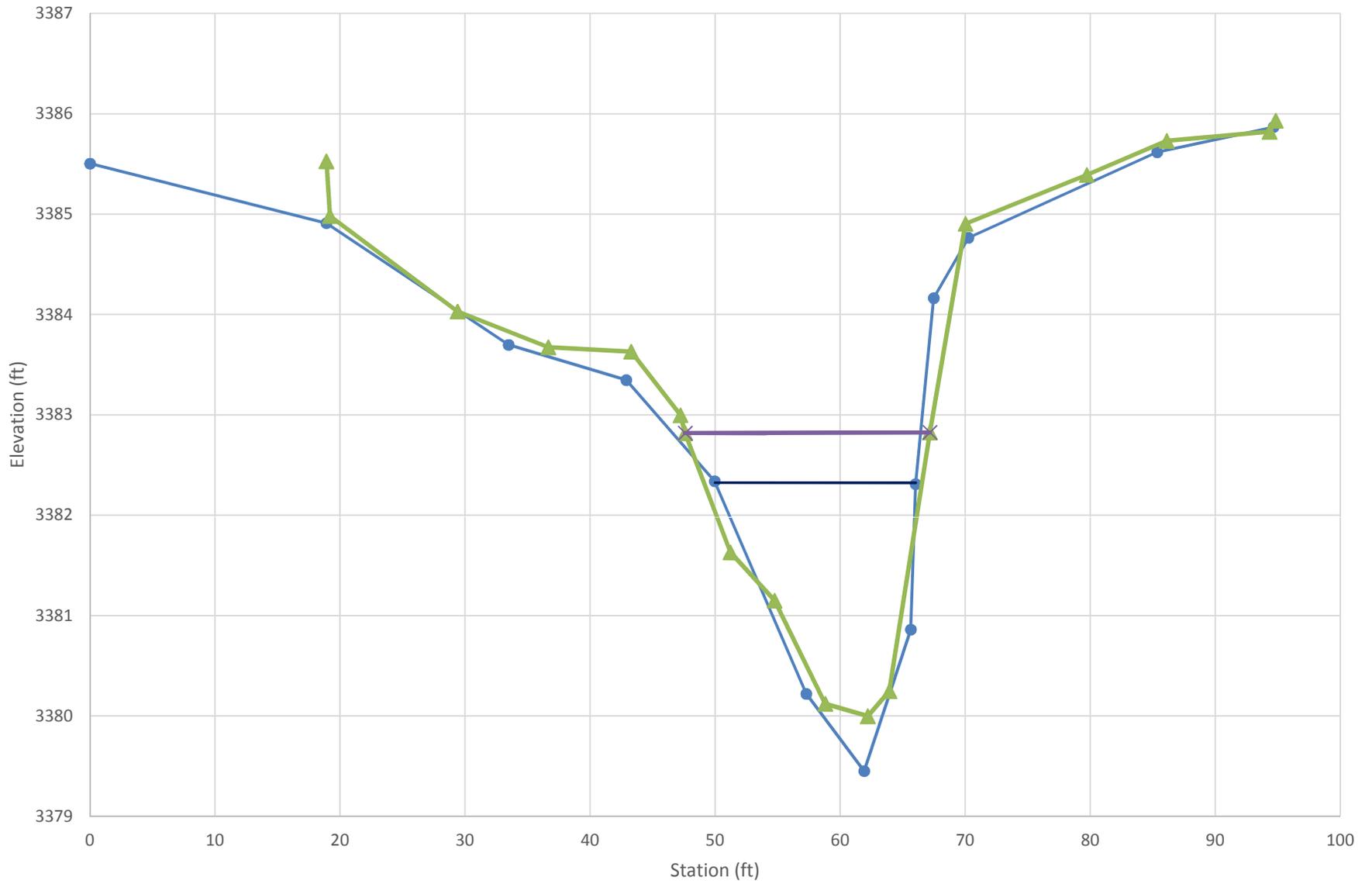
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Sweathouse Creek Transect #1 - Riffle



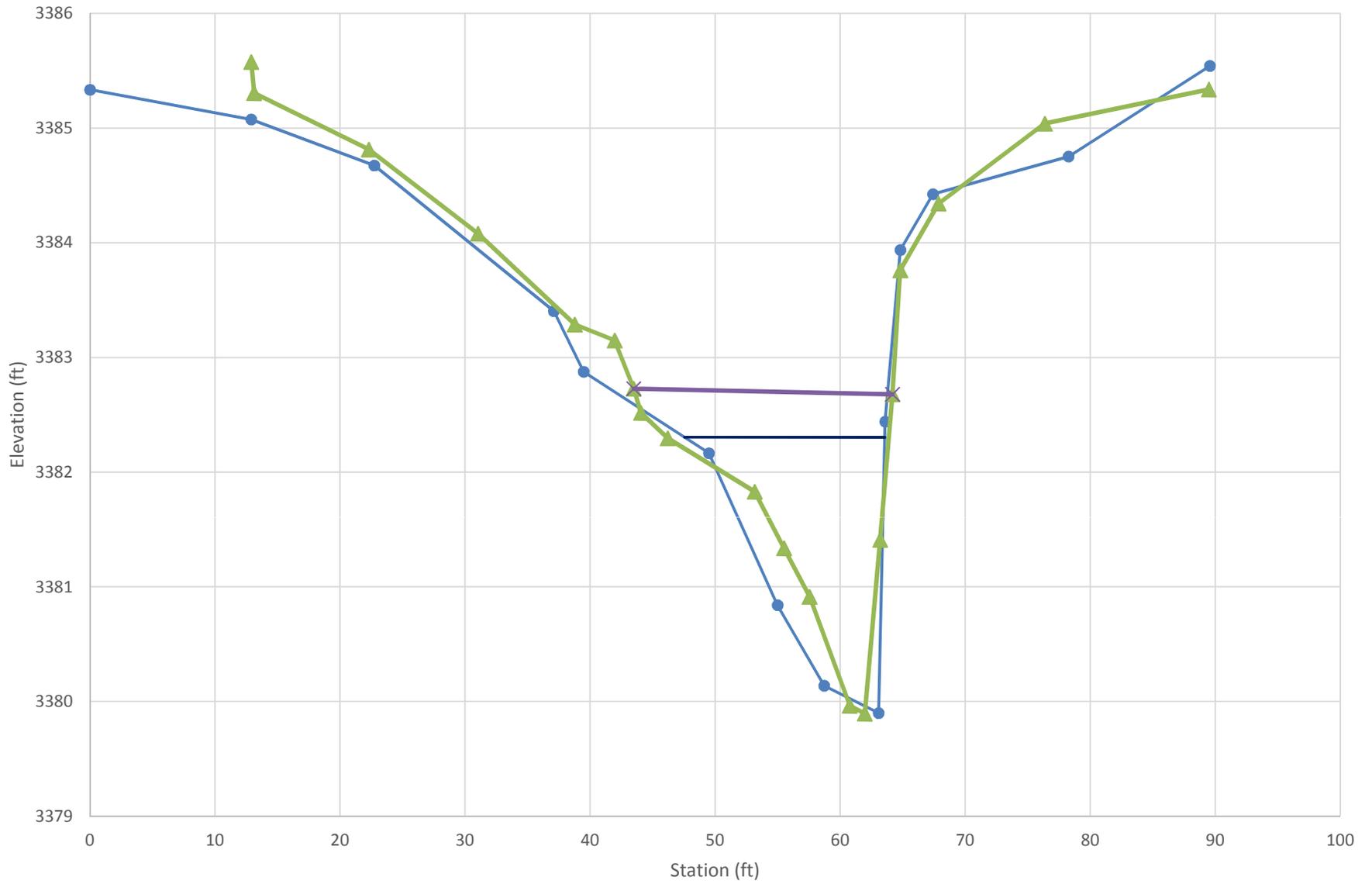
● 2013 XS    — 2013 WS    ▲ 2014 XS    × 2014 WS

### Sweathouse Creek Transect #2 - Pool



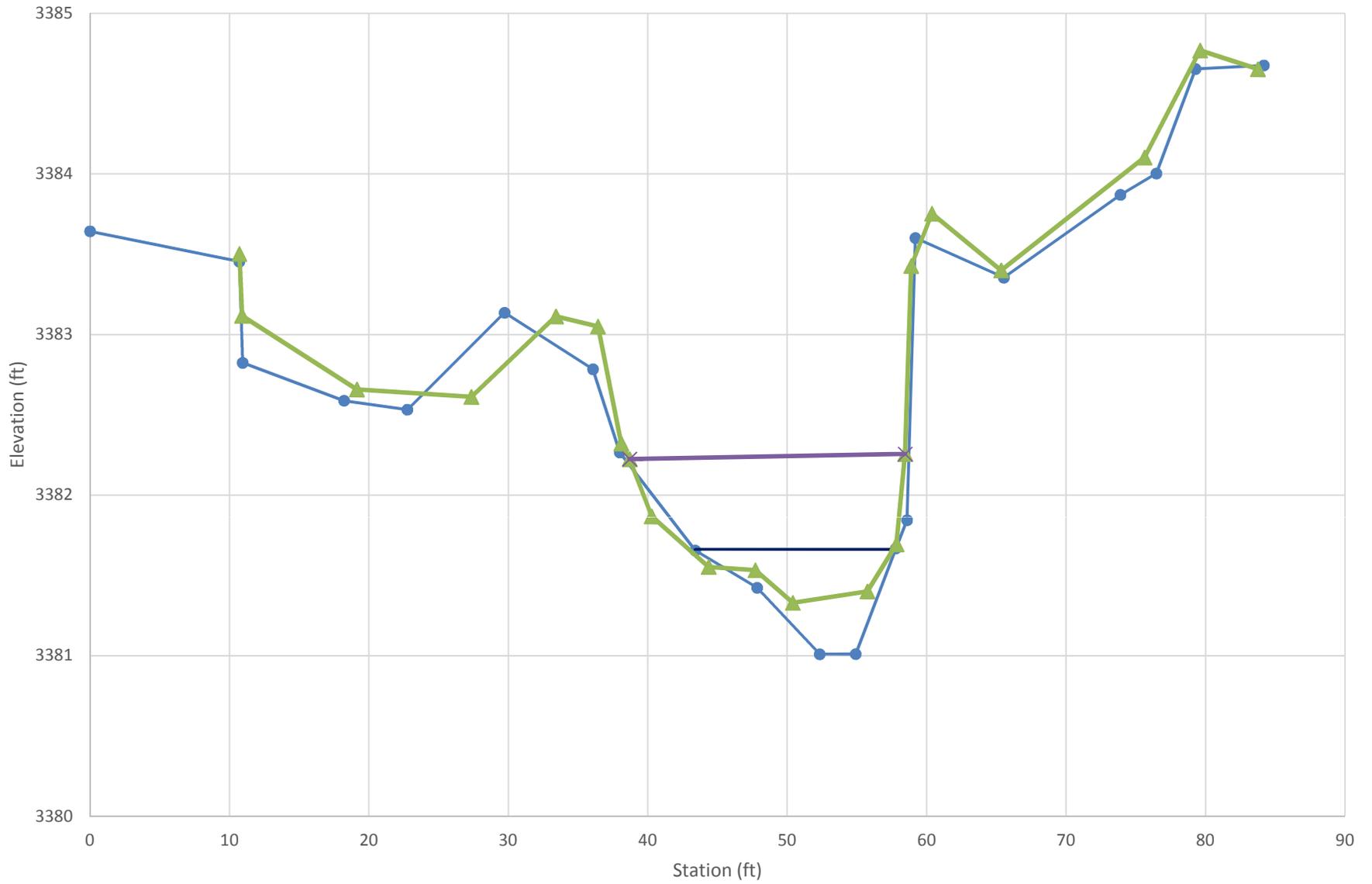
● 2013 XS    — 2013 WS    ▲ 2014 XS    × 2014 WS

Sweathouse Creek Transect #3 - Pool



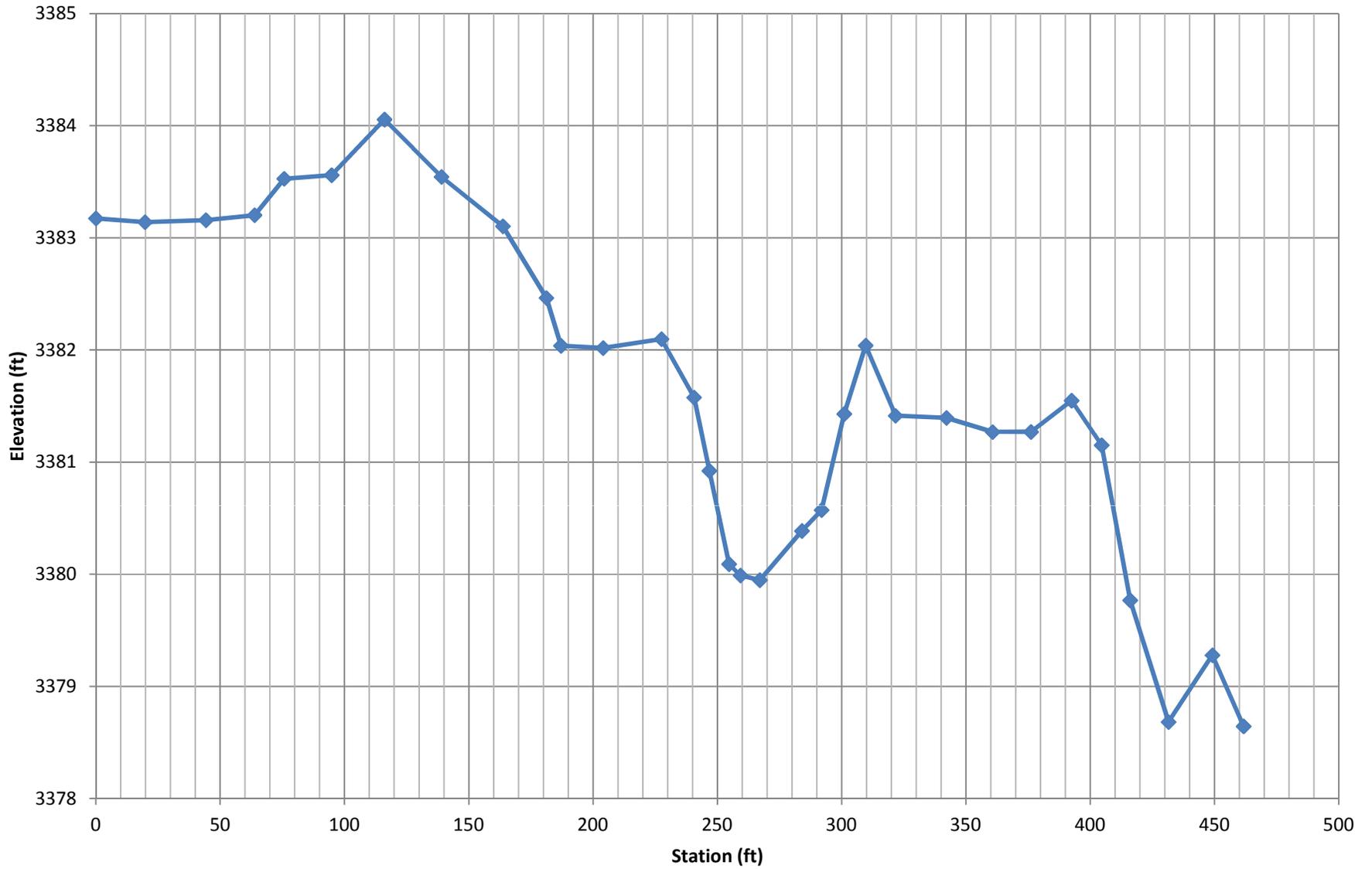
● 2013 XS    — 2013 WS    ▲ 2014 XS    × 2014 WS

Sweathouse Creek Tansect #4 - Riffle



● 2013 XS    — 2013 WS    ▲ 2014 XS    × 2014 WS

# Sweathouse Creek Longitudinal Profile



—◆— Channel Bed

## **Appendix C**

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Project Site Photos

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



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



**Photo Point 1.1—2014**  
**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—2014**  
**Description:** View of both banks looking downstream from bridge abutment. **Compass:** 68 (East-Northeast)



**Photo Point 2.1—2013**  
**Description:** View of un-keyed coir log on south bank  
**Compass:** 90 (East)



**Photo Point 2.1—2014**  
**Description:** View of un-keyed coir log on south bank  
**Compass:** 90 (East)

## PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo Point 3.1—2013**

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



**Photo Point 3.1—2014**

**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—2014**

**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—2014**

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

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



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



**Photo Point 4.1—2014**  
**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—2014**  
**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—2014**  
**Description:** View of both banks looking downstream.  
**Compass:** 225 (Southwest)

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



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



**Photo Point 5.1—2014**  
**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—2014**  
**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—2014**  
**Description:** View of vegetation on north bank.  
**Compass:** 90 (East)

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



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



**Photo Point 6.1—2014**  
**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—2014**  
**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—2014**  
**Description:** View looking across channel from north bank. **Compass:** 90 (East)

## PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo Point 7.1—2013**  
**Description:** View of north streambank upstream of bridge. **Compass:** 68 (East-Northeast)



**Photo Point 7.1—2014**  
**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—2014**  
**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—2014**  
**Description:** View of north bank looking across stream channel. **Compass:** 0 (North)

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek

DATE: July 24, 2014



**Photo 1—2013**  
**Description:** Root wads along south streambank.  
**Compass:** 45 (Northeast)



**Photo 1—2014**  
**Description:** Root wads along south streambank.  
**Compass:** 45 (Northeast)



**Photo 2—2013**  
**Description:** Point bar formation on north side of channel.  
**Compass:** 250 (West-Southwest)



**Photo 2—2014**  
**Description:** Point bar formation on north side of channel.  
**Compass:** 250 (West-Southwest)



**Photo 3—2013**  
**Description:** Log structure along south streambank.  
**Compass:** 110 (East-Southeast)



**Photo 3—2014**  
**Description:** Log structure along south streambank.  
**Compass:** 110 (East-Southeast)

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



**Photo 4—2013**  
**Description:** Willow growth from coir along south streambank. **Compass:** 90 (East)



**Photo 4—2014**  
**Description:** Eroding bank along right (south bank). **Compass:** 90 (East)

## **Appendix D**

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### As Built Surveys & Planting Schematics

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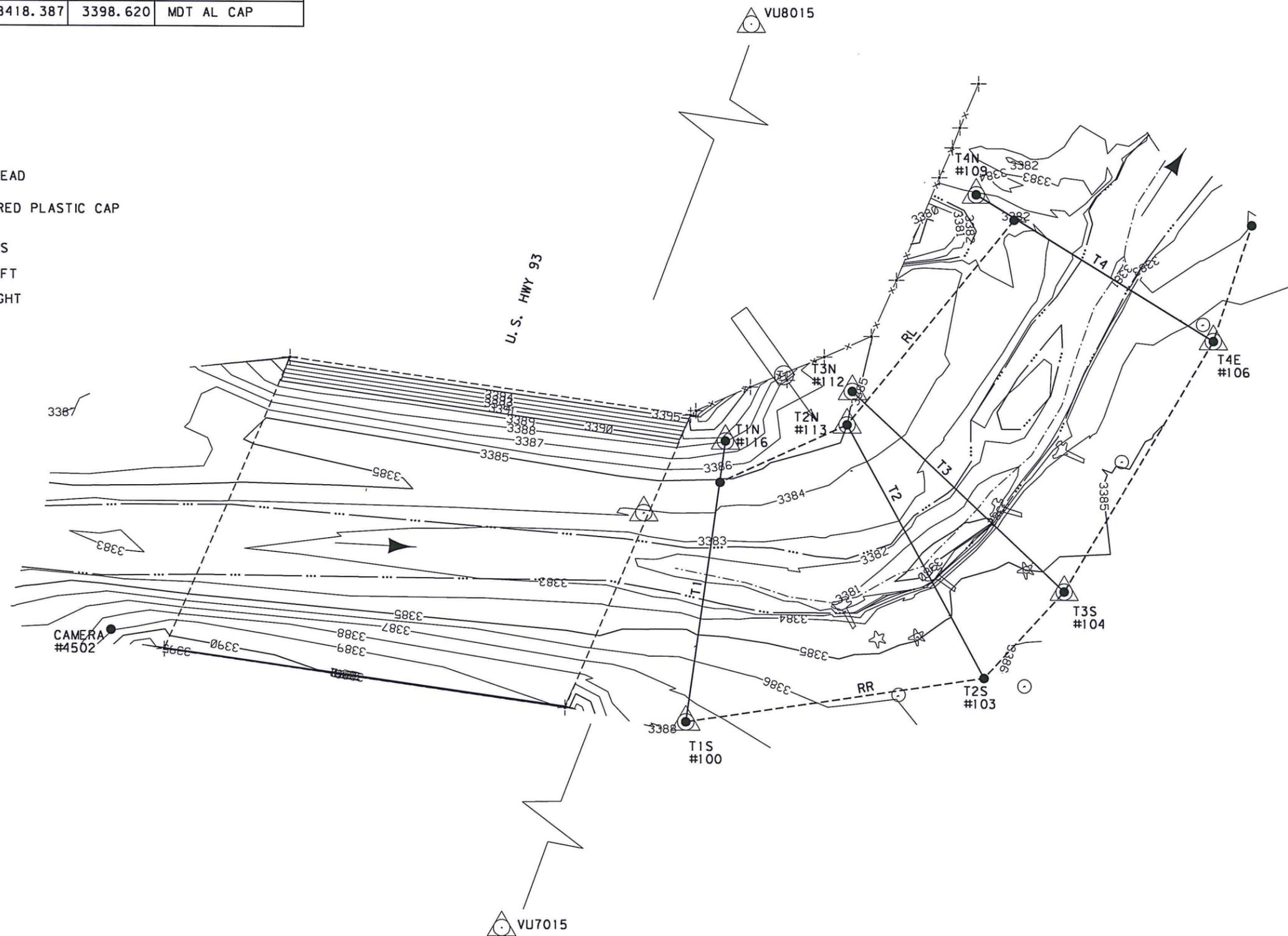
MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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CONTROL TABLE				
PNT#	NORTHING	EASTING	ELEV.	DESCRIPTION
VU8015	828172.704	798795.833	3398.807	MDT AL CAP
VU7015	826995.289	798418.387	3398.620	MDT AL CAP

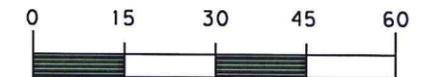
LEGEND

-  ROOT BALL
-  TREE STUMP
-  SPRINKLER HEAD
-  IRON PIN W/RED PLASTIC CAP
- T1 TRANSECTIONS
- RL RIPTRANS LEFT
- RR RIPTRANS RIGHT



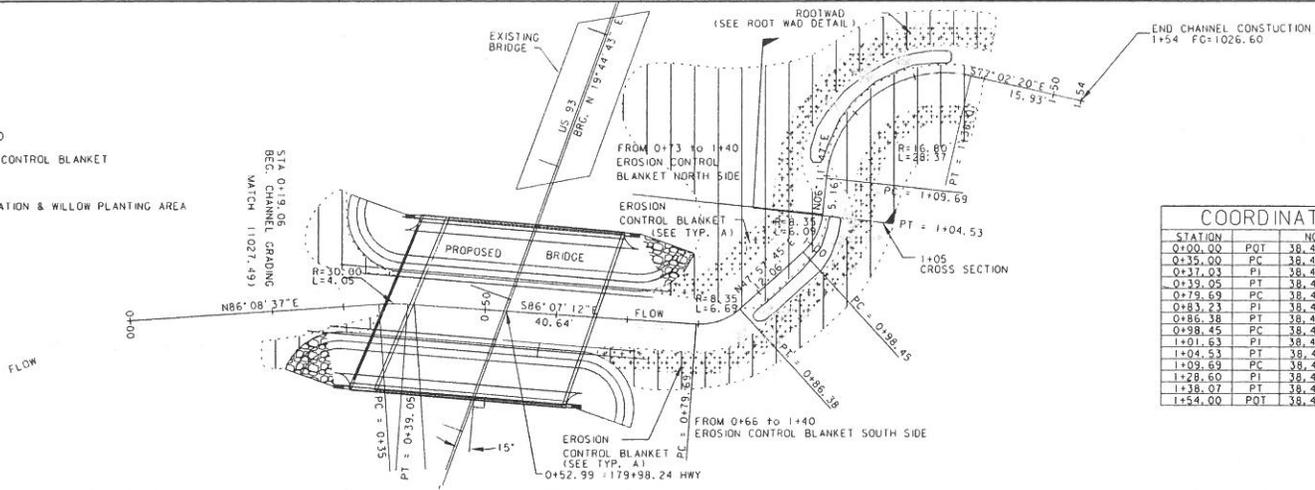
SURVEYOR NOTES:

- THIS SURVEY IS BASED ON FOUND MDT ALUMINUM CAPS STAMPED VU8015 AND VU7015 BUT THEY DO NOT HAVE ESTABLISHED MDT COORDS AND ELEVATIONS. THEREFORE LOCAL CONTROL WAS ESTABLISHED FOR THIS SITE WITH TRIMBLE GPS RTK SURVEY AND THE APPROXIMATE ASSUMED ELEVATION AT MDT ALUM CAP VU8015.
- THE COORDINATES SHOWN HEREON ARE BASED ON MONTANA STATE PLANE GRID



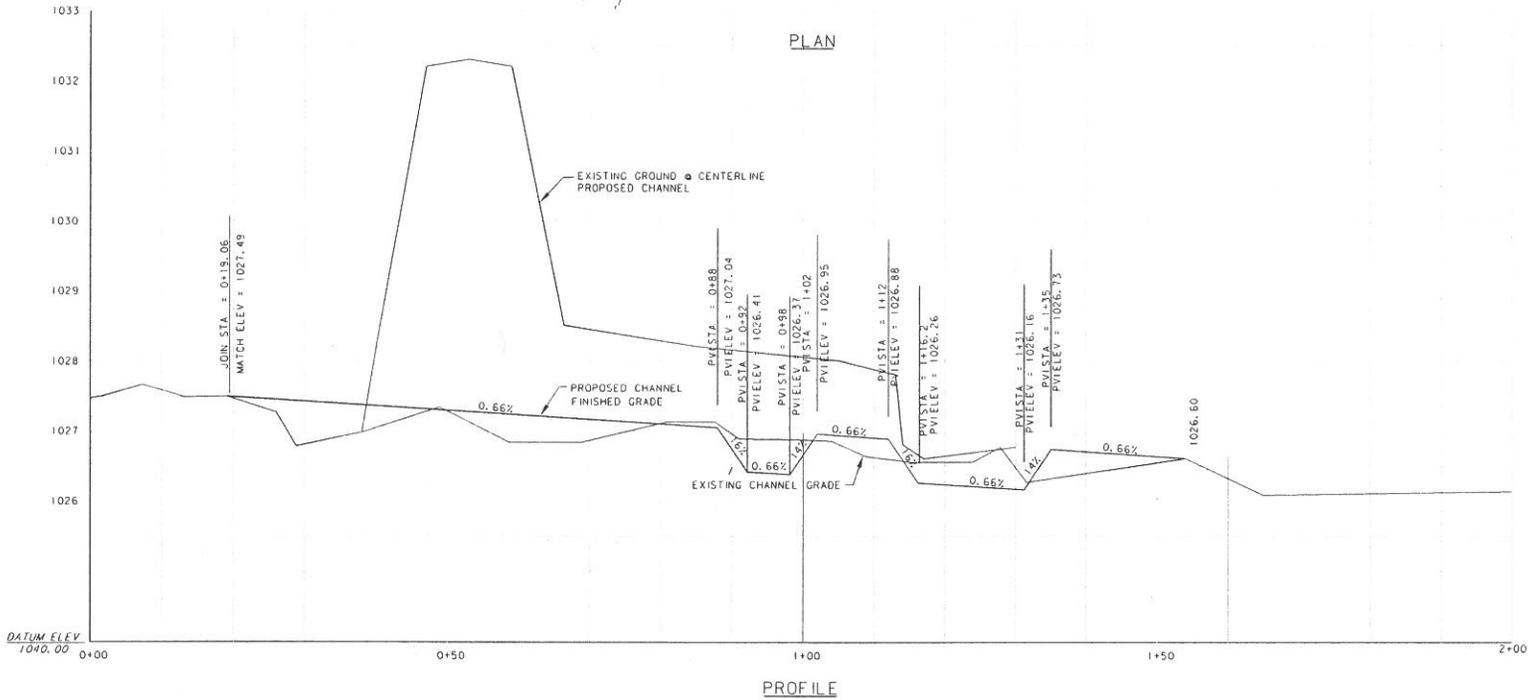
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 7-11115159	28
VICTOR URBAN		

- LEGEND**
- ROOT WAD
  - EROSION CONTROL BLANKET
  - RIP RAP
  - VEGETATION & WILLOW PLANTING AREA



**COORDINATE TABLE**

STATION	POT	NORTHING	EASTING
0+00.00	POT	38,404.6187	56,198.6875
0+35.00	PC	38,407.0326	56,233.6082
0+37.03	PI	38,407.1630	56,235.6320
0+39.05	PT	38,407.0319	56,237.6558
0+79.69	PC	38,404.2817	56,278.2049
0+83.23	PI	38,404.0424	56,281.7341
0+86.38	PT	38,406.4110	56,284.3612
0+88.45	PC	38,414.4878	56,293.3196
1+01.63	PI	38,416.6210	56,295.6857
1+04.53	PT	38,419.7881	56,296.0296
1+09.69	PC	38,424.9181	56,296.5855
1+28.60	PI	38,443.7182	56,298.6277
1+38.07	PT	38,439.4768	56,317.0564
1+54.00	POT	38,435.9032	56,332.5834



SWEATHOUSE CREEK  
CHANNEL  
RESTORATION  
DETAIL  
STA. 179+98  
SHEET 1 OF 2  
NO SCALE

MDTX MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

LAND & WATER CONSULTING, INC.

06/21/2019  
10:00 AM  
00208

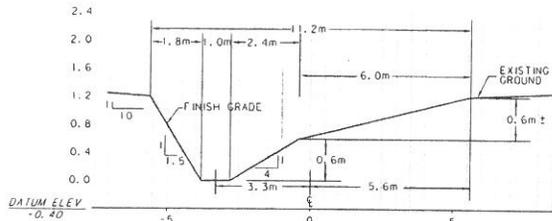
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 7-1(115)59	29
VICTOR URBAN		

MDTX MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

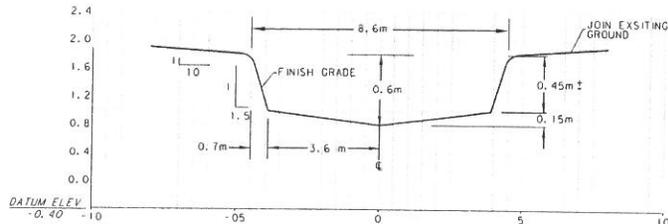
LAND & WATER CONSULTING, INC.

15000 15000 15000 15000  
 9/27/2010  
 11:21 AM  
 CPS - 10208



TYPICAL POOL LEFT CROSS SECTION

LEFT POOL 1+16.2 TO 1+31  
RIGHT POOL 0+92 TO 0+98



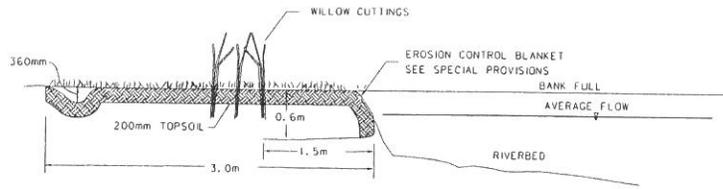
TYPICAL RIFFLE CROSS SECTION

RIFFLE

(INCLUDES TRANSITIONS)

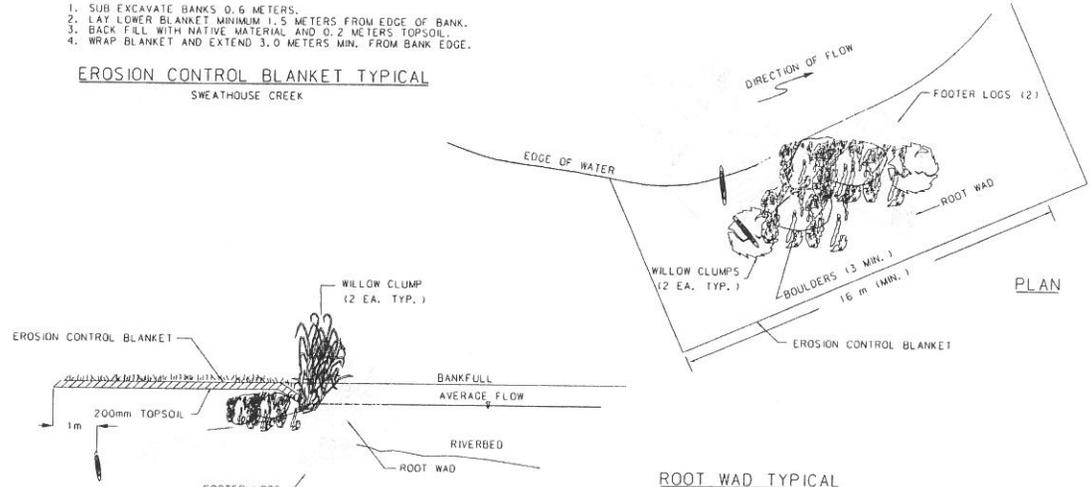
NOTES:

- SEE PLANS FOR POOL LOCATIONS. POOL LEFT (PL) SHOWN, MIRROR ABOUT CENTERLINE (C) FOR POOL RIGHT LOOKING DOWNSTREAM.
- TRANSITION 4.0m BETWEEN POOL: RIFFLE.
- ROUND SLOPES FOR NATURAL APPEARANCE.

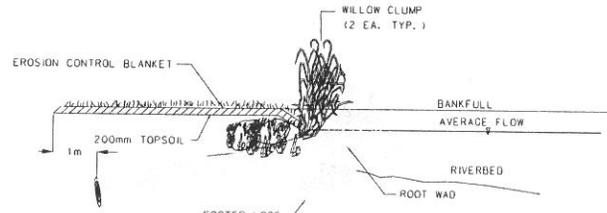


EROSION CONTROL BLANKET TYPICAL  
SWEATHOUSE CREEK

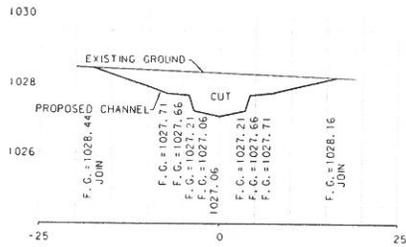
- SUB EXCAVATE BANKS 0.6 METERS.
- LAY LOWER BLANKET MINIMUM 1.5 METERS FROM EDGE OF BANK.
- BACK FILL WITH NATIVE MATERIAL AND 0.2 METERS TOPSOIL.
- WRAP BLANKET AND EXTEND 3.0 METERS MIN. FROM BANK EDGE.



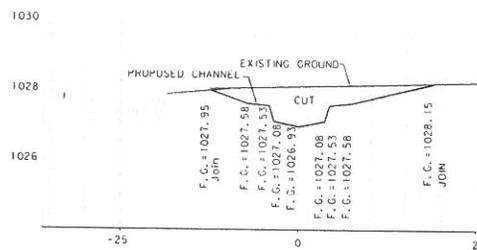
ROOT WAD TYPICAL  
SWEATHOUSE CREEK



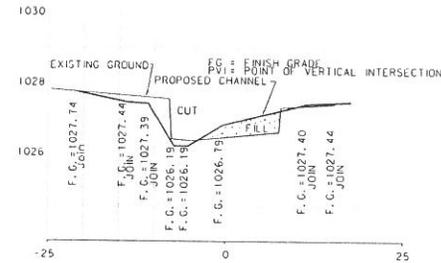
CROSS SECTION



CROSS SECTION 0+85



CROSS SECTION 1+05



CROSS SECTION 1+25

SWEATHOUSE CREEK  
CHANNEL  
RESTORATION  
DETAILS  
STA. 179+98  
SHEET 2 OF 2  
NO SCALE