
MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

*North Fork Bear Creek
Ravalli County, Montana*



Prepared for:

MONTANA
MDT★
DEPARTMENT OF TRANSPORTATION
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December 2013

MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT:

YEAR 2013

*North Fork Bear Creek
Ravalli County, Montana*

MDT Project Number: NH-7-1(114)56
Control Number: 2015 003

MTFWP: MDT-R2-64-2010
USACE: NWO-1997-90821-MTH

Prepared for:

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CCI Project No: MDT_.007

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Cover. View of North Fork Bear Creek upstream of U.S. Hwy 93.

1.0 INTRODUCTION

This 2013 Monitoring Report presents the results of the first year of post stream reconstruction monitoring along the North Fork Bear Creek near Victor, Montana. This report includes an evaluation of monitoring results in comparison to project performance standards, as set by the U.S. Army-Corps of Engineers (USACE) based on a July 24, 2013 field survey.

The Montana Department of Transportation (MDT) requested authorization to replace bridges at North and South Fork Bear Creek, construct a new stream channel segment, and to place 0.07 acres of wetland fill. The North Fork Bear Creek work included: removal and replacement of the existing bridge, placement of rock at bridge abutments, placement of fill within the stream channel, creation of a new stream channel, and removal of gabions downstream of the bridge. Root wads, erosion control blankets and willow plantings were installed in the project area.

Stream mitigation was implemented to offset placement of riprap and other fill materials within the ordinary high watermark of the stream corridor. Mitigation associated with streambank riprap placement included placement of willow sprigs along the right streambank upstream and downstream of the bridge. Willows clumps were planted near root wads along the right streambank. Mitigation is to be monitored for five years to evaluate compliance toward meeting performance standards.

The USACE approved reporting requirements and performance standards for the North Fork Bear Creek site include:

1. **Riparian coverage** - Visual estimates of aerial (canopy) coverage will be made of each plant life form class within the riparian buffer zone. Success criteria are as follows:
 - a) Greater than 50% aerial coverage of desirable perennial plants. Desirable plants include seeded species and those colonizing from adjacent undisturbed habitats.
 - b) Greater than 25% aerial coverage of woody riparian shrubs and/or trees.
 - c) Less than 10% aerial coverage of Montana State listed noxious weeds.
2. **Streambank Stability** - An assessment of bank stability will involve visual evaluation of the entire length of reconstructed banks. Areas of active erosion will be documented as a linear measurement and a qualitative estimate of severity. Success criteria will be based on less than 25% of total bank length exhibiting signs of active erosion/cutting.
3. **As-built** - An as-built drawing will be prepared with a list of planting for the riparian areas within the stream channel construction zone.
4. **Weed Control** - Monitoring will include identification of state designated noxious weeds and an estimate of aerial coverage of each weed species. Weed control

will be performed, as necessary, to prevent weeds from attaining aerial coverage greater than 10%.

5. **Photo Points** - A minimum of 4 photo points will be established to document conditions along the newly constructed sections.
 - a) Photo points will be established to show upstream and downstream bank conditions at bridge locations.
 - b) Streambank reconstruction not associated with bridges will include photo points from upstream and downstream angles.

2.0 SITE LOCATION

The project site is located on site along the North Fork Bear Creek in Section 31, Township 8 North, Range 20 West, approximately 1 mile south of Victor, Montana (Figure 1).

3.0 MONITORING METHODS

Monitoring field crews visited the project site on July 25, 2013 while survey crews visited the site on August 13, 2013. The following data were collected at the North Fork Bear Creek stream mitigation site:

3.1. Streambank Stability

Both stream banks within the project area were visually assessed to document eroding banks. Eroding stream banks were labeled with a specific numeric identifier, photographed, and a GPS location was recorded.

3.2. Riparian Vegetation Establishment

Visual estimates of all vegetation species, woody species, and noxious weeds were performed within riparian areas which extended 25 feet on either side of the active stream channel. Percent cover was recorded for each vegetative category based on ocular estimates.

3.3. Photo Documentation

Four photo points were selected to photo-document vegetation establishment and stream bank conditions within the project site. Photo documentation includes upstream and downstream bank conditions at the Highway 93 Bridge. All sites selected for photo-documentation were recorded using GPS and compass direction noted to allow for repetition during future monitoring (Appendix B).

3.4. As-Built Drawings

An as-built topographic drawing of the project site includes 1 foot elevation contours and control points established by MDT during project construction. The as-built plans include a list of plantings installed within the project site (provided by MDT) (Appendix C).

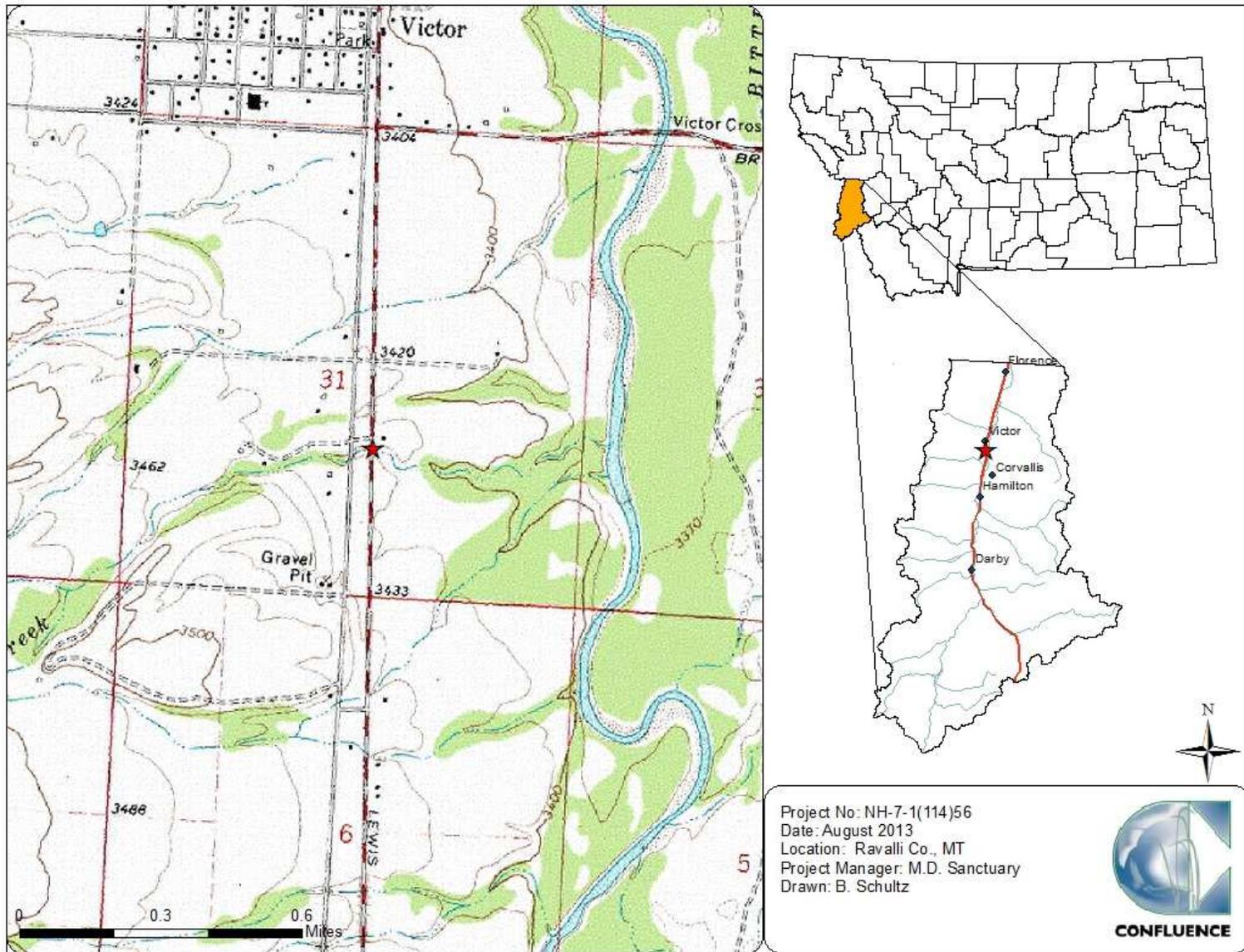


Figure 1. Project location of North Fork Bear Creek stream mitigation site.

4.0 RESULTS

4.1. Bank Erosion Inventory

Field examination of the North Fork Bear Creek project site documented no eroding stream banks within the project area. All stream banks exhibited vegetative establishment following channel reconstruction. New banks with large woody debris installations appeared stable with no undercutting or bank sloughing.

4.2. Riparian Vegetation Inventory

Results of the visual estimate of areal coverage are summarized in Table 1 to indicate total areal vegetative cover, areal cover by woody species, and areal cover of noxious weeds. Approximately 10% of the project site was bare ground, with 90% of the area vegetated with herbaceous and woody species. The site exhibited a relatively high percentage of noxious weeds, which composed approximately 35% of the total cover.

Table 1. Visual estimate of plant coverage at the North Fork Bear Creek Stream Mitigation Site.

Total % Riparian Cover	% Bare Ground	% Woody Cover	% Noxious Weed Cover
90	10	27	35

Forty two plant species were observed on site in 2013. Table 2 shows a comprehensive list of plant species observed on site in 2013. Plants observed were primarily upland, indicating that this stream reach is relatively dry and does not support riparian habitat upstream of the Highway 93 Bridge. This upstream reach contains relatively steep streambanks, which hinder growth of riparian vegetation. Downstream of the bridge, streambanks are less steep and grasses (*Phleum pratense*, *Dactylis glomerata*, *Elymus repens*, and *Poa pratensis*) are abundant.

Table 2. Comprehensive list of plant species observed at the North Fork Bear Creek Stream Mitigation Site in 2013.

Scientific Name	Common Name
<i>Agropyron cristatum</i>	Crested Wheatgrass
<i>Agrostis gigantea</i>	Black Bent
<i>Alnus incana</i>	Speckled Alder
<i>Bromus inermis</i>	Smooth Brome
<i>Bromus tectorum</i>	Cheatgrass
<i>Centaurea maculosa</i>	Spotted knapweed
<i>Cirsium arvense</i>	Canadian Thistle
<i>Crataegus douglasii</i>	Black Hawthorn
<i>Cynoglossum officinale</i>	Gypsy-Flower

Table 2 (continued). Comprehensive list of plant species observed at the North Fork Bear Creek Stream Mitigation Site in 2013.

Scientific Name	Common Name
<i>Dactylis glomerata</i>	Orchard Grass
<i>Dasiphora fruticosa</i>	Golden-Hardhack
<i>Elymus repens</i>	Creeping Wild Rye
<i>Elymus trachycaulus</i>	Slender Wild Rye
<i>Hordeum jubatum</i>	Fox-Tail Barley
<i>Lactuca serriola</i>	Prickly Lettuce
<i>Lepidium latifolium</i>	Broad-Leaf Pepperwort
<i>Leucanthemum vulgare</i>	Ox-Eye Daisy
<i>Melilotus officinalis</i>	Yellow Sweet-Clover
<i>Pascopyrum smithii</i>	Western-Wheat Grass
<i>Phleum pratense</i>	Common Timothy
<i>Pinus ponderosa</i>	Ponderosa Pine
<i>Poa pratensis</i>	Kentucky Blue Grass
<i>Populus angustifolia</i>	Narrow-Leaf Cottonwood
<i>Populus balsamifera</i>	Balsam Poplar
<i>Polygonum spp.</i>	Japanese Knotweed
<i>Prunus virginiana</i>	Choke Cherry
<i>Ranunculus sp.</i>	Buttercup
<i>Rosa woodsii</i>	Woods' Rose
<i>Rumex acetosella</i>	Common Sheep Sorrel
<i>Salix amygdaloides</i>	Peach-Leaf Willow
<i>Salix drummondiana</i>	Drummond's Willow
<i>Salix lasiandra</i>	Pacific willow
<i>Salix sp.</i>	Willow
<i>Solidago canadensis</i>	Canadian Goldenrod
<i>Sonchus arvensis</i>	Field Sow-Thistle
<i>Symphoricarpos albus</i>	Common Snowberry
<i>Tanacetum vulgare</i>	Common Tansy
<i>Taraxacum officinale</i>	Common Dandelion
<i>Tragopogon dubius</i>	Yellow Salisify
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Verbascum thapsus</i>	Great Mullein

4.3. Noxious weeds

The North Fork Bear Creek visual estimate of aerial coverage included identification of noxious weeds listed on the 2010 Montana Department of Agriculture Noxious Weeds List. Weeds identified within the riparian corridor (within 25 feet of the channel) included:

- Priority 1B weeds: Japanese knotweed (*Polygonum spp.*);
- Priority 2B weeds: spotted knapweed (*Centaurea maculosa*), Canadian thistle (*Cirsium arvense*), oxeye daisy (*Leucanthemum vulgare*), and common tansy (*Tanacetum vulgare*).
- Priority 3 regulated plant: cheatgrass (*Bromus tectorum*),

Visual observations estimated 35% of the project site exhibits weed colonization. Weeds were observed on both stream banks, and were primarily concentrated upstream of the Highway 93 bridge.

4.4. Woody riparian cuttings

Attempts at establishing woody riparian vegetation within the project reach included installing cuttings along the banks upstream and downstream of the bridge. Cottonwood and willow cuttings installed along the banks were largely unsuccessful (4 of approximately 90 cuttings were found alive). Upon inspection, all cuttings were installed to a depth of approximately one foot, with 4 to 5 feet of the stem extending above ground (Photo 5, Appendix B). High mortality rates were attributed to the inability of the cuttings to extend roots to the low water table elevation.

4.5. Dewatered channel observations

The site visit for this first monitoring event occurred in late August, 2013 during a period of drought. Below average precipitation in 2013 led to dewatered conditions in many streams in the Bitterroot watershed, as well as the main stem Bitterroot River. The North Fork of Bear Creek was not flowing during the site visit, and although specific performance criteria are related to stream flow, the lack of discharge in the channel may affect the establishment of riparian and woody vegetation within the mitigation site. Water observed within the project area was isolated to one pool adjacent to root wads installed downstream of the highway bridge. This pool was approximately 2 feet deep and contained several stranded small fish as a result of the dewatered conditions. Ed Snook (2013), Bitterroot NF Hydrologist, indicated that Bear Creek at the highway crossing is often dry in late summer due to irrigation demand and low flow. Bear Creek stream has a “distributary” system in which the main channel forks upstream of Highway 93 and both channels can go dry with multiple diversions below the Bitterroot Forest boundary and above the Highway 93 Bridge.

5.0 COMPARISON OF RESULTS TO PERFORMANCE CRITERIA

Monitoring of the North Fork Bear Creek Stream Mitigation site is intended to document whether the reconstructed segment of the channel is meeting performance standards outlined in the Army Corps 404 permit issued for this project. The first year of

monitoring suggests three of the four quantitative performance standards are being met three years post-construction, including total vegetative cover within the riparian zone, woody vegetation cover, and stream bank stability (Table 3). Percent cover of noxious weed species within the riparian zone did not meet success criteria of less than 10%. All additional reporting requirements, including as-built drawings (Appendix C) and establishment of photo points (Appendix B) have been provided in this monitoring report.

Table 3. Summary of monitoring and reporting criteria for NF Bear Creek.

Monitoring or Reporting Requirement	Parameter	Performance Criteria	Status
1a	Riparian Cover	At least 50% aerial coverage of desirable perennial plants, including seeded species and those colonizing from adjacent undisturbed habitats	Desirable cover estimated at 55% (90% total cover - 35% weed cover).
1b	Riparian Cover	At least 25% aerial coverage of woody riparian shrubs and/or trees	Woody riparian species cover estimated at 27% of project area
1c	Riparian Cover	Less than 10% aerial coverage of site has Montana noxious weeds	Noxious weed cover is estimated at 35% of the project area.
2	Streambank Stability	Less than 25% of total bank length exhibiting signs of active erosion/cutting	Erosion inventory documented 0% of project reach exhibits active erosion/cutting
3	As-Built	An as-built drawing will be prepared with a list of planting for the riparian areas within the stream channel construction zone.	As-Built and revegetation plans provided in Appendix C
4	Weed Control	Monitoring will include identification of state designated noxious weeds and an estimate of aerial coverage of each weed species. Weed control will be performed, as necessary, to prevent weeds from attaining aerial coverage greater than 10%.	Documentation of noxious weeds provided in Section 4
5	Photo Points	A minimum of 4 photo points will be established to document conditions along the newly constructed sections. A) photo points will be established to show upstream and downstream bank conditions at bridge locations. B) Streambank reconstruction not associated with bridges will include photo points from upstream and downstream angles.	Photo Documentation of project site included in Appendix B

5.1. Riparian Cover

Desirable perennial plants including riparian shrubs, trees, grasses, and forbs were estimated at 55% cover for the project site. This estimate was calculated by subtracting the sum of noxious weed cover (35%) and bare ground cover (10%) from 100. The monitoring criteria specify a minimum of 50% of the project reach must exhibit desirable vegetation coverage; therefore this performance criterion is currently being met. Woody vegetation was estimated at 27% cover, which exceeds the 25% performance criteria.

Noxious weeds were estimated at 35% aerial coverage of the project site, which does not meet the performance standard of less than 10% aerial coverage. Five weeds listed on the Montana Noxious Weed list (MDT 2008) were identified including spotted knapweed, Canadian thistle, oxeye daisy, common tansy, and Japanese knotweed. All noxious species were distributed along both banks of the project reach, and were primarily concentrated upstream of the Highway 93 Bridge.

5.2. Streambank Stability

No streambank erosion was noted along the reconstructed banks within North Fork Bear Creek Stream Mitigation Site. Root wads placed along the north bank appear to be stable, with no excessive scour or lateral bank movement. As a result, no measures are necessary to improve bank stability within the project reach.

6.0 MANAGEMENT RECOMMENDATIONS

6.1. Recommendations for installing woody cuttings

Successfully establishing woody vegetation from un-rooted cuttings requires the cuttings be installed to a depth that allows newly established roots to reach the low water table elevation. The North Fork of Bear Creek was dry during the site visit, with water only visible in an isolated pool created by root wads downstream of the bridge. This observation indicates the low water table elevation in the North Fork of Bear Creek may actually be below the stream bed elevation during some years.

Installing woody cuttings to this depth can be very challenging, especially when the native bank materials consist of alluvial cobbles and large gravels overlain with a thin layer of topsoil. Installing riparian cuttings to the proper depth through these materials requires using either an excavator-mounted stinger or a hand-held stinger outfitted with pressurized water. Cuttings cannot be installed through alluvial cobbles properly with hand tools such as crow bars and hammers.

An alternative planting technique for cuttings involves placing cuttings at the toe of the bank prior to backfilling with material used for bank construction. This technique may have been effective along the bank upstream of the bridge, where the old channel was backfilled with alluvial cobbles, root wads, and topsoil.

Monitoring observations revealed many of the cuttings were approximately 2-3" in diameter. Cutting survival and ease of installation may be improved by harvesting cuttings that are no more than 1" in diameter. It is highly recommended to harvest cuttings only while they are dormant, typically between October 15 and April 15. Following installation of un-rooted cuttings, exposed stems should be trimmed to allow exposure of approximately 12" of the stem. This technique focuses the energy of the cutting toward establishing roots rather than leaves and stems, and improves long term survival rates.

Mortality rates of woody cuttings at the North Fork Bear Creek site may have been reduced if channel restoration details included planting specifications for un-rooted cuttings. Based on the poor survival rates encountered at this site, the alternative planting techniques described above, and the incorporation of more detailed planting specifications is recommended for future MDT projects involving bioengineered stream bank stabilization projects.

6.2. Coir Fabric Installation

Channel restoration details specified placing coir erosion control netting along the reconstructed stream banks to protect the upper banks from erosion during high water events. Inspections revealed the leading edge of the coir fabric was exposed after being draped over the top of the bank and staked down with wood stakes. Design details called for backfilling 4.5 feet (1.5 meters) of the leading edge of the coir, followed by wrapping the remaining coir around the fill material to create an encapsulated soil lift. It appears the contractor did not follow this procedure, as evidenced by the installation of cuttings within one foot of the edge of the exposed fabric (Photo 5, Appendix B). As constructed, the coir fabric provides little protection from soil erosion along the top of the bank, particularly along the rootwads placed upstream of the bridge. Downstream of the bridge, herbaceous vegetation has established through the coir, and is providing some degree of protection against soil losses along the upper bank.

6.3. Storm Water Erosion Control Materials

Several straw logs used for stormwater erosion control were used adjacent to the bridge abutments. Remnants of several straw logs remained, with plastic webbing remaining along the stream banks. Photo 4 in Appendix B shows the remnant netting materials in a horse corral adjacent to the stream channel. Plastic webbing used to reinforce straw logs and woven fabrics along stream banks typically do not photo-degrade and end up as trash caught in debris jams and may act as gill nets. Straw logs and coir fabrics made with biodegradable or photodegradable materials are recommended for erosion control of future projects adjacent to stream channels.

6.4. Weed Control

This monitoring event documented relatively high occurrences of five noxious weeds within the project site, causing an overall decline in the percent cover for desirable species. Implementation of a weed control plan at this project site would improve the likelihood of achieving the performance standards established for a) total vegetative cover of desirable species, and b) noxious weed cover. Noxious weeds were observed on both banks, and were primarily concentrated on the upstream side of the Highway 93 Bridge. Locations of specific species infestations are included on Figure 2 in Appendix A.

7.0 LITERATURE CITED

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

Snook, E. 2013. Personal correspondence via 10/22/2013 email. Hydrologist, Bitterroot National Forest, Hamilton, MT.

Appendix A

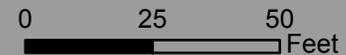
Project Site Map

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana



Legend

- * Photo Points
- ▲ *Centaurea maculosa*
- × *Cirsium arvense*
- ◆ *Leucanthemum vulgare*
- ▲ *Polygonum* sp.
- × *Tanacetum vulgare*



**2013 Monitoring
NF Bear Creek**

Figure 2

Date: 10/15/2013

X:MDT_.007/mains

Appendix B

Project Area Photos

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: July 24, 2013



Photo Point 1.1
Description: Left streambank towards tributary/culvert.
Compass: 270 (West)



Photo Point 1.4
Description: Left streambank looking upstream.
Compass: 230 (Southwest)



Photo Point 1.2
Description: Left streambank looking downstream.
Compass: 45 (Northeast)



Photo Point 2.1
Description: Left streambank root wads.
Compass: 225 (Southwest)



Photo Point 1.3
Description: Right streambank.
Compass: 90 (East)



Photo Point 2.2
Description: Left streambank.
Compass: 180 (South)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: July 24, 2013



Photo Point 2.3
Description: Left streambank looking downstream.
Compass: 135 (Southeast)



Photo Point 3.3
Description: Right bank from left bridge abutment.
Compass: 270 (West)



Photo Point 3.1
Description: Downstream from left bridge abutment.
Compass: 90 (East)



Photo Point 4.1
Description: Upstream from downstream extent.
Compass: 270 (West)



Photo Point 3.2
Description: Right streambank from left abutment.
Compass: 135 (Southeast)



Photo Point 4.2
Description: Left streambank at downstream extent.
Compass: 0 (North)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: July 24, 2013



Photo Point 4.3

Description: Downstream extent of project site.
Compass: 68 (East-Northeast)



Photo 3

Description: Plastic remnants from coir logs in corral.
Compass: 0 (North)



Photo 1

Description: Erosion rills on downstream side of bridge
Compass: 315 (Northwest)



Photo 4

Description: Non-biodegradable plastic remnants.
Compass: 335 (North-Northwest)



Photo 2

Description: Downstream extent of channel.
Compass: 90 (East)



Photo 5

Description: Dead willow cuttings with coir fabric.
Compass: 245 (West-Southwest)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: July 24, 2013



Photo 6
Description: Dead willow cutting with small, dry roots.
Compass: 0 (North)



Photo 9
Description: Upstream from downstream extent.
Compass: 290 (West—Northwest)



Photo 7
Description: Root wads along left streambank.
Compass: 68 (East-Northeast)



Photo 10
Description: Downstream of project site.
Compass: 135 (Southeast)



Photo 8
Description: Root wads downstream of bridge.
Compass: 6 (North)



Photo 11
Description: Sprouting willow cutting.
Compass: 0 (North)



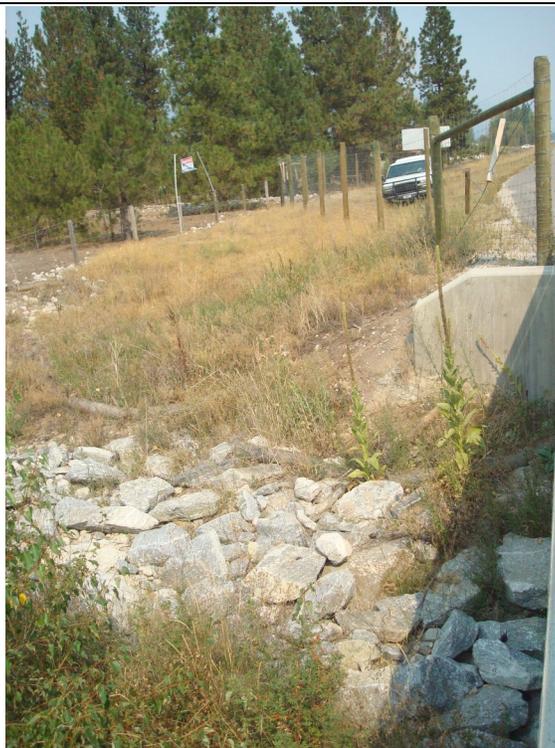
PHOTOGRAPHIC INFORMATION page 1 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek

DATE: August 13, 2013



Bear Creek Looking West



West Bridge Center Looking North
B-5



PHOTOGRAPHIC INFORMATION page 2 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek
DATE: August 13, 2013



West Bridge Center Looking South



West Bridge Center Looking Southeast
B-6



PHOTOGRAPHIC INFORMATION page 3 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek

DATE: August 13, 2013



West of Bridge in Channel Looking Upstream West



West of Bridge in Channel Looking Downstream East



PHOTOGRAPHIC INFORMATION page 4 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek
DATE: August 13, 2013



West of Bridge in Channel Looking West at Root wads



West of Bridge in Channel Looking Southwest Upstream
B-8



PHOTOGRAPHIC INFORMATION page 5 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek

DATE: August 13, 2013



West of Bridge in Channel Looking Upstream Southwest



Confluence Side Channel Looking West
B-9



PHOTOGRAPHIC INFORMATION page 6 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek
DATE: August 13, 2013



East side of Bridge Center Channel Looking East Downstream



East Bridge Center Looking North
B-10



PHOTOGRAPHIC INFORMATION page 7 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek

DATE: August 13, 2013



East Bridge Center Looking South

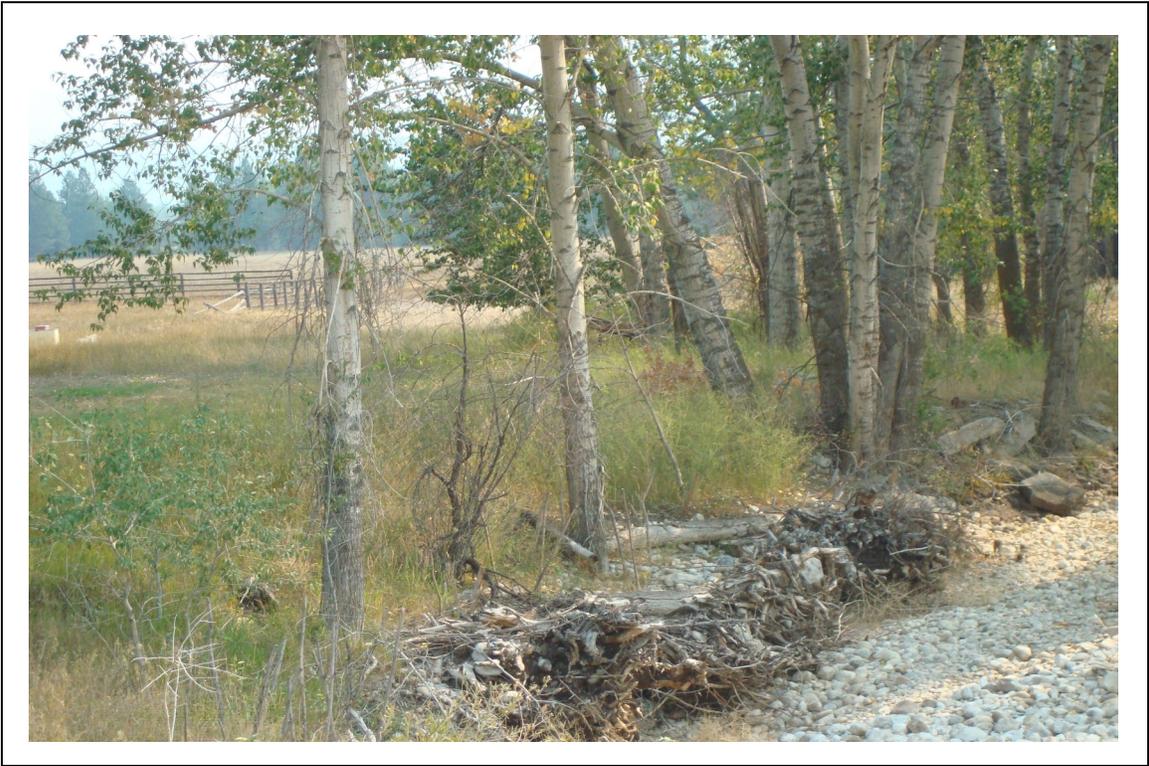


East of Bridge in Channel Looking Downstream Along South bank



PHOTOGRAPHIC INFORMATION page 8 of 8

PROJECT NAME: MDT Stream Mitigation North Fork Bear Creek
DATE: August 13, 2013



East of Bridge in Channel Looking Downstream Along North bank



East of Bridge in Channel Looking Downstream East
B-12

Appendix C

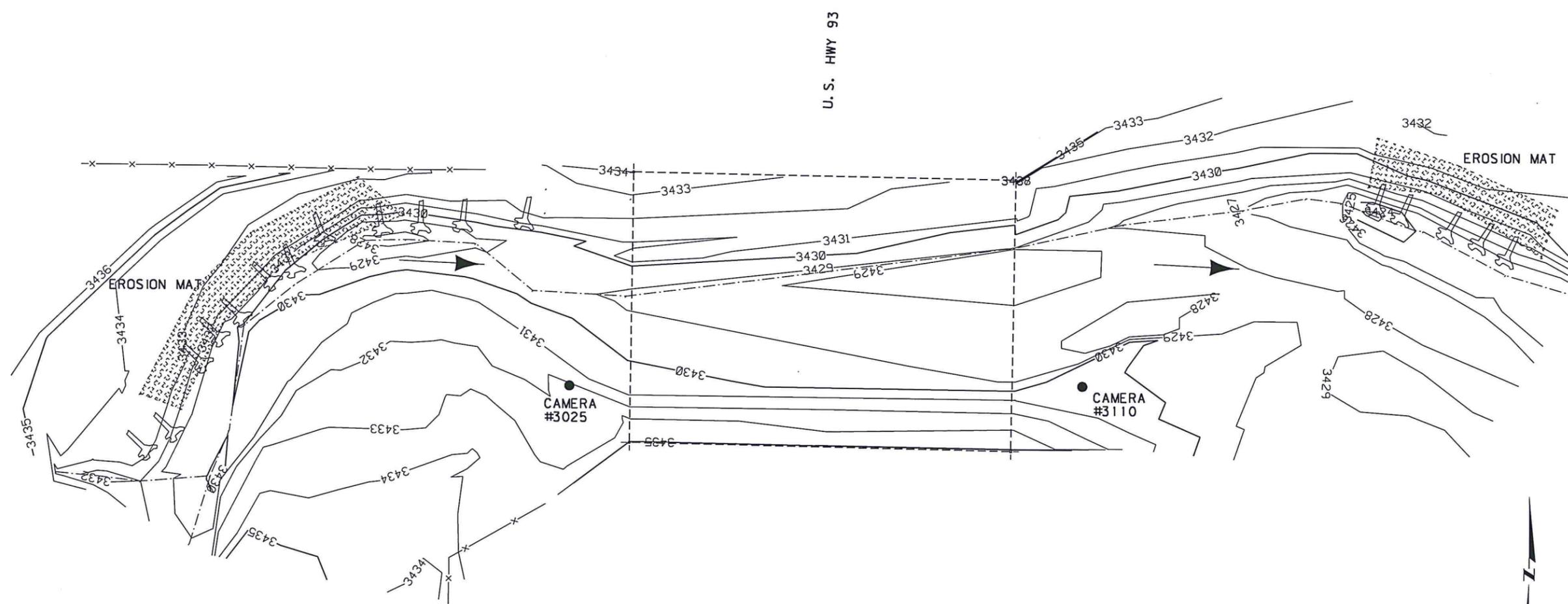
As Built Drawings and Design Schematics

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana

CONTROL TABLE				
PNT#	NORTHING	EASTING	ELEV.	DESCRIPTION
CI2015	820308.760	797947.813	3435.224	MDT AL CAP
CG2015	819805.449	798080.492	3436.854	MDT AL CAP



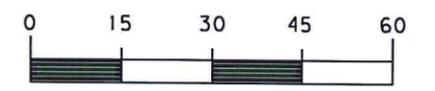
LEGEND
 ROOT BALL



AS-BUILT TOPOGRAPHIC DRAWING OF THE NORTH FORK OF BEAR CREEK CHANNEL

SURVEYOR NOTES:

1. THIS SURVEY IS BASED ON FOUND MDT ALUMINUM CAPS STAMPED CI2015 AND CG2015 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 CI2015.
2. THE COORDINATES SHOWN HEREON ARE BASED ON MONTANA STATE PLANE GRID



3
2
1

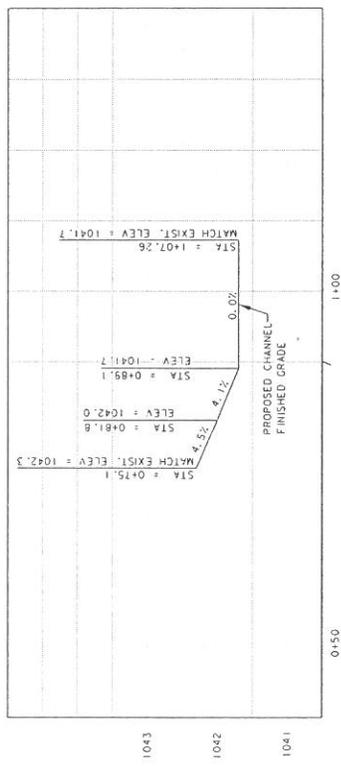
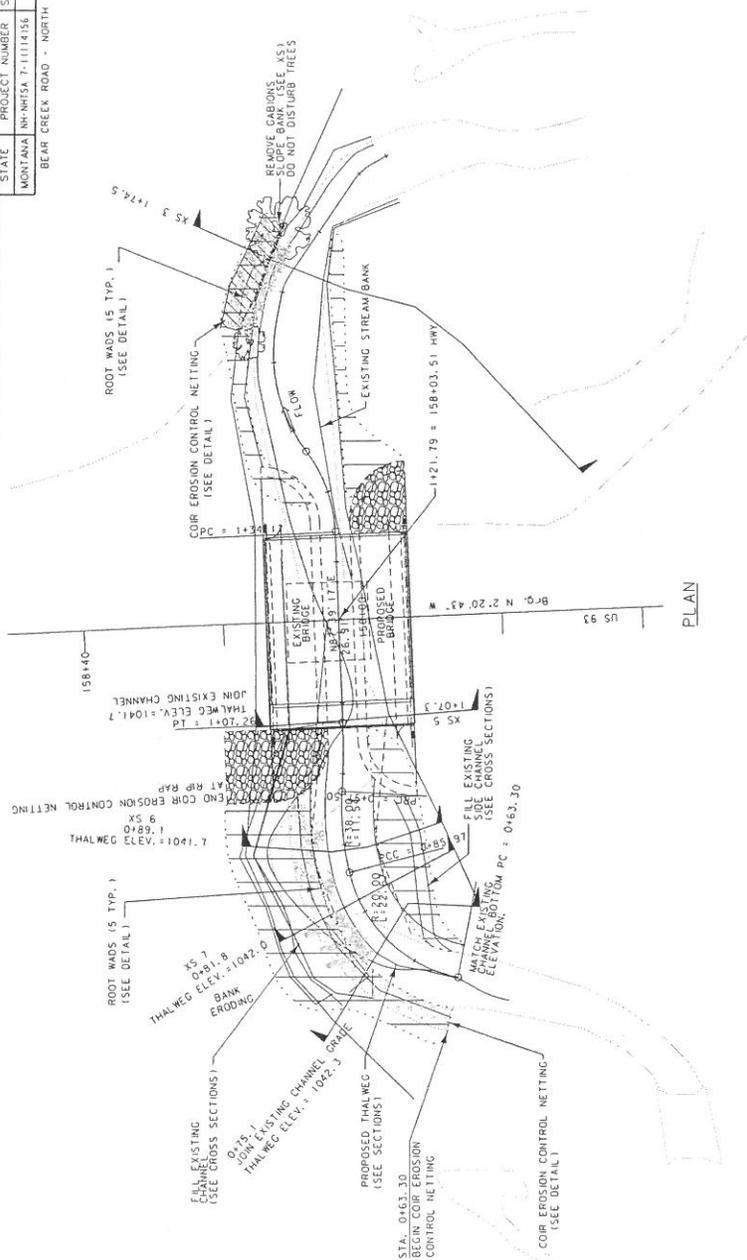
MDT MONTANA DEPARTMENT OF TRANSPORTATION

...NF BEAR CREEK PLAN.dgn
 12/9/2013
 11:02:51 AM awibe

DESIGNED BY ARNE W
 REVIEWED BY
 CHECKED BY LARRY R

N.F. BEAR CREEK

MDT STREAM MITIGATION MONITORING SURVEY

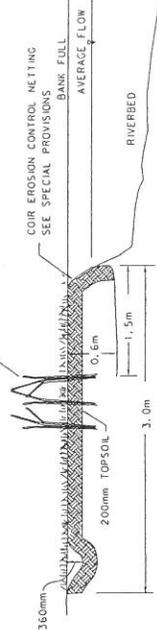


COORDINATE TABLE

STATION	NORTHING	EASTING
0+76.03	36,218.1167	56,132.1603
0+85.97	36,221.2271	56,204.3003
0+91.78	36,222.6477	56,210.5363
1+02.39	36,222.0482	56,221.2141
1+07.46	36,222.2420	56,226.0927
1+10.14	36,223.4034	56,226.3948
1+15.61	36,223.6668	56,222.3869
1+20.48	36,227.4917	56,224.3830
1+25.35	36,231.0305	56,226.2933
1+30.22	36,230.1936	56,227.8178
1+35.09	36,229.8772	56,229.1522
1+39.96	36,229.1764	56,230.7597
1+44.83	36,218.2584	56,304.6191
1+49.70	36,216.0744	56,305.8532

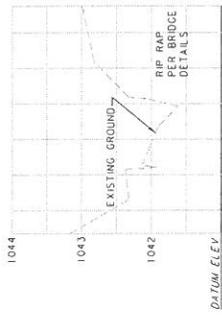
- NOTES:**
- REMOVE ALL EXISTING GABIONS, APPROXIMATE STATION 1+63 TO 1+78, AS DIRECTED BY ENGINEER.
 - INSTALL SIX (6) ROOT WAD STRUCTURES BETWEEN STATIONS 1+63 AND 1+78 AS DIRECTED BY ENGINEER.
 - INSTALL SIX (6) ROOT WAD STRUCTURES BETWEEN STATION 0+66 AND 1+10 AS DIRECTED BY ENGINEER.
 - DO NOT DISTURB EXISTING STUMPS/ROOT WADS NEAR STATION 0+90
 - DO NOT DISTURB TREES IN GABION AREA 1+78



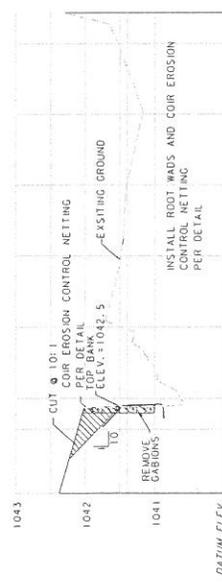


1. SUB EXCAVATE BANKS 0.6 METERS FROM EDGE OF BANK.
2. BACK FILL WITH NATIVE MATERIAL AND 0.2 METERS TOPSOIL.
3. BACK FILL WITH NATIVE MATERIAL AND 0.2 METERS TOPSOIL.
4. WRAP NETTING AND EXTEND 3.0 METERS MIN. FROM BANK EDGE.

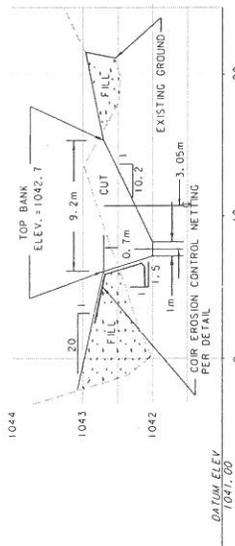
COIR EROSION CONTROL NETTING TYPICAL
N. FORK BEAR CREEK



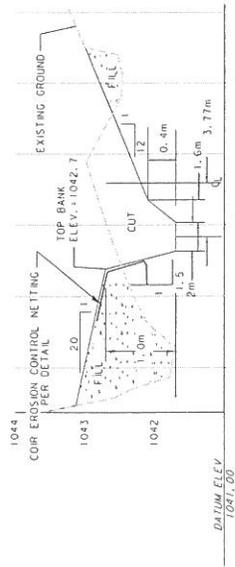
1+07.3



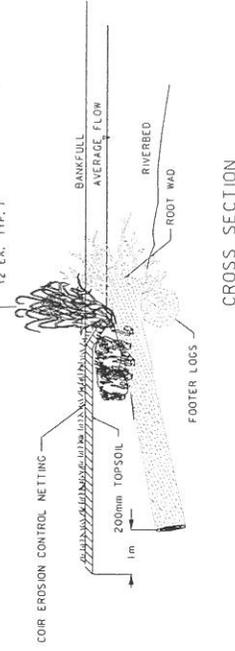
1+74.5



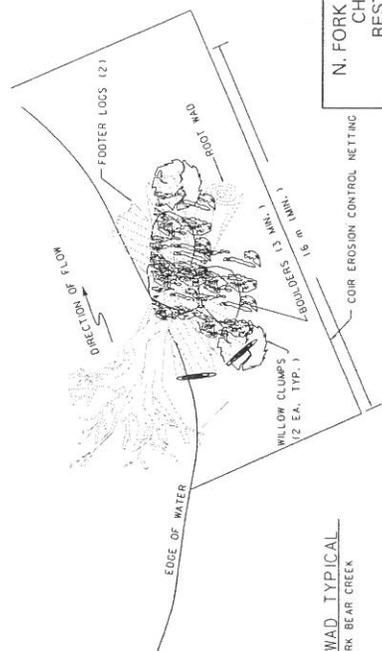
0+81.8



0+89.1



0+75.1



ROOT WAD TYPICAL
N. FORK BEAR CREEK

PLAN

N. FORK BEAR CREEK
CHANNEL
RESTORATION
DETAILS
STA. 158+03
SHEET 2 OF 2
NO SCALE