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# MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

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*Ashley Creek  
Flathead County, Montana*



Prepared for:

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**MDT**★  
DEPARTMENT OF TRANSPORTATION  
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December 2013

# **MONTANA DEPARTMENT OF TRANSPORTATION**

## **STREAM MITIGATION MONITORING REPORT:**

**YEAR 2013**

Ashley Creek  
Flathead County, Montana

MDT Project Number: NH-MT 5-3(59) FST  
Control Number: 2038

USACE Permit: NWO-2009-01808-MTM

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CCI Project No: MDT\_.007



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Cover Photo: Rocky Mountain Bee Plant along the banks of the Ashley Creek Stream Mitigation Site.

## 1.0 INTRODUCTION

As part of construction of the Kalispell Bypass U.S. Highway 2 South, the Montana Department of Transportation (MDT) modified a portion of Ashley Creek at the North Bridge crossing. The purpose of the Ashley Creek stream mitigation project is to create, enhance, restore, and maintain permanent, naturally self-sustaining, native, or native-like stream and riparian habitat. This project is intended to provide compensatory mitigation for stream impacts associated with the U.S. 93 ALT widening segment of the Kalispell Bypass in the Missoula District.

The specific objectives of the Ashley Creek modification were to widen the stream channel and lay back the slopes from 1.5:1 to 2:1 and implement an aggressive re-vegetation plan to reestablish native riparian and upland vegetation. The Ashley Creek stream mitigation was intended to create new tree-shrub riparian stream habitat by reconstructing the floodplain and stream channel and enhancing in-stream fish habitat.

This report includes the results of the first year (2013) monitoring of the Ashley Creek project site. This monitoring report includes the results of vegetation and streambank erosion monitoring, a topographic survey of the project site, surveys at four perpendicular transects, photo-documentation of the project site, a map indicating the endpoints of riparian belt and perpendicular transect surveys, and a map of existing vegetation communities and noxious weeds.

Specifications of the USACE permit include monitoring of on and off-site stream mitigation areas for five years following channel construction to determine streambank stability and the success of riparian vegetation establishment. Performance criteria for the USACE permit include:

1. **Riparian Buffer Success** will be achieved when woody and riparian vegetation becomes established, and noxious weeds do not exceed 10% cover within the riparian buffer areas. Any area within the creditable buffer area disturbed by the project construction must have at least 50% aerial cover of non-noxious weed species by the end of the monitoring period.
  - a. **Vegetation Success** will be achieved where combined aerial cover of riparian and streambank vegetation communities is  $\geq 70\%$  and Montana State-listed noxious weeds do not exceed 10% cover.
  - b. **Woody Plants** planted trees and shrubs will be considered successful where they exhibit 50% survival after 5 years.
2. **Vegetation along Streambanks** will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indexes  $\geq 6$  (subject to 1.a and 1.b above).
3. **Streambank Stability Success** will be achieved where; following restoration, less than 25% of bank length is unstable and classified as eroding bank. For this purpose "eroding bank" will be defined as any bank greater than two feet in length that is more than 50% bare mineral soil and has no roots, surface

vegetation, or other stabilizing structure (e.g. rock, woody debris) to inhibit erosion.

4. **Channel Form Success** will be achieved when the stream stabilizes includes pool and riffle features, allows for flood events to occupy the floodplain, and the habitat features such as riparian plant communities have successfully established along streambanks.
5. **Photo Document Success** of restored stream channel and streambank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the established reference reach.
6. **Weed Control** will be based upon annual monitoring of the site to determine weed species and degree of infestation with the site, and control measures based upon the monitoring results will be implemented by MDT in cooperation with the Flathead County Weed District to minimize and/or eliminate the intrusion of Montana State Listed Noxious weed species within the site.

## **2.0 SITE LOCATION**

The project reach includes approximately 525 feet of Ashley Creek on either side of U.S. Highway 93 ALT (Figure 1). The site extends approximately 300 feet upstream of the Highway 93 Bridge and approximately 225 feet downstream of the Highway 93 Bridge to a grade control structure downstream of a pedestrian bridge. The project site is located in Section 13, Township 7 North, Range 22 West, in Flathead County, Montana.

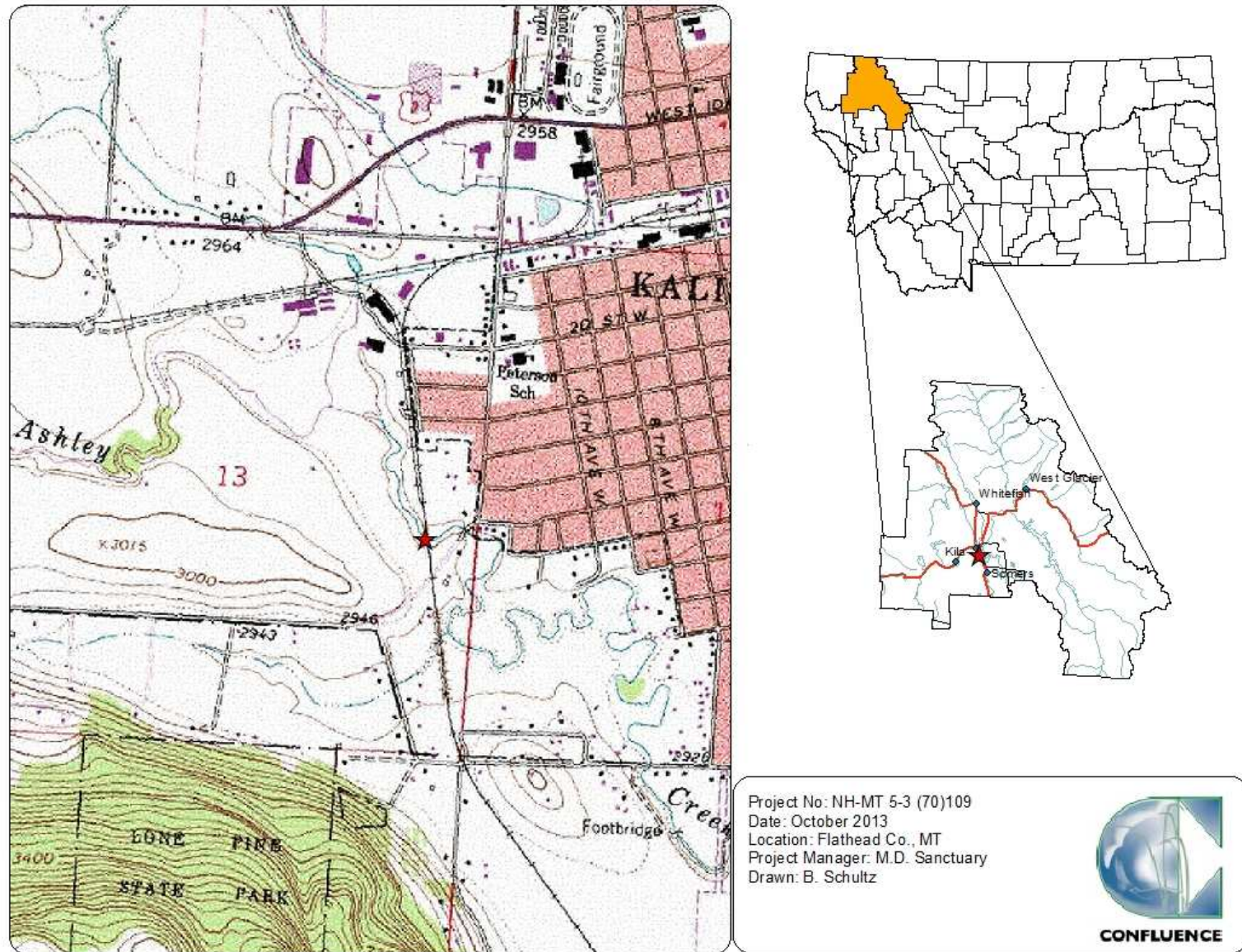


Figure 1. Location of Ashley Creek stream mitigation monitoring site.

### **3.0 MONITORING METHODS**

Monitoring field crews visited the project site on September 10, 2013 while survey crews visited the site on October 22, 2013. The following data were collected at the Ashley Creek stream mitigation site:

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

Two riparian belt transects were established; one on each side of the stream channel. The riparian transect on the right (south) bank runs parallel to the channel for 208 feet, while the riparian transect on the left (north) bank is 243 feet long (Figure 2, Appendix A). GPS points were logged at riparian transect endpoints, and each endpoint of the riparian transects was marked with t-posts to allow for relocation during subsequent monitoring events. Field data collection at each riparian transect included aerial percent cover of total vegetation, woody vegetation, and noxious weeds.

#### **3.2. Stream Bank Vegetation Inventory**

A vegetation inventory was conducted along both stream banks, and included documenting dominant species presence and a list of all species encountered within 3 feet of the active channel. A vegetation inventory was performed along the entire length of both banks within the project reach.

#### **3.3. Noxious Weed Inventory**

The project site was visually inspected to document the presence of noxious weeds. All noxious weed infestations were mapped on aerial photographs, with species, and extents noted.

#### **3.4. Vegetation Community Mapping**

Dominant vegetation communities within the project area were mapped on aerial photos to document vegetative establishment within upland and riparian zones.

#### **3.5. Woody Plant Survival Inventory**

The project area was visually inspected to document survival rates of woody vegetation plantings. The inspection included recording the total number of live and dead woody plantings observed.

#### **3.6. Perpendicular Transects**

Four perpendicular transects (cross sections) were surveyed; two at riffles and two at pools. Endpoints of each transect were marked with a pin, flagging, or stake for locating during subsequent monitoring events. Horizontal bank pins were placed on the left and right banks of the channel to document lateral erosion at each perpendicular transect. Photo-documentation of each transect included photos taken facing upstream, downstream, left, and right from the channel centerline.

#### **3.7. Bank Erosion Inventory**

Both stream banks within the project reach were visually inspected to document eroding banks. Each eroding bank within the project reach was photo-documented. Data

collected at each eroding bank included bank length and potential causes of bank erosion.

### **3.8. Wildlife Documentation**

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

### **3.9. Photo-Documentation**

The project site was photographed from several locations to document vegetation establishment and stream bank conditions within the project site. All sites selected for photo-documentation were recorded on field maps with headings noted to allow for repetition during subsequent monitoring years.

## **4.0 RESULTS**

### **4.1. Riparian and Stream Bank Vegetation Inventory**

The two riparian belt transects included a 208 foot long transect on the south (right) bank and a 243 foot transect on the north (left) bank. Both transects ran parallel to the stream, and were within 25 feet of the channel. The 25-foot wide riparian transects encompassed the stream bank zone, defined as within 3 feet of the active channel. As such, results reported in Table 1, including aerial percent cover of total vegetation, woody vegetation, and noxious weeds reflect both the riparian and stream bank zones along Ashley Creek.

Vegetation monitoring of the riparian and streambank areas along Ashley Creek indicated 88% of disturbed areas had successfully revegetated with non-weedy species following channel construction. Desirable vegetative cover (77%) was determined by subtracting the percent of weedy species cover (11%) from the total vegetative cover in riparian areas (88%). Additional data specific to noxious weed identification and dispersal is included in section 4.5.

**Table 1. Percent cover along riparian belt transects at Ashley Creek in 2013.**

| <b>Belt Transect</b> | <b>Length (ft)</b> | <b>Total % Riparian Cover</b> | <b>% Bare Ground</b> | <b>% Woody Cover</b> | <b>% Noxious Weed Cover</b> |
|----------------------|--------------------|-------------------------------|----------------------|----------------------|-----------------------------|
| Right (south bank)   | 208                | 92                            | 8                    | 23                   | 12                          |
| Left (north bank)    | 243                | 85                            | 16                   | 30                   | 10                          |
| Total                | 451                | 88                            | 12                   | 26                   | 11                          |

Table 2 is a comprehensive list of vegetative species identified along the two belt transects, two streambank transects, and other incidental plants observed on site. In 2013, 54 plant species were observed on site. Data collected from the riparian and stream bank transects were combined with visual observations of dominant vegetation types to generate vegetation community maps of the project area. The vegetation communities observed along Ashley Creek are included on Figure 3 in Appendix A.



**Table 2. Comprehensive vegetative species list for Ashley Creek in 2013.**

| Scientific Name               | Common Name             | Scientific Name                | Common Name            |
|-------------------------------|-------------------------|--------------------------------|------------------------|
| <i>Agropyron</i> sp.          | Wheatgrass              | <i>Lupinus lepidus</i>         | Pacific Lupine         |
| <i>Agrostis gigantea</i>      | Black Bent              | <i>Medicago lupulina</i>       | Black Medick           |
| <i>Alnus incana</i>           | Speckled Alder          | <i>Medicago sativa</i>         | Alfalfa                |
| <i>Alopecurus pratensis</i>   | Field Meadow-Foxtail    | <i>Melilotus officinalis</i>   | Yellow Sweet-Clover    |
| <i>Artemisia biennis</i>      | Biennial Wormwood       | <i>Onopordum acanthium</i>     | Scotch Cottonthistle   |
| Bare Ground                   | Bare Ground             | <i>Pascopyrum smithii</i>      | Western-Wheat Grass    |
| <i>Betula pumila</i>          | Bog Birch               | <i>Phalaris arundinacea</i>    | Reed Canary Grass      |
| <i>Brassica kaber</i>         | Wild Mustard            | <i>Plantago major</i>          | Great Plantain         |
| <i>Bromus carinatus</i>       | California Brome        | <i>Poa palustris</i>           | Fowl Blue Grass        |
| <i>Bromus inermis</i>         | Smooth Brome            | <i>Poa pratensis</i>           | Kentucky Blue Grass    |
| <i>Bromus tectorum</i>        | Cheatgrass              | <i>Populus angustifolia</i>    | Narrow-Leaf Cottonwood |
| <i>Centaurea maculosa</i>     | Spotted knapweed        | <i>Pseudoroegneria spicata</i> | Blue-Bunch Wheatgrass  |
| <i>Chenopodium album</i>      | Lamb's-Quarters         | <i>Rosa woodsii</i>            | Woods' Rose            |
| <i>Cirsium arvense</i>        | Canadian Thistle        | <i>Rumex crispus</i>           | Curly Dock             |
| <i>Cirsium vulgare</i>        | Bull Thistle            | <i>Salix bebbiana</i>          | Gray Willow            |
| <i>Cleome serrulata</i>       | Rocky Mountain Beeplant | <i>Salix exigua</i>            | Narrow-Leaf Willow     |
| <i>Convolvulus arvensis</i>   | Field Bindweed          | <i>Salix lasiandra</i>         | Pacific willow         |
| <i>Cornus alba</i>            | Red Osier               | <i>Silene latifolia</i>        | White Champion         |
| <i>Cynoglossum officinale</i> | Gypsy-Flower            | <i>Silene repens</i>           | Pink Champion          |
| <i>Elymus canadensis</i>      | Nodding Wild Rye        | <i>Solidago canadensis</i>     | Canadian Goldenrod     |
| <i>Elymus repens</i>          | Creeping Wild Rye       | <i>Sonchus arvensis</i>        | Field Sow-Thistle      |
| <i>Equisetum hyemale</i>      | Tall Scouring-Rush      | <i>Symphoricarpos albus</i>    | Common Snowberry       |
| <i>Galium aparine</i>         | Sticky-Willy            | <i>Tanacetum vulgare</i>       | Common Tansy           |
| <i>Helianthus maximiliani</i> | Maximilian's Sunflower  | <i>Taraxacum officinale</i>    | Common Dandelion       |
| <i>Helianthus nuttallii</i>   | Nuttall's Sunflower     | <i>Thlaspi arvense</i>         | Filed Penny-Cress      |
| <i>Lactuca serriola</i>       | Prickly Lettuce         | <i>Verbascum thapsus</i>       | Great Mullein          |
| <i>Lupinus argenteus</i>      | Silvery Lupine          | <i>Vicia americana</i>         | American Purple Vetch  |

#### 4.2. Streambank Vegetation Composition

Thirty plant species were identified along the stream banks, defined as within three feet of the active stream channel (Table 3). Stability ratings were assigned to each species observed along the banks to help determine overall bank stability. Stability ratings (1-10 scale) indicate a plant's ability to resist erosive forces based on root characteristics (Winward 2000). Sixteen of the 30 plants have stability indices provided by Winward; while the remaining 14 species observed do not. Scores for plants without stability indices are listed in Table 3 as N/A. Fifteen of the 19 species (79%) with stability indices scored 6 or higher. The dominant species observed along streambanks was reed canary grass (*Phalaris arundinacea*), which has a stability index of 9.



**Table 3. Comprehensive list of stream bank species and accompanying stability index values (from Winward 2000).**

| Streambank Species            | Left Bank | Right Bank | NWPL R9 Indicator** | Stability Index |
|-------------------------------|-----------|------------|---------------------|-----------------|
| <i>Phalaris arundinacea</i> * | x         | x          | FACW                | 9               |
| <i>Cornus alba</i>            |           | x          | FACW                | 8               |
| <i>Poa palustris</i>          | x         | x          | FAC                 | 8               |
| <i>Salix bebbiana</i>         | x         | x          | FACW                | 8               |
| <i>Salix exigua</i>           | x         |            | FACW                | 8               |
| <i>Alnus incana</i>           |           | x          | FACW                | 7               |
| <i>Equisetum hyemale</i>      | x         | x          | FACW                | 7               |
| <i>Salix lasiandra</i>        |           | x          | FACW                | 7               |
| <i>Cirsium arvense</i>        | x         |            | FAC                 | 6               |
| <i>Elymus repens</i>          |           | x          | FAC                 | 6               |
| <i>Galium aparine</i>         |           | x          | FACU                | 6               |
| <i>Rosa woodsii</i>           | x         | x          | FACU                | 6               |
| <i>Artemisia biennis</i>      | x         | x          | FACW                | 4               |
| <i>Lupinus argenteus</i>      |           | x          | UPL                 | 4               |
| <i>Agrostis gigantea</i>      | x         |            | FAC                 | 3               |
| <i>Bromus tectorum</i>        |           | x          | UPL                 | 3               |
| <i>Bare Ground</i>            | x         | x          | NL                  | 1               |
| <i>Agropyron spp.</i>         |           | x          | NL                  | N/A             |
| <i>Centaurea maculosa</i>     |           | x          | UPL                 | N/A             |
| <i>Chenopodium album</i>      | x         |            | FACU                | N/A             |
| <i>Cleome serrulata</i>       |           | x          | FACU                | N/A             |
| <i>Helianthus maximiliani</i> | x         | x          | UPL                 | N/A             |
| <i>Helianthus nuttallii</i>   |           | x          | FACW                | N/A             |
| <i>Lactuca serriola</i>       | x         | x          | FACU                | N/A             |
| <i>Medicago lupulina</i>      |           | x          | FACU                | N/A             |
| <i>Melilotus officinalis</i>  | x         |            | FACU                | N/A             |
| <i>Onopordum acanthium</i>    | x         |            | UPL                 | N/A             |
| <i>Pascopyrum smithii</i>     |           | x          | FACU                | N/A             |
| <i>Sonchus arvensis</i>       |           | x          | NL                  | N/A             |
| <i>Tanacetum vulgare</i>      | x         | x          | FACU                | N/A             |
| <i>Taraxacum officinale</i>   | x         |            | FACU                | N/A             |

\*dominant species observed along Ashley Creek stream banks.

\*\*National Wetland Plant List Region 9 Wetland Plant Indicator Status.

### 4.3. Noxious Weed Inventory

The Ashley Creek field assessment included identification of six noxious weeds including Canadian thistle (*Cirsium arvense*), gypsy-flower (*Cynoglossum officinale*), spotted knapweed (*Centaurea maculosa*), common tansy (*Tanacetum vulgare*),

houndstongue, and field bindweed (*Convolvulus arvensis*). Noxious weeds were observed on both banks and distributed relatively evenly across the project site. Total cover of noxious weeds across the site was 11%. Figure 2 in Appendix A indicates locations of two common tansy infestations for use in developing a weed management plan for the site.

#### 4.4. Woody Plant Survival

Willow, alder, snowberry, and Wood's rose shrubs were observed on site as planted woody vegetation species. Table 4 indicates a survival rate of 94% for woody plants observed within the project site.

**Table 4. Woody plant survival at the Ashley Creek stream mitigation site in 2013.**

| Total Plants Inspected | Surviving Plants | Plant Survival Percentage |
|------------------------|------------------|---------------------------|
| 99                     | 93               | 94%                       |

#### 4.5. Bank Erosion Inventory

Two segments of eroding stream banks were observed along Ashley Creek, with bank erosion observations described in Table 5. Photos of each eroding bank are included in Appendix D of this report. Figure 2, Appendix A shows the GIS mapped location of eroding streambanks. Eroding streambank length totaled 85 feet, or 8% of the total project bank length of 1050 feet.

**Table 5. Inventoried streambank erosion segments on Ashley Creek.**

| ID No.                | Photo No. | Length (ft) | Severity | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------|-----------|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EBL1<br>north<br>bank | 7         | 32          | Moderate | Steep bank angle. Fine grained soils are becoming saturated and sloughing off. Toe is not protected by clay lens. No streambank vegetation along eroding bank. Upstream and downstream of erosion bank contains phalaris and equisetum. Eroding streambank may be causing undercutting of riprap installation below culvert drain directly downstream of erosion. Bank erosion likely due to combination of steep stream bank, fine grained soils, and saturation of soils when drain culvert is flowing. |
| EBR1<br>south<br>bank | 6         | 53          | Moderate | Steep, nearly vertical bank slope. Fine grained materials are getting saturated during high stream flows and sloughing off. Bank toe is a clay lens, which may be helping to keep the bank intact. There is no vegetation along the streambank at bankfull elevation.                                                                                                                                                                                                                                     |

#### 4.6. Perpendicular Transect Surveys

Evidence of the channel's habitat features are provided by the results of surveyed pool and riffle transects. Two pools and two riffles were surveyed within the project reach (Appendix B) to indicate the ability of the channel to scour pools and provide habitat diversity. A deep pool exists at the upstream end of the project reach, where the newly aligned segment of Ashley Creek turns east (transect #1). This scour pool is generated by a tight bend in the channel, causing scour against the north bank. Excessive scour against this bank could jeopardize the adjacent pedestrian trail; therefore, riprap was

installed to prevent excessive northward migration of the channel. A second pool exists downstream of this bend (transect #2) and transitions into a riffle that extends the remaining length of the project reach. Both pools were approximately 4 feet deep during base flows. The upper pool exhibits a bankfull depth of approximately 6 feet, with a well developed floodplain bench on the south side of the channel. This floodplain feature extends only a short distance downstream before the channel becomes confined by high banks for the majority of its remaining length within the project reach.

Another floodplain terrace was constructed on the north bank near the downstream end of the project reach where Spring Creek joins Ashley Creek. This floodplain bench is illustrated on the left side of riffle transect #4 in Appendix B, and was likely designed as part of the Spring Creek reconstruction effort (documented in separate mitigation monitoring report). Pool transect #2 and riffle transect #3 occur within a straight the channel segment with relatively steep and high stream banks. Floodplain access through the straight segment has been reduced by the bank slopes; however the straight alignment should limit scour during flood events and maintain lateral stability. Continued monitoring of the established transects will document any adjustments in the channel configuration and cross section dimensions through this segment of Ashley Creek.

#### 4.7. Wildlife Documentation

Table 6 provides a list of the wildlife observations during the 2013 monitoring event. Two mammals and six bird species were observed within the project area.

**Table 6. Wildlife species observed at Ashley Creek during the 2013 site visit.**

| Common Name          | Scientific Name               |
|----------------------|-------------------------------|
| <b>Birds</b>         |                               |
| Black-billed Magpie  | <i>Pica hudsonia</i>          |
| Common Raven         | <i>Corvus corax</i>           |
| Mallard              | <i>Anas platyrhynchos</i>     |
| Swallow Spp.         |                               |
| Red-winged Blackbird | <i>Agelaius phoeniceus</i>    |
| Sparrow Spp.         |                               |
| <b>Mammals</b>       |                               |
| Raccoon              | <i>Procyon lotor</i>          |
| White-tailed Deer    | <i>Odocoileus virginianus</i> |

#### 5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Ashley 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 the project. The first year of monitoring suggests 5 of the 6 quantitative performance standards are being met, including combined vegetation establishment, vegetative cover of riparian and streambank vegetation, woody plant survival, root stability indices, and streambank stability (Table 7). Percent cover of weed species did not meet performance criteria.

**Table 7. Summary of performance criteria and reporting requirements, Ashley Creek mitigation site.**

| Monitoring Requirement | Type                              | Parameter                     | Performance Standard                                                                                                                                                                                                                                                                                                                                         | Status                                                                                                                 |
|------------------------|-----------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1a                     | Quantitative Performance Criteria | Riparian Buffer Establishment | Areas within creditable riparian buffer disturbed during construction must have 50% or greater aerial cover of non-noxious weed species by the end of the monitoring period                                                                                                                                                                                  | Vegetation transect surveys indicate <b>77%</b> of the riparian areas have re-vegetated with non-noxious weed species. |
| 1b                     | Quantitative Performance Criteria | Riparian Buffer Establishment | Montana State-listed noxious weeds do not exceed 10% cover                                                                                                                                                                                                                                                                                                   | Vegetation surveys indicate <b>11%</b> cover of the project area by noxious weeds.                                     |
| 1c                     | Quantitative Performance Criteria | Riparian Buffer Establishment | Combined aerial cover of riparian and stream bank vegetation communities is at least 70%                                                                                                                                                                                                                                                                     | Combined aerial cover of riparian and stream bank vegetation communities is <b>77%</b> .                               |
| 1d                     | Quantitative Performance Criteria | Riparian Buffer Establishment | Planted trees and shrubs must exhibit 50% survival after 5 years                                                                                                                                                                                                                                                                                             | Inspections indicated <b>94%</b> survival of observed woody plantings                                                  |
| 2                      | Quantitative Performance Criteria | Vegetation along Streambanks  | Majority of plants on the river bank must have root stability indexes of at least 6                                                                                                                                                                                                                                                                          | 15 of 19 species ( <b>79%</b> ) observed with root stability ratings score 6 or higher.                                |
| 3                      | Quantitative Performance Criteria | Streambank Stability Success  | Less than 25% of bank length is unstable and classified as eroding bank. Eroding bank will be defined as any bank greater than two feet in length that is more than 50% bare mineral soil and has no roots, surface vegetation, or other stabilizing structure (rock, woody debris) to inhibit erosion                                                       | Total eroding streambank length is 85', or <b>8%</b> of the total bank length within the project reach.                |
| 4                      | Qualitative Performance Criteria  | Channel Form Success          | Achieved when the stream stabilizes, includes pool and riffles, allows for flood events to occupy the floodplain, and the habitat features such as riparian plant communities have successfully established along streambanks.                                                                                                                               | Channel form narrative included in Section 5.4 of 2013 Monitoring Report                                               |
| 5                      | Reporting Requirement             | Photo Documentation           | Document restored stream channel and streambank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the established reference reach.                                                                                                                                        | Photo Documentation provided in Appendix D of 2013 Monitoring Report                                                   |
| 6                      | Maintenance Requirement           | Weed Control                  | Will be based upon annual monitoring of the site to determine weed species and degree of infestation with the site, and control measures based upon the monitoring results will be implemented by MDT in cooperation with the Flathead County Weed District to minimize and/or eliminate the intrusion of State Listed Noxious weed species within the site. | Documentatin of noxious weeds identified within the project reach are included in Section 4.3.                         |

### **5.1. Riparian Buffer Establishment**

Performance criteria for vegetative cover require 50% or greater cover of non-noxious weed species by the end of the monitoring period. The first year monitoring results indicated 77% of the riparian areas were vegetated with desirable species, with 88% total cover and 11% noxious weeds. Areas of bare ground were observed on both banks, and appeared limited to areas where reseeding efforts did not completely take hold during the first growing season. No large patches of bare ground were observed. Overall, the riparian areas adjacent to Ashley Creek are revegetating well with a diverse stand of wetland, upland, and woody species present. The performance criteria for percent cover of desirable vegetation species is currently being met following the first year of monitoring at this site.

Noxious weeds cover was approximately 11% of the project site, with relatively even distribution of weeds on both streambanks. Performance criteria for noxious weeds require 10% or less cover; as a result, weed control efforts along Ashley Creek will be necessary to achieve this performance target. The majority of the riparian areas along the project reach occur on steeply sloped banks within 25 feet of the channel; therefore, chemical treatment may be challenging without compromising water quality. Hand pulling may be the most effective treatment for weed eradication along Ashley Creek.

Riparian vegetation transects were conducted along the narrowly vegetated zone between the active stream channel and the adjacent pedestrian trail / vehicle access road. These riparian areas included the 3-foot stream bank vegetation zone on both banks; therefore, the results provided in Table 1 are also reflective of the combined stream bank and riparian zones. These results indicate 77% of the combined riparian and stream bank areas have successfully vegetated with non-noxious weed species, which meets the performance criteria goal of 70% cover.

Woody vegetation plantings indicated a survival rate of 93%, which exceeds the performance criteria of 50% five years following construction. Given the short timeframe since these plants were installed, the shrubs observed remain relatively small and will likely provide increased percent cover over time as they mature.

### **5.2. Vegetation Along Streambanks**

Stream bank vegetation inventories along Ashley Creek identified the majority (79%) of species had stability scores  $\geq 6$  when compared to all species having stability scores (Winward 2000). The dominant vegetation along Ashley Creek's banks is *Phalaris arundinacea*, which scores 9 out of a possible 10 in the stability rating index. The combination of multiple vegetative species with good stability ratings and the dominant vegetation exhibiting a very high stability rating provides evidence that any erosion or bank instability occurring along the project reach is not likely due to inadequate vegetation composition along the streambanks.

### **5.3. Streambank Stability Success**

The streambank inventory identified a total of 85 feet, or 8% of the total project bank length (1050 feet) exhibiting eroding streambanks. Bank erosion along the right (south) bank is limited to a short segment where the creek abuts a high terrace. This bank was not disturbed during construction, and should not be considered unstable. A clay lens exists along the toe of the slope, which will likely prevent excessive erosion at this location.

Erosion along the left (north) bank includes bank sloughing beneath a hardened culvert outlet. Stone placed underneath the culvert to the toe of the stream bank was installed to prevent localized bank erosion from flows through the culvert; however, this material was placed at a very steep angle to the stream bed. These stone materials are sloughing into the channel, as the bank is developing a more gradual angle of repose (Photo 7, Appendix D). Bank erosion at this location is likely due to a combination of steep bank angle, fine grained soils along the bank, and periodic saturation of the soils when the drain culvert releases water on this bank segment. This bank should be carefully monitored to determine whether accelerated erosion or culvert destabilization occurs following future flood events. Although two eroding banks were observed within the project reach, the performance criteria of less than 25% of the project reach exhibiting signs of instability is currently being met at this site.

### **5.4. Channel Form Success**

Monitoring of the reconstructed segment of Ashley Creek beneath the new Highway 93 Alternative Bridge indicates the channel is relatively stable, with minor bank erosion and no vertical headcuts identified within the project reach. Vertical grade control is provided by a concrete slab previously installed on Ashley Creek downstream of the project reach below the confluence of Spring Creek and Ashley Creek. Lateral erosion is evident against a high terrace on the south bank, but is not considered a sign of instability. A short bank segment along the north side of the creek indicates evidence of bank sloughing, and may be attributed to the relatively steep bank angle construction and saturation of soils while a drain culvert upstream of Hwy 93 discharges water on the north bank. The combination of eroding banks makes up only 8% of the project reach, with the remaining 92% of the reach exhibiting stable characteristics.

Pool and riffle habitat features are evident in the reconstructed channel, and are illustrated by the survey plots in Appendix B. The majority of the project reach exhibits a straight channel alignment, and is subsequently dominated by riffle habitat (transects #3 and #4). The bankfull depth at the riffle surveyed just upstream of the junction with Spring Creek is approximately 3 feet. A deep pool exists along a sharp meander at the upstream extent of the project reach (transect #1), and a second pool exists where the channel abuts a terrace on the south side of the creek (transect #2). These pools have approximate bankfull depths of 6 feet, and provide slow moving fish habitat.

Vegetation transects conducted during this monitoring event indicate the riparian corridor adjacent to Ashley Creek has largely vegetated with desirable species. Woody plantings indicate high survival rates and the majority of planted areas have established



a diverse stand of herbaceous vegetation. Bare ground is sparse across the site, and no large patches of bare ground were observed.

### **5.5. Photo Documentation**

Photo documentation of the project site is included in Appendix D, and includes views from established photo points and surveyed transects. Photos will be repeated at these locations to provide documentation of the project's success toward meeting mitigation performance standards.

### **5.6. Weed Control**

Vegetation monitoring conducted in 2013 identified six noxious weed species within the project site. Weeds are dispersed sporadically on both banks. Two areas exhibiting dense common tansy are illustrated on Figure 2 in Appendix A. The documentation of noxious weeds provided in Section 4.3 of this monitoring report allow for MDT and the Flathead County Weed District to develop management plans for controlling noxious weeds along the reconstructed segment of Ashley Creek.

## **6.0 MANAGEMENT AND DESIGN RECOMMENDATIONS**

### **6.1. Bank Slopes**

Typical cross section details provided for Ashley Creek are not to scale and do not denote the slope of the banks (Appendix E). Visual observations and results of the surveyed transects suggest the north bank through the modified channel segment is approximately 1V:1H, with an estimated bank height to the pedestrian trail of 10 feet. These bank slopes and heights result in an incised channel segment with steeply vegetated banks. Tall, steeply constructed stream banks are susceptible to erosion, as there is little opportunity for flood discharges to spread across a functional floodplain and dissipate energy. Portions of the bank toe consist of a clay lens which provides some degree of toe stability and protection from erosion. However, much of the toe consists of fine grained soils that will saturate and slough when constructed to steep slopes. Bank sloughing is occurring on the left bank near the upstream end of the project reach beneath the culvert outlet (Photo Point 4.2), and may partially be attributed to the steeply constructed bank in this area.

The reconstructed bridge span accommodates paved pedestrian trails on both sides of the creek. However, the span does not accommodate a functional floodplain on either side of the channel. Future bridge span designs are recommended to accommodate gentler bank slopes (2H:1V minimum) and a floodplain bench on one or both sides of the channel (such as that shown in Photo Point 3.2) to allow flood discharges to dissipate energy and decrease the potential for bank erosion. Pedestrian and bike trails can be designed to function as floodplain terraces if designed to the proper elevation, (although they would be periodically inundated during flood events preventing pedestrian use). This approach would allow for a greater capacity for flooding while maintaining a pedestrian use corridor.

### **6.2. Culvert outlet on north bank**

Stone materials placed along the toe of the bank beneath a culvert upstream from the new bridge have sloughed into the channel. These materials appear to be sloughing due to the steep bank angle (steeper than 1H:1V) and saturation of the bank when the culvert discharges water on the bank. Stone toe protection beneath this culvert may need to be replaced to maintain bank and culvert protection if additional material continues to slough.

### **6.3. Woody planting success**

Woody plantings within the Ashley Creek project area appeared to have very good survival success. If survival rates continue to show promising results, these planting specifications are recommended for future designs along similar stream channel configurations.

## **7.0 LITERATURE CITED**

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

Winward, A.H. 2000. Monitoring the Vegetation Resources in Riparian Areas. USFS RMRS-GTR-47.

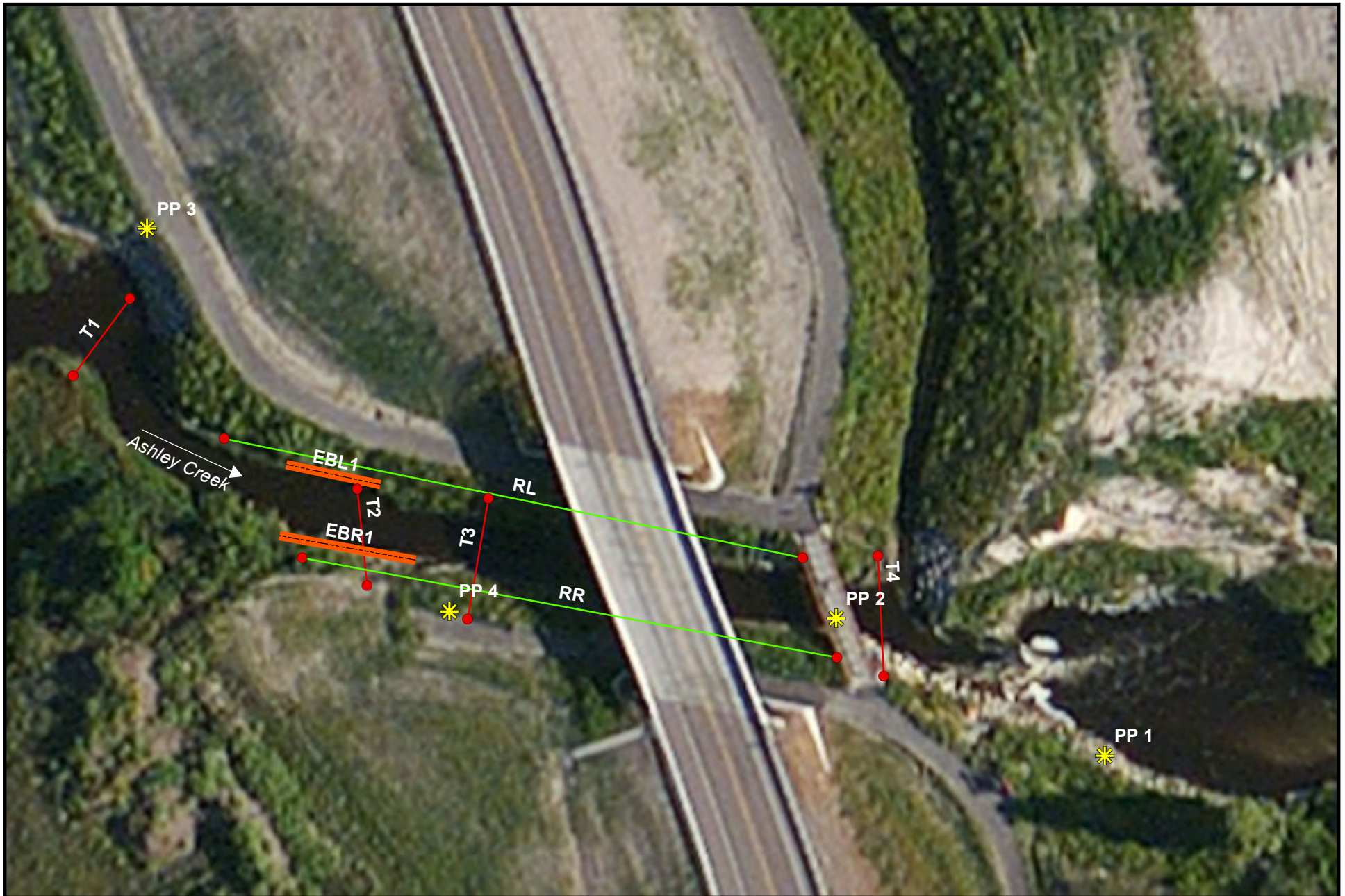
## **Appendix A**

---

### **Project Site Maps**

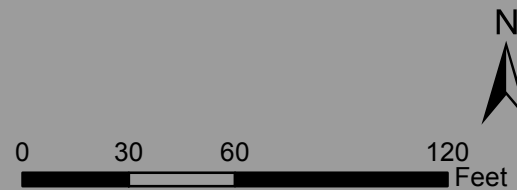
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MDT Stream Mitigation Monitoring  
Ashley Creek  
Flathead County, Montana



## Legend

- ✱ Photo Points
- Riparian and Perpendicular Transect Endpoints
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects



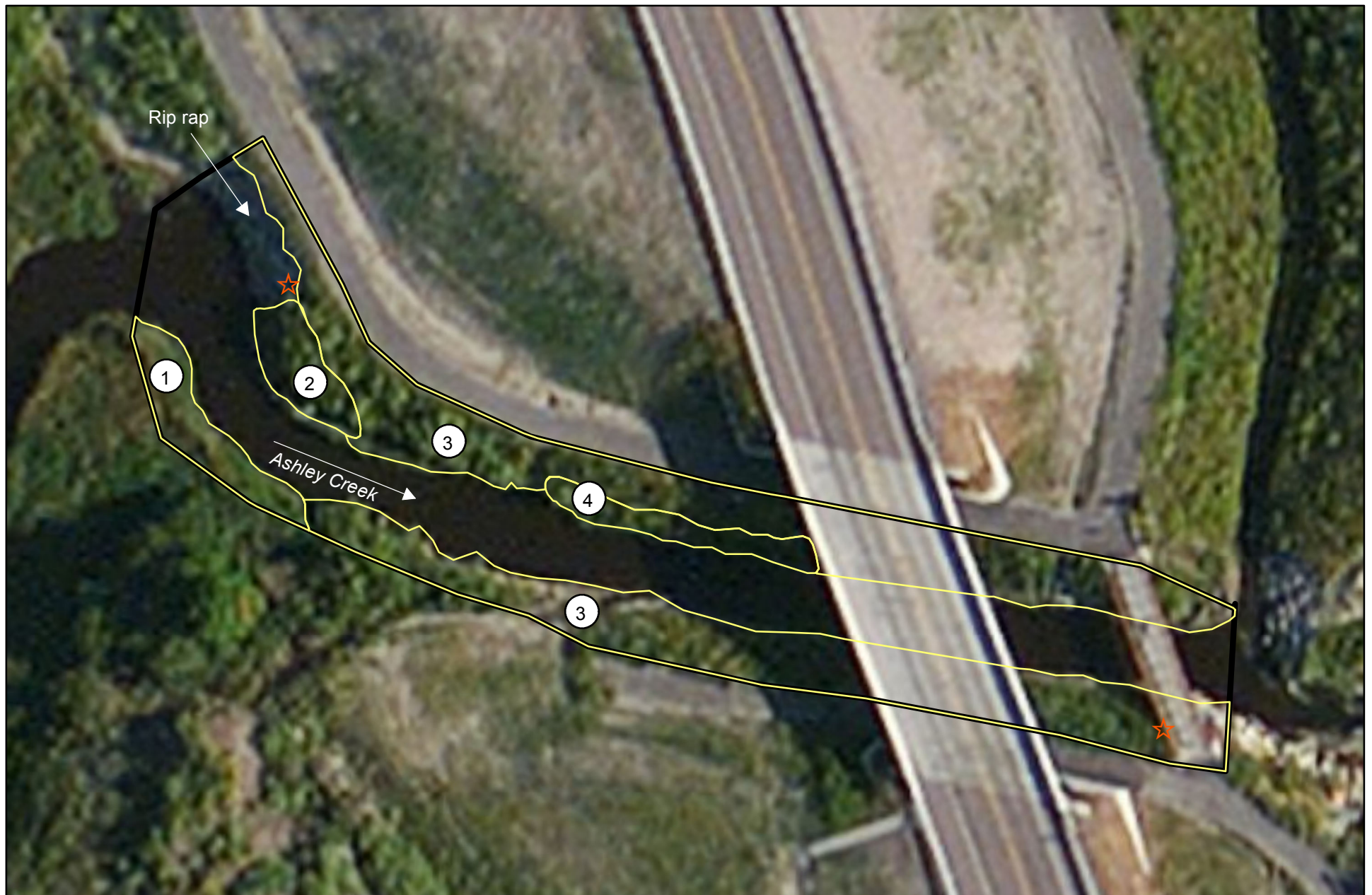
## 2013 Monitoring Ashley Creek

Figure 2

Date: 10/15/2013

X:/MDT\_007/mains





## Legend



Tanacetum vulgare



Project Boundary



Vegetation Community Boundary

1

Phalaris Community

2

Phalaris/Melilotus Community

3

Phalaris/Elymus Community

4

Salix/Helianthus Community



0 25 50 Feet

## 2013 Monitoring Ashley Creek

Figure 3

Date: 11/06/2013

X:/MDT\_.007/mains

## **Appendix B**

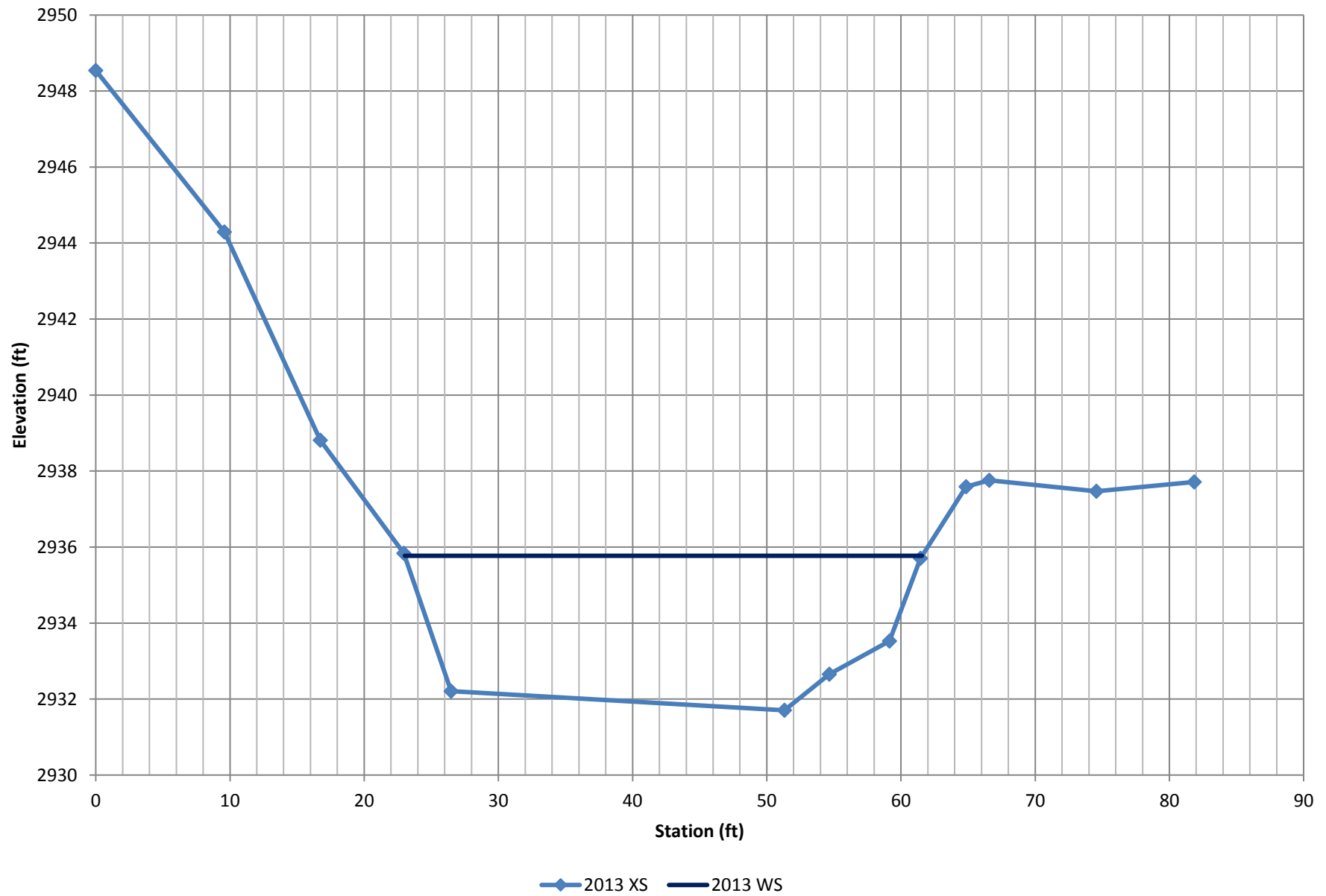
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### Perpendicular Transect Plots

---

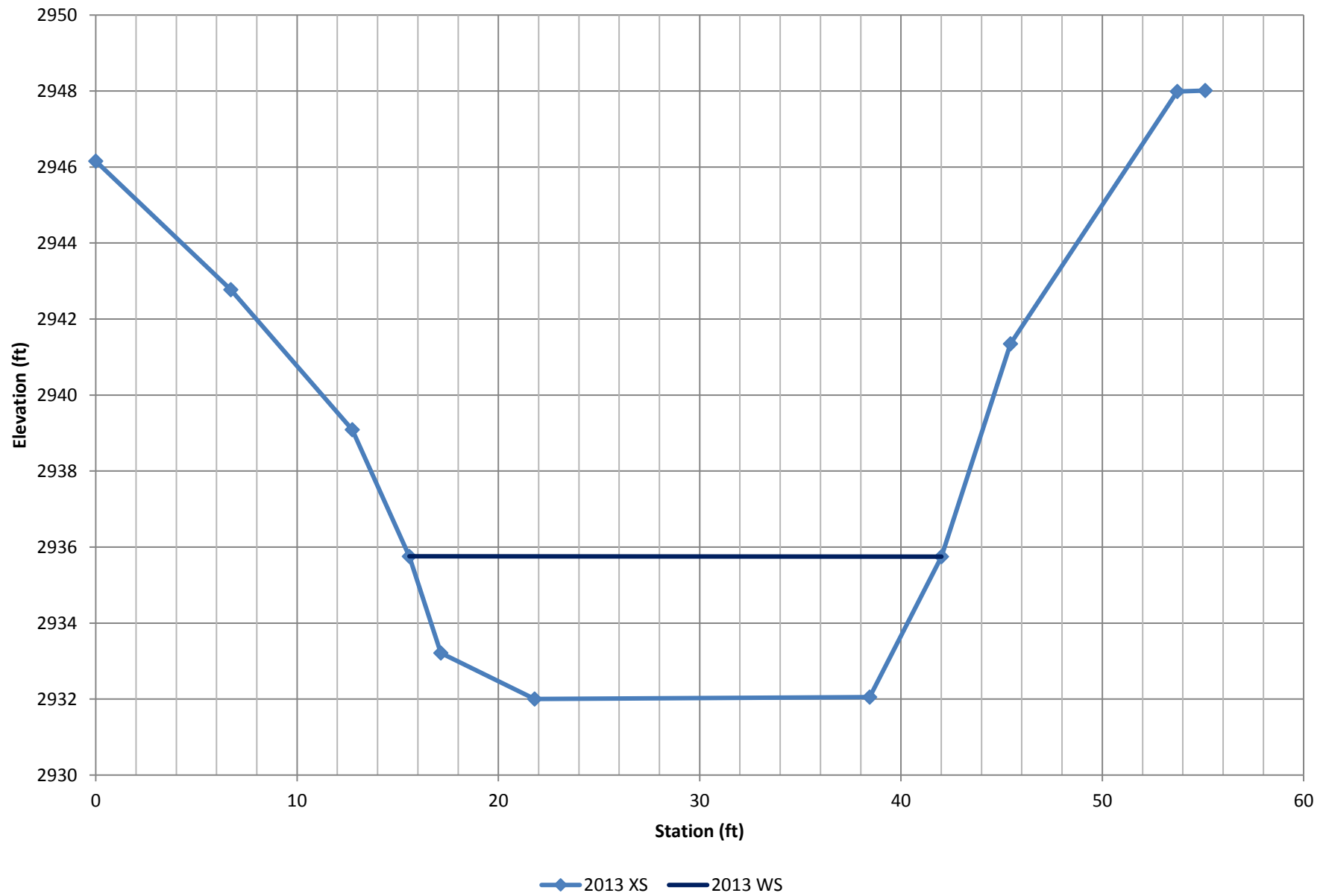
MDT Stream Mitigation Monitoring  
Ashley Creek  
Flathead County, Montana

## Ashley Creek Transect #1 - Pool

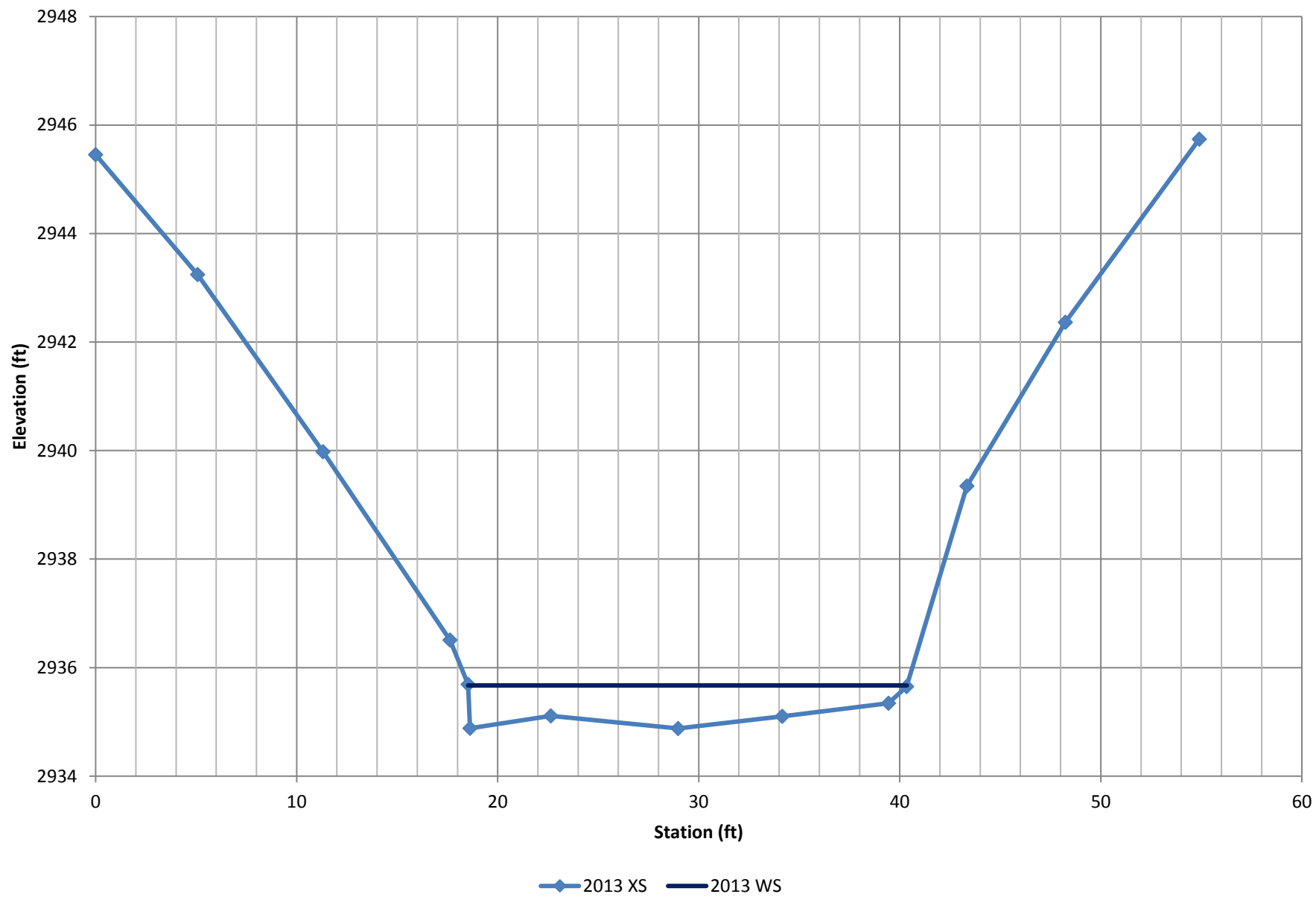




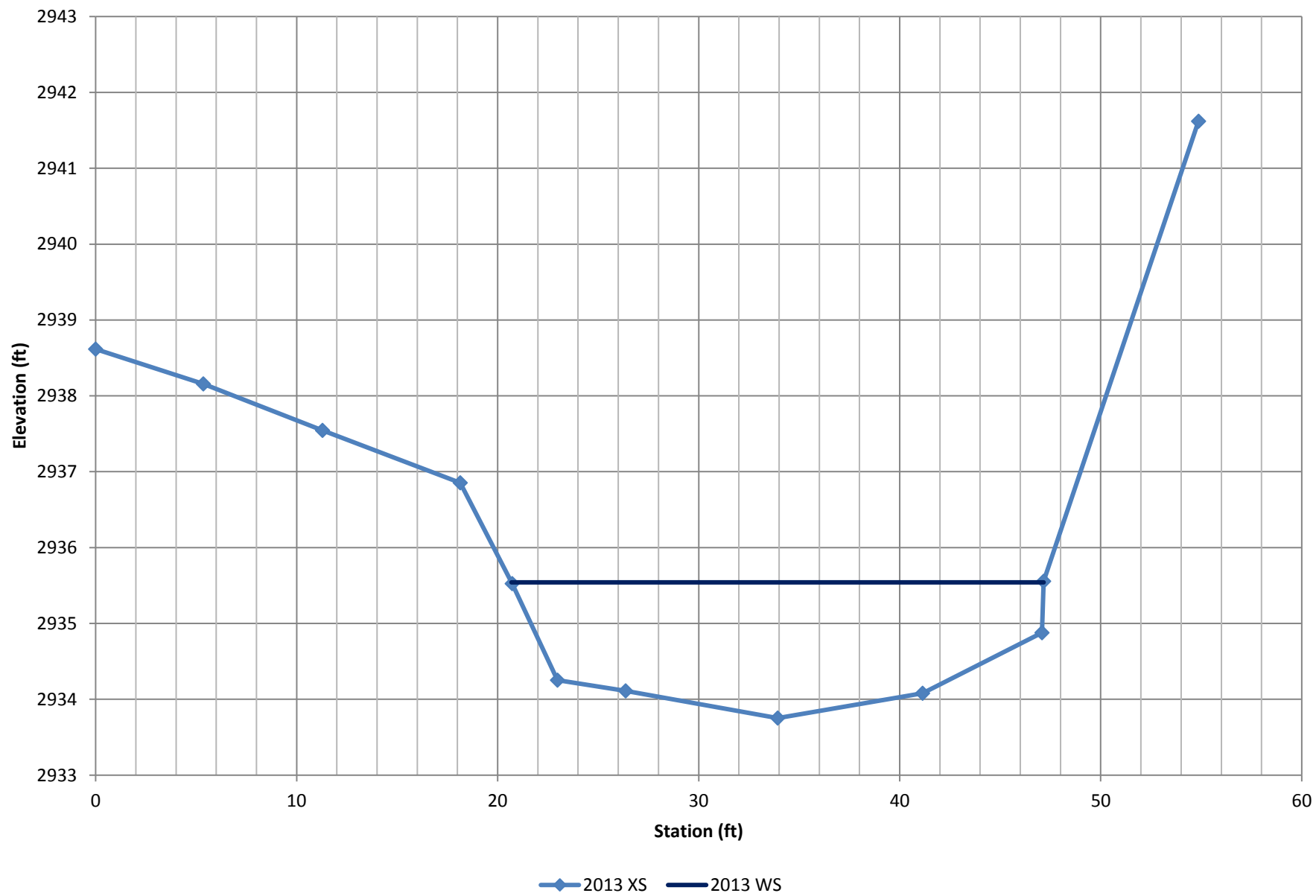
## Ashley Creek Transect #2 - Pool



### Ashley Creek Transect #3 - Riffle



## Ashley Creek Transect #4 - Riffle



## **Appendix C**

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### Riparian Vegetation Transect Data

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MDT Stream Mitigation Monitoring  
Ashley Creek  
Flathead County, Montana

# Interval Data Summary Report

Site: **Ashley Creek**

date: 9/10/2013 9:41:22 AM

**Transect Number:** 1 **Compass Direction from Start:** \_\_\_\_\_

## Interval Data:

**Ending Station** 208 **Community Type:** /

| Species                 | Cover class | Species                | Cover class |
|-------------------------|-------------|------------------------|-------------|
| Agropyron sp.           | 3           | Alnus incana           | 2           |
| Alopecurus pratensis    | 1           | Artemisia biennis      | 1           |
| Bare Ground             | 2           | Betula pumila          | 1           |
| Brassica kaber          | 0           | Bromus carinatus       | 1           |
| Bromus inermis          | 2           | Centaurea maculosa     | 0           |
| Chenopodium album       | 1           | Cirsium arvense        | 1           |
| Cirsium vulgare         | 0           | Cleome serrulata       | 2           |
| Cornus alba             | 1           | Cynoglossum officinale | 0           |
| Elymus canadensis       | 4           | Elymus repens          | 4           |
| Equisetum hyemale       | 1           | Galium aparine         | 1           |
| Helianthus nuttallii    | 1           | Lactuca serriola       | 1           |
| Onopordum acanthium     | 0           | Phalaris arundinacea   | 5           |
| Poa pratensis           | 3           | Populus angustifolia   | 1           |
| Pseudoroegneria spicata | 2           | Rosa woodsii           | 1           |
| Salix exigua            | 1           | Silene repens          | 0           |
| Solidago canadensis     | 0           | Sonchus arvensis       | 1           |
| Symphoricarpos albus    | 2           | Tanacetum vulgare      | 2           |
| Thlaspi arvense         | 0           | Verbascum thapsus      | 0           |

## Transect Notes:

start at 3rd beam in on upstream end foot bridge.

# Interval Data Summary Report

Transect Number: 2

Compass Direction from Start: \_\_\_\_\_

## Interval Data:

Ending Station 208 Community Type: /

| Species              | Cover class | Species            | Cover class |
|----------------------|-------------|--------------------|-------------|
|                      |             | Agropyron sp.      | 2           |
| Alnus incana         | 1           | Artemisia biennis  | 1           |
| Bare Ground          | 3           | Bromus tectorum    | 0           |
| Centaurea maculosa   | 0           | Cleome serrulata   | 1           |
| Cornus alba          | 1           | Elymus repens      | 4           |
| Equisetum hyemale    | 0           | Galium aparine     | 1           |
| Helianthus nuttallii | 1           | Lactuca serriola   | 1           |
| Lupinus argenteus    | 0           | Medicago lupulina  | 0           |
| Onopordum acanthium  | 0           | Pascopyrum smithii | 1           |
| Phalaris arundinacea | 5           | Poa palustris      | 1           |
| Rosa woodsii         | 1           | Salix bebbiana     | 1           |
| Salix lasiandra      | 2           | Sonchus arvensis   | 1           |
| Tanacetum vulgare    | 1           |                    |             |

Transect Notes:

edge of water

Transect Number: 8

Compass Direction from Start: \_\_\_\_\_

## Interval Data:

Ending Station 243 Community Type: /

| Species                | Cover class | Species             | Cover class |
|------------------------|-------------|---------------------|-------------|
| Agrostis gigantea      | 1           | Artemisia biennis   | 2           |
| Bare Ground            | 2           | Chenopodium album   | 1           |
| Cirsium arvense        | 1           | Equisetum hyemale   | 3           |
| Helianthus maximiliani | 3           | Lactuca serriola    | 1           |
| Melilotus officinalis  | 3           | Onopordum acanthium | 1           |
| Phalaris arundinacea   | 5           | Poa palustris       | 2           |
| Rosa woodsii           | 1           | Salix bebbiana      | 1           |
| Salix exigua           | 2           | Tanacetum vulgare   | 0           |
| Taraxacum officinale   | 1           |                     |             |

Transect Notes:

edge of water



# Interval Data Summary Report

Transect Number: 9

Compass Direction from Start: \_\_\_\_\_

## Interval Data:

Ending Station 243 Community Type: /

| Species                | Cover class | Species                 | Cover class |
|------------------------|-------------|-------------------------|-------------|
| Alnus incana           | 1           | Artemisia biennis       | 1           |
| Bare Ground            | 3           | Bromus carinatus        | 1           |
| Centaurea maculosa     | 1           | Chenopodium album       | 1           |
| Cirsium arvense        | 1           | Cleome serrulata        | 1           |
| Convolvulus arvensis   | 1           | Cornus alba             | 1           |
| Cynoglossum officinale | 0           | Elymus canadensis       | 4           |
| Elymus repens          | 3           | Equisetum hyemale       | 1           |
| Galium aparine         | 1           | Helianthus maximiliani  | 3           |
| Helianthus nuttallii   | 0           | Lactuca serriola        | 1           |
| Lupinus lepidus        | 0           | Medicago lupulina       | 0           |
| Medicago sativa        | 1           | Melilotus officinalis   | 4           |
| Onopordum acanthium    | 0           | Pascopyrum smithii      | 2           |
| Phalaris arundinacea   | 5           | Plantago major          | 0           |
| Poa pratensis          | 2           | Pseudoroegneria spicata | 2           |
| Rosa woodsii           | 2           | Rumex crispus           | 0           |
| Salix bebbiana         | 3           | Silene latifolia        | 0           |
| Solidago canadensis    | 1           | Sonchus arvensis        |             |
| Symphoricarpos albus   | 2           | Taraxacum officinale    | 1           |
| Thlaspi arvense        | 1           | Verbascum thapsus       | 0           |
| Vicia americana        | 3           |                         |             |

## Transect Notes:

Start at third beam in on footbridge at down stream end and continue to flagged birch

## **Appendix D**

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### Project Area Photos

---

MDT Stream Mitigation Monitoring  
Ashley Creek  
Flathead County, Montana

## **PHOTO INFORMATION**

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: September 10, 2013



**Photo Point 1**

**Description:** View of grade control structure downstream of project area. **Compass:** 315 (Northwest)



**Photo Point 2**

**Description:** View looking upstream from pedestrian bridge. **Compass:** 293 (West-Northwest)



**Photo Point 3.1**

**Description:** View looking south at upstream end of project site. **Compass:** 180 (South)



**Photo Point 3.2**

**Description:** View looking west at upstream end of project site. **Compass:** 225 (Southwest)



**Photo Point 4.1**

**Description:** View of channel looking downstream. **Compass:** 90 (East)



**Photo Point 4.2**

**Description:** View of channel looking upstream. **Compass:** 315 (Northwest)

## **PHOTO INFORMATION**

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: September 10, 2013



**Photo 5**

**Description:** View of Ashley/Spring Creek confluence.  
**Compass:** 0 (North)



**Photo 6**

**Description:** View of eroding bank on south side of channel. **Compass:** 225 (South-Southwest)



**Photo 7**

**Description:** View of eroding bank beneath culvert outlet on north streambank upstream of bridge.  
**Compass:** 0 (North)





**PHOTOGRAPHIC INFORMATION** page 1 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



PP1 Looking Upstream West



West of Bridge Looking Upstream West  
D-3





**PHOTOGRAPHIC INFORMATION**    page 2 of 23

PROJECT NAME:    MDT Stream Mitigation Ashley Creek

DATE:    October 22, 2013



West of Bridge Looking Downstream East



West of Transect 1 Looking Downstream South  
D-4





**PHOTOGRAPHIC INFORMATION**    page 3 of 23

PROJECT NAME:    MDT Stream Mitigation Ashley Creek

DATE:    October 22, 2013



Transect 1 Left Looking Southwest



Transect 1 North  
D-5





**PHOTOGRAPHIC INFORMATION** page 4 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 Left Looking Northeast Riprap



Transect 1 Left Bank Looking Downstream





**PHOTOGRAPHIC INFORMATION** page 5 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 Left Looking Southwest



Transect 1 Left Looking Northwest Upstream



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 2 North



Transect 2 Left Looking South  
D-8





**PHOTOGRAPHIC INFORMATION** page 7 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 2 Left Looking Southeast



Transect 2 Left Looking West  
D-9





**PHOTOGRAPHIC INFORMATION** page 8 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 3 North



Transect 3 Left Looking South  
D-10



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 3 Left Looking North



Transect 3 Left Looking Upstream West  
D-11





**PHOTOGRAPHIC INFORMATION** page 10 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 3 Left Looking Southeast



Transect 3 Left Looking South  
D-12



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 4 North



Transect 4 Left Looking South  
D-13



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 4 Left Looking North



Transect 4 Left Looking Upstream West  
D-14





**PHOTOGRAPHIC INFORMATION** page 13 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 4 Left Looking East



Transect 4 Left Looking Upstream West  
D-15



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 4 Left Looking Downstream East



Transect 4 South  
D-16



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 4 Right Looking North



Transect 4 Right Looking South Riprap  
D-17



PROJECT NAME:    MDT Stream Mitigation Ashley Creek

DATE:    October 22, 2013



Transect 4 Right Looking Upstream West



Transect 4 Right Looking Downstream East  
D-18





**PHOTOGRAPHIC INFORMATION** page 17 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 3 South



Transect 3 Right Looking North  
D-19





**PHOTOGRAPHIC INFORMATION** page 18 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 3 Right Looking North



Transect 3 South  
D-20





**PHOTOGRAPHIC INFORMATION** page 19 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 2 Right Looking North



Transect 3 Right Looking North  
D-21



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 South



Transect 1 Right Looking Northeast  
D-22





**PHOTOGRAPHIC INFORMATION** page 21 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 Right Looking Northeast



Transect 1 Right Looking Northeast  
D-23



PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 Right Looking Downstream Southeast



Transect1 Right Looking Upstream North  
D-24



**PHOTOGRAPHIC INFORMATION** page 23 of 23

PROJECT NAME: MDT Stream Mitigation Ashley Creek

DATE: October 22, 2013



Transect 1 Right Looking Downstream East

## **Appendix E**

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### Channel Construction Details

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MDT Stream Mitigation Monitoring  
Ashley Creek  
Flathead County, Montana

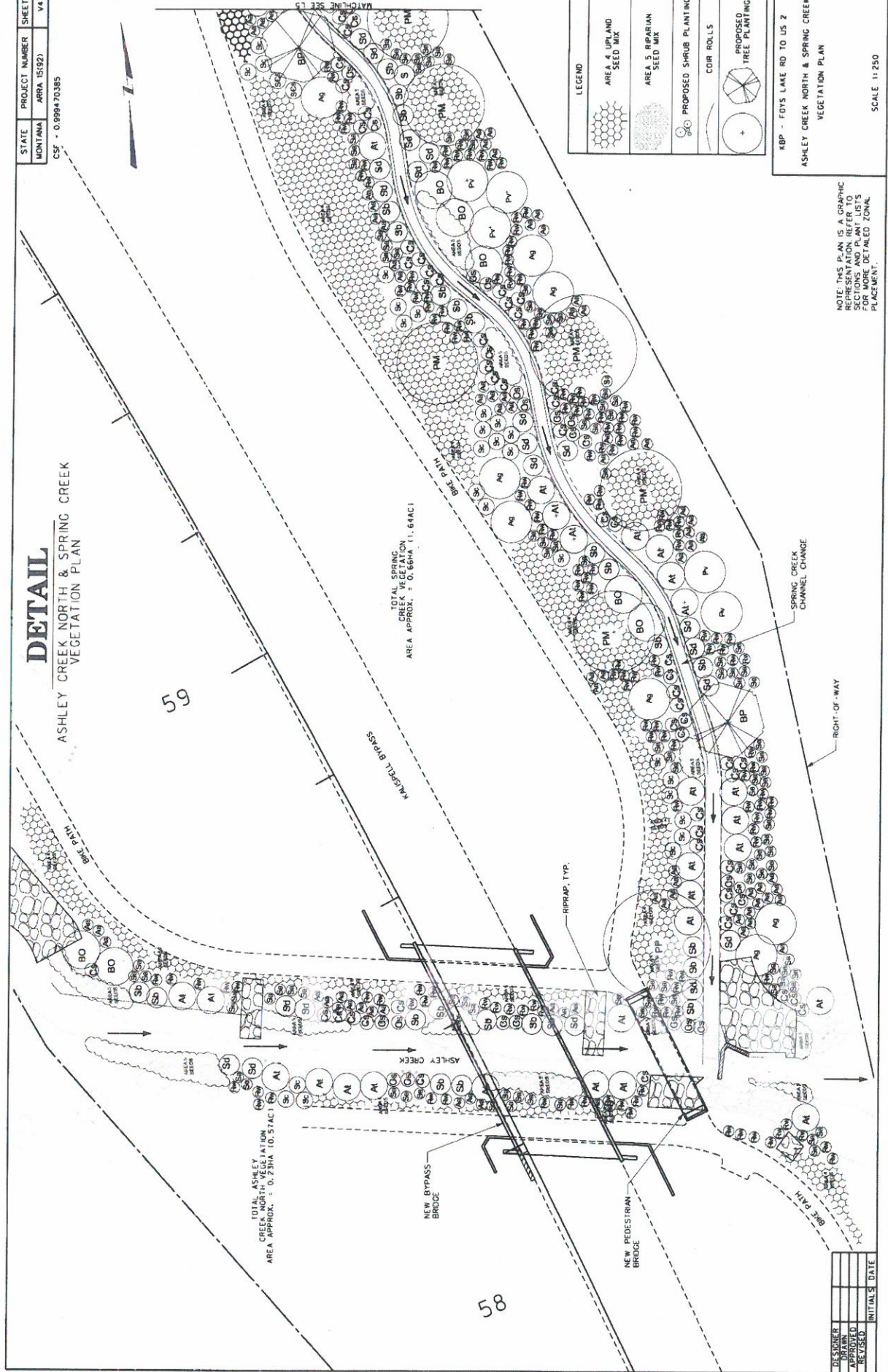






|                  |                |           |
|------------------|----------------|-----------|
| STATE            | PROJECT NUMBER | SHEET NO. |
| MONTANA          | ARRA 151921    | VA        |
| CSF - 0.99470385 |                |           |

# **DETAIL** ASHLEY CREEK NORTH & SPRING CREEK VEGETATION PLAN



| LEGEND |                          |
|--------|--------------------------|
|        | AREA 4 UPLAND SEED MIX   |
|        | AREA 5 RIPARIAN SEED MIX |
|        | PROPOSED SHRUB PLANTING  |
|        | COR ROLL                 |
|        | PROPOSED TREE PLANTING   |

KBP - FOYS LAKE RD TO US 2  
 ASHLEY CREEK NORTH & SPRING CREEK  
 VEGETATION PLAN

NOTE: THIS PLAN IS A GRAPHIC REPRESENTATION OF THE SECTIONS AND PLANT LISTS FOR MORE DETAILED ZONAL PLACEMENT.

SCALE 1:250



|          |      |
|----------|------|
| DESIGNER | DATE |
| DRAWN    |      |
| APPROVED |      |
| REVISED  |      |







