MONTANA DEPARTMENT OF TRANSPORTATION
STREAM MITIGATION MONITORING REPORT

Ashley Creek
Flathead County, Montana

Project Completed: 2010
Monitoring Report #5: December, 2019

Prepared for:

VISION ZERO
zero deaths · zero serious injuries
MONTANA DEPARTMENT OF TRANSPORTATION

Prepared by:

CONFLUENCE

MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #5

YEAR 2019

Ashley Creek
Flathead County, Montana

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

USACE Permit: NWO-2009-01808-MTM

Prepared for:

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1.0 INTRODUCTION

As part of construction of the U.S. Highway 2 South Kalispell Bypass project, the Montana Department of Transportation (MDT) modified a segment of Ashley Creek at the North Bridge crossing. The following report provides results of the fifth year of post construction mitigation monitoring along this segment of Ashley Creek and compares results to project performance standards outlined in the post-construction monitoring plan for the site. This project was constructed in 2010; therefore, these results provide documentation of the site's condition nine years following the project's completion. Monitoring of this site occurred annually from 2013-2015 but was not monitored in 2016 and 2017 due to construction of a second bridge over Ashley Creek. It has since been monitored in both 2018 and 2019.

One of the goals of the project is to provide compensatory mitigation for stream impacts associated with the U.S. 93 Alternative widening segment of the Kalispell Bypass in the Missoula District. If successful, the project will create, enhance, restore, and maintain permanent, naturally self-sustaining, native or native-like stream and riparian habitat. Prior to the project, Ashley Creek had been modified by human activities, and was V-shaped with steep side slopes (1.5:1). Objectives intended to meet the project's goal include:

- Widening 413 feet of the Ashley Creek stream channel and laying back the slopes from 1.5:1 to 2:1,
- Implementing an aggressive re-vegetation plan along the re-sloped banks to re-establish native riparian and upland vegetation.

Provisions outlined within the USACE permit include monitoring of the on and off-site stream mitigation areas for five years following channel construction to determine whether the site meets, or is trending toward meeting the performance standards specified in the mitigation plan for the site. The performance standards for the on-site mitigation plan for Ashley Creek are outlined below.

<u>Quantitative success criteria for Ashley Creek:</u>

1. **Riparian Buffer Success** will be achieved when:
    a. Woody and riparian vegetation becomes established, and noxious weeds do not exceed 10% cover within the riparian buffer areas.
    b. Any area within the creditable buffer area disturbed by the project construction must have at least 50% areal cover of non-noxious weed species by the end of the monitoring period.
2. **Vegetation Success** will be achieved when:
    a. Combined areal cover of riparian and stream bank vegetation communities is ≥70%

b. Planted trees and shrubs will be considered successful where they exhibit 50% survival after 5 years.

3. **Vegetation along Stream banks** will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indexes ≥6 (subject to 1.a and 1.b above).

4. **Stream bank 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.

Qualitative success criteria for Ashley Creek:

5. **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 stream banks.

Additional reporting requirements include:

6. **Photo Documentation** success of restored stream channel and stream bank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the established reference reach.

Results of the fifth year monitoring of the Ashley Creek project are included in Section 4 and compared to performance standards in Section 5. Additional reporting requirements including maps indicating the endpoints of riparian belt transects, perpendicular transect surveys and locations of noxious weed infestations, repeated survey results at four perpendicular transects and a longitudinal stream profile, photo documentation of the project site, comprehensive plant species list, streambank species list, noxious weed list, wildlife species list, and a planting schematic from the approved design are included as appendices to this report.

2.0 SITE LOCATION

The project reach includes approximately 430 feet of Ashley Creek, and extends to upstream and downstream of the U.S. Highway 93 ALT Bridge (Figure 1). The project site is located in Section 13, Township 7 North, Range 22 West, in Flathead County, Montana.

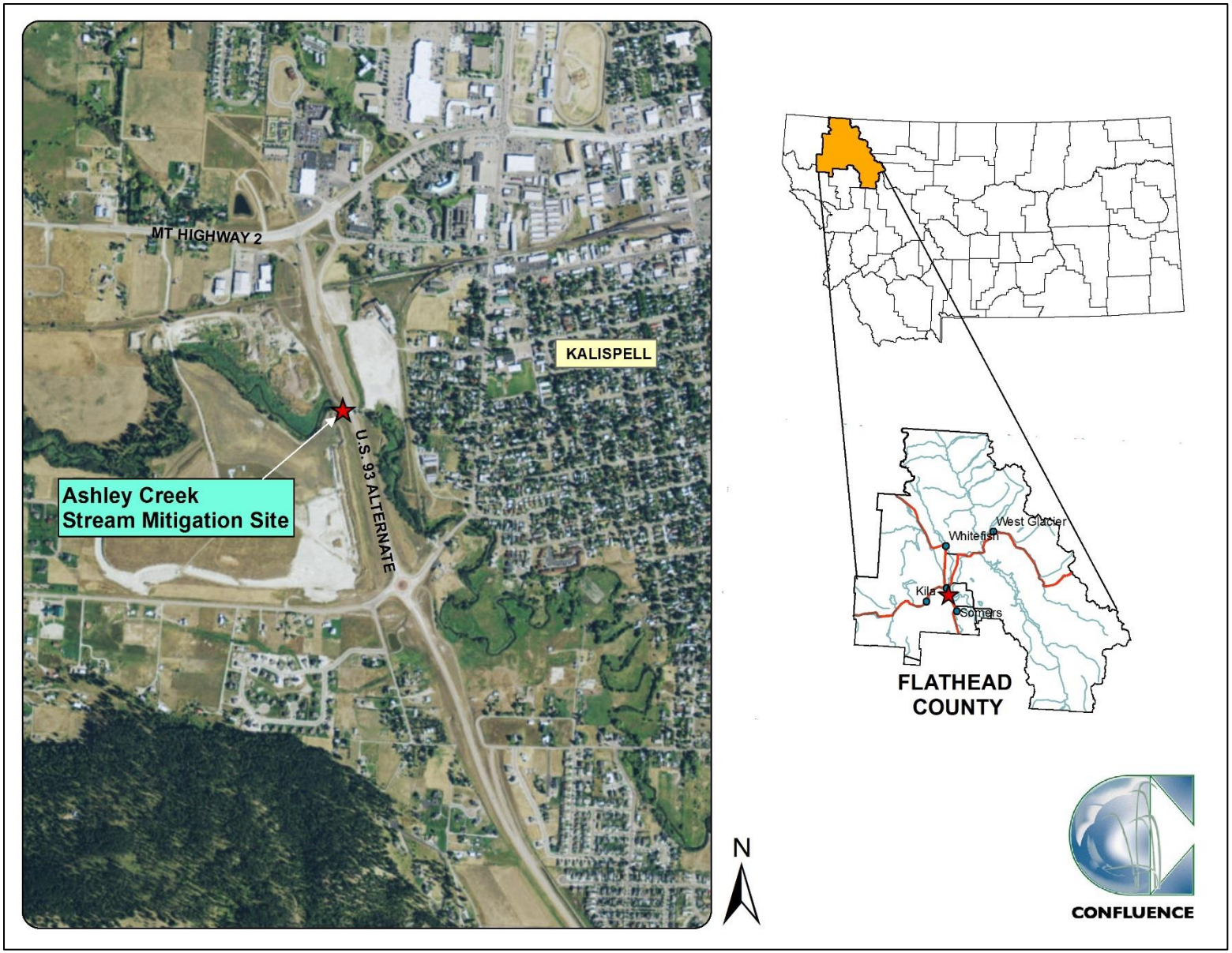


Figure 1. Location of the Ashley Creek stream mitigation monitoring site.

3.0 MONITORING METHODS

Monitoring field crews visited the project site on August 14, 2019 while survey crews visited the site on September 4, 2019. Field data collection and surveys followed methodologies as described in the 2013 monitoring report for the Ashley Creek mitigation site, which may be accessed at the following Montana Department of Transportation website:
https://www.mdt.mt.gov/publications/brochures/stream-mitigation.shtml.

4.0 RESULTS

4.1. Riparian and Stream Bank Vegetation Inventory

Table 1 summarizes the areal percent cover of total vegetation, bare ground, woody vegetation, and noxious weeds for the riparian transects surveyed along Ashley Creek. The channel was designed with a consistent slope from the toe of the bank up to the pedestrian/bike trail and has no definable top of bank or floodplain bench on either side of the channel (see Photo Point 2 on page C-1). As a result, the stream banks along Ashley Creek were considered within the riparian vegetation transect. In 2019 the total percent riparian cover decreased to 70%, with 17% cover by woody species, 4% by noxious weeds, and 30% bare ground. Overall, 66% of the reach exhibited non-noxious vegetation cover (70% total riparian cover minus 4% noxious weed cover).

Table 1. Percent cover along riparian belt transects at Ashley Creek in 2013 through 2015, and 2018 through 2019.

Belt Transect	Length (ft)	Total % Riparian Cover					% Bare Ground					% Woody Cover					% Noxious Weed Cover				
		2013	2014	2015	2018	2019	2013	2014	2015	2018	2019	2013	2014	2015	2018	2019	2013	2014	2015	2018	2019
Right (south bank)	208	92%	95%	85%	70%	70%	8%	5%	15%	30%	30%	23%	25%	25%	15%	15%	12%	15%	11%	7%	5%
Left (north bank)	243	84%	90%	90%	80%	70%	16%	10%	10%	20%	30%	30%	30%	30%	20%	18%	10%	10%	10%	5%	3%
Total	451	88%	92%	88%	75%	70%	12%	8%	12%	25%	30%	26%	28%	28%	18%	17%	11%	12%	10%	6%	4%

Dominant species recorded along the riparian transects were combined with visual observations in other areas to develop a vegetation community map (Figure 3, Appendix A). The same four community types documented in 2018 were observed during the 2019 monitoring event. These include community Types 1 – *Phalaris arundinacea*, 3 – *Phalaris arundinacea/Elymus* spp., 4 – Bare Ground/*Elymus* spp., and 5 – *Cornus alba/Alnus incana*. Side slopes along the straight channel alignment are dominated by bare ground, wild rye (*Elymus* spp.), and reed canary grass *(Phalaris arundinacea).* The right bank along the upstream extent of the project reach, which was not disturbed during construction, is dominated by reed canary grass. Community Type 3 on both the left and right stream banks has shifted since the 2015 monitoring event, to include community Types 4 and 5, due to the increase observed in 2018 and 2019 in bare ground, red osier dogwood (*Cornus alba*), and speckled alder (*Alnus incana*). While large patches of bare ground were observed along the steep stream banks of Ashley Creek, the majority of the bare ground observed within the riparian corridor was concentrated under the bridge overpass in an area that is permanently to partially shaded. This absence of direct sunlight and precipitation beneath the overpass is contributing to the lack of overall vegetation cover, poor vigor and mortality of woody

species, and an increase in bare ground (see additional photos 7, 8, and 9 on page C-5). In 2019, there was a notable increase in bare ground observed along the left bank, particularly in areas that had been previously sprayed with herbicide and areas adjacent to dead and dying shrubs. In general, total vegetation cover beneath the bridge overpass, from both woody and herbaceous species, is expected to decrease over time due to the lack of sunlight and precipitation available to vegetation establishing beneath the bridge. A reduction in vegetation is likely to contribute to increased erosion and bank instability.

Appendix D includes a comprehensive list of plant species observed during the 2013 through 2015, and 2018 through 2019 monitoring events. In 2019, 89 plant species were observed, representing an increase of 7 species since 2018, and 33 species since the initial monitoring event in 2013. Five of the seven new species observed in 2019 were native and considered beneficial to the restoration efforts within the project area, as they increase overall native species diversity and enhance riparian habitat complexity. These newly observed plant species included American slough grass (*Beckmannia syzigachne*), panicled willowherb (*Epilobium brachycarpum*), American manna grass (*Glyceria grandis*), American wild mint (*Mentha arvensis*), and silverweed (*Potentilla anserina*). German-madwort (*Asperugo procumbens*) and white clover (*Trifolium repens*), species native to Eurasia, were also observed in 2019 within the project area. Forty of the 89 species (45%) observed in 2019 were hydrophytic based on the 2016 National Wetland Plant List (NWPL) (Lichvar *et al*., 2016).

4.2. Stream Bank Vegetation Composition

The stream bank vegetation inventory identified 24 plant species along the banks of Ashley Creek (Appendix E). Stability ratings are provided on a scale from 1 to 10, and indicate a plant's ability to resist erosive forces based on root characteristics (Winward 2000). The Winward stability ratings are based on vegetation communities rather than individual species; therefore, a vegetation community was assigned to each stream bank based on one or more dominant species. If the community type was defined by more than one dominant species, the more dominant species stability rating was reported. Success criteria outlined in the monitoring plan state the vegetation along the stream banks will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indices ≥6. Reed canary grass comprised greater than 50% cover along the left stream bank and between 11 and 20% on the right. Bare ground accounted for greater than 50% of the right stream bank and between 11 and 20% on the left. Therefore, reed canary grass, with a root stability index of 9, dominated approximately half of the streambank vegetation, while the other half was dominated by bare ground, with a root stability index of 1. The majority of the bare ground observed along the stream banks was concentrated under the bridge overpass, where there is restricted sunlight and precipitation, making it difficult for vegetation to establish.

4.3. Noxious Weed Inventory

Eight infestations of three Montana Listed Priority 2B noxious weeds were mapped within the riparian corridor at the Ashley Creek stream mitigation site and are listed in Appendix F. Noxious weed occurrences are displayed on Figure 3 in Appendix A with the exception of those observed in trace amounts, which were not mapped. Spotted knapweed (*Centaurea stoebe*) and houndstongue (*Cynoglossum officinale*) were observed in isolated trace amounts, and were therefore not mapped, but are included in Table 4. A low cover class (1 to 5 percent) was identified for all mapped weed occurrences within the project area. An estimated 4% of the project area has been colonized by noxious weeds, with common tansy (*Tanacetum vulgare*) identified as the most prevalent noxious weed observed on site. Cheatgrass (*Bromus tectorum*), a Priority 3 regulated weed species (not noxious), was also observed within the site.

4.4. Woody Plant Survival

Woody plantings observed included bog birch, serviceberry, chokecherry, Woods' rose, snowberry, coyote willow, Bebb's willow, Drummond's willow, speckled alder, and red osier dogwood. Table 2 indicates the total number of woody plantings observed and the number of those that remained alive. The Ashley Creek planting plan called for installation of 130 trees and shrubs. As compared to the planting plan, 72% (94 of 130 plants) remain alive nine years following construction. While a decrease in total woody cover was observed within the riparian corridor, this increase in overall survival of planted woody shrubs includes a substantial number of shrubs observed with poor vigor. Poor vigor for many of the planted woody shrubs is likely due primarily to a lack of direct sunlight and precipitation to shrubs installed beneath the bridge overpass. The poor vigor of shrubs planted along the lower banks (particularly along the south bank) is also likely influenced by the erosion that's occurring here. Additionally, it is becoming challenging to locate shrubs that may have died several years ago, which can skew the results toward a higher survival rate if the number of live shrubs is compared to the number of dead shrubs observed.

Table 2. Woody plant survival at the Ashley Creek stream mitigation site in 2013 through 2015, and 2018 through 2019.

Year	Total Plants Inspected	Surviving Plants	# of Woody Plantings in Design	Plant Survival based on Planting Plan
2013	99	93	130	72%
2014	73	66		51%
2015	106	92		71%
2018	65	60		46%
2019	104	94		72%

4.5. Bank Erosion Inventory

Previous monitoring reports documented bank erosion beneath the bridge and in the vicinity of a storm water culvert outlet. The following section provides an updated bank erosion inventory where new erosion is occurring and where previous erosion has been addressed. Photos of each eroding bank are included in Appendix C of this report,

while Figure 2 in Appendix A provides the locations of each eroding bank. The total length of eroding bank along the reconstructed segment of Ashley Creek is 312 feet, or 36% of the total bank length of 860 feet. Of the 312 feet of eroding bank, 190 feet (61% of erosion) occurs beneath the highway bridge

Eroding bank EBL1 was originally documented in 2013 along the outlet of a storm water culvert discharging into Ashley Creek upstream of the highway bridge. During the first construction phase of the project, riprap was improperly placed below the culvert outlet to protect the bank from erosion, causing it to slough into the creek. During the most recent construction phase of the project, additional riprap was placed and keyed into the stream bed. As a result, this bank has stabilized and is no longer classified as eroding.

Eroding bank EBL2 occurs along the straight channel segment of Ashley Creek beneath the bridge. This bank segment exhibits little in terms of lateral migration; however, bare soil and upper bank sloughing provide signs of bank instability. The presence of bare soil, reduced vegetation coverage, and sloughing stems from a lack of direct sunlight and precipitation beneath the bridge, which is causing the vegetation to become sparser each year. The sloughing bank length at EBL2 has more than doubled from the originally mapped length of 40 feet in 2014 to 84 feet in 2019. This closely corresponds to an original 2-lane bridge width of 50 feet, which expanded to a width of 100 feet following completion of the second 2-lane bridge deck over Ashley Creek. Bank conditions and causes of erosion are due to fine grained soils, relatively steep bank slopes, lack of a functional floodplain adjacent to the channel to dissipate energy, and lack of woody shrubs. A clay lens is protecting the left bank from more accelerated erosion.

Eroding banks EBR1 and EBR2 were originally mapped as separate eroding bank segments; however, in 2018, erosion noted between these two segments resulted in their being combined in the inventory as a single eroding bank which is referred to as EBR1-2. Erosion along bank EBR1-2 begins along a high terrace that was not disturbed during construction of the project, extends along the straight segment of the channel, and terminates at the pedestrian bridge over Ashley Creek. The eroding bank length increased from 53 feet to 97 feet in 2015, and has now lengthened to 228 feet. Sloughing of the upper bank is getting close to undermining the bike path on the south side of the channel.

Of the total eroding bank length along EBR1-2, 110 feet occurs beneath the bridge decks (Additional Photos 3 and 4 in Appendix C). Erosion along this bank appears to stem from saturation of fine-grained bank materials during high flows followed by sloughing of the lower bank. Vegetation vigor along EBR1-2 has continued to decline due to the bridge widening project in 2016, and does not appear capable of withstanding erosion and sloughing following high flows and has resulted in the exposure of bare ground along a steep lower bank angle. A clay lens exists along the toe of the bank which protects it from more rapidly eroding; however it does not protect the upper bank from sloughing. The upper bank has retreated by as much as four feet since 2013 (see bank transect #2, page B-2), and many cracks were observed along

the entire bank. Erosion of the upper bank may be due to a combination of lower bank failure, increased surface runoff from the adjacent bike/foot path, and disturbance during construction of the expanded bridge. Erosion severity along this bank is considered high due to the lack of vegetation capable of stabilizing the bank, the relatively steep bank angle, fine grained bank materials, and lack of functional floodplain along this segment of the channel. Due to these factors, erosion is likely to continue along this bank, albeit at a slow pace due to the presence of the clay lens.

4.6. Channel Form

The presence of pool and riffle habitats within the project reach are illustrated by perpendicular transect and longitudinal profile plots of the channel bed. Bankfull widths and maximum depths surveyed at two pools and two riffles within the project reach are summarized in Table 3, while plotted survey results are included in Appendix B.

The longitudinal profile indicates the three distinct pools originally surveyed within the reach have maintained their depth over the past six years (see profile page B-5). A deep pool exists at the upstream end of the project reach, where the newly aligned segment of Ashley Creek turns east. Transect #1 runs through this pool, which is formed by a tight meander bend in the channel generating scour against the riprapped north bank. This pool exhibits a bankfull width of 44.9 feet, maximum depth of 9.7 feet, and a well-developed floodplain bench on the south side of the channel. Surveys indicate the point bar along the right (south) bank initially extended northward, but has since retreated. It should be noted the left (north) bank of this transect has been riprapped. Surveying through riprap can often lead to varying results based on the exact location of surveyed points; therefore elevation changes along the left bank are not attributed to bank retreat or erosion.

Transect #2 runs through a second pool which has formed along a straight channel segment between Station 1+40 and 2+30. The bankfull width of the channel at Transect #2 has narrowed from 31 feet in 2015 to 25.0 feet in 2019 due to a bar developing on the left (north) side of the channel. The developing bar is immediately downstream of a culvert outlet that was repaired in 2015 by placing additional rock along the toe of the bank. This rock may be contributing to the bar development, which is likely to direct water toward the south bank. This bank (EBR1-2) shows continued signs of instability and bank sloughing; however the clay lens at the bank toe has protected it from more severe lateral migration. The cross section plot (page B-2) illustrates the sloughing and soil loss observed along the upper bank on the right (south) side of the channel over the past six years.

Transect #3 runs through a 50-foot riffle that extends from Station 2+30 to 2+80. Bank erosion along the toe of the channel (EBR1-2) has been relatively limited at the transect location, also due to the clay lens that acts to protect the channel from more severe erosion. Inspection of the cross section (page B-3) indicates the upper bank along the right (south) side of the channel has retreated by as much as four feet over the past six years. In addition, a thalweg has begun to develop along the left side of the channel.

The bankfull width and depth at Transect #3 is have remained relatively consistent over the monitoring period, and are 25.3 and 3.0 feet respectively.

Transect #4 is located just upstream of the confluence with Spring Creek. As shown in the longitudinal profile, its location lies at the tail end of the third pool, and is approximately 20 feet upstream of the next riffle crest. The channel has exhibited minor changes since 2013, and has a bankfull width of 28 feet and maximum depth of 3.0 feet. The bed of the channel has developed a shallow bar, which may be resulting from sediment delivery from Spring Creek depositing just downstream of the confluence of the two creeks.

With the exception of pool transect #2, bankfull channel widths have adjusted by less than two feet over the past six years. The point bar developing just downstream of the rocked culvert outlet has influenced bankfull width at transect #2, which has decreased by four feet since 2013. The minor reduction in bankfull channel width at transect #3 is likely due to upper bank sloughing and material accumulation at the bankfull elevation.

Water surface elevations surveyed in 2019 were lower than during previous monitoring events despite the relatively wet summer. This is most likely due to the timing of the survey, which occurred later (September 4th) as compared to previous years, when surveys occurred between late July and mid-August.

Table 3. Channel width and depth surveyed at Ashley Creek transects.

Transect	Type	Maximum Depth (ft)					Bankfull Width (ft)				
		2013	2014	2015	2018	2019	2013	2014	2015	2018	2019
1	Pool	**	9.9	10.1	10.1	9.7	43.8	43.6	45.1	45.5	44.9
2	Pool	**	8.2	7.9	7.8	7.4	29.0	30.8	31.0	26.5	25.0
3	Riffle	2.6	2.8	2.8	2.7	3.0	26.3	26.3	27.0	26.3	25.3
4	Riffle	3	2.7	2.6	2.9	3.0	30.0	29.5	28.5	28.0	28.0
Average Riffles		**2.8**	**2.8**	**2.7**	**2.8**	**3.0**	**28.2**	**27.9**	**27.8**	**27.1**	**26.7**
Average Pools		N/A	**9.1**	**9.0**	**9.0**	**8.6**	**36.4**	**37.2**	**38.1**	**36.0**	**35.0**

** Maximum depth was not surveyed at pools in 2013.

4.7. Wildlife Documentation

Appendix G provides a comprehensive list of wildlife observed on site during the five monitoring events. In 2019, two mallard ducks and a few chewed stems, likely from beaver, were observed along the left bank in the upstream extent of the project area. The relatively low number of species observed is attributed to the proximity of the project to Highway 93, frequent usage of the bike path next to the stream channel, and an overall lack of mature riparian habitat. Swallows are utilizing the bridge for nesting habitat despite the heavy use by pedestrians along the bike path beneath the bridge.

5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the modified segment of Ashley Creek is intended to document whether the site is meeting, or trending toward meeting the performance standards outlined in the monitoring plan. The fifth year of monitoring suggests four of the six quantitative

performance standards are being met nine years after the project was constructed (Table 4). Channel form success is considered a qualitative criterion, and is discussed in more detail in the following section. Additional reporting requirements including photo documentation of the project site, and as-built topographic surveys have been completed and are included as appendices to this annual monitoring report to provide further evidence of the site's condition.

5.1. Riparian Buffer Establishment

Performance criteria for vegetation cover require 50% or greater cover of non-noxious weed species by the end of the monitoring period. The fifth year monitoring results indicated 66% of the riparian areas were vegetated with non-noxious species, with 70% total cover, and 4% noxious weed cover. Bare ground was observed in 2019 on both banks, and was 5% higher than observed during the 2018 monitoring event.

Noxious weeds comprised approximately 4% of the riparian transects, therefore the site is currently meeting the performance goal of 10% or less noxious weed cover. Although noxious weed infestations were scattered along the entire length of both banks, they were most heavily concentrated near the pedestrian bridge and adjacent to the highway overpass.

5.2. Vegetation Success

Riparian vegetation transects were established 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 the combined aerial cover for riparian and stream bank vegetation communities is 70%, which just meets the performance criteria goal of at least 70% cover. While the combined aerial cover is meeting the success criteria, low sunlight and lack of precipitation beneath the bridge overpass is limiting riparian vegetation growth and establishment. With the addition of a second bridge over Ashley Creek, 48% (220 of 460 feet) of the riparian transects are affected by partial or total shade.

An estimated total of 104 planted trees and shrubs were located within the project area. Of these, 94 were alive, although many observed with poor vigor. The planting plan sheet called for 130 planted trees and shrubs; therefore, 36 additional trees/shrubs were not located. If 100% of the planted trees/shrubs that were not located are assumed dead, the current survival rate is 72% (94 of 130 plants). The performance criteria requires >50% survival five years following construction. As compared to the planting plan for Ashley Creek, survival rates of woody vegetation installed within the project area are currently meeting the success criteria. While planted woody survival is currently meeting the success criteria, the majority of woody shrubs were installed beneath the bridges, which have permanently shaded the banks beneath them and likely hinder the ability of both woody and herbaceous plants to thrive. In general, planted woody vegetation cover beneath the bridge overpass, is expected to decrease over time resulting in increased erosion and bank instability.

Table 4. Summary of performance criteria and reporting requirements, Ashley Creek stream mitigation site, 2019.

Type	Parameter	Performance Standard	Status	Site Meeting Performance Standards?
Quantitative Performance Criteria	Riparian Buffer Establishment	1a. 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 **66%** of the riparian areas have revegetated with non-noxious weed species.	**YES**
		1b. Montana State-listed noxious weeds do not exceed 10% cover	Vegetation surveys indicate **4%** cover of the project area by noxious weeds.	**YES**
	Vegetation Success	2a. 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 **70%**.	**YES**
		2b. Planted trees and shrubs must exhibit 50% survival after 5 years	Inspections indicated **72%** survival of woody plantings, based on planting plan	**YES**
	Vegetation along Stream Banks	3. Majority of plants on the stream bank must have root stability indices of at least 6	Dominant vegetation along 50% of both stream banks is reed canarygrass, with root stability index of 9, while the other 50% of both stream banks is dominated by bare ground with a root stability index of 1**.**	**NO**
	Stream Bank Stability Success	4. Less than 25% of bank length is unstable and classified as eroding bank.	Total eroding stream bank length is 312', or **36%** of the total bank length within the project reach.	**NO**
Qualitative Performance Criteria	Channel Form Success	5. 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 stream banks.	Channel form narrative included in Section 5.5 of 2015 Monitoring Report	**NO**

Riparian vegetation transects were established 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 the combined aerial cover for riparian and stream bank vegetation communities is 70%, which just meets the performance criteria goal of at least 70% cover. While the combined aerial cover is meeting the success criteria, low sunlight and lack of precipitation beneath the bridge overpass is limiting riparian vegetation growth and establishment. With the addition of a second bridge over Ashley Creek, 48% (220 of 460 feet) of the riparian transects are affected by partial or total shade.

An estimated total of 104 planted trees and shrubs were located within the project area. Of these, 94 were alive, although many observed with poor vigor. The planting plan sheet called for 130 planted trees and shrubs; therefore, 36 additional trees/shrubs were not located. If 100% of the planted trees/shrubs that were not located are assumed dead, the current survival rate is 72% (94 of 130 plants). The performance criteria requires >50% survival five years following construction. As compared to the planting plan for Ashley Creek, survival rates of woody vegetation installed within the project area are currently meeting the success criteria. While planted woody survival is currently meeting the success criteria, the majority of woody shrubs were installed beneath the bridges, which have permanently shaded the banks beneath them and likely hinder the ability of both woody and herbaceous plants to thrive. In general, planted woody vegetation cover beneath the bridge overpass, is expected to decrease over time resulting in increased erosion and bank instability.

5.3. Stream Bank Vegetation Composition

Reed canary grass comprised greater than 50% cover along the left stream bank and between 11 and 20% on the right. Bare ground, due to bank erosion and limited sunlight beneath the bridge overpass, accounted for greater than 50% of the right stream bank and between 11 and 20% on the left. Therefore, reed canary grass, with a root stability index of 9, dominated approximately half of the streambank vegetation, while the other half was dominated by bare ground, with a root stability index of 1. Based on the high amount of bare ground present within the project reach, the stream bank vegetation is not currently meeting the success criteria.

Placement of the 100-foot wide bridge over Ashley Creek and its adjacent riparian corridor has affected the ability of vegetation to successfully establish due to a lack of direct sunlight and precipitation. To help achieve the desired performance standards, MDT may wish to revegetate the sloped banks with more shade tolerant species.

5.4. Stream Bank Stability Success

The stream bank inventory identified two eroding stream banks, totaling 312 feet, or 36% of the total project bank length of 860 feet. Of this 312 feet, approximately 190 feet (61% of the erosion) is occurring beneath the bridge decks where vegetation establishment is limited by precipitation and sunlight and no functional floodplain exists.

Eroding banks EBR1 and EBR2 combined into one continuous eroding bank segment (EBR1-2) that has lengthened to 228 feet long. Erosion along EBL2 has lengthened to 84 feet, and can be attributed to construction of the additional bridge deck in 2016 causing a reduction in riparian vegetation establishment. Although inspection of the surveyed transects indicates the erosion rate is not particularly rapid along either of the eroding banks, lateral movement of the toe has resulted in a steep bank angle, upper bank sloughing, soils and vegetation collapsing into the channel. The toe of the south bank is partially protected by a clay lens; however the steep bank angle, lack of floodplain to dissipate energy during high flows, and poorly establishing vegetation along the stream banks will likely result in continued; albeit slow bank erosion. Success criteria for channel stability indicate less than 25% of the banks may exhibit erosion; which is currently not being met along Ashley Creek. MDT is planning to stabilize these eroding bank segments as part of a larger project on U.S. Highway 93 Bypass in either 2020 or 2021.

5.5. Channel Form Success

The development of pool and riffle habitat features within this segment of Ashley Creek is evident by inspecting the longitudinal profile and transects at pool and riffle features (Appendix B). Three pools have continued to exhibit deeper habitats within the reach, each of which are separated by a distinct riffle. Pool features occur along a sharp meander bend at the upstream extent of the project and within the straight segment of the channel. Pool depths are considerably deep (8-10 feet) and provide adequate, slow water habitat for fish. Maximum riffle depths average 3.0 feet, and continue to provide shallower habitat for insect production.

Bank erosion has been observed within the project reach along the straight segment of the channel upstream and beneath the Highway 93 Bridge. Erosion rates do not appear overly rapid, (<1 foot/year); however, the length of erosion observed has increased during each of the past five monitoring events. An eroding bank that was previously identified where a storm water culvert outlets to the channel has been repaired; however both the north and south banks shows continued signs of sloughing, particularly beneath the bridge where vegetation establishment is limited. A vertical grade control structure exists at the downstream extent of the project reach, immediately below the confluence of Spring Creek. This grade control will provide long term vertical stability of the altered segment of Ashley Creek.

Construction of the bypass highway over Ashley Creek included incorporating a bike path on both sides of the creek beneath the new bridge. These bike paths were built on embankments well above the floodplain to ensure their protection during high water events. While these embankments provide adequate elevation to protect the bike paths, they encroach against the channel and eliminate a functional floodplain along nearly all of the project reach. During high water events, Ashley Creek must pass through this confined reach, which contains fine grained stream banks graded to a relatively steep slope. As a result of these conditions, the lower slopes of the embankments are eroding and preventing establishment of stable vegetation communities. Erosion along the lower banks and sloughing of the upper banks is

expected to continue as the channel attempts to establish a functional floodplain. Additionally, low sunlight and lack of precipitation beneath the bridge overpass, which was enlarged in 2016, is limiting riparian vegetation establishment, thus influencing overall channel form success. Therefore, channel form along Ashley creek is not currently meeting the success criteria, and additional actions are likely warranted to prevent continued erosion.

6.0 LITERATURE CITED

Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. *Measuring and monitoring plant populations*. Bureau of Land Management (BLM) Technical Reference 1730-1. Washington, DC: U.S. Department of the Interior.

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

Montana Department of Agriculture. *Montana Noxious Weed List*. June 2019. Accessed October 2019 at: https://agr.mt.gov/Portals/168/Documents/Weeds/2019%20Montana%20Noxious%20Weed%20List.pdf?ver=2019-07-02-095540-487

RESPEC. 2014. Technical Memorandum provided to KLJ on 10/22/14. Subject: Kalispell Bypass – Ashley Creek Culvert

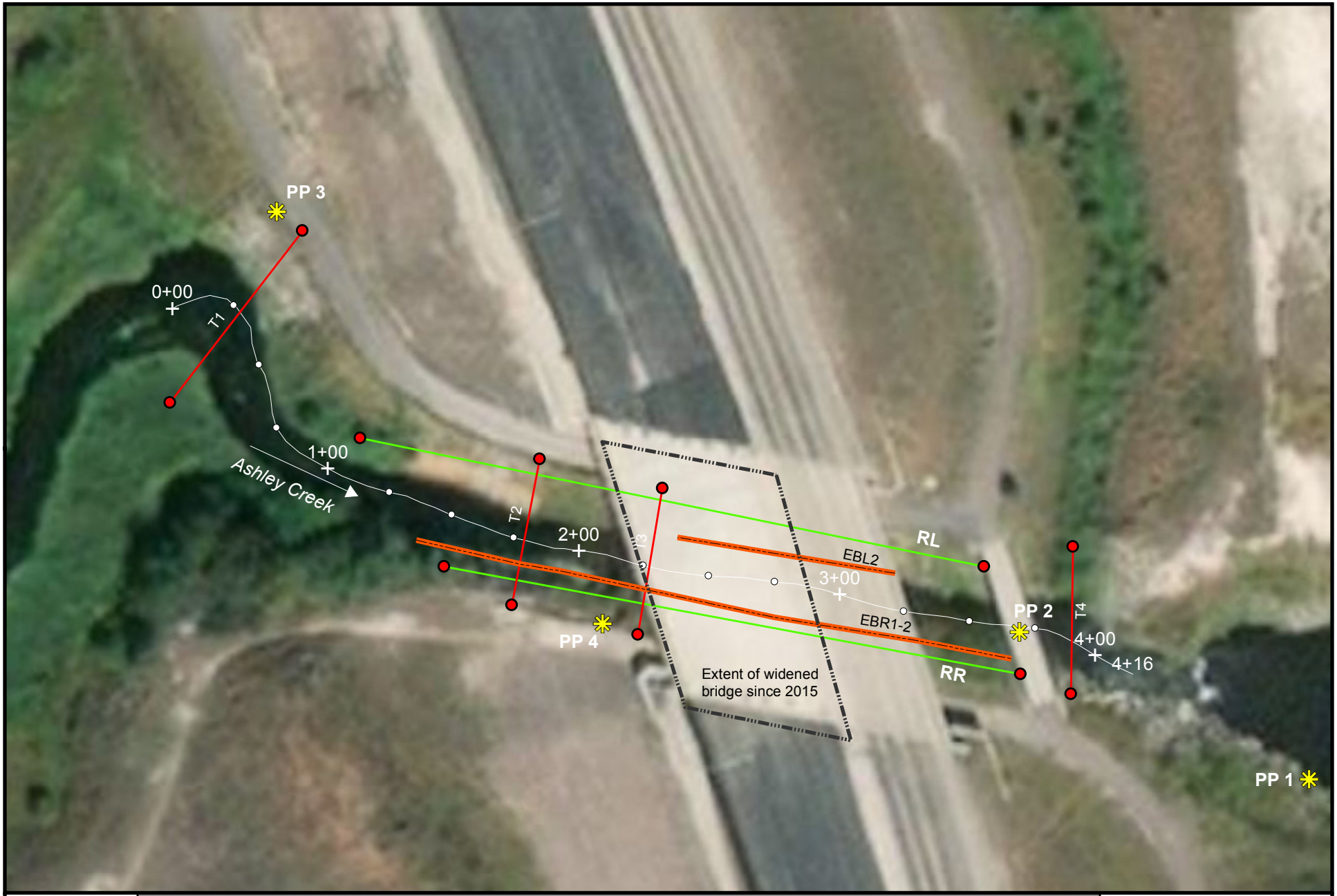
USDA, NRCS. 2019. *The PLANTS Database*. National Plant Data Team, Greensboro, NC 27401-4901 USA. Accessed October 2019 at: http//plants.usda.gov

Winward. 2000. Monitoring the Vegetation Resources in Riparian Areas. Gen. Tech. Report RMRS-GTR.47. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana



CONFLUENCE
consulting incorporated

Legend

- Photo Points
- Channel Thalweg
- Major Station (100')
- Minor Station (25')
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects

N

0 25 50 100 Feet

Ashley Creek - 2019 Monitoring Features

Figure 2

Date: 10/23/2019

Ashley_features2019.mxd

CONFLUENCE
consulting incorporated

Legend

Vegetation Community Boundary

Cirsium arvense

Convolvulus arvensis

Tanacetum vulgare

1 Phalaris Community

3 Phalaris/Elymus Community

4 Bare Ground/Elymus Community

5 Cornus/Alnus Community

Ashley Creek - 2019 Noxious Weeds and Vegetation Communities

Figure 3

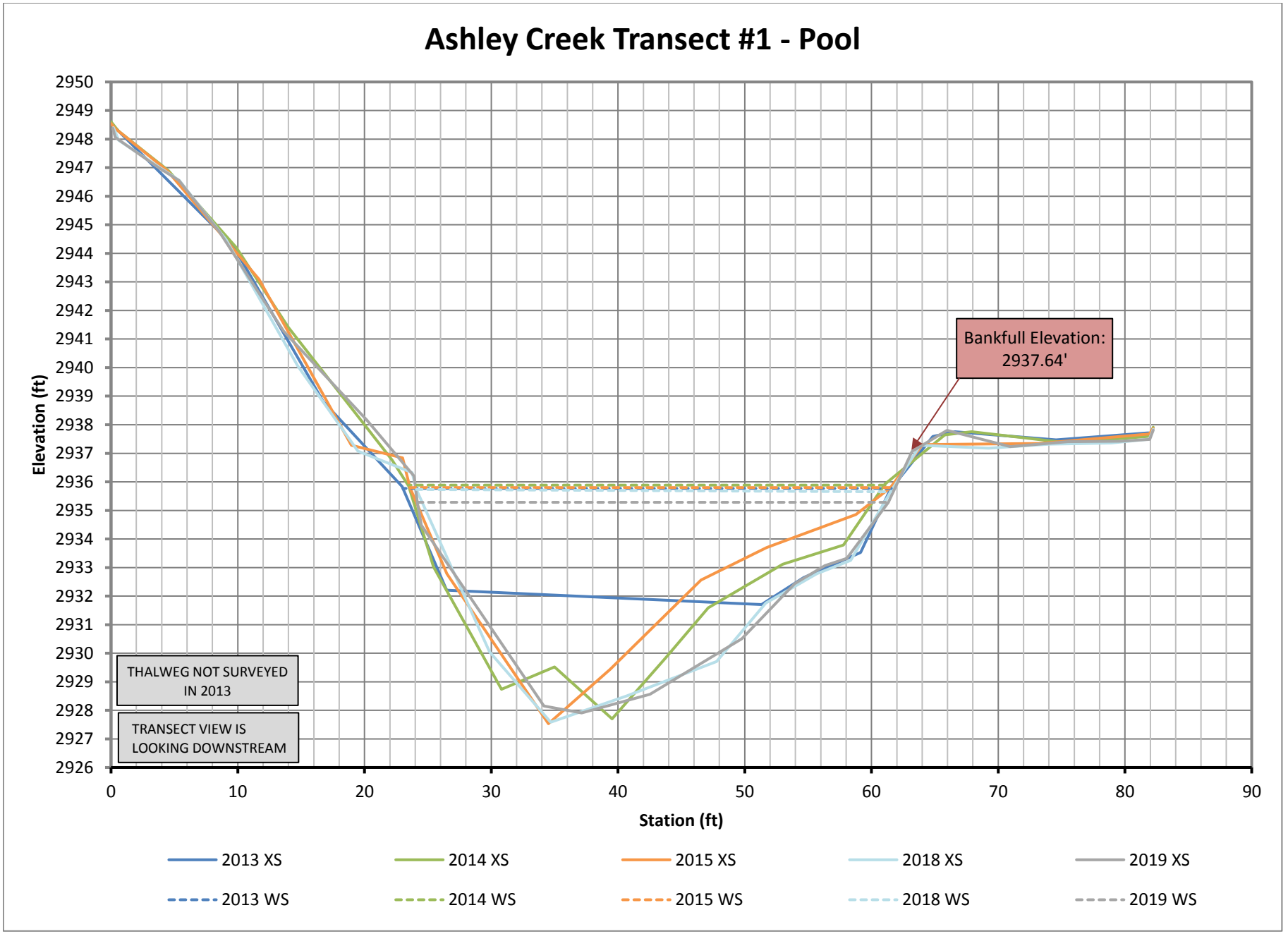
Date: 10/15/2019

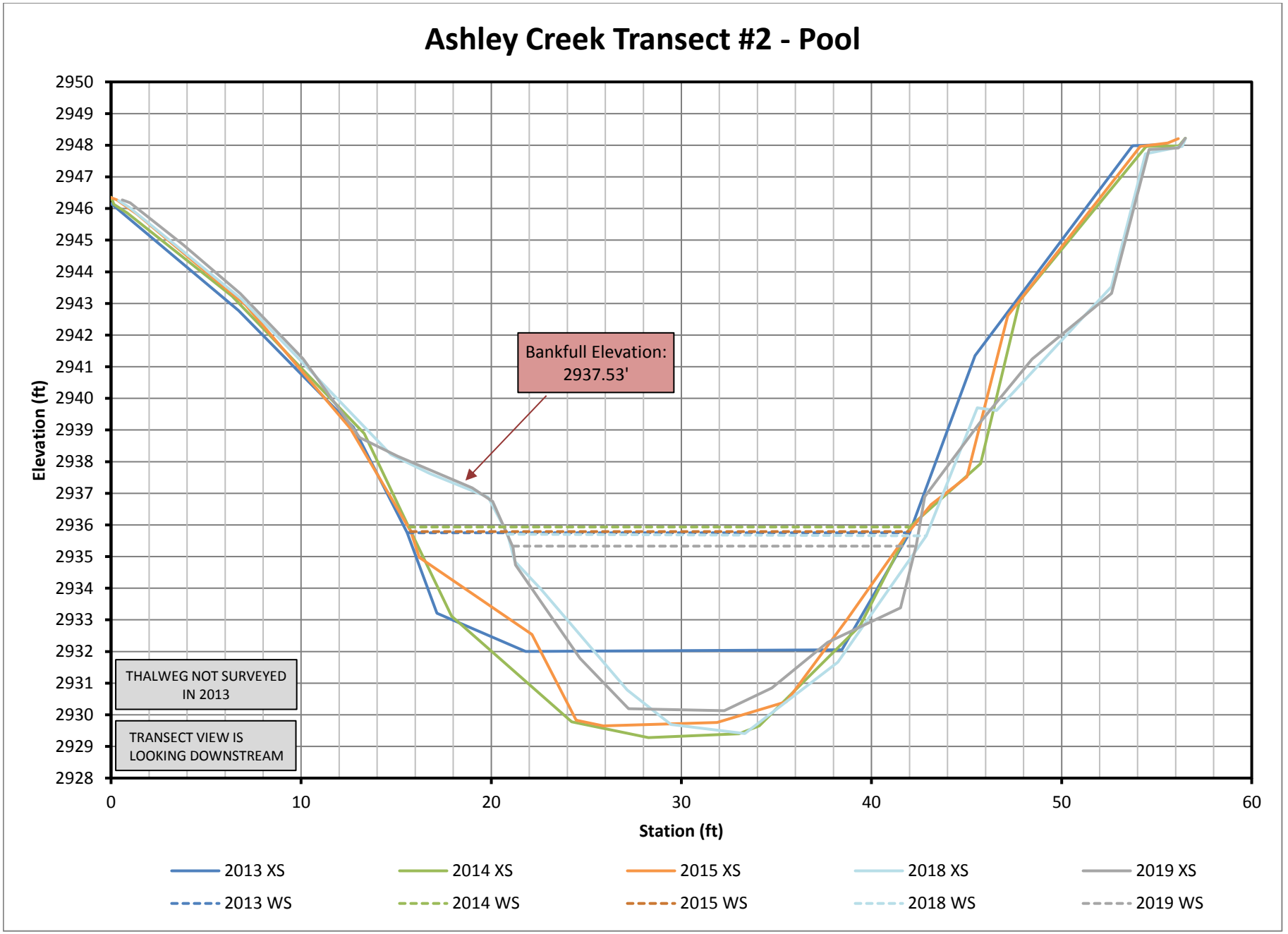
Ashley_monitor2019.mxd

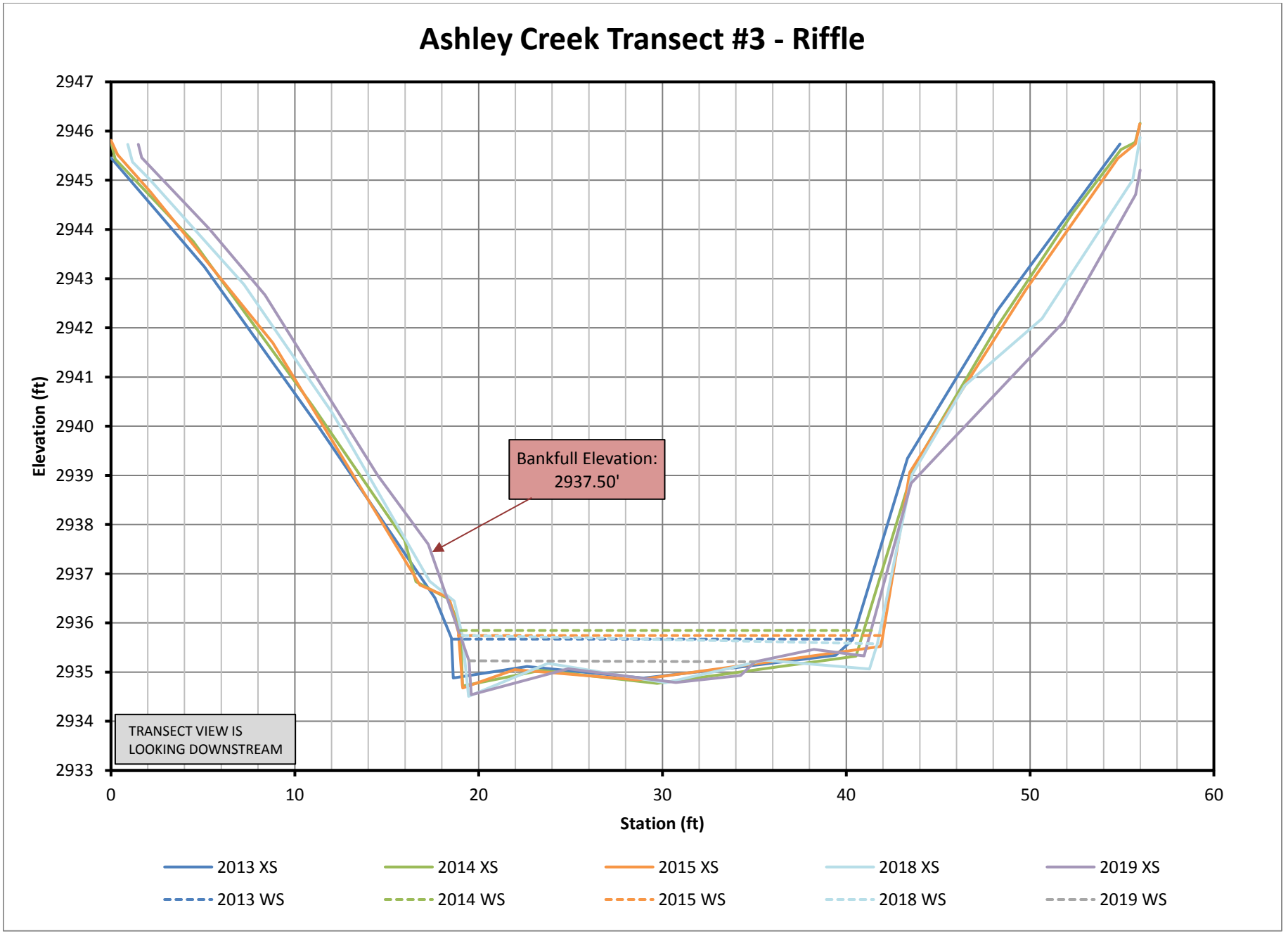
Appendix B

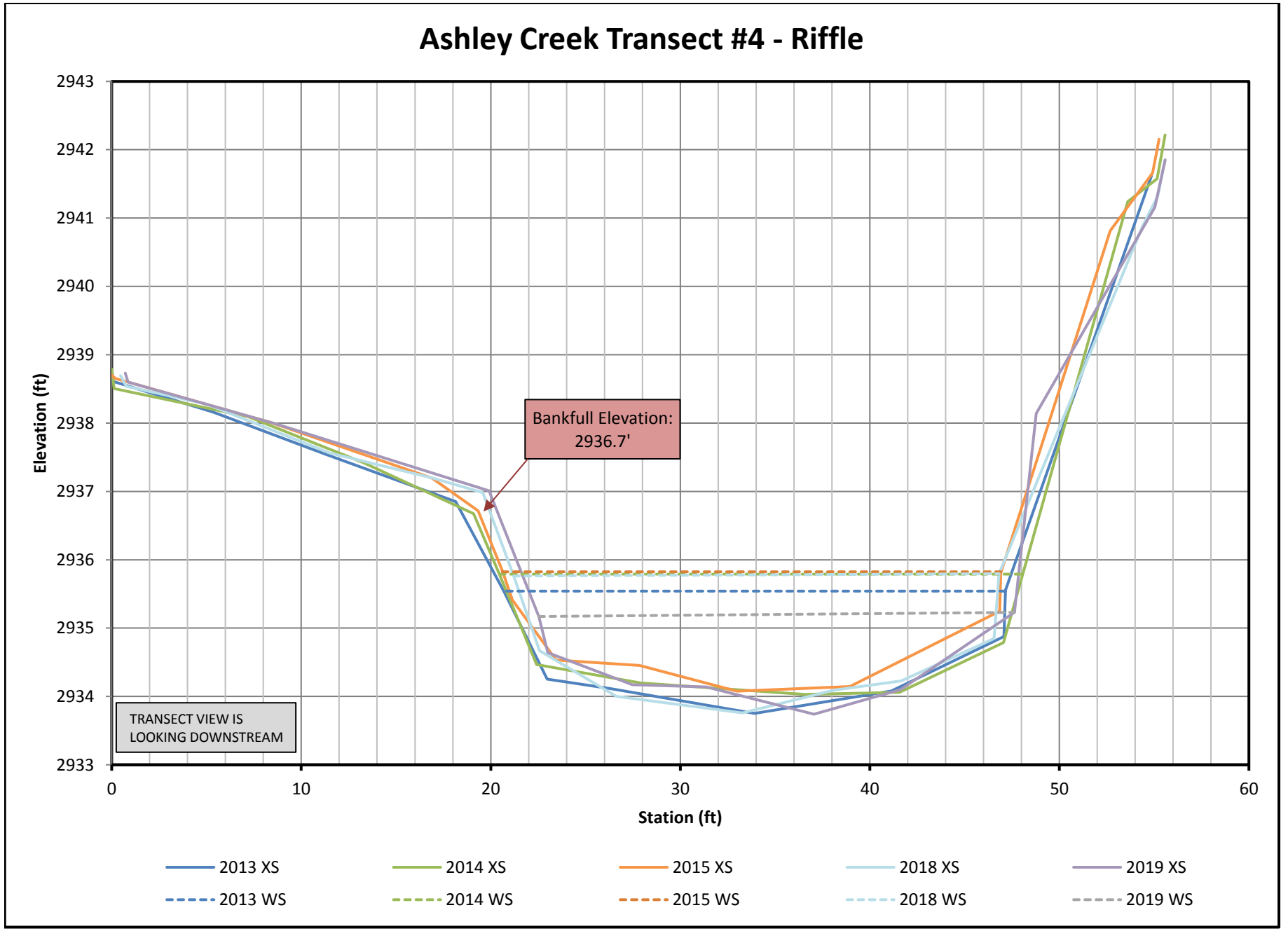
Perpendicular Transect Plots and Longitudinal Profile

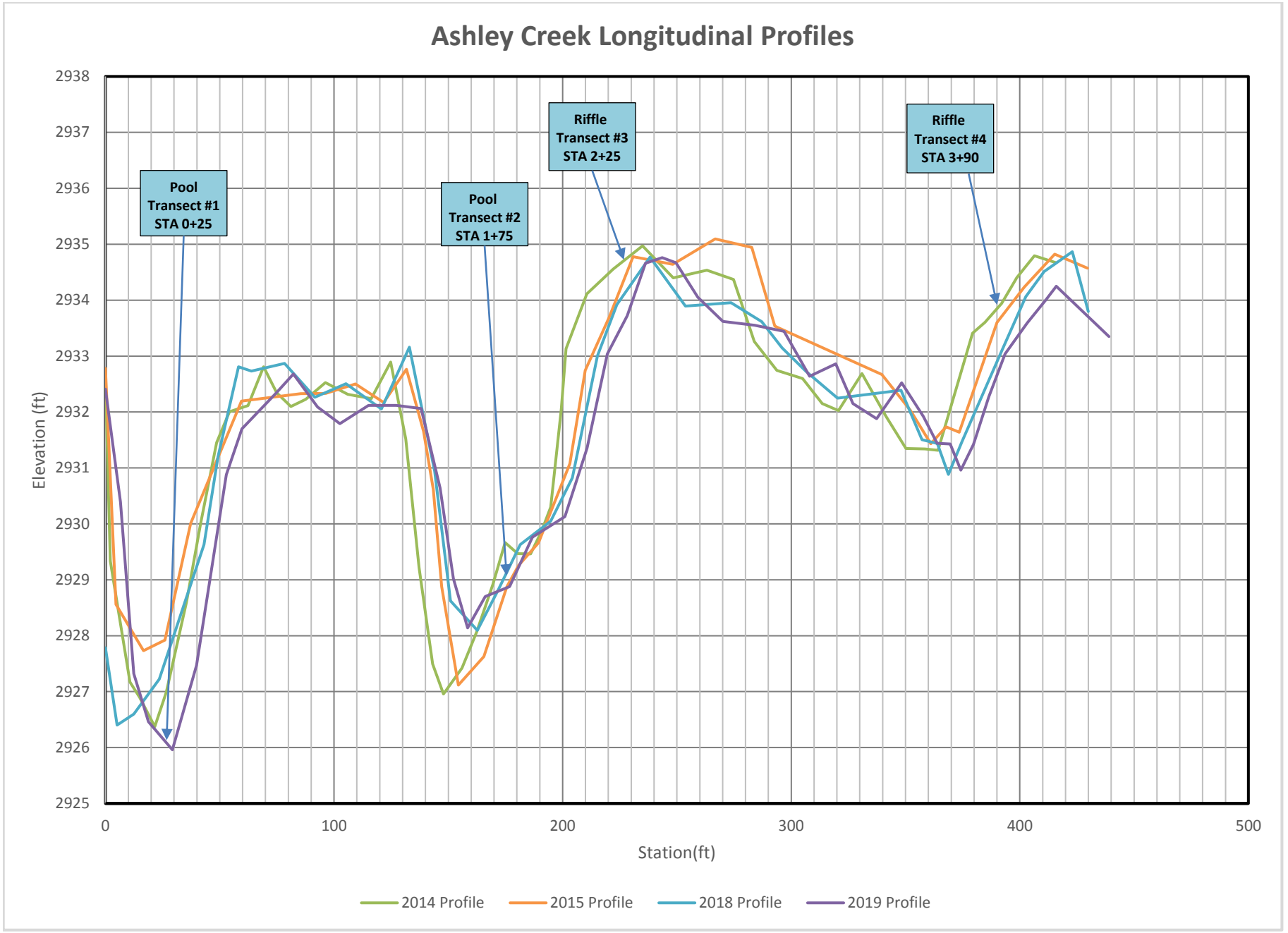
MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana


Ashley Creek Transect #1 - Pool
Elevation (ft)
2950
2949
2948
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
2932
2931
2930
2929
2928
2927
2926
0
10
20
30
40
50
60
70
80
90
Station (ft)
Bankfull Elevation: 2937.64'
THALWEG NOT SURVEYED IN 2013
TRANSECT VIEW IS LOOKING DOWNSTREAM
2013 XS
2014 XS
2015 XS
2018 XS
2019 XS
2013 WS
2014 WS
2015 WS
2018 WS
2019 WS


Ashley Creek Transect #2 - Pool
Elevation (ft)
2950
2949
2948
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
2932
2931
2930
2929
2928
Bankfull Elevation: 2937.53'
THALWEG NOT SURVEYED IN 2013
TRANSECT VIEW IS LOOKING DOWNSTREAM
0
10
20
30
40
50
60
Station (ft)
2013 XS
2014 XS
2015 XS
2018 XS
2019 XS
2013 WS
2014 WS
2015 WS
2018 WS
2019 WS


Ashley Creek Transect #3 - Riffle
Elevation (ft)
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
0
10
20
30
40
50
60
Station (ft)
Bankfull Elevation: 2937.50'
TRANSECT VIEW IS LOOKING DOWNSTREAM
2013 XS
2014 XS
2015 XS
2018 XS
2019 XS
2013 WS
2014 WS
2015 WS
2018 WS
2019 WS


Ashley Creek Transect #4 - Riffle
Elevation (ft)
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
Bankfull Elevation:
2936.7'
TRANSECT VIEW IS
LOOKING DOWNSTREAM
0
10
20
30
40
50
60
Station (ft)
2013 XS
2014 XS
2015 XS
2018 XS
2019 XS
2013 WS
2014 WS
2015 WS
2018 WS
2019 WS


Ashley Creek Longitudinal Profiles
Pool Transect #1 STA 0+25
Pool Transect #2 STA 1+75
Riffle Transect #3 STA 2+25
Riffle Transect #4 STA 3+90
Elevation (ft)
2938
2937
2936
2935
2934
2933
2932
2931
2930
2929
2928
2927
2926
2925
0
100
200
300
400
500
Station(ft)
2014 Profile
2015 Profile
2018 Profile
2019 Profile

Appendix C

Project Area Photos

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2019 Monitoring Events

CONFLUENCE

2013 **2019**

Photo Point 1: View of grade control structure downstream of project area. **Compass:** 315 (Northwest)

2013 **2019**

Photo Point 2: View looking upstream from pedestrian bridge. **Compass:** 315 (Northwest)

2013 **2019**

Photo 3.1: View looking south at upstream end of project site. **Compass:** 180 (South)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2019 Monitoring Events

CONFLUENCE

2013 **2019**

Photo 3.2: View looking at upstream end of project site. **Compass:** 225 (Southwest)

2013 **2019**

Photo 4.1: View looking downstream from south bank. Compass 90 (East)

2013 **2019**

Photo 4.2: View of channel looking upstream from south bank. Compass 315 (Northwest)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2019 Monitoring Events

CONFLUENCE

2013 **2019**

Additional Photo 1: View of Ashley/Spring Creek confluence.

2013 **2019**

Additional Photo 2: Upper end of Eroding Bank EBR1 –2

2013 **2019**

Additional Photo 3: Middle of Eroding Bank EBR1-2.

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2019 Monitoring Events

CONFLUENCE

2018 **2019**

Additional Photo 4: Middle of Eroding Bank EBR1-2.

2013 **2019**

Additional Photo 5: Downstream end of eroding Bank EBR 1-2.

2014 **2019**

Additional Photo 6: Stabilized culvert outlet.

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2019 Monitoring Events

CONFLUENCE

2013

2019

Additional Photo 7: Eroding Bank EBL2

2019

Additional Photo 8: Toe of eroding bank EBR1-2 showing bank sloughing.

2019

Additional Photo 9: Toe of eroding bank EBR1-2 showing loss of woody vegetation.

PROJECT NAME: 2019 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 09-04-19

T1 Left: Looking Southwest to T1 Right

T1 Right: Looking Northeast to T1 Left

T1 Left: Looking Southwest upstream

T1 Left: Looking Southeast downstream

T1 Right: Looking North upstream

T1 Right: Looking East downstream

T2 Left: Looking South to T2 Right

T2 Right: Looking North to T2 Left

T2 Left: Looking West upstream

T2 Left: Looking East downstream

T2: Looking West from creek

T2: Looking East from creek

T2 Right: Looking North upstream

T2 Right: Looking East downstream

T3 Left: Looking Southwest to T3 Right

T3 Right: Looking Northeast to T3 Left

T3 Left: Looking West upstream

T3 Left: Looking East downstream

PROJECT NAME: 2019 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 09-04-19

T3: Looking West from creek

T3: Looking East from creek

PROJECT NAME: 2019 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 09-04-19

T3 Right: Looking West upstream

T3 Right: Looking East downstream

T4 Left: Looking South to T4 Right

T4 Right: Looking North to T4 Left

PROJECT NAME: 2019 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 09-04-19

T4 Left: Looking West upstream

T4 Left: Looking East downstream

T4: Looking West from creek

T4: Looking East from creek

PROJECT NAME: 2019 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 09-04-19

T4 Right: Looking West upstream

T4 Right: Looking East downstream

Appendix D

Comprehensive Plant Species List

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

Comprehensive plant species list for the Ashley Creek stream mitigation site from 2013 through 2015, and 2018 through 2019.

Scientific Name	Common Name	WMVC Indicator Status*
Agropyron sp.	Wheatgrass	N/A
Agrostis gigantea	Black Bent	FAC
Agrostis stolonifera	Spreading Bent	FAC
Alnus incana	Speckled Alder	FACW
Alopecurus pratensis	Field Meadow-Foxtail	FAC
Amelanchier alnifolia	Saskatoon Service-Berry	FACU
Artemisia absinthium	Absinthium	UPL
Artemisia biennis	Biennial Wormwood	FACW
Asperugo procumbens	**German-Madwort**	**UPL**
Avena fatua	Wild Oats	UPL
Bassia scoparia	Mexican-Fireweed	FAC
Beckmannia syzigachne	**American Slough Grass**	**OBL**
Betula pumila	Bog Birch	OBL
Bromus carinatus	California Brome	UPL
Bromus inermis	Smooth Brome	UPL
Bromus tectorum	Cheatgrass	UPL
Carex stipata	Stalk-Grain Sedge	OBL
Centaurea stoebe	Spotted Knapweed	UPL
Chenopodium album	Lamb's-Quarters	FACU
Cirsium arvense	Canadian Thistle	FAC
Cirsium vulgare	Bull Thistle	FACU
Convolvulus arvensis	Field Bindweed	UPL
Cornus alba	Red Osier	FACW
Cynoglossum officinale	Gypsy-Flower	FACU
Descurainia sophia	Herb Sophia	UPL
Elodea canadensis	Canadian Waterweed	OBL
Elymus canadensis	Nodding Wild Rye	FAC
Elymus hispidus	Intermediate Wheatgrass	UPL
Elymus repens	Creeping Wild Rye	FAC
Elymus trachycaulus	Slender Wild Rye	FAC
Epilobium brachycarpum	**Panicled Willowherb**	**UPL**
Epilobium ciliatum	Fringed Willowherb	FACW
Equisetum arvense	Field Horsetail	FAC
Equisetum hyemale	Tall Scouring-Rush	FACW
Festuca idahoensis	Bluebunch Fescue	FACU
Galium aparine	Sticky-Willy	FACU
Glyceria grandis	**American Manna Grass**	**OBL**
Helianthus maximiliani	Maximilian Sunflower	UPL
Helianthus nuttallii	Nuttall's Sunflower	FACW
Lactuca serriola	Prickly Lettuce	FACU
Lepidium perfoliatum	Clasping Pepperwort	FACU
Lupinus argenteus	Silvery Lupine	UPL
Lupinus lepidus	Stemless-dwarf Lupine	UPL
Lupinus sp.	Lupine	N/A
Malva neglecta	Dwarf Cheeseweed	UPL
Medicago lupulina	Black Medick	FACU
Medicago sativa	Alfalfa	UPL
Melilotus albus	White Sweetclover	UPL
Melilotus officinalis	Yellow Sweet-Clover	FACU
Mentha arvensis	**American Wild Mint**	**FACW**
Onopordum acanthium	Scotch Thistle	UPL
Pascopyrum smithii	Western-Wheat Grass	FACU
Peritoma serrulata	Rocky Mountain Beeplant	FACU
Phalaris arundinacea	Reed Canary Grass	FACW
Plantago major	Great Plantain	FAC
Poa palustris	Fowl Blue Grass	FAC
Poa pratensis	Kentucky Blue Grass	FAC
Populus angustifolia	Narrow-Leaf Cottonwood	FACW
Populus balsamifera	Balsam Poplar	FAC
Potamogeton richardsonii	Red-Head Pondweed	OBL
Potentilla anserina	**Silverweed**	**OBL**
Prunus virginiana	Choke Cherry	FACU
Rosa woodsii	Woods' Rose	FACU
Rumex acetosa	Garden Sorrel	FAC
Rumex crispus	Curly Dock	FAC
Salix bebbiana	Gray Willow	FACW
Salix drummondiana	Drummond's Willow	FACW
Salix exigua	Narrow-Leaf Willow	FACW
Salix lasiandra	Pacific Willow	FACW
Scirpus microcarpus	Red-Tinge Bulrush	OBL
Silene latifolia	Bladder Campion	UPL
Silene repens	Creeping Catchfly	UPL
Silene vulgaris	Maiden's-tears	UPL
Sinapis arvensis	Corn Mustard	UPL
Sisymbrium altissimum	Tall Hedge-Mustard	FACU
Solanum dulcamara	Climbing Nightshade	FAC
Solidago canadensis	Canadian Goldenrod	FACU
Sonchus arvensis	Field Sow-Thistle	FACU
Symphoricarpos albus	Common Snowberry	FACU
Symphoricarpos occidentalis	Western Snowberry	FAC
Symphyotrichum ascendens	Western American-Aster	FACU
Symphyotrichum laeve	Smooth Blue American-Aster	FACU
Tanacetum vulgare	Common Tansy	FACU
Taraxacum officinale	Common Dandelion	FACU
Thlaspi arvense	Field Pennycress	UPL
Tragopogon dubius	Meadow Goat's-Beard	UPL
Trifolium repens	**White Clover**	**FAC**
Verbascum thapsus	Great Mullein	FACU
Vicia americana	American Purple Vetch	FAC

*2016 National Wetland Plant List; *Western Mountains, Valleys, and Coasts* (WMVC) (Lichvar *et al.* 2016)
New species identified in 2019 are **bolded**.
Species identified to genus level have been assigned an indicator status of N/A.

Appendix E

2019 Stream Bank Plant Species List

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

Plant species and their associated cover classes along the stream banks of the Ashley Creek stream mitigation site in 2019.

Streambank Species	Left Bank	Left Bank Cover Class	Right Bank	Right Bank Cover Class	WMVC Indicator Status*
Agrostis stolonifera	X	0	X	0	FAC
Alnus incana	X	0	X	0	FACW
Bassica scoparia	X	0			FAC
Beckmannia syzigachne	X	0			OBL
Bromus inermis	X	1	X	2	UPL
Carex stipata	X	0			OBL
Cornus alba	X	0	X	1	FACW
Elymus repens	X	1	X	2	FAC
Epilobium brachycarpum			X	0	UPL
Epilobium ciliatum	X	0			FACW
Equisetum arvense	X	1	X	1	FAC
Glyceria grandis	X	0			OBL
Helianthus maximiliani	X	0			UPL
Lactuca serriola	X	0	X	0	FACU
Medicago lupulina	X	0			FACU
Melilotus officinalis	X	0			FACU
Mentha arvensis	X	0			FACW
*Phalaris arundinacea***	X	5	X	3	FACW
Potentilla anserina			X	0	OBL
Salix bebbiana	X	0			FACW
Salix drummondiana	X	0			FACW
Sonchus arvensis	X	1			FACU
Tanacetum vulgare	X	0	X	0	FACU
Thlaspi arvense			X	0	UPL

*2016 National Wetland Plant List; *Western Mountains, Valleys, and Coasts* (WMVC) (Lichvar *et al.* 2016)
** *Dominant species observed along Ashley Creek stream banks*
Classification Values and Percent Cover Classes: 0 = <1%, 1 = 1-5%, 2 = 6-10%, 3 = 11-20%, 4 = 21-50%, 5 = >50%

Appendix F

2019 Noxious Weed Species List

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

Montana State listed noxious weed and regulated species observed in 2019 at the Ashley Creek Stream Mitigation Site.

Category*	Scientific Name	Common Name
Priority 2B	*Centaurea stoebe*	Spotted Knapweed
	Cirsium arvense	Canadian Thistle
	Convolvulus arvensis	Field Bindweed
	Cynoglossum officinale	Houndstongue
	Tanacetum vulgare	Common Tansy
Priority 3 State Regulated	*Bromus tectorum*	Cheatgrass

*Based on the Montana Department of Agriculture's Noxious Weed List, June 2019.

Appendix G

Comprehensive Wildlife Species List

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

Comprehensive list of wildlife species observed at Ashley Creek.

Common Name	Scientific Name
Birds	
American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Black-billed Magpie	*Pica hudsonia*
Black-capped chickadee	*Poecile atricapillus*
Canada Goose	*Branta canadensis*
Common Raven	*Corvus corax*
Mallard	*Anas platyrhynchos*
Red-winged Blackbird	*Agelaius phoeniceus*
Sparrow sp.	*Passer* sp.
Swallow sp.	*Tachycineta* sp.
Mammals	
Beaver (chew)	***Castor canadensis***
Raccoon (tracks)	*Procyon lotor*
White-tailed Deer (tracks)	*Odocoileus virginianus*

New species identified in 2019 are **bolded**.

Appendix H

Channel Construction Details

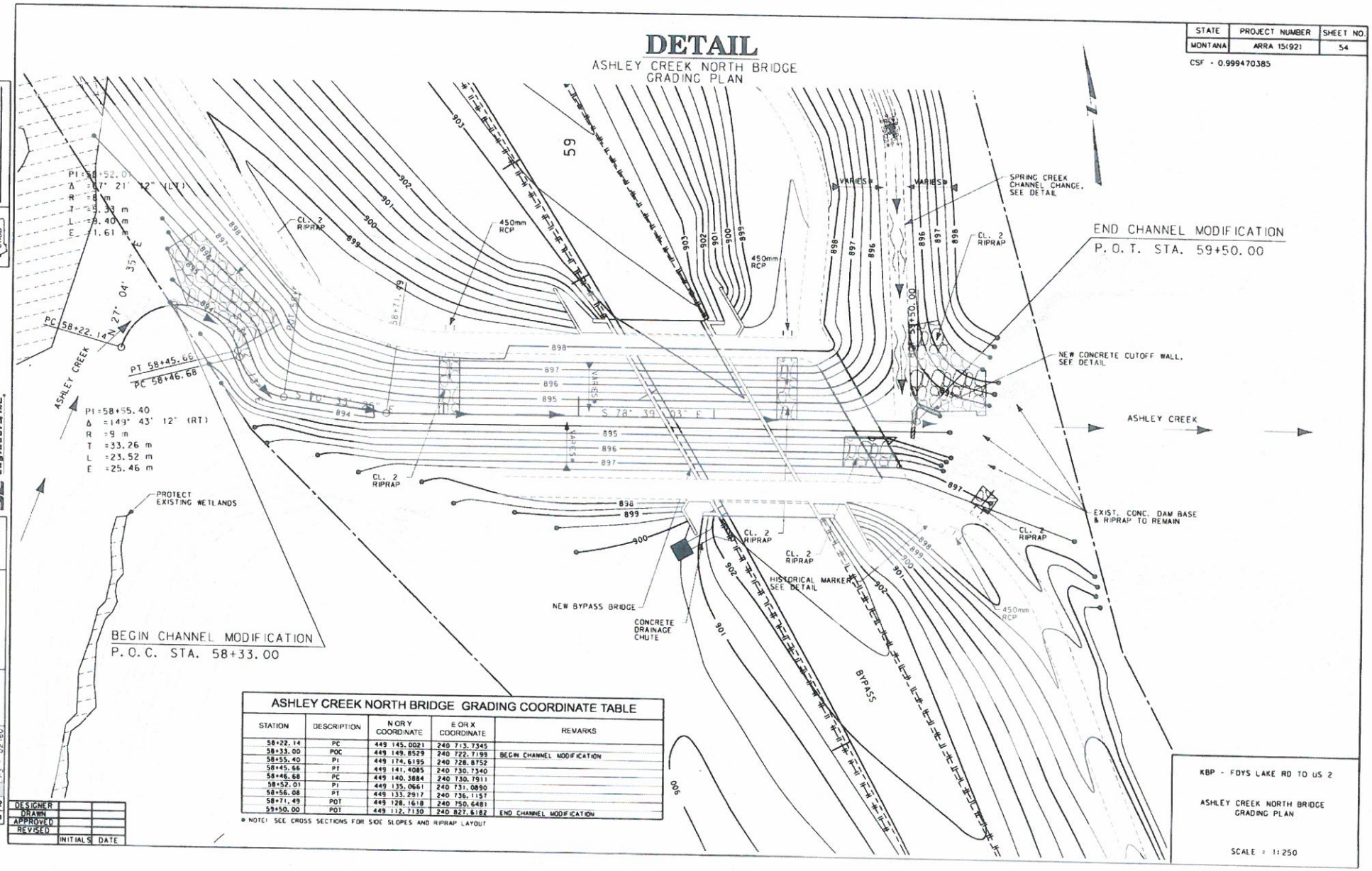
MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

DETAIL

ASHLEY CREEK NORTH BRIDGE
GRADING PLAN

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	54

CSF - 0.999470385



ASHLEY CREEK NORTH BRIDGE GRADING COORDINATE TABLE

STATION	DESCRIPTION	N OR Y COORDINATE	E OR X COORDINATE	REMARKS
58+22.14	PC	449 145.0021	240 713.7345	
58+33.00	POC	449 149.8529	240 722.7199	BEGIN CHANNEL MODIFICATION
58+55.40	PI	449 174.6195	240 728.8752	
58+45.66	PT	449 141.4085	240 730.7340	
58+46.68	PC	449 140.3884	240 730.7911	
58+52.01	PI	449 135.0661	240 731.0890	
58+56.08	PT	449 133.2917	240 736.1157	
58+71.49	POT	449 128.1618	240 750.6481	
59+50.00	POT	449 112.7130	240 827.6182	END CHANNEL MODIFICATION

* NOTE! SEE CROSS SECTIONS FOR SIDE SLOPES AND RIPRAP LAYOUT

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH BRIDGE
GRADING PLAN

SCALE = 1:250

	INITIALS	DATE
DESIGNER		
DRAWN		
APPROVED		
REVISED		

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stallings Engineers, Inc.

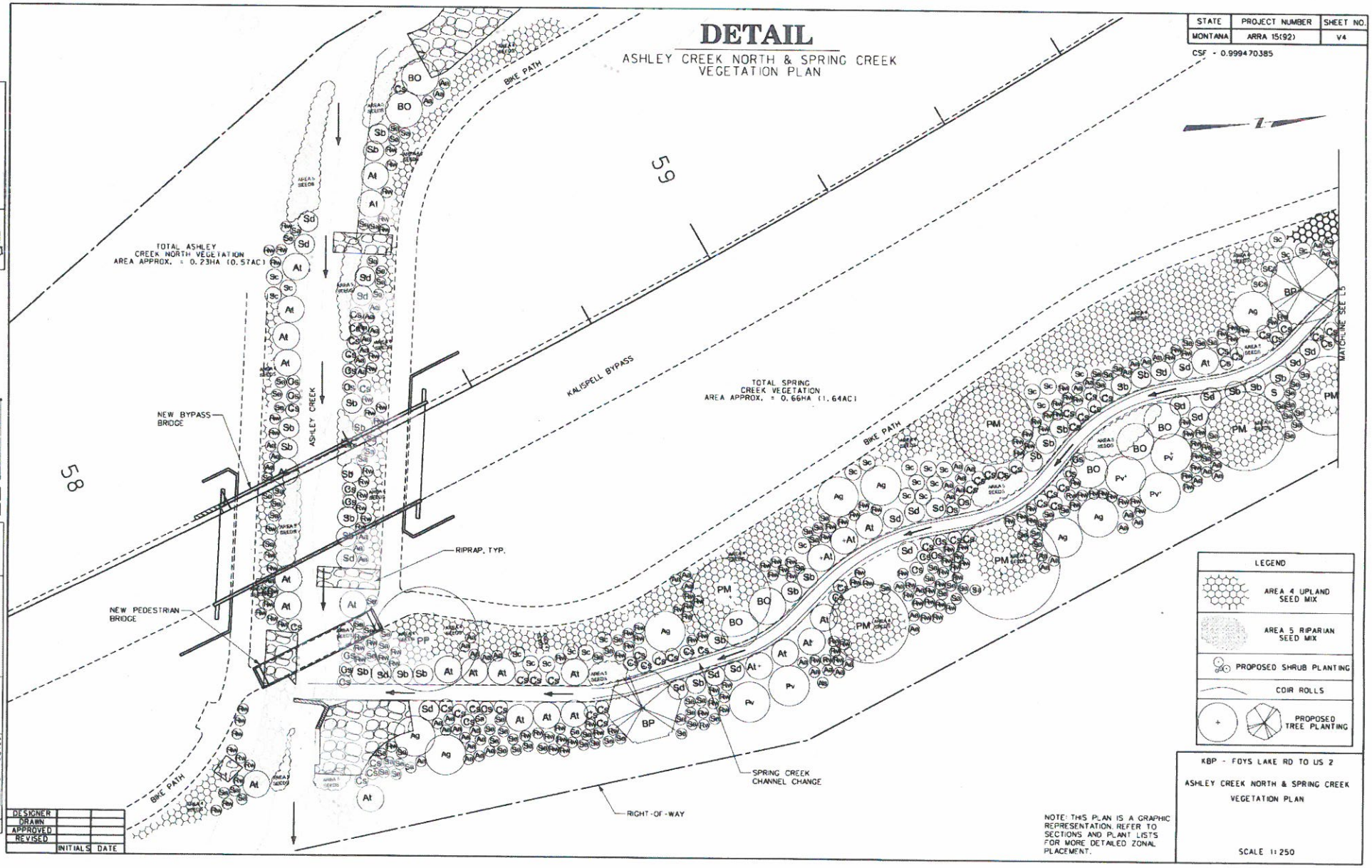
S:\dgn\20180\0dgns\54.DGN CHECKED BY
10/6/2009 11:16:22 AM REVIEWED BY
CHECKED BY
NO. DATE

DETAIL

ASHLEY CREEK NORTH & SPRING CREEK
VEGETATION PLAN

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V4

CSF - 0.999470385



LEGEND

- AREA 4 UPLAND SEED MIX
- AREA 5 RIPARIAN SEED MIX
- PROPOSED SHRUB PLANTING
- COIR ROLLS
- PROPOSED TREE PLANTING

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

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION PLAN

SCALE 1:250

	INITIALS	DATE
DESIGNER		
DRAWN		
APPROVED		
REVISED		

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stalling Engineers, INC.

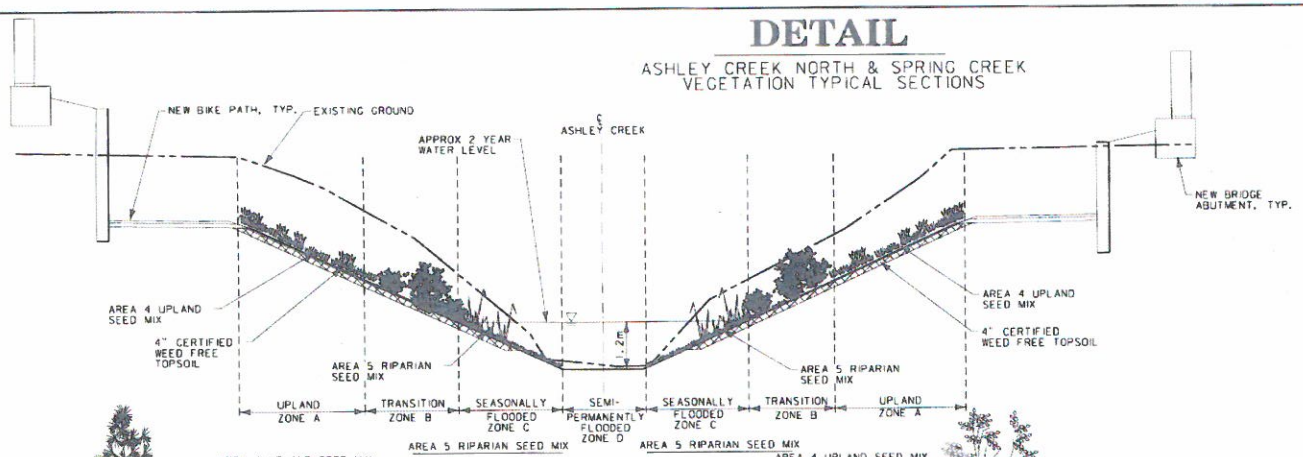
DETAIL

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION TYPICAL SECTIONS

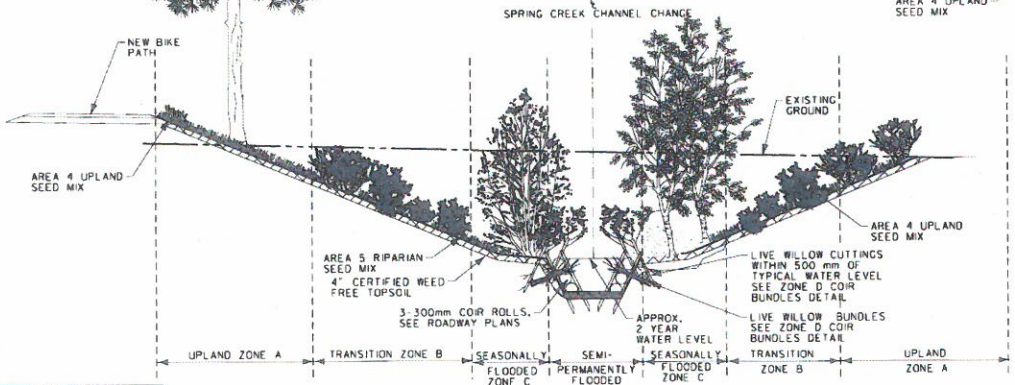
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V3

CSF = 0.999470385

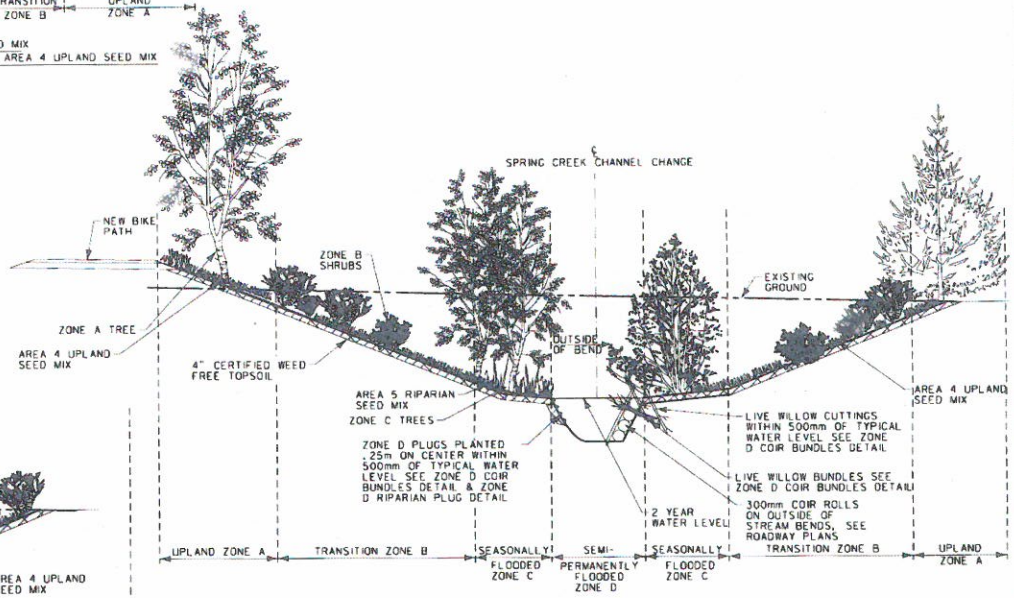
NOTES: 1. SEE ROADWAY PLANS FOR CHANNEL CONSTRUCTION DETAILS.
2. TYPICAL SECTIONS ARE GENERAL CONCEPTUAL DESIGN. FOR INFORMATION ONLY



ASHLEY CREEK NORTH BRIDGE TYPICAL SECTION
SCALE: NOT TO SCALE



SPRING CREEK CHANNEL CHANGE RIFFLE TYPICAL SECTION
SCALE: NOT TO SCALE



SPRING CREEK CHANNEL CHANGE POOL TYPICAL SECTION
SCALE: NOT TO SCALE

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION TYPICAL SECTIONS

NO SCALE

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stalling Engineering, Inc.

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V2

CSF = 0.999470385

DETAIL

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION SUMMARY & DETAILS

CHANNEL PLANTING SEQUENCE

1. PLACE COIR ROLL AS PER COIR ROLLS DETAIL IN ROADWAY PLANS AND SPECIAL PROVISIONS.
2. INSTALL PLANTS BETWEEN THE DATES OF OCTOBER 1 AND NOVEMBER 15 OR APRIL 30 AND JUNE 1 PROVIDED THE GROUND IS NOT FROZEN.
3. PLANT RIPARIAN PLUGS AS PER PLANTING DETAIL. INSTALL CUTTINGS BETWEEN APRIL 15 AND MAY 1.
4. PLANT WILLOW CUTTINGS AND BUNDLES AS PER PLANTING DETAIL.
5. INSTALL JUTE NETTING ON SLOPES GREATER THAN 3:1 AS PER SPECIAL PROVISIONS.
6. SEED UPLAND AREA 4 AND RIPARIAN AREA 5 AS PER SEEDING SPECIAL PROVISIONS.
7. PLANT TREES AND SHRUBS AS PER PLANTING DETAILS.
8. APPLY WEED FREE ORGANIC COMPOST MULCH AS PER SPECIAL PROVISIONS.

ASHLEY CREEK NORTH & SPRING CREEK CHANNEL CHANGE PLANT LIST *

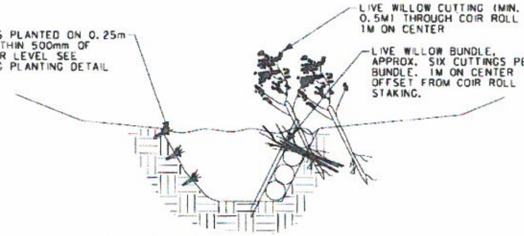
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
ZONE A UPLAND				
TREES				
BP	BETULA PAPYRIFERA	PAPER BIRCH	4	10' B&B
PP	PINUS PONDEROSA	PONDEROSA PINE	3	7' B&B
PM	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	8	6' B&B
ZONE B TRANSITIONAL				
SHRUBS				
Ao	AMELANCHIER ALNIFOLIA	SASKATOON SERVICEBERRY	108	1 GAL.
Pv	PRUNUS VIRGINIANA	COMMON CHOKECHERRY	8	5 GAL.
Rw	ROSA WOODSII	WOODS ROSE	243	1 GAL.
Sc	SHEPHERDIA CANADENSIS	CANADA BUFFALOBERRY	41	1 GAL.
Sa	SYMPHORICARPOS ALBUS	SNOWBERRY	156	1 GAL.
ZONE C SEASONALLY FLOODED				
TREES				
BO	BETULA OCCIDENTALIS	WATER BIRCH	11	15 GAL.
SHRUBS				
At	ALNUS INCANA SSP. TENUIFOLIA	THIN-LEAF ALDER	43	5 GAL.
Cs	CORNUS STOLONIFERA/SERICEA	RED-OSIER DOGWOOD	102	1 GAL.
Sb	SALIX BEBBIANA	BEBB WILLOW	38	5 GAL.
Sd	SALIX DRUMMONDIANA	DRUMMOND WILLOW	33	5 GAL.
ZONE D SEMI-PERMANENTLY FLOODED				
COIR ROLL STAKING (SPACE @ 1m ON CENTER)				
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	500	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	500	CUTTINGS
COIR ROLL LAYERING (SPACE 6 CUTTINGS PER BUNDLE @ 1m ON CENTER)				
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	1500	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	1500	CUTTINGS
STREAMBANK PLUGS				
	CAREX NEBRASCENSIS	NEBRASKA SEDGE	288	PLUGS
	CAREX UTRICULATA	BEAKED SEDGE	403	PLUGS
	CAREX VESICARIA	INFLATED SEDGE	288	PLUGS
	GLYCERIA ELATA (STRIATA)	FOWL MANNAGRASS	173	PLUGS

* FOR INFORMATION ONLY. INCLUDE ALL COSTS AND INCIDENTAL ITEMS ASSOCIATED WITH THE INSTALLATION OF THIS ITEM IN THE LUMP SUM BID PRICE FOR "VEGETATION".

JUTE NETTING *

STATION FROM	STATION TO	square meters
58+19.58	61+31.96	6372
TOTAL		6372

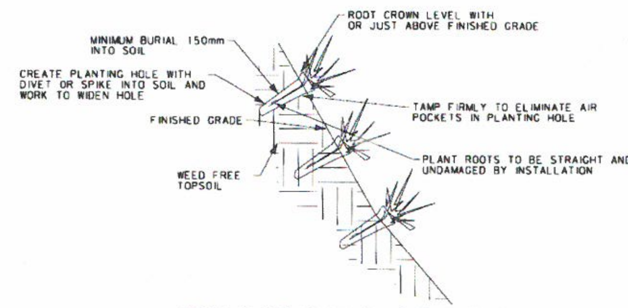
* FOR INFORMATION ONLY. INCLUDE ALL COSTS AND INCIDENTAL ITEMS ASSOCIATED WITH THE INSTALLATION OF THIS ITEM IN THE LUMP SUM BID PRICE FOR "VEGETATION".



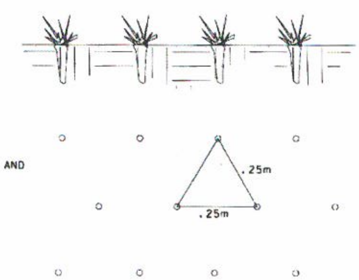
ZONE D COIR BUNDLES WITH WILLOW CUTTINGS AND LAYERING
SCALE: NOT TO SCALE

HARVESTING AND INSTALLATION NOTE:

1. HARVEST AND PLANT CUTTINGS DURING DORMANT SEASON.
2. USE HEALTHY STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE CUTTINGS OR SPLIT ENDS DURING INSTALLATTION.
4. BRIEFLY SOAK CUTTINGS IN WATER AND ROOTING HORMONE PRIOR TO INSTALLATION.
5. FOR LAYERING, BUNDLE 6 CUTTINGS TOGETHER AND BIND WITH BIODEGRADABLE JUTE STRING.
6. INSTALL WILLOW CUTTING AND WILLOW BUNDLE LAYERING DURING BANK GRADING AND COIR PLACEMENT.
7. WILLOW CUTTING AND WILLOW BUNDLES SHALL EXTEND INTO EXPECTED MOISTURE SOIL ZONES.
8. IF NECESSARY, CUT SMALL HOLES IN COIR ROLLS AND INSERT LIVE WILLOW CUTTING.
9. INSERT BUNDLES INTO SOIL BETWEEN COIR ROLLS.



ZONE D RIPARIAN PLUG PLANTING
FOR INSIDE BEND OF SPRING CREEK POOLS
SCALE: NOT TO SCALE



SPACING

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stelling Engineers, Inc.

	DESIGNER		
2	DRAWN		
1	APPROVED		
	REVISED		
		INITIALS	DATE

10/6/2009 11:22:02 AM DESIGNED BY REVIEWED BY CHECKED BY CPS - U2160

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION SUMMARY & DETAILS

NO SCALE