Montana Department of Transportation Stream Mitigation Monitoring Report

MILL CREEK MITIGATION SITE

Project Overview

Watershed: Watershed 3# - Lower Clark Fork

Monitoring Year: 2020

Years Monitored: 8th year of monitoring

Corps Permit Number: NWO-1997-90821-MTH

Monitoring Conducted By: Confluence Consulting Inc.

Monitoring Dates: July 29, 2020

Purpose of the approved project:

As part of the construction of the Bear Creek Road-South segment of U.S. Highway 93, the Montana Department of Transportation (MDT) relocated a segment of Mill Creek to align with a new permanent bridge. The realignment of Mill Creek included deactivating and filling approximately 630 feet of the channel and constructing approximately 581 feet of new channel through a relic flood swale.

Site Location:

Upstream Coordinates: 46.349572, -114.150031

Downstream Coordinates: 46.349953, -114.147307

County: Ravalli **Nearest Town:** Hamilton, MT

Map Included: Yes

Mitigation Site Construction Started: 2011 **Construction Ended:** 2011

Dates of any recent corrective or maintenance activities (since previous report):
Activity: none **Date:** N/A

Specific recommendations for additional corrective actions: None.

Previous Monitoring Reports and Methods Descriptions:
https://www.mdt.mt.gov/publications/brochures/stream-mitigation.shtml

Requirements (from approved mitigation plan, banking instrument, or DA permit conditions)

Monitoring Period: 5 years from construction completion or until concurrence by US Army Corps of Engineers (USACE).

Performance Standards: Data gathered during the 2020 monitoring event indicate that the Mill Creek stream mitigation site is meeting two of the three performance standards established in the monitoring plan. Nine years post-construction, total vegetative cover throughout the site is 84% and the stream banks are reasonably stable. Woody vegetation cover failed to meet the success criteria of >50%.

Table 1. Summary of Performance Standards.

Performance Standards	Success Criteria	Criteria Achieved Y/N	Discussion
Riparian Cover	80% total vegetative coverage after 3rd year	Y	Total vegetative cover of the project site is 84% following the eighth year of monitoring (95% of south bank and 80% of north bank).
	50% woody species coverage after 3rd year	N	Woody cover of the project site is 28% following the eighth year of monitoring (60% of south bank and 18% of north bank).
Stream Bank Stability	Unstable banks identified within the project reach will require corrective action	Y	While several unstable banks were identified within the project, none are threatening infrastructure or the current channel alignment and thus do not require corrective action.

Additional Reporting Criteria:

1. **As-built survey** - as built drawings of the relocated channel at a 1:50 scale or smaller and planting schematic with a planted species list and number of plants planted.
2. **Monitoring stations** - establishment of 4 channel monitoring stations (i.e. transects) 75' apart, permanent marked with bank pins, where cross sections are annually surveyed.
3. **Photo points** - color photos at each monitoring station (i.e. transect) showing views upstream, downstream, and of both banks.

Summary Data

Riparian Vegetation Inventory

Visual estimates of vegetative areal coverage for 2013, and 2018 through 2020 are provided in Table 2. In 2020, the total percent riparian cover was 84%, which included 56% cover by herbaceous species and 28% cover by woody species. The site exhibited a decrease in noxious weed cover, from 14% areal coverage in 2019 to 6% in 2020. This reduction in noxious weed cover was largely the result of weed control activities on the left (north) bank, where noxious weed infestations have been prevalent since 2013. Increased bare ground and several dead and dying trees and shrubs were observed on both the left (north) and right (south) banks in 2020. On the right bank, total percent cover decreased by 2% due to a reduction in woody vegetation from beaver activity. Total percent cover estimates decreased by 5% on the left bank since 2019 due to mowing and clearing on the upstream end of the project reach, and herbicide applications in the vicinity of the bridge. The owners of the property on the upstream end of the left bank have removed nearly all woody vegetation, and mowed all vegetation between stations 0+00 and 1+75, and are in the process of constructing a new home not far from the creek.

Appendix C includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas from 2013 through 2020. In 2020, 128 species were observed, which is an increase of two species since the 2019 monitoring event. Catnip (*Nepeta cataria*), a non-native upland species, and American manna grass (*Glyceria grandis*), a native hydrophytic species, were observed for the first time in 2020. Sixty-one of the species (48%) observed between 2013 and 2020 are hydrophytic based on the 2018 National Wetland Plant List (USACE 2018).

Table 2. Vegetative cover estimates at the Mill Creek Stream Mitigation Site in 2013, and 2018 through 2020.

Belt Transect	Length (ft)	Total % Riparian Cover				% Woody Cover				% Noxious Weed Cover			
		2013	2018	2019	2020	2013	2018	2019	2020	2013	2018	2019	2020
Right (south) bank	140	100	97	97	95	60	63	63	60	1	3	1	1
Left (north) bank	435	75	82	85	80	15	18	20	18	15	17	18	7
Area weighted Average	575	81	86	88	84	26	29	30	28	11	14	14	6

Stream Bank Vegetation Composition

Vegetation along the minimally disturbed south stream bank was dominated by Woods' rose (*Rosa woodsii*), ponderosa pine (*Pinus ponderosa*), and non-native perennial grass species such as spreading bent (*Agrostis stolonifera*), creeping wild rye (*Elymus repens*), and flat-stem blue grass (*Poa compressa*). Vegetation along the restored north stream bank is now dominated by native and non-native grass and forb species, with lesser cover by woody species. Non-native grasses such as smooth brome (*Bromus inermis*), spreading bent, and flat-stem blue grass dominated the west end of the north bank, which was mowed up to its eroding top of bank. These upland species are shallow-rooted and provide minimal stability to the bank.

Noxious Weed Inventory

The vegetation inventory along Mill Creek identified eight noxious species (Table 3). Isolated occurrences of houndstongue (*Cynoglossum officinale*), St. Johnswort (*Hypericum perforatum*), and leafy spurge (*Euphorbia esula*) were observed within the project area during the 2020 monitoring events but were not mapped. Noxious weed infestations mapped within the project area were within the trace (less than 1 percent) and low (1 to 5 percent) cover classes. Locations of all noxious weed infestations, with the exception of isolated weed occurrences, are shown on Figure 3 of Appendix A. Many of these infestations occur on private properties outside of the road right-of-way and are therefore inaccessible to MDT weed control contractors without landowner permission.

Woody Plant Survival

Woody vegetation cover along the north bank was estimated at 18% cover, which falls well below the success criteria threshold of 50%. No woody vegetation was observed along the backfilled channel segment, but there are some woody shrubs and saplings along the north

bank of the newly aligned channel. Several mature ponderosa pine trees remain along the north bank and provide most of the woody species cover. Overall woody cover decreased along the north bank in 2020 due to herbicide application, beaver activity, and landscape development, which included substantial removal of woody cover. Woody vegetation cover along the south bank was estimated at 60%. The area weighted average of woody vegetation cover for the north and south bank belt transects was 28%, which does not meet the 50% cover threshold specified in the performance criteria.

Table 3. Weeds observed within the Mill Creek riparian zone in 2020.

Category*	Scientific Name	Common Name
Priority 2B	*Berteroa incana*	Hoary Alyssum
	Centaurea stoebe	Spotted Knapweed
	Cirsium arvense	Canada Thistle
	Cynoglossum officinale	Houndstongue
	Hypericum perforatum	St. Johnswort
	Euphorbia esula	Leafy Spurge
	Leucanthemum vulgare	Oxeye Daisy
	Tanacetum vulgare	Common Tansy

* Based on the MT Department of Agriculture 2019 Noxious Weed List

Bank Erosion Inventory

Over the past eight years, stream bank erosion has been observed both upstream of the project reach and within the project reach. During this time, several different bank segments have eroded as a result of depositional processes, lateral channel migration, and scour from high flow events. Some of these banks have stabilized over time while the length of eroding bank has increased along others.

In 2020, continued bank erosion was noted in five locations (Table 4) within the monitoring reach and continues to occur along a sharp meander bend immediately upstream of the monitoring reach. Descriptions of erosion at these eroding banks are provided below, while locations are illustrated on Figure 2 in Appendix A.

Table 4. Eroding banks documented at the Mill Creek stream mitigation site.

Eroding Bank	Approximate Length (feet)	Actively Eroding in 2020?
EBL 1-2*	264	Yes
EBL5	31	Yes
EBL3	53	Yes
EBL4	118	Yes
ERB2	78	Yes
EBR3	54	Yes
EBR1	58	No

*EBL 1-2 occurs upstream of the project reach

Bank erosion upstream of the project reach - Banks EBL1 and EBL2 were originally documented as two separate eroding bank segments that combined into one long, 247-foot eroding bank in

2014 (herein referred to as EBL1-2). This eroding bank occurs on private land upstream of the project reach but has been documented in previous monitoring reports due to the potential of continued erosion affecting the project reach. The upper 150 feet of EBL1-2 has shown relatively little change over the past five monitoring years and has shown a bank retreat rate of between 0.2 and 0.6 feet per year (see Additional Photo 1 in Appendix B). The lower 100 plus feet of the bank has migrated northward at a more rapid pace than the upper bank segment, especially in the vicinity of a large ponderosa pine tree that fell into the channel in 2016 which can be seen in the photos. The bank has migrated to the north at a rate of 6-7 feet/year for the past four years (see Additional Photo 10 in Appendix B). Severity of the erosion along EBL1-2 is considered very high, particularly along the lower end of the bank.
EBL1-2 is eroding due to extensive gravel deposition just upstream of and across the channel from the eroding bank. Mid-channel bars and an advancing point bar on the right bank are forcing the thalweg up against an exposed, unstable stream bank that runs along a relatively sharp meander bend. Root wads and large rocks that were placed on, but not keyed into the toe of the banks are now in the middle of the channel and are causing increased scour against the bank toe. Lateral migration of this bank has been noted along this bank since 2013, and the erosion rates have increased steadily over time.

Bank erosion within the project reach – As with previous years, several eroding banks were observed within the project area in 2020 (Figure 2, Appendix A). In 2018, bank erosion was observed on the left bank of the monitoring reach just downstream of EBL1-2. This bank (EBL5) is located at the upstream end of the monitoring reach at the mouth of the channel that was backfilled during construction. Erosion along this bank increased from 20 feet in 2018 to 30 feet in 2020 as a result of increased scour along the bank. This bank has retreated by approximately 5 feet between 2019 and 2020, and approximately 24 feet since 2013 (Appendix D Transect #1). EBL5 is now connected to the long eroding bank (EBL1-2) described above, but was mapped separately, as it lies within the project reach as opposed to EBL1-2, which lies upstream of the mitigation area. While the creek has begun to erode into the former channel that was plugged during construction, it is not threatening to abandon its existing configuration and overtake the former alignment. The former alignment has been completely backfilled to the height of the surrounding floodplain and is not a preferential flow path for Mill Creek's current alignment.

Erosion has been observed just downstream of EBL5 in a location previously numbered as EBL3. This eroding bank was originally observed in 2014 but was removed from the eroding bank inventory in 2019 because it had stabilized following the development of an inset floodplain. However, in 2020, this inset floodplain had been washed away by high flow events and EBL3 was again eroding. The severity of the erosion on this bank is low and the potential for redevelopment of an inset floodplain exists.

Lateral erosion at bank EBL4 has been observed over the last five years and is likely being perpetuated by a log jam forming adjacent to the bank causing localized scour (see Additional Photo 5 in Appendix B). The bank has retreated approximately two feet in the past year and 10-12 feet in the past six years. Bank instability at this location was potentially caused by natural channel adjustments and debris jams that formed following construction. These debris jams are considered beneficial to the restored channel alignment, as they improve habitat complexity

and generate pool scour features to the benefit of fish. The dominant vegetation along the bank includes reed canary grass and smooth brome, the former of which offers dense roots capable of withstanding erosion more effectively than most species. Erosion severity along this bank is considered low, as it does not jeopardize any infrastructure elements or the newly installed bridge downstream.

Erosion at EBR2 was originally noted in 2014 along 65 feet of the channel across from the head of the deactivated (backfilled) stream channel. Erosion at this location is tied to sediment deposition leading to channel adjustments, and scour along the outside of a meander. Additional erosion along this bank segment was not observed between 2015 and 2017; however, the bank showed signs of erosion again beginning in 2018, including undercutting, slumping sod mats, and root exposure (see Additional Photo 7 in Appendix B). The eroding bank length increased from 40 to 80 feet between 2018 and 2019 and remained around 80 feet in length in 2020. This bank appears to be stabilizing, likely due to the development of a large point bar upstream of and adjacent to the bank (Photo Point 4.3 and Additional photo 6, Appendix B) which is forcing the stream away from the bank, resulting in a reduction of erosive forces.

Eroding bank EBR3 was observed in 2017 adjacent to a woody debris jam on the right bank and was characterized by upper bank sloughing and toe scour. Vegetation along the upper bank includes reed canary grass, oxeye daisy, woods rose, wheatgrass, brome, small cottonwood saplings, and young willows. While the bank did not retreat between the 2019 and 2020 monitoring events and the length of bank erosion has remained the same, the bank does not appear to have stabilized (Additional Photo 8, Appendix B). During high flow events, stream flow is direct at this bank and is likely prohibiting stabilization. However, a mid-channel bar has developed in front of this bank and is high enough in elevation that vegetation is establishing on the bar (Additional Photo 7, Appendix B). Should the bar persist over time and vegetation continue to establish, EBR3 will likely become stable over time.

Eroding bank EBR1 was observed in 2014 and is directly across the channel from EBL4. Previous monitoring efforts documented fallen trees both into the channel and away from the channel along this bank. Continued erosion was not observed along the bank between 2015 and 2017, but minor erosion along the toe of the bank was noted in 2018 (See Additional Photo 6 in Appendix B). No additional erosion was observed in 2019 or 2020; as such it has been removed from the list of actively eroding banks.

Channel Form

Mill Creek has recently developed several depositional features, including mid-channel and point bars, and the stream banks have shown signs of increased erosion within the last year (see bank erosion section above). The point bar adjacent to the right bank on the upstream end of the project reach has increased in height and width in the last year (Additional photo 2, Appendix B), and a mid-channel bar has deposited on the left side of the channel adjacent to EBL4 (Additional photo 5, Appendix B). The point bar on the upstream end of the project area is forcing the thalweg against the left bank and is thus contributing to the erosion on EBLs 1-2 and 5. The dimensions of the mid channel bar adjacent to EBL4 were captured in the Transect #3

cross sections survey (Appendix D). This gravel bar is increasing water surface elevations at higher flows and forcing higher velocity water against both banks, thus placing erosive forces on EBL3 and EBL4 (See photo of T3 looking East, Appendix B). Such features are commonly observed in streams that transport large bedloads, and Mill Creek is one of the many tributaries that flow east out of the Bitterroot Mountains which contain a high bedload.

Longitudinal Profile - A longitudinal profile has been surveyed annually from 2014 to 2020 and a plot which includes the 2020 longitudinal survey results as compared to previous years is included in Appendix D. As would be expected in a highly dynamic system, the 2020 longitudinal profile indicates that the thalweg has shifted laterally and that large amounts of sediment have been redistributed within the reach, thus raising the bed elevation in some places and lowering it in others. Though the longitudinal profile has changed significantly over the years, the 2020 data indicate that the reach continues to support several pool and riffle sequences. Five pools are being maintained with riffle structures between the pools; thus indicating that the mitigation reach is supporting a healthy diversity of aquatic habitat types.

Channel Cross Sections - Four permanently established channel cross sections (i.e. transects) were surveyed in 2020, as has been the case since 2014. When the monitoring reach was established, transects #2 and #3 were installed at scour pools formed by woody debris jams, and transects #1 and #4 were established in riffles; however, the forms of these features have changed over time.

While transect #1 was originally positioned at a riffle, survey data from 2013-2015 indicated that a pool had formed in this location; likely caused by a point bar that developed on the right side of the channel. In 2016, a large ponderosa pine tree fell into the channel just upstream from transect #1, and a mid-channel gravel bar developed in the vicinity of tree which has persisted over the last four years. Over the last 2 years, additional deposition closer to the right bank has forced more flow against the left bank, where a deep pool has developed, and increased bank erosion has been observed. Additionally, the channel width has gradually increased across transect #1 as a result of erosion on the left bank. Plots of this transect indicate that the is channel actively adjusting in this location due to scour and deposition across the transect (Appendix D).

Transect #2 was originally established at a pool adjacent to a woody debris jam along the left bank. Since 2015, gravel deposition has been observed adjacent to the left bank which has caused the thalweg to shift toward the right bank over time. This gravel bar has enlarged, creating a pool on the right side of the channel (see photos of Transect #2, Appendix B).

Transect #3 generally maintained the same geometry from 2013 to 2019, although increased pool depth was observed in 2019. However, between the 2019 and 2020 monitoring events, a large gravel bar developed along the left bank, forcing the thalweg and the majority of the flow to shift to the right side of the channel. A secondary flow path now runs along the left bank (Appendix D).

Transect #4 is located at a riffle just upstream of the U.S. Highway 93 Bridge. Channel geometry has remained relatively consistent at this location since 2013. A point bar has gradually

developed along the left bank, and the thalweg has moved closer to the right bank. Bar development along the left bank may eventually result in erosion along the right bank; however increased erosion has not been observed in the vicinity of transect #4 to date (see photos of T4, Appendix B and transect Figures in Appendix D).

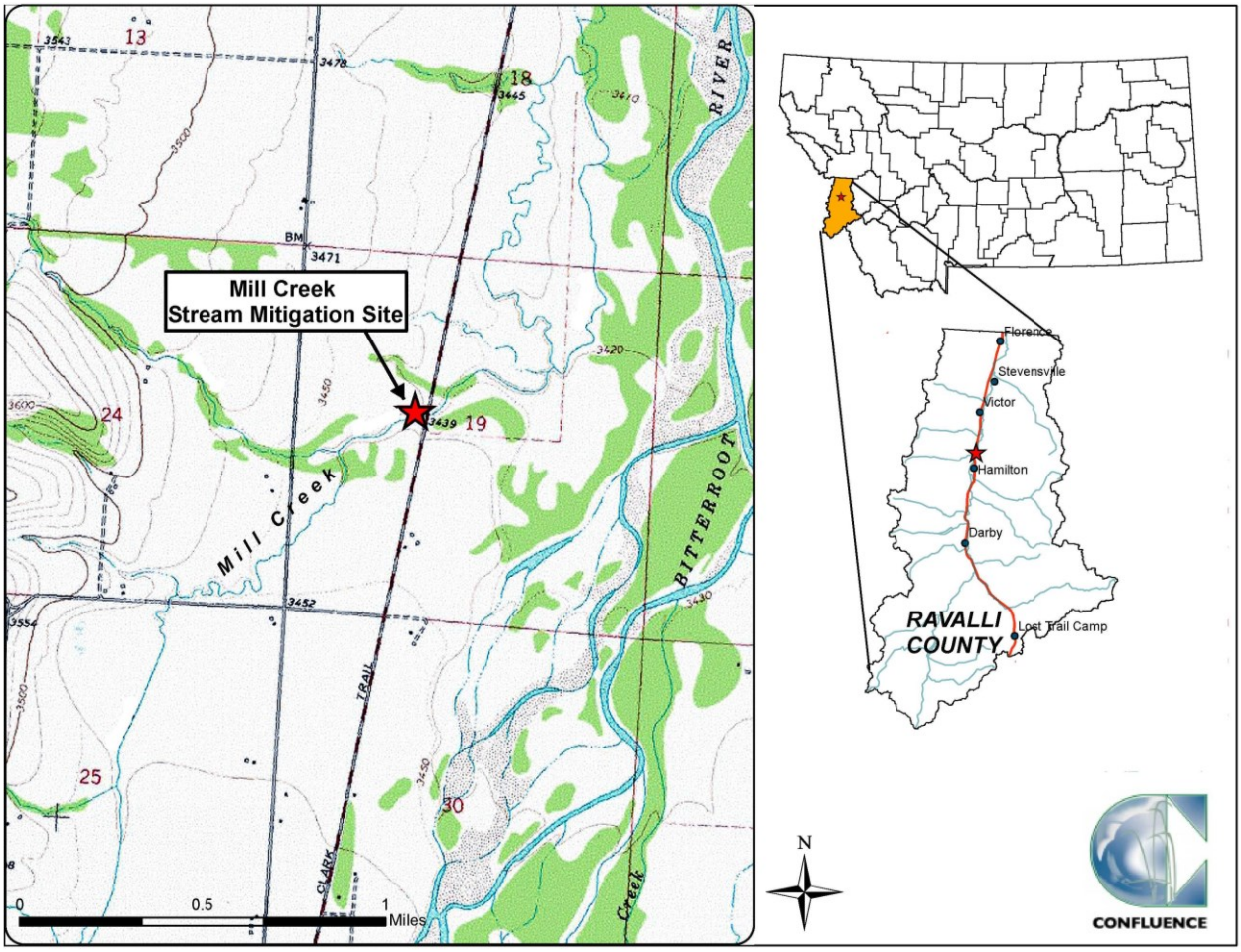
Conclusions

The site is meeting all performance standards except for the Riparian Cover Success category which requires 50% woody species coverage after the 3rd year. Woody cover meets this performance standard along the south bank but does not along the north bank and woody cover along the north bank is trending away from meeting this performance standard. MDT will coordinate with the Corps to discuss future monitoring of this stream mitigation area, and to evaluate potential modifications to woody planting performance standards for this stream mitigation effort.

Further evidence of Mill Creek being a highly dynamic system with regard to channel form was observed in 2020. This trend is likely to continue within the project reach, and the channel dimensions are expected to evolve over time. Bank erosion and changes in channel form observed within the monitoring reach are thought to be the result of natural fluvial processes in the Mill Creek watershed that occur in association with high flow events. This conclusion is supported by longitudinal and cross-sectional profiles surveyed over the past seven years, which indicate that the Mill Creek stream bed naturally adjusts to accommodate high sediment loads and the influx of woody debris. Because these changes are a result of natural channel adjustments and no infrastructure is in jeopardy, no corrective actions are warranted at this this time. The current hands-off management approach which allows the channel to freely adjust and migrate over time, is beneficial to the project reach as it has enabled the development of high-quality habitat features, including deep scour pools, that provide productive and diverse habitat for aquatic species.

Maps, Plans, Photos:

Figure 1. Mill Creek mitigation site Location Map



Project Area Maps: See Appendix A

Photos: See Appendix B

Comprehensive Plant Species List: See Appendix C

Perpendicular Transect and Longitudinal Profile Plots: See Appendix D

Plans: See Appendix G of 2013 Monitoring Report - https://www.mdt.mt.gov/other/webdata/external/planning/STREAM-MITIGATION/2013_REPORTS/2013_MILL_CREEK_MONITORING_REPORT.PDF

References

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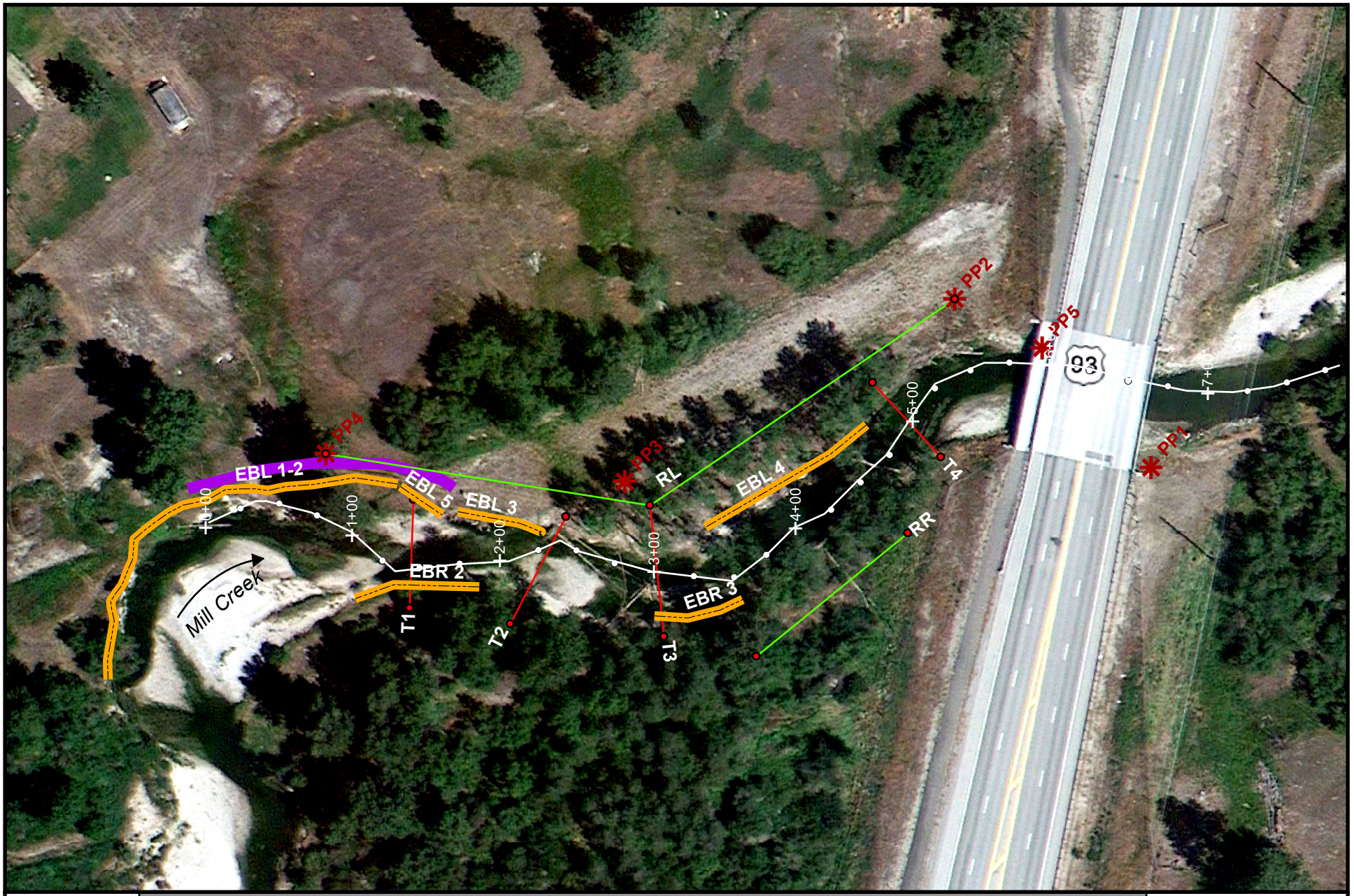
APPENDIX A
PROJECT AREA MAPS

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana



CONFLUENCE
consulting incorporated

Legend

- Channel Thalweg
- Major Station (100')
- Minor Station (25')
- Photo Points
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects
- 2020 Land Clearing

0 50 100 200 Feet

N

2020 Monitoring Features Mill Creek

Figure 2

Date: 10/15/2020

MillCreek_features2020

CONFLUENCE
consulting incorporated

Legend

- *Berteroa incana*
- *Centaurea stoebe*
- *Cirsium arvense*
- *Leucanthemum vulgare*
- *Tanacetum vulgare*

N

0 50 100 150 200 Feet

2020 Monitoring Noxious Weeds Mill Creek

Figure 3

Date: 10/04/2020

MillCreek_Weeds2020.mxd

APPENDIX B
PROJECT AREA PHOTOGRAPHS

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2020

CONFLUENCE

2013

2020

Photo Point 1.2: View from southeast corner of bridge looking downstream. **Compass:** 45° (Northeast)

2013

2020

Photo Point 2.3: View from Photo Point 2 looking upstream. **Compass:** 248° (West-Southwest)

2013

2020

Photo Point 2.5: View of deactivated channel alignment. **Compass:** 248° (West-Southwest)

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2020

2013

2020

Photo Point 3.1: View of deactivated channel segment from Photo point 3. **Compass:** 68° (East-Northeast)

2013

2020

Photo Point 3.2: View of deactivated channel plug. **Compass:** 45° (East)

2013

2020

Photo Point 3.5: View of upstream extent of deactivated channel segment. **Compass:** 270° (West)

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2020

2013

2020

Photo Point 3.8: View looking across deactivated channel segment. **Compass:** 90° (East)

2013

2020

Photo Point 4.3: View of point bar formation from Photo Point 4. **Compass:** 225° (Southwest)

2013

2020

Photo Point 5.2: View looking upstream from bridge. **Compass:** 203° (South-Southwest)

SITE NAME: Mill Creek
MONITORING YEARS: 2014 and 2020

2014

2020

Additional Photo 1: Upper end of eroding Bank EBL1-2.

SITE NAME: Mill Creek
MONITORING YEARS: 2014 and 2020

2014

2020

Additional Photo 2: Lower end of eroding Bank EBL1-2.

SITE NAME: Mill Creek
MONITORING YEARS: 2014 and 2020

2014

2020

Additional Photo 3: Upper section of Eroding Streambank EBL3.

SITE NAME: Mill Creek
MONITORING YEARS: 2014 and 2020

2014

2020

Additional Photo 4: Lower section of Eroding Streambank EBL3.

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2020

2013

2020

Additional Photo 5: Eroding streambank EBL4.

2013

2020

Additional Photo 6: Eroding streambank EBR2.

2013

2020

Additional Photo 7: Eroding streambank EBR3.

Survey Photo Log

SITE NAME: Mill Creek
MONITORING YEAR: 2020

CONFLUENCE

Survey Photo 1. T1 looking North, upstream from T1 South bank.

Survey Photo 2. T1 looking South downstream from T1 North bank.

Survey Photo 3. T1 looking West upstream from South bank.

Survey Photo 4. T1 looking East downstream from South bank.

Survey Photo 5. T1 looking West upstream from middle of creek.

Survey Photo 6. T1 looking East downstream from middle of creek.

SITE NAME: Mill Creek
MONITORING YEAR: 2020

Survey Photo 7. T1 looking West upstream from North bank.

Survey Photo 8. T1 looking East downstream from North bank.

Survey Photo 9. T2 looking North upstream from T2 South bank.

Survey Photo 10. T2 looking South downstream from T2 North bank.

Survey Photo 11. T2 looking West upstream from South bank.

Survey Photo 12. T2 looking East downstream from South bank.

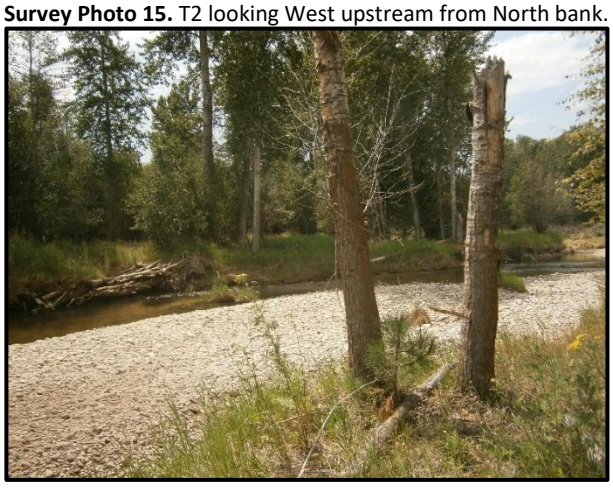
SITE NAME: Mill Creek
MONITORING YEAR: 2020

Survey Photo 13. T2 looking West upstream from middle of creek.

Survey Photo 14. T2 looking East downstream from middle of creek.

Survey Photo 15. T2 looking West upstream from North bank.

Survey Photo 16. T2 looking East downstream from North bank.



Survey Photo 17. T3 looking South upstream from T3 North bank.

Survey Photo 18. T3 looking South downstream from T3 South bank.

SITE NAME: Mill Creek
MONITORING YEAR: 2020

Survey Photo 19. T3 looking West upstream from South bank.

Survey Photo 20. T3 looking East downstream from South bank.

Survey Photo 21. T3 looking West upstream from middle of creek.

Survey Photo 22. T3 looking East downstream from middle of creek.

Survey Photo 23. T3 looking West upstream from North bank.

Survey Photo 24. T3 looking East downstream from North bank.

SITE NAME: Mill Creek
MONITORING YEAR: 2020

Survey Photo 25. T4 looking North upstream from T4 South bank.

Survey Photo 26. T4 looking South downstream from T4 North bank.

Survey Photo 27. T4 looking West upstream from South bank.

Survey Photo 28. T4 looking East downstream from South bank.

Survey Photo 29. T4 looking West upstream from middle creek.

Survey Photo 30. T4 looking East downstream from middle creek.

Survey Photo 31. T4 looking West upstream from North bank.

Survey Photo 32. T4 looking East downstream from North bank.

APPENDIX C
2013 – 2020 COMPREHENSIVE PLANT SPECIES LIST

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana

Comprehensive list of plant species observed at the Mill Creek Stream Mitigation Site from 2013 through 2020.

Scientific Name	Common Name	WMVC Indicator Status*
Achillea millefolium	Common Yarrow	FACU
Agropyron cristatum	Crested Wheatgrass	UPL
Agrostis gigantea	Black Bent	FAC
Agrostis scabra	Rough Bent	FAC
Agrostis stolonifera	Spreading Bent	FAC
Algae, brown	Algae, brown	N/A
Algae, green	Algae, green	N/A
Alnus incana	Speckled Alder	FACW
Alopecurus aequalis	Short-Awn Meadow-Foxtail	OBL
Alyssum alyssoides	Pale Alyssum	UPL
Amelanchier alnifolia	Saskatoon Service-Berry	FACU
Antennaria parvifolia	Nuttall's Pussytoes	UPL
Artemisia absinthium	Absinthium	UPL
Aster sp.	Aster	N/A
Bassia scoparia	Burningbush	FAC
Berteroa incana	Hoary False-Alyssum	UPL
Betula pumila	Bog Birch	OBL
Bromus arvensis	Field Brome	UPL
Bromus inermis	Smooth Brome	UPL
Bromus japonicus	Japanese Brome	UPL
Bromus tectorum	Cheatgrass	UPL
Calamagrostis canadensis	Bluejoint	FACW
Calamagrostis stricta	Slim-Stem Reed Grass	FACW
Camelina microcarpa	Little-Pod False Flax	FACU
Carduus nutans	Nodding Plumeless-Thistle	UPL
Carex aquatilis	Leafy Tussock Sedge	OBL
Carex bebbii	Bebb's Sedge	OBL
Carex nebrascensis	Nebraska Sedge	OBL
Carex sp.	Sedge	N/A
Carex stipata	Stalk-Grain Sedge	OBL
Carex utriculata	Northwest Territory Sedge	OBL
Centaurea stoebe	Spotted Knapweed	UPL
Cerastium arvense	Field Mouse-Ear Chickweed	FACU
Chamaenerion angustifolium	Narrow-Leaf Fireweed	FACU
Cicuta douglasii	Western Water-Hemlock	OBL
Cirsium arvense	Canadian Thistle	FAC
Cirsium vulgare	Bull Thistle	FACU
Collomia linearis	Narrow-Leaf Mountain-Trumpet	FACU
Cornus alba	Red Osier	FACW
Crataegus douglasii	Black Hawthorn	FAC

Scientific Name	Common Name	WMVC Indicator Status*
Cynoglossum officinale	Gypsy-Flower	FACU
Dactylis glomerata	Orchard Grass	FACU
Dasiphora fruticosa	Golden-Hardhack	FAC
Deschampsia caespitosa	Tufted Hairgrass	FACW
Descurainia sophia	Herb Sophia	UPL
Eleocharis palustris	Common Spike-Rush	OBL
Elymus canadensis	Nodding Wild Rye	FAC
Elymus glaucus	Blue Wild Rye	FACU
Elymus repens	Creeping Wild Rye	FAC
Epilobium brachycarpum	Panicled Willowherb	UPL
Epilobium ciliatum	Fringed Willowherb	FACW
Equisetum arvense	Field Horsetail	FAC
Equisetum hyemale	Tall Scouring-Rush	FACW
Erodium cicutarium	Stork's Bill	UPL
Euphorbia esula	Leafy Spurge	UPL
Festuca idahoensis	Bluebunch Fescue	FACU
Filago arvensis	Field Fluffweed	UPL
Fragaria virginiana	Virginia Strawberry	FACU
Geum macrophyllum	Large-Leaf Avens	FAC
Geum sp.	Avens	N/A
Glyceria grandis	**American Manna Grass**	**OBL**
Glyceria striata	Fowl Manna Grass	OBL
Holcus lanatus	Common Velvet Grass	FAC
Hypericum perforatum	Common St. John's-Wort	FACU
Juncus balticus	Baltic Rush	FACW
Juncus effusus	Lamp Rush	FACW
Juncus ensifolius	Dagger-Leaf Rush	FACW
Juncus sp.	Rush	N/A
Juncus tenuis	Lesser Poverty Rush	FAC
Juniperus scopulorum	Rocky Mountain Juniper	UPL
Lactuca serriola	Prickly Lettuce	FACU
Lepidium campestre	Field Pepper-Grass	UPL
Leucanthemum vulgare	Ox-Eye Daisy	FACU
Lolium perenne	Perennial Rye Grass	FAC
Lotus corniculatus	Garden Bird's-Foot-Trefoil	FAC
Lupinus sericeus	Pursh's Silky Lupine	UPL
Lycopus asper	Rough Water-Horehound	OBL
Maianthemum stellatum	Starry False Solomon's-Seal	FAC
Medicago lupulina	Black Medick	FACU
Melilotus officinalis	Yellow Sweet-Clover	FACU
Mentha arvensis	American Wild Mint	FACW
Mimulus guttatus	Seep Monkey-Flower	OBL

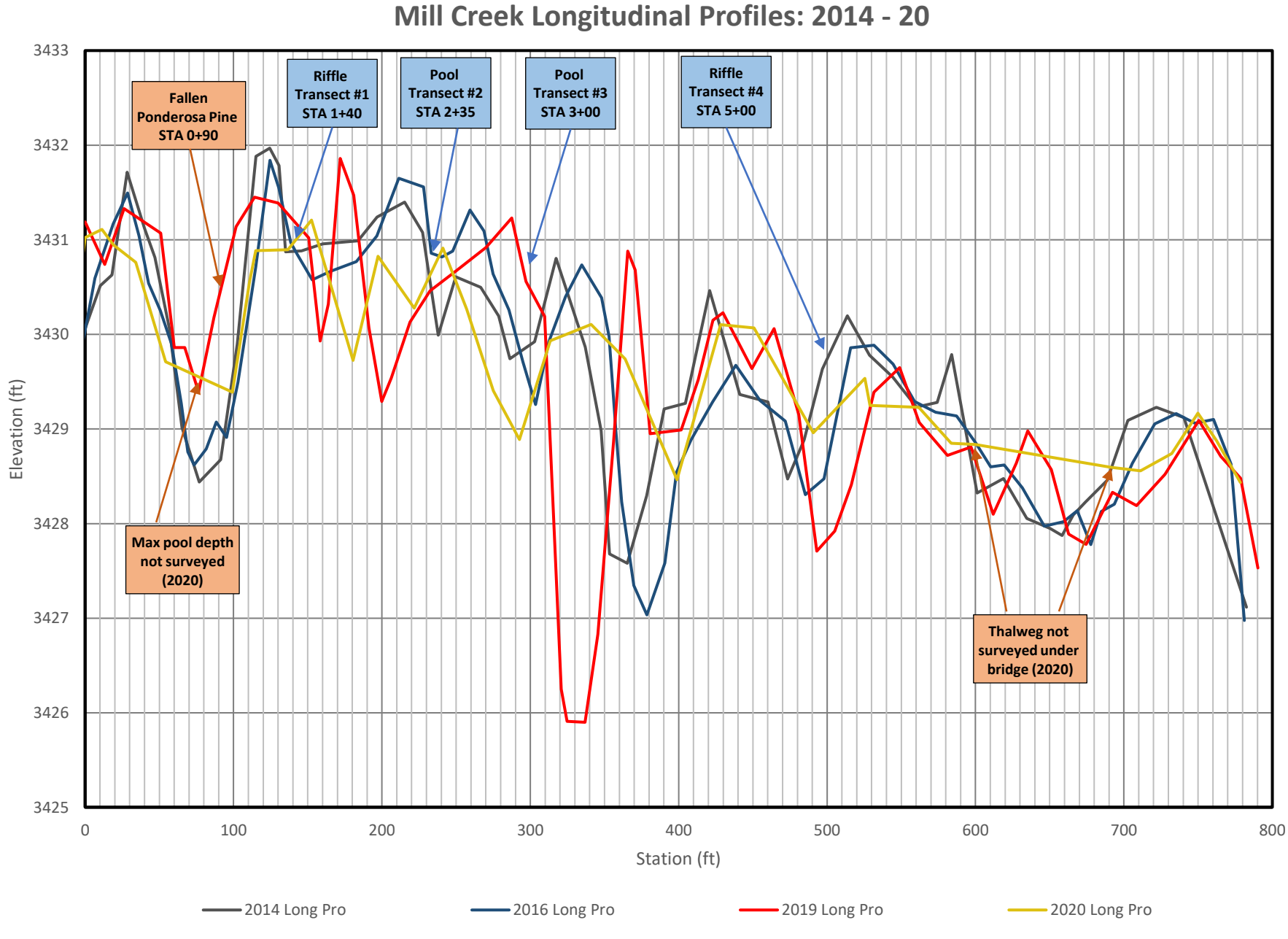
Scientific Name	Common Name	WMVC Indicator Status*
Myosotis laxa	Bay Forget-Me-Not	OBL
Nepeta cataria	**Catnip**	**FACU**
Oenothera villosa	Hairy Evening-Primrose	FAC
Onopordum acanthium	Scotch Thistle	UPL
Pascopyrum smithii	Western-Wheat Grass	FACU
Persicaria amphibia	Water Smartweed	OBL
Persicaria sp.	Smartweed	N/A
Phalaris arundinacea	Reed Canary Grass	FACW
Phleum pratense	Common Timothy	FAC
Pinus ponderosa	Ponderosa Pine	FACU
Plantago major	Great Plantain	FAC
Poa compressa	Flat-Stem Blue Grass	FACU
Poa palustris	Fowl Blue Grass	FAC
Poa pratensis	Kentucky Blue Grass	FAC
Populus angustifolia	Narrow-Leaf Cottonwood	FACW
Populus balsamifera	Balsam Poplar	FAC
Prunella vulgaris	Common Selfheal	FACU
Pseudoroegneria spicata	Bluebunch Wheatgrass	UPL
Ranunculus aquatilis	White Water-Crowfoot	OBL
Ranunculus repens	Creeping Buttercup	FAC
Ranunculus sp.	Buttercup	N/A
Ribes lacustre	Bristly Black Gooseberry	FAC
Rosa woodsii	Woods' Rose	FACU
Rubus idaeus	Common Red Raspberry	FACU
Rumex acetosella	Common Sheep Sorrel	FACU
Rumex crispus	Curly Dock	FAC
Salix bebbiana	Gray Willow	FACW
Salix exigua	Narrow-Leaf Willow	FACW
Salix lasiandra	Pacific Willow	FACW
Scirpus microcarpus	Red-Tinge Bulrush	OBL
Silene vulgaris	Maiden's-tears	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
Symphyotrichum laeve	Smooth Blue American-Aster	FACU
Tanacetum vulgare	Common Tansy	FACU
Taraxacum officinale	Common Dandelion	FACU
Thinopyrum intermedium	Intermediate Wheatgrass	UPL
Thlaspi arvense	Field Pennycress	UPL
Tragopogon pratensis	Meadow Goat's-beard	UPL

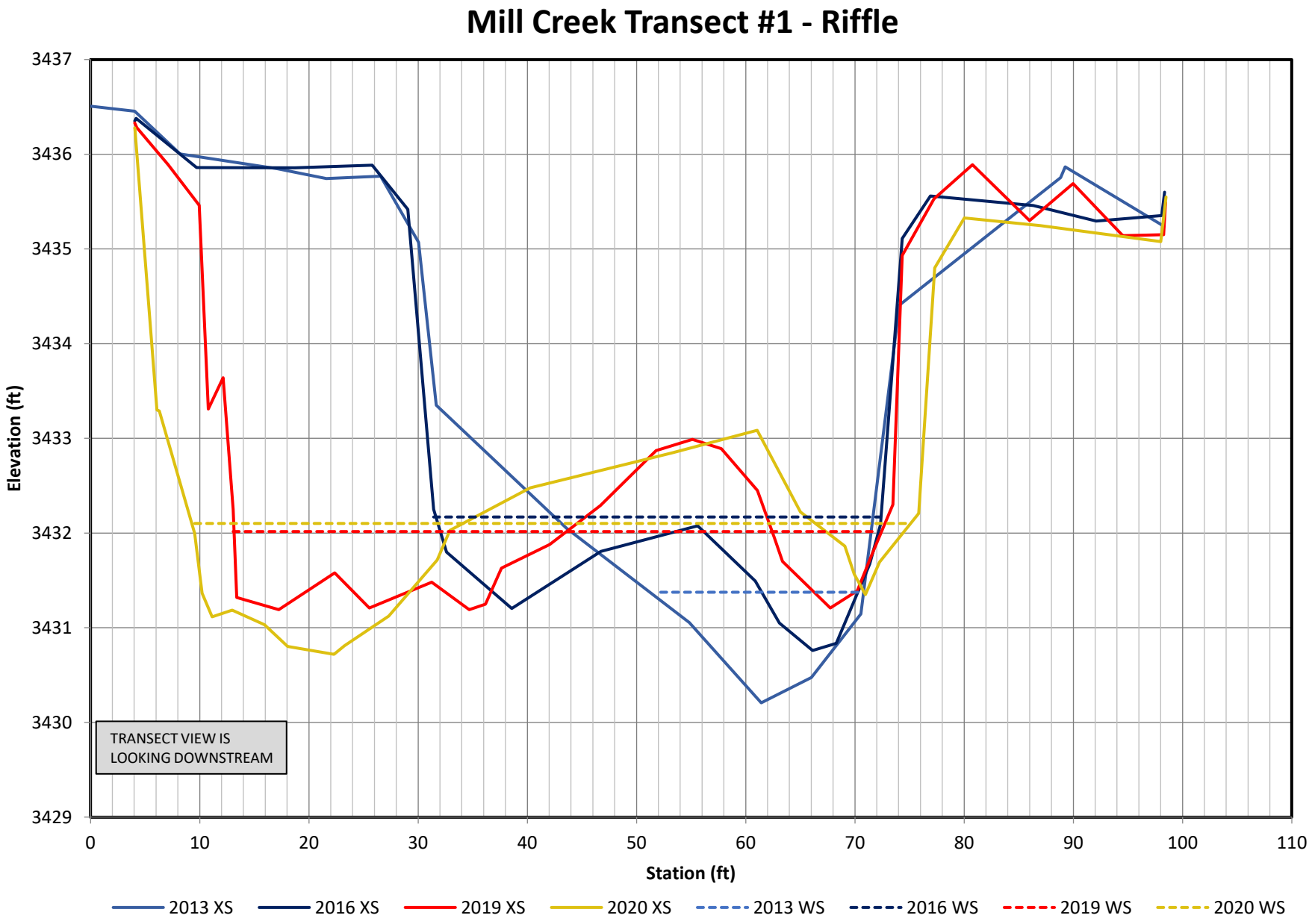
Scientific Name	Common Name	WMVC Indicator Status*
Trifolium pratense	Red Clover	FACU
Trifolium repens	White Clover	FAC
Verbascum thapsus	Great Mullein	FACU
Veronica americana	American-Brooklime	OBL

* 2018 National Wetland Plant List; Western Mountains, Valleys, and Coast Region (WMVC) (USACE 2018)
Duration: A=Annual; B=Biennial; P=Perennial; USDA PLANTS Database (2020)
New species identified in 2020 are **bolded**
Species identified to genus level have been assigned an indicator status of N/A

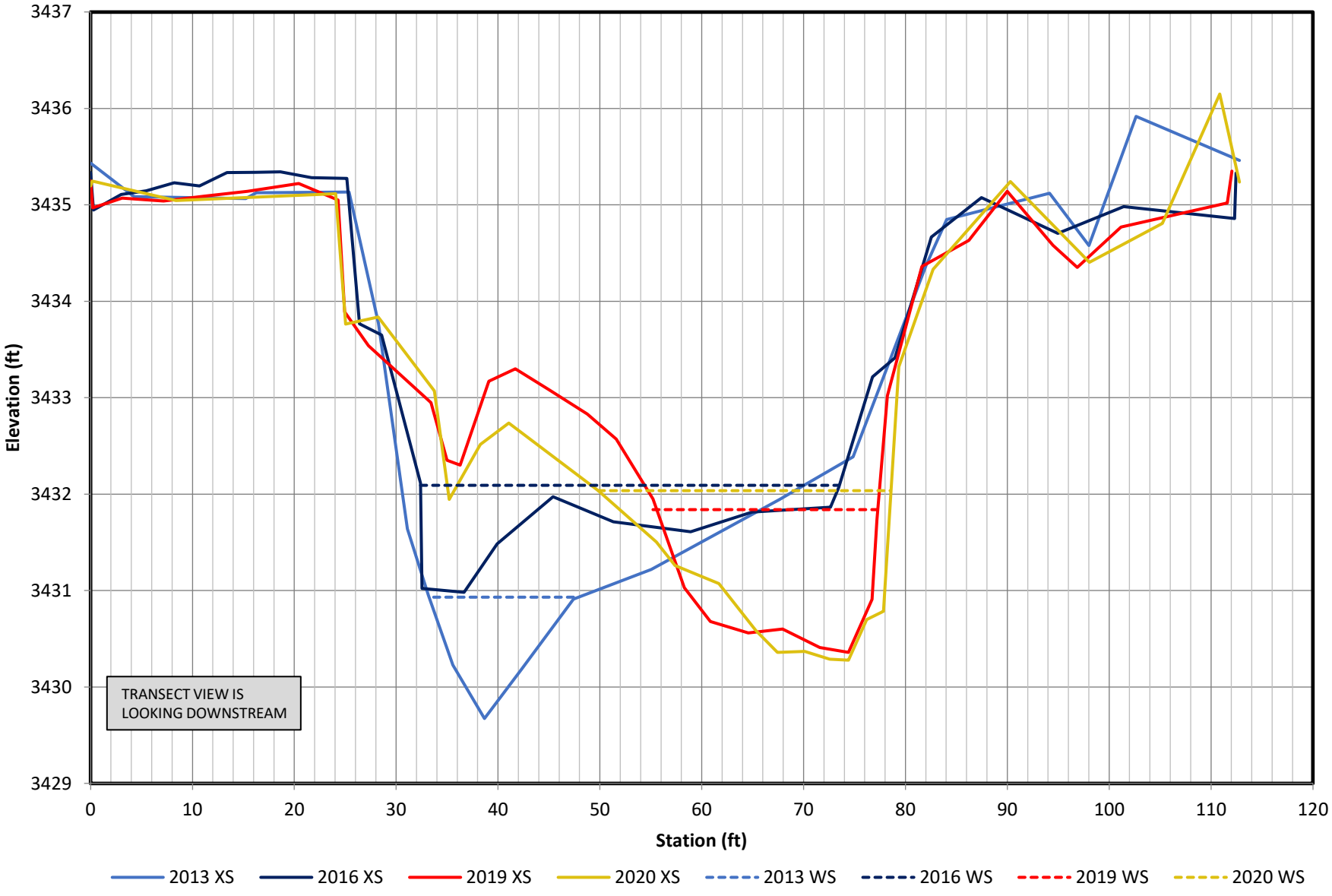
APPENDIX D
LONGITUDINAL PROFILE AND PERPENDICULAR TRANSECT PLOTS

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana

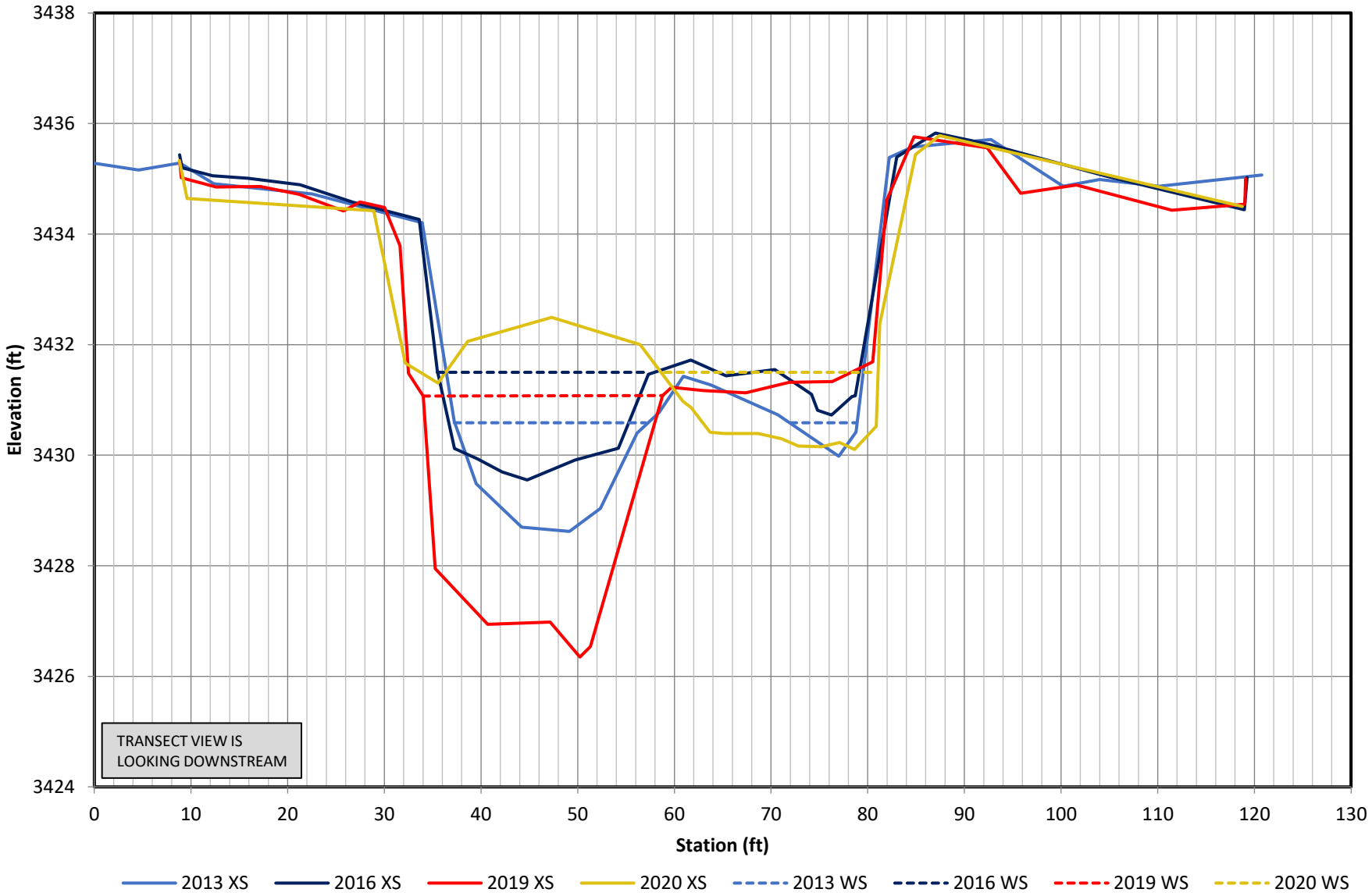

Mill Creek Longitudinal Profiles: 2014 - 20
Fallen Ponderosa Pine STA 0+90
Riffle Transect #1 STA 1+40
Pool Transect #2 STA 2+35
Pool Transect #3 STA 3+00
Riffle Transect #4 STA 5+00
Max pool depth not surveyed (2020)
Thalweg not surveyed under bridge (2020)
Elevation (ft)
3433
3432
3431
3430
3429
3428
3427
3426
3425
0
100
200
300
400
500
600
700
800
Station (ft)
2014 Long Pro
2016 Long Pro
2019 Long Pro
2020 Long Pro


Mill Creek Transect #1 - Riffle
Elevation (ft)
3437
3436
3435
3434
3433
3432
3431
3430
3429
0
10
20
30
40
50
60
70
80
90
100
110
Station (ft)
TRANSECT VIEW IS
LOOKING DOWNSTREAM
2013 XS
2016 XS
2019 XS
2020 XS
2013 WS
2016 WS
2019 WS
2020 WS

Mill Creek Transect #2 - Pool



Mill Creek Transect #3 - Pool



Mill Creek Transect #4 - Riffle