Colorado Emergency Watershed Protection (EWP) Program

2013 Flood Recovery

SH60

Watershed Recovery Project

Final Report

Local Project Sponsor: Middle South Platte River Alliance

Project Location: South Platte River, Milliken, CO

Project Cost: $ 495,143.79

Date Project Completed: 11/09/2017

Report Prepared by: Chloe Lewis, MSPRA

December 6th, 2017

USDA United States Department of Agriculture Natural Resources Conservation Service

COLORADO Colorado Water Conservation Board Department of Natural Resources

Summary

The primary objective of the work at the SH60 project was to protect life and property. This was accomplished by increasing channel stability upstream of the bridge and helping to minimize bank erosion and sediment transport, so that under flood conditions, sediment will be mobilized through the bridge. The project also enhanced the ecological conditions of the river. Specific improvements include bendway weirs; woody toe protection through the use of rootwads to encourage habitat; and resilient and stable channel banks capable of minimizing erosion under a wide range of flow conditions.

Background

Heavy, sustained rains in September 2013 caused significant flooding along the South Platte River. Many bridges were inundated and overtopped, resulting in infrastructure damage and damage to property. Along the South Platte River, aggradation and degradation occurred, changing the landscape of the South Platte River floodplain. In some areas, bank erosion is the result of this changing landscape, resulting in loss of property. Within the project reach, the channel migration to the west could impact SH-60 over time or remain problematic in future high water events.

In response to the flood event, a damage survey report (DSR) was conducted by the Natural Resource Conservation Service (NRCS). In this report, the negative impacts of the flood at the SH60 site were determined to have a monetary value of $584,000. Based on this estimate, the MSPRA was able to coordinate matching funds from Weld County to supplement funds available through the Emergency Watershed Protection Program.

In addition to the DSR, the Middle South Platte River Alliance partnered with CDM Smith to compile a River Restoration Master Plan. Through their study, our SH60 project team was able to gain a detailed understanding channel and stream evolution through this reach. In the SH60 Basis of design report, CH2M indicates that, “CDM Smith and Otak (2016) modified the Cluer and Thorne Stream Evolution Model (SEM) based on the sitespecific channel responses observed within the Middle South Platte. The team noted that many of the reaches were determined to be cycling through the unstable stages of the SEM (Stages 3 – 5) as the aggradational reach responds to hydromodification and channelization. In their analysis, they indicate that Reach 5 (upstream of SH-60) is at Stage 3 - Degradation. Active widening and the extensive sand and gravel bar development since at least 1999, suggest that the project reach upstream of the bridge is on a Stage 5 trajectory.” (CH2M, 2017) In either case, as defined by Cluer and Thorne’s SEM, the upstream reach could be considered unstable.

Located in Weld, County Colorado, the SH60 bridge is 2.5 miles southeast of the Town of Milliken at approximately Northing: 50013.38, Easting: 76031.97 (Figure 1).

The final design included 4 bendway weirs immediately upstream of the SH60 Bridge, installation of anchored woody toe revetment and aquatic habitat features in the project limits and revegetation of the floodplain surfaces within the project limits. The project reach spans approximately 0.75 miles.

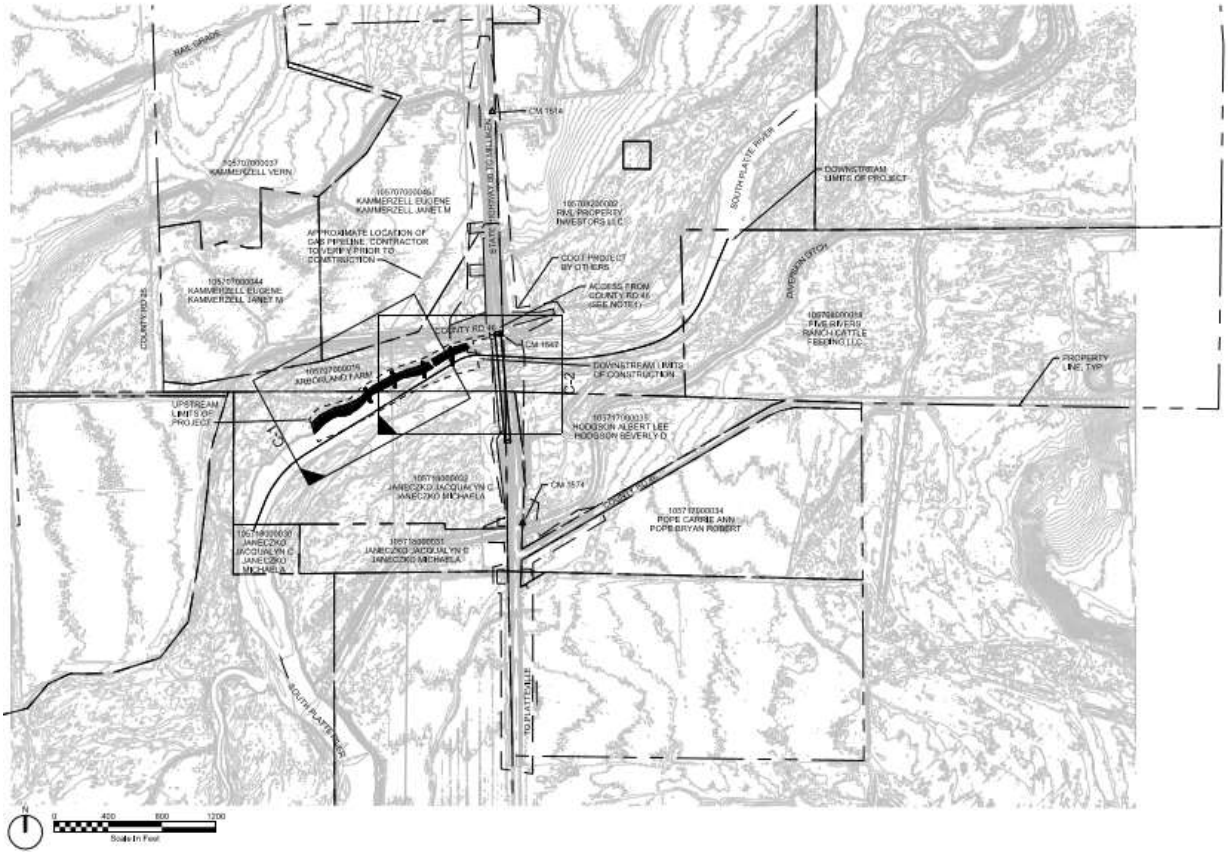

Figure 1: SH60 Project Site

Goals & Objectives

The channel improvements along the project reach intend to increase safety while protecting property and existing infrastructure.

The improvements established:

- Increased stability of the channel bank
- Retraining of the South Platte River to the center of the existing channel
- Mitigation of additional damage to existing and/or future infrastructure
- Establishment of woody material to increase habitat for aquatic life
- Restoration of native plant communities
- Lastly, through the revegetation efforts, the project will provide a water quality benefit, increase the riparian habitat, and improve habitat.
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These objectives coincide with goals originally proposed in the DSR, suggestions from the MSPRA Master Plan in addition to concerns described by CDOT's Bridge Enterprise Program.

Implementation and Benefits

As previously described, there were several goals and objectives for the SH60 Project. Different methods were employed to achieve each of these objectives, as indicated below:

Increased stability of the channel bank

- Rip rap was installed at the bank toe near the structures in order to stabilize the bank in areas where is was incised and continuing to erode (Figure 2). This, coupled with revegetation, will provide additional stability during annual flows in addition to high flow events, such as 100 year floods. Approximately 0.75 miles of the bank was stabilized during this process. Figure 4 illustrated how this material was used in conjunction with woody material to increase the stability of the bank.
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Figure 2: Bank erosion at SH60

Figure 3: Bank erosion upstream of the SH60 bridge

Retraining of the South Platte River to the center of the existing channel

- Four bendway weirs were installed in order to 'train' the river and redirect flows towards the center of the channel. These were constructed out of rock material of various sizes and extended in to the river approximately 50 feet at the locations indicated in Figure 4.
- Figure 5 and 6 illustrate what was determined to be the best method for the construction/installation of each weir.

WEIR POINT TABLE

POINT	NORTHING	EASTING	ELEV
W3-1	48155.73	75511.14	4706.40
W3-2	48110.84	75529.07	4706.70
W3-3	48039.45	75528.99	4701.00
W4-1	48262.89	75717.45	4705.60
W4-2	48228.32	75731.68	4705.90
W4-3	48127.34	75739.38	4700.80

FOR WEIR ELEV SEE DT-2

Figure 4: Weir Points for the SH60 Project

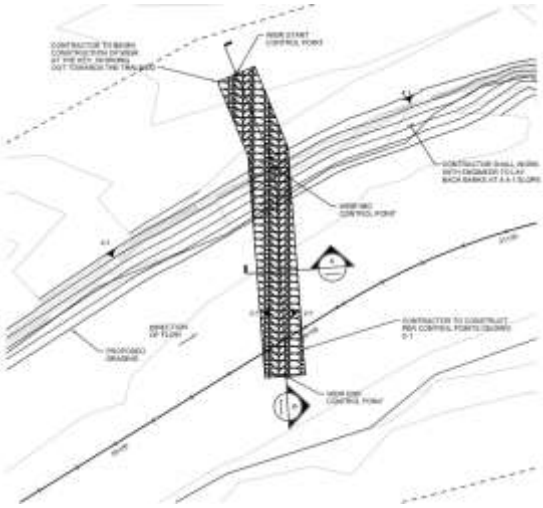

Figure 5: Weir structure overhead sketch

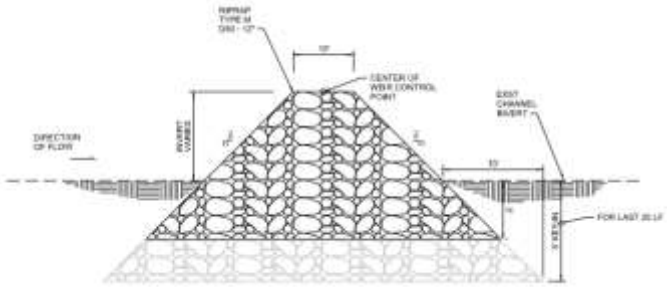

Figure 6: Side view of weir detail

Mitigation of additional damage to existing and/or future infrastructure

- The project team anticipates that over time, as the river maintains its flow towards the center of the channel, this will decrease the scour at the bank in addition to encouraging flows perpendicular to the bridge. Since the CDOT bridge is anticipating reconstruction in 2019, the number of pillar and bridge revetments in the channel will be significantly lower. This, coupled with the river training structures, will improve the passage of sediment through this reach of river.

Establishment of woody material to increase habitat for aquatic life

- The use of rootwads and woody materials requires logs at least 12' in length, with a minimum diameter of 16 inches. A nearby property owner collected fallen trees and was willing to provide the material at no cost to the project for construction. Trees from the Hodgson property fulfilled the entire quantity needed to successfully incorporate woody material in to the project.
- The woody material was installed in accordance with current best practices throughout the industry. The team used 'duckbill anchors' that extended five feet below the footer logs as shown in Figure 7.

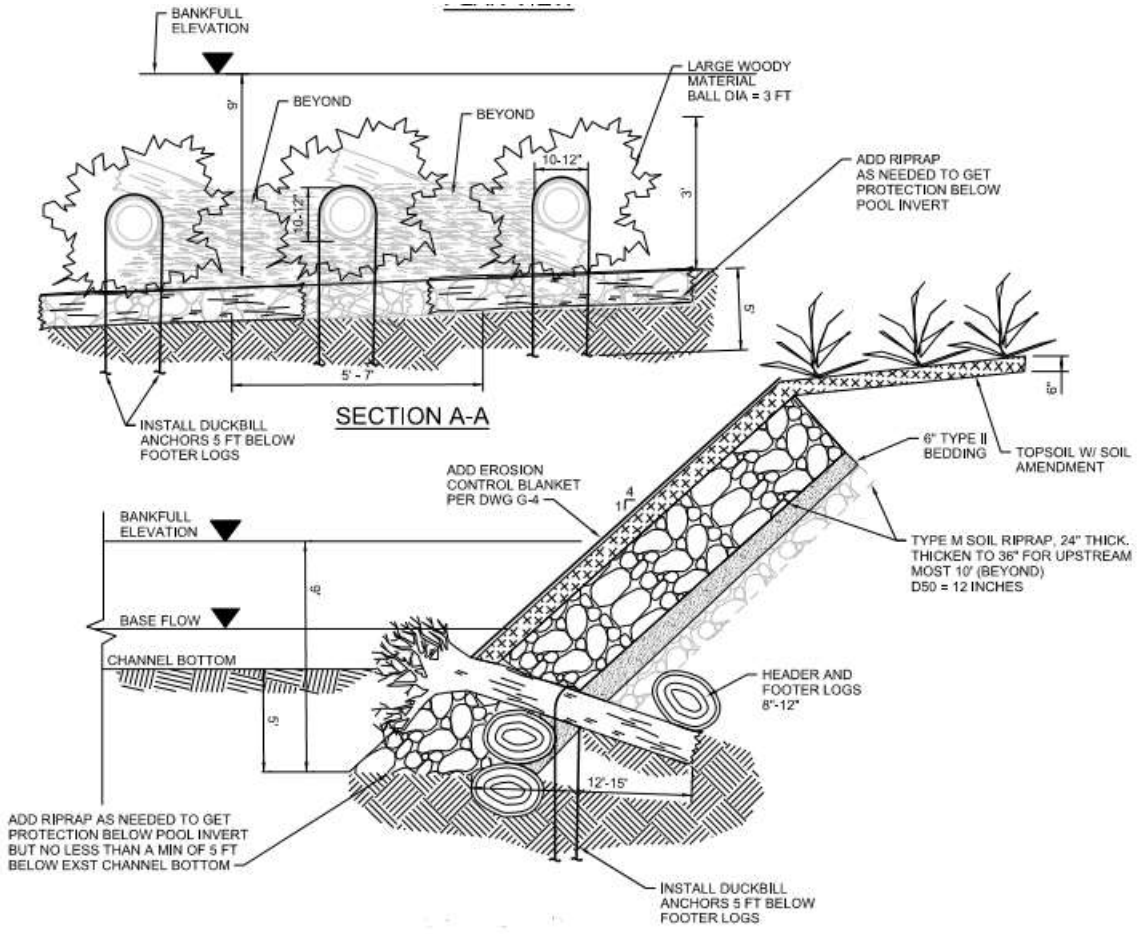

Figure 7: Woody toe and bank stabilization

Restoration of native plant communities

- In partnership with Great Ecology, a list of native riparian species was compiled and finalized based on collaboration and input from the landowner
- The land owner has agreed to take ownership/responsibility of irrigation activities for the next few seasons in addition to allocating some of their water rights for this purpose

Additional Benefits

- Increased economic value. Riparian buffers have a positive economic value when measured in terms of private and public benefits
- Riparian buffers support both land and water functions by enhancing or maintaining water quality, habitats and resilience
- Activation of diverse networks and collaboration. This project provided a platform from which a newly emerging non-profit could gain local, regional and national support. In addition, this was an ideal situation in which groups with different interests could collaborate and work towards a common goal. As our ability to foster mutually beneficial projects increases, the MSPRA can reduce the duplication of efforts across parties – subsequently increasing overall benefit to the local community, region, landowners and all external partners.
- Public Safety. With increased bank stabilization and the flow returning to the center of the channel, it is anticipated that in future high water events the impacts to CR 46, the Kammerzell property and SH60 will decrease substantially.
- This project provides a demonstration of novel restoration, stabilization and flood mitigation activities. In an area where traditional practices often involve cement or car bodies, this offers a different perspective on ways to effectively address concerns while also increasing habitat and resilience.
- Adaptive management and increased knowledge of a complex system. This project provides the MSPRA, as well as other entities and environmental managers, the opportunity to learn more about how this system responds to implementation.

Expended Budget

Entity	Percent Match	Total ($)
NRCS	75%	144,956.93
CWCB	12.5%	24,159.49
Weld Co	12.5%	24,159.49
Total Expended Budget	100%	495,143.79

Partnerships

Partners

- Natural Resource Conservation Service
- Colorado Water Conservation Board
- Weld County
- Middle South Platte River Alliance

Consultants

- Naranjo Civil Constructors
- CH2M
- Great Ecology

Each partner and consultant listed here remained actively involved throughout the duration of the project. The Colorado Water Conservation Board provided technical assistance from the beginning, which helped the MSPRA to remain compliant with all expectations of the NRCS and Emergency Watershed Protection Program.

The MSPRA and CH2M had weekly meeting to ensure efficiency and organization. These meetings extended to include Naranjo and Great Ecology when the project progressed in to the implementation phase.

Weld County commissioners attended the MSPRA Steering Committee meetings to stay informed and supportive of the restoration efforts.

Maintenance, Monitoring, and Next Steps

Maintenance and monitoring will occur on the project site in accordance with the Operation, Inspection and Maintenance Plan (OIM) in Appendix A.

With the landowner taking responsibility for irrigation and weed control, maintenance on the immediate project site will be consistent over the next few seasons. In addition, a local boy scout group has offered to help said landowner with their efforts.

The MSPRA is currently exploring various opportunities to expand upstream and downstream of this project. There are some areas of concern on an upstream bend where flood waters overtopped the bank and overtook a county road. Another possibility is downstream where a cattle company has a retention pond concerningly close to the river. Adjacent to the retention pond is an area of substantive bank loss which should be addressed before water contamination becomes problematic.

Primary Project Contact

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Photos

Pre-construction Photos

Pre-construction view of the Weir 1 location. Looking west.

Pre-construction view of weir 2 location looking south west.

Pre-construction view of the Weir 3 location. Looking east towards SH60 bridge.

Pre-construction view of the woody toe section. Looking east towards SH60 bridge.

Post Construction Photos

This image is post construction looking east towards the SH60 bridge. This captures the entire project area. The near end of the bank includes the woody toe, and from closest the farthest the weirs can been seen in order from Weir 4, Weir 3, Weir 2 and then Weir 1.

This is an aerial view of Weir 1 and the SH60 bridge.

This image shows Weir 2 immediately upstream of the return flow channel from the Kammerzel property.

This shows Weir 3 to the north (left as shown) of the sand bar regrading.

Weir 4 to the north (left as shown) of the sandbar