Horse Creek Restoration Project

Goffena Property

Initial Project Assessment

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1.0 Introduction

The Landowner Incentive Program/Yellowstone Cutthroat Trout project (LIP-YCT) assists private landowners seeking to improve habitat for Yellowstone cutthroat trout on their property. This report, or project assessment, documents preliminary evaluations for potential projects in Horse Creek drainage, a tributary drainage to the Shields River near Wilsall, Montana. The objectives of the project assessment are to describe relevant literature and data, describe existing conditions and potential, and provide recommendations to landowners. If landowners agree to proceed with conservation activities, Montana Fish, Wildlife & Parks' Yellowstone cutthroat trout restoration biologist will provide technical, financial, and planning assistance to implement restoration projects on these private lands.

2.0 Project Background

Horse Creek is a tributary to the Shields River that supports presumably pure Yellowstone cutthroat trout (Figure 2-1). The potential project, or set of projects, encompasses the lower reaches of the north and south forks of Horse Creek, and portions of the main stem (Figure 2-2). The property in question lies in T3N R9E Section 24.

Melvin Goffena, property owner and agricultural producer, is interested in several opportunities to promote conservation of Yellowstone cutthroat trout in Horse Creek. Specifically, he saw potential to improve habitat by restoring a series of eroding banks. In addition, we discussed options to reduced fish loss by altering an irrigation canal to allow fish to return to Horse Creek. A culvert on the upstream end of his property is a likely barrier to fish, and we discussed options promote connectivity. Another objective is to obtain data on flows contributed from the north and south forks of Horse Creek and evaluate the quantity of water diverted for irrigation.

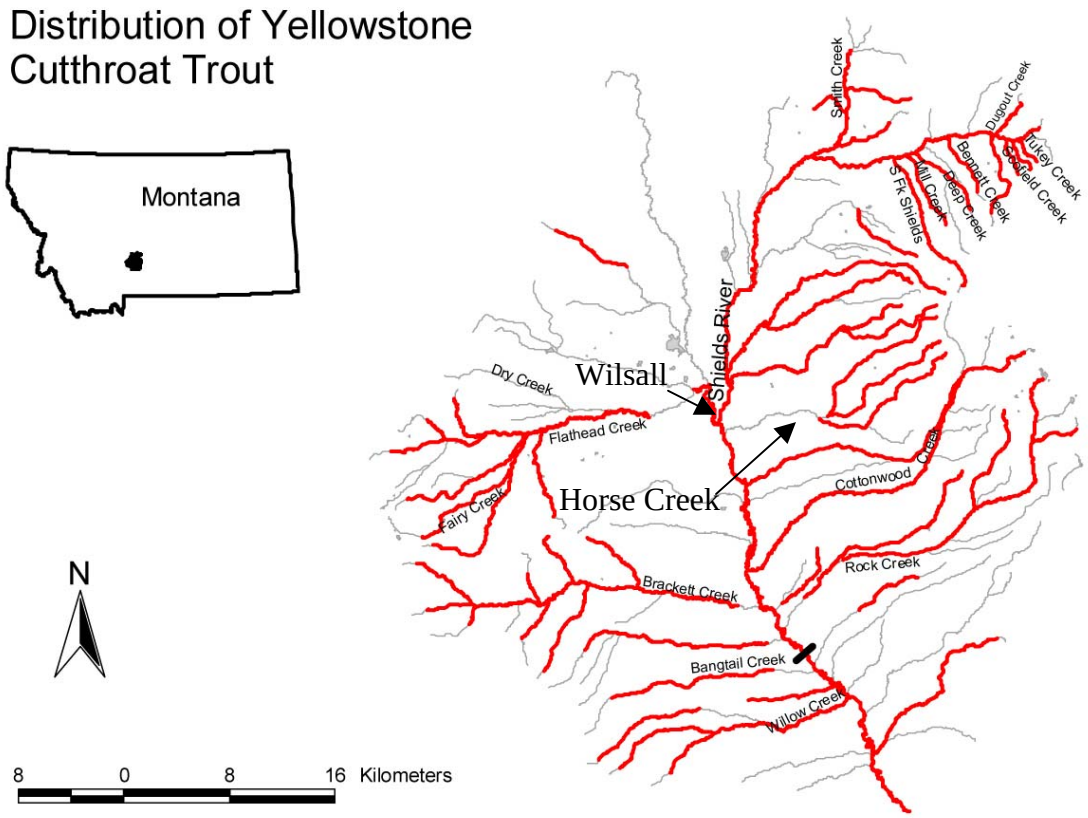

Figure 2-1: Map of the Shields River watershed showing location of South Fork Horse Creek.

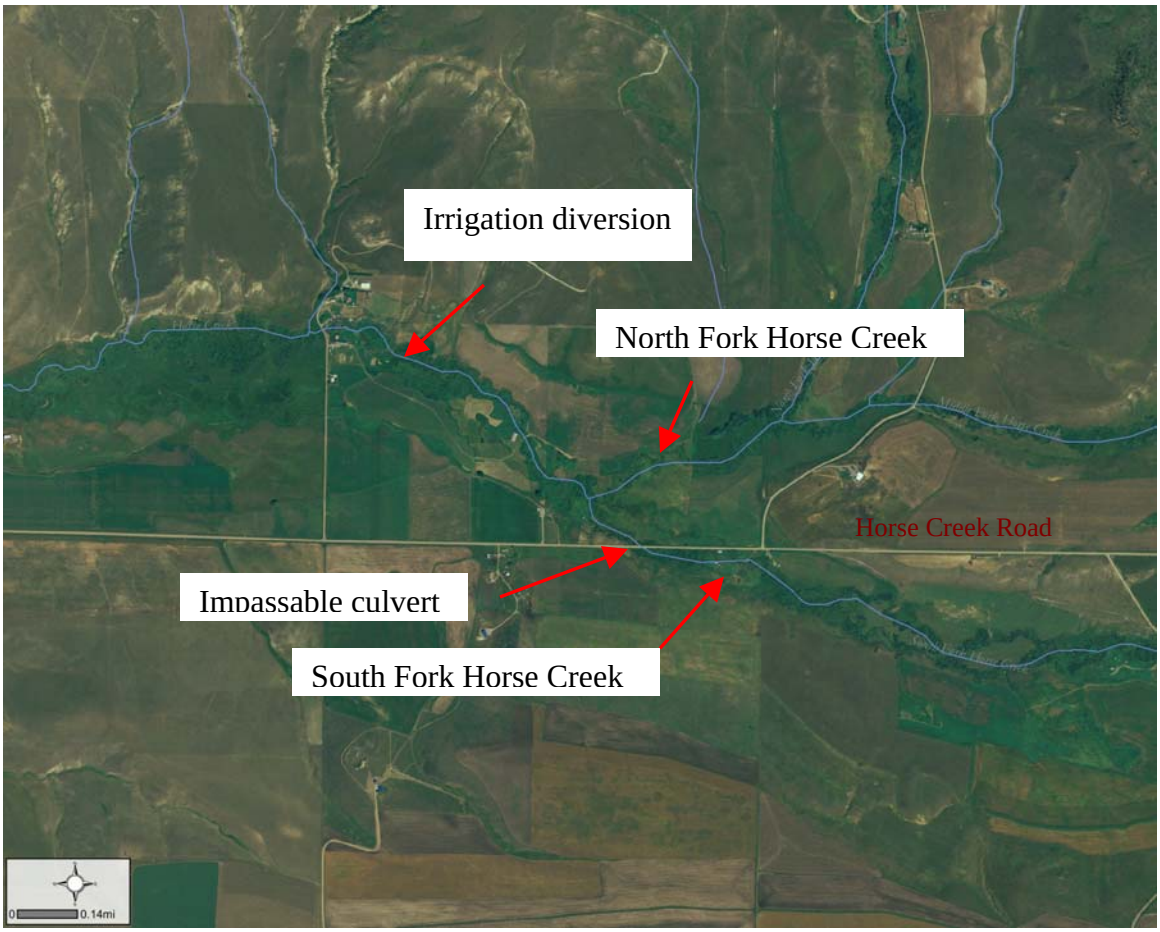

Figure 2-2: Aerial view of project area.

3.0 Fisheries Data Review

The Shields River drainage is a stronghold for Yellowstone cutthroat trout, and is rare among Montana watersheds supporting this species, as Yellowstone cutthroat trout occur throughout the entire drainage. In contrast, a common distributional pattern is for Yellowstone cutthroat trout to be relegated to headwater portions of streams. The abundance and widespread distribution of Yellowstone cutthroat trout within the Shields River watershed makes this an important area in native species conservation. Currently, a conservation strategy for Yellowstone cutthroat trout is under development for the Shields River basin that emphasizes connectivity, reducing entrainment in irrigation ditches, and improving and restoring habitat quality, including promotion of sufficient in stream flows.

Fisheries data for the Horse Creek drainage include population estimates on the main stem and north fork, and analyses of genetics. A fish survey conducted in 1999 found the main stem supported exceptionally high densities of Yellowstone cutthroat trout (Tohtz 1999) and analysis of these fish them to be pure Yellowstone cutthroat trout (Leary

2001). Population estimates above and below an irrigation diversion on North Fork Horse Creek in 2003 indicated similar densities of Yellowstone cutthroat trout in this tributary (MFWP unpublished data). South Fork Horse Creek data are limited to tissue analyses to evaluate the genetic purity of Yellowstone cutthroat trout in this stream (Leary 1992). At all diagnostic loci, only alleles characteristic of Yellowstone cutthroat trout were detected; however, a small sample size limited the certainty associated with results, making slight introgression from westslope cutthroat trout or rainbow trout a possibility. Nonetheless, pending collection of additional data, this population is to be managed as a pure Yellowstone cutthroat trout population. Combined, the genetic and population estimate data confirm the value of the Horse Creek drainage in supporting a healthy population of potentially pure Yellowstone cutthroat trout.

An informational gap relating to this potential project is a lack of understanding of seasonal movements and habitat use by Yellowstone cutthroat trout in the Shields River watershed. Information on timing of movements and size classes of fish making seasonal migrations is important in design specifications to ensure fish passage. For example, investigations of seasonal movements and habitat use of the closely related westslope cutthroat trout found fish moved considerable distances to access spawning, summer, and overwintering habitat (Magee 1993, Ireland 1993). Without an understanding of fish migration patterns in the Shields River watershed, fish passage requirements should allow for passage of all sizes through a range of flows.

4.0 Site Visit

On April 25, 2007, Melvin Goffena and I visited the site to evaluate potential for developing projects to benefit Yellowstone cutthroat trout. We evaluated existing culverts, riparian and stream habitat condition, and the irrigation infrastructure supplying water to several irrigators. We also discussed his management objectives for his property and developing Yellowstone cutthroat trout conservation strategies that would be compatible with a profitable ranching operation. Mr. Goffena stated a strong preference for a least intensive approach that capitalized on the stream's natural capacity to heal.

4.1 Culverts/Fish Passage

The Goffena property along the South Fork of Horse Creek begins at the downstream extent of a potentially impassible culvert under Horse Creek Road. This culvert was the subject of an earlier project assessment (Endicott 2007), which included the following observations:

> "Readily identifiable characteristics that suggest this culvert blocks fish movement include its steep gradient and length. Coarse field measurements suggested the pipe has an 8% slope over its 70 ft length. Within the pipe, the slope varies, as the upper few feet has a steeper slope owing to accumulation of debris (Figure 4-1). The combination of high slope and considerable length probably makes this culvert a passage barrier at most, if not all, flows."

Figure 4-1: Culvert presenting a probable fish barrier on the lower end of the Brumfield property.

Mr. Goffena supplied additional background on this culvert and some potential alternatives to improving fish passage and accommodation of flood flows. In the late 1800s, a bridge spanned South Fork Horse Creek at this road crossing. This was replaced with a culvert in the early part of the 1900s. In addition to being a fish barrier, backwatering during flood flows has caused South Fork Horse Creek to flow over the road as recently as 2003. He suggested construction of an overflow channel, which could occur on his property, designed to protect integrity of the road and reduce sediment loading from floodwaters.

Other culverts on the Goffena property include newly installed culverts crossing the north and south forks just above their confluence. Both are of sufficient size and are placed at an appropriate grade to facilitate fish movement. Nonetheless, including these in the inventory of road crossings, along with measurements allowing evaluation of fish passage potential, is consistent with the draft Shields River watershed Yellowstone cutthroat trout conservation strategy. Seeding the slopes of the road grade is also advisable to decrease sediment loading to Horse Creek.

Figure 4-2: New culvert crossing one of the forks of Horse Creek.

4.2 Stream Morphology and Riparian Condition

Stream channel and riparian conditions on the Goffena property are varied, but are generally compatible with a healthy fishery. Most of the stream has sufficient herbaceous ground cover and shrub canopy to promote bank stability, filtering of sediment and nutrients, and stream shading (Figure 4-3). Dominant species included thick stands of graminoids including reed canary grass (*Phalaris arundinacea* L.) and sedges (*Carex* sp.), and willows (*Salix* spp.). Historically, this system was likely beaver dominated, as evidenced by fine bank material. The stream channel is mostly a meandering Rosgen C channel. (Delineative criteria for C channels include slight entrenchment and moderate to high sinuosity [Rosgen 1996].) Width-to-depth ratios of C channels can be variable and range from moderate to very high. Relatively high and turbid flows obscured bed features; however, channel dimensions seemed to be stable and the channel did not appear to be overly wide.

Figure 4-3: View of typical stream and riparian conditions on Horse Creek and its forks on the Goffena property.

Although riparian condition and the stream channel morphology was typically intact and functioning, localized areas with sub-optimal conditions were present and related to current and past land uses. Several stretches of stream bank were actively eroding, with an absence of a deep root mass being a causal factor (Figure 4-4). These conditions have implications for water and habitat quality. Eroding banks contribute fine sediment and the lack of a willow canopy reduces shading, which leads to warmer summer water temperatures. Likewise, eroding banks do not provide quality habitat for fish along the bank margins. Moreover, if left unchecked, these lateral adjustments can result in an overly wide and shallow channel, which reduces the stream's ability to transport sediment and warms more easily during summer months.

Figure 4-4: Example of bank erosion on the main stem of Horse Creek.

Other features observed on the main stem of Horse Creek included past stream bank stabilization projects and a reach that was channelized prior to the passage of the Montana Natural Streambed and Land Preservation Act or 310 law. The channelized reach was stable and had regained some length. Although not optimal, the relatively short length, combined with the expense associated with renaturalizing the channel, makes this alteration a low priority for restoration. In other cases, eroding banks have been stabilized with rock of varying sizes. The use of boulder size rock that occurred in one reach is among practices no longer likely to be permitted under the 310 law permitting guidelines. In other cases, applying cobble-sized rock at the toe of the bank arrested additional erosion. The use of bank armoring, as opposed to an emphasis on vegetative stability, is unlikely to be permitted under current 310 permitting guidelines.

Figure 4-5: Eroding bank stabilized with application of cobble sized rock at the bank's toe.

4.3 Irrigation Infrastructure and Fish Entrainment

An irrigation diversion on Horse Creek supplies water to several irrigators with senior water rights (Figure 2-2). This diversion is a slide or Waterman gate, and likely entrains fish. Mr. Goffena suggested excavating a return channel back to the stream. This approach has been shown to be effective in Nevada where ditch flows became too warm, prompting fish to move back into streams. Alternatively, a fish screen, such as a rotating drum, coanda, or turbulent fountain screen, may be an appropriate conservation measure.

4.4 Flow and Temperature Monitoring

Mr. Goffena's priority was to obtain stream flow data from the north and south forks of Horse Creek and evaluate the quantity flows diverted at the diversion mapped in Figure 2-2. We discussed the use of data loggers such as AquaRods or other commercially available brands. The mouths of the south and north forks both lie on his property and are easily accessible from Horse Creek Road.

5.0 Conclusions and Recommendations

This property presents several opportunities to promote conservation of Yellowstone cutthroat trout, and is an appropriate candidate for assistance through the Landowner Incentive Program. Notably, the potential projects are consistent with the Yellowstone cutthroat trout conservation strategy under development for the Shields River watershed. These include promotion of connectivity, implementation of habitat and riparian restoration, reducing entrainment of fish into irrigation ditches, and obtaining information on stream flow throughout the basin.

As described in the project assessment for the upstream property (Endicott 2007), the culvert under Horse Creek Road is likely a barrier to fish movement, which is inconsistent with the conservation strategy for the watershed with its emphasis on promoting connectivity. Interest from both the upstream and downstream landowners, combined with Mr. Goffena's generous offer to allow use of his property for over flow is promising. After confirming both landowner's desire to proceed, the next steps will be to communicate with the county road department about a potential project, investigate funding opportunities, and develop conceptual plans to promote fish passage while protecting the road and promoting transport of sediment and debris.

Although the stream morphology and riparian health and function are generally intact, localized areas of eroding bank would benefit from stabilization and riparian plantings. Figure 5-1 illustrates a conceptual approach to stabilizing banks of this type. Essentially, this method emphasizes restoration the stable bank geometry and the promotion of the functional attributes of riparian vegetation in maintaining bank stability. Associated benefits include improved water quality through shading of the stream and increasing bank line roughness, which will trap fine sediment, thereby reducing siltation.

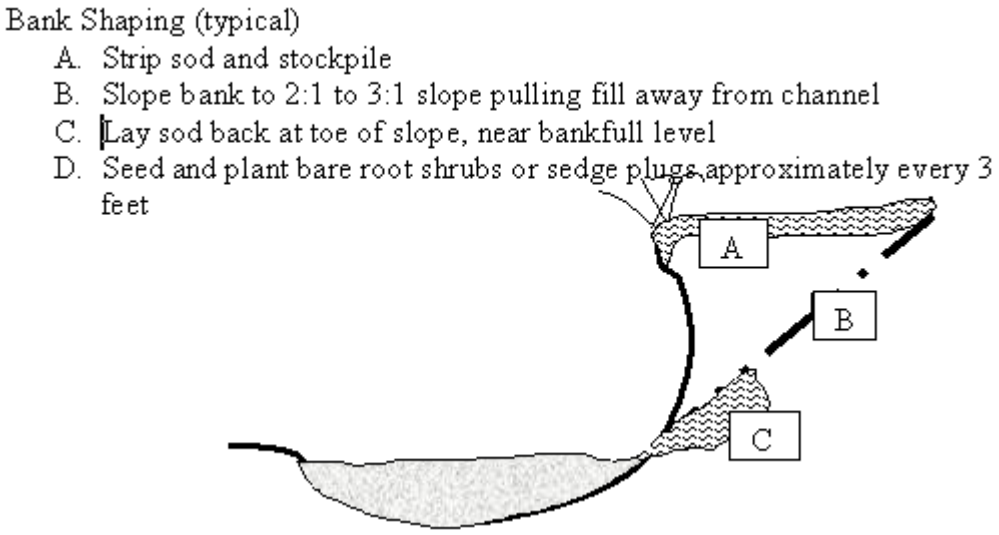

Figure 5-1: Conceptual approach to stabilizing steep eroding stream banks.

Previous work to stabilize banks on Horse Creek involved armoring banks with rock of varying size. Current guidelines followed by the conservation district require justification for the use of rock in stabilizing banks. As rock is largely absent from naturally stable banks, and vegetation is sufficient in maintaining stability, the "soft" approach, which emphasizes riparian plantings, bank resloping, and use of biodegradable erosion control fabric, is the preferred method.

Implementation of agricultural best management practices is another recommendation to maintain bank stability and riparian health. As noted, existing practices are largely compatible with stream health. Nonetheless, maintaining a sufficient buffer of deep-

rooted riparian plants between hayed fields and the stream along eroding banks is one applicable measure. The use of temporary, portable electric fence may further protect these banks from livestock during recovery. Development of off-stream water is another option.

Financial assistance is often available for implementation of grazing management activities and habitat restoration. The Natural Resources Conservation Service is currently seeking applications for its Environmental Quality Incentives Program (EQIP). If the landowner agrees to pursue this approach, the LIP-YCT biologist can prepare the grant application.

Three options exist for preventing or reducing entrainment of Yellowstone cutthroat trout in to the irrigation ditch on this property. Following MFWP guidance on shutting down ditch operations is the least intensive approach. Essentially, this calls for staggering shutdown over three days. The gradual decline in flow will cue fish to move upstream and out of the irrigation ditch. Maintaining the ditch so that it lacks refugia such as pools or boulders is an important corollary activity to this approach.

An alternative to managing cessation of ditch operations is installation of a fish screen that allows delivery of water while blocking fish entrainment. Several options are available including coanda screens, rotating drum screens, and turbulent fountains. In addition, grant funds are available through several sources for installation of these effective solutions to fish loss. Evaluation of fish entrainment at the existing head gate is needed to justify costs.

Construction of a bypass channel that returns fish to the stream is the third option. Mr. Goffena suggested this approach and identified suitable locations. This option has the advantage of being less expensive than a fish screen.

Data gaps identified in the draft Yellowstone cutthroat trout conservation strategy included a lack of information on stream flows and limited understanding of fish movements and critical habitats for spawning and rearing. Installation of data loggers to evaluate stream flow and temperature is therefore compatible with the conservation strategy for the basin. Likewise, collecting flow data to develop a ratings curve correlating stage to flow provides opportunities to collect additional information, such as redd counts.

In conclusion, the property presents several opportunities to enhance and conserve Yellowstone cutthroat trout in the Horse Creek drainage, and the larger Shields River watershed. In the event that the landowner is interested in proceeding, the following are the next logical activities:

- Assess potential fish passage using a standard methodology at all road crossings from the mouth of Horse Creek to its headwaters.
- Develop conceptual design and initial cost estimate for culvert replacement or modification as needed.

- Work with landowner to develop a livestock grazing strategy that accommodates needs for forage and stock water while protecting stream banks, channel, and riparian vegetation.
- Develop a conceptual plan and initial cost estimate for stream restoration and bank stabilization.
- Evaluate fish loss through the existing head gate.
- Work with landowner to develop an appropriate approach to reducing or eliminating fish entrainment (staggered shut down or fish screen).
- If selected, develop a conceptual plan and initial cost estimate for installing a fish screen.
- Apply for grants to fund restoration and enhancement activities.
- Install flow measuring devices at several locations, including the mouths of the north and south forks, and in the irrigation ditch.

6.0 Literature Cited

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