# Willow Creek

Initial Project Assessment

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# Table of Contents



# List of Figures

# 1.0 Introduction

The Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), a Montana native, has declined in abundance and distribution throughout its historic range. Seeking to reverse this trend on private lands, the Landowner Incentive Program/Yellowstone cutthroat trout project 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 on Willow Creek, a tributary of Soda Butte Creek near Silver Gate, 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 substantial benefits to Yellowstone cutthroat trout are possible, and if landowners agree to proceed with conservation activities, Montana Fish, Wildlife & Parks' (FWP's) Yellowstone cutthroat trout restoration biologist will provide technical, financial, and planning assistance to implement restoration activities on these private lands.

# 2.0 Project Area

Willow Creek is in the Yellowstone headwaters hydrologic unit (hydrologic unit code [HUC] 10070001) in south central Montana, just north of the border of Yellowstone National Park (Figure 2-1). This stream is unmapped and lacks an official name; however, local residents refer to it as Willow Creek. Willow Creek originates in a sedge (*Carex* sp.) and willow-dominated (*Salix* sp.) wetland on the north and south sides of Highway 212, and flows through the small town of Silver Gate, for about 1/3-miles until its confluence with Soda Butte Creek. The surrounding watershed is mountainous, and dominated by lodgepole pine (*Pinus contorta*) forest. The area burned in the 1988 fires, and standing, dead timber still occupies the surrounding hillslopes (Figure 2-2).

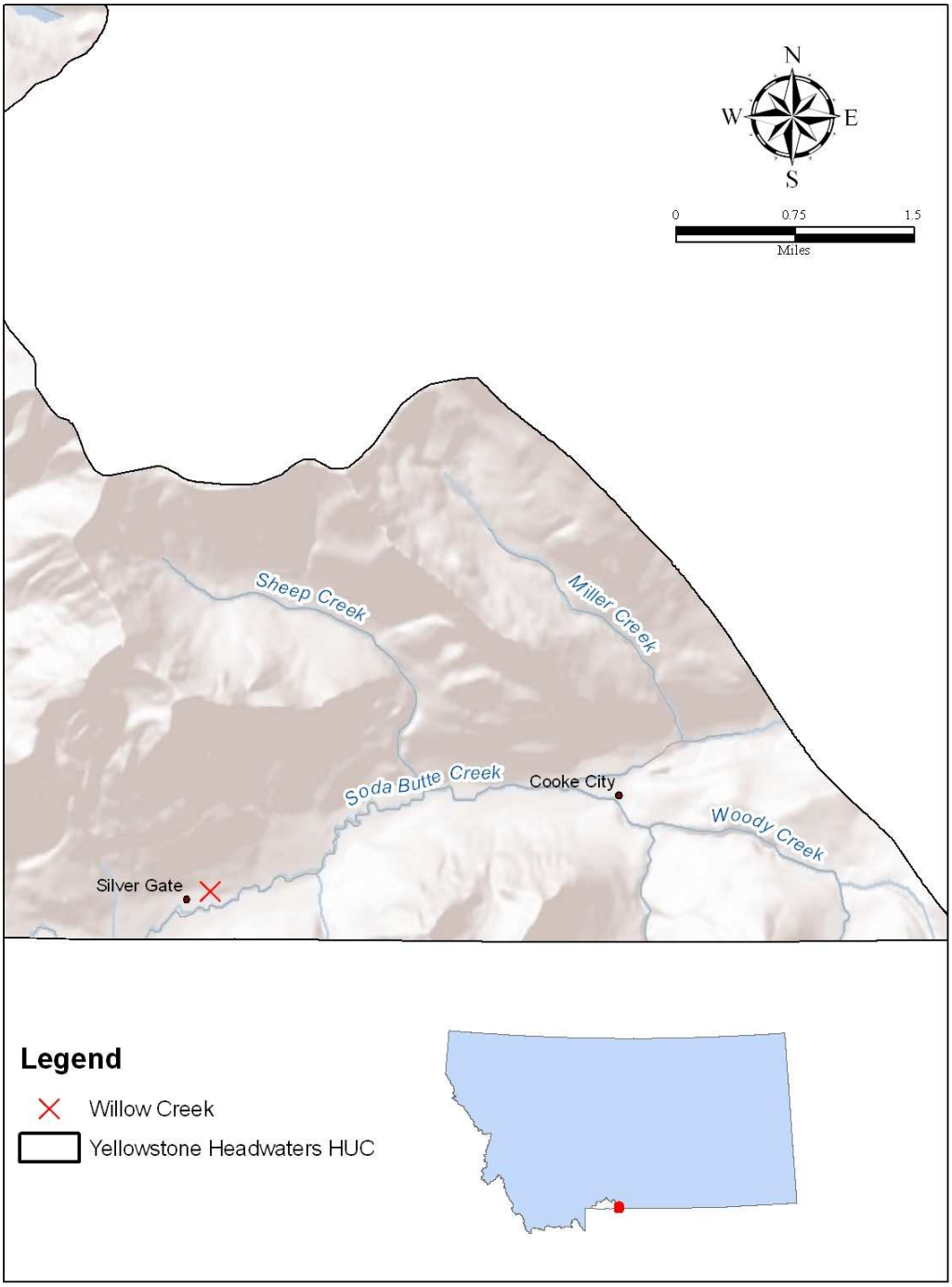


**Figure 2-1: Overview map of Soda Butte Creek in the Yellowstone headwaters HUC.**


**Figure 2-2: Aerial view of Willow Creek.**

# 3.0 Field Investigations

On August 31, 2009, Carol Endicott, FWP's Landowner Incentive Program biologist and Jeremiah Wood, the area fisheries biologist visited Willow Creek. Willow Creek is part of an ongoing brook trout (*Salvelinus fontinalis*) suppression project in the Soda Butte Creek watershed, and activities included electrofishing the entire length of Willow Creek, and evaluating habitat quality and restoration potential. Marcia Woolman, a part-time resident accompanied FWP biologists, and provided historic context of conditions in Willow Creek

According to Ms. Woolman, Ann Herman, a long-time landowner who is now deceased, reported Willow Creek once supported a strong Yellowstone cutthroat trout spawning run. During June, she would often count more than 200 spawning cutthroat ascending from Soda Butte Creek. Likewise, Howard Sloan, a long-time summer resident recalled Ann Herman showing him the spawning cutthroat in the 1980s. The fish were so thick in Willow Creek that it seemed like you could walk across them. The 1988 fires burned extensively in the surrounding watershed, and resulted in delivery of substantial amounts of fine sediment to Willow Creek, which led to a crash in the cutthroat trout spawning run. In recent years, adjacent landowners have observed a few fish spawning in Willow Creek, but far less than pre-fire numbers.

Field observations supported the contention that accumulation of fine sediment has impaired the potential for spawning in much of Willow Creek. In places, anaerobic mud dominated the streambed, and achieved depths of greater than two feet. Gravel was rare, and where present, had high levels of fine sediment clogging interstices, and limiting the quality of potential spawning habitat.

Although hillslope erosion following the 1988 fires likely contributed considerably to the impaired habitat and water quality in Willow Creek, other factors are preventing Willow Creek from recovering from this disturbance. Road construction on the adjacent Highway 212 has been ongoing for at least three years, and is a source of fine sediment. Although some erosion control best management practices (BMPs) are in place, substantial gaps are present that allow for delivery of fines (Figure 3-1). Periodic thunderstorms were rolling through during the field visit, and an influx of sediment was readily apparent.

**Figure 3-1: Erosion control BMPs and gaps allowing delivery of fine sediment.**

Undersized and improperly placed culverts present another factor limiting habitat quality, and Willow Creek's ability to transport sediment contributed from burned hillslopes and road construction. For example, one road culvert place perpendicular to stream flow is likely inefficient in conveying flow and transporting sediment and debris (Figure 3-2). Likewise, a number of stream crossings associated with residences impound flows, resulting in near lentic conditions, with deep accumulations of mud burying any gravel that may be present (Figure 3-3).

**Figure 3-2: Improperly placed culvert on Willow Creek.**

**Figure 3-3: Portion of Willow Creek impounded by an improperly placed and undersized culvert.**

Upstream of the residential area, Willow Creek flows through a wet meadow dominated by sedges and willows (Figure 3-4). Before the highway construction, the channel consisted of a simple ditch next to the highway that lacked habitat features for fish (Jim Olsen, FWP, personal communication). Highway construction coincided with excavation of a new channel, located farther from the highway. Overall, this was beneficial to Willow Creek, as it likely reduced loading of fine sediment from the highway. Nonetheless, the channel constructed to convey flow does not have the form and function of a natural stream channel (Figure 3-5).

**Figure 3-4: Newly constructed channel in wet meadow east of Silver Gate.**

**Figure 3-5: Excavated channel in the meadow reach of Willow Creek.**

Electrofishing of the length of Willow Creek resulted in capture of 28 Yellowstone cutthroat trout and 2 brook trout. The brook trout were both ripe males, and were killed, consistent with the brook trout suppression project underway. Fish were typically not encountered in impounded reaches with deep muck bottoms, but were concentrated where stream form and function were largely intact. Despite its unnatural channel configuration, several cutthroat trout occupied the newly created channel, including some of the larger fish encountered. In general, Willow Creek had some relatively large fish for such a small stream (Figure 3-6). Electrofishing results suggest Willow Creek could support an impressive resident fishery with restoration of habitat and water quality.

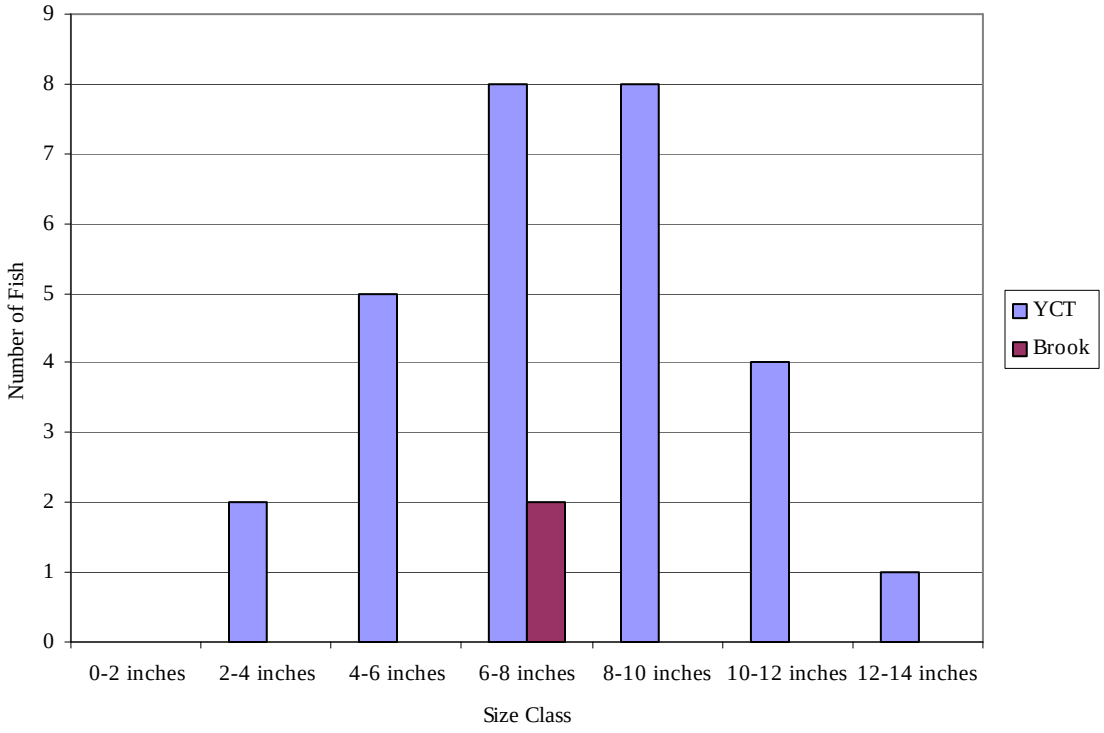


**Figure 3-6: Length frequency histogram of fish captured in Willow Creek.**

# 4.0 Conclusions and Recommendations

Natural disturbance, roads, and infrastructure associated with residences have limited Willow Creek's ability to provide high quality habitat for resident fish. Likewise, these alterations have possibly reduced recruitment of Yellowstone cutthroat trout to Soda Butte Creek. Nonetheless, a number of actions would restore habitat and water quality, along with associated fisheries values. Essentially, the goals are to improve sediment transport and flow conveyance, and improve habitat for all life history stages of Yellowstone cutthroat trout.

Construction of a new, functioning stream channel within the wet meadow upstream of Silver Gate would be beneficial in improving habitat and increasing Yellowstone cutthroat trout recruitment. The recommended actions involve excavating a new channel having cross-sectional channel dimensions and planform typical of natural spring creeks. The spoils from the new channel would be used to fill the channel created during highway construction to a depth that allows this channel to function as an emergent wetland.

A recently completed spring creek project near Big Timber, Montana illustrates this approach (Figure 4-1). The original channel was relatively straight, and did not provide habitat features such as pools, overhead cover, or substrate suitable for spawning. The new channel was constructed within the wet sedge meadow, a setting very similar to Willow Creek. The constructed channel had greater sinuosity and its bed morphology

consisted of riffle/pool sequences, typical of natural channels. Spawning size gravel was imported to the stream to provide high quality spawning habitat.

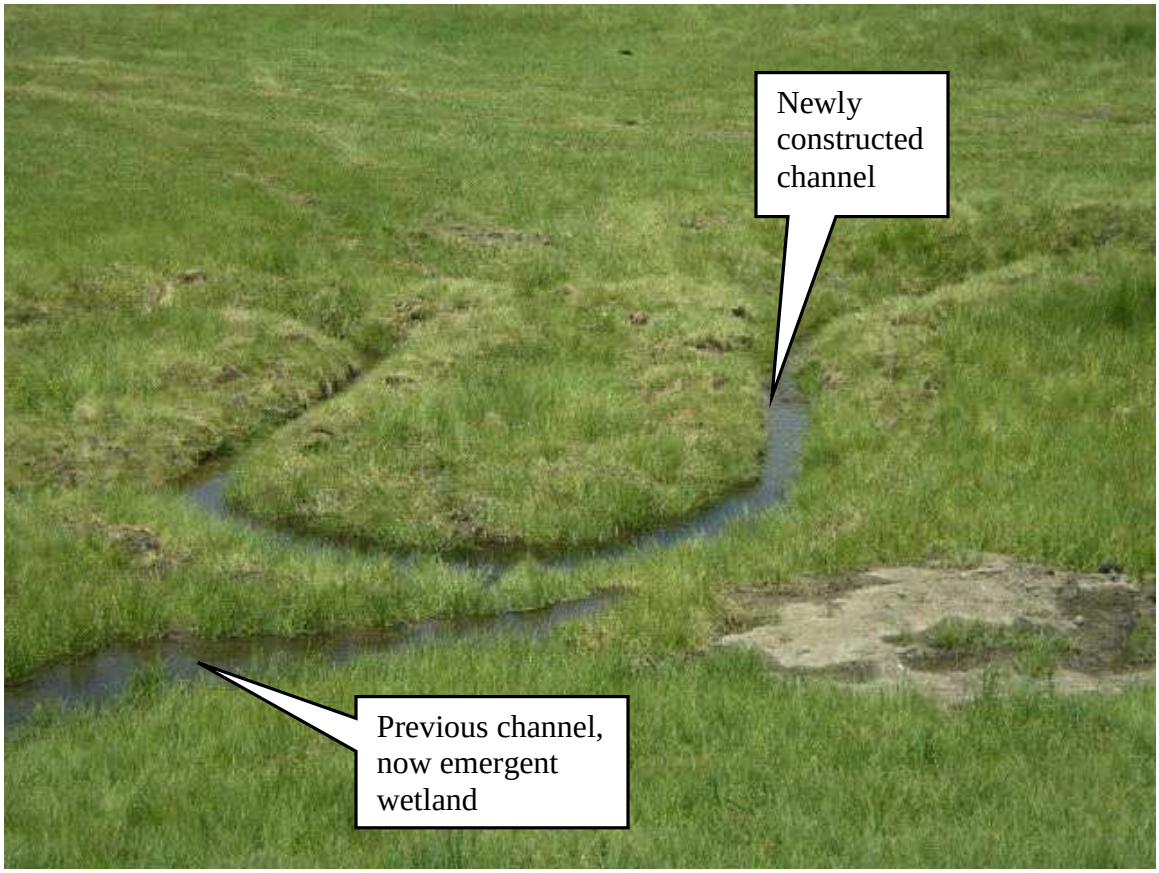


**Figure 4-1: Recent spring creek enhancement project**

Ideally, channel construction would hit a layer of native gravels that would provide the streambed features required for spawning. The channel excavated during highway work did not encounter a gravel layer, suggesting these particles would need to be imported to the site. The new channel would be over-excavated to accommodate introduced gravel (Figure 4-2). Banks would be constructed of stacked sod mats salvaged during channel excavation, or borrowed from elsewhere on site.

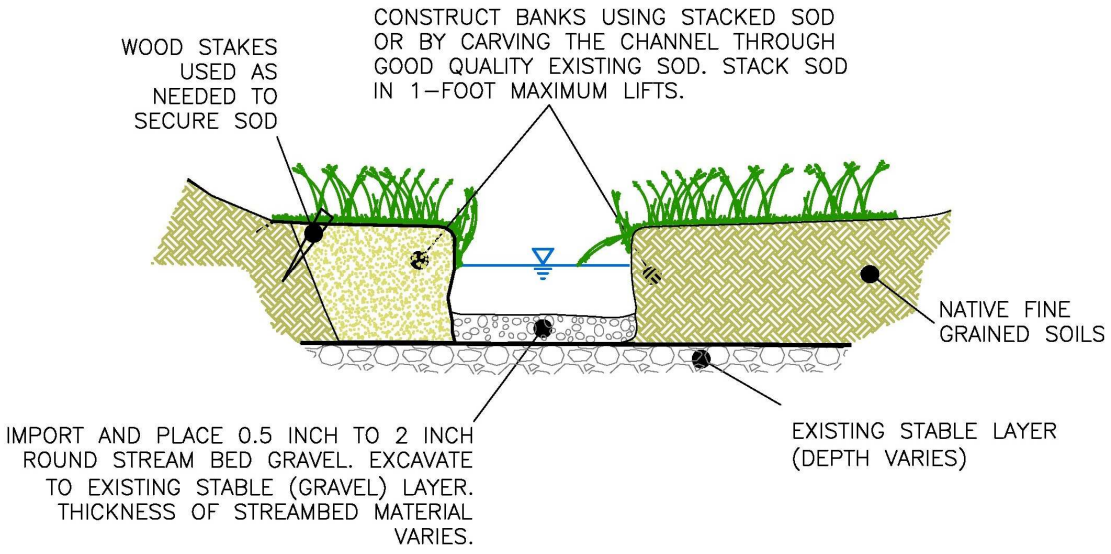


**Figure 4-2: Typical riffle cross-section of a constructed channel for Willow Creek (from OASIS 2008).**

Replacing or modifying culverts associated with roads and residences would contribute to improving stream form and function. This component would require working with landowners to ensure the stream crossing option meets their requirements. In some cases, a footbridge may be sufficient. Bottomless arch culverts of sufficient size are likely appropriate for established road crossings or residential crossings that need to accommodate vehicles.

Although some channel restoration may be feasible in the residential portion of Willow Creek, the density of structures may preclude use of heavy equipment for much of its length. Replacing stream crossings with bridges or culverts that adequately convey flow, debris, and sediment may be sufficient in restoring habitat quality. Over time, Willow Creek would recover without mechanical channel restoration, as restoring flow conveyance and sediment transport would allow the stream to become narrower in places, and scour and maintain pools. Evaluating the feasibility of mechanical restoration, and the cost benefits of mechanical channel restoration versus natural recovery would be informative.

The complexity of landownership along Willow Creek presents a challenge to restoration planning. About 15 different landowners own property adjacent to this stream, and few are year round residents. According to Marcia Woolman, many adjacent landowners are aware of the potential to restore water and habitat quality in Willow Creek, and are in favor of the project. The planning component of this project would require strong outreach and communication elements.

In summary, Willow Creek has exceptional potential to support resident Yellowstone cutthroat trout, and provide spawning habitat for fluvial fish migrating from Soda Butte Creek. Potential conservation actions include creation of a functioning natural stream channel in the meadow reach, and improving infrastructure within the residential portions to improve flow conveyance and sediment transport. The recommended next steps are as follows:

1. Contact adjacent landowners to inform them of the potential project and obtain permission for accessing private properties for survey and data collection.
2. Develop a cost estimate for a design and feasibility study.
3. Procure grant funds to pay for the design and feasibility study, which would then be used to acquire grant funds for restoration and construction.

# 5.0 Literature Cited

OASIS. 2008. Kickabuck Spring Creek channel design and barrier feasibility study. Report prepared for Montana Fish, Wildlife & Parks. OASIS Environmental, Livingston, Montana.