SMITH RIVER BASINWIDE ASSESSMENT
& WATERSHED RESTORATION PLAN

DECEMBER 2024

Prepared For
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Acronym List

Aquatic Organism Passage (AOP)

Beaver Restoration Assessment Tool (BRAT)

Bureau of Land Management (BLM)

Conservation District (CD)

Conservation Network Subwatersheds (CWNs)

cubic feet per second (cfs)

Environmental Assessment (EA)

Environmental Impact Statement (EIS)

Environmental Protection Agency (EPA)

Fishing Access Site (FAS)

General Land Office (GLO)

Major Land Resource Areas (MLRAs)

Memorandum of Understanding (MOU)

Montana Bureau of Mines and Geology (MBMG)

Montana Department of Environmental Quality (DEQ)

Montana Department of Fish, Wildlife, and Parks (FWP)

Montana Department of Natural Resources and Conservation (DNRC)

Monana Land Reliance (MLR)

Montana Natural Heritage Program (MTNHP)

Montana State Library (MSL)

National Aerial Imagery Program (NAIP)

National Hydrography Dataset (NHD)

National Water Quality Incentive (NWQI) Restoration Plan

Natural Resources Conservation Service (NRCS)

Northern Continental Divide Ecosystem (NCDE)

Rangeland Analysis Program (RAP)

Soil Conservation Service (SCS)

Statewide Fisheries Management Plan (SFMP)

Smith River Habitat Project (SRHP)

Smith River Corridor Enhancement Account (SRCEA)

Soil Survey Geographic Database (SSURGO)

Targeted Implementation Plan (TIP)

Total Dissolved Solids (TDS)

Total Maximum Daily Load (TMDL)

Total Suspended Solids (TSS)

United States Department of Agriculture (USDA)

United States Forest Service (USFS)

United States Geological Survey (USGS)

United States Fish and Wildlife Service (USFWS)

Watershed Restoration Plan (WRP)

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1 Introduction

The Smith River basin supports a strong agricultural economy and a similarly robust recreational resource. Both of these primary land uses have left their signature on the landscape, creating pressures that in some cases have demonstrably impacted the health of its water resources. To date, there has been substantial assessment, management and restoration work planned and performed on public lands located at higher elevations on the watershed margins. However, little has been done lower in the basin where streams become larger and private land is extensive. This assessment focuses on the lower elevation stream corridors that are largely on privately owned working lands. Additionally, special focus is given to the recreational float corridor of the Smith River Canyon which hosts a mix of private and public land ownership.

The Smith River basin has been subject to similar impacts as many watersheds in Montana, starting with mining speculation in the 1860s, followed by homesteading in the 1880s, a rise of agriculture and ranching through the early 1900s, and the timber harvest and land development that accompany these land uses. The historic impacts to the water resources of the Smith River basin are widespread but tend to be largely diffuse such that there is little in the way of any "smoking gun" that can be directly addressed to provide large scale system-wide benefit. The widespread and dispersed impacts provide an excellent opportunity to engage landowners and public land managers in the application of a broad array of established practices to improve overall watershed health.

To that end, this assessment was performed to identify feasible strategies to improve the ecological health of the Smith River watershed through "win-win" projects that benefit the watershed and meet landowner needs. The document is intended to provide a foundation that can be continually updated as more scientific data becomes available, new projects are developed, and other projects are completed.

This document is intended to provide a practical resource for all stakeholders in the basin. It will help Montana Fish, Wildlife, and Parks (FWP) prioritize the use of Smith River Corridor Enhancement Account (SRCEA) funds, satisfy requirements of a Montana Department of Environmental Quality (DEQ) and Environmental Protection Agency (EPA) approved 319 Watershed Restoration Plan (WRP), and support the potential future development of a Natural Resources Conservation Service (NRCS) National Water Quality Incentive (NWQI) Restoration Plan. Meeting these other agency plan requirements improves the plan's completeness while opening up potential funding sources for future project work.

In early 2023, FWP contracted with Geum Environmental Consulting of Hamilton, Montana to lead the assessment. Geum engaged the services of Slough Creek Consulting (formerly Applied Geomorphology of Bozeman, Montana) for assistance.

Specific tasks completed as part of the assessment include:

- Compile and summarize existing data, perform a field review, and identify primary limitations to watershed health.
- Identify restoration strategies to improve degraded stream and floodplain conditions.
- Identify specific stream segments where specific restoration strategies are appropriate.

- As possible, further develop projects to a site-scale with stakeholder engagement.
- Compile results into a plan that summarizes the likely historic and current condition of the streams in the basin, describes how negatively affected streams have become degraded, lists strategies to reverse degradational trends, and prioritizes approaches to optimize beneficial outcomes.
- Engage stakeholders throughout the process. This is critical as the lack of a local non-profit watershed group that can spearhead a large-scale restoration program will require creative collaboration strategies.
- Deliverables from the assessment include: assessment report; spatial layers created during assessment analyses (see Section 5.1); and a public share drive with access to the assessment report and spatial layers created as part of the assessment, meeting presentations, reference documents, georeferenced photos, basin maps and a compiled list of sources and spatial data layers used as part of the assessment.

1.1 Source of Funding

This assessment was funded by FWP through SRCEA funds. Expenditure of SRCEA funds is described in Montana Code 23-2-409 (MT Code 2021):

I. All money collected as recreational and commercial user fees for floating and camping on the Smith River waterway pursuant to 23-2-408 must be deposited in the state treasury in the Smith River Corridor enhancement account in the state special revenue fund to the credit of the department.
    a. The following portions of recreational and commercial user fees deposited in the Smith River Corridor enhancement account must be used for the purposes in subsection (2)(b):
        i. $50 of each commercial outfitter client fee:
        ii. all revenue from sale of super permit lottery chances; and
        iii. 5% of other floater fee revenue, except for the nonrefundable permit application fee.
    b. The sum of the funds described in subsection (2)(a) must be expended to:
        i. protect and enhance the integrity of the natural and scenic beauty of the Smith River waterway and its recreational, fisheries, and wildlife values through the lease or acquisition of property, including lease or acquisition of partial interests in property by the department within the Smith River Corridor;
        ii. pursue projects that serve to protect, enhance, and restore fisheries habitat, streambank stabilization, erosion control, and recreational values within the Smith River Corridor, including Smith River tributaries; and
        iii. pursue projects that serve to maintain and enhance instream flows for recognized recreational and aquatic ecosystem values in the Smith River Corridor.

II. All other funds in the Smith River Corridor enhancement account may be used to manage, operate, and maintain the Smith River Corridor.

1.2 Acknowledgements

Over the past year, numerous people have graciously offered their time and expertise to support the assessment effort. Jason Mullen of FWP provided continual support towards project management, logistics, field work assistance, site interpretations, document review and general day-to-day support; this project would have been exceedingly difficult without that contribution. Early meetings with Lacey Rasmussen with the Meagher County Conservation District (CD) and Jennifer Paddock with the White Sulphur Springs NRCS office were very helpful in identifying watershed issues and providing landowner introductions. Representatives from the NRCS, Cascade CD, FWP, DEQ, the Helena National Forest, and the Meagher County Stewardship Council provided valuable input and documents that greatly facilitated the work.

Nate Klutz of FWP floated the recreational corridor with the project team and his insights were valuable as a past river ranger in that section. His breadth of knowledge of the Smith River Canyon is unsurpassed. Several river guides encountered during the float were similarly generous with their first-hand knowledge of the river and issues.

Lastly, several Meagher and Cascade County landowners also shared their views and provided access to stream corridors on their properties. This plan is for the people of the Smith River watershed, and the intent is for the information provided to facilitate their continued stewardship of this unparalleled resource.

1.3 Project Information Sharing

A SharePoint OneDrive folder is available to the public to access information compiled or created as part of the assessment. The folder can be accessed at the following link:

https://geumcons-my.sharepoint.com/:f:/g/personal/asacry_geumcons_onmicrosoft_com/EnELsbPxun1Drglvz9OKuLABuzKBpqgDWlPtdez1Z2cyRw?e=ldFBfi

This folder includes the following:

- Meeting presentations and recordings
- A source list and source documents
- Pdf files of report and executive summary
- Select spatial layers created as part of the assessment
- Geotagged photographs taken as part of the assessment

1.4 Overview of Issues and Document Organization

The main issues affecting the health of the Smith River basin are reduced water quantity, impaired water quality and degraded riparian and aquatic habitat. Optimal restoration outcomes for the basin are to have sufficient low flows, water quality and habitat conditions to optimally support robust and sustainable populations of desired aquatic and terrestrial life while also supporting people, agriculture and recreation. These three conditions are interrelated in terms of cause and remedy, which provides opportunities to address multiple impacts with individual strategies. Whereas habitat degradation tends to be site-specific, degraded water quality and dewatering issues are widespread and connected. This indicates that work needs to include restoring channels at given sites, restoring floodplain function, and modifying the current patterns of water use.

Improving low flow conditions on Montana's rivers is an active endeavor across the state. No single approach has proven to be a major success on all systems due to the individuality of watershed conditions, resources, and political will. In a similar fashion, there are no major point sources in the basin that contribute to water quality degradation, hence the solutions are broad and provide incremental gains. Because issues are common and widespread, a long-term collaborative approach to restoration in the basin is needed.

A wide range of actions are available to address the issues in the Smith River basin. Potential actions to address water quantity issues include modifying irrigation practices, finding additional water storage opportunities, water leasing or purchasing, implementing alternative agricultural practices, removing conifer encroachment, and developing a drought response plan for the basin. Potential actions to address water quality issues include creating riparian buffers, restoring floodplain connectivity, grazing management, nutrient management, implementing road Best Management Practices (BMPs) and road decommissioning, and improving recreation management. Potential actions to address riparian and stream habitat issues include streambank and channel restoration, restoring floodplain vegetation communities, improving forest and grassland health, and integrated weed management. Conservation of existing high quality aquatic habitats and floodplains is a high priority for the Smith River basin as is maintaining the high level of fluvial connectivity in the basin.

This document provides information ranging from the history of development in the basin, to a summary of relevant research, assessments and management plans, to specific actions needed on individual streams. To help readers and users navigate the document and find desired information, the below provides an overview of document sections:

Section 2 – Smith River Basin Overview (p. 7)

This section provides an overview of the Smith River basin including physical characteristics, hydrology, vegetation, fisheries, wildlife and socioeconomic conditions.

Section 3 – History of Basin Development (p. 30)

This section describes the history of human occupation and development in the basin from early indigenous peoples to settlers and the onset of mining, agriculture, logging, water development and recreation.

Section 4 – Summary of Relevant Research, Assessments, Management Plans, and Agreements for the Smith River Basin (p. 42)

This section provides a summary of the most relevant research, assessments, management plans and agreements that apply to water resources in the Smith River basin. The purpose of this section is to provide readers with an understanding of the current state of knowledge of water resources in the basin as well as information on how the basin is currently managed. This section is organized by: planning and management (4.1); general stream assessments (4.2); water quantity assessments (4.3); water quality assessments (4.4); and a summary of research and assessments completed by Sandfire Resources America (SRA) for the Sheep Creek watershed (4.5).

Section 5 – Primary Issues Causing Basin Degradation (p. 69)

This section describes how the Smith River basin has been degraded and causes of degradation. Methods used to assess basin degradation are described in this section. An overview of the main degradation issues in the basin and their causes. There is a sub-section for each issue that describes potential causes, resulting conditions and ecological consequences. This section provides information on the following issues: climate change (5.2.1); water quantity (5.2.2); water quality (5.2.3); riparian and aquatic habitat (5.2.4); upland vegetation (5.2.5); and recreation (5.2.6).

Section 6 – Restoration Framework (p. 101)

This section provides context for restoration in the basin describing how issues are interrelated, what the desired future conditions for the basin might be, and the unknowns and uncertainties related to accomplishing large-scale restoration.

Section 7 - Restoration and Management Actions (p. 108)

This section describes the range of restoration and management actions proposed for the Smith River basin. Restoration actions are discussed in terms of three main categories of impacts – Water Quantity, Water Quality, and Riparian and Stream Habitat.

Section 8 – Target Area Restoration Actions (p. 125)

This section includes information on where degradational issues occur in the Smith River basin and what restoration actions are recommended in those areas. For purposes of this assessment, ***target areas*** are those streams or stream segments where substantial cumulative benefits to the system could be achieved through the application of established, cost-effective restoration techniques. Some target areas selected for further analysis and assessment are referred to as ***near-term focus target areas***. These are target areas where available data or field observations identified significant impairment and were therefore selected as the highest priority areas to start addressing issues and implementing restoration actions in the basin.

This section describes the process for selecting near-term focus target areas, methods for remote assessment of near-term focus target areas, and a summary of issues and proposed restoration actions for each target area.

Section 9 – Restoration Implementation Plan (p. 217)

This section can be considered the User's Guide to implementing the restoration actions described in Section 8. This section describes pilot projects identified during the assessment process that will be implemented to provide examples of project work and start addressing issues identified in the basin. This section provides a strategy for developing leadership and partnerships in the basin to continue addressing basinwide issues as well as a strategy for education and outreach to increase stakeholder awareness of issues in the basin. This section also describes potential funding and technical support for restoration work in the basin, guidance on how to consistently monitor restoration actions and adapt the WRP over time, and a schedule for implementing the WRP.

Appendix A – Smith River Basin Maps

This appendix provides additional resource maps of the Smith River Basin showing precipitation, geology, ecoregions, soils, water quality monitoring stations, and soil nitrate leaching potential.

Appendix B – Near-term Focus Target Area Remote Assessment Methods and Results

This appendix provides the results of the remote assessment completed to quantify issues identified in near-term focus target streams. This analysis quantifies issues within the riparian buffer of near-term focus target streams.

Appendix C – Potential Funding Sources for Planning and Project Implementation

This appendix provides an overview of funding sources that could be used for work addressing the primary issues causing basin degradation. The appendix includes a description of each funding source, who is eligible to apply, and funding limits for each source.

Appendix D – Boat Camp Bioengineering Suitability

This appendix provides a summary of bank erosion conditions at each boat camp within the Smith River recreational float corridor and identifies which are most suitable for soil erosion control measures that can be implemented without the use of heavy equipment.

2 Smith River Basin Overview

The Smith River basin straddles Meagher and Cascade Counties almost due south of Great Falls, Montana (Figure 1). The watershed is approximately 75 miles long between the headwaters to the south and its confluence with the Missouri River near Ulm, Montana. It occupies about 2,000 square miles (1.3 million acres) and is bounded by the Big Belt Mountains to the west and the Little Belt and Castle Mountains to the east. The headwaters are part of the northern Rocky Mountains with elevations reaching 9,500 feet, and the lower river valley lies within the Great Plains, with an elevation of 3,320 feet at the mouth.

Meagher County hosts the upper watershed, and as the river flows northward towards its confluence with the Missouri River it crosses southern Cascade County. The largest community in the watershed is White Sulphur Springs which is located in the south-central portion of the basin. Overall ownership consists of 70% private lands, 23% U.S. Forest Service (USFS), 6% State of Montana, and 1% Bureau of Land Management (BLM) (Figure 2).

The mainstem Smith River is 120 miles long, flowing from the confluence of the North Fork and South Fork a few miles southwest of the community of White Sulphur Springs to its confluence with the Missouri River. In the uppermost watershed, the North Fork drains the eastern flanks of the Little Belt Mountains, a large isolated island mountain range, and northern margin of the Castle Mountains, an island mountain range east of White Sulphur Springs. The South Fork flows along the axis of the watershed from the south, originating on the southwest margin of the Castle Mountains.

The Smith River basin can generally be divided into three main reaches: upstream of Camp Baker, Camp Baker to Eden Bridge with a distinct canyon section and including the recreational float corridor, and downstream of Eden Bridge (Figure 3). Upstream of Newlan and Camas Creeks, the Smith River flows through a broad, unconfined low gradient valley near White Sulphur Springs (Figure 4). General Land Office (GLO) survey notes from the late 1800s describe "boggy bottoms" in several areas that are characterized by groundwater upwelling today. This is especially prevalent between the confluence of the South Fork and North Fork and Newlan Creek. Just below the Newlan Creek confluence, a diorite sill is exposed on the ground surface; researchers have indicated that this groundwater barrier drives upwelling upstream (Caldwell and Eddy-Miller, 2013) (Figure 5). Riparian vegetation along the Smith River in this upper reach is predominantly introduced pasture grasses with sandbar willow on inside bends. Occasionally cottonwood stands occur in historic channel meanders. Major tributaries contributing to this upper section include the North Fork, South Fork, Big Birch Creek, and Newlan Creek.

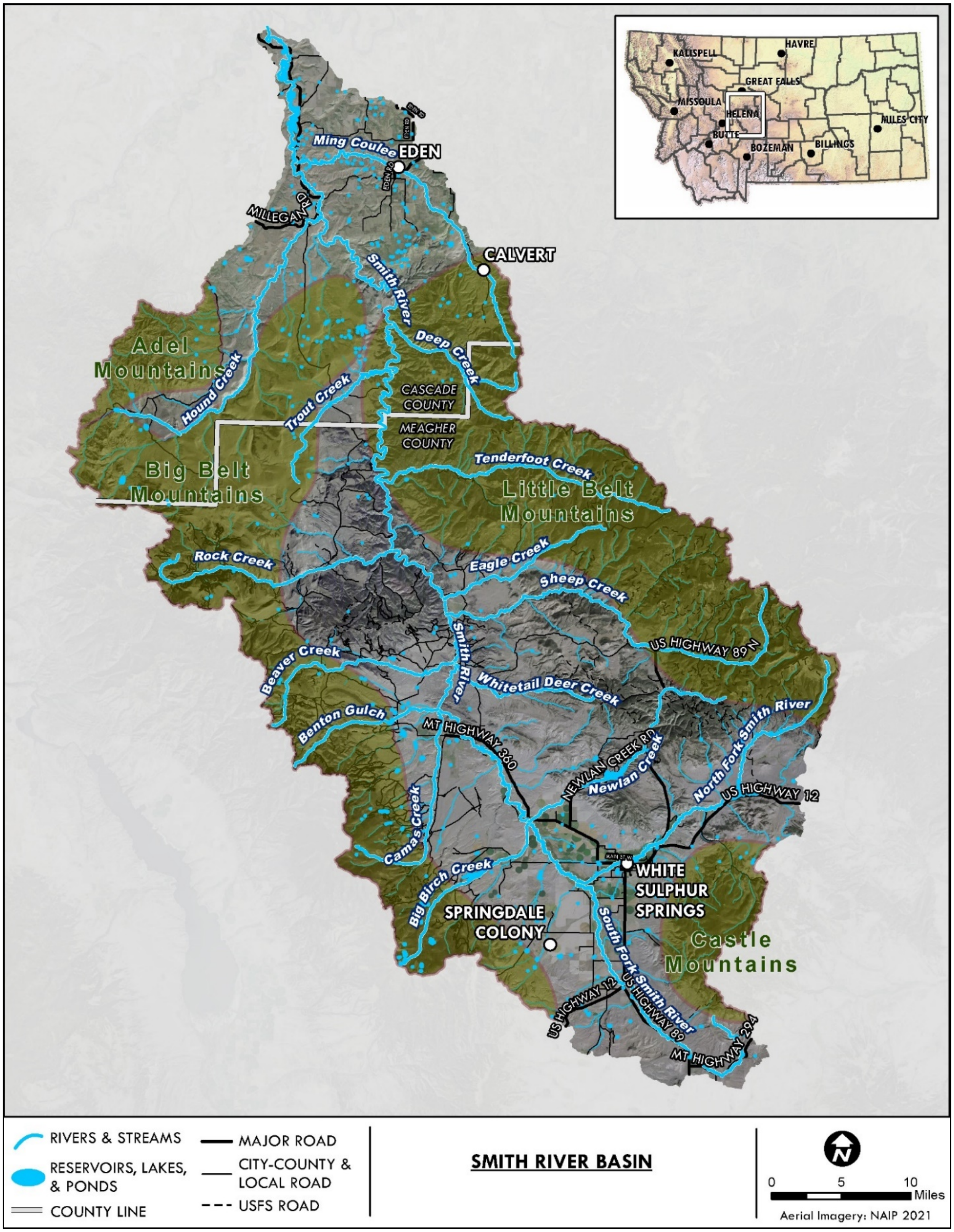


Figure 1. Smith River basin overview.

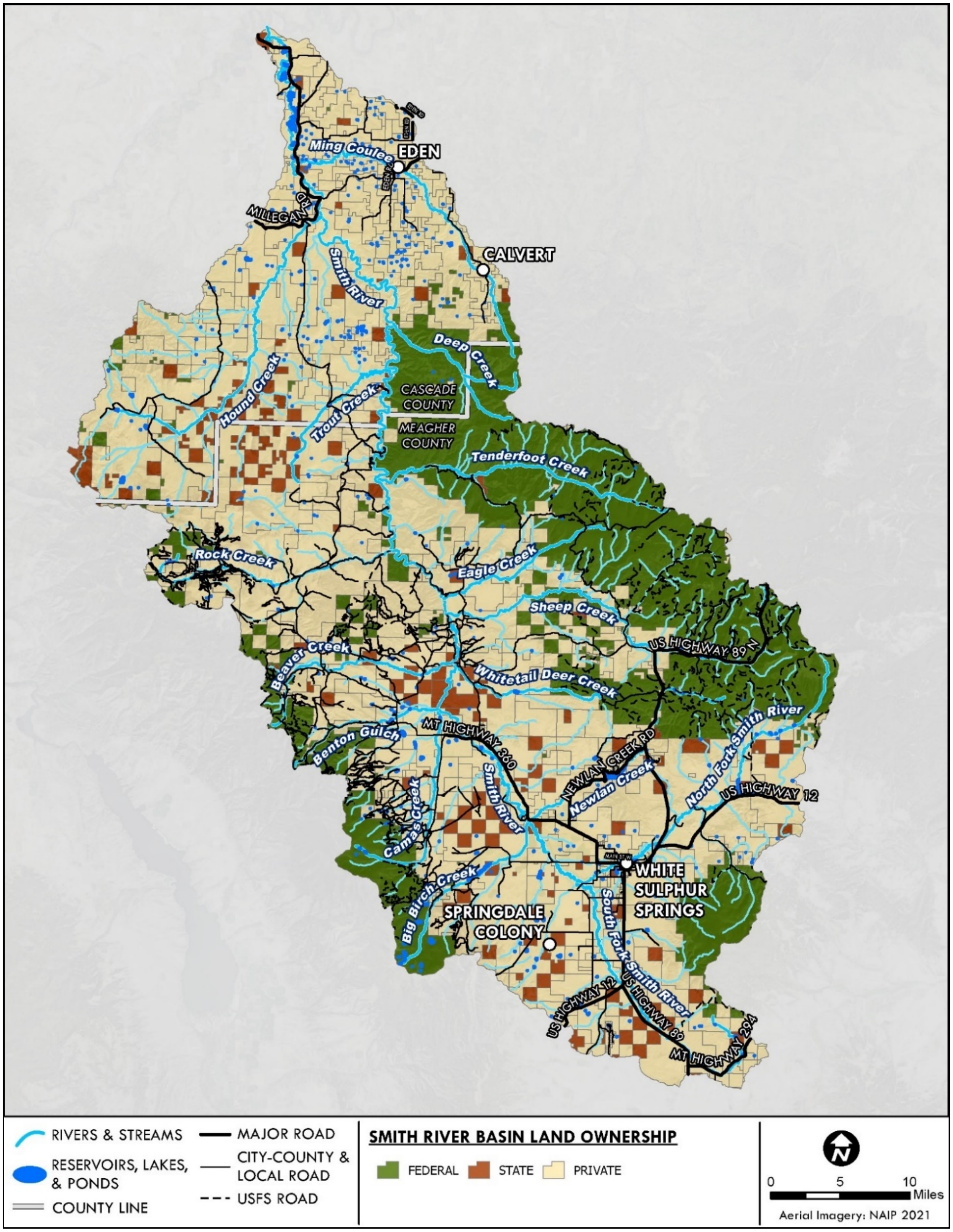


Figure 2. Smith River basin land ownership.

Figure 3. Smith River basin mainstem river reaches.

Figure 4. Unconfined, low gradient channel of the mainstem Smith River in the upper basin; view is to north from Birch Creek Road.

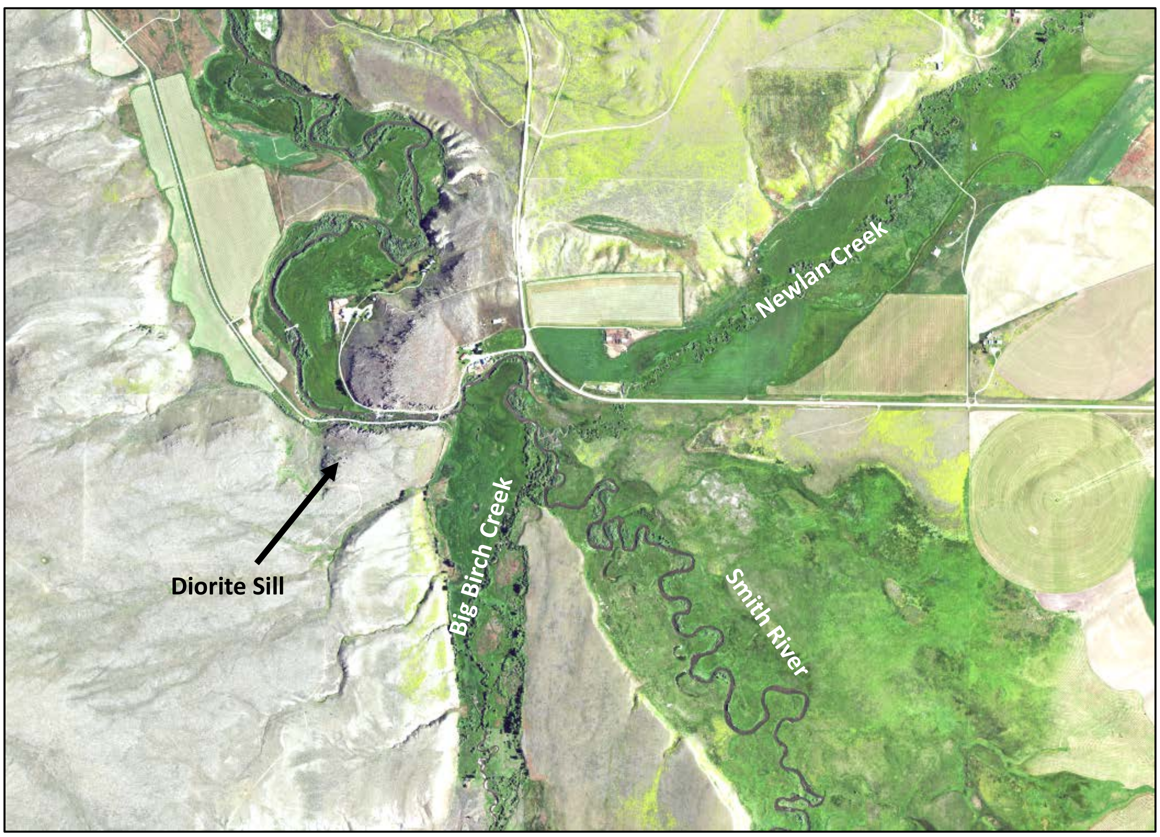


Figure 5. Diorite sill located downstream of where Newlan Creek and Big Birch Creek enter the mainstem Smith River. This sill functions to check groundwater up in the Smith River floodplain up valley.

Below Newlan Creek, the river becomes more pronouncedly affected by scattered bedrock outcrops, resulting in an increasingly confined valley bottom (Figure 6). Riparian vegetation consists of a narrow fringe of willows, introduced pastures grasses and reed canarygrass. The primary tributary that enters this reach is Camas Creek.

Figure 6. Views downstream showing semi-confined stream channel at mouth of Thompson Gulch (RM 105.8). Outcrop is Newlan Formation limestone which is part of the Pre-Cambrian age Belt Supergroup.

Below Beaver and Whitetail Creeks the river again becomes less steep and more sinuous with sections having multiple channel threads. There are several irrigation headgates in this reach and wide areas of irrigated pasture (Figure 7). Reed canarygrass is dominant in this reach and bank erosion is common (Figure 8). Riparian vegetation consists primarily of pastures and hayfields dominated by introduced pastures grasses. Some areas of dense willow occur in split flow and backwater areas. Occasional cottonwood stands are also present in the floodplain.

Figure 7. Sinuous Smith River channel and extensive floodplain conversion and irrigation downstream of Beaver and Whitetail Creeks.

Figure 8. Reed canarygrass and bank erosion along the Smith River between Whitetail Creek and Camp Baker.

Near the mouth of Sheep Creek, there is an abrupt geologic change as the river enters a deep 45 mile-long bedrock canyon that supports the primary recreational corridor of Smith River State Park. This canyon is deeply cut into primarily Mission Canyon Formation limestones of the Madison Group (Figure 9). These limestones formed in a shallow ocean that covered most of North America between 399 and 326 million years ago (Hyndman and Thomas, 2020). The canyon is spectacular in nature and the crest of the canyon wall commonly extends laterally onto high plateaus that are deeply dissected by numerous tributaries. These streams, including Sheep Creek, Rock Creek, Tenderfoot Creek, and Deep Creek are critically important to the health of the river as they contribute substantial cold flow inputs and provide connected aquatic habitat.

The pattern of the Smith River is highly sinuous where it cuts the canyon across the limestone (Figure 10). This pattern indicates that the channel once meandered across a low-gradient floodplain of soft sediment, and as the mountains rose the river simultaneously down cut, preserving its meandering form. The river is now entrenched yet surrounded by a complex series of strath (bedrock-floored) and alluvial terraces. Although channel migration is not a predominant geomorphic process in this reach, there are areas where low alluvial terraces remain erodible and thus floodplain turnover is active. Many boat camps are located on these low terraces and hence are susceptible to active erosion.

Riparian vegetation consists of narrow fringes of conifers, mixed riparian shrub species, willows on low alluvial bar surfaces and backwater areas, and cottonwoods, conifers and introduced pasture grasses on alluvial terraces.

Figure 9. Limestone cliffs of the Smith River Canyon.

Figure 10. View from canyon wall showing entrenched sinuous planform of Smith River.

As the river exits the limestone canyon it flows onto the Great Plains through a broad, largely unconfined alluvial valley. In some areas the channel is laterally dynamic as exemplified in Figure 11 where a recent avulsion had recruited large wood to the system and the dynamics support multiple cottonwood age classes. In other areas the channel is heavily armored to protect adjacent irrigated fields. Riparian vegetation consists of pastures and hayfields dominated by introduced pasture grasses and cottonwood forests.

Figure 11. Unconfined, dynamic section of Smith River below canyon at RM 22.8.

2.1 Physical Characteristics

The physical characteristics of this central-Montana basin reflect both common attributes of inter-montane basins of Montana as well as unique geologic attributes that complicate the overall setting. In addition, over a century of human-induced change overlays that physical setting, in some cases fundamentally altering the historic condition. Ongoing threats of continued human-induced change, including changes in climate, will continue to alter the baseline condition in coming decades.

2.1.1 Climate

The Smith River basin climate has been described as semi-arid with some semi-humid areas at higher elevations (Caldwell and Eddy-Miller, 2013). Monthly mean temperatures at White Sulphur Springs range from less than 20 degrees Fahrenheit (F) in January to the mid-70s in mid-summer. Because of the topographic variability in the basin, precipitation is both spatially and temporally variable. Whereas the mountains receive over 40 inches per year, low elevation areas commonly receive less than 12 inches per year (see Map 1 in Appendix A). High elevation precipitation is stored as snowpack that is retained longer into the summer than low elevation. The timeframe of higher elevation snowmelt is an important aspect of seasonal water budgets lower in the basin.

2.1.2 Ecoregions and Landscape Characteristics

The Smith River basin lies within the Middle Rockies and Northwestern Great Plains Level 3 Ecoregions as defined by the EPA (US EPA, 2021). Within the basin, the Middle Rockies and Northwestern Great Plains Ecoregions include the Brown Glaciated Plains, Northern Rocky Mountain Foothills, Central Rocky Mountains, and Northern Rocky Mountain Valleys Major Land Resource Areas (MLRAs) (USDA, 2006). The upper portion of the basin includes Central Rocky Mountain MLRA in the surrounding Big Belt, Little Belt, and Castle Mountains and Northern Rocky Mountain Valleys in the valley bottoms. The lower portion of the basin includes Northern Rocky Mountain Foothills and Brown Glaciated Plains as the basin transitions into the Northwestern Great Plains Ecoregion (see map 2 in Appendix A).

The Central Rocky Mountains and Northern Rocky Mountain Valleys MLRAs are characterized by rugged, glaciated mountains, thrust and block-faulted mountains, deep canyons, hills, plateaus, and valleys. Valleys are nearly level, broad floodplains bordered by sloping terraces and alluvial fans. The mountains bordering the valleys are uplifted fault blocks that have been recently glaciated. Streams eroding the mountains have created alluvial fans at the edges of the valleys and deposited silt, sand, and gravel as alluvial valley fill. Soils on mountain side slopes and ridges formed in colluvium, residuum, and glacial till and have mixed mineralogy. Soils in the valleys are generally very deep. This area supports conifer forests and grassland vegetation. Land uses are dominated by forestry and livestock production on grasslands.

The Northern Rocky Mountain Foothills MLRA is in the Missouri Plateau, glaciated section of the Great Plains. The area occurs at the extreme western edge of the southern extent of continental glaciation so few glacial landforms and minor glacial deposits are present. The area occurs on an old plateau of uplifted marine sediments. The rugged hills and low mountains are cut by many narrow valleys with steep gradients. This area supports grass and shrub vegetation in the valleys and foothills and forest vegetation at higher elevations. Most of the area is in farms and ranches.

The lowest and northernmost portion of the basin is within the Brown Glaciated Plain MLRA which is entirely in north-central Montana and includes glacier till plains of the Missouri Plateau that are nearly level to gently rolling, but belts of steep slopes border some of the larger rivers. This MLRA also includes glacial lake plains formed by prehistoric proglacial Lake Great Falls. The average annual precipitation is 10 to 19 inches and the majority of precipitation occurs during the growing season as steady, soaking, frontal system rains. This area supports grassland vegetation. Nearly all this area is in farms and ranches.

2.1.3 Geology and Groundwater

Map 3 in Appendix A provides an overview of rock ages and types in the Smith River basin. The Smith River valley is uniquely situated in a geologic sense because it lies in a structurally complex region between the Big Belt uplift, the Little Belt uplift, and the Castle Mountains dome. The Smith River valley is the apparent zone of intersection of the huge central Montana Disturbed Belt (Big Belt, Little Belt, Big Snowy, Porcupine uplift) and the Disturbed Belt (southeast-trending zone of imbricate thrust faulting), which extends from Canada to the Lombard-Three Forks area (Groff, 1965).

The Castle Mountains are a combination of landforms that appear as one. Western slopes culminate in a gently rising, flat-topped dome of volcanic origin that is comprised of a group of castle-like outcrops of granite. The eastern section is characterized by plateaus of sedimentary origin (USFS, 2021a).

The geology of the Little Belts is rich in limestone with pockets of metamorphic and igneous rock. Some of the oldest rocks in Montana are located within the Little Belts. Bands of limestone bluffs break up uniform expanses of evergreen forest (USFS, 2021a).

The geology of the Big Belts is complex. The southern parts are predominantly granitic, uplifted, sedimentary, Precambrian limestone, sandstones, and shale. The northwest end of the Big Belts has an excellent exposure of the Precambrian-aged Helena (Empire shale) Formation (USFS, 2021a).

The canyon exposes miles of Mississippian Mission Canyon Limestone with many caverns. The limestone formed in a shallow ocean that covered most of North America between 359 and 326 million years ago (Hyndman and Thomas, 2020). All the rocks exposed in the canyon are sedimentary (made up of particles of older rocks) and include over 3,000 feet of shale, mudstone, siltstone, sandstone, and limestone, deposited between 520 and 150 million years (my) ago. Limestone dominates these formations, including the Madison Limestone, which is over 1,600 feet thick and spectacularly exposed in the Park. The Madison and other limestone layers were deposited in warm, shallow seas along an ancient coastline, as sea level repeatedly rose and fell (MBMG, 2021).

Below the canyon, geology consists of coastal marine Kibbey and Otter Formations of the Big Snowy Group, shallow marine Sawtooth and Swift Formations of the Ellis Group, and the non-marine Morrison Formation. The non-marine Kootenai Formation is also exposed in the hills surrounding the river along the last few miles (MBMG, 2021).

In the upper Smith River basin above Fort Logan, groundwater is stored within unconfined, confined, and semi-confined alluvial aquifers in the basin fill deposits (Caldwell and Eddy-Miller, 2013). The sedimentary fill in the upper basin is about 26,000 feet thick, with up to 1,500 feet of Tertiary age (2 to 65 million year old) fill near White Sulphur Springs. There are several discreet aquifers in the upper basin. The largest groundwater yields are derived from the shallower Quaternary sediments; the deeper and older Tertiary-age sediment tends to be fine grained and relatively impermeable. Although a few high-yielding wells have been completed in the deeper, older Tertiary-age sediments that tend to be lower in permeability, most productive wells are in unconfined aquifers at less than 30-foot depths. The deeper wells typically have low yields and are utilized for domestic and stock water (Caldwell and Eddy-Miller, 2013).

2.1.4 Soils

Early descriptions of the soils of the upper basin note that “the soil types of Meagher County do not cover extensive areas due to the topographical features within the county and the extreme variation of parent material which includes igneous, metamorphic, and sedimentary rock” (MT State Engineers Office, 1950). The valley bottoms and river floodplains were described as undifferentiated alluvial soils that vary with the physiographic area. In general, Meagher County floodplains tend to have poorly drained wet bottoms with dark alluvial soils that range from clay loams and silt loams to gravelly loams and stony loams that are used primarily for pasture or the production of tame and wild hay. Where there are better drained soils, they were noted as appropriate for crops and small grains (See Map 4 in Appendix A).

2.2 Hydrology

Streamflow on the Smith River and tributaries is fed by snowmelt, precipitation and contributions from groundwater (base flow). Peak flows typically occur from mid-May through mid-June. Flows generally decrease rapidly in late June and early July, coinciding with declining snowmelt and irrigation withdrawals in the upper basin. The lowest flows occur from December through March, and in late August and September. Baseflow contributions are related to groundwater recharge, evapotranspiration, groundwater flow directions, and reservoir operations. These base flows can be highly variable both spatially and temporally. From 1977-2016, the mean Smith River discharge at Fort Logan was 144 cfs (FWP, 2019). The mean discharge of the Smith River for a 24-year period (1952-2016) at the USGS gage near Eden (river mile 27) was 341 cfs.

Flood frequencies for the three main Smith River stream gages are shown in Table 1 (see Figure 32 for gage locations). These values were calculated using the USGS Guidelines for Determining Flood Flow Frequency Bulletin 17C (England et.al, 2018). Each of the gages has at least 25 years of recorded flows, although the datasets are not all continuous. Figure 12 and Figure 13 show flood peaks in the upper basin, with flows exceeding a 10-year event in 1981, 1996, 1997, 2011, and 2023. Floods exceeding a 10-year event in the lower portion of the basin near Eden were recorded in 1953, 1981, and 2011 (Figure 14).

The largest flood recorded in the Smith River basin was in June 1953 when flows exceeded a 100-year event near Eden (Figure 14). This was part of a major record-breaking flooding pattern in the upper Missouri Basin, ultimately exceeding over $8.6 million dollars in damages in 15 counties (USGS, 1957). The flood was caused by heavy rains from May 23 to June 4, and was augmented by a persistent late snowpack . On the Smith River the flood peaked at 1 am on June 4, with Hound Creek and other small drainages in the lower basin contributing the most substantial stream flows measured downstream (USGS, 1957). Local residents indicated that the 1953 flood was comparable to the previous major flood of 1908.

Another flood that exceeded a 100-year event in the Smith River basin was in May 1981, when flows reached 4,600 cfs near Fort Logan (Figure 12) and 11,800 cfs near Eden (Figure 14). The driver for this flood was similar to that of the 1953 event, in that persistent spring rain resulted in extensive ground saturation; subsequent additional rains combined with snowmelt produced destructive flooding throughout west-central Montana. According to Parrett and others (1982), flooding on the Smith River upstream of Hound Creek may have been more severe in 1981 than in 1953, as evidenced by the “severe channel erosion and deposition on upstream tributaries noted by observers after the flood.” Property damage in the Smith River basin was reported to be limited due to its rural nature.

Over the last decade, the only substantial high water on the Smith River occurred in May 2023. On May 5th of that year, Montana FWP authorized an emergency closing of the Truly Bridge Fishing Access Site (FAS) due to flooding and inundation of the site (Figure 15). FWP noted that “people are at risk of unexpectedly being swept into the river, resulting in injury or drowning.”

Tributary inputs are critical to the Smith River. Table 2 and Figure 16 show the estimated flow inputs from each major tributary based on basin characteristics. Table 3 shows a series of flow measurements taken at the mouths of some major tributary streams during spring runoff in 1971 (Petersen, 1995). The North Fork and South Fork are major contributors of streamflow in the upper basin. Sheep Creek, Rock Creek, and Tenderfoot Creek contribute significant flow in the canyon reach, including sources of cool, clean water which also make these important trout spawning tributaries. Hound Creek is the main tributary flow contributor in the lower basin.

Table 1. USGS Bulletin 17c flood frequency values for Smith River gages using available data through water year 2022 (England et. al, 2018).

USGS Gage ID	Drainage Area (sq mi)	Annual Exceedance Probability (cfs)						
		50% 2-yr	20% 5-yr	10% 10-yr	2% 50-yr	1% 100-yr	0.50% 200-yr	0.20% 500-yr
6076690 Smith River near Fort Logan	845	**672**	**1,302**	**1,870**	**3,624**	**4,617**	**5,784**	**7,637**
6077200 Smith River below Eagle Creek near Fort Logan	1,087	**1,336**	**2,166**	**2,812**	**4,509**	**5,349**	**6,268**	**7,615**
6077500 Smith River near Eden	1,588	**1,993**	**3,457**	**4,719**	**8,487**	**10,571**	**12,999**	**16,827**

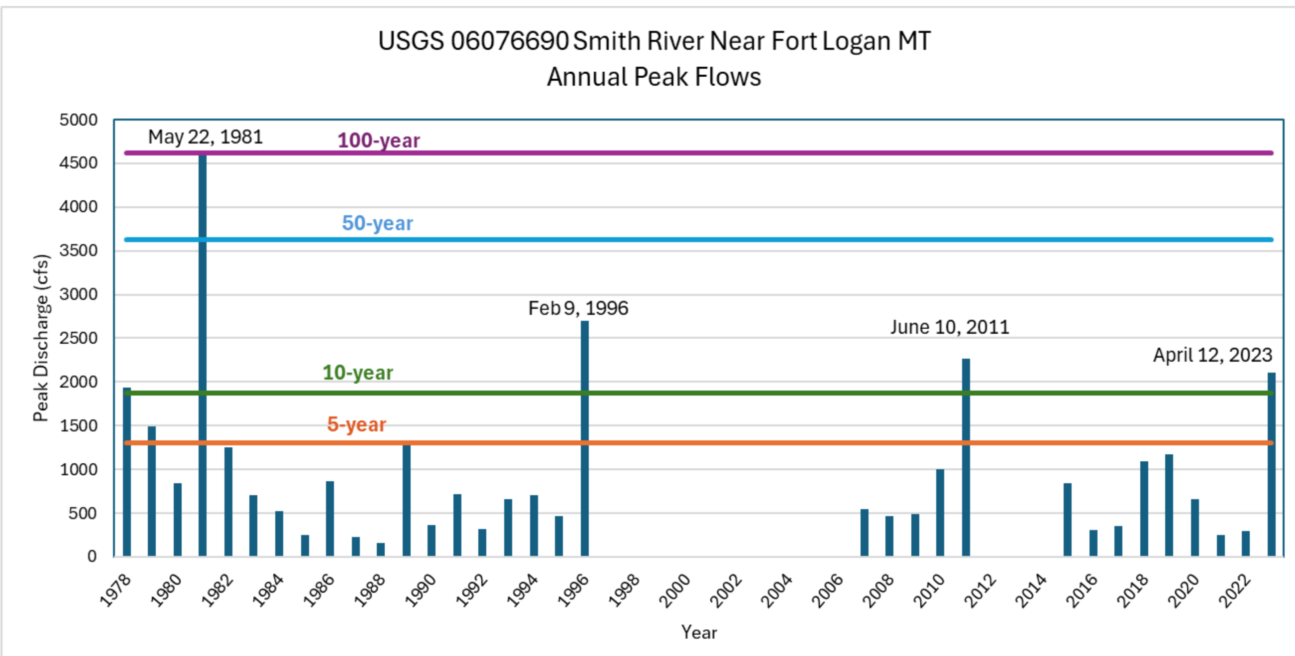


Figure 12. Annual peak flow record for Smith River near Fort Logan (USGS 06076690).

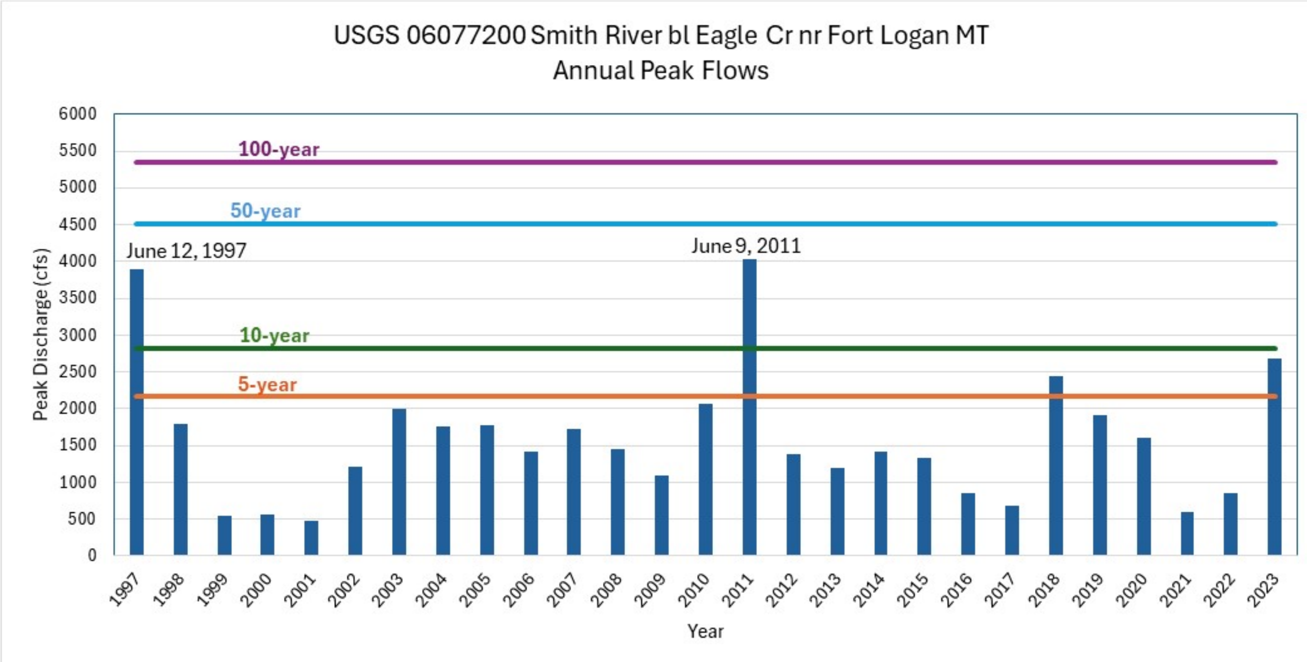


Figure 13. Annual peak flow record for Smith River below Eagle Creek near Fort Logan (USGS 06077200).

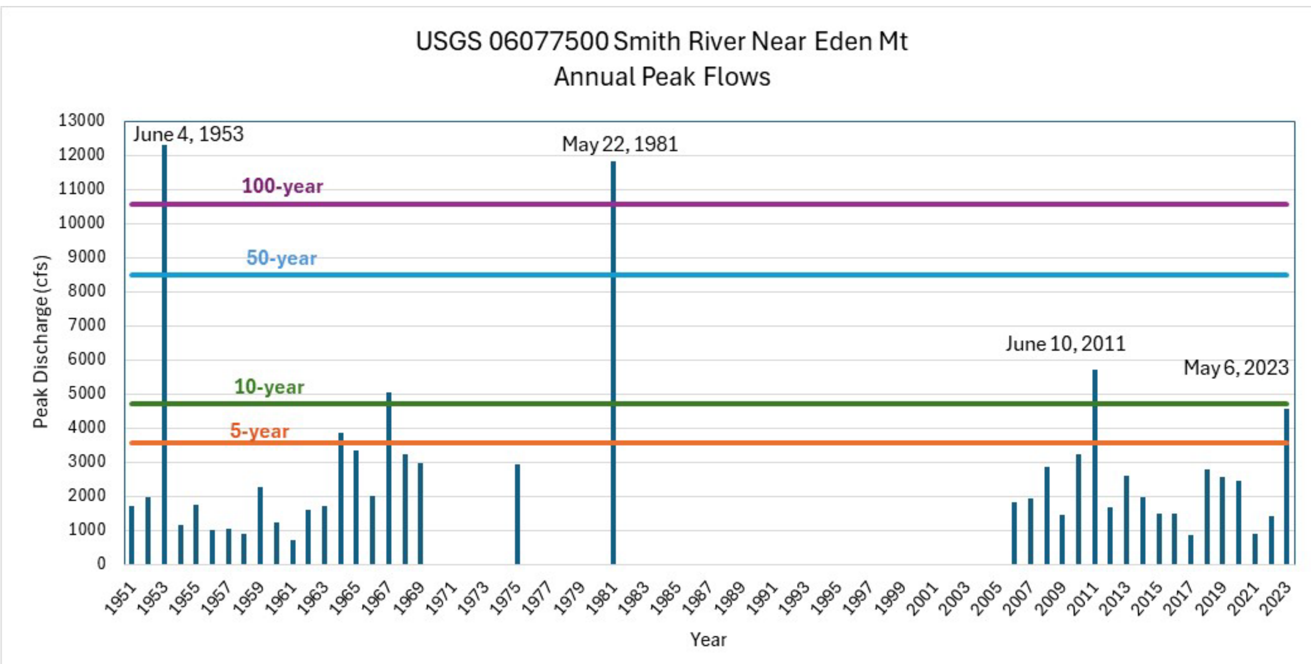


Figure 14. Annual peak flow record for Smith River near Eden (USGS 06077500).

Figure 15. Flooding of the Truly Bridge Fishing Access site in May 2023 causing an emergency closure due to high water (FWP).

Table 2. Drainage area size and estimated flow volumes for major Smith River Tributaries. Flows generated using basin characteristics method in Streamstats (USGS, 2019).

Smith River Basin Waterbody	Watershed Area (sq mi)	Estimated flows based on Basin Characteristics (cfs)		
Major Tributaries		Q2	Q10	Q100
South Fork Smith River	170.5	495	1,610	3,890
North Fork Smith River	180.6	634	1,590	3,310
Newlan Creek	51.9	225	637	1,440
Camas Creek	61.8	235	610	1,310
Benton Gulch	30	111	366	929
Whitetail Deer Creek	36.1	134	517	1,420
Beaver Creek	48.7	135	574	1,390
Sheep Creek	194.7	730	1,640	3,210
Eagle Creek	43.1	196	553	1,250
Rock Creek	147.2	465	1,180	2,490
Tenderfoot Creek	109	450	1,070	2,190
Trout Creek	33.3	118	495	1,420
Deep Creek	44.6	189	577	1,370
Hound Creek	228.4	584	1,800	4,310
Ming Coulee	61.1	179	791	2,330
Smith River				
Smith River above Fort Logan	736.8	1,780	4,510	9,350
Smith River above Eden Bridge	1847	3,790	8,840	17,200
Smith River at Mouth	2007	4,010	9,690	19,300

Q2 = streamflow that on average would only be equaled or exceeded once in 2 years (2-percentile flow based on long-term gage data)
Q10 = streamflow that on average would only be equaled or exceeded once in 10 years (10-percentile flow based on long-term gage data)
Q100 = streamflow that on average would only be equaled or exceeded once in 100 years (100-percentile flow based on long-term gage data)

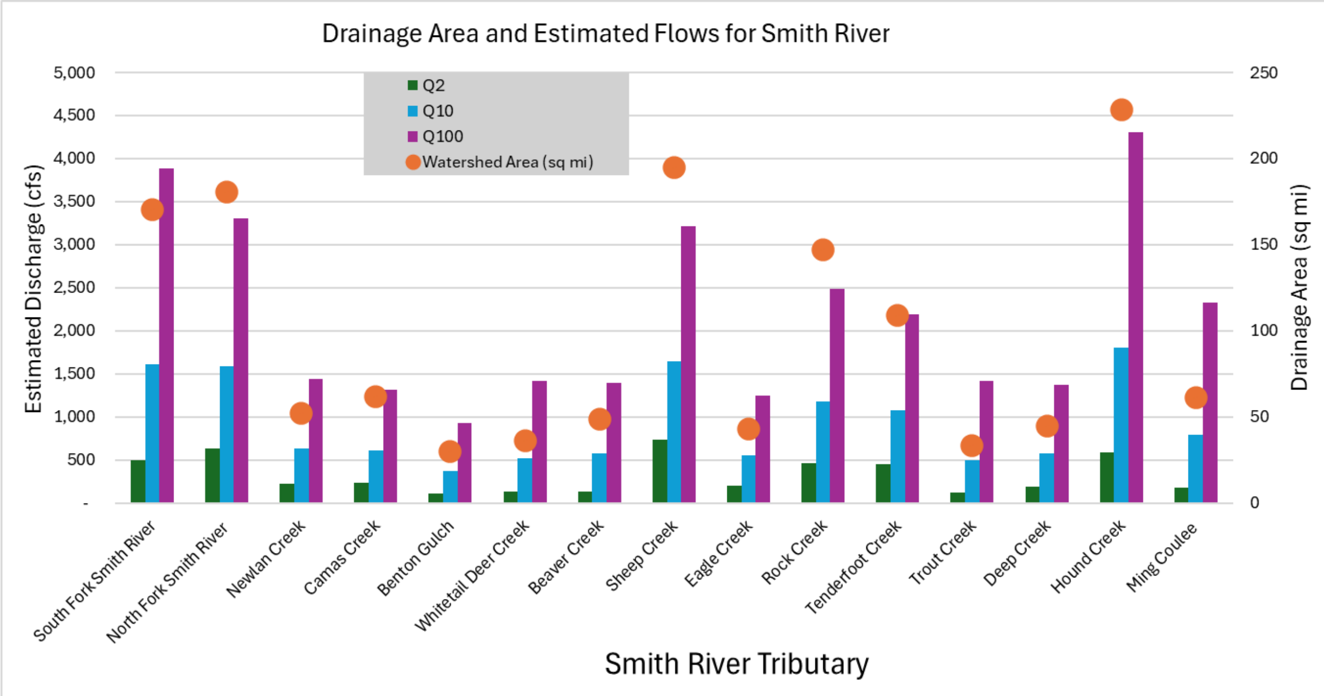


Figure 16. Smith River tributaries estimated discharges based on watershed size (Streamstats – USGS, 2019).

Q2 = streamflow that on average would only be equaled or exceeded once in 2 years (2-percentile flow based on long-term gage data)
Q10 = streamflow that on average would only be equaled or exceeded once in 10 years (10-percentile flow based on long-term gage data)
Q100 = streamflow that on average would only be equaled or exceeded once in 100 years (100-percentile flow based on long-term gage data)

Table 3. Spring runoff tributary inputs measured in 1971 (Petersen, 1995).

Tributary	Smith River Mile at Mouth of Tributary	Spring Discharge (cfs)
North Fork Smith River	121.1	125
South Fork Smith River	121.1	50
Camas Creek	92.2	125
Beaver Creek	87.4	100
Sheep Creek	81.2	400
Eagle Creek	80.0	150
Rock Creek	72.4	70
Hound Creek	24.0	250

2.3 Vegetation Types

The Smith River basin supports a mosaic of productive grasslands and conifer forests. Valley bottoms support grasslands, pastures and irrigated fields, and riparian vegetation types. Foothills tend to be partly wooded or shrub-and grass-covered. Above the foothills, montane forests are interspersed with grass and shrublands. Lower elevation land cover within the montane forest consists of Douglas-fir and ponderosa pine on south facing slopes. As elevations get higher, lodgepole pine replaces the ponderosa as co-dominant with Douglas-fir. Limber pine, Engelmann spruce, subalpine fir and whitebark pine can be found at the highest elevations. Aspen forests also occur in specific sites throughout the basin.

The Big Belt Mountains support a mosaic of productive grasslands and conifer forests and are characterized as partially forested foothills with large grassland openings (USFS, 2021a). The Big Belts are notable for a preponderance of warm, dry potential vegetation types and potential to promote ponderosa pine, aspen, limber pine, and open savannas, as well as whitebark pine on cold potential vegetation types at the highest elevations. Cool moist potential vegetation types and associated species (including lodgepole pine, subalpine fir, and Engelmann spruce) are present but less common in this portion of the basin compared to other areas (USFS, 2021a). Extensive aspen communities are also present.

The Little Belt Mountains support thick stands of conifers, dominated by limber pine and ponderosa pine, transitioning to Douglas-fir and lodgepole pine forests; and Engelmann spruce, subalpine fir and whitebark pine at the highest elevations (USFS, 2021a). Subalpine and montane forest types occupy in the Little Belt Mountains in almost equal proportions (Helmbrecht et. al, 2012). Aspen is present in moist areas but rare.

The Castle Mountains fringing the south terminus of the basin have dense conifers on north and northwestern aspects. At higher elevations and on sun-exposed aspects, forest intergrades with grassland meadows, or parks. These expansive grasslands consist of robust native plant communities that provide forage for both wildlife and livestock. The Castle Mountain area is dominated by nonforested and warm dry potential vegetation types, with more aspen, lodgepole pine, and limber pine than other areas of the basin, along with less Douglas-fir, ponderosa pine, and subalpine fir. Aspen stands grow in moist areas, and the western portion of the mountain range supports a large expanse of whitebark pine forest at the highest elevations. On the drier, eastern sections, plant communities are dominated by grassy parks interspersed with patches of conifers (USFS, 2021a).

Grasslands and shrublands dominate the foothills and valley bottoms of the upper and lower basin. Dominant grassland species include Idaho fescue, rough fescue and bluebunch wheatgrass. Sagebrush steppe occurs in the upper basin. A large portion of sagebrush steppe has been cleared for agriculture. Grasslands have also been extensively converted for agriculture and consist of introduced pasture grasses. Pastures and hayfields are common in valley bottoms throughout the basin. Flood irrigated pastures often support wet meadows dominated by introduced species such as Garrison creeping foxtail, timothy and Kentucky bluegrass or native grass, sedge and rush species (NRCS, 2022a). Irrigated fields are typically managed in alfalfa hay rotation. Orchardgrass and meadow brome are common grass species in these fields. Dryland pastures are mostly crested wheatgrass or Russian wildrye (NRCS, 2022a).

Riparian areas and wetlands occur throughout the basin along streams, at the base of slopes or other groundwater recharge areas, and in association with irrigation return areas and irrigation infrastructure such as dams and reservoirs. These areas are dominated by a mix of alder, willows, cottonwoods and wet graminoid species.

Historically, fire was a primary shaper of vegetation communities in the basin. In the montane forest types of the basin, the historical fire regime was characterized by relatively frequent fires of low to mixed severity with occasional stand replacement events (Helmbrecht et. al, 2012). In the sub-alpine types, the historical fire regime was less frequent with mixed to high severity fire (Helmbrecht et. al, 2012).

2.4 Fisheries

The Smith River basin hosts about 1,220 miles of perennial streams and about 740 miles of those streams can support salmonids (FWP, 2023a). Fish native to the watershed include westslope cutthroat trout, arctic grayling (extirpated), mountain whitefish, Rocky Mountain sculpin, longnose sucker, white sucker, plains sucker, longnose dace, stonecat, and burbot. In the early 1900s, the watershed supported native trout, arctic grayling, and mountain whitefish. Today, wild populations of introduced species, including brook, rainbow and brown trout predominate. Small headwater streams are dominated by brook trout while rainbow and brown trout dominate higher order, lower elevation streams.

Within the recreational float corridor, the Smith River fishery is classified as a high resource value. Between 2001 and 2019 FWP documented 15,318 angler days that generated annual revenues of over $13.5 million. The fishery has been managed as a wild trout fishery since 1974. Between 1928 and 1974, approximately 3.5 million trout were stocked in the mainstem Smith River (FWP, 2023a). In the early 1970s studies in the Madison River drainage demonstrated that hatchery stocking inhibited fish populations and that rivers supported higher densities of fish without stocking. Since the mid-1970s, FWP no longer stocks most rivers and streams except for native species recovery and conservation.

Tributary streams have been recognized as an important component of the life history strategies of trout in the system. Tenderfoot, Sheep, Birch, and Rock Creek have been documented as supporting extensive spawning use by Smith River fish, highlighting the importance of maintaining connectivity and habitat quality in tributary streams (FWP, 2023a and Lance et al., 2024).

Below Camp Baker near Eagle Creek, estimated salmonid densities in fall 2020 were 414 rainbow trout per mile and 135 brown trout per mile, with long-term average abundance of 439 rainbow trout per mile and 286 brown trout per mile. In the mid-canyon area downstream of Tenderfoot Creek sampling data from 2015 through 2020 at the Cascade-Meagher County line had a mean density of rainbow trout and brown trout of 271 and 344 fish per mile, respectively (FWP, 2023a).

Figure 17 shows rainbow trout and brown trout population estimates (fish per mile) for fish greater than 8 inches at the Eagle Creek sampling site from 1969-2023. Since about 2006, fish sampling has showed near average populations of these salmonid species. Downstream at the County Line site in the canyon, the rainbow trout estimates for fish greater than 8 inches show consistently lower densities relative to Eagle Creek since sampling started in 2015 (Figure 17). Brown trout estimates at the County Line site have been similar to or greater than estimates at the Eagle Creek site, since sampling began.

Several conservation populations of westslope cutthroat trout (WCT) have been documented in the Smith River drainage, including Big Camas, Cottonwood, Daniels, Deep, Fourmile, French, Iron Mines, Jumping, Lake, Lone Willow, Pickfoot, South Fork Tenderfoot, South Fork Willow, Tenderfoot, Thompson Gulch, Tyrell, and Urvi creeks. The majority of remaining populations of westslope cutthroat trout are located in high elevation streams on National Forest land. The short-term conservation goal for this species is to protect remaining non-hybridized populations. In the long term, the conservation goal for these populations is to have 20% of the historically occupied habitat restored to secure conservation populations (FWP, 2023a). Several ongoing projects have been launched to help meet those short-term goals (see *On-going Work* sections for target areas in Section 8).

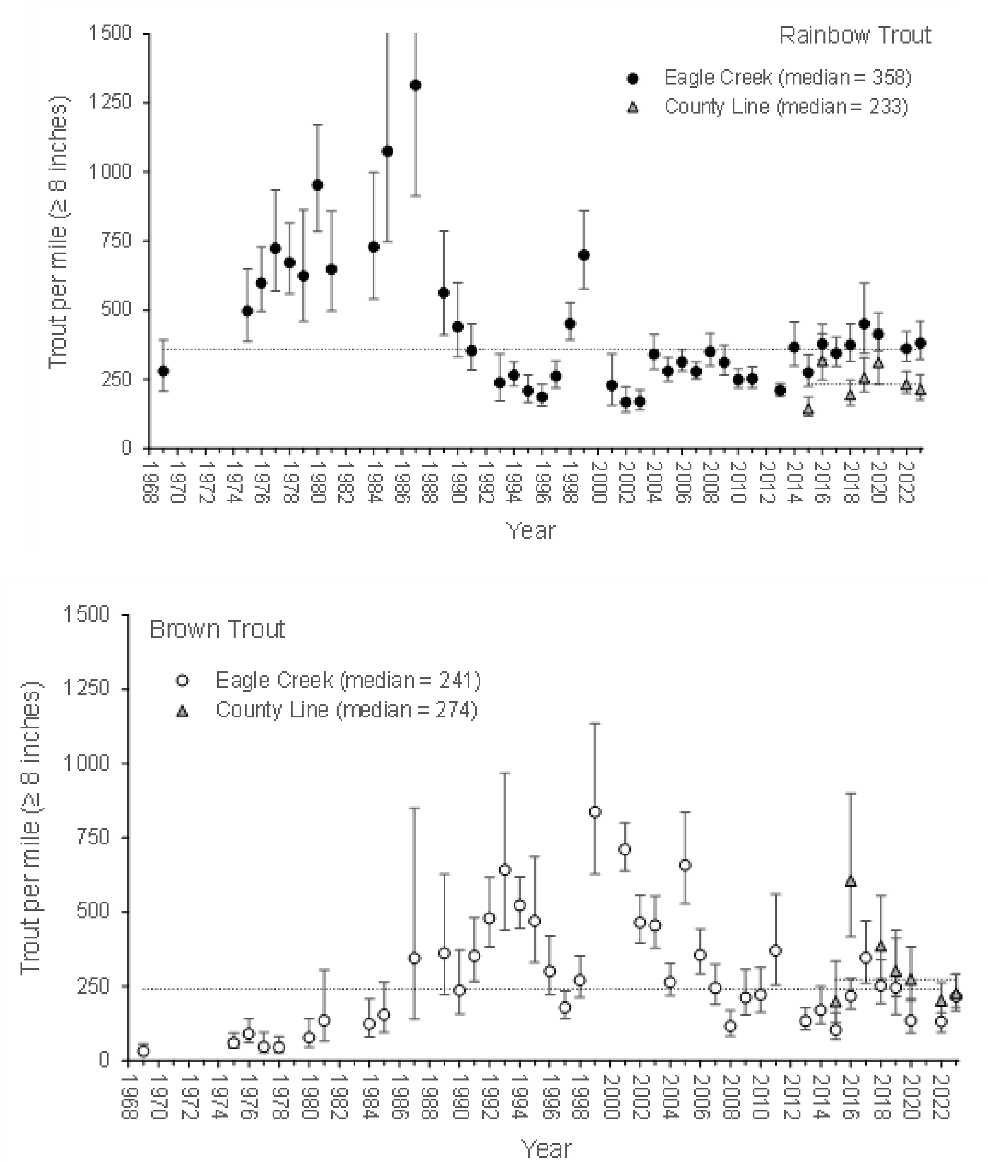


Figure 17. Population estimates of rainbow and brown trout (fish >8”/mile) from 1969-2023 at County Line (FWP, 2024a).

2.5 Wildlife

Wildlife habitats depend largely on terrestrial vegetation and the Smith River basin supports a diversity of plant communities across a wide range of physical environments. This diversity of communities and ecosystems supports a great diversity of wildlife species (USFS, 2021a). Historically, trapping affected wildlife populations in the Smith River basin. Following the eradication of buffalo from the valley by the late 19th century, trappers and hunters were successful in eradicating, or nearly eradicating predators in the valley, much of which was stimulated by government subsidies. By the mid-20th century wolves and grizzly bears were no longer found in the basin, and coyotes, mountain lions, and black bears were very rare (Petersen, 1995). Today, black bears, mountain lions, wolverine, grizzly bears, grey wolves and other carnivore species are either common or present in the basin (FWP personal communication, 2024).

Native ungulates, also referred to as big game, are an important component of wildlife diversity in the basin. Elk, mule and white-tailed deer, pronghorn and moose are common big game speices (NRCS, 2022a). Elk and mule deer generally summer at high elevations, usually USFS lands, and then migrate to lower elevations at the beginning of winter. White-tailed deer generally live yearlong at lower elevations. Pronghorn usually remain yearlong on the lowest river bottoms and adjacent foothills with open habitats such as sagebrush and grasslands; however, some antelope will range into the higher foothills during the summer. Moose occupy river valleys, mountain meadows, clear-cuts, willow flats, and swampy areas during the summer, but transition to closed canopy coniferous forests adjacent to willow flats in the winter (MTNHP, 2024). The majority of the low country is private land where approximately 80% of elk, deer and antelope winter range occurs. Elk numbers are high, and they consume large amounts of forage on private land with livestock grazing (NRCS, 2022a).

Sharp-tailed grouse, sage-grouse, ruffed grouse, blue grouse, and Franklin's grouse are native upland game birds in Meagher County (NRCS, 2022a). Other upland game birds found in the basin include gray (Hungarian) partridge, pheasant and wild turkey. Sage-grouse habitat has decreased in the basin through conversion to pasture and grassland and remaining sagebrush habitat is critical to maintain sage-grouse populations (NRCS, 2022a). Portions of Meagher County are classifed as EO-General Habitat for sage-grouse (DNRC, 2024). Meagher County has many documented and active sage grouse leks and well distributed year-long sage grouse populations, despite the loss of some historic sagebrush habitat (FWP personal communication, 2024).

The Big Belt Mountains provide a variety of habitats for a diversity of wildlife species including mountain goats, bighorn sheep, bald eagles, and cliff-nesting raptors such as peregrine falcons and golden eagles. Lewis's woodpecker and flammulated owls, species of conservation concern, are also found here (USFS, 2021a). Nearly all elk winter range in the Big Belt Mountains is on private and DNRC lands. Some elk move seasonally to higher elevation public land during summer and fall, but large numbers use private land year round. Private landowners in this area use a variety of elk management strategies to manage high elk numbers (FWP, 2023b).

The Little Belt Mountains support a wide variety of wildlife species, including carnivores such as black bear, mountain lion, bobcat, and wolverine, and big game such as moose, elk, mule deer, and white-tailed deer (USFS 2021a). USFS lands in the Little Belts include important big game winter range. The Little Belt Mountains historically supported bighorn sheep but were extirpated by the early 1900s. Bighorn sheep were translocated into the Little Belt Mountains in 2023 to habitats they used to occupy (McKean, 2021) and groups of bighorn sheep have been observed in the Little Belts in recent years (USFS, 2021a). Mountain goats were introduced in the early to mid-1900s, where they did not historically occur. This population did not persist, although occasional individual mountain goats are found there (USFS, 2021a). Elk can be widely dispersed during summer and fall in this area but quite concentrated when winter weather becomes severe. Winter weather tends to drive elk off USFS lands and onto private land winter range (FWP, 2023b).

The Castle Mountains provide habitat for a variety of wildlife species, including elk, mule deer, white-tailed deer, and black bear. This area includes extensive sagebrush grasslands, likely supporting several species that use that habitat type, such as Vesper sparrow and possibly Brewer's sparrow and loggerhead shrike. The northeast portion of this area has important elk winter range (USFS, 2021a). The central and eastern portions are more sparsely timbered and provide less uniform fall elk habitat security (FWP, 2023).

There is one Wildlife Management Area (WMA) in the Smith River basin. The Smith River WMA is 3,367 acres and located approximately 18 miles northwest of White Sulphur Springs. The WMA was purchased using sportsman's dollars to provide access to the Smith River and to protect upland winter range important to elk, mule deer, antelope, and other species (FWP, 2024).

Threatened, endangered, proposed, and candidate species are identified by the U.S. Fish and Wildlife Service (USFWS). At the time of this assessment, four listed species are reported as occurring in the Smith River basin: Canada lynx (threatened, grizzly bear (threatened, North American wolverine (threatened) and monarch butterfly (candidate) (USFWS, 2024b). No listed critical habitat for lynx or grizzly bear is present in the basin.

The Smith River basin is part of the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Population (NCDE Subcommittee, 2019); however it is outside of the Primary Conservation Area and Zone 1 areas where the main grizzly bear population occurs. The Big Belts are in Zone 2, an area of potential genetic connectivity between the NCDE and the Greater Yellowstone Ecosystem where the management goal is to maintain the opportunity for grizzly bears to move between the NCDE and other ecosystems. The Little Belts and Castle Mountains are in Zone 3, which include areas occupied by grizzly bears but not likely to provide habitat linkage to other populations. Long-term survival and occupancy of grizzly bears is not expected to occur in Zone 3 due to lack of sufficient suitable habitat. Grizzly bears may be present in the Little Belts. Grizzly bears have not been documented in the Castles as of early 2020 (USFS, 2021a).

2.6 Socioeconomic Conditions

The largest community in this rural watershed is White Sulphur Springs, which is the Meagher County Seat. The 2020 census reported a population of 955 people within the city limits. In 2017 the county-wide population of Meagher County was 1,866, indicating that about half of county residents live in White Sulphur Springs.

Over 57% of the land in Meagher County is classified as agricultural, with a total of 145 farms with a median size of 1,800 acres and an average size of 6,048 acres (MSU Extension, 2021a). In 2017 there were 88 farms exceeding 1,000 acres. The market value of all property in Meagher County was approximately $424 million in 2019, and agricultural property comprised 18% of the county's taxable value. From 2012 to 2017, the number of farms using no till, reduced tillage, intensive tillage, or cover crops increased from 136 to 145 operations.

Meagher County farm revenue (including market value of products sold, government payments, and other farm-related income) was over $39 million in 2017 while production expenses were over $32 million. The market value of livestock is the highest share of agricultural income; in 2017 for example, there was about $32.3 million in Meagher County livestock market value and $4.4 million in crops (Figure 18; MSU Extension, 2021a).

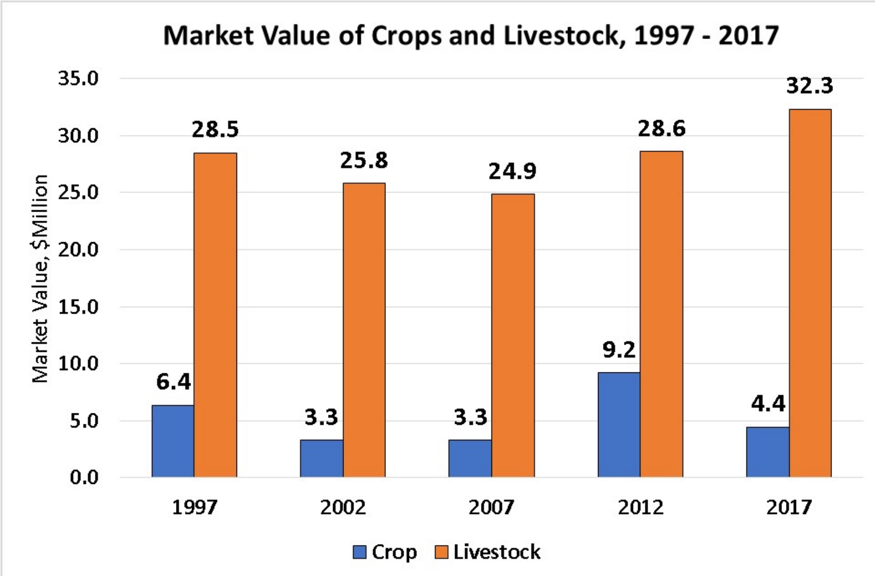


Figure 18. Market Value of crops and livestock in Meagher County (MSU Extension, 2021a).

The population of agricultural producers in Meagher County is older than the general Montana population, with 36% over 65 years old. Ranching was the primary occupation of 63% of producers in the county (MSU Extension, 2021a)

In the lower basin, Cascade County has a much larger populus than Meagher, with a 2017 population of 81,643 in the county and 60,382 living in its largest city of Great Falls. About three quarters of the land in Cascade County is classified as agriculture, which is the primary land use of the lower Smith River basin (MSU Extension, 2021b). The largest Cascade County community in the Smith basin is right at the mouth at the town of Ulm, which had 738 residents recorded by the 2012 census. Because the portion of the Smith River watershed in Cascade County is relatively small, the county statistics do not effectively portray the economics of the lower basin.

A major aspect of the socioeconomic conditions of the basin is Smith River State Park, which provides an important economic boost to gateway communities. Visitors to Camp Baker, the entrance to Smith River state Park and start of the recreation corridor, patronize businesses in White Sulphur Springs for gasoline, food, supplies, and lodging and as visitors depart the corridor at Eden Bridge, they often stop in Ulm or Cascade for gasoline and food. Professionally guided fishing trips through the corridor provide additional employment and income for many businesses in the area. There are also seven commercial fishing outfitters that provide guide and outfitter services to floaters on the Smith River and two vehicle-shuttle services that provide seasonal employment opportunities. Guided fishing and hunting extends into the upper watershed where many landowners supplement their ranch income with paid recreational use.

3 History of Basin Development

The history of the Smith River basin is rooted in its landscape, and as an ecological and cultural place it is characteristically western. It supports a rich history of indigenous occupation followed by conflict as non-indigenous settlers arrived, which included a military presence in the late 1800s. Logging and agriculture rapidly expanded as settlers had access to markets driven by both mining booms and the growth of larger population centers such as Great Falls. This rapid expansion of ranching sheep and then cattle left an indelible imprint on the landscape that is highly visible today.

3.1 Early Indigenous History

Human occupation began at least 12,000 years ago in the Pleistocene ice-age environment. By 11,000 years ago the ice had retreated and the area began to look like it is today (Peterson, 1995). Numerous tribes used the area and over the last few centuries it was used extensively by the Blackfeet. American Indians were attracted to the area for many centuries prior to Euro-American exploration of the Smith River basin. The recesses of the canyon offered shelter from the harsh winters and concentrations of game animals provided food, clothing and other necessities of life (FWP, 2009).

There are numerous cultural resources in the basin including rock paintings and quarries. The Smith River Canyon is well-known for extensive rock art, and there is a large prehistoric quarry site near Camp Baker. Cascade and Meagher Counties have the highest density of recorded rock art sites in the state of Montana (Greer, 1995).

The first Euro-Americans into the area were a result of fur trade with trappers floating their catch down the Smith and Missouri River to eastern trade centers. Several researchers have reported that the Blackfeet, as a plains tribe, understood the value of beaver on the landscape in terms of water storage, which prompted them to repel early beaver trappers from the area (Morgan, 1991). By the 1840s, however, trading commodities in the area shifted from beaver pelts to buffalo hides. This economic shift, coupled with increased mobility with the introduction of the horse, reduced the limitations of water resources for plains tribes. This in turn resulted in an erosion of traditional cultural ecological relationships like that between the Blackfeet and the beaver (Petersen, 1995). Beaver trapping became more common on the Missouri River and its tributaries, although demand was simultaneously dropping as European fashions changed. Ultimately, however, it is likely that the pre-1840 Blackfeet conservation of the beaver in the drainages of the Upper Missouri shielded that animal from the over-hunting and local extirpation which was almost universal elsewhere.

In describing the motivations of the Blackfeet to oppose beaver trapping, Petersen (1995) writes: "By doing so they made a logical, but not an easy, ecological choice. By resisting the fur trade, they conserved the water resources of riparian ecosystems like the Smith River, which were so valuable in the arid and drought prone West, but they were also limiting their ability to trade for increasingly valued goods, like guns and iron tools."

Prior to the arrival of American settlers and fire suppression, the Smith River Valley was significantly shaped by Native American fire ecology. They cleared forest undergrowth to stimulate seed germination to increase bison and big game and the basin's three distinct vegetative zones, the grass covered bottomlands in the northern and southern broad intermountain valleys, and the forested central canyon region, were products of this manipulation (Petersen, 1995).

3.2 Non-Indigenous Exploration, Settlers, and the Military

The Lewis and Clark expedition described the mouth of the Smith River in July 1805, but they did not venture upstream. Lewis named the river in honor of Robert Smith, the secretary of the Navy.

Lewis and Clark (July 15, 1805):
"we passed the river near where we dined and just above the entrance of a beautiful river 80 yards wide which falls in on the lard side which in honour of Mr. Robert Smith the Secretary of the Navy we called Smith's River. This stream meanders through a most lovely valley to the (southeast) for about 25 miles when it enters the Rocky mountains and is concealed from our view. Many herds of buffaloe were feeding in this valley."

The first documented trip higher in the basin by non-indigenous explorers was decades later, when, in 1860 Dr. F.V. Hayden passed through on his exploratory journey of the Missouri and Yellowstone River with Raynold's Expedition. Soon after Hayden's trip, American settlers began arriving (Petersen, 1995).

As non-indigenous settlers began to enter the area, concerns over conflict with the Blackfeet became a priority issue. A U.S. Army post at Camp Baker near the head of the Smith River Canyon was established in 1869 to protect settlers from the Blackfeet. It supported up to 50 soldiers. The camp was named after Colonel Baker, who became infamous for leading a bloody massacre on the Marias as part of the Piegan War of 1870; this battle effectively destroyed the Blackfeet presence in the area.

This timeframe continued to greatly affect indigenous tribes beyond the military conflict; for example, by the 1870s buffalo populations were collapsing and the species was rapidly approaching extinction.

At the end of 1870, Camp Baker was moved about 10 miles upstream to Camas Creek, and the original camp was entirely abandoned by 1880.

Many of the first white settlers in the basin came in response to the 1864 gold discovery in Confederate Gulch which is directly west of the Smith River over the Big Belt Mountains. Silver was discovered in the Castle Mountains in 1883 and by 1891 Cumberland Mine near Castletown was the largest producer of lead and silver ore in Montana.

Large scale mining was short-lived in the basin but attracted people to the area. Many mines were abandoned during the panic of 1893, a deep depression tied to the abrupt collapse of the silver industry after two decades of explosive growth. Mines, businesses that supported mines, and farmers who grew food for mining towns deeply suffered.

3.3 Early Agriculture and Logging

By 1865, many people who migrated to the Smith River valley ran sheep and cattle grazing operations to supply market economy. During this early phase of ranching, the public domain was largely leveraged as open range. The arrival of the railroad in 1883 opened markets to broader areas, greatly increasing ranching activity in the basin. Throughout the 1870s and early 1880s the majority of cattle in Montana were in Meagher and Choteau Counties. In the mid-1870s there were about 20,000 sheep in Meagher County and by 1880 there were at least 30,000 cattle in the Smith River valley.

The ranching "balloon" that saw tremendous stocking rates in the watershed effectively popped with the harsh winter of 1886-1887. Whereas there were an estimated 600,000 head of cattle on Montana range at the start of that winter, by spring only 82,000 had survived.

Logging began in the 1880s to support the rapid growth of Great Falls. The work concentrated on the east side of the Little Belt Mountains, where splash dams were used to carry logs down Sheep Creek to the Smith River. Between 1890 and 1892, over 10 million board feet were harvested in the Little Belts and carried down the Smith River to Great Falls. The dams were sometimes dynamited to release the logs (Peterson, 1995). One report from the Meagher County News in 1891 described the following:

> *"On the morning of the 12th we visited the jam in the canyon and witnessed a sight which we shall long remember. The logs were piled fifteen to thirty five feet high upon one another, and we waited expectantly for the flood from the two dams above to come and move the intense mass. When the water arrived the men commenced to pick out the logs which formed the key and with about fifteen minutes work the vast mass gave way, fell seething into the water and went curling down the stream like a mammoth sea serpent wriggling on the water."*

By 1890, most of the timber that was easy to access had been harvested, so the loggers moved to Deep Creek, which ultimately played out as well.

The tremendous loss of cattle during the winter of 1886-1887 prompted the development of fencing and irrigation to better manage livestock. This also included the clearing of native vegetation; by 1915, it has been estimated that nearly 50% (12,000 acres) of sagebrush had been eradicated and replaced by introduced pasture grasses west of White Sulphur Springs (Petersen, 1995).

During the 10 years from 1938 to 1949 cattle numbers in Meagher County increased from 18,952 to 29,851 animals, an increase of 56% (MT State Engineers Office, 1950). During that same timeframe, sheep numbers dropped from 130,477 to 64,734, which is more than a 50% reduction. The production shift from sheep to cattle has been attributed mainly to a scarcity of dependable labor and the comparatively high operating costs of sheep operations. Severe over-grazing of rangeland occurred in the early 1900s culminating in Dust Bowl like conditions and soil erosion by 1934 (Peterson, 1995). Charlie Russell, the famous cowboy artist from Great Falls, wrote in a letter in 1913 of the Smith River valley, "…it's all grass side down now… a gopher couldn't graze now."

3.4 Mining Development

Near the end of the Civil War in 1864, four ex-confederate soldiers discovered gold on the upper Missouri River just north of Townsend and due west of the Smith River Valley (Peterson, 1995). This area became known as Confederate Gulch, and the discovery was associated with the first permanent white settlement in the Smith River country. Mining camps then spread across the Big Belts west of White Sulphur Springs, concentrating around the boom town of Diamond City on the west side of the divide. Some exploration expanded eastward to tributaries of the Smith River basin, in both the Big Belt and Little Belt mountains.

In the early 20th Century small coal mines were developed in the lower basin in Cascade County. There are two major clusters of abandoned coal mines/exploratory areas in the basin, one near the Hound Creek/Smith River confluence with about 20 sites mapped and another in Upper Hound Creek that has a few abandoned workings.

The Big Belt and Castle Mountains each host numerous abandoned hard rock mines. Although they are largely abandoned, metals exploration in the Smith River basin has continued in recent decades. In 1983, Cominco American Mining Company explored a lead and zinc deposit at the Camp Baker boat launch site, considering the potential for a massive mining operation. This effort was eventually abandoned due to a lack of viability.

The Black Butte copper deposit, located in the Sheep Creek watershed, was discovered early in the 20th Century, and its potential development is ongoing. The discovery was originally made through the identification of gossans on the surface, which are highly iron-rich rock that forms by the oxidation by weathering and leaching of a sulfide body. Early mining in the area included the work of Johnny Lee, who homesteaded in the area in 1910 and sank a shaft near the Johnny Lee deposit near Black Butte. The property then lay dormant until Homestake mining company drilled into a laminated pyrite bed and Cominco and Anaconda Companies drilled additional exploratory holes. The deposit became more economically viable in the 1980s with the discovery of rich copper ore. But, as copper prices were low at the time, it was not developed (White et. al, 2013).

Sandfire Resources America, Inc. (SRA) is now the primary owner of the mine. In 2020, a final Environmental Impact Statement (EIS) was completed for the mine and permitting was granted by DEQ to mine the Johnny Lee deposit (SRA, 2020). An initial phase of construction began. In June of 2020 a legal challenge was filed by a coalition of environmental groups (Montana Trout Unlimited, Montana Environmental Information Center, American Rivers and Earthworks) against DEQ and SRA's wholly owned subsidiary, Tintina Montana, Inc. (www.sandfire.com). A Montana district court found in favor of the plaintiffs and the construction effort stopped. SRA and DEQ appealed the ruling to the Montana Supreme Court. In 2024, the Montana Supreme Court sided with DEQ and SRA, concluding that DEQ made a "reasoned decision" when it approved the initial permit (Montana Free Press, 2024).

In March 2024, the Supreme Court heard initial arguments for another lawsuit filed by the same coalition and that case is currently pending. In this case the filing also named the Montana Department of Natural Resources and Conservation (DNRC). The coalition argued the DNRC has failed to show that existing water rights would be protected under the mine's groundwater management proposal (Montana Free Press, 2024).

3.5 Water Development

The shift from sheep to cattle operations was synchronous with irrigation water development and fencing. By the 1970s, there were about 33,000 irrigated acres in the basin, most of which were in Meagher County. Even then, the river was recognized as dewatered.

The upper Smith River basin supports extensive irrigation including widely-distributed small private irrigation systems and larger reservoirs on the North Fork and Newlan Creek. Irrigation water is derived from both surface water diversions and groundwater wells. Most irrigated acres are flood irrigated. Figure 19 shows the percent of irrigated land by irrigation type. Figure 20 shows the estimated distribution of irrigated lands in the upper basin in 2007; there has been a general expansion of flood irrigated fields to sprinkler pivots from about 50 to 300 acres over the past several decades.

In 2000, water used to irrigate about 32,600 acres of agricultural lands in the Smith River watershed accounted for about 685 acre feet per day of water withdrawals. Of the withdrawals for irrigation, surface water accounted for about 676 acre feet per day and groundwater accounted for about 8 acre feet per day (Sando et al., 2017). About 54% of irrigated lands are hay (grass and alfalfa), 26% is spring and winter wheat, 18% is barley, and 2% is classified as other.

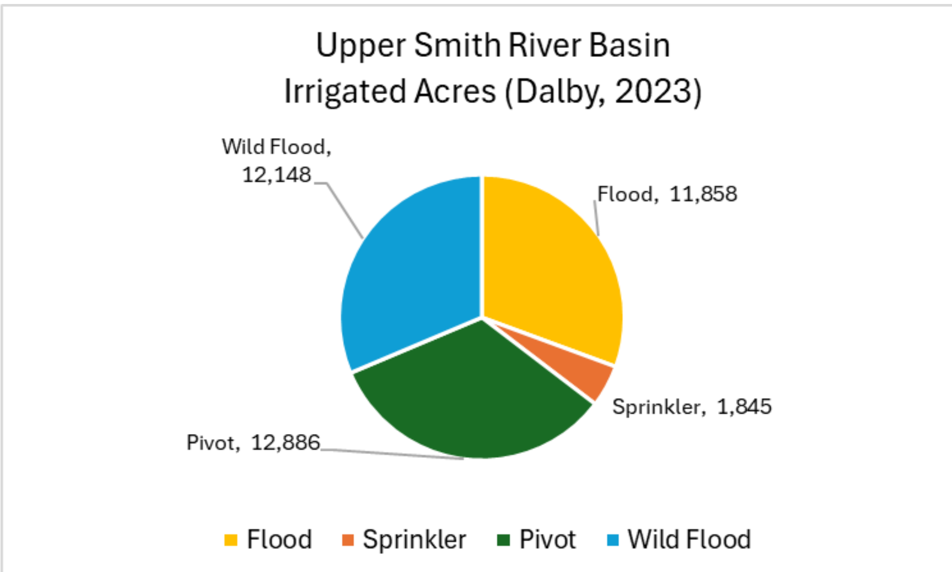


Figure 19. Upper Smith River basin irrigated acres by irrigation type (Dalby et. al, 2023).

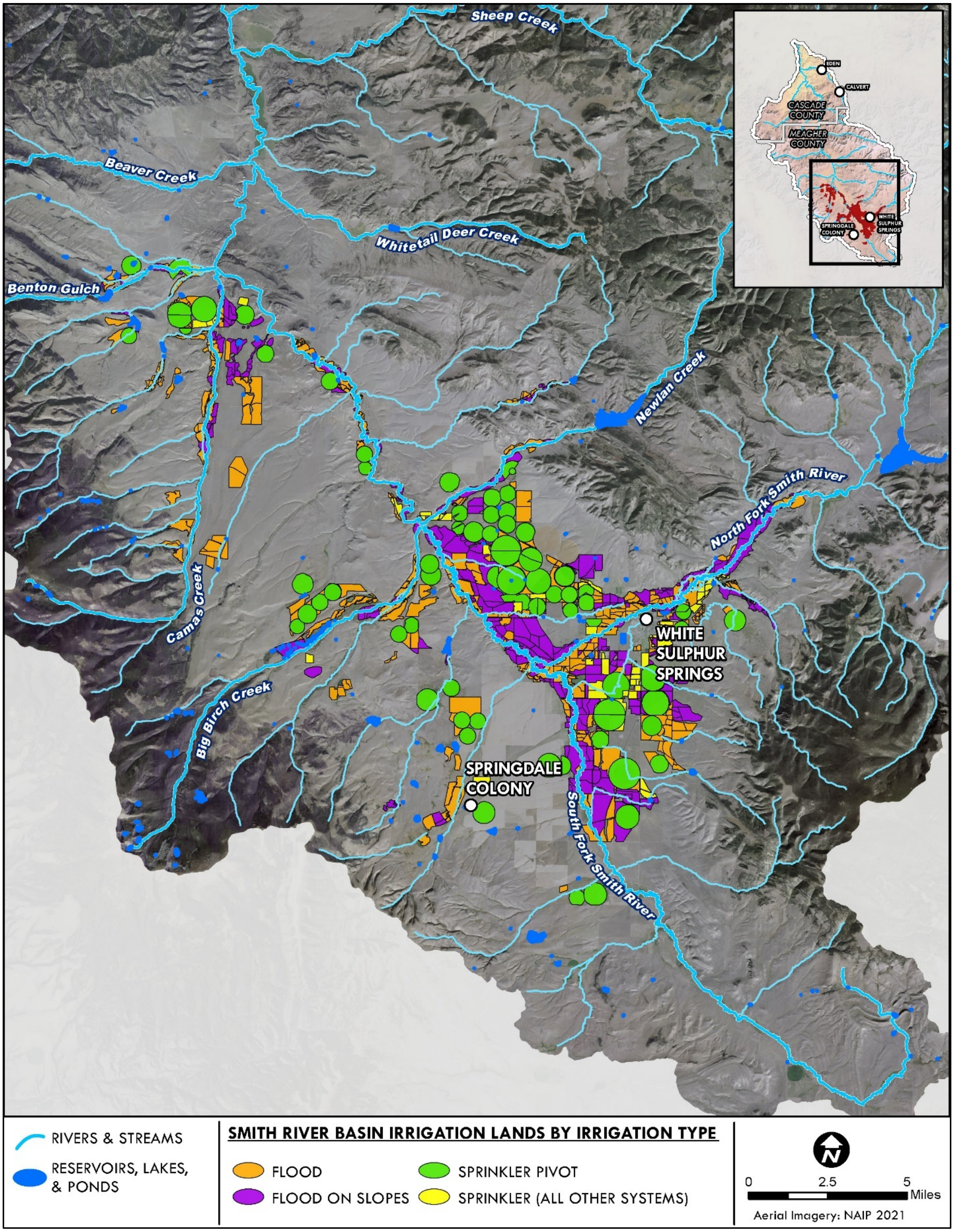


Figure 20. Upper Smith River basin estimated irrigated lands, 2007 (recreated from Dalby et. al, 2023).

There are two major water storage reservoirs in the basin, one on the North Fork Smith River and one on Newlan Creek. The North Fork of the Smith River Dam (also called Lake Sutherlin) was built in 1936 and has been operated since then by the North Fork of the Smith River Water Users Association (Figure 21). It has a capacity of about 11,500 acre feet over 335 surface acres. Ownership remains in the hands of the DNRC. In 2006, major rehabilitation work costing approximately $850,000 was undertaken on the dam.

Figure 21. Lake Sutherlin on North Fork Smith River.

In 1977, Newlan Creek Dam was constructed, creating Newlan Creek Reservoir, to provide irrigation water for the Meagher County Newlan Creek Water District (Water District) and to provide water-based recreational opportunities to White Sulphur Springs and the greater Great Falls, Helena, Butte, Livingston, and Bozeman areas (FWP, 2012) (Figure 22). The dam was engineered by the Soil Conservation Service (SCS) and built by a contractor out of Plains, Montana. The dam stores runoff in the Newlan Creek watershed, drawing from 43.4 square miles of watershed area.

Figure 22. Newlan Creek Reservoir.

Discharge from the groundwater system includes well withdrawals, seepage to streams and drains, and evapotranspiration from wet lowlands, flood-irrigated lands, and grasslands and pastures. As of 2011 there were approximately 900 documented water wells in the Smith River watershed (Nilges and Caldwell, 2012). The wells are unevenly distributed over the study area, with the majority of the wells located in the more populated area near White Sulphur Springs and in the valley flats. Several groundwater wells are used for irrigation in the upper basin (Figure 23).

The Smith River basin has been a focus area for the investigation of interactions between groundwater and surface water in Montana. The work was stimulated by concerns that increasing demands for groundwater will directly affect surface water flows and all of its beneficial uses. In the late 1980s and 1990s, the State Legislature recognized that many of Montana's rivers were over-appropriated, and enacted a series of basin closure laws that place a moratorium on the processing of new requests for appropriation until final decrees of water claims are completed. Although a basin closure was established for the Upper Missouri Basin, the closure continued to allow new withdrawals for groundwater, which was defined as water that had no "direct connection" to surface water.

In 1999, several Smith River basin irrigators requested that the DNRC conduct a hydrologic study of the basin, largely in response to active conversion from surface water supplied flood irrigation to groundwater supplied sprinkler irrigation and an associated increase in irrigated acreage. DNRC began collecting data in 2000, but the study was controversial and not completed. In 2001, the river went dry in sections, causing fish kills, and irrigators recognized that despite the basin closure, groundwater permits were continuing to be granted. At this point, Montana Trout Unlimited pushed for DNRC to complete an Environmental Assessment (EA) for 15 pending groundwater applications.

The EA included language that stated, "the Smith River and its principal tributaries are interpreted to be gaining streams that are hydraulically connected to groundwater", and that new wells would reduce surface flows with the impacts increasing with time (Ziemer et. al, 2006). This was followed by a district court filing in 2003 by 9 irrigators and landowners, three outfitters, and Montana Trout Unlimited. The plaintiffs alleged that DNRCs continued processing of groundwater applications after the agency determined that groundwater pumping would deplete surface flows was not adhering to the basin closure law (Ziemer et. al, 2006). Although the district court ruled in 2004 that the basin closure implementation was subject to agency discretion, the Montana Supreme court reversed that decision in a 5-2 opinion. As a result, the court ruled that DNRC must take the impacts of groundwater pumping into account in their management.

Testimonies of landowners near White Sulphur Springs included observations of the South Fork Smith River drying up following the completion of new irrigation wells within a quarter mile of the stream, suggesting a direct link between surface and groundwater along the South Fork Smith River (Ziemer et. al, 2006).

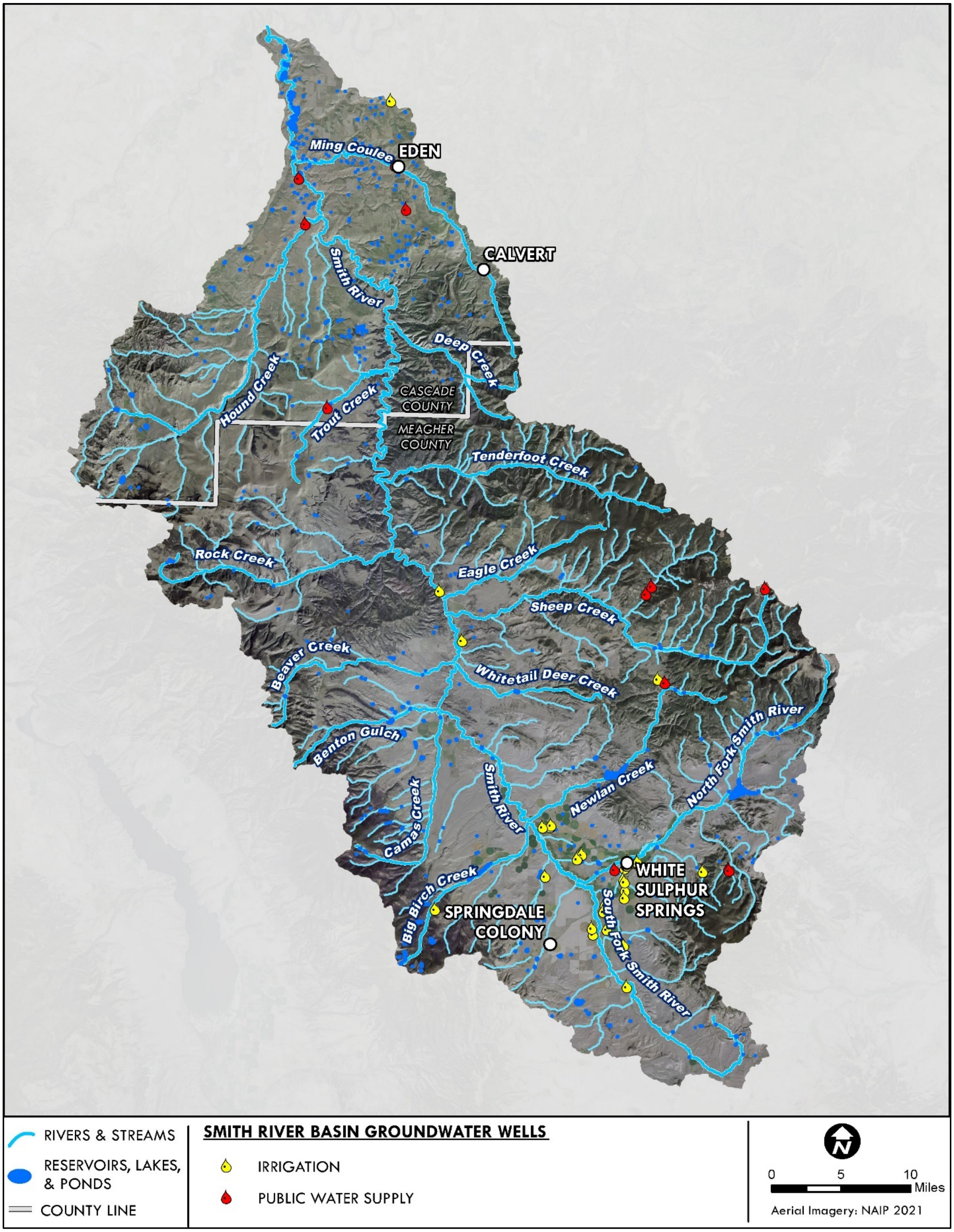


Figure 23. Locations of groundwater wells used for irrigation and public water supply in the Smith River basin.

3.6 Recreational Development

Public use of the Smith River increased significantly in the 1960s, creating safety issues and conflict between private landowners and the public. The Camp Baker Fishing Access Site was purchased by the State from private landowners in 1968. The early 1970s saw the onset of meetings held to discuss active recreational management of the Smith River in response to increased recreational use of the canyon portion of the river. Although many landowners and sportsmen agreed at that time that Wild and Scenic designation may be the most effective way to stop ongoing development in the corridor, the State had concerns over their ability to manage the river with that designation. A council convened by the Governor in 1970 recommended the following legislation:

1. An act designating the Smith River a State Recreational Waterway: providing that fish, wildlife, and recreation are legal beneficial users of water; and declaring it a navigable stream for the purposes of navigation.
2. An act recommending to the Constitutional Convention, revision of Montana's Constitution to permit the exchange of State lands with private individuals when such an exchange is in the public interest.
3. An act appropriating funds for acquiring scenic easements and obtaining land use options.

The Smith River State Recreational Waterway, also known as Smith River State Park, is a river corridor and "virtual park" managed by the State of Montana that provides multi-day recreational floating opportunities via a permit system. The park includes 58.9 miles of the state-owned Smith River, with 27 boat camps (52 total camp sites) located on FWP and USFS lands, as well as several leased boat camps from private landowners. Also included is the Camp Baker put-in and Eden Bridge take-out point (Figure 24). Approximately 80% of the land bordering the river is owned and managed by the USFS. The park is managed by FWP through a cost-share agreement with the USFS.

A timeline of major events related to management of the Smith River Corridor following the Governor's Council recommendations includes:

<u>1980</u>: The first river ranger is hired and FWP publishes a Smith River map and floater's guide. Designated boat camps are established, float gates and hazard signing installed and a floater-landowner survey is implemented.

<u>1983</u>: Pit latrines installed at high-use boat camps. The seasonal housing cabin is established at Camp Baker. FWP acquires 13 parcels of land via a three-way exchange between FWP, BLM and DNRC.

<u>1985</u>: Peak launch day saw 158 people put in on the river, prompting the establishment of a carrying capacity of 100 people launching per day.

<u>1988</u>: FWP drafts the first Smith River Management Plan. The plan initiates a system for managing public use of the river; defined a logical process for developing criteria to implement future regulations; and provided a foundation for a Department initiative to seek additional legislative authority for managing the river.

<u>1989</u>: The Montana Legislature adopts the Smith River Management Act (MCA 23-2-401) giving the Montana Fish and Wildlife Commission rulemaking authority to regulate recreational and commercial floating and camping use on the Smith River waterway. The purpose and intent of the legislation was to provide continued recreational and commercial use and enjoyment of the Smith River waterway, consistent with the river's capacity; seek ways to minimize conflicts between river users and private landowners; and protect the integrity of the river's water and canyon resources for future generations. The legislation also instructed FWP the responsibility to administer the river to allow the continuation of compatible existing recreational and public land uses; maintain the opportunity to enjoy the natural scenic beauty and solitude; and conserve fish and wildlife and scientific and recreational values.

1990-1992: FWP requires mandatory registration for outfitters, limits the total number of outfitter launches to historic use, implements user fees for private and outfitted floaters and limits the maximum group size to 15 people. The Smith River Corridor Enhancement Account is established through legislation, requiring that portions of user fees deposited into the account must be expended to lease or acquire property in the corridor; develop projects that protect enhance and restore fish habitats, streambank stabilization, erosion control, and recreation values; and to maintain and enhance instream flows for recreational and aquatic values in the corridor.

1993: Private floaters are required to pre-register by submitting a launch application. A random lottery drawing is implemented for any dates with over 8 private launch applications. After February 16, launch applications are accepted on a first-come, first-served basis, for any dates with unallocated launches.

1996: FWP drafts the second Smith River Management Plan. The purpose and need of the this plan was to, update the 1988 plan to reflect subsequent legislative and commission actions; establish the policy for adopting biennial rules and/or promulgating administrative rules in accordance with the Smith River Management Act; develop methods to ensure consistency and coordination between FWP and the USFS in regulating and managing outfitter permits and boat camps; define use of the Smith River Corridor Enhancement Account; and comply with the Montana Environmental Policy Act.

2009: FWP drafts the third Smith River Management Plan. The objectives of the plan addressed ways to promote a high quality floater experience; conserve natural and cultural resources; minimize conflicts between river users and private landowners; promote quality commercial outfitting; and implement management actions that are technically and socially feasible, reasonable, legal, affordable, measurable and enforceable. The plan would consider less-restrictive management tools before proceeding to more-restrictive management tools.

2022: The 2009 Management Plan is updated targeting four main management concerns – management of Camp Baker, human waste management, natural and cultural resource impacts, and floater opportunities.

2024: Pit toilets are removed from the Smith River and all float parties, private and commercial, are required to pack out their human waste from the river corridor. FWP identifies multiple types of portable, hard-sided toilets acceptable for human waste disposal. A SCAT (Sanitizing Containers with Alternative Technology) machine for disposing of human waste and cleaning portable toilets is installed at the Eden Bridge take-out.

Figure 24. Smith River State Park recreational float corridor (FWP).

4 Summary of Relevant Research, Assessments, Management Plans, and Agreements for the Smith River Basin

Substantial work has been performed in the Smith River basin related to planning, data collection, and assessment. To our knowledge, however, little of this work has been integrated or widely applied in resource management. The following section contains brief summaries of the most relevant work performed such that the results can be incorporated into this assessment and planning effort.

4.1 Planning and Management

There has been substantial work performed in the basin for long-range planning and management strategy development. The following section briefly describes those most relevant to this assessment.

4.1.1 2023-2026 Montana Statewide Fisheries Management Plan (FWP)

The guiding document for fisheries management in the Smith River basin is the Statewide Fisheries Management Plan (SFMP) that was first developed and implemented in 2013, and then updated in 2019. Subsequent legislation passed in 2021 (SB 360) stipulated a plan update, and the agency has now released four editions, with the more recent plans being more comprehensive and including more prescriptive actions. The plan will be updated every four years with extensive public input. The last update occurred in October, 2023 (FWP, 2023a).

Fish populations are heavily affected by environmental factors such as winter habitat and low summer streamflows, promoting the need for special regulations that include temperature-induced restrictions and closures. Management strategies also include making calls on FWP-owned Murphy Water Rights when flows are especially low. State legislation passed in 1969 secured these “Murphy” rights on 12 priority rivers in Montana, including the Smith River, with priority dates of either 1970 or 1971.

Low flow/high temperature mitigation is critical to the health of the Smith River fishery and its supporting aquatic ecology; lethal water temperatures as high as 83 degrees F have been recorded. At least two fish kills involving trout and whitefish that have occurred in the mainstem near Eden Bridge were attributed to the combination of low flows and high water temperatures. Over the past decade, recurring fish kills in late July involving stonecat have been reported in isolated lower sections of the float corridor, however specific cause is unknown but thought to include disease or parasites combined with environmental stress.

Drought related fishing restrictions are activated when low water flows and/or high water temperatures in trout bearing streams become potentially lethal. “Hoot Owl” restrictions are enacted usually between 2 pm and midnight when: daily maximum temperatures have reached or exceeded 73 degrees F at any time during 3 consecutive days; stream flows fall to or below 95% daily exceedance level based on hydrologic records; and/or water conditions meet the criteria established in any Drought Management Plan.

The SFMP also includes the following additional points of interest related to fisheries management objectives in the Smith River watershed:

- There are 1,220 miles of perennial streams in the basin, 100 of which are named. About 740 miles of those streams can support salmonids.
- Prior to 1973, the system was heavily stocked, and the Smith has been managed as a wild trout fishery since 1974.
- Small headwater streams are dominated by brook trout whereas rainbow and brown trout dominate higher order, lower elevation streams.
- The majority of extant populations of westslope cutthroat trout are located in high elevation streams on USFS land. One of FWPs management goals in the conservation of these populations is to have 20% of the historically occupied habitat restored to secure conservation populations.
- Hot springs feed the surface water system near White Sulphur Springs and in the uppermost segments of the South Fork, resulting in elevated water temperatures.
- Trout that were tagged in the Smith system are commonly found utilizing the Missouri and Sun River between Ulm and Great Falls.

A tabulated summary of the management directions for individual waterbodies in the Smith River drainage can be found in the FWP management Plan: https://fwp.mt.gov/binaries/content/assets/fwp/conservation/fisheries-management/statewide-fisheries-management-plan-2023-2026/2.21_smith-river-drainage.pdf.

4.1.2 Meagher County Long-Range Plan (NRCS, 2022a)

The Meagher County Long Range Plan was first written in 1978 and subsequently updated as a working document that describes the natural resources of Meagher County, inventories resource problems, and prioritizes projects for NRCS incentive programs. Partners in the plan development include Meagher County CD, FWP, and the Meagher County Weed District.

Primary resource concerns in Meagher County were identified as follows:

1. **Water Quality Degradation**: The types of water quality degradation listed include excess nutrients (nitrogen and phosphorous), excess fine sediment, removal/alteration of riparian vegetation from grazing, low flows, and nuisance algae levels.
2. **Insufficient Water (South Fork Smith River, Birch Creek, North Fork Smith River, Camas Creek, Sheep Creek, Smith River)**: Concerns were identified regarding the impacts of low flows on fish habitat and water use.
3. **Soil Erosion:** Accelerated erosion was described in terms of the removal of streamside soil-binding vegetation, as well and fall tillage with fields left without cover, can experience excessive erosion.
4. **Degraded Plant Condition – Plant Productivity and Health**: Rangeland productivity was noted as below potential. With grazing pressure, forbs replace grasses, and hayfields that receive either too much or too little water or poorly distributed water experience low productivity.

5. **Degraded Plant Condition – Excessive Plant Pest Pressure**: Noxious weeds were identified as a major concern that requires continued diligence to control. Spruce budworm has killed/defoliated thousands of acres of Douglas-fir in the basin, and mountain pine beetle have killed thousands of lodgepole pine trees. The standing dead and downed trees create a fire hazard and make forage inaccessible for grazing.
6. **Degraded Plant Condition – Wildfire Hazard, Excessive Biomass Accumulation**: Because of a lack of fire, fuels have accumulated on forested lands that are currently overstocked with young trees. Additionally, Douglas-fir and pine have been documented as encroaching onto grasslands, altering hydrology and forage potential.
7. **Inadequate Habitat for Fish and Wildlife**: The largest concern regarding upland habitats is the conversion of sagebrush to cropland through herbicide or mechanical means; affecting populations of sage-grouse, elk, deer, pronghorn, small mammals, and small birds.
8. **Livestock Production Limitation – Inadequate Feed and Forage:** In terms of rangeland productivity, it was noted that many areas of range are producing less than 30% of their potential forage. The most impacted areas tend to be low elevation rangelands that are used for spring grazing.
9. **Inefficient Energy Use – Farming and Ranching Practices and Field Operations**: Irrigation pumps are used to irrigate fields that could be irrigated with gravity lines and smaller pumps. Tillage could be reduced on some operations, reducing the amount of fuel needed to grow crops.

A wide range of desired management actions are described in the plan, including the following:

- Conifer removal from rangelands
- Improvement of forage for both wildlife and livestock
- Reduction of insect and disease infestations
- Reductions in wildfire risk
- Continued weed control
- Implementation of facilitating practices such as stock water and fences to utilize unused forage, increase plant recovery and improve rangeland health
- Improved riparian vegetation on streams
- Leave large riparian buffers between streams/rivers and winter grazing
- Reduced erosion and sediment recruitment in streams
- Improved irrigation efficiency to increase streamflow
- Reduced application of nutrients in spring before runoff
- Reduced tillage of cropland
- Reduced burning of croplands
- Utilization of more crops in rotation

Since the 2022 Meagher County long-range plan update, NRCS has implemented projects to improving grazing land health in the basin (see Section 4.1.4).

4.1.3 Cascade County Long Range Plan (NRCS, 2019)

The Cascade County Long Range Planning effort led by the NRCS included locally lead meetings. The plan describes the natural resources of Cascade County, inventories resource problems, and prioritizes projects for NRCS incentive programs. Partners in the plan development include Cascade County CD, FWP, and the Cascade County Weed District. The two primary issues raised included plant pest pressure and streambank erosion.

Primary resource concerns in Cascade County were identified as follows:

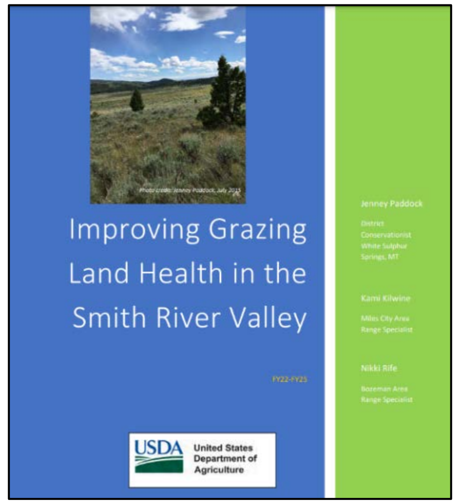
1. **Soil Erosion:** Streambank erosion was the biggest concern in all the meetings held. Soil health education was highly recommended.
2. **Water Quality and Quantity:** These concerns relate to excessive chemical and fertilizer runoff, Alkali/saline seeps, storm water runoff from urban development, and acidic water from abandoned mines. Excess water in the irrigated areas was noted as creating excess water and salinity issues. Alkali/saline seeps, storm water runoff from urban development, and acidic water from abandoned mines are not issues identified in the Smith River basin.
3. **Plant Suitability, Condition and Management:** Identified invasive and noxious weeds include leafy spurge, houndstongue, spotted and Russian knapweed, Dalmatian toadflax, hoary cress, whitetop, oxeye daisy, cheatgrass and hoary alyssum. Ventenata has been recently discovered in Cascade County and must be addressed before the density is above the economic threshold. Forest management was listed in terms of fire mitigation, thinning and downfall.
4. **Animals Domestic and Wildlife:** These issues relate to cheatgrass on rangelands, lack of livestock water, and overgrazing.

The plan notes that the Cascade County NRCS field office will deliver the following:

- Specific actions to address the resource concern.
- A measurable amount of each resource concern to address that is feasible and financially responsible.
- Actions that are attainable within the timeframe of the objective 3-5 years.
- Realistic results and change from current condition to predicted condition.
- Monitoring and follow up before, during and after plan is developed.

NRCS is working with landowners in the Smith River basin to address issues related to the 2021 Harris Mountain Fire including excluding livestock from burned areas, water development, fencing, improved stream crossings, and construction of beaver dam analogs (BDAs) to capture sediment from fire-related run-off.

4.1.4 *Targeted Implementation Plan (TIP): Improving Grazing Land Health in the Smith River Valley (NRCS, 2022b)*



Targeted Implementation Plans (TIPs) are local-level Environmental Quality Incentives Program (EQIP) initiatives used by NRCS in Montana to guide on-the-ground implementation of locally developed Long Range County Plans. The Meagher County office of the NRCS has recently developed a FY 2022-2025 TIP for the Smith River Valley with a goal of improving plant productivity and health on rangelands, which has been Meagher County's long-standing priority resource concern.

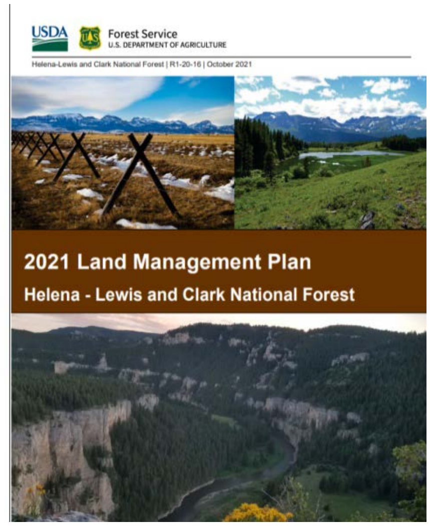
The area specified for the TIP includes 12 ranches, many of which use private forest land and USFS land for summer grazing, using their deeded ground for spring and fall grazing. The area was chosen because of the number of family operations that could be improved through better grazing management and grazable forest enhancement practices as well as its proximity to the USFS Horsefly Vegetation Project. The area is broken into three phases, covering a wide area of Meagher County.

The impetus for the project stems from trends that show forests becoming increasingly dominated by mature stands, with greater proportions of shade-tolerant species, higher stand densities, and conifer encroachment in forest openings. This encroachment has been ongoing over the past 120 years to varying degrees across the landscape as fires have been suppressed. As the timber cover has increased, the carrying capacity of the rangeland has dropped. The conifer encroachment into the valley has also reduced productive winter range for elk and mule deer.

The restoration of a fire regime would be highly beneficial in meeting project goals, but doing so would require extensive burns that are difficult to implement and manage. The TIP approaches the restoration by mimicking natural fire disturbance through fuels reduction via thinning and removal of woody vegetation.

4.1.5 Helena-Lewis and Clark National Forest Plan (USFS, 2021a)

The Smith River basin contains three major Geographic Areas (GA) of the Helena-Lewis and Clark National Forest: the Big Belts GA, Little Belts GA, and Castles GA. In 2021, the USFS published a forest plan that includes priorities and desired conditions for each of these areas. A total of 3,300 acres of the Smith River Corridor are listed in the plan as an "emphasis area" of the Little Belts GA.



The Forest Plan includes Forestwide Directions for Soil, Air Quality, Fire and Fuels Management, Vegetation, Wildlife, Recreation, Cultural Resources, Land Status/Ownership, Infrastructure, and Benefits to People. The following is a summary of the ***Forestwide Directions for Aquatic Ecosystems***.

Specific objectives for the 296 ***Subwatersheds*** included in the plan are as follows:

1. Within at least four priority watersheds, complete essential work as defined by the Watershed Restoration Actions Plans identified in the Watershed Condition Framework.
2. Improve soil and watershed function and resiliency on an average of 500 acres/year with an emphasis on priority watersheds under the Watershed Condition Framework and Conservation Watershed Network.
3. Plan and implement restoration activities on at least two acres of groundwater dependent ecosystems every five years.

For ***Riparian Management Zones***, forest-wide objectives include:

1. Improve at least 500 acres of riparian habitat during the life of the forest plan. Improvements can be actions such as, but are not limited to, road obliteration, riparian planting, and reconstructing floodplains by removing road prisms or berms.

For ***Fisheries and Aquatic Habitat***, forest-wide objectives include:

1. Improve the habitat quality and hydrologic function of at least 20 miles of aquatic habitat, focusing on streams with listed species or species of conservation concern. Activities include, but are not limited to, berm removal, large woody debris placement, road decommissioning or stormproofing, riparian planting, and channel reconstruction.
2. In streams with recreational fishing populations, improve the habitat quality and hydrologic function of at least 20 linear miles of habitat. Prioritize impacted, highly productive stream segments.
3. Reconnect at least 10 miles of habitat in streams disconnected by roads or culverts where aquatic and riparian-associated species migratory needs are limiting distribution of those species.

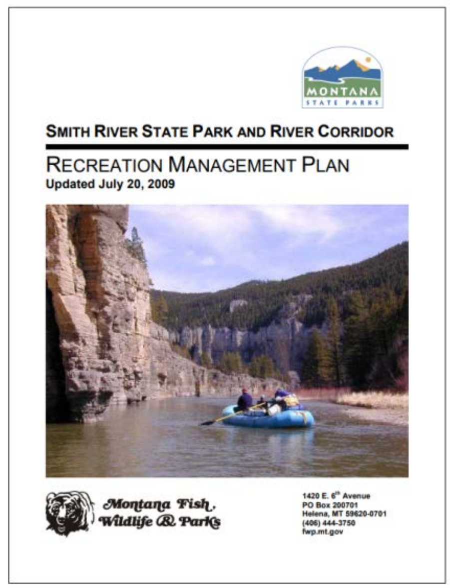
Conservation Network Subwatersheds **(CWNs)** that lie within the Smith River basin include Newlan Creek, Rock Creek, Camas Creek, the Smith River, North Fork Smith River, and South Fork Smith River, Sheep Creek, and Tenderfoot Creek. These watersheds have been prioritized for long-term conservation and preservation of westslope cutthroat trout and water quality. Objectives for these CWNs include:

1. Repair at least two road/stream crossings every five years at locations where chronic sediment sources are found (for example, up-size culverts, reduce sediment delivery to waterways from roads, realign stream constraining road segments, improve livestock stream crossings and trailing, etc.).
2. Stormproof at least 15% of the roads in the conservation watershed network. Restoration to benefit threatened, endangered, proposed, and candidate aquatic species is the first priority, followed by restoration for aquatic species of conservation concern, and municipal watersheds.

4.1.6 Smith River State Park and River Corridor Recreation Management Plan (FWP, 2009)

Smith River State Park is located in FWP's Administrative Region 4. It is a protected river corridor that is approximately 58.9 miles long. It is comprised of:

- One public put-in access point owned by FWP, also referred to as Camp Baker.
- Fifty-two boat camps (27 owned by USFS, 15 owned by FWP, 10 leased by FWP) along the river; and
- One public take-out point owned by FWP, also referred to as Eden Bridge.



Beyond the boat camps, put-in and take-out areas, much of the surrounding shore-line area is owned by the USFS, BLM, and private landowners.

Smith River State Park is managed under the Smith River State Park and River Corridor Recreation Management Plan (originally published by FWP in 1988 and updated in 2009), as well as a subsequent update in the Smith River State Park and River Corridor 2022 Recreation Management Plan Update (FWP, 2009 updated 2022). A wide range of management directions aimed at reaching stated desired conditions are contained in the plan.

FWP has witnessed a notable increase in use of the Smith River Corridor and the associated impacts to river resources and the river recreation experience. These observations, coupled with a growing demand for recreational opportunities in Montana, led to the need for further river recreation management planning through an updated plan. The most recent update addressed issues related to the Camp Baker put-in, the permit lottery system, user impacts on natural and cultural resources, and management of human waste.

Some key management directions specific to ecosystem services within the corridor include the following:

1. ***Fisheries Resources:*** FWP will promote conservation practices that enhance stream and riparian habitats and minimize the potential for introduction of noxious and aquatic nuisance species. Efforts will be made to improve understanding of the fishery and aquatic resource through applied research.
2. ***Water Resources:*** FWP will seek to enhance in-stream flows by supporting collaborative and cooperative relationships with private landowners, agencies, and conservation organizations. Biological and mechanical applications will be used to enhance native riparian vegetation.
3. ***Vegetation and Soil:*** FWP will pursue streambank stabilization and riparian revegetation projects in high priority areas and continue to promote river recreationists to practice the principles of 'Leave no Trace' as a means of minimizing adverse impacts to vegetation and soil.
4. ***Noxious Weeds:*** FWP will continue to cooperate and collaborate with the Meagher and Cascade County Weed CDs, the USFS, and the Smith River Habitat Project (SRHP) (see 4.1.8 below) to aggressively treat noxious weed infestations, evaluate current treatment techniques, explore alternative treatment strategies, and seek continued and varied funding for weed control.

The 2022 update of the 2009 Management Plan update targeting four main management concerns – management of Camp Baker, human waste management, natural and cultural resource impacts, and floater opportunities.

4.1.7 FWP/USFS Recreation Corridor Memorandum of Understanding (MOU)

FWP and the Lewis and Clark and Helena National Forests established a Smith River Maintenance and Operating Agreement in 1993 for the purpose of cooperating in the management of public resources on the Smith River. This agreement endorses FWP's responsibility for the management and administration of the floater permit lottery system, the mandatory floater permit and allocation system, Camp Baker put-in and Eden Bridge take-out facilities, maintenance of 52 designated boat camps, and a river ranger patrol program. This agreement was supplemented in 1995 with a Challenge Cost Share Agreement and annual Financial and Operating Plan. The Challenge Cost Share Agreement is updated annually and includes a funding allocation from the USFS ($7,000 in 2008) to support FWP operations on the Smith River.

FWP and the USFS maintain a strong collaborative and cooperative relationship that is built on a foundation of open and frequent communication. The agencies conduct an annual Smith River work and maintenance float, an annual Smith River operations review meeting, and co-host an annual meeting with the authorized outfitters.

4.1.8 Smith River Corridor Coordinated Weed Management Area Agreement

This agreement is between the SRHP, FWP; Cascade County, Meagher County, and the Helena-Lewis and Clark National Forest (USFS, 2021b). The purpose of this agreement is to document the cooperation between the groups to plan and implement projects that enable a more effective noxious weed inventory, monitoring, and treatment program in the Corridor.

The agreement meets the mandates of the various agencies through:

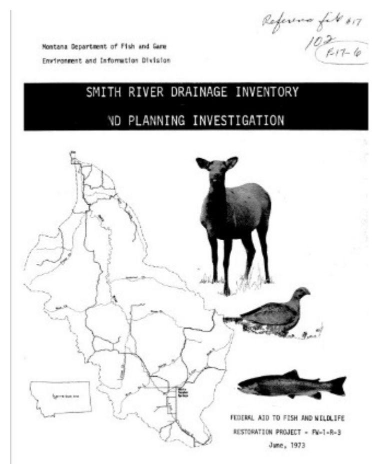
- The USFS has a responsibility to establish integrated weed management systems to control or contain undesirable plant species and to fund noxious weed management program on USFS lands (Federal Noxious Weed Act).
- The Counties oversee weed management programs on private lands under their jurisdiction.
- FWP is required by the Montana County Noxious Weed management Act of 1985 to control noxious weeds on its lands. The Smith River Management Plan of 2009 directs FWP to work with cooperating partners to aggressively treat noxious weed infestations, evaluate current treatment techniques, explore alternative treatment strategies, and seek continued and varied funding for weed control.

The SRHP is a private non-profit 501(c)(3) organization formed in 2003 to protect the Smith River's diverse agricultural, recreational, cultural, and natural resources from the threat of invasive species. The SRHP has a volunteer board of landowners and other stakeholders. This organization submit grants to the Montana Noxious Weed Fund annually to support the program and hire and manage the weed control contractors. Noxious weed treatment and monitoring efforts have occurred within and around the Corridor since 2005 through this agreement.

4.2 General Stream Assessments

Several stream assessments have been completed in various parts of the Smith River basin over the last several decades.

4.2.1 Smith River Drainage Inventory and Planning Investigation (Montana Fish and Game, 1973).



This assessment was a comprehensive inventory of fish and wildlife in the basin between 1969-1972 and was the first inventory to be completed at a watershed-scale in Montana.

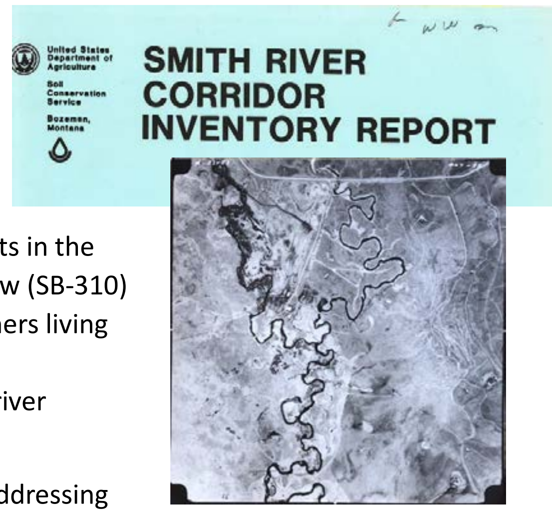
Of interest in this assessment are the similarities between issues 50 years ago and today, including low summer flows and elevated stream temperatures. This assessment also noted deterioration of stream habitat on all streams as an issue for fish and wildlife. The main recommendation made in this assessment was for stream preservation and control of water pollution (siltation). Additional interesting recommendations related to maintain and enhancing fishery resource in the Smith River drainage included:

- Including all projects involving stream channels under the Montana Stream Preservation Act.
- The need for a state water quality and monitoring plan and stringent enforcement of the Montana Water Pollution Control Act.
- Declaring floatable rivers as navigable to allow public access, for the purpose of recreation.
- Legislation for proper planning and zoning to restrict development on streambanks or floodplains.
- Legislation to permit the exchange of state lands with private individuals.

- Increase land purchase for access along important fishing rivers and streams.
- Designation of the Smith River as a State Recreational Waterway and declared navigable from Hwy 360 to the confluence.
- Feasibility study for flow and habitat maintenance in the Smith River by means of storage facilities on the river near Fort Logan and on Sheep Creek.

4.2.2 Smith River Corridor Inventory (USDA SCS Bozeman, 1985)

The Smith River Corridor Inventory was based on aerial imagery that included the lower half of the South Fork, most of the North Fork, and all of the Smith River mainstem to the Missouri River. It was conducted at the request of the Meagher and Cascade County CDs. The inventory was conducted during summers of 1983 and 1984 to provide baseline resource data to assist the districts in the administration of the Streambed Land and Preservation Law (SB-310) and in making management recommendations to landowners living along the Smith River. The study was intended to develop baseline/benchmark data to apply a systems approach to river management.



Primary recommendations in the report relate mostly to addressing bank instability by maximize long-term bank stability and maintaining channel equilibrium. Specific recommendations included: bank assessments, treatment developments, riparian grazing plans, riparian buffer management, and upgrading of in-stream irrigation infrastructure.

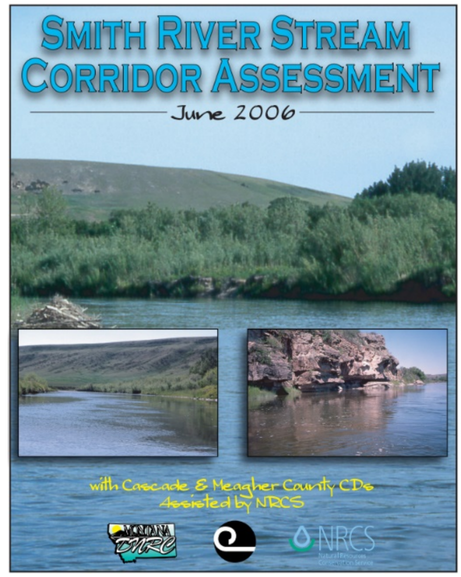
4.2.3 DNRC Stream Assessment for Birch and Camas Creeks (Meagher County CD, 1995)

Between 1993 and 1995, the Meagher County CD was conducting water quality sampling on the Smith River and its major tributaries, which led to a spring 1995 decision to complement that data collection effort with stream assessments. Birch Creek and Camas Creek were selected to be assessed in the first year. The assessment consisted of a rapid assessment that characterized the relative condition of the streams by identifying both healthy conditions and problem areas. The effort also incorporated stakeholder input through interviewing long-time operators.

The assessment showed Birch Creek as having minor impairments related to bank erosion, noxious weeds, dewatering, lack of stream shading, and fine sediment accumulations on gravels. The authors noted brook trout and cutthroat trout in upper reaches, moderately high quality fish habitat, and areas of healthy riparian zones.

Camas Creek was also determined to have minor impairments, with similar issues of bank erosion, riparian degradation, noxious weeds, and near-stream corrals. There were also segments with wide riparian zones, complex channel form, and low silt concentrations.

4.2.4 2006 DNRC Smith River Stream Corridor Assessment, (Warren Kellogg for Meagher County and Cascade County CDs, 2006)



In 2006, Cascade and Meagher County CDs teamed with NRCS to complete an assessment of the Smith River basin.

The assessment contains observations and planning considerations for specific stream segments throughout the watershed. The assessment included the mainstem Smith River, North Fork, South Fork, Birch Creek and Camas Creek. The main planning considerations included irrigation infrastructure improvements, weed management, riparian vegetation management/improvement, and channel improvements.

The NRCS method for assigning functional conditions was used to evaluate channel condition, hydrologic alterations, streambank stability, and riparian health. Riparian conditions were described as “relatively good for trout and coldwater aquatic life” in the upper reach above the Smith River Canyon. In the canyon reach, geologic controls result in a much more limited riparian zone. Below the canyon, the lowest reach has limited riparian vegetation and some sections with high, steep, eroding banks.

The effort included water quality sampling for nutrients (nitrogen and phosphorus), chlorophyll a, total recoverable metals, total suspended solids and total dissolved solids. Field measurements of pH, specific conductance, and water temperature were also collected. Water quality was described as generally good, with moderate total dissolved solids (TDS) values in the North and South Forks. It was noted, however, that nutrient enrichment high enough to cause excessive algal growth was a problem, with phosphorous levels above the desired maximum of 0.1mg/l having been documented by USGS water quality data at five sampling sites in the upper basin. Additional problems noted on the mainstem included dewatering, flow alterations, nutrients and pathogens. The segment of the Smith River below Hound Creek was described as having similar problems, with warm water, bank erosion, and aquatic/riparian habitat degradation.

Noxious weed issues are identified throughout the assessment, with leafy spurge identified as the primary noxious weed along the mainstem and throughout the corridor. Houndstongue was noted as present to a “varying degree” in the corridor but its infestations were noted as poorly documented. Other weeds include common tansy, Canada thistle, field bindweed, sulfur cinquefoil, whitetop, and toadflax.

Recommendations included:

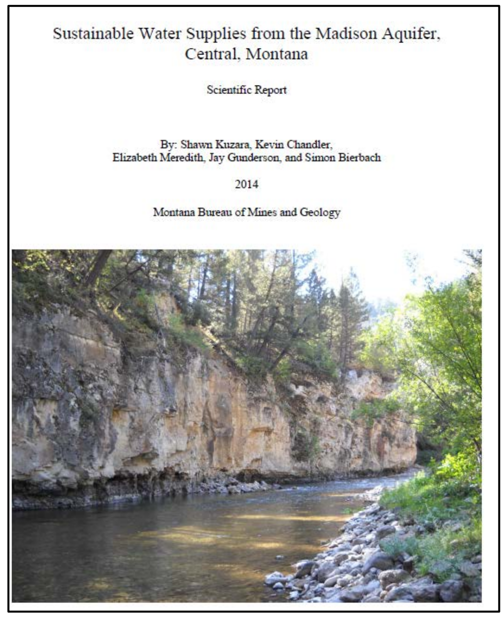
- Channel and streambank stabilization;
- Reduce manure run-off from corral systems and winter feeding areas;
- Riparian vegetation improvements and riparian buffers;
- Noxious weed management;
- Irrigation diversion and system improvements and efficiencies;
- Subdivision septic maintenance and education program;

- Address recreational boat camp impacts;
- Sutherlin Reservoir Operation Plan to reduce water quality impacts;
- Further investigation of water quality impairment sources;
- Ground water investigations to determine basin impacts from increasing conversion of flood irrigation to sprinkler irrigation.

4.3 Water Quantity Assessments

Several water quantity assessments have been completed in various parts of the Smith River basin over the last several decades.

4.3.1 Sustainable Water Supplies from the Madison Aquifer, Central Montana (MBMG, 2014)


Sustainable Water Supplies from the Madison Aquifer, Central, Montana

Scientific Report

By: Shawn Kuzara, Kevin Chandler, Elizabeth Meredith, Jay Gunderson, and Simon Bierbach

2014

Montana Bureau of Mines and Geology

The Madison limestone is a large groundwater aquifer system in the middle and lower Smith River basin. Faulting, fracturing, and karstification of the limestone has greatly increased aquifer storage and transmissivity but these features are unevenly distributed. Because of its importance as a resource, the Montana Bureau of Mines and Geology (MBMG) preformed a study in parts of Cascade, Judith Basin and Fergus Counties to evaluate water levels, spring and stream flow rates, and water quality measurements associated with the aquifer.

The researchers found that the primary aquifer is in the Mission Canyon Formation of the Madison Group, which is referred to as the "Madison Limestone Aquifer". This aquifer has surface exposures in the Big Belts, Little Belts, and Big Snowy mountain ranges.

The Smith River was the largest stream evaluated in the study. About 36 miles of Smith River streambed crosses Madison Group outcrop through the Smith River Canyon, so this river segment provided a good opportunity to evaluate the amount of surface water lost to the limestone or groundwater contributed to the stream directly via the aquifer system.

The results showed that the net effect of stream interaction with the limestone was a cumulative loss of about 150 cfs over that 36 mile stretch of river (Figure 25). Although the net effect was surface water losses to the aquifer, there were discrete areas where upwelling is occurring, the most significant of which is where the river crosses a major fault zone near Tenderfoot Creek. Additional gains were measured just below Trout Creek.

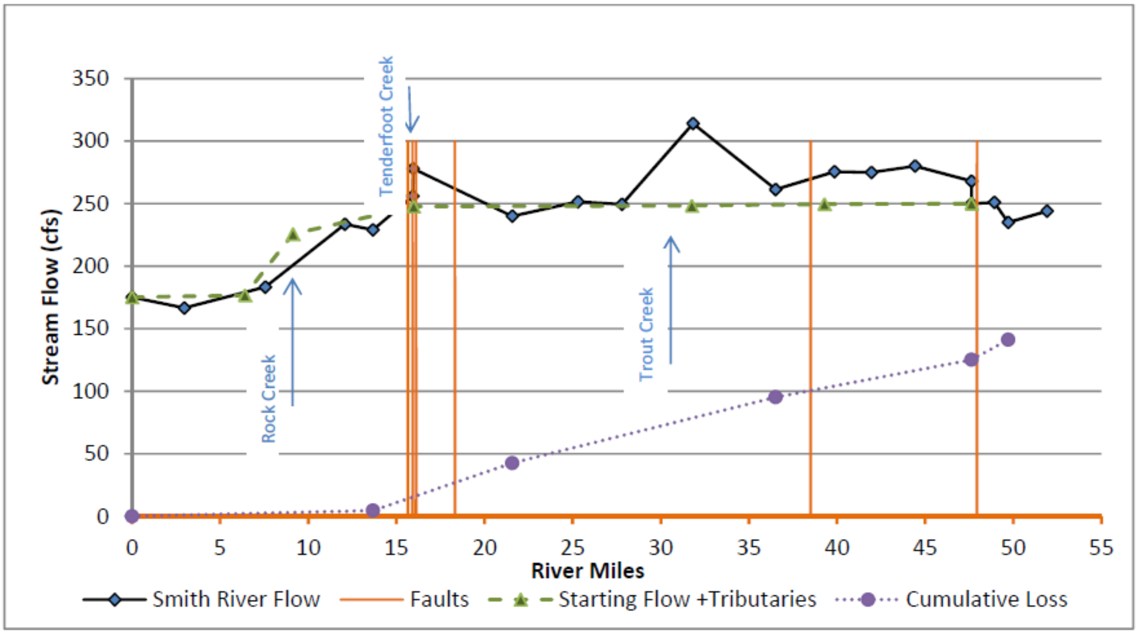


Figure 25. Gains and losses in flow on the Smith River based on September 11 measurements. The orange bars represent the approximate locations of faults crossing the stream channel. (MBMG, 2014).

4.3.2 Groundwater and Surface-Water Interaction Within the Upper Smith River Watershed Montana 2006-2010 (Caldwell and Eddy-Miller, 2013)

In the Upper Smith River basin, understanding how surface and groundwater interacts during irrigation and non-irrigation seasons has been an area of interest in recent years. The USGS has done substantial work in this area, publishing several documents and conference abstracts in the process.

In the upper basin, the most productive and developed aquifers are contained within shallow alluvium as well as deeper Tertiary-age basin fill sediments. The alluvial aquifers are generally composed of sand and gravel with varying clay layers. The basin fill aquifers are generally fine grained with lower permeability, however, some of the most productive wells produce water from the basin fill sediments.

Nearly 35,000 acres of land are irrigated in the upper watershed, using water primarily from the Smith River and its tributaries. In 2000 it was estimated that total use for irrigation was about 224.54 million gallons per day or 252,200 acre feet per year. Groundwater was a small portion of that at 2.7 million gallons per day. Almost 99% of the water withdrawn was used to irrigate 34,650 acres of cropland and pasture. Many irrigators have switched from flood to sprinkler systems, which can affect groundwater flux patterns. Some irrigators have considered using groundwater instead of surface water which could cause additional changes in hydrology.

In terms of general patterns, the results showed the following:

- Groundwater levels were typically highest in late spring to early summer, fell during summer and then recovered late summer through fall.
- Groundwater levels rebounded during mid-August to mid-September at most sites as a result of decreases in irrigation, increased flow in losing streams, decreased evapotranspiration (ET), and the onset of local flood irrigation at some sites.

- Groundwater levels increased coincident with timing of flood irrigation. At one cross section groundwater levels went from 0.1 feet below the stream stage to 0.6 feet above the stream stage within 5 days in response to flood irrigation.

Figure 26 shows results of stream flow measurements made near White Sulphur Springs during the non-irrigation season as well as during the irrigation season. The results showed that, during the non-irrigation season, the following streamflow conditions were observed:

- 2-9 cfs net gains on the lower South Fork
- 2-9 cfs net losses on the lower North Fork
- 13-29 cfs gains on the upper 41 miles of mainstem

During the irrigation season, losses are more prevalent, with the following conditions observed:

- Neutral conditions on the lower South Fork
- Approximately 70 cfs losses on the lower North Fork
- 2 to 8 cfs losses on the upper 41 miles of mainstem

These irrigation season values represent both water withdrawals as well as infiltration.

The mapped diorite sill just downstream of the mouth of Newlan Creek (Figure 5) has been suggested as a driver of high groundwater elevations as it forms a subsurface ridge of relatively impermeable rock that has created somewhat of a groundwater dam in that area and potentially lifted groundwater levels up-valley. The area around the North/South Fork confluence has been described as far back as during GLO surveys as “boggy bottom” and drain ditches in the lower South Fork valley all support the persistence of high groundwater levels in this area.

General conclusions presented in the study include the following:

- Groundwater and surface water are hydraulically connected along the Smith River and its tributaries.
- Both losing and gaining reaches occur throughout the area.
- Dynamic changes occur in the direction and magnitude of water flow between the stream and groundwater through time, emphasizing their overall connectivity.
- Local flood irrigation affects groundwater levels and gradients.
- Local flood irrigation results in irrigation return flows to area streams.

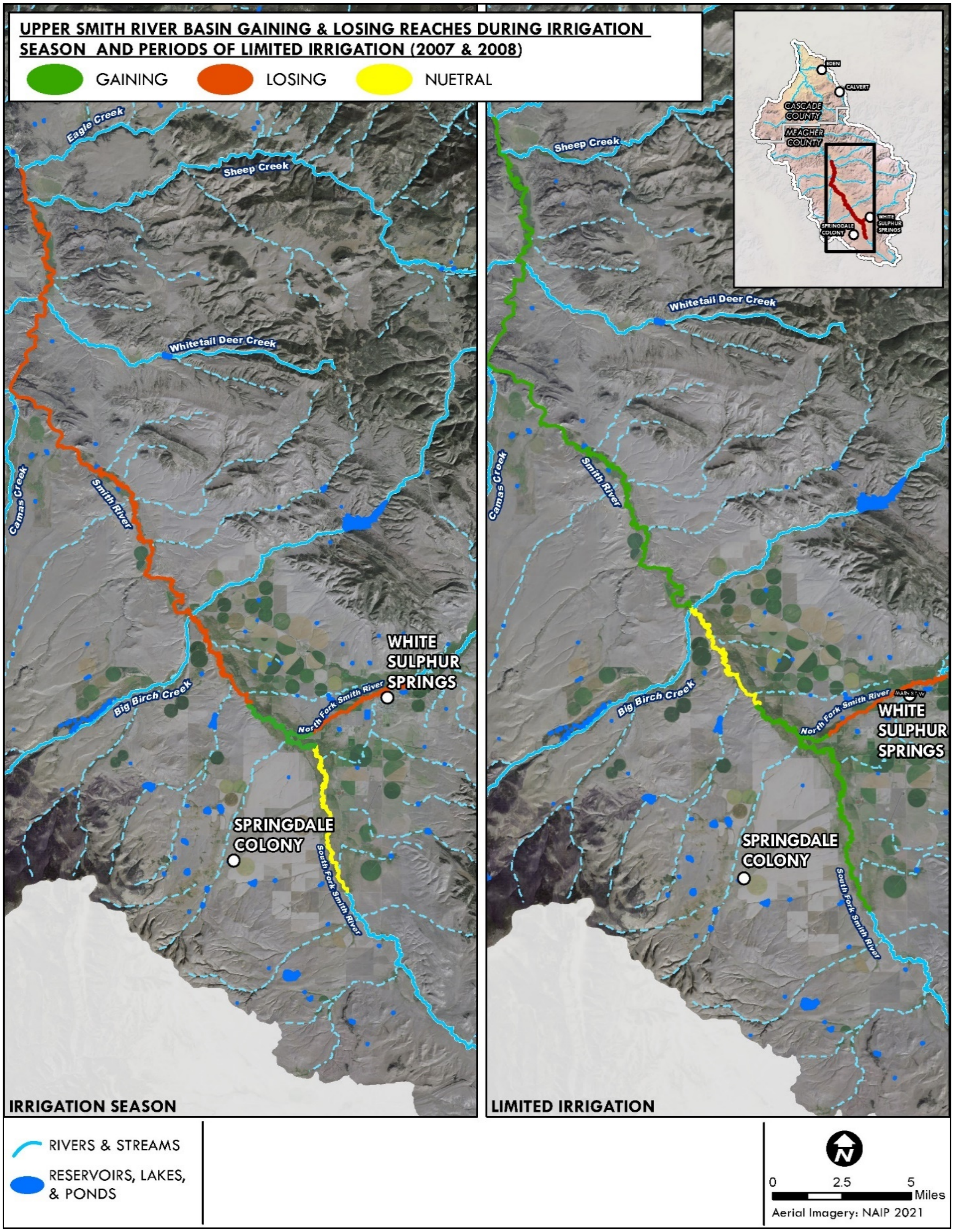


Figure 26. Gaining and losing reaches near White Sulphur Springs during an irrigation season event (left panel) and a non-irrigation season sampling event (right panel) (Caldwell and Eddy-Miller, 2013).

4.3.3 Evaluating the Impact of Irrigation on Surface Water-Groundwater Interaction and Stream Temperature (Essaid and Caldwell, 2017)

Changes in groundwater discharge to streams caused by irrigation practices can influence stream temperature. This analysis included observations along two flood-irrigated reaches in the upper Smith River watershed and showed a downstream temperature decrease resulting from groundwater discharge to the river. Model results were used to compare streamflow, groundwater recharge, and groundwater discharge to the stream for three scenarios: natural/pre-irrigation conditions, current irrigation practices involving mainly stream diversion for flood and sprinkler irrigation, and a hypothetical scenario with only groundwater supplying sprinkler irrigation.

The results of the analysis tied flood irrigation to increases in groundwater discharge to streams, leading to cooler water temperatures and improved thermal conditions for wild trout populations during summer (Figure 27).

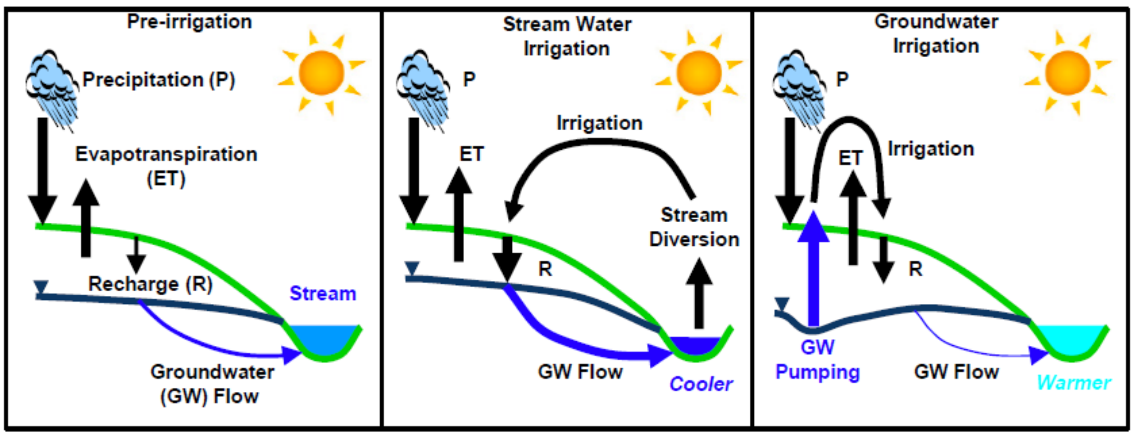


Figure 27. Conceptual diagram of groundwater recharge to the stream without irrigation (left), with flood irrigation (middle), and with groundwater pumping irrigation (right) (Essaid and Caldwell, 2017).

4.3.4 USGS Irrigation Efficiency Evaluations (Sando et al., 2017)

An evaluation of irrigation efficiencies by the USGS included an estimation of total water use by flood and sprinkler irrigation (Sando et.al, 2017). During the growing season of 2002, about 685 acre-feet per day of water was withdrawn to irrigate about 51 square miles of agricultural lands in the Smith River basin. Of those withdrawals, surface water accounted for about 677 acre feet per day and groundwater accounted for about 8.1 acre feet per day. About 54% of the irrigated land was hay (grass and alfalfa), 26% spring and winter wheat, 18% barley, and 2% other.

The mean accumulated consumptive use of irrigation water over the growing season was estimated to be 27 inches for sprinkler systems and 24.5 inches for flood irrigation. Compared to non-irrigated dryland, sprinkler irrigation increases consumptive use by 59% to 82% per unit area. Sprinkler irrigation adds an additional 11,500 acre feet of consumptive water use in an average growing season which is a 3% increase.

The authors concluded that it can be assumed that if an individual field is converted from natural non-irrigated vegetation to sprinkler, it might increase net consumptive water use of that field by 59%. But in the big picture its effect is “marginal”.

4.3.5 Stream Dewatering and Murphy Water Rights (FWP, 2005)

In 2005 Montana Fish Wildlife and Parks published an updated list of significantly dewatered streams throughout the state that are considered important fisheries (Table 4). The dewatered designation reflects reductions in streamflow below the point where stream habitat is adequate for fish. A total of 56 miles of stream in the basin were listed as chronically dewatered with another 167 miles periodically dewatered. FWP notes that the extent of dewatering is likely substantially larger than this, especially on smaller order streams.

Table 4. List of Smith River Watershed streams identified as dewatered by FWP (FWP, 2005).

Chronic Dewatering -- streams where dewatering is a significant problem in virtually all years	**Miles**
Camas Creek	5
North Fork Smith River, Dam to Mouth	23
Smith River: McKamey Diversion to Mouth	28
TOTAL MILES Listed as *Chronically Dewatered*	***56***
Periodic Dewatering--streams where dewatering is a significant problem only in drought or water-short years	**Miles**
Smith River: Junction of North/South Forks to McKamey Diversion	97
South Fork Smith River	15
Hound Creek: East Fork to Mouth	25
Sheep Creek: Jumping Creek to Mouth	30
TOTAL MILES Listed as *Periodically Dewatered*	***167***

In order to help address this statewide issue of stream dewatering, state legislation was passed in 1969 to provide FWP instream flow rights on 12 Montana rivers with priority dates of either 1970 or 1971. These are referred to as Murphy Rights. The Smith River was included in the Murphy Rights legislation, with the stream gages above the Smith River Canyon below Eagle Creek (06077200) and below the Smith River Corridor near Eden (06077500) used as monitoring locations used to meet the flow targets (Table 5).

Table 5. Murphy Water Rights established for the Smith River (FWP, 2022).

Reach	Priority Date	Period	Flow (cfs)	USGS Gage
Hound Creek to Cascade County line.	December 17, 1970	Jul 1 – Apr 30	150	06077500 Smith River near Eden
		May 1 – May 15	372	
		May 16 – Jun 15	400	
		Jun 16 – Jun 30	398	
Above Cascade County Line	December 22, 1970	Sep 1 – Mar 31	125	06077200 Smith River below Eagle Creek near Fort Logan
		Apr 1 – Apr 30	140	
		May 1 – Jun 30	150	
		Jul 1 – Aug 31	140	

On the upper portion of the Smith River Corridor below Eagle Creek, median flows measured from 1997-2020 generally meet or exceed the Murphy Right until late July and then recover above this level in October (Figure 28). Lower flows, shown by the 80th percentile exceedance (flows exceeded 8 out of 10 years) fall below the Murphy Right by the beginning of July and do not exceed that right until the next spring (FWP, 2022).

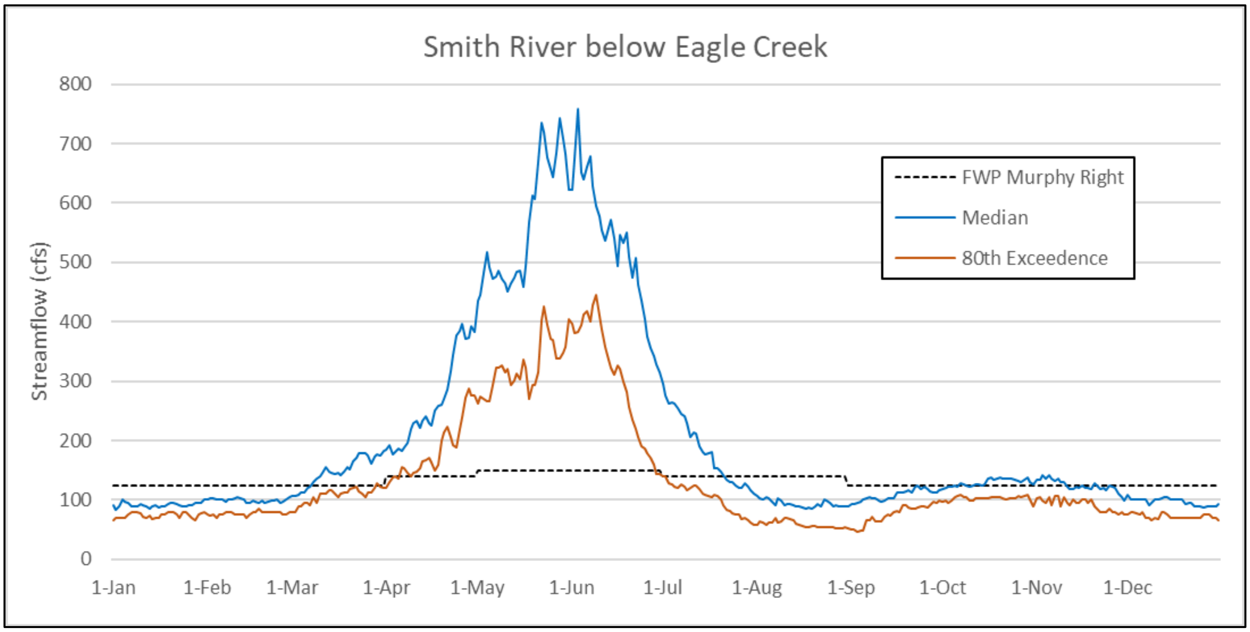


Figure 28. Smith River hydrograph showing 1979-2022 median flows, 80% exceedance flows, and Murphy Rights at Smith River near below Eagle Creek (USGS Gage 06077200; FWP, 2022).

Below the Smith River Corridor near Eden, the 1997-2020 median streamflow generally meets or exceeds the Murphy Right until early August and then recovers to near the Murphy Right level in October (Figure 29). The 80th percentile exceedance (generally low flows) typically falls below the Murphy Right by late July and does not exceed that flow volume until the next spring.

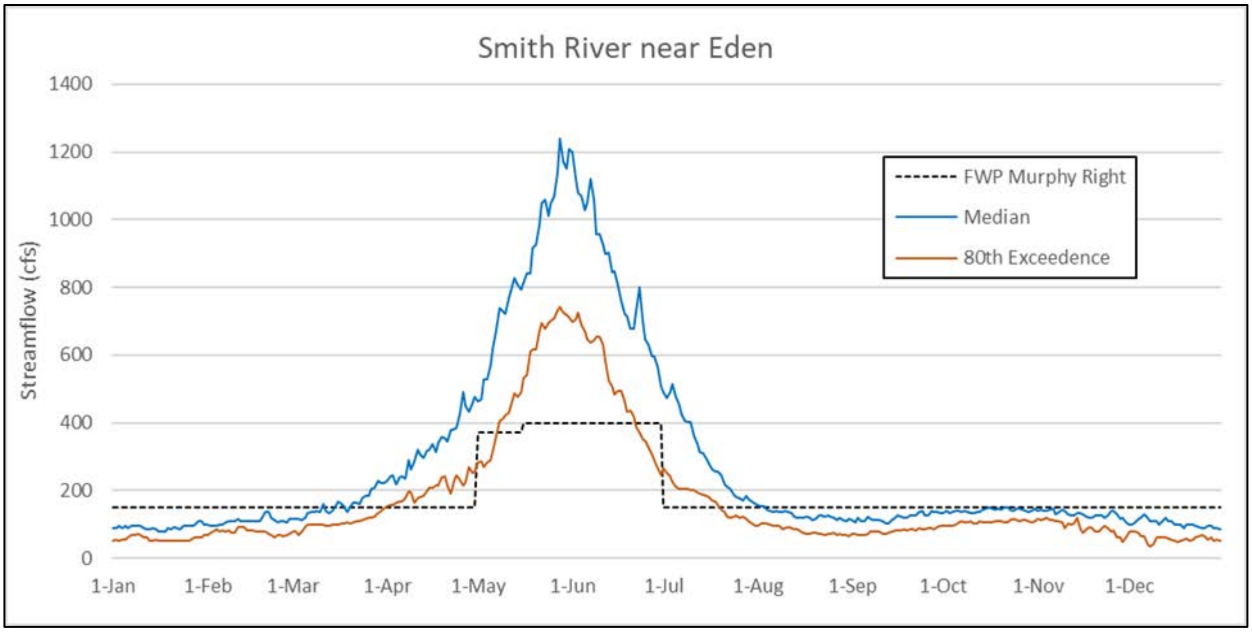


Figure 29. Smith River hydrograph showing 1979-2022 median flows, 80% exceedance flows, and Murphy Rights at Smith River near Eden (USGS Gage 06077500; FWP, 2022).

The hydrographs show that based on 1979-2020 flow data, a call on junior water rights could have potentially occurred at either gage over half of those years, especially during late summer. In order to help define conditions that warrant a call, FWP has developed protocols for exercising those Murphy Rights on the Smith River (FWP, 2022). The current basis for making a call on Smith River water is "predicated on FWP's instream flow Murphy rights which vary by reach and period as follows: A call would not be made late in a period when the instream flow for the subsequent period is substantially lower. For example, if flow at the Eden gage was 200 cfs the last week in June, a call would not be made because on July 1 the instream flow value would decrease to 150 cfs which is substantially lower than flow would likely be at that time (FWP, 2022)."

Since 2000, FWP has called junior water rights in the Smith River basin 11 times, including in 2000. FWP reports that DNRC's water rights database includes junior water rights in the Smith River basin above Hound Creek. Table 6 lists those water rights by general purpose category.

Table 6. Summary of water rights in the Smith River basin that are junior to FWP Murphy rights (FWP, 2022).

Purpose	Call	No Call	Total Called Flow Rate
Fish, Wildlife, Recreation Ponds	5	0	1.92 cfs
Irrigation	28	17	88.62 cfs
Mining	2	8	2.77 cfs
Stock	0	18	-
Domestic	0	3	-
Total	**35**	**46**	**93.31 cfs**

The locations of junior water rights above Hound Creek are shown in (Figure 30). The call protocol indicates that, when dewatering negatively impacts fisheries, a call on junior water rights is justified for those rights that are not being administered by a water commissioner and that would likely result in improved or less rapidly declining streamflow. As there is a water commissioner on the North Fork Smith, calls would not be made on that water.

In 1992, rulings based on the Upper Missouri Basin Water Order established water rights in the upper Missouri River Basin above Fort Peck Dam to 17 municipalities, 15 CDs, and four state and federal agencies. These water reservations have a priority date of July 1, 1985. The water reservations were based on instream flow studies that defined upper and lower inflection points in the channel that are good indicators of aquatic habitat inundation. Because these rights are junior to the Murphy rights, they are not considered as useful on the Smith River for maintaining instream flows in support of aquatic habitat.

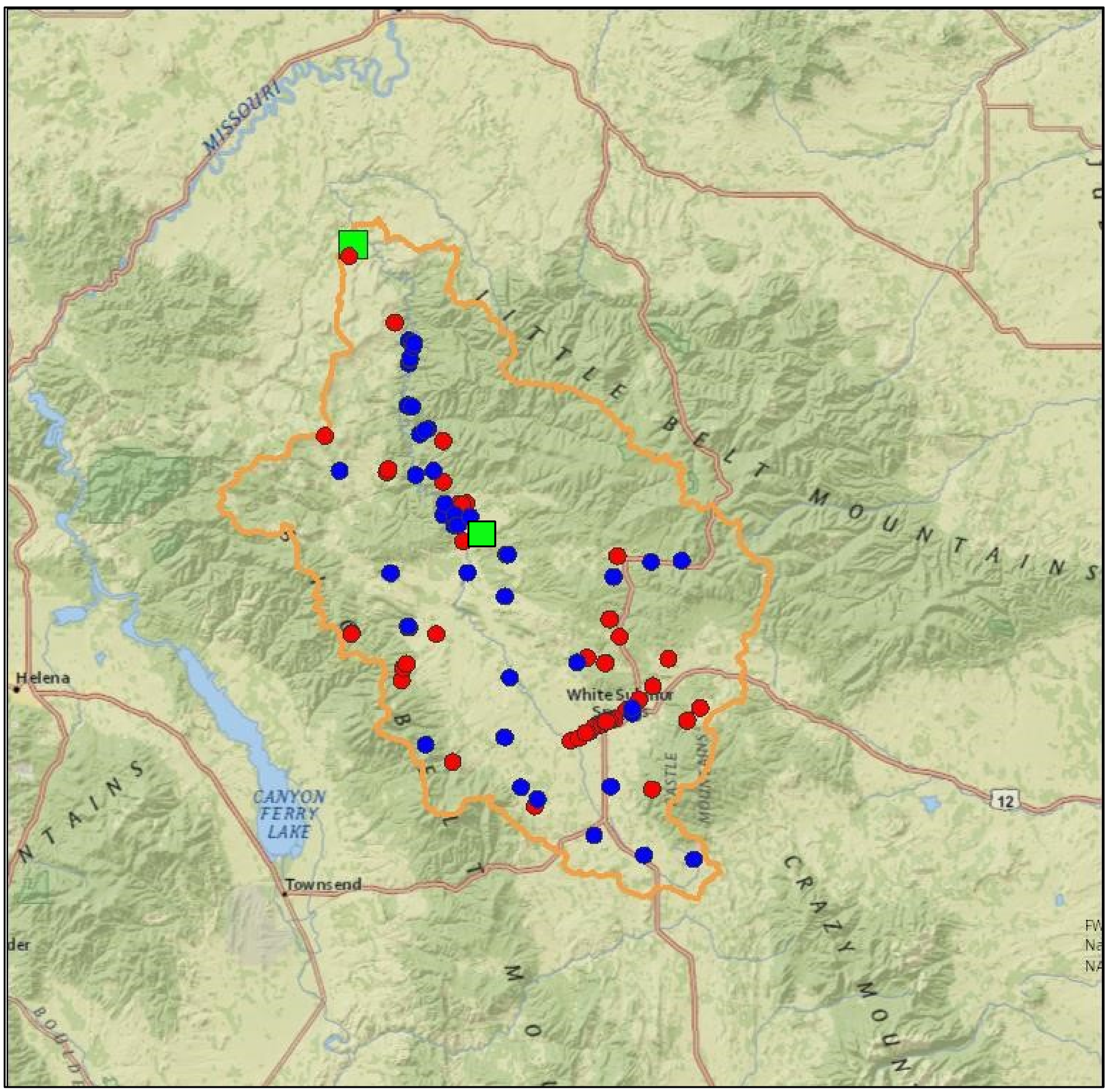


Figure 30. Locations of junior water rights in the Smith River watershed above Hound Creek; green squares are monitoring gages, blue dots would be called, red dots would not.

4.4 Water Quality Assessments

The following section describes several water quality assessment efforts in the basin that focus entirely on water quality issues. As described above, additional water quality data have been collected as part of general stream assessments and as part of USGS work described in Section 4.4.

4.4.1 Montana's List of Impaired Waters (DEQ and EPA)

Montana's List of Impaired Waters, required by the federal Clean Water Act, focuses on waters in the state which have been assessed as having one or more beneficial uses impaired by human-caused pollutants. Impaired waters in the Smith River watershed are summarized in Table 7 and shown in Figure 31. The causes of impairment include E. coli, nutrients, metals, low flow alterations, sediment and temperature. Sources range from agriculture to rangeland grazing to irrigated crop production to natural sources.

The impairment listings were originally developed in 2005. Although the listings have been developed, very little subsequent load allocation work has been completed.

The only exception is on Sheep Creek, where Total Maximum Daily Loads (TMDLs) were developed for E.coli and aluminum. The potential sources of E.coli include agriculture, septic systems and natural background inputs. The restoration approaches presented to address E.coli on Sheep Creek include:

1. Grazing and manure management to increase riparian vegetation density, reduce bare ground and limit transport to water bodies.
2. Additional sampling over longer period that captures both high and low flow conditions.
3. Additional work to better understand the influences of septic tank conditions, waste management at campgrounds and other recreation sites, and current grazing and manure strategies.

In 2020, an aluminum TMDL was developed for Sheep Creek. High levels of aluminum have been documented in both Sheep and Moose Creeks, a tributary to Sheep creek. The sources were deemed to be natural. However, as the proposed Black Butte Copper Mine includes a discharge permit application, the evaluation was undertaken as a high priority to help identify mining-related aluminum discharge limits to the stream.

In response to reports of nuisance level algae in the Smith River, DEQ initiated an algae study in 2018 (see Section 4.3.3 and Section 5.3.3). The data acquired through this study was sufficient to warrant an impairment update for the Smith River which is currently in progress by DEQ. DEQ has indicated that impairments will only be updated for the mainstem Smith River and no tributary streams.

Table 7. Smith River basin list of impaired streams.

Water Body	Cause of Impairment	Source
Smith River, North and South Forks to Hounds Creek	Flow Regime Modification[1]	Crop production (irrigated)
	Total Phosphorous	Agriculture, Crop production (irrigated), Rangeland Grazing
	E. coli	Agriculture, Rangeland Grazing
North Fork Smith River, Lake Sutherlin to mouth	Chlorophyll-a	Source unknown
	E.coli	
	Total Nitrogen	
	Total Phosphorous	
Sheep Creek, headwaters to mouth of Smith	Aluminum	Natural sources
	E. coli	Grazing in riparian zone
Beaver Creek, headwaters to mouth	Alteration in stream-side vegetative cover[1]	Grazing in riparian zone
	Chlorophyll-a	
	Total Nitrogen	
	Total Phosphorous	
	Sediment/siltation	
Benton Gulch	E. coli	Source unknown
Elk Creek, headwaters to mouth (Camas Creek)	Flow regime modification[1]	Crop production (irrigated) Livestock (grazing or feeding operations)
	Total Nitrogen	
	Total Phosphorous	
	Sedimentation/Siltation	
	Temperature	
Thompson Gulch	Alteration in stream-side vegetative cover[1]	Grazing in riparian zone
	Total Nitrogen	
	Sedimentation/Siltation	
Newlan Creek, Newlan Reservoir to mouth	Alteration in stream-side vegetative cover[1]	Grazing in riparian zone Crop production (irrigated)
	E. coli	
	Flow regime modification[1]	
	Sedimentation/Siltation	
	Temperature	
Newlan Creek, headwaters to Newlan Reservoir	Alteration in stream-side vegetative cover[1]	Grazing in riparian zone Impacts from abandoned mine lands Transfer of water from an outside watershed
	Cadmium	
	Sedimentation/Siltation	
	Total Nitrogen	
	Total Phosphorous	

Water Body	Cause of Impairment	Source
Little Camas Creek, junction of Big and Little Camas Creeks to mouth	E. coli	Source unknown
Moose Creek, headwaters to mouth (Sheep Creek)	Aluminum	Natural source
Hound Creek, Spring Creek to mouth	Alteration in stream-side vegetative cover[1]	Grazing in riparian zones
	Chlorophyll-a	
	Total nitrogen	

[1] Non-pollutant (TMDLs are not required for non-pollutants but may be addressed by a pollutant TMDL)

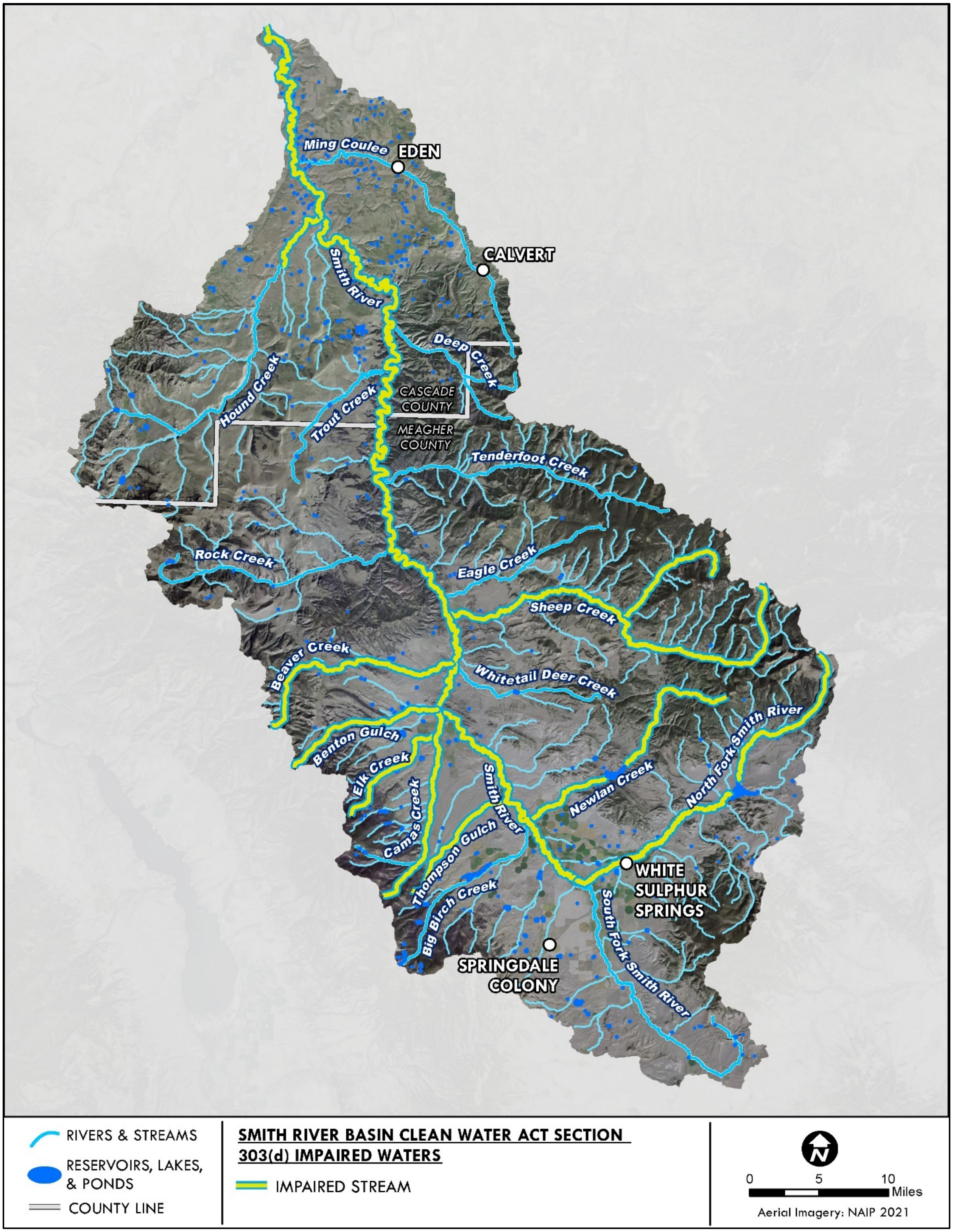
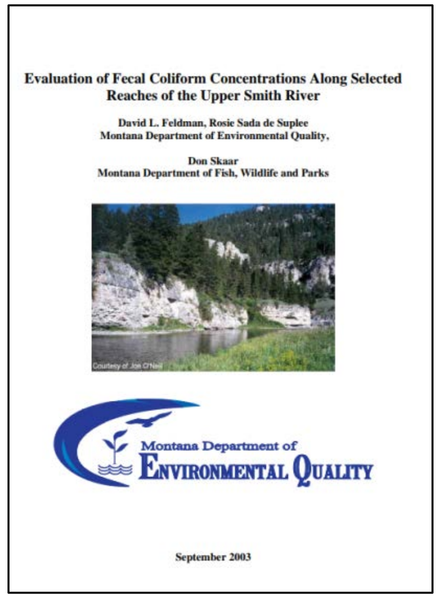


Figure 31. Smith River basin impaired streams.

4.4.2 Evaluation of Fecal Coliform Concentrations along Selected Reaches of the Upper Smith River (Feldman et al., 2005)


Evaluation of Fecal Coliform Concentrations Along Selected Reaches of the Upper Smith River

David L. Feldman, Rosie Sada de Suplee
Montana Department of Environmental Quality,

Don Skaar
Montana Department of Fish, Wildlife and Parks

Montana Department of
Environmental Quality

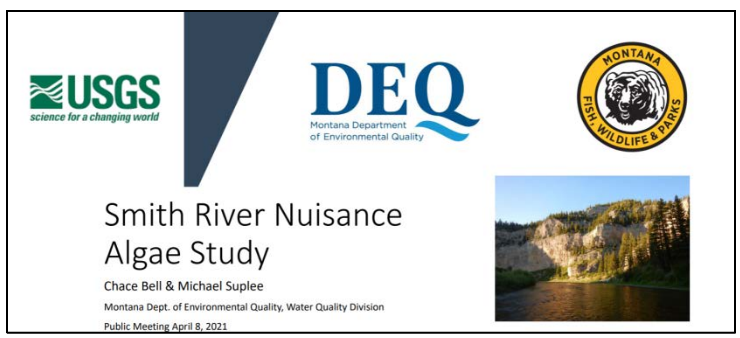
September 2003

In 2003, DEQ published results of an evaluation of fecal coliform contributions from recreational floaters during the 2002 float season. As the beneficial use of the Smith river is classified as B-1, the data were compared to the standard for waters classified as B-1, which is as follows: “During periods when the daily maximum water temperature is greater than 60 degrees F, the geometric mean number of organisms in the fecal coliform group must not exceed 20 colony-forming unit (CFU)/100 milliliters, nor are 10% of the total samples during any 30-day period to exceed 400 coliforms per 100 milliliters”. This was the standard at the time of the assessment but is no longer the current standard.

Two groups of sites were selected for evaluation. The first group consisted of three sites: one above Camp Baker which served as a control, another just downstream of Camp baker and a third near the take-out point at Eden Bridge.

The second group consisted of another fifteen boat camp sites distributed through the Corridor. Overall, fecal coliform concentrations were well below the standard at the time of the assessment for waters classified as B-1, and no trends were observed in the downstream direction. DEQ concluded that this study demonstrated that recreational floaters do not cause a measurable increase of coliform bacteria to the Smith River.

4.4.3 Smith River Nuisance Algae Study (DEQ, 2021b)



In response to reports of increasing nuisance algae in the Smith River Corridor, DEQ and the USGS collected data between 2018 and 2020 to evaluate the causes of nuisance algae on the Smith River. The data has yet to be fully evaluated. As such, there is currently no formal document that summarizes the study. However, in April 2021 the agencies involved held a public meeting to describe the study and preliminary results; the presentation used in that public meeting, in combination with discussions with the researchers, is summarized below.

The main question prompting the assessment was: *Why is Cladaphora reaching nuisance levels in the Smith River?*

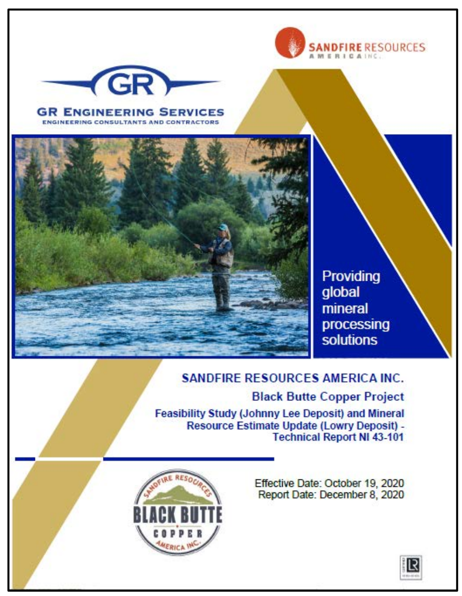
The study looked at air and water temperature changes over time; discharge patterns (timing, magnitude, duration), hydrology/scour, recent changes in nutrient concentrations, pH and water hardness at several sites along the mainstem river from the confluence of the North and South Fork to the mouth, including the mouths of numerous tributaries.

The strongest relationships observed are that under current conditions, nutrients are sufficient to support chlorophyll-a and algae growth and temperature/flow patterns create heavy algae growth during the floating season. Local air temperature has significantly increased 3.6 degrees F over the last 24 years along with Smith River water temperatures, particularly in the first half of June allowing algae to start growing earlier.

The researchers were not able to identify any tributary as a dominant source of nutrients. The data showed that the Smith River has high phosphorous levels most of the year, whereas in most river systems it goes non-detect in the non-growing season. This prompted a follow-up phosphorous loading study by the USGS to determine phosphorous sources upstream of Camp Baker which identified Camas Creek and the North Fork Smith River as contributing a significant amount of the phosphorous load but also a large amount of the load not accounted for by tributary inputs.

Ultimately, they concluded that it's a “sad reality” that only a couple of degrees of change in water temperature can have a major impact on algae growth, especially during spring runoff when nutrients are always present. Historically, the Smith had been protected from excessive algae growth because it was relatively consistently cold. Now it is commonly in the optimal temperature growth range and the nutrients contributed during spring create prime conditions for algal growth.

4.5 Sandfire Resources America, Inc. (SRA) Assessments -Black Butte Copper Mine



The Black Butte Copper Project is located about 17 miles north of White Sulphur Springs in the Sheep Creek watershed. It encompasses almost 8,000 acres of fee simple lands under mineral lease by SRA and 700 unpatented mining claims on USFS land also leased by SRA.

The copper deposits are hosted by Paleoproterozoic sedimentary rocks of the Newland Formation of the Belt Supergroup. The copper is primarily located within two massive sulphide units in the sedimentary sequence, and the mineralization is primarily in the form of copper sulphides.

In 2020, SRA published the results of a Feasibility Study for its proposed project (SRA, 2020). Several baseline studies for the project were performed including the following:

1. ***Surface/groundwater hydrology:*** this included baseline flow monitoring starting in 2011.
2. ***Soils:*** the baseline soil survey included 30 soil survey locations with soil quality samples from 25 locations.
3. ***Vegetation:*** Vegetation surveys were conducted in the spring/summer of 2015 using 185 sample plots in the area.
4. ***Wetlands:*** baseline wetland and waterbody surveys were conducted in 2014, which identified 329 acres of wetlands within the wetland analysis areas.

5. ***Wildlife:*** A list of major terrestrial wildlife species was compiled from general literature, refined by legal status, occurrence status, and whether or not preferred/primary habitats were available in the study area.
6. ***Aquatic Biology:*** Periodic annual and seasonal aquatic monitoring began in 2014, and included the assessment of fish, mussel, macroinvertebrates, periphyton, and stream habitat sites in the Project Area of the Sheep Creek drainage.

The proposed Black Butte Copper Project continues to be in litigation. As the future of the mine and its impacts are uncertain and highly complicated, it was fundamentally excluded from this assessment and WRP, although the background information has proven useful for general basin characterization and Sheep Creek is included as a target area for restoration to address non-mine related degradational issues.

5 Primary Issues Causing Basin Degradation

This section describes how the Smith River basin has been degraded and causes of degradation. Specifically, this section includes:

- Methods used to assess basin degradation.
- An overview of the main degradation issues in the basin and their causes.

5.1 Assessment Methods

The following methods were used to evaluate existing conditions in the basin and identify impairments and causes of impairments in the basin:

1. Compile existing information and data.
2. Conduct remote assessments of overall watershed conditions.
3. Complete data analyses using existing data.
4. Conduct driving and float tours.
5. Conduct outreach and hold meetings with stakeholders.
6. Conduct landowner outreach and visit properties.

5.1.1 Compile Existing Information and Data

Existing information is available primarily through agency or other organizations' reports, studies and data. All existing documents and data have been categorized and compiled and are available to the public via the SharePoint OneDrive folder (see Section 1.3). The primary existing information and data used for the assessment includes:

- Past watershed assessments (1973, 1985, 2006)
- Water quality data:
    - 1993-1995 and 2000-2001 (DEQ and EPA data for original impairment listing)
    - 2006 water quality data (NRCS)
    - 2018-2020 nuisance algae study (DEQ)
    - 2021-2022 dissolved phosphorous study (USGS)
    - Black Butte Copper Mine Sheep Creek and mainstem data (SRA)
- USGS stream gage data
- FWP biological data
- Black Butte Copper Mine biological data
- USFS reports

Numerous spatial data layers were used for the assessment and are summarized in an excel spreadsheet publicly available via the SharePoint One Drive, along with sourcing information. Primary spatial layers included:

- Recent imagery collected by the United States Department of Agriculture (USDA) as part of the National Aerial Imagery Program (NAIP) in 2013, 2015, 2017, 2019 and 2021.
- Historical imagery from the 1950s compiled and georeferenced by the Rangeland Analysis Program (RAP).
- GLO georectified hand drawn maps from the late 1800s and 1900s.

- Cadastral landownership from the Montana State Library (MSL).
- Hydrology including rivers and water bodies from the National Hydrography Dataset (NHD).
- Soil units and properties prepared by the USDA NRCS.
- Soil Nitrate Leaching Potential by NRCS Soil Survey Geographic Database (SSURGO) (see Map 6 in Appendix A).
- Geologic units provided by the USGS.
- USGS Gaining/Losing reaches from USGS, 2008.
- Recreational areas such as boat camps and state parks provided by FWP.
- USFS management layers including Hazard Fuel Treatment, Fire Perimeter, Range Vegetation Improvements, Timber Harvest and Integrated Resource Restoration.
- FWP layers including Instream Water Rights, Fish Distribution, Genetic Sample Locations, Dams, Dewatered Streams, Future Fisheries Projects, Westslope Cutthroat Conservation Populations, Fish Barriers, Priority Barriers, and Habitat Measures.
- NRCS Rangeland Health.
- DNRC Water Rights layers including Groundwater Wells, Reservoirs, and Diversion Points.
- DEQ Impaired Streams and Abandoned Mines.
- Montana Natural Heritage Program (MTNHP) Beaver Restoration Assessment Tool (BRAT) spatial model data layers.
- USGS Irrigated Lands and Irrigated Land Conversion (Dalby et. al, 2023).

5.1.2 Data Analyses

5.1.2.1 Water Quality

Water quality data were analyzed to determine where water quality issues occur in the basin. To evaluate water quality issues, water quality for the last 10 years was requested from DEQ (DEQ 10-year data). This data set includes most of the water quality data collected for the basin in the last ten years, including recent data collected for the algae and phosphorous studies.

The purpose of the water quality analysis was not to determine impairment levels based on water quality standards but identify what water quality parameters are issues and where they might occur. See Figure in Appendix A for water quality sampling locations in the basin.

5.1.2.2 USGS Gage Data

Table 8 summarizes all of the gages with at least 10 years of peak flow data in the basin. Note that several of the gages are no longer active. Figure 32 shows the locations of gaging stations in the basin. USGS gage station data were used for several analyses in this assessment, including low flow conditions, flood frequency, and temperature/flow correlations.

Table 8. USGS stream gaging stations with over 10 years of peak flow records for the Smith River basin (https://waterdata.usgs/gov).

ID	Gage Name	Status	Data Summary
06078000	Smith River at Truly	Inactive	Eight Peak Flow Measurements from 1905-1954
06077500	Smith River near Eden	Active	Daily flows 3/1/2006-current Water temperature 4/1/2012-7/1/2017
06077200	Smith River below Eagle Creek near Fort Logan	Active	Daily flows 10/1/1977- current Peak flows 1978-current Water Temperature 11/5/1996- current
06076690	Smith River near Ft Logan	Active	Daily flows 10/1/1977-current Peak flows 1978-current Some water quality data 1982-2021
06076560	Smith River below Newlan Creek near White Sulphur Springs	Inactive	Daily flows 10/1/2004-9/30/2008 Peak flows 2005-2011 Some water quality data 2004-2021
06075500	Smith River above Fivemile Creek near White Sulphur Springs	Inactive	Daily flows 4/1/1934-7/21/2021 Peak flows 1934-1943
06074500	Smith River near White Sulphur Springs	Inactive	Daily flows 10/1/1922-9/29/1936 Peak flows 1923-1936
06077000	Sheep Creek near White Sulphur Springs	Inactive	Daily flows 8/1/1941-10/4/1972 Peak flows 1942-1981 Water quality samples June-July 1980
06076700	Sheep Cr near Neihart MT	Inactive	Peak flows 1960-1991
6076500	Newlan Creek near dam site near White Sulphur Springs MT	Inactive	Daily flows 8/9/1950-9/259/1957 Peak flows 1951-1957
6076000	Newlan Creek near White Sulphur Springs	Inactive	Daily flows 10/1/1945-11/30/1953 Peak flows 1945-1973

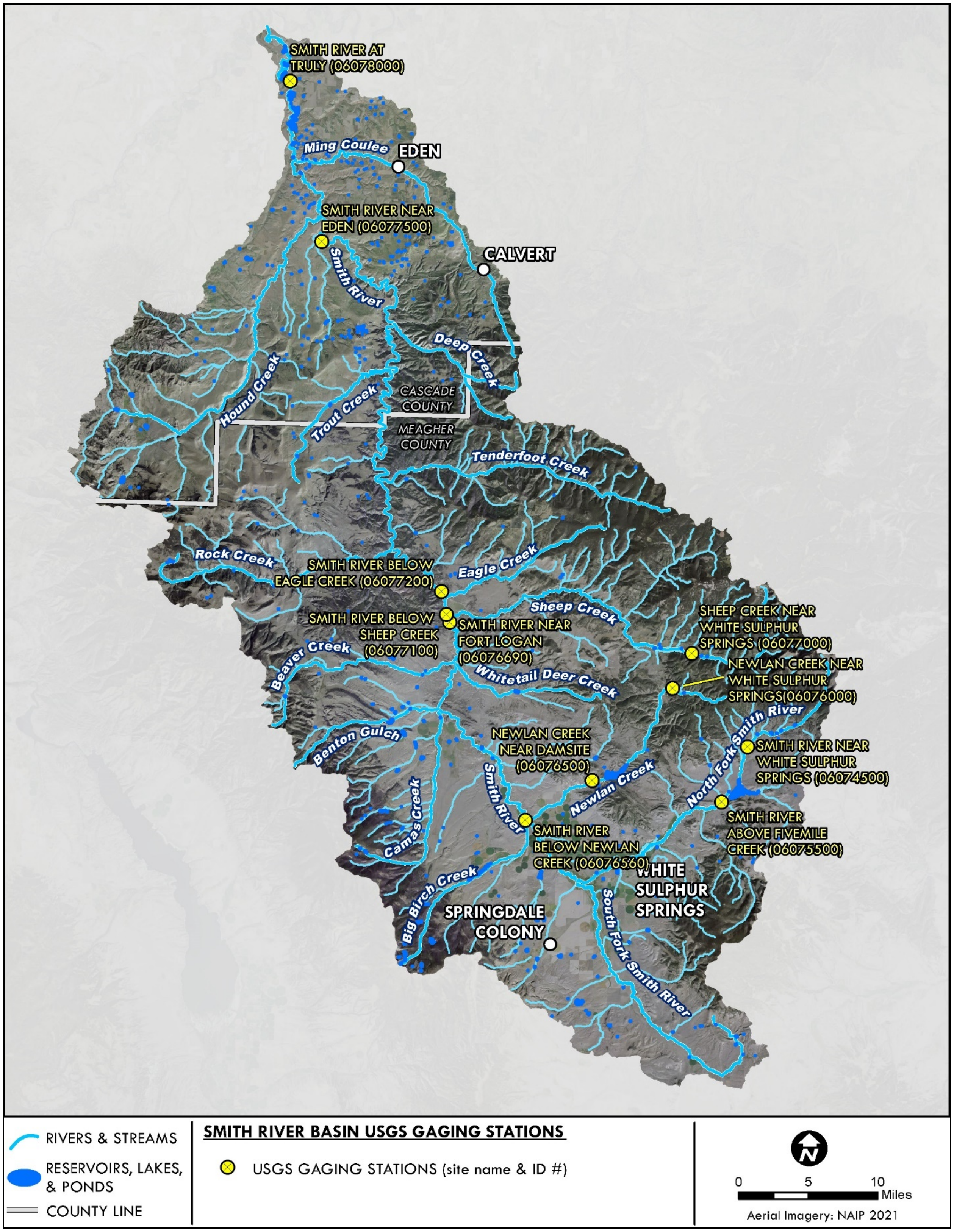


Figure 32. Smith River basin USGS gaging stations.

5.1.3 Remote Assessment

Remote assessments were completed to evaluate conditions and identify issues in the basin. Remote assessments included:

- Mapping resource issues.
- Mapping woody vegetation in 1950s and 2021 imagery.
- Digitizing 1985 stream Inventory data (USDA SCS Bozeman, 1985).
- Mapping current bank erosion and stabilization on the mainstem Smith River.
- Mapping impairments in near-term focus area streams to quantify impacts.

5.1.3.1 Mapping Resource Issues

Using spatial data listed above in Section 5.1.1.1 in ArcGIS, points were placed at locations within the Smith River basin where potential issues were observed. Issues were categorized primarily by altered landscape conditions, channel alterations, riparian degradation, streamflow inputs or withdrawals, and water quality. Additional more specific information was included within these categories; for example, channel alteration points were further defined as channelization, channel location changes, or meander cut offs and riparian degradation points were further defined as caused by recreational impacts or more generally as woody vegetation loss.

Points were also placed in locations that were not necessarily potential issues, but provided context for the issues, such as GLO map notes and geologic and hydrologic observations.

This spatial compilation of issues identified tributaries and mainstem reaches where degradation was pronounced.

5.1.3.2 Mapping Woody Vegetation in the 1950s and 2021

Using the 1950s black and white imagery and USDA NAIP 2021 imagery within ArcGIS, woody riparian vegetation was mapped within the floodplain of the mainstem Smith River (from the confluence of the North and South Fork Smith River to the confluence of the Smith River with the Missouri River), approximately 121 river miles. Upland conifers were not mapped. Mapping consisted of digitizing polygons around discrete areas of woody riparian vegetation. Areas of woody riparian vegetation smaller than approximately 150 square feet were typically not mapped or lumped with an adjacent polygon. Woody vegetation in the 1950s imagery was characterized by a darker gray to black with a bumpy texture, and shadows cast by tall vegetation (i.e. cottonwoods). Woody vegetation in the 2021 imagery was typically a soft green, cast a shadow, and, like the 1950s imagery, was characterized by a bumpy texture.

The total area digitized on 1950s imagery was compared to the total area digitized on 2021 imagery to evaluate woody riparian vegetation change over time.

5.1.3.3 Digitizing 1985 Maps with Handwritten Observations of Channel and Riparian Area Conditions

In 1985, the North and South Forks of the Smith River, the mainstem of the Smith River, and Hound Creek were floated and channel conditions were documented on hard copy black and white aerial imagery maps flown specifically for the assessment (USDA SCS Bozeman, 1985 - see Section 4.2.2 for description of this assessment). Data collected as part of the 1985 assessment included observations of stream channel alterations, irrigation withdrawal points, irrigation return flow points, eroding banks, rock riprap, rock jetties, mass wasting banks, vertical non-eroding banks, gravel alterations, channel obstructions, and car bodies. These data were digitized as point and line layers in ArcGIS to make the data more readily available to those working in the basin and comparable to compare with current or future conditions.

5.1.3.4 Mapping Current Streambank Erosion

Current bank erosion and bank stabilization along the mainstem Smith River between the confluence of the forks and Eden Bridge was digitized on USDA NAIP 2023 imagery using georeferenced photos and field map mark-ups recorded during float tours.

Bank erosion and stabilization lengths were compared to the lengths recorded during the 1985 assessment to evaluate bank erosion changes over time.

5.1.3.5 Near-term Focus Area Remote Assessment

Near-term focus areas were selected to conduct more detailed remote assessments of impairment quantities and locations. The selection process is described in Section 8 and assessment methods described in detail in Appendix C.

5.1.4 Float and Driving Tours

Float and driving tours were conducted as part of the assessment to evaluate basin conditions. A driving tour of the South Fork, North Fork, and south and west sides of the basin along Lingshire Road and north and east sides of the basin from Sheep Creek upstream along Highway 89 were completed between May 22 and May 25, 2023.

The mainstem from Camp Baker to Eden Bridge was floated from June 15 to 18, 2023. The mainstem downstream of Newlan Creek to Camp Baker was floated on July 13 to 14, 2023.

During float and driving tours, the following data were collected:

- Geo-referenced photos.
- GPS points of bank erosion, irrigation infrastructure or other infrastructure.
- Map mark-ups of issues and conditions that were later turned into a spatial data layer.
- Visual estimate of stream flow at the mouth of each major tributary during floats.
- Temperature and TDS measurements at the mouth of each major tributary during floats.

5.1.5 Stakeholder Outreach, Meetings, and Landowner Site Visits

Several agencies, organizations, and landowners were contacted for the assessment. The assessment team conducted two public meetings, met with individual organizations and agencies, and completed landowner site visits.

5.1.5.1 Stakeholder Outreach

Several agencies, organizations, and landowners were contacted for the assessment. Outreach was done via e-mail and phone calls. Landowner outreach was done by identifying large landowners with ownership along the mainstem river or major tributaries and through recommendations by agency personnel.

Watershed stakeholders contacted during the assessment include:

- FWP
- USFS – Helena National Forest, White Sulphur Springs Ranger District
- Meagher County NRCS Office
- Cascade County NRCS Office
- Meagher County CD
- Cascade County CD
- Meagher County Stewardship Council
- BLM
- DNRC
- USGS
- SRHP
- Missouri River Fly Fishers
- Tintina, Inc.
- Landowners on the North Fork Smith River, South Fork Smith River, Smith River upstream of Camp Baker, Big Birch Creek, Newlan Creek, Benton Gulch, Smith River Corridor and Hound Creek.

5.1.5.2 Landowner Site Visits

During the process of stakeholder outreach, several landowners allowed access to their properties to evaluate conditions or discuss specific resource concerns. Three of these site visits resulted in moving forward with projects to address non-point source water quality issues or other basin degradation issues identified during the assessment (see Section 9).

5.1.5.3 Public Meetings

Two public meetings were held in White Sulphur Springs:

- May 24, 2023 to present an overview of initial basin conditions and solicit input on issues from stakeholders.
- June 17, 2024 to present the results of the assessment and discuss next steps with stakeholders.

One public meeting was held in Great Falls:

- June 18, 2024 at the Cascade County CD office to present the results of the assessment and discuss landowner resource needs.

5.1.5.4 Advisory Committee

An advisory committee was established to review assessment methods and selection of near-term focus areas. The committee consisted of representatives from FWP, USFS, NRCS, DEQ, Meagher CD, Cascade County CD, Meagher County Stewardship Council, Smith River guides and outfitters, the North Fork Water Users Association, the SRHP, SRA, Montana Trout Unlimited and private landowners in the basin.

One committee meeting was held on February 24, 2024 to present an overview of the issues and proposed near-term focus areas. Committee members were encouraged to provide feedback. A draft of the assessment was also provided to the committee and others that expressed interest, and feedback was solicited.

5.2 Overview of Issues

This section discusses the degradation issues identified for the Smith River basin including causes, resulting conditions and ecological consequences.

The main degradational issues identified in the Smith River basin include:

- **Reduced Water Quantity** – reduced stream flows from irrigation withdrawals and floodplain conversion affecting aquatic life, recreation, agricultural production and exacerbating water quality issues.
- **Degraded Water Quality** – increased water temperatures, fine sediment, nutrients, and E. coli from loss of woody riparian vegetation, agriculture and livestock grazing, affecting aquatic life and causing nuisance level algae.
- **Altered Riparian and Aquatic Habitat** – alterations to riparian and stream habitat leading to loss of floodplain connectivity, lower water tables, over widened channels, and simplified habitat affecting aquatic life and water quality.
- **Altered Upland Vegetation** – loss of sagebrush, degraded forest stand conditions, and conifer encroachment leading to reduced grassland and rangeland health and altered basin hydrology.
- **Recreation** – heavy recreation use in the Smith River Corridor causing soil erosion, compaction, and loss of vegetation affecting water quality and aquatic life.

These are not stand alone issues but rather integrated with each other, often in complex ways. For example, reduced water quantity may result from direct removal of water from streams for irrigation during periods of natural reduced streamflow but also indirectly from conversion to pivot irrigation or from conifer encroachment into grasslands outside of areas immediately along streams, altered forest conditions, channel incision resulting from channel straightening or ditching, or removal of riparian vegetation. Recreational impacts have the ability to affect water quality, alter vegetation communities and degrade stream habitat.

5.2.1 Climate Change

Climate change is not an issue that can be addressed through restoration actions in the basin but is included in this section because of the potential to strongly impact the water resources of the Smith River basin and exacerbate other issues and impairments. Climate change affects will result primarily due to predicted increases in air temperatures. In general, increased temperatures are expected to decrease the availability of water, increase water temperatures, affect agricultural yields, and further increase the risk of wildfires. The Montana Climate Assessment places the Smith River basin in the Central Region of Montana (Figure 33), and the following discussion is a summary of the assessment results for that area (Whitlock et. al, 2017).

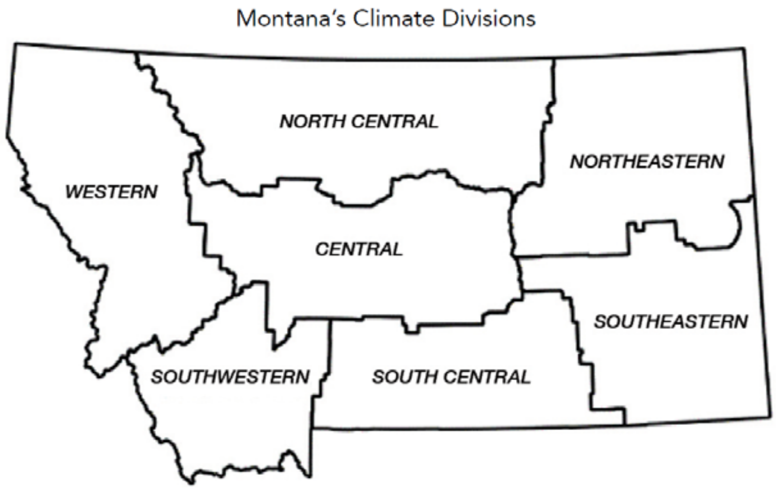


Figure 33. Montana regional areas described in the Montana Climate assessment; the Smith River basin is within the Central Region (Whitlock et al., 2017).

The historic workup on the assessment concluded that average air temperatures in the Central Region of Montana rose by 2 to 3 degrees F from 1950 to 2015 (Whitlock, et al., 2017). Under a "business as usual" scenario, the predicted trend is for temperatures to warm by an additional 6 degrees F by mid-century and by approximately 10.0 degrees F by the end of the century (Figure 34). This is anticipated to be accompanied by an increase of 25 to 30 days above 90 degrees F, and a 20-40 day increase in the number of frost free days (minimum temperatures above freezing).

The "business as usual" scenario is a worst case condition for projected climate change. In the event greenhouse gas emissions are substantially reduced in coming decades, these changes will be tempered but they are unlikely to be fully arrested or reversed.

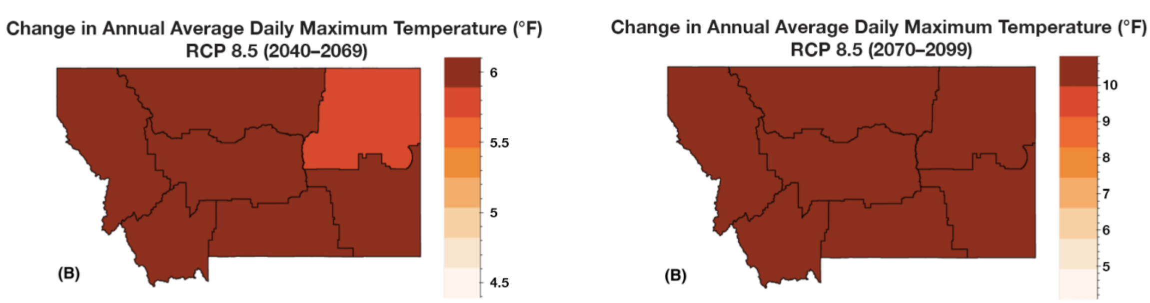


Figure 34. The projected increase in annual average daily maximum temperature (°F) under a "business as usual" emission scenario for the middle (left) and latter (right) part of the 21st Century (Whitlock et al., 2017).

Across the state, precipitation is projected to increase in winter, spring, and fall; with projected reductions in summer rainfall. Figure 35 and Figure 36 show those projected changes for the mid- and latter- parts of the 21st century, respectively. The Central Region shows drier summers lengthening with time.

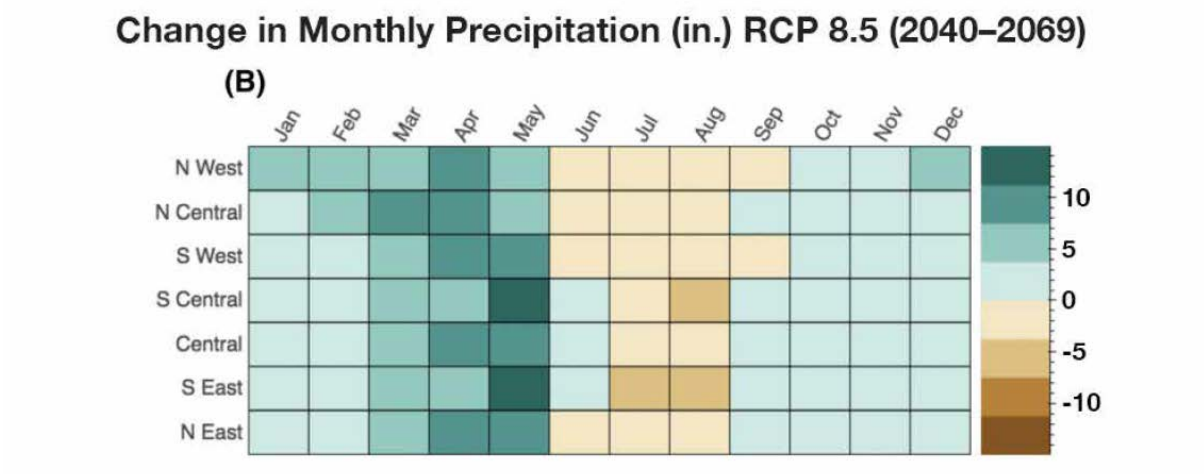


Figure 35. Projected monthly changes in average precipitation (inches) for each Montana climate division at the middle of the 21st century (2040-2069) under a "business as usual" emission scenario (Whitlock et al., 2017).

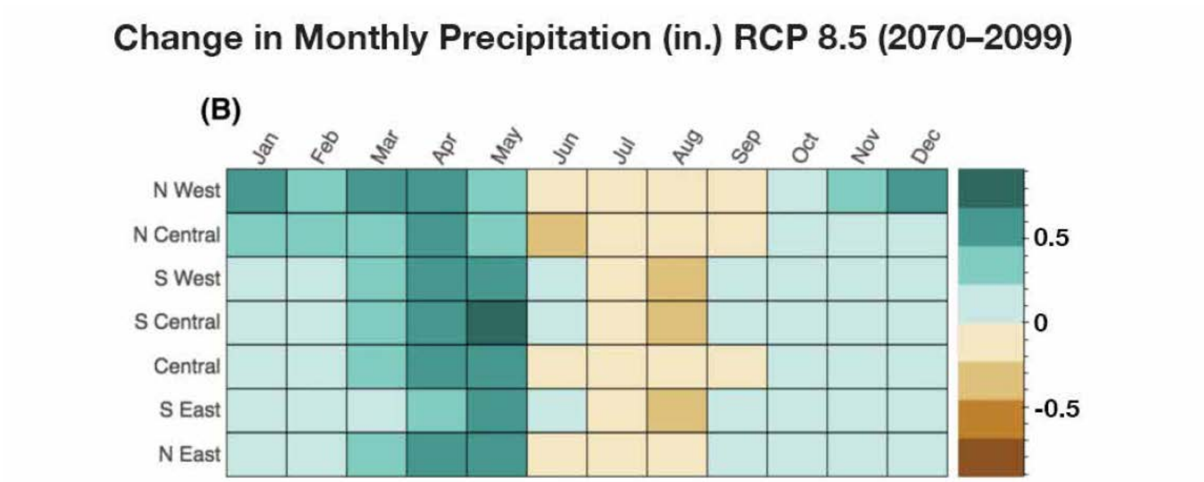


Figure 36. Projected monthly changes in average precipitation (inches) for each Montana climate division at the end of the 21st century (2070-2099) under a "business as usual" emission scenario (Whitlock et al., 2017).

Increasing temperatures will affect water availability, as snowmelt-reliant watersheds such as the Smith will experience an earlier onset of high elevation snowmelt and a consequent reduction in late summer water availability. This reduction in late season surface water availability is likely to increase demands on groundwater across the state.

Droughts are not uncommon in Central Montana, and they can occur on an annual, multi-year, or decadal scale. With rising temperatures, droughts are expected to continue across the state, and their severity will be worse. Late summer and early fall months will be the most susceptible to increased frequencies and durations of drought.

Agriculture is expected to be heavily impacted by these projected changes, as virtually every component of agriculture is related to climate. According to the climate assessment, a reduction in late season irrigation water will most severely impact hay, sugar beet, malt barley, market garden, and potato production across the state (Whitlock et al., 2017). Annual weeds such as cheatgrass are expected to expand in winter crops and rangeland, decreasing crop yields and increasing fire risk. Optimal adaptation to these changes in the agricultural sector will include the adoption of diversified cropping systems, including rotation with pulse crops and innovations in tillage and cover.

Climate change is also expected to affect forests in the Central Region of Montana. Increased temperatures will alter humidity, soil moisture, and water stress. These effects could be either beneficial or detrimental to forest health. Increased fire risk is expected, and bark beetle survival is expected to increase.

5.2.2 Water Quantity

As described in section 4.3.5, over 200 miles of streams have been conservatively described as either chronically (56 miles) or periodically (167 miles) dewatered in the Smith River basin. Ecological issues related to critically low flows include loss of aquatic habitat quality and area, elevated stream temperatures, and concentrated water quality constituents including nutrients.

The drivers for low flows are both man-made and climate driven. Drought will always play a role in the low flow issue. Figure 37 and Figure 38 show the number of days where the Smith River at Fort Logan averaged less than 50 cfs for 1978-1996 and 2007-2023, respectively. Below the flow plots in Figure 37 and Figure 38, Meagher County drought conditions are shown for the same timeframes, with positive values marked by orange colors reflecting drought extent and severity. In general, there is a clear relationship between drought years and the duration of low flows, with multi-year effects evident. The drought of 1987-1989 resulted in over three months of flows less than 50 cfs (Figure 37). The recent dry summer periods of 2021-2022 created “back to back” low flow summer conditions, which are reflected by over 4.5 months of flows less than 50 cfs. “Back to back” events can result in cumulative impacts to stream ecology.

It is important to note, however, that not all drought events are associated with low flows. For example, the substantial drought years of 1980 and 1995 had no days of flows less than 50 cfs. The timing of drought can also be relevant; in 2017 for example, a late summer “flash drought” caused a late summer low flow response even after a relatively wet spring (Figure 38).

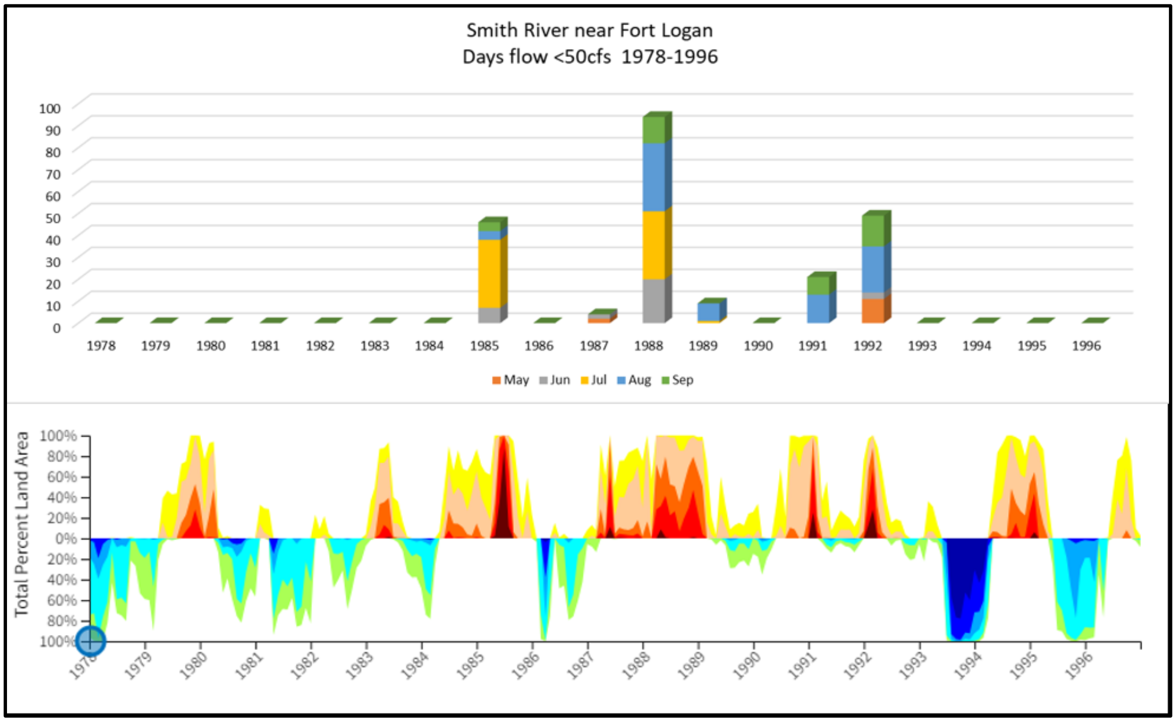


Figure 37. Number of days with mean daily flows less than 50cfs near Fort Logan (top) with corresponding annual drought cycles (bottom) for 1978-1996; basin-wide drought is reflected by high positive numbers on vertical axis.

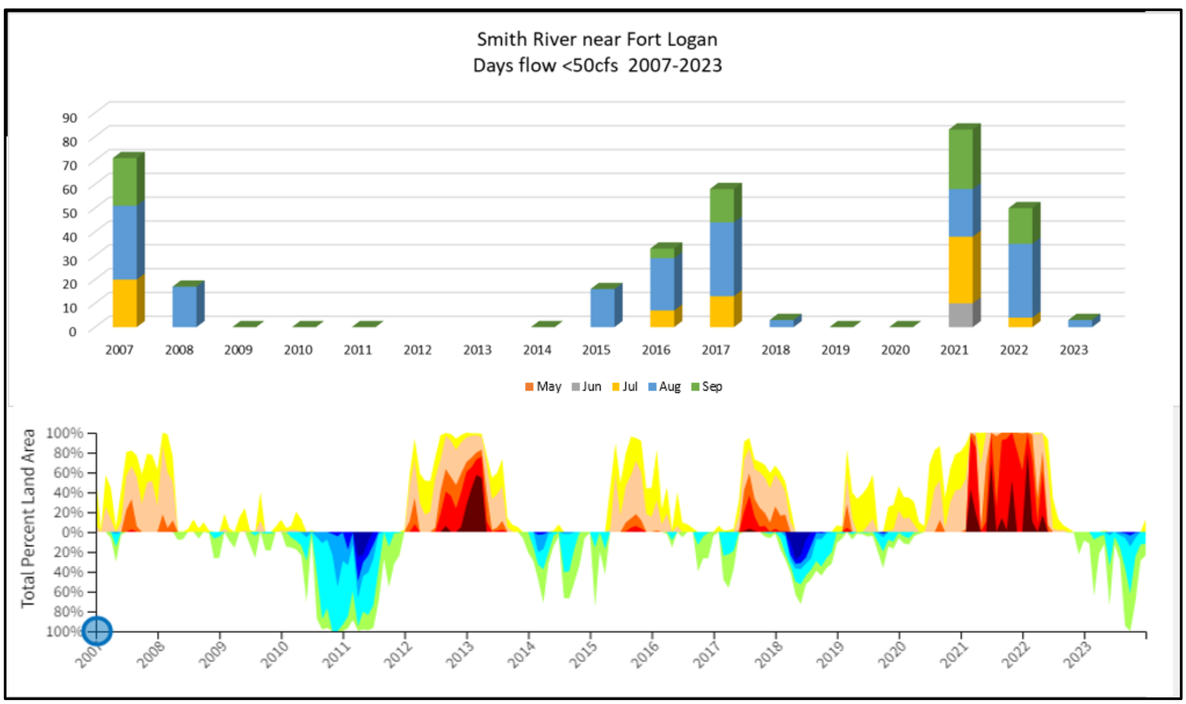


Figure 38. Number of days with mean daily flows less than 50cfs near Fort Logan (top) with corresponding annual drought cycles (bottom) for 2007-2023; basin-wide drought is reflected by high positive numbers on vertical axis. Flow data from 2012-2013 are missing.

Over the 19 years between 1978 and 2006, the total number of days of flows less than 50 cfs at Fort Logan was about 225, which is a long term average of about 8 days per year. Over the last 10 years, however, flows have been below 50 cfs about 250 days, an average of 25 days per year (Figure 39). Whether this is drought, water use, or a combination of both, it suggests actions to mitigate low flow conditions should be integrated as much as possible.

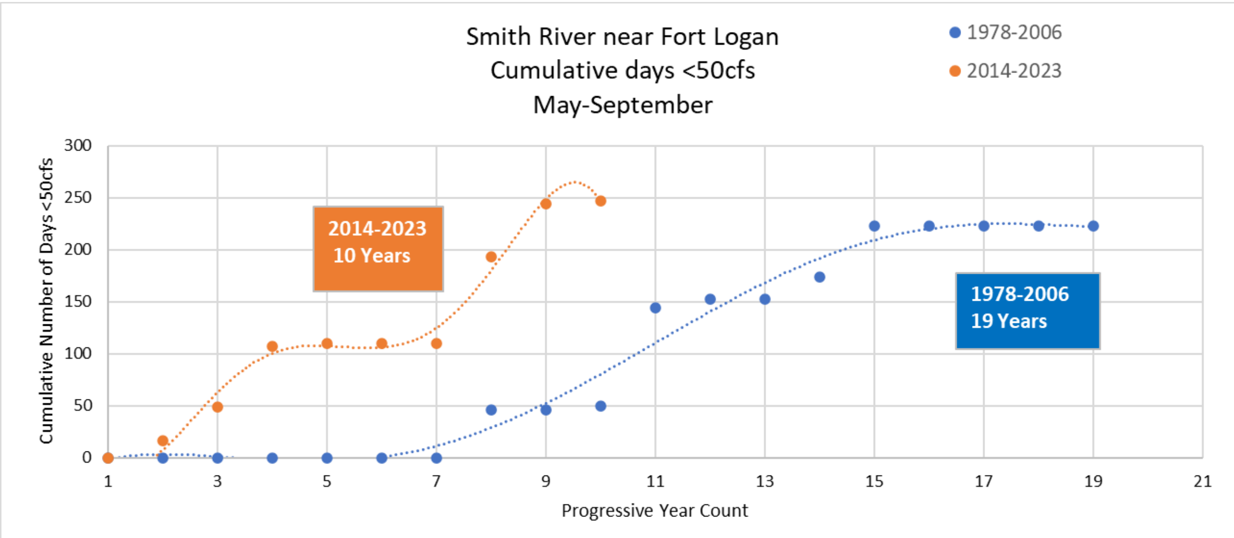


Figure 39. Cumulative number of days with flows <50cfs on the Smith River near Fort Logan for 1978-2006 and 2014-2023 timeframes.

5.2.3 Water Quality

The quality of the water in rivers and streams affects the health of fish and other organisms that live there as well as the ability to use the water for swimming, drinking, and other purposes. Water quality monitoring has occurred throughout the basin for many years (see Map 5 in Appendix A). There are several water quality issues in the basin. The impaired waterbodies in the Smith River watershed are summarized in Table 7 and shown in Figure 31. The causes of impairment include water temperature, nutrients, fine sediment, E. coli, metals, and low flow alterations. Water quality impairments are not limited to impaired streams. This section discusses water quality degradation in the basin.

5.2.3.1 Temperature

As discussed in previous sections, water use in the basin for irrigation, livestock, and domestic uses have resulted in dewatering and relatively high temperature return flows that have affected the fishery of the Smith River. Temperatures as high as 83 degrees F have been recorded, and low water levels and elevated water temperatures have been described as “probably the greatest factor limiting present game fish populations (NRCS, 2022a)”. At least three trout/mountain whitefish fish kills have been documented in the South Fork Smith and the mainstem near Eden Bridge; both occurred during periods of elevated water temperatures combined with dewatering of the river. Recurring fish kills involving stonecat have been reported in isolated lower sections of the floating reach over the past decade, generally occurring in late July (NRCS, 2019). In 2017, fish from the Smith River moved into Sheep Creek in response to a single instance when water temperature in the river exceeded 78.8 degrees F and temperatures in Sheep Creek were 75 degrees F (Lance et. al, 2024). The mainstem Smith River above Eden Bridge has been classified as a “priority drought water” where hoot owl fishing restriction may be enacted under low flow and high temperature conditions. Low water levels combined with elevated water temps are the greatest problems for fish in the Smith although the trout populations seem to be stable at this time.

Stream temperature can be affected by reduced stream flows, increased removal of stream-side vegetation, or over-widening and shallowing of channels, and is closely tied to air temperature and drought conditions. In general, in years when drought intensity is not severe and moisture is average or above average, streamflow is not depleted for extended periods of time and elevated stream temperatures are not a concern. As described in Section 5.2.1, annual air temperatures have risen 2 to 3 degrees F between 1950 and 2015. Temperatures are predicted to warm by 4.5 to 6.0 degrees F by mid-century and by 6.0 to 10.0 degrees F by the end of the century in central Montana. Droughts are expected to become more common. In addition, the number of days above 90 degrees F are projected to increase by 25 to 30 days by mid-century for central Montana.

Stream temperatures have increased in the last several decades. Seventy-three (73) degrees F is typically used as the maximum threshold that is suitable for trout growth and survival, and also when hoot owl restrictions kick in. Since 1997 stream temperatures exceeding 70 degrees F have occurred in most years (Figure 41). The number of days 73 degrees F is exceeded is closely related to streamflow. Figure 40 shows the relationship between flows and stream temperature recorded at the Eagle Creek gage downstream of Camp Baker. The number of days flows are below 100 cfs closely correspond with an increase in number of days where water temperature exceeds 73 degrees F. Years with more days below 100 cfs closely correspond with an increase in number of days with water temperatures exceeding 73 degrees F (Figure 41). Stream flow and temperatures are also closely tied to drought severity. Meagher County had exceptional drought conditions in 2021, severe drought conditions in 2022 and no drought conditions in 2023 (NDMC, USDA and NOAA, 2023). As shown in Figure 41, under Exceptional Drought conditions 2021 had nearly 100 days where flows dropped below 100 cfs and over 40 days exceeding 73 degrees F water temperature. In contrast, under No drought conditions, 2023 only had a couple of days where flows dropped below 100 cfs and six days where water temperatures exceeded 73 degrees F.

Increased water temperatures will slowly shift composition of aquatic life. Recent data for the Smith River has shown that pearlshell mussels are no longer present (Stagliano, 2022) and crayfish numbers have increased significantly (Stagliano, 2019). Crayfish are one of the most invasive species groups in the world and non-native crayfish may disrupt aquatic environments by changing plant densities, disturbing sediments, and altering food webs (FWP, 2023a). On-going monitoring in the Sheep Creek and Tenderfoot Creek drainages show a decline in Rocky Mountain sculpin in the past few years (Stagliano, 2023). Warming-related declines of sculpin have been documented in other Montana rivers (Hossack et. al, 2023).

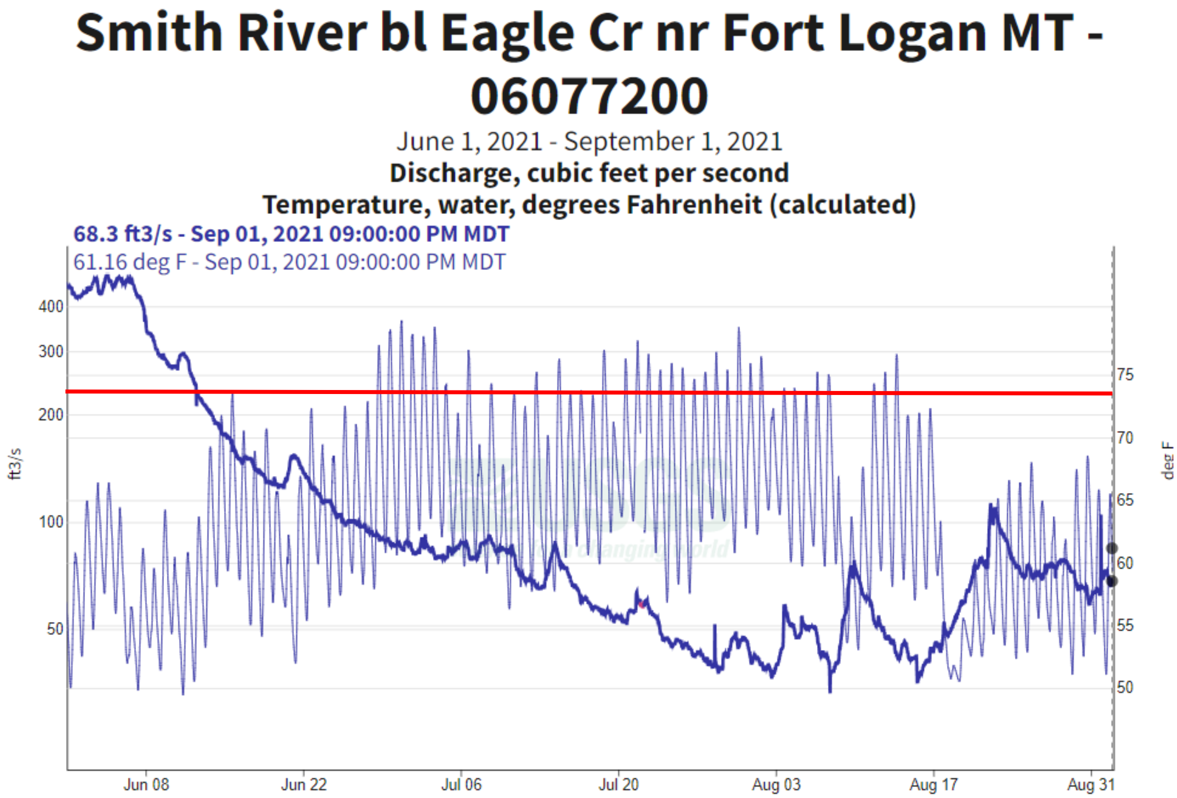


Figure 40. 2021 stream temperature and flow data at the Eagle Creek gage downstream of Camp Baker showing the rise in water temperature as flows decline. The red line indicates 73 degrees F which starts to be exceeded when flows near 100 cfs.

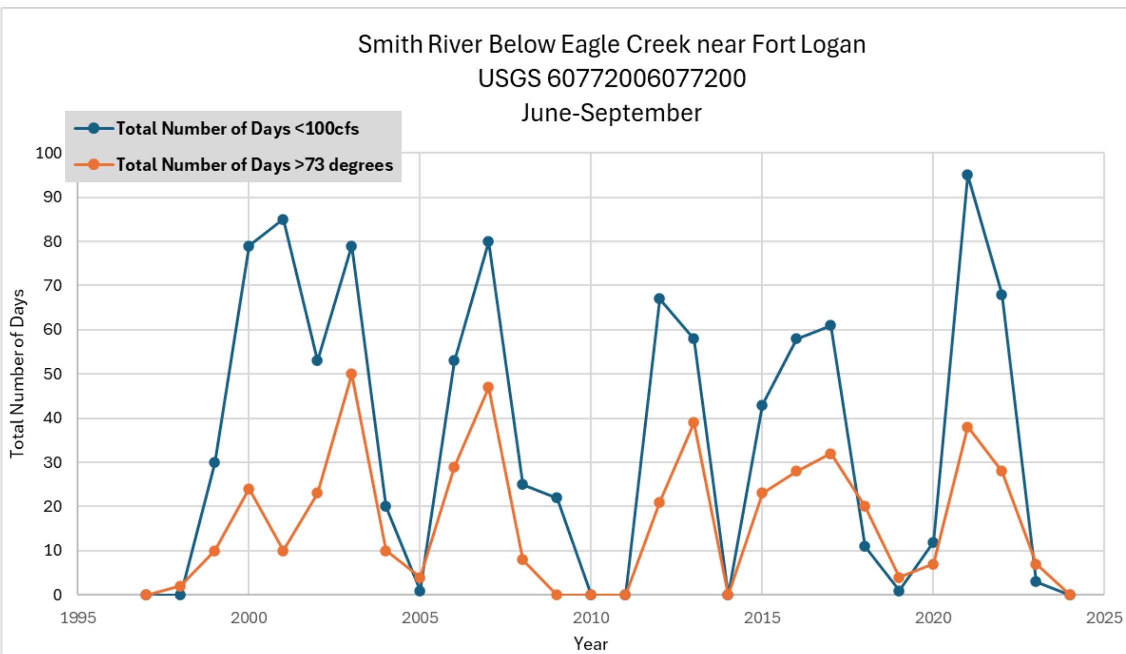


Figure 41. The number of days 73 degrees F has been exceeded (orange line) compared with the number of days flow drops below 100 cfs (blue line) at the Eagle Creek gage downstream of Camp Baker between 1997 and 2023.

5.2.3.2 Nutrients

Nitrogen and phosphorous are elevated throughout the basin, but particularly upstream of Camp Baker in the agricultural dominated portion of the watershed. Excess nutrients can lead to significant water quality problems including algal blooms, declines in fisheries, and have been linked to increases in human pathogens. Nutrient issues can intensify when combined with less water and warming water. Nutrient sources are typically from agricultural practices such as grazing and crop production. Both nitrogen and phosphorous are common ingredients in commercial fertilizers.

DEQ 10-year data showed elevated nitrogen levels throughout the upper basin, but not extreme levels. The 2018-2019 nuisance algae study conducted by DEQ showed phosphorous was elevated during both runoff and baseflow conditions, which is unusual. This prompted a USGS study to look at where the phosphorous load in the upper watershed was coming from. They identified two tributaries in the upper basin as providing the most phosphorous, but also determined that the tributaries evaluated collectively contributed less than half the total phosphorous measured in the Smith River at Camp Baker (Table 9). The USGS installed continuous monitoring stations near the mouth of the North Fork and Camas Creek to further evaluate nutrient sources. For example, the Camas Creek data can be used to evaluate the effects of fire on sediment load and nutrients, as the Woods Creek Fire burned a significant amount of the upper Camas Creek watershed. The North Fork flows through the city of White Sulphur Springs where septic systems and fertilizer may be nutrient sources. DEQ also installed groundwater monitoring wells in the Smith River floodplain near the channel to see if the floodplain itself might be a source of phosphorous, as a legacy of fertilizer use, grazing, and flood water retentions in the floodplain could be a long-term, slow releasing source of nutrients.

Agriculture, particularly fertilizer application to hay and crop fields, and grazing are sources of nitrogen and phosphorous. Septic tanks and waste water treatment areas may also be potential nutrient sources, but their contributions are likely relatively small in this largely rural watershed. As phosphorous is directly correlated with turbidity, it mostly enters the stream through streambank erosion. In the Smith basin, most of the plowed and fertilized crops are outside the floodplain; nutrients are therefore likely delivered to the floodplain from ditches or other runoff and then stored in floodplain soils that may be prone to erosion. Ditch cleaning that delivers soil into the stream may also be a source. Upland erosion following fires can result in elevated sediment and nutrient delivery; 2021 was a major fire year in Central Montana with the Woods Creek fire burning portions of the upper Big Birch and Camas Creek watersheds and the Harris Mountain fire burning the upper Hound Creek watershed. Phosphorous may also be naturally sourced from rocks and soils.

Table 9. Phosphorous load upstream of Camp Baker (DEQ, 2021b).

Tributary	Tributary P Load (%) to Smith River at Camp Baker	
	June 10, 2019	June 25, 2019
Camas Creek	**19.4%**	**25.2%**
North Fork Smith River	**10.7%**	**17.1%**
South Fork Smith River	5.2%	2.1%
Benton Gulch	4.4%	5.3%
Newlan Creek	No flow data	0.7%

5.2.3.3 Metals

Metals have not been identified as a significant cause of impairment in the Smith River basin. The Sheep Creek Aluminum TMDL identified elevated levels of aluminum in Sheep Creek and Moose Creek, a tributary to Sheep Creek, but determined levels were from natural sources (DEQ, 2021a). Aluminum loads were developed for Sheep Creek in response to the potential for the Black Butte Copper Mine to increase aluminum levels in Sheep Creek tributaries. Aluminum and iron are also slightly elevated in other upper basin tributaries but there are no known point sources and sources are assumed to be natural.

Cadmium was recorded as elevated in Newlan Creek above the reservoir in 2004 but has not been measured since that time. There are several abandoned hard rock mines in the Big Belt Mountains including upper Newlan Creek which could be a source of metals such as cadmium.

In the lower basin, lead has been detected in slightly elevated levels but the source is known. The lower watershed was part of the Great Falls Coal Field and there are abandoned coal mines in Hound Creek and Ming Coulee.

5.2.3.4 Sediment

Fine sediment was identified as a cause of impairment of aquatic life, coldwater fisheries, and/or public contact recreation in several tributaries to the Smith River. Sediment is impacting beneficial water uses in these streams by altering aquatic insect communities, reducing fish spawning success, and increasing levels of turbidity. Sediment/siltation is an issue because it can stress aquatic organisms but it can also affect irrigation efficiency and overall stream function. Based on field reviews and review of 10-year DEQ data, siltation is a widespread issue throughout the basin.

Two common measurements of fine sediment in streams are Total Suspended Solids (TSS); solids in water that may include a wide variety of material such as silt, decaying plant and animal matter, industrial wastes, and sewage; and TDS, a measure of the amount of material dissolved in water. This material can include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions. High TSS can increase turbidity and block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. A reduced rate of photosynthesis causes less dissolved oxygen to be released into the water by plants which can lead to fish kills. However, reduced photosynthesis could also reduce the amount of chlorophyll-a being produced which could reduce aquatic macrophyte or algae growth. High TSS can also cause an increase in surface water temperature because the suspended particles absorb heat from sunlight. This can cause dissolved oxygen levels to fall even further. High concentrations of TDS may also reduce water clarity, contribute to decreased photosynthesis, combine with toxic compounds and heavy metals, and lead to an increase in water temperature.

The main sources of TSS and TDS are from loss of riparian vegetation and bank erosion. Irrigation return points are also sources of excess sediment entering the river. Sedimentation caused by erosion from agricultural and forest lands was identified as the most significant issue affecting water quality in the basin in the 1988 Smith River Management Plan (FWP, 1988).

5.2.3.1 E.coli

E.coli levels have been high to extreme in past water quality samples in several tributaries of the Smith River. E. coli is primarily a human health issue that can cause diseases such as gastroenteritis, giardia, hepatitis or cholera. In 2002, DEQ completed a study of the effect of recreation on E. coli levels in the Smith River Corridor. This study found that overall concentrations were well below the standard for waters classified as B-1 and concluded that recreational floaters do not cause a measurable increase in E. coli levels. The recent enactment of a human waste pack-out system for the Smith River Corridor should further reduce the risk of E. coli from recreational users.

Sheep Creek showed up to 80% exceedance in E. coli levels during the DEQ 2017 TMDL assessment which identified the primary source as cattle grazing in riparian areas, with manure management/use as fertilizer, septic systems, recreation, and natural background (wildlife) as other potential sources (DEQ, 2017). This assessment indicated that more analysis of septic tank conditions and manure management was warranted. In the upper basin, numerous high to extreme E. coli samples have been documented in the last 10 years and cattle grazing in riparian areas is likely the main source.

5.2.3.2 Nuisance Algae Blooms

Nuisance algae blooms are a relatively new issue in the Smith River basin with reports of nuisance algae beginning in 2015 (Figure 42); although algal blooms have been noted in previous assessments in 2006 (DNRC, 2006). The combination of reduced stream flow, elevated stream temperature, elevated nutrients and increased fine sediment culminate in the issue of nuisance level algal blooms.

Algae is common in Montana rivers and the species of algae that often reaches nuisance levels is *Cladophora glomerata,* which is a native species that has been documented in biological assessments since the 1990s (Bahls, 1999). However, *Cladophora* growth can reach nuisance levels where it becomes a recreation annoyance, clogs irrigation diversions, and can potentially affect dissolved oxygen levels and alters insect populations which could affect fish populations. Chlorophyll-a (chl-a) is a specific pigment that occurs in plant cells and is used to measure the amount (biomass) of algae in water samples. When quantities of these very tiny algae become so numerous (sometimes referred to as algal bloom), they use up so much of the available oxygen in the water that it can create toxic conditions for fish and insects because they are unable to breathe.

The DEQ study initiated in 2018 in response to increased reports of nuisance level algae in the Smith River Corridor looked at water and air temperature, magnitude and timing of stream discharge, nutrient concentrations, chlorophyll-a, water hardness and pH. DEQ sampled water quality parameters at several sites throughout the basin (Figure 43). This study is still in progress, but early results indicate:

- Minimum daily air temperatures have increased between May and July by 3.6 degrees F over the last 24 years.
- Water temperature is significantly increasing during the first two weeks of June. This allows water temperatures to rise earlier in June which increases chlorophyll-a levels and allows algae to start growing earlier creating conditions for it to reach nuisance levels before nutrients start to limit growth. The optimal water temperature range for algae growth is 55.4 to 62.6 degrees F.
- Nuisance algae occurred during years when average water temperatures during the first half of June were in the optimal range for growth and flows were not too high. The first half of June 2020 was too cold, resulting in less pronounced algae growth.

- Nitrogen levels are high everywhere in the basin and highest upstream of Camp Baker. The study demonstrated that nutrient levels haven't changed significantly since the 1970s and are high enough for algae growth during the growing period. Nutrient levels naturally taper off as flows recede so nutrients typically become too low for algae growth later in the summer.
- Nutrient levels are highest in April, lowest in October, typically below growth needs of algae by July, and become limiting for algae growth later in the summer.
- No significant correlations with high flow patterns were observed. High flows in 2018 did not appear to prevent nuisance level algae; however, quantitative data from earlier low flow years was not collected for comparison.
- Researchers noted a 40% reduction in phosphorous could help reduce nuisance level algae, but acknowledged that such a reduction would be very hard to practically achieve.

The preliminary overall conclusion of the study is that increased air temperatures allow water to warm earlier in June so algae starts growing sooner and gets to nuisance levels before nutrients become limiting. Algae growth is primarily driven by water temperature and nutrients. When water temperatures are increasing and nutrients are not limiting, chlorophyll-a can be produced earlier, allowing algae to start growing earlier and reach nuisance levels in some years. Algae doesn't typically start to grow until water temperatures are above 55 degrees F and there are enough nutrients available to feed chlorophyll-a.

The exact level of chlorophyll-a needed for algae to reach nuisance levels is not fully understood, and the amount of algae considered a nuisance is somewhat subjective (Suplee and Watson, 2009). Figure 44 shows the relationship of chl-a to nuisance levels and potential biological effects. Two thresholds have been suggested – 75 mg chl-a/m^2 indicates enough chl-a is present for algae to reach nuisance levels. This corresponds with the maximum level of chl-a documented in reference streams in the Rocky Mountains (DEQ, 2021b). At this level few biological effects to insect or trout are expected. The second threshold, 150 mg chl-a/m^2 is what people visually consider nuisance levels. At this level, potential effects to insect and trout, such as shifts in insect community species composition, possible reduction in dissolved oxygen, and potential affects to trout growth and survival could occur. In the mainstem Smith River, the 150 mg/m^2 chl-a level is exceeded at Camp Baker and downstream by June but has not been exceeded often upstream of Camp Baker which may explain why nuisance levels become more common in the Smith River Corridor.

Algae growth in other rivers has shown some correlation to stream flow. In general, deeper water reduces algae growth as light can't penetrate to the substrate. Low flows contribute to higher water temperatures. In other rivers where nuisance algae is very common such as the Clark Fork River, data have shown that high flows that mobilize larger substrate have prevented algae from reaching nuisance levels. This effect, however, was not observed in the Smith River as 2018 was a high flow year and nuisance algae levels were still observed that year.

Figure 42. Nuisance algae bloom 7 miles above Eden Bridge on July 1, 2019 (DEQ, 2021b).

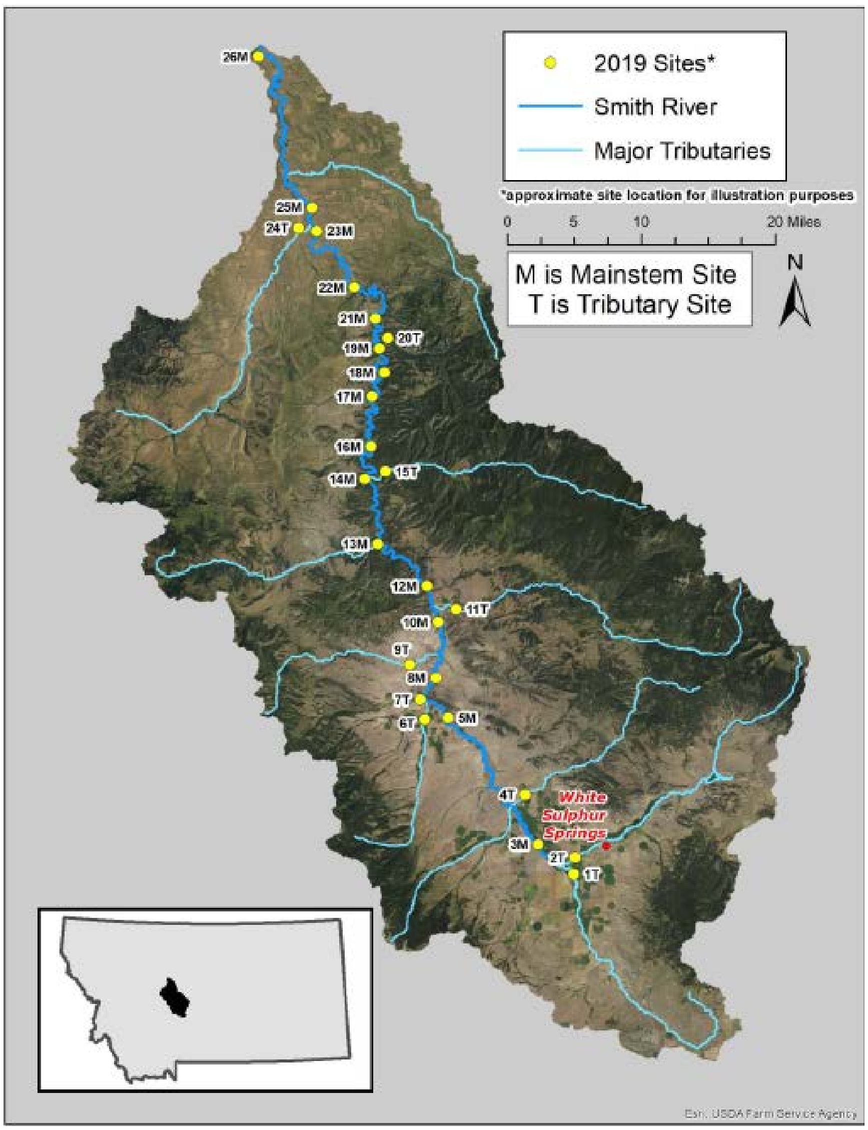


Figure 43. DEQ nuisance algae study monitoring sites (DEQ, 2021b).

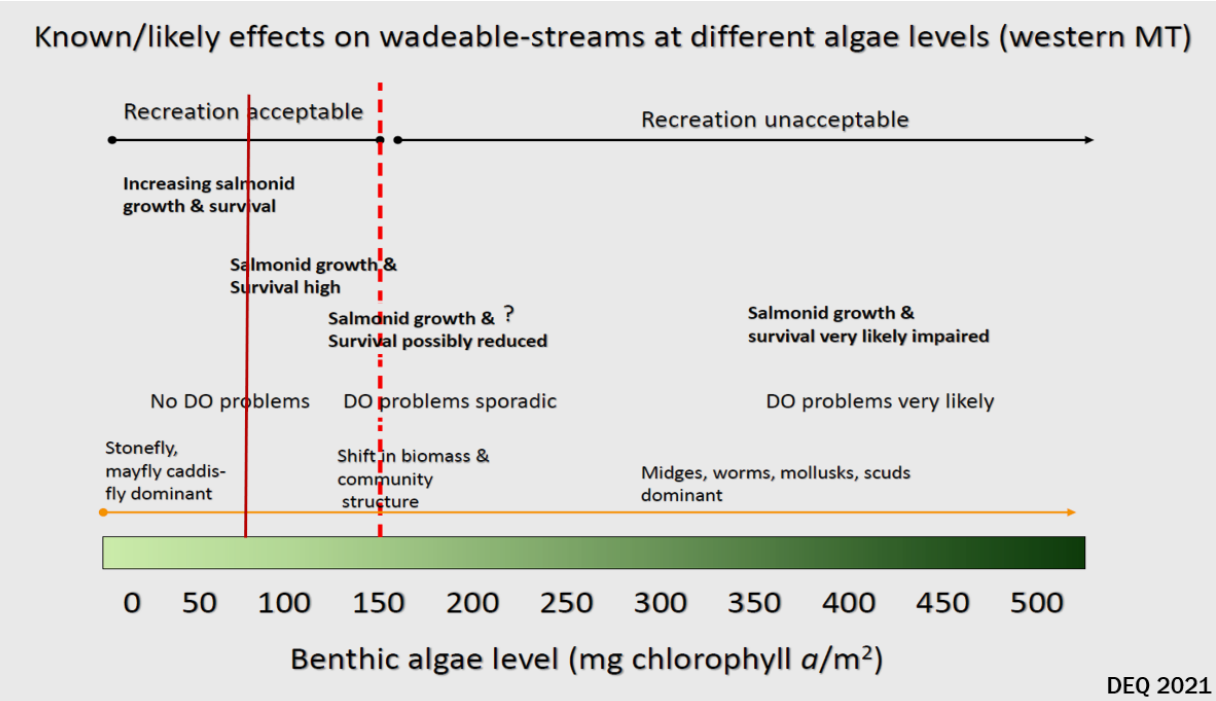


Figure 44. Relationship between chl-a levels, nuisance algae and biological effects. The solid red line represents the 75 mg/m^2 level that is the maximum recorded in reference Rocky Mountain streams. The dashed red line represents the 150 mg/m^2 level that correlated what recreationists considered a nuisance level of algae. The figure shows the relationship of those levels with potential biological effect to stream biota (DEQ, 2021b).

5.2.4 Riparian and Aquatic Habitat

Riparian areas and streams in the Smith River basin are greatly altered from the historic condition. While the Smith River basin was somewhat protected from extensive beaver trapping, it did occur. The removal of beaver and land conversion for agriculture would have driven the first major changes to streams and floodplains, as was the case throughout most of the west. Removal of beaver led to channel incision and bank erosion, reduced floodplain connectivity, draining of floodplain aquifers, and loss of wetlands. Beaver are still common throughout the basin but large beaver-dominated valley bottoms are rare.

These alterations were further realized through the introduction of livestock and agriculture. Floodplains and riparian areas are naturally sub-irrigated and as a result the first areas cleared and converted to introduced pasture grasses to support livestock and hay production. Extensive clearing of woody vegetation from the Smith River floodplain and tributary streams occurred to support agriculture. Most of this conversion occurred prior to the 1950s, with only 20% of the floodplain area supporting woody vegetation by that time. Approximately 700 additional acres of woody vegetation was lost from the Smith River floodplain between the 1950s and 2021 (Figure 45 and Figure 46). Livestock concentrate along streams and channels leading to over-use of these areas resulting in further removal of riparian vegetation and bank trampling. Introduced pasture grasses such as reed canarygrass, meadow foxtail, and smooth brome are now the dominant riparian vegetation throughout the basin, commonly outcompeting native riparian vegetation in stream corridors (Figure 47).

There is ample evidence that the upper basin supported extensive floodplain wetlands, such as high groundwater, areas dominated by native wetland vegetation, and deep fine textured soils. Water tables were high enough to have likely supported wet meadow and wetland bog complexes over woody riparian vegetation. Many areas have been actively ditched to drain high water tables (Figure 48). This reduces natural water storage in floodplains which can affect water quantity basin-wide and degrade habitat.

While these initial alterations occurred more than a hundred years ago, current land use practices perpetuate the altered state. Land uses such as grazing and haying have a different intensity, frequency and duration compared to natural disturbances such as fires and floods. While less intense, high frequency and long duration grazing make it difficult for riparian areas to recover. The altered disturbance regime, combined with reduced floodplain area, have greatly altered the function of floodplains, streams and riparian areas on the landscape, reducing streamflow, and degrading aquatic habitat. Natural recovery potential is further restricted by the predominance of introduced pasture grasses that create static vegetation communities, resisting the formation of new habitats and ability of native vegetation to colonize sites during flood disturbances.

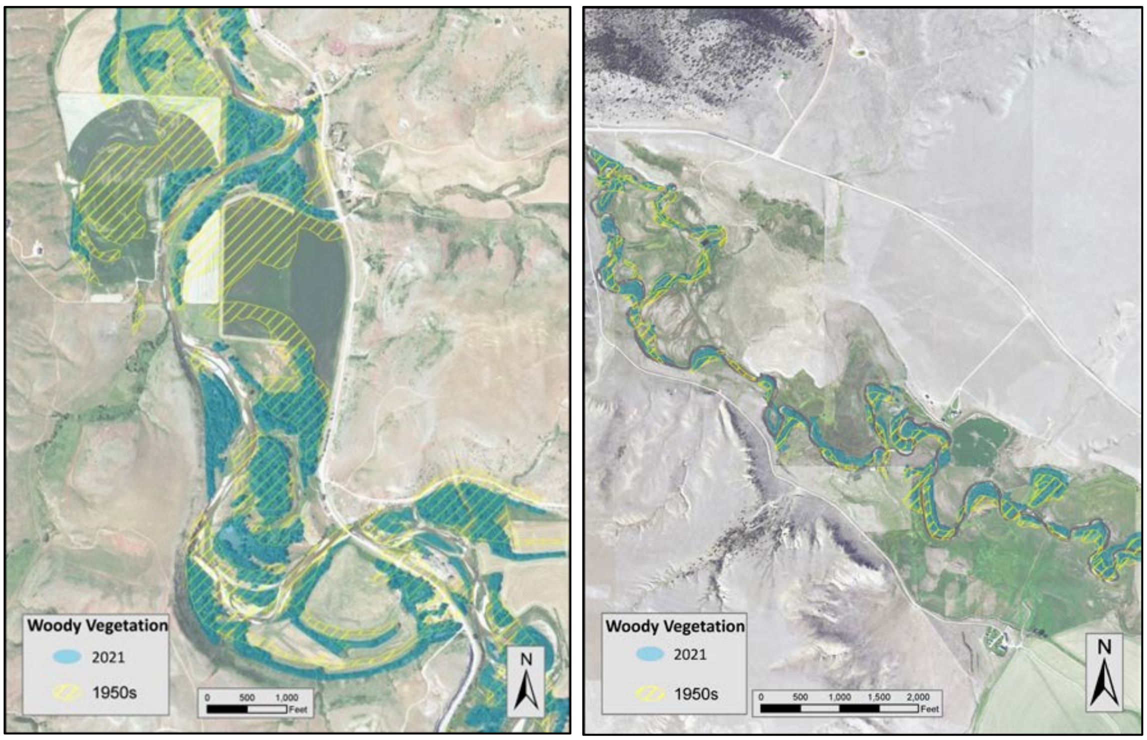
Stream channels have evolved in response to historic alterations. The removal of beaver effectively destroys complex systems of natural grade controls (dam complexes) that both maintain streambed elevations and spread excess flow energy across the floodplain. With the loss of beaver dams, stream energy is concentrated through largely fine sediment, which commonly causes rapid erosion and channel downcutting. Streams have also been straightened to increase access to agricultural fields and accommodate transportation infrastructure (Figure 49). These actions can also have dramatic effects on the geomorphic stability of channels, as straightened streams become over-steepened, resulting in high velocities and channel incision, and thereby adding to the consequences of beaver removal. As straightened, over-steepened, or incised streams evolve further, bank erosion and fine sediment production rates can remain elevated for decades. A common quasi-equilibrium end state is a channel that is vertically detached from its historic floodplain, as evidenced by high eroding cutbanks against that surface. These perched historic floodplains become terraces that are typically incapable of supporting woody riparian vegetation, and their lack of deep binding woody vegetation on eroding banklines can increase erosion rates and cause channel widening. With time, as the channel continues to migrate laterally, a new floodplain will be constructed in the wake of that movement, and the new, relatively low surface will support riparian recovery, especially on new point bars. This process will ultimately re-stabilize the channel profile, although elevated sediment loads will persist until the terraces are largely eroded out. Figure 50 compares a channel connected with its floodplain to one that has evolved to an altered and incised state.

The alterations to floodplain and riparian vegetation and channel morphology has resulted in degraded and over-simplified aquatic habitat, specifically in areas with wider valley bottoms. The 1973 Montana Department of Fish and Game Smith River watershed investigation noted past impacts to stream channels and physical stream habitat on nearly every stream in the drainage. Some of the main alterations to aquatic habitat include:

- Reduced streambank habitat (over-hanging woody vegetation, undercut streambanks).
- Over-widened channel conditions or over-simplification from small, deep multi-thread channels to single, shallow, wide channels.

- Channel entrenchment/loss of floodplain connectivity.
- Reduced instream cover.
- High fine sediment load creating embedded substrates and supporting high cover aquatic macrophytes.

Examples of these alterations are shown in Figure 51. Removal of woody riparian vegetation along streambanks, draining of floodplains, and over-widening of channels exacerbates water quality effects by increasing fine sediment inputs and reducing stream depths allowing stream temperatures to increase and aquatic vegetation and algae to reach nuisance levels.



Woody Cover Smith River Floodplain (acres)					
	1950s		2021		
	Acres	% Floodplain Area	Acres	% Floodplain Area	Change (acres)
Willow	1677	16%	1099	11%	-578
Cottonwood	296	3%	82	1%	-215
Cottonwood/Willow	404	4%	486	5%	82
Total	**2377**	**23%**	**1666**	**16%**	**-711**

Figure 45. Change in woody vegetation cover between the 1950s and 2021. Left image shows an example of woody vegetation change in the lower watershed (River Mile 18 to 19) and right image shows an example of woody vegetation change in the upper watershed (River Mile 97 to 99).

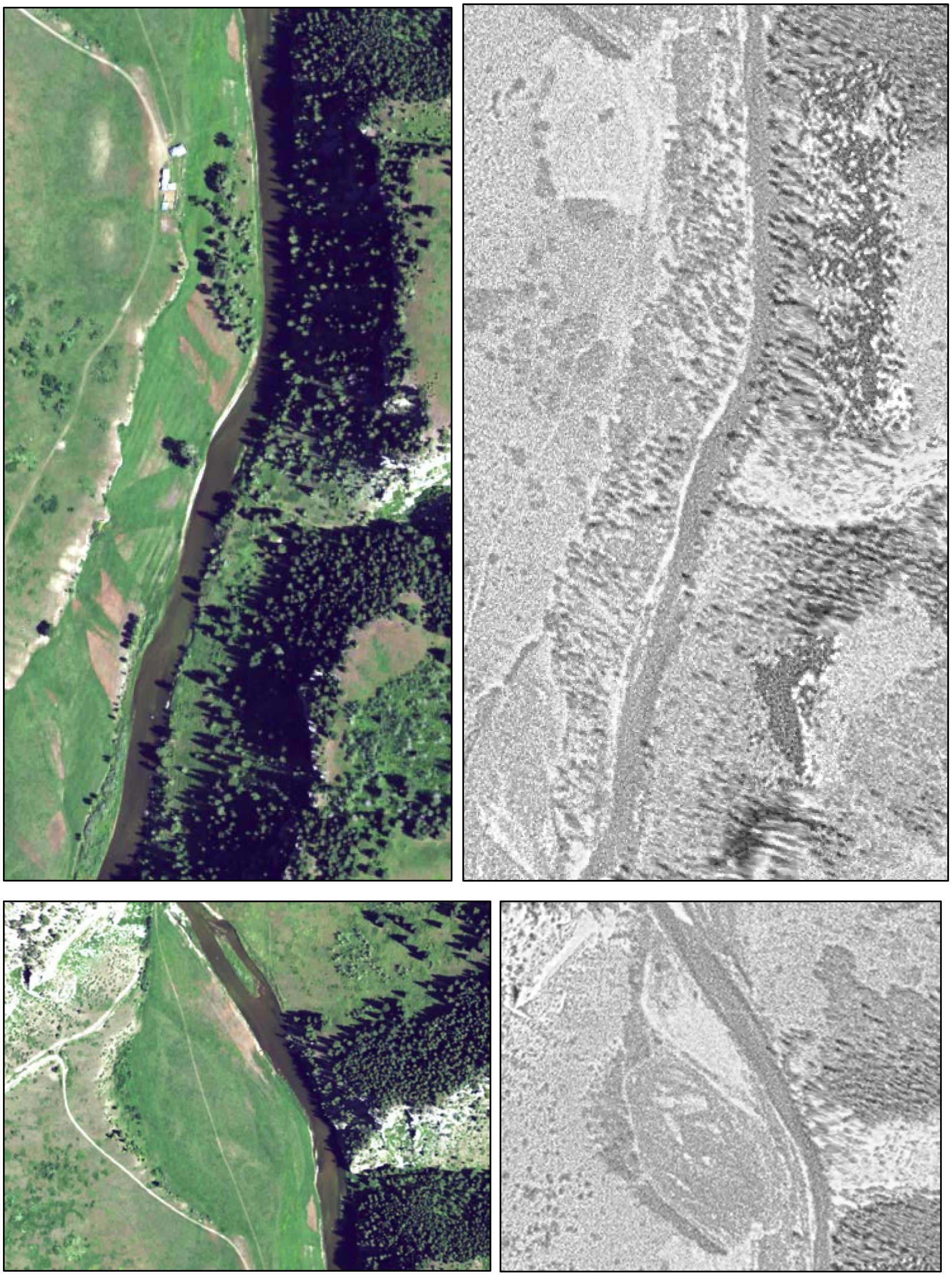


Figure 46. Cleared woody riparian vegetation in Smith River Corridor. Top photos show loss of cottonwood forest (left photo is 2021 imagery and right photo is 1950s imagery). Bottom photos show loss of willow vegetation (left photo is 2021 imagery and right photo is 1950s imagery).

Figure 47. Conversion of floodplain to introduced pastures grasses and high cutbanks resulting from channel entrenchment from woody riparian vegetation removal over time.

Figure 48. Smith River floodplain drainage ditches upstream of Newlan and Birch Creek.

Figure 49. Example of channel adjustments over time (left) and pre 1950s meander cutoffs in agriculture area in lower watershed (right).

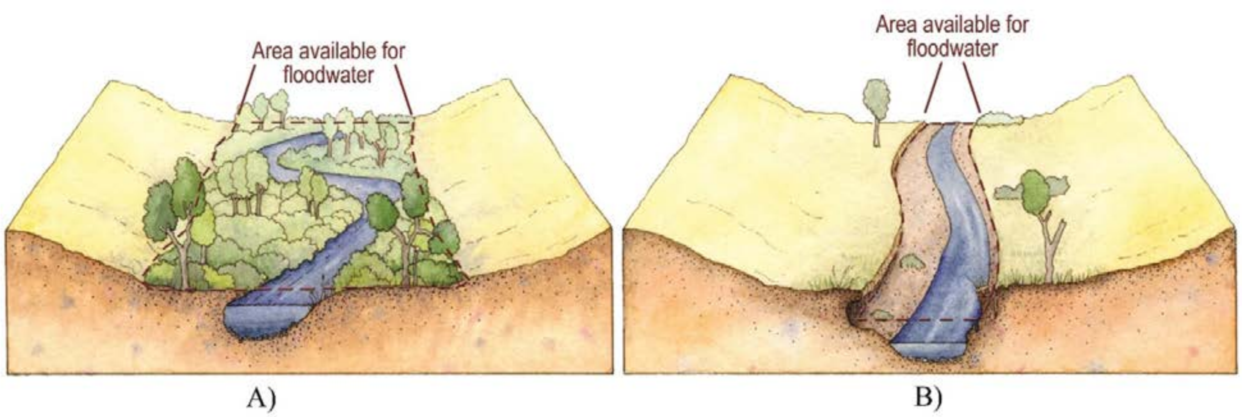


Figure 50. A) Unaltered floodplain corridor with a diverse mosaic of habitats, inundation during floods allowing sediment deposition and attenuation of flood flows, high water table supporting riparian vegetation and passive water storage and late season groundwater recharge to the river. B) Altered floodplain corridor with disconnected channel and floodplain, flood flows confined to channel and no inundation during flood flows, reduced diversity and productivity, reduced percolation and groundwater recharge, lowered water table, reduced natural storage of water, and conversion to dry vegetation. Graphic source: superiorrivers.org.

Figure 51. Channel incision and loss of riparian vegetation resulting in accelerated streambank erosion.

5.2.5 Upland Vegetation

The effect of human settlement on natural vegetation in the Smith River valley was pronounced. In order to create range for cattle and sheep, sagebrush in the valley was plowed, burned, mowed and chemically treated. In a 1970 survey, a historical review of sagebrush eradication was taken in two township areas west of White Sulphur Springs. The study showed that nearly 50% (12,000 acres) of the original sagebrush stand in the area had been eradicated since 1915, and replaced by introduced grasses (Petersen, 1995). The 1973 assessment stated that only 8% of the drainage supported sagebrush-grassland habitat and sage-grouse were the most heavily hunted upland game bird in the upper portion of the drainage (FWP, 1973). The assessment noted the general population trend of sage-grouse appeared to be downward and would continue in this direction until the destruction of sagebrush was halted.

Conifer forests have also been greatly altered in the basin. Increased fire suppression efforts following the Great Fire of 1910 have drastically reduced fire frequency in the west, altering forest stand health and condition. Barrett (1993) studied the fire history of the Tenderfoot Creek Experimental Forest, an 8,600-acre Forest Service study area within the subalpine forests of the Little Belt Mountains, and describes the fire regime as being characterized predominantly by large, stand-replacing fire events occurring close in time, followed by long fire free intervals with occasional mixed-severity events, primarily on the more gently sloped mid- to upper-elevations in the area. The extensive even age classes of lodgepole pine seen today are the result of stand-replacing fires from the early- to mid-1700s and mid- to late-1800s (Leiburg 1904, Barrett 1993) with very few similar fires occurring since then.

Timber harvest was extensive in the basin in the late 1800s. Private land logging between 1950 and 1990 led to forest stands being high graded with the best trees taken and poorly formed or diseased trees left (NRCS, 2022a). In the last 30 years, timber harvest has decreased significantly as local mills have closed. However, in the past 25 years there has been an increase in timber harvest on private lands, some focused on removing dead trees (NRCS, 2022a).

Insects, disease and over stocking have led to deteriorating forest health. Forests are becoming increasingly dominated by mature stands, with greater proportions of shade-tolerant species, higher stand densities, and conifer encroachment in forest openings (NRCS, 2022b). Mortality of Douglas-fir is occurring at a landscape level as a result of drought, insects and disease (USFS, 2022). Spruce budworm has killed or severely defoliated thousands of acres of Douglas-fir trees; mountain pine beetle has killed thousands of acres of lodgepole and ponderosa pine and the dead and downed trees leave a fire hazard and make forage inaccessible for grazing (NRCS, 2022a). It is no longer possible for natural fire regimes to return to the landscape to restore forests and grasslands. Projections show the need to increase fire regimes by at least 3 to 7 times to return forests and rangelands to natural fire regime conditions (NRCS, 2022b).

Conifer encroachment into grasslands has been ongoing over the past 120 years to varying degrees across the landscape as fires have been suppressed (Figure 52). As the timber cover has increased, the carrying capacity of the rangeland has dropped and reduced productive winter range for elk and mule deer. The reduced forage also increases competition between elk and livestock. Conifer encroachment into grasslands also affects overall basin hydrology as conifers have a much greater moisture demand compared to native bunchgrasses. There have been reports of springs that have been dry for many years flowing again after removal of conifers.

Numerous noxious weeds are present in Meagher and Cascade counties (Meagher County and Cascade County noxious weed lists). Spotted knapweed, leafy spurge, and houndstongue are the most common in Meagher County. Noxious weeds were first documented in the basin in 1934 and Meagher County started a weed control program as early as 1940, targeting leafy spurge. The 1973 assessment states that “spurge probably came into the Smith River drainage along Tenderfoot Creek during the Great Depression.” Spurge was inventoried from the mouth of Tenderfoot Creek downstream in the 1970s, and subsequent inventories up to about 1995 showed that the infestation had tripled and spread upstream above Tenderfoot Creek as far as Eagle Creek.

The Smith River recreational float corridor is infested by four species of noxious weeds: leafy spurge, spotted knapweed, houndstongue and Dalmatian toadflax. Several factors influence the increased need for weed treatment and monitoring efforts within the Corridor. The Smith River experiences fluctuating water levels. During times of high water or flooding, weed seeds are transported and deposited onto neighboring riparian areas. The area receives a high level of recreation use including rafters, fishermen and hunters which results in an increased risk for noxious weeds to spread onto neighboring private, state and USFS lands. A continuation and enhancement of past and current efforts is needed to better control noxious weeds within the area and project neighboring lands from being invaded by noxious weeds through spread from infestations in the corridor (USFS, 2021b).

Invasive annual grasses such as cheatgrass and ventenata are also an increasing threat in the basin. An estimated 40,000 acres of Meagher County are infested with cheatgrass.

The sustainability of rangelands is critical to the ranching economy in the basin and plant productivity and health could be improved on most rangelands. NRCS (2022a) reports that plant composition is 30% of what the historical climax plan community would produce in Meagher County. Rangeland health is affected by weed invasions, conifer encroachment, and proper irrigation and grazing management. It influences water quantity, water quality and riparian and aquatic habitat conditions.

Figure 52. Douglas-fir and juniper encroachment into grasslands in the upper Smith River basin.

5.2.6 Recreation

The Smith River Corridor experiences very high levels of recreational use. Between 2018 and 2020 the average number of floaters per year in the Corridor increased by nearly 25% compared to 2015 through 2017 and with increased use came noticeable increases in resource impacts. This use is generally concentrated in boat camps. Trash and waste through the Corridor is a concern for agencies and adjacent landowners. FWP and USFS staff members have observed an increasing amount of natural and cultural resource degradation at the river corridor's boat camps and riverbank landings due to increased visitor use and foot traffic, such as:

- Sloughing of riverbanks at boat landings (Figure 53)
- Loss of vegetative cover and barren core areas (Figure 54, Figure 55)
- Erosion
- Soil compaction (Figure 54)
- Root exposure
- Growth and prominence of social trails
- Diminished tree seeding
- Depletion of down and dead wood
- Loss of cultural resources
- Dead and dying conifers (Figure 56)

Recent tree mortality is a concern for recreation managers in the Smith River Corridor. Tree mortality is likely a combination of compaction, drought, physical damage and potential damage from herbicide application, causing a loss of trees susceptible to insects and disease such as Douglas-fir beetle, western spruce budworm, and Armillaria root disease (USFS, 2022).

The recreational float corridor is especially susceptible to weed invasion from high recreation traffic. The long standing collaboration to treat noxious weeds in the corridor has been effective but a legacy of herbicide use has altered the state of vegetation in some areas, including bare ground and secondary invasion (Figure 57). Further, the use of herbicide in some well-drained floodplain areas may pose a risk to water quality (Figure 58).


Figure 53. Bank erosion at Syringa Boat Camp.


Figure 54. Compaction at Indian Springs Boat Camp.

1999

2021

Figure 55. Vegetation changes over time at Cow Coulee Boat Camp (FWP, 2023c).

Figure 56. High concentration of dying conifers at Trout Creek Boat Camp.

Figure 57. Potential herbicide damage on low elevation floodplain area within Smith River Corridor. Left photo shows site in 2014 with high densities of leafy spurge and right photo shows site in 2022 after several years of herbicide application. Photos provided by FWP.

Figure 58. Dry alluvial floodplain deposit susceptible to noxious weed invasion and secondary invasion of cheatgrass after herbicide application.

6 Restoration Framework

6.1 Focus Issues

Section 5.2 describes the main issues in the Smith River basin. Climate Change is included as an over-arching driver of some of the issues in the basin rather than an issue restoration and management actions can address directly at a local scale. ***Upland Vegetation*** and ***Recreation*** issues were also described in Section 5 but are integrated into other categories for purposes of describing restoration and management actions. For example, alterations to upland vegetation affect water quantity at the watershed scale, directly influence riparian and aquatic habitat, and may affect water quality. Similarly, recreation impacts affect water quality and riparian and aquatic habitat. Therefore, the focus issues for the WRP are ***Water Quantity, Water Quality*** and ***Riparian and Aquatic Habitat*** (Figure 59).

Figure 60 shows a conceptual timeline for the human impacts on streams in the Smith River basin and the alterations they have caused that have resulted in degradation of water quantity, water quality and riparian and aquatic habitat. In the pre-development stage, streams in open valley bottoms were more densely vegetated with a strong connection between the channel and floodplain, creating high water tables, floodplain wetlands, and in some cases multi-thread channel patterns. Beaver trapping was the first broad scale impact to these channel types across the state, as trappers who expanded into the Upper Missouri basin largely extirpated the species. It is difficult to know the historic distribution of beaver in the upper Smith River, however GLO survey mapping from the late 1800s describe well-connected floodplains with “boggy bottoms”. Even by that time, however, beaver trapping had been active and streams were responding to the loss of the grade control that beaver dams provided.

With the onset of agriculture, the impacts were more direct, with stream segments channelized to make room for infrastructure such as roads and railroads, riparian areas were cleared to make room for forage crops, and flow was diverted to irrigate those crops. Channels became unstable, riparian bank strengthening was lost, and conditions became ripe for noxious weed expansion. Expanding recreation, especially in the Smith River Canyon, has contributed to those responses. Since then, on-going land uses have continued many of these trends, with increasing sediment and nutrient loads, flow depletions, and associated ecological response.

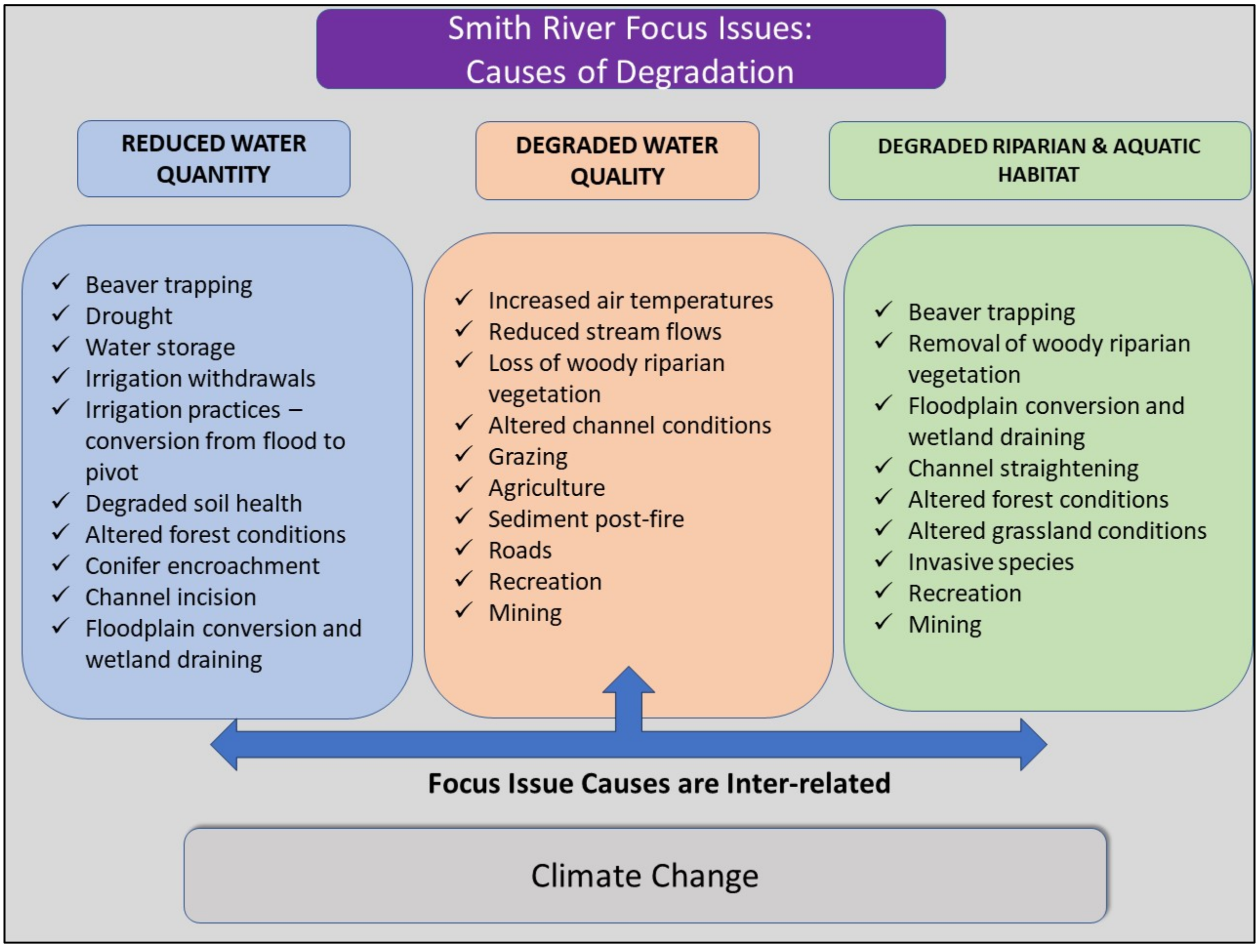


Figure 59. Smith River basin focus issues.

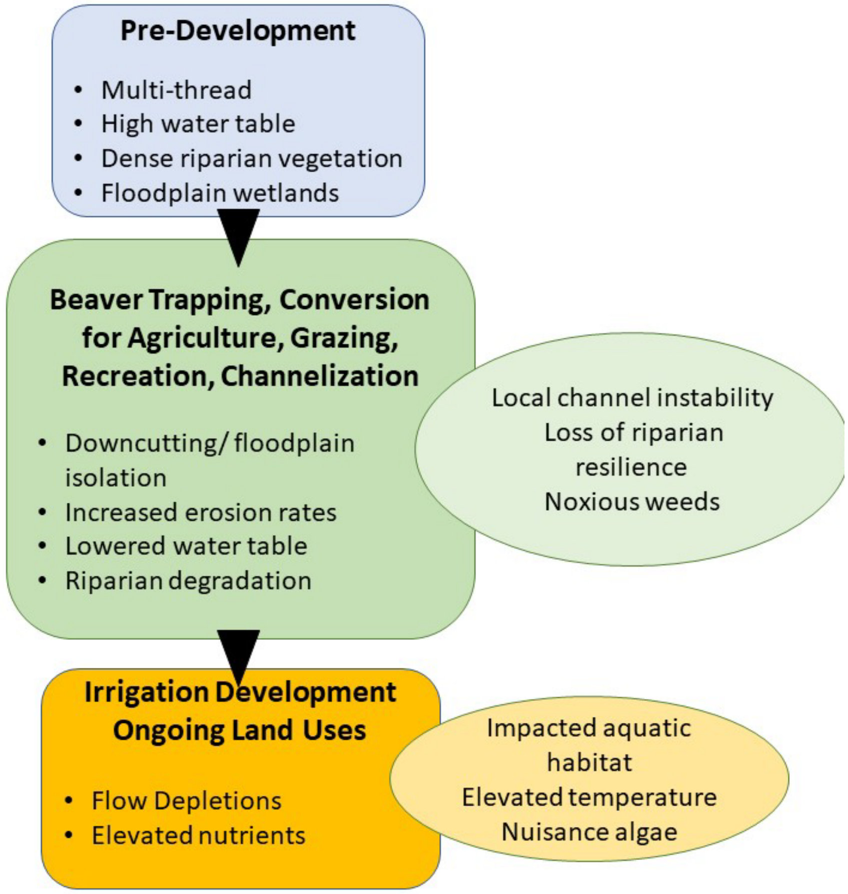


Figure 60. Conceptual timeline illustrating alterations to Smith River streams and resulting channel responses and impacts and degradation.

6.2 Desired Future Conditions

Optimal restoration outcomes for the Smith River basin are to have sufficient low flows, water quality, and habitat conditions to optimally support robust and sustainable populations of desired aquatic and terrestrial life while also supporting people, agriculture and recreation. These three conditions are interrelated in terms of cause and remedy, which provides opportunities to address multiple impacts with individual strategies.

Restoration strategies should aim to reduce the stress of impacts and add resiliency. Outcomes are intended to provide long-term sustainable conditions that address historic impacts while adding resilience in the face of anticipated climate change. Achieving optimal restoration outcomes requires an understanding of realistic desired future conditions and what natural processes are available to sustain those conditions.

Each reach within a river network has a relatively narrow range of channel and riparian conditions that match its physiographic and climatic setting, and restoration actions should be designed to recover that range (Beechie et al., 2010). These natural conditions dictate the potential of the site to support a certain plant community, type of habitat, or channel form. So optimally, restoration actions will collectively help the system reach its maximum potential, which will be the most sustainable and robust ecological condition possible given the setting. However, as the potential of a site is strongly affected by both the natural conditions as well as processes at play, a shift in both form and process due to human impacts can alter the site potential. For example, alluvial floodplains that are no longer connected to the river channel and have been converted to introduced pasture grasses, have low natural recovery potential, and restoration strategies need to directly address this condition either through passively allowing long-term processes to erode that surface and rebuild a lower floodplain, or through actively reconnecting and restoring the surface to regain its potential. Ultimately, developing restoration objectives to actively or passively recover optimal potential increases the chances for successful restoration outcomes that improve site resiliency.

The Smith River basin has several ecological potentials that should be considered as restoration moves forward (Figure 61). Some of the main ecological potentials are described below.

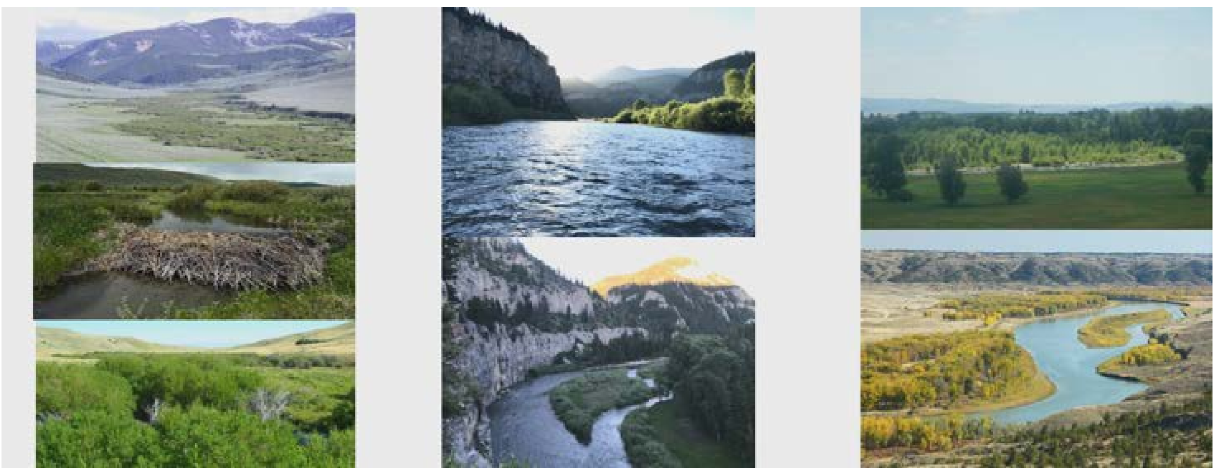


Figure 61. Examples of varying potentials in the Smith River basin ranging from large beaver mediated willow dominated valley bottoms (left panel of photos) to confined canyon sections with limited alluvial terrace formation (center panel of photos) to highly dynamic alluvial floodplains with cottonwood forests (right panel of photos).

6.2.1 Mainstem Smith River Broad Alluvial Floodplains

The Smith River downstream of the Smith River Canyon enters a large alluvial river valley with some ancient lacustrine sediments. The bed and banks are made up of mobile sediments and soils that are frequently re-worked to create new floodplain surfaces. The rate of floodplain turnover is driven by the magnitude and frequency of flood events that erode, deposit and transport the sediment.

The ecological potential for these areas is to support cottonwood gallery forest riparian complexes (Hansen, 1995) (Figure 61, right panel). Cottonwood forests start when cottonwood seedlings colonize bare substrates deposited by floods. In the absence of continued disturbance, cottonwood seedlings grow and reach the pole stage where they begin to compete with each other and stem exclusion occurs. In the continued absence of large flood disturbance, cottonwoods continue to grow, shade increases, soils begin to develop, and later successional species such as red-osier dogwood and conifers begin to colonize the understory. Cottonwood gallery forest riparian complexes also support willow and wet herbaceous vegetation types, transitioning to upland vegetation types at the edges of the valley.

Alluvial valley bottoms are highly dynamic, with riparian vegetation succession constantly being initiated and driven by flood processes, making them diverse mosaics of habitat in an unaltered state. The dynamic nature of these areas and influence of fluvial processes help these areas recover if unnatural disturbances are removed.

6.2.2 Mainstem Smith River Confined Valley Bottoms and Canyon Reach

The Smith River has several segments that are confined by bedrock. In these sections, the valley bottom width is greatly reduced, limiting channel migration and floodplain turnover potential. Alluvial terraces still occur within these confined valley bottoms but to a limited extent (Figure 61, middle panel). Within the Corridor, strath terraces also occur along the river which are bedrock with a shallow layer of soil or old alluvium on top (Figure 62). These terraces were formed by the channel etching through bedrock over a very long period of time.

Alluvial terraces have very different ecological potentials compared to strath terraces. Strath terraces are not vulnerable to fluvial erosive forces and have very shallow soils resulting in their natural potential to support grassland vegetation communities rather than cottonwood forests. However, once the vegetation in these areas is disturbed, it is very difficult to recover through restoration actions. In contrast, alluvial terraces are typically lower in elevation with high water tables and deeper fine-grained soils, increasing the natural recovery potential

Figure 62. Terrace types in the Smith River canyon reach. T1 terraces represent alluvial terraces formed by flood induced erosion and deposition. T2 terraces represent bedrock strath terraces.

6.2.3 Mainstem Smith River Upper Valley Wide Valley Bottoms

The upper valley is characterized by a wide unconfined valley bottom with high groundwater. While fluvial processes still initiate and drive riparian vegetation succession in the upper valley, the broad floodplain, high groundwater and deep organic soils create more stable conditions than lower broad alluvial floodplains. Ecological potentials for the upper wide valley bottoms are a diverse mosaic of vegetation types, such as willows or herbaceous wetland and wet meadow communities, that establish in response to varying degrees of wetness and the influence of flooding, scouring and channel changes. Cottonwood gallery forests would occur in areas where fluvial disturbance is higher, such as meander cutoffs.

Both flood processes and beaver are capable of initiating natural recovery processes in these areas once unnatural disturbances are removed.

6.2.4 Tributary Streams

Tributary streams also transition between wide valley bottoms and confined valley bottoms restricted by bedrock walls or steep valley segments in headwater areas. Ecological potentials for tributary streams range from conifer dominated in steep headwater areas to willow dominated in wider valley segments. Historically, beaver would have been common in the wide valley bottoms of tributary streams, creating valley bottom wide willow complexes (Figure 61, left panel). Willows and riparian shrubs remain the ecological potential for the lower elevation portion of tributary streams as they flow through bedrock confined segments. Many of these segments still support dense willow stands due to limited area for land conversion and restricted livestock access. Flooding is a primary driver of vegetation community succession in these areas, creating and destroying sites for the establishment of vegetation through the transport and accumulation of coarse sediment.

Both flood processes and beaver are capable of initiating natural recovery processes in these areas once unnatural disturbances are removed.

Several tributaries entering the Smith River through the Canyon, including Rock Creek, Tenderfoot Creek and Deep Creek provide examples of minimally disturbed ecological potentials for tributary streams in this portion of the basin. In the upper basin, portions of the North Fork, Camas Creek and Big Birch Creek have high ecological function.

6.3 Uncertainties and Unknowns

As restoration and conservation of the Smith River basin moves forward in the coming years, there are several uncertainties and unknowns that will affect the outcome and should be considered and incorporated into planning and restoration actions, such as:

- Climate change
- Population increases
- Recreation pressure increases
- Legacy ranches transitioning to new owners
- The scale at which restoration is needed
- Data gaps

Climate change should be a consideration in all future actions that attempt to address issues in the basin. As described previously in this assessment, climate change is a main driver of some of the issues occurring in the watershed, such as increased water temperatures and nuisance algae levels. The collateral effects of a changing climate are difficult to predict. For example, with warming waters will trout become more susceptible to disease and parasites, and at what point will stream temperatures no longer support trout in the river? How will altered precipitation timing and amounts change stream channels and flood disturbance patterns and therefore recovery potential?

Riparian and stream restoration provides opportunities to respond proactively to projected climate change effects, increase riparian ecosystem resilience to climate change, and simultaneously addressing effects of both climate change and other human disturbances. However, climate change may alter which restoration methods are most effective and which restoration objectives can be achieved. Considering the effects of climate change in restoration planning and design is critical to long-term restoration of desired functions and conditions.

Because the potential effects of climate change are difficult to predict, how to build in resiliency to the potential changes is also difficult to know. Some strategies for considering climate change in restoration actions include:

- Adopt water conservation and natural water storage as standard practices.
- Emphasize conservation of intact, highly functioning and connected habitats throughout the watershed, particularly in headwater areas.
- Use available tools that predict future climate, streamflow and ecology into restoration project identification and methods.
- Maximize diversity, floodplain connectivity and process space (room for natural processes to do their work) in restoration projects at all scales and to the extent possible.
- Use treatments that provide short-term stability but allow for long-term deformability, such that channels can naturally evolve in a changing climate.
- Integrate flexibility to adjust to future conditions into any future planning as new science and data become available.
- Use multiple plant propagule sources and implement actions over multiple sites and seasons to reduce risk (Zabin et. al, 2022).

Montana's population spiked in the two years following the Covid-19 pandemic, adding 19,155 residents in 2021 and 16,512 residents in 2022. Population increases slowed in 2023 (9,934 new residents for a 0.9% growth rate), but remains above past average increases (U.S. Census Bureau, 2024). At a local level, the proposed Black Butte Copper mine has the potential to greatly increase the population of White Sulphur Springs and the surrounding area (Meagher County Stewardship Council, 2023). Population growth increases demand for food, water, housing, energy, etc. This can put pressure on water resources and increase loss of natural habitats and contribute to other ecological degradation.

Recreation pressure continues to increase in the basin, particularly in the Smith River recreation float corridor. The current recreation related issues such as erosion, compaction, vegetation removal, and waste and trash accumulation could increase making actions more difficult to effectively implement.

The sale of legacy ranches is another factor that could influence restoration in the basin. These ranches may be purchased by conservation minded buyers, developers, or large corporations. The outcomes could result in continued ranching activities, subdivision, other large-scale land conversion, or present conservation and restoration opportunities.

Another uncertainty related to implementing restoration in the basin is the scale at which restoration needs to occur to effectively address issues. Addressing degradation to aquatic and riparian habitat can be done effectively through direct actions with immediate localized benefits. Other issues, such as increased water temperature may not be possible to address through direct actions as it appears to be directly related to climate change and increased air temperatures.

Existing data provide a broad snapshot of basin conditions, but additional information could benefit future restoration work. Some of the data limitations recognized in this assessment include: identification of primary sources of nutrients and sediment from tributaries; locations of stream temperature hot spots; and the need to further understand where issues occur.

7 Restoration and Management Actions

This section describes the range of restoration and management actions proposed for the Smith River watershed. Restoration actions are discussed in terms of three main categories of impacts – Water Quantity, Water Quality, and Riparian and Stream Habitat:

- **Water Quantity:** This action category includes actions that have the potential to improve water quantity, specifically late season flows. Restoration actions range from finding more water storage opportunities, including physical storage reservoirs, passive storage utilizing floodplains, process based restoration, improving irrigation practices to help conserve water, and removing conifer encroachment in the uplands.
- **Water Quality:** This action category includes actions that have the potential to improve water quality. Proposed water quality restoration actions focus on those actions that could help mitigate rising stream temperatures or reduce sediment or nutrient inputs to the streams. Restoration actions include grazing and nutrient management, creating floodplain wetlands to filter overland flow runoff that may have high amounts of fine sediment or nutrients, and addressing other non-point sources such as sediment from post fire runoff and roads.
- **Riparian and Stream Habitat:** This action category includes actions that directly improve riparian and stream habitat. Restoration actions include restoring woody vegetation to streambanks, narrowing and increasing cover in channels, improving upland forest and grassland health, and integrated weed management.

Figure 63 provides an overview of restoration actions identified for the Smith River basin to address the three primary issues. Restoration actions typically address more than one issue (Table 10). For example, creating a riparian buffer and restoring woody riparian vegetation to the buffer and streambanks would benefit water quality and improve riparian and stream habitat. In general, any restoration action that improves the water quantity and streamflow in the basin will also benefit water quality and riparian and stream habitat. Any restoration action that improves water quality would also likely benefit riparian and stream habitat. Identifying opportunities to preserve areas that currently provide significant amounts of clean water or high quality riparian and stream habitat or help support the high level of connectivity in the basin are a high priority.

Restoration actions are discussed in more detail in this section, including restoration actions specific to issues in the Smith River Corridor.

Figure 63. Overview of restoration and management actions by impact category

Table 10. Smith River issues and associated restoration actions.

Issue	Restoration Actions
Water Quantity	
Reduced summer streamflow Irrigation return flows Irrigation infrastructure Reservoir storage	✓ **Preserve existing high-quality habitats** ✓ **Murphy water rights** ✓ **Irrigation practices** ✓ **Water storage (active and passive)** ✓ **Water leasing/ purchasing** ✓ **Alternative agriculture practices (crop selection, soil health)** ✓ **Conifer encroachment removal** ✓ **Drought Response Plan**
Water Quality	
Temperature Nutrients Sediment/Turbidity E.coli Metals Nuisance algae	✓ **Preserve existing high-quality habitats** ✓ **Riparian buffers** ✓ **Restore streambank woody riparian vegetation** ✓ **Increase floodplain connectivity** ✓ **Create floodplain wetlands** ✓ **Grazing management (off site water, fencing, relocate corrals)** ✓ **Increase overland runoff filtration** ✓ **Nutrient management** ✓ **Sediment retention post-fire** ✓ **Road BMPs and decommissioning** ✓ **Recreation use management**
Riparian and Aquatic Habitat	
Agricultural encroachment Channel incision/lost floodplain connectivity Channelization Floodplain conversion/loss of woody riparian vegetation Bank erosion Road encroachment Grazing Altered forest condition/conifer encroachment Floodplain dewatering/draining Recreation impacts Noxious weeds	✓ **Preserve existing high-quality habitats** ✓ **Restore streambank woody riparian vegetation** ✓ **Channel restoration (narrowing, restoring historic meanders, increasing cover and complexity)** ✓ **Improve forest stand health** ✓ **Improve upland grassland health** ✓ **Integrated weed management**

7.1 Water Quantity

7.1.1 Murphy Water Rights

Murphy water rights are owned by FWP and have priority dates of either 1970 or 1971 (Section 4.3.5). There are a total of 93.3 cfs in existing water rights upstream of Hound Creek that are junior to the Murphy rights and could potentially be called on to augment low flows during chronically dry periods. Since 2000, FWP has called junior water rights in the Smith River basin 11 times, including 2000. The current protocol for making Murphy rights calls is that, when dewatering negatively impacts fisheries, a call is justified for those rights that are not being administered by a water commissioner and that would likely result in improved or less rapidly declining streamflow in the Smith River. As there is a water commissioner on the North Fork, calls would not be made on that water.

Murphy rights established for the Smith River change seasonally, with minimum flows of 125 cfs at the USGS stream gage 'Smith River below Eagle Creek near Fort Logan' (06077200) gage and 150 cfs downstream at the 'Smith River at Eden' (06077500) gage (Figure 32). As described in Section 5.2.3, water temperatures begin to regularly exceed 73 degrees F when flows drop below 100 cfs at the Eagle Creek gage. Meeting the Murphy water right, or even calling Murphy rights to increase flows to 100 cfs at the Eagle Creek gage would also help keep water temperatures below 73 degrees F.

Section 4.3.5 describes Murphy rights in more detail. Making calls on these rights is a viable tool for improving low flow conditions when necessary. However, calling these rights does not ensure the water reaches the areas where the increased flows are most needed.

7.1.2 Irrigation Practices

How to best support minimum flows in river systems through changes in irrigation systems is a complex topic that is the subject of much active research. The most direct means of improving flows is to upgrade headworks, conveyance and delivery infrastructure; and improve measurement to minimize the diversion of flows beyond a water right maximum. This can be an effective water saving measure yet it can also be difficult to enforce. However, working with willing landowners to upgrade diversion structure efficiencies is a viable means to mitigate low flow issues.

The "paradox of irrigation" (Lonsdale et al., 2020) refers to the increasing recognition that, although sprinkler irrigation and canal linings may initially appear to consume less water than flood irrigation and unlined canals, in actuality the conversion to sprinkler commonly results in increased water consumption and a gradual decline in alluvial groundwater levels. Further, Donnelly, et. al (2024) found that seasonally flooded grasslands associated with cultivated grass-hay are important agroecological wetland resources on private working ranches, accounting for 57.8% of temporary and 6.1% of semi-permanent wetlands in the Intermountain West from 2013 to 2022 and mimicking historic riparian wetland functions such as groundwater recharge.

Sprinkler irrigation does allow for a better linking between crop water requirements and amount of water applied. This in turn can substantially increase crop production which leads to an increase in net water loss through evapotranspiration (evaporation and plant uptake). More land tends to be irrigated with pivot conversion as landforms marginal for flood irrigation become accessible. This may not always occur, which highlights the site specific nature of the value of conversion.

Another important consideration in the attempts to reduce streamflow diversion volumes is the potential loss of those flow augmentations by downstream users. As such, effective shifts in water use to support stream ecology requires strategic collaboration between users. Table 11 lists potential outcomes of different irrigation systems (Lonsdale et al., 2020).

The conversion of flood to pivot irrigation, or the integrated use of both types of water application to a single field requires careful analysis as to the effect of those changes on streamflow.

On Gold Creek, which is a tributary to the Clark Fork River, strategic changes in irrigation methods resulted in substantial gains in instream flow (Lonsdale et al., 2020). In 2007 and 2008, ranches in the upper part of the system maintained their flood irrigation practices, whereas two ranches on the lower end of the creek converted to pivots, which allowed them to reduce their diversion volumes by 75%. With upper watershed flood irrigation providing aquifer recharge and lower users taking less flow, streamflow of 10 cfs or more is now consistently maintained in the last three miles of the small creek. Another irrigation water management project is currently underway in the same drainage looking at how to manage pivots to manage the groundwater storage and stream recharge achieved through flood irrigation. This project is evaluating potential hybrid irrigation systems where flood irrigation is used early in the season when water is more abundant to fill the groundwater aquifer and then switching to pivots with more efficient water use when water is scarce later in the season.

Some actions that improve irrigation efficiency include replacing leaky headgates, lining or putting ditches into pipes, and tailwater management. Actions like replacing headgates and infrastructure that loses water would be beneficial; however, putting ditches into pipes could have similar effects as described above for flood irrigation pivots, where ditches can often provide supplemental groundwater through leakage. To achieve this same function, lined or piped canals would need to include turnouts specifically intended to recharge groundwater or support wetlands.

Table 11. Generalized impacts of flood irrigation/unlined canals vs sprinklers/lined canals (Lonsdale et al., 2020)

TYPE OF IMPACT	Flood Irrigation† or Unlined Canals††	Sprinklers† or Lined Canals/Pipes††
Economical	• Labor and time intensive • Low power costs† • Increased potential need to add nitrate to soil due to leaching† • Annual canal maintenance required††	• Lower labor and time intensity† • Increased power costs† • High initial investment • Maintenance costs • Reduces application rates and cost for fertilizers and other agricultural chemicals† (due to precision application by sprinklers) • Increases ability for additional harvest† • Increases ability to irrigate sloped fields† • Increases ability of some producers to earn income from off-farm employment†
Water Supply	• Recharges aquifer • Supports groundwater contribution to streamflow • Requires more water diverted from streams/rivers (compared to pivot/pipe) • Reduces spring peak streamflow	• Reduces aquifer recharge • Reduces groundwater contribution to streamflow • Leaves more water instream at the time and place of diversion • Potential increase in consumptive use at watershed scale†
Water Quality	• Leaches nitrates from the soil† • Results in fertilizer runoff into streams and leaching of fertilizer into GW† • Provides cooling effect on summer stream temperatures due to groundwater contribution to streamflow	• Reduction in leaching of nitrates† • Reduced contribution of agricultural chemicals to surface and groundwater† • Reduced sedimentation of surface water† • Increase in summer stream temperatures due to reduced groundwater contribution to streamflow
Ecological	• Maintains natural and/or incidental wetlands • Provides important migratory bird habitat† • Reduced spring peak flow results in: ° Reduced numbers of young cottonwood trees ° Impacts on fish habitat ° Impacts on channel maintenance • Higher diversion rates may negatively impact stream connectivity	• Reduction in natural and/or incidental wetlands • Higher spring peak flows result in: ° Increased numbers of young cottonwood trees ° Improved fish habitat ° Improved channel maintenance • Lower diversion rates may improve stream connectivity

7.1.3 Water Storage

Water storage can be an effective means of mitigation for seasonal low flow conditions because the timing of water delivery can be changed. Although this can be achieved by man-made dams, in the process restoration field it generally refers to enhanced floodplain connectivity, flow infiltration, and consequent “natural storage” of water in floodplains. On the Musselshell River, improving floodplain connectivity over an approximately 175 square mile area near Melstone was projected to both reduce flooding and increase the amount of water naturally stored in the floodplain to about 50% of the volume anticipated to be impounded by a large dam at Horse Creek (Holmes, 2016). Natural storage can therefore contribute substantial benefits while greatly reducing costs and negative ecological impacts of floods. In the Smith River basin, there are numerous floodplain areas with naturally high water storage potential that could be taken advantage of to increase natural water storage.

Natural storage actions include projects that increase connectivity between the stream channel and adjacent floodplain and include meander reactivation, raising channel beds, encouraging beaver reoccupation or mimicking beaver activity that checks up and spreads water across the floodplain. Other opportunities for natural water storage occur in headwater slope wetland areas throughout the watershed (Figure 64).

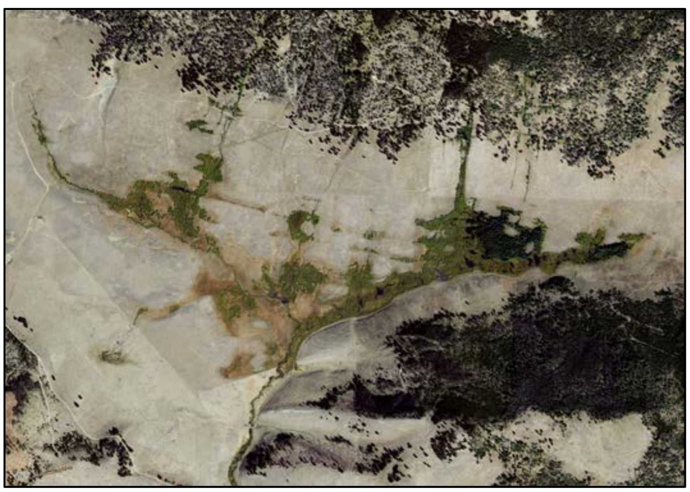


Figure 64. Degraded headwater slope wetland on Rock Creek that has natural water storage restoration potential.

7.1.4 Water Leasing/Purchasing

Perhaps the most direct means of adding streamflow to dewatered channels is to simply buy it. In 2002, FWP purchased 1,000 acre feet of water in Newlan Creek reservoir at $5 per acre-foot in an effort to augment low flows in the mainstem Smith River (Nelson and Culver, 1992). The releases occurred between August 28 and October 4. Flows were monitored on Newlan Creek and the Smith River to evaluate the effectiveness of the releases in increasing flows on the mainstem. The results of the monitoring effort showed that, when irrigation diversions are minimal on Newlan Creek, flow augmentations on the mainstem Smith are achievable. These flows can be protected to the mouth of Newlan Creek as the water is administered by a water commissioner and decree. Once the flow reaches the Smith River, however, the water was highly subject to diversion prior to reaching Fort Logan. During the release, correlations between Newlan Creek flows and the mainstem streamflows at Fort Logan were not consistent, demonstrating the potential of intervening diversions over that stretch of river.

FWP concluded that a flow exceeding about 20cfs will cause flooding on Newlan Creek. With water users having a cumulative water right of 24.4cfs below Newlan Reservoir, it is unlikely that augmented water can be safely sent down Newlan Creek when all diversions are operating.

Based on these results, the monitoring effort culminated in the following recommendations:

1. FWP should limit purchases of water from Newlan Creek Reservoir until mechanisms are in place to protect those waters in the desired reach of the Smith River.
2. Follow-up flow measurements on Newlan Creek should be made during the peak irrigation season to evaluate the physical ability of the Newlan Creek channel to transport the purchased flows.
3. Establish a working group to pursue water leasing/purchasing opportunities.

Other water leasing strategies, such as split-season instream leases, are emerging as ways to continue crop production while increasing late season flows. This type of lease allows the water right holder to use the water during part of the growing season, and then lease the water right to instream flows during the later part of the growing season. These types of leases are being used successfully in the upper Clark Fork River basin.

Although there are clearly obstacles in optimizing the ecological benefit of purchased/leased water, the strategy has the strong potential to improve conditions with effective communication, collaboration, monitoring, and enforcement.

7.1.5 Alternative Agricultural Practices

Strategies for addressing water shortages that focus on augmenting water supply include expanding reservoirs and replenishing groundwater with surplus water, as described above. However, these approaches become less effective as the timing and availability of precipitation becomes more unpredictable (DeFranco, 2020). There are numerous regenerative agricultural practices that could increase the capacity of the landscape to store, retain, and slowly release water.

Water conservation strategies such as reducing total crop acreage, periodic crop fallowing, and shifting toward higher value crops are options. No-till farming, which helps reduce soil exposure and erosion, is slowly increasing in Meagher County (NRCS, 2022a). Another alternative agricultural practice is to consider alternative crops that utilize less water or provide cover in months where fields are susceptible to soil erosion. Research on alternative cover crops in Montana is evolving. Improving soil health through actions that increase soil organic matter and prevent soil loss can also increase water storage. Healthy soil retains water. A one percent increase in soil organic matter can help the soil retain an additional 20,000 gallons of water per acre that can be banked and become available when plants need it most (Nichols, 2015).

7.1.6 Conifer Encroachment Removal

Land use and fire suppression have allowed conifers such as Rocky Mountain juniper and Douglas-fir to expand their typical ranges into native grass and sagebrush ecosystems. Removing these tree species from native grass and shrubland areas will enhance terrestrial habitat for wildlife, reduce water depletion, provide additional forage for grazers like elk and livestock, and increase the productivity and vitality of sage brush-grassland habitats. Identifying and prioritizing areas for removal of conifer encroachment to strategically improve water quantity could also be considered. Removal of conifer encroachment is a high priority activity for NRCS and USFS.

7.1.7 Drought Response Plan

Drought timing and severity can't be controlled but resilience to drought effects can be fostered. Developing a drought response plan for the Smith River basin in anticipation of the need for increased water conservation in coming years could be a highly valuable action. There are several examples of voluntary drought management plans in Montana including: the Blackfoot Drought Response Plan (Blackfoot Challenge, 2016); the Big Hole Drought Management Plan (BHWC, 2016); and the Jefferson River Drought Monitoring Plan (JRWC, 1999) and Watershed Drought Resilience Plan (Norman, 2019).

The Blackfoot Drought Response Plan is based on the premise of "share giving" with the goal of involving all water users in a cooperative effort to minimize the adverse effects of drought on fisheries and to aid in the equitable distribution of water during low flow periods. Under the Blackfoot plan, water right holders junior and senior to the in-stream flow water right are asked to voluntarily reduce water consumption when flows reach predetermined thresholds to maintain critical in-stream flows. Water users participate by following individual water conservation plans, tailored to their water rights, uses and conservation strategies. Prior to development of the Blackfoot Drought Response Plan, junior water users were required to stop water withdrawals if FWP made a "call for water" in enforcing their water right. The Blackfoot plan offers an alternative to traditional enforcement by allowing junior water users who voluntarily conserve water or take other beneficial conservation actions to potentially continue using their water. The end-goal is to maintain critical in-stream flows during drought periods through basin-wide pooling of water resources.

The Big Hole River Drought Management Plan is also a shared sacrifice model where ranchers and anglers both sacrifice for the health of the river when drought conditions are met. This means that water users are asked to reduce withdrawals and anglers are restricted or rivers are closed to angling to reduce impacts to fish. The Big Hole plan sets flow and temperature targets on the mainstem Big Hole River. In a drought year, the plan begins with voluntary conservation participation by river users. When conditions worsen beyond voluntary conservation targets, state-managed fishing restrictions are put in place and enforced by FWP.

The Jefferson River Drought Management Plan is a cooperation between the Jefferson River Watershed Council (JRWC), FWP, Montana Trout Unlimited, and local irrigators. The purpose of the voluntary plan is to reduce resource damage and to aid in the equitable distribution of water resources during critical low flow periods. The plan prescribes water conservation measures to occur when river flow drops below specified levels or when maximum daily water temperatures exceed 73 degrees F for three consecutive days. In 2019, JRWC completed the Bureau of Reclamation National Drought Resilience Partnership (NDRP) along with other upper Missouri River watershed to improve on the ground relationships with water users and the public to increases drought planning that will work toward mitigating future impacts of climate change (jeffersonriverwc.com/drought/).

Montana DNRC recently approved the Montana Drought Management Plan (DNRC, 2023) which includes support for developing and maintaining watershed-led drought plans and provides resources and technical assistance for plan development.

7.2 Water Quality

7.2.1 Riparian Buffers

Extensive clearing of woody riparian vegetation has occurred along the Smith River to increase grasses for grazing and hay production. The remote assessment completed for the Smith River upstream of Camp Baker showed that 64.4% of the river had riparian buffer cover less than 25% of expected. 86.6% of the river is grazed and 30% has haying occurring within the riparian buffer.

Riparian buffer zones provide protection to surrounding landscapes by creating transition zones between streams and upland habitats. They provide many benefits such as vegetation diversity, disturbance resiliency, flood event protection, pollution filtration, streambank stability, and diverse habitat for aquatic and terrestrial species. Riparian buffers will address nutrient, sediment, temperature and riparian and stream habitat issues.

7.2.2 Floodplain Connectivity

Floodplain connectivity is greatly reduced from historic levels. Floodplains, when connected, can create extensive wetland areas and function to filter nutrients and sediments. Connectivity that more frequently spreads water across the floodplain also lessens stream power and erosive stress in the channel. Floodplain wetlands supported by connected floodplains provide a variety of ecosystem functions including groundwater recharge, baseflow storage, high water temperature mitigation, flood attenuation, flow regulation, pollutant removal from surface water and groundwater, and provides aquatic and terrestrial wildlife habitat. Increasing floodplain connectivity and floodplain wetland area provides additional water storage that can improve baseflows and decrease stream water temperatures.

Floodplain reconnection strategies and actions include:

- Reactive abandoned meanders.
- Actively raise channel beds.
- Mimic beaver activity and encourage beaver occupation.
- Take advantage of areas that have the potential to store a significant amount of water, which are typically areas with wide valley bottoms with deep organic soils.
- Plug drained wetlands that are being actively drained.
- Where possible, adjust land uses to allow for seasonal saturation in areas naturally prone to shallow groundwater.
- Protect existing wetland resources during land development activities.
- Create wetlands at irrigation return points (irrigation tailwater control).

A combination of historic channel activation and localized raising of the channel bed was used to restore extensive connection of the historic floodplain along the Ruby River near Alder, Montana (Figure 65). Restoring floodplain connectivity and creating floodplain wetlands will address both water quantity and water quality issues while improving riparian and aquatic habitat.

Figure 65. Restoration on the Ruby River increasing floodplain connectivity and natural water storage.

7.2.3 Grazing Management

Grazing occurs throughout the Smith River basin and is a significant source of water quality and riparian and aquatic habitat degradation. Grazing management BMPs are intended to protect water quality and aquatic/riparian habitats by improving the health and vigor of desired plant communities and reducing erosion. Grazing BMPs may include:

- Encourage development of grazing management plans.
- Riparian pasture development.
- Riparian fencing or virtual fencing where appropriate.
- Develop off-stream or additional water sources.
- Develop water gaps and hardened stream crossings or access points.
- Create enhanced riparian buffers and filter strips.
- Practice rotational grazing.

In talking with landowners in the basin, off-stream water sources are a high priority. Assistance in implementing grazing BMPs is available from state and federal agencies and detailed descriptions can be found in the NRCS Electronic Field Office Technical Guide (https://efotg.sc.egov.usda.gov/). Grazing management will address nutrient, sediment, temperature and riparian and stream habitat issues.

7.2.4 Nutrient Management

Nutrients are elevated throughout the Smith River basin, particularly in the agriculture dominated portion upstream of Camp Baker. A reduction in stream nutrient levels will require large-scale implementation of actions to address non-point source issues. Grazing management is key to nutrient management. Other nutrient management actions that are needed in the Smith River basin include:

- Encourage development of nutrient management plans.

- Moving animal confinement structures such as corrals and pens away from streams and wetlands.
- Employing proper manure management.
- Septic system maintenance.
- Lawn and garden fertilizer management in White Sulphur Springs and sub-divisions in the Smith River Corridor.
- Adjust fertilizer application timing to reduce entrainment into streams (i.e. fall application instead of winter application).
- Create filter strips, riparian buffers and wetlands.
- Preserve existing high quality riparian vegetation.

7.2.5 Sediment Retention Post Fire

Post-fire erosion can have significant effects on water quality. 2021 was the last major fire season to occur in the Smith River basin with the Woods Creek fire and Harris Mountain fire burning large areas of the Little Belt Mountains in headwaters of Smith River tributary streams. The Harris Mountain Fire burned a total of 31,565 acres, 11,847 of which were in the Hound Creek watershed. This resulted in extensive sediment transport to headwater streams in the Hound Creek watershed. An emergency TIP was created by the Cascade County NRCS to help producers manage grazing in burned areas. The NRCS is also helping many of these producers install sediment retention structures in burn areas to help retain sediment and reduce the potential to severely degrade Hound Creek water quality (NRCS, 2021). The Woods Creek fire burned a total of 55,385 acres, 21,751 of which were in the Camas Creek watershed. The 2022 USGS nutrient study hopes to capture the potential effects of this fire on Camas Creek water quality.

7.2.6 Road BMPs and Decommissioning

Roads can be significant sources of sediment and other contaminants entering streams. Road encroachment and stream crossings are common on tributary streams in the basin. Road BMPs include grading, relocation, decommissioning, and bridge or culvert replacement in areas where they create disruption of sediments or erosion of stream banks.

7.2.7 Recreation Management

The primary water quality issue related to recreation use is the potential for pathogens to enter the stream and make people sick. The fate of enteric pathogens on or in soils is highly variable and dependent on the complex interactions of many factors, most importantly soil type, moisture, and temperature (Cilimburg et al., 2000). In 2003 DEQ found that human waste in the Smith River Corridor did not result in E. coli levels exceeding the water quality standard (Fieldman et al, 2003); however, use levels are currently higher than they were during the 2003 study.

Recreation use levels are managed by FWP through the Smith River Management Plan. In 2024, FWP implemented a human waste pack-out system for the Smith River Corridor. If floaters adhere to rules related to this system, this action should ensure that human waste does not affect water quality in the Corridor.

Other restoration actions related to recreation management are covered in Section 7.4.

7.3 Riparian and Stream Habitat

7.3.1 Streambank and Channel Restoration

The remote assessment completed for the Smith River upstream of Camp Baker showed that 64.4% of the river had riparian buffer cover less than 25% of expected, meaning the type and cover of riparian vegetation you would expect to find in a relatively un-altered stream system of comparable size, topography, geology, and climate. Streambank erosion has increased more than 5% since 1985. Streambank and channel restoration can narrow channels, restore appropriate planforms and habitat features, and increase aquatic habitat diversity and cover.

Active restoration of streambanks and channels can greatly improve riparian and stream habitat but is difficult to do cost effectively at the watershed scale.

7.3.2 Restore Floodplain Vegetation Communities

The Yellowstone Cumulative Effects Study showed that, on average, bank erosion rates are higher through cleared floodplain areas relative to native riparian areas (U.S. Army Corps of Engineers and Yellowstone River Conservation District Council, 2015). Woody riparian vegetation has been extensively cleared in the riparian areas and floodplains within the Smith River basin. Increasing woody riparian vegetation along streambanks, within riparian buffers or in other areas such as overland flow return points will address nutrient, sediment, temperature and riparian and stream habitat issues.

There are also opportunities to restore lost cottonwood galleries or willow dominated valley bottoms throughout the basin.

7.3.3 Preserve Existing High-quality Habitat

Preserving existing, high-quality habitats in the Smith River basin should be a high priority. These include cottonwood forests, willow dominated valley bottoms, intact floodplain wetlands, headwater slope wetlands, and undisturbed forested headwater streams. Mechanisms to preserve these areas include landowner education on the importance of these areas and conservation easements.

7.3.4 Forest Stand Health

Conifer forests have also been extensively altered in the basin by fire suppression, road construction, grazing and timber harvest. Forest health is closely tied to overall watershed health. They are far from their desired condition of multiple age classes and cover heterogeneity and threats from insect and diseases continue to increase with increased drought and climate change.

The USFS implement numerous actions in the Smith River basin to improve forest health through prescribed fire, selective thinning, disease prevention, removal of woody vegetation expanding into grasslands and reforestation (see Section 4.1.5). Their actions try to mimic natural fire disturbance. The Horsefly Vegetation Project is a large-scale project implementing these actions, and is underway north of White Sulphur Springs in the Smith River basin.

7.3.5 Upland Grassland Health

Grasslands have been affected by fire suppression, road construction, grazing, weed invasion, conifer encroachment, and conversion for agriculture. Grassland health is closely tied to overall watershed health with grasslands protecting streams by preserving soils and filtering and absorbing overland runoff that prevents sediment and nutrients from entering streams and recharges valley bottom aquifers. Healthy grasslands prevent concentration and overuse of riparian areas and stream bottoms.

The NRCS in the Smith River basin works closely with landowners to initiate projects to improve native rangeland. Currently, the NRCS in Meagher County is implementing the *Improving Grazing Land Health in the Smith River Valley* TIP which helps producers implement practices in grazeable forests to improve the health, productivity, and resilience of grazing lands. Actions include development of grazing management plans, stand thinning and improvements, aspen restoration, meadow restoration, and planting. These actions will cover a large portion of the upper basin (Figure 66).

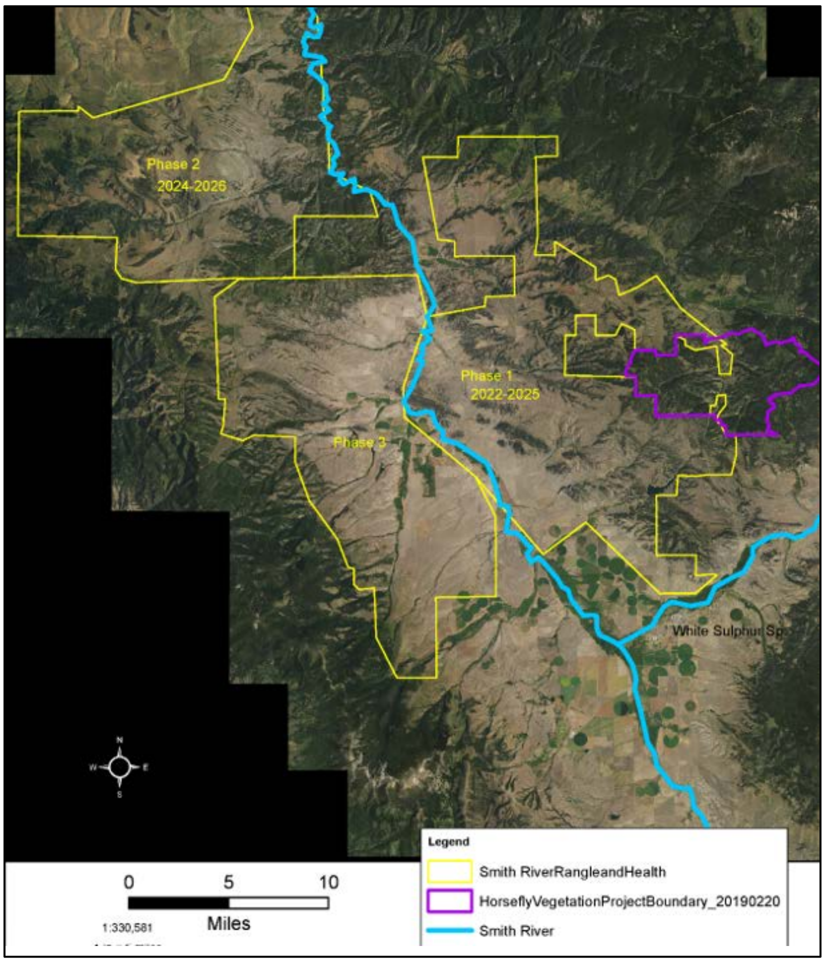


Figure 66. NRCS Grazing Land Health TIP areas (NRCS, 2022b). Phase 1 overlaps with the USFS Horsefly Vegetation Project.

7.3.6 Integrated Weed Management

Noxious weeds are widespread in the Smith River basin and is one of the main concerns and management issues landowners face on their properties. Weed invasion risks and weed management should be integrated into restoration actions for the basin.

7.4 Specific Strategies and Actions for the Smith River Corridor

The Smith River Corridor is unique in that it supports the Smith River Canyon and the Smith River State Park. While many of the impacts and issues are similar to the rest of the watershed, the canyon environment and high recreation use create special circumstances that warrant specific restoration strategies and actions.

7.4.1 Boat Camps

There are 27 boat camps (52 total campsites) within the Smith River Corridor (Figure 24). As described in Section 5.2.6, several issues have been identified at boat camps, which are inter-related and complex. The following actions are needed at boat camps:

- Conduct an inter-disciplinary resource impact assessment of each boat camp that results in a site specific action plan.
- Develop a long-term program for implementing restoration actions to address issues over time.
- Designate staff and resources to implementing restoration strategies and actions. There is currently only one full-time equivalent (FTE) and one .75 FTE designated to management of the Smith River State Park which limits the ability of FWP to develop and implement restoration actions.
- Increase floater awareness of issues at boat camps and importance of private land ownership resource protection.

To address issues at boat camps soil bioengineering and recreation ecology measures should be utilized. Recreation ecology measures aim to provide high quality recreational opportunities while preserving natural resource conditions (Marion et. al, 2018). This centers on impact management strategies such as dispersal and containment strategies that provide infrastructure including sustainably designed trails and campsites. Measures that could be implemented include:

- Define boat camp boundaries.
- Define core kitchen areas, tenting sites, and groover sites and harden specific use areas as appropriate to support concentrated use.
- Create live fences or barriers to restrict use of sensitive or recovering areas.
- Reclaim unnecessary trails and access routes.
- Construct rock steps to route traffic to desired locations.
- Decompact and revegetate damaged areas that are not needed for use.

Soil bioengineering uses a combination of native plant material and soil to accomplish bank stabilization, erosion control, improved habitat and water quality. The remote nature of boat camps makes it challenging to address these issues and will require the use of on-site materials and hand labor for most sites. Some of the key criteria in determining if bioengineering is appropriate and feasible include:

- Bank length, height and angle. Shorter banks less than 2 feet high and with a non-vertical bank angle are easier to treat with bioengineering techniques built with on-site materials and volunteer labor.
- Soil and substrate types. The presence of coarse toe substrate and loam to silt loam mineral soils are easier to implement bioengineering strategies compared to sites with very little coarse material or sandy soils.

- Geomorphic position. Erosive outside bend would be difficult to effectively treat with bioengineering techniques using on-site materials and hand labor compared to passive margins where erosion is from recreation use rather than river hydraulics.
- Availability of on-site materials (wood, rock, vegetation).

Appendix D includes an overview of initial bioengineering criteria for each boat camp along with example treatment options.

7.4.2 Ecologically Based Integrated Weed and Vegetation Management Program

Noxious weeds exist throughout the Smith River basin and are a particularly complex issue in the Corridor due to the high level of recreation use, mandates for agencies to control weeds, and the feasibility of doing so a heavily used river corridor. Weed control is challenging, particularly in river corridors with frequent flood disturbance importing weed propagules and high water tables limiting herbicide types and application methods. The current partnership (SRHP, USFS, FWP, BLM, private landowners, and herbicide applicators) is working together to improve weed management, develop BMPs, and consider ecological outcomes of management activities. Refinement of the current program should include everyone involved in weed management in the Corridor.

Considerations for development of an ecologically based integrated weed and vegetation management program for the Smith River Corridor include:

- Understand that eradication of noxious weeds is not realistic and develop management goals based on ecological targets. Some examples of ecological targets could include:
    - Increase structural diversity of native riparian shrubs to prevent infestations and improve overall riparian ecological function.
    - Increase perennial grass cover to reduce the potential for secondary invasion of annual grasses and support mule deer habitat.
    - Create structural diversity for small mammal, migratory bird habitat and user aesthetics.
- Identify the ecological potential and vegetation succession pathways of the area being treated and understand that herbicide application is introducing an unnatural disturbance to the area. Developing and implementing revegetation strategies to achieve management goals may be required, particularly on state and federal lands. Potential questions to consider include:
    - Where can natural processes such as flooding help revegetate an area?
    - Where do site conditions limit natural site revegetation, such as areas with shallow or coarse soils, lack of perennial grasses, etc.?
- Prioritize weed treatment locations where treatment will be most effective and develop strategies for different types of areas. Some examples include:
    - Treat noxious weeds in areas with high natural recovery potential due to the presence of perennial grasses.
    - Floodplain surfaces with high cover of native woody riparian vegetation such as willows or cottonwoods may be a lower priority for noxious weed control as the woody vegetation is providing desired ecological function.
    - Higher elevation gravel bars within or immediately adjacent to the active river channel have a high risk of herbicide entering the groundwater and river channel. These areas have not been colonized by willows due to the high elevation and have a high risk of

secondary invasion from cheatgrass. These areas should be a lower priority for herbicide application.
  - Establish a riparian buffer along the river and do not treat within the buffer to ensure herbicide does not enter the river and vegetation needed for streambank stabilization is not harmed.
  - Identify high quality areas for preservation and conservation, such as the upper bench at the Fraunhofer boat camp that supports an intact native bunchgrass vegetation community (Figure 67). Initiate different approaches for weed control in these areas that will maintain the integrity of the existing vegetation.
- Consider the risk of secondary invasions from cheatgrass and other noxious weeds.

Section 6.2 provides an overview of ecological potentials of the Smith River Corridor. Understanding natural vegetation types and succession pathways will help with development of a long-term, ecologically based, integrated weed and vegetation management program.


Figure 67. High quality riparian habitat at Deep Creek conservation easement (left photo) and native bunchgrass bench at Fraunhofer boat camp (right photo).

7.4.3 Grazing Management

Grazing is widespread in the Corridor. Although there are no active leases on FWP lands and one on USFS land within the corridor, livestock grazing occurs anywhere livestock can access. Because use is naturally restricted by steep canyon walls, effects of grazing become concentrated in accessible areas. Some FWP and USFS boat camps have been degraded due to livestock grazing that is not permitted. In the past FWP has funded installation of drop-down fences across the river channel to contain livestock to certain areas. Maintenance of these fences was left to individual landowners and the frequent damage to them during floods made this difficult. Grazing management in the Corridor will require close coordination with livestock owners to determine what options there may be to restrict livestock damage in boat camp areas. In some areas, fencing can be strategically placed to block natural access routes that feed cattle into the stream corridor.

8 Target Area Restoration Actions

This section includes information on where degradational issues occur in the Smith River basin and what restoration actions are recommended in those areas. For purposes of this assessment and WRP, ***target areas*** are those streams or stream segments where substantial cumulative benefits to the system could be achieved through the application of established, cost-effective restoration techniques. Target areas include the mainstem Smith River and key tributaries. Some target areas selected for further analysis and assessment are referred to as ***near-term focus target areas***. These are target areas where available data or field observations identified significant impairment and were therefore selected as the highest priority areas to start addressing issues and implementing restoration actions in the basin. Figure 68 and Figure 69 provide an overview of target areas and which target areas were selected as near-term focus areas. All other target areas are referred to as long-term target areas.

This section includes a summary of issues and proposed restoration actions for each target area. These may be fairly general and based on field observations, stakeholder input, and existing data. The near-term focus areas were further assessed to meet the requirements of a DEQ-approved WRP, including the identification of ***restoration targets.*** In contrast to the more general recommendations for the long-term target areas, the restoration targets for near-term focus areas provide specific and largely quantitative restoration objectives. To first quantify impacts, a remote assessment was completed for each of these areas; the assessments provide a starting point for addressing degradational issues in the basin and to support on-going and future restoration efforts. Restoration work is not limited to near-term focus areas; they simply provide an initial starting point based on available information and data.

This section includes:

- Selection process for near-term focus area selection.
- Methods for remote assessment of near-term focus areas.
- Summary of issues for near-term and long-term target areas.
- Restoration actions applicable to each target area, including near-term and long-term focus areas.
- 5-year restoration targets for near-term focus areas based on results of remote assessments.

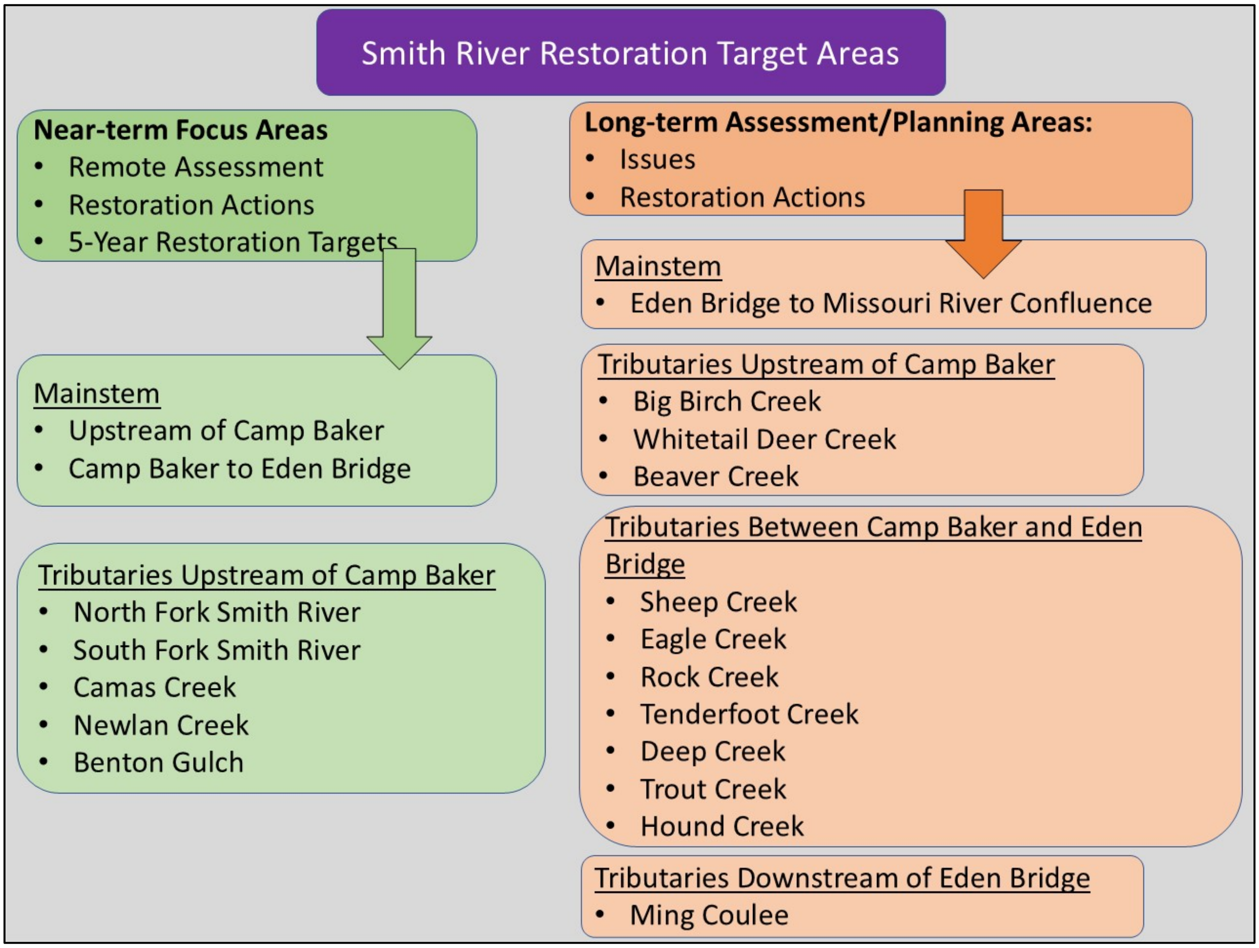


Figure 68. Smith River basin near-term and long-term target areas.

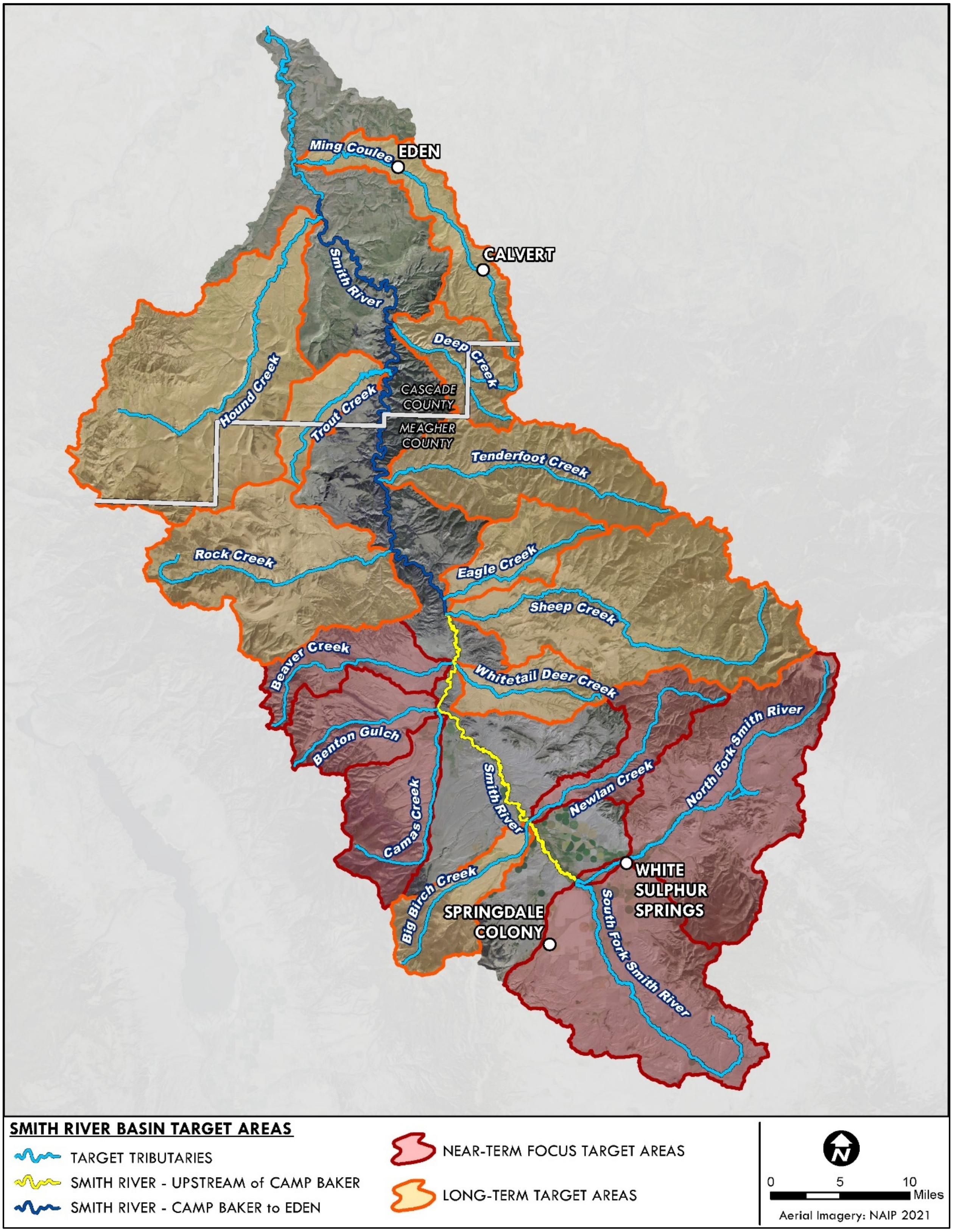


Figure 69. Smith River basin target areas and target areas selected as near-term focus areas.

8.1 Near-term Focus Target Areas

Seven areas were selected as near-term focus target areas for more detailed assessment and restoration planning.

8.1.1 Selection Process

The overall approach for identifying near-term focus areas was to determine where available data show significant impairments affecting overall watershed health and combining that with where actions could be expected to have the most overall benefit to watershed health. This approach allows those working on restoration in the basin to understand where focused efforts may be the most beneficial. The main information used to select near-term focus areas was water quality data from the DEQ database for the past 10 years (DEQ 10-year water quality data); field observations; spatial data layers; and communications with landowners, resource managers, and others working in the basin.

As described in Section 5, water quantity, water quality and riparian and aquatic habitat are the primary issues of concern in the basin. Addressing these impairment issues drove the selection of near-term focus areas. This resulted in focusing on the agriculturally dominated portion of the upper watershed in Meagher County. The main reasons for focusing on the watershed upstream of Camp Baker include:

- Flows are regularly depleted in the Smith River at Camp Baker.
- Most irrigation diversions are in the upper part of the basin upstream of Camp Baker.
- Improving water quantity system-wide can be most effective with improvements in upper basin areas.
- Stream temperatures regularly exceed desired limits in the Smith River upstream of Camp Baker and can decrease downstream of Camp Baker.
- Nitrogen is elevated in streams throughout the upper basin but does not increase, and actually decreases downstream of Camp Baker.
- The main sources of phosphorous are upstream of Camp Baker.
- The chlorophyll-a level for creating nuisance algae conditions is first exceeded at Camp Baker so temperature and nutrient issues creating nuisance algae conditions occur upstream of Camp Baker.
- The majority of non-point pollution sources occur in the upper agriculture dominated valley and improvements in water quality and quantity in upstream areas result in benefits downstream.

Other criteria used to select near-term focus areas included:

- SRCEA funds are generated from Smith River recreational float corridor user fees and enhancement of the Smith River Corridor is a priority for use of these funds.
- A recognized conservation need, landowner interest, and/or education/demonstration value of work in the area.

Based on available data and information, and the guidelines and criteria described above, seven near-term-term focus areas were selected (Figure 68, Figure 69):

- South Fork Smith River
- North Fork Smith River below Sutherlin Reservoir
- Smith River upstream of Camp Baker

- Camas Creek
- Newlan Creek below Newlan Reservoir
- Benton Gulch
- Smith River from Camp Baker to Eden Bridge (recreational float corridor)

Table 12 provides an overview of why each area was selected.

8.1.2 Assessment Methodology

Remote assessments were completed to quantify and locate issues in each near-term focus area, help prioritize restoration activities in each area, and support development of quantifiable restoration targets to support near-term restoration planning. These methods could be applied to long-term areas in the future to support restoration planning efforts.

The remote assessment applied to each near-term focus area closely follows methods developed by DEQ to "help local conservation organizations identify and prioritize water quality restoration projects" (DEQ, in preparation). This methodology uses air photos to map the conditions of streambanks and riparian zones, as well as to identify point features such as bridges, culverts, corrals, etc. Table 13 provides an overview of the attributes created during the remote assessment. The spatial results were summarized to determine areas, lengths, and relative percentages representing various channel and riparian conditions and impacts. Details on remote assessment methods and results of the remote assessment for each of the seven near-term focus target areas are provided in Appendix B.

Restoration targets were developed for each near-term focus target area by identifying the highest priority issues and applying a quantitative value (target) for addressing the issue within a 5-year timeframe (2025-2030). The quantitative values selected for restoration targets were considered reasonable efforts within a near-term focus area if partners are able to concentrate efforts in each area. Restoration targets for each near-term focus are included in Section 8.2.

Table 12. Near-term focus area basis of selection.

Near-Term Focus Area	Reasons for Selection
Smith River upstream of Camp Baker	• Located in the upper basin. • Agriculture dominated. • Large-scale floodplain conversion primarily for agricultural purposes. • Listed as chronically dewatered by FWP and flows are consistently low at the Fort Logan gage. • General over-widening trend and high bank erosion due to loss of woody riparian vegetation. • Fine sediment load is high resulting in elevated cover of aquatic macrophytes and potential for high levels of algae which increases in a downstream direction. • Listed as impaired for phosphorous and E. coli and more recent water quality data has shown high temperatures and high turbidity. • Numerous opportunities for irrigation efficiency projects. • Landowner interest in addressing non-point source pollution issues. • Large sections of state-owned land that provide educational/demonstration project opportunities such as floodplain reconnection, channel narrowing, streambank restoration and floodplain wetland restoration targeting irrigation return flows.
Smith River Camp Baker to Eden Bridge	• Smith River State Park, fee float corridor. • Listed as chronically dewatered by FWP. • Listed as impaired for E.coli and low flow alteration. • Current data show E.coli levels didn't exceed standards and that nutrient levels don't increase downstream of Camp Baker for many miles. Turbidity can be high. Nuisance algae blooms are common. • Floodplain conversion throughout canyon section of reach for grazing (i.e. most floodplains have reduced woody vegetation cover and are dominated by introduced pasture grasses). • Agriculture increases downstream of canyon reach. • Recreation use is high and mostly concentrated at boat camps causing bank erosion, compaction and vegetation damage • Existing partnership between FWP, USFS and SRHP to treat noxious weeds. Partners interested in creating an integrated weed management program to improve resource conditions. • Agency interest in improving boat camp conditions.
North Fork Smith River below Sutherlin Reservoir	• Located in the headwaters of the basin. • Accounts for 26% of Smith River flow at Camp Baker. • Water storage reservoir present (Sutherlin Reservoir) operated by North Fork of the Smith River Water Users Association. • Agriculture dominated watershed. • Municipal water source for White Sulphur Springs (Willow Creek). • Listed as impaired for nitrogen, phosphorous and E.coli and recent data shows that a large portion of the phosphorous load in the river upstream of Camp Baker comes from the North Fork.

Near-Term Focus Area	Reasons for Selection
	• Large amount of floodplain has been cleared of woody riparian vegetation resulting in erosion and channel widening. • Listed as chronically dewatered by FWP. • Numerous ditches and diversions for irrigation creating opportunities for irrigation efficiency improvement projects. • Landowner interest in addressing non-point source pollution issues.
South Fork Smith River	• Located in the headwaters of the basin and provides substantial water storage capacity. • Agriculture dominated watershed. • Substantial loss of woody riparian vegetation. • Channel is incised with limited floodplain connectivity. • Water quality data is limited but has been high for E. coli, nitrogen and water temperature. • Listed as periodically dewatered by FWP. • Significant springs and groundwater recharge in the watershed - USGS study showed the stream as strongly gaining at the mouth having a cooling effect on stream temperatures so even though it doesn't account for a large amount of flow to the Smith River it has potential to support strategies for increased late season flows. • A large restoration project to restore floodplain connectivity and wetlands is in progress. • Landowner interest in additional restoration work.
Newlan Creek below Newlan Reservoir	• Smith River tributary upstream of Camp Baker. • Water storage reservoir present (Newlan Reservoir) operated by Newlan Water Users Association. • Agriculture dominated. • Listed as impaired for E. coli, sedimentation and siltation and water temperature. • Very high turbidity observed at the mouth. • Channel incision and active erosion below main irrigation ditch diversion. • Several diversions and irrigation return flow points. • Active beaver and areas of wide connected floodplain creating potential to address water quality issues and potentially increase late season streamflow. • Landowner interest in addressing non-point source pollution issues.
Camas Creek	• Smith River tributary upstream of Camp Baker. • Accounts for 14% of Smith River flow at Camp Baker. • Private portion agriculture dominated. • Recent fire in headwaters. • Listed as impaired for E. coli. • Current data shows the highest phosphorous load of any tributary upstream of Camp Baker. Also high turbidity and sedimentation and low dissolved oxygen documented in recent data.

Near-Term Focus Area	Reasons for Selection
	• Areas of concentrated livestock use on channel and loss of a lot of riparian vegetation from grazing. • Listed as chronically dewatered by FWP. • Substantial irrigation occurs in watershed with some larger private water storage reservoirs. • High potential to effectively treat issues using BMPs and irrigation efficiency projects. • NRCS is working on grazing issues in this watershed.
Benton Gulch	• Smith River tributary upstream of Camp Baker. • Agriculture dominated. • Private water storage reservoir. • Listed as impaired for E. coli. • Current data shows very high turbidity and very high nitrogen and phosphorous. • Road encroachment and erosion in the upper watershed. • Channelization, extensive woody vegetation clearing and incision in the lower watershed. • Landowner interest in addressing non-point source pollution issues and ecological restoration.

Table 13. Remote assessment features and impact categories assigned to near-term focus areas.

Feature Type	Impact Category	Details
Channel Centerline - Impacts	Channelization	Terrace, Canyon, Straightened, Meander Cutoff
	Road Crossings	Bridge, Culvert
	Channel incision	
	Split flow	Natural, Human-caused
	Multi-thread	Natural, Human-caused
Riparian Buffer – Vegetation Cover	Riparian Vegetation Cover	<25% cover 25-75% cover >75% cover
Riparian Buffer - Impacts	Crop, Hay, Grazing	Crop, Hay, Grazing
	Pens, Corrals	Concentrated use, high impact
		Widespread use, low impact
	Durable infrastructure	Road, Ditch, Building, Fencing
	Soft infrastructure	Residential (lawn), Channel ford, Cattle access, Hay storage, Two-track, Pond
Impact Points	Durable infrastructure	Road crossing (bridge, culvert), Fencing, Diversion structure (boulder, rock, tarp, pin and plank, etc.), Building, Boat ramp, Erosion protection (riprap, car bodies), Old infrastructure
	Soft infrastructure	Channel ford, Cattle access
	Withdrawal	Irrigation diversion (diversion structure, no diversion structure)
	Inflow	Irrigation return flow, Spring, Tributary stream
Streambanks - Impacts	Erosion	
	Stabilization	Riprap, Car bodies

8.2 Near-term Focus Target Area Results

Figure 70 through Figure 73 provide an overview of the remote assessment results for each near-term focus area. Appendix B provides detailed results for each area.

In addition to the remote assessments, additional data and information were compiled for each area to provide further detail on impacts. Table 14 provides an overview of the issues in each near-term focus area and the severity of each issue based on the results of the remote assessment and existing data. The severity level is listed as Low, Moderate, High or Extreme. These are relative to issues within each near-term focus area and relative to other near-term focus areas. These do not indicate levels associated with established water quality standards or limits. The intent of this analysis is to provide stakeholders with an initial idea of what issues to focus on. This high-level impairment analysis can be coupled with the remote assessment described in Section 8.1.2 and Appendix B to further quantify and locate impairments in each area.

Table 15 provides an overview of proposed restoration actions for each near-term focus area. Restoration actions and restoration targets for select restoration actions are described in the following sections for each near-term focus area.

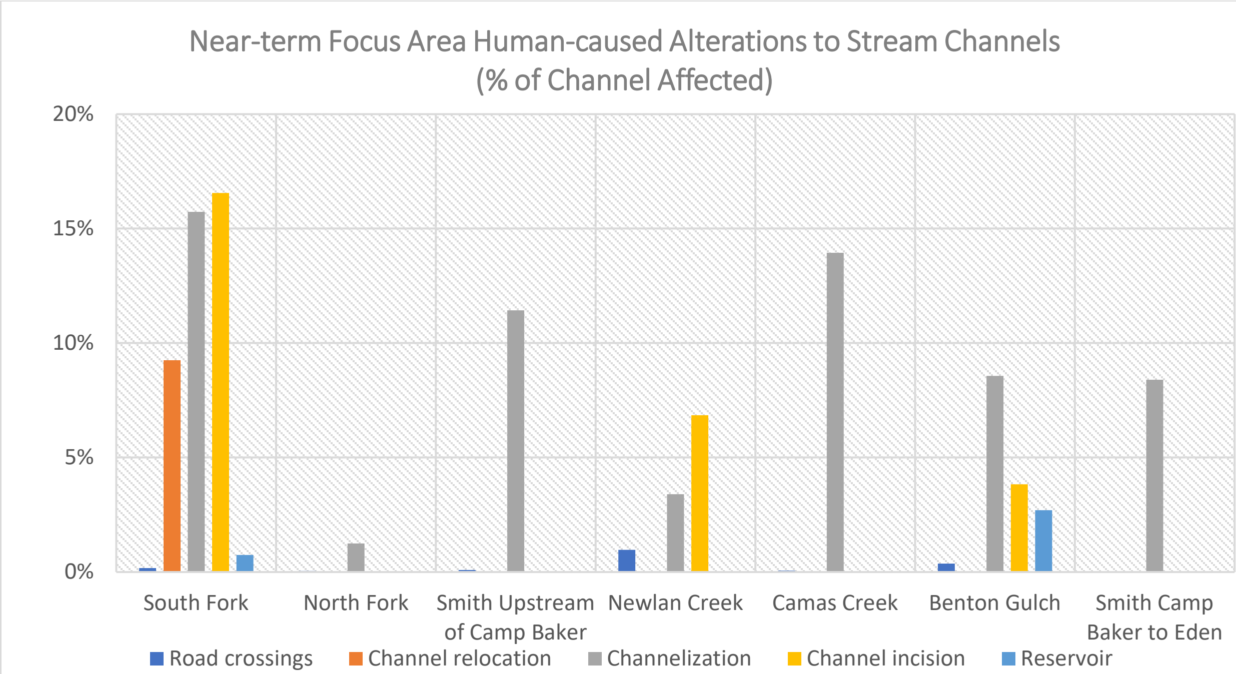


Figure 70. Results of near-term focus area remote assessment showing type of human-caused impact affecting the channel by percent of channel affected.

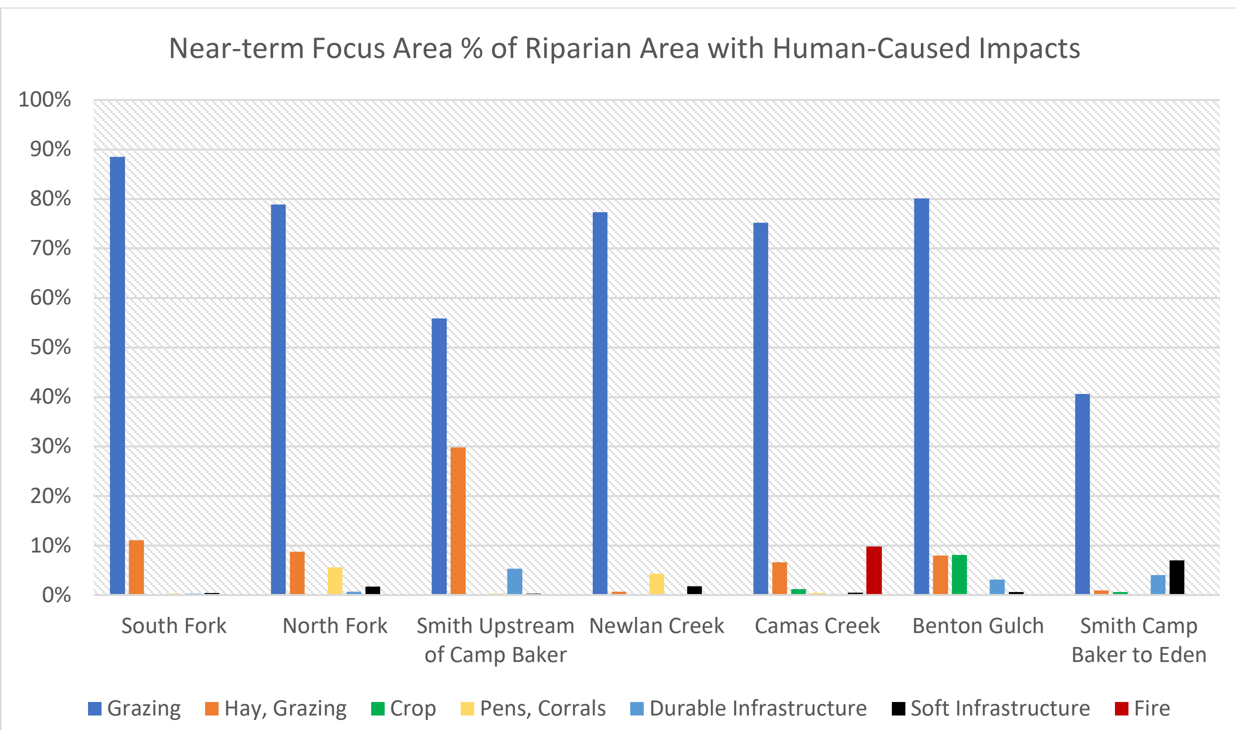


Figure 71. Results of near-term focus area remote assessment showing type of human-caused impact affecting the riparian buffer zone by percent of area affected.

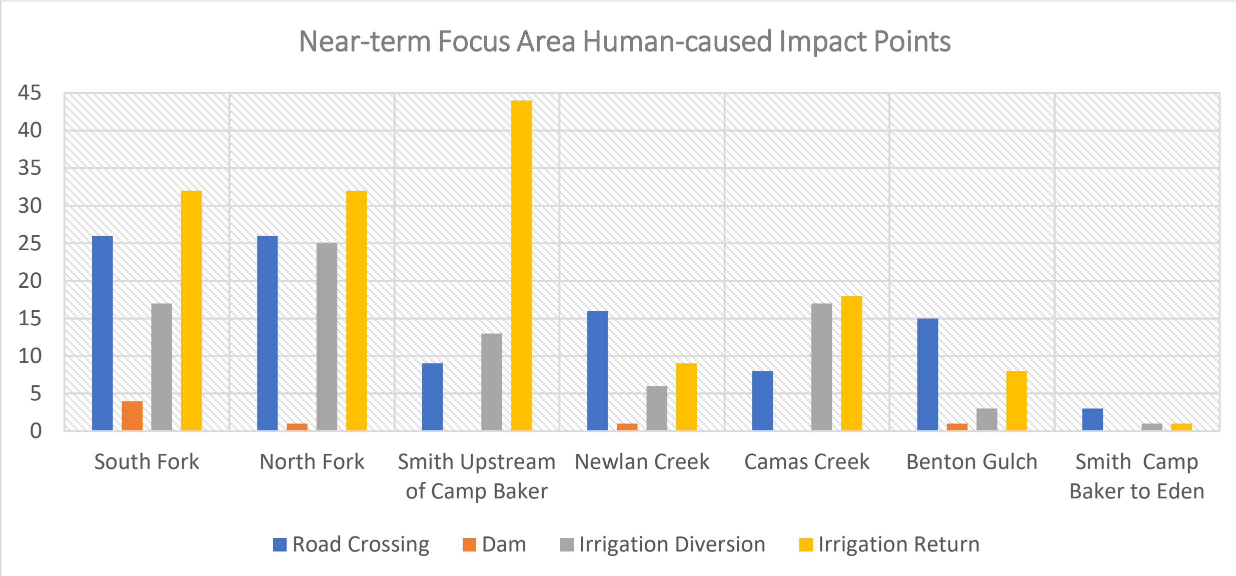


Figure 72. Results of near-term focus area remote assessment showing number of human-caused impact points by impact type.

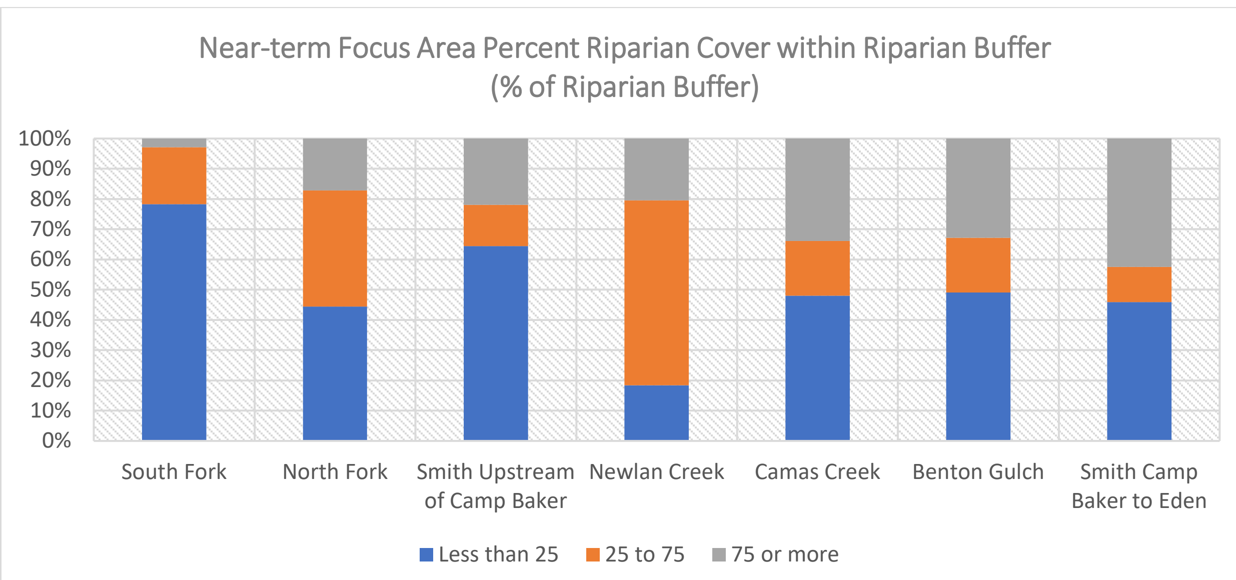


Figure 73. Results of near-term focus area remote assessment showing percent riparian cover within the riparian buffer zone.

Table 14. Overview of near-term focus target area issues and issue severity.

Issue	South Fork	North Fork	Mainstem Forks to Camp Baker	Newlan Creek	Camas Creek	Benton Gulch	Mainstem Camp Baker to Eden Bridge
Water Quantity							
Reduced summer streamflow	PERIODIC	CHORONIC	PERIODIC	CHRONIC	CHRONIC	LIKELY	PERIODIC
Irrigation return flows	YES	YES	YES	YES	YES	YES	NO
Irrigation infrastructure	HIGH	MODERATE	HIGH	HIGH	HIGH	EXTREME	LOW
Reservoir storage	NO	YES	NO	YES	NO	YES	NO
Water Quality							
Temperature	MODERATE	HIGH	HIGH	HIGH	HIGH	EXTREME	HIGH
Nutrients	HIGH (N & P)	EXTREME (P)	HIGH (N & P)	HIGH (P)	EXTREME (P)	HIGH (N & P)	MODERATE (N & P)
Sediment/Turbidity	MODERATE	HIGH	HIGH	EXTREME	HIGH	EXTREME	HIGH
E.coli	MODERATE	HIGH	HIGH	HIGH	HIGH	EXTREME	HIGH
Metals	LOW	LOW	LOW	LOW	LOW	LOW	LOW
Nuisance Algae	MODERATE	MODERATE	HIGH	LOW	MODERATE	LOW	EXTREME
Riparian and Stream Habitat							
Agricultural encroachment	EXTREME	MODERATE	EXTREME	HIGH	HIGH	EXTREME	LOW
Channel incision/lost floodplain connectivity	EXTREME	MODERATE	MODERATE	MODERATE	LOW	EXTREME	LOW
Channelization	HIGH	LOW	MODERATE	MODERATE	LOW	EXTREME	LOW
Floodplain conversion/loss of woody riparian vegetation	EXTREME	MODERATE	HIGH	HIGH	HIGH	EXTREME	MODERATE
Bank erosion	HIGH	HIGH	HIGH	HIGH	HIGH	EXTREME	MODERATE
Road encroachment	HIGH	MODERATE	MODERATE	MODERATE	LOW	EXTREME	LOW
Grazing	HIGH	MODERATE	HIGH	HIGH	HIGH	HIGH	MODERATE
Altered forest condition/Conifer encroachment	LOW	MODERATE	LOW	LOW	HIGH	HIGH	LOW
Floodplain dewatering/draining	HIGH	MODERATE	HIGH	HIGH	HIGH	EXTREME	LOW
Recreation impacts	LOW	LOW	MODERATE	LOW	LOW	LOW	HIGH
Noxious weeds	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	EXTREME

Table 15. Proposed restoration actions in near-term focus areas.

Restoration Action	South Fork	North Fork	Mainstem Upstream of Camp Baker	Newlan Creek	Camas Creek	Benton Gulch	Mainstem Camp Baker to Eden Bridge
Improve Water Quantity[1]							
Irrigation efficiency improvements	√	√	√	√	√	√	
Irrigation management alternatives	√	√	√	√	√	√	
Active water storage	√		√	√	√	√	
Passive water storage	√	√	√	√	√	√	
Water lease/purchase	√	√	√	√	√	√	√
Re-evaluate minimum flow requirements	√	√	√	√	√	√	√
Alternative agricultural practices	√	√	√	√	√	√	
Conifer encroachment removal		√		√	√	√	
Improve Water Quality[2]							
Riparian buffers	√	√	√	√	√	√	√
Restore floodplain connectivity	√	√	√	√			√
Filtration wetlands at irrigation return flow points	√		√	√	√	√	
Grazing management							
Nutrient management	√	√	√	√	√	√	
Road BMPs and decommissioning				√	√	√	
Recreation management							√
Improve Riparian and Aquatic Habitat							
Streambank restoration	√	√	√	√	√	√	√
Channel restoration	√	√	√	√	√	√	
Floodplain vegetation restoration	√	√	√	√	√	√	√
Preserve existing high quality habitat		√	√	√	√	√	√
Improve forest stand health		√	√	√	√	√	√
Improve grassland health	√	√	√	√	√	√	√
Integrated weed management	√	√	√	√	√	√	√

[1]All actions that improve water quantity will benefit water quality and riparian and aquatic habitat.

[2]All actions that benefit water quantity and water quality will improve riparian and aquatic habitat.

8.2.1 Smith River Upstream of Camp Baker

The mainstem Smith River upstream of Camp Baker is 39.8 miles in length and originates at the confluence of the North Fork and South Fork Smith River (Figure 74). Because the Smith River upstream of Camp Baker was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B. The remote assessment for the Smith River upstream of Camp Baker also included mapping woody riparian vegetation loss since the 1950s and mapping current bank erosion and stabilization.

Attribute	Value
Watershed Size	3,234 (5 sq mi)
Elevation Range	4,377-4,904 ft
Stream Miles	39.8
Land Ownership	**3,234 total acres**
Private	2,832 acres (87%)
State	402 acres (12%)
Road Miles	**1,094 total miles**
City-County	279
USFS	459
Other	356
Number of Diversions	13
Number of Reservoirs	48

Includes Smith River and adjacent floodplain and watershed area not accounted for by target area tributaries

8.2.1.1 Primary Issues

The following are the main degradational issues identified for the mainstem Smith River upstream of Camp Baker:

- Low late season flows. This reach of the Smith River is listed for periodic dewatering by FWP. The remote assessment showed a total of 13 irrigation diversions originating from the mainstem Smith River upstream of Camp Baker. Some of this irrigation infrastructure could be upgraded (Figure 76).
- Floodplain conversion for agriculture and loss of woody riparian vegetation. Remote assessment showed that 64.4% of the riparian buffer has less than 25% expected riparian vegetation cover (Figure 73) and 11.4% of the stream is channelized (Figure 70).
- Agricultural encroachment. Remote assessment showed that 30% of the riparian buffer is hayed.
- Grazing with some areas of concentrated use. Remote assessment showed that 86% of the riparian buffer is grazed and four corrals are located within the riparian buffer, three with high concentrated or high intensity use.
- Erosion and sedimentation from removal of woody riparian vegetation, grazing and agricultural encroachment (Figure 75). Remote assessment showed that 11.8% of streambanks are actively eroding, a 5.8% increase from the 1980 assessment.
- Channel over-widening and aquatic habitat simplification from loss of woody riparian vegetation.
- Elevated E.coli and nutrients from grazing and agriculture.
- Elevated turbidity from streambank erosion and irrigation return flows. The streambed has high levels of fine sediment in some sections supporting dense macrophyte growth (Figure 77).
- Elevated water temperature and low dissolved oxygen from decreased late season flows, removal of woody riparian vegetation and channel widening.
- Nutrients and stream temperatures elevated to level that supports nuisance algae.

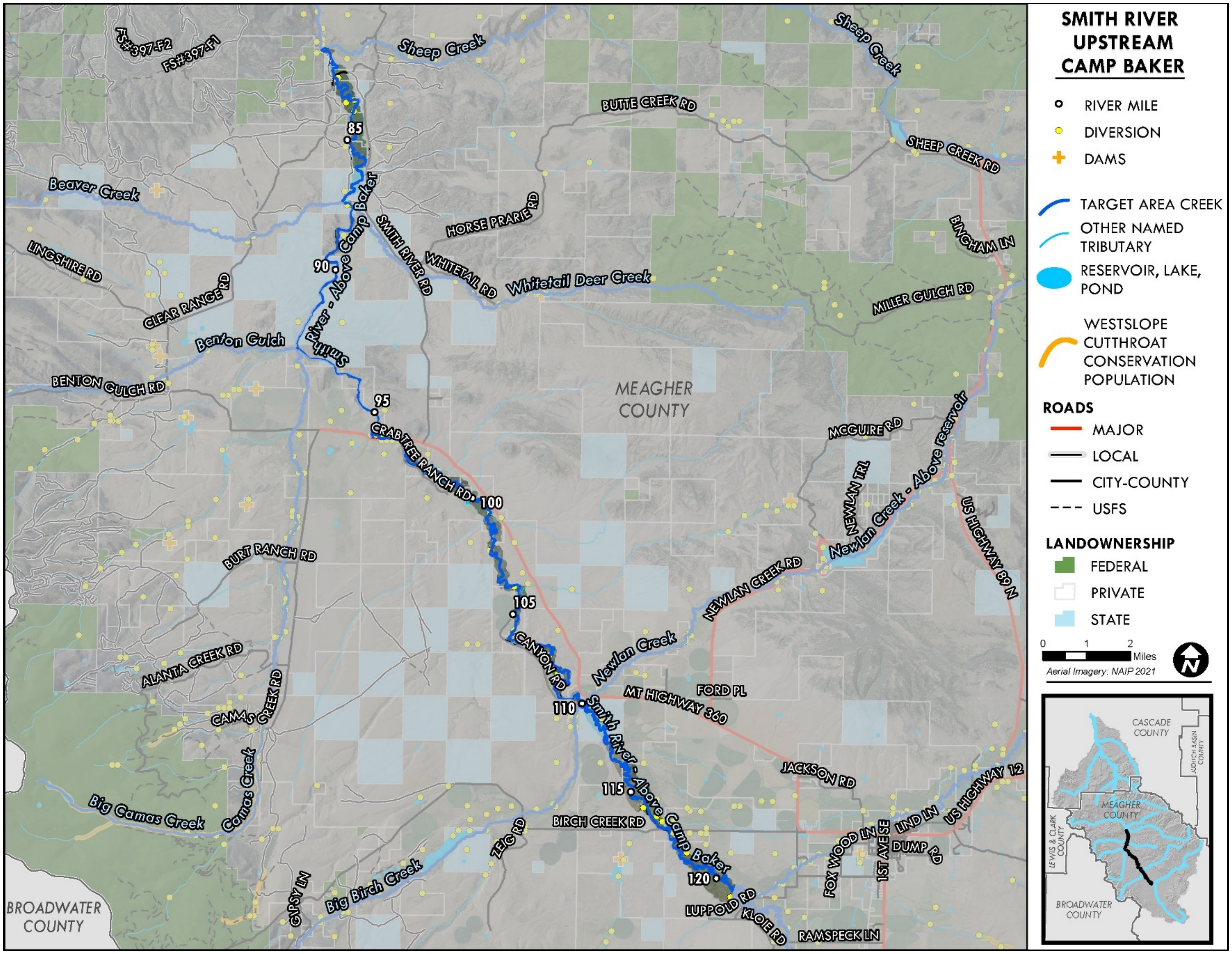


Figure 74. Smith River upstream of Camp Baker target area overview.

Figure 75. Floodplain conversion to introduced pasture grasses and bank erosion along Smith River upstream of Camp Baker.

Figure 76. Irrigation diversion structure that could benefit from efficiency upgrades.

Figure 77. Extensive macrophyte growth on Smith River bed upstream of Camp Baker.

Figure 78. Car bodies used as bank stabilization along the Smith River upstream of Camp Baker.

8.2.1.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for the Smith River upstream of Camp Baker include:

- Irrigation infrastructure upgrades, specifically improvements to irrigation diversion structures and ditch relocations.
- Habitat restoration to narrow and deepen the channel and increase woody riparian vegetation cover.
- Future Fisheries Smith River and Thompson Creek fencing and off-stream watering project.
- Future Fisheries Smith River riparian fencing project.
- Streambank and woody riparian vegetation restoration project on private land.
- Fort Logan grazing management.
- Three Montana Land Reliance (MLR) conservation easements.
- FWP Statewide Management Plan (2023) indicates the management direction for the Smith River upstream of Sheep Creek (Camp Baker) is to maintain a recreational fishery within historic levels and identified the following habitat needs and activities:
    - Explore opportunities to improve instream flows, habitat and water quality.
    - Maintain habitat and instream flow reservation of 78.5 cfs.
    - Protect Murphy rights, which are 150 cfs from 5/1-6/30 and 90 cfs from 7/1-4/30.
    - Improve habitat and flow conditions as opportunities allow.
- Drought related restrictions and closures to protect fishery.

8.2.1.3 Proposed Additional Restoration Actions

Restoration actions for the mainstem Smith River upstream of Camp Baker include:

- Grazing management (off site water, riparian fencing, reduce concentrated livestock areas).
- Riparian buffers and woody riparian vegetation expansion, particularly between hay fields and the river.
- Nutrient reductions through nutrient management, reducing streambank erosion, increasing floodplain connectivity and floodplain wetland area.
- Floodplain reconnection to increase floodplain water retention.

- Increase area of floodplain wetlands at irrigation return flow points to reduce nutrient and sediment inputs. This is particularly suitable in the wide valley bottom with deep organic soils and a high water table upstream of the diorite sill constriction point just downstream of the Newlan and Big Birch Creek confluences (Figure 5).
- Irrigation efficiency projects to reduce leakage through headgates and canals (Figure 76).
- Streambank restoration to reduce erosion and fine sediment inputs.
- Channel restoration to increase in-stream and riparian cover, channel roughness, and reduce channel widths.
- Explore opportunities to take advantage of significant wetland capacity and floodplain water storage potential in upper reach.

8.2.1.4 Restoration Targets

Five-year restoration targets for the Smith River upstream of Camp Baker are listed in Table 16. The remote assessment indicated that 396 acres of the riparian buffer and 7 miles (314,652 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 64% of the riparian area. A total of 59,530 feet (11.3 miles, 11.8%) of streambanks were mapped as actively eroding. The 1985 assessment mapped a total of 30,600 linear feet (5.8 miles) of streambank as actively eroding indicating that bank erosion has almost doubled in the last 40 years. Water quality data for the Smith River upstream of Camp Baker has shown high turbidity, E. coli and nutrient levels as well as elevated stream temperatures. Chlorophyll-a levels are sufficient to support nuisance algae growth at Camp Baker. This reach of the Smith River is also listed as periodically dewatered by FWP.

Based on the remote impact analysis, restoration actions on the mainstem Smith River upstream of Camp Baker should focus on improving water quality or quantity. This includes projects that increase floodplain connectivity and utilize the floodplains for water quality improvement; grazing management to reduce streambank erosion and restore woody riparian vegetation; stream and bank restoration to narrow the channel and increase aquatic habitat diversity; reduce erosion and improve habitat; and irrigation efficiency projects.

Table 16. Smith River upstream of Camp Baker 5-year (2025-2030) restoration targets to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	396	Implement grazing BMPs or re-establish woody vegetation in 5% (3 acres)of riparian area
Streambanks with less than 25% cover (ft)	314,625	Reduce erosion and restore woody cover on 5% (3,000 linear feet) of high priority eroding streambanks[1,2]
Pens and corrals within riparian buffer with concentrated use (ac)	1.2	Establish well vegetated buffer between corral and stream for one site
Irrigation return flows (each)	44	Evaluate irrigation return flow points for evidence of nutrient or sediment inputs

[1] Projects currently in progress.

[2]High priority eroding streambanks have not been determined for this area but includes streambanks with erosion rates above natural levels that are contributing fine sediment to the stream.

8.2.2 *Smith River Camp Baker to Eden Bridge*

The mainstem Smith River between Camp Baker and Eden Bridge is 63.6 miles in length (Figure 79). Because the Smith River between Camp Baker and Eden Bridge was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B. The remote assessment for the Smith River upstream of Camp Baker also included mapping woody riparian vegetation loss since the 1950s and mapping current bank erosion and stabilization.

Attribute	Value
Watershed Size	2,920 acres (4.5 sq mi)
Elevation Range	3,403-4,377 ft
Stream Miles	58.8
Land Ownership	**2,920 total acres**
Private	2,429 acres (83%)
State	96 acres (3%)
Federal	396 acres (14%)
Road Miles	**423 total miles**
City-County	161
USFS	87
Other	174
Number of Diversions	21
Number of Reservoirs	90

Includes Smith River and adjacent floodplain and watershed area not accounted for by target area tributaries

8.2.2.1 Primary Issues

The following are the main degradational issues identified for the mainstem Smith River upstream of Camp Baker:

- Low late season flows. Reduced flow issues mostly originate upstream of Camp Baker however several tributaries entering the Smith River in this reach have dewatering issues. This reach of the Smith River is listed for periodic dewatering by FWP.
- Floodplain conversion/loss of woody riparian vegetation. Remote assessment showed that 45.9% of the riparian buffer has less than 25% expected riparian vegetation cover (Figure 73).
- Boat camps and high recreation use areas have altered vegetation, increased soil erosion and soil compaction (Figure 80).
- Grazing is generally unrestricted except by natural features. Remote assessment showed that 42.2% of the riparian buffer is grazed.
- Vegetation management and a legacy of herbicide use have altered some vegetation communities (Figure 81). Remote assessment showed that 2.6% of the riparian corridor may be affected by herbicide impacts.
- Agricultural encroachment increases downstream of the Smith River Canyon.
- Erosion and sedimentation from removal of woody riparian vegetation, grazing and agricultural encroachment. Remote assessment showed that 9.4% of streambanks are actively eroding, a 6% increase from the 1980 assessment.
- Ice jams occur in the Smith River Canyon and cause streambank erosion within and downstream of the canyon.
- Elevated E. coli has been documented.
- Elevated water temperatures are common late in the season.
- Nutrient levels and stream temperatures elevated to a level that supports nuisance algae but do not increase above levels documented at Camp Baker significantly.
- High nitrogen and turbidity have been recorded through the reach.
- Noxious weed infestations are ubiquitous, especially leafy spurge.

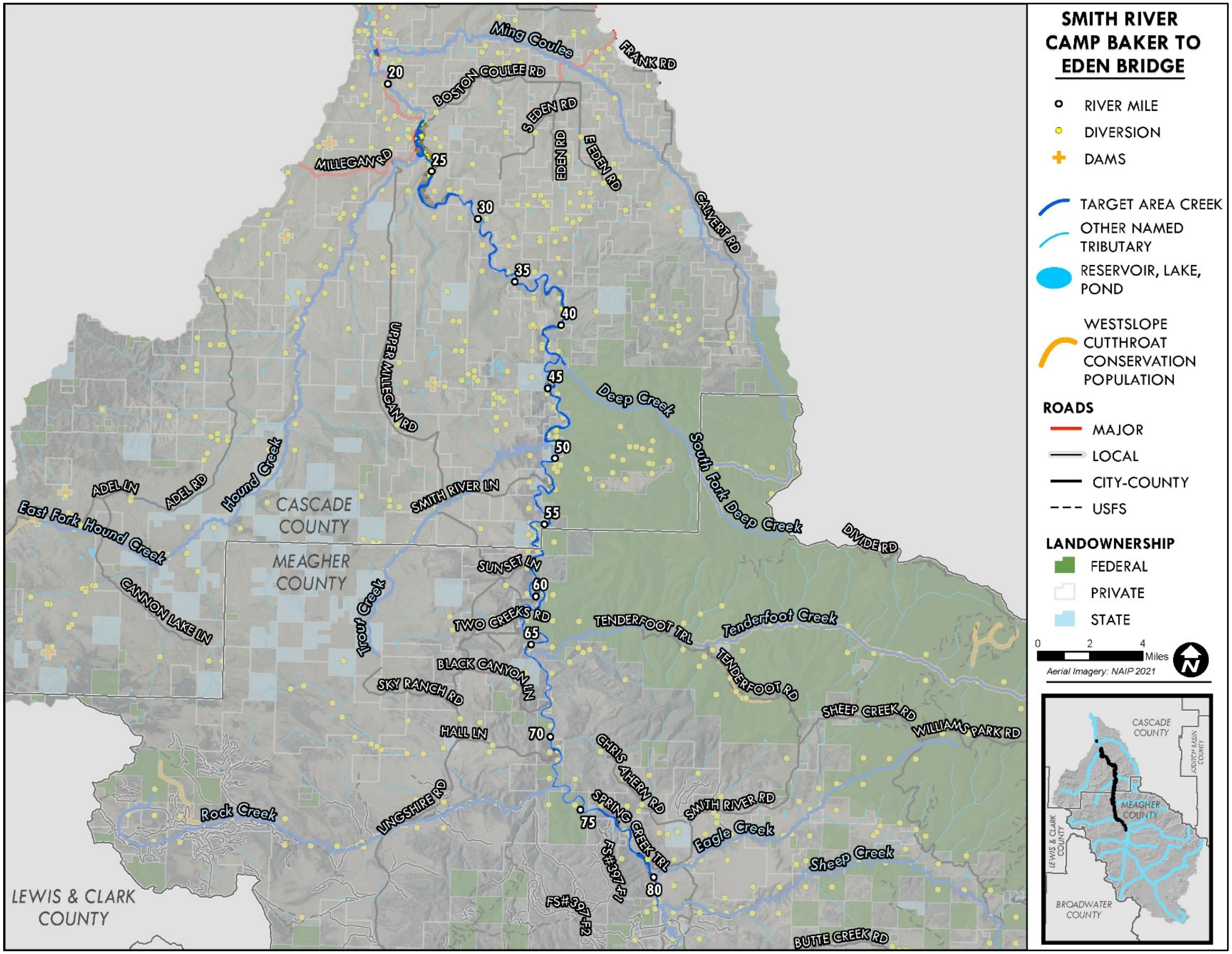


Figure 79. Smith River between Camp Baker and Eden Bridge target area overview.

Figure 80. Bank erosion (left) and soil compaction (right) at boat camps.

Figure 81. Grazing and herbicide impacts in floodplain.

8.2.2.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for the Smith River between Camp Baker and Eden Bridge include:

- Boat camp maintenance including tree removal and removal of pit toilets.
- SRHP MOU with USFS and FWP to complete weed control at boat camps.
- Improvements at Smith River State Park boat camps being planned including streambank bioengineering and recreation ecology measures (in progress).
- Smith River Corridor Enhancement Project that included riparian fencing on Rockin' Cs.
- Camp Baker streambank bioengineering and boat launch removal project (Figure 82).
- BLM grazing allotment monitored.
- Twelve MLR conservation easements within the Smith River Canyon.
- FWP Statewide Management Plan (2023) indicates the management direction for the Smith River from Sheep Creek to Hound Creek is to maintain a recreational fishery within historic levels and identified the following habitat needs and activities:
    - Explore opportunities to improve instream flows, habitat and water quality.
    - Maintain habitat and instream flow reservation of 150 cfs.
    - Protect Murphy Rights, which vary from 125 to 400 cfs depending on location and time of year.
- Smith River Management Act and Smith River Recreation Plan describe other operations.
- Drought related restrictions and closures to protect fishery.

Figure 82. Camp Baker streambank stabilization project.

8.2.2.3 Proposed Additional Restoration Actions

Restoration actions for the mainstem Smith River between Camp Baker and Eden Bridge include:

- Boat camp streambank restoration/erosion control (soil bioengineering).
- Boat camp recreation ecology measures.
- Increase floater education about boat camp impacts and river ecological function.
- Grazing management opportunities include working with landowners to restrict livestock use on public lands.

- Develop an ecologically based integrated weed management program that continues to target noxious weeds but also promotes desirable vegetation.
- Floodplain reconnection to increase floodplain water retention and promote ecological function.
- Riparian buffers and woody riparian vegetation expansion, particularly downstream of Rattlesnake Bend boat camp.
- Streambank restoration to reduce erosion and fine sediment inputs.

8.2.2.4 Restoration Targets

Five-year restoration targets for the Smith River between Camp Baker and Eden Bridge are listed in Table 17. The remote assessment (Appendix B) indicated that 42% of the reach is used for grazing. The assessment results showed 435 acres of the riparian buffer and 55 miles (219,535 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 46% of the riparian area. A total of 64,530 feet (12.2 miles, 9%) of streambank were mapped as actively eroding. The 1985 assessment mapped a total of 32,600 linear feet (6.2 miles) as actively eroding indicating that bank erosion has doubled in the last 40 years. Water quality data for the Smith River between Camp Baker and Eden Bridge has shown high turbidity, E. Coli and nutrient levels as well as elevated stream temperatures. Chlorophyll-a levels are sufficient to support nuisance algae growth. This reach of the Smith River is also listed as periodically dewatered by FWP.

Based on the remote impact analysis, restoration actions on the mainstem Smith River between Camp Baker and Eden Bridge should address boat camp issues, grazing, reduce potential herbicide damage, and allow vegetation recovery. This would include streambank bioengineering and recreation ecology measures at boat camps, working with landowners on grazing management to reduce grazing and livestock impacts on public lands and boat camps, and developing ecologically based weed management strategies.

Table 17. Smith River Camp Baker to Eden Bridge 5-year restoration targets (2025-2030) to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Boat camp bank erosion (ft)	6,609	Identify, design and implement streambank bioengineering and recreation ecology measures at three boat camps[1]
Herbicide impacts (ac)	14	Develop and implement an ecologically based integrated weed management program[1]
Grazing	N/A	Work with landowners to reduce grazed riparian corridor area using natural features coupled with strategic fencing

[1] Projects currently in progress.

8.2.3 North Fork Smith River

The North Fork Smith River originates on the south flank of the Little Belt Mountains and flows 34.3 miles before joining the South Fork Smith River to form the Smith River near White Sulphur Springs (Figure 83). Because the North Fork Smith River below Sutherlin Reservoir was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B.

Attribute	Value
Watershed Size	115,440 acres (180.4 sq mi)
Elevation Range	4,900-7,9035 ft
Stream Miles	34.3
Land Ownership	**115,440 total acres**
Private	71,314 acres (62%)
State	5,038 acres (4%)
Federal	39,088 acres (34%)
Road Miles	**112 total miles**
City-County	30
Local Access	0
Primary	20
Secondary	1
USFS	60
Number of Diversions	99
Number of Reservoirs	40

8.2.3.1 Primary Issues

The following are the main degradational issues identified for the North Fork Smith River:

- Agricultural encroachment into the active stream corridor.
- Loss of woody riparian vegetation (Figure 84). Remote assessment showed that 44.5% of the riparian buffer has less than 25% expected riparian vegetation cover (Figure 73) and 4.2% of the stream is over widened.
- Low late season flows from irrigation withdrawals. The North Fork is listed for chronic dewatering by FWP. The remote assessment showed a total of 25 irrigation diversions originating from the mainstem North Fork Smith River (Figure 72).
- Grazing and some areas of livestock concentration areas along the stream. Remote assessment showed that 92.1% of the riparian buffer is grazed and nine corrals are located within the riparian buffer, five with concentrated, high intensity use.
- Infrastructure in floodplain (roads, bridges, utilities, houses) (Figure 85).
- Erosion and sedimentation from removal of woody riparian vegetation, grazing and agricultural encroachment (Figure 86). Sedimentation from erosion at outlet of Sutherlin Reservoir.
- Channel straightening and bank armoring.
- Elevated E.coli and nutrients from grazing, agriculture, and urban runoff.
- Elevated turbidity from streambank erosion and irrigation return flows.
- Elevated water temperature and low dissolved oxygen from decreased late season flows, removal of woody riparian vegetation and channel widening.

8.2.3.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for the North Fork Smith River watershed include:

- FWP streambank revegetation, riparian buffer and off-site water project (in progress).
- USFS Fourmile Creek long-term riparian restoration project which will install numerous beaver dam analog (BDA) structures to restore riparian health (in progress).
- Future Fisheries experimental riparian fencing (2010).
- Future Fisheries Lake Creek fish barrier (2007).
- Riparian revegetation projects on properties within White Sulphur Springs.

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 1 (in progress).
- USFS thinning for hazardous fuel reduction and noxious weed control (in progress).
- DEQ/USGS ortho-phosphorous study (completed, awaiting publication).
- USFS Castle Mountain Restoration Project (fuels and rangeland conifer encroachment; 721 ac brush management, 818 acres forest stand improvement, 78 acres woody residue treatment) (in progress).
- BLM grazing allotment monitoring.
- Two MLR conservation easements.
- FWP Statewide Management Plan (2023) indicates the management direction for the North Fork is to maintain recreational fishery within historic levels and identifies the following habitat needs and activities:
    - Explore opportunities to improve instream flows, habitat, and water quality.
    - Maintain habitat and instream flows of 9 cfs.
- There are several conservation populations of westslope cutthroat trout in the North Fork drainage headwater streams (Figure 83). FWP is exploring opportunities to protect existing populations, expand populations and establish new populations.

8.2.3.3 Proposed Additional Restoration Actions

Restoration actions for the North Fork Smith River include:

- Grazing management (off site water, riparian fencing, reduce concentrated livestock areas).
- Riparian buffers and woody riparian vegetation expansion (including lawns in White Sulphur Springs which may be one source of elevated nutrients).
- Nutrient management through reducing streambank erosion, increasing floodplain connectivity and floodplain wetland area, reducing livestock overwintering on the stream and concentrated livestock use areas, and potential fertilizer use options for lawns and hayfields.
- Streambank restoration to reduce erosion and increase woody riparian vegetation cover.
- Irrigation efficiency projects to address reduced streamflow.
- Potential reservoir water management options to increase late season streamflow.
- Conservation protections to protect existing high quality conditions, especially in tributaries supporting westslope cutthroat trout or sections of the stream with high cover of woody riparian vegetation.

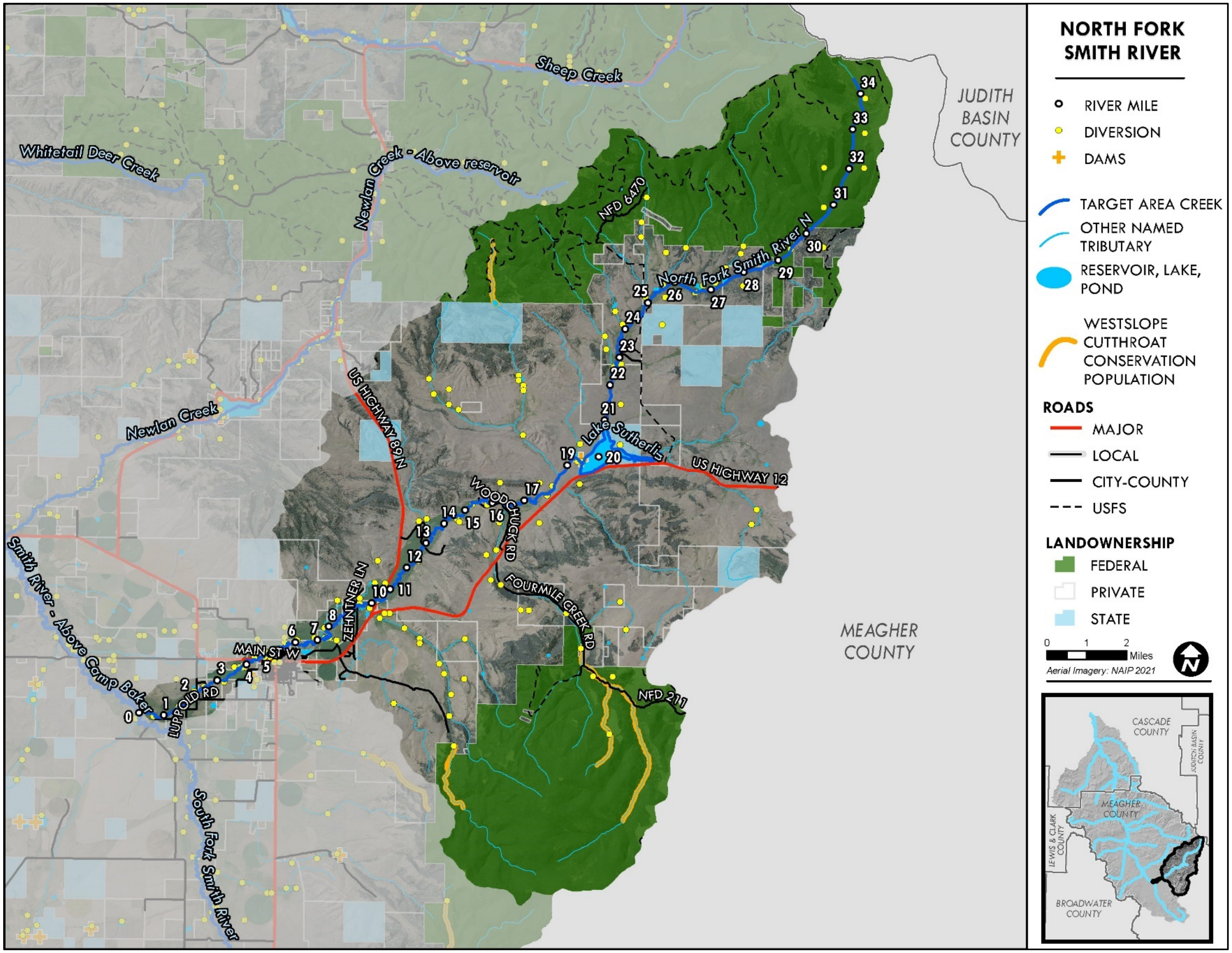


Figure 83. North Fork Smith River target area overview.

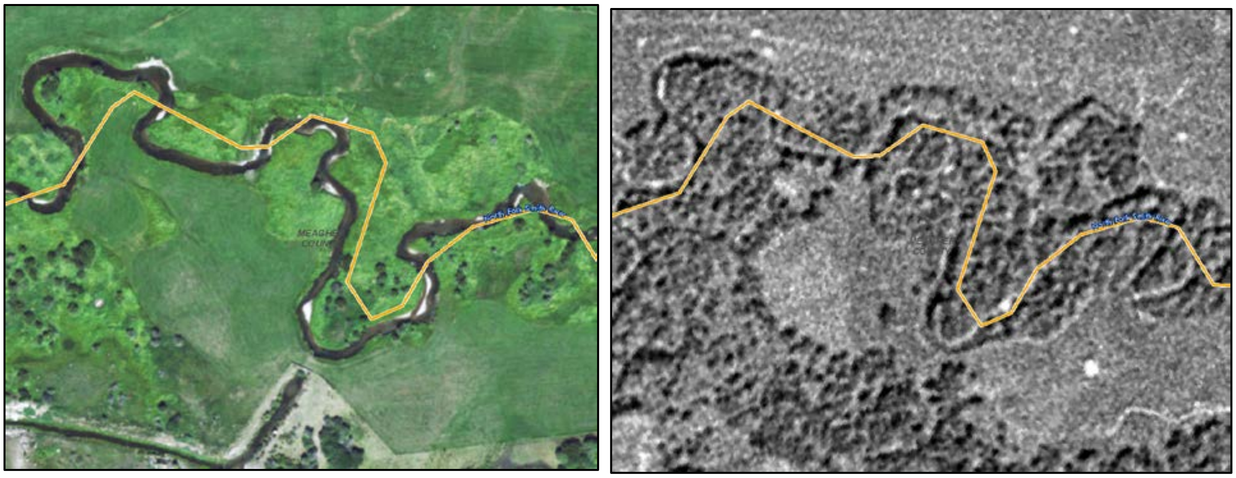


Figure 84. Reduced woody riparian vegetation cover on the North Fork Smith River from the 1950s (right) to current (left).

Figure 85. North Fork Smith River as it flows along the north edge of White Sulphur Springs.

Figure 86. Typical eroding cutbank conditions along the North Fork Smith River with limited woody vegetation and a predominance of introduced pasture grasses such as timothy, meadow foxtail, smooth brome and reed canarygrass.

8.2.3.4 Restoration Targets

Five-year restoration targets for the North Fork Smith River are listed in Table 18. The remote assessment (Appendix B) indicated that 128 acres of the riparian buffer and 3 miles (125,936 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 45% of the riparian area. The assessment could not remotely discern the proportion of streambanks lacking expected riparian vegetation cover that are actively eroding but bank erosion was commonly observed during field reviews and conversion to introduced pasture grasses extensive. Water quality data for the North Fork have shown high turbidity, E. coli and nutrients as well as periods of low dissolved oxygen when streamflow is low and temperature elevated. Further, the North Fork accounted for up to 17% of the bioavailable Phosphorous load upstream of Camp Baker, the second largest contributor identified in the DEQ study. The North Fork is also listed as chronically dewatered by FWP.

Based on the available data and the results of the remote impact analysis, restoration actions in the North Fork should focus on dewatering and nutrient sources. This would include projects that reduce streambank erosion, restore woody riparian vegetation, move corrals and concentrated livestock use areas away from streams, grazing management, and irrigation efficiency projects. These treatments will also improve geomorphic stability and aquatic habitat.

Table 18. North Fork Smith River 5-year restoration targets (2025-2030) to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	127	Implement grazing BMPs or re-establish woody vegetation in 10% (12.7 acres) of riparian area
Streambanks with less than 25% cover (ft)	125,936	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks[1,2]
High impact pens and corrals within riparian buffer with concentrated use (ac)	1.8	Relocate or establish well vegetated buffer between corral and stream for one site[2]

[1]Not all streambanks with less than 25% cover have elevated rates of erosion and high priority eroding streambanks have not been determined for this area. High priority streambanks have erosion rates above natural levels that are contributing fine sediment to the stream.
[2] Projects currently in progress.

8.2.4 South Fork Smith River

The South Fork Smith River originates in the Castle Mountains and flows 37.9 miles before joining the North Fork Smith River to form the Smith River (Figure 87). Because the South Fork Smith River was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B.

Attribute	**Value**
Watershed Size	108,972 acres (170.3 sq mi)
Elevation Range	4,900 - 6,141 ft
Stream Miles	37.9
Land Ownership	**108,972 total acres**
Private	91,392 acres (84%)
State	12,001 acres (11%)
Federal	5,580 acres (5%)
Road Miles	**96 total miles**
City County	57
Other	29
USFS	10
Number of Diversions	68
Number of Reservoirs	46

8.2.4.1 Primary Issues

The main degradational issues identified for the South Fork Smith River include:

- Agricultural encroachment into the active stream corridor. Remote assessment showed that 11.1% of the riparian buffer is hayed (Figure 71).
- Woody riparian vegetation loss. Remote assessment showed that 78.3% of the riparian buffer has less than 25% expected riparian vegetation cover.
- Erosion and sedimentation from removal of woody riparian vegetation (Figure 90).
- Channelization, channel incision and loss of floodplain connectivity from highway and railroad construction, floodplain conversion and draining and agriculture (Figure 88). Remote assessment showed that 9.2% of the channel has been relocated, 15.7% of the stream is channelized, and 16.5% is incised (Figure 70).
- Irrigation withdrawals/floodplain dewatering and reduced late season stream flow. The South Fork is listed for periodic dewatering by FWP. Remote assessment identified 17 irrigation diversions originating from the mainstem South Fork Smith River.
- Grazing including concentrated livestock use and winter feeding areas along stream. Remote assessment showed that 99.6% of the riparian buffer is grazed (Figure 70). Only one corral was identified within the riparian buffer.
- Elevated nitrogen and E.coli from livestock grazing and agriculture, including winter application of fertilizer to the floodplain.
- Elevated turbidity from streambank erosion and irrigation return flows.
- Elevated water temperature from woody vegetation removal and natural hot spring inputs.

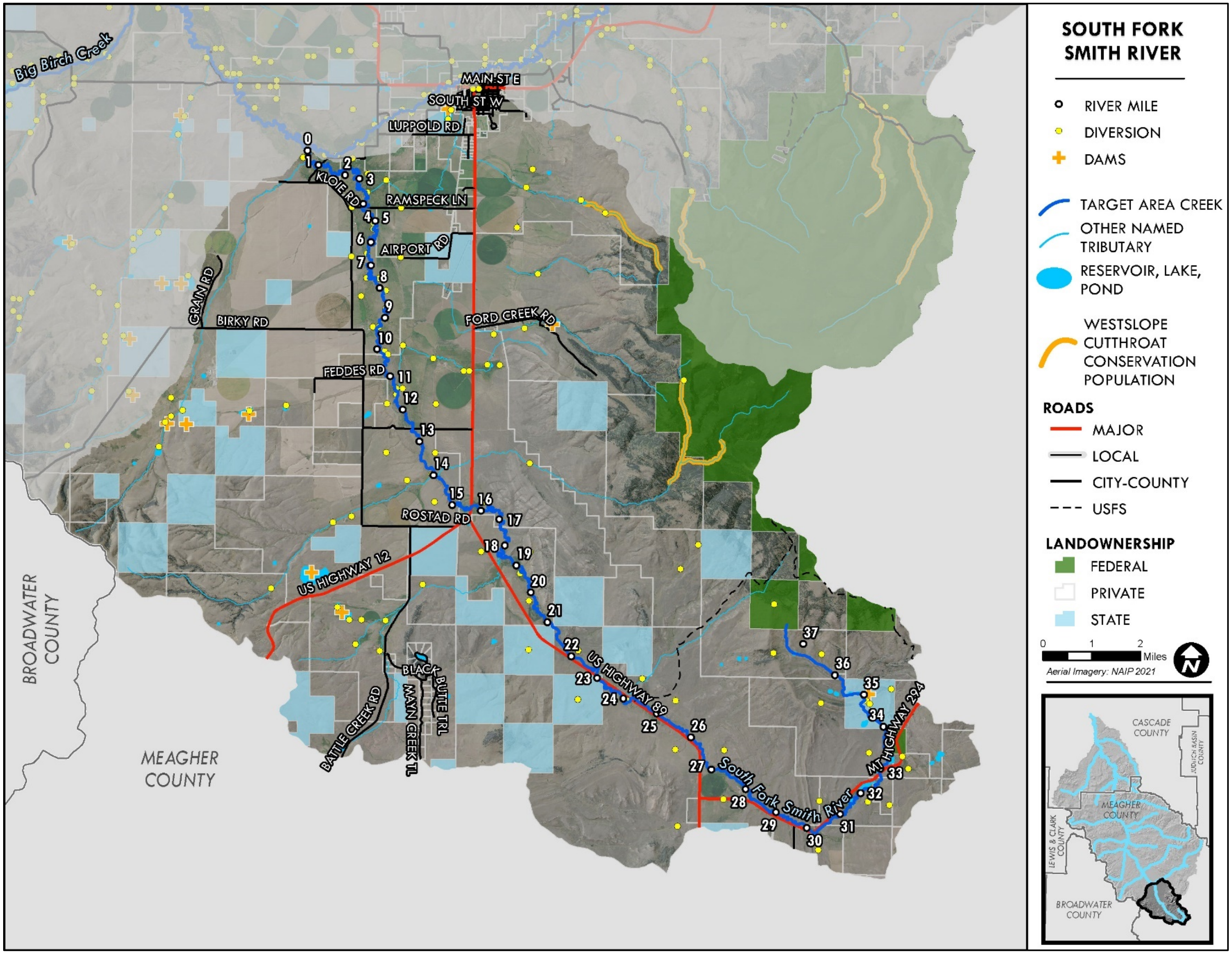


Figure 87. South Fork Smith River target area overview.

Figure 88. Channelization of the South Fork River due to Highway 89 and railroad grade construction.

Figure 89. Large spring entering the South Fork Smith River at Hwy 12 bridge crossing.

Figure 90. Channel widening and erosion (left) and channel incision and loss of woody riparian vegetation (right) on the South Fork Smith River.

8.2.4.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for the South Fork Smith River include:

- Irrigation infrastructure upgrades have occurred in the lower South Fork to reduce water loss into ditches and improve effectiveness of diversion structures.
- Future Fisheries experimental riparian fencing occurred in 2009 and 2010.
- Future Fisheries off site water and fence project occurred in 1999.
- Wetland creation and floodplain reconnection is in progress along a 4-mile reach of the South Fork.
- Stream channel restoration, floodplain reconnection and woody riparian vegetation expansion work is planned for a 1.5-mile long reach of the South Fork.
- Agricultural BMPs such as off-site stock water are planned for the South Fork.
- DEQ/USGS ortho-phosphorous study (completed, awaiting publication).
- BLM grazing allotment monitoring.
- One MLR conservation easement.
- FWP Statewide Management Plan (2023) indicates the management direction for the South Fork is to maintain recreational fishery within historic levels and identifies the following habitat needs and activities:
    - Explore opportunities to improve instream flows, habitat, and water quality.
    - Maintain habitat and instream flows of 7 cfs.
- Cottonwood Creek, a tributary to the South Fork supports a conservation population of westslope cutthroat trout (Figure 87). FWP is exploring potential barrier sites to prevent non-native fish migration into Cottonwood Creek.

8.2.4.3 Proposed Additional Restoration Actions

Restoration actions for the South Fork Smith River include:

- Floodplain reconnection to increase floodplain water retention to increase water storage and late season recharge.
- Grazing management including development of off-site water and alternatives to concentrated livestock use and over-wintering areas along the stream.
- Create riparian buffers and increase woody riparian vegetation cover.
- Streambank restoration to reduce accelerated erosion and increase woody riparian vegetation cover.
- Channel restoration including reconnection of cutoff meander bends in channelized areas and aquatic habitat enhancement.
- Irrigation efficiency projects.
- Nutrient management including investigating alternatives to late winter fertilizer application in the floodplain.
- Investigate opportunities to take advantage of springs and the lower gaining reach with extensive groundwater recharge for passive floodplain water storage and late season streamflow recharge (Figure 89).

- Conservation protections to protect existing high quality conditions, especially in lower reach where stream is actively gaining groundwater inputs and supports high value wetlands.

8.2.4.4 Restoration Targets

Five-year restoration targets for the South Fork Smith River are listed in Table 19. The remote assessment (Appendix B) indicated that 320 acres of the riparian buffer and 10 miles (433,668 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 78% of the riparian area. The assessment could not remotely discern the proportion of streambanks lacking expected riparian vegetation cover that are actively eroding but bank erosion was commonly observed during field reviews and conversion to introduced pasture grasses extensive. The assessment also showed that 8.7 miles (16.5%) of the channel are incised and no longer connected to the floodplain. This length is probably greater if ground verification of the remote assessment were to occur. Water quality data are limited for the South Fork but indicate nutrients and siltation are issues.

Based on the available data and the results of the remote impact analysis, high priority restoration actions in the South Fork are to reconnect the floodplain with the stream, restore woody riparian vegetation, relocate concentrated livestock use areas away from the channel or create riparian buffers, and investigate alternatives to winter application of fertilizer to help reduce nutrients entering the stream.

Table 19. South Fork Smith River 5-year restoration targets (2025-2030) to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	320	Implement grazing BMPs or re-establish woody vegetation in 5% (16 acres) of riparian area
Streambanks with less than 25% cover (ft)	433,667	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks[1,2]
Pens and corrals within riparian buffer with concentrated use (ac)	1.3	Relocate or establish well vegetated buffer between corral and stream for one site
Incised stream (miles)	8.7	Reconnect 5 miles of channel and floodplain*
Nutrients	N/A	Investigate alternatives to winter fertilizer application

[1]Not all streambanks with less than 25% cover have elevated rates of erosion and high priority eroding streambanks have not been determined for this area. High priority streambanks have erosion rates above natural levels that are contributing fine sediment to the stream.
[2] Projects currently in progress.

8.2.5 *Newlan Creek*

Newlan Creek originates in the Little Belt Mountains and flows southwest for 21.7 miles before joining the Smith River (Figure 91). Because Newlan Creek downstream of Newlan Reservoir was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B.

Attribute	Value
Watershed Size	33,200 acres (52 sq mi)
Elevation Range	4,803-7,087 ft
Stream Miles	21.7
Land Ownership	**33,200 total acres**
Private	16,385 acres (49%)
State	962 acres (3%)
Federal	15,853 acres (48%)
Road Miles	**69 total miles**
City-County	12
Other	17
USFS	40
Number of Diversions	29
Number of Reservoirs	7

8.2.5.1 Primary Issues

The following are the main degradational issues identified for Newlan Creek:

- Agricultural encroachment (Figure 93).
- Loss of woody riparian vegetation. Remote assessment showed that 18.4% of the riparian buffer has less than 25% expected riparian vegetation cover and 61.2% had between 25 and 75% expected riparian vegetation cover (Figure 73).
- Grazing including concentrated livestock use areas along the stream (Figure 93). Remote assessment showed that 79.7% of the riparian buffer is grazed and four corrals are located within the riparian buffer, two with high intensity use.
- Straightened and over-widened channel from woody riparian vegetation loss and channel relocation.
- Altered flow regime from Sheep Creek transbasin diversion (Holmstrom Ditch) and Newlan Reservoir.
- Erosion and turbidity from Holmstrom Ditch and irrigation return flows (Figure 96).
- Erosion and sedimentation from removal of woody riparian vegetation and active channel incision (Figure 94).
- Low late season flows from irrigation withdrawals downstream of Newlan Reservoir. Remote assessment showed a total of 6 irrigation diversions originating from the mainstem Newlan Creek downstream of Newlan Reservoir.
- Elevated E.coli and nutrients from grazing and agriculture.
- Elevated turbidity from streambank erosion and irrigation return flows (Figure 92). Remote assessment showed a total of 9 irrigation return flow points entering the mainstem Newlan Creek downstream of Newlan Reservoir.
- Elevated water temperature and low dissolved oxygen from decreased late season flows, removal of woody riparian vegetation, and late season releases from Lake Sutherlin. Lake Sutherlin is a heat sink during the summer and fall and discharged water is often several degrees warmer than coming in and when drawn down silt can get stirred up causing turbidity (Kellog, 2006).
- Extensive conifer encroachment in upper watershed.

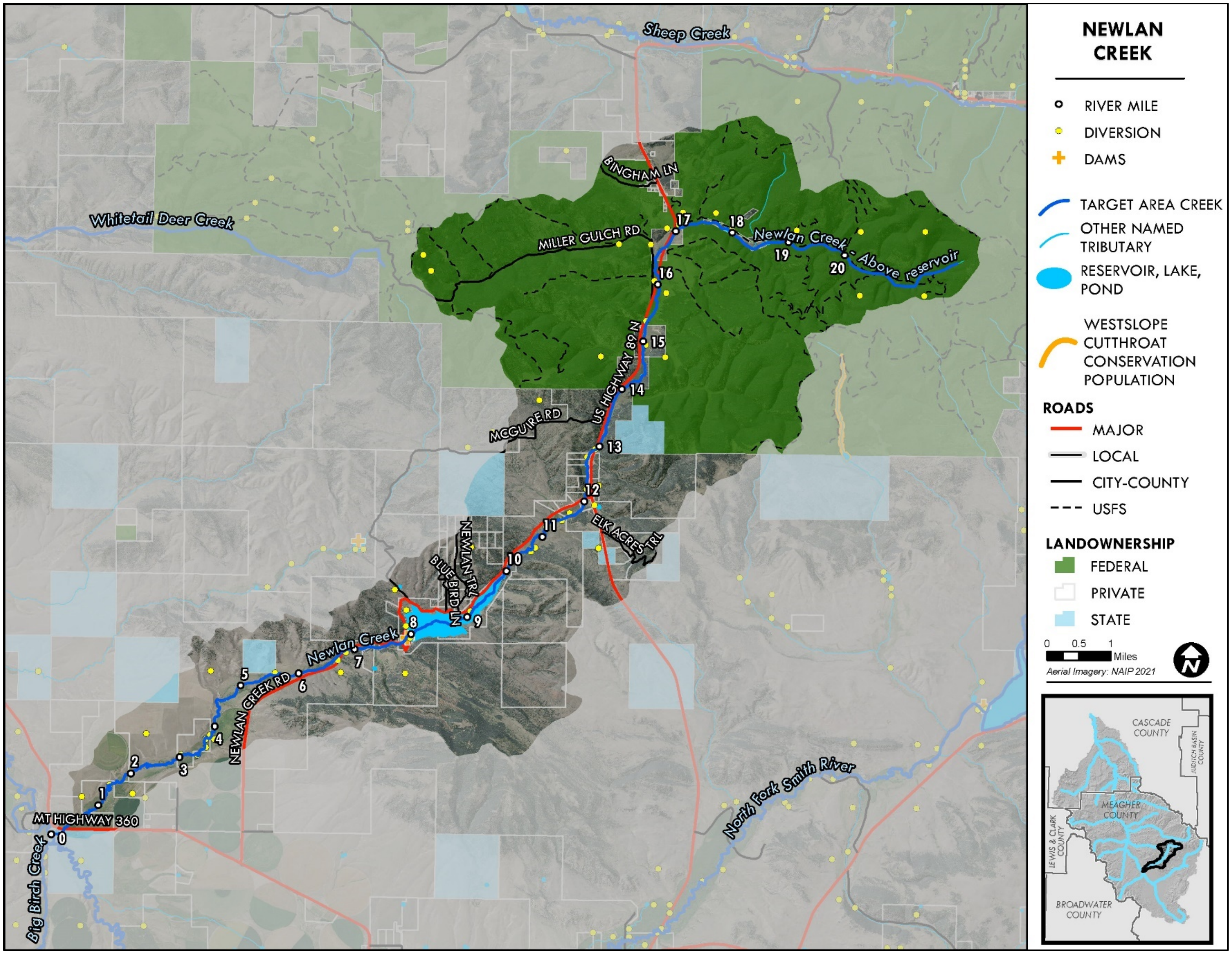


Figure 91. Newlan Creek target area overview.

Figure 92. Sediment entering Smith River from Newlan Creek (2023 top left photo, 2019 top right photo). Bottom photo is mouth of Newlan Creek in July 2023.

Figure 93. Newlan Creek agricultural encroachment (left) and concentrated livestock use on stream (right).

Figure 94. Channel incision and bank erosion along Newlan Creek downstream of the main irrigation diversion downstream of Newlan Reservoir.

Figure 95. Recent beaver activity (2019) on Newlan Creek.

Figure 96. Erosion in Holmstrom Ditch upstream of confluence with Newlan Creek.

8.2.5.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Newlan Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 1 (in progress).
- USFS Horsefly Vegetation Project (in progress).
- USFS integrated resource restoration including reforestation, and noxious weed control (in progress.)
- USFS Newlan Creek WRAP (road decommissioning, aquatic organism passage (AOP) culverts, riparian exclosures, etc.) (in progress).
- One MLR conservation easement.
- DEQ/USGS ortho-phosphorous study (completed, waiting publication).
- FWP has purchased water from Newlan Reservoir in the past (1992) to augment streamflows in the recreational float corridor in response to drought and low flow conditions. This increased flows in the Smith River below Newlan Creek but the increased flows were not realized at Fort Logan or Camp Baker.
- FWP Statewide Management Plan (2023) indicates the management direction for Newlan Creek is to maintain a recreational fishery within historic levels and identifies the following habitat needs and activities:
  - Maintain habitat and instream flows of 3.8 cfs.
  - Consider potential for conveyance of stored water to enhance instream flows in the Smith River.
  - Evaluate potential solutions to reduce impacts from sediment transport from trans-basin diversion ditch.

8.2.5.3 Proposed Additional Restoration Actions

Restoration actions for Newlan Creek include:

- Streambank restoration to reduce erosion and fine sediment inputs.
- Create riparian buffers and increase woody riparian vegetation cover.
- Irrigation water management and create wetlands at irrigation return points to filter out fine sediment to reduce turbidity entering the Smith River.
- Floodplain reconnection/beaver habitat enhancement to increase passive water storage and create areas to store fine sediment loads to reduce turbidity.
- Potential reservoir water purchase to increase late season streamflow. This would need to be accompanied by agreements with downstream users to ensure water makes it to needed locations downstream in the Smith River.
- Conservation protections to protect existing high quality areas such as beaver created habitats (Figure 95). Encourage landowners to allow beaver activity to occur on their properties.

8.2.5.4 Restoration Targets

Five-year restoration targets for Newlan Creek downstream of Newlan Reservoir are listed in Table 20. The remote assessment (Appendix B) indicated that 14.3 acres of the riparian buffer and 4.9 miles

(25,674 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 18% of the riparian area. The assessment could not remotely discern the proportion of streambanks lacking expected riparian vegetation cover that are actively eroding but bank erosion was commonly observed during field reviews and conversion to introduced pasture grasses extensive. The remote assessment also noted 4,819 feet (6.8%) of the channel is incised. Field observations confirmed that active incision and accompanying elevated levels of erosion occur on Newlan Creek. Water quality data for Newlan Creek have shown high turbidity, E. coli and nutrients. Sedimentation has been noted as severe for Newlan Creek. Elevated water temperatures have also been recorded at the mouth of Newlan Creek along with low dissolved oxygen levels. Newlan Creek accounted for less than 2% of the bioavailable Phosphorous load upstream of Camp Baker.

Based on the available data and results of the remote impact analysis, high priority restoration actions on Newlan Creek are to reduce streambank erosion and incision, create wetlands to filter irrigation return flows or other actions that encourage beaver activity to passively restore floodplain connectivity, store fine sediment and trap nutrients.

Table 20. Newlan Creek 5-year restoration targets (2025-2030) to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	14.3	Implement grazing BMPs or re-establish woody vegetation in 10% (1.4 acres) of riparian area
Streambanks with less than 25% cover (ft)	25,674	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks[1]
Irrigation return flows (each)	9.0	Evaluate irrigation return flow points for evidence of nutrient or sediment inputs
Channel incision (ft)	4,819	Explore opportunities to reconnect floodplains

[1]Not all streambanks with less than 25% cover have elevated rates of erosion and high priority eroding streambanks have not been determined for this area. High priority streambanks have erosion rates above natural levels that are contributing fine sediment to the stream.

8.2.6 Camas Creek

Camas Creek originates in the Big Belt Mountains and flows 18.4 miles before joining the Smith River (Figure 97). Because Camas Creek was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B.

Attribute	Value
Watershed Size	39,464 acres (62 sq mi)
Elevation Range	4,545-7,345 ft
Stream Miles	18.4
Land Ownership	**39,464 total acres**
Private	21,400 acres (54%)
State	770 acres (2%)
Federal	17,295 acres (44%)
Road Miles	**135 total miles**
City-County	18
Other	70
USFS	46
Number of Diversions	68
Number of Reservoirs	32

8.2.6.1 Primary Issues

The following are the main degradational issues identified for Camas Creek:

- Low late season flows from irrigation withdrawals. Camas Creek is s listed for chronic dewatering by FWP. The remote assessment showed a total of 17 irrigation diversions originating from the mainstem Camas Creek.
- Loss of woody riparian vegetation. Remote assessment showed that 48% of the riparian buffer has less than 25% expected riparian vegetation cover (Figure 73) and 14% of the stream is channelized (Figure 70, Figure 99).
- Grazing including concentrated livestock use areas along the stream (Figure 98). Remote assessment showed that 93% of the riparian buffer is grazed (Figure 71) and 4 corrals are located within the riparian buffer with high intensity use (Figure 72).
- Agricultural encroachment.
- Elevated E.coli and nutrients from grazing and agriculture.
- Elevated turbidity from streambank erosion and irrigation return flows (Figure 100).
- Elevated water temperature and low dissolved oxygen from decreased late season flows, removal of woody riparian vegetation.
- Conifer encroachment in adjacent uplands.
- Historic riparian logging.
- Placer mining resulting in channelization near confluence with Atlanta Creek.
- The Woods Creek Fire burned a sizable portion of the forested headwaters area in 2021.

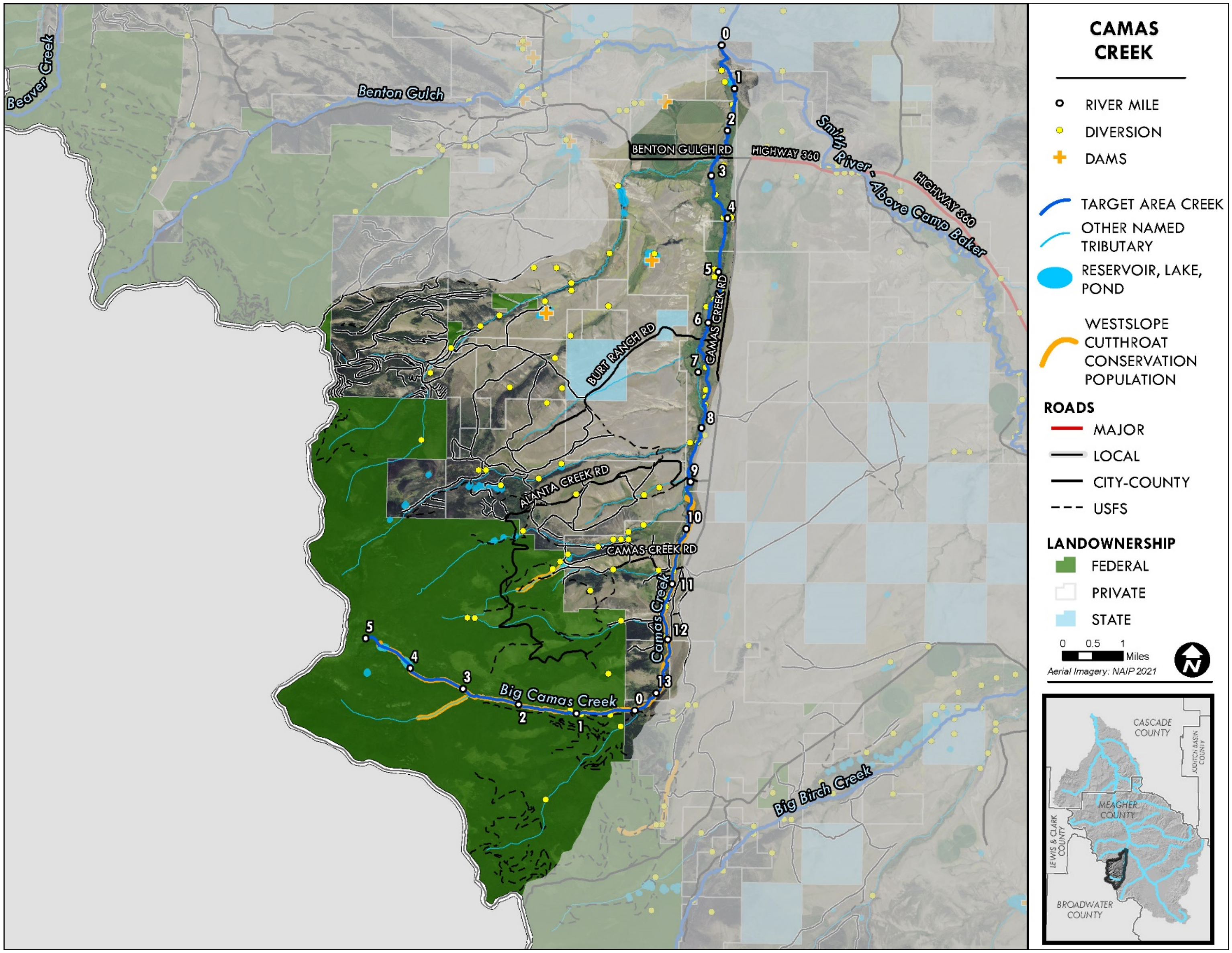


Figure 97. Camas Creek target area overview

Figure 98. Concentrated livestock use on Camas Creek.

Figure 99. Extensive irrigation and riparian floodplain conversion and loss of woody riparian vegetation on Camas Creek.

Figure 100. High turbidity at the mouth of Camas Creek, July 2023.

8.2.6.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Camas Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 3 (planning in progress).
- USFS grazing allotment management.
- Four MLR conservation easements including the confluence with the Smith River.
- DEQ/USGS ortho-phosphorous study (completed, awaiting publication).
- FWP Statewide Management Plan (2023) indicates the management direction for Camas Creek is to maintain westslope cutthroat trout conservation populations in Camas Lake and the Middle Fork Camas Creek.

8.2.6.3 Proposed Additional Restoration Actions

Restoration actions for Camas Creek include:

- Grazing management including development of off-site water and alternatives to concentrated livestock use along the stream.
- Irrigation efficiency projects.
- Create riparian buffers and increase woody riparian vegetation cover.
- Nutrient management through reducing streambank erosion, increasing floodplain connectivity and floodplain wetland area, reducing livestock overwintering on the stream and concentrated livestock use areas.
- Streambank restoration to reduce erosion and fine sediment inputs.
- Channel restoration to restore over-widened channel conditions.
- Floodplain reconnection to increase passive water storage.

8.2.6.4 Restoration Targets

Five-year restoration targets for Camas Creek are listed in Table 21. The remote assessment (Appendix B) indicated that 98 acres of the riparian buffer and 20.8 miles (109,850 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 48% of the riparian area. The assessment could not remotely discern the proportion of streambanks lacking expected riparian vegetation cover that are actively eroding but bank erosion was commonly observed during field reviews and conversion to introduced pasture grasses extensive. Water quality data for Camas Creek have shown high turbidity, E. coli and nutrients. Further, Camas Creek accounted for up to 25% of the phosphorous load upstream of Camp Baker, the largest contributor identified in the DEQ study. The sources of phosphorous are still being investigated and may include agriculture and grazing, erosion from the Woods Creek fire or natural sources. The Camas Creek is also listed as chronically dewatered by FWP.

Based on the available data and the results of the remote impact analysis, the highest priority restoration action for Camas Creek is to reduce fine sediment inputs to the stream to lower the amount of phosphorous entering the Smith River. This could be done by reducing bank erosion, improving riparian buffers, and removing corrals or other concentrated livestock use areas off the stream channel.

Table 21. Camas Creek 5-year restoration targets (2025-2030) to begin addressing resource issues.

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	98	Implement grazing BMPs or re-establish woody vegetation in 10% (9.8 acres) of riparian area
Streambanks with less than 25% cover (ft)	21	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks[1]
Nutrients	N/A	Investigate high phosphorous load (fire, land use, etc.)

[1]Not all streambanks with less than 25% cover have elevated rates of erosion and high priority eroding streambanks have not been determined for this area. High priority streambanks have erosion rates above natural levels that are contributing fine sediment to the stream.

8.2.7 *Benton Gulch*

Benton Gulch originates in the Big Belt Mountains and flows 13.0 miles to the Smith River (Figure 101). Because Benton Gulch was selected as a near-term focus area, additional remote assessment work was completed to quantify and determine the extent of degradational issues. The results of the remote assessment are provided in Appendix B.

Attribute	Value
Watershed Size	35,170 acres (55 sq mi)
Elevation Range	4,539-6,569 ft
Stream Miles	13.0
Land Ownership	**35,170 total acres**
Private	23,421 acres (67%)
State	1,921 acres (5%)
Federal	9,829 acres (28%)
Road Miles	**111 total miles**
City-County	20
Other	38
USFS	53
Number of Diversions	38
Number of Reservoirs	12

8.2.7.1 Primary Issues

The following are the main degradational issues identified for Benton Gulch:

- Loss of woody riparian vegetation. Remote assessment showed that 49% of the riparian buffer has less than 25% expected riparian vegetation cover (Figure 73) and 9% of the stream is channelized (Figure 70).
- Agricultural encroachment. Over 7,000 feet of channel (9%) flow directly through pivot irrigated hayfields with no woody riparian vegetation (Figure 104).
- Road encroachment in upper reaches. Remote assessment showed that 22% of the riparian buffer had roads present.
- Extreme channel incision from loss of woody riparian vegetation and channelization from road encroachment and agriculture (Figure 102). Remote assessment showed that 4% of the channel was incised.
- Livestock grazing. Remote assessment showed that 96% of the riparian buffer is grazed.
- Elevated turbidity from streambank erosion and irrigation return flows (Figure 103). A sediment plume into the river from Benton Gulch was also noted in the 2006 DNRC assessment.
- Elevated E.coli and nutrients from grazing and agriculture. Benton Gulch has historically had some of the highest E.coli levels in the basin.
- Elevated water temperature and low dissolved oxygen from decreased late season flows, removal of woody riparian vegetation.

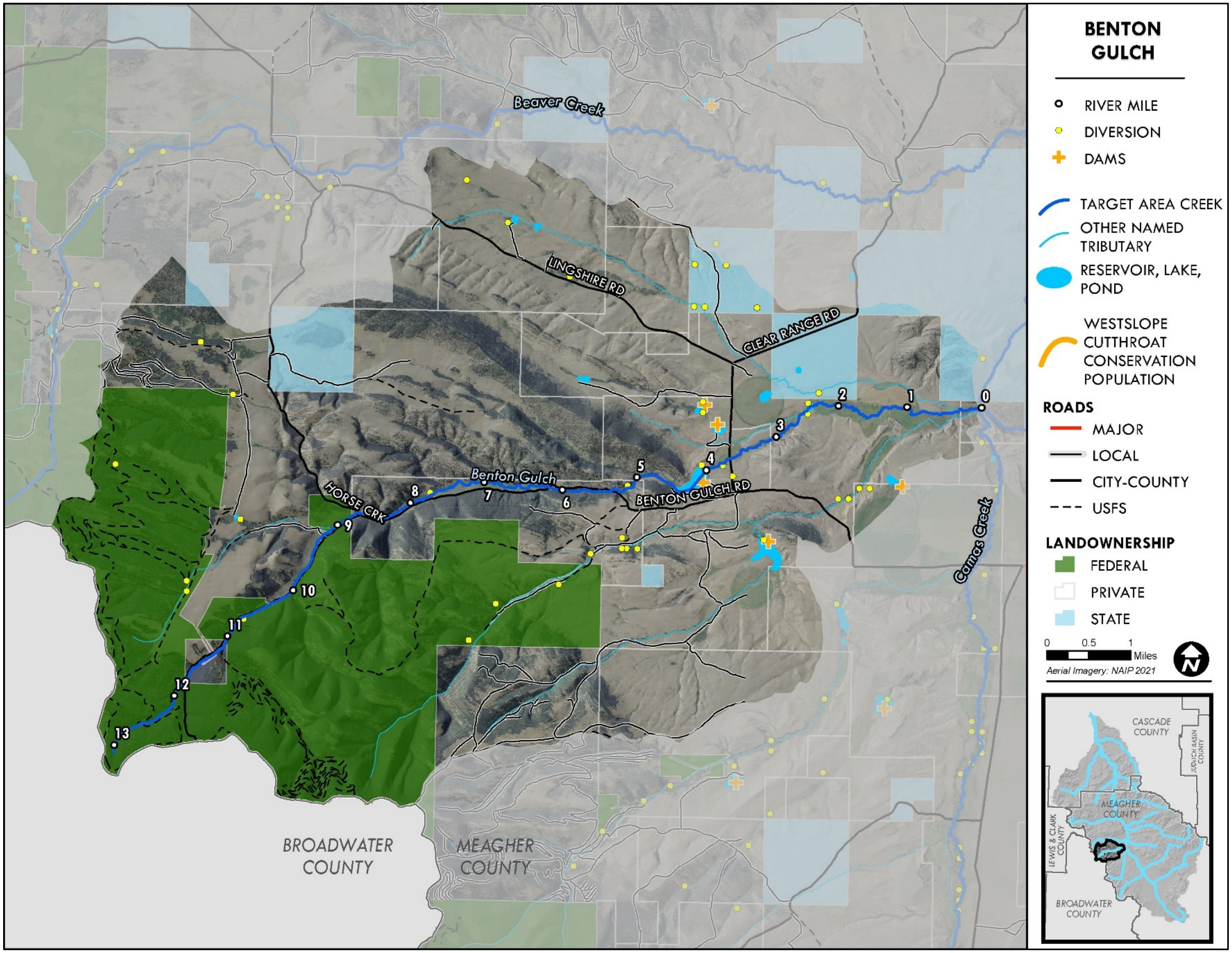


Figure 101. Benton Gulch target area overview.

Figure 102. Extreme channel incision due to removal of woody riparian vegetation and channelization in upper Benton Gulch (left photo) and lower Benton Gulch (right photo).

Figure 103. Benton Gulch turbidity, May 2024 (left photo) and June 2024 at mouth (right photo).

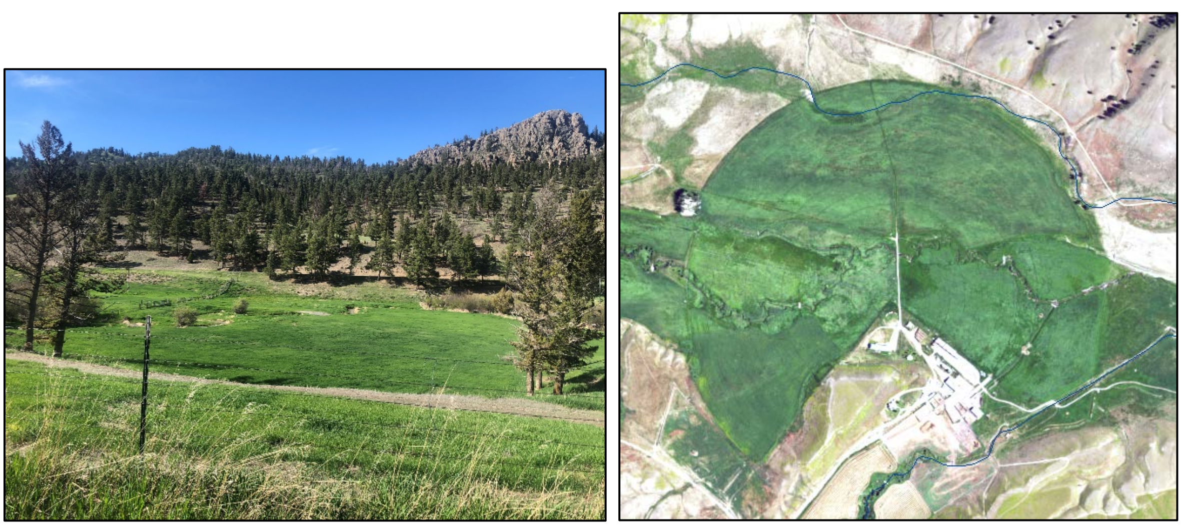


Figure 104. Loss of woody riparian vegetation and agriculture encroachment in upper Benton Gulch (left photo) and lower Benton Gulch (right photo).

8.2.7.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Benton Gulch include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 3 (planning in progress).
- USFS hazard fuel treatment, range improvement on grazing allotment, and noxious weed control (in progress).
- Six MLR conservation easements including the confluence with the Smith River.
- DEQ/USGS ortho-phosphorous study (completed, awaiting publication).
- Benton Gulch was not included in the FWP Statewide Management Plan (2023).

8.2.7.3 Proposed Additional Restoration Actions

Restoration actions for Benton Gulch include:

- Channel and streambank restoration to reduce erosion and fine sediment inputs.
- Floodplain reconnection/beaver habitat enhancement to increase passive water storage and create areas to store fine sediment loads to reduce turbidity.
- Create riparian buffers and increase woody riparian vegetation cover.
- Grazing management including development of off-site water and alternatives to concentrated livestock use and over-wintering areas along the stream.
- Irrigation efficiency projects.
- Nutrient management including review of fertilizer application rates and timing.
- Inventory and implement road BMPs on Benton Gulch Road in upper watershed.
- Investigate opportunities for water purchase and storage in private reservoirs to enhance late season flows in the Smith River.

8.2.7.4 Restoration Targets

Five-year restoration targets for Benton Gulch are listed in Table 22. The remote assessment (Appendix B) indicated that 45 acres of the riparian buffer and 15.2 miles (80,172 feet) of streambanks have less than 25% expected riparian vegetation cover. This represents 49% of the riparian area. The assessment could not remotely discern the proportion of streambanks lacking expected riparian vegetation cover that are actively eroding but bank erosion was commonly observed during field reviews. Water quality data for Benton Gulch have shown high turbidity, E. coli and nutrients. Further, Benton Gulch accounted for up to 5% of the phosphorous load upstream of Camp Baker, a fairly significant amount given its lower flow volume. Benton Gulch is also listed as chronically dewatered by FWP.

Based on the available data and the results of the remote impact analysis high priority actions for Benton Gulch include actions that reduce erosion, reduce channel incision, improve floodplain connectivity, and lower water temperatures, such as grazing management, road BMPs, streambank restoration and woody riparian vegetation.

Table 22. Benton Gulch 5-year restoration targets (2025-2030) to begin addressing resource issues

IMPACT CATEGORY	QUANTITY	RESTORATION TARGET (2025-2030)
Riparian buffers with less than 25% cover (ac)	45	Implement grazing BMPs or re-establish woody vegetation in 10% (4.5 acres) of riparian area
Streambanks with less than 25% cover (ft)	80,171	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks[1]
Road encroachment (ac)	21	Inventory road sediment issues
Channel incision (ft)	3,127	Implement actions to reduce active incision and work with landowners on long-term solutions

[1]Not all streambanks with less than 25% cover have elevated rates of erosion and high priority eroding streambanks have not been determined for this area. High priority streambanks have erosion rates above natural levels that are contributing fine sediment to the stream.

8.3 Long-term Target Area Results

Figure 68 and Figure 69 provide an overview of target areas. This section provides an overview of issues and restoration actions identified for long-term target areas. Table 23 provides an overview of issues identified in each area. Table 24 provides an overview of proposed restoration actions for each long-term target area. No restoration targets were developed for long-term target areas. The sections below describe the issues in each area, work currently ongoing in each area, and proposed additional restoration actions.

Table 23. Issues in long-term target areas.

Issue	Big Birch Creek	Whitetail Deer Creek	Beaver Creek	Sheep Creek	Eagle Creek	Rock Creek	Tenderfoot Creek	Trout Creek	Deep Creek	Hound Creek	Smith Below Eden	Ming Coulee
Water Quantity												
Reduced summer streamflow	√	√	√	√	√	√[1]	√[1]	√[1]	√[1]	√	√	√
Irrigation return flows	√	√	√	√	√	√		√		√	√	√
Irrigation infrastructure	√	√	√	√	√	√		√		√	√	√
Water Quality												
Temperature	√	√	√	√	√	√		√		√		√
Nutrients	√	√	√	√	√					√		
Sediment/Turbidity	√	√	√	√	√	√		√				√
E.coli	√	√	√	√		√		√		√	√	
Metals				√[1]								
Nuisance algae				√						√	√	
Riparian and Stream Habitat												
Agricultural encroachment	√	√	√	√	√	√		√		√	√	√
Channel incision/lost floodplain connectivity		√								√	√	√
Channelization				√						√		√
Floodplain conversion/ loss of woody vegetation	√	√	√	√	√	√		√		√	√	√
Bank erosion	√	√	√	√	√	√		√		√	√	√
Road encroachment				√			√			√		
Grazing	√	√	√	√	√	√	√	√	√	√	√	√
Altered forest condition/ conifer encroachment	√	√	√	√	√	√		√				
Floodplain dewatering	√		√	√	√	√				√		√
Recreation impacts							√					
Noxious weeds	√	√	√	√	√	√	√	√	√	√	√	

[1]Natural sources/causes

Table 24. Proposed restoration actions in long-term target areas.

Restoration Action	Big Birch Creek	Whitetail Deer Creek	Beaver Creek	Sheep Creek	Eagle Creek	Rock Creek	Tenderfoot Creek	Trout Creek	Deep Creek	Hound Creek	Smith River Below Eden Bridge	Ming Coulee
Improve Water Quantity[1]												
Irrigation efficiency improvements	√	√	√	√	√	√		√		√		√
Irrigation management alternatives	√	√		√	√	√		√		√		√
Active water storage	√	√	√	√	√	√		√		√		√
Passive water storage	√	√	√	√	√	√		√		√		√
Water lease/purchase	√	√	√	√	√	√		√		√	√	√
Re-evaluate minimum flow requirements	√			√	√	√		√		√	√	√
Alternative agricultural practices	√	√	√	√	√	√		√		√	√	√
Conifer encroachment removal	√			√		√		√				
Improve Water Quality[2]												
Riparian buffers	√	√	√	√	√	√		√		√	√	√
Restore floodplain connectivity	√	√	√	√	√	√		√		√	√	√
Filtration wetlands at irrigation return points	√	√								√		
Grazing management	√	√	√	√	√	√		√	√	√	√	√
Nutrient management	√	√	√	√						√	√	√
Road BMPs and decommissioning	√	√		√			√		√			
Recreation management							√					
Improve Riparian and Stream Habitat												
Streambank restoration	√	√	√	√	√	√		√		√	√	√
Channel restoration	√	√	√	√				√		√		√
Floodplain vegetation restoration	√	√	√	√	√	√		√		√	√	√
Preserve existing high quality habitat	√	√	√	√	√	√	√	√	√			
Improve forest stand health	√	√	√	√	√	√	√	√	√	√	√	√
Improve grassland health	√	√	√	√		√		√	√	√	√	√
Weed management	√	√	√	√	√	√	√	√	√	√	√	√

[1]All actions that improve water quantity will benefit water quality and riparian and aquatic habitat.

[2]All actions that benefit water quantity and water quality will improve riparian and aquatic habitat.

8.3.1 Smith River Downstream of Eden Bridge

The mainstem Smith River between Eden Bridge and its confluence with the Missouri River is 22.4 miles in length (Figure 105).

Attribute	Value
Watershed Size	4,629 acres (7.2 sq mi)
Elevation Range	3,328-3,447 ft
Stream Miles	22.4
Land Ownership	**102,128 total acres**
Private	4,312 acres (93%)
State	318 acres (7%)
Federal	0 acres (0%)
Road Miles	**77 total miles**
City-County	53
USFS	0
Other	24
Number of Diversions	19
Number of Reservoirs	109

Includes Smith River and adjacent floodplain and watershed area not accounted for by target area tributaries

8.3.1.1 Primary Issues

The following are the main degradational issues identified for the mainstem Smith River from Eden Bridge to the confluence with the Missouri River:

- Low late season flows. Irrigation withdrawals increase in this reach. This reach of the Smith River is listed for chronic dewatering by FWP.
- Agricultural encroachment.
- Road and bridge encroachment.
- Floodplain conversion for agriculture and loss of woody riparian vegetation (Figure 106).
- Grazing with some areas of concentrated livestock use.
- Channel entrenchment and incision characterizes the entire length of this reach from lost floodplain connectivity, agriculture and streambank stabilization.
- Streambank erosion and extensive streambank stabilization.
- Erosion and sedimentation from removal of woody riparian vegetation, grazing and agricultural encroachment.
- Elevated water temperatures are common late in the season.
- Nutrient levels and stream temperatures elevated to level that supports nuisance algae.

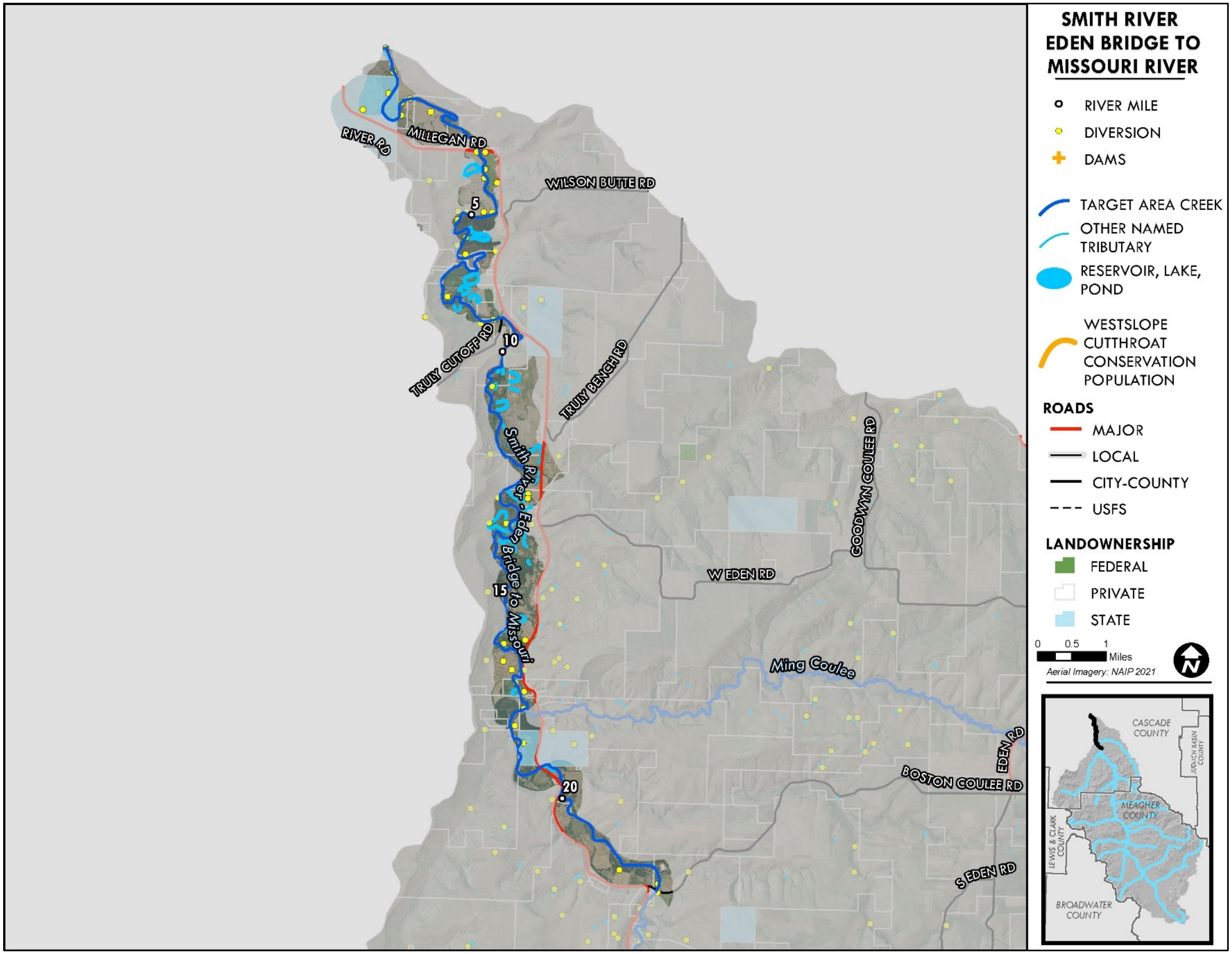


Figure 105. Smith River downstream of Eden Bridge target area overview.

Figure 106. Floodplain conversion and channelization of the Smith River downstream of Eden Bridge.

8.3.1.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for the Smith River downstream of Eden Bridge include:

- Noxious weed management completed by SRHP.
- FWP Statewide Management Plan (2023) indicates the management direction for the Smith River downstream of Hound Creek is to maintain populations within historic levels providing a recreational fishery and identified the following habitat needs and activities:
    - Maintain habitat and instream flow of 80 cfs.

8.3.1.3 Proposed Additional Restoration Actions

Restoration actions for the mainstem Smith River from Eden Bridge to the confluence with the Missouri River include:

- Grazing management including off site water development, riparian fencing, or reducing concentrated livestock areas.
- Riparian buffers and woody riparian vegetation expansion, particularly between hay fields and the river.
- Nutrient management through reducing streambank erosion and increasing floodplain connectivity and floodplain wetland area.
- Floodplain reconnection to increase floodplain water retention.
- Increase area of floodplain wetlands at irrigation return flows to reduce nutrient and sediment inputs.
- Irrigation efficiency projects.
- Streambank restoration to reduce erosion and fine sediment inputs and potentially replace riprap.

8.3.2 *Whitetail Deer Creek*

Attribute	Value
Watershed Size	23,089 acres (36.1 sq mi)
Elevation Range	4,471-6,412 ft
Stream Miles	13.2
Land Ownership	**23,088 total acres**
Private	15,249 acres (66%)
State	3,137 acres (14%)
Federal	4,702 acres (20%)
Road Miles	**25.7 total miles**
City-County	9.6
Local Access	0.6
USFS	15.5
Number of Diversions	13
Number of Reservoirs	2

Whitetail Deer Creek originates in the Little Belt Mountains and flows 13.2 miles to the Smith River. (Figure 107).

8.3.2.1 Primary Issues

The following are the main degradational issues identified for Whitetail Deer Creek:

- Loss of woody riparian vegetation.
- Agricultural encroachment (Figure 108).
- Channel incision from loss of woody riparian vegetation, Camp Baker Road, and agriculture and grazing (Figure 109).
- Livestock grazing (Figure 109).
- Elevated turbidity and nutrients from streambank erosion, grazing and agriculture (Figure 110).

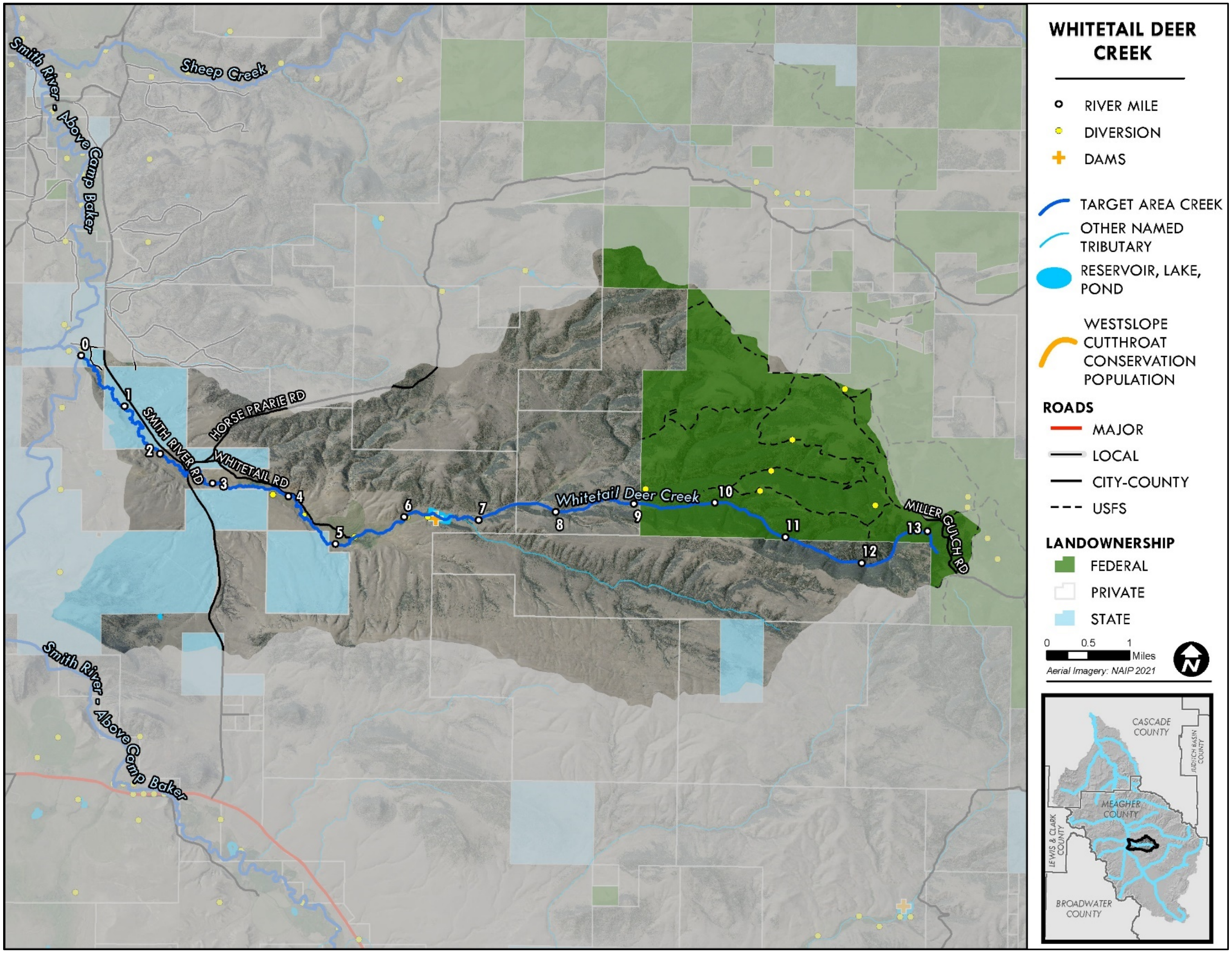


Figure 107. Whitetail Creek target area overview.

Figure 108. Whitetail Deer Creek at mouth. Right photo shows fenceline contrast between private (grazed) and state (ungrazed) property.

Figure 109. Channel incision and loss of woody riparian vegetation along Whitetail Deer Creek.

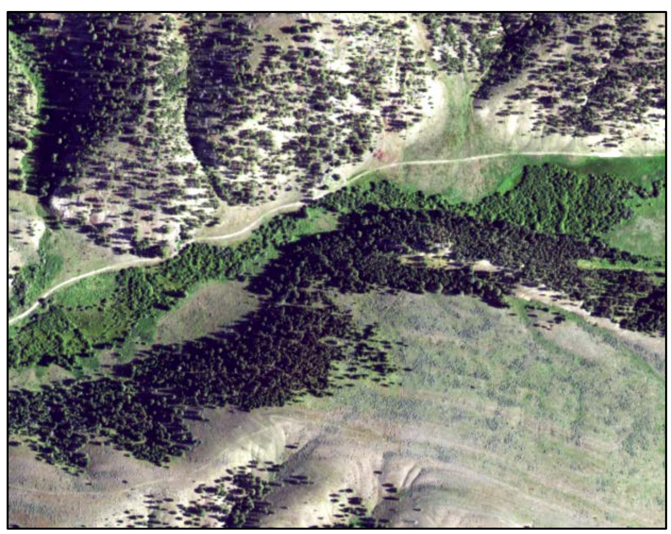


Figure 110. Agricultural encroachment on Whitetail Deer Creek (photo left) and intact riparian vegetation in upper watershed (photo right).

8.3.2.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Whitetail Deer Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 1 (in progress).
- USFS projects including forest stand improvement, range management (conifer encroachment removal), and noxious weed control (in progress).
- One MLR conservation easement.
- Not included in FWP Statewide Management Plan (2023).

8.3.2.3 Proposed Additional Restoration Actions

Restoration actions for Whitetail Deer Creek include:

- Channel and streambank restoration to reduce erosion and fine sediment inputs.
- Irrigation efficiency projects.
- Grazing management including development of off-site water and alternatives to concentrated livestock use and over-wintering areas along the stream.
- Create riparian buffers and increase woody riparian vegetation cover.
- Nutrient management including fertilizer application rates and timing.
- Investigate opportunities for water purchase and storage in private reservoirs to enhance late season flows in the Smith River.
- Conservation protections to protect existing high quality areas such as riparian areas with dense cover of woody riparian vegetation (Figure 110).

8.3.3 Beaver Creek

Beaver Creek originates in the Big Belt Mountains and flows 19.4 miles before joining the Smith River (Figure 111).

Attribute	Value
Watershed Size	31,124 acres (48.6 sq mi)
Elevation Range	4,464-6,485 ft
Stream Miles	19.4
Land Ownership	**31,124 total acres**
Private	21,323 acres (69%)
State	3,712 acres (12%)
Federal	6,089 acres (20%)
Road Miles	**98 total miles**
City-County	11
Other	47
USFS	40
Number of Diversions	25
Number of Reservoirs	12

8.3.3.1 Primary Issues

The following are the main degradational issues identified for Beaver Creek:

- Loss of woody riparian vegetation in upper watershed, lower watershed has extensive areas of intact riparian vegetation (Figure 112).
- Dewatering, low late season flows.
- Livestock grazing.
- Elevated turbidity and nutrients from streambank erosion, grazing and agriculture (Figure 113). Beaver Creek contributes 0.7% of the total phosphorous load at Camp Baker, the least of any tributary sampled.

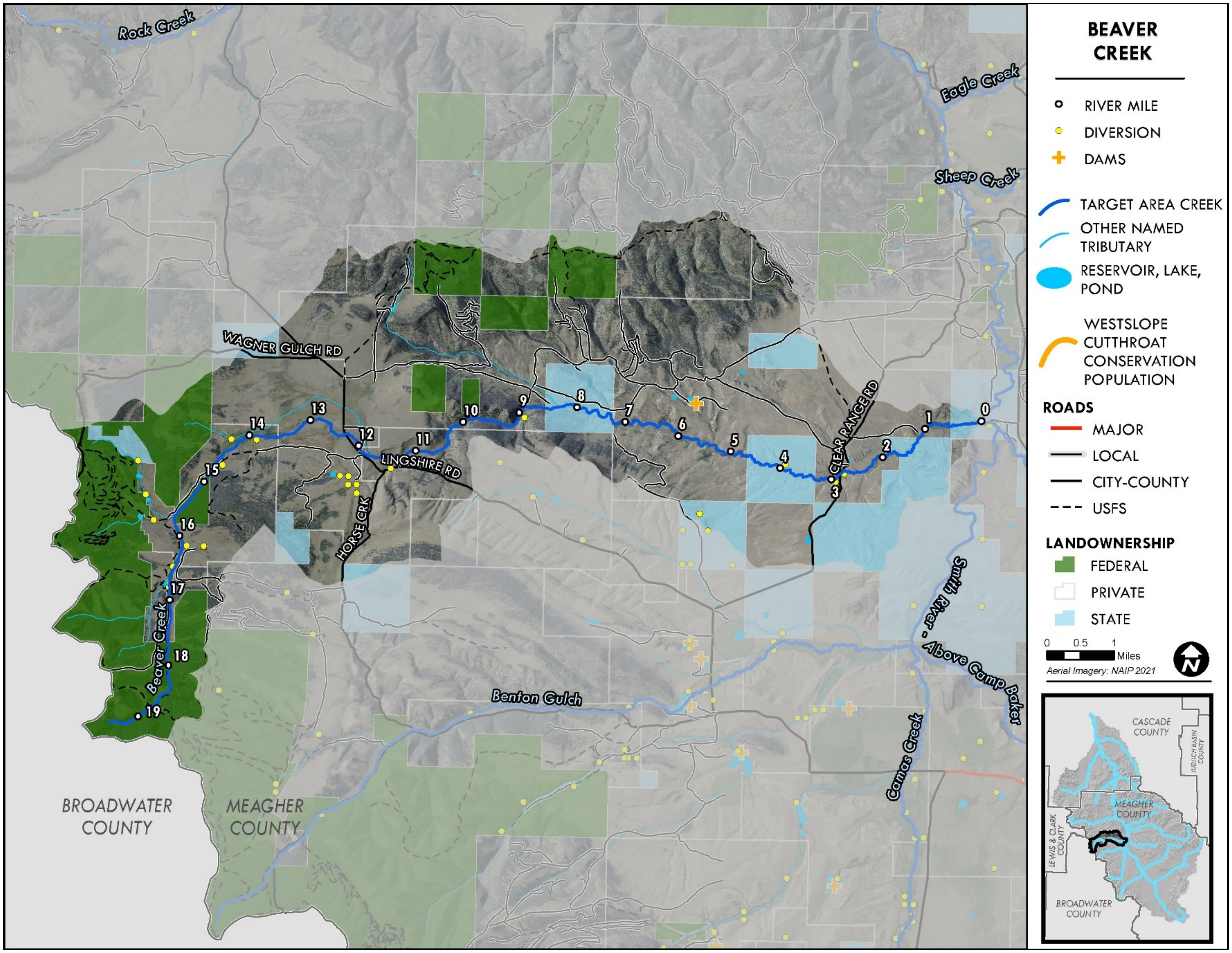


Figure 111. Beaver Creek target area overview.

Figure 112. Beaver Creek at Lingshire Road.

Figure 113. Beaver Creek at mouth.

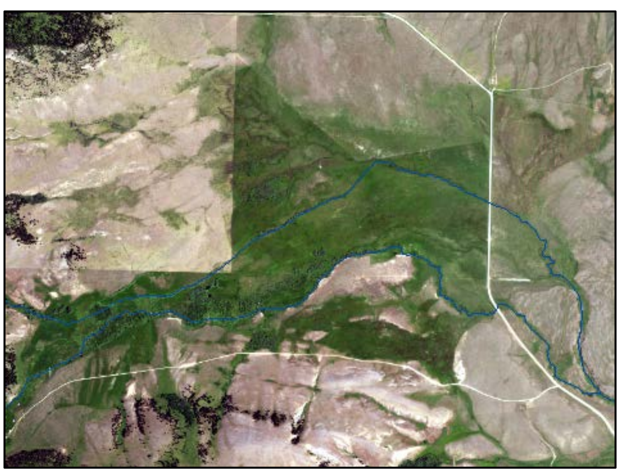


Figure 114. Large slope wetland on Beaver Creek upstream of Lingshire Road.

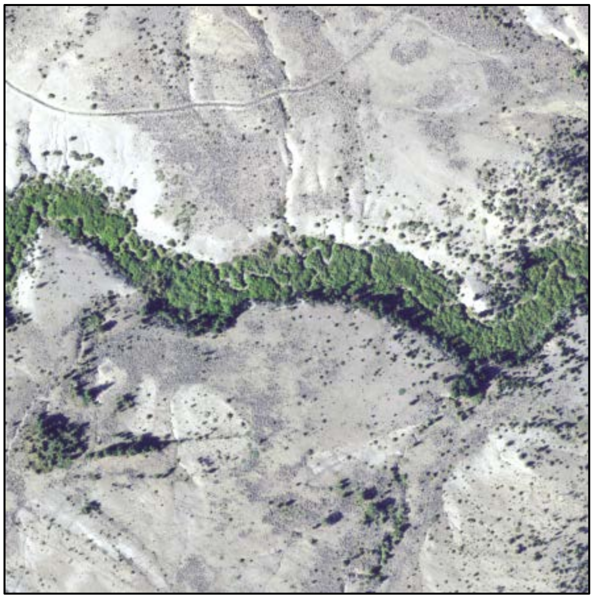


Figure 115. Dense stands of intact woody riparian vegetation on lower Beaver Creek.

8.3.3.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Beaver Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 3 (in progress).
- DEQ/USGS ortho-phosphorous study (completed, awaiting publication).
- USFS rearrangement of fuels, hazard fuel management and noxious weed management.
- USFS past timber harvest.
- BLM grazing allotment monitoring.
- Not included in FWP Statewide Management Plan (2023).

8.3.3.3 Proposed Additional Restoration Actions

Restoration actions for Beaver Creek include:

- Potential restoration opportunities at large slope wetland near Lingshire Road crossing (Figure 114).
- Conservation of existing high quality intact riparian and aquatic habitat (Figure 115).
- Grazing management including fencing and development of off-site water.
- Create riparian buffers and increase woody riparian vegetation cover.

8.3.4 *Big Birch Creek*

Big Birch Creek originates in the Big Belt Mountains at Gipsy Lake and flows 16.1 miles before entering the Smith River (Figure 116).

Attribute	Value
Watershed Size	29,527 acres (46 sq mi)
Elevation Range	4,802-8,519 ft
Stream Miles	16.1
Land Ownership	**29,527 total acres**
Private	16,088 acres (54%)
State	2,324 acres (8%)
Federal	11,116 acres (38%)
Road Miles	**55 total miles**
City-County	14
Other	31
USFS	10
Number of Diversions	31
Number of Reservoirs	115

8.3.4.1 Primary Issues

The following are the main degradational issues identified for Big Birch Creek:

- Agricultural encroachment.
- Woody riparian vegetation loss (Figure 118).
- Low late season flows from irrigation withdrawals, floodplain ditching and dewatering. Big Birch Creek is s listed for chronic dewatering by FWP.
- Grazing including concentrated livestock use areas along the stream (Figure 117).
- Erosion and sedimentation from removal of woody riparian vegetation (Figure 119) and road erosion in the upper watershed.
- Elevated nutrients from livestock grazing and agriculture.

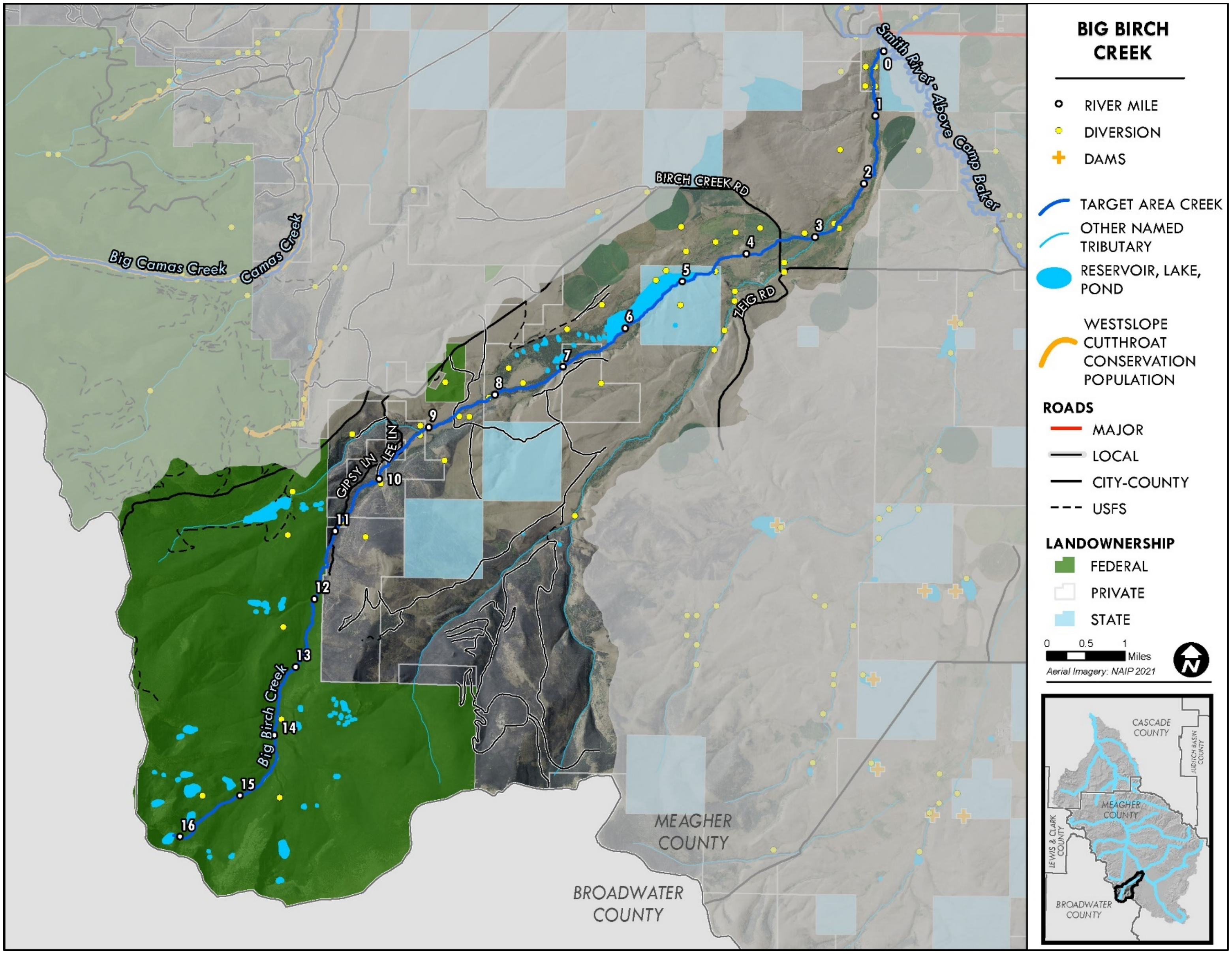


Figure 116. Big Birch Creek target area overview.

Figure 117. Concentrated livestock use area along Big Birch Creek.

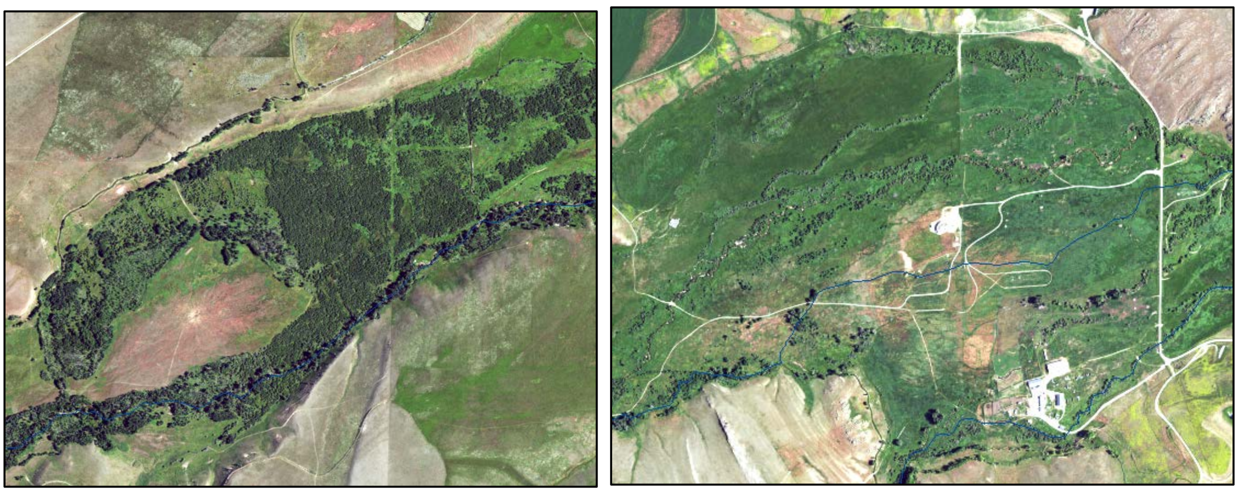


Figure 118. Broad valley bottoms along Big Birch Creek with high cover of woody vegetation (left) and low cover of woody vegetation (right).

Figure 119. Big Birch Creek near mouth.

8.3.4.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Big Birch Creek include:

- USFS hazard fuel reduction treatments.
- USFS integrated resource restoration and noxious weed management.
- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 3 area (in progress).
- BLM grazing allotment monitoring.
- One MLR conservation easement.
- FWP Statewide Management Plan (2023) indicates the management direction for Big Birch Creek is to maintain resident and Smith River spawning populations and identifies the following habitat needs and activities:
    - Maintain habitat and instream flows of 11 cfs.

8.3.4.3 Proposed Additional Restoration Actions

Restoration actions for Big Birch Creek include:

- Grazing management including development of off-site water and riparian fencing.
- Remove pastures and concentrated livestock areas off the stream.
- Create riparian buffers and increase woody riparian vegetation cover.
- Streambank restoration to reduce accelerated erosion and increase woody riparian vegetation cover.
- Channel restoration to improve habitat for resident trout populations and Smith River spawning trout populations.
- Irrigation efficiency projects including potential ditch consolidation or decommissioning.
- Investigate opportunities for water purchase and storage in private reservoirs to enhance late season flows in the Smith River.
- Conservation protections to protect existing high quality condition such as large intact stands of woody riparian vegetation and evaluate potential restoration to reconnect and enhance these areas (Figure 118).

8.3.6 Sheep Creek

Attribute	Value
Watershed Size	124,449 acres (195 sq mi)
Elevation Range	4,425-7,413 ft
Stream Miles	36.6
Land Ownership	**124,449 total acres**
Private	38,500 acres (31%)
State	199 acres (1%)
Federal	85,750 acres (68%)
Road Miles	**247 total miles**
City-County	59
Other	19
USFS	169
Number of Diversions	47
Number of Reservoirs	18

Sheep Creek originates in the Big Belt Mountains and flows 36.6 miles before joining the Smith River (Figure 120).

8.3.6.1 Primary Issues

As described in Section 4.5, the proposed Black Butte copper mining operation in the Sheep Creek watershed is currently undergoing continued technical evaluations and legal approvals. As a result, water quality and water quantity issues that may be introduced or exacerbated by the mine are uncertain and complex. However, there are still degradational issues that can be addressed regardless of the future of the proposed mine.

The following are the main degradational issues identified for Sheep Creek:

- Agricultural encroachment.
- Woody riparian vegetation loss (Figure 122 and Figure 126).
- Erosion and sedimentation from removal of woody riparian vegetation.
- Channelization from agriculture.
- Irrigation withdrawals, floodplain ditching and dewatering including a large transbasin diversion that dewaters Sheep Creek for a short distance downstream (Figure 121).
- Dewatering. Sheep Creek is listed for chronic dewatering by FWP and 2022 streamflows recorded as part of on-going monitoring in the watershed were the lowest reported in 9 years of data (Stagliano, 2023).
- Grazing with some areas of concentrated livestock use.
- Elevated nutrients and E. coli from livestock grazing and agriculture.
- Potential Black Butte copper mine effects on water quality and quantity.

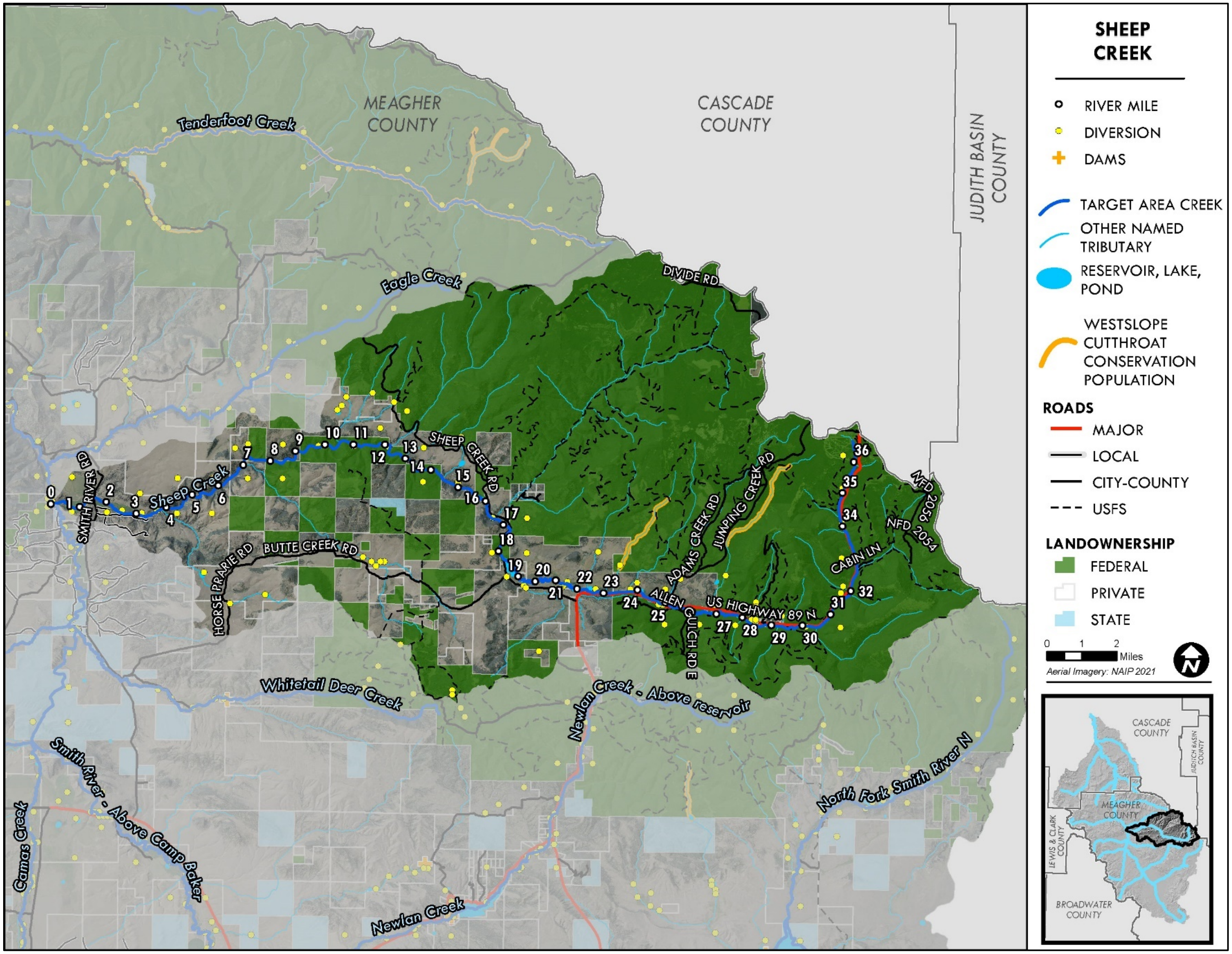


Figure 120. Sheep Creek target area overview


Figure 121. Holmstrom Diversion on Sheep Creek (left photo) and Holmstrom Ditch (right photo).


Figure 122. Sheep Creek upper watershed.


Figure 123. Lower Sheep Creek.


Figure 124. Mouth of Sheep Creek at Smith River.

Figure 125. Sheep Creek instream habitat project.

8.3.6.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Sheep Creek include:

- USFS WRAP for Upper Sheep Creek including Jumping Creek, Adams Creek and headwaters of Sheep Creek. Actions include road decommissioning, AOP culverts, riparian exclosures, etc.
- Future Fisheries riparian fencing project.
- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 1 (in progress).
- USFS Horsefly Vegetation Project.
- USFS instream habitat project (Figure 125).
- BLM grazing allotment monitoring.
- One MLR conservation easement.
- FWP Statewide Management Plan (2023) indicates the management direction for Sheep Creek is to maintain resident and Smith River spawning populations and identifies the following habitat needs and activities:
    - Maintain habitat and instream flows of 35 cfs.

  - Monitor developments and activity associated with the approved mine, including monitoring activities.
- There are conservation populations of westslope cutthroat trout in the Sheep Creek watershed in Daniels Creek and Jumping Creek and FWP is implementing projects to maintain or enhance these populations.

8.3.6.3 Proposed Additional Restoration Actions

Restoration actions for Sheep Creek include:

- High priority for preservation as it provides a lot of cold, clean water and is a rainbow and brown trout spawning tributary.
- Address dewatering downstream of Holmstrom Ditch.
- Grazing management including development of off-site water, riparian fencing and reducing concentrated livestock use areas.
- Riparian buffers and woody riparian vegetation expansion.
- Irrigation efficiency projects.
- Streambank restoration to reduce erosion and increase woody riparian vegetation cover.
- Protect conservation populations of westslope cutthroat trout.

8.3.7 Eagle Creek

Eagle Creek originates in the Little Belt Mountains and flows 13.9 miles before joining the Smith River just below Camp Baker (Figure 128).

Attribute	Value
Watershed Size	27,577 ac (43 sq mi)
Elevation Range	4,358-7,134 ft
Stream Miles	13.9
Land Ownership	**27,577 total acres**
Private	16,867 acres (61%)
State	639 acres (2%)
Federal	10,071 acres (37%)
Road Miles	**30 total miles**
City-County	23
Local Access	3
USFS	4
Number of Diversions	17
Number of Reservoirs	7

8.3.7.1 Primary Issues

The following are the main degradational issues identified for Eagle Creek:

- Loss of woody riparian vegetation.
- Agricultural encroachment and water diversion (Figure 126).
- Grazing.
- No known water quality issues. Eagle Creek had low temperatures and TDS in June 2023 (Figure 127).

Figure 126. Diversions for water storage ponds on Eagle Creek.

Figure 127. Mouth of Eagle Creek.

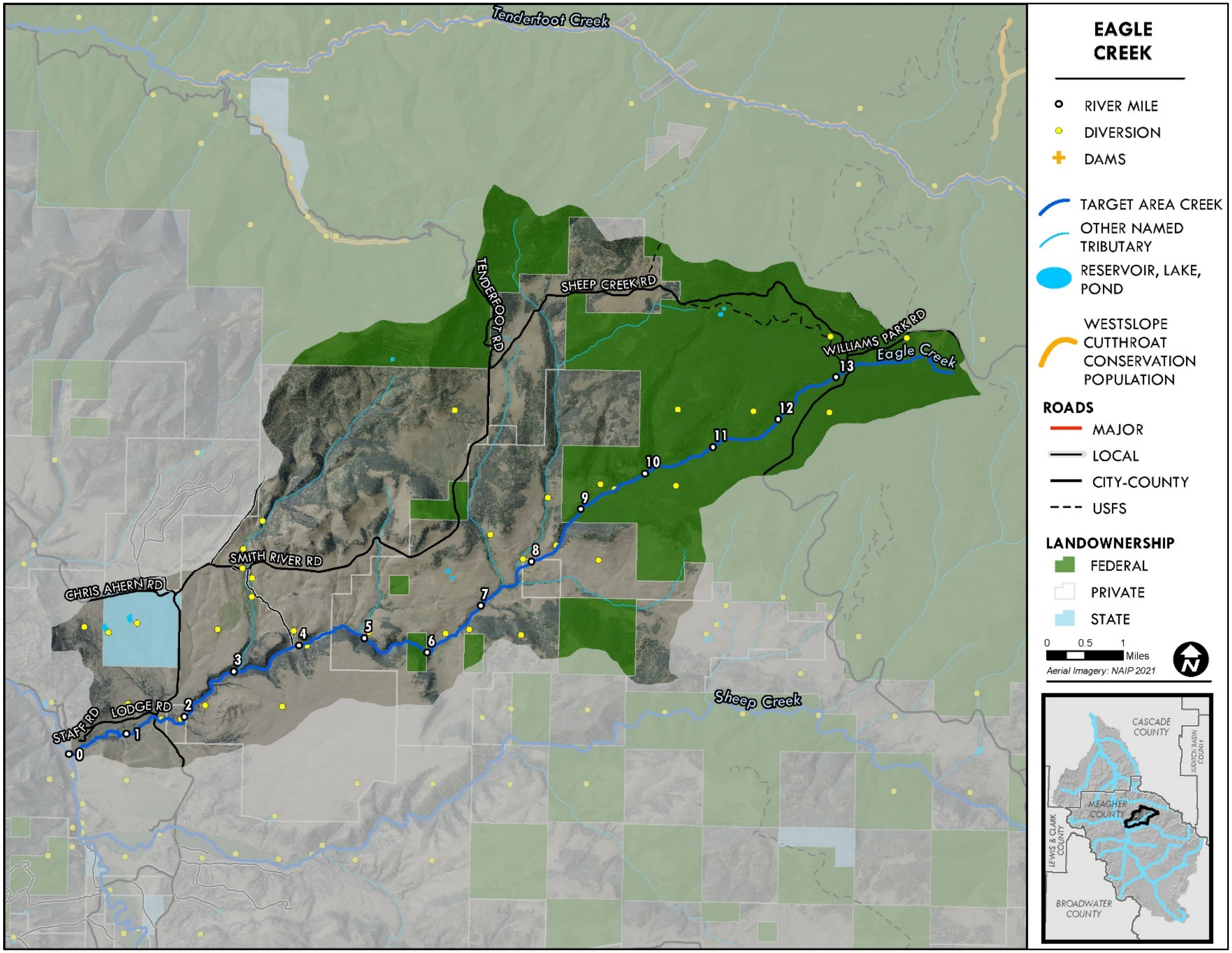


Figure 128. Eagle Creek target area overview.

8.3.7.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Eagle Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 1 (in progress).
- USFS noxious weed control.
- BLM grazing allotment monitoring.
- Not included in FWP Statewide Management Plan (2023).

8.3.7.3 Proposed Additional Restoration Actions

Restoration actions for Eagle Creek include:

- Grazing management including fencing and development of off-site water.
- Create riparian buffers and increase woody riparian vegetation cover.
- Irrigation efficiency projects.

8.3.8 Rock Creek

Rock Creek originates in the Big Belt Mountains and flows 22.8 miles before joining the Smith River (Figure 129).

Attribute	Value
Watershed Size	94,089 acres (147 sq mi)
Elevation Range	4,248-6,427 ft
Stream Miles	22.8
Land Ownership	**94,089 total acres**
Private	82,455 acres (88%)
State	1,375 acres (2%)
Federal	10,259 acres (10%)
Road Miles	**215 total miles**
City County	19
Other	152
USFS	44
Number of Diversions	21
Number of Reservoirs	25

8.3.8.1 Primary Issues

The following are the main degradational issues identified for Rock Creek:

- Loss of woody riparian vegetation (Figure 131).
- Grazing including pens and corrals on channel (Figure 133).
- Agricultural encroachment (Figure 131).
- Erosion and sedimentation from removal of woody riparian vegetation (Figure 132).
- Local access road encroachment lower several miles (Figure 134).
- Rock Creek has sections that dewater due to natural causes but is not listed by FWP as having dewatering issues.
- No known water quality issues. In June 2023, Rock Creek water temperature was 51.8 degrees F and TDS was 150 mg/L (conductivity 300 µS/c) which is relatively high.

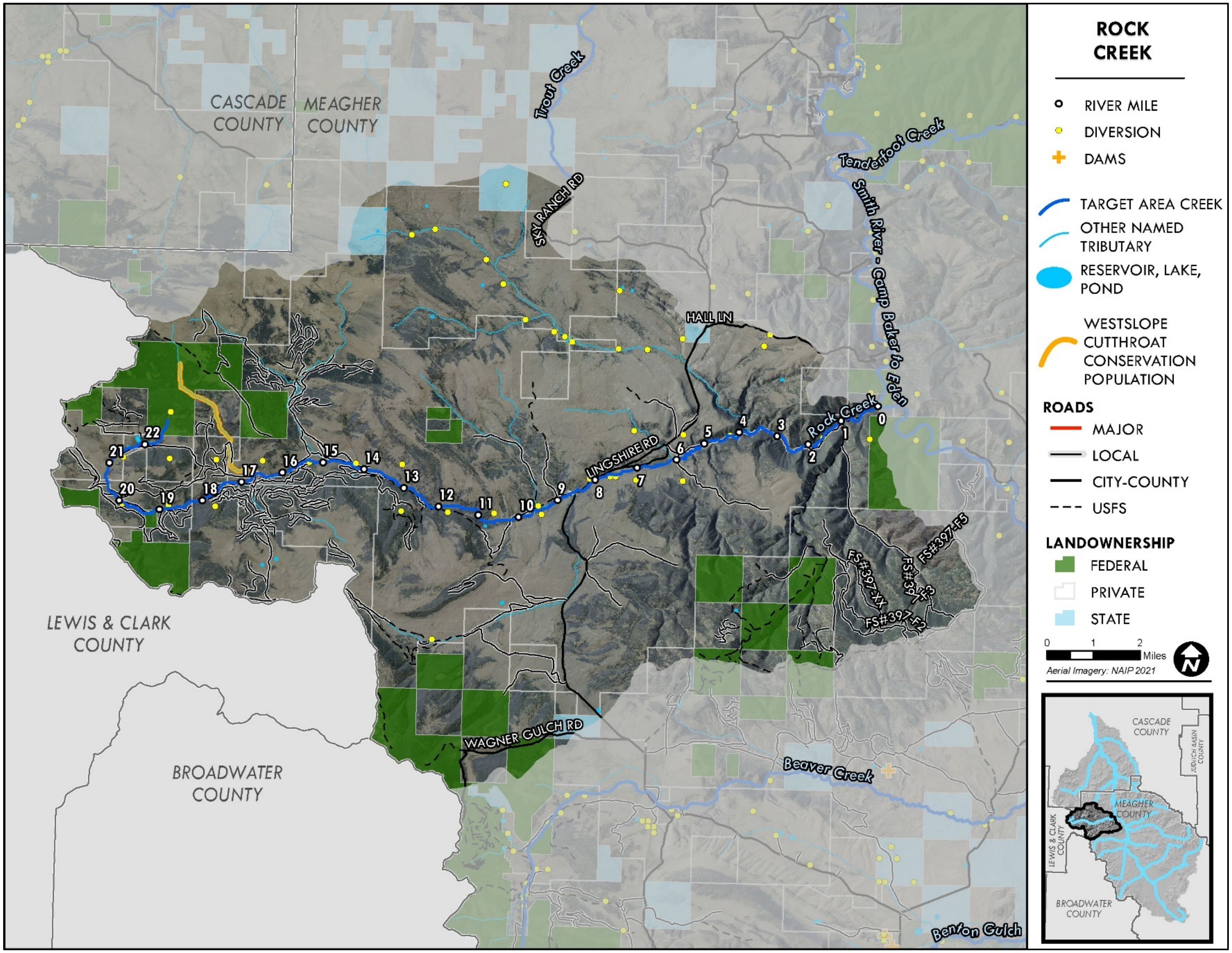


Figure 129. Rock Creek target area overview.

Figure 130. Mouth of Rock Creek at Smith River.

Figure 131. Looking across Rock Creek valley from Lingshire Road.

Figure 132. Rock Creek adjacent to Lingshire Road (left photo) and immediately downstream of Lingshire Road (photo right).

Figure 133. Rock Creek loss of woody riparian vegetation, channelization and concentrated livestock use area on stream.

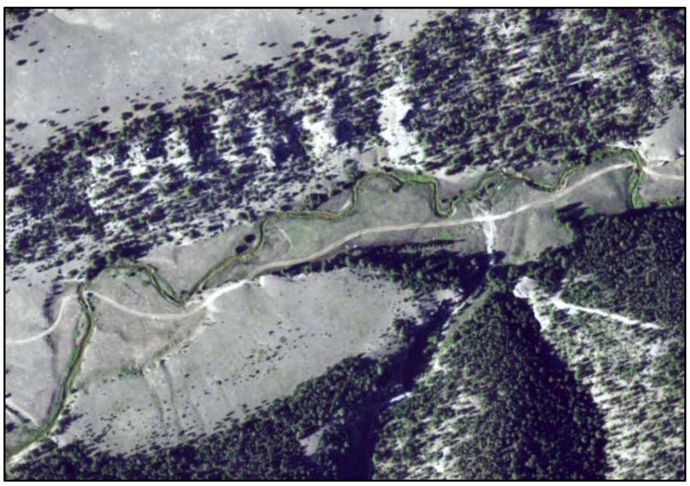


Figure 134. Private access road with several stream crossings on lower Rock Creek.

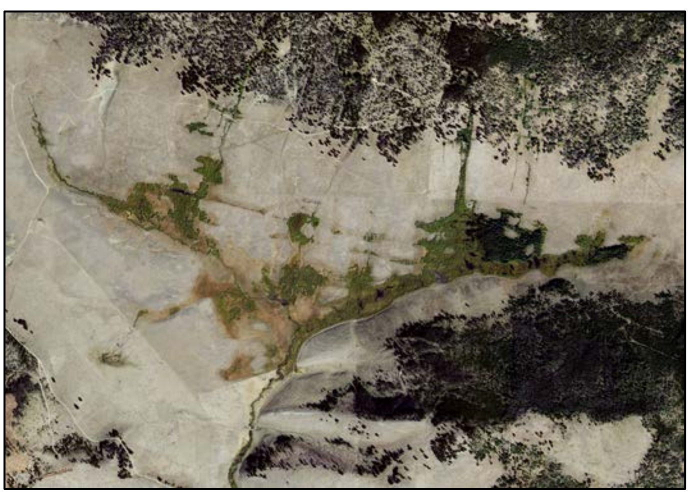


Figure 135. Headwater slope wetland on Rock Creek.

8.3.8.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Rock Creek include:

- A portion of the watershed is included in the NRCS *Improving Grazing Land Health in the Smith River Valley* TIP Phase 2 (in progress).
- USFS range cover manipulation, fencing, fuels management and noxious weed control.
- BLM grazing allotment monitoring.
- FWP Statewide Management Plan (2023) indicates the management direction for Rock Creek is to maintain populations within historic levels providing for recreational use and identified the following habitat needs and activities:
    - Maintain habitat and instream flows of 11 cfs.

8.3.8.3 Proposed Additional Restoration Actions

Restoration actions for Rock Creek include:

- High priority for preservation and restoration as it provides a lot of relatively clean, cold water to the Smith River and is a brown trout spawning tributary (Figure 130).
- Grazing management including fencing and development of off-site water.
- Reduce road erosion along Lingshire Road and local access road (Figure 132, Figure 134).
- Headwater slope wetland restoration potential (Figure 135).
- Protect conservation populations of westslope cutthroat trout (French Creek).

8.3.9 Tenderfoot Creek

Tenderfoot Creek originates in the Little Belt Mountains and flows 25.9 miles before joining the Smith River (Figure 136).

Attribute	Value
Watershed Size	69,645 acres (109 sq mi)
Elevation Range	4,106-7,435 ft
Stream Miles	25.9
Land Ownership	**69,645 total acres**
Private	3,434 acres (5%)
State	397 acres (1%)
Federal	65,813 acres (94%)
Road Miles	**67 total miles**
City-County	28
Other	0
USFS	39
Number of Diversions	15
Number of Reservoirs	3

8.3.9.1 Primary Issues

The following are the main degradational issues identified for Tenderfoot Creek:

- Public use for fishing is increasing causing some degradation.
- USFS grazing allotments.
- Past timber harvest.
- Road erosion.
- No consumptive water use but naturally dewatered sections of channel and natural fish barriers.
- In June 2023, Tenderfoot Creek water temperature was 46.0 degrees F, the coldest of all streams measured. TDS was 50 mg/L (conductivity 100 µS/c), the lowest of all streams measured. Estimated flows were 100 cfs. Tenderfoot Creek provides clean, cold water to the Smith River and is an important trout spawning tributary (Figure 137).

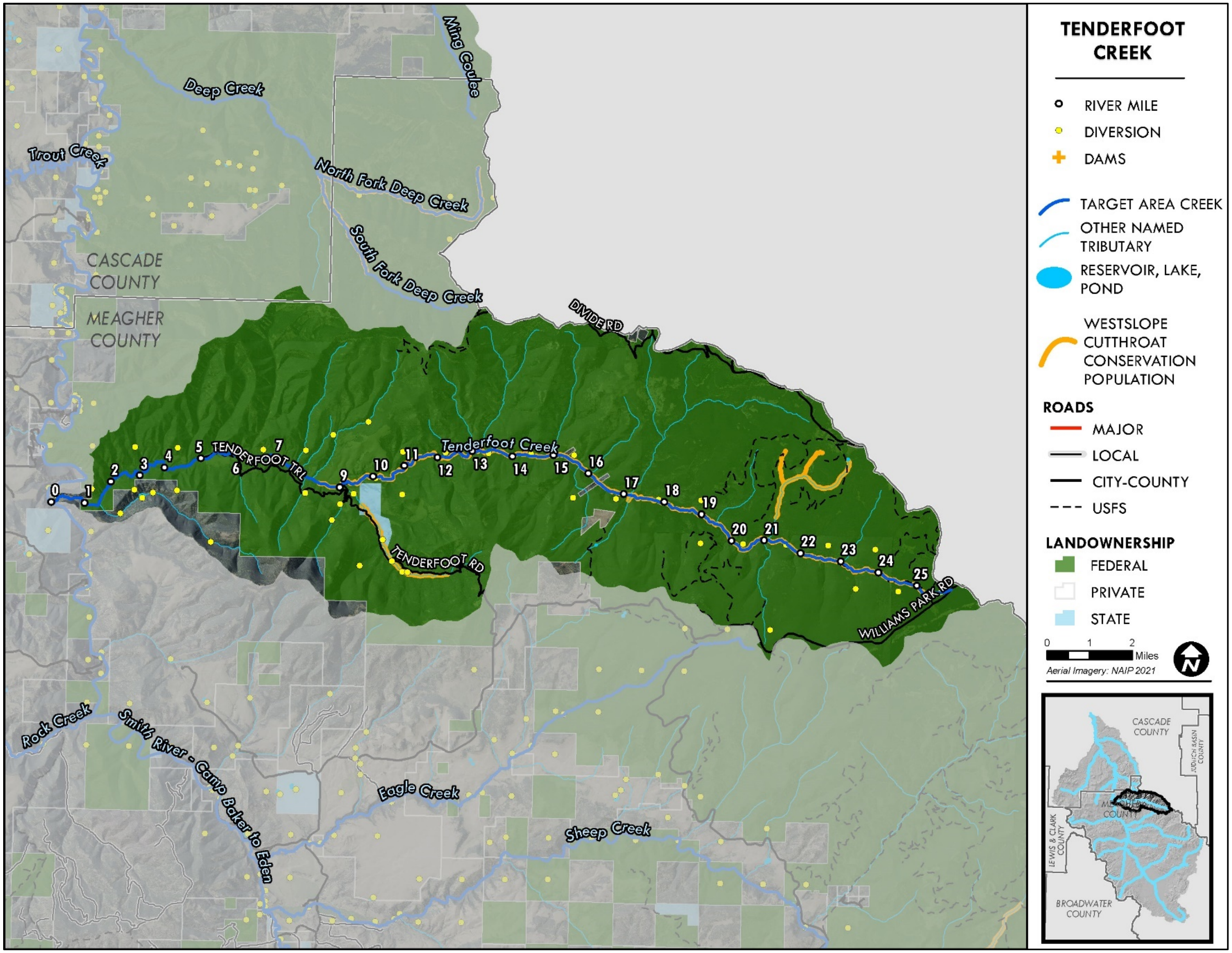


Figure 136. Tenderfoot Creek target area overview.

Figure 137. Tenderfoot Creek mouth at Smith River.

8.3.9.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Tenderfoot Creek include:

- USFS range improvements within grazing allotments.
- USFS noxious weed control
- Tenderfoot Creek Experimental Forest.
- Onion Creek Research Natural Area.
- FWP Statewide Management Plan (2023) indicates the management direction for Tenderfoot Creek is to maintain resident and Smith River spawning populations with the following habitat needs and activities identified:
    - Maintain habitat and instream flows of 15 cfs.

8.3.9.3 Proposed Additional Restoration Actions

Restoration actions for Tenderfoot Creek include:

- High priority for preservation as it provides a lot of cold, clean water to the Smith River and is a rainbow trout spawning tributary.
- Address road sediment issues.
- Support efforts for USFS to purchase Bair Ranch Foundation properties in the drainage
- Protect conservation populations of westslope cutthroat trout in Iron Mines Creek, South Fork Tenderfoot Creek and Urvi Creek.

8.3.10 Trout Creek

Trout Creek originates in the Big Belt Mountains and flows 17.2 miles before joining the Smith River (Figure 138).

Attribute	Value
Watershed Size	21,267 acres (33 sq mi)
Elevation Range	4,900 – 7,120 ft
Stream Miles	17.2 miles
Land Ownership	**21,267 total acres**
Private	18,972 acres (89%)
State	2,266 acres (11%)
Federal	29 acres (0%)
Road Miles	**96 total miles**
City-County	9
Other	0
USFS	10
Number of Diversions	17
Number of Reservoirs	13

8.3.10.1 Primary Issues

The following are the main degradational issues identified for Trout Creek:

- Livestock grazing (Figure 139).
- Loss of woody riparian vegetation (Figure 140).
- Agricultural encroachment.
- Channel incision and erosion from loss of woody riparian vegetation, agriculture and grazing.
- Dewatering from irrigation withdrawals and natural causes through canyon section.
- In June 2023, Trout Creek water temperature was 62 degrees F which was the highest of all streams measured during the float. Temperature measured by DEQ in June 1999 was 68 degrees F. In June 2023, TDS was 250 mg/L (conductivity 390 µS/c) which is relatively high. Figure 141 shows the confluence of Trout Creek in June 2023.

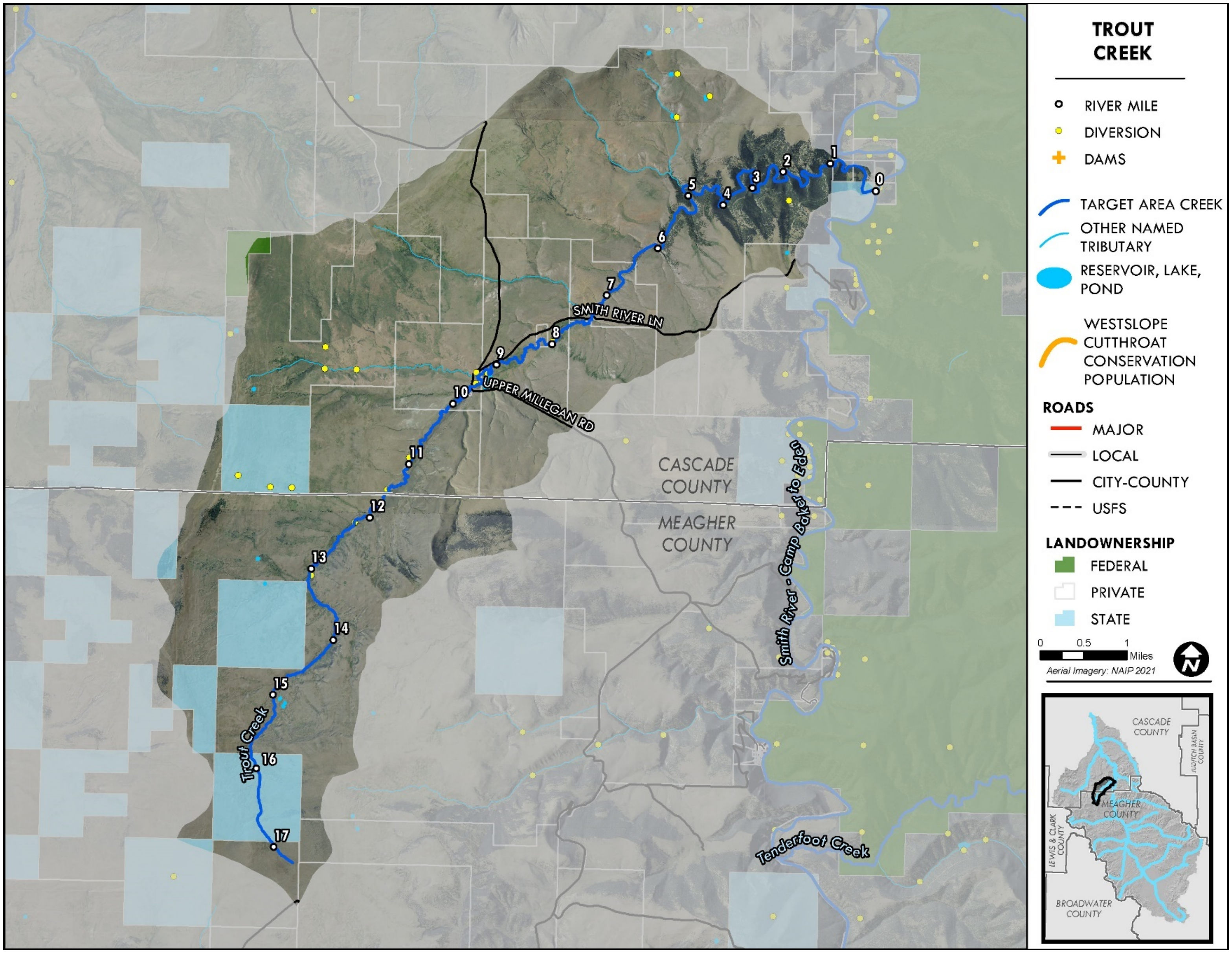


Figure 138. Trout Creek target area overview.

Figure 139. Trout Creek at Lingshire Road.

Figure 140. Overview of Trout Creek upper valley from Lingshire Road.

Figure 141. Mouth of Trout Creek at Smith River.

8.3.10.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Trout Creek include:

- USFS noxious weed treatment near mouth.
- BLM grazing allotment monitoring.
- One MLR conservation easement.
- Not included in FWP Statewide Management Plan (2023).

8.3.10.3 Proposed Additional Restoration Actions

Restoration actions for the Trout Creek include:

- Grazing management including fencing and development of off-site water.
- Investigate water quality to determine if also a source of warm water late in the season.

8.3.11 Deep Creek

Deep Creek originates in the Little Belt Mountains and flows 17.7 miles before joining the Smith River (Figure 141).

Attribute	Value
Watershed Size	28,493 acres (45 sq mi)
Elevation Range	3,760-6,690 ft
Stream Miles	17.7
Land Ownership	**28,493 total acres**
Private	4,423 acres (16%)
State	0 acres (0%)
Federal	24,069 acres (84%)
Road Miles	**0.4 total miles**
City-County	0
Other	0
USFS	0.4
Number of Diversions	6
Number of Reservoirs	3

8.3.11.1 Primary Issues

The following are the main degradational issues identified for Deep Creek:

- Mostly federal ownership but has had minimal timber harvest.
- Intermittent flows are natural.
- In June 2023, Deep Creek water temperature was 51.0 degrees F. TDS was 90 mg/L (conductivity 200 u/s) which is not high. Estimated flows were 30 cfs. The Smith River upstream of Deep Creek was 58.2 degrees F (123 TDS mg/L and 260 conductivity µS/c) and the Smith River downstream of Deep Creek was 51.8 degrees F (100 TDS mg/L and 200 conductivity µS/c) indicating that Deep Creek may be an important source of clear, cold water into the Smith River. Deep Creek provides clean, cold water to the Smith River and is an important trout spawning tributary (Figure 143).

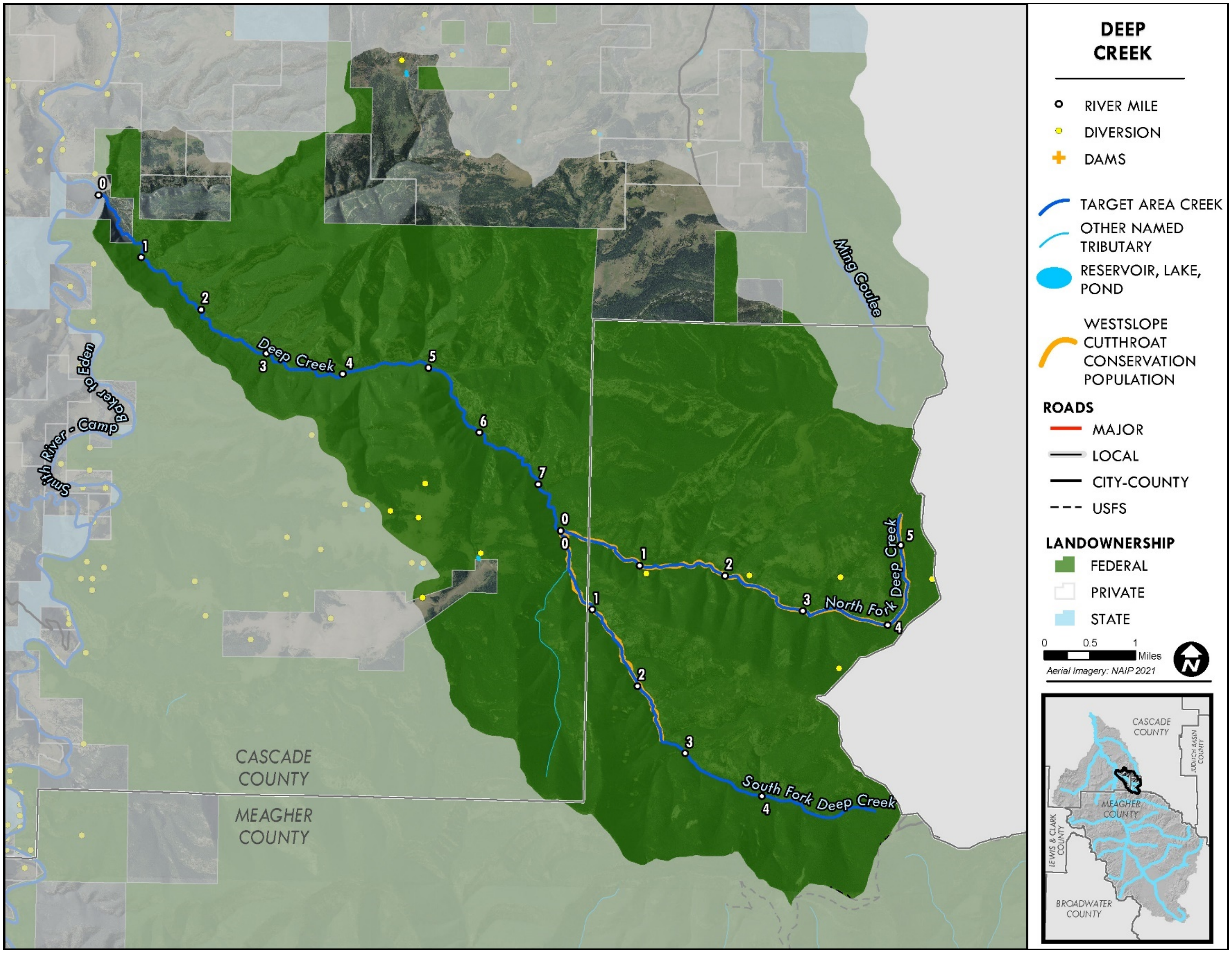


Figure 142. Deep Creek target area overview.

Figure 143. Mouth of Deep Creek at Smith River.

8.3.11.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Deep Creek include:

- BLM grazing allotment monitoring.
- One conservation easement at the confluence with the Smith River.
- FWP Statewide Management Plan (2023) indicates the management direction for Deep Creek is for westslope cutthroat trout conservation.

8.3.11.3 Proposed Additional Restoration Actions

Restoration actions for the Deep Creek include:

- High priority for preservation as it provides cold, clean water to the Smith River and is a rainbow trout spawning tributary (Figure 143).
- Protect conservation populations of westslope cutthroat trout.

8.3.13 Hound Creek

Hound Creek originates in the northern Big Belt Mountains and flows 30.8 miles before joining the Smith River (Figure 144).

Attribute	Value
Watershed Size	146, 004 acres (228 sq mi)
Elevation Range	3,471-5,092 ft
Stream Miles	30.8
Land Ownership	**146,003 total acres**
Private	123,940 acres (85%)
State	18,495 acres (13%)
Federal	3,568 acres (2%)
Road Miles	**38 total miles**
City-County	36
Other	2
USFS	0
Number of Diversions	78
Number of Reservoirs	43

8.3.13.1 Primary Issues

The following are the main degradational issues identified for Hound Creek:

- Agricultural encroachment.
- Woody riparian vegetation loss (Figure 145).
- Erosion and sedimentation from removal of woody riparian vegetation, channelization from agriculture.
- Channelization, channel incision and loss of floodplain connectivity from floodplain conversion and agriculture (Figure 146).
- Irrigation withdrawals and floodplain dewatering causing reduced late season stream flow. Hound Creek is listed for periodic dewatering by FWP.
- Grazing including concentrated livestock use and winter feeding areas along stream.
- Elevated nutrients and E.coli from livestock grazing and agriculture.
- Elevated turbidity from streambank erosion, irrigation return flows and erosion from loss of vegetation during the 2021 Harris Mountain Fire.
- Elevated water temperature from woody vegetation removal.
- Nutrient levels and stream temperatures high enough to support nuisance algae growth.
- Abandoned coal mines with unknown effects on water quality (Figure 147).

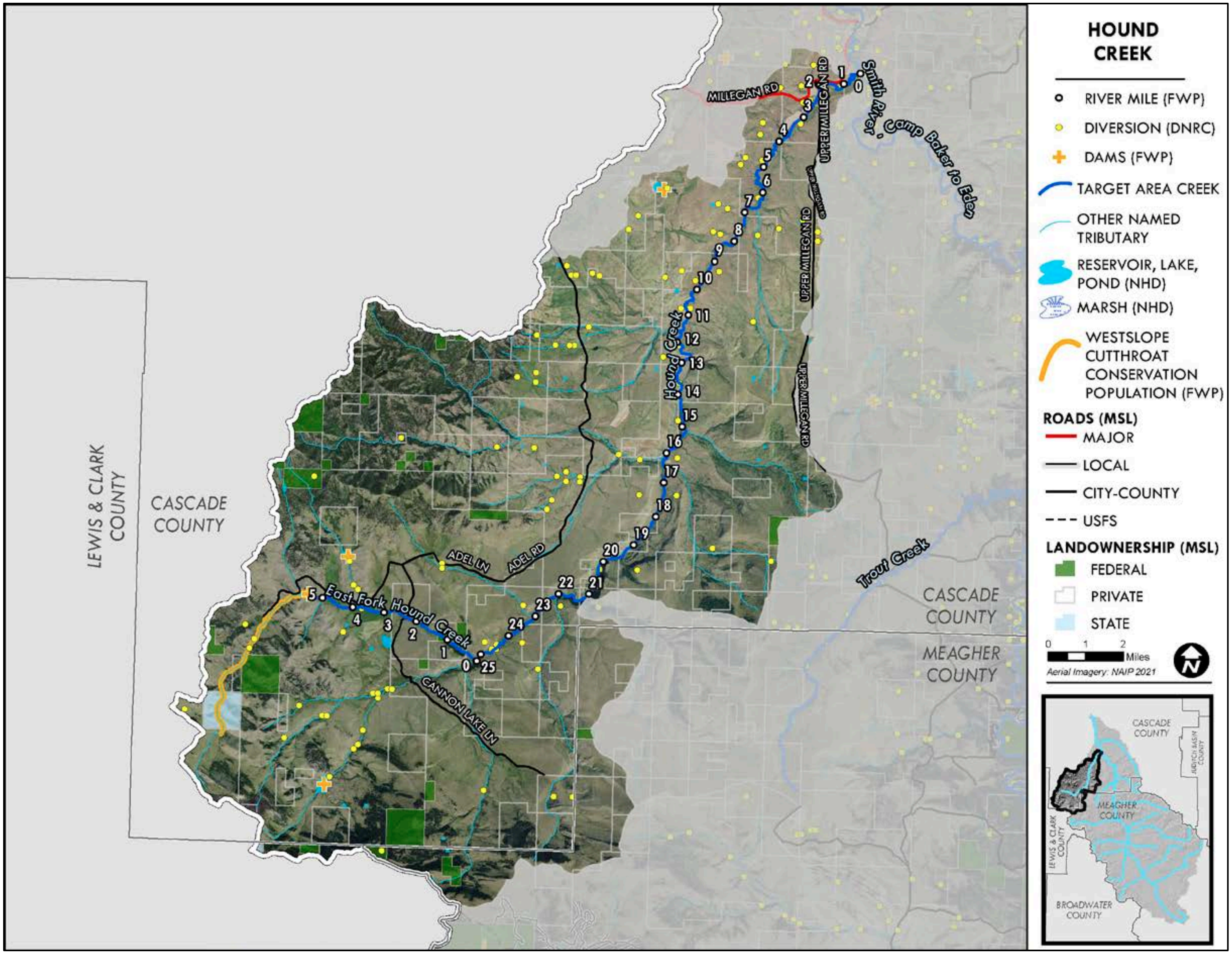


Figure 144. Hound Creek target area overview.

Figure 145. Hound Creek mouth at Smith River.

Figure 146. Hound Creek at Lingshire Road crossing (left photo) and overview of Hound Creek valley from Lingshire Road (right photo).

Figure 147. Abandoned coal mines adjacent to lower Hound Creek.

8.3.13.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Hound Creek include:

- NRCS Emergency TIP for Harris Mountain Fire to exclude livestock from burned areas, water development and fencing.
- NRCS TIP for BDAs to capture increased sediment load from fire-related run-off including improvements of 13 crossings on the West Fork.
- Natural water storage projects implemented on the East Fork by private landowner.
- BLM grazing allotment monitoring.
- One MLR conservation easements.
- FWP Statewide Management Plan (2023) indicates the management direction for Hound Creek is to maintain resident and Smith River spawning populations and identifies the following habitat needs and activities:
    - Maintain habitat and instream flows of 35 cfs.

8.3.13.3 Proposed Additional Restoration Actions

Restoration actions for Hound Creek include:

- Grazing management including development of off-site water and alternatives to concentrated livestock use along the stream.
- Create riparian buffers and increase woody riparian vegetation cover.
- Floodplain reconnection and passive water storage projects.
- Nutrient management through reducing streambank erosion, increasing floodplain connectivity and floodplain wetland area, and reducing livestock overwintering on the stream and concentrated livestock use areas.
- Irrigation efficiency projects.
- Streambank restoration to reduce accelerated erosion and increase woody riparian vegetation cover.
- Channel restoration to improve habitat for Smith River spawning brown trout population.
- Protect conservation populations of westslope cutthroat trout in Tyrell Creek and Hound Creek Reservoir.

8.3.14 Ming Coulee

Ming Coulee originates in the Little Belt Mountains and flows 31.9 miles through the foothills before entering the Smith River (Figure 149).

Attribute	Value
Watershed Size	39,029 acres (61 sq mi)
Elevation Range	3,404-6,537 ft
Stream Miles	31.9
Land Ownership	**39,029 total acres**
Private	34,343 acres (88%)
State	1,009 acres (3%)
Federal	3,677 acres (9%)
Road Miles	**22 total miles**
City-County	18
Other	4
USFS	0
Number of Diversions	40
Number of Reservoirs	54

8.3.14.1 Primary Issues

The following are the main degradational issues identified for Ming Coulee:

- Agricultural encroachment (Figure 148).
- Livestock grazing.
- Woody riparian vegetation loss.
- Erosion and sedimentation from removal of woody riparian vegetation, channelization from agriculture.
- Irrigation withdrawals and floodplain dewatering causing reduced late season stream flow. Ming Coulee typically goes dry each year.
- Recreation impacts in upper watershed from ATVs.
- Historic coal mining with unknown effects on water quality.

Figure 148. Ming Coulee agricultural encroachment.

8.3.14.2 Ongoing Work

Restoration actions addressing degradational issues completed to date or planned for Ming Coulee include:

- BLM grazing allotment monitoring.
- Not included in FWP Statewide Management Plan (2023).

8.3.14.3 Proposed Additional Restoration Actions

Restoration actions for the Ming Coulee include:

- Grazing management including development of off-site water and riparian fencing.
- Create riparian buffers and increase woody riparian vegetation cover.
- Floodplain reconnection and passive water storage projects.
- Irrigation efficiency projects.
- Recreation management.
- Investigate water quality.

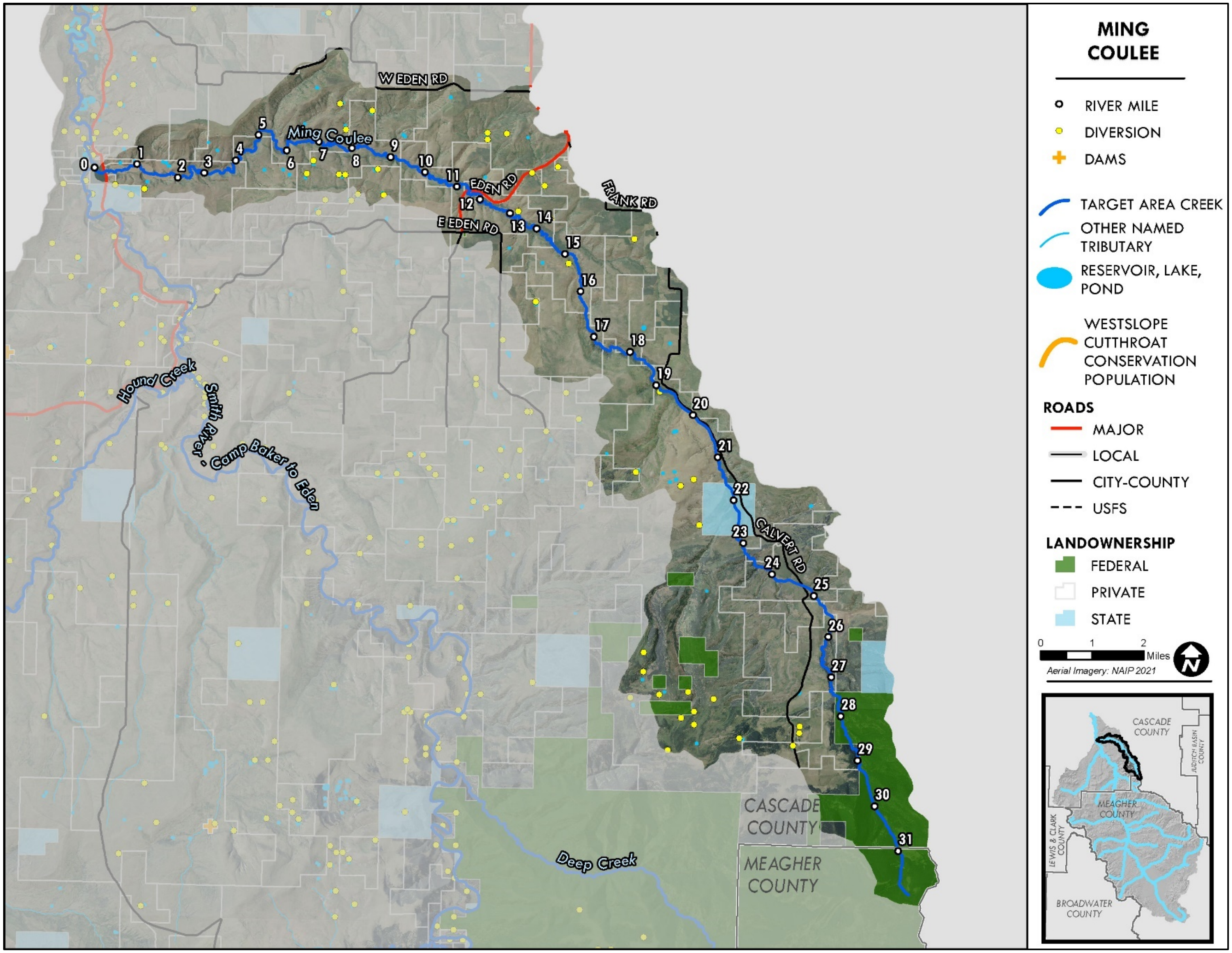


Figure 149. Ming Coulee target area overview

9 Restoration Implementation Plan

This section describes implementation of the WRP for the Smith River basin. The WRP includes implementing the 5-year near-term focus area restoration actions described in Section 8.1. The WRP implementation plan includes:

- Implementing pilot projects identified during the assessment process to provide examples of project work and start addressing issues identified in the basin (Section 9.1).
- A strategy for developing leadership and partnerships in the basin to continue addressing basinwide issues (Section 9.2).
- A strategy for education and outreach to increase stakeholder awareness of issues in the basin (Section 9.3).
- Potential funding and technical support for restoration work in the basin (Section 9.4).
- Guidance on how to consistently monitor restoration actions and adapt the WRP over time (Section 9.5).
- A schedule for implementing the WRP (Section 9.6).

9.1 Pilot Projects

Through the process of completing this assessment FWP and their contractors identified and are moving forward with several pilot projects that implement restoration actions identified in the plan that will begin to implement the WRP (Table 25). These projects will be implemented between 2024 and 2026.

Table 25. Pilot projects that will be implemented between 2024 and 2026 to begin addressing issues identified in the assessment.

Project Location	Degradational Issues Project Will Address	Conceptual Restoration Actions	Funding Source
South Fork Smith River	• Loss of floodplain connectivity • Erosion and loss of woody riparian vegetation • Riparian grazing	• Floodplain reconnection • Woody riparian revegetation • Off-site water	FWP SRCEA
North Fork Smith River	• Erosion and loss of woody riparian vegetation • Riparian grazing	• Streambank restoration • Establishment of woody riparian buffer • Off-site water	FWP SRCEA
Mainstem upstream of Camp Baker	• Erosion and loss of woody riparian vegetation • Agricultural encroachment	• Streambank restoration • Establishment of woody riparian buffer	Private landowner
Mainstem Camp Baker to Eden Bridge (boat camps in recreational float corridor)	• Erosion in boat camps • Reduced vegetative cover in boat camps	• Streambank bioengineering for erosion control • Revegetation	FWP SRCEA

9.2 Developing Partnerships and Leadership Roles

As described in this assessment, issues occur throughout the Smith River basin which will require a long-term, collaborative approach to restoration. Success of restoration will depend upon developing effective public-private partnerships.

Through the assessment process, numerous organizations, agencies and individuals have expressed interest in working to address issues in the basin. Significant progress was achieved in terms of engagement and awareness related to issues in the watershed and several partnership and leadership development tasks are planned to continue the momentum built around the assessment. While there is no one organization that has committed to leading implementation of the WRP, actions are nevertheless underway to address issues that can be cumulatively recorded to measure progress. Table 26, Table 27 and Table 28 identify potential organizations and agencies that can create partnerships or provide leadership roles for addressing issues in the basin.

Several actions have been taken to begin developing partnerships in the basin through the assessment process and several organizations have the potential to take on leadership roles as restoration in the Smith River basin evolves and continues over the coming years. Table 29 provides an overview of the leadership and partnership strategy for implementing the plan.

Table 26. Potential partner roles for Smith River Meagher County projects.

Meagher County Projects												
Potential Partner	**Grant Program Sources for Financial Support**	**Grant Applicant**	**Project Management/ Grant Management**	**Technical Expertise**	**Education/ Outreach/ Community Engagement**	**Landowner Outreach**	**Information Sharing**	**Design Review**	**Study Collaboration**	**Implementation Management**	**Cost Sharing for Implementation**	**In-Kind Contributions (Time, Equipment, Project Materials)**
MT FWP	√	√	√	√	√	√	√	√	√	√	√	
Meagher County CD		√	√	√	√	√	√	√	√	√	√	√
MT DNRC	√			√			√		√			√
MT DEQ	√			√			√		√			
NRCS	√			√			√	√	√	√		√
USFS				√			√	√	√			√
BLM				√			√	√	√			√
Newlan Water Users Association		√	√	√		√	√	√	√	√		√
City of White Sulphur Springs	√	√	√	√		√				√		
Meagher County Stewardship Council		√	√		√	√	√					√
Montana Trout Unlimited & Local Chapters	√	√	√	√	√	√	√	√	√	√	√	√
Other Non-profit Organizations	√	√	√		√		√		√	√	√	√
Landowners		√		√		√	√			√	√	√

Table 27. Potential partner roles for Smith River Corridor projects.

Smith River State Park Recreation Corridor Projects-- Meagher and Cascade Counties												
Potential Partner	**Grant Program Sources for Financial Support**	**Grant Applicant**	**Project Management/ Grant Management**	**Technical Expertise**	**Education/ Outreach/ Community Engagement**	**Landowner Outreach**	**Information Sharing**	**Design Review**	**Study Collaboration**	**Implementation Management**	**Cost Sharing for Implementation**	**In-Kind Contributions (Time, Equipment, Project Materials)**
MT FWP	√	√	√	√	√	√	√	√	√	√	√	
Meagher County CD		√	√	√	√	√	√	√	√	√	√	√
Cascade County CD		√	√	√	√	√	√	√	√	√	√	√
MT DNRC	√			√			√		√			√
MT DEQ	√			√			√		√			
NRCS	√			√	√		√	√	√			√
USFS				√			√	√	√			√
BLM				√			√	√	√			√
Smith River Habitat Project	√	√	√	√	√	√	√	√	√	√	√	
Meagher County Stewardship Council		√	√		√	√						
Montana Trout Unlimited & Local Chapters	√	√	√	√	√	√	√	√	√	√	√	√
Other Non-profit Organizations		√	√	√	√					√	√	√
River guides				√			√				√	
Landowners		√		√		√	√			√	√	√

Table 28. Potential partner roles for Cascade County projects.

Cascade County Projects												
Potential Partner	**Grant Program Sources for Financial Support**	**Grant Applicant**	**Project Management/ Grant Management**	**Technical Expertise**	**Education/ Outreach/ Community Engagement**	**Landowner Outreach**	**Information Sharing**	**Design Review**	**Study Collaboration**	**Implementation Management**	**Cost Sharing for Implementation**	**In-Kind Contributions (Time, Equipment, Project Materials)**
MT FWP	√	√	√	√	√	√	√	√	√	√	√	
Cascade CD	√	√	√	√	√	√	√	√	√	√	√	
MT DNRC	√			√			√		√			√
MT DEQ	√			√			√		√			
NRCS	√			√			√	√	√			√
USFS				√			√	√	√			√
BLM				√			√	√	√			√
Montana Trout Unlimited & Local Chapters	√	√	√	√	√	√	√	√	√	√	√	√
Other Non-profit Organizations	√	√	√	√	√					√	√	√
Landowners		√		√		√	√			√	√	√

Table 29. Smith River basin leadership and partnership development strategy initial tasks.

Task	Lead Agency/Organization	Description
Implement Pilot Projects	FWP	FWP will take a leadership role in implementing pilot projects between 2024 and 2026 and integrate as many project partners as possible into the process to help build momentum for watershed restoration actions. FWP will continue to support project development and provide project funding past 2026.
Cascade County Landowner Outreach and Project Development	Cascade County CD	Cascade County CD has prioritized the Smith River watershed and will take a leadership role in landowner outreach within the Smith River basin in Cascade County to identify landowner needs and concerns and identify and develop watershed restoration projects.
Meagher County Network Building and Project Identification	Meagher County Stewardship Council	Through a DEQ watershed planning grant, MCSC has developed an Implementation Plan to collaborate with landowners and support water quality initiatives in Meagher County. The plan identifies continued support of the WRP through outreach to ensure the WRP addresses water quality and supports needs of farmers and ranchers. The Community Benefits Agreement MCSC is negotiating with the Black Butte Copper mine includes a Natural Resources section that can integrate the assessment issues and WRP.
Restoration Project Identification	Meagher County NRCS, Meagher County CD, FWP and Meagher County Stewardship Council	As the main local resource for landowners to get technical support for water quality related projects, NRCS and Meagher County CD will be able to direct landowners to additional resources and contacts as a result of the assessment work. One of the pilot projects was identified and referred to the assessment team through NRCS. FWP will continue to support project development and provide project funding past 2026. The MCSC may pursue potential projects in the Sheep Creek watershed to improve and protect natural resources.
Basinwide Restoration Planning and Implementation	Montana Trout Unlimited	Montana Trout Unlimited has indicated they are interested in supporting Smith River restoration in whatever capacity is necessary.
Potential for Large-scale Water Quality Project	NRCS	Potential to do TIP focused on water quality or other large-scale National Water Quality Initiative (NWQI) project in the basin. NWQI are large grants that would be an option in the future, particularly in near-term focus areas or as DEQ findings focus in on priority areas and needs in the watershed.

Task	Lead Agency/Organization	Description
Forest Plan Implementation	Helena Lewis and Clark National Forest	Through implementation of the forest plan the USFS is addressing numerous issues identified in the basinwide assessment on federal lands such as weed control, removal of conifer encroachment, and upland forest health improvement. The USFS coordinates with NRCS to increase scale and effectiveness of some actions.
Large-scale Weed Control Collaboration in Smith River Corridor	Smith River Habitat Project MOU with FWP and USFS	Continued collaboration with FWP and USFS on weed control. This is one example of a partnership that can be expanded to address more issues and there is potential for the SRHP to extend their role to watershed restoration projects.

9.3 Education and Outreach

Education and outreach are one of the biggest needs in the Smith River basin for implementing a long-term WRP. As described above in Section 9.2, leadership roles and partnerships are developing in the basin that have the potential to implement the WRP. Significant outreach and education were completed as part of the assessment process, resulting in immediate on-the-ground actions (pilot projects) to start addressing issues.

The current education and outreach strategy is to continue to increase awareness of the issues identified in the Smith River basin by ensuring stakeholders are aware of the assessment and WRP and understand avenues for addressing issues and developing projects. This will be done through existing organizations having access to the assessment document and increasing stakeholder awareness of it. Table 26, Table 27 and Table 28 identify potential organizations and agencies that can provide education and outreach support. Table 30 provides specific tasks being completed by agencies and organizations in the basin that will result in outreach and education of the issues identified in this assessment.

As leadership roles and partnerships continue to evolve in the basin, the primary topics that require education and outreach include:

- Current state of water quality.
- Relationship between flows, water quality and fisheries health.
- Overall causes of impairments to stream function to help stakeholder understanding of what issues look like and what can be done to address them (i.e. good v. bad erosion and the need to let streams move and deform).
- The need for partnerships and collaborations.

Priority target audiences for stakeholder education and outreach include:

- Agricultural community
- Landowners along target streams
- Urban residents
- Agency personnel
- Recreationists
- Outfitters and guides
- Political leaders

Table 30. Smith River outreach and education strategy by agency/organization.

Agency/Organization	Education and Outreach Tasks
Montana Fish, Wildlife and Parks (FWP)	• FWP will take a leadership role in implementing pilot projects between 2024 and 2026 and integrate as many project partners into the process as possible to help build momentum for watershed restoration. • FWP will make the assessment available to the public and continue to make stakeholders aware of it. • FWP will increase education efforts with guides/outfitters and recreationists in Smith River State Park. FWP is pursuing restoration work at boat camps starting in 2025 which will provide education and volunteer opportunities.
Meagher County Stewardship Council (MCSC)	• Completed several education and outreach tasks through DEQ watershed planning grant that high-lighted the assessment and issues identified in the assessment. • Developed an engagement plan that emphasizes "collaboration with landowners to ensure conservation efforts reflect the values of our agricultural community" (MCSC, 2024).
Natural Resource Conservation Service (NRCS)	• The NRCS in both Cascade and Meagher County provide significant education and outreach tools for landowners related to issues identified in the assessment such as improved irrigation practices, grazing practices, water quality, weeds, conifer encroachment, etc. • County NRCS offices have TIPs in place. In Meagher County TIPs currently focus on conifer encroachment removal and forest stand improvements that required landowner education and outreach. As a result, the issue of conifer encroachment and the effects on upland grassland health and water quantity seem to be well understood and supported in the basin. In Cascade County, current TIPs focus on projects that reduce or capture sediment loads from the Harris Mountain Fire in the Hound Creek area. This effort included tours of completed BDA projects. • NRCS has proven to be an effective mechanism in Meagher County to identify interested landowners and potential projects that address non-point source pollution. • Hold annual local working group meetings comprised of a range of stakeholders as part of long-range planning that identify and prioritize needs in each county. The assessment and WRP can help support this process.
Meagher County CD	• Provide education to landowners about stream permitting requirements and other conservation related issues. • Host an annual winter seminar covering various topics, some related to issues identified in the assessment.
Cascade County CD	• Hosted Smith River landowner meeting in Cascade County on June 18, 2024 to educate landowners about issues in the basin and provide resources for landowner needs. This led to interest from a large landowner to solicit help with erosion and other stream related issues on their property.

Agency/Organization	Education and Outreach Tasks
	• Selected the Smith River as a priority focus watershed and will actively engage in landowner outreach and education in the next few years.
Smith River Habitat Project (SRHP)	• One of the few non-profit organizations active in the basin and work with several private landowners along the Smith River providing substantial education and outreach about noxious weed control. • Potential to take a role in project development and implementation and increase outreach and education efforts. • Collaborating with FWP and USFS through MOU to improve ecological considerations of weed control program which will translate to education of landowners.
Montana Trout Unlimited	• Ability and interest in supporting education and outreach in the basin through numerous potential pathways. • Have a wealth of project examples to draw on for demonstration or education purposes, including many on private, working lands. • Two Montana TU chapters located in Great Falls and Helena with interest in supporting work in the basin.
Smith River Guides and Outfitters	• The high use of the Smith River corridor for recreation provides a significant opportunity for education and outreach and potential funding opportunities as watershed restoration progresses in the basin. Guides and outfitters have expressed willingness to spread the word about issues and opportunities as well as support active restoration in various ways.
Montana DEQ	• Montana DEQ is the main source of water quality data for the basin and is working on updating impairment listings for the mainstem Smith River. This information, along with publication of other studies related to nutrients and nuisance algae will increase understanding of water quality issues in the basin.

9.4 Technical and Financial Needs and Funding Sources

Numerous technical and financial resources are available to support WRP implementation. Table 26, Table 27 and Table 28 identify potential organizations and agencies that can provide technical and financial support for restoration work in the basin. Appendix C provides an overview of funding sources available to implement actions described in this WRP that can be referenced by stakeholders developing or implementing restoration actions.

9.5. Monitoring and Restoration Plan Adaptation

This section provides a framework for monitoring WRP implementation and effectiveness. In addition, using effectiveness monitoring to adapt the plan will be key to long-term plan implementation, reducing impairments and improving Smith River basin conditions. The intent is to adapt the WRP as new data become available, projects are implemented and evaluated, and new project opportunities arise.

9.5.1 Project Monitoring

Table 31 summarizes the restoration actions identified for the Smith River basin and evaluation criteria that can be used to evaluate implemented actions. These criteria can be used by all organizations, agencies and private landowners implementing restoration actions in the basin to help track progress towards addressing issues basinwide.

FWP will document restoration activities they complete under the WRP starting with the 2025 pilot projects described in Section 9.1. FWP will document pre-project conditions and post-project conditions with photographs and the criteria from Table 31 for each project. In addition, FWP will incorporate WRP implementation and effectiveness monitoring results into their annual/semi-annual monitoring reports or reports required for funding agencies. These reports will include a summary of actions and quantities of actions completed, photos of completed actions, and the evaluation criteria from Table 31 for relevant actions.

Table 31.Criteria to evaluate the effectiveness of restoration actions implemented in the Smith River basin.

Restoration Action (see Section 7)	Evaluation Criteria
Water Quantity	
Murphy water rights	Documentation of when rights called
Irrigation practices	Education and outreach conducted, Documentation of increased instream flows
Water storage	Documentation of actions completed
Water leasing/purchasing	Education and outreach conducted, Documentation of increased instream flows
Alternative agriculture practices	Education and outreach conducted
Conifer encroachment removal	Documentation of acres and areas treated
Drought Response Plan	Documentation of plan development
Water Quality	
Riparian buffers	Documentation of locations and actions completed, Length of channel with buffers established
Restore streambank woody riparian vegetation	Documentation of locations and actions completed, Length of channel with woody vegetation restored
Increase floodplain connectivity	Documentation of locations and actions completed,
Create floodplain wetlands	Documentation of locations and actions completed,
Grazing management	Documentation of sites addressed and management methods used
Increase overland runoff infiltration	Documentation of locations and actions completed
Nutrient management	Documentation of locations and actions completed
Sediment retention post-fire	Documentation of locations and actions completed
Road BMPs and decommissioning	Documentation of locations and actions completed
Recreation use management	Documentation of locations and actions completed
Riparian and Aquatic Habitat	
Restore streambank woody riparian vegetation	Documentation of locations of actions completed, Length of streambank revegetated
Channel restoration	Documentation of locations of actions completed, Length of channel restored
Preserve existing high-quality habitats	Documentation of locations of actions completed
Improve forest stand health	Documentation of locations of actions completed
Improve upland grassland health	Documentation of locations of actions completed
Integrated weed management	Education and outreach conducted, Documentation of treatments applied

9.5.2 Long-term Monitoring and Restoration Plan Evaluation and Adaptation

This WRP covers a 5-year period. The 5-year restoration targets identified for near-term focus areas are summarized in Table 32. FWP will coordinate a stakeholder meeting at the end of the 5-year period to evaluate progress towards meeting restoration targets in near-term and long-term focus areas, and to discuss future restoration activities and direction. Pilot project implementation will make considerable progress towards achieving restoration targets for some near-term focus areas and this is reflected in Table 8. At the 5-year meeting organized by FWP, actions implemented by FWP as well as others will be compiled. For example, the NRCS long-range plans for Meagher County and Cascade County, as well as TIPs in these counties, include actions that address some of the issues identified in the basin. The USFS Forest Wide Plan also includes actions that address issues identified in the basin. In addition, the USFS has several on-going Watershed Restoration Action Plan (WRAP) projects that address basinwide issues and require monitoring and reporting.

It will be important to evaluate long-term trends to track improvements to water quantity, water quality and aquatic and riparian habitat in the basin. Long-term trend evaluation will require coordination between agencies and others working in the watershed. The main agencies that collect data related to basinwide issues include FWP, DEQ, USGS and USFS. The 5-year meeting organized by FWP will aim to develop a strategy for evaluating long-term trends related to water quantity, water quality and aquatic and riparian habitat in the basin.

Long-term changes in streamflow and temperature will be evaluated using data from real-time gages located at: 1) Smith River near Ft Logan MT, USGS gage 06076690; 2) Smith River bl Eagle Cr near Fort Logan MT, USGS gage 06077200; 3) Sun River at Simms, USGS gage 06085800; and 3) Smith River near Eden MT, USGS gage 06077500. While these data may be difficult to use to detect short-term trends or response to WRP implementation it will be important to integrate these data into long-term restoration planning.

DEQ is in the process of updating impairments for the Smith River basin based on data collected during the 2018-2020 nuisance algae study and corresponding USGS nutrient study. The impairment updates and publication of the nuisance algae study and nutrient study will provide essential information to help refine restoration target areas and actions. DEQ will continue to monitor water quality and re-evaluate impairments in the Smith River basin in the future as new data become available. If DEQ determines additional TMDLs should be developed for the Smith River basin, the WRP will be updated to integrate new information on causes and sources and provide estimated pollutant load reductions.

FWP monitors fish populations at two locations in the mainstem Smith River. They will continue to monitor these long-term sites to evaluate changes in the fish population. This monitoring can also be used to evaluate how restoration actions may affect mainstem fish populations. The FWP Statewide Management Plan indicates the management direction for streams and rivers in Montana. WRP implementation progress and achievements will also be integrated into the management direction specified in the management plan.

To evaluate long-term improvements to riparian and aquatic habitat, the 1985 streambank assessment completed by the USDA SCS (Section 4.2.3) and repeated in 2023 as part of the Smith River basinwide assessment (Section 5.1.3.4) will be repeated in the future.

Table 32. Overview of Smith River WRP 5-year restoration targets.

Near-term Focus Target Area	Restoration Target	Applicable Evaluation Criteria	Status	Progress Toward Target
Smith River upstream of Camp Baker	Implement grazing BMPs or re-establish woody vegetation in 5% (3 acres) of riparian area	1) Length of streambank revegetated 2) Length of channel with woody vegetation restored	425 feet of streambank treated in fall 2024 resulting in approximately 0.2 acres of woody riparian re-establishment	-0.07%
	Reduce erosion on 5% (3,000 linear feet) of high priority eroding streambanks	1) Documentation of locations of actions completed 2) Length of channel with woody vegetation restored	425 feet of streambank treated in fall 2024 Additional sites to be identified through the 310 permit process with FWP recommending vegetation focused treatments	14%
	Establish well vegetated buffer between corral and stream for one site	1) Documentation of locations of actions completed 2) Length of channel with buffers established	Not currently planned	0%
	Evaluate irrigation return flow points for evidence of nutrient or sediment inputs	1) Education and outreach conducted	Not currently planned	0%
Smith River Camp Baker to Eden Bridge	Identify, design and implement streambank bioengineering and recreation ecology measures at three boat camps	1) Documentation of locations and actions completed 2) Length of streambank revegetated	Assessment has been completed for 3 boat camps and projects will be implemented in 2025	100% when 2025 projects complete
	Develop and implement an ecologically based integrated weed management program	1) Education and outreach conducted 2) Documentation of treatments applied	Smith River Habitat Project in cooperation with the USFS and FWP will be implementing new herbicide application best practices and revegetation in the Smith River Corridor	100% after 2025 season

Near-term Focus Target Area	Restoration Target	Applicable Evaluation Criteria	Status	Progress Toward Target
	Work with landowners to reduce grazed riparian corridor area using natural features coupled with strategic fencing	1) Education and outreach conducted 2) Documentation of sites addressed management methods used	Not currently planned	0%
North Fork Smith River	Implement grazing BMPs or re-establish woody vegetation in 10% (12.7 acres) of riparian area	1) Education and outreach conducted 2) Documentation of sites addressed management methods used 3) Length of channel with woody vegetation restored	Woody vegetation will be established in approximately 1 acre as part of pilot project work	8% after 2025 pilot project implemented
	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks	1) Documentation of locations of actions completed 2) Length of channel with woody vegetation restored	Approximately 1,500 feet of eroding streambank restoration will occur in fall 2025	100% after 2025 pilot project implemented
	Relocate or establish well vegetated buffer between corral and stream for one site	1) Documentation of locations of actions completed 2) Length of channel with buffers established	A vegetated buffer will be established at a corral site on the North Fork in 2025	100% after 2025 pilot project implemented
South Fork Camp Baker	Implement grazing BMPs or re-establish woody vegetation in 5% (16 acres) of riparian area	1) Length of streambank revegetated 2) Length of channel with woody vegetation restored	Woody vegetation will be re-established on approximately 1 acre as part of pilot project work	0.06% after 2025 pilot project implemented
	Reduce erosion and restore woody cover on 1,000 linear feet of high	1)Documentation of locations of actions completed	The channel will be relocated away from approximately 800	80% after 2025 pilot project implemented

Near-term Focus Target Area	Restoration Target	Applicable Evaluation Criteria	Status	Progress Toward Target
	priority eroding streambanks	2)Length of channel with woody vegetation restored	linear feet of eroding streambank	
	Relocate or establish well vegetated buffer between corral and stream for one site	1) Documentation of locations of actions completed 2) Length of channel with buffers established	Not currently planned	0%
	Reconnect 5 miles of channel and floodplain	1) Documentation of locations and actions completed	0.75 miles of channel and floodplain will be reconnected Additional planned work by others will restore floodplain connectivity to a 4-mile stretch of the South Fork	15% after 2025 pilot project implemented
	Investigate alternatives to winter fertilizer application	1) Education and outreach conducted	Not currently planned	0%
Newlan Creek	Implement grazing BMPs or re-establish woody vegetation in 10% (1.4 acres) of riparian area	1) Length of streambank revegetated 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks	1) Documentation of locations of actions completed 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Evaluate irrigation return flow points for evidence of nutrient or sediment inputs	1) Education and outreach conducted	Not currently planned	0%

Near-term Focus Target Area	Restoration Target	Applicable Evaluation Criteria	Status	Progress Toward Target
	Explore opportunities to reconnect floodplains	1) Education and outreach conducted	Not currently planned	0%
Camas Creek	Implement grazing BMPs or re-establish woody vegetation in 10% (9.8 acres) of riparian area	1) Length of streambank revegetated 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks	1) Documentation of locations of actions completed 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Investigate high phosphorous load (fire, land use, etc.)	1) Education and outreach conducted	Not currently planned	0%
Benton Gulch	Implement grazing BMPs or re-establish woody vegetation in 10% (4.5 acres) of riparian area	1) Length of streambank revegetated 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Reduce erosion and restore woody cover on 1,000 linear feet of high priority eroding streambanks	1) Documentation of locations of actions completed 2) Length of channel with woody vegetation restored	Not currently planned	0%
	Inventory road sediment issues	1) Education and outreach conducted	Not currently planned	0%
	Implement actions to reduce active incision and work with landowners on long-term solutions	1) Education and outreach conducted 2) Length of channel restored	Not currently planned	0%

9.6 Implementation Schedule and Milestones

The WRP is based on a 5-year implementation schedule. After that point, FWP will organize a meeting with major stakeholders to evaluate progress towards meeting restoration targets in near-term and long-term focus areas, and to discuss future restoration activities and direction. In organizing this meeting, FWP will request documentation of completed restoration activities in target areas from basin stakeholders.

Currently, FWP is initiating restoration actions in the basin to build momentum and encourage other groups to initiate restoration efforts and collaboratively track progress. The pilot projects described in Section 9.1 have already been implemented or will be implemented in 2025 or 2026. As described in Section 9.2, 9.3 and 9.5.1 others are also implementing restoration actions that address the main issues identified in the basin. This work is currently in progress and expected to continue in the basin on a semi-annual basis. Future direction of the WRP will depend on leadership roles and partnerships that emerge over the next five years. FWP will provide the documentation of work completed and coordinate with others in the basin to re-visit leadership and partnership roles and prompt collaboration to re-visit restoration priorities and targets for the basin and integrate any new data available to assess water quality and the WRP updated. Leadership to continue restoration efforts will be determined at that time.

The goal of the Smith River WRP is to provide a blueprint for basin stakeholders (Table 26 through Table 28) to identify and implement restoration projects that lead to improved water quantity, water quality and riparian and aquatic habitat and the eventual removal of streams from DEQ's list of impaired streams. Milestones measuring implementation of nonpoint-source management projects include:

Short-term milestones (2-year):

- Complete pilot projects by 2026.
- Continue to conduct outreach and education per Section 9.3.

Mid-term milestones (5-year):

- Complete additional watershed restoration projects as identified and time and resources allow
- Track WRP implementation actions completed between 2025-2030.
- Collaborate with stakeholders to determine leadership and partnership roles and update WRP.

Long-term milestones:

- Develop long-term leadership roles for restoration in the basin.
- Engage agricultural community in restoration in the basin that provides win-win solutions.
- Establish a monitoring network for water quality and water quantity throughout the basin.
- Develop issue specific goals for the basin.

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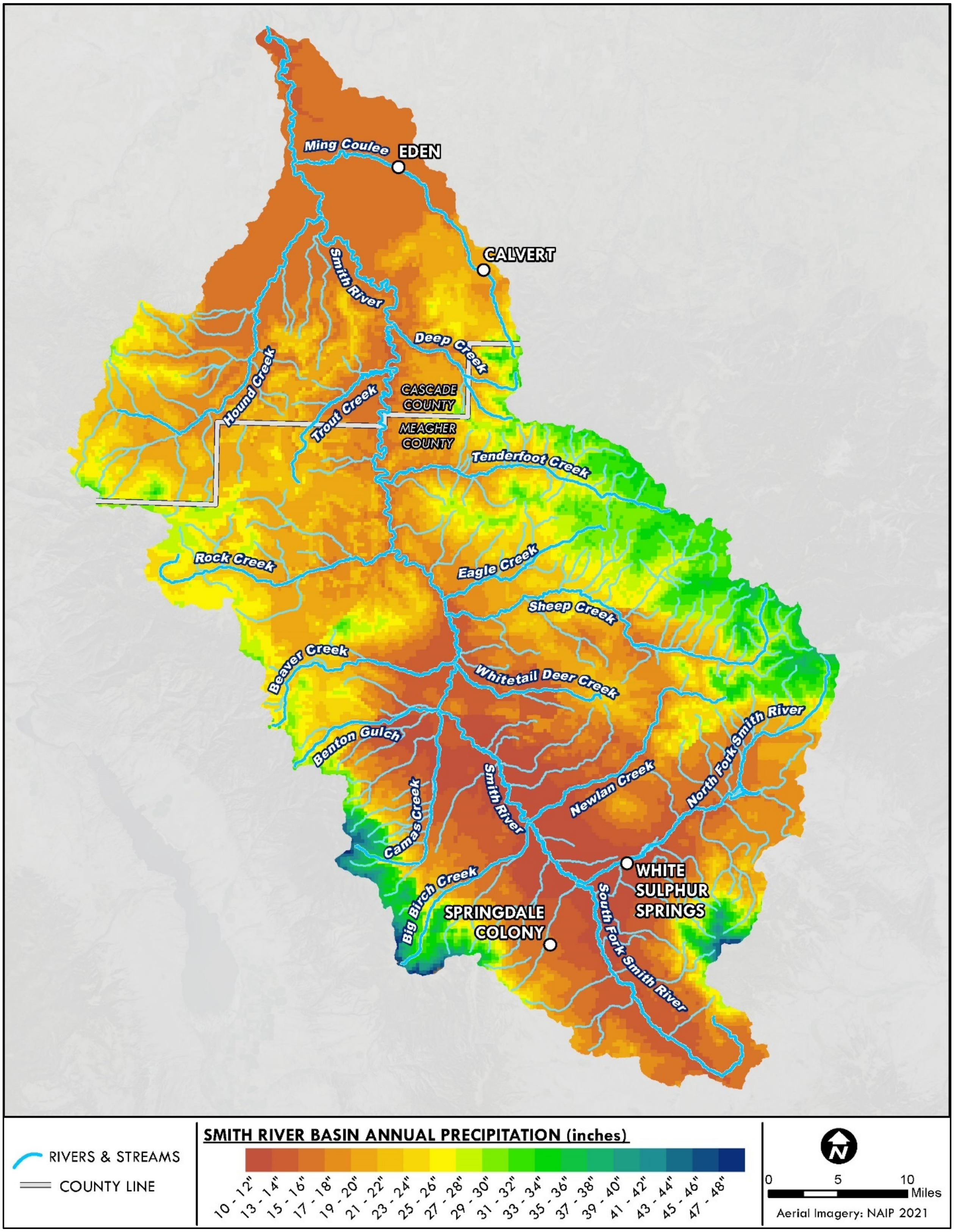
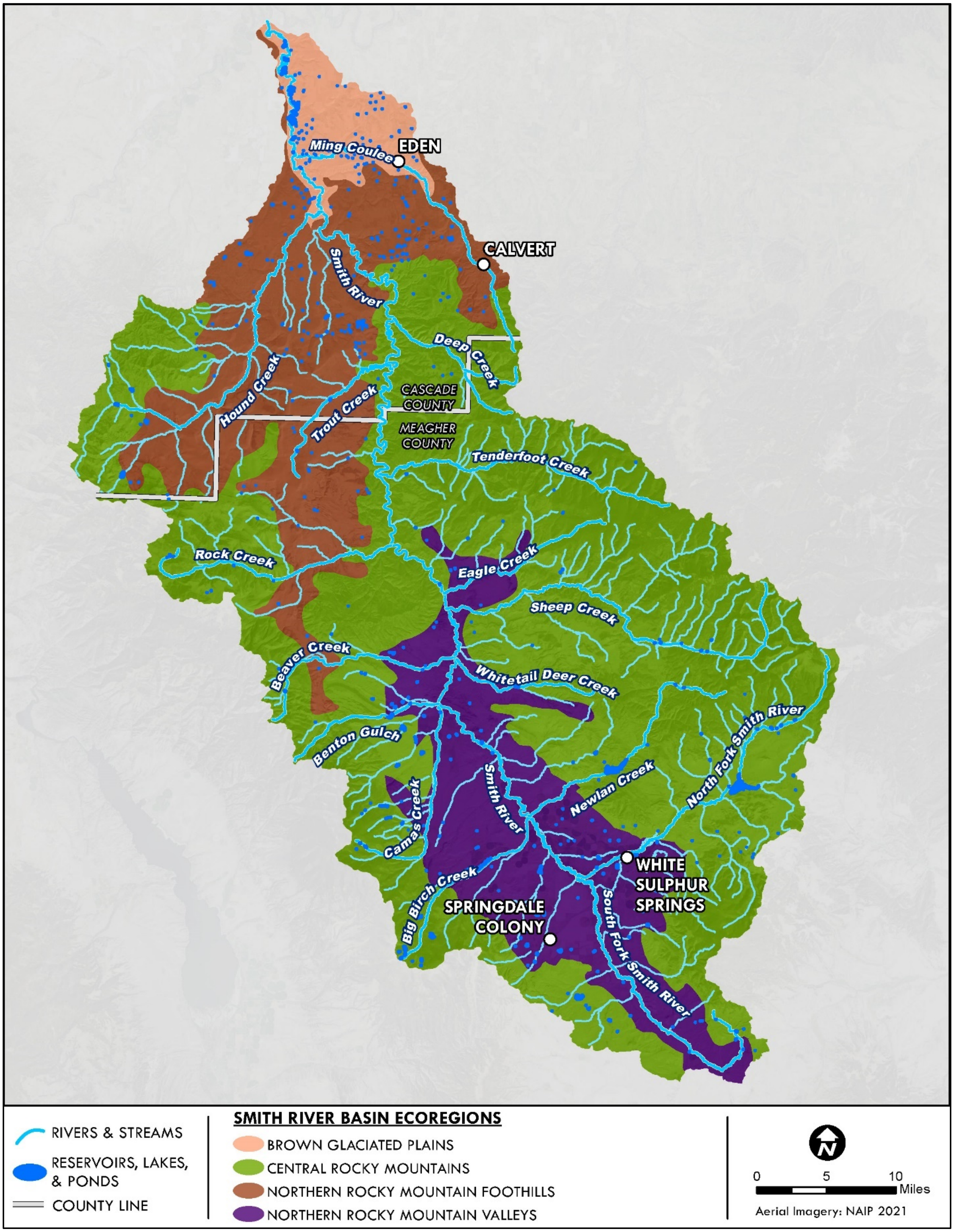
Appendix A. Smith River Basin Maps

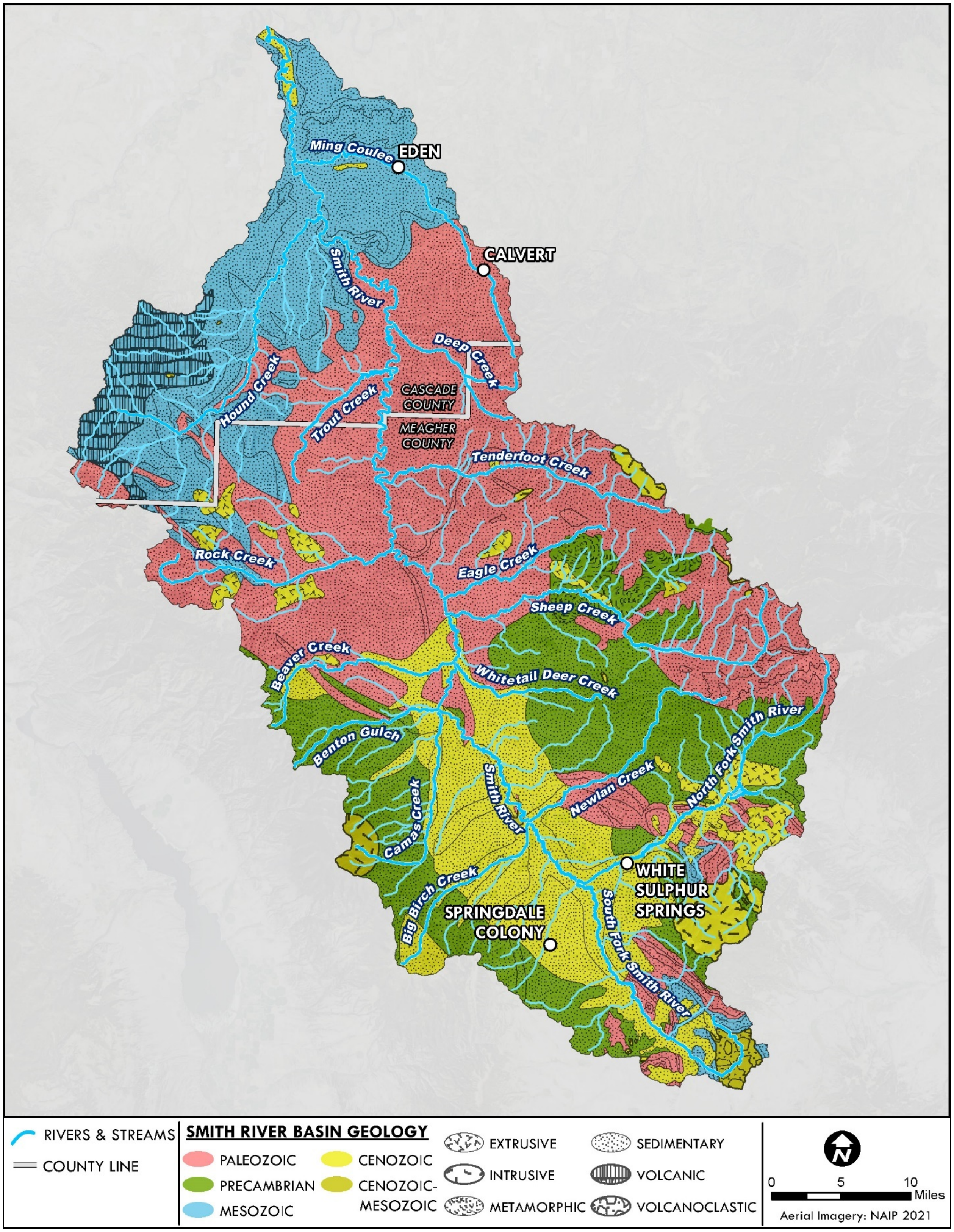
MAP 1. SMITH RIVER BASIN PRECIPITATION



MAP 2. SMITH RIVER BASIN ECOREGIONS

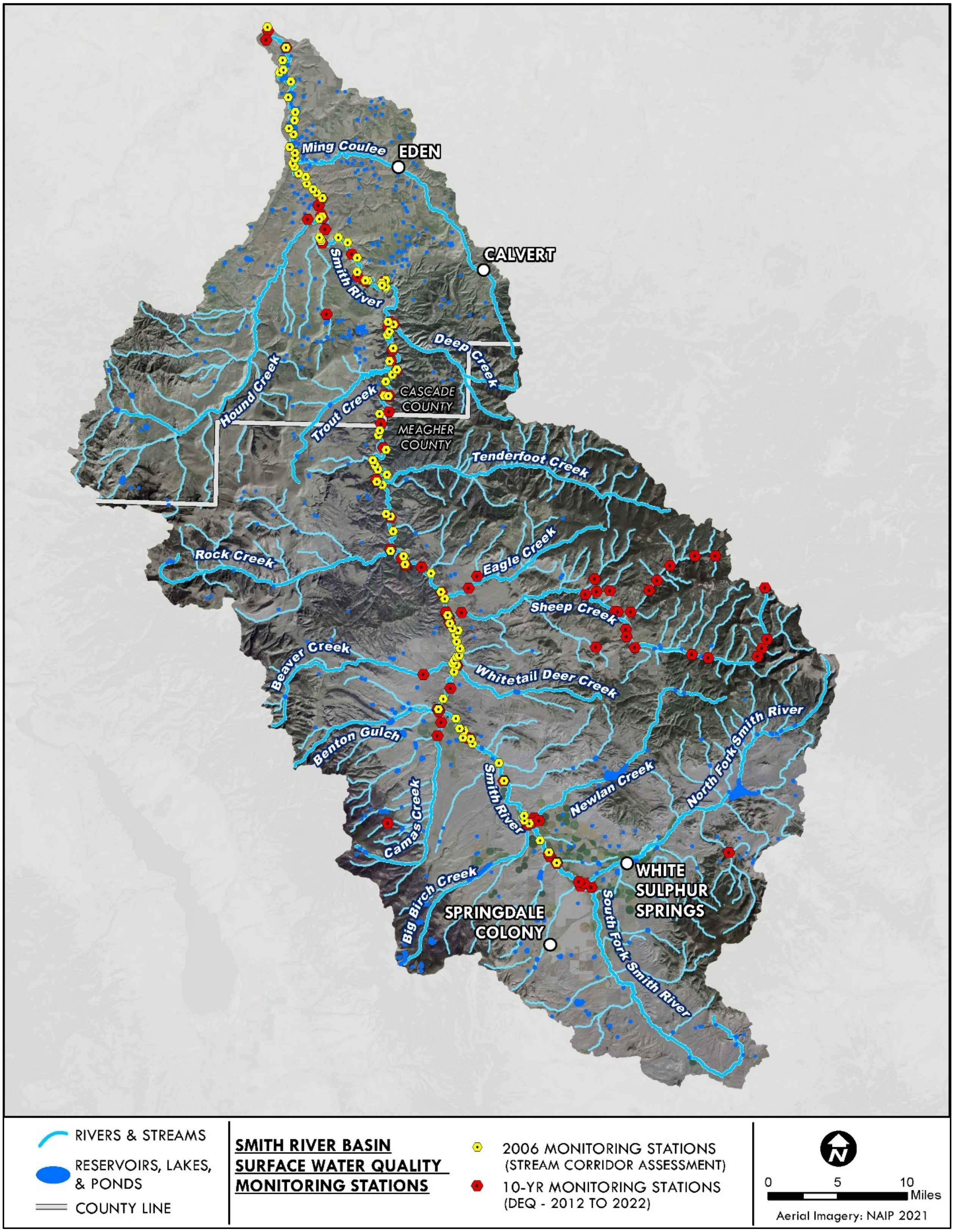


MAP 3. SMITH RIVER BASIN GEOLOGY

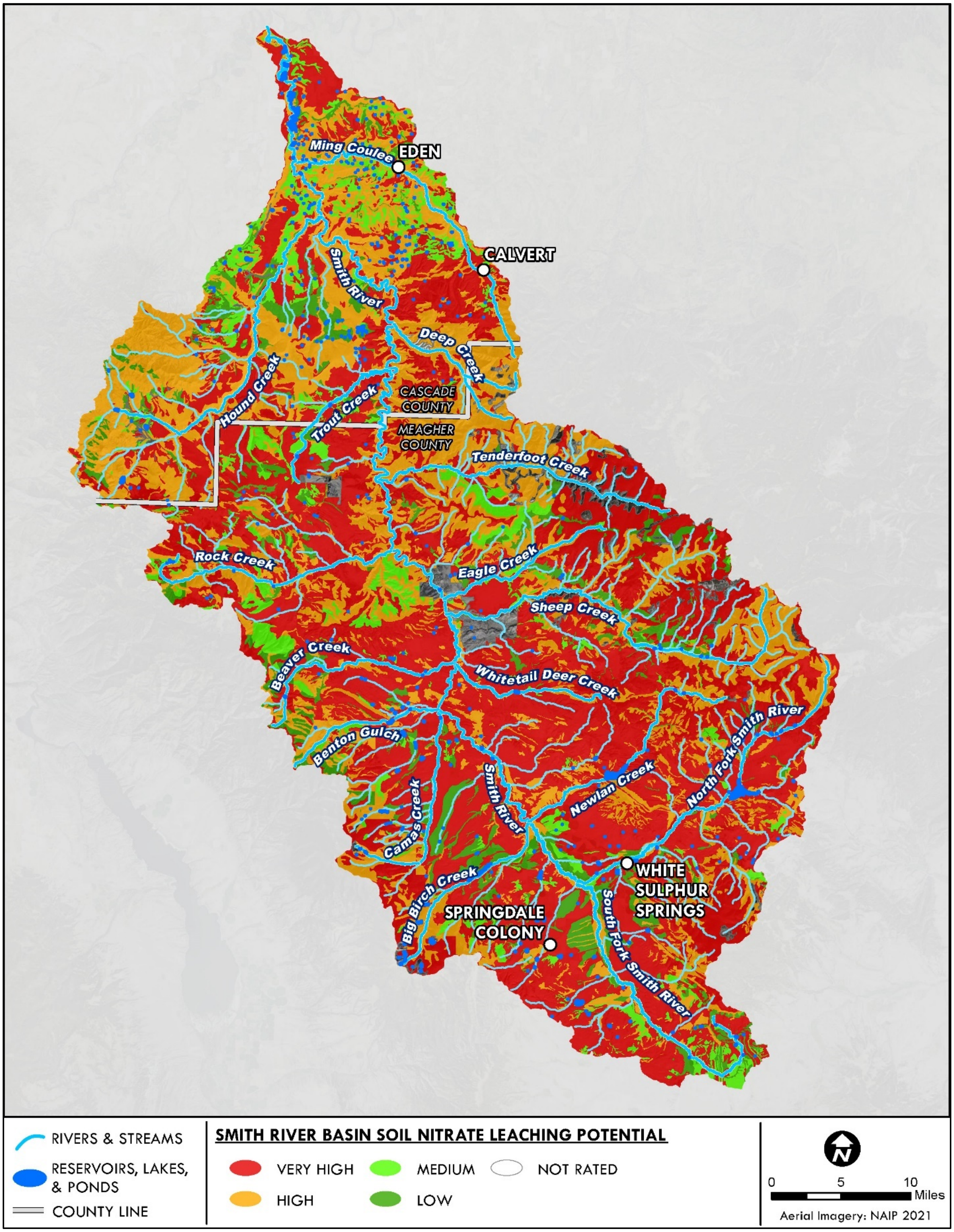


MAP 4. SMITH RIVER BASIN SOILS

MAP 5. SMITH RIVER BASIN WATER QUALITY MONITORING STATIONS



MAP 6. SMITH RIVER BASIN NITRATE LEACHING POTENTIAL



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Appendix B. Near-term Focus Target Area Remote Assessment Methods and Results

Methods

This section provides a summary of remote assessment methodology used to quantify impacts in near-term focus target areas. The methods described in this section can be applied to other target areas to assist further planning efforts in the basin. The remote assessment closely follows methods provided by DEQ intended to "help local conservation organizations identify and prioritize water quality restoration projects" (DEQ Potential Project Mapping Method, in preparation). For more detailed information on the DEQ methodology, DEQ should be contacted directly.

The remote assessment includes the following principal steps:

1. In ArcGIS, digitize the main channel centerline in each area as a polyline layer. For large channels, such as the Smith River mainstem, digitize and create a polyline feature for both the left and right streambanks.
2. Split the polyline feature based on channel conditions.
3. Buffer the channel polyline feature or bank polyline features to create a polygon layer on both left and right bank that represents the riparian buffer area.
4. Divide the riparian buffer polygons on left and right bank into sub polygons based on 1) percent cover of contextually appropriate vegetation, and 2) impacts to stream and riparian health.
5. Create a separate point layer to support identification of localized impacts not necessarily captured by an area and better quantified as a count.
6. Export all layer attribute tables for quantification.

The spatial results were summarized to determine areas, lengths, and relative percentages representing various channel and riparian conditions and impacts. Each step is described in more detail below. **Bold** words represent layers created in GIS. *Italicized* words represent tools used within GIS.

Step 1

Channel centerlines were digitized when the channel width was less than 50 feet and channel centerlines and left and right bank were digitized when the channel width was greater than 50 feet. Channel centerlines were digitized for all near-term focus area channels. A channel centerline as well as left and right bank were digitized for the Smith River upstream of Camp Baker and the Smith River between Camp Baker and Edgen Bridge. Digitizing typically occurred at a scale between 1:1,000 and 1:3,000 feet and used NAIP aerial imagery from 2005, 2017, 2019, 2021, and 2023 and ESRI Basemap imagery (year varies by location).

Attributes for centerlines included:

- Waterbody (channel name)
- BankfullWidthCat (category of the width of the channel - see below)
- Impact (human caused or natural)
- Notes (primary descriptor of impact such as Bridge, Channelized, Incision, Split Flow, etc.)
- Notes2 (further description of the primary impact)

Attributes for banklines (left and right) included:

- Waterbody (channel name)
- Bank (left or right)
- BankfullWidthCat (category of the width of the channel - see below)

- SB_Condition (streambank condition such as erosion or bank stabilization)
- Notes (primary descriptor of streambank condition such as Terrace, Riprap, Car Bodies, Water Gap, etc.)
- Notes2 (further description of streambank condition)

All centerlines and bankline attributes were populated when observations were made and left as "Null" otherwise.

The "BankfullWidthCat" was populated based on the bankfull width of the channel and is associated with the buffer polygon that will be produced in Step 2. Appendix Table 1 includes the bankfull width categories and associated buffer widths.

Appendix Table 1. Bankfull width categories and associated buffer widths (sourced from DEQ Potential Project Mapping Method, in preparation).

Stream Width	(Digitized Line)	Buffer Width (Feet)
0 to 15 feet	(centerline)	25
15 to 30 feet	(centerline)	45
30 to 50 feet	(centerline)	55
50 feet or more	(bankline)	65

Step 2

Step 2A) An empty polygon layer was created for each near-term focus area called **Buffer** with the attribute "Waterbody" and "Bank". Using the *Buffer* tool in the *Modify Features Pane* in ArcPro, the channel centerline or bankline was buffered on both left and right bank using the buffer width corresponding to the stream width. Note that buffering only to the left or right of a line in order to create a separate polygon for both right and left bank is easily done in ArcPro by toggling left or right bank (not both).

Step 2B) The **Buffer** layer was exported and used to create a **RiparianCover** layer. The following attributes were added, "RiparianCov" and "RiparianCov_Notes".

Step 2C) The **Buffer** layer was exported and used to create an **Impacts** layer. The following attributes were added:

- Impact1
- Impact1_details
- Impact1_notes
- Impact2
- Impact2_details
- Impact2_notes

Step 2D) An empty point layer was created called **ImpactsPts** and the following attributes were added:

- Waterway
- Impact1
- Impact1_details

- Impact1_notes
- Impact2
- Impact2_details
- Impact2_notes

Step 3

Step 3A) Within the **RiparianCov** layer, the left and right bank polygons were divided into sub polygons representing the different riparian cover categories using the *Cut* tool. Riparian cover categories are described in Appendix Table 2**Error! Reference source not found.** below. Additional notes about riparian cover were documented in the "RiparianCov_Notes" attribute.

Appendix Table 2. Riparian cover categories and definitions (sourced from DEQ Potential Project Mapping Method, in preparation).

Riparian Cover: An estimate of the percentage of the buffer filled by contextually appropriate riparian cover, defined as the vegetation density and growth habit you would expect to find in a relatively un-altered stream system of comparable size, topography, geology, and climate. Contextually appropriate riparian cover will vary from cottonwood galleries on large rivers, to willow communities on low-gradient, intermontane streams, to alders and conifers in high-gradient mountain streams, to sedges and rushes in prairie streams and high-mountain meadows. Use your best judgement, and where helpful, add comments in the "Notes" field to help explain your decisions.	
Category	**Category Definition**
75 or more	Greater than 75% of the buffer contains contextually appropriate riparian cover. Note that terrace features were included in this category.
25 to 75	25% to 75% of the buffer contains contextually appropriate riparian cover.
Less than 25	Less than 25% of the buffer contains contextually appropriate riparian cover.
Undetermined	Unable to determine % contextually appropriate riparian cover. Use in rare instances where aerial imagery lacks sufficient clarity to identify vegetation.

Step 3B) Within the **Impact** layer, the left and right bank polygons were divided into sub polygons representing impact categories using the *Cut* tool. Impact categories are described in Appendix Table 3 below. Additional detail describing the impact were documented in the attribute Impact1_details and were predetermined to maintain consistency. For example, Durable Infrastructure includes features described in the definition in Appendix Table 3 (i.e. roads, bridges, culverts, buildings, ditches, etc.). Further notes and clarification were included in the attribute Impact1_Notes. If two impacts were observed within the buffer (for example, Crop, Hay, Grazing as well as Herbicide Impacts, a second impact was recorded in the attributes Impact2, Impact2_details and Impact2_notes. The second impact was not a lesser impact but rather an additional impact observed.

Appendix Table 3. Impact categories and definitions from DEQ Potential Project Mapping Method, in preparation, with some modifications to include other relevant impacts).

Impact	Definition
Channelization	Stream straightening. Humans taking a meandering stream and putting it into a straight channel, a ditch, or a pipe. Channelization designations should be the same for left and right banks. Note: This category included things like channel confinement from downcutting, channel migration zone impingement by infrastructure, road culverts, or areas where transportation networks have cut off a meander loop.
Crop_Hay_Grazing	Row crops, irrigated ag fields, hayed fields (look for bales or equipment tracks), pastures, grazed rangeland, cattle crossings, winter feeding areas (look for barren or trampled banks, livestock with direct access to the stream, livestock trails, feeding lines). Note: this category does not include pens or corrals. For the Smith assessment, each polygon was only assigned the land use applicable to the polygon. For example, a polygon was only defined as 'crop' if it appeared to be cultivated or 'hay' if mowing and equipment tracks were observed. Grazing occurs in most accessible areas so many 'crop' and 'hay' polygons were also assigned 'grazing'.
Durable_Infrastructure	Roads, bridges, culverts, dams; rip-rap, buildings, pipelines, parking lots, irrigation canals, dikes, railroad grades, fencing, or other durable structures located adjacent to or spanning a waterbody. These structures are often very difficult to remove, both physically and socially. Note: this category does not include beaver dams, pens and corrals, or mining.
Inflow	Any inflow of water or wastewater. Includes tributaries, irrigation return flows, stormwater discharge pipes, spillways, treated wastewater discharges, off-stream pond return flows, etc. Note: this is the one "impact" that may be human-caused, natural, or a mixture of both.
Mining	Placer piles, waste rock dumps, spoil piles, tailings piles, rock quarries, gravel pits, acid mine drainage, oil derricks, gas wells, and coal mines.
None	Default value.
Other_Specify (split into "Other_Specify_Diff", "Other_Specify_RA" to indicate restorability)	Use this category when none of the other impact categories will reasonably fit. For example, you might use it to identify impacts from forest fires or historic logging. In the Notes field, provide a clear description of the observed problem and its effect on the waterbody.
Pens_Corrals	Livestock confinement areas, pens, corrals, barns, manure lagoons, barnyards, horse riding arenas, livestock watering stations, cattle crossings. These areas are typically characterized as having little-to-no vegetation and some accumulation of manure. The Smith assessment further defined Pens_Corrals as 'high impact' or 'low impact' based on visual observations of bare ground in each area.

Impact	Definition
Soft_Infrastructure	Lawns, parks, golf courses, hiking trails, boat docks/ramps, fords, ATV trails, ball fields (provided that none of these are currently protected by rip-rap). These impacts are often less expensive to address and may only require revegetation.
Unknown_Veg_Removal	Use this category when contextually appropriate vegetation is missing but the root cause is not apparent.
Withdrawal	Any human-caused diversion of water out of a stream or lake, even for temporary use. This includes irrigation diversions, pump sites, drinking water diversions, industrial cooling water diversions, diversions for off-stream ponds, etc. It does not include penstocks used for hydro-electric power generation, provided the penstocks are immediately adjacent to a dam.

Step 3C) Within the **ImpactPts** layer, points were digitized at localized impact locations including bridges, fencelines up to or crossing the channel, water access for livestock, fords, recreational access, irrigation return flow outlets, diversion withdrawal locations, etc. These points were assigned an impact category consistent with Table X above and provide a count of each type of feature rather than deducing this from the impact polygon area.

Step 4

After all spatial layers were drafted, reviewed, and finalized. The attribute tables from all layers were exported to Microsoft Excel for analysis. Analysis in Excel included creating pivot tables to summarize impact quantities.

Results

Smith River Upstream of Camp Baker

The remote assessment was completed along the mainstem Smith River from the confluence of the North and South Fork downstream to Camp Baker. Maps displaying the results of the remote assessment for the Smith River upstream of Camp Baker are shown in Appendix Figure 1 through Appendix Figure 7.

Appendix Figure 1 shows remotely assessed human caused alterations to the Smith River channel upstream of Camp Baker. Appendix Table 4 provides a summary of quantities of remotely assessed human caused impairments to the Smith River channel upstream of Camp Baker. The main human caused alterations to the Smith River channel include road crossings, culverts, and channelization; over 5 miles of channel was mapped as straightened in this section.

Appendix Figure 2 shows remotely assessed human caused impact areas within the riparian buffer of the Smith River upstream of Camp Baker. Appendix Figure 3 shows remotely assessed human caused impact points within the riparian buffer of Smith River upstream of Camp Baker. Appendix Table 5 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 6 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 86.0% of the area. Of that total, haying also occurs in 29.8% of the riparian buffer along with grazing. There are four corrals located within the riparian buffer; three with concentrated, high intensity use. There are a total of nine road crossings, 13 irrigation diversions of which 12 have in channel diversion structure, and 44 irrigation return flow points.

Appendix Figure 4 shows remotely assessed riparian vegetation cover categories along Smith River upstream of Camp Baker. Appendix Table 8 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 9 shows the length of streambank within each cover category. Most (64.4%) of the riparian buffer and streambank length is in the <25% cover category. Appendix Figure 5 shows an example of the woody riparian vegetation mapping using 1950s imagery and 2021 imagery. Appendix Table 9 shows the percent of woody vegetation change between the 1950s and 2021. During that period a total of 22 acres (0.6%) of woody riparian vegetation was lost.

Appendix Table 10 provides lengths of eroding streambanks and bank armoring. 11.8% of banks are actively eroding and 1.0% of banks have been stabilized. In the 1980s assessment, 6% of streambanks were documented as eroding and 0.2% stabilized. Appendix Figure 6 shows eroding streambanks and streambanks where bank armoring has occurred. Appendix Figure 7 provides a detail view of bank condition mapping for the Smith River upstream of Camp Baker.

Appendix Table 4. Smith River upstream of Camp Baker human-caused channel alterations.

HUMAN CAUSED CHANNEL ALTERATIONS	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings (bridge or culvert)	220	0.04	0.09%
Channelization	27,917	5.3	11.4%
No remotely observed human caused channel alterations	216,168	40.9	88.5%
TOTAL	**244,305**	**46.3**	**100%**

Appendix Table 5. Smith River upstream of Camp Baker human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	14,981,485	343.9	55.9%
Hay, Grazing	8,001,714	183.7	29.8%
Hay, Grazing, Durable infrastructure (ditch)	65,835	1.5	0.2%
Total Grazing	**23,049,034**	**529.1**	**86.0%**
Durable infrastructure (Camp Baker)	209,371	4.8	0.8%
Durable infrastructure (building)	20,811	0.7	0.1%
Durable infrastructure (dirt road)	565,049	1.8	2.1%
Durable infrastructure (dirt road, ditch)	17,795	1.8	0.1%
Durable infrastructure (ditch)	459,775	14.3	1.7%
Total Durable Infrastructure	**1,418,553**	**21.0**	**5.3%**
Soft infrastructure (hay storage)	10,380	17.9	0.0%
Soft infrastructure (lawn)	29,916	0.4	0.1%
Soft infrastructure (two-track)	33,360	2.9	0.1%
Total Soft Infrastructure	**73,656**	4.8	0.3%
Pens, corrals (high impact)	119,176	1.2	0.4%
Pens, corrals (low impact)	26,575	1.2	0.1%
Total Pens, Corrals	**219,407**	4.8	0.3%
No remotely observed human caused channel alterations	2,275,474	52.2	8.5%
TOTAL	**26,816,717**	**286.8**	**100%**

Appendix Table 6. Smith River upstream of Camp Baker Creek impact points.

IMPACT POINT CATEGORY	TOTAL OBSERVATIONS
Durable Infrastructure	
Boat ramp	2
Road crossings	9
Irrigation diversion with instream structure	12
Fenceline	37
Old infrastructure	2
Soft Infrastructure	
Access point	3
Cattle access	10
Channel ford	9
Withdrawal	
Irrigation diversion	13
Inflow	
Irrigation return flow	44
Pens, Corrals	
High impact	3
Low impact	1
TOTAL	**145**

Appendix Table 7. Smith River upstream of Camp Baker riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	17,268,929	396.4	64.4%
25 to 75	3,679,429	84.5	13.7%
75 or more	5,868,359	134.7	21.9%
TOTAL	**26,816,717**	**616**	**100%**

Appendix Table 8. Smith River upstream of Camp Baker riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH* (feet)	TOTAL BANKLINE LENGTH* (miles)	PERCENT OF TOTAL BANKLINE*
Less than 25	314,625	7.2	64.4%
25 to 75	67,060	1.5	13.7%
75 or more	106,925	2.5	21.9%
TOTAL	**488,610**	**11.2**	**100%**

**includes both left and right banks*

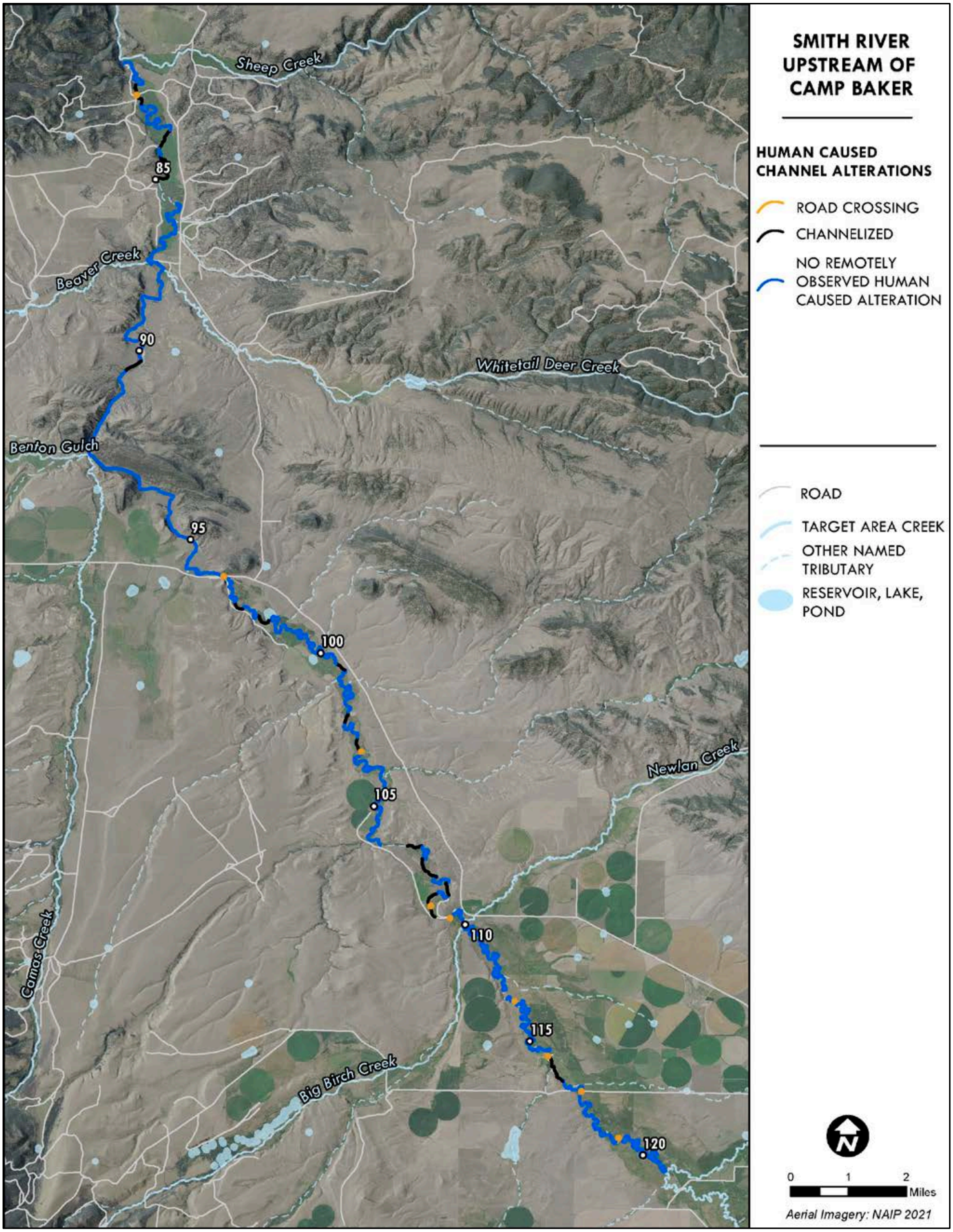
Appendix Table 9. Smith River upstream of Camp Baker woody riparian vegetation loss since 1950s.

	1950s		2021		Change (acres)	Change (%)
	Acres	% Floodplain Area	Acres	% Floodplain Area		
Willow	374	11.6%	355	11.0%	-19	0.6%
Cottonwood	30	0.9%	29	0.9%	-1	0%
Cottonwood/willow	9	0.3%	10	0.3%	-1	0%
TOTAL	**413**	**12.8%**	**394**	**12.2%**	**-22**	**0.6%**

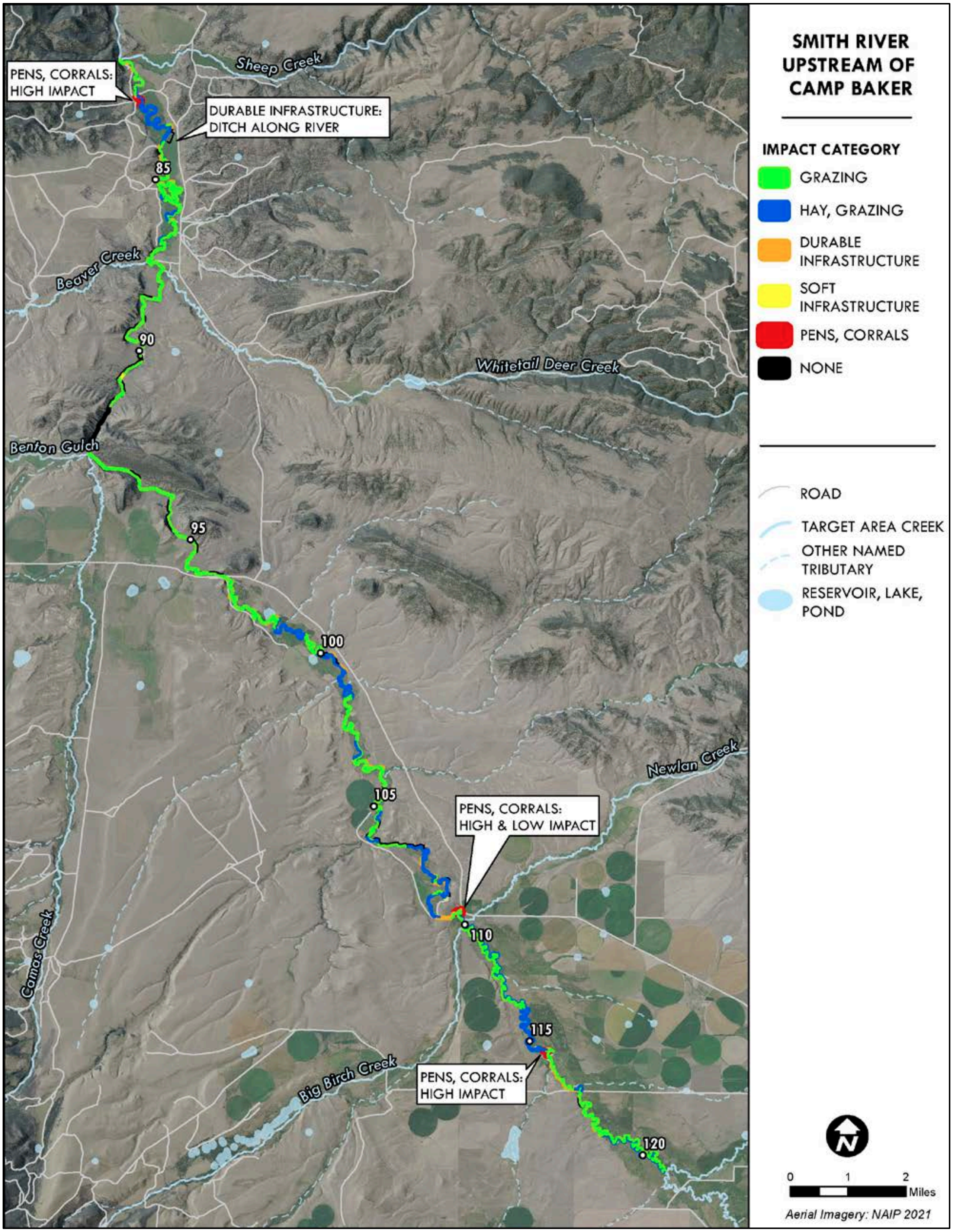
Appendix Table 10. Smith River upstream of Camp Baker streambank condition.

STREAMBANK CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Bank stabilization	5,073	1.0	1.0%
Bank erosion	59,530	11.3	11.8%
No erosion or stabilization	439,148	83.2	87.2%
TOTAL	**503,751**	**95.4**	**100.0%**

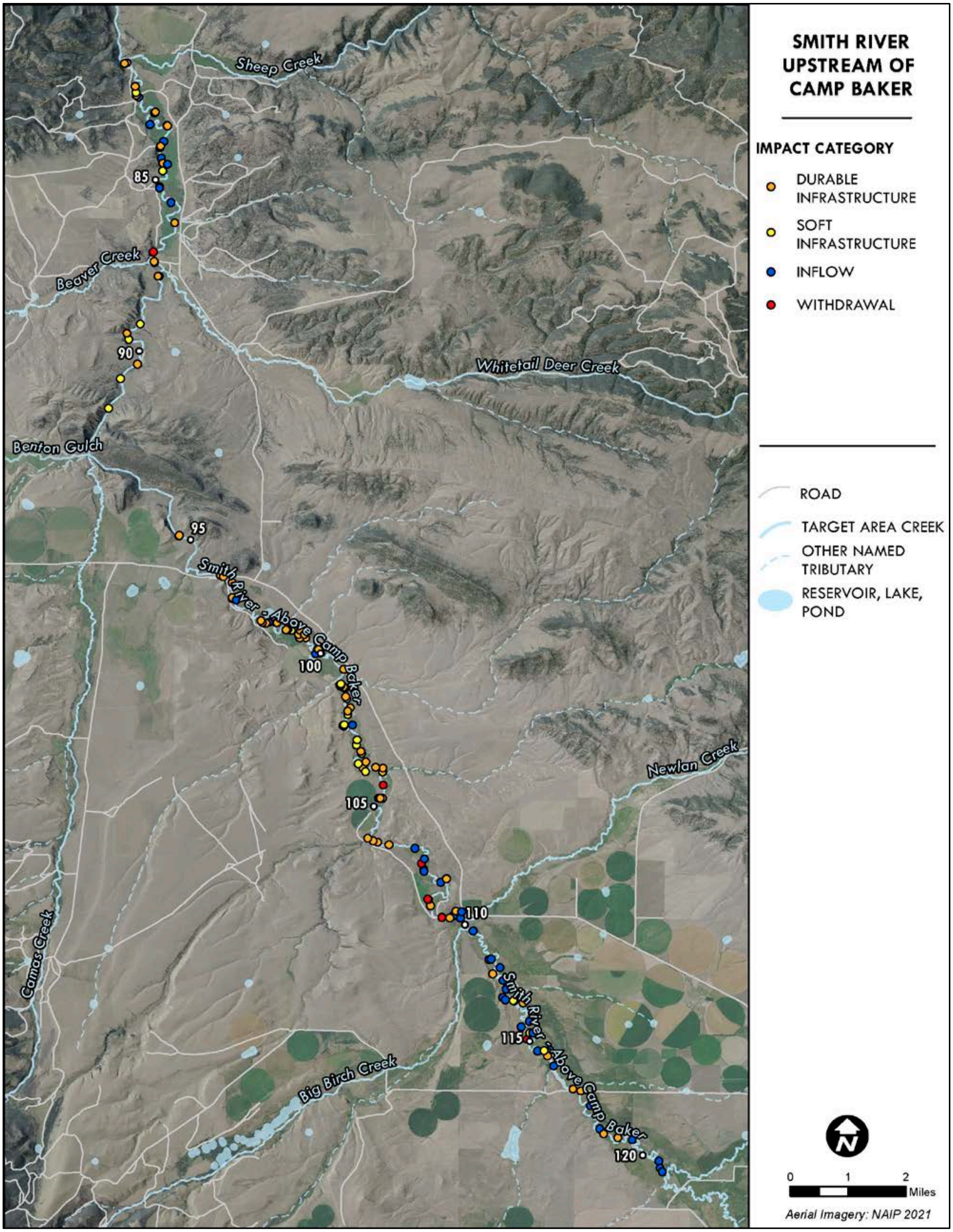
*includes both left and right bank



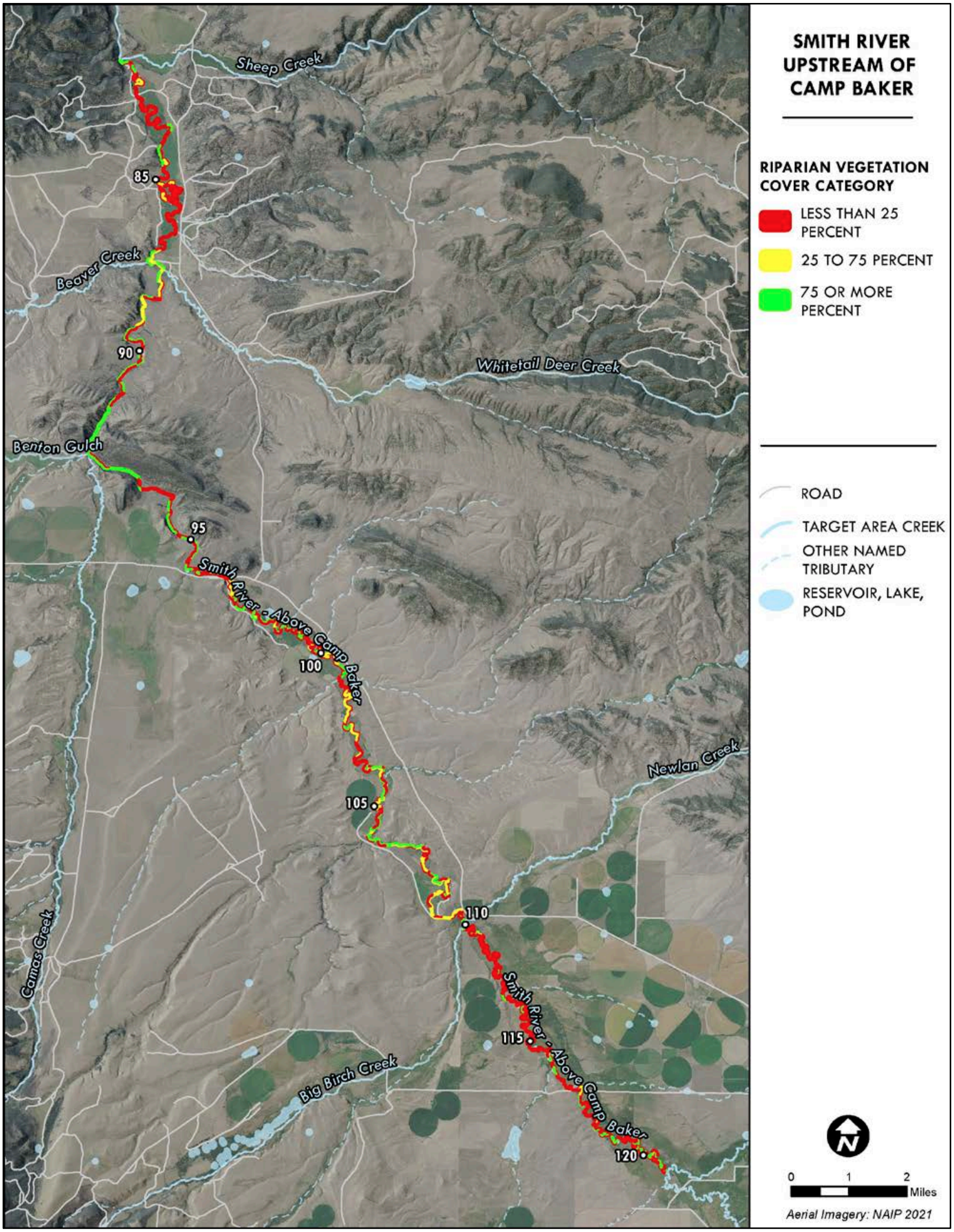
Appendix Figure 1. Smith River upstream of Camp Baker remote assessment human caused channel alterations.



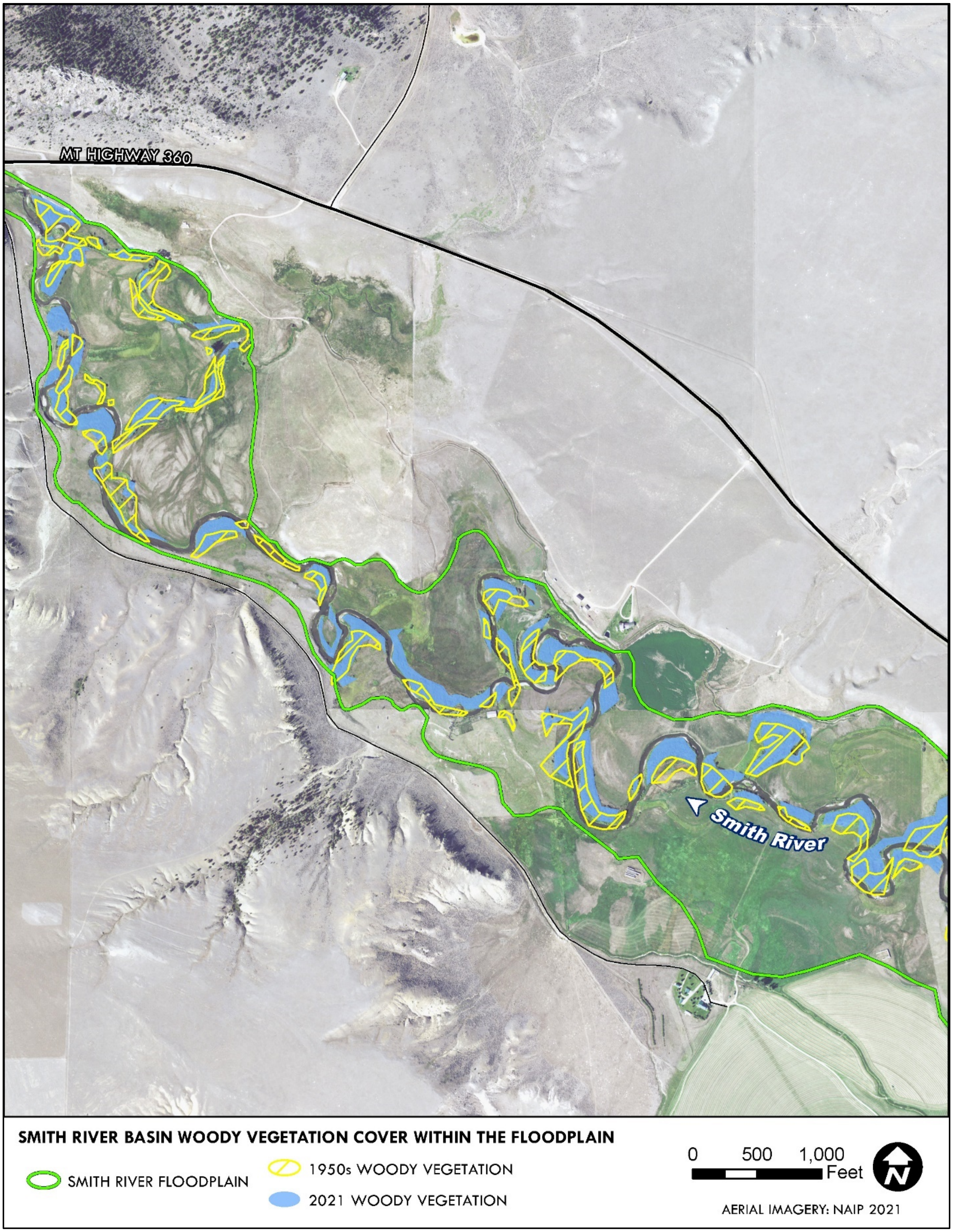
Appendix Figure 2. Smith River upstream of Camp Baker remote assessment human caused impacts within the riparian buffer.



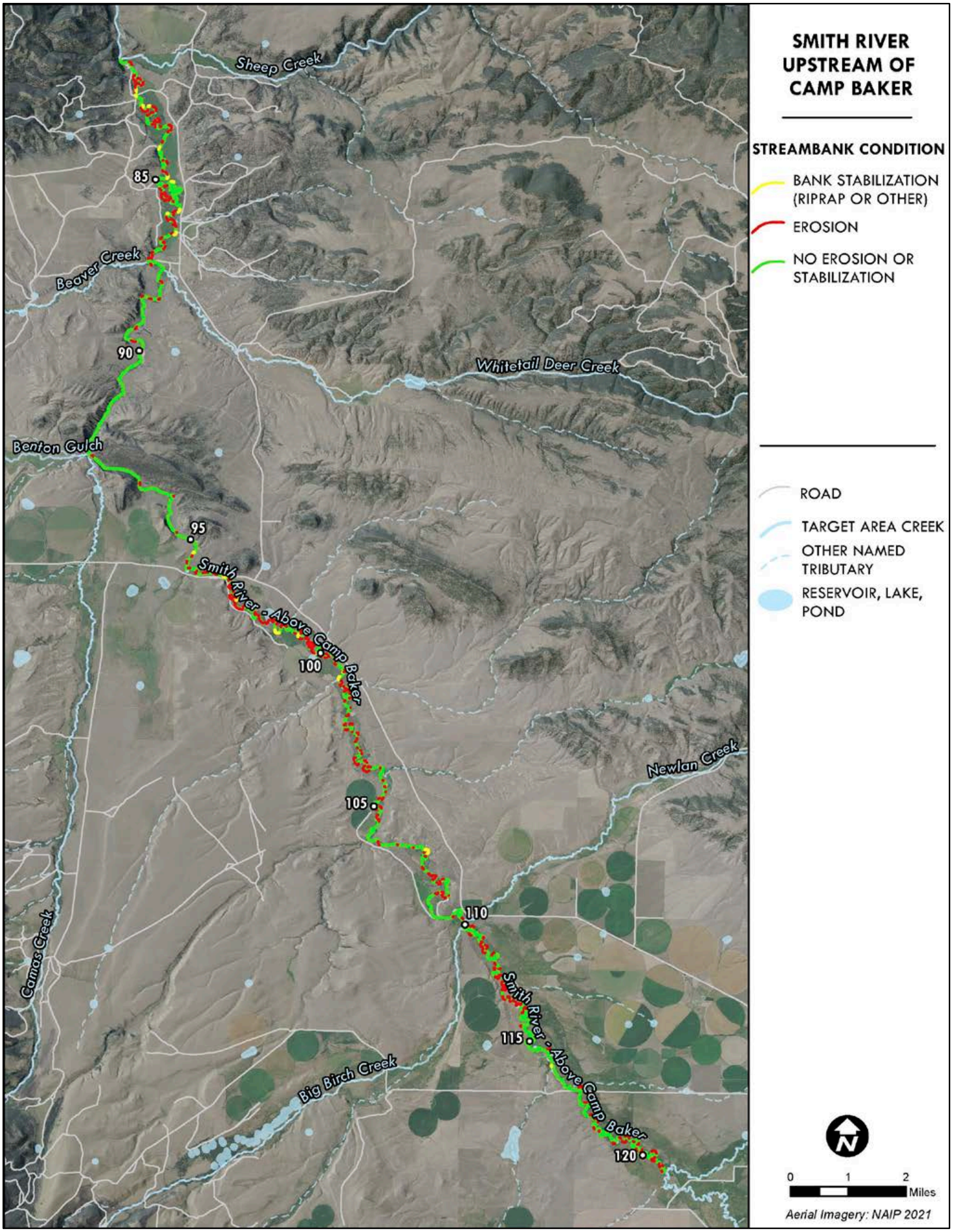
Appendix Figure 3. Smith River upstream of Camp Baker remote assessment impact points within the riparian buffer.



Appendix Figure 4. Smith River upstream of Camp Baker remote assessment riparian vegetation cover categories within riparian buffer.



Appendix Figure 5. Example of woody vegetation cover within the floodplain extent and woody vegetation change between the 1950s and 2021 along the mainstem Smith River upstream of Camp Baker.



Appendix Figure 6. Smith River upstream of Camp Baker remote assessment streambank condition.

Appendix Figure 7. Example of streambank condition mapping mainstem Smith River upstream of Camp Baker.

Smith River Camp Baker to Eden Bridge

The remote assessment was completed along the mainstem Smith River from Camp Baker to Eden Bridge. Maps displaying the results of the remote assessment for the Smith River from Camp Baker to Eden Bridge are shown in Appendix Figure 8 through Appendix Figure 13. Appendix Figure 8shows remotely assessed human caused alterations to the Smith River channel between Camp Baker and Eden Bridge.

Appendix Table 11 provides a summary of quantities of remotely assessed human caused impairments to the Smith River between Camp Baker and Eden Bridge. The main human caused alteration to the Smith River channel is channelization. Appendix Figure 9 shows remotely assessed human caused impact areas within the riparian buffer of the Smith River between Camp Baker and Eden Bridge. Appendix Figure 10 shows remotely assessed human caused impact points within the riparian buffer of Smith River between Camp Baker and Eden Bridge.

Appendix Table 12 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 13 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 42.2% of the area. Of that total, haying also occurs in 0.9% of the riparian buffer. Within the grazed area, potential herbicide impacts occur in 1.3% of the riparian buffer. An additional 1.3% of the riparian buffer also had signs of potential herbicide impacts. Downstream of the canyon, there are some cultivated crop fields occupying 0.6% of the riparian buffer. There are a total of three road crossings and nine channel fords, one irrigation diversion, and one irrigation return flow points.

Appendix Figure 11 shows remotely assessed riparian vegetation cover categories along the Smith River between Camp Baker and Eden Bridge. Appendix Table 14 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 15 shows the length of streambank within each cover category. Most (45.9%) of the riparian buffer and streambank length is in the <25% cover category. Appendix Figure 12 shows an example of the woody riparian vegetation mapping using 1950s imagery and 2021 imagery. Appendix Table 16 shows the percent of woody vegetation change between the 1950s and 2021. During that period a total of 143 acres (4.8%) of woody riparian vegetation was lost.

Appendix Figure 13 shows eroding streambanks and streambanks where bank armoring is present. Appendix Table 17 provides lengths of eroding streambanks and bank armoring. 9.4% of banks are actively eroding and 0.1% of banks have been stabilized. In the 1980s assessment, 3.4% of streambanks were documented as eroding and 0.6% stabilized. Appendix Figure 14 provides a detail view of bank condition mapping for the Smith River upstream of Camp Baker.

Appendix Table 11. Smith River Camp Baker to Eden Bridge human-caused channel alterations.

CHANNEL CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Channelization	18,136	3.4	8.4%
No remotely observed human caused channel alterations	197,961	37.5	91.6%
TOTAL	**216,097**	**40.9**	**100%**

Appendix Table 12. Smith River Camp Baker to Eden Bridge human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	16,130,305	370.3	39.0%
Crop	246,071	5.6	0.6%
Hay, Grazing	389,974	9.0	0.9%
Grazing, Soft Infrastructure (two-track)	142,634	3.3	0.3%
Grazing, Herbicide impacts	529,614	12.2	1.3%
Total Grazing	**17,438,598**	**400.3**	**42.2%**
Durable infrastructure (buildings)	316,850	7.3	0.8%
Durable infrastructure (dirt road)	709,204	16.3	1.7%
Durable infrastructure (dirt road, riprap)	392,112	9.0	0.9%
Durable infrastructure (ditch)	152,176	3.5	0.4%
Durable infrastructure (road)	74,585	1.7	0.2%
Total Durable Infrastructure	**1,644,927**	**37.8**	**4.0%**
Soft infrastructure (crossing)	14,089	0.3	0.03%
Soft infrastructure (recreation, boat camp)	1,952,871	44.8	4.7%
Soft infrastructure (recreation, private)	78,867	1.8	0.2%
Soft infrastructure (residential)	637,628	14.6	1.5%
Soft infrastructure (two-track)	218,443	5.0	0.5%
Total Soft Infrastructure	**2,901,899**	**66.6**	**7.0%**
Other (herbicide impacts)	522,325	12.0	1.3%
Total Other	**522,325**	**12.0**	**1.3%**
No remotely observed human caused channel alterations	**18,833,136**	**432.3**	**45.6%**
TOTAL	**41,340,885**	**949.1**	**100%**

Appendix Table 13. Smith River Camp Baker to Eden Bridge Creek impact points.

IMPACT POINT CATEGORY	TOTAL OBSERVATIONS
Durable Infrastructure	
Road crossings (bridge or culvert)	3
Fenceline	6
Pivot pump	1
Soft Infrastructure	
Access point	11
Boat camp	54
Channel ford	9
Withdrawal	
Pivot pump	1
Inflow	
Irrigation return flow	1
Total	**86**

Appendix Table 14. Smith River Camp Baker to Eden Bridge riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	18,965,481	435.4	45.9%
25 to 75	4,845,994	111.2	11.7%
75 or more	17,525,015	402.3	42.4%
TOTAL	**41,336,490**	**949**	**100%**

Appendix Table 15. Smith River Camp Baker to Eden Bridge riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH (feet)	TOTAL BANKLINE LENGTH (miles)	PERCENT OF TOTAL BANKLINE
Less than 25	291,535	55.2	45.9%
25 to 75	74,494	14.1	11.7%
75 or more	269,383	51.0	42.4%
TOTAL	**635,413**	**120.3**	**100%**

**includes both left and right bank*

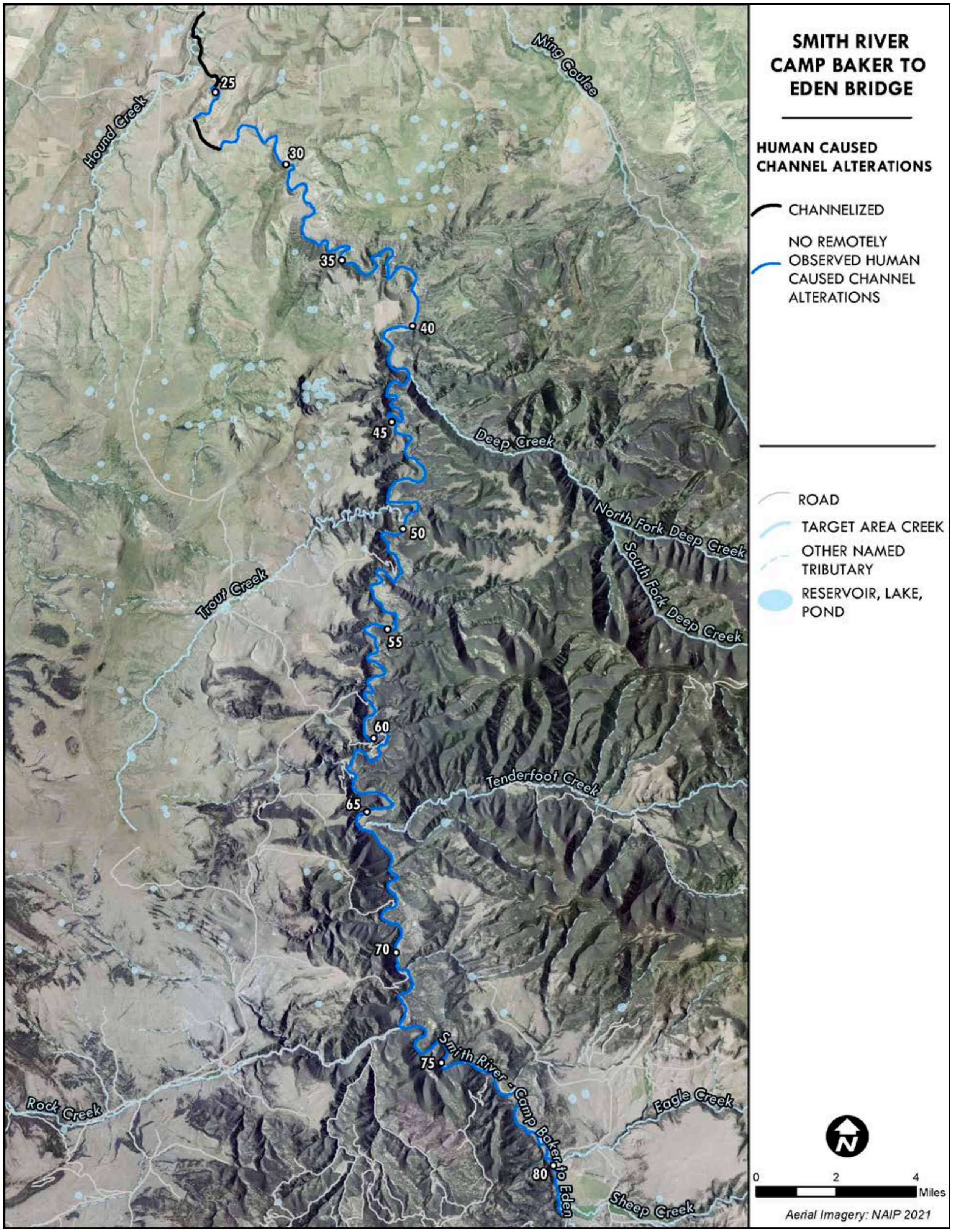
Appendix Table 16. Smith River Camp Baker to Eden Bridge woody riparian vegetation loss since 1950s.

	1950s		2021		Change (acres)	Change (%)
	Acres	% Floodplain Area	Acres	% Floodplain Area		
Willow	179	6.1%	238	8.2%	+59	+2.10%
Cottonwood	151	5.2%	32	1.1%	-119	-4.10%
Cottonwood/willow	157	5.4%	74	2.5%	-83	-2.6%
TOTAL	**487**	**16.6%**	**344**	**11.8%**	**-143**	**-4.8%**

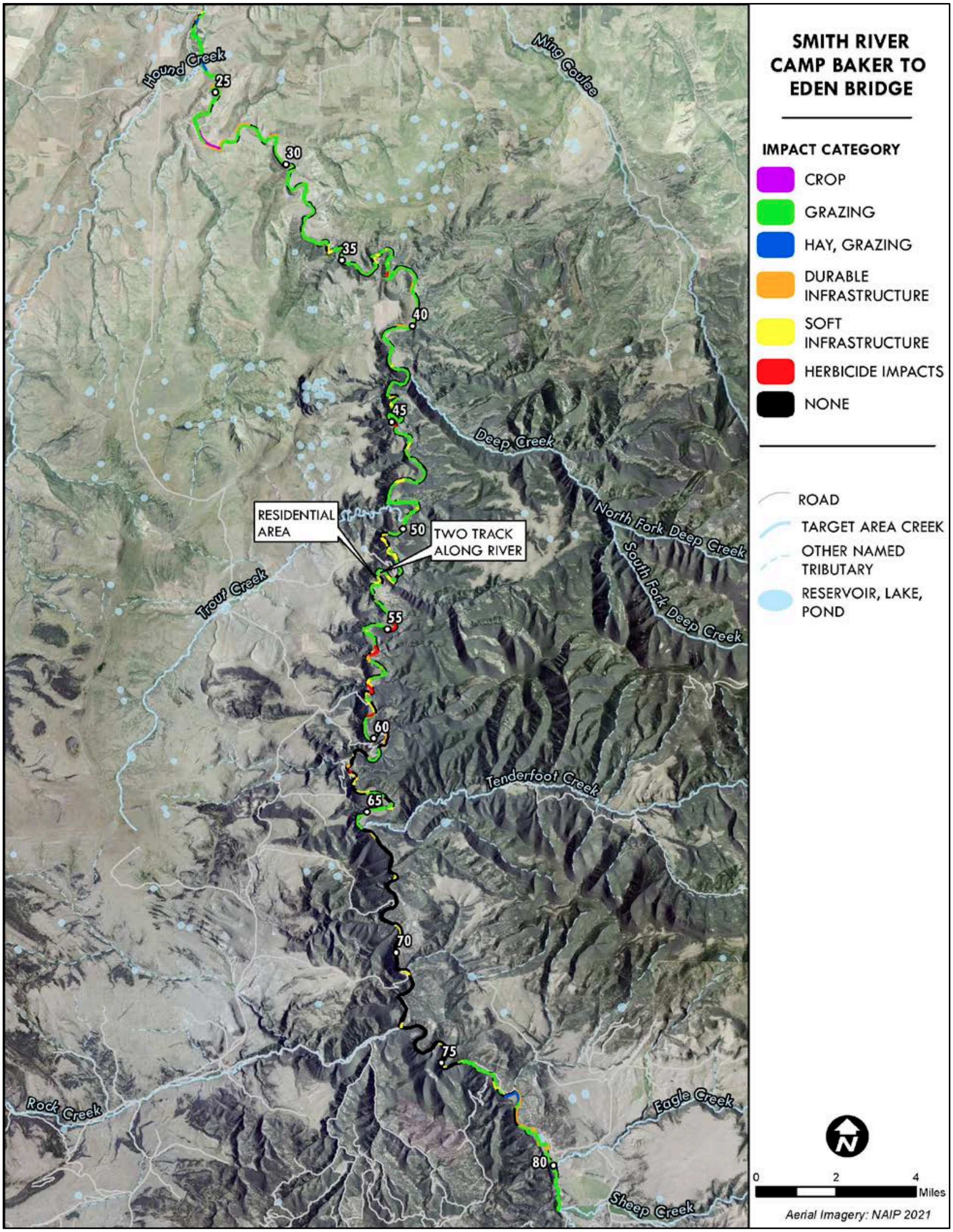
Appendix Table 17. Smith River Camp Baker to Eden Bridge streambank condition.

STREAMBANK CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Bank stabilization	945	0.2	0.1%
Bank erosion	64,530	12.2	9.4%
No erosion or stabilization	624,339	118.2	90.5%
TOTAL	**689,814**	**130.6**	**100%**

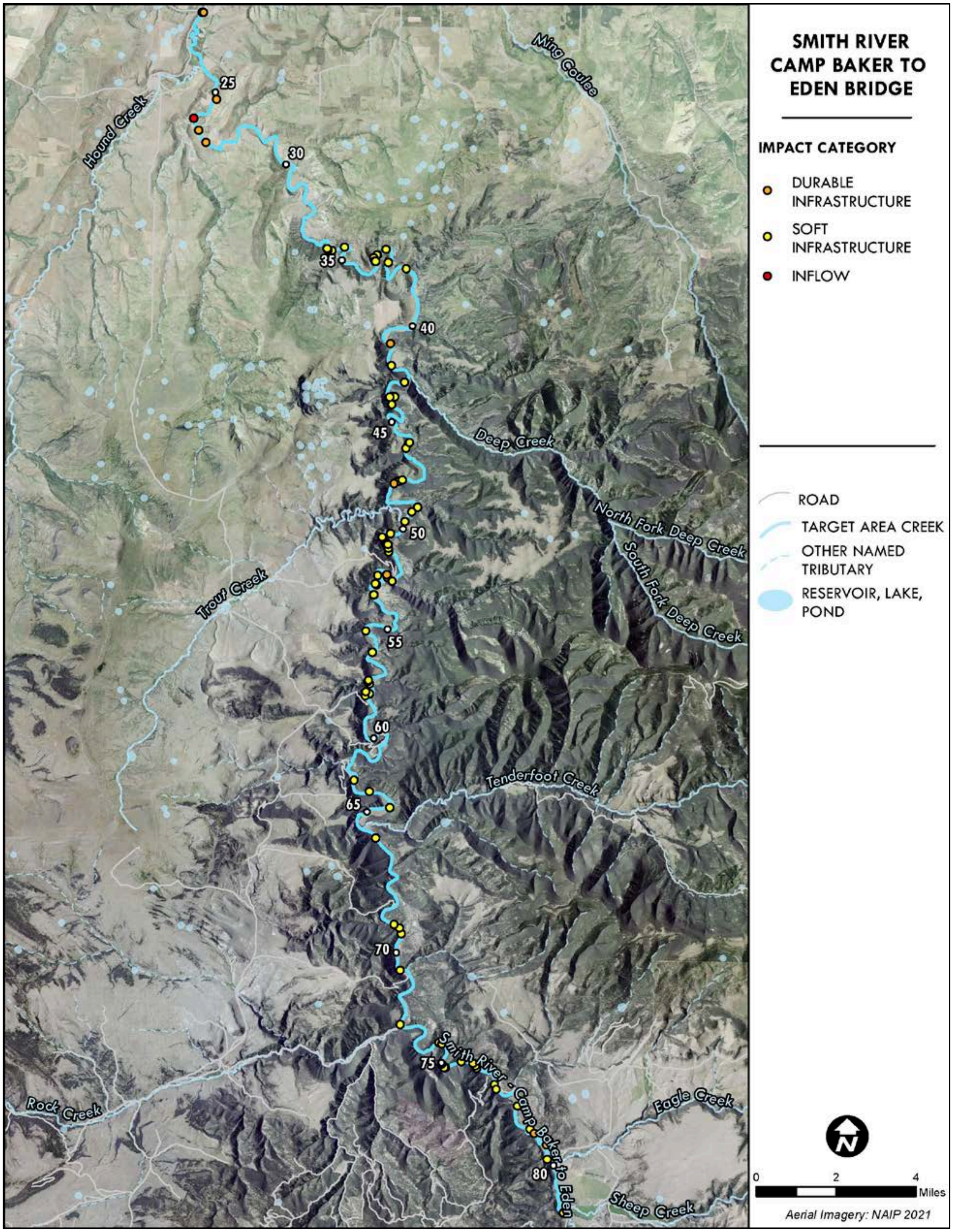
**includes both left and right bank*



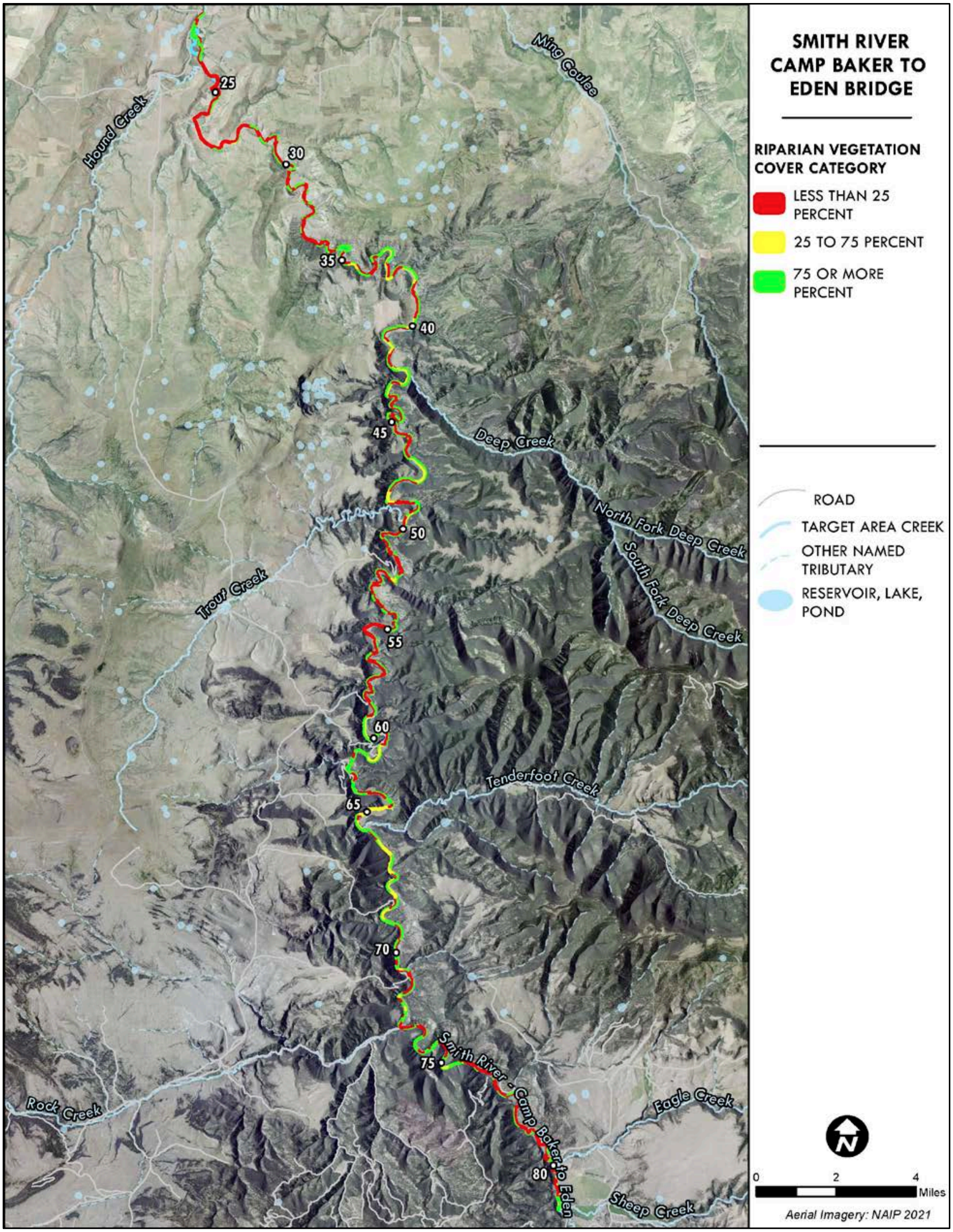
Appendix Figure 8. Smith River Camp Baker to Eden Bridge remote assessment human caused channel alterations.



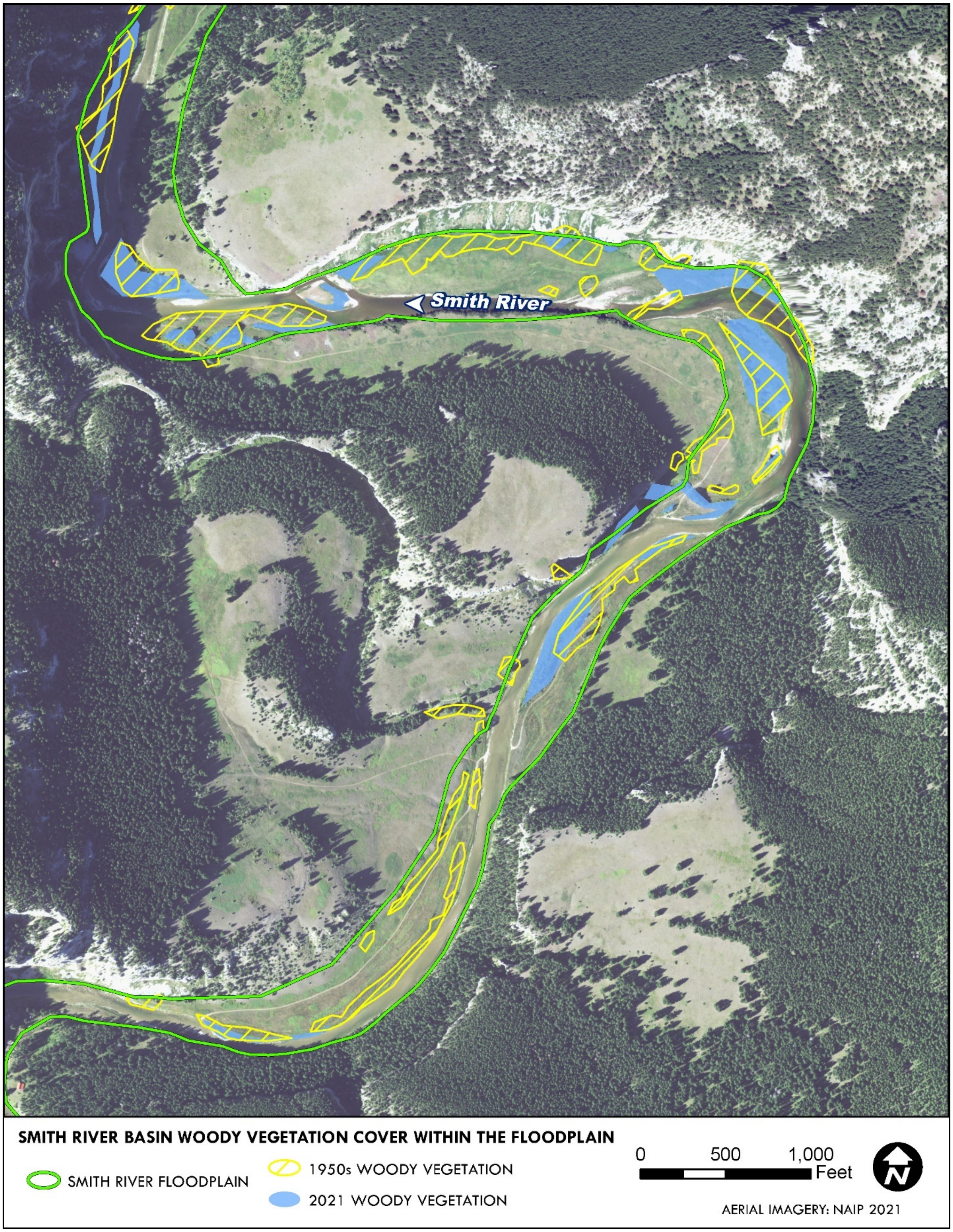
Appendix Figure 9. Smith River Camp Baker to Eden Bridge remote assessment human caused impacts within the riparian buffer.



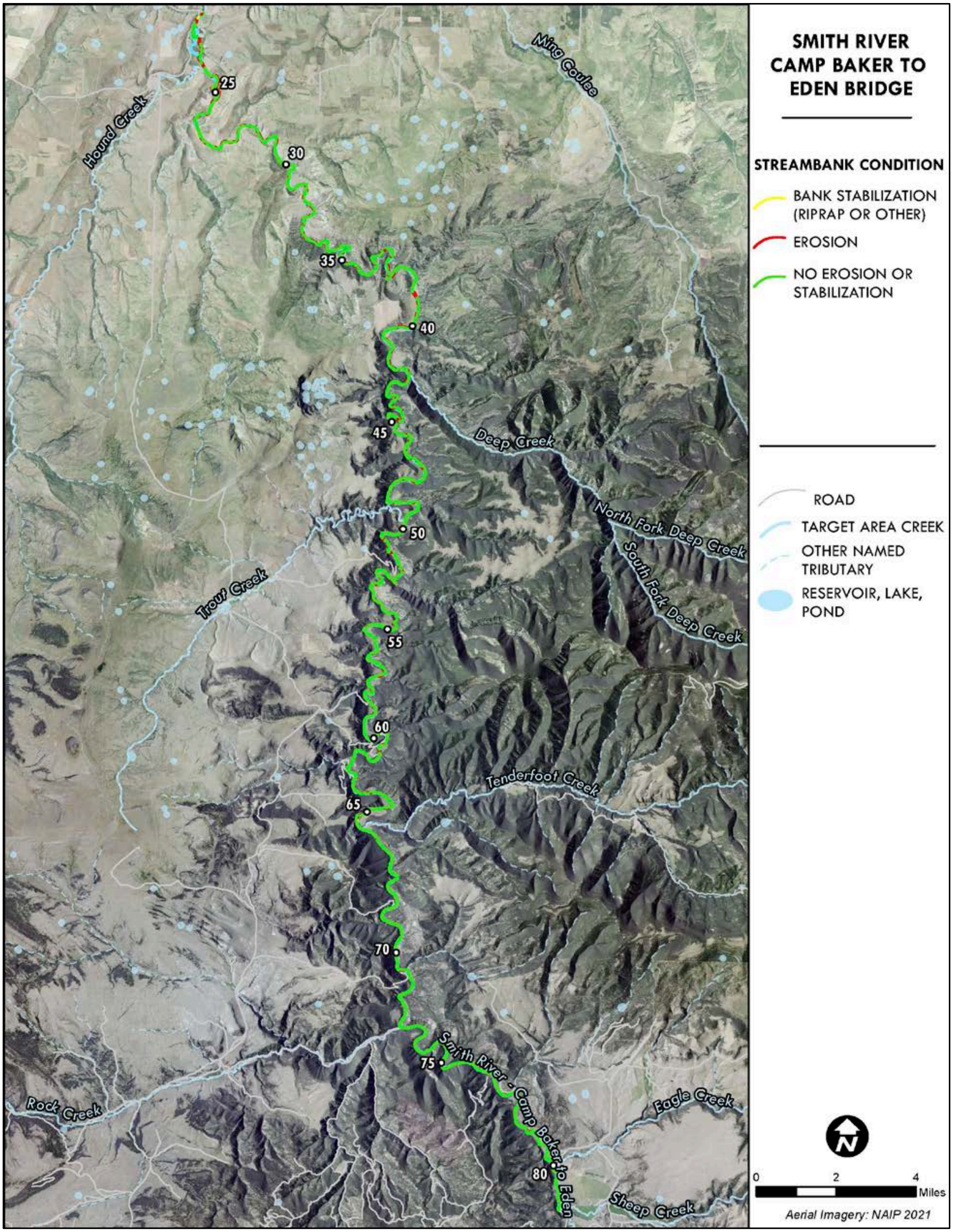
Appendix Figure 10. Smith River Camp Baker to Eden Bridge remote assessment impact points within the riparian buffer.



Appendix Figure 11. Smith River Camp Baker to Eden Bridge remote assessment riparian vegetation cover categories within riparian buffer.



Appendix Figure 12. Example of woody vegetation cover within the floodplain extent and woody vegetation change between the 1950s and 2021 along the mainstem Smith River between Camp Baker and Eden Bridge.



Appendix Figure 13. Smith River Camp Baker to Eden Bridge remote assessment streambank condition

Appendix Figure 14. Example of streambank condition mapping mainstem Smith River between Camp Baker and Eden Bridge.

North Fork Smith River

The remote assessment was completed along the mainstem North Fork River from the outlet of Sutherlin Reservoir to the mouth. Maps displaying the results of the remote assessment for the North Fork Smith River are shown in Appendix Figure 15 through Appendix Figure 18.

Appendix Figure 15 shows remotely assessed human caused alterations to the North Fork Smith River channel. Appendix Table 18 provides a summary of quantities of remotely assessed human caused impairments to the North Fork Smith River channel. The main human caused alterations to the North Fork Smith River channel include channelization and channel over widening.

Appendix Figure 16 shows remotely assessed human caused impact areas within the riparian buffer of the North Fork Smith River. Appendix Figure 17 shows remotely assessed human caused impact points within the riparian buffer of the North Form Smith River. Appendix Table 19 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 20 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 92.1% of the area. Of that total, haying occurs in 8.7% of the riparian buffer in addition to grazing. There are nine corrals located within the riparian buffer; five with concentrated, high intensity use. There are a total of 26 road crossings, 25 irrigation diversions, and 32 irrigation return flow points.

Appendix Figure 18 shows remotely assessed riparian vegetation cover categories along the North Fork Smith River. Appendix Table 21 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 22 shows the length of streambank within each cover category. Most (44.5%) of the riparian buffer and streambank length is in the <25% cover category.

Appendix Table 18. North Fork Smith River human-caused channel alterations.

HUMAN CAUSED CHANNEL ALTERATIONS	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings (bridge or culvert)	63	0.01	0.04%
Channelization	1,776	0.3	1.3%
Over-widened channel	5,969	1.1	4.2%
Split flow	11,279	2.1	8.0%
No remotely observable human caused channel alterations	122,479	23.2	86.5%
TOTAL	**141,566**	**26.6**	**100%**

Appendix Table 19. North Fork Smith River human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	9,850,290	226.1	78.9%
Hay, Grazing	1,092,469	25.1	8.7%
Grazing, Vegetation removal	558,771	12.8	4.5%
Total Grazing	**11,501,531**	**264.0**	**92.1%**
Durable infrastructure (building)	32,480	0.7	0.3%
Durable infrastructure (road)	51,181	1.2	0.4%
Total Durable Infrastructure	**83,661**	**1.9**	**0.7%**
Soft infrastructure (highway ROW)	18,600	0.4	0.1%
Soft infrastructure (residential lawn)	62,569	1.4	0.5%
Soft infrastructure (two-track)	127,554	2.9	1.0%
Total Soft Infrastructure	**208,723**	**4.8**	**1.7%**
Pens, corrals (high impact)	76,989	1.8	0.6%
Pens, corrals (low impact)	621,004	14.3	5.0%
Total Pens, Corrals	**697,993**	**16.0**	**5.6%**
TOTAL	**12,491,908**	**286.8**	**100%**

Appendix Table 20. North Fork Smith River impact points.

IMPACT CATEGORY	# Points
Durable Infrastructure	
Dam	1
Road crossings (bridge or culvert)	26
Fenceline	26
Irrigation diversion with instream structure	6
Pipe	1
Soft Infrastructure	
Cattle access	3
Channel ford	5
Off channel stock pond	1
Withdrawal	
Irrigation diversion	25
Inflow	
Irrigation return flow point	32
Pens, Corrals	
High impact	5
Low impact	4
TOTAL	**134**

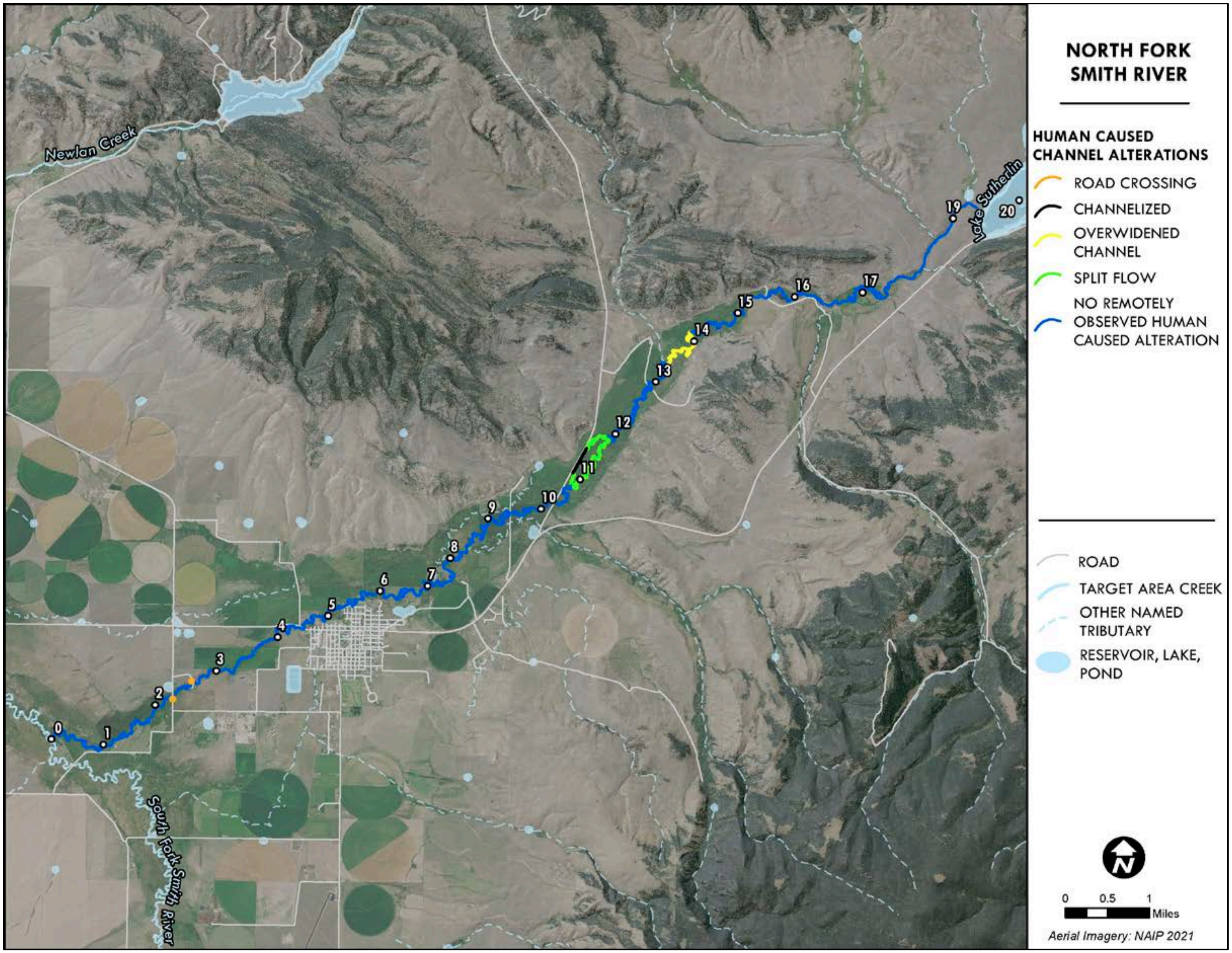
Appendix Table 21. North Fork Smith River riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
25 to 75	4,789,414	109.9	38.3%
75 or more	2,147,033	49.3	17.2%
Less than 25	5,555,456	127.5	44.5%
TOTAL	**12,491,903**	**287**	**100%**

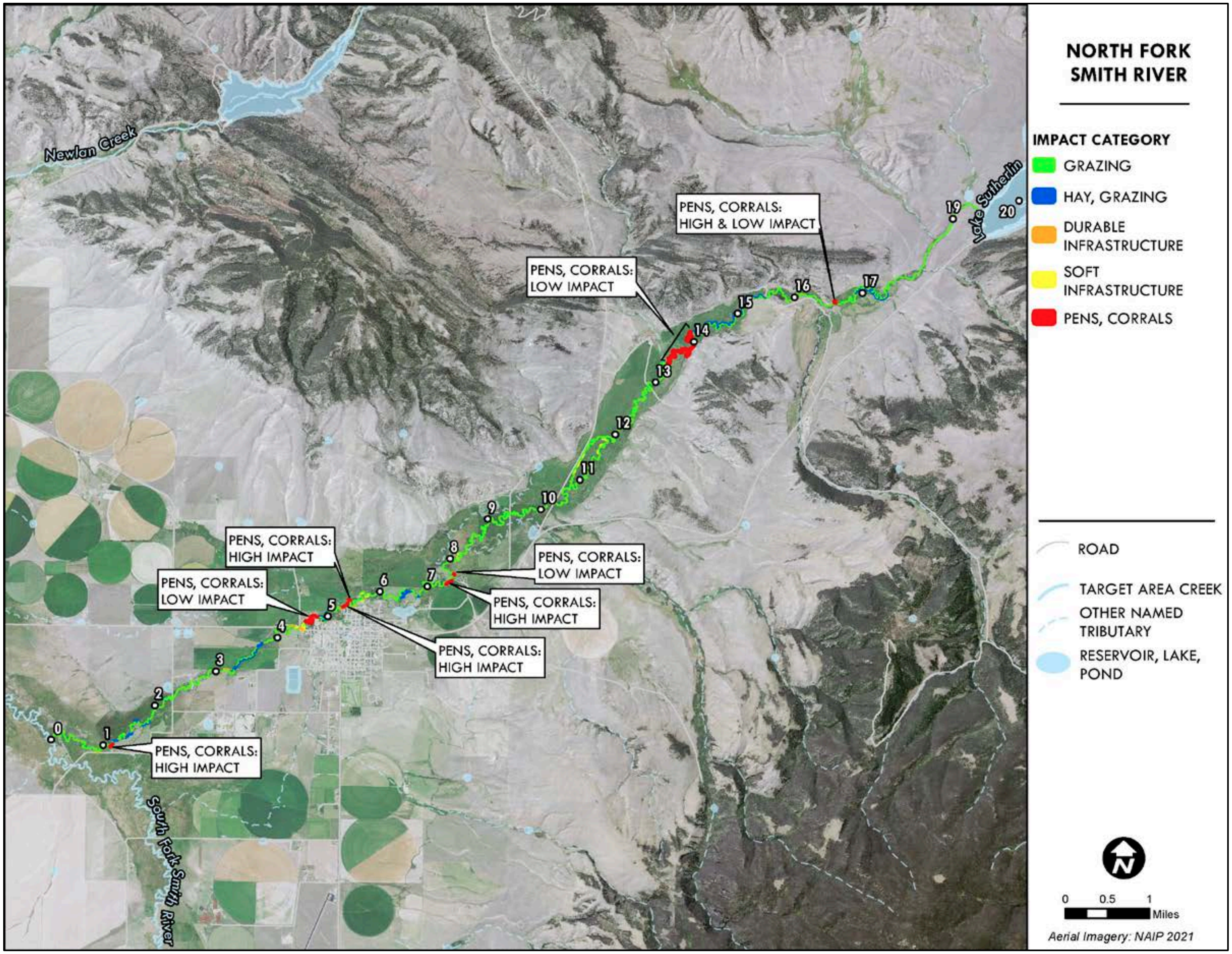
Appendix Table 22. North Fork Smith River riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH (feet)	TOTAL BANKLINE LENGTH (miles)	PERCENT OF TOTAL BANKLINE
Less than 25	125,936	2.9	44.5%
25 to 75	108,554	2.5	38.3%
75 or more	48,642	1.1	17.2%
TOTAL	**283,133**	**6.5**	**100%**

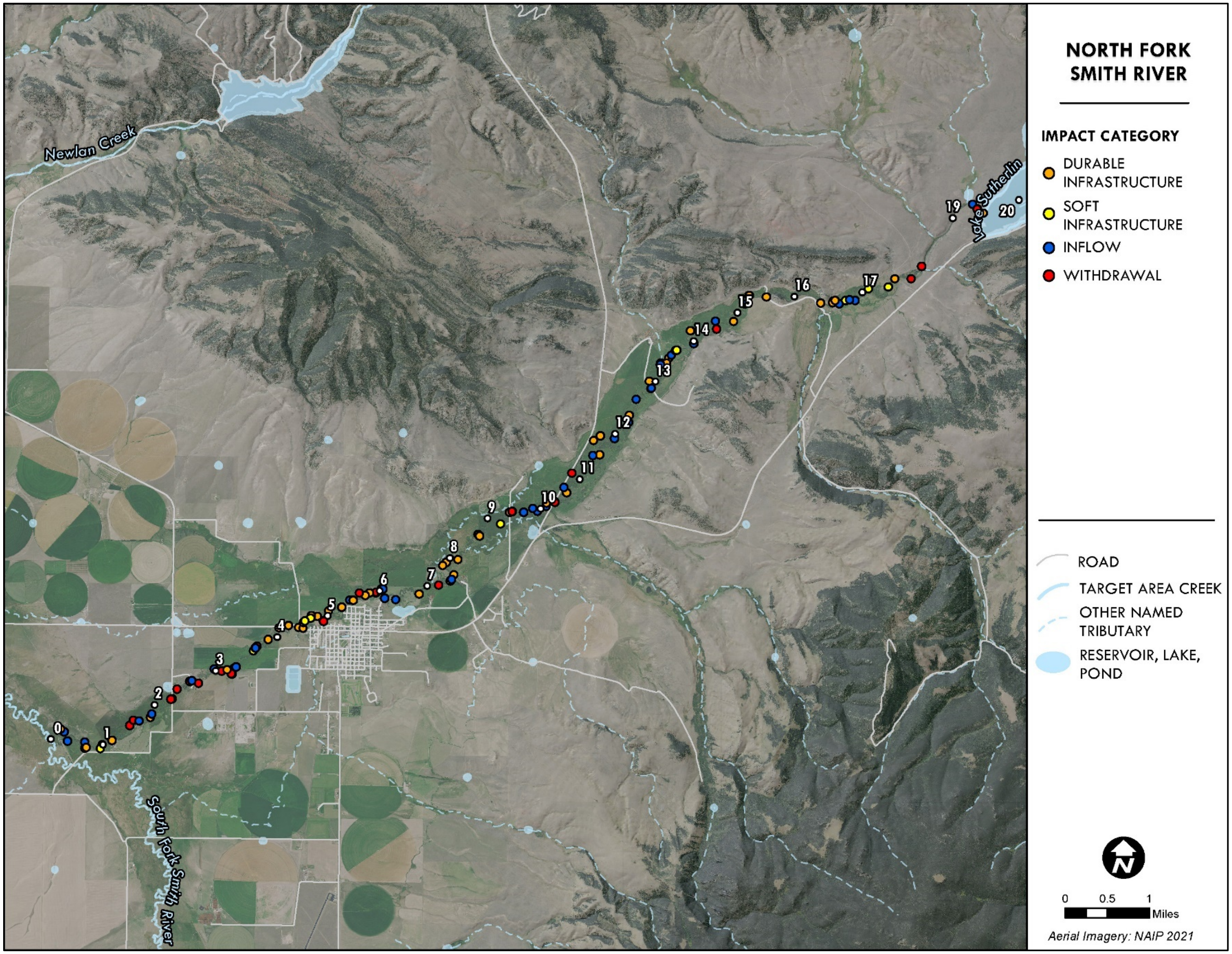
**includes both left and right banks*



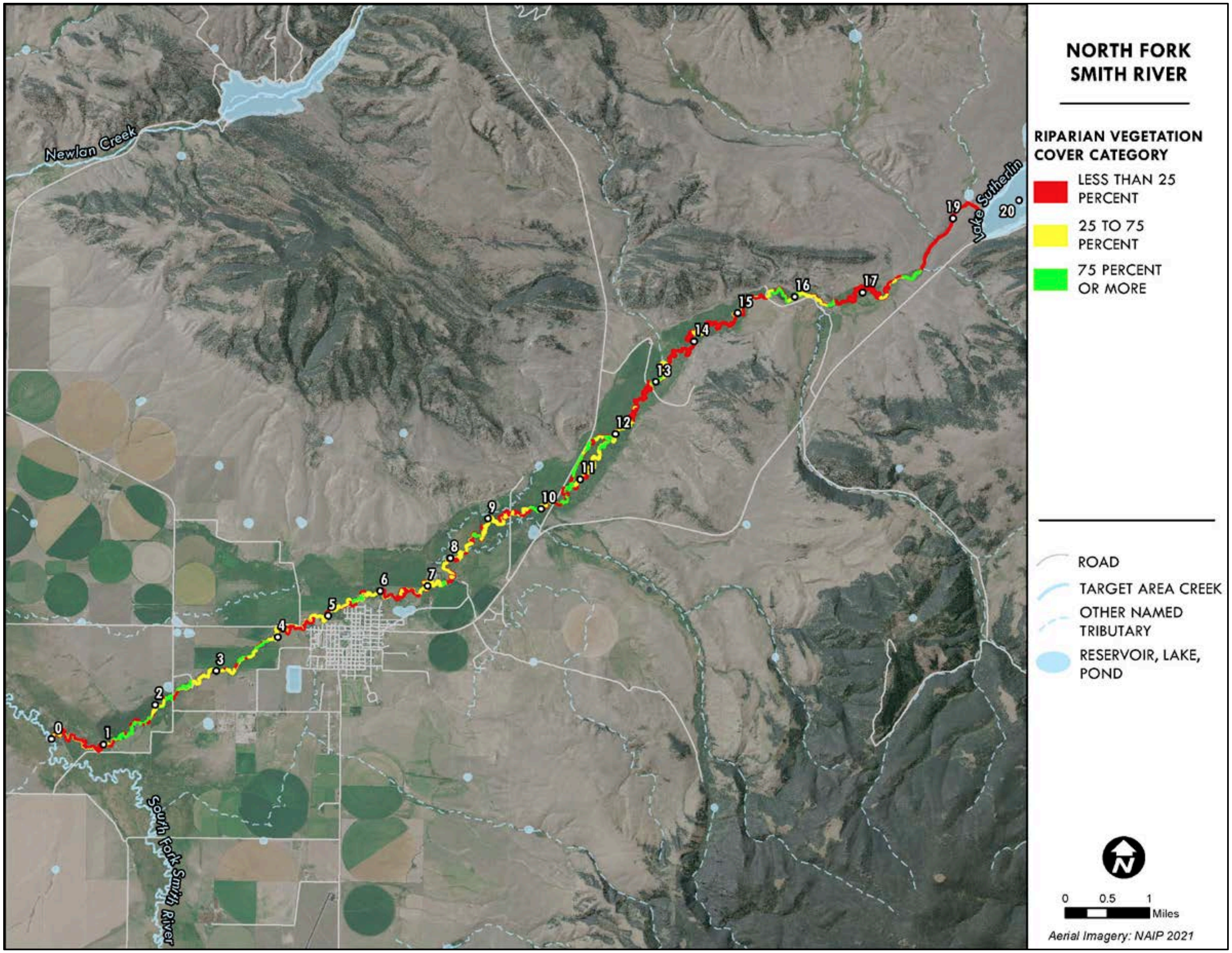
Appendix Figure 15. North Fork Smith River remote assessment human caused channel alterations.



Appendix Figure 16. North Fork Smith River remote assessment human caused impacts within the riparian buffer.



Appendix Figure 17. North Fork Smith River remote assessment impact points within the riparian buffer.



Appendix Figure 18. North Fork Smith River remote assessment riparian vegetation cover categories within riparian buffer.

South Fork Smith River

The remote assessment was completed along the mainstem South Fork River from the headwaters to the mouth. Maps displaying the results of the remote assessment for the South Fork Smith River are shown in Appendix Figure 19 through Appendix Figure 22.

Appendix Figure 19 shows remotely assessed human caused alterations to the South Fork Smith River channel. Appendix Table 23 provides a summary of quantities of remotely assessed human caused impairments to the South Fork Smith River channel. The main human caused alterations to the South Fork Smith River channel include channel relocation, channelization and channel incision. Channel relocation occurred primarily for Hwy 89, Hwy 12 and historic railroads.

Appendix Figure 20 shows remotely assessed human caused impact areas within the riparian buffer of the South Fork Smith River. Appendix Figure 21 shows remotely assessed human caused impact points within the riparian buffer of the South Fork Smith River. Appendix Table 24 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 25 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 99.6% of the area. Of that total, 11.1% of the riparian buffer includes haying in addition to grazing. There is one corral located within the riparian buffer with concentrated, high intensity use. There are a total of 26 road crossings, 17 irrigation diversions, and 32 irrigation return flow points.

Appendix Figure 22 shows remotely assessed riparian vegetation cover categories along the South Fork Smith River. Appendix Table 26 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 27 shows the length of streambank within each cover category. Most (78.3%) of the riparian buffer and streambank length is in the <25% cover category.

Appendix Table 23. South Fork Smith River human-caused channel alterations.

HUMAN CAUSED CHANNEL ALTERATIONS	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings	473	0.1	0.2%
Channel relocation	25,583	4.8	9.2%
Channelization	43,571	8.3	15.7%
Channel incision	45,818	8.7	16.5%
Reservoir	2,049	0.4	0.7%
Split flow	649	0.1	0.2%
No remotely observable human caused channel alteration	158,712	30.1	57.3%
TOTAL	**118,143**	**52.4**	**100%**

Appendix Table 24. South Fork Smith River human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	15,026,933	345.0	84.4%
Grazing, Durable infrastructure (dam)	62,756	1.4	0.4%
Grazing, Durable infrastructure (road)	551,841	12.7	3.1%
Grazing, Durable infrastructure (ditch)	24121.8	0.6	0.1%
Grazing, Soft infrastructure (two-track)	81,835	1.9	0.5%
Grazing, Soft infrastructure (cattle access)	9129.0	0.2	0.1%
Hay, Grazing	1,967,927	45.2	11.1%
Total Grazing	**17,724,542**	**406.9**	**99.6%**
Durable infrastructure (building)	7,691	0.2	0.0%
Durable infrastructure (road)	13,833	0.3	0.1%
Total Durable Infrastructure	**21,524**	**0.5**	**0.1%**
Pens, Corrals (high impact)	57,548	1.3	0.3%
Total Pens and Corrals	**57,548**	**1.3**	**0.3%**
TOTAL	**17,803,615**	**408.7**	**100%**

Appendix Table 25. South Fork Smith River impact points within the riparian buffer.

IMPACT CATEGORY	# Points
Durable Infrastructure	
Road crossings (bridge or culvert)	26
Dam	4
Fenceline	71
Powerline	1
Soft Infrastructure	
Cattle crossing	3
Channel ford	5
Off channel stock pond	1
Withdrawal	
Irrigation diversion	17
Inflow	
Irrigation return flow point	32
Pens and Corrals	
High impact	1
TOTAL	**42**

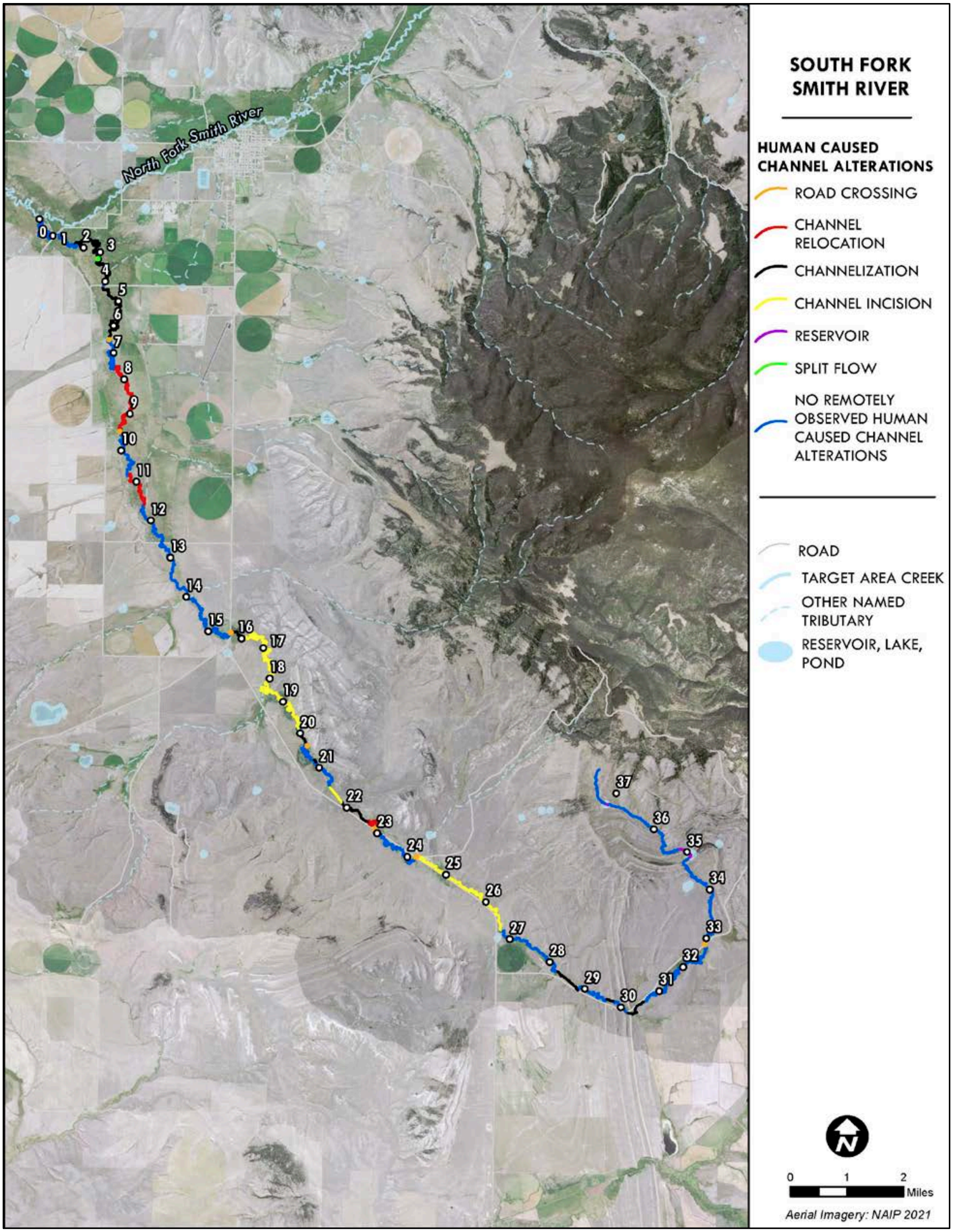
Appendix Table 26. South Fork Smith River riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	13,943,641	320.1	78.3%
25 to 75	3,352,703	77.0	18.8%
75 or more	507,434	11.6	2.9%
TOTAL	**17,803,778**	**409**	**100%**

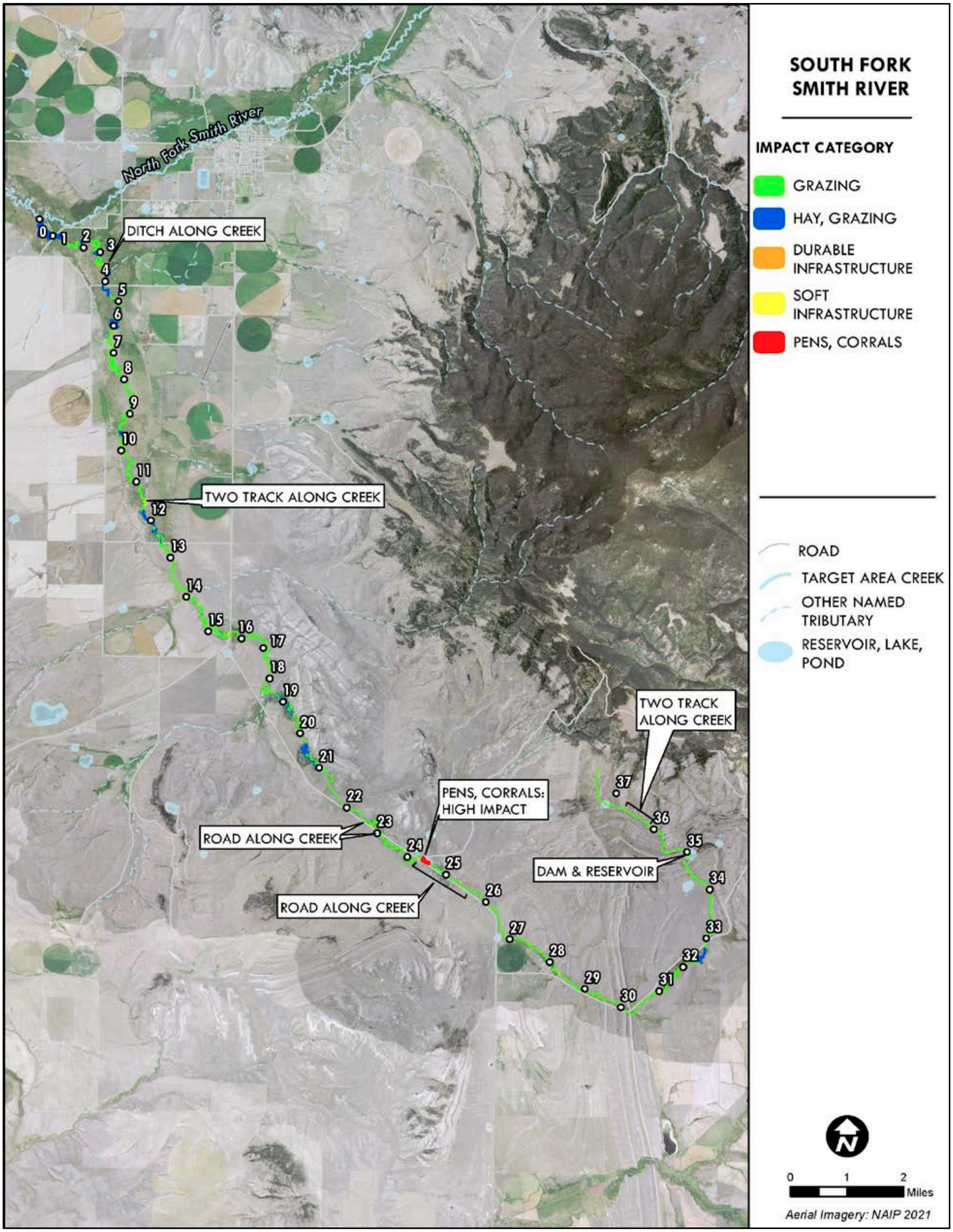
Appendix Table 27. South Fork Smith River riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH* (feet)	TOTAL BANKLINE LENGTH* (miles)	PERCENT OF TOTAL BANKLINE*
Less than 25	433,668	10.0	78.3%
25 to 75	104,265	2.4	18.8%
75 or more	15,777	0.4	2.9%
TOTAL	**553,711**	**12.7**	**100%**

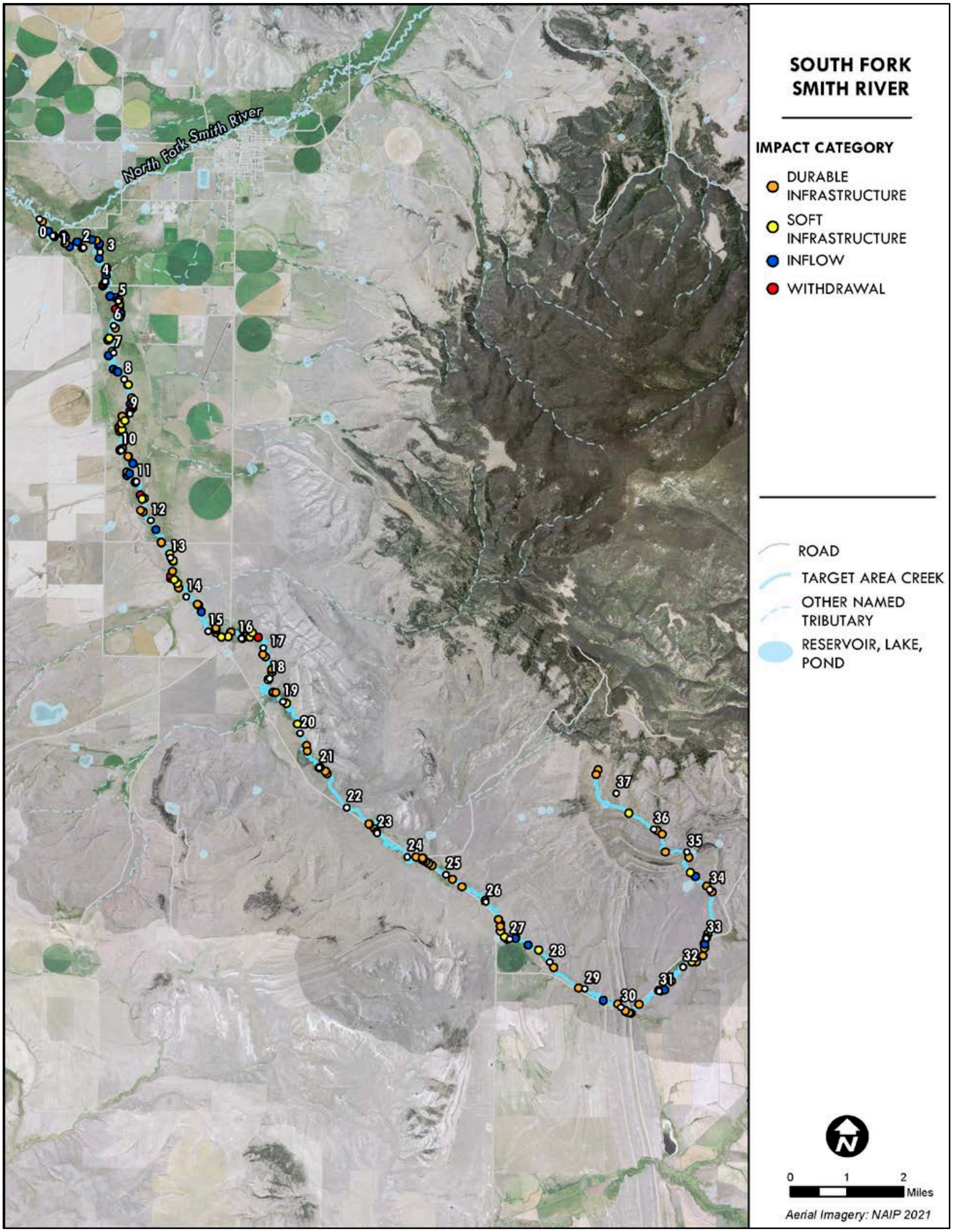
**includes both left and right banks*



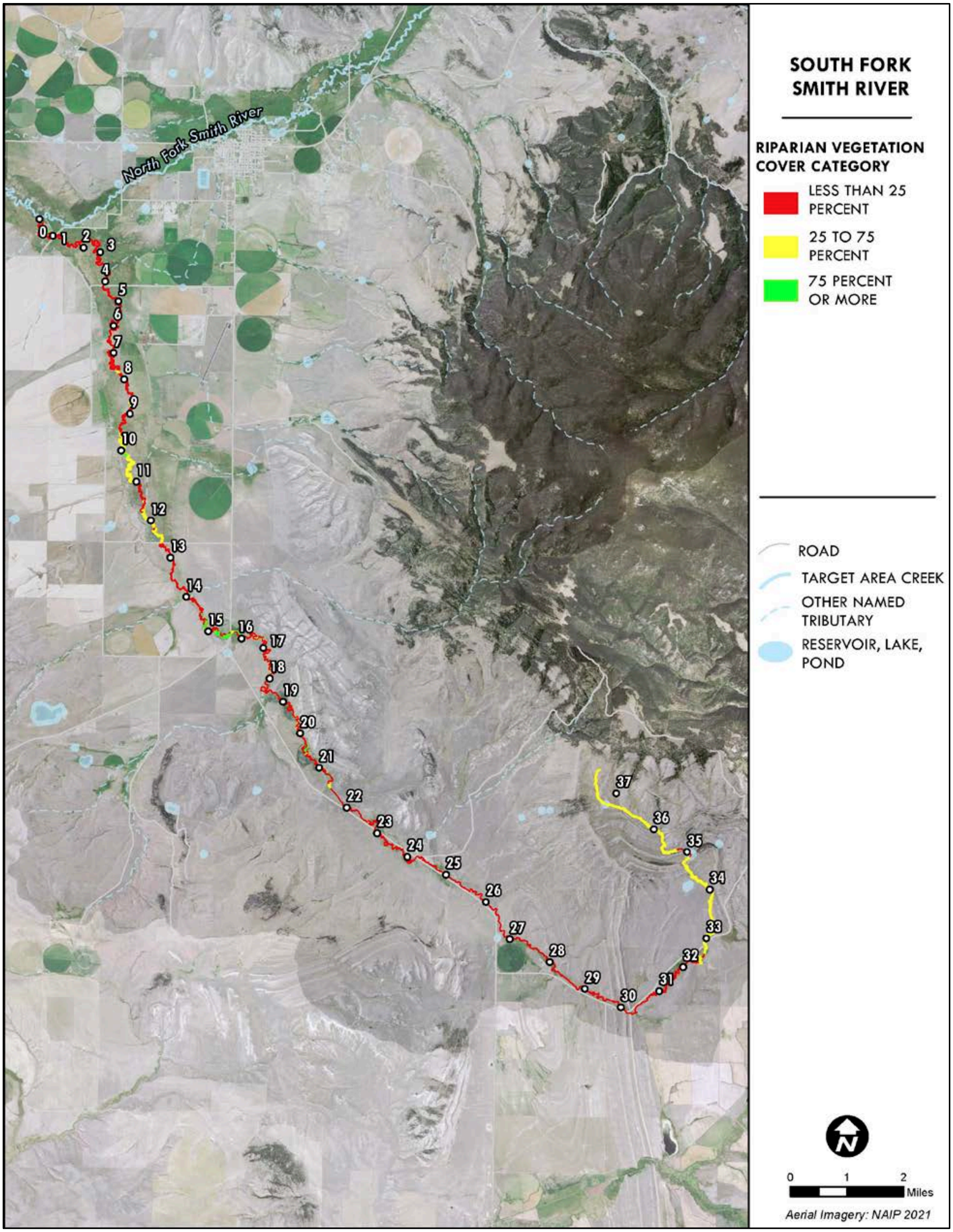
Appendix Figure 19. South Fork Smith River remote assessment human caused channel alterations.



Appendix Figure 20. South Fork Smith River remote assessment human caused impacts within the riparian buffer.



Appendix Figure 21. South Fork Smith River remote assessment impact points within the riparian buffer.



Appendix Figure 22. South Fork Smith River remote assessment riparian vegetation cover categories within riparian buffer.

Newlan Creek

The remote assessment was completed along the mainstem Newlan Creek from the outlet of Newlan Reservoir to the mouth. Maps displaying the results of the remote assessment for Newlan Creek are shown in Appendix Figure 23 through Appendix Figure 26.

Appendix Figure 23 shows remotely assessed human caused alterations to the Newlan Creek channel. Appendix Table 29 provides a summary of quantities of remotely assessed human caused impairments to the Newlan Creek channel. The main human caused alterations to the Newlan Creek channel include channelization and channel incision. Appendix Figure 24 shows remotely assessed human caused impact areas within the riparian buffer of Newlan Creek. Appendix Figure 25 shows remotely assessed human caused impact points within the riparian buffer of Newlan Creek.

Appendix Table 29 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 30 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 79.7% of the area. Of that total, haying also occurs in 0.7% of the riparian buffer along with grazing. There are four corrals located within the riparian buffer; two with concentrated, high intensity use. There are a total of 16 road crossings, six irrigation diversions, and nine irrigation return flow points.

Appendix Figure 26 shows remotely assessed riparian vegetation cover categories along Newlan Creek. Appendix Table 31 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 32 shows the length of streambank within each cover category. Most (61.2%) of the riparian buffer and streambank length is in the 25-75% cover category. 18.4% of the riparian buffer and streambanks are in the <25% cover category.

Appendix Table 28. Newlan Creek human-caused channel alterations.

CHANNEL CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings	680	0.1	1.0%
Channelization	2,396	0.5	3.4%
Channel incision	4,819	0.9	6.8%
Split flow	1,057	0.2	1.5%
No remotely observed human caused channel alterations	61,471	11.6	87.3%
TOTAL	**70,422**	**13.3**	**100%**

Appendix Table 29. Newlan Creek human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	2,626,672	60.3	77.3%
Grazing, vegetation cleared	57,436	1.3	1.7%
Hay, Grazing	23,672	0.5	0.7%
Total Grazing	**2,707,779**	**529.1**	**79.7%**
Durable infrastructure (road)	5,684	0.1	0.2%
Total Durable Infrastructure	**5,684**	**0.1**	**0.2%**
Soft infrastructure (lawn)	60,073	1.4	1.8%
Total Soft Infrastructure	**60,073**	**4.8**	**1.8%**
Pens, corrals (high impact)	27,263	0.6	0.8%
Pens, corrals (low impact)	119,414	2.7	3.5%
Total Pens, Corrals	**146,677**	**3.4**	**4.3%**
No remotely observed human caused channel alterations	**476,904**	**10.9**	**14.0%**
TOTAL	**3,397,117**	**548**	**100%**

Appendix Table 30. Newlan Creek impact points within riparian buffer.

IMPACT POINT CATEGORY	TOTAL OBSERVATIONS
Durable Infrastructure	
Dam	1
Road crossings (bridge or culvert)	16
Fenceline	25
Soft Infrastructure	
Channel ford	5
Withdrawal	
Irrigation diversion	6
Inflow	
Irrigation return flows	9
Pens, Corrals	
High impact	2
Low impact	2
Total	**65**

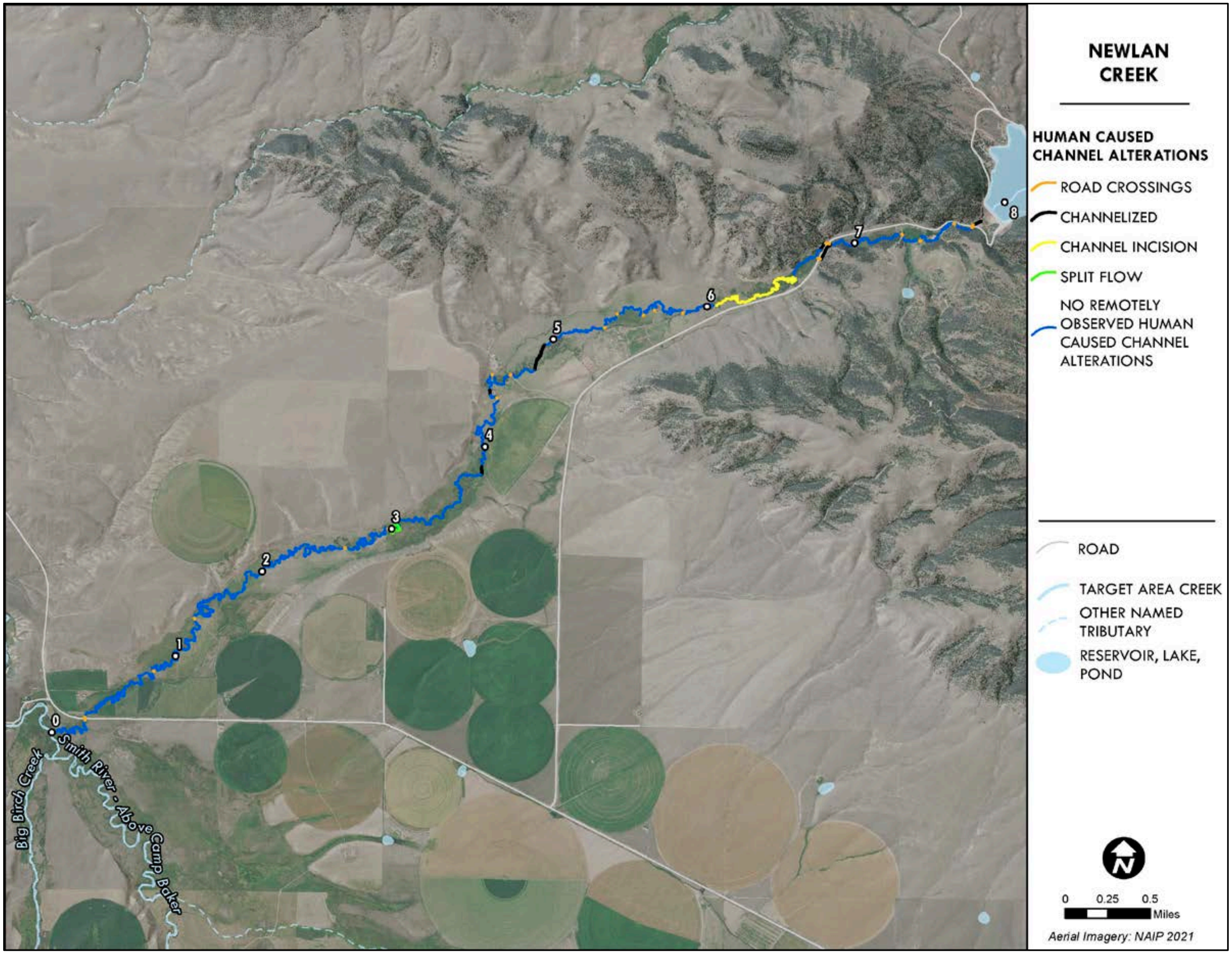
Appendix Table 31. Newlan Creek riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	624,997	14.3	18.4%
25 to 75	2,078,366	47.7	61.2%
75 or more	693,281	15.9	20.4%
TOTAL	**3,396,644**	**78.0**	**100%**

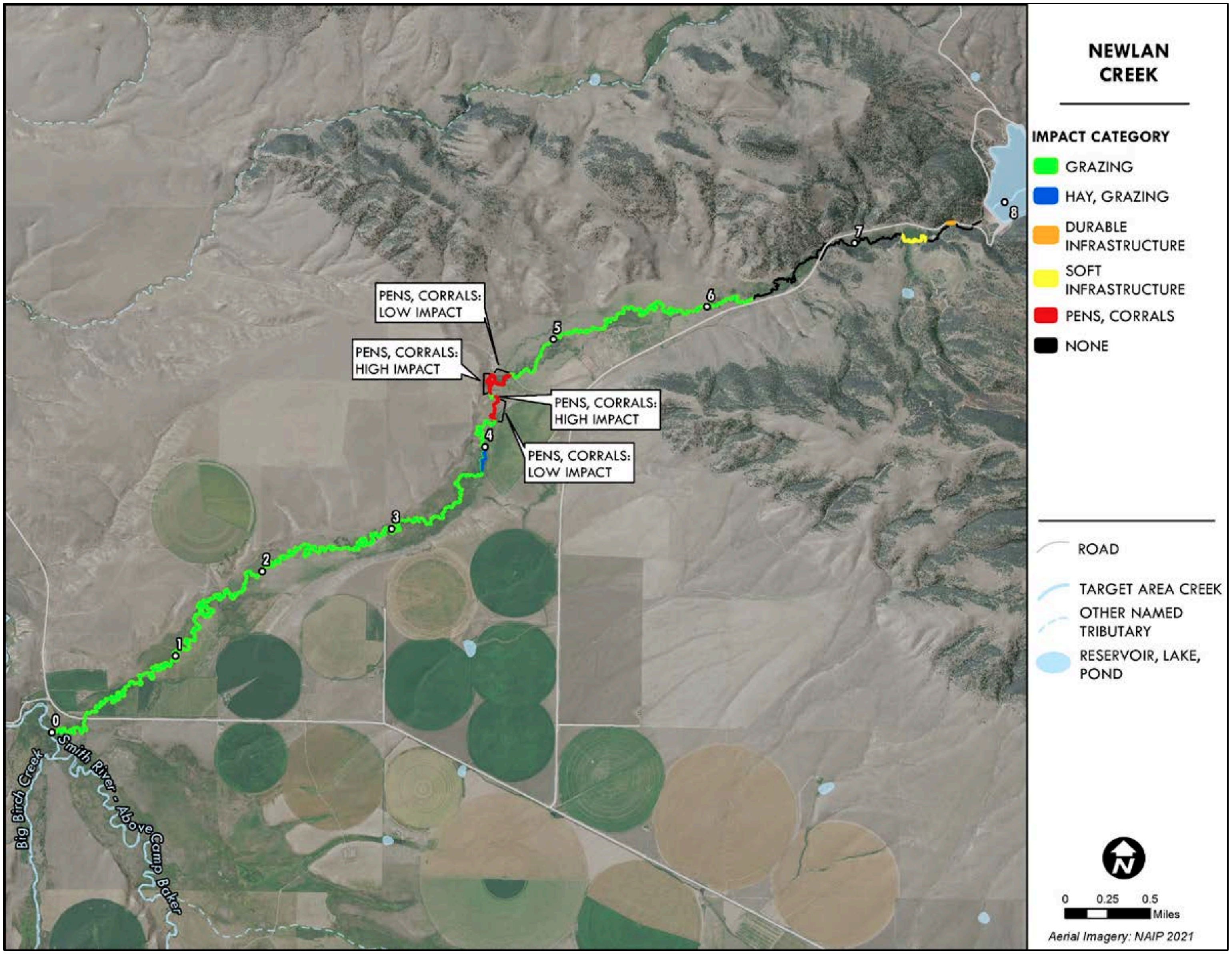
Appendix Table 32. Newlan Creek riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH (feet)	TOTAL BANKLINE LENGTH (miles)	PERCENT OF TOTAL BANKLINE
Less than 25	25,674	4.4	18.4%
25 to 75	85,367	16.2	61.2%
75 or more	28,475	5.4	20.4%
TOTAL	**139,517**	**26.0**	**100%**

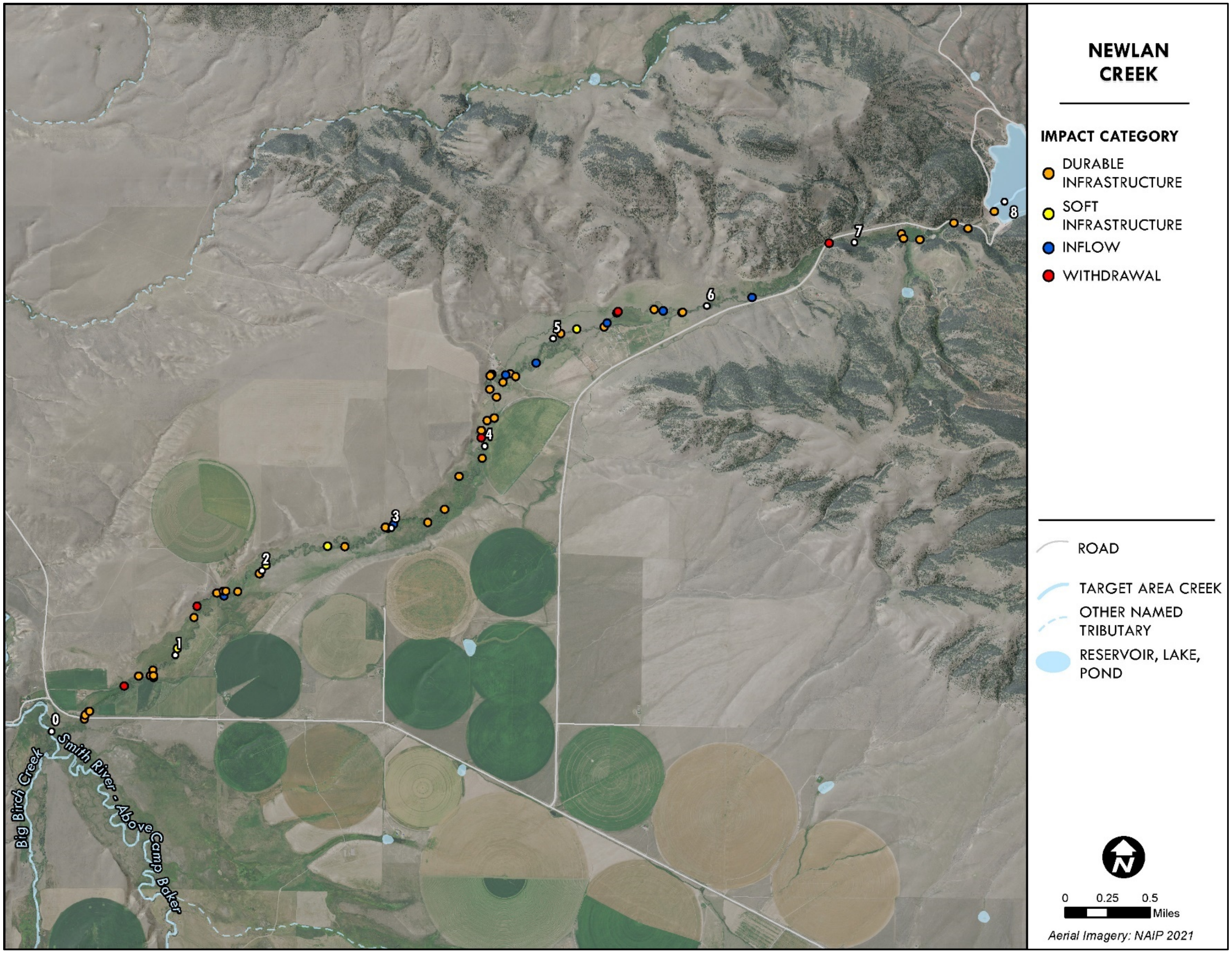
**includes both left and right banks*



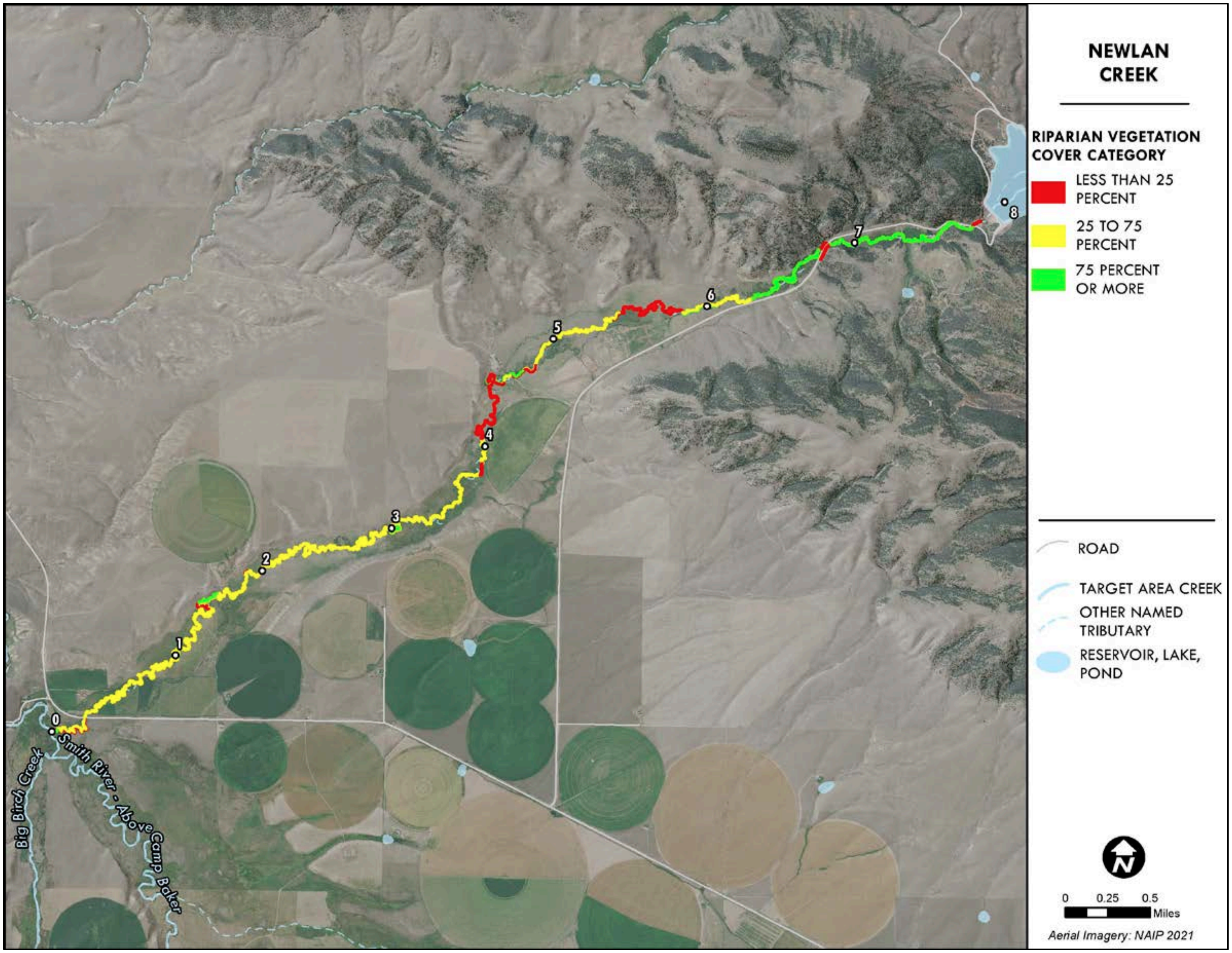
Appendix Figure 23. Newlan Creek remote assessment human caused channel alterations.



Appendix Figure 24. Newlan Creek remote assessment human caused impacts within the riparian buffer.



Appendix Figure 25. Newlan Creek remote assessment impact points within the riparian buffer.



Appendix Figure 26. Newlan Creek remote assessment riparian vegetation cover categories within riparian buffer.

Camas Creek

The remote assessment was completed along the mainstem Camas Creek from the headwaters to the mouth. Maps displaying the results of the remote assessment for Newlan Creek are shown in Appendix Figure 27through Appendix Figure 30.

Appendix Figure 27 shows remotely assessed human caused alterations to the Camas Creek channel. Appendix Table 33 provides a summary of quantities of remotely assessed human caused impairments to the Camas Creek channel. The main human caused alteration to the Camas Creek channel is channelization. 15.5% of the channel was within the 2021 Woods Creek Fire burn area.

Appendix Figure 28 shows remotely assessed human caused impact areas within the riparian buffer of Camas Creek. Appendix Figure 29 shows remotely assessed human caused impact points within the riparian buffer of Camas Creek. Appendix Table 33 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 34 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 92.9% of the area. Within that area, haying also occurs in 6.6% of the riparian buffer along with grazing. 9.8% of the riparian buffer is within the 2021 Woods Creek Fire burn area. There are three corrals located within the riparian buffer; two with concentrated, high intensity use. There are a total of eight road crossings, 17 irrigation diversions, and 18 irrigation return flow points.

Appendix Figure 30 shows remotely assessed riparian vegetation cover categories along Camas Creek. Appendix Table 36 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 37 shows the length of streambank within each cover category. Most (48%) of the riparian buffer and streambank length are in the <25% cover category.

Appendix Table 33. Camas Creek human-caused channel alterations.

CHANNEL CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings (bridge and culvert)	73	0.01	0.1%
Channelization	15,960	3.0	13.9%
Dewatered below diversion	3,059	0.6	2.7%
Erosion	3,127	0.6	2.7%
Fire	17,710	3.4	15.5%
No remotely observed human caused channel alterations	74,478	14.1	65.1%
TOTAL	**114,407**	**21.7**	**100%**

Appendix Table 34. Camas Creek human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	6,718,419	154.2	75.2%
Crop, Grazing	109,915	2.5	1.2%
Hay, Grazing	590,073	13.5	6.6%
Grazing, Fire	879,435	20.2	9.8%
Total Grazing	**8,297,843**	**190.5**	**92.9%**
Durable infrastructure (irrigation canal)	19,020	0.4	0.2%
Total Durable Infrastructure	**19,020**	**0.4**	**0.2%**
Soft infrastructure (residential)	12,369	0.3	0.1%
Soft infrastructure (two-track)	32,494	0.7	0.4%
Total Soft Infrastructure	**44,863**	**1.0**	**0.5%**
Pens, corrals (high impact)	29,579	0.7	0.3%
Pens, corrals (low impact)	6,681	0.2	0.1%
Pens, Corrals	**36,260**	**0.8**	**0.4%**
No remotely observed human caused channel alterations	**531,988**	**12.2**	**6.0%**
TOTAL	**8,929,974**	**205.0**	**100%**

Appendix Table 35. Camas Creek impact points within the riparian buffer.

IMPACT POINT CATEGORY	TOTAL OBSERVATIONS
Durable Infrastructure	
Road crossings (bridge or culvert)	8
Fenceline	19
Soft Infrastructure	
Cattle access	3
Channel ford	5
Withdrawal	
Irrigation diversion	17
Inflow	
Irrigation return flows	18
Pens, Corrals	
High impact	2
Low impact	1
Total	**73**

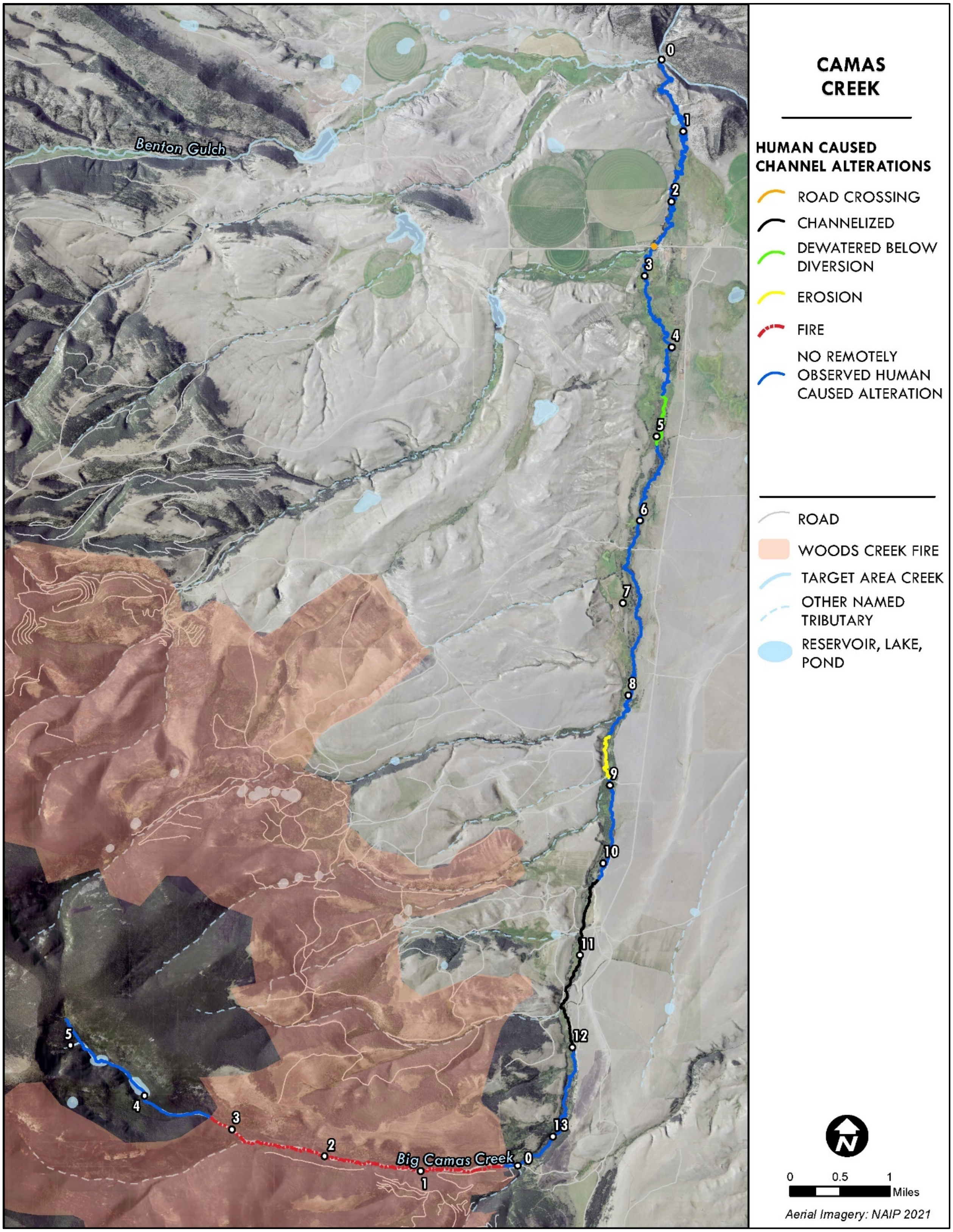
Appendix Table 36. Camas Creek riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	4,287,232	98.4	48.0%
25 to 75	1,617,357	37.1	18.1%
75 or more	3,025,384	69.5	33.9%
TOTAL	**8,929,974**	**205**	**100%**

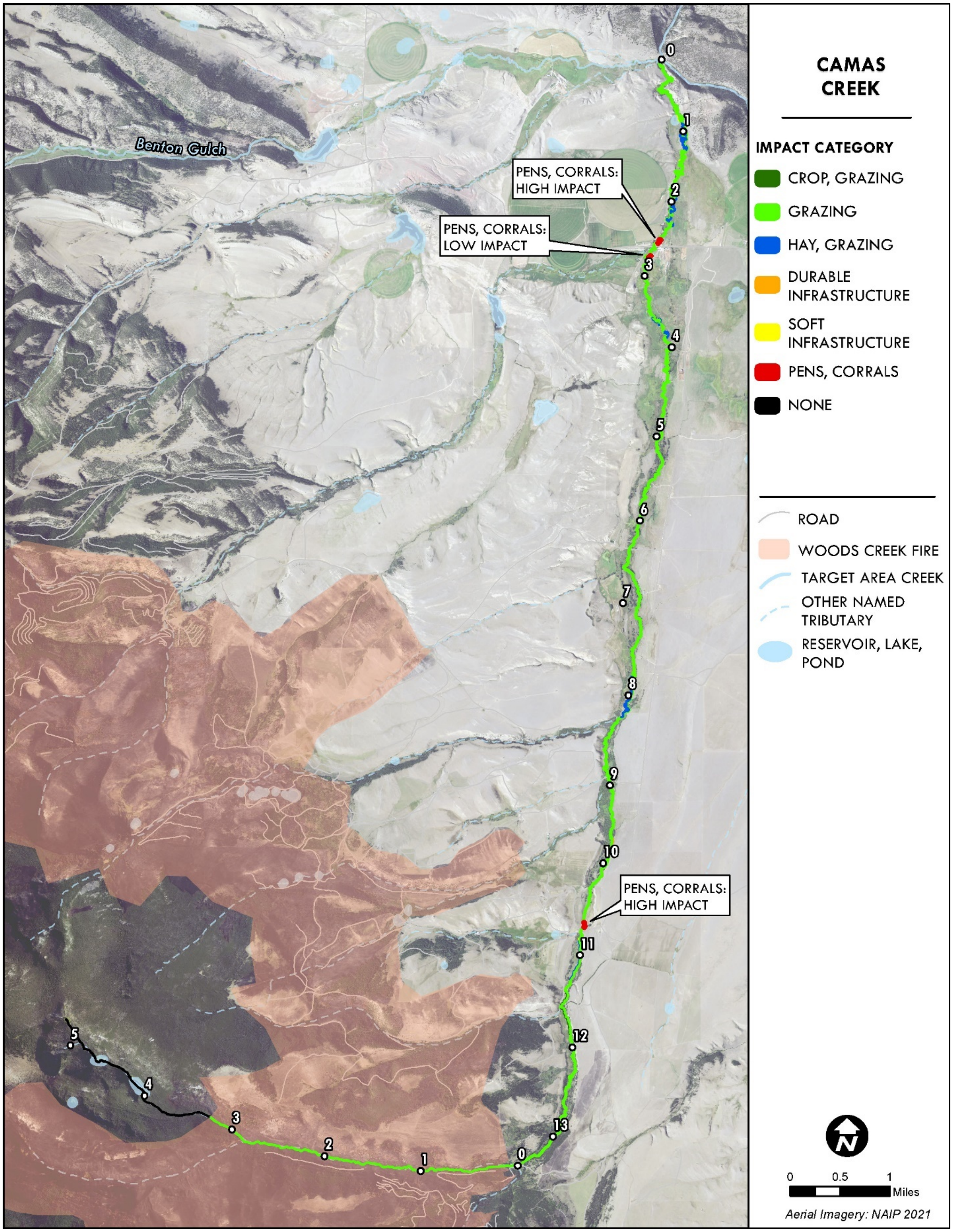
Appendix Table 37. Camas Creek riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH (feet)	TOTAL BANKLINE LENGTH (miles)	PERCENT OF TOTAL BANKLINE
Less than 25	109,850	20.8	48.0%
25 to 75	41,446	7.8	18.1%
75 or more	77,517	14.7	33.9%
TOTAL	**228,813**	**43.3**	**100%**

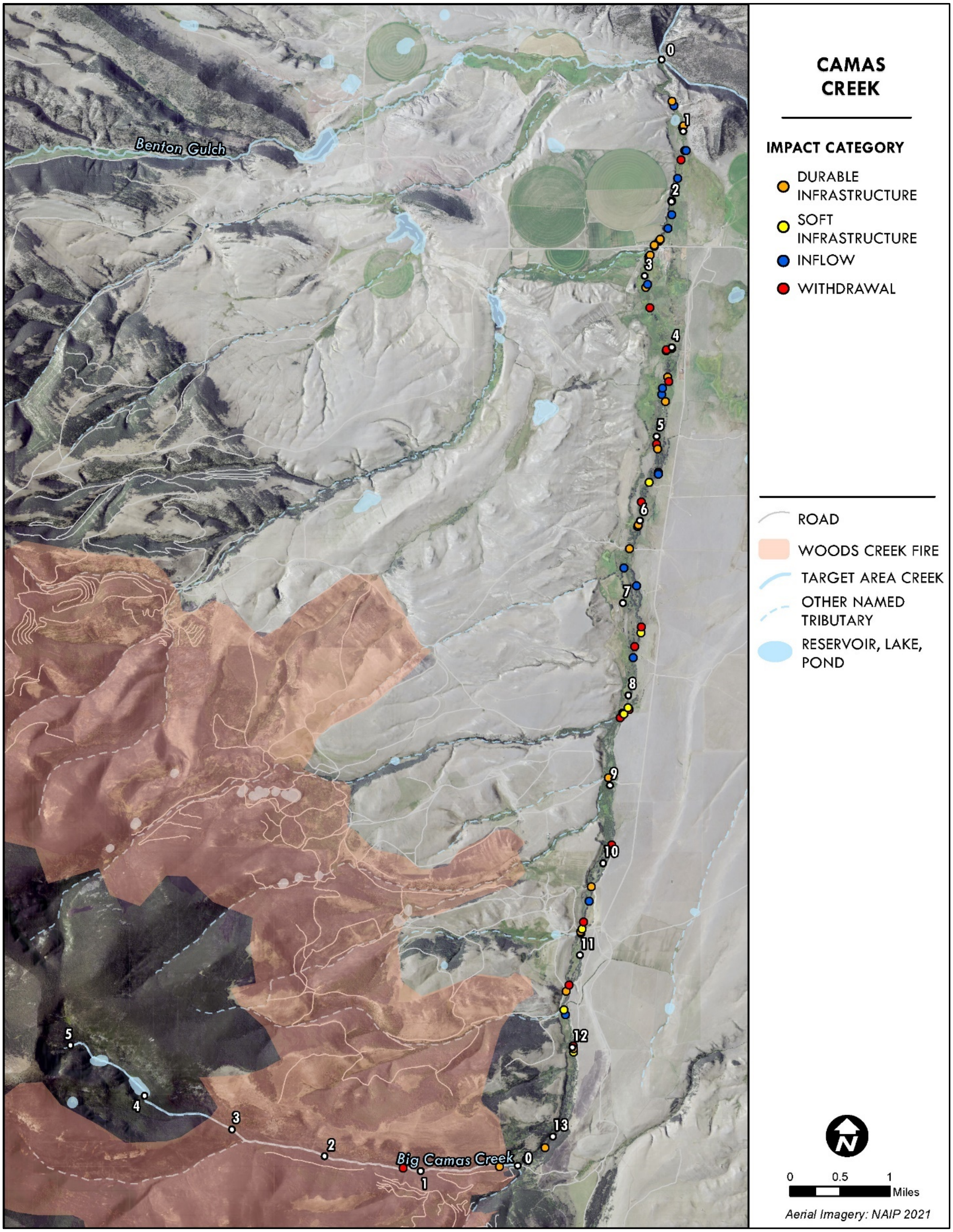
*includes both left and right bank



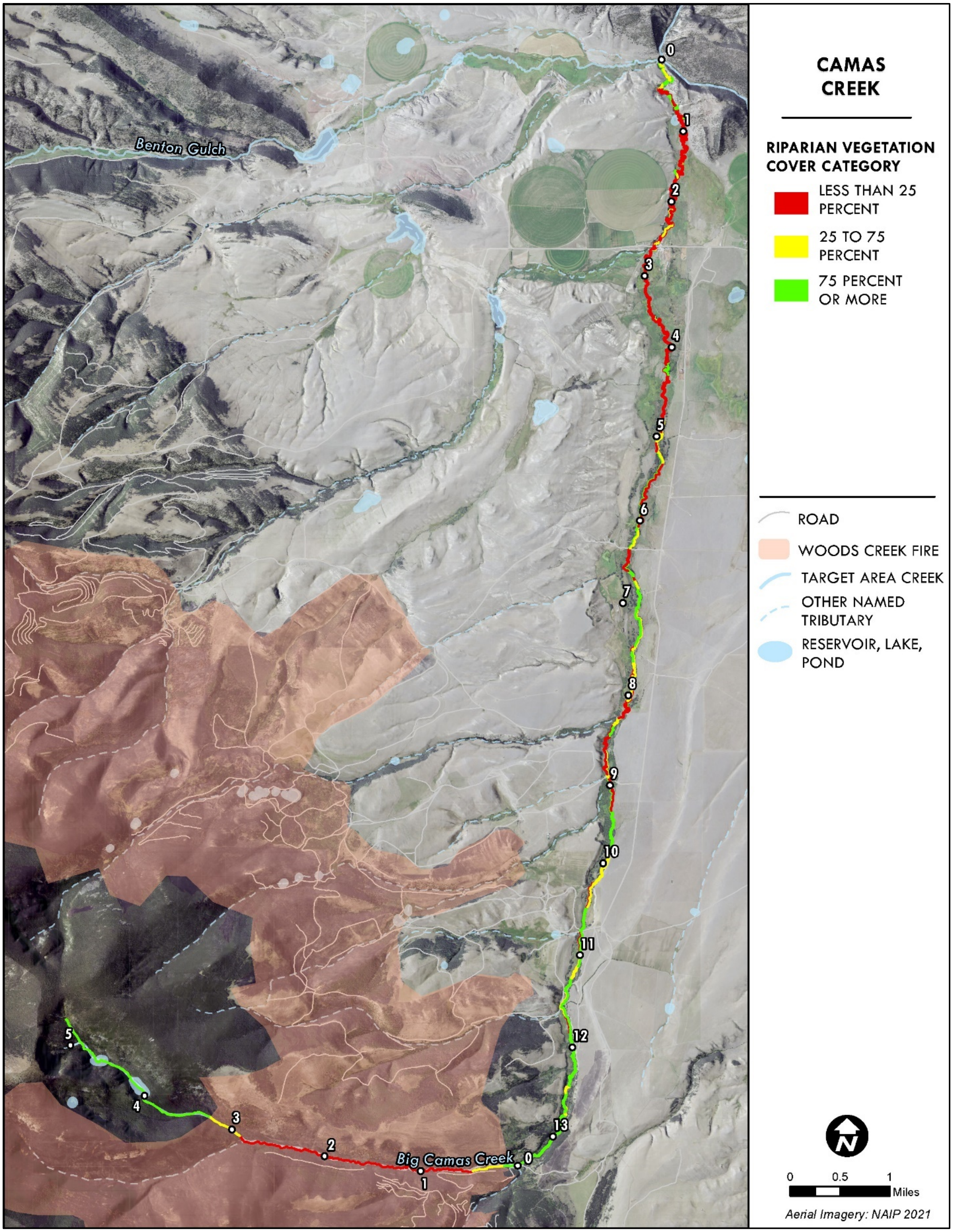
Appendix Figure 27. Camas Creek remote assessment human caused channel alterations.



Appendix Figure 28. Camas Creek remote assessment human caused impacts within the riparian buffer.



Appendix Figure 29. Camas Creek remote assessment impact points within the riparian buffer.



Appendix Figure 30. Camas Creek remote assessment riparian vegetation cover categories within riparian buffer.

Benton Gulch

The remote assessment was completed along the mainstem Benton Gulch from the headwaters to the mouth. Maps displaying the results of the remote assessment for Benton Gulch are shown in Appendix Figure 31 through Appendix Figure 34.

Appendix Figure 31 shows remotely assessed human caused alterations to the Benton Gulch channel. Appendix Table 38 provides a summary of quantities of remotely assessed human caused impairments to the Benton Gulch channel. The main human caused alteration to the Benton Gulch channel is channelization and incision.

Appendix Figure 32 shows remotely assessed human caused impact areas within the riparian buffer of Benton Gulch. Appendix Figure 33 shows remotely assessed human caused impact points within the riparian buffer of Benton Gulch. Appendix Table 38 provides a summary of quantities of remotely assessed human caused impacts within the riparian buffer and Appendix Table 39 shows human caused impact points recorded within the riparian buffer. Grazing is the primary impact within the riparian buffer, occurring in 96.3% of the area. Within that total, haying combined with grazing occurs in 8.0% of the riparian buffer. 22.1% of the riparian buffer is occupied by roads and also grazed. 7,335 feet (8.9%) of Benton Gulch flows through a pivot hayfield. This section is heavily channelized and incised. There are a total of 15 road crossings, three irrigation diversions, and eight irrigation return flow points.

Appendix Figure 34 shows remotely assessed riparian vegetation cover categories along Benton Gulch. Appendix Table 41 shows the area of riparian vegetation within each cover category within the riparian buffer. Appendix Table 42 shows the length of streambank within each cover category. Most (49%) of the riparian buffer and streambank length are in the <25% cover category.

Appendix Table 38. Benton Gulch human-caused channel alterations.

CHANNEL CONDITION	LINEAR FEET	MILES	PERCENT OF CHANNEL LENGTH
Road crossings (bridge and culvert)	296	0.06	0.4%
Channelization	6,998	1.3	8.6%
Aggradation	643	0.1	0.8%
Incision	3,127	0.6	3.8%
Reservoir	2,207	0.4	2.7%
Pivot irrigated field	7,335	1.4	8.9%
No remotely observed human caused channel alterations	61,116	11.6	74.8%
TOTAL	**81,725**	**15.5**	**100%**

Appendix Table 39. Benton Gulch human caused impacts within the riparian buffer.

IMPACT CATEGORY	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Grazing	2,338,097	53.7	58.0%
Crop, Grazing	326,001	7.5	8.1%
Hay, Grazing	322,848	7.4	8.0%
Grazing, Road	891,938	20.5	22.1%
Total Grazing	**3,878,884**	**68.6**	**96.3%**
Durable infrastructure - buildings	5,712	0.1	0.1%
Durable infrastructure - ditch	6,644	0.2	0.2%
Durable infrastructure - reservoir	114,073	2.6	2.8%
Total Durable Infrastructure	**126,429**	**0.3**	**3.1%**
Soft infrastructure - residential	23,698	0.5	0.6%
Total Soft Infrastructure	**23,698**	**0.5**	**0.6%**
TOTAL	**4,029,011**	**69.4**	**100%**

Appendix Table 40. Benton Gulch impact points.

IMPACT POINT CATEGORY	TOTAL OBSERVATIONS
Durable Infrastructure	
Dam	1
Building	2
Road crossings (bridge or culvert)	15
Fenceline	22
Pivot wheel line	20
Soft Infrastructure	
Cattle access	3
Channel ford	10
Withdrawal	
Irrigation diversion	3
Inflow	
Irrigation return flows	8
Pens, corrals drain	1
Total	**84**

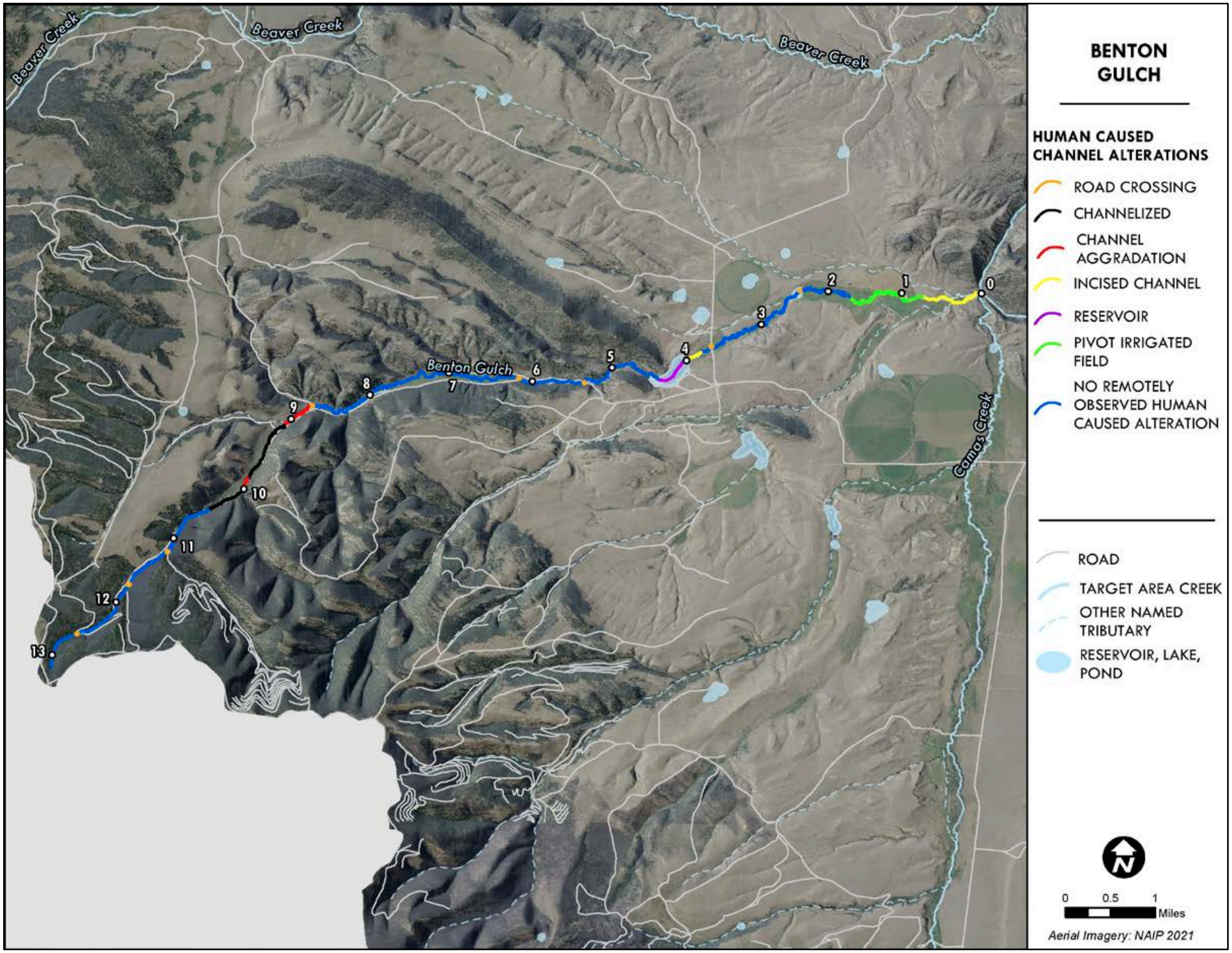
Appendix Table 41. Benton Gulch riparian vegetation cover categories within riparian buffer.

PERCENT RIPARIAN COVER	TOTAL AREA (sq ft)	TOTAL AREA (ac)	PERCENT OF TOTAL BUFFER
Less than 25	1,976,192	45.4	49.0%
25 to 75	730,447	16.8	18.1%
75 or more	1,322,372	30.4	32.8%
TOTAL	**4,029,011**	**92.0**	**100%**

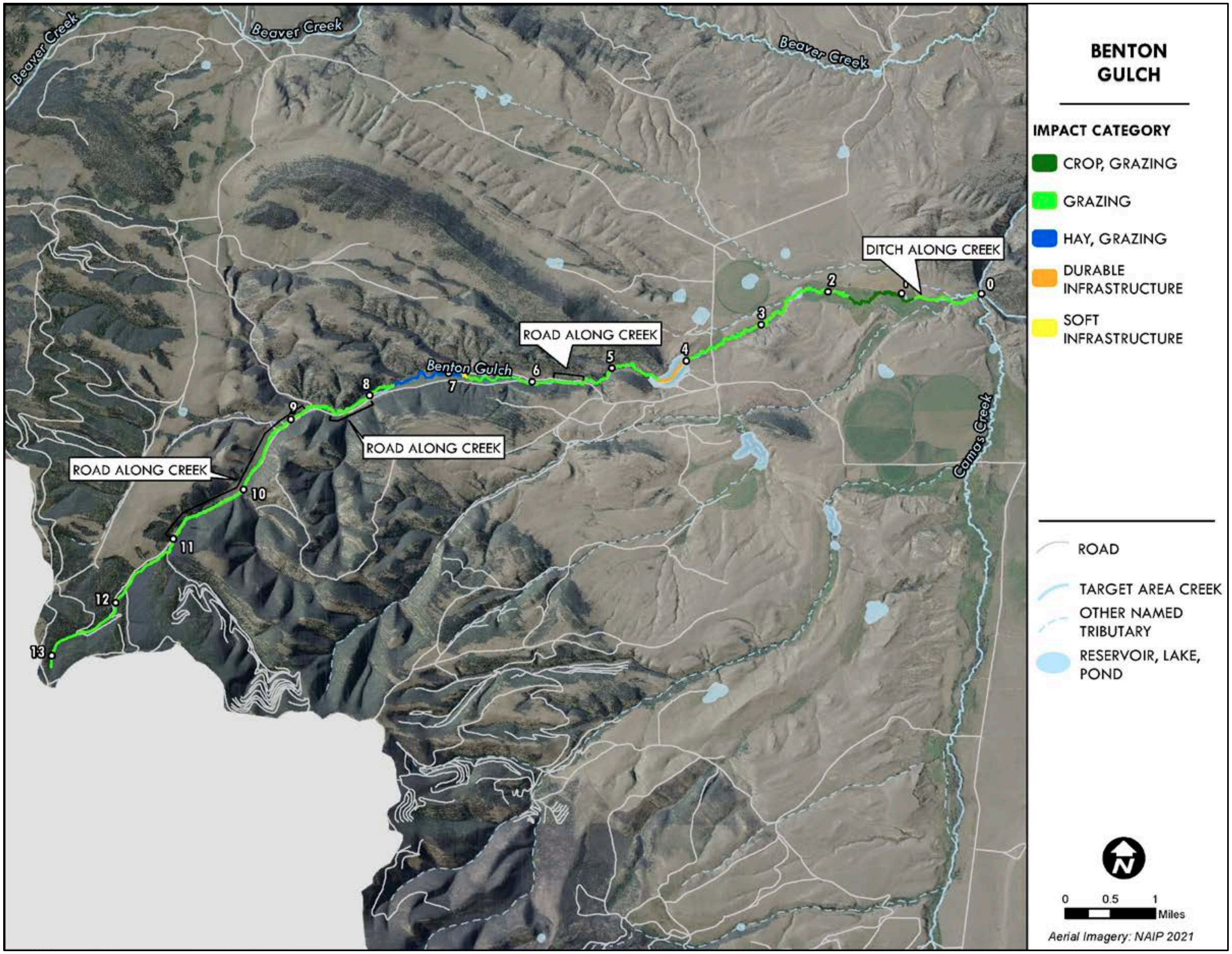
Appendix Table 42. Benton Gulch riparian vegetation cover categories for streambanks.

PERCENT RIPARIAN COVER	TOTAL BANKLINE LENGTH (feet)	TOTAL BANKLINE LENGTH (miles)	PERCENT OF TOTAL BANKLINE
Less than 25	80,172	15.2	49.0%
25 to 75	29,634	5.6	18.1%
75 or more	53,646	10.2	32.8%
TOTAL	**163,451**	**31.0**	**100%**

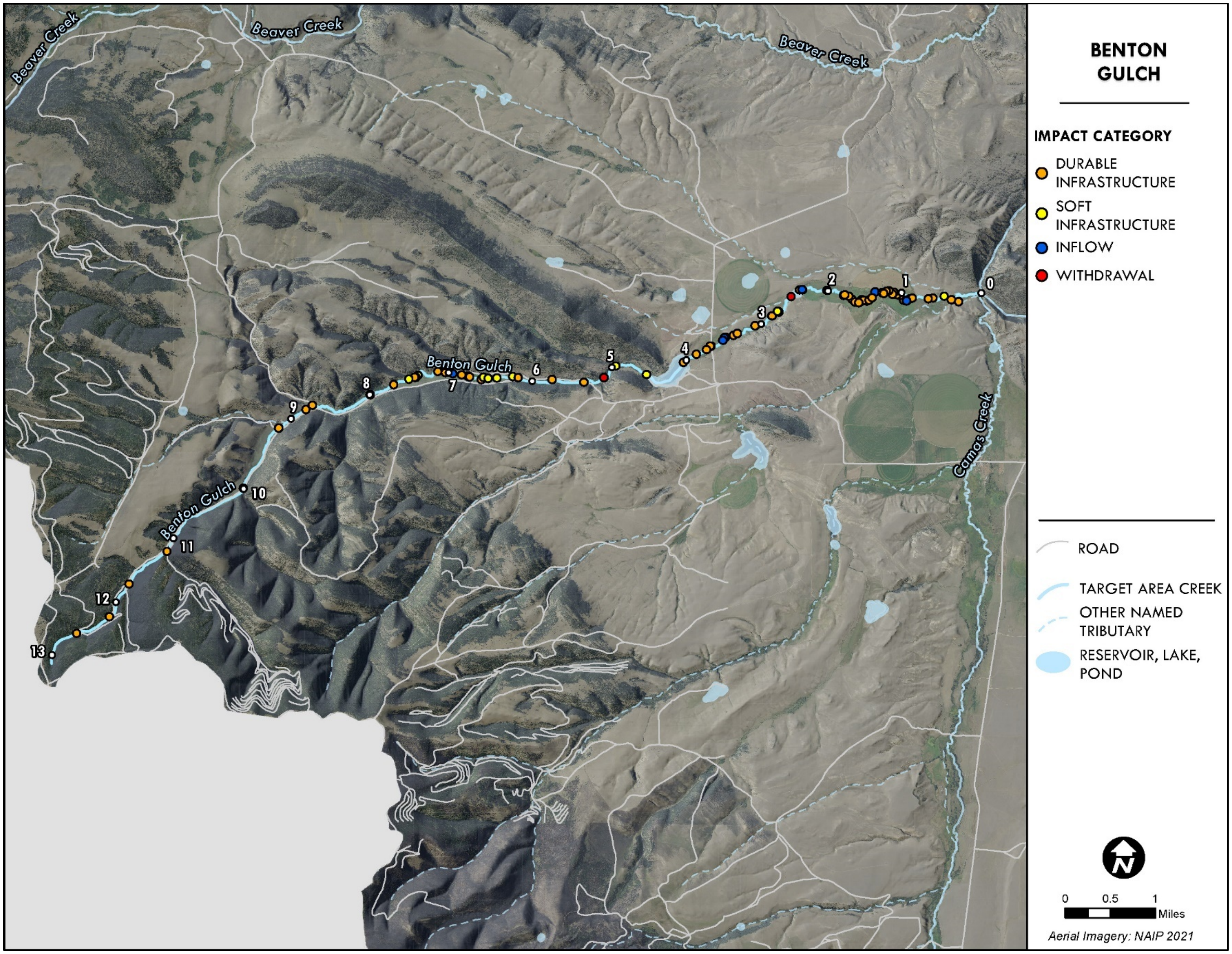
**includes both left and right bank*



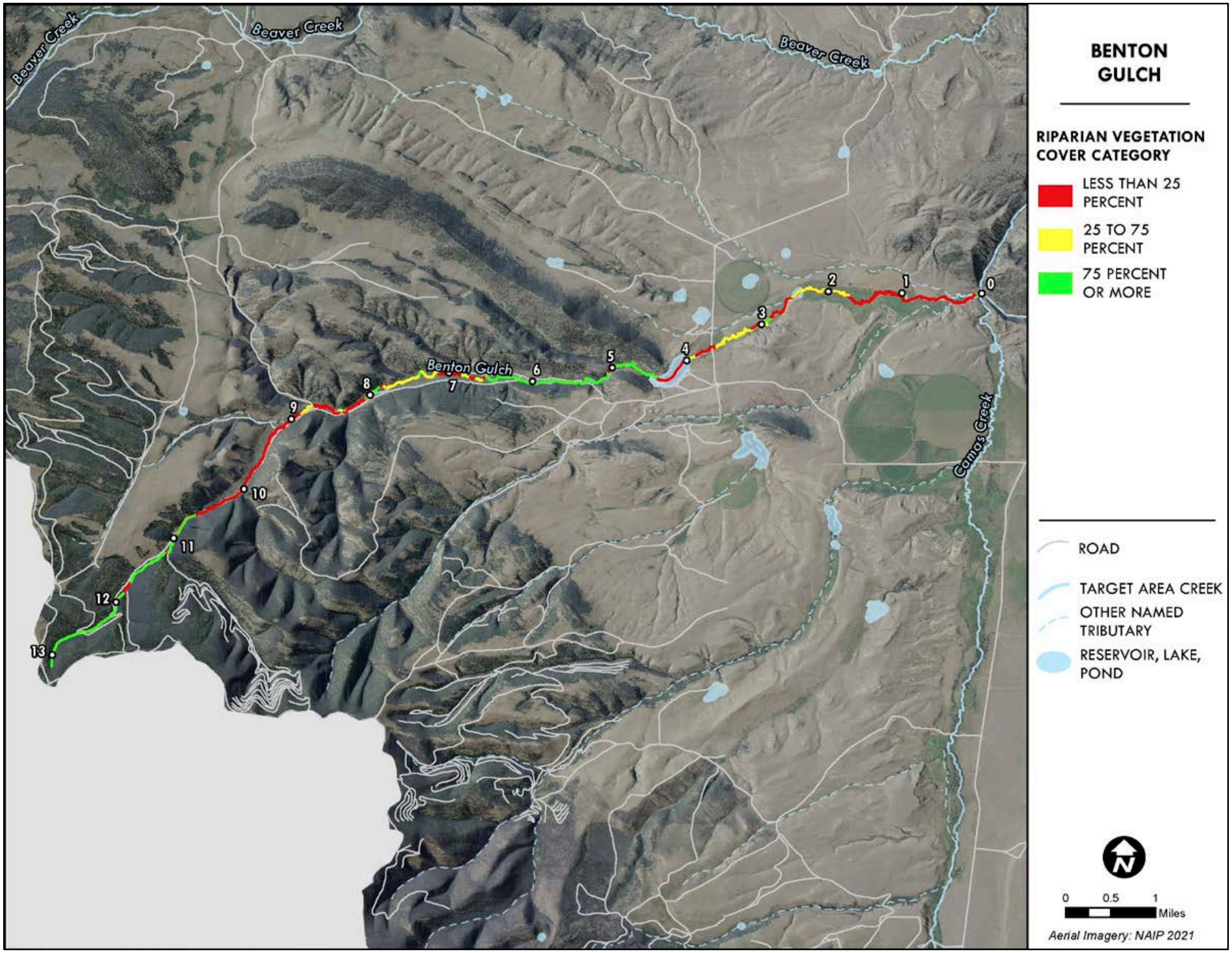
Appendix Figure 31. Benton Gulch remote assessment human caused channel alterations.



Appendix Figure 32. Benton Gulch remote assessment human caused impacts within the riparian buffer.



Appendix Figure 33. Benton Gulch remote assessment impact points within the riparian buffer.



Appendix Figure 34. Benton Gulch remote assessment riparian vegetation cover categories within riparian buffer.

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Appendix C. Potential Funding Sources for Planning and Project Implementation

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
	FEDERAL				
USBR WaterSMART: Water and Energy Efficiency Grants	HB 632 created four commissions with oversight over federal EPA funds, including an “Infrastructure Advisory Commission” which is staffed by the DNRC. This commission assigns $582 million towards Infrastructure and State/Local Water and Wastewater projects.	Infrastructure improvements, water planning	Up to $500,000 for projects completed within two years; up to $2 million for projects to be completed within three years, and up to $5 million for large projects to be completed within three years. Non-Federal Costs Share: 50% or greater.	States, Indian tribes, Irrigation districts, water districts, or other organizations with water or power delivery authority. Also includes non-profit conservation organizations partnering with those entities.	https://www.usbr.gov/watersmart/index.html
USBR WaterSMART: Drought Resiliency Projects	Funding for on-the-ground projects and modeling tools that will increase water reliability and improve water management.	Drought Resiliency, Water Management	Up to $750,000 for Task A-C projects completed within two years. Up to 3 million for Task A-C projects completed within 3 years. Up to 10 million for Task D projects completed within 3 years. Non-Federal cost share of 50% or greater required for Tasks A-C; 5% required for Task D.		

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
USBR WaterSMART: Environmental Resources Projects	Funding for projects that result in quantifiable and sustained water savings and benefit ecological values; water management or infrastructure improvements to mitigate drought-related impacts to ecological values; and watershed management or restoration projects benefiting ecological values that have a nexus to water resources or water resource management.	Ecological restoration that contributes to drought resiliency	Up to $3 million for a project to be completed within three years if total cost is $6 million or less; up to $5 million for watershed groups for projects completed within 5 years. Non-Federal Cost Share: 25%		
USBR WaterSMART: Applied Science Grants	Funding for projects that develop hydrologic information and water management tools and to improve modeling and forecasting capabilities.	Data collection and modeling	Up to $400,000 for a project that can be completed within two years. Non-Federal Cost Share: 25-50%		
USBR WaterSMART: Cooperative Watershed Management Program Phase 1	Watershed group development, watershed restoration planning, and watershed management project design.	Watershed group development, watershed restoration planning, and watershed management project design	Up to $300,000 may be awarded to an applicant per year. Non-Federal cost share not required.		
USBR WaterSMART: Drought Contingency Planning	Funding for developing or updating comprehensive drought plans.	Drought Planning	Up to $400,000 for a project completed within 3 years. Non-Federal Cost Share: 0% or 25-50%		

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
FSA Continuous Conservation Reserve Program (CRP)	Land conservation program administered by the Farm Service Agency (FSA) . In exchange for a yearly payment, farmers agree to remove environmentally sensitive land from agricultural production. Includes CRPs for grasslands, rivers, wildlife enhancement, and wetlands.	Agricultural lands protection	Annual rental payments based on soil productivity and average rentals rates in the country. Up to 50% cost-share assistance for establishing approved conservation practices.	Land owners	https://www.fsa.usda.gov/mt
FSA Emergency Conservation Program (ECP)	Helps farmers and ranchers to repair damage to farmlands caused by natural disasters and to help implement methods for water conservation during severe drought	Agricultural lands protection, drought resiliency	Up to 75% cost-share assistance for approved conservation practices. Up to 90% cost-share assistance for limited resource producers.	Land owners	http://www.fsa.usda.gov/FSA/
NRCS Environmental Quality Incentives Program (EQIP)	NRCS provides agricultural producers with financial resources and one-on-one help to plan and implement NRCS Conservation Practices.	Agricultural conservation practices	Varies by program	Private landowners who meet approval requirements	http://www.nrcs.usda.gov
NRCS Focused Conservation: Targeted Implementation Plans (TIPs)	The NRCS has a program called "Montana Focused Conservation" that begins with county-level Long Range Plans. Based on those plans, the NRCS can create Target Implementation Plans (TIPs) to guide project implementation.	High priority resource needs	Varies; funds are provided for 2-3 years.	Organized by NRCS	
NRCS National Water Quality Initiative (NWQI) Program	A partnership between NRCS, state water quality agencies and U.S. EPA to identify and address impaired water bodies through voluntary conservation.	Water quality	Varies		
NRCS Regional Conservation Partnership Program	The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. Partners, working closely with	Agricultural conservation practices	Varies	Some of the eligible partners are producer associations, state or local	

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
	producers and communities, define and propose projects that will achieve collective natural resource goals while also meeting complementary local conservation priorities.			governments, and water and irrigation districts.	
NRCS Wetlands Reserve Enhancement Partnership (WREP)	WREP offers landowners the means to restore, enhance, and protect wetlands on their property through permanent easements. The NRCS also provides technical and financial assistance to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement.	Wetland protection, restoration, enhancement	Up to $10 million	Much of east-central Montana is prioritized as part of a Greater Sage Grouse Landscape Conservation Initiative	
US Fish and Wildlife Service State Wildlife Grant Program (SWG)	The State Wildlife Grants program provides federal grant funds for developing and implementing programs that benefit wildlife and their habitats, including species not hunted or fished. Priority is placed on projects that benefit species of greatest conservation need. The funds must be used to address needs identified within a State's Comprehensive Wildlife Conservation Plan/Strategy.	Wildlife habitat	Up to 25% of project costs.	State entities	https://www.fws.gov/program/state-wildlife-grants
US Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) Grants Program	The U.S. Standard and Small Grants Programs are competitive, matching grants programs that support public-private partnerships carrying out projects in the United States that further the goals of the North American Wetlands Conservation Act (NAWCA). Projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands for the benefit of all wetland-associated migratory birds.	Wetland habitat	Varies; requires a 1:1 match	Any person, agency, or organization	https://www.fws/gov/service/north-american-wetlands-conservation-act-nawca-grants-us-standard-program
STATE					

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
DEQ/SWCDM Ranching for Rivers	Funding for riparian pasture management for improvement of fish habitat, instream flows, and riparian areas.	Fencing materials, off-site water infrastructure, and grazing management plans.	Cost share covers up to 50% of a project	Private Landowners, Conservations Districts and Watershed Groups Priority given where a DEQ approved Watershed Restoration Plan has been completed	https://swcdm.org/programs/r4r/
DNRC HB223 Grants	Funding for Conservation District projects	Any CD-sponsored project	Up to $20,000 for planning projects; up to $50,000 for project implementation; up to $5,000 for education projects	Conservation Districts	http://dnrc.mt.gov/grants-and-loans
DNRC Irrigation Development Grants	Projects typically address irrigation efficiency, expansion of irrigated acreage, improved production, improved management, and/or improved inter-basin cooperation among water users.	Irrigation	$5,000-$50,000 Private individuals are eligible for 50% of project costs up to a program maximum of $50,000 and total project cost minimum of $100,000.	Private for-profit, non-profit, governmental and Tribal entities	
DNRC Reclamation and Development Grants (RDG)	Projects that repair, reclaim, and mitigate environmental damage to public resources from non-renewable resource extraction. Also funds projects that protect Montana's environment and ensure the quality of public resources for the benefit of all Montanans. Planning grants are available to prepare the project grant application.	Mining impacts, public resource protection	Planning Grants: up to $75,000 Project Grants: up to $300,000-$500,000	Local government, counties, tribes, and Conservation Districts	
DNRC Renewable Resource Grants (RRGL)	Projects that conserve, manage, develop, or protect Montana's renewable resources.	Renewable resource	Planning Grants: up to $40,000	State, local, or tribal government	

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
	Planning grants are available to prepare the project grant application.	conservation, management, development, or preservation	Project Grants: up to $125,000 per project.	entities, Conservation Districts, irrigation districts	
DNRC Watershed Management Grant	Watershed planning and management activities that conserve, develop, manage, or preserve Montana's renewable resources and/or support the implementation and development of the Montana State Water Plan.	Watershed planning	Up to $50,000; Non-Federal cost share up to 50%.	Local, state, and tribal government entities	
DEQ-SWCDM Mini Grants	Water quality related outreach and education.	Water quality related outreach and education	Up to $5,000	Governmental entities or a nonprofit organization	https://swcdm.org/programs/mini-grants/
FWP Smith River Corridor Enhancement Account	Funded by recreational and commercial user fees for floating the Smith River. Funds in the Smith River Corridor Enhancement Account may be used for watershed restoration activities as defined in state statute.	Water quality, water quantity, aquatic habitat, other	No limit but requires legislative authority	FWP	
FWP Future Fisheries	For more than a decade, FWP's Future Fisheries Improvement Program (FFIP) has worked to restore rivers, streams and lakes to improve and restore Montana's wild fish habitats. Funding is for on-the-ground projects.	Fisheries, aquatic habitat	Limited by availability	Any group or individual. Should include consultation with local FWP biologist	https://fwp.mt.gov/ffip
Montana DEQ 319	The Montana Department of Environmental Quality (DEQ) 319 grant program funds projects related to watershed restoration and education/outreach. DEQ issues a Call for Grant Applications every year under Section 319(h) of the Federal Clean Water Act (CWA).	Addresses non-point-source (NPS) pollution in waterbodies listed as impaired	Up to $300,000 for on-the-ground projects; Up to $30,000 for education and outreach projects.	Governmental entities or a nonprofit organization; watersheds must have DEQ-accepted Watershed Restoration Plan	https://deq.mt.gov/water/Programs/nonpoint

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
Montana Noxious Weed Trust Fund Grant	The Montana Noxious Weed Trust Fund Grant program provides funding for the development and implementations of weed management programs throughout the state.	Noxious weed research, education, local cooperative/land owner cost share	Up to $75,000 per project.	Weed districts, educational institutions, Conservation District, other organizations	https://agr.mt.gov/NoxiousWeedTrustFund
		OTHER			
Montana Trout Unlimited mini grants	Montana TU Habitat Protection and Enhancement Fund to fund specific projects that further MTU's mission to "conserve, protect, and restore Montana's coldwater fisheries and their watersheds."	Cold water fisheries related restoration, monitoring, education	Varies year to year.	TU chapters or their affiliates	https://montanatu.org/mini-grants/
National Wildlife Foundation (private non-profit)	The NWF funds projects that sustain, restore, and enhance the nation's fish, wildlife, and plants and their habitats. Several programs are available for Montana.	Habitat	Varies by program.	Federal, state, and local governments, educational institutions, non-profits	https://www.nfwf.org/programs
Monitoring Montana Waters: Flathead Lake Biological Station	FLBS program that provides scientific expertise and guidance to citizen-led watershed monitoring groups.	Citizen water quality monitoring	Up to $1,500 funds for gear.	Watershed groups with approved SAPs or SOPs	https://flbs.umt.edu/newflbs/outreach/mmw/monitoring-montana-waters/
Cinnabar Foundation Special Projects Grants	Funding for programs, projects, and campaigns that address issues related to climate action, conservation, public lands, sustainable agriculture, water quality, fisheries.	A wide range of natural resource conservation projects	Up to $15,000.	Non-Profits that serve Montana or the Greater Yellowstone Ecosystem	https://www.thecinnabarfoundation.org/grant-program.html
Montana Trout Foundation Grant Program	Montana Trout Foundation offers grants to preserve and enhance the wild trout resources of Montana.	Research, education,	Varies but typically up to $2,500- $15,000	Individuals or groups	https://www.mttroutfoun

SOURCE	DESCRIPTION	PROJECT TYPES	FUNDING LIMITS	WHO CAN APPLY?	URL
		habitat enhancement			dation.org/grant-program
Private Grants	Numerous private organizations and foundations with potential to provide grants or matching funds for watershed restoration work (i.e. Montana Community Foundation, Four Corners Community Foundation, etc.)		Varies by source		

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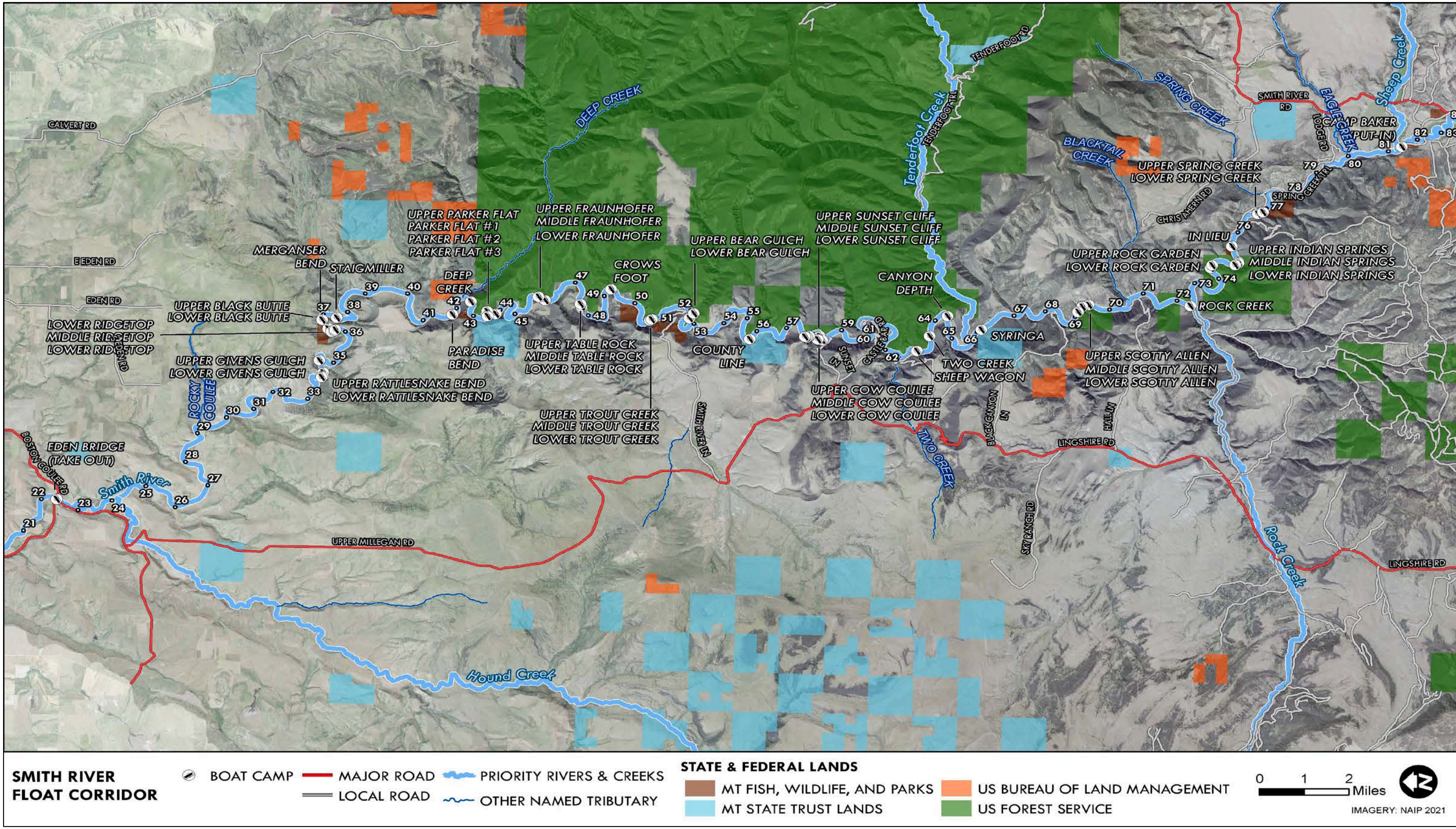
Appendix D. Boat Camp Bioengineering Suitability Assessment


SMITH RIVER
FLOAT CORRIDOR
BOAT CAMP
MAJOR ROAD
LOCAL ROAD
PRIORITY RIVERS & CREEKS
OTHER NAMED TRIBUTARY
STATE & FEDERAL LANDS
MT FISH, WILDLIFE, AND PARKS
MT STATE TRUST LANDS
US BUREAU OF LAND MANAGEMENT
US FOREST SERVICE
0 1 2 Miles
IMAGERY: NAIP 2021
EDEN BRIDGE (TAKE OUT)
CAMP BAKER (PUT-IN)
Smith River
Hound Creek
Rock Creek
Tenderfoot Creek
DEEP CREEK
Sheep Creek
EAGLE CREEK
SPRING CREEK
BLACKTAIL CREEK
TWO CREEK
ROCKY COULEE
UPPER MILLEGAN RD
LINGSHIRE RD
CALVERT RD
E EDEN RD
EDEN RD
SMITH RIVER RD

SMITH RIVER BOAT CAMP ISSUE SUMMARY*						STREAMBANK BIOENGINEERING SUITABILITY CRITERIA					
Name		**Corridor River Mile**	**Full River Mile**	**Bank**	**Ownership**	**Erosion**	**Geomorphic Position**	**Soil Type**	**Bank height and angle**	**Materials Available on-site**	**Other Issues**
Spring Creek	Upper Lower	4.4	76.8	LB	FWP	Low	Straight	N/A	N/A	Unknown	Low use
In-lieu		5.6	75.5	RB	FWP	Low	Straight	N/A	N/A	Unknown	Low use
Indian Springs	Upper Middle Lower	6	74.8	RB	USFS	Moderate	Inside bend	Silt loam 0.5' underlaid by alluvium 2-3'	Approx. 3' 50 degrees	Unknown	Compaction, dead/dying trees
Rock Garden	Upper Lower	6.8	74.2	LB	USFS	Moderate	Inside bend	Silt loam 0.5' underlaid by alluvium 2-3'	Approx. 2' 50-90 degrees	No willows, snowberry, conifers, probably rock	Compaction
Rock Creek		8.9	72.4	RB	USFS	Low	Inside Bend	N/A	N/A	Unknown	Compaction
Scotty Allen	Upper Middle Lower	12	69.5	LB	USFS	Low	Inside bend	Clay loam	Approx. 1' 90 degrees	Limited shrubs, conifers, maybe rock	Compaction, bank recession
Syringa		15.2	66.1	LB	DNRC	Severe	Transition to Inside Bend	Silt loam 2' underlain by alluvium (good cobble toe)	Approx. 3' 80-90 degrees	Some shrubs, conifers, maybe rock	Compaction, dead conifers, bare ground
Canyon Depth		16.9	64.4	RB	USFS	Severe	Outer Bend - Transition to rock cliff face	1' loam (dark, organic) underlain by 3-4' alluvium; lower end more silt deposition	Approx. 5' 90 degrees	Unknown	Dead conifers, compaction, bare ground

SMITH RIVER BOAT CAMP ISSUE SUMMARY*						STREAMBANK BIOENGINEERING SUITABILITY CRITERIA					
Name		**Corridor River Mile**	**Full River Mile**	**Bank**	**Ownership**	**Erosion**	**Geomorphic Position**	**Soil Type**	**Bank height and angle**	**Materials Available on-site**	**Other Issues**
Two Creek		17.8	63.8	RB	USFS	Moderate	Downstream end of outer bend	1' silt loam underlaid by alluvium	Approx. 1' 80-90 degrees	Willows, sod, limited conifers, maybe rock	Compaction, bare ground
Sheep Wagon		18.4	62.8	RB	USFS	Low to moderate	Inside bend	1' silt loam underlaid by alluvium	Approx. 2' 70-90 degrees	Willows, conifers, sod, maybe rock	Compaction, bare ground
Cow Coulee	Upper Middle Lower	22.8	58.3	RB	USFS	Low	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 2' 30-40 degrees	Shrubs, conifers, sod, maybe rock	Compaction, bare ground, herbicide, altered vegetation, dying conifers
Sunset Cliff	Upper Middle Lower	23.6	57.9	RB	USFS	Low	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 2' 40-50 degrees	Willows, conifers, sod, maybe rock	Compaction, bare ground
County Line		25.5	55.6	RB	USFS	None	Straight into inside bend	N/A	N/A	Shrubs, sod, some conifer, maybe rock	Spurge increasing in native grassland, compaction, vegetation alterations in camp sites
Bear Gulch	Upper, *Lower*	29	52.2	RB	USFS	Moderate	Straight	Silt loam top 0.5' underlaid by alluvium 2' (good cobble toe)	Approx. 2' 70 degrees	Willows, shrubs, limited	Over-widened, compaction, low

SMITH RIVER BOAT CAMP ISSUE SUMMARY*						STREAMBANK BIOENGINEERING SUITABILITY CRITERIA					
Name		**Corridor River Mile**	**Full River Mile**	**Bank**	**Ownership**	**Erosion**	**Geomorphic Position**	**Soil Type**	**Bank height and angle**	**Materials Available on-site**	**Other Issues**
										conifers, maybe rock	vegetation cover
Trout Creek	Upper, Middle , Lower	30.3	51	LB	FWP	Moderate	Split flow upstream; Inside Bend	Silt loam top 1' underlaid by alluvium 2-3' (good cobble toe)	Approx. 3' 70-90 degrees	Some shrubs, conifers, maybe sod, maybe rock	Cheatgrass, dead trees
Crow's Foot		32	49.3	LB	FWP	Low	Inside bend	Sandy loam (sediment deposition)	Approx. 3' 60 degrees	Willows, sod, limited conifers, maybe rock	Compaction, bare ground
Table Rock	Upper, *Middle,* Lower	33.5	47.8	RB	USFS	Moderate	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 3' 70-80 degrees	Some shrubs, conifers on slope approx. 500' from camp, maybe sod, maybe rock	Cheatgrass, dead trees, dense leafy spurge
Fraunhofer	Upper, Middle , Lower	35.4	46	RB	USFS	Moderate	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 3' 60 degrees	Willows Lower, conifers on slope approx. 300' from camp, maybe sod, maybe rock	Some weeds
Meadow Bend		36	45.7	LB	USFS	Low	Inside bend	N/A	N/A	Some shrubs	Hazard trees removed, compaction, grazed, spurge

SMITH RIVER BOAT CAMP ISSUE SUMMARY*						STREAMBANK BIOENGINEERING SUITABILITY CRITERIA					
Name		Corridor River Mile	Full River Mile	Bank	Ownership	Erosion	Geomorphic Position	Soil Type	Bank height and angle	Materials Available on-site	Other Issues
Upper Parker Flat		37.5	43.8	RB	USFS	Moderate	Inside bend	Clay-loam entire profile	Approx. 3' 90 degrees	Shrubs, conifers, sod, maybe rock	Compaction, bare ground
Parker Flat	#1, #2, #3	37.9	43.5	LB	FWP	Low	Inside bend	#1: Silt loam top 1' underlaid by 2' alluvium; #2 and #3 0.5' silt loam underlaid alluvium	#1: 90 degrees; #2: 50 degrees; #3: 20 degrees	Some shrubs, conifers, sod, maybe rock	Cheatgrass
Deep Creek		38.7	42.7	LB	Private	Low	Inside bend	Silt loam 2', alluvium at toe	Approx. 1' 80 degrees	Shrubs, conifers, sod, maybe rock	Erosion, grazing
Paradise Bend		39.5	41.8	RB	FWP	Low	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 2' 70-80 degrees	Shrubs, conifers, sod, maybe rock	Erosion, weeds
Staigmiller		44	37.5	RB	Private	Low	Inside bend	Sandy loam (sediment deposition)	Approx. 1' 60 degrees	Willows, sod, conifers, maybe rock	Compaction, bare ground
Merganser Bend		44.5	36.9	LB	FWP	Low	Inside bend	Silty sandy loam 2' underlaid by alluvium	Approx. 2' 40 degrees	Willows, sod, conifers, maybe rock	Compaction, bare ground
Black Butte	Upper, Lower	44.8	36.7	RB	FWP	Low	Inside bend	N/A	N/A	Unknown	Compaction, bare ground
Ridgetop	Upper, Middle, Lower	45	36.2	LB	Private	Low	Inside bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 2' 30 degrees	Some shrubs, conifers, maybe rock	Hazard trees removed, heavy cheatgrass
Upper Givens Gulch		47.2	34.4	LB	Private	Moderate	Inside Bend	Silt loam top 1' underlaid by alluvium 2-3'	Approx. 3' 90 degrees	Willows, shrubs, conifers, sod, maybe rock	Leafy spurge

SMITH RIVER BOAT CAMP ISSUE SUMMARY*						STREAMBANK BIOENGINEERING SUITABILITY CRITERIA					
Name		Corridor River Mile	Full River Mile	Bank	Ownership	Erosion	Geomorphic Position	Soil Type	Bank height and angle	Materials Available on-site	Other Issues
Lower Givens Gulch		47.2	34.1	LB	Private	Low	Inside bend	Silt loam top 1' underlaid by cobble and boulders (some angular colluvial)	Approx. 3' 40 degrees to 90 degrees	Willows (bars upstream), conifers, sod, rock	Weeds, compaction
Rattlesnake Bend	Upper, Lower	47.4	33.9	RB	Private	Moderate	Inside bend	Silt loam 3-4' underlaid by large cobble/boulders (some angular colluvial)	Approx. 5' 70 degrees Upper to 90 degrees Lower	Willows (bar upstream), sod, limited conifers, maybe rock)	Weeds, compaction, erosion, loss of vegetation

*Boat camps high-lighted in yellow are good initial candidates for soil bioengineering for erosion control.
Boat camps high-lighted in orange are good initial candidates for revegetation projects.